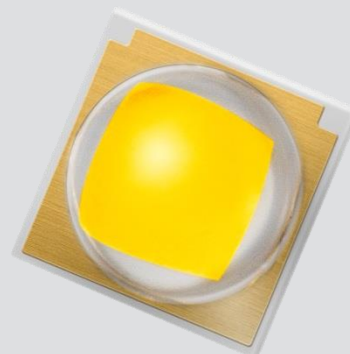


High Power LED Series 3535 Ceramic Hot Binning

LH351B



High efficacy and high quality color rendering makes the LH351B suitable use in a broad range of applications

Features & Benefits

- Operates at a maximum current of up to 1.5 A
- Uniform light distribution under any beam angle
- 80 CRI makes it well suited for most applications
- Hot binning @ 85 °C
- Completed 10,000 hours of LM-80 testing @ 1 A, 105 °C

Applications

- Indoor Lighting: Spotlight, Downlight
- Outdoor Lighting: Street Light, Tunnel Light, Security Light, Parking Lot Light
- Industrial Lighting: High Bay Light, Low Bay Light
- Consumer Lighting: Torch Light



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1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Operating Temperature	T_a	-40 ~ +85	°C	-
Storage Temperature	T_{stg}	-40 ~ +120	°C	-
LED Junction Temperature	T_j	150	°C	-
Forward Current	I_F	1500	mA	-
Assembly Process Temperature	-	260 <10	°C s	-
ESD (HBM)	-	±5	kV	-

b) Electro-optical Characteristics

Item	Unit	Nominal CCT (K)	Condition		Value Typ.
			I _F (mA)	T _J (°C)	
Luminous Flux (Φ _v)	lm	3000 (80 CRI)	350	25	129
			350	85	117
			700	85	211
			1000	85	279
			1500	85	376
		4000 (70 CRI)	350	25	164
			350	85	152
			700	85	274
			1000	85	363
			1500	85	477
Forward Voltage (V _F)	V		350	25	2.94
			350	85	2.80
			700	85	2.91
			1000	85	2.98
			1500	85	3.07
Reverse Voltage (@ 5 mA)	V		350	25	0.7~1.2
Thermal Resistance (junction to solder point)	°C/W		350	25	4
Beam Angle	°		350	25	120

Notes:

- 1) Samsung maintains measurement tolerance of: luminous flux = ±7 %, forward voltage = ±0.1 V
- 2) Characteristics @ 25 °C are for reference only

c) Luminous Flux Characteristics (T_j = 85 °C)

Nominal CCT (K)	CRI (R _a) Min. ¹⁾	Sorting @ 350 mA (lm)		Calculated Minimum Flux ²⁾ (lm)		
		Flux Rank	Flux Min. ¹⁾	@ 700 mA	@ 1000 mA	@ 1500 mA
2700	80	F3 (G3)	90 (100)	162 (177)	213 (233)	283 (309)
		G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)
		H3 (J3)	110 (120)	197 (216)	259 (284)	343 (377)
3000	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
	80	G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)
		H3 (J3)	110 (120)	197 (216)	259 (284)	343 (377)
3500	80	G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)
		H3 (J3)	110 (120)	197 (216)	259 (284)	343 (377)
4000	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)
		N3 (P3)	150 (160)	270 (288)	355 (379)	471 (502)
	80	G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)
		H3 (J3)	110 (120)	197 (216)	259 (284)	343 (377)
		J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)

(value in bracket): Minimum luminous flux @ 25 °C, for reference only

Notes:

- 1) Samsung maintains measurement tolerance of: luminous flux = ±7 %, CRI = ±3
- 2) Calculated minimum flux values are for reference only

c) Luminous Flux Characteristics ($T_j = 85\text{ }^{\circ}\text{C}$)

Nominal CCT (K)	CRI (R _a) Min. ¹⁾	Sorting @ 350 mA (lm)		Calculated Minimum Flux ²⁾ (lm)		
		Flux Rank	Flux Min. ¹⁾	@ 700 mA	@ 1000 mA	@ 1500 mA
5000	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)
		N3 (P3)	150 (160)	270 (288))	355 (379)	471 (502)
	75	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)
	80	K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)
5700	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)
		N3 (P3)	150 (160)	270 (288))	355 (379)	471 (502)
	75	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)
6500	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)
		M3 (N3)	140 (150)	253 (270)	333 (355)	441 (471)

(value in bracket): Minimum luminous flux @ 25 °C, for reference only

Notes:

- 1) Samsung maintains measurement tolerance of: luminous flux = $\pm 7\%$, CRI = ± 3
- 2) Calculated minimum flux values are for reference only

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	2	L	3	D	3	0	E	D	4	V	0	G	3

Digit	PKG Information	Code	Specification
1 2 3	Samsung Package High Power	SPH	
4 5	Color	WH	White
6	Product Version	2	
7 8	Product	L3	LH351 Series
9	Lens Type	D	Dome lens
10	Internal Code	3	
11	Not Defined	0	Default
12	CRI & Sorting Temperature	C D E	Min. 70 Min. 75 85 °C Min. 80
13 14	Forward Voltage (V)	D 4	2.6~3.0 Bin Code: D2 2.6~2.8 F2 2.8~3.0
15 16	CCT (K)	W★ V★ U★ T★ R T Q T P T	2700 W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG, WM 3000 V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG, VM 3500 U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG, UM 4000 T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG, TM 5000 R1, R2, R3, R4 5700 Q1, Q2, Q3, Q4 6500 P1, P2, P3, P4
			★ : "0" (Whole bin), "P" (Quarter bin), or "M" (MacAdam 3-step ellipse bin)
17 18	Luminous Flux (lm)	F 3 G 3 H 3 J 3 K 3 M 3 N 3	90~120 90~100 100~130 100~110 110~140 110~120 120~150 120~130 130~160 130~140 140~170 140~150 150~180 150~160 160~170 170~180 F 3 G 3 H 3 J 3 K 3 M 3 N 3
			Digit 17: Min. spec. Digit 18: The number of higher bin(s) from min. spec. e.g.: F1 = 90~100 lm, F3 = 90~120 lm

a) Luminous Flux Bins ($I_f = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Flux Rank	Flux Bin	Flux Range (Φ _v , lm)
2700	80	SPHWH2L3D30ED4W☆F3	F3	F1	90 ~ 100
				G1	100 ~ 110
				H1	110 ~ 120
		SPHWH2L3D30ED4W☆G3	G3	G1	100 ~ 110
				H1	110 ~ 120
				J1	120 ~ 130
	70	SPHWH2L3D30ED4W☆H3	H3	H1	110 ~ 120
				J1	120 ~ 130
				K1	130 ~ 140
		SPHWH2L3D30CD4V☆J3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
3000	80	SPHWH2L3D30CD4V☆K3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30ED4V☆G3	G3	G1	100 ~ 110
				H1	110 ~ 120
				J1	120 ~ 130
	70	SPHWH2L3D30ED4V☆H3	H3	H1	110 ~ 120
				J1	120 ~ 130
				K1	130 ~ 140
3500	80	SPHWH2L3D30ED4U☆G3	G3	G1	100 ~ 110
				H1	110 ~ 120
				J1	120 ~ 130
				H1	110 ~ 120
		SPHWH2L3D30ED4U☆H3	H3	J1	120 ~ 130
				K1	130 ~ 140
				K1	130 ~ 140
				K1	130 ~ 140

"☆" can be "0" (Whole bin), "P" (Quarter bin), or "M" (MacAdam 3-step ellipse bin) of the color binning

a) Luminous Flux Bins ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

Nominal CCT (K)	CRI (R_a) Min.	Product Code	Flux Rank	Flux Bin	Flux Range (Φ_v , lm)
4000	70	SPHWH2L3D30CD4T☆J3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
		SPHWH2L3D30CD4T☆K3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30CD4T☆M3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170
	80	SPHWH2L3D30CD4T☆N3	N3	N1	150 ~ 160
				P1	160 ~ 170
				Q1	170 ~ 180
		SPHWH2L3D30ED4T☆G3	G3	G1	100 ~ 110
				H1	110 ~ 120
				J1	120 ~ 130
		SPHWH2L3D30ED4T☆H3	H3	H1	110 ~ 120
				J1	120 ~ 130
				K1	130 ~ 140
		SPHWH2L3D30ED4T☆J3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150

