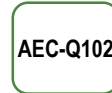


Superior high Flux for High Current System

**3014-SunLike**

**STW9E12WE-SA**



## Product Brief

### Description

- This White Colored surface-mount LED comes in standard package dimension. Package Size : 3.0 × 1.4 × 0.52mm
- 
- It has a substrate made up of a molded plastic reflector sitting on top of a lead frame.
- The die is attached within the reflector cavity and the cavity is encapsulated by silicone.
- The package design coupled with careful selection of component materials allow these products to perform with high reliability.

### Features and Benefits

- High Lumen Output and Efficacy
- ESD Class H3A
- Viewing angle 120°
- High Color Quality
- AEC-Q102 Qualified
- RoHS compliant

### Key Applications

- Automotive system

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## Performance Characteristics

**Table 1. Electro Optical Characteristics,  $I_F=65\text{mA}$  ,  $T_j = 25^\circ\text{C}$ , RH30%**

Parameter	Symbol	Min	Typ	Max	Unit
Forward Voltage <sup>[1]</sup>	$V_F$	2.8	3.0	3.1	V
Luminous Intensity(5000K) <sup>[2] [1]</sup>	$\Phi_V$	5.5 (18.8)	6.5 (22.2)	8.0 (27.4)	cd (lm)
CRI	$R_a$	95			-
Viewing Angle <sup>[3]</sup>	$2\theta_{1/2}$		120		deg.
Reverse voltage	$I_R$	Not designed for reverse operation			
Real thermal resistance <sup>[4]</sup>	$R_{th JS real}$		33	38	K / W
Electrical thermal resistance <sup>[4]</sup>	$R_{th JS el}$		20	23	K / W

**Notes :**

- (1) Tolerance :  $V_F : \pm 0.1\text{V}$ ,  $I_V : \pm 7\%$ ,  $C_x, C_y : \pm 0.007$
  - (2) The luminous flux was measured at the peak of the spatial pattern which may not be aligned with the mechanical axis of the LED package.
  - (3)  $\Theta_{1/2}$  is the off-axis where the luminous intensity is 1/2 of the peak intensity
  - (4) Thermal resistance =  $R_{th JS}$  : Junction/solder point .  $R_{th max}$  is based on statistic values
- ※ Not applicable for reverse operation

\* No values are provided by real measurement. Only for reference purpose.

## Performance Characteristics

**Table 2. Absolute Maximum Ratings  $T_j = 25^\circ\text{C}$ , RH30%**

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Forward Current <sup>[1]</sup>	$I_F$	-	-	150	mA
Power Dissipation	$P_d$	-	-	0.48	W
Reverse Voltage	$V_R$	Not designed for reverse operation			V
Junction Temperature	$T_j$	-	-	125	$^\circ\text{C}$
Operating Temperature	$T_{opr}$	- 40	-	110	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	- 40	-	110	$^\circ\text{C}$
Surge current ( $t \leq 10\mu\text{s}$ , $D=0.005$ , $T_s=25^\circ\text{C}$ )	$I_{FM}$	300			mA
Soldering Temperature	$T_{sld}$	Reflow Soldering : $260^\circ\text{C}$ for 10sec. Hand Soldering : $315^\circ\text{C}$ for 4sec.			
ESD <sup>[2]</sup>		ESD Class H3A (JESD22-A114-E)			

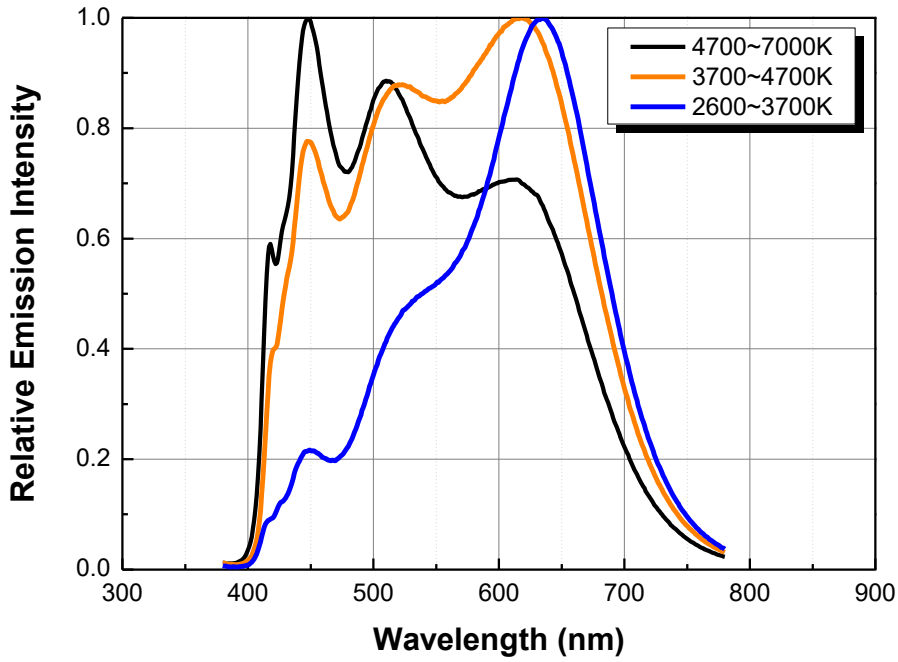
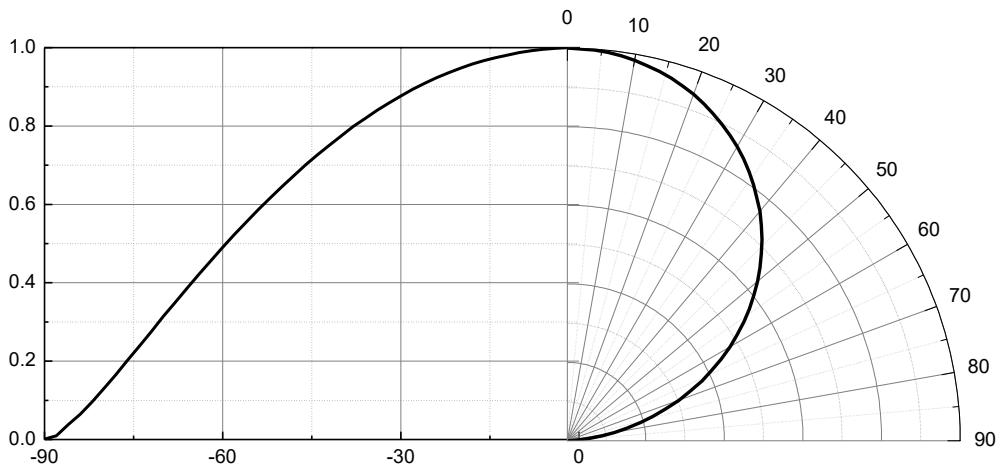
**Notes :**

(1) At Junction Temperature  $25^\circ\text{C}$  condition.

(2) A ESD Protection device is included for protection.

- LED's properties might be different from suggested values like above and below tables if operation condition will be exceeded our parameter range. Care is to be taken that power dissipation does not exceed the absolute maximum rating of the product.
- All measurements were made under the standardized environment of Seoul Semiconductor.

