#### Enabling the best Im/W in Mid Power Range

#### Mid-Power LED - 5630 Series

STW8Q14C (Cool, Neutral, Warm)









#### **Product Brief**

#### **Description**

- This White Colored surface-mount LED comes in standard package dimension. Package Size: 5.6x3.0x0.75mm
- 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**

- The Best Efficacy in Mid Power LEDs
- Market Standard 5630 Package Size
- High Color Quality, CRI Min. 80
- Wide CCT range 2600~7000K
- ANSI & MacAdam 3 Step compliant
- RoHS compliant

#### **Key Applications**

- Interior lighting
- General lighting
- Indoor and outdoor displays
- Architectural / Decorative lighting

**Table 1. Product Selection Table** 

Part Number		ССТ		
Part Number	Color	Min.	Тур.	Max.
STW8Q14C	Cool White	4700K	5600K	7000K
STW8Q14C	Neutral White	3700K	4200K	4700K
STW8Q14C	Warm White	2600K	3000K	3700K

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### **Performance Characteristics**

Table 2. Electro Optical Characteristics,  $I_F = 100 \text{mA}$ ,  $T_i = 25^{\circ}\text{C}$ , RH30%

	<b>743</b>		Luminous	Intensity [2]	Luminou	ıs Flux <sup>[3]</sup>	CRI
Part Number	CCT (K) [1]	RANK	l <sub>v</sub> (	cd)	Φν	(lm)	Ra
	Тур.		Min	Max	Min	Max	Min.
		U7	11.7	12.5	36.3	38.8	80
	6500	V5	12.5	13.5	38.8	41.9	80
	6500 -	W5	13.5	14.5	41.9	45.0	80
		X5	14.5	15.2	45.0	47.1	80
-		U7	11.7	12.5	36.3	38.8	80
	- -	V5	12.5	13.5	38.8	41.9	80
	5600 -	W5	13.5	14.5	41.9	45.0	80
	-	X5	14.5	15.2	45.0	47.1	80
		U7	11.7	12.5	36.3	38.8	80
	- -	V5	12.5	13.5	38.8	41.9	80
	5000 -	W5	13.5	14.5	41.9	45.0	80
	-	X5	14.5	15.2	45.0	47.1	80
		U7	11.7	12.5	35.7	38.1	80
	4500	V5	12.5	13.5	38.1	41.2	80
	4500 -	W5	13.5	14.5	41.2	44.2	80
STW8Q14C	-	X5	14.5	15.2	44.2	46.4	80
		U7	11.7	12.5	35.7	38.1	80
	-	V5	12.5	13.5	38.1	41.2	80
	4000 -	W5	13.5	14.5	41.2	44.2	80
	-	X5	14.5	15.2	44.2	46.4	80
-		U7	11.7	12.5	35.1	37.5	80
	3500	V5	12.5	13.5	37.5	40.5	80
	-	W5	13.5	14.5	40.5	43.5	80
-		U0	11	11.7	33.0	35.1	80
	-	U7	11.7	12.5	35.1	37.5	80
	3000 -	V5	12.5	13.5	37.5	40.5	80
	_	W5	13.5	14.5	40.5	43.5	80
-		U0	11	11.7	33.0	35.1	80
	-	U7	11.7	12.5	35.1	37.5	80
	2700 -	V5	12.5	13.5	37.5	40.5	80
	_	W5	13.5	14.5	40.5	43.5	80

#### Notes:

- (1) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.
- (2) Seoul Semiconductor maintains a tolerance of  $\pm 7\%$  on Intensity and power measurements. The luminous intensity IV was measured at the peak of the spatial pattern which may not be aligned with the mechanical axis of the LED package.
- (3) The lumen table is only for reference.

### **Performance Characteristics**

Table 3. Absolute Maximum Ratings,  $I_F = 100 \text{mA}$ ,  $T_i = 25^{\circ}\text{C}$ , RH30%

Dozemeter	Cumbal		Value		Unit
Parameter	Symbol	Min.	Тур.	Max.	Onit
Forward Current	I <sub>F</sub>	-	100	160	mA
Forward Voltage <sup>[1]</sup>	V <sub>F</sub> (100mA)	2.8	-	3.4	V
Reverse Voltage	V <sub>r</sub>	-	0.9	1.2	V
Luminous Intensity (5,000 K) [1]	I <sub>v</sub> (100mA)	-	14 (43)	-	cd
Luminous Intensity (3,500 K) [1]	I <sub>v</sub> (100mA)	-	12.7 (38.1)	-	(lm)
Color Rendering Index [1]	Ra	80	83	90	-
Viewing Angle [2]	2Θ <sub>1/2</sub>		120		
Power Dissipation	$P_d$	-	-	560	mW
Junction Temperature	T <sub>j</sub>	-	-	125	°C
Operating Temperature	$T_{opr}$	- 40	-	+ 85	°C
Storage Temperature	$T_{stg}$	- 40	-	+ 100	°C
Thermal resistance (J to S) [3]	Rθ <sub>J-S</sub>	-	18	-	°C/W
ESD Sensitivity(HBM) [4]	-	-	-	5000	V

#### Notes:

(1) Tolerance : VF : $\pm$ 0.1V, IV : $\pm$ 7%, Ra : $\pm$ 2, x,y : $\pm$ 0.007

(2)  $\Theta_{1/2}$  is the off-axis where the luminous intensity is 1/2 of the peak intensity

(3) Thermal resistance : Rth<sub>JS</sub> (Junction / solder)

(4) A zener diode is included for ESD 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,  $I_F$  = 100mA,  $T_j$  = 25°C, RH30%

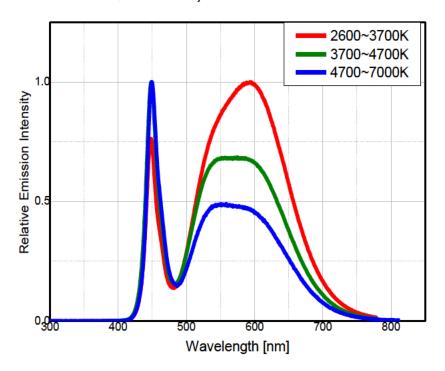
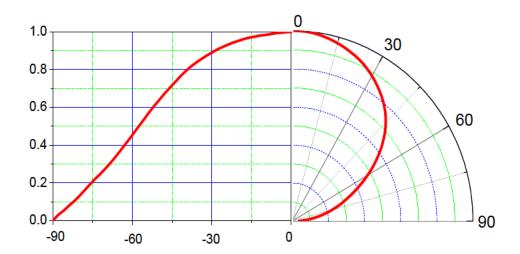


Fig 2. Viewing Angle Distribution,  $I_F = 100 \text{mA}$ 



## **Forward Current Characteristics**

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

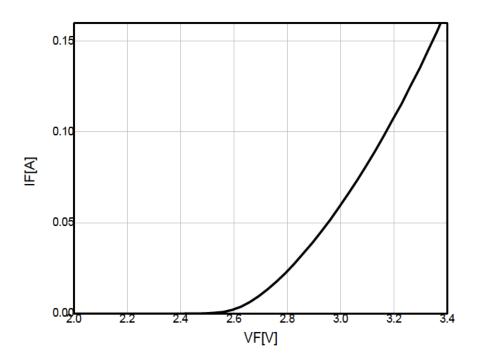
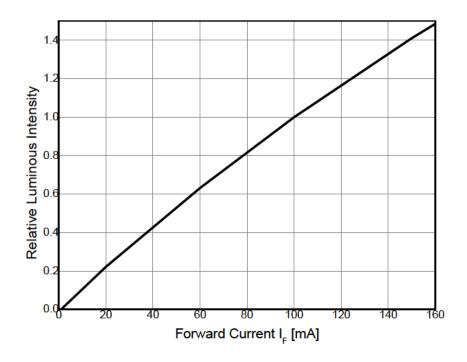
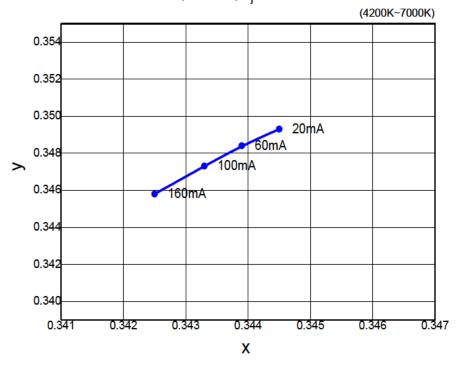


