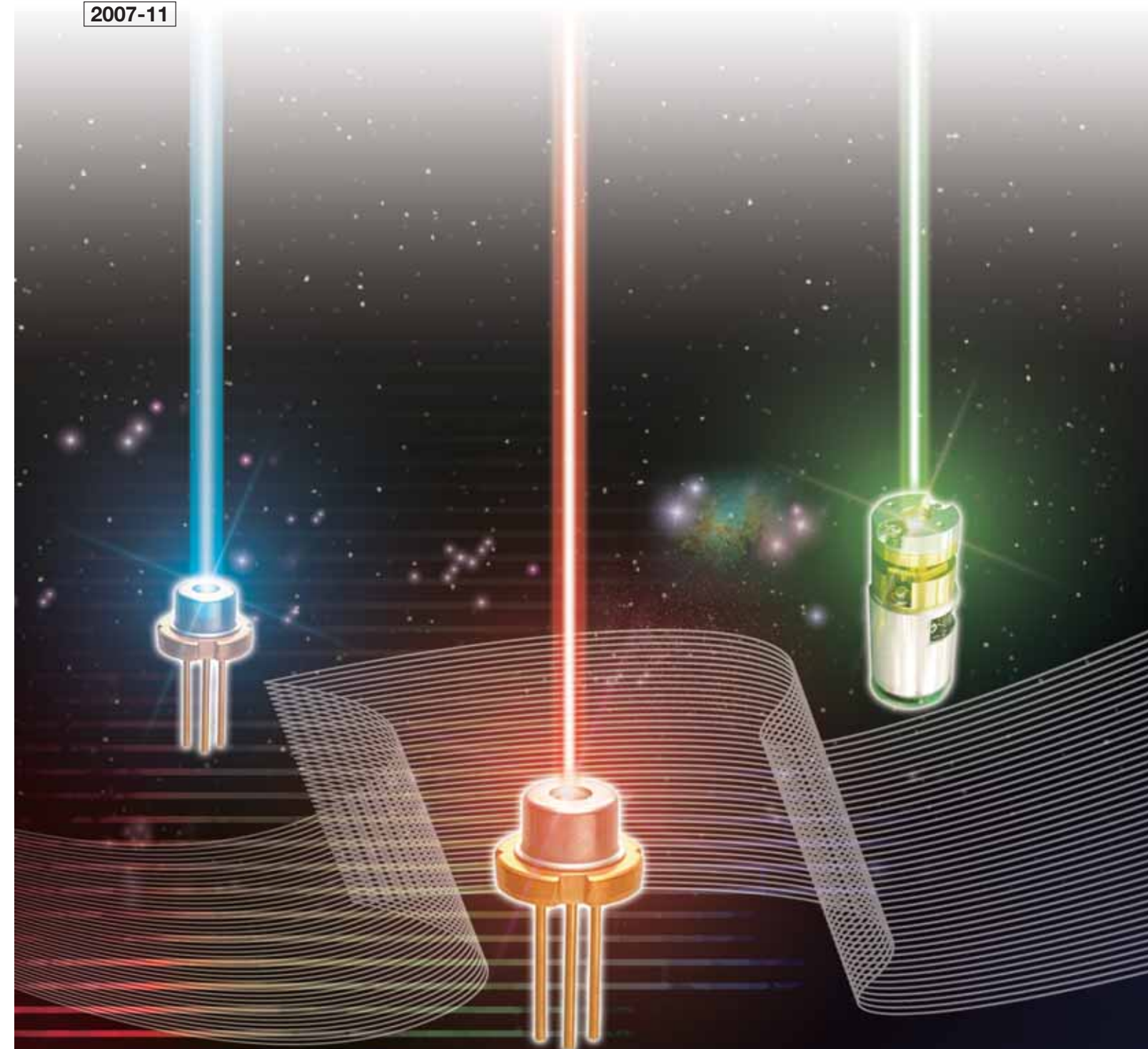
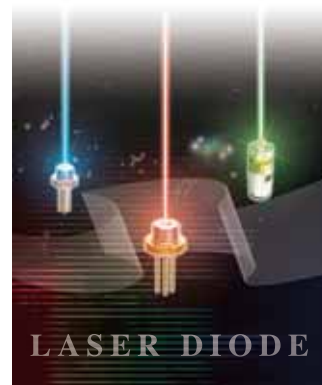


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SANYO

LASER DIODE

2007-11



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LASER DIODE

SANYO Laser Diodes

support advanced information society.

We offer a complete range of laser diodes, from 405nm to 830nm. Our laser diodes are especially characterized by high power models for use with CD-R, whereas for industrial use, we satisfy various kinds of needs, including diodes at 635nm for barcodes, line markers, or pointers, and 808nm for light source for green modules. We also supply 405nm blue-violet lasers for next-generation optical disks (for recording) and other industrial applications.

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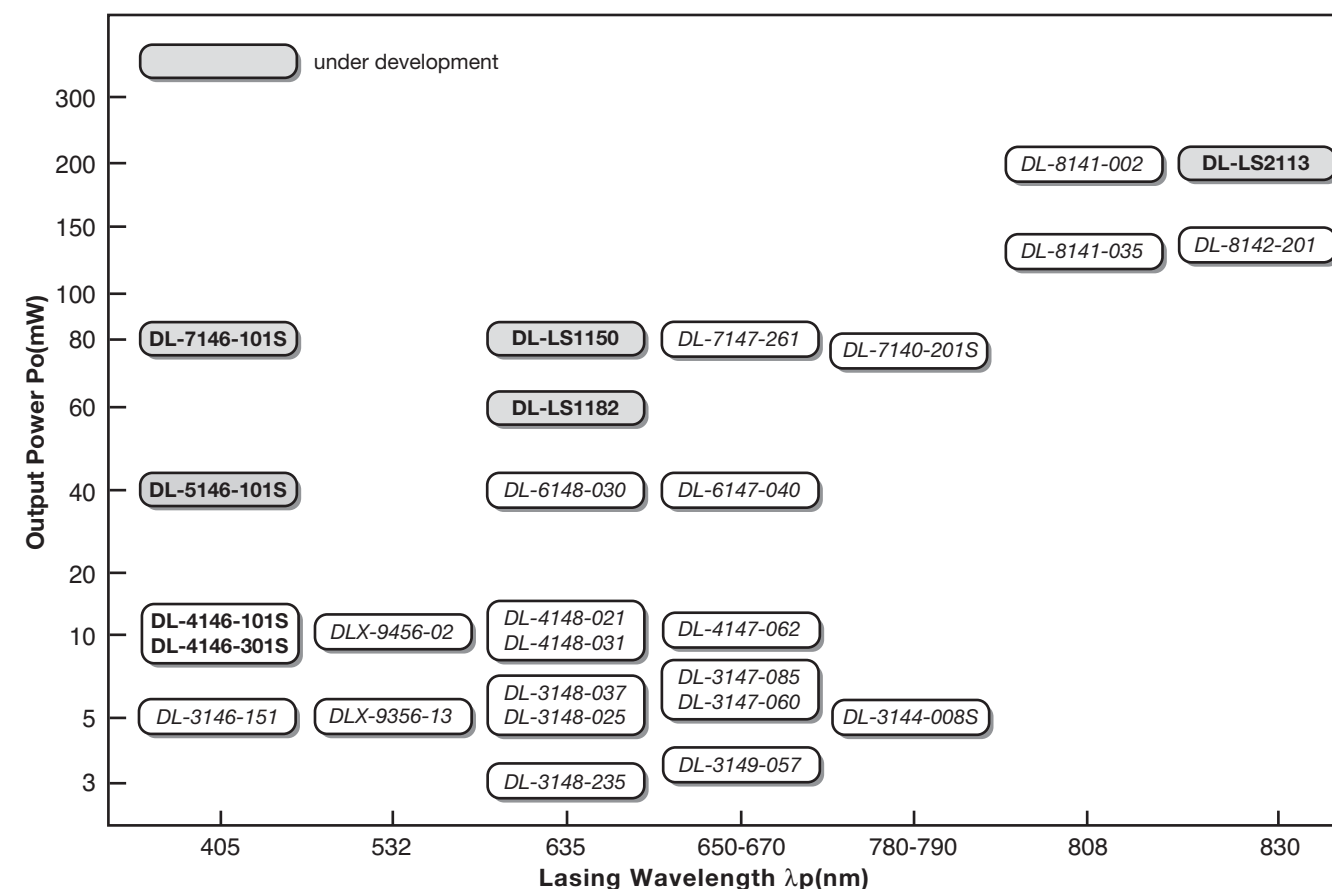
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Laser Line-up for Industrial Use



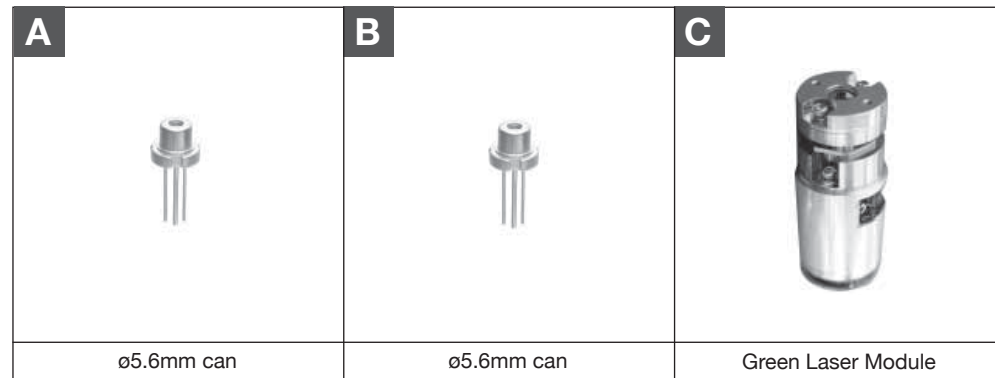
Summary of Features (Typ.)

Part No.	Main Feature	Absolute Maximum Ratings			Electrical and Optical Characteristics						Pin Connection Type	Application
		Light Output	Operating Temperature	Ratings	Threshold Current	Operating Current	Lasing Wavelength	Monitor Current	Beam Divergence			
		P_o mW	T_{opr} °C	P_o mW	I_{th} mA	I_{op} mA	λ_p nm	I_m mA	Parallel deg	Perpendicular deg		
Blue-Violet Laser Diode												
DL-3146-151	5mW at 60°C	7	0 to +60	5	35	40	405	0.2	8	20	II	IDI
DL-4146-301S	10mW at 75°C	20	0 to +75	10	26	34	405	-	8.5	19	V	IDI
DL-4146-101S	10mW at 75°C	20	0 to +75	10	26	35	405	0.2	8.5	19	II	IDI
DL-5146-101S	40mW at 75°C	45	0 to +75	40	35	70	405	0.3	8	19	II	IDI
DL-7146-101S	80mW at 75°C	85	0 to +75	80	45	110	405	0.3	8	19	II	IDI
Red Laser Diode												
DL-3148-235	3mW at 50°C	3	-10 to +50	3	20	25	635	0.15	8	30	III	LP
DL-3148-025	5mW at 40°C	6	-10 to +40	5	20	30	635	0.25	8	30	I	LP
DL-3148-037	5mW at 50°C	7	-10 to +50	5	20	30	635	0.25	8	30	I	LP, LM
DL-4148-021	10mW at 40°C	12	-10 to +40	10	40	60	635	0.25	8	30	I	LM
DL-4148-031	10mW at 50°C	12	-10 to +50	10	40	60	635	0.25	8	30	I	LM
DL-5148-030	20mW at 50°C	25	-10 to +50	20	60	80	638	0.3	8	16	I	LM
DL-6148-030	40mW at 50°C	40	-10 to +50	40	60	100	638	0.6	8.5	16	I	LD
DL-LS1182	60mW at 50°C	65	-10 to +50	60	60	120	642	0.2	8	19	I	LD
DL-3147-060	5mW at 70°C	7	-10 to +70	5	20	30	650	0.2	8	30	I	BS, LP
DL-3147-260	5mW at 70°C	7	-10 to +70	5	20	30	650	0.15	8	30	III	BS
DL-3147-085	5mW at 80°C	7	-10 to +80	5	20	30	650	0.2	8	30	I	BS
DL-4147-062	10mW at 70°C	12	-10 to +70	10	30	50	650	0.3	8	30	I	BS, LP
DL-6147-040	40mW at 60°C	45	-10 to +60	40	30	65	658	0.4	10	16	I	IDI
DL-7147-201	50mW at 70°C	60	-10 to +70	50	35	90	658	-	9	17	IV	IDI
DL-7147-261	80mW at 60°C	80	-10 to +60	80	50	130	658	-	9.5	17	IV	IDI
DL-3149-057	5mW at 60°C	7	-10 to +60	5	25	40	670	1.5	8	30	I	Sensor
Infrared Laser Diode												
DL-3144-008S	5mW at 60°C	8	-10 to +60	5	25	40	785	2	8.5	26	I	LBP
DL-7140-201S	70mW at 60°C	80	-10 to +60	70	30	100	785	0.25	8	17	III	IDI
DL-8141-035	150mW at 50°C	160	-10 to +50	150	50	185	808	0.5	8	16	I	GLM
DL-8141-235	150mW at 50°C	160	-10 to +50	150	50	175	808	0.4	8	16	III	IDI
DL-8141-002	200mW at 50°C	210	-10 to +50	200	50	230	808	0.5	8	16	I	GLM
DL-8142-201	150mW at 50°C	180	-10 to +50	150	50	200	830	0.4	8	16	III	IDI
DL-LS2113	200mW at 50°C	210	-10 to +50	200	50	230	830	0.6	8	16	III	IDI

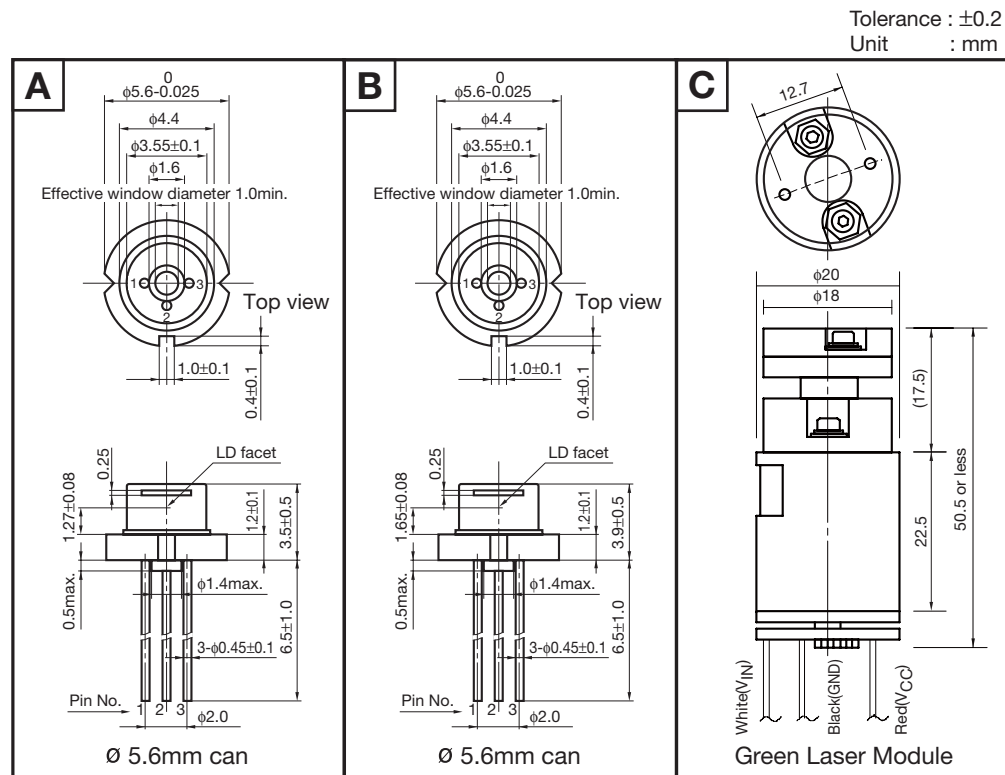
◆ Example of Application LP: Laser pointer BS: Bar-code scanner LM: Line marker LD: Laser display
 LBP: Laser beam printer GLM: Green Laser Module IDI: Industrial Instrument/Equipment
 Specifications and information herein are subject to change without notice. Therefore, You should confirm "Specifications sheet" that you intend to use.
 Please ask our sales staff for more details if necessary.