## Relative Spectral Distribution

**Fig 1. Color Spectrum,  $T_s=25^\circ\text{C}$ ,  $I_F=65\text{mA}$** 

**Fig.2 Viewing Angle Distribution,  $I_F = 65\text{mA}$** 


## Forward Current Characteristics

Fig 3. Forward Voltage vs. Forward Current,  $T_j = 25^\circ\text{C}$

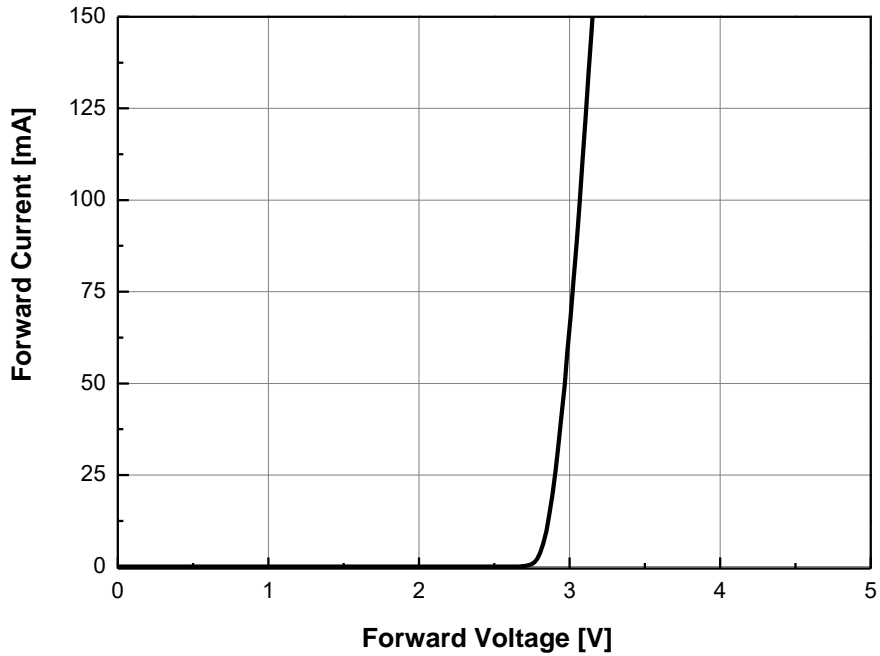
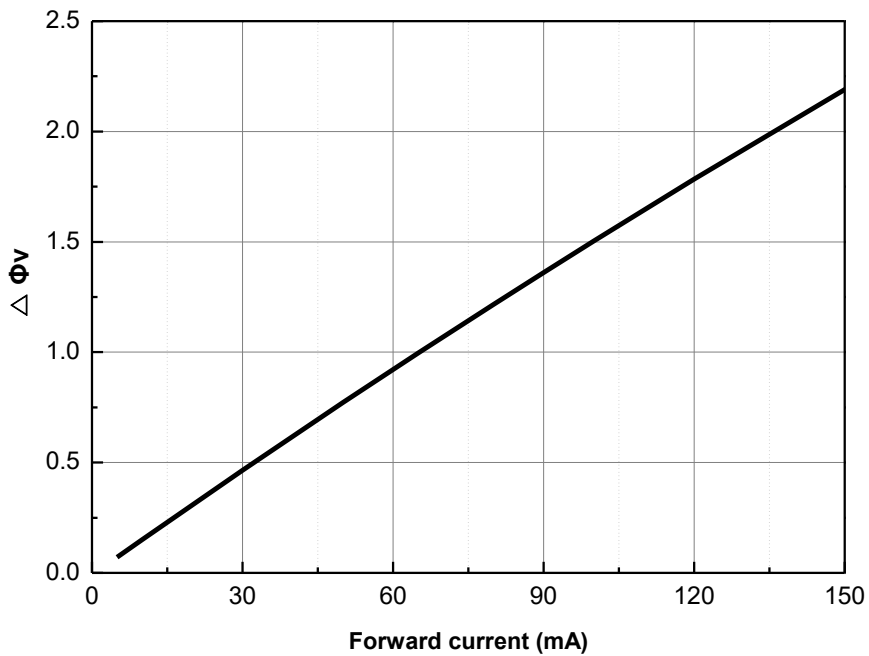


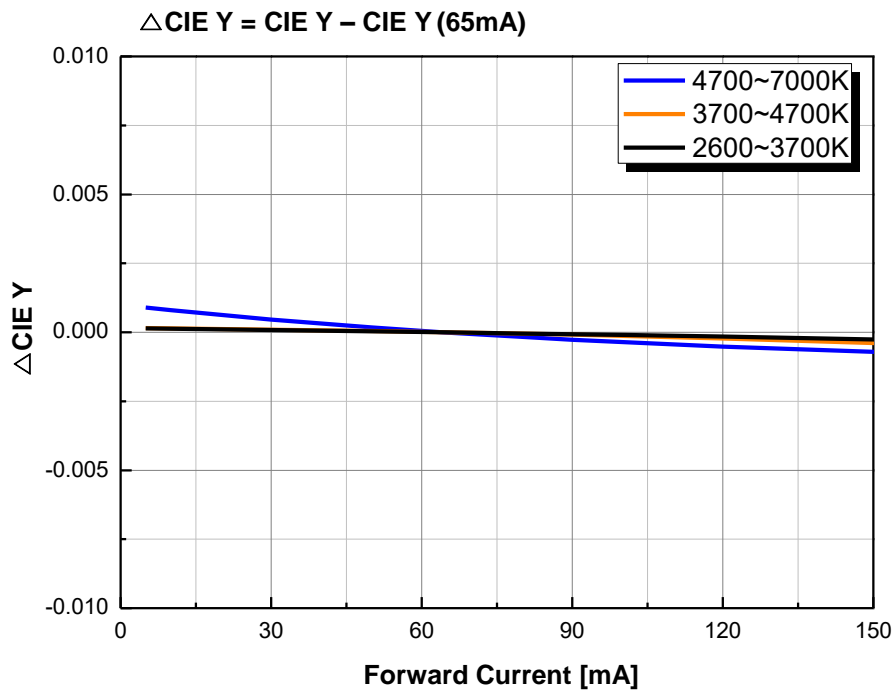
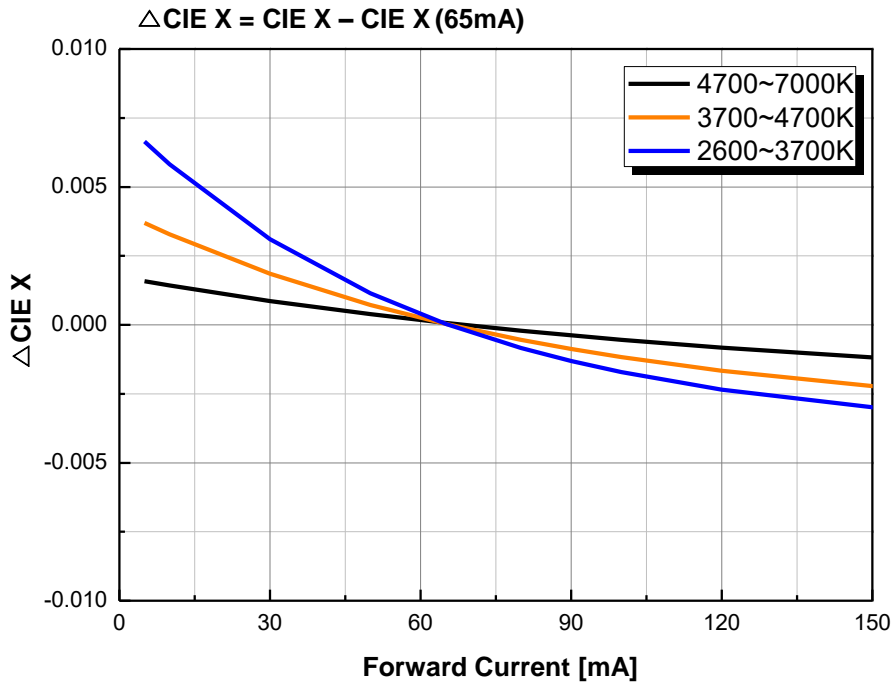
Fig 4. Forward Current vs. Relative Luminous Intensity,  $T_j = 25^\circ\text{C}$