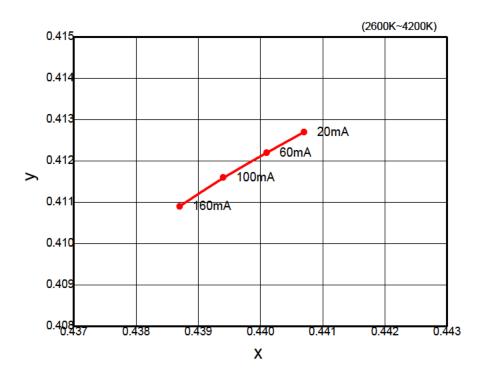
Fig 4. Forward Current vs. Relative Luminous Flux, T<sub>i</sub> = 25°C



### **Forward Current Characteristics**

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





# **Junction Temperature Characteristics**

Fig 6. Relative Light Output vs. Junction Temperature, I<sub>F</sub> = 100mA

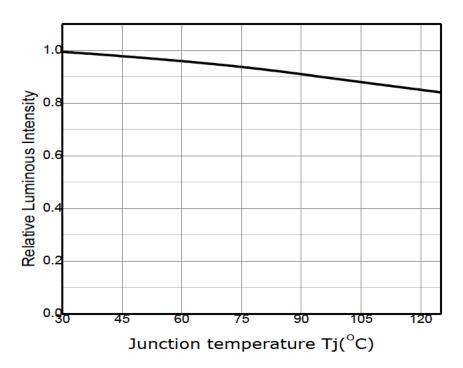
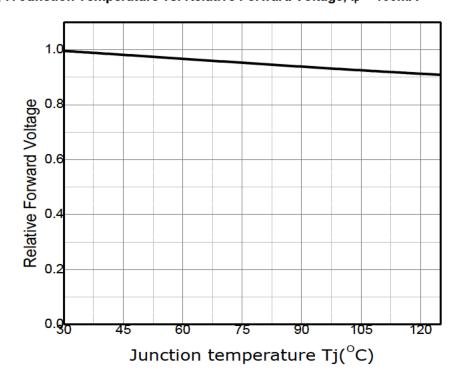
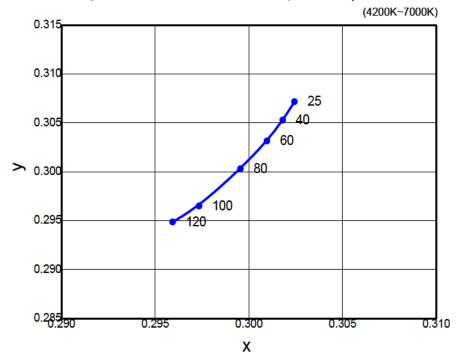


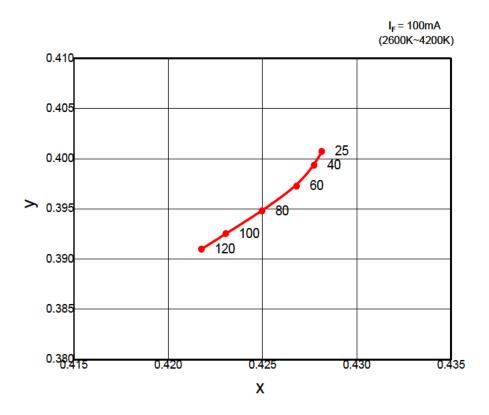
Fig 7. Junction Temperature vs. Relative Forward Voltage, I<sub>F</sub> = 100mA



# **Junction Temperature Characteristics**

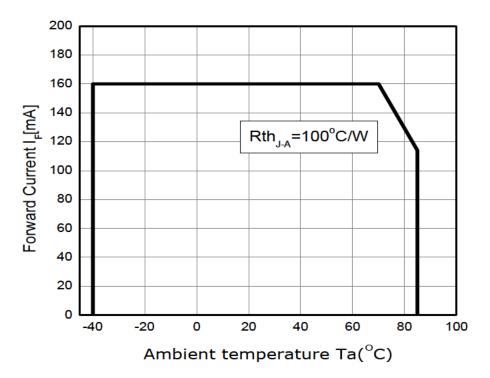
Fig 8. Chromaticity Coordinate vs. Junction Temperature,  $I_F = 100 \text{mA}$ 





# **Ambient Temperature Characteristics**

Fig 9. Maximum Forward Current vs. Ambient Temperature



### **Color Bin Structure**

Table 4. Bin Code description

Part Number		ninous Intensity (cd) Color Typical Forv $@I_F = 100 \text{mA}$ Chromaticity Voltage $(V_f) @I_F$					
	Bin Code	Min.	Max.	@ I <sub>F</sub> = 100mA	Bin Code	Min.	Max.
	U0	11.0	11.7		Y2	2.8	2.9
	U7	11.7	12.5		Y3	2.9	3.0
STW8Q14C	V5	12.5	13.5	Defer to page 42	Z1	3.0	3.1
STW6Q14C	W5	13.5	14.5	Refer to page.12	<b>Z2</b>	3.1	3.2
	<b>X</b> 5	14.5	15.2		Z3	3.2	3.3
	J15 15.2 16		A1	3.3	3.4		

Table 7. Intensity rank distribution

сст	CIE			IV Rank		
6000 ~ 7000K	Α	U0	U7	V5	W5	<b>X</b> 5
5300 - 6000K	В	U0	U7	V5	W5	<b>X</b> 5
4700 ~ 5300K	С	U0	U7	V5	<b>W</b> 5	<b>X</b> 5
4200 ~ 4700K	D	U0	U7	V5	W5	<b>X</b> 5
3700 ~ 4200K	Е	U0	U7	V5	<b>W</b> 5	<b>X</b> 5
3200 ~ 3700K	F	U0	U7	V5	W5	<b>X</b> 5
2900 ~ 3200K	G	U0	U7	V5	W5	<b>X</b> 5
2600 ~ 2900K	Н	U0	U7	V5	W5	<b>X</b> 5

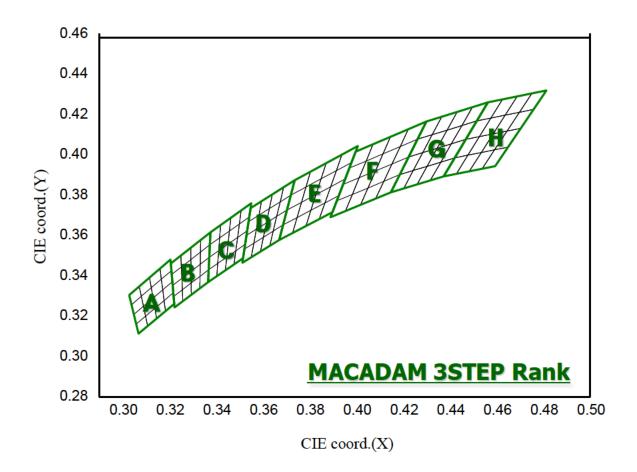
#### \*Notes:

Available ranks
Not yet available ranks

<sup>(1)</sup> All measurements were made under the standardized environment of Seoul Semiconductor In order to ensure availability, single color rank will not be orderable.

### **Color Bin Structure**

CIE Chromaticity Diagram,  $I_F = 100$ mA,  $T_i = 25$ °C,

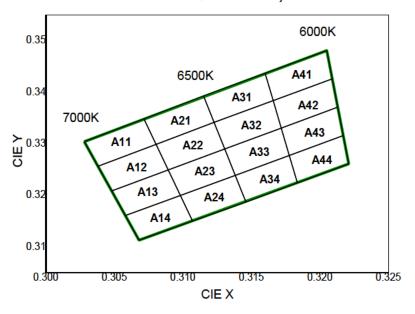


#### \*Notes:

- Energy Star binning applied to all 2600~7000K.
- ullet Measurement Uncertainty of the Color Coordinates :  $\pm$  0.007



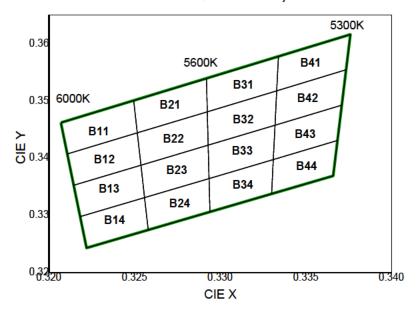
CIE Chromaticity Diagram (Cool White),  $I_F = 100$ mA,  $T_i = 25$ °C,



