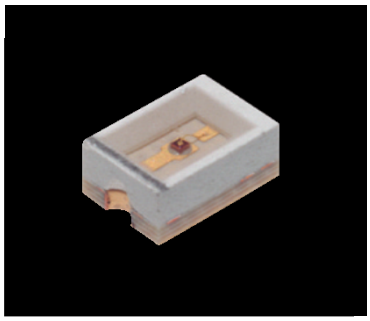
SML-012x/013x Series

Data Sheet

■ Features

- Reflector type (3.0×2.0mm, t=1.3mm)
- Reflector improved the concentration of viewing angle and luminous intensity to the front direction

■ Outline

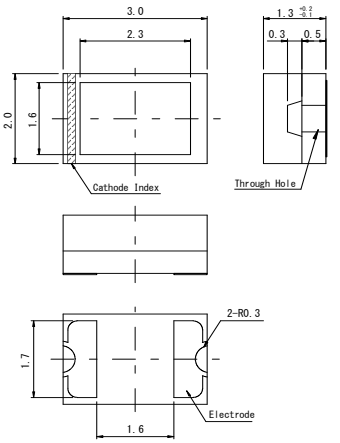


■ Size

3020 (1208)
3.0 × 2.0mm (t=1.3mm)

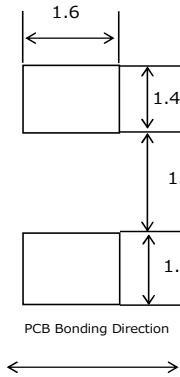
Color Type: V U D Y W M P

■ Dimensions



Tolerance : ±0.2
(unit : mm)

■ Recommended Solder Pattern



(unit : mm)

■ Moisture sensitivity level(MSL) : Level 3

■ Specifications

Part No.	Chip Structure	Emitting Color	Absolute Maximum Ratings (Ta=25ºC)						Electrical and Optical Characteristics (Ta=25ºC)										
			Power Dissipation P_D(mW)	Forward Current I_F(mA)	Peak Forward Current I_{FP}(mA)	Reverse Voltage V_R(V)	Operating Temp. T_{opr}(ºC)	Storage Temp. T_{stg}(ºC)	Forward Voltage V_F Typ.(V)	I_F(mA)	Reverse Current I_R Max.(μA)	V_R(V)	Dominant Wavelength λD Min.*2(nm)	Typ.(nm)	Max.*2(nm)	I_F(mA)	Luminous Intensity I_V Min.(mcd)	Typ.(mcd)	I_F(mA)
SML-012VT(A)	AlGaInP	Red	75	30	100*1	5	-40~+100	-40~+100	2.0	20	10	5	626	630	636	20	35.5	71	20
SML-012V8T			54	20			-40~ +85		2.2				625		635		25	63	
SML-013UT			75	30			-30~ +85		2.0				619	624	629		90	220	
SML-012U8T			54	20			-40~ +85		2.2				615	620	625		40	100	
SML-012UT			75	30			-40~+100		2.0				618	624	630		36		
SML-012DT(A)		Orange	54	20			-40~ +85		2.2				603	605	609		71	140	
SML-012D8T													602		608		63	160	
SML-012DT			75	30			-40~+100		2.0					606	610		36	100	
SML-012YT(A)		Yellow											585	587	590		56	112	
SML-012Y8T			54	20			-40~+85		2.2				587	590	593		40	100	
SML-012YT			75	30			-40~+100		2.0				586		594		36		
SML-013YT							-40~+85		2.1				587		593		100	250	
SML-012WT(A)							-40~+100		2.0								140	280	
SML-012M8T		Yellow Green	54	20			-40~+85		2.2				569	572	575		16	40	
SML-012PT(A)		Green	62	25	60*1		-40~+100		2.1				558	560	564		9	18	
SML-012P8T			54	20	100*1		-40~+85		2.2				557		563		2.5	10	

*1: Duty1/10, 1kHz *2 : Measurement tolerance:±1nm

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■ Electrical Characteristics Curves

