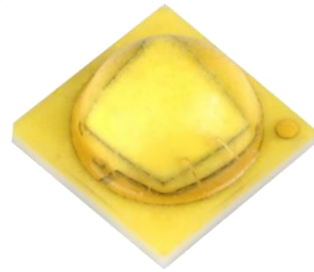


Superior Efficacy & Lumen output with Small Form Factor

High-Power LED – Z5-M2

S1W0-3535xx7003-00000000-00001

(Cool, Neutral, Warm)



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
- Wide CCT range 2600~7000K
- High Color quality with CRI Min.80(R9>0)
- ANSI compliant Binning
- RoHS compliant

Key Applications

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

Table 1. Product Selection Table

Reference Code	Color	Nominal CCT	Part Number	CRI	
				Min	
SZ5-M2-W0-00	Cool White	6500K	S1W0-3535657003-00000000-00001	70	
		5700K	S1W0-3535577003-00000000-00001		
		5000K	S1W0-3535507003-00000000-00001		
SZ5-M2-WN-00	Neutral White	4500K	S1W0-3535457003-00000000-00001		
		4000K	S1W0-3535407003-00000000-00001		
		3500K	S1W0-3535357003-00000000-00001		
SZ5-M2-WW-00	Warm White	3000K	S1W0-3535307003-00000000-00001		
		2700K	S1W0-3535277003-00000000-00001		
		6500K	S1W0-3535658003-00000000-00001		
SZ5-M2-W0-C8	Cool White	5700K	S1W0-3535578003-00000000-00001	80	
		5000K	S1W0-3535508003-00000000-00001		
		4500K	S1W0-3535458003-00000000-00001		
SZ5-M2-WN-C8	Neutral White	4000K	S1W0-3535408003-00000000-00001		
		3500K	S1W0-3535358003-00000000-00001		
		3000K	S1W0-3535308003-00000000-00001		
SZ5-M2-WW-C8	Warm White	2700K	S1W0-3535278003-00000000-00001		
		3500K	S1W0-3535359003-00000000-00001		90
		3000K	S1W0-3535309003-00000000-00001		
SZ5-M2-WW-C9	Warm White	2700K	S1W0-3535279003-00000000-00001		

Table of Contents

Index	
• Product Brief	1
• Table of Contents	2
• Performance Characteristics	3
• Characteristics Graph	5
• Color Bin Structure	10
• Mechanical Dimensions	20
• Recommended Solder Pad	21
• Reflow Soldering Characteristics	22
• Packaging Information	23
• Product Nomenclature	25
• Handling of Silicone Resin for LEDs	26
• Precaution For Use	27
• Company Information	30

Performance Characteristics

Table 2. Product Selection Guide

Min. CRI, R _a ^[4]	Nominal CCT [K] ^[1]	Min. Flux [lm]	Typ. Luminous Flux Φ _v ^[3] [lm]			Typ. Luminous Efficacy [lm/W] @700mA	Part Number
			700mA	1000mA	1500mA		
			70				
	6500	275	287	371	488	140	S1W0 - 3535657003-00000000-00001
	5700	278	290	374	494	142	S1W0 - 3535577003-00000000-00001
	5000	282	294	380	500	144	S1W0 - 3535507003-00000000-00001
	4500	280	292	377	497	143	S1W0 - 3535457003-00000000-00001
	4000	280	292	377	497	143	S1W0 - 3535407003-00000000-00001
	3500	249	261	337	444	128	S1W0 - 3535357003-00000000-00001
	3000	250	262	338	446	128	S1W0 - 3535307003-00000000-00001
	2700	242	254	328	432	124	S1W0 - 35353277003-00000000-00001
80							
	6500	255	267	345	454	131	S1W0 - 3535658003-00000000-00001
	5700	258	270	349	459	132	S1W0 - 3535578003-00000000-00001
	5000	262	274	354	466	134	S1W0 - 3535508003-00000000-00001
	4500	238	250	323	425	122	S1W0 - 3535458003-00000000-00001
	4000	238	250	323	425	122	S1W0 - 3535408003-00000000-00001
	3500	217	229	296	390	112	S1W0 - 3535358003-00000000-00001
	3000	218	230	297	391	113	S1W0 - 3535308003-00000000-00001
	2700	214	226	292	385	111	S1W0 - 35353278003-00000000-00001

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.

Performance Characteristics

Table 2. Product Selection Guide

Min. CRI, R _a ^[4]	Nominal CCT [K] ^[1]	Min. Flux [lm]	Typ. Luminous Flux Φ _v ^[3] [lm]			Typ. Luminous Efficacy [lm/W] @700mA	Part Number
			700mA	1000mA	1500mA		
90	3500	189	191	247	325	93	S1W0 - 3535359003-00000000-00001
	3000	180	192	248	327	94	S1W0 - 3535309003-00000000-00001
	2700	160	172	222	293	84	S1W0 - 3535279003-00000000-00001

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.

Performance Characteristics

Table 3. Characteristics

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Forward Current ^[1]	I_F	-	-	1500	mA
Peak Pulsed Forward Current ^[2]	I_F			2000	mA
Reverse Voltage	V_R	-	-	5	V
Power Dissipation	P_D	-	-	5.22	W
Forward Voltage (@700mA, 85°C)	V_F	-	-	3.0	V
Junction Temperature	T_j	-	-	150	°C
Operating Temperature	T_{opr}	- 40	-	125	°C
Storage Temperature	T_{stg}	- 40	-	125	°C
Viewing angle	θ		118		degree
Thermal resistance (J to S) ^[3]	$R\theta_{J-S}$	-	3.45	-	K/W
ESD Sensitivity(HBM) ^[4]		Class 3A JEDEC JS-001-2017			

Notes :

(1) At Junction Temperature 85°C condition.

(2) Pulse width $\leq 10\text{ms}$, duty cycle $\leq 10\%$ condition.

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

(4) The zener diode is included to protect the product from ESD.

- 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, $T_j=25^{\circ}\text{C}$