A	11	A	21	A3	31	A	41
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3028	0.3304	0.3072	0.3349	0.3115	0.3393	0.3160	0.3437
0.3038	0.3256	0.3080	0.3299	0.3123	0.3342	0.3166	0.3384
0.3080	0.3299	0.3123	0.3342	0.3166	0.3384	0.3209	0.3426
0.3072	0.3349	0.3115	0.3393	0.3160	0.3437	0.3205	0.3481
Α	12	A	22	A3	2	A	42
CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
0.3038	0.3256	0.3080	0.3299	0.3123	0.3342	0.3166	0.3384
0.3048	0.3209	0.3089	0.3249	0.3131	0.3290	0.3172	0.3331
0.3089	0.3249	0.3131	0.3290	0.3172	0.3331	0.3213	0.3371
0.3080	0.3299	0.3123	0.3342	0.3166	0.3384	0.3209	0.3426
Α	13	A	23	A3	3	A	43
CIE X	13 CIE Y	CIE X	23 CIE Y	CIE X	CIE Y	CIE X	43 CIE Y
	-						
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
CIE X 0.3048	CIE Y 0.3209	CIE X 0.3089	CIE Y 0.3249	CIE X 0.3131	CIE Y 0.3290	CIE X 0.3172	CIE Y 0.3331
CIE X 0.3048 0.3058	CIE Y 0.3209 0.3161	CIE X 0.3089 0.3098	CIE Y 0.3249 0.3200	CIE X 0.3131 0.3138	CIE Y 0.3290 0.3239	CIE X 0.3172 0.3178	CIE Y 0.3331 0.3277
CIE X 0.3048 0.3058 0.3098 0.3089	CIE Y 0.3209 0.3161 0.3200	CIE X 0.3089 0.3098 0.3138 0.3131	CIE Y 0.3249 0.3200 0.3239	CIE X 0.3131 0.3138 0.3178	CIE Y 0.3290 0.3239 0.3277 0.3331	CIE X 0.3172 0.3178 0.3217 0.3213	CIE Y 0.3331 0.3277 0.3316
CIE X 0.3048 0.3058 0.3098 0.3089	CIE Y 0.3209 0.3161 0.3200 0.3249	CIE X 0.3089 0.3098 0.3138 0.3131	CIE Y 0.3249 0.3200 0.3239 0.3290	CIE X 0.3131 0.3138 0.3178 0.3172	CIE Y 0.3290 0.3239 0.3277 0.3331	CIE X 0.3172 0.3178 0.3217 0.3213	CIE Y 0.3331 0.3277 0.3316 0.3371
CIE X 0.3048 0.3058 0.3098 0.3089	CIE Y 0.3209 0.3161 0.3200 0.3249	CIE X 0.3089 0.3098 0.3138 0.3131	CIE Y 0.3249 0.3200 0.3239 0.3290	CIE X 0.3131 0.3138 0.3178 0.3172	CIE Y 0.3290 0.3239 0.3277 0.3331	CIE X 0.3172 0.3178 0.3217 0.3213	CIE Y 0.3331 0.3277 0.3316 0.3371
CIE X 0.3048 0.3058 0.3098 0.3089	CIE Y 0.3209 0.3161 0.3200 0.3249 14 CIE Y	CIE X 0.3089 0.3098 0.3138 0.3131	CIE Y 0.3249 0.3200 0.3239 0.3290 24 CIE Y	CIE X 0.3131 0.3138 0.3178 0.3172 A3	CIE Y 0.3290 0.3239 0.3277 0.3331	CIE X 0.3172 0.3178 0.3217 0.3213 A CIE X	CIE Y 0.3331 0.3277 0.3316 0.3371 44 CIE Y
CIE X 0.3048 0.3058 0.3098 0.3089  A CIE X 0.3058	CIE Y 0.3209 0.3161 0.3200 0.3249 14 CIE Y 0.3161	CIE X 0.3089 0.3098 0.3138 0.3131 ACCIE X 0.3098	CIE Y 0.3249 0.3200 0.3239 0.3290 24 CIE Y 0.3200	CIE X 0.3131 0.3138 0.3178 0.3172 A3 CIE X 0.3138	CIE Y 0.3290 0.3239 0.3277 0.3331 4 CIE Y 0.3239	CIE X 0.3172 0.3178 0.3217 0.3213 A CIE X 0.3178	CIE Y 0.3331 0.3277 0.3316 0.3371 44 CIE Y 0.3277

### **Color Bin Structure**

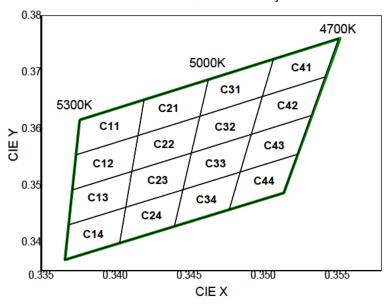
CIE Chromaticity Diagram (Cool White),  $I_F = 100 \text{mA}$ ,  $T_j = 25 ^{\circ}\text{C}$ ,



	B <sup>,</sup>	11	В	21	B3	31	В	41
	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
	0.3207	0.3462	0.3250	0.3501	0.3292	0.3539	0.3334	0.3578
	0.3211	0.3407	0.3252	0.3444	0.3293	0.3481	0.3333	0.3518
	0.3252	0.3444	0.3293	0.3481	0.3333	0.3518	0.3374	0.3554
	0.3250	0.3501	0.3292	0.3539	0.3334	0.3578	0.3376	0.3616
	В	12	В	22	В3	32	В	42
	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
	0.3211	0.3407	0.3252	0.3444	0.3293	0.3481	0.3333	0.3518
	0.3215	0.3353	0.3254	0.3388	0.3293	0.3423	0.3332	0.3458
	0.3254	0.3388	0.3293	0.3423	0.3332	0.3458	0.3371	0.3493
	0.3252	0.3444	0.3293	0.3481	0.3333	0.3518	0.3374	0.3554
	B <sup>,</sup>	12	D	23	В3	12	ь	43
	Ь	IJ	D.	20	D	10	D.	40
ľ	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y
							_	
	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
	CIE X 0.3215	CIE Y 0.3353	CIE X 0.3254	CIE Y 0.3388	CIE X 0.3293	CIE Y 0.3423	CIE X 0.3332	CIE Y 0.3458
	CIE X 0.3215 0.3218	CIE Y 0.3353 0.3298	CIE X 0.3254 0.3256	CIE Y 0.3388 0.3331	CIE X 0.3293 0.3294	CIE Y 0.3423 0.3364	CIE X 0.3332 0.3331	CIE Y 0.3458 0.3398
	CIE X 0.3215 0.3218 0.3256 0.3254	CIE Y 0.3353 0.3298 0.3331	CIE X 0.3254 0.3256 0.3294 0.3293	CIE Y 0.3388 0.3331 0.3364	CIE X 0.3293 0.3294 0.3331	CIE Y 0.3423 0.3364 0.3398 0.3458	CIE X 0.3332 0.3331 0.3369 0.3371	CIE Y 0.3458 0.3398 0.3431
	CIE X 0.3215 0.3218 0.3256 0.3254	CIE Y 0.3353 0.3298 0.3331 0.3388	CIE X 0.3254 0.3256 0.3294 0.3293	CIE Y 0.3388 0.3331 0.3364 0.3423	CIE X 0.3293 0.3294 0.3331 0.3332	CIE Y 0.3423 0.3364 0.3398 0.3458	CIE X 0.3332 0.3331 0.3369 0.3371	CIE Y 0.3458 0.3398 0.3431 0.3493
	CIE X 0.3215 0.3218 0.3256 0.3254	CIE Y 0.3353 0.3298 0.3331 0.3388	CIE X 0.3254 0.3256 0.3294 0.3293	CIE Y 0.3388 0.3331 0.3364 0.3423	CIE X 0.3293 0.3294 0.3331 0.3332	CIE Y 0.3423 0.3364 0.3398 0.3458	CIE X 0.3332 0.3331 0.3369 0.3371	CIE Y 0.3458 0.3398 0.3431 0.3493
	CIE X 0.3215 0.3218 0.3256 0.3254 B*CIE X	CIE Y 0.3353 0.3298 0.3331 0.3388 14 CIE Y	CIE X 0.3254 0.3256 0.3294 0.3293 B CIE X	CIE Y 0.3388 0.3331 0.3364 0.3423 24 CIE Y	CIE X 0.3293 0.3294 0.3331 0.3332	CIE Y 0.3423 0.3364 0.3398 0.3458	CIE X 0.3332 0.3331 0.3369 0.3371 B	CIE Y 0.3458 0.3398 0.3431 0.3493 44 CIE Y
	CIE X 0.3215 0.3218 0.3256 0.3254 B: CIE X 0.3218	CIE Y 0.3353 0.3298 0.3331 0.3388 14 CIE Y 0.3298	CIE X 0.3254 0.3256 0.3294 0.3293 B: CIE X 0.3256	CIE Y 0.3388 0.3331 0.3364 0.3423 24 CIE Y 0.3331	CIE X 0.3293 0.3294 0.3331 0.3332 B3 CIE X 0.3294	CIE Y 0.3423 0.3364 0.3398 0.3458 4 CIE Y 0.3364	CIE X 0.3332 0.3331 0.3369 0.3371 B CIE X 0.3331	CIE Y 0.3458 0.3398 0.3431 0.3493 44 CIE Y 0.3398
	CIE X 0.3215 0.3218 0.3256 0.3254  B' CIE X 0.3218 0.3222	CIE Y 0.3353 0.3298 0.3331 0.3388 14 CIE Y 0.3298 0.3243	CIE X 0.3254 0.3256 0.3294 0.3293  B: CIE X 0.3256 0.3256	CIE Y 0.3388 0.3331 0.3364 0.3423 24 CIE Y 0.3331 0.3275	CIE X 0.3293 0.3294 0.3331 0.3332 B3 CIE X 0.3294 0.3294	CIE Y 0.3423 0.3364 0.3398 0.3458 4 CIE Y 0.3364 0.3306	CIE X 0.3332 0.3331 0.3369 0.3371  B CIE X 0.3331 0.3330	CIE Y 0.3458 0.3398 0.3431 0.3493 44 CIE Y 0.3398 0.3338



