

High Voltage LED Series Chip on Board

LC009D – Gen.2



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

Table of Contents

1.	Characteristics	-----	3
2.	Product Code Information	-----	5
3.	Typical Characteristics Graphs	-----	8
4.	Outline Drawing & Dimension	-----	10
5.	Reliability Test Items & Conditions	-----	11
6.	Label Structure	-----	12
7.	Precautions in Handling & Use	-----	13

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	150	°C	-
Case Temperature	T_C	115	°C	-
Forward Current	I_F	690	mA	-
Power Dissipation	P_D	25.9	W	-
ESD (HBM)	-	±2	kV	-
ESD (MM)	-	±0.5	kV	-

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

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 case point)	°C/W		-	0.99	-
Beam Angle	°		-	115	-
Nominal Power	W			9.3	

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 = $\pm 5 \%$, CRI = ± 1
- 3) Refer to the derating curve, '3. Typical Characteristics Graph' designed within the range.

c) Luminous Flux Characteristics ($I_F = 270 \text{ mA}$)

CRI (R_a) Min.	Nominal CCT (K)	Flux Rank	Flux @ $T_c = 85 \text{ }^\circ\text{C}$ (lm)		
			Min.	Typ.	Max.
80	2700	D2	1275	1342	-
	3000	D2	1347	1418	-
	3500	D2	1386	1459	-
	4000	D2	1419	1494	-
	5000	D2	1431	1506	-
	5700	D2	1431	1506	-
	6500	D2	1414	1488	-
90	2700	D2	1094	1152	-
	3000	D2	1146	1206	-
	3500	D2	1182	1245	-
	4000	D2	1209	1273	-
	5000	D2	1214	1278	-

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 = ± 1

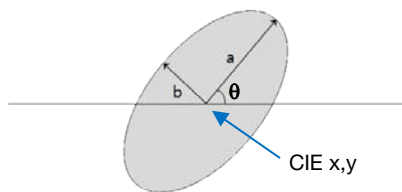
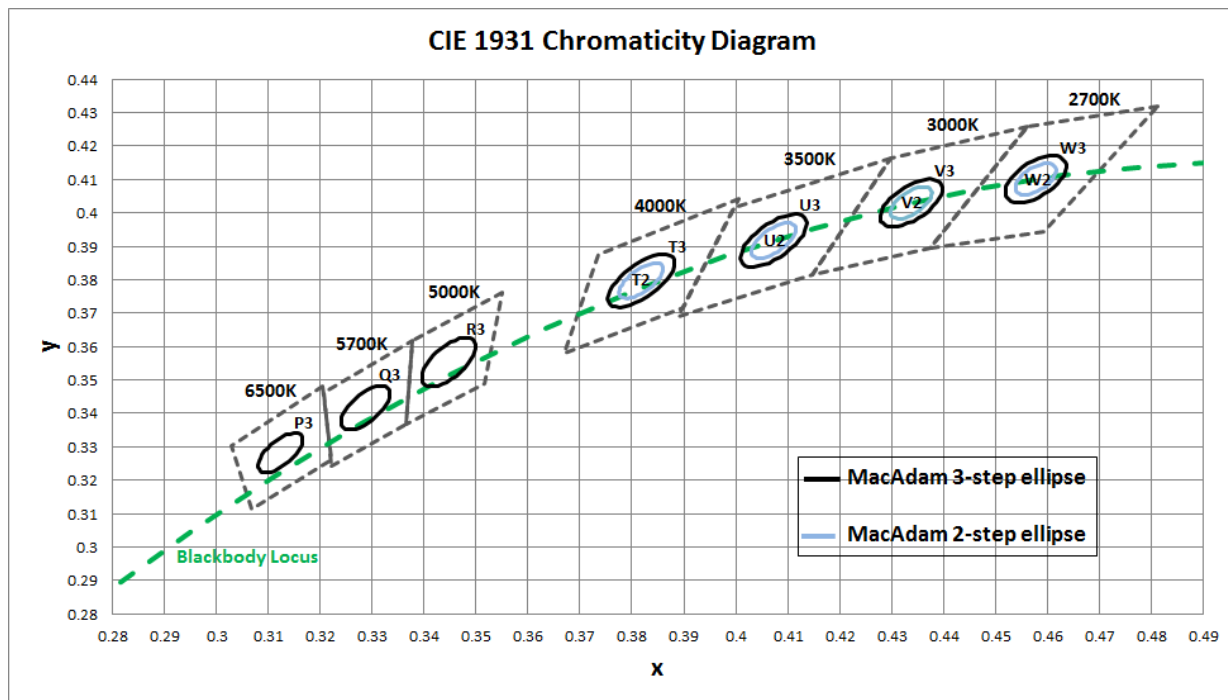
2. Product Code Information

