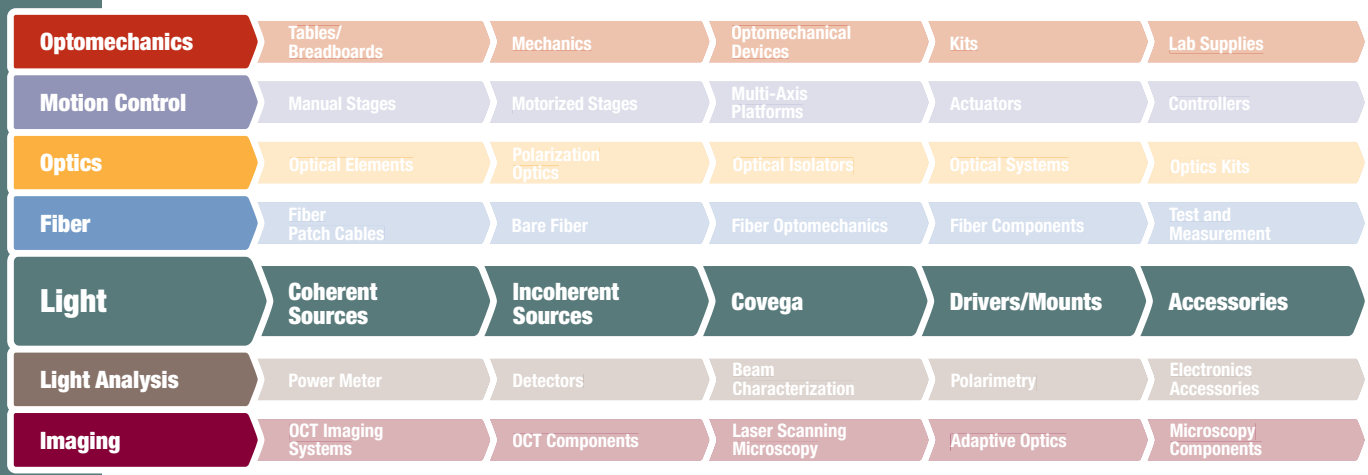
Light Catalog



The same categories can be found online: www.thorlabs.com

Light

Coherent Sources . . . . . Pages 1031-1090

Incoherent Sources . . . . . Pages 1091-1131

Covega . . . . . Pages 1132-1173

Drivers/Mounts . . . . . Pages 1174-1230

Accessories . . . . . Pages 1231-1245

Menlo Systems . . . . . Pages 1246-1263

Coherent Sources Selection Guide

Pages 1032-1090

Ø5.6 mm, Ø9 mm and Pigtailed Laser Diodes

- Laser Diodes Available from 405 nm to 1625 nm
- Single and Multimode Fiber with Internal 8° Angle Cleave
- Compatiable with Thorlabs' Laser Diode and TEC Controllers
- Fiber Bragg Grating Wavelength Stablized Laser Diode

See Pages 1032-1054

Single and Multichannel Fiber-Coupled Laser Sources

- SM and PM Pigtailed Laser Diode Sources (405 nm to 1550 nm)
- SLD Pigtailed Sources (Center Wavelengths: 1310 nm and 1550 nm)
- Fiber-Coupled Optical Amplifiers

See Pages 1058-1063

PRO8 Modular WDM Systems

- Foundation for WDM Laser Diode Plug-In Modules
- DWDM Laser Modules Covering the C- and L- Bands
- LS5000 DWDM Laser Sources for Active and Passive DWDM Component Testing

See Pages 1064-1073

Helium-Neon Lasers

- Self-Contained 632.8 nm HeNe Lasers Ideal for Alignment Applications
- Cylindrical Tube HeNe Lasers Mount Easily into Optical Systems
- Keyed Power Supply with Built-in Interlock

See Pages 1074-1078

Laser Diode Modules and Kits

- Available Wavelengths of 405 nm and 635 nm
- Laser Diode Kits Ideal for General Purpose Alignment Aid
- Small, Lightweight CPS Series Laser Modules

See Pages 1079-1080

Benchtop and OEM Tunable Lasers

- Low-Noise, High-Power Lasers
- Ideal for Integration into High-End Optical Test Instruments
- Also Available for use with TXP5000

See Pages 1081-1087

Frequency Swept Lasers Sources

- 55 kHz Frequency Swept Laser Sources at 1050 and 1325 nm
- Ideal for Optical Coherence Tomography and Optical Frequency Domain Reflectometry
- Greater than 100 nm Tuning Range
- Greater than 10 mW of Fiber-Coupled Ouput Power

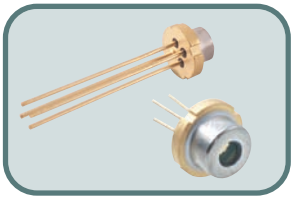
See Pages 1088-1089

Terahertz Transmitter

See Page 1090

All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

LASER DIODE OVERVIEW



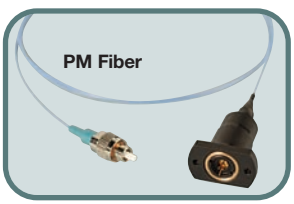
- Output Powers up to 1 W
- Standard Pin Configurations
- 405 to 1550* nm
- Compatible with Thorlabs' Laser Diode and TEC Controllers

*See page 1056 for wavelengths up to 1625 nm

Thorlabs offers an extensive selection of discrete laser diodes in Ø5.6 mm, Ø9 mm, and VCSEL packages. Ranging in wavelengths from 405 nm to 1550 nm, we have a diode to work in nearly any application. Our selection of Ø5.6 mm and Ø9 mm diodes includes both Fabry-Perot and DFB lasers in a variety of standard pin configurations.

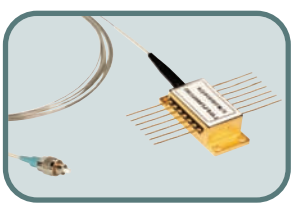
- 8° Angled-Cleaved Fiber at Laser Diode
- Visible to Near IR Models
- Single Mode and Multimode Fibers
- Pigtailing of Customer Supplied Diodes Available

Thorlabs' full line of fiber pigtailed laser diodes (supplied by either Thorlabs or our customers) are assembled at our extensive pigtailing facilities in the United States. A high-quality alignment process ensures maximum efficiency at an affordable price.



- Slow Axis of PM Fiber Aligned to Connector Key
- Interal 8° Angled-Cleaved Fiber Minimizes Intensity Noise
- Single Mode and Multimode Fibers
- FC/PC Connector

Thorlabs offers a full line of PM fiber-pigtailed laser diodes. Our high-quality alignment process includes multiple test and inspection points that ensure that the coupling efficiency is maximized and properly aligned.



- Fiber Bragg Grating Wavelength Stabilized
- Built-In Cooler and Photodiode
- Compact, Low-Profile 14-Pin Butterfly Package
- Telecordia GR-468-CORE Qualified

The PL980P330J consists of a field-proven 980 nm patented quantum-well laser chip in a 14-pin butterfly package with an integrated thermoelectric cooler and monitor photodiode. The compact design includes a fiber Bragg grating (FBG) for providing reliable wavelength-stabilized operation.

NOTE: The products on pages 1032 through 1057 are designated for use solely as components and are not sold as a finished product. The purchaser assumes responsibility to comply with US 21 CFR 1040.10 and 1040.11 or IEC 60825-1 with regard to the safe use of these components in a laboratory environment or their introduction into commerce.

Laser Diode Selection Guide

NEW versions

ITEM#	WAVELENGTH (nm)	P (mW)	PACKAGE (mm)	PIN CODE	PAGE
DL3146-151	405	5	5.60	5B	1034
NEW GH04020B2A	406	20	5.60	5B	1034
NEW GH04125A2A	406	125	5.60	5B	1034
NEW LPS-406-FC	406	5.0	Pigtailed	5B	1056
LPS-635-FC	635	2.5	Pigtailed	9A	1037
HL6314MG[a,b]	635	3	5.60	5A	1035
HL6312G[a,b]	635	5	9.00	9A	1035
HL6335G	635	5	9.00	9A	1035
DL3148-025	635	5	5.60	5A	1036
HL6320G[a,b]	635	10	9.00	9A	1036
HL6344G	635	10	9.00	9A	1036
HL6322G	635	15	9.00	9A	1037
DL5038-021	635	30	9.00	9A	1037
LPS-PM635-FC	635	2.5	Pigtailed	9A	1057
NEW LPM-635-SMA	635	7.5	Pigtailed	9A	1056
NEW DL5148-030	638	20	5.60	5A	1037
NEW DL6148-030	638	40	5.60	5A	1038
DL3147-060	650	5	5.60	5A	1038
GH06510B2A	654	10	5.60	5B	1038
HL6501MG[a]	658	35	5.60	5C	1039
DL6147-040	658	45	5.60	5A	1039
HL6512MG	658	50	5.60	OPEN	1039
DL7147-201	658	60	5.60	OPEN	1040
ML120G21	658	80	5.60	5E	1040
HL6548FG	660	90	9.00	9F	1040
NEW HL6545MG	660	120	5.60	OPEN	1041
LPS-660-FC	660	7.5	Pigtailed	5C	1056

[a]Single Mode - Longitudinal [b]Single Mode - Transverse [c]Patented Device Structure: F0000380501

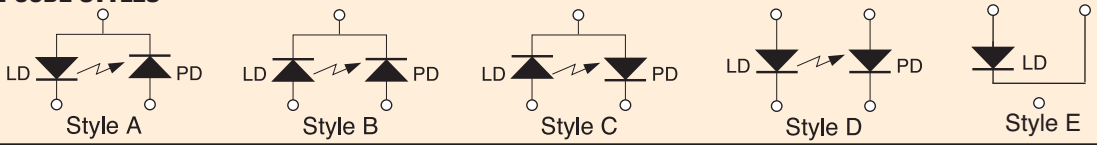
Laser Diode Selection Guide

ITEM#	WAVELENGTH (nm)	P (mW)	PACKAGE (mm)	PIN CODE	PAGE	
LPM-660-SMA	660	22.5	Pigtailed	5C	1056	
HL6724MG[a,b]	670	5	5.60	5A	1041	
DL3149-057	670	5	5.60	5A	1041	
HL6714G[a,b]	670	10	9.00	9A	1042	
LPS-675-FC	675	2.5	Pigtailed	9A	1056	
HL6738MG[a,b]	690	35	5.60	5C	1042	
HL7001MG	705	40	5.60	5C	1042	NEW
VCSEL-780	780	1.65	–	–	1043	
L780P010	780	10	5.60	5A	1043	
DL4140-001S	785	25	5.60	5A	1043	
HL7851G[a,b]	785	50	9.00	9A	1044	
DL7140-201S	785	70	5.60	5C	1044	
L785P100	785	100	5.60	5A	1044	
LPS-785-FC	785	6.25	Pigtailed	5A	1056	
LPS-PM785-FC	785	6.25	Pigtailed	5A	1057	NEW
L808P010	808	10	5.60	5A	1045	
L808P030	808	30	5.60	5A	1045	
L808P200	808	200	5.60	5A	1045	
L808P1WJ[c]	808	1WATT	9.00	9A	1046	
DL5032-001	830	30	9.00	9A	1046	
HL8325G[a,b]	830	40	9.00	9C	1046	
DL7032-001[a,b]	830	100	9.00	9A	1047	
DL8142-201	830	150	5.60	5C	1047	
LPS-830-FC	830	10.0	Pigtailed	9C	1056	
LPS-PM830-FC	830	10.0	Pigtailed	9C	1057	NEW
VCSEL-850	850	1.85	–	–	1047	
L850P010	850	10	5.60	5A	1048	
L850P030	850	30	5.60	5A	1048	
L850P100	850	100	5.60	5A	1048	
L904P010	904	10	5.60	5A	1049	
L904P030	904	30	5.60	5A	1049	
L915P1WJ[c]	915	1WATT	9.00	9A	1049	
L975P1WJ[c]	975	1 WATT	9.00	9A	1050	
VCSEL-980	980	1.85	–	–	1050	
L980P010	980	10	5.60	5A	1050	
L980P030	980	30	5.60	5A	1051	
L9805E2P5[b]	980	50	5.60	5A	1051	
L980P100	980	100	5.60	5A	1051	
L980P200J[c]	980	200	9.00	9A	1052	
L980P300J[c]	980	300	9.00	9A	1052	
PL980P330J	980	330	Pigtailed	BFY-14PIN	1054	NEW
L1060P100J[c]	1060	100	9.00	9A	1052	
LPS-1060-FC	1060	20	Pigtailed	9A	1056	
ML725B11F	1310 DFB	10	5.60	5D	1055	DFB
LPS-1310-FC	1310	2.5	Pigtailed	5D	1056	
LPSC-1310-FC	1310	80	Pigtailed	–	1056	
LPS-PM1310-FC	1310	2.5	Pigtailed	5D	1057	NEW
ML925B45F	1550	6	5.60	5D	1055	
ML925B11F	1550 DFB	10	5.60	5D	1055	DFB
LPS-1550-FC	1550	1.5	Pigtailed	5D	1056	
LPS-PM1550-FC	1550	1.5	Pigtailed	5D	1057	NEW
LPSC-1550-FC	1550	50	Pigtailed	–	1056	NEW
LPSC-1625-FC	1625	50	Pigtailed	–	1056	NEW

[a]Single Mode - Longitudinal [b]Single Mode - Transverse [c]Patented Device Structure: F0000380501

All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

PIN CODE STYLES



1. All specifications are typical; see individual items for complete details.
2. Pin code is based on laser pin configuration and is used to help select socket cable assemblies.

Note: The 5 and 9 of the pin code designate 5.6 mm or 9 mm packages, respectively.

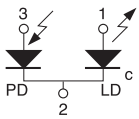
All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

λ = 405 nm, P = 5 mW, Single Mode Sanyo DL3146-151

- Ø5.6 mm ØPackage
- 405 nm (Typ.) Wavelength
- 5 mW Output Power (CW)
- 35 mA (Typ.) Threshold Current

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser anode
2 common case
3 monitor diode anode



PIN CODE 5B

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL3146-151	£ 1,124.70	€ 1.450,70	¥ 13,757.20

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL3146-151	$ 1630.00	$ CALL	$ CALL	Sanyo 405 nm, 5 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	7 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	0 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	35 mA	55 mA
Operating Current	I_{op}	–	40 mA	60 mA
Operating Voltage	V_{op}	–	5.0 V	6.0 V
Lasing Wavelength	λ_p	395 nm	405 nm	415 nm
Beam Divergence (FWHM)	$\theta\perp$	16°	20°	24°
	θ//	6°	8°	14°
Off-Axis Angle (Perpendicular)	$\Delta\theta_v$	-3°	–	3°
Off-Axis Angle (Parallel)	$\Delta\theta_h$	-2°	–	2°
Slope Efficiency (mW/ mA)	η_s	0.5	0.8	–
Monitor Current (mA)	I_m	0.1	0.2	1.0

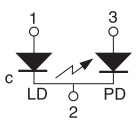
λ = 406 nm, P = 20 mW, Single Mode Sharp GH04020B2A

- Ø5.6 mm Package
- 406 nm (Typ.) Wavelength
- 20 mW Output Power (CW)
- 23 mA (Typ.) Threshold Current

CAUTION: ELECTROSTATIC SENSITIVE

NEW product

Pin Description
1 laser anode
2 common case
3 monitor diode anode



PIN CODE 5B

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
GH04020B2A	£ 217.35	€ 280,35	¥ 2,658.60

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
GH04020B2A	$ 315.00	$ CALL	$ CALL	Sharp 406 nm, 20 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output (CW)	P_O	25 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 70 °C
Storage Temperature	Tstg	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 20 mW)

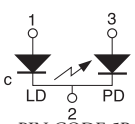
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	23 mA	50 mA
Operating Current	I_{op}	–	38 mA	60 mA
Operating Voltage	V_{op}	–	4.9 V	5.8 V
Lasing Wavelength	λ_p	400 nm	406 nm	413 nm
Beam Divergence (FWHM)	$\theta\perp$	15°	20°	24°
	θ//	6.0°	9.5°	12°
Off-Axis Angle (Perpendicular)	$\Delta\theta_v$	-3.0	–	3.0
Off-Axis Angle (Parallel)	$\Delta\theta_h$	-2.5	–	2.5
Slope Efficiency (mW/mA)	η_s	0.7	1.1	1.6
Monitor Current (mA)	I_m	0.3	0.6	0.9

Note: All data is presented as typical unless otherwise specified.

λ = 406 nm, P = 125 mW, Single Mode Sharp GH04125A2A

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser anode
2 common case
3 monitor diode anode



PIN CODE 5B

NEW product

- Ø5.6 mm Package
- 125 mW Output Power (CW)
- 0.6 mA (Typ.) Monitor Current

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
GH04125A2A	£ 868.80	€ 1.120,60	¥ 10,626.00

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
GH04125A2A	$ 1259.00	$ CALL	$ CALL	Sharp 406 nm, 125 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	150 mW
LD Reverse Voltage	$V_{R(PD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 70 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 20 mW)

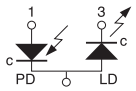
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	35 mA	50 mA
Operating Current	I_{op}	–	125 mA	155 mA
Monitor Current	I_m	0.1	0.3	0.5
Operating Voltage	V_{op}	–	5.4 V	6.4 V
Lasing Wavelength	λ_p	400 nm	406 nm	413 nm
Beam Divergence (FWHM)	$\theta\perp$	16°	19°	24.5°
	θ//	6.0°	9.5°	12°
Off-Axis Angle (Perpendicular)	$\Delta\theta_h$	-3.0	–	3.0
Off-Axis Angle (Parallel)	$\Delta\theta_h$	-2.5	–	2.5
Slope Efficiency (mW/mA)	η_s	0.9	1.3	–
Monitor Current (mA)	I_m	0.1	0.3	0.5

Note: All data is presented as typical unless otherwise specified.

λ = 635 nm, P = 3 mW, Single Mode Hitachi HL6314MG

- Ø5.6 mm Package
- AlGaInP Index-Guided MQW Structure
- Single Longitudinal Mode
- Low 8 µm Astigmatism @3 mW
- High Polarization Ratio >350:1 @ 3 mW

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 5A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6314MG	£ 21.74	€ 28,04	¥ 265.90

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6314MG	$ 31.50	$ 26.78	$ 21.11	Hitachi 635 nm, 3 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	3 mW
Pulsed Optical Power	$P_{O(pulse)}$	5 mW*
LD Reverse Voltage	$V_{R(PD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

*Pulse condition: Pulse width ≤ 1 µs, Duty ≤ 50%

Characteristics (T_C = 25 °C, P = 3 mW)

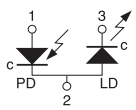
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	25 mA	35 mA
Operation Current	I_{op}	–	30 mA	42 mA
Operation Voltage	V_{op}	–	–	2.7 V
Lasing Wavelength	λ_p	630 nm	635 nm	640 nm
Beam Divergence (FWHM)	θ//	6°	8°	10°
	θ⊥	23°	30°	39°
Monitor Current	I_m	0.08 mA	0.15 mA	0.40 mA

Note: All data is presented as typical unless otherwise specified.

λ = 635 nm, P = 5 mW, Single Mode Hitachi HL6312G

- Ø9 mm Package
- AlGaInP Index-Guided MQW Structure
- Single Longitudinal Mode
- Low 6 µm Astigmatism @ 5 mW
- High Polarization Ratio >400 @ 5 mW
- 6 mW Pulsed Optical Power with a 50% Duty Cycle and a Maximum Pulse Width of 1 µs

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 9A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6312G	£ 25.19	€ 32,49	¥ 308.06

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6312G	$ 36.50	$ 31.03	$ 24.46	Hitachi 635 nm, 5 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	5 mW
Pulsed Optical Power	$P_{O(pulse)}$	6 mW
LD Reverse Voltage	$V_{R(PD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 5 mW)

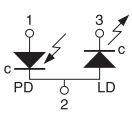
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	20 mA	45 mA	70 mA
Operation Current	I_{op}	–	55 mA	85 mA
Operation Voltage	V_{op}	–	–	2.7 V
Lasing Wavelength	λ_p	625 nm	635 nm	640 nm
Beam Divergence (FWHM)	θ//	5°	8°	11°
	θ⊥	25°	31°	37°
Monitor Current	I_m	0.2 mA	0.4 mA	0.8 mA

Note: All data is presented as typical unless otherwise specified.

λ = 635 nm, P = 5mW, Single Mode Hitachi HL6335G

Pin Description
1 monitor diode anode
2 common case
3 laser cathode

- Ø9 mm Package
- 5 mW (Min) Operating Current
- TM Mode Oscillation
- Single Longitudinal Mode



PIN CODE 9A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6335G	£ 34.16	€ 44,06	¥ 417.80

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6335G	$ 49.50	$ 42.08	$ 33.17	Hitachi 635 nm, 5 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	5 mW
Pulsed Optical Output Power	$P_{O(Pulse)}$	6 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to +50 °C
Storage Temperature	T_{stg}	-40 to +85 °C

*Note: Pulse condition: Pulse width ≤ 1 µs, duty = 50%

Characteristics (T_C = 25 °C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Optical Output Power	P_O	5 mW	–	–
Threshold Current	I_{th}	–	20 mA	30 mA
Slope Efficiency	ηs	0.5 mW/mA	0.8 mW/mA	1.1 mW/mA
Operation Current	I_{op}	–	25 mA	40 mA
Operation Voltage	V_{op}	–	2.4 V	2.7 V
Lasing Wavelength	λ_p	630 nm	635 nm	640 nm
Beam Divergence (FWHM)	θ//	13°	17°	25°
	θ⊥	16°	20°	25°
Aspect Ratio	θ⊥/θ//	–	1.2	1.5
Monitor Current	I_m	0.03 mA	0.07 mA	0.12 mA

Note: All data is presented as typical unless otherwise specified.

λ = 635 nm, P = 5 mW, Single Mode Sanyo DL3148-025

Absolute Maximum Ratings (T_C = 25 °C)

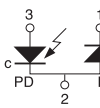
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power	P_O	6 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to +40 °C
Storage Temperature	T_{stg}	-40 to +85 °C

Characteristics (T_C = 25 °C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	20 mA	35 mA
Operation Current	I_{op}	–	30 mA	45 mA
Operation Voltage	V_{op}	–	2.2 V	2.4 V
Lasing Wavelength	λ_p	630 nm	635 nm	640 nm
Beam Divergence (FWHM)	θ//	6°	8°	10°
	θ⊥	25°	30°	35°
Astigmatism	As	–	8 µm	–
Monitor Current	I_m	0.08	0.2	0.5

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 20 mA (Typ.) Threshold Current
- 2.2V (Typ.) Operating Voltage
- Laser Pointer Applications

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL3148-025	£ 12.63	€ 16,29	¥ 154.46

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL3148-025	$ 18.30	$ 15.56	$ 12.27	Sanyo 635 nm, 5mW

λ = 635 nm, P = 10 mW, Single Mode Hitachi HL6320G

Maximum Ratings (T_C = 25 °C)

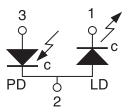
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	Tstg	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 10 mW)

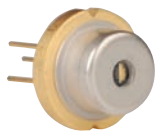
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	20 mA	50 mA	75 mA
Operation Current	I_{op}	–	70 mA	95 mA
Operation Voltage	V_{op}	–	–	2.7 V
Lasing Wavelength	λ_p	625 nm	635 nm	640 nm
Beam Divergence (FWHM)	θ//	5°	8°	11°
	θ⊥	25°	31°	37°
Monitor Current	I_m	0.05 mA	0.17 mA	0.30 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 9A



CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- InGaAsP Index Guided Structure
- 10 mW CW Optical Output Power

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6320G	£ 49.34	€ 63,64	¥ 603.50

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6320G	$ 71.50	$ 60.78	$ 47.91	Hitachi 635nm, 10mW

λ = 635 nm, P = 10 mW, Single Mode Hitachi HL6344G

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
Pulse Optical Output Power	$P_{O(Pulse)}$	12 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to +50 °C
Storage Temperature	T_{stg}	-40 to +85 °C

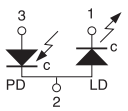
Pulse condition: Pulse width ≤ 1µs, duty = 50%

Characteristics (T_C = 25 °C, P = 10 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	Ith	–	20 mA	35 mA
Operation Current	I_{OP}	–	35 mA	45 mA
Operation Voltage	V_{OP}	–	2.4 V	2.7 V
Lasing Wavelength	λp	630 nm	635 nm	640 nm
Beam Divergence (FWHM)	θ//	13	17°	25°
	θ⊥	13	20°	25°
Aspect Ratio	θ⊥/θ//	–	1.2	1.5
Slope Efficiency	ηs	0.5 mW/ mA	0.8 mW/ mA	1.2 mW/ mA
Monitor Current	I_m	0.06 mA	0.14 mA	0.24 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 9A

- Ø9 mm Package
- 1.2 (Typ.) Aspect Ratio
- 35 mA (Typ.) Operating Current
- TM Mode Oscillation
- Single Longitudinal Mode

See Our Selection of VCSEL Laser Diodes Starting on Page 1043

CAUTION: ELECTROSTATIC SENSITIVE

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6344G	£ 70.81	€ 91,33	¥ 866.10

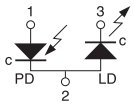
*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6344G	$ 102.62	$ 92.36	$ 71.84	Hitachi 635 nm, 10 mW

λ = 635 nm, P = 15 mW, Single Mode Hitachi HL6322G

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 9A

- Ø9 mm Package
- TM Mode Oscillation
- 15 mW Optical Output Power (CW)
- Single Longitudinal Mode

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6322G	£ 86.19	€ 111,17	¥ 1,054.16

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6322G	$ 124.90	$ 118.66	$ 99.92	Hitachi 635 nm, 15 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	15 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_{opr}	-10 to 50 °C
Storage Temperature	Tstg	-40 to 85 °C

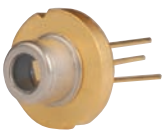
Characteristics (T_C = 25 °C, P = 15 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	20 mA	55 mA	70 mA
Operation Current	I_{op}	–	85 mA	100 mA
Operation Voltage	V_{op}	–	–	2.7 V
Lasing Wavelength	λp	630 nm	635 nm	640 nm
Beam Divergence	θ//	6°	8°	11°
(FWHM)	θ⊥	25°	30°	36°
Slope Efficiency	ηs	0.3 mW/ mA	–	0.7 mW/ mA
Monitor Current	I_m	0.1 mA	0.2 mA	0.4 mA

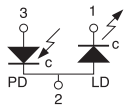
Note: All data is presented as typical unless otherwise specified.

λ = 635 nm, P = 30 mW, Single Mode Sanyo DL5038-021

CAUTION: ELECTROSTATIC SENSITIVE



Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A

- Ø9 mm Package
- AlGaInP Index Guided-MQW Structure
- High Power/Low Threshold Current
- 1 x 3 µm Emitter Size

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL5038-021	£ 265.38	€ 342,30	¥ 3,246.10

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL5038-021	$ 384.60	$ 338.45	$ 307.68	Sanyo 635 nm, 30 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	35 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 40 °C
Storage Temperature	Tstg	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 30 mW)

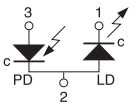
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	50 mA	70 mA
Operation Current	I_{op}	–	90 mA	110 mA
Operation Voltage	V_{op}	–	2.4 V	2.7 V
Lasing Wavelength	λp	–	635 nm	645 nm
Beam Divergence	θ//	6°	7°	9°
(FWHM)	θ⊥	25°	30°	35°
Monitor Current	I_m	0.1 mA	0.3 mA	0.6 mA

Note: All data is presented as typical unless otherwise specified.

λ = 638 nm, P = 20 mW, Single Mode Sanyo DL5148-030

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- 20 mW Output Power (CW)
- 60 mn (Typ.) Threshold Current
- 2:1 Aspect Ratio

NEW products

Mechanical Drawings Available on the WEB

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL5148-030	£ 93.50	€ 120,60	¥ 1,143.70

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL5148-030	$ 135.50	$ 115.18	$ 94.85	Sanyo 638 nm, 20 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_o	25 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	Tstg	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 20 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	60 mA	85 mA
Operation Current	I_{op}	–	80 mA	105 mA
Operation Voltage	V_{op}	–	2.3 V	2.7 V
Lasing Wavelength	λp	–	638 nm	645 nm
Beam Divergence	θ//	6°	8°	12°
(FWHM)	θ⊥	12°	16°	20°
Monitor Current	I_m	0.1 mA	0.3 mA	0.6 mA

Note: All data is presented as typical unless otherwise specified.

All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

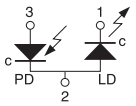
All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

λ = 638 nm, P = 40 mW, Single Mode Sanyo DL6148-030

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 60 mA (Typ.) Threshold Current
- Single Longitudinal Mode
- 2:1 Aspect Ratio (Typ.)

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL6148-030	£ 164.20	€ 211,80	¥ 2,007.90

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL6148-030	$ 237.90	$ 214.11	$ 190.32	Sanyo 638 nm, 40 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	40 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 40 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	60 mA	85 mA
Operation Current	I_{op}	–	100 mA	130 mA
Operation Voltage	V_{op}	–	2.4 V	2.7 V
Lasing Wavelength	λp	635 nm	638 nm	645 nm
Beam Divergence	θ//	6.5°	8.5°	12°
(FWHM)	θ⊥	12°	16°	22°
Monitor Current	I_m	0.3 mA	0.6 mA	0.9 mA

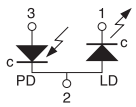
Note: All data is presented as typical unless otherwise specified.

λ = 650 nm, P = 5 mW, Single Mode Sanyo DL3147-060

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 20 mA (Typ.) Threshold Current
- Operating Temperature of 70 °C at 5 mW
- TE Mode

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL3147-060	£ 7.80	€ 10,06	¥ 95.38

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL3147-060	$ 11.30	$ 9.95	$ 7.58	Sanyo 650 nm, 5 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Power Output (CW)	P_O	7 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 70 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	20 mA	35 mA
Operation Current	I_{op}	–	30 mA	45 mA
Operation Voltage	V_{op}	–	2.3 V	2.6 V
Lasing Wavelength	λp	645 nm	650 nm	660 nm
Beam Divergence	θ//	7°	8°	10°
(FWHM)	θ⊥	25°	30°	35°
Monitor Current	I_m	0.08 mA	0.2 mA	0.4 mA
Astigmatism	As	–	8 µm	–

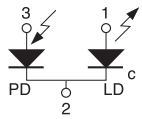
Note: All data is presented as typical unless otherwise specified.

λ = 654 nm, P = 10 mW, Single Mode Sharp GH06510B2A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 40 mA (Typ.) Low Current Drive
- 10 mW Maximum Optical Power Output (CW)
- 70 °C (Max) Operating Temperature

Pin Description
1 laser anode
2 common case
3 monitor diode anode



PIN CODE 5B

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
GH06510B2A	£ 14.84	€ 19,14	¥ 181.46

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
GH06510B2A	$ 21.50	$ 20.43	$ 17.20	Sharp 654 nm, 10 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Power Output	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 70 °C
Storage Temperature	T_{stg}	-40 to 85 °C
Soldering Temperature	T_{sld}	260 °C

Characteristics (T_C = 25 °C, P = 7 mW)

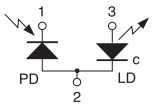
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	30 mA	45 mA
Operation Current	I_{op}	–	40 mA	55 mA
Operation Voltage	V_{op}	–	2.2 V	2.5 V
Lasing Wavelength	λ_p	640 nm	654 nm	660 nm
Divergence Parallel	θ//	7°	8.5°	10°
Divergence Perpendicular	θ⊥	24°	29°	33°
Monitor Current	I_m	0.08 mA	0.2 mA	0.4 mA

Note: All data is presented as typical unless otherwise specified.

λ = 658 nm, P = 35 mW, Single Mode Hitachi HL6501MG

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 monitor diode cathode
2 common case
3 laser anode



PIN CODE 5C

- Ø5.6 mm Package
- AlGaInP Structure
- 1 x 5 µm Emitter Size
- Single Longitudinal Mode
- Pulsed Optical Power of 50 mW with a ≤ 50% Duty Cycle, Maximum Pulse Width of 100 ns

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6501MG	£ 27.26	€ 35,16	¥ 333.38

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6501MG	$ 39.50	$ 33.58	$ 25.68	Hitachi 658 nm, 35 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	35 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 30 mW)

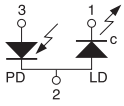
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	30 mA	45 mA	70 mA
Operation Current	I_{op}	–	65 mA	95 mA
Operation Voltage	V_{op}	2.1	2.6 V	3.0 V
Lasing Wavelength	λ_p	645 nm	658 nm	665 nm
Beam Divergence	θ//	7°	8.5°	10.5°
(FWHM)	θ⊥	18°	22°	26°
Monitor Current	I_m	0.05 mA	0.2 mA	1.5 mA

Note: All data is presented as typical unless otherwise specified.

λ = 658 nm, P = 45 mW, Single Mode Sanyo DL6147-040

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- 30 mA (Typ.) Threshold Current
- Single Longitudinal Mode

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL6147-040	£ 24.64	€ 31,78	¥ 301.31

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL6147-040	$ 35.70	$ 32.13	$ 24.99	Sanyo 658 nm, 45 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	45 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
Operation Case Temperature	T_c	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 40 mW)

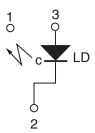
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	30 mA	50 mA
Operation Current	I_{op}	–	65 mA	85 mA
Operation Voltage	V_{op}	–	2.4 V	2.8 V
Lasing Wavelength	λ_p	650 nm	658 nm	665 nm
Beam Divergence	θ//	7°	10°	13°
(FWHM)	θ⊥	12°	16°	20°
Monitor Current	I_m	0.3 mA	0.5 mA	0.7 mA

Note: All data is presented as typical unless otherwise specified.

λ = 658 nm, P = 50 mW, Single Mode Hitachi HL6512MG

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 no connection
2 laser cathode
3 laser anode



OPEN PIN CODE
(Compatible with Styles A, B, & C)

- Ø5.6 mm Package
- AlGaInP Structure
- Single Longitudinal Mode
- 70 mW Output Power with 100 ns Pulse Width, 50% Duty Cycle

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6512MG	£ 34.02	€ 43,88	¥ 416.10

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6512MG	$ 49.30	$ 46.84	$ 43.39	Hitachi 658 nm, 50 mW

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	50 mW
Optical Output Power (Pulse)	P_O	70 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
Operation Case Temperature	T_c	-10 to 70 °C**
Storage Temperature	T_{stg}	-40 to 85 °C*

*Pulse Width = 100 ns, Duty Cycle = 50%.
**Note: The value of -10 to +70 °C is effective under pulse operation. The value under CW operation is -10 to +60 °C.

Characteristics (T_C = 25 °C, P = 50 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	30 mA	45 mA	60 mA
Operation Current	I_{op}	–	115 mA	135 mA
Operation Voltage	V_{op}	2.1	2.6 V	3.0 V
Beam Divergence	θ//	7°	8.5°	11°
(FWHM)	θ⊥	18°	21°	26°
Lasing Wavelength	λ_p	650 nm	658 nm	662 nm
Astigmatism	A_S	–	5 µm	–

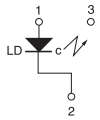
Note: All data is presented as typical unless otherwise specified.

λ = 658 nm, P = 50 mW, Single Mode Sanyo DL7147-201

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 1 µm Astigmatism @ 50 mW
- Pulsed Optical Power: P_o = 100 mW with a 50% or less Duty Cycle and a Max Pulse width of 0.1 µs

Pin Description
1 laser anode
2 laser cathode
3 no connection



OPEN PIN CODE (Compatible with Styles B & C)

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL7147-201	£ 32.37	€ 41,75	¥ 395.84

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL7147-201	$ 46.90	$ 42.21	$ 30.49	Sanyo 658 nm, 50 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	60 mW
Optical Output Power (Pulse)	P_O	100 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
Operation Case Temperature	T_c	-10 to 75 °C
Storage Temperature	T_{stg}	-40 to 85 °C

*Note: Pulse width ≤0.1 µs, duty = 50%

Characteristics (T_C = 25 °C, P = 50 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	40 mA	50 mA
Operation Current	I_{op}	–	90 mA	120 mA
Operation Voltage	V_{op}	–	2.5 V	3.0 V
Lasing Wavelength	λ_p	–	658 nm	662 nm
Beam Divergence (FWHM)	θ//	7.5°	9°	11°
	θ⊥	15°	16°	20°

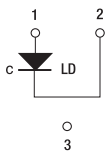
Note: All data is presented as typical unless otherwise specified.

λ = 658 nm, P = 80 mW, Single Mode Mitsubishi ML120G21

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 1.8 (Typ.) Aspect Ratio
- 1 µm (Typ.) Astigmatic Distance
- 0.95 W/A (Typ.) Efficiency

Pin Description
1 laser anode
2 laser cathode
3 no connection



PIN CODE 9E

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
ML120G21	£ 48.65	€ 62,75	¥ 595.02

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
ML120G21**	$ 70.50	$ 66.98	$ 59.93	Mitsubishi 658 nm, 80 mW

**Not Compatible with TCLDM9

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	80 mW
Optical Output Power (Pulse)	P_O	160 mW*
Reverse Voltage	V_{RL}	2 V
Operation Case Temperature	T_C	-10 to 75 °C
Storage Temperature	T_{stg}	-40 to 100 °C

*Note: Pulse width ≤50 ns, duty = 50%

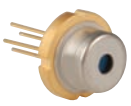
Characteristics (T_C = 25 °C, P = 80 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	65 mA	–
Operation Current	I_{OP}	–	150 mA	–
Operation Voltage	V_{OP}	–	2.4V	3.0 V
Slope Efficiency	ηs	–	0.95 mW/mA	–
Peak Wavelength	λp	654 nm	658 nm	662 nm
Beam Divergence (FWHM)	θ//	7°	9.5°	12°
	θ⊥	14°	17°	20°

Note: All data is presented as typical unless otherwise specified.

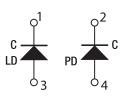
λ = 660 nm, P = 90 mW, Single Mode Hitachi HL6548FG

CAUTION: ELECTROSTATIC SENSITIVE



- Ø9 mm Package
- AlGaInP Structure
- Single Longitudinal Mode

Pin Description
1 laser cathode
2 monitor diode cathode/case
3 laser anode
4 monitor diode anode



PIN CODE 9F

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6548FG*	£ 137.31	€ 177,11	¥ 1,679.60

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6548FG**	$ 199.00	$189.05	$ 175.12	Hitachi 660 nm, 90 mW

**Not Compatible with TCLDM9

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	100 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_{stg}	-10 to 60 °C
StorageTemperature	T_c	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 90 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	55 mA	70 mA
Operation Current	I_{op}	–	140 mA	180 mA
Operation Voltage	V_{op}	–	2.4 V	2.8 V
Lasing Wavelength	λ	654 nm	660 nm	665 nm
Beam Divergence (FWHM)	θ//	7°	10°	13°
	θ⊥	15°	17°	20°
Monitor Current	I_m	–	0.6 mA	–

Note: All data is presented as typical unless otherwise specified.

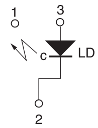
λ = 660 nm, P = 120 mW, Single Mode Hitachi HL6545MG

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	130 mW
Pulse Optical Output Power	$P_{O(pulse)}$	300 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
CW Operation Case Temperature	T_{cw}	-10 to +75 °C
Pulse Operation Case Temperature	$T_{(pulse)}$	-10 to +75 °C
Storage Temperature	T_{stg}	-40 to +85 °C

*Note: Pulse width = 30 ns, duty = 35%

Pin Description
1 no connection
2 laser cathode
3 laser anode



OPEN PIN CODE (Compatible with Styles B & C)

CAUTION: ELECTROSTATIC SENSITIVE

NEW product

- Ø5.6 mm Package
- 1 µm Astigmatism @ 5 mW
- 170 mA (Typ.) Operating Current

Characteristics (T_C = 25 °C, P = 120 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	55 mA	75 mA
Operation Current	I_{OP}	–	170 mA	210 mA
Operation Voltage	V_{OP}	2.45 V	2.6 V	3.0 V
Lasing Wavelength	λ_p	652 nm	660 nm	664 nm
Beam Divergence (FWHM)	θ//	7.5°	10°	12°
	θ⊥	15°	17°	19°
Astigmatism (P_O = 5 mW)	A_s	–	1 µm	–

Note: All data is presented as typical unless otherwise specified.

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6545MG	£ 50.03	€ 64,53	¥ 611.90

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6545MG	$ 72.50	$ 61.63	$ 50.75	Hitachi 660 nm, 120 mW

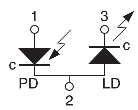
λ = 670 nm, P = 5 mW, Single Mode Hitachi HL6724MG

Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	5 mW
Optical Output Power (Pulse)	P_O	6 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

*Note: Pulse width ≤ 1 µs, duty ≤ 50%

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 5A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- AlGaInP Index-Guided Laser Diode With a Multi-Quantum Well (MQW) Structure
- Pulsed Optical Power of 6 mW with a 50% Duty Cycle and a Maximum Pulse Width of 1 µs @ 5 mW
- 5 µm Astigmatism @ 5 mW

Characteristics (T_C = 25 °C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	25 mA	35 mA
Operation Current	I_{op}	–	35 mA	50 mA
Operation Voltage	V_{op}	–	–	2.7 V
Lasing Wavelength	λp	660 nm	670 nm	680 nm
Beam Divergence (FWHM)	θ//	5°	8°	11°
	θ⊥	22°	30°	40°
Monitor Current	I_m	0.4 mA	0.9 mA	2 mA

Note: All data is presented as typical unless otherwise specified.

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6724MG	£ 15.77	€ 20,34	¥ 192.86

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6724MG	$ 22.85	$ 21.71	$ 19.43	Hitachi 670 nm, 5 mW

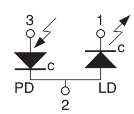
All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

λ = 670 nm, P = 5 mW, Single Mode Sanyo DL3149-057

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	7 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- AlGaInP Index-Guided MQW Structure
- 8 µm Astigmatism @ 7 mW
- High Operating Temperature of 5 mW at 60 °C

Characteristics (T_C = 25 °C, P = 5 mW)

Characteristic	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	25 mA	35 mA
Operating Current	I_{op}	–	40 mA	45 mA
Operating Voltage	V_{op}	–	2.3 V	2.6 V
Lasing Wavelength	λ_p	660 nm	670 nm	678 nm
Beam Divergence (FWHM)	θ//	6.5°	8°	10°
	θ⊥	25°	30°	35°
Monitor Current	I_m	0.5 mA	1.5 mA	2.0 mA

Note: All data is presented as typical unless otherwise specified.

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL3149-057	£ 10.56	€ 13,62	¥ 129.14

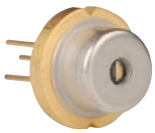
*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL3149-057	$ 15.30	$ 13.47	$ 10.26	Sanyo 670 nm, 5 mW

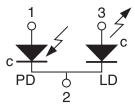
All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

λ = 670 nm, P =10 mW, Single Mode Hitachi HL6714G

CAUTION: ELECTROSTATIC SENSITIVE



Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 9A

- Ø9 mm Package
- AlGaInP Index-Guided Laser Diode with a Multi-Quantum Well (MQW) Structure
- Pulsed Optical Power 12 mW with a 50% Duty Cycle and a Maximum Pulse Width of 1 µs
- Single Longitudinal Mode
- Low Astigmatism at 10 µm (Typ.)

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6714G	£ 49.06	€ 63,28	¥ 600.09

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6714G	$ 71.10	$ 63.99	$ 56.88	Hitachi 670nm, 10mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
Optical Output Power (Pulse)	P_O	12 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

*Note: Pulse width ≤ 1 µs, duty ≤ 50%

Characteristics (T_C = 25 °C, P = 10 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	20 mA	35 mA	60 mA
Operating Current	I_{op}	–	55 mA	90 mA
Lasing Wavelength	λp	660 nm	670 nm	680 nm
Beam Divergence (FWHM)	θ//	5°	8°	11°
	θ⊥	18°	22°	30°
Monitor Current	I_m	0.3 mA	0.8 mA	1.5 mA

Note: All data is presented as typical unless otherwise specified

λ = 690 nm, P = 35 mW, Single Mode Hitachi HL6738MG

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	35 mW
Pulse Optical Output Power	$P_{O(pulse)}$	50 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 70 °C
Storage Temperature	T_{stg}	-40 to 85 °C

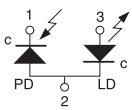
*Pulse width = 100 ns, duty cycle = 50%.

Characteristics (T_C = 25 °C, P = 30 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	30 mA	45 mA	70 mA
Operation Current	I_{op}	–	65 mA	95 mA
Operation Voltage	V_{op}	2.1 V	2.5 V	2.8 V
Lasing Wavelength	λp	680 nm	690 nm	695 nm
Beam Divergence (//)	θ//	7°	8.5°	10.5°
(FWHM)	θ⊥	17°	19°	23°
Monitor Current	I_m	0.02 mA	0.1 mA	0.45 mA

Note: All data is presented as typical unless otherwise specified

Pin Description
1 monitor diode cathode
2 common case
3 laser anode



PIN CODE 5C

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- AlGaInP Structure
- 6 µm Astigmatism @ 5 mW
- High Operating Temperature (70 °C)

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL6738MG	£ 38.02	€ 49,04	¥ 465.05

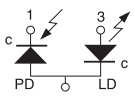
*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL6738MG	$ 55.10	$ 48.49	$ 44.08	Hitachi 690 nm, 35 mW

λ = 705 nm, P = 40 mW, Single Mode Hitachi HL7001MG

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 monitor diode cathode
2 common case
3 laser anode



PIN CODE 5C

- Ø5.6 mm Package
- InGaAsP Structure
- Single Longitudinal Mode
- Suitable for Medical Sensor Applications

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL7001MG	£ 479.55	€ 618,55	¥ 5,865.80

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL7001MG	$695.00	$ 590.75	$486.50	Hitachi 705 nm, 40 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	40 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 40 mW)

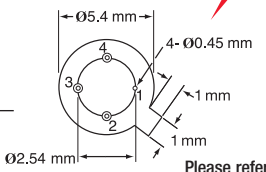
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	30 mA	60 mA
Operating Current	I_{op}	–	75 mA	100 mA
Operating Voltage	Vop	–	2.5 V	–
Lasing Wavelength	λp	695 nm	705 nm	715 nm
Beam Divergence	θ//	7°	9°	14°
(FWHM)	θ⊥	14°	18°	25°
Monitor Current	I_m	0.15 mA	0.30 mA	0.60 mA

Note: All data is presented as typical unless otherwise specified

λ = 780 nm, P = 1.65 mW, Multimode VCSEL-780

- Monitor Photodiode
- Flat Window Design
- Telecommunications and High-Speed Data Communications Applications
- 2.5 Gbps Speed
- Multimode

CAUTION: ELECTROSTATIC SENSITIVE



Pin Description
1 Case
2 VCSEL anode
3 VCSEL cathode/PD anode
4 PD cathode

Please refer to our website for complete models and drawings.

Characteristics (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION
Peak Wavelength	λ_p	770	780	795	nm	If = 8 mA @ RT
Spectral Width (FWHM)	Δλ	–	0.5	1	nm	If = 8 mA @ RT
Beam Divergence	θ	10	16	30	Deg	Full width at $1/e^2$; If = 8 mA @ RT
Forward Voltage	V_f	1.7	2.1	2.5	V	If = 8 mA @ RT
Threshold Current	I_{th}	0.5	1.5	3	mA	–
Slope Efficiency	ΔP/ΔI	0.12	0.24	0.4	W/A	If = 8 mA @ RT
Optical Output Power	P_{out}	–	1.65	–	mW	If = 8 mA @ RT
Dynamic Resistance	ΔV/ΔI	40	55	65	Ω	If = 8 mA @ RT
Reverse Breakdown Voltage	V_{br}	–	10	–	V	–
Monitor Current	I_m	100	–	–	µA	If = 8 mA @ RT
Dark Current	λ_r	–	0.2	1	nA	V_r = 10 V
Shunt Resistance	R_p	100	200	–	GΩ	–
Breakdown Voltage	V_{br}	–	50	–	V	–
Junction Capacitance	C_p	–	40	–	pF	@ V_r = 10 V, 10 kHz

Note: All data is presented as typical unless otherwise specified

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	MIN	MAX	CONDITION
Storage Temperature	-40 °C	100 °C	–
Operating Temperature	0 °C	70 °C	–
Continuous Forward Current	–	8 mA	–
Continuous Reverse Voltage	–	5 V	@ 10 µA

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
VCSEL-780	£ 16.77	€ 21,63	¥ 205.10

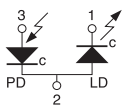
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
VCSEL-780	$ 24.30	$ 23.09	$ 20.66	780 nm VCSEL, 1.65 mW

*For quantities over 5 pieces, please call our local office for pricing.

λ = 780 nm, P = 10 mW, Single Mode Thorlabs L780P010

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size
- 0.3 mA (Typ.) Monitor Current

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 10 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	15 mA	35 mA	50 mA
Operation Current	I_{op}	25 mA	50 mA	70 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.3 mW/mA	0.5 mW/mA	0.7 mW/mA
Lasing Wavelength	λp	770 nm	780 nm	795 nm
Beam Divergence (//)	θ//	8°	10°	12°
(FWHM)	θ⊥	25°	30°	40°
Astigmatism	As	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1.0 mA

Note: All data is presented as typical unless otherwise specified

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L780P010	£ 15.12	€ 19,50	¥ 184.84

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L780P010	$ 21.90	$ 20.81	$ 18.62	Thorlabs 780 nm, 10 mW

λ = 785 nm, P = 25 mW, Single Mode Sanyo DL4140-001S

Absolute Maximum Ratings (T_C = 25 °C)

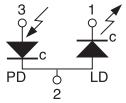
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	25 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 60 °C
Storage Temperature	T_{stg}	-20 to 85 °C

Characteristics (T_C = 25 °C, P = 20 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	30 mA	50 mA
Operation Current	I_{op}	–	65 mA	90 mA
Slope Efficiency	ηs	0.3 mW/mA	0.6 mW/mA	0.8 mW/mA
Lasing Wavelength	λp	776 nm	785 nm	800 nm
Beam Divergence	θ//	7°	9°	12°
(FWHM)	θ⊥	15°	25°	35°
Astigmatism	As	–	–	10 µm
Monitor Current	I_m	0.3	0.8	1.5 mA

Note: All data is presented as typical unless otherwise specified

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 30 mA (Typ.) Threshold Current
- 10 µm (Max) Astigmatism

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL4140-001S	£ 26.91	€ 34,71	¥ 329.16

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL4140-001S	$ 39.00	$ 34.32	$ 29.25	Sanyo 785 nm, 25 mW

λ = 785 nm, P = 50 mW, Single Mode Hitachi HL7851G

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	50 mW
Pulsed Optical Output Power	$P_{O(pulse)}$	60 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

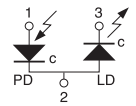
*Pulse condition: Pulse width ≤ 1 µs, Duty ≤ 50%

Characteristics (T_C = 25 °C, P = 50 mW)

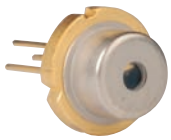
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	45 mA	70 mA
Operation Current	I_{op}	–	135 mA	165 mA
Operation Voltage	V_{op}	–	2.3 V	2.7 V
Lasing Wavelength	λp	775 nm	785 nm	795 nm
Beam Divergence (FWHM)	θ//	8°	9.5°	12°
	θ⊥	18°	23°	28°
Monitor Current (P = 5 mW)	I_m	30 µA	45 µA	150 µA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 monitor diode anode
2 common case
3 laser cathode



PIN CODE 9A



- Ø9 mm Package
- MQW Structure
- <5 µm (Typ.) Astigmatism @ 5 mW
- 9.5:23 Beam Ellipticity

CAUTION: ELECTROSTATIC SENSITIVE

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL7851G	£ 59.83	€ 77,17	¥ 731.75

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL7851G	$ 86.70	$ 82.37	$ 76.30	Hitachi 785 nm, 50 mW Laser Diode

λ = 785 nm, P = 70 mW, Single Mode Sanyo DL7140-201S

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	80 mW
Optical Output Power (Pulse)	P_O	85 mW*
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

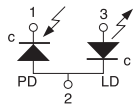
*Pulse condition: Pulse width ≤ 1 µs, Duty ≤ 50%

Characteristics (T_C = 25 °C, P= 70 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	30 mA	50 mA
Operation Current	I_{op}	–	100 mA	140 mA
Operation Voltage	V_{op}	–	2.0 V	2.8 V
Lasing Wavelength	λp	775 nm	785 nm	800 nm
Beam Divergence (FWHM)	θ//	6°	8°	10°
	θ⊥	15°	17°	20°
Monitor Current	I_m	0.1 mA	0.25 mA	0.6 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 monitor diode cathode
2 common case
3 laser anode



PIN CODE 5C

- Ø5.6 mm Package
- Single Mode Index-Guided Structure
- Operation Temperature of 60 °C @ 70 mW (CW)
- 10 µm Astigmatism @ 70 mW

CAUTION: ELECTROSTATIC SENSITIVE

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL7140-201S	£ 27.26	€ 35,16	¥ 333.38

*For quantities over 5 pieces, please call a local office for pricing.

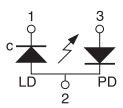
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL7140-201S	$ 39.50	$ 33.58	$ 25.68	Sanyo 785 nm, 70 mW

λ = 785 nm, P = 100 mW, Multimode Thorlabs L785P100

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 100 mW (CW) or 220 mW (Pulsed) Optical Output Power
- Multimode

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	100 mW
Optical Output Power (Pulse)*	P_{op}	220 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
Operating Temperature	Top	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

*Pulse Condition: Pulse width = 0.5 µs, duty = 50%.

Characteristics (T_C = 25 °C, P = 90 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	25 mA	35 mA	55 mA
Operation Current	I_{op}	90 mA	115 mA	160 mA
Operation Voltage	V_{op}	1.5 V	2.0 V	2.2 V
Slope Efficiency	ηs	0.8 mW/mA	1.1 mW/mA	1.3 mW/mA
Lasing Wavelength	λp	775 nm	785 nm	795 nm
Beam Divergence (FWHM)	θ//	8°	9°	10°
	θ⊥	15°	17°	19°
Monitor Current	I_m	0.1 mA	0.5 mA	0.7 mA

Note: All data is presented as typical unless otherwise specified.

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L785P100	£ 26.91	€ 34,71	¥ 329.16

*For quantities over 5 pieces, please call a local office for pricing.

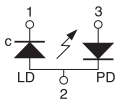
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L785P100	$ 39.00	$ 35.10	$ 30.42	Thorlabs 785 nm, 100 mW

λ = 808 nm, P = 10 mW, Single Mode Thorlabs L808P010

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size
- 11 µm Astigmatism

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L808P010	£ 13.39	€ 17,27	¥ 163.74

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L808P010	$ 19.40	$ 18.43	$ 16.49	Thorlabs 808 nm, 10 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 10 mW)

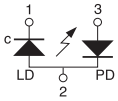
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	10 mA	25 mA	40 mA
Operation Current	I_{op}	25 mA	50 mA	70 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.3 mW/mA	0.5 mW/mA	0.7 mW/mA
Lasing Wavelength	λp	795 nm	808 nm	815 nm
Beam Divergence	θ//	8°	10°	12°
(FWHM)	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1.0 mA

λ = 808 nm, P = 30 mW, Single Mode Thorlabs L808P030

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size
- 11 µm Astigmatism

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L808P030	£ 51.00	€ 65,78	¥ 623.72

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L808P030	$ 73.90	$ 70.21	$ 62.82	Thorlabs 808 nm, 30 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	30 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 30 mW)

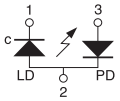
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	30 mA	50 mA	70 mA
Operation Current	I_{op}	40 mA	100 mA	150 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.5 mW/mA	0.7 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	795 nm	808 nm	820 nm
Beam Divergence	θ//	8°	10°	12°
(FWHM)	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1 mA

λ = 808 nm, P = 200 mW, Multimode Thorlabs L808P200

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 40 µm Emitter Size
- Multimode

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L808P200	£ 41.96	€ 54,12	¥ 513.16

*For quantities over 5 pieces, please call our local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L808P200	$ 60.80	$ 57.76	$ 51.68	Thorlabs 808 nm, 200 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	200 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 200 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	60 mA	80 mA	100 mA
Operation Current	I_{op}	220 mA	260 mA	300 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.5 mW/mA	0.7 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	805 nm	808 nm	811 nm
Beam Divergence	θ//	8°	10°	12°
(FWHM)	θ⊥	25°	30°	40°
Monitor Current	I_m	0.5 mA	1.3 mA	2.0 mA

All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

λ = 808 nm, P = 1 Watt, Multimode Thorlabs L808P1WJ

Absolute Maximum Ratings (T_C = 25 °C)

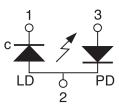
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	1 W
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
Operating Temperature	T_{op}	-20 to 40 °C
Storage Temperature	T_{stg}	-40 to 80 °C

Characteristics (T_C = 25 °C, P = 1 W)

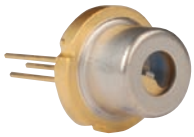
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	1 A	1.2 A
Operating Current	I_{op}	–	1.9 A	2.5 A
Operating Voltage	V_{op}	–	1.65 V	2.0 V
Slope Efficiency	ηs	0.8 W/A	1.2 W/A	–
Lasing Wavelength	λp	798 nm	808 nm	818 nm
Beam Divergence	θ//	5°	8°	11°
(FWHM)	θ⊥	30°	35°	40°
Monitor Current	I_m	0.1 mA	–	10 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A



CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- Single Emitter
- 1 x 100 µm Emitter Size
- Patented Device Structure
- Multimode

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L808P1WJ	£ 250.20	€ 322,72	¥ 3,060.40

*For quantities over 5 pieces, please call our local office for pricing.

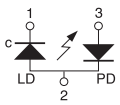
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L808P1WJ	$ 362.60	$ 326.34	$ 290.08	Thorlabs 808 nm, 1 W

λ = 830 nm, P = 30 mW, Single Mode Sanyo DL5032-001

CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- 30 mA (Typ.) Threshold Current
- 30 mW Output Power
- Single Transverse Mode
- 10 µm Astigmatism

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Light Output (CW)	P_O	40 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{opr}	-10 to +60 °C
Storage Temperature	T_{stg}	-40 to +80 °C

Characteristics (T_C = 25 °C, P = 30 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	20 mA	30 mA	40 mA
Operation Current	I_{op}	–	60 mA	90 mA
Operation Voltage	V_{op}	–	1.9 V	2.5 V
Lasing Wavelength	λp	810 nm	830 nm	840 nm
Beam Divergence	θ//	5°	7.5°	10°
(FWHM)	θ⊥	15°	18°	23°
Monitor Current	I_m	0.05 mA	0.1 mA	–
Astigmatism	A_s	–	–	10 µm

Note: All data is presented as typical unless otherwise specified.

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL5032-001	£ 66.24	€ 85,44	¥ 810.24

*For quantities over 5 pieces, please call a local office for pricing.

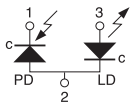
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL5032-001	$ 96.00	$ 81.60	$ 62.40	Sanyo 830 nm, 30 mW

λ = 830 nm, P = 40 mW, Single Mode Hitachi HL8325G

CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- GaAlAs Triple Quantum Well Structure
- Pulsed Optical Power 50 mW with a 50% Maximum Duty Cycle and a Maximum Pulse Width of 1µs
- Single Longitudinal Mode

Pin Description
1 monitor diode cathode
2 common case
3 laser anode



PIN CODE 9C

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	40 mW
Pulse Optical Output Power*	P_O	50 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_c	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

*Pulse Condition: Pulse width = 1 µs, duty = 50%.

Characteristics (T_C = 25 °C, P = 40 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	40 mA	70 mA
Operation Current	I_{op}	–	120 mA	–
Slope Efficiency	ηs	0.4 mW/mA	0.5 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	820 nm	830 nm	840 nm
Beam Divergence	θ//	7°	10°	14°
(FWHM)	θ⊥	18°	22°	32°
Monitor Current (P=4 mW)	I_m	20 µA	40 µA	130 µA

Note: All data is presented as typical unless otherwise specified.

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
HL8325G	£ 129.59	€ 167,15	¥ 1,585.10

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
HL8325G	$ 187.80	$ 159.63	$ 131.46	Hitachi 830 nm, 40 mW

Optical Power Meters

See Page 1265

λ = 830 nm, P = 100 mW, Single Mode Sanyo DL7032-001

Absolute Maximum Ratings (T_C = 25 °C)

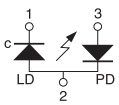
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	100 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	15 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 100 mW)

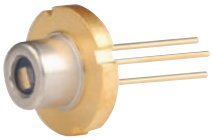
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	50 mA	70 mA
Operation Current	I_{op}	–	140 mA	180 mA
Operating Voltage	V_{op}	–	1.9 V	2.4 V
Lasing Wavelength	λp	810 nm	830 nm	840 nm
Slope Efficiency	ηs	0.6 mW/ mA	1 mW/mA	1.3mW/ mA
Beam Divergence (FWHM)	θ//	5°	7°	11°
	θ⊥	12°	18°	23°
Monitor Current	I_m	0.05 mA	0.3 mA	–
Astigmatism	A_s	–	10 µm	–

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A



CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- Single Longitudinal Mode
- 100 mW @ 50 °C High Output Power
- 140 mA (Typ.) Operating Current
- 10 µm Astigmatism

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL7032-001	£ 210.11	€ 271,01	¥ 2,569.98

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL7032-001	$ 304.50	$ 258.83	$ 213.15	Sanyo 830 nm, 100 mW

λ = 830 nm, P = 150 mW, Single Mode Sanyo DL8142-201

Absolute Maximum Ratings (T_C = 25 °C)

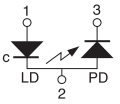
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	180 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 150 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	50 mA	70 mA
Operation Current	I_{op}	–	200 mA	250 mA
Operation Voltage	V_{op}	–	1.9 V	2.2 V
Lasing Wavelength	λp	815 nm	830 nm	840 nm
Beam Divergence (FWHM)	θ//	5°	8°	11°
	θ⊥	12°	16°	25°
Slope Efficiency	ηs	0.7 mW/ mA	1 mW mA	–
Monitor Current	I_m	0.15 mA	0.4 mA	1.0 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser anode
2 common case
3 monitor diode cathode



PIN CODE 5C

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- 150 mW @ 50 °C Power Output
- <150 mW CW Recommended Usage
- 50 mA (Typ.) Threshold Current

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
DL8142-201	£ 229.10	€ 295,50	¥ 2,802.10

*For quantities over 5 pieces, please call a local office for pricing.

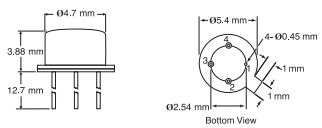
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
DL8142-201	$ 332.00	$ 315.40	$ 298.80	Sanyo 830 nm, 150 mW

λ = 845 nm, P = 1.85 mW, Multimode VCSEL-850

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 Case
2 LD anode
3 LD cathode/PD anode
4 PD Cathode

- Flat Window
- Monitor Photodiode
- High Speed 2.5Gbps
- Multimode



Please refer to our website for complete models and drawings.

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	MIN	MAX	UNIT	CONDITION
Storage Temperature	-40	100	°C	–
Operating Temperature	0	85	°C	–
Continuous Forward Current	–	10	mA	–
Continuous Reverse Voltage	–	5	V	@ 10 A

Characteristics (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	MIN	TYP	MAX	UNIT
Peak Wavelength*	λp	830	845	860	nm
Spectral Width (RMS)*	Δλ	–	–	0.85	nm
Beam Divergence	θ	–	25	30	Deg
Forward Voltage*	V_f	1.7	1.9	2.2	V
Threshold Current	I_{th}	–	2.2	3	mA
Slope Efficiency*	ηs	0.12	0.32	0.4	W/A
Optical Output Power*	P_{out}	–	1.85	–	mW
Dynamic Resistance*	ΔV/ΔI	20	40	65	Ω
Rise / Fall Time	t_r / t_f	–	50	100	ps
Operating Temp. Range	T_{op}	–5	25	80	°C
Monitor Current	I_m	100	–	–	mA
Dark Current (V_r = 10 V)	I_r	–	0.2	1	nA
Shunt Resistance	P_p	100	200	–	G Ω
Breakdown Voltage	V_{br}	–	50	–	V
Junction Capacitance (@ Vr = 10 V, 10 kHz)	C_p	–	40	–	pF

*Forward current = 8 mA@RT Note: All data is presented as typical unless otherwise specified

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
VCSEL-850	$ 28.90	$ 27.46	$ 26.01	845 nm VCSEL, 1.85 mW

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
VCSEL-850	£ 19.95	€ 25,73	¥ 243.92

*For quantities over 5 pieces, please call a local office for pricing.

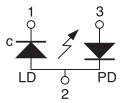
Optical Filter Wheels

See Page 277

λ = 850 nm, P = 10 mW, Single Mode Thorlabs L850P010

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 11 µm (Typ.) Astigmatism
- 1 x 5 µm Emitter Size

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L850P010	£ 15.12	€ 19,50	¥ 184.84

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L850P010	$ 21.90	$ 19.71	$ 17.52	Thorlabs 850 nm, 10 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 10 mW)

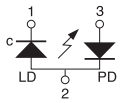
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	10 mA	25 mA	40 mA
Operation Current	I_{op}	25 mA	50 mA	70 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.3 mW/mA	0.5 mW/mA	0.7 mW/mA
Lasing Wavelength	λp	835nm	850 nm	865 nm
Beam Divergence (FWHM)	θ//	8°	10°	12°
	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1 mA

Note: All data is presented as typical unless otherwise specified.

λ = 850 nm, P = 30 mW, Single Mode Thorlabs L850P030

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size
- 15 µm (Max) Astigmatism

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L850P030	£ 56.93	€ 73,43	¥ 696.30

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L850P030	$ 82.50	$ 74.25	$ 66.00	Thorlabs 850 nm, 30 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	30 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 60 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 30 mW)

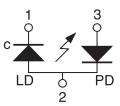
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	20 mA	35 mA
Operation Current	I_{op}	–	65 mA	95 mA
Operation Voltage	V_{op}	–	2.0 V	2.5 V
Slope Efficiency	ηs	0.4 mW/mA	0.7 mW/mA	1.0 mW/mA
Lasing Wavelength	λp	840 nm	850 nm	860 nm
Beam Divergence (FWHM)	θ//	7°	8.5°	12°
	θ⊥	23°	30°	35°
Astigmatism	A_s	–	–	15 µm
Monitor Current	I_m	–	0.2 mA	0.5 mA

Note: All data is presented as typical unless otherwise specified.

λ = 850 nm, P = 100 mW, Multimode Thorlabs L850P100

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- Multimode
- 1 x 40 µm Emitter Size
- 11 µm (Typ.) Astigmatism

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L850P100	£ 66.59	€ 85,89	¥ 814.46

*For quantities over 5 pieces, please call a local office for pricing.

ITEM #	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L850P100	$ 96.50	$ 86.85	$ 77.20	Thorlabs 850 nm, 100 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	100 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 100 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	50 mA	70 mA	90 mA
Operation Current	I_{op}	150 mA	200 mA	350 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.5 mW/mA	0.7 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	835 nm	850 nm	865 nm
Beam Divergence (FWHM)	θ//	8°	10°	12°
	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.1 mA	0.3 mA	1.5 mA

Note: All data is presented as typical unless otherwise specified.

λ = 904 nm, P = 10 mW, Single Mode Thorlabs L904P010

Absolute Maximum Ratings (T_C = 25 °C)

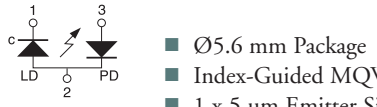
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 10 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	10 mA	25 mA	40 mA
Operation Current	I_{op}	25 mA	50 mA	70 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.3 mW/mA	0.5 mW/mA	0.7 mW/mA
Lasing Wavelength	λp	890 nm	904 nm	920 nm
Beam Divergence (//)	θ//	8°	10°	12°
(FWHM)	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1.0 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size
- 11 µm (Typ.) Astigmatism

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L904P010	£ 16.70	€ 21,54	¥ 204.25

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L904P010	$ 24.20	$ 21.78	$ 19.36	Thorlabs 904 nm, 10 mW

λ = 904 nm, P = 30 mW, Single Mode Thorlabs L904P030

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	30 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 30 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	30 mA	50 mA	70 mA
Operation Current	I_{op}	40 mA	100 mA	150 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.5 mW/mA	0.7 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	890 nm	904 nm	920 nm
Beam Divergence (//)	θ//	8°	10°	12°
(FWHM)	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1.0 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode

PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size
- 11 µm (Typ.) Astigmatism

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L904P030	£ 55.55	€ 71,65	¥ 679.42

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L904P030	$ 80.50	$ 72.45	$ 64.40	Thorlabs 904 nm, 30 mW

λ = 915 nm, P = 1W, Multimode Thorlabs L915P1WJ

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	1W
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
Operating Temperature	T_{op}	-20 to 40 °C
Storage Temperature	T_{stg}	-40 to 80 °C

Optical-Electrical Characteristics (T_C = 25 °C, P = 1 W)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	0.47 A	0.65 A
Operation Current	I_{op}	–	1.6 A	1.85 A
Operation Voltage	V_{op}	–	1.4 V	1.8 V
Slope Efficiency	ηs	0.85 W/A	1.0 W/A	–
Lasing Wavelength	λp	905 nm	915 nm	925 nm
Beam Divergence	θ//	3°	5°	7°
(FWHM)	θ⊥	28°	32°	36°
Monitor Current	I_m	0.1 mA	–	10 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode

PIN CODE 9A

- Ø9 mm Package
- Multimode
- 1 x 100 µm Emitter Size
- Patend Device Structure, F000038US01

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L915P1WJ	£ 255.10	€ 329,00	¥ 3,119.50

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L915P1WJ	$ 369.60	$ 332.64	$ 295.68	Thorlabs 915 nm, 1 W

Polarization Measurement Tools

See Page 1323

All laser diodes are extremely electrostatic sensitive; see page 1244 for our selection of antistatic products.

λ = 975 nm, P = 1 W, Multimode Thorlabs L975P1WJ

Absolute Maximum Ratings (T_C = 25 °C)

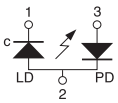
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	1 W
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
Operating Temperature	T_{op}	-20 to 40 °C
Storage Temperature	T_{stg}	-40 to 80 °C

Characteristics (T_C = 25 °C, P = 1 W)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	0.35 A	0.45 A
Operation Current	I_{op}	–	1.5 A	1.8 A
Operation Voltage	V_{op}	–	1.4 V	2.0 V
Slope Efficiency	ηs	0.75 mW/A	0.85 mW/A	–
Lasing Wavelength	λp	965 nm	975 nm	985 nm
Beam Divergence (FWHM)	θ//	2°	5°	8°
	θ⊥	30°	35°	40°
Monitor Current	I_m	0.1 mA	–	10 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- Multimode
- 1 x 100 µm Emitter Size
- Patented Device Structure, F000038US01

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L975P1WJ	£ 260.48	€ 335,98	¥ 3,186.10

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L975P1WJ	$377.50	$ 339.75	$ 302.00	Thorlabs 975 nm, 1 W

λ = 980 nm, P = 1.85 mW, Multimode VCSEL-980

Absolute Maximum Ratings

CHARACTERISTIC	MIN	MAX	UNIT	CONDITION
Storage Temperature	–40	100	°C	–
Operating Temperature	0	85	°C	–
Continuous Forward Current	–	10	mA	–
Continuous Reverse Voltage	–	5	V	@ 10 A

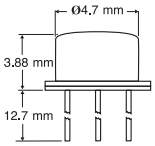
Characteristics (T_C = 25 °C, I_f = 8 mA)

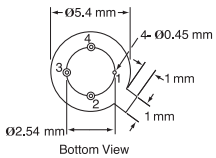
PARAMETER	SYMBOL	MIN	TYP	MAX
Peak Wavelength	λp	970 nm	980 nm	990 nm
Spectral Width (RMS)	Δλ	–	–	0.85 nm
Beam Divergence	θ	–	25°	30°
Forward Voltage	V_f	1.7 V	1.9 V	2.2 V
Threshold Current	I_{th}	–	2.2 mA	3 mA
Slope Efficiency	ΔP/ΔI	0.12 W/A	0.32W/A	0.4 W/A
Optical Output Power	P_O	–	1.85 mW	–
Dynamic Resistance	dV/dI	20 Ω	40 Ω	65 Ω
Rise / Fall Time	t_r / t_f	–	50 ps	100 ps
Jitter p-p	ti	–	35 ps	–
λp Temperature Coefficient	Δλp/ΔT	–	0.06 nm/°C	–
Operating Temp. Range	T_{op}	–5 °C	25 °C	80 °C
Monitor Current	I_m	100 µA	–	–

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 Case
2 LD anode
3 LD cathode/PD anode
4 PD cathode

CAUTION: ELECTROSTATIC SENSITIVE





Please refer to our website for complete models and drawings.

- Multimode
- Flat Window
- Monitor Photodiode
- 2.5 Gbps Speed

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
VCSEL-980	£ 17.19	€ 22,17	¥ 210.16

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
VCSEL-980	$ 24.90	$ 22.41	$ 19.92	980 nm VCSEL, 1.85mW

λ = 980 nm, P = 10 mW, Single Mode Thorlabs L980P010

Absolute Maximum Ratings (T_C = 25 °C)

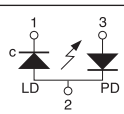
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 10 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	10 mA	25 mA	40 mA
Operation Current	I_{op}	25 mA	50 mA	70 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.3 mW/mA	0.5 mW/mA	0.7 mW/mA
Lasing Wavelength	λp	965 nm	980 nm	995 nm
Beam Divergence (FWHM)	θ//	8°	10°	12°
	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.05 mA	0.3 mA	1 mA

Note: All data is presented as typical unless otherwise specified.

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

CAUTION: ELECTROSTATIC SENSITIVE

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L980P010	£ 17.53	€ 22,61	¥ 214.38

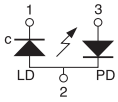
*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L980P010	$ 25.40	$ 24.13	$ 21.59	Thorlabs 980 nm, 10 mW

λ = 980 nm, P = 30 mW, Single Mode Thorlabs L980P030

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 5 µm Emitter Size

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L980P030*	£ 56.93	€ 73,43	¥ 696.30

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L980P030	$ 82.50	$ 74.25	$ 66.00	Thorlabs 980 nm, 30 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	30 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 30 mW)

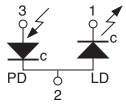
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	30 mA	50 mA	70 mA
Operation Current	I_{op}	40 mA	100 mA	150 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.5 mW/mA	0.7 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	965 nm	980 nm	995 nm
Beam Divergence (FWHM)	θ//	8°	10°	12°
	θ⊥	25°	30°	40°
Monitor Current	I_m	0.05 mA	0.3 mA	1 mA

Note: All data is presented as typical unless otherwise specified.

λ = 980 nm, P = 50 mW, Single Mode Thorlabs L9805E2P5

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- 980 nm (Typ.) Lasing Wavelength
- 50 mW Output Power (CW)
- Index-Guided Structure
- Single Transverse Mode

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L9805E2P5	£ 154.08	€ 198,74	¥ 1,884.66

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L9805E2P5	$ 223.30	$ 200.97	$ 178.64	Thorlabs 980 nm, 50 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	50 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operation Case Temperature	T_C	-10 to +60 °C
Storage Temperature	T_{stg}	-40 to +85 °C

Characteristics (T_C = 25 °C, P = 50 mW)

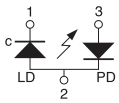
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	10 mA	15 mA	30 mA
Operation Current	I_{op}	–	95 mA	120 mA
Operation Voltage	V_{op}	–	1.5 V	1.7 V
Lasing Wavelength	λp	970 nm	980 nm	983 nm
Slope Efficiency	hs	0.5 mW/mA	0.7 mW/mA	1 mW/mA
Beam Divergence (FWHM)	θ//	7°	8°	12°
	θ⊥	30°	33°	38°
Monitor Current	I_m	–	0.75 mA	1.0 mA

Note: All data is presented as typical unless otherwise specified.

λ = 980 nm, P = 100 mW, Multimode Thorlabs L980P100

CAUTION: ELECTROSTATIC SENSITIVE

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 5A

- Ø5.6 mm Package
- Index-Guided MQW Structure
- 1 x 40 µm Emitter Size
- Multimode

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L980P100	£ 68.38	€ 88,20	¥ 836.41

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L980P100	$ 99.10	$ 89.19	$ 79.28	Thorlabs 980 nm, 100 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	100 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	30 V
Operating Temperature	T_{op}	-10 to 50 °C
Storage Temperature	T_{stg}	-40 to 85 °C

Characteristics (T_C = 25 °C, P = 100 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	35 mA	50 mA	70 mA
Operation Current	I_{op}	100 mA	200 mA	300 mA
Operation Voltage	V_{op}	1.8 V	2.0 V	2.5 V
Slope Efficiency	ηs	0.5 mW/mA	0.7 mW/mA	0.9 mW/mA
Lasing Wavelength	λp	965 nm	980 nm	995 nm
Beam Divergence (FWHM)	θ//	8°	10°	12°
	θ⊥	25°	30°	40°
Astigmatism	A_s	–	11 µm	–
Monitor Current	I_m	0.5 mA	2 mA	3 mA

Note: All data is presented as typical unless otherwise specified.

Fiber-Coupled Laser Sources

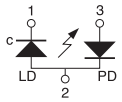
See Page 1580

λ = 980 nm, P = 200 mW, Single Mode Thorlabs L980P200J

CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- 0.85 mW/mA (Typ.) Slope Efficiency
- Single Transverse Mode
- Patented Device Structure, F000038US01

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L980P200J	£ 341.49	€ 440,47	¥ 4,176.96

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L980P200J	$ 494.90	$ 445.41	$ 395.92	Thorlabs 980 nm, 200 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power	P_O	200 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
Operating Temperature	T_{op}	-20 to 40 °C
Storage Temperature	T_{stg}	-40 to 80 °C

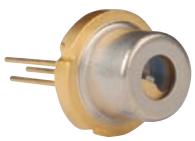
Characteristics (T_C = 25 °C, P= 200 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	90 mA	130 mA
Operating Current	I_{op}	–	320 mA	390 mA
Operating Voltage	V_{op}	–	1.4 V	2.0 V
Slope Efficiency	ηs	0.75 mW/mA	0.85 mW/mA	–
Lasing Wavelength	λp	970 nm	980 nm	990 nm
Beam Divergence (FWHM)	θ//	4°	7°	10°
	θ⊥	25°	30°	35°
Monitor Current	I_m	0.1 mA	–	10 mA

Note: All data is presented as typical unless otherwise specified.

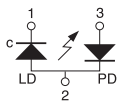
λ = 980 nm, P = 300 mW, Single Mode Thorlabs L980P300J

CAUTION: ELECTROSTATIC SENSITIVE



- Ø9 mm Package
- 0.85 mW/mA (Typ.) Slope Efficiency
- Single Transverse Mode
- Patented Device Structure, F000038US01

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L980P300J	£ 407.80	€ 526,00	¥ 4,987.20

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L980P300J	$ 590.90	$ 561.36	$ 502.27	Thorlabs 980 nm, 300 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power	P_O	300 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(LD)}$	20 V
Operating Temperature	T_{op}	-20 to 40 °C
Storage Temperature	T_{stg}	-40 to 80 °C

Characteristics (T_C = 25 °C, P = 300 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	90 mA	130 mA
Operating Current	I_{op}	–	440 mA	530 mA
Operating Voltage	V_{op}	–	1.45 V	2.0 V
Slope Efficiency	ηs	0.75 mW/mA	0.85 mW/mA	–
Lasing Wavelength	λp	970 nm	980 nm	990 nm
Beam Divergence (FWHM)	θ//	4°	7°	10°
	θ⊥	25°	30°	35°
Monitor Current	I_m	0.1 mA	–	10 mA

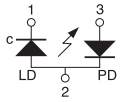
Note: All data is presented as typical unless otherwise specified.

λ = 1060 nm, P = 100 mW, Single Mode Thorlabs L1060P100J

CAUTION: ELECTROSTATIC SENSITIVE

- Ø9 mm Package
- 0.85 mW/mA (Typ.) Slope Efficiency
- Single Transverse Mode
- Patented Device Structure, F000038US01

Pin Description
1 laser cathode
2 common case
3 monitor diode anode



PIN CODE 9A

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
L1060P100J	£ 525.30	€ 677,56	¥ 6,425.38

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
L1060P100J	$ 761.30	$ 685.17	$ 609.04	Thorlabs 1060 nm, 100 mW

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power	P_O	100 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(LD)}$	20 V
Operating Temperature	T_{op}	-20 to 40 °C
Storage Temperature	T_{stg}	-40 to 80 °C

Characteristics (T_C = 25 °C, P = 100 mW)

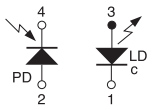
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	50 mA	80 mA
Operating Current	I_{op}	–	165 mA	200 mA
Operating Voltage	V_{op}	–	1.35 V	2.0 V
Slope Efficiency	ηs	0.7 mW/mA	0.85 mW/mA	–
Lasing Wavelength	λp	1040 nm	1060 nm	1080 nm
Beam Divergence (FWHM)	θ//	4°	7°	10°
	θ⊥	25°	30°	35°
Monitor Current	I_m	0.1 mA	–	10 mA

Note: All data is presented as typical unless otherwise specified.

λ = 1310 nm, P = 10 mW DFB, Mitsubishi ML725B11F

- Ø5.6 mm Package
- Well Suited as Light Source for Long-Distance Digital Transmission Systems
- Hermetically Sealed Device
- High Side Mode Suppression Ratio (40 dB Typ.)
- DFB (Distributed Feedback)

Pin Description
1 laser cathode
2 monitor diode anode
3 case/laser anode
4 monitor diode cathode



PIN CODE 5D

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
ML725B11F	£ 167.19	€ 215,65	¥ 2,045.10

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
ML725B11F	$ 242.30	$ 218.07	$ 193.84	Mitsubishi 1310 nm, 10 mW, DFB

Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
Operation Case Temperature	T_C	-40 to +85 °C
Storage Temperature	T_{stg}	-40 to +100 °C

Characteristics (T_C = 25 °C, P = 5 mW)

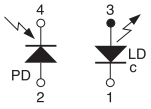
CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	6 mA	12 mA
Operation Current	I_{op}	–	16 mA	30 mA
Operation Voltage	V_{op}	–	1.1 V	1.5 V
Lasing Wavelength	λp	1290 nm	1310 nm	1330 nm
Beam Divergence (FWHM)	θ//	–	25°	35°
	θ⊥	–	30°	40°
Monitor Current	Im	0.05 mA	0.2 mA	–
Side Mode Suppression Ratio	SMSR	35 dB	40 dB	–

Note: All data is presented as typical unless otherwise specified.

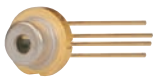
λ = 1550 nm, P = 6 mW, Single Mode Mitsubishi ML925B45F

- Ø5.6 mm Package
- MQW Active Layer
- 10 mA (Typ.) Threshold Current
- 30 mA (Typ.)Operating Current

Pin Description
1 laser cathode
2 monitor diode anode
3 case/laser anode
4 monitor diode cathode



PIN CODE 5D



Characteristics (T_C = 25° C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	3 mA	10 mA	20 mA
Operation Current	I_{op}	10 mA	30 mA	50 mA
Operation Voltage	V_{op}	–	1.1 V	1.5 V
Slope Efficiency	ηs	0.15 mW/mA	0.25 mW/mA	0.5 mW/mA
Lasing Wavelength	λp	1520 nm	1550 nm	1580 nm
Spectral Width(RMS)	Δλ	–	1.5 nm	3 nm
Beam Divergence (//)	θ//	–	25°	–
Beam Divergence (⊥)	θ⊥	–	30°	–
Rise and Fall Time	tr / tf	–	0.3 ns	0.7 ns
Monitoring Output	I_m	0.1 mA	0.5 mA	1 mA
PD Dark Current	I_D	–	_	0.1 µA
PD Capacitance	C_t	–	10 pF	20 pF

Note: All data is presented as typical unless otherwise specified.

Absolute Maximum Ratings (T_C = 25 °C)

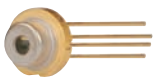
CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	6 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
PD Forward Current	I_{FD}	2 mA
Operation Case Temperature	T_C	-40 to 85 °C
Storage Temperature	T_{stg}	-40 to 100 °C

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
ML925B45F	£ 31.74	€ 40,94	¥ 388.24

*For quantities over 5 pieces, please call a local office for pricing.

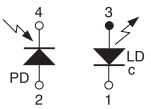
ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
ML925B45F	$ 46.00	$ 39.10	$ 32.20	Mitsubishi 1550 nm, 6 mW

λ = 1550 nm, P = 10 mW DFB, Mitsubishi ML925B11F



- Ø5.6 mm Package
- InGaAsP MQW, DFB (Multiple Quantum Well Distributed Feedback) Structure
- Fast Response Time (0.1 ns Typical Risetime, 0.2 ns Maximum Falltime)
- Side Mode Suppression Ratio 40 dB (Typ.) (35 dB Min) @ 5 mW

Pin Description
1 laser cathode
2 monitor diode anode
3 case/laser anode
4 monitor diode cathode



PIN CODE 5D

ITEM#	£* 1-5 PCS	€* 1-5 PCS	RMB* 1-5 PCS
ML925B11F	£ 171.81	€ 221,61	¥ 2,101.56

*For quantities over 5 pieces, please call a local office for pricing.

ITEM#	PRICE 1-5 PCS	PRICE 6-10 PCS	PRICE 11-20 PCS	DESCRIPTION
ML925B11F	$ 249.00	$ 211.65	$ 174.30	Mitsubishi 1550 nm, 10 mW

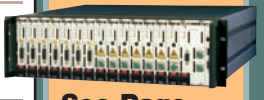
Absolute Maximum Ratings (T_C = 25 °C)

CHARACTERISTIC	SYMBOL	RATING
Optical Output Power (CW)	P_O	10 mW
LD Reverse Voltage	$V_{R(LD)}$	2 V
PD Reverse Voltage	$V_{R(PD)}$	20 V
Operation Case Temperature	T_C	-40 to 85 °C
Storage Temperature	T_{stg}	-40 to 100 °C

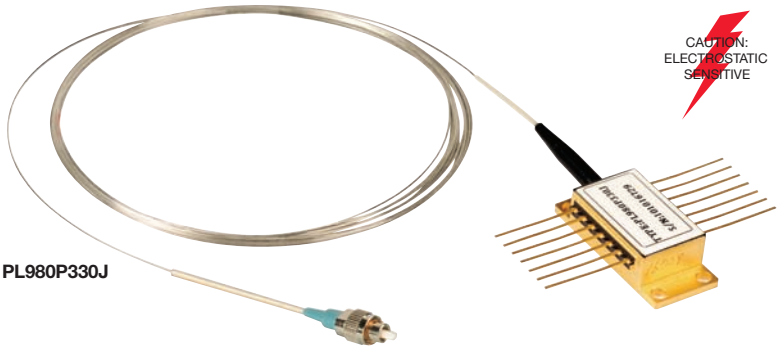
Characteristics (T_C = 25 °C, P = 5 mW)

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX
Threshold Current	I_{th}	–	8 mA	15 mA
Operation Current	I_{op}	–	25 mA	40 mA
Operation Voltage	V_{op}	–	1.1 V	1.5 V
Lasing Wavelength	λp	1530 nm	1550 nm	1570 nm
Beam Divergence (FWHM)	θ//	–	25°	35°
	θ⊥	–	35°	45°
Monitor Current	I_m	0.05 mA	0.2 mA	–
Side Mode Suppression Ratio	SMSR	35 dB	40 dB	–

Note: All data is presented as typical unless otherwise specified.

Laser Diode Banks

See Page 1068

980 nm, Fiber Bragg Grating-Stabilized, 330 mW Pump Laser (Page 1 of 2)



PL980P330J

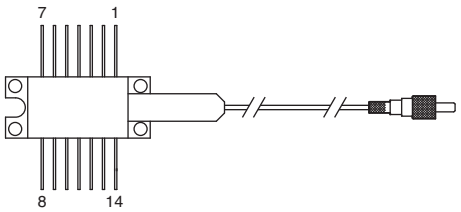
Features

- 330 mW at Fiber Output
- Fiber Bragg Grating Wavelength Stabilized
- Internal Thermoelectric Cooler and Photodiode Monitor
- Compact, Low-Profile 14-Pin Butterfly Package
- Patented Device Structure: F000038US01
- Telecordia GR-468-CORE Qualified

Applications

- Fiber Laser Pump
- EDFAs

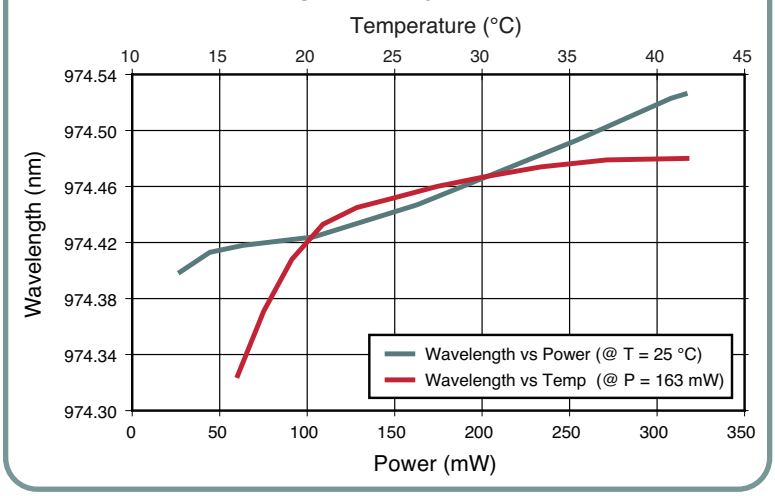
The PL980P330J consists of a field-proven, 980 nm, patented quantum-well laser chip in a 14-pin butterfly package with an integrated thermoelectric cooler and monitor photodiode. The compact design includes a fiber Bragg grating (FBG) that provides reliable wavelength-stabilized operation. The laser is coupled into a single mode Fiber Pigtail with an FC/APC connector.



Mechanical Drawings Available on the WEB

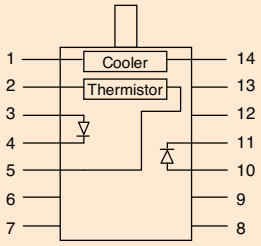
Compatible with LM14S2 Butterfly Mount Using Type 1 Adapter Card (See Page 1216)

Wavelength Stability of PL980P330J



ABSOLUTE MAXIMUM RATINGS	MIN	MAX
Storage Temperature	-40 °C	85 °C
Operating Case Temperature	-20 °C	70 °C
Soldering Temperature. (10 s, Max)	–	260 °C
LD Forward Current	–	800 mA
LD Reverse Voltage	–	2 V
Monitor Forward Current	–	5 mA
Monitor Reverse Current	–	20 V
ESD Damage	–	500 V
Fiber Pigtail Bend Radius	25 mm	–

Pin Connection Drawing



1	Cooler(+)	14	Cooler(-)
2	Thermistor	13	Case ground
3	PD Anode	12	NC
4	PD Cathode	11	Laser Cathode
5	Thermistor	10	Laser Anode
6	NC	9	NC
7	NC	8	NC

980 nm, Fiber Bragg Grating-Stabilized, 330 mW Pump Laser (Page 2 of 2)

PARAMETER	CONDITION	MIN	TYP	MAX
Operating Power (P_{OP})	–	–	–	330 mW
Operating Current (I_{OP})	–	–	–	720 mA
Free Power (Pk)	–	–	–	>363 mW
Kink Free Current (Ik)	–	–	–	>792 mA
ELECTRICAL/OPTICAL CHARACTERISTICS				
Threshold Current	–	–	75 mA	90 mA
Forward Voltage	at I_{op}	–	1.7 V	1.9 V
Peak Wavelength	as Specified ±1 nm	–	975 nm	–
Spectral Width (95% power)	at P_{op} with FBG			2.0 nm
Spectral Shift with Temperature	FBG Temp	–	–	0.02 nm/°C
Side Mode Suppression	at P_{op} with FBG	-13 dB	–	–
Monitor Responsivity	–	1 A/mW	3 A/mW	20 A/mW
TEC Current	Chip 25 °C, Case 70 °C	–	–	1.8 A
TEC Voltage	Chip 25 °C, Case 70 °C	–	–	3.0 V
Thermistor Resistance	T= 25 °C	–	10 kΩ	–
Thermistor Constant	–	–	3892 K	–
Fiber Type	HI1060, Single Mode	–	–	–

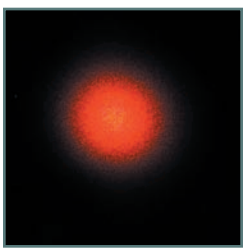
ITEM#	$	£	€	RMB	DESCRIPTION
PL980P330J	$ 1,600.00	£ 1,109.00	€ 1.420,50	¥ 13,511.00	980 nm FBG Stabilized Pump Laser, P = 330 mW

Fiber Pigtailed Laser Diodes

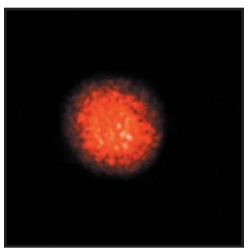
Features

- Choice of Single Mode or Multimode Fibers
- Assorted Wavelengths from Visible to Near IR
- Minimized Noise and Maximum Coupling Efficiency
- FC/PC and SMA Fiber Connectors (Custom Connectors Available Upon Request)
- High-Power Pigtails Available (>25 mW)
- Pigtailing Service of Customer-Supplied Diodes

Thorlabs offers a full line of fiber pigtailed laser diodes using either single mode or multimode fibers. Our high-quality alignment process includes multiple test and inspection points that ensure that the coupling efficiency is maximized. In addition, the input end of the fiber is cleaved at an 8° angle in order to minimize back reflections that can cause the output intensity to fluctuate. Single mode pigtails provide coherent fiber-coupled output from a laser diode. Multimode pigtails deliver higher power from the diode than single mode pigtails, but coherence is not maintained.



Single Mode Beam



Multimode Beam

ITEM #	λ	$	£	€	RMB	MODE	P (Min)	P (Typ)	P (Max)	PIN CODE
LPS-406-FC	406 nm	$ 595.00	£ 412.50	€ 528,30	¥ 5,024.20	SM	4.0 mW	5.0 mW	7.0 mW	5B
LPS-635-FC	635 nm	$ 446.00	£ 309.20	€ 396,00	¥ 3,766.10	SM	2.0 mW	2.5 mW	3.5 mW	9A
LPM-635-SMA	635 nm	$ 394.00	£ 273.20	€ 349,80	¥ 3,327.00	MM	6.0 mW	7.5 mW	8.5 mW	9A
LPS-660-FC	660 nm	$ 446.00	£ 309.20	€ 396,00	¥ 3,766.10	SM	6.0 mW	7.5 mW	9.0 mW	5C
LPM-660-SMA	660 nm	$ 359.00	£ 248.90	€ 318,80	¥ 3,031.50	MM	18.0 mW	22.5 mW	25.5 mW	5C
LPS-675-FC	675 nm	$ 446.00	£ 309.20	€ 396,00	¥ 3,766.10	SM	2.0 mW	2.5 mW	3.5 mW	9A
LPS-785-FC	785 nm	$ 419.00	£ 290.50	€ 372,00	¥ 3,538.10	SM	5.0 mW	6.25 mW	7.5 mW	5A
LPS-830-FC	830 nm	$ 494.00	£ 342.50	€ 438,60	¥ 4,171.40	SM	8.0 mW	10.0 mW	12.0 mW	9C
LPS-1060-FC	1060 nm	$1,200.00	£ 831.90	€1.065,40	¥10,133.00	SM	15.0 mW	20.0 mW	–	9A
LPS-1310-FC	1310 nm	$ 446.00	£ 309.20	€ 396,00	¥ 3,766.10	SM	2.0 mW	2.5 mW	3.0 mW	5D
LPSC-1310-FC	1310 nm	$ 621.00	£ 430.50	€ 551,40	¥ 5,243.80	SM	60 mW	80 mW	100 mW	5E
LPS-1550-FC	1550 nm	$ 534.00	£ 370.20	€ 474,10	¥ 4,509.20	SM	1.2 mW	1.5 mW	1.8 mW	5D
LPSC-1550-FC	1550 nm	$ 685.00	£ 474.90	€ 608,20	¥ 5,784.20	SM	40 mW	50 mW	60 mW	5E
LPSC-1625-FC	1625 nm	$ 685.00	£ 474.90	€ 608,20	¥ 5,784.20	SM	40 mW	50 mW	60 mW	5E

Features

- Convenient Diode Mounting
- SR9 ESD Protection and Strain Relief Cable Compatible

The LPS and LPM Series of pigtailed lasers featured above may be conveniently mounted to a breadboard or a TR post using a PTLB1 Fiber Pigtail Bracket. The universal design allows the L-bracket to be used with both imperial and metric components. The PTLB1 has a 13/30-40 tap through the center of the mounting area, allowing the end user to plug the pigtail into an SR9 (ESD protection and strain relief cable).

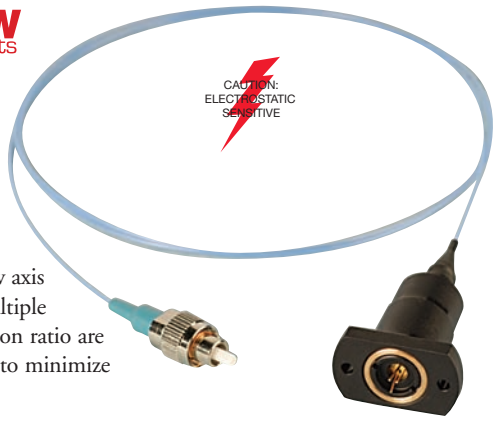
ITEM#	$	£	€	RMB	DESCRIPTION
PTLB1	$ 22.00	£ 15.30	€ 19,60	¥ 185.80	Fiber Pigtail L-Bracket

Fiber-Pigtailed Laser Diode, Polarization-Maintaining Fiber

NEW products

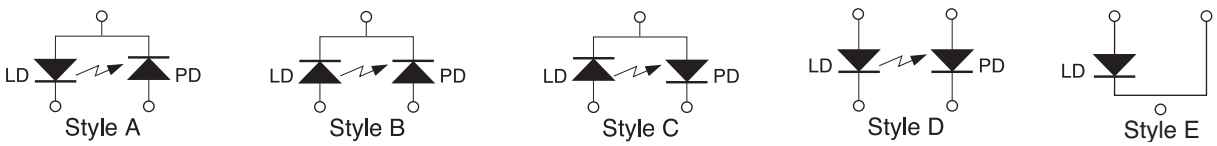
Features

- Slow Axis of PM Fiber Aligned to Connector Key
- FC/PC Connector
- Internal 8° Angle-Cleaved Fiber Minimizes Intensity Noise



PM fiber-pigtailed laser diodes couple the light emitted from the diode into the slow axis of a polarization-maintaining fiber. Our high-quality alignment process includes multiple test and inspection points that ensure that the power coupling efficency and extinction ratio are maximized. In addition, the input end of the fiber is cleaved at an 8° angle in order to minimize back reflections that can cause the output intensity to fluctuate.

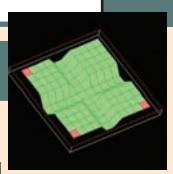
Pin Codes



Note: The 5 and 9 of the pin code designate Ø5.6 mm or Ø9.0 mm laser diode packages, respectively

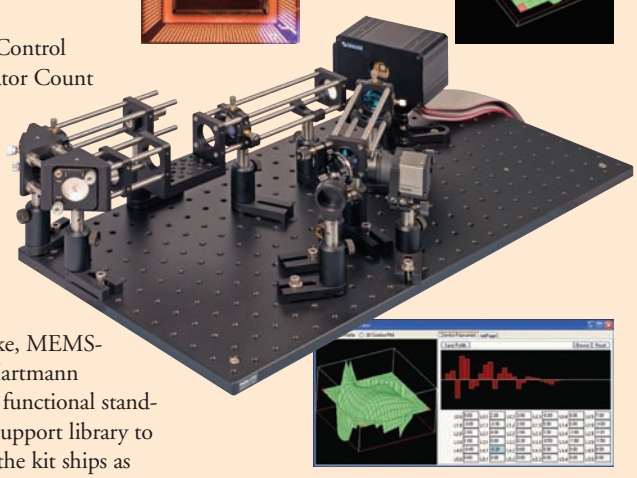
ITEM #	λ	$	£	€	RMB	P (Min)	P (Typ)	P (Max)	PIN CODE	ER	Fiber	LD ITEM#
LPS-PM635-FC	635 nm	$ 887.30	£ 615.10	€ 787,80	¥ 7,492.40	2.0 mW	2.5 mW	3.5 mW	9A	>20 dB	PM630-HP	HL6320G
LPS-PM785-FC	785 nm	$ 822.80	£ 570.40	€ 730,50	¥ 6,947.80	5.0 mW	6.25 mW	7.5 mW	5A	>20 dB	PM780-HP	DL4140-001S
LPS-PM830-FC	830 nm	$ 854.00	£ 592.10	€ 758,20	¥ 7,211.20	8.0 mW	10.0 mW	12.0 mW	9C	>20 dB	PM830-HP	HL8325G
LPS-PM1310-FC	1310 nm	$ 804.40	£ 557.70	€ 714,20	¥ 6,792.40	2.0 mW	2.5 mW	3.0 mW	5D	>23 dB	PM1300-HP	ML725B8F
LPS-PM1550-FC	1550 nm	$ 856.40	£ 593.70	€ 760,40	¥ 7,231.50	1.2 mW	1.5 mW	1.8 mW	5D	>23 dB	PM1550-HP	ML925B45F

Adaptive Optics Toolkit



Features

- Out-of-the-Box Functionality for Real-Time, High-Precision Wavefront Control
- MEMS-Based DM Achieves High Spatial Resolution Due to High Actuator Count and Low Inter-Actuator Coupling
- Shack-Hartmann Wavefront Sensor with High Resolution CCD Camera and High-Quality Microlens Array
- Includes Light Source, Imaging Optics, and Associated Mounting Hardware



Thorlabs' new Adaptive Optics (AO) Toolkits remove the barrier for entry into adaptive optics, making this real-time wavefront-correcting technology accessible to researchers and OEM users alike. The kit includes Boston Micromachines Corporation's state of-the-art, 140-element, 3.5 micron stroke, MEMS-based deformable mirror. Also included is a Thorlabs' WFS150-5C Shack-Hartmann wavefront sensor, all necessary imaging optics and mounting hardware, fully functional stand-alone control software for immediate control of the system, and a low-level support library to assist with tailored applications authored by the end user. In addition, since the kit ships as three pre-aligned optomechanical sections that only need to be arranged on a user-supplied breadboard, our adaptive optics toolkits provide a near out-of-the-box solution for real-time wavefront compensation.

See Pages 1406-1411

Fiber-Coupled Laser Sources

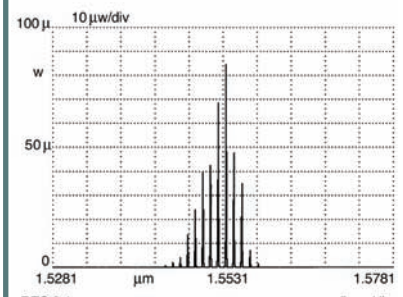
S1FC635

NEW versions

S1FC Series Features

- Single Mode FC/PC Fiber Interface
- Low Noise, Highly Stable Output
- 9 Standard Models from 635 to 1550 nm
- Custom Wavelengths Available (Call for Details)
- Angle-Cleaved Fiber Minimizes Back Reflections at the Laser

Spectrum S1FC1550 (Typ.)



The S1FC Series of Fiber-Coupled Laser Sources utilize internally pigtailed laser diodes that are connected to the front panel FC feedthrough via single mode fiber. By providing a fiber-to-fiber connection at the output, these devices typically deliver more useful optical power than systems that use a receptacle with embedded optics. All of our fiber pigtailed lasers utilize an angled fiber ferrule at the internal laser/fiber launch point to minimize reflections back into the laser diode, thereby increasing the overall stability.

ITEM#	$	£	€	RMB	DESCRIPTION*,**
S1FC635	$ 1,222.00	£ 847.20	€ 1.084,90	¥ 10,319.00	FC/PC Fiber-Coupled Laser Source, 635 nm, 2.5 mW, Class 3R
S1FC675	$ 1,203.60	£ 834.40	€ 1.068,60	¥ 10,164.00	FC/PC Fiber-Coupled Laser Source, 675 nm, 2.5 mW, Class 3R
S1FC780	$ 1,234.20	£ 855.60	€ 1.095,80	¥ 10,422.00	FC/PC Fiber-Coupled Laser Source, 780 nm, 2.5 mW, Class 3B
S1FC1310	$ 1,324.00	£ 917.90	€ 1.175,50	¥ 11,180.00	FC/PC Fiber-Coupled Laser Source, 1310 nm, 1.5 mW, Class 1M
S1FC1550	$ 1,376.00	£ 953.90	€ 1.221,70	¥ 11,619.00	FC/PC Fiber-Coupled Laser Source, 1550 nm, 1.5 mW, Class 1M

*Nominal wavelength, actual wavelength may vary by ±15 nm **Minimum power available at the output connector, the actual power may be greater.

ITEM#	$	£	€	RMB	DESCRIPTION*,**
NEW S1FC635PM	$ 1,560.00	£ 1,081.50	€ 1.385,00	¥ 13,173.00	FC/PC Fiber-Coupled Laser Source 635 nm, 2.5 mW, PM, Class 3R
NEW S1FC780PM	$ 1,600.00	£ 1,109.00	€ 1.420,50	¥ 13,511.00	FC/PC Fiber-Coupled Laser Source, 780 nm, 2.5 mW, PM, Class 3B
NEW S1FC1310PM	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	FC/PC Fiber-Coupled Laser Source, 1310 nm, 1.5 mW, PM, Class 1M
NEW S1FC1550PM	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	FC/PC Fiber-Coupled Laser Source, 1550 nm, 1.5 mW, PM, Class 1M

*Nominal wavelength, actual wavelength may vary by ±15 nm **Minimum power available at the output connector, the actual power may be greater

DFB Fiber-Coupled Laser Sources

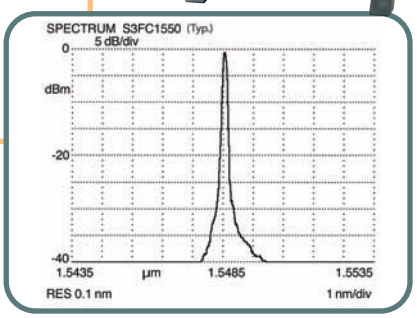
The S3FC Series includes two Fiber-Coupled Laser Sources that feature a narrow linewidth DFB laser diode and a 40 dB optical isolator to eliminate back reflections and frequency jitter.

Additionally, the S3FC Series incorporates an integrated temperature control system for increased wavelength and power stability. The diode temperature can be adjusted using the front panel potentiometer, allowing limited wavelength tuning.