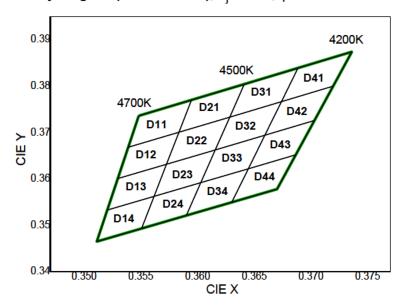
### CIE Chromaticity Diagram (Cool White), $I_F = 100$ mA, $T_i = 25$ °C,



	C11	C	21	C	31	C	41
CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
0.3376	0.3616	0.3420	0.3652	0.3463	0.3687	0.3507	0.3724
0.3374	0.3554	0.3415	0.3588	0.3457	0.3622	0.3500	0.3657
0.3415	0.3588	0.3457	0.3622	0.3500	0.3657	0.3542	0.3692
0.3420	0.3652	0.3463	0.3687	0.3507	0.3724	0.3551	0.3760
	C12	C	22	C	32	C	42
CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
0.3374	0.3554	0.3415	0.3588	0.3457	0.3622	0.3500	0.3657
0.3371	0.3493	0.3411	0.3525	0.3452	0.3558	0.3492	0.3591
0.3411	0.3525	0.3452	0.3558	0.3492	0.3591	0.3533	0.3624
0.3415	0.3588	0.3457	0.3622	0.3500	0.3657	0.3542	0.3692
	040	_	•••				10
	C13	C	23	C	33	C	43
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
CIE X 0.3371							
	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3371	CIE Y 0.3493	CIE X 0.3411	CIE Y 0.3525	CIE X 0.3452	CIE Y 0.3558	CIE X 0.3492	CIE Y 0.3591
0.3371 0.3369	CIE Y 0.3493 0.3431	CIE X 0.3411 0.3407	CIE Y 0.3525 0.3462	CIE X 0.3452 0.3446	CIE Y 0.3558 0.3493	CIE X 0.3492 0.3485	CIE Y 0.3591 0.3524
0.3371 0.3369 0.3407	CIE Y 0.3493 0.3431 0.3462	CIE X 0.3411 0.3407 0.3446 0.3452	CIE Y 0.3525 0.3462 0.3493	CIE X 0.3452 0.3446 0.3485	CIE Y 0.3558 0.3493 0.3524 0.3591	CIE X 0.3492 0.3485 0.3523 0.3533	CIE Y 0.3591 0.3524 0.3555
0.3371 0.3369 0.3407	CIE Y 0.3493 0.3431 0.3462 0.3525	CIE X 0.3411 0.3407 0.3446 0.3452	CIE Y 0.3525 0.3462 0.3493 0.3558	CIE X 0.3452 0.3446 0.3485 0.3492	CIE Y 0.3558 0.3493 0.3524 0.3591	CIE X 0.3492 0.3485 0.3523 0.3533	CIE Y 0.3591 0.3524 0.3555 0.3624
0.3371 0.3369 0.3407 0.3411	CIE Y 0.3493 0.3431 0.3462 0.3525	CIE X 0.3411 0.3407 0.3446 0.3452	CIE Y 0.3525 0.3462 0.3493 0.3558	CIE X 0.3452 0.3446 0.3485 0.3492	CIE Y 0.3558 0.3493 0.3524 0.3591	CIE X 0.3492 0.3485 0.3523 0.3533	CIE Y 0.3591 0.3524 0.3555 0.3624
0.3371 0.3369 0.3407 0.3411	CIE Y 0.3493 0.3431 0.3462 0.3525 C14 CIE Y	CIE X 0.3411 0.3407 0.3446 0.3452 CIE X	CIE Y 0.3525 0.3462 0.3493 0.3558 24 CIE Y	CIE X 0.3452 0.3446 0.3485 0.3492	CIE Y 0.3558 0.3493 0.3524 0.3591 34 CIE Y	CIE X 0.3492 0.3485 0.3523 0.3533	CIE Y 0.3591 0.3524 0.3555 0.3624 44 CIE Y
0.3371 0.3369 0.3407 0.3411 CIE X 0.3369	CIE Y 0.3493 0.3431 0.3462 0.3525 C14 CIE Y 0.3431	CIE X 0.3411 0.3407 0.3446 0.3452 CIE X 0.3407	CIE Y 0.3525 0.3462 0.3493 0.3558 24 CIE Y 0.3462	CIE X 0.3452 0.3446 0.3485 0.3492 CIE X 0.3446	CIE Y 0.3558 0.3493 0.3524 0.3591 34 CIE Y 0.3493	CIE X 0.3492 0.3485 0.3523 0.3533 CIE X 0.3485	CIE Y 0.3591 0.3524 0.3555 0.3624 44 CIE Y 0.3524
0.3371 0.3369 0.3407 0.3411 CIE X 0.3369 0.3366	CIE Y 0.3493 0.3431 0.3462 0.3525 C14 CIE Y 0.3431 0.3369	CIE X 0.3411 0.3407 0.3446 0.3452  CIE X 0.3407 0.3403	CIE Y 0.3525 0.3462 0.3493 0.3558 24 CIE Y 0.3462 0.3399	CIE X 0.3452 0.3446 0.3485 0.3492 CIE X 0.3446 0.3440	CIE Y 0.3558 0.3493 0.3524 0.3591 34 CIE Y 0.3493 0.3428	CIE X 0.3492 0.3485 0.3523 0.3533  CIE X 0.3485 0.3477	CIE Y 0.3591 0.3524 0.3555 0.3624 44 CIE Y 0.3524 0.3458

### **Color Bin Structure**

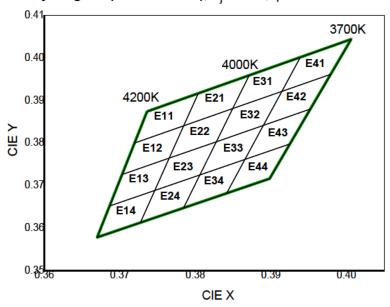
### CIE Chromaticity Diagram (Neutral White), $T_j$ = 25 $^{\circ}$ C, $I_F$ = 100mA



