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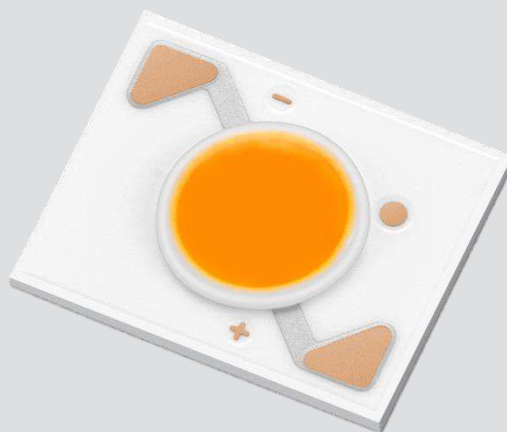
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# High Voltage LED Series Chip on Board - Small LES COB line-up - LCo10C



Small LES COBs are well-suited for compact spot light system

## Features & Benefits

- Suitable for luminaires with narrow beam angle such as shop lighting
- Maximize Center Beam Candle Power(CBCP)
- Reduce lighting system cost with smaller optical component
- High reliability without wire-bonding



## Applications

- Spotlight / Downlight
- LED Retrofit Bulbs

## 1. Characteristics

### a) Absolute Maximum Rating

Item	Symbol	Rating	Unit
Ambient / Operating Temperature	$T_a$	-40 ~ +105	°C
Storage Temperature	$T_{stg}$	-40 ~ +120	°C
Case Temperature	$T_c$	105	°C
LED Junction Temperature	$T_J$	140	°C
Forward Current	$I_F$	405	mA
Minimum Current	$I_{F\_min}$	10	mA
ESD (HBM)	-	±2	kV

#### Notes:

- 1) Refer to 4. Outline Drawing & Dimension for  $T_c$  point.
- 2) Refer to the Derating curve for proper driving current that maintained below Maximum junction temperature.

### b) Electro-optical Characteristics ( $I_F = 270 \text{ mA}$ , $T_J = 85 \text{ °C}$ )

Item	Unit	Rank	Min.	Typ.	Max.
Forward Voltage ( $V_F$ ) *1, *2	V	-	32.5	34.5	38.5
Color Rendering Index ( $R_a$ ) *1, *2		5	80	-	-
		7	90	-	-
Thermal Resistance (Junction to $T_c$ point)	°C/W		-	2.6	3.0
Beam Angle	°		-	115	-

#### Notes:

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature ( $T_J = T_C = 85 \text{ °C}$ ).
- 2) Samsung maintains measurement tolerance of: Forward Voltage = ±5 %, CRI = ±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	W	H	2	H	D	N	A	0	5	Y	H	V	3	C	1

Digit	PKG Information	Code	Specification																														
1 2 3	Samsung Package High Power	<b>SPH</b>																															
4 5	Color	<b>WH</b>	White																														
6	Product Version	<b>2</b>	Version																														
7 8	Form Factor	<b>HD</b>	COB																														
9	Lens Type	<b>N</b>	No lens																														
10	Internal Code	<b>A</b>	LC010C																														
11	Chip Type	<b>0</b>	Minor version																														
12	CRI & Sorting Temperature	<b>5</b> <b>7</b>	Min. 80 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 3000 K 3500 K 4000 K 5000 K 5700 K																														
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>C1</b>	<table border="0"> <tr> <td>Ra min.80</td><td>2700K</td><td>C2, B2, A2</td></tr> <tr> <td></td><td>3000K</td><td>D2, C2, B2</td></tr> <tr> <td></td><td>3500K</td><td>D2, C2, B2</td></tr> <tr> <td></td><td>4000K</td><td>D2, C2, B2</td></tr> <tr> <td></td><td>5000K</td><td>E2, D2, C2</td></tr> <tr> <td></td><td>5700K</td><td>E2, D2, C2</td></tr> <tr> <td>Ra min.90</td><td>2700K</td><td>K1, H1, G1</td></tr> <tr> <td></td><td>3000K</td><td>L1, K1, H1</td></tr> <tr> <td></td><td>3500K</td><td>A2, L1, K1</td></tr> <tr> <td></td><td>4000K</td><td>B2, A2, L1</td></tr> </table>	Ra min.80	2700K	C2, B2, A2		3000K	D2, C2, B2		3500K	D2, C2, B2		4000K	D2, C2, B2		5000K	E2, D2, C2		5700K	E2, D2, C2	Ra min.90	2700K	K1, H1, G1		3000K	L1, K1, H1		3500K	A2, L1, K1		4000K	B2, A2, L1
Ra min.80	2700K	C2, B2, A2																															
	3000K	D2, C2, B2																															
	3500K	D2, C2, B2																															
	4000K	D2, C2, B2																															
	5000K	E2, D2, C2																															
	5700K	E2, D2, C2																															
Ra min.90	2700K	K1, H1, G1																															
	3000K	L1, K1, H1																															
	3500K	A2, L1, K1																															
	4000K	B2, A2, L1																															

a) 10W Luminous Flux Characteristics ( $I_F = 270 \text{ mA}$ )

CRI ( $R_a$ )	Lumen Flux	Sorting <sup>1)</sup> @ $T_J = 85 \text{ }^\circ\text{C}$ (lm)	CCT									
			Min.	Rank	Min.	Max.	2700K	3000K	3500K	4000K	5000K	5700K
80	F	2	1380	1480								
	E	2	1290	1380								
	D	2	1200	1290								
	C	2	1130	1200								
	B	2	1050	1130								
	A	2	980	1050								
	L	1	920	980								
	K	1	860	920								
	H	1	800	860								
	G	1	750	800								

CRI ( $R_a$ )	Lumen Flux	Sorting <sup>1)</sup> @ $T_J = 85 \text{ }^\circ\text{C}$ (lm)	CCT								
			Min.	Rank	Min.	Max.	2700K	3000K	3500K	4000K	
90	E	2	1290	1380							
	D	2	1200	1290							
	C	2	1130	1200							
	B	2	1050	1130							
	A	2	980	1050							
	L	1	920	980							
	K	1	860	920							
	H	1	800	860							
	G	1	750	800							

