

High Power LED Series  
Chip on Board

# LC006B - Gen3



High efficacy COB LED package,  
well-suited for use in spotlight applications

## Features & Benefits

- Chip on Board (COB) solution makes it easy to design in
- Simple assembly reduces manufacturing cost
- Low thermal resistance
- InGaN/GaN MQW LED with long time reliability
- Completed 6,000 hours of LM-80 Testing

## Applications

- Spotlight / Downlight
- LED Retrofit Bulbs
- Outdoor Illumination



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## 1. Characteristics

### a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	$T_a$	-40 ~ +105	°C	-
Storage Temperature	$T_{stg}$	-40 ~ +120	°C	-
LED Junction Temperature	$T_j$	140	°C	-
Case Temperature	$T_c$	105	°C	*Note
Forward Current	$I_F$	320	mA	-
Power Dissipation	$P_D$	12.2	W	-
ESD (HBM)	-	±2	kV	-
ESD (MM)	-	±0.5	kV	-

### b) Electro-optical Characteristics ( $I_F = 180 \text{ mA}$ , $T_a = 25 \text{ °C}$ )

Item	Unit	Rank	Min.	Typ.	Max.
Forward Voltage ( $V_F$ )	V	YH	32.5	35.5	38.5
Color Rendering Index (Ra)		5	80	-	-
		7	90	-	-
Thermal Resistance (junction to chip point)	°C/W		-	2.4	-
Beam Angle	°		-	115	-
Nominal Power	W			6.4	
Eye Protection		Risk 1	-		-

#### Notes:

- 1) The COB is tested in pulsed condition at rated test current (10 ms pulse width) and rated temperature ( $T_j = T_c = T_a = 25 \text{ °C}$ )
- 2) Samsung maintains measurement tolerance of: forward voltage =  $\pm 5 \%$ , CRI =  $\pm 1$
- 3) Refer to the derating curve, '3. Typical Characteristics Graph' designed within the range.

### c) Luminous Flux Characteristics ( $I_F = 180 \text{ mA}$ )

CRI (R <sub>a</sub> ) Min.	Nominal CCT (K)	Flux Rank	Flux Bin	Sorting <sup>1)</sup> @ T <sub>c</sub> = 25 °C (lm)		Calculated Flux <sup>2)</sup> @ T <sub>c</sub> = 85 °C (lm)	
				Min.	Max.	Min.	Max.
80	2700	B3	E3	833	888	758	808
			E4	888	942	808	858
			E5	942	1008	858	917
	3000	B3	E3	887	945	807	860
			E4	945	1003	860	912
			E5	1003	1079	912	982
	3500	B3	E3	913	973	831	885
			E4	973	1033	885	940
			E5	1033	1110	940	1010
	4000	B3	E2	878	940	799	855
			E3	940	1001	855	911
			E4	1001	1079	911	982
	5000	B3	E2	887	949	807	863
			E3	949	1011	863	920
			E4	1011	1089	920	991
	5700	B3	E2	887	949	807	863
			E3	949	1011	863	920
			E4	1011	1089	920	991
90	2700	B3	C2	698	754	636	686
			C3	754	810	686	737
			C4	810	886	737	806
	3000	B3	C3	770	827	700	752
			C4	827	907	752	825
			C5	907	993	825	904
	3500	B3	C3	793	851	721	775
			C4	851	948	775	863
	4000	B3	C3	816	876	742	797
			C4	876	973	797	885

#### Notes:

- 1) The COB is tested in pulsed condition at rated test current (10 ms pulse width) and rated temperature ( $T_j = T_c = T_a = 25 \text{ °C}$ )
- 2) Calculated flux values are for reference only
- 3) Samsung maintains measurement tolerance of: luminous flux =  $\pm 7 \%$ , CRI =  $\pm 1$

## 2. Product Code Information

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S	P	H	C	W	1	H	D	N	8	2	5	Y	H	R	T	B	3

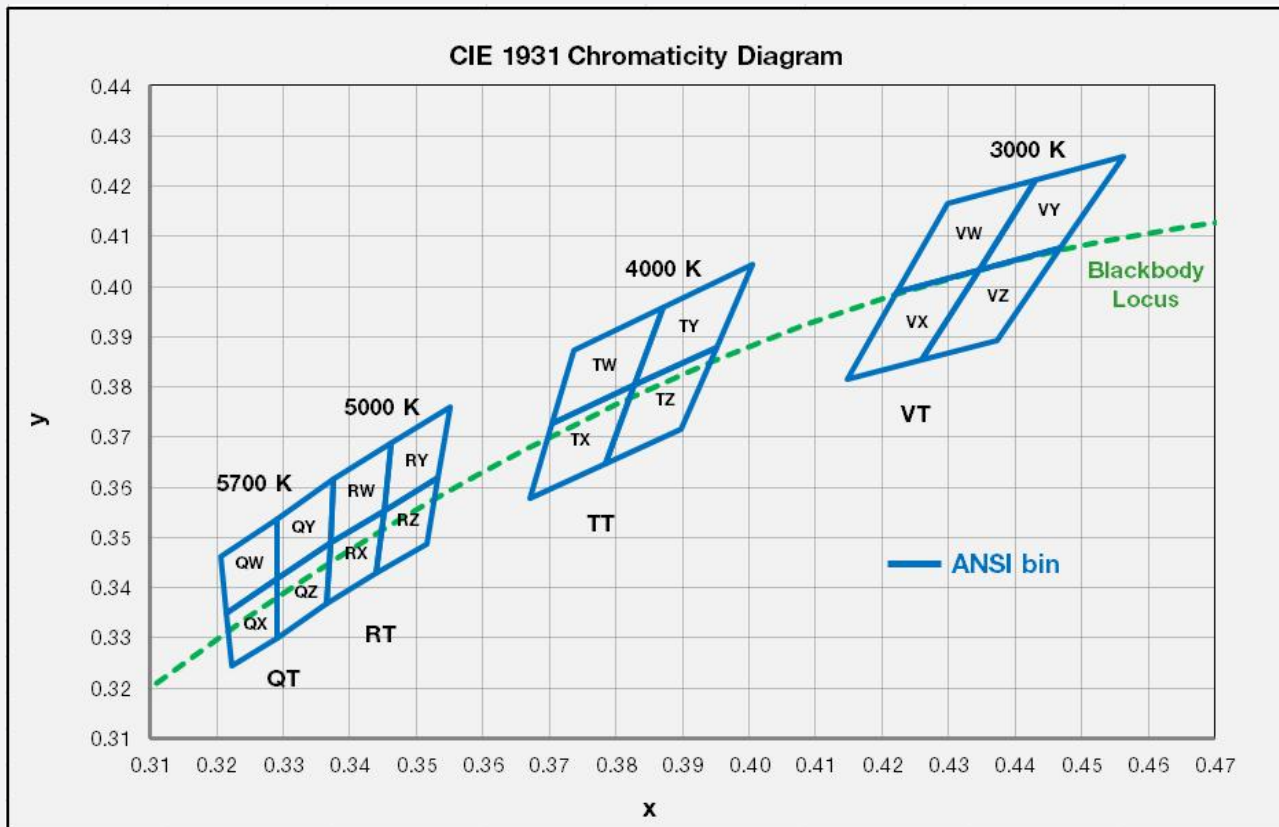
Digit	PKG Information	Code	Specification
1 2 3	Samsung Package High Power	<b>SPH</b>	
4 5	Color	<b>WW</b> <b>CW</b>	Warm White (T/U/V/W Ranks) Cool White (Q/R Ranks)
6	Product Version	<b>1</b>	
7 8	Form Factor	<b>HD</b>	COB
9	Lens Type	<b>N</b>	No lens
10	Internal Code	<b>8</b>	LC006B
11	Chip Type	<b>2</b>	
12	CRI & Sorting Temperature	<b>5</b> <b>7</b>	Min. 80 25 °C Min. 90
13 14	Forward Voltage (V)	<b>YH</b>	32.5~38.5
15	CCT (K)	<b>W</b> <b>V</b> <b>U</b> <b>T</b> <b>R</b> <b>Q</b>	2700 K WA, WB (MacAdam Ellipse) 3000 K VA, VB (MacAdam Ellipse) VW, VX, VY, VZ (ANSI bin) 3500 K UA, UB (MacAdam Ellipse) 4000 K TA, TB (MacAdam Ellipse) TW, TX, TY, TZ (ANSI bin) 5000 K RA (MacAdam Ellipse) RW, RX, RY, RZ (ANSI bin) 5700 K QW, QX, QY, QZ (ANSI bin)
16	MacAdam / ANSI	<b>2</b> <b>3</b> <b>T</b>	MacAdam 2-step MacAdam 3-step ANSI bin
17 18	Luminous Flux	<b>B3</b>	Bin Code: E2, E3, E4, E5 (80 CRI) C2, C3, C4 (90 CRI)