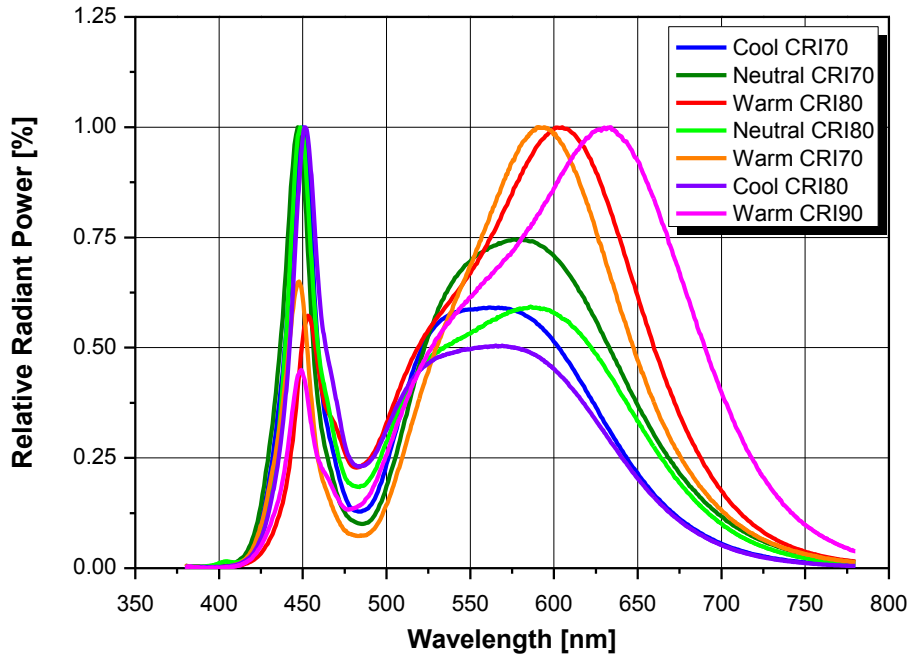
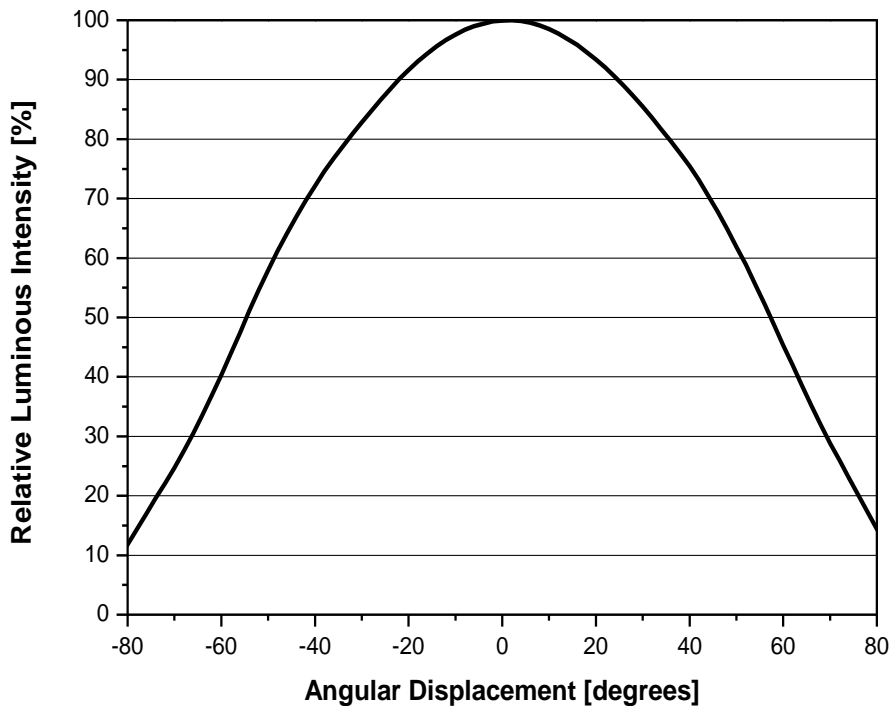


Fig 2. Typical Spatial Distribution



Characteristics Graph

Fig 3. Forward Voltage vs. Forward Current, $T_j=85^{\circ}\text{C}$

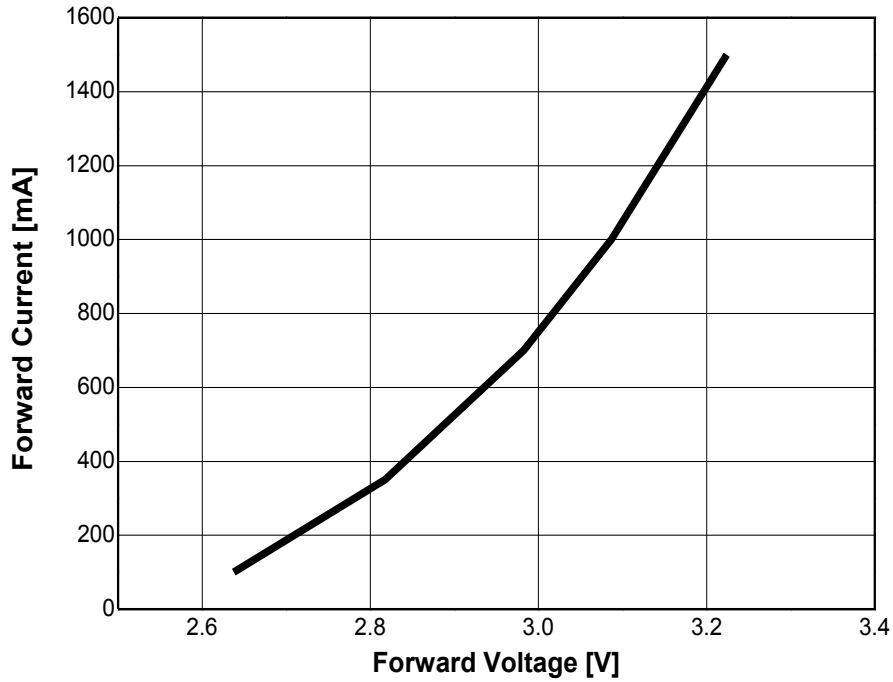
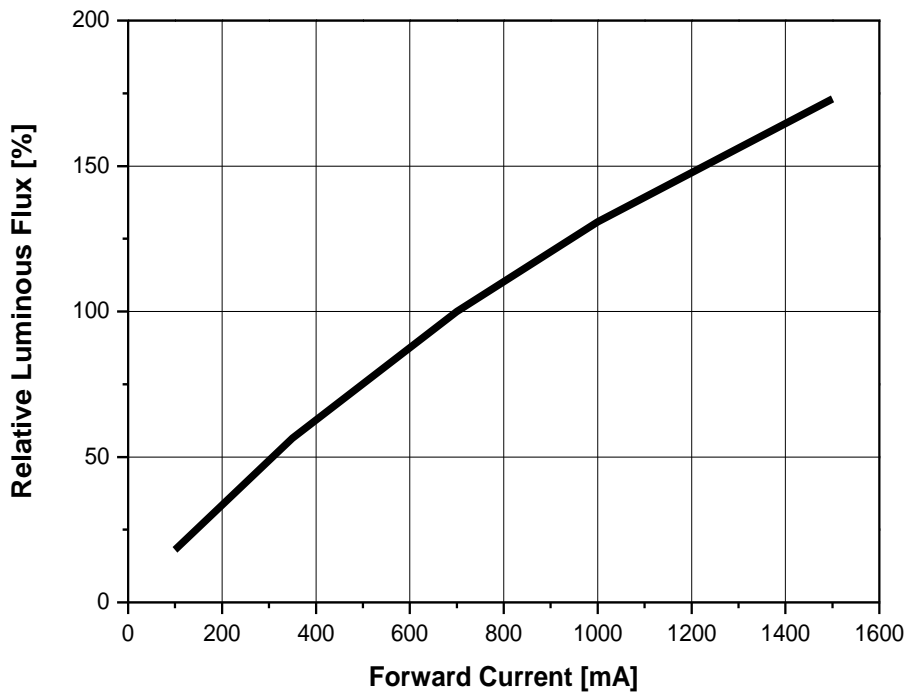
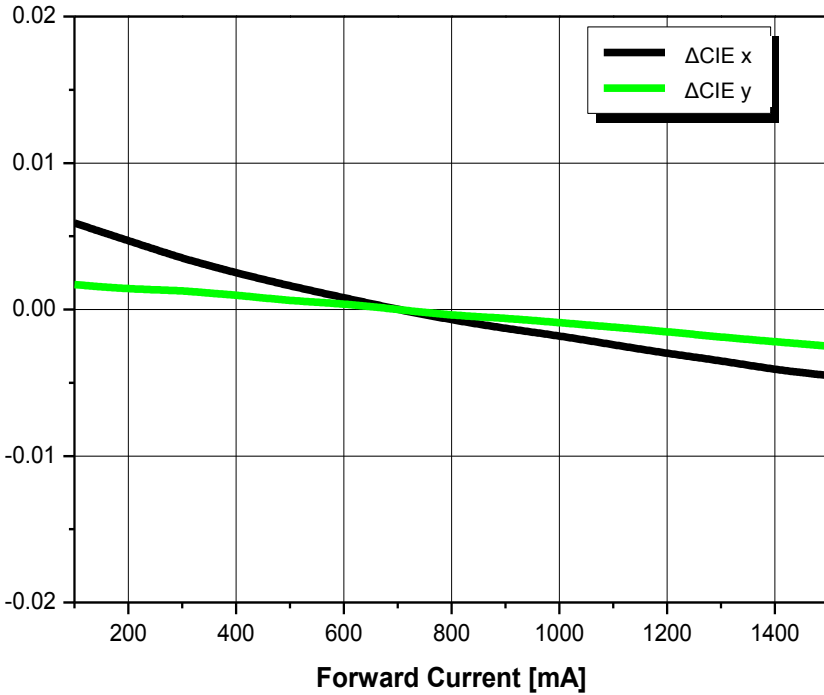
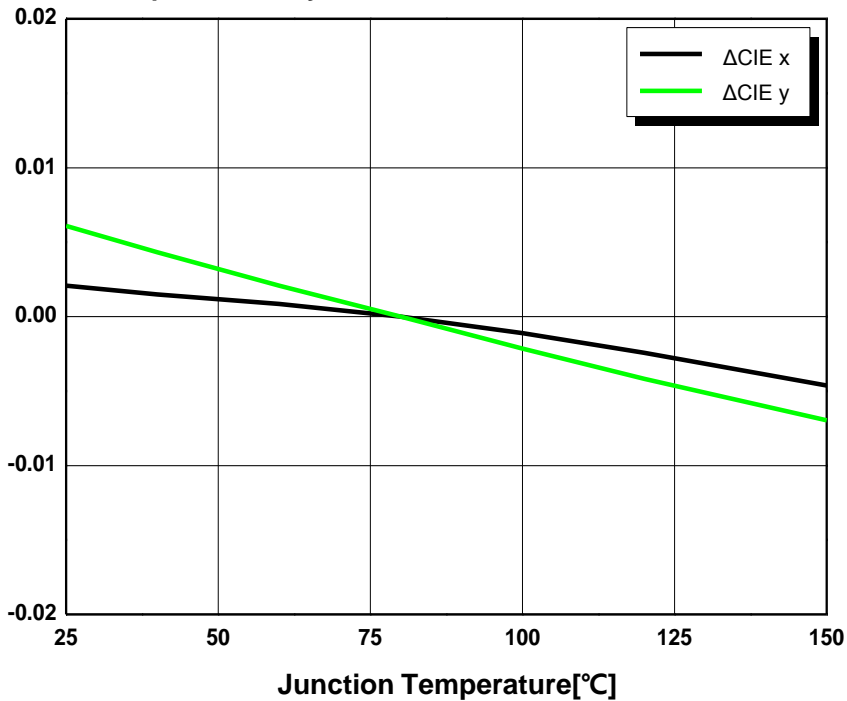