Reference

Fig.1 Forward Current - Forward Voltages

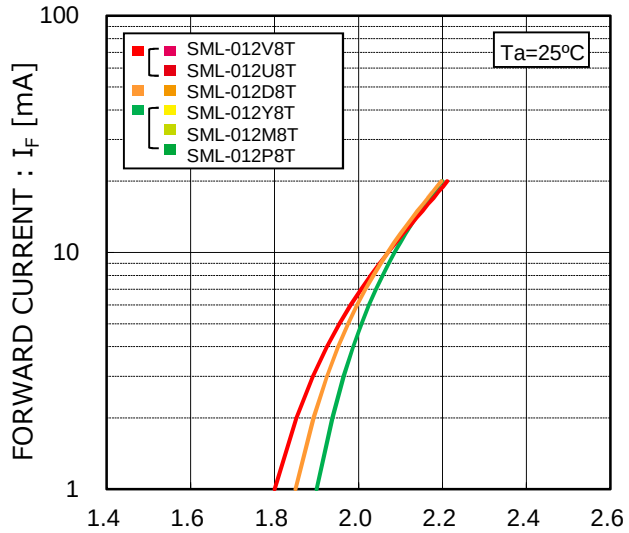


Fig.2 Luminous Intensity - Atmosphere Temperature

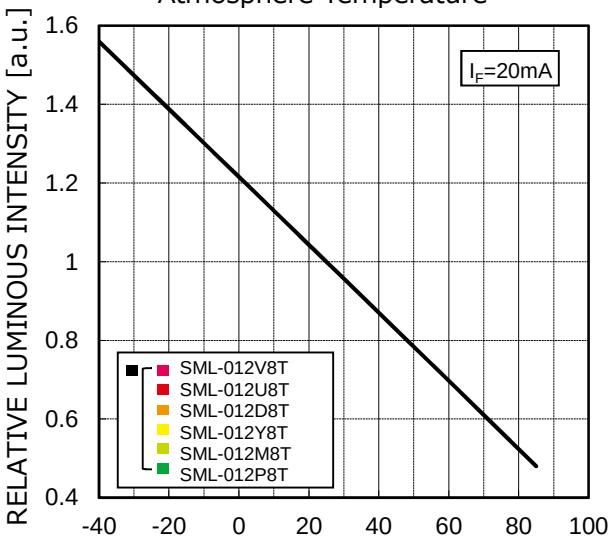


Fig.3 Luminous Intensity - Forward Current

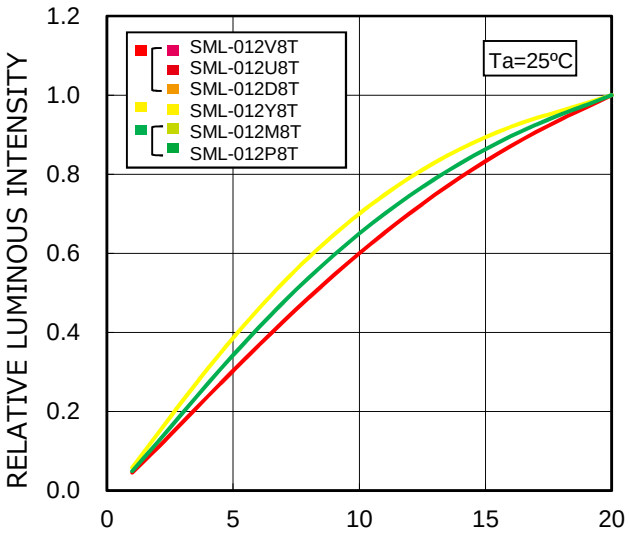
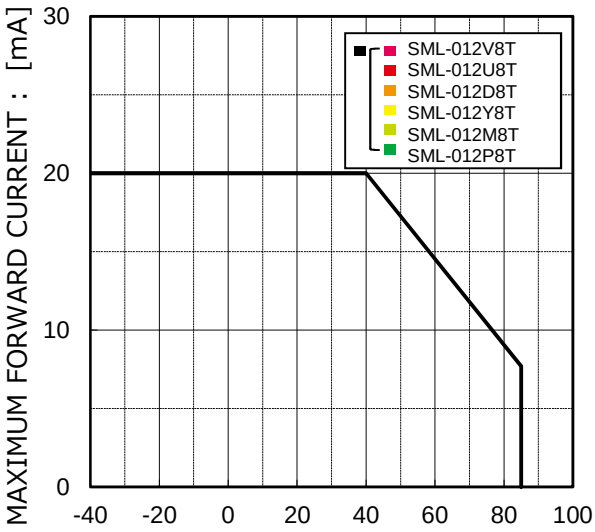


Fig.4 Derating



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■ Electrical Characteristics Curves

