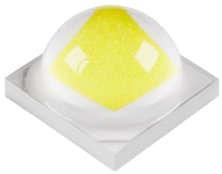
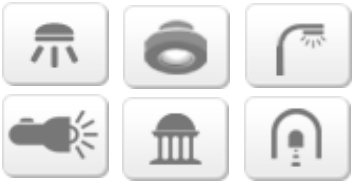
Superior Efficacy & Lumen output with Small Form Factor

Z Power LED – Z5-M3





RoHS

MacAdam 3-Step

Product Brief

Description

- The Z-Power series is designed for high flux output applications with high current operation capability.
- It incorporates state of the art SMD design and low thermal resistant material.
- The Z Power LED is ideal light sources for directional lighting applications such as Spot Lights, various outdoor applications, automotive lightings and high performance torches .

Features and Benefits

- High Lumen Output and Efficacy
- Designed for high current operation
- Low Thermal Resistance
- ANSI compliant Binning
- Ceramic package

Key Applications

- Architectural
- Industrial
- Outdoor area
- Exterior Lighting
- Commercial

Table of Contents

Performance Characteristics

Table 1.Product Selection Guide, I_F=700mA, T_j=85℃

CRI Min	CCT	Performance	Flux & lm/W(Typ.) IF=700mA
70	6500K	Flux	343
		lm/W	176
	5700K	Flux	348
		lm/W	178
	5000K	Flux	350
		lm/W	179
	4000K	Flux	352
		lm/W	180
	3500K	Flux	349
		lm/W	178
	3000K	Flux	329
		lm/W	169
	2700K	Flux	320
		lm/W	164
80	6500K	Flux	327
		lm/W	167
	5700K	Flux	327
		lm/W	168
	5000K	Flux	331
		lm/W	169
	4000K	Flux	327
		lm/W	168
	4500K	Flux	333
		lm/W	171
	3500K	Flux	320
		lm/W	164
	3000K	Flux	302
		lm/W	154
	2700K	Flux	281
		lm/W	343

Notes :

(1) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.

(2) Seoul Semiconductor maintains a tolerance of ±7% on flux and power measurements

(3) Typ lumen table is only for reference .

Performance Characteristics

Table 2. Characteristics

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max. [4]	
Forward Current	I_F	-	700	1500	mA
Peak Pulsed Forward Current [2]	I_F	-	-	2000	mA
Forward Voltage (@700mA, 85ºC)	V_F	-	-	3.00	V
Junction Temperature	T_j	-	-	150	ºC
Operating Temperature	T_{op}	-40	-	105	ºC
Storage Temperature	T_{stg}	-40	-	120	ºC
Viewing angle	θ		120		degree
Thermal resistance (J to S) [3]	$R\theta_{J-S}$	-	3.2	-	K/W
ESD Sensitivity(HBM)		Class 3B JEDEC JS-001-2017			

Notes :

(1) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.

Color coordinate : ±0.005, CCT ±5% tolerance.

(2) Seoul Semiconductor maintains a tolerance of ±7% on flux and power measurements.

(3) Φ_V is the total luminous flux output as measured with an integrating sphere.

(4) Tolerance is ±2.0 on CRI measurements.

(5) Tolerance is ±0.06V on forward voltage measurements.

(6) $R\theta_{J-S}$ is tested at 700mA.

- It is recommended to use it in the condition that the reliability is secured within the Max value.
- Thermal resistance can be increased substantially depending on the heat sink design/operating condition, and the maximum possible driving current will decrease accordingly.

Characteristics Graph

Fig 1. Color Spectrum

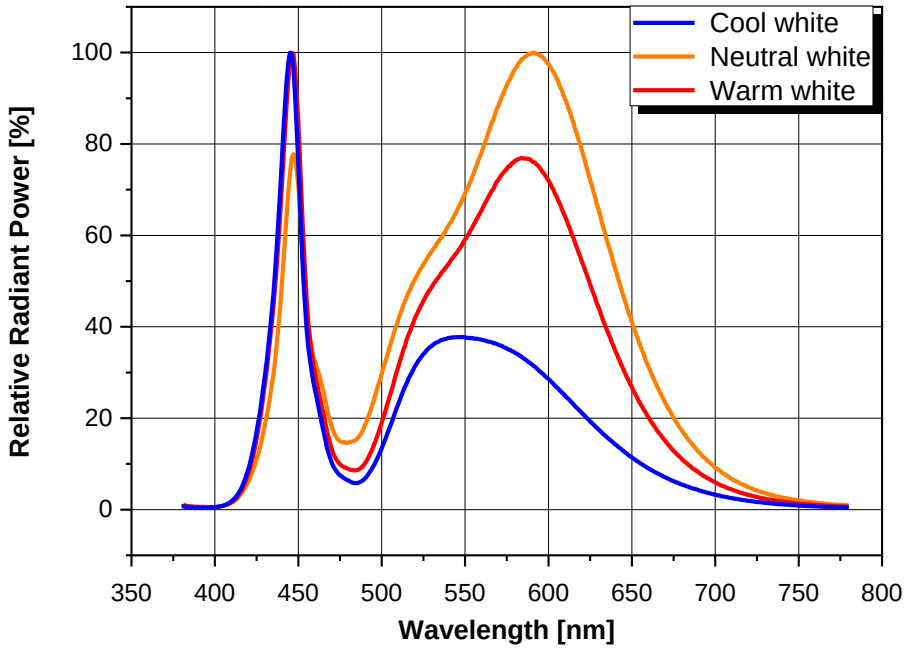
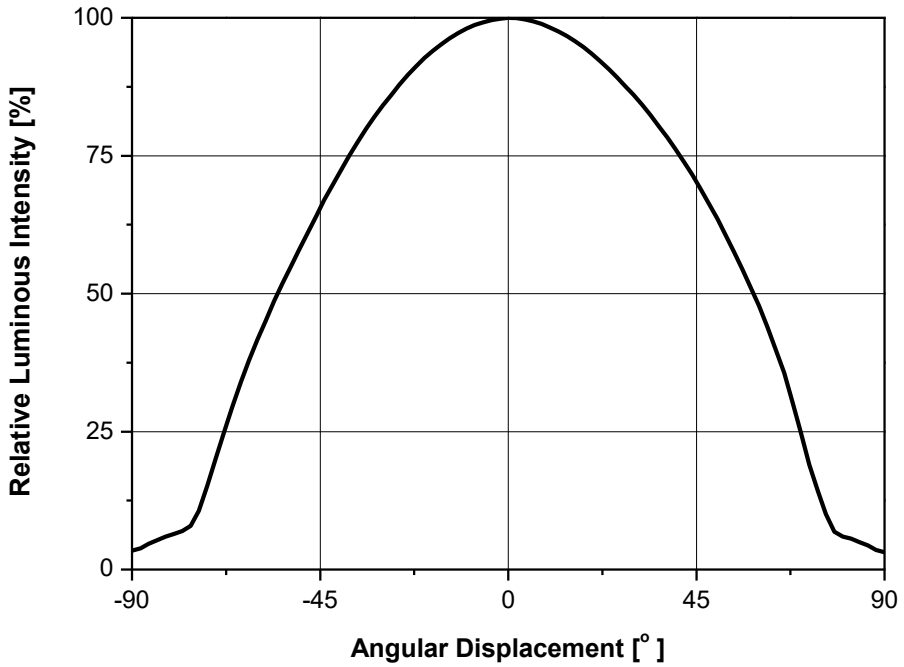