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	C	2	5	Y	Z	W	3	D	2

Digit	PKG Information	Code	Specification
1 2 3	Samsung Package High Power	SPH	
4 5	Color	WH	White
6	Product Version	A	
7 8	Form Factor	HD	COB
9	Lens Type	N	No lens
10	Wattage or Model	C	LC009D
11	Internal Code	2	
12	CRI & Sorting Temperature	5	Min. 80 (85°C)
		7	Min. 90 (85°C)
13 14	Forward Voltage (V)	YZ	31.8~37.5
15	CCT (K)	W V U T R Q P	2700K 3000K 3500K 4000K 5000K 5700K 6500K
16	MacAdam Step	2 3	MacAdam 2-step MacAdam 3-step
17 18	Luminous Flux (Lm)	D2	COB D-series Gen.2 level

a) 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	Flux Rank	Flux Range (Φ_v , lm)
80	2700	SPHWAHDNC25YZW2D2	YZ	W2	D2	1275 ~
		SPHWAHDNC25YZW3D2		W3		
	3000	SPHWAHDNC25YZV2D2	YZ	V2	D2	1347 ~
		SPHWAHDNC25YZV3D2		V3		
	3500	SPHWAHDNC25YZU2D2	YZ	U2	D2	1386 ~
		SPHWAHDNC25YZU3D2		U3		
	4000	SPHWAHDNC25YZT2D2	YZ	T2	D2	1419 ~
		SPHWAHDNC25YZT3D2		T3		
	5000	SPHWAHDNC25YZR3D2	YZ	R3	D2	1431 ~
	5700	SPHWAHDNC25YZQ3D2	YZ	Q3	D2	1431 ~
	6500	SPHWAHDNC25YZP3D2	YZ	P3	D2	1414 ~
90	2700	SPHWAHDNC27YZW2D2	YZ	W2	D2	1094 ~
		SPHWAHDNC27YZW3D2		W3		
	3000	SPHWAHDNC27YZV2D2	YZ	V2	D2	1146 ~
		SPHWAHDNC27YZV3D2		V3		
	3500	SPHWAHDNC27YZU2D2	YZ	U2	D2	1182 ~
		SPHWAHDNC27YZU3D2		U3		
	4000	SPHWAHDNC27YZT2D2	YZ	T2	D2	1209 ~
		SPHWAHDNC27YZT3D2		T3		
	5000	SPHWAHDNC27YZR3D2	YZ	R3	D2	1214 ~

b) Chromaticity Region & Coordinates ($I_F = 270 \text{ mA}$, $T_J = 85^\circ\text{C}$)


MacAdam Ellipse (W2, W3)					
Step	CIE x	CIE y	θ	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	θ	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	θ	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	θ	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	θ	a	b
3-step	0.3447	0.3553	59.62	0.0082	0.0035

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

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

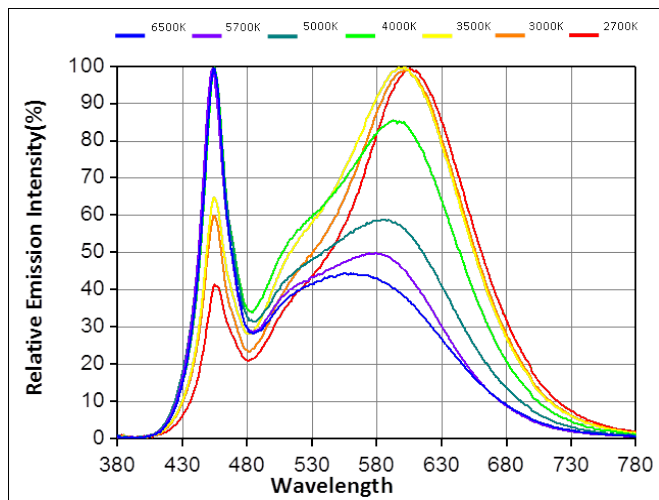
Note:

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

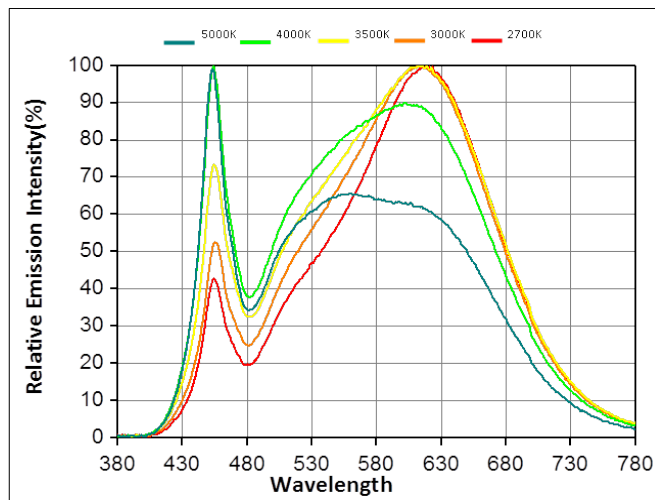
3. Typical Characteristics Graphs

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

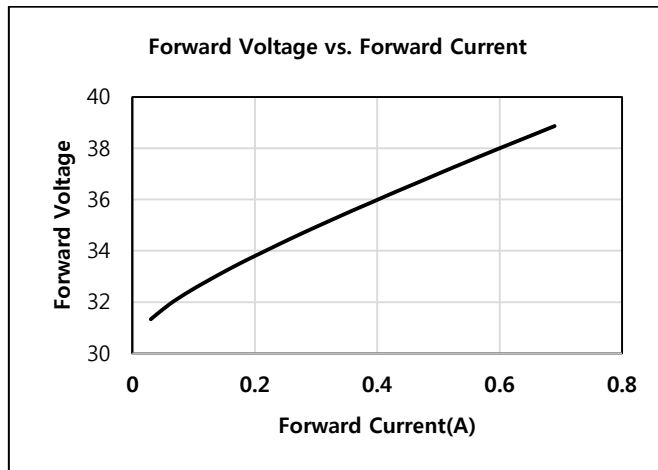
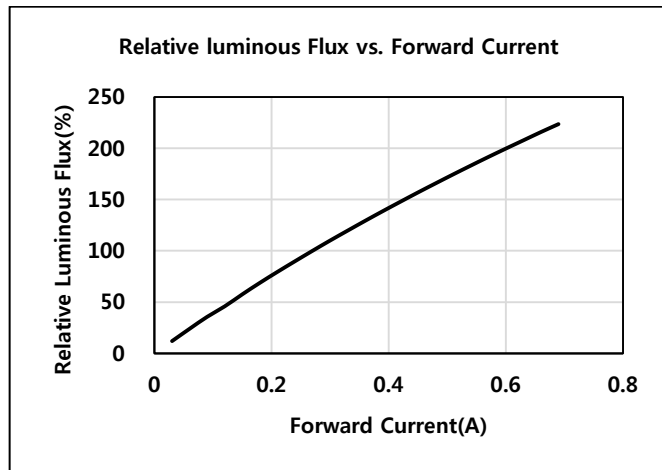
CRI Ra 80+