S3FC DFB Series Features

- Narrow Spectral Linewidths of Less than 0.6 nm
- Thermoelectric Temperature Stabilization
- Active Power Stabilization
- 40 dB Optical Isolation
- Adjustable Temperature Setpoint
- Adjustable Power

S3FC1550
Actively Stabilized Power and Temperature



ITEM#	$	£	€	RMB	DESCRIPTION*,**
S3FC1310	$ 2,550.00	£ 1,767.50	€ 2.264,00	¥ 21,533.00	FC/PC DFB Fiber-Coupled Laser Source, 1310 nm, 1.5 mW, Class 1M
S3FC1550	$ 2,652.00	£ 1,838.50	€ 2.354,50	¥ 22,394.00	FC/PC DFB Fiber-Coupled Laser Source, 1550 nm, 1.5 mW, Class 1M

*Nominal wavelength, actual wavelength may vary by ±15 nm
**Minimum power available at the output connector, the actual power may be greater

S3FC Series of Fabry-Perot Laser Sources

Features
- Thermoelectric Temperature Stabilization
- Adjustable Temperature Setpoint
- Adjustable Power
- Standard Wavelengths of 405, 473, and 488 nm

NEW versions

S3FC405
Actively Stabilized
Power and Temperature

Thorlabs offers a selection of Benchtop Fiber Pigtailed Laser Sources that are ideal for fiber-based applications requiring output at 405, 473, or 488 nm. These S3FC lasers come with a pigtailed Fabry-Perot Laser diode with single mode fiber behind an FC/PC bulkhead connector. They also feature keylock power switches and remote interlock inputs, as well as an input for a 0 to 5 V analog signal for low frequency modulation or remote power adjustments. The laser has a built-in TEC and TEC current controller, allowing the user to adjust the temperature for stable output.

ITEM#	$	£	€	RMB	DESCRIPTION*,**
S3FC405	$ 3,160.00	£ 2,190.50	€ 2.805,50	¥ 26,684.00	FC/PC Fiber-Coupled Laser Source, 405 nm,* 1 mW,** Class 3B
S3FC473	$ 8,375.00	£ 5,806.00	€ 7.436,00	¥ 70,719.00	FC/PC Fiber-Coupled Laser Source, 473 nm,* 5 mW,** Class 3B
S3FC488	$ 7,825.00	£ 5,425.00	€ 6.948,00	¥ 66,075.00	FC/PC Fiber-Coupled Laser Source, 488 nm,* 5 mW,** Class 3B

*Nominal wavelength, actual wavelength may vary by ±15 nm
**Minimum power available at the output connector, the actual power may be greater.

T-Cube™ apt™ USB Laser Source

TLS001

Measuring only 4.8" x 2.4" x 1.8" (120 mm x 60 mm x 47 mm), the TLS001 T-Cube Laser Source is a fully functional, highly compact laser source. The device, which is available in both 635 nm and 1550 nm variants, incorporates driver electronics and a pigtailed Fabry-Perot laser diode, thereby increasing the total available output power compared to an air-to-fiber version. It can be controlled by a manual or USB interface. The output laser power is monitored continuously, and a feedback circuit adjusts the laser power to achieve a constant output power.

Multiple T-Cube units can be connected to a single PC via standard USB hub technology or by using the T-Cube Controller Hub (TCH002) for multi-function control applications.

Features
- FC/PC Single Mode Fiber Interface
- Manual- or PC-Controlled Operation via USB Interface
- Safety Enable Key Switch and Laser Safety Interlock Jack
- Software Compatible with Other apt™ Controllers

ITEM#	$	£	€	RMB	DESCRIPTION
TLS001-635	$ 995.00	£ 689.80	€ 883,40	¥ 8,401.90	T-Cube™ Laser Source, 635 nm Output, Class 3R
TLS001-1550	$ 1,075.00	£ 745.30	€ 954,40	¥ 9,077.40	T-Cube™ Laser Source, 1550 nm Output, Class 1M
TPS101	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	5 V Power Supply Unit for a Single T-Cube, 1.6 A
TCH002	$ 726.90	£ 504.00	€ 645,40	¥ 6,138.00	T-Cube™ Controller Hub and Power Supply Unit

Fiber-Coupled SLD Benchtop Sources

S5FC Series SLD Source

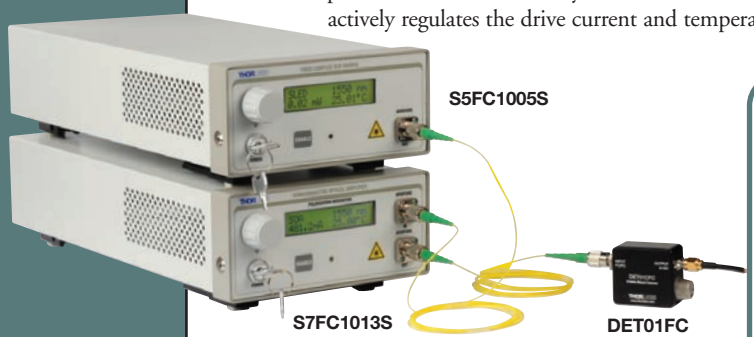
Features

- Superluminescent Diodes (SLDs) with Broadband Emissions Centered at 1310 or 1550 nm
- Single SLD Output Channel
- FC/APC Bulkhead Connector
- TEC Temperature Stabilized
- Low Noise Output
- USB 2.0 Interface
- SOA and BOA Compatible

The S5FC Series of Benchtop SLD Sources contain a broadband SLD pigtailed to a single mode fiber. The SLD is driven with a high-precision, low-noise constant current source, and the temperature of the SLD is independently controlled with an internal TEC element.

The front panel LCD display and controls allow the user to view and set the current and temperature parameters. While the SLD is enabled, the display will show the wavelength (not measured), operating power (calculated from the SLD monitoring diode), and the actual temperature of the SLD. The system's microcontroller actively regulates the drive current and temperature of the SLD as well as monitors the system for fault conditions. The microcontroller has a USB interface that allows for remote adjustment of the output power and temperature of the SLD as well as the enabling of the SLD output.

An analog input is provided on the rear panel; it allows the user to modulate the output of the SLD using an external signal. To prevent damage, the microcontroller will disable the output if the analog input plus the internal setpoint exceeds the SLDs limits. There is an interlock located on the rear panel that can be used to disable the SLD output when an unsafe condition exists. The interlock must be shorted in order for the SLD output to be enabled. The SLD output can be easily amplified thereby increasing the output power using a benchtop semiconductor optical amplifier (SOA), as shown in the picture below.



Controller Characteristics

Setpoint Resolution	0.01 A
Adjustment Range	~0 - Full Power
AC Input	100 - 240 VAC 50 - 60 Hz
Modulation Input	0 - 5 V Scaled to Current Limit
Modulation Bandwidth	500 kHz
Temperature Control	Integrated TEC
Temperature Stability	<0.01 °C
Temperature Adjustment Range	20 - 30 °C
Connector Type	FC/APC
Dimensions (L x W x H)	5.8" x 11.4" x 2.6" (146 mm x 290 mm x 66 mm)

Superluminescent Diodes

Thorlabs' extensive line of Superluminescent Diodes (SLDs) in butterfly and DIL (Dual In-Line) packages are excellent high-power broadband light sources.

See Page 1156

Integrated TEC and Thermistor

ITEM#	S5FC1021S			S5FC1108S			S5FC1018S			S5FC1005S		
Optical Characteristics	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**
Wavelength (nm)	–	1310	–	1290	1310	1330	1530	1550	1570	1530	1550	1570
Output Power (mW)	10	12.5	–	22	30	–	2.0	2.5	–	2.0	22	–
Optical Bandwidth (nm)	80	85	–	40	45	–	85	95	–	45	50	–
RMS Gain Ripple (dB)	–	0.1	0.35	–	0.1	0.35	–	–	0.25	–	0.2	0.35

ITEM#	$	£	€	RMB	DESCRIPTION*
S5FC1005S	$ 2,566.00	£ 1,779.00	€ 2.278,00	¥ 21,668.00	Fiber-Coupled SLD Source, 1550 nm, 22 mW
S5FC1018S	$ 2,954.00	£ 2,048.00	€ 2.622,50	¥ 24,944.00	Fiber-Coupled SLD Source, 1310 nm, 30 mW
S5FC1021S	$ 2,704.00	£ 1,874.50	€ 2.400,50	¥ 22,833.00	Fiber-Coupled SLD Source, 1310 nm, 12.5 mW
S5FC1108S	$ 2,384.00	£ 1,652.50	€ 2.116,50	¥ 20,131.00	Fiber-Coupled SLD Source, 1550 nm, 2.5 mW

*Typical values, see the specificaitons table for more information.

Fiber-Coupled SOA and BOA Benchtop Sources

NEW products

Features

- Semiconductor Optical Amplifiers with High Saturation Power, Large Gain, and Low Noise
- Single SOA or BOA and Amplifier Channel
- FC/APC Input and Output Bulkhead Connectors
- TEC Temperature Stabilized
- Central Wavelengths: 1300, 1550*, 1590, and 1625 nm
- USB2.0 Interface

*Polarization-Insensitive (SOA) and Polarization-Maintaining (BOA) Models

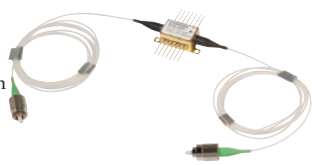
Thorlabs' Polarization-Maintaining (S9FC Series) and Polarization-Insensitive (S7FC Series) Semiconductor Optical Amplifiers integrate a fiber-coupled optical amplifier into an easy-to-use benchtop platform with FC/APC input and output bulkhead connectors. Input parameters for the microcontroller regulating the temperature and drive current of the amplifier can be set via the front panel interface or remotely via a USB interface. The LCD display shows the operating wavelength (not measured), drive current, actual temperature of the amplifier, and whether the unit is a SOA (polarization-insensitive optical amplifier) or BOA (polarization-maintaining optical amplifier). The rear panel has an analog input to allow the drive current of the amplifier to be modulated. To prevent damage, the microcontroller will disable the output if the analog input plus the internal setpoint exceeds the set limits. There is an interlock input on the rear panel that can be used to disable the output of the amplifier when unsafe conditions exist. The interlock must be shorted in order to enable the amplifier.

When using the SOA-based S7FC1013S benchtop optical amplifier, the input polarization is not important since the optical amplifier is insensitive to the polarization of the light (i.e., all polarizations are amplified). The BOA-based benchtop optical amplifiers will only amplify light with a polarization axis defined by the device. As a result, the BOA has PM fiber pigtails where the slow axis of the fiber is aligned to the FC/APC bulkhead connector. The light coupled into the slow axis of the PM fiber is amplified. In order to use a BOA amplifier with the SLD sources on the previous page or some other source with an unknown polarization axis, consider using a passive polarization controller (see pages 968-970).

Booster and Semiconductor Optical Amplifiers

Thorlabs' extensive line of BOAs and SOAs are single-pass, traveling-wave amplifiers that perform well with both monochromatic and multi-wavelength signals.

See Page 1147



Compact Design in a Butterfly Package

Controller Characteristics

Setpoint Resolution	0.01 A
AC Input	100-240 VAC, 50-60 Hz
Temperature Control	Integrated TEC
Temperature Stability	<0.01 °C
Temperature Adj. Range	20 - 30 °C
Connector Type	2 FC/PC Bulkhead Connector
Dimensions (L x W x H)	5.8" x 11.4" x 2.6" (146 mm x 290 mm x 66 mm)

ITEM#	S7FC1013S		
SOA Optical Characteristics	**Min**	**Typ**	**Max**
Wavelength (nm)	1528	1550	1562
Saturation Output Power (@ -3 dB) (mW)	12	14	–
Optical Bandwidth (nm)	70	74	–
Small Signal Gain (dB)	10	13	–
RMS Gain Ripple (dB)	–	0.1	0.5
Noise Figure (dB)	–	8	9.5

ITEM#	S9FC1132P			S9FC1004P			S9FC1080P			S9FC1082P		
BOA Optical Characteristics	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**
Wavelength (nm)	1290	1300	1315	1530	1550	1570	1570	1590	1610	1600	1625	1650
Saturation Output Power (@ -3 dB) (mW)	13	15	–	90	100	–	12	15	–	10	13	–
Optical Bandwidth (nm)	80	87	–	90	100	–	80	90	–	70	80	–
Small Signal Gain (dB)	27	30	–	25	28	–	20	25	–	14	18	–
RMS Gain Ripple (dB)	–	0.2	0.3	–	0.1	0.2	–	0.05	0.2	–	0.05	0.3
Noise Figure (dB)	–	7.0	9.0	–	7.0	9.0	–	7.0	9.0	–	7.0	9.0

ITEM#	$	£	€	RMB	DESCRIPTION
S7FC1013S	$ 2,572.00	£ 1,783.00	€ 2.283,50	¥ 21,719.00	Semiconductor Optical Amplifier, 1550 nm, Polarization Insensitive
S9FC1132P	$ 3,048.00	£ 2,113.00	€ 2.706,00	¥ 25,738.00	Semiconductor Optical Amplifier, 1300 nm, Polarization Maintaining
S9FC1004P	$ 2,836.00	£ 1,966.00	€ 2.518,00	¥ 23,948.00	Semiconductor Optical Amplifier, 1550 nm, Polarization Maintaining
S9FC1080P	$ 2,996.00	£ 2,077.00	€ 2.660,00	¥ 25,299.00	Semiconductor Optical Amplifier, 1590 nm, Polarization Maintaining
S9FC1082P	$ 3,236.00	£ 2,243.50	€ 2.873,00	¥ 27,325.00	Semiconductor Optical Amplifier, 1625 nm, Polarization Maintaining

4-Channel, Fiber-Coupled Laser Source (Page 1 of 2)

MCLS1

Features

- Four Laser Output Channels with FC/PC Connectors
- Independent Temperature Control Leads to High Temperature Stability
- Low Noise Output
- USB Interface
- Low-Profile Package
- Choose Any 4 of 13 Available Source Wavelengths

Thorlabs' 4-Channel, Fiber-Coupled, Customizable Laser Source provides simple control of laser-diode-driven fiber optics. The laser source is configured to accept any combination of four fiber-pigtailed laser diodes; choose from the following wavelengths: 406, 473, 488, 635, 658, 670, 785, 808, 850, 904, 980, 1310, and 1550 nm.

Each laser diode is operated from an independent, high-precision, low-noise, constant-current source and temperature control unit. An intuitive LCD interface allows the user to view and set the laser current and temperature control independently for each fiber-coupled laser. The display indicates the channel number selected, the output wavelength of the source, the operating power calculated from the laser diode monitor diode, and the actual temperature of the laser diode.

This device comes equipped with a microcontroller to monitor the system for fault conditions and to fully control the laser's optical power and temperature. The laser source includes a USB connection that allows remote adjustment of power and temperature as well as the enabling of the SLD output. On the rear panel, analog inputs are available to modulate the lasers with an external signal. To prevent damage, the microcontroller will disable the output if the analog input plus the internal setpoint exceeds the laser limits.

FC Fiber Patch Cables

Thorlabs' extensive line of patch cables and connectors includes standard and custom lengths with FC/PC or FC/APC terminations.


Single Mode and Polarization-Maintaining Fiber

See Page 843

Off-Axis Parabolic Collimators

Thorlabs offers a line of collimators that use an off-axis parabolic mirror to provide diffraction-limited performance across the entire 400 to 2000 nm wavelength range without needing to adjust the collimator.


SM05 Threading

See Page 934

GENERAL SPECIFICATIONS	MCLS1
AC Input	100-240 VAC, 50-60 Hz
Fuse Ratings	250 mA
Fuse Type	IEC60127-2/III, (250 V, Slow Blow Type 'T')
Fuse Size	5 mm x 20 mm
Dimensions (W x H x D)	12.6" x 2.5" x 10.6" (320 mm x 64 mm x 269 mm)
Weight	8.5 lbs
Operating Temperature	15 to 35 °C
Storage Temperature	0 to 50 °C
Connections and Controls	
Interface Control	Optical Encoder with Push Button
Enable and Laser Select	Keypad Switch Enable with LED indication
Power On	Key Switch
Fiber Ports	FC/PC
Display	LCD, 16 x 2 Alphanumeric Characters
Input Power Connection	IEC Connector
Modulation Input Connector	BNC (Referenced to Chassis)
Interlock	2.5 mm Mono Phono Jack
Communications	
Communications Port	USB 2.0
COM Connection	USB Type B Connector
Required Cable	2 m USB Type A to Type B Cable (Replacement Part Number USB-A-79)

4-Channel, Fiber-Coupled Laser Source (Page 2 of 2)

Safety

While most output sources fall within the class 3R laser rating, the system was fully designed to meet laser class 3B requirements. There is an interlock located on the rear panel that must be shorted in order for any laser output to be enabled. This can easily be configured to be triggered by doors to disable the lasers. The power switch is a keylock system to prevent accidental or unwanted use. Each source has its own enable button allowing the user to choose the light source or sources they wish to be active as well as a master enable that must also be set. Each channel includes a green LED indicator to easily determine its current state. There is a three second delay before the lasers turn on, and the user is warned of the imminent light output by the rapidly blinking LED.

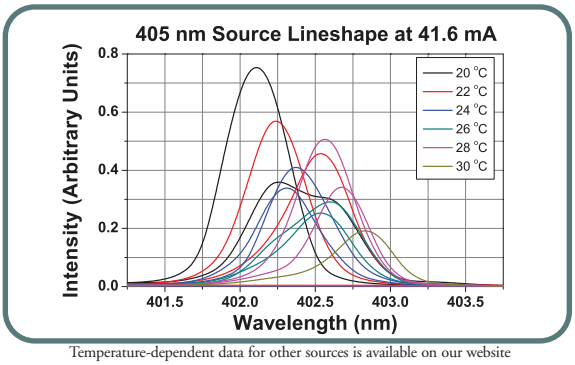
PERFORMANCE SPECIFICATIONS	
Display Power Accuracy	±10%
Current Setpoint Resolution	0.01 mA
Temperature Adjust Range	20.00 to 30.00 °C
Temp Setpoint Resolution	±0.01 °C
Noise	<0.5% Typical (Source Dependent)
Rise/Fall Time	<5 µs
Modulation Input	0-5 V = 0 - Full Power
Modulation Bandwidth	80 kHz Full Depth of Modulation

In the Box

The MCLS1 includes a universal power that allows the unit to be plugged into any 100-240 VAC outlet without the need for selecting the line voltage. The fuse access is conveniently located on the rear panel. This unit is supplied with a US line cord, a standard European line cord, the pre-configured MCLS1 with all selected lasers installed, and the manual.

NEW versions

View of Back Panel



Temperature-dependent data for other sources is available on our website

Configuring a 4-Channel Source

The table below lists the 13 available output wavelengths for our 4-Channel Source. Choose any combination and add the individual source cost to the MCLS1 base unit price.

Example: MCLS1 with fiber-pigtailed laser diodes providing output at 406 nm, 635 nm, 658 nm, and 670 nm costs $3499.00 + $649.00 + $410.00 + $306.00 + $342.00 = $5206.00.

ITEM#	λ	MINIMUM POWER	LASER TYPE	FIBER	$	£	€	RMB
MCLS-406	406 nm	3.0 mW	Fabry-Perot	S405-HP	$ 649.00	£ 449.90	€ 576,20	¥ 5,480.20
MCLS-473	473 nm	4.0 mW	Fabry-Perot	S460-HP	$ 5,200.00	£3,605.00	€4.617,00	¥43,909.00
MCLS-488	488 nm	4.5 mW	Fabry-Perot	S460-HP	$ 4,800.00	£3,328.00	€4.262,00	¥40,532.00
MCLS-635	635 nm	2.5 mW	Fabry-Perot	SM600	$ 410.00	£ 284.30	€ 364,10	¥ 3,462.10
MCLS-658	658 nm	6.0 mW	Fabry-Perot	SM600	$ 306.00	£ 212.20	€ 271,70	¥ 2,583.90
MCLS-670	670 nm	1.5 mW	Fabry-Perot	SM600	$ 342.00	£ 237.10	€ 303,70	¥ 2,887.90
MCLS-785	785 nm	4.0 mW	Fabry-Perot	SM800-5.6-125	$ 320.00	£ 221.90	€ 284,10	¥ 2,702.10
MCLS-808	808 nm	4.5 mW	Fabry-Perot	SM800-5.6-125	$ 360.00	£ 249.60	€ 319,70	¥ 3,039.90
MCLS-850	850 nm	4.5 mW	Fabry-Perot	SM800-5.6-125	$ 385.00	£ 266.90	€ 341,90	¥ 3,251.00
MCLS-904	904 nm	4.5 mW	Fabry-Perot	SM800-5.6-125	$ 369.00	£ 255.80	€ 327,70	¥ 3,115.90
MCLS-980	980 nm	4.5 mW	Fabry-Perot	980HP	$ 380.00	£ 263.50	€ 337,40	¥ 3,208.80
MCLS-1310	1310 nm	1.5 mW	Fabry-Perot	SMF-28e	$ 305.00	£ 211.50	€ 270,80	¥ 2,575.50
MCLS-1550	1550 nm	1.0 mW	Fabry-Perot	SMF-28e	$ 320.00	£ 221.90	€ 284,10	¥ 2,702.10
MCLS-1550DFB	1550 nm	1.5 mW	DFB	SMF-28e	$ 908.00	£ 629.50	€ 806,20	¥ 7,667.20

ITEM#	$*	£*	€*	RMB*	DESCRIPTION
MCLS1	$ 3,499.00	£ 2,425.50	€ 3.106,50	¥ 29,546.00	4-Channel Laser Source, TEC Stabilized, USB, Controller Only

* Price listed is for base system, excluding sources

Rack Systems: WDM Laser Source Overview (1530 – 1610 nm)

Modular Platform Solutions

For multiple wavelength systems with simultaneous control capabilities, Thorlabs offers two modular platform solutions: the PRO8 system (with local control for stand-alone operation and remote IEEE-488 or RS-232 control) and the TXP5000 platform (with remote TCP/IP and USB control).

Two types of mainframes are available for the PRO8 system. The PRO800 accommodates two single modules, while the PRO8000 can operate up to eight modules. In addition to the DWDM laser modules (listed below), this platform offers a host of laser diode drivers, optical switches, TEC controllers, and photodiode amplifiers.The PRO8 has been the mainstay for many laser diode manufacturing and test facilities. The TXP5000 system also includes two types of mainframes: the TXP5004 with USB control for up to four TXP modules and the 19" rack unit TXP5016 with Ethernet control for up to 16 modules. TXP5001AD is an easy-to-use USB adapter for single TXP cards. The TXP platform features high versatility and is the base for Thorlabs' complex Test and Measurement Systems.

PRO8000 Modular Laser System

- Our PRO8000 system provides an outstanding platform for eight-channel DWDM laser sources; it has a number of preconfigured offerings and a complete range of laser source modules from which to choose. Together these modules cover the full C- and L- Bands of the 100 GHz ITU Grid* (1530.33 -1611.79 nm).

*Subject to DFB Laser Availability, 50 GHz and 25 GHz grid upon request.

- The PRO8000 DWDM laser modules offer precise tunability, long-term wavelength and power stability, and adjustable coherence control, making them ideal for both active and passive DWDM component testing as well as multiwavelength transmission experiments. These features are possible by combining the sophisticated laser diode control circuit designed by our experienced instrumentation group with high performance DFB lasers.

TXP5000 Modular Laser System

- The TXP5000 system is available as a multichannel laser source platform with the addition of our LS5000 series of DWDM laser source modules. Populating a TXP5016 chassis with up to sixteen DWDM DFB laser source modules produces a versatile and easy-to-use multichannel laser source system when combined with the outstanding features of our TXP platform.

- The LS5000 DWDM laser modules for the TXP5000 Series systems offer precise tunability, as well as long-term wavelength and power stability. Adjustable coherence control makes them ideal for both active and passive DWDM component testing as well as multiwavelength transmission experiments.
- These WDM laser modules are ideally suited for all DWDM applications, ranging from test systems for fiber optic DWDM components and EDFA production to multi-laser optical sources for DWDM transmission experiments.

Laser Safety Goggles

See Page 1233

WDM Laser Banks Selection Guide

Pages 1065-1073

The PRO8 Modular System Platform and Laser Modules are a scalable system for component testing and multi-wavelength transmission measurements in the C- and L-Bands. In addition to laser modules, the platform supports optical switch, TEC controller, current controller, and sensor modules with plug-and-play compatibility. The control parameters are accessible from the front panel and higher level commands are available when the system is run through the IEEE-488.2 interface via the included divers.

PRO8 Modular WDM System Platform

- Foundation for WDM Laser Diode Plug-In Modules
- Additional Modules Include Optical Switches and Sensors
- Sophisticated Control Features

See Pages 1066-1067

DWDM Laser Modules for the PRO8 Series

- Cover the Full C- and L- Bands (1530.33 - 1611.79 nm)
- Provide Precise Tunability, High Wavelength, and Power Stability
- Feature Adjustable Coherence Control and Internal Modulation
- Ideal for Component Testing and Multi-Wavelength Transmission Experiments

See Pages 1068-1071

The TXP5000 Modular Laser Platform is a scalable platform with a configuration that allows modules to be swapped out without interrupting the function of the remaining modules. In addition, all of the DWDM series laser modules provide an adjustable coherence length control, which makes the TXP5000 platform ideal for testing active and passive DWDM components.

LS5000 DWDM Laser Sources for TXP5000 Series

- Offers Precise Tunability as well as Long-Term Wavelength and Power Stability
- Adjustable Coherence Control
- Ideal for Active and Passive DWDM Component Testing and Multiwavelength Transmission Experiments

See Pages 1070-1073

Multichannel WDM Source Platform – PRO8 Series (Page 1 of 2)

PRO8000 System
WDM and DFB Laser Module

PRO8000 Series Compatible Modules

- **Laser Diode Controllers:** Pages 978-979
- **Multichannel Laser Diode Controllers:** Pages 980-981
- **Temperature Controllers:** Pages 982-983
- **Combination LD and TEC Controllers:** Pages 984-985
- **DFB Laser Sources and DWDM:** Pages 986-989
- **Photodiode Amplifier:** Page 990
- **Optical Switches:** Pages 991-992

Introduction

The PRO8000 Chassis serves as a multi-wavelength test system when populated with DWDM laser modules (see page 986 for specifications). In addition to these DFB laser sources, DFB laser sources for our TXP platform (see page 994) and a series of PRO8 series optical switches (see pages 991-992) are available.

The modular design of the PRO8000 chassis can accept up to eight WDM laser sources per chassis. We support the 100 GHz spacing ITU wavelengths across the C- and L-bands with 20 mW output power.* Many of the laser modules are available directly from stock.

All PRO8 WDM laser modules utilize telecom-rated laser diodes housed in butterfly packages; each DFB laser contains a temperature sensor and a Peltier element for optimal long-term stability. Standard optical output is a PM fiber that is terminated with an unaligned FC/APC connector. Other output connector options are available by special order.

PRO8000 Series Highlights

- Modular Chassis has a Vacuum-Fluorescence Display with Bright 4 x 20 Characters
- Universal Platform with Interchangeable Modules that Include Laser Diode Current Controllers, TEC Controllers, WDM Sources, and Optical Switches
- Fast IEEE-488.2 and RS-232C Interfaces Standard
- Instrument Drivers for LabVIEW™ and LabWindows™/CVI Included

Precise Wavelength Calibration and Control

Using the front panel controls of the PRO8000, the wavelength of each laser source module can be tuned by ±.85 nm (approximately ±100 GHz) while retaining strict control of the output power because of the comprehensive factory calibration (wavelength dependence on both the temperature and the drive current) of each laser module; the calibration data is stored in nonvolatile memory within each laser module. This calibration data, coupled with our high-performance electronics, allows extremely precise control of the laser wavelength. See page 986 for full details.

IEEE-488 Computer Control of Multiple PRO8000s

The PRO8000 chassis is equipped with a fast IEEE-488.2 interface supported by the various LabVIEW™ and LabWindows™/CVI drivers provided. The PRO8000 can source up to 16 A, which is sufficient to power eight of our WDM laser modules. All PRO8 Series chassis are also equipped with an RS-232C interface. Utilizing IEEE-488.2 compliant commands allows complete control of each individual laser within the software environment.

User-Friendly Operation

The PRO8000 Series offers user-friendly menus to configure and operate the various modules that can be driven (laser modules, optical detectors, optical switches, and a large variety of electrical modules – see page 975). The PRO800, a two-slot chassis, is offered for the research laboratory. This compact version supports all the modules available for the larger PRO8000 chassis. With the exception of the size differences and power supply, both chassis utilize the same electrical interface and operating system.

Since each plug-in module automatically identifies itself to the processor in the chassis, configuring a system is as simple as inserting the desired modules and setting the control parameters via the front panel. A brightly lit display with 4 x 20 characters allows the user to scroll through and select any of the installed modules. With the desired module selected, all of its control parameters are accessible from the front panel.

Higher-level commands are available when operating the system via the IEEE-488.2 interface. For example, there is a command to tune the wavelength of a laser module, which facilitates the measurement of crosstalk in adjacent channels of a DWDM component.

Choose from Multiple Families of Laser Modules

Details on the standard DWDM laser modules for the PRO8 platform, as well as solutions with customer-supplied lasers, are presented on the following pages. Contact Thorlabs for details.

*Subject to DFB Laser Availability, 50 GHz and 25 GHz grid upon request.

Multichannel WDM Source Platform – PRO8 Series (Page 2 of 2)

PRO8 Series Chassis Specifications

	PRO800	PRO8000	PRO8000-4
Slots	2	8	8
Max Output Current for All Cards	8 A	16 A	32 A
Max Power Consumption	220 VA	500 VA	800 VA
Display	Alphanumeric Display with 4 x 20 Characters		
Operation	Menu-Driven		
Setting	Function Keys and Rotary Knob		
Protection Features	Key-Operated Power Switch		
TTL Modulation Frequency Range	DC to 10 kHz (Synchronous for all Lasers in Chassis)		
TTL Duty Cycle	Selectable (Synchronous for all Lasers in Chassis)		
TTL Modulation Input	BNC		
TTL Trigger Output	BNC		
IEEE-488.2 Interface	24-Pin IEEE Jack (Rear Panel)		
RS-232C Interface	9-Pin D-Sub Plug (Rear Panel)		
Chassis Ground	4 mm Banana (Rear Panel)		
Line Voltage	100 VAC, 115 VAC, and 230 VAC ± 10%		
Line Frequency	50 to 60 Hz		
Operating Temperature	0 to 40 °C		
Storage Temperature	-40 to 70 °C		
Relative Humidity	<80% up to 30°, decreasing to 50% at 40 °C		
Dimensions (W x H x D)	232 mm x 147 mm x 396 mm (9.13" x 5.78" x 15.59")	449 mm x 147 mm x 396 mm (17.68" x 5.78" x 15.95")	449 mm x 177 mm x 456 mm (17.68" x 6.97" x 17.95")
Weight (Chassis Only)	<9 kg (19.84 lb)	<17 kg (37.48 lb)	<21 kg (46.31 lb)

ITEM#	$	£	€	RMB	DESCRIPTION
PRO800	$ 1,798.80	£ 1,247.00	€ 1.597,00	¥ 15,190.00	2-Slot Modular Benchtop Chassis
PRO8000	$ 2,470.80	£ 1,713.00	€ 2.193,50	¥ 20,864.00	8-Slot Modular Rack Chassis
PRO8000-4	$ 3,336.00	£ 2,312.50	€ 2.961,50	¥ 28,170.00	8-Slot High-Power Modular Rack Chassis
PRO8000-R32	$ 64.30	£ 44.60	€ 57,10	¥ 543.00	19" Mounting Kit for PRO8000
PRO8000-R42	$ 89.00	£ 61.70	€ 79,10	¥ 751.60	19" Mounting Kit for PRO8000-4
PRO8000-C	$ 24.80	£ 17.20	€ 22,10	¥ 209.50	PRO8000 Blind Cover Plate for Empty Slots

DWDM Laser Sources – PRO8 Series (Page 1 of 2)

ITU Coverage: We are committed to providing quick delivery of any of the 100 lasers (on a 100 GHz grid) that comprise the DWDM C- and L-bands.* When ordering, please refer to the tables presented on pages 1070 and 1071, which are organized based on 100 GHz channel spacings. Pricing and ordering codes can also be found there. Our order codes are a combination of the band designator (C or L), the 100 GHz channel number (01 through 50), and an additional character (A, B, C, or D) that indicates the frequency offset from the base channel.

*Subject to Laser Diode Availability, 50 GHz and 25 GHz grid upon request

Introduction – DWDM Laser Modules

The PRO8 DWDM laser modules offer precise tunability as well as long-term wavelength and power stability. Provided with adjustable coherence control, these laser modules are ideally suited for all DWDM applications such as test systems for fiber optic DWDM components, EDFA manufacturing, and multi-laser optical sources for DWDM transmission experiments.

Stability, Accuracy, and Dependability

This DWDM laser platform is the ideal choice for demanding DWDM test and measurement applications with laser linewidths of less than 10 MHz, center wavelength stability of better than 0.002 nm per 24 hours, and wavelength accuracy of better than ±0.025 nm.

We use only telecom-rated, butterfly packaged DFB lasers with integrated TEC elements, optical isolators, and low back-reflection fiber pigtails. When combined with our sophisticated drive circuits, the result is an extremely stable, low-noise laser source that exhibits optical power stability better than 0.005 dB per 15 minutes and a relative intensity noise (RIN) figure of -145 dB/Hz (Typ.).

Our laser sources are supplied with a PM fiber and a non-orientated FC/APC connector. As a custom option, Thorlabs can also offer an option to align the slow axis to an orientated FC/APC connector. Additionally, Thorlabs can incorporate user-supplied lasers into our modules. Please contact Thorlabs for details.

Features

- Center Wavelengths on 100 GHz ITU-T Grid*
- Wavelengths in C- and L-Bands*
- Wavelength Stability of <0.002 nm (24 Hours)
- Extremely Stable Output Power of <0.01 dB (24 Hours)
- Precise Wavelength Tuning Over ±0.85 nm
- Direct Display of Wavelength During Tuning
- Precise Power Tunning Over >6 dB (Typical 10 dB)
- Variable Coherence Control, Linewidths up to 1 GHz
- Synchronous Modulation of All Laser Sources via Common External TTL Signal
- Instrument Drivers for LabVIEW™ and LabWindows™/CVI Included
- FC/APC Connector

*Subject to Laser Diode Availability, 50 GHz and 25 GHz grid upon request

Putting it all TOGETHER

PRO8000 Optical Switch Modules:
The OSW8000 optical switch modules facilitate distribution of test signals in complex test setups for cost-efficient use of laser sources. The modularity of 1 x 2, 1 x 4, 1 x 8, and 2 x 2 switches allows flexible routing paths.

For more details, see page 991.

DWDM Sources in PRO8000 Chassis

DWDM Laser Sources – PRO8 Series (Page 2 of 2)

Coherence Control, Internal Modulation

For high-precision power measurements, the narrow linewidth of a DFB laser can lead to interference effects caused by reflections from the multiple surfaces that are present in most optical systems. These multiple reflections, while extremely small, can accumulate due to the long coherence length of the laser light. Brillouin scattering is another effect that can lead to significant errors when making optical power measurements in fiber-based systems.

Specifications

Wavelength

- **Options:** 100 Wavelengths on the 100 GHz ITU Grid, (C- and L-Band)*
- **Tuning Range:** ±0.85 nm
- **Accuracy:** ±0.025 nm, Typical< ±0.01 nm
- **Stability:** <0.002 nm over 24 Hours (Typ.)
- **Resolution:** 1 pm
- **Laser Linewidth:** <10 MHz

Output Power

- **Optical Power:** 20 mW
- **Accuracy (abs/rel):** 0.6 dB/0.4 dB
- **Stability:** <0.002 dB over 15 s, <0.005 dB Over 15 min, <0.01 dB Over 24 hrs
- **Attenuation:** >6 dB, 10 dB (Typ.)
- **Resolution:** 0.01 dB
- **Side Mode Suppression Ratio at Max Power:** >40 dB (Typ.), >36 dB (Min.)
- **Relative Intensity Noise (RIN):** -145 dB/Hz (Typ.)
- **Optical Isolation:** >35 dB

Coherence Control (Standard Feature, All Models)

- **Linewidth:** Up to 1 GHz (Adjustable)
- **Shape:** Noise, Sine, and Square (Triangle Upon Request)
- **Frequency:** 0.02 to up to 50 kHz
- **Modulation Depth:** 0.1 to 100%

Modulation

- **Synchronous TTL:** DC - 10 kHz (All Lasers via BNC Input)
- **Analog LF Modulation:** DC-50 kHz (Option via SMA Input)

General Data

- **Optical Output:** FC/APC Connector**
- **Fiber:** PMF (Connector Key Aligned to Slow Axis upon Request)
- **Operating Temperature:** 0 to 35 °C Non-Condensing
- **Storing Temperature:** -40 to 60 °C
- **Warm-Up Time:** 15 min for Rated Accuracy
- **Laser Module Width:** 1 Slot
- **Laser Safety Class:** 1 M

All Data Valid at 23 ±5 °C and 45 ± 15% Relative Humidity.
* Subject to Laser Diode Availability, 50 GHz and 25 Ghz Grid upon request
** Other Connector Styles, (i.e., SC, E2000) and Non-Angled (PC) Ferrule upon request.

DWDM Sources in PRO800 Chassis

The magnitude of these effects can be significantly reduced by increasing the linewidths of the source. Therefore, all the DWDM-series laser sources provide an adjustable coherence length control. Here a small signal modulation on the laser current is used to broaden the DFB laser linewidth from a few MHz up to 1 GHz. The PRO8 provides continuous adjustment of the linewidth over this entire range. An internal broadband noise source or an internal, freely running, sine wave/square wave generator is used to modulate the laser current. The modulation frequency range of the function generator is 20 Hz to 50 kHz with up to 100% modulation depths. Using these features, an ideal non-discrete Gaussian-shaped distribution or a discrete spectral distribution is generated.

External Digital Modulation, DC to 10 kHz

All laser modules within a chassis can be modulated synchronously by an external TTL signal. The modulation bandwidth ranges from DC to 10 kHz. The modulation signal input is on the back panel of the chassis and operates simultaneously on all laser modules of the chassis.

External Analog Low Frequency (LF) Modulation, DC to 50 kHz (Optional)

For applications where a precise LF modulation up to 50 kHz is required, the DWDM modules are available with an LF modulation option. With this option, the output power can be modulated via an optional SMA input. The laser remains fully protected due to a precise limit circuit located inside the module.

Precision Wavelength Tuning

The wavelength is displayed with a resolution of 0.001 nm on the PRO8000 front panel or can be read through the IEEE-488 interface and has a resolution of 0.001 nm. By precisely controlling the temperature of the laser chip, the emitted wavelength can be tuned over a range of ±0.85 nm (approximately ±100 GHz). This range allows the central wavelength of the source to be shifted from one transmission channel to either of the adjacent channels for dense WDM systems with 100 GHz channel spacing or tuning over up to 8 channels for systems with 25 GHz channel spacing. This feature is useful for simulating crosstalk between channels. It can also be used to measure the profile of narrow band DWDM filters.

Manual polarization controllers can be supplied as accessories for laser modules. They can be used to adapt the state of polarization in the fiber to polarization-dependant external modulators. Please contact your local Tech Support for ordering information.

See next page for pricing and order codes for laser modules.

DWDM Laser Sources Ordering Guide

The Thorlabs DWDM laser sources cover 100 lasers from the C-, and L-bands with a 100 GHz spacing. They are organized based on the ITU 100 GHz Grid in column A shown in the table on the next page. Sources from the 50 GHz and 25 GHz grid (i.e., sources from columns B, C, and D) are available upon request. For all sources the lead times are subject to laser diode availability.

To get the correct item name when ordering the sources, please read the appropriate codes for Band, Channel, and Column from the ITU Grid on the right and fill them into the item name template in the Ordering and Price Information box below.

Ordering Information for WDM8

WDM8- □ - □□□ -20-NM
BAND CODE (C or L)
ITU GRID COLUMN (A, B*, C*, or D*)
CHANNEL CODE

*Columns B (50 GHz Offset), C and D (25 GHz Offset) upon request; subject to laser diode availability.

Ordering Information for LS5

LS5- □ - □□□ -20-NM
BAND CODE (C or L)
ITU GRID COLUMN (A, B*, C*, or D*)
CHANNEL CODE

*Columns B (50 GHz Offset), C and D (25 GHz Offset) upon request; subject to laser diode availability.

REF Ordering Examples:

If you want to order a laser source for 1561.42 nm (192.00 THz), which is from the C-Band, you'll find it under C-Band, Column A, Channel 11. The item name therefore is: WDM8-C-11A-20-NM.

To order a source for 1590.20 nm (188.525 THz) the codes are L-Band , Column C, Channel 26, and the order code is WDM8-L-26C-20-NM.

If you order 8 DWDM sources you get the PRO8000 Chassis for free! In this case please use DWDM820 for the item number in your order and our Tech-Support team will contact you for the details about the individual laser sources.

Item# DWDM820 -Buy 8 DWDM Models, Get the PRO8000 Chassis FREE!

Lead times depend on the wavelengths of our laser sources. Please contact our technical support team for more information.

ITEM#	$	£	€	RMB	DESCRIPTION
WDM8-X-XXX-20-NM	$ 2,856.00	£ 1,980.00	€ 2.535,50	¥ 24,117.00	Single PRO8 WDM Laser Source, 20 mW, No Direct Modulation
DWDM820	$ 22,848.00	£15,839.00	€ 20.285,00	¥ 192,930.00	WDM Laser Sources, 20 mW, No Direct Modulation w/ PRO8000 Chassis
PRO800	$ 1,798.80	£ 1,247.00	€ 1.597,00	¥ 15,190.00	2-Slot Modular Benchtop Chassis
PRO8000	$ 2,470.80	£ 1,713.00	€ 2.193,50	¥ 20,864.00	8-Slot Modular Rack Chassis
PRO8000-4	$ 3,336.00	£ 2,312.50	€ 2.961,50	¥ 28,170.00	8-Slot High-Power Modular Rack Chassis

TOOLS OF THE TRADE

See Page 1072 for Details.

LS5000 DFB SOURCES FOR TXP PLATFORM

These Laser Sources are available for our TXP measurement platform as well. They can be combined with a multitude of plug-in modules for most demanding test and measurement applications.

ITU Grid Ordering Guide

C-Band (1529.75 nm - 1569.59 nm)

Channel	100 GHz Grid 0.80 nm		50 GHz Offset 0.40 nm		-25 GHz Offset 0.20 nm		+25 GHz Offset 0.20 nm	
	THz	nm	THz	nm	THz	nm	THz	nm
	Column A		Column B*		Column C*		Column D*	
01	191.00	1569.59	191.05	1569.18	191.025	1569.39	191.075	1568.98
02	191.10	1568.77	191.15	1568.36	191.125	1568.57	191.175	1568.16
03	191.20	1567.95	191.25	1567.54	191.225	1567.75	191.275	1567.34
04	191.30	1567.13	191.35	1566.72	191.325	1566.93	191.375	1566.52
05	191.40	1566.31	191.45	1565.90	191.425	1566.11	191.475	1565.70
06	191.50	1565.50	191.55	1565.09	191.525	1565.29	191.575	1564.88
07	191.60	1564.68	191.65	1564.27	191.625	1564.47	191.675	1564.07
08	191.70	1563.86	191.75	1563.45	191.725	1563.66	191.775	1563.25
09	191.80	1563.05	191.85	1562.64	191.825	1562.84	191.875	1562.44
10	191.90	1562.23	191.95	1561.83	191.925	1562.03	191.975	1561.62
REF 11	192.00	1561.42	192.05	1561.01	192.025	1561.22	192.075	1560.81
12	192.10	1560.61	192.15	1560.20	192.125	1560.40	192.175	1560.00
13	192.20	1559.79	192.25	1559.39	192.225	1559.59	192.275	1559.19
14	192.30	1558.98	192.35	1558.58	192.325	1558.78	192.375	1558.38
15	192.40	1558.17	192.45	1557.77	192.425	1557.97	192.475	1557.57
16	192.50	1557.36	192.55	1556.96	192.525	1557.16	192.575	1556.76
17	192.60	1556.55	192.65	1556.15	192.625	1556.35	192.675	1555.95
18	192.70	1555.75	192.75	1555.34	192.725	1555.55	192.775	1555.14
19	192.80	1554.94	192.85	1554.54	192.825	1554.74	192.875	1554.34
20	192.90	1554.13	192.95	1553.73	192.925	1553.93	192.975	1553.53
21	193.00	1553.33	193.05	1552.93	193.025	1553.13	193.075	1552.73
22	193.10	1552.52	193.15	1552.12	193.125	1552.32	193.175	1551.92
23	193.20	1551.72	193.25	1551.32	193.225	1551.52	193.275	1551.12
24	193.30	1550.92	193.35	1550.52	193.325	1550.72	193.375	1550.32
25	193.40	1550.12	193.45	1549.72	193.425	1549.92	193.475	1549.52
REF 26	193.50	1549.32	193.55	1548.91	193.525	1549.11	193.575	1548.71
27	193.60	1548.51	193.65	1548.11	193.625	1548.31	193.675	1547.92
28	193.70	1547.72	193.75	1547.32	193.725	1547.52	193.775	1547.12
29	193.80	1546.92	193.85	1546.52	193.825	1546.72	193.875	1546.32
30	193.90	1546.12	193.95	1545.72	193.925	1545.92	193.975	1545.52
31	194.00	1545.32	194.05	1544.92	194.025	1545.12	194.075	1544.72
32	194.10	1544.53	194.15	1544.13	194.125	1544.33	194.175	1543.93
33	194.20	1543.73	194.25	1543.33	194.225	1543.53	194.275	1543.13
34	194.30	1542.94	194.35	1542.54	194.325	1542.74	194.375	1542.34
35	194.40	1542.14	194.45	1541.75	194.425	1541.94	194.475	1541.55
36	194.50	1541.35	194.55	1540.95	194.525	1541.15	194.575	1540.76
37	194.60	1540.56	194.65	1540.16	194.625	1540.36	194.675	1539.96
38	194.70	1539.77	194.75	1539.37	194.725	1539.57	194.775	1539.17
39	194.80	1538.98	194.85	1538.58	194.825	1538.78	194.875	1538.38
40	194.90	1538.19	194.95	1537.79	194.925	1537.99	194.975	1537.59
41	195.00	1537.40	195.05	1537.00	195.025	1537.20	195.075	1536.81
42	195.10	1536.61	195.15	1536.22	195.125	1536.41	195.175	1536.02
43	195.20	1535.82	195.25	1535.43	195.225	1535.63	195.275	1535.23
44	195.30	1535.04	195.35	1534.64	195.325	1534.84	195.375	1534.45
45	195.40	1534.25	195.45	1533.86	195.425	1534.05	195.475	1533.66
46	195.50	1533.47	195.55	1533.07	195.525	1533.27	195.575	1532.88
47	195.60	1532.68	195.65	1532.29	195.625	1532.49	195.675	1532.09
48	195.70	1531.90	195.75	1531.51	195.725	1531.70	195.775	1531.31
49	195.80	1531.12	195.85	1530.72	195.825	1530.92	195.875	1530.53
50	195.90	1530.33	195.95	1529.94	195.925	1530.14	195.975	1529.75

L-Band (1569.80 nm - 1611.79 nm)

Channel	100 GHz Grid 0.80 nm		50 GHz Offset 0.40 nm		-25 GHz Offset 0.20 nm		+25 GHz Offset 0.20 nm	
	THz	nm	THz	nm	THz	nm	THz	nm
	Column A		Column B*		Column C*		Column D*	
01	186.00	1611.79	186.05	1611.35	186.025	1611.57	186.075	1611.14
02	186.10	1610.92	186.15	1610.49	186.125	1610.70	186.175	1610.27
03	186.20	1610.06	186.25	1609.62	186.225	1609.84	186.275	1609.41
04	186.30	1609.19	186.35	1608.76	186.325	1608.98	186.375	1608.54
05	186.40	1608.33	186.45	1607.90	186.425	1608.11	186.475	1607.68
06	186.50	1607.47	186.55	1607.04	186.525	1607.25	186.575	1606.820
07	186.60	1606.60	186.65	1606.17	186.625	1606.39	186.675	1605.96
08	186.70	1605.74	186.75	1605.31	186.725	1605.53	186.775	1605.10
09	186.80	1604.88	186.85	1604.46	186.825	1604.67	186.875	1604.24
10	186.90	1604.03	186.95	1603.60	186.925	1603.81	186.975	1603.38
11	187.00	1603.17	187.05	1602.74	187.025	1602.95	187.075	1602.53
12	187.10	1602.31	187.15	1601.88	187.125	1602.10	187.175	1601.67
13	187.20	1601.46	187.25	1601.03	187.225	1601.24	187.275	1600.81
14	187.30	1600.60	187.35	1600.17	187.325	1600.39	187.375	1599.96
15	187.40	1599.75	187.45	1599.32	187.425	1599.53	187.475	1599.11
16	187.50	1598.89	187.55	1598.47	187.525	1598.68	187.575	1598.25
17	187.60	1598.04	187.65	1597.62	187.625	1597.83	187.675	1597.40
18	187.70	1597.19	187.75	1596.76	187.725	1596.98	187.775	1596.55
19	187.80	1596.34	187.85	1595.91	187.825	1596.13	187.875	1595.70
20	187.90	1595.49	187.95	1595.06	187.925	1595.28	187.975	1594.85
21	188.00	1594.64	188.05	1594.22	188.025	1594.43	188.075	1594.00
22	188.10	1593.79	188.15	1593.37	188.125	1593.58	188.175	1593.16
23	188.20	1592.95	188.25	1592.52	188.225	1592.73	188.275	1592.31
24	188.30	1592.10	188.35	1591.68	188.325	1591.89	188.375	1591.47
25	188.40	1591.26	188.45	1590.83	188.425	1591.04	188.475	1590.62
26	188.50	1590.41	188.55	1589.99	188.525	1590.20	188.575	1589.78
27	188.60	1589.57	188.65	1589.15	188.625	1589.36	188.675	1588.94
28	188.70	1588.73	188.75	1588.30	188.725	1588.51	188.775	1588.09
29	188.80	1587.88	188.85	1587.46	188.825	1587.67	188.875	1587.25
30	188.90	1587.04	188.95	1586.62	188.925	1586.83	188.975	1586.41
31	189.00	1586.20	189.05	1585.78	189.025	1585.99	189.075	1585.57
32	189.10	1585.36	189.15	1584.95	189.125	1585.16	189.175	1584.74
33	189.20	1584.53	189.25	1584.11	189.225	1584.32	189.275	1583.90
34	189.30	1583.69	189.35	1583.27	189.325	1583.48	189.375	1583.06
35	189.40	1582.85	189.45	1582.44	189.425	1582.64	189.475	1582.23
36	189.50	1582.02	189.55	1581.60	189.525	1581.81	189.575	1581.39
37	189.60	1581.18	189.65	1580.77	189.625	1580.98	189.675	1580.56
38	189.70	1580.35	189.75	1579.93	189.725	1580.14	189.775	1579.73
39	189.80	1579.52	189.85	1579.10	189.825	1579.31	189.875	1578.89
40	189.90	1578.69	189.95	1578.27	189.925	1578.48	189.975	1578.06
41	190.00	1577.86	190.05	1577.44	190.025	1577.65	190.075	1577.23
42	190.10	1577.03	190.15	1576.61	190.125	1576.82	190.175	1576.40
43	190.20	1576.20	190.25	1575.78	190.225	1575.99	190.275	1575.57
44	190.30	1575.37	190.35	1574.95	190.325	1575.16	190.375	1574.75
45	190.40	1574.54	190.45	1574.13	190.425	1574.33	190.475	1573.92
46	190.50	1573.71	190.55	1573.30	190.525	1573.51	190.575	1573.09
47	190.60	1572.89	190.65	1572.48	190.625	1572.68	190.675	1572.27
48	190.70	1572.06	190.75	1571.65	190.725	1571.86	190.775	1571.45
49	190.80	1571.24	190.85	1570.83	190.825	1571.03	190.875	1570.62
50	190.90	1570.42	190.95	1570.01	190.925	1570.21	190.975	1569.80

*Columns B (50 GHz Offset), C and D (25 GHz Offset) upon request; subject to laser diode availability.

DWDM Laser Sources for TXP5000 – LS5000 Series (Page 1 of 2)

ITU Coverage: We are committed to providing quick delivery of any of the 100 lasers (on a 100 GHz grid) that comprise the DWDM C- and L-bands*. When ordering, please refer to the tables presented on the previous page which are organized based on 100 GHz channel spacings. Pricing and ordering codes can also be found there. Our order codes are a combination of the band designator (C or L), the 100 GHz channel number (01 through 50), and an additional character (A, B, C, or D) that indicates the frequency offset from the base channel.

*Subject to Laser Diode Availability, 50 GHz and 25 GHz grid upon request.

Introduction – LS5000 DWDM Laser Modules

The LS5000 DWDM laser modules for the TXP5000 Series Test and Measurement Platform offer precise tunability as well as long-term wavelength and power stability. Adjustable coherence control makes them ideal for both active and passive DWDM component testing as well as multi-wavelength transmission experiments.

The WDM laser modules are ideally suited for all DWDM applications, ranging from test systems for fiber optic DWDM components and EDFA production to multi-laser optical sources for DWDM transmission experiments.

Stability, Accuracy, and Dependability

This DWDM laser platform is the ideal choice for demanding DWDM test and measurement applications with laser linewidths of less than 10 MHz, center wavelength stability of better than 0.005 nm per 24 hours, and wavelength accuracy of better than ±0.025 nm. We use only telecom-rated, butterfly-packaged DFB lasers with integrated TEC elements, optical isolators, and low back-reflection fiber pigtails. When combined with our sophisticated drive circuits, the result is an extremely stable, low-noise laser source that exhibits optical power stability that is better than 0.005 dB per 60 minutes and a relative intensity noise RIN figure of 145 dB/Hz (Typ.). All Thorlabs' instruments are backed by an extensive two-year warranty on materials and workmanship.

Extensive Inventories

Thorlabs' DWDM sources covet the ITU grid containing wavelenghts (100 GHz channels) spanning the C- and L-Bands. Wavelengths on the 50 GHz and 25 GHz grid are available upon request.

For manufacturers of laser diodes, Thorlabs also offers the service of incorporating user-supplied lasers into our modules. Please contact technical support for details.

The LS5000 Sources for the TXP Test and Measurement Platform offer more general test and measurement applications than the WDM8 sources. The TXP platform consists of a combined laser diode current and TEC controller to drive the LS5000 sources, modules for polarization analysis and control (see Pages 1326-1336), and a tunable laser module (See Page 1086). It offers TCP/IP or USB interfaces to allow to enable very flexible setups.

Features

- 100 Wavelengths on 100 GHz ITU Grid*
- Wavelengths in C- and L-Bands*
- Wavelength Stability <0.005 nm (24 Hours)
- Output Power Stability <0.01 dB (24 Hours)
- Precise Wavelength Tuning Over ±0.85 nm
- Direct Display of Wavelength During Tuning
- Precise Power Tuning Over >6 dB (10 dB Typ.)
- Variable Coherence Control, Linewidths up to 1 GHz
- Instrument Drivers for LabVIEW™ and LabWindows™/CVI Included
- FC/APC Connector

* Subject to Laser Diode Availability, 50 GHz and 25 GHz grid upon request.

TXP5000 Series Specifications

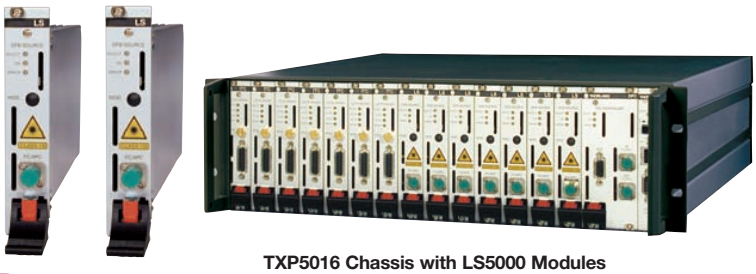
See Pages 993-1007 for Details.

	TXP5016	TXP5004	TXP5001AD
Maximum Power Consumption	300 W	100 W	36 W
Number of Slots	16 Slots	4 Slots	1 Slot
Operation	GUI on Rem PC		
Remote Interface	Ethernet 10Base-T	USB 2.0	USB 2.0
Remote Drivers	LabVIEW™, LabWindows/CVI™, and C++		
Chassis Ground	4 mm Banana		4.8 mm Fast-On
Line Voltage	100 to 240 VAC ±10%		
Line Frequency	50 to 60 Hz ± 5%		
Operating Temperature	0 to 40 °C		
Storage Temperature	-40 to 70 °C		
Dimensions	449 mm x 148 mm x 435 mm	168 mm x 148 mm x 315 mm	124 mm x 23 mm x 112 mm
Weight (w/o Modules)	7 kg (15.41lb)	3 kg (6.61lb)	0.2 kg (0.44lb)

DWDM Laser Sources for TXP5000 – LS5000 Series (Page 2 of 2)

Coherence Control

All the DWDM series laser modules provide an adjustable coherence length control. For high-precision power measurement, the narrow linewidth of a DFB laser can lead to coherent interference effects due to reflections from the multiple surfaces that are present in most optical systems.



TXP5016 Chassis with LS5000 Modules

Specifications

Wavelength

- **Options:** 100 Wavelengths on the 100 GHz ITU Grid (C- and L-Bands)*
- **Tuning Range:** ±0.85 nm
- **Accuracy:** ± 0.025 nm, < ±0.01 nm (Typical)
- **Stability:** < 0.005 nm over 24 Hours (Typical)
- **Resolution:** 1 pm
- **Laser Linewidth:** < 10 MHz

Output Power

- **Optical Power:** 20 mW
- **Accuracy (Abs/Rel):** 0.6 dB/0.4 dB
- **Stability:** < 0.002 dB over 15 s, < 0.005 dB Over 1 hr, < 0.01 dB over 24 hrs
- **Attenuation:** >6 dB, 10 dB (Typical) (Continuously Variable)
- **Resolution:** 0.01 dB
- **Side Mode Suppression Ratio:** >40 dB (Typical), >36 dB Min (at Max Power)
- **Relative Intensity Noise (RIN):** -145 dB/Hz (Typical)
- **Optical Isolation:** >35 dB

Coherence Control (Standard Feature, All Models)

- **Linewidth:** up to 1 GHz (Adjustable)
- **Shape:** Sine, Square, and Triangle
- **Frequency:** 0.02 up to 20 kHz
- **Modulation Depth:** 0.1 to 100%

Modulation

- **Analog LF Modulation:** DC - 50 kHz (Optional via SMA Input)

General Data

- **Optical Output:** FC/APC Connector**
- **Fiber:** PMF (Connector Key Aligned to Slow Axis upon Request)
- **Operating temperature:** 0 to 35 °C Non Condensing
- **Storing temperature:** -40 to 60 °C
- **Warm-up Time:** 15 min for Rated Accuracy
- **Laser Module Width:** 1 Slot
- **Laser Safety Class:** 1M

*Subject to Laser Diode Availability, 50 GHz and 25 GHz grid upon request.

**Other Connector Styles, (i.e., SC, E2000) and Non-Angled (PC) Ferrule upon request.

Interference Effects

For high-precision power measurements, the narrow linewidth of a DFB laser can lead to interference effects caused by reflections from the multiple surfaces that are present in most optical systems. These multiple reflections, while extremely small, can accumulate due to the long coherence length. Brillouin scattering is another effect that can lead to significant errors when making optical power measurements in fiber-based systems. The magnitude of these effects can be significantly reduced by increasing the linewidths of the source. Therefore, all the LS5000 series laser sources provide a control to adjust the coherence length; a small signal modulation on the laser current is used to broaden the DFB laser linewidth from a few MHz up to more than 1 GHz. The LS5000 modules provide continuous adjustment of the linewidth over this entire range. An internal freely running sine/square/triangle wave generator is used to modulate the laser current. The modulation frequency range of the function generator is 20 Hz to 50 kHz with up to 100% modulation depths. Using these features, an ideal non-discrete, Gaussian-shaped or a discrete spectral distribution is generated.

External Analog Low Frequency (LF) Modulation DC to 50 kHz (Optional)

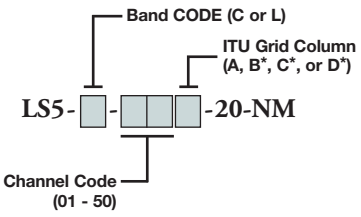
For applications where a precise LF modulation up to 50 kHz is required, the LS5000 modules are available with an LF modulation option. With this option, the output power can be modulated via an optional SMA input. The laser remains fully protected due to a precise limit circuit located inside the module.

Precision Wavelength Tuning

The wavelength is displayed with a resolution of 0.001 nm. By precisely controlling the temperature of the laser chip, the emitted wavelength can be tuned over a range of ±0.85 nm (approximately ±100 GHz). This range allows the central wavelength of the source to be shifted from one transmission channel to the adjacent channels in dense WDM systems with 100 GHz channel spacing, and a tuning over up to 8 channels in systems with 25 GHz channel spacing. This feature is useful for simulating crosstalk between channels and can also be used to measure the profile of narrow band DWDM filters.

Ordering Information

The item name for the order of your laser source can be obtained from the ITU Grid on page 1071 in the same way as for the WDM8 sources. Just replace WDM8 by LS5.



*Columns B, C, and D Upon Request

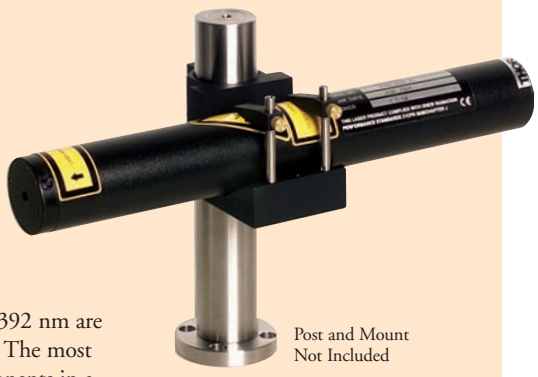
ITEM#	$	£	€	RMB	DESCRIPTION
LS5-X-XXX-20-NM	$ 2,754.00	£ 1,909.00	€ 2.445,00	¥ 23,255.00	Single TXP WDM Laser Source, 20 mW, No Direct Modulation
TXP5004	$ 1,222.80	£ 847.70	€ 1.085,70	¥ 10,326.00	TXP Test and Measurement, 4 Slot with USB Control
TXP5016	$ 3,549.60	£ 2,460.50	€ 3.151,50	¥ 29,973.00	TXP Test and Measurement, 16 Slot with Ethernet Control

HeNe Lasers Selection Guide

Pages 1074-1078

Wavelengths at 543, 594, 604, 612, 633, 1523, and 3392 nm

Post and Mount
Not Included



Post and Mount
Not Included

Thorlabs offers a variety of Helium-Neon Lasers with powers from 0.5 to 35 mW as stock items. Wavelengths of 543, 594, 604, 612, 633, 1523, and 3392 nm are available in various package styles and with two different output polarizations. The most commonly used HeNe lasers are at 633 nm and have become common components in a variety of applications in both research and industry. Thorlabs also offers a wavelength-selectable HeNe laser that can be tuned to 633, 612, 604, 594, or 543 nm by adjusting a screw on the back of the unit. Tuning is achieved by incorporating a low-loss plasma tube with one sealed Brewster window and an external, adjustable Littrow prism all within the laser's case.

All Thorlabs HeNe lasers are CE compliant and include separate or integrated power supplies.

HeNe Laser Selection Guide

WAVELENGTH (nm)	CW OUTPUT POWER (mW)	1/e² BEAM DIAMETER (mm)	BEAM DIVERGENCE (mrad)	LONGITUDINAL MODE SPACING (MHz)	MODE STRUCTURE	LASER HEAD LENGTH* (inch/mm)	POLARIZATION RATIO	ITEM#	PAGE
543	0.5	0.72	0.96	416	TEM_{00} >99%	16.75/425.5	500:1	HGP005	1077
543	0.5	0.64	1.07	566	TEM_{00} > 99%	13/330.2	Random	HGR005	1077
543	2.0	0.83	0.84	303	TEM_{00} > 99%	21/533.4	Random	HGR020	1077
594	2.0	0.74	1.03	416	TEM_{00} > 99%	16.75/425.5	500:1	HYP020	1077
633	0.5	0.57	1.41	416	TEM_{00} > 99%	6.75/171.4**	Random	HRR005S	1075
633	0.5	0.57	1.41	416	TEM_{00} > 99%	6.75/171.4**	500:1	HRP005S	1075
633	0.5	0.57	1.41	1082	TEM_{00} > 99%	7.0/177.8	Random	HRR005	1075
633	0.8	0.57	1.41	1082	TEM_{00} > 99%	7.0/177.8	500:1	HRP008	1075
633	1.5	0.64	1.25	714	TEM_{00} > 99%	9.5/241.3	500:1	HRP015	1075
633	1.5	0.57	1.41	1082	TEM_{00} > 99%	7.0/177.8	Random	HRR015	1075
633	2.0	0.81	1.00	566	TEM_{00} > 99%	13/330.2	500:1	HRP020	1075
633	2.0	0.81	1.00	566	TEM_{00} > 99%	13/330.2	Random	HRR020	1075
633	5.0	0.80	1.01	441	TEM_{00} > 99%	16.75/425.5	500:1	HRP050	1076
633	5.0	0.80	1.01	441	TEM_{00} > 99%	16.75/425.5	Random	HRR050	1076
633	12.0	0.88	0.92	316	TEM_{00} > 99%	21/533.2	500:1	HRP120	1076
633	12.0	0.88	0.92	316	TEM_{00} > 99%	21/533.2	Random	HRR120	1076
633	17.0	0.98	0.82	252	TEM_{00}> 99%	26/660.4	500:1	HRP170	1076
633	17.0	0.98	0.82	252	TEM_{00} > 99%	26/660.4	Random	HRR170	1076
633	35.0	1.22	0.66	163	TEM_{00} > 99%	3.75/95	500:1	HRP350	1076
1523	1.0	1.36	1.43	316	TEM_{00} > 99%	21/533.4	500:1	H152P1	1077
3392	2.0	2.02	2.13	316	TEM_{00} > 99%	21/533.4	500:1	H339P2	1077

*All laser bodies are cylindrical except HRP350, which is square. ** Length of self-contained units

Wavelength-Selectable HeNe Laser - See Page 1077

WAVELENGTH (nm)	MODE STRUCTURE	MINIMUM POWER (mW)	BEAM DIAMETER (mm)	DIVERGENCE (mrad)	POLARIZATION RATIO	LONGITUDINAL MODE SPACING (MHz)
633	TEM_{00} > 99%	4.0	0.77	1.05	500:1	428
612	TEM_{00} > 99%	2.5	0.76	1.03	500:1	428
604	TEM_{00} > 99%	0.5	0.75	1.02	500:1	428
594	TEM_{00} > 99%	0.6	0.74	1.02	500:1	428
543	TEM_{00} > 99%	0.3	0.71	0.97	500:1	428

Self-Contained, Red (632.8 nm) Helium-Neon Lasers

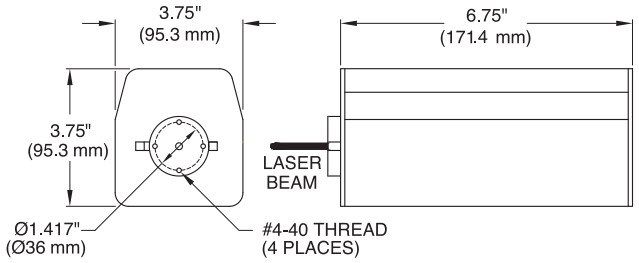
These compact, self-contained Helium-Neon lasers integrate a red (632.8 nm) HeNe laser tube with a built-in switchable power supply. They are the ideal choice for applications, such as alignments, that require a small, low-power laser. The rugged enclosure includes four #4-40 mounting holes for easy attachment of accessories.

HRP005S

Features

- Ideal for Alignment Applications
- Available in Polarized and Random Polarization Versions
- Built-in Switchable Beam Block and Power Supply
- CE Compliant
- Improved Start-up Circuit
- Four #4-40 Tapped Mounting Holes for Easy Attachment of Accessories

Switchable (110/230 VAC) Power Supply Included



Please refer to our website for complete models and drawings.

ITEM#	λ	$	£	€	RMB	POWER	DESCRIPTION	POLARIZATION
HRP005S	632.8 nm	$ 887.00	£ 614.90	€ 787,50	¥ 7,489.90	0.5 mW	HeNe Laser System, 633 nm, 0.5 mW, Polarized	Linear >500:1
HRR005S	632.8 nm	$ 855.00	£ 592.80	€ 759,10	¥ 7,219.70	0.5 mW	HeNe Laser System, 633 nm, 0.5 mW, Random	Random

Low-Power, Compact, Red (632.8 nm) Helium-Neon Lasers 0.5 mW to 2.0 mW

Low-Power and Compact HeNe Laser Features

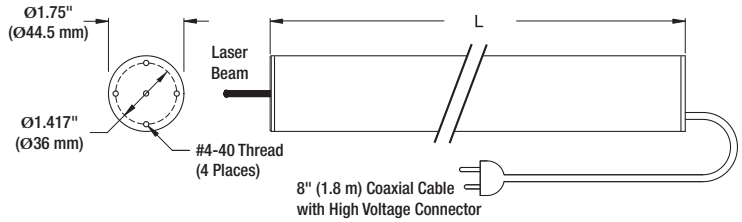
- Cylindrical Tube Mounts Easily into Optical Systems
- Four #4-40 Tapped Mounting Holes for Easy Attachment of Accessories
- Keyed Power Supply with Built-in Interlock Included
- CE Compliant


HRR005

Post and Mount Not Included

Mechanical Drawings Available on the WEB

Switchable (110/230 VAC) Power Supply Included



Please refer to our website for complete models and drawings.

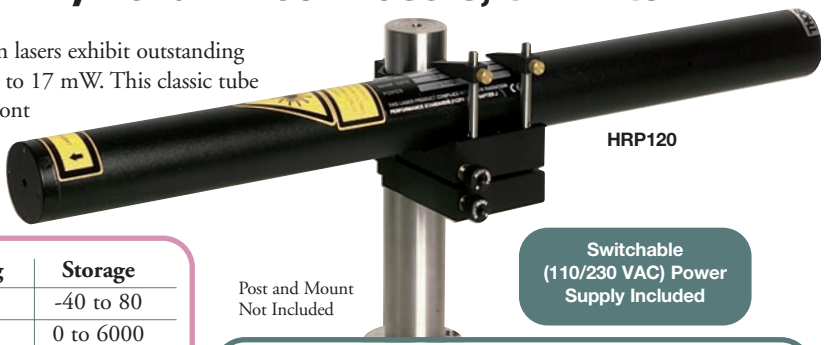
These cylindrical, low-power, red (632.8 nm) Helium-Neon lasers range in power from 0.5 to 2.0 mW. The classic tube design makes it easy to mount in nearly any optical system. The HeNe laser comes with a built-in interlock for safety. Thorlabs offers the 632.8 nm laser with either linear (>500:1) or random polarization and beam divergences ranging from 1.00 to 1.41 mrad.

ITEM#	POWER	POLARIZATION	L	$	£	€	RMB	1/e² BEAM DIAMETER	BEAM DIVERGENCE	LONGITUDINAL MODE SPACING
HRR005	0.5 mW	Random	7.00"	$ 948.00	£ 657.20	€ 841,70	¥ 8,005.00	0.57 mm	1.41 mrad	1082 MHz
HRP008	0.8 mW	Linear >500:1	7.00"	$ 1,018.00	£ 705.70	€ 903,80	¥ 8,596.10	0.57 mm	1.41 mrad	1082 MHz
HRP015	1.5 mW	Linear >500:1	9.50"	$ 1,038.00	£ 719.60	€ 921,60	¥ 8,764.90	0.64 mm	1.25 mrad	714 MHz
HRR015	1.5 mW	Random	7.00"	$ 998.00	£ 691.90	€ 886,10	¥ 8,427.20	0.57 mm	1.41 mrad	1082 MHz
HRP020	2.0 mW	Linear >500:1	13.00"	$ 996.00	£ 690.50	€ 884,30	¥ 8,410.30	0.81 mm	1.00 mrad	566 MHz
HRR020	2.0 mW	Random	13.00"	$ 950.00	£ 658.60	€ 843,50	¥ 8,021.90	0.81 mm	1.00 mrad	566 MHz

LASER RADIATION
AVOID DIRECT EYE EXPOSURE
CLASS 3R LASER PRODUCT
543-700nm <5mw
IEC 60825-1 EDITION 1.2 2001-08

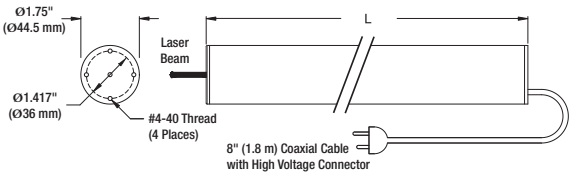
High-Power, Red (632.8 nm) Helium-Neon Lasers, 5 mW to 17 mW

These high-power, red (632.8 nm), Helium-Neon lasers exhibit outstanding stability and performance with power outputs up to 17 mW. This classic tube design features four #4-40 holes located on the front for easy mounting of accessories. Please visit our website (www.thorlabs.com) for the latest accessories.



Switchable (110/230 VAC) Power Supply Included

Specifications	Operating	Storage
Temperature (°C)	-20 to 70	-40 to 80
Altitude (m)	0 to 3000	0 to 6000
Humidity	≤80%	≤95%
Shock	15 g for 11 ms	
Start-up Voltage	<10 kVDC	
Beam Drift (After 20 min Warm-up)	<0.2 mrad	
Long-Term Beam Drift	<0.05 mrad	
Noise (30 Hz to 10 MHz)	<1% RMS	



Please refer to our website for complete models and drawings.

ITEM#	POWER	POLARIZATION	L	$	£	€	RMB	1/e² BEAM DIAMETER	BEAM DIVERGENCE	LONGITUDINAL MODE SPACING
HRP050	5.0 mW	Linear >500:1	16.75"	$ 1,127.00	£ 781.30	€ 1.000,60	¥ 9,516.50	0.80 mm	1.01 mrad	441 MHz
HRR050	5.0 mW	Random	16.75"	$ 1,150.00	£ 797.30	€ 1.021,00	¥ 9,710.70	0.80 mm	1.01 mrad	441 MHz
HRP120	12.0 mW	Linear >500:1	21.00"	$ 1,978.00	£ 1,371.00	€ 1.756,00	¥ 16,703.00	0.88 mm	0.92 mrad	316 MHz
HRR120	12.0 mW	Random	21.00"	$ 1,620.00	£ 1,123.00	€ 1.438,00	¥ 13,680.00	0.88 mm	0.92 mrad	316 MHz
HRP170	17.0 mW	Linear >500:1	26.00"	$ 2,450.00	£ 1,698.50	€ 2.175,00	¥ 20,688.00	0.98 mm	0.82 mrad	252 MHz
HRR170	17.0 mW	Random	26.00"	$ 2,370.00	£ 1,643.00	€ 2.104,00	¥ 20,013.00	0.98 mm	0.8 mrad	252 MHz

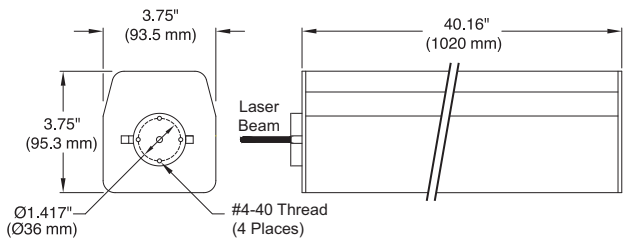
35 mW, Red (632.8 nm) Helium-Neon Lasers

The HRP350 and HRP350-EC Helium-Neon Lasers are based on a novel extension of the hard-seal technology used in the cylindrical HeNe lasers. These lasers bring the same reliable, long-life operation to high-power applications as their lower power counterparts. The innovative construction of this system includes a rigid outer housing, which maintains mirror alignment and leads to a much lighter laser that is less susceptible to misalignment during shipment and installation than other designs.

Features

- 35 mW of Output Power
- Complete System with Power Supply
- Novel Design for Long Life and Extreme Stability
- External Power Supply Provided
  - HRP350 for 110 VAC Nominal Input
  - HRP350-EC for 230 VAC Nominal Input

Specifications	Operating	Storage
Temperature (°C)	-20 to 70	-40 to 80
Altitude (m)	0 to 3000	0 to 6000
Humidity	≤80%	≤95%
Shock	15 g for 11 ms	
Startup Voltage	<10 kVDC	
Beam Drift (After 20 min Warm-up)	<0.2 mrad	
Long-Term Beam Drift	<0.05 mrad	
Noise (30 Hz to 10 MHz)	<1% RMS	



Please refer to our website for complete models and drawings.

ITEM#	POWER	POLARIZATION	$	£	€	RMB	1/e² BEAM DIAMETER	BEAM DIVERGENCE	LONGITUDINAL MODE SPACING
HRP350*	35.0 mW	Linear >500:1	$ 6,320.00	£ 4,382.00	€ 5.611,00	¥ 53,367.00	1.22 mm	0.66 mrad	163 MHz
HRP350-EC**	35.0 mW	Linear >500:1	$ 6,320.00	£ 4,382.00	€ 5.611,00	¥ 53,367.00	1.22 mm	0.66 mrad	163 MHz

*110 VAC External Power Supply Included **230 VAC External Power Supply Included

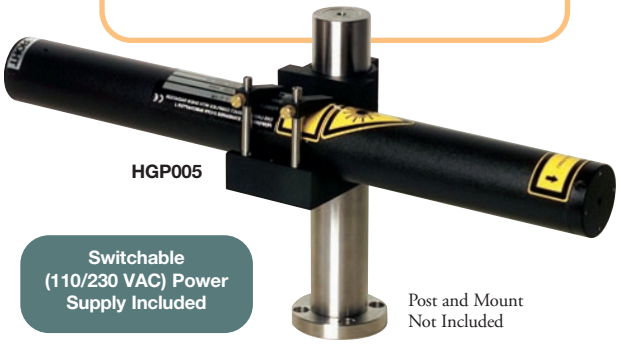
Green, Yellow, and IR Helium-Neon Lasers

Thorlabs offers a selection of HeNe lasers with output at 543 nm, 594 nm, 1523 nm, or 3392 nm. These HeNe Lasers have power levels ranging from 0.5 to 2.0 mW. The HGP005, HYP020, H152P1, and H339P2 are polarized models, whereas the HGR005 and HGR020 exhibit random polarization.

Features

- Output at 543, 594, 1523, or 3392 nm
- Long Lifetimes
- Ideal for Alignment Applications and Precision Metrology

Specifications	Operating	Storage
Temperature Range (°C)	-20 to 70	-40 to 80
Maximum Altitude (m)	0 to 3000	0 to 6000
Humidity	≤80%	≤95%
Shock	15 g for 11 ms	
Startup Voltage	<10 kV DC	
Beam Drift (After 20 min Warm-up)	<0.2 mrad	
Long-Term Beam Drift	<0.05 mrad	
Noise (30 Hz to 10 MHz)	<1% RMS	

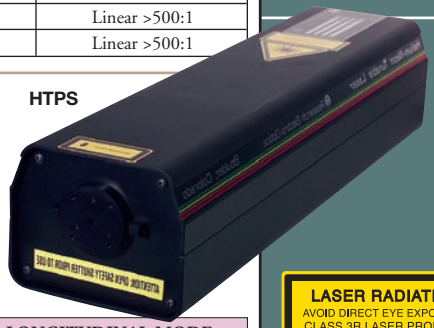


Switchable (110/230 VAC) Power Supply Included

Post and Mount Not Included

ITEM#	POWER	WAVELENGTH	L	$	£	€	RMB	1/e² BEAM DIAMETER	BEAM DIVERGENCE	POLARIZATION
HGP005	0.5 mW	543 nm	16.75"	$ 1,487.00	£ 1,031.00	€1.320,00	¥ 12,557.00	0.72 mm	0.96 mrad	Linear >500:1
HGR005	0.5 mW	543 nm	13.00"	$ 1,265.00	£ 877.00	€1.123,10	¥ 10,682.00	0.64 mm	1.07 mrad	Random
HGR020	2.0 mW	543 nm	21.00"	$ 1,995.00	£ 1,383.00	€1.771,00	¥ 16,846.00	0.83 mm	0.84 mrad	Random
HYP020	2.0 mW	594 nm	16.75"	$ 2,079.00	£ 1,441.00	€1.846,00	¥ 17,556.00	0.74 mm	1.03 mrad	Linear >500:1
H152P1	1.0 mW	1523 nm	21.00"	$ 2,498.00	£ 1,731.50	€2.217,50	¥ 21,094.00	1.36 mm	1.43 mrad	Linear >500:1
H339P2	2.0 mW	3392 nm	21.00"	$ 3,035.00	£ 2,104.00	€2.694,50	¥ 25,628.00	2.02 mm	2.13 mrad	Linear >500:1

Wavelength-Selectable Helium-Neon Laser

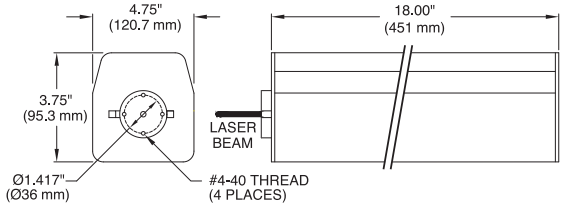


- Output at 633, 612, 604, 594, or 543 nm
- Excellent Power, Beam Pointing, and Thermal Stability

Thorlabs offers a line of selectable-wavelength, five-color, HeNe laser systems that can switch between all of the main visible neon laser transitions (543 nm, 594 nm, 604 nm, 612 nm, and 633 nm), making the system a versatile and economical research tool.

WAVELENGTH (nm)	MODE STRUCTURE	MINIMUM POWER (mW)	BEAM DIAMETER (mm)	DIVERGENCE (mrad)	POLARIZATION RATIO	LONGITUDINAL MODE SPACING (MHz)
543	TEM_{00} >99%	0.3	0.71	0.97	Linear >500:1	428
594	TEM_{00} >99%	0.6	0.74	1.02	Linear >500:1	428
604	TEM_{00} >99%	0.5	0.75	1.02	Linear >500:1	428
612	TEM_{00} >99%	2.5	0.76	1.03	Linear >500:1	428
633	TEM_{00} >99%	4.0	0.77	1.05	Linear >500:1	428

The HTPS and HTPS-EC HeNe Lasers incorporate a low-loss plasma tube with one sealed Brewster Window and an external Littrow Prism. By adjusting the angle of the Littrow Prism using the micrometer adjustments on the rear panel, the user can select among the visible neon laser transitions. A power supply is housed internally in the laser, making the unit completely self-contained. Choose the HTPS for 110 V operation and the HTPS-EC for 230 V operation.



Please refer to our website for complete models and drawings.

Specifications	Operating	Storage
Temperature Range (°C)	-20 to 70	-40 to 80
Maximum Altitude (m)	0 to 3000	0 to 6000
Humidity	≤80%	≤95%
Shock	15 g for 11 ms	
Startup Voltage	<10 kVDC	
Beam Drift (After 20 min Warm-up)	<0.2 mrad	
Long-Term Beam Drift	<0.05 mrad	
Noise (30 Hz to 10 MHz)	<1% RMS	

ITEM#	λ(nm)	$	£	€	RMB	POWER	DESCRIPTION	POLARIZATION
HTPS	543-633	$ 5,678.00	£ 3,937.00	€ 5.041,00	¥ 47,946.00	0.3-4.0 mW	Wavelength-Selectable, Five-Color HeNe Laser, 110 VAC	Linear >500:1
HTPS-EC	543-633	$ 5,678.00	£ 3,937.00	€ 5.041,00	¥ 47,946.00	0.3-4.0 mW	Wavelength-Selectable, Five-Color HeNe Laser, 230 VAC	Linear >500:1

FiberPort Collimators

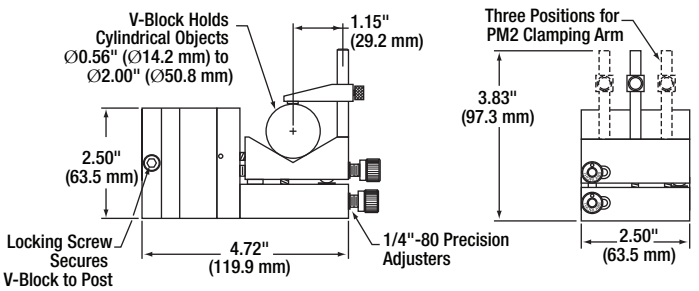
See Pages 907-909

Fine Adjustment Helium-Neon Laser Mount

Features

- Pitch and Yaw Adjustment for Easy Beam Pointing
- Kinematic Design Provides Stability
- Ø2" (Ø50.8 mm) Maximum Clamping Diameter
- Ø0.56" (Ø14 mm) Minimum Clamping Diameter
- Compatible with Standard Ø1.5" Mounting Posts

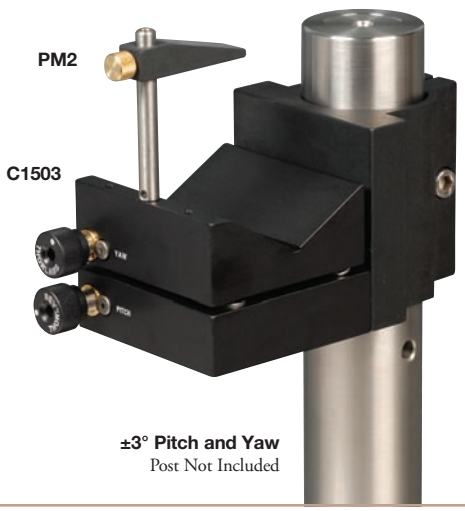
The C1503 is a kinematic cylindrical laser mount that provides two axes of precision angular adjustment. The angular adjustments provide control of the beam point, while the vertical height can be set by moving the unit along the support post. A series of hardened chromium steel balls and ball seats form a true kinematic mechanism that works with gravity to provide long-term stability.



Please refer to our website for complete models and drawings.

ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
C1503*	C1503/M*	$ 221.00	£ 153.30	€ 196,30	¥ 1,866.20	Kinematic Laser Mount
PM2	PM2/M	$ 14.70	£ 10.20	€ 13,10	¥ 124.20	Extra Clamping Arm

*One PM2(/M) included with each unit.



±3° Pitch and Yaw
Post Not Included

FiberPort Mounts

Features

- HeNe Industry Standard Four Bolt Pattern
- Includes #4-40 Cap Screws for Attaching to HeNe Laser
- Includes #2-56 Cap Screws for Attaching to FiberPort
- Features Internal C-Mount Threading

HCL

The HCL adapter allows a FiberPort to be attached directly to the front of a HeNe laser utilizing a HeNe industry standard four bolt pattern. This adapter includes the necessary #4-40 cap screws for attaching to a HeNe as well as four cap screws to attach a FiberPort. For added mounting options, the HCL features internal C-Mount threading, which is utilized on some lasers. See pages 907-909 for FiberPort details.

ITEM#	$	£	€	RMB	DESCRIPTION
HCL	$ 30.60	£ 21.30	€27,20	¥258.40	HeNe Laser to Fiber Port Adapter

HCL Fiber Port Adapter with HeNe Laser, Kinematic Mount, Clamp Arm, FiberPort Collimator, and Fiber Patch Cable
HCL, HRP-15, C1503, PM2, PAF-X-5-B, P1-630A-FC-2, and Post Sold Separately

LDM Series of Laser Diode Modules

The LDM Series of Laser Diode Modules are offered with output wavelengths of 405, 635, 670, 785, 850, or 1550 nm. These self-contained laser diode modules, which include a built-in constant power laser diode driver system for stable CW output, provide collimated output beams. Equipped with SM1-compatible threading, these user-friendly modules are directly compatible with many of our optics packages for focusing or collimating light sources. The output power can be controlled via a user-accessible adjustment pot, a beam shutter, or an enable switch.

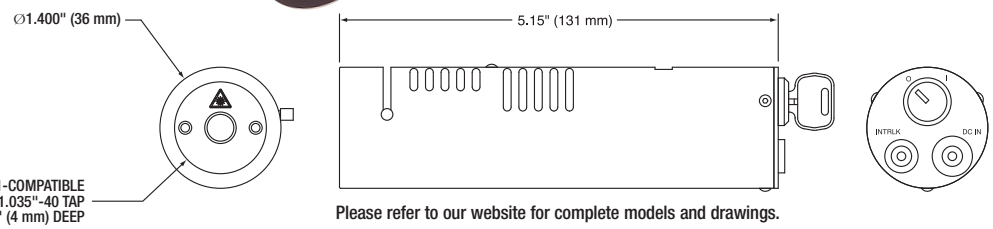
The LDM Series has all of the required safety features, including a keylock power switch, remote interlock connection, beam shutter, and Laser ON indicator. Operating from a 9 VDC power supply, which is included with the module, each module can be mounted to any optical table using one of our C1502, C1503, KM200B, or VC3 V-Groove Mounts.

Features

- Choose from 6 Wavelengths
- Adjustable Output Power
- IEC60825-1/CDRH Compliant
- Collimated Output Beam
- Beam Shutter
- SM1 Compatible

LDM635 Shown in a KM200V Kinematic Mount (Sold Separately)

See Page 234



Please refer to our website for complete models and drawings.

ITEM#	$	£	€	RMB	DESCRIPTION
LDM405	$ 912.90	£ 632.90	€ 810,50	¥ 7,708.60	405 nm, 4.5 mW, LDM Laser Module, Class 3R
LDM635	$ 579.40	£ 401.70	€ 514,40	¥ 4,892.50	635 nm, 4.5 mW, LDM Laser Module, Class 3R
LDM670	$ 574.90	£ 398.60	€ 510,50	¥ 4,854.50	670 nm, 5.5 mW, LDM Laser Module, Class 3B
LDM785	$ 609.80	£ 422.80	€ 541,40	¥ 5,149.20	785 nm, 20 mW, LDM Laser Module, Class 3B
LDM850	$ 689.80	£ 478.20	€ 612,50	¥ 5,824.70	850 nm, 20 mW, LDM Laser Module, Class 3B
LDM1550	$ 650.50	£ 451.00	€ 577,60	¥ 5,492.90	1550 nm, 4.5 mW, LDM Laser Module, Class 1M

Laser Diode Kit

Features

- S2011 Laser Kit Comes Complete with Laser Module, Mount, and Power Supply
- Ideal as a General Purpose Alignment Aid
- 635 nm, 4.5 mW

The S2011 utilizes the CPS196 laser module, which features a focusable output beam. The laser diode wavelength is 635 nm, and the output power is 4.5 mW. (See next page for Laser Diode specifications). Included in the kit are the post, post holder, base, and LDS1 power supply shown in the picture.

Complete as Shown in Photograph.

- **S2011 Power Supply:** 110/120 VAC, 50-60 Hz
- **S2011-EC Power Supply:** 220/240 VAC, 50-60 Hz

ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
S2011	S2011-EC	$ 334.60	£ 232.00	€ 297,10	¥ 2,825.40	635 nm, 4.5 mW Laser Diode Kit

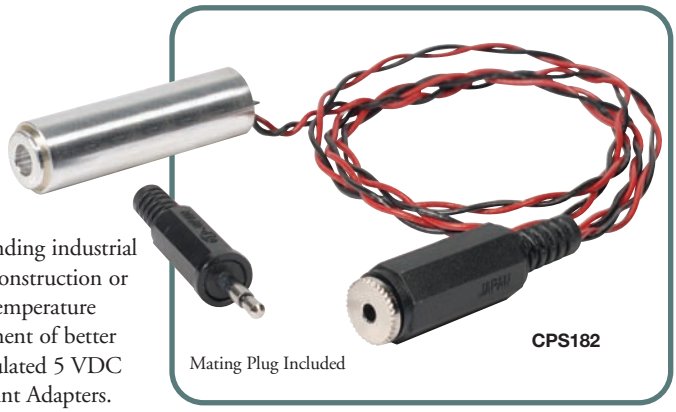
CPS Laser Module Mounting Adapters

See Page 305 and 220

CPS Series of Laser Modules (λ = 635 – 808 nm)

Features

- Designed to Handle Large Temperature Variations
- Small Package, Lightweight
- 5 VDC Power Supply



Mating Plug Included

The CPS Series of Laser Diode Modules are designed for demanding industrial applications. These laser modules feature welded stainless steel construction or lightweight aluminum packages engineered to withstand large temperature variations. Most modules maintain optical to mechanical alignment of better than 15 mrad. All modules are compatible with our LDS1 Regulated 5 VDC Power Supply as well as our AD8F and AD11F Kinematic Mount Adapters.

ITEM#	CPS180	CPS182	CPS184	CPS186	CPS192	CPS808
Wavelength	635 nm	635 nm	650 nm	670 nm	780 nm	808 nm
Power	1.0 mW	4.5 mW	4.5 mW	4.5 mW	4.5 mW	10.0 mW
Housing Material	Welded SS*	Al**	Al**	Al**	Al**	Welded SS*
Housing Dimensions (mm)	Ø11.0 x 55	Ø11.0 x 42	Ø8.0 x 42	Ø8.0 x 42	Ø8.0 x 42	Ø11 x 50
Beam Diameter (mm)	4.0 x 4.0	4.0 x 0.6	4.4 x 1.2	4.4 x 1.2	4.4 x 1.7	4.5 x 3.0
Axis Deviation (Max)	10 mrad	15 mrad	15 mrad	15 mrad	15 mrad	20 mrad
Beam Divergence (⊥)	0.3 mrad	0.6 mrad	0.6 mrad	0.6 mrad	0.6 mrad	0.8 mrad
Beam Divergence (//)	0.3 mrad	1.8 mrad	1.8 mrad	1.8 mrad	1.8 mrad	0.4 mrad
Operating Temperature (°C)	-10 to 50 °C	-10 to 60 °C	-10 to 60 °C	-10 to 60 °C	-10 to 60 °C	-10 to 50 °C
Operating Current (Typ)	60 mA	55 mA	55 mA	55 mA	45 mA	140 mA
DC Operating Voltage (Typ)	-5 V	-5 V	-5 V	-5 V	-5 V	-5 V
Safety Class	Class 3R	Class 3R	Class 3R	Class 3R	Class 3B	Class 3B

*Stainless Steel. **Aluminum

Focusable Laser Modules

ITEM#	CPS196	CPS198
Wavelength	635 nm	670 nm
Power	4.5 mW	4.5 mW
Housing Material	Al*	Al*
Housing Dimensions (mm)	Ø11.0 x 46.0	Ø11.0 x 46.0
Focal Range (mm)	50 to infinity	50 to infinity
Axis Deviation (Max)	15 mrad	15 mrad
Beam Divergence (⊥)	0.6 mrad	0.6 mrad
Beam Divergence (//)	1.8 mrad	1.8 mrad
Operating Temperature	-10 to 40 °C	-10 to 40 °C
Operating Current (Typ)	55 mA	55 mA
DC Operating Voltage (Typ)	-5 V	-5 V
Safety Class	Class 3R	Class 3R

*Aluminum

Mating Plug Included

ITEM#	$	£	€	RMB	DESCRIPTION
CPS180	$ 123.90	£ 85.90	€ 110,00	¥ 1,046.30	635 nm, 1 mW Laser Module
CPS182	$ 93.60	£ 64.90	€ 83,10	¥ 790.40	635 nm, 4.5 mW Laser Module
CPS184	$ 104.10	£ 72.20	€ 92,50	¥ 879.10	650 nm, 4.5 mW Laser Module
CPS186	$ 104.10	£ 72.20	€ 92,50	¥ 879.10	670 nm, 4.5 mW Laser Module
CPS192	$ 104.10	£ 72.20	€ 92,50	¥ 879.10	780 nm, 4.5 mW Laser Module
CPS196	$ 150.30	£ 104.20	€ 133,50	¥ 1,269.20	635 nm, 4.5 mW Laser Module
CPS198	$ 127.10	£ 88.20	€ 112,90	¥ 1,073.30	670 nm, 4.5 mW Laser Module
CPS808	$ 268.00	£ 185.80	€ 238,00	¥ 2,263.00	808 nm, 10 mW Laser Module
LDS1	$ 83.10	£ 57.70	€ 73,80	¥ 701.70	5 VDC Power Supply

LDS1 Power Supply
5 VDC @ 250 mA

110/120 VAC
220/240 VAC
50/60 Hz

Tunable Laser Selection Guide

Pages 1081-1089

Thorlabs' INTUN™ family of narrowband, CW lasers are designed for demanding applications such as microscopy and spectroscopy. Sixteen models span the 770 - 1650 nm range and provide output power up to 20 mW. Custom center wavelengths (780 nm - 1100 nm and 1200 nm - 1650 nm) are available upon request.

INTUN™ Free-Space Tunable Lasers

- Wavelength Ranges from 770 to 1650 nm
- Up to 20 mW of Output Power
- Instantaneous Linewidth of 120 kHz

See Pages 1084-1085

Thorlab's narrowband PICO D Series of lasers are ideal for fiber optic test and measurement applications, providing mode-hop free tuning and more than 5 dBm of output power.

PICO D Series Continuously Tunable S, C, and L Bands

- Low-Noise, High-Power Lasers
- Ideal for Integration into High-End Optical Test Instruments
- Tuning Range from 1519 to 1630 nm

See Page 1086

The ECL5000D is an external cavity laser module for the TXP Platform that utilizes Thorlabs' patented ECL Technology to provide high stability, high output power, and smooth, continuous tuning over the 1519 - 1630 nm range.

ECL5000DT — USB Benchtop Linear Tunable Laser

- Versatile Benchtop Tunable Laser
- 110 nm Continuous Tuning Range
- Also Available for use with PMD5000

See Page 1087

Thorlabs' SL1325-P55 tunable laser is based on an external cavity semiconductor laser that has been specifically optimized for SS-OCT applications. The compact design, robust alignment, high repetition rate, and central wavelengths available make this system ideal for many biological and material science applications.

Rapidly Swept Tunable Lasers

- Designed for Swept Source OCT Applications
- Operates at over 55 kHz Sweep Rate
- Offers 6 mm Coherence Length Capability
- Tuning Range Exceeds 130 nm in the 1300 nm Wavelength Region

See Pages 1088-1089

Tunable Lasers: Overview



Benchtop Systems • TXP Modules • OEM Modules

Thorlabs' tunable lasers are all based on external cavity tunable laser technology with tuning ranges up to 150 nm. Since they are able to continuously tune or step between ITU grid wavelengths, Thorlabs' tunable lasers are ideal for both test and measurement as well as for research and development applications. Using our proprietary technology, all models exhibit mode-hop-free tuning with 0.1 pm of wavelength resolution and absolute wavelength accuracy within ±10 pm. The highly stable output and quick tuning speed of our continuous tuning models allow the units to tune over their entire range in less than a second. The low source spontaneous emission (SSE) makes them an ideal source for testing fiber-optic components, spectroscopy, or basic research applications. Our tunable lasers cover wavelengths ranging from 770 nm to 1650 nm and are available with fiber output or with free-space collimated beams. The various models offer different features from benchtop units to OEM modules for integrating into larger applications.

ECL Technology

Thorlabs' models are based on external cavity lasers (ECL), which are capable of delivering very high output powers in combination with a wide tuning range.

In addition, ECL technology has the advantage of continuous, mode-hop-free tuning. ECL lasers are comprised of a laser diode with high gain and a separate grating that is mounted on a pivoting arm to form the cavity (see fig. 1). To tune the laser's wavelength, the angle of the grating is changed by turning the arm with an actuator. The positioning and alignment of the grating assembly and the actuator design are critical to optimal scanning performance.

Scanning Capabilities

The patented inductive motor design of our continuously tunable models enables a smooth and quick sweep over the full wavelength range in both directions with perfect repeatability. Optional step mode operation and true continuous linear tuning without any ripple result from this unique design.

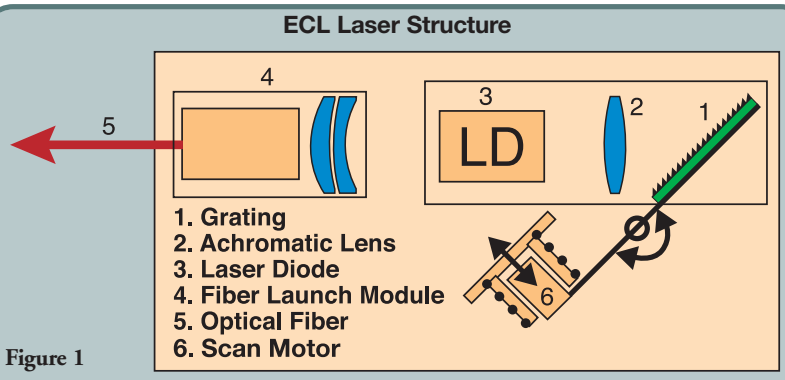
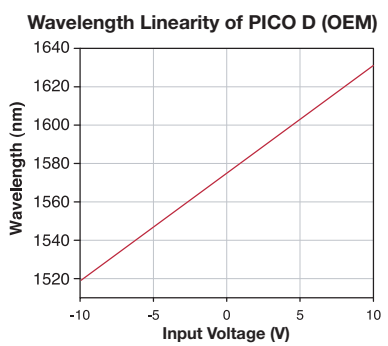
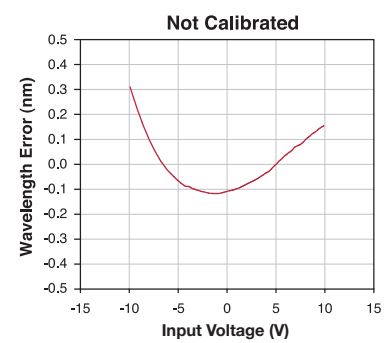


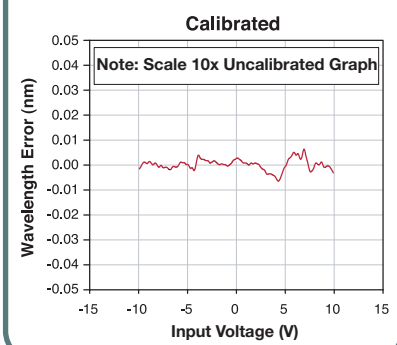
Figure 1

These lasers provide excellent sweep performance while being robust and reliable at the same time.

The waveforms below show the excellent linearity of the ECL across the entire tuning range.







Applications

Heterodyne Interferometry

Optical Heterodyne Interferometry is an important measurement technique that benefits from Thorlabs' continuously tunable lasers.

Laser requirements for this high-precision measurement include smooth continuous tuning, high accuracy measurement, control of the wavelength, low noise, and narrow linewidth.

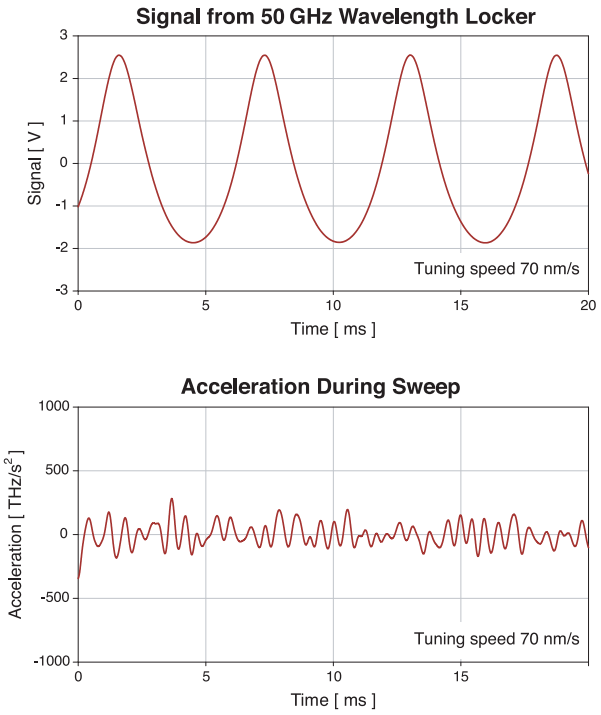
Our patented motor design enables a highly constant tuning speed. The constant sweep speed (low acceleration) makes these lasers suitable for interferometric and heterodyne measurements.

The acceleration during sweep (variation in the tuning speed) is measured using a wavelength locker (low finesse etalon). The wavelength locker signal provides evenly spaced peaks (clock) in the frequency space (k-space). There are several methods to acquire data, which enable the calculation of the tuning speed and the acceleration. One method is to use the k-space clock to determine the time fluctuations of the tuning speed (acceleration). In the figure to the right, we have used (in addition to the k-space clock) the knowledge of the finesse of the etalon to improve the time resolution of the measurement. When using the knowledge of the finesse, the time resolution of the tuning speeds and the measurement of the acceleration is limited to the sampling frequency rather than the k-space clock.

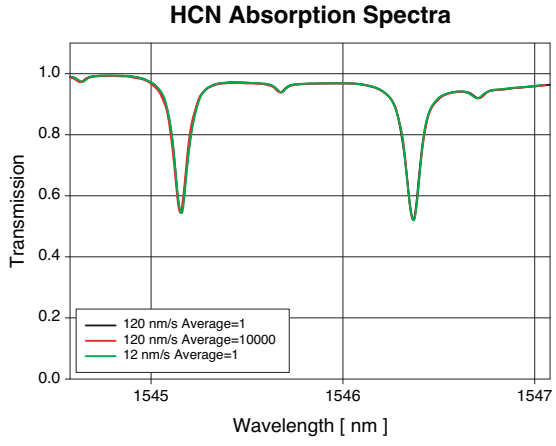
Spectral Monitoring

The ECL tunable lasers provide an outstanding building block in spectral measuring and monitoring. The waveform shows an HCN (Hydrogen Cyanide) scan using Thorlabs' ECL technology. See pages 824-829 for our gas cell products.

The impressive scan-to-scan repeatability allows the user to average spectral features without smearing (see figure to the right).



Plot of the Fluctuation of the Tuning Velocity (PICO D)



WAVELENGTH (nm)	TUNING RANGE (nm)	POWER (mW)	FIBER OUTPUT	MODEL
780	15	>5	–	INTUN
980	25	20	–	INTUN
1320	>110	>20	–	INTUN
1560	>130	>20	Yes	INTUN. PICO D ECL5000

LASER SELECTION TABLE	PICO D	ECL5000DT	INTUN-B
Mode-Hop-Free Tuning	***	***	***
Fiber Output	***	***	**
Swept Wavelength Applications	***	***	*
Step and Measurement	*	*	***
Digital Interface		***	***

Legend *** Best ** Select Models Only * Standard

INTUN™ Continuously Tunable Lasers (Page 1 of 2)

Features

- Wavelength Ranges from 770 - 1650 nm
- 4 Models with Output Powers Ranging from >5 to >20 mW
- Instantaneous Linewidth of 120 kHz (Minimum)

TL1550-B

Thorlabs offers a family of tunable lasers designed for demanding applications such as spectroscopy. With four models spanning the wavelength range from 770 nm to 1650 nm, this family covers the widest spectral range of any of our tunable products. The heart of the INTUN system is based on the same technology used in the high-performance PICO D tunable laser featured on pages 1086-1087.

All lasers in the INTUN family have reduced spontaneous emission to further improve the laser performance. The INTUN has an SM1-compatible thread on the output port and mounting holes for our 30 mm cage system to allow ease of use with our optomechanical equipment. The output is a collimated free-space beam.

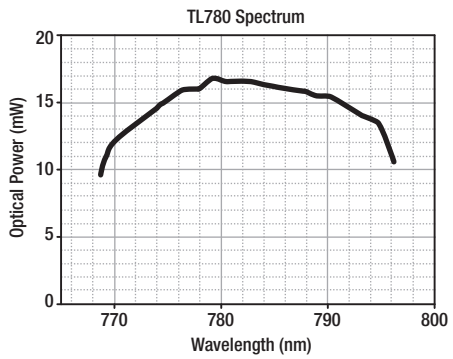
The INTUN-B has the means to lock the wavelength to an external wavelength reference such as a gas cell or a frequency comb. Contact techsupport@thorlabs.com for more information on this application (see pages 824-829 for our selection of gas cells).