Outline of Laser Diodes

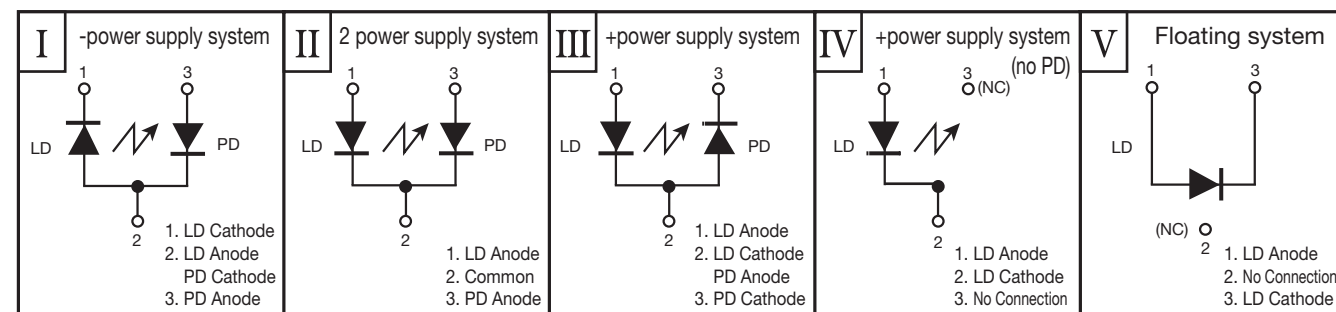
Photograph



External Appearance Dimensions



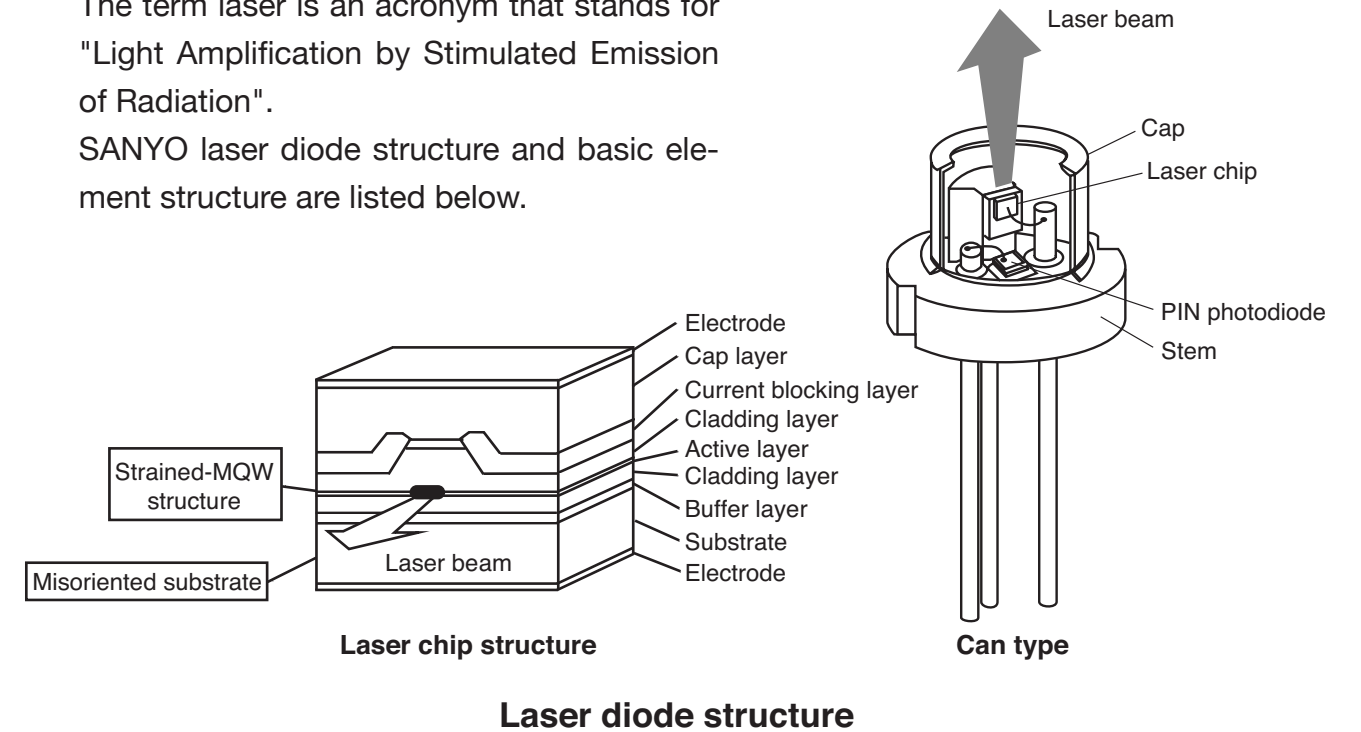
Pin Connection



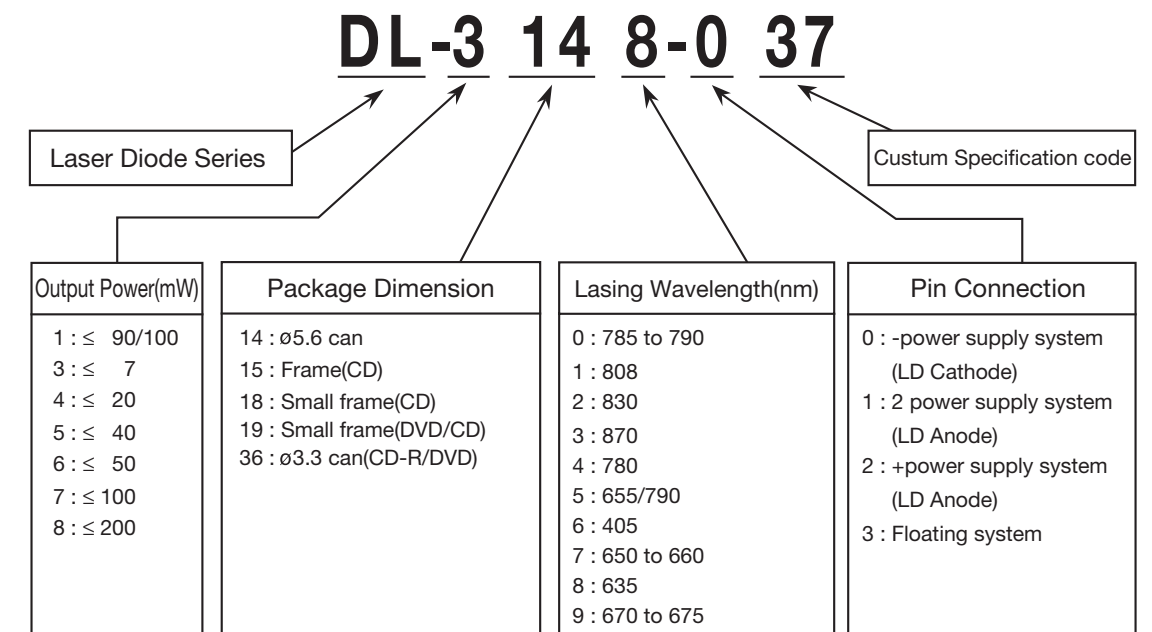
What is Laser Diode

The term laser is an acronym that stands for "Light Amplification by Stimulated Emission of Radiation".

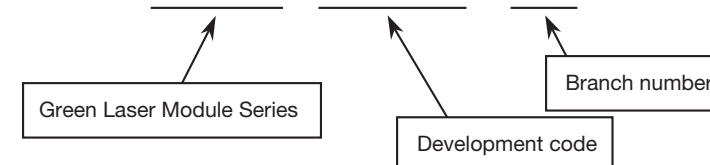
SANYO laser diode structure and basic element structure are listed below.



Part Number Coding



DLX-9356-13



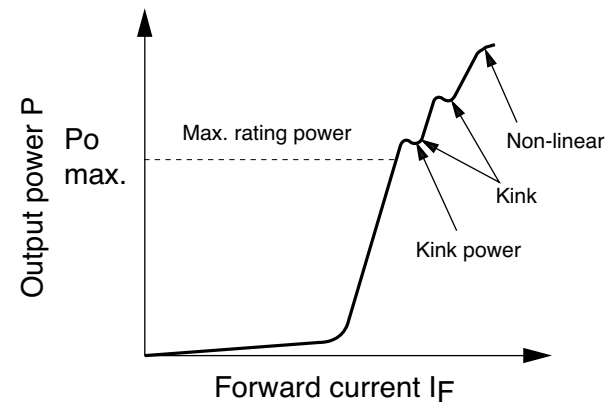
Definition of Feature

1. Absolute Maximum Ratings

Absolute maximum ratings are levels that can not be exceeded even momentarily under any external conditions. The levels are stipulated in terms of case temperature $T_c=25^\circ\text{C}$.

Light output power (P_o)

This is maximum allowable output during continuous operation. In the drive current light output characteristics shown in the figure on the right, there are no kinks or bends under this light output power.



Output power vs. Forward current (P-I_F)

Reverse voltage (VR)

This is maximum allowable voltage with a reverse bias applied to the element. The level is stipulated separately for a laser diode and a photodiode.

Ambient operating temperature (T_{opr})

This is the maximum ambient temperature in which the element can operate. The level is defined by case temperature of the element.

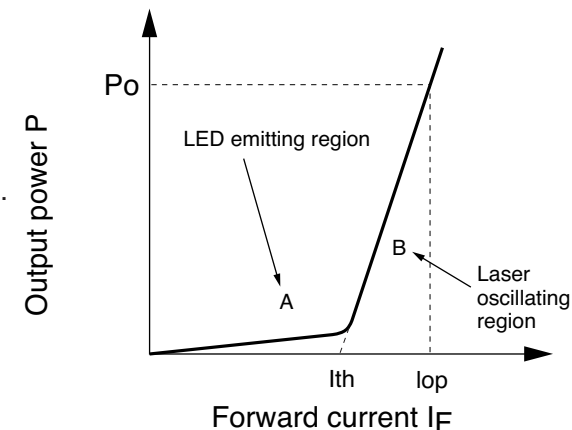
Ambient storage temperature (T_{stg})

This is the maximum ambient temperature for element storage.

2. Electric Optical Characteristics

Threshold current (I_{th})

Although P-I_F curve distinguishes the LED light emitting region A from the laser oscillating region B, the current level that triggers laser oscillating is the threshold current. In actuality, I_{th} is defined as the point where the straight line in B intersects the X axis.



Output power vs. Forward current (P-I_F)

Rated light output power (P_o)

This is recommended light output power during continuous operation.

Operating current (I_{op})

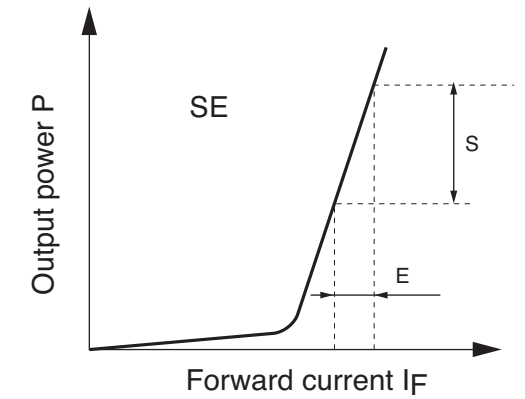
This is a current in the forward direction that is required to generate rated light output power.

Monitor current (I_m)

This is an output current of the photodiode at rated light output power.

Differential efficiency (SE)

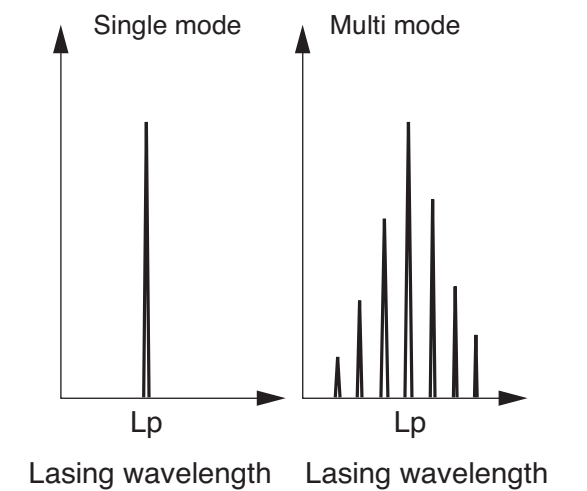
This is the increase in light output power per unit of drive current. The amount is given by the angle of the straight light output power line with respect to forward current in the laser oscillating range.



Output power vs. Forward current (P-I_F)

Lasing wavelength (L_p)

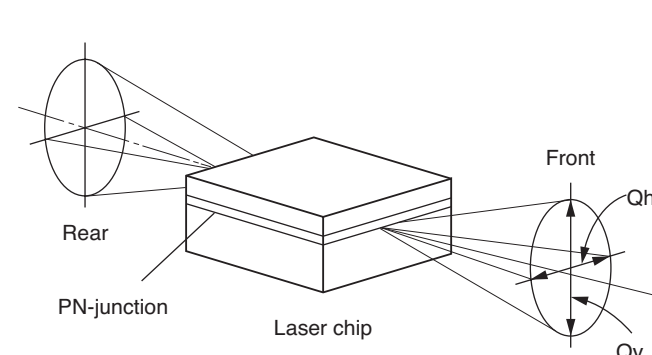
This is peak lasing wavelength at rated light output power. The lasing spectrum is broadly classified as either a single mode or a multi-mode as shown in the figure on the right, and peak lasing wavelength is defined by the maximum spectral intensity in either mode.



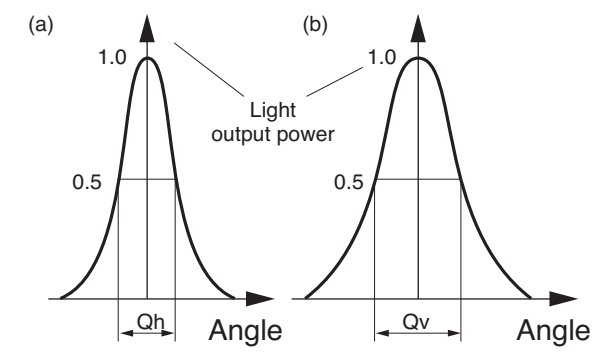
Lasing spectrum

Beam divergence angle : Parallel (Q_h), Perpendicular (Q_v)

Light radiating from laser chip diverges as shown in the figure on the lower left. When the light distribution is measured in the parallel (X axis) and perpendicular (Y axis) directions with respect to the surface of the PN-junction on laser chip, (a) and (b) are shown in the figure on the lower right. The beam divergence angle at 1/2 of the peak intensity of the light distribution (full angle at half maximum) is defined as Q_h and Q_v .