Reference

Fig.1 Forward Current - Forward Voltages

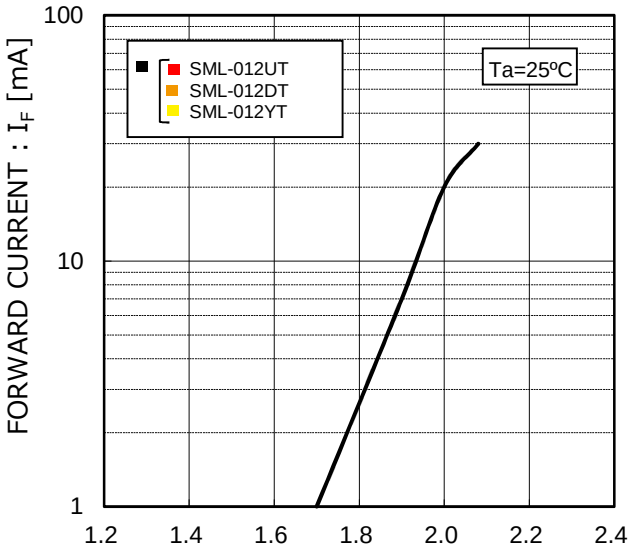


Fig.2 Luminous Intensity - Atmosphere Temperature

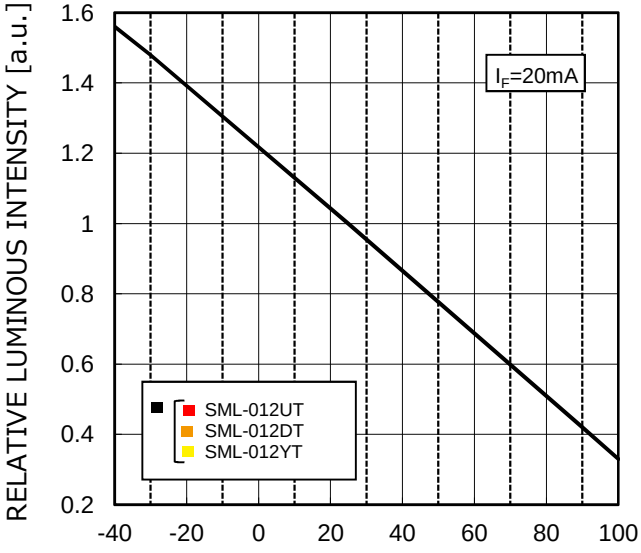


Fig.3 Luminous Intensity - Forward Current

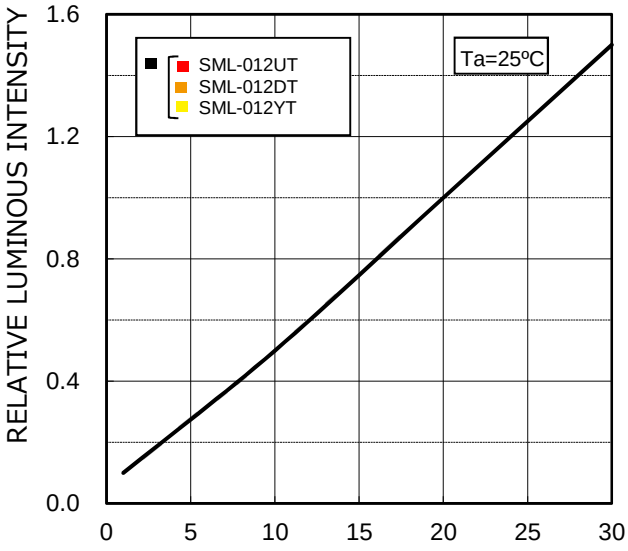
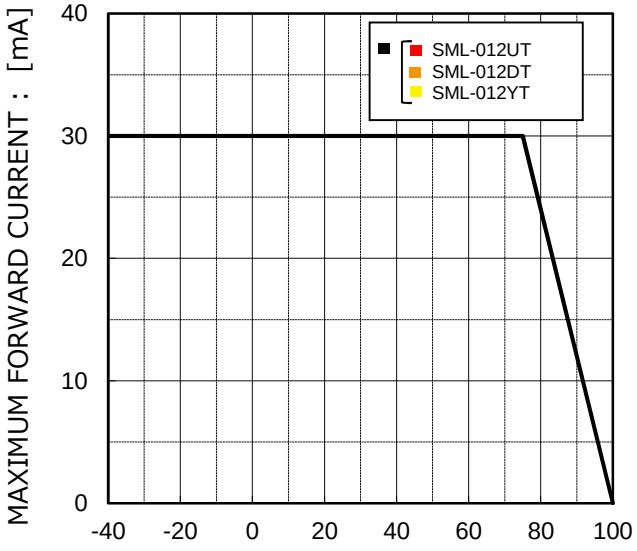


Fig.4 Derating



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■ Electrical Characteristics Curves