The INTUN-B model comes with a simple LabVIEW™ software interface that enables the user to control the laser via a computer.

All communication with the laser is done via a convenient USB interface.

Applications

- Characterization of Optical Components
- Spectroscopy
- Polarization Measurements
- Real-Time Process Monitoring
- General R&D



Plot of TL780 INTUN Laser Showing Optical Power as a Function of Wavelength

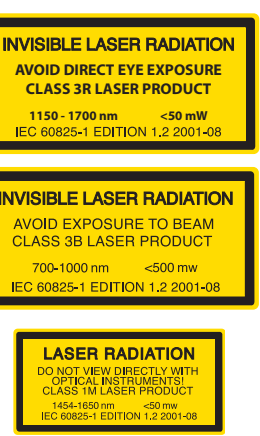
Electric and Interface Specifications for the INTUN-B

DC Input	48 V/20 W
Analog Modulation Input	2 V_{p-p}
Analog Wavelength Output	0 - 4 V

Electrical Connectors

DC Input Voltage	Rear Panel Socket
Digital Status	0 - 5 V
Interlock	DB9
Communications	USB 2.0
Analog Inputs	BNC
Operating Temperature Range	15 - 30 °C
Dimensions	242 mm x 87 mm x 142 mm

Power supply and all required cables included.



INTUN™ Continuously Tunable Lasers (Page 2 of 2)

SM1-Compatible Thread on the Output Port and Mounting Holes for Cage Systems

Optical Specifications

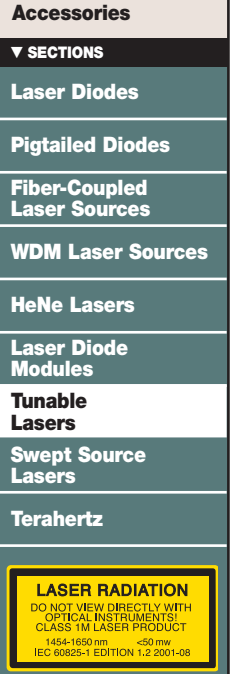
Wavelength Resolution	0.1 pm
Wavelength Repeatability	1 pm
Absolute Wavelength Accuracy	±50 pm
Wavelength Stability (1h/24hr)	±2 pm/±10 pm
Power Resolution	25 µW
Spectral Linewidth	150 kHz Max[a]
Effective Linewidth	1.5 MHz
Coherence Control	1 GHz or 2 GHz
Side Mode Suppression Ratio (SMSR)	45 dBc (Min)
Signal to Source Spontaneous Emission Ratio (SSE)	70 dB/nm[b]
Signal to Total Source Spontaneous Emission Ratio (STSSER)	65 dB
Optical Power Output	>5 mW to >20 mW
Relative Intensity Noise (RIN)	-140 (dB/Hz)
Continuous Tuning Speed TL780 TL980 TL1300 TL1550	 0 - 15 nm/s 0 - 15 nm/s 0 - 50 nm/s 0 - 50 nm/s
Optical Output	Collimated Free-Space Beam

[a] Measurement Time <1 ms.
[b] Depending on Applications

GUI for INTUN-B Series Lasers

The B series has a USB interface, providing remote digital functionality. Also, LabVIEW™ drivers are available for integration into customer software.

ITEM#	CENTER λ	TUNING RANGE	PIEZO TUNING RANGE	OPTICAL POWER TYPICAL	$	£	€	RMB
TL780-B	780 nm	15 nm	300 GHz	>5 mW	$ 21,924.00	£ 15,199.00	€ 19.465,00	¥ 185,127.00
TL980-B	980 nm	25 nm	200 GHz	>20 mW	$ 21,924.00	£ 15,199.00	€ 19.465,00	¥ 185,127.00
TL1300-B	1320 nm	>110 nm	200 GHz	>20 mW	$ 21,924.00	£ 15,199.00	€ 19.465,00	¥ 185,127.00
TL1550-B	1550 nm	>150 nm	175 GHz	>20 mW	$ 21,924.00	£ 15,199.00	€ 19.465,00	¥ 185,127.00



PICO D Series Continuously Tunable OEM Lasers (1519-1630 nm)

Thorlabs' PICO D family of OEM tunable ECLs allows for integration into larger or custom environments. The PICO D family is specially designed for swept wavelength applications and interferometric measurements. The laser has an outstanding tuning smoothness, which is a necessity in applications such as interferometric optical component testing and high-resolution fiber sensing.

The PICO D features analog tuning and continuous mode-hop free tuning across more than 100 nm in the C- and L-bands (1519-1630 nm). The standard product offers a typical output power of >5 dBm across the tuning range. The PICO D offers low SSE, providing a Signal to Total Source Spontaneous Emission Ratio (STSSER) of >65 dB. This makes the PICO D an ideal source for testing optical components.

The PICO series is ideal for fiber sensor-based temperature and pressure monitoring in petrochemical facilities, refineries, oil wells, power plants, and bridges.

Optical Specifications

Parameter	Typical
Tuning Range* PICO D (C- and L-Bands)	 1519 - 1630 nm
Mode Hops	0
Continuous Tuning Speed	0 - 130 nm/s
Tuning Speed 1 nm 10 nm 100 nm Step	 30 ms 100 ms 800 ms
Wavelength Resolution	0.6 pm
Wavelength Repeatability	1 pm
Absolute Wavelength Accuracy	±10 pm
Wavelength Stability pm (1hr) (24hr)	±2 pm ±10 pm
Optical Peak Power	>6 dBm
Optical Power Over Entire Tuning Range	>2 dBm
Power Resolution	0.1 µW
Spectral Linewidth	150 kHz Max**
Coherence Control	Optional
Side Mode Suppression Ratio (SMSR)	45 dBc
Signal to Source Spontaneous Emission (SSE)	70 dBm/nm
Signal to Total Source Spontaneous Emission Ratio (STSSER)	65 dB
Optical Isolation	60 dB
Relative Intensity Noise (RIN)	-140 (dB/Hz)

* Standard product, other wavelengths available upon request.
**Measurement time <1ms.

Features

- Tuning without Mode-Hop
- Models Covering C and L Bands Available
- Peak Power >6 dBm (Typical)
- Low SSE >70 dB/ nm
- Other Wavelengths Available by Request

Electrical and Interface Specifications

- **Operating Temperature Range:** 15 - 40 °C
- **Optical Connector:** FC/APC
- **DC Power:** +5 V and ±15 V
- **Wavelength Set Voltage:** ±10 V
- **Output Power Set Voltage:** -1 V to 10 V
- **Digital Control and Status:** 0 - 5 V
- **Electrical Connectors:**
  - 6-Pin Power Rear Panel
  - 40-Pin Electrical Rear Panel
- **Physical Size (W x H x L):** 49 mm x 93 mm x 273 mm

ITEM#	$	£	€	RMB	DESCRIPTION
PICOD-SM	$ 20,790.00	£ 14,413.00	€ 18.458,00	¥ 175,552.00	Continuously Tunable Laser, 1519-1630 nm SM Fiber
PICOD-PM	$ 21,420.00	£ 14,849.00	€ 19.017,00	¥ 180,871.00	Continuously Tunable Laser, 1519-1630 nm PM Fiber

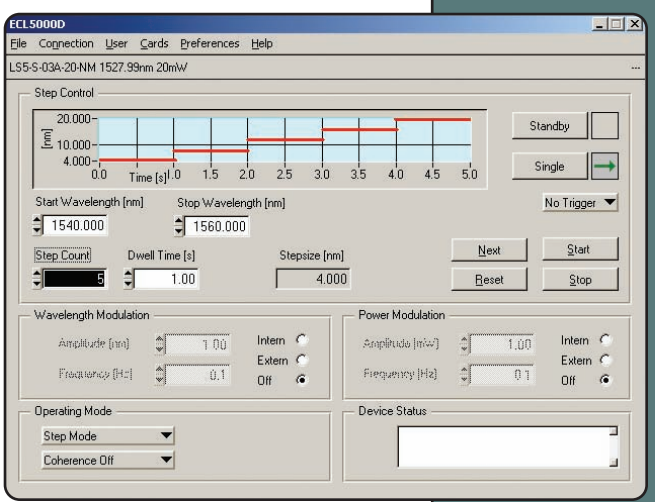
ECL5000 Continuously Tunable, PC-Controlled Laser, 1519 - 1630 nm

Comes Complete with Laptop and Installed Software!

The ECL5000DT benchtop tunable laser utilizes Thorlabs' patented ECL technology, providing high stability, high output power, and smooth continuous tuning over the 110 nm tuning range. The benchtop unit is comprised of a Thorlabs PICO D Series Tunable Laser packaged in a rugged TXP5004 chassis. The microprocessor-controlled unit provides both digital and analog modes of controlling the unit. In the analog mode, the wavelength and power can be controlled by applying a voltage to the front input connectors. This can be a DC voltage for step control or a modulated signal for sweeping either the wavelength, the power, or both. The digital control is achieved through the USB interface. The easy-to-use interactive GUI (Graphical User Interface) allows direct tuning, step tuning, and selectable sweep operation. The laser is ready for use as soon as the USB cable, included with the unit, is plugged in.

LabVIEW™ and LabWindows™/CVI drivers are provided for those who need to integrate the programming of the tunable laser with other equipment. These two methods of tuning provide the powerful, flexible control necessary to meet the most demanding testing applications to synchronize with external events.

The ECL5000DT also provides trigger-in and trigger-out connectors. The output voltage at the analog out jack is proportional to the optical wavelength.



Specifications

Parameter	Typical Data
Wavelength Range	1519 - 1630 nm[a]
Mode Hops	0
Tuning Speed Continuous	0 - 130 nm/s
Tuning Speed Step (Includes Settling Time)	1 nm: <50 ms 10 nm: <100 ms 100 nm: <800 ms
Wavelength Resolution	1 pm
Wavelength Repeatability	±5 pm (1 Hour)
Wavelength Accuracy	±15 pm
Wavelength Stability	±5 pm[b] (1 Hour)
Wavelength Modulation Bandwidth	100 Hz
Power Repeatability	±0.1 dB (1 hour)
Optical Power Modulation Bandwidth	>100 kHz
Optical Peak Power	9 dBm
Optical Output Power	Peak: 9 dBm 50 nm: 6 dBm Full Range: 3 dBm
Spectral Linewidth FWHM	<150 kHz[c]
SMSR	>50 dBc
STSSER	65 dB
Optical Isolation	60 dB[d]
RIN	-140 dB/√Hz
Optical Interface	FC/APC
Analog Input Voltage Range	±10 V
Input Power	100-240 VAC 50-60 Hz
Dimensions ECL5000DT (mm)	168 x 133 x 315

[a] Standard product, other wavelengths available upon request.
[b] ΔT ±0.5 °C
[c] Measurement time 1ns.
[d] Peak isolation

ECL5000D TXP MODULE

The PMD5000, a versatile PMD and polarization analysis system, is an application example of an ECL5000D in a complex TXP-based test and measurement system (see pages 993-1007).

Highlights

- Mode-Hop Free Tuning
- Internal and External Wavelength and Power Modulation
- Smooth and Continuous Tuning
- 1519 - 1630 nm Tuning Range
- Continuous Sweep and Step Mode Operation
- High Output Power
- USB with Intuitive Graphical Interface

ITEM#	$	£	€	RMB	DESCRIPTION
ECL5000DT	$26,000.00	£ 18,024.00	€ 23.083,00	¥ 219,545.00	Complete Benchtop Linear Tunable Laser Including Laptop

Frequency Swept Laser Sources (Page 1 of 2)

SL1325-P55
Patent Pending

Features

- 1050 and 1325 nm Available Wavelengths
- 55 kHz Sweep Rate
- FWHM Bandwidth: >100 nm (SL1050-P55)
  >130 nm (SL1325-P55)
- Fiber Coupled Power: >10 mW (SL1050-P55)
  >20 mW (SL1325-P55)
- >6.0 mm Coherence Length Capability

Thorlabs is pleased to offer new high-speed swept source lasers optimized for OCT imaging applications. The swept source laser employs novel tunable filter technology with highly efficient laser cavity design to achieve broad wavelength tuning (>130 nm @ 1325 nm) at a high sweep rate (55,000 A-scans per second). Excellent coherence length (>6 mm) is maintained during the high-speed tuning of the swept source laser, which supports reasonable OCT imaging depth inside biological tissue or other industrial samples. To generate high-quality OCT images, the laser cavity design has been optimized for good output power and bandwidth with minimized intensity noise.

The swept source laser consists of a high-performance semiconductor gain chip at 1325 nm and a high-speed tunable filter in the cavity. The tunable filter temporarily sweeps the wavelength band to rapidly vary the output frequencies of the laser. The measured output spectrum of the swept source laser, averaged over a few scanning iterations, is shown in Fig. 1. The averaged laser output power is above 20 mW with peak power above 40 mW. The high power density for every laser sweep is essential for sensitive detection of weak reflections from samples at very high speed.

As an estimation of the averaged dynamic instantaneous linewidth of the swept source laser, the coherence length of the laser is measured experimentally. The coherence length value is defined as the path length difference in an external Mach-Zehnder interferometer where the interference fringe contrast amplitude drops to 50% (3 dB) of the original contrast amplitude at zero delay. The longer the coherence length, the slower the sensitivity roll-off of the OCT imaging system and the better the capability of the system to resolve reflections from deeper regions of the sample. The displayed depth of OCT images is usually half of the coherence length due to the double-pass optical delay in the sample arm reflections of standard OCT systems. For many conventional biological tissue samples like the skin, the light can hardly penetrate more than 1-2 mm into the tissue. Therefore for many similar imaging applications, the 3 mm displayed imaging depth allowed by the 6 mm coherence length of the laser is considered sufficient. For demanding imaging applications requiring larger coherence lengths, the laser can be customized to support coherence lengths in excess of 6 mm.

The swept source laser has a built-in MZI clock module with intensity profile and frequency monitoring (MZI clock) signals available. The intensity profile can be used to diagnose the intensity noise of the swept source laser. The MZI clock signals are from a Mach-Zehnder interferometer with a fixed 3 mm delay, generating interference fringes with 100 GHz spacing. A wide band (DC-200 MHz) balanced detector is used to record the MZI clock signals with maximum fringe contrast (Fig. 3). The peaks and zero-crossings in the MZI clock signals are equally spaced in optical frequency domain and can be used as the frequency reference to calibrate the real OCT interference signals from detailed sample structures.

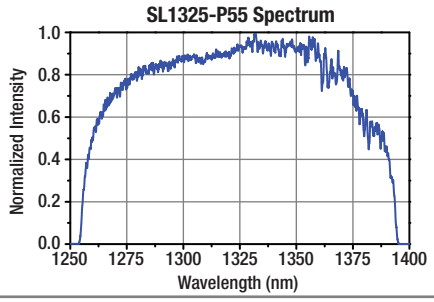


Figure 1. Time-averaged output spectrum of the swept source laser with 55,000 A-scans per second. The linear plot shows the 140 nm tuning range centered at 1325 nm.

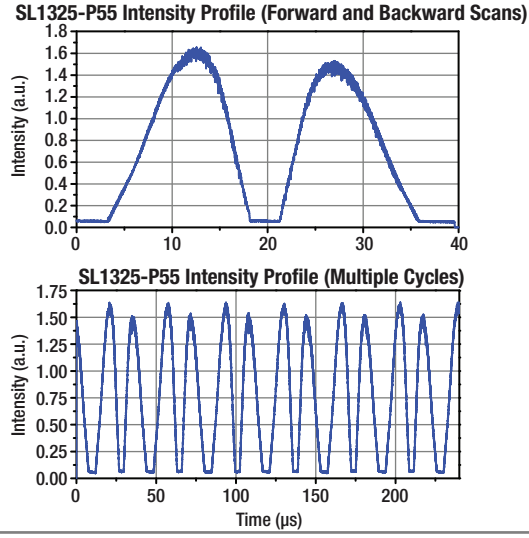


Figure 2. (Top) Transient temporal intensity profile of the swept source laser with 55,000 A-scans per second. One complete scan cycle of the laser contains one forward scan (from short to long wavelength) and one backward scan (from long to short wavelength). (Bottom) The Intensity profile of multiple scan cycles showing the identical scan-to-scan repeatability.

Frequency Swept Laser Sources (Page 2 of 2)

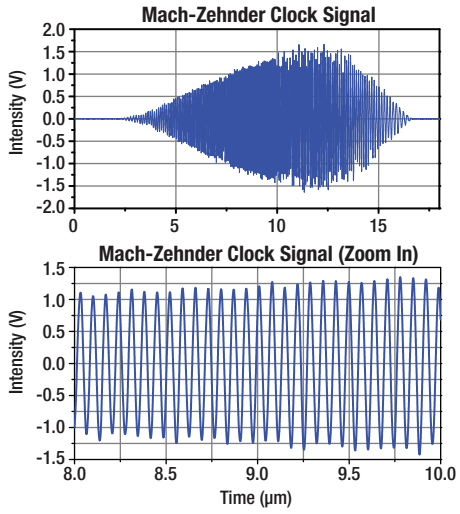


Figure 3. (Top) MZI clock signals of the forward scan of the laser with 55,000 A-scans per second. The MZI clock signals are acquired from a Mach-Zehnder interferometer with fixed 3 mm delay. (Bottom) The zoom-in view of the MZI clock signals acquired at the peak scanning speed of the same swept source laser. The MZI clock signals with clear fringe contrast visibility can be used as the frequency (k-clock) reference signals of the laser to calibrate the OCT interference signals into optical frequency domain prior to the Fourier transformation operations. The dots in the signal trace are the actual sampled data points from a 125 MSamples/second data acquisition card.

Key Features:

- **Wavelength Versions:** 1050 nm or 1325 nm
- **Wavelength Sweep Rate:** 55 kHz
- **Output:** Single Mode Fiber
- **Compact Housing:** 12.4" x 11.6" x 5.8" (315 mm x 295 mm x 146 mm)

Rear Panel of Swept Source Laser

315 mm x 295 mm x 146 mm (W x D x H)

The rear panel provides connections for the power monitor signal, the MZI clock, the sweep trigger, and the RS232 port.

OCT Swept Laser Source Specifications

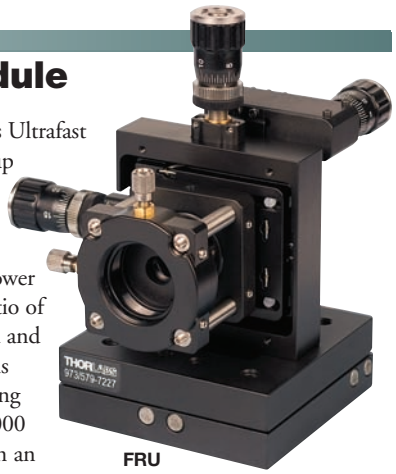
PARAMETER*	SL1050-P55	SL1325-P55
Center Wavelength (Typical)	1050 nm	1325 nm
Spectral Bandwith (10 dB)	>100 nm	>130 nm
Axial Scan Rate	55 kHz	
Coherence Length**	>5.0 mm	>6.0 mm
Average Output Power	>10 mW	>20 mW
Duty Cycle	85% – 90%	
Optical Power Stability	±0.5 dB	
Operating Temperature	10 - 40 °C	
Physical Size (Width x Depth x Height)	12.4" x 11.6" x 5.8" (315 mm x 295 mm x 146 mm)	
Input Voltage	100 - 240 VAC 50 - 60 Hz	
Optical Output	SMF-28 Single Mode Fiber	
Output Connector	FC/APC	
Electrical Output Connectors	BNC	

*Please Note: Due to on-going developments, these specifications are subject to change. Please refer to our website (www.thorlabs.com) for up-to-date details.
**Swept Lasers are capable of >6 mm coherence length. Please call for more details.

Please See Page 1354 for Details on Complete OCT Systems.

ITEM#	$	£	€	RMB	DESCRIPTION
SL1050-P55	$ 25,000.00	£ 17,331.00	€ 22.196,00	¥ 211,101.00	55 kHz Frequency Swept Laser Source @ 1050 nm
SL1325-P55	$ 25,000.00	£ 17,331.00	€ 22.196,00	¥ 211,101.00	55 kHz Frequency Swept Laser Source @ 1325 nm

Terahertz Transmitter/Receiver Mounting Module



FRU

Research interest in the terahertz (THz) region of the electromagnetic spectra has been substantially increasing. This region is defined as the spectral region between the infrared and microwave spectral bands and ranges from 100 µm to 1000 µm (300 GHz to 3 THz). In this region, the photon energies range from 1.2 to 12.4 eV and the equivalent black body temperature ranges from 14 K to 140 K, which is below the earth's ambient background.

The Ultrafast Terahertz Research Group at Oklahoma State University (OSU) in Stillwater has put together a THz Time Domain Spectroscopy (THz-TDS) system based on Thorlabs' optomechanical components, as shown in Figure 1. Their system includes two FRU modules; one houses a transmitter and the other houses a receiver. A femtosecond laser is used to illuminate the THz transmitter, biased coplanar transmission lines fabricated on high-resistivity GaAs that has geometry similar to that shown in Figure 3. The laser is focused on the edge of the positively biased line and generates a very large number of photo-induced charge carriers in the high electric field region, creating synchronous bursts of THz radiation. Their receiver FRU includes a receiver chip that has antennae structures fabricated on an ion-implanted silicon-on-sapphire (SOS) wafer. The antennae structures have geometries similar to that shown in Figure 2.

The pulsed THz radiation is focused between the gap of an antenna and induces a transient bias voltage. The portion of the femtosecond laser beam that is directed into the receiver is also focused onto the antenna, inducing a transient photocurrent that synchronously gates the receiver. One can consider this detection process a sub-picosecond boxcar integrator.

With this system, OSU's Ultrafast Terahertz Research Group has scanned out past 5 THz. Their system generates THz radiation with ~10 nW average power with a signal-to-noise ratio of 10,000:1. The generated and detected THz radiation is coherent, and the resulting receiver sensitivity is ~1000 times more sensitive than an incoherent liquid helium-cooled bolometer. The receiver module of the THz-TDS system uses the same optomechanical components as the receiver module. Thorlabs stocks this kit (part number FRU), which includes all the optomechanical parts needed to mount a transmitter or receiver module to a silica lens. See page 1258 for terahertz transmitters and antennaes from Menlo Systems.

Terahertz Kit

- THz Transmitter/Receiver Mount Module Using Thorlabs Catalog Components
- Free-Space Coupled
- Fiber Coupling by Request
- Highly Stable

Applications

- THz-TDS: Terahertz Time Domain Spectroscopy
- THz-DTDS: Terahertz Differential Time Domain Spectroscopy
- Interferometry

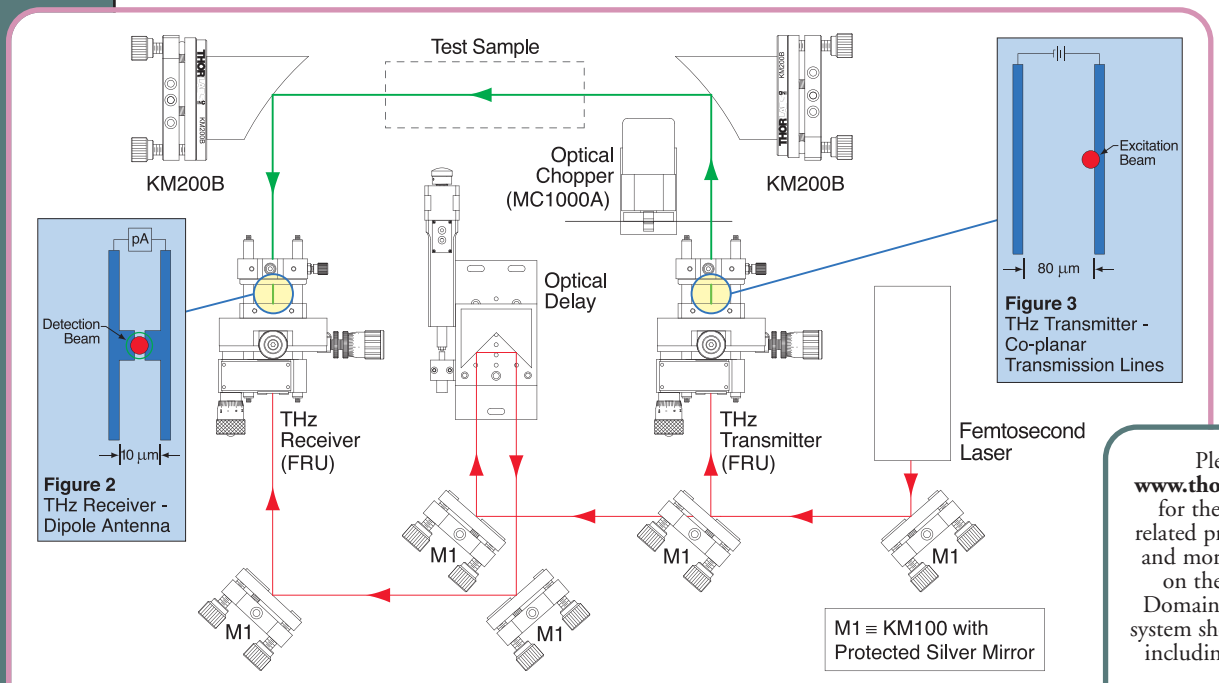


Figure 2
THz Receiver - Dipole Antenna

Figure 3
THz Transmitter - Co-planar Transmission Lines

Figure 1
THz-TDS System Based on Thorlabs' Standard Optomechanical Components

Please visit **www.thorlabs.com/thz** for the latest THz-related product offering and more information on the THz Time Domain Spectroscopy system shown at the left, including a full list of parts.

ITEM #	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
FRU	FRU/M	$ 950.30	£ 658.80	€ 843,70	¥ 8,024.40	THz Transmitter/Receiver Mounting Module

Incoherent Sources Selection Guide

Pages 1091-1131

Mounted LEDs

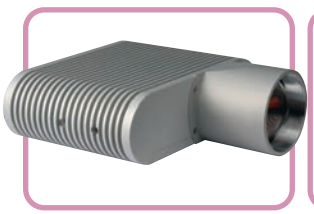
- Available with or without Collimation Optics
- Collimated Versions are Microscope Compatible
- Center Wavelengths from 365 nm to 850 nm and White Light
- LED Arrays Available

See Pages 1092-1103

Mounted LED Drivers

- T-Cube and new DC Series Available
- Pulsed or CW Operation
- Four-Channel Driver and Hub Offered

See Pages 1104-1105



Four-Color LED Source and Driver

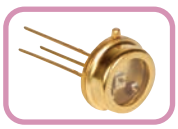
- Combines Four Wavelengths into One Beam
- Wavelengths from 385 nm to 660 nm
- Microscope Adapters Available

See Pages 1106-1107

Fluorescence Lifetime Imaging Microscopy LED Source

- Ideal for Frequency Domain FLIM
- Center Wavelengths from 365 nm to 630 nm

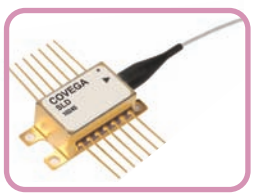
See Pages 1108-1111



Unmounted LEDs

- Wavelength from 260 nm to 4500 nm Including RGB and White
- Powers up to 22 mW

See Pages 1112-1124



Superluminescent Diodes

- Wavelengths from 1280 nm to 1550 nm
- Broad Bandwidths Exceeding 100 nm

See Pages 1125-1128

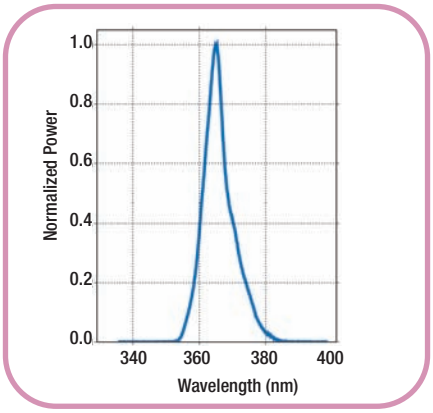
High-Power Light Sources

- ASE Source for C and L Bands
- Solid State Source for 350 nm to 700 nm
- Halogen Lamp

See Pages 1129-1131

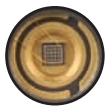
NOTE: The products on pages 1091-1128 are designated for use solely as components and are not sold as a finished product. The purchaser assumes responsibility to comply with US 21 CFR 1040.10 and 1040.11 or IEC 60825-1 with regard to the safe use of these components in a laboratory environment or their introduction into commerce.

365 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 500 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products


Typical Emitter

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	360 nm	365 nm	370 nm
Spectral Full Width	–	15 nm	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	1000 mA	–
Forward Voltage	–	4.4 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	500 hrs	–

Mounted LED, P = 350 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded


LEDC35

Collimated LED, P = 83 - 100 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC33	Olympus BX/IX	100 mW	Ø50 mm	1963 mm²
LEDC34	Leica DMI	83 mW	Ø37 mm	1075 mm²
LEDC35	Nikon Eclipse (F Mount)	88 mW	Ø43 mm	1452 mm²
LEDC36	Zeiss Axioskop	88 mW	Ø44 mm	1521 mm²

Thorlabs offers 365 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

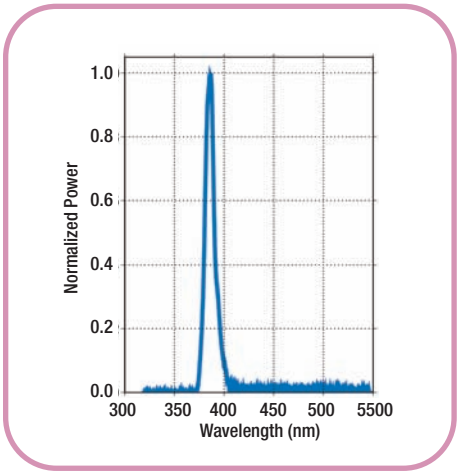

LEDD1A


DC2100

ITEM#	$	£	€	RMB	DESCRIPTION
M365L1	$ 395.00	£ 273.90	€ 350,70	¥ 3,335.40	365 nm, 350 mW, Mounted LED
LEDC33	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	365 nm, 100 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC34	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	365 nm, 83 mW, Collimated LED for Leica DMI Microscopes
LEDC35	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	365 nm, 88 mW, Collimated LED for Nikon Eclipse
LEDC36	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	365 nm, 88 mW, Collimated LED for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

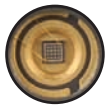
* Power supply sold separately, see TPS001 or page 1104.

385 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 500 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products


Typical Emitter

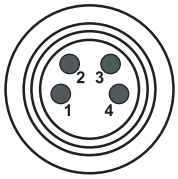
CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	380 nm	385 nm	390 nm
Spectral Full Width	–	20 nm	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	1000 mA	–
Forward Voltage	–	4.3 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	500 hrs	–

Thorlabs offers 385 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.



Pin	Description
1	LED +Ve
2	LED -Ve
3	Not Connected
4	Not Connected

Mounted LED, P = 450 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded


LEDC37

Collimated LED, P = 111 - 135 mW

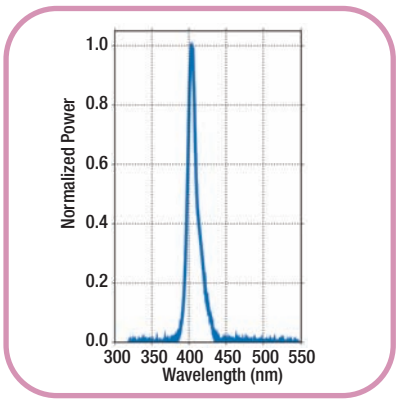
- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC37	Olympus BX/IX	135 mW	Ø50 mm	1963 mm²
LEDC38	Leica DMI	111 mW	Ø37 mm	1075 mm²
LEDC39	Nikon Eclipse (F Mount)	118 mW	Ø43 mm	1452 mm²
LEDC40	Zeiss Axioskop	119 mW	Ø44 mm	1521 mm²

ITEM#	$	£	€	RMB	DESCRIPTION
M385L1	$ 395.00	£ 273.90	€ 350,70	¥ 3,335.40	385 nm, 450 mW, Mounted LED
LEDC37	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	385 nm, 135 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC38	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	385 nm, 111 mW, Collimated LED for Leica DMI Microscopes
LEDC39	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	385 nm, 118 mW, Collimated LED for Nikon Eclipse
LEDC40	$ 660.00	£ 457.60	€ 586,00	¥ 5,573.10	385 nm, 119 mW, Collimated LED for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

* Power supply sold separately, see TPS001 or page 1104.

405 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 500 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products


Typical Emitter

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	400 nm	405 nm	410 nm
Spectral Full Width	–	25.4 nm	–
Forward Current	–	–	1000 mA
Forward Voltage	–	4.64 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	500 hrs	–

Mounted LED, P = 670 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded


LEDC42

Collimated LED, P = 325 - 394 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC41	Olympus BX/IX	394 mW	Ø50 mm	1963 mm²
LEDC42	Leica DMI	325 mW	Ø37 mm	1075 mm²
LEDC43	Nikon Eclipse (F Mount)	345 mW	Ø43 mm	1452 mm²
LEDC44	Zeiss Axioskop	347 mW	Ø44 mm	1521 mm²

Mounted LEDs that provide light output at 405 nm are available with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

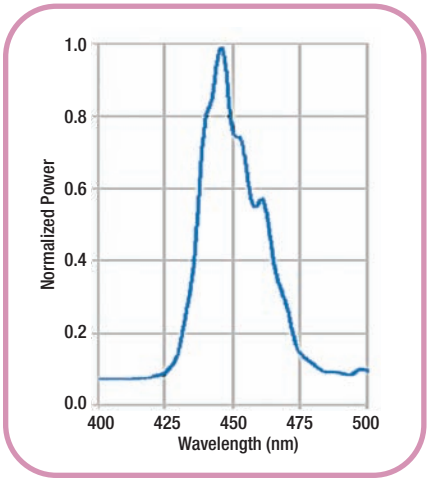

LEDD1A


DC2100

ITEM#	$	£	€	RMB	DESCRIPTION
M405L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	405 nm, 670 mW, Mounted LED
LEDC41	$ 420.00	£ 291.20	€ 372,90	¥ 3,546.50	405 nm, 394 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC42	$ 420.00	£ 291.20	€ 372,90	¥ 3,546.50	405 nm, 325 mW, Collimated LED for Leica DMI Microscopes
LEDC43	$ 420.00	£ 291.20	€ 372,90	¥ 3,546.50	405 nm, 345 mW, Collimated LED for Nikon Eclipse
LEDC44	$ 420.00	£ 291.20	€ 372,90	¥ 3,546.50	405 nm, 347 mW, Collimated LED for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

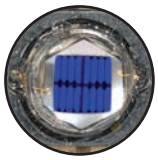
* Power supply sold separately, see TPS001 or page 1104.

455 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime: 100,000 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products



Typical Emitter

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	440 nm	455 nm	460 nm
Spectral Full Width	–	38 nm	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	–	1,000 mA
Forward Voltage	5.43 V	6.8 V	8.31 V
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Mounted LEDs that provide light output at 455 nm are available with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

Pin	Description
1	LED +Ve
2	LED -Ve
3	Not Connected
4	Not Connected

Mounted LED, P = 730 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded

LEDC3

Collimated LED, P = 132 - 160 mW

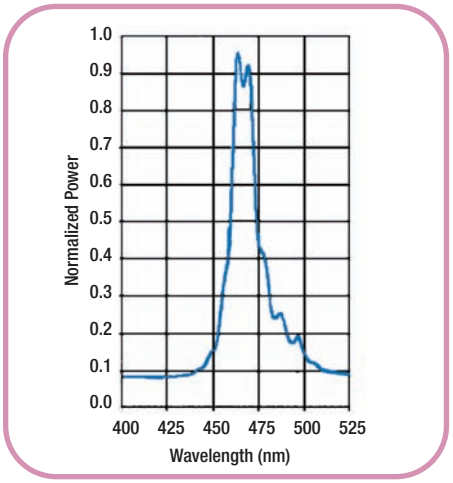
- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC1	Olympus BX/IX	160 mW	Ø50 mm	1963 mm²
LEDC2	Leica DMI	132 mW	Ø37 mm	1075 mm²
LEDC3	Nikon Eclipse (F Mount)	140 mW	Ø43 mm	1452 mm²
LEDC4	Zeiss Axioskop	141 mW	Ø44 mm	1521 mm²

ITEM#	$	£	€	RMB	DESCRIPTION
M455L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	455 nm, 730 mW, Mounted LED NEW
LEDC1	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	455 nm, 160 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC2	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	455 nm, 132 mW, Collimated LED for Leica DMI Microscopes
LEDC3	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	455 nm, 140 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC4	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	455 nm, 141 mW, Collimated LED for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA NEW

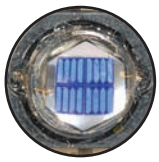
* Power supply sold separately, see TPS001 or page 1104.

470 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 100,000 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products


Typical Emitter

CHARACTERISTIC (T_a = 25 °C, I = 700 mA)	MIN	TYP	MAX
Peak Wavelength	460 nm	470 nm	490 nm
Spectral Full Width	–	48.8 nm	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	–	1000 mA
Forward Voltage	5.43 V	6.84 V	8.31 V
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Mounted LED, P = 625 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded


LEDC6

Collimated LED, P = 161 - 195 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC5	Olympus BX/IX	195 mW	Ø50 mm	1963 mm²
LEDC6	Leica DMI	161 mW	Ø37 mm	1075 mm²
LEDC7	Nikon Eclipse (F Mount)	171 mW	Ø43 mm	1452 mm²
LEDC8	Zeiss Axioskop	172 mW	Ø44 mm	1521 mm²

Thorlabs offers 470 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

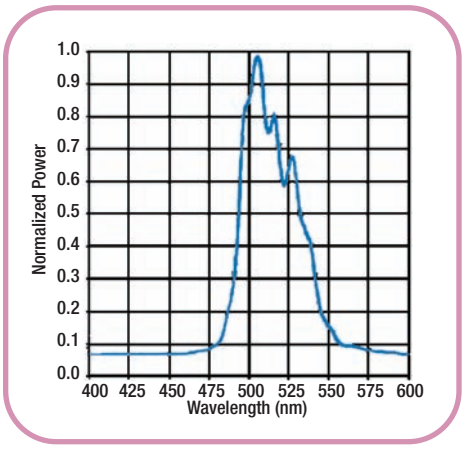

LEDD1A


DC2100

ITEM#	$	£	€	RMB	DESCRIPTION
NEW M470L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	470 nm, 625 mW, Mounted LED
LEDC5	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	470 nm, 195 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC6	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	470 nm, 161 mW, Collimated LED for Leica DMI Microscopes
LEDC7	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	470 nm, 171 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC8	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	470 nm, 172 mW, Collimated LED for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
NEW DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

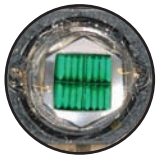
* Power supply sold separately, see TPS001 or page 1104.

505 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 100,000 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products


Typical Emitter

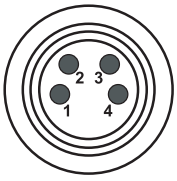
CHARACTERISTIC (T_a = 25 °C, I = 700 mA)	MIN	TYP	MAX
Peak Wavelength	490 nm	505 nm	520 nm
Spectral Full Width	–	58.6 nm	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	–	1,000 mA
Forward Voltage	5.43 V	6.84 V	8.31 V
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Thorlabs offers 505 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.



Pin	Description
1	LED +Ve
2	LED -Ve
3	Not Connected
4	Not Connected

Mounted LED, P = 420 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded


LEDC12

Collimated LED, P = 101 - 115 mW

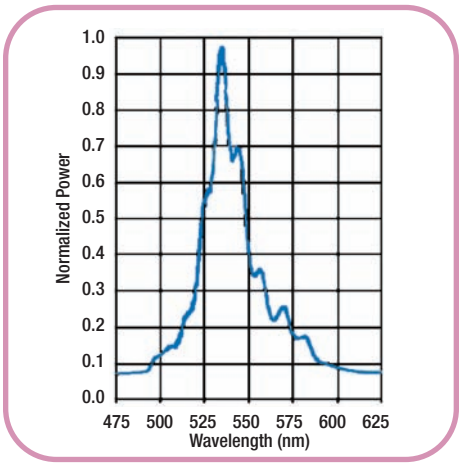
- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC9	Olympus BX/IX	115 mW	Ø50 mm	1963 mm^2
LEDC10	Leica DMI	115 mW	Ø37 mm	1075 mm^2
LEDC11	Nikon Eclipse (F Mount)	101 mW	Ø43 mm	1452 mm^2
LEDC12	Zeiss Axioskop	101 mW	Ø44 mm	1521 mm^2

ITEM#	$	£	€	RMB	DESCRIPTION
M505L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	505 nm, 420 mW, Mounted LED NEW
LEDC9	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	505 nm, 115 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC10	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	505 nm, 115 mW, Collimated LED for Leica DMI Microscopes
LEDC11	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	505 nm, 101 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC12	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	505 nm, 101 mW, Collimated LED for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1,553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA NEW

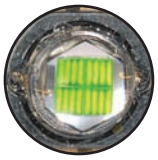
* Power supply sold separately, see TPS001 or page 1104.

530 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 100,000 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products



Typical Emitter

CHARACTERISTIC (T_a = 25 °C, I = 700 mA)	MIN	TYP	MAX
Peak Wavelength	520 nm	530 nm	550 nm
Spectral Full Width	–	60.8 nm	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	–	1000 mA
Forward Voltage	5.43 V	6.84 V	8.31 V
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Mounted LED, P = 275 mW

- Uncollimated, Lambertian Radiation Pattern.
- Internally SM1 Threaded

LEDC14

Collimated LED, P = 55 - 67 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate Into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC13	Olympus BX/IX	67 mW	Ø50 mm	1963 mm²
LEDC14	Leica DMI	55 mW	Ø37 mm	1075 mm²
LEDC15	Nikon Eclipse (F Mount)	59 mW	Ø43 mm	1452 mm²
LEDC16	Zeiss Axioskop	59 mW	Ø44 mm	1521 mm²

Mounted LEDs that provide light output at 530 nm are available with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

LEDD1A

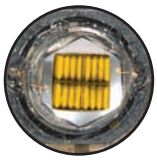
DC2100

ITEM#	$	£	€	RMB	DESCRIPTION
NEW M530L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	530 nm, 275 mW, Mounted LED
LEDC13	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	530 nm, 67 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC14	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	530 nm, 55 mW, Collimated LED for Leica DMI Microscopes
LEDC15	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	530 nm, 59 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC16	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	530 nm, 59 mW, Collimated for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
NEW DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

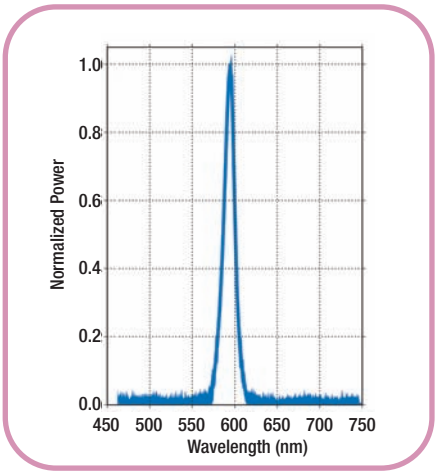
* Power supply sold separately, see TPS001 or page 1104.

590 nm Mounted or Mounted and Collimated LEDs

- High-Power LED
- Average Lifetime of 100,000 Hours
- Mounted on Heatsink
- Compatible with Our DC2100 LED Controller (See Page 1105)



Typical Emitter



CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	584 nm	590 nm	597 nm
Spectral Full Width	–	28.8 nm	–
Forward Current	–	–	1540 mA
Peak Pulsed Forward Current	–	2,200 mA	–
Forward Voltage	–	3.5 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Mounted LEDs that provide light output at 590 nm are available with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using the LEDD1A T-Cube driver or the DC2100 LED driver to control these LEDs. The DC2100 is a sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current, that help to prolong the life of the LED. Please see page 1105 for more details on the DC2100.

Mounted LED, P = 150 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded

Collimated LED, P = 30 - 36 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate Into Standard Microscopes

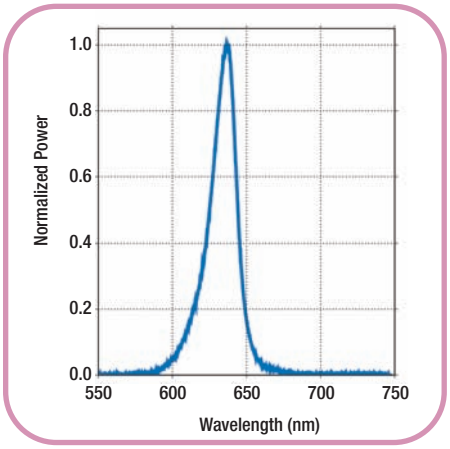
Pin	Description
1	LED +Ve
2	LED -Ve
3	Not Connected
4	Not Connected

NEW products

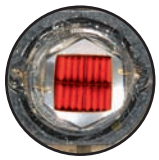
ITEM#	MICROSCOPE	POWER	BEAM DIA.	BEAM AREA
LEDC21	Olympus BX/IX	36 mW	50 mm	1963 mm^2
LEDC22	Leica DMI	30 mW	37 mm	1075 mm^2
LEDC23	Nikon Eclipse (F Mount)	32 mW	43 mm	1452 mm^2
LEDC24	Zeiss Axioskop	32 mW	44 mm	1521 mm^2

ITEM#	$	£	€	RMB	DESCRIPTION
M590L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	590 nm, 150 mW, Mounted LED
LEDC21	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	590 nm, 36 mW for Olympus BX/IX Microscopes, Collimated LED
LEDC22	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	590 nm, 30 mW for Leica DMI Microscopes, Collimated LED
LEDC23	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	590 nm, 32 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC24	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	590 nm, 32 mW, Collimated LED for Zeiss Axioskop Microscopes
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

627 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 100,000 Hours
- Mounted on Heatsink
- Compatible with Our DC2100 LED Controller (See Page 1105)


Typical Emitter

CHARACTERISTIC (T_a = 25 °C, I = 700 mA)	MIN	TYP	MAX
Peak Wavelength	620 nm	627 nm	645nm
Spectral Full Width	–	48.4 nm	–
Forward Current	–	–	1540 mA
Peak Pulsed Forward Current	–	2200 nm	–
Forward Voltage	–	3.5 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Mounted LED, P = 500 mW

- Uncollimated, Lambertian Radiation Pattern.
- Internally SM1 Threaded


LEDC27

Collimated LED, P = 144 - 174 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate Into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC25	Olympus BX/IX	174 mW	Ø50 mm	1963 mm²
LEDC26	Leica DMI	144 mW	Ø37 mm	1075 mm²
LEDC27	Nikon Eclipse (F Mount)	152 mW	Ø43 mm	1452 mm²
LEDC28	Zeiss Axioskop	153 mW	Ø44 mm	1521 mm²

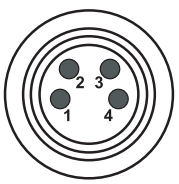
Thorlabs offers 627 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using the DC2100 LED driver to control the LED. The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current, that help to prolong the life of the LED. Please see pages 1223-1228 for more details on this driver as well as other compatible drivers.

DC2100

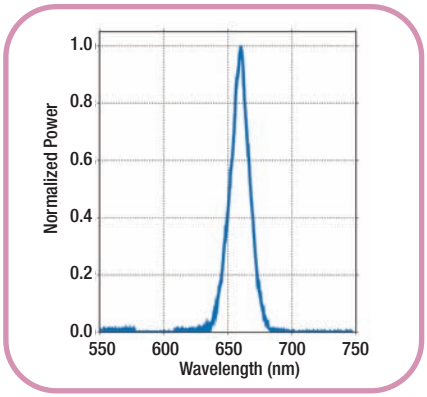
NEW products



Pin	Description
1	LED +Ve
2	LED -Ve
3	Not Connected
4	Not Connected

ITEM#	$	£	€	RMB	DESCRIPTION
M627L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	627 nm, 500 mW, Mounted LED
LEDC25	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	627 nm, 174 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC26	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	627 nm, 144 mW, Collimated LED for Leica DMI Microscopes
LEDC27	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	627 nm, 152 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC28	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	627 nm, 153 mW, Collimated LED for Zeiss Axioskop Microscopes
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

660 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 500 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)


Typical Emitter

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	658 nm	660 nm	670 nm
Spectral Full Width	–	33.2 nm	–
Forward Current	–	–	700 mA
Forward Voltage	–	4.4 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	500 hrs	–

Thorlabs offers 660 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

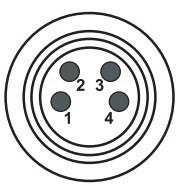
Mounted LED, P = 850 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded


LEDC45

Collimated LED, P = 302 - 366 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate Into Standard Microscopes



Pin	Description
1	LED +Ve
2	LED -Ve
3	Not Connected
4	Not Connected

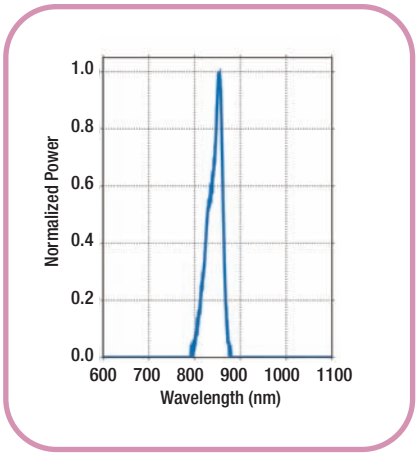
NEW products

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC45	Olympus BX/IX	366 mW	Ø50 mm	1963 mm²
LEDC46	Leica DMI	302 mW	Ø37 mm	1075 mm²
LEDC47	Nikon Eclipse (F Mount)	320 mW	Ø43 mm	1452 mm²
LEDC48	Zeiss Axioskop	323 mW	Ø44 mm	1521 mm²

ITEM#	$	£	€	RMB	DESCRIPTION
M660L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	660 nm, 850 mW, Mounted LED
LEDC45	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	660 nm, 366 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC46	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	660 nm, 302 mW, Collimated LED for Leica DMI Microscopes
LEDC47	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	660 nm, 320 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC48	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	660 nm, 323 mW, Collimated for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA NEW

* Power supply, see TPS001 or page 1104

850 nm Mounted or Mounted and Collimated LEDs



- High-Power LED
- Average Lifetime of 500 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

NEW products


Typical Emitter

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP	MAX
Peak Wavelength	–	850 nm	–
Spectral Full Width	–	80 nm	–
Forward Current	–	–	700 mA
Forward voltage	–	4.4 V	–
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	500 hrs	–

Mounted LED, P = 400 mW

- Uncollimated, Lambertian Radiation Pattern.
- Internally SM1 Threaded


LEDC51

Collimated LED, P = 97 - 117 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate Into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM	BEAM AREA
LEDC49	Olympus BX/IX	117 mW	Ø50 mm	1963 mm^2
LEDC50	Leica DMI	97 mW	Ø37 mm	1075 mm^2
LEDC51	Nikon Eclipse (F Mount)	102 mW	Ø43 mm	1452 mm^2
LEDC52	Zeiss Axioskop	103 mW	Ø44 mm	1521 mm^2

Thorlabs offers 850 nm mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1-threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.


LEDD1A


DC2100

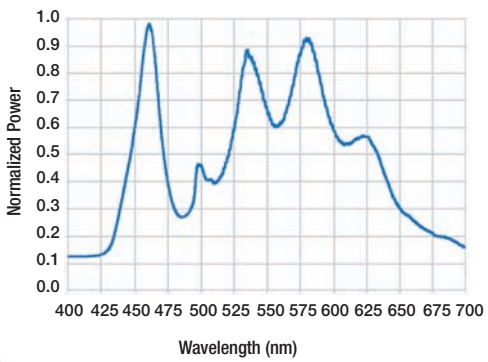
ITEM#	$	£	€	RMB	DESCRIPTION
M850L1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	850 nm, 400 mW, Mounted LED
LEDC49	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	850 nm, 117 mW, Collimated LED for Olympus BX/IX Microscopes
LEDC50	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	850 nm, 97 mW, Collimated LED for Leica DMI Microscopes
LEDC51	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	850 nm, 102 mW, Collimated LED for Nikon Eclipse (F Mount) Microscopes
LEDC52	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	850 nm, 103 mW, Collimated for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA

* Power supply sold separately, see TPS001 or page 1104.

White Light Mounted or Mounted and Collimated LEDs

- High-Power LED
- Average Lifetime of 100,000 Hours
- Mounted on Heatsink
- Compatible with Many of Our LED Controllers (See Pages 1223-1228)

Typical Emitter



CHARACTERISTIC (T_a = 25 °C, I = 700 mA)	MIN	TYP	MAX
Peak Wavelength	435 nm	–	675 nm
Spectral Full Width	–	–	–
Forward Current	–	–	700 mA
Peak Pulsed Forward Current	–	–	1000 mA
Forward Voltage	5.43 V	6.84 V	8.31 V
Operating Temperature	-40 °C	–	120 °C
Storage Temperature	-40 °C	–	120 °C
Lifetime	–	100,000 hrs	–

Thorlabs offers white light mounted LEDs with or without collimation optics. Both types of units use the same LED with EEPROM, which is housed in an internally SM1 threaded housing. The mounted LED can be easily incorporated into lens tube or cage systems via the SM1 threading. The collimated versions house an optic in a microscope-compatible adapter that can be easily installed into the epi-illumination port of many microscopes made by Leica, Nikon, Zeiss, or Olympus.

Drivers

We recommend using either the LEDD1A T-Cube driver or the DC2100 LED driver to control the LED. The T-Cube version is compact and offers basic controls for current and toggling between CW or pulsed operation. When pulsing the LED, an external trigger must be connected to the T-Cube's BNC connection. Please note that a power supply is not included with our T-Cubes, but the TPS001 single-channel power supply is available below.

The DC2100 is a more sophisticated controller that is capable of CW or pulsed operation up to 10 kHz. If an external trigger is used, pulse frequency can be increased up to 100 kHz. Additionally, the DC2100 can read the LED's EEPROM, which contains operating parameters, such as the maximum current that help to prolong the life of the LED. Please see pages 1223-1228 for more details on these drivers as well as other compatible drivers.

LEDD1A

NEW products

DC2100

Mounted LED, P = 500 mW

- Uncollimated, Lambertian Radiation Pattern
- Internally SM1 Threaded

LEDC20

Collimated LED, P = 122 - 148 mW

- Closely Collimated Beam
- High Power Density
- Adjustable Focus
- Designed to Integrate Into Standard Microscopes

ITEM#	MICROSCOPE	POWER	BEAM.	BEAM AREA
LEDC17	Olympus BX/IX	148 mW	Ø50 mm	1963 mm^2
LEDC18	Leica DMI	122 mW	Ø37 mm	1075 mm^2
LEDC19	Nikon Eclipse (F Mount)	130 mW	Ø43 mm	1452 mm^2
LEDC20	Zeiss Axioskop	130 mW	Ø44 mm	1521 mm^2

ITEM#	$	£	€	RMB	DESCRIPTION
MCWHL1	$ 127.50	£ 88.40	€ 113,20	¥ 1,076.70	White, 500 mW, Mounted LED, Cold NEW
LEDC17	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	148 mW, Collimated LED, White, for Olympus BX/IX Microscopes
LEDC18	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	122 mW, Collimated LED, White for Leica DMI Microscopes
LEDC19	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	130 mW, Collimated LED, White for Nikon Eclipse (F Mount) Microscopes
LEDC20	$ 331.50	£ 229.90	€ 294,40	¥ 2,799.20	130 mW, Collimated LED, White for Zeiss Axioskop Microscopes
LEDD1A*	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	T-Cube Power Supply
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power LED Driver with Modulation, 2000 mA NEW

* Power supply sold separately, see TPS001 or page 1104.

T-Cube LED Controllers

LEDD1A
T-Cube LED Driver
(Power Supply Sold Separately)

Features

- Easy-to-Use LED Driver
- Constant Current and Pulsed Current Modes
- Compact T-Cube Footprint
- Pulse Width and Frequency Controllable via External 0 - 5 V TTL Signal

ITEM#	LEDD1	LEDD1A
Output Current	700 mA	1000 mA
Maximum Forward Voltage	13 V	10 V
Maximum Flash Frequency	10 kHz	
Minimum Strobe Pulse Width	50 µs	
Strobe Turn-On / Turn-Off Time	<25 µs	
Power Supply	15 VDC	
Operating Temperature	0 to 40 °C	
Storage Temperature	-40 to 70 °C	
Physical Size	2.4" x 2.4" x 1.8" 60 mm x 60 mm x 47 mm	

LED Interface Pin Connections

Pin	Description
1	LED +Ve
2	LED –Ve
3	N/C
4	N/C

The T-Cube LEDD1 Series is a variable intensity, compact LED driver that was designed for use with our mounted or mounted and collimated LEDs (MxxxL1, LEDCx).

The LED brightness can be adjusted via a potentiometer, which regulates the LED current up to a maximum of 700 mA (LEDD1) or 1 A (LEDD1A). This adjuster also turns the controller on and off. The LEDD1 Series offers a continuous current mode (CC) and an externally triggered pulsed mode (via BNC 5 V TTL input), which makes the LEDD1 an ideal choice for imaging with CCD cameras or photodiodes (CW mode) or for applications that strobe the LED with pulse width modulation. Each controller is shipped attached to a removable base plate that allows the T-Cube to be secured to an optical table. Please note that our T-Cubes do not include a power supply, but three power supply options are available below.

ITEM#	$	£	€	RMB	DESCRIPTION
LEDD1	$ 249.00	£ 172.70	€ 221,10	¥ 2,102.60	T-Cube LED Driver, 700 mA Drive Current (Max)
LEDD1A	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA Drive Current (Max)

T-Cube LED Driver Power Supply Options

The LEDD1 and LEDD1A can be powered using a TPS001 Single T-Cube Power Supply, a TPS008 8-Channel Power Supply, or the TCH002 T-Cube Hub and Power Supply. TPS001 and TPS008 plug into a standard wall outlet and provide +15 VDC. The TCH002 Hub and Power Supply consists of two parts: the hub, which can support up to six standard-footprint T-Cubes, and a power supply that plugs into a standard wall outlet and powers the hub, which in turn powers all the T-Cubes connected to the hub.

TCH002

Power Supply for a Single T-Cube Controller

- Provides +15 VDC

TPS001

Power Supply for Eight T-Cube Controllers

- Provides Eight +15 VDC Outputs
- An AC Adapter with 4 m Cable Enables Convenient Positioning

TPS008

ITEM#	$	£	€	RMB	DESCRIPTION
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	15 V Power Supply Unit for a Single T-Cube
TPS008	$ 175.00	£ 121.40	€ 155,40	¥ 1,477.80	15 V Power Supply Unit for up to 8 T-Cubes
TCH002	$ 726.90	£ 504.00	€ 645,40	¥ 6,138.00	T-Cube™ Controller Hub and Power Supply Unit

High-Power LED Driver with Pulse Modulation

DC2100
High-Power Driver
(Power Supply Included)

NEW product

Features

- Ideal for LED Currents up to 2 A and Voltages up to 24 V
- Modulation Frequency up to 100 kHz, Sine Wave
- Three Modes of Operation
  - Constant Current Mode
  - Pulse Width Modulation Mode
  - Customizable External Trigger Mode with Adjustable Modulation Frequency
- USB2.0 Interface for PC Control

Applications:

- Operation of Very High Power LEDs or High-Power LED Arrays
- LED Characterization
- Microscopy Applications with Trigger or Pulse Control Requirements

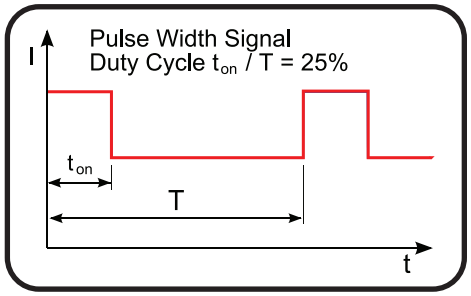
Thorlabs' new DC2100 LED Driver provides up to 2 A of output current for very high-power LEDs with a maximum forward voltage up to 24 V. The pulse width modulation feature offers flexible pulse control: pulse height via LED current, pulse frequency, duty cycle, and number of pulses down to single pulse operation. The LED current can be controlled via an external trigger input voltage as well, which allows modulation up to 100 kHz.

The DC2100 is ultra stable and designed for applications that are sensitive to even small high frequency brightness fluctuations. If connected to our MxxxL1 or LEDCx Series of Mounted LEDs (see pages 1092-1103), the DC2100 automatically reads the stored LED data from the EEPROM and adjusts the controller's settings accordingly; for example, the maximum current can be set to avoid LED damage.

The DC2100 can operate in three modes:

- **Constant Current Mode:** For visual inspection the LED current is adjustable from 0 to 2 A in 1 mA increments.
- **Pulse Width Modulation Mode:** Enables control for single LED pulses with adjustable LED current (0 - 2 A), pulse frequency (1 Hz - 10 kHz), duty cycle (1% - 100%), and number of pulses (1 - 100 or continuous pulse emission).
- **External Control Mode:** Customizable external trigger with adjustable modulation frequency up to 100 kHz, input voltage from 0 V to 10 V (1 V corresponds to 200 mA LED current).

The DC2100 can be connected to a PC using a USB2.0 interface. The unit comes with a GUI interface and drivers.



Flexible Pulse Width Control via Duty Cycle Adjustment that is Defined as t_{on} / T

ITEM#	DC2100
Constant Current Mode	
LED Current Range	0 - 2 A (1 mA Resolution)
LED Current Resolution	1 mA
LED Current Accuracy	±20 mA
LED Forward Voltage	24 V
Pulse Width Modulation Mode	
PWM Frequency Range	1 Hz - 10 kHz
PWM Frequency Resolution	1 Hz (for Frequencies <1 kHz) 100 Hz (for Frequencies >1 kHz)
Duty Cycle	1 - 100%
Duty Cycle Resolution	1%
External Control Mode	
Modulation Frequency Range	0 - 100 kHz, Sine Wave
Modulation	Arbitrary
Trigger Input Max.	10 V 1 V Corresponds to 200 mA
General	
Operating Temperature Range*	0 to 40 °C
Storage Temperature Range	-40 to 70 °C
Dimensions (W x H x D) w/o Operating Elements	160 mm x 80 mm x 150 mm
Dimensions (W x H x D) w/ Operating Elements	160 mm x 80 mm x 168 mm
Warm-up Time for Rated Accuracy	<10 min
Weight	<1 kg

*Non-Condensing

ITEM#	$	£	€	RMB	DESCRIPTION
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power, 1-Channel LED Driver with Pulse Modulation, 2 A, 24 V

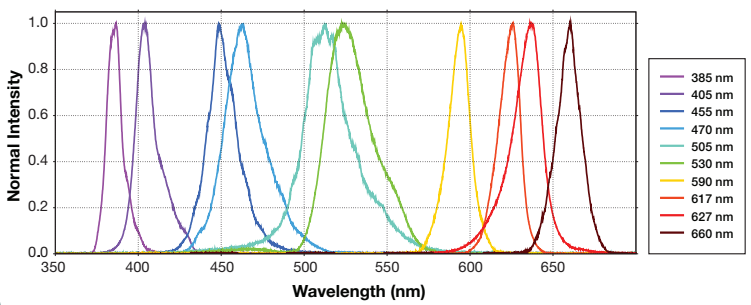
4-Wavelength High-Power LED Sources

NEW products

LED4C Series
4-Wavelength LED Source

Features

- Rapid Switching and Intensity Adjustments via LED Current Settings (Compatible with DC4100 Driver)
- Adapters Available for Olympus, Nikon, Zeiss, and Leica Microscope Lightports
- ±0.1 nm Wavelength Stability, ±1.5% Power Stability
- Three Factory Configured Combinations
  - 455, 530, 590, and 627 nm
  - 405, 470, 530, and 617 nm
  - 505, 590, 617, and 660 nm



Thorlabs' 4-Wavelength LED Source combines four LED beams into a single collimated emission beam. Together with the DC4100 4-Channel Driver (featrued on the next page), the DC4100 provides a versatile light source with rapid switching and modulation of individual LEDs. Compared to non-LED sources, the LED4C provides a higher signal-to-noise ratio due to narrow bandwidth emission, simple operation without maintenance cycles, and no active cooling requirements. Microscope adapters are available and listed at the bottom of the page. For custom wavelength combinations, please contact Tech Support.

Available Wavelengths for 4-Wavelength LED Source

Color	Center Wavelength	Spectral Range	Power	Lifetime
UV	385 nm	380 - 390 nm	10 mW	>500 Hours
UV	405 nm	400 - 405 nm	130 mW	>100,000 Hours
Royal Blue	455 nm	440 - 460 nm	40 mW	>100,000 Hours
Blue	470 nm	460 - 490 nm	25 mW	>100,000 Hours
Cyan	505 nm	530 - 520 nm	20 mW	>100,000 Hours
Green	530 nm	520 - 550 nm	15 mW	>100,000 Hours
Amber	590 nm	584.5 - 597 nm	25 mW	>100,000 Hours
Orange	617 nm	613.5 - 620.5 nm	30 mW	>100,000 Hours
Red	627 nm	620.5 - 645 nm	40 mW	>100,000 Hours
Deep Red	660 nm	658 - 670 nm	10 mW	>100,000 Hours

For other wavelength combinations, please contact Tech Support.

ITEM#	$	£	€	RMB	DESCRIPTION
LED4C1	$ 2,495.00	£ 1,729.50	€ 2.215,00	¥ 21,068.00	4-Color LED Head (455, 530, 590, and 627 nm)
LED4C2	$ 2,495.00	£ 1,729.50	€ 2.215,00	¥ 21,068.00	4-Color LED Head (405, 470, 530, and 617 nm)
LED4C3	$ 2,495.00	£ 1,729.50	€ 2.215,00	¥ 21,068.00	4-Color LED Head (505, 590, 617, and 660 nm)

LED4C Series of Microscope Adapters

These adapters mate the LED4C Series of 4-Wavelength, High-Power LED Sources (featured above) to the illumination port of Olympus, Nikon, Zeiss, and Leica Microscopes.

NEW products

LED4A1 LED4A2 LED4A3 LED4A4

ITEM#	$	£	€	RMB	DESCRIPTION
LED4A1	$ 60.00	£ 41.60	€ 53,30	¥ 506.70	LED4C Source Adapter, SM2 Thread to Olympus Mount
LED4A2	$ 60.00	£ 41.60	€ 53,30	¥ 506.70	LED4C Source Adapter, SM2 Thread to Leica Mount
LED4A3	$ 60.00	£ 41.60	€ 53,30	¥ 506.70	LED4C Source Adapter, SM2 Thread to Nicon Eclipse
LED4A4	$ 60.00	£ 41.60	€ 53,30	¥ 506.70	LED4C Source Adapter, SM2 Thread to Zeiss Mount

4-Channel LED Driver

NEW products

DC4100
4-Channel LED Driver
(Power Supply Included)

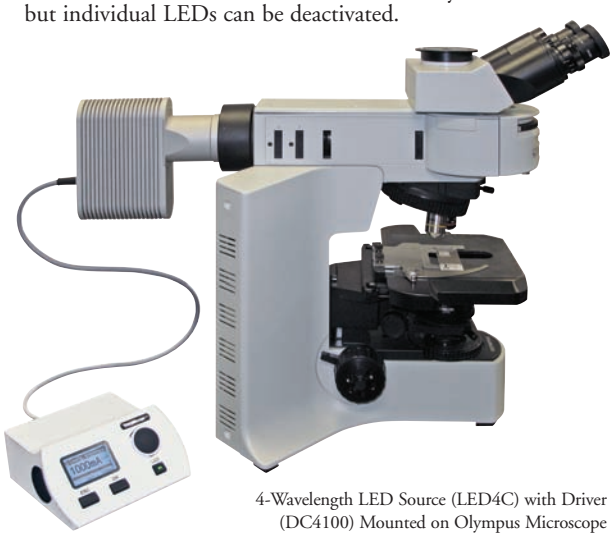
Features

- Controls Thorlabs' 4-Wavelength LED4C Source or 4 Individual LEDs (Using DC4100-HUB)
- Ideal for Multi-Wavelength Fluorescence Imaging Applications
- Drives LED Currents up to 1 A with Modulation up to 100 kHz, Sine Wave
- Three Modes of Operation
  - Constant Current
  - Brightness
  - External Control

Back View

Thorlabs' DC4100 is designed to drive our 4-Wavelength LED Source (LED4C, see previous page) or four individual high-power LEDs (MxxxL1 or LEDCx series). The LED current of each channel can be adjusted independently from 0 mA to 1000 mA or modulated simultaneously via an external voltage. The DC4100 controller is ideal for microscopy applications to drive up to four LEDs with adjustable intensity. The DC4100 has a compact housing with an easy-to-read backlit LCD display. It can operate in three modes:

- **Constant Current Mode** - the LED current is kept constant at a preset current value. This mode is ideal for general illumination applications. LED current can be individually set for each LED.
- **Brightness Mode** - Controls the LED current at a set percentage of the maximum current. This mode is optimal for fluorescence microscopy applications. LED current percentage can be individually set for each LED.
- **External Control Mode** - Enables control of all LED currents via a single external trigger voltage (0 to 10 V). 1 V corresponds to an LED current of 100 mA. This mode allows customers to set custom modulation settings of the LED current. All activated LEDs are simultaneously controlled, but individual LEDs can be deactivated.



4-Wavelength LED Source (LED4C) with Driver (DC4100) Mounted on Olympus Microscope

ITEM#	DC4100
Constant Current Mode	
LED Current Range	0 - 1000 mA
LED Current Resolution	1 mA
LED Current Accuracy	±10 mA
LED Forward Voltage	5 V
Brightness Mode	
LED Current Range	1 - 100%
LED Current Resolution	0.1% (1 mA Min)
LED Current Accuracy	±10 mA
LED Forward Voltage	5 V
External Control Mode	
Modulation	0 - 100 kHz, Sine Wave
Trigger Input	0 - 10 V 1 V Corresponds to 100 mA
General	
Operating Temperature*	0 to 40 °C
Storage Temperature	-40 to 70 °C
Dimensions (W x H x D)	160 mm x 80 mm x 168 mm
Warm-Up Time for Rated Accuracy	10 min
Weight	<1 kg

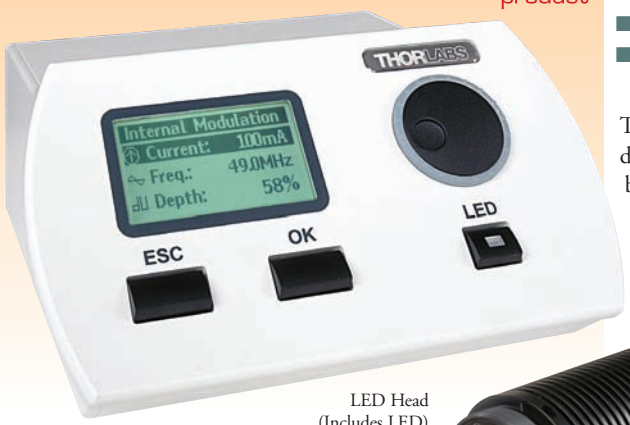
*Non-Condensing

ITEM#	$	£	€	RMB	DESCRIPTION
DC4100	$ 2,495.00	£ 1,729.50	€ 2.215,00	¥ 21,068.00	4-Channel LED Driver, 1 A, 5 V
DC4100-HUB	$ 150.00	£ 104.00	€ 133,20	¥ 1,266.70	4-Channel Hub for MxxxL and LEDCx Series LEDs

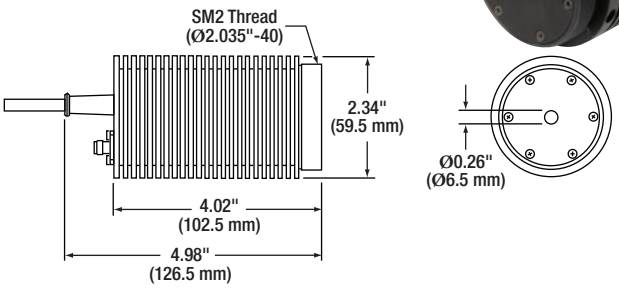
LED Source: 10 MHz to 100 MHz Modulation (Page 1 of 2)

High-Power DC3100 Series Driver
(Power Supply Included)

NEW product



LED Head
(Includes LED)



Please refer to our website for complete models and drawings.

3 Operation Modes

- Internal Modulation Mode for FLIM Applications
- External Trigger Mode for Non-FLIM Applications
- Constant Current Mode for Visual Inspection

Thorlabs' new DC3100 series of Modulated LED Sources are designed for applications that benefit from modulated, high-brightness LED sources, such as frequency-domain Fluorescence Lifetime Imaging Microscopy (FLIM). FLIM is an imaging technology that utilizes the lifetime of the fluorophore signal to create an image. Using this technique, one can distinguish dyes, even those that fluoresce at the same wavelength, and indirectly measure biomolecular concentrations. This technique is also beneficial for imaging applications in which the excitation wavelength is close to the emission wavelength.

These compact LED sources enable the aforementioned measurements. They include a high-current, high-power LED driver with three operation modes, an LED head with modulating electronics that are designed for high-brightness LEDs with high thermal dissipation, and the LED itself. There are four standard wavelengths available: 365 nm, 405 nm, 470 nm, and 630 nm. Other wavelengths are available upon request. The DC3100 can be remotely operated via USB2.0 by the included software package with an intuitive GUI and an extensive driver set.

Specifications	
LED Current	0 to 1 A
Internal Modulation Mode	
Modulation Frequency	10 - 100 MHz in 0.1 MHz Steps*
Modulation Depth	0 to 100%
Trigger Output	Sine Wave
External Modulation Mode	
Drive Voltage	0 to 10 V (1 V/100 mA)
Modulation	Arbitrary
Modulation Frequency	0 to 100 kHz (Sine Wave)
Mechanical	
LED Mounting**	Compatible with Standard Star-Shaped PCB-Packaged LEDs

*LED dependant **LED is delivered mounted in housing.

ITEM#	Center Peak	I (Max)	Cutoff Frequency
DC3100-365	365 nm	700 mA	90 MHz
DC3100-405	405 nm	1000 mA	95 MHz
DC3100-470	470 nm	1000 mA	80 MHz
DC3100-630	630 nm	1000 mA	70 MHz

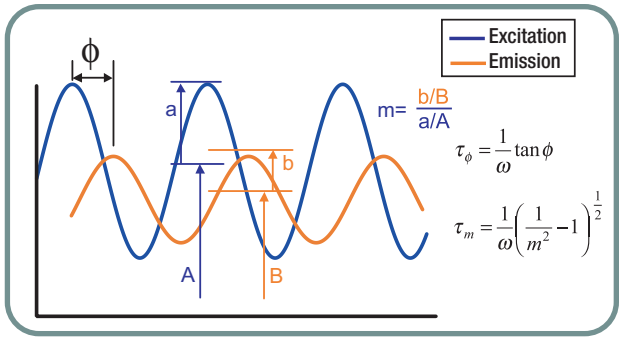
LED Head shown with Leica DMI Collimation Adapter (Collimation Adapter Sold Separately, see Following Page)

ITEM#	$	£	€	RMB	DESCRIPTION
DC3100-365	$ 1,950.00	£ 1,352.00	€ 1.731,00	¥ 16,466.00	Modulated LED Source for FLIM with Head, 365 nm
DC3100-405	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	Modulated LED Source for FLIM with Head, 405 nm
DC3100-470	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	Modulated LED Source for FLIM with Head, 470 nm
DC3100-630	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	Modulated LED Source for FLIM with Head, 630 nm

LED Source: 10 MHz to 100 MHz Modulation (Page 2 of 2)

Frequency-Domain FLIM

FLIM (Fluorescence Lifetime Imaging Microscopy) is an imaging technology that utilizes the exponential fluorescence decay rate from a fluorescent sample; it is used with confocal microscopy, two-photon microscopy, and other microscope systems. The image in FLIM is based on the lifetime of the fluorophore signal rather than its intensity, which minimizes photon scattering in thick sample layers.

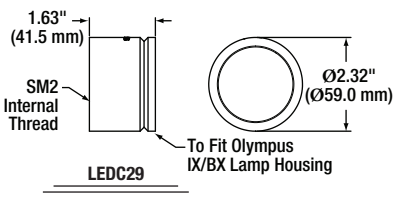


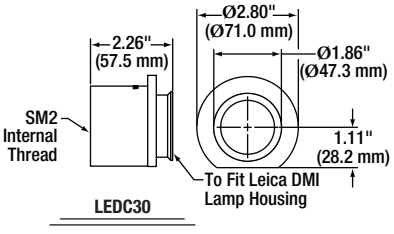
As an alternative to Time-Domain FLIM, where the decay time of single excitation pulses is measured, Frequency-Domain FLIM (FD-FLIM) determines the fluorescence lifetimes two ways: 1) by measuring the phase delay between the fluorescent and excitation signals and 2) by using the modulation ratio (defined in the diagram to the right). In FD-FLIM the intensity of the light source is continuously modulated at high frequency. The phase delay of the fluorescence signal with respect to the excitation signal is due to the lifetime of the excited state, and is reduced in amplitude.

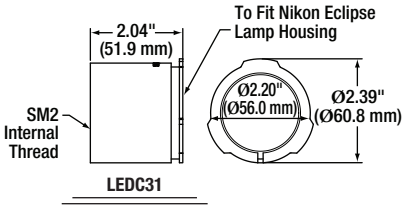
Microscope Adapters for Collimation of FLIM LEDs

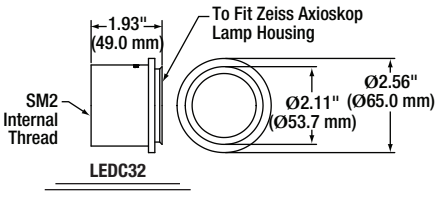
Four collimating lens housings are offered that adapt our DC3100 series of LED mounting heads directly to the illumination ports on the Olympus IX/BX (LEDC29), Leica DMI (LEDC30), Nikon Eclipse (LEDC31), or Zeiss Axioskop (LEDC32) microscopes. They collimate the light emitted by the LED modules. To switch between LED sources, simply unscrew the LED housing and replace it with an alternative housing.

LED Head Shown with LEDC29 Collimation Adapter









Please refer to our website for complete models and drawings.

NEW products

ITEM#	$	£	€	RMB	DESCRIPTION
LEDC29	$ 175.70	£ 121.80	€ 156,00	¥ 1,483.70	Accessory for Modulated FLIM LEDs, Olympus IX/BX Port
LEDC30	$ 175.70	£ 121.80	€ 156,00	¥ 1,483.70	Accessory for Modulated FLIM LEDs, Leica DMI Port
LEDC31	$ 218.60	£ 151.60	€ 194,10	¥ 1,845.90	Accessory for Modulated FLIM LEDs, Nikon Eclipse (Bayonet Mount) Port
LEDC32	$ 175.70	£ 121.80	€ 156,00	¥ 1,483.70	Accessory for Modulated FLIM LEDs, Zeiss Axioskop Port

LED Array Light Source (Page 1 of 2)

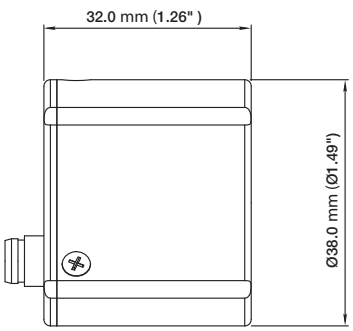
The LIU series of LED light sources are available in red, blue, green, or white LED arrays. Conveniently mounted in a 1.5" outer diameter housing, these light sources can be used for a variety of applications. The housing can be readily secured into most optical mounts used in camera illumination units.

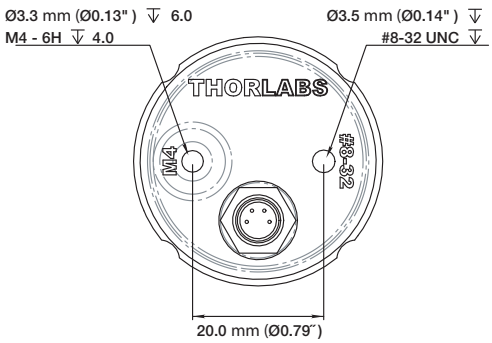
Each LED array light source unit consists of 20 individual LEDs that are mounted in an array on a printed circuit board. When operating with 100 mA of current, the red, green, and blue LED units have an output intensity of more than 600 µW/cm², while the white LED unit has an output intensity of greater than 1700 µW/cm². These intensities were measured at a distance of 100 mm from the LED array along the central axis.

LIU Light Sources
Power Cord not Included

Features

- 20 High-Brightness LEDs
- Longer Lifetime than Traditional Light Sources
- LED Array Output can be Modulated
- Fits Many Commerical Camera Illumination Units
- Compatible with the 30 mm Cage System

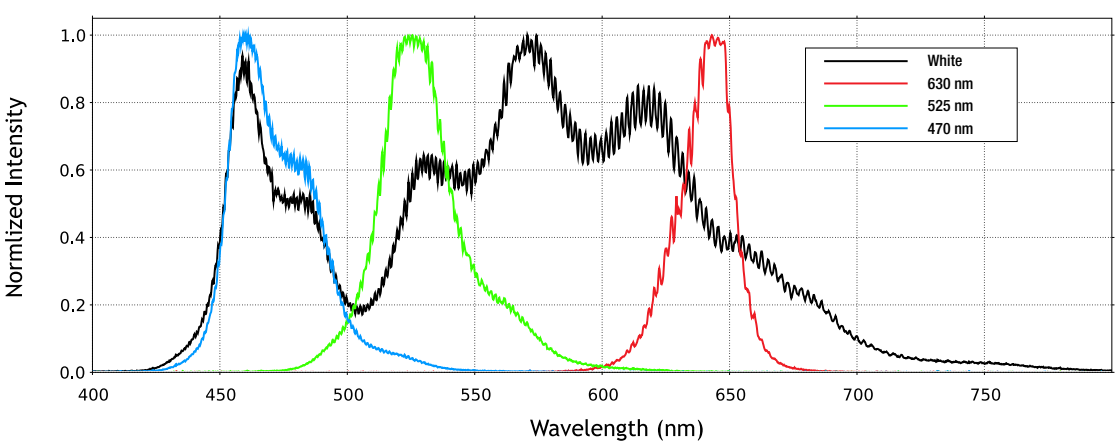




Pin	DESCRIPTION
1	LED +Ve
2	Channel One Controller Input
3	Coded Input
4	Channel Two Controller Input

ITEM#	COLOR	APROXIMATE CENTRAL WAVELENGTH	INTENSITY*	MAX CURRENT	MAX VOLTAGE
LIU001	Red	630 nm	600 µW/cm²	120 A	24 V
LIU002	Green	525 nm	600 µW/cm²	120 A	24 V
LIU003	Blue	470 nm	600 µW/cm²	120 A	24 V
LIU004	White	White	1700 µW/cm²	120 A	24 V

*When measured at a distance of 100 mm from the LED along the control axis



LED Array Light Source (Page 2 of 2)

The AD38 double-bored mounting ring holds an LIU series LED array in place with a single #8-32 setscrew. The outside of the ring is Ø2" so that it can mount inside many optical-mechanical parts suitable for Ø2" components.

Additional mounting options include two threaded holes on the rear of each housing, one M4 x 0.7 and one #8-32, as well as grooves running the length of the housing that allow the LED unit to be placed in a 30 mm cage system. The LED unit will be suspended by the cage rods, but not restrained from moving along the optical axis of the cage system. To fix the position of the LED unit, sandwich it between two fixed cage elements.

LIU004 LED Array in a 30 mm Cage System Application
All Components Sold Separately

LIU002
LED Array with AD38 Mounting Ring Secured in a KS2 Mount on a TR Series Post

AD38
Mounting Ring used with LED Arrays

All Components Sold Separately

ITEM#	$	£	€	RMB	DESCRIPTION
LIU001	$ 114.00	£ 79.10	€ 101,30	¥ 962.70	Red LED Array, 1.5" Outer Diameter
LIU002	$ 114.00	£ 79.10	€ 101,30	¥ 962.70	Green LED Array, 1.5" Outer Diameter
LIU003	$ 114.00	£ 79.10	€ 101,30	¥ 962.70	Blue LED Array, 1.5" Outer Diameter
LIU004	$ 119.00	£ 82.50	€ 105,70	¥ 1,004.90	White LED Array, 1.5" Outer Diameter
AD38	$ 16.00	£ 11.10	€ 14,30	¥ 135.20	LED Mounting Ring
LIU-PS	$ 33.30	£ 23.10	€ 29,60	¥ 281.20	Power Supply for LED Array

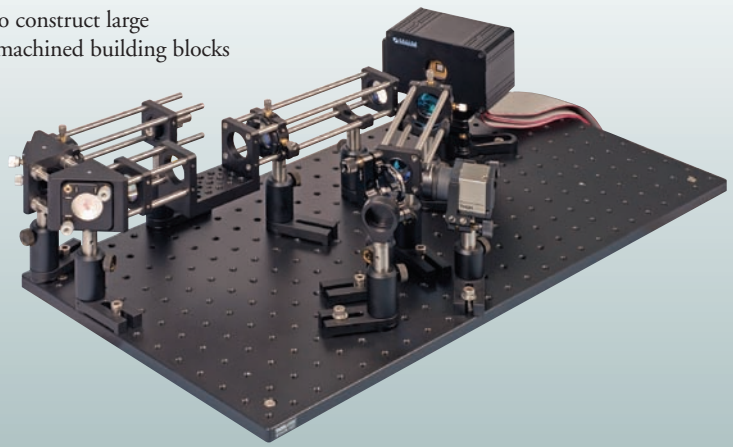
Cage Systems

Thorlabs' Cage Assembly Systems provide a convenient way to construct large optomechanical systems with an established line of precision-machined building blocks designed for flexibility and accurate alignment.

Available Components Include:

- Kinematic Mounts
- Translation Stages
- Rotation Mounts
- Filter Wheel Mounts
- Cage Cubes

See Pages 147-184




KCB1


CFW6


HPT1

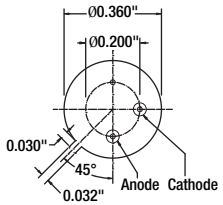

CP90F


CT1

Compact • Rigid • Accurate Alignment • Flexible

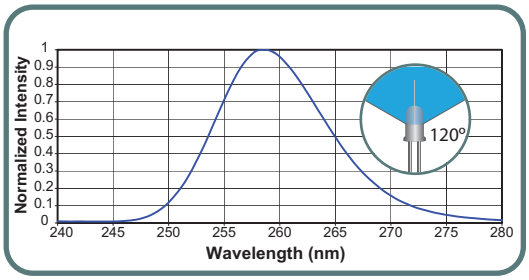
λ = 260 nm, P = 0.30 mW LED

- UVTOP® UV LED with Window
- TO-39 Package



CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	255 nm	260 nm	264 nm
Optical Power @ 20 mA, CW	0.18 mW	0.30 mW	–
Spectral Half Width	–	12 nm	15 nm
Viewing Full Angle	–	120°	–
Forward Current	–	–	30 mA
Pulsed Forward Current*	–	–	200 mA
Reverse Voltage	–	–	6.0 V
Forward Voltage @ 20 mA	–	6.5 V	8.0 V
Operating Temperature	-30 °C	–	55 °C
Storage Temperature	-30 °C	–	100 °C

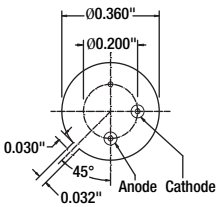
*1 ms Pulse with 1% Duty Cycle



ITEM#	$	£	€	RMB	DESCRIPTION
LED260W	$ 289.00	£ 200.40	€ 256,60	¥ 2,440.40	UVTOP® UV LED with Window, 260 nm, 0.30 mW, TO-39

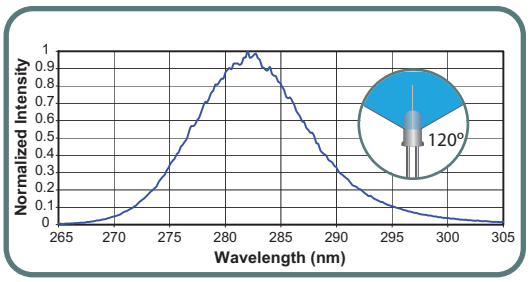
λ = 285 nm, P = 0.80 mW LED

- UVTOP® UV LED with Window
- TO-39 Package



CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	280 nm	285 nm	290 nm
Optical Power @ 20 mA, CW	0.48 mW	0.80 mW	–
Spectral Half Width	–	12 nm	15 nm
Viewing Full Angle	–	120°	–
Forward Current	–	–	30 mA
Pulsed Forward Current*	–	–	200 mA
Reverse Voltage	–	–	6.0 V
Forward Voltage @ 20 mA	–	6.5 V	7.0 V
Operating Temperature	-30 °C	–	55 °C
Storage Temperature	-30 °C	–	100 °C

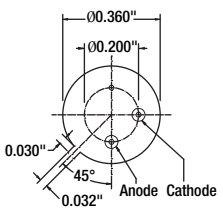
*1 ms Pulse with 1% Duty Cycle



ITEM#	$	£	€	RMB	DESCRIPTION
LED285W	$ 182.00	£ 126.20	€ 161,60	¥ 1,536.90	UVTOP® UV LED with Window, 285 nm, 0.80 mW, TO-39

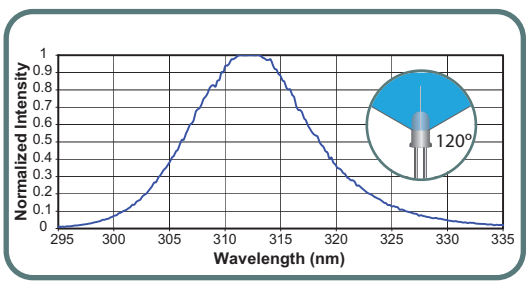
λ = 315 nm, P = 0.60 mW LED

- UVTOP® UV LED with Window
- TO-39 Package



CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	310 nm	315 nm	320 nm
Optical Power @ 20 mA, CW	0.36 mW	0.60 mW	–
Spectral Half Width	–	10 nm	20 nm
Viewing Full Angle	–	120°	–
Forward Current	–	–	30 mA
Pulsed Forward Current*	–	–	200 mA
Reverse Voltage	–	–	6.0 V
Forward Voltage @ 20 mA	–	5.5 V	7.5 V
Operating Temperature	-30 °C	–	55 °C
Storage Temperature	-30 °C	–	100 °C

*1 ms Pulse with 1% Duty Cycle



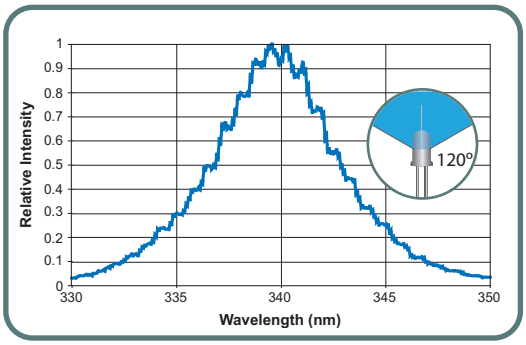
ITEM#	$	£	€	RMB	DESCRIPTION
LED315W	$ 142.00	£ 98.50	€ 126,10	¥ 1,199.10	UVTOP® UV LED with Windo, 315 nm, 0.60 mW, TO-39

λ = 340 nm, P = 0.33 mW LED

- UVTOP® UV LED with Window
- TO-39 Package

Mechanical Drawings Available on the WEB

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	335 nm	340 nm	345 nm
Optical Power @ 20 mA, CW	0.24 mW	0.33 mW	–
Spectral Half Width	–	15 nm	–
Viewing Full Angle	–	120°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	200 mA
Reverse Voltage	–	–	6.0 V
Forward Voltage @ 20 mA	–	5.5 V	6.2 V
Operating Temperature	-30 °C	–	55 °C
Storage Temperature	-30 °C	–	100 °C



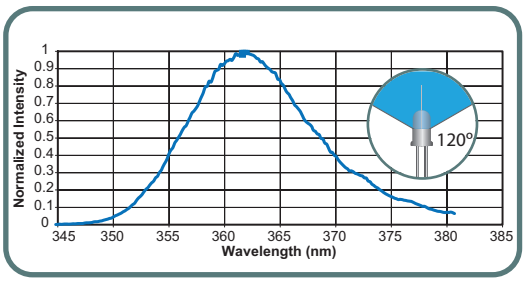
ITEM#	$	£	€	RMB	DESCRIPTION
LED341W	$ 175.00	£ 121.40	€ 155,40	¥ 1,477.80	UVTOP® UV LED with Window, 340 nm, 0.35 mW, TO-39

λ = 365 nm, P = 0.80 mW LED

- UVTOP® UV LED with Window
- TO-39 Package

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	335 nm	365 nm	375 nm
Optical Power @ 20 mA, CW	0.48 mW	0.80 mW	–
Spectral Half Width	–	15 nm	20 nm
Viewing Full Angle	–	120°	–
Forward Current	–	4.5 mA	6.5 mA
Pulsed Forward Current*	–	–	200 mA
Reverse Voltage	–	–	6.0 V
Forward Voltage @ 20 mA	–	5.5 V	30 V
Operating Temperature	-30 °C	–	55 °C
Storage Temperature	-30 °C	–	100 °C

*1 ms Pulse with 1% Duty Cycle



ITEM#	$	£	€	RMB	DESCRIPTION
LED365W	$ 65.00	£ 45.10	€ 57,80	¥ 548.90	UVTOP® UV LED with Window, 365 nm, 0.80 mW, TO-39

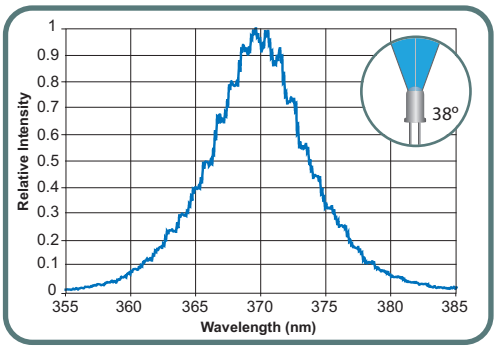
WARNING

This UV LED radiates intense UV light during operation. Do not expose any part of a human body to UV light. This can be harmful especially to the eyes and skin.