Beam divergence

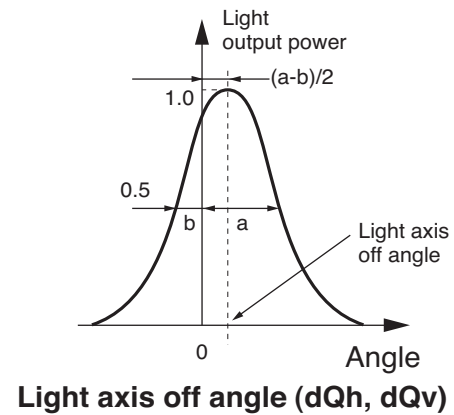


Beam divergence (Q_h, Q_v)

Definition of Feature

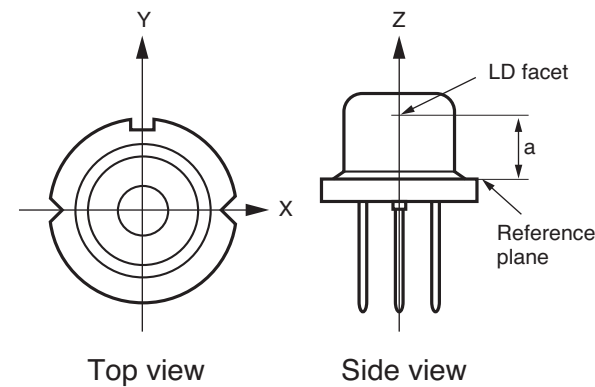
Light axis off angle : Parallel (dQh), Perpendicular (dQv)

This is expressed by a light axis shift with respect to a reference surface. In a beam divergent distribution of the parallel and perpendicular directions as shown in the figure on the right, shifts in both directions are defined by $(a-b)/2$.



Light emission off center point (ΔX , ΔY , ΔZ)

This is expressed by a shift in the position of the light emitting area. ΔX and ΔY represent the shift from the center of the package, while ΔZ represents a shift with respect to stipulated positions (a) from a reference surface to the edge of a laser diode (LD).



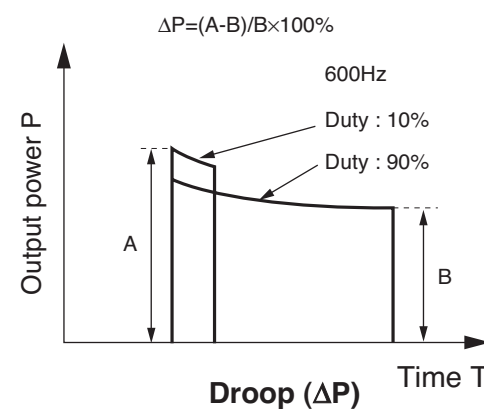
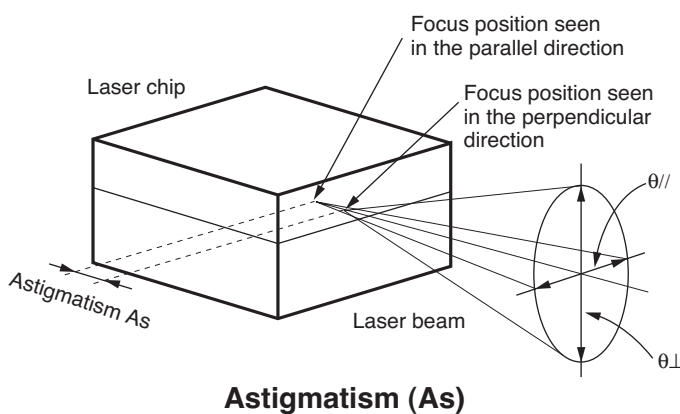
Light emission off center point (ΔX , ΔY , ΔZ)

Astigmatism (A_s)

An astigmatism refers to a shift in focus position seen in the perpendicular and parallel directions on the PN-junction surface of laser chip as shown in the figure on lower left.

Droop (ΔP)

This is the rate of light output power attenuation when a laser is driven by pulsed constant current. The rate is defined by $(A-B) / B \times 100\%$ as shown in the figure on the lower right.



Precautions for Use

1. Absolute Maximum Ratings

Do not exceed, even momentarily, the maximum ratings.

When laser diode is driven in excess of the maximum ratings, it causes not only instant breakdown or deterioration but also considerable reduction in reliability.

- (1) Laser diode may be damaged by surge current generated at power on-off operation. Check on the transient characteristics of power supply to make sure that such surge current does not exceed the maximum ratings.
- (2) The maximum ratings are specified by case temperature at 25°C. Design should be made well to work with temperature. As temperature goes up, power dissipation as well as maximum light output power is reduced.

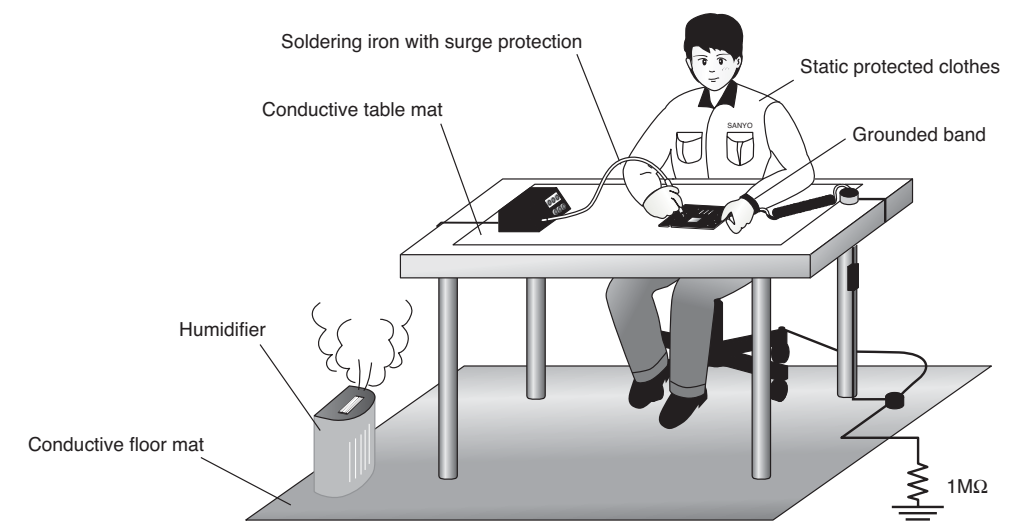
2. Soldering Conditions

Maximum temperature is set at 260°C and soldering time is within 3.0 seconds and minimum clearance of 1.6mm from the root of a lead is necessary.

3. Prevention of breakdown due to static electricity or surge current

Laser diode may be adversely affected by static electricity and surge current and, consequently causes breakdown of element and reduction of reliability unless the following cares are taken :

- (1) Power supply, installation and measuring equipment should be grounded. A noise filter or noise-cut transformer is to be provided to power supply input utilized.
- (2) During operation, working clothes, hats and shoes should be static-protected when in use. Also, a workman body should be static-protected by use of an earth-band or the like and grounded through high resistance (500kΩ-1MΩ).
- (3) A soldering iron should be grounded to protect laser diodes from voltage leak.
- (4) Any container for carriage and storage should be static-protected.
- (5) Avoid using laser diodes at a place where high frequent surge current may be generated as an inductive electric field gives breakdown or deterioration. (Avoid being placed around fluorescent grow lamp, for example).



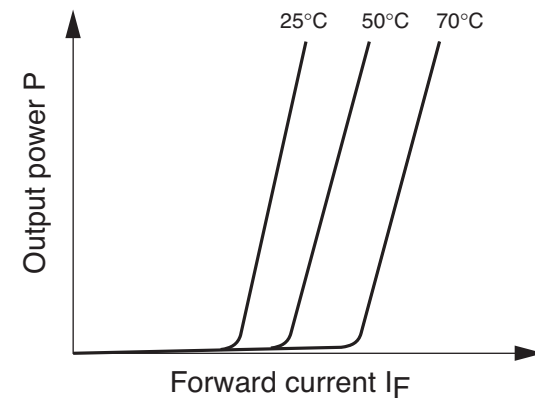
Precautions for Use

4. Package Handling

- (1) Package must not be cut off, reworked nor deformed. Do not hold the cap of laser diode tight, otherwise it may bring about cracks onto the window glass.
- (2) Do not touch the surface of the window glass.
Any scratch or contamination may result in reduction of optical characteristics.
- (3) Remove small contaminations on the surface softly using a cotton stick with a small amount of methyl alcohol.

5. Temperature Characteristics

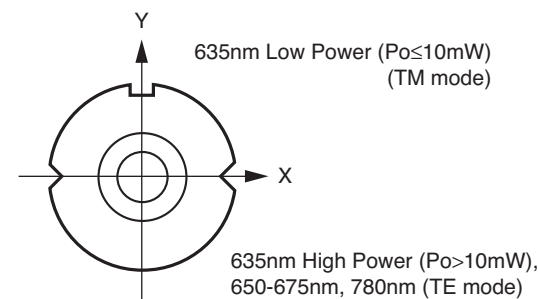
Laser characteristics (wavelength, operating current) vary with temperature, and variation is more extreme at shorter wavelength. We recommend installing an APC circuit to maintain a constant output because operating current varies significantly with temperature. By the same token, laser reliability can be improved by designing products based on their heat release characteristics. Since laser reliability falls off steeply at a higher temperature, never allow the case to exceed the operating temperature range given in specifications while a laser is in use.



Temperature characteristics of I-L curves

6. Polarizing Characteristics

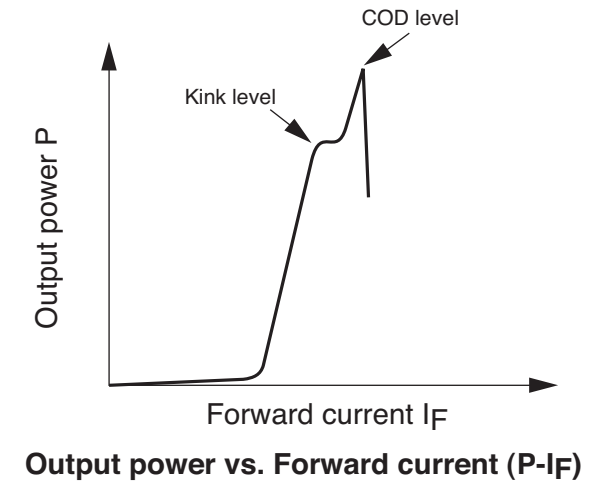
Polarizing characteristics of red lasers vary with distortions in the active layer. Conventional infrared lasers as well as 650 to 675nm lasers oscillate in the TE mode (polarizing direction parallel to the junction plane). As such, special care must be taken when using polarized optical parts with 635nm low power laser because it oscillates in the TM mode (polarizing direction perpendicular to the junction plane).



Top view of the can

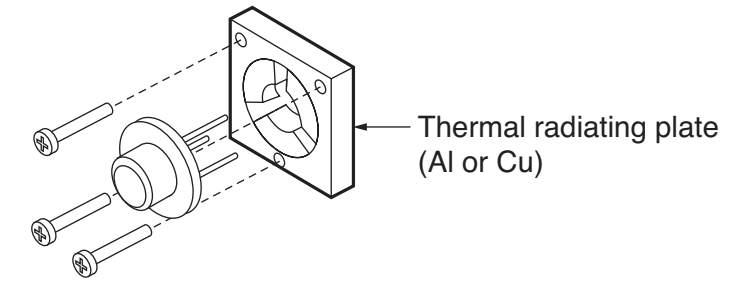
7. COD (Catastrophic Optical Damage) Level

If current is flowing into the forward direction and output continues to rise following a kink or other deviation, then the laser eventually reaches facet breakdown (COD) level where the crystal at the facet melts due to the high optical density. Special care must be taken in the handling of red lasers because they may continue to oscillate with a low power of 2 to 3mW even after occurring facet breakdown. There are several ways to tell whether an element is damaged or destroyed, such as through a far field pattern or an increase in the operating current. The life of a laser is significantly curtailed once the element is damaged, so special care must be taken to avoid not only exceeding current when adjusting the output, but surge like static electricity as well.



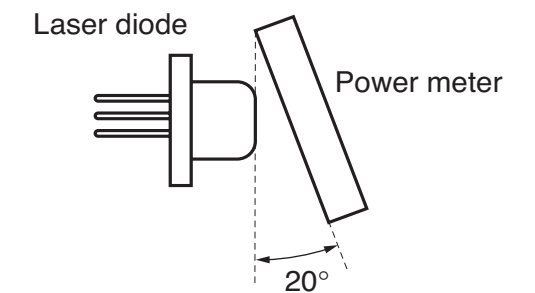
8. Thermal Radiation

Make sure that a thermal radiating plate (W30 xL30xt5mm) made of aluminum or some other high thermal conducting materials is mounted to laser diode. The reliability of laser diode is closely linked to junction temperature, so reliability rapidly declines at a higher temperature. Do not overlook thermal radiation.



9. Measuring Light Output Power

Use a light power meter to measure light output power of laser diodes. When measuring with APC drive, set a power meter at an angle as shown in the right figure so that a photodiode in a laser diode is not exposed to reflected light from the power meter.



Blue-Violet Laser Diode

Precautions for Use

1. Voltage of our blue-violet laser diode is 4-6V, which is higher than 1.8-3V of the other laser diodes. Take care of operating voltage when you design an APC circuit.
2. An assembly line has to be protected from static electricity or surge current. Use an earth-band or the like when handling blue-violet laser diodes.
3. Output light from our blue-violet laser diode is very reactive and harmful to a human eye. Avoid looking at the output light directly or even indirectly through a lens while oscillating. Parts exposed to the output light such as a lens or body should be made from material strong for ultraviolet damage.
4. Reselling, disassembling, or reverse engineering of a blue-violet laser diode is prohibited.
5. Our laser diode is not intended for use in applications where extremely high reliability is required, or human life is directly involved, e.g. life-support systems or cars.
6. We are not liable to any undesirable result caused by a misuse or inappropriate use.

Export Control

1. Our laser diode is subject to the export control regulations (of foreign exchanges and foreign trading). When exporting laser diodes (including service), care should be taken to insure that any necessary procedures are complied with.
2. Laser diodes should be destroyed to avoid infringing on export when you end the use of them.
3. Use in military applications is prohibited.

Please ask our sales staff for more details if necessary.

DL-4146-101S (DL-LS5042)

Tentative

Features

- Short wavelength : 405nm(Typ.)
- Low threshold current : I_{th} = 26mA(Typ.)
- Package : ϕ 5.6mm with PD

Applications

- Industrial use

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o (CW)	20	mW
Reverse Voltage Laser	V _R	2	V
Operating Temperature ^{*1}	T _{opr}	0 to +75	°C
Storage Temperature	T _{stg}	-40 to +85	°C

*1 : Case temperature.

Electrical and Optical Characteristics

*1 *2 *3 *5

(T_c=25°C)

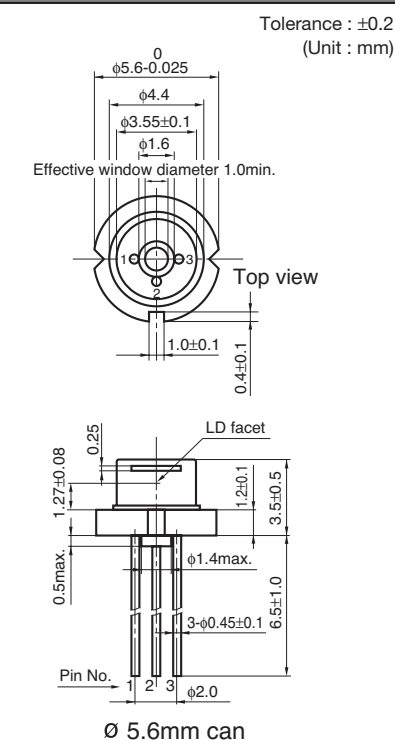
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	26	50	mA	
Operating Current	I _{op}	P _o =10mW	—	35	60	mA	
Operating Voltage	V _{op}	P _o =10mW	—	4.8	5.6	V	
Lasing Wavelength	L _p	P _o =10mW	395	405	415	nm	
Beam ^{*4} Divergence	Perpendicular	Q _v	P _o =10mW	16	19	23	°
	Parallel	Q _h	P _o =10mW	6	8.5	12	°
Off Axis Angle	Perpendicular	dQ _v	P _o =10mW	-2	—	2	°
	Parallel	dQ _h	P _o =10mW	-2	—	2	°
Differential Efficiency	SE	P _o =10mW	0.7	1.1	—	mW/mA	
Monitoring Output Current	I _m	P _o =10mW	0.1	0.2	0.5	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

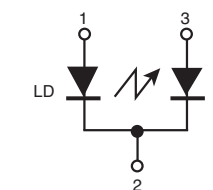
*3 : Reference values. *4 : Full angle at half maximum. *5 : Measurement condition : CW

◆ Specifications and information herein are subject to change without notice. Therefore, You should confirm "Specifications sheet" that you intend to use.

