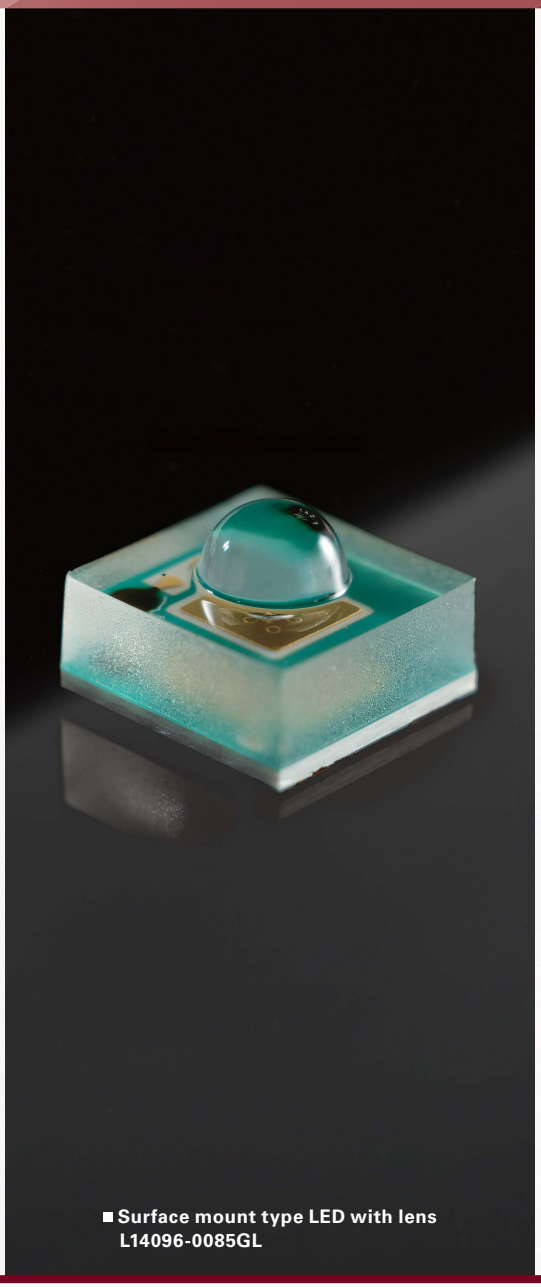
HAMAMATSU
PHOTON IS OUR BUSINESS

Selection guide - November 2018

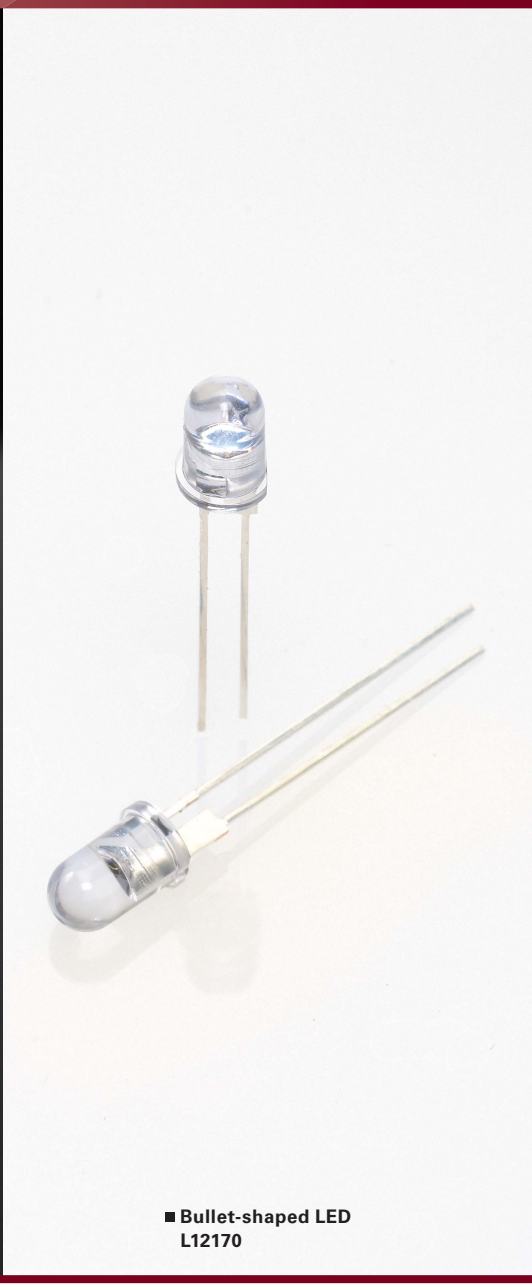
LED

Rich variety of light emitters for wide range of applications

■ Metal package type LED
L9337-02



■ Surface mount type LED with lens
L14096-0085GL



■ Bullet-shaped LED
L12170

HAMAMATSU PHOTONICS K.K.

LED

LEDs are opto-semiconductors that convert electrical energy into light energy. LEDs offer the advantages of low cost and a long service life compared to laser diodes (LDs).
LEDs are grouped into visible LEDs and invisible LEDs. Visible LEDs are mainly used for display or illumination, where LEDs are used individually. Invisible LEDs, however, are mainly used with photosensors such as photodiodes or CMOS image sensors.
Hamamatsu provides various LEDs from red to mid infrared range, which are mainly used in combination with photosensors.
Based on crystal growth technology and process technology supporting numerous compound semiconductor materials, we provide a product lineup that covers various wavelengths. The products feature high quality and high reliability backed by strictly controlled assembly process and inspection process.

