



**THE DATASHEET OF  
SPHWAHDM231ZR3DB**



High Voltage LED Series  
Chip on Board

# COB D-Gen.2 Plus



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	-----	11
3.	Typical Characteristics Graphs	-----	34
4.	Outline Drawing & Dimension	-----	42
5.	Reliability Test Items & Conditions	-----	45
6.	Label Structure	-----	46
7.	Packing structure	-----	47
8.	Precautions in Handling & Use	-----	53

## 1. Characteristics

### a) Absolute Maximum Rating

Item	Symbol	Model	Rating	Unit	Condition
Ambient / Operating Temperature	T <sub>a</sub>	-	-40 ~ +105	°C	-
Storage Temperature	T <sub>stg</sub>	-	-40 ~ +120	°C	-
LED Junction Temperature	T <sub>J</sub>	-	150	°C	-
Case Temperature	T <sub>c</sub>	-	115	°C	-
		LC003D	180 / 6.6, 360 / 6.6		-
		LC006D	360 / 13.3		-
		LC009D	540 / 19.9		-
		LC013D	720 / 26.6		-
		LC016D	900 / 33.2		-
Forward Current / Power Dissipation	I <sub>F</sub> / P <sub>D</sub>	LC019D	1080 / 39.9	mA / W	-
		LC026D	1440 / 53.1		-
		LC033D	1800 / 66.4		-
		LC040D	2160 / 79.7		-
		LC060D	2160 / 119.4		-
		LC080D	3240 / 179.2		-
ESD (HBM)	-	-	±2	kV	-

b) Electro-optical Characteristics ( $I_F$  = Sorting Current,  $T_J = 85\text{ }^\circ\text{C}$ )

Item	Unit	Model	Rank	Min.	Typ.	Max.
Forward Voltage ( $V_F$ )	V	All model	WJ	15.6	17.0	18.5
			YZ	31.2	34.0	36.9
			1Z	46.9	51.1	55.3
Color Rendering Index ( $R_a$ )	-	All model	3	70	-	-
			5	80	-	-
			7	90	-	-
Beam Angle	$^\circ$	-	-	-	115	-
Nominal Power / Sorting Current	W / mA	LC003D	-	-	3.1 / 90 3.1 / 180	-
		LC006D	-	-	6.1 / 180	-
		LC009D	-	-	9.2 / 270	-
		LC013D	-	-	12.2 / 360	-
		LC016D	-	-	15.3 / 450	-
		LC019D	-	-	18.4 / 540	-
		LC026D	-	-	24.5 / 720	-
		LC033D	-	-	30.6 / 900	-
		LC040D	-	-	36.7 / 1080	-
		LC060D	-	-	55.2 / 1080	-
		LC080D	-	-	82.8 / 1620	-
Thermal Resistance (Junction to chip case)	$^\circ\text{C/W}$	LC003D	-	-	2.56	-
		LC006D	-	-	1.48	-
		LC009D	-	-	0.99	-
		LC013D	-	-	0.85	-
		LC016D	-	-	0.67	-
		LC019D	-	-	0.6	-
		LC026D	-	-	0.47	-
		LC033D	-	-	0.4	-
		LC040D	-	-	0.32	-
		LC060D	-	-	0.24	-
		LC080D	-	-	0.16	-

**Notes:**

- 1) The COB is tested in pulsed condition at rated test current (10 ms pulse width) and rated temperature ( $T_J = T_C = T_a = 85\text{ }^\circ\text{C}$ )
- 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<sub>F</sub> = Sorting Current)**

Model	CRI (R <sub>a</sub> )		Flux Rank	Flux@ T <sub>J</sub> = 85 °C (lm)				
	Min.	Nominal CCT (K)		Min.	Typ.	Max.		
LC003DB	80	2700	DB	440	468	-		
		3000	DB	456	485	-		
		3500	DB	471	501	-		
		4000	DB	479	510	-		
		5000	DB	485	516	-		
		5700	DB	485	516	-		
		6500	DB	479	510	-		
	90	2700	DB	368	392	-		
		3000	DB	385	410	-		
		3500	DB	398	423	-		
		4000	DB	406	432	-		
		5000	DB	414	440	-		
		LC006DB	80	2700	DB	873	928	-
				3000	DB	913	971	-
3500	DB			941	1001	-		
4000	DB			963	1024	-		
5000	DB			959	1020	-		
5700	DB			949	1010	-		
6500	DB			948	1008	-		
90	2700	DB	739	786	-			
	3000	DB	775	824	-			
	3500	DB	801	853	-			
	4000	DB	818	870	-			
	5000	DB	825	878	-			

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

Model	CRI (R <sub>a</sub> ) Min.	Nominal CCT (K)	Flux Rank	Flux@ T <sub>J</sub> = 85 °C (lm)		
				Min.	Typ.	Max.
LC009DB	70	3000	DB	1455	1548	-
		4000	DB	1496	1591	-
		5000	DB	1529	1626	-
	80	2700	DB	1299	1382	-
		3000	DB	1340	1425	-
		3500	DB	1378	1466	-
		4000	DB	1412	1502	-
		5000	DB	1423	1513	-
		5700	DB	1423	1513	-
	90	6500	DB	1406	1496	-
		2700	DB	1088	1158	-
		3000	DB	1139	1212	-
		3500	DB	1182	1257	-
		4000	DB	1208	1285	-
	LC013DB	70	5000	DB	1226	1304
3000			DB	1885	2006	-
4000			DB	1946	2070	-
80		5000	DB	1936	2060	-
		2700	DB	1667	1773	-
		3000	DB	1746	1857	-
		3500	DB	1764	1877	-
		4000	DB	1815	1930	-
		5000	DB	1822	1938	-
90		5700	DB	1812	1928	-
		6500	DB	1804	1919	-
		2700	DB	1397	1486	-
		3000	DB	1463	1556	-
		3500	DB	1537	1635	-
		4000	DB	1570	1670	-
		5000	DB	1574	1674	-

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

Model	CRI (R <sub>a</sub> )		Flux Rank	Flux@ T <sub>J</sub> = 85 °C (lm)		
	Min.	Nominal CCT (K)		Min.	Typ.	Max.
LC016DB	70	3000	DB	2460	2617	-
		4000	DB	2513	2674	-
		5000	DB	2526	2688	-
	80	2700	DB	2167	2305	-
		3000	DB	2255	2399	-
		3500	DB	2315	2463	-
		4000	DB	2369	2520	-
		5000	DB	2377	2529	-
		5700	DB	2377	2529	-
	90	6500	DB	2357	2507	-
		2700	DB	1669	1776	-
		3000	DB	1867	1986	-
		3500	DB	1969	2094	-
		4000	DB	2027	2156	-
		5000	DB	2068	2200	-
LC019DB	70	3000	DB	2921	3107	-
		4000	DB	3014	3207	-
		5000	DB	3000	3191	-
	80	2700	DB	2577	2742	-
		3000	DB	2704	2877	-
		3500	DB	2746	2921	-
		4000	DB	2816	2996	-
		5000	DB	2832	3013	-
		5700	DB	2818	2998	-
	90	6500	DB	2788	2966	-
		2700	DB	2163	2301	-
		3000	DB	2268	2413	-
		3500	DB	2375	2526	-
		4000	DB	2426	2581	-
		5000	DB	2441	2596	-

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

Model	CRI (R <sub>a</sub> ) Min.	Nominal CCT (K)	Flux Rank	Flux@ T <sub>J</sub> = 85 °C (lm)		
				Min.	Typ.	Max.
LC026DB	70	3000	DB	3819	4063	-
		4000	DB	3941	4193	-
		5000	DB	3942	4194	-
	80	2700	DB	3399	3616	-
		3000	DB	3536	3762	-
		3500	DB	3640	3872	-
		4000	DB	3713	3950	-
		5000	DB	3744	3983	-
		5700	DB	3706	3943	-
	90	6500	DB	3694	3930	-
		2700	DB	2865	3048	-
		3000	DB	2999	3190	-
		3500	DB	3119	3319	-
		4000	DB	3184	3387	-
		5000	DB	3227	3433	-
LC033DB	70	3000	DB	4713	5014	-
		4000	DB	4865	5175	-
		5000	DB	4890	5202	-
	80	2700	DB	4195	4462	-
		3000	DB	4364	4643	-
		3500	DB	4492	4779	-
		4000	DB	4582	4875	-
		5000	DB	4621	4916	-
		5700	DB	4598	4891	-
	90	6500	DB	4582	4875	-
		2700	DB	3554	3781	-
		3000	DB	3739	3977	-
		3500	DB	3850	4096	-
		4000	DB	3929	4180	-
		5000	DB	3983	4237	-