**Notes:**

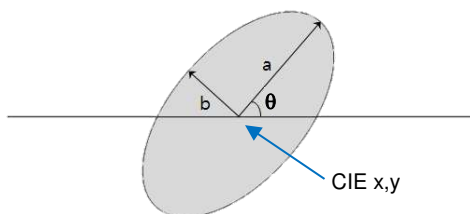
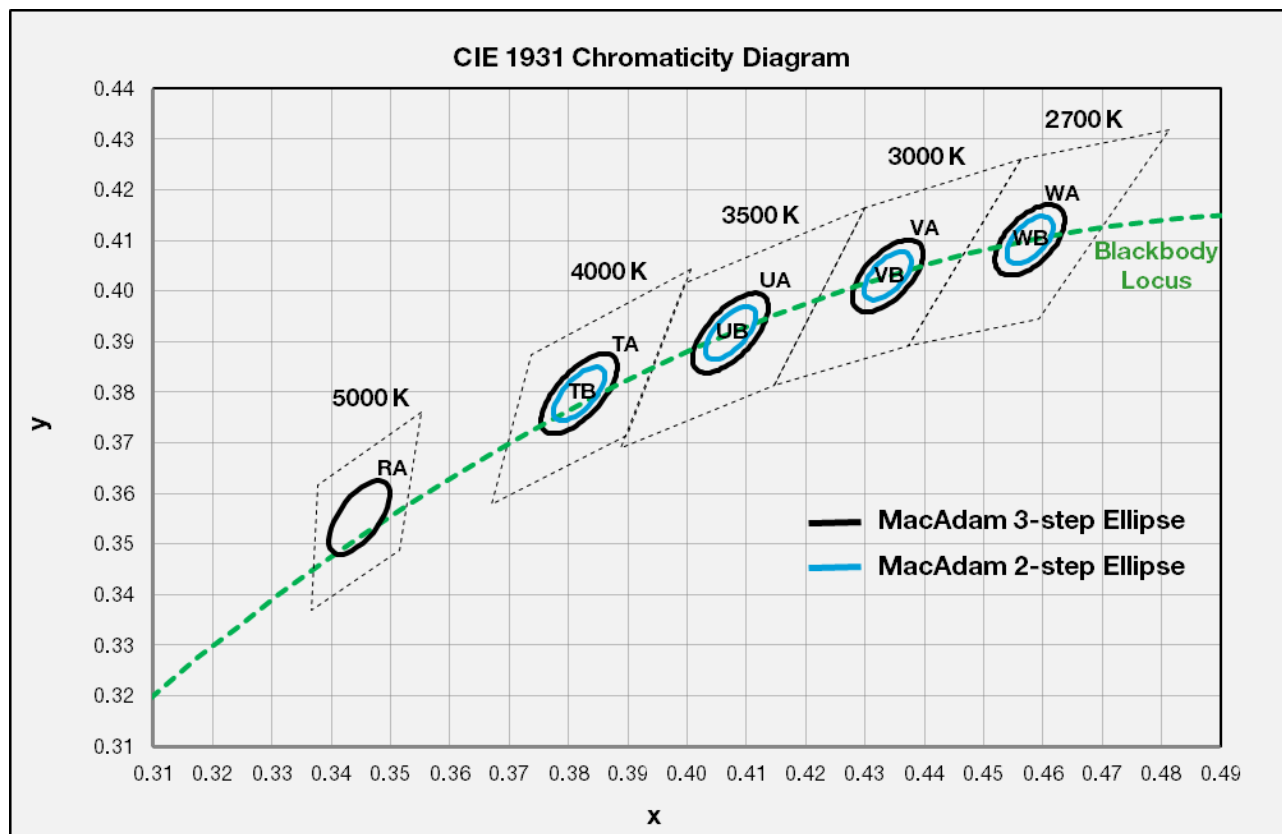
- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature ( $T_J = T_C = 85 \text{ }^\circ\text{C}$ ).
- 2) Samsung maintains measurement tolerance of: Luminous flux =  $\pm 7 \%$ , CRI =  $\pm 1$

b) Binning Structure ( $I_F = 270 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

CRI ( $R_a$ ) Min.	Nominal CCT (K)	Product Code	$V_F$ Rank	Color Rank	Color Bin	Flux Rank	Flux (lm) Typ.	Flux Range ( $\Phi_v$ , lm)		
								Flux Bin	Min.	Max.
80	2700	SPHWH2HDNA05YHW2C1	YH	W2	WB	C1	1070	C 2	1130	1200
								B 2	1050	1130
								A 2	980	1050
		SPHWH2HDNA05YHW3C1	YH	W3	WA, WB	C1	1070	C 2	1130	1200
								B 2	1050	1130
								A 2	980	1050
	3000	SPHWH2HDNA05YHV2C1	YH	V2	VB	C1	1110	D 2	1200	1290
								C 2	1130	1200
								B 2	1050	1130
		SPHWH2HDNA05YHV3C1	YH	V3	VA, VB	C1	1110	D 2	1200	1290
								C 2	1130	1200
								B 2	1050	1130
	3500	SPHWH2HDNA05YHU2C1	YH	U2	UB	C1	1160	D 2	1200	1290
								C 2	1130	1200
								B 2	1050	1130
		SPHWH2HDNA05YHU3C1	YH	U3	UA, UB	C1	1160	D 2	1200	1290
								C 2	1130	1200
								B 2	1050	1130
	4000	SPHWH2HDNA05YHT2C1	YH	T2	TB	C1	1190	D 2	1200	1290
								C 2	1130	1200
								B 2	1050	1130
		SPHWH2HDNA05YHT3C1	YH	T3	TA, TB	C1	1190	D 2	1200	1290
								C 2	1130	1200
								B 2	1050	1130
5000	SPHWH2HDNA05YHR3C1	YH	R3	RA	C1	1260	E 2	1290	1380	
							D 2	1200	1290	
							C 2	1130	1200	
	SPHWH2HDNA05YHRTC1	YH	RT	RW, RX, RY, RZ	C1	1260	E 2	1290	1380	
							D 2	1200	1290	
							C 2	1130	1200	
5700	SPHWH2HDNA05YHQTC1	YH	QT	QW, QX, QY, QZ	C1	1260	E 2	1290	1380	
							D 2	1200	1290	
							C 2	1130	1200	

b) Binning Structure ( $I_F = 270 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