D'	11	D	21	D3	31	D <sub>4</sub>	41
CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
0.3548	0.3736	0.3595	0.3770	0.3641	0.3804	0.3689	0.3839
0.3539	0.3668	0.3584	0.3701	0.3628	0.3733	0.3674	0.3767
0.3584	0.3701	0.3628	0.3733	0.3674	0.3767	0.3720	0.3800
0.3595	0.3770	0.3641	0.3804	0.3689	0.3839	0.3736	0.3874
D.	12	D	22	D3	32	D4	42
CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
0.3539	0.3668	0.3584	0.3701	0.3628	0.3733	0.3674	0.3767
0.3530	0.3601	0.3573	0.3632	0.3616	0.3663	0.3659	0.3694
0.3573	0.3632	0.3616	0.3663	0.3659	0.3694	0.3703	0.3726
0.3584	0.3701	0.3628	0.3733	0.3674	0.3767	0.3720	0.3800
D'	12	D	23	D3	12	D	43
	13	<b>D</b>	20	Di	10	יט	45
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
CIE X 0.3530	CIE Y 0.3601	CIE X 0.3573	CIE Y 0.3632	CIE X 0.3616	CIE Y 0.3663	CIE X 0.3659	CIE Y 0.3694
CIE X 0.3530 0.3520	CIE Y 0.3601 0.3533	CIE X 0.3573 0.3562	CIE Y 0.3632 0.3562	CIE X 0.3616 0.3603	CIE Y 0.3663 0.3592	CIE X 0.3659 0.3645	CIE Y 0.3694 0.3622
CIE X 0.3530 0.3520 0.3562	CIE Y 0.3601 0.3533 0.3562 0.3632	CIE X 0.3573 0.3562 0.3603 0.3616	CIE Y 0.3632 0.3562 0.3592	CIE X 0.3616 0.3603 0.3645	CIE Y 0.3663 0.3592 0.3622 0.3694	CIE X 0.3659 0.3645 0.3687 0.3703	CIE Y 0.3694 0.3622 0.3652
CIE X 0.3530 0.3520 0.3562 0.3573	CIE Y 0.3601 0.3533 0.3562 0.3632	CIE X 0.3573 0.3562 0.3603 0.3616	CIE Y 0.3632 0.3562 0.3592 0.3663	CIE X 0.3616 0.3603 0.3645 0.3659	CIE Y 0.3663 0.3592 0.3622 0.3694	CIE X 0.3659 0.3645 0.3687 0.3703	CIE Y 0.3694 0.3622 0.3652 0.3726
CIE X 0.3530 0.3520 0.3562 0.3573	CIE Y 0.3601 0.3533 0.3562 0.3632	CIE X 0.3573 0.3562 0.3603 0.3616	CIE Y 0.3632 0.3562 0.3592 0.3663	CIE X 0.3616 0.3603 0.3645 0.3659	CIE Y 0.3663 0.3592 0.3622 0.3694	CIE X 0.3659 0.3645 0.3687 0.3703	CIE Y 0.3694 0.3622 0.3652 0.3726
CIE X 0.3530 0.3520 0.3562 0.3573	CIE Y 0.3601 0.3533 0.3562 0.3632 14 CIE Y	CIE X 0.3573 0.3562 0.3603 0.3616	CIE Y 0.3632 0.3562 0.3592 0.3663 24 CIE Y	CIE X 0.3616 0.3603 0.3645 0.3659 D3	CIE Y 0.3663 0.3592 0.3622 0.3694 CIE Y	CIE X 0.3659 0.3645 0.3687 0.3703	CIE Y 0.3694 0.3622 0.3652 0.3726
CIE X 0.3530 0.3520 0.3562 0.3573 D: CIE X 0.3520	CIE Y 0.3601 0.3533 0.3562 0.3632 14 CIE Y 0.3533	CIE X 0.3573 0.3562 0.3603 0.3616  D CIE X 0.3562	CIE Y 0.3632 0.3562 0.3592 0.3663 24 CIE Y 0.3562	CIE X 0.3616 0.3603 0.3645 0.3659 D3 CIE X 0.3603	CIE Y 0.3663 0.3592 0.3622 0.3694 4 CIE Y 0.3592	CIE X 0.3659 0.3645 0.3687 0.3703  CIE X 0.3645	CIE Y 0.3694 0.3622 0.3652 0.3726 44 CIE Y 0.3622
CIE X 0.3530 0.3520 0.3562 0.3573  CIE X 0.3520 0.3511	CIE Y 0.3601 0.3533 0.3562 0.3632 14 CIE Y 0.3533 0.3465	CIE X 0.3573 0.3562 0.3603 0.3616  D CIE X 0.3562 0.3551	CIE Y 0.3632 0.3562 0.3592 0.3663 24 CIE Y 0.3562 0.3493	CIE X 0.3616 0.3603 0.3645 0.3659  D3 CIE X 0.3603 0.3590	CIE Y 0.3663 0.3592 0.3622 0.3694 4 CIE Y 0.3592 0.3521	CIE X 0.3659 0.3645 0.3687 0.3703  CIE X 0.3645 0.3630	CIE Y 0.3694 0.3622 0.3652 0.3726 44 CIE Y 0.3622 0.3550



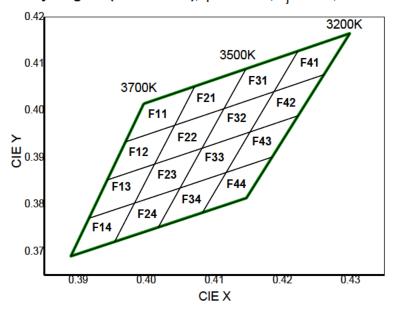
### CIE Chromaticity Diagram (Neutral White), $T_j$ = 25 $^{\circ}$ C, $I_F$ = 100mA



	E	11	E	21	E3	31	E	41
	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
	0.3736	0.3874	0.3804	0.3917	0.3871	0.3959	0.3939	0.4002
	0.3720	0.3800	0.3784	0.3841	0.3849	0.3881	0.3914	0.3922
	0.3784	0.3841	0.3849	0.3881	0.3914	0.3922	0.3979	0.3962
	0.3804	0.3917	0.3871	0.3959	0.3939	0.4002	0.4006	0.4044
	E <sup>r</sup>	12	Е	22	E3	32	E	42
	CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
	0.3720	0.3800	0.3784	0.3841	0.3849	0.3881	0.3914	0.3922
	0.3703	0.3726	0.3765	0.3765	0.3828	0.3803	0.3890	0.3842
	0.3765	0.3765	0.3828	0.3803	0.3890	0.3842	0.3952	0.3880
	0.3784	0.3841	0.3849	0.3881	0.3914	0.3922	0.3979	0.3962
	F-4	12	_	02		2	_	12
	=	13	E	23	E3	00	B	43
	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y
	CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
	CIE X 0.3703	CIE Y 0.3726	CIE X 0.3765	CIE Y 0.3765	CIE X 0.3828	CIE Y 0.3803	CIE X 0.3890	CIE Y 0.3842
	CIE X 0.3703 0.3687	CIE Y 0.3726 0.3652	CIE X 0.3765 0.3746	CIE Y 0.3765 0.3689	CIE X 0.3828 0.3806	CIE Y 0.3803 0.3725	CIE X 0.3890 0.3865	CIE Y 0.3842 0.3762
	CIE X 0.3703 0.3687 0.3746 0.3765	CIE Y 0.3726 0.3652 0.3689	CIE X 0.3765 0.3746 0.3806 0.3828	CIE Y 0.3765 0.3689 0.3725	CIE X 0.3828 0.3806 0.3865	CIE Y 0.3803 0.3725 0.3762 0.3842	CIE X 0.3890 0.3865 0.3925 0.3952	CIE Y 0.3842 0.3762 0.3798
	CIE X 0.3703 0.3687 0.3746 0.3765	CIE Y 0.3726 0.3652 0.3689 0.3765	CIE X 0.3765 0.3746 0.3806 0.3828	CIE Y 0.3765 0.3689 0.3725 0.3803	CIE X 0.3828 0.3806 0.3865 0.3890	CIE Y 0.3803 0.3725 0.3762 0.3842	CIE X 0.3890 0.3865 0.3925 0.3952	CIE Y 0.3842 0.3762 0.3798 0.3880
	CIE X 0.3703 0.3687 0.3746 0.3765	CIE Y 0.3726 0.3652 0.3689 0.3765	CIE X 0.3765 0.3746 0.3806 0.3828	CIE Y 0.3765 0.3689 0.3725 0.3803	CIE X 0.3828 0.3806 0.3865 0.3890	CIE Y 0.3803 0.3725 0.3762 0.3842	CIE X 0.3890 0.3865 0.3925 0.3952	CIE Y 0.3842 0.3762 0.3798 0.3880
	CIE X 0.3703 0.3687 0.3746 0.3765	CIE Y 0.3726 0.3652 0.3689 0.3765	CIE X 0.3765 0.3746 0.3806 0.3828	CIE Y 0.3765 0.3689 0.3725 0.3803 24 CIE Y	CIE X 0.3828 0.3806 0.3865 0.3890 E6	CIE Y 0.3803 0.3725 0.3762 0.3842 64 CIE Y	CIE X 0.3890 0.3865 0.3925 0.3952	CIE Y 0.3842 0.3762 0.3798 0.3880 44 CIE Y
	CIE X 0.3703 0.3687 0.3746 0.3765 E: CIE X 0.3687	CIE Y 0.3726 0.3652 0.3689 0.3765 14 CIE Y 0.3652	CIE X 0.3765 0.3746 0.3806 0.3828 E CIE X 0.3746	CIE Y 0.3765 0.3689 0.3725 0.3803 24 CIE Y 0.3689	CIE X 0.3828 0.3806 0.3865 0.3890 E8 CIE X 0.3806	CIE Y 0.3803 0.3725 0.3762 0.3842 34 CIE Y 0.3725	CIE X 0.3890 0.3865 0.3925 0.3952 Ex CIE X 0.3865	CIE Y 0.3842 0.3762 0.3798 0.3880 44 CIE Y 0.3762
	CIE X 0.3703 0.3687 0.3746 0.3765  E' CIE X 0.3687 0.3670	CIE Y 0.3726 0.3652 0.3689 0.3765 14 CIE Y 0.3652 0.3578	CIE X 0.3765 0.3746 0.3806 0.3828  E CIE X 0.3746 0.3727	CIE Y 0.3765 0.3689 0.3725 0.3803 24 CIE Y 0.3689 0.3613	CIE X 0.3828 0.3806 0.3865 0.3890 E3 CIE X 0.3806 0.3784	CIE Y 0.3803 0.3725 0.3762 0.3842 0.3842 CIE Y 0.3725 0.3647	CIE X 0.3890 0.3865 0.3925 0.3952  CIE X 0.3865 0.3841	CIE Y 0.3842 0.3762 0.3798 0.3880 44 CIE Y 0.3762 0.3682