$$\Delta LF = \Phi_v / \Phi_v(65\text{mA})$$



## Forward Current Characteristics

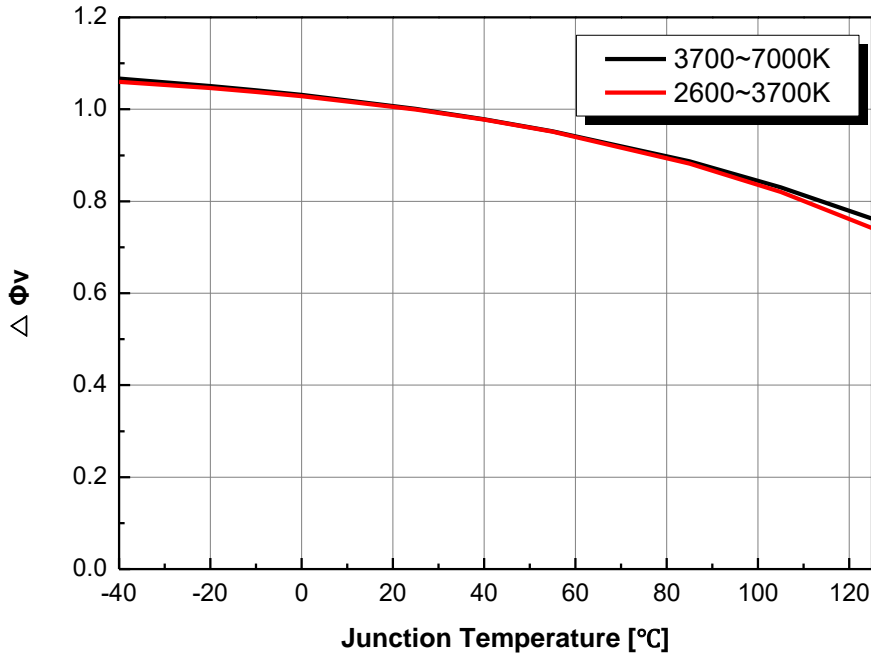
Fig 5. Forward Current vs. CIE X, Y Shift ,  $T_j = 25^\circ\text{C}$



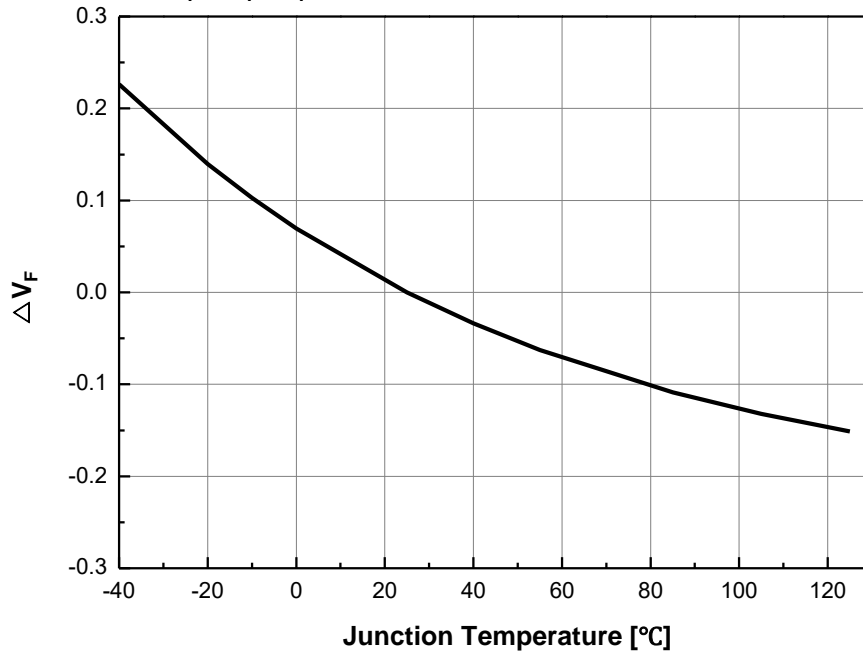
## Junction Temperature Characteristics

**Fig 6. Relative Light Output vs. Junction Temperature,  $I_F = 65\text{mA}$** 

$$\Delta LF = \Phi_V / \Phi_V(25^\circ\text{C})$$


**Fig 7. Relative Forward vs. Junction Temperature,  $I_F = 65\text{mA}$** 

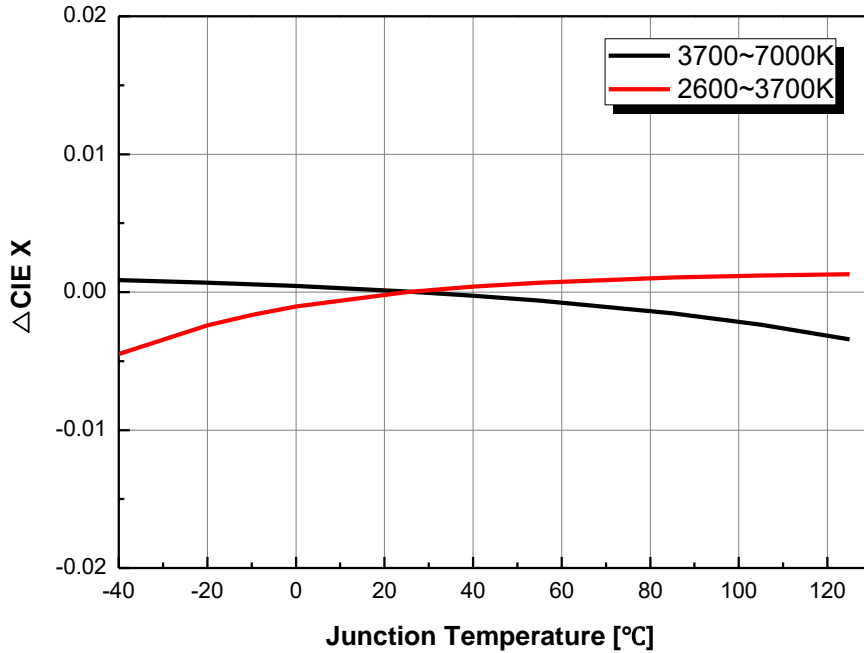
$$\Delta V_F = V_F - V_F(25^\circ\text{C})$$