CRI ( $R_a$ ) Min.	Nominal CCT (K)	Product Code	$V_F$ Rank	Color Rank	Color Bin	Flux Rank	Flux (lm) Typ.	Flux Range ( $\Phi_v$ , lm)		
								Flux Bin	Min.	Max.
90	2700	SPHWH2HDNA07YHW2C1	YH	W2	WB	C1	800	K 1	860	920
								H 1	800	860
								G 1	750	800
		SPHWH2HDNA07YHW3C1	YH	W3	WA, WB	C1	800	K 1	860	920
								H 1	800	860
								G 1	750	800
	3000	SPHWH2HDNA07YHV2C1	YH	V2	VB	C1	860	L 1	920	980
								K 1	860	920
								H 1	800	860
		SPHWH2HDNA07YHV3C1	YH	V3	VA, VB	C1	860	L 1	920	980
								K 1	860	920
								H 1	800	860
3500	SPHWH2HDNA07YHU2C1	YH	U2	UB	C1	900	A 2	980	1050	
							L 1	920	980	
							K 1	860	920	
	SPHWH2HDNA07YHU3C1	YH	U3	UA, UB	C1	900	A 2	980	1050	
							L 1	920	980	
							K 1	860	920	
4000	SPHWH2HDNA07YHT2C1	YH	T2	TB	C1	920	B 2	1050	1130	
							A 2	980	1050	
							L 1	920	980	
	SPHWH2HDNA07YHT3C1	YH	T3	TA, TB	C1	980	B 2	1050	1130	
							A 2	980	1050	
							L 1	920	980	

c) Chromaticity Region & Coordinates ( $T_J = 85\text{ }^\circ\text{C}$ )

2700K 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

3000K MacAdam Ellipse (VA, VB)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.4338	0.4030	53.22	0.0056	0.0027
3-step	0.4338	0.4030	53.22	0.0083	0.0041

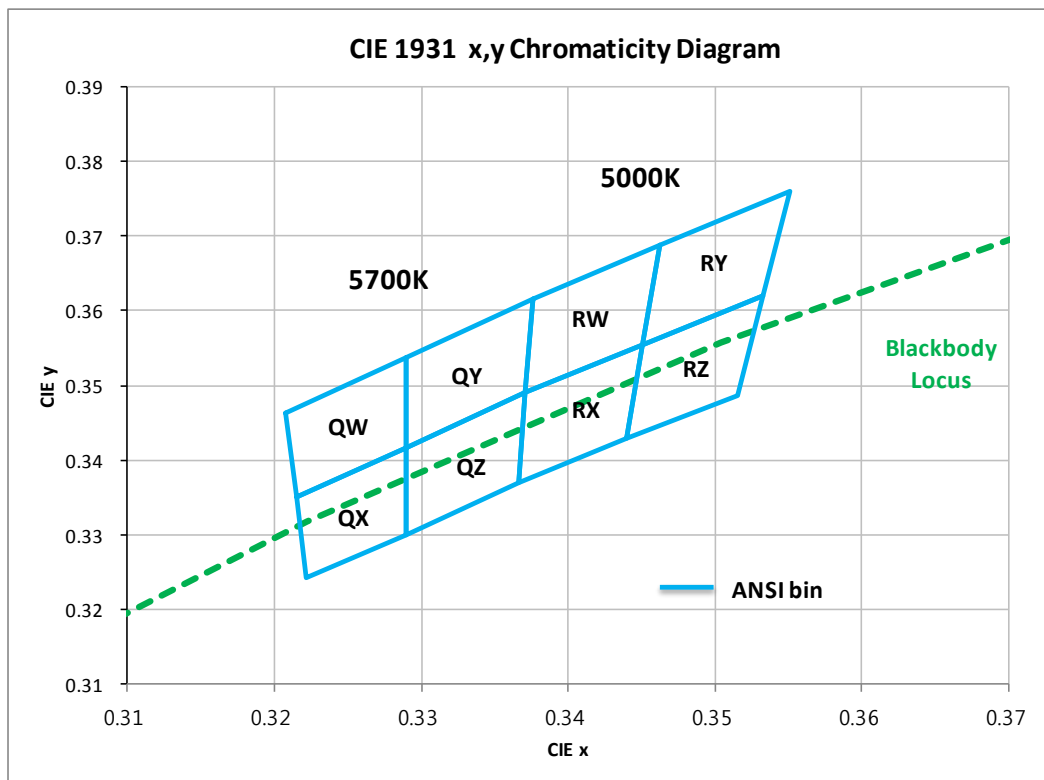
3500K MacAdam Ellipse (UA, UB)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.4073	0.3917	54.00	0.0062	0.0028
3-step	0.4073	0.3917	54.00	0.0093	0.0041

4000K 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

5000K 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:  $C_x, C_y = \pm 0.005$



c) Chromaticity Region & Coordinates ( $T_J = 85\text{ }^\circ\text{C}$ )

Region	CIE x	CIE y	Region	CIE x	CIE y
<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

