LJ5027RM-E - June 28, 2024

Item # LJ5027RM-E was discontinued on June 28, 2024. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

PLANO-CONVEX ROUND CYLINDRICAL LENSES, CAF_2, MOUNTED

- **Focus Light Along a Single Axis**
- **Ø1/2" or Ø1" Engraved Mount**
- **Focal Length Options from 20 to 200 mm**
- **Uncoated or AR Coated for 1.65 - 3.0 µm or 2 - 5 µm**

LJ5440RM-D

LJ5386RM

LJ5654RM

LJ5709RM-E

OVERVIEW

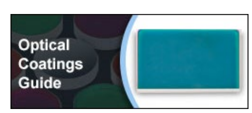
Features

- Calcium Fluoride (CaF_2) Substrate for 180 nm - 8.0 µm
- Available Uncoated or with Broadband AR Coating for 1.65 - 3.0 µm or 2 - 5 µm
- Mounted in Ø1/2" or Ø1" Housing with Focal Length Engraving
- Seven Focal Lengths from 20 mm to 200 mm
- Bring Collimated Light to a Line Focus
- Useful for Correcting Astigmatism

Zemax Files
Click on the red Document icon next to the item numbers below to access the Zemax file download. Our entire Zemax Catalog is also available.

Common Specifications[a]	
Substrate	Calcium Fluoride (CaF_2)[b]
Design Wavelength	4 µm
Focal Length Tolerance	±1%
Surface Quality	40-20 Scratch-Dig
Centration	<5 arcmin
Surface Flatness (Plano Side)	λ/2
Cylindrical Surface Power[c] (Convex Side)	3λ/2

a. Please see the tables below for item-specific specifications.
b. Click Link for Detailed Specifications on the Substrate
c. Much like surface flatness for flat optics, surface power is a measure of the deviation between the surface of the curved optic and a calibrated reference gauge. This specification is also commonly referred to as surface fit.



Thorlabs' Mounted Plano-Convex Round Cylindrical Lenses focus or collimate light along a single axis. The lenses sold on this page are fabricated from a calcium fluoride (CaF_2) substrate that provides high transmission throughout the mid-IR spectral region, as shown in the *Graphs* tab. They are available with focal lengths ranging from 20 mm to 200 mm and can be ordered uncoated or with a broadband antireflection (AR) coating. The broadband AR coatings provide <1% average reflectance (per surface) over the 1.65 - 3.0 µm wavelength range or <1.25% average reflectance (per surface) over the 2 - 5 µm wavelength range.

Unlike typical cylindrical lenses, which are rectangular, these cylindrical lenses are packaged in round, black anodized aluminum housings, as shown by the image at the top of the page. Each housing is engraved with the Item # and focal length of the lens; the housings can be secured by retaining rings into standard optic mounts and rotation mounts, as well as either Ø1/2" or Ø1" lens tubes. Since they only focus light along one dimension, they can be used in pairs to anamorphically shape images or correct for astigmatism. This property makes them particularly useful for Mid-IR Quantum Cascade Lasers (QCLs) and Interband Cascade Lasers (ICLs), which have strongly differing beam divergence angles along the parallel and perpendicular axes.

CaF_2 is commonly used for applications requiring high transmission from the ultraviolet to the mid-IR spectral range. The material possesses a low refractive index that varies from 1.51 to 1.35 within its usage range of 180 nm to 8.0 µm. Calcium fluoride is also fairly chemically inert and offers superior hardness compared to its

LIDT CALCULATIONS

In order to illustrate the process of determining whether a given laser system will damage an optic, a number of example calculations of laser induced damage threshold are given below. For assistance with performing similar calculations, we provide a spreadsheet calculator that can be downloaded by clicking the button to the right. To use the calculator, enter the specified LIDT value of the optic under consideration and the relevant parameters of your laser system in the green boxes. The spreadsheet will then calculate a linear power density for CW and pulsed systems, as well as an energy density value for pulsed systems. These values are used to calculate adjusted, scaled LIDT values for the optics based on accepted scaling laws. This calculator assumes a Gaussian beam profile, so a correction factor must be introduced for other beam shapes (uniform, etc.). The LIDT scaling laws are determined from empirical relationships; their accuracy is not guaranteed. Remember that absorption by optics or coatings can significantly reduce LIDT in some spectral regions. These LIDT values are not valid for ultrashort pulses less than one nanosecond in duration.

LIDT Calculator

CW Laser Example

Suppose that a CW laser system at 1319 nm produces a 0.5 W Gaussian beam that has a 1/e^2 diameter of 10 mm. A naive calculation of the average linear power density of this beam would yield a value of 0.5 W/cm, given by the total power divided by the beam diameter:

However, the maximum power density of a Gaussian beam is about twice the maximum power density of a uniform beam, as shown in the graph to the right. Therefore, a more accurate determination of the maximum linear power density of the system is 1 W/cm.