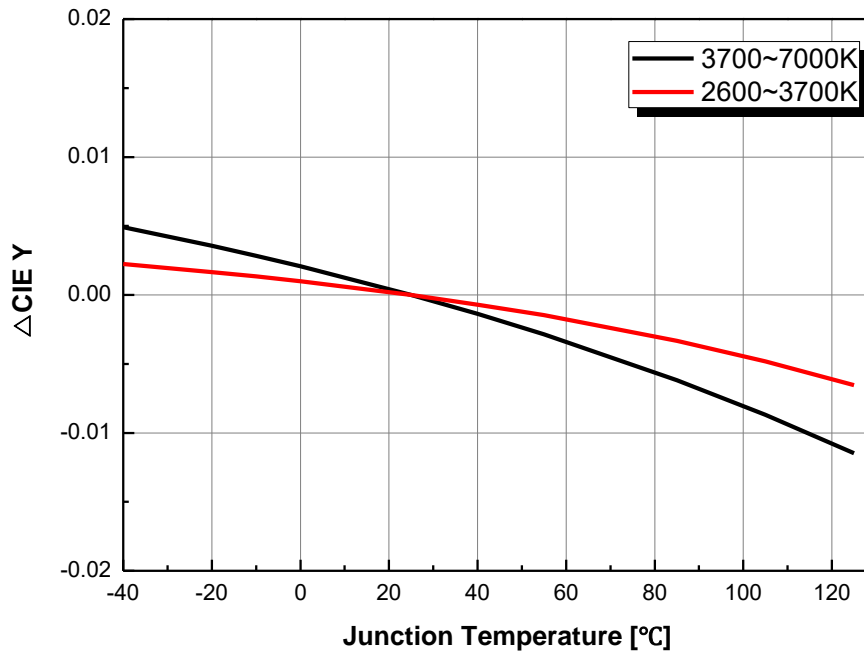
## Junction Temperature Characteristics

**Fig 8. Junction Temperature vs CIE X, Y shift ,  $I_F = 65\text{mA}$** 

$$\Delta \text{CIE X} = \text{CIE X} - \text{CIE X} (25^\circ\text{C})$$

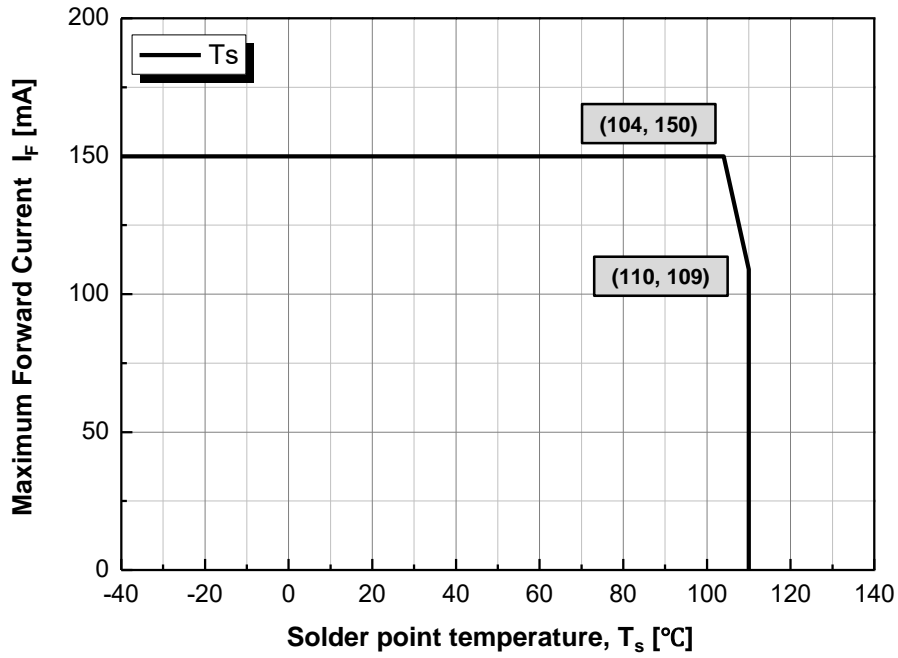


$$\Delta \text{CIE Y} = \text{CIE Y} - \text{CIE Y} (25^\circ\text{C})$$



## Ambient Temperature Characteristics

Fig 9. Maximum Forward Current vs. Solder point Temperature,  $T_j(\text{max.}) = 125^\circ\text{C}$



## Color Bin Structure

**Table 3. Bin Code description (@ $I_F=65mA$ ,  $T_J=25^\circ C$ )**

Part Number	Luminous Intensity [cd] (Luminous flux [lm])			Color Chromaticity Coordinate	Forward voltage [V]		
	Bin Code	Min.	Max.		Bin Code	Min.	Max.
STW9E12WE-SA	N	5.5 (18.8)	6.0 (20.5)		Y2	2.8	2.9
	P0	6.0 (20.5)	6.5 (22.2)		Y3	2.9	3.0
	P5	6.5 (22.2)	7.0 (23.9)		Z1	3.0	3.1
	Q0	7.0 (23.9)	7.5 (25.7)				
	Q5	7.5 (25.7)	8.0 (27.4)				

**Table 4. Intensity & Flux Rank Distribution**

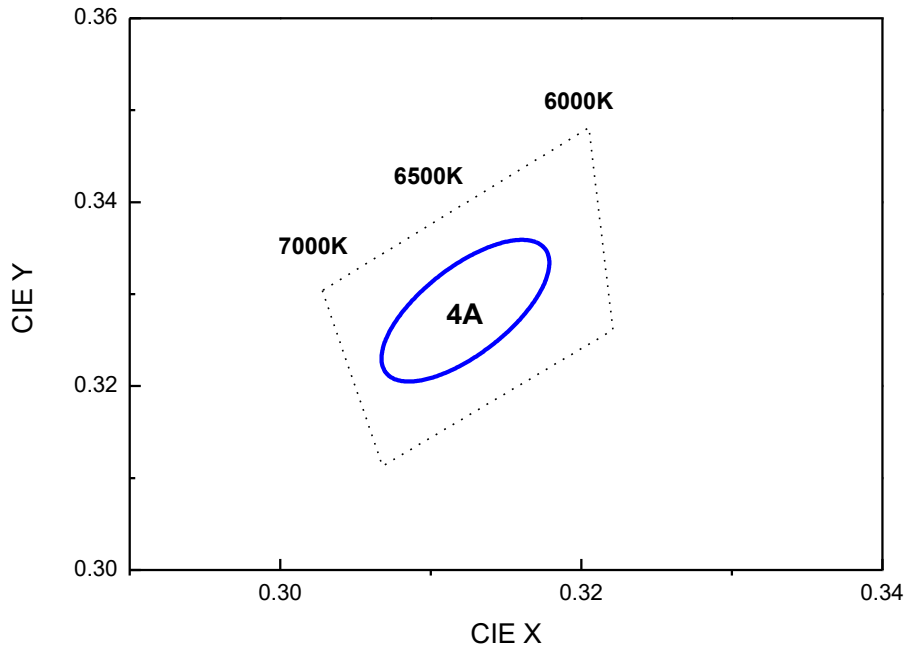
Available Rank

CCT	CIE	IV Rank			
6000 ~ 7000K	4A	P0	P5	Q0	Q5
4200K	4EL	P0	P5	Q0	Q5
2600 ~ 2900K	4H	N	P0	P5	Q0

(1) Available flux rank is depending on wavelength

## Color Bin Structure

CIE Chromaticity Diagram (Cool white),  $T_j=25^\circ\text{C}$ ,  $I_f=65\text{mA}$



