Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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High Voltage LED Series
Chip on Board

LC019B

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
- ENEC certified: Integral LED Module

Applications

- Spotlight / Downlight
- LED Retrofit Bulbs
- Outdoor Illumination

SAMSUNG

Table of Contents

1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	T_a	-40 ~ +105	ºC	-
Storage Temperature	T_{stg}	-40 ~ +120	ºC	-
LED Junction Temperature	T_j	150	ºC	-
Case Temperature	Tc	105	ºC	*Note
Forward Current	I_F	980	mA	-
Power Dissipation	P_D	36.3	W	-
ESD (HBM)	-	±2	kV	-
ESD (MM)	-	±0.5	kV	-

b) Electro-optical Characteristics (I_F = 540 mA, T_c = 25 ºC)

Item	Unit	Rank	Min.	Typ.	Max.
Forward Voltage (V_F)	V	YH	32.5	35.5	38.5
Color Rendering Index (R_a)	-	3	70	-	-
		5	80	-	-
		7	90	-	-
		8	95		
Thermal Resistance (junction to chip point)	ºC/W		-	1.5	-
Beam Angle	º		-	115	-
Working Voltage for Insulation	V				50
Nominal Power	W			19.2	
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 °C)
2) Samsung maintains measurement tolerance of: forward voltage = ±5 %, CRI = ±1
3) Max Tc=105℃ (at max current) is for ENEC condition. Refer to the derating curve, '3. Typical Characteristics Graph' designed within the range.

c) Luminous Flux Characteristics (I_F = 540 mA)

CRI (R_a) Min.	Nominal CCT (K)	Flux Rank	Flux Bin	Sorting[1] @ T_c = 25 °C (lm)		Calculated Flux[2] @ T_c = 85 °C (lm)	
				Min.	Max.	Min.	Max.
70	3000	2F	21	2388	2714	2149	2443
			22	2714	3040	2443	2736
	4000	2F	21	2508	2850	2257	2565
			22	2850	3192	2565	2872
	5000	2F	21	2532	2877	2278	2589
			22	2877	3222	2589	2900
80	2700	2J	22	2162	2325	1967	2115
			23	2325	2487	2115	2263
			24	2487	2650	2263	2411
		1G	23	2325	2487	2115	2263
			24	2487	2650	2263	2411
	3000	2J	22	2300	2473	2093	2250
			23	2473	2646	2250	2408
			24	2646	2819	2408	2565
		1G	23	2473	2646	2250	2408
			24	2646	2819	2408	2565
	3500	2J	22	2369	2547	2156	2318
			23	2547	2725	2318	2480
			24	2725	2904	2480	2642
		1G	23	2547	2725	2318	2480
			24	2725	2904	2480	2642
	4000	2J	22	2438	2621	2218	2385
			23	2621	2805	2385	2552
			24	2805	2988	2552	2719
		1G	23	2621	2805	2385	2552
			24	2805	2988	2552	2719
	5000	2J	22	2461	2646	2239	2408
			23	2646	2831	2408	2576
			24	2831	3016	2576	2745
		1G	23	2646	2831	2408	2576
			24	2831	3016	2576	2745
	5700	2J	22	2461	2646	2239	2408
			23	2646	2831	2408	2576
			24	2831	3016	2576	2745
		1G	23	2646	2831	2408	2576
			24	2831	3016	2576	2745

c) Luminous Flux Characteristics (I_F = 540 mA)

CRI (R_a) Min.	Nominal CCT (K)	Flux Rank	Flux Bin	Sorting[1] @ T_c = 25 °C (lm)		Calculated Flux[2] @ T_c = 85 °C (lm)	
				Min.	Max.	Min.	Max.
90	2700	2J	21	1751	1917	1593	1745
			22	1917	2084	1745	1897
			23	2084	2251	1897	2048
	3000	2J	21	1786	1957	1626	1780
			22	1957	2127	1780	1935
			23	2127	2297	1935	2090
	3500	2J	21	1840	2015	1674	1834
			22	2015	2191	1834	1993
			23	2191	2366	1993	2153
	4000	2J	21	1894	2074	1723	1887
			22	2074	2254	1887	2051
			23	2254	2435	2051	2216
95	2700	1F	11	1714	1905	1560	1733
			12	1905	2095	1733	1907
	3000	1F	11	1767	1964	1608	1787
			12	1964	2160	1787	1966
	3500	1F	11	1820	2023	1657	1841
			12	2023	2225	1841	2025

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 °C)
2) Calculated flux values are for reference only
3) Samsung maintains measurement tolerance of: luminous flux = ±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	C	W	1	H	D	N	B	2	5	Y	H	R	T	2	J

Digit	PKG Information	Code	Specification
1 2 3	Samsung Package High Power	SPH	
4 5	Color	WW	Warm White (T/U/V/W Ranks)
		CW	Cool White (Q/R Ranks)
6	Product Version	1	
7 8	Form Factor	HD	COB
9	Lens Type	N	No lens
10	Internal Code	B	LC019
11	Chip Type	2	
12	CRI & Sorting Temperature	3	Min. 70
		5	Min. 80
		7	Min. 90
		8	Min 95
13 14	Forward Voltage (V)	YH	32.5~38.5
15	CCT (K)	W	2700 K, Bin Code: WA,WB (MacAdam Ellipse)
		V	3000 K, Bin Code: VA, VB (MacAdam Ellipse), VW, VX, VY, VZ (ANSI bin)
		U	3500 K, Bin Code: UA, UB (MacAdam Ellipse)
		T	4000 K, Bin Code: TA, TB (MacAdam Ellipse), TW, TX, TY, TZ (ANSI bin)
		R	5000 K, Bin Code: RA (MacAdam Ellipse), RW, RX, RY, RZ (ANSI bin)
		Q	5700 K, QW, QX, QY, QZ (ANSI bin)
16	MacAdam / ANSI	2	MacAdam 2-step
		3	MacAdam 3-step
		T	ANSI bin
17 18	Luminous Flux	1F	Bin Code: 11, 12 (95 CRI)
		2J	21, 22, 23 (90 CRI); 22, 23, 24 (80 CRI)
		2F	21, 22 (70 CRI)
		1G	23, 24 (80 CRI)