λ = 375 nm, P = 2.5 mW LED

- Epoxy Lens, 38° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	365 nm	375 nm	385 nm
Optical Power @ 20 mA, CW	–	2.5 mW	–
Spectral Half Width	–	10 nm	–
Viewing Full Angle	–	38°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	–
Reverse Voltage	–	–	3.0 V
Forward Voltage @ 20 mA	–	3.5 V	4.3 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C

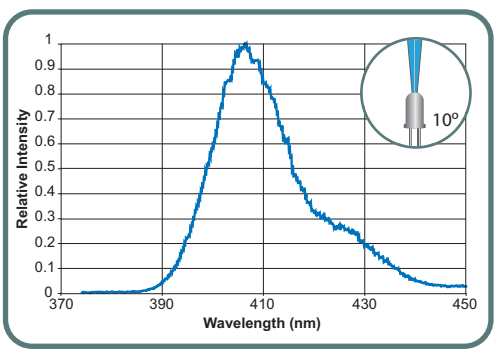


ITEM#	$	£	€	RMB	DESCRIPTION
LED370E	$ 4.40	£ 3.05	€ 4,00	¥ 37.20	Epoxy Encased LED, 375 nm, 2.5 mW, T-1 3/4

λ = 405 nm, P = 6.0 mW LED

- Epoxy Lens, 10° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	395 nm	405 nm	415 nm
Optical Power @ 20 mA, CW	–	6.0 mW	10 mW
Spectral Half Width	–	15 nm	–
Viewing Full Angle	–	10°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	–
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.8 V	4.3 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C



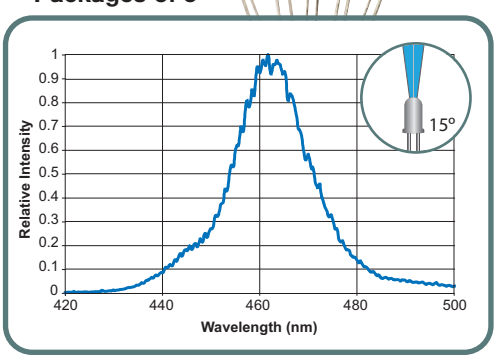
ITEM#	$	£	€	RMB	DESCRIPTION
LED405E	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	Epoxy Encased LED, 405 nm, 6.0 mW, T-1 3/4

λ = 470 nm, P = 8.5 mW LED

Sold in Packages of 5

- Epoxy Lens, 15° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	460 nm	470 nm	480 nm
Optical Power @ 20 mA, CW	–	–	8.5 mW
Spectral Half Width	–	23 nm	–
Viewing Full Angle	–	15°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	100 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.2 V	3.85 V
Operating Temperature	-40 °C	–	85 °C
Storage Temperature	-40 °C	–	120 °C

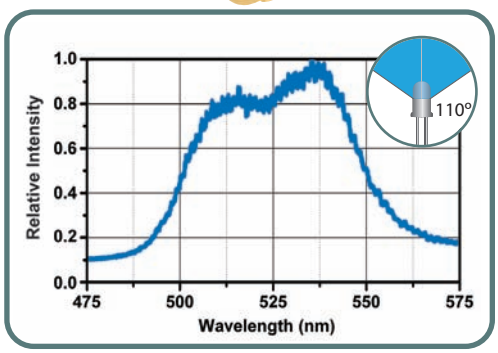


ITEM#	$	£	€	RMB	DESCRIPTION
LED470E	$ 9.00	£ 6.25	€ 8,00	¥ 76.00	Epoxy Encased LED, 470 nm, 8.5 mW, T-1 3/4 (Qty. 5)

λ = 525 nm, P = 2.0 mW LED with Monitoring Photodiode

- Monitoring Photodiode for Constant Power Mode
- TO-18 Package

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	515 nm	525 nm	535 nm
Optical Power @ 20 mA, CW	–	2.0 mW	–
Spectral Half Width	–	40 nm	–
Viewing Full Angle	–	110°	–
Forward Current	–	30 mA	–
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.5 V	4.3 V
Operating Temperature	-20 °C	–	85 °C
Storage Temperature	-30 °C	–	95 °C
PD Reverse Voltage	–	–	100 V
PD Output Current	–	55 µA	–



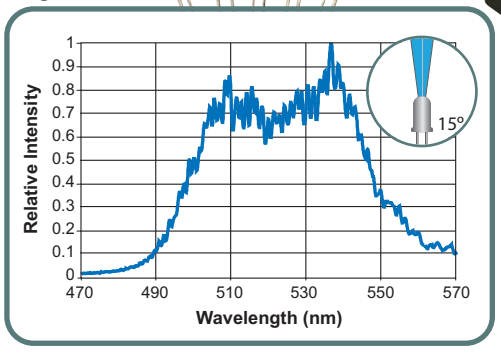
ITEM#	$	£	€	RMB	DESCRIPTION
LED521M	$ 80.00	£ 55.50	€ 71,10	¥ 675.60	LED with a Monitoring Photodiode, 525 nm, 2.0 mW, TO-18

λ = 525 nm, P = 2.6 mW LED

- Epoxy Lens, 15° Viewing Full Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	520 nm	525 nm	540 nm
Optical Power @ 20 mA, CW	–	–	2.6 mW
Spectral Half Width	–	32 nm	–
Viewing Full Angle	–	15°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	–
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.3 V	3.85 V
Operating Temperature	-40 °C	–	85 °C
Storage Temperature	-40 °C	–	120 °C



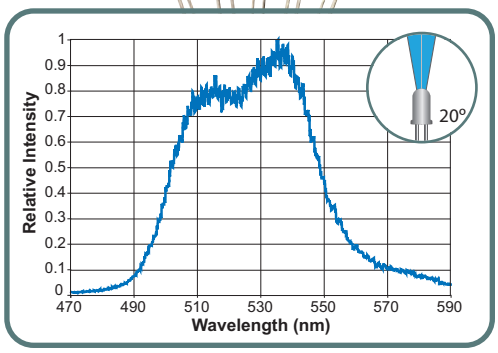
ITEM#	$	£	€	RMB	DESCRIPTION
LED525E	$ 9.00	£ 6.25	€ 8,00	¥ 76.00	Epoxy Encased LED, 525 nm, 2.6 mW, T-1 3/4

λ = 525 nm, P = 3.5 mW LED

- Epoxy Lens, 20° Viewing Half Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	515 nm	525 nm	535 nm
Optical Power @ 20 mA, CW	–	–	3.5 mW
Spectral Half Width	–	40 nm	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	–
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.5 V	4.3 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C



ITEM#	$	£	€	RMB	DESCRIPTION
LED528E	$ 15.00	£ 10.40	€ 13,40	¥ 126.70	Epoxy Encased LED, 525 nm, 3.5 mW, T-1 3/4

Universal LED Mounts

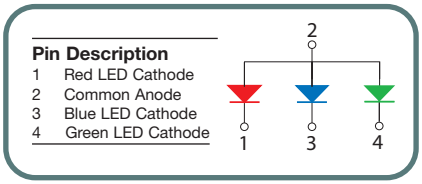
See Page 1229

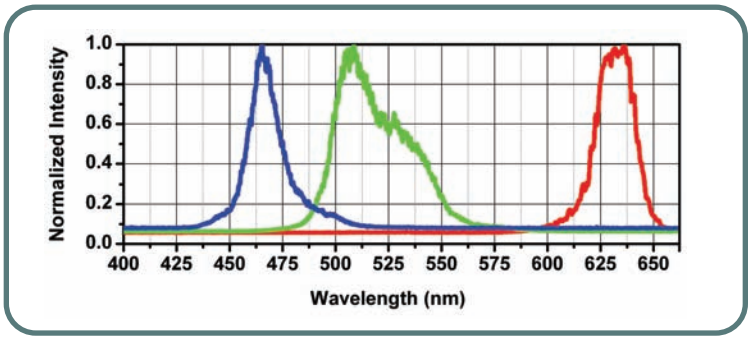
RGB, P = 5.8 mW, 3.1 mW, and 6.2 mW LED

CHARACTERISTIC (Ta = 25 °C)	MIN (R,G, & B)	TYP. (R,G, & B)	MAX (R,G, & B)
Peak Wavelength	620/515/460 nm	–	635/535/475 nm
Optical Power @ 20 mA, CW	–	5.8/3.1/6.2 mW	–
Spectral Half Width	8.0 nm	10.0 nm	8.0 nm
Viewing Full Angle	–	12.5°	–
Forward Current	–	–	50 mA
Pulsed Forward Current	–	–	100 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	1.7/2.8/2.8 V	–	2.4/3.6/3.6 V
Operating Temperature	-40 °C	–	95 °C
Storage Temperature	-40 °C	–	100 °C

- Red, Green, and Blue LEDs Packaged Together (Can be Operated Separately)
- Epoxy Lens, 12.5° Viewing Half Angle
- T-1 3/4 Package

Sold in Packages of 5

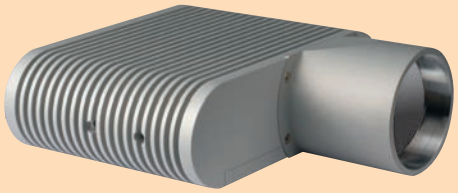




ITEM#	$	£	€	RMB	DESCRIPTION
LEDRGBE	$ 7.75	£ 5.35	€ 6,90	¥ 65.50	Epoxy-Encased RGB LEDs, T-1 3/4 (Qty. 5)

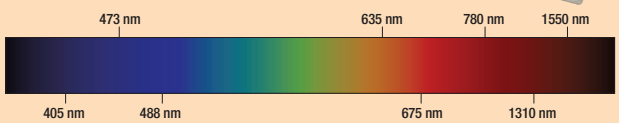
4-Wavelength, High-Power LED Source

- 4-Wavelength Source
- Precisely Defined Spectral Range
- Fast Switching and Intensity Adjustments via LED Current Settings
- High Emission Stability and Reproducibility
- High Thermal and Mechanical Stability
- Rugged and Vibration Free, No Moving Parts
- Long Life-Time Lightsource
- Three Preselected Combinations of 4 LED Wavelengths
  - LED4C1: 455, 530, 590, and 627 nm
  - LED4C2: 405, 470, 530, and 617 nm
  - LED4C3: 505, 590, 617, and 660 nm
- Adapter for Olympus, Nikon, Zeiss, and Leica Microscope Lightports Included



LED4C Series
4-Color LED Source

Ideally Operated by LEDD4 Driver



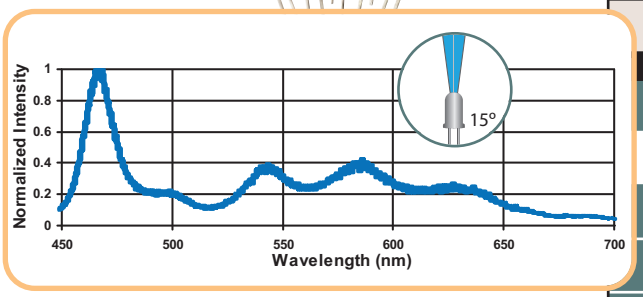
For More Information, See Pages 1106-1107

White Light, P = 1.0 mW LED

- Epoxy Lens, 15° Viewing Full Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Optical Power @ 20 mA, CW	–	1.0 mW	2.6 mW
Viewing Full Angle	–	15°	–
Forward Current	–	–	30 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.2 V	3.6 V
Operating Temperature	-30 °C	–	80 °C
Storage Temperature	-40 °C	–	100 °C



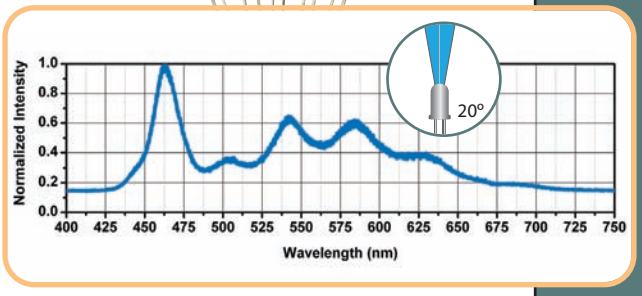
ITEM#	$	£	€	RMB	DESCRIPTION
LEDWE-15	$ 9.00	£ 6.25	€ 8,00	¥ 76.00	Epoxy Encased White Light LED, 1.0 mW, T-1 3/4 (Qty. 5)

White Light, P = 2.6 mW LED

- Epoxy Lens, 10° Viewing Half Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Optical Power @ 20 mA, CW	–	2.6 mW	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	80 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.2 V	3.6 V
Operating Temperature	-30 °C	–	80 °C
Storage Temperature	-40 °C	–	100 °C



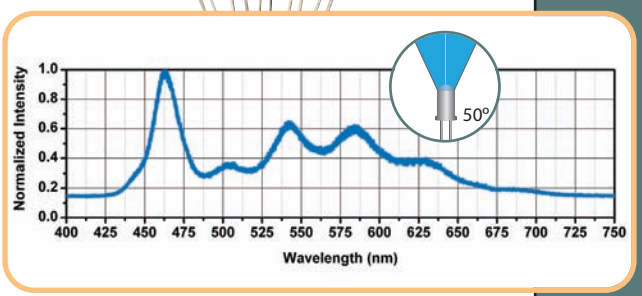
ITEM#	$	£	€	RMB	DESCRIPTION
LEDWE-10	$ 10.00	£ 6.95	€ 8,90	¥ 84.50	Epoxy-Encased White Light LED, 2.6 mW, T-1 3/4 (Qty. 5)

White Light, P = 3.7 mW LED

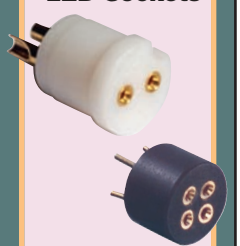
- Epoxy Lens, 50° Viewing Full Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Optical Power @ 20 mA, CW	–	3.7 mW	–
Viewing Full Angle	–	50°	–
Forward Current	–	–	30 mA
Pulsed Forward Current	–	–	150 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	3.1 V	3.6 V
Operating Temperature	-40 °C	–	80 °C
Storage Temperature	-40 °C	–	85 °C

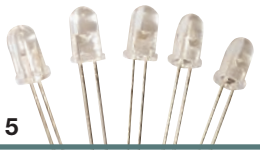


ITEM#	$	£	€	RMB	DESCRIPTION
LEDWE-50	$ 5.75	£ 4.00	€ 5,20	¥ 48.60	Epoxy-Encased White Light LED, 3.7 mW, T-1 3/4 (Qty. 5)

LED Sockets

See Page 381

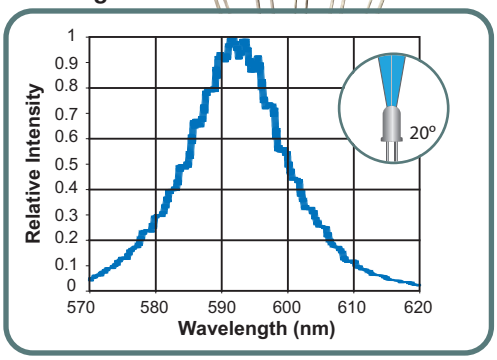
λ = 590 nm, P = 2.0 mW LED

- Epoxy Lens, 20° Viewing Full Angle
- T-1 3/4 Package



Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	580 nm	590 nm	600 nm
Optical Power @ 20 mA, CW	–	2.0 mW	–
Spectral Half Width	–	20 nm	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	50 mA
Pulsed Forward Current	–	–	140 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	2.2 V	2.6 V
Operating Temperature	-25 °C	–	85 °C
Storage Temperature	-25 °C	–	100 °C

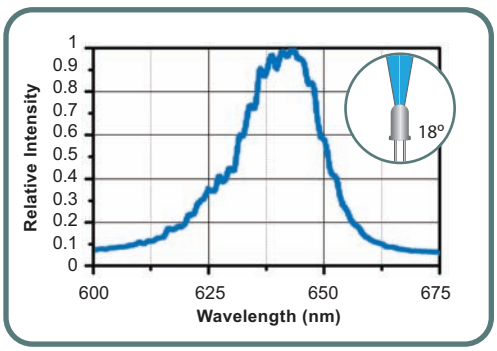


ITEM#	$	£	€	RMB	DESCRIPTION
LED591E	$ 18.00	£ 12.50	€ 16,00	¥ 152.00	Epoxy-Encased LED, 590 nm, 2.0 mW, T-1 3/4 (Qty. 5)

λ = 635 nm, P = 4.0 mW LED

- Epoxy Lens, 18° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	625 nm	635 nm	645 nm
Optical Power @ 20 mA, CW	–	4.0 mW	–
Spectral Half Width	–	10 nm	–
Viewing Full Angle	–	18°	–
Forward Current	–	–	50 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	2.2 V	2.6 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C



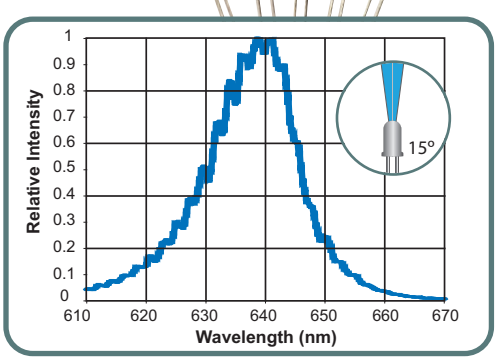
ITEM#	$	£	€	RMB	DESCRIPTION
LED631E	$ 3.00	£ 2.10	€ 2,70	¥ 25.40	Epoxy-Encased LED, 635 nm, 4.0 mW, T-1 3/4

λ = 639 nm, P = 7.2 mW LED

- Epoxy Lens, 15° Viewing Half Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	629 nm	639 nm	649 nm
Optical Power @ 20 mA, CW	–	7.2 mW	–
Spectral Half Width	–	17 nm	–
Viewing Full Angle	–	15°	–
Forward Current	–	–	50 mA
Pulsed Forward Current	–	–	100 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	2.0 V	2.5 V
Operating Temperature	-40 °C	–	100 °C
Storage Temperature	-40 °C	–	120 °C



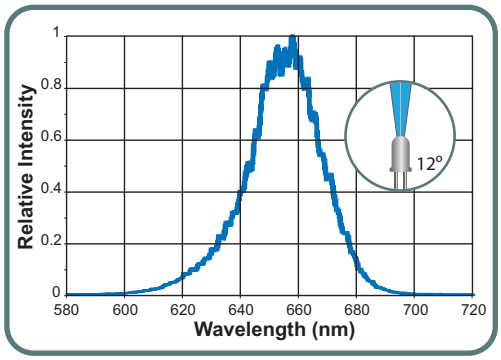
ITEM#	$	£	€	RMB	DESCRIPTION
LED630E	$ 6.00	£ 4.15	€ 5,40	¥ 50.70	Epoxy-Encased LED, 639 nm, 7.2 mW, T-1 3/4

λ = 655 nm, P = 1.7 mW LED

- Glass Lens, 12° Viewing Full Angle
- TO-18 Package

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	645 nm	655 nm	665 nm
Optical Power @ 20 mA, CW	–	1.7 mW	–
Spectral Half Width	–	20 nm	–
Viewing Full Angle	–	12°	–
Forward Current	–	–	50 mA
Pulsed Forward Current*	–	–	75 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.9 V	2.2 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C

*1 ms Pulse with 1% Duty Cycle

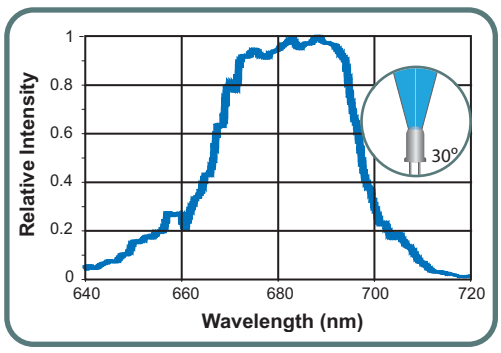


ITEM#	$	£	€	RMB	DESCRIPTION
LED661L	$ 4.25	£ 2.95	€ 3,80	¥ 35.90	LED with Glass Lens, 655 nm, 1.7 mW, TO-18

λ = 670 nm, P = 0.45 mW LED

- Glass Window, 30° Viewing Full Angle
- TO-18 Package

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	650 nm	670 nm	700 nm
Optical Power @ 20 mA, CW	–	0.45 mW	–
Spectral Half Width	–	20 nm	–
Viewing Full Angle	–	30°	–
Forward Current	–	–	60 mA
Pulsed Forward Current	–	–	500 mA
Reverse Voltage	–	–	3.0 V
Forward Voltage @ 20 mA	–	1.9 V	2.2 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-40 °C	–	100 °C
Rise/Fall Time	–	60 ns	100 ns

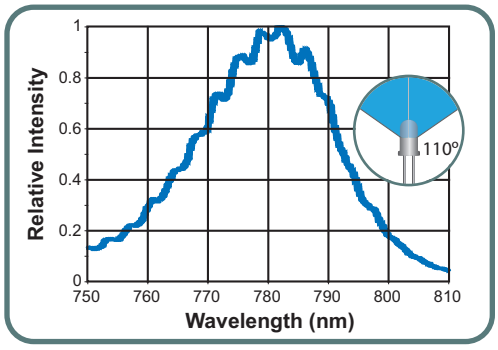


ITEM#	$	£	€	RMB	DESCRIPTION
LED661W	$ 3.75	£ 2.60	€ 3,40	¥ 31.70	LED with Glass Window, 670 nm, 0.45 mW, TO-18

λ = 780 nm, P = 6.0 mW LED

- LED with Integrated Photodiode
- TO-18 Package

CHARACTERISTIC (Ta = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	765 nm	780 nm	795 nm
Optical Power @ 20 mA, CW	3 mW	6 mW	–
Spectral Half Width	–	35 nm	–
Viewing Full Angle	–	110°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	500 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.7 V	2.0 V
Operating Temperature	-20 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	60/40 ns	–



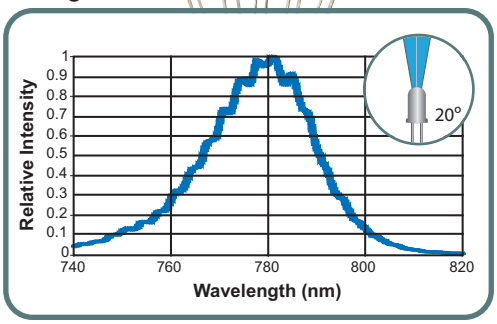
ITEM#	$	£	€	RMB	DESCRIPTION
LED781M	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	LED with Intergrated Photodiode, 780 nm, 6.0 mW, TO-18

λ = 780 nm, P = 18.0 mW LED

- Epoxy Lens, 20° Viewing Full Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	770 nm	780 nm	790 nm
Optical Power @ 20 mA, CW	13 mW	18 mW	–
Spectral Half Width	–	30 nm	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	500 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.75 V	1.95 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	80/80 ns	–

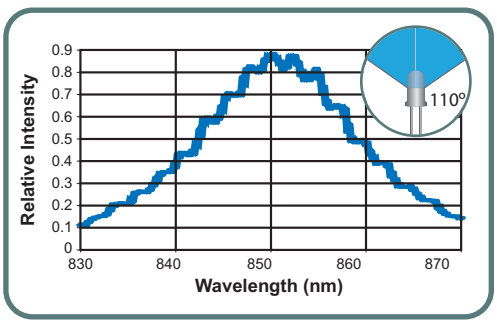


ITEM#	$	£	€	RMB	DESCRIPTION
LED780E	$ 16.25	£ 11.30	€ 14,50	¥ 137.30	Epoxy Lens LED, 780 nm, 18.0 mW, T-1 3/4 (Qty. 5)

λ = 850 nm, P = 8.0 mW LED

- LED with Glass Window
- TO-18 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	835 nm	850 nm	865 nm
Optical Power @ 20 mA, CW	5.0 mW	8.0 mW	–
Spectral Half Width	–	40 nm	–
Viewing Full Angle	–	110°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.55 V	1.7 V
Operating Temperature	-30 °C	–	90 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	30/25 ns	–

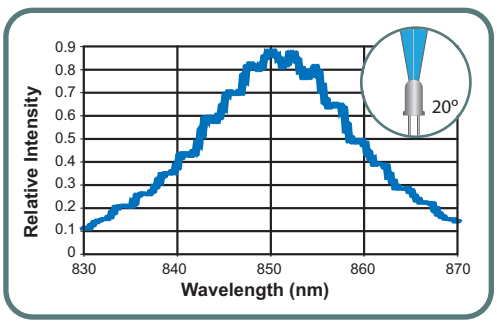


ITEM#	$	£	€	RMB	DESCRIPTION
LED851W	$ 3.80	£ 2.65	€ 3,40	¥ 32.10	LED with Glass Window, 850 nm, 8.0 mW, TO-18

λ = 850 nm, P = 18.0 mW LED

- Glass Lens, 20° Viewing Full Angle
- TO-18 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	835 nm	850 nm	865 nm
Optical Power @ 20 mA, CW	11 mW	18 mW	–
Spectral Half Width	–	40 nm	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.55 V	1.7 V
Operating Temperature	-30 °C	–	90 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	30/25 ns	–



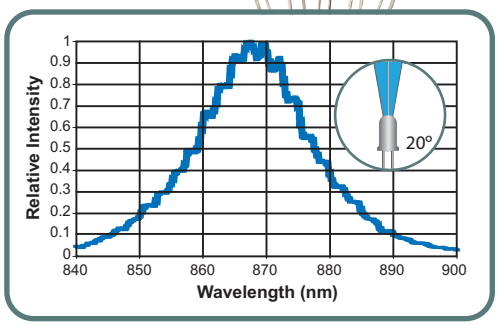
ITEM#	$	£	€	RMB	DESCRIPTION
LED851L	$ 3.75	£ 2.60	€ 3,40	¥ 31.70	LED with Glass Lens, 850 nm, 18.0 mW, TO-18

λ = 870 nm, P = 22.0 mW LED

- Epoxy Lens, 20° Viewing Full Angle
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	–	870 nm	–
Optical Power @ 20 mA, CW	18 mW	22 mW	–
Spectral Half Width	–	40 nm	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.55 V	1.7 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	15/10 ns	–



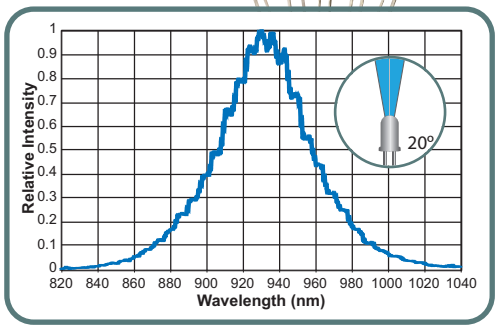
ITEM#	$	£	€	RMB	DESCRIPTION
LED870E	$ 16.25	£ 11.30	€ 14,50	¥ 137.30	LED with Epoxy Lens, 870 nm, 22.0 mW, T-1 3/4 (Qty. 5)

λ = 940 nm, P = 18.0 mW LED

- Epoxy Lens, 20° Full Viewing
- T-1 3/4 Package

Sold in Packages of 5

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	–	940 nm	–
Optical Power @ 20 mA, CW	14 mW	18 mW	–
Spectral Half Width	–	50 nm	–
Viewing Full Angle	–	20°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.3 V	1.45 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	1/0.5 ns	–



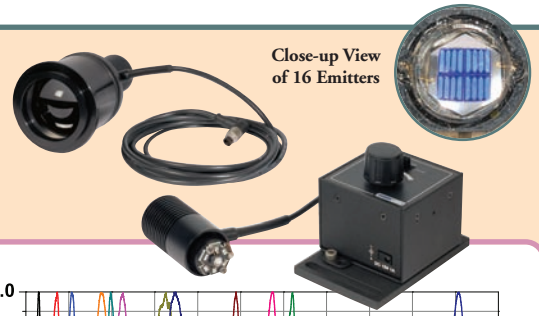
ITEM#	$	£	€	RMB	DESCRIPTION
LED940E	$ 11.25	£ 7.80	€ 10,00	¥ 95.00	LED with Epoxy Lens, 940 nm, 18.0 mW, T-1 3/4 (Qty. 5)

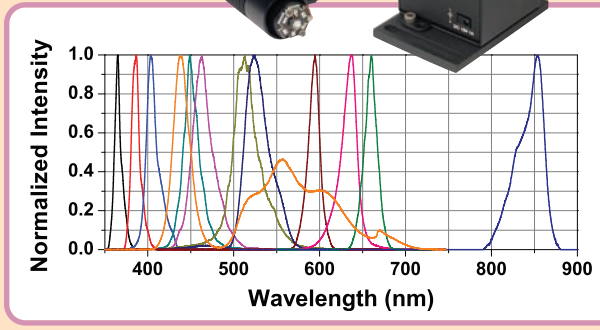
Mounted LED Sources

12 Output Wavelengths

- 365 nm, 350 mW
- 385 nm, 450 mW
- 405 nm, 670 mW
- 455 nm, 730 mW
- 470 nm, 625 mW
- 505 nm, 420 mW
- 530 nm, 275 mW
- 590 nm, 34 mW
- 633 nm, 500 mW
- 660 nm, 850 mW
- 850 nm, 400 mW
- White, 500 mW

Selection Starts on Page 1092

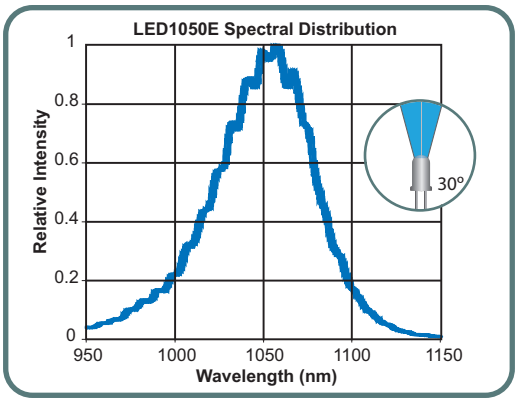




λ = 1050 nm, P = 2.5 mW LED

- Epoxy Lens, 30° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	1000 nm	1050 nm	1100 nm
Optical Power @ 20 mA, CW	1.0 mW	2.5 mW	–
Spectral Half Width	–	55 nm	–
Viewing Full Angle	–	30°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	500 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.25 V	1.55 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	10 ns	–

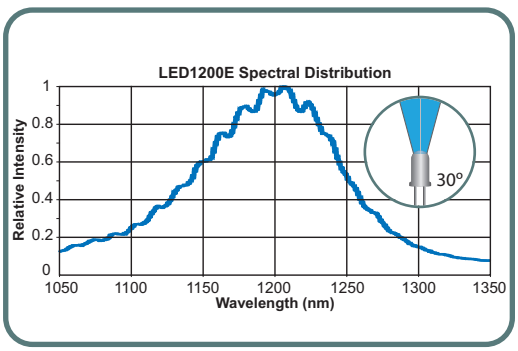


ITEM#	$	£	€	RMB	DESCRIPTION
LED1050E	$ 14.25	£ 9.90	€ 12,70	¥ 120.40	LED with Epoxy Lens, 1050 nm, 2.5 mW, T-1 3/4

λ = 1200 nm, P = 2.5 mW LED

- Epoxy Lens, 30° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	1150 nm	1200 nm	1250 nm
Optical Power @ 20 mA, CW	–	2.5 mW	–
Spectral Half Width	–	100 nm	–
Viewing Full Angle	–	30°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.2 V	1.5 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	10 ns	–

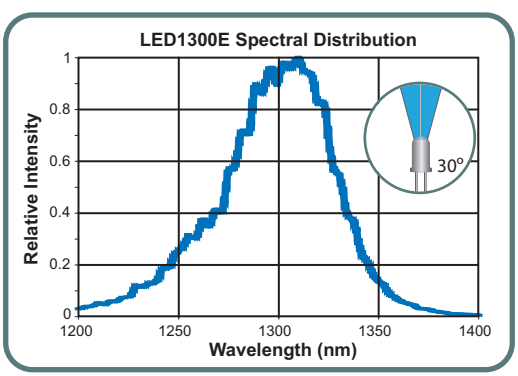


ITEM#	$	£	€	RMB	DESCRIPTION
LED1200E	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	LED with Epoxy Lens, 1200 nm, 2.5 mW, T-1 3/4

λ = 1300 nm, P = 2.0 mW LED

- Epoxy Lens, 30° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	1250 nm	1300 nm	1350 nm
Optical Power @ 20 mA, CW	–	2.0 mW	–
Spectral Half Width	–	100 nm	–
Viewing Full Angle	–	30°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.2 V	1.5 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	10 ns	–

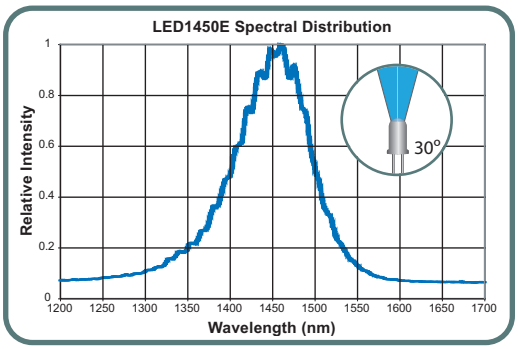


ITEM#	$	£	€	RMB	DESCRIPTION
LED1300E	$ 16.25	£ 11.30	€ 14,50	¥ 137.30	LED with Epoxy Lens, 1300 nm, 2.0 mW, T-1 3/4

λ = 1450 nm, P = 2.0 mW LED

- Epoxy Lens, 30° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	1400 nm	1450 nm	1500 nm
Optical Power @ 20 mA, CW	–	2.0 mW	–
Spectral Half Width	–	100 nm	–
Viewing Full Angle	–	30°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.2 V	1.5 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	10/10 ns	–

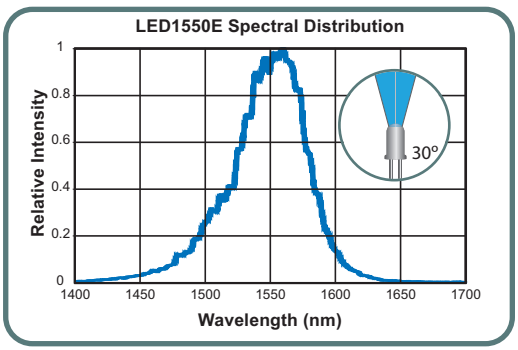


ITEM#	$	£	€	RMB	DESCRIPTION
LED1450E	$ 16.85	£ 11.70	€ 15,00	¥ 142.30	LED with Epoxy Lens, 1450 nm, 2.0 mW, T-1 3/4

λ = 1550 nm, P = 2.0 mW LED

- Epoxy Lens, 30° Viewing Full Angle
- T-1 3/4 Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	1500 nm	1550 nm	1600 nm
Optical Power @ 20 mA, CW	–	2.0 mW	–
Spectral Half Width	–	100 nm	–
Viewing Full Angle	–	30°	–
Forward Current	–	–	100 mA
Pulsed Forward Current	–	–	1000 mA
Reverse Voltage	–	–	5.0 V
Forward Voltage @ 20 mA	–	1.2 V	1.5 V
Operating Temperature	-30 °C	–	85 °C
Storage Temperature	-30 °C	–	100 °C
Rise/Fall Time	–	10/10 ns	–



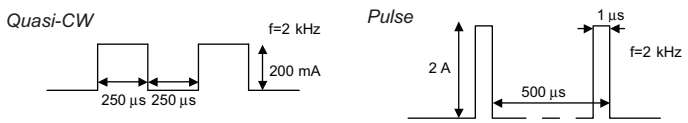
ITEM#	$	£	€	RMB	DESCRIPTION
LED1550E	$ 15.25	£ 10.55	€ 13,60	¥ 128.80	LED with Epoxy Lens, 1550 nm, 2.0 mW, T-1 3/4

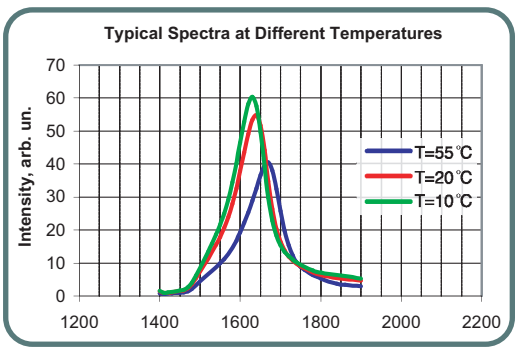
λ = 1650 nm, P = 0.9 mW LED

- LED with Parabolic Reflector
- TO-18R Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	1600 nm	1650 nm	1690 nm
Optical Power, (0.2 A Pulse)	0.7 mW	0.9 mW	1.1 mW
Optical Power (2A Pulse)	15 mW	20 mW	25 mW
Spectral Half Width	100 nm	150 nm	200 nm
Switching Time	10 ns	30 ns	50 ns

Recommended Regimes of Operation



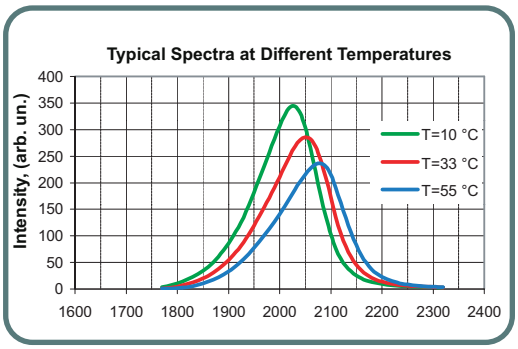


ITEM#	$	£	€	RMB	DESCRIPTION
LED1650P	$ 102.00	£ 70.80	€ 90,60	¥ 861.30	LED with Parabolic Reflector, 1650 nm, 0.9 mW, TO-18R

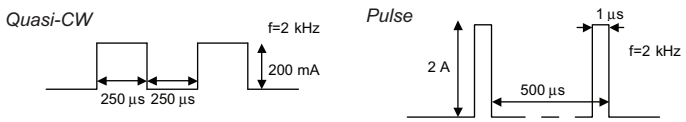
λ = 2050 nm, P = 1.1 mW LED

- LED with Parabolic Reflector
- TO-18R Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	2000 nm	2050 nm	2090 nm
Optical Power, (0.2 A Pulse)	0.9 mW	1.1 mW	1.3 mW
Optical Power (2A Pulse)	25 mW	28 mW	30 mW
Spectral Half Width	150 nm	200 nm	250 nm
Switching Time	10 ns	30 ns	50 ns



Recommended Regimes of Operation

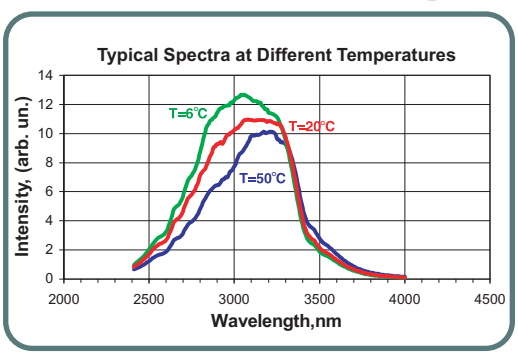


ITEM#	$	£	€	RMB	DESCRIPTION
LED2050P	$ 108.00	£ 74.90	€ 95,90	¥ 912.00	LED with Parabolic Reflector, 2050 nm, 1.1 mW, TO-18R

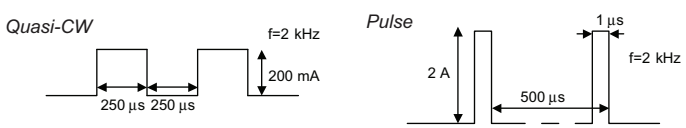
λ = 3100 nm, P = 14.0 µW LED

- LED with Parabolic Reflector
- TO-18R Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	3000 nm	3100 nm	3200 nm
Optical Power, (0.2 A Pulse)	12 µW	14 µW	16 µW
Optical Power (2A Pulse)	180 µW	200 µW	220 µW
Spectral Half Width	600 nm	700 nm	800 nm
Switching Time	10 ns	30 ns	50 ns



Recommended Regimes of Operation

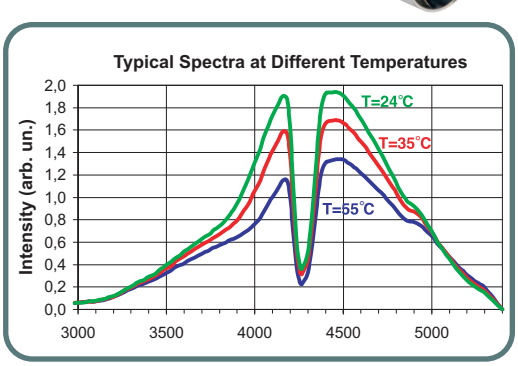


ITEM#	$	£	€	RMB	DESCRIPTION
LED3100P	$ 143.00	£ 99.20	€ 127,00	¥ 1,207.50	LED with Parabolic Reflector, 3100 nm, 14 µW, TO-18R

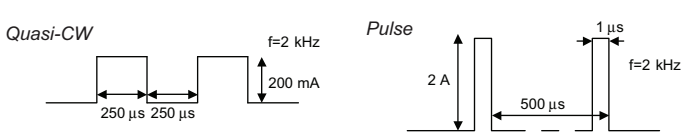
λ = 4500 nm, P = 6.0 µW LED

- LED with Parabolic Reflector
- TO-18R Package

CHARACTERISTIC (T_a = 25 °C)	MIN	TYP.	MAX
Peak Wavelength	4400 nm	4500 nm	4600 nm
Optical Power, (0.2 A Pulse)	4.0 µW	6.0 µW	8.0 µW
Optical Power (2A Pulse)	100 µW	120 µW	140 µW
Spectral Half Width	1000 nm	1100 nm	1200 nm
Switching Time	10 ns	30 ns	50 ns



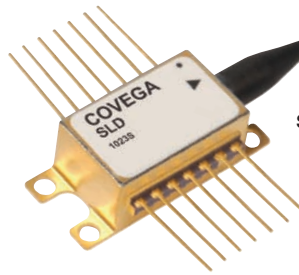
Recommended Regimes of Operation



ITEM#	$	£	€	RMB	DESCRIPTION
LED4600P	$ 182.00	£ 126.20	€ 161,60	¥ 1,536.90	LED with Parabolic Reflector, 4500 nm, 6.0 µW, TO-18R

1280 nm Superluminescent Diodes

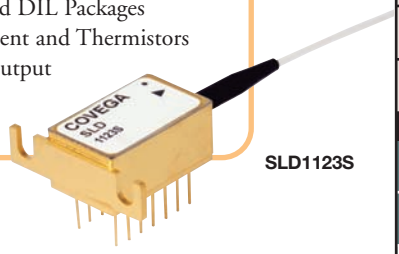
NEW products



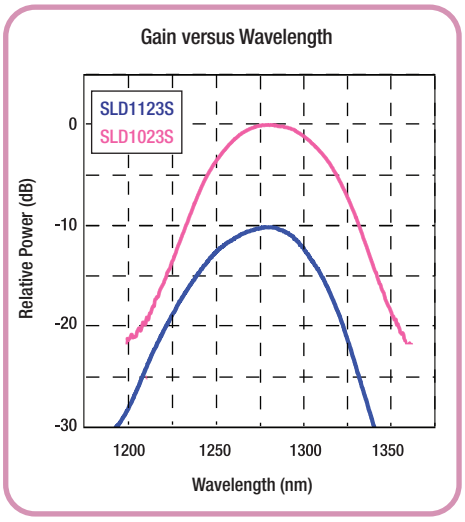
SLD1023S

Features

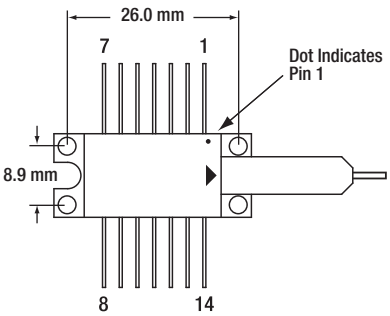
- Standard Butterfly and DIL Packages
- Integrated TEC Element and Thermistors
- SM Fiber-Coupled Output
- FC/APC Connector



SLD1123S



Superluminescent Diodes (SLDs) in butterfly packages are excellent high-power broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). The SLDs offered here are Indium Phosphide (InP) devices manufactured by Covega, Thorlabs' Quantum Electronics Division. Each device has an integrated thermoelectric cooler (TEC) and thermistor to ensure output stability. The output is coupled into an SM fiber terminated with an FC/APC connector.



Pin Description

1	+TEC	14	-TEC
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	Dev Cathode
5	Thermistor	10	Dev Anode
6	NC	9	NC
7	NC	8	NC

Optical Power Meters

- Large Selection of Sensors and Meters
- Interchangeable Sensors with NIST-Traceable Calibration Data
- Sensors for Measurements from 100 pW to 250 W, 190 nm to 25 µm

See Pages 1265-1284

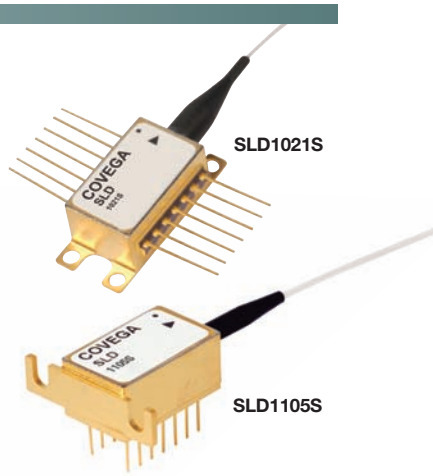
Optical-Electrical Characteristics

ITEM#		SLD1123S			SLD1023S		
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Min**	**Typical**	**Max**
Center Wavelength	λ	1260 nm	1280 nm	1300 nm	1270 nm	1280 nm	1290 nm
ASE Power		1 mW	1.5 mW	–	10 mW	15 mW	–
Optical Bandwidth	BW	75 nm	95 nm	–	40 nm	45 nm	–
RMS Gain Ripple	ΔG	–	–	0.25 dB	–	–	0.35 dB
Operating Current	I_{OP}	–	500 mA	600 mA	–	600 mA	800 mA
Forward Voltage	V_F	–	1.6 V	2.0 V	–	1.4 V	2.0 V

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1123S	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	1 mW, 75 nm Bandwidth SLD, CWL: 1280 nm, DIL Pkg, SM Fiber, FC/APC
SLD1023S	$ 2,150.50	£ 1,491.00	€ 1.909,00	¥ 18,159.00	10 mW, 45 nm Bandwidth SLD, CWL: 1280 nm, Butterfly Pkg, SM Fiber, FC/APC

1310 nm Superluminescent Diodes

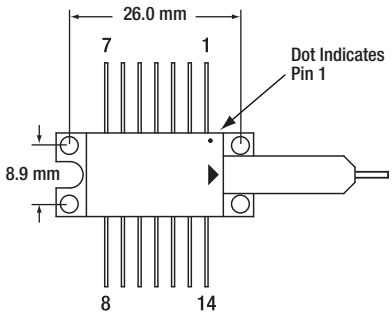
Superluminescent Diodes (SLDs) in butterfly packages are excellent high-power, broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). The SLDs offered here are Indium Phosphide (InP) devices manufactured by Covega, Thorlabs' Quantum Electronics Division. Each device has an integrated thermoelectric cooler (TEC) and thermistor to ensure output stability. The output is coupled into an SM or PM fiber terminated with an FC/APC connector. Our SLDs are available in standard or premium versions. The premium SLDs, denoted with the suffix XL, are hand picked to provide higher bandwidth and power.



NEW products

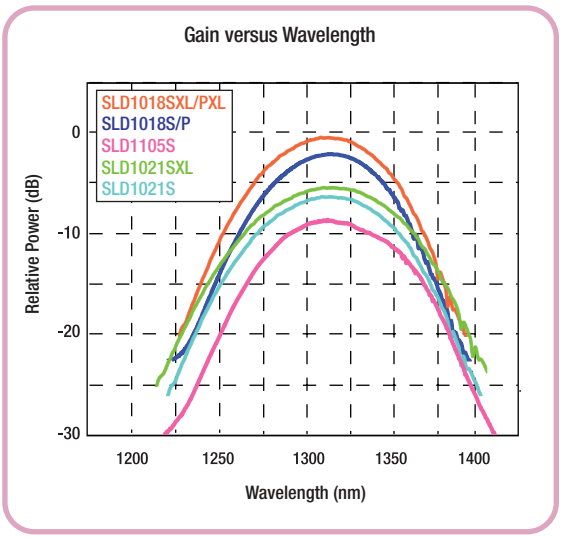
Features

- Standard Butterfly and DIL Packages
- Integrated TEC Element and Thermistor
- SM or PM Fiber Coupled Output
- FC/APC Connector



Pin Description

1	+TEC	14	-TEC
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	Dev Cathode
5	Thermistor	10	Dev Anode
6	NC	9	NC
7	NC	8	NC



Wide Bandwidth

ITEM#		SLD1021SXL			SLD1021S			SLD1105S		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1290 nm	1310 nm	1330 nm	1290 nm	–	1330 nm	1290 nm	1310 nm	1330 nm
ASE Power		13.0 mW	–	–	10 mW	12.5 mW	–	5 mW	7 mW	–
Optical Bandwidth	BW	85 nm	–	–	80 nm	85 nm	–	60 nm	65 nm	–
RMS Gain Ripple	ΔG	–	0.1 dB	0.35 dB	–	0.1 dB	0.35 dB	–	–	0.25 dB
Operating Current	I_{OP}	–	700 mA	900 mA	–	700 mA	900 mA	–	500 mA	650 mA
Forward Voltage	V_F	–	1.55 V	1.8 V	–	1.55 V	1.8 V	–	1.3 V	2.0 V

High Power

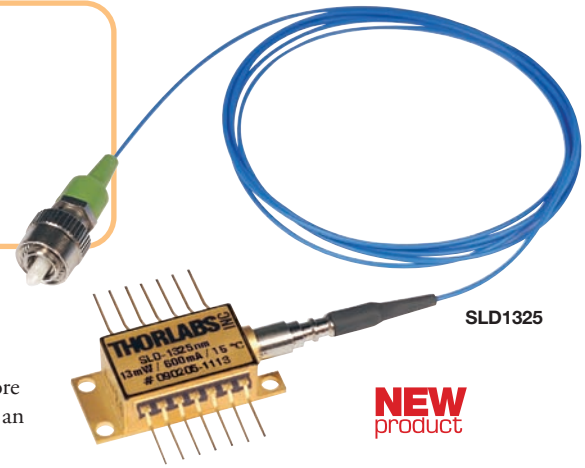
ITEM#		SLD1018SXL/SLD1018PXL			SLD1018S/SLD1018P		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1290 nm	1310 nm	1330 nm	1290 nm	1310 nm	1330 nm
ASE Power		30 mW	–	–	22 mW	30 mW	–
Optical Bandwidth	BW	45 nm	–	–	40 nm	45 nm	–
RMS Gain Ripple	ΔG	–	0.1 dB	0.35 dB	–	0.1 dB	0.35 dB
Operating Current	I_{OP}	–	600 mA	800 mA	–	600 mA	800 mA
Forward Voltage	V_F	–	1.5 V	1.8 V	–	1.5 V	1.8 V

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1105S	$ 1,450.00	£ 1,005.00	€ 1.287,50	¥ 12,244.00	Wide-Bandwidth 5 mW SLD, CWL: 1310 nm, DIL Pkg, SM Fiber, FC/APC
SLD1021S	$ 1,850.00	£ 1,282.50	€ 1.642,50	¥ 15,622.00	Wide-Bandwidth 10 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1018S	$ 2,150.00	£ 1,490.50	€ 1.909,00	¥ 18,155.00	High-Power 22 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1018P	$ 2,300.00	£ 1,594.50	€ 2.042,00	¥ 19,422.00	High-Power 22 mW SLD, CWL: 1310 nm, Butterfly Pkg, PM Fiber, FC/APC
SLD1018SXL	$ 4,300.00	£ 2,981.00	€ 3.817,50	¥ 36,310.00	High-Power 30 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1018PXL	$ 4,600.00	£ 3,189.00	€ 4.084,00	¥ 38,843.00	High-Power 30 mW SLD, CWL: 1310 nm, Butterfly Pkg, PM Fiber, FC/APC
SLD1021SXL	$ 3,700.00	£ 2,565.00	€ 3.285,00	¥ 31,243.00	High-Power 30 mW SLD, CWL: 1310 nm, Butterfly Pkg, PM Fiber, FC/APC

Superluminescent Diode Light Source for OCT Systems

Features

- Integrated Optical Isolator
- Thermistor for Enhanced Output Stability
- FC/APC-Terminated Fiber Pigtail Minimizes Optical Feedback
- Integrated TEC and Thermistor for Temperature Control
- Hermetically Sealed 14-Pin Butterfly Package



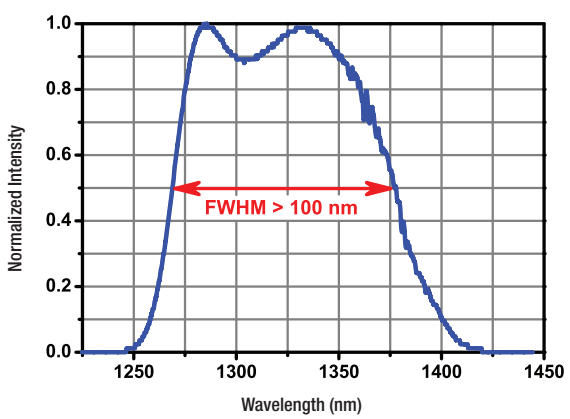
NEW product

The SLD1325 is a high-power, broadband 1325 nm Super Luminescent Diode (SLD). It is hermetically sealed in a 14-pin butterfly package and includes a built-in thermoelectric cooler and thermistor for temperature control. Each device goes through burn-in screening, mechanical robustness testing, and characterization testing before being packaged. The output is coupled into an SM fiber terminated with an FC/APC connector.

Superluminescent Diodes (SLDs) in butterfly packages are excellent high-power broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs).

Each SLD is shipped with its own characterization sheet.

Typical Emission Spectra of an SLD1325



PARAMETERS	
Central Wavelength	1325 nm
Bandwidth (FWHM)	>100 nm
Fiber-Coupled Power	>10 mW
Maximum SLD Injection Current	780 mA
Maximum Voltage	4 V
Operating Temperature Range	0 - 40 °C
Isolation of Integrated Isolator	>30 dB
Fiber Pigtail	SMF-28e
Fiber Length	~1 m
Fiber Connector	FC/APC
Return Loss of FC/APC Connector	>50 dB
Thermoelectric Cooler Current (Max)	4 A
Thermoelectric Cooler Voltage (Max)	4 V
Thermistor Resistance*	10 kΩ

*Steinhart - Hart Coefficients: C_1 = 1.1291, C_2 = 2.3413, and C_3 = 0.8767

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1325	$ 3,200.00	£ 2,218.50	€ 2.841,00	¥ 27,021.00	FC/APC Pigtailed SLD, 1325 nm, >10 mW, >100 nm FWHM

Butterfly Laser Diode Mount

Features

- Laser Diode Mount for 14-Pin Butterfly Package
- Laser-Enabled LED Indicator
- User-Defined Pin Out Configuration

Laser Diode and Temperature Controllers - ITC4000 Series

Features

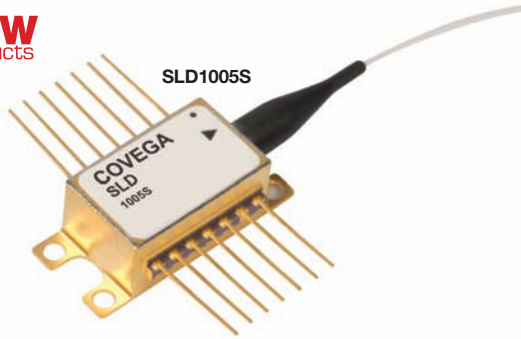
- 3 Models Provide Laser Currents of ±1 A, ±5 A, and, ±20 A @ 10 V
- TEC Power Outputs: >225 W and >180 W
- Constant Current (CC) and Constant Power (CP) Control Modes
- Supports Thermistor, RTD, and IC Temperature Sensors

See Pages 1175-1230 for More Information

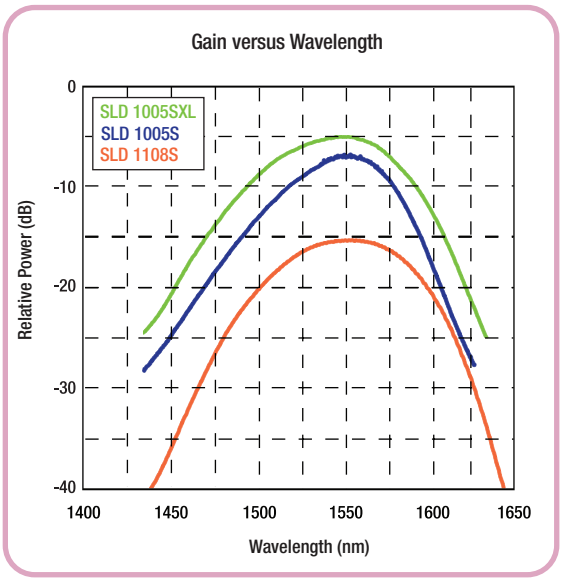
1550 nm Superluminescent Diodes

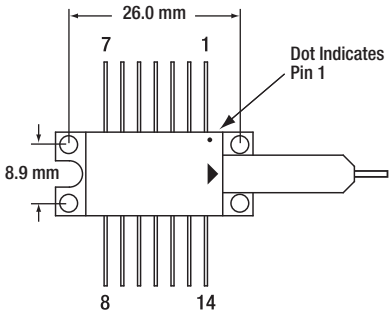
NEW products

Superluminescent Diodes (SLDs) in butterfly packages are excellent high-power, broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). The SLDs offered here are Indium Phosphide (InP) devices manufactured by Covega, Thorlabs' Quantum Electronics Division. Each device has an integrated thermoelectric cooler (TEC) and thermistor to ensure output stability. The output is coupled into an SM fiber with an FC/APC connector. Our SLDs are available in standard or premium versions. The premium SLDs, denoted with the suffix XL, are hand picked to provide higher bandwidth and power.



Typical Power vs. Current, Voltage vs. Current, and Emission Intensity (AU) vs. Wavelength plots for each Superluminescent Diode model are available on our website: www.thorlabs.com.



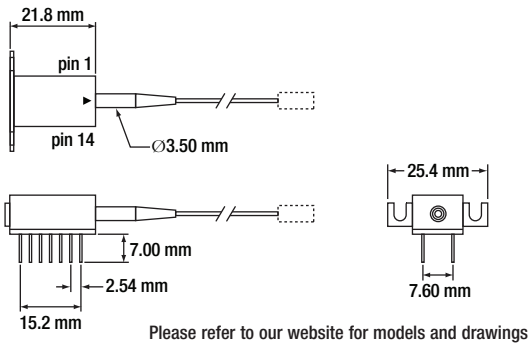


Pin Description

1	+TEC	14	-TEC
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	Dev Cathode
5	Thermistor	10	Dev Anode
6	NC	9	NC
7	NC	8	NC

Features

- Standard Butterfly Package
- Integrated TEC Element and Thermistor
- SM Fiber Coupled Output
- FC/APC Connector



Please refer to our website for models and drawings

Mechanical Drawings Available on the WEB

Pin Description

1	+TEC	14	-TEC
2	NC	13	Case Ground
3	NC	12	Thermistor
4	NC	11	Thermistor
5	SLED	10	NC
6	NC	9	SLED Cathode
7	PD Cathode	8	PD Anode

Optical-Electrical Characteristics

ITEM#		SLD1005SXL			SLD1005S			SLD1108S		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1535 nm	1550 nm	1565 nm	1530 nm	1550 nm	1570 nm	1530 nm	1550 nm	1570 nm
ASE Power		22 mW	–	–	20 mW	22 mW	–	2 mW	2.5 mW	–
Optical Bandwidth	BW	55 nm	–	–	45 nm	50 nm	–	85 nm	90 nm	–
RMS Gain Ripple	ΔG	–	0.2 dB	0.35 dB	–	0.2 dB	0.35 dB	–	–	0.25 dB
Operating Current	I_{OP}	–	600 mA	800 mA	–	600 mA	800 mA	–	450 mA	550 mA
Forward Voltage	V_F	–	1.4V	1.6 V	–	1.4 V	1.6 V	–	1.6 V	2.0 V

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1108S	$ 1,450.00	£ 1,005.00	€ 1.287,50	¥ 12,244.00	2 mW SLD, CWL: 1550 nm, DIL Pkg, SM Fiber, FC/APC
SLD1005S	$ 1,677.50	£ 1,163.00	€ 1.489,50	¥ 14,165.00	20 mW SLD, CWL: 1550 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1005SXL	$ 3,355.00	£ 2,326.00	€ 2.978,50	¥ 28,330.00	22 mW SLD, CWL: 1550 nm, Butterfly Pkg, SM Fiber, FC/APC

C and L Band High-Power White Light Source

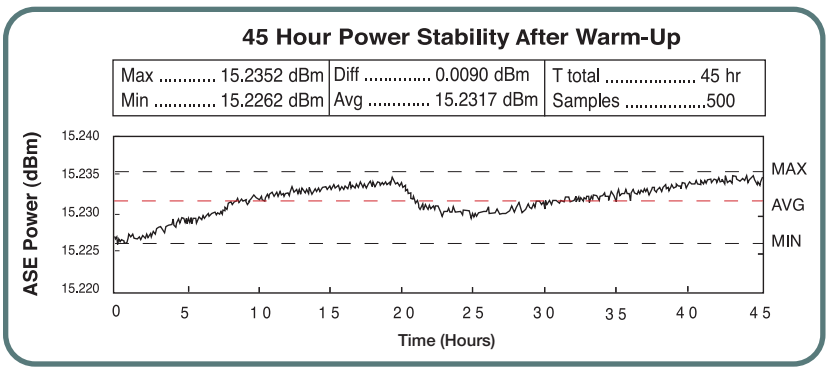
Features

- Additional L Band Power
- High-Power (30 mW)
- Standard SMF-28e Output Fiber

ASE730

The ASE730 White Light Test Source delivers more than 15 dBm of output power across the C and L Band wavelengths (1530 to 1625 nm). This ASE source satisfies the demand for higher power, longer wavelength test equipment in the L Band market, while also supporting existing C-Band test instrumentation. The ASE730 is the lowest noise, high-power C- and L-Band test source available today. (See Figure A for test results)

The ASE730 test source is designed to perform well beyond the industry standard. Key features of all of our ASE modules include low intensity noise, broadband output, and exceptional wavelength stability (see Figure B). This ASE source takes advantage of Erbium-doped fluoride fiber, pumped with a single 1480 nm laser diode, to produce 30 mW (15 dBm) of broadband white light. This rare-earth fiber design allows for a higher degree of power and wavelength stability than conventional silica fibers with multiple pumping lasers. The output fiber is a standard SMF-28 silica fiber.



1530 nm to 1565 nm
C&L
BAND
1565 nm to 1625 nm

Figure A - The wavelength stability of the ASE730 is shown above.
Trace C is the difference between two scans (traces A and B) taken 15 minutes apart.

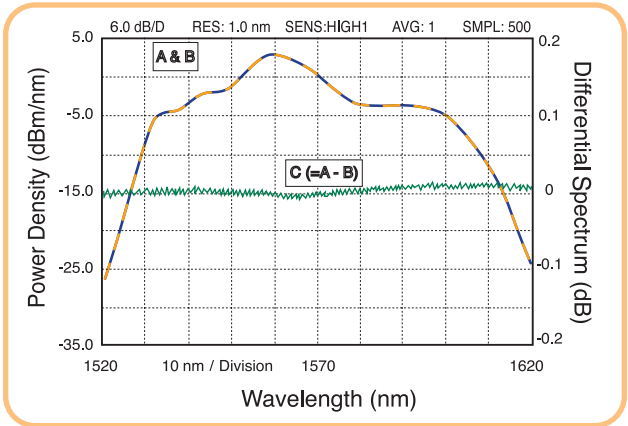


Figure B - The ASE730 offers low noise, broadband output, and exceptional stability as illustrated. Our optical power stability specification of ±0.005 dB (maximum) offers an exceptional broadband test instrument and is touted as the best in the industry.

Specifications

- **Total Output Power:** >15 dBm (30 mW)
- **Spectral Power Density (Typical):**
  > -18 dBm/nm at 1530 nm,
  > -11 dBm/nm for 1540 - 1600 nm,
  > -18 dBm/nm at 1610 nm
- **Output Power Stability:** ±0.001 dB
  (15 min After 1 hr Warmup), ±0.005 dB (Max)
- **Wavelength Range:** 1530 - 1625 nm
- **Output Connector:** FC/PC
- **Output Fiber:** SMF-28e
- **Size:** 88 mm x 230 mm x 352 mm
  19" Rack-Mount Compatible
- **Operation Temperature:** 0 to 40 °C
- **Storage Temperature:** -10 to 45 °C
- **Warranty:** 2 years

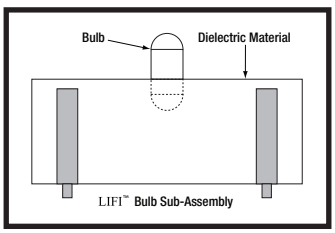
ITEM#	$	£	€	RMB	DESCRIPTION
ASE730	$ 11,340.00	£ 7,862.00	€ 10.068,00	¥ 95,756.00	30 mW, 1530 - 1625 nm ASE Test Source

High-Power Solid State Light Sources

Thorlabs' High-Power Light Sources are solid-state plasma light sources (LIFI®) that combine the best features of solid-state electronics and full spectrum plasma emitters. The HPLS series uses a dielectric resonant cavity to efficiently couple power from a solid-state power amplifier into a high-intensity discharge vessel unlike other electrodeless sources. The results are a long life (>10,000 hours*), high energy efficiency, and a complete color spectrum, making this source ideal for applications such as endoscopy, microscopy, and other medical lighting and inspection applications. This unit also offers many additional features including a USB 2.0 control interface and instantaneous intensity dimming.

HPLS-30-04

At the heart of LIFI® is the bulb sub-assembly where a sealed bulb is embedded in a dielectric material. This design is more reliable than conventional light sources that insert degradable electrodes into the bulb. The dielectric material serves two purposes: first as a waveguide for the RF energy transmitted by the RF Power Amplifier Circuit (PA) and second as an electric field concentrator that focuses energy in the bulb. The energy from the electric field rapidly heats the material in the bulb to a plasma state that emits light of high intensity and full spectrum.



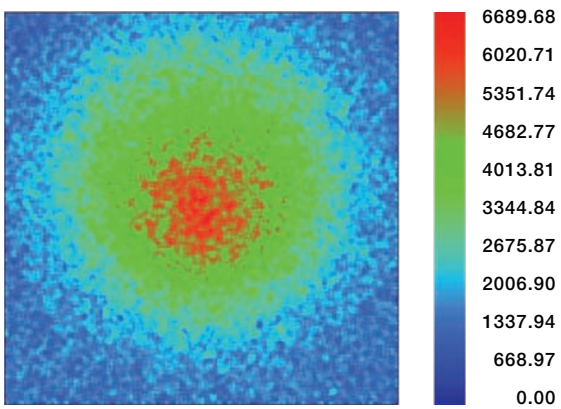
Features

- 350-700 nm Wavelength Range
- 10,000 hr Typical Lifetime*
- Ultra Low Flicker
- Dimming Control, 20-100 %

* Lumen maintenance typical operating condition is defined as mean time to 50% of original output.

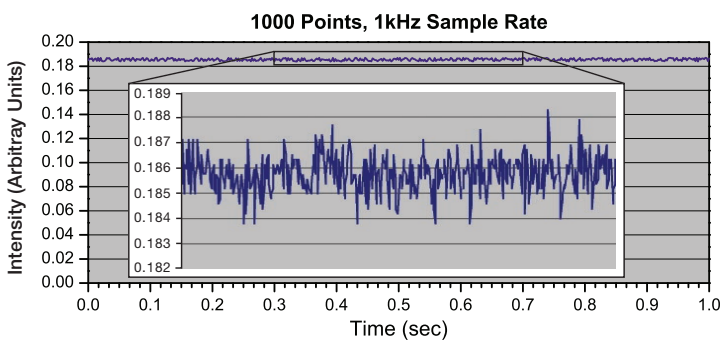
ITEM#	HPLS-30-02	HPLS-30-03	HPLS-30-04
Spectral Range	350 to 700 nm		
Color Rendering Index (CRI)	94		
Luminous Flux	2260 lm	1950 lm	2800 lm
Numerical Aperature (NA)	0.66	0.5	0.5
Rated Average Lifetime	10,000 Hours		
Dimming Range	20% to 100%		
Electrical			
AC Line Voltage	85 VAC to 264 VAC		
DC Input Voltage	28 VDC (Rated at 8.5 A)		
Nominal Power Use	230 W		

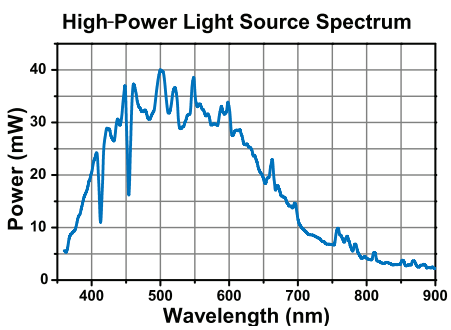
	Power Collected (Ø5 mm Aperture)		
Wavelength Range	HPLS-30-02	HPLS-30-03	HPLS-30-04
UV (200-400 nm)	1.0 W	0.9 W	1.3 W
VIS (400-750 nm)	8.2 W	7.1 W	10.2 W
NIR (750-1400 nm)	2.0 W	1.7 W	2.5 W
SWIR (1400-3000 nm)	0.5 W	0.4 W	0.6 W



Detector Image: Luminance in Position Space

Detector 6, NSCG Surface 1: Rect Near Field
Size: 5.000 W x 5.000 H mm, Pixels 181 W x 181 H, Total Hits = 289,841





ITEM#	$	£	€	RMB	DESCRIPTION
HPLS-30-02	$ 1,950.00	£ 1,352.00	€ 1.731,00	¥ 16,466.00	Light Source, Focused, NA 0.50, Lumens 2260, UV Screened Spectrum*
HPLS-30-03	$ 1,950.00	£ 1,352.00	€ 1.731,00	¥ 16,466.00	Light Source, Focused, NA 0.50, Lumens 1950
HPLS-30-04	$ 1,950.00	£ 1,352.00	€ 1.731,00	¥ 16,466.00	Light Source, Focused, NA 0.66, Lumens 2800

* UV screened at 315 - 400 nm

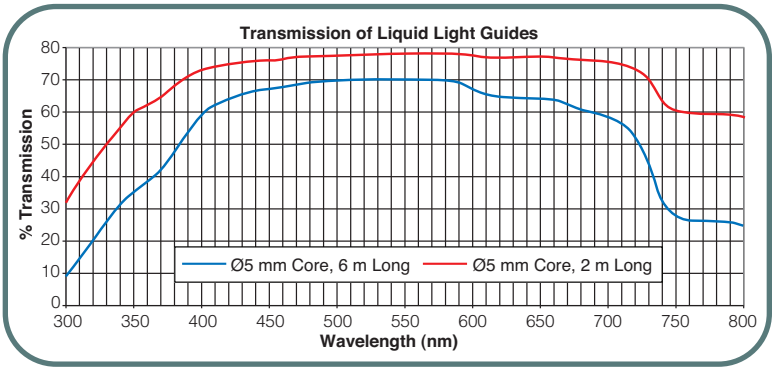
Liquid Light Guide

LLG0338-6

Features

- Excellent Transmission from 340 to 800 nm
- Outstanding White Light Illumination
- Suitable for Rugged Environments
- -5 to 35 °C Long-Term Temperature Range
- Custom Core Diameters and Lengths Available Upon Request

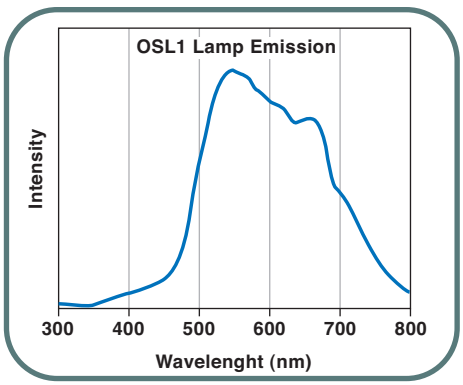
Thorlabs' Liquid Light Guides, which are available in 4', 6', and 8' lengths with either a Ø3 mm or Ø5 mm core, offer outstanding transmission from 340-800 nm for white light illumination applications. They provide superior transmission of UV radiation up to 5 W and excellent transmission from the UV to the near IR range. These light guides are recommended for use with the following light sources: tungsten halogen, xenon, metal halide. The long-term temperature range for the liquid light guides range from -5 to 35 °C.



ITEM#	$	£	€	RMB	DESCRIPTION
LLG0338-4	$ 215.00	£ 149.10	€ 190,90	¥ 1,815.50	Liquid Light Guide Ø3 mm Core, 4' (1.2 m) Length
LLG0338-6	$ 252.00	£ 174.70	€ 223,80	¥ 2,127.90	Liquid Light Guide Ø3 mm Core, 6' (1.8 m) Length
LLG0338-8	$ 297.00	£ 205.90	€ 263,70	¥ 2,507.90	Liquid Light Guide Ø3 mm Core, 8' (2.4 m)Length
LLG0538-4	$ 271.00	£ 187.90	€ 240,60	¥ 2,288.40	Liquid Light Guide Ø5 mm Core, 4' (1.2 m)Length
LLG0538-6	$ 338.00	£ 234.40	€ 300,10	¥ 2,854.10	Liquid Light Guide Ø5 mm Core, 6' (1.8 m) Length
LLG0538-8	$ 424.00	£ 294.00	€ 376,50	¥ 3,580.30	Liquid Light Guide Ø5 mm Core, 8' (2.4 m) Length

High-Intensity Fiber Light Source

OSL1
Includes 36" (91cm) Long Fiber Bundle with Ø1/4" Output Port

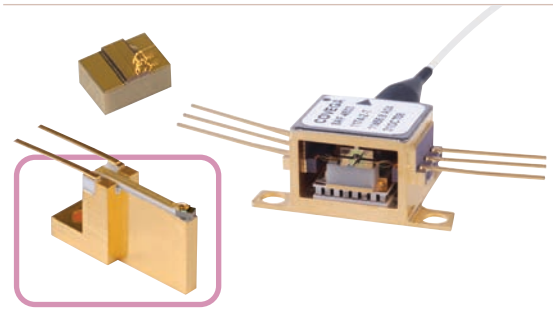


Our 150 W (3200 K Color Temp) Halogen OSL Light Source is designed to deliver strong, cool light for microscopy and lab applications. The rugged design with thermal switch and safety cutoff features a 150 W halogen lamp with a 1000:1 variable control and is shipped complete with a lamp, bulb, 36" (91 cm), Ø1/4" fiber bundle, and fiber adapter chuck. Versions offering either 110 V or 230 V (CE compliant) are available. To mount the fiber, we recommend using our AD12F mounting adapter, which allows easy integration of the fiber bundle into any of our SM1-compatible mounting hardware. In addition, Thorlabs also offers intense white light LED arrays, single emitter LEDs, collimated multi-emitter LEDs, and uncollimated multi-emitter LEDs (See Page 1110).

SPECIFICATIONS	
Input Voltage	110 - 120 VAC or 220 - VAC, 180 W Max
Light Output	40,000 Foot-Candles
Lamp Adjustment Range	1000:1 (0 to 100%)
Color Temperature	3200 K with Standard EKE Lamp at Max Intensity
Lamp Life	250 - 10,000 Hours
Operating Temperature	0 - 40 °C
Humidty Range	0 - 80% Non Condensing
Weight (Light Source (without Fiber Bundle)	7.5 lbs (3.4 kg)

ITEM#	$	£	€	RMB	DESCRIPTION
OSL1	$ 497.50	£ 344.90	€ 441,70	¥ 4,201.00	High-Intensity Fiber-Coupled Light Source, 110 - 120 VAC
OSL1-EC	$ 499.80	£ 346.50	€ 443,80	¥ 4,220.40	High-Intensity Fiber-Coupled Light Source, 220 - 240 VAC, CE Approved
OSL1B	$ 34.70	£ 24.10	€ 30,90	¥ 293.10	Replacement Bulb for High-Intensity Fiber Light Source

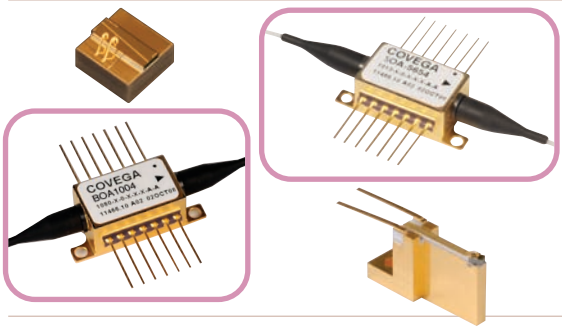
Covega Section Guide



Gain Chips

- ECL Tutorial
- Available on Heatsinks, Submounts, or Fiber Coupled
- Designs for 1150-1750 nm

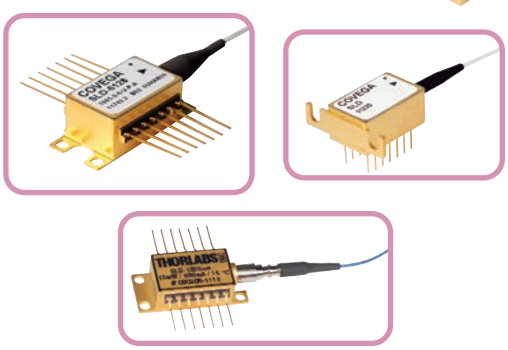
See Pages 1136-1146



Semiconductor Optical Amplifers

- SOA Tutorial
- Available on Heatsinks, Submounts, or Fiber Coupled
- Designs for 1150-1750 nm

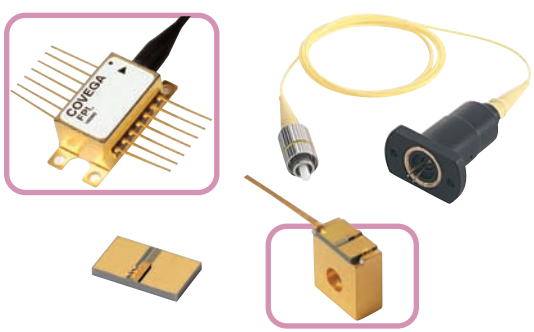
See Pages 1147-1155



Superluminescent Diodes

- High-Power, Wide-Bandwidth Devices
- Butterfly and DIL Packages
- Designs at 1280, 1310, 1325, and 1550 nm
- Supports OCT and Sensor Market

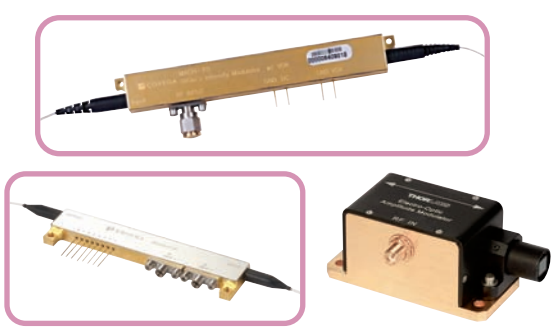
See Pages 1156-1160



Fabry-Perot Lasers

- High-Power Fiber-Coupled Devices
- Available on Heatsinks, Submounts, or Fiber Coupled
- Designs at 1310, 1550, 1625, and 1650 nm
- Broad Area Devices: 2W @ 1208 nm, 3W @ 1450 nm

See Pages 1161-1164



Optical Modulators

- High-Speed Intensity, Phase, and DQPSK Modulators
- High-Speed Analog Products
- 10, 20, and 40 GHz Designs
- Free-Space Amplitude and Phase Products

See Pages 1165-1173

The Thorlabs Family of Companies Welcomes Covega

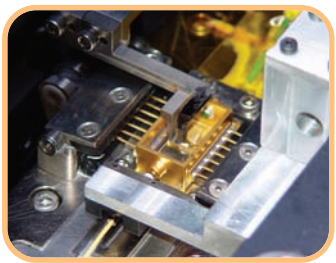
In March 2009, the Thorlabs family added to its growing portfolio of companies by acquiring Thorlabs Quantum Electronics, formerly Covega Corporation. Covega is well known as a world-class manufacturer of InP and LiNbO3 products. Their superior opto-electronic product technologies are supported by a manufacturing infrastructure capable of producing high-performance optical devices and modules that are designed to meet the needs of a diverse customer base. Their components are widely used by laboratory researchers, product developers, and OEM companies alike.

We are excited about the addition of Covega, Thorlabs Quantum Electronics into the Thorlabs family. Thorlabs Quantum Electronics complements and enhances the capabilities of the Thorlabs family as we continue to move toward more complete solutions for our customers. The products from Thorlabs Quantum Electronics enable and support vital technology areas that are important to Thorlabs, including superluminescent diodes, laser sources, optical modulators, tunable laser components, and active opto-electronic subsystems. With these technologies, Thorlabs continues its pursuit of the advanced imaging markets.

Expertise and Facilities

Thorlabs Quantum Electronics is a vertically integrated company with full in-house Indium Phosphide (InP) and Lithium Niobate (LiNbO3) capabilities and foundry services, which include device design and modeling, wafer growth and fabrication, and electro-optic device packaging. Members of Thorlabs Quantum Electronics' technology team are pioneers in high-power semiconductor lasers, optical amplifiers, and LiNbO3 modulators. The team's vast knowledge includes materials science, device design, wafer growth and fabrication, processing, advanced electro-optic device packaging, manufacturing, and system engineering. Thorlabs Quantum Electronics has a 40,000 square foot building in central Maryland, which includes 18,000 square feet of class 100 and 10,000 cleanroom facilities.

Thorlabs Quantum Electronics' InP products are designed for use in the 1150 – 1750 nm spectral range and are typically found in telecommunication, medical instrumentation, and sensor applications. The company's InP product families include SAF gain block, Semiconductor Optical Amplifiers (SOA), Booster Optical Amplifiers (BOA), Fabry-Perot Lasers, Broad-Area Lasers, and Superluminescent Diodes (SLD). The company uses their technological advantage of high-power InP active waveguide designs to build an array of products with superior performance by providing various combinations, including broad bandwidth, high power, and stable operation. In parallel, the company also takes full advantage of their Lithium Niobate technological advantage to offer a family of high performance, Telcordia-compliant, optical intensity and phase modulators with industry-leading long-term reliability. These modulators operate over a range of 10 Gb/s to 40 Gb/s and are sold to a variety of customers and industries.

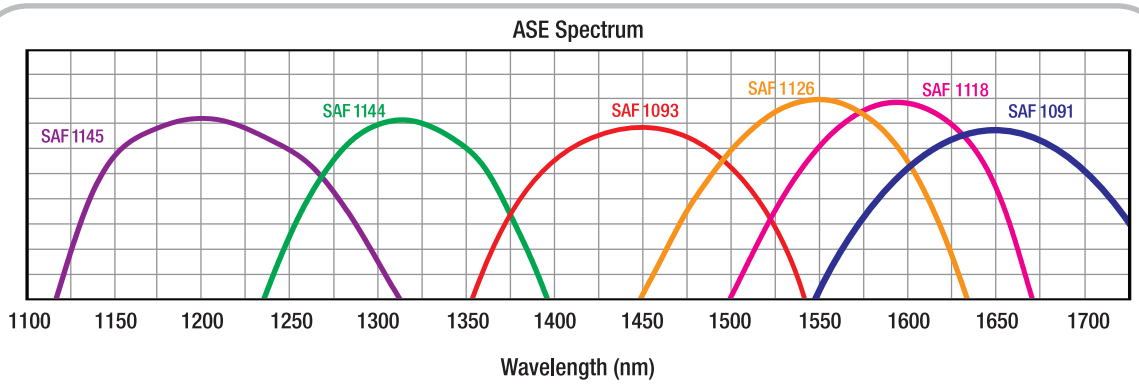


The devices are supplied in solutions ranging from packaged modules to chip-level subassemblies. These solutions are ideally suited for communication systems, instrumentation, photonics sensors, scientific applications, interferometric fiber optic gyroscopes, and other aerospace applications. Customers will benefit from the acquisition via Thorlabs' ability to develop more solutions from the ground up.

Gain Chips Selection Guide

Pages 1135-1146

Available Wavelengths



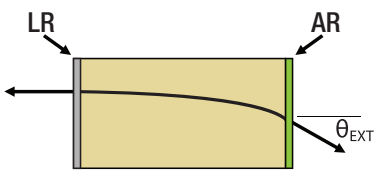
See Page 1142
See Page 1143
See Page 1144
See Page 1145
See Page 1145
See Page 1146

Custom Solutions Available

Contact Tech Support

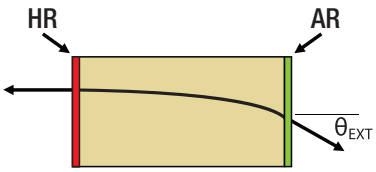
Device Configurations

SAF Facet Coatings
LR ~ 10% and AR < 0.01%



LR: Low Reflectance
AR: Antireflectance

SAF Facet Coatings
HR ~ 90% and AR < 0.01%



HR: High Reflectance
AR: Antireflectance

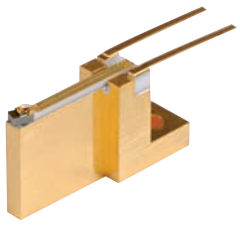
Package Options

SAF Gain Chip
on Submount

Available in 1220, 1320, 1450, 1550, 1590, and 1650 nm

- Eutectic Die Bonded
- Wire Bonded
- Burn-in
- 100% Tested
- Small Size

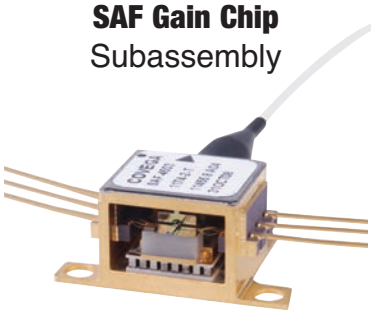
SAF Gain Chip
on Heatsink



Available in 1220, 1320, 1450, 1550, 1590, and 1650 nm

- Experimental Platform
- Access to
  - Gain Chip Facet
  - Device Leads
- Easy Installation

SAF Gain Chip
Subassembly

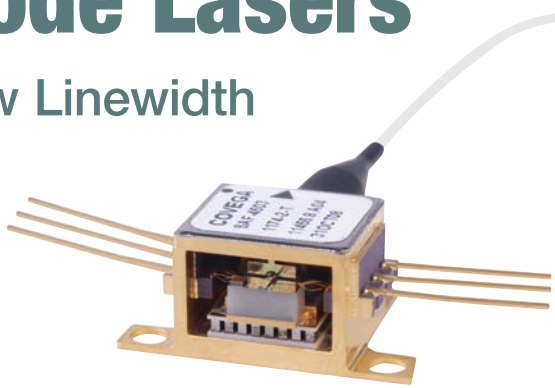


Available in 1320 and 1550 nm

- Housing and TEC Designed for Gain Chip
- Fiber-Coupled Output
- Isolator to Minimize Optical Feedback

External Cavity Diode Lasers

Tunable Wavelength and Narrow Linewidth



Two elements are required for a laser to operate: (1) an active gain medium that amplifies the optical signal and (2) a feedback mechanism to provide sustained laser

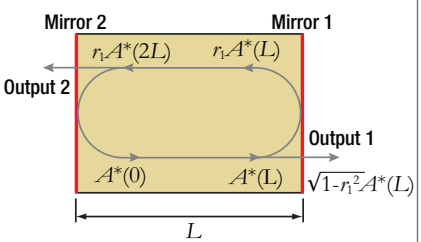


Figure 1: Fabry-Perot Laser Structure

oscillation. In a Fabry-Perot laser, two mirrors having a reflection coefficient r_1 and r_2 (power reflectance $R_1 = r_1^2$ and $R_2 = r_2^2$) provide feedback for the optical field, as shown in Figure 1. The round-trip gain for the optical field within a cavity of length L can be expressed as

$$\sqrt{G_{RT}} = r_1 r_2 e^{(g-\alpha_i)L} e^{-j\frac{2\pi n_{eff}}{\lambda}2L}$$

Equation 1: Round-trip gain for optical field

where g and α_i are the gain and internal loss coefficients, respectively, λ is the vacuum wavelength, n_{eff} is the effective refractive index, and L is the cavity length. Solving for unity results in the threshold amplitude and phase conditions:

$$g_{th} = \alpha_i + \frac{1}{2L}\ln\left(\frac{1}{R_1 R_2}\right) = \alpha_i + \alpha_m$$

Equation 2: The amplitude condition

$$\lambda_N = \frac{2n_{eff}L}{N}$$

Equation 3: The phase condition

where α_m is defined as the mirror loss and N is a running integer index representing the mode number.

In a semiconductor (diode) laser, the gain medium is excited by injecting a current into the junction region of a forward biased diode. The high concentration of electrons and holes in the engineered quantum-well junction of a semiconductor laser makes it possible to create the population inversion required for optical gain.

When the gain medium is a semiconductor material, a Fabry-Perot cavity can be created by the Fresnel optical reflections at the cleaved facets of the chip. The junction is effectively a waveguide that extends from one facet to the other. An uncoated "as-cleaved" facet perpendicular to the waveguide has a reflectivity of R~ 30%. However, the maximum output power of the device can be optimized by modifying the reflectance of the facets with optical coatings. Maximum power for a Fabry-Perot laser diode is typically achieved with a high-reflectivity (HR) coating on the back facet and a low-reflectivity (LR) coating on the front facet.

The emission spectrum of the Fabry-Perot laser diode device will be dependent on the injection current. When biased below threshold with $g > \alpha_i$ the emission spectrum consists of a broad series of peaks corresponding to the longitudinal modes of the Fabry-Perot cavity defined by the phase equation. Lasing does not occur until the injection current is increased to the point where $g = \alpha_i + \alpha_m$. The lasing wavelength is determined by the longitudinal mode that first achieves the threshold condition. The output spectrum does not always collapse into a single lasing wavelength but can consist of a narrow spectrum of longitudinal modes.

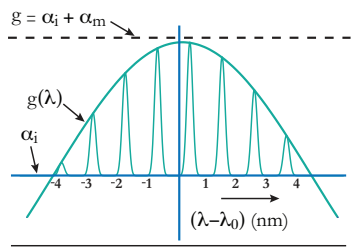


Figure 2: Gain Curve of a Fabry-Perot Laser

This is particularly true for InP-based

External Cavity Diode Lasers (Page 2 of 4)

Fabry-Perot lasers, which typically have an optical bandwidth of 5 to 10 nm. GaAs-based devices can operate in a single longitudinal mode, depending on wavelength and output power. They typically have an output bandwidth <2 nm.

A typical 850 nm laser diode with a length of 300 µm and a group index around 4 will have a longitudinal mode spacing of 0.3 nm, which is similar to a 1 mm long 1550 nm laser diode. Changing the length or refractive index of the cavity, for example by heating or cooling the laser diode, will shift the whole comb of modes and consequently the output wavelength.

Laser Linewidth

The linewidth of a semiconductor laser single longitudinal lasing mode (FWHM) is given by the modified Schawlow and Townes formula that incorporates the Henry linewidth enhancement factor α_H:[1]

$$\Delta\nu = \frac{h\nu\, v_g^2(\alpha_i + \alpha_m)\alpha_m n_{sp}}{8\pi P_{out}}\left(1+\alpha_H^2\right)$$

Equation 4: Schawlow-Townes-Henry Laser Linewidth

where $h\nu$ is the photon energy, v_g is the group velocity, n_{sp} is the population inversion factor, and P_{out} is the single-facet output power. This equation describes the spectral broadening of the laser linewidth due to phase and amplitude fluctuations caused by the unavoidable addition of spontaneous emission photons to the coherent lasing mode. These so-called quantum noise fluctuations define a lower limit on the laser linewidth, which may be masked by larger noise fluctuations caused by mechanical/acoustic vibration or thermal variation.

Extending the length of the cavity will decrease α_m (see Eq. 2), which reduces the linewidth. This can be understood by viewing the quantum noise-limited linewidth (see Eq. 4) as being proportional to the ratio of the number of spontaneous emission photons in the lasing mode compared to the total number of photons in the lasing mode. Increasing the cavity length both reduces the number of spontaneous emission photons (by decreasing the "cold-cavity" spectral width of each longitudinal mode) and increases the total number of photons in the cavity for a fixed output power. This is why the cavity length term appears twice in the Schallow-Townes equation.

A single-frequency distributed feedback (DFB) diode laser with a cavity of 0.3 mm will typically have an emission linewidth on the order of 1 to 10 MHz. Increasing the length of the cavity to 3 cm, for example, will narrow the emission linewidth by a factor of more than 100. It has been shown [2] that the linewidth of the emission from an extended cavity semiconductor lasers can be reduced to <1 kHz.

Single Wavelength Operation and Tuning

For many applications, it is desirable to have a single longitudinal mode (single frequency) laser, to be able to adjust the lasing wavelength, or both. To accomplish this, a wavelength-selective feedback element external to the semiconductor laser chip can be used to select the lasing wavelength. Proper operation of this external cavity laser (ECL) requires suppression of the intrinsic optical feedback from the semiconductor chip Fabry-Perot cavity so that it does not interfere with the external feedback. The gain chip's Fabry-Perot cavity effect can be reduced by applying an antireflection (AR) optical coating to one chip facet.

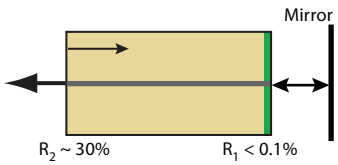


Figure 3: External Cavity Operation Based on a Gain Chip

At a minimum, the chip facet reflectance (R_1) should be 20 dB less than the external feedback (R_{ext}); that is, $R_1 < 10^{-2} \times R_{ext.}$ [3] Even with the AR coating, the residual reflection from the AR-coated FP gain chip facet often limits the stability, output power, and spectral quality of the ECL, especially if the laser is tunable. To further reduce the reflection at the chip facet, the combination of an angled waveguide and an AR coating can be used to effectively remove most of the feedback from the internal chip Fabry-Perot cavity.[4] This single-angled-facet (SAF) gain chip provides a superior structure for ECLs, in particular broadband tunable ECLs.

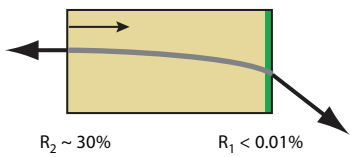


Figure 4: Single-Angled-Facet Gain Chip

External Cavity Laser Design

There are numerous approaches for implementing an external cavity semiconductor laser.[3] The first consideration for most approaches is the choice of a wavelength selective feedback

External Cavity Diode Lasers (Page 3 of 4)

element. One of the most common feedback elements is a diffraction grating, which can be used as the feedback element in both single-frequency and broadly tunable external cavity lasers.

When the collimated output of the gain chip is incident on a diffraction grating at angle θ with respect to the grating surface normal and perpendicular to the grating lines, the diffracted beams exit the grating at an angle θ′ determined by the grating equation:

$$n\lambda = d(sin\theta + sin\theta')$$

Equation 5: Grating Equation

Here, n is the order of diffraction, λ is the diffracted wavelength, and d is the grating constant (the distance between grooves). For n>0, the diffraction grating will spatially separate a polychromatic incident beam by diffracting the beam at an angle θ′, which is wavelength dependent. Once the spectral content of the gain chip is spatially separated, a variety of means can be employed to selectively reflect light with a specific wavelength back into the gain medium.

Littrow ECL Configuration

One of the simplest approaches is to use a Littrow configuration where the diffraction grating is oriented so that the first-order diffraction is retroreflected back into the gain chip [i.e., θ = θ′ in Eq. (5) above]:

$$n\lambda = 2d(sin\theta)$$

Equation 6: Grating Equation, Littrow configuration

The laser output power can be taken from the zero-order reflection of the grating, which is often done because it minimizes the number of optical elements required to construct the ECL (a collimating lens and the diffraction grating).

Wavelength tuning is accomplished by rotating the diffraction grating, which varies the wavelength of the light that is reflected back into the waveguide. When the diffraction grating (grating constant), collimation lens, and cavity length are chosen so that only one longitudinal mode is reflected back to the gain chip within the acceptance angle of the waveguide, the external cavity laser will produce a single frequency laser spectrum. Note that the selection of collimation lens is important because it affects the amount of grating area that is illuminated as well as the focused spot size coupling back into the semiconductor gain chip. One of the disadvantages of this configuration is that the angle of the zero-order output beam changes as the wavelength is tuned. However, this problem can be avoided if the output of the ECL is emitted from the normal facet of the SAF gain chip. In this configuration, the reflectance of the SAF normal facet is typically reduced to R~ 10% and a grating is chosen that efficiently diffracts light into the order being used to create the ECL to maximize the output power of the laser.

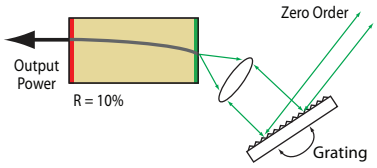


Figure 5: Littrow External Cavity Laser

Littman-Metcalf ECL Configuration

Another common ECL implementation is the Littman-Metcalf configuration, which uses an additional adjustable mirror to select the feedback wavelength.[5] The double-pass of the diffraction grating at an increased angle of incidence results in an external cavity that has better wavelength selectivity. As a result, the output beam of a Littman-Metcalf ECL typically has a narrower linewidth than a similar laser built using a Littrow configuration. In the Littman-Metcalf configuration, the output beam of the laser is typically the zero-order reflection from the diffraction grating, since the propagation direction remains fixed as the wavelength is tuned. In this case, the SAF normal facet is coated with a high-reflective (HR) coating, typically >90%, in order to minimize the losses in the ECL, which maximizes the output power.

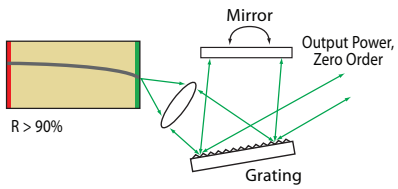


Figure 6: Littman-Metcalf External Cavity Laser

For some applications it may still be desirable to use the normal facet of the SAF chip as the output coupler of the laser. For these applications, a low reflection coating on the normal facet of the SAF gain chip would be required in order to maximize the output power of the laser.

One drawback to the Littman-Metcalf design is that the internal losses are higher than in the Littrow configuration, and hence, the output power of the laser is typically lower. The increase in internal losses are mainly due to the loss of the zero-order beam reflected from the tuning mirror and the increased loss due to the decrease in the efficiency of the grating when used to reflect light at a large angle of incidence.

External Cavity Diode Lasers (Page 4 of 4)

Innovative ECL Designs

The innovative design of an SAF gain chip is ideal for use in external cavity lasers because it virtually eliminates the unwanted feedback from the intracavity facet of the gain chip. Thorlabs offers SAF chips with both low- and high-reflectivity coatings on the normal facet in order to support a wide variety of external cavity configurations. For information on custom coatings that optimize the performance of a particular external cavity laser configuration, please contact Thorlabs.

1) C. H. Henry, "*Theory of the Linewidth of Semiconductor Lasers*" IEEE J. of Quantum Electron, **QE-18**, 259 (1982).

2) R. Wyatt, K. H. Cameron and M.R. Matthews, "T*unable Narrow Line External Cavity Lasers for Coherent Optical Communication Systems*", Br. Telecom. Technol. J. **3**, 5 (1985).

3) P. Zorabedian, "Tunable External Cavity Semiconductor Lasers." Tunable Lasers Handbook, Ed. F. J. Duarte. New York, Academic, 1995. Chapter 8.

4) P. J. S. Heim, Z. F. Fan, S. -H. Cho, K. Nam, M. Dagenais, F. G. Johnson and R. Leavitt, "*Single-angled-facet Laser Diode for Widely Tunable External Cavity Semiconductor Lasers with High Spectral Purity*", Electron. Lett., **33**, 1387 (1997).

5) M.G. Littman and H. J. Metcalf, "*Spectrally narrow pulsed dye laser without beam expander*," App. Opt. **17**, 2224 (1978).

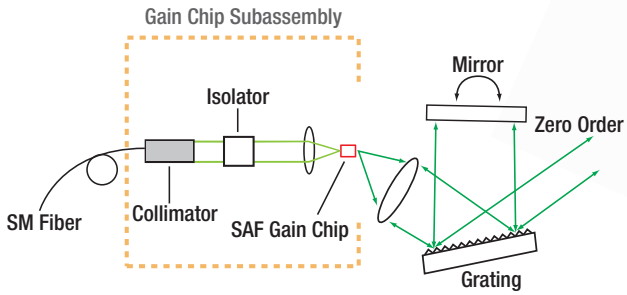
SAF Gain Chip Assemblies, λ_C = 1320 and 1550 nm (Page 1 of 2)

Thorlabs offers two varieties of single-angled-facet gain chips mounted in a fiber-coupled subassemblies for easy integration into ECL cavities. The SAF1174S is offered for the 1300 to 1400 nm range, whereas the SAF1176S is fabricated for the 1500 to 1600 nm range. These devices are optimized for high gain, high power, broad tunability, and minimal mode hopping.

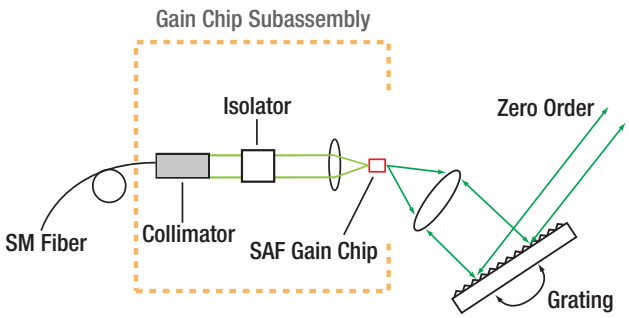
Both devices are superior gain elements for tunable Extended Cavity Lasers (ECLs) in term of laser stability, output power, and spectral quality. To achieve these qualities, the SAF gain chips have an angled waveguide and AR coatings on both ends to virtually eliminate unwanted reflective feedback from the intra-cavity facet of the gain chip. In addition, the devices use a proven SOA structure to give designers of tunable ECLs the highest power and widest tuning range available in the market.

SAF1174S
Gain Chip in Subassembly

Ideal for Building External Cavity Lasers



Basic Littman-Metcalf Configuration



Basic Littrow Configuration

To simplify integration of the gain chip into an extended cavity design, Thorlabs offers an open butterfly package assembly, which couples the output of the normal facet to a fiber pigtail. By using the assembly, the designer gains the advantage of a fiber-coupled ECL cavity.

The butterfly assembly includes the gain chip mounted on a thermoelectric cooler such that the gain chip's normal facet is pre-aligned with a collimating lens, optical isolator, and a single mode fiber pigtail. The optical isolator prevents any unwanted reflections from an external system from disrupting the ECL in operation. All devices undergo a monitored burn-in procedure to assure long-term stability and device quality.

Optical-Electrical Characteristics*

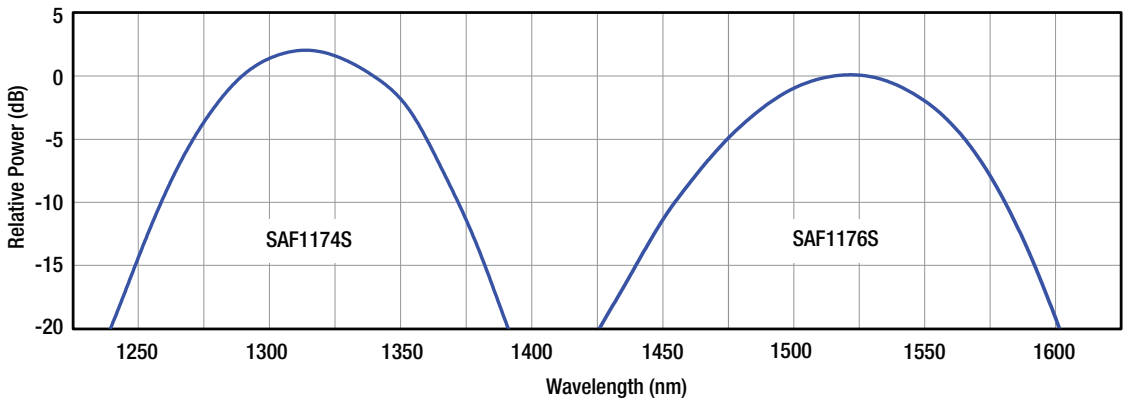
ITEM#		SAF1174S			SAF1176S		
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Min**	**Typical**	**Max**
Center Wavelength	λ	1290 nm	1320 nm	1340 nm	1500 nm	1550 nm	1600 nm
ASE 3 dB Bandwidth	BW	60 nm	80 nm	–	60 nm	80 nm	–
ASE Power @ I_{OP}	P_{OUT}	0.4 mW	0.5 mW	–	0.4 mW	0.5 mW	–
Peak Gain @ I_{OP}	G	–	39 dB	–	–	17 dB	–
Gain Ripple, rms**		–	0.35 dB	1 dB	–	0.1 dB	0.4 dB
Angled Facet Reflectivity	R_1	–	0.005%	0.01%	–	0.005%	0.01%
Normal Facet Reflectivity	R_2	–	10%	–	–	10%	–
Lateral Beam Exit Angle	θ_{EXT}	–	26.5°	–	–	19.5°	–
Beam Divergence	θ_T	20°	30°	40°	27°	31°	35°
(FWHM)	θ_L	10°	20°	30°	14°	17°	21°
Operating Current	I_{OP}	–	600 mA	800 mA	–	300 mA	500 mA
Forward Voltage	V_F	–	1.3 V	1.8 V	–	1.1 V	1.4 V
Chip Length	L	–	2.0 mm	–	–	1.0 mm	–

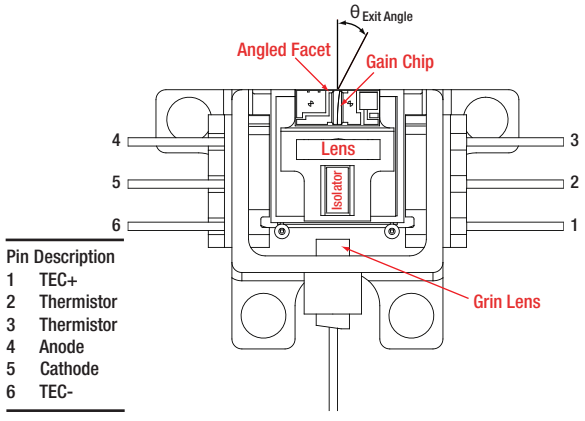
* Specifications based on Littrow external cavity configuration, R_2 = 10%, external cavity losses <5 dB, CW T (Chip) = 25%
** @ I_{OP} (Res. BW = 0.1 nm)

SAF Gain Chip Assemblies, λ_C = 1320 and 1550 nm (Page 2 of 2)

The innovative design of an SAF gain chip is ideal for use in external cavity lasers because it virtually eliminates the unwanted feedback from the intracavity facet of the gain chip. These devices offer superior performance in a wide variety of external cavity configurations. Shown below are typical SAF1174S and SAF1176S ASE spectras, details on the packaged devices, and the resultanting tuning curves.

SAF Gain Chip ASE Spectra



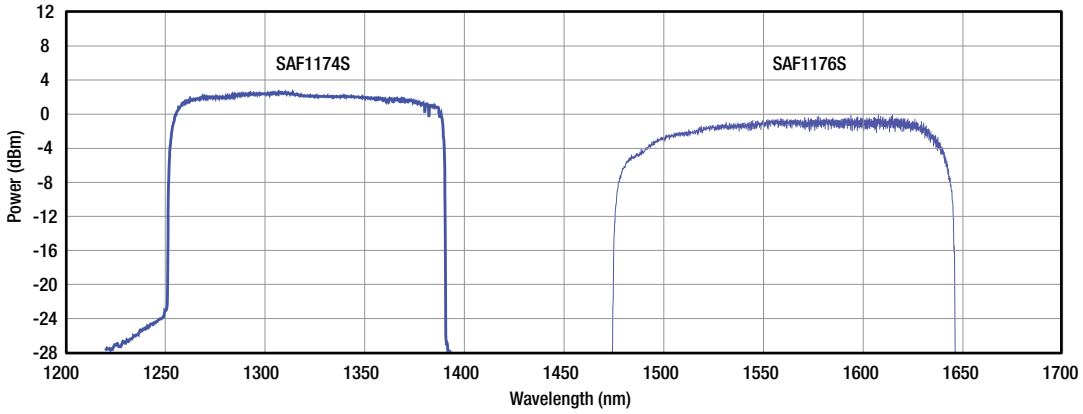


Pin	Description
1	TEC+
2	Thermistor
3	Thermistor
4	Anode
5	Cathode
6	TEC-

Schematic of Gain Chip in Subassembly

SAF1176S
Gain Chip in Subassembly

Sample Results Using a Basic Littrow Configuration

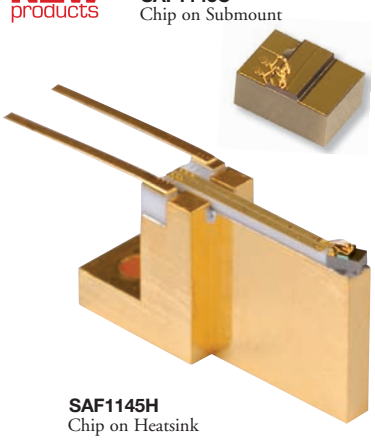


ITEM#	$	£	€	RMB	DESCRIPTION
SAF1174S	$ 2,500.00	£ 1,733.00	€ 2.219,50	¥ 21,111.00	1320 nm Single-Angled-Facet Gain Chip in Subassembly, R_2 = 10%
SAF1176S	$ 2,500.00	£ 1,733.00	€ 2.219,50	¥ 21,111.00	1550 nm Single-Angled-Facet Gain Chip Subassembly, R_2 = 10%

SAF Gain Chips, λ_C = 1220 nm

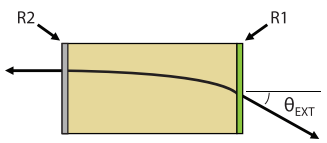
NEW products

SAF1145C
Chip on Submount



SAF1145H
Chip on Heatsink

For tunable laser designs from 1200 to 1300 nm, Thorlabs Quantum Electronics (Covega) offers two single-angled-facet gain chips.The SAF1145 InP gain chip is available either as a Chip on Submount (CoS) or a Chip on Heatsink (CoH). Both chips are coated with a 10% HR coating on the normal facet (R_2) and a <0.05% AR coating on the angled facet (R_1), making them ideal for extended cavity setups.



Single-Angled-Facet Gain Chip

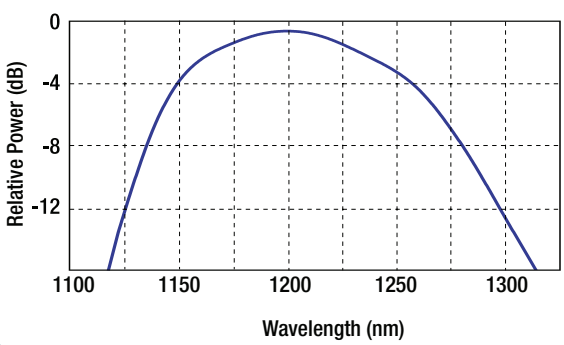
Covega's gain chips use a geometric technique to further reduce the reflection at the chip facet by using a combination of curved or angled waveguide and AR coatings to selectively remove reflective feedback from the cavity. This single-angled-facet (SAF) gain chip provides a superior gain element for Extended Cavity Lasers (ECLs), particularly tunable ECLs, since any residual reflection from the AR-coated Fabry-Perot (FP) gain chip facet often limits the stability, output power, and spectral quality of the laser.

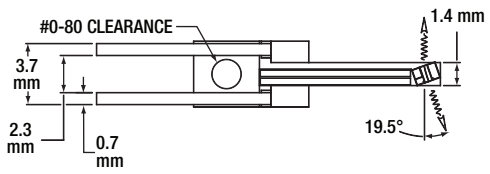
Optical-Electrical Characteristics*

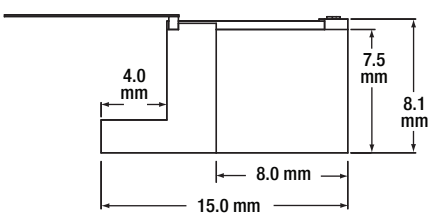
ITEM#		SAF1145		
Parameter	**Symbol**	**Min**	**Typical**	**Max**
Center Wavelength	λ	1190 nm	1220 nm	1250 nm
ASE 3 dB Bandwidth	BW	60 nm	80 nm	–
ASE Power @ I_{OP}	P_{OUT}	1 mW	1.25 mW	–
Peak Gain @ I_{OP}	G	–	20 dB	–
Gain Ripple, rms**		–	0.35 dB	1 dB
Angled Facet Reflectivity	R_1	–	–	0.05%
Normal Facet Reflectivity	R_2	–	10%	–
Lateral Beam Exit Angle	θ_{EXT}	–	19.5°	–
Beam Divergence	θ_T	20°	30°	40°
(FWHM)	θ_L	10°	20°	30°
Operating Current	I_{OP}	–	300 mA	500 mA
Forward Voltage	V_F	–	1.4 V	1.8 V
Chip Length	L	–	1.0 mm	–

* Specifications based on Littrow external cavity configuration, R_2 = 10%, external cavity losses <5 dB, CW T (Chip) = 25%
** @ I_{OP} (Res. BW = 0.1nm)

ASE Spectrum of the SAF1145

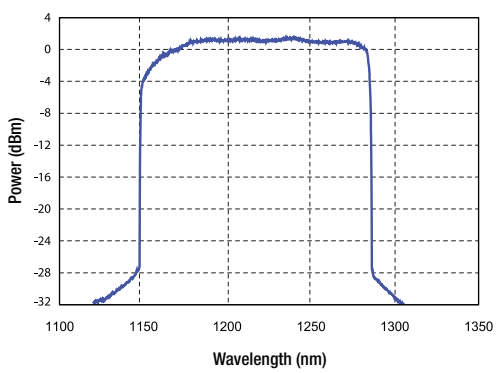


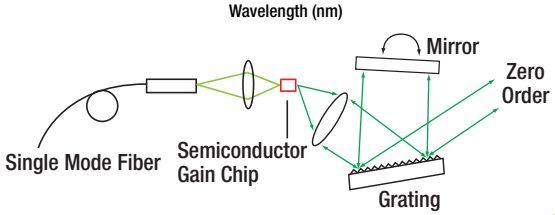




Mechanical Drawings Available on the WEB

Sample Results of SAF1145 used in a Basic Littman-Metcalf Configuration





ITEM#	$	£	€	RMB	DESCRIPTION
SAF1145C	$625.00	£ 433.30	€ 554,90	¥ 5,277.60	1220 nm Single-Angled-Facet Gain Chip on Submount, R_2 = 10%
SAF1145H	$625.00	£ 433.30	€ 554,90	¥ 5,277.60	1220 nm Single-Angled-Facet Gain Chip on Heatsink. R_2 = 10%

SAF Gain Chips, λ_C = 1320 nm

For the 1300 to 1400 nm range, Thorlabs offers two versions of single-angled-facet gain chips: a standard Chip on Submount (CoS) package and a Chip on Heatsink (CoH) package.

SAF1144C
Chip on Submount

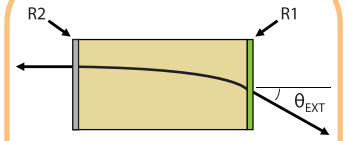
SAF1144H
Chip on Heatsink

NEW products

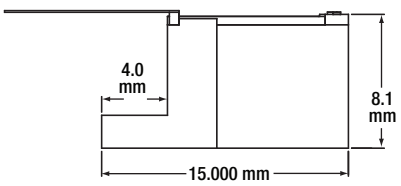
Optical-Electrical Characteristics*

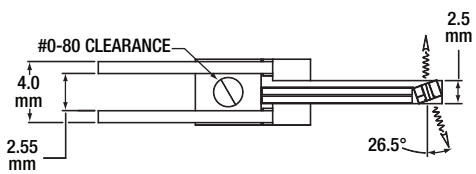
ITEM#		SAF1144		
Parameter	**Symbol**	**Min**	**Typical**	**Max**
Center Wavelength	λ	1290 nm	1320 nm	1340 nm
ASE 3 dB Bandwidth	BW	30 nm	50 nm	–
ASE Power @ I_{OP}	P_{OUT}	10 mW	20 mW	–
Peak Gain @ I_{OP}	G	–	30 dB	–
Gain Ripple, rms**		–	0.35 dB	1 dB
Angled Facet Reflectivity	R_1	–	0.005%	0.01%
Normal Facet Reflectivity	R_2	–	10%	–
Lateral Beam Exit Angle	θ_{EXT}	–	26.5°	–
Beam Divergence (FWHM)	θ_T	20°	30°	40°
	θ_L	10°	20°	30°
Operating Current	I_{OP}	–	600 mA	800 mA
Forward Voltage	V_F	–	1.3 V	1.8 V
Chip Length	L	–	2.0 mm	–

*Specifications based on Littrow external cavity configuration, R_2 = 10%, external cavity losses <5 dB, CW T (Chip) = 25%
**at I_{OP} (Res. BW = 0.1 nm)



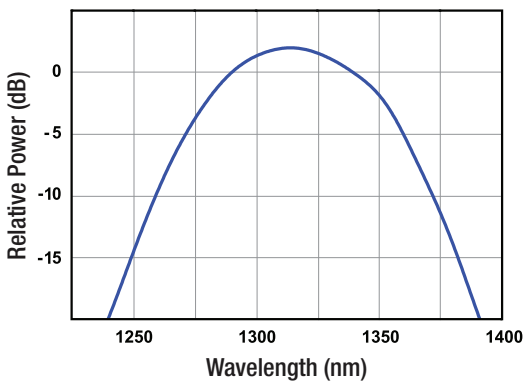
Single-Angled-Facet Gain Chip



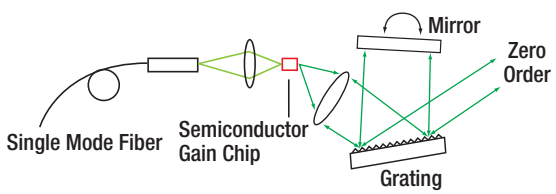


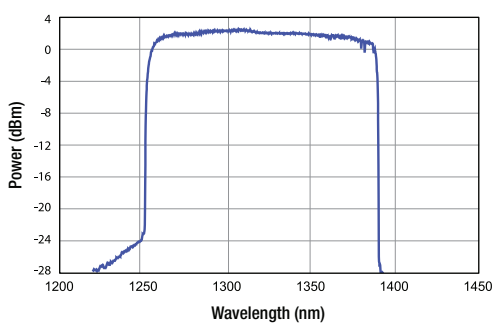
Please refer to our website for complete models and drawings.

ASE Spectrum of the SAF1144



Sample Results of SAF1144 used in a Basic Littman-Metcalf Configuration





ITEM#	$	£	€	RMB	DESCRIPTION
SAF1144C	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1320 nm Single-Angled-Facet Gain Chip on Submount, R_2 = 10%
SAF1144H	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1320 nm Single-Angled-Facet Gain Chip on Heatsink, R_2 = 10%

OCT Lasers

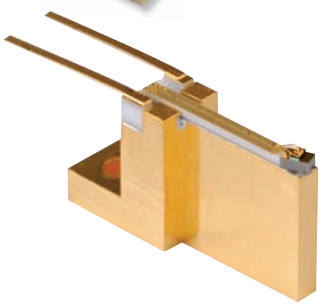
SL1325-P55
Patent Pending

See Pages 1088-1089

SAF Gain Chips, λ_C = 1450 nm

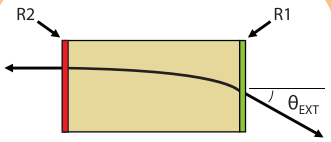
NEW products

SAF1093C
Chip on Submount



SAF1093H
Chip on Heatsink

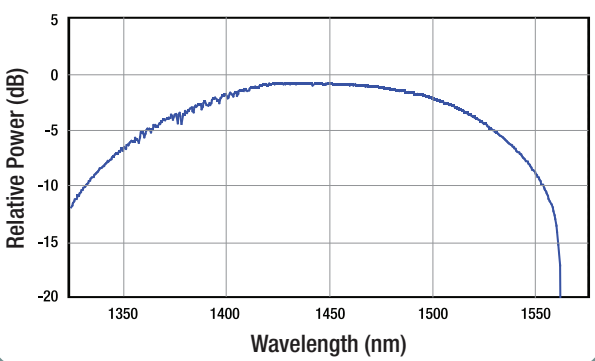
For tunable laser designs in the 1400 to 1500 nm range, Thorlabs Quantum Electronics (Covega) offers two single-angled-facet (SAF) gain chips.The SAF1093 InP gain chip is available as a Chip on Submount (CoS) or a Chip on Heatsink. Both chips are coated with a 90% HR coating on the normal facet (R_2) and a <0.01% AR coating on the angled facet (R_1), making them ideal for extended cavity setups.



