



**THE DATASHEET OF  
SPHWHAHDNK25YZP3D1**



## High Voltage LED Series Chip on Board

# LCo40D – Gen.1



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

### 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	-
Forward Current	$I_F$	2760	mA	-
Power Dissipation	$P_D$	103.5	W	-
ESD (HBM)	-	±2	kV	-
ESD (MM)	-	±0.5	kV	-

### b) Electro-optical Characteristics ( $I_F = 1080 \text{ mA}$ , $T_J = 85 \text{ °C}$ )

Item	Unit	Rank	Min.	Typ.	Max.
Forward Voltage ( $V_F$ )	V	YZ	31.8	34.6	37.5
Color Rendering Index ( $R_a$ )	-	5	80	-	-
		7	90	-	-
Thermal Resistance (junction to chip point)	°C/W		-	0.8	-
Beam Angle	°		-	115	-
Nominal Power	W			40.5	

#### Notes:

- 1) The COB is tested in pulsed condition at rated test current (10 ms pulse width) and rated temperature ( $T_J = T_C = T_a = 85 \text{ °C}$ )
- 2) Samsung maintains measurement tolerance of: forward voltage = ±5 %, CRI = ±1
- 3) Refer to the derating curve, '3. Typical Characteristics Graph' designed within the range.

c) Luminous Flux Characteristics ( $I_F = 1080 \text{ mA}$ )

CRI ( $R_a$ ) Min.	Nominal CCT (K)	Flux Rank	Flux @ $T_J = 85 \text{ }^\circ\text{C}$ (lm)		
			Min.	Typ.	Max.
80	2700	M7	4746	4996	-
		D1	4996	5246	-
	3000	M9	4994	5257	-
		D1	5257	5520	-
	3500	N1	5147	5418	-
		D1	5418	5689	-
	4000	N2	5258	5535	-
		D1	5535	5812	-
	5000	N2	5283	5561	-
		D1	5561	5839	-
	5700	N3	5309	5588	-
		D1	5588	5868	-
	6500	N2	5251	5528	-
		D1	5528	5804	-

CRI ( $R_a$ ) Min.	Nominal CCT (K)	Flux Rank	Flux @ $T_J = 85 \text{ }^\circ\text{C}$ (lm)		
			Min.	Typ.	Max.
90	2700	M0	4068	4283	-
		D1	4283	4497	-
	3000	M2	4298	4525	-
		D1	4525	4751	-
	3500	M4	4408	4640	-
		D1	4640	4872	-
	4000	M5	4505	4742	-
		D1	4742	4979	-
	5000	M5	4556	4796	-
		D1	4796	5036	-

**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 =  $\pm 1$

## 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	A	H	D	N	K	2	5	Y	Z	W	3	M	7

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>A</b>	
7 8	Form Factor	<b>HD</b>	COB
9	Lens Type	<b>N</b>	No lens
10	Wattage or Model	<b>K</b>	LC040D
11	Internal Code	<b>2</b>	
12	CRI & Sorting Temperature	<b>5</b> <b>7</b>	Min. 80 (85°C) Min. 90 (85°C)
13 14	Forward Voltage (V)	<b>YZ</b>	31.8~37.5
15	CCT (K)	<b>W</b> <b>V</b> <b>U</b> <b>T</b> <b>R</b> <b>Q</b> <b>P</b>	2700K 3000K 3500K 4000K 5000K 5700K 6500K
16	MacAdam Step	<b>2</b> <b>3</b>	MacAdam 2-step MacAdam 3-step
17 18	Luminous Flux	<b>M0</b> <b>M2</b> <b>M4</b> <b>M5</b> <b>M7</b> <b>M9</b> <b>N1</b> <b>N2</b> <b>N3</b> <b>D1</b>	Min. 4000 Min. 4200 Min. 4400 Min. 4500 Min. 4700 Min. 4900 Min. 5100 Min. 5200 Min. 5300 Add rank

a) Binning Structure ( $I_F = 1080 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