a) Binning Structure (I_F = 540 mA, T_c = 25 ºC)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	V_F Rank	Color Rank	Chrom. Bin	Flux Rank	Flux Bin	Flux Range (Φ_v, lm)
70	3000	SPHWW1HDNB23YHVT2F	YH	VT	VW, VX VY, VZ	2F	21	2388 ~ 2714
							22	2714 ~ 3040
	4000	SPHWW1HDNB23YHTT2F	YH	TT	TW, TX TY, TZ	2F	21	2508 ~ 2850
							22	2850 ~ 3192
	5000	SPHCW1HDNB23YHRT2F	YH	RT	RW, RX RY, RZ	2F	21	2532 ~ 2877
							22	2877 ~ 3222
80	2700	SPHWW1HDNB25YHW22J	YH	W2	WB	2J	22	2162 ~ 2325
							23	2325 ~ 2487
							24	2487 ~ 2650
		SPHWW1HDNB25YHW32J	YH	W3	WA, WB	2J	22	2162 ~ 2325
							23	2325 ~ 2487
							24	2487 ~ 2650
		SPHWW1HDNB25YHW21G	YH	W2	WB	1G	23	2325 ~ 2487
							24	2487 ~ 2650
		SPHWW1HDNB25YHW31G	YH	W3	WA, WB	1G	23	2325 ~ 2487
							24	2487 ~ 2650
	3000	SPHWW1HDNB25YHV22J	YH	V2	VB	2J	22	2300 ~ 2473
							23	2473 ~ 2646
							24	2646 ~ 2819
		SPHWW1HDNB25YHV32J	YH	V3	VA, VB	2J	22	2300 ~ 2473
							23	2473 ~ 2646
							24	2646 ~ 2819
		SPHWW1HDNB25YHV21G	YH	V2	VB	1G	23	2473 ~ 2646
							24	2646 ~ 2819
		SPHWW1HDNB25YHV31G	YH	V3	VA, VB	1G	23	2473 ~ 2646
							24	2646 ~ 2819
	3500	SPHWW1HDNB25YHU22J	YH	U2	UB	2J	22	2369 ~ 2547
							23	2547 ~ 2725
							24	2725 ~ 2904
		SPHWW1HDNB25YHU32J	YH	U3	UA, UB	2J	22	2369 ~ 2547
							23	2547 ~ 2725
							24	2725 ~ 2904
		SPHWW1HDNB25YHU21G	YH	U2	UB	1G	23	2547 ~ 2725
							24	2725 ~ 2904
		SPHWW1HDNB25YHU31G	YH	U3	UA, UB	1G	23	2547 ~ 2725
							24	2725 ~ 2904

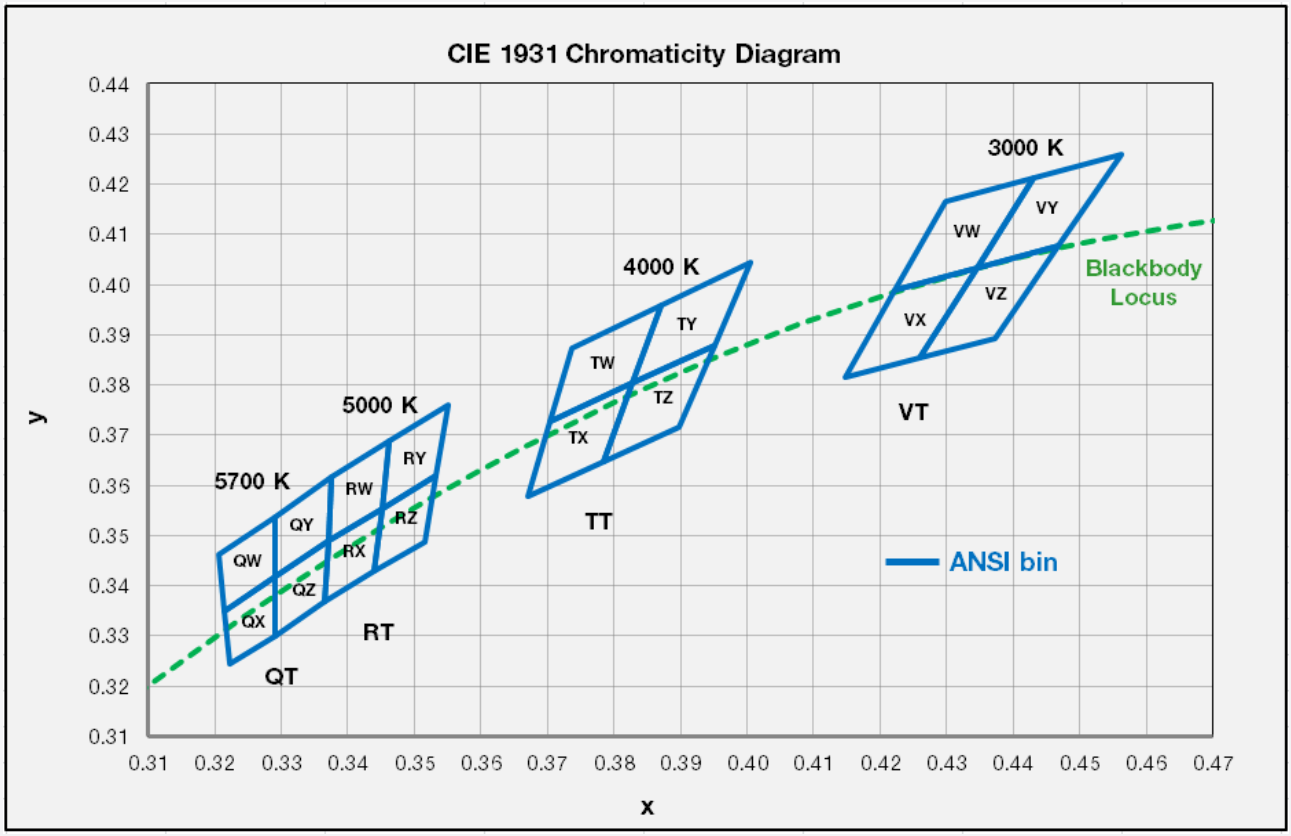
a) Binning Structure (I_F = 540 mA, T_c = 25 °C)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	V_F Rank	Color Rank	Chrom. Bin	Flux Rank	Flux Bin	Flux Range (Φ_v, lm)
80	4000	SPHWW1HDNB25YHT22J	YH	T2	TB	2J	22	2438 ~ 2621
							23	2621 ~ 2805
							24	2805 ~ 2988
		SPHWW1HDNB25YHT32J	YH	T3	TA, TB	2J	22	2438 ~ 2621
							23	2621 ~ 2805
							24	2805 ~ 2988
		SPHWW1HDNB25YHT21G	YH	T2	TB	1G	23	2621 ~ 2805
							24	2805 ~ 2988
		SPHWW1HDNB25YHT31G	YH	T3	TA, TB	1G	23	2621 ~ 2805
							24	2805 ~ 2988
	5000	SPHCW1HDNB25YHR32J	YH	R3	RA	2J	22	2461 ~ 2646
							23	2646 ~ 2831
							24	2831 ~ 3016
		SPHCW1HDNB25YHRT2J	YH	RT	RW, RX, RY, RZ	2J	22	2461 ~ 2646
							23	2646 ~ 2831
							24	2831 ~ 3016
		SPHCW1HDNB25YHR31G	YH	R3	RA	1G	23	2646 ~ 2831
							24	2831 ~ 3016
		SPHCW1HDNB25YHRT1G	YH	RT	RW, RX, RY, RZ	1G	23	2646 ~ 2831
							24	2831 ~ 3016
	5700	SPHCW1HDNB25YHQT2J	YH	QT	QW, QX QY, QZ	2J	22	2461 ~ 2646
							23	2646 ~ 2831
							24	2831 ~ 3016
		SPHCW1HDNB25YHQT1G	YH	QT	QW, QX QY, QZ	1G	23	2646 ~ 2831
							24	2831 ~ 3016