Single-Angled-Facet Gain Chip

Covega's gain chips use a geometric technique to further reduce the reflection at the chip facet by using a combination of curved or angled waveguide and AR coatings to selectively remove reflective feedback from the cavity. This SAF gain chip provides a superior gain element for extended cavity lasers (ECLs), particularly tunable ECLs, since any residual reflection from the AR-coated FP gain chip facet often limits the stability, output power, and spectral quality of the laser.

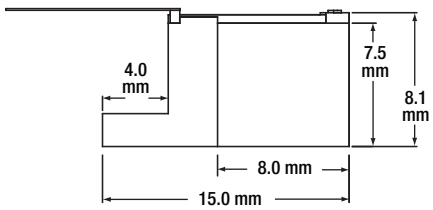
ASE Spectrum of the SAF1093

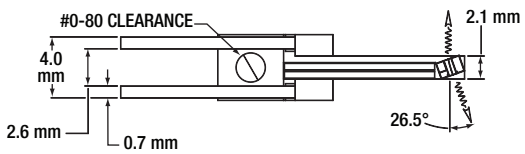


Optical-Electrical Characteristics*

ITEM#		SAF1093		
Parameter	Symbol	Min	Typical	Max
Center Wavelength	λ	1420 nm	1450 nm	1480 nm
ASE 3 dB Bandwidth	BW	80 nm	95 nm	–
ASE Power @ I_{OP}	P_{OUT}	10 mW	20 mW	–
Peak Gain @ I_{OP}	G	–	33 dB	–
Gain Ripple, rms**		–	0.3 dB	1 dB
Angled Facet Reflectivity	R_1	–	0.005%	0.01%
Normal Facet Reflectivity	R_2	–	90%	–
Lateral Beam Exit Angle	θ_{EXT}	–	26.5°	–
Beam Divergence	θ_T	20°	30°	40°
(FWHM)	θ_L	10°	20°	30°
Operating Current	I_{OP}	–	500 mA	800 mA
Forward Voltage	V_F	–	1.4 V	1.8 V
Chip Length	L	–	1.5 mm	–

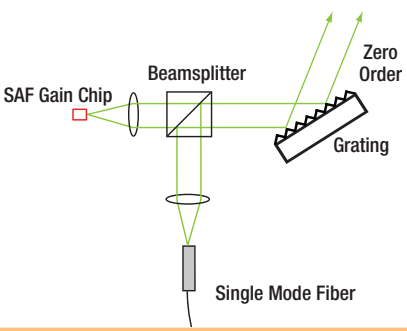
* Specifications based on Littrow external cavity configuration, R_2 = 10%, external cavity losses <5 dB, CW T (Chip) = 25%
** @ I_{OP} (Res. BW = 0.1 nm)

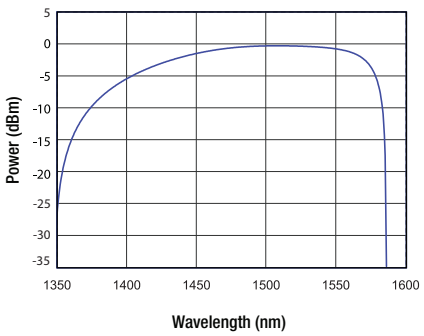




Please refer to our website for complete models and drawings.

Sample Results of SAF1093 used in a Basic Littrow Configuration





ITEM#	$	£	€	RMB	DESCRIPTION
SAF1093C	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1450 nm Single-Angled-Facet Gain Chip on Submount, R_2 = 90%
SAF1093H	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1450 nm Single-Angled-Facet Gain Chip on Heatsink, R_2 = 90%

SAF Gain Chips, λ_C = 1550 nm and 1590 nm

NEW products

For the 1500 to 1600 nm range, Covega, Thorlabs Quantum Electronics, offers two versions of single-angled-facet (SAF) gain chips, each with two different packaging styles. Standard Chip on Submount (CoS) or Chip on Heatsink (CoH) packages are available. Both devices are coated with a 10% LR coating on the normal facet and a less than 0.01% AR coating on the angled facet.

These SAF gain chip devices are optimized for high gain, high power, broad tunability, and minimial mode hopping. Both devices are superior gain elements for tunable external cavity lasers (ECLs) in term of laser stability, output power, and spectral quality. To achieve these qualities, the devices are built using a combination of an angled waveguide and AR coatings to virtually eliminate reflective feedback from the ECL cavity. In addition, the devices use a proven SOA structure to give designers of tunable ECLs the highest power and widest tuning range available in the market.

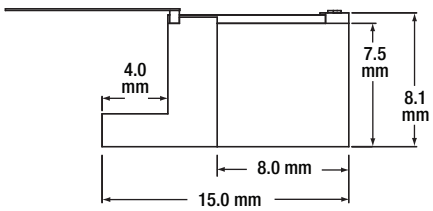
SAF1118C
Chip on Submount

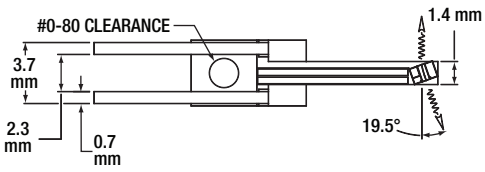
SAF1118H
Chip on Heatsink

Optical-Electrical Characteristics*

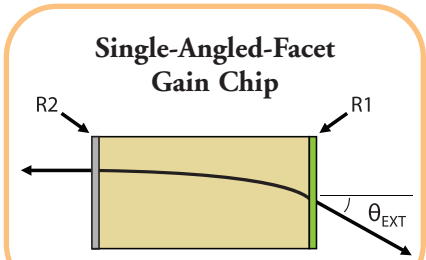
ITEM#		SAF1126			SAF1118		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1500 nm	–	1560 nm	1540 nm	–	1600 nm
ASE 3 dB Bandwidth	BW	85 nm	–	100 nm	85 nm	–	100 nm
ASE Power @ I_{OP}	P_{OUT}	0.4 mW	–	–	0.4 mW	–	–
Peak Gain @ I_{OP}	G	–	20 dB	–	–	20dB	–
Gain Ripple, rms**		–	–	1.2 dB	–	–	1.2 dB
Angled Facet Reflectivity	R_1	–	0.005%	0.01%	–	0.005%	0.01%
Normal Facet Reflectivity	R_2	–	10%	–	–	10%	–
Lateral Beam Exit Angle	θ_{EXT}	–	19.5°	–	–	19.5°	–
Beam Divergence	θ_T	26°	30°	34°	26°	30°	34°
(FWHM)	θ_L	–	16°	–	–	16°	–
Operating Current	I_{OP}	–	300 mA	350 mA	–	300 mA	350 mA
Forward Voltage	V_F	–	1.3 V	1.8 V	–	1.3 V	1.8 V
Chip Length	L	–	1.0 mm	–	–	1.0 mm	–

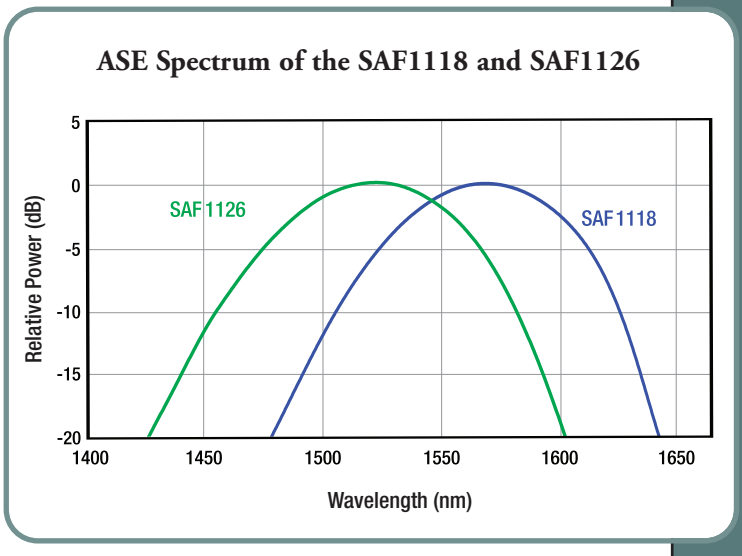
* Specifications based on Littrow external cavity configuration, R_2 = 10%, external cavity losses <5 dB, CW T (Chip) = 25%
** @ I_{OP} (Res. BW = 0.1 nm)





Mechanical Drawings Available on the WEB





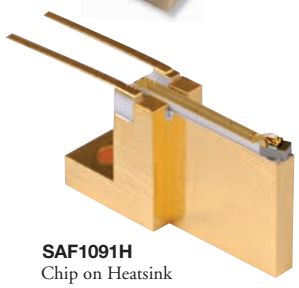
INTUN Tunable Lasers
TL1550-B
See Pages 1084-1085

ITEM#	$	£	€	RMB	DESCRIPTION
SAF1126C	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1550 nm Single-Angled-Facet Gain Chip on Submount, R_2 = 10%
SAF1126H	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1550 nm Single-Angled-Facet Gain Chip on Heatsink, R_2 = 10%
SAF1118C	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1590 nm Single-Angled-Facet Gain Chip on Submount, R_2 = 10%
SAF1118H	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1590 nm Single-Angled-Facet Gain Chip on Heatsink, R_2 = 10%

SAF Gain Chips, λ_C = 1650 nm

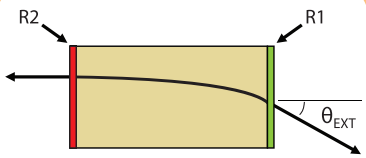
NEW products

SAF1091C
Chip on Submount



SAF1091H
Chip on Heatsink

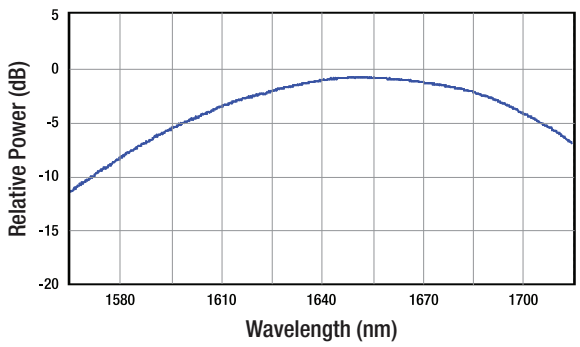
For tunable laser designs in the 1600 to 1700 nm range, Covega, Thorlabs Quantum Electronics, offers two single-angled-facet (SAF) gain chips. The SAF1091 InP gain chip is available as a Chip on Submount (CoS) or a Chip on Heatsink. Both chips are coated with a 90% HR coating on the normal facet and a <0.01% AR coating on the angled facet, making them ideal for extended cavity setups.



Single-Angled-Facet Gain Chip

Covega's gain chips use a geometric technique to further reduce the reflection at the chip facet by using a combination of curved or angled waveguide and AR coatings to selectively remove reflective feedback from the cavity. This SAF gain chip is a superior gain element for external cavity lasers (ECLs), particularly tunable ECLs, since any residual reflection from the AR-coated FP gain chip facet often limits the stability, output power, and spectral quality of the laser.

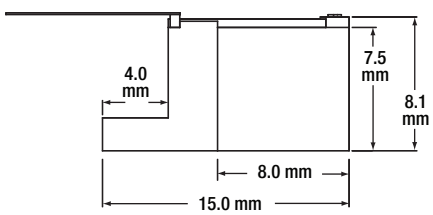
ASE Spectrum of the SAF1091



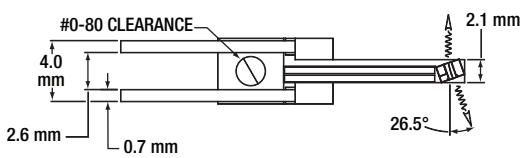
Optical-Electrical Characteristics*

ITEM#		SAF1091		
Parameter	**Symbol**	**Min**	**Typical**	**Max**
Center Wavelength	λ	1620 nm	1650 nm	1680 nm
ASE 3 dB Bandwidth	BW	80 nm	90 nm	–
ASE Power @ I_{OP}	P_{OUT}	2.5 mW	3.5 mW	–
Peak Gain @ I_{OP}	G	–	23 dB	–
Gain Ripple, rms**		–	0.1 dB	0.35 dB
Angled Facet Reflectivity	R_1	–	0.005%	0.01%
Normal Facet Reflectivity	R_2	–	90%	–
Lateral Beam Exit Angle	θ_{EXT}	–	26.5°	–
Beam Divergence	θ_T	20°	30°	40°
(FWHM)	θ_L	10°	18°	30°
Operating Current	I_{OP}	–	500 mA	800 mA
Forward Voltage	V_F	–	1.35 V	1.6 V
Chip Length	L	–	1.5 mm	–

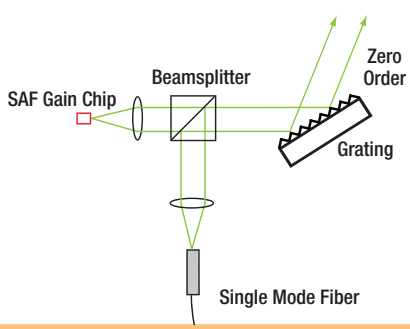
* Specifications based on Littrow external cavity configuration, R_2 = 10%, external cavity losses <5 dB, CW T (Chip) = 25%
** @ I_{OP} (Res. BW = 0.1 nm)

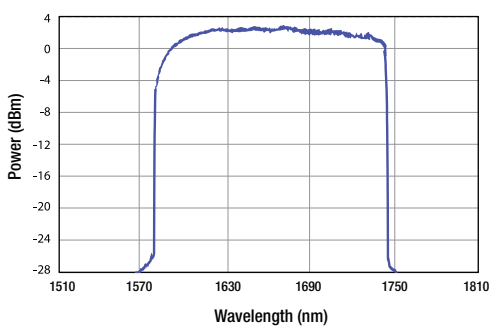


Please refer to our website for complete models and drawings.



Sample Results of SAF1091 used in a Basic Littrow Configuration

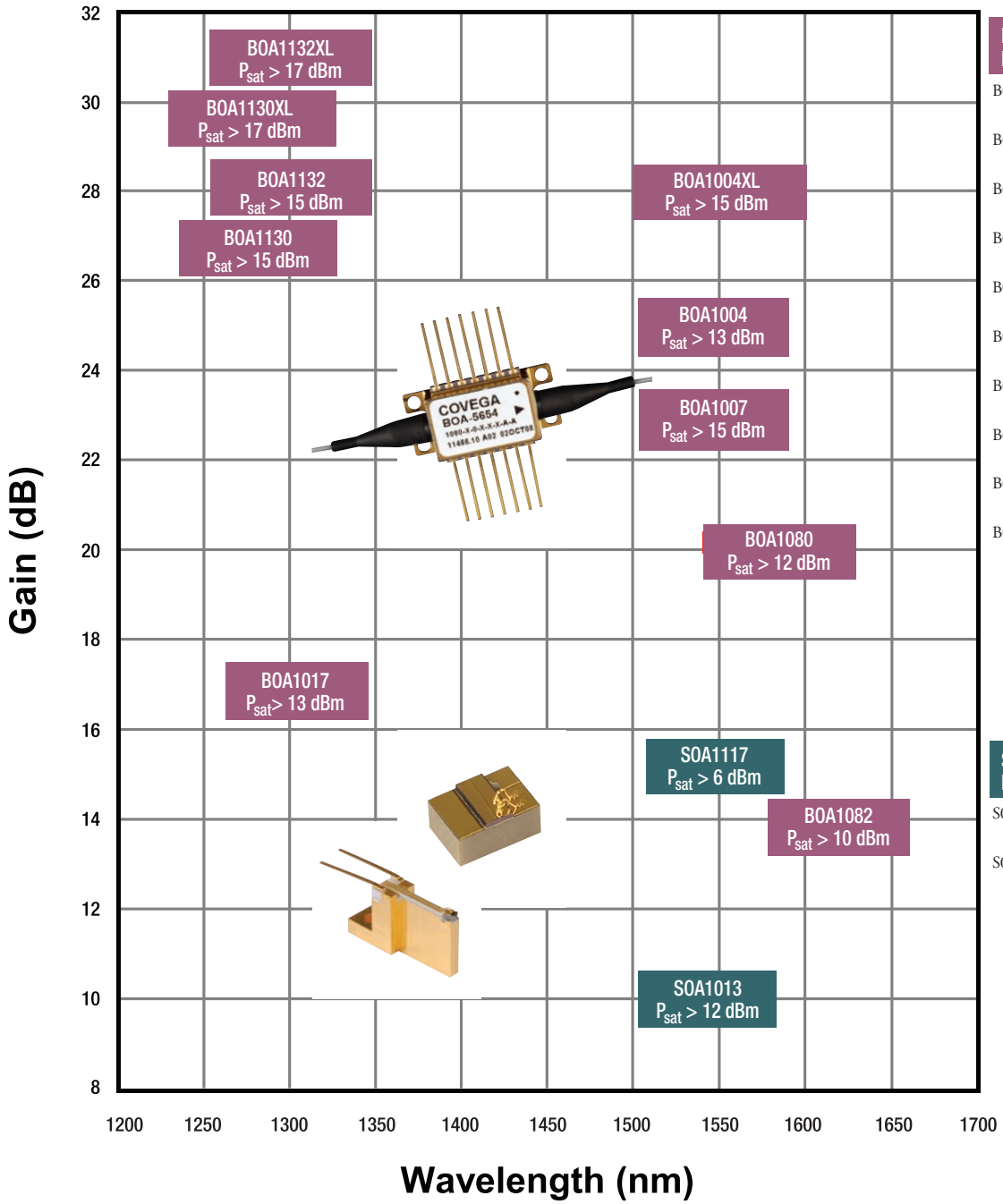




ITEM#	$	£	€	RMB	DESCRIPTION
SAF1091C	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1650 nm Single-Angled-Facet Gain Chip on Submount, R_2 = 90%
SAF1091H	$ 625.00	£ 433.30	€ 554,90	¥ 5,277.60	1650 nm Single-Angled-Facet Gain Chip on Heatsink, R_2 = 90%

Optical Amplifiers Selection Guide

Pages 1147-1155



BOA - Booster Optical Amplifier
Polarization Dependent

B0A1132XL
Pages 1150-1151

B0A1130XL
Pages 1150-1151

B0A1132
Pages 1150-1151

B0A1004XL
Page 1152

B0A1030
Pages 1150-1151

B0A1004
Page 1152

B0A1007
Page 1152

B0A1080
Page 1155

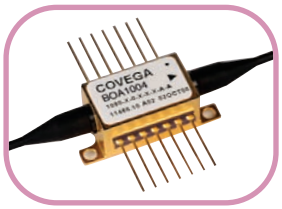
B0A1017
Pages 1150-1151

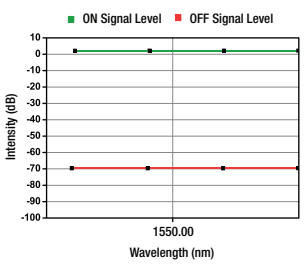
B0A1082
Page 1155

SOA - Semiconductor Optical Amplifier
Polarization Independent

S0A1117
Page 1153

S0A1013
Page 1153





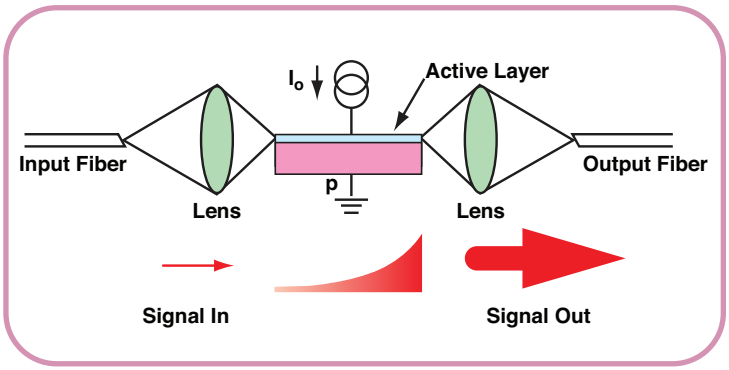
Amplifiers as Optical Switches/Shutters

- Isolation >40 dB
- High Fiber-to-Fiber Gain
- High Switching Speed <1 ns

See Pages 1148-1155

Semiconductor Optical Amplifiers Overview (Page 1 of 2)

Semiconductor Optical Amplifiers (SOAs) are devices that directly amplify optical signals using the properties of semiconductors. The Semiconductor Optical Amplifier structure consists of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structure grown on an InP wafer and processed into a waveguide. Thorlabs' Semiconductor Optical Amplifiers are designed as single-pass, traveling-wave optical amplifiers that perform well with both monochromatic and multi-wavelength signals. As seen in the functional diagram to the right, the input and output of the amplifier is coupled to the well-proven ridge waveguide on the optical amplifier chip. The device is contained in a standard 14-pin butterfly package with either SMF or PMF pigtails that are terminated with FC/APC connectors.

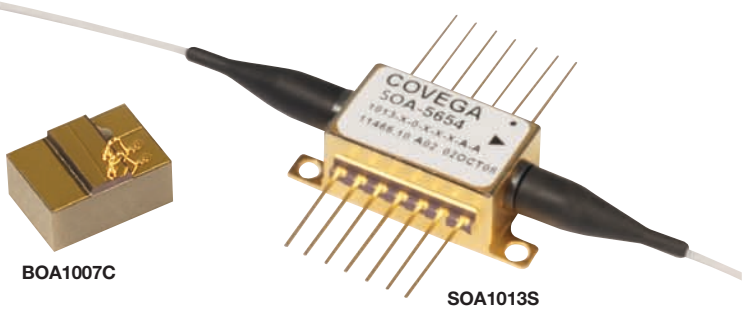


Functional Diagram

SOA and BOA Semiconductor Optical Amplifiers

Thorlabs offers two varieties of Semiconductor Optical Amplifiers: traditional SOAs and BOAs (Booster Optical Amplifiers). SOAs amplify input signals independent of the state of input polarization, while BOAs amplify only certain polarization states of the input signal. As input signals are coupled into a SOA waveguide, SOAs ideally amplify both the TE and TM modes equally. A polarization-independent amplifier (i.e., an SOA) is required in applications where the input polarization is unknown or fluctuates. When input signals are coupled into a BOA waveguide, it will only amplify the TE mode. Thus, BOAs are used in applications where the polarization state of the input light is known and controlled to match the device. For those applications where the state of polarization is known, BOAs offer improved gain, noise, bandwidth, and saturation power compared to their SOA counterparts. We also offer hand-picked BOAs that have been determined to have superior specifications to the design specifications of the device. These premium devices are known as our XL Series. While the normal product line is specified with typical values, the XL line is specified with minimum values and typically feature larger bandwidths and greater gain.

Available as Packaged Devices or Chip on Submount



BOA1007C

SOA1013S

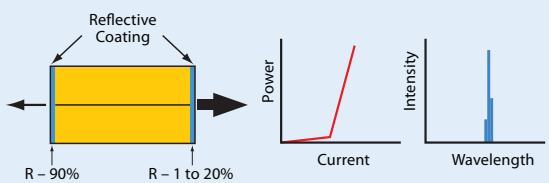
Features

- World-Class Semiconductor Optical Amplifiers Functionality
  - C-Band Polarization Independent (Linear/Nonlinear)
  - O-Band, C-Band, and L-Band Polarization Dependent
- High Saturation Power (up to 23 dBm)
- High Gain Levels (up to 30 dB)
- Low Interface Reflections due to AR-Coated End Faces (R <0.01%)
- Available as Packaged Device or CoS/CoH
  - SM or PM Fiber Pigtailed Butterfly Package
  - Chip on Submount
  - Chip on Heatsink
- FC/APC Connectors

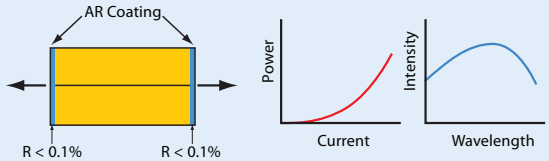
SOAs Compared to Fabry-Perot Laser Diodes

All Semiconductor Optical Amplifiers (SOAs and BOAs) are similar in design to Fabry-Perot Laser Diodes. The difference is that Fabry-Perot laser diodes have reflective coatings on both end faces of the semiconductor chip. The optical feedback from the end faces establishes a cavity in which lasing can occur. SOAs and BOAs have antireflection (AR) coatings on both end faces of the semiconductor chip. These AR coatings limit the optical feedback into the chip so that lasing does not occur.

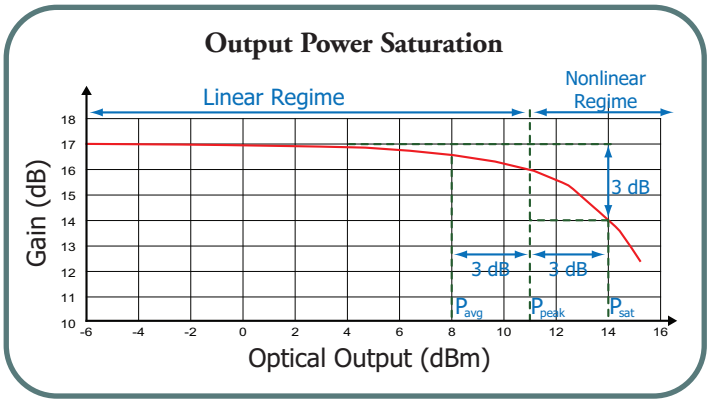
Typical Fabry-Perot Laser Diode



Semiconductor Optical Amplifier



Semiconductor Optical Amplifiers Overview (Page 2 of 2)

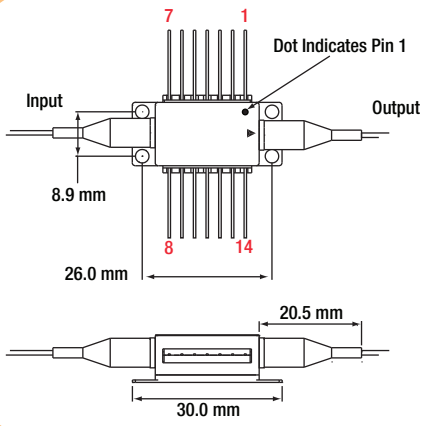


Linear versus Nonlinear

As is typical for all amplifiers, SOAs and BOAs operate in two regimes: a linear, flat, constant gain regime and a nonlinear, saturated output regime. When used to amplify a modulated signal, the linear regime is typically used to eliminate pattern-dependent distortion, multi-channel crosstalk, and transient response issues common to Erbium-Doped Fiber Amplifiers (EDFAs). The nonlinear regime is used to take advantage of the highly nonlinear attributes of the semiconductor gain medium (cross-gain modulation, cross phase modulation) to perform wavelength conversion, optical 3R regeneration, optical pattern recognition, and other high-speed optical signal processing functions.

The amount of output power that can be linearly produced without significant distortion by the amplifier is denoted by the saturation output power (P_{sat}) parameter. P_{sat} is defined as the output power at which the gain of the amplifier has been compressed by 3 dB from the maximum gain available to input signals (see Output Power Saturation diagram above). In the diagram, the gain of the output signal decreases as the level of output increases. At an output signal level of 14 dBm, the signal gain has decreased 3 dB and has reached the level of saturation. Any output signals that are below P_{sat} are considered to be distortion free and replicas of the input signal. The practical output power limit of SOAs and BOAs is approximately 3 dB higher than the saturation power value.

The devices are packaged in a standard butterfly package as shown in the illustration to the right. The SOAs and BOAs can be customized upon request to have isolators on the input, output, or both.



Pin Identification

1. TEC +	14. TEC -
2. Thermistor	13. Case
3. Not Used	12. Not Used
4. Not Used	11. SOA Cathode
5. Thermistor	10. SOA Anode
6. Not Used	9. Not Used
7. Not Used	8. Not Used

Recommended mounting torque is 10 - 20 oz·in (0.07 - 0.14 N·m)

Butterfly Driver Products

See Pages 1193-1195

Laser Diode / TEC Controllers – ITC4001

- Laser Currents up to ±1 A
- TEC Currents up to ±15 A
- Extremely Low Noise and High Stability

Butterfly Laser Diode Mounts – LM14S2

- 14-Pin Butterfly Package Laser Diode Mount
- ZIF Mounting Socket
- Laser Diode TEC Temperature Regulation
- User-Defined Pinout Configuration

See Page 1216

Standalone LD/TEC Controller – LDC1300B

- Laser Diode Driver
- Controlled via RS-232 Interface
- Suited for use with BOAs, SOAs, SLDs, and FPLs
- Integrated TEC Controller
- 14-Pin Butterfly Package Mount

See Page 1217

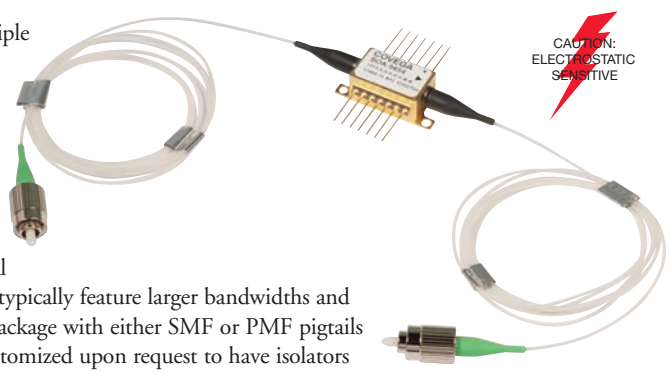
1300 nm (O-Band) Polarization-Dependent BOAs (Page 1 of 2)

Thorlabs has ten varieties of O-Band Polarization-Dependent Booster Optical Amplifiers (BOAs). Our advanced epitaxial wafer growth and opto-electronic packaging techniques enable a high output saturation power, low noise figure, and large gain across a broad spectral bandwidth. The major differences between the models are the center wavelength and input and output fiber types.

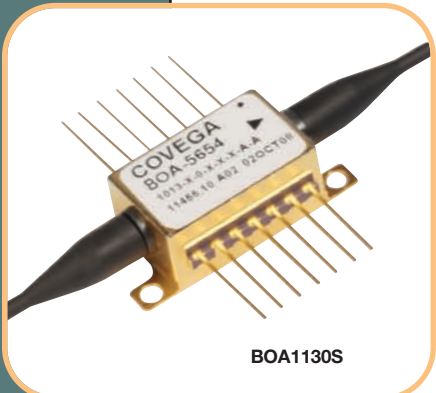
These BOAs were designed and tested to ensure the highest available gain and P_{sat} on the market. The devices come in an industry-standard 14-pin butterfly package with either single mode fiber or polarization-maintaining fiber pigtails.

BOA – Polarization-Dependent Optical Amplifier

- Polarization-Dependent Amplification
- High Saturation Power (up to 18 dBm)
- High Gain Levels (up to 30 dB)
- Available as SM or PM Fiber-Pigtailed Butterfly Package
- 1.5 m Fiber-Pigtailed FC/APC Connectors
- Typical Applications are Amplification of Lasers and Transmitter Signals and Swept-Source Tunable Lasers



BOAs, a polarization-dependent variety of Semiconductor Optical Amplifiers (SOAs), directly amplify optical signals using the properties of semiconductors. The Semiconductor Optical Amplifiers structure consists of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structure grown on an InP wafer and processed into a waveguide. Thorlabs' SOAs are designed as single-pass, traveling-wave optical amplifiers that perform well with both monochromatic and multi-wavelength signals. We also offer O-Band Optical Amplifiers that have been tested and determined to have significantly superior performance over the design specifications of the device. These premium devices are known as our XL series. While the normal product line is specified with typical values, the XL line is specified with minimum values. These devices typically feature larger bandwidths and greater gain. The device is packaged in a standard 14-pin butterfly package with either SMF or PMF pigtails that are terminated with FC/APC connectors. The BOAs can be customized upon request to have isolators on the input, output, or both. Please contact Tech Support for help in customizing a BOA for your application.



BOA1130S

ITEM#	BOA1130S / BOA1130P			BOA1130SXL / BOA1130PXL		
Parameter	Min	Typical	Max	Min	Typical	Max
Operating Current	–	600 mA	750 mA	–	600 mA	750 mA
Center Wavelength	1265 nm	1285 nm	1295nm	1265 nm	1275 nm	1290 nm
Optical 3 dB Bandwidth	80 nm	87 nm	–	90 nm	–	–
Saturation Output Power (@ -3 dB)	15 dBm	17 dBm	–	17 dBm	18 dBm	–
Small Signal Gain Across BW (@ Pin = -20 dBm)	27 dB	30 dB	–	30 dB	–	–
Gain Ripple (p-p) @ IOP	–	0.2 dB	0.3 dB	–	0.2 dB	0.3 dB
Noise Figure	–	7.0	9.0	–	7.0	9.0
Forward Voltage	–	1.6 V	2.0 V	–	1.6 V	2.0 V
TEC Current*	–	0.4 A	1.5 A	–	0.4 A	1.5 A
TEC Voltage*	–	0.5 V	4.0 V	–	0.5 V	4.0 V
Thermistor Resistance*	–	10 kΩ	–	–	10 kΩ	–

* TEC Operation (Typ/Max @ TCASE = 25/70 °C)

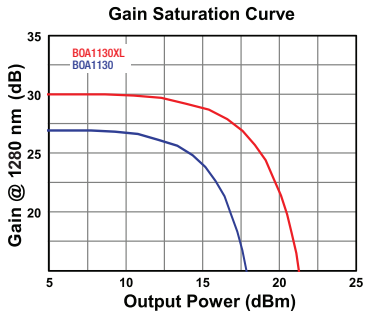
ITEM#	BOA1017S / BOA1017P			BOA1132S / BOA1132P			BOA1132SXL / BOA1132PXL		
Parameter	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
Operating Current	–	500 mA	600 mA	–	700 mA	750 mA	–	700 mA	750 mA
Center Wavelength	1290 nm	1310 nm	1330 nm	1290 nm	1300 nm	1315 nm	1290 nm	1300 nm	1315 nm
Optical 3 dB Bandwidth	60 nm	70 nm	–	80 nm	87 nm	–	90 nm	–	–
Saturation Output Power (@ -3 dB)	13 dBm	15 dBm	–	15 dBm	17 dBm	–	17 dBm	18 dBm	–
Small Signal Gain Across BW (@ Pin = -20 dBm)	17 dB	23 dB	–	27 dB	30 dB	–	30 dB	–	–
Gain Ripple (p-p) @ IOP	–	0.3 dB	0.8 dB	–	0.2 dB	0.3 dB	–	0.1 dB	0.2 dB
Noise Figure	–	7.0 dB	9.0 dB	–	7.0 dB	9.0 dB	–	6.0 dB	7.0 dB
Forward Voltage	–	1.4 V	1.6 V	–	1.6 V	2.0 V	–	1.6 V	2.0 V
TEC Current*	–	0.15 A	1.5 A	–	0.4 A	1.5 A	–	0.4 A	1.5 A
TEC Voltage*	–	0.35 V	3.5 V	–	0.5 V	4.0 V	–	0.5 V	4.0 V
Thermistor Resistance*	–	10 kΩ	–	–	10 kΩ	–	–	10 kΩ	–

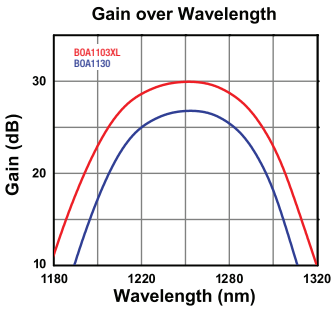
* TEC Operation (Typ/Max @ TCASE = 25/70 °C)

1300 nm (O-Band) Polarization-Dependent BOAs (Page 2 of 2)

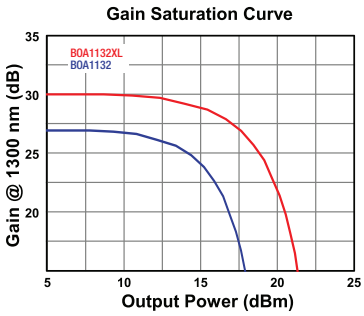
NEW products

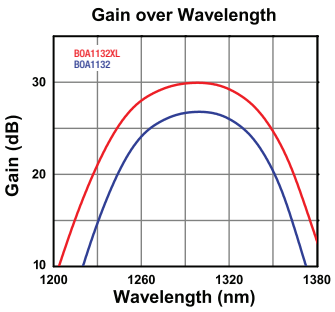
BOA1130



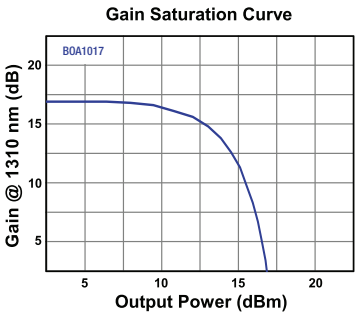


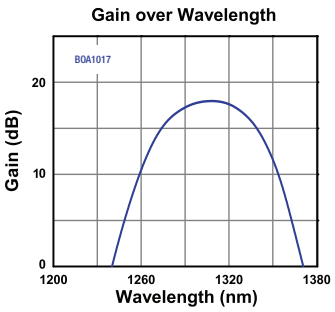
BOA1132





BOA1017





Booster Optical Amplifiers

ITEM#	$	£	€	RMB	DESCRIPTION
BOA1130S	$ 2,115.00	£ 1,466.00	€ 1.877,50	¥ 17,860.00	1285 nm BOA, 80 nm BW, Butterfly, SMF, FC/APC
BOA1130P	$ 2,380.00	£ 1,650.00	€ 2.113,00	¥ 20,097.00	1285 nm BOA, 80 nm BW, Butterfly, PMF, FC/APC
BOA1130SXL	$ 4,230.00	£ 2,932.50	€ 3.755,50	¥ 35,719.00	1275 nm BOA, 90 nm BW, Butterfly, SMF, FC/APC
BOA1130PXL	$ 4,760.00	£ 3,300.00	€ 4.226,00	¥ 40,194.00	1275 nm BOA, 90 nm BW, Butterfly, PMF, FC/APC
BOA1132S	$ 2,015.00	£ 1,397.00	€ 1.789,00	¥ 17,015.00	1300 nm BOA, 80 nm BW, Butterfly, SMF, FC/APC
BOA1132P	$ 2,280.00	£ 1,580.50	€ 2.024,00	¥ 19,253.00	1300 nm BOA, 80 nm BW, Butterfly, PMF, FC/APC
BOA1132SXL	$ 4,030.00	£ 2,793.50	€ 3.578,00	¥ 34,030.00	1300 nm BOA, 90 nm BW, Butterfly, SMF, FC/APC
BOA1132PXL	$ 4,560.00	£ 3,162.00	€ 4.049,00	¥ 38,505.00	1300 nm BOA, 90 nm BW, Butterfly, PMF, FC/APC
BOA1017S	$ 1,875.00	£ 1,300.00	€ 1.664,50	¥ 15,833.00	1310 nm BOA, 60 nm BW, Butterfly, SMF, FC/APC
BOA1017P	$ 2,140.00	£ 1,483.50	€ 1.900,00	¥ 18,071.00	1310 nm BOA, 60 nm BW, Butterfly, PMF, FC/APC

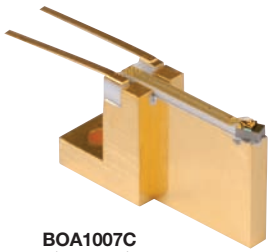
NEW design

New Wavelengths Available
Benchtop PM Fiber-Coupled Sources

See Page 1058

- Single Mode FC/PC Fiber Interface
- Narrow Key PM Fiber Aligned to the Slow Axis
- Low Noise, Highly Stable Output
- 5 Standard Models: 635, 675, 780, 1310, and 1550 nm
- Custom Wavelengths Available

1550 nm (C-Band) Polarization-Dependent BOAs



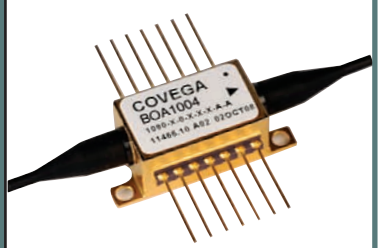
BOA1007C
Chip on Submount

Thorlabs has six varieties of 1550 nm Booster Optical Amplifiers (BOAs), a polarization-dependent variant of Semiconductor Optical Amplifiers (SOAs). Our advanced epitaxial wafer growth and opto-electronic packaging techniques enable a high output saturation power, low noise figure, and large gain across a broad spectral bandwidth. The BOA devices are available as chip on submount (CoS), as chip on heatsink (CoH), or in butterfly packages. Our BOA devices are designed and tested to ensure the highest available gain and saturated output power on the market. The butterfly devices come in an industry-standard 14-pin package with single mode fiber or polarization-maintaining pigtails. Devices can be customized to include input or output isolators.

Semiconductor Optical Amplifiers are devices that directly amplify optical signals using the properties of semiconductors. The SOAs structure consists of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structure grown on an InP wafer and processed into a waveguide. Thorlabs' Semiconductor Optical Amplifiers are designed as single-pass, traveling-wave optical amplifiers that perform well with both monochromatic and polychromatic signals. Please contact Tech Support for help customizing a BOA.

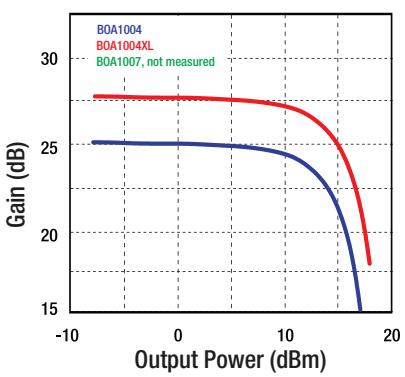
ITEM#	BOA1004S / BOA1004P			BOA1004SXL / BOA1004PXL			BOA1007C / BOA1007H		
Parameter	**Min**	**Typical**	**Max**	**Min**	**Typical**	**Max**	**Min**	**Typical**	**Max**
Operating Current	–	600 mA	750 mA	–	600 mA	750 mA	–	500 mA	–
Center Wavelength	1530 nm	1550 nm	1570 nm	1530 nm	1550 nm	1570 nm	1530 nm	1550 nm	1570 nm
Optical 3 dB Bandwidth	90 nm	100 nm	–	100 nm	–	–	90 nm	100 nm	–
Saturation Output Power (@ -3 dB)	13 dBm	15 dBm	–	15 dBm	–	–	N/A*	N/A*	N/A*
Small Signal Gain Across BW (@ Pin = -20 dBm)	25 dB	28 dB	–	28 dB	–	–	N/A*	N/A*	N/A*
Gain Ripple (p-p) @ IOP	–	0.1 dB	0.2 dB	–	0.1 dB	0.2 dB	–	0.05 dB	0.2 dB
Noise Figure	–	7.5 dB	9.0 dB	–	–	7.0 dB	N/A*	N/A*	N/A*
Forward Voltage	–	1.4 V	1.6 V	–	1.4 V	1.6 V	–	1.3 V	1.6 V
TEC Current**	–	0.12 A	1.5 A	–	0.12 A	1.5 A	–	–	–
TEC Voltage**	–	0.25 V	4.0 V	–	0.25 V	4.0 V	–	–	–
Thermistor Resistance**	–	10 kΩ	–	–	10 kΩ	–	–	–	–
Chip Length	–	–	–	–	–	–	–	1.5 mm	–
Lateral Beam Angle	–	–	–	–	–	–	–	19.5 °	–
Beam Divergence Angle (FWHM), Transverse	–	–	–	–	–	–	32 °	36 °	40 °
Beam Divergence Angle (FWHM), Lateral	–	–	–	–	–	–	10 °	14 °	18 °

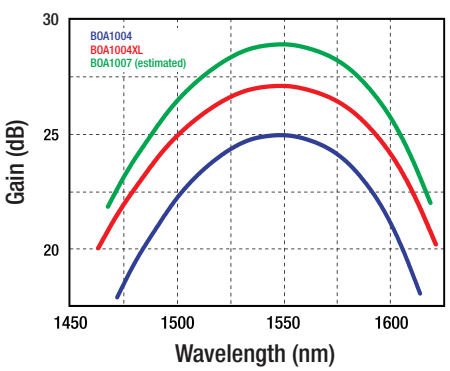
* Not Applicable
** TEC Operation (Typ/Max @ TCASE = 25/70 °C)



BOA1004SXL

Observed Gain and P_{sat} Performance

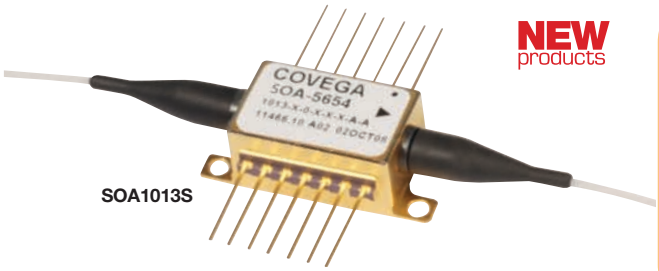




NEW products

ITEM#	$	£	€	RMB	DESCRIPTION
BOA1004S	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	1550 nm BOA, 90 nm BW, Butterfly Pkg, SMF, FC/APC
BOA1004SXL	$ 3,500.00	£ 2,426.50	€ 3.107,50	¥ 29,555.00	1550 nm BOA, 100 nm BW, Butterfly Pkg, PMF, FC/APC
BOA1004P	$ 2,015.00	£ 1,397.00	€ 1.789,00	¥ 17,015.00	1550 nm BOA, 90 nm BW, Butterfly Pkg, SMF, FC/APC
BOA1004PXL	$ 4,030.00	£ 2,793.50	€ 3.578,00	¥ 34,030.00	1550 nm BOA, 100 nm BW, Butterfly Pkg, PMF, FC/APC
BOA1007C	$ 850.00	£ 589.30	€ 754,70	¥ 7,177.50	1550 nm BOA, 90 nm BW, Chip on Submount
BOA1007H	$ 925.00	£ 641.30	€ 821,30	¥ 7,810.80	1550 nm BOA, 90 nm BW, Chip on Heatsink

1550 nm (C-Band) Polarization-Independent SOAs



SOA1013S

NEW products

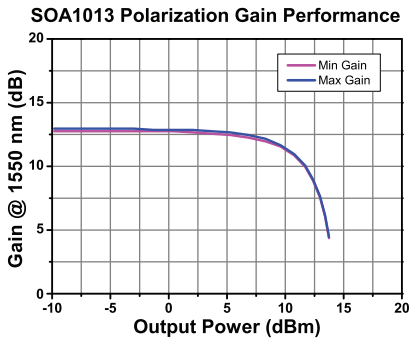
SOA – Polarization-Independent Optical Amplifier

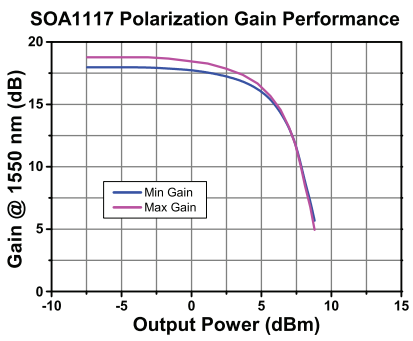
- Linear/Nonlinear Operation
- High Saturation Power (up to 14 dBm)
- High Gain Levels (up to 20 dB)
- SM or PM Fiber Pigtailed Butterfly Package
- 1.5 m Fiber Pigtailed FC/APC Connectors
- Typical Applications Include Inline Amplifier and Detector Pre-Amp

For applications in the 1550 nm, where the input polarization is unknown or fluctuates, Thorlabs has two varieties of C-band polarization-independent optical amplifiers – the linear SOA1013S and the nonlinear SOA1117S/P. Our advanced epitaxial wafer growth and opto-electronic packaging techniques enable a high output saturation power, low noise figure, and large gain across a broad spectral bandwidth.

Semiconductor Optical Amplifiers (SOAs) are devices that directly amplify optical signals using the properties of semiconductors. Thorlabs' SOAs are designed as single pass, traveling-wave optical amplifiers that perform well with both monochromatic and polychromatic signals. The SOA structure consists of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structure grown on an InP wafer and processed into a proven reliable ridge waveguide. The device is packaged in an industry-standard 14-pin butterfly package with either SMF or PMF pigtails that are terminated with FC/APC connectors. The SOAs can be customized upon request to have isolators on the input, output, or both. Please contact Tech Support for help customizing a device for your application.

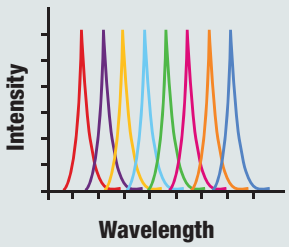
Observed Gain Performance for Linear and Nonlinear SOAs





WDM Sources

See Pages 1064-1073



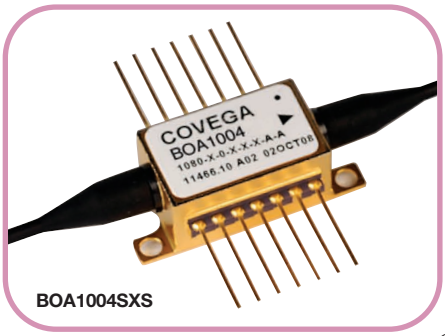
ITEM#	SOA1013S			SOA1117S / P		
Parameter	Min	Typical	Max	Min	Typical	Max
Operating Current	–	500 mA	600 mA	–	500 mA	600 mA
Center Wavelength	1520 nm	1550 nm	1570 nm	1520 nm	1550 nm	1570 nm
Optical 3 dB Bandwidth	70 nm	74 nm	–	50 nm	60 nm	–
Saturation Output Power (@ -3 dB)	12 dBm	14 dBm	–	6 dBm	9 dBm	–
Small Signal Gain Across BW (@ Pin = -20 dBm)	10 dB	13 dB	–	15 dB	20 dB	–
Gain Flatness @ IOP	–	5 dB	7 dB	–	–	–
Gain Ripple (p-p) @ IOP	–	0.1 dB	0.5 dB	–	0.2 dB	0.5 dB
Noise Figure	–	8.0	9.5	–	9.0	11.0
Forward Voltage	–	1.6 V	1.8 V	–	1.4 V	2.0 V
TEC Current*	–	0.23 A	1.5 A	–	0.2 A	1.2 A
TEC Voltage*	–	0.5 V	3.5 V	–	0.4 V	3.5 V
Thermistor Resistance*	–	10 kΩ	–	–	10 kΩ	–

* TEC Operation (Typ/Max @ TCASE = 25/70 °C)

Mechanical Drawings Available on the WEB

ITEM#	$	£	€	RMB	DESCRIPTION
SOA1013S	$ 1,685.00	£ 1,168.00	€ 1.496,00	¥ 14,229.00	1550 nm Linear SOA, 70 nm BW, Butterfly Pkg, SMF, FC/APC
SOA1117S	$ 1,585.00	£ 1,099.00	€ 1.407,00	¥ 13,384.00	1550 nm Nonlinear SOA, 50 nm BW, Butterfly Pkg, SMF, FC/APC
SOA1117P	$ 1,850.00	£ 1,282.50	€ 1.642,50	¥ 15,622.00	1550 nm Nonlinear SOA, 50 nm BW, Butterfly Pkg, PMF, FC/APC

Semiconductor Optical Amplifier as an Optical Shutter Switch

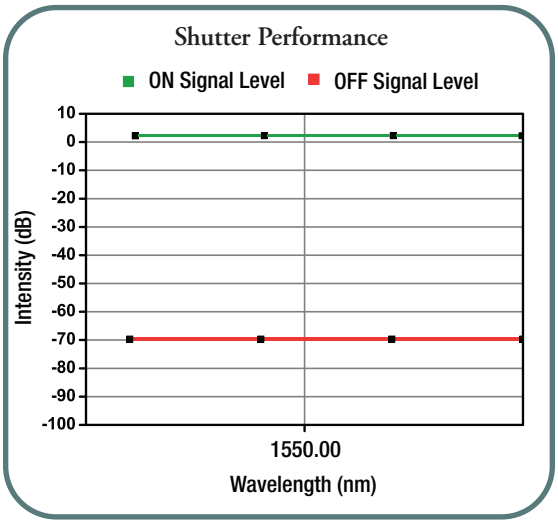


BOA1004SXS

The SOA1013SXS and BOA1004PXS Optical Switches are designed specifically for applications requiring an optical shutter in the 1530 to 1570 nm range. Both the polarization-independent SOA1013SXS and the polarization-dependent BOA1004PXS provide isolation greater than 60 dB. The devices are based on our semiconductor amplifier platform consisting of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structures grown on an InP wafer and processed into a proven reliable ridge waveguide. The device can operate as a lossless, high-speed, optical isolation switch, a full-range variable optical attenuator (VOA), or an optical shutter for protection of delicate optical equipment.

SOA as an Optical Switch

- Polarization-Dependent and Polarization-Independent Versions
- High Fiber-to-Fiber Gain
- On/Off Isolation >45 dB
- High Switching Speed of <1 ns
- Available as SM Fiber-Pigtailed Butterfly
- FC/APC Connectors. Key Aligned to Slow Axis on BOA1004PXS
- Typical Applications Include LIDAR Systems, Remote Sensing Systems, and Cavity Ring-Down Sensors



The SOA1013SXS polarization-independent switch features the right combination of low polarization sensitivity, wide optical bandwidth, and high extinction ratio for an optical isolation switch. Using the gain/absorption properties of the MQW structure, the device can function as an optical blocking shutter with no reflections. In addition, the switch is also designed to support the highest gain and signal levels, allowing it to function reliably at signal levels of 15 dBm and above. The SOA1013SXS is also ideal for applications where the input signal polarization is unknown or fluctuates.

The BOA1004PXS polarization-dependent switch offers the user full control of the power level making it ideal for high-power laser pulse generation systems like cavity ring-down sensors and LIDAR systems. The device comes in an industry-standard 14-pin butterfly package with PMF pigtails that are terminated with FC/APC connectors and key aligned to the slow axis. The BOAs can be customized upon request to have isolators on the input, output, or both. Please contact Tech Support for help customizing a device for your application.

Optical Power Meters

See Pages 1265-1284

ITEM#	SOA1013SXS			BOA1004PXS		
Parameter	Min	Typical	Max	Min	Typical	Max
Operating Current	–	500 mA	600 mA	–	500 mA	600 mA
Operating Wavelength	1528 nm	–	1562 nm	1528 nm	–	1562 nm
Optical Isolation (P_{IN} / P_{OUT}) @ 0 mA and 1550 nm	45 dB	–	–	40 dB	–	–
Extinction Ratio (On/Off @ P_{IN} = -20 dBm and 1550 nm)	–	60 dB	–	–	70 dB	–
Switching Speed	–	1ns	–	–	1 ns	–
Max Output Power for CW Input Signal	–	17 dBm	–	–	18 dBm	–
Max Output Power for Modulated Input Signal	–	9 dBm	–	–	10 dBm	–
Saturation Output Power (@ -3 dB)	12 dBm	14 dBm	–	13 dBm	15 dBm	–
Small Signal Gain Across BW (@ Pin = -20 dBm)	10 dB	13 dB	–	25 dB	28 dB	–
Polarization Dependant Gain	–	1 dB	1.5 dB	–	–	–
Noise Figure	–	8.0 dB	9.5 dB	–	8.0 dB	9.5 dB
Forward Voltage	–	1.6 V	1.8 V	–	1.6 V	1.8 V
TEC Current*	–	0.23 A	1.5 A	–	0.23 A	1.5 A
TEC Voltage*	–	0.5 V	3.5 V	–	0.5 V	3.5 V
Thermistor Resistance*	–	10 kΩ	–	–	10 kΩ	–

* TEC Operation (Typ/Max @ TCASE = 25/70 °C)

ITEM#	$	£	€	RMB	DESCRIPTION
SOA1013SXS	$ 1,854.00	£ 1,285.00	€ 1.646,00	¥ 15,656.00	1550 nm Polarization-Independent Optical Shutter/Switch, Butterfly, SMF, FC/APC
BOA1004PXS	$ 2,218.00	£ 1,537.50	€ 1.969,00	¥ 18,729.00	1550 nm Polarization-Dependent Optical Shutter/Switch, Butterfly, PMF, FC/APC

1600 nm (L-Band) Polarization-Dependent BOAs

For support of applications in the 1570-1650 nm wavelength range, Thorlabs has two wavelength variations of L-band polarization-dependent optical amplifiers (BOAs) – the BOA1080S/P and the BOA1082S/P. Polarization-sensitive BOAs only amplify one state of polarization so they are best suited for applications where the input polarization of the light is known. Our advanced epitaxial wafer growth and opto-electronic packaging techniques enable a high output saturation power, low noise figure, and large gain across a broad spectral bandwidth.

BOA – Polarization-Dependent Optical Amplifier

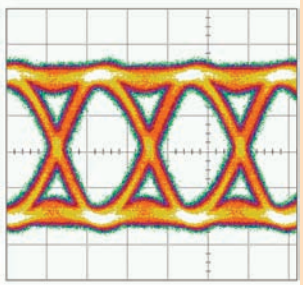
- High Saturation Power (up to 12 dBm)
- High Gain Levels (up to 20 dB)
- Available as SM or PM Fiber-Pigtailed Butterfly Package
- 1.5 m Fiber Pigtailed FC/APC Connectors
- Typical Applications Include Amplification of Lasers and Transmitter Signals and Swept-Source Tunable Lasers

BOAs, a polarization-dependent variant of Semiconductor Optical Amplifiers (SOAs), directly amplify optical signals using the properties of semiconductors. Thorlabs' Booster Optical Amplifiers are designed as single pass, traveling-wave optical amplifiers that perform well with both monochromatic and multi-wavelength signals. The BOA structure consists of a highly efficient InP/InGaAsP Multiple Quantum Well (MQW) layer structure grown on an InP wafer and processed into a proven reliable ridge waveguide. The device is packaged in an industry-standard 14-pin butterfly package with either SMF or PMF pigtails that are terminated with FC/APC connectors. The BOAs can be customized upon request to have isolators on the input, output, or both. Please contact Tech Support for help in customizing a device for your application.

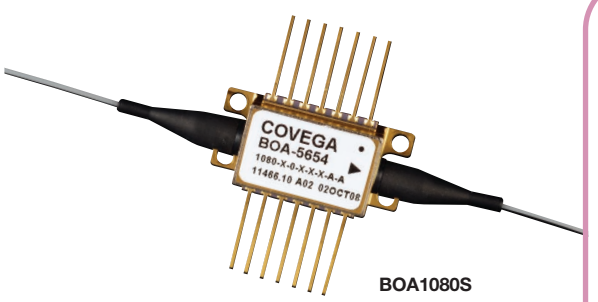
ITEM#	BOA1080S/P			BOA1082S/P		
Parameter	**Min**	**Typical**	**Max**	**Min**	**Typical**	**Max**
Operating Current	–	500 mA	600 mA	–	600 mA	–
Center Wavelength	1570 nm	1590 nm	1610 nm	1600 nm	1625 nm	1650 nm
Optical 3 dB Bandwidth	80 nm	90 nm	–	70 nm	80 nm	–
Saturation Output Power (@ -3 dB)	12 dBm	15 dBm	–	10 dBm	13 dBm	–
Small Signal Gain Across BW (@ Pin = -20 dBm)	20 dB	25 dB	–	14 dB	18 dB	–
Gain Ripple (p-p) @ I_{OP}	–	0.05 dB	0.2 dB	–	0.05 dB	0.3 dB
Noise Figure	–	7.0 dB	9.0 dB	–	7.0 dB	9.0 dB
Forward Voltage	–	1.5 V	2 V	–	1.5 V	2 V
TEC Current*	–	0.12 A	1.5 A	–	0.12 A	1.5 A
TEC Voltage*	–	0.25 V	4.0 V	–	0.25 V	4.0 V
Thermistor Resistance*	–	10 kΩ	–	–	10 kΩ	–

* TEC Operation (Typ/Max @ TCASE = 25/70 °C)

10G & 40G Optical Modulators

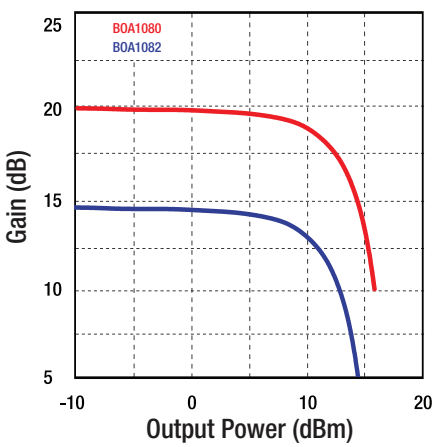


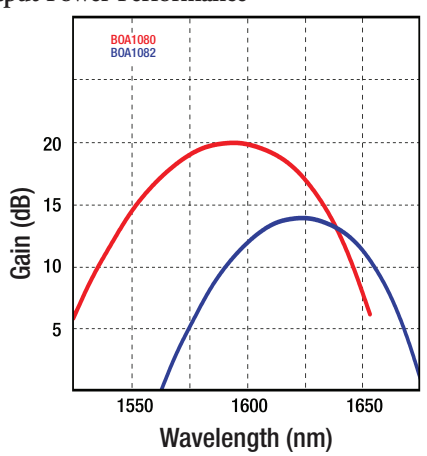
See Page 1165



BOA1080S

Observed Gain and Output Power Performance





NEW products

ITEM#	$	£	€	RMB	DESCRIPTION
BOA1080S	$ 1,950.00	£ 1,352.00	€ 1.731,00	¥ 16,466.00	1600 nm L-Band BOA, 80 nm BW, Butterfly Pkg, SMF, FC/APC
BOA1080P	$ 2,215.00	£ 1,535.50	€ 1.966,50	¥ 18,704.00	1600 nm L-Band BOA, 80 nm BW, Butterfly Pkg, PMF, FC/APC
BOA1082S	$ 2,250.00	£ 1,559.50	€ 1.997,50	¥ 19,000.00	1625 nm L-Band BOA, 70 nm BW, Butterfly Pkg, SMF, FC/APC
BOA1082P	$ 2,515.00	£ 1,743.50	€ 2.233,00	¥ 21,237.00	1625 nm L-Band BOA, 70 nm BW, Butterfly Pkg, PMF, FC/APC

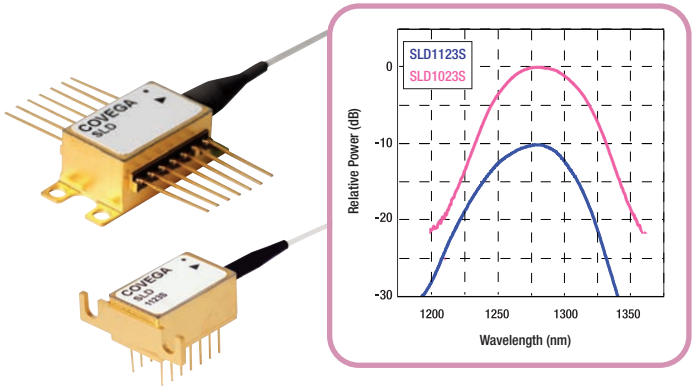
Superluminescent Diodes Selection Guide

Pages 1156-1160

1280 nm Superluminescent Diodes

- Available in Butterfly or DIL Packages
- Minimum Bandwidths from 35-75 nm
- Minimum Power: 1-10 mW

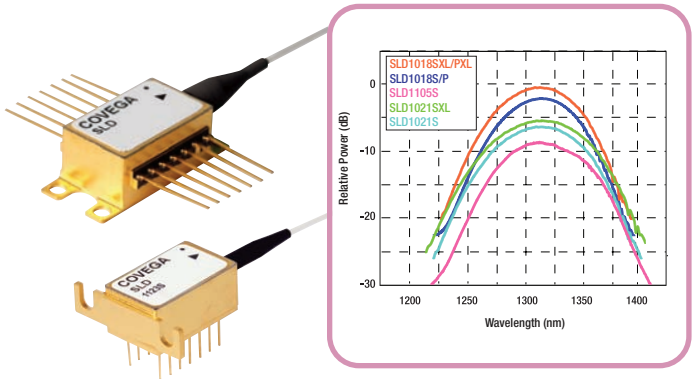
See Page 1157



1310 nm Superluminescent Diodes

- Available in Butterfly or DIL Packages
- Minimum Bandwidths from 35-85 nm
- Minimum Power: 5-30 mW

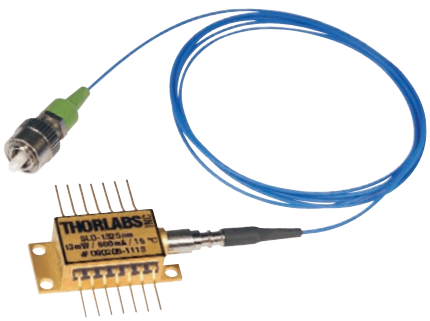
See Page 1158

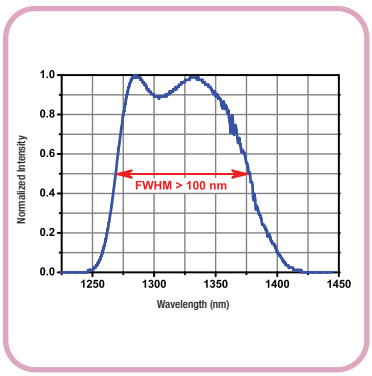


1325 nm Superluminescent Diode for OCT Systems

- 100 nm Minimum Bandwidth
- 10 mW Minimum Power
- Ideal for SD-OCT Systems

See Page 1159

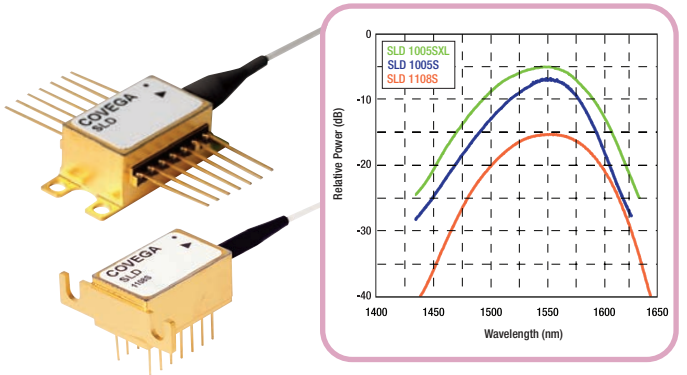




1550 nm Superluminescent Diodes

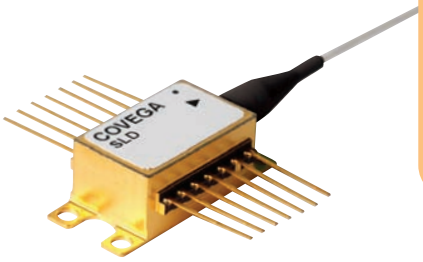
- Available in Butterfly or DIL Packages
- Minimum Bandwidths from 40-100 nm
- Minimum Power: 0.75-2 mW

See Page 1160



NOTE: The products on pages 1156-1160 are designated for use solely as components and are not sold as a finished product. The purchaser assumes responsibility to comply with US 21 CFR 1040.10 and 1040.11 or IEC 60825-1 with regard to the safe use of these components in a laboratory environment or their introduction into commerce.

1280 nm Superluminescent Diodes



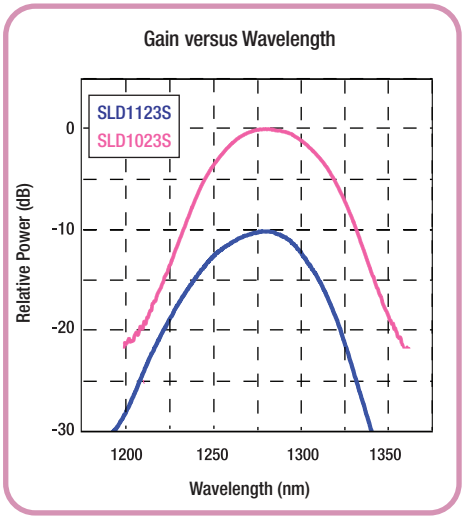
SLD1023S
Butterfly Package

Features

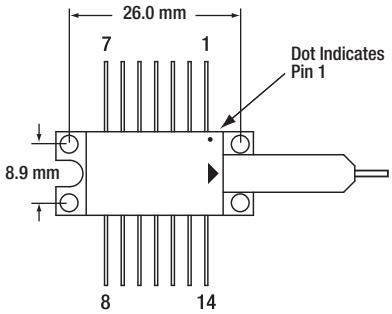
- Standard Butterfly and DIL Packages
- Integrated TEC Element and Thermistor
- SM Fiber-Coupled Output
- FC/APC Connector

SLD1123S
DIL Package

Superluminescent Diodes (SLDs) are excellent high-power broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). The SLDs offered here are Indium Phosphide (InP) devices manufactured by Covega, Thorlabs' Quantum Electronics Division. They are available in either a standard butterfly or dual in-line (DIL) package. Each device has an integrated thermoelectric cooler (TEC) and thermistor to ensure output stability. The output is coupled into an SM fiber terminated with an FC/APC connector.



Mechanical Drawings Available on the WEB



Pin Description			
1	+TEC	14	-TEC
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	Dev Cathode
5	Thermistor	10	Dev Anode
6	NC	9	NC
7	NC	8	NC

Optical Power Meters

- Large Selection of Sensors and Meters
- Interchangeable Sensors with NIST-Traceable Calibration Data
- Sensors for Measurements from 100 pW to 250 W, 190 nm to 25 µm

See Pages 1265-1284

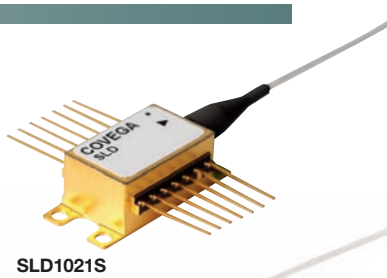
Optical-Electrical Characteristics

ITEM#		SLD1123S			SLD1023S		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1260 nm	1280 nm	1300 nm	1270 nm	1280 nm	1290 nm
ASE Power		1 mW	1.5 mW	–	10 mW	15 mW	–
Optical Bandwidth	BW	75 nm	95 nm	–	40 nm	45 nm	–
RMS Gain Ripple	ΔG	–	–	0.25 dB	–	–	0.35 dB
Operating Current	I_{OP}	–	500 mA	600 mA	–	600 mA	800 mA
Forward Voltage	V_F	–	1.6 V	2.0 V	–	1.4 V	2.0 V

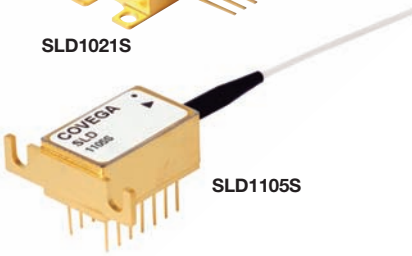
ITEM#	$	£	€	RMB	DESCRIPTION
SLD1123S	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	1 mW, 75 nm BW SLD, CWL: 1280 nm, DIL Pkg, SM Fiber, FC/APC
SLD1023S	$ 2,150.50	£ 1,491.00	€ 1.909,00	¥ 18,159.00	10 mW, 45 nm BW SLD, CWL: 1280 nm, Butterfly Pkg, SM Fiber, FC/APC

1310 nm Superluminescent Diodes

Superluminescent Diodes (SLDs) are excellent high-power, broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). The SLDs offered here are Indium Phosphide (InP) devices manufactured by Covega, Thorlabs' Quantum Electronics Division. They are available in either a standard butterfly or dual in-line (DIL) package. Each device has an integrated thermoelectric cooler (TEC) and thermistor to ensure output stability. The output is coupled into an SM or PM fiber terminated with an FC/APC connector. Our SLDs are available in standard or premium versions. The premium SLDs, denoted with the suffix XL, are hand-picked to provide higher bandwidth and power.



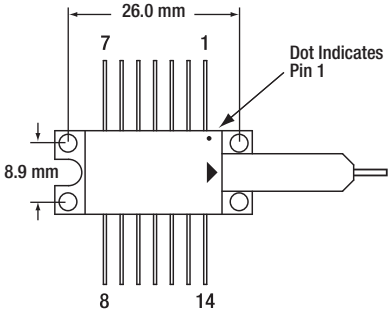
SLD1021S



SLD1105S

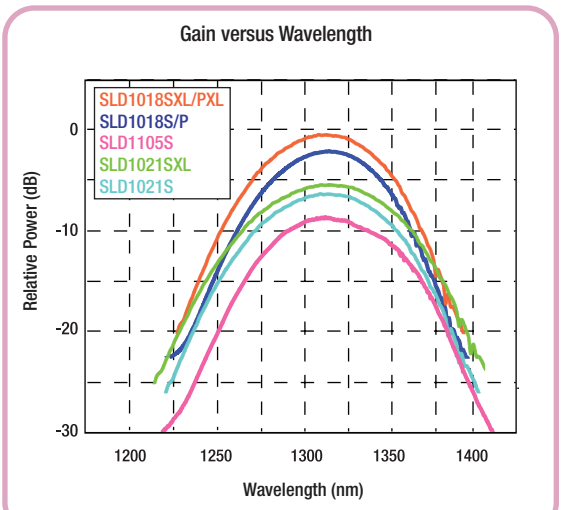
Features

- Standard Butterfly or DIL Package
- Integrated TEC Element and Thermistor
- SM or PM Fiber Coupled Output
- FC/APC Connector



Pin Description

1	+TEC	14	-TEC
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	Dev Cathode
5	Thermistor	10	Dev Anode
6	NC	9	NC
7	NC	8	NC



Wide Bandwidth

ITEM#		SLD1021SXL			SLD1021S			SLD1105S		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1290 nm	1310 nm	1330 nm	1290 nm	–	1330 nm	1290 nm	1310 nm	1330 nm
ASE Power		13 mW	–	–	10 mW	12.5 mW	–	5 mW	7 mW	–
Optical Bandwidth	BW	85 nm	–	–	80 nm	85 nm	–	60 nm	65 nm	–
RMS Gain Ripple	ΔG	–	0.1 dB	0.35 dB	–	0.1 dB	0.35 dB	–	–	0.25 dB
Operating Current	I_{OP}	–	700 mA	900 mA	–	700 mA	900 mA	–	500 mA	650 mA
Forward Voltage	V_F	–	1.55 V	1.8 V	–	1.55 V	1.8 V	–	1.3 V	2.0 V

High Power

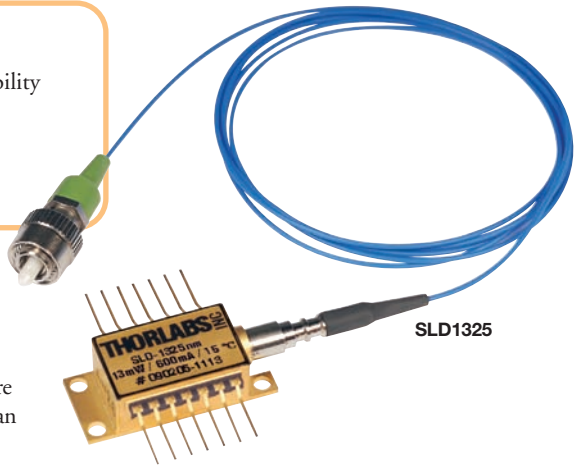
ITEM#		SLD1018SXL/SLD1018PXL			SLD1018S/SLD1018P		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1290 nm	1310 nm	1330 nm	1290 nm	1310 nm	1330 nm
ASE Power		30 mW	–	–	22 mW	30 mW	–
Optical Bandwidth	BW	45 nm	–	–	40 nm	45 nm	–
RMS Gain Ripple	ΔG	–	0.1 dB	0.35 dB	–	0.1 dB	0.35 dB
Operating Current	I_{OP}	–	600 mA	800 mA	–	600 mA	800 mA
Forward Voltage	V_F	–	1.5 V	1.8 V	–	1.5 V	1.8 V

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1105S	$ 1,450.00	£ 1,005.00	€ 1.287,50	¥ 12,244.00	Wide-Bandwidth 5 mW SLD, CWL: 1310 nm, DIL Pkg, SM Fiber, FC/APC
SLD1021S	$ 1,850.00	£ 1,282.50	€ 1.642,50	¥ 15,622.00	Wide-Bandwidth 10 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1018S	$ 2,150.00	£ 1,490.50	€ 1.909,00	¥ 18,155.00	High-Power 22 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1018P	$ 2,300.00	£ 1,594.50	€ 2.042,00	¥ 19,422.00	High-Power 22 mW SLD, CWL: 1310 nm, Butterfly Pkg, PM Fiber, FC/APC
SLD1018SXL	$ 4,300.00	£ 2,981.00	€ 3.817,50	¥ 36,310.00	High-Power 13 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1018PXL	$ 4,600.00	£ 3,189.00	€ 4.084,00	¥ 38,843.00	High-Power 30 mW SLD, CWL: 1310 nm, Butterfly Pkg, PM Fiber, FC/APC
SLD1021SXL	$ 3,700.00	£ 2,565.00	€ 3.285,00	¥ 31,243.00	Wide-Bandwidth 13 mW SLD, CWL: 1310 nm, Butterfly Pkg, SM Fiber, FC/APC

Superluminescent Diode Light Source for OCT Systems

Features

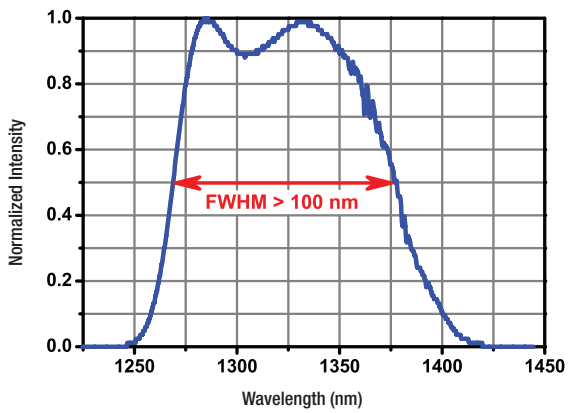
- Integrated Optical Isolator, Thermistor for Enhanced Output Stability
- FC/APC-Terminated Fiber Pigtail Minimizes Optical Feedback
- Integrated TEC and Thermistor for Temperature Control
- Hermetically Sealed 14-Pin Butterfly Package



The SLD1325 is a high-power, broadband 1325 nm Super Luminescent Diode (SLD). It is hermetically sealed in a 14-pin butterfly package and includes a built-in thermoelectric cooler and thermistor for temperature control. Each device goes through burn-in screening, mechanical robustness testing, and characterization testing before being packaged. The output is coupled into an SM fiber terminated with an FC/APC connector.

SLDs in butterfly packages are excellent high-power broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). Each SLD is shipped with its own characterization sheet.

Typical Emission Spectra of an SLD1325



PARAMETERS	
Central Wavelength	1325 nm
Bandwidth (FWHM)	>100 nm
Fiber-Coupled Power	>10 mW
Maximum SLD Injection Current	780 mA
Maximum Voltage	4 V
Operating Temperature Range	0 - 40 °C
Isolation of Integrated Isolator	>30 dB
Fiber Pigtail	SMF-28e
Fiber Length	~1 m
Fiber Connector	FC/APC
Return Loss of FC/APC Connector	>50 dB
Max Thermoelectric Cooler Current	4 A
Max Thermoelectric Cooler Voltage	4 V
Thermistor Resistance*	10 kΩ

*Steinhart - Hart Coefficients: C_1 = 1.1291, C_2 = 2.3413, and C_3 = 0.8767

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1325	$ 3,200.00	£ 2,218.50	€ 2.841,00	¥ 27,021.00	FC/APC Pigtailed SLD, 1325 nm, >10 mW, >100 nm FWHM

Butterfly Laser Diode Mount

Features

- Laser Diode Mount for 14-Pin Butterfly Package
- Laser-Enabled LED Indicator
- User-Defined Pin Out Configuration

LM14S2

Laser Diode and Temperature Controllers - ITC4000 Series

ITC4020

Features

- Laser Currents for 3 Models: ±1 A, ±5 A, and, ±20 A @ 10 V
- TEC Currents of ±12 A @ 15 V
- Constant Current (CC) and Constant Power (CP) Control Modes
- Supports Thermistor, RTD, and IC Temperature Sensors

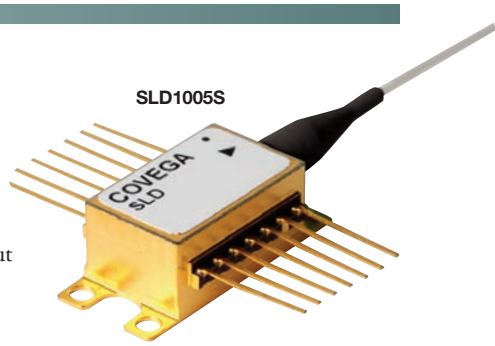
See Pages 1175-1230 for More Information

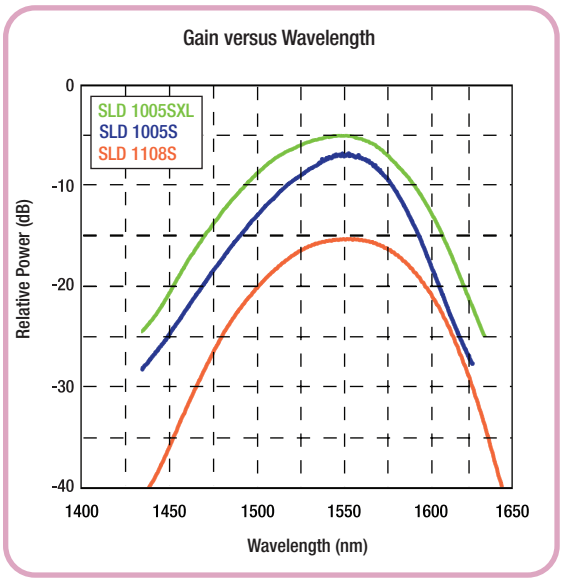
1550 nm Superluminescent Diodes

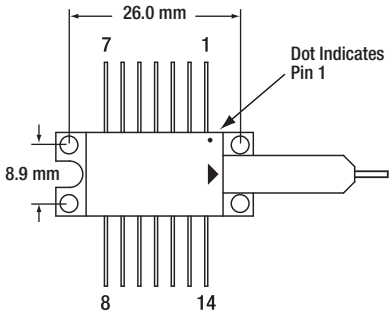
Superluminescent Diodes (SLDs) are excellent high-power, broadband light sources for use as ASE Light Sources and in applications like Optical Coherence Tomography (OCT) Imaging Systems and Fiber Optic Gyroscopes (FOGs). The SLDs offered here are Indium Phosphide (InP) devices manufactured by Covega, Thorlabs' Quantum Electronics Division. They are available in either a standard butterfly or dual in-line (DIL) package. Each device has an integrated thermoelectric cooler (TEC) and thermistor to ensure output stability. The output is coupled into an SM fiber with an FC/APC connector.

Our SLDs are available in standard or premium versions. These premium SLDs, denoted with the suffix XL, are hand-picked to provide higher bandwidth and power.

Typical Power versus Current, Voltage versus Current, and Emission Intensity (AU) versus Wavelength plots for each superluminescent diode model are available on our website: www.thorlabs.com.





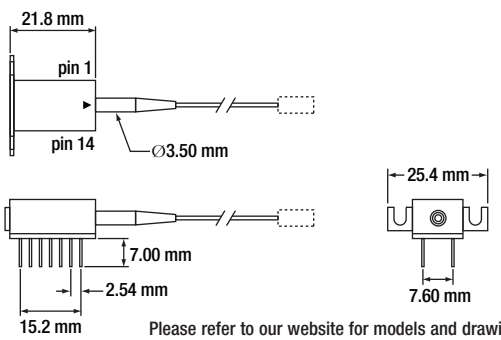


Pin Description

1	+TEC	14	-TEC
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	Dev Cathode
5	Thermistor	10	Dev Anode
6	NC	9	NC
7	NC	8	NC

Features

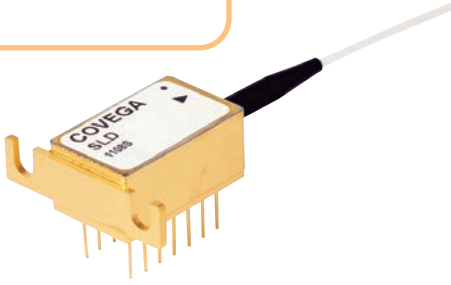
- Standard Butterfly Package
- Integrated TEC Element and Thermistor
- SM Fiber Coupled Output
- FC/APC Connector



Please refer to our website for models and drawings

Pin Description

1	+TEC	14	-TEC
2	NC	13	Case Ground
3	NC	12	Thermistor
4	NC	11	Thermistor
5	SLED	10	NC
6	NC	9	SLED Cathode
7	PD Cathode	8	PD Anode



SLD1108S

Optical-Electrical Characteristics

ITEM#		SLD1108S			SLD1005S			SLD1005SXL		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1530 nm	1550 nm	1570 nm	1530 nm	1550 nm	1570 nm	1535 nm	1550 nm	1565 nm
ASE Power		2 mW	2.5 mW	–	20 mW	22 mW	–	22 mW	–	–
Optical Bandwidth	BW	85 nm	90 nm	–	45 nm	50 nm	–	55 nm	–	–
RMS Gain Ripple	ΔG	–	–	0.25 dB	–	0.2 dB	0.35 dB	–	0.2 dB	0.35 dB
Operating Current	I_{OP}	–	450 mA	550 mA	–	600 mA	800 mA	–	600 mA	800 mA
Forward Voltage	V_F	–	1.6 V	2.0 V	–	1.4 V	1.6 V	–	1.4V	1.6 V

ITEM#	$	£	€	RMB	DESCRIPTION
SLD1108S	$ 1,450.00	£ 1,005.00	€ 1.287,50	¥ 12,244.00	2 mW SLD, CWL = 1550 nm, DIL Pkg, SM Fiber, FC/APC
SLD1005S	$ 1,677.50	£ 1,163.00	€ 1.489,50	¥ 14,165.00	20 mW SLD, CWL= 1550 nm, Butterfly Pkg, SM Fiber, FC/APC
SLD1005SXL	$ 3,355.00	£ 2,326.00	€ 2.978,50	¥ 28,330.00	22 mW SLD, CWL= 1550 nm, Butterfly Pkg, SM Fiber, FC/APC

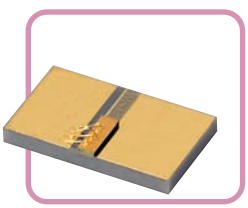
Fabry-Perot Lasers Selection Guide

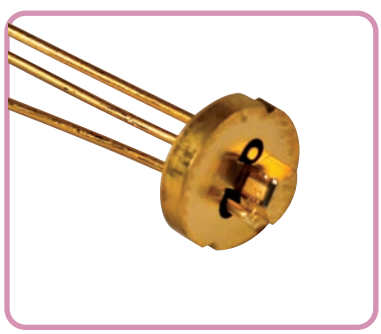
Pages 1161-1164

Pigtailed Fabry-Perot Lasers

- Coupled into Single Mode Fiber
- 1310 nm, 1550 nm, and 1625 nm Wavelengths Available
- Use in Continuous Wave (CW) or Pulse Mode

See Page 1162

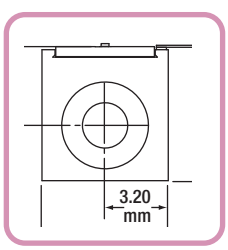


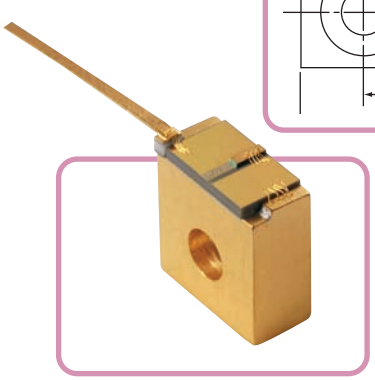


Chips on Submounts and TO Headers

- 1310 nm, 1550 nm, 1625 nm, and 1650 nm Wavelengths Available
- Use in Continuous Wave (CW) or Pulse Mode
- High-Power Output >225 mW (Pulsed)

See Page 1163



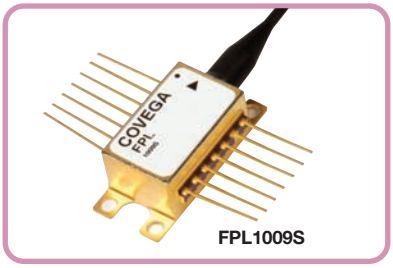


Broad-Area Lasers

- 1208 nm, 3W; 1400 nm, 2 W
- 100 µm Strip Width
- Assembled on C-Mount

See Page 1164

Fiber-Pigtailed Laser Diodes

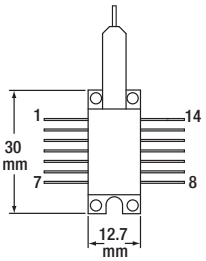


14-Pin Butterfly Fabry-Perot Lasers

NEW products

1550 nm Fabry-Perot Lasers – Standard and XL Series with SM or PM Fiber

The FPL1009S and FPL1009P are high-power fiber-coupled Fabry-Perot Lasers made by Covega, Thorlabs Quantum Electronics. These butterfly packaged lasers are coupled to 1.5 m of FC/APC connectorized SM and PM fiber, respectively. An integrated thermistor allows these lasers to be temperature controlled, thus stabilizing the lasing wavelength and power. The XL versions of these lasers are premium-grade, hand-picked devices offering the highest power.



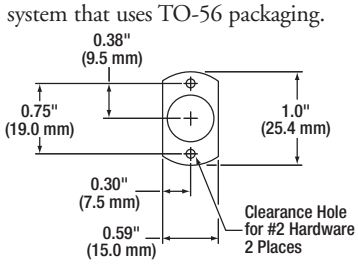
Pin	Description	Pin	Description
1	TEC Anode	14	TEC Cathode
2	Thermistor	13	Case
3	NC	12	NC
4	NC	11	LD Cathode
5	Thermistor	10	LD Anode
6	NC	9	NC
7	NC	8	NC

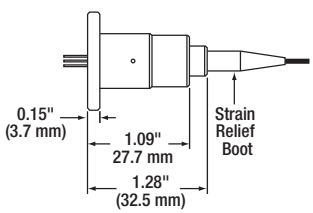
ITEM#		FPL1009SXL / FPL1009PXL			FPL1009S / FPL1009P		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1530 nm	1550 nm	1570 nm	1530 nm	1550 nm	1570 nm
Spectral Bandwidth (rms)	BW	–	–	18 nm	–	10 nm	20 nm
Output Power @ IOP	I_{OP}	100 mW	–	–	80 mW	100 mW	–
Slope Efficiency		0.2 W/A	0.3 W/A	–	0.2 W/A	0.3 W/A	–
Threshold Current	I_{TH}	–	38 mA	45 mA	–	35 mA	55 mA
Operating Current	I_{CW}	–	400 mA	500 mA	–	400 mA	500 mA
Forward Voltage	V_F	–	1.4 V	1.6 V	–	1.4 V	1.6 V

ITEM#	$	£	€	RMB	DESCRIPTION
FPL1009S	$ 1,270.00	£ 880.40	€ 1.127,60	¥ 10,724.00	Fabry-Perot Laser, 1550 nm, 80 mW, SM Fiber, Butterfly Package
FPL1009P	$ 1,402.50	£ 972.24	€ 1.245,00	¥ 11,843.00	Fabry-Perot Laser, 1550 nm, 80 mW, PM Fiber, Butterfly Package
FPL1009SXL	$ 2,540.00	£ 1,761.00	€ 2.255,00	¥ 21,448.00	Fabry-Perot Laser, 1550 nm, 100 mW, SM Fiber, Butterfly Package
FPL1009PXL	$ 2,805.00	£ 1,944.50	€ 2.490,50	¥ 23,686.00	Fabry-Perot Laser, 1550 nm, 100 mW, PM Fiber, Butterfly Package

Pigtailed Fabry-Perot Laser

The LPSC-1310-FC, LPSC-1550-FC, and LPSC-1625-FC are pigtailed versions of Covega's TO-56 fabry-perot lasers that have 1m of fiber terminated with an FC/PC connector. These economical lasers do not include a TEC controller and can be integrated into any system that uses TO-56 packaging.






LPSC-1310-FC

Bracket for TO Pigtails

The LPS pigtailed lasers may be conveniently mounted to a breadboard or a TR post using a PTLB1 Fiber Pigtail Bracket. The universal design allows the L-bracket to be used with both imperial and metric components. The PTLB1 has a 13/30"-40 tap through the center of the mounting area, allowing the end user to plug the pigtail into an SR9 Cable and connect to an LD driver (see page 1176).

ITEM#	$	£	€	RMB	DESCRIPTION
PTLB1	$ 22.00	£ 15.30	€ 19,60	¥ 185.80	Fiber Pigtail L-Bracket

ITEM#		LPSC-1310-FC			LPSC-1550-FC			LPSC-1625-FC		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1290 nm	1310 nm	1330 nm	1530 nm	1550 nm	1570 nm	1605 nm	1625 nm	1645 nm
Spectral Bandwidth (rms)	BW	–	5 nm	8 nm	–	6 nm	10 nm	–	7 nm	12 nm
Output Power Pulsed @ I_{PULSE}	P_{PULSED}	120 mW	–	–	85 mW	–	–	75 mW	–	–
Output Power CW @ I_{CW}	P_{CW}	60 mW	80 mW	–	40 mW	50 mW	–	40 mW	50 mW	–
Threshold Current	I_{TH}	–	30 mA	50 mA	–	40 mA	50 mA	–	45 mA	55 mA
Operating Current Pulsed*	I_{PULSE}	–	750 mA	1000 mA	–	750 mA	1000 mA	–	750 mA	1000 mA
Operating Current CW	I_{CW}	–	400 mA	500 mA	–	400 mA	500 mA	–	400 mA	500 mA
Forward Voltage	V_F	–	2.0 V	3.0 V	–	2.0 V	3.0 V	–	2.0 V	3.0 V

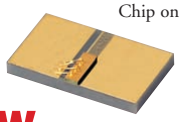
*Pulse width = 10 µs; Duty Cycle = 1%

ITEM#	$	£	€	RMB	DESCRIPTION
LPSC-1310-FC	$ 621.00	£ 430.50	€ 551,40	¥ 5,243.80	Fabry-Perot Laser, 1310 nm, 60 mW, SM Fiber, Pigtailed TO Package
LPSC-1550-FC	$ 685.00	£ 474.90	€ 608,20	¥ 5,784.20	Fabry-Perot Laser, 1550 nm, 40 mW, SM Fiber, Pigtailed TO Package
LPSC-1625-FC	$ 685.00	£ 474.90	€ 608,20	¥ 5,784.20	Fabry-Perot Laser, 1625 nm, 40 mW, SM Fiber, Pigtailed TO Package

Fabry-Perot Lasers, Chips on Submounts and TO Headers

The Fabry-Perot Laser products from Covega, Thorlabs Quantum Electronics, are reliable laser diodes based on high-power Multiple Quantum Well (MQW), InP ridge waveguide devices. These diodes, optimized for 1300-1650 nm operation, can be used in either continuous wave (CW) or pulsed operation. Each Fabry-Perot Laser is available as chip-on-submount (CoS) or chip-on-TO-56 header. The TO-56 header option is a Ø5.6 mm header, featuring an anode pin, cathode pin, and an unused pin.

FPL1054C
Chip on Submount



NEW products

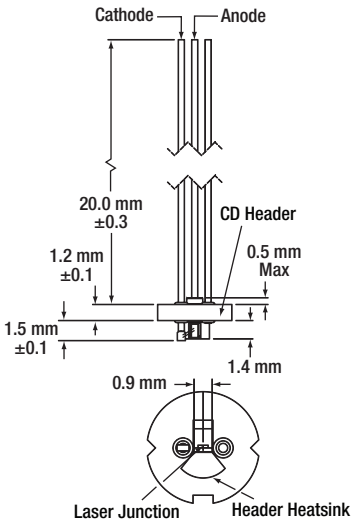
FPL1059T
Chip on TO Header

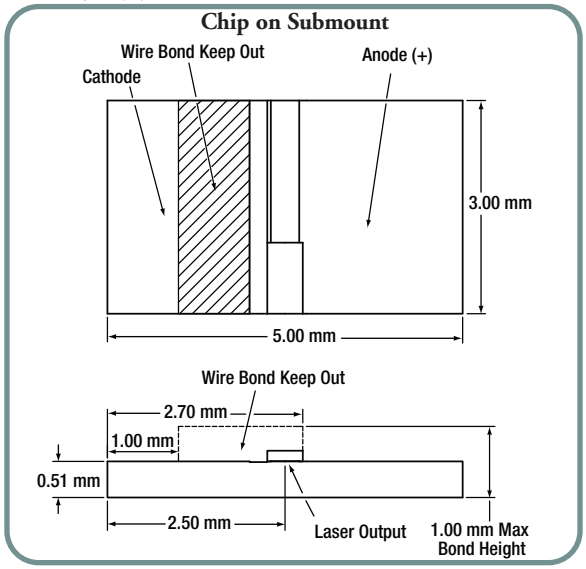
Optical-Electrical Characteristics

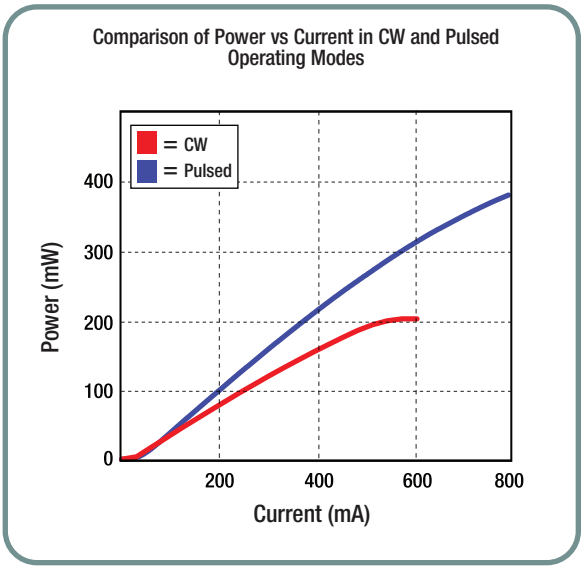
ITEM#		FPL1053C/FPL1053T			FPL1055C/FPL1055T		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1290 nm	1310 nm	1330 nm	1530 nm	1550 nm	1570 nm
Spectral Bandwidth (rms)	BW	–	5 nm	8 nm	–	6 nm	10 nm
Output Power Pulsed @ I_{PULSE}	P_{PULSED}	300 mW	–	–	300 mW	–	–
Output Power CW @ I_{CW}	P_{CW}	160 mW	–	–	140 mW	–	–
Threshold Current	I_{TH}	–	30 mA	50 mA	–	40 mA	50 mA
Operating Current Pulsed[1]	I_{PULSE}	–	750 mA	1000 mA	–	750 mA	1000 mA
Operating Current CW	I_{CW}	–	400 mA	500 mA	–	400 mA	500 mA
Forward Voltage	V_F	–	2.0 V	3.0 V	–	2.0 V	3.0 V
Transverse Far Field Angle[2] (FWHM)	θ_T	–	27°	33°	–	28°	33°
Lateral Far Field Angle[2] (FWHM)	θ_L	–	15°	23°	–	15°	23°

ITEM#		FPL1054C/FPL1054T			FPL1059C/FPL1059T		
Parameter	Symbol	Min	Typical	Max	Min	Typical	Max
Center Wavelength	λ	1605 nm	1625 nm	1645 nm	1630 nm	1650 nm	1670 nm
Spectral Bandwidth (rms)	BW	–	7 nm	12 nm	–	7 nm	12 nm
Output Power Pulsed @ I_{PULSE}	P_{OUT}	250 mW	–	–	225 mW	–	–
Output Power CW @ I_{CW}	P_{CW}	130 mW	–	–	125 mW	–	–
Threshold Current	I_{TH}	–	45 mA	55 mA	–	50 mA	60 mA
Operating Current Pulsed*	I_{OP}	–	750 mA	1000 mA	–	750 mA	1000 mA
Operating Current CW	I_{CW}	–	400 mA	500 mA	–	400 mA	500 mA
Forward Voltage	V_F	–	2.0 V	3.0 V	–	2.0 V	3.0 V
Transverse Far Field Angle**(FWHM)	θ_T	–	28°	33°	–	28°	33°
Lateral Far Field Angle** (FWHM)	θ_L	–	15°	23°	–	15°	23°

*Pulse width = 10 µs; Duty Cycle = 1% **CW @ 400 mA







ITEM#	$	£	€	RMB	DESCRIPTION
FPL1053C	$ 250.00	£ 173.40	€ 222,00	¥ 2,111.10	Fabry-Perot Laser, 1310 nm, Chip on Submount
FPL1053T	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	Fabry-Perot Laser, 1310 nm, Chip on TO Header
FPL1055C	$ 250.00	£ 173.40	€ 222,00	¥ 2,111.10	Fabry-Perot Laser, 1550 nm, Chip on Submount
FPL1055T	$ 350.00	£ 242.70	€ 310,80	¥ 2,955.50	Fabry-Perot Laser, 1550 nm, Chip on TO Header
FPL1054C	$ 275.00	£ 190.70	€ 244,20	¥ 2,322.20	Fabry-Perot Laser, 1625 nm, Chip on Submount
FPL1054T	$ 385.00	£ 266.90	€ 341,90	¥ 3,251.00	Fabry-Perot Laser, 1625 nm, Chip on TO Header
FPL1059C	$ 300.00	£ 208.00	€ 266,40	¥ 2,533.30	Fabry-Perot Laser, 1650 nm, Chip on Submount
FPL1059T	$ 420.00	£ 291.20	€ 372,90	¥ 3,546.50	Fabry-Perot Laser, 1650 nm, Chip on TO Header

Broad-Area Lasers

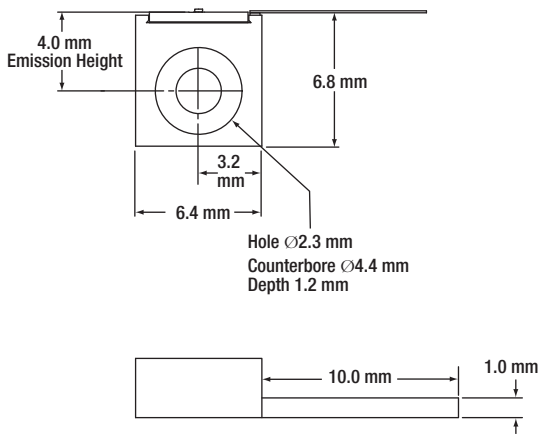
BAL1112
Broad-Area Laser on C-mount

Features

- 100 µm Strip Width
- High Power CW operation
  - 2 W @ 1400 nm
  - 2.5 W @ 1208 nm
- Available as Chip on C-mount

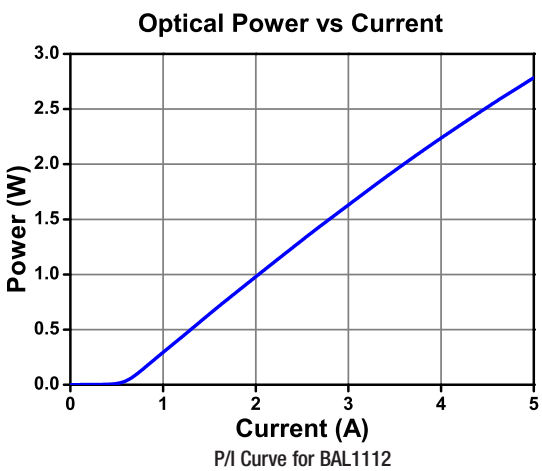
Thorlabs offers two IR Broad-Area Lasers. The Broad-Area Laser products from Covega,Thorlabs Quantum Electronics, are reliable Fabry-Perot (FP) laser diodes based on a high-power InP ridge waveguide device design, combined with a Multiple Quantum Well (MQW) chip optimized for 1200 nm or 1400 nm. Product features include high output power in excess of 1.8 W for the 1400 nm chip and in excess of 2.7 W for the 1200 nm chip. In addition to the advanced ridge waveguide technology, these devices also benefit from the advanced epitaxial wafer growth techniques and die bonding processes.

Covega's family of devices are used as optical sources for free-space optical wireless systems and as laser transmitters for eye-safe remote sensing applications. Additional packaging options such as fiber-pigtailed TO cans, butterfly packaging, chip on TO header, and chip-on-submount (CoS) are available upon request.

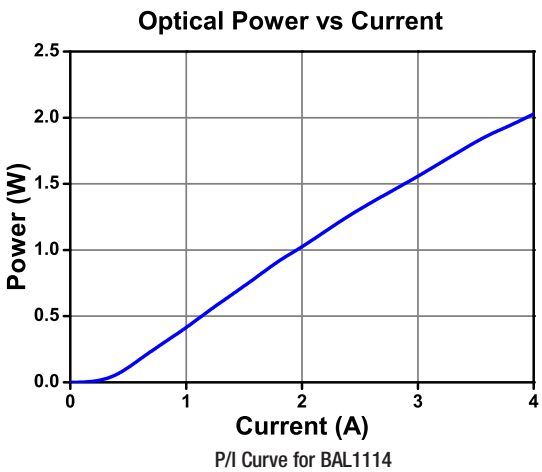


Optical-Electrical Characteristics

ITEM#		BAL1112			BAL1114		
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Min**	**Typical**	**Max**
Center Wavelength	λ	1188 nm	1208 nm	1228 nm	1380 nm	1400 nm	1420 nm
Spectral Bandwidth (rms)	BW	–	1.5 nm	5 nm	–	3 nm	6 nm
CW Output Power	P_{CW}	2.5 W	3 W	–	1.8 W	2 W	–
Operating Current	I_{OP}	–	5 A	7 A	–	4 A	5 A
Threshold Current	I_{TH}	–	0.6 A	0.75 A	–	0.33 A	0.4 A
Slope Efficiency		0.5 W/A	0.6 W/A	–	0.48 W/A	0.55 W/A	–
Operating Voltage	V_F	–	1.33 V	1.6 V	–	1.22 V	1.5 V
EO Efficiency		35 %	40 %	–	35 %	40 %	–
Vertical Farfield (FWHM)	θ_T	21 °C	26 °C	31 °C	31 °C	36 °C	41 °C
Lateral Farfield ($1/e^2$)	θ_L	15 °C	20 °C	25 °C	12 °C	17 °C	22 °C



P/I Curve for BAL1112

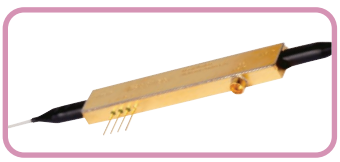


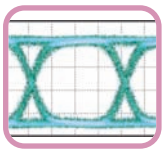
P/I Curve for BAL1114

ITEM#	$	£	€	RMB	DESCRIPTION
BAL1112CM	$ 650.00	£ 450.60	€ 577,10	¥ 5,488.70	1208 nm, 3 W, Broad-Area Fabry-Perot Laser on C-Mount
BAL1114CM	$ 650.00	£ 450.60	€ 577,10	¥ 5,488.70	1400 nm, 2 W, Broad-Area Fabry-Perot Laser on C-Mount

Optical Modulators Selection Guide

Pages 1165-1173

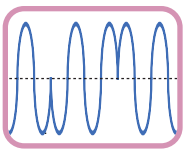


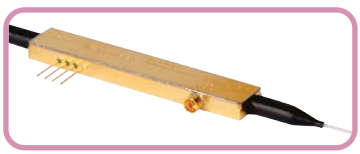


10 GHz Intensity Modulators

- Mach-Zehnder Interferometer Design
- Available in Zero and Fixed-Chirp Design
- Supports Data Rates up to 12.5 Gb/s

See Pages 1166-1167

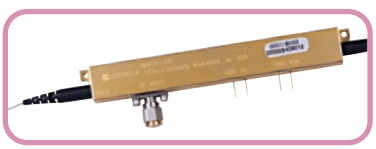


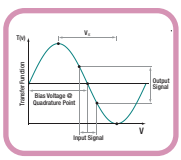


10 GHz Phase Modulator

- Ideal for Coherent Communication and Sensing
- Available with and without Output Polarizer
- Supports Data Rates up to 12.5 Gb/s

See Page 1168





20 GHz, Low V_π Analog Intensity Modulator

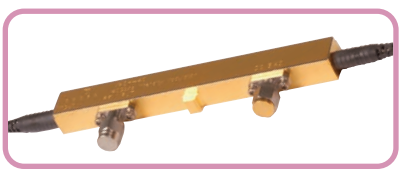
- Low V_π < 3.9 V
- Ideal for Microwave Photonics and Remote Sensing
- Supports Bandwidths up to 20 GHz

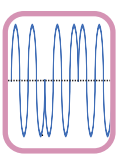
See Page 1169

40 GHz Intensity Modulators

- Fixed-Chirp Coefficient of ±0.7
- Ideal for NRZ and RZ Data Formats
- Supports Data Rates up to 40 Gb/s

See Page 1170

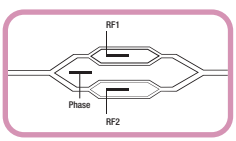


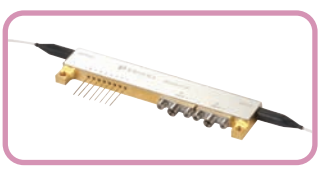


40 GHz Phase Modulators

- Ideal for Coherent Communication and Sensing
- Available with and without Output Polarizer
- Supports Data Rates up to 40 Gb/s

See Page 1170

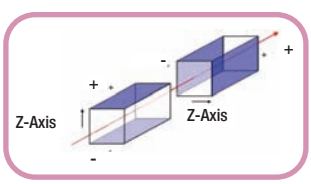




40 GHz DQPSK Modulator

- Ideal for QPSK or 4QAM Modulations
- Two Mach-Zehnder Modulators and a Phase Controller
- Supports Data Rates up to 20 Gb/s in Each Channel

See Page 1171



Free Space Amplitude and Phase Modulators

- Free-Space $LiNbO_3$ Amplitude Modulators
- Free-Space $LiNbO_3$ Phase Modulators
- High Voltage Amplifier

See Pages 1172-1173

10 GHz Intensity Modulators (Page 1 of 2)

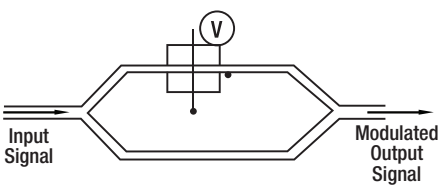
LN63S
10 GHz Phase Modulator

Thorlabs' 10 Gb/s Intensity Modulators are made from Titanium-Indiffused Lithium Niobate Modulators from Covega, Thorlabs Quantum Electronics. All of these high-performance optical modulators are designed for simple system integration to benefit customers developing high-speed modulation systems. These high-performance 10 GHz (10 Gb/s) modulators, which have an extremely small footprint and profile, feature a single-ended drive configuration with separate DC bias pins.