Package



Pin Connection



DL-5146-101S (DL-LS5043)

Tentative

Features

- Short wavelength : 405nm(Typ.)
- Package : $\phi 5.6$ mm with PD

Applications

- Industrial use

Absolute Maximum Ratings

(Tc=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	Po (CW)	45	mW
Reverse Voltage Laser	VR	2	V
Operating Temperature*1	Topr	0 to +75	°C
Storage Temperature	Tstg	-40 to +85	°C

*1 : Case temperature.

Electrical and Optical Characteristics

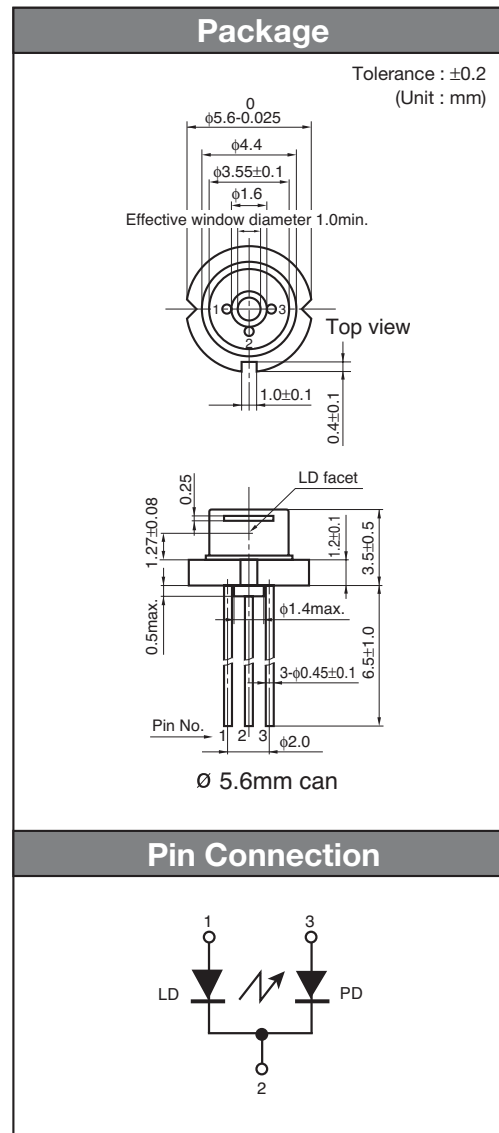
*1 *2 *3 *5

(Tc=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	Ith	CW	—	35	55	mA	
Operating Current	Iop	Po=40mW	—	70	100	mA	
Operating Voltage	Vop	Po=40mW	—	5.2	5.7	V	
Lasing Wavelength	Lp	Po=40mW	395	405	415	nm	
Beam *4 Divergence	Perpendicular	Qv	Po=40mW	16	19	23	°
	Parallel	Qh	Po=40mW	6	8	12	°
Off Axis Angle	Perpendicular	dQv	Po=40mW	-2	—	2	°
	Parallel	dQh	Po=40mW	-2	—	2	°
Differential Efficiency	SE	Po=40mW	0.8	1.2	—	mW/mA	
Monitoring Output Current	Im	Po=40mW	0.1	0.3	1.0	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Reference values. *4 : Full angle at half maximum. *5 : Measurement condition : CW



DL-7146-101S (DL-LS5044)

Tentative

Features

- Short wavelength : 405nm(Typ.)
- Package : $\phi 5.6$ mm with PD

Applications

- Industrial use

Absolute Maximum Ratings

(Tc=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	Po (CW)	85	mW
Reverse Voltage Laser	VR	2	V
Operating Temperature*1	Topr	0 to +75	°C
Storage Temperature	Tstg	-40 to +85	°C

*1 : Case temperature.

Electrical and Optical Characteristics

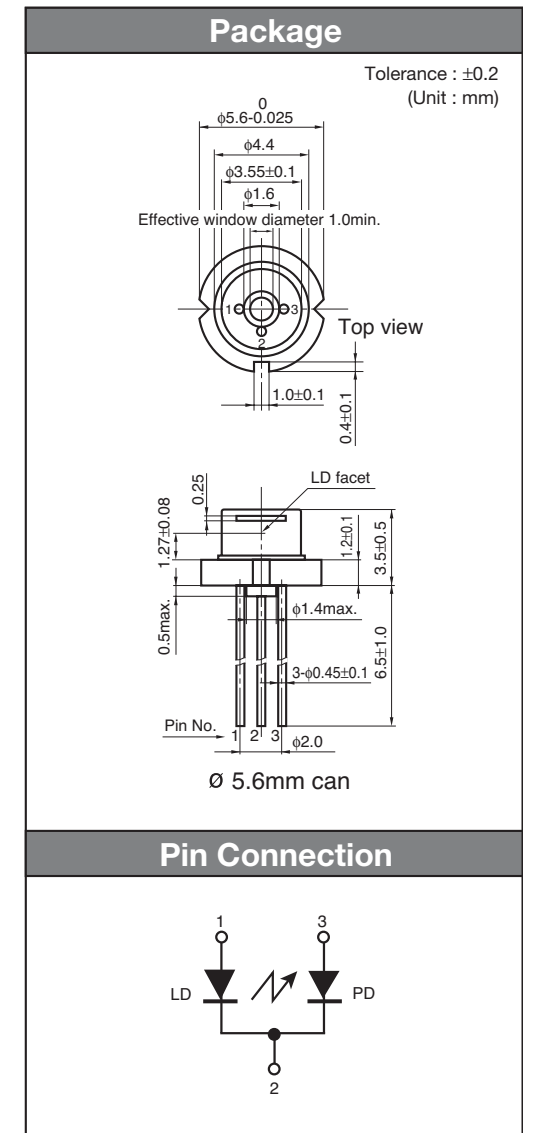
*1 *2 *3 *5

(Tc=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	Ith	CW	—	45	60	mA	
Operating Current	Iop	Po=80mW	—	110	140	mA	
Operating Voltage	Vop	Po=80mW	—	5.4	6.0	V	
Lasing Wavelength	Lp	Po=80mW	395	405	415	nm	
Beam *4 Divergence	Perpendicular	Qv	Po=80mW	16	19	23	°
	Parallel	Qh	Po=80mW	6	8	12	°
Off Axis Angle	Perpendicular	dQv	Po=80mW	-2	—	2	°
	Parallel	dQh	Po=80mW	-2	—	2	°
Differential Efficiency	SE	Po=80mW	0.8	1.2	—	mW/mA	
Monitoring Output Current	Im	Po=80mW	0.1	0.3	1.0	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Reference values. *4 : Full angle at half maximum. *5 : Measurement condition : CW



DL-3148-025

Features

- Short wavelength : 635nm(Typ.)
- Low threshold current : I_{th} = 20mA(Typ.)
- Output power : 5mW at 40°C(CW)
- Low operating voltage : V_{op} = 2.2V(Typ.)

Applications

- Laser pointer

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o	6	mW
Reverse Voltage Laser PD	V _R	2	V
		30	
Operating Temperature	T _{opr}	-10 to +40	°C
Storage Temperature	T _{stg}	-40 to +85	°C

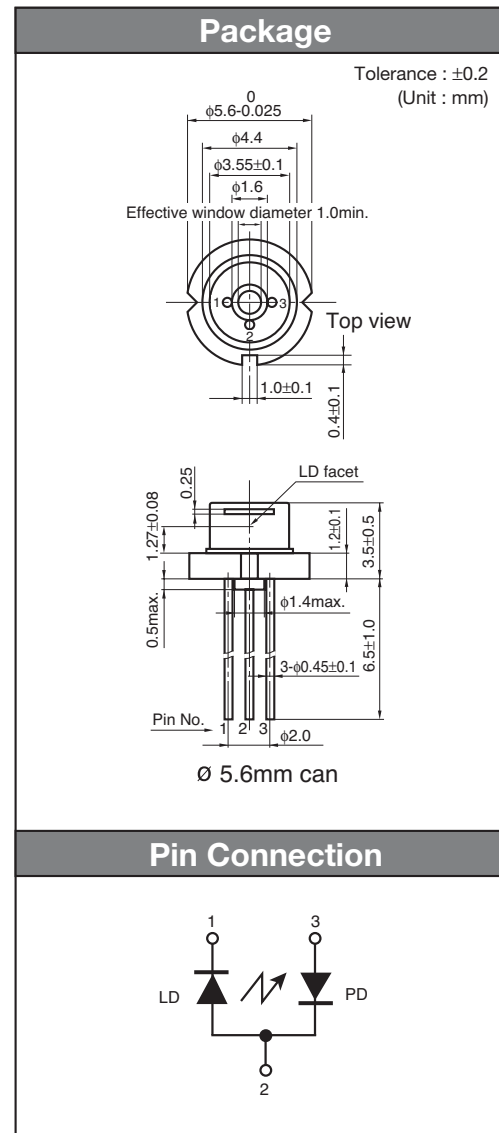
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	-	20	35	mA	
Operating Current	I _{op}	P _o =5mW	-	30	45	mA	
Operating Voltage	V _{op}	P _o =5mW	-	2.2	2.4	V	
Lasing Wavelength	L _p	P _o =5mW	630	635	640	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =5mW	25	30	35	°
	Parallel	Q _h	P _o =5mW	6	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =5mW	-3	-	3	°
	Parallel	dQ _h	P _o =5mW	-3	-	3	°
Differential Efficiency	SE	P _o =5mW	-	0.5	-	mW/mA	
Monitoring Output Current	I _m	P _o =5mW	0.08	0.25	0.5	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-3148-037

Features

- Short wavelength : 635nm(Typ.)
- Low threshold current : I_{th} = 20mA(Typ.)
- Output power : 5mW at 50°C(CW)
- Low operating voltage : V_{op} = 2.3V(Typ.)

Applications

- Laser pointer
- Leveler
- Line marker

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o	7	mW
Reverse Voltage Laser PD	V _R	2	V
		30	
Operating Temperature	T _{opr}	-10 to +50	°C
Storage Temperature	T _{stg}	-40 to +85	°C

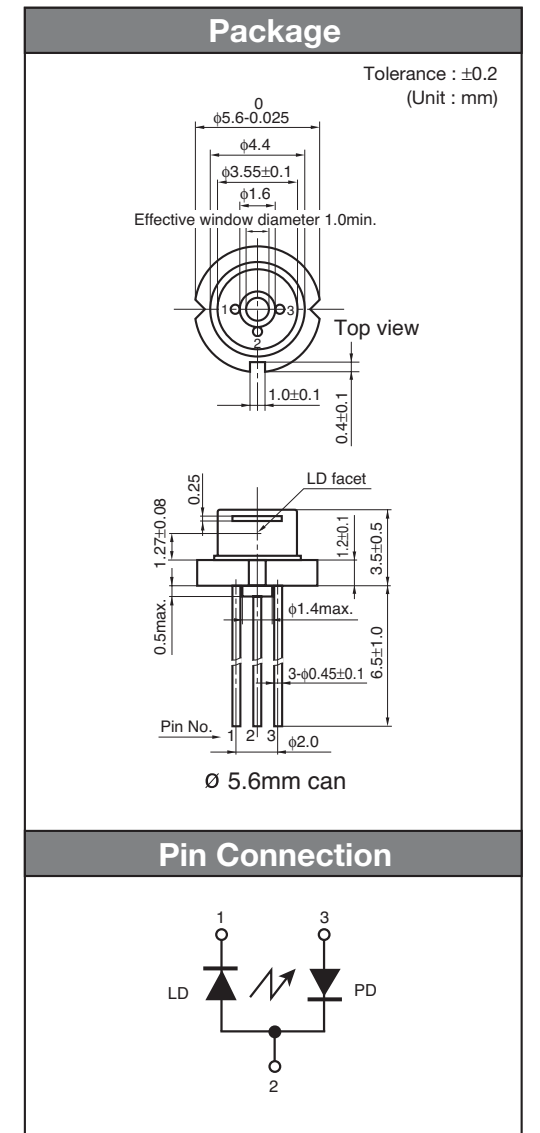
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	-	20	40	mA	
Operating Current	I _{op}	P _o =5mW	-	30	50	mA	
Operating Voltage	V _{op}	P _o =5mW	-	2.3	2.5	V	
Lasing Wavelength	L _p	P _o =5mW	630	635	640	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =5mW	25	30	35	°
	Parallel	Q _h	P _o =5mW	6	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =5mW	-3	-	3	°
	Parallel	dQ _h	P _o =5mW	-3	-	3	°
Differential Efficiency	SE	P _o =5mW	-	0.5	-	mW/mA	
Monitoring Output Current	I _m	P _o =5mW	0.1	0.25	0.4	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-4148-031

Features

- Short wavelength : 635nm(Typ.)
- Low threshold current : I_{th} = 40mA(Typ.)
- High output power : 10mW at 50°C(CW)

Applications

- Line marker
- Leveler

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit	
Light Output	CW	P _o	12	mW
Reverse Voltage	Laser	V _R	2	V
	PD		30	
Operating Temperature	T _{opr}	-10 to +50	°C	
Storage Temperature	T _{stg}	-40 to +85	°C	

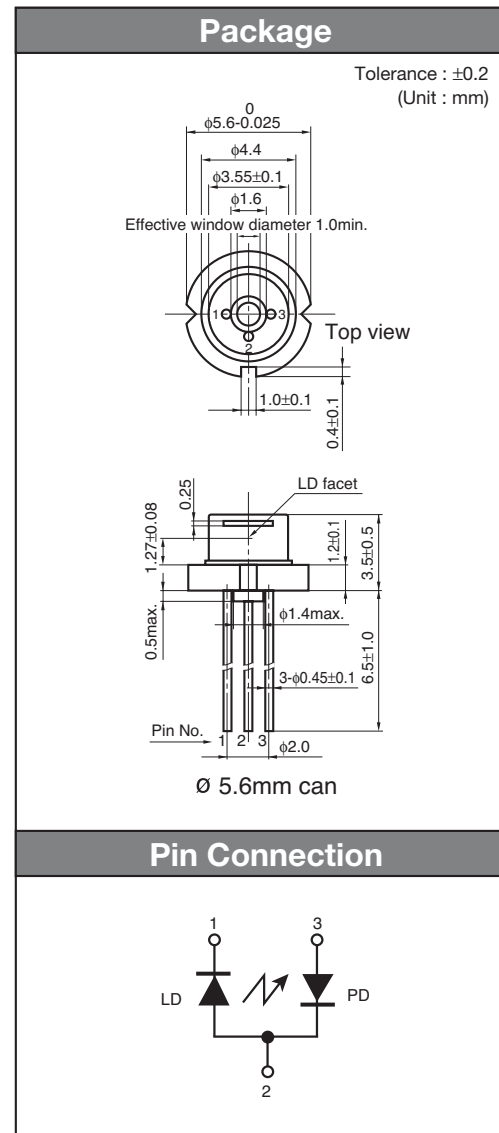
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Threshold Current	I _{th}	CW	-	40	60	mA
Operating Current	I _{op}	P _o =10mW	-	60	80	mA
Operating Voltage	V _{op}	P _o =10mW	-	2.3	2.5	V
Lasing Wavelength	L _p	P _o =10mW	-	635	645	nm
Beam *3 Divergence	Perpendicular	Q _v	25	30	35	°
	Parallel	Q _h	6	8	10	°
Off Axis Angle	Perpendicular	dQ _v	-2	-	2	°
	Parallel	dQ _h	-2	-	2	°
Differential Efficiency	SE	P _o =10mW	-	0.5	-	mW/mA
Monitoring Output Current	I _m	P _o =10mW	0.05	0.25	0.4	mA