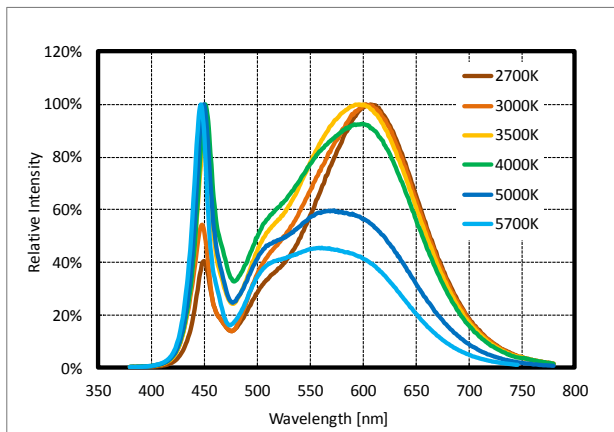
Region	CIE x	CIE y	Region	CIE x	CIE y
<b>Q rank (5700 K)</b>					
QW	0.3207	0.3462	QY	0.3290	0.3538
	0.3290	0.3538		0.3376	0.3616
	0.3290	0.3417		0.3371	0.3490
	0.3215	0.3350		0.3290	0.3417
QX	0.3215	0.3350	QZ	0.3290	0.3417
	0.3290	0.3417		0.3371	0.3490
	0.3290	0.3300		0.3366	0.3369
	0.3222	0.3243		0.3290	0.3300

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

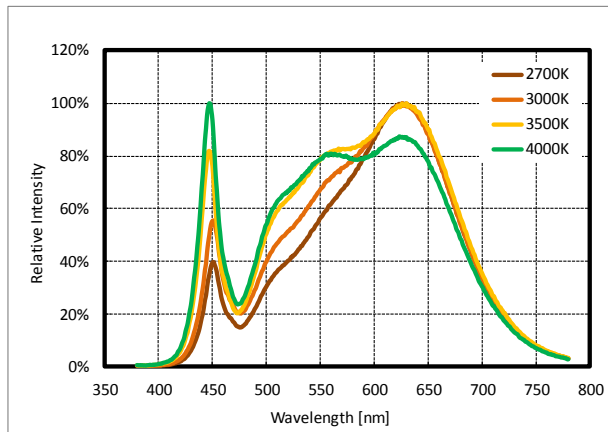
### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_F = 270 \text{ mA}$ , $T_J = 85 \text{ }^\circ\text{C}$ )

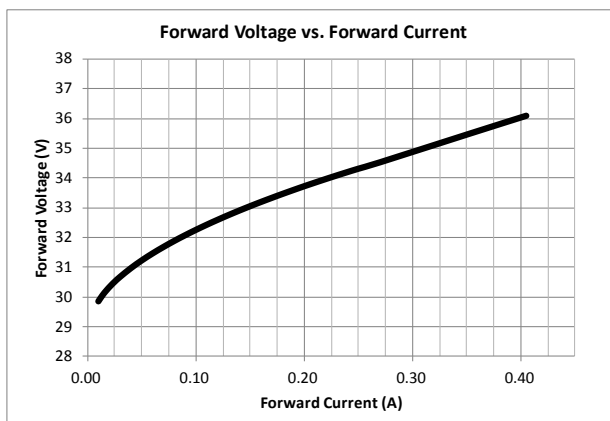
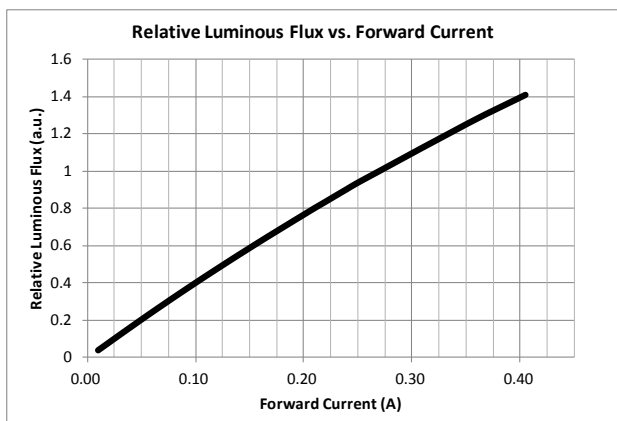
CRI Ra 80+



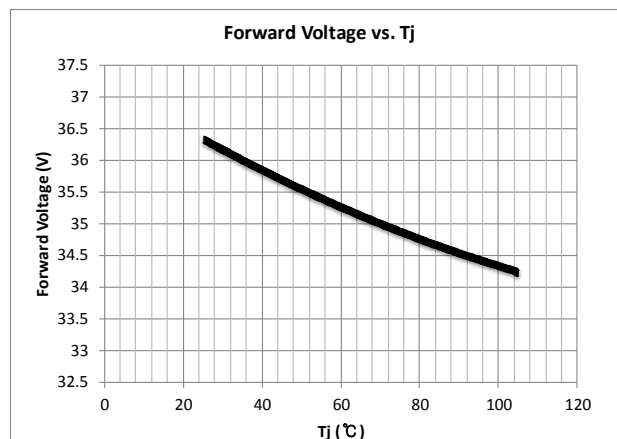
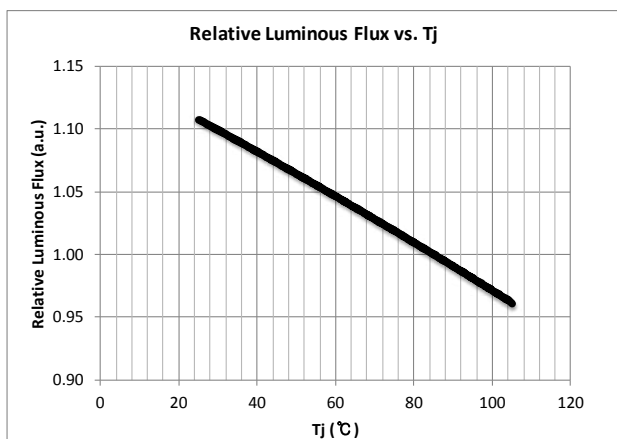
CRI Ra 90+