Reference

Fig.1 Forward Current - Forward Voltages

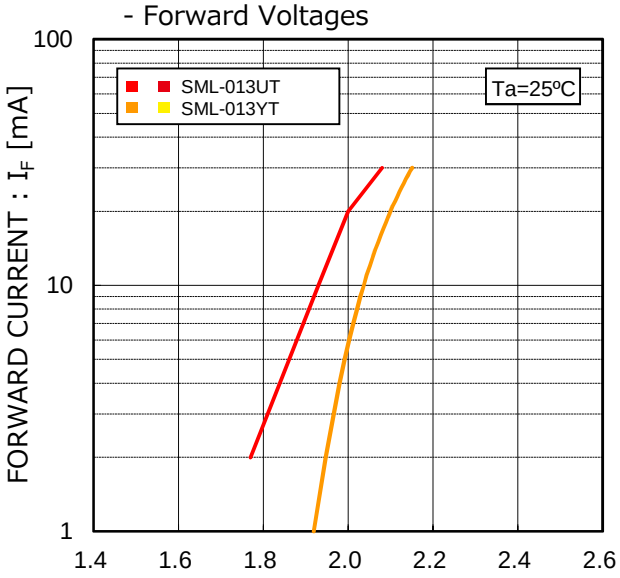


Fig.2 Luminous Intensity - Atmosphere Temperature

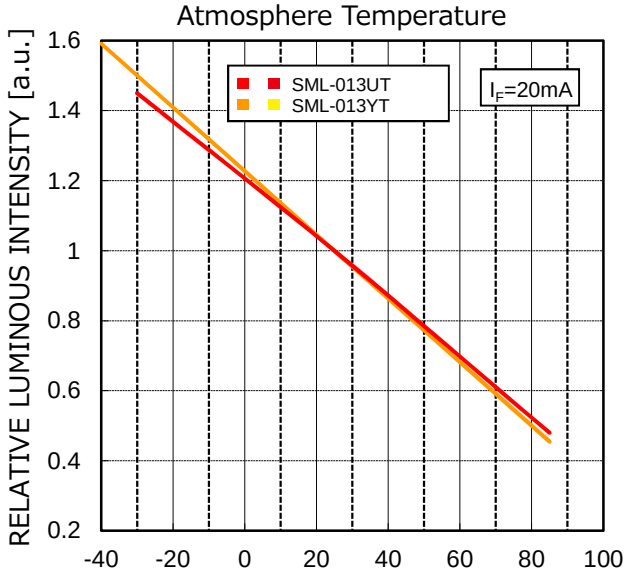


Fig.3 Luminous Intensity - Forward Current

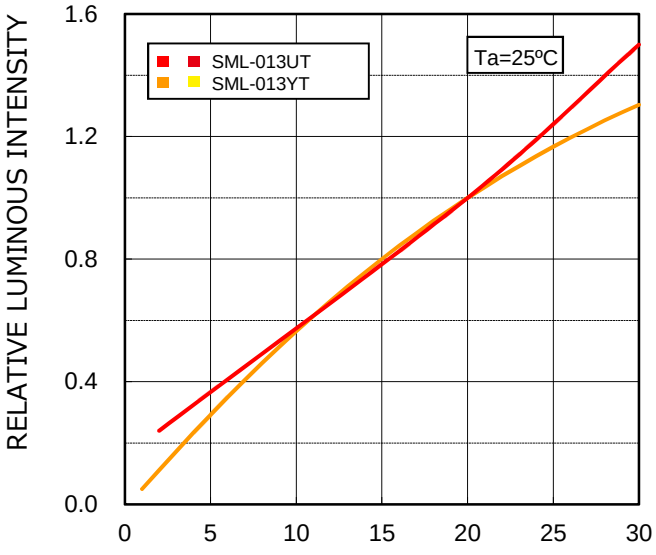
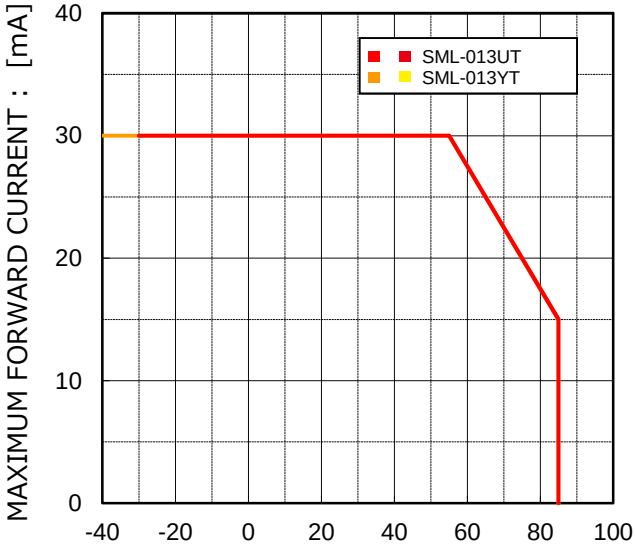


Fig.4 Derating



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■ Electrical Characteristics Curves