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

Model	CRI (R <sub>a</sub> ) Min.	Nominal CCT (K)	Flux Rank	Flux@ T <sub>J</sub> = 85 °C (lm)		
				Min.	Typ.	Max.
LC040DB	70	3000	DB	5926	6304	-
		4000	DB	6115	6506	-
		5000	DB	6086	6474	-
	80	2700	DB	5241	5575	-
		3000	DB	5487	5837	-
		3500	DB	5570	5925	-
		4000	DB	5719	6084	-
		5000	DB	5746	6113	-
		5700	DB	5716	6081	-
	90	6500	DB	5654	6015	-
		2700	DB	4380	4660	-
		3000	DB	4628	4923	-
		3500	DB	4794	5100	-
		4000	DB	4900	5213	-
		5000	DB	5006	5325	-
LC060DB	70	3000	DB	8672	9225	-
		4000	DB	8949	9521	-
		5000	DB	8906	9475	-
	80	2700	DB	7659	8148	-
		3000	DB	7989	8499	-
		3500	DB	8159	8680	-
		4000	DB	8370	8905	-
		5000	DB	8412	8949	-
		5700	DB	8368	8902	-
	90	6500	DB	8323	8855	-
		2700	DB	6443	6854	-
		3000	DB	6773	7205	-
		3500	DB	7087	7539	-
		4000	DB	7171	7629	-
		5000	DB	7326	7793	-

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

Model	CRI (R <sub>a</sub> )		Flux Rank	Flux@ T <sub>J</sub> = 85 °C (lm)		
	Min.	Nominal CCT (K)		Min.	Typ.	Max.
LC080DB	70	3000	DB	12658	13465	-
		4000	DB	13128	13966	-
		5000	DB	13199	14041	-
	80	2700	DB	11328	12051	-
		3000	DB	11720	12468	-
		3500	DB	12081	12852	-
		4000	DB	12335	13123	-
		5000	DB	12404	13196	-
		5700	DB	12338	13126	-
	90	6500	DB	12334	13121	-
		2700	DB	9548	10157	-
		3000	DB	10037	10678	-
		3500	DB	10344	11004	-
		4000	DB	10573	11247	-
		5000	DB	10746	11432	-

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) 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	W	H	A	H	D	N	G	2	5	Y	Z	W	3	D	B

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>A</b> <b>B</b> <b>C</b> <b>D</b> <b>E</b> <b>F</b> <b>G</b> <b>H</b> <b>K</b> <b>L</b> <b>M</b>	LC003D LC006D LC009D LC013D LC016D LC019D LC026D LC033D LC040D LC060D LC080D
11	Internal Code	<b>2</b>	
12	CRI & Sorting Temperature	<b>3</b> <b>5</b> <b>7</b>	Min. 70 (85°C) Min. 80 (85°C) Min. 90 (85°C)
13 14	Forward Voltage (V)	<b>WJ</b> <b>YZ</b> <b>1Z</b>	15.6~18.5 31.2~36.9 46.9~55.3
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>1</b> <b>2</b> <b>3</b>	MacAdam 1-step MacAdam 2-step MacAdam 3-step
17 18	Luminous Flux (Lm)	<b>DB</b>	COB D-series Gen.2 Plus

## a) Binning Structure

※ LC003D(I<sub>F</sub> = 180 mA, T<sub>J</sub> = 85 °C)

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)
80	2700	SPHWHAHDNA25WJW1DB	WJ	W1	DB	440~
		SPHWHAHDNA25WJW2DB		W2		
		SPHWHAHDNA25WJW3DB		W3		
	3000	SPHWHAHDNA25WJV1DB	WJ	V1	DB	456~
		SPHWHAHDNA25WJV2DB		V2		
		SPHWHAHDNA25WJV3DB		V3		
	3500	SPHWHAHDNA25WJU1DB	WJ	U1	DB	471~
		SPHWHAHDNA25WJU2DB		U2		
		SPHWHAHDNA25WJU3DB		U3		
	4000	SPHWHAHDNA25WJT1DB	WJ	T1	DB	479~
		SPHWHAHDNA25WJT2DB		T2		
		SPHWHAHDNA25WJT3DB		T3		
	5000	SPHWHAHDNA25WJR2DB	WJ	R2	DB	485~
		SPHWHAHDNA25WJR3DB		R3		
		SPHWHAHDNA25WJQ2DB		Q2		
	5700	SPHWHAHDNA25WJQ3DB	WJ	Q3	DB	458~
		SPHWHAHDNA25WJP2DB		P2		
	6500	SPHWHAHDNA25WJP3DB	WJ	P3	DB	479~
SPHWHAHDNA27WJW1DB		WJ		W1		
2700	SPHWHAHDNA27WJW2DB		W2			
	SPHWHAHDNA27WJW3DB		W3			
	3000	SPHWHAHDNA27WJV1DB	WJ	V1	DB	385~
SPHWHAHDNA27WJV2DB		V2				
SPHWHAHDNA27WJV3DB		V3				
3500	SPHWHAHDNA27WJU1DB	WJ	U1	DB	398~	
	SPHWHAHDNA27WJU2DB		U2			
	SPHWHAHDNA27WJU3DB		U3			
4000	SPHWHAHDNA27WJT1DB	WJ	T1	DB	406~	
	SPHWHAHDNA27WJT2DB		T2			
	SPHWHAHDNA27WJT3DB		T3			
5000	SPHWHAHDNA27WJR2DB	WJ	R2	DB	414~	
	SPHWHAHDNA27WJR3DB		R3			

※ LC003D(I<sub>F</sub> = 90 mA, T<sub>J</sub> = 85 °C)

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)
80	2700	SPHWAHDNA25YZW1DB	YZ	W1	DB	440~
		SPHWAHDNA25YZW2DB		W2		
		SPHWAHDNA25YZW3DB		W3		
	3000	SPHWAHDNA25YZV1DB	YZ	V1	DB	456~
		SPHWAHDNA25YZV2DB		V2		
		SPHWAHDNA25YZV3DB		V3		
	3500	SPHWAHDNA25YZU1DB	YZ	U1	DB	471~
		SPHWAHDNA25YZU2DB		U2		
		SPHWAHDNA25YZU3DB		U3		
	4000	SPHWAHDNA25YZT1DB	YZ	T1	DB	479~
		SPHWAHDNA25YZT2DB		T2		
		SPHWAHDNA25YZT3DB		T3		
	5000	SPHWAHDNA25YZR2DB	YZ	R2	DB	485~
		SPHWAHDNA25YZR3DB		R3		
	5700	SPHWAHDNA25YZQ2DB	YZ	Q2	DB	458~
		SPHWAHDNA25YZQ3DB		Q3		
	6500	SPHWAHDNA25YZP2DB	YZ	P2	DB	479~
		SPHWAHDNA25YZP3DB		P3		
90	2700	SPHWAHDNA27YZW1DB	YZ	W1	DB	368~
		SPHWAHDNA27YZW2DB		W2		
		SPHWAHDNA27YZW3DB		W3		
	3000	SPHWAHDNA27YZV1DB	YZ	V1	DB	385~
		SPHWAHDNA27YZV2DB		V2		
		SPHWAHDNA27YZV3DB		V3		
	3500	SPHWAHDNA27YZU1DB	YZ	U1	DB	398~
		SPHWAHDNA27YZU2DB		U2		
		SPHWAHDNA27YZU3DB		U3		
	4000	SPHWAHDNA27YZT1DB	YZ	T1	DB	406~
		SPHWAHDNA27YZT2DB		T2		
		SPHWAHDNA27YZT3DB		T3		
	5000	SPHWAHDNA27YZR2DB	YZ	R2	DB	414~
		SPHWAHDNA27YZR3DB		R3		

※ LCoo6D(I<sub>F</sub> = 180 mA, T<sub>J</sub> = 85 °C)

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)
80	2700	SPHWAHADB25YZW1DB	YZ	W1	DB	873~
		SPHWAHADB25YZW2DB		W2		
		SPHWAHADB25YZW3DB		W3		
	3000	SPHWAHADB25YZV1DB	YZ	V1	DB	913~
		SPHWAHADB25YZV2DB		V2		
		SPHWAHADB25YZV3DB		V3		
	3500	SPHWAHADB25YZU1DB	YZ	U1	DB	941~
		SPHWAHADB25YZU2DB		U2		
		SPHWAHADB25YZU3DB		U3		
	4000	SPHWAHADB25YZT1DB	YZ	T1	DB	963~
		SPHWAHADB25YZT2DB		T2		
		SPHWAHADB25YZT3DB		T3		
	5000	SPHWAHADB25YZR2DB	YZ	R2	DB	959~
		SPHWAHADB25YZR3DB		R3		
		SPHWAHADB25YZQ2DB		Q2		
	5700	SPHWAHADB25YZQ3DB	YZ	Q3	DB	959~
		SPHWAHADB25YZQ3DB		Q3		
	6500	SPHWAHADB25YZP2DB	YZ	P2	DB	948~
SPHWAHADB25YZP3DB		P3				
90	2700	SPHWAHADB27YZW1DB	YZ	W1	DB	739~
		SPHWAHADB27YZW2DB		W2		
		SPHWAHADB27YZW3DB		W3		
	3000	SPHWAHADB27YZV1DB	YZ	V1	DB	775~
		SPHWAHADB27YZV2DB		V2		
		SPHWAHADB27YZV3DB		V3		
	3500	SPHWAHADB27YZU1DB	YZ	U1	DB	801~
		SPHWAHADB27YZU2DB		U2		
		SPHWAHADB27YZU3DB		U3		
	4000	SPHWAHADB27YZT1DB	YZ	T1	DB	818~
		SPHWAHADB27YZT2DB		T2		
		SPHWAHADB27YZT3DB		T3		
	5000	SPHWAHADB27YZR2DB	YZ	R2	DB	825~
		SPHWAHADB27YZR3DB		R3		