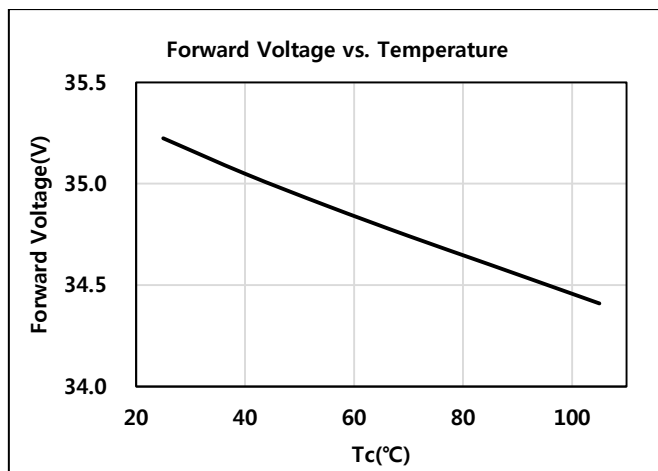
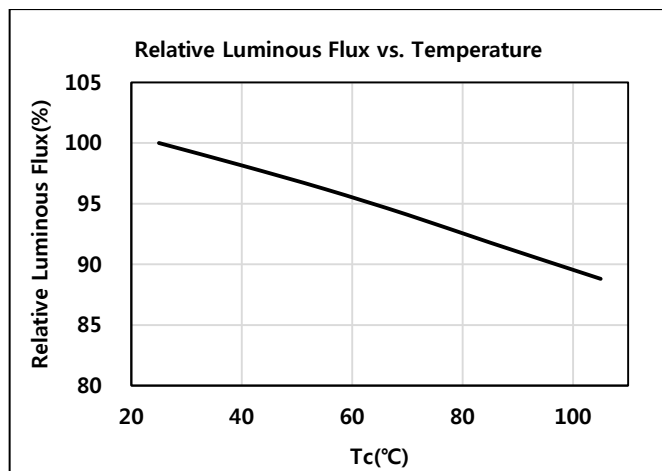
CRI Ra 90+



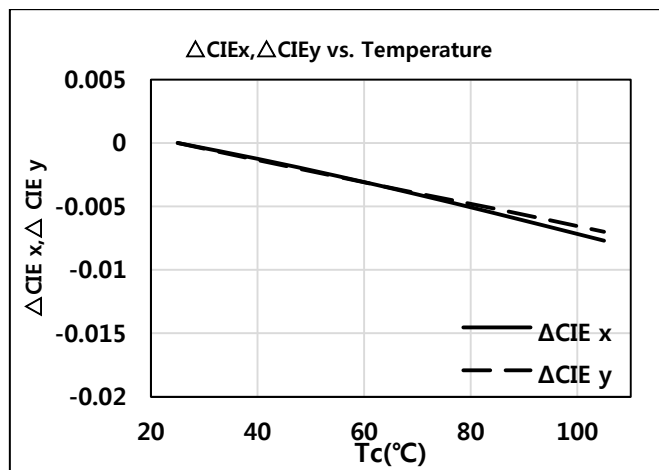
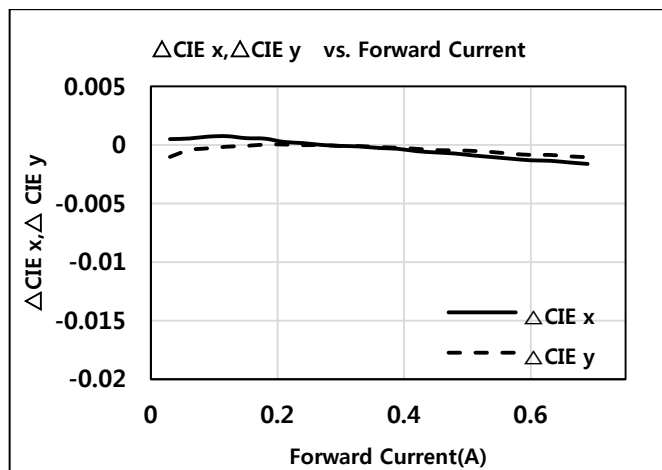
b) Forward Current Characteristics ($T_J = 85^\circ\text{C}$)



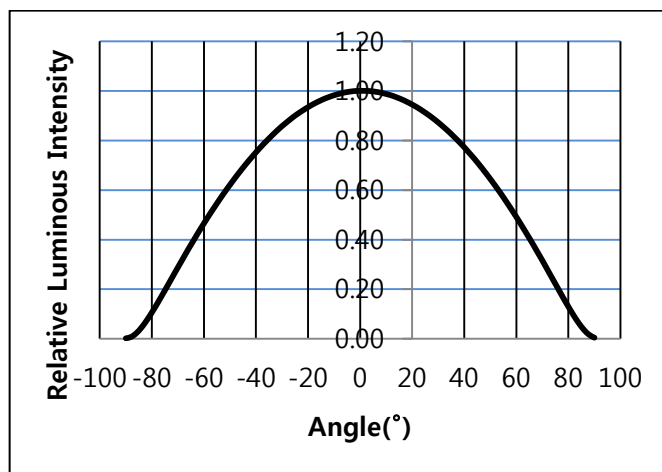
c) Temperature Characteristics ($I_f = 270 \text{ mA}$)