Fig 4. Forward Current vs. Relative Luminous Flux, $T_j=85^{\circ}\text{C}$



Characteristics Graph

Fig 5. Forward Current vs CIE x, y Shift

Fig 6. Junction Temp. vs. CIE x, y Shift


Characteristics Graph

Fig 7. Relative Light Output vs. Junction Temperature, $I_F = 350\text{mA}$

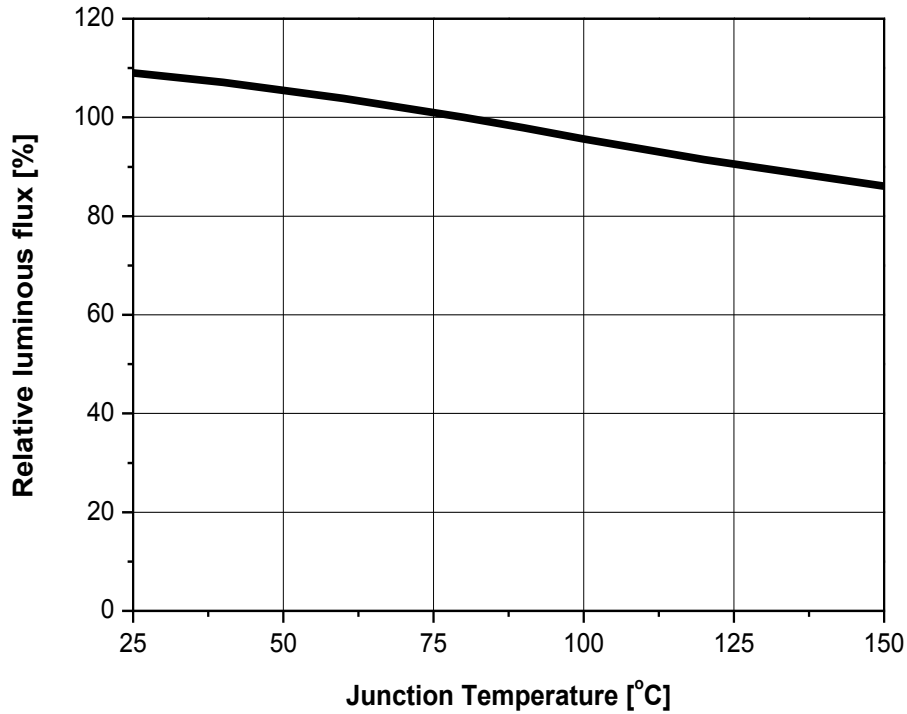
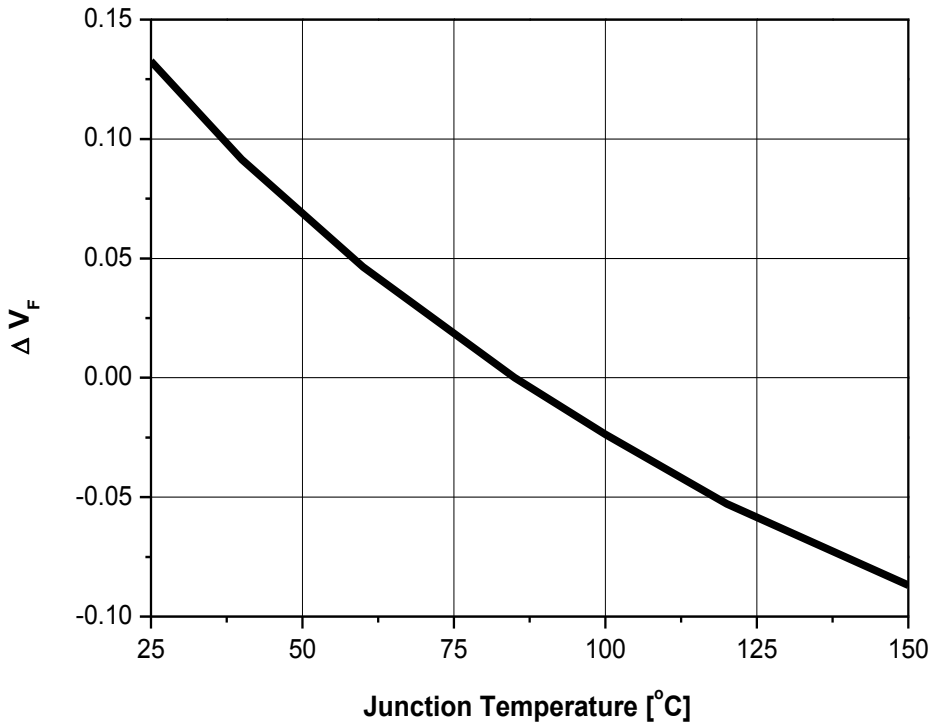
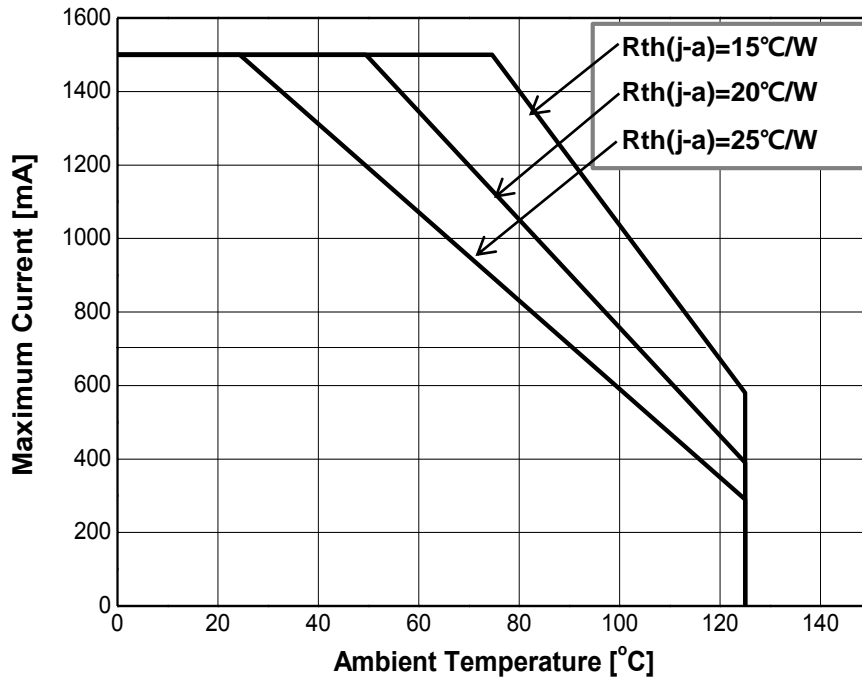