※ LCoogD(I<sub>F</sub> = 270 mA, T<sub>J</sub> = 85 °C)

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)
70	3000	SPHWHAHDC23YZV2DB	YZ	V2	DB	1455~
		SPHWHAHDC23YZV3DB		V3		
	4000	SPHWHAHDC23YZT2DB	YZ	T2	DB	1496~
		SPHWHAHDC23YZT3DB		T3		
	5000	SPHWHAHDC23YZR2DB	YZ	R2	DB	1529~
		SPHWHAHDC23YZR3DB		R3		
80	2700	SPHWHAHDC25YZW1DB	YZ	W1	DB	1299~
		SPHWHAHDC25YZW2DB		W2		
		SPHWHAHDC25YZW3DB		W3		
	3000	SPHWHAHDC25YZV1DB	YZ	V1	DB	1340~
		SPHWHAHDC25YZV2DB		V2		
		SPHWHAHDC25YZV3DB		V3		
	3500	SPHWHAHDC25YZU1DB	YZ	U1	DB	1378~
		SPHWHAHDC25YZU2DB		U2		
		SPHWHAHDC25YZU3DB		U3		
	4000	SPHWHAHDC25YZT1DB	YZ	T1	DB	1412~
		SPHWHAHDC25YZT2DB		T2		
		SPHWHAHDC25YZT3DB		T3		
	5000	SPHWHAHDC25YZR2DB	YZ	R2	DB	1423~
		SPHWHAHDC25YZR3DB		R3		
	5700	SPHWHAHDC25YZQ2DB	YZ	Q2	DB	1423~
		SPHWHAHDC25YZQ3DB		Q3		
	6500	SPHWHAHDC25YZP2DB	YZ	P2	DB	1406~
		SPHWHAHDC25YZP3DB		P3		

※ LCoogD(I<sub>F</sub> = 270 mA, T<sub>J</sub> = 85 °C)

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	SPHWHAHDC27YZW1DB	YZ	W1	DB	1088~
		SPHWHAHDC27YZW2DB		W2		
		SPHWHAHDC27YZW3DB		W3		
	3000	SPHWHAHDC27YZV1DB	YZ	V1	DB	1139~
		SPHWHAHDC27YZV2DB		V2		
		SPHWHAHDC27YZV3DB		V3		
	3500	SPHWHAHDC27YZU1DB	YZ	U1	DB	1182~
		SPHWHAHDC27YZU2DB		U2		
		SPHWHAHDC27YZU3DB		U3		
	4000	SPHWHAHDC27YZT1DB	YZ	T1	DB	1208~
		SPHWHAHDC27YZT2DB		T2		
		SPHWHAHDC27YZT3DB		T3		
	5000	SPHWHAHDC27YZR2DB	YZ	R2	DB	1226~
		SPHWHAHDC27YZR3DB		R3		

※ LCo13D(I<sub>F</sub> = 360 mA, T<sub>J</sub> = 85 °C)

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)
70	3000	SPHWHHDND23YZV2DB	YZ	V2	DB	1885~
		SPHWHHDND23YZV3DB		V3		
	4000	SPHWHHDND23YZT2DB	YZ	T2	DB	1946~
		SPHWHHDND23YZT3DB		T3		
	5000	SPHWHHDND23YZR2DB	YZ	R2	DB	1936~
		SPHWHHDND23YZR3DB		R3		
80	2700	SPHWHHDND25YZW1DB	YZ	W1	DB	1667~
		SPHWHHDND25YZW2DB		W2		
		SPHWHHDND25YZW3DB		W3		
	3000	SPHWHHDND25YZV1DB	YZ	V1	DB	1746~
		SPHWHHDND25YZV2DB		V2		
		SPHWHHDND25YZV3DB		V3		
	3500	SPHWHHDND25YZU1DB	YZ	U1	DB	1764~
		SPHWHHDND25YZU2DB		U2		
		SPHWHHDND25YZU3DB		U3		
	4000	SPHWHHDND25YZT1DB	YZ	T1	DB	1815~
		SPHWHHDND25YZT2DB		T2		
		SPHWHHDND25YZT3DB		T3		
	5000	SPHWHHDND25YZR2DB	YZ	R2	DB	1822~
		SPHWHHDND25YZR3DB		R3		
	5700	SPHWHHDND25YZQ2DB	YZ	Q2	DB	1812~
		SPHWHHDND25YZQ3DB		Q3		
	6500	SPHWHHDND25YZP2DB	YZ	P2	DB	1804~
		SPHWHHDND25YZP3DB		P3		

※ LCo13D(I<sub>F</sub> = 360 mA, T<sub>J</sub> = 85 °C)

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	SPHWHAMDND27YZW1DB	YZ	W1	DB	1397~
		SPHWHAMDND27YZW2DB		W2		
		SPHWHAMDND27YZW3DB		W3		
	3000	SPHWHAMDND27YZV1DB	YZ	V1	DB	1463~
		SPHWHAMDND27YZV2DB		V2		
		SPHWHAMDND27YZV3DB		V3		
	3500	SPHWHAMDND27YZU1DB	YZ	U1	DB	1537~
		SPHWHAMDND27YZU2DB		U2		
		SPHWHAMDND27YZU3DB		U3		
	4000	SPHWHAMDND27YZT1DB	YZ	T1	DB	1570~
		SPHWHAMDND27YZT2DB		T2		
		SPHWHAMDND27YZT3DB		T3		
	5000	SPHWHAMDND27YZR2DB	YZ	R2	DB	1574~
		SPHWHAMDND27YZR3DB		R3		

※ LCo16D(I<sub>F</sub> = 450 mA, T<sub>J</sub> = 85 °C)

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)
70	3000	SPHWWAHDNE23YZV2DB	YZ	V2	DB	2460~
		SPHWWAHDNE23YZV3DB		V3		
	4000	SPHWWAHDNE23YZT2DB	YZ	T2	DB	2513~
		SPHWWAHDNE23YZT3DB		T3		
	5000	SPHWWAHDNE23YZR2DB	YZ	R2	DB	2526~
		SPHWWAHDNE23YZR3DB		R3		
80	2700	SPHWWAHDNE25YZW1DB	YZ	W1	DB	2167~
		SPHWWAHDNE25YZW2DB		W2		
		SPHWWAHDNE25YZW3DB		W3		
	3000	SPHWWAHDNE25YZV1DB	YZ	V1	DB	2255~
		SPHWWAHDNE25YZV2DB		V2		
		SPHWWAHDNE25YZV3DB		V3		
	3500	SPHWWAHDNE25YZU1DB	YZ	U1	DB	2315~
		SPHWWAHDNE25YZU2DB		U2		
		SPHWWAHDNE25YZU3DB		U3		
	4000	SPHWWAHDNE25YZT1DB	YZ	T1	DB	2369~
		SPHWWAHDNE25YZT2DB		T2		
		SPHWWAHDNE25YZT3DB		T3		
	5000	SPHWWAHDNE25YZR2DB	YZ	R2	DB	2377~
		SPHWWAHDNE25YZR3DB		R3		
	5700	SPHWWAHDNE25YZQ2DB	YZ	Q2	DB	2377~
		SPHWWAHDNE25YZQ3DB		Q3		
	6500	SPHWWAHDNE25YZP2DB	YZ	P2	DB	2357~
		SPHWWAHDNE25YZP3DB		P3		