Contents

Features of Hamamatsu LEDs

Product lineup that covers a wide variety of wavelengths

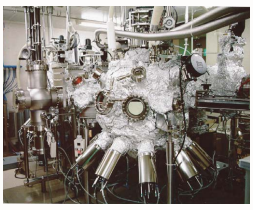
Product	Peak emission wavelength	Main applications
Red LED	660 to 700 nm	Optical switch, POF data communication, barcode reader
Near infrared LED	850 to 945 nm	Optical encoder, optical communication (optical fiber communication, FSO), optical switch
	1.2 to 1.55 µm	Moisture measurement, analysis, near infrared lighting
Mid infrared LED	3.3 to 4.3 µm	Gas detection

Wide variety of packages

Package type	Characteristics
Metal	High reliability
Plastic	Low cost
Surface mount type	Compact, thin case
With lens	Narrow directivity
For high output	High heat radiation

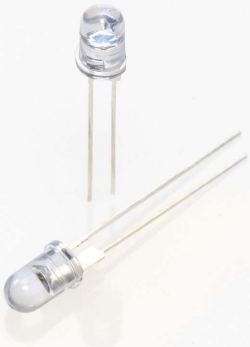
Custom devices available

In addition to changes in specifications of catalog products, fully customized products that entail new epitaxial wafer crystal growth can be provided.