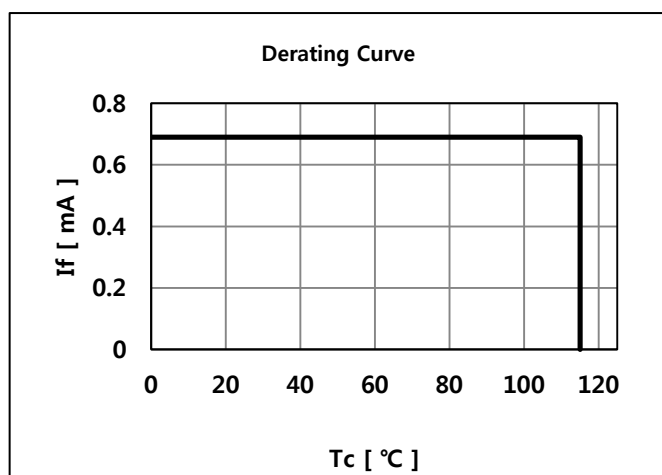
d) Color Shift Characteristics ($T_J = 85^\circ\text{C}$, $I_F = 180\text{mA}$, $\text{CRI} = 80+$)



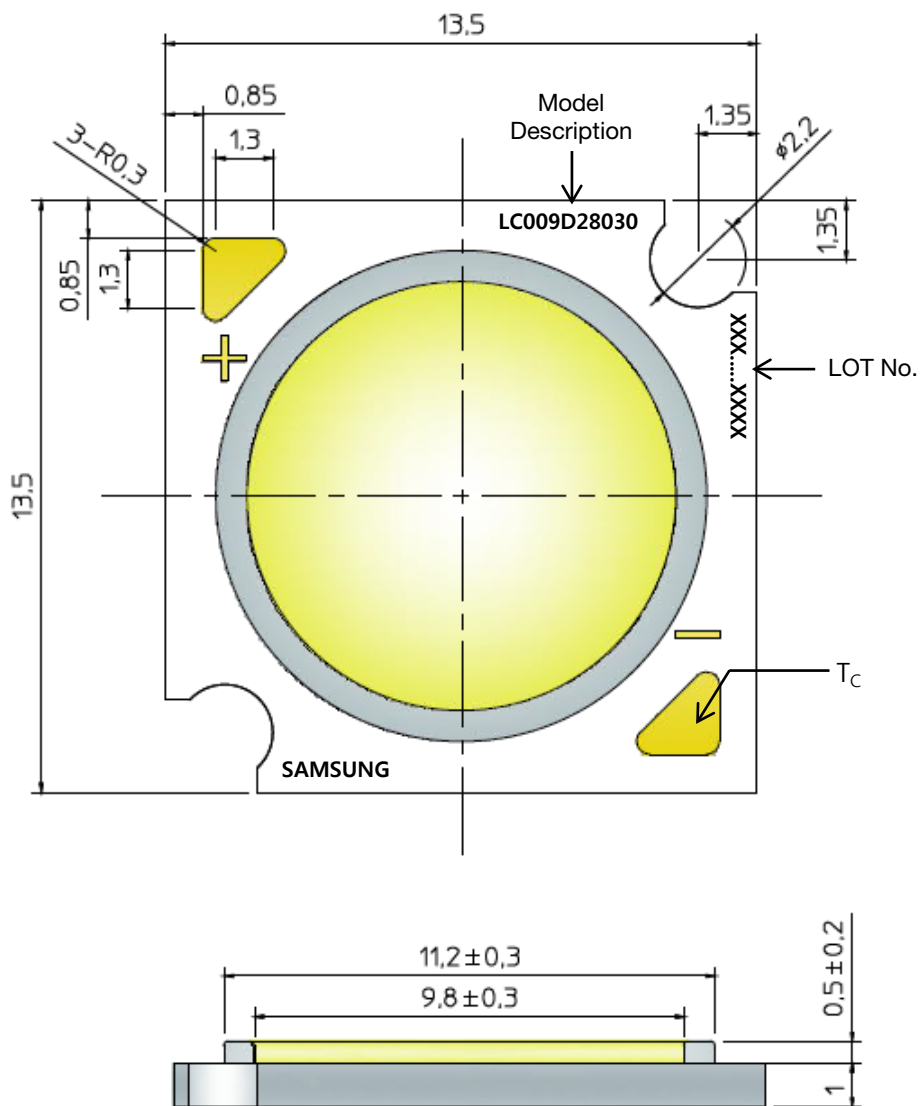
e) Beam Angle Characteristics ($I_F = 270\text{ mA}$, $T_J = 85^\circ\text{C}$)