Reference

Fig.1 Forward Current - Forward Voltages

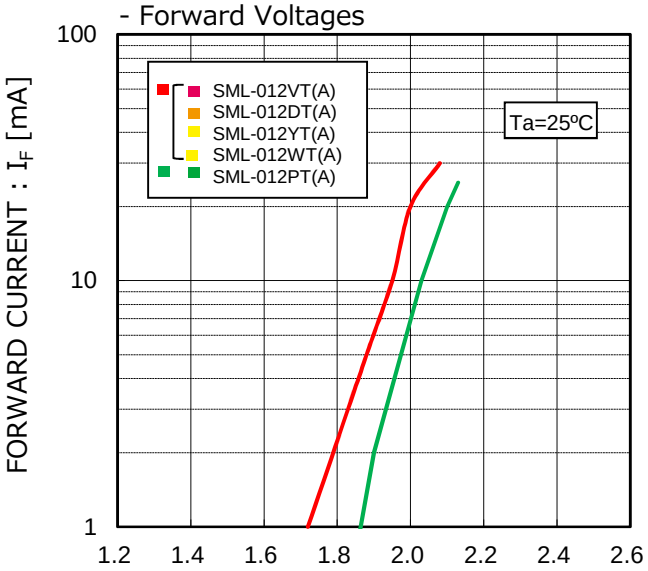


Fig.2 Luminous Intensity - Atmosphere Temperature

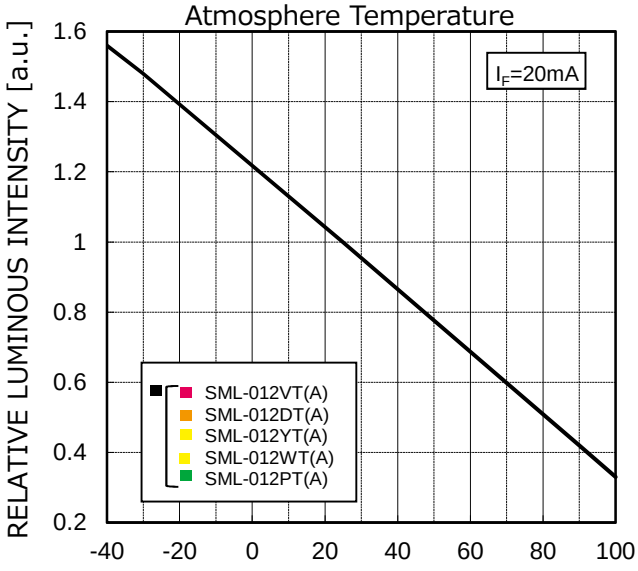


Fig.3 Luminous Intensity - Forward Current

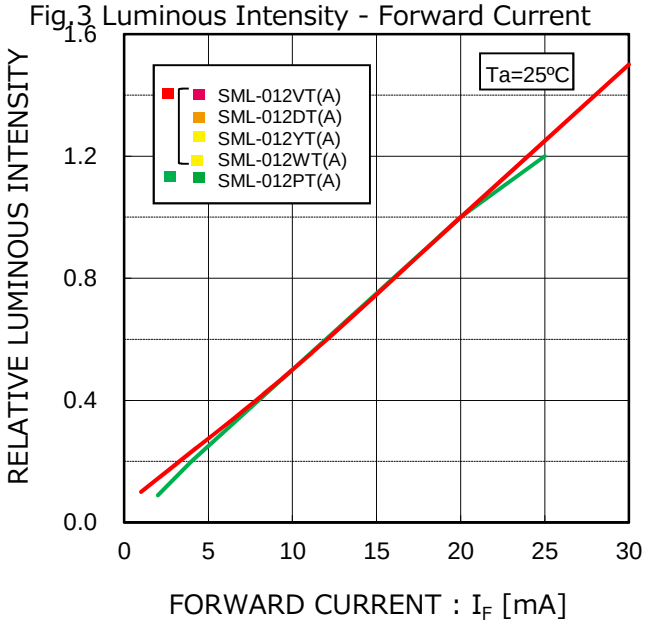
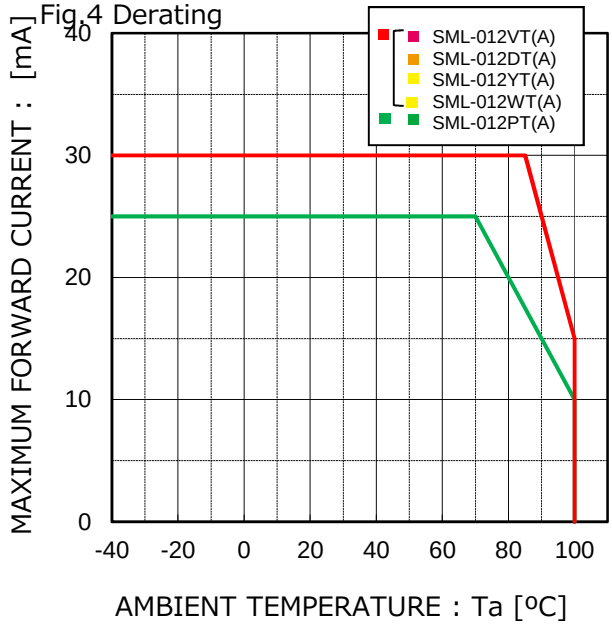


Fig.4 Derating

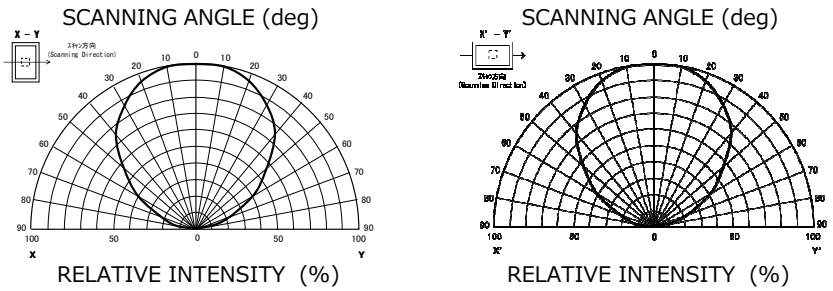


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■Viewing Angle

Reference



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■ Rank Reference of Brightness*

*Measurement tolerance:±10%

Red(V,U)

(Ta=25ºC, I_F = 20mA)

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.5~4.0	4.0~6.3	6.3~10	10~16	16~25	25~40	40~63	63~100	100~160	160~250	250~400	400~630	630~1000	1000~1600
SML-012V8T														
SML-012U8T														

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.2~4.5	3.6~7.1	5.6~11	9~18	14~28	22~45	36~71	56~110	90~180	140~280	220~450	360~710	560~1100	900~1800
SML-013UT														
SML-012UT														

Rank	AG	AH	AJ	AK	AL	AM	AN	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
Iv (mcd)	9.0~11.2	11.2~14	14~18	18 ~22.4	22.4~28	28~35.5	35.5~45	45~56	56~71	71~90	90~112	112~140	140~180	180~224	224~280	280~355	355~450	450~560
SML-012VT(A)																		

*Please note that the brightness of some products may fall between ranks (half rank)

Orange(D)

(Ta=25ºC, I_F = 20mA)

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.5~4.0	4.0~6.3	6.3~10	10~16	16~25	25~40	40~63	63~100	100~160	160~250	250~400	400~630	630~1000	1000~1600
SML-012D8T														

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.2~4.5	3.6~7.1	5.6~11	9~18	14~28	22~45	36~71	56~110	90~180	140~280	220~450	360~710	560~1100	900~1800
SML-012DT														

Rank	AG	AH	AJ	AK	AL	AM	AN	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
Iv (mcd)	9.0~11.2	11.2~14	14~18	18 ~22.4	22.4~28	28~35.5	35.5~45	45~56	56~71	71~90	90~112	112~140	140~180	180~224	224~280	280~355	355~450	450~560
SML-012DT(A)																		