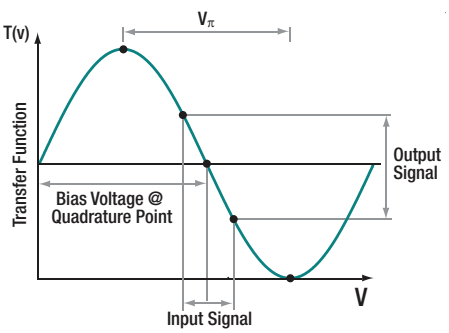
All modulators are based on a Titanium-indiffused $LiNbO_3$ structure and packaged in a hermetic housing with PM fiber and SM fiber pigtails on the device input and output, respectively. The pigtails are connectorized with FC/PC and SC/PC connectors. Please note that polarization-maintaining fiber and a full range of connectorization options are available for all Lithium Niobate Modulators; contact our Technical Support Team for assistance and details. Within the set of Intensity Modulators, Fixed-Chirp and Zero-Chirp devices are offered for dispersion control.

Mach-Zehnder Modulator Operation

Applying a voltage across one arm of the Mach-Zehnder modulator shifts the phase of the signal through that arm by an amount proportional to the voltage applied. If the phase shift equates to an integral number of wavelengths, the two beams will combine constructively and the intensity of the output power will be at its maximum. If the phase shift is a half wavelength out of phase, the two beams will combine destructively and the output power will be at its minimum.



Schematic Diagram of a Mach-Zehnder Modulator



Transfer Function of a Mach-Zehnder Modulator

Fixed-Chirp Modulators

Thorlabs offers two types of Z-Cut, Fixed-Chirp Modulators for signal control: LN63S and LN82S have an integrated photodetector, while LN83S has an integrated Variable Optical Attenuator. The LN63S and LN82S Intensity Modulators are equipped with SMP and GPO connectors, respectively.

The photodetectors integrated into LN63S and LN82S have a sensitivity range of at least 15 dB and enable optical power monitoring and modulator bias control, thereby eliminating the need for an external fiber tap and splicing. The Variable Optical Attenuator integrated into LN83S has an active attenuation range in excess of 15 dB; the attenuator enables dynamic channel equalization by active attenuation of optical output power. These features and levels of integration give designers of NRZ and RZ data format modulation systems an ideal set of components and tools to create modulation systems.

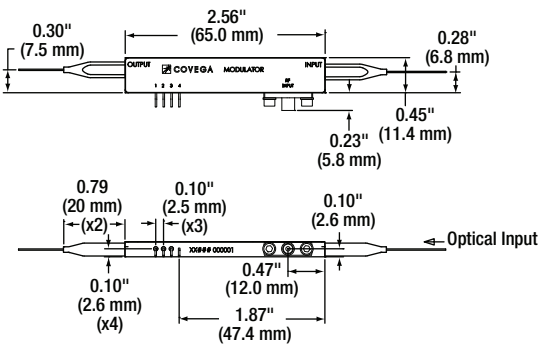
ITEM#		LN63S / LN82S / LN83S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dB)	$f_{c\text{-}3dB}$	10.0 GHz	–	–
Bit Rate Frequency	f_{BR}	9.953 Gbs	–	12.5 Gbs
Optical On/Off Extinction Ratio	E.R.	20 dB	–	–
Optical Extinction Ratio (PRBS)	E.R.	13 dB	–	–
Chirp Parameter (Fixed / Zero Chirp)	|α|	0.6 / -0.1 GHz	–	0.8 / 0.1 GHz
Optical Insertion Loss (Connectorized)	I.L.	–	4.0 dB	5.0 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB
Optical Return Loss		40 dB	–	–
Operating Wavelength	λ	1525 nm	–	1605 nm
S11 (DC to 10 GHz)		–	-12 dB	-10 dB
RF Drive Voltage (PRBS)	V_{PRBS}	–	5.5 V	6.0 V
V_π @ DC		–	3.0 V	8.0 V
DC Bias Voltage Range (EOL)	V_{BIAS}	-8.0 V	–	8.0 V
PD Responsitivity (Ref. to Output Power)		0.1 A/W	–	0.5 A/W
Output Optical Power Monitoring		-5 dBm	–	10 dBm
Output Monitor Variation		-0.5 dB	–	0.5 dB
Monitor Photodiode Reverse Bias Voltage		-5.5 V	–	-3.0 V
Vp Attenuator Port (@DC)		0.1 V	–	0.5 V
VOA Control Voltage Range (EOL)		-5 V	–	10 V
Attenuation Range		-0.5 dB	–	0.5 dB

10 GHz Intensity Modulators (Page 2 of 2)

Zero-Chirp Modulators

Covega, Thorlabs Quantum Electronics, offers two Zero-Chirp 10 Gb/s Intensity Modulators. These modulators have a Mach-Zehnder interferometric architecture and offer a large bandwidth with an industry-leading low RF drive voltage, supporting data rates up to 12.5 Gb/s. The LN56S and LN81S are X-cut Zero-Chirp modulators with an integrated photodetector. The LN81S has a GPO connector, while the LN56S has an SMP connector. The integrated photodetector, which has a sensitivity range of at least 15 dB, enables optical power monitoring and modulator bias control, eliminating the need for an external fiber tap and splicing. The modulators were designed for implementing NRZ and RZ data format modulation systems.

ITEM#		LN56S / LN81S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dBe)	$f_{c\text{-}3dB}$	10.0 GHz	–	–
Bit Rate Frequency	f_{BR}	9.953 GHz	–	12.5 GHz
Optical On/Off Extinction Ratio	E.R.	20 dB	–	–
Optical Extinction Ratio (PRBS)	E.R.	13 dB	–	–
Chirp Parameter (Fixed / Zero Chirp)	|α|	0.6 / -0.1 GHz	–	0.8 / 0.1 GHz
Optical Insertion Loss (Connectorized)	I.L.	–	4.0 dB	5.0 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB
Optical Return Loss		40 dB	–	–
Operating Wavelength	λ	1525 nm	–	1605 nm
S11 (DC to 10 GHz)		–	-12 dB	-10 dB
RF Drive Voltage (PRBS)	V_{PRBS}	–	5.5 V	6.0 V
Vπ @ DC		–	5.5 V	8.0 V
DC Bias Voltage Range (EOL)	V_{BIAS}	-8.0 V	–	8.0 V
PD Responsitivity (ref. to output power)		0.1 A/W	–	0.5 A/W
Output Optical Power Monitoring		-5 dBm	–	10 dBm
Output Monitor Variation		-0.5 dB	–	0.5 dB
Monitor Photodiode Reverse Bias Voltage		-5.5 V	–	-3.0 V



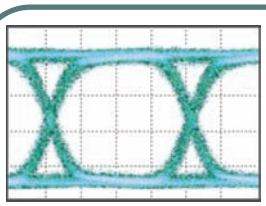
10 GHz Modulator Package Drawing

	LN56S / LN63S LN83S	LN81S / LN82S
RF Input	GPO Connector	SMP Connector
Pin 1	Detector Cathode	Detector Cathode
Pin 2	Detector Anode	Detector Anode
Pin 3	DC Bias Voltage	DC Bias Voltage
Pin 4	Case Ground	Case Ground

OPTICAL PORTS

Input : PM Fiber
Output : SM Fiber

Please refer to our website for complete models and drawings.



The display of a receiver "Eye Pattern" is a convenient graphical method to indicate the data signal quality produced by the communications channel. As one of the first elements in the communication channel, the modulators from Covega, Thorlabs Quantum Electronics, have been Telcordia GR-468-CORE qualified for use in communication systems.

The image is an example "Eye Pattern" produced by a Covega Modulators, showing the oscilloscope trace at the receiver of a two-level modulation scheme such as an "On-Off-Keying" (OOK) signal.

Other connector styles are available, contact Thorlabs

ITEM#	$	£	€	RMB	DESCRIPTION
LN56S-FC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD, FC/PC Connectors
LN56S-SC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD, SC/PC Connectors
LN63S-FC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD, FC/PC Connectors
LN63S-SC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD, SC/PC Connectors
LN81S-FC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD and Replaceable GPO Connector, FC/PC Connectors
LN81S-SC	$ 1,275.00	£ 883.90	€ 1.132,00	¥ 10,767.00	Zero-Chirp, 10 GHz Intensity Modulator, Integrated PD and Replaceable GPO Connector, SC/PC Connectors
LN82S-FC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated PD and Replaceable GPO Connector, FC/PC Connectors
LN82S-SC	$ 1,350.00	£ 935.90	€ 1.198,60	¥ 11,400.00	Fixed-Chirp, 10 GHz Intensity Modulator, and Replaceable GPO Connector, SC/PC Connectors
LN83S-FC	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated Variable Optical Attenuator, FC/PC Connectors
LN83S-SC	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	Fixed-Chirp, 10 GHz Intensity Modulator, Integrated Variable Optical Attenuator, SC/PC Connectors

10 GHz Phase Modulators

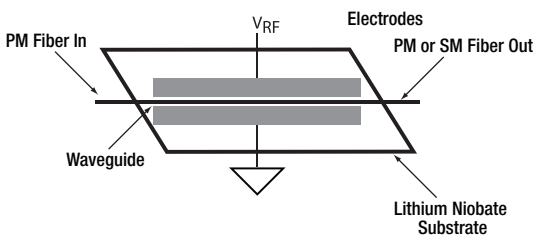
The LN53S and the LN65S are Phase Modulators from Covega, Thorlabs Quantum Electronics. These modulators are high-performance optical modulators with a Titanium-indiffused Lithium Niobate design, which allows for ease of use in high-speed modulation systems.

LN53S
10 GHz Phase Modulator

The LN53S and the LN65S are high-performance 10 GHz (10 Gb/s) phase modulators that have a large bandwidth, allowing for chirp control in high-speed data communication; they can support data rates up to 12.5 Gb/s. These modulators are also ideal for applications in coherent communications, sensing, all-optical frequency-shifting, and data encryption. The LN53S and the LN65S 10 Gb/s Phase Modulators are identical aside from the inclusion of an optical polarizer before the output fiber of the LN65S.

The LN53S and LN65S modulators are based on Z-Cut Titanium-indiffused LiNbO3 and packaged in a hermetic housing with PM and SM fiber pigtails on the device input and output, respectively. The pigtails are connectorized with FC/PC and SC/PC connectors. PM fiber pigtails are available on the device output upon request.

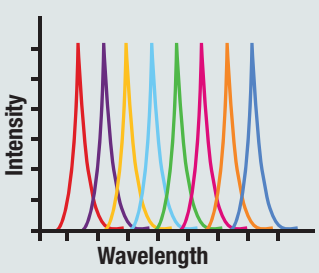
ITEM#		LN53S / LN65S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dB)	$f_{c\text{-}3dB}$	10.0 GHz	–	–
Bit Rate Frequency	f_{BR}	9.953 GHz	–	12.5 GHz
Optical Insertion Loss (Connectorized)	I.L.	–	3.5 dB	4.5 dB
Operating Wavelength	λ	1525 nm	–	1605 nm
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB
Optical Return Loss		40 dB	–	–
S11 (DC to 10 GHz)		–	-12 dB	-10 dB
RF Drive Voltage (PRBS)	V_{PRBS}	–	4.5 V	5.0 V
V_π @ DC		–	3.5 V	4.0 V
Operating Case Temperature		0 °C	–	70 °C
Storage Temperature		-40 °C	–	85 °C



Phase Modulator Waveguide

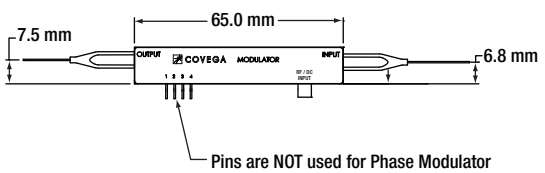
WDM Sources

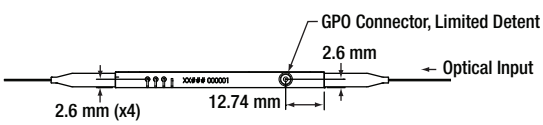
See Pages 1064-1073



Mechanical Drawings Available on the WEB

OPTICAL PORTS
Input : PM Fiber
Output : SM Fiber



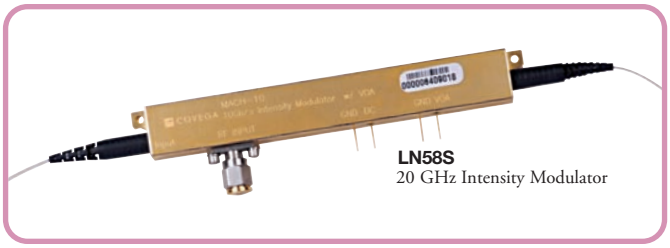


10 GHz Modulator Package Drawing

ITEM#	$	£	€	RMB	DESCRIPTION
LN53S-FC	$ 1,550.00	£ 1,074.50	€ 1.376,00	¥ 13,089.00	10 GHz Phase Modulator without Polarizer, FC/PC Connectors
LN53S-SC	$ 1,550.00	£ 1,074.50	€ 1.376,00	¥ 13,089.00	10 GHz Phase Modulator without Polarizer, SC/PC Connectors
LN65S-FC	$ 1,550.00	£ 1,074.50	€ 1.376,00	¥ 13,089.00	10 GHz Phase Modulator with Polarizer, FC/PC Connector
LN65S-SC	$ 1,550.00	£ 1,074.50	€ 1.376,00	¥ 13,089.00	10 GHz Phase Modulator with Polarizer, SC/PC Connectors

20 GHz Low V_π Analog Intensity Modulator

The LN58S is a 20 GHz Analog Intensity Modulator from Covega, Thorlabs Quantum Electronics. This innovative Titanium-Indiffused Z-cut Lithium Niobate Optical Modulator is designed for ease of system integration to benefit customers developing high-speed analog modulation systems.


LN58S
20 GHz Intensity Modulator

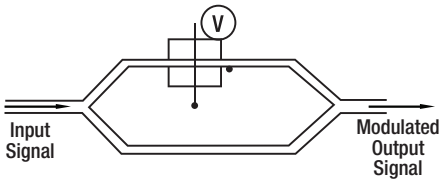
The LN58S Analog Modulator is a high-performance, low V_π, single-ended drive modulator capable of supporting analog signaling up to 20 GHz. The industry-leading, low RF drive and V_π voltages simplify any design based around the LN58S. The LN58S Analog Modulator has a Mach-Zehnder interferometric architecture that offers a large bandwidth, a low drive voltage (V_π < 3.9 V @ 20 GHz), and supports 20 GHz operating frequencies, making it an ideal solution for microwave photonics and fiber optic antenna remote solutions.

The LN58S modulator is based on Z-cut Titanium-indiffused LiNbO3 and packaged in a hermetic housing with a K-connector RF input signal port and PM and SM fiber pigtails on the device input and output, respectively. The fiber pigtails are connectorized with FC/PC and SC/PC connectors.

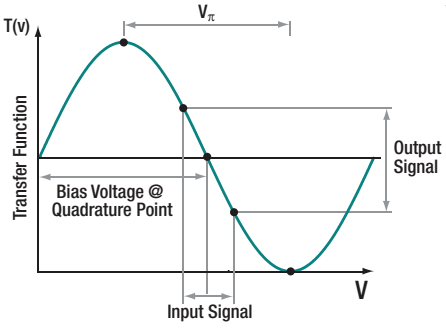
ITEM#		LN58S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dB)	$f_{c\text{-}3dB}$	20 GHz	25 GHz	–
Optical On/Off Extinction Ratio	E.R.	–	20 dB	–
Optical Insertion Loss (Connectorized)	I.L.	–	–	5.5 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	–
Optical Return Loss		–	40 dB	–
Operating Wavelength	λ	1525 nm	–	1605 nm
S11 (DC to 10 GHz)		–	-12 dB	-10 dB
S11 (10 GHz to 20 GHz)		–	-10 dB	-8 dB
V_π @ 20 GHz		–	3.5 V	3.9 V
V_π @ DC		–	1.5 V	2.0 V
Operating Case Temperature		0 °C	–	70 °C
Storage Temperature		-40 °C	–	85 °C

Mach-Zehnder Modulator Operation

The voltage applied to an arm of the Mach-Zehnder modulator shifts the phase of the signal through that arm by an amount proportional to the voltage applied. If the phase shift equates to an integral number of wavelengths, the two beams will combine constructively and the intensity of the output power will be at its maximum. If the phase shift is a half-wavelength out of phase, the two beams will combine destructively, and the output power will be at its minimum.

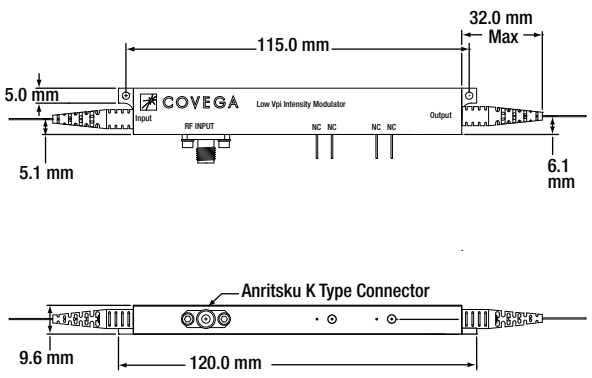


Schematic Diagram of a Mach-Zehnder Modulator



Transfer Function of a Mach-Zehnder Modulator

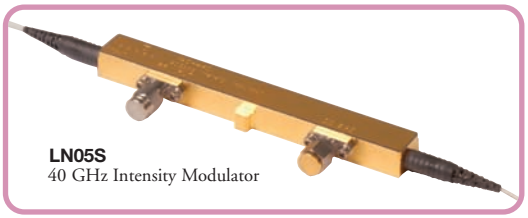
20 GHz Modulator Package Drawing



Mechanical Drawings Available on the WEB

ITEM#	$	£	€	RMB	DESCRIPTION
LN58S-FC	$ 5,250.00	£ 3,640.00	€ 4.661,00	¥ 44,332.00	20 GHz Low V_π Intensity Modulator, FC/PC Connectors
LN58S-SC	$ 5,250.00	£ 3,640.00	€ 4.661,00	¥ 44,332.00	20 GHz Low Vπ Intensity Modulator, SC/PC Connectors

40 GHz Phase and Intensity Modulators



LN05S
40 GHz Intensity Modulator

The LN05S, LN27S, and the LN66S are 40 Gb/s Modulators manufactured by Covega,Thorlabs Quantum Electronics. These three revolutionary, Titanium-indiffused Z-cut Lithium Niobate, high-performance optical modulators were designed for ease of system integration; they offer large bandwidths and are ideal for developing high-speed modulation systems.

The LN05S intensity modulator with external DC bias is a high-performance 40 GHz (40 Gb/s) modulator that has a single-ended drive configuration with a fixed chirp coefficient of ±0.7 and an industry-leading low RF drive voltage. The LN05S has a Mach-Zehnder interferometric architecture with external DC bias, ideal for both NRZ and RZ data format solutions.

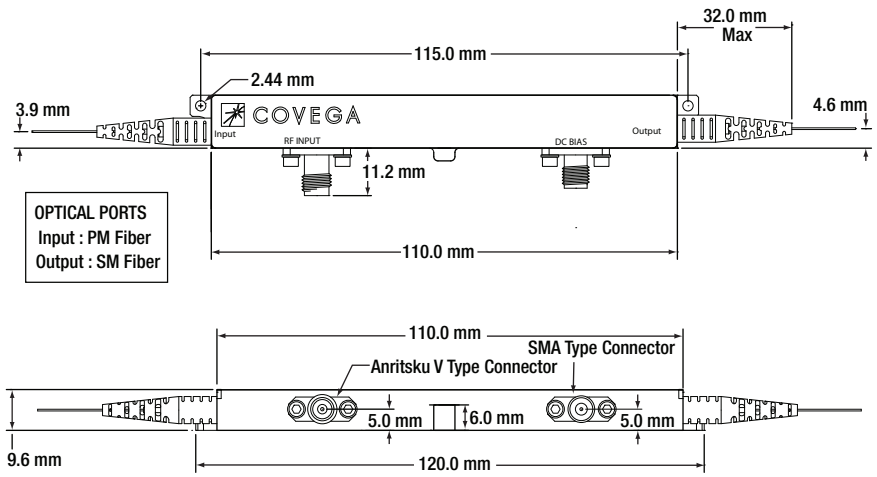
The LN27S and the LN66S are high-performance 40 GHz (40 Gb/s) phase modulators, allowing for chirp control in high-speed data communications; these modulators, which can support data rates up to 43 Gb/s, are also ideal for applications in coherent communications, sensing, all-optical frequency shifting, and data encryption. The LN27S and LN66S modulators both offer internal RF terminations, but the LN27S also offers an optical polarizer not included with the LN66S.

ITEM#		LN05S			LN27S / LN66S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**
E/O Bandwidth (-3 dB)	$f_{c\text{-}3dB}$	30 GHz	35 GHz	–	30 GHz	35 GHz	–
Bit Rate Frequency	f_{BR}	–	40 Gb/s	–	–	40 Gb/s	–
Optical On/Off Extinction Ratio	E.R.	–	20 dB	–	N/A	N/A	N/A
Optical Extinction Ratio (PRBS)		–	13 dB	–	N/A	N/A	N/A
Optical Insertion Loss (Connectorized)	I.L.	–	4.0 dB	5.0 dB	–	4.0 dB	5.0 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB	-0.5 dB	–	0.5 dB
Optical Return Loss		40 dB	–	–	40 dB	–	–
Operating Wavelength	λ	1525 nm	–	1605 nm	1525 nm	–	1605 nm
S11 (DC to 10 GHz)		–	-12 dB	-10 dB	–	-12 dB	-10 dB
S11 (30 GHz to 40 GHz)		–	-10 dB	-8 dB	–	-10 dB	-8 dB
RF Drive Voltage (PRBS)	V_{PRBS}	–	5.5 V	–	–	5.5 V	–
V_{π} @ DC		–	5.5 V	6.0 V	–	5.5 V	6.0 V
Operating Case Temperature		0 °C	–	70 °C	0 °C	–	70 °C
Storage Temperature		-40 °C	–	85 °C	-40 °C	–	85 °C
V-Connector		RF Signal			RF Signal		
SMA Connector		DC Bias Voltage			Not Used / No Connect		

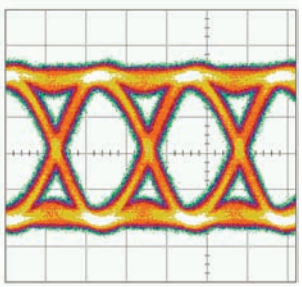
All three modulators are based on Z-cut Titanium-indiffused $LiNbO_3$ and are hermetically packaged in a dual-port housing with PM and SM fiber pigtails on the device input and output, respectively. The fiber pigtails are connectorized with FC/PC and SC/PC connectors.

Please note that polarization-maintaining fiber and a full range of connectorization options are available for all Lithium Niobate Modulators. Contact our Technical Support Team for assistance and details.

40 GHz DQPSK Modulator Package Drawing



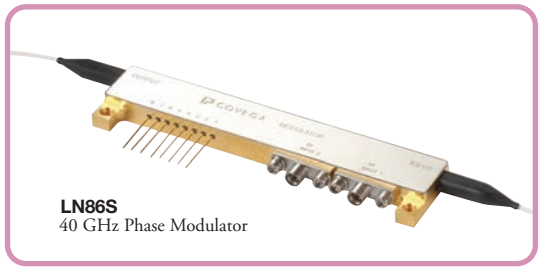
Please refer to our website for complete models and drawings.



The image above is an example "Eye Pattern" produced by Thorlabs Quantum Electronics' Modulators showing the oscilloscope trace of a two-level modulation scheme such as an "On-Off-Keying" (OOK) signal. The modulators have been Telcordia GR-468-CORE qualified for use in communication systems.

ITEM#	$	£	€	RMB	DESCRIPTION
LN05S-FC	$ 4,850.00	£ 3,363.00	€ 4.306,00	¥ 40,954.00	40 GHz Intensity Modulator, FC/PC Connectors
LN05S-SC	$ 4,850.00	£ 3,363.00	€ 4.306,00	¥ 40,954.00	40 GHz Intensity Modulator, SC/PC Connectors
LN66S-FC	$ 4,350.00	£ 3,016.00	€ 3.862,00	¥ 36,732.00	40 GHz Phase Modulator without Polarizer, FC/PC Connectors
LN66S-SC	$ 4,350.00	£ 3,016.00	€ 3.862,00	¥ 36,732.00	40 GHz Phase Modulator without Polarizer, SC/PC Connectors
LN27S-FC	$ 4,350.00	£ 3,016.00	€ 3.862,00	¥ 36,732.00	40 GHz Phase Modulator with Polarizer, FC/PC Connectors
LN27S-SC	$ 4,350.00	£ 3,016.00	€ 3.862,00	¥ 36,732.00	40 GHz Phase Modulator without Polarizer, SC/PC Connectors

40 GHz DQPSK/4QAM Modulator

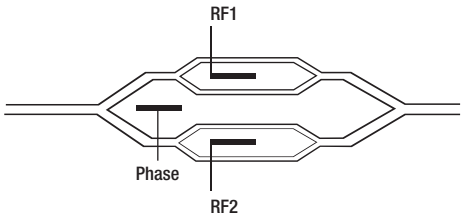


LN86S
40 GHz Phase Modulator

The LN86S Titanium-Indiffused X-Cut Lithium Niobate Modulator, a Dual-Parallel Modulator, is the latest addition to Covega's high-performance offerings. It is capable of providing a 40 Gb/s signaling rate and offers a large bandwidth to benefit customers developing high-speed modulation systems. Each Mach-Zehnder Interferometer (MZI) has an independently controlled bias section to achieve maximum performance.

The front end of the modulator is a phase modulator to allow for the required phase control in the signal channel. The back end of the modulator consists of two MZIs in parallel. Each MZI is an intensity modulator with separate external DC bias controls, giving the user the ability to perform multi-level signaling. The LN86S is designed for quadrature modulation (QPSK or 4QAM) and single side-band suppressed carrier (SSB-SC) transmission.

The LN86S modulator is part of a family of high-performance, Telcordia-compliant external optical modulators with industry-leading long-term stability. This modulator is hermetically packaged in a durable housing with PMF and SMF fiber pigtails on the device input and output, respectively. The standard device has fiber pigtails connectorized with FC/PC and SC/PC connectors.



System Diagram of a Dual Parallel Modulator

Mach-Zehnder Modulator Operation

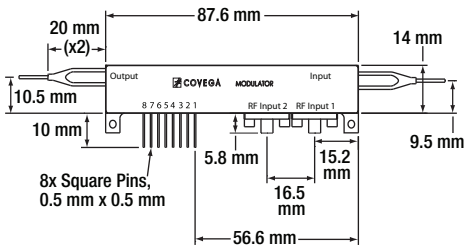
In this dual-parallel modulator, the incoming signal is equally split into two legs and sent through a low speed phase modulator. The phase modulator serves the purpose of applying a phase delay between the legs. The signals in each leg are then sent through separate intensity modulators. Each intensity modulator is modulated with a DPSK format. The outputs of each intensity modulator's legs are re-combined to form the output signal of the dual-parallel modulator. This resultant re-combined signal forms a DQPSK signal through the interference effects.

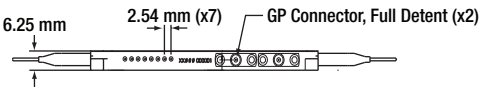
ITEM#		LN86S		
Parameter	**Symbol**	**Min**	**Typ**	**Max**
Optical Extinction Ratio (@ DC)*	E.R.	20 dB	–	–
Optical Insertion Loss (Connectorized)	I.L.	–	5 dB	6 dB
Insertion Loss Variation (EOL)	ΔI.L.	-0.5 dB	–	0.5 dB
Optical Return Loss		–	–	40 dB
Operating Wavelength	λ	1525 nm	–	1575 nm
Operating Case Temperature TCASE		0 °C	–	70 °C
Storage Temperature		-40 °C	–	85 °C
Vpi RF Ports (@ DC)		–	2.5 V	4.5 V
Vπ RF Ports (@ 1 GHz)		–	4.5 V	6 V
Vπ Bias Ports (@ 1 GHz)		–	4.5 V	5.5V
RF Port S11		–	-12 dB	-10 dB
RF Parameters				
E/O Bandwidth (-3 dB)	$f_{c\text{-}3dB}$	16.0 GHz	–	–
S21 Amplitude Ripple**		-1.5 dB	–	-1.5 dB
S21 Phase Difference		10°	–	10°
Phase Ripple		10°	–	10°
Differential RF Delay		-5 ps	–	5 ps
Phase Modulator				
DC Input V_π		–	–	6 V
E/O Bandwidth		1 MHz	–	–
RF Detectors				
Threshold		–	–	0.5 V
Slope		0.1 V/V_{pp}	–	0.4 V/V_{pp}
Linearity		-5 %	–	5 %

*per MZI E.R. **(50 MHz to 20 GHz)

40 GHz DQPSK Modulator Package Drawing

	LN86S
1	RF2 Detector (-ve)
2	RF2 Detector (+ve)
3	RF1 Detector (-ve)
4	RF1 Detector (+ve)
5	RF2 Bias (Electrode 2)
6	RF1 Bias (Electrode 1)
7	Phase Modulator
8	Ground





Please refer to our website for complete models and drawings.

ITEM#	$	£	€	RMB	DESCRIPTION
LN86S-FC	$ 4,850.00	£ 3,363.00	€ 4.306,00	¥ 40,954.00	40 GHz DQPSK Modulator, FC/PC Connectors
LN86S-SC	$ 4,850.00	£ 3,363.00	€ 4.306,00	¥ 40,954.00	40 GHz DQPSK Modulator, SC/PC Connectors

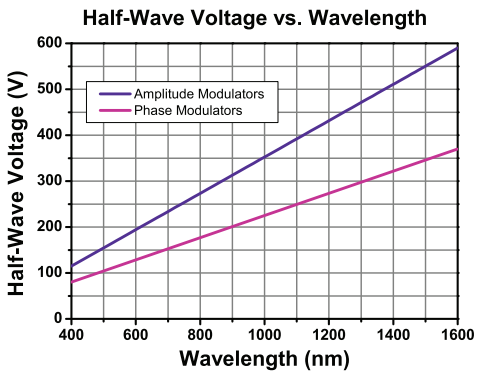
Electro-Optic Modulators (Page 1 of 2)

EO-PM-NR-C1

Features

- High Performance in a Compact Package
- Broadband DC Coupled
- Broadband AR Coatings
- Ø2 mm Clear Aperture
- SMA Female Modulation Input Connector
- DC to 100 MHz
- Custom Versions Available
- #8-32 Tapped Hole on Bottom

Thorlabs' free-space electro-optic amplitude and phase modulators use undoped lithium niobate. These broadband DC-coupled modulators have an SMA RF input, which is directly compatible with our HVA200 high voltage amplifier. The HVA200 is capable of modulating these EO devices up to 1 MHz.

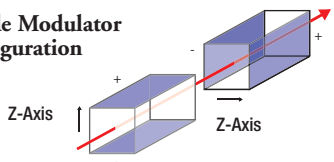


SPECIFICATION	Amplitude Modulators (EO-AM)	Phase Modulators (EO-PM)
Wavelength Range		
C4	400-600 nm	400-600 nm
C1	600-900 nm	600-900 nm
C2	900-1250 nm	900-1250 nm
C3	1250-1650 nm	1250-1650 nm
Clear Aperture	Ø2 mm	Ø2 mm
Electrical Input	Female SMA	Female SMA
Max Optical Power Density	2 W/mm² @ 532 nm 4 W/mm² @ 1064 nm	2 W/mm² @ 532 nm 4 W/mm² @ 1064 nm
Half-Wave Drive Voltage, Vπ	360 V @ 1064 nm (Typ)	240 V @ 1064 nm (Typ)
Capacitance (Typ)	14 pF	14 pF

EO Amplitude Modulator

The electro-optic amplitude modulators (EO-AM), which are Pockels cell type modulators, consist of two matched lithium niobate crystals packaged in a compact housing with an RF input connector. Applying an electric field to the crystal induces a change in the indices of refraction (both ordinary and extraordinary), giving rise to an electric field-dependent birefringence, which leads to a change in the polarization state of the optical beam. The EO crystal acts as a variable wave plate whose retardance is linearly dependent on the applied electric field. By placing a linear polarizer at the exit, the beam intensity through the polarizer varies sinusoidally with a linear change in applied voltage.

EO Amplitude Modulator Crystal Configuration



ITEM#	$	£	€	RMB	DESCRIPTION
EO-AM-NR-C4	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Amplitude Modulator, 400-600 nm
EO-AM-NR-C1	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Amplitude Modulator, 600-900 nm
EO-AM-NR-C2	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Amplitude Modulator, 900-1250 nm
EO-AM-NR-C3	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Amplitude Modulator, 1250-1650 nm

EO Phase Modulator

Our electro-optic phase modulators provide a variable phase shift on the linearly polarized input beam. The input beam is linearly polarized along the vertical direction, which is the Z-axis of the crystal. A voltage at the RF input is applied across the Z-axis electrodes inducing a change in the crystal's extraordinary index of refraction and thereby causing a phase shift in the optical signal.

The control signal may be a DC or a time-varying RF signal. When the control voltage is a time varying signal, the optical beam undergoes frequency modulation whereby some of the energy at the fundamental frequency is converted into sidebands separated from the fundamental frequency by integer multiples of the modulating frequency. The amount of energy converted into sidebands is determined by the depth of modulation.

ITEM#	$	£	€	RMB	DESCRIPTION
EO-PM-NR-C4	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Phase Modulator, 400-600 nm
EO-PM-NR-C1	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Phase Modulator, 600-900 nm
EO-PM-NR-C2	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Phase Modulator, 900-1250 nm
EO-PM-NR-C3	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	Electro-Optic Phase Modulator, 1250-1650 nm

Electro-Optic Modulators (Page 2 of 2)

High Voltage Amplifier for Free-Space EO Modulators

NEW product

The HVA200 High Voltage Amplifier is designed to drive our free-space electro-optic modulators. The amplifier has many features, including a ±200 V output, a continuous current output of 100 mA, a 1 MHz bandwidth, and low noise (1.5 mV_{rms}). The voltage amplifier boosts the input voltage by a factor of -20. The high voltages are needed to drive lithium niobate broadband modulators. An adjustable bias allows for precise DC offset control.

The HVA200 uses a high voltage, wideband, high-slew-rate output amplifier to achieve the desired output. The input amplifier includes a summing junction, which allows an adjustable DC bias to be added to the input modulation. This composite signal is then boosted by a factor of -20 by the output amplifier. For added safety, a front panel HV Enable button must be pressed to connect the HV output to the output BNC. The DC bias control consists of a rotary encoder, which allows precise control and repeatability. The bias adjustment is typically used to shift the DC level of the output as needed by the application.
A voltage monitor output is provided to allow real-time monitoring of the high voltage output. The monitor has a scaling of 20:1 (when used with high impedance detectors) so that an output of 200 V results in a 10 V monitor voltage.

HVA200

Specifications

- ±200 V Output
- 1 MHz Bandwidth
- 400 V/µs Slew Rate
- -20 ± 2% Gain
- 200 mA Pulsed Output Current (100 mA Continuous)

ITEM#	$	£	€	RMB	DESCRIPTION
HVA200	$ 2,346.00	£ 1,626.50	€ 2.083,00	¥ 19,810.00	High Voltage Amplifier for Free-Space EO Modulators

Features

- GTH5M Mounting Adapter for Our Electro-Optic Modulators
- Easily Rotates into and out of Beam Path
- Ø13 mm Aperture for use with GTH5M
- #2-56 Mounting Screw and Washer Included

EO-AM-NR-C2 with EO-GTH5M


EO-PMT

The EO-PMT is a specialty mount designed to hold a Glan Thompson polarizer (see pages 896-897) in front of the input aperture of Thorlabs' Electro-Optic Modulators. The swivel arm design of the EO-PMT allows the polarizer to be easily moved into and out of the beam path, which simplifies the alignment of the beam through the EO modulator. The EO-GTH5M packages the Glan Thompson polarizer (GTH5M) with the mounting adapter.

ITEM#	$	£	€	RMB	DESCRIPTION
EO-PMT	$ 25.50	£ 17.70	€ 22,70	¥ 215.40	EO Modulator Mounting Adapter
EO-GTH5M	$ 357.00	£ 247.50	€ 317,00	¥ 3,014.60	EO Modulator Mounting Adapter with GTH5M Polarizer

FiberTable Adapter for Free-Space EO Modulators

For mounting our free-space EO modulators on our FiberTables (see page 896-897), we offer the FT-EOMA. This mounts the modulator on its side so that the SMA connector for the RF input is vertical for easy access.

Mechanical Drawings Available on the WEB


FT-EOMA


EO Modulator and FiberTable Assembly

ITEM#	$	£	€	RMB	DESCRIPTION
FT-EOMA	$ 45.00	£ 31.20	€ 40,00	¥ 380.00	EO Modulator FiberTable Mounting Adapter

Benchtop Systems: Laser Diode/TEC Controller Overview

Benchtop Solutions

Thorlabs offers benchtop solutions to suit your instrumentation needs, from industrial customers who need to drive and monitor multiple devices simultaneously, to customers who prefer to have all of their instrumentation controlled from one convenient location.

The LDC200C series of laser diode controllers all provide features that ensure outstanding performance. There are seven models with different current ranges, each configured to provide optimal performance for its particular intended laser application.

The laser diode controllers of the LDC200C can be driven in constant current (CC) or constant power (CP) mode. All laser diode and photodiode configuration types are supported.

In comparison to driver designs that require a floating ground, this grounded operation of the laser diode offers advantages regarding noise, transient suppression, and stability.

The LDC4000 Series of Laser Diode Current Controllers provide precise and stable current for driving high-power laser diodes with injection currents up to 20 A. It supports all laser diode and monitor diode pin configurations and features a constant current or constant power mode.

This benchtop controller is designed for stand-alone operation and is controlled via front panel keys and intuitive operation menus on a large and easy-to-read graphic LCD display. Additionally the LDC4000 Series can be fully remote controlled via an SCPI-compatible USB Interface.

Compared to the LDC200C Series, the LDC4000 Series offers higher injection currents plus additional features like the Quasi-Continuous Wave (QCW) operation mode, an internal modulation generator, a thermopile input, laser voltage measurement, and an optical power limit. These features, together with the new design, which offers silent and power-efficient operation, make the LDC4000 Series Laser Diode Controllers an ideal choice for most applications.

The TED200C is a precision temperature controller designed to drive thermoelectric cooler (TEC) elements with currents up to ±2 A. It is equipped with a PID feedback circuit that allows independent setting of the P (proportional) gain, the I (integral) offset control, and the D (differential) rate control, allowing the user to adjust the TED200C to obtain the optimal performance for a wide variety of thermal loads.

The TED4015 is a high-performance digital temperature controller designed to drive thermoelectric cooler (TEC) elements with currents up to ±15 A. It supports most common temperature sensors and can be adapted to different thermal loads.

Compared to the TED200 Series, the TED4015 Series Controller offers a wider TEC current range plus additional features like full digital control, easy auto PID setting, constant TEC current mode, set temperature protection, TEC voltage measurement, and adjustable temperature window protection. These features together with the new design, which offers silent and efficient operation, make the

TED4015 Series Laser Diode Controllers an ideal choice for demanding applications.

The ITC4000 Series combination controller incorporates the LDC4000 series laser diode controller with the TED4015 temperature controller. It has been designed to provide precise and stable current for laser diodes with injection currents from 1 A up to 20 A and an excellent temperature stabilization of
0.002 °C within 24 hrs. It supports all laser diode and monitor diode pin configurations and features a constant current (CC) or constant power (CP) mode. These features, together with the new design, which offers silent and efficient operation, make the ITC4000 Series an ideal choice for most applications.

Driver/Mount Selection Guide

Pages 1175-1230

Benchtop and OEM Laser Diode Current Controllers

- 9 Benchtop Models for Laser Diode Currents from 20 mA to 20 A
- Selection of OEM Drivers for Different Laser Diode PIN Styles and Currents up to 3 A

See Pages 1176-1186

Benchtop and OEM TEC Controllers and Kits

- Highly Stable Low Noise ±2 A and ±15 A Thermoelectric Temperature Controllers
- Complete Kit Including Laser Mount and Other Accessories

See Pages 1186-1191

High-Power Benchtop TEC Controllers and OEM LD/TEC Boards

- 3 Benchtop Combined Current and TEC Controllers for LD Currents of 1 A, 5 A, and 20 A
- 3 OEM Combined Current and TEC Controllers for LD Currents of 200 mA, 1 A, and 3 A

See Pages 1192-1197

Laser Diode/TEC Controller Platforms, Modular

- PRO8 LDC8000 and MLC8000 Series Laser Controller Modules
- PRO8 TED8000 and ITC8000 Series Temperature Controller Modules

See Pages 1198-1214

Butterfly Laser Diode and Ø5.6 mm and Ø9 mm/TEC Mounts

- Butterfly Laser Diode Mounts with Support for External Modulation
- Ø5.6 mm and Ø9 mm Laboratory-Style Laser Diode Mount with Built-in TEC Elements

See Pages 1215-1222

Benchtop and OEM LED Drivers

- 4 Benchtop Models for LED Currents from 700 mA to 2 A
- Selection of OEM Constant Current Drivers from 250 mA to 2.5 A

See Pages 1223-1228

Ø4.7 mm and Ø5 mm Table and Lens Tube LED Mounts

- Ø4.7 mm and Ø5 mm Table and Post-Mountable Mounts
- SM1 and SM2 Series Slip Rings and Ø2" LIU Series Mount

See Pages 1229-1230

Laser Diode Controller Selection Guide

ITEM#	DRIVE CURRENT	COMPLIANCE VOLTAGE	LD/TEC	CC*	CP*	MODULATION	PACKAGE (UNITS/19" RACK)	# OF CHANNELS/ UNIT # OF MODULES / CHASIS	PAGE
LDC200CV	20 mA	6 V		✔	✔	External	Benchtop		1179
MLC8200-8	50 mA / 200 mA	4 V		✔	✔		19" Chassis	8 / 8 / PRO8000	1225
LDC201CU	100 mA	5 V		✔	✔	External	Benchtop		1179
LDC8001	100 mA	2.5 V		✔	✔	External	19" Chassis	1 / 8 / PRO8000	1202
LD2000R	100 mA	3.5 V			✔	External	OEM		1184
EK2000	100 mA	3.5 V			✔	External	OEM		1184
LDC202C	200 mA	10 V		✔	✔	External	Benchtop		1179
LDC8002	200 mA	5 V		✔	✔	External	19" Chassis	1 / 8 / PRO8000	1202
ITC8022	200 mA	5 V	✔	✔	✔		19" Chassis	1 / 8 / PRO8000	1204
ITC5022	200 mA	2.5 V	✔	✔	✔	Int/Ext	19" Chassis	1 / 16 / TXP5000	1001
TLD001	200 mA	8 V		✔	✔	External	T-Cube		1182
ITC102	200 mA	4 V	✔	✔	✔	External	OEM		1196
IP250-BV	250 mA	8 V		✔	✔	External	OEM		1183
LD1100	250 mA	8 V			✔		OEM		1184
EK1101	250 mA	8 V			✔		OEM		1184
EK1102	250 mA	8 V			✔		OEM		1184
LD1255R	250 mA	3.3 V		✔		External	OEM		1185
LDC205C	500 mA	10 V		✔	✔	External	Benchtop		1179
LDC8005	500 mA	5 V		✔	✔	External	19" Chassis	1 / 8 / PRO8000	1202
ITC8052	500 mA	5 V	✔	✔	✔		19" Chassis	1 / 8 / PRO8000	1208
ITC5052	500 mA	2.5 V	✔	✔	✔	Int/Ext	19" Chassis	1 / 16 / TXP5000	1001
IP500	500 mA	3 V		✔	✔	External	OEM		1183
LDC210C	1 A	10 V		✔	✔	External	Benchtop		1179
LDC8010	1 A	5 V		✔	✔	External	19" Chassis	1 / 8 / PRO8000	1202
ITC8102	1 A	5 V	✔	✔	✔		19" Chassis	1 / 8 / PRO8000	1208
ITC4001	1 A	10 V	✔	✔	✔	Int/Ext	Benchtop		1193
ITC5102	1A	2.5 V	✔	✔	✔	Int/Ext	19" Chassis	1 / 16 / TXP5000	1001
ITC110	1A	4 V	✔	✔	✔	External	OEM		1196
LDC220C	2 A	4 V		✔	✔	External	Benchtop		1179
LDC8020	2 A	5 V		✔	✔	External	19" Chassis	1 / 8 / PRO8000	1202
LD3000R	2.5 A	3.3 V		✔		External	OEM		1185
ITC133	3 A	4 V	✔	✔	✔	External	OEM		1196
LDC240C	4 A	5 V		✔	✔	External	Benchtop		1179
LDC8040	4 A	5 V		✔	✔	External	19" Chassis	1 / 8 / PRO8000	1202
LDC8080	8 A	5 V		✔	✔	External	19" Chassis	1 / 4 / PRO8000	1202
ITC4005	5 A	10 V	✔	✔	✔	Int/Ext	Benchtop		1183
LDC4005	5 A	10 V		✔	✔	Int/Ext	Benchtop		1181
ITC4020	20 A	10 V	✔	✔	✔	Int/Ext	Benchtop		1181
LDC4020	20 A	10 V		✔	✔	Int/Ext	Benchtop		1193

*CC = Constant Current, CP = Constant Power

Laser Diode Pigtailing

See Page 1056

Temperature Controller Selection Guide

				Temperature Sensors								
ITEM#	DRIVE CURRENT	MAX TEC POWER	LD/ TEC	NTC TH	AD590 & 592 LM335	LM35	Pt100	KRYO	TUNE IN	PACKAGE	CHANNELS (19" RACK)	PAGE
TCM1000T	±1 A	3 W		✔						OEM		1186
TTC001	±1 A	4 W			✔					T-Cube		1187
ITC5022	±1.5 A	5.25 W	✔	✔					✔	19" Chassis	1/ 16 /TXP5000	1211
ITC5052	±1.5 A	5.25 W	✔	✔					✔	19" Chassis	1 / 16 /TXP5000	1211
ITC5102	±1.5 A	5.25 W	✔	✔					✔	19" Chassis	1 / 16 /TXP5000	1211
ITC102	±2 A	12 W	✔	✔	✔			Option	✔	OEM	1	1196
ITC110	±2 A	12 W	✔	✔	✔			Option	✔	OEM	1	1196
TED200C	±2 A	12 W		✔	✔				✔	Benchtop	1	1189
TED8020	±2 A	16 W		✔	✔		Option	Option	✔	19" Chassis	1 / 8 / PRO8000	1206
ITC8022	±2 A	16 W	✔	✔	✔					19" Chassis	1 / 8 / PRO8000	1208
ITC8052	±2 A	16 W	✔	✔	✔					19" Chassis	1 / 8 / PRO8000	1208
ITC8102	±2 A	16 W	✔	✔	✔					19" Chassis	1 / 8 / PRO8000	1208
ITC133	±3 A	18 W	✔	✔	✔			Option	✔	OEM	1	1196
TED8040	±4 A	32 W		✔	✔		Option	Option	✔	19" Chassis	1 / 8 / PRO8000	1206
TED8080	±8 A	64 W		✔	✔		Option		✔	19" Chassis	1 / 4 / PRO8000	1206
TED4015	±15 A	225 W	✔	✔	✔	✔	✔			Benchtop	1	1190
ITC4001	±15 A	225 W	✔	✔	✔	✔	✔			Benchtop	1	1195
ITC4005	±15 A	225 W	✔	✔	✔	✔	✔			Benchtop	1	1195
ITC4020	±12 A	180 W	✔	✔	✔	✔	✔			Benchtop	1	1195

Current/TEC Controllers Selection Guide

Pages 1177-1197

Benchtop Laser Diode Current Controllers: LDC200C Series

- 7 Models for Laser Diode Currents from 20 mA to 4 A
- Special Versions for VCSELs, Blue Lasers, and Low Noise and Ultra Low Noise Operation

See Pages 1178-1179

Benchtop Laser Diode Current Controllers: LDC4000 Series

- High-Power Laser Diode Controllers for 5 A and 20 A
- Remotely Controlled with USB2.0 Interface

See Pages 1180-1181

Compact Laser Diode T-Cube Controller Module: TLD001

- Highly Economic and Easy-to-use Current Controller Module for up to 200 mA
- Compatible with T-Cube Hub

See Page 1182

OEM Laser Diode Driver Boards

- Selection of OEM Drivers for Different Laser Diodes PIN Styles and Currents up to 3 A
- Drivers for Constant Current and Constant Power Operation

See Pages 1183-1186

Compact TEC T-Cube Controller Module: TTC001

- Highly Economic and Easy-to-use TEC Controller Module for up to 1 A / 4 W
- Compatible with T-Cube Platform

See Page 1187

Benchtop TEC Controller: TED200C

- Highly Stable Low Noise Controller for ±2 A / 12 W TEC Power
- Independent PID Parameter Settings for Minimum Settling Times

See Pages 1188-1189

High-Power Benchtop TEC Controller: TED4015

- Highly Stable and Full Featured Temperature Controller for ±15 A / 225 W TEC Power
- Digitally Controlled with USB2.0 Interface

See Pages 1190-1191

Laser Diode and Temperature Controller Kit

- Complete Kit Including Laser Mount and other Accessories

See Page 1192

High-Power Laser Diode and TEC Controllers: ITC4000 Series

- 3 Benchtop Combined Current and TEC Controllers for LD Currents: 1 A, 5 A, and 20 A
- Remotely Controlled with USB2.0 Interface

See Pages 1193-1195

OEM Current and TEC Controller Board: ITC100 Series

- 3 OEM Combined Current and TEC Controllers for LD Currents of 200 mA, 1 A, and 3 A
- Optional Display Add-On Module and other Accessesories

See Pages 1196-1197

Expanded Selection of Laser Diodes

See Page 1033

Benchtop Laser Diode Controllers (Page 1 of 2)

LDC205C

Includes Power Cord and Mount Connection Cable (CAB400)

Highlights

- 10 V Compliance Voltage on LDC202C, LDC205C, and LDC210C for Blue Laser Diodes
- Extremely Low Noise (LDC201CU Offers 0.2 µA RMS)
- 5-Digit Display
- Analog Control Input and Output
- Reliable Laser Diode Protection
- Operates with All Laser Diode and Photodiode Polarities
- Seven Models with Laser Diode Current Ranges from 20 mA to 4 A

7 Models Offering Currents from 20 mA to 4 A

The LDC200C series of laser diode controllers all provide features that ensure outstanding performance. There are seven models with different current ranges, each configured to provide optimal performance for its particular intended laser application. Please refer to the Specifications and Selection Guide on the following page, and the Typical Applications Table (below) for an overview of the product range.

MODES:

With the laser diode controllers of the LDC200C series, laser diodes can be driven in constant current (CC) or constant power (CP) mode. All laser diode and photodiode configuration types are supported. The laser diode is always driven with respect to ground. In comparison to driver designs that require a floating ground, this grounded operation of the laser diode offers advantages regarding noise, transient suppression, and stability.

In CC mode, the current to the laser is held precisely at the prescribed level. This mode is used when the lowest noise and highest response speed are required. Most applications in this mode require stabilizing the temperature as well; see page 1188 for our temperature controllers.

In CP mode, a feedback cicuit uses the signal generated by the internal photodiode integrated into most laser diode packages or an external photodiode to actively stabilize the laser's output power. An adjustment of the full scale photodiode current in CP mode is provided in order to compensate for the differences in the photodiode currents between different laser diodes.

CONTROLLER OUTPUTS:

Independent of the selected operating mode, the 5-digit LED display can show the laser current, photodiode monitor current, or laser current limit. It can also display the optical power in milliwatts. The power readout can be calibrated to the responsivity of the monitor photodiode by adjusting a front panel trim potentiometer. In many applications, the aforementioned benefits eliminate the need for a separate optical power meter. A TTL input for remote laser on/off, a modulation input for laser current or power, and a control output proportional to the laser diode current are all available from the rear of the unit.

PROTECTION FEATURES:

Current Limit: A precisely adjustable current limit ensures that the maximum laser current cannot be exceeded. Thorlabs has intentionally provided limited access to this feature to prevent accidental adjustment. An attempt to increase the laser drive current above the preset limit will result in a visible and short audible indicator. Even when utilizing the external modulation feature, the current limit setpoint cannot be exceeded.

Current Source: If the connection between the current source and laser diode is interrupted, the current source automatically switches off the current output. The open current circuit condition is indicated by the "OPEN" indicator on the controller and a short acoustic warning. The separate laser ON key switches the laser current on and off. When switched off, an electronic switch within the LDC200C

Typical Applications	LDC200CV	LDC201CU	LDC202C	LDC205C	LDC210C	LDC220C	LDC240C
Low-Current VCSEL	✔						
Low-Power Lasers	✔	✔	✔				
Medium-Power Lasers			✔	✔	✔		
Higher-Power Lasers					✔	✔	✔
Blue Lasers–High Compliance Voltage			✔	✔	✔		
Low-Noise Operation	✔		✔	✔	✔	✔	✔
Ultra-Low-Noise Operation		✔					

Benchtop Laser Diode Controllers (Page 2 of 2)

short circuits the laser diode for added protection. After being switched on, a soft start ensures a slow increase of the laser current without voltage peaks. Even in the case of line failure, the laser current remains transient free. Voltage peaks on the AC line are effectively suppressed by electrical filters, shielding of the transformer, and careful grounding of the chassis.

Laser Diode Controllers Specifications and Selection Guide*

Model Number	LDC200CV	LDC201CU	LDC202C	LDC205C	LDC210C	LDC220C	LDC240C
Current Control							
Control Range (Continuous)	0 to ±20 mA	0 to ±100 mA	0 to ±200 mA	0 to ±500 mA	0 to ±1 A	0 to ±2 A	0 to ±4 A
Compliance Voltage	6 V	5 V	10 V	10 V	10 V	4 V	5 V
Resolution	1.0 µA	10 µA	10 µA	10 µA	100 µA	100 µA	100 µA
Accuracy (Full Scale)	±20 µA	±50 µA	±100 µA	±0.5 mA	±1.0 mA	±2.0 mA	±4.0 mA
Typical Noise without Ripple (10 Hz to 10 MHz, RMS)	<1.0 µA	<0.2 µA	<1.5 µA	< 3 µA	<5 µA	<15 µA	<50 µA
Typical Ripple (50/60 Hz, RMS)	<0.5 µA	<0.5 µA	<1.5 µA	< 2 µA	<3 µA	<5 µA	<8 µA
Transients (Typical)	<10 µA	<10 µA	<0.2 mA	< 0.5 mA	<1 mA	<2 mA	<4 mA
Typical Drift in 24 hours (0-10 Hz at Constant Ambient Temperature)	<1 µA	<2 µA	<3 µA	<10 µA	<20 µA	<100 µA	<200 µA
Temperature Coefficient	<50 ppm/°C						
Current Limit (CC Mode)							
Setting Range (20-Turn Trim Pot)	0 to ≥20 mA	0 to ≥100 mA	0 to ≥200 mA	0 to ≥500 mA	0 to ≥1 A	0 to ≥2 A	0 to ≥4 A
Resolution	1.0 µA	10 µA	10 µA	10 µA	100 µA	100 µA	100 µA
Accuracy	±50 µA	±200 µA	±500 µA	±1.5 mA	±2.5 mA	±5 mA	±10 mA
Power Control (PC Mode)							
Photocurrent Control Range	5 µA to 2 mA	25 µA to 10 mA			50 µA to 20 mA		
Photocurrent Resolution	0.1 µA	1 µA			1 µA		
Photocurrent Accuracy	±2 µA	±10 µA			±20 µA		
Analog Modulation Input							
Input Resistance	10k Ω						
3 dB Bandwidth, CC**	DC-100 kHz	DC-0.2 kHz	DC-250 kHz	DC-150 kHz	DC-100 kHz	DC-50 kHz	DC-30 kHz
Modulation Coefficient, CC	2 mA/V ±5%	10 mA/V ±5%	20 mA/V ±5%	50 mA/V ±5%	100 mA/V ±5%	200 mA/V ±5%	400 mA/V ±5%
Modulation Coefficient, CP	0.2 mA/V ±5%	1 mA/V ±5%			2 mA/V ±5%		
General Data							
Safety Features	Soft Start, Interlock, Short Circuit when Laser is Off, Laser Current Limit, Open Circuit Detection						
Display	LED, 5 Digits						
Connectors, Back Panel	9-Pin D-Sub (F) for Laser, BNC for Remote Laser On/Off TTL Input, BNC for Modulation, and BNC for Laser Monitor						
Operating Temperature	0 to 40 °C						
Line Voltage/Frequency	100 V, 115 V, 230 V, +15%/-10% and 50 to 60 Hz						
Warm-up Time	10 Minutes						
Storage Temperature	-40 to 70 °C						
Dimensions (W x H x D)	5.75" x 2.60" x 11.42"(146 mm x 66 mm x 290 mm), Box Only, No Knobs or Feet						
Weight	<3.1 kg						<3.3 kg

*All data valid at 23 ± 5 °C and 45 ± 15% relative humidity **Small signal bandwidth

See Page 1192

Laser and Temperture Control System Kits

All LDC200C Series Controllers are Certified, CSA Approved, and RoHS Compliant

ITEM#	$	£	€	RMB	DESCRIPTION
LDC200CV	$ 998.00	£ 691.90	€ 886,10	¥ 8,427.20	Laser Diode Controller, 20 mA for VCSEL
LDC201CU	$ 998.00	£ 691.90	€ 886,10	¥ 8,427.20	Laser Diode Controller, 100 mA Ultra-Low Noise
LDC202C	$ 950.00	£ 658.60	€ 843,50	¥ 8,021.90	Laser Diode Controller, 200 mA
LDC205C	$ 950.00	£ 658.60	€ 843,50	¥ 8,021.90	Laser Diode Controller, 500 mA
LDC210C	$ 998.00	£ 691.90	€ 886,10	¥ 8,427.20	Laser Diode Controller, 1 A
LDC220C	$ 1,100.00	£ 762.60	€ 976,60	¥ 9,288.50	Laser Diode Controller, 2 A
LDC240C	$ 1,195.00	£ 828.40	€ 1.061,00	¥ 10,091.00	Laser Diode Controller, 4 A
CAB400	$ 66.00	£ 45.80	€ 58,60	¥ 557.40	LDC200C Series to LD Mount, 9-Pin D-Sub Connector

Laser Diode Controllers, 5 A and 20 A (Page 1 of 2)

LDC4020

Includes power cord, connection cable for our laser mounts, Sub-D connector kit, and USB cable.

Features

- Two Models for 5 A and 20 A LD Currents and 10 V Compliance Voltage
- Operate with Anode- or Cathode-Grounded Laser Diodes and Photodiodes
- Constant Current (CC) and Constant Power (CP) Control Modes
- Continuous Wave (CW) or Quasi-Continuous Wave (QCW) Operation
- Internal Function Generator for Analog Modulation
- External Modulation Input
- Analog Monitor Output for the Laser Current
- Compatible Optical Detectors: Photodiodes, Thermopiles, Common Sensor Amplifiers and Power Meters with Voltage Output
- Laser Diode Voltage Measurement
- Enable Key Switch and Interlock
- Enhanced Laser Diode Protection
- SCPI-Compliant USB Interface and Driver Set
- Power Efficient by Active Power Management

The LDC4000 Series of Laser Diode Current Controllers provide precise and stable current for driving high-power laser diodes with injection currents up to 20 A. It supports all laser diode and monitor diode pin configurations and features a constant current or constant power mode. This benchtop controller is designed for stand-alone operation and is controlled via front panel keys and intuitive operation menus on a large and easy-to-read graphic LC display. Additionally the LDC4000 Series can be fully remote controlled via an SCPI-compatible USB Interface. A higher setting and measurement resolution is offered via remote control*.

Compared to the LDC200C Series, the LDC4000 Series offers higher injection currents plus additional features like the Quasi-Continuous Wave (QCW) operation mode, an internal modulation generator, a thermopile input, laser voltage measurement, and an optical power limit. These features together with the new design, which offers silent and efficient operation, make the LDC4000 Series Laser Diode Controllers an ideal choice for most applications.

Constant Current and Constant Power Modes

The laser diodes can be driven in either constant current (CC) or constant power (CP) mode. In CC mode, the laser current is held precisely at the level set by the user. The CC mode is ideal when the lowest noise and highest response speed is required. In CP mode, the monitoring optical sensor is used to actively stabilize the output power of the laser. A feedback circuit controls the output power of the laser. A power limit can be set to restrict the control loop to a maximum laser output power. To ensure best possible performance, laser diodes are driven with respect to ground, offering significant advantages regarding noise, transient suppression, and stability.

Photodiode and Thermopile Monitor Input

The LDC4000 Series allows the user to select photodiodes or thermopiles as the sensor for monitoring the laser diode power output. For each, a monitor input is provided. The photodiode input provides two ranges: 2 mA or 20 mA maximum current. An adjustable-bias voltage can be applied to the photodiode to improve the linearity. The thermopile input provides four ranges: 10 mV, 100 mV, 1 V, or 10 V maximum voltage. Instead of bare thermopile sensors, sensor amplifiers or power meters with analog voltage output can be connected here as well. Both monitor inputs can be calibrated by a sensor response parameter to directly display the optical power in milliwatts.

ITEM#	LDC4005		LDC4020	
Specifications	**Front Panel***	**Remote* Control**	**Front Panel***	**Remote* Control**
Current Control (Constant Current Mode)				
Control Range	0 to ±5 A		0 to ±20 A	
Compliance Voltage	>10 V			
Setting/Measurement Resolution	1 mA	80 µA	1 mA	320 µA
Accuracy	±(0.1% + 2 mA)		±(0.1% + 8 mA)	
Noise and Ripple (10 Hz to 10 MHz, rms, Typ.)	<1.5 mA		<10 mA	
Drift, 24 hrs (0-10 Hz, Typ., at Constant Ambient Temp)	<300 µA		<1 mA	
Temperature Coefficient	<50 ppm/°C			
Current Limit				
Setting Range	0 to 5 A		0 to 20 A	
Resolution	1 mA	80 µA	1 mA	320 µA
Accuracy	±(0.12% + 3 mA)		±(0.12% + 12 mA)	
Power Monitor Input - Photodiode				
Photocurrent Measurement Ranges	2 mA / 20 mA			
Photocurrent Measurement Resolution	1 µA / 10 µA	32 nA / 320 nA	1 µA / 10 µA	32 nA / 320 nA
Photocurrent Accuracy	±(0.08% +0.5 µA)			
Photodiode Reverse Bias Voltage	0 to 10 V			
Power Monitor Input - Thermopile**				
Sensor Voltage Measurement Ranges	10 mV, 100 mV, 1 V, 10 V			
Sensor Voltage Measurement Resolution	1 µV, 10 µV, 100 µV, 1 mV	0.16 µV, 1.6 µV, 16 µV, 160 µV	1 µV, 10 µV, 100 µV, 1 mV	0.16 µV, 1.6 µV, 16 µV, 160 µV
Sensor Voltage Measurement Accuracy	±(0.1% + 10 µV), ±(0.1% + 100 µV), ±(0.1% + 1 mV), ±(0.1% + 5 mV)			
Constant Power Control				
Photocurrent Control Ranges	1 µA to 2 mA, 10 µA to 20 mA			
Voltage Control Ranges	1 µV to 10 mV, 10 µV to 100 mV, 100 µV to 1V, 1 mV to 10 V			

*The front panel resolution is limited by the display. A higher setting and measurement resolution is offered via remote control.
**The Thermopile Power Monitor Input can also be used for sensor amplifiers and power meters with voltage output.

Laser Diode Controllers, 5 A and 20 A (Page 2 of 2)

External and Internal Analog Modulation

The analog modulation input enables the external modulation of the laser diode in constant current as well as in constant power mode. Alternatively an internal function generator offers sine, triangle, or square waveform modulation.

Continuous Wave (CW) or Quasi-Continuous Wave (QCW) Operation

The LDC4000 Series can be operated in continuous wave (CW) or quasi-CW (QCW) mode. An integrated pulse generator can be triggered internally with an adjustable repetition rate or externally via a BNC jack at the rear of the unit.

Enhanced Protection Features for the Laser Diode

For optimal LD protection, the LDC4000 Series offers a set of enhanced protection features. Independent of operation mode or compliance voltage, a precisely adjustable current limit ensures that the maximum allowed laser current cannot be exceeded. The LDC will return an error signal whenever this pre-set limit is reached by user settings or external modulation. The soft start feature ensures a slow increase of the laser current without voltage peaks after the device is switched on. Voltage peaks on the AC line are effectively suppressed by electrical filters and by careful grounding of the chassis. Even in the case of power line failure, the laser current remains transient-free. When the output is disabled, the laser is additionally protected by an electronic output short circuit. If the connection between current source and laser diode is interrupted, or the laser voltage exceeds the adjustable voltage protection threshold, the laser current is switched off.

ITEM#	LDC4005		LDC4020	
Specifications	Front Panel*	Remote Control	Front Panel*	Remote Control
Power Limit				
Photocurrent Limit Ranges	1 µA to 2 mA, 10 µA to 20 mA			
Sensor Voltage Limit Ranges	1 µV to 10 mV	10 µV to 100 mV	100 µV to 1 V	1 mV to 10 V
Laser Voltage Measurement				
Measurement Principle	4-Wire			
Measurement Resolution	1 mV	160 µV	1 mV	160 µV
Accuracy	±10 mV			
Laser Overvoltage Protection				
Setting Range	1 to 10 V			
Laser Current Monitor Output				
Load Resistance	>10 kΩ			
Transmission Coefficient	2 V/A ±5%		500 mV/A ±5%	
External Modulation Input				
Input Impedance	10 kΩ			
Small Signal 3 dB Bandwidth, CC Mode	DC to 100 kHz		DC to 50 kHz	
Modulation Coefficient, CC Mode	500 mA/V ±5%		2 A/V ±5%	
Internal Modulation				
Waveforms	Sine, Square, Triangle			
Frequency Range	20 Hz to 100 kHz		20 Hz to 50 kHz	
Modulation Depth	1 to 100%			
QCW Mode				
Pulse Width Range	0.1 to 1 s			
Pulse Width Resolution	1 µs			
Repetition Rate Range	1 ms to 5 s (0.2 Hz to 1 kHz)			
Repetition Rate Resolution	10 µs			
Trigger				
Input	Rising Edge Triggered, Starts QCW Pulse with Internal Adjusted Width			
Input Level	TTL or 5 V CMOS			
Output	Active High, Tracks Pulse Width			
Output Level	TTL or 5 V CMOS			
Digital I/O Port				
Number of I/O Lines	4 (Separately Configurable)			
Interface				
USB2.0	According to USBTMC/USBTMC-USB488 Specification Rev. 1.0			
Protocol	SCPI Compliant Command Set			
Drivers	VISA VXI pnp™, MS Visual Studio™, MS Visual Studio.net™, LabVIEW™, Labwindos/CVI™			
General Data				
Safety Features	Interlock, Inhibit, Keylock Switch, Laser Current Limit, Laser Power Limit, Soft Start, Short Circuit when Laser off, Adjustable Laser Overvoltage Protection, Over Temperature Protection			
Display	LCD 320 x 240 Pixel			
Connector for Laser, Photodiode, Interlock & Laser On Signal	13W3 Mixed D-Sub Jack (female)			
Connectors for Control Input / Output	BNC			
Connector for USB-Interface	USB Type B			
Line Voltage / Frequency	100 to 120 V and 200 to 240 V ±10%, 50 to 60 Hz			
Maximum Power Consumption	200 VA		600 VA	
Operating Temperature	0 to 40 °C			
Dimensions (W x H x D) without Operating Elements	10.35" x 4.8" x 12.09" (263 mm x 122 mm x 307 mm)			

* Measurement Resolution is limited by display

ITEM#	$	£	€	RMB	DESCRIPTION
LDC4005	$ 2,000.00	£ 1,386.50	€ 1.775,50	¥ 16,889.00	Benchtop Laser Diode Controller, ±5 A
LDC4020	$ 2,700.00	£ 1,871.50	€ 2.397,00	¥ 22,799.00	Benchtop Laser Diode Controller, ±20 A
CAB4005	$ 80.65	£ 56.00	€ 71,70	¥ 681.10	Cable for LDC4000 Series, 5 A, 13W3 to D-Sub-9, 1.5 m
CAB4006	$ 80.65	£ 56.00	€ 71,70	¥ 681.10	Cable for LDC4000 Series, 20 A, 13W3 to 13W3, 1.5 m
CON4005	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	Connector Kit for LDC4000 Series, 20 A, 13W3 Male

Expanded Selection of Laser Diodes

See Page 1033

T-Cube USB Laser Diode Controller

NEW products

TLD001
Double Wide T-Cube Footprint:
4.72" x 2.36" x 1.85"
120 mm x 60 mm x 47 mm

Features

- Constant Current and Constant Power Modes
- Five-Digit LED Display
- Removable On/Off Key
- Enable Laser Button
- Safety Interlock Input
- Manual and USB Interfaces
- External Modulation Input
- Flexible Software Libraries

Specifications

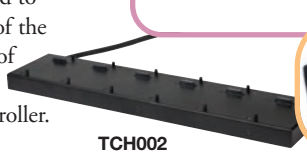
- **Laser Diode (LD) Output:** 9-Pin D-Type
- **Operating Current Range:** 20 mA to 200 mA
- **LD Compliance Voltage:** >8 V
- **LD Current Setting Resolution:** 10 µA
- **LD Power Setting Resolution:** 1 µW
- **LD Current/Power Measurement Resolution:** 10 µA (14-Bit)
- **Temperature Drift:** <70 ppm/°C (Typ.)
- **LD Current Noise:** <3 µA RMS (Typ.)
- **Supported LD/PD Configurations:** All
- **LD Protection:** Relay - Open Circuit, Under/Over Voltage
- **Operating Modes:** Constant Current or Constant Power
- **Modulation Input (SMA) Range:** 0 - 10 V
- **Modulation Bandwidth:** 20 kHz
- **Interlock Input:** 3.5 mm Jack Socket
- **Power Input:** +15 V, -15 V, +5 V
- **Dimensions (W x D x H):** 120 x 60 x 47 mm (4.90" x 2.40" x 1.85")

Overview

The TLD001 T-Cube is a full-featured, compact, stand-alone laser diode/LED controller for use with devices that have a compliance voltage of 10 V or less. The output connector is a 9-Pin, D-type connector that is compatible with Thorlabs' entire line of laser diode mounts. The TLD001 unit is double the width of the standard T-Cube footprint. As a result, the TLD001 will take up two ports when used with the T-Cube hub featured on page 546.

Operation

The TLD001 T-Cube Laser Diode/LED Driver can be controlled by the manual interface on the top of each unit or via a USB connection to a computer running the included apt™ software or ActiveX® command modules. The apt software is a stand-alone program that provides an intuitive graphical command interface for all of the T-Cubes currently connected to the computer running the software. The laser diode/LED driver T-Cube supports constant current and constant power modes of operation, has an input to allow the diode output to be modulated by an external source, and comes with a removable key to power the unit on or off. A separate enable button controls when the laser diode is being powered. In addition, the TLD001 has an input jack that allows an interlock device to be used for safety purposes. The software suite included with the unit contains all of the ActiveX controls required to create customized advanced control sequences. The functionality of the ActiveX controls and apt software are the same for the entire line of T-Cubes, which greatly simplifies the integration of other T-Cube products into any setup that utilizes the TLD001 laser diode controller.



TCH002

TPS101

TPS002

Power Supply Options

The TLD001 T-Cube can be powered using either a TPS002 power supply or a TCH002 T-Cube hub and power supply. The TPS002 power supply plugs into a standard wall outlet and provides +5, +15, and -15 VDC to the TLD001. The TCH002 consists of two parts: a hub that can support up to six standard footprint T-Cubes and a power supply that plugs into a standard wall outlet and powers the hub, which, in turn, powers all of the T-Cubes connected to the hub. In addition, the hub's single USB connection provides USB connectivity to all the T-Cubes plugged into the hub.

ITEM#	$	£	€	RMB	DESCRIPTION
TLD001	$ 750.00	£ 520.00	€ 665,90	¥ 6,333.10	T-Cube™ Laser Diode Controller
TPS101	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	5 V Power Supply Unit for a Single T-Cube, 1.6 A
TPS002	$ 105.00	£ 72.80	€ 93,30	¥ 886.70	±15 V/5 V Power Supply Unit for up to 2 T-Cubes
TCH002	$ 726.90	£ 504.00	€ 645,40	¥ 6,138.00	T-Cube™ Controller Hub and Power Supply Unit
CAB400	$ 66.00	£ 45.80	€ 58,60	¥ 557.40	Cable for Laser Diode Current Controller, 9-Pin D-Sub Connector, 1.5 m

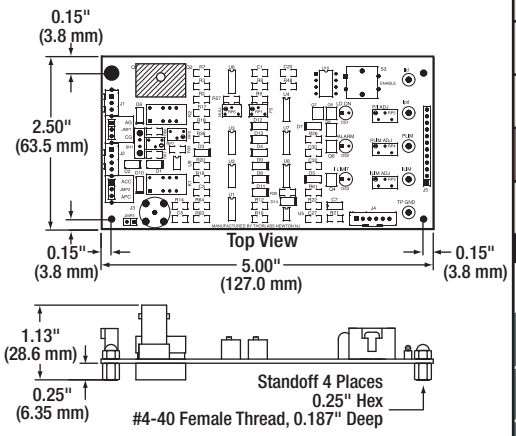
Thorlabs' Selection of Laser Diodes and Laser Diode Mounts are found on Pages 1215-1222.

500 mA Laser Diode Driver

The IP500 is a universal 500 mA board-level driver capable of supporting all pin configurations in either constant current or constant power mode. Designed for use within higher-level assemblies, this versatile device can easily and safely control all laser diode/photodiode pin configurations in Ø5.6 mm and Ø9 mm laser packages.

The driver accepts photodiode feedback currents up to 2.0 mA. Pin configurations and operating modes are easily set using on-board jumpers. Three indicators display whether the laser is enabled, operating at current limit, or in an alarm shutdown condition. There is also no need to power down the entire unit because a separate enable switch turns the laser on and off. Connections are provided for remote interlocks and remote monitoring. Wire harnesses for all required connections are provided with the unit.

IP500 with Base Plate



Laser Diode Pin Codes Supported

ITEM #	$	£	€	RMB	DESCRIPTION
IP500	$ 299.00	£ 207.30	€ 265,50	¥ 2,524.80	500 mA Universal Laser Diode Driver

IP500 Features

- Supports all LD/PD Pin Configurations
- Constant Current and Constand Power Operations
- User-Configurable Current and Power Limits
- Laser Diode Inputs Shorted During Idle Operation to Protect the Device
- Auto Alarm Shutdown when Laser Connection is Open or Reversed
- Includes Input and Output Wires
- Test Points for Laser Diode Current, Monitor Photodiode Current, Current Limit, and Power Limit Setpoint
- OEM Plug-In Version Available (Call for Details)

IP500 Specifications

- **Input Power:** ±5 VDC @ 600 mA

Constant Current Mode

- **Control Range:** 0 to ±500 mA
- **Setting Accuracy:** ±0.5 mA
- **Compliance Voltage:** >3.0 VDC
- **Ripple and Noise (10 Hz to 10 MHz):** <10 µA RMS
- **Short Time Fluctuations (<15 s, <10 Hz):** <50 µA
- **Temperature Coefficient:** <100 ppm/°C
- **Drift (30 min, <10 Hz):** <100 µA
- **Limit Adjust Range:** 0 to >500 mA
- **Limit Accuracy:** ±1% of Limit Setpoint

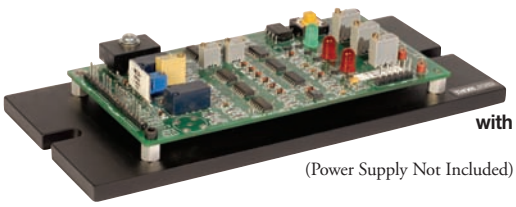
Constant Power Mode

- **Photodiode Current Range:** 5 µA to 2 mA
- **Setting Accuracy:** ±2 µA
- **Drift (30 min, <10Hz):** <1 µA
- **Limit Adjust Range:** 0 to >2.5 mA
- **Limit Accuracy:** ±2 µA

Analog Modulation/ Control Voltage

- **Input Resistance:** 10 kΩ
- **Bandwidth:** DC to 50 kHz
- **Transfer Function (ACC Mode):** 50 mA/V
- **Input Range:** 0-10 V

250 mA Blue-Violet Laser Diode Driver



IP200-BV with Base Plate

(Power Supply Not Included)

Features

- 250 mA Blue Laser Diode Driver
- Optimized for Lasers with V_{op} Less than 8 VDC
- **Input Power:** ±12 VDC @ 275 mA
- **Control Range:** 0 to ±250 mA (CC), 5 µA to 2 mA (CP)
- **0-10 V Analog Modulation Bandwidth:** DC to 50 kHz

The IP250-BV is a medium-power, board-level laser diode controller optimized for the higher operating voltages of blue and blue-violet laser diodes. The driver is in the form of a PCB assembly and is easily integrated into other higher-level assemblies. It can accommodate only common cathode (cathode-grounded) laser diode pin-out configurations and allows control of the laser by means of either constant current or constant power modes. The driver contains circuitry for complying with the various laser safety requirements as well as protection circuitry for the laser diode.

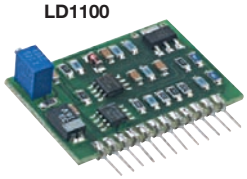
The driver has a maximum injection current of 250 mA, and the operating modes are easily set using on-board jumpers. It automatically shuts itself down when laser connections are open or reversed. Laser diode inputs are shorted during idle operation to protect the device. The end user must provide DC power and the proper connections between the unit and the laser diode. They are also responsible for the proper limit settings needed for their particular laser diode and its application.

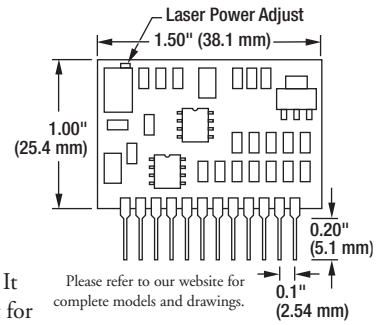
Laser Diode Pin Codes Supported

ITEM #	$	£	€	RMB	DESCRIPTION
IP250-BV	$ 299.00	£ 207.30	€ 265,50	¥ 2,524.80	250 mA Blue Laser Diode Driver

Constant Power Laser Diode Driver

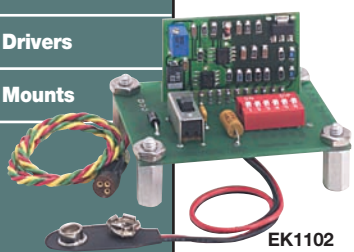
LD1100





Please refer to our website for complete models and drawings.

The LD1100 Laser Diode Driver is a constant-power laser driver module, driving lasers up to 250 mA. It featuresan on-board, 12-turn trim pot for continuous laser output adjustment, pin-programmable feedback gain, On/Off control input, and current monitor output for observing the laser drive current. With dimensions of only 1.0" x 1.5" (25.4 mm x 38.1 mm), the LD1100 is a compact module that can be embedded into a custom design. All input and output signals are provided on a 12-pin SIP connector, which allows simple integration into a printed circuit design.



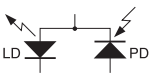
EK1102

The EK1100 Series of Evaluation Kits are ready-to-use, pre-assembled LD1100 Laser Drivers with an evaluation PCB (EB1100), a cable with laser socket (S8060), and a power supply cable (9 V battery clip). Some soldering is necessary. Simply attach the laser and battery, set the gain-setting jumper, and operate the laser.

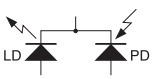
LD1100 Features

- APC (Automatic Power Control) CW Operation
- 0-250 mA Drive Current
- Pin-Programmable Feedback Gain
- Supports Monitor Photodiode Currents from 5 µA to 5 mA
- 12-Turn Power Adjustment
- Output Current Monitor
- External On/Off Control
- Compact 1.0" x 1.5"(25.4 x 38.1 mm) SIP Package
- Single Supply Operation (8-12 VDC)

LD1100 Supports Laser Pin Configurations:
Common Laser Anode - Photodiode Cathode
Common Laser Cathode - Photodiode Cathode



PIN STYLE A
EK1101 is pre-wired for this laser pin-out

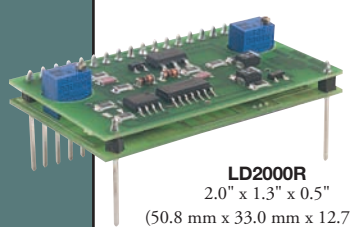


PIN STYLE B
EK1102 is pre-wired for this laser pin-out

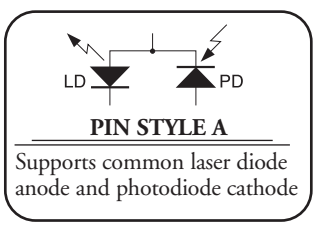
ITEM#	$	£	€	RMB	DESCRIPTION
LD1100*	$ 79.60	£ 55.20	€ 70,70	¥ 672.20	APC Laser Driver, 0-250 mA
EK1101*	$ 99.90	£ 69.30	€ 88,70	¥ 843.60	Driver Kit Pre-Wired for Laser Pin Style A
EK1102*	$ 99.90	£ 69.30	€ 88,70	¥ 843.60	Driver Kit Pre-Wired for Laser Pin Style B
LDS2	$ 83.10	£ 57.70	€ 73,80	¥ 701.70	9 VDC Power Supply for EK1101 and EK1102

* LDS2, 9 VDC Power Supply Sold Separately (see below)

Constant Power Laser Diode Driver with Analog Modulation



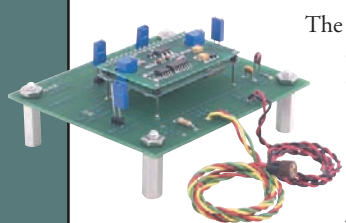
LD2000R
2.0" x 1.3" x 0.5"
(50.8 mm x 33.0 mm x 12.7 mm)
Supports Pin Configuration A



PIN STYLE A
Supports common laser diode anode and photodiode cathode

LD2000R Features

- Constant Power Mode from 20 µA to 125 µA
- Laser Drive Currents from 0 - 100 mA
- Low-Noise/Ultra-Stable Laser Control
- On-Board Trim Pots Control Laser Power and Current Limit
- Slow Start for Diode Protection
- Compact 2.05" x 1.30" (52.1 x 33 mm) Design



EK2000
Power Supply
Sold Separately

The LD2000R low-noise, ultra-stable laser diode current source can be operated with laser diodes that have a common laser diode anode and monitor photodiode cathode. The driver operates in an automatic power control (APC) mode using the built-in monitor photodiode integrated in the laser diode for feedback. On-board trim pots are provided for controlling the laser power and current limit, which can also be controlled via an external voltage source. The LD2000R supports pin style A laser diodes (common laser diode anode and photodiode cathode) with drive currents up to 100 mA and photodiode currents from 20 µA to 125 µA. The LD2000R also has an external input for support of applications requiring modulation of the laser output.

LDS2
Power Supply

ITEM#	$	£	€	RMB	DESCRIPTION
LD2000R*	$ 100.00	£ 69.40	€ 88,80	¥ 844.50	100 mA APC Diode Laser Driver, DC-30 kHz Modulation
EK2000*	$ 159.00	£ 110.30	€ 141,20	¥ 1,342.60	Evaluation Kit, Pre-Wired for Laser Pin Style A
LDS2	$ 83.10	£ 57.70	€ 73,80	¥ 701.70	9 VDC Power Supply for EK2000 Evaluation Kit

*LDS2 power supply sold separately.

250 mA Ultra-Stable Constant Current Laser Driver

LD1255R Features

- Low Current Noise
- Low Temperature Drift
- On-Board 12-Turn Laser Current Control
- External Input for Laser Current Control
- Monitor Outputs for Laser Current and Photodiode Current
- Laser Disable Pin
- Slow-Start Circuit for Laser Protection

Specifications

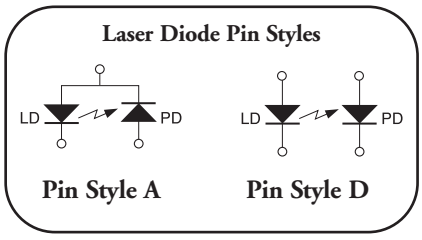
- **Drive Current:** 0.2-250 mA
- **Current Noise:** <1 μA_{RMS}
- **Output Current Drift:** 2 µA/°C
- **Current Control Input:** 0-5 V (50 mA/V)
- **Laser Current Monitor:** 10 mV/ mA
- **Photodiode Monitor:** 1V/ mA
- **Power Requirements:** ±8 to ±12 VDC, 300 mA
- **Signal Bandwidth:** 1.2 kHz

The LD1255R low-noise, ultra-stable, constant current laser diode driver supplies up to 250 mA of drive current, supports laser pin configurations A and D, and is ideally suited for demanding diode laser applications such as operating a laser diode in an external cavity tunable laser.

LD1255R
Mounted on an LD1255P (LD1255P and Power Supply Not Included)

This second-generation laser diode driver measures 2.45" x 1.00" (62.2 x 25.4 mm) and includes on-board Zener and Schottky diode protection as well as a disable pin. The op-amp and voltage reference design enables more precise laser current control.

A power cable assembly (LD1255-CAB) is available to connect the LD1255R driver to Thorlabs' PS-12DC-US power supply (±12 VDC).



PS-12DC-US

ITEM#	$	£	€	RMB	DESCRIPTION
LD1255R*	$ 121.40	£ 84.20	€ 107,80	¥ 1,025.20	250 mA Ultra-Stable Constant Current Diode Driver
LD1255P	$ 17.00	£ 11.80	€ 15,10	¥ 143.60	Mounting Plate for LD1255R
LD1255-CAB	$ 14.30	£ 9.90	€ 12,70	¥ 120.80	LD1255R Power Cable Assembly
PS-12DC-US	$ 38.80	£ 26.90	€ 34,50	¥ 327.70	±12 VDC Power Supply, 100/120 VAC
PS-12DC-EU	$ 61.00	£ 42.30	€ 54,20	¥ 515.10	±12 VDC Power Supply, 220/240 VAC

*Power supply sold separately

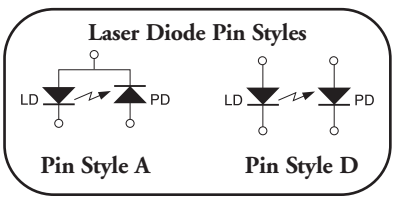
2.5 A Ultra-Stable Constant Current Laser Driver

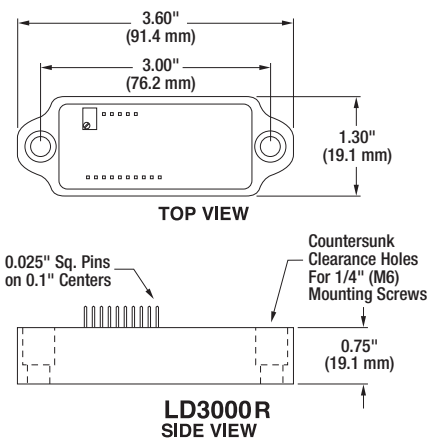
The LD3000R is a higher-power version of our popular LD1255R ultra-stable, low-noise laser diode driver featured above. It utilizes high-current components and supplies 2.5 A. The aluminum housing provides additional heat sinking to provide a highly stable diode driver in a relative small package. This device can operate both LEDs and laser diodes. LD3000R supports PIN configurations A and D.

Power Supply Not Included

LD3000R Features

- Low-Noise, Stable Constant Current Sources
- On-Board 12-Turn Laser Current Control
- External Input for Laser Current Control
- Monitor Outputs for Laser Current and Photodiode Current
- Slow-Start Circuit for Laser Protection
- Low Noise 12 μA_{RMS} @ 1.0 A





Specifications

- **Drive Current:** 2 mA - 2.5 A
- **Operating Mode:** Constant Current
- **Current Control Input:** 0-5 V (500 mA/V)
- **Laser Current Monitor:** 1 V/A
- **Photodiode Monitor:** 1 V/mA
- **Signal Bandwidth:** 1.1 kHz
- **Power Requirements:** ±8 to ±12 VDC / 2.7 A

ITEM#	$	£	€	RMB	DESCRIPTION
LD3000R	$ 168.00	£ 116.50	€149,20	¥ 1,418.60	2.5 A Ultra-Stable Constant Current Laser Driver

OEM VCSEL Diode Driver with Current Modulator: 1 Hz to 10 kHz

VITC002
3.15" x 5.51" (80 mm x 140 mm)

This Laser Diode Controller is ideally suited for powering anode grounded VCSEL diodes. The VCSEL laser diodes can be plugged directly into the on-board sockets. Any other VCSEL diodes with grounded laser anode can be operated using a shielded DB9 cable. This controller is designed to supply the low-drive current typical of a VCSEL. Special attention has been paid to ensure an extremely clean, low-noise drive current to prevent damage to highly sensitive VCSEL diodes.

An integrated current modulation feature allows high-speed sweeping of the wavelength of the VCSEL for spectroscopy applications. Alternatively, an analog input enables external modulation of the wavelength. An adjustable upper limit on the modulation current protects the laser diode from accidental damage when using either of these features. A temperature window indicator LED shows when the diode leaves a desired operation temperature range. This indicates a potential occurence of a wavelength shift. Two other features, an open circuit detector and an interlock, enhance the safe operation of a sensitive VCSEL diode.

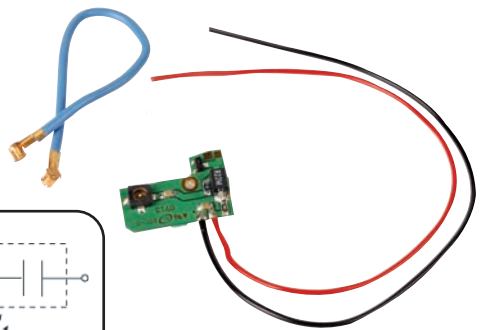
OEM VCSEL Diode Drivers

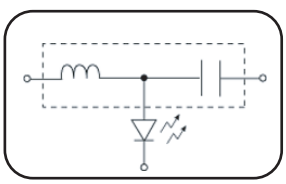
- **Output Current:** 0-25 mA
- **Compliance Voltage:** >5 V
- **Integrated Current Modulator:** 1 Hz to 10 kHz
- **Temperature Control:** 10-40° C (VITC002 only)
- Adjustable Hardware Current Limit
- Monitor Current Output
- On-Board Laser Diode Socket
- Open Output Detection and Safety Interlock
- Complete with Universal Input 5 VDC Power Supply

ITEM#	$	£	€	RMB	DESCRIPTION
VITC002	$ 428.40	£ 297.00	€ 380,40	¥ 3,617.50	VCSEL Driver w/ Temp. Controller

Laser Diode Bias-T PCB

A bias-T makes it possible to superimpose a modulation current onto the laser diode DC-supply current. This three-port bias-T is useful for modulation frequencies in the 10 kHz to 1 GHz range. The actual frequency range is determined by the properties of the impedance network surrounding the laser diode. The transmission line from the coaxial connecter (SMD) has a characteristic impedance of 50 Ω. To protect the laser diode, there is a DC blocking capacitor and a reverse bias protection diode included.





Features

- Modulation Frequencies from 10 kHz to 1 GHz
- 50 Ω Impedance

ITEM#	$	£	€	RMB	DESCRIPTION
T1G	$ 112.20	£ 77.80	€ 99,70	¥ 947.50	Laser Diode Bias-T PCB

OEM 3 W TEC Controller Module

Mechanical Drawings Available on the WEB

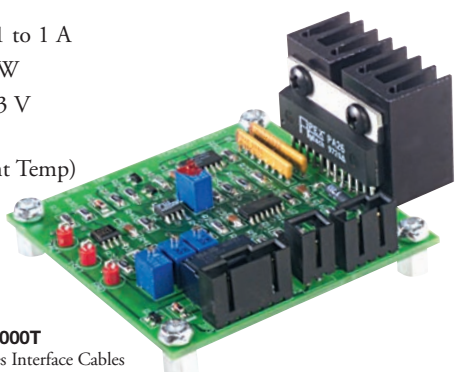
The TCM1000T TEC Controller Module regulates current through a Thermalelectric cooler (TEC), maintaining a constant temperature of a device, typically a laser diode.

Features

- High-Precision Temperature Control
- TEC Power of 3 W (Max)
- TEC Current of 1 A (Max)
- Compatible Temperture Sensors: 10 kΩ NTC Type Thermistor Sensors
- Temperature Control Range: 5 to 10 kΩ Max.
- Interface Cables Included
- OEM Plug-In Version Available (Call for Details)

Specifications

- **TEC Current Range:** -1 to 1 A
- **Max Output Power:** 3 W
- **Compliance Voltage:** >3 V
- **Stability:** ±0.1 °C (24 hrs @ Fixed Ambient Temp)
- **Input Power:** +5 VDC @ 1.25 A Max



TCM1000T
Includes Interface Cables
(Power Supply Not Included)

ITEM#	$	£	€	RMB	DESCRIPTION
TCM1000T	$ 243.80	£ 169.10	€ 216,50	¥ 2,058.70	3 W TEC Control Module

T-Cube™ USB-Based TEC Controller

TTC001

Rear View

Features

- Highly Compact T-Cube Footprint
- Microcontroller-Based PID Temperature Control
- Five-Digit LED Display
- Temperature and Current Limit Setpoints
- Manual and USB Interfaces

Specifications

- **Current Measurement Range:** 100 nA to 10 mA
- **TEC Output:** -1 to 1 A
- **Compliance Voltage:** 4 V
- **Output Power (Max):** 4 W
- **TEC Connection:** 15-Pin D-Sub
- **Thermistor:** 20 kΩ/200 kΩ
- **Control Input:** 0 - 5 V SMA
- **Power Supply:** 5 VDC
- **Dimensions (W x D x H):** 2.36" x 2.36" x 1.85" (60 mm x 60 mm x 47 mm)

Overview

The TTC001 T-Cube TEC Controller is designed to monitor and precisely control the temperature of small, thermally sensitive components like laser diodes and CCD arrays. The unit is capable of supplying a maximum current of ±1 A (4 W Max) to a Peltier effect thermoelectric heater/cooler or a resistive heating cartridge while simultaneously monitoring the signal from a standard thermistor or IC temperature sensor in order to provide closed-loop temperature regulation.

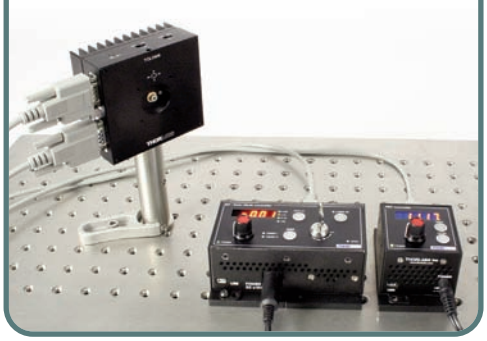
Operation

The TTC001 T-Cube can be controlled by the manual interface on the top of the unit or via a USB connection to a computer running the included apt™ software or ActiveX® command modules. The apt software included with the unit provides the same functionality as the manual controls on the unit, while the ActiveX command modules can be used to create customized advanced control sequences like temperature cycling for reliability testing. Independent of the method used to control the TTC001, various parameters such as the temperature setpoint, current limit, temperature sensor type, and PID (Proportional-Integral-Derivative) parameters can be set. The TTC001 is compatible with the LM14S2 and TCLDM9 thermoelectrically cooled laser diode mounts. It can also be used with the TEC3-2.5 thermoelectric cooler and TH10K thermistor (see page 380). The connection to the heating/cooling element and the temperature sensor is through a 15-pin D-sub connector located on the side of the T-Cube.

Power Supply Options

The TTC001 may be mounted directly onto an optical table and operated as a stand-alone unit with the included 5 V, 500 mA power supply. Alternately, the TEC controller can be connected using our T-Cube Controller Hub (TCH002). The TCH002 provides power and USB connectivity for up to six T-Cube devices and includes a power supply that plugs into a standard wall outlet, which powers the hub as well as all of the T-Cubes connected to the hub. In addition, the hub's single USB connection provides USB connectivity to all the T-Cubes plugged into the hub.

The T-Cube Laser Diode Driver is an ideal companion to this TEC controller. Please see page 1182 for details on the Laser Diode Driver.


TCLDM9 Controlled with TLD001 and TTC001 T-Cubes.

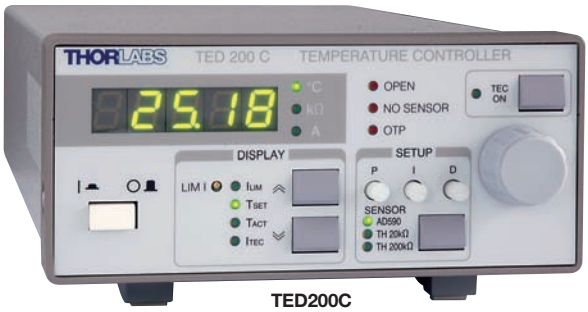
ITEM#	$	£	€	RMB	DESCRIPTION
TTC001	$ 637.00	£ 441.60	€ 565,60	¥ 5,378.90	T-Cube™ TEC Controller
TCH002	$ 726.90	£ 504.00	€ 645,40	¥ 6,138.00	T-Cube™ Controller Hub and Power Supply Unit

Thorlabs' Selection of Laser Diodes and Laser Diode Mounts are Found on Pages 1032-1053 and 1215-1222, Respectively.

Ø5.6 mm and Ø9 mm TEC Laser Mounts

See Page 1216-1222

Benchtop Temperature Controller, ±2 A, 12 W (Page 1 of 2)



TED200C

Includes power cord and cable for connection to mount, CAB420-15

Why temperature control a laser diode?
The characteristics and the efficiency of a laser diode strongly depend on the temperature of the laser chip. For example, in the case of a typical GaAlAs diode, the wavelength increases by about 0.25 nm for every 1 °C increase in temperature. With a single mode laser diode, this change in wavelength can result in undesirable mode hopping, which results in both frequency and intensity noise. Output power is proportional to laser temperature; therefore, fluctuating temperature can lead to premature failure of the laser if it is running near its maximum power.

TED200C Highly Stable, Low Noise ±2 A Thermoelectric Temperature Controller

Introduction

The TED200C is a precision temperature controller designed to drive thermoelectric cooler (TEC) elements with currents up to ±2 A. It is equipped with a PID feedback circuit that allows independent setting of the P (proportional) gain, the I (integral) offset control, and the D (differential) rate, thereby allowing the user to adjust theTED200C to obtain the optimal performance for a wide variety of thermal loads.

FEATURES

Temperature Display/Setpoint:

The illuminated 5-digit LED display can show the set temperature, the actual temperature, the heating or cooling current, and the current limit for the TE cooler. The temperature is displayed with a resolution of 0.01 °C when used with an AD590 temperature sensor or when used with a thermistor with a resolution of either 1 Ω using the 0 to 20 kΩ range or a resolution of 10 Ω using the 0 to 200 kΩ range.

The temperature setpoint can be designated either by adjusting the front panel control knob or by sending a control signal to the analog input connector at the rear of the unit. This feature is used for adjusting the wavelength of the laser diode via the laser temperature in a control loop.

TEC Protection: The TED200C is designed for maximum protection of the TEC element. An adjustable TEC output current limit can be set anywhere within the controller's range to prevent the controller from overdriving the TEC element.

OPERATION

Adaptability to Different Thermal Loads:

The TED200C can easily be adapted to different thermal loads. For example, with optimum PID adjustment, the settling time for a temperature change from 30 °C to 20 °C is less than two seconds for a laser in a butterfly package (mounted in our LM14S2 laser diode mount). The PID controls are located on the front panel for easy access when optimizing the response. The proportional gain optimizes the response time of the feedback loop while the integral gain provides precise zero-offset regulation. The derivative gain optimizes the dynamic response of the feedback loop to account for rapid changes in the thermal load.

Fault Indication:

For safe and continuous operation at ambient temperatures up to 40 °C, the TED200C is equipped with a cooling fan and over-temperature protection. The system detects incorrect or missing temperature sensors and connection problems between sensor and controller. In these cases, the output gets switched off and an LED fault indicator is lit. All LED faults are accompanied by a short audible warning signal.

Temperature Monitor Output:

The TED200C provides an output monitoring voltage signal that is proportional to the actual temperature being measured. The signal is accessed via a BNC connector located on the back panel. This feature allows the long-term recording of the temperature of a device.

Highlights

- ±2 A/12 W Low Noise TEC Output
- Temperature Stability ≤0.002 °C
- Can be Operated with All Common Sensors (Thermistor, AD590, AD592, LM135/LM335)
- Wide Temperature Range from -45 to 145 °C (IC-sensor) or 10 Ω to 200 kΩ (thermistor)
- Separate Control of the P, I, and D Gains for Perfect Adaptation to the Thermal Load
- 5-Digit Display with a Resolution of 0.01 °C (IC-Sensor) or 1 Ω (Thermistor)
- Analog Control via the TUNE IN Input
- CSA Approved and CE Certified

Applications

- Stabilization of Laser Diodes for Interferometry and Spectroscopy
- Cooling of Detectors for Noise Reduction
- Temperature Stabilization of Nonlinear Crystals and Industrial Systems

Benchtop Temperature Controller, ±2 A, 12 W (Page 2 of 2)

Supported Temperature Sensors:

The TED200C temperature controller controls common temperature sensors, thermistors up to 200 kΩ, or temperature-sensing IC such as the following: AD590, AD592, LM135, and LM335. When a thermistor is selected, the temperature is displayed as the resistance value of the thermistor with a control range from 10 Ω to 200 kΩ.

When an AD590, an AD592, or an LM335 is selected, the temperature is displayed directly in °C with a resolution of 0.01 °C. The temperature control range of the controller is from -45 to 145 °C when IC sensors rated for this range are used.

Companion Products:

The LDC200C family of Laser Diode Controllers are ideal companions for the TED200C. When combined with our laser mounts that contain TEC elements, the TED200C is capable of achieving 1 mK stability. This temperature stability when combined with our low-noise laser diode controllers, provides the precision needed for demanding applications such as diode laser wavelength tuning and atomic absorption cell spectroscopy. See pages 1176-1214 for our selection of laser drivers and pages 1215-1222 for our selection of TEC laser mounts. Please call Thorlabs or visit our website for more information.

Specifications

TEC Output

- **Control Range of TEC Current:** -2 A to 2 A
- **Compliance Voltage:** >6 V
- **Maximum Output Power:** 12 W
- **Measurement Resolution TEC Current:** 1 mA
- **Measurement Accuracy TEC Current:** ±10 mA
- **Noise and Ripple (Typ.):** <1 mA

Temperature Sensors Thermistor[a]

- **Control Ranges (Switchable):** 10 Ω to 20 kΩ, 100 Ω to 200 kΩ
- **Resolution:** 1 Ω, 10 Ω
- **Accuracy:** ±10 Ω, 100 Ω
- **Stability:** <0.5 Ω, 5 Ω

IC-Sensors (AD590/AD592, LM135/LM335)

- **Control Range:** -45 to 145 °C[b]
- **Resolution:** 0.01 °C
- **Accuracy:** ±0.1 °C
- **Stability (24 Hours):** <0.002 °C

TEC Current Limit

- **Setting Range:** 0 to ≥2 A
- **Resolution:** 1 mA
- **Setting Accuracy:** ±20 mA

Temperature Control Input

- **Input Resistance:** 10 kΩ
- **Control Voltage:** -10 to 10 V
- **Transmission Coefficient IC-Sensors:** 20 °C/V ±5%
- **Transmission Coefficient Thermistor, 20 kΩ and 200 kΩ Range:** 2 kΩ/V and 20 kΩ/V ±5%

Temperature Control Output

- **Load Resistance:** >10 k Ω
- **Transmission Coefficient IC Sensors:** 50 mV/°C ±5%
- **Transmission Coefficient Thermistor, (±5%) 20 kΩ and 200 kΩ Range:** 500 mV/kΩ and 50 mV/kΩ

Connectors

- **Sensor, TE Cooler, TEC ON Signal:** 15-pin D-Sub Plug
- **Control Input:** BNC
- **Control Output:** BNC
- **Chassis Ground:** 4 mm Banana Jack

General Data

- **Line Voltage (Switchable):** 110 V +15% - 10%, 115 V +15%/-10%, 230 V +15% - 10 %
- **Line Frequency:** 50 - 60 Hz
- **Maximum Power Consumption:** 60 VA
- **Operating Temperature:** 0 to 40 °C
- **Storing Temperature:** -40 to 70 °C
- **Warm-up Time for Rated Accuracy:** 10 min
- **Weight:** <3.1 kg
- **Dimensions (W x H x D):**[c] 5.75" x 2.60" x 1.42" (146 mm x 66 mm x 290 mm)

[a]Setting 1 and Setting 2 [b]Range is limited by rating of sensors and by thermal setup [c]Without Operating elements

CAB420-15 TED200C Interface Cable

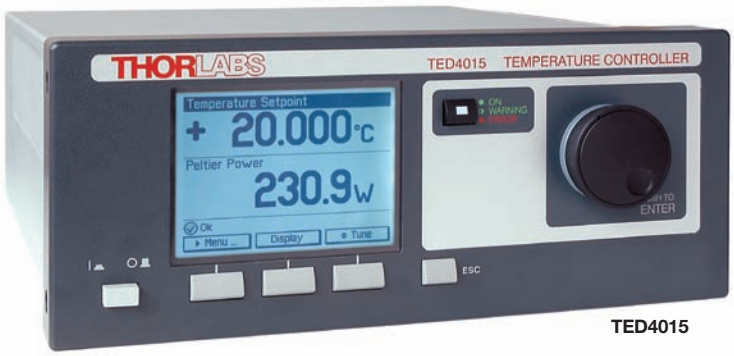
All of our benchtop temperature controllers come with the necessary cable for connecting to our laser diode mounts with a DB9 interface. We also have a full line of additional cables or replacement cables from which to choose.