Thin-film crystal growth under ultra-high vacuum in MBE equipment

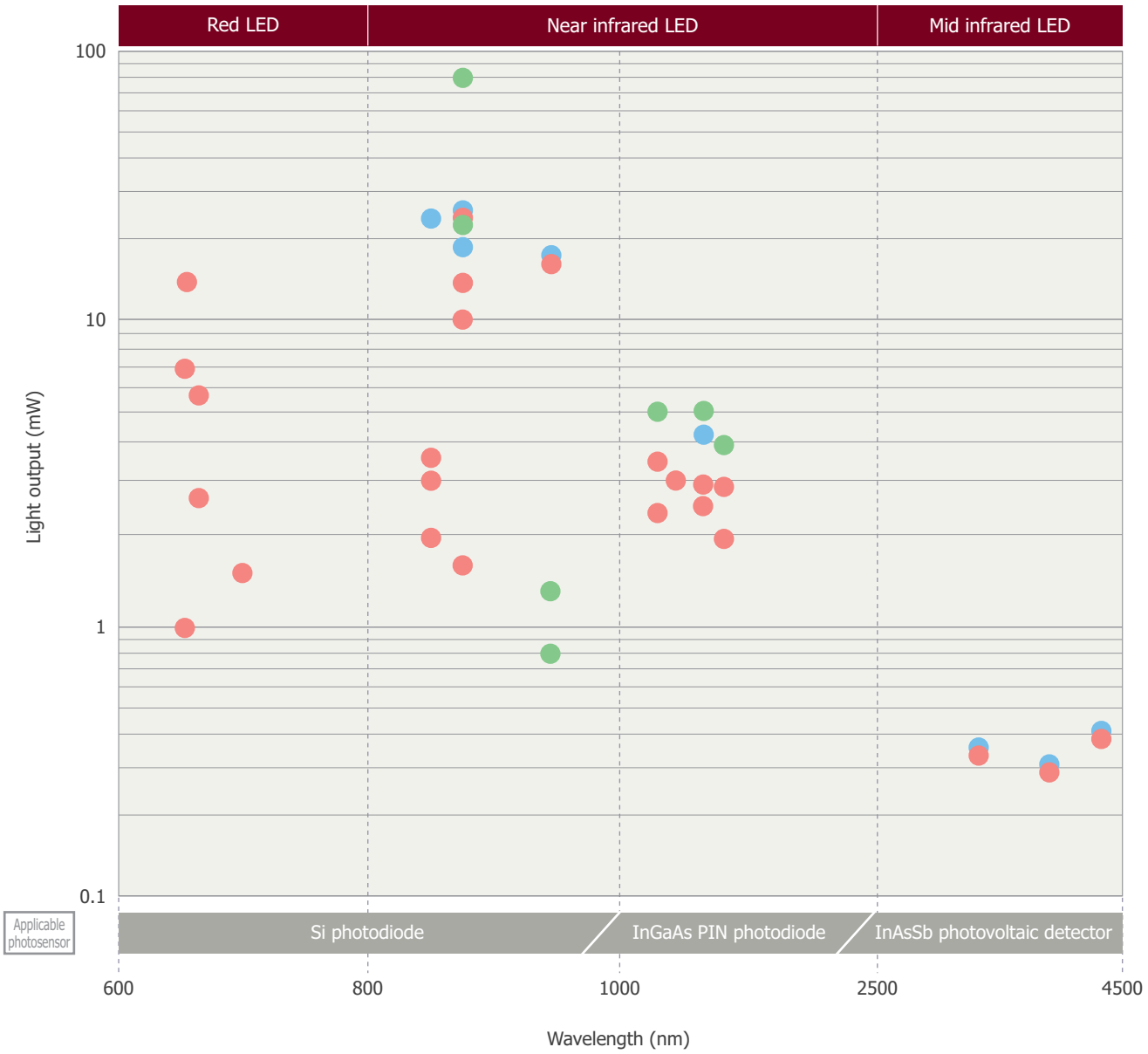
Thin-film crystal growth with MOCVD equipment



Product lineup

Hamamatsu Photonics offers various packages of LEDs that support different wavelengths and light outputs.

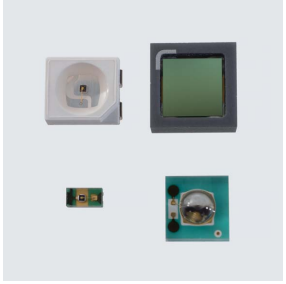
Wide-ranging product lineup



Metal packages

Plastic packages

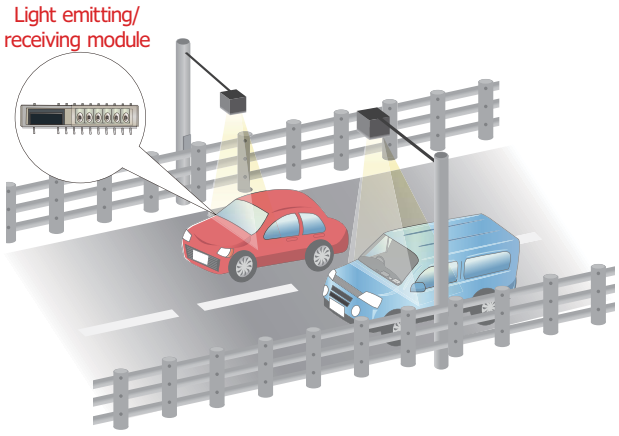
Surface mount types



Note: For details on directivity, see pages 9 and 10.