Fig 8. Relative Forward vs. Junction Temperature, $I_F = 350\text{mA}$



Characteristics Graph

Fig 9. Maximum Forward Current vs. Ambient Temperature, $T_j(\text{max.})=150^\circ\text{C}$, $I_F=1500\text{mA}$



Color Bin Structure

Table 4. Bin Code description, $I_F=700\text{mA}$, $T_j=85^\circ\text{C}$

Part Number	Luminous Flux [lm]			Color Chromaticity	Typical Forward Voltage [V_F] ^[1]		
	Bin Code	Min.	Max.	Coordinate	Bin Code	Min.	Max.
S1W0-3535xxx003-00000000-00001	U1	132	145	Refer to page. 13~15	G	2.75	3
	U2	145	159				
	U3	159	185				
	V1	185	203				
	V2	203	218				
	V3	218	240				
	W1	240	256				
	W2	256	272				
	W3	272	285				
	W4	285	299				
	W5	299	313				

Notes :

 (1) Tolerance is $\pm 0.06\text{V}$ on forward voltage measurements.

Color Bin Structure

Table5. Flux Rank Distribution
CR170

Available Rank

CCT	CIE	Flux Rank						
6000 ~ 7000K	A	V2	V3	W1	W2	W3	W4	W5
5300 ~ 6000K	B	V2	V3	W1	W2	W3	W4	W5
4700 ~ 5300K	C	V2	V3	W1	W2	W3	W4	W5
4200 ~ 4700K	D	V2	V3	W1	W2	W3	W4	W5
3700 ~ 4200K	E	V2	V3	W1	W2	W3	W4	W5
3500 ~ 3700K	F	V2	V3	W1	W2	W3	W4	W5
2900 ~ 3200K	G	V2	V3	W1	W2	W3	W4	W5
2600 ~ 2900K	H	V2	V3	W1	W2	W3	W4	W5

CR180

Available Rank

CCT	CIE	Flux Rank						
7000 ~ 8200K	Z	V1	V2	V3	W1	W2	W3	W4
6000 ~ 7000K	A	V1	V2	V3	W1	W2	W3	W4
5300 ~ 6000K	B	V1	V2	V3	W1	W2	W3	W4
4700 ~ 5300K	C	V1	V2	V3	W1	W2	W3	W4
4200 ~ 4700K	D	V1	V2	V3	W1	W2	W3	W4
3700 ~ 4200K	E	V1	V2	V3	W1	W2	W3	W4
3500 ~ 3700K	F	V1	V2	V3	W1	W2	W3	W4
2900 ~ 3200K	G	V1	V2	V3	W1	W2	W3	W4
2600 ~ 2900K	H	V1	V2	V3	W1	W2	W3	W4

CR190

Available Rank

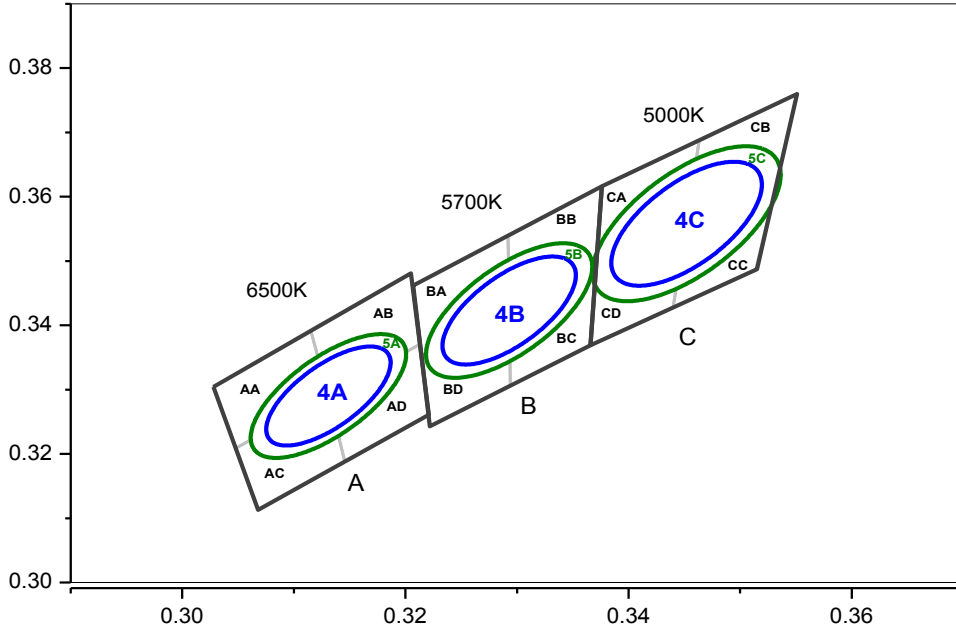
CCT	CIE	Flux Rank						
3500 ~ 3700K	F	U1	U2	U3	V1	V2	V3	W1
2900 ~ 3200K	G	U1	U2	U3	V1	V2	V3	W1
2600 ~ 2900K	H	U1	U2	U3	V1	V2	V3	W1

Notes :

 (1) Tolerance is $\pm 0.06V$ on forward voltage measurements.