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-6148-030

Features

- Wavelength : 638nm(Typ.)
- Threshold current : I_{th} = 60mA(Typ.)
- Output power : 40mW at 50°C(CW)
- Low aspect ratio ≈ 2

Applications

- Laser Display
- Fiber module
- Industry machiney

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit	
Light Output	CW	P _o (CW)	40	mW
Reverse Voltage	Laser	V _R	2	V
	PD		30	
Operating Temperature	T _{opr}	-10 to +50	°C	
Storage Temperature	T _{stg}	-40 to +85	°C	

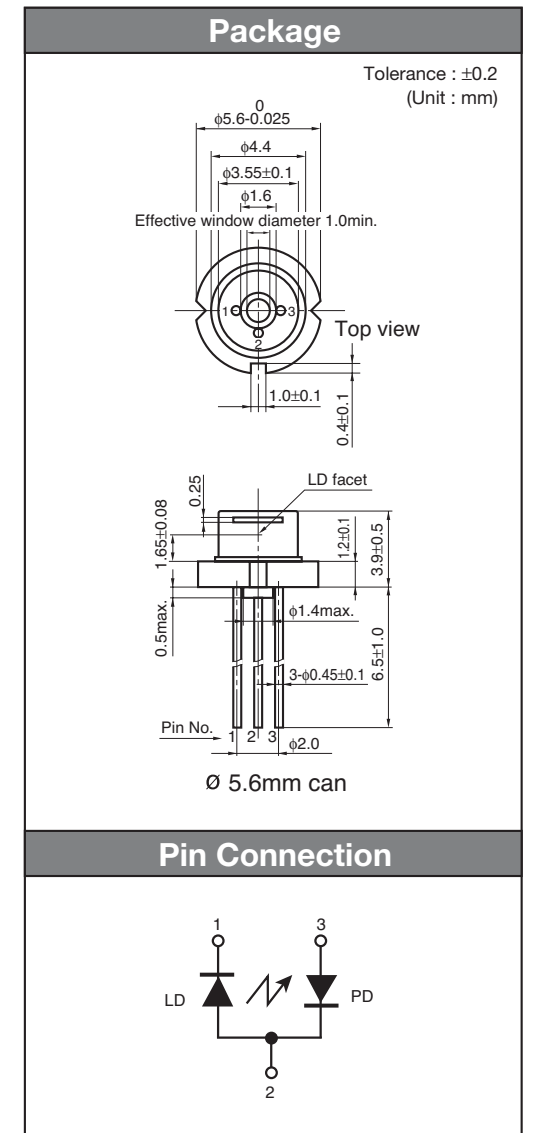
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Threshold Current	I _{th}	CW	-	60	85	mA
Operating Current	I _{op}	P _o =40mW	-	100	130	mA
Operating Voltage	V _{op}	P _o =40mW	-	2.4	2.7	V
Lasing Wavelength	L _p	P _o =40mW	635	638	645	nm
Beam *3 Divergence	Perpendicular	Q _v	12	16	22	°
	Parallel	Q _h	6.5	8.5	12	°
Off Axis Angle	Perpendicular	dQ _v	-3	-	3	°
	Parallel	dQ _h	-3	-	3	°
Differential Efficiency	SE	P _o =40mW	0.8	1.0	1.2	mW/mA
Monitoring Output Current	I _m	P _o =40mW	0.3	0.6	0.9	mA

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-3147-060

Features

- Wavelength : 650nm(Typ.)
- Low threshold current : I_{th} = 20mA(Typ.)
- High operating temperature : 5mW at 70°C(CW)
- TE mode

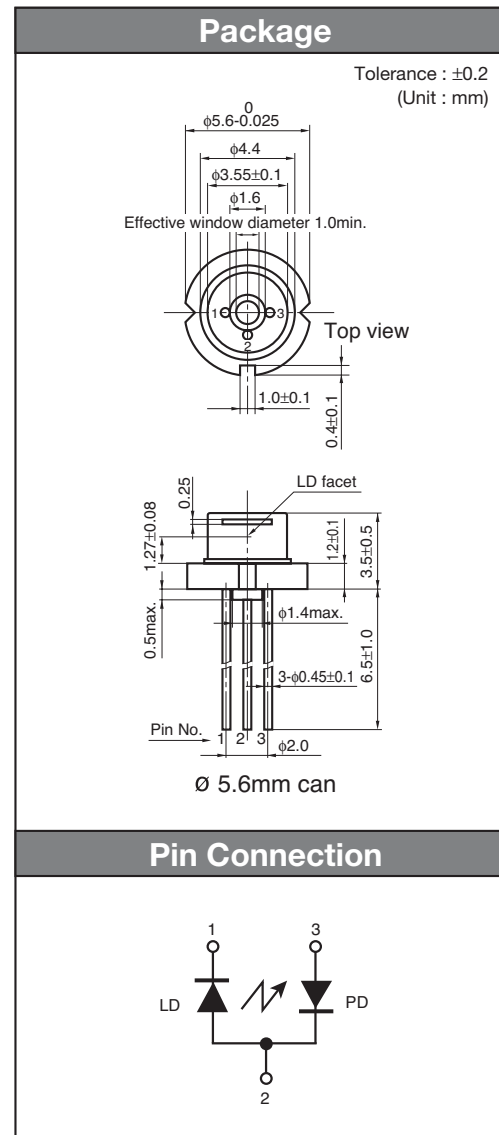
Applications

- Bar-code scanner
- Laser module
- Industrial instrument

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o	7	mW
Reverse Voltage Laser	V _R	2	V
		30	
Operating Temperature	Topr	-10 to +70	°C
Storage Temperature	Tstg	-40 to +85	°C



Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	–	20	35	mA	
Operating Current	I _{op}	P _o =5mW	–	30	45	mA	
Operating Voltage	V _{op}	P _o =5mW	–	2.3	2.6	V	
Lasing Wavelength	L _p	P _o =5mW	645	650	660	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =5mW	25	30	35	°
	Parallel	Q _h	P _o =5mW	7	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =5mW	–3	–	3	°
	Parallel	dQ _h	P _o =5mW	–2	–	2	°
Differential Efficiency	SE	P _o =5mW	0.3	0.5	0.8	mW/mA	
Monitoring Output Current	I _m	P _o =5mW	0.08	0.2	0.4	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.
*3 : Full angle at half maximum.

DL-4147-062

Features

- Wavelength : 650nm(Typ.)
- Low threshold current : I_{th} = 30mA(Typ.)
- High operating temperature : 10mW at 70°C(CW)
- TE mode

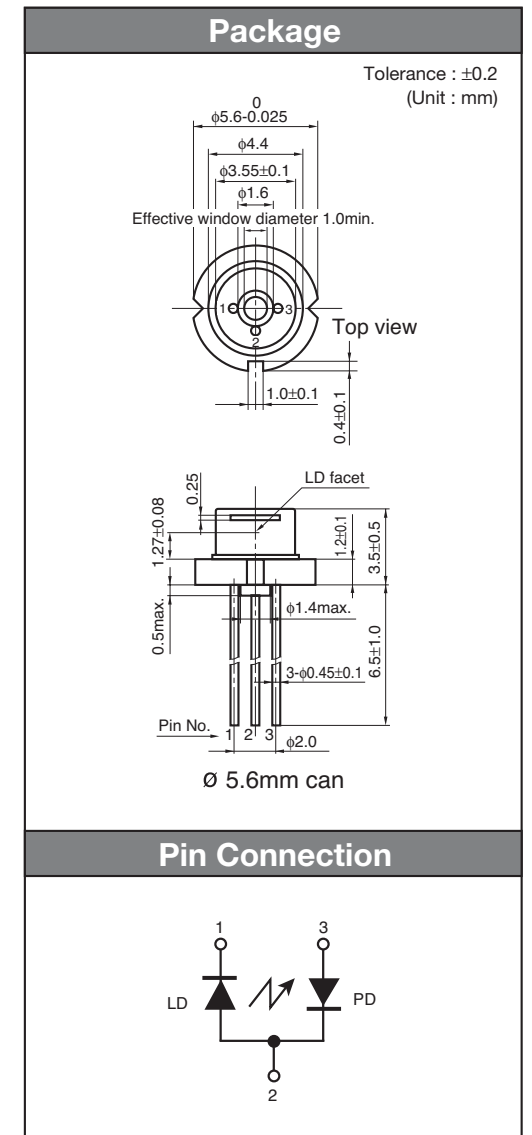
Applications

- Bar-code scanner
- Laser module

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o	12	mW
Reverse Voltage Laser	V _R	2	V
		30	
Operating Temperature	Topr	-10 to +70	°C
Storage Temperature	Tstg	-40 to +85	°C



Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	–	30	50	mA	
Operating Current	I _{op}	P _o =10mW	–	50	70	mA	
Operating Voltage	V _{op}	P _o =10mW	–	2.3	2.6	V	
Lasing Wavelength	L _p	P _o =10mW	–	650	660	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =10mW	23	30	35	°
	Parallel	Q _h	P _o =10mW	7	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =10mW	–3	–	3	°
	Parallel	dQ _h	P _o =10mW	–2	–	2	°
Differential Efficiency	SE	P _o =10mW	0.2	0.5	0.8	mW/mA	
Monitoring Output Current	I _m	P _o =10mW	0.1	0.3	0.5	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.
*3 : Full angle at half maximum.

DL-6147-040

Features

- Short wavelength : 658nm(Typ.)
- Low threshold current : I_{th} = 30mA(Typ.)
- High output power : 40mW at 60°C(CW)

Applications

- Industrial equipment
- Laser beam printer

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o	45	mW
Reverse Voltage Laser	V _R	2	V
		30	
Operating Temperature	T _{opr}	-10 to +60	°C
Storage Temperature	T _{stg}	-40 to +85	°C

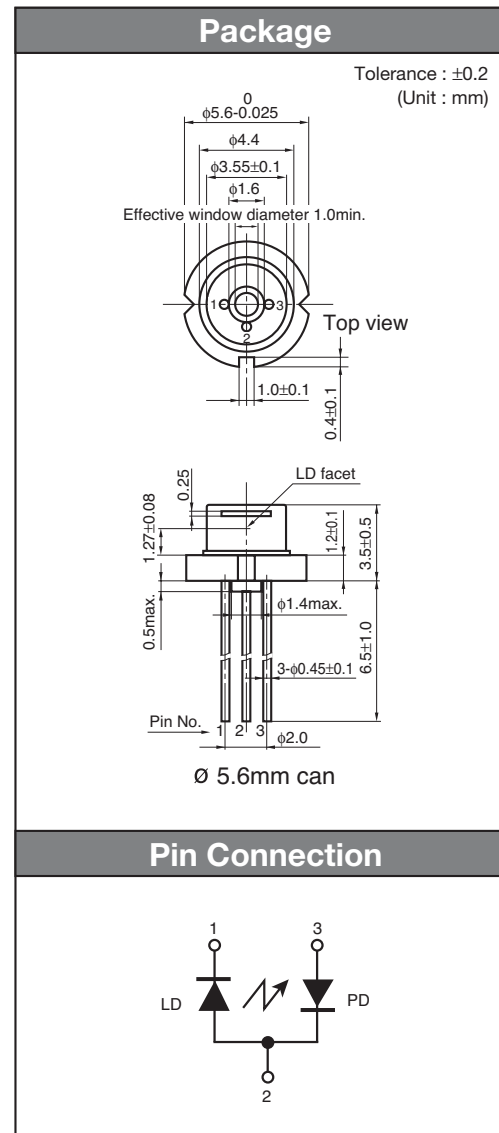
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	30	50	mA	
Operating Current	I _{op}	P _o =40mW	—	65	85	mA	
Operating Voltage	V _{op}	P _o =40mW	—	2.4	2.8	V	
Lasing Wavelength	L _p	P _o =40mW	650	658	665	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =40mW	12	16	20	°
	Parallel	Q _h	P _o =40mW	7	10	13	°
Off Axis Angle	Perpendicular	dQ _v	P _o =40mW	-3	—	3	°
	Parallel	dQ _h	P _o =40mW	-3	—	3	°
Differential Efficiency	SE	P _o =40mW	—	1.1	—	mW/mA	
Monitoring Output Current	I _m	P _o =40mW	0.2	0.4	0.6	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-7147-261

Features

- Wavelength : 658nm(Typ.)
- Threshold current : I_{th} = 50mA(Typ.)
- High output power : 80mW at 60°C(CW)
- TE mode

Applications

- Industrial equipment

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output CW	P _o (CW)	80	mW
Reverse Voltage Laser	V _R	2	V
Operating Temperature	T _{opr}	-10 to +60	°C
Storage Temperature	T _{stg}	-40 to +85	°C

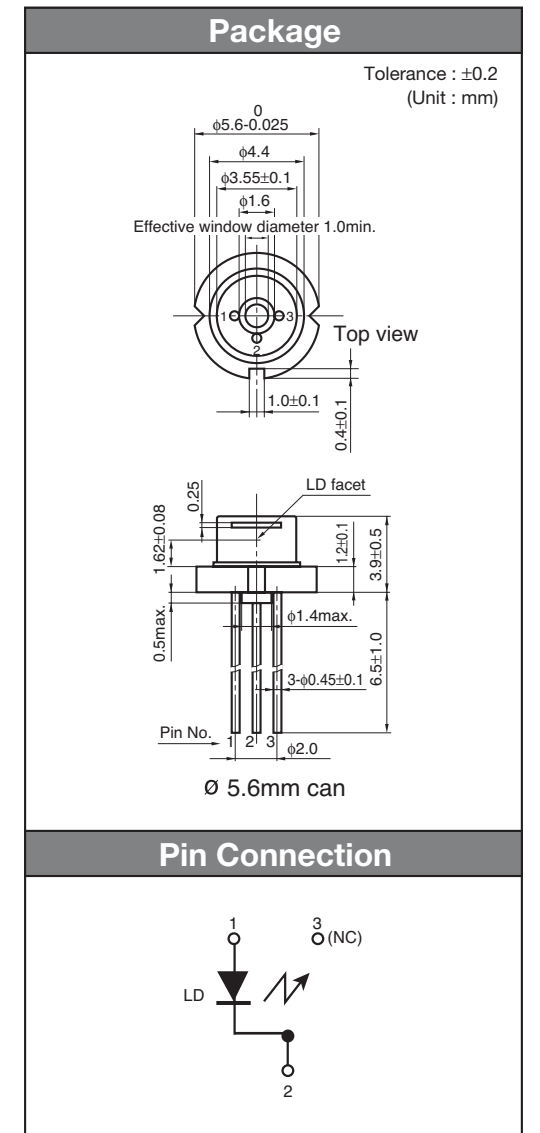
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	50	80	mA	
Operating Current	I _{op}	P _o =80mW	—	130	160	mA	
Operating Voltage	V _{op}	P _o =80mW	—	2.6	3.0	V	
Lasing Wavelength	L _p	P _o =80mW	652	658	664	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =80mW	15	17	20	°
	Parallel	Q _h	P _o =80mW	7	9.5	12	°
Off Axis Angle	Perpendicular	dQ _v	P _o =80mW	-3	—	3	°
	Parallel	dQ _h	P _o =80mW	-3	—	3	°
Differential Efficiency	SE	P _o =80mW	—	1.0	—	mW/mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-3149-057

