

High VoltageLED Series
Chip on Board

COB D-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



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1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Model	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 / Power Dissipation	I_F / P_D	LC003D	230 / 8.6	mA / W	-
		LC006D	460 / 17.2		-
		LC009D	690 / 25.9		-
		LC013D	920 / 34.5		-
		LC016D	1150 / 43.1		-
		LC019D	1380 / 51.8		-
		LC026D	1840 / 69.0		-
		LC033D	2300 / 86.0		-
		LC040D	2760 / 103.5		-
		LC060D	2760 / 155.1		-
		LC080D	4140 / 232.6		-
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	YZ	31.8	34.6	37.5
			1Z	47.8	52.0	56.2
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	-
		LC006D	-	-	6.2 / 180	-
		LC009D	-	-	9.3 / 270	-
		LC013D	-	-	12.5 / 360	-
		LC016D	-	-	15.6 / 450	-
		LC019D	-	-	18.7 / 540	-
		LC026D	-	-	24.9 / 720	-
		LC033D	-	-	31.1 / 900	-
		LC040D	-	-	37.4 / 1080	-
		LC060D	-	-	56.2 / 1080	-
		LC080D	-	-	84.2 / 1620	-
		LC003D	-	-	2.56	-
		LC006D	-	-	1.48	-
		LC009D	-	-	0.99	-
Thermal Resistance (Junction to chip case)	$^{\circ}\text{C/W}$	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 = ± 1
- 3) Refer to the derating curve, '3. Typical Characteristics Graph' designed within the range.

c) Luminous Flux Characteristics (I_F = Sorting Current)

Model	CRI (R _a) Min.	Nominal CCT (K)	Flux Rank	Flux@ T _J = 85 °C (lm)		
				Min.	Typ.	Max.
LC003D2	80	2700	D2	436	459	-
		3000	D2	459	483	-
		3500	D2	476	501	-
		4000	D2	482	507	-
		5000	D2	488	513	-
		5700	D2	488	513	-
	90	6500	D2	482	507	-
		2700	D2	368	388	-
		3000	D2	385	406	-
		3500	D2	398	419	-
		4000	D2	406	427	-
		5000	D2	409	430	-
LC006D2	80	2700	D2	877	924	-
		3000	D2	922	971	-
		3500	D2	951	1001	-
		4000	D2	973	1024	-
		5000	D2	979	1030	-
		5700	D2	979	1030	-
	90	6500	D2	967	1018	-
		2700	D2	747	786	-
		3000	D2	783	824	-
		3500	D2	810	853	-
		4000	D2	827	870	-
		5000	D2	830	874	-

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 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

Model	CRI (R _a) Min.	Nominal CCT (K)	Flux Rank	Flux@ T _j = 85 °C (lm)		
				Min.	Typ.	Max.
LC009D2	70	3000	D2	1428	1503	-
		4000	D2	1497	1576	-
		5000	D2	1545	1626	-
	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	-
LC013D2	70	3000	D2	1905	2006	-
		4000	D2	1966	2070	-
		5000	D2	1997	2102	-
	80	2700	D2	1676	1764	-
		3000	D2	1764	1857	-
		3500	D2	1819	1915	-
		4000	D2	1852	1950	-
		5000	D2	1869	1967	-
		5700	D2	1869	1967	-
		6500	D2	1841	1938	-
	90	2700	D2	1433	1509	-
		3000	D2	1501	1580	-
		3500	D2	1554	1635	-
		4000	D2	1587	1670	-
		5000	D2	1591	1674	-

Notes:

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

Model	CRI (R _a) Min.	Nominal CCT (K)	Flux Rank	Flux@ T _j = 85 °C (lm)		
				Min.	Typ.	Max.
LC016D2	70	3000	D2	2486	2617	-
		4000	D2	2566	2701	-
		5000	D2	2605	2742	-
	80	2700	D2	2179	2293	-
		3000	D2	2302	2423	-
		3500	D2	2387	2513	-
		4000	D2	2430	2558	-
		5000	D2	2452	2581	-
		5700	D2	2452	2581	-
	90	6500	D2	2430	2558	-
		2700	D2	1868	1967	-
		3000	D2	1980	2084	-
		3500	D2	2038	2146	-
		4000	D2	2079	2189	-
LC019D2	70	5000	D2	2098	2209	-
		3000	D2	2952	3107	-
		4000	D2	3046	3207	-
	80	5000	D2	3093	3256	-
		2700	D2	2592	2728	-
		3000	D2	2733	2877	-
		3500	D2	2817	2965	-
		4000	D2	2875	3026	-
		5000	D2	2906	3059	-
	90	5700	D2	2906	3059	-
		6500	D2	2875	3026	-
		2700	D2	2219	2336	-
		3000	D2	2327	2449	-
		3500	D2	2412	2539	-
	90	4000	D2	2465	2594	-
		5000	D2	2467	2596	-

Notes:

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

Model	CRI (R _a) Min.	Nominal CCT (K)	Flux Rank	Flux@ T _J = 85 °C (lm)		
				Min.	Typ.	Max.
LC026D2	70	3000	D2	3860	4063	-
		4000	D2	3983	4193	-
		5000	D2	4045	4258	-
	80	2700	D2	3401	3580	-
		3000	D2	3574	3762	-
		3500	D2	3679	3872	-
		4000	D2	3752	3950	-
		5000	D2	3784	3983	-
		5700	D2	3784	3983	-
		6500	D2	3752	3950	-
	90	2700	D2	2910	3064	-
		3000	D2	3061	3223	-
		3500	D2	3153	3319	-
		4000	D2	3218	3387	-
		5000	D2	3245	3416	-
LC033D2	70	3000	D2	4764	5014	-
		4000	D2	4916	5175	-
		5000	D2	4992	5255	-
	80	2700	D2	4197	4418	-
		3000	D2	4411	4643	-
		3500	D2	4540	4779	-
		4000	D2	4631	4875	-
		5000	D2	4670	4916	-
		5700	D2	4670	4916	-
		6500	D2	4631	4875	-
	90	2700	D2	3592	3781	-
		3000	D2	3778	3977	-
		3500	D2	3891	4096	-
		4000	D2	3971	4180	-
		5000	D2	4005	4216	-

Notes:

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

Model	CRI (R _a) Min.	Nominal CCT (K)	Flux Rank	Flux@ T _J = 85 °C (lm)		
				Min.	Typ.	Max.
LC040D2	70	3000	D2	5989	6304	
		4000	D2	6180	6506	
		5000	D2	6276	6607	
	80	2700	D2	5270	5547	-
		3000	D2	5545	5837	-
		3500	D2	5715	6016	-
		4000	D2	5838	6146	-
		5000	D2	5866	6175	-
		5700	D2	5894	6205	-
		6500	D2	5831	6138	-
	90	2700	D2	4517	4755	-
		3000	D2	4773	5024	-
		3500	D2	4894	5152	-
		4000	D2	5002	5266	-
		5000	D2	5059	5325	-
LC060D2	70	3000	D2	8764	9225	-
		4000	D2	9045	9521	-
		5000	D2	9185	9668	-
	80	2700	D2	7702	8107	-
		3000	D2	8115	8542	-
		3500	D2	8371	8812	-
		4000	D2	8545	8995	-
		5000	D2	8587	9039	-
		5700	D2	8629	9084	-
		6500	D2	8540	8990	-
	90	2700	D2	6611	6959	-
		3000	D2	6984	7352	-
		3500	D2	7162	7539	-
		4000	D2	7320	7706	-
		5000	D2	7404	7793	-

Notes:

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

Model	CRI (R _a) Min.	Nominal CCT (K)	Flux Rank	Flux@ T _j = 85 °C (lm)		
				Min.	Typ.	Max.
LC080D2	70	3000	D2	12792	13465	-
		4000	D2	13202	13896	-
		5000	D2	13406	14112	-
	80	2700	D2	11224	11815	-
		3000	D2	11845	12468	-
		3500	D2	12209	12852	-
		4000	D2	12466	13123	-
		5000	D2	12536	13196	-
		5700	D2	12596	13258	-
		6500	D2	12465	13121	-
	90	2700	D2	9649	10157	-
		3000	D2	10195	10731	-
		3500	D2	10454	11004	-
		4000	D2	10685	11247	-
		5000	D2	10806	11375	-

Notes:

- 6) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T_J = T_C = 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	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	A LC003D B LC006D C LC009D D LC013D E LC016D F LC019D G LC026D H LC033D K LC040D L LC060D M LC080D	
11	Internal Code	2	
12	CRI & Sorting Temperature	3 Min. 70 (85°C) 5 Min. 80 (85°C) 7 Min. 90 (85°C)	
13 14	Forward Voltage (V)	YZ 31.8~37.5 1Z 47.8~56.2	
15	CCT (K)	W 2700K V 3000K U 3500K T 4000K R 5000K Q 5700K P 6500K	
16	MacAdam Step	1 MacAdam 1-step 2 MacAdam 2-step 3 MacAdam 3-step	
17 18	Luminous Flux (Lm)	D2	COB D-series Gen.2 level

a) Binning Structure

※ LC003D(I_F = 90 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
80	2700	SPHWAHDNA25YZW1D2	YZ	W1	D2	436 ~
		SPHWAHDNA25YZW2D2		W2		
	3000	SPHWAHDNA25YZV1D2	YZ	V1	D2	459 ~
		SPHWAHDNA25YZV2D2		V2		
	3500	SPHWAHDNA25YZU1D2	YZ	U1	D2	476 ~
		SPHWAHDNA25YZU2D2		U2		
	4000	SPHWAHDNA25YZT1D2	YZ	T1	D2	482 ~
		SPHWAHDNA25YZT2D2		T2		
	5000	SPHWAHDNA25YZR2D2	YZ	R2	D2	488 ~
		SPHWAHDNA25YZR3D2		R3		
	5700	SPHWAHDNA25YZQ2D2	YZ	Q2	D2	488 ~
		SPHWAHDNA25YZQ3D2		Q3		
	6500	SPHWAHDNA25YZP2D2	YZ	P2	D2	482 ~
		SPHWAHDNA25YZP3D2		P3		
90	2700	SPHWAHDNA27YZW1D2	YZ	W1	D2	368 ~
		SPHWAHDNA27YZW2D2		W2		
	3000	SPHWAHDNA27YZV1D2	YZ	V1	D2	385 ~
		SPHWAHDNA27YZV2D2		V2		
	3500	SPHWAHDNA27YZU1D2	YZ	U1	D2	398 ~
		SPHWAHDNA27YZU2D2		U2		
	4000	SPHWAHDNA27YZT1D2	YZ	T1	D2	406 ~
		SPHWAHDNA27YZT2D2		T2		
	5000	SPHWAHDNA27YZR2D2	YZ	R2	D2	409 ~
		SPHWAHDNA27YZR3D2		R3		

※ LC006D(I_F = 180 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
80	2700	SPHWAHDNB25YZW1D2	YZ	W1	D2	877~
		SPHWAHDNB25YZW2D2		W2		
	3000	SPHWAHDNB25YZV1D2	YZ	V1	D2	922~
		SPHWAHDNB25YZV2D2		V2		
	3500	SPHWAHDNB25YZU1D2	YZ	U1	D2	951~
		SPHWAHDNB25YZU2D2		U2		
	4000	SPHWAHDNB25YZT1D2	YZ	T1	D2	973~
		SPHWAHDNB25YZT2D2		T2		
	5000	SPHWAHDNB25YZR2D2	YZ	R2	D2	979~
		SPHWAHDNB25YZR3D2		R3		
	5700	SPHWAHDNB25YZQ2D2	YZ	Q2	D2	979~
		SPHWAHDNB25YZQ3D2		Q3		
	6500	SPHWAHDNB25YZP2D2	YZ	P2	D2	967~
		SPHWAHDNB25YZP3D2		P3		
90	2700	SPHWAHDNB27YZW1D2	YZ	W1	D2	747 ~
		SPHWAHDNB27YZW2D2		W2		
	3000	SPHWAHDNB27YZV1D2	YZ	V1	D2	783 ~
		SPHWAHDNB27YZV2D2		V2		
	3500	SPHWAHDNB27YZU1D2	YZ	U1	D2	810 ~
		SPHWAHDNB27YZU2D2		U2		
	4000	SPHWAHDNB27YZT1D2	YZ	T1	D2	827 ~
		SPHWAHDNB27YZT2D2		T2		
	5000	SPHWAHDNB27YZR2D2	YZ	R2	D2	830 ~
		SPHWAHDNB27YZR3D2		R3		