Color Bin Structure

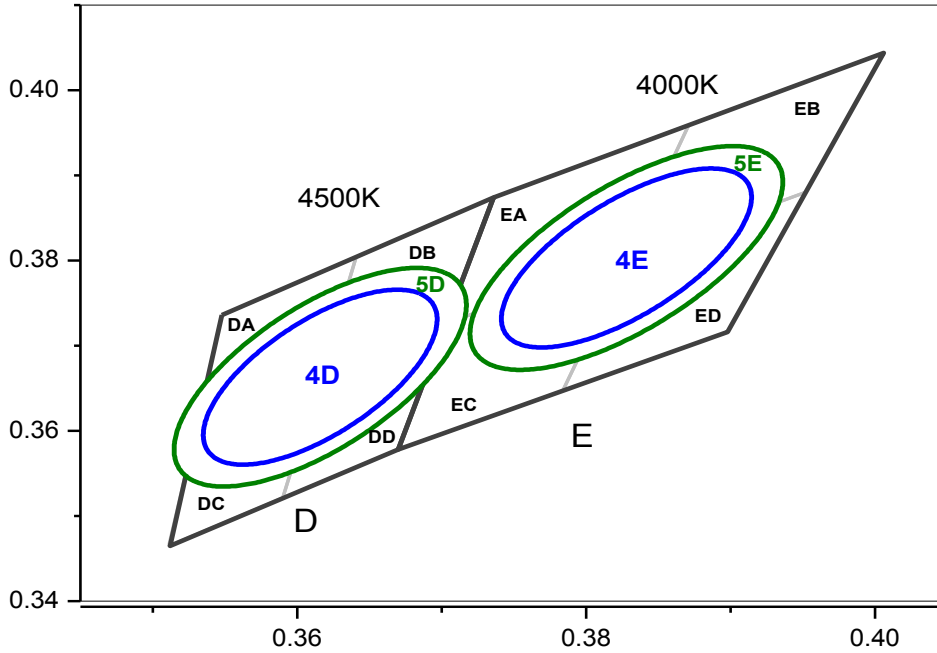
CIE Chromaticity Diagram (Cool white), $T_j=85^\circ\text{C}$, $I_f=700\text{mA}$



6500K 4Step				5700K 4Step				5000K 4Step			
4A				4B				4C			
Center point		0.3123 : 0.3282		Center point		0.3287 : 0.3417		Center point		0.3447 : 0.3553	
Major Axis a		0.0088		Major Axis a		0.0095		Major Axis a		0.0108	
Minor Axis b		0.0036		Minor Axis b		0.0040		Minor Axis b		0.0047	
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		0.0118		Major Axis a		0.0135	
Minor Axis b		0.0045		Minor Axis b		0.0050		Minor Axis b		0.0058	
Ellipse Rotation Angle		58		Ellipse Rotation Angle		59		Ellipse Rotation Angle		60	
AA		AB		AC		AD					
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y				
0.3028	0.3304	0.3115	0.3393	0.3131	0.329	0.3048	0.3209				
0.3048	0.3209	0.3131	0.329	0.3146	0.3187	0.3068	0.3113				
0.3131	0.329	0.3213	0.3371	0.3221	0.3261	0.3146	0.3187				
0.3115	0.3393	0.3205	0.3481	0.3213	0.3371	0.3131	0.329				
BA		BB		BC		BD					
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y				
0.3207	0.3462	0.3292	0.3539	0.3293	0.3423	0.3215	0.3353				
0.3215	0.3353	0.3293	0.3423	0.3294	0.3306	0.3222	0.3243				
0.3293	0.3423	0.3371	0.3493	0.3366	0.3369	0.3294	0.3306				
0.3292	0.3539	0.3376	0.3616	0.3371	0.3493	0.3293	0.3423				
CA		CB		CC		CD					
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y				
0.3376	0.3616	0.3463	0.3687	0.3452	0.3558	0.3371	0.3493				
0.3371	0.3493	0.3452	0.3558	0.344	0.3428	0.3366	0.3369				
0.3452	0.3558	0.3533	0.3624	0.3514	0.3487	0.344	0.3428				
0.3463	0.3687	0.3551	0.376	0.3533	0.3624	0.3452	0.3558				

Color Bin Structure

CIE Chromaticity Diagram (Neutral White), $T_j=85^{\circ}\text{C}$, $I_f=700\text{mA}$


4500K 4Step

4D	
Center point	0.3611 : 0.3658
Major Axis a	0.0120
Minor Axis b	0.0052
Ellipse	55
Rotation Angle	55

4000K 4Step

4E	
Center point	0.3818 : 0.3797
Major Axis a	0.0125
Minor Axis b	0.0053
Ellipse	53
Rotation Angle	53

4500K 5Step

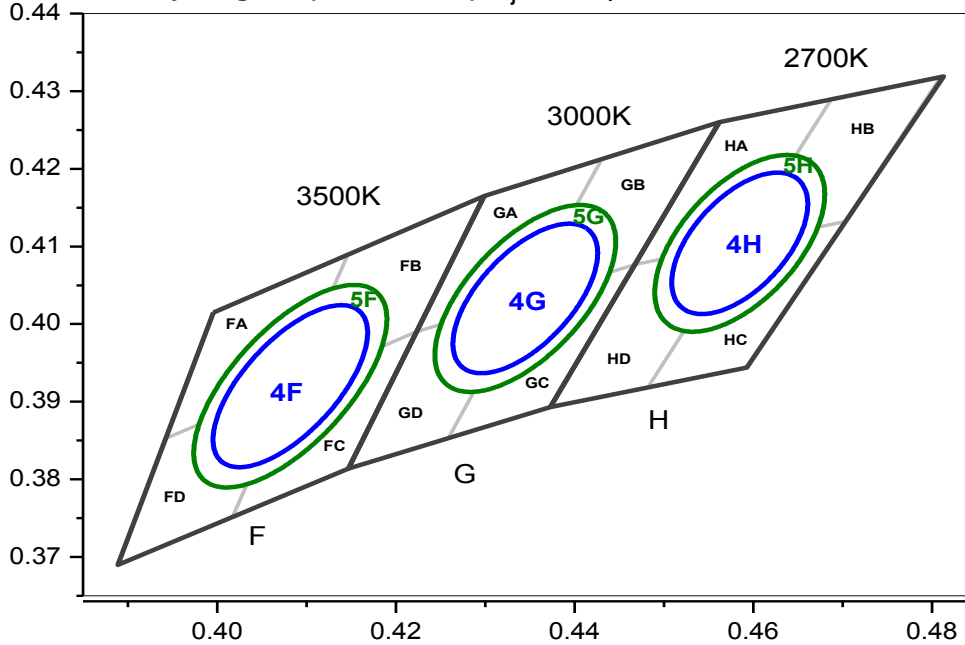
5D	
Center point	0.3611 : 0.3658
Major Axis a	0.0150
Minor Axis b	0.0065
Ellipse	55
Rotation Angle	55