a) Binning Structure (I_F = 540 mA, T_c = 25 ºC)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	V_F Rank	Color Rank	Chrom. Bin	Flux Rank	Flux Bin	Flux Range (Φ_v, lm)
90	2700	SPHWW1HDNB27YHW22J	YH	W2	WB	2J	21	1751 ~ 1917
							22	1917 ~ 2084
							23	2084 ~ 2251
		SPHWW1HDNB27YHW32J	YH	W3	WA, WB	2J	21	1751 ~ 1917
							22	1917 ~ 2084
							23	2084 ~ 2251
	3000	SPHWW1HDNB27YHV22J	YH	V2	VB	2J	21	1786 ~ 1957
							22	1957 ~ 2127
							23	2127 ~ 2297
		SPHWW1HDNB27YHV32J	YH	V3	VA, VB	2J	21	1786 ~ 1957
							22	1957 ~ 2127
							23	2127 ~ 2297
	3500	SPHWW1HDNB27YHU22J	YH	U2	UB	2J	21	1840 ~ 2015
							22	2015 ~ 2191
							23	2191 ~ 2366
		SPHWW1HDNB27YHU32J	YH	U3	UA, UB	2J	21	1840 ~ 2015
							22	2015 ~ 2191
							23	2191 ~ 2366
	4000	SPHWW1HDNB27YHT22J	YH	T2	TB	2J	21	1894 ~ 2074
							22	2074 ~ 2254
							23	2254 ~ 2435
		SPHWW1HDNB27YHT32J	YH	T3	TA, TB	2J	21	1894 ~ 2074
							22	2074 ~ 2254
							23	2254 ~ 2435
95	2700	SPHWW1HDNB28YHW21F	YH	W2	WB	1F	11	1714 ~ 1905
							12	1905 ~ 2095
		SPHWW1HDNB28YHW31F	YH	W3	WA,WB	1F	11	1714 ~ 1905
							12	1905 ~ 2095
	3000	SPHWW1HDNB28YHV21F	YH	V2	VB	1F	11	1767 ~ 1964
							12	1964 ~ 2160
		SPHWW1HDNB28YHV31F	YH	V3	VA,VB	1F	11	1767 ~ 1964
							12	1964 ~ 2160
	3500	SPHWW1HDNB28YHU21F	YH	U2	UB	1F	11	1820 ~ 2023
							12	2023 ~ 2225
		SPHWW1HDNB28YHU31F	YH	U3	UA,UB	1F	11	1820 ~ 2023
							12	2023 ~ 2225

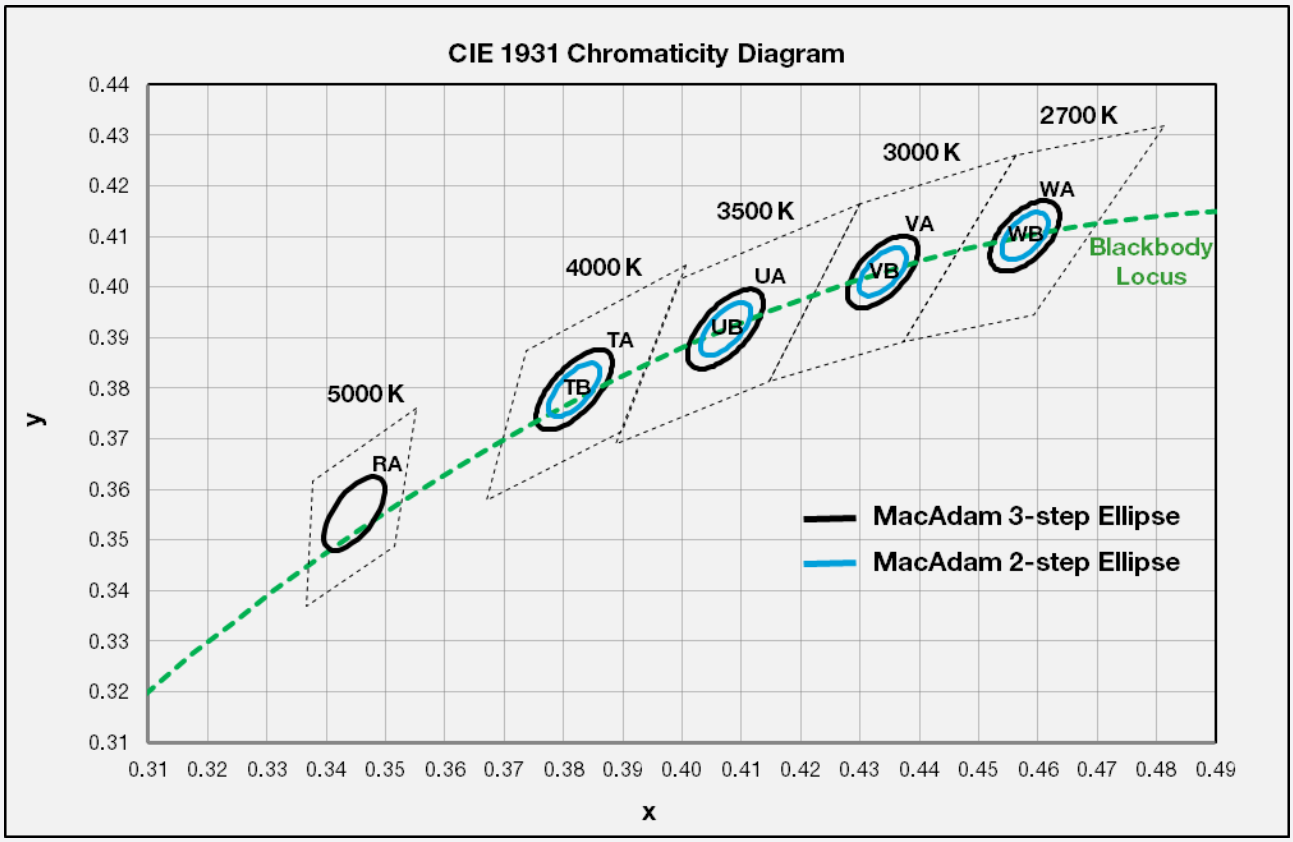
b) Chromaticity Region & Coordinates (I_F = 540 mA, T_a = 25 °C)

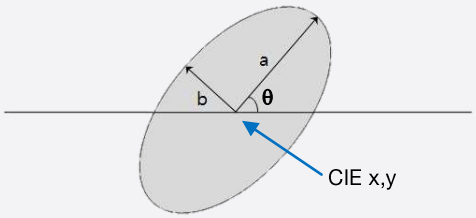


Region	CIE x	CIE y	Region	CIE x	CIE y
V rank (3000 K)					
VW	0.4223	0.399	VY	0.4345	0.4033
	0.4345	0.4033		0.4468	0.4077
	0.4431	0.4213		0.4562	0.4260
	0.4299	0.4165		0.4431	0.4213
VX	0.4223	0.399	VZ	0.4260	0.3854
	0.4147	0.3814		0.4373	0.3893
	0.4260	0.3854		0.4468	0.4077
	0.4345	0.4033		0.4345	0.4033
R rank (5000 K)					
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
T rank (4000 K)					
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
Q rank (5700 K)					
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 = 540 mA, T_a = 25 °C)