*Please note that the brightness of some products may fall between ranks (half rank)

Yellow(Y)

(Ta=25ºC, I_F = 20mA)

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.5~4.0	4.0~6.3	6.3~10	10~16	16~25	25~40	40~63	63~100	100~160	160~250	250~400	400~630	630~1000	1000~1600
SML-012Y8T														

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.2~4.5	3.6~7.1	5.6~11	9~18	14~28	22~45	36~71	56~110	90~180	140~280	220~450	360~710	560~1100	900~1800
SML-013YT														
SML-012YT														

Rank	AG	AH	AJ	AK	AL	AM	AN	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
Iv (mcd)	9.0~11.2	11.2~14	14~18	18 ~22.4	22.4~28	28~35.5	35.5~45	45~56	56~71	71~90	90~112	112~140	140~180	180~224	224~280	280~355	355~450	450~560
SML-012YT(A)																		
SML-012WT(A)																		

*Please note that the brightness of some products may fall between ranks (half rank)

Yellow Green/Green(M,P)

(Ta=25ºC, I_F = 20mA)

Rank	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
Iv (mcd)	2.5~4.0	4.0~6.3	6.3~10	10~16	16~25	25~40	40~63	63~100	100~160	160~250	250~400	400~630	630~1000	1000~1600
SML-012M8T														
SML-012P8T														

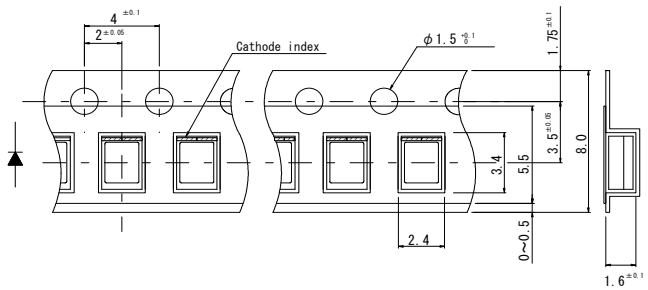
Rank	AG	AH	AJ	AK	AL	AM	AN	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
Iv (mcd)	9.0~11.2	11.2~14	14~18	18 ~22.4	22.4~28	28~35.5	35.5~45	45~56	56~71	71~90	90~112	112~140	140~180	180~224	224~280	280~355	355~450	450~560
SML-012PT(A)																		

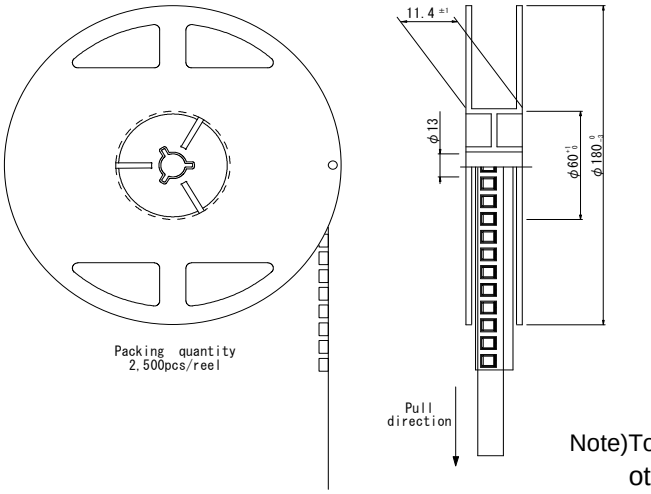
*Please note that the brightness of some products may fall between ranks (half rank)

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■Taping（T86）





Unit:mm

Note)Tolerance is within ±0.2mm unless otherwise specified.

■Part No. Construction

*"-"will be taken out for emitting color WB/B/E series.

Special Code will be applied for Emitting color WB/B/E series.

Chromaticity rank (for white LED)

Rank sign (Brightness Rank)*

S	M	L	–	0	1	2	U	8	T	T	8	6		P

Series name / Package Type / Chip type / Emitting Color / Resin Color / Taping Specification

SML	Chip LED
SCM	Chip LED

P1	1.0x0.6 t=0.2mm
E1	1.6x0.8 t=0.36mm
D1	1.6x0.8 t=0.55mm
H1 / M1	2.0x1.25 t=0.8mm
01	3.0x2.0 t=1.3mm
Z1/ZN	3.5x2.8 t=1.9mm
A1	1.6x1.15 t=0.55mm
81/82	3.4x1.25 t=1.1mm
K1	4.5x2.0 t=0.6mm
S1	3.2x1.6 t=1.85mm
P2	1.0x1.0 t=0.2mm
52	1.3x1.5 t=0.6mm
P34	1.0x1.0 t=0.2mm
P36	1.5x1.0 t=0.2mm
VN	3.5x2.8 t=0.6mm
01	3.0x1.5 t=2.2mm

0	Standard Type
1	Low Current Type
2	High Brightness type
3	Ultra High Brightness type
4	
5	
6	
7	
8	

V	Red
U	Red
U2	Red
D	Orange
Y3	Yellow
Y2	Yellow
Y	Yellow
W	Yellow
M2	Yellowish green
M	Yellowish green
F	Green
P	Green
E	Green
B	Blue
WB	White
T	Phototransistors
RGB	Red/Green/Blue

T	Transparent Colorless
W	Milky White
B	Black

T86	Cathode at sprocket hole side(the top)

*Concerning the Brightness rank.
*Please refer to the rank chart above for luminous intensity classification.
*Part name is individual for each rank.
*When shipped as sample,the part name will be a representative part name.
General products are free of ranks.
Please contact sales if rank appointment is needed.