※ LCo16D( $I_F = 450 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

CRI( $R_a$ ) Min.	Nominal CCT(K)	Product Code	$V_F$ Rank	Color Rank	Flux Rank	Flux Range ( $\Phi_v$ , lm)
90	2700	SPHWAHDNE27YZW1DB	YZ	W1	DB	1669~
		SPHWAHDNE27YZW2DB		W2		
		SPHWAHDNE27YZW3DB		W3		
	3000	SPHWAHDNE27YZV1DB	YZ	V1	DB	1867~
		SPHWAHDNE27YZV2DB		V2		
		SPHWAHDNE27YZV3DB		V3		
	3500	SPHWAHDNE27YZU1DB	YZ	U1	DB	1969~
		SPHWAHDNE27YZU2DB		U2		
		SPHWAHDNE27YZU3DB		U3		
	4000	SPHWAHDNE27YZT1DB	YZ	T1	DB	2027~
		SPHWAHDNE27YZT2DB		T2		
		SPHWAHDNE27YZT3DB		T3		
	5000	SPHWAHDNE27YZR2DB	YZ	R2	DB	2068~
		SPHWAHDNE27YZR3DB		R3		

※ LCo19D(I<sub>F</sub> = 540 mA, T<sub>J</sub> = 85 °C)

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)
70	3000	SPHWWAHDNF23YZV2DB	YZ	V2	DB	2921~
		SPHWWAHDNF23YZV3DB		V3		
	4000	SPHWWAHDNF23YZT2DB	YZ	T2	DB	3014~
		SPHWWAHDNF23YZT3DB		T3		
	5000	SPHWWAHDNF23YZR2DB	YZ	R2	DB	3000~
		SPHWWAHDNF23YZR3DB		R3		
80	2700	SPHWWAHDNF25YZW1DB	YZ	W1	DB	2577~
		SPHWWAHDNF25YZW2DB		W2		
		SPHWWAHDNF25YZW3DB		W3		
	3000	SPHWWAHDNF25YZV1DB	YZ	V1	DB	2704~
		SPHWWAHDNF25YZV2DB		V2		
		SPHWWAHDNF25YZV3DB		V3		
	3500	SPHWWAHDNF25YZU1DB	YZ	U1	DB	2746~
		SPHWWAHDNF25YZU2DB		U2		
		SPHWWAHDNF25YZU3DB		U3		
	4000	SPHWWAHDNF25YZT1DB	YZ	T1	DB	2816~
		SPHWWAHDNF25YZT2DB		T2		
		SPHWWAHDNF25YZT3DB		T3		
	5000	SPHWWAHDNF25YZR2DB	YZ	R2	DB	2832~
		SPHWWAHDNF25YZR3DB		R3		
	5700	SPHWWAHDNF25YZQ2DB	YZ	Q2	DB	2818~
		SPHWWAHDNF25YZQ3DB		Q3		
	6500	SPHWWAHDNF25YZP2DB	YZ	P2	DB	2788~
		SPHWWAHDNF25YZP3DB		P3		

※ LCo19D(I<sub>F</sub> = 540 mA, T<sub>J</sub> = 85 °C)

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	SPHWAHDF27YZW1DB	YZ	W1	DB	2163~
		SPHWAHDF27YZW2DB		W2		
		SPHWAHDF27YZW3DB		W3		
	3000	SPHWAHDF27YZV1DB	YZ	V1	DB	2268~
		SPHWAHDF27YZV2DB		V2		
		SPHWAHDF27YZV3DB		V3		
	3500	SPHWAHDF27YZU1DB	YZ	U1	DB	2375~
		SPHWAHDF27YZU2DB		U2		
		SPHWAHDF27YZU3DB		U3		
	4000	SPHWAHDF27YZT1DB	YZ	T1	DB	2426~
		SPHWAHDF27YZT2DB		T2		
		SPHWAHDF27YZT3DB		T3		
	5000	SPHWAHDF27YZR2DB	YZ	R2	DB	2441~
		SPHWAHDF27YZR3DB		R3		

※ LCo26D(I<sub>F</sub> = 720 mA, T<sub>J</sub> = 85 °C)

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)
70	3000	SPHWHHDNG23YZV2DB	YZ	V2	DB	3819~
		SPHWHHDNG23YZV3DB		V3		
	4000	SPHWHHDNG23YZT2DB	YZ	T2	DB	3941~
		SPHWHHDNG23YZT3DB		T3		
	5000	SPHWHHDNG23YZR2DB	YZ	R2	DB	3942~
		SPHWHHDNG23YZR3DB		R3		
80	2700	SPHWHHDNG25YZW1DB	YZ	W1	DB	3399~
		SPHWHHDNG25YZW2DB		W2		
		SPHWHHDNG25YZW3DB		W3		
	3000	SPHWHHDNG25YZV1DB	YZ	V1	DB	3536~
		SPHWHHDNG25YZV2DB		V2		
		SPHWHHDNG25YZV3DB		V3		
	3500	SPHWHHDNG25YZU1DB	YZ	U1	DB	3640~
		SPHWHHDNG25YZU2DB		U2		
		SPHWHHDNG25YZU3DB		U3		
	4000	SPHWHHDNG25YZT1DB	YZ	T1	DB	3713 ~
		SPHWHHDNG25YZT2DB		T2		
		SPHWHHDNG25YZT3DB		T3		
	5000	SPHWHHDNG25YZR2DB	YZ	R2	DB	3744 ~
		SPHWHHDNG25YZR3DB		R3		
	5700	SPHWHHDNG25YZQ2DB	YZ	Q2	DB	3706~
		SPHWHHDNG25YZQ3DB		Q3		
	6500	SPHWHHDNG25YZP2DB	YZ	P2	DB	3694~
		SPHWHHDNG25YZP3DB		P3		

※ LCo26D(I<sub>F</sub> = 720 mA, T<sub>J</sub> = 85 °C)

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	SPHWHHDNG27YZW1DB	YZ	W1	DB	2865~
		SPHWHHDNG27YZW2DB		W2		
		SPHWHHDNG27YZW3DB		W3		
	3000	SPHWHHDNG27YZV1DB	YZ	V1	DB	2999~
		SPHWHHDNG27YZV2DB		V2		
		SPHWHHDNG27YZV3DB		V3		
	3500	SPHWHHDNG27YZU1DB	YZ	U1	DB	3119~
		SPHWHHDNG27YZU2DB		U2		
		SPHWHHDNG27YZU3DB		U3		
	4000	SPHWHHDNG27YZT1DB	YZ	T1	DB	3184~
		SPHWHHDNG27YZT2DB		T2		
		SPHWHHDNG27YZT3DB		T3		
	5000	SPHWHHDNG27YZR2DB	YZ	R2	DB	3227~
		SPHWHHDNG27YZR3DB		R3		

※ LCo33D(I<sub>F</sub> = 900 mA, T<sub>J</sub> = 85 °C)

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)
70	3000	SPHWWAHDNH23YZV2DB	YZ	V2	DB	4713 ~
		SPHWWAHDNH23YZV3DB		V3		
	4000	SPHWWAHDNH23YZT2DB	YZ	T2	DB	4865 ~
		SPHWWAHDNH23YZT3DB		T3		
	5000	SPHWWAHDNH23YZR2DB	YZ	R2	DB	4890~
		SPHWWAHDNH23YZR3DB		R3		
80	2700	SPHWWAHDNH25YZW1DB	YZ	W1	DB	4195~
		SPHWWAHDNH25YZW2DB		W2		
		SPHWWAHDNH25YZW3DB		W3		
	3000	SPHWWAHDNH25YZV1DB	YZ	V1	DB	4364~
		SPHWWAHDNH25YZV2DB		V2		
		SPHWWAHDNH25YZV3DB		V3		
	3500	SPHWWAHDNH25YZU1DB	YZ	U1	DB	4492~
		SPHWWAHDNH25YZU2DB		U2		
		SPHWWAHDNH25YZU3DB		U3		
	4000	SPHWWAHDNH25YZT1DB	YZ	T1	DB	4582~
		SPHWWAHDNH25YZT2DB		T2		
		SPHWWAHDNH25YZT3DB		T3		
	5000	SPHWWAHDNH25YZR2DB	YZ	R2	DB	4621~
		SPHWWAHDNH25YZR3DB		R3		
	5700	SPHWWAHDNH25YZQ2DB	YZ	Q2	DB	4598~
		SPHWWAHDNH25YZQ3DB		Q3		
	6500	SPHWWAHDNH25YZP2DB	YZ	P2	DB	4582~
		SPHWWAHDNH25YZP3DB		P3		

※ LCo33D( $I_F = 900 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

CRI( $R_a$ ) Min.	Nominal CCT(K)	Product Code	$V_F$ Rank	Color Rank	Flux Rank	Flux Range ( $\Phi_v$ , lm)
90	2700	SPHWAHDNH27YZW1DB	YZ	W1	DB	3554~
		SPHWAHDNH27YZW2DB		W2		
		SPHWAHDNH27YZW3DB		W3		
	3000	SPHWAHDNH27YZV1DB	YZ	V1	DB	3739~
		SPHWAHDNH27YZV2DB		V2		
		SPHWAHDNH27YZV3DB		V3		
	3500	SPHWAHDNH27YZU1DB	YZ	U1	DB	3850~
		SPHWAHDNH27YZU2DB		U2		
		SPHWAHDNH27YZU3DB		U3		
	4000	SPHWAHDNH27YZT1DB	YZ	T1	DB	3929~
		SPHWAHDNH27YZT2DB		T2		
		SPHWAHDNH27YZT3DB		T3		
	5000	SPHWAHDNH27YZR2DB	YZ	R2	DB	3983~
		SPHWAHDNH27YZR3DB		R3		