a) Binning Structure ( $I_F = 180 \text{ mA}$ ,  $T_a = 25 \text{ }^\circ\text{C}$ )

CRI (Ra) Min.	Nominal CCT (K)	Product Code	V <sub>F</sub> Rank	Color Rank	Chrom. Bin	Flux Rank	Flux Bin	Flux Range (Φ <sub>v</sub> , lm)
80	2700	SPHWW1HDN825YHW2B3	YH	W2	WB	B3	E3	833 ~ 888
							E4	888 ~ 942
							E5	942 ~ 1008
		SPHWW1HDN825YHW3B3	YH	W3	WA, WB	B3	E3	833 ~ 888
							E4	888 ~ 942
							E5	942 ~ 1008
	3000	SPHWW1HDN825YHV2B3	YH	V2	VB	B3	E3	887 ~ 945
							E4	945 ~ 1003
							E5	1003 ~ 1079
		SPHWW1HDN825YHV3B3	YH	V3	VA, VB	B3	E3	887 ~ 945
							E4	945 ~ 1003
							E5	1003 ~ 1079
	3500	SPHWW1HDN825YHU2B3	YH	U2	UB	B3	E3	913 ~ 973
							E4	973 ~ 1033
							E5	1033 ~ 1110
		SPHWW1HDN825YHU3B3	YH	U3	UA, UB	B3	E3	913 ~ 973
							E4	973 ~ 1033
							E5	1033 ~ 1110
	4000	SPHWW1HDN825YHT2B3	YH	T2	TB	B3	E2	878 ~ 940
							E3	940 ~ 1001
							E4	1001 ~ 1079
		SPHWW1HDN825YHT3B3	YH	T3	TA, TB	B3	E2	878 ~ 940
							E3	940 ~ 1001
							E4	1001 ~ 1079
5000	SPHCW1HDN825YHR3B3	YH	R3	RA	B3	E2	887 ~ 949	
						E3	949 ~ 1011	
						E4	1011 ~ 1089	
	SPHCW1HDN825YHRTB3	YH	RT	RW, RX, RY, RZ	B3	E2	887 ~ 949	
						E3	949 ~ 1011	
						E4	1011 ~ 1089	
5700	SPHCW1HDN825YHQT B3	YH	QT	QW, QX, QY, QZ	B3	E2	887 ~ 949	
						E3	949 ~ 1011	
							E4	1011 ~ 1089

a) Binning Structure ( $I_F = 180 \text{ mA}$ ,  $T_a = 25 \text{ }^\circ\text{C}$ )