Fig 2. Typical Spatial Distribution



Characteristics Graph

Fig 3. Forward Voltage vs. Forward Current, T_j=85℃

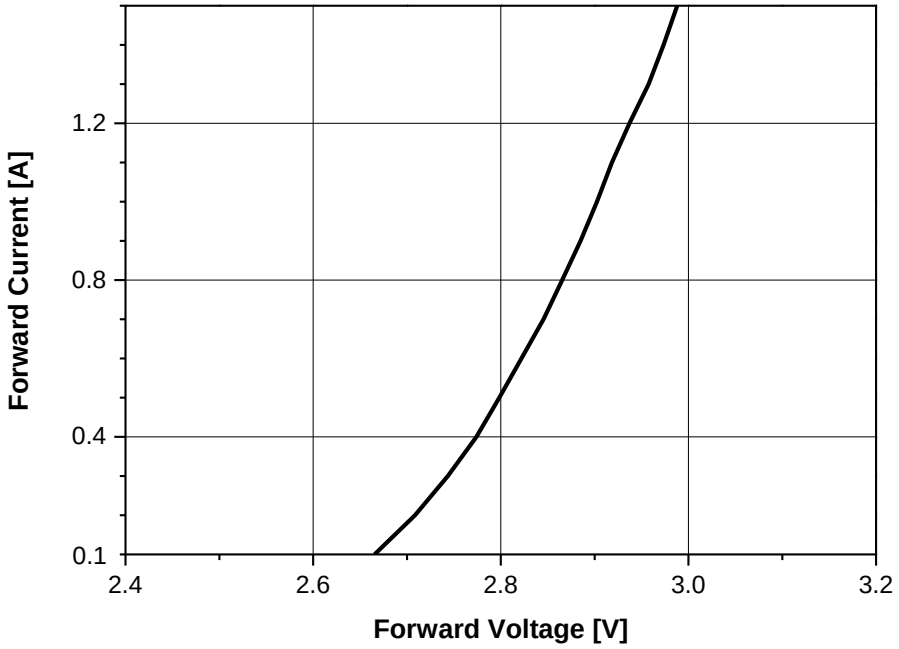
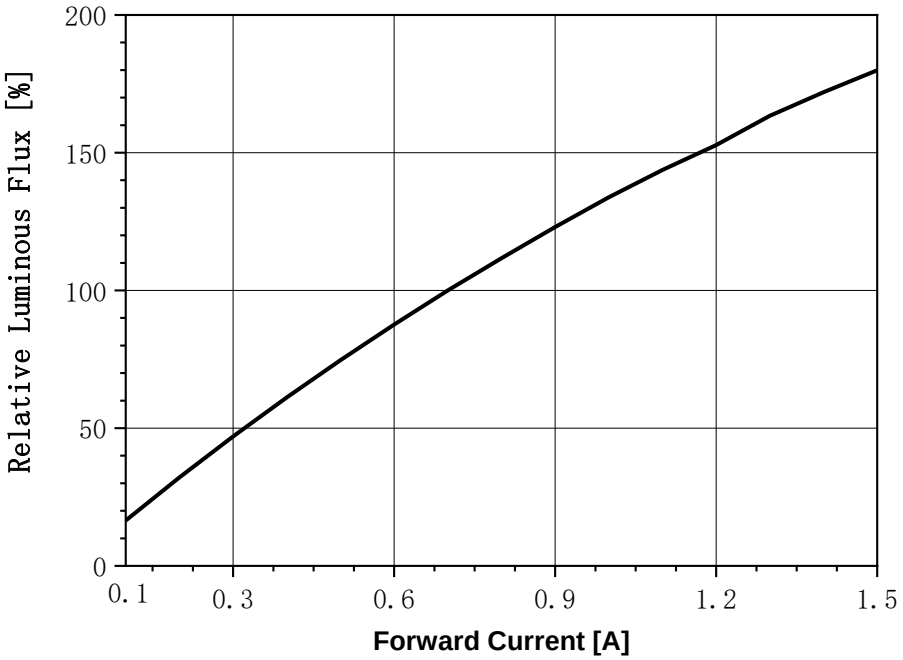


Fig 4. Forward Current vs. Relative Luminous Flux, T_j=85℃



- Using less than 100mA is not recommended

Characteristics Graph

Fig 5. Forward Current vs. CIE X, Y Shift, T_j=85℃

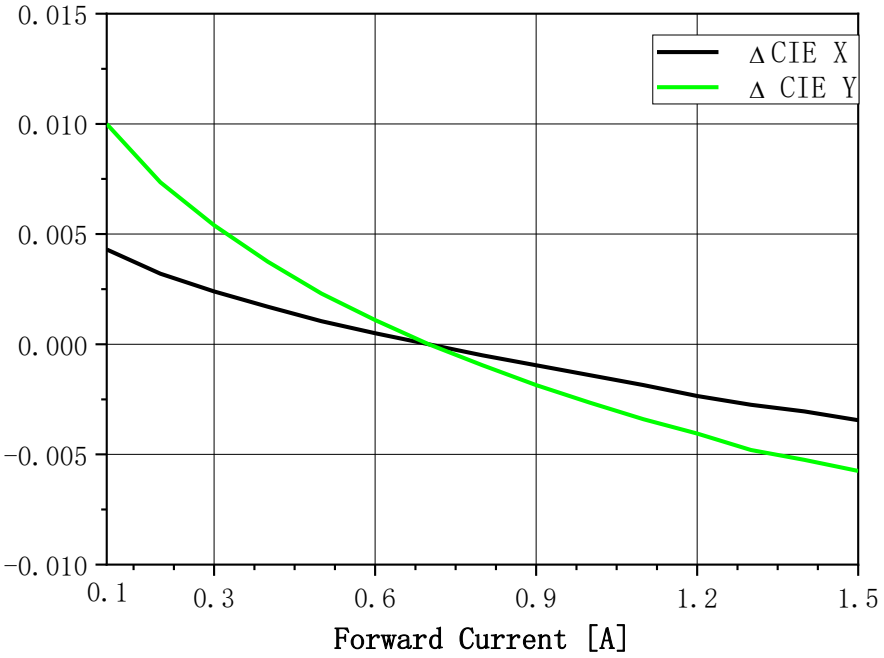
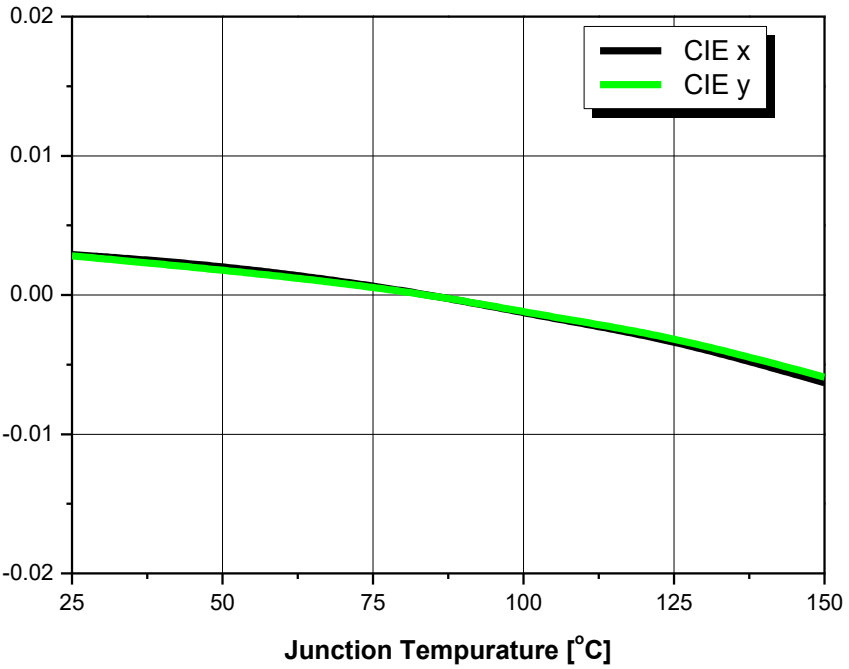