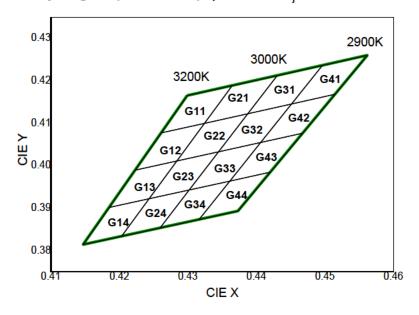
CIE Chromaticity Diagram (Warm White),  $I_F = 100$ mA,  $T_i = 25$ °C,



F	11	F:	21	F3	31	F4	41
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3996	0.4015	0.4071	0.4052	0.4146	0.4089	0.4223	0.4127
0.3969	0.3934	0.4042	0.3969	0.4114	0.4005	0.4187	0.4041
0.4042	0.3969	0.4114	0.4005	0.4187	0.4041	0.4261	0.4077
0.4071	0.4052	0.4146	0.4089	0.4223	0.4127	0.4299	0.4165
F	12	F	22	F3	32	F4	42
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.3969	0.3934	0.4042	0.3969	0.4114	0.4005	0.4187	0.4041
0.3943	0.3853	0.4012	0.3886	0.4082	0.3920	0.4152	0.3955
0.4012	0.3886	0.4082	0.3920	0.4152	0.3955	0.4223	0.3990
0.4042	0.3969	0.4114	0.4005	0.4187	0.4041	0.4261	0.4077
	13	F.	22	F2	2		12
Г	19	F.	23	F3	3	F4	43
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
CIE X 0.3943	CIE Y 0.3853	CIE X 0.4012	CIE Y 0.3886	CIE X 0.4082	CIE Y 0.3920	CIE X 0.4152	CIE Y 0.3955
CIE X 0.3943 0.3916	CIE Y 0.3853 0.3771	CIE X 0.4012 0.3983	CIE Y 0.3886 0.3803	CIE X 0.4082 0.4049	CIE Y 0.3920 0.3836	CIE X 0.4152 0.4117	CIE Y 0.3955 0.3869
CIE X 0.3943 0.3916 0.3983 0.4012	CIE Y 0.3853 0.3771 0.3803	CIE X 0.4012 0.3983 0.4049 0.4082	CIE Y 0.3886 0.3803 0.3836	CIE X 0.4082 0.4049 0.4117	CIE Y 0.3920 0.3836 0.3869 0.3955	CIE X 0.4152 0.4117 0.4185 0.4223	CIE Y 0.3955 0.3869 0.3902
CIE X 0.3943 0.3916 0.3983 0.4012	CIE Y 0.3853 0.3771 0.3803 0.3886	CIE X 0.4012 0.3983 0.4049 0.4082	CIE Y 0.3886 0.3803 0.3836 0.3920	CIE X 0.4082 0.4049 0.4117 0.4152	CIE Y 0.3920 0.3836 0.3869 0.3955	CIE X 0.4152 0.4117 0.4185 0.4223	CIE Y 0.3955 0.3869 0.3902 0.3990
CIE X 0.3943 0.3916 0.3983 0.4012	CIE Y 0.3853 0.3771 0.3803 0.3886	CIE X 0.4012 0.3983 0.4049 0.4082	CIE Y 0.3886 0.3803 0.3836 0.3920	CIE X 0.4082 0.4049 0.4117 0.4152	CIE Y 0.3920 0.3836 0.3869 0.3955	CIE X 0.4152 0.4117 0.4185 0.4223	CIE Y 0.3955 0.3869 0.3902 0.3990
CIE X 0.3943 0.3916 0.3983 0.4012	CIE Y 0.3853 0.3771 0.3803 0.3886 14 CIE Y	CIE X 0.4012 0.3983 0.4049 0.4082	CIE Y 0.3886 0.3803 0.3836 0.3920 24 CIE Y	CIE X 0.4082 0.4049 0.4117 0.4152 FS	CIE Y 0.3920 0.3836 0.3869 0.3955	CIE X 0.4152 0.4117 0.4185 0.4223	CIE Y 0.3955 0.3869 0.3902 0.3990 44 CIE Y
CIE X 0.3943 0.3916 0.3983 0.4012 F CIE X 0.3916	CIE Y 0.3853 0.3771 0.3803 0.3886 14 CIE Y 0.3771	CIE X 0.4012 0.3983 0.4049 0.4082 F: CIE X 0.3983	CIE Y 0.3886 0.3803 0.3836 0.3920 24 CIE Y 0.3803	CIE X 0.4082 0.4049 0.4117 0.4152 F3 CIE X 0.4049	CIE Y 0.3920 0.3836 0.3869 0.3955 64 CIE Y 0.3836	CIE X 0.4152 0.4117 0.4185 0.4223 FZ CIE X 0.4117	CIE Y 0.3955 0.3869 0.3902 0.3990 44 CIE Y 0.3869
CIE X 0.3943 0.3916 0.3983 0.4012 F CIE X 0.3916 0.3889	CIE Y 0.3853 0.3771 0.3803 0.3886 14 CIE Y 0.3771 0.3690	CIE X 0.4012 0.3983 0.4049 0.4082  CIE X 0.3983 0.3953	CIE Y 0.3886 0.3803 0.3836 0.3920 24 CIE Y 0.3803 0.3721	CIE X 0.4082 0.4049 0.4117 0.4152  F3 CIE X 0.4049 0.4017	CIE Y 0.3920 0.3836 0.3869 0.3955 4 CIE Y 0.3836 0.3751	CIE X 0.4152 0.4117 0.4185 0.4223  F4 CIE X 0.4117 0.4082	CIE Y 0.3955 0.3869 0.3902 0.3990 44 CIE Y 0.3869 0.3783



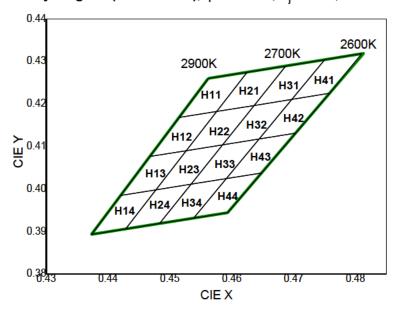
CIE Chromaticity Diagram (Warm White),  $I_F = 100$ mA,  $T_j = 25$ °C,