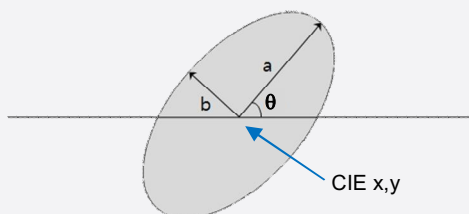
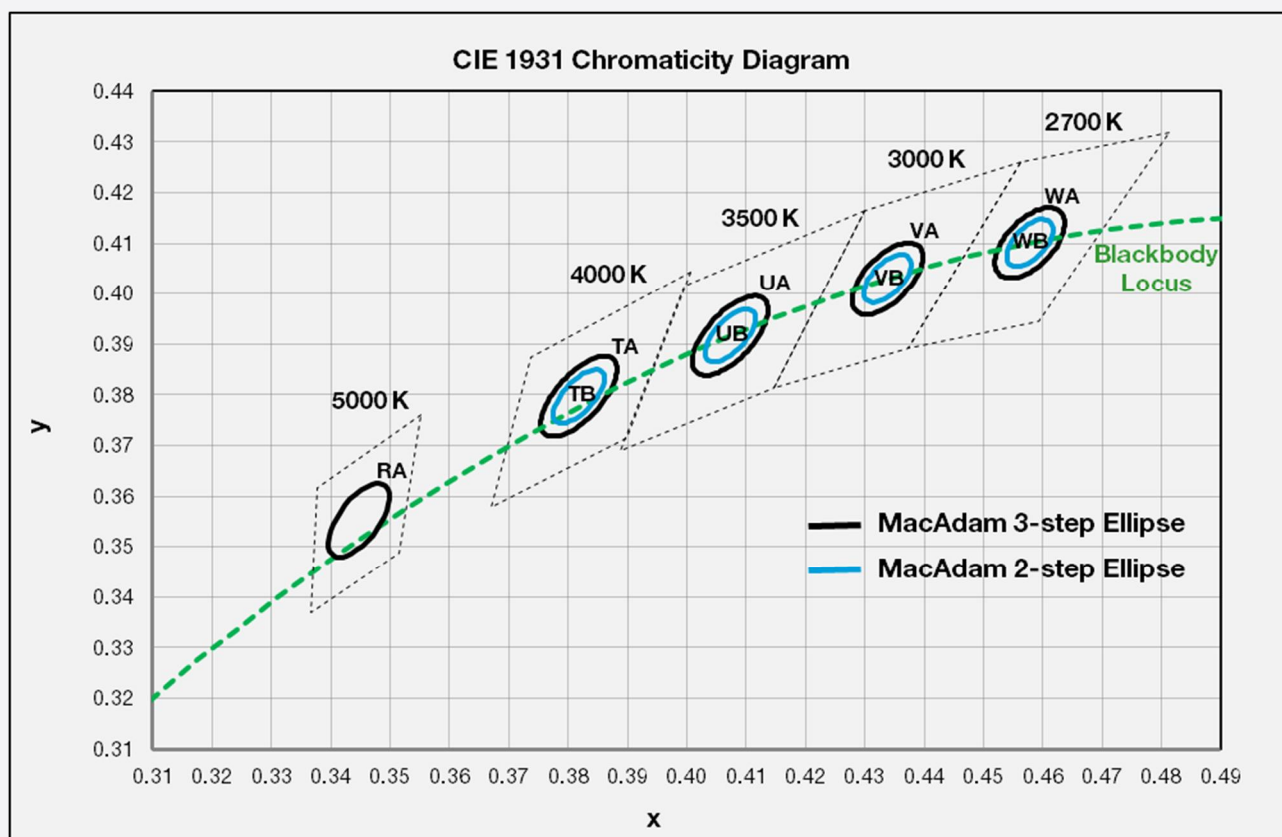
CRI ( $R_a$ ) Min.	Nominal CCT (K)	Product Code	$V_F$ Rank	Color Rank	Chrom. Bin	Flux Rank	Flux Bin	Flux Range ( $\Phi_v$ , lm)
90	2700	SPHWW1HDN827YHW2B3	YH	W2	WB	B3	C2	698 ~ 754
							C3	754 ~ 810
							C4	810 ~ 886
		SPHWW1HDN827YHW3B3	YH	W3	WA, WB	B3	C2	698 ~ 754
							C3	754 ~ 810
							C4	810 ~ 886
	3000	SPHWW1HDN827YHV2B3	YH	V2	VB	B3	C3	770 ~ 827
							C4	827 ~ 907
							C5	907 ~ 993
		SPHWW1HDN827YHV3B3	YH	V3	VA, VB	B3	C3	770 ~ 827
							C4	827 ~ 907
							C5	907 ~ 993
	3500	SPHWW1HDN827YHU2B3	YH	U2	UB	B3	C3	793 ~ 851
							C4	851 ~ 948
		SPHWW1HDN827YHU3B3	YH	U3	UA, UB	B3	C3	793 ~ 851
							C4	851 ~ 948
	4000	SPHWW1HDN827YHT2B3	YH	T2	TB	B3	C3	816 ~ 876
							C4	876 ~ 973
SPHWW1HDN827YHT3B3		YH	T3	TA, TB	B3	C3	816 ~ 876	
						C4	876 ~ 973	

b) Chromaticity Region & Coordinates ( $I_F = 180 \text{ mA}$ ,  $T_a = 25 \text{ }^\circ\text{C}$ )

Region	CIE x	CIE y	Region	CIE x	CIE y
<b>V rank (3000 K)</b>					
VW	0.4223	0.399	VY	0.4345	0.4033
	0.4345	0.4033		0.4468	0.4077
	0.4431	0.4213		0.4562	0.4260
	0.4299	0.4165		0.4431	0.4213
VX	0.4223	0.399	VZ	0.4260	0.3854
	0.4147	0.3814		0.4373	0.3893
	0.4260	0.3854		0.4468	0.4077
	0.4345	0.4033		0.4345	0.4033
<b>R rank (5000 K)</b>					
RW	0.3376	0.3616	RY	0.3463	0.3687
	0.3463	0.3687		0.3551	0.3760
	0.3451	0.3554		0.3533	0.3620
	0.3371	0.3490		0.3451	0.3554
RX	0.3371	0.3490	RZ	0.3451	0.3554
	0.3451	0.3554		0.3533	0.3620
	0.3440	0.3428		0.3515	0.3487
	0.3366	0.3369		0.3440	0.3428

Region	CIE x	CIE y	Region	CIE x	CIE y
<b>T rank (4000 K)</b>					
TW	0.3736	0.3874	TY	0.3871	0.3959
	0.3871	0.3959		0.4006	0.4044
	0.3828	0.3803		0.3952	0.388
	0.3703	0.3726		0.3828	0.3803
TX	0.3703	0.3726	TZ	0.3828	0.3803
	0.3828	0.3803		0.3952	0.388
	0.3784	0.3647		0.3898	0.3716
	0.367	0.3578		0.3784	0.3647
<b>Q rank (5700 K)</b>					
QW	0.3207	0.3462	QY	0.3290	0.3538
	0.3290	0.3538		0.3376	0.3616
	0.3290	0.3417		0.3371	0.3490
	0.3215	0.3350		0.3290	0.3417
QX	0.3215	0.3350	QZ	0.3290	0.3417
	0.3290	0.3417		0.3371	0.3490
	0.3290	0.3300		0.3366	0.3369
	0.3222	0.3243		0.3290	0.3300



**b) Chromaticity Region & Coordinates ( $I_F = 180 \text{ mA}$ ,  $T_a = 25 \text{ }^\circ\text{C}$ )**


MacAdam Ellipse (WA, WB)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.4578	0.4101	53.70	0.0054	0.0028
3-step	0.4578	0.4101	53.70	0.0081	0.0042

MacAdam Ellipse (VA, VB)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.4338	0.403	53.22	0.0056	0.0027
3-step	0.4338	0.4030	53.22	0.0083	0.0041

MacAdam Ellipse (UA, UB)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.4073	0.3917	54.00	0.0062	0.0028
3-step	0.4073	0.3917	54.00	0.0093	0.0041

MacAdam Ellipse (TA, TB)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.3818	0.3797	53.72	0.0063	0.0027
3-step	0.3818	0.3797	53.72	0.0094	0.0040

MacAdam Ellipse (RA)					
Step	CIE x	CIE y	$\theta$	a	b
3-step	0.3447	0.3553	59.62	0.0082	0.0035