MacAdam Ellipse (WA, WB)					
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 (VA, VB)					
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 (UA, UB)					
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 (TA, TB)					
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 (RA)					
Step	CIE x	CIE y	θ	a	b
3-step	0.3447	0.3553	59.62	0.0082	0.0035

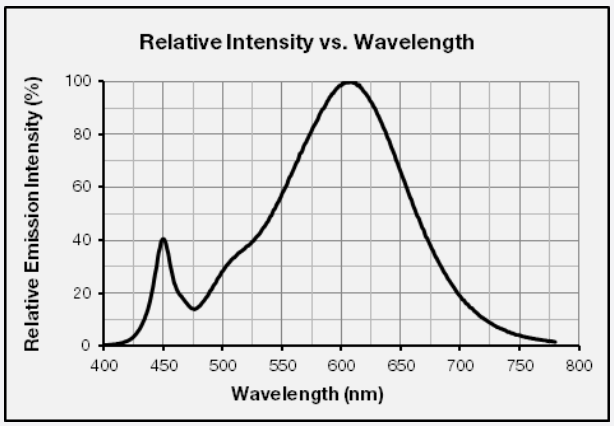
Note:

Samsung maintains measurement tolerance of: Cx, Cy = ±0.005

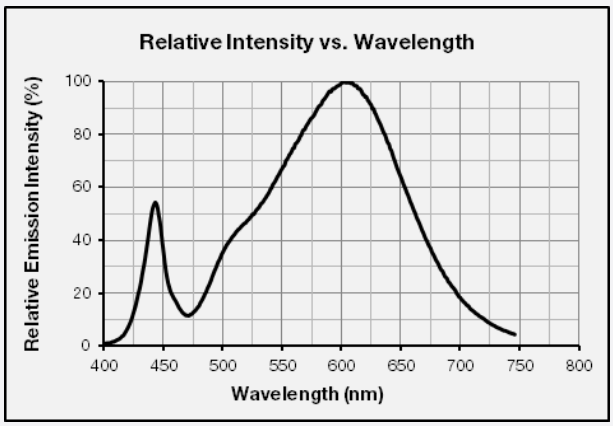
3. Typical Characteristics Graphs

a) Spectrum Distribution (I_F = 540 mA, T_c = 25 ºC)