Application examples

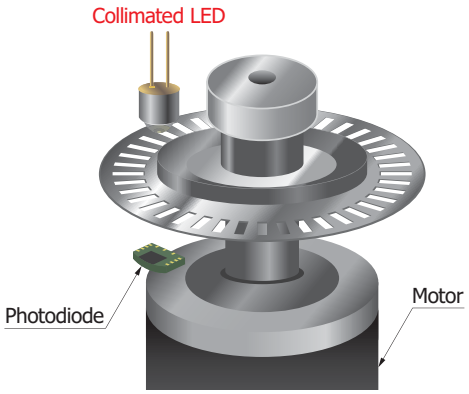
VICS



KLEDC0029EB

Light emitting/receiving modules with built-in LEDs and a photosensor are embedded in VICS (Vehicle Information and Communication System) in-vehicle devices.

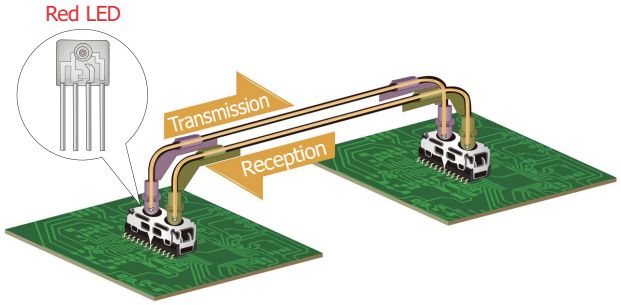
Encoders



KLEDC0054EA

Optical transmission encoders require a collimated LED to achieve high accuracy.

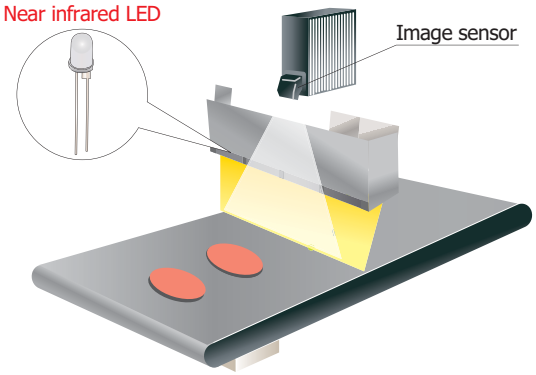
Optical communication



KLEDC0055EA

LEDs are used for POF (plastic optical fiber) communications and FSO (free space optics).

Lighting for infrared cameras



KLEDC0056EA

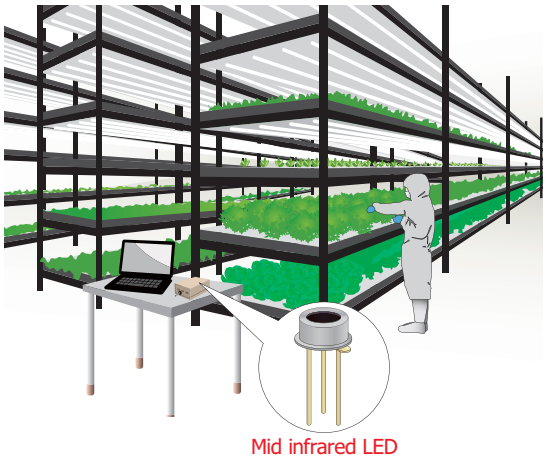
Infrared LEDs with large output are used as light sources for infrared camera imaging. These LEDs are arranged around the camera.

Skin moisture measurement

KLEDC0057EA

Compact near infrared LEDs are used for measuring skin moisture levels.

Gas detection



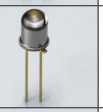
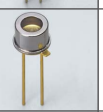
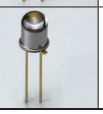
KLEDC0058EA

Mid infrared LEDs are used for CO_2 density measurements in plant factories.