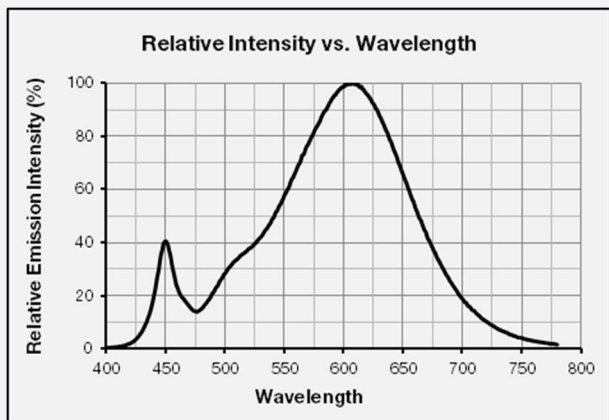
**Note:**

Samsung maintains measurement tolerance of:  $C_x, C_y = \pm 0.005$

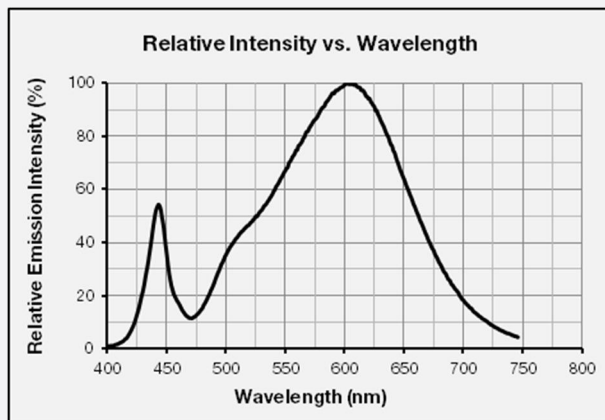
### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_f = 180 \text{ mA}$ , $T_a = 25 \text{ }^\circ\text{C}$ )

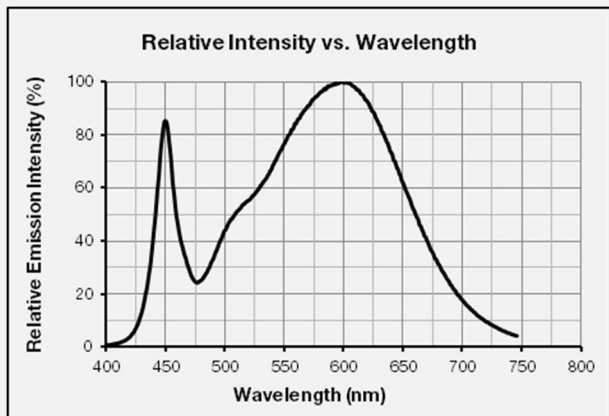
CCT: 2700 K



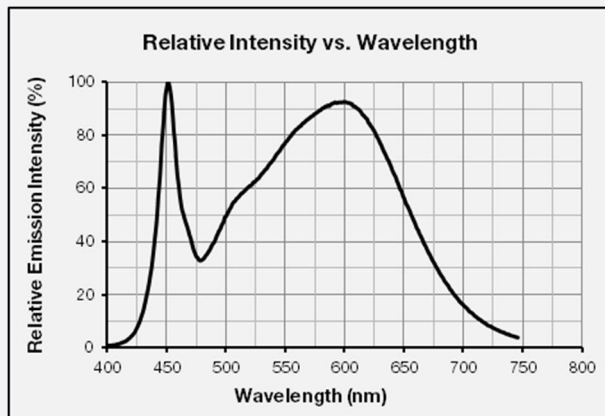
CCT: 3000 K



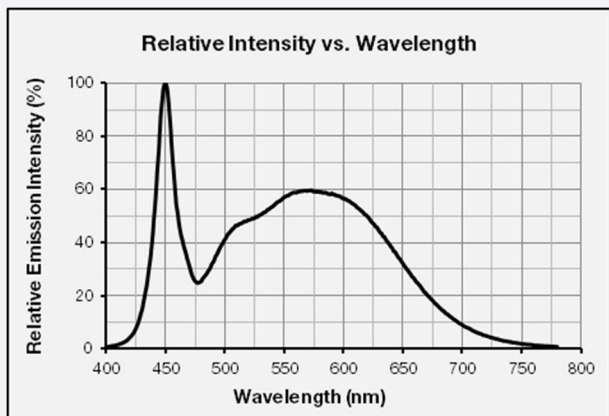
CCT: 3500 K



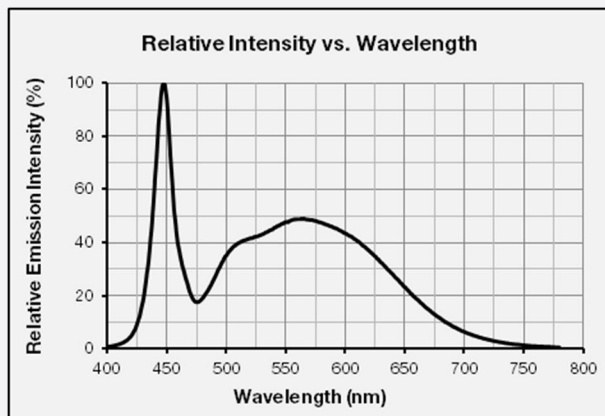
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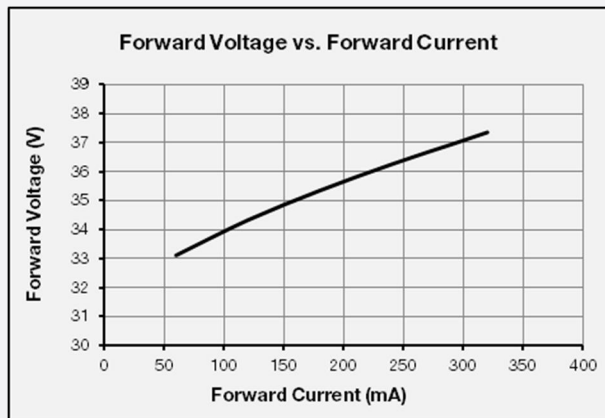
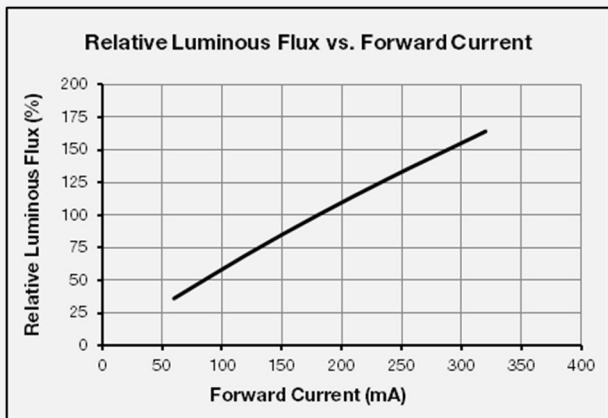
CCT: 5000 K