■Packing Specification

Complying with IPC/JEDEC J-STD-033.

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■Precaution (Surface Mount Device)

1．Storage

If the product is heated during the reflow under the condition of hygroscopic state, it may vaporize and expand which will influence the performance of the product. Therefore, the package is waterproof. Please use the product following the conditions:

・Using Conditions

Classification	Temperature	Humidity	Expiration Date	Remark
①Before using	5～30℃	30～70%RH	Within 1 year from Receiving	Storage with waterproof package
②After opening package	5～30℃	Below 70%RH	Within 168h	Please storing in the airtight container with our desiccant (silica gel)

・Baking

Bake the product in case of below:
①The expiration date is passed.
②The color of 5% and 10% on humidity indicator card is not green.
(Even if the product is before expiration date.)

・Baking Conditions

Temperature	Time	Humidity
60±3℃	12～24h	Below 20%RH
Remark	・Bake products in reel. ・Reel and embossed tape are easy to be deformed when baking, so please try not to apply stress on it. ・Recommend bake once.	

2．Application Methods

2－1．Precaution for Drive System and Off Mode

Design the circuit without the electric load exceeding the ABSOLUTE MAXIMUM RATING that applies on the products. If drive by constant voltage, it may cause current deviation of the LED and result in deviation of luminous intensity, so we recommend to drive by constant current. (Deviation of VF Value will cause deviation of current in LED.) Furthermore, for off mode, please do not apply voltage neither forward nor reverse. Especially, for the products with the Ag-paste used in the die bonding, there's high possibility to cause electro migration and result in function failure.

2－2．About Derating

It is considered that derating characteristics will not result in LED chip's electrical destruction. Even within the derating, the reliability and luminous life can be affected depending on operating conditions and ambient environment. So we would be appreciate it if you can confirm with your application again.

2－3．About product life

Depending on operating conditions and environment(applied current, ambient temperature and humidity, corrosive gas), decreasing of luminosity and change of chromaticity may occur even within the specification conditions.
Please contact our sales office if you use it for the following applications.
①It requires long luminosity life
②It is always lit

2－4．Applied Stress on Product

No resin hardening agent such as filler is used in the sealing resin of the product.
Therefore, please pay attention to the overstress on it which may influence its reliability.

2－5．Usage

The Product is LED. We are not responsible for the usage as the diode such as Protection Chip, Rectifier, Switching and so on.

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3. Others

3 – 1. Surrounding Gas

Notice that if it is stored under the condition of acid gas (chlorine gas, sulfured gas) or alkali gas (ammonia), it may result in low soldering ability (caused by the change in quality of the plating surface) or optical characteristics changes (light intensity, chrominance) and change in quality of cause die bonding (Ag-paste) materials. All of the above will function failure of the products.
Therefore, please pay attention to the storage environment for mounted product (concern the generated gas of the surrounding parts of the products and the atmospheric environment).

3 – 2. Electrostatic Damage

The product is part of semiconductor and electrostatic sensitive, there's high possibility to be damaged by the electrostatic discharge. Please take appropriate measures to avoid the static electricity from human body and earthing of production equipment. Especially, InGaN type LEDs have lower resistance value of electrostatic discharge and it is recommended to introduce the ESD protection circuit.
The resistance values of electrostatic discharge (actual values) vary with products, therefore, please call our Sales staffs for inquiries.

3 – 3. Electromagnetic Wave

Applications with strong electromagnetic wave such as, IH cooker, will influence the reliability of LED, therefore please evaluate before using it.

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4． Mounting

4 – 1． Soldering

・No resin hardening agent such as filler is used in the sealing resin of the product. Therefore, resin expansion and moisture absorption at humidity will cause heat stress during soldering process and finally has bad influence on the product's reliability.
・The product is not guaranteed for flow soldering.
・Do not expose the product in the environment of high temperature (over 100℃) or rapid temperature shift (within 3℃/sec. of temperature gradient) during the flow soldering of surrounding parts.
In case of carrying out flow soldering of surrounding parts without recommended conditions, please contact us for inquiries.
・Please set appropriate reflow temperature based on our product usage conditions and specification.
・The max for reflowing is 2 times, please finish the second reflow soldering and flow soldering with other parts within the usage limitation after open the moistureproof package.
・Compare with N2 reflow, during air reflow, because of the heat and surrounding conditions, it may cause the discoloration of the resin.
・For our product that has no solder resist, because of its solder amount and soldering conditions, one of its specific characteristics is that solder will penetrate into LED. Thus, there's high possibility that will influence its reliability.Therefore, please be informed, concerning it before using it.