※ LCo4oD(I<sub>F</sub> = 1080 mA, T<sub>J</sub> = 85 °C)

CRI(R <sub>a</sub> )	Nominal	Product Code	V <sub>F</sub>	Color	Flux	Flux Range
Min.	CCT(K)		Rank	Rank	Rank	(Φ <sub>v</sub> , lm)
70	3000	SPHWWAHDNK23YZV2DB	YZ	V2	DB	5926 ~
		SPHWWAHDNK23YZV3DB		V3		
	4000	SPHWWAHDNK23YZT2DB	YZ	T2	DB	6115~
		SPHWWAHDNK23YZT3DB		T3		
	5000	SPHWWAHDNK23YZR2DB	YZ	R2	DB	6086~
		SPHWWAHDNK23YZR3DB		R3		
80	2700	SPHWWAHDNK25YZW1DB	YZ	W1	DB	5241~
		SPHWWAHDNK25YZW2DB		W2		
		SPHWWAHDNK25YZW3DB		W3		
	3000	SPHWWAHDNK25YZV1DB	YZ	V1	DB	5487~
		SPHWWAHDNK25YZV2DB		V2		
		SPHWWAHDNK25YZV3DB		V3		
	3500	SPHWWAHDNK25YZU1DB	YZ	U1	DB	5570~
		SPHWWAHDNK25YZU2DB		U2		
		SPHWWAHDNK25YZU3DB		U3		
	4000	SPHWWAHDNK25YZT1DB	YZ	T1	DB	5719~
		SPHWWAHDNK25YZT2DB		T2		
		SPHWWAHDNK25YZT3DB		T3		
	5000	SPHWWAHDNK25YZR2DB	YZ	R2	DB	5746~
		SPHWWAHDNK25YZR3DB		R3		
	5700	SPHWWAHDNK25YZQ2DB	YZ	Q2	DB	5716~
		SPHWWAHDNK25YZQ3DB		Q3		
	6500	SPHWWAHDNK25YZP2DB	YZ	P2	DB	5654~
		SPHWWAHDNK25YZP3DB		P3		

※ LCo4oD(I<sub>F</sub> = 1080 mA, T<sub>J</sub> = 85 °C)

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	SPHWAHDNK27YZW1DB	YZ	W1	DB	4380~
		SPHWAHDNK27YZW2DB		W2		
		SPHWAHDNK27YZW3DB		W3		
	3000	SPHWAHDNK27YZV1DB	YZ	V1	DB	4628~
		SPHWAHDNK27YZV2DB		V2		
		SPHWAHDNK27YZV3DB		V3		
	3500	SPHWAHDNK27YZU1DB	YZ	U1	DB	4794~
		SPHWAHDNK27YZU2DB		U2		
		SPHWAHDNK27YZU3DB		U3		
	4000	SPHWAHDNK27YZT1DB	YZ	T1	DB	4900~
		SPHWAHDNK27YZT2DB		T2		
		SPHWAHDNK27YZT3DB		T3		
	5000	SPHWAHDNK27YZR2DB	YZ	R2	DB	5006 ~
		SPHWAHDNK27YZR3DB		R3		

※ LCo6oD(I<sub>F</sub> = 1080 mA, T<sub>J</sub> = 85 °C)

CRI(R <sub>a</sub> ) Min.	Nominal CCT(K)	Product Code	V <sub>F</sub> Rank	Chrom. Bin	Flux Rank	Flux Range (Φ <sub>v</sub> , lm)
70	3000	SPHWWAHDNL231ZV2DB	1Z	V2	DB	8672 ~
		SPHWWAHDNL231ZV3DB		V3		
	4000	SPHWWAHDNL231ZT2DB	1Z	T2	DB	8949~
		SPHWWAHDNL231ZT3DB		T3		
	5000	SPHWWAHDNL231ZR2DB	1Z	R2	DB	8906~
		SPHWWAHDNL231ZR3DB		R3		
80	2700	SPHWWAHDNL251ZW1DB	1Z	W1	DB	7659~
		SPHWWAHDNL251ZW2DB		W2		
		SPHWWAHDNL251ZW3DB		W3		
	3000	SPHWWAHDNL251ZV1DB	1Z	V1	DB	7989~
		SPHWWAHDNL251ZV2DB		V2		
		SPHWWAHDNL251ZV3DB		V3		
	3500	SPHWWAHDNL251ZU1DB	1Z	U1	DB	8159~
		SPHWWAHDNL251ZU2DB		U2		
		SPHWWAHDNL251ZU3DB		U3		
	4000	SPHWWAHDNL251ZT1DB	1Z	T1	DB	8370~
		SPHWWAHDNL251ZT2DB		T2		
		SPHWWAHDNL251ZT3DB		T3		
	5000	SPHWWAHDNL251ZR2DB	1Z	R2	DB	8412~
		SPHWWAHDNL251ZR3DB		R3		
	5700	SPHWWAHDNL251ZQ2DB	1Z	Q2	DB	8368~
		SPHWWAHDNL251ZQ3DB		Q3		
	6500	SPHWWAHDNL251ZP2DB	1Z	P2	DB	8323~
		SPHWWAHDNL251ZP3DB		P3		

※ LCo6oD( $I_F = 1080 \text{ mA}$ ,  $T_J = 85 \text{ }^\circ\text{C}$ )

CRI( $R_a$ ) Min.	Nominal CCT(K)	Product Code	$V_F$ Rank	Chrom. Bin	Flux Rank	Flux Range ( $\Phi_v$ , lm)
90	2700	SPHWAHDNL271ZW1DB	1Z	W1	DB	6443~
		SPHWAHDNL271ZW2DB		W2		
		SPHWAHDNL271ZW3DB		W3		
	3000	SPHWAHDNL271ZV1DB	1Z	V1	DB	6773~
		SPHWAHDNL271ZV2DB		V2		
		SPHWAHDNL271ZV3DB		V3		
	3500	SPHWAHDNL271ZU1DB	1Z	U1	DB	7087~
		SPHWAHDNL271ZU2DB		U2		
		SPHWAHDNL271ZU3DB		U3		
	4000	SPHWAHDNL271ZT1DB	1Z	T1	DB	7171~
		SPHWAHDNL271ZT2DB		T2		
		SPHWAHDNL271ZT3DB		T3		
	5000	SPHWAHDNL271ZR2DB	1Z	R2	DB	7326~
		SPHWAHDNL271ZR3DB		R3		

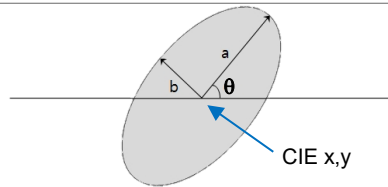
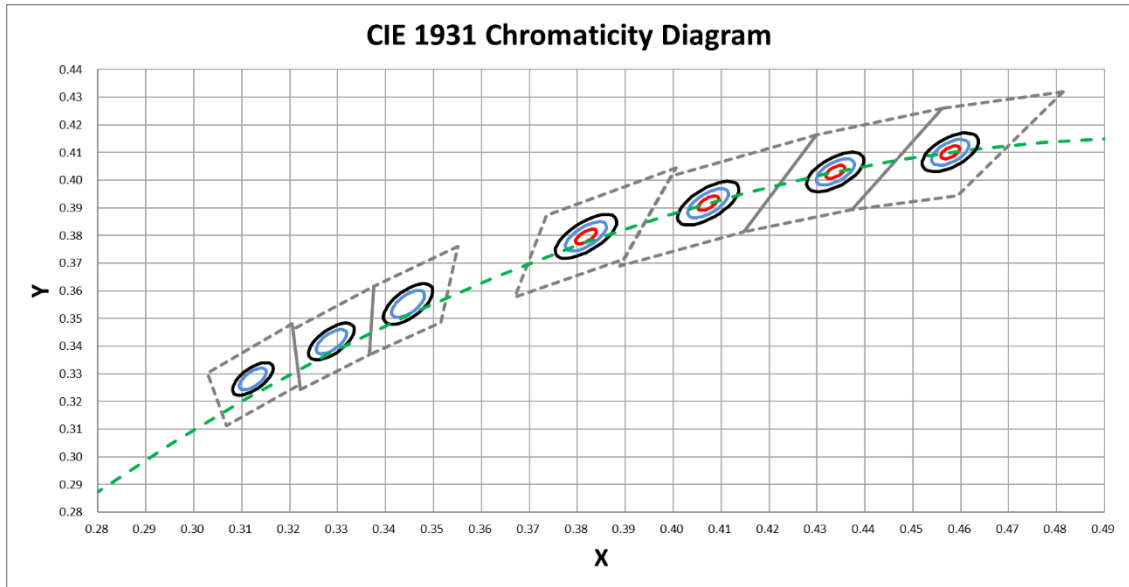
※ LCo8oD(I<sub>F</sub> = 1620 mA, T<sub>J</sub> = 85 °C)