4000K 5Step

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

DA		DB		DC		DD	
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3548	0.3736	0.3641	0.3804	0.3616	0.3663	0.353	0.3601
0.353	0.3601	0.3616	0.3663	0.359	0.3521	0.3511	0.3465
0.3616	0.3663	0.3703	0.3726	0.367	0.3578	0.359	0.3521
0.3641	0.3804	0.3736	0.3874	0.3703	0.3726	0.3616	0.3663
EA		EB		EC		ED	
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3736	0.3874	0.3871	0.3959	0.3828	0.3803	0.3703	0.3726
0.3703	0.3726	0.3828	0.3803	0.3784	0.3647	0.367	0.3578
0.3828	0.3803	0.3952	0.388	0.3898	0.3716	0.3784	0.3647
0.3871	0.3959	0.4006	0.4044	0.3952	0.388	0.3828	0.3803

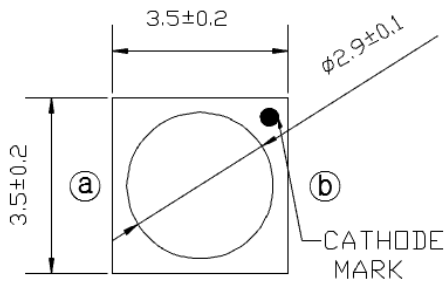
Color Bin Structure

CIE Chromaticity Diagram (Warm White), $T_j=85^\circ\text{C}$, $I_f=700\text{mA}$


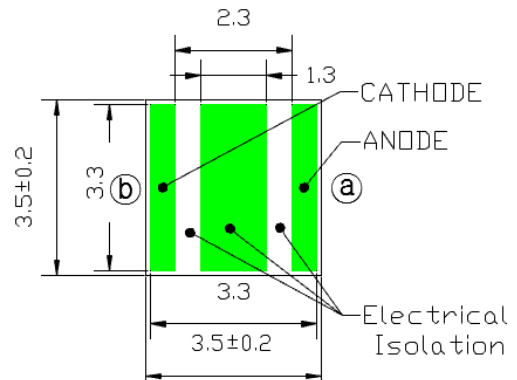
3500K 4Step		3000K 4Step		2700K 4Step			
4 Step		4 Step		4 Step			
Center point	0.4073 : 0.3917	Center point	0.4338 : 0.4030	Center point	0.4578 : 0.4101		
Major Axis a	0.0124	Major Axis a	0.0113	Major Axis a	0.0105		
Minor Axis b	0.0055	Minor Axis b	0.0055	Minor Axis b	0.0055		
Ellipse Rotation Angle	53	Ellipse Rotation Angle	53	Ellipse Rotation Angle	54		
3500K 5Step		3000K 5Step		2700K 5Step			
5 Step		5 Step		5 Step			
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	53	Ellipse Rotation Angle	53	Ellipse Rotation Angle	54		
FA		FB		FC		FD	
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3996	0.4015	0.4146	0.4089	0.4082	0.392	0.3943	0.3853
0.3943	0.3853	0.4082	0.392	0.4017	0.3751	0.3889	0.369
0.4082	0.392	0.4223	0.399	0.4147	0.3814	0.4017	0.3751
0.4146	0.4089	0.4299	0.4165	0.4223	0.399	0.4082	0.392
GA		GB		GC		GD	
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.4299	0.4165	0.443	0.4212	0.4345	0.4033	0.4223	0.399
0.4223	0.399	0.4345	0.4033	0.4259	0.3853	0.4147	0.3814
0.4345	0.4033	0.4468	0.4077	0.4373	0.3893	0.4259	0.3853
0.443	0.4212	0.4562	0.426	0.4468	0.4077	0.4345	0.4033
HA		HB		HC		HD	
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.4562	0.426	0.4687	0.4289	0.4585	0.4104	0.4468	0.4077
0.4468	0.4077	0.4585	0.4104	0.4483	0.3919	0.4373	0.3893
0.4585	0.4104	0.4703	0.4132	0.4593	0.3944	0.4483	0.3919
0.4687	0.4289	0.481	0.4319	0.4703	0.4132	0.4585	0.4104

Mechanical Dimensions

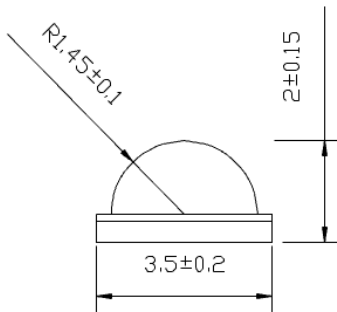
Top View



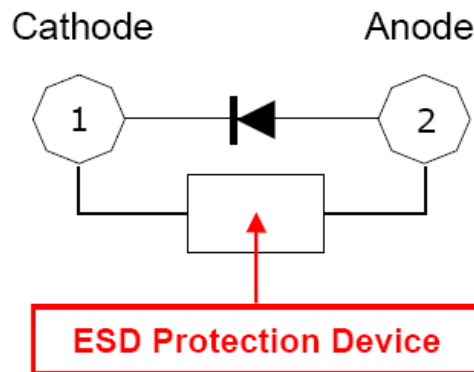
Bottom View



Side View

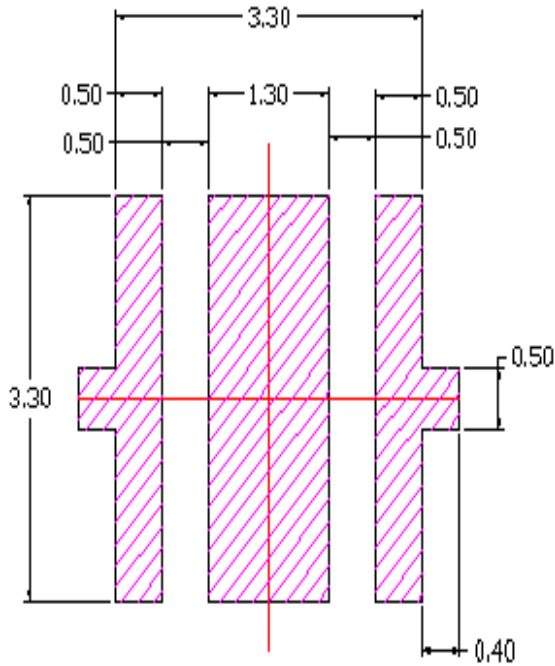


Circuit

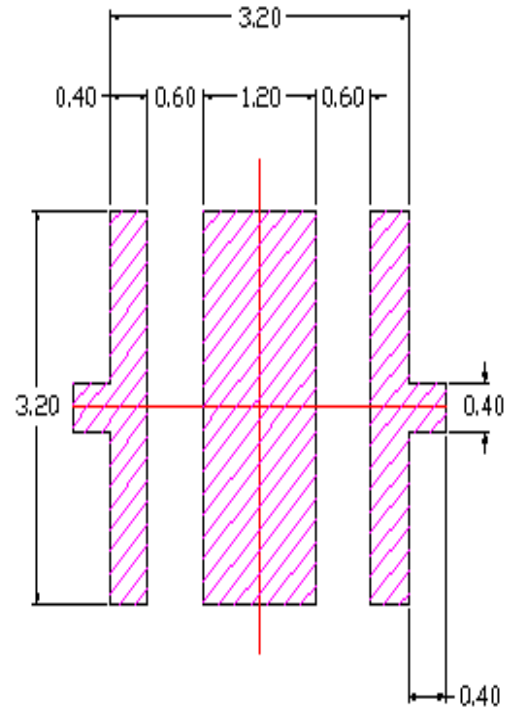


- (1) All dimensions are in millimeters.
- (2) Scale : none
- (3) Undefined tolerance is ± 0.1 mm