#### b) Forward Current Characteristics ( $T_J = 85 \text{ }^\circ\text{C}$ )



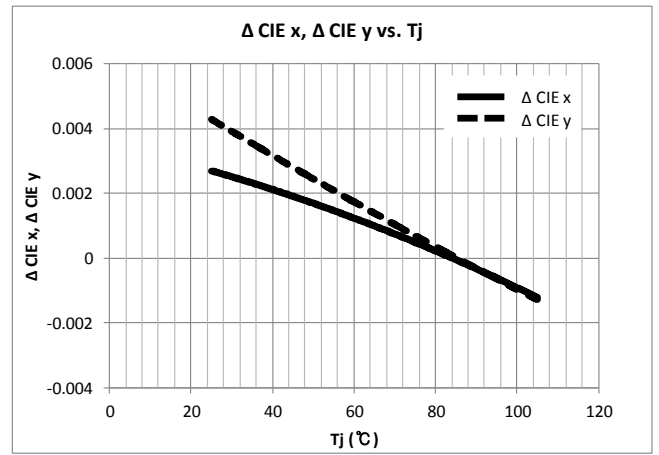
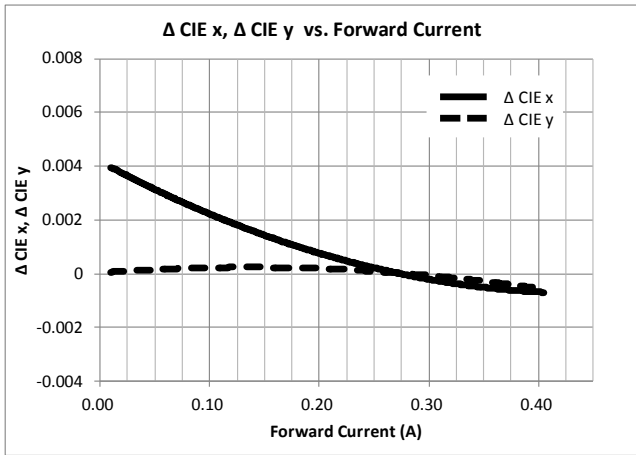
#### c) Temperature Characteristics ( $I_F = 270 \text{ mA}$ )



d) Color Shift Characteristics

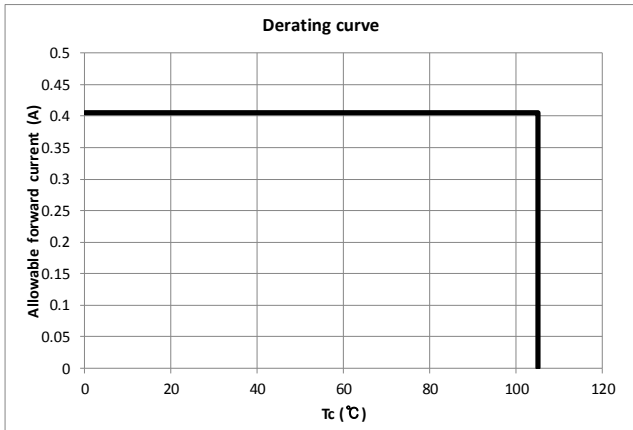
$T_J = 85^\circ\text{C}$

$I_F = 270\text{ mA}$

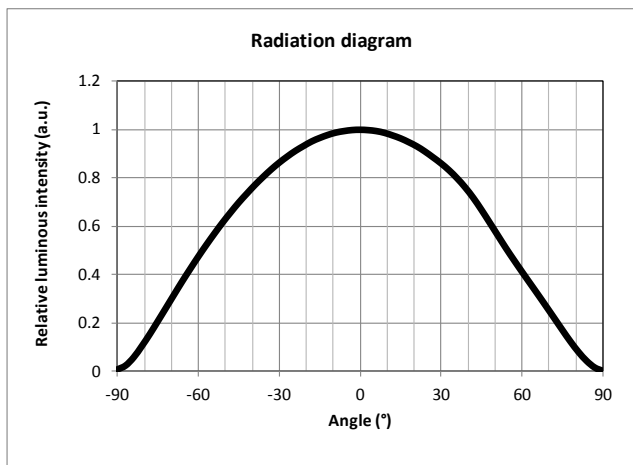


e) Derating Characteristics

Case temperature vs. Allowable Forward Current

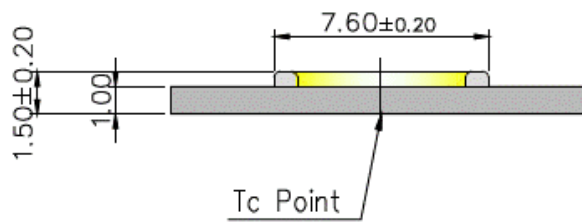
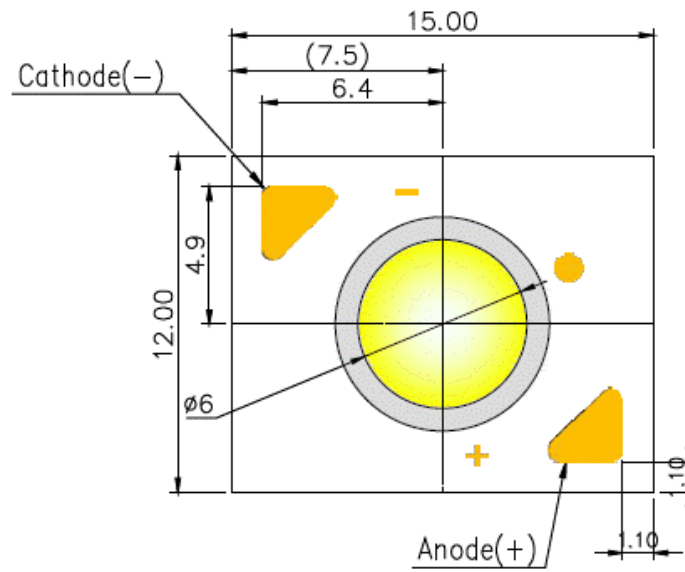


f) Beam Angle Characteristics ( $I_F = 270\text{ mA}$ ,  $T_a = 25^\circ\text{C}$ )