Fig 6. Junction Temp. vs. CIE X, Y Shift, I_F=700mA



- Using less than 100mA is not recommended

Characteristics Graph

Fig 7. Relative Light Output vs. Junction Temperature, I_F=700mA

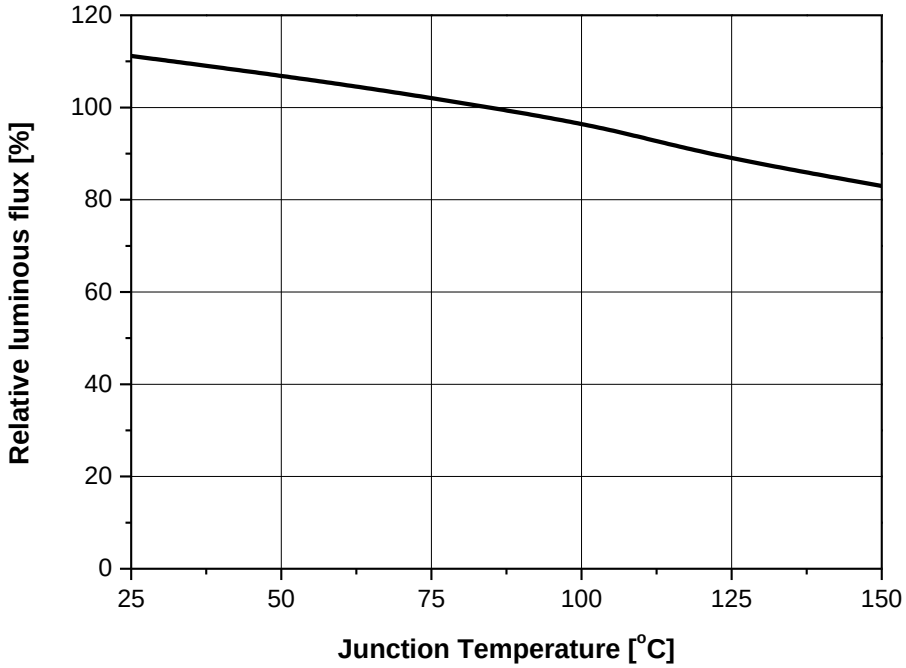
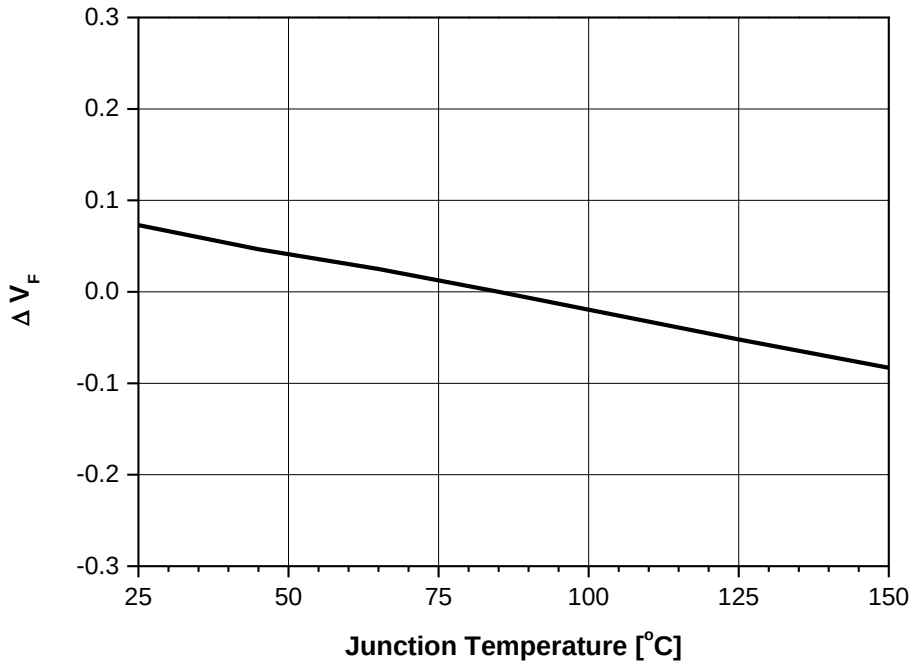
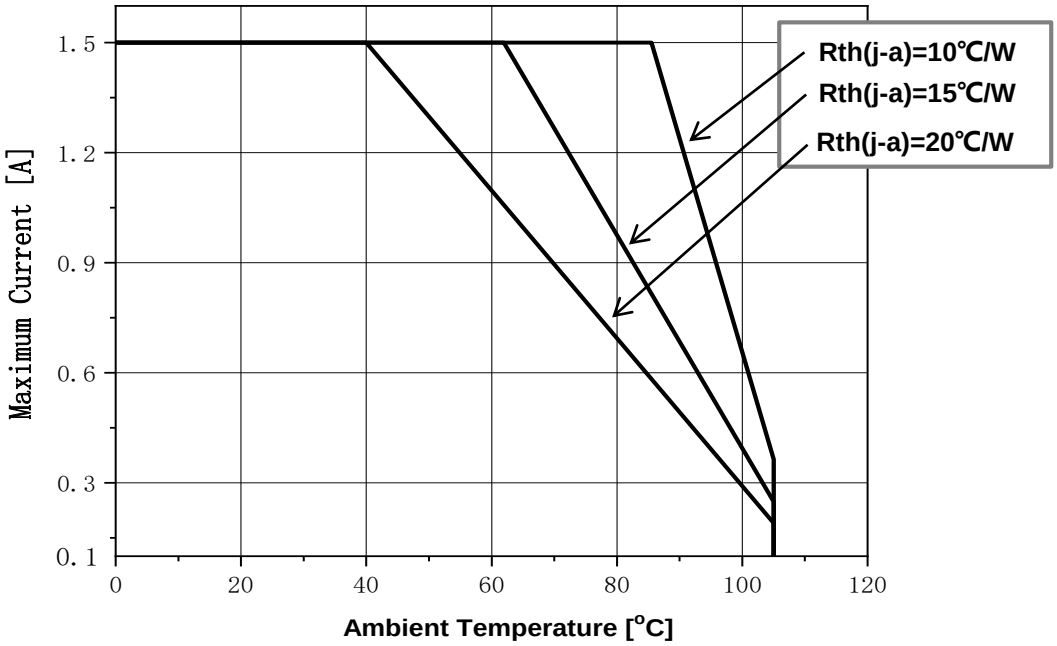


Fig 8. Relative Forward Voltage vs. Junction Temperature, I_F=700mA



Characteristics Graph

Fig 9. Maximum Forward Current vs. Ambient Temperature, T_j(max.)=150℃



- Using less than 100mA is not recommended

Color Bin Structure

Table 3. Bin Code description, I_F=700mA, T_j=85℃

Luminous Flux [lm]		
Bin Code	Min.	Max.
250	250	265
265	265	280
280	280	295
295	295	310
310	310	325
325	325	340
340	340	355
355	355	370
370	370	385

Forward Voltage (V)		
Bin Code	Min.	Max.
290	2.75	2.90
300	2.90	3.00

Notes :

(1) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.

Color coordinate : ±0.005, CCT ±5% tolerance.

(2) Seoul Semiconductor maintains a tolerance of ±7% on flux and power measurements.

(3) Φ_V is the total luminous flux output as measured with an integrating sphere.

(4) Tolerance is ±2.0 on CRI measurements.

(5) Tolerance is ±0.06V on forward voltage measurements.

Color Bin Structure

Table 4. Available Flux Rank, I_F=700mA, T_j=85℃

CRI	CCT	CIE	Flux Bin								
70	6500K	A	250	265	280	295	310	325	340	355	370
	5700K	B	250	265	280	295	310	325	340	355	370
	5000K	C	250	265	280	295	310	325	340	355	370
	4000K	E	250	265	280	295	310	325	340	355	370
	3500K	F	250	265	280	295	310	325	340	355	370
	3000K	G	250	265	280	295	310	325	340	355	370
	2700K	H	250	265	280	295	310	325	340	355	370
80	6500K	A	250	265	280	295	310	325	340	355	370
	5700K	B	250	265	280	295	310	325	340	355	370
	5000K	C	250	265	280	295	310	325	340	355	370
	4000K	E	250	265	280	295	310	325	340	355	370
	4500K	D	250	265	280	295	310	325	340	355	370
	3500K	F	250	265	280	295	310	325	340	355	370
	3000K	G	250	265	280	295	310	325	340	355	370
	2700K	H	250	265	280	295	310	325	340	355	370

Notes : (1) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.