f) Derating Characteristics



4. Outline Drawing & Dimension



1. Unit: mm
2. Tolerance: ± 0.30 mm

Item	Dimension	Tolerance	Unit
Length	13.5	± 0.15	mm
Width	13.5	± 0.15	mm
Height	1.50	± 0.20	mm
Light Emitting Surface (LES) Diameter	9.8	± 0.30	mm

Note: Denoted product information above is only an example
(LC009D28030 : LC009D, Gen2, CRI80+, 3000K)

5. Reliability Test Items & Conditions

a) Test Items

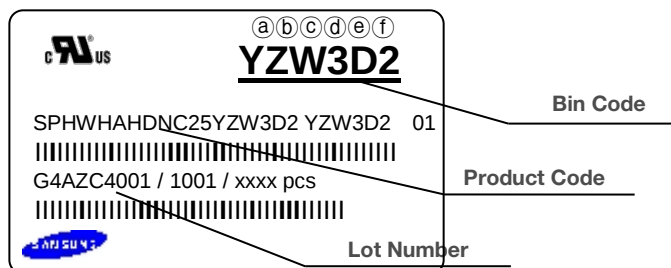
Test Item	Test Condition	Test Hour / Cycle
High Temperature Humidity Life Test	60 °C, 90 % RH,, DC Derating, I_F	1000 h
High Temperature Life Test	85 °C, DC Derating, I_F	1000 h
Low Temperature Life Test	-40 °C, DC, Derating I_F	1000 h
High Temperature Storage	120 °C	1000 h
Low Temperature Storage	-40 °C	1000 h
Temperature Humidity Storage	60 °C, 90% RH	1000h
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 Ω R_2 : 1.5 k Ω C: 100 pF	5 times
ESD (MM)	R_1 : 10 M Ω R_2 : 0 k Ω C: 200 pF	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	1500g, 0.5 ms each of the 6 surfaces (3 axis x 2 sides)	5 times

b) Criteria for Judging the Damage

Item	Symbol	Test Condition ($T_c = 25\text{ °C}$)	Limit	
			Min.	Max.
Forward Voltage	V_F	$I_F = 270\text{ mA}$	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	Φ_v	$I_F = 270\text{ mA}$	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:

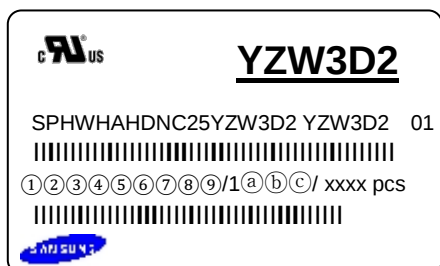
ⒶⒷ: Forward Voltage bin (refer to page 11)

ⒸⒹ: 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)