CRI ( $R_a$ ) Min.	Nominal CCT (K)	Product Code	$V_F$ Rank	Color Rank	Flux Rank	Flux Range ( $\Phi_v$ , lm)
80	2700	SPHWWAHDNK25YZW2M7	YZ	W2	M7	4746 ~
		SPHWWAHDNK25YZW3M7		W3		
		SPHWWAHDNK25YZW2D1		W2	D1	
		SPHWWAHDNK25YZW3D1		W3		
	3000	SPHWWAHDNK25YZV2M9	YZ	V2	M9	4994 ~
		SPHWWAHDNK25YZV3M9		V3		
		SPHWWAHDNK25YZV2D1		V2	D1	
		SPHWWAHDNK25YZV3D1		V3		
	3500	SPHWWAHDNK25YZU2N1	YZ	U2	N1	5147 ~
		SPHWWAHDNK25YZU3N1		U3		
		SPHWWAHDNK25YZU2D1		U2	D1	
		SPHWWAHDNK25YZU3D1		U3		
	4000	SPHWWAHDNK25YZT2N2	YZ	T2	N2	5258 ~
		SPHWWAHDNK25YZT3N2		T3		
		SPHWWAHDNK25YZT2D1		T2	D1	
		SPHWWAHDNK25YZT3D1		T3		
	5000	SPHWWAHDNK25YZR3N2	YZ	R3	N2	5283 ~
		SPHWWAHDNK25YZR3D1			D1	5561 ~
	5700	SPHWWAHDNK25YZQ3N3	YZ	Q3	N3	5309 ~
		SPHWWAHDNK25YZQ3D1			D1	5588 ~
6500	SPHWWAHDNK25YZP3N2	YZ	P3	N2	5251 ~	
	SPHWWAHDNK25YZP3D1			D1	5528 ~	

CRI (R <sub>a</sub> ) Min.	Nominal CCT (K)	Product Code	V <sub>F</sub> Rank	Color Rank	Flux Rank	Flux Range (Φ <sub>v</sub> , lm)
90	2700	SPHWAHDNK27YZW2M0	YZ	W2	M0	4068 ~
		SPHWAHDNK27YZW3M0		W3		
		SPHWAHDNK27YZW2D1		W2	D1	
		SPHWAHDNK27YZW3D1		W3		
	3000	SPHWAHDNK27YZV2M2	YZ	V2	M2	4298 ~
		SPHWAHDNK27YZV3M2		V3		
		SPHWAHDNK27YZV2D1		V2	D1	
		SPHWAHDNK27YZV3D1		V3		
	3500	SPHWAHDNK27YZU2M4	YZ	U2	M4	4408 ~
		SPHWAHDNK27YZU3M4		U3		
		SPHWAHDNK27YZU2D1		U2	D1	
		SPHWAHDNK27YZU3D1		U3		
	4000	SPHWAHDNK27YZT2M5	YZ	T2	M5	4505 ~
		SPHWAHDNK27YZT3M5		T3		
		SPHWAHDNK27YZT2D1		T2	D1	
		SPHWAHDNK27YZT3D1		T3		
	5000	SPHWAHDNK27YZR3M5	YZ	R3	M5	4556 ~
		SPHWAHDNK27YZR3D1		R3	D1	4796 ~

b) Chromaticity Region & Coordinates ( $I_F = 1080 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

MacAdam Ellipse (W2, W3)					
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 (V2, V3)					
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 (U2, U3)					
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 (T2, T3)					
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 (R3)					
Step	CIE x	CIE y	$\theta$	a	b
3-step	0.3447	0.3553	59.62	0.0082	0.0035

MacAdam Ellipse (Q3)					
Step	CIE x	CIE y	$\theta$	a	b
3-step	0.3287	0.3417	59.0950	0.0075	0.0032

MacAdam Ellipse (P3)					
Step	CIE x	CIE y	$\theta$	a	b
3-step	0.3123	0.3282	58.5700	0.0067	0.0029

**Note:**

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

### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_F = 1080 \text{ mA}$ , $T_J = 85 \text{ }^\circ\text{C}$ )