Recommended Solder Pad



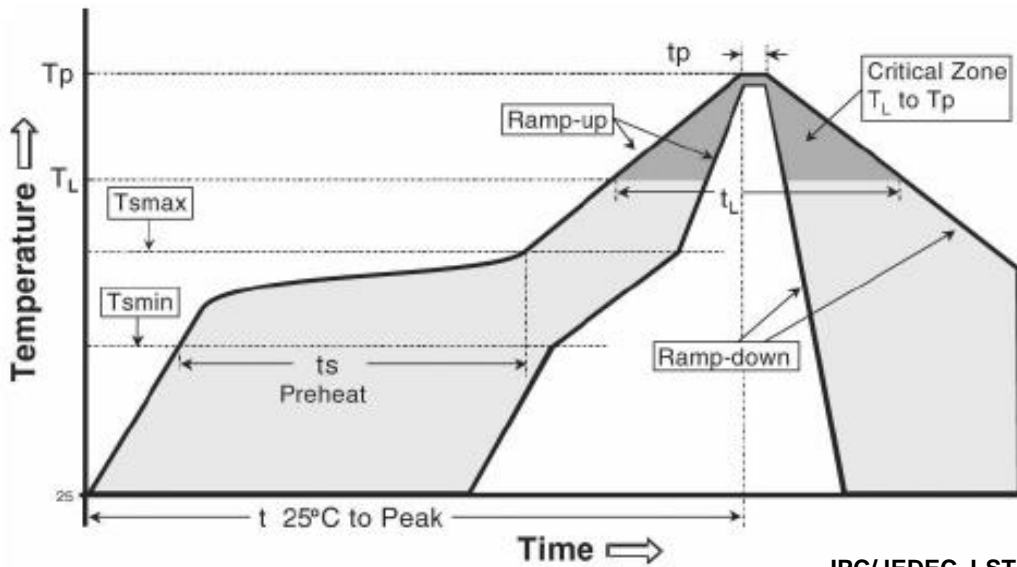
Recommended PCB Solder Pad



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 ± 0.1 mm.

Reflow Soldering Characteristics

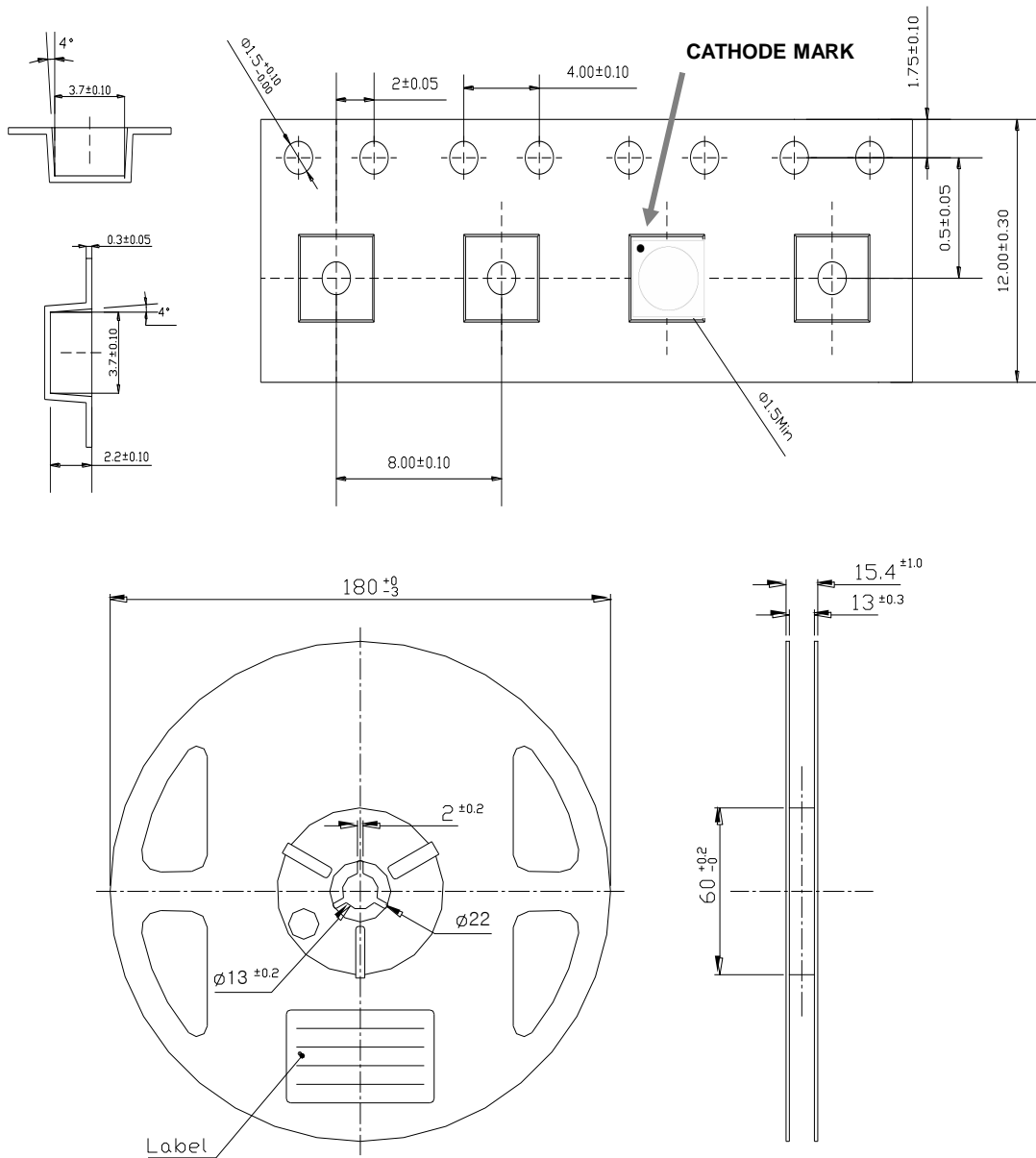

IPC/JEDEC J-STD-020

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T _{smax} to T _p)	3° C/second max.	3° C/second max.
Preheat - Temperature Min (T _{smin}) - Temperature Max (T _{smax}) - Time (T _{smin} to T _{smax}) (t _s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-180 seconds
Time maintained above: - Temperature (T _L) - Time (t _L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak Temperature (T _p)	215°C	260°C
Time within 5°C of actual Peak Temperature (t _p) 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