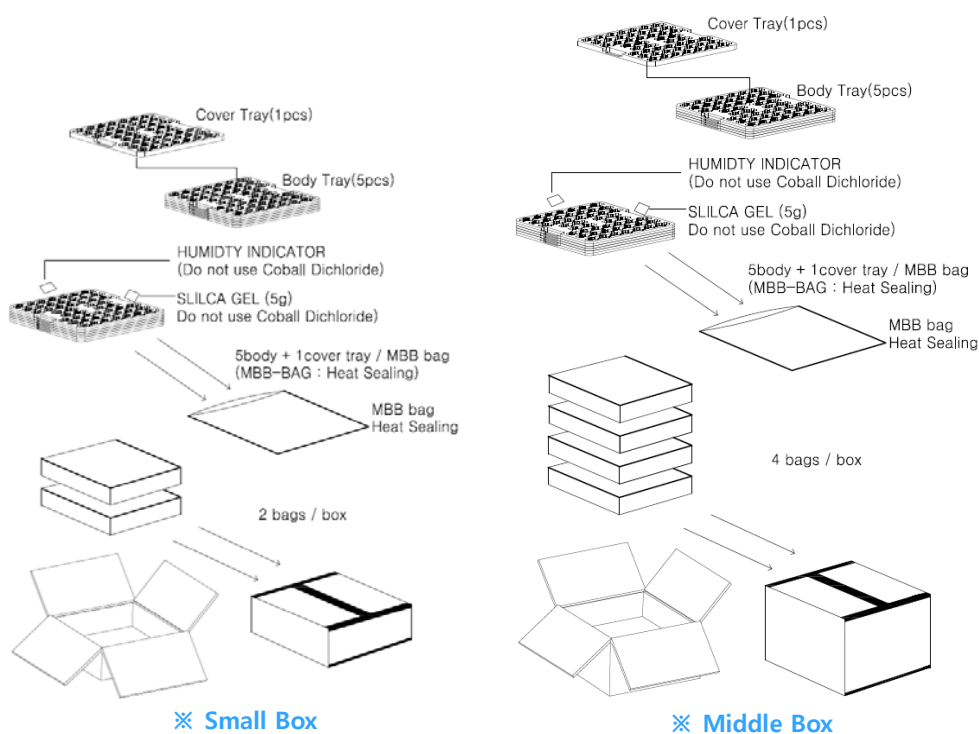
⑥⑦⑧⑨ : Day (1~9, A, B~V)

ⒶⒷⒸ : Product serial number (001 ~ 999)

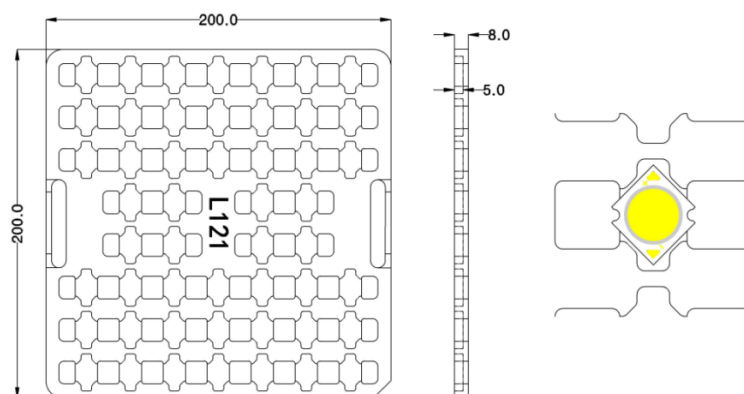
7. Packing Structure

Packing material	Max. quantity in pcs of COB	Dimension(mm)			Tolerance
		Length	Width	Height	
Tray	50	200	200	8	1
Aluminum Bag	250 (5 trays)	320	270	-	+/- 0.5
Outer Box	500 (2 bags)	225	225	65	5
Outer Box	1000 (4 bags)	225	225	130	5

a) Packing Structure

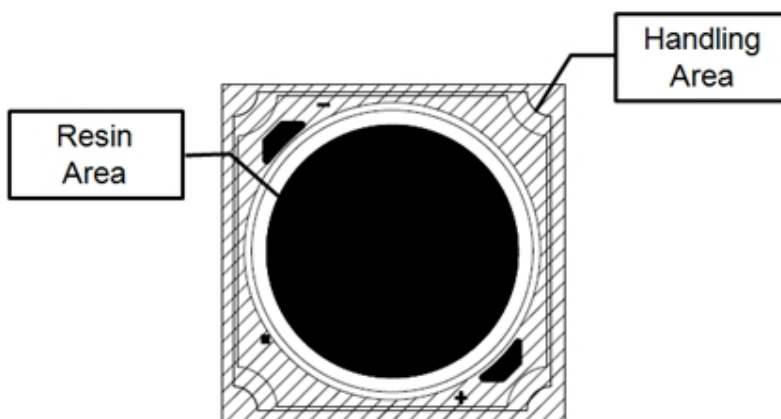


b) Tray



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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