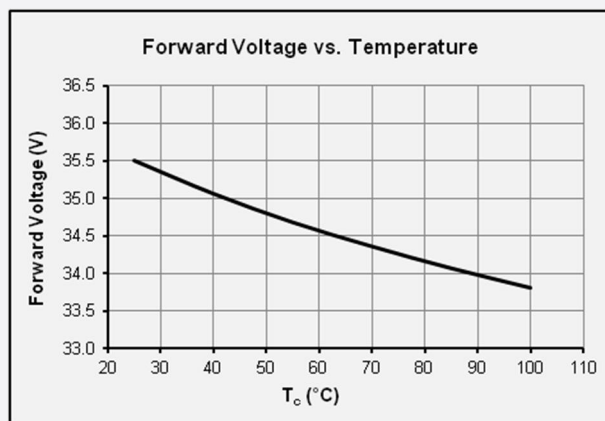
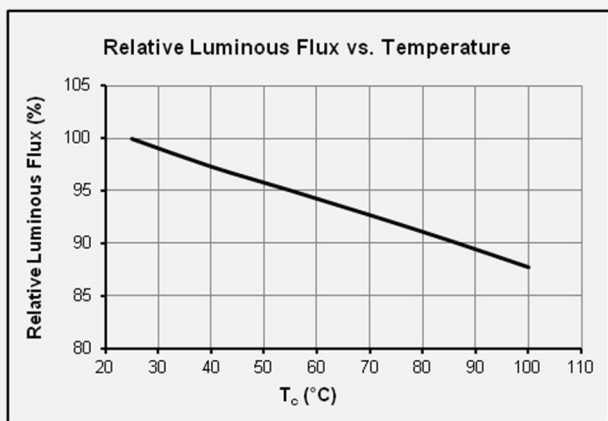
CCT: 5700 K



b) Forward Current Characteristics ( $T_a = 25\text{ }^\circ\text{C}$ )



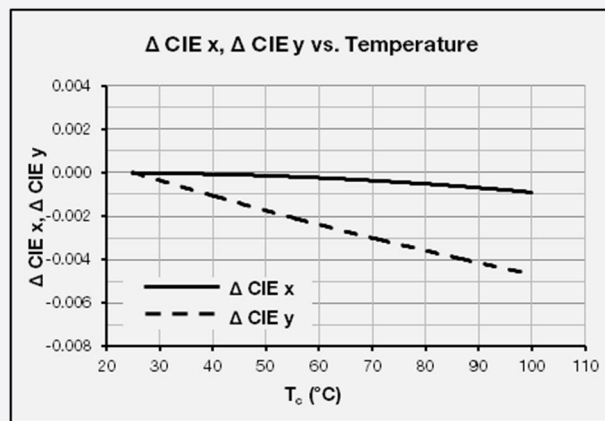
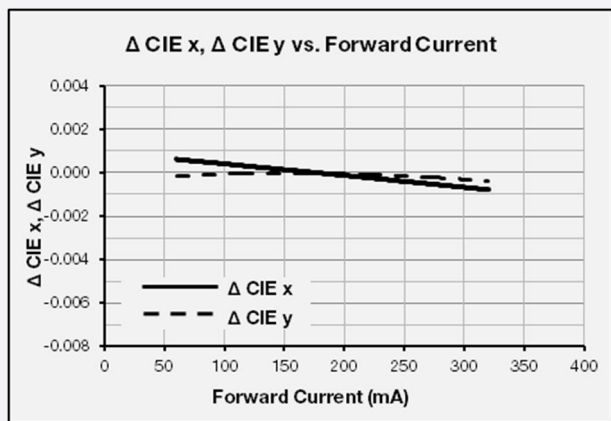
c) Temperature Characteristics ( $I_F = 180\text{ mA}$ )



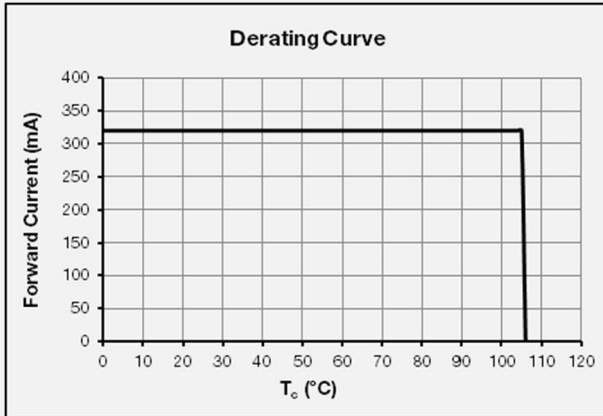
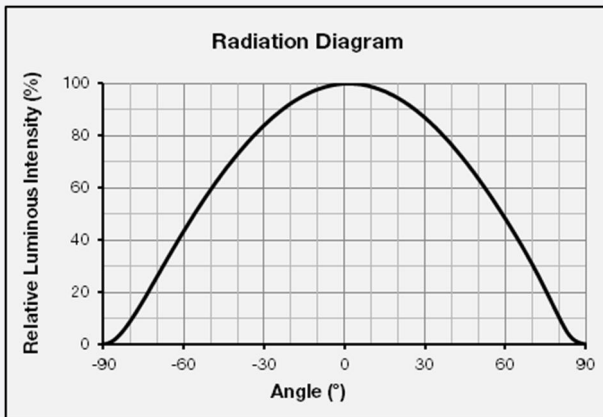
d) Color Shift Characteristics