### 6500K 4Step

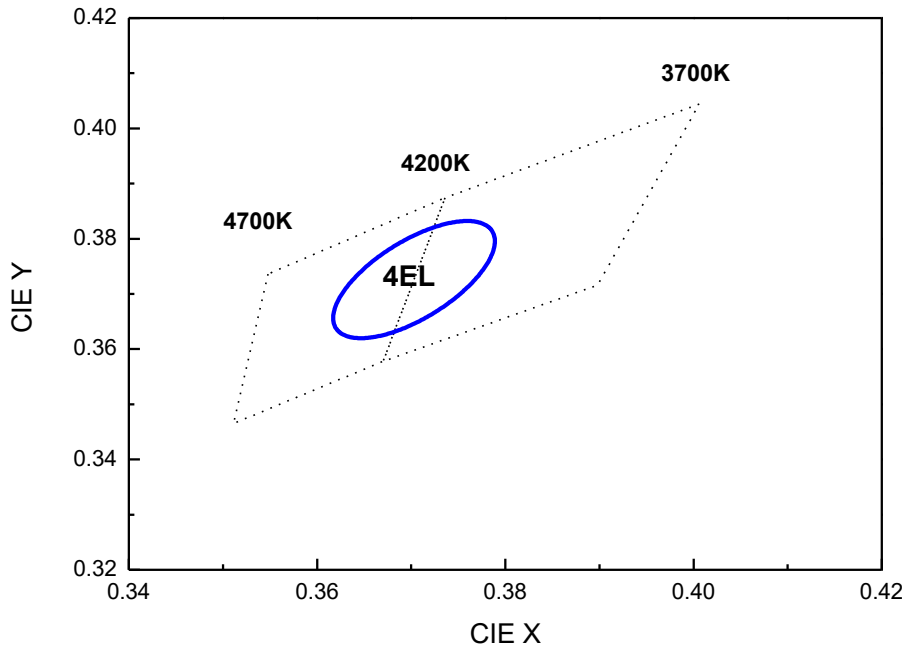
4A	
Center point	0.3123 : 0.3282
Major Axis a	0.0088
Minor Axis b	0.0036
Ellipse Rotation Angle	58

A	
CIE X	CIE Y
0.3028	0.3304
0.3068	0.3113
0.3221	0.3261
0.3205	0.3481

(1) Available flux rank is depending on wavelength

## Color Bin Structure

CIE Chromaticity Diagram (Cool white),  $T_j=25^{\circ}\text{C}$ ,  $I_F=65\text{mA}$



**4200K 4Step**

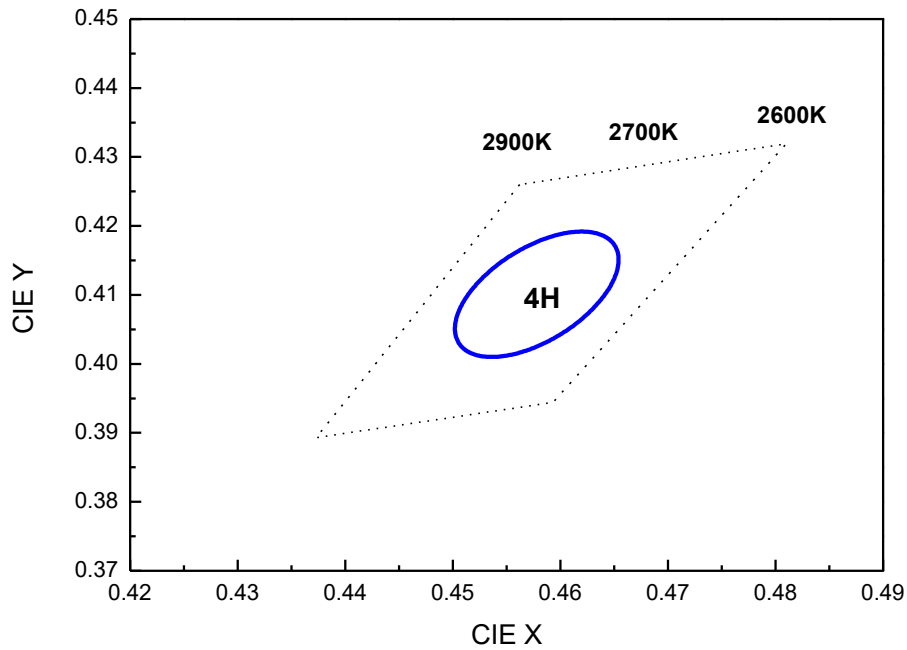
4EL	
Center point	0.3703 : 0.3726
Major Axis a	0.0125
Minor Axis b	0.00535
Ellipse Rotation Angle	54

D		E	
CIE X	CIE Y	CIE X	CIE Y
0.3548	0.3736	0.3736	0.3874
0.3511	0.3465	0.3670	0.3578
0.3670	0.3578	0.3898	0.3716
0.3736	0.3874	0.4006	0.4044

(1) Available flux rank is depending on wavelength

## Color Bin Structure

CIE Chromaticity Diagram (Cool white),  $T_j=25^\circ\text{C}$ ,  $I_F=65\text{mA}$

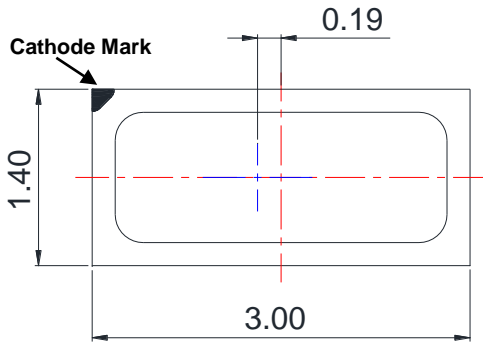
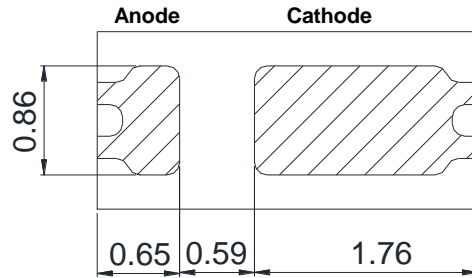
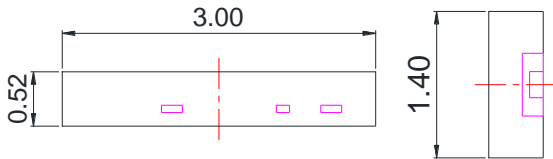


### 2700K 4Step

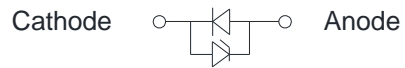
4H	
Center point	0.4578 : 0.4101
Major Axis a	0.0105
Minor Axis b	0.0055
Ellipse Rotation Angle	54