Selection guide

Red LED

Red LEDs have a peak emission wavelength in the 660 to 700 nm range. They are used in a wide range of applications including optical switches, POF data communication, and barcode readers. Various types are available including a type with a reflector (cavity) on the metal base to increase the irradiance, a type with lens featuring narrow directivity, and a type that can irradiate over a wide range without a reflector.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Emission area (mm)	Radiant flux (mW)	Forward voltage (V)	Cutoff frequency (MHz)	Measurement condition Forward current (mA)	Photo	Directivity (P.9, 10)	Features	Application examples
L10762	660	15	ϕ0.4	1.0*1	1.9	70	20		⑧	High fiber end output	POF data communication
L11767		18	□0.31	13	2.1	6			①	High output, wide directivity	Optical switches
L11767-0066L			ϕ4.65	7					⑤	High reliability, narrow directivity	
L6108	670	25	□0.25	5.5	1.8	5	20		①	Wide directivity	Optical switches
L6112			ϕ1.15						②	Wide directivity	
L6112-01			ϕ4.65	2.5					⑤	High reliability, narrow directivity	
L6112-02			ϕ1.15						③	High reliability, wide directivity	
L10363	700	20	ϕ4.65	1.4	1.7	5	20		⑤	High reliability, narrow directivity	Optical switches

*1: POF core diameter=ϕ1 mm, length=1 m, Z (distance between the cap surface and the fiber end)=0.3 mm

Near infrared LED (850 to 945 nm)

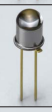
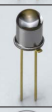
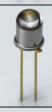
These near infrared LEDs have a peak emission wavelength in the 850 to 945 nm range. They are used in a wide range of applications including optical switches, optical fiber communication, FSO, optical rangefinders, near infrared lighting, and encoders. A wide product lineup (high output, high-speed response, superior collimation, current confinement type with mini light spot, high reliability type for in-vehicle applications, etc.) is available.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Emission area (mm)	Radiant flux (mW)	Forward voltage (V)	Cutoff frequency (MHz)	Measurement condition Forward current (mA)	Photo	Directivity (P.9, 10)	Features	Application examples
L11913	850	25	ϕ4.65	3.4*2	1.45	20	20		⑥	High reliability, superior collimation	Encoders
L13141-0085K		30	ϕ0.11	2.8	1.7	25	50		⑦	Wide directivity, current confinement type	Optical switches
L13142-0085K		35	ϕ0.4	3					⑧	Narrow directivity, current confinement type	
L13142-0085L		30	ϕ4.65						⑥	Narrow directivity, current confinement type	
L13814-0085K		30	ϕ0.05	2	1.9	25			⑦	Current confinement type, mini light spot	
L14096-0085GL		25	ϕ1.4	23		20			⑫	High output, narrow directivity	
L8013	870	45	ϕ1.15	45 μW*3	1.45	50	30		⑦	Easy fiber alignment	POF data communication
L9337			ϕ0.75	23	1.42	40	50		②	High output	Optical switches
L9337-01			ϕ4.65	13					⑤	High reliability, narrow directivity	
L9337-02			ϕ0.75	10					③	High reliability, wide directivity	
L9437			ϕ4.65	1.6*2	1.5		30		⑥	High reliability, superior collimation	Encoders
L9725-01			ϕ2.4	23	1.45	40	50		⑭	High output, surface mount type	In-vehicle
L10843			□0.39			50			①	High output, wide directivity	Optical switches
L11368-01		35	ϕ1.7	65 μW*4	2	50	50		④	Current confinement type	Optical communication
L12170		45	ϕ5.0	80	1.45	40	200		⑨	Large current, high output, narrow directivity	Near infrared lighting
				1200	2.4		3000*5				
L12171-0087G			□0.24	18	1.55		50		⑪	Surface mount type, compact	Optical switches
L12756			ϕ3.0	23	1.5				⑩	High output, narrow directivity	Near infrared lighting
NEW L14097-0094GL	940	40	ϕ1.4	60	2.5	10	50		⑬	Large current, High output	Near infrared lighting
				1200	3.0		1000*5				
L9338	945	60	ϕ0.75	15	1.34	0.3	50		②	High output	Optical switches
L9726			ϕ2.4		1.35				⑭	High output, surface mount type	In-vehicle

*2: light output *3: PCF200 fiber end output *4: GI50 fiber end output *5: Pulse value=10 μs, duty ratio=1%

Near infrared LED (1.2 to 1.55 µm)