A Gaussian beam profile has about twice the maximum intensity of a uniform beam profile.

An AC127-030-C achromatic doublet lens has a specified CW LIDT of 350 W/cm, as tested at 1550 nm. CW damage threshold values typically scale directly with the wavelength of the laser source, so this yields an adjusted LIDT value:

The adjusted LIDT value of 350 W/cm x (1319 nm / 1550 nm) = 298 W/cm is significantly higher than the calculated maximum linear power density of the laser system, so it would be safe to use this doublet lens for this application.

Pulsed Nanosecond Laser Example: Scaling for Different Pulse Durations

Suppose that a pulsed Nd:YAG laser system is frequency tripled to produce a 10 Hz output, consisting of 2 ns output pulses at 355 nm, each with 1 J of energy, in a Gaussian beam with a 1.9 cm beam diameter (1/e^2). The average energy density of each pulse is found by dividing the pulse energy by the beam area:

$$Energy\ Density = \frac{Pulse\ Energy}{Beam\ Area}$$

As described above, the maximum energy density of a Gaussian beam is about twice the average energy density. So, the maximum energy density of this beam is ~0.7 J/cm^2.

The energy density of the beam can be compared to the LIDT values of 1 J/cm^2 and 3.5 J/cm^2 for a BB1-E01 broadband dielectric mirror and an NB1-K08 Nd:YAG laser line mirror, respectively. Both of these LIDT values, while measured at 355 nm, were determined with a 10 ns pulsed laser at 10 Hz. Therefore, an adjustment must be applied for the shorter pulse duration of the system under consideration. As described on the previous tab, LIDT values in the nanosecond pulse regime scale with the square root of the laser pulse duration:

$$Adjusted\ LIDT = LIDT\ Energy\sqrt{\frac{Your\ Pulse\ Length}{LIDT\ Pulse\ Length}}$$

This adjustment factor results in LIDT values of 0.45 J/cm^2 for the BB1-E01 broadband mirror and 1.6 J/cm^2 for the Nd:YAG laser line mirror, which are to be compared with the 0.7 J/cm^2 maximum energy density of the beam. While the broadband mirror would likely be damaged by the laser, the more specialized laser line mirror is appropriate for use with this system.

Pulsed Nanosecond Laser Example: Scaling for Different Wavelengths

Suppose that a pulsed laser system emits 10 ns pulses at 2.5 Hz, each with 100 mJ of energy at 1064 nm in a 16 mm diameter beam (1/e^2) that must be attenuated with a neutral density filter. For a Gaussian output, these specifications result in a maximum energy density of 0.1 J/cm^2. The damage threshold of an NDUV10A Ø25 mm, OD 1.0, reflective neutral density filter is 0.05 J/cm^2 for 10 ns pulses at 355 nm, while the damage threshold of the similar NE10A absorptive filter is 10 J/cm^2 for 10 ns pulses at 532 nm. As described on the previous tab, the LIDT value of an optic scales with the square root of the wavelength in the nanosecond pulse regime:

$$Adjusted\ LIDT = LIDT\ Energy\sqrt{\frac{Your\ Wavelength}{LIDT\ Wavelength}}$$

This scaling gives adjusted LIDT values of 0.08 J/cm^2 for the reflective filter and 14 J/cm^2 for the absorptive filter. In this case, the absorptive filter is the best choice in order to avoid optical damage.

Pulsed Microsecond Laser Example
Consider a laser system that produces 1 µs pulses, each containing 150 µJ of energy at a repetition rate of 50 kHz, resulting in a relatively high duty cycle of 5%. This system falls somewhere between the regimes of CW and pulsed laser induced damage, and could potentially damage an optic by mechanisms associated with either regime. As a result, both CW and pulsed LIDT values must be compared to the properties of the laser system to ensure safe operation.

If this relatively long-pulse laser emits a Gaussian 12.7 mm diameter beam (1/e^2) at 980 nm, then the resulting output has a linear power density of 5.9 W/cm and an energy density of 1.2 x 10^{-4} J/cm^2 per pulse. This can be compared to the LIDT values for a WPQ10E-980 polymer zero-order quarter-wave plate, which are 5 W/cm for CW radiation at 810 nm and 5 J/cm^2 for a 10 ns pulse at 810 nm. As before, the CW LIDT of the optic scales linearly with the laser wavelength, resulting in an adjusted CW value of 6 W/cm at 980 nm. On the other hand, the pulsed LIDT scales with the square root of the laser wavelength and the square root of the pulse duration, resulting in an adjusted value of 55 J/cm^2 for a 1 µs pulse at 980 nm. The pulsed LIDT of the optic is significantly greater than the energy density of the laser pulse, so individual pulses will not damage the wave plate. However, the large average linear power density of the laser system may cause thermal damage to the optic, much like a high-power CW beam.