$T_a = 25\text{ }^\circ\text{C}$

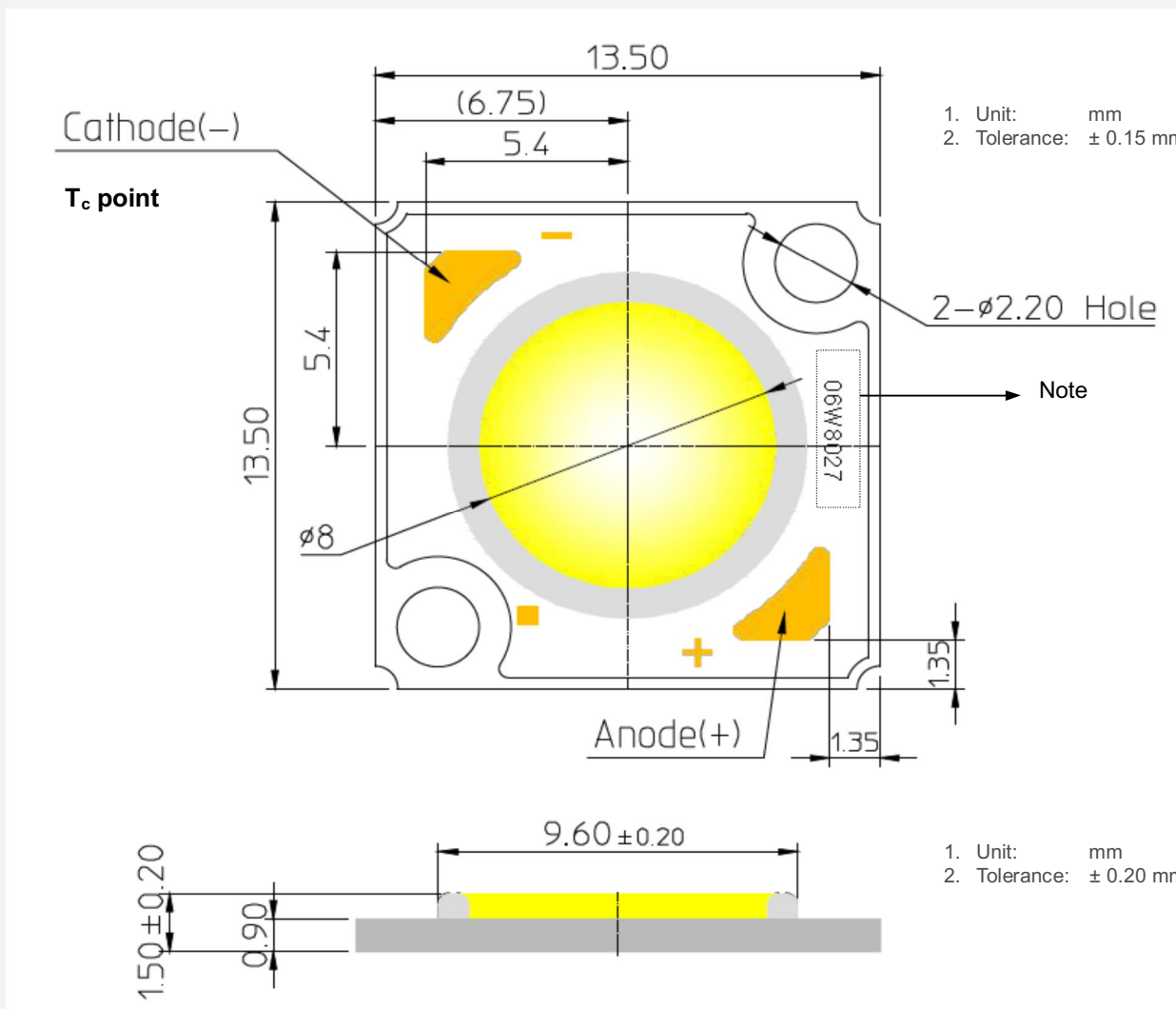
$I_F = 180\text{ mA}$



## e) Derating Curve

f) Beam Angle Characteristics ( $I_F = 180$  mA,  $T_a = 25$  °C)

### 4. Outline Drawing & Dimension



Item	Dimension	Tolerance	Unit
Length	13.50	±0.15	mm
Width	13.50	±0.15	mm
Height	1.50	±0.20	mm
Light Emitting Surface (LES) Diameter	8	±0.15	mm
Screw Hole Size	2.2	±0.15	mm

Note: Denoted product information above is only an example  
( 06W8027 : 6.4W, CRI80+, 2700K )

## 5. Reliability Test Items & Conditions

### a) Test Items

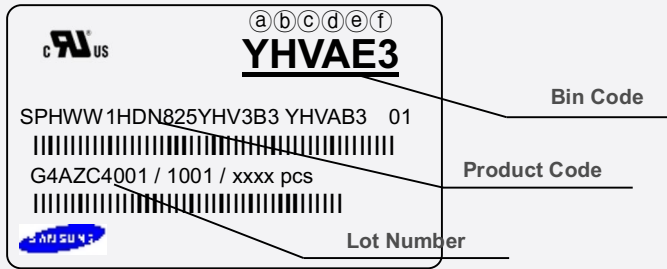
Test Item	Test Condition	Test Hour / Cycle
Room Temperature Life Test	25 °C, I <sub>F</sub> = max	1000 h
High Temperature Humidity Life Test	60 °C, 90 % RH, DC Derating, I <sub>F</sub> = max	1000 h
High Temperature Life Test	105 °C, DC Derating, I <sub>F</sub> = max	1000 h
Low Temperature Life Test	-40 °C, DC 320 mA	1000 h
High Temperature Storage	120 °C	1000 h
Low Temperature Storage	-40 °C	1000 h
Thermal Shock	-45 °C / 15 min ↔ 125 °C / 15 min temperature change in 5 min	200 cycles
Temperature Cycle On/Off Test	-40 °C / 85 °C each 20 min, 100 min transfer power on/off each 5 min, DC 240 mA	100 cycles
ESD (HBM)	R <sub>1</sub> : 10 MΩ R <sub>2</sub> : 1.5 kΩ C: 100 pF V: ±2 kV	5 times
ESD (MM)	R <sub>1</sub> : 10 MΩ R <sub>2</sub> : 0 kΩ C: 200 pF V: ±0.5 kV	5 times
Vibration Test	20 ~ 80 Hz (displacement: 0.06 inch, max. 20 g) 80 ~ 2 kHz (max. 20 g) min. frequency ↔ max. frequency 4 min transfer	4 times
Mechanical Shock Test	1500 g, 0.5 ms each of the 6 surfaces (3 axis x 2 sides)	5 times
Salt Spray Test	35 °C, 5 % salt water 8 h spray, 16 h dwell	2 cycles

### b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T <sub>c</sub> = 25 °C)	Limit	
			Min.	Max.
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 180 mA	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	Φ <sub>v</sub>	I <sub>F</sub> = 180 mA	L.S.L. * 0.7	U.S.L. * 1.3

## 6. Label Structure

### a) Label Structure



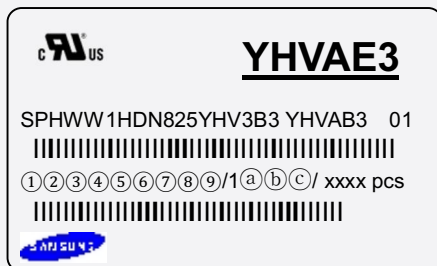
Note: Denoted bin code and product code above is only an example (see description on page 5)