These high output near infrared LEDs have a peak emission wavelength at 1 µm or higher. 1.2 µm, 1.3 µm, 1.45 µm, and 1.55 µm peak emission wavelength types are available. They are used for moisture measurements, analysis, near infrared lighting, and so on. Various packages (metal package, with lens, bullet-shaped) are available.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Emission area (mm)	Radiant flux (mW)	Forward voltage (V)	Cutoff frequency (MHz)	Measurement condition Forward current (mA)	Photo	Directivity (P.9, 10)	Features	Application examples
L13072-0120K	1200	80	ϕ1.15	2.2	1.1	15	50		③	High reliability, high output	Analysis, near infrared lighting
L13072-0120L			ϕ4.65	3.2					⑤		
L13072-0120P			ϕ3.0	5					⑩	High output, narrow directivity	
L12771	1300	90	ϕ1.15	2.8	1	15	50		③	High reliability, high output	Analysis, near infrared lighting
L12771-01			ϕ4.65	3.1					⑤		
L10660	1450	120	ϕ1.15	2.4	1	15	50		③	High reliability	Moisture measurement, near infrared lighting
L10660-01			ϕ4.65	2.8					⑤		
L13895-0145P			ϕ3.0	5	0.9	10			⑩	High output	
NEW L13895-0145G			□0.31	4					⑪	Surface mount type, compact	
L12509-0155K	1550	120	ϕ1.15	1.9	0.8	15	50		③	High reliability, high output	Analysis, near infrared lighting
L12509-0155L			ϕ4.65	2.7					⑤		
L12509-0155P			ϕ3.0	3.8					⑩	High output	

Mid infrared LED

Mid infrared LEDs with peak emission wavelengths in the middle infrared region (3.3 µm, 3.9 µm, 4.3 µm) feature high output and are used for gas detection. They are used in combination with quantum type detectors such as InAsSb photovoltaic detectors.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Emission area (mm)	Radiant flux (mW)	Forward voltage (V)	Rise time max. (µs)	Measurement condition: Forward current QCW mode (mA)	Photo	Directivity (P.9, 10)	Features	Application examples
L13771-0330M	3300	300	□1.04	0.25	2.1	1	50		③	High reliability	Methane detection
L13771-0330C									⑮	Surface mount type	
L13454-0390M	3900	500		0.2	1.7		80		③	High reliability	Reference light source for gas detection
L13454-0390C									⑮	Surface mount type	
L13201-0430M	4300	700		0.3	1.6				③	High reliability	CO_2 detection
L13201-0430C									⑮	Surface mount type	

LED array (2-chip type)

This LED array incorporates a 670 nm red LED chip and an 870 nm near infrared LED chip.
It is provided in a surface mount type, compact package (3.5 × 2.8 × 1.9 mm) and is suitable for optical switch light sources.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Radiant flux (mW)	Forward voltage (V)	Cutoff frequency (MHz)	Measurement condition: Forward current (mA)	Package
L10922	670	25	4	1.8	3	20	
	870	45	18	1.47	40	50	

Light emitting/receiving module

This VICS in-vehicle module employs six 870 nm LED chips and one Si photodiode in a plastic package.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Pulse radiant intensity*1 (mW/sr)	Pulse forward voltage*1 (V)	Cutoff frequency (MHz)	Measurement condition: Pulse forward current (mA)	Package
P12793	870*2	45*2	1550	6.7	15	900	

*1: 64 kHz, duty ratio=50%, 4 ms ON, average peak value during pulse operation *2: I_F=100 mA

SIP type LED

These LEDs are provided in a compact, plastic package with the LED chip molded in transparent resin and with a lens.