CRI(R <sub>a</sub> ) Min.	Nominal CCT(K)	Product Code	V <sub>F</sub> Rank	Chrom. Bin	Flux Rank	Flux Range (Φ <sub>v</sub> , lm)
70	3000	SPHWHAHDNM231ZV2DB	1Z	V2	DB	12658~
		SPHWHAHDNM231ZV3DB		V3		
	4000	SPHWHAHDNM231ZT2DB	1Z	T2	DB	13128~
		SPHWHAHDNM231ZT3DB		T3		
	5000	SPHWHAHDNM231ZR2DB	1Z	R2	DB	13199~
		SPHWHAHDNM231ZR3DB		R3		
80	2700	SPHWHAHDNM251ZW1DB	1Z	W1	DB	11328~
		SPHWHAHDNM251ZW2DB		W2		
		SPHWHAHDNM251ZW3DB		W3		
	3000	SPHWHAHDNM251ZV1DB	1Z	V1	DB	11720 ~
		SPHWHAHDNM251ZV2DB		V2		
		SPHWHAHDNM251ZV3DB		V3		
	3500	SPHWHAHDNM251ZU1DB	1Z	U1	DB	12081 ~
		SPHWHAHDNM251ZU2DB		U2		
		SPHWHAHDNM251ZU3DB		U3		
	4000	SPHWHAHDNM251ZT1DB	1Z	T1	DB	12335~
		SPHWHAHDNM251ZT2DB		T2		
		SPHWHAHDNM251ZT3DB		T3		
	5000	SPHWHAHDNM251ZR2DB	1Z	R2	DB	12404~
		SPHWHAHDNM251ZR3DB		R3		
	5700	SPHWHAHDNM251ZQ2DB	1Z	Q2	DB	12338~
		SPHWHAHDNM251ZQ3DB		Q3		
	6500	SPHWHAHDNM251ZP2DB	1Z	P2	DB	12334 ~
		SPHWHAHDNM251ZP3DB		P3		

※ LCo8oD(I<sub>F</sub> = 1620 mA, T<sub>J</sub> = 85 °C)

CRI(R <sub>a</sub> ) Min.	Nominal CCT(K)	Product Code	V <sub>F</sub> Rank	Chrom. Bin	Flux Rank	Flux Range (Φ <sub>v</sub> , lm)
90	2700	SPHWHAHDNM271ZW1DB	1Z	W1	DB	9548~
		SPHWHAHDNM271ZW2DB		W2		
		SPHWHAHDNM271ZW3DB		W3		
	3000	SPHWHAHDNM271ZV1DB	1Z	V1	DB	10037~
		SPHWHAHDNM271ZV2DB		V2		
		SPHWHAHDNM271ZV3DB		V3		
	3500	SPHWHAHDNM271ZU1DB	1Z	U1	DB	10344 ~
		SPHWHAHDNM271ZU2DB		U2		
		SPHWHAHDNM271ZU3DB		U3		
	4000	SPHWHAHDNM271ZT1DB	1Z	T1	DB	10573~
		SPHWHAHDNM271ZT2DB		T2		
		SPHWHAHDNM271ZT3DB		T3		
	5000	SPHWHAHDNM271ZR2DB	1Z	R2	DB	10746~
		SPHWHAHDNM271ZR3DB		R3		

b) Chromaticity Region & Coordinates ( $I_F$  = Sorting Current,  $T_J$  = 85 °C)



MacAdam Ellipse (W1, W2)					
Step	CIE x	CIE y	$\theta$	a	b
1-step	0.4578	0.4101	53.70	0.0027	0.0014
2-step	0.4578	0.4101	53.70	0.0054	0.0028
3-step	0.4338	0.4101	53.70	0.0081	0.0042

MacAdam Ellipse (V1, V2, V3)					
Step	CIE x	CIE y	$\theta$	a	b
1-step	0.4338	0.4030	53.22	0.0028	0.0014
2-step	0.4338	0.4030	53.22	0.0056	0.0027
3-step	0.4338	0.4030	53.22	0.0083	0.0041

MacAdam Ellipse (U1, U2)					
Step	CIE x	CIE y	$\theta$	a	b
1-step	0.4073	0.3917	54.00	0.0031	0.0014
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 (T1, T2, T3)					
Step	CIE x	CIE y	$\theta$	a	b
1-step	0.3818	0.3797	53.72	0.0031	0.0013
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 (R2, R3)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.3447	0.3553	59.62	0.0055	0.0024
3-step	0.3447	0.3553	59.62	0.0082	0.0035

MacAdam Ellipse (Q2, Q3)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.3287	0.3417	59.10	0.0050	0.0021
3-step	0.3287	0.3417	59.10	0.0075	0.0032

MacAdam Ellipse (P2, P3)					
Step	CIE x	CIE y	$\theta$	a	b
2-step	0.3123	0.3282	58.57	0.0045	0.0019
3-step	0.3123	0.3282	58.57	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<sub>f</sub> = Sorting Current, T<sub>J</sub> = 85 °C)

CRI Ra 80+



CRI Ra 90+



CRI Ra 70+



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

1) LC003D



2) LC006D



## 3) LC009D



## 4) LC013D



## 5) LC016D



6) LC019D



7) LC026D



8) LC033D



## 9) LC040D



## 10) LC060D



## 11) LC080D



c) Temperature Characteristics ( $I_F$  = Sorting Current)