Ø1/2" CaF_2 Plano-Convex Cylindrical Lenses, Uncoated

Item #	Housing Diameter	Focal Length[a,b]	Back Focal Length[a,b]	Clear Aperture	Working Distance[a,b]	Housing Thickness[a]	Center Thickness[a]	Radius of Curvature[a]	Focal Shift	Reference Drawing
LJ5386RM		20.0 mm	16.4 mm	>10.5 mm	15.1 mm	7.4 mm	5.0 mm	8.2 mm	Raw Data	
LJ5440RM	Ø1/2"	50.0 mm	47.9 mm	>10.5 mm	46.6 mm	5.0 mm	3.0 mm	20.5 mm	Raw Data	
LJ5667RM		80.0 mm	78.2 mm	>10.5 mm	76.9 mm	5.0 mm	2.5 mm	32.8 mm	Raw Data	

a. These quantities are defined in the Reference Drawing.
b. These values are quoted at the design wavelength, 4 µm. The Focal Shift column contains a plot of the wavelength dependence of the focal length.

Part Number	Description	Price	Availability
LJ5386RM	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 20.0 mm, Uncoated	$188.88	Today
LJ5440RM	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 50.0 mm, Uncoated	$188.88	Today
LJ5667RM	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 80.0 mm, Uncoated	$188.88	Today

Ø1/2" CaF_2 Plano-Convex Cylindrical Lenses, AR Coated: 1.65 - 3.0 µm

Item #	Housing Diameter	AR Coating Range	Focal Length[a,b]	Back Focal Length[a,b]	Clear Aperture	Working Distance[a,b]	Housing Thickness[a]	Center Thickness[a]	Radius of Curvature[a]	Focal Shift	Reference Drawing
LJ5386RM-D			20.0 mm	16.4 mm	>10.5 mm	15.1 mm	7.4 mm	5.0 mm	8.2 mm	Raw Data	
LJ5440RM-D	Ø1/2"	1.65 - 3.0 µm (R_{avg} < 1%)	50.0 mm	47.9 mm	>10.5 mm	46.6 mm	5.0 mm	3.0 mm	20.5 mm	Raw Data	
LJ5667RM-D			80.0 mm	78.2 mm	>10.5 mm	76.9 mm	5.0 mm	2.5 mm	32.8 mm	Raw Data	

a. These quantities are defined in the Reference Drawing.
b. These values are quoted at the design wavelength, 4 µm. The Focal Shift column contains a plot of the wavelength dependence of the focal length.

Part Number	Description	Price	Availability
LJ5386RM-D	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 20.0 mm, ARC: 1.65 - 3.0 µm	$237.58	Today
LJ5440RM-D	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 50.0 mm, ARC: 1.65 - 3.0 µm	$237.58	Today
LJ5667RM-D	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 80.0 mm, ARC: 1.65 - 3.0 µm	$237.58	Today

Ø1/2" CaF_2 Plano-Convex Cylindrical Lenses, AR Coated: 2 - 5 µm

Item #	Housing Diameter	AR Coating Range	Focal Length[a,b]	Back Focal Length[a,b]	Clear Aperture	Working Distance[a,b]	Housing Thickness[a]	Center Thickness[a]	Radius of Curvature[a]	Focal Shift	Reference Drawing
LJ5386RM-E	Ø1/2"	2 - 5 µm (R_{avg} < 1.25%)	20.0 mm	16.4 mm	>10.5 mm	15.1 mm	7.4 mm	5.0 mm	8.2 mm	Raw Data	
LJ5440RM-E			50.0 mm	47.9 mm	>10.5 mm	46.6 mm	5.0 mm	3.0 mm	20.5 mm	Raw Data	
LJ5667RM-E			80.0 mm	78.2 mm	>10.5 mm	76.9 mm	5.0 mm	2.5 mm	32.8 mm	Raw Data	

a. These quantities are defined in the Reference Drawing.
b. These values are quoted at the design wavelength, 4 µm. The Focal Shift column contains a plot of the wavelength dependence of the focal length.

Part Number	Description	Price	Availability
LJ5386RM-E	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 20.0 mm, ARC: 2 - 5 µm	$237.58	Today
LJ5440RM-E	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 50.0 mm, ARC: 2 - 5 µm	$237.58	Today
LJ5667RM-E	Customer Inspired! Ø1/2" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 80.0 mm, ARC: 2 - 5 µm	$237.58	Today