CCT: 2700 K (80 CRI)



CCT: 3000 K (80 CRI)



CCT: 3500 K (80 CRI)



CCT: 4000 K (80 CRI)



CCT: 5000 K (80 CRI)



CCT: 5700 K (80 CRI)



CCT: 6500 K (80 CRI)



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



### c) Temperature Characteristics ( $I_F = 1080\text{mA}$ )



d) Color Shift Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ ,  $I_F = 1080\text{mA}$ , CRI80+)



e) Beam Angle Characteristics ( $I_F = 1080\text{ mA}$ ,  $T_J = 85\text{ }^\circ\text{C}$ )



f) Derating Characteristics



4. Outline Drawing & Dimension



- 1. Unit: mm
- 2. Tolerance: ± 0.3 mm

Item	Dimension	Tolerance	Unit
Length	28.0	±0.15	mm
Width	28.0	±0.15	mm
Height	1.50	±0.20	mm
Light Emitting Surface (LES) Diameter	22.0	±0.30	mm

Note: Denoted product information above is only an example  
 ( LC040D18030 : LC040D, CRI80+, 3000K )

## 5. Reliability Test Items & Conditions

### a) Test Items

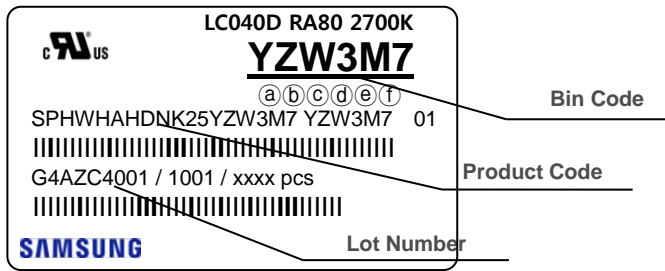
Test Item	Test Condition	Test Hour / Cycle
High Temperature Humidity Life Test	60 °C, 90 % RH,, DC Derating, $I_F$	1000 h
High Temperature Life Test	85 °C, DC Derating, $I_F$	1000 h
Low Temperature Life Test	-40 °C, DC , $I_F = 1900$ mA	1000 h
Pulsed Operating Life Test	55 °C, Pulse width 100 $\mu$ s, 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	500 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)	$R_1$ : 10 M $\Omega$ $R_2$ : 1.5 k $\Omega$ C: 100 pF V: $\pm 2$ kV	5 times
ESD (MM)	$R_1$ : 10 M $\Omega$ $R_2$ : 0 k $\Omega$ C: 200 pF V: $\pm 0.2$ kV	5 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	$V_F$	$I_F = 1080$ mA	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	$\Phi_v$	$I_F = 1080$ mA	L.S.L * 0.7	U.S.L * 1.3

## 6. Label Structure

### a) Label Structure



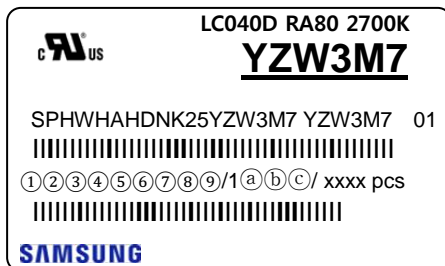
Note: Denoted bin code and product code above is only an example (see description on page 5)

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:



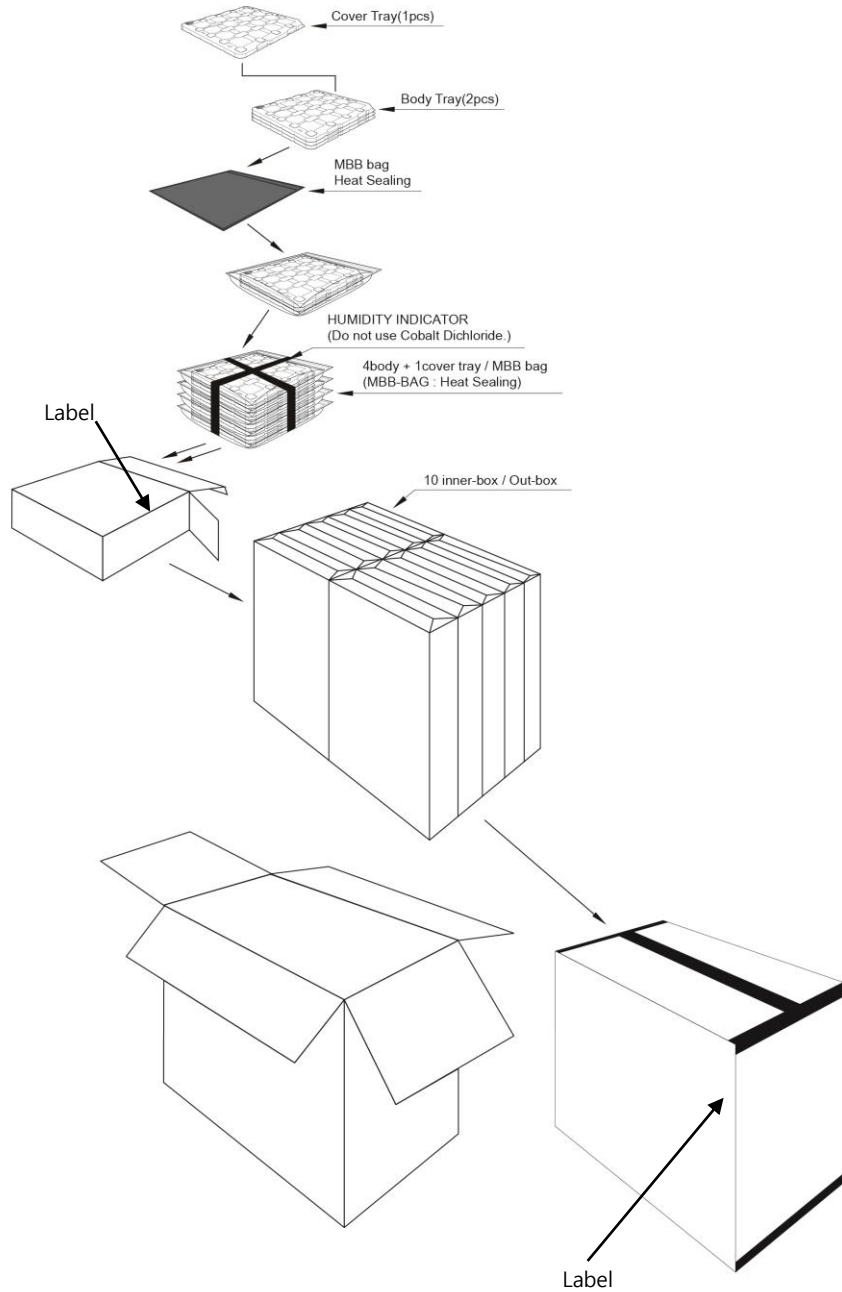
① ③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / xxxx pcs

- 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)

## 6. Packing Structure

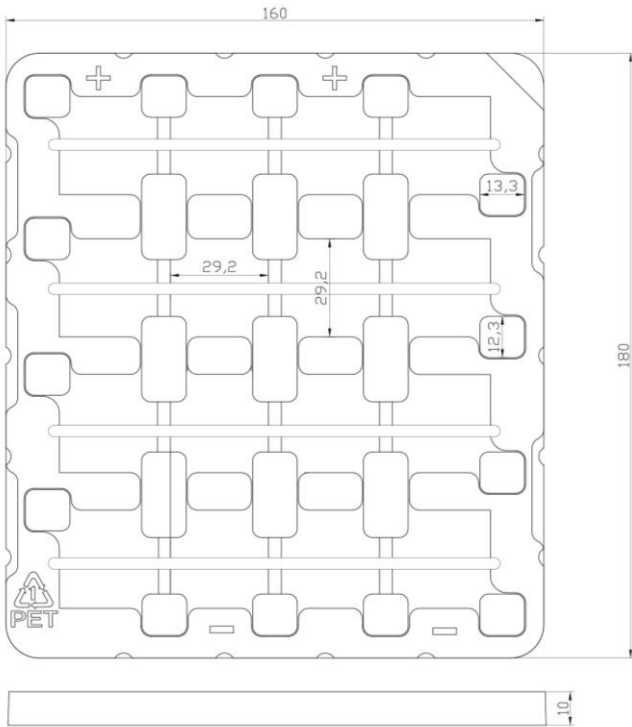
Packing material	Max. quantity in pcs of COB	Dimension(mm)			
		Length	Width	Height	Tolerance
<b>Tray</b>	16	160	180	10	1.0
<b>Aluminum Bag</b>	32(2 trays)	210	241		10
<b>Inner Box</b>	128	230	84	260	2
<b>Outer Box</b>	1280	476	445	272	5