Features

- Short wavelength : 670nm(Typ.)
- Low threshold current : Ith = 25mA(Typ.)
- High operating temperature : 5mW at 60°C(CW)

Applications

- Sensor system

Absolute Maximum Ratings

(Tc=25°C)

Parameter	Symbol	Ratings	Unit
Light Output	CW Po	7	mW
Reverse Voltage	Laser VR	2	V
	PD	30	
Operating Temperature	Topr	-10 to +60	°C
Storage Temperature	Tstg	-40 to +85	°C

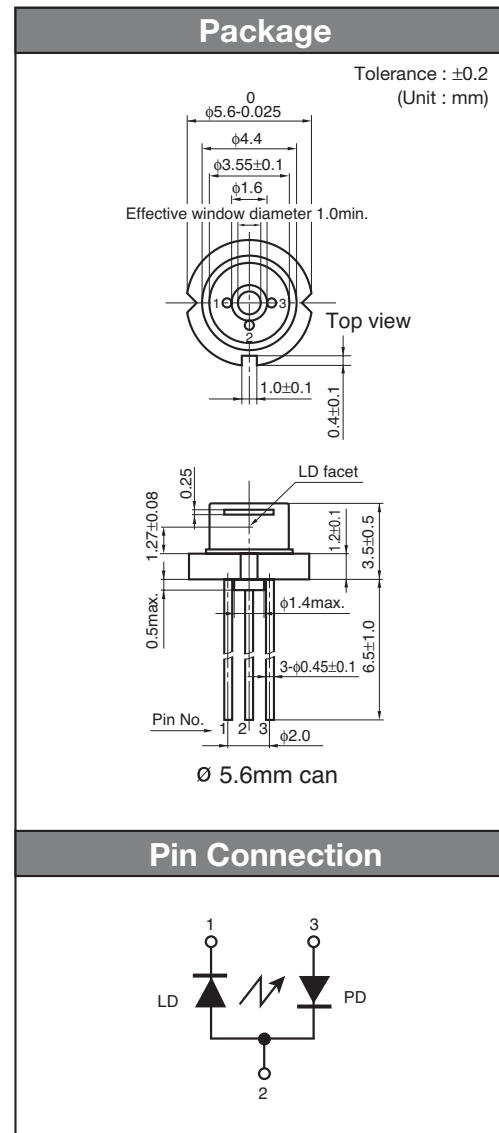
Electrical and Optical Characteristics *1 *2

(Tc=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	Ith	CW	-	25	35	mA	
Operating Current	Iop	Po=5mW	-	40	45	mA	
Operating Voltage	Vop	Po=5mW	-	2.3	2.6	V	
Lasing Wavelength	Lp	Po=5mW	660	670	678	nm	
Beam *3 Divergence	Perpendicular	Qv	Po=5mW	25	30	35	°
	Parallel	Qh	Po=5mW	6.5	8	10	°
Off Axis Angle	Perpendicular	dQv	Po=5mW	-3	-	3	°
	Parallel	dQh	Po=5mW	-3	-	3	°
Differential Efficiency	SE	Po=5mW	0.2	0.4	0.6	mW/mA	
Monitoring Output Current	Im	Po=5mW	0.5	1.5	2	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-3144-008S

Features

- Wavelength : 785nm(Typ.)
- Threshold current : Ith = 25mA(Typ.)
- Output power : 5mW at 60°C(CW)

Applications

- Laser beam printer

Absolute Maximum Ratings

(Tc=25°C)

Parameter	Symbol	Ratings	Unit
Light Output	Po(CW)	8	mW
Reverse Voltage	Laser VR	2	V
	PIN	30	
Operating Temperature	Topr	-10 to +60	°C
Storage Temperature	Tstg	-40 to +85	°C

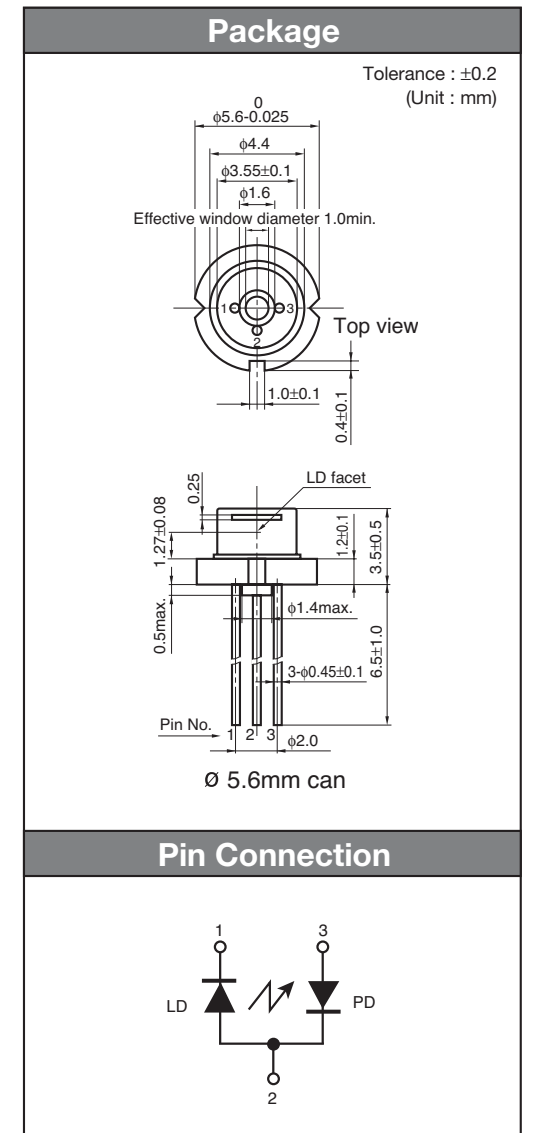
Electrical and Optical Characteristics *1 *2

(Tc=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	Ith	CW	15	25	40	mA	
Operating Current	Iop	Po=5mW	-	40	55	mA	
Lasing Wavelength	Lp	Po=5mW	770	785	800	nm	
Beam *3 Divergence	Perpendicular	Qv	Po=5mW	20	26	30	°
	Parallel	Qh	Po=5mW	7	8.5	11	°
Off Axis Angle	Perpendicular	dQv	Po=5mW	-3	-	+3	°
	Parallel	dQh	Po=5mW	-2	-	+2	°
Differential Efficiency	SE	Po=5mW	0.2	0.35	0.55	mW/mA	
Monitoring Output Current	Im	Po=5mW	1.0	2.0	3.5	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-7140-201S

Features

- Wavelength : 785nm(Typ.)
- Threshold current : I_{th} = 30mA(Typ.)
- High operating temperature : 70mW at 60°C(CW)

Applications

- Sensor system
- Industrial use

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output	CW	P _o (CW)	80
	Pulse *1	P _o (pulse)	85
Reverse Voltage	Laser	V _R	2
	PD		30
Operating Temperature	T _{opr}	-10 to +60	°C
Storage Temperature	T _{stg}	-40 to +85	°C

*1 : Pulse width ≤1.0μs, Duty ≤50%, Peak power

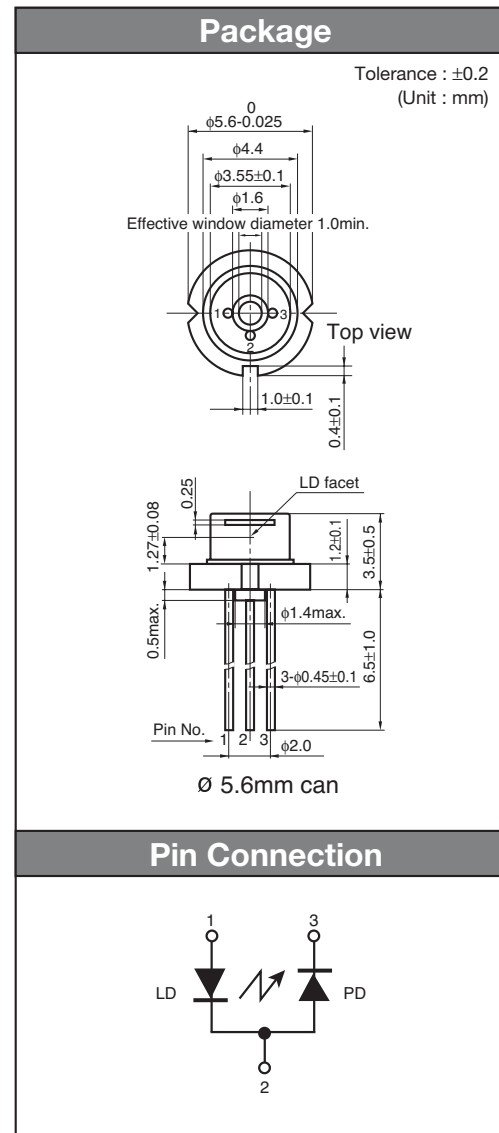
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	30	50	mA	
Operating Current	I _{op}	P _o =70mW	—	100	140	mA	
Operating Voltage	V _{op}	P _o =70mW	—	2.0	2.8	V	
Lasing Wavelength	L _p	P _o =70mW	775	785	800	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =70mW	14	17	20	°
	Parallel	Q _h	P _o =70mW	6	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =70mW	-3	—	+3	°
	Parallel	dQ _h	P _o =70mW	-3	—	+3	°
Differential Efficiency	SE	P _o =70mW	0.6	1.0	1.4	mW/mA	
Monitoring Output Current	I _m	P _o =70mW	0.1	0.25	0.6	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-8141-035

Features

- Lasing wavelength : 808nm(Typ.)
- Low threshold current : I_{th} = 50mA(Typ.)
- High output power : 150mW at 50°C(CW)
- Single longitudinal mode
- Fundamental transverse mode

Applications

- Solid state laser pumping

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit
Light Output	CW	P _o	160
Reverse Voltage	Laser	V _R	2
			PD
Operating Temperature	T _{opr}	-10 to +50	°C
Storage Temperature	T _{stg}	-40 to +85	°C

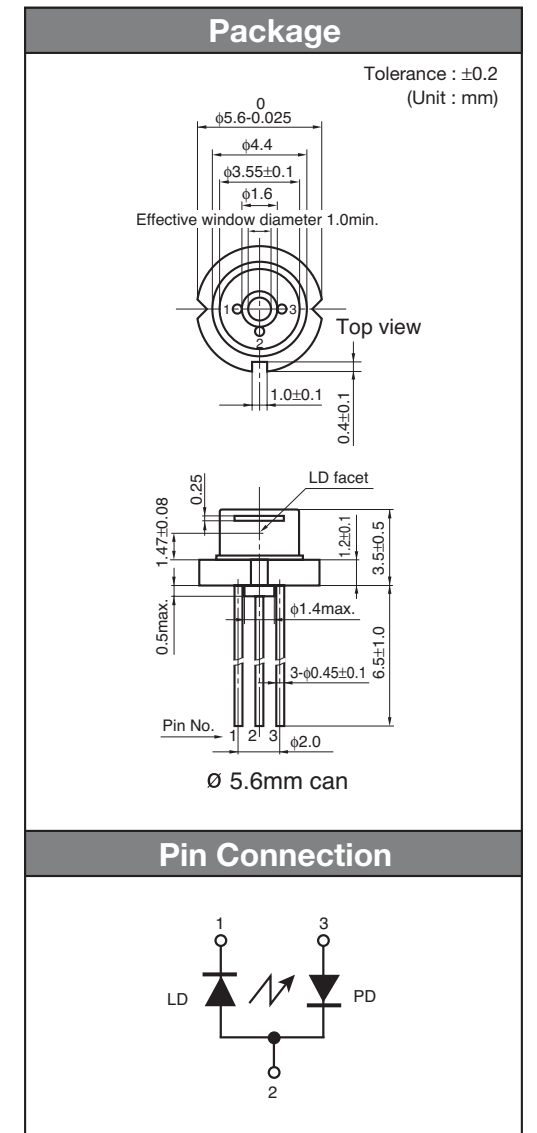
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	50	70	mA	
Operating Current	I _{op}	P _o =150mW	—	185	240	mA	
Operating Voltage	V _{op}	P _o =150mW	—	2.0	2.4	V	
Lasing Wavelength	L _p	P _o =150mW	798	808	818	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =150mW	12	16	20	°
	Parallel	Q _h	P _o =150mW	6	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =150mW	-3	—	3	°
	Parallel	dQ _h	P _o =150mW	-3	—	3	°
Differential Efficiency	SE	P _o =150mW	0.8	1.1	—	mW/mA	
Monitoring Output Current	I _m	P _o =150mW	0.1	0.5	1.0	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-8141-002

Features

- Lasing wavelength : 808nm(Typ.)
- Low threshold current : I_{th} = 50mA(Typ.)
- High output power : 200mW at 50°C(CW)
- Single longitudinal mode
- Fundamental transverse mode

Applications

- Solid state laser pumping

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit	
Light Output	CW	P _o	210	mW
Reverse Voltage	Laser	V _R	2	V
	PD		30	
Operating Temperature	T _{opr}	-10 to +50	°C	
Storage Temperature	T _{stg}	-40 to +85	°C	

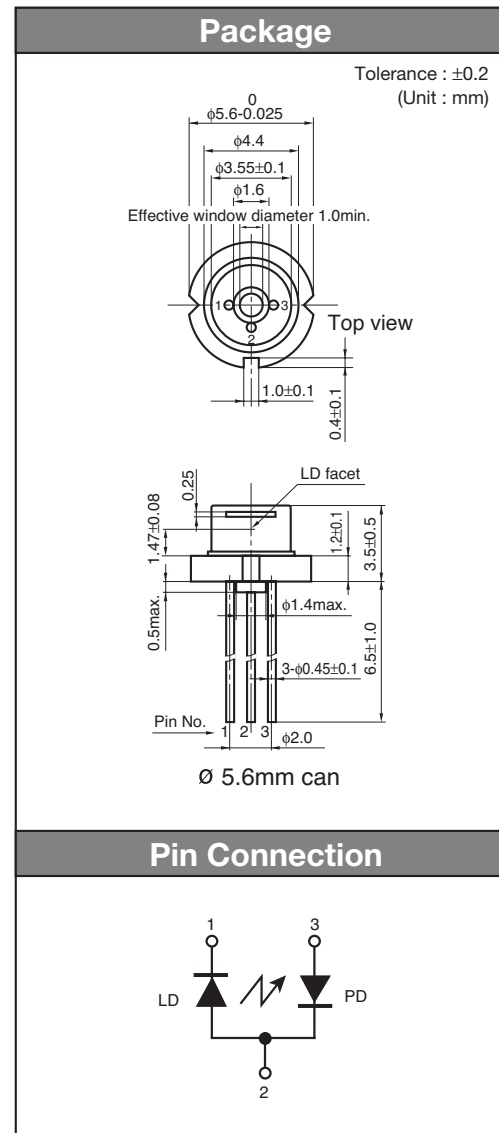
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	50	70	mA	
Operating Current	I _{op}	P _o =200mW	—	230	260	mA	
Operating Voltage	V _{op}	P _o =200mW	—	2.0	2.4	V	
Lasing Wavelength	L _p	P _o =200mW	798	808	818	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =200mW	12	16	20	°
	Parallel	Q _h	P _o =200mW	6	8	10	°
Off Axis Angle	Perpendicular	dQ _v	P _o =200mW	-3	—	3	°
	Parallel	dQ _h	P _o =200mW	-3	—	3	°
Differential Efficiency	SE	P _o =200mW	0.8	1.2	—	mW/mA	
Monitoring Output Current	I _m	P _o =200mW	0.15	0.5	0.9	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DL-8142-201