※ LC009D(I_F = 270 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWWAHDNC23YZV2D2	YZ	V2	D2	1428 ~
		SPHWWAHDNC23YZV3D2		V3		
	4000	SPHWWAHDNC23YZT2D2	YZ	T2	D2	1497 ~
		SPHWWAHDNC23YZT3D2		T3		
	5000	SPHWWAHDNC23YZR2D2	YZ	R2	D2	1545 ~
		SPHWWAHDNC23YZR3D2		R3		
80	2700	SPHWWAHDNC25YZW1D2	YZ	W1	D2	1275 ~
		SPHWWAHDNC25YZW2D2		W2		
	3000	SPHWWAHDNC25YZV1D2	YZ	V1	D2	1347 ~
		SPHWWAHDNC25YZV2D2		V2		
	3500	SPHWWAHDNC25YZU1D2	YZ	U1	D2	1386 ~
		SPHWWAHDNC25YZU2D2		U2		
	4000	SPHWWAHDNC25YZT1D2	YZ	T1	D2	1419 ~
		SPHWWAHDNC25YZT2D2		T2		
	5000	SPHWWAHDNC25YZR2D2	YZ	R2	D2	1431 ~
		SPHWWAHDNC25YZR3D2		R3		
	5700	SPHWWAHDNC25YZQ2D2	YZ	Q2	D2	1431 ~
		SPHWWAHDNC25YZQ3D2		Q3		
	6500	SPHWWAHDNC25YZP2D2	YZ	P2	D2	1414 ~
		SPHWWAHDNC25YZP3D2		P3		
90	2700	SPHWWAHDNC27YZW1D2	YZ	W1	D2	1094 ~
		SPHWWAHDNC27YZW2D2		W2		
	3000	SPHWWAHDNC27YZV1D2	YZ	V1	D2	1146 ~
		SPHWWAHDNC27YZV2D2		V2		
	3500	SPHWWAHDNC27YZU1D2	YZ	U1	D2	1182 ~
		SPHWWAHDNC27YZU2D2		U2		
	4000	SPHWWAHDNC27YZT1D2	YZ	T1	D2	1209 ~
		SPHWWAHDNC27YZT2D2		T2		
	5000	SPHWWAHDNC27YZR2D2	YZ	R2	D2	1214 ~
		SPHWWAHDNC27YZR3D2		R3		

※ LC013D(I_F = 360 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWWAHDND23YZV2D2	YZ	V2	D2	1905 ~
		SPHWWAHDND23YZV3D2		V3		
	4000	SPHWWAHDND23YZT2D2	YZ	T2	D2	1966 ~
		SPHWWAHDND23YZT3D2		T3		
	5000	SPHWWAHDND23YZR2D2	YZ	R2	D2	1997 ~
		SPHWWAHDND23YZR3D2		R3		
80	2700	SPHWWAHDND25YZW1D2	YZ	W1	D2	1676 ~
		SPHWWAHDND25YZW2D2		W2		
	3000	SPHWWAHDND25YZV1D2	YZ	V1	D2	1764 ~
		SPHWWAHDND25YZV2D2		V2		
	3500	SPHWWAHDND25YZU1D2	YZ	U1	D2	1819 ~
		SPHWWAHDND25YZU2D2		U2		
	4000	SPHWWAHDND25YZT1D2	YZ	T1	D2	1852 ~
		SPHWWAHDND25YZT2D2		T2		
	5000	SPHWWAHDND25YZR2D2	YZ	R2	D2	1869 ~
		SPHWWAHDND25YZR3D2		R3		
	5700	SPHWWAHDND25YZQ2D2	YZ	Q2	D2	1869 ~
		SPHWWAHDND25YZQ3D2		Q3		
	6500	SPHWWAHDND25YZP2D2	YZ	P2	D2	1841 ~
		SPHWWAHDND25YZP3D2		P3		
90	2700	SPHWWAHDND27YZW1D2	YZ	W1	D2	1433 ~
		SPHWWAHDND27YZW2D2		W2		
	3000	SPHWWAHDND27YZV1D2	YZ	V1	D2	1501 ~
		SPHWWAHDND27YZV2D2		V2		
	3500	SPHWWAHDND27YZU1D2	YZ	U1	D2	1554 ~
		SPHWWAHDND27YZU2D2		U2		
	4000	SPHWWAHDND27YZT1D2	YZ	T1	D2	1587 ~
		SPHWWAHDND27YZT2D2		T2		
	5000	SPHWWAHDND27YZR2D2	YZ	R2	D2	1591 ~
		SPHWWAHDND27YZR3D2		R3		

※ LC016D(I_F = 450 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWWAHDNE23YZV2D2	YZ	V2	D2	2486 ~
		SPHWWAHDNE23YZV3D2		V3		
	4000	SPHWWAHDNE23YZT2D2	YZ	T2	D2	2566 ~
		SPHWWAHDNE23YZT3D2		T3		
	5000	SPHWWAHDNE23YZR2D2	YZ	R2	D2	2605 ~
		SPHWWAHDNE23YZR3D2		R3		
80	2700	SPHWWAHDNE25YZW1D2	YZ	W1	D2	2179 ~
		SPHWWAHDNE25YZW2D2		W2		
	3000	SPHWWAHDNE25YZV1D2	YZ	V1	D2	2302 ~
		SPHWWAHDNE25YZV2D2		V2		
	3500	SPHWWAHDNE25YZU1D2	YZ	U1	D2	2387 ~
		SPHWWAHDNE25YZU2D2		U2		
	4000	SPHWWAHDNE25YZT1D2	YZ	T1	D2	2430 ~
		SPHWWAHDNE25YZT2D2		T2		
	5000	SPHWWAHDNE25YZR2D2	YZ	R2	D2	2452 ~
		SPHWWAHDNE25YZR3D2		R3		
	5700	SPHWWAHDNE25YZQ2D2	YZ	Q2	D2	2452 ~
		SPHWWAHDNE25YZQ3D2		Q3		
	6500	SPHWWAHDNE25YZP2D2	YZ	P2	D2	2430 ~
		SPHWWAHDNE25YZP3D2		P3		
90	2700	SPHWWAHDNE27YZW1D2	YZ	W1	D2	1868 ~
		SPHWWAHDNE27YZW2D2		W2		
	3000	SPHWWAHDNE27YZV1D2	YZ	V1	D2	1980 ~
		SPHWWAHDNE27YZV2D2		V2		
	3500	SPHWWAHDNE27YZU1D2	YZ	U1	D2	2038 ~
		SPHWWAHDNE27YZU2D2		U2		
	4000	SPHWWAHDNE27YZT1D2	YZ	T1	D2	2079 ~
		SPHWWAHDNE27YZT2D2		T2		
	5000	SPHWWAHDNE27YZR2D2	YZ	R2	D2	2098 ~
		SPHWWAHDNE27YZR3D2		R3		

※ LC019D(I_F = 540 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWWAHDNF23YZV2D2	YZ	V2	D2	2952 ~
		SPHWWAHDNF23YZV3D2		V3		
	4000	SPHWWAHDNF23YZT2D2	YZ	T2	D2	3046 ~
		SPHWWAHDNF23YZT3D2		T3		
	5000	SPHWWAHDNF23YZR2D2	YZ	R2	D2	3093 ~
		SPHWWAHDNF23YZR3D2		R3		
80	2700	SPHWWAHDNF25YZW1D2	YZ	W1	D2	2592 ~
		SPHWWAHDNF25YZW2D2		W2		
	3000	SPHWWAHDNF25YZV1D2	YZ	V1	D2	2733 ~
		SPHWWAHDNF25YZV2D2		V2		
	3500	SPHWWAHDNF25YZU1D2	YZ	U1	D2	2817 ~
		SPHWWAHDNF25YZU2D2		U2		
	4000	SPHWWAHDNF25YZT1D2	YZ	T1	D2	2875 ~
		SPHWWAHDNF25YZT2D2		T2		
	5000	SPHWWAHDNF25YZR2D2	YZ	R2	D2	2906 ~
		SPHWWAHDNF25YZR3D2		R3		
	5700	SPHWWAHDNF25YZQ2D2	YZ	Q2	D2	2906 ~
		SPHWWAHDNF25YZQ3D2		Q3		
	6500	SPHWWAHDNF25YZP2D2	YZ	P2	D2	2875 ~
		SPHWWAHDNF25YZP3D2		P3		
90	2700	SPHWWAHDNF27YZW1D2	YZ	W1	D2	2219 ~
		SPHWWAHDNF27YZW2D2		W2		
	3000	SPHWWAHDNF27YZV1D2	YZ	V1	D2	2327 ~
		SPHWWAHDNF27YZV2D2		V2		
	3500	SPHWWAHDNF27YZU1D2	YZ	U1	D2	2412 ~
		SPHWWAHDNF27YZU2D2		U2		
	4000	SPHWWAHDNF27YZT1D2	YZ	T1	D2	2465 ~
		SPHWWAHDNF27YZT2D2		T2		
	5000	SPHWWAHDNF27YZR2D2	YZ	R2	D2	2467 ~
		SPHWWAHDNF27YZR3D2		R3		

※ LC026D(I_F = 720 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWWAHDNG23YZV2D2	YZ	V2	D2	3860 ~
		SPHWWAHDNG23YZV3D2		V3		
	4000	SPHWWAHDNG23YZT2D2	YZ	T2	D2	3983 ~
		SPHWWAHDNG23YZT3D2		T3		
	5000	SPHWWAHDNG23YZR2D2	YZ	R2	D2	4045 ~
		SPHWWAHDNG23YZR3D2		R3		
80	2700	SPHWWAHDNG25YZW1D2	YZ	W1	D2	3401 ~
		SPHWWAHDNG25YZW2D2		W2		
	3000	SPHWWAHDNG25YZV1D2	YZ	V1	D2	3574 ~
		SPHWWAHDNG25YZV2D2		V2		
	3500	SPHWWAHDNG25YZU1D2	YZ	U1	D2	3679 ~
		SPHWWAHDNG25YZU2D2		U2		
	4000	SPHWWAHDNG25YZT1D2	YZ	T1	D2	3752 ~
		SPHWWAHDNG25YZT2D2		T2		
	5000	SPHWWAHDNG25YZR2D2	YZ	R2	D2	3784 ~
		SPHWWAHDNG25YZR3D2		R3		
	5700	SPHWWAHDNG25YZQ2D2	YZ	Q2	D2	3784 ~
		SPHWWAHDNG25YZQ3D2		Q3		
	6500	SPHWWAHDNG25YZP2D2	YZ	P2	D2	3752 ~
		SPHWWAHDNG25YZP3D2		P3		
90	2700	SPHWWAHDNG27YZW1D2	YZ	W1	D2	2910 ~
		SPHWWAHDNG27YZW2D2		W2		
	3000	SPHWWAHDNG27YZV1D2	YZ	V1	D2	3061 ~
		SPHWWAHDNG27YZV2D2		V2		
	3500	SPHWWAHDNG27YZU1D2	YZ	U1	D2	3153 ~
		SPHWWAHDNG27YZU2D2		U2		
	4000	SPHWWAHDNG27YZT1D2	YZ	T1	D2	3218 ~
		SPHWWAHDNG27YZT2D2		T2		
	5000	SPHWWAHDNG27YZR2D2	YZ	R2	D2	3245 ~
		SPHWWAHDNG27YZR3D2		R3		

※ LC033D(I_F = 900 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWAHDNH23YZV2D2	YZ	V2	D2	4764 ~
		SPHWAHDNH23YZV3D2		V3		
	4000	SPHWAHDNH23YZT2D2	YZ	T2	D2	4916 ~
		SPHWAHDNH23YZT3D2		T3		
	5000	SPHWAHDNH23YZR2D2	YZ	R2	D2	4992 ~
		SPHWAHDNH23YZR3D2		R3		
	2700	SPHWAHDNH25YZW1D2	YZ	W1	D2	4197 ~
		SPHWAHDNH25YZW2D2		W2		
	3000	SPHWAHDNH25YZV1D2	YZ	V1	D2	4411 ~
		SPHWAHDNH25YZV2D2		V2		
80	3500	SPHWAHDNH25YZU1D2	YZ	U1	D2	4540 ~
		SPHWAHDNH25YZU2D2		U2		
	4000	SPHWAHDNH25YZT1D2	YZ	T1	D2	4631 ~
		SPHWAHDNH25YZT2D2		T2		
	5000	SPHWAHDNH25YZR2D2	YZ	R2	D2	4670 ~
		SPHWAHDNH25YZR3D2		R3		
	5700	SPHWAHDNH25YZQ2D2	YZ	Q2	D2	4670 ~
		SPHWAHDNH25YZQ3D2		Q3		
	6500	SPHWAHDNH25YZP2D2	YZ	P2	D2	4631 ~
		SPHWAHDNH25YZP3D2		P3		
	2700	SPHWAHDNH27YZW1D2	YZ	W1	D2	3592 ~
		SPHWAHDNH27YZW2D2		W2		
	3000	SPHWAHDNH27YZV1D2	YZ	V1	D2	3778 ~
		SPHWAHDNH27YZV2D2		V2		
90	3500	SPHWAHDNH27YZU1D2	YZ	U1	D2	3891 ~
		SPHWAHDNH27YZU2D2		U2		
	4000	SPHWAHDNH27YZT1D2	YZ	T1	D2	3971 ~
		SPHWAHDNH27YZT2D2		T2		
	5000	SPHWAHDNH27YZR2D2	YZ	R2	D2	4005 ~
		SPHWAHDNH27YZR3D2		R3		