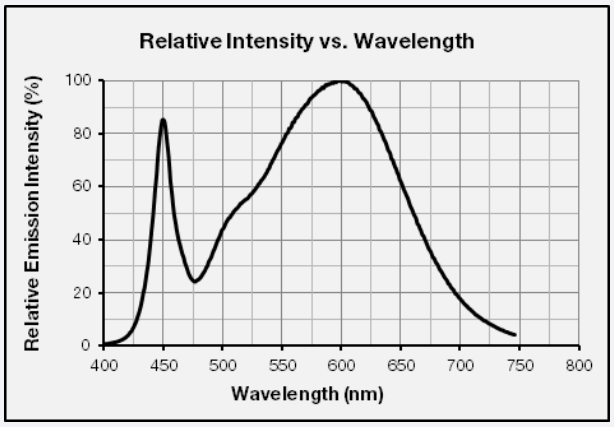
CCT: 2700 K



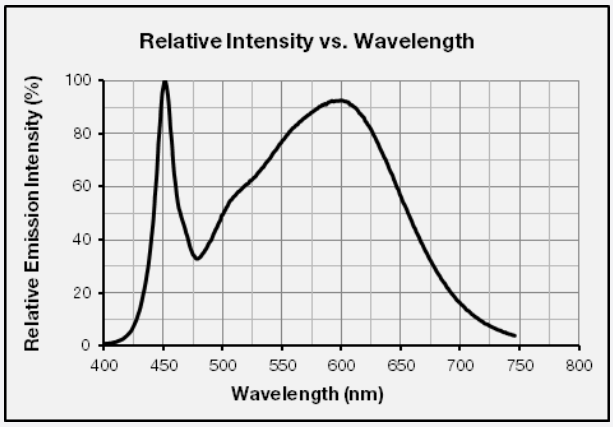
CCT: 3000 K



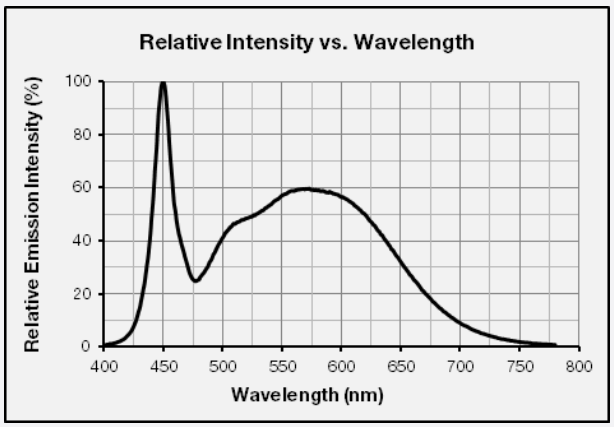
CCT: 3500 K



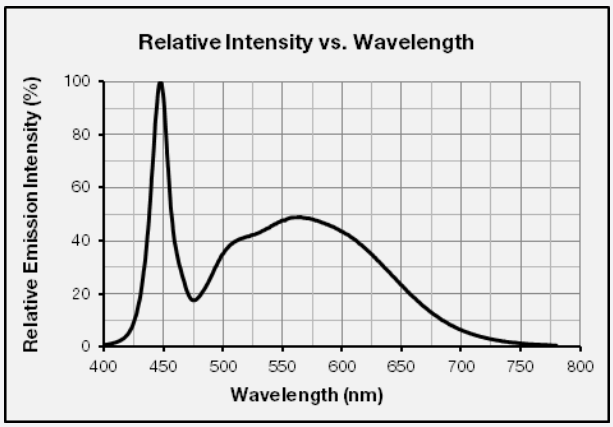
CCT: 4000 K



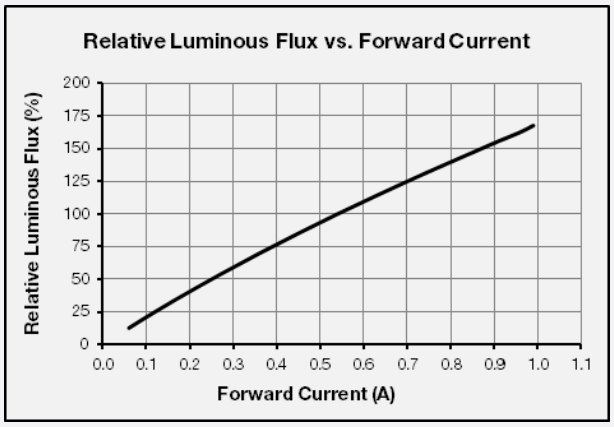
CCT: 5000 K

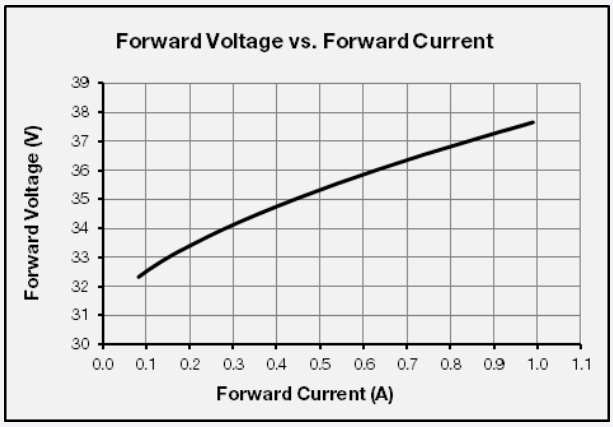


CCT: 5700 K

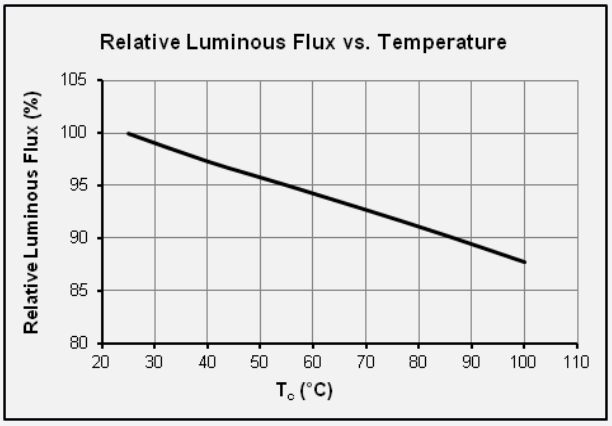


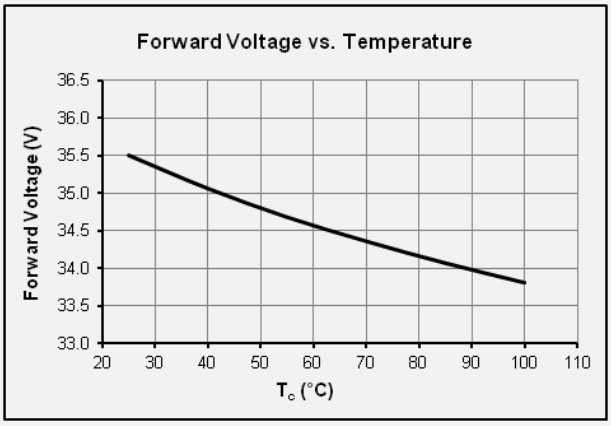
b) Forward Current Characteristics (T_c = 25 °C)



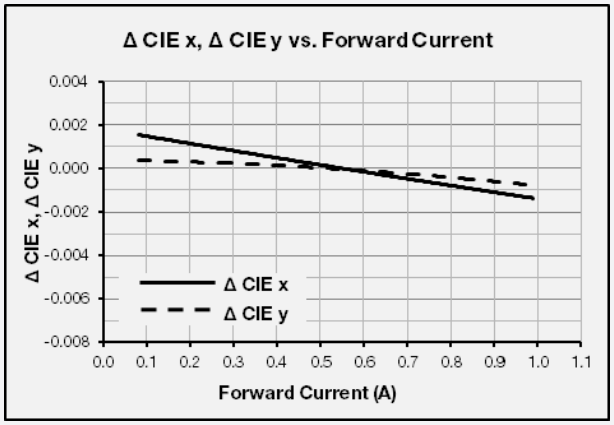


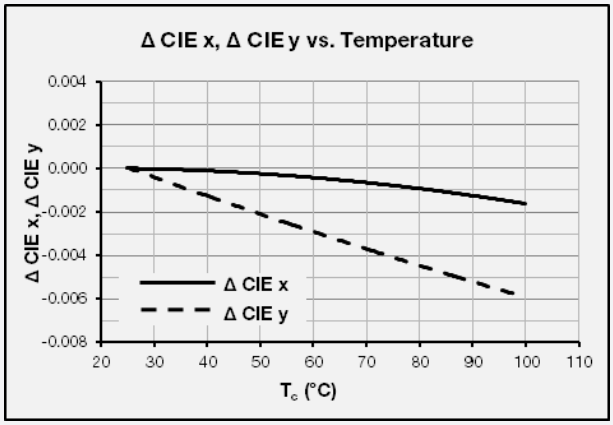
c) Temperature Characteristics (I_F = 540 mA)