Color coordinate : ±0.005, CCT ±5% tolerance.

(2) Seoul Semiconductor maintains a tolerance of ±7% on flux and power measurements.

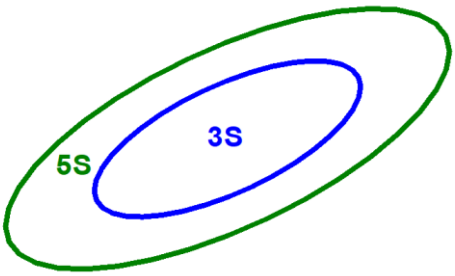
(3) Φ_V is the total luminous flux output as measured with an integrating sphere.

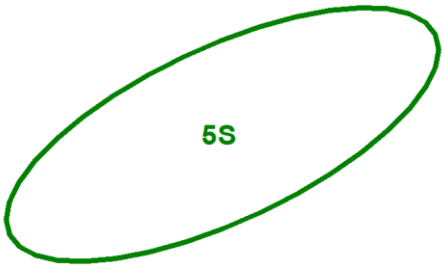
(4) Tolerance is ±2.0 on CRI measurements.

(5) Tolerance is ±0.06V on forward voltage measurements.

Color Bin Structure

CIE Chromaticity Diagram T_j=85℃, I_F=700mA





Order	Box Packing Method
xx3S	3S(3step) Single
xx4M	3S(3step) Single or 3S+5S Mixing

Order	Box Packing Method
xx5S	5S(5step) Single

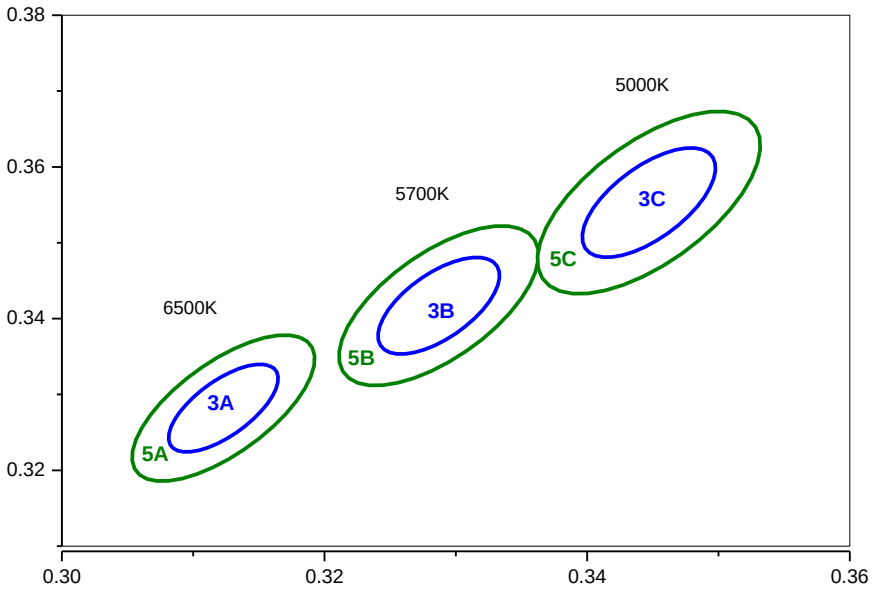
Notes :

1. xx3S Order will ship 3S only
2. xx5S Order will ship 5S (=also include 3S)
3. xx4M Order will ship 3S & 5S Mixing(=also include 3S)
4. Doughnut Bin will not ship alone(=Will ship with mixing bin)

* 'xx' can be 65=6500K, 57=5700K, 50=5000K, 40=4000K, 30=3000K, 27= 2700K.,22=2200K

Color Bin Structure

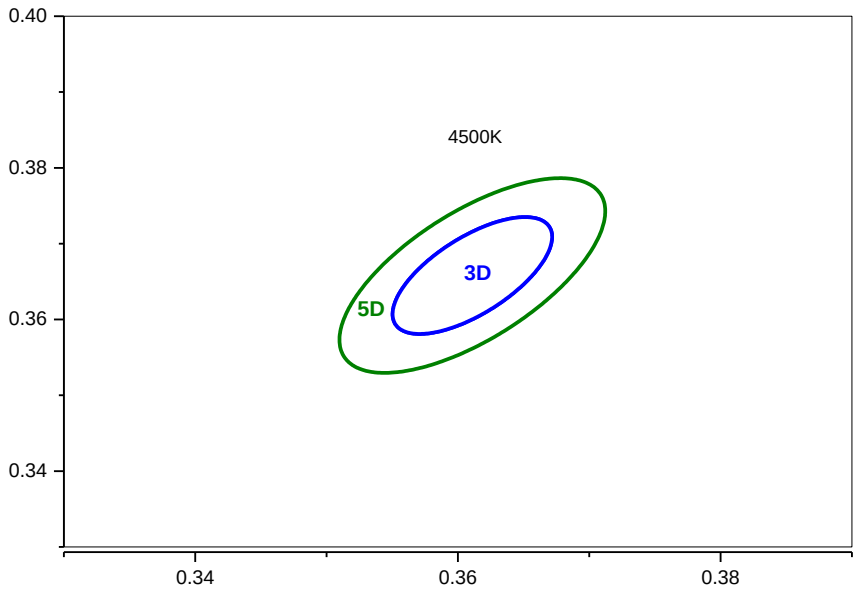
CIE Chromaticity Diagram (Cool White), T_j=85℃, I_F=700mA



6500K 3Step		5700K 3Step		5000K 3Step	
3A		3B		3C	
Center point	0.3123 : 0.3282	Center point	0.3287 : 0.3417	Center point	0.3447 : 0.3553
Major Axis a	0.0066	Major Axis a	0.0072	Major Axis a	0.0081
Minor Axis b	0.0027	Minor Axis b	0.0032	Minor Axis b	0.0035
Ellipse Rotation Angle	58	Ellipse Rotation Angle	59	Ellipse Rotation Angle	60
6500K 5Step		**5700K 5Step**		**5000K 5Step**	
5A		5B		5C	
Center point	0.3123 : 0.3282	Center point	0.3287 : 0.3417	Center point	0.3447 : 0.3553
Major Axis a	0.0110	Major Axis a	0.0119	Major Axis a	0.0135
Minor Axis b	0.0045	Minor Axis b	0.0052	Minor Axis b	0.0059
Ellipse Rotation Angle	58	Ellipse Rotation Angle	59	Ellipse Rotation Angle	60

Color Bin Structure

CIE Chromaticity Diagram (Neutral White), T_j=85℃, I_F=700mA



4500K 3Step

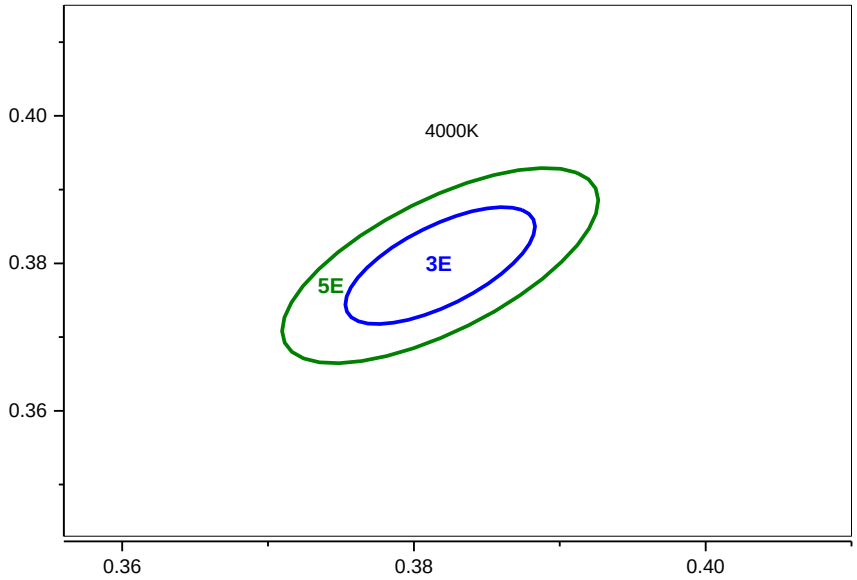
3D	
Center point	0.3611 : 0.3658
Major Axis a	0.0090
Minor Axis b	0.0039
Ellipse Rotation Angle	55