※ LC040D(I_F = 1080 mA, T_J = 85 °C)

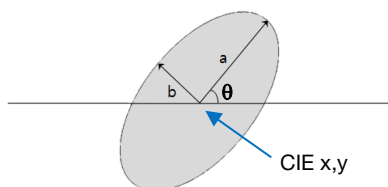
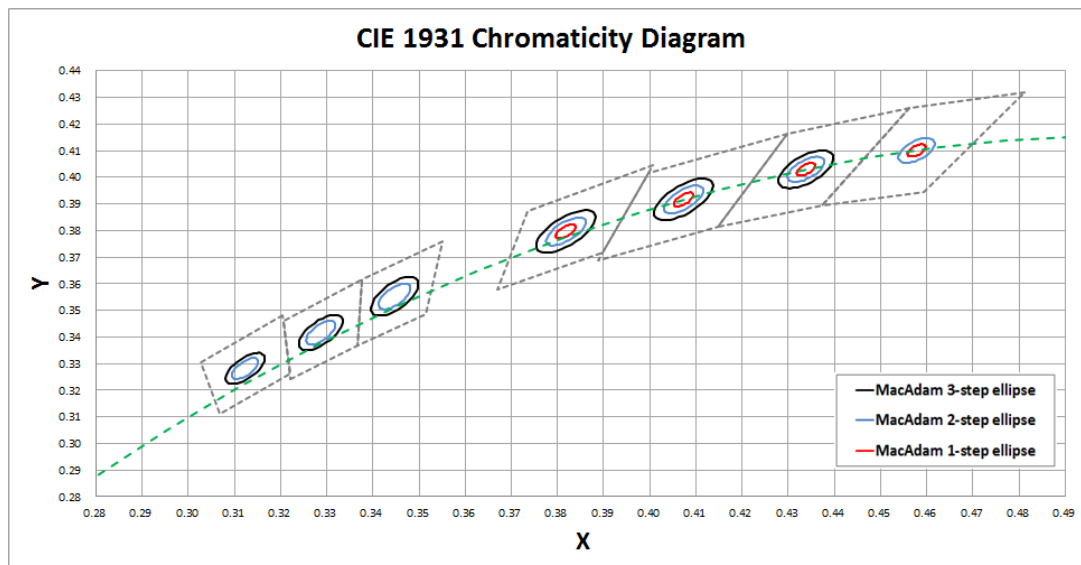
CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Color Rank	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWAHDNK23YZV2D2	YZ	V2	D2	5989 ~
		SPHWAHDNK23YZV3D2		V3		
	4000	SPHWAHDNK23YZT2D2	YZ	T2	D2	6180 ~
		SPHWAHDNK23YZT3D2		T3		
	5000	SPHWAHDNK23YZR2D2	YZ	R2	D2	6276 ~
		SPHWAHDNK23YZR3D2		R3		
80	2700	SPHWAHDNK25YZW1D2	YZ	W1	D2	5270 ~
		SPHWAHDNK25YZW2D2		W2		
	3000	SPHWAHDNK25YZV1D2	YZ	V1	D2	5545 ~
		SPHWAHDNK25YZV2D2		V2		
	3500	SPHWAHDNK25YZU1D2	YZ	U1	D2	5715 ~
		SPHWAHDNK25YZU2D2		U2		
	4000	SPHWAHDNK25YZT1D2	YZ	T1	D2	5838 ~
		SPHWAHDNK25YZT2D2		T2		
	5000	SPHWAHDNK25YZR2D2	YZ	R2	D2	5866 ~
		SPHWAHDNK25YZR3D2		R3		
	5700	SPHWAHDNK25YZQ2D2	YZ	Q2	D2	5894 ~
		SPHWAHDNK25YZQ3D2		Q3		
	6500	SPHWAHDNK25YZP2D2	YZ	P2	D2	5831 ~
		SPHWAHDNK25YZP3D2		P3		
90	2700	SPHWAHDNK27YZW1D2	YZ	W1	D2	4517 ~
		SPHWAHDNK27YZW2D2		W2		
	3000	SPHWAHDNK27YZV1D2	YZ	V1	D2	4773 ~
		SPHWAHDNK27YZV2D2		V2		
	3500	SPHWAHDNK27YZU2D2	YZ	U1	D2	4894 ~
		SPHWAHDNK27YZU2D2		U2		
	4000	SPHWAHDNK27YZT1D2	YZ	T1	D2	5002 ~
		SPHWAHDNK27YZT2D2		T2		
	5000	SPHWAHDNK27YZR2D2	YZ	R2	D2	5059 ~
		SPHWAHDNK27YZR3D2		R3		

※ LC060D(I_F = 1080 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Chrom. Bin	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWAHDNL231ZV2D2	1Z	V2	D2	8764 ~
		SPHWAHDNL231ZV3D2		V3		
	4000	SPHWAHDNL231ZT2D2	1Z	T2	D2	9045 ~
		SPHWAHDNL231ZT3D2		T3		
	5000	SPHWAHDNL231ZR2D2	1Z	R2	D2	9185 ~
		SPHWAHDNL231ZR3D2		R3		
80	2700	SPHWAHDNL251ZW1D2	1Z	W1	D2	7702 ~
		SPHWAHDNL251ZW2D2		W2		
	3000	SPHWAHDNL251ZV1D2	1Z	V1	D2	8115 ~
		SPHWAHDNL251ZV2D2		V2		
	3500	SPHWAHDNL251ZU1D2	1Z	U1	D2	8371 ~
		SPHWAHDNL251ZU2D2		U2		
	4000	SPHWAHDNL251ZT1D2	1Z	T1	D2	8545 ~
		SPHWAHDNL251ZT2D2		T2		
	5000	SPHWAHDNL251ZR2D2	1Z	R2	D2	8587 ~
		SPHWAHDNL251ZR3D2		R3		
	5700	SPHWAHDNL251ZQ2D2	1Z	Q2	D2	8629 ~
		SPHWAHDNL251ZQ3D2		Q3		
	6500	SPHWAHDNL251ZP2D2	1Z	P2	D2	8540 ~
		SPHWAHDNL251ZP3D2		P3		
90	2700	SPHWAHDNL271ZW1D2	1Z	W1	D2	6611 ~
		SPHWAHDNL271ZW2D2		W2		
	3000	SPHWAHDNL271ZV1D2	1Z	V1	D2	6984 ~
		SPHWAHDNL271ZV2D2		V2		
	3500	SPHWAHDNL271ZU1D2	1Z	U1	D2	7162 ~
		SPHWAHDNL271ZU2D2		U2		
	4000	SPHWAHDNL271ZT1D2	1Z	T1	D2	7320 ~
		SPHWAHDNL271ZT2D2		T2		
	5000	SPHWAHDNL271ZR2D2	1Z	R2	D2	7404 ~
		SPHWAHDNL271ZR3D2		R3		

※ LC080D(I_F = 1620 mA, T_J = 85 °C)

CRI(R _a) Min.	Nominal CCT(K)	Product Code	V _F Rank	Chrom. Bin	Flux Rank	Flux Range (Φ _v , lm)
70	3000	SPHWWAHDNM231ZV2D2	1Z	V2	D2	12792 ~
		SPHWWAHDNM231ZV3D2		V3		
	4000	SPHWWAHDNM231ZT2D2	1Z	T2	D2	13202 ~
		SPHWWAHDNM231ZT3D2		T3		
	5000	SPHWWAHDNM231ZR2D2	1Z	R2	D2	13406 ~
		SPHWWAHDNM231ZR3D2		R3		
80	2700	SPHWWAHDNM251ZW1D2	1Z	W1	D2	11224 ~
		SPHWWAHDNM251ZW2D2		W2		
	3000	SPHWWAHDNM251ZV1D2	1Z	V1	D2	11845 ~
		SPHWWAHDNM251ZV2D2		V2		
	3500	SPHWWAHDNM251ZU1D2	1Z	U1	D2	12209 ~
		SPHWWAHDNM251ZU2D2		U2		
	4000	SPHWWAHDNM251ZT1D2	1Z	T1	D2	12466 ~
		SPHWWAHDNM251ZT2D2		T2		
	5000	SPHWWAHDNM251ZR2D2	1Z	R2	D2	12536 ~
		SPHWWAHDNM251ZR3D2		R3		
	5700	SPHWWAHDNM251ZQ2D2	1Z	Q2	D2	12596 ~
		SPHWWAHDNM251ZQ3D2		Q3		
	6500	SPHWWAHDNM251ZP2D2	1Z	P2	D2	12465 ~
		SPHWWAHDNM251ZP3D2		P3		
90	2700	SPHWWAHDNM271ZW1D2	1Z	W1	D2	9649 ~
		SPHWWAHDNM271ZW2D2		W2		
	3000	SPHWWAHDNM271ZV1D2	1Z	V1	D2	10195 ~
		SPHWWAHDNM271ZV2D2		V2		
	3500	SPHWWAHDNM271ZU1D2	1Z	U1	D2	10454 ~
		SPHWWAHDNM271ZU2D2		U2		
	4000	SPHWWAHDNM271ZT1D2	1Z	T1	D2	10685 ~
		SPHWWAHDNM271ZT2D2		T2		
	5000	SPHWWAHDNM271ZR2D2	1Z	R2	D2	10806 ~
		SPHWWAHDNM271ZR3D2		R3		
	5700	SPHWWAHDNM271ZQ2D2	1Z	Q2	D2	10806 ~
		SPHWWAHDNM271ZQ3D2		Q3		

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


MacAdam Ellipse (W1, W2)					
Step	CIE x	CIE y	θ	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

MacAdam Ellipse (V1, V2, V3)					
Step	CIE x	CIE y	θ	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, U3)					
Step	CIE x	CIE y	θ	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	θ	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	θ	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	θ	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	θ	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

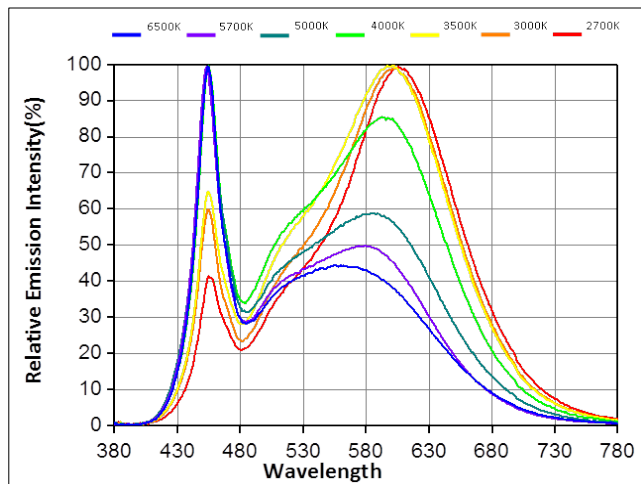
Note:

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

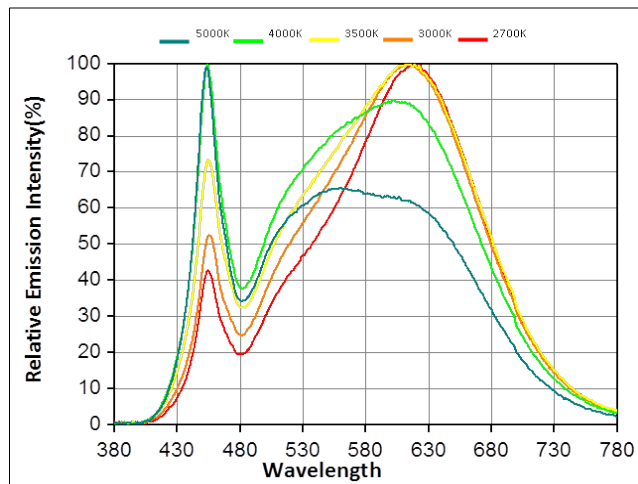
3. Typical Characteristics Graphs

a) Spectrum Distribution (I_f = Sorting Current, T_J = 85 °C)