H	
CIE X	CIE Y
0.4562	0.4260
0.4373	0.3893
0.4593	0.3944
0.4810	0.4319

## Mechanical Dimensions

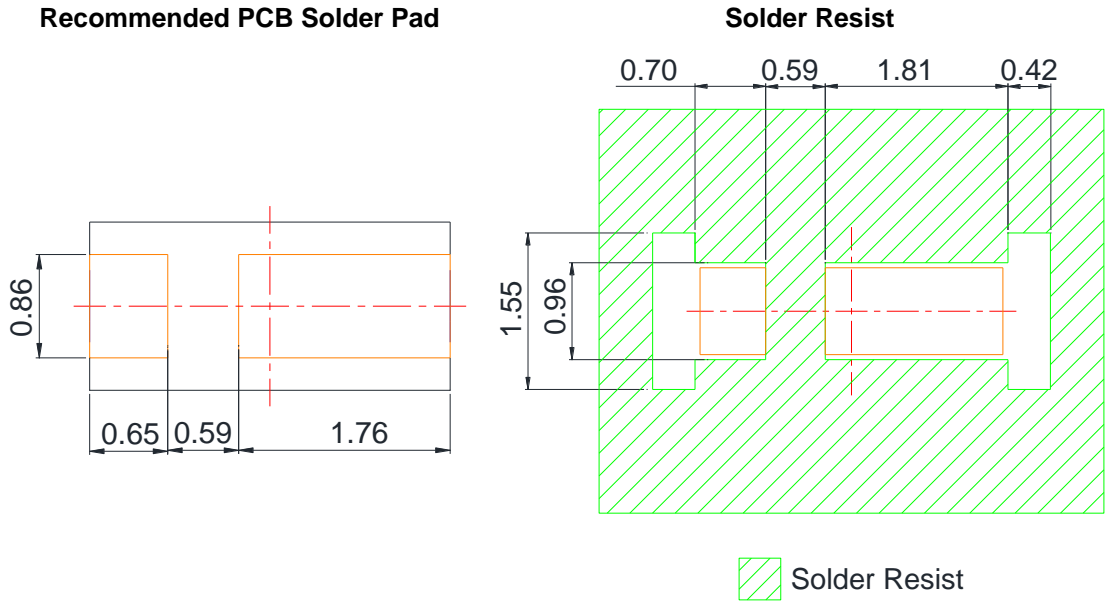
**Top View**

**Bottom View**

**Side View**


- PKG Center
- Optic Center

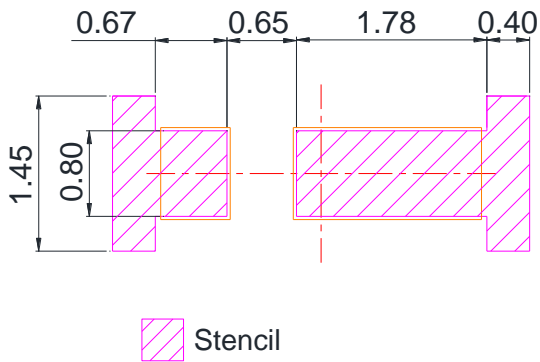
**Circuit**

**Notes :**

- (1) All dimensions are in millimeters.
- (2) Scale : none
- (3) Undefined tolerance is  $\pm 0.1\text{mm}$

## Recommended Solder Pad



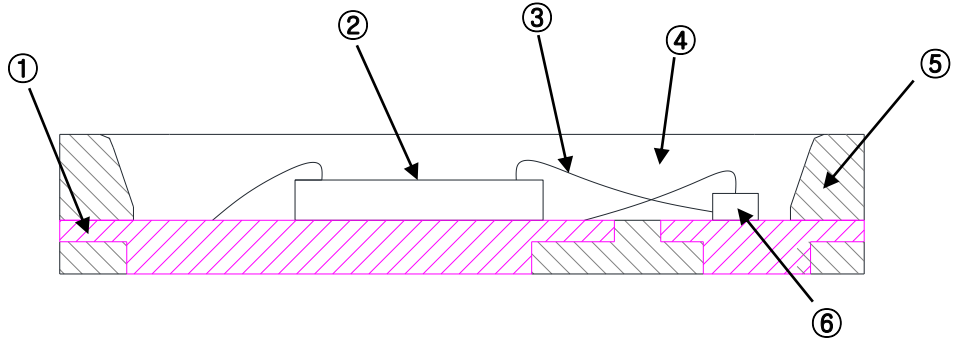
### Recommended Stencil Pattern



### Notes :

- (1) All dimensions are in millimeters.
- (2) Scale : none
- (3) This drawing without tolerances are for reference only.
- (4) Undefined tolerance is  $\pm 0.1\text{mm}$ .

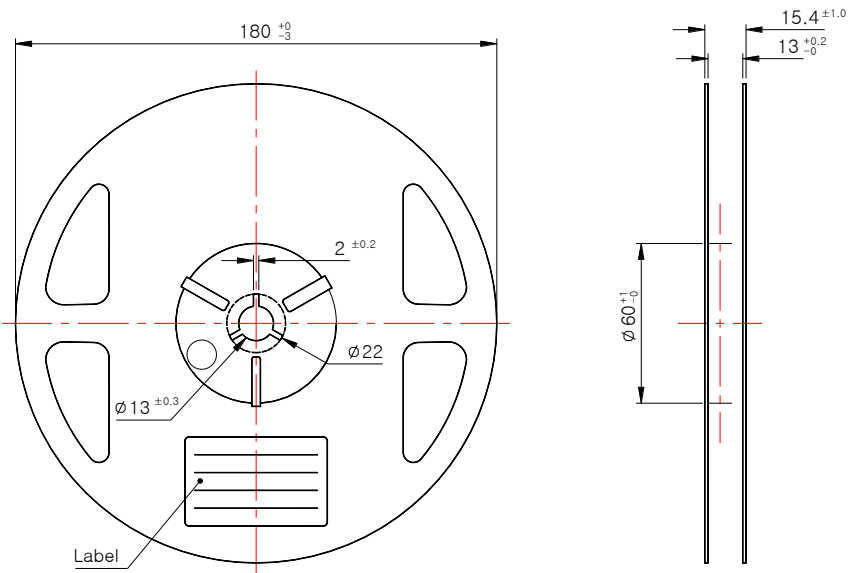
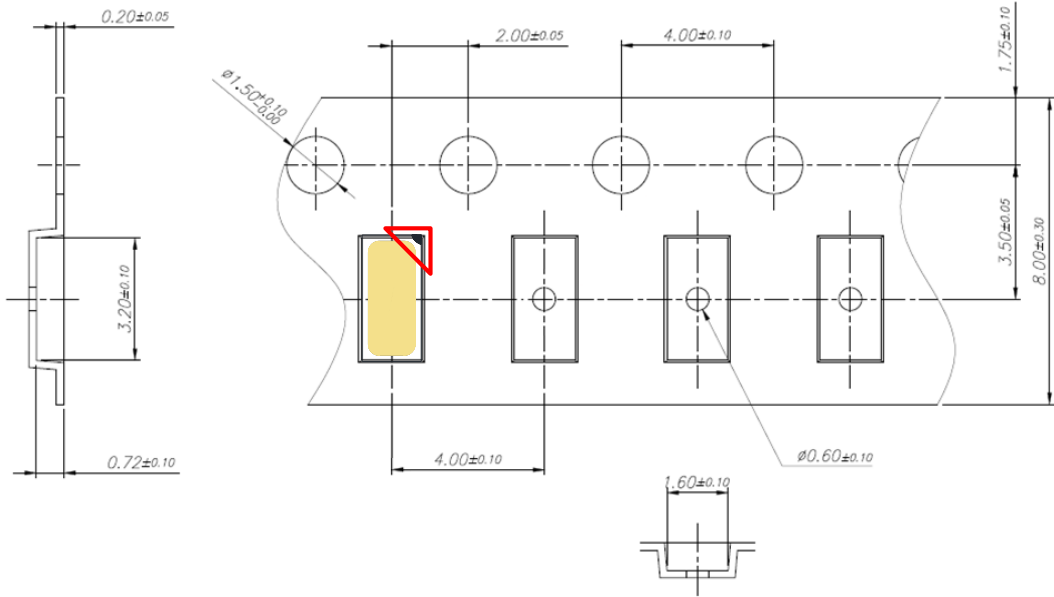
## Mechanical Dimensions