Features

- Lasing wavelength : 830nm(Typ.)
- Threshold current : I_{th} = 50mA(Typ.)
- High output power : 150mW at 50°C(CW)

Applications

- Printing instrument
- Measuring instrument

Absolute Maximum Ratings

(T_c=25°C)

Parameter	Symbol	Ratings	Unit	
Light Output	CW	P _o	180	mW
Reverse Voltage	Laser	V _R	2	V
	PD		30	
Operating Temperature	T _{opr}	-10 to +50	°C	
Storage Temperature	T _{stg}	-40 to +85	°C	

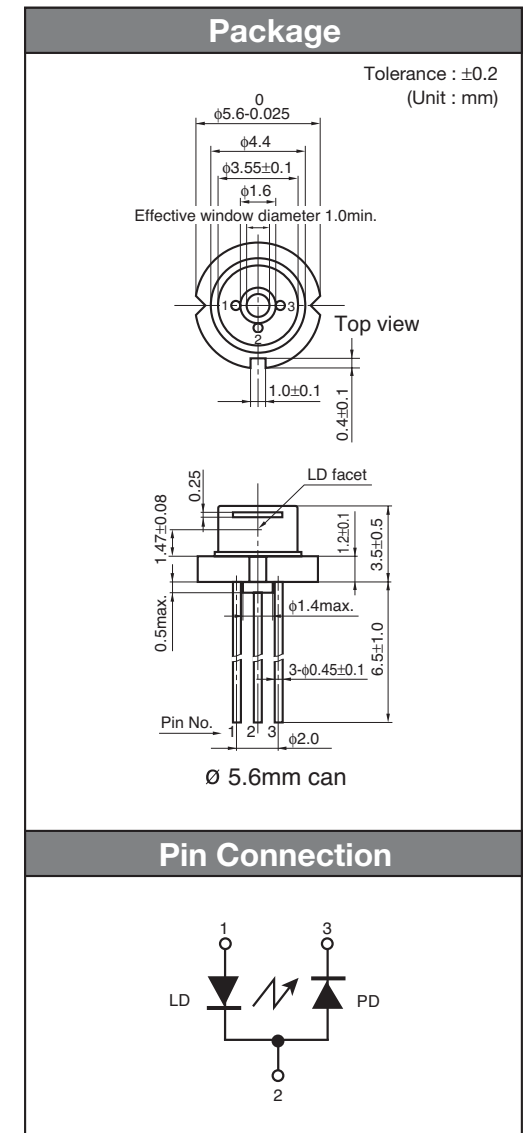
Electrical and Optical Characteristics *1 *2

(T_c=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Threshold Current	I _{th}	CW	—	50	70	mA	
Operating Current	I _{op}	P _o =150mW	—	200	250	mA	
Operating Voltage	V _{op}	P _o =150mW	—	1.9	2.3	V	
Lasing Wavelength	L _p	P _o =150mW	815	830	840	nm	
Beam *3 Divergence	Perpendicular	Q _v	P _o =150mW	12	16	25	°
	Parallel	Q _h	P _o =150mW	5	8	11	°
Off Axis Angle	Perpendicular	dQ _v	P _o =150mW	-3	—	3	°
	Parallel	dQ _h	P _o =150mW	-3	—	3	°
Differential Efficiency	SE	P _o =150mW	0.7	1.0	—	mW/mA	
Monitoring Output Current	I _m	P _o =150mW	0.15	0.4	1.0	mA	

*1 : Initial values. *2 : All the above values are evaluated with Tottori SANYO's measuring apparatus.

*3 : Full angle at half maximum.



DLX-9356-13

Tentative

Features

- Structure : Diode pumped solid-state green lasers(with thermo electric control)
- Lasing wavelength : 532nm
- Output power : 5mW
- Operating temperature : -10 to +50°C

Applications

- Leveler
- Laser marker

Absolute Maximum Ratings

(Tc=25°C)

Parameter	Symbol	Ratings	Unit
Supply Voltage	VCC	+3.5	V
Reverse Voltage (Supply)	VRCC	-0.2	V
Input Signal Voltage	VIN	+3.5	V
Reverse Voltage (Signal)	VRIN	-0.2	V
Operating Temperature *1	Topr	-10 to +50	°C
Storage Temperature *1	Tstg	-15 to +70	°C

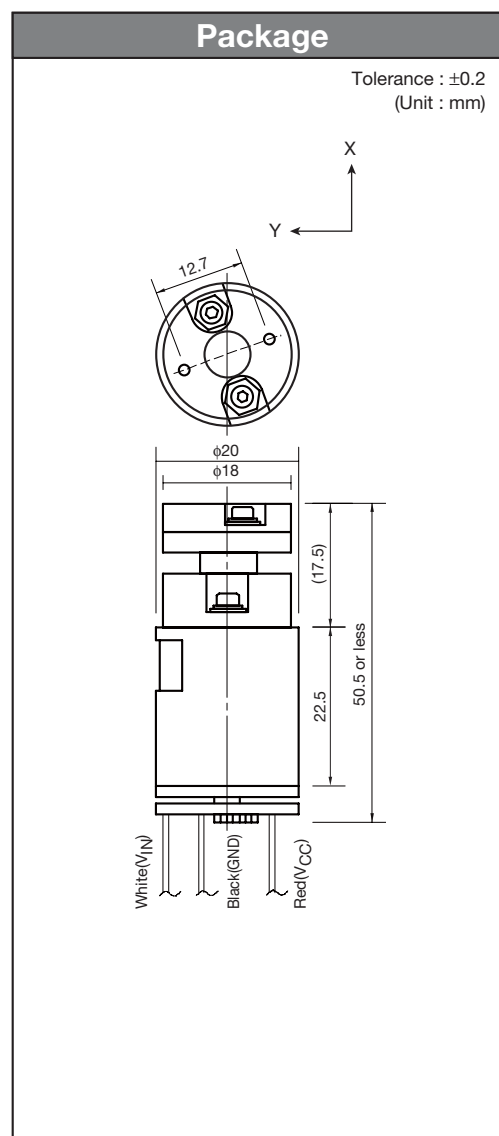
*1 : Case temperature. No do be dewy.

Electrical and Optical Characteristics *1 *2

(Tc=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Wavelength	λ_P		531	532	533	nm
Output Power	PO		—	5	—	mW
Power Stability *3	ΔPO	Topr=-10 to +50°C	-10	—	+10	%
M ²	M ²				1.2	
Beam Diameter *5	2wr	$\Delta l=5m$ *4	2.1	2.4	2.7	mm
Beam Divergence *5	2 θ_r			0.3	0.4	mrad
Beam Ellipticity	Er	$\Delta l=5m$ *4			1.2	

*1 : Initial values. *2 : Each value is measured by using our measuring instrument. *3 : 8 Hour/ @0 to 50Hz

*4 : Δl :The distance from laser beam window. *5 : X axial direction

DLX-9456-02

Tentative

Features

- Structure : Diode pumped solid-state green lasers(with thermo electric control)
- Lasing wavelength : 532nm
- Output power : 10mW
- Operating temperature : -10 to +50°C

Applications

- Leveler
- Laser marker

Absolute Maximum Ratings

(Tc=25°C)

Parameter	Symbol	Ratings	Unit
Supply Voltage	VCC	+3.5	V
Reverse Voltage (Supply)	VRCC	-0.2	V
Input Signal Voltage	VIN	+3.5	V
Reverse Voltage (Signal)	VRIN	-0.2	V
Operating Temperature *1	Topr	-10 to +50	°C
Storage Temperature *1	Tstg	-15 to +70	°C

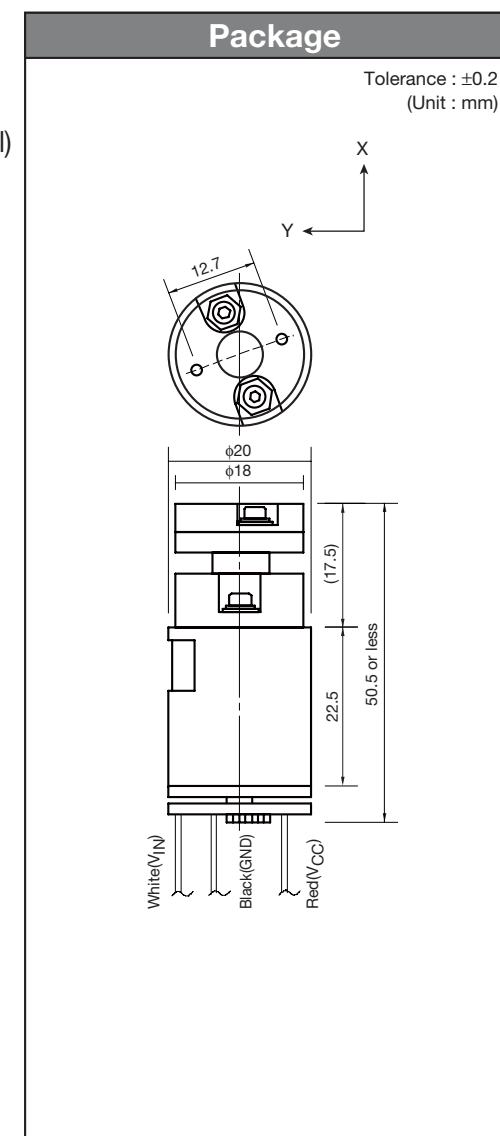
*1 : Case temperature. No do be dewy.

Electrical and Optical Characteristics *1 *2

(Tc=25°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Wavelength	λ_P		531	532	533	nm
Output Power	PO		—	10	—	mW
Power Stability *3	ΔPO	Topr=-10 to +50°C	-10	—	+10	%
M ²	M ²				1.2	
Beam Diameter *5	2wr	$\Delta l=5m$ *4	2.0	—	3.0	mm
Beam Divergence *5	2 θ_r			0.3	0.4	mrad
Beam Ellipticity	Er	$\Delta l=5m$ *4			1.2	

*1 : Initial values. *2 : Each value is measured by using our measuring instrument. *3 : 8 Hour/ @0 to 50Hz

*4 : Δl :The distance from laser beam window. *5 : X axial direction

Quality Assurance

1. Quality assurance (as per JIS Z 8101)

1-1 Initial-quality assurance standard

Inspection shall be conducted for each delivery lot.

The inspection shall be made according to the ANSI/ASQC Z1. 4, normal inspection, single sampling.

Item	AQL (%)
Electrical/optical characteristics	0.25
Outer dimension	0.65
Appearance (Scratch, foreign matter)*	2.5

* The imperfections in appearance that will undoubtedly affect the electrical or optical properties or the external dimensions and are likely to cause incompliance with the criteria depending on a measuring method shall be rejected as substandard. Boundary samples shall be prepared as necessary.



- 1) This product is not intended for use in applications where extremely high reliability is required, or human life is directly involved, e.g. life-support systems. If you intend to use the product in such application, please contact your SANYO sales representatives in advance.
- 2) We are not liable to any undersirable result caused by a misuse or inappropriate use.
- 3) When change in application, cautionary instruction or assurance standard is necessary, please let us know in advance through our sales office to allow us to amend the specifications.

1-2 Acceptance

- (1) The results of acceptance test shall be notified in writing to us within 10 days after the delivery of the pertinent lot as to the initial quality assurance mentioned in item 1-1.
- (2) The delivery of this product is deemed to have been accomplished upon receipt of notification that the acceptance test in item (1) was complete and then the lot was accepted or that all or part of the products have been put into your manufacturing process, or in case of failure of such notification within a stipulated period.
- (3) Upon the accomplishment of previous item (2), we shall not be liable for any occurrence at your end such as shortage of quantity and defectives which may be found thereafter.

1-3 Scope of assurance

Products that have been delivered within the effective time of the specifications will be assured in quality. However, any problem involving safety will be excluded.

1-4 Handling

The samples that have been actually subjected to your lot acceptance inspection and judged as defective shall be returned to us together with the inspect results with the reason of the rejection stated.

If the returned samples have been confirmed to be defective, we will accept the rejected lot and deliver a replacement or reselected products.

In the case of doubt, the matter shall be subjected to discussion.

2. Recommended Storage Environment

Products, except their packing materials, are recommended to be stored in the following environment to maintain their quality.

- (1) Temperature: +15°C to +35°C (as per IEC 60068-1 and JIS 60068-1)
- (2) Humidity: 25 to 75% RH (as per IEC 60068-1 and JIS 60068-1)
- (3) There shall be no condensing or freezing.

- (4) Shall be protected from corrosive gases, such as hydrogen sulfide or salty wind.
- (5) Shall be protected from direct sun.
- (6) Shall be protected from the force that can result in deforming or deterioration.

3. Recommended Operating Conditions

Products are recommended to be operated in the following conditions and environment.

- (1) Continuous light output: 70% of rated power
- (2) Temperature: +15°C to +35°C (as per IEC 60068-1 and JIS 60068-1)
- (3) Humidity: 25 to 75% RH (as per IEC 60068-1 and JIS 60068-1)
- (4) There shall be no condensing or freezing.
- (5) Shall be protected from corrosive gases, such as hydrogen sulfide or salty wind.
- (6) Shall be protected from direct sun.
- (7) Shall be protected from the stress that can result in deforming or deterioration.
- (8) Shall be fitted in an applied product or have its leads soldered in such a way as no stress or residual stress may be exerted on the chip.

4. Safety Design

We constantly make every effort to improve the quality and reliability. However, it is unavoidable, as far as optodevice products are concerned, to prevent an error or defect from arising at a certain probability. Sufficient care will be required so that defect of our product may not result in bodily accidents, fire or social damage. Such cares will include redundant design, fire retardant design, misuse prevention design, etc. (EC Machinery Directive. MIL Standard: MIL-STD-882)

5. Effective Period

These specifications shall be effective for a period of 1(one) year from the date of issue. However, it shall be extended on the same terms and conditions for a period of 1(one) year unless either party hereto gives a written notice of termination to the other party hereto at least 2(two) months before the expiration date. The same shall follow thereafter.

6. Amendment

The content of these specifications may be amended or deleted upon mutual agreement. However, we Tottori SANYO may amend the items except the following without notice:

- absolute maximum rating
- electrical and optical characteristics
- external dimensions, and
- quality assured items

7. Other

Both parties here to shall discuss in good faith the matters not specified in these specifications or, in case of doubt, the matters concerning the content of these specifications.