"☆" can be "0" (Whole bin), "P" (Quarter bin), or "M" (MacAdam 3-step ellipse bin) of the color binning

a) Luminous Flux Bins ($I_f = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Flux Rank	Flux Bin	Flux Range (Φ_v , lm)
5000	70	SPHWH2L3D30CD4RTJ3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
		SPHWH2L3D30CD4RTK3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30CD4RTM3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170
		SPHWH2L3D30CD4RTN3	N3	N1	150 ~ 160
				P1	160 ~ 170
				Q1	170 ~ 180
	75	SPHWH2L3D30DD4RTJ3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
		SPHWH2L3D30DD4RTK3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30DD4RTM3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170
	80	SPHWH2L3D30ED4RTK3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30ED4RTM3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170

a) Luminous Flux Bins ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Flux Rank	Flux Bin	Flux Range (Φ _v , lm)
5700	70	SPHWH2L3D30CD4QTJ3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
		SPHWH2L3D30CD4QTK3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30CD4QTM3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170
	75	SPHWH2L3D30CD4QTN3	N3	N1	150 ~ 160
				P1	160 ~ 170
				Q1	170 ~ 180
		SPHWH2L3D30DD4QTJ3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
		SPHWH2L3D30DD4QTK3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
6500	70	SPHWH2L3D30DD4QTM3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170
		SPHWH2L3D30CD4PTJ3	J3	J1	120 ~ 130
				K1	130 ~ 140
				M1	140 ~ 150
		SPHWH2L3D30CD4PTK3	K3	K1	130 ~ 140
				M1	140 ~ 150
				N1	150 ~ 160
		SPHWH2L3D30CD4PTM3	M3	M1	140 ~ 150
				N1	150 ~ 160
				P1	160 ~ 170

b) Color Bins ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Color Rank	Chromaticity Bins
2700	80	SPHWH2L3D30ED4W0F3	W0 (Whole bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG
		SPHWH2L3D30ED4W0G3		
		SPHWH2L3D30ED4W0H3		
		SPHWH2L3D30ED4WPF3	WP (Quarter bin)	W6, W7, WA, WB
		SPHWH2L3D30ED4WPG3		
		SPHWH2L3D30ED4WPH3		
		SPHWH2L3D30ED4WMF3	WM (MacAdam 3-step)	WM
		SPHWH2L3D30ED4WMG3		
		SPHWH2L3D30ED4WMH3		
3000	70	SPHWH2L3D30CD4V0J3	V0 (Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
		SPHWH2L3D30CD4V0K3		
		SPHWH2L3D30CD4VPJ3	VP (Quarter bin)	V6, V7, VA, VB
		SPHWH2L3D30CD4VPK3		
	80	SPHWH2L3D30CD4VMJ3	VM (MacAdam 3-step)	VM
		SPHWH2L3D30CD4VMK3		
		SPHWH2L3D30ED4V0G3	V0 (Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
		SPHWH2L3D30ED4V0H3		
3500	80	SPHWH2L3D30ED4VPG3	VP (Quarter bin)	V6, V7, VA, VB
		SPHWH2L3D30ED4VPH3		
		SPHWH2L3D30ED4VMG3	VM (MacAdam 3-step)	VM
		SPHWH2L3D30ED4VMH3		
	80	SPHWH2L3D30ED4U0G3	U0 (Whole bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG
		SPHWH2L3D30ED4U0H3		
		SPHWH2L3D30ED4UPG3	UP (Quarter bin)	U6, U7, UA, UB
		SPHWH2L3D30ED4UPH3		
		SPHWH2L3D30ED4UMG3	UM (MacAdam 3-step)	UM
		SPHWH2L3D30ED4UMH3		

b) Color Bins ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Color Rank	Chromaticity Bins
4000	70	SPHWH2L3D30CD4T0J3	T0 (Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
		SPHWH2L3D30CD4T0K3		
		SPHWH2L3D30CD4T0M3		
		SPHWH2L3D30CD4T0N3		
		SPHWH2L3D30CD4TPJ3	TP (Quarter bin)	T6, T7, TA, TB
		SPHWH2L3D30CD4TPK3		
		SPHWH2L3D30CD4TPM3		
		SPHWH2L3D30CD4TPN3		
		SPHWH2L3D30CD4TMJ3	TM (MacAdam 3-step)	TM
		SPHWH2L3D30CD4TMK3		
		SPHWH2L3D30CD4TMM3		
		SPHWH2L3D30CD4TMN3		
	80	SPHWH2L3D30ED4T0G3	T0 (Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
		SPHWH2L3D30ED4T0H3		
		SPHWH2L3D30ED4T0J3		
		SPHWH2L3D30ED4TPG3	TP (Quarter bin)	T6, T7, TA, TB
		SPHWH2L3D30ED4TPH3		
		SPHWH2L3D30ED4TPJ3		
		SPHWH2L3D30ED4TMG3	TM (MacAdam 3-step)	TM
		SPHWH2L3D30ED4TMH3		
		SPHWH2L3D30ED4TMJ3		
5000	70	SPHWH2L3D30CD4RTJ3		
		SPHWH2L3D30CD4RTK3		
		SPHWH2L3D30CD4RTM3		
		SPHWH2L3D30CD4RTN3		
	75	SPHWH2L3D30DD4RTJ3	RT (Half bin)	R1, R2, R3, R4
		SPHWH2L3D30DD4RTK3		
		SPHWH2L3D30DD4RTM3		
	80	SPHWH2L3D30ED4RTK3		
		SPHWH2L3D30ED4RTM3		