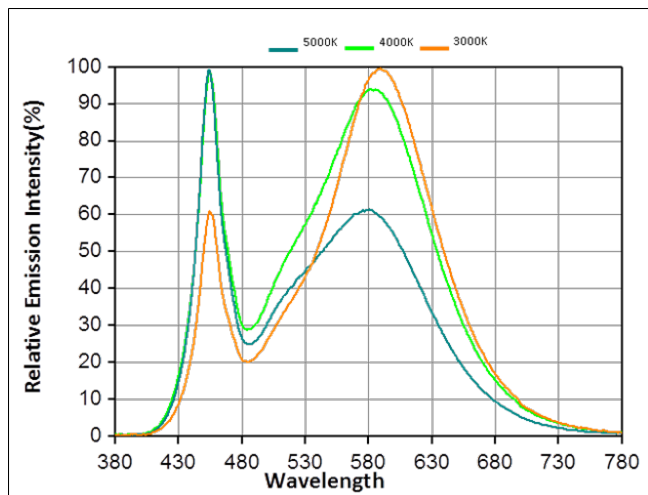
CRI Ra 80+



CRI Ra 90+

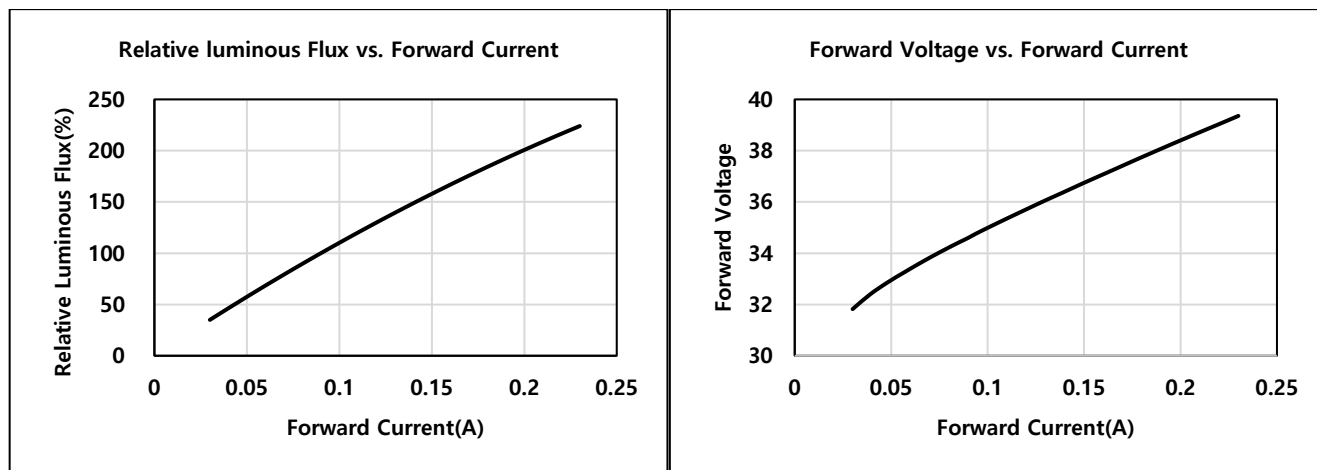


CRI Ra 70+

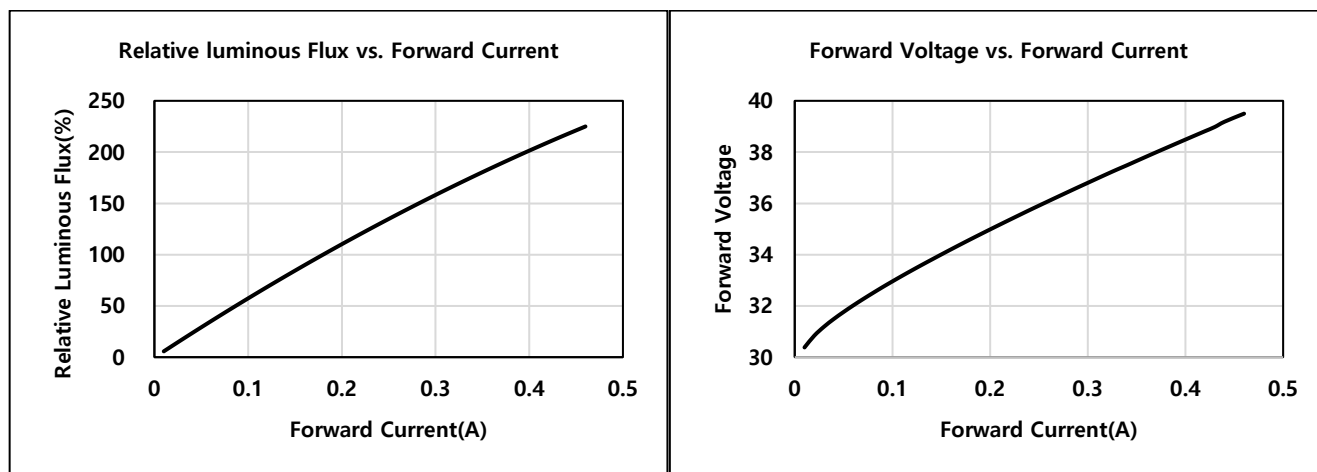


b) Forward Current Characteristics ($T_J = 85^\circ\text{C}$)