4000K 5Step

5D	
Center point	0.3611 : 0.3658
Major Axis a	0.015
Minor Axis b	0.0065
Ellipse Rotation Angle	55

Color Bin Structure

CIE Chromaticity Diagram (Neutral White), T_j=85℃, I_F=700mA



4000K 3Step

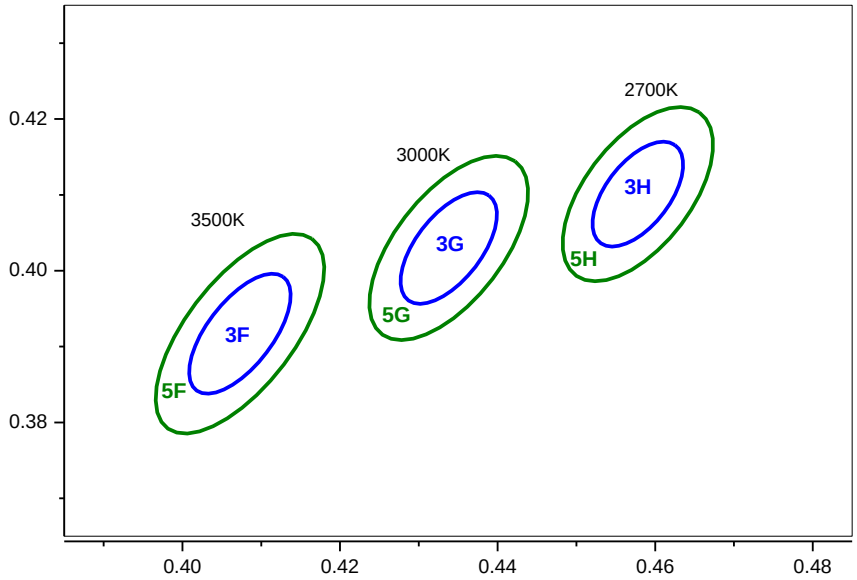
3E	
Center point	0.3818 : 0.3797
Major Axis a	0.0094
Minor Axis b	0.0041
Ellipse Rotation Angle	53.4

4000K 5Step

5E	
Center point	0.3818 : 0.3797
Major Axis a	0.0157
Minor Axis b	0.0067
Ellipse Rotation Angle	53

Color Bin Structure

CIE Chromaticity Diagram (Warm White), T_j=85℃, I_F=700mA



3500K 3Step		3000K 3Step		2700K 3Step	
3F		3G		3H	
Center point	0.4073 : 0.3917	Center point	0.4338 : 0.4030	Center point	0.4578 : 0.4101
Major Axis a	0.0093	Major Axis a	0.0086	Major Axis a	0.0080
Minor Axis b	0.0042	Minor Axis b	0.0042	Minor Axis b	0.0041
Ellipse Rotation Angle	54	Ellipse Rotation Angle	54	Ellipse Rotation Angle	54
3500K 5Step		**3000K 5Step**		**2700K 5Step**	
5F		5G		5H	
Center point	0.4073 : 0.3917	Center point	0.4338 : 0.4030	Center point	0.4578 : 0.4101
Major Axis a	0.0155	Major Axis a	0.0142	Major Axis a	0.0132
Minor Axis b	0.0068	Minor Axis b	0.0068	Minor Axis b	0.0068
Ellipse Rotation Angle	54	Ellipse Rotation Angle	54	Ellipse Rotation Angle	54

Mixing order kiting combination

Kiting Combination with xx4M

Combination	Reel	FLUX	CIE	VF	Qty
Kiting_a	Reel 1	xxx	3S	290	900
	Reel 2	xxx	3S	290	900
Kiting_b	Reel 1	xxx	3S	290	900
	Reel 2	xxx	5S	290	900
Kiting_c	Reel 1	xxx	3S	290	900
	Reel 2	xxx	3S	300	900
Kiting_d	Reel 1	xxx	3S	290	900
	Reel 2	xxx	5S	300	900

Product Nomenclature

Table 5. Nomenclature example

S	Z	5	-	M	3	-	W	x	-	C	x	-	E	x	A	x	0	0	0	a	b	c	d	d	e	e	f	f	f
X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}	X_{20}	X_{21}	X_{22}	X_{23}	X_{24}	X_{25}	X_{26}	X_{27}	X_{28}	X_{29}	X_{30}

Code digits	Value	References	Description
X_1	S	Seoul Semiconductor	Company
X_2X_3	Z5	Series	Z5 Series
X_4	-	-	-
X_5X_6	Mx	Chip Size	
X_7	-	-	-
X_8X_9	Wx	CCT	W0:5000K~6500K WN:4000K WW:2700K~3500K
X_{10}	-	-	-
$X_{11}X_{12}$	Cx	CRI	C7:CRI70 C8:CRI80
X_{13}	-	-	-
$X_{14}X_{15}$	Ex	Technology	
$X_{16}X_{17}$	Ax	PCB	A3:AL2O3 AN:ALN
$X_{18}X_{19}X_{20}$	000	Internalcode	
$X_{21}X_{22}X_{23}$	abc	Flux（Min）	xxx
$X_{24}X_{25}$	dd	CCT	65=6500K, 57=5700K, 50=5000K, 40=4000K, 30=3000K, 27= 2700K
$X_{26}X_{27}$	ee	Step	3S-3step single /5S: 5step single / 4M: 4step Mixing
$X_{28}X_{29}X_{30}$	fff	VF Bin(Max）	xxx

Product Nomenclature

Table 6. Product Selection Table

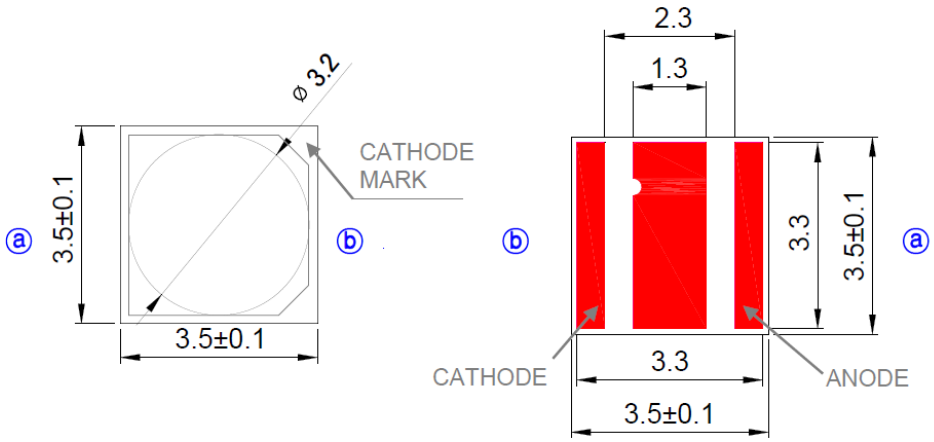
Reference P/N	Order code	Flux bin （Min）	CCT	Step	VF bin（Max）
SZ5-M3-W0-C7-E1A3000	xxx65xS290	xxx:325	65:6500K	3S: 5step single 5S: 5step single	290
	xxx57xS290	xxx:325	57:5700K		
	xxx50xS290	xxx:325	50:5000K		
SZ5-M3-WN-C7-E1A3000	xxx40xS290	xxx:325	40:4000K		
SZ5-M3-WW-C7-E1A3000	xxx35xS290	xxx:325	35:3500K		
	xxx30xS290	xxx:310	30:3000K		
	xxx27xS290	xxx:295	27:2700K		
SZ5-M3-W0-C8-E1A3000	xxx65xS290	xxx:310	65:6500K		
	xxx57xS290	xxx:310	57:5700K		
	xxx50xS290	xxx:310	50:5000K		
SZ5-M3-WN-C8-E1A3000	xxx40xS290	xxx:310	40:4000K		
	xxx45xS290	xxx:310	45:4500K		
SZ5-M3-WW-C8-E1A3000	xxx35xS290	xxx:295	35:3500K		
	xxx30xS290	xxx:280	30:3000K		
	xxx27xS290	xxx:265	27:2700K		