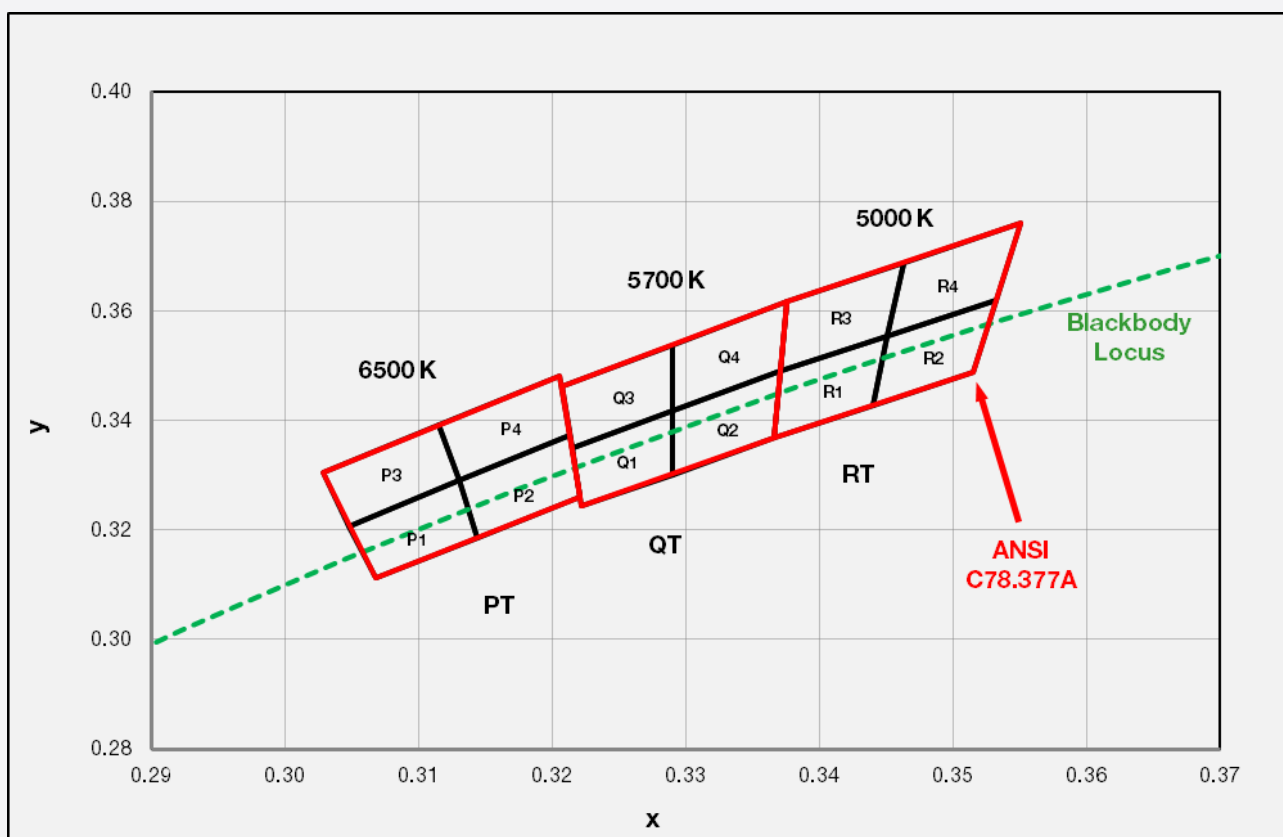
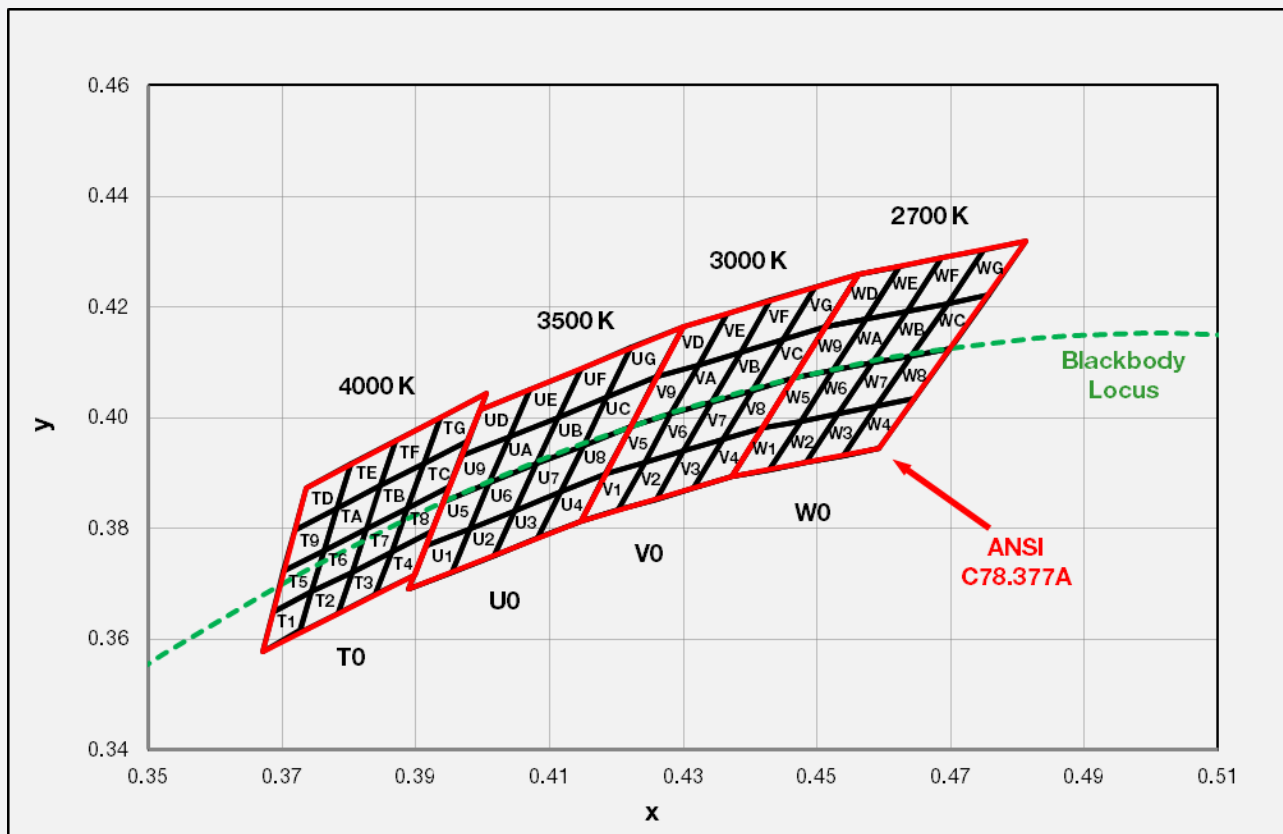
b) Color Bins ($I_F = 350 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Color Rank	Chromaticity Bins
5700	70	SPHWH2L3D30CD4QTJ3	QT (Half bin)	Q1, Q2, Q3, Q4
		SPHWH2L3D30CD4QTK3		
		SPHWH2L3D30CD4QTM3		
	75	SPHWH2L3D30CD4QTN3		
		SPHWH2L3D30DD4QTJ3		
		SPHWH2L3D30DD4QTK3		
6500	70	SPHWH2L3D30DD4QTM3	PT (Half bin)	P1, P2, P3, P4
		SPHWH2L3D30CD4PTJ3		
		SPHWH2L3D30CD4PTK3		
		SPHWH2L3D30CD4PTM3		

c) Voltage Bins ($I_F = 350 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$)

Nominal CCT (K)	CRI (R _a) Min.	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	D4	D2	2.6 ~ 2.8
				F2	2.8 ~ 3.0

d) Chromaticity Region & Coordinates ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)



d) Chromaticity Region & Coordinates ($I_F = 350 \text{ mA}$, $T_j = 85 \text{ }^\circ\text{C}$)

Region	CIE x	CIE y	Region	CIE x	CIE y
W rank (2700 K)					
W1	0.4373	0.3893	W9	0.4465	0.4071
	0.4418	0.3981		0.4513	0.4164
	0.4475	0.3994		0.4573	0.4178
	0.4428	0.3906		0.4523	0.4085
W2	0.4428	0.3906	WA	0.4523	0.4085
	0.4475	0.3994		0.4573	0.4178
	0.4532	0.4008		0.4634	0.4193
	0.4483	0.3919		0.4582	0.4099
W3	0.4483	0.3919	WB	0.4582	0.4099
	0.4532	0.4008		0.4634	0.4193
	0.4589	0.4021		0.4695	0.4207
	0.4538	0.3931		0.4641	0.4112
W4	0.4538	0.3931	WC	0.4641	0.4112
	0.4589	0.4021		0.4695	0.4207
	0.4646	0.4034		0.4756	0.4221
	0.4593	0.3944		0.4700	0.4126
W5	0.4418	0.3981	WD	0.4513	0.4164
	0.4465	0.4071		0.4562	0.4260
	0.4523	0.4085		0.4624	0.4274
	0.4475	0.3994		0.4573	0.4178
W6	0.4475	0.3994	WE	0.4573	0.4178
	0.4523	0.4085		0.4624	0.4274
	0.4582	0.4099		0.4687	0.4289
	0.4532	0.4008		0.4634	0.4193
W7	0.4532	0.4008	WF	0.4634	0.4193
	0.4582	0.4099		0.4687	0.4289
	0.4641	0.4112		0.4750	0.4304
	0.4589	0.4021		0.4695	0.4207
W8	0.4589	0.4021	WG	0.4695	0.4207
	0.4641	0.4112		0.4750	0.4304
	0.4700	0.4126		0.4813	0.4319
	0.4646	0.4034		0.4756	0.4221