G1	1	G	21	G	31	G	41
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.4299	0.4165	0.4364	0.4188	0.4430	0.4212	0.4496	0.4236
0.4261	0.4077	0.4324	0.4099	0.4387	0.4122	0.4451	0.4145
0.4324	0.4100	0.4387	0.4122	0.4451	0.4145	0.4514	0.4168
0.4365	0.4189	0.4430	0.4212	0.4496	0.4236	0.4562	0.4260
G1	2	G	22	G3	32	G	42
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
0.4261	0.4077	0.4324	0.4100	0.4387	0.4122	0.4451	0.4145
0.4223	0.3990	0.4284	0.4011	0.4345	0.4033	0.4406	0.4055
0.4284	0.4011	0.4345	0.4033	0.4406	0.4055	0.4468	0.4077
0.4324	0.4100	0.4387	0.4122	0.4451	0.4145	0.4515	0.4168
G1	3	G	23	G	33	G	43
G1 CIE X	3 CIE Y	CIE X	23 CIE Y	GS CIE X	CIE Y	G. CIE X	43 CIE Y
CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
CIE X 0.4223	CIE Y 0.3990	CIE X 0.4284	CIE Y 0.4011	CIE X 0.4345	CIE Y 0.4033	CIE X 0.4406	CIE Y 0.4055
CIE X 0.4223 0.4185	CIE Y 0.3990 0.3902	CIE X 0.4284 0.4243	CIE Y 0.4011 0.3922	CIE X 0.4345 0.4302	CIE Y 0.4033 0.3943	CIE X 0.4406 0.4361	CIE Y 0.4055 0.3964
CIE X 0.4223 0.4185 0.4243	CIE Y 0.3990 0.3902 0.3922 0.4011	CIE X 0.4284 0.4243 0.4302 0.4345	CIE Y 0.4011 0.3922 0.3943	CIE X 0.4345 0.4302 0.4361	CIE Y 0.4033 0.3943 0.3964 0.4055	CIE X 0.4406 0.4361 0.4420	CIE Y 0.4055 0.3964 0.3985 0.4077
CIE X 0.4223 0.4185 0.4243 0.4284	CIE Y 0.3990 0.3902 0.3922 0.4011	CIE X 0.4284 0.4243 0.4302 0.4345	CIE Y 0.4011 0.3922 0.3943 0.4033	CIE X 0.4345 0.4302 0.4361 0.4406	CIE Y 0.4033 0.3943 0.3964 0.4055	CIE X 0.4406 0.4361 0.4420 0.4468	CIE Y 0.4055 0.3964 0.3985 0.4077
CIE X 0.4223 0.4185 0.4243 0.4284	CIE Y 0.3990 0.3902 0.3922 0.4011	CIE X 0.4284 0.4243 0.4302 0.4345	CIE Y 0.4011 0.3922 0.3943 0.4033	CIE X 0.4345 0.4302 0.4361 0.4406	CIE Y 0.4033 0.3943 0.3964 0.4055	CIE X 0.4406 0.4361 0.4420 0.4468	CIE Y 0.4055 0.3964 0.3985 0.4077
CIE X 0.4223 0.4185 0.4243 0.4284 G1 CIE X	CIE Y 0.3990 0.3902 0.3922 0.4011 4 CIE Y	CIE X 0.4284 0.4243 0.4302 0.4345 G: CIE X	CIE Y 0.4011 0.3922 0.3943 0.4033 24 CIE Y	CIE X 0.4345 0.4302 0.4361 0.4406	CIE Y 0.4033 0.3943 0.3964 0.4055	CIE X 0.4406 0.4361 0.4420 0.4468 GCIE X	CIE Y 0.4055 0.3964 0.3985 0.4077 44 CIE Y
CIE X 0.4223 0.4185 0.4243 0.4284 G1 CIE X 0.4243	CIE Y 0.3990 0.3902 0.3922 0.4011 4 CIE Y 0.3922	CIE X 0.4284 0.4243 0.4302 0.4345 G: CIE X 0.4302	CIE Y 0.4011 0.3922 0.3943 0.4033 24 CIE Y 0.3943	CIE X 0.4345 0.4302 0.4361 0.4406 GS CIE X 0.4302	CIE Y 0.4033 0.3943 0.3964 0.4055 34 CIE Y 0.3943	CIE X 0.4406 0.4361 0.4420 0.4468 G CIE X 0.4361	CIE Y 0.4055 0.3964 0.3985 0.4077 44 CIE Y 0.3964

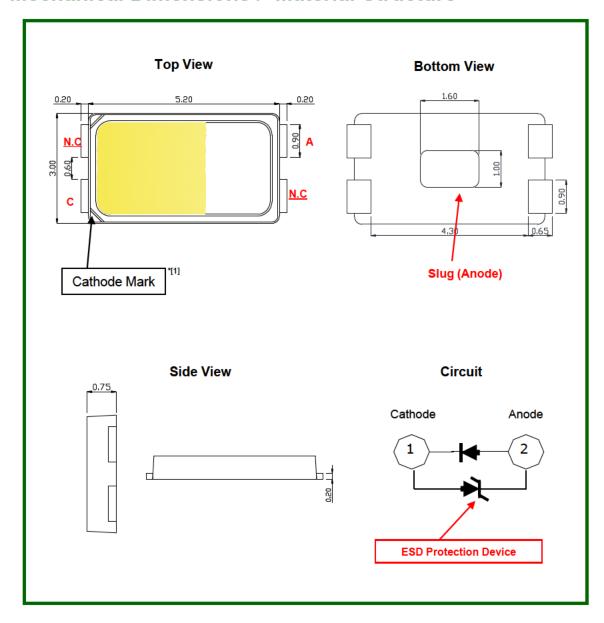


CIE Chromaticity Diagram (Warm White),  $I_F = 100$ mA,  $T_i = 25$ °C,



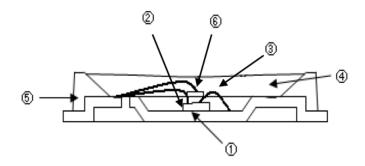
	H	11	H	21	H3	31	H-	41
	CIE X	CIE Y	CIE X	CIEY	CIE X	CIE Y	CIE X	CIE Y
(	0.4562	0.4260	0.4625	0.4275	0.4687	0.4289	0.4750	0.4304
(	0.4515	0.4168	0.4575	0.4182	0.4636	0.4197	0.4697	0.4211
(	0.4575	0.4182	0.4636	0.4197	0.4697	0.4211	0.4758	0.4225
(	0.4625	0.4275	0.4687	0.4289	0.4750	0.4304	0.4810	0.4319
	H12		H22		H32		H42	
	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
(	0.4515	0.4168	0.4575	0.4182	0.4636	0.4197	0.4697	0.4211
(	0.4468	0.4077	0.4526	0.4090	0.4585	0.4104	0.4644	0.4118
(	0.4526	0.4090	0.4585	0.4104	0.4644	0.4118	0.4703	0.4132
(	0.4575	0.4182	0.4636	0.4197	0.4697	0.4211	0.4758	0.4225
	H	12	119	23	112	2		43
		เจ	п	23	H3	3	п	40
	CIEX	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
(	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y	CIE X	CIE Y
(	CIE X 0.4468	CIE Y 0.4077	CIE X 0.4526	CIE Y 0.4090	CIE X 0.4585	CIE Y 0.4104	CIE X 0.4644	CIE Y 0.4118
(	CIE X 0.4468 0.4420	CIE Y 0.4077 0.3985	CIE X 0.4526 0.4477	CIE Y 0.4090 0.3998	CIE X 0.4585 0.4534	CIE Y 0.4104 0.4012	CIE X 0.4644 0.4591	CIE Y 0.4118 0.4025
(	CIE X 0.4468 0.4420 0.4477 0.4526	CIE Y 0.4077 0.3985 0.3998	CIE X 0.4526 0.4477 0.4534 0.4585	CIE Y 0.4090 0.3998 0.4012	CIE X 0.4585 0.4534 0.4591	CIE Y 0.4104 0.4012 0.4025 0.4118	CIE X 0.4644 0.4591 0.4648	CIE Y 0.4118 0.4025 0.4038 0.4132
	CIE X 0.4468 0.4420 0.4477 0.4526	CIE Y 0.4077 0.3985 0.3998 0.4090	CIE X 0.4526 0.4477 0.4534 0.4585	CIE Y 0.4090 0.3998 0.4012 0.4104	CIE X 0.4585 0.4534 0.4591 0.4644	CIE Y 0.4104 0.4012 0.4025 0.4118	CIE X 0.4644 0.4591 0.4648 0.4703	CIE Y 0.4118 0.4025 0.4038 0.4132
(	CIE X 0.4468 0.4420 0.4477 0.4526	CIE Y 0.4077 0.3985 0.3998 0.4090	CIE X 0.4526 0.4477 0.4534 0.4585	CIE Y 0.4090 0.3998 0.4012 0.4104	CIE X 0.4585 0.4534 0.4591 0.4644	CIE Y 0.4104 0.4012 0.4025 0.4118	CIE X 0.4644 0.4591 0.4648 0.4703	CIE Y 0.4118 0.4025 0.4038 0.4132
	CIE X 0.4468 0.4420 0.4477 0.4526 H	CIE Y 0.4077 0.3985 0.3998 0.4090 14 CIE Y	CIE X 0.4526 0.4477 0.4534 0.4585	CIE Y 0.4090 0.3998 0.4012 0.4104 24 CIE Y	CIE X 0.4585 0.4534 0.4591 0.4644 H3	CIE Y 0.4104 0.4012 0.4025 0.4118 34 CIE Y	CIE X 0.4644 0.4591 0.4648 0.4703	CIE Y 0.4118 0.4025 0.4038 0.4132 44 CIE Y
	CIE X 0.4468 0.4420 0.4477 0.4526 H CIE X 0.4420	CIE Y 0.4077 0.3985 0.3998 0.4090 14 CIE Y 0.3985	CIE X 0.4526 0.4477 0.4534 0.4585 H: CIE X 0.4477	CIE Y 0.4090 0.3998 0.4012 0.4104 24 CIE Y 0.3998	CIE X 0.4585 0.4534 0.4591 0.4644 H3 CIE X 0.4534	CIE Y 0.4104 0.4012 0.4025 0.4118 34 CIE Y 0.4012	CIE X 0.4644 0.4591 0.4648 0.4703 HA CIE X 0.4591	CIE Y 0.4118 0.4025 0.4038 0.4132 44 CIE Y 0.4025
	CIE X 0.4468 0.4420 0.4477 0.4526 H CIE X 0.4420 0.4373	CIE Y 0.4077 0.3985 0.3998 0.4090 14 CIE Y 0.3985 0.3985	CIE X 0.4526 0.4477 0.4534 0.4585 H: CIE X 0.4477 0.4428	CIE Y 0.4090 0.3998 0.4012 0.4104 24 CIE Y 0.3998 0.3906	CIE X 0.4585 0.4534 0.4591 0.4644 H3 CIE X 0.4534 0.4483	CIE Y 0.4104 0.4012 0.4025 0.4118 34 CIE Y 0.4012 0.3919	CIE X 0.4644 0.4591 0.4648 0.4703 H- CIE X 0.4591 0.4538	CIE Y 0.4118 0.4025 0.4038 0.4132 44 CIE Y 0.4025 0.3932