#### 4. Outline Drawing & Dimension

- 1. Unit: mm
- 2. Tolerance: ± 0.20 mm



- 1. Unit: mm
- 2. Tolerance: ± 0.2 mm

**Note :** Tc point : The Center of the back side of substrate.

Item	Dimension	Tolerance	Unit
Length	15.00	±0.20	mm
Width	12.00	±0.20	mm
Height	1.50	±0.20	mm
Light Emitting Surface (LES) Diameter	6	±0.15	mm

## 5. Reliability Test Items & Conditions

### a) Test Items

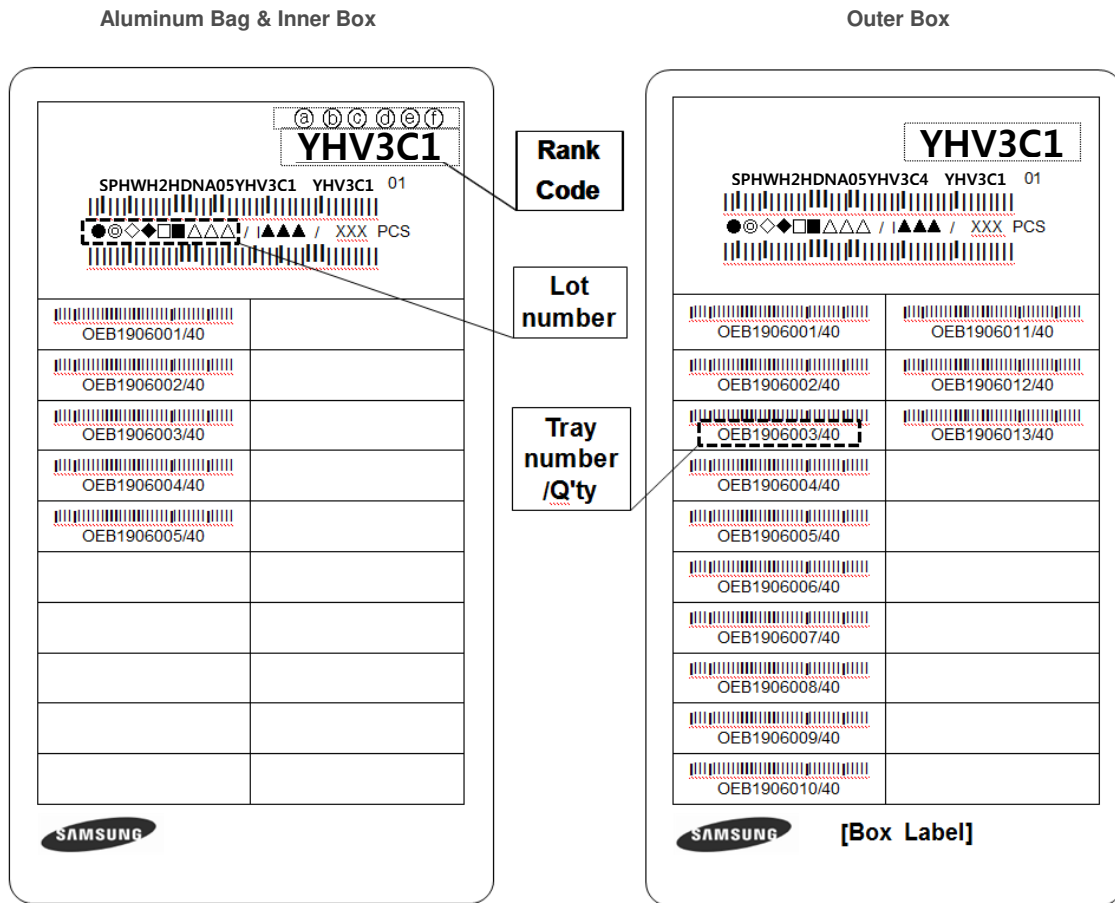
Test Item	Test Condition	Test Hour / Cycle
High Temperature Humidity Life Test	60 °C, 90 % RH., DC Derating, $I_F$	1000 h
High Temperature Life Test	85 °C, DC Derating, $I_F$	1000 h
Low Temperature Life Test	-40 °C, DC 405 mA	1000 h
Pulsed Operating Life Test	55 °C, Pulse width 100 $\mu$ s, duty cycle 3 %	1000 h
High Temperature Storage	120 °C	1000 h
Low Temperature Storage	-40 °C	1000 h
Temperature Humidity Storage	60 °C, 90% RH	1000h
Thermal Cycle	-45 °C / 15 min $\leftrightarrow$ 125 °C / 15 min temperature change in 5 min	800 cycles
Temperature Cycle On/Off Test	-40 °C / 85 °C each 20 min, 30 min transfer power on/off each 5 min, DC Derating, $I_F = \text{max}$	100 cycles
ESD (HBM)	R <sub>1</sub> : 10 M $\Omega$ R <sub>2</sub> : 1.5 k $\Omega$ C: 100 pF V: $\pm$ 2 kV	3 times
ESD (MM)	R <sub>1</sub> : 10 M $\Omega$ R <sub>2</sub> : 0 k $\Omega$ C: 200 pF V: $\pm$ 0.2 kV	3 times
Vibration Test	20 ~ 80 Hz (displacement: 0.06 inch, max. 20 g) 80 ~ 2 kHz (max. 20 g) min. frequency $\leftrightarrow$ 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
Sulfur Resistance	25 °C, 75%, H2S 15 ppm	504h

### b) Criteria for Judging the Damage

Item	Symbol	Test Condition ( $T_c = 25$ °C)	Limit	
			Min.	Max.
Forward Voltage	$V_F$	$I_F = 270$ mA	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	$\Phi_v$	$I_F = 270$ mA	L.S.L. * 0.7	U.S.L. * 1.3

## 6. Label Structure

### a) Label Structure



Note: Denoted rank code and product code above is only an example (see description on page 6)

Rank Code:

ⒶⒷ: Forward Voltage rank (refer to page 3)

ⒸⒹ: Chromaticity bin (refer to page 5-6)

ⒺⒻ: Luminous Flux bin (refer to page 4)

## b) Lot Number

The lot number is composed of the following characters:

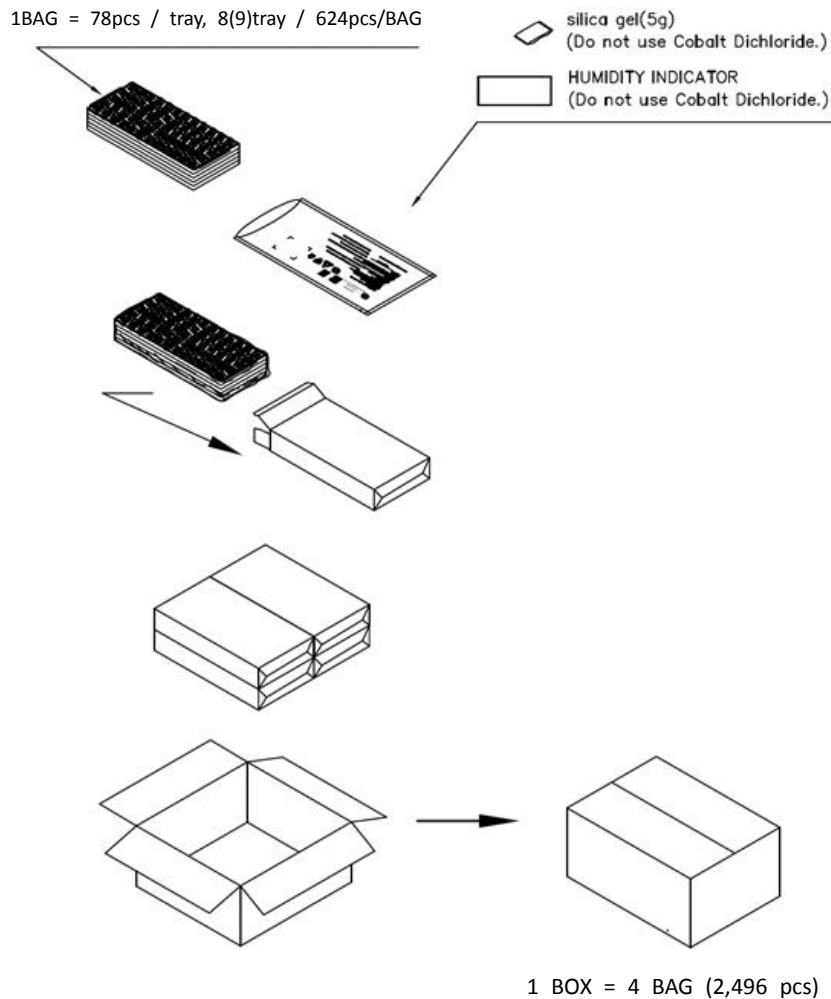
●◎◇◆□■△△△ / 1▲▲▲ / xxx PCS

- : Production site (S: Giheung, Korea, G: Tianjin, China)
- ◎ : L (LED)
- ◇ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ◆ : Year (Y: 2014, Z: 2015, A: 2016, ...)
- : Month (1~9, A, B, C)
- : Day (1~9, A, B~V)
- △△△ : Product serial number (001 ~ 009)
- ▲▲▲ : Tray number (001 ~ 999)

## 7. Packing Structure

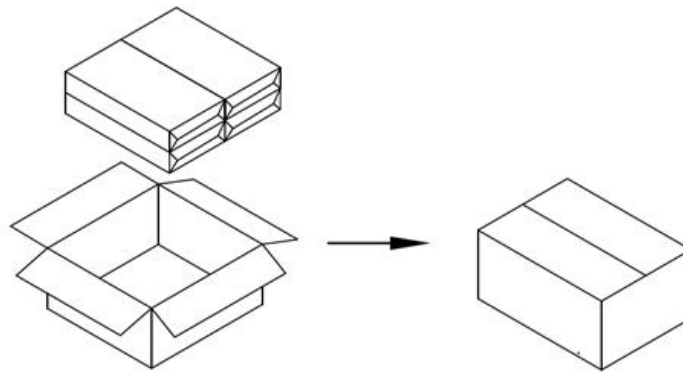
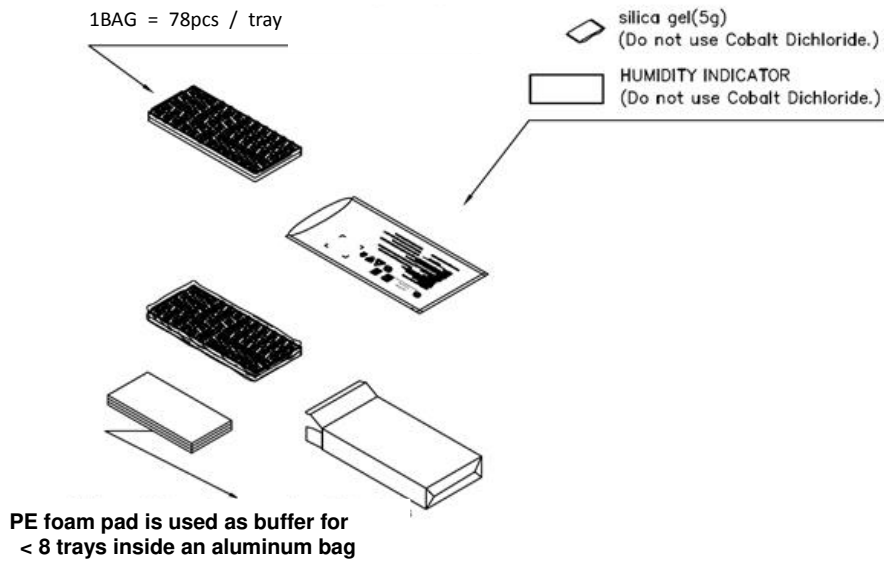
Packing material	Max. quantity in pcs of COB	Dimension (mm)			
		Length	Width	Height	Tolerance
Tray	78	322.6	135.9	11	0.25
Aluminum Bag	624 (8 trays)	450	230	-	10
PE Foam Pad	-	280	130	10	2
Inner Box	624 (1 aluminum bag)	338	148	55	2
Outer Box	2,496 (4 inner boxes)	351	308	120	5
Pallet	139,776 (56 outer boxes)	1000	1000	970	10