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



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



## f) Derating Characteristics

1) LC003D



2) LC006D



3) LC009D



4) LC0013D



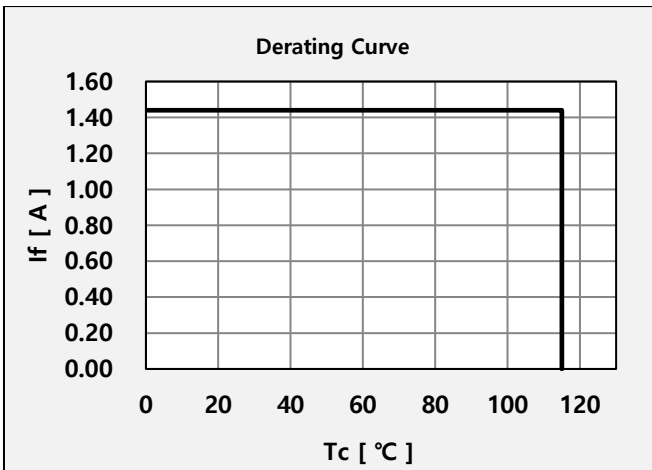
5) LC016D



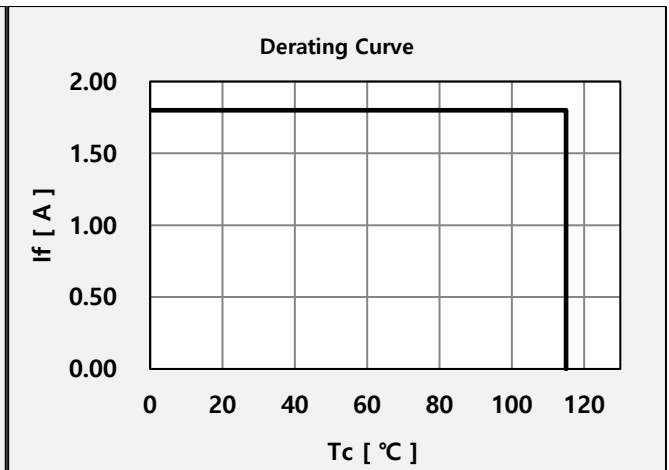
6) LC0019D



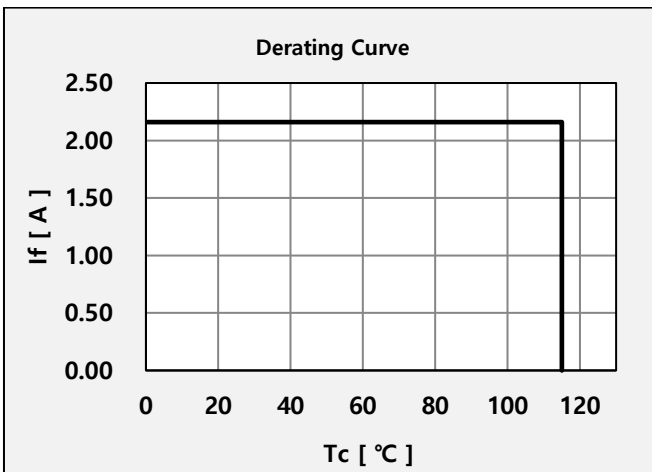
7) LC026D



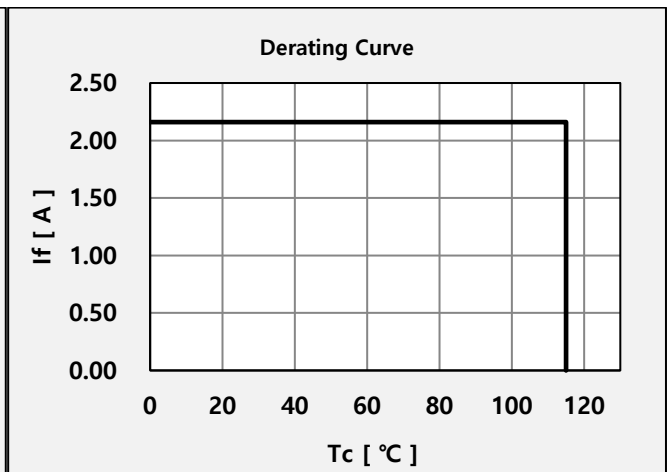
8) LC0033D



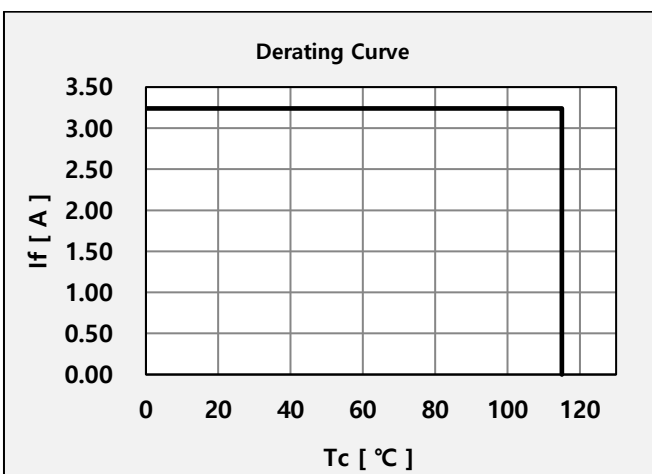
9) LC040D



10) LC060D

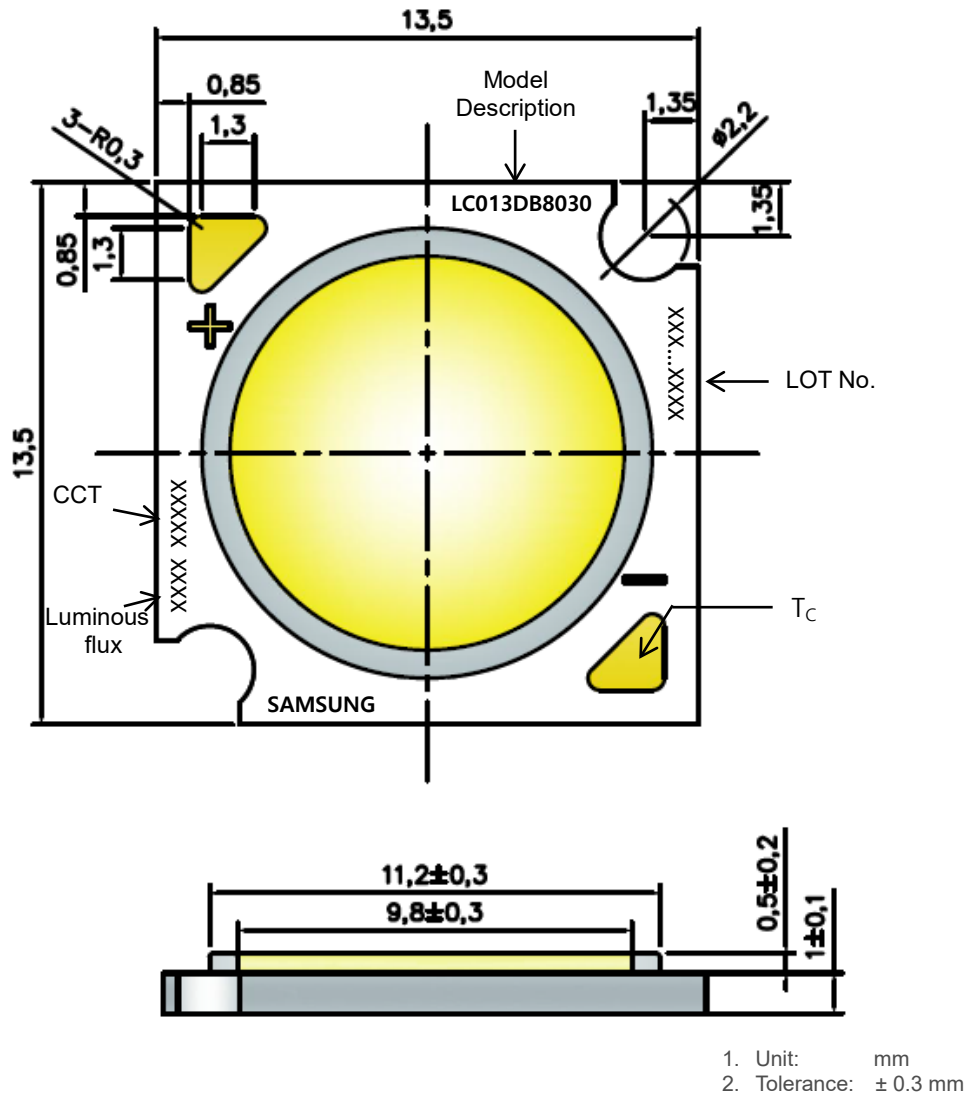


11) LC080D



4. Outline Drawing & Dimension

※ Model : LC003D, LC006D, LC009D, LC013D



1. Unit: mm
2. Tolerance: ± 0.3 mm

Item	Dimension	Tolerance	Unit
Length	13.5	±0.15	mm
Width	13.5	±0.15	mm
Height	Dam	±0.20	mm
	Substrate	±0.10	mm
LES Diameter	Light Emitting Surface	±0.30	mm

Note: Denoted product information above is only an example (LC013DB8030 :LC013D, Gen2 Plus, Ra80, 3000K)

※ Model : LC016D, LC019D, LC026D, LC033D



1. Unit: mm
2. Tolerance: ± 0.3 mm

Item	Dimension	Tolerance	Unit
Length	19.0	±0.15	mm
Width	19.0	±0.15	mm
Height	Dam	0.5	±0.20
	Substrate	1.0	±0.10
LES Diameter	Light Emitting Surface	14.5	±0.30

Note: Denoted product information above is only an example  
 ( LC026DB8030 : LC026D, Gen2 Plus, CRI80+, 3000K )

※ Model : LC040D, LC060D, LC080D



- 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	Dam	0.5	±0.20	mm
	Substrate	1.0	±0.10	mm
LES Diameter	Light Emitting Surface	22.0	±0.30	mm

Note: Denoted product information above is only an example  
 ( LC040DB8030 : LC040D, Gen2 Plus, 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 <sub>F</sub>	1000 h
High Temperature Life Test	85 °C, DC Derating, I <sub>F</sub>	1000 h
Low Temperature Life Test	-40 °C, DC, Derating I <sub>F</sub>	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 shock	-40 °C to 125 °C, Transfer Time : < 20 seconds	200 cycles
ESD (HBM)	R1: 10 MΩ R2: 1.5 kΩ C: 100 pF V: ±2kV	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 (3axis x 2 sides)	5 times
Sulfur Resistance	25 °C, 75%, H2S 15 ppm	504h
High Temperature Humidity Life Test	60 °C, 90 % RH,, DC Derating, I <sub>F</sub>	1000 h

### 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> = <b>Sorting Current</b>	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	Φ <sub>v</sub>	I <sub>F</sub> = <b>Sorting Current</b>	L.S.L. * 0.7	U.S.L. * 1.3

## 6. Label Structure

### a) Label Structure



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

Bin Code:

ⒶⒷ: Forward Voltage bin (refer to page 9)

ⒸⒹ: Chromaticity bin (refer to page 21)

ⒺⒻ: Luminous Flux bin (refer to page 5-8)

### b) Lot Number

The lot number is composed of the following characters:



① ②③④⑤⑥⑦⑧⑨ / 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 (F: 2021, G: 2022, H: 2023...)