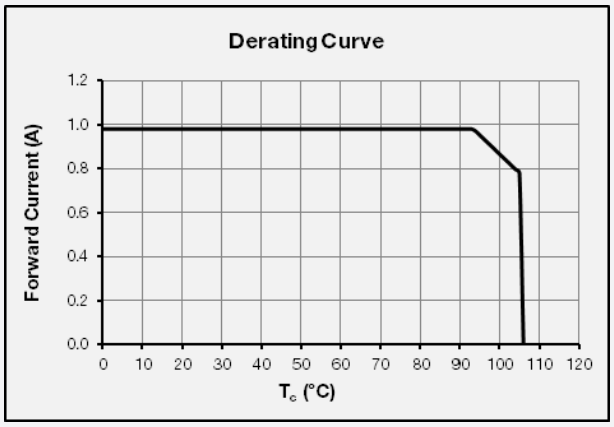


d) Color Shift Characteristics T_c = 25 °C I_F = 540 mA

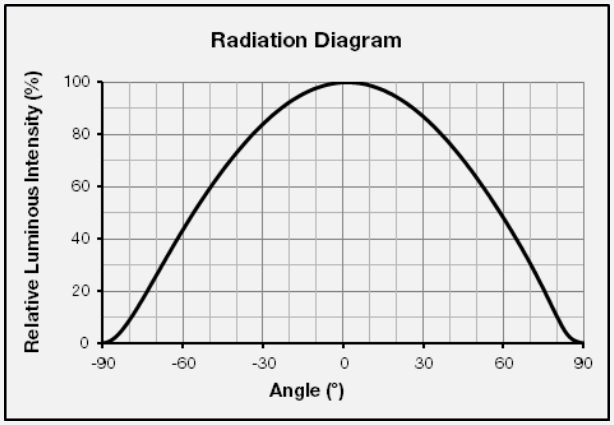




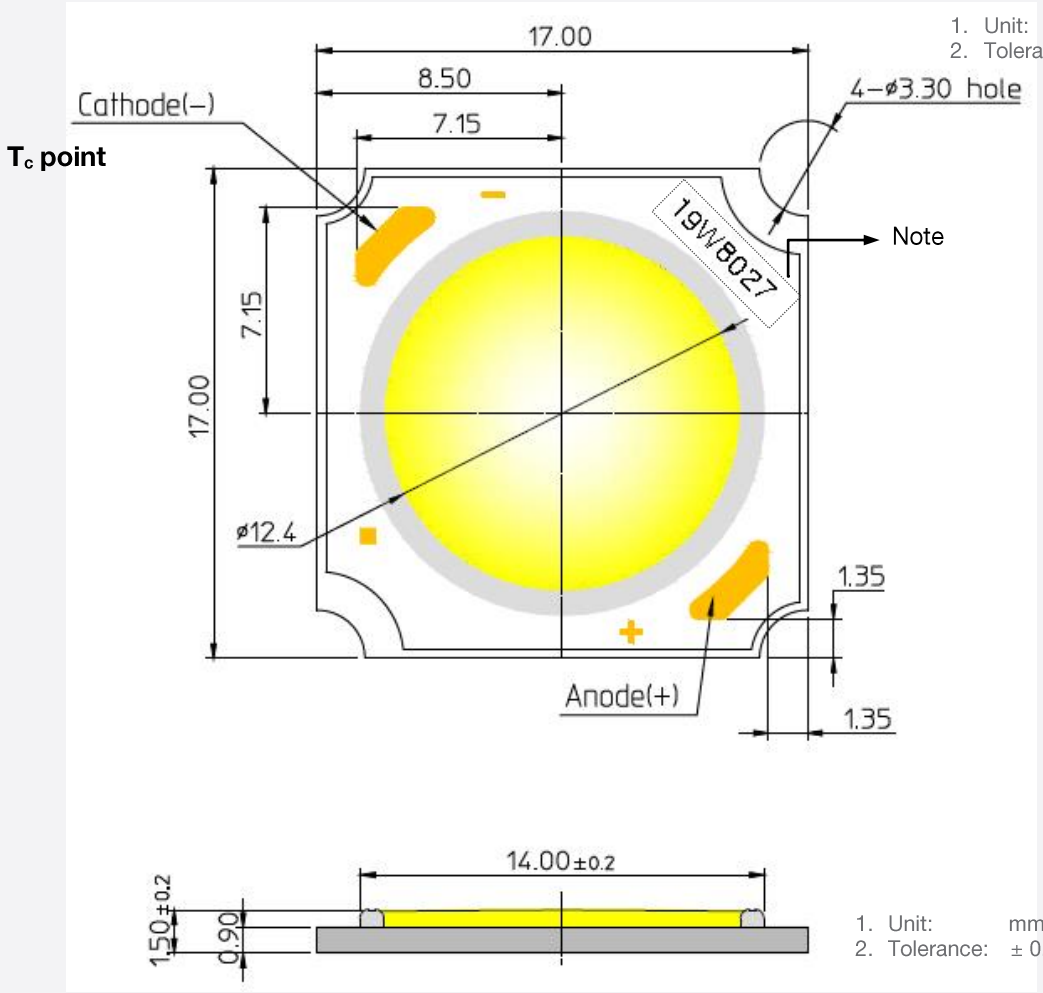
e) Derating Curve



f) Beam Angle Characteristics (I_F = 540 mA, T_c = 25 ºC)



4. Outline Drawing & Dimension



Item	Dimension	Tolerance	Unit
Length	17.0	±0.15	mm
Width	17.0	±0.15	mm
Height	1.50	±0.20	mm
Light Emitting Surface (LES) Diameter	12.4	±0.15	mm

Note: Denoted product information above is only an example
(19W8027 : 19W, CRI80+, 2700K)

5. Reliability Test Items & Conditions

a) Test Items

Test Item	Test Condition	Test Hour / Cycle
Room Temperature Life Test	25 °C, I_F = max	1000 h
High Temperature Humidity Life Test	85 °C, 85 % RH, DC Derating, I_F = max	1000 h
High Temperature Life Test	105 °C, DC Derating, I_F = max	1000 h
Low Temperature Life Test	-40 °C, DC 980 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 540 mA	100 cycles
Temperature Humidity Storage Test	-10 °C ↔ 25 °C, 95 % RH ↔ 85 °C, 95 % RH (24 h / cycle)	100 cycles
ESD (HBM)	R_1: 10 MΩ R_2: 1.5 kΩ C: 100 pF V: ±2 kV	5 times
ESD (MM)	R_1: 10 MΩ R_2: 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

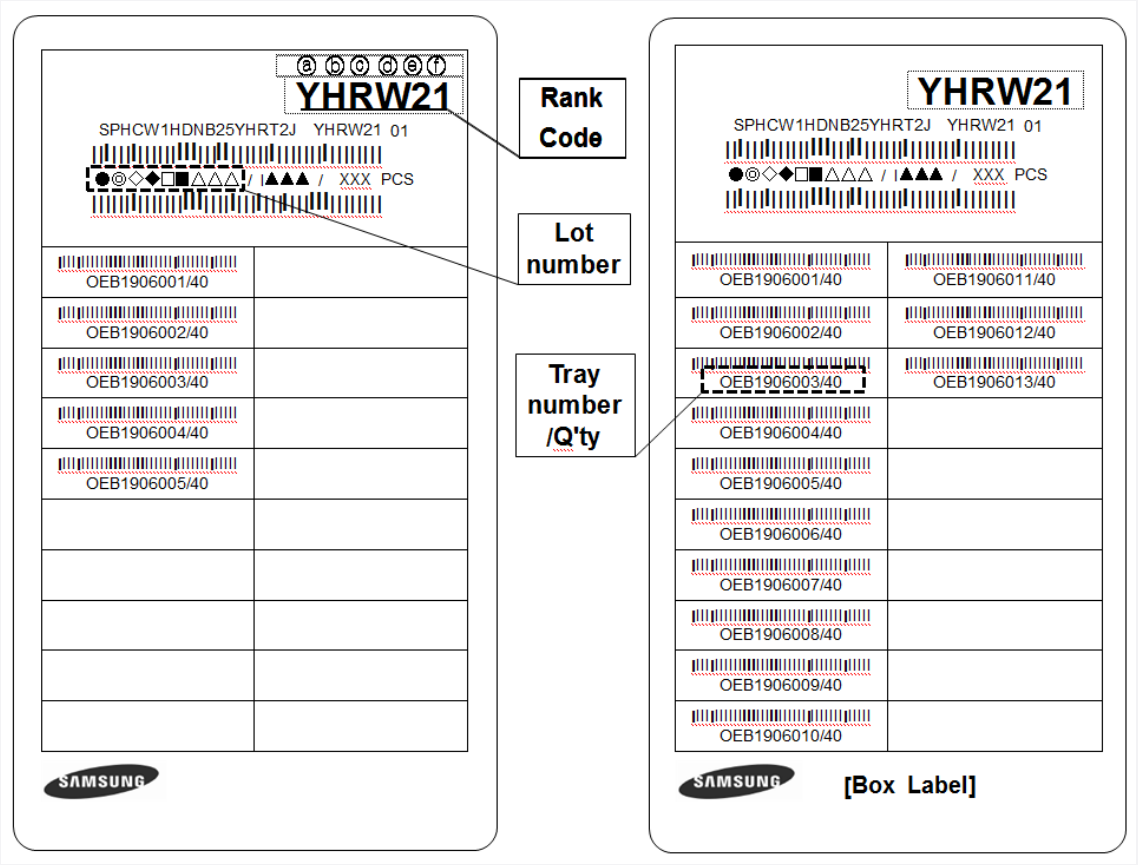
Item	Symbol	Test Condition (T_c = 25 °C)	Limit	
			Min.	Max.
Forward Voltage	V_F	I_F = 540 mA	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	Φ_v	I_F = 540 mA	L.S.L * 0.7	U.S.L * 1.3