### a) Packing Structure

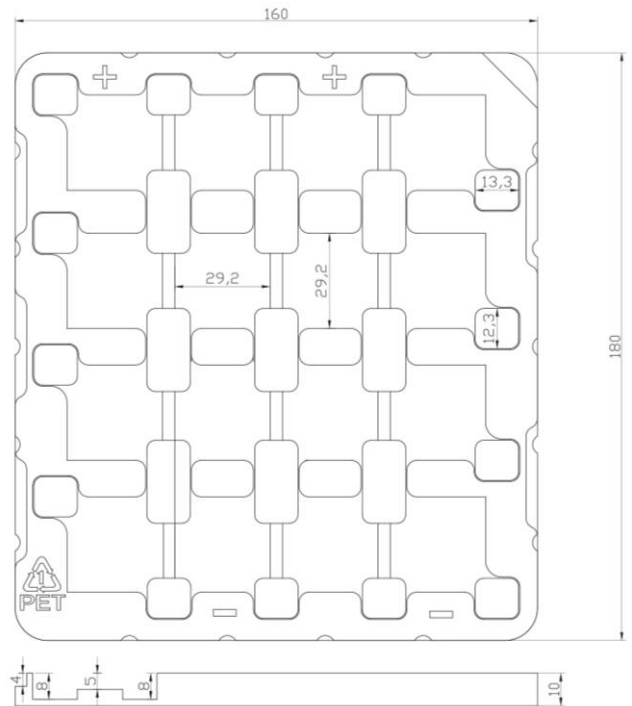


b) Tray

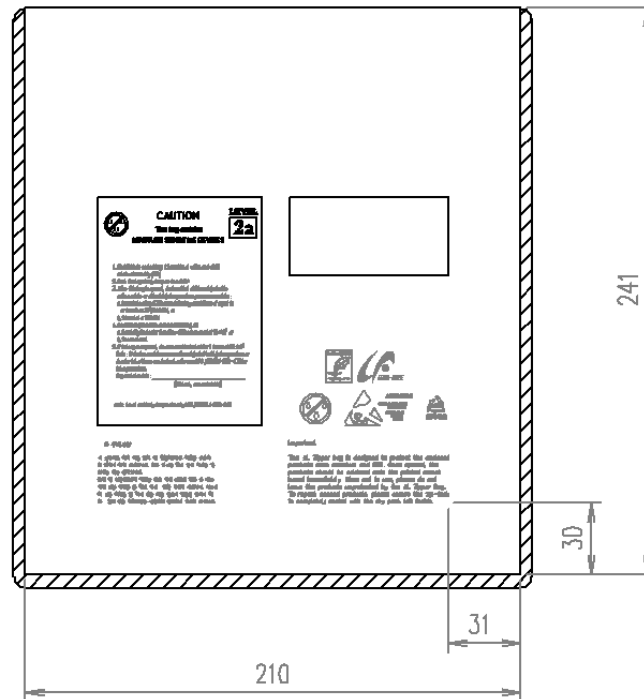
① Cover



② Body



c) 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, 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) 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 LEDs around the minimum current level ( $I_{f\_min}$ ), 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.



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