### **Mechanical Dimensions / Material Structure**



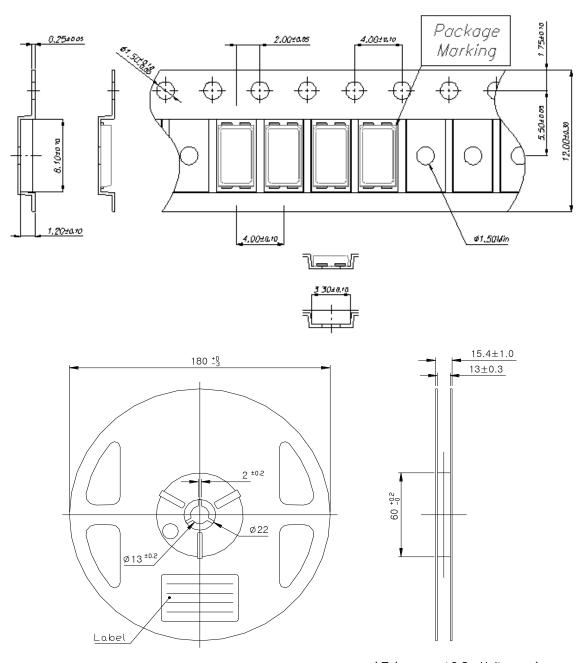
- (1) All dimensions are in millimeters.
- (2) Scale: none
- (3) Undefined tolerance is  $\pm 0.1$ mm
- (4) The LED package has two Cathode Marks. \*[1]

## **Mechanical Dimensions / Material Structure**



Parts No.	Name	Description	Materials
①	LEAD FRAME	Metal	Copper Alloy (Silver Plated)
2	Chip Source	Blue LED	GaN on Sapphire
3	Wire	Metal	Gold Wire
4	Encapsulation	Silicone	+Phosphor
<b>⑤</b>	Body	Thermo Plastic	Heat-resistant Polymer
6	Zener Diode	Si	-

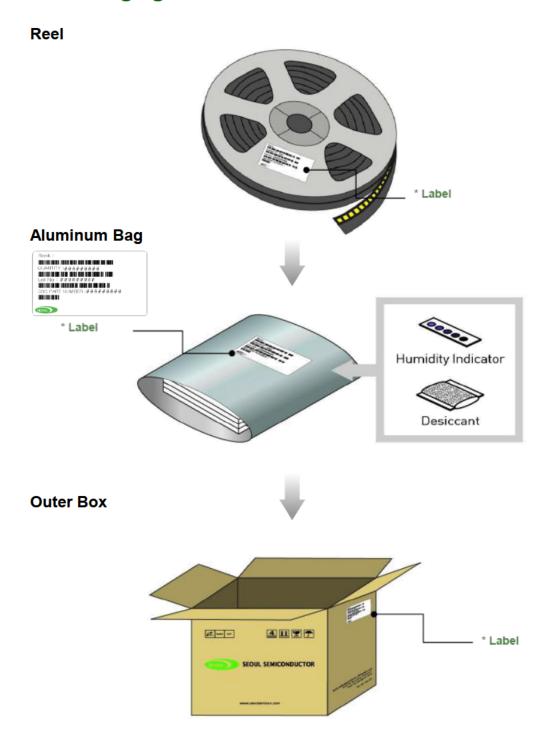
## **Reel Packaging**



( Tolerance:  $\pm 0.2,\; \text{Unit: mm}$  )

- (1) Quantity: Max 3,500pcs/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° to the carrier tape.
- (4) Package: P/N, Manufacturing data Code No. and Quantity to be indicated on a damp proof Package.

# **Reel Packaging**



### **Product Nomenclature**

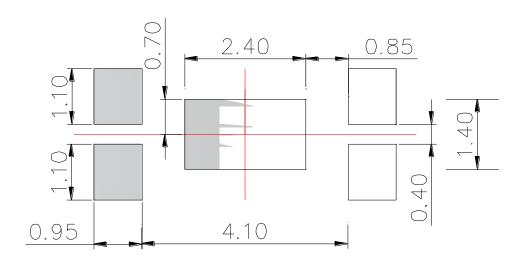
Table 5. Part Numbering System :  $X_1X_2X_3X_4X_5X_6X_7$ 

Part Number Code	Description	Part Number	Value
X <sub>1</sub>	Company	S	
X <sub>2</sub>	Top View LED series	Т	
X <sub>3</sub>	Color Specification	W8	CRI 80
X <sub>4</sub>	Package series	Q	Q series
X <sub>5</sub> X <sub>6</sub>	Characteristic code	14	
X <sub>7</sub> Revision		С	

Table 6. Lot Numbering System  $: Y_1Y_2Y_3Y_4Y_5Y_6Y_7Y_8Y_9Y_{10} - Y_{11}Y_{12}Y_{13}Y_{14}Y_{15}Y_{16}Y_{17}$ 

Lot Number Code	Description	Lot Number	Value
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		

### **Recommended Solder Pad**



#### Notes:

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

## **Reflow Soldering Characteristics**

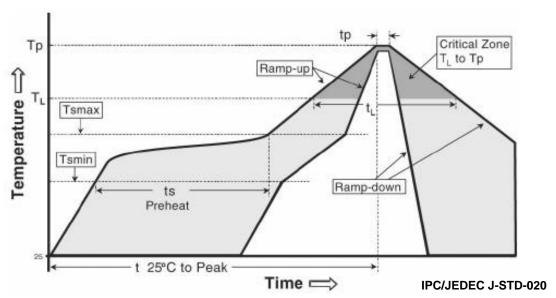


Table 7.

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

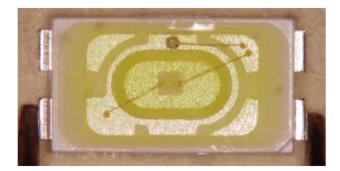
- (1) Reflow soldering is recommended not to be done more than two times. In the case of more than 24 hours passed soldering after first, LEDs will be damaged.
- (2) Repairs should not be done after the LEDs have been soldered. When repair is unavoidable, suitable tools must be used.
- (3) Die slug is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

### Handling 5630 Series

(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.

#### **Precaution for Use**

(1) Storage

To avoid the moisture penetration, we recommend store in a dry box with a desiccant. The recommended storage temperature range is 5  $^{\circ}$ C to 30  $^{\circ}$ 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 ~ 40 °C Humidity : less than RH30%
- b. If the package has been opened more than 4 week(MSL\_2a) or the color of the desiccant changes, components should be dried for 10-12hr at  $60\pm5$  °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 properly to maintain the device. If the LEDs are stored for 3 months or more after being shipped from SSC, a sealed container with a nitrogen atmosphere should be used for storage.

#### **Precaution for Use**

- (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.
- (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) Attaching LEDs, do not use adhesives that outgas organic vapor.
- (15) 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.
- (16) Similar to most Solid state devices;
  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 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 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**

#### Published by

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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.

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