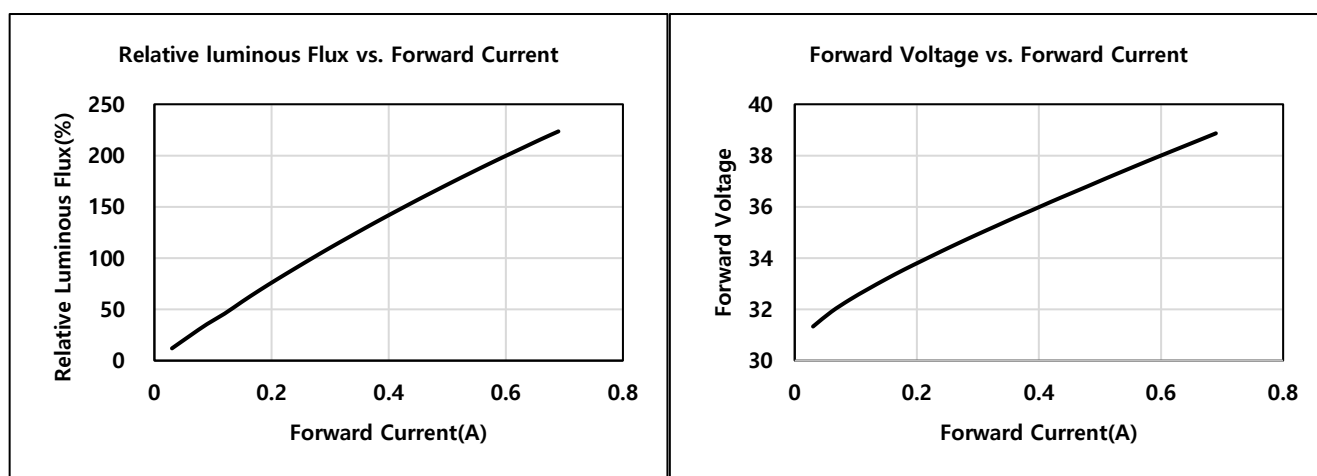
1) LC003D



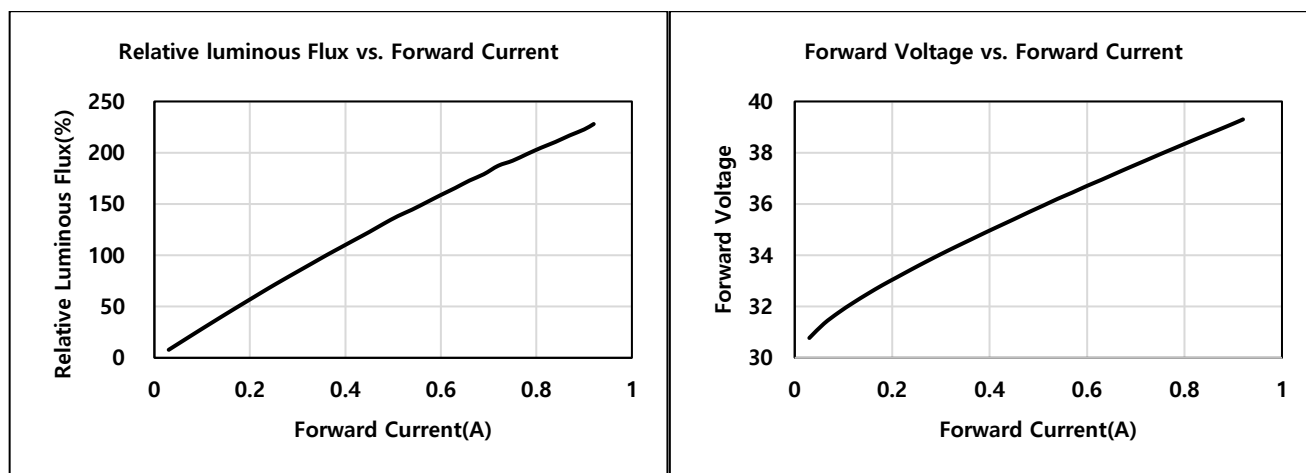
2) LC006D



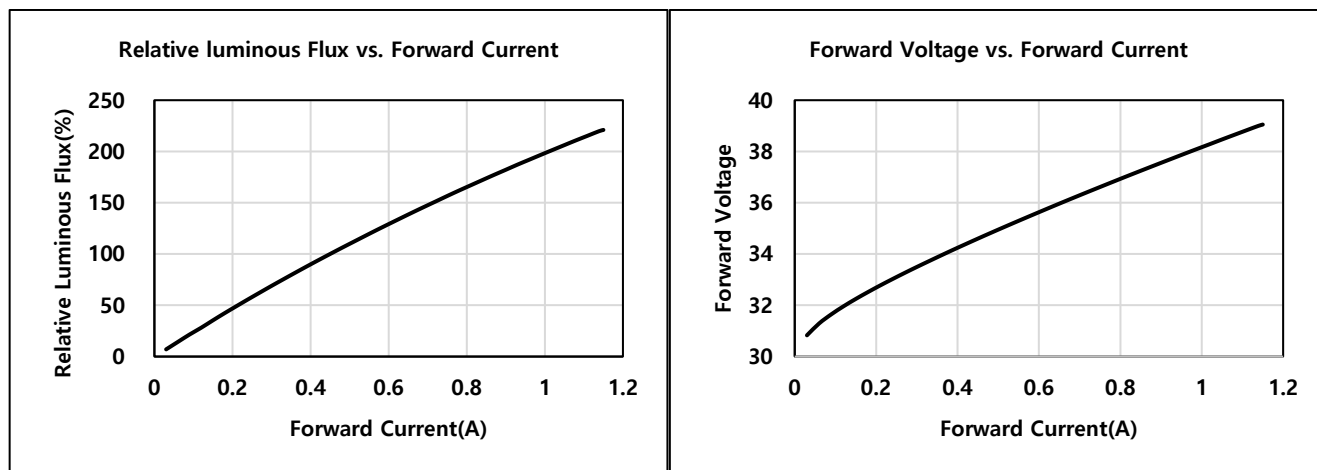
3) LC009D



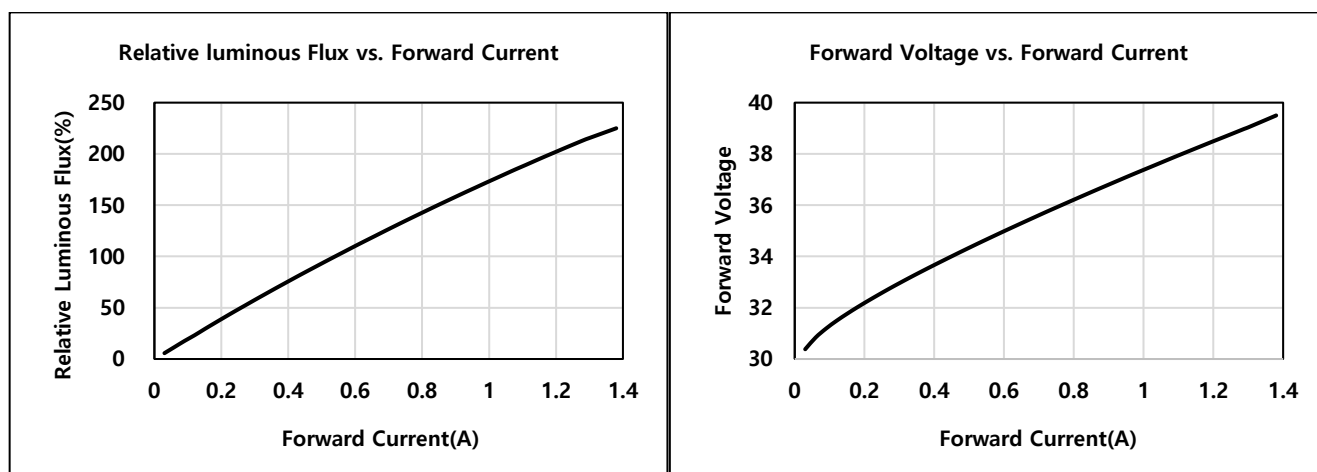
4) LC013D



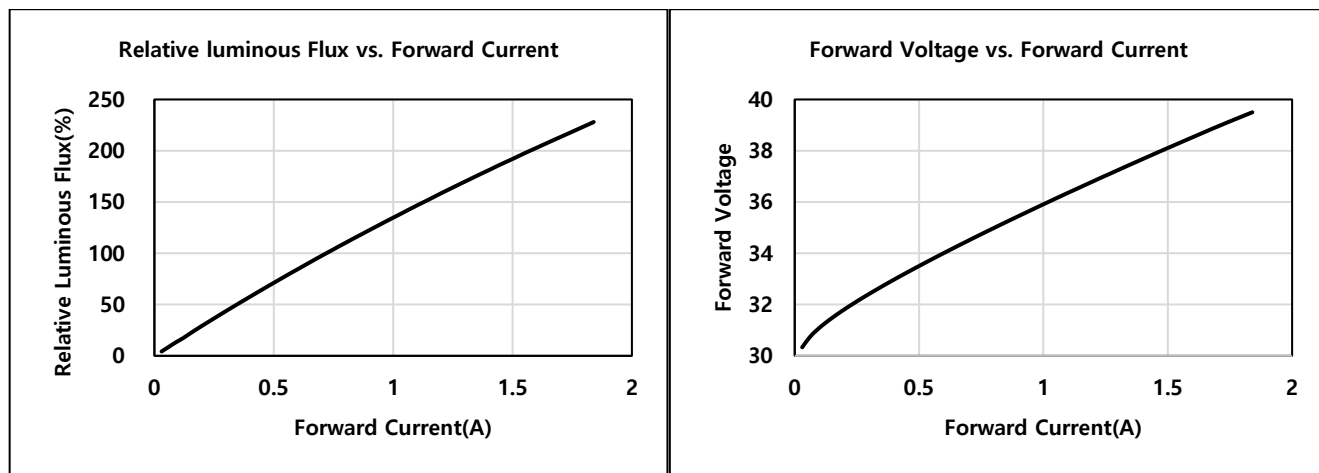
5) LC016D



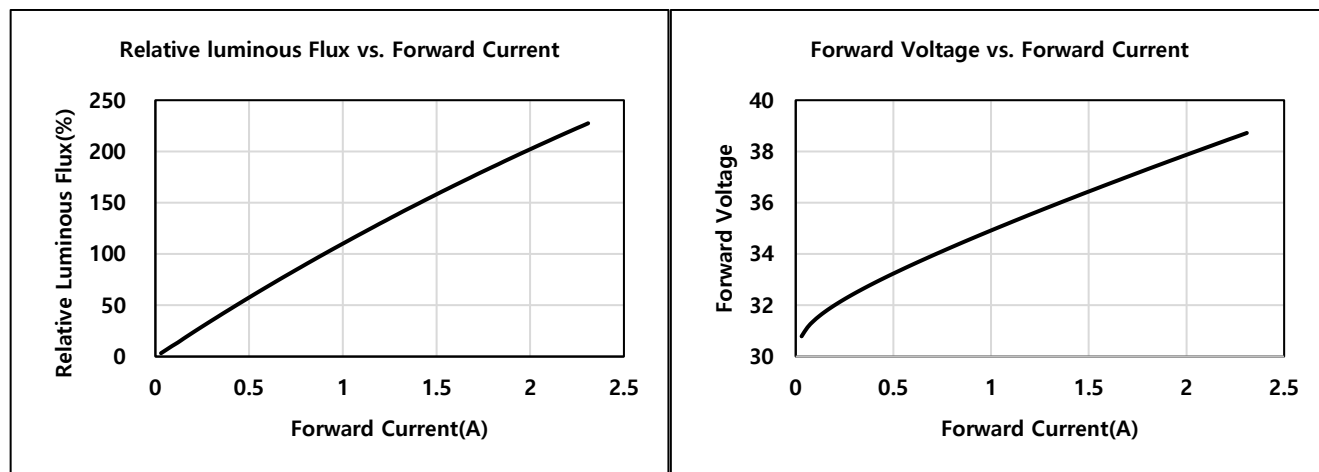
6) LC019D



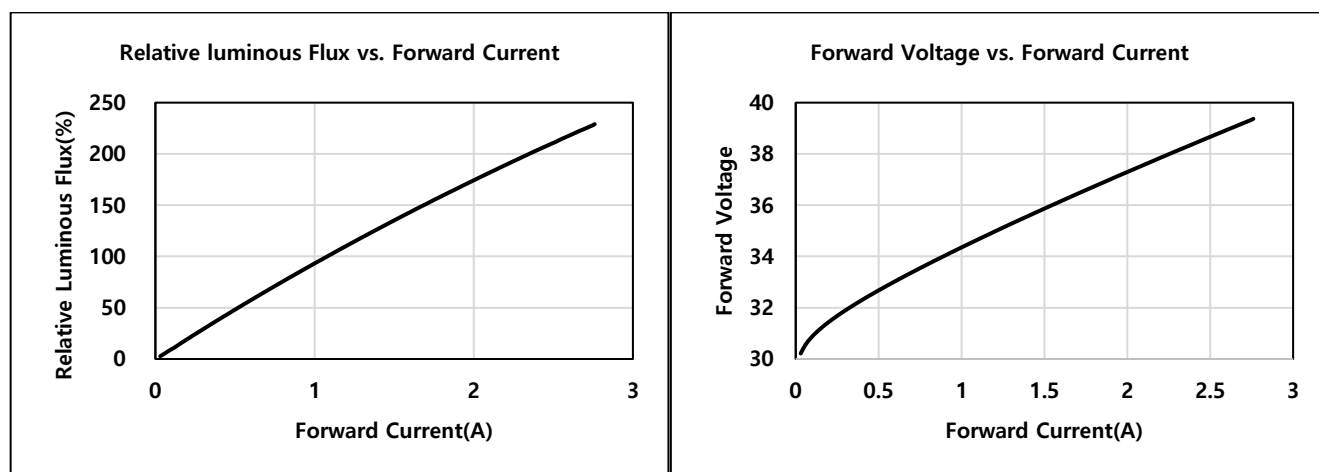
7) LC026D



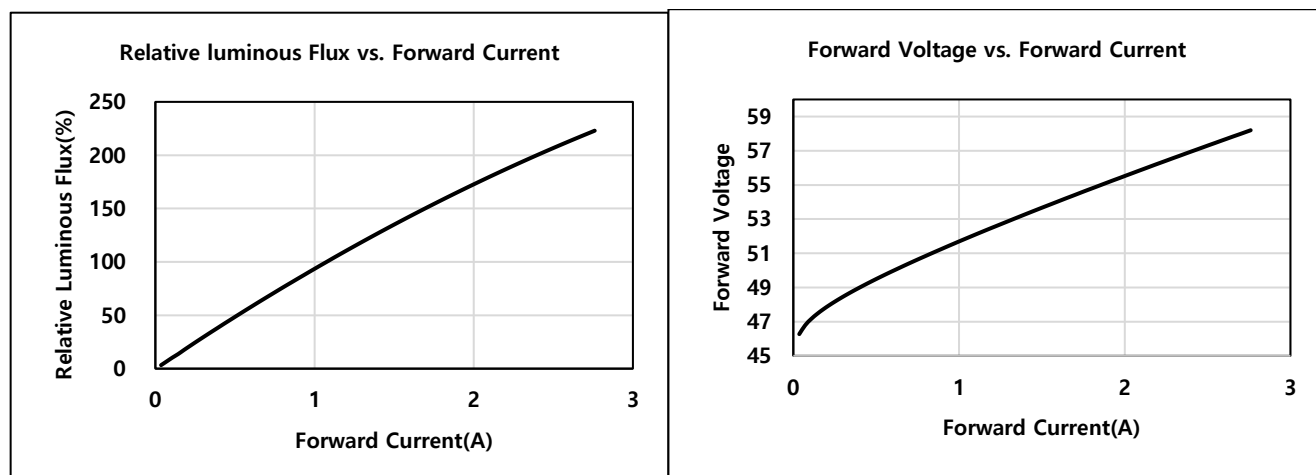
8) LC033D



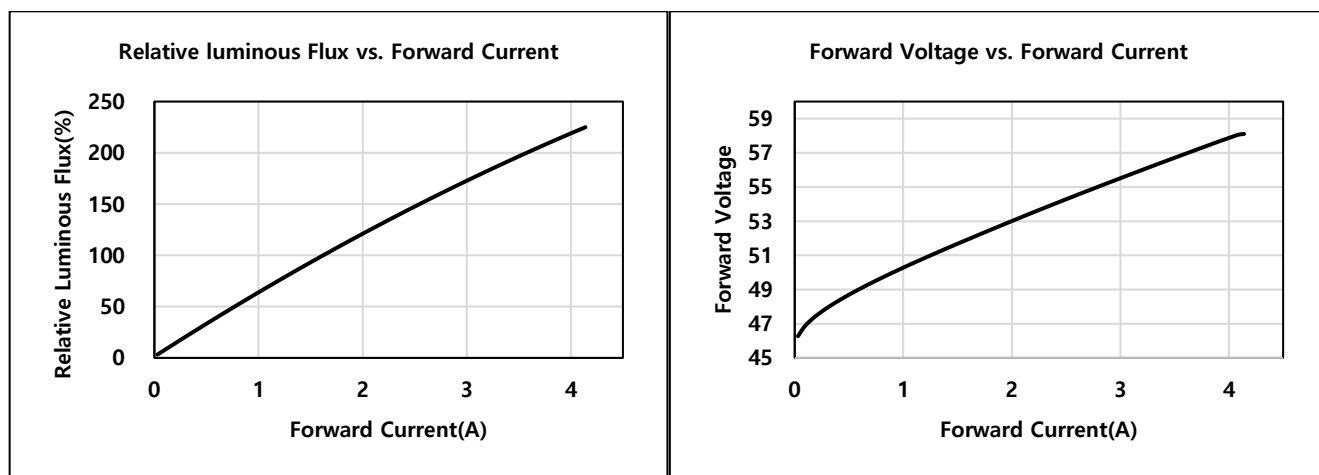
9) LC040D



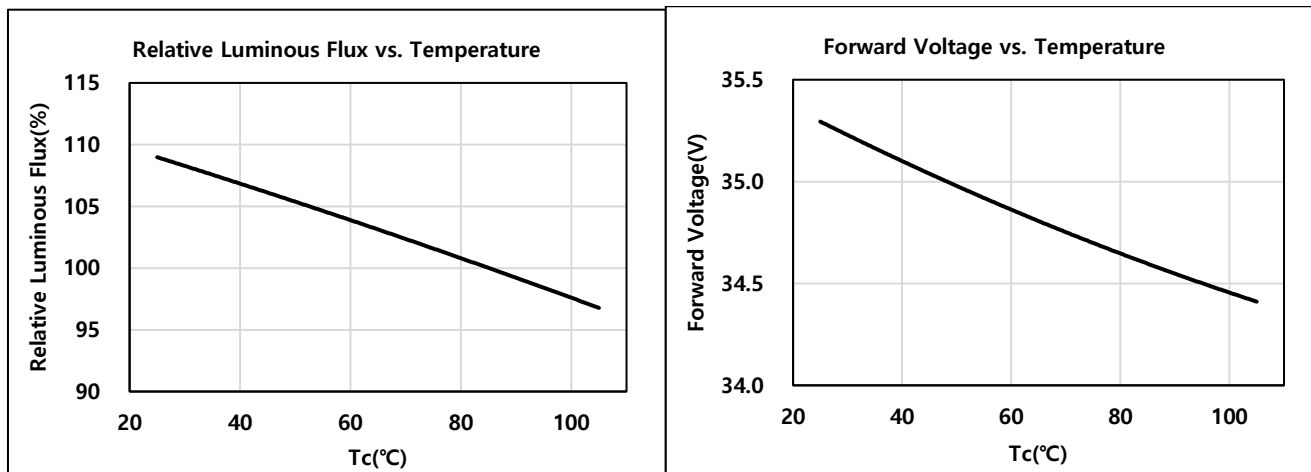
10) LC060D



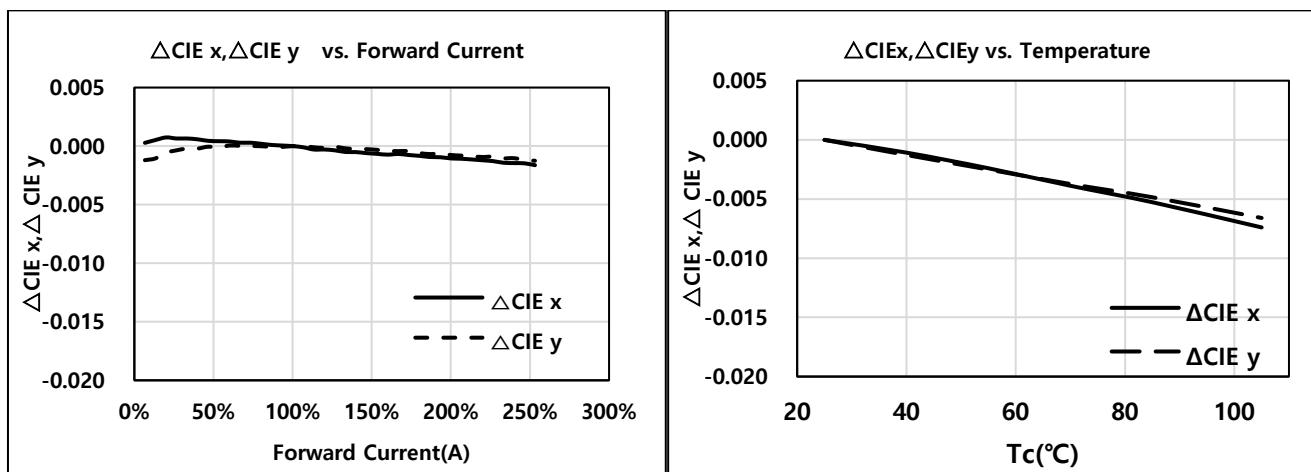
11) LC080D



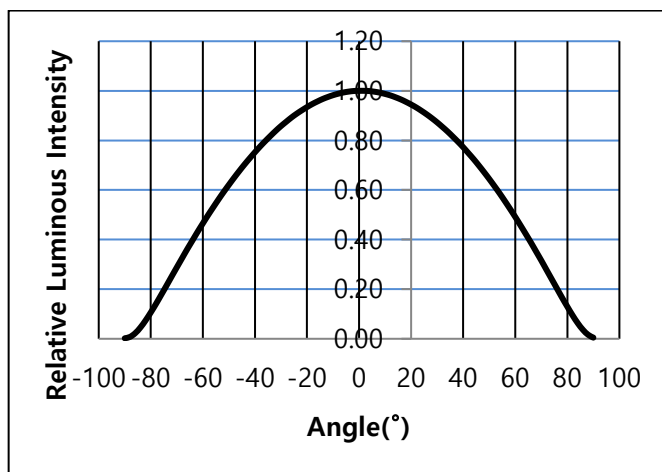
c) Temperature Characteristics(I_f = Sorting Current)