Region	CIE x	CIE y	Region	CIE x	CIE y
V rank (3000 K)					
V1	0.4147	0.3814	V9	0.4221	0.3984
	0.4183	0.3898		0.4259	0.4073
	0.4242	0.3919		0.4322	0.4096
	0.4203	0.3833		0.4281	0.4006
V2	0.4203	0.3833	VA	0.4281	0.4006
	0.4242	0.3919		0.4322	0.4096
	0.4300	0.3939		0.4385	0.4119
	0.4259	0.3853		0.4342	0.4028
V3	0.4259	0.3853	VB	0.4342	0.4028
	0.4300	0.3939		0.4385	0.4119
	0.4359	0.3960		0.4449	0.4141
	0.4316	0.3873		0.4403	0.4049
V4	0.4316	0.3873	VC	0.4403	0.4049
	0.4359	0.3960		0.4449	0.4141
	0.4418	0.3981		0.4513	0.4164
	0.4373	0.3893		0.4465	0.4071
V5	0.4183	0.3898	VD	0.4259	0.4073
	0.4221	0.3984		0.4299	0.4165
	0.4281	0.4006		0.4364	0.4188
	0.4242	0.3919		0.4322	0.4096
V6	0.4242	0.3919	VE	0.4322	0.4096
	0.4281	0.4006		0.4364	0.4188
	0.4342	0.4028		0.4430	0.4212
	0.4300	0.3939		0.4385	0.4119
V7	0.4300	0.3939	VF	0.4385	0.4119
	0.4342	0.4028		0.4430	0.4212
	0.4403	0.4049		0.4496	0.4236
	0.4359	0.3960		0.4449	0.4141
V8	0.4359	0.3960	VG	0.4449	0.4141
	0.4403	0.4049		0.4496	0.4236
	0.4465	0.4071		0.4562	0.4260
	0.4418	0.3981		0.4513	0.4164

d) Chromaticity Region & Coordinates

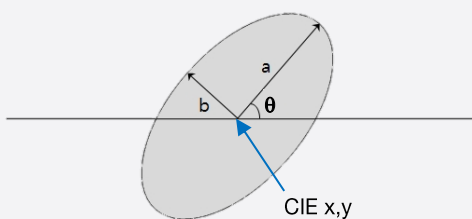
Region	CIE x	CIE y	Region	CIE x	CIE y
U rank (3500 K)					
U1	0.3889	0.3690	U9	0.3941	0.3848
	0.3915	0.3768		0.3968	0.3930
	0.3981	0.3800		0.4040	0.3966
	0.3953	0.3720		0.4010	0.3882
U2	0.3953	0.3720	UA	0.4010	0.3882
	0.3981	0.3800		0.4040	0.3966
	0.4048	0.3832		0.4113	0.4001
	0.4017	0.3751		0.4080	0.3916
U3	0.4017	0.3751	UB	0.4080	0.3916
	0.4048	0.3832		0.4113	0.4001
	0.4116	0.3865		0.4186	0.4037
	0.4082	0.3782		0.4150	0.3950
U4	0.4082	0.3782	UC	0.4150	0.3950
	0.4116	0.3865		0.4186	0.4037
	0.4183	0.3898		0.4259	0.4073
	0.4147	0.3814		0.4221	0.3984
U5	0.3915	0.3768	UD	0.3968	0.3930
	0.3941	0.3848		0.3996	0.4015
	0.4010	0.3882		0.4071	0.4052
	0.3981	0.3800		0.4040	0.3966
U6	0.3981	0.3800	UE	0.4040	0.3966
	0.4010	0.3882		0.4071	0.4052
	0.4080	0.3916		0.4146	0.4089
	0.4048	0.3832		0.4113	0.4001
U7	0.4048	0.3832	UF	0.4113	0.4001
	0.4080	0.3916		0.4146	0.4089
	0.4150	0.3950		0.4222	0.4127
	0.4116	0.3865		0.4186	0.4037
U8	0.4116	0.3865	UG	0.4186	0.4037
	0.4150	0.3950		0.4222	0.4127
	0.4221	0.3984		0.4299	0.4165
	0.4183	0.3898		0.4259	0.4073

Region	CIE x	CIE y	Region	CIE x	CIE y
T rank (4000 K)					
T1	0.3670	0.3578	T9	0.3702	0.3722
	0.3726	0.3612		0.3763	0.3760
	0.3744	0.3685		0.3782	0.3837
	0.3686	0.3649		0.3719	0.3797
T2	0.3726	0.3612	TA	0.3763	0.3760
	0.3783	0.3646		0.3825	0.3798
	0.3804	0.3721		0.3847	0.3877
	0.3744	0.3685		0.3782	0.3837
T3	0.3783	0.3646	TB	0.3825	0.3798
	0.3840	0.3681		0.3887	0.3836
	0.3863	0.3758		0.3912	0.3917
	0.3804	0.3721		0.3847	0.3877
T4	0.3840	0.3681	TC	0.3887	0.3837
	0.3898	0.3716		0.3950	0.3875
	0.3924	0.3794		0.3978	0.3958
	0.3863	0.3758		0.3912	0.3917
T5	0.3686	0.3649	TD	0.3719	0.3797
	0.3744	0.3685		0.3782	0.3837
	0.3763	0.3760		0.3802	0.3916
	0.3702	0.3722		0.3736	0.3874
T6	0.3744	0.3685	TE	0.3782	0.3837
	0.3804	0.3721		0.3847	0.3877
	0.3825	0.3798		0.3869	0.3958
	0.3763	0.3760		0.3802	0.3916
T7	0.3804	0.3721	TF	0.3847	0.3877
	0.3863	0.3758		0.3912	0.3917
	0.3887	0.3836		0.3937	0.4001
	0.3825	0.3798		0.3869	0.3958
T8	0.3863	0.3758	TG	0.3912	0.3917
	0.3924	0.3794		0.3978	0.3958
	0.3950	0.3875		0.4006	0.4044
	0.3887	0.3836		0.3937	0.4001

d) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y	Region	CIE x	CIE y
R rank (5000 K)			Q rank (5700 K)			P rank (6500 K)		
R1	0.3371	0.3490	Q1	0.3215	0.3350	P1	0.3068	0.3113
	0.3451	0.3554		0.3290	0.3417		0.3144	0.3186
	0.3440	0.3427		0.3290	0.3300		0.3130	0.3290
	0.3366	0.3369		0.3222	0.3243		0.3048	0.3207
R2	0.3451	0.3554	Q2	0.3290	0.3417	P2	0.3144	0.3186
	0.3533	0.3620		0.3371	0.3490		0.3221	0.3261
	0.3515	0.3487		0.3366	0.3369		0.3213	0.3373
	0.3440	0.3427		0.3290	0.3300		0.3130	0.3290
R3	0.3376	0.3616	Q3	0.3207	0.3462	P3	0.3048	0.3207
	0.3463	0.3687		0.3290	0.3538		0.3130	0.3290
	0.3451	0.3554		0.3290	0.3417		0.3115	0.3391
	0.3371	0.3490		0.3215	0.3350		0.3028	0.3304
R4	0.3463	0.3687	Q4	0.3290	0.3538	P4	0.3130	0.3290
	0.3551	0.3760		0.3376	0.3616		0.3213	0.3373
	0.3533	0.3620		0.3371	0.3490		0.3205	0.3481
	0.3451	0.3554		0.3290	0.3417		0.3115	0.3391

e) MacAdam 3-step Ellipse ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)



Nom. CCT (K)	Color Rank	Center		Rotation Angle θ (°)	a	b
		CIE x	CIE y			
2700	WM	0.4578	0.4101	53.70	0.0081	0.0042
3000	VM	0.4338	0.4030	53.22	0.0083	0.0041
3500	UM	0.4073	0.3917	54.00	0.0093	0.0041
4000	TM	0.3818	0.3797	53.72	0.0094	0.0040

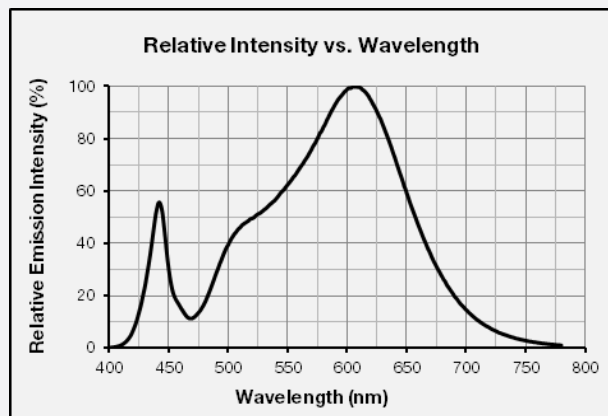
Note:

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

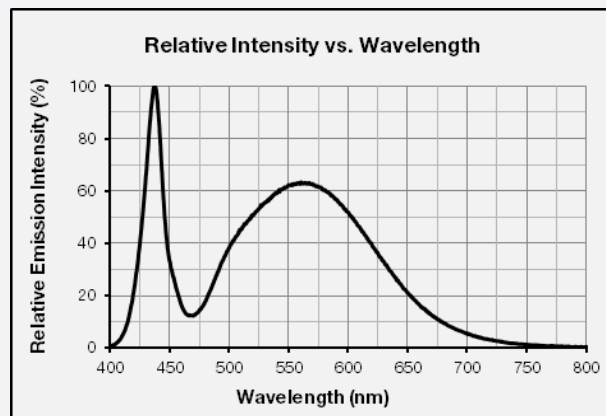
3. Typical Characteristics Graphs

a) Spectrum Distribution ($I_F = 350 \text{ mA}$, $T_j = 85^\circ\text{C}$)

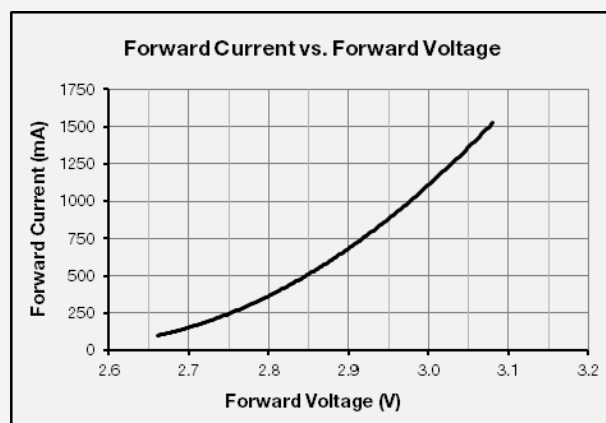
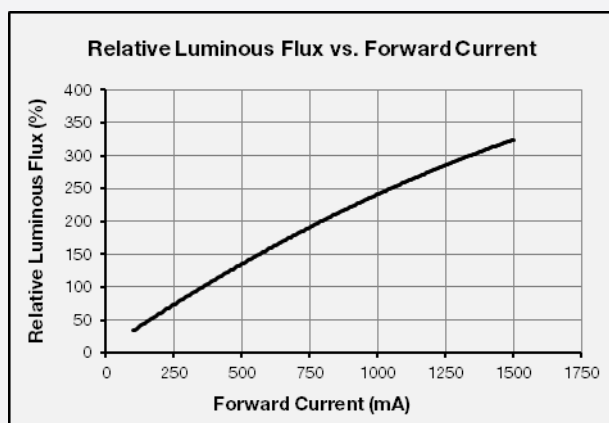
Warm White



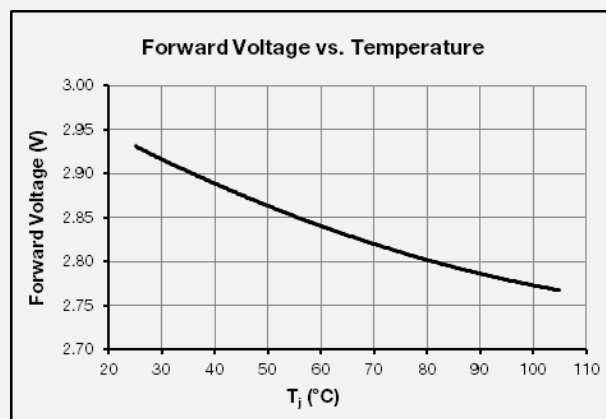
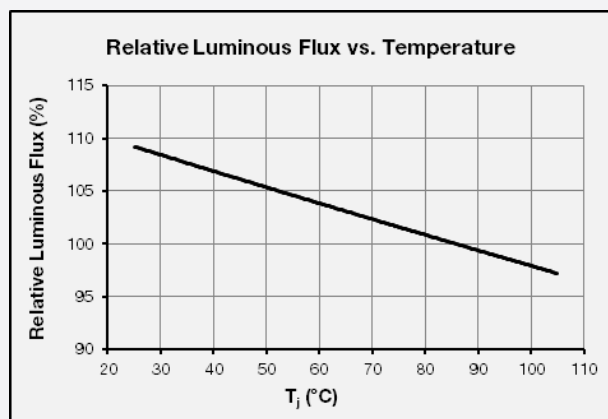
Cool White



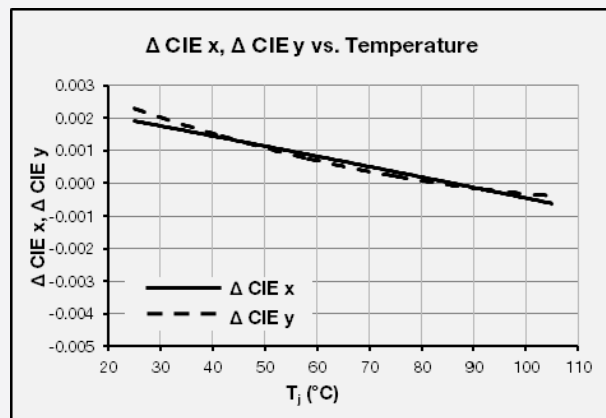
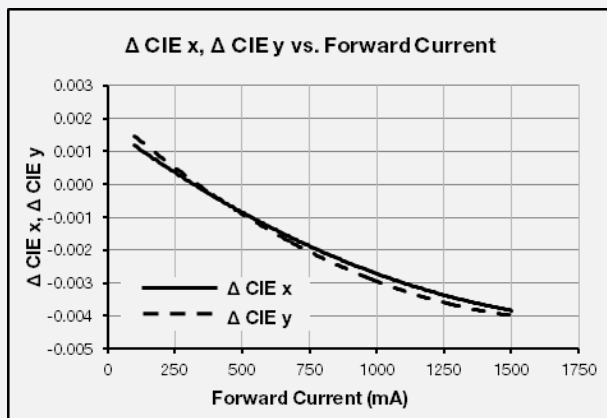
b) Forward Current Characteristics ($T_j = 85^\circ\text{C}$)



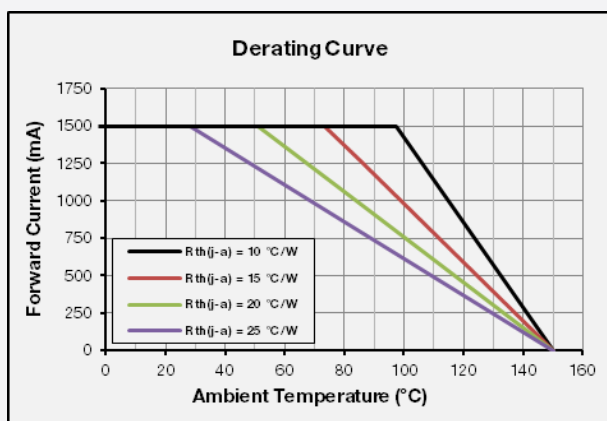
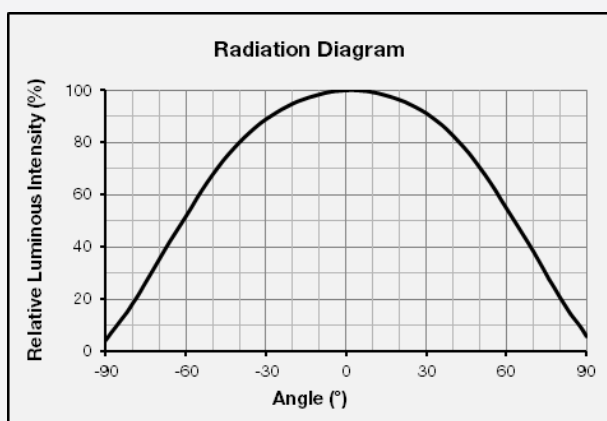
c) Temperature Characteristics ($I_F = 350 \text{ mA}$)