PRECAUTIONS

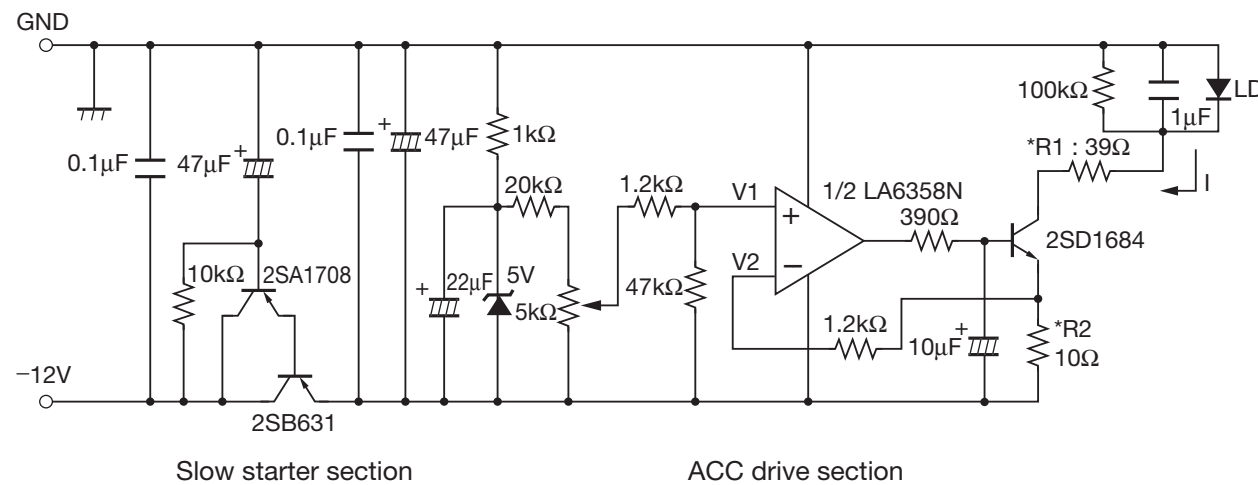
Some of the products listed in this catalog may contain gallium arsenic substance which is designated toxic by law. Special precautions should be taken in handling this type of product. Importantly, when such a toxic substance is disposed of, its method shall be subject to applicable law and regulations enacted therefor.

Laser Drive System

Drive circuits for laser diodes are either automatic current control (ACC) circuit that maintain a constant current, or automatic power control (APC) circuits that maintain a constant light output power.

ACC circuit is only used in specialized situations such as for measuring the characteristics of laser diodes. Even with constant current drive, light output power of laser diodes varies tremendously with ambient temperature, so APC circuits are more commonly used, since they provide a constant light output power despite variations in ambient temperature.

1. ACC Circuit



ACC circuit is comprised of a slow starter section and an ACC drive section. Current I to a laser diode (LD) flows to resistor $R2$ through a transistor to generate an electric potential $V2 = I \times R2$. An op amp compares electric potential $V2$ with reference electric potential $V1$ to drive the transistor so that $V1 = V2$ is constantly maintained. As the result, current $I = V2/R2 = V1/R2 = \text{constant}$. Current is set with a $5k\Omega$ volume switch.

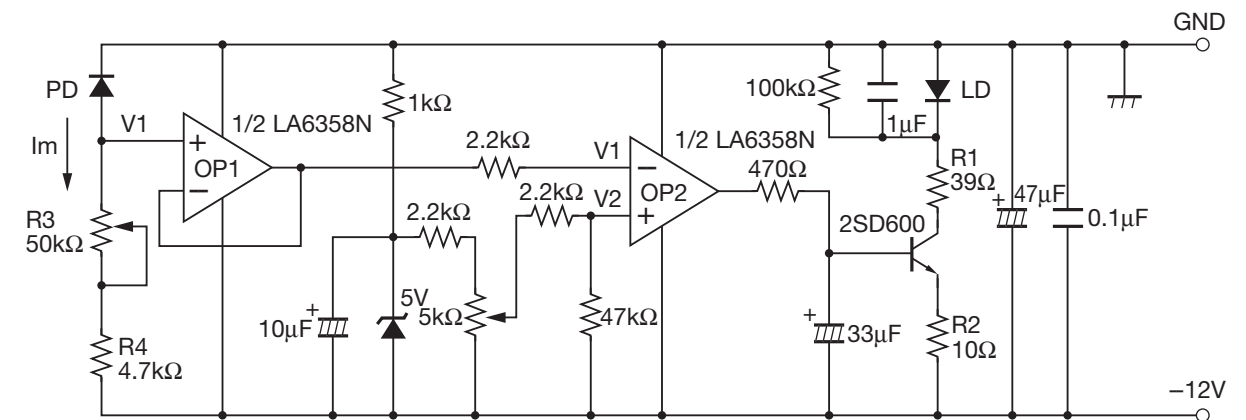
Resistance $R1$ and $R2$ vary with operating current, so be sure to use the values in the following table.

*Table1 : Settings for resistance $R1$ and $R2$

Operating current range	0-100mA	0-200mA
$R1$	39Ω	18Ω
$R2$	10Ω	5Ω

2. APC Circuit

a. APC Circuit1



This APC drive circuit is used for type I pin connecting diagram.

When a laser diode (LD) emits light, light current (I_m) proportionated to light output power flows to a monitoring photodiode (PD) and a voltage $V1 = I_m (R3+R4)$ generates. This voltage is sent by the op amp OP1 through a buffer to the op amp OP2.

Reference voltage $V2$ obtained from constant-voltage diode and volume switch is also sent to the op amp OP2. The op amp OP2 compares two voltages and then varies base current of output transistor while controlling the current flowing to laser diode so that $V1 = V2$ is constantly maintained. This is how constant light output power is obtained.

< Adjustment >

- (1) Turn volume switch $R3$ as high as it will go, and set $5k\Omega$ volume switch so that $V2 = 0$.
- (2) Mount laser diode with power turned off.
- (3) Turn power on, and turn $5k\Omega$ volume switch to the center point while measuring light output power with a light power meter. Here, light output power should be 1/2 of the setting level. If difference from the setting level is significant, then turn off power and adjust $R3$ and $R4$.
- (4) Turn volume switch $R3$ until light output power matches the setting level.

Laser Drive System

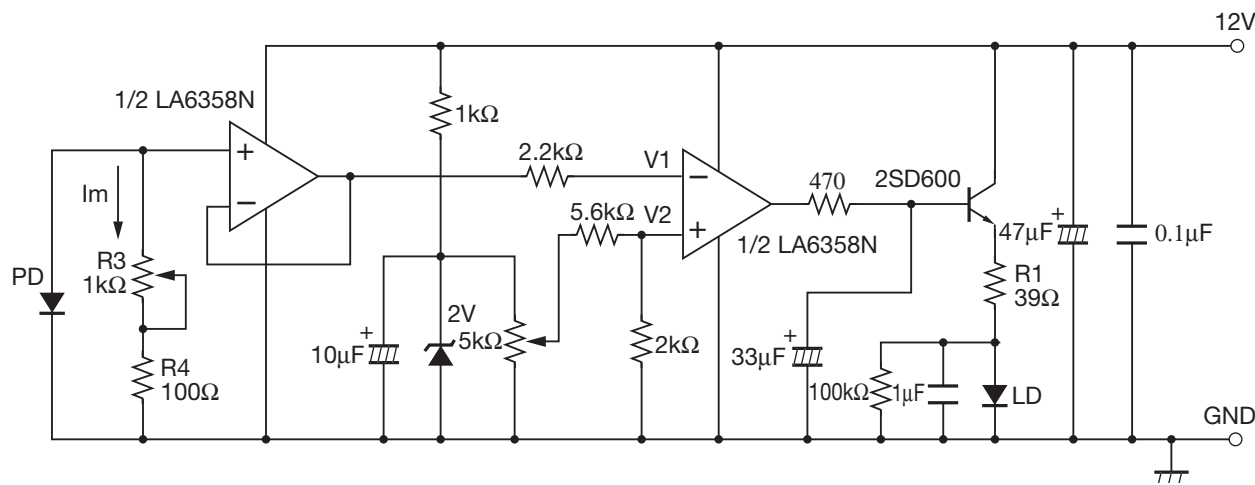
< R1-R4 setting procedure >

- (1) Set light output range based on the data for laser diode characteristics and then use the table below to determine proper operating current and monitoring output current for light output power.

Light output power	Operating current	Monitoring output current
Pmax	I _{max}	I _m max
Pmin	I _{min}	I _m min

- (2) Set power resistance R1 and R2 for I_{max} based on table 1 used with the ACC circuit.
- (3) After adjustments on the previous page, V₂ will be about 1.7 volts.
Determine resistance R4 so that I_mmax × R4 = 1.7.
(P_{max} = 4mW and P_{min} = 1mW when using 3mW.)

b. APC Circuit 2

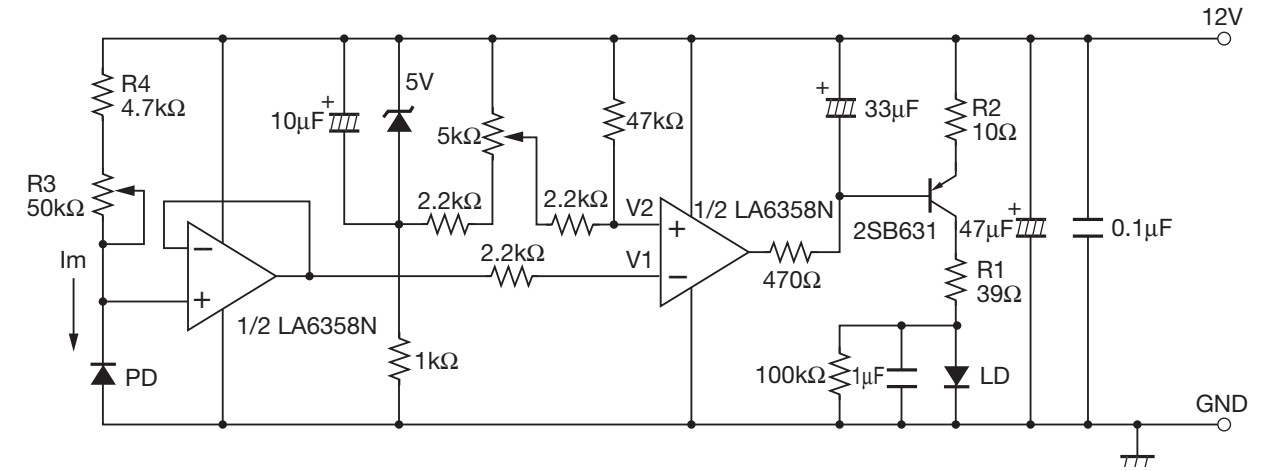


This drive circuit is used for type II pin connecting diagram. Operating principle and adjustment procedure is exactly the same as that for APC circuit 1, except that the resistance R3 and R4 settings are different.

< R1-R4 setting procedure >

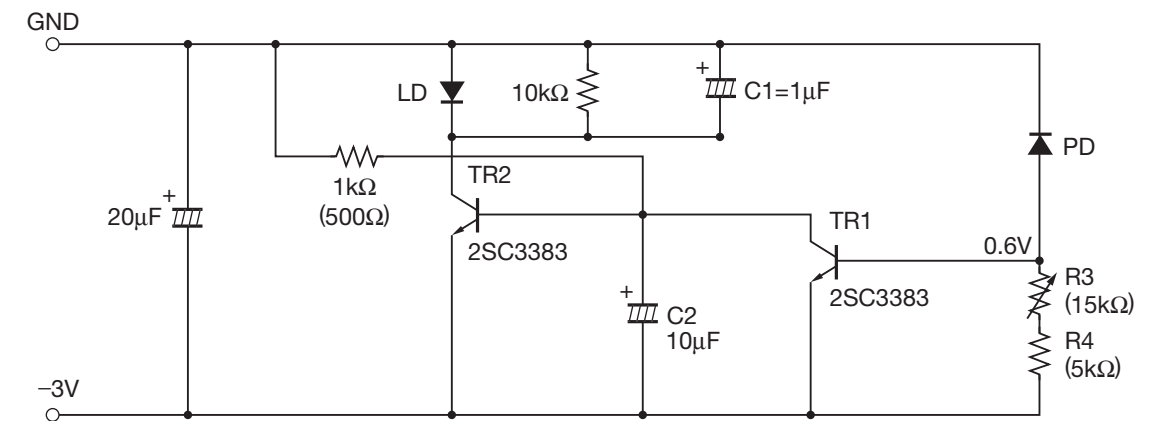
- (1) V₂ in the circuit is about 0.26 volt, so determine resistance R4 so that I_mmax × R4 = 0.26.
- (2) Determine resistance R3 so that I_mmin × (R3+R4) = 0.26.
(Be sure to set R3 so that voltage V₁ is less than 0.5 volt because reverse bias is not applied to a photodiode).

c. APC Circuit3



This drive circuit is used for type III pin connecting diagram. The circuit is a version of APC circuit 1 altered for reverse polarity characteristics and has the same operating principle, adjustment procedure and resistance settings as APC circuit 1.

d. APC Circuit4



This is an example of an APC circuit for battery-powered Type I pin connection circuits. It is ideally suited for a low-current DL-3148-023. The reference voltage here is the voltage between the base and emitter of transistor TR1, and is normally 0.6 volts.

Since the absolute maximum rated power of the DL-3148-023 is 3mW, the power adjustment range for the circuit is between 0.5 and 2mW. Resistors R3 and R4 used for adjusting power are set as outlined below.

Since I_m is 0.12mA at a maximum power of 2mW, then R4 = V_{BE}/I_m = 0.6/0.12 = 5kΩ.

Then since R3 determines minimum optical output and I_m is 0.03mA with 0.5mW of power, then R3+R4 = V_{BE}/I_m = 0.6/0.03 = 20kΩ and R3 = 15kΩ.

Safety

The output light from laser diode is visible or invisible, and harmful to a human eye. Avoid looking at the output light of laser diode directly or even indirectly through a lens while oscillating. When an optical axis is to be adjusted to a laser beam and outer optical systems, a laser beam should be observed through an infrared TV camera or other equipment. Particularly when the light is collimated or focused through a lens, safety glasses should be worn and care should be taken to absolutely protect human eyes from the directly entering beam.

CAUTION- THE USE OF OPTICAL INSTRUMENTS WITH THIS PRODUCT WILL INCREASE EYE HAZARD.

Refer to IEC 60825-1 and 21 CFR 1040. 10 - 1040. 11 as a radiation safety standard as to laser products.

Warning label	Aperture label	Identification label

RoHS Compliance

In order to supply environment-friendly ("Think GAIA") products to customers, we make all SANYO laser diodes comply with RoHS Directive and ship them now.

We attach the identification mark "RSF" to RoHS-compliant products. After delivery, please check the identification mark "RSF" at your place.

ISO

Quality assurance system

Photonics Business Division of Tottori SANYO Electric Co., LTd, takes pride in providing its customers with the highest quality LED products possible. We are especially proud of the fact that all LED products of our company have already obtained the verification of ISO 9001 in accordance with IECQ (IEC Quality Assessment for Electronic Components). It is our goal that, by making the best use of production system, we develop quality control activities which are supported by the verification of ISO, and offer the products in 100% conformance with our customers specification.

Our quality assurance activities for release of continually improving new products are carried out reflecting customers desires which are constantly fed back into our production lines.



Our mass-production is controlled by standardized processes such as massproduction trial approval, a quality control method to confirm the trial products being made identical. The guarantee shall be applied only to the products delivered by our company.

Environmental management system

Photonics Business Division of Tottori SANYO Electric Co., Ltd. has already obtained the verification of ISO 14001 in accordance with the assessment approval system of Environmental management system. The sphere of ISO 14001 are the development, design, manufacture and sales on the Optoelectronic device.



INFORMATION

EXPORT CONTROL-REGULATIONS FOR SEMICONDUCTORIZED OPTOELECTRONIC PRODUCTS

The products represented in this catalog are Strategic Products subject to the Export Control-regulations (of foreign exchanges and foreign trading). It is understood that the products (including services) should not be exported without authorization of the appropriate governmental agencies. In addition, the following precautions should carefully be taken, in violation of the special agreement restricting the sale of strategic goods to the Countries as designated.

1. When exporting semiconductorized optoelectronic products (including services), care should be taken to insure that any necessary procedures subject to the regulations mentioned above or regulations involved therein, are complied with.
2. Semiconductorized optoelectronic products should be destroyed in cases when they are not to be used, to avoid infringing on export.
3. When semiconductorized optoelectronic products are supplied or sold to a third party, the above points 1 and 2 should be circulated in writing. All business transactions with those who would infringe on the regulations are forbidden.

Any queries or further information shall be directed to our sales forces.