6. Label Structure

a) Label Structure

Aluminum Bag & Inner Box

Outer Box



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

Rank Code:

ⓐⓑ: Forward Voltage rank (refer to page 6-7)

ⓒⓓ: Chromaticity bin (refer to page 8-9)

ⓔⓕ: Luminous Flux bin (refer to page 6-7)

b) Lot Number

The lot number is composed of the following characters:

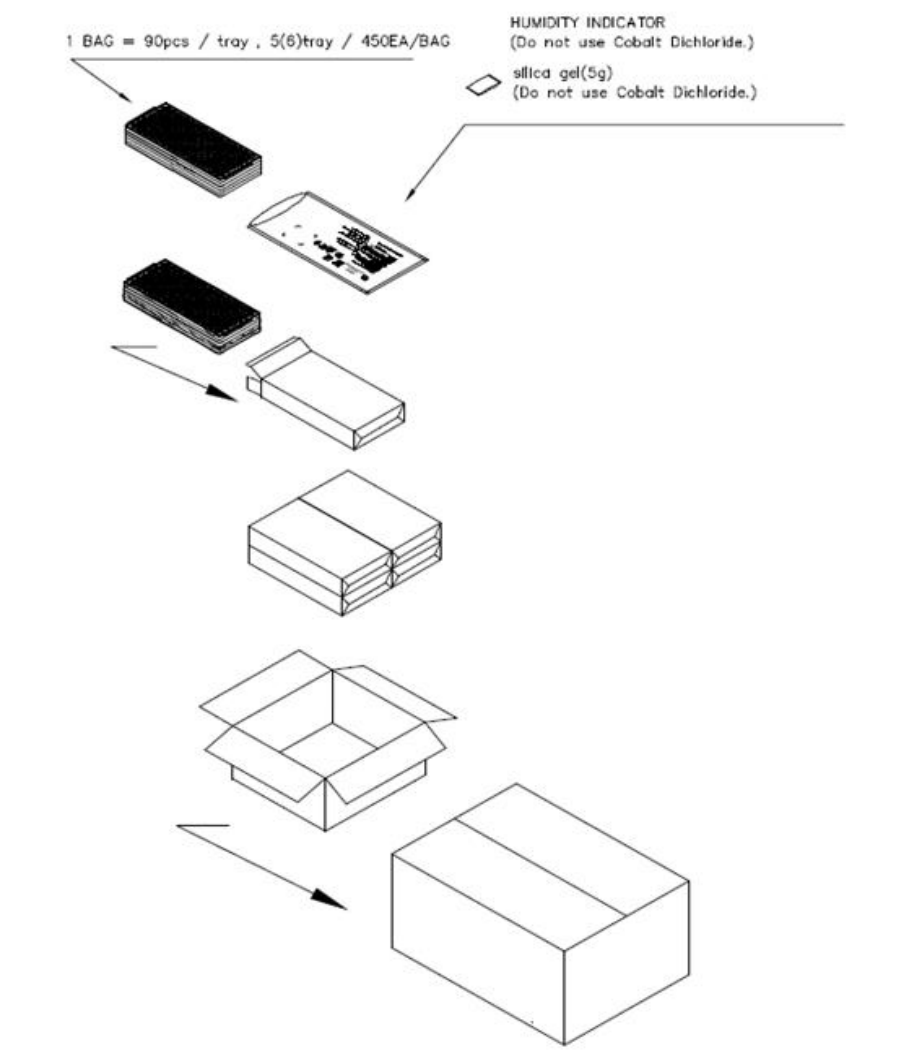
●◎◇◆□■△△△ / 1▲▲▲ / xxx PCS

●	:	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)

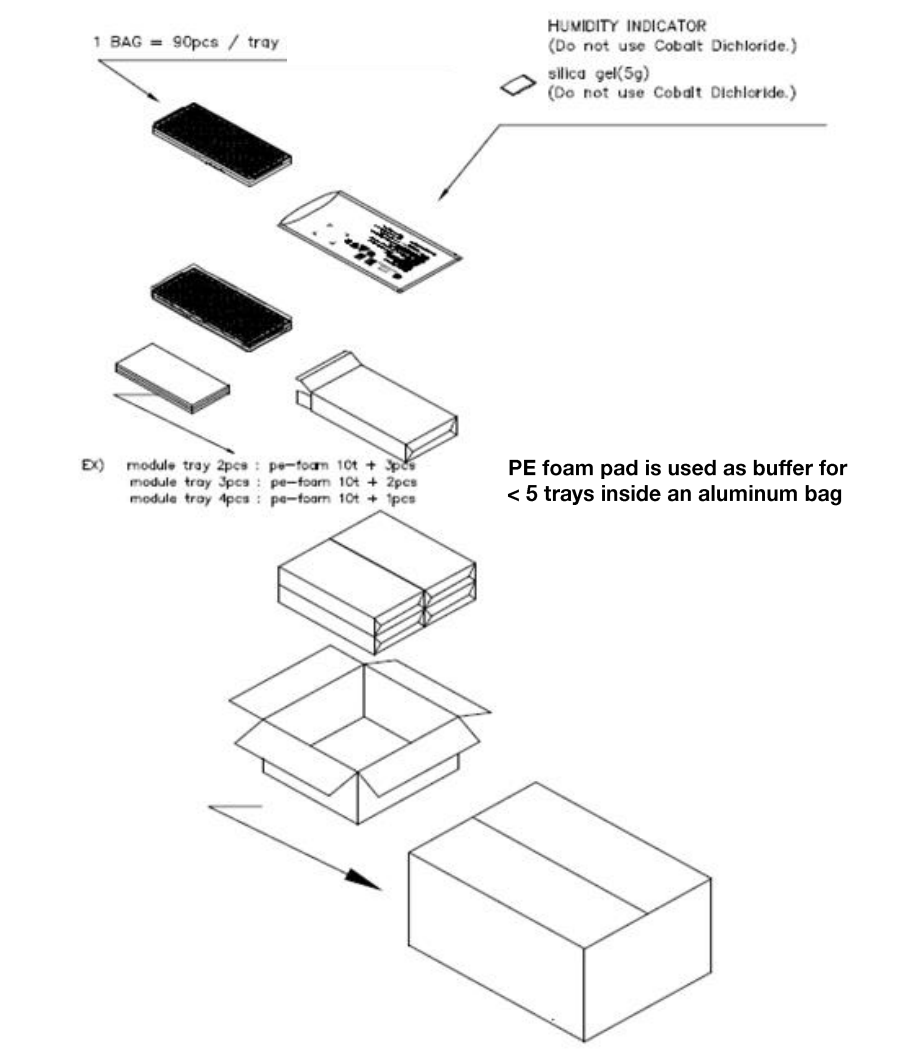
7. Packing Structure

Packing material	Max. quantity in pcs of COB	Dimension (mm)			
		Length	Width	Height	Tolerance
Tray	90	322.6	135.9	11	0.25
Aluminum Bag	450 (5 trays)	450	230	-	10
PE Foam Pad	-	280	130	10	2
Inner Box	450 (1 aluminum bag)	338	148	55	2
Outer Box	1800 (4 inner boxes)	351	308	120	5
Pallet	100,800 (56 outer boxes)	1000	1000	970	10