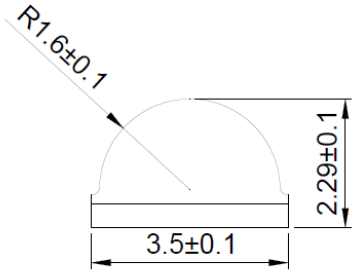
Product Nomenclature

Table 7. Product Selection Table

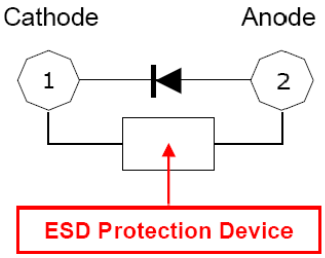
Reference P/N	Order code	Flux bin （Min）	CCT	Step	VF bin（Max）
SZ5-M3-W0-C7-E1A3000	xxx654M290	xxx:325	65:6500K	4M: 4step Mixing	ALL
	xxx574M290	xxx:325	57:5700K		
	xxx504M290	xxx:325	50:5000K		
SZ5-M3-WN-C7-E1A3000	xxx404M290	xxx:325	40:4000K		
SZ5-M3-WW-C7-E1A3000	xxx354M290	xxx:325	35:3500K		
	xxx304M290	xxx:310	30:3000K		
	xxx274M290	xxx:295	27:2700K		
SZ5-M3-W0-C8-E1A3000	xxx654M290	xxx:310	65:6500K		
	xxx574M290	xxx:310	57:5700K		
	xxx504M290	xxx:310	50:5000K		
SZ5-M3-WN-C8-E1A3000	xxx404M290	xxx:310	40:4000K		
	xxx454M290	xxx:310	45:4500K		
SZ5-M3-WW-C8-E1A3000	xxx354M290	xxx:295	35:3500K		
	xxx304M290	xxx:280	30:3000K		
	xxx274M290	xxx:265	27:2700K		

Mechanical Dimensions



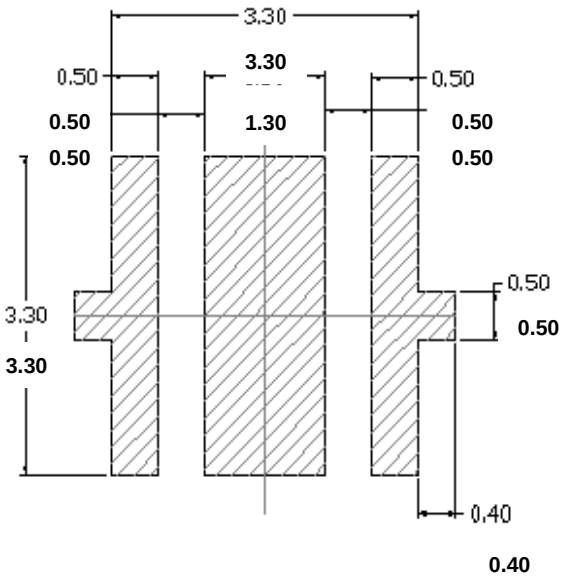


Circuit

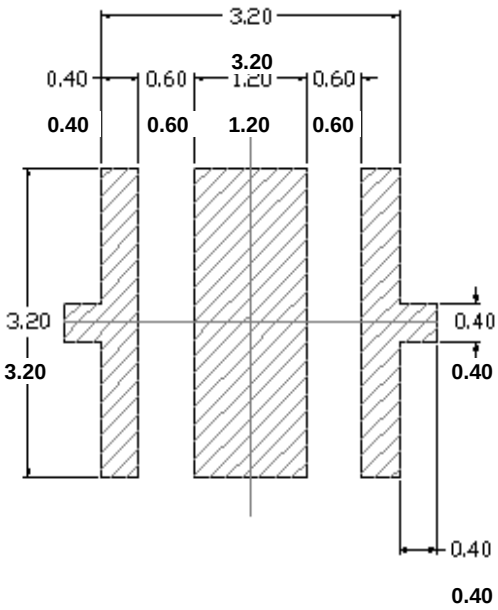


(1) All dimensions are in millimeters.
(2) Scale : none
(3) Undefined tolerance is ±0.1mm

Recommended Solder Pad



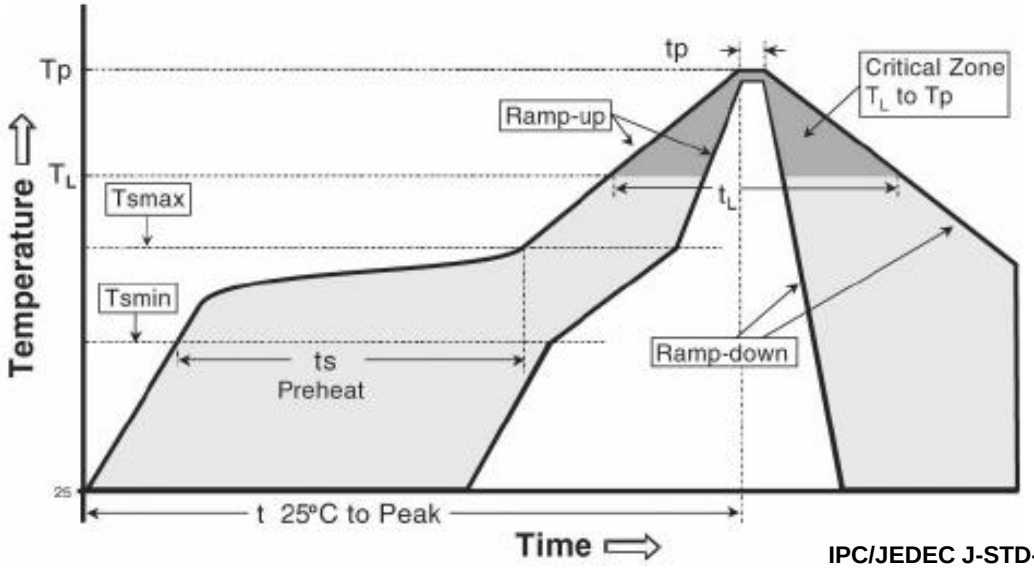
Recommended PCB Solder Pad



Recommended Stencil Pattern

(1) All dimensions are in millimeters.
(2) Scale : none
(3) This drawing without tolerances are for reference only.
(4) Undefined tolerance is ±0.1mm.