Ø1" CaF_2 Plano-Convex Cylindrical Lenses, Uncoated

Item #	Housing Diameter	Focal Length[a,b]	Back Focal Length[a,b]	Clear Aperture	Working Distance[a,b]	Housing Thickness[a]	Center Thickness[a]	Radius of Curvature[a]	Focal Shift	Reference Drawing
LJ5195RM	Ø1"	50.0 mm	45.7 mm	>21 mm	44.4 mm	7.9 mm	6.0 mm	20.5 mm	Raw Data	
LJ5709RM		75.0 mm	71.8 mm	>21 mm	70.5 mm	7.0 mm	4.5 mm	30.7 mm	Raw Data	
LJ5654RM		100.0 mm	97.2 mm	>21 mm	95.9 mm	7.0 mm	4.0 mm	41.0 mm	Raw Data	
LJ5027RM		200.0 mm	197.5 mm	>21 mm	196.2 mm	5.3 mm	3.5 mm	81.9 mm	Raw Data	

a. These quantities are defined in the Reference Drawing.
b. These values are quoted at the design wavelength, 4 µm. The Focal Shift column contains a plot of the wavelength dependence of the focal length.

Part Number	Description	Price	Availability
LJ5195RM	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 50.0 mm, Uncoated	$250.65	Today
LJ5709RM	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 75.0 mm, Uncoated	$250.65	Today
LJ5654RM	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 100.0 mm, Uncoated	$250.65	Today
LJ5027RM	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 200.0 mm, Uncoated	$250.65	Today

Ø1" CaF_2 Plano-Convex Cylindrical Lenses, AR Coated: 1.65 - 3.0 µm

Item #	Housing Diameter	AR Coating Range	Focal Length[a,b]	Back Focal Length[a,b]	Clear Aperture	Working Distance[a,b]	Housing Thickness[a]	Center Thickness[a]	Radius of Curvature[a]	Focal Shift	Reference Drawing
LJ5195RM-D	Ø1"	1.65 - 3.0 µm (R_{avg} < 1%)	50.0 mm	45.7 mm	>21 mm	44.4 mm	7.9 mm	6.0 mm	20.5 mm	Raw Data	
LJ5709RM-D			75.0 mm	71.8 mm	>21 mm	70.5 mm	7.0 mm	4.5 mm	30.7 mm	Raw Data	
LJ5654RM-D			100.0 mm	97.2 mm	>21 mm	95.9 mm	7.0 mm	4.0 mm	41.0 mm	Raw Data	
LJ5027RM-D			200.0 mm	197.5 mm	>21 mm	196.2 mm	5.3 mm	3.5 mm	81.9 mm	Raw Data	

a. These quantities are defined in the Reference Drawing.
b. These values are quoted at the design wavelength, 4 µm. The Focal Shift column contains a plot of the wavelength dependence of the focal length.

Part Number	Description	Price	Availability
LJ5195RM-D	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 50.0 mm, ARC: 1.65 - 3.0 µm	$299.36	Today
LJ5709RM-D	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 75.0 mm, ARC: 1.65 - 3.0 µm	$299.36	Today
LJ5654RM-D	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 100.0 mm, ARC: 1.65 - 3.0 µm	$299.36	Lead Time
LJ5027RM-D	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 200.0 mm, ARC: 1.65 - 3.0 µm	$299.36	Today

Ø1" CaF_2 Plano-Convex Cylindrical Lenses, AR Coated: 2 - 5 µm

Item #	Housing Diameter	AR Coating Range	Focal Length[a,b]	Back Focal Length[a,b]	Clear Aperture	Working Distance[a,b]	Housing Thickness[a]	Center Thickness[a]	Radius of Curvature[a]	Focal Shift	Reference Drawing
LJ5195RM-E	Ø1"	2 - 5 µm (R_{avg} < 1.25%)	50.0 mm	45.7 mm	>21 mm	44.4 mm	7.9 mm	6.0 mm	20.5 mm	Raw Data	
LJ5709RM-E			75.0 mm	71.8 mm	>21 mm	70.5 mm	7.0 mm	4.5 mm	30.7 mm	Raw Data	
LJ5654RM-E			100.0 mm	97.2 mm	>21 mm	95.9 mm	7.0 mm	4.0 mm	41.0 mm	Raw Data	
LJ5027RM-E			200.0 mm	197.5 mm	>21 mm	196.2 mm	5.3 mm	3.5 mm	81.9 mm	Raw Data	

a. These quantities are defined in the Reference Drawing.
b. These values are quoted at the design wavelength, 4 µm. The Focal Shift column contains a plot of the wavelength dependence of the focal length.

Part Number	Description	Price	Availability
LJ5195RM-E	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 50.0 mm, ARC: 2 - 5 µm	$299.36	Today
LJ5709RM-E	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 75.0 mm, ARC: 2 - 5 µm	$299.36	Today
LJ5654RM-E	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 100.0 mm, ARC: 2 - 5 µm	$299.36	Today
LJ5027RM-E	Customer Inspired! Ø1" Mounted Plano-Convex CaF_2 Cylindrical Lens, f = 200.0 mm, ARC: 2 - 5 µm	$299.36	Today