Parts No.	Name	Description	Materials
①	Substrate	Metal	Copper Alloy (Ag Plated)
②	Chip Source		
③	Wire	Metal	Au
④	Encapsulation	Silicone + Phosphor	
⑤	Body		Epoxy Molding Compound
⑥	ESD Protection Device	Si	-

**Notes :**

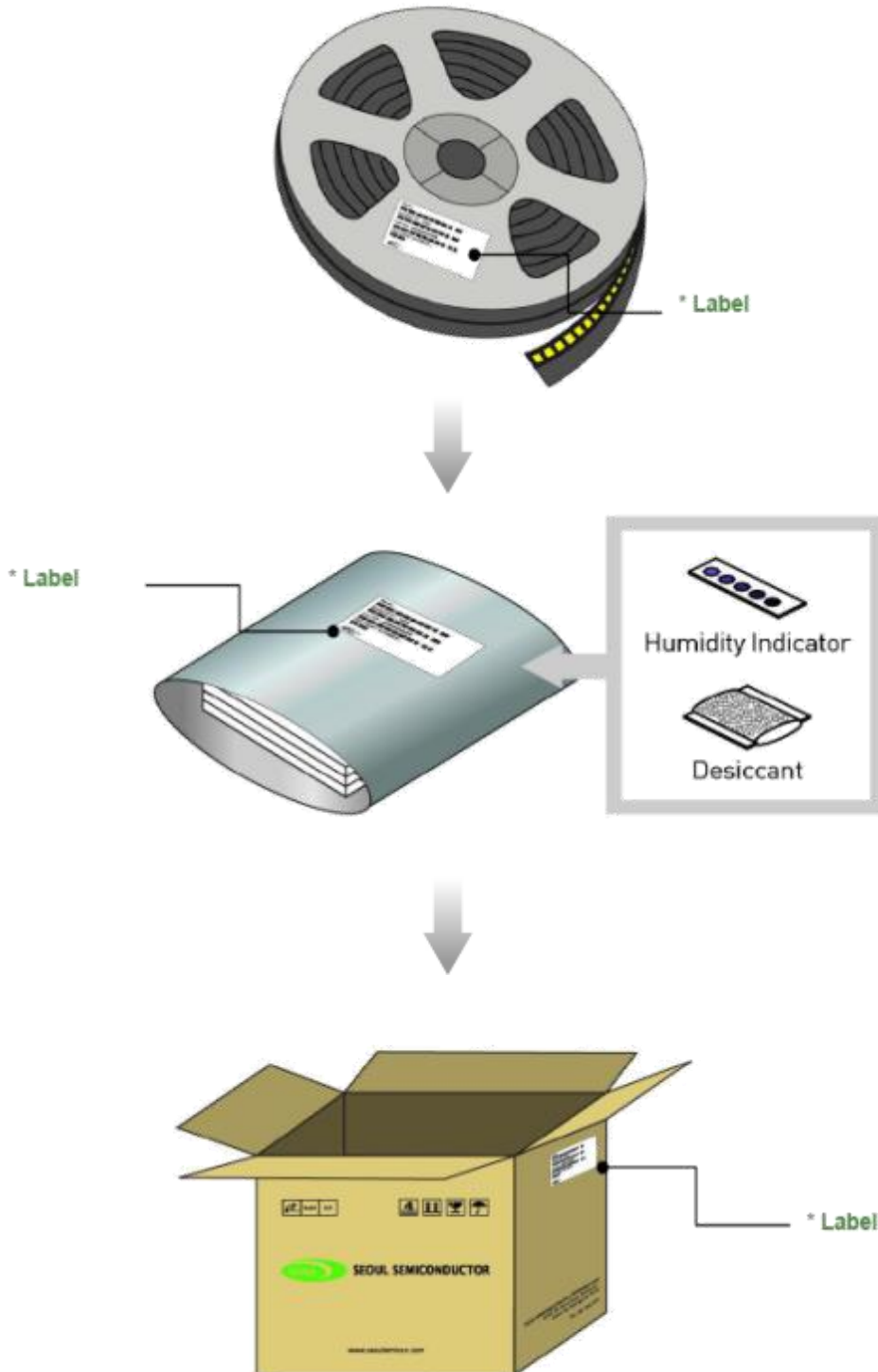
## Emitter Tape & Reel Packaging



( Tolerance:  $\pm 0.2$ , Unit: mm )

- (1) Quantity : 5000pcs/Reel
- (2) Cumulative Tolerance : Cumulative Tolerance/10 pitches to be  $\pm 0.2$ mm
- (3) Adhesion Strength of Cover Tape  
Adhesion strength to be 0.1-0.7N when the cover tape is turned off from the carrier tape at the angle of  $10^\circ$  to the carrier tape.
- (4) Package : P/N, Manufacturing data Code No. and Quantity to be indicated on a damp proof Package.

# Emitter Tape & Reel Packaging




## Product Nomenclature


**RANK : Z<sub>1</sub>Z<sub>1</sub>Z<sub>2</sub>Z<sub>2</sub>Z<sub>3</sub>Z<sub>3</sub>**

**QUANTITY : 5000**

**LOT NUMBER : Y<sub>1</sub>Y<sub>1</sub>Y<sub>2</sub>Y<sub>3</sub>Y<sub>3</sub>Y<sub>4</sub>Y<sub>5</sub>Y<sub>5</sub>Y<sub>5</sub> - Y<sub>6</sub>Y<sub>6</sub>Y<sub>6</sub> - Y<sub>7</sub>Y<sub>7</sub>Y<sub>7</sub> - Y<sub>8</sub>Y<sub>8</sub>Y<sub>8</sub>Y<sub>8</sub>Y<sub>8</sub>**



**SSC PART NUMBER : X<sub>1</sub>X<sub>2</sub>X<sub>3</sub>X<sub>4</sub>X<sub>5</sub>X<sub>6</sub>X<sub>7</sub>X<sub>8</sub>X<sub>9</sub>-X<sub>10</sub>X<sub>11</sub>**



**Table 4. Part Numbering System : X<sub>1</sub>X<sub>2</sub>X<sub>3</sub>X<sub>4</sub>X<sub>5</sub>X<sub>6</sub>X<sub>7</sub>X<sub>8</sub>X<sub>9</sub>-X<sub>10</sub>X<sub>11</sub>**