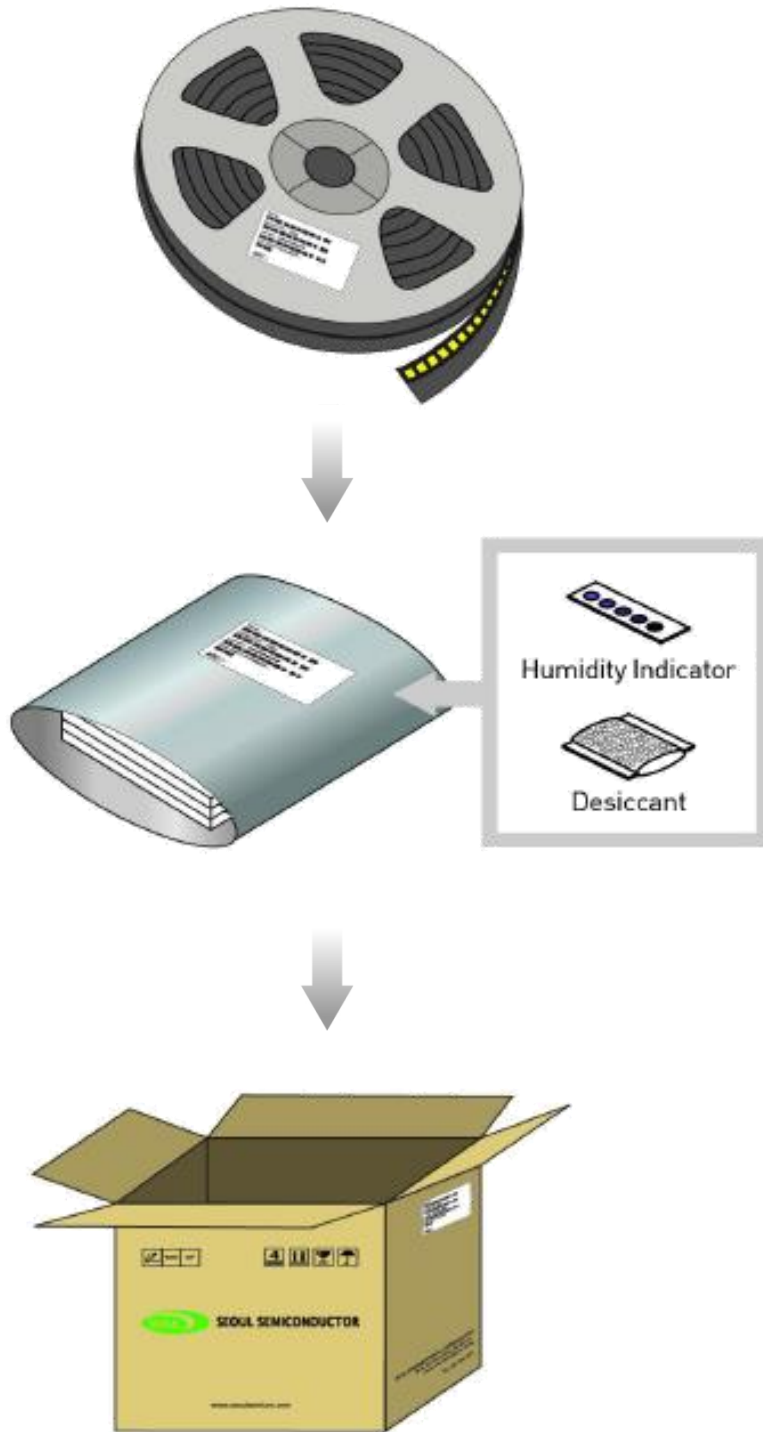
- (1) Reflow soldering is recommended not to be done more than two times. In the case of more than 24 hours passed soldering after first, LEDs will be damaged.
- (2) Repairs should not be done after the LEDs have been soldered. When repair is unavoidable, suitable tools must be used.
- (3) Die slug is 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 :

1. Quantity : 1000pcs/Reel
2. Cumulative Tolerance : Cumulative Tolerance/10 pitches to be $\pm 0.2\text{mm}$
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 10° to the carrier tape
4. Package : P/N, Manufacturing data Code No. and quantity to be indicated on a damp proof Package

Packaging Information



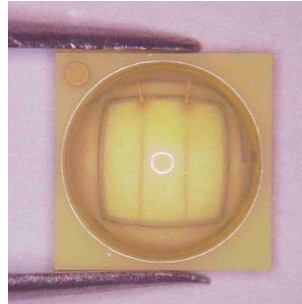
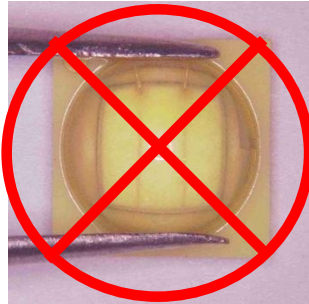
Product Nomenclature

Table 6. Part Numbering System : X₁X₂X₃X₄X₅X₆X₇X₈-X₉

Part Number Code	Description	Part Number	Value
X ₁	Company	S	Seoul Semiconductor
X ₂	Level of Integration	1	Discrete LED
X ₃ X ₄	Technology	W0	General White
X ₅ X ₆ X ₇ X ₈	Dimension	3535	
X ₉ X ₁₀	CCT	40	
X ₁₁ X ₁₂	CRI	70	
X ₁₃ X ₁₄	Vf	03	
X ₁₅ X ₁₆ X ₁₇	Characteristic code Flux Rank	000	
X ₁₈ X ₁₉ X ₂₀	Characteristic code Vf Rank	000	
X ₂₁ X ₂₂	Characteristic code Color Step	00	
X ₂₃ X ₂₄	Type	00	
X ₂₅ X ₂₆ X ₂₇	Internal code	001	

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) 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 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 SMD 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) 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 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.

(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 reverse voltage is applied to LED, migration can be generated resulting in LED damage.

(15) 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) 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
1.0	2014-11-03	All	Preliminary Datasheet
1.0	2014-12-08	All	Initial release of data sheet applied
2.0	2015-02-23	10	Add 'Table5.Flux Rank Distribution' Revise Forward Voltage
2.1	2015-04-30	1,3,5,10 4	Add Part Number, CCT, CRI Add Thermal Resistance Comment
2.2	2015-11-30	1,3,5,10 27	Add Part Number, CCT, CRI Revise 'Precaution for Use'
3.0			
3.1	2016-02-01	10	Revise V3 max luminous flux value (Table5)
4.0	2016-04-15	1 3,4,11,12 ,13,14 23 5	Delete Automotive of Key Applications Add Flux W4 rank Add CIE Z rank Revise Available Rank Revise tolerance from 3.5±0.1mm to 3.5±0.2mm Absolute Maximum Ratings → Characteristics
4.1	2016-07-22	3,11,12 13	Added W3 rank Changed CIE tolerance (±0.007 → ±0.005)
5.0	2016-09-12	3,11,12	Added W5 rank (SZ5-M2-W0-00)
6.0	2016-11-21	3,11,12	Added W5 rank (SZ5-M2-WN-00 / D, E rank) Added W1 rank (SZ5-M2-WW-C8 / F rank)
1	2017-09-26	1,3,4,11 13,14,15 21	Revised for Future