Bin Code:

- ⒶⒷ: Forward Voltage bin (refer to page 11)
- ⒸⒹ: Chromaticity bin (refer to page 9-10)
- ⒺⒻ: Luminous Flux bin (refer to page 6)

### b) Lot Number

The lot number is composed of the following characters:



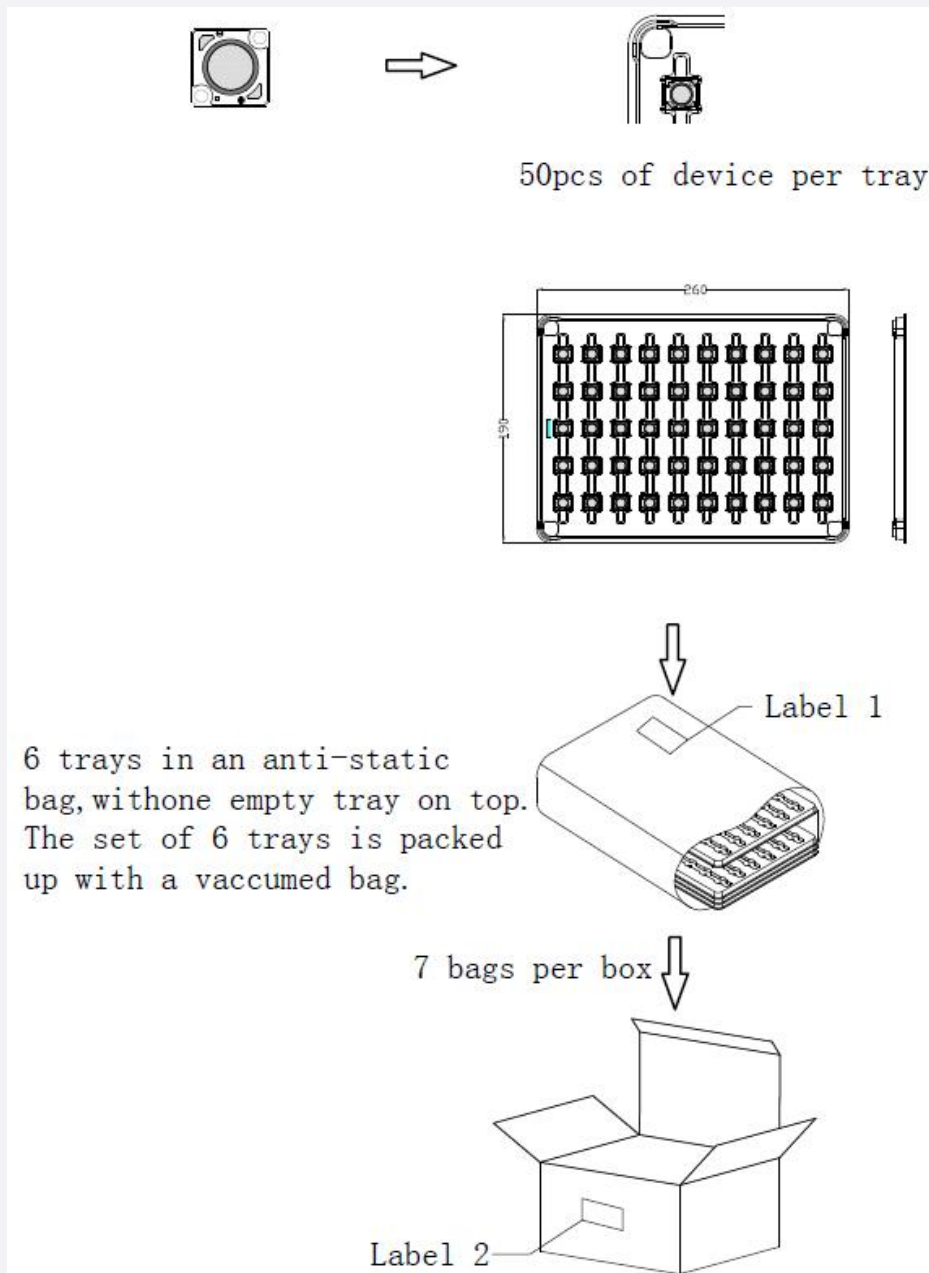
① ③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / xxxx pcs

- ① : Production site (S: Giheung, Korea, G: Tianjin, China)
- ② : 4 (LED)
- ③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ④ : Year (Z: 2015, A: 2016, B: 2017...)
- ⑤ : Month (1~9, A, B, C)
- ⑥⑦⑧⑨ : Day (1~9, A, B~V)
- ⒶⒷⒸ : Product serial number (001 ~ 999)

## 7. Packing Structure

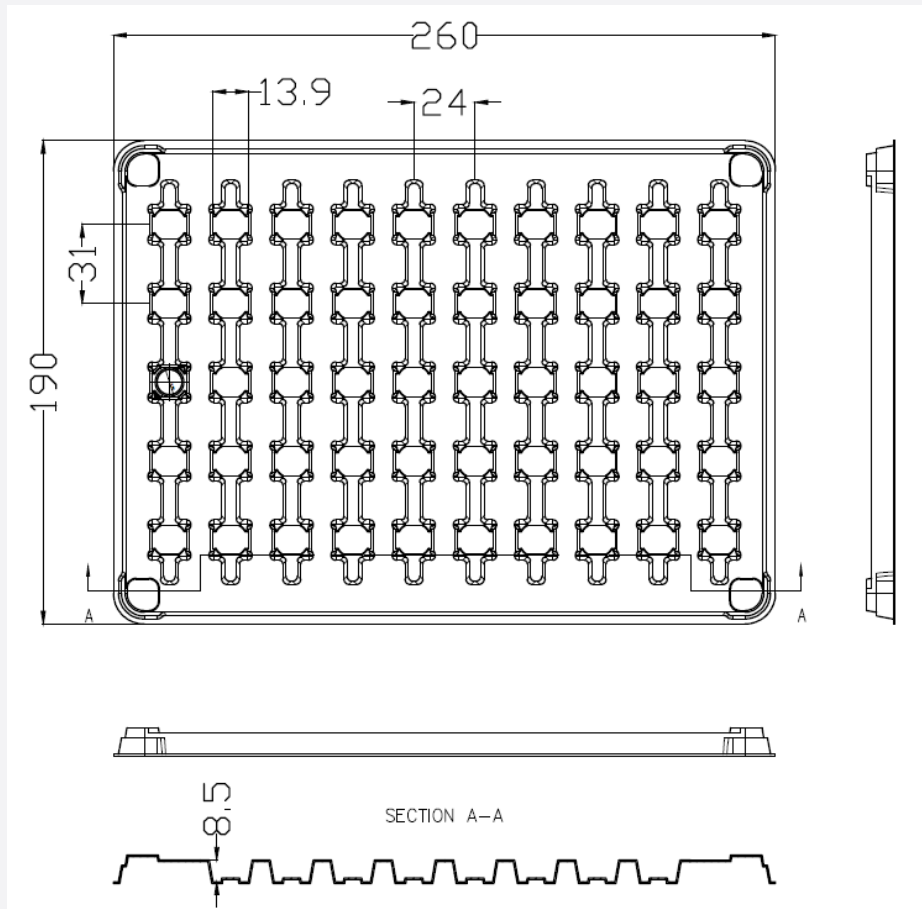
Packing material	Max. quantity in pcs of COB	Dimension (mm)			
		Length	Width	Height	Tolerance
Tray	50	260	190	11.5	1.0
Anti-static Bag	250 (6 trays)	387	350	-	10.0
Box	1,750 (7 anti-static bag)	270	200	255	10