4 – 2． Automatic Mounting

4 - 2 - 1 . Suction nozzle

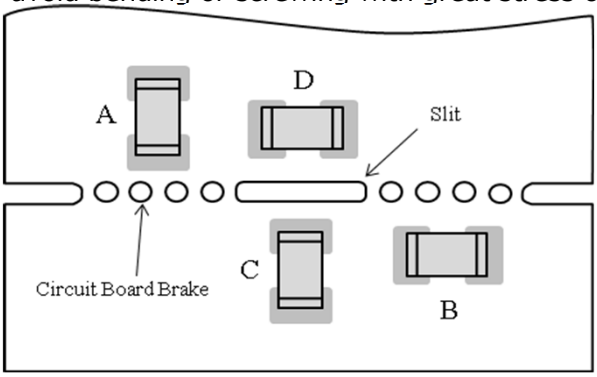
Excessive load may cause damage inside the LED product, so select an optimal suction nozzle according to the material and shape of the LED product.

4 - 2 - 2 . Mini Package (Smaller than 1608 size)

・Vibration may result in low mounting rate since it will cause the static electricity of product and adhere to top cover tape. Therefore, the magnet should be set on parts feeder cassette of the mounter to control the product stabilization. In addition, it is recommended to set ionizer to prevent electrostatic charge.

4 – 3 . Mounting Location

The stress like bending stress of circuit board dividing after mounting, may cause LED package crack or damage of LED internal junction, therefore, please concern the mounting direction and position to avoid bending or screwing with great stress of the circuit board.



Stress strength according to he mounting position:
A> B> C> D

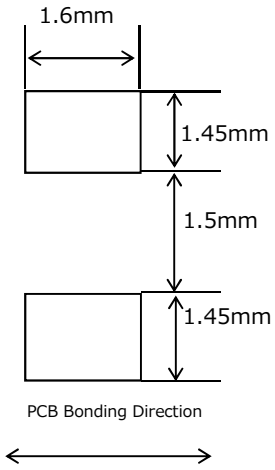
4—4 . Mechanical Stress after Mounting

The mechanical stress may damage the LED after Circuit Mounting, so please pay attention to the touch on product.

4 – 5． Soldering Pattern for Recommendation

We recommend the soldering pattern that shows on the right.
It will be different according to mounting situation of circuit board, therefore, please concern before designing.

※The product has adopted the electrode structure that it should solder with back electrode of the product.
Thus, please be informed that the shape of electrode pin of solder fillet formation is not guaranteed.
The through hole on electrode surface is for conduction of front and rear electrodes but not for formation of solder fillet.



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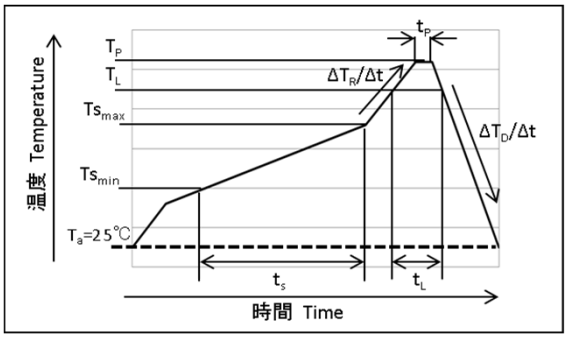
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4 – 6. Reflow Profile

For reflow profile, please refer to the conditions below:(※)

■Meaning of marks, Conditions

Mark	Meanings	Conditions
Ts_{max}	Maximum of pre-heating temperature	180℃
Ts_{min}	Minimum of pre-heating temperature	140℃
t_s	Time from Tsmin to Tsmax	Over 60sec.
T_L	Reference temperature	210～250℃
t_L	Retention time for TL	Within 40sec.
T_P	Peak temperature	250℃(Max)
t_P	Time for peak temperature	Within 10sec.
$\Delta T_R/\Delta t$	Temperature rising rate	Under 3℃/sec.
$\Delta T_D/\Delta t$	Temperature decreasing rate	Over -3℃/sec.



※Above conditions are for reference. Therefore, evaluate by customer's own circuit boards and reflow furnaces before using, because stress from circuit boards and temperature variations of reflow furnaces vary by customer's own conditions.

4 – 7. Attention Points in Soldering Operation

This product was developed as a surface mount LED especially suitable for reflow soldering.
So reflow soldering is recommended. In case of implementing manual soldering,
please take care of following points.

①SOLDER USED

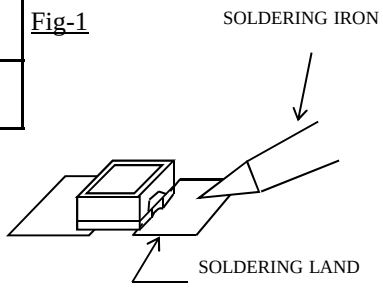
Sn-Cu, Sn-Ag-Cu, Sn-Ag-Bi-Cu

②HAND SOLDERING CONDITION

LED products do not contain reinforcement material such as a glass fillers.
So thermal stress by soldering greatly influence its reliability.
Please keep following points for manual soldering.

	ITEM	RECOMMENDED CONDITION
a)	Heating method	Condition) Temp. of iron top less than 400℃ within 3 sec. Heating on PCB pattern, not direct to the LED. (Fig-1)
b)	Handling after soldering	Please handle after the part temp. goes down to room temp.

Fig-1



4 – 8. Cleaning after Soldering

Please follow the conditions below if the cleaning is necessary after soldering.

Solvent	We recommend to use alcohols solvent such as, isopropyl alcohols
Temperature	Under 30℃ within 3 minutes
Ultrasonic Cleaning	15W／Below 1 liter (capacity of tank)
Drying	Under 100℃ within 3 minutes

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