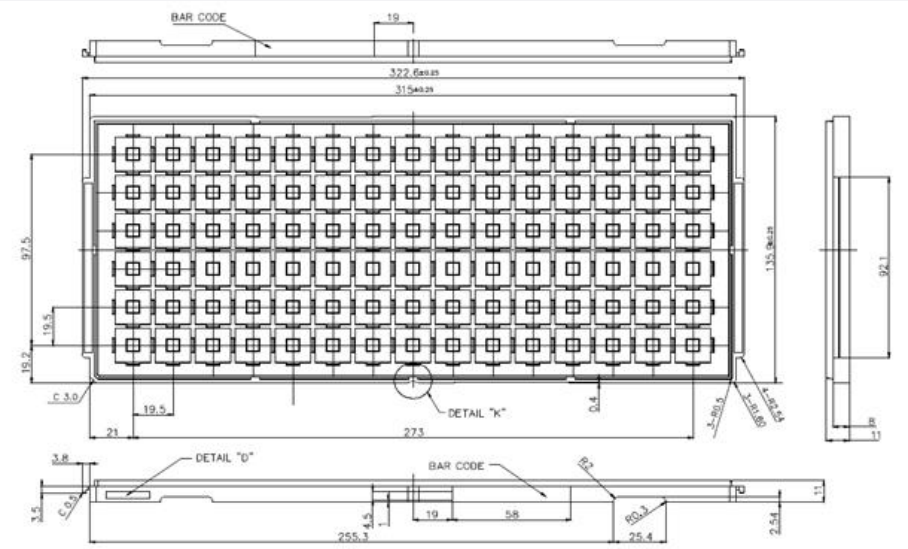
a) Packing Structure for 5 trays inside Aluminum Bag



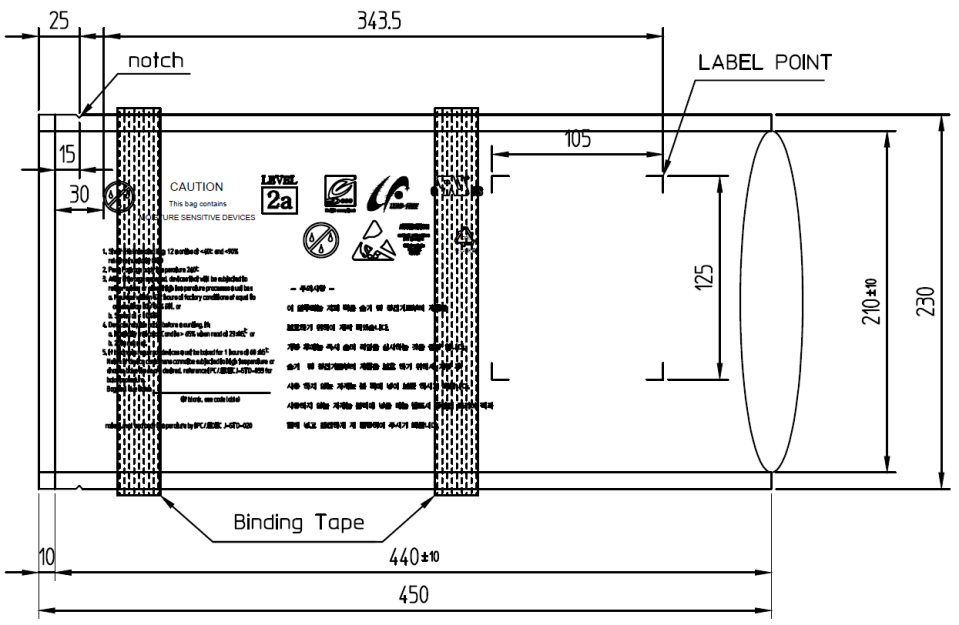
b) Packing Structure for <5 trays inside Aluminum Bag



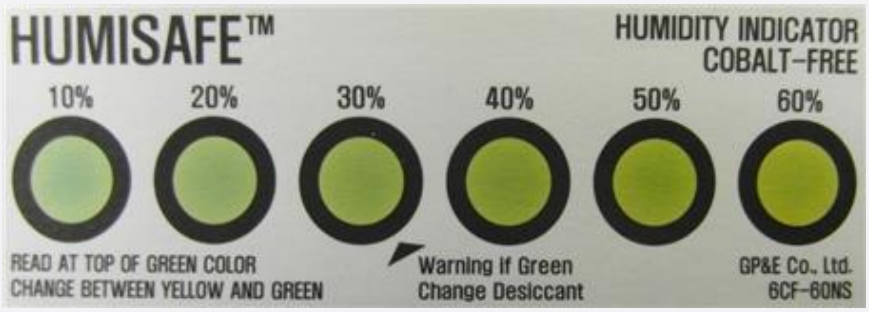
c) Tray



d) Aluminum Vinyl Packing Bag

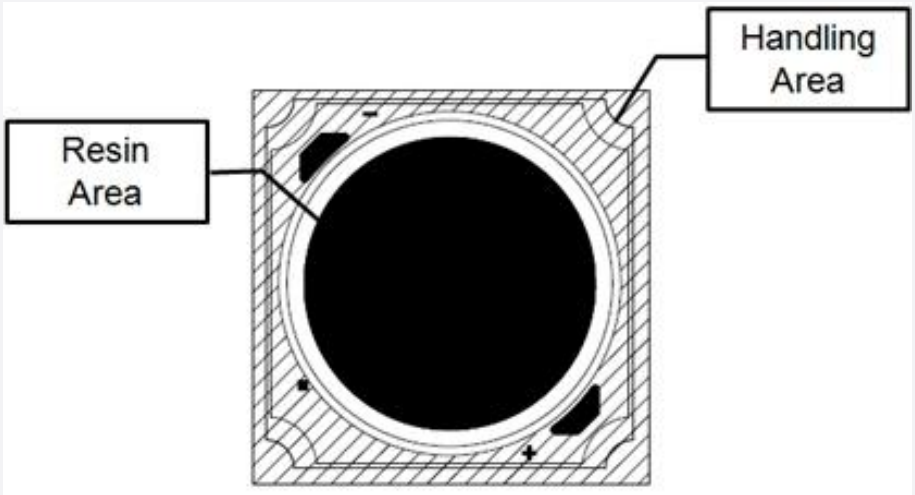


e) Silica Gel & Humidity Indicator Card inside Aluminum Vinyl Packing Bag



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 ºC, 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 ºC / 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 ºC.
6) Devices must be baked for 1 hour at 60 ± 5 ºC, 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) 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.
9) 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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Samsung Electronics Co., Ltd. inspires the world and shapes the future with transformative ideas and technologies, redefining the worlds of TVs, smartphones, wearable devices, tablets, cameras, digital appliances, printers, medical equipment, network systems and semiconductors. We are also leading in the Internet of Things space through, among others, our Digital Health and Smart Home initiatives. We employ 307,000 people across 84 countries. To discover more, please visit our official website at www.samsung.com and our official blog at global.samsungtomorrow.com.

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