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

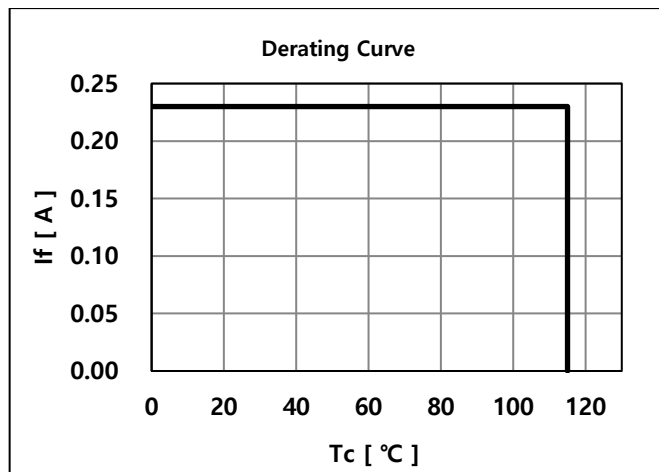


e) Beam Angle Characteristics (I_f = Sorting Current, $T_J = 85^{\circ}\text{C}$)

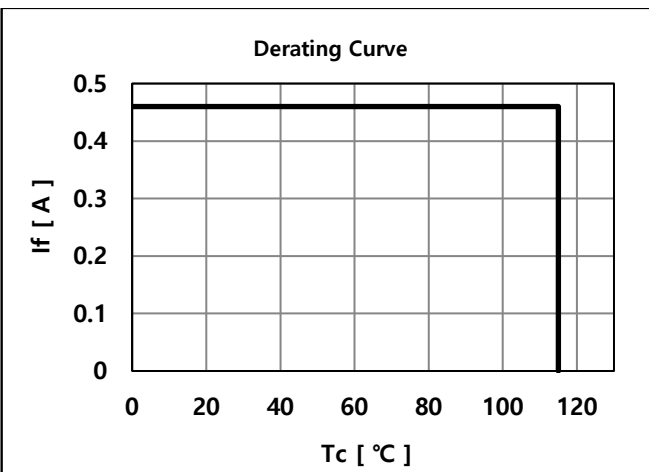


f) Derating Characteristics

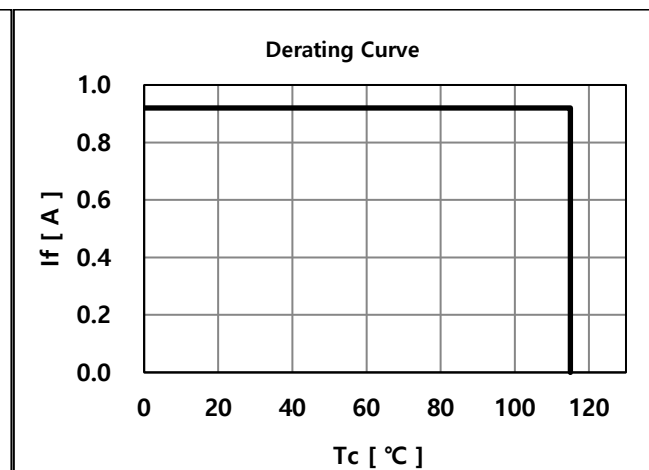
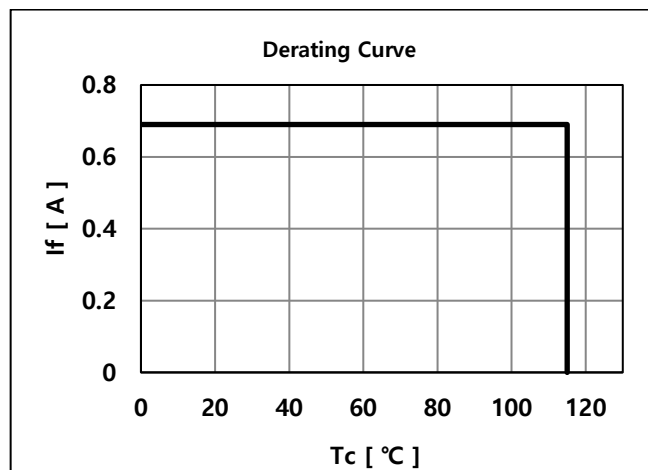
1) LC003D