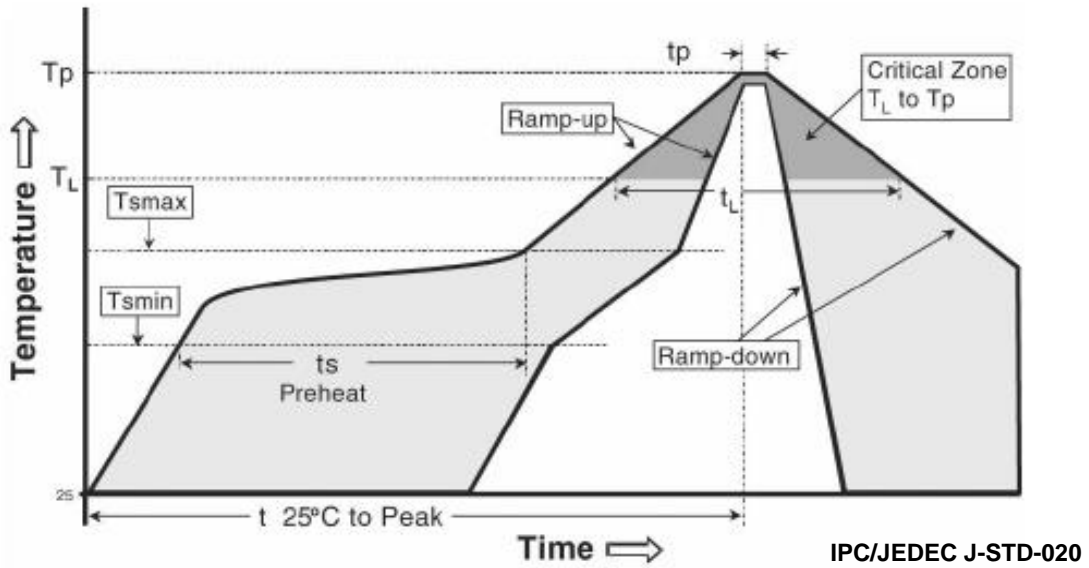
Part Number Code	Description	Part Number	Value
X <sub>1</sub>	Company	S	
X <sub>2</sub>	Top View LED series	T	
X <sub>3</sub> X <sub>4</sub>	Color Specification	W9	CRI 90
X <sub>5</sub>	Package series	E	3014 series
X <sub>6</sub> X <sub>7</sub> X <sub>8</sub> X <sub>9</sub>	Characteristic code	12WE	
X <sub>10</sub> X <sub>11</sub>	Product revision	SA	Sunlike

**Table 5. Lot Numbering System : Y<sub>1</sub>Y<sub>2</sub>Y<sub>3</sub>Y<sub>4</sub>Y<sub>5</sub>Y<sub>6</sub>Y<sub>7</sub>Y<sub>8</sub>Y<sub>9</sub>Y<sub>10</sub>-Y<sub>11</sub>Y<sub>12</sub>Y<sub>13</sub>Y<sub>14</sub>Y<sub>15</sub>Y<sub>16</sub>Y<sub>17</sub>**

Lot Number Code	Description
Y <sub>1</sub> Y <sub>2</sub>	Year
Y <sub>3</sub>	Month
Y <sub>4</sub> Y <sub>5</sub>	Day
Y <sub>6</sub>	Top View LED series
Y <sub>7</sub> Y <sub>8</sub> Y <sub>9</sub> Y <sub>10</sub>	Mass order
Y <sub>11</sub> Y <sub>12</sub> Y <sub>13</sub> Y <sub>14</sub> Y <sub>15</sub> Y <sub>16</sub> Y <sub>17</sub>	Internal Number

[1] Z<sub>1</sub>: Flux rank   Z<sub>2</sub>: Chromaticity   Z<sub>3</sub>: VF rank

## Reflow Soldering Characteristics


**Table 6.**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T <sub>max</sub> to T <sub>p</sub> )	3° C/second max.	3° C/second max.
Preheat - Temperature Min (T <sub>min</sub> ) - Temperature Max (T <sub>max</sub> ) - Time (T <sub>min</sub> to T <sub>max</sub> ) (t <sub>s</sub> )	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-180 seconds
Time maintained above: - Temperature (T <sub>L</sub> ) - Time (t <sub>L</sub> )	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak Temperature (T <sub>p</sub> )	215°C	260°C
Time within 5°C of actual Peak Temperature (t <sub>p</sub> ) <sup>2</sup>	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

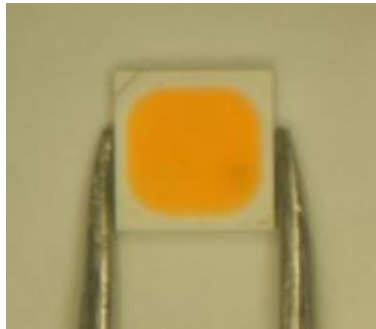
- (1) Reflow soldering is recommended not to be done more than two times. In the case of more than 24 hours passed soldering after first, LEDs will be damaged.
- (2) Repairs should not be done after the LEDs have been soldered. When repair is unavoidable, suitable tools must be used.
- (3) When soldering,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

## 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, LEDs should only be handled from the side. By the way, this also applies to LEDs 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) SSC 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.

## Precaution for Use

### (1) Storage

To avoid the moisture penetration, we recommend storing Z5 Series LEDs in a dry box with a desiccant. The recommended storage temperature range is 5°C to 30°C and a maximum humidity of RH50%.

### (2) Use Precaution after Opening the Packaging

Use proper SMT techniques when the LED is to be soldered dipped 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°C Humidity : less than RH60%

#### b. If the package has been opened more than 1 year (MSL\_2) or the color of the desiccant changes, components should be dried for 10-24hr at 65±5°C

(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 LEDs are in operation the maximum current should be decided after measuring the package temperature.

(10) LEDs must be stored in a clean environment. We recommend LEDs store in nitrogen-filled container.

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

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

## Precaution for Use

(13) VOCs (Volatile organic compounds) emitted from materials used in the construction of fixtures can penetrate silicone encapsulants of LEDs and discolor when exposed to heat and photonic energy. The result can be a significant loss of light output from the fixture. Knowledge of the properties of the materials selected to be used in the construction of fixtures can help prevent these issues.

(14) The slug is electrically isolated.

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

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

(17) LEDs are sensitive to Electro-Static Discharge (ESD) and Electrical Over Stress (EOS). Below is a list of suggestions that Seoul Semiconductor purposes to minimize these effects.

### a. ESD (Electro Static Discharge)

Electrostatic discharge (ESD) is 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 LEDs may cause 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](http://www.SeoulSemicon.com)) manufactures 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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## Revision History

Revision	Date	Page	Remarks
0.0	01. Sep 2020	All	Preliminary establishment
0.1	26. Feb 2021	14	H rank 추가
0.2	01. June 2021	All	3014B Lead Frame 특성 반영
0.3	08. July 2021	11	VF 랭크 변경
1.0	09. Aug 2021	All	Datasheet 정식 버전
1.1	11.Dec.2024	18, 20	Change the reel quantity
1.2	04.Feb.2025	11	Add Table 4. Intensity & Flux Rank Distribution