See Page 377

ITEM	$	£	€	RMB	DESCRIPTION
CAB420-15	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	TED200C to LD Mount

ITEM	$	£	€	RMB	DESCRIPTION
TED200C	$ 968.00	£ 671.10	€ 859,40	¥ 8,173.90	Benchtop TEC Controller ±2 A/12 W

Temperature Controller, 15 A, 225 W (Page 1 of 2)



TED4015

Includes power cord, connection cable for our laser mounts, Sub-D connector kit, and USB cable.

Features

- For TEC Elements up to 15 A, 225 W
- Excellent Temperature Stability of 0.002 °C (24 hrs)
- Digital PID Control with Auto PID Setting Function
- Temperature Display in °C, °F, or K
- Adjustable Temperature Sensor Offset
- Supports all Common Temperature Sensors; NTC Termistor, IC Sensors, Pt100/Pt1000 RTD Sensors
- Constant Temperature and Constant Current Control Modes
- Enhanced TEC Element Protection
- SCPI-Compliant USB Interface and Driver Set
- Power Efficient by Active Power Management

Applications

- Precise Temperature Stabilization of Laser Diodes for use in Interferometry and Spectroscopy
- Cooling of Detectors for Noise Reduction
- Temperature Stabilization of Nonlinear Crystals
- Temperature Stabilization of Industrial Systems

The TED4015 is a high performance digital temperature controller designed to drive thermoelectric cooler (TEC) elements with currents up to ±15 A. It supports most common temperature sensors and can be adapted to different thermal loads. The TED4015 can be fully controlled via its robust SCPI-compatible USB Interface. The digital PID control offers an auto PID setting function for separate control of the P, I, D parameters. The TED4015 boasts an excellent temperature stability of 0.002 °C within 24 hrs, enhanced safeguard features, and error indicators, making this device ideal for cooling very sensitive devices where high stability, reliability, and precision is required.

Compared to the TED200 Series, the TED4015 Controller offers a wider TEC current range plus additional features like full digital control, easy auto PID settings, constant TEC current mode, set temperature protection, TEC voltage measurement, and adjustable temperature window protection. These features together with the new design, which offer silent and efficient operation, make the TED4015 Laser Diode Controller an ideal choice for demanding applications.

Adaptability to Different Thermal Loads

The TED4015 can easily be adapted to different thermal loads by a digital PID loop. The P (proportional) gain, the I (integral) offset control, and the D (derivative or differential) rates can be individually adjusted by the user or by the auto PID function. With optimum PID parameters, the settling time for a temperature change of 1 °C for a laser mounted in our LM14S2 Laser Diode Mount is less than 2 seconds.

Supported Temperature Sensors

The TED4015 Temperature Controller supports almost all common temperature sensors. A sensor selection in the Temperature Control Menu allows thermistors up to 1000 kΩ, the use of a temperature sensing ICs (AD590, AD592, LM335 LM235, LM135, LM35) or Platinum RTD sensors like Pt100 or Pt1000. The temperature can be displayed in Celsius, Fahrenheit, or Kelvin. For thermistors, two temperature calculation methods can be selected: the Steinhart-Hart or the exponential method. The maximum control range is -55 to 150 °C, limited by the rated temperature range of the connected sensor and thermal setup.

Enhanced Security Features

The TED4015 is designed for maximum TEC element protection and stable as well as reliable operation. An adjustable TEC output current limit prevents the controller from overdriving the TEC element. This limit can be set from 0.1 A to the current range of the controller. Adjustable temperature limits and the temperature window protection provide alerts if the temperature of the TEC element exceeds certain values.

The system indicates the presence of an incorrect or missing temperature sensor and a failed connection between sensor and controller by an LED placed on the TEC "On" key and an audible warning signal. The TEC current is automatically switched off if an error occurs.

Temperature Monitor Output

The TED4015 provides a monitoring signal proportional to the difference between actual and set temperature. An oscilloscope or an analog data acquisition card can be connected directly to the rear panel BNC connector to monitor the settling behavior with different thermal loads.

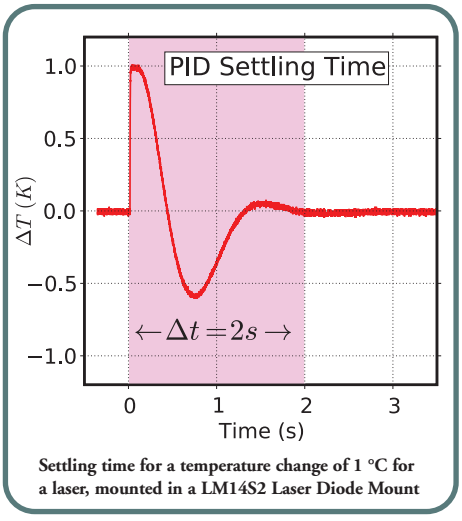
Temperature Controller, 15 A, 225 W (Page 2 of 2)

NEW product

Companion Products

The LDC4000 Laser Diode Controller Series and the LDC200C Laser Diode Controller Series are an ideal companion for the TED4015 (See page 1190). When combined with our TEC laser mounts (see page 1215), the TED4015 can achieve a thermal stability of 0.002 °C. This temperature stability is required for applications like diode laser wavelength tuning and atomic absorption cell spectroscopy.

The TED4015 ships complete with a Laser Mount Cable CAB4000 (5 A, 17W2, D-Sub-9), a Mixed D-Sub Connector CON4001 (17W2, male, including two high current contacts, 20 A), and a USB Cable A-B with a length of 2 m.



Settling time for a temperature change of 1 °C for a laser, mounted in a LM14S2 Laser Diode Mount

SPECIFICATIONS	FRONT PANEL*	REMOTE CONTROL*
TEC Current Output		
Control Range	-15 to 15 A	
Compliance Voltage	>15 V	
Maximum Output Power	>225 W	
Resolution (Constant Current Mode)	1 mA	0.1 mA
Accuracy	±(0.2% + 20 mA)	
Noise and Ripple (Typical)	<10 mA rms	
TEC Current Limit		
Setting Range	0.1 to 15 A	
Resolution	1 mA	0.1 mA
Accuracy	±(0.2% + 10 mA)	
NTC Thermistor Sensors		
Resistance Measurement Range	100 Ω to 100 kΩ / 1 kΩ to 1 MΩ (2 Ranges)	
Control Range (Max)**	-55 to 150 °C	
Resolution (Temperature)	0.001 °C	
Resolution (Resistance, 100 kΩ/1 MΩ Range)	0.1 Ω/1 Ω	0.03 Ω/0.3 Ω
Accuracy (100 kΩ/1 MΩ Range)	±(0.06% + 1 Ω/5 Ω)	
Temperature Stability 24 Hours (Typical)**	<0.002 °C	
Temperture Coefficient	<5 mK/°C	
IC Sensors		
Supported IC Temperature Sensors	AD590, AD592 (Current); LM335, LM235, LM135, LM35 (Voltage)	
IC Control Ranges	-55 to 150 °C (Depending on Connected IC Sensor)	
Resolution	0.001 °C	0.0001 °C
Accuracy	±(0.04% + 0.08 µA) for AD590; ±(0.03% + 1.5 mV) for LM335/LM35	
Temperature Stability 24 Hours	<0.002 °C	
Temperature Coefficient	<5 mK/°C	
Pt100/Pt1000 RTD Sensors		
Temperature Control Range	-55 to 150 °C	
Resolution	0.001 °C	0.0003 °C
Accuracy Pt100/Pt1000 (4-Wire Measurement)	±0.3 °C/±0.1 °C	
Temperature Stability 24 Hours	<0.005 °C	
Temperture Coefficient	<20 mK/°C	
Temperature Window Protection		
Setting Range T_{win}	0.01 to 100.0 °C	
Temperature Control Output		
Load Resistance	>10 kΩ	
Transmission Coefficient	ΔT * 5V / Twin ±0.2 % (Temperature Deviation Scaled toTemperature Window)	

SPECIFICATIONS	FRONT PANEL*	REMOTE CONTROL*
TEC Voltage Measurement		
Measurement Principle	4-Wire/2-Wire	
Resolution	100 mV	40 mV
Accuracy (with 4-Wire Measurement)	±50 mV	
Digital I/O Port		
Number of I/O Lines	4 (Separately Configurable)	
Interface		
USB2.0	According to USBTMC USBTMC-USB488 Specification Rev. 1.0	
Protocol	SCPI-Compliant Command Set	
Drivers	VISA VXI pnp™, MS Visual Studio™, MS Visual Studio.net™, LabVIEW™, Labwindows/CVI™	
General Data		
Safety Features	TEC Current Limit, Sensor Fault Protection, Short Circuit when TEC Off, Open Circuit Protection, Temperature Setpoint Limit, Window Protection, Over Temperature Protection	
Display	LCD 320 x 240 Pixels	
Connectors Deviation Out Window Protection Out	17W2 Mixed D-Sub Jack (Female)	
Connector for Sensor, TE Cooler, TEC On Signal	BNC	
Connector for USB Interface	USB Type B	
Line Voltage/Frequency	100 to 120 V / 200 to 240 V ±10%, 50 to 60 Hz	
Maximum Power Consumption	600 VA	
Operating Temperature	0 to 40 °C	
Dimensions (W x H x D) w/o Operating Elements	10.35" x 4.80" x 12.09" (263 mm x 122 mm x 307 mm)	

*Via the front panel, the resolution is limited by the display. Via Remote Control, a higher resolution is offered.

**Control range and thermal stability depend on thermistor parameters.

ITEM	$	£	€	RMB	DESCRIPTION
TED4015	$ 2,700.00	£ 1,871.50	€ 2.397,00	¥ 22,799.00	Benchtop Temperature Controller ±15 A / 225 W
CAB4000	$ 65.00	£ 45.10	€ 57,80	¥ 548.90	Cable for TED4000, 5 A, 17W2, D-Sub-9
CAB4001	$ 170.00	£ 117.90	€ 151,00	¥ 1,435.50	Cable for TED4000, 20 A, 17W2, 17W2
CON4001	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	Connector Kit for TED4000, 20 A, 17W2 Male

Laser Diode Pigtailing

See Page 1054

Laser and Temperature Control System

Includes All Cables and Accessories

Buy the Complete Kit and Save 10%

The complete system is shown in the photograph and includes the diffraction-limited aspheric collimation optic.

Our popular LDC205C Laser Diode Controller, TED200C Temperature Controller, and TCLDM9 TEC laser diode mount are now available in a bundled package, complete with all necessary cables to connect both controllers to the mount, plus all accessories shown above. When purchased together, you will save 10% over the cost of buying each product separately!
This package is a versatile, easy-to-use laser diode operating system. The 500 mA LDC205C has been a favorite laser controller of ours for years, offering precise control of a laser diode's power in either a constant current mode or constant power mode. The new "C" version offers a higher compliance voltage. The 12 W TED200C has been our mainstay temperature controller, providing current and stability to the two TEC elements incorporated into our TCLDM9 mount.

For more detailed specifications, see pages 1178-1179 for the LDC205C, page 1188 for the TED200C, and page 1218 for the TCLDM9, or visit www.thorlabs.com.

A wide selection of Ø5.6 mm and Ø9 mm laser diodes is available starting on page 1032. Both sizes are compatible with our TCLDM9 mount.

Specifications for LTC100-B

- LDC205C Laser Diode Controller (See Page 1178)
- TED200C Temperature Controller (See Page 1188)
- TCLDM9 TEC-Cooled LD Mount (See Page 1218)
- Includes All Necessary Cables
- SM1NT, SPW909, S1TM09, SPW301, ESD Wrist Strap, Post, Post Holder, and Base Included
- AR Coated: 600 - 1050 nm Lens (C230TME-B)

Specifications for LTC100-C

- LDC205C Laser Diode Controller (See Page 1178)
- TED200C Temperature Controller (See Page 1188)
- TCLDM9 TE-Cooled LD Mount (See Page 1218)
- Includes All Necessary Cables
- SM1NT, SPW909, S1TM09, SPW301, ESD Wrist Strap, Post, Post Holder, and Base Included
- AR-Coated: 1050-1600 nm Lens (C230TME-C)

TED200C Highlights

- ±2 A/12 W Low Noise TEC Output
- Temperature Stability <0.002 °C
- Compatible with All Common Sensors (Thermistor, AD590/AD592/LM335)
- Wide Temperature Range from -45 to 145 °C (IC-sensor) or 10 kΩ to 200 kΩ (Thermistor)
- Separate Control of the P-, I-, and D-Gains for Perfect Adaptation to the Thermal Load
- 5-Digit Display with a Resolution of 0.01 °C (IC-Sensor) or 1 Ω (Thermistor)
- Analog Control via the TUNE IN Input

LDC205C Highlights

- Low Noise
- Five-Digit Display with 100 µA Resolution
- Analog Control Input and Analog Monitor Output
- Reliable Laser Diode Protection
- Operates with All Polarities of Laser Diode and Photodiode
- Maximum Laser Current of ±500 mA
- Compliance Voltage >10 V
- Drift (24 hrs 0 - 10 Hz typ.) <10 µA
- Accuracy ±100 µA

ITEM	$	£	€	RMB	DESCRIPTION
LTC100-B	$ 2,293.00	£ 1,589.50	€ 2.035,50	¥ 19,363.00	LD and Temperature Control System, AR-Coated: 600-1050 nm
LTC100-C	$ 2,293.00	£ 1,589.50	€ 2.035,50	¥ 19,363.00	LD and Temperature Control System, AR-Coated: 1050-1600 nm

Laser Diode and Temperature Controllers, 20 A (Page 1 of 3)

ITC4020

Includes power cord, connection cable for our laser mounts, Sub-D connector kit, and USB cable.

Features

- 3 Models for Laser Currents of ±1 A, ±5 A, and ±20 A at 10 V and TEC Currents of ±12 A and ±15 A at 15 V
- Excellent Temperature Stability of 0.002 °C (24 hrs)
- For Anode- and Cathode-Grounded Laser Diodes and Photodiodes
- Constant Current (CC) and Constant Power (CP) Control Modes
- Continuous Wave (CW) or Quasi-Continuous Wave (QCW) Operation
- Modulation via Internal Function Generator or External Modulation Input
- Analog Laser Current Monitor Output
- Supports Photodiodes, Thermopiles, Sensor Amplifiers, and Power Meters with Voltage Output for Optical Power Control
- Sensor Calibration for Power Display in mW
- Supports Thermistor, RTD, and IC Temperature Sensors
- Enable Key Switch and Interlock
- Enhanced Laser Diode and TEC Element Protection
- Digital PID Control with Auto PID Setting Function
- SCPI-Compliant USB Interface and Driver Set
- Power Efficient by Active Power Management

The ITC4000 Series is a laser diode current controller combined with a TEC elements controller, which is a combination of a LDC4000 series current controller and a TEC4020 temperature controller. It has been designed to provide a precise, stable current for laser diodes with injection currents of 1 A up to 20 A and an excellent temperature stabilization of 0.002 °C within 24 hrs. It supports all laser diode and monitor diode pin configurations and features a constant current (CC) or constant power (CP) mode. Most common temperature sensors can be used, and the ITC4000 can be adapted to different thermal loads via a digital PID controller. It offers an auto PID setting function or separate control of the P, I, and D parameters. The ITC4000 device is controlled via front panel keys and intuitive operation menus on a large and easy-to-read graphic LCD display. Additionally, the ITC4000 can be controlled by a SCPI-compatible USB Interface. A higher setting and measurement resolution is offered via remote control operation.* Many enhanced features like the Quasi-Continuous Wave (QCW) operation mode, an internal modulation generator, easy auto PID setting, and diverse laser diode and TEC element protection features are provided. These features, together with the new design, provide silent and power-efficient operation, making the ITC4000 Series an ideal choice for most applications.

Laser Diode Operation Modes

The laser diodes can be driven in either constant current (CC) mode, where the laser current is held precisely at the level adjusted by the user, or constant power (CP) mode, where an optical power sensor is used to monitor the output power of the laser for active power control. The ITC4000 Series offers two independent monitor inputs: one for photodiodes and one for thermopiles, both of which can be chosen for controlling the laser diode.

The analog modulation via external input or the internal function generator allows modulation of the laser diode in CC and CP modes. A control output voltage proportional to the laser current is provided for monitoring purposes.

Depending on the application, the ITC4000 Series of laser diode drivers can be operated in continuous wave (CW) or quasi-CW (QCW) mode. The integrated pulse generator can be triggered internally with an adjustable repetition rate or externally via a BNC jack at the rear of the unit. (see page 1178 and page 1180 for more details about the operation modes)

Enhanced Protection Features for the Laser Diode

The maximum allowed laser current, which is set as a precisely adjustable current limit, cannot be exceeded in any operation mode or for any compliance voltage. Electrical filters, careful grounding of the chassis, electronic output short-circuit, and the soft start feature ensure that the laser current remains transient-free in any case, even in the case of power line failure. (see page 1178 for details about the protection features)

TEC Controller

The ITC4000 Series contains a high-performance digital TEC controller for currents up to ±15 A. It offers an excellent temperature stability of 0.002 °C within 24 hrs together with the same enhanced safeguard and operation features similar to the TED4015 Series. The digital PID controller can adapt to different thermal loads by individual adjustable parameters or by the auto PID function. (For more details see page 1190). The ITC4000 Series supports thermistors up to 1000 kΩ, temperature sensing ICs or Platinum RTD sensors with a maximum control range of -55 to 150 °C. This temperature range is only a theoretical value; the actual rated temperature range is limited by the connected sensor and thermal setup.

For maximum TEC element protection, the ITC offers the same features as the TED4015. These protection features include an adjustable TEC output current limit, temperature sensor operation alerts, and monitoring of the actual and set temperature by an ouput signal.

*The front panel resolution is limited by the display. A higher setting and measurement resolution is offered via remote control.

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Laser Diode and Temperature Controllers, 20 A (Page 2 of 3)

ITEM#	ITC4001		ITC4005		ITC4020	
Specifications	**Front Panel***	**Remote Control***	**Front Panel***	**Remote Control***	**Front Panel***	**Remote Control***
Current Control (Constant Current Mode)						
Control Range	0 to ±1 A		0 to ±5 A		0 to ±20 A	
Compliance Voltage	>10 V					
Setting/Measurement Resolution	100 µA	16 µA	1 mA	80 µA	1 mA	320 µA
Accuracy	±(0.1% + 500 µA)		±(0.1% + 2 mA)		±(0.1% + 8 mA)	
Noise and Ripple (rms, Typ.)	<1 mA		<1.5 mA		<10 mA	
Drift, 24 Hours (0-10 Hz, Typ.)	<100 µA		<300 µA		<1 mA	
Temperature Coefficient	<50 ppm/°C					
Current Limit						
Setting Range	0 to 1A		0 to 5A		0 to 20A	
Resolution	100 µA	16 µA	1 mA	80 µA	1 mA	320 µA
Accuracy	±(0.12% + 800 µA)		±(0.12% + 3 mA)		±(0.12% + 12 mA)	
Power Monitor Input - Photodiode						
Photocurrent Measurement Ranges	2 mA / 20 mA					
Photocurrent Measurement Resolution	1 µA / 10 µA	32 nA / 320 nA	1 µA / 10 µA	32 nA / 320 nA	1 µA / 10 µA	32 nA / 320 nA
Photocurrent Accuracy	±(0.08% +0.5 µA) / ±(0.08% +5 µA)					
Photodiode Reverse Bias Voltage	0 to 10 V					
Power Monitor Input - Thermopile**						
Voltage Measurement Ranges	10 mV / 100 mV / 1 V / 10 V					
Voltage Measurement Resolution	1 µV / 10 µV 100 µV / 1 mV	0.16 µV / 1.6 µV 16 µV / 160 µV	1 µV / 10 µV 100 µV / 1 mV	0.16 µV / 1.6 µV 16 µV / 160 µV	1 µV / 10 µV 100 µV / 1 mV	0.16 µV / 1.6 µV 16 µV / 160 µV
Voltage Accuracy	±(0.1% + 10 µV) / ±(0.1% + 100 µV) / ±(0.1% + 1 mV) / ±(0.1% + 5 mV)					
Constant Power Control						
Photocurrent Control Ranges	1 µA to 2 mA / 10 µA to 20 mA					
Photocurrent Setting Resolution	1 µA / 10 µA	32 nA / 320 nA	1 µA / 10 µA	32 nA / 320 nA	1 µA / 10 µA	32 nA / 320 nA
Voltage Control Ranges	1 µV to 10 mV / 10 µV to 100 mV / 100 µV to 1V / 1 mV to 10V					
Voltage Setting Resolution	1 µV / 10 µV 100 µV / 1 mV	0.16 µV / 1.6 µV 16 µV / 160 µV	1 µV / 10 µV 100 µV / 1 mV	0.16 µV / 1.6 µV 16 µV / 160 µV	1 µV / 10 µV 100 µV / 1 mV	0.16 µV / 1.6 µV 16 µV / 160 µV
Power Limit						
Photocurrent Limit Range	1 µA to 2 mA / 10 µA to 20 mA					
Sensor Voltage Limit Range	1 µV to 10 mV / 10 µV to 100 mV / 100 µV to 1 V / 1 mV to10 V					
Laser Voltage Measurement						
Measurement Principle	4-Wire					
Laser Overvoltage Protection						
Setting Range	1 V to 10 V					
Laser Current Monitor Output						
Load Resistance	>10 kΩ					
External Modulation Input						
Small Signal 3 dB Bandwidth, CC Mode	DC to 100 kHz		DC to 100 kHz		DC to 50 kHz	
Internal Modulation						
Waveforms			Sine, Square, Triangle			
Frequency Range	20 Hz to 100 kHz		20 Hz to 100 kHz		20 Hz to 50 kHz	
Modulation Depth			0.1 to 100%			
QCW Mode						
Pulse Width Range	100 µs to 1 s					
Pulse Width Resolution	1 µs					
Repetition Rate Range	1 ms to 5 s (0.2 to 1000 Hz)					
Repetition Rate Resolution	10 µs					
Trigger						
Input and Output Level	TTL or 5V CMOS					
TEC Current Output						
Control Range	-15 to 15 A		-15 to 15 A		-12 to 12 A	
Compliance Voltage	>15 V		>15 V		>15 V	
Maximum Output Power	>225 W		>225 W		>180 W	
Resolution (Constant Current Mode)	1 mA	0.1 mA	1 mA	0.1 mA	1 mA	0.1 mA
Accuracy	± (0.2% + 20 mA)		± (0.2% + 20 mA)		± (0.2% + 20 mA)	
TEC Current Limit						
Setting Range	0.1 A to 15 A		0.1 A to 15 A		0.1 A to 12 A	

*The front panel resolution is limited by the display. A higher setting and measurement resolution is offered via remote control.
**The Thermopile Power Monitor Input can also be used for sensor amplifiers and power meters with voltage output.

...continued on next page

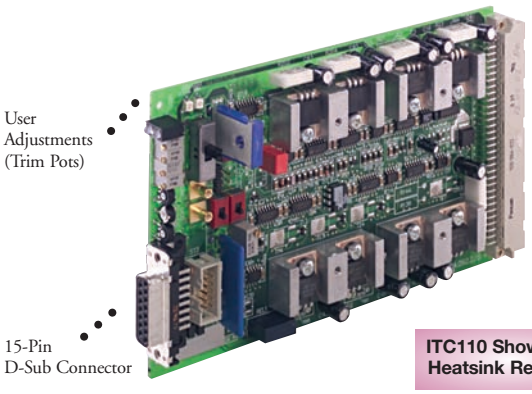
Laser Diode and Temperature Controllers, 20 A (Page 3 of 3)

ITEM#	ITC4001		ITC4005		ITC4020	
Specifications	**Front Panel***	**Remote Control***	**Front Panel***	**Remote Control***	**Front Panel***	**Remote Control***
NTC Thermistor Sensors						
Resistance Measurement Range	100 Ω to 100 kΩ / 1 kΩ to 1 MΩ (2 Ranges)					
Control Range (Max)	-55 to 150 °C					
Resolution (Temperature)	0.001 °C					
Resolution (Resistance, 100 kΩ/1 MΩ Range)	0.1 Ω / 1 Ω	0.03 Ω / 0.3 Ω	0.1 Ω / 1 Ω	0.03 Ω / 0.3 Ω	0.1 Ω / 1 Ω	0.03 Ω / 0.3 Ω
IC Sensors						
Supported Temperature Sensors	AD590, AD592 (Current); LM335, LM235, LM135, LM35 (Voltage)					
Control Range with AD590	-55 to 150 °C					
Control Range with AD592	-25 to 105 °C					
Control Range with LM335	-40 to 100 °C					
Control Range with LM235	-40 to 125 °C					
Control Range with LM135	-55 to 150 °C					
Control Range with LM35	-55 to 150 °C					
Resolution	0.001 °C	0.0001 °C	0.001 °C	0.0001 °C	0.001 °C	0.0001 °C
Pt100/Pt1000 RTD Sensors						
Temperature Control Range	-55 to 150 °C					
Resolution	0.001 °C	0.0003 °C	0.001 °C	0.0003 °C	0.001 °C	0.0003 °C
Temperature Window Protection						
Setting Range Twin	0.01 to 100.0 °C					
Protection Reset Delay	0 s to 600 s					
Window Protection Output	BNC, TTL					
Temperature Control Output						
Load Resistance	>10 kΩ					
Transmission Coefficient	ΔT * 5 V / T ±0.2 % (Temperature Deviation, scaled to Temperature Window)					
TEC Voltage Measurement						
Measurement Principle	4-Wire/2-Wire					
Resolution	100 mV	40 mV	100 mV	40 mV	100 mV	40 mV
Accuracy (with 4-Wire Measurement)	±50 mV					
Digital I/O Port						
Number of I/O lines	4 (Separately Configurable)					
Input Level	TTL or CMOS, Voltage Tolerant up to 24 V					
Output Level (Source Operation)	TTL or 5 V CMOS, 2 mA MAX.					
Output Level (Sink Operation)	Open Collector, up to 24 V, 400 mA MAX.					
Interface						
USB2.0	According to USBTMC/USBTMC-USB488 Specification Rev. 1.0					
Protocol	SCPI Compliant Command Set					
Drivers	VISA VXI pnp™, MS Visual Studio™, MS Visual Studio.net™, LabVIEW™, LabWindows/CVI™					
General Data						
Safety Features	Interlock, Inhibit, Keylock Switch, Laser Current Limit, Laser Power Limit, Soft Start, Short Circuit when Laser off, Adjustable Laser Overvoltage Protection, Over Temperature Protection, Temperature Window Protection					
Display	LCD 320 x 240 Pixel					
Line Voltage / Frequency	100 to 120 V and 200 to 240 V ±10%, 50 to 60 Hz					
Operating Temperature	0 to 40 °C					
Dimensions (W x H x D) without Operating Elements	10.35" x 4.80" x 12.09" (263 mm x 122 mm x 307 mm)					

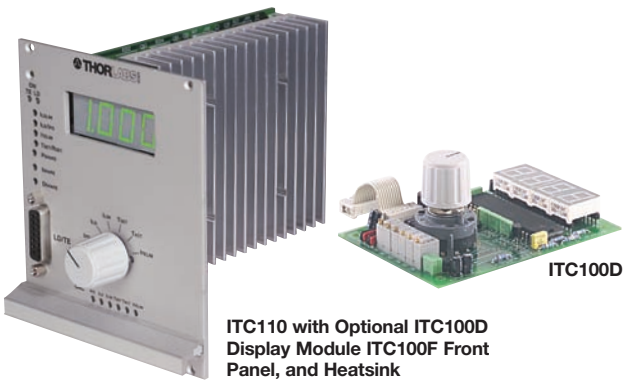
*The front panel resolution is limited by the display. A higher setting and measurement resolution is offered via remote control.

ITEM#	$	£	€	RMB	DESCRIPTION
ITC4001	$ 2,500.00	£ 1,733.00	€ 2.219,50	¥ 21,111.00	Benchtop Laser Diode and TEC Controller ±1 A
ITC4005	$ 2,800.00	£ 1,941.00	€ 2.486,00	¥ 23,644.00	Benchtop Laser Diode and TEC Controller, ±5 A
ITC4020	$ 3,200.00	£ 2,218.50	€ 2.841,00	¥ 27,021.00	Benchtop Laser Diode and TEC Controller, ±20 A
CAB4005	$ 80.65	£ 56.00	€ 71,70	¥ 681.10	Cable for LDC4000 Series, 5 A, 13W3 to D-Sub-9, 1.5 m
CAB4006	$ 80.65	£ 56.00	€ 71,70	¥ 681.10	Cable for LDC4000 Series, 20 A, 13W3 to 13W3, 1.5m
CON4005	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	Connector Kit for LDC4000 Series, 20 A, 13W3 male
CAB4000	$ 65.00	£ 45.10	€ 57,80	¥ 548.90	Cable for TED4000, 5 A, 17W2, D-Sub-9
CAB4001	$ 170.00	£ 117.90	€ 151,00	¥ 1,435.50	Cable for TED4000, 20 A, 17W2, 17W2
CON4001	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	Connector Kit for TED4000, 20 A, 17W2 male

Laser Diode/TEC Controllers (Page 1 of 2)



ITC110 Shown with Heatsink Removed



ITC100D

ITC110 with Optional ITC100D Display Module ITC100F Front Panel, and Heatsink

Introduction

The ITC100 Series combines a low-noise, low-drift current controller with a precise thermoelectric cooler (TEC) controller on a single eurocard-sized board, which can be extended by the optional display unit ITC100D.

The ITC100 Series includes three controller models for laser currents up to ±200 mA, ±1 A, and ±3 A. All three models feature bipolar temperature control with TEC current/power up to ±2 A/12 W, ±2 A/12 W, and ±3 A/18 W, respectively. To operate the ITC133 version with a laser current of ±3 A and a TEC current of ±3 A, forced cooling or a bigger heat sink is required.

Highlights

- Excellent Temperature Stability of <0.004 °C
- Supports All Laser Diode Pin Configurations
- Supports AD590, AD592, and LM335 IC and Common NTC Thermistors as Temperature Sensor
- Extensive Laser Diode Protection Features
- Individually Adjustable P, I, and D Parameters
- Analog Modulation of Laser Power up to 200 kHz

FEATURES

Constant Current and Constant Power Modes

The ITC100 Series offers constant current (CC) and constant power (CP) operation modes and supports all laser diode and photodiode pin configurations. For temperature control, all common NTC thermistors and IC temperature sensors (AD590, AD592, and LM335) can be used. The temperature displays in kΩ when using a thermistor and in °C when using temperature sensor ICs.

Adaptable PID Temperature Control Loop

The TEC controller features a full PID feedback loop with independent P, I, and D settings for temperature stabilization. When tuned correctly, the PID circuit typically settles to the desired temperature setpoint within seconds.

External Modulation

All ITC100 Series controllers can be externally modulated in constant current (CC) or constant power (CP) mode.

Extensive Laser Protection Features

After the module is powered on, a soft-start circuit ensures a slow increase in laser current without voltage peaks. The laser is also protected when the laser controller is turned off by an automatic shorting of the laser diode to ground. A built-in protection feature prevents the laser current limits from being exceeded, even while using external modulation. Additional protection features includeover and under temperature protection, a supply voltage monitor to ensure appropriate supply voltage, and a safety interlock signal that can be used to shut down the laser. This is often required for higher power lasers.

Temperature Window Protection

To additionally safeguard the laser diode, the ITC100 series provides an adjustable temperature window that allows both an upper and lower temperature limit to be set. If the actual laser temperature departs from the preset window, the laser diode injection current will automatically be switched off. When the laser temperature returns back to the set window, the laser current will be soft started again.

System Integration

Setting up the ITC100 Series modules requires solid knowledge and skills in electronics and laser diode control techniques. This OEM board is ideal for system integrators experienced in this technology.

Two electrical connectors are provided to facilitate integrating these OEM drivers into larger systems. A 15-pin D-sub connector located along the front edge of the main board provides all the required connections to operate the laser diode and TEC element. The optional CAB430 Series Y cable can be used to connect to Thorlabs Laser Mounts. The 64-pin DIN connector located along the back edge of the board provides access to the full array of Input/Output functions of the ITC100 series for the laser diode, a photodiode for power monitoring, and the TEC element.

Contact Thorlabs Technical Support

To get further information and facilitate the integration of the OEM ITC100 Series into your system, please contact our technical support group at any of the offices listed on the back cover of this catalog.

Laser Diode/TEC Controllers (Page 2 of 2)

ITC100 Laser Controller Specifications

	ITC102	ITC110	ITC133
Current Control			
Control Range of Laser Current	0 to ±200 mA	0 to ±1 A	0 to ±3 A*
Compliance Voltage		>4 V	
Setting Accuracy/Repeatability (Full Scale)		±2% (Typical)/±0.1%	
Noise (10 Hz to 10 MHz, rms)	<2 µA	<6 µA	<25 µA
Drift (30 min., 0-10 Hz, Typ.)	<20 µA	<100 µA	<300 µA
Temperature Coefficient		<50 ppm/°C	
Power Control			
Control Range Photocurrent		5 µA to 2 mA	
Accuracy / Repeatability (Full Scale)		±2% (Typical)/±0.1%	
Current Limit			
Setting Range	0 to >200 mA	0 to >1 A	0 to >3 A
Setting Accuracy/Repeatability (Full Scale)		±2% (Typical)/±0.1%	
Analog Modulation Input			
Input Resistance		10 kΩ	
Modulation Coefficient, CC	40 mA/V ±5%	200 mA/V ±5%	600 mA/V ±5%
Small Signal 3 dB Bandwidth, CC	DC to 200 kHz	DC to 50 kHz	DC to 20 kHz
Modulation Coefficient, CP		0.4 mA/V ±5%	
TTL Modulation Input			
Rise/Fall time	<10 µs	<50 µs	<100 µs
General Data			
Supply Voltage/Current	±12 to ±15 V/2.3 A	±12 to ±15 V/3.1 A	±12 to ±15 V/3.1 A*
Operating Temperature		0 to 40 °C	
Dimensions (W x H x D)		3.94" x 1.64" x 6.30" (100 mm x 42 mm x 160 mm), Eurocard	
TEC Output			
Control Range of TEC current	-2 to 2 A	-2 to 2 A	-3 to 3 A*
Compliance Voltage		>6 V	
Thermistor Temperature Sensors			
Control Range		100 Ω to 80 kΩ	
Setting Accuracy (Full Scale)		±2% (Typical)	
Repeatability (Full Scale)		±0.1%	
Temperature Stability (Typ)		<2 Ω	
IC Temperature Sensors AD590, AD592, & LM335			
Control Range		-20 to 80 °C	
Setting Accuracy (Full Scale)		±2% (Typical)	
Repeatability (Full Scale)		±0.1%	
Temperature Stability (Typ)		<0.004 °C	
TEC Current Limit			
Setting Range	0 to ≥2 A	0 to ≥2 A	0 to ≥3 A
Accuracy		±5%	
Temperature Control Inputs			
TTL Control Input		TEC ON	
Analog Control Input		T_{SET} / R_{SET}	
Input Resistance		10 kΩ	
Input Coefficient Thermistor		16 kΩ/V	
Input Coefficient IC-Sensor		20 °C/V	

*The total combined current for the ITC133 is limited by the total thermal dissipation loss. Optimized cooling by fan or bigger heat sink allows 3 A LD and 3 A TEC at the same time provided the power supply provides 6.1 A

ITEM	$	£	€	RMB	DESCRIPTION
ITC102	$ 569.20	£ 394.60	€ 505,40	¥ 4,806.40	LD and TEC Controller, LD 200mA, TEC 12 W
ITC110	$ 569.20	£ 394.60	€ 505,40	¥ 4,806.40	LD and TEC Controller, LD 1 A, TEC 12 W
ITC133	$ 599.80	£ 415.80	€ 532,60	¥ 5,064.80	LD and TEC Controller, LD 3 A, TEC 18 W
ITC100D	$ 153.00	£ 106.10	€ 135,90	¥ 1,292.00	ITC100 Display Control Module, Removable
ITC100F	$ 49.00	£ 34.00	€ 43,60	¥ 413.80	ITC100 Series Front Panel
ITC100P	$ 18.40	£ 12.80	€ 16,40	¥ 155.40	64-Pin Female DIN Connector
CAB430	$ 120.00	£ 83.20	€ 106,60	¥ 1,013.30	15-Pin to 9-Pin D-Sub Y-Cable for LD and TEC Controller

Rack Systems: Laser Diode/TEC Controller Overview

Modular Platform Solutions

Thorlabs offers different platforms for modular, easy-to-customize instrumentation. The PRO8 and TXP platforms are described in this section. For details about our compact T-Cube platform, please see pages 542-547.

The PRO8 platform has become a mainstay for many laser diode manufacturing and test facilities. It offers a selection of laser diode controller modules, WDM laser source modules, photodiode amplifiers, and a series of optical switch modules. The PRO8 platform is available as a rack version (PRO8000) for up to eight modules and a benchtop version (PRO800) for up to two modules, both of which can be operated as a stand-alone system without a PC or remotely controlled via IEEE or RS-232.

The TXP5000 platform is targeted at broader test and measurement applications. The system offers compatible WDM laser sources, laser diode modules, a tunable laser, and high-performance polarization analysis and control modules. The TXP5000 system is available as a rack-compatible version that mounts up to 16 modules or as a benchtop version that can mount up to 4 modules and a single module interface (TXP5001AD). The TXP series are remotely controlled by PC via a USB or TCP/IP interface.

PRO8 Modular Laser Diode Current and Temperature Controller

- The LDC8000 Series modules offer laser diode drivers for almost any application from 100 mA up to 8 A. These drivers provide many of the same features and capabilities as our benchtop units.
- The MLC8000 Series modules are high-density laser diode controller modules. Each can power up to eight laser diodes. This family of plug-ins are ideally suited for OEM applications that require testing and characterization of large volumes of laser diodes.

PRO8 Modular Laser Diode Temperature Controllers

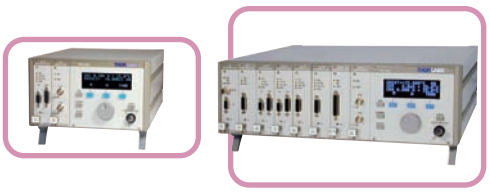
- The TED8000 series of temperature controllers provide excellent temperature stabilization of laser diodes as well as other temperature-sensitive devices. Typically the temperature stability will be in the ±0.001 °C range. Three modules with up to 8 A/64 W of TEC power are offered.

PRO8 and TXP Modular Combined Laser Diode Current and Temperature Controller

- The ITC8000 Series of modules for the PRO8 platform are designed for applications that require temperature stabilization and laser diode control. The modules offer maximum laser drive currents from 200 mA to 1 A. All modules offer 2 A/16 W of TEC power.
- The ITC5000 for the TXP Platform allows space-saving simultaneous current and temperature control of a laser diode with a single module. This series offers three current ranges (±200 mA, ±500 mA, and ±1 A) and incorporates a TEC controller that provides up to 1.5 A/5.25 W. The modules can be modulated internally or externally.

Laser/TEC Drivers-Platform Selection Guide

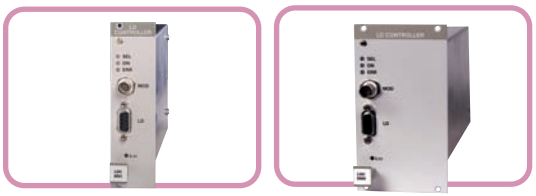
Pages 1199-1214



Modular Systems: PRO8

- Stand-Alone Operation or Remote Control via IEEE-488 Interface
- 2 Chassis Versions with 2 or 8 Plug-in Modules
- Control Features Accessed via Front Panel or IEEE-488 Interface

See Pages 1200-1201



Laser Current Controller Modules: LDC8000

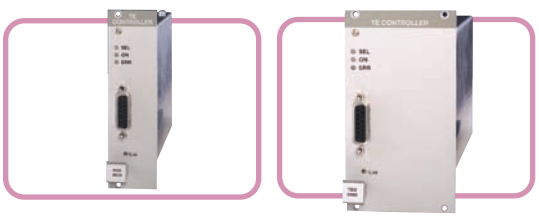
- Current Range of 100 mA to 8 A
- Driver Suited for Most Laser Diode Applications

See Pages 1202-1203

Laser Current Controller, 8-Channel Modules: MLC8000

- Powers up to 8 Laser Diodes
- For High-Throughput Testing of Many Laser Diodes

See Pages 1204-1205



Temperature Control Modules: TED8000

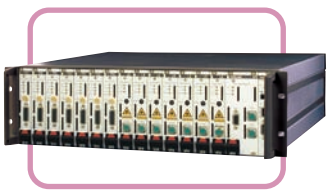
- Excellent Temperature Stabilization of Laser Diodes
- Temperature Stability Typically ±0.001 °C
- Three Models for up to ±8 A/64 W of TEC Power

See Pages 1206-1207

Combination Laser Diode/TEC Controller Modules: ITC8000

- Powers up to 8 Lasers and TEC Elements
- For Laser Diode Control with Temperature Stabilization
- Maximum TEC Current/Power of ±2 A/16 W

See Pages 1208-1209



Test and Measurement Platform: TXP5000

- 3 Chassis Versions for 1, 4, and 16 Slots
- For Remote Control via USB or TCP/IP

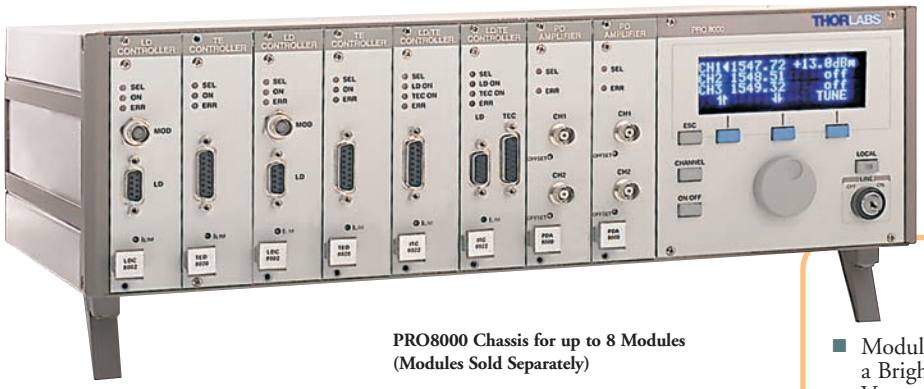
See Pages 1210-1211

Laser Sources and TEC Controller: ITC5000

- For Laser Diode Control with Temperature Stabilization
- 3 Models for Laser Diode Currents of ±200 mA, ±500 mA, or ±1 A

See Pages 1212-1214

PRO8000 Modular Controller Systems (Page 1 of 2)



PRO8000 Chassis for up to 8 Modules (Modules Sold Separately)

Stand-Alone Operation without PC, IEEE 488.2, and RS-232 Interfaces

PRO8 Series Highlights

- Modular Controllers with a Bright 4 x 20 Character Vacuum-Fluorescence Display
- Universal Platform Interchangeable Modules Include Laser Diode Controllers, TEC Controllers, WDM Sources, Photocurrent Measurement Modules, and Optical Switches
- Current Modules from 100 mA to 8 A (16-Bit), Temperature Modules up to 8 A/64 W (16-Bit), Combination Modules up to 1 A Current Plus 2 A/16 W Temperature
- Control Eight Lasers from One Module: VCSEL, Fabry-Perot, or DFB.
- Combine Eight Modules in One Chassis for 64 Lasers from a Single Chassis
- Burn-in and Test Station
- Macro Functions for Fast Acquisition of P/I Curves
- Fast IEEE-488.2 and RS-232 Interfaces
- Instrument Drivers for LabVIEW™ and LabWindows™/CVI

Introduction

The PRO8 Series is a modular platform that provides a flexible solution to almost all laser diode control requirements. It is available in two versions: a compact benchtop unit for two modules (PRO800) or a 19" rack versions for up to eight modules (PRO8000). Together with an extensive range of modules (i.e., single or multi-channel current and temperature controllers, switches, photocurrent amplifiers, and laser sources), a PR08 system can be configured for almost any application.

The PR08 Series offers solutions to operate anywhere from one to hundreds of laser diodes. For example, a single PRO8000 19" rack with eight modules of our eight-channel drivers can drive 64 laser diodes. For a flexible controller system for one or two lasers, the PRO800 is the ideal choice.

The standard PRO8000 can supply up to 16 A of total driving current for all installed modules; for larger applications, we offer the PRO8000-4, which can supply up to 32 A.

User-Friendly Controls

The PRO8 display menu allows easy configuration of any module in the chassis. Mnemonic symbols provide user-friendly access to all operational parameters. All settings are retained in memory and automatically recalled upon powering on the mainframe as long as modules are not moved to different slots during power down. Individual modules are automatically identified and, when selected, can be configured and controlled using the softkeys.

PRO8000-Compatible Modules

Laser Diode Controllers - See Page 1202
- 100 mA to 8 A

Multi-Channel Laser Diode Controllers See Pages 1204-1205
- 5 mA to 200 mA

Temperature Controllers - See Page 1206
- 2 A to 8 A

Combination LD and TEC Controllers See Page 1208
- 200 mA to 1 A Laser/2 A TEC

Optical Switches - See Pages 991-992
- 1 x 2, 2 x 2, 1 x 4, and 1 x 8

Photodiode Amplifier - See Page 990
- 10 nA to 10 mA

DFB WDM Laser Sources See Pages 986-989
- ITU Precision Sources

Interchangeable Modules

All modules can be driven in the compact PRO800, the standard PRO8000, and the full-size 19" PRO8000-4 units. Aside from the size difference of the PRO800 and the heavy-duty power supply of the PRO8000-4, all the chassis utilize the same operating system and protocols. All chassis models can power any of the plug-in modules that are found in this section, as well as our selection of DFB laser modules found on our website.

Each system is assembled and tested to your specific configuration. Contact our technical support team for expert advice on optimum solutions for your needs.

PRO8 Modular Controller Systems (Page 2 of 2)

All PRO8 series controllers are equipped with IEEE-488.2 and RS-232 interfaces. Each system is delivered with LabVIEW™ and LabWindows™/CVI drivers to support the individual modules, as well as their integration into a comprehensive test and measurement system.

Easy Operation
All modules are self-identifying and are operated via menu-driven softkeys; the analog values are set with a rotary knob on the front panel.

PRO800 Chassis
Modules Sold Separately

PRO800 Bench Top Chassis

The smaller PRO800 is the benchtop version of the PRO8 system offering slots for two modules. It is menu driven, flexible, and supports a multitude of electrical and optical modules. The PRO800 is ideal for crowded lab environments and offers the same features as the larger eight-slot chasis PRO8000.

All values are displayed by a 4 x 20 character alphanumeric display. The functions of the softkeys change in accordance with the activated module. A key-operated power switch protects the PRO8000 series against unauthorized use.

Additional Modules for the PRO8 Series:

- DWDM Laser Sources in the C- and L-Band (See Pages 986-989)
- Optical Switch Modules (See Pages 991-992)

Specifications	PRO800	PRO8000	PRO8000-4
Slots (Maximum Number of Modules)	2	8	8
Maximum Output Current for All Modules	8 A	16 A	32 A
Maximum Power Consumption	220 VA	500 VA	800 VA
Display	Alphanumeric Display with 4 x 20 Characters		
Operation	Menu Driven		
Setting	Function Keys and Rotary Knob		
Protection Features	Key-Operated Power Switch		
TTL Modulation Frequency Range*	DC to 10 kHz		
TTL Duty Cycle*	Selectable		
TTL Modulation Input (Max 5 V)	BNC		
TTL Trigger Output (Max 5 V)	BNC		
IEEE-488.2 Interface	24-Pin IEEE Jack (Rear Panel)		
RS-232 Interface	9-Pin D-sub Plug (Rear Panel)		
Chassis Ground	4 mm Banana (Rear Panel)		
Line Voltage	100 V, 115 V and 230 V AC ± 10%		
Line Frequency	50 to 60 Hz		
Operating Temperature	0 to 40 °C		
Storage Temperature	-40 to 70 °C		
Relative Humidity	< 80% up to 31 °C, Decreasing to 50% @ 40 °C		
Dimensions (Chassis Only)	9.13" x 5.79" x 15.59" (232 x 147 x 396 mm)	17.68" x 5.79" x 15.59" (449 x 147 x 396 mm)	17.68" x 6.97" x 17.95" (449 x 177 x 456 mm)
Weight (Chassis Only)	<9 kg	<17 kg	<21 kg

*External synchronous current modulation for all cards in the chassis

ITEM#	$	£	€	RMB	DESCRIPTION
PRO800	$ 1,798.80	£ 1,247.00	€ 1.597,00	¥ 15,190.00	2-Slot Modular Benchtop Chassis
PRO8000	$ 2,470.80	£ 1,713.00	€ 2.193,50	¥ 20,864.00	8-Slot Modular Rack Chassis
PRO8000-4	$ 3,336.00	£ 2,312.50	€ 2.961,50	¥ 28,170.00	8-Slot High-Power Modular Rack Chassis
PRO8000-R32	$ 64.30	£ 44.60	€ 57,10	¥ 543.00	19" Mounting Kit for PRO8000
PRO8000-R42	$ 89.00	£ 61.70	€ 79,10	¥ 751.60	19" Mounting Kit for PRO8000-4
PRO8000-C	$ 24.80	£ 17.20	€ 22,10	¥ 209.50	PRO800 / PRO8000 Front Cover Plate

PRO8 Laser Controller Modules (Page 1 of 2)

8 A


4 A


2 A


1 A


500 mA


200 mA


100 mA

Highlights

- 100 mA, 200 mA, 500 mA, 1 A, 2 A, 4 A, and 8 A Modules
- Ultra-Stable Current Control with 16-Bit Resolution
- Extensive Laser Diode Protection Features
- Switchable Photodiode Bias for Improved Sensor Linearity
- Easily Configured Self-Identifying Modules
- External Modulation of Laser Output

Introduction

The modular laser diode current controllers of the LDC8 series provide optimal performance. All of these current controller modules offer extremely low noise and drift, resulting in exceptional laser stability.

Seven Current Ranges

Seven different current controller modules are available, with maximum output currents ranging from 100 mA up to 8 A (10 A upon request). The drive current can be set precisely with 16-bit resolution (i.e., one part in 65,000). An analog control input allows all current modules to be operated in either constant current (CC) or constant power (CP) mode. The maximum modulation frequency is dependent on the mode used.

User-Friendly Controls

After installing a new module into a PRO8 chassis, the front-panel control screen is used to configure the plug in. The softkeys are used to scroll through the slot location to access the basic settings. The operational settings are easily accessed; displayed mnemonic symbols and simple prompts provide for user-friendly operation. All settings are retained in memory and automatically recalled upon powering the mainframe.

Laser Diode Protection Features

The LDC8000 Series current modules incorporate laser protection features to safeguard sensitive laser diodes. An advanced circuit design ensures that AC power line transients or power outage, as well as RF pickup, cannot affect the laser diode.

For each current module, three independent limits can be set to safeguard the laser. Two of the limits are programmable, which prevent the laser current and the laser power from exceeding the user-defined maximum values.

The third limit is set via a recessed front panel trim pot that sets a "hardware" current limit and protects against programming errors and accidental adjustment of the front panel knob. Even while externally modulating the laser, it is not possible to exceed the hard or soft limits.

After activating the laser diode, a soft-start function slowly increases the laser current without voltage overshoots.

Even in the case of AC power fluctuation, the laser current remains transient free. Voltage peaks on the AC line are effectively suppressed by electronic filters, shielding of the transformer, and careful grounding of the modules and chassis. The LDC8000 series meets the international requirements regarding laser protection (e.g., CDRH US21, CFR 1040.10). Furthermore, the module's operation is protected by the PRO8 system's key-operated power switch, its interlock, and a delay of the output current, plus many additional features.

Protection Features

- Soft Start Slowly Increases Laser Drive Current
- Programmable Limits for Current and Optical Power
- Hardware Current Limit for Protection Against Errors Through Programming, Modulation, and Wrong Settings
- Extensive AC Power Filtering Eliminates Transients
- Temperature Window Protection with TED8000 Card
- Meets Applicable CDRH and CE Regulations

External Modulation of Laser Output

An analog control input enables the modulation of the laser diode in constant current or constant power mode. The maximum modulation frequency depends on the current module used. See the specifications table on the next page.

ITC8000 Combination Laser Diode and TEC Controllers

I_{LD} = ±200 mA, ±500 mA, and ±1 A
I_{TEC} = ±2 A/16 W

See Page 1208

PRO8 Laser Controller Modules (Page 2 of 2)

Laser Diode Controllers Specifications

	LDC8001	LDC8002	LDC8005	LDC8010	LDC8020	LDC8040	LDC8080
Current Control							
Control Range (Continuous)	0 to ±100 mA	0 to ±200 mA	0 to ±500 mA	0 to ±1 A	0 to ±2 A	0 to ±4 A	0 to ±8 A[a]
Compliance Voltage	>2.5 V	>5 V	>5 V	>5 V	>5 V	>5 V	>5 V
Resolution	1.5 µA	3 µA	7.5 µA	15 µA	30 µA	70 µA	130 µA
Accuracy (Full Scale)	±0.05%	±0.05%	±0.05%	±0.1%	±0.1%	±0.1%	±0.3%
Noise Without Ripple (10 Hz to 10 MHz, RMS, Typ.)	<1 µA	<3 µA	<5 µA	<10 µA	<20 µA	<50 µA	<100 µA
Ripple (50/60 Hz, RMS, Typ.)	<0.8 µA	<1 µA	<1 µA	<1.5 µA	<3 µA	<4 µA	<8 µA
Transients (Processor, Typ.)	<10 µA	<15 µA	<30 µA	<50 µA	<80 µA	<120 µA	<200 µA
Transients (Other, Typical)	<100 µA	<200 µA	<500 µA	<1 mA	<2 mA	<4 mA	<8 mA
Drift 60 min/24 hr (Typ., 0-10 Hz, at Constant Ambient Temp)	<0.5 µA/<1.5 µA	<0.5 µA/<1.5 µA	<2 µA/<4 µA	<5 µA/<20 µA	<15 µA/<100 µA	<25 µA/<150 µA	<100 µA/<200 µA
Temperature Coefficient	<50 ppm/°C						
Power Control							
Control Range of Photocurrent	10 µA to 5 mA (Other Ranges Available upon Request)						
Reverse Bias Voltage	5 V (Can be Switched Off)						
Resolution	100 nA						
Accuracy (Full Scale)	±0.05%						
Current Limit							
Setting Range (20-Turn Trim Pot)	0 to ≥100 mA	0 to ≥200 mA	0 to ≥500 mA	0 to ≥1 A	0 to ≥2 A	0 to ≥4 A	0 to ≥8 A
Resolution	3 µA	6 µA	15 µA	30 µA	60 µA	130 µA	250 µA
Accuracy	±100 µA	±200 µA	±500 µA	±2 mA	±4 mA	±8 mA	±50 mA
Power Limit							
Photocurrent Range	0 to 5 mA						
Resolution	1.25 µA						
Accuracy	±50 µA						
Laser Voltage Measurement							
Measurement Principle	4-Wire (Improves Accuracy by Compensating for Cable Resistance)						
Measurement Range	0 to 5 V						
Resolution	0.2 mV						
Accuracy	±5 mV						
Analog Modulation Input							
Input Resistance	10 kΩ						
3 dB-Bandwidth, CC[b]	DC to 2.5 kHz	DC to 200 kHz	DC to 100 kHz	DC to 50 kHz	DC to 30 kHz	DC to 20 kHz	DC to 10 kHz
Modulation Coefficient, CC	10 mA/V ± 5%	20 mA/V ± 5%	50 mA/V ± 5%	100 mA/V ± 5%	200 mA/V ± 5%	400 mA/V ± 5%	800 mA/V ± 5%
Modulation Coefficient, CP				0.5 mA/V ±5%			
Rise and Fall Time, Typical[c]	<100 µs	<2 µs	<4 µs	<5 µs	<6 µs	<9 µs	<15 µs
General Data							
Card Width	1 Slot						2 Slots
Connector	9-Pin D-Sub (f)						15-Pin HD D-Sub (f)
Weight		< 300 g		< 500 g		< 750 g	
Operating Temperature	0 to +40 °C						
Storage Temperature	-40 to +70 °C						

[a] 10 A Available upon request [b] External TTL Modulation synchronous for all current cards [c] Small signal bandwidth
All data valid at 23 ± 5 °C and 45 ±15% relative humidity

Drive up to 64 Lasers from 1 Chassis – See Next Page

ITEM#	$	£	€	RMB	DESCRIPTION
LDC8001	$ 1,100.40	£ 762.90	€ 977,00	¥ 9,291.90	PRO8000 LD Control Module, 100 mA
LDC8002	$ 1,039.20	£ 720.40	€ 922,70	¥ 8,775.10	PRO8000 LD Control Module, 200 mA
LDC8005	$ 1,063.70	£ 737.40	€ 944,40	¥ 8,982.00	PRO8000 LD Control Module, 500 mA
LDC8010	$ 1,075.90	£ 745.90	€ 955,20	¥ 9,085.00	PRO8000 LD Control Module, 1 A
LDC8020	$ 1,160.40	£ 804.50	€ 1.030,30	¥ 9,798.50	PRO8000 LD Control Module, 2 A
LDC8040	$ 1,170.20	£ 811.30	€ 1.039,00	¥ 9,881.20	PRO8000 LD Control Module, 4 A
LDC8080	$ 1,215.50	£ 842.70	€ 1.079,20	¥ 10,264.00	PRO8000 LD Control Module, 8 A, 2 Slots
CAB400	$ 66.00	£ 45.80	€ 58,60	¥ 557.40	DB9 Cable, LDC8000 Module to LD Mount

PRO8 High-Density Laser Controllers (Page 1 of 2)

Introduction

The MLC8000 Series laser diode controllers have been field proven in demanding applications for many years. They are designed to control up to eight lasers from a single module. When fully populated, a PRO8000 chassis can simultaneously power up to 64 laser diodes.

Designed to support high-density laser diode test and burn-in, this series provides eight different maximum drive current ranges. The PRO8000 chassis can support up to a total of 16 A of laser diode drive current (i.e., the sum of the output drive currents from all the installed cards) and therefore can easily support the demands of driving 64 lasers at 200 mA each.

200 mA

100 mA

50 mA

25 mA

Highlights

- Drives Eight Lasers from a Single Module and 64 Lasers from a Single MLC Chassis
- 5 mA, 10 mA, 25 mA, 50 mA, 100 mA, and 200 mA Ranges
- Ultra-Stable Current Control with 12-Bit Resolution
- Extensive Laser Diode Protection Features
- Improved Sensor Linearity
- Easily Configured Self-Identifying Modules

Intuitive User-Friendly Controls

Each module provides eight independent outputs, all operating within the same set parameters (current range, current limit, and constant current or constant power operating mode). The laser drive current for each output, however, can be individually set. The various modules of the MLC8000 series can be used interchangeably, along with other PRO8 modules, in any of the three chassis to implement a large variety of systems.

After installing a new module into a PRO8 chassis, the front-panel control screen is used to configure the plug in. The softkeys are used to scroll through the slot locations to access the settings for the individual modules. The operational parameters are easily accessed using mnemonic symbols and simple prompts. All settings are retained in memory and automatically recalled upon powering on the mainframe.

The polarity of the laser diodes, either anode or cathode ground, is factory fixed. The eight outputs are switched on together, but the current control or power control is independent for each channel.

Laser Diode Protection

The MLC8000 Series of modules incorporate proven laser protection features to safeguard sensitive laser diodes. These features include a hardware current limit, a soft-start circuit, and an interrupt sensing circuit that shuts down the laser upon detecting a break in the electrical connection to the laser diode. Additionally, extensive precautions have been taken to protect the laser diodes during AC power fluctuation or outages.

The current limit is accessed only via a front-panel trim-pot to prevent the risk of accidental adjustment. All eight output channel current limits are identical for an individual card. After activating the laser power, a soft-start function slowly increases the laser current, preventing overshoots.

Even in the case of an AC power fluctuation, the laser current remains transient free. Voltage peaks on the AC line are effectively suppressed by electronic filters, shielding of the transformer, and careful grounding of the modules and chassis.

The MLC8000 Series meets the international requirements regarding laser protection (e.g., CDRH US21 CFR 1040.10). Furthermore, the modules' operation is protected by the PRO8 systems' key-operated power switch, its interlock, and a delay of the output current, in addition to many other features.

System Applications

The MLC8000 Series is an ideal choice for burn-in applications due to its high-density (64 lasers per PRO8000 chassis) drive capability coupled with the user-friendly advanced control features.

For technical support and advice about specific system configurations, please contact our Technical Support Team.

Easy User Interface

Each plug-in is automatically identified upon plugging in the module. A brightly lit 4 x 20 characters fluorescent display allows the user to select any of the installed modules. When selected, the control parameters can be changed quickly.

Laser Diode Grounding

The MLC8000 controllers are divided into two groups: one for grounded laser cathodes and one for grounded anodes. Each supports both PD polarities. Under all conditions, the laser diode is driven with respect to ground, ensuring maximum protection for the laser diode.

PRO8 High-Density Laser Controllers (Page 2 of 2)

Burn-In Station:
Pictured System Powers 512 Lasers

The MLC8000 Series modules are designed to simultaneously supply drive current to eight laser diodes. Therefore, up to 64 laser diodes can be operated by a single PRO8000 chassis.

An automated test station for hundreds of laser diodes can be set up by connecting many PRO8000 systems via the IEEE-488 interface. High-level software macros speed the process of developing automated burn-in and final test routines.

LDC Series Interface Cable

LDC modules ending in 8001 to 8040 with 9-pin D-Sub connectors can be connected directly to Thorlabs' laser diode mounts with DB9 interface using a shielded CAB400 cable (not included with the module). For additional or replacement cables, we have a full line from which to choose.

CAB400

See Page 1203

MLC8000 Series-High Density Laser Diode Controllers Specifications

	MLC8200-8
Current Control (Two Ranges): Control Ranges Switchable (8 Channels Per Module)	0 to 50 mA and 0 to 200 mA
Laser Diode Polarity	Fixed, Either Anode Ground (AG)* or Cathode Ground (CG)**
Compliance Voltage	>4 V
Accuracy	±150 µA/±600 µA
Resolution	12 µA/50 µA
Noise w/o Ripple (10 Hz to 10 MHz), Typ.	<0.5 µA/<1.5 µA
Ripple (50/60 Hz, RMS), Typical	<0.5 µA/<1 µA
Transients (Other, Typical)	<200 µA
Drift (30 min, 0 to 10 Hz), Typical	<1.5 µA/<5 µA
Temperature Coefficient	<50 ppm/°C
Power Control Control Range of Photocurrent	5 µA to 2 mA
Accuracy	±6 µA
Resolution Photocurrent	0.5 µA
Reverse Bias Voltage	0 V/5 V (Wireable)
Current limit Setting Range (20-Turn Pot)	0 to 50 mA / 0 to 200 mA
Resolution	12 µA /50 µA
Accuracy	±0.5 mA /±1 mA
General Data Connector	44-Pin HD D-Sub (F) (For Laser Diode, Photodiode, and General Interlocks, etc.)
Card Width	1 Slot
Weight	<500 g
Operating Temperature	0 to 40 °C
Storage Temperature	-40 to 70 °C

*AG: Laser Anode Grounded
**CG: Laser Cathode Grounded
All data valid at 23 ± 5 °C and 45 ± 15% relative humidity

ITEM#	$	£	€	RMB	DESCRIPTION
MLC8200-8AG	$ 1,222.80	£ 847.70	€ 1.085,70	¥ 10,326.00	PRO8 Multi-Channel LD Controller, 200 mA, AG
MLC8200-8CG	$ 1,222.80	£ 847.70	€ 1.085,70	¥ 10,326.00	PRO8 Multi-Channel LD Controller, 200 mA, CG

PRO8 Temperature Control Modules (Page 1 of 2)

Introduction

A range of thermoelectric temperature control modules is available from ±2 A/16 W to ±8 A/64 W with 16-bit resolution. For optimal laser operation in applications that require precise thermal control, the TED8000 Series of modules provide excellent temperature stabilization, typically <0.001 °C when using an AD590 thermal sensor. This facilitates highly stable operation of temperature-sensitive components, such as optical nonlinear birefringent crystal experiments.

Separate adjustment of the P, I, and D settings of the PID servo loop enable optimal settling times for different thermal loads.

The temperature controllers in the TED8000 series operate within our PRO8 series mainframe and are ideal companions to our LDC8000 laser diode current controller modules shown on page 1202.

High-Power/Channel Count Laser Systems

With up to 64 W of cooling power, the TED8080 is well matched to our LDC8080 laser diode control module, which provides 8 A of laser drive current (see page 1202). Laser diodes typically operate at approximately 2 to 3 V forward bias. Operation at 8 A results in an overestimated thermal load of 16 to 24 W, assuming 0% lasing efficiency and that all the electrical energy is converted to thermal energy.

When using our eight-channel laser controller (MLC8000 series), the TED8080 is an ideal choice to temperature stabilize a large number of lasers mounted on a common cooling plate.

PID Control System Functionality

The P, I, and D settings of the temperature control loop can be set via menu-driven softkeys or via the remote interface. Optimized adjustment ensures fast laser temperature settling times and long-term temperature stability of better than 1 mK.

A PID control system combines three different control strategies into one feedback loop. The PID refers to how the error signal (i.e., the difference between the actual temperature and the set current) is processed prior to being fed back to the driving element responsible for changing the system. The purely proportional controller simply scales the error signal by some number prior to feeding it back to the drive element.

TED8000 Series Temperature Control

	TED8020	TED8040	TED8080
Type of Controller	PID with Adjustable Share		
PID-Share	12-Bit Control Range		
Card Width	1 Slot	1 Slot	2 Slots
Connector	15-Pin D-Sub (F)		
Weight	<500 g	<600 g	<700 g
Operating Temperature	0 to 40 °C		
Storage Temperature	-40 to 70 °C		

Protection Features

Damage to the TE cooler is prevented by setting an adjustable TEC current limit. This can be set via a recessed potentiometer on the module front panel (hardware limit), the front panel softkeys, or one of the standard interfaces (software limit).

When used with our laser diode current controllers, the temperature window protection safety feature can be enabled. If the laser temperature departs from the preset temperature window, the laser current will be switched off immediately. The temperature modules of the TED8000 series meet extremely high standards regarding precision and drift performance and provide a low noise, bipolar output, enabling extremely stable wavelength control and safe thermal load management.

Choice of Temperature Sensors

The temperature modules of the TED8000 series can be operated with thermistors, AD590/AD592 IC sensors, and LM135/LM335 transducers. When operated with a thermistor, the thermistor calibration constant can be set so that all applicable settings and displays are given directly in degrees celsius rather than in ohms.

With the modules of the TED8000PT series, a Pt100 temperature sensing element can be operated, replacing the IC sensor.

For extremely low temperature applications, such as the operation of lead-salt lasers, a cryogenic option is offered for all models. As a Pt1000 sensor is used for operating temperatures in the range of 20 to 310 K, the controller is modified to control a heating element.

Use the PRO800 chassis with one of our LDC8000 and TED8000 Series modules to set up a space-saving laser current and temperature controller. Also see page 1208 for the ITC8000 Combination Series or page 1293 for benchtop devices.

PRO8 Temperature Control Modules (Page 2 of 2)

The PID control loop involves three separate parameters: the Proportional (P), the Integral (I), and the Derivative (D) parameter. The P value determines the reaction to the current temperature error, the I value determines the reaction based on the sum of recent temperature errors, and the D value determines the reaction based on the rate at which the temperature error has been changing. The weighted sum of these three terms is used to adjust the temperature via the current supply of a cooling/heating element (TEC element).

By "tuning" the values for these three parameters independently, the PID controller can be optimized to the setup and requirements of the application (e.g., minimizing temperature settling time for each specific thermal load and temperature level). The response of the PID controller can be described in terms of the responsiveness of the controller to an error, the degree to which the controller overshoots the setpoint, and the degree of system oscillation.

You can deactivate P, I, or D by setting it to zero (i.e., for using the controller only as PI controller just set the D value to zero). This may be useful in a noisy environment since derivative action is very sensitive to measurement noise. Deactivating the I value may prevent the system from reaching its target temperature and is therefore not recommended.

TED8000 Specifications

	TED8020	TED8040	TED8080
Control Range	-2 to 2 A	-4 to 4 A	-8 to 8 A
Compliance Voltage		>8 V	
Maximum Output Power	16 W	32 W	64 W
Measurement Resolution I_{TEC}	0.07 mA	0.15 mA	0.3 mA
Measurement Accuracy I_{TEC}	±10 mA	±20 mA	±50 mA
Measurement Resolution U_{TEC}		0.3 mV	
Measurement Accuracy U_{TEC}		± 20 mV	
Noise and Ripple (Typical)	<1 mA	<2 mA	<4 mA
Temperature Sensors: Thermistor (TED80x0 and TED80x0PT)			
Control Range		5 Ω to 20 kΩ Switchable 50 Ω to 200 kΩ	
Calibration		Exponential Form, Steinhart-Hart	
Resolution		0.3 Ω/3 Ω	
Accuracy		±2.5 Ω/±25 Ω	
Stability (Typical)		<0.5 Ω/<5 Ω	
Temperature Sensor: IC-Sensors (AD590/AD592/LM135/LM335) (TED80x0)			
Control Range		-12.375 to 90 °C	
Calibration		2-Point Linearization	
Resolution		0.0015 °C	
Accuracy		±0.1 °C	
Stability (Typical)		<0.001 °C	
Temperature Sensor Pt100 Platinum: Optional Feature (PT) for TED80x0			
Control Range		-12.375 to 90 °C	
Resolution		0.0015 °C	
Accuracy		±0.3 °C	
Stability (Typical)		<0.005 °C	
Temperature Sensor Pt1000 KRYO: Optional Feature (KRYO) for TED8020			
Control Range		20 to 310 K	
Resolution		2 mK (Within 20-155 K)	
Accuracy		±2 K (Within 20-155 K)	
Stability (Typical)		0.005 K (Within 20-155 K)	
TEC Current Limit			
Setting Range (20-Turn Pot)	0 to ≥2 A	0 to ≥4 A	0 to ≥8 A
Resolution D/A Converter	0.5 mA	1 mA	2 mA
Accuracy	±20 mA	±40 mA	±80 mA

All data valid at 23 ± 5 °C and 45 ±15% relative humidity

ITEM#	$	£	€	RMB	DESCRIPTION
TED8020	$ 610.80	£ 423.50	€ 542,30	¥ 5,157.70	PRO8 TEC Controller, 16 W
TED8040	$ 610.80	£ 423.50	€ 542,30	¥ 5,157.70	PRO8 TEC Controller, 32 W
TED8080	$ 732.40	£ 507.80	€ 650,30	¥ 6,184.50	PRO8 TEC Controller, 64 W

Laser Mount Connection Cable CAB420-15 Series

All modules in the TED8000 Series, except PT or KRYO options, can be connected to Thorlabs' laser diode mounts with a DB9 interface using a shielded CAB420-15 cable (not included with module). For additional or replacement cables, we have a full line from which to choose.

See Page 377

ITEM#	$	£	€	RMB	DESCRIPTION
CAB420-15	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	DB9(F) to DB15(M) Cable

PRO8 Combination – Laser Diode & TEC Controllers (Page 1 of 2)

ITC8000 Combination Laser Diode and TEC Controllers
3 Models
ILD = ±200 mA to ±1 A
ITEC = ±2 A/16 W

Introduction

The ITC8000 series for the PRO8 platform incorporates a laser current controller combined with a TEC temperature controller in one space-saving module. Three models are available offering laser drive current ranges of 0 to ±200 mA, 0 to ±500 mA, and 0 to ±1 A. All three incorporate a TEC controller that provides up to ±2 A/16 W.

Each module comes in two versions: the ITC8000 with a 9-pin connector for laser current output and a 15-pin connector for TEC current output. Alternatively, the ITC8000DS15 has a common 15-pin connector for both laser and TEC current output.

All of the ITC8000 modules offer the same exceptional performance as our separate laser controller and temperature controller modules. All laser diode and photodiode pin configurations are supported.

Extremely Low Noise

The ITC8000 Series modules feature exceptionally low laser current noise (from 2 - 10 µA depending on the model, see table on next page) and outstanding temperature stability of better than <0.001 °C when an AD590 temperature sensor is used. The performance of the ITC8000 modules is independent of the operation mode (constant current or constant power).

User-Friendly Controls

After installing a new module into a PRO8 chassis, the module can be configured via the front-panel softkey controls or via one of the remote computer interfaces. The softkeys on the PRO8 are used to scroll through the slot locations to access all the module settings. Alternatively, the IEEE-488.2 interface also provides convenient access to the controller settings. Once set, all the settings are retained in memory and automatically recalled upon powering up the mainframe.

Laser Diode Protection Features

The modules incorporate proven laser diode protection features. Aside from common protection functions such as current limits, laser current soft start, and interrupt protection, an advanced circuit design ensures that AC power line transients, power outages, and RF pickup cannot affect the laser diode.

Additionally, a temperature window can be set that will shut the laser down in the event the high or low thresholds of the window are exceeded.

The ITC8000 Series meets the international requirements regarding laser protection (i.e., CDRHUS21 CFR 1040.10). Furthermore, the module's operation is protected by the PRO8 system's key-operated power switch, its interlock, and a delay of the output current, in addition to many other features.

Calibrating the Power Display

The display of the laser power can be easily calibrated with respect to the laser's monitor-photodiode current to provide a readout directly in milliwatts. This is accomplished by adjusting the "CALPD" calibration constant that is accessed via the front-panel softkeys or the computer interface. Please note that an optical power meter is required.

Setting the Temperature Control Loop

The P (gain), I, and D settings of the PID control loop can each be set independently to optimize the temperature response of the system to different thermal loads.

ITC8000 Series of Interface Cables

Thorlabs offers three cables that can be used to connect the ITC8000 combination modules to our laser diode mounts with DB9 interface: the CAB400 for all DB9 outputs of the LDC controllers, the CAB420-15 for all DB15 TEC controller outputs, and the CAB430 for all ITC8000DS15 modules. These cables are not included with the modules. For additional or replacement cables, we have a full line to choose from with same-day delivery.

ITEM#	$	£	€	RMB	DESCRIPTION
CAB400	$ 66.00	£ 45.80	€ 58,60	¥ 557.40	DB9(M) to DB9(M) Cable
CAB420-15	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	DB9(F) to DB15(M) Cable
CAB430	$ 120.00	£ 83.20	€ 106,60	¥ 1,013.30	DB9(M) & DB9(F) to DB15(M) Cable


CAB400


CAB420-15


CAB430

See Page 377

PRO8 Combination – Laser Diode & TEC Controllers (Page 2 of 2)

Specifications

	ITC8022	ITC8052	ITC8102
Laser Controller: Current Control			
Control Range of Injection Current	0 to ±200 mA	0 to ±500 mA	0 to ±1 A
Compliance Voltage		>5 V	
Resolution	3 µA	7.5 µA	15 µA
Accuracy (Full Scale)	±0.05%		±0.1%
Noise w/o Ripple (10 Hz to 10 MHz, RMS, Typ.)	<2 µA	<5 µA	<10 µA
Ripple (50 Hz, RMS, Typ.)	<1µA		<1.5 µA
Transients (Processor, Typ.)	<15 µA	<30 µA	<50 µA
Transients (Other, Typ.)	<200 µA	<500 µA	<1 mA
Drift (24 hrs, at Constant Ambient Temperature, Typ.)	<3 µA	<10 µA	<25 µA
Temperature Coefficient		<50 ppm/°C	
Laser Controller: Power Control			
Control Range of Photocurrent	10 µA to 2 mA		
Reverse Bias Voltage	0 to 10 V (Adjustable)		
Resolution Photocurrent	30 nA		
Accuracy (Typ.)	±0.1%		
Laser Controller: Current Limit			
Setting Range	0 to ≥200 mA	0 to ≥500 mA	0 to ≥ 1A
Resolution	6 µA	15 µA	30 µA
Accuracy	±200 µA	±500 µA	±2 mA
Laser Voltage Measurement			
Measurement Principle	4-wire (Improves Accuracy by Compensating for Cable Resistance)		
Measurement Range	0 to 10 V		
Resolution	0.3 mV		
Accuracy	±5 mV		
Temperature Controller: Output			
Control Range of TEC Current	-2 to 2 A		
Compliance Voltage	>8 V		
Maximum Output Power	16 W		
Measurement Resolution of TEC	0.07 mA (Current) / 0.3 mV (Voltage)		
Noise and Ripple Typical	<1 mA		
Temperature Controller: Current Limit			
Setting Range (20-Turn Pot)	0 to ≥ 2A		
Resolution	0.5 mA		
Setting Accuracy	±20 mA		
Temperature Controller: Sensor Data			
Thermistor:			
Control Range	200 Ω to 40 kΩ (10 kΩ Nominal Resistance @ 25 °C)		
Resolution	0.7 Ω		
Accuracy	±10 Ω		
Stability	<1 Ω		
AD590, AD592, and LM335:			
Control Range	-12.375 to 90 °C		
Resolution	0.0015 °C		
Accuracy	±0.1 °C		
Temperature Stability (Typical)	<0.001 °C		
Connector: LD/TEC	9-Pin (LD)/15-Pin (TEC) D-Sub (ITC8000)		

ITEM#	$	£	€	RMB	DESCRIPTION
ITC8022	$ 1,713.60	£ 1,188.00	€ 1.521,50	¥ 14,470.00	PRO8 LD and TEC Controller, 200 mA/16 W, 9-Pin/15-Pin D-Sub Connector
ITC8052	$ 1,854.00	£ 1,285.00	€ 1.646,00	¥ 15,656.00	PRO8 LD and TEC Controller, 500 mA/16 W, 9-Pin/15-Pin D-Sub Connector
ITC8102	$ 2,080.80	£ 1,442.50	€ 1.847,50	¥ 17,571.00	PRO8 LD and TEC Controller, 1000 mA/16 W, 9-Pin/15-Pin D-Sub Connector

Test and Measurement Platform (Page 1 of 2)

TXP5016 Chassis
Modules Sold Separately, Laptop not Included

Three Chassis Versions

- **TXP5004:** 4 Slots with USB Control
- **TXP5016:** 16 Slots with Ethernet Control
- **TXP5001AD:** Single Module Adapter with Desktop Power Supply and USB Control (See Next Page)

Available Modules

- **ITC5000:** Combination Laser Diode Current and TEC Temperature Control (See Page 1212)
- **LS5000:** Optical Sources from 1470 - 1620 nm (See Page 1072)
- **IPM5300:** High-Speed Inline Polarimeter (See Page 1329)
- **DPC5500:** Inline Deterministic Polarization Controller (See Page 1331)
- **ECL5000D:** Continuously Tunable External Cavity Diode Laser (See Page 1087).
- **PAX5710/5720:** Rotating λ/4 Wave Plate Polarimeter for VIS and NIR (See Page 1326)

Introduction

The TXP5000 Series is a flexible platform that allows you to combine different modules to quickly build the specific test and measurement system that your application requires. The broad range of available modules for this platform cover many optical disciplines (e.g., polarization analysis and control, laser diode current control, optical signal generation, and monitoring).

Benchtop and Rack Version

The three available TXP versions also offer great flexibility regarding size, complexity, and connectivity of the system. The TXP5016 rack version for up to 16 modules includes a TCP/IP port and is optimized for larger and complex systems in industrial environments. The TXP5004 benchtop version for up to four modules is controlled via a USB port and is targeted for R&D test and measurement applications in lab environments. The TXP5001AD single module interface offers low-cost evaluation with full functionality for a single module with USB connectivity.

TXP5004

The family of plug and play modules for a broad range of photonic applications include integrated laser drivers and TEC controllers, DWDM DFB laser sources, tunable lasers, and advanced polarimetry control and measurement devices. All modules are interchangeable and can be integrated with LabVIEW™ and LabWindows™/CVI control. The TXP5000 platform incorporates an efficient architecture that shares common functionality within the mainframe. Only building blocks required for specific functionality or for real-time applications are implemented into the module itself.

Typical Applications

Typical applications of TXP systems span from qualification, test, and burn-in systems for optical equipment in manufacturing environments to PMD analysis in complex network architectures. High-performance polarization analysis and control is an application where the TXP system especially excels.

User-Friendly Controls

The TXP5000 system utilizes USB and TCP/IP protocol for communication, which offers easy connection to PCs and integration into networks. The TXP5004 benchtop is controlled by a connected PC via USB, whereas the TXP5016 rack unit offers direct connection to Ethernet networks by an embedded server. The system is easily configured through the TXP Explorer, a control tool similar to Windows™ Explorer, that comes with all TXP5000 systems. The TXP Explorer makes local or remote administering very easy, and since it is completely network based, it enables worldwide access to the system.

Modularity, Interchangeability, and Flexibility

The "hot swap" feature of the TXP5000 system allows any module to be replaced without interrupting other modules in the same mainframe that are in operation. Arbitrary module assemblies can be pooled together into individual systems by specialized software modules, allowing them to perform new and more complex tasks through a single interface or GUI. This facilitates the ever-changing requirements and the reuse of existing hardware for customized and more specialized applications. A customer who already owns the necessary modules needs only the software module to run that application. The internet-embedded architecture allows new or upgraded GUIs, software tools, and firmware to be easily downloaded and installed into the system.

Security Interlock

The TXP chassis provide global interlocks to secure setups involving the TXP against external events, such as opening of lab doors or pushing of emergency switches. The reaction of the TXP depends on the type of card inserted. Besides the global interlock, some TXP cards have an individual interlock line.

Test and Measurement Platform (Page 2 of 2)

TXP5000 Series Chassis Specifications

	TXP5016	TXP5004	TXP5001AD*
Maximum Power Consumption	400 VA	150 VA	75 VA
Number of Slots	16 Slots	4 Slots	1 Slot
Operation	GUI on Remote PC		
Remote Interface	Ethernet 10BaseT	USB 2.0	USB 2.0
Remote Drivers	LabVIEW™, LabWindows/CVI™, and C++		
Chassis Ground	4 mm Banana		4.8 mm Fast-On
Line Voltage	100 to 240 VAC ±10%		
Line Frequency	50 to 60 Hz ± 5%		
Operating Temperature	0 to 40 °C		
Storage Temperature	-40 to 70 °C		
Dimensions	17.68" x 5.83" x 17.13" 449 x 148 x 435 mm	6.61" x 5.83" x 12.40" 168 x 148 x 315 mm	4.88" x 0.91" x 4.41" 124 x 23 x 112 mm
Weight (w/o Modules)	7 kg	3 kg	0.2 kg

*Please see order information at the bottom of the page.

2 Versions of TXP5000 Series Chassis: 4-Slot and 16-Slot Systems

ITEM#	$	£	€	RMB	DESCRIPTION
TXP5004	$ 1,222.80	£ 847.70	€ 1.085,70	¥ 10,326.00	TXP5000 4 Slot Chassis with USB Control
TXP5016	$ 3,549.60	£ 2,460.50	€ 3.151,50	¥ 29,973.00	TXP5000 16 Slot Chassis with Ethernet Control

TXP Series Accessories and Replacement Items

ITEM#	$	£	€	RMB	DESCRIPTION
TXP5000C	$ 47.00	£ 32.60	€ 41,80	¥ 396.90	Front Cover Plate for TXP Chassis
TXP5000-R32	$ 70.40	£ 48.90	€ 62,60	¥ 594.50	Rack Mounting Kit, 19" for TXP5016
TXP5016-IBC	$ 23.50	£ 16.30	€ 20,90	¥ 198.50	TXP5016 Interlock Bypass Connector
TXPCABCRO	$ 23.50	£ 16.30	€ 20,90	¥ 198.50	TXP5016 Crosslink Cable, 2 m
TXPCABETH	$ 23.50	£ 16.30	€ 20,90	¥ 198.50	TXP5016 Ethernet Cable, 2m
TXPCABSER	$ 29.40	£ 20.40	€ 26,20	¥ 248.30	TXP5016 Serial Service Cable for Software Upgrades
TXPCABUSB	$ 29.40	£ 20.40	€ 26,20	¥ 248.30	TXP5004 USB Cable, 2m

Single Module Interface

- Power/Control any Module for TXP5000 Series
- Ideal for Test Bench Operation of a Single Module
- USB Interface for Direct PC Connection and Control
- Also Available as an OEM Integration Tool for TXP5000 Technology
- USB Cable and External Power Supply Included


TXP5001AD

The TXP5001AD is a low-cost adapter for any TXP5000 Series module. It provides a USB interface and allows a single module to be operated without any additional equipment except a PC. The adapter comes with the TXP5000 software installation package including LabVIEW™ and LabWindows/CVI™ drivers. The connection to the user PC is accomplished via the included USB cable. The adapter offers the easiest and most cost-effective way to start using the modules of the TXP5000 series, such as laser diode controllers, optical signal sources/controllers, and polarimetric controllers and analyzers. A 48 V power supply is included that operates from 100 - 240 VAC, 50 - 60 Hz.

TXP5001AD shown here with a TXP5000 Module (not included). See the following pages for details on TXP laser controllers, TEC controllers, and laser sources.

ITEM	$	£	€	RMB	DESCRIPTION
TXP5001AD	$ 275.40	£ 191.00	€ 244,60	¥ 2,325.50	TXP5000 Single Module Interface with USB Control

Combination Laser/TEC Controller (Page 1 of 2)

Introduction

The ITC5000 series combines current and temperature controller modules for the TXP5000 series. They allow space saving simultaneous current and temperature control of a laser diode by a single module. The ITC5000 series offers three current ranges (±200 mA, ±500 mA, and ±1 A) that support all laser diode and photodiode polarities. These modules can be modulated externally or internally. All three models incorporate a TEC controller that provides up to ±1.5 A/5.25 W.

Besides common protection functions such as interlock and soft start, an advanced circuit design ensures that transient spikes cannot affect the laser current.

The temperature controller, identical for all modules, is designed to keep the laser temperature constant for highly stable power and wavelength operation. Separate adjustment of the P, I, and D parameters of the integrated PID control loop minimize temperature settling times. An additional temperature window protection circuit switches the laser current off if the laser temperature leaves a preset temperature range.

The ITC5000 models offer exceptional noise and stability performance. All laser diode and photodiode pin configurations are supported.

Extremely Low Noise

The combination controller modules of the ITC5000 series all feature exceptionally low laser current noise (from 2 µA to 20 µA depending on the model, see table on next page) and exceptional temperature stability of better than 0.002 °C at 20 °C. The performance of the ITC5000 Series is independent of the operation mode – constant current (CC) or constant power (CP).

User-Friendly Controls

After installing a new module into any TXP5000 chassis, the modules can be configured via remote computer interface. All settings can be stored on the computer and recalled the next time it is powered on.

Laser Diode Protection Features

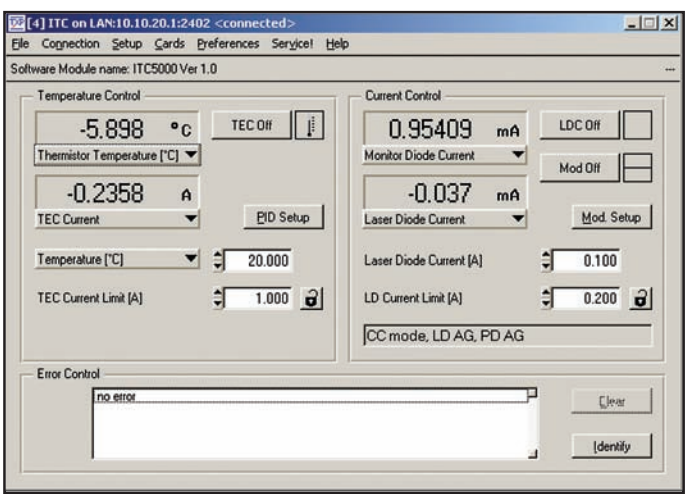
The ITC5000 series modules incorporate proven laser protection features to safeguard sensitive laser diodes. Besides common protection functions, such as current limits, laser current soft start, and interrupt protection, an advanced circuit design ensures that AC power line transients or power outages, as well as RF pickup, cannot affect the laser diode.

A laser current limit can be set to safeguard the laser diode. To protect the Peltier element, a TEC current limit is also provided. Additionally, a temperature window can be set that will shut the laser down in the event that the high or low thresholds of the window are exceeded. The limits and the window can be set independently for each installed module.

All ITC5000 modules also include an interlock and a delay of the output current.

Highlights

- Simultaneous Current and Temperature Control
- Low Noise and Ultra-Stable Control of Injection Current
- Constant Current and Constant Power Operation
- Laser Driven with Respect to Ground
- Protected Analog Modulation of the Laser Diode
- Extensive Protection Features
- Safe and Ultra-Stable User Diode Operation



GUI for the ITC5000 Series Module

ITEM#	$	£	€	RMB	DESCRIPTION
ITC5022	$ 2,080.80	£ 1,442.50	€ 1.847,50	¥ 17,571.00	TXP5000 Laser Diode Current/TEC Controller, ±200 mA/1.5 A
ITC5052	$ 2,080.80	£ 1,442.50	€ 1.847,50	¥ 17,571.00	TXP5000 Laser Diode Current/TEC Controller, ±500 mA/1.5 A
ITC5102	$ 2,080.80	£ 1,442.50	€ 1.847,50	¥ 17,571.00	TXP5000 Laser Diode Current/TEC Controller, ±1 A/1.5 A

Combination Laser/TEC Controller (Page 2 of 2)

Specifications

	ITC5022	ITC5052	ITC5102
Laser Controller: Current Control Current Range	0 to ±200 mA	0 to ±500 mA	0 to ±1 A
Compliance Voltage	>2.5 V (Typical >3 V)		
Resolution	4 µA	10 µA	20 µA
Accuracy (Typ. Full Scale)	±100 µA	±250 µA	±1 mA
Noise Without Ripple (10 Hz to 10 MHz, RMS, Typ.)	<2 µA	<7 µA	<20 µA
Ripple (50 Hz, RMS, Typ.)	<0.5 µA		
Transients (Processor, Typ.)	<15 µA	<30 µA	<50 µA
Transients (Other, Typ.)	<200 µA	<500 µA	<1 mA
Drift (24 hrs, at Constant Ambient Temperature, Typ.)	<2 µA	<5 µA	<20 µA
Temperature Coefficient	<50 ppm/°C		
Laser Controller: Power Control Control Range of Photocurrent	10 µA to 5 mA		
Reverse Bias Voltage	0 to 4 V (Adjustable)		
Resolution Photocurrent	0.1 µA		
Accuracy (Typ.)	±5 µA		
Laser Controller: Current Limit Setting Range	0 to >200 mA	0 to >500 mA	0 to >1 A
Resolution	50 µA	125 µA	250 µA
Accuracy	±200 µA	±500 µA	±2 mA
Laser Voltage Measurement Measurement Principle	4-Wire (Improves Accuracy by Compensating for Cable Resistance)		
Measurement Range	0 to 4 V		
Resolution	0.15 mV		
Accuracy	±5 mV		
Analog Modulation Input Impedance	10 kΩ		
Modulation Coefficient CC	20 mA/V ±10%	50 mA/V ±10%	100 mA/V ±10%
Small Signal 3 dB-Bandwidth at CC	200 kHz		
Modulation Coefficient CP	0.5 mA/V ±10%		
Internal Modulation Form	Sinusoidal, Triangle, Square		
Frequency	0.02 kHz to 20 kHz		
Rise/Fall Time	4 µs		
Temperature Controller: Output Range of TEC Current	-1.5 to 1.5 A		
Compliance Voltage	>3.5 V		
Maximum Output Power	5.25 W		
Measurement Resolution of TEC Current	60 uA		
Measurement Range TEC Voltage	-4 to 4 V		
Measurement Resolution of TEC Voltage	0.2 mV		
Noise and Ripple Typical	<1 mA		
Temperature Sensors: Thermistor Control Range	0.2 to 40 kΩ		
Resolution	0.8 Ω		
Accuracy	±10 Ω		
Stability (24 hrs.)	1 Ω		
General Data Common LD/TEC Connector	15-Pin D-Sub		
LD MOD IN Connector	SMA		
Size	1 Slot		
Weight	675 g		

All data valid at 23 ± 5 °C and 45 ± 15% relative humidity.

TXP DWDM Laser Sources – LS5000 Series

LS5000 DFB Laser Source Module for TXP Platform

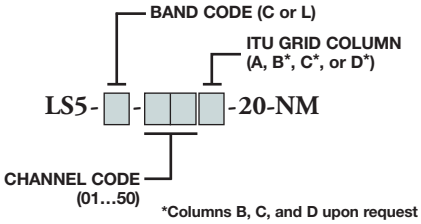
Features

- CW DFB Laser Source
- L- and C-Band on 100 GHz ITU Grid*
- 20 mW Optical Power
- Excellent Wavelength and Power Stability (±2 pm, ±0.01 dB for 24 hrs.)
- Wavelength Tuning (±0.85 nm)
- Power Tuning (>6 dB, Typical 10 dB)
- Versatile Coherence Control

*Depending on Laser Diode Availability, 50 GHz and 25 GHz grid upon request.

Ordering Information

The item name for the order of your laser source can be obtained from the ITU Grid on page 1071 in the same way as for the WDM8 sources. Just replace WDM8 by LS5.



The TXP5000 system offers an extensive range of DFB laser source modules for the DWDM domain, covering the 1530.33 - 1611.79 nm wavelength range on the 100 GHz ITU grid.* They provide 20 mW of output, power tuning in excess of 6 dB (typ. 10 dB), and wavelength tuning over ±0.85 nm. The light source modules have been designed for excellent stability in power and wavelength for reliable measurement results as required in test setups to characterize BER (Bit Error Rate) performance and EDFA parameters. The modules feature internal modulation capabilities for flexible coherence control to suppress coherent optical effects, especially the triangular modulation format for efficient suppression of Stimulated Brillouin Scattering in fibers.

*Depending on Laser Diode Availability, 50 GHz and 25 GHz grid upon request.

For More Information and Pricing, Please See Pages 1070-1073

ITEM#	$	£	€	RMB	DESCRIPTION
LS5-X-XXX-20-NM	$ 2,754.00	£ 1,909.00	€ 2.445,00	¥ 23,255.00	WDM Laser Source 20 mW, No Direct Modulation

TOOLS OF THE TRADE

TXP Series Polarimeter Modules

Inline Deterministic Polarization Controller

The DPC5500-T, an in-line deterministic polarization controller, combines deterministic state of polarization control, high speed, low loss, and high accuracy in a unique and unprecedented way. It is a versatile solution that may be utilized in many applications, ranging from R&D and manufacturing to industrial applications.

Polarimeter

Our PAX5700 series rotating wave plate-based polarimeter for free-space and fiber applications offers precision State of Polarization (SOP) measurements. It has a high dynamic range of up to 70 dB in the wavelength range of 400 - 1700 nm. It is designed for lab and industry application measurements. The modular design of the PAX5700 series allows easy integration into setups for Jones/Mueller Matrix analysis.

Inline Polarimeter

The IPM5300-T fiber-optic polarimeter module enables high-speed measurements of the State of Polarization (SOP).

See Polarization Tools on Pages 1323-1336

Laser Diode Mount Selection Guide

Pages 1215-1222

Butterfly Laser and Electro-Optic Package Mounts

- Zero Insertion Force (ZIF) Sockets
- Compact Low-Profile Design
- Compatible with One- and Two-Port Devices

See Page 1216

Complete LD/TEC Controllers with Mount

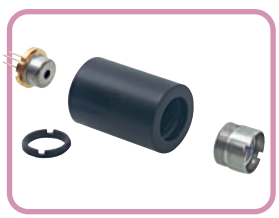
- Laser Diode Driver Integrated with TEC Controller
- Choose from 14-Pin Butterfly or DIL Mount
- Suited for use with BOAs, SOAs, SLDs, and FPLs

See Page 1217

Mounts for Ø5.6 mm and Ø9 mm Laser Packages

- Controls Temperature of Ø5.6 mm and Ø9 mm Laser Diode Packages
- Includes TEC Lockout Circuitry
- Completely Compatible with Our Line of Laser Diode and TEC Controllers

See Pages 1218-1219



Collimation and Focusing Tubes with Optics

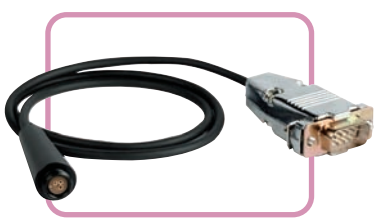
- For Ø5.6 mm and Ø9 mm Laser Packages
- Laser Diodes can be Easily Replaced
- Lens Mounts with Adjustable Focus

See Page 1220

Universal and SM Series Laser Diode Mounts

- Ø5.6 mm and Ø9 mm Table-Mountable Packages
- SM05 and SM1 Lens Tube Mounting Packages
- Ø5.6 mm and Ø9 mm Mounting Packages

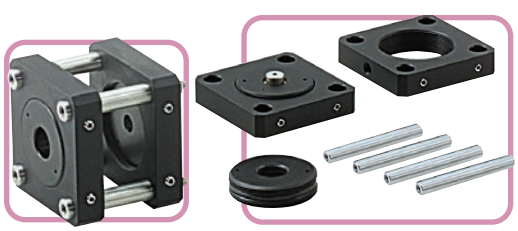
See Page 1221



Strain Relief and ESD Protection

- Includes Laser Socket and Shielded Cable
- Threads into LT Series Housing, Secures Laser Socket
- Available with DB9 Connector

See Page 1221



Collimation Packages and Laser Mounts

- Ø5.6 mm and Ø9 mm Universal Laser Mount
- TO-3 Collimation Package and Laser Mount
- Ø5.6 mm and Ø9 mm Collimation Packages

See Page 1222

Butterfly Mounts

LM14S2

The LM14S2 Butterfly Mount is designed to operate with all lasers and two-port electro-optic devices in a 14-pin butterfly package. The top surface includes heat sink fins and a recessed region to mount the laser diode, resulting in a very low-profile package. The LM14S2 includes a laser diode TEC lockout feature, which disables the laser when the TEC Controller is not active.* It is designed to allow up to 5 A of laser currrent and 5 A of TEC currrent. This mount also provides Zero Insertion Force Sockets (ZIF), a remote interlock connection, and an LED to indicate that the laser diode is enabled. This package comes with two adapter cards, each plugging into the connector at the bottom of the mount. The first module is preconfigured for both type-1 and type-2 lasers, and the second is user-configured to allow custom wiring of the mount. A Bias-T Adapter is also included with the product, allowing for RF modulation of butterfly lasers specifically designed with this capability. The LM14S2 is pin-for-pin compatible with all Thorlabs' Benchtop Laser Diode Controllers, eliminating the need for custom-made interface cables.

* TEC lockout, which is easily bypassed if not required, only functions with Thorlabs' lasers and TEC controllers. The TEC controller requires that the laser package have an integrated TEC and thermal sensor.

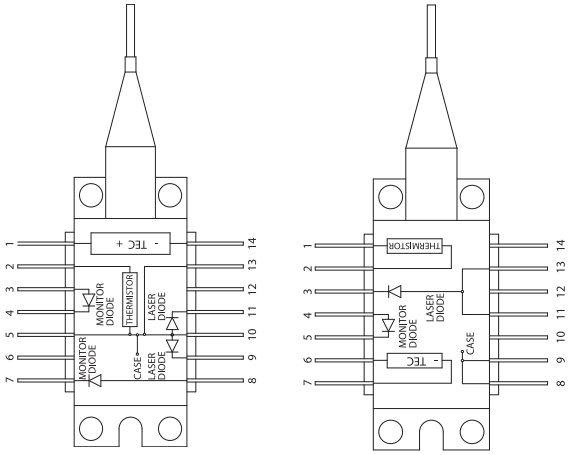
Features

- Compatible with all Commercially Available Laser Modules in 14-Pin Butterfly Packages and Electro-Optic Devices
- Zero Insertion Force (ZIF) Sockets
- Easy Intergration with Thorlabs' Laser Diode and TEC Controllers
- Compact, Low-Profile Design
- TEC Lockout Protection Circuit
- Compatible with One and Two Port Devices

Electrical Parameter	Value
Maximum Laser Current	5 A
Polarity of Laser Diode	AG
Polarity of Monitor Diode	Floating
Maximum TEC Current	5 A
Temperature Sensor	Thermistor*
Temperature Range*,**	0 to 70 °C
Temperature Coefficient of Heat Sink	3 °C/W
Dimensions	3.50" x 3.50" x 1.25" 88.7 mm x 88.9 mm x 31.8 mm

*At 25 °C with 2 A TEC current, integrated into laser package. **Depends on laser diode used

LM14S2: Shown with a Two Port Electro-Optic Device



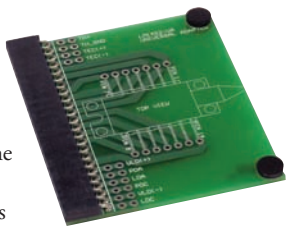
Type 1 Pump Laser Diode*

Type 2 Telecom Laser Diode*

*View shows alternate locations for monitor and laser diodes

Please refer to our website for complete models and drawings.

Universal Adapter Card for Custom PIN Configuration



The LM14S2 eliminates the restriction of fixed pin configurations by using swappable configuration cards that plug into a connector located on the bottom of the mount. Two cards are delivered with the LM14S2. One card is pre-configured for both type 1 and type 2 lasers. The second card is a user-configurable card (LM14S2-UA) designed to allow custom wiring of the mount.

Pin#	Connector (Type 1)	Connector (Type 2)
1	TEC Anode	Thermistor Ground
2	Thermistor	Thermistor
3	PD Anode	LD Cathode (Dc)
4	PD Cathode	PD Anode
5	Thermistor Ground	PD Cathode
6	n.c	TEC Anode
7	PD Cathhode	TEC Cathode
8	PD Anode	LD Anode, Ground
9	LD Cathode	LD Anode, Ground
10	LD Anode, Ground	n.c
11	LD Cathode	LD Anode, Ground
12	N.C.	LD Cathode (Rf)
13	LD Anode, Ground	LD Anode, Ground
14	TEC Cathode	N.C.

ITEM#	$	£	€	RMB	DESCRIPTION
LM14S2	$ 321.30	£ 222.80	€ 285,30	¥ 2,713.10	Universal 14-Pin Butterfly Laser Diode Mount
LM14S2-UA	$ 28.60	£ 19.90	€ 25,40	¥ 241.50	LM14S2 Universal Adapter Card for Custom PIN Configuration

Complete LD/TEC Controllers with Mount

LD1300B

NEW products

LD1300D

The LDC1300 Series of Laser Diode Controllers combines a laser driver, thermoelectric cooler (TEC) controller, and either a butterfly or Dual in-line (DIL) mount into a compact package that can be controlled through an RS-232 interface. The controller is well suited for use with our Fabry-Perot Lasers, Superluminescent Diodes, Semiconductor Optical Amplifiers (SOAs), and Booster Optical Amplifiers (BOAs) that have an integrated TEC in a 14-pin butterfly or dual in-line package. The LDC drive board can deliver source currents up to 1 A and TEC currents of 2.5 A. The controller is adjusted for stable operation at 25 °C, assuming adequate heat sinking of the device. An LED indicator light is illuminated when the laser diode is enabled. The controller is also equipped with a monitor photodiode sensor that has an FC mating port that can be used to measure the output power of the device (in either dBm or mW).

ELECTRICAL PARAMETER	VALUE		
	MIN	TYP.	MAX
Supply Current	–	–	2.4 A
Supply Voltage	4.5 V	5.0 V	5.5 V
Drive Current	-	–	1000 mA
Drive Current Resolution	-	16 Bit	–
TEC Setpoint	10 °C	-	40 °C
TEC Step		0.1 °C	
Update Rate		3 Hz	
Operation Temperature		25 °C	
Dimensions	85 mm x 140 mm (3.35" x 5.51")		
COMPUTER INTERFACE			
Compatibility	Windows 95, 98, NT, 2000, or XP		
Interface	RS-232		

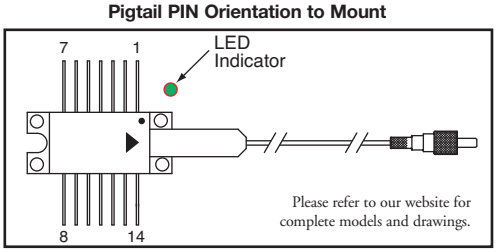
Features

- Laser Diode Driver Integrated with TEC Controller
- Choose from 14-Pin Butterfly or DIL Mount
- Controlled via RS-232 Interface
- Laser-Enabled LED Indicator
- Suited for use with BOAs, SOAs, SLDs, and FPLs

PC Software Interface

- Accurate Temperature and Current Control: Real-time temperature and current stability plots are displayed on the screen.
- TEC Safety Lockout Mechanism: Reduces the risk of damage by runaway heating due to improper TEC controller settings, incorrect TEC wiring, or inadequate heat sinking.
- Standalone Driver Configuration: Save the settings and the driver will boot up in this state every time power is applied.
- Optical Power - Voltage - Current Graphs: Can be viewed on screen or exported in .csv (comma separated value) format for use with other programs such as Microsoft Excel.

Pigtail PIN Orientation to Mount



Please note that the device is mounted on the LDC board such that the output of the device is oriented towards the LED on the LDC board.

PIN#	PIN-TO-CONNECTOR CONFIGURATION
1	TEC Anode
2	Thermistor
3	No Contact
4	No Contact
5	Thermistor
6	No Contact
7	No Contact
8	No Contact
9	No Contact
10	Device Anode
11	Device Cathode
12	No Contact
13	Case
14	TEC Cathode

ITEM#	$	£	€	RMB	DESCRIPTION
LDC1300B	$ 1,885.00	£ 1,306.50	€ 1.673,50	¥ 15,917.00	Laser Diode Controller for Butterfly Packages
LDC1300D	$ 1,885.00	£ 1,306.50	€ 1.673,50	¥ 15,917.00	Laser Diode Controller for DIL (Dual In-Line) Packages

Mounts for Ø5.6 mm and Ø9 mm Laser Packages

TCLDM9

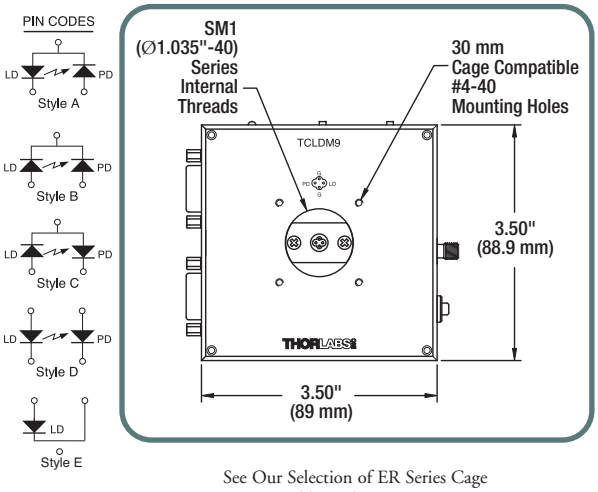
The TCLDM9 mount is ideal for temperature-controlled operation of all 3- and 4-pin laser diodes in Ø9 mm (TO-18) and Ø5.6 mm (TO-46) packages, as well as our fiber-coupled pigtailed lasers. It includes a Bias-T for RF modulation of the laser current up to 500 MHz and can be easily integrated into any existing optical setup. The mount can be adapted to the polarity of the laser and monitor diodes by miniature switches located at the top.