### a) Packing Structure

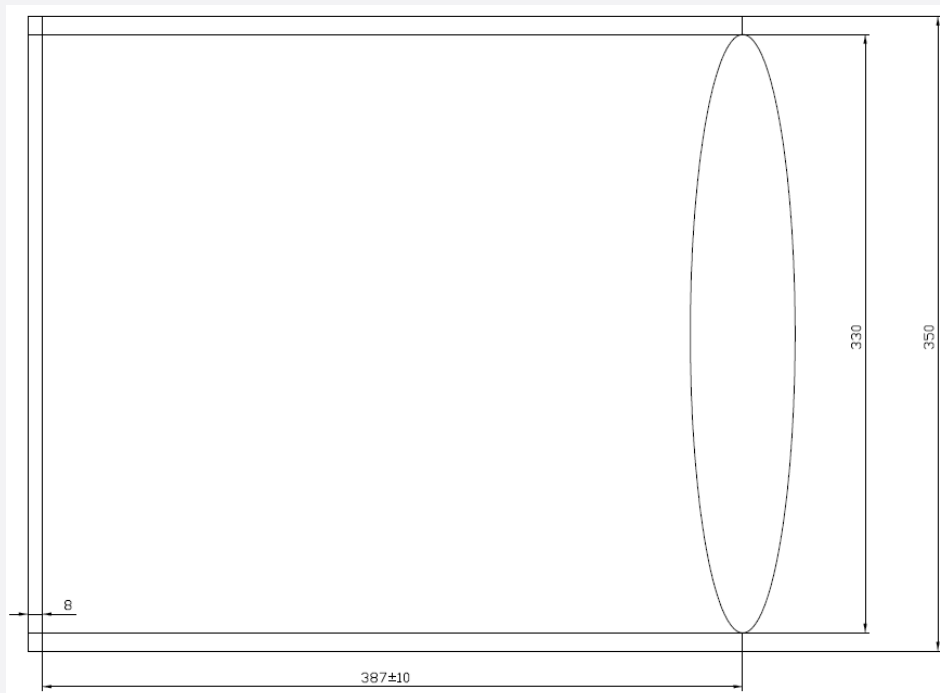




## b) Tray

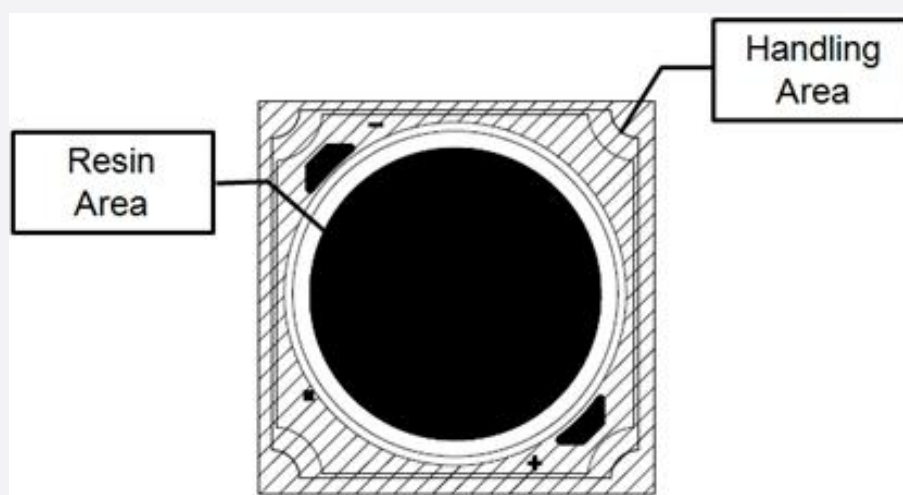


## c) Anti-static Bag



## 8. Precautions in Handling & Use

- 1) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When cleaning is required, IPA is recommended as the cleaning agent. Some solvent-based cleaning agent may damage the silicone resins used in the device.
- 2) LEDs must be stored in a clean environment. If the LEDs are to be stored for three months or more after being shipped from Samsung, they should be packed with a nitrogen-filled container (shelf life of sealed bags is 12 months at temperature 0~40 °C, 0~90 % RH).
- 3) After storage bag is opened, device subjected to soldering, solder reflow, or other high temperature processes must be:
  - a. Mounted within 672 hours (28 days) at an assembly line with a condition of no more than 30 °C / 60 % RH, or
  - b. Stored at <10 % RH
- 4) Repack unused products with anti-moisture packing, fold to close any opening and then store in a dry place.
- 5) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5 °C.
- 6) Devices must be baked for 1 hour at 60 ± 5 °C, if baking is required.
- 7) The LEDs are sensitive to the static electricity and surge current. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs. If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices. Damaged LEDs may show some unusual characteristics such as increase in leakage current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.
- 8) In case of driving the LC006B around the extremely low current level, chips might exhibit different brightness due to the variation in I-V characteristics of each one. This is normal and does not adversely affect the performance of product.
- 9) VOCs (Volatile Organic Compounds) can be generated from adhesives, flux, hardener or organic additives used in luminaires (fixtures). Transparent LED silicone encapsulant is permeable to those chemicals and they may lead to a discoloration of encapsulant when they exposed to heat or light. This phenomenon can cause a significant loss of light emitted (output) from the luminaires. In order to prevent these problems, we recommend users to know the physical properties of materials used in luminaires and they must be carefully selected.
- 10) The resin area is very sensitive, please do not handle, press, touch, rub, clean, or pick by with tweezers on it. Instead, please pick at the handling area as indicated below.



# Legal and additional information.

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