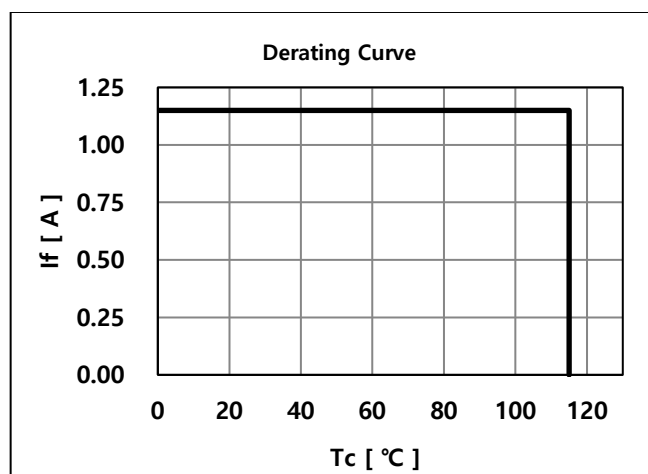
2) LC006D



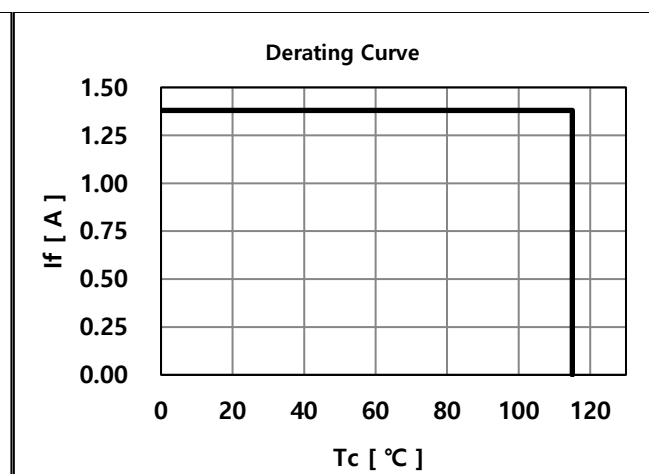
3) LC009D4) LC0013D



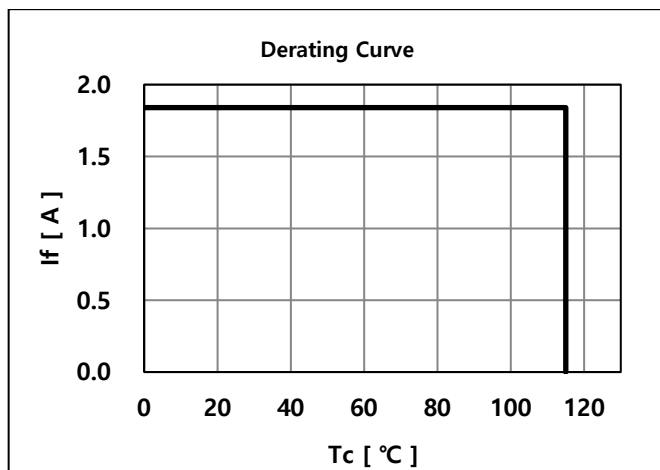
5) LC016D



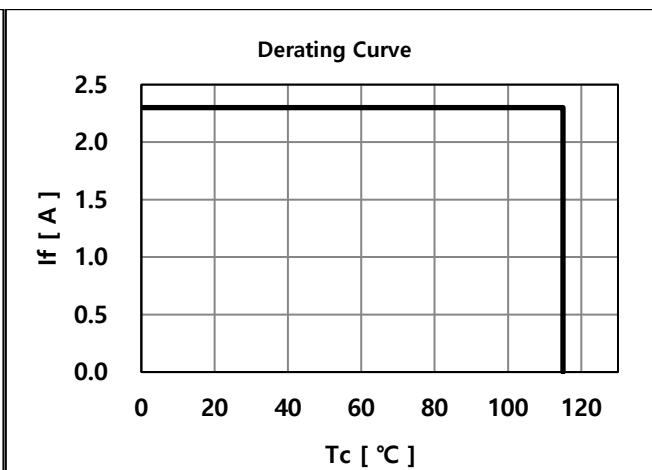
6) LC0019D



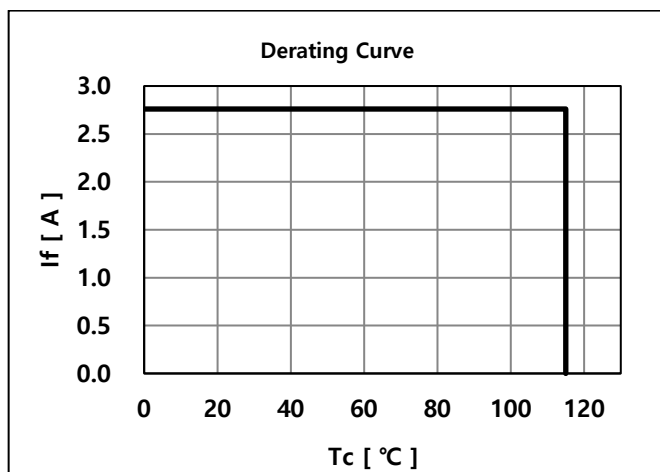
7) LC026D



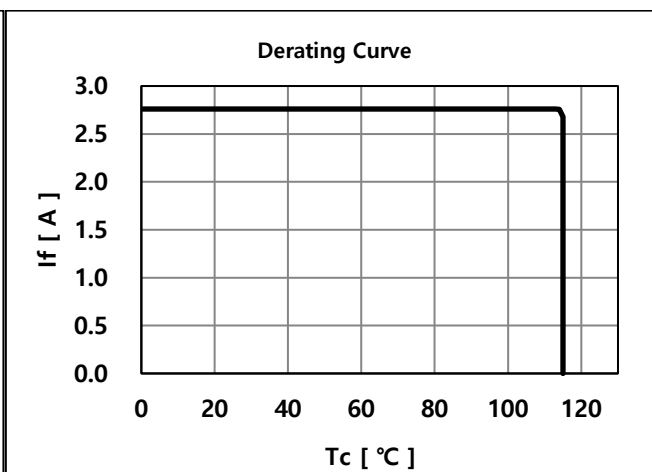
8) LC0033D



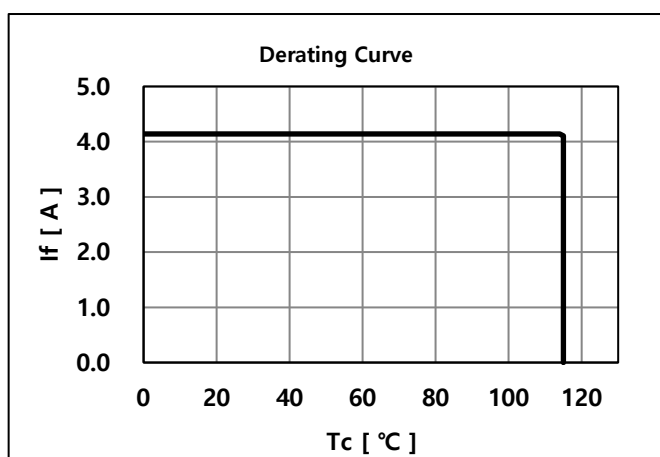
9) LC040D



10) LC060D

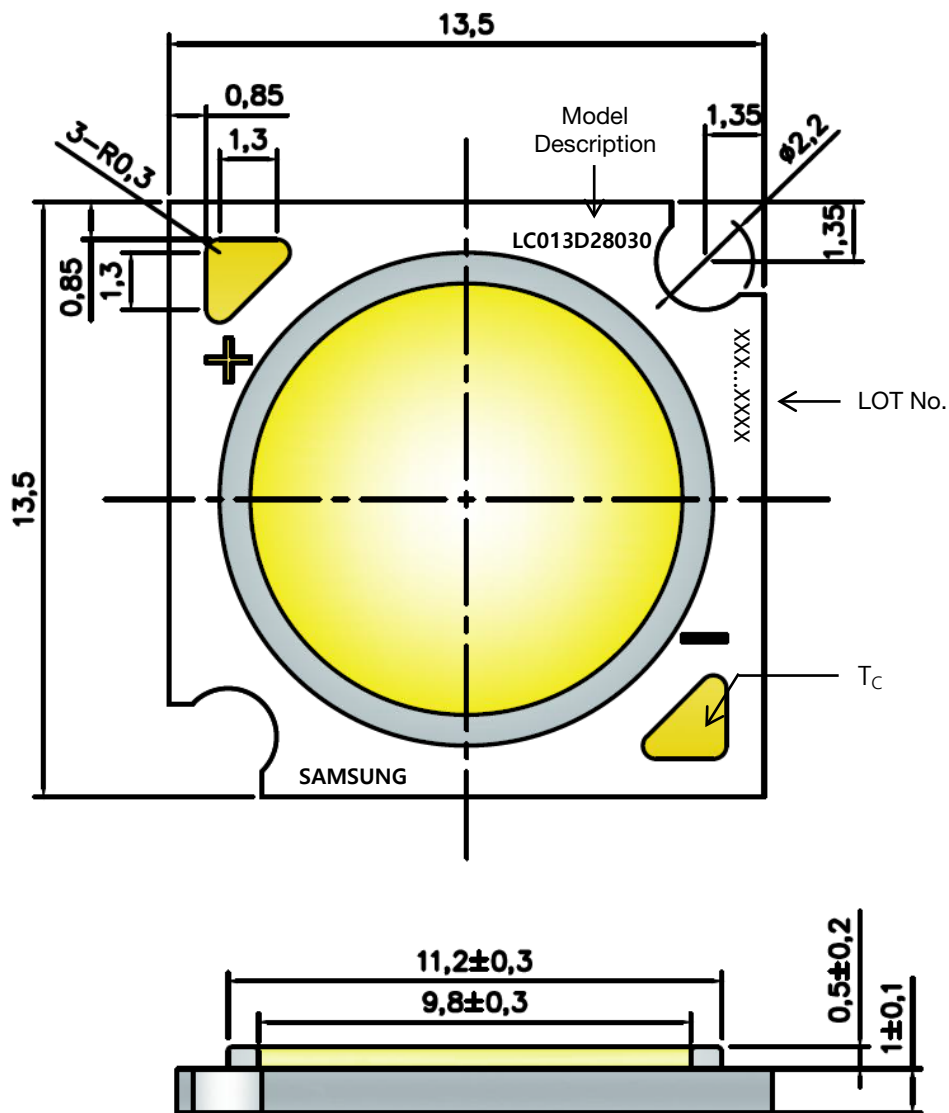


11) LC080D



4. Outline Drawing & Dimension

※ Model : LC003D, LC006D, LC009D, LC013D

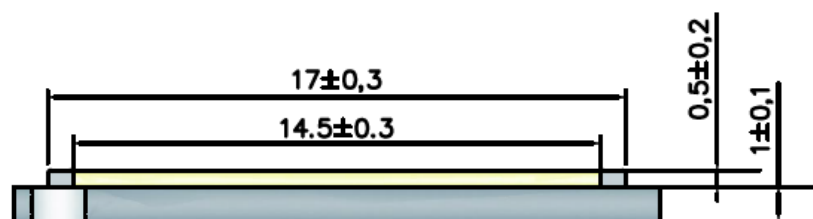
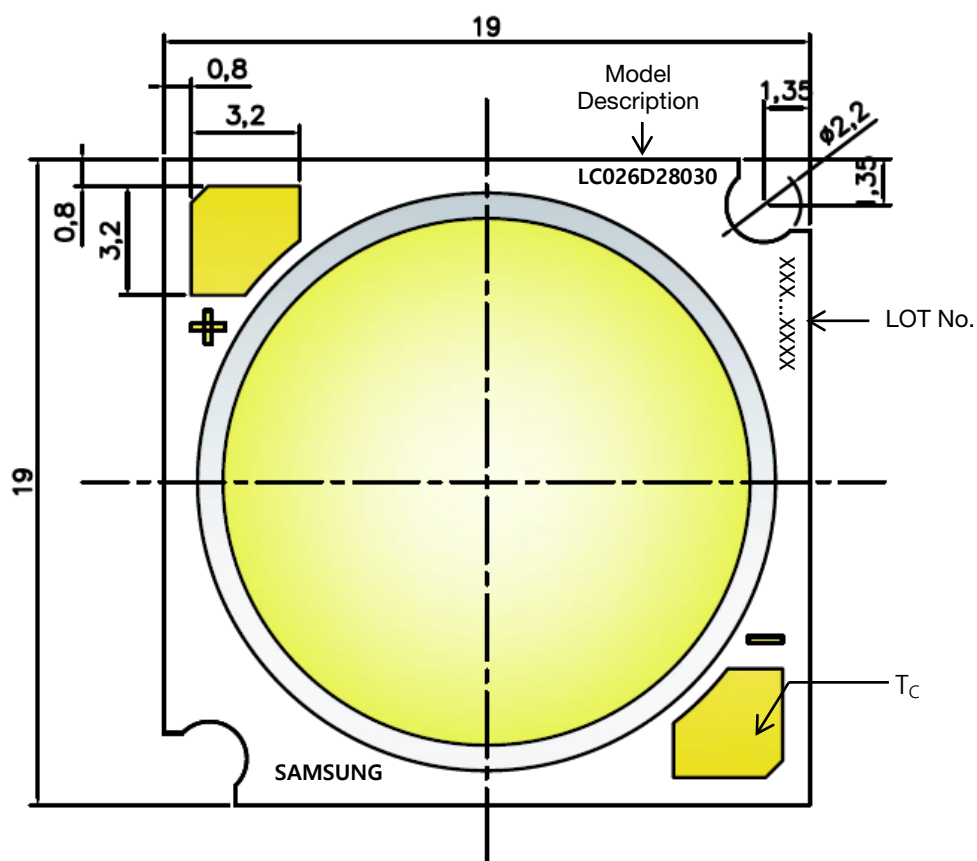


1. Unit: mm
2. Tolerance: ± 0.3 mm

Item	Dimension	Tolerance	Unit
Length	13.5	±0.20	mm
Width	13.5	±0.20	mm
Dam	0.5	±0.20	mm
Substrate	1	±0.10	mm
Height	From the bottom of the substrate to the LES	2	Max
LES Diameter	Light Emitting Surface	9.8	±0.30

Note: Denoted product information above is only an example
(LC013D28030 :LC013D, Gen3, Ra80, 3000K)

※ Model : LC016D, LC019D, LC026D, LC033D

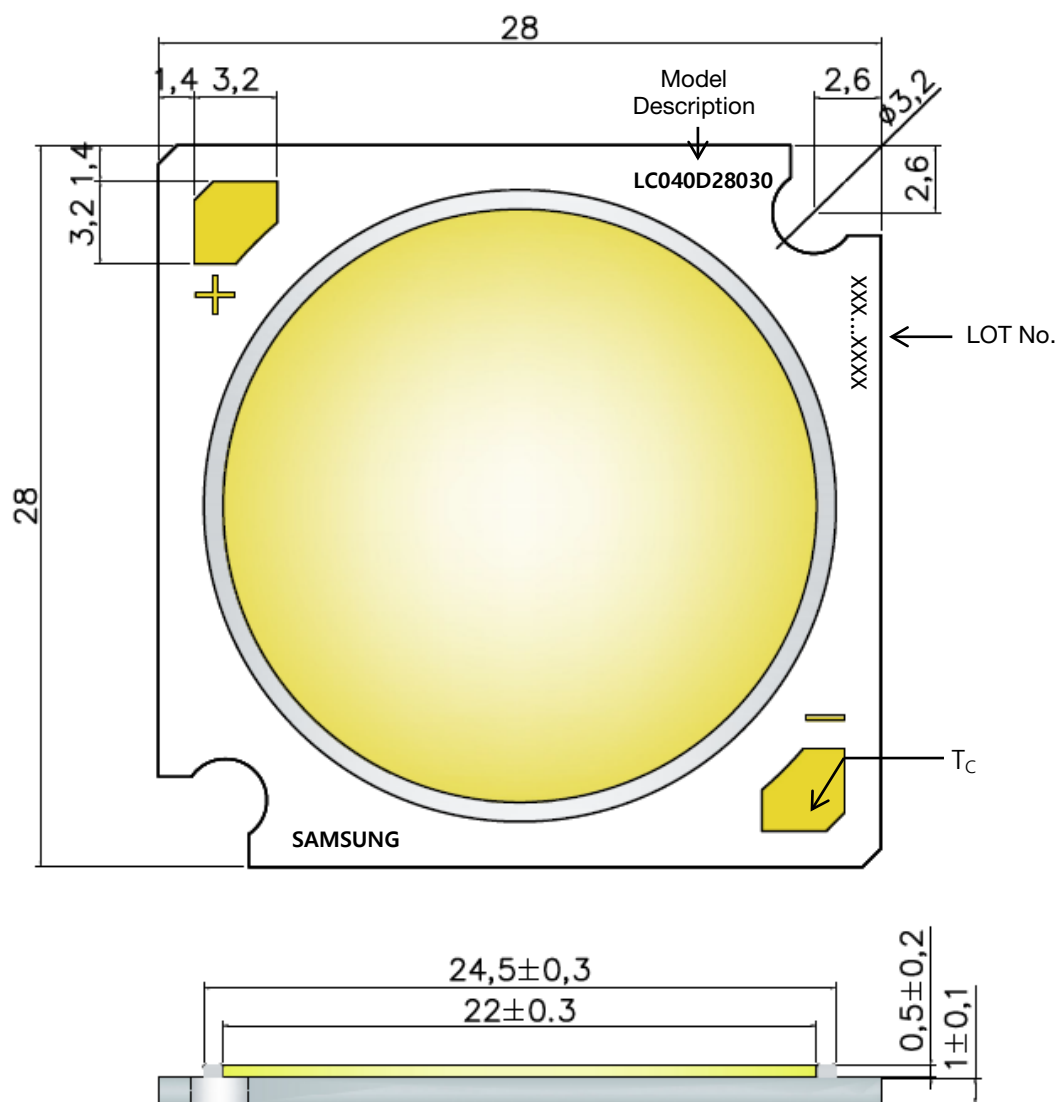


1. Unit: mm
2. Tolerance: ± 0.3 mm

Item	Dimension	Tolerance	Unit
Length	19.0	± 0.20	mm
Width	19.0	± 0.20	mm
Height	Dam	± 0.20	mm
	Substrate	± 0.10	mm
	From the bottom of the substrate to the LES	Max	mm
LES Diameter	Light Emitting Surface	± 0.30	mm

Note: Denoted product information above is only an example
(LC026D28030 : LC026D, Gen3, CRI80+, 3000K)

※ Model : LC040D, LC060D, LC080D



1. Unit: mm
2. Tolerance: ± 0.3 mm

	Item	Dimension	Tolerance	Unit
Length		28.0	± 0.20	mm
Width		28.0	± 0.20	mm
Height	Dam	0.5	± 0.20	mm
	Substrate	1.0	± 0.10	mm
	From the bottom of the substrate to the LES	2.0	Max	mm
LES Diameter	Light Emitting Surface	22.0	± 0.30	mm

Note: Denoted product information above is only an example
(LC040D28030 : LC040D, Gen2, CRI80+, 3000K)

5. Reliability Test Items & Conditions

a) Test Items

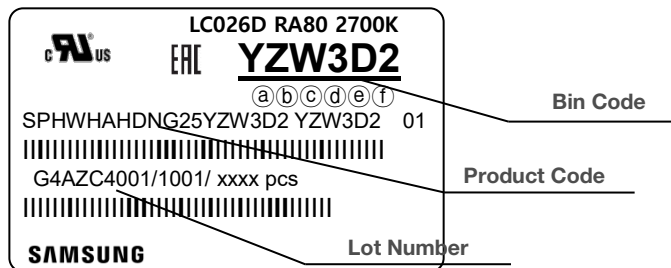
Test Item	Test Condition	Test Hour / Cycle
High Temperature Humidity Life Test	60 °C, 90 % RH,, DC Derating, I_F	1000 h
High Temperature Life Test	85 °C, DC Derating, I_F	1000 h
Low Temperature Life Test	-40 °C, DC, Derating I_F	1000 h
High Temperature Storage	120 °C	1000 h
Low Temperature Storage	-40 °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)	R1: 10 M Ω R2: 1.5 k Ω C: 100 pF V: ± 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	1500g, 0.5 ms each of the 6 surfaces (3axis x 2 sides)	5 times
Sulfur Resistance	25 °C, 75%, H ₂ S 15 ppm	504h
High Temperature Humidity Life Test	60 °C, 90 % RH,, DC Derating, I_F	1000 h

b) Criteria for Judging the Damage

Item	Symbol	Test Condition ($T_c = 25\text{ °C}$)	Limit	
			Min.	Max.
Forward Voltage	V_F	$I_F = \text{Sorting Current}$	L.S.L. * 0.9	U.S.L. * 1.1
Luminous Flux	ν	$I_F = \text{Sorting Current}$	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 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 (D: 2019, E: 2020, F: 2021...)