Type no.	Peak emission wavelength (nm)	Spectral half width (nm)	Radiant flux (mW)	Forward voltage (V)	Measurement condition: Forward current (mA)	Features	Package
L10881	650	25 max.	-4.5 dBm*3	1.9	20	High output for 156 Mbps optical link	
L5276	880	50	2.2	1.3	20	For optical switches	
L6286	940	45	0.8*4	1.25			
L6895-10	940	60	1.2*4	1.25	20	For encoders	

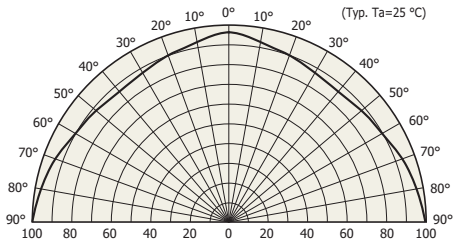
*3: fiber coupled optical power *4: minimum value

Directivity (typical examples)

The directivities of the representative products for each type of package are provided below. The directivity may vary to some degree between individual products.
For the directivity of individual products, refer to the datasheet.

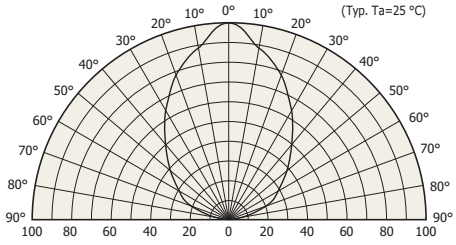
Metal package

① Resin potted type (no reflector)



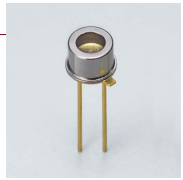
KLEDB0348EA

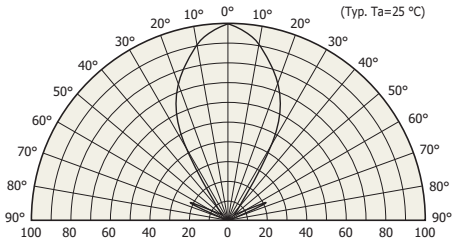
② Resin potted type (with reflector)



KLEDB0473EA

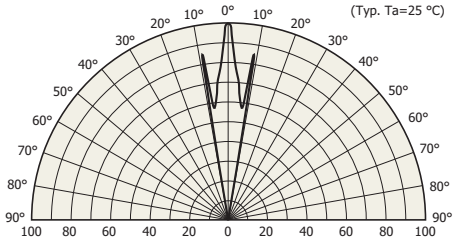
③ Flat cap





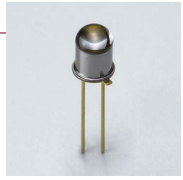
KLEDB0474EA

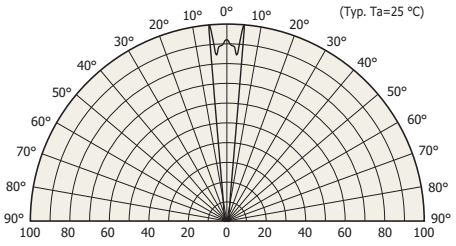
④ With mini lens



KLEDB0463EA

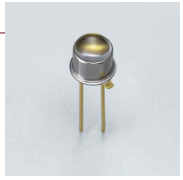
⑤ With lens

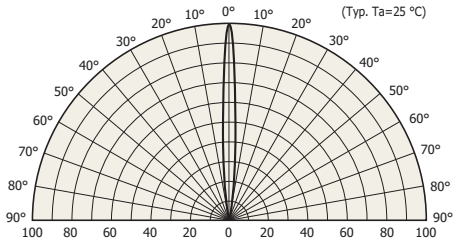




KLEDB0475EA

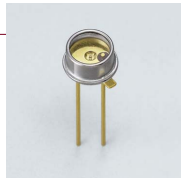
⑥ With lens (high collimation)