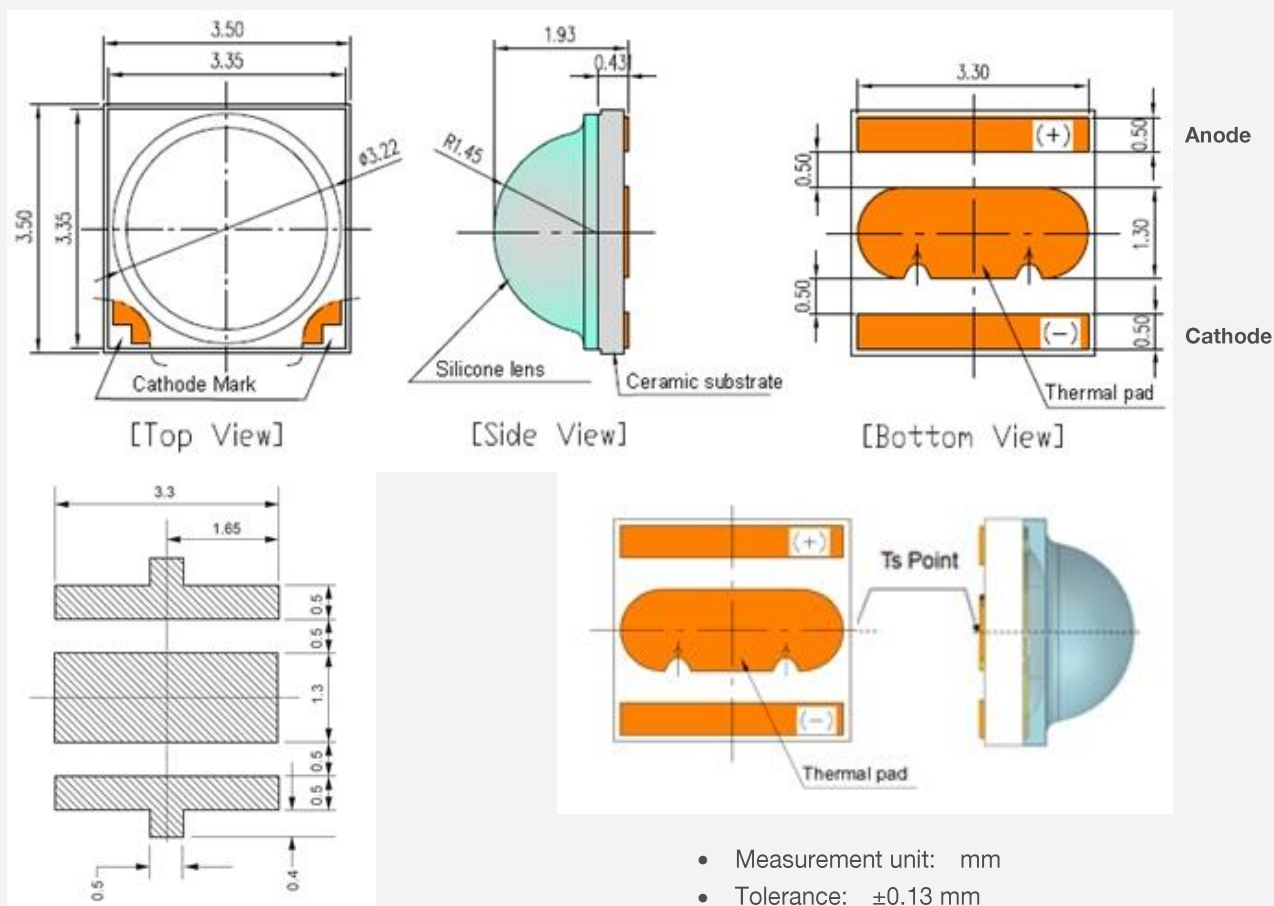
d) Color Shift Characteristics

 $T_j = 85^\circ\text{C}$ $I_F = 350\text{ mA}$ 

e) Derating Curve

f) Beam Angle Characteristics ($I_F = 350\text{ mA}$, $T_j = 25^\circ\text{C}$)

4. Outline Drawing & Dimension



Recommended Soldering Pattern

Notes:

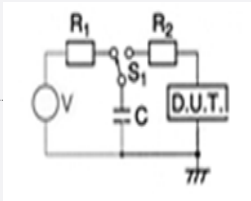
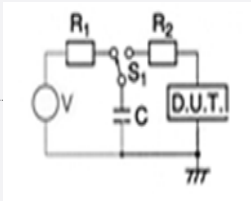
- 1) This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).
- 2) The thermal pad is electrically isolated from the anode and cathode contact pads.
- 3) T_s point and measurement method:
 - ① Measure the nearest point to thermal pad as shown above. If necessary, remove PSR of PCB to reach T_s point.
 - ② All pads must be soldered to the PCB to dissipate heat properly, otherwise the LED can be damaged.

Precautions:

- 1) Pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid strong pressure on the LEDs. Do not put stress on the LEDs during heating.
- 2) Re-soldering should not be done after the LEDs have been soldered. If re-soldering is unavoidable, LED's characteristics should be carefully checked before and after such repair.
- 3) Do not stack assembled PCBs together. Since materials of LEDs is soft, abrasion between two PCB assembled with LED might cause catastrophic failure of the LEDs.

5. Reliability Test Items & Conditions

a) Test Items

Test Item	Test Condition	Test Hour / Cycle	Sample Size
Room Temperature Life Test	25 °C, DC 1000 mA	1000 h	22
High Temperature Life Test	85 °C, DC 1000 mA	1000 h	22
High Temperature Humidity Life Test	85 °C, 85 % RH, DC 1000 mA	1000 h	22
Low Temperature Life Test	-40 °C, DC 1000 mA	1000 h	22
Temperature Humidity Cycle Test	-10 °C ↔ 25 °C 95 % RH ↔ 65 °C 95 % RH DC 1000 mA, 24 h / 1 cycle	10 cycles	11
Powered Temperature Cycle Test	-40 °C / 85 °C each 20 min, 100 min transfer power on/off each 5 min, DC 1000 mA	100 cycles	11
Thermal Shock	-45 °C / 15 min ↔ 125 °C / 15 min temperature change within 5 min	500 cycles	100
High Temperature Storage	120 °C	1000 h	11
Low Temperature Storage	-40 °C	1000 h	11
ESD (HBM)	 R₁: 10 MΩ R₂: 1.5 kΩ C: 100 pF V: ±5 kV	5 times	30
ESD (MM)	 R₁: 10 MΩ R₂: 0 C: 200 pF V: ±0.5 kV	5 times	30
Vibration Test	20~2000~20 Hz, 200 m/s ² , sweep 4 min X, Y, Z 3 direction, each 1 cycle	4 cycles	11
Mechanical Shock Test	1500 g, 0.5 ms 3 shocks each X-Y-Z axis	5 cycles	11

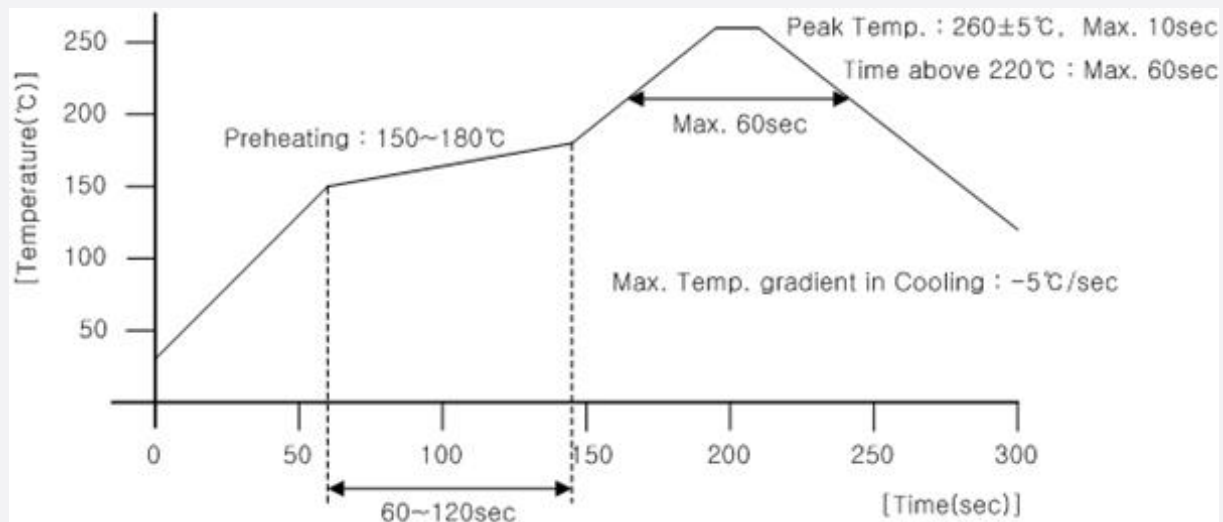
b) Criteria for Judging the Damage

Item	Symbol	Test Condition ($T_j = 25$ °C)	Limit	
			Min.	Max.
Forward Voltage	V_F	$I_F = 350$ mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φ_v	$I_F = 350$ mA	Init. Value * 0.7	Init. Value * 1.1