⑤ : Month (1~9, A, B, C)

⑥⑦⑧⑨ : Day (1~9, A, B~V)

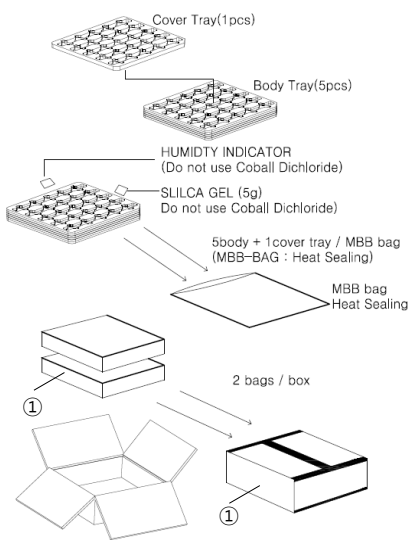
ⒶⒷⒸ : Product serial number (001 ~ 999)

## 7. Packing Structure

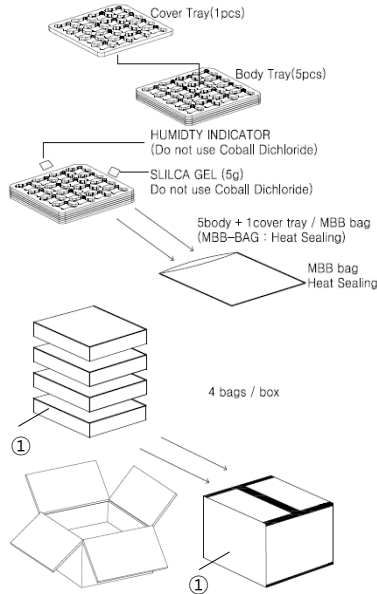
※ Model : L003D, LC006D, LC009D, LC013D

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

### a) Packing Structure



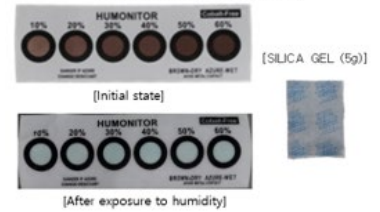
※ Small Box



※ Middle Box



[MBB BAG drawing]



### ① Side Label



LC013D RA80 2700K  
**YZW3DB**

SPHWHAHNDND25YZW3DB YZW3DB 01  
G4AZC4001/1001/ xxxx pcs

**SAMSUNG**  

(1P) Supplier Part Number : SPHWHAHNDND25YZW3DB (Q) Quantity : XXXX

(33P) Bin Code / YZW3DB (100) Data Code : 2109

(1T) Lot Number / 1001 (4L) Country of Origin : CN

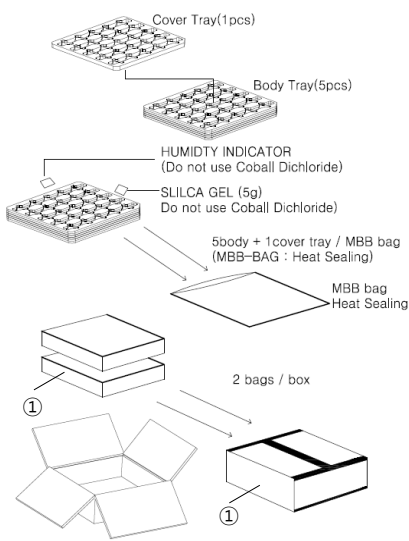
## b) Tray



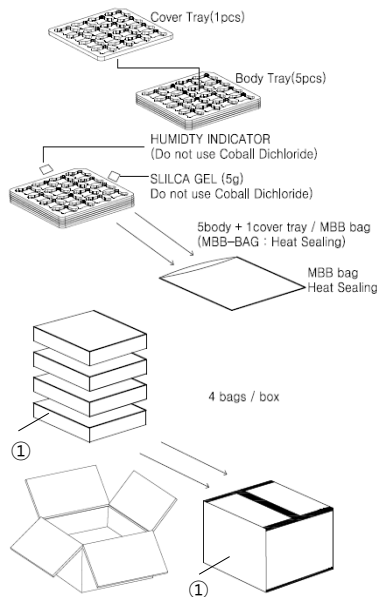
※ Model : LC016D, LC019D, LC026D, LC033D

Packing material	Max. quantity in pcs of COB	Dimension(mm)			
		Length	Width	Height	Tolerance
Tray	25	200	200	8	1
Anti-Static Bag	125 (5 trays)	320	270	-	+/- 0.5
Outer Box (Small)	250 (2 bags)	225	225	65	5
Outer Box (Middle)	500 (4 bags)	225	225	130	5

a) Packing Structure



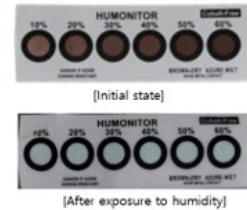
※ Small Box



※ Middle Box



[MBB BAG drawing]



[SILICA GEL (5g)]

[Initial state]

[After exposure to humidity]

① Side Label


**LC026D RA80 2700K**  
**YZW3DB**  
 SPHWAHDNG25YZW3DB YZW3DB 01  
 G4AZC4001/1001/ xxxx pcs  
**SAMSUNG**  

(1P) Supplier Part Number : SPHWAHDNG25YZW3DB (Q) Quantity : XXXX  
 (33P) Bin Code / YZW3DB (100) Data Code : 2109  
 (1T) Lot Number / 1001 (4L) Country of Origin : CN

## b) Tray



※ Model : LC040D, LC060D, LC080D

Packing material	Max. quantity in pcs of COB	Dimension(mm)			
		Length	Width	Height	Tolerance
Tray	16	200	200	8	1
Anti-Static Bag	80 (5 trays)	320	270	-	+/- 0.5
Outer Box (Small)	160 (2 bags)	225	225	65	5
Outer Box (Middle)	320 (4 bags)	225	225	130	5

a) Packing Structure



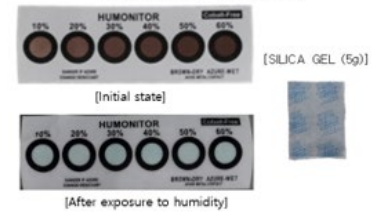
※ Small Box



※ Middle Box



[MBB BAG drawing]

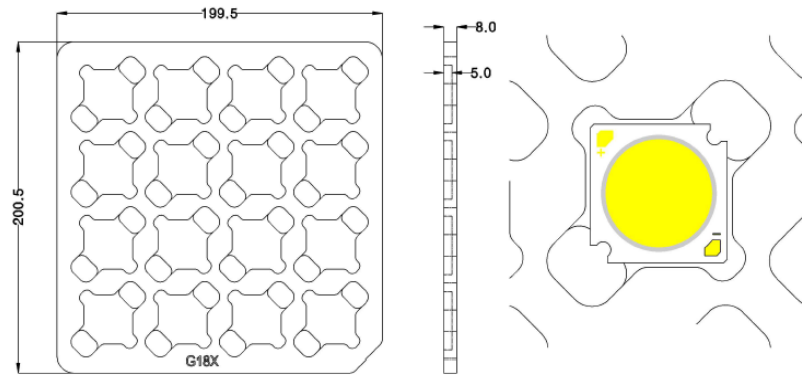


① Side Label

LC040D RA80 2700K  
**YZW3DB**  
SPHWHAHDNK25YZW3DB YZW3DB 01  
G4AZC4001/1001/ xxxx pcs  
SAMSUNG c<sub>us</sub> EAC

(1P) Supplier Part Number : SPHWHAHDNK25YZW3DB (Q) Quantity : XXXX  
(33P) Bin Code / YZW3DB (100) Data Code : 2109  
(1T) Lot Number / 1001 (4L) Country of Origin : CN

## 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. Some solvent-based cleaning agent may damage the silicone resins used in the device.
- 2) LEDs must be stored in a clean environment. 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 (wiring), 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.



# Legal and additional information.

## [About Samsung Electronics Co., Ltd.](#)

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](http://www.samsung.com) and our official blog at [global.samsungtomorrow.com](http://global.samsungtomorrow.com).

Samsung provides limited warranty for its LED products, the full text of which is available at <https://www.samsung.com/led/support/warranties>.

Copyright © 2015 Samsung Electronics Co., Ltd. All rights reserved.

Samsung is a registered trademark of Samsung Electronics Co., Ltd.

Specifications and designs are subject to change without notice. Non-metric weights and measurements are approximate. All data were deemed correct at time of creation. Samsung is not liable for errors or omissions. All brand, product, service names and logos are trademarks and/or registered trademarks of their respective owners and are hereby recognized and acknowledged.

Samsung Electronics Co., Ltd.

95, Samsung 2-ro

Giheung-gu

Yongin-si, Gyeonggi-do, 446-711



KOREA

[www.samsung.com/led](http://www.samsung.com/led)







**SAMSUNG**

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

-  [View SPHWHADNM231ZR3DB on WIN SOURCE](#)
-  [Samsung Information](#)

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management