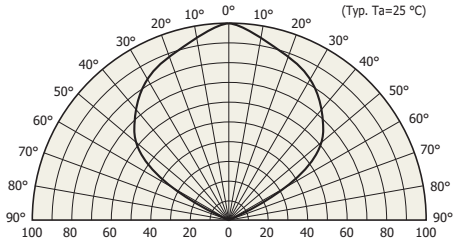




KLEDB0396EA

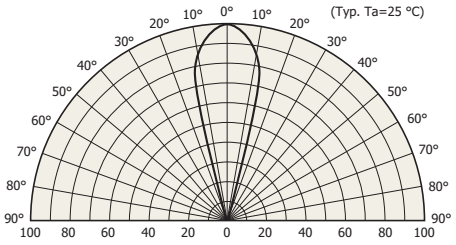
⑦ Low-profile flat cap





KLEDB0422EA

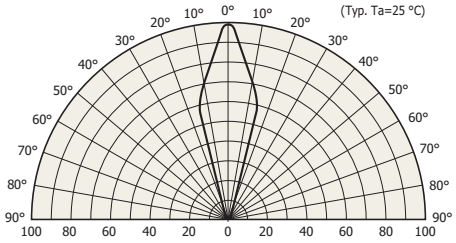
⑧ With ball lens



KLEDB0477EA

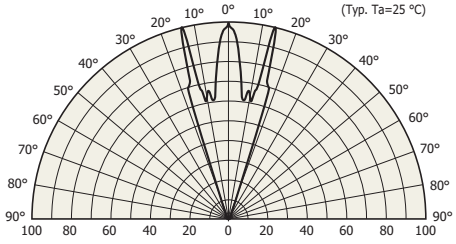
Plastic package

⑨ Bullet-shaped (ϕ5 mm)



KLEDB0375EA

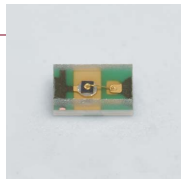
⑩ Bullet-shaped (ϕ3 mm)

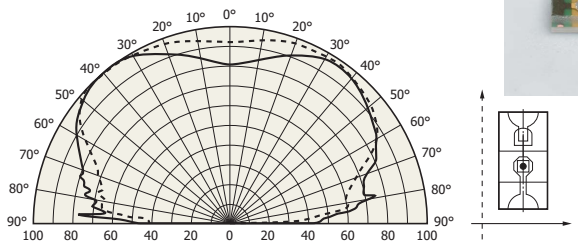


KLEDB0386EA

Surface mount type

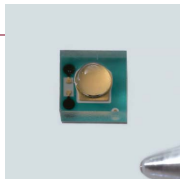
⑪ COB (chip-on-board)

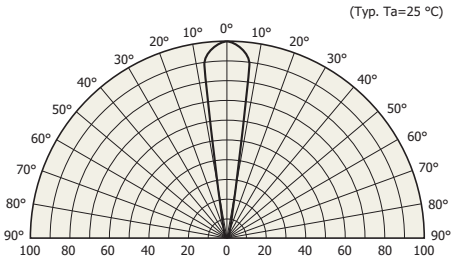




KLEDB0461EA

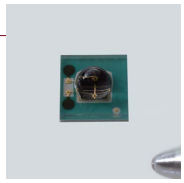
⑫ COB with lens

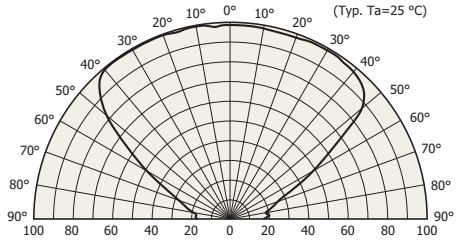




KLEDB0462EA

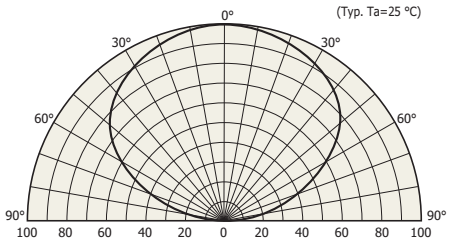
⑬ COB with lens (high output)





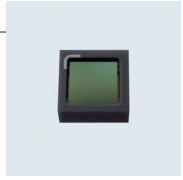
KLEDB0500EA

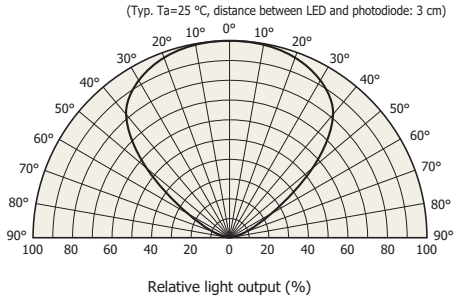
⑭ Premolded type



KLEDB0360EA

⑮ Ceramic type





KLEDB0464EA

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