6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



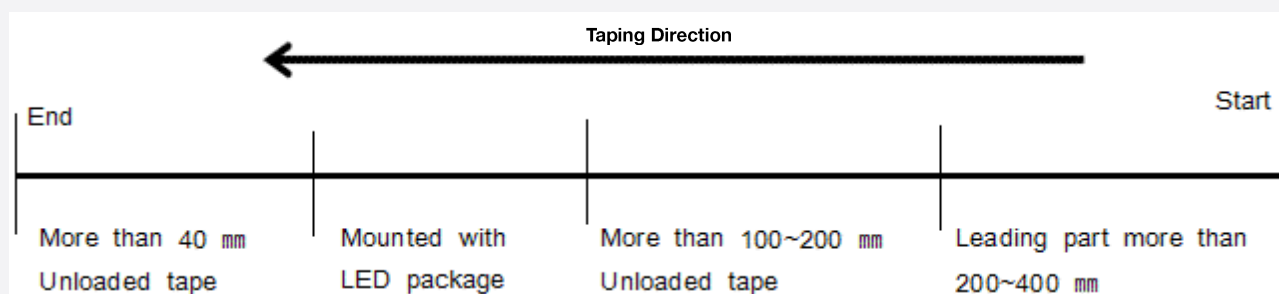
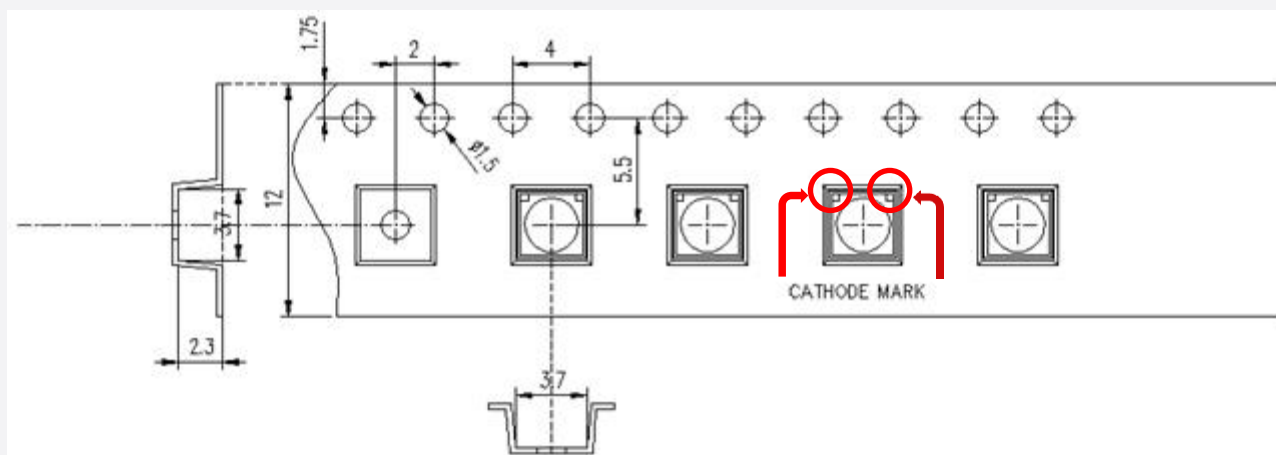
b) Manual Soldering Conditions

Not more than 5 seconds @ max. 300 °C, under soldering iron.

7. Tape & Reel

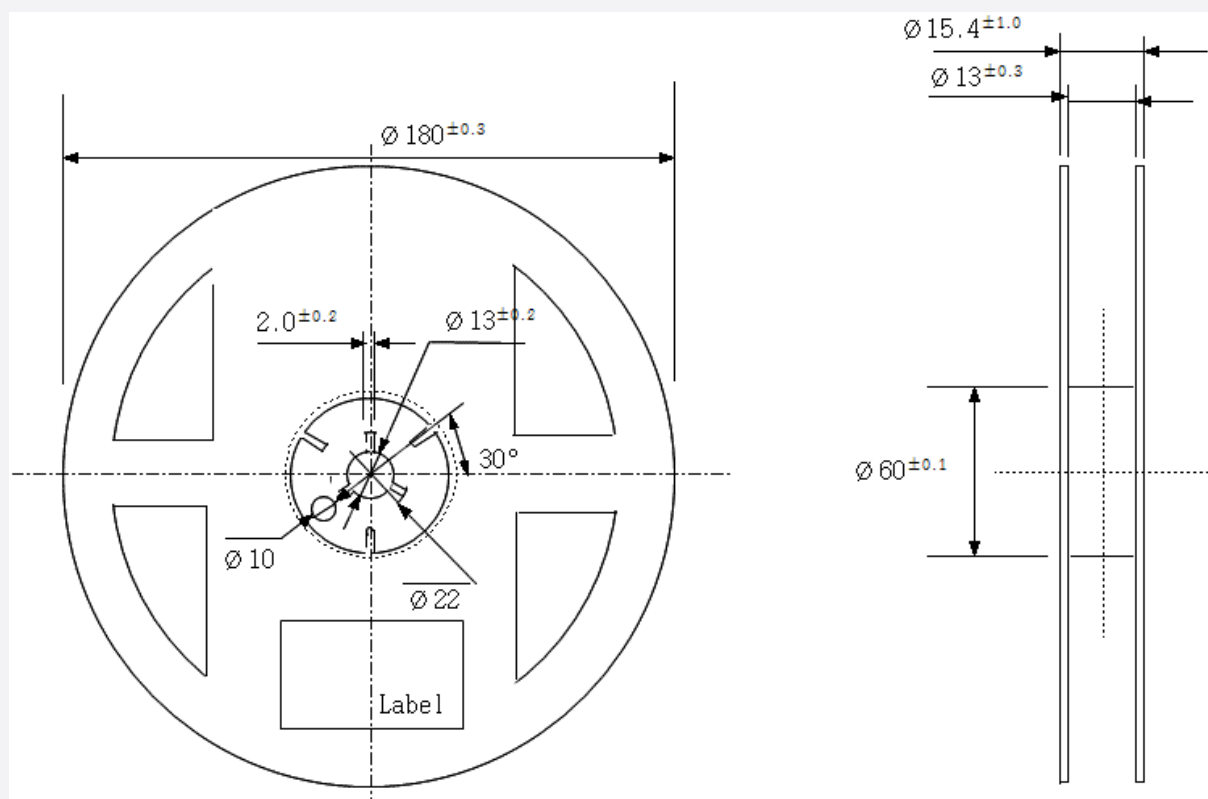
a) Taping Dimension

(unit: mm)



b) Reel Dimension

(unit: mm)

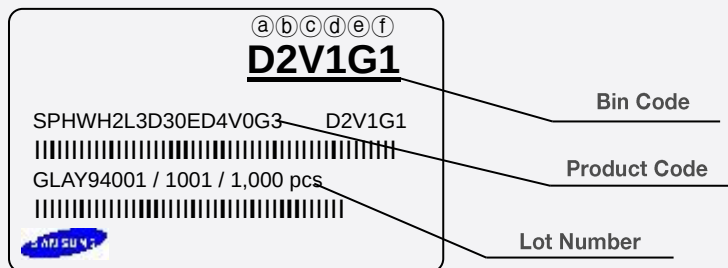


Notes:

- 1) Quantity: The quantity/reel is 1,000 pcs
- 2) Cumulative tolerance: Cumulative tolerance / 10 pitches is ± 0.2 mm
- 3) Adhesion strength of cover tape: Adhesion strength is 0.1-0.7 N when the cover tape is turned off from the carrier tape at 10° angle to the carrier tape
- 4) Packaging: P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag

8. Label Structure

a) Label Structure



Note: Denoted bin code and product code above is only an example (see description on page 7)

Bin Code:

(a)(b): Forward Voltage bin (refer to page 14)

(c)(d): Chromaticity bin (refer to page 16~18)

(e)(f): Luminous Flux bin (refer to page 8-11)

b) Lot Number

The lot number is composed of the following characters:



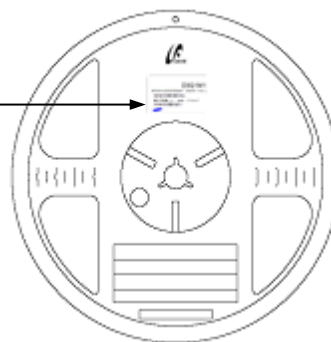
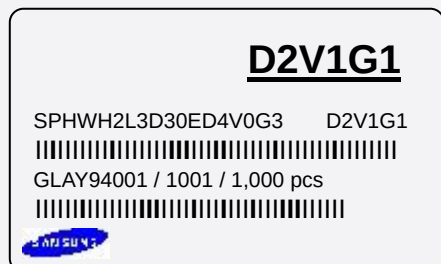
①②③④⑤⑥⑦⑧⑨ / 1(a)(b)(c) / 1,000 pcs

- ① : Production site (S: Giheung, Korea, G: Tianjin, China)
- ② : L (LED)
- ③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ④ : Year (Y: 2014, Z: 2015, A: 2016, ...)
- ⑤ : Month (1~9, A, B, C)
- ⑥ : Day (1~9, A, B~V)
- ⑦⑧⑨ : Product serial number (001 ~ 999)
- (a)(b)(c) : Reel number (001 ~ 999)

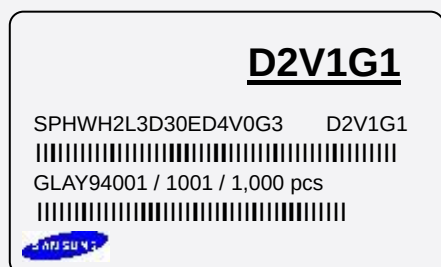
9. Packing Structure

a) Packing Process

Reel



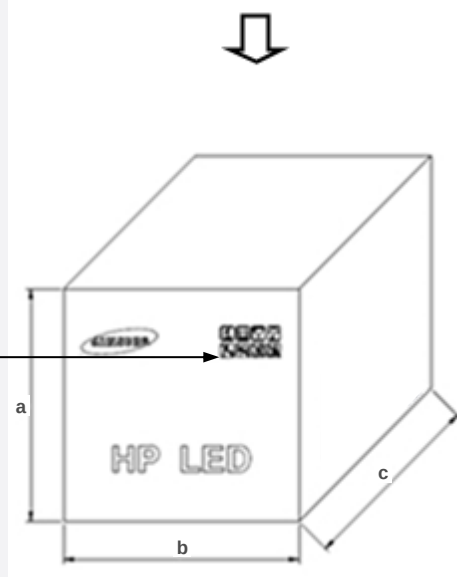
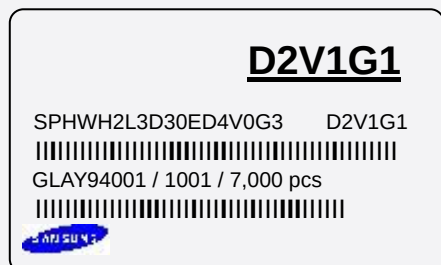
Aluminum Vinyl Packing Bag



Outer Box

Material: Paper (DW2A / DWAB)

Type	Size (mm)			Note
	(a)	(b)	(c)	
7 inch	250 ± 5	225 ± 5	190 ± 5	Up to 7 reels



b) Aluminum Vinyl Packing Bag



CAUTION

This bag contains
MOISTURE SENSITIVE DEVICES

LEVEL
2a

1. Shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)
2. Peak package body temperature: 240 °C
3. After this bag is opened, devices that will be subjected to reflow solder or other high temperature processes must be:
 - a. Mounted within 672 hours at factory conditions of equal to or less than 30°C /60% RH, or
 - b. Stored at < 10% RH
4. Devices require bake, before mounting, if:
 - a. Humidity Indicator Card is > 65% when read at 23±5°C, or
 - b. 2a is not met.
5. If baking is required, devices must be baked for 1 hours at 60±5°C

Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure.

Bag seal due date: _____

(If blank, see code label)

Note: Level and body temperature by IPC/JEDEC J-STD-020

D2V1G1

SPHWH2L3D30ED4V0G3 D2V1G1

|||||

GLAY94001 / 1001 / 1,000 pcs

|||||

SAMSUNG




ATTENTION

OBserve PREcautions
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES



■ 주의 사항

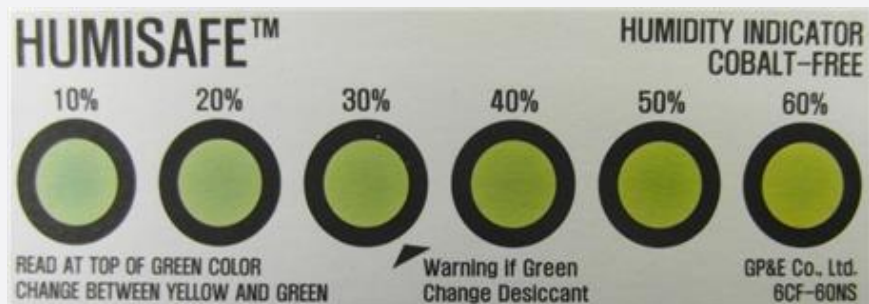
이 알루미늄 지퍼 백은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

습기 및 정전기로부터 제품을 보호 하기 위해서 개봉 후 사용하지 않는 자재는 본 팩에 넣어 보관 하시기 바랍니다. 사용하지 않는 자재를 본 팩에 넣을 때는 반드시 동봉된 드라이 팩과 함께 넣고 지퍼부분을 완전하게 밀봉하여 주시기 바랍니다.

■ Important

This Al Zipper bag is designed to protect the enclosed products from moisture and ESD. Once opened, the products should be soldered onto the printed circuit board immediately. When not in use, please do not leave the products unprotected by the Al Zipper Bag. To repack unused products., please ensure the zip-lock is completely sealed with the dry pack left inside.

c) Silica Gel & Humidity Indicator Card inside Aluminum Vinyl Bag



10. Precautions in Handling & Use

- 1) For over-current protection, users are recommended to apply resistors connected in series with the LEDs to mitigate sudden change of the forward current caused by shift of forward voltage.
- 2) 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.
- 3) When the device is in operation, the forward current should be carefully determined considering the maximum ambient temperature and corresponding junction temperature.
- 4) LEDs must be stored in a clean environment. If the LEDs are to be stored for three months or more after being shipped from Samsung, they should be packed with a nitrogen-filled container (shelf life of sealed bags is 12 months at temperature 0~40 °C, 0~90 % RH).
- 5) 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
- 6) Repack unused devices with anti-moisture packing, fold to close any opening and then store in a dry place.
- 7) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5 °C.
- 8) Devices must be baked for 1 hour at 60 ± 5 °C, if baking is required.
- 9) 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.
- 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) Risk of sulfurization (or tarnishing)
 The LED from Samsung uses a silver-plated lead frame and its surface color may change to black (or dark colored) when it is exposed to sulfur (S), chlorine (Cl) or other halogen compound. Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution. Due to possible sulfurization of lead frame, LED should not be used and stored together with oxidizing substances made of materials such as rubber, plain paper, lead solder cream, etc.

Legal and additional information.

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