⑤ : Month (1~9, A, B, C)

⑥⑦⑧⑨ : Day (1~9, A, B~V)

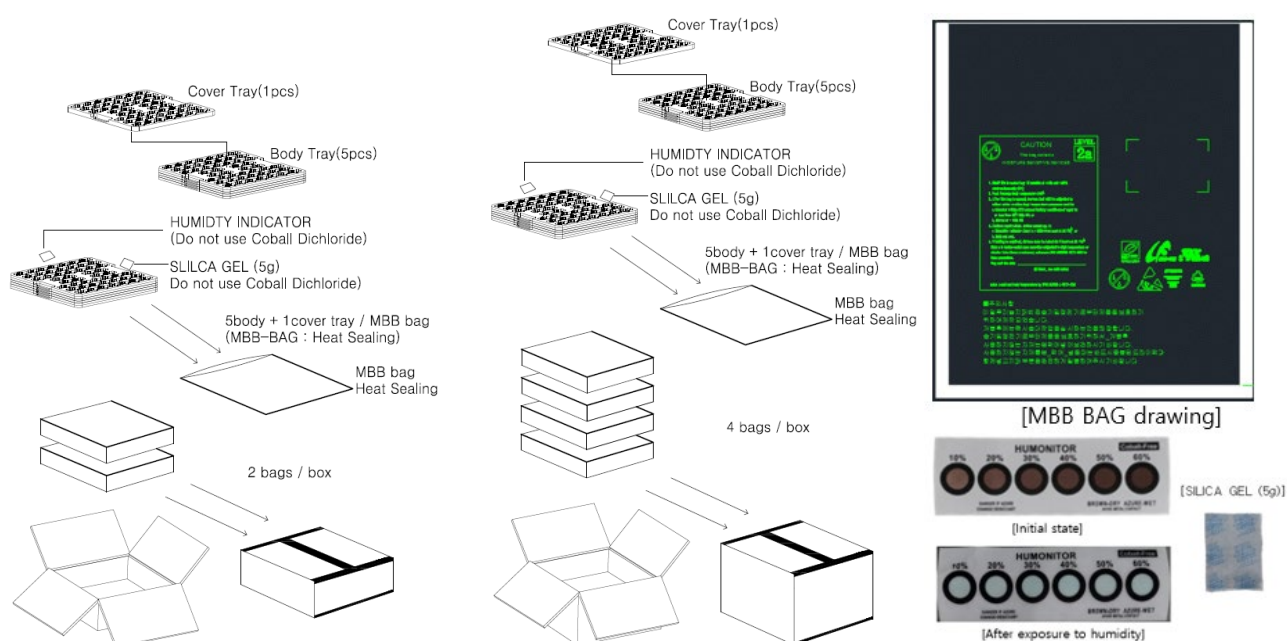
ⒶⒷⒸ : Product serial number (001 ~ 999)

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

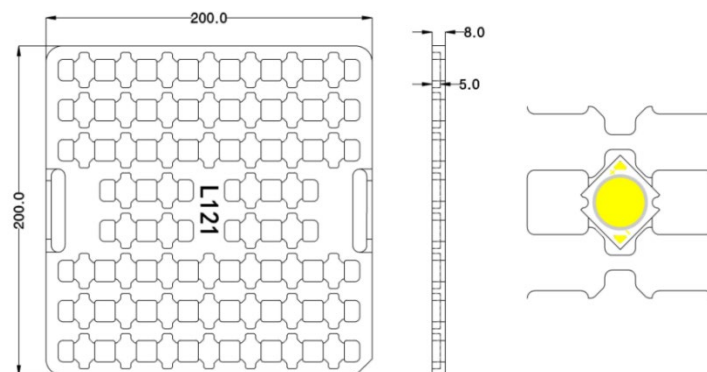
a) Packing Structure



※ Small Box

※ Middle Box

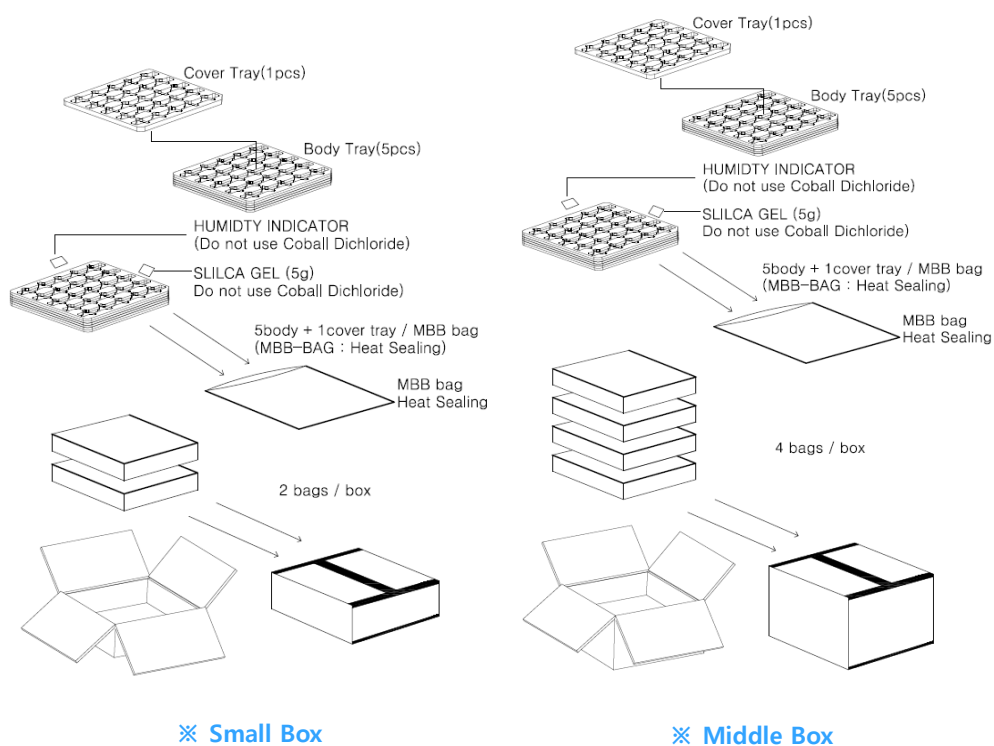
b) Tray



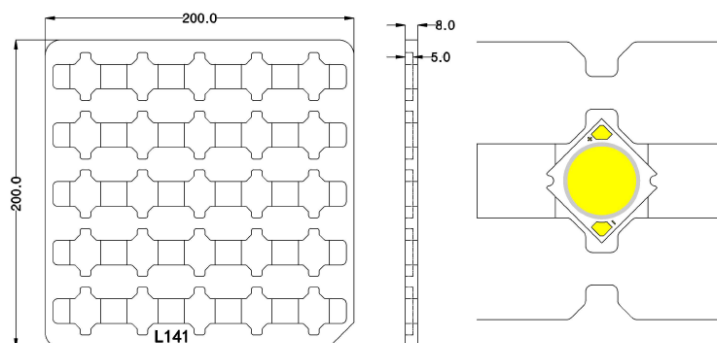
※ Model : LC016D, LC019D, LC026D, LC033D

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



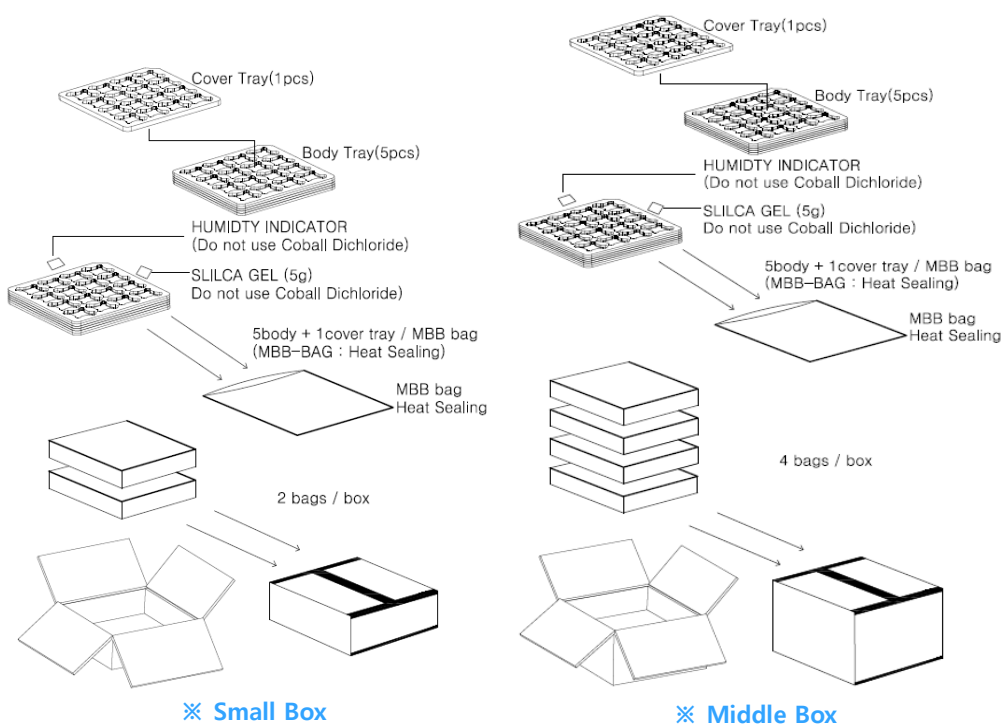
b) Tray



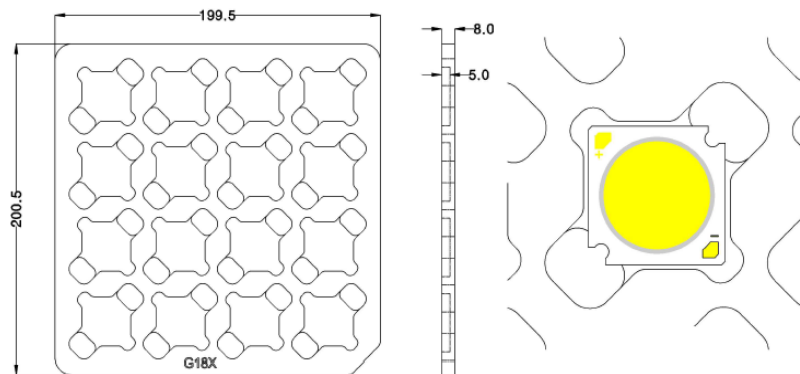
※ Model : LC040D, LC060D, LC080D

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

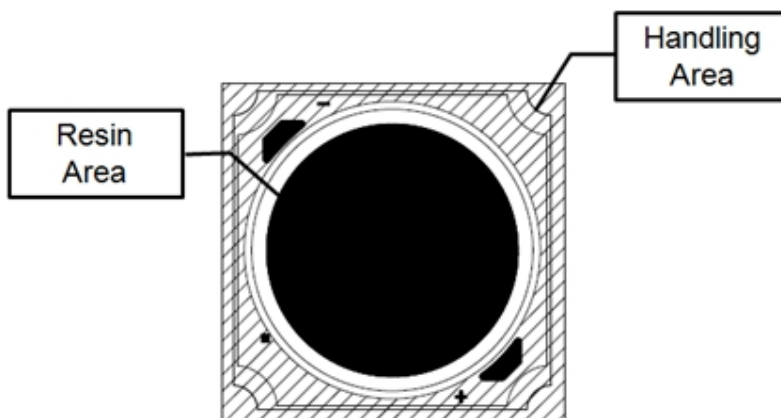


b) Tray



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, 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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