Reflow Soldering Characteristics



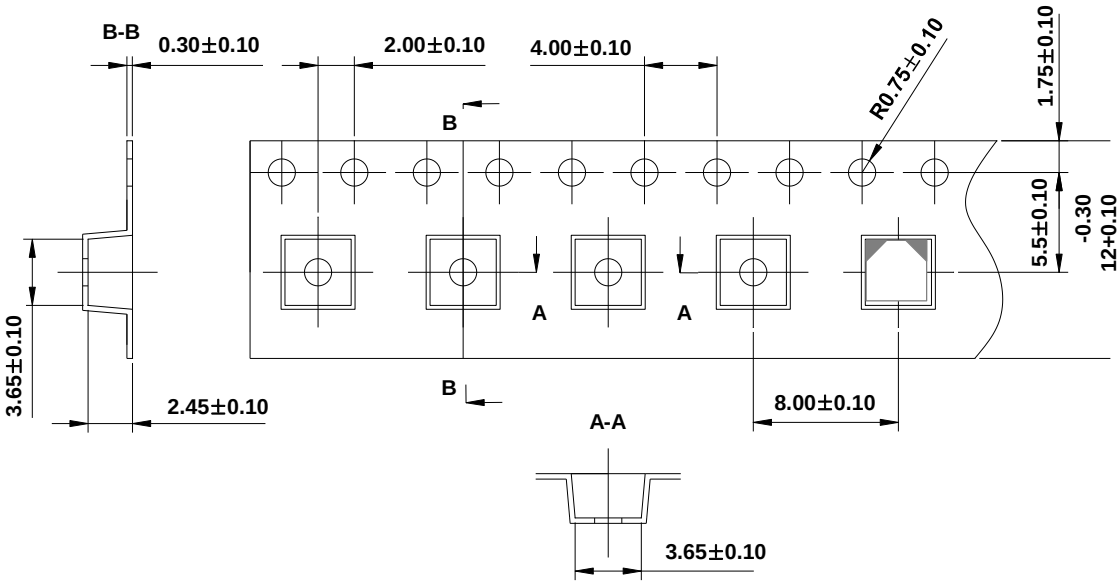
IPC/JEDEC J-STD-020

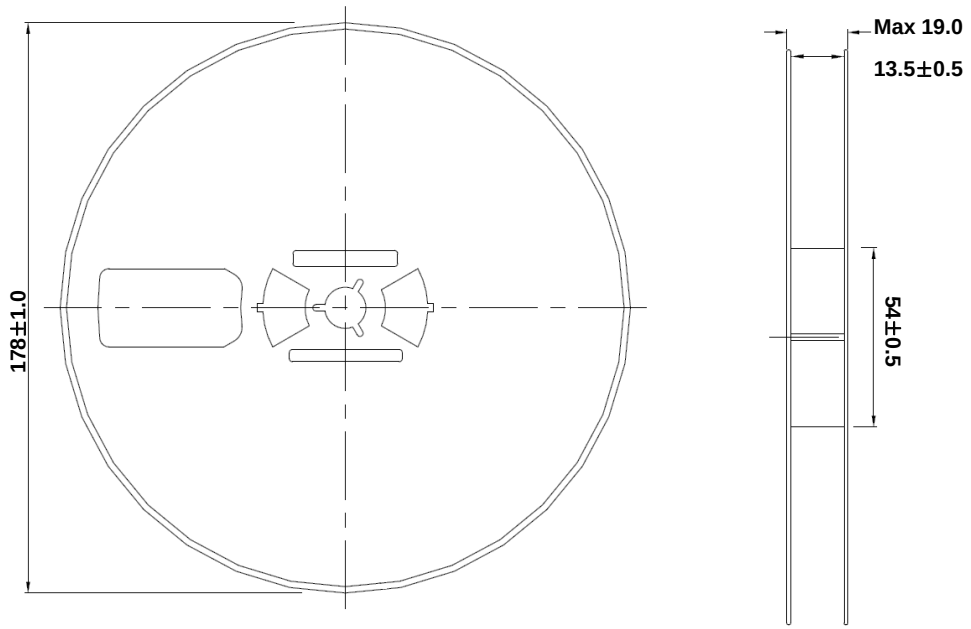
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (Tsmax to Tp)	3° C/second max.	3° C/second max.
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (Tsmin to Tsmax) (ts)	 100 °C 150 °C 60-120 seconds	 150 °C 200 °C 60-180 seconds
Time maintained above: - Temperature (TL) - Time (tL)	 183 °C 60-150 seconds	 217 °C 60-150 seconds
Peak Temperature (Tp)	215℃	260℃
Time within 5°C of actual Peak Temperature (tp)2	10-30 seconds	20-40 seconds
Ramp-down Rate	6 °C/second max.	6 °C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

Caution

(1) Reflow soldering is recommended not to be done more than two times. In the case of more than 24 hours passed soldering after first, LEDs will be damaged.
(2) Repairs should not be done after the LEDs have been soldered. When repair is unavoidable, suitable tools must be used.
(3) Die slug is to be soldered.
(4) When soldering, do not put stress on the LEDs during heating.
(5) After soldering, do not warp the circuit board.

Emitter Tape & Reel Packaging



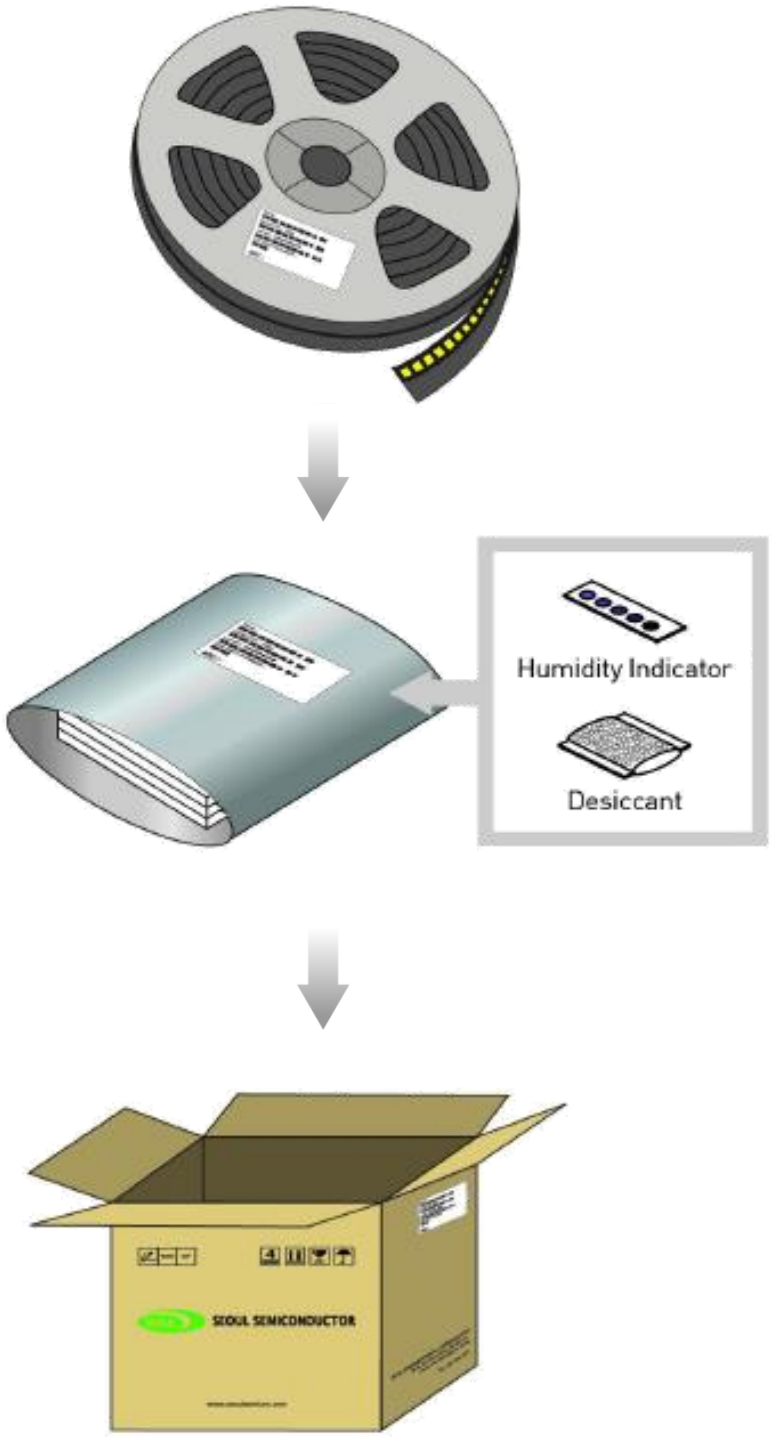


Notes :