### a) Packing Structure for 8 trays inside Aluminum Bag

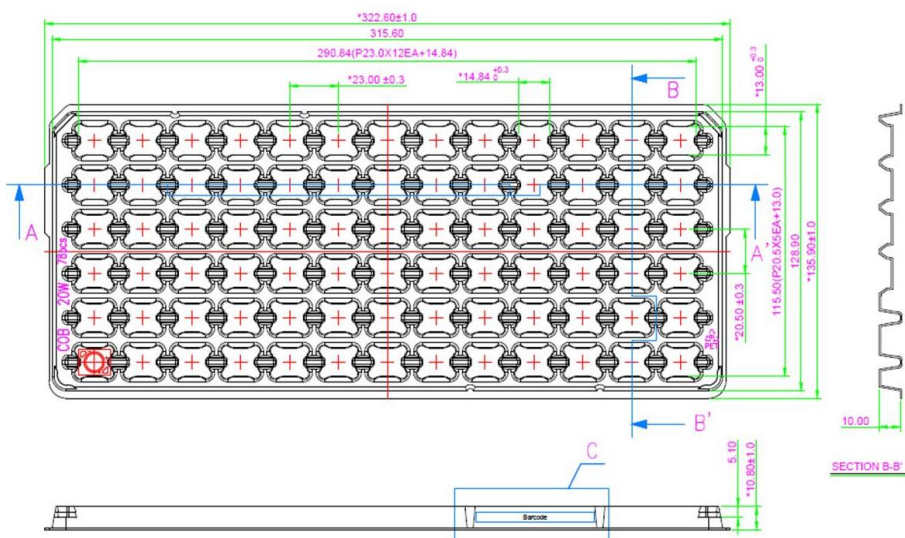




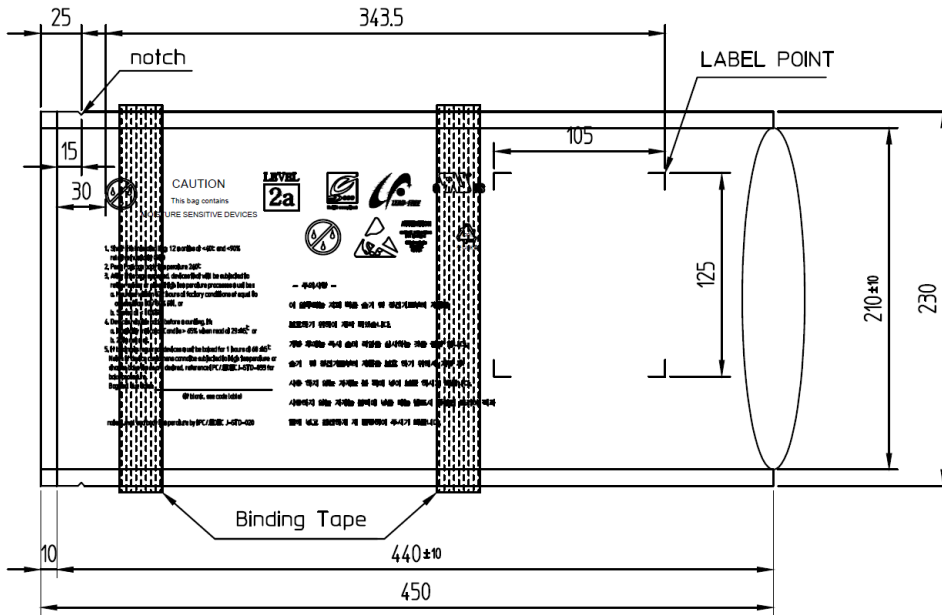
b) Packing Structure for <8 trays inside Aluminum Bag



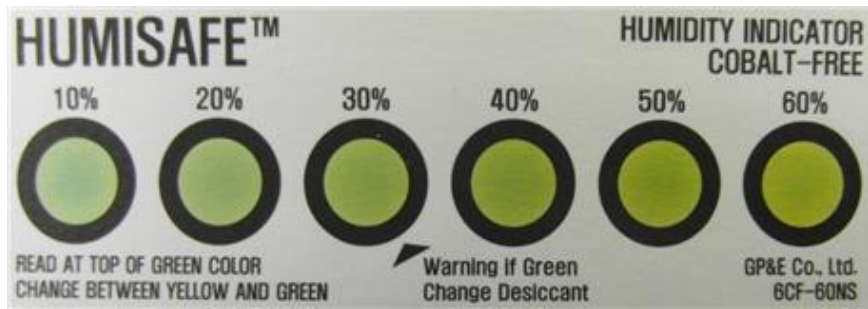
c) Tray



d) Aluminum Vinyl Packing Bag



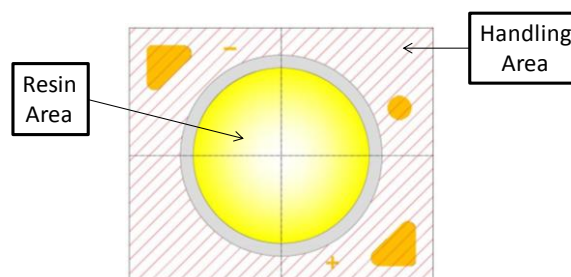
e) Silica Gel & Humidity Indicator Card inside Aluminum Vinyl Packing Bag



## 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 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) The thermal management is one of the most critical factors for the LED lighting system. Especially the LED junction temperature should not exceed the absolute maximum rating while operation of LED lighting system.  
For more information, please refer to Application Note 'Mechanical & Thermal Guide for COB'.
- 9) In case of driving the LC010C around the minimum current level (If\_min), 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.
- 10) 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.
- 11) 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.

For more information, please refer to Application Note 'LED Handling Guide'.



# Legal and additional information.

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