User-protection features of the TCLDM9 mount include an LED located on the top that indicates an enabled laser and a remote interlock connector located on the side. The bottom surface features #8-32 and M4 x 0.7 mounting holes, and the front plate features tapped holes to mount our ER-Series Cage Assembly Rods (see page 155). A laser diode can be changed quickly by simply inserting the laser diode into the socket according to the imprinted pin assignment and fastening the clamp ring with two screws. The diode socket is located very close to the front of the cold plate, making the connection of short lead devices easier. The pass-through design of the socket allows installation of long lead diodes [up to 3/4" (19.1 mm)] without trimming. Laser protection features include optional grounding configurations and the TEC Lockout circuit* that prevents the laser from being enabled when the TEC controller is inactive. The built-in TEC facilitates temperature-controlled operation of the laser diode, which is protected against air drafts by the clamp ring.

*TEC Lockout only functions with Thorlabs lasers' and TEC controllers and can be easily bypassed if not required.

Features

- Integrated TEC Element for Temperature-Controlled Operation of the Laser Diode
- Compatible with 3- and 4- Pin Laser Diodes in Ø9 mm (TO-18) and Ø5.6 mm (TO-46) Packages
- Compatible with Thorlabs' SM Pigtailed Laser Diodes and PM Pigtailed Laser Diodes
- Integrated Bias-T Adapter Allows for RF Modulation of the Laser Current up to 500 MHz
- 30 mm Cage System Compatible
- SM1 Lens Tube Compatible
- Integrate TEC Lockout Circuit to Protect LD (Can be Disabled)
- #8-32 and M4 x 0.7 Tapped Holes for Easy Mounting on a Post



See Our Selection of ER Series Cage Assembly Rods on Page 155

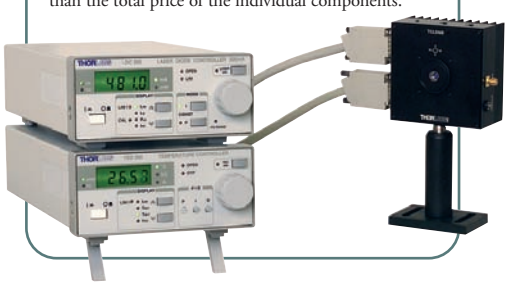
Please refer to our website for complete models and drawings.

LD/TEC Controllers
See Our LD/TEC Controllers for Details on these Specialized Products
LD Mounts

See Page 1192

LTC100 Series Kits

The LTC100 Series Kit includes a current controller, temperature controller, and the TCLDM9 mount featured on this page. In addition, the kit includes a mounted aspheric lens, ESD wrist strap, aspheric lens adapter, and two spanner wrenches for tightening the adapter and aspheric lens. The kit price is 10% lower than the total price of the individual components.



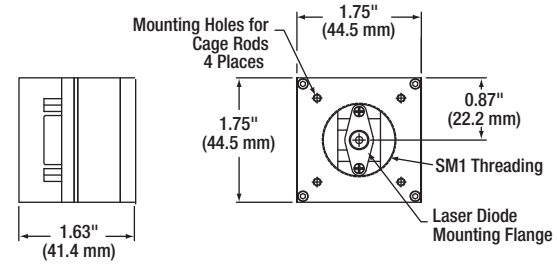
ELECTRICAL PARAMETER	VALUE
Laser Diode Package	Ø5.6 mm and Ø9 mm
Support Pin Configurations	A, B, C, and Most D
Maximum Laser Current	2 A
Polarity of Laser Diode	Selectable
Polarity of Monitor Diode	Selectable
Maximum RF Power	200 mW, RMS
RF Input Resistance (Bias-T)	50 Ω
Modulation Frequency (Bias-T)	0.2 - 500 MHz
Maximum TEC Current	5 A
Maximum TEC Voltage	4 V
TEC Heating / Cooling Capacity	20 W
TEC Interface	DB9 Male
Temperature Sensor	AD592, 10k Thermistor
Temperature Range (at 25 °C with 2 A TEC Current)	5 - 70 °C
Dimensions	3.50" x 3.50" x 2.0" 8.89 mm x 88.9 mm x 50.8 mm

ITEM#	$	£	€	RMB	DESCRIPTION
TCLDM9	$ 440.70	£ 305.60	€ 391,30	¥ 3,721.30	TEC LD Mounts, Ø5.6 mm and Ø9 mm Laser Packages

Miniature TEC-Cooled Laser Diode Mount

Specifications

- **Laser Diode Packages:** Ø5.6 mm and Ø9 mm
- **Maximum Laser Current:** 1 A
- **Polarity of Laser Diode:** Selectable
- **Polarity of Monitor Diode:** Selectable
- **Maximum TEC Current:** 5 A
- **Temperature Sensor:** 10 kΩ Thermistor
- **Temperature Range:** 20 - 30 °C
- **Laser Interface:** Female DB9
- **Temperature Interface:** Male DB9



Please refer to our website for complete models and drawings.

The LDM21 Miniature TEC-Cooled Laser Diode Mount measures half the size of our TCLDM9 mount and is capable of accepting both Ø5.6 mm and Ø9 mm laser diode packages. With an integrated thermal electric cooler element and a 10 kΩ thermistor, this mount keeps laser wavelengths stabilized by precisely holding the case temperature to within 0.002 °C.

Completely compatible with our extensive line of laser diode and TEC controllers, the small size of the LDM21 makes this mount ideal for optical setups where space is limited. It can be used with all standard laser diode pin configurations.

The front side of the mount has a standard 1.035"-40 thread, making it compatible with all our SM1-threaded optomehanical components and allowing for the addition of collimating or focusing optics. The front of the mount also has #4-40 taps, making it compatible with our 30 mm cage systems. The back side of the mount accepts DB9 inputs from a laser current source and TEC controller.

LDM21
Optics and Adapter Not Included

See Our SM1 Accessories on Page 123

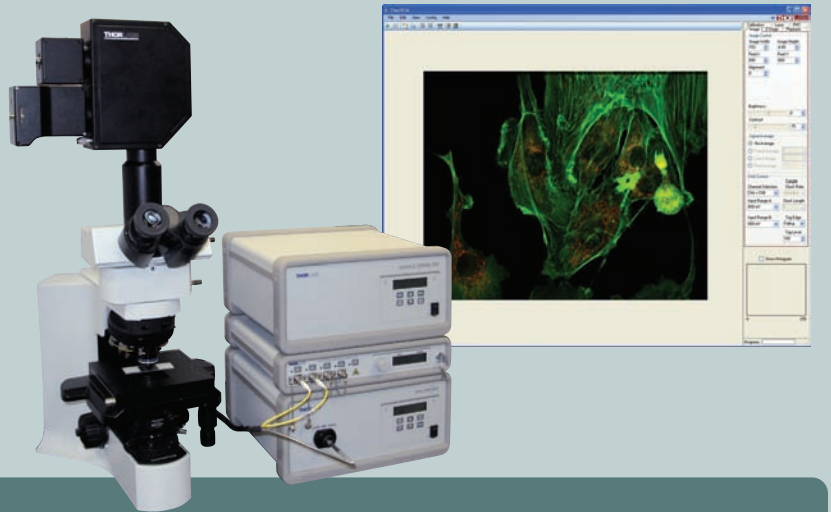
Laser Diodes Sold Separately. See Page 1032

ITEM#	$	£	€	RMB	DESCRIPTION
LDM21*	$ 305.00	£ 211.50	€ 270,80	¥ 2,575.50	Miniature TEC-Cooled Laser Diode Mount
S1TM09	$ 20.10	£ 14.00	€ 17,90	¥ 169.80	SM1 to Ø9 mm Lens Cell Adapter
SM1NT	$ 5.90	£ 4.10	€ 5,30	¥ 49.90	SM1 (Ø1.035"-40) Locking Ring, 1.25" (31.8 mm) Outer Diameter

*Universal Design is Imperial and Metric Compatible

Laser Scanning Microscopy and Accessories

Our new Video-Rate Confocal Imaging System is a compact, modular design that provides a high degree of configuration flexibility. Various add-on detection and source options, including our new four-channel fiber-coupled laser source, are available. Z-axis scanning is possible using the optional, software-controlled, voice coil-driven Z translation stage. Other optional acessories include a beam combiner and pinhole selector. Together, these components allow you to create a truly customized solution for your confocal laser scanning needs.



See Page 1394

Collimation Tubes with Optics for Ø5.6 mm and Ø9 mm Laser Packages

Includes Optic

Collimation and Focusing Tube
For Ø5.6 mm and Ø9 mm Packages
Adapter for Ø5.6 mm Lasers Included

SPW301
Spanner Wrench
For Focus Adjustment of Our Collimation Package

Features

- Precision Mount for Standard Ø9 mm and Ø5.6 mm Laser Packages
- Threaded Retaining Ring for Holding Laser
- Easily Replace Laser Diodes
- Lens Mount with Adjustable Focus

Lens Tube with Strain Relief and ESD Protection Cable

Thorlabs' line of collimation and focusing tubes with optics offer precision mounts for standard Ø9 mm and Ø5.6 mm laser packages. Lasers can be easily replaced, and the lens mounts have an adjustable focus. The packages include a main tube, an optic, a retaining ring, a rubber O-ring, and an adapter (for the Ø5.6 mm packages). The collimation tubes feature a diffraction-limited aspheric optic with a multilayer broadband AR coating.

Mechanical Drawings Available on the WEB

Collimation Tubes and Optics

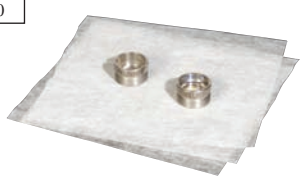
ITEM#	$	£	€	RMB	WAVELENGTH RANGE	PACKAGE LENGTH	NUMERICAL APERTURE	f (mm)
LT110P-B	$ 111.00	£ 77.00	€ 98,60	¥ 937.30	650 - 1050 nm	0.85"	0.40	6.24
LT220P-B	$ 111.00	£ 77.00	€ 98,60	¥ 937.30	650 - 1050 nm	1.00"	0.25	11.0
LT230P-B	$ 111.00	£ 77.00	€ 98,60	¥ 937.30	650 - 1050 nm	0.75"	0.55	4.5
LT240P-B	$ 143.00	£ 99.20	€ 127,00	¥ 1,207.50	650 - 1050 nm	0.95"	0.50	8.0

C230220P-B
Details on these molded glass aspheres as well as our entire selection of these products can be found on pages 626-643.

Focusing Tubes and Optics

ITEM#	$	£	€	RMB	DESCRIPTION	L
LT230220P-B	$ 228.00	£ 158.10	€ 202,50	¥1,925.30	Laser Tube with C230220P-B Optic Pair	0.24"
LT230260P-B	$ 228.00	£ 158.10	€ 202,50	¥1,925.30	Laser Tube with C230260P-B Optic Pair	0.55"

*Compatible with SPW301 and AD15F shown above



SPW301

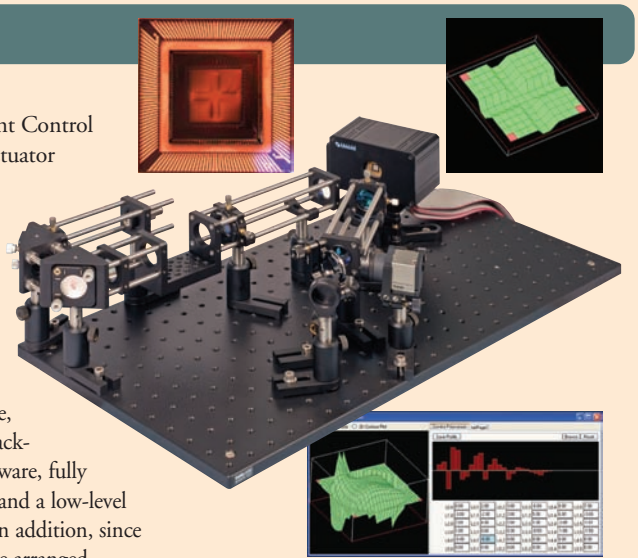
ITEM#	$	£	€	RMB	DESCRIPTION
SPW301	$ 14.00	£ 9.70	€ 12,50	¥ 118.30	Spanner Wrench for LT110P, LT220P, and LT230P
SPW302	$ 14.50	£ 10.05	€ 12,90	¥ 122.50	Spanner Wrench for LT240P
AD15F	$ 29.90	£ 20.80	€ 26,60	¥ 252.50	Adapter for Collimation Tubes to SM1 Thread

AD15F
Mounting adapter to integrate collimation tubes into our SM1-threaded components.

Adaptive Optics Toolkit

Features

- Out-of-the-Box Functionality for Real-Time, High-Precision Wavefront Control
- MEMS-Based DM Achieves High Spatial Resolution Due to High Actuator Count and Low Inter-Actuator Coupling
- Shack-Hartmann Wavefront Sensor with High Resolution CCD Camera and High-Quality Microlens Array
- Includes Light Source, Imaging Optics, and Associated Mounting Hardware



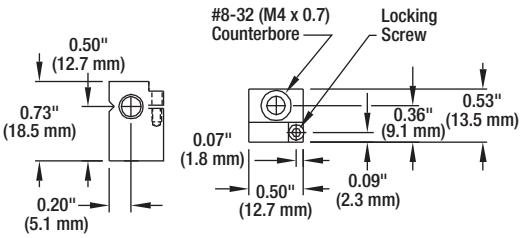
Thorlabs' new Adaptive Optics (AO) Toolkits removes the barrier for entry into adaptive optics, making this real-time wavefront-correcting technology accessible to researchers and OEM users alike. The kit includes Boston Micromachines Corporation's state of-the-art, 140-element, 3.5 micron stroke, MEMS-based deformable mirror. Also included is a Thorlabs' WFS150C Shack-Hartmann wavefront sensor, all necessary imaging optics and mounting hardware, fully functional stand-alone control software for immediate control of the system, and a low-level support library to assist with tailored applications authored by the end user. In addition, since the kit ships as three pre-aligned optomechanical sections that only need to be arranged on a user-supplied breadboard, our adaptive optics toolkits provide a near out-of-the-box solution for real-time wavefront compensation.

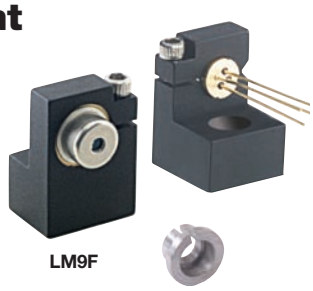
See Pages 1406-1411

Ø5.6 mm and Ø9 mm Universal Laser Diode Mount

The LM9F Laser Diode Mount provides a simple solution for quick and easy mounting of Ø5.6 mm or Ø9 mm laser diodes to a Ø1/2" post. An adapter, which is included, provides compatibility with either the Ø5.6 mm or Ø9 mm diode.

Please refer to our website for complete models and drawings.





ITEM#	$	£	€	RMB	DESCRIPTION
LM9F*	$ 25.20	£ 17.50	€ 22,40	¥ 212.80	Ø5.6 mm and Ø9 mm Universal Laser Mount

Adapter for Ø5.6 mm Laser Diodes Included

*Universal Design is Imperial and Metric Compatible with Ø5.6 mm and Ø9.0 mm Lasers

Ø5.6 mm and Ø9 mm SM-Compatible Laser Diode Mounts

These laser diode mounts are designed for mounting Ø5.6 mm or Ø9 mm laser diodes directly into our SM05 or SM1 lens tube systems, respectively. The mounts come packaged with one aluminum adapter and two retaining rings; if using the mount with a Ø9 mm diode, simply use the thinner black retaining ring to secure the diode into place. Alternatively, if the mount is to be used with a Ø5.6 mm diode, the aluminum adapter is first placed inside the main housing; then, the Ø5.6 mm diode is secured into place using the thicker black retaining ring.

(Laser Diode Not Included)

ITEM#	$	£	€	RMB	DESCRIPTION
S1LM9	$ 26.80	£ 18.60	€ 23,80	¥ 226.30	SM1 Series Mount for Ø5.6 mm and Ø9 mm Laser Diodes
S05LM9	$ 22.00	£ 15.30	€ 19,60	¥ 185.80	SM05 Series Mount for Ø5.6 mm and Ø9 mm Laser Diodes

Strain Relief and ESD Protection

Features

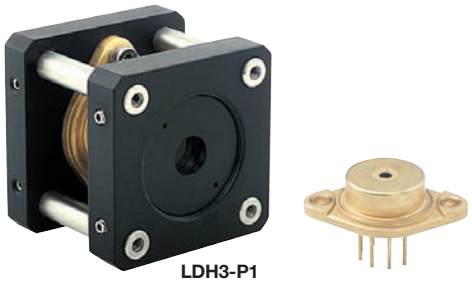
- Includes Laser Socket and 2' of Shielded Cable
- Threads into LT Housing, Secures Laser Socket
- Includes Clamping and Reverse Protection Diodes to Suppress ESD
- Available with DB9 Connector for Mating Directly with all LDC Series Drivers and ITC5XX Series Laser Diode and Temperture Controllers

The SR9 Series of strain relief and ESD protection products offer a convenient and safe means of connecting a Ø5.6 mm or Ø9 mm laser diode to our line of Laser Diode Controllers. Each model comes with a laser socket mounted to a small printed circuit board (PCB). The PCB contains a Schottky diode to clamp any reverse voltages that might occur across the laser diode, as well as a 3.3 V Zener diode to shunt any excessive voltages or ESD away from the diode. Each model of the SR9 Series corresponds to one of the standard pin styles for laser diodes (see the diagram below) and is compatible with our LT Series of Collimation Tubes presented on the facing page. The SR9HB is especially designed for blue laser diodes with built-in photodiodes that support pin style B.

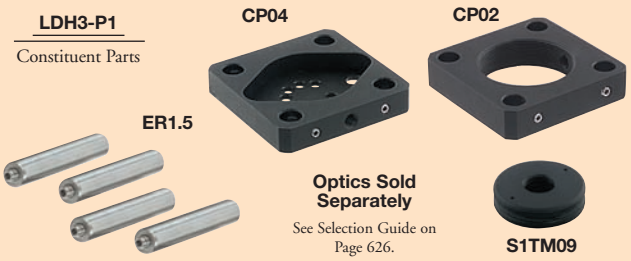
The SR9HE is specifically designed to work with our new, 3-pin blue laser diodes that have no built-in photodiodes. Both can be used with a maximum laser diode forward voltage of 7.5 V. The series is available with or without a DB9 connector. All SR9x-DB9 models are pin compatible with all LDC Series Drivers and ITC5XX Series Laser Diode and Temperture Controllers.

ITEM#	$	£	€	RMB	DESCRIPTION
SR9A	$ 42.90	£ 29.80	€ 38,10	¥ 362.30	ESD Protection and Strain Relief, Pin Style A
SR9A-DB9	$ 45.90	£ 31.90	€ 40,80	¥ 387.60	ESD Protection and Strain Relief, Pin Style A with DB9
SR9B	$ 42.90	£ 29.80	€ 38,10	¥ 362.30	ESD Protection and Strain Relief, Pin Style B
SR9B-DB9	$ 45.90	£ 31.90	€ 40,80	¥ 387.60	ESD Protection and Strain Relief, Pin Style B with DB9
SR9C	$ 42.90	£ 29.80	€ 38,10	¥ 362.30	ESD Protection and Strain Relief, Pin Style C
SR9C-DB9	$ 45.90	£ 31.90	€ 40,80	¥ 387.60	ESD Protection and Strain Relief, Pin Style C with DB9
SR9D	$ 42.90	£ 29.80	€ 38,10	¥ 362.30	ESD Protection and Strain Relief, Pin Style D
SR9D-DB9	$ 45.90	£ 31.90	€ 40,80	¥ 387.60	ESD Protection and Strain Relief, Pin Style D with DB9
SR9HB	$ 42.90	£ 29.80	€ 38,10	¥ 362.30	ESD Protection and Strain Relief, Pin Style B, 7.5 V
SR9HB-DB9	$ 45.90	£ 31.90	€ 40,80	¥ 387.60	ESD Protection and Strain Relief, Pin Style B, 7.5 V with DB9
SR9HE	$ 42.90	£ 29.80	€ 38,10	¥ 362.30	ESD Protection and Strain Relief, Blue LD w/o PD, 7.5 V
SR9HE-DB9	$ 45.90	£ 31.90	€ 40,80	¥ 387.60	ESD Protection and Strain Relief, Blue LD w/o PD, 7.5 V with DB9

TO3 Collimation Package

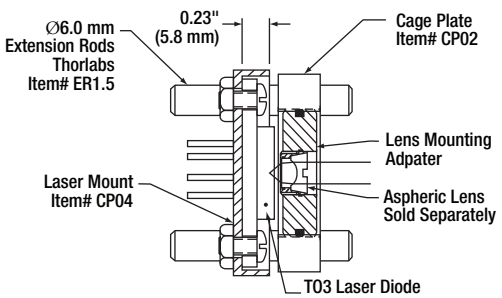


LDH3-P1
Laser Sold Separately



- Ideal for Collimating High-Power Laser Diodes
- Complete Package (as Shown in the Photograph Above)
- Each Unit is Shipped Assembled Less the Laser and the Aspheric Lens
- Compatible with Our Extensive Line of Ø1" SM1 Series Lens Tubes (See Page 123)
- Broad Selection of Collimation Optics (Sold Separately, See Page 626)

The LDH3 TO3 Collimation Package can be used one of two ways. If the laser output power is low and no heat sinking is required, the laser can be mounted directly to the LDH3 (as shown in the photograph). For higher power lasers or where temperature regulation is required, the LDH3 can be mounted directly onto any heatsink that is designed to accept TO3 laser packages.



ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
LDH3-P1*	LDH3-P1/M*	$ 119.90	£ 83.20	€ 106,50	¥ 1,012.50	TO3 Collimation Package

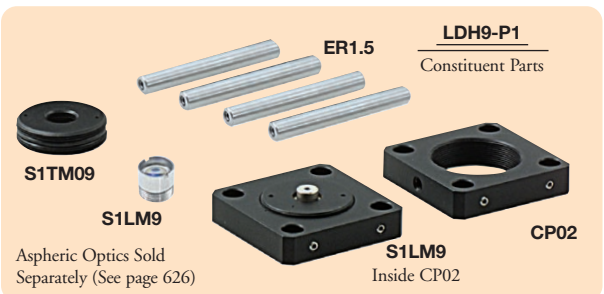
*Compatible with C110TME, C220TME, and C230TME (See page 626).

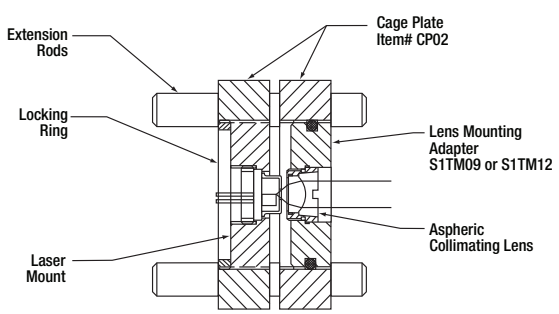
Ø5.6mm and Ø9mm Collimation Packages

LDH9-P1

Compatible with Both Ø5.6 mm and Ø9 mm Laser Diode Packages

- Ideal for Collimating Laser Diodes in Both Ø5.6 mm and Ø9 mm Packages
- Complete Package as Shown in the Photograph (Each Unit is Shipped Assembled Less the Laser and the Aspheric Lens)
- Compatible with Our Extensive Line of Ø1" Lens Tubes (See Page 123)
- Broad Selection of Collimation Optics (Sold Separately, See Page 626)





ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
LDH9-P1*	LDH9-P1/M*	$ 96.50	£ 66.90	€ 85,70	¥ 814.90	Ø9 mm Laser Collimation Package

*Compatible with C110TME, C220TME, and C230TME (see page 626).

Mechanical Drawings Available on the WEB

LED Drivers

Pages 1223-1228

Compact Benchtop LED Controllers

- 700 mA and 1000 mA Output Currents
- Constant Current and Pulsed Current Modes
- Compact Footprint
- External Pulse Width and Frequency Control

See Page 1224

High-Power LED Driver with Pulse Modulation

- 2 A Output Current and up to 24 V Forward Voltage
- Three Operation Modes
  - Constant Current Mode
  - Pulse Width Modulation Mode
  - Customizable External Trigger Mode with Adjustable Modulation Frequency

See Page 1225

4-Channel Benchtop LED Driver

- 4 Independent Adjustable Channels with up to 1 A Each
- Three Operation Modes
  - Constant Current Mode for Current Settings in mA
  - Brightness Mode for Current Settings in Percent
  - External Control Mode for Simultaneous Modulation of all Channels via External Trigger Voltage

See Page 1226

Fast Modulating LED Source

- Complete System with Driver and Mounted LED
- Three Operation Modes
  - Fast Internal Modulation for 100 MHz Max
  - Customizable External Trigger Mode for 100 kHz Max
  - Constant Adjustable Current up to 1 A

See Page 1227

OEM Laser Diode and LED Drivers

- Drivers with Different Features and Footprints
- Constant Current and Constant Power Diode Drivers for 100 mA, 250 mA, 500 mA, and 2.5 A
- Drivers with Modulation
- Drivers for Different Diode and Sensor PIN Styles

See Page 1228

T-Cube LED Controllers

NEW versions

LEDD1A
T-Cube LED Driver with Cable Included
(Power Supply Sold Separately)

Features

- Easy-to-use LED Driver
- Constant Current and Pulsed Current Modes
- Compact T-Cube Footprint
- Pulse Width and Frequency Controllable via External 0 - 5 V TTL Signal

ITEM#	LEDD1	LEDD1A
Output Current	700 mA	1000 mA
Maximum Forward Voltage	13 V	10 V
Maximum Flash Frequency	10 kHz	
Minimum Strobe Pulse Width	50 µs	
Strobe Turn-On / Turn-Off Time	<25 µs	
Power Supply	15 VDC	
Operating Temperature	0 to 40 °C	
Storage Temperature	-40 to 70 °C	
Physical Size	2.4" x 2.4" x 1.8" (60 mm x 60 mm x 47 mm)	

LED Interface Pin Connections

Pin	Description
1	LED +Ve
2	LED –Ve
3	N/C
4	N/C

The T-Cube LEDD1 Series is a variable intensity, compact LED driver that can drive the most recent generation of high-power, low compliance voltage LEDs available on the market (e.g., Philips/ Lumiled LEDs). Combined with the Thorlabs LED collimator assembly (see page 1109) or a Koehler Illuminator, the LEDD1 makes a cost-effective light source for microscopy (including fluorescence microscopy).

The LED brightness can be adjusted via a potentiometer, which regulates the LED current up to a maximum of 700 mA (LEDD1) or 1 A (LEDD1A). This adjuster also turns the controller on and off. The LEDD1 Series offers a continuous current mode and an externally triggered pulsed mode (via BNC 5 V TTL input). This makes the LEDD1 an ideal choice for imaging with CCD cameras or photodiodes (CW mode) or for applications that strobe the LED with pulse width modulation.

Each controller is shipped attached to a removable base plate that allows the T-Cube to be secured to an optical table. To attach the unit to a T-Cube Controller Hub, the base plate must be removed.

ITEM#	$	£	€	RMB	DESCRIPTION
LEDD1	$ 249.00	£ 172.70	€ 221,10	¥ 2,102.60	T-Cube LED Driver, 700 mA Drive Current (Max)
LEDD1A	$ 269.00	£ 186.50	€ 238,90	¥ 2,271.50	T-Cube LED Driver, 1000 mA Drive Current (Max)

T-Cube LED Driver Power Supply Options

The LEDD1 and LEDD1A can be powered using a TPS001 Single-Channel T-Cube Power Supply, a TPS008 8-Channel Power Supply, or the TCH002 T-Cube Hub and Power Supply. TPS001 and TPS008 plug into a standard wall outlet and provide +15 VDC. The TCH002 Hub and Power Supply consists of two parts: the hub, which can support up to six standard-footprint T-Cubes, and a power supply that plugs into a standard wall outlet and powers the hub, which in turn powers all the T-Cubes connected to the hub.

TCH002

Power Supply for a Single T-Cube Controller

- Provides +15 VDC

TPS001

Power Supply for Eight T-Cube Controllers

- Provides Eight +15 VDC Outputs
- An AC Adapter with 4 m Cable Enables Convenient Positioning

TPS008

ITEM#	$	£	€	RMB	DESCRIPTION
TPS001	$ 25.00	£ 17.40	€ 22,20	¥ 211.20	15 V Power Supply Unit for a Single T-Cube
TPS008	$ 175.00	£ 121.40	€ 155,40	¥ 1,477.80	15 V Power Supply Unit for up to 8 T-Cubes
TCH002	$ 726.90	£ 504.00	€ 645,40	¥ 6,138.00	T-Cube™ Controller Hub and Power Supply Unit

High-Power LED Driver with Pulse Modulation

NEW product

DC2100
High-Power Driver
(Power Supply Included)

Features

- Ideal for LED Currents up to 2 A and Voltages up to 24 V
- Modulation Frequency up to 100 kHz, Sine Wave
- Three Modes of Operation
  - Constant Current Mode
  - Pulse Width Modulation Mode
  - Customizable External Trigger Mode with Adjustable Modulation Frequency
- USB 2.0 Interface for PC Control

Applications:

- Operation of Very High-Power LEDs or High-Power LED Arrays
- LED Characterization
- Microscopy Applications with Trigger or Pulse Control Requirements

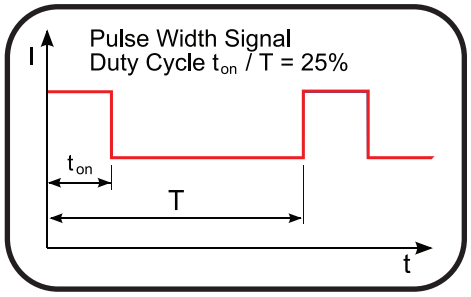
Thorlabs' new DC2100 LED Driver provides up to 2 A output current for very high-power LEDs with a maximum forward voltage up to 24 V. The pulse width modulation feature offers flexible pulse control: pulse height via LED current, pulse frequency, duty cycle, and number of pulses down to single pulse operation. The LED current can be controlled via an external trigger input voltage as well, which allows modulation up to 100 kHz.

The DC2100 is ultra stable and designed for applications that are sensitive to even small high-frequency brightness fluctuations. If connected to our MxxxL1 Series of Mounted LEDs (see page 1102), the DC2100 automatically reads the stored LED data from the EEPROM (e.g., maximum current to avoid LED damage) and adjusts the controller's settings accordingly.

The DC2100 can operate in three modes:

- **Constant Current Mode:** For visual inspection, the LED current can be adjusted from 0 to 2 A in 1 mA increments.
- **Pulse Width Modulation Mode:** Enables single LED pulses with adjustable LED current (0 - 2 A), pulse frequency (1 Hz - 10 kHz), duty cycle (1% - 100%), and number of pulses (1 - 100 or continuous pulse emission).
- **External Control Mode:** Customizable external trigger with adjustable modulation frequency up to 100 kHz, input voltage from 0 V to 10 V (1 V corresponds to 200 mA LED current).

The DC2100 can be connected to a PC using a USB 2.0 interface. The unit comes with a GUI interface and drivers.



Flexible Pulse Width Control via Duty Cycle Adjustment that is Defined as t_{on} / T

ITEM#	DC2100
Constant Current Mode	
LED Current Range	0 - 2 A (1 mA Resolution)
LED Current Resolution	1 mA
LED Current Accuracy	±20 mA
LED Forward Voltage	24 V
Pulse Width Modulation Mode	
PWM Frequency Range	1 Hz - 10 kHz
PWM Frequency Resolution	1 Hz (for Frequencies <1 kHz) 100 Hz (for Frequencies >1 kHz)
Duty Cycle	1 - 100%
Duty Cycle Resolution	1%
External Control Mode	
Modulation Frequency Range	0 - 100 kHz, Sine Wave
Modulation	Arbitrary
Trigger Input (Max)	10 V 1 V Corresponds to 200 mA
General	
Operating Temperature Range*	0 to 40 °C
Storage Temperature Range	-40 to 70 °C
Dimensions (W x H x D) without Operating Elements	160 mm x 80 mm x 150 mm
Dimensions (W x H x D) with Operating Elements	160 mm x 80 mm x 168 mm
Warm-up Time for Rated Accuracy	<10 min
Weight	<1 kg

*Non-Condensing

ITEM#	$	£	€	RMB	DESCRIPTION
DC2100	$ 1,750.00	£ 1,213.00	€ 1.553,50	¥ 14,778.00	High-Power, 1-Channel LED Driver with Pulse Modulation, 2 A, 24 V

4-Channel LED Driver

NEW products

DC4100
4-Channel LED Driver
(Power Supply Included)

Features

- Controls up to 4 Individual LEDs or Thorlabs' 4-Wavelength LED4C Source
- Individual Current Settings per Channel up to 1 A
- 3 Modes of Operation
  - Constant Current Mode for Current Settings in mA
  - Brightness Mode for Current Settings in %
  - External Control Mode for Simultaneous Modulation of all Channels via External Trigger Voltage
- USB 2.0 Interface for PC Control

Applications

- Driver for 4-Wavelength LED Source (LED4C)
- Fluorescence Microscopy with Multiple Wavelength Requirements

This new 4-Channel LED Controller can drive up to four high-power LEDs simultaneously with independent current settings for each channel from 0 to 1000 mA. All channels can be modulated simultaneously via an external voltage with a maximum frequency of 100 kHz. Additionally each channel can be individually switched on and off with a typical switching time of 25 µs. Typical applications are fluorescence microscopy or other applications that need to quickly switch between up to four different wavelengths. It is the ideal driver for the LED4C Series of Four-Wavelength LED Sources (see page 1106). Via the optional DC4100-HUB, it also can drive four high-power LEDs simultaneously (see pages 1107).

The DC4100 is ultra stable and designed for applications that are sensitive to even small high-frequency brightness fluctuations. It has a compact housing with a backlit, easy-to-read LCD display and a wheel selector.

- **Constant Current Mode:** The LED current is kept constant at a preset current value. This mode is ideal for general illumination applications. LED current can be individually set for each LED.
- **Brightness Mode:** Controls the LED current at a set percentage of the maximum current. This mode is optimal for fluorescence microscopy applications. LED current percentage can be individually set for each LED.
- **External Control Mode:** Enables control of all LED currents via a single external trigger voltage (10 V). 1 V corresponds to an LED current of 100 mA. This mode allows customers to set custom modulation settings of the LED current. All activated LEDs are simultaneously controlled, but individual LEDs can be deactivated.

The DC4100 can be connected to a PC using a USB2.0 interface. The unit comes with a GUI interface and drivers.

ITEM#	DC4100
Constant Current Mode	
LED Current Range	0 - 1000 mA
LED Current Resolution	1 mA
LED Current Accuracy	±10 mA
LED Forward Voltage	5 V
Brightness Mode	
LED Current Range	1 - 100%
LED Current Resolution	0.1% (1 mA Min)
LED Current Accuracy	±10 mA
LED Forward Voltage	5 V
Modulation	
Modulation Frequency Range	0 - 100 kHz, Sine Wave
Modulation	Arbitrary
External Trigger Input (Max)	10 V 1 V Corresponds to 100 mA
General	
Operating Temperature Range*	0 to 40 °C
Storage Temperature Range	-40 to 70 °C
Dimensions (W x H x D) without Operating Elements	160 mm x 80 mm x 150 mm (6.3" x 3.1" x 5.9")
Warm-up Time for Rated Accuracy	10 min
Weight	<1 kg

*Non-Condensing.

Optional DC4100-HUB

DC4100-HUB
LED Connector Hub
(Sold Separately)

The optional DC4100-HUB allows you to connect four individual high brightness LEDs like Thorlabs' Mounted LEDs of the MxxxL1-series or MxLED-series to the DC4100. Each LED is connected by a standard M8x1 sensor circular connector.

ITEM#	$	£	€	RMB	DESCRIPTION
DC4100	$ 2,495.00	£ 1,729.50	€ 2.215,00	¥ 21,068.00	4-Channel LED Driver, 1 A, 5 V
DC4100-HUB	$ 150.00	£ 104.00	€ 133,20	¥ 1,266.70	DC4100 Single LED Connector Hub

Modulating LED Source

NEW products

High-Power DC3100 Series Driver with 630 nm head (Power Supply Included)

LED Head shown with Leica DMI Collimation Adapter (Collimation Adapter Sold Separately, on page 1109)

Thorlabs' Modulated LED Sources in the DC3100 series are designed for frequency domain Fluorescence Lifetime Imaging FLIM and other microscopy applications that require advanced, modulated, high-brightness LED sources. This compact LED source consists of a high-current, high-power driver and a LED head with modulating electronics that are designed for high-brightness LEDs with high thermal dissipation losses. The LED is included in the head. There are four standard wavelengths available: 365 nm, 405 nm, 470 nm, and 630 nm (other wavelengths upon request). Collimated mounting adapters for Olympus BX and IX, Leica DMI, Nikon Eclipse (Bayonet-Mount), and Zeiss Axioskop Microscopes are available as optional accessories (see pages 1109).

The DC3100 Series is from our new line of ultra-stable HB-LED drivers and light sources for demanding scientific applications that suffer when even the smallest high-frequency brightness fluctuation occurs.

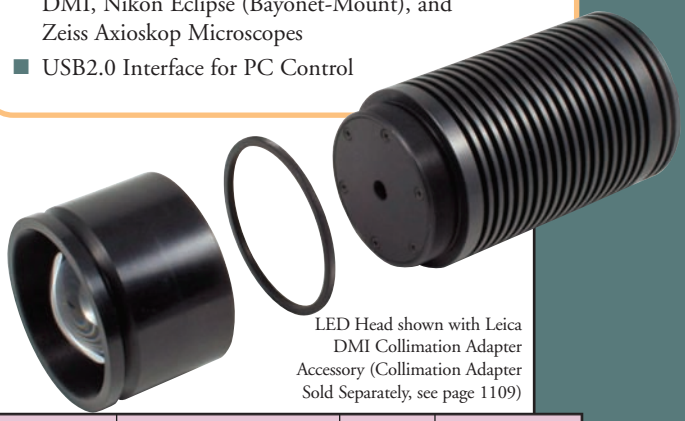
The DC3100 can be connected to a PC using a USB2.0 interface. The unit comes with a GUI interface and drivers.

Features

- Very-Stable, Non-Switching, High-Brightness LED Driver
- Modulation Frequency: 10 - 100 MHz Sine Wave
- LED Current up to 1 A
- 3 Modes of Operation
  - Internal Modulation Mode for FLIM Applications
  - External Trigger Mode for Non-FLIM Applications
  - Constant Current Mode for Visual Inspection
- SM2 Head Mounting Option Compatible with Thorlabs' Lens Tubes
- Optional Adapters for Olympus BX and IX, Leica DMI, Nikon Eclipse (Bayonet-Mount), and Zeiss Axioskop Microscopes
- USB2.0 Interface for PC Control

SPECIFICATIONS	
LED Current Range	0 - 1000 mA
INTERNAL MODULATION MODE	
Modulation Frequency Range	10 - 100 MHz in 0.1 MHz Steps*
Modulation Depth	0 - 100 %
Trigger Output	Sine Wave
EXTERNAL MODULATION MODE	
Modulation Frequency Range	0 - 100 kHz, Sine Wave
Modulation	Arbitrary
Trigger Input, Max	10 V, 1 V Corresponds to 100 mA
GENERAL TECHNICAL DATA	
Operating Temperature Range	0 to 40 °C
Dimensions (W x H x D) with Operating Elements	160 mm x 80 mm x 168 mm
Warm Up Time for Rated Accuracy	<10 min
Weight	<1 kg

*LED Dependent



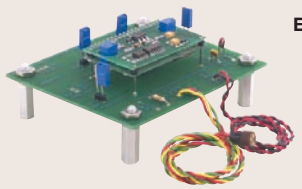
LED Head shown with Leica DMI Collimation Adapter Accessory (Collimation Adapter Sold Separately, see page 1109)

ITEM#	CENTER WAVELENGTH PEAK	I (MAX)	CUTOFF FREQUENCY
DC3100-365	365 nm	700 mA	90 MHz
DC3100-405	405 nm	1000 mA	95 MHz
DC3100-470	470 nm	1000 mA	80 MHz
DC3100-630	630 nm	1000 mA	70 MHz

For the DC3100 LED Head, Optional Microscopy Adapters are Available (See Page 1109)

ITEM#	$	£	€	RMB	DESCRIPTION
DC3100-365	$ 1,950.00	£ 1,352.00	€ 1.731,00	¥ 16,466.00	Modulated LED Source for FLIM with Head, 365 nm
DC3100-405	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	Modulated LED Source for FLIM with Head, 405 nm
DC3100-470	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	Modulated LED Source for FLIM with Head, 470 nm
DC3100-630	$ 1,650.00	£ 1,144.00	€ 1.465,00	¥ 13,933.00	Modulated LED Source for FLIM with Head, 630 nm

LED Drivers: OEM Solutions



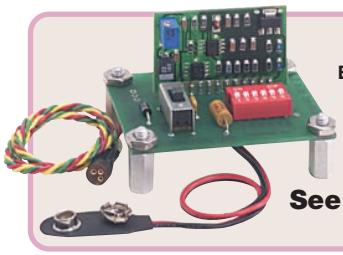
EK2000

See Page 1184

100 mA, 5.5 V Constant Power with Modulation LED Driver

- Constant Power Driver Module
- Low Noise / Ultra-Stable Control
- Slow Start for Diode Protection

The EK2000 Series Evaluation Kit allows users to quickly set up the LD2000R with a laser diode/LED and a DC power supply. All of the LD2000R features are supported with convenient, easy-to-use connector interfaces.



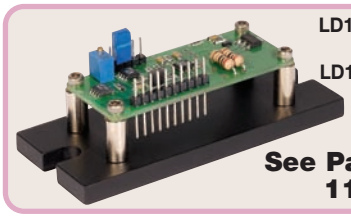
EK1102

See Page 1184

250 mA Constant Power LED Driver

- Constant-Power Driver Module
- Automatic Power Control (APC), CW Operation
- Single Supply Operation, 8 - 12 VDC

The EK1100 Series Evaluation Kit is a ready-to-use, preassembled LD1100 Diode/LED Driver with an evaluation PCB (LD1100), cable with socket (S8060), and a power supply cable (9 V battery clip).



LD1255R with LD1255P

See Page 1185

250 mA, 3.3 V Precision, Constant-Current LED Driver

- Low Noise, Low Temperature Drift
- External Input for Laser-Current Control
- Monitor Outputs for Laser Current and Photodiode Current

The LD1255R is low-noise, ultra-stable constant-current laser diode driver. This 250 mA driver supports both LEDs as well as diode lasers.

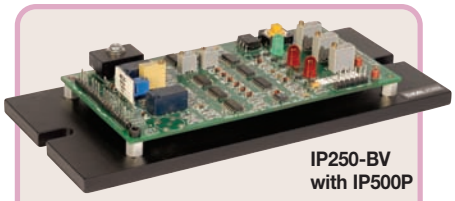
LD3000R

See Page 1185

2.5 mA, 7.7 V Constant Current LED Driver

- Low Noise, Ultra-Stable, High Power Constant Current Driver
- Small Aluminum Housing Provides Additional Heat Sinking
- Monitor Outputs for Laser Current and Photodiode Current

The LD3000 is a higher power, 2.5 A version of the LD1255R. The LD3000 utilizes high-current components and an aluminum housing that provides an additional heat sink to enable a high-power laser diode/LED driver in a relatively small package.



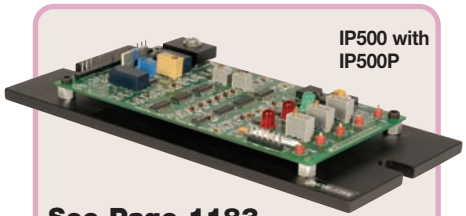
IP250-BV with IP500P

See Page 1183

250 mA, 8 V Constant Current / Power LED Driver

- Optimized for Diodes with Higher Voltages
- Automatic Power Control (APC)
- Modulation Bandwidth of 0 - 50 kHz

This medium power driver is in the form of a PCB assembly and can be mounted into other higher level assemblies. It can accommodate only common cathode (cathode grounded) laser diode/LED pin-out configurations, and it allows control of the laser/LED by means of either constant current or constant power modes.



IP500 with IP500P

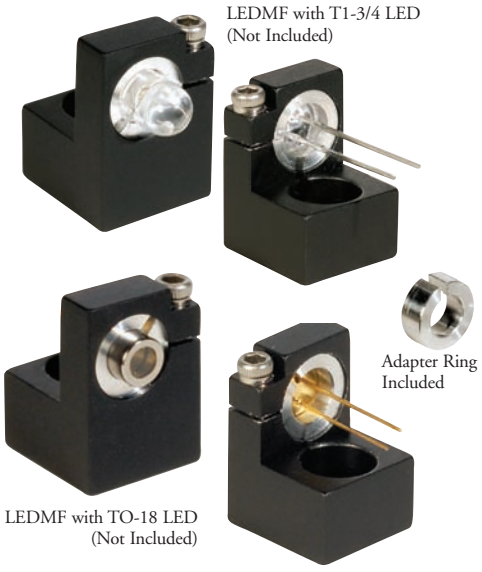
See Page 1183

500 mA, 3 V Constant Current / Power LED Driver

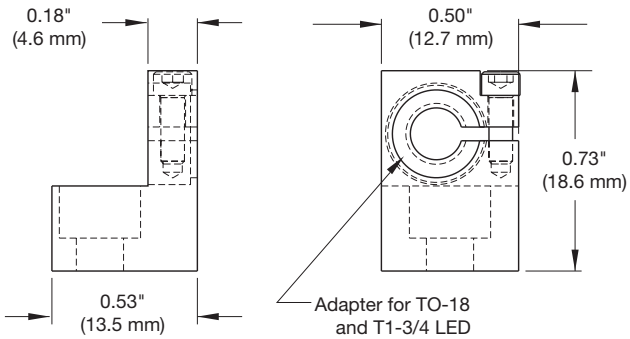
- Constant Power and Constant Current Mode
- Test Points for Diode Current, Monitor Photodiode Current, and Current Limit and Power Limit Setpoints
- Modulation Bandwidth of 0 - 50 kHz

Designed for use within higher level assemblies while also being value priced as a laboratory diode/LED driver. This versatile device can easily and safely control all Laser Diode/LED pin configurations in Ø5.6 mm and Ø9 mm packages.

Ø4.7 mm and Ø5 mm Universal LED Mount



The LEDMF LED Mount is designed to hold any of Thorlabs' T1-3/4 or TO-18 packages using one of the included adapter rings (Ø4.7 mm adapter for TO-18 or Ø5 mm adapter for T1-3/4). The L-shaped mount has a countersunk through hole suitable for an #8-32 (M4) caphead screw so that the LEDMF can be attached to a TR Series Post.



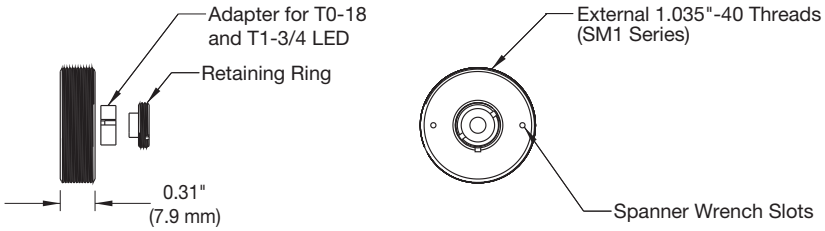
Please refer to our website for complete models and drawings.

ITEM#	$	£	€	RMB	DESCRIPTION
LEDMF*	$ 24.50	£ 17.00	€ 21,80	¥ 206.90	Universal LED Mount, 4.7 mm and 5 mm Packages

*Compatible with Imperial and Metric mounting holes.

Ø4.7 mm and Ø5 mm Threaded LED Mount

The S1LEDM LED Mount is designed to hold any of Thorlabs' TO-18, TO-39, or T1-3/4 packages using the included adapter rings. The external SM1 threading on the S1LEDM mount allows it to be used in a wide variety of SM1-compatible components, including our Kinematic Mounts, Cage Plates, Lens Tubes, and XY Translating Mounts.



Please refer to our website for complete models and drawings.

ITEM#	$	£	€	RMB	DESCRIPTION
S1LEDM	$ 26.00	£ 18.10	€ 23,10	¥ 219.60	SM1-Threaded Mount for LEDs

Lens Tube Slip Rings

Features

- SM1RC is Compatible with Our Mounted LEDs (See Pages 1092-1103)
- SM2RC is Compatible with the LEDC Family of Collimated LEDs
- Slim Body Size to Conserve Space
- Flat Sides Facilitate Mounting Several Slip Rings Side by Side
- Locking Screw Secures LEDs in Slip Ring

SM1RC
LED and Post Not Included

These slip rings are designed to mount preassembled optical lens tube systems by passing the lens tube through the mounting ring and securing it with a locking screw. Their small-body design and flat sides make them more versatile in optical assemblies. The locking screw is conveniently located along the top surface of the mount for easy access. The SM slip rings can easily be mounted to any of our posts using the #8-32 (M4 x 0.7) mounting hole on the bottom.

ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
SM1RC	SM1RC/M	$ 22.00	£ 15.30	€ 19,60	¥ 185.80	SM1 Series Slim Slip Ring
SM2RC	SM2RC/M	$ 26.75	£ 18.60	€ 23,80	¥ 225.90	SM2 Series Slim Slip Ring

Ø2" LIU Series Mount

Features

- 2" Outer Diameter to Fit Standard Optic Mounts
- Compatible with SM2 Lens Tube using an SM2RR Retaining Ring
- Nylon-Tipped Setscrew to Secure LIU LED in Place
- 1.5" (38 mm) Inner Diameter Compatible with LIU Housing and Ø1.5" (Ø38 mm) Optics

AD38

AD38
KS2, LED, and Post Not Included

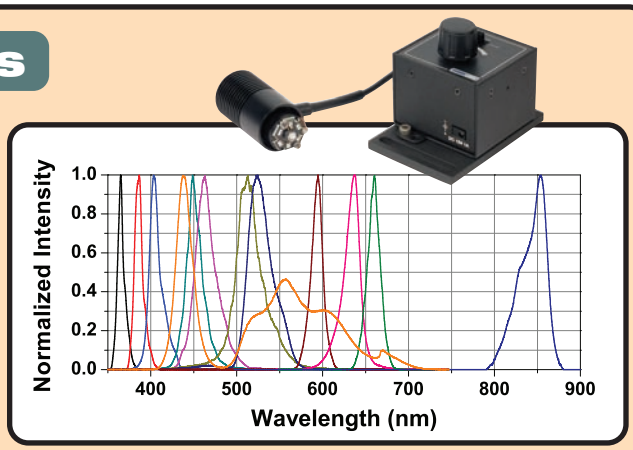
The AD38 adapter allows our LIU series of LED light sources to be mounted in Ø2" lens tubes or optic mounts. The inner diameter accepts the LIU housing or Ø1.5" (Ø38 mm) optics and secures them with a nylon-tipped setscrew.

ITEM#	$	£	€	RMB	DESCRIPTION
AD38	$ 16.00	£ 11.10	€ 14,30	¥ 135.20	External Ø2" LIU Series Mount

Mounted LED Sources

12 Output Wavelengths

- 365 nm, 350 mW
- 385 nm, 450 mW
- 405 nm, 670 mW
- 455 nm, 730 mW
- 470 nm, 625 mW
- 505 nm, 420 mW
- 530 nm, 275 mW
- 590 nm, 34 mW
- 625 nm, 500 mW
- 660 nm, 850 mW
- 850 nm, 400 mW
- White, 500 mW



Selection Starts on Page 1092

Accessories Selection Guide

Pages 1231-1245

Laser Safety Signs

- Signs and Lighted Boxes
- ANSI-Z136.1 Compliant

See Page 1232

Laser Glasses

- Safety Glasses for 190 nm - 10.6 µm
- Protect Eyes from Laser Damage
- CE Certified

See Pages 1233-1235

Blackout Materials

- New Laser Safety Barrier
- Self-Adhesive Paper
- Foil, Fabric, Hardboard, Tape, etc.

See Pages 1236-1238

Beam Blocks

- Lab Safety Shutter and Controllers
- Beam Traps Absorb Laser Light

See Pages 1239-1241

Alignment Tools

- Fluorescing Cards for UV, Visible, and IR
- Alignment Disks for Lens Tubes
- Drop-in Cage Alignment Plates

See Pages 1242-1243

ESD Protection

- 2' x 4' Table Mat
- Grounding Wrist Straps

See Pages 1244-1245

Laser Safety Signs

Complies with ANSI-Z136.1

The LSL10 Laser Safety Box provides a clear and concise indication that a laser system is in use, illuminating the appropriate user-chosen warning message and laser classification. Designed to meet ANSI Z136.1, the ANSI Standard for Safe Use of Lasers, the box operates from 110 VAC or 220 VAC and has safety interlock features that prevent the use of interlock-equipped laser systems unless the safety light is turned on.

LSL10 Shown with LSL10-3A
(H x W x D): 10" x 12" x 3" (254 mm x 305 mm x 76 mm)

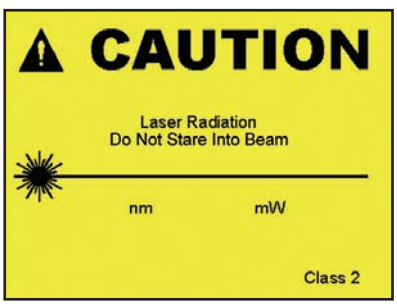
Features

- Provides a Clear and Concise Indication that a Laser is in Use
- Four Signs Available
- Dimensions: 10" x 12" x 3" (254 mm x 305 mm x 76 mm)

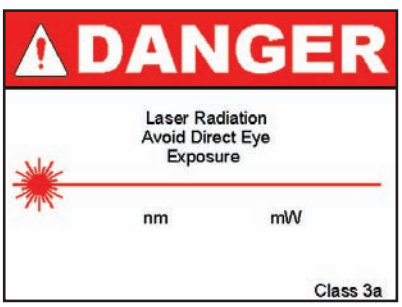
Measuring 10" x 12" (254 mm x 305 mm), these illuminated signs are large enough to be read in all laboratories where safe laser operation is a must. The LSL10 series of signs are useful tools for any research or manufacturing facility.

The LSL10 accepts any one of the four signs available for covering Laser Classes 2 through 4. Each sign comes with a set of alpha-numeric labels enabling each user the ability to customize the sign for a specific wavelength and output power, as required by ANSI Z136.1 and other pertinent laser safety specifications.

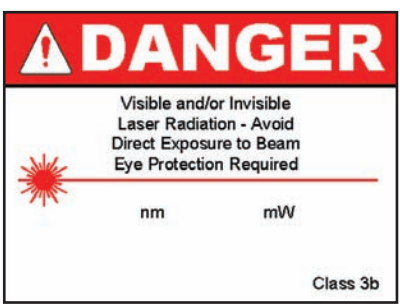
These laser safety signs can be displayed on desktops or benchtops, or they can be mounted to any wall. A convenient line cord latch prevents the AC line cord from disengaging from the unit.



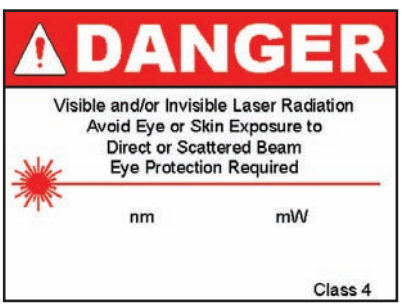
LSL10-2



LSL10-3A



LSL10-3B



LSL10-4

ITEM#	$	£	€	RMB	DESCRIPTION
LSL10	$ 235.70	£ 163.40	€ 209,30	¥ 1,990.30	Lighted Laser Safety Box, 110 VAC Input
LSL10-EC	$ 246.90	£ 171.20	€ 219,20	¥ 2,084.90	Lighted Laser Safety Box, 220 VAC Input
LSL10-2	$ 45.00	£ 31.20	€ 40,00	¥ 380.00	Class 2 Laser Safety Sign
LSL10-3A	$ 45.00	£ 31.20	€ 40,00	¥ 380.00	Class 3A Laser Safety Sign
LSL10-3B	$ 45.00	£ 31.20	€ 40,00	¥ 380.00	Class 3B Laser Safety Sign
LSL10-4	$ 45.00	£ 31.20	€ 40,00	¥ 380.00	Class 4 Laser Safety Sign

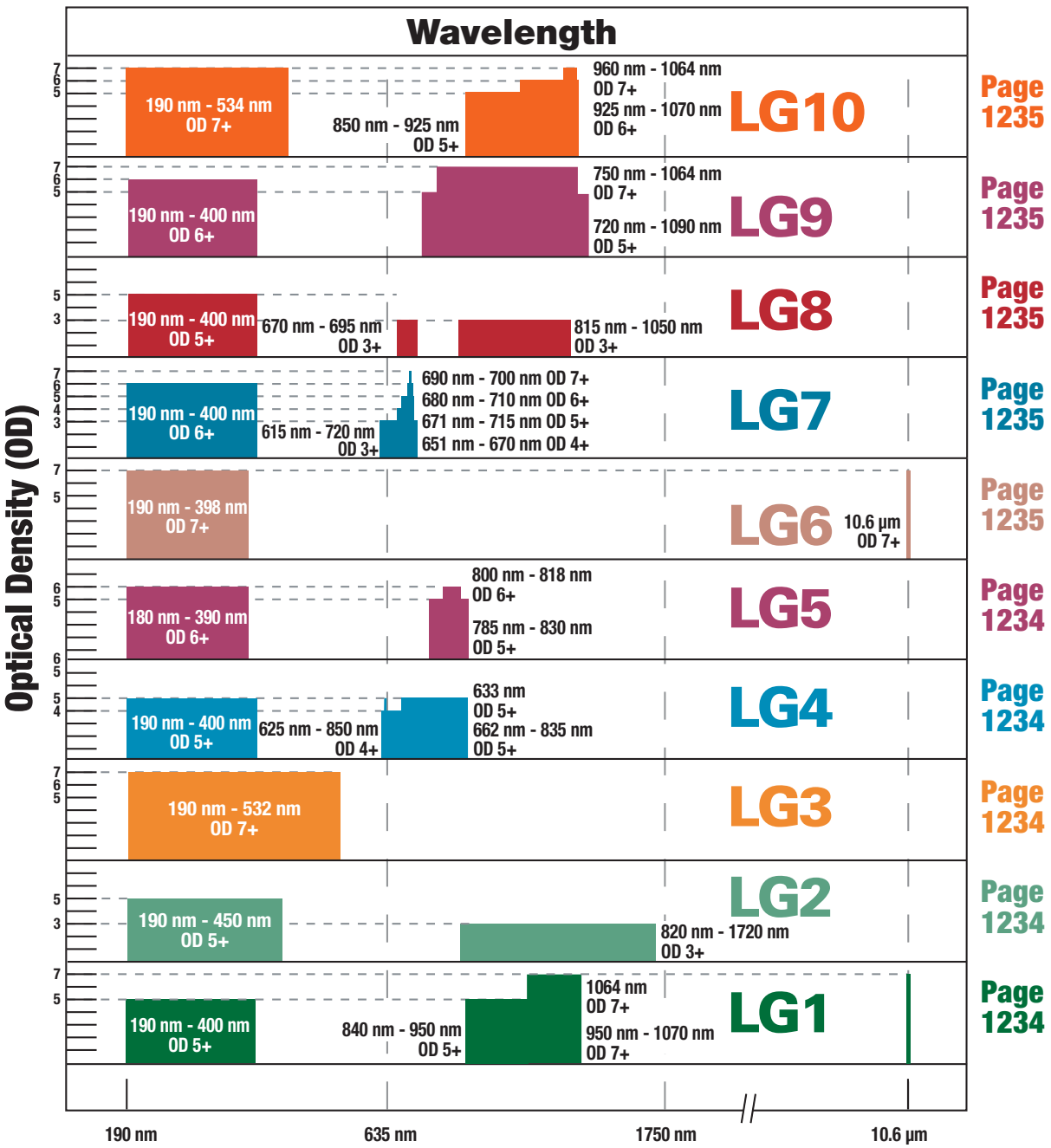
Laser Glasses Selection Guide

- Top and Side Shield Protection
- A Variety of Laser Glasses that Protect from 190 nm to 10.6 µm
- Comfortable Frame Style can be used Over Prescription Glasses
- All Laser Glasses are CE Certified and EN207 Compliant

Optical Density = Log_{10} (1/T) or T = 10^{-OD}

Thorlabs offers a variety of laser safety glasses for protection in the 190 nm to 10.6 µm range. These laser glasses are available in a comfortable frame style to avoid any inconvenience to the user in a lab environment. Every pair of Thorlabs' laser glasses received the CE certification mark, ensuring the end user protection from the wavelengths that have been specified for each of the glasses.

Range for Laser Glasses

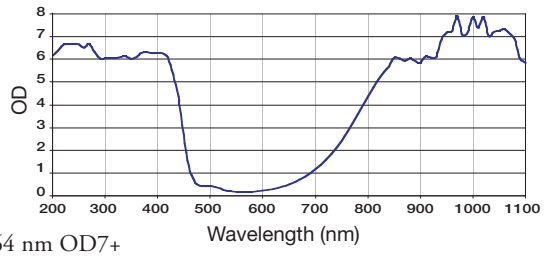


Laser Glasses (Page 1 of 2)

All graphics represent nominal filter characteristics.

LG1

CE CERTIFIED

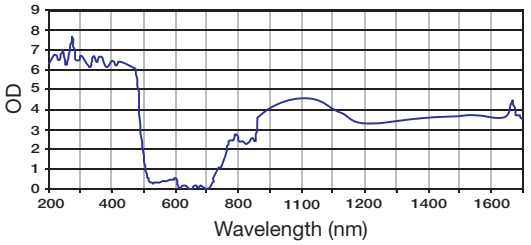


- **Green Lens:** 59% VLT
- **Useful Range:**
  190 - 400 nm OD5+, 840 - 950 nm OD5+, 950 - 1070 nm OD7+, 1064 nm OD7+

ITEM#	$	£	€	RMB	DESCRIPTION
LG1	$ 167.30	£ 116.00	€ 148,60	¥ 1,412.70	Laser Glasses, 190 - 400 nm OD5+, 840 - 950 nm OD5+, 950 - 1070 nm OD7+, 1064 nm OD7+

LG2

CE CERTIFIED

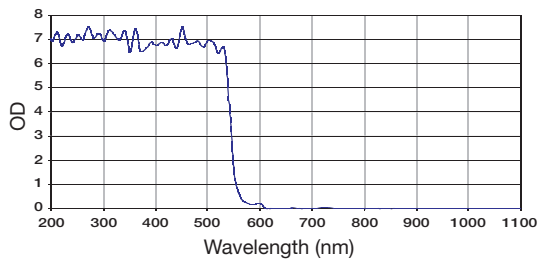


- **Green Lens:** 19% VLT
- **Useful Range:**
  190 - 450 nm OD5+, 820 - 1720 nm OD3+

ITEM#	$	£	€	RMB	DESCRIPTION
LG2	$ 177.50	£ 123.10	€ 157,60	¥ 1,498.90	Laser Glasses, 190 - 450 nm OD5+, 820 - 1720 nm OD3+

LG3

CE CERTIFIED

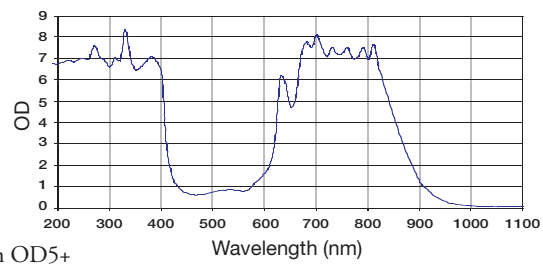


- **Orange Lens:** 48% VLT
- **Useful Range:**
  190 - 532 nm OD7+

ITEM#	$	£	€	RMB	DESCRIPTION
LG3	$ 145.90	£ 101.20	€ 129,60	¥ 1,232.00	Laser Glasses, 190 - 532 nm OD7+

LG4

CE CERTIFIED

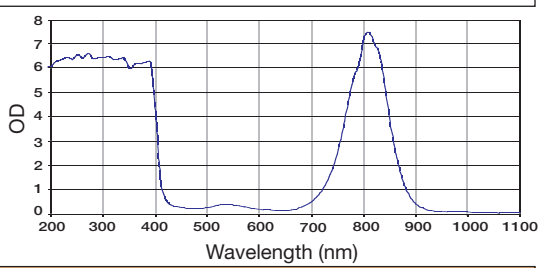


- **Blue Lens:** 12% VLT
- **Useful Range:**
  190 - 400 nm OD5+, 625 - 850 nm OD4+, 662 - 835 nm OD5+, 633 nm OD5+

ITEM#	$	£	€	RMB	DESCRIPTION
LG4	$ 156.10	£ 108.30	€ 138,60	¥ 1,318.20	Laser Glasses, 190 - 400 nm OD5+, 625 - 850 nm OD4+, 633 nm OD5+, 662 - 835 nm OD5+

LG5

CE CERTIFIED



- **Pink Lens:** 61% VLT
- **Useful Range:**
  180 - 390 nm OD6+, 785 - 830 nm OD5+, 800 - 818 nm OD6+

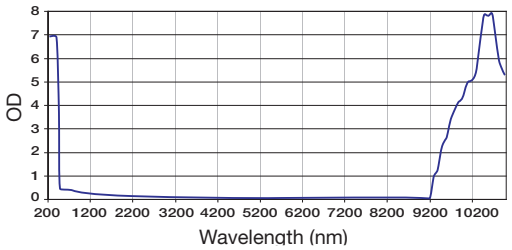
ITEM#	$	£	€	RMB	DESCRIPTION
LG5	$ 167.30	£ 116.00	€ 148,60	¥ 1,412.70	Laser Glasses, 180 - 390 nm OD6+, 785 - 830 nm OD5+, 800 - 818 nm OD6+

Laser Glasses (Page 2 of 2)

All graphics represent nominal filter characteristics.

LG6

CE CERTIFIED

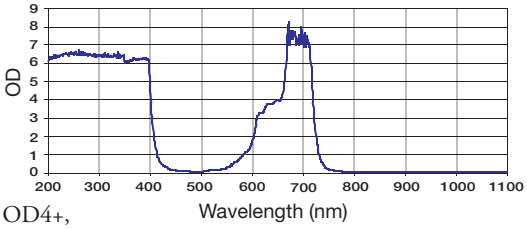


- **Clear Lens:** 93% VLT
- **Useful Range:**
  190 - 398 nm OD7+, 10.6 µm OD7+

ITEM#	$	£	€	RMB	DESCRIPTION
LG6	$ 145.90	£ 101.20	€ 129,60	¥ 1,232.00	Laser Glasses, 190 - 398 nm OD7+, 10.6 µm OD7+

LG7

CE CERTIFIED

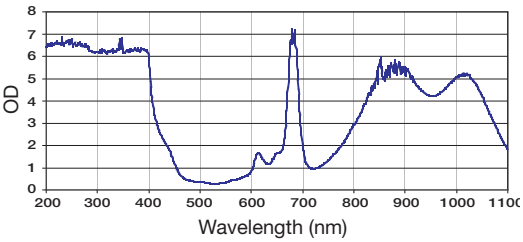


- **Teal Lens:** 35% VLT
- **Useful Range:** 190 - 400 nm OD6+, 615 - 720 nm OD3+, 651 - 670 nm OD4+, 671 - 715 nm OD5+, 680 - 710 nm OD6+, 690 - 700 nm OD7+

ITEM#	$	£	€	RMB	DESCRIPTION
LG7	$ 203.00	£ 140.80	€ 180,30	¥ 1,714.20	Laser Glasses, 190 - 400 nm OD6+, 615 - 720 nm OD3+, 651 - 670 nm OD4+, 671 - 715 nm OD5+, 680-710 nm OD6+, 690-700 nm OD7+

LG8

CE CERTIFIED

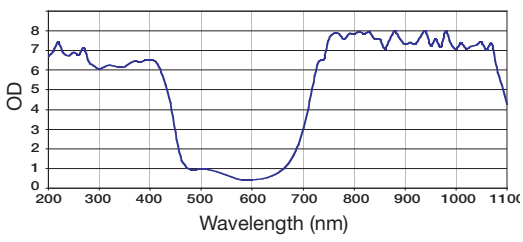


- **Green Lens:** 35% VLT
- **Useful Range:**
  190 - 400 nm OD5+, 670 - 695 nm OD3+, 815 - 1050 nm OD3+

ITEM#	$	£	€	RMB	DESCRIPTION
LG8	$ 203.00	£ 140.80	€ 180,30	¥ 1,714.20	Laser Glasses, 190-400 nm OD5+, 670-695 nm OD3+, 815-1050 nm OD3+

LG9

CE CERTIFIED

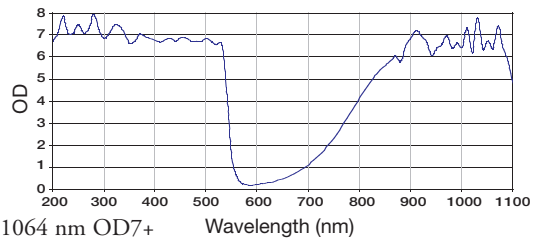


- **Amber Lens:** 25% VLT
- **Useful Range:**
  190 - 400 nm OD6+, 720 - 1090 nm OD5+, 750 - 1064 nm OD7+

ITEM#	$	£	€	RMB	DESCRIPTION
LG9	$ 188.70	£ 130.90	€ 167,60	¥ 1,593.40	Laser Glasses, 190 - 400 nm OD6+, 720 - 1090 nm OD5+, 750 - 1064 nm OD7+

LG10

CE CERTIFIED



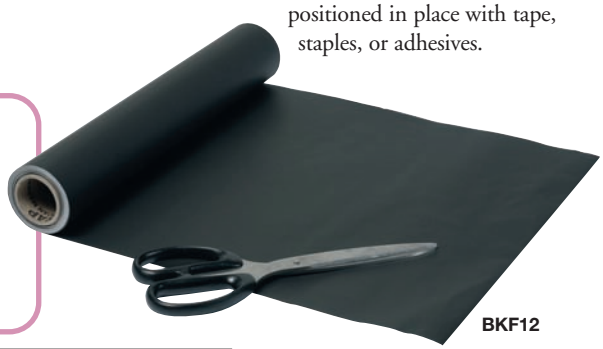
- **Amber Lens:** 35%VLT
- **Useful Range:**
  190 - 534 nm OD7+, 850 - 925 nm OD5+, 925 -1070 nm OD6+, 960 - 1064 nm OD7+

ITEM#	$	£	€	RMB	DESCRIPTION
LG10	$ 188.70	£ 130.90	€ 167,60	¥ 1,593.40	Laser Glasses, 190 - 534 nm OD7+, 850 - 925 nm OD5+, 925 - 1070 nm OD6+ 960 - 1064 nm OD7+

Black Aluminum Foil

This black foil material is mainly used to block out light. It has a matte black finish to absorb any reflective light from an ambient or conventional light source. The foil is ideal for masking light leaks and/or eliminating unwanted reflections. It can be quickly molded to form blackout covers, dark rooms, laser channels, or other configurations. Lightweight, yet durable, it can be quickly positioned in place with tape, staples, or adhesives.

- Ideal for Masking Light Leaks
- Eliminate Unwanted Reflections
- High Flexibility and Lightweight
- Corrosion and Abrasion Resistant
- For Use with a Wide Range of Radiation Sources (Including X-Ray, UV, etc.)



BKF12

ITEM#	$	£	€	RMB	DESCRIPTION
BKF12	$ 27.60	£ 19.20	€ 24,60	¥ 233.10	1' x 50' (305 mm x 15.2 m) Black Aluminum Foil
BKF24	$ 27.60	£ 19.20	€ 24,60	¥ 233.10	2' x 25' (609 mm x 7.62 m) Black Aluminum Foil

Black Rubberized Fabric

BK5

Black rubberized fabric provides an easy method for protecting light-sensitive equipment. The rubberized coating prevents light from penetrating through the weave of the fabric.

- Not Intended for use in Laser Curtain Applications
- Double-Layer use for Extremely Sensitive Applications
- Custom Lengths Available

ITEM#	$	£	€	RMB	DESCRIPTION
BK5*	$ 44.20	£ 30.70	€ 39,30	¥ 373.30	60" x 3 yds (1.5 m x 2.7 m)

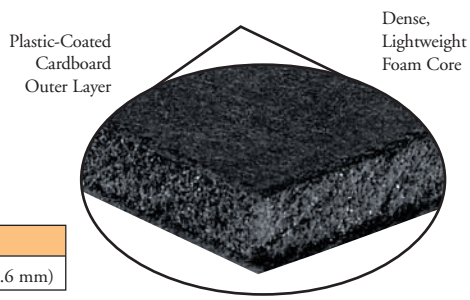
*For longer lengths, add $14.25 per additional yard, and request a quotation from tech support.

Black Hardboard

This material is a heavy-duty construction board consisting of a dense foam core sandwiched between two plastic-coated cardboard outer layers with a thickness of 5 mm; the material can be easily cut with a utility knife for easy construction of lightweight boxes. We recommend using our 2" wide black masking tape (T137-2.0) for corners and other joints to eliminate the passage of light through those areas. Custom sizes are available.

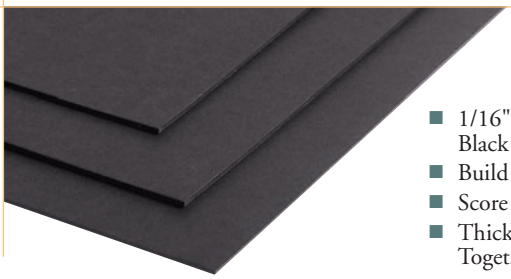
TB4

- Multilayer Rugged Construction Board
- Dense, Durable, and Moisture-Resistant
- Hard, Smooth Finish
- Lightweight Polystyrene Foam Core
- Custom Sizes Available



ITEM#	$	£	€	RMB	DESCRIPTION
TB4	$ 60.90	£ 42.30	€ 54,10	¥ 514.30	3 sheets, 24" x 24"(609.6 mm x 609.6 mm)

Black Poster Board



- 1/16" (1.6 mm) Thick Solid Black Board
- Build Light-Tight Boxes
- Score and Fold
- Thick Outer Skin Holds Box Together

Application Idea

These 1/16" thick panels are ideal for buiding light-tight enclosures. Simply score the board with a utility knife and fold to make light-tight corners.

ITEM#	$	£	€	RMB	DESCRIPTION
TB5	$ 42.10	£ 29.20	€ 37,40	¥ 355.50	5 Sheets, 20" x 30" (50 cm x 76 cm)

Black, Flocked, Self-Adhesive Paper

- Economical Solution for Eliminating Stray Light
- Self-Adhesive
- Does Not Shed Dust or Lint

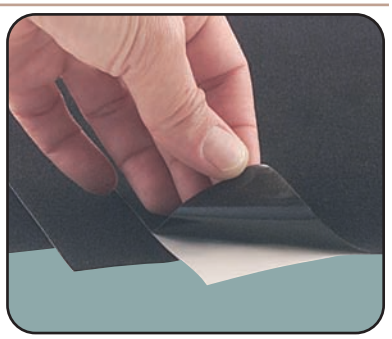
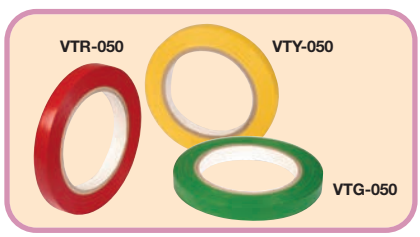


Image contrast can suffer when stray light reaches the focal plane of an application where the light path travels through a tube or other enclosed area. Although applying a flat, black paint to the inside may help, a textured, matte, black surface is much more effective. For large angles of incidence, this flocked, self-adhesive paper absorbs virtually 100% of the light that strikes it. In addition, the fibers will not shed dust or lint, unlike some velvet and felt materials. This flocked paper is 0.015" (0.381 mm) thick with the backing and 0.012" (0.305 mm) thick without the backing. **Caution:** Do not cut the BFP1 with a laser cutting tool.

ITEM#	$	£	€	RMB	DESCRIPTION
BFP1	$ 28.40	£ 19.70	€ 25,30	¥ 239.90	1 Sheet, Black Flock Paper, 30" x 30" (76 cm x 76 cm)

Black Masking and Colored Vinyl Tape



- 1/2" (12.7 mm) Wide Vinyl Tape
- 36 Yard (33 m) Roll
- Red, Green, and Yellow Colors

Keep track of lab tools and coordinate application setups by using our colored rolls of vinyl tape to color-code fibers, cables, samples, and optomechanics. Besides color-coding, the user can make notes on the semi-gloss finish of the vinyl tape with a permanent marker. Although the tape can be used in the 4 to 75 °C range, it is best to apply the tape at room temperature.

General-purpose black masking tape is often used along with our blackout materials to form temporary light-tight coverings for sensitive equipment.

ITEM#	$	£	€	RMB	DESCRIPTION
T137-1.0	$ 8.10	£ 5.60	€ 7,20	¥ 68.40	1.0" x 60 Yd. (25 mm x 55 m), Black Masking Tape
T137-2.0	$ 14.20	£ 9.85	€ 12,70	¥ 120.00	2.0" x 60 Yd. (50 mm x 55 m), Black Masking Tape
VTG-050	$ 3.59	£ 2.50	€ 3,20	¥ 30.30	1/2" x 36 Yd. (12.7 mm x 33 m) Green Vinyl Tape
VTR-050	$ 3.59	£ 2.50	€ 3,20	¥ 30.30	1/2" x 36 Yd. (12.7 mm x 33 m) Red Vinyl Tape
VTY-050	$ 3.59	£ 2.50	€ 3,20	¥ 30.30	1/2" x 36 Yd. (12.7 mm x 33 m) Yellow Vinyl Tape

Laser Safety Barrier

NEW product

Features

- 5' x 6' (1.5 m x 1.8 m) Laser Safety Barrier
- High Damage Threshold
- Includes Strip of Material for Coupling Barriers Side-by-Side
- Wheels Provide Mobility
- Leveling Feet for Stationary Stability
- No-Trip Design Base Eliminates Cross-Feet
- All Components are Stored Within Base
- Simple to Assemble

SB5X6
New Product
Please Check
www.thorlabs.com
for Latest Details

Laser safety barriers are an essential laser safety component for use in many high-power laser labs where scattered light must be blocked to avoid the potential for irreparable eye damage. Please check our website for detailed damage threshold information and ANSI certification.

Compact Design

The 5' x 6' (1.5 m x 1.8 m) barrier is supported by a base with a footprint of only 60.13" x 12.3" (1.5 m x 30.8 cm). By not using cross-feet, the base eliminates the tripping hazard that many other laser barriers create. Mobility is provided via two fixed wheels on one end and two leveling feet on the other end. When one side of the barrier is lifted, it can be easily transported around your lab. When lowered, the leveling feet ensure that the barrier will remain stationary.

All construction components are stored in the base upon shipment. The barrier is bolted together using locking collars and 1/4"-20 cap screws. The barrier material simply wraps around the construction rods and is secured onto the rods using hook and loop fasteners.

Coupling Multiple Barriers Together

When a longer barrier is needed, place multiple SB5X6 barriers side-by-side and use the included strip of safety material to couple the SB5X6's together. These strips attach to the barrier using hook and loop fasteners so that larger safety barriers are simple to construct. If a different laser barrier configuration is needed for your lab, please contact our Technical Support team to discuss our custom capabilities.

ITEM#	$	£	€	RMB	DESCRIPTION
SB5X6	$ 1,098.00	£ 761.20	€ 974,90	¥ 9,271.60	Laser Safety Barrier, 5' x 6' (1.5 m x 1.8 m)

Table Mounted Protective Screens

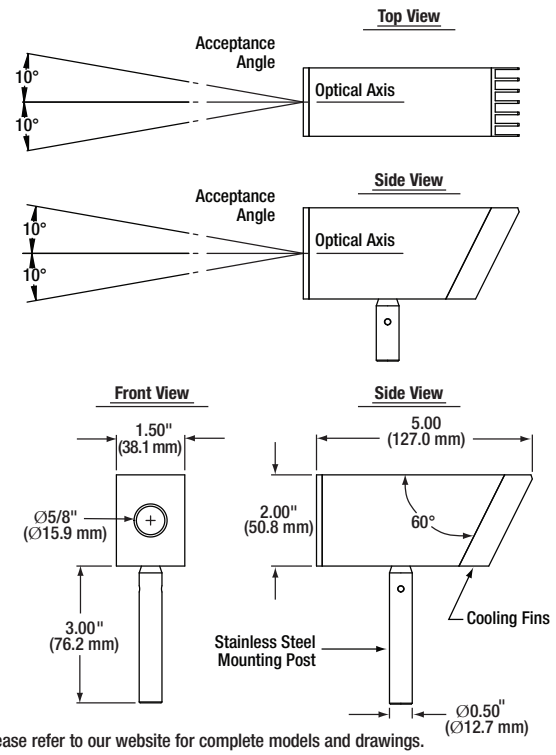
Features

- Three Sizes Available
  - TPS1: 8" x 6" (203 mm x 152 mm)
  - TPS2: 12" x 12" (300 mm x 300 mm)
  - TPS3: 12" x 24" (300 mm x 600 mm)
- Screens Bolt Directly to Breadboard or Optical Table
- Slotted Mounting Holes Provide Mounting Flexibility

Thorlabs' protective screens shield optical experiments from unwanted light. These screens are constructed with black anodized aluminum, making them lightweight, while minimizing reflected light. Mounting is simple using the slotted through holes for 1/4" or M6 cap screws. The TPS1 has the added benefit that it is post mountable via a through hole for #8-32 or M4 x 0.6 cap screws.

ITEM#	$	£	€	RMB	DESCRIPTION
TPS1	$ 29.00	£ 20.20	€ 25,80	¥ 244.90	8" x 6" (203 mm x 152 mm) Protective Screen
TPS2	$ 42.00	£ 29.20	€ 37,30	¥ 354.70	12" x 12" (300 mm x 300 mm) Protective Screen
NEW TPS3	$ 56.00	£ 38.90	€ 49,80	¥ 472.90	12" x 24" (300 mm x 600 mm) Protective Screen

Beam Trap



Please refer to our website for complete models and drawings.

Features

- Minimize Scattered Laser Beam Energy
- ±10° Acceptance Angle
- Ø0.625" (Ø15.9 mm) Aperture
- 3" (75 mm) Post Included

BT500

Base Sold Separately

(See Page 85)

Beam traps are common laser lab safety devices that are designed to absorb a laser beam's energy. To use, simply aim a beam into the Ø0.625" (Ø15.9 mm) entrance aperture. The trap has a ±10° entrance angle to simplify the alignment process. One TR3 (TR75/M) post is included with each beam trap.

ITEM#	BT500	BT510
Wavelength Range	200 -1500 nm	400 – 1500 nm
Laser Type	CW & Pulsed	Pulsed & CW
Max Average Power	40 W[a]	30 W
Max Average Power Density	70 W/cm^2	15 W/cm^2
Max Average Energy Density[b]	30 mJ/cm^2	18.8 J/cm^2 (1064 nm, 20 Hz) 44 J/cm^2 (1064 nm, 5 Hz)
Backscatter[c]	6 x 10^{-4}	6 x 10^{-6}

a Withstands higher powers, but the BT500's temperature will be >100 °C.
b Performance varies based on material variability.
c Integrated backscatter based on fraction of power from the incident beam.

ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
BT500	BT500/M	$ 229.50	£ 159.10	€ 203,80	¥ 1,938.00	Beam Trap for CW Lasers
BT510	BT510/M	$ 290.70	£ 201.60	€ 258,10	¥ 2,454.70	Beam Trap for Pulsed Lasers

Beam Block

Features

- Absorbs CW Beams up to 10 W
- Includes 3" (75 mm) Long TR Series Post
- Large 1.4" (35.6 mm) x 0.7 " (17.8 mm) Target Area

The LB1 Beam Block is a compact solution, capable of absorbing CW laser beams up to 10 W. This beam block has a 1.4" (35.6 mm) x 0.7 " (17.8 mm) aperture, which allows for larger beams and scattered light to be absorbed. An interchangeable Ø1/2" x 3" (Ø12.7 mm x 75 mm) TR post (see page 88) is included with each LB1.

LB1

ITEM#	METRIC ITEM#	$	£	€	RMB	DESCRIPTION
LB1	LB1/M	$ 45.20	£ 31.40	€ 40,20	¥ 381.70	1.4" x 0.7" (35.6 mm x 17.8 mm) Beam Block

Power Meter Section Starts on Page 1265

Beam Shutter

The SH05 Beam Shutter utilizes a rotary, electromechanical actuator to provide sub-millisecond shutter operation. In general operation, the shutter remains in a closed position and then opens with a pulse control signal. As long as the control voltage to the shutter remains high, the shutter will stay open; however, if the voltage drops, the shutter will close, providing inherent fail-safe operation. An optical sensor detects the shutter blade position in the housing to confirm the state of the shutter position, making it ideal in applications where a laser safety lockout is required. The rate at which the device is opened can be controlled, but the shutter is not meant for precise timing purposes.

The input aperture of the SH05 is threaded with Thorlabs' SM05 (Ø0.535"-40) thread to interface easily with all of our SM05 lens tubes. The SH05 is English and Metric System compatible and comes with a 10' cable to connect the shutter directly to the SC10 or TSC001 Controller.

Our SC10 and TSC001 controllers for the SH05 include an "interlock mode" incorporated into the control logic of the controller. The SH05 can also be used with a third-party controller.

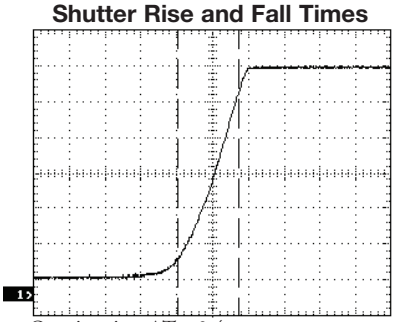
Post Assembly Not Included

SH05 Beam Shutter Features

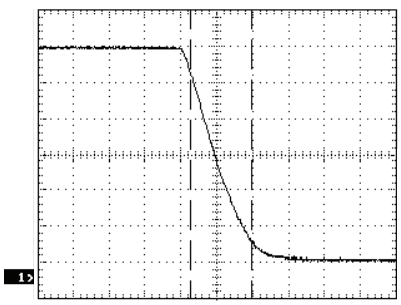
- Closed Resting State
- Fast Response
- SM05-Threaded Aperture
- Laser Safety Applications
- Passive Closure Mechanism
- Compatible with the SC10 and TSC001 Controllers

ITEM#	SH05
Shutter Activation Time to Open	<1 ms (Typ 20 V Pulse)
Shutter Activation Time to Close	<1.5 ms (Spring Activated)
Actuation Pulse	8 V to 50 V (Time Dependent)
Holding Voltage	8 V to 12 V
Aperture	Ø0.5" (Ø12.7 mm)
Initial State	Normally Closed
Maximum Pulse Rate	10 Hz Steady, 25 Hz Burst
Duty Cycle	Optimum @ 10 Hz = 40%

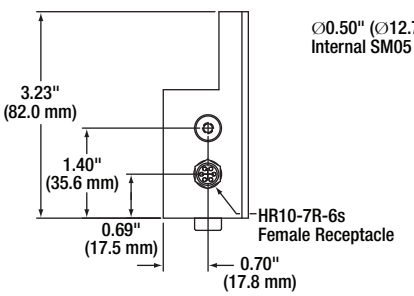
Shutter Rise and Fall Times

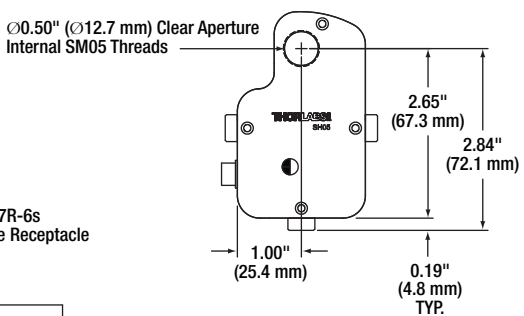


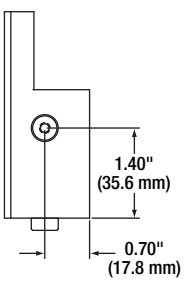
Opening time ΔT = 0.4 ms



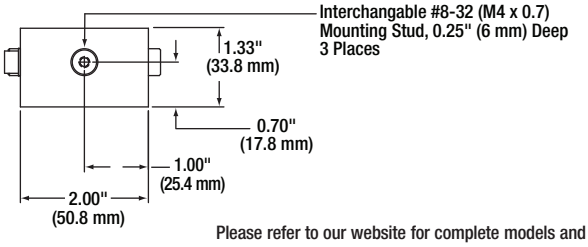
Closing time ΔT = 0.6 ms







Beam Shutter Specifications (When Not Using SC10 Controller)	
ITEM#	**SH05**
Solenoid Coil Resistance	28 Ω
MAX SOLENOID POWER (20 °C)	
Steady State	4 W @ Continuous
50% Duty Cycle	8 W @ 100 s
25% Duty Cycle	16 W @ 36 s
5% Duty Cycle	80 W @ 2.5 s
Maximum Applied Solenoid Voltage	<12 VDC



Please refer to our website for complete models and drawings.

ITEM#	$	£	€	RMB	DESCRIPTION
SH05*	$ 433.50	£ 300.60	€ 384,90	¥ 3,660.50	Ø1/2" Aperture Beam Shutter

*Imperial and Metric Compatible

Shutter Controller

Features

- Automatic, Single, Manual, Repeat, and External Gate Operation
- Safety Alarm when Coupled with SH05 Beam Shutter
- Input and Output Triggers
- Remote PC Control, LabWindow™, and LabVIEW™ Interface

SC10

The SC10 shutter controller is a versatile instrument designed to control the SH05 Beam Shutter with millisecond accuracy. The front panel of the controller features an LED that displays the status of the shutter at a glance and an interactive LCD that provides access to the control parameters. Computer control is provided through a digital I/O, RS232 port on the back of the unit, as well as a BNC connector for a 5 V external trigger. As a special feature, the unit incorporates a laser safety interlock feature that overrides all system commands and closes the shutter. The unit must be re-enabled to resume operation.

The SC10 also doubles as a stand-alone digital delay generator with 1 ms resolution, 0.1 ms accuracy, and a TTL output trigger. The SC10 has three basic user interfaces: control from the front panel, control from a PC, and direct control from an external trigger event.

This shutter controller comes with an executable software package written in LabWindows. The libraries and function panel are included. In addition, it also comes with a library that contains VI's for LabVIEW applications.

ITEM#	$	£	€	RMB	DESCRIPTION
SC10	$ 668.50	£ 463.50	€ 593,50	¥ 5,644.90	Shutter Controller, 115 - 230 VAC @ 50 - 60 Hz

T-Cube Solenoid Controller

TSC001

The T-Cube Solenoid Controller (TSC001) is an extremely compact, single-channel controller for easy manual and automated control of solenoid-operated shutters, flipper mounts, and other such devices. Designed to operate 15 V solenoid-actuated devices, this mini controller offers complete control features. Embedded software functionality allows this unit to be used to control solenoid devices manually (using panel buttons), automatically with DSP-timed operation, or via external trigger signals for operation with third-party equipment. An SMA trigger out connection allows multiple T-Cube controllers to be connected together for multi-channel 'synchronized' operation. Please see page 579 for power supply options for the TSC001.

Features

- Compact T-Cube Footprint Solenoid Controller
- Automatic, Single, Manual, and Triggered Operating Modes
- Operates Thorlabs' Solenoid Operated Flippers/Shutters
- Manual- or PC-Controlled Operation via USB
- Input/Output Triggering (Daisy Chaining)
- Easy-to-Use Manual Controls via 'Mode' and 'Enable' Buttons
- Safety Enable Key Switch
- Laser Safety Interlock Jack
- Software Control Suite Included, Extensive ActiveX® Programming Interfaces
- Software Compatible with Other apt™ Controllers (Integrated Systems Development)

Specifications

- **Timing Resolution:** 250 µs
- **On/Off Times:** 100 ms to 10 s
- **Maximum Repetition Rate:** Up to 10 Hz
- **SMA Trigger In/Out:** TTL
- **Output Enable:** Key Switch and Interlock Jack Plug

Operating Modes

- **Manual:** User-Controlled On/Off
- **Single:** DSP-Controlled Single On/Off Cycle
- **Auto:** DSP-Controlled Multiple On/Off Cycles
- **Triggered:** Externally Triggered On/Off

Output (6-Pin Hirose)

- **Solenoid Drive:** 15 V Pulse (10 V Hold)
- **Position Sensor Feedback:** Photodiode

Input Power Requirements:

- **Voltage:** 15 V Regulated DC
- **Current:** 1 A Peak, 300 mA Steady State

General

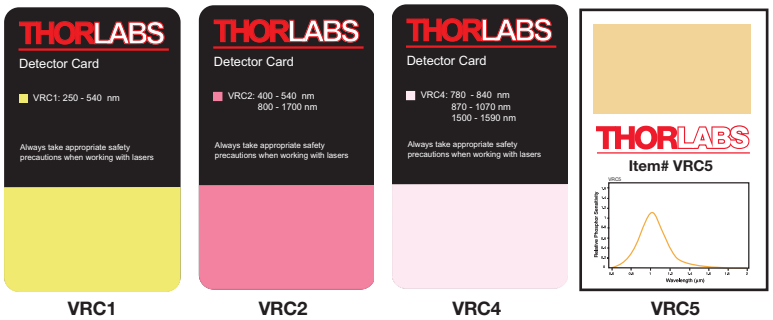
- **Housing Dimensions (W x D x H):** 60.3 mm x 60.3 mm x 47.5 mm (2.37" x 2.37" x 1.87")
- **Weight:** 160 g (5.5 oz)

ITEM#	$	£	€	RMB	DESCRIPTION
TSC001	$ 545.00	£ 377.90	€ 483,90	¥ 4,602.00	T-Cube Flipper/Shutter Controller (Power Supply Not Included)

Viewing Cards

Features

- Detects Beams as Low as 1 nW/cm^2
- Minimal Optical Charging
- Free of Hazardous Reflections
- Cards for the UV, Visible, and IR

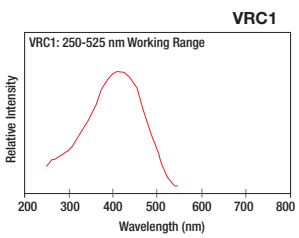


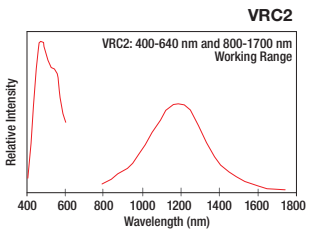
VRC1 VRC2 VRC4 VRC5

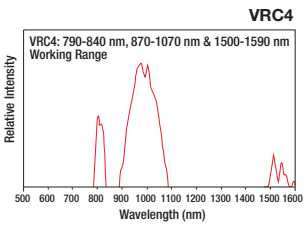
Thorlabs offers viewing cards for UV, visible, and IR beams. As UV and IR light are invisible to the human eye, these cards emit a visible spot at the location of the beam. They are commonly used for beam alignment and when collimating a laser beam.

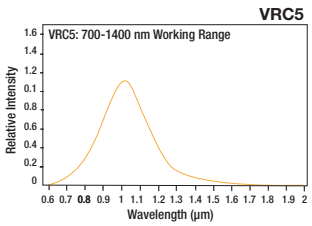
VRC1, VRC2, and VRC4

The cards are made from a durable plastic with a photosensitive region adhered to the front surface of the card. The active region on the VRC1 and VRC4 is fast charging, thus emission is persistent even when used in CW applications in a darkened room. The 1.25" x 2.1" (31.8 mm x 53.3 mm) detection region on these cards extends all the way to the edge of the card in order to facilitate its use during alignment procedures. In addition, when the card is used in a darkened room with a sufficiently bright source, the fluorescence from the activated photosensitive region can be seen through the back of the card. This is especially useful for aligning the overlap of two beams. The VRC2 is similar to the VRC4 and VRC1 except that it requires the user to charge the card with light from a visible light source.









VRC5

Our VRC5 IR viewing card has a photosensitive region sandwiched between two plastic layers. The card has a smaller detection region than our other viewing cards but offers a broader working range.

ITEM#	$	£	€	RMB	WORKING RANGE (nm)	ACTIVE AREA
VRC1	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	250 - 525	1.25" x 2.1" (31.8 x 53.3 mm)
VRC2	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	400 - 640, 800 - 1700	1.25" x 2.1" (31.8 x 53.3 mm)
VRC4	$ 72.00	£ 50.00	€ 64,00	¥ 608.00	790 - 840, 870 - 1070, 1500 - 1590	1.25" x 2.1" (31.8 x 53.3 mm)
VRC5	$ 113.00	£ 78.40	€ 100,40	¥ 954.20	700 - 1400	0.75" x 1.5" (19.1 x 38.1 mm)

IR Alignment Disks

- Use with Ø1/2" or Ø1" Optic Mounts
- Ø2 mm Alignment Hole (Ø1 mm on VRC2D1)

VRC2D1 Shown with LMR1 and Post (Sold Separately)

VRC2D1
Ø1" Outer Diameter

VRC2D05
Ø1/2" Outer Diameter

These IR alignment disks are ideally used as drop-in tools to simplify active alignment of IR and visible setups. Available as Ø1/2" or Ø1" drop-in disks, these disks align beams to the optical axis of our mounts or lens tubes. They are made of slow-fading phosphor that is active in the IR. See graphs above for absorption spectrums.

ITEM#	SIZE	$	£	€	RMB	DESCRIPTION
VRC2D05	Ø1/2"	$ 19.40	£ 13.50	€ 17,30	¥ 163.90	Ø1/2" IR Alignment Disk, Working Ranges: 400-640 nm and 800-1700 nm
VRC2D1	Ø1"	$ 29.60	£ 20.60	€ 26,30	¥ 250.00	Ø1" IR Alignment Disk, Working Ranges: 400-640 nm and 800-1700 nm
VRC4D05	Ø1/2"	$ 19.00	£ 13.20	€ 16,90	¥ 160.50	Ø1/2" Enhanced Alignment Disk, Working Ranges: 790 - 840 nm, 870 - 1070 nm, and 1500 - 1590 nm
VRC4D1	Ø1"	$ 29.00	£ 20.20	€ 25,80	¥ 244.90	Ø1" Enhanced Alignment Disk, Working Ranges: 790 - 840 nm, 870 - 1070 nm, and 1500 - 1590 nm

Threaded IR Viewing/Alignment Disk

- Slow Fading, Nearly Constant Emission for Viewing CW Beams
- Ideal Alignment Aids
- RMS or SM1 Threaded
- 400 - 640 nm and 800 - 1700 nm Absorption Bands

ITEM#	SIZE	$	£	€	RMB	DESCRIPTION
VRC2RMS	Ø0.8"	$ 80.00	£ 55.50	€ 71,10	¥ 675.60	RMS IR Alignment Disk, Working Ranges: 400-640 nm and 800-1700 nm
VRC2SM1	Ø1"	$ 76.50	£ 53.10	€ 68,00	¥ 646.00	SM1 IR Alignment Disk, Working Ranges: 400-640 nm and 800-1700 nm

Frosted Glass Alignment Disks

NEW products

Features

- Ø1/2", Ø1", and Ø2" Versions Available
- 1500 Grit Ground Glass Diffuser with Centering Hole
- Clear Aperture > 90% of Diameter
- Great for Viewing Beams Exiting a Lens Tube
- 2 mm Thick

Our frosted glass alignment disks are made from 1500 grit ground glass diffusers. These disks are ideally suited for viewing the alignment of a visible beam that is exiting a lens tube. The ground glass allows you to see the beam's location with respect to the center-drilled hole. The centering hole has the added benefit that it allows a portion of the beam to be transmitted into the optical system during the alignment process.

These alignment disks are available with outer diameters of 1/2", 1", and 2", providing compatibility with our SM05, SM1, and SM2 series lens tubes, respectively. The Ø1/2" and Ø1" disks have a Ø1 mm centering hole, while the Ø2" has a Ø2 mm hole.

ITEM#	$	£	€	RMB	DESCRIPTION
DG05-1500-H1	$ 16.30	£ 11.30	€ 14,50	¥ 137.70	Ø1/2" Frosted Glass Alignment Disk, Ø1 mm Hole
DG10-1500-H1	$ 20.40	£ 14.20	€ 18,20	¥ 172.30	Ø1" Frosted Glass Alignment Disk, Ø1 mm Hole
DG20-1500-H2	$ 32.60	£ 22.60	€ 29,00	¥ 275.30	Ø2" Frosted Glass Alignment Disk, Ø2 mm Hole

Visible Alignment Disks

The SM05A7 and SM1A7 Visible Alignment Disks provide a useful aid when building optical assemblies from our SM05 or SM1 series products. Both alignment disks have tick marks every 1 mm along both the X and Y axes to help locate the center of an SM05- or SM1-threaded assembly.


SM05A7


SM1A7

Features

- SM05- and SM1-Threaded Alignment Disks
- Alignment Tick Marks Every 1 mm

ITEM#	$	£	€	RMB	DESCRIPTION
SM05A7	$ 21.50	£ 15.00	€ 19,10	¥ 181.60	Externally SM05-Threaded Visible Alignment Disk
SM1A7	$ 24.00	£ 16.70	€ 21,40	¥ 202.70	Externally SM1-Threaded Visible Alignment Disk

Extensive Line of Lens Tubes

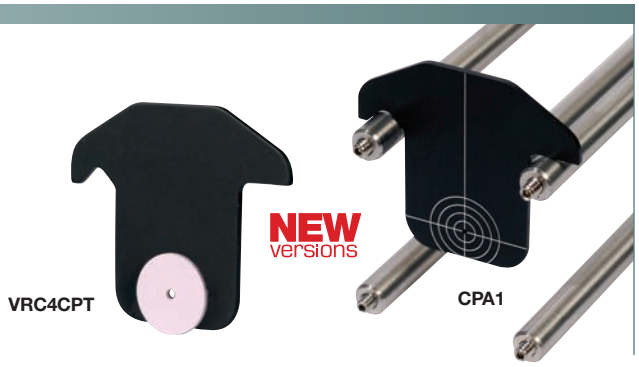
See Page 117

- Constant Multi-Element Systems
- Available in Ø1/2', Ø1.00", Ø30.0 mm, Ø2.00" and Ø3.00"
- Adapters Available for Interchangablity
- New Lens Tubes with Internal Threads Also Available

Cage Alignment Plates

Features

- Alignment Plates for 16, 30, and 60 mm Cage Systems
- Quick Drop-In Visual Aid
- VRC4CPT Features IR Disk with Absorption Bands Ranging 790 - 840 nm, 870 - 1070 nm, and 1500 - 1590 nm (Ø1/2" Active Region)



Cage alignment plates are handy tools when building a cage system as beam alignment can be difficult. These alignment plates drop into 16, 30, or 60 mm cages and provide an alignment target for your laser beam. A Ø1 mm hole (Ø5 mm on CPA2) on each alignment plate shows the center of a cage assembly. The VRC4CPT has an IR fluorescing disk for aligning IR beams with a 30 mm cage system. Its absorption bands are 790 to 840 nm, 870 to 1070 nm, and 1500 to 1590 nm.

ITEM#	$	£	€	RMB	DESCRIPTION
NEW SCPA1	$ 8.25	£ 5.70	€ 7,40	¥ 69.70	16 mm Cage Alignment Plate with Ø1 mm Hole
CPA1	$ 9.20	£ 6.40	€ 8,20	¥ 77.70	30 mm Cage Alignment Plate with Ø1 mm Hole
CPA2	$ 9.20	£ 6.40	€ 8,20	¥ 77.70	30 mm Cage Alignment Plate with Ø5 mm Hole
NEW VRC4CPT	$ 28.76	£ 20.00	€ 25,60	¥ 242.90	30 mm Cage Alignment Plate with IR Disk
NEW LCPA1	$ 15.30	£ 10.60	€ 13,60	¥ 129.20	60 mm Cage Alignment Plate with Ø1 mm Hole

ESD Wrist Straps

Features

- **WS01:** Black Metal Strap with 12' Grounding Wire
- **WS02:** Blue Fabric Strap with 6' Grounding Wire
- Removes Static Charges
- Recommended for use with Thorlabs' Static-Sensitive Devices

Thorlabs' Grounding Wrist Straps safely remove static charges from individuals who handle laser diodes, amplified photodetectors, and other static-sensitive devices. The ground cord has a built-in 1 MΩ resistor for user safety, and the straps work with our Static Control Table Mat featured above to protect against static discharge.

The WS01 strap consists of an expandable, metal wristband that is flexible, durable, and comfortable, allowing for extended use. The band has a relaxed (i.e., not stretched) circumference of 5.5" and includes an alligator clip that fits over the installed banana jack on the 12' long grounding cord. The WS02 adjustable fabric strap is available in one size and includes a 6' coiled cord and alligator clip to provide ground connection.

ITEM#	$	£	€	RMB	DESCRIPTION
WS01	$ 30.10	£ 20.90	€ 26,80	¥ 254.20	Metal Grounding Wrist Strap, 12' (3.6 m) Coiled Cord
WS02	$ 12.20	£ 8.45	€ 10,90	¥ 103.10	Fabric Grounding Wrist Strap, 6' (1.8 m) Coiled Cord

ESD Table Mat

ESD Wrist Strap
Not Included

Features

- Heavy-Duty 2' x 4' (610 mm x 1219 mm) Table Mat
- 50 ms Static Charge Decay

The Thorlabs Static Control 2' x 4' (610 mm x 1219 mm) Table Mat provides a static dissipative surface to protect sensitive optoelectronic components from damaging electrostatic discharge. These heavy-duty mats have a 50 ms static charge decay time, ensuring protection under extreme conditions. The mat comes with a connector for an ESD wrist strap (available separately below).

ITEM#	$	£	€	RMB	DESCRIPTION
TM2448	$ 78.60	£ 54.50	€ 69,80	¥ 663.80	Static Control Table Mat, 2' x 4'

Clean-Walk Mats

Features

- Thin Profile Suitable for Wheeled Traffic
- 18" x 36" Adhesive Mat Contains 30 Sheets

Our multilayer adhesive floor mats effectively capture dirt and dust from foot traffic and equipment wheels before entering controlled environments. Each layer is numbered, which helps both to ensure one-sheet removal and to identify the number of remaining applications. Low-profile construction reduces the risk of tripping and allows free movement of foot or wheel traffic. The adhesive mat contains 30 transparent sheets, 18" × 36" (457.2 mm × 914.4 mm), with polyethylene film backing.

ITEM#	$	£	€	RMB	DESCRIPTION
ESD20	$ 53.10	£ 36.90	€ 47,20	¥ 448.40	18" x 36" (457.2 mm x 914.4 mm) Adhesive Mat (30 sheets)