UNIT: mm

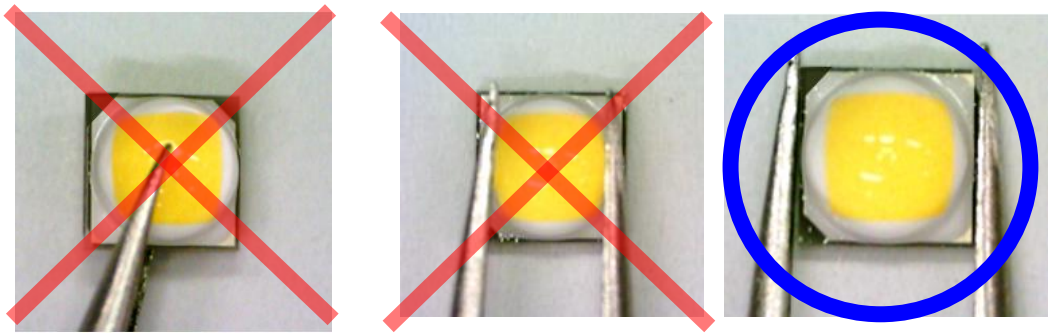
1. Quantity : 900pcs/Reel
2. Cumulative Tolerance : Cumulative Tolerance/10 pitches to be ±0.2mm
3. Adhesion Strength of Cover Tape : Adhesion strength to be 10-60g when the cover tape is turned off from the carrier tape at the angle of 10º to the carrier tape
4. Package : P/N, Manufacturing data Code No. and quantity to be indicated on a damp proof Package

Packaging Information



Handling of Silicone Resin for LEDs

(1) During processing, mechanical stress on the surface should be minimized as much as possible. Sharp objects of all types should not be used to pierce the sealing compound.



(2) In general, LED should only be handled from the side. By the way, this also applies to LED without a silicone sealant, since the surface can also become scratched.

(3) When populating boards in SMT production, there are basically no restrictions regarding the form of the pick and place nozzle, except that mechanical pressure on the surface of the resin must be prevented. This is assured by choosing a pick and place nozzle which is larger than the LED's reflector area.

(4) Silicone differs from materials conventionally used for the manufacturing of LEDs. These conditions must be considered during the handling of such devices. Compared to standard encapsulants, silicone is generally softer, and the surface is more likely to attract dust. As mentioned previously, the increased sensitivity to dust requires special care during processing. In cases where a minimal level of dirt and dust particles cannot be guaranteed, a suitable cleaning solution must be applied to the surface after the soldering of components.

(5) Seoul Semiconductor suggests using isopropyl alcohol for cleaning. In case other solvents are used, it must be assured that these solvents do not dissolve the package or resin. Ultrasonic cleaning is not recommended. Ultrasonic cleaning may cause damage to the LED.

(6) Please do not mold this product into another resin (epoxy, urethane, etc) and do not handle this product with acid or sulfur material in sealed space.

(7) Avoid leaving fingerprints on silicone resin parts.

Precaution for Use

(1) Storage

To avoid the moisture penetration, we recommend storing LED in a dry box with a desiccant . The recommended storage temperature range is 5℃ to 30℃ and a maximum humidity of RH50%.

(2) Use Precaution after Opening the Packaging

Use SMD techniques properly when solder the LED as separation of the lens may affect the light output efficiency.

Pay attention to the following:

a. Recommend conditions after opening the package

- Sealing / Temperature : 5 ~ 30℃ Humidity : less than RH60%

b. If the package has been opened more than 4 weeks **(MSL 2a)** or the color of the desiccant changes, components should be dried for 10-24hr at 65±5℃

(3) Do not apply mechanical force or excess vibration during the cooling process to normal temperature after soldering.

(4) Do not rapidly cool device after soldering.

(5) Components should not be mounted on warped (non coplanar) portion of PCB.

(6) Radioactive exposure is not considered for the products listed here in.

(7) Gallium arsenide is used in some of the products listed in this publication. These products are dangerous if they are burned or shredded in the process of disposal. It is also dangerous to drink the liquid or inhale the gas generated by such products when chemically disposed of.

(8) This device should not be used in any type of fluid such as water, oil, organic solvent and etc. When washing is required, IPA (Isopropyl Alcohol) should be used.

(9) When the LED are in operation the maximum current should be decided after measuring the package temperature.

(10) The appearance and specifications of the product may be modified for improvement without notice.

(11) Long time exposure of sunlight or occasional UV exposure will cause lens discoloration.

Precaution for Use

(12) VOCs (Volatile organic compounds) emitted from materials used in the construction of fixtures ca n penetrate silicone encapsulants of LED and discolor when exposed to heat and photonic energy. Th e result can be a significant loss of light output from the fixture. Knowledge of the properties of the mat erials selected to be used in the construction of fixtures can help prevent these issues.

(13) Attaching LEDs, do not use adhesives that outgas organic vapor.

(14) The driving circuit must be designed to allow forward voltage only when it is ON or OFF. If the rev erse voltage is applied to LED, migration can be generated resulting in LED damage.

(15) LED is sensitive to Electro-Static Discharge (ESD) and Electrical Over Stress (EOS). Below is a li st of suggestions that Seoul Semiconductor purposes to minimize these effects.

a. ESD (Electro Static Discharge)

Electrostatic discharge (ESD) is the defined as the release of static electricity when two objects come into contact. While most ESD events are considered harmless, it can be an expensive problem in many industrial environments during production and storage. The damage from ESD to an LED may c ause the product to demonstrate unusual characteristics such as:

- Increase in reverse leakage current lowered turn-on voltage
- Abnormal emissions from the LED at low current

The following recommendations are suggested to help minimize the potential for an ESD event.
One or more recommended work area suggestions:

- Ionizing fan setup
- ESD table/shelf mat made of conductive materials
- ESD safe storage containers

One or more personnel suggestion options:
- Antistatic wrist-strap
- Antistatic material shoes
- Antistatic clothes

Environmental controls:
- Humidity control (ESD gets worse in a dry environment)

Precaution for Use

b. EOS (Electrical Over Stress)

Electrical Over-Stress (EOS) is defined as damage that may occur when an electronic device is subjected to a current or voltage that is beyond the maximum specification limits of the device. The effects from an EOS event can be noticed through product performance like:

- Changes to the performance of the LED package
  (If the damage is around the bond pad area and since the package is completely encapsulated the package may turn on but flicker show severe performance degradation.)
- Changes to the light output of the luminaire from component failure
- Components on the board not operating at determined drive power

Failure of performance from entire fixture due to changes in circuit voltage and current across total circuit causing trickle down failures. It is impossible to predict the failure mode of every LED exposed to electrical overstress as the failure modes have been investigated to vary, but there are some common signs that will indicate an EOS event has occurred:

- Damaged may be noticed to the bond wires (appearing similar to a blown fuse)
- Damage to the bond pads located on the emission surface of the LED package
  (shadowing can be noticed around the bond pads while viewing through a microscope)
- Anomalies noticed in the encapsulation and phosphor around the bond wires.
- This damage usually appears due to the thermal stress produced during the EOS event.

c. To help minimize the damage from an EOS event Seoul Semiconductor recommends utilizing:

- A surge protection circuit
- An appropriately rated over voltage protection device
- A current limiting device

Company Information

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Company Information

Seoul Semiconductor (www.SeoulSemicon.com) manufacturers and packages a wide selection of light emitting diodes (LEDs) for the automotive, general illumination/lighting, Home appliance, signage and back lighting markets. The company is the world's fifth largest LED supplier, holding more than 10,000 patents globally, while offering a wide range of LED technology and production capacity in areas such as "nPola", "Acrich", the world's first commercially produced AC LED, and "Acrich MJT - Multi-Junction Technology" a proprietary family of high-voltage LEDs.

The company's broad product portfolio includes a wide array of package and device choices such as Acrich and Acirch2, high-brightness LEDs, mid-power LEDs, side-view LEDs, and through-hole type LEDs as well as custom modules, displays, and sensors.

Legal Disclaimer

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