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Middle Power LED Series
2835

LM281A

Designed for better lm/$, Lamps, Down light and Ambient

Features& Benefits

- 0.5 W class middle-power LED
- Extremely wide viewing angle.
- Standard form factor for design flexibility
- Mid-performance and Mid-efficacy

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1. Product Code Information

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S	P	M	W	H	T	2	2	8	F	D	5	B	A	V	0	S	0

Digit	PKG Information	Code	Specification
1 2 3	Samsung Package Middle Power	**SPM**	
4 5	Color	**WH**	White
6	Product Version	**T**	Initial version
7 8	Form Factor	**22**	2.8 x 3.5 x 0.65 mm; 2 pads
9	Product	**8**	LM281A
10	Sorting Current (mA)	**F**	150 mA
11	Chromaticity Coordinates	**D**	ANSI Standard
12	CRI& Sorting Temperature	**5**	Min. 80 25 °C
13 14	Forward Voltage (V)	**BA**	2.9~3.4 Bin Code: **A2** 2.9~3.0 **A3** 3.0~3.1 **A4** 3.1~3.2 **A5** 3.2~3.3 **A6** 3.3~3.4
15 16	CCT (K)	**W0**	2700 W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG
		V0	3000 V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
		U0	3500 U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG
		T0	4000 Bin Code: T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
		R0	5000 R1, R2, R3, R4, R5, R6, R7, R8, R9, RA
		Q0	5700 Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, QA
		P0	6500 P1, P2, P3, P4, P5, P6, P7, P8, P9, PA
		S0	S1 S2 S3

a) Luminous Flux Bins(I_F = 150 mA, T_s= 25°C)

Nominal CCT (K)	CRI (R_a) Min.	Product Code	Flux Bin	Flux Range (Φ_v, lm)
2700	80	SPMWHT228FD5BAW0S0	S1	51.0 ~ 54.5
			S2	54.5 ~ 58.0
			S3	58.0 ~ 61.5
3000	80	SPMWHT228FD5BAV0S0	S1	52.0 ~ 55.5
			S2	55.5 ~ 59.0
			S3	59.0 ~ 62.5
3500	80	SPMWHT228FD5BAU0S0	S1	53.0 ~ 56.5
			S2	56.5 ~ 60.0
			S3	60.0 ~ 63.5
4000	80	SPMWHT228FD5BAT0S0	S1	55.5 ~ 59.0
			S2	59.0 ~ 62.5
			S3	62.5 ~ 66.0
5000	80	SPMWHT228FD5BAR0S0	S1	57.5 ~ 61.0
			S2	61.0 ~ 64.5
			S3	64.5 ~ 68.0
5700	80	SPMWHT228FD5BAQ0S0	S1	56.5 ~ 60.0
			S2	60.0 ~ 63.5
			S3	63.5 ~ 67.0
6500	80	SPMWHT228FD5BAP0S0	S1	55.5 ~ 59.0
			S2	59.0 ~ 62.5
			S3	62.5 ~ 66.0

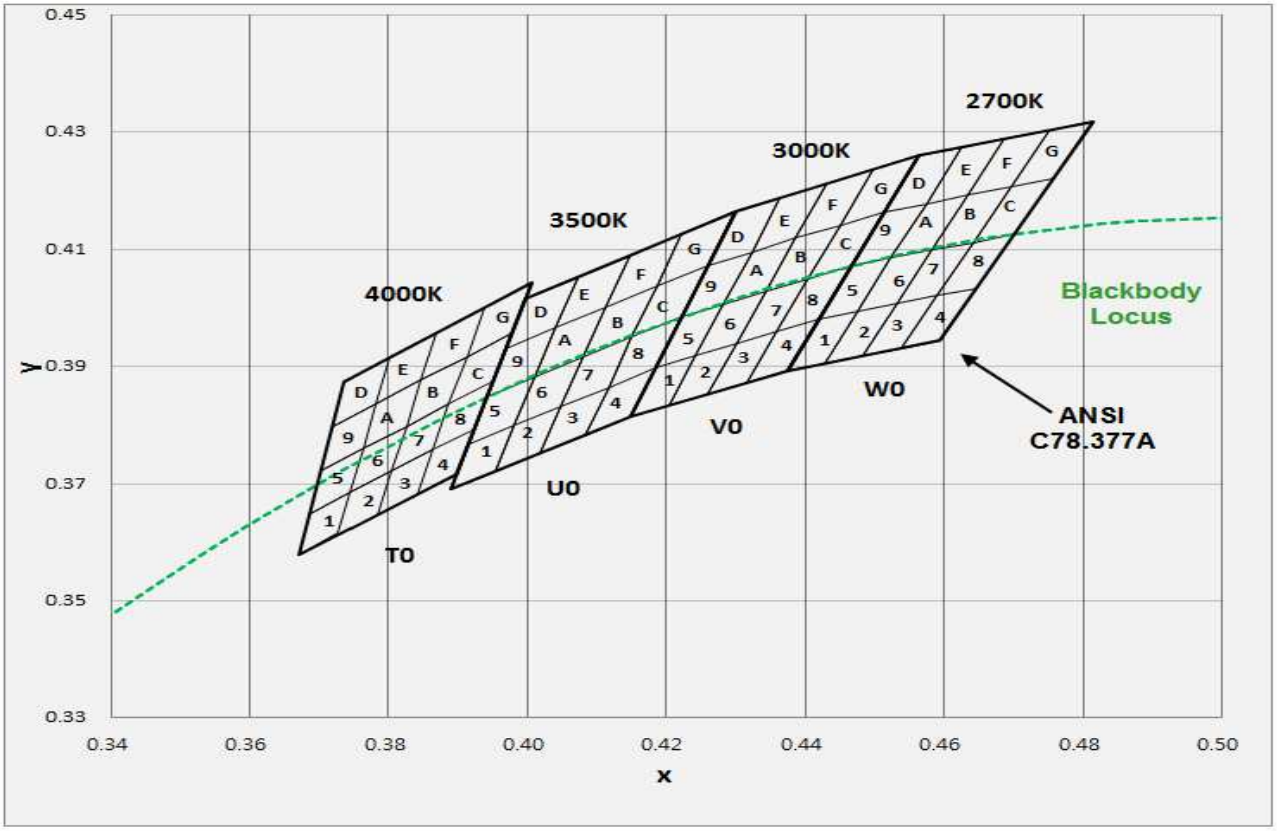
b) Color Bins (I_F = 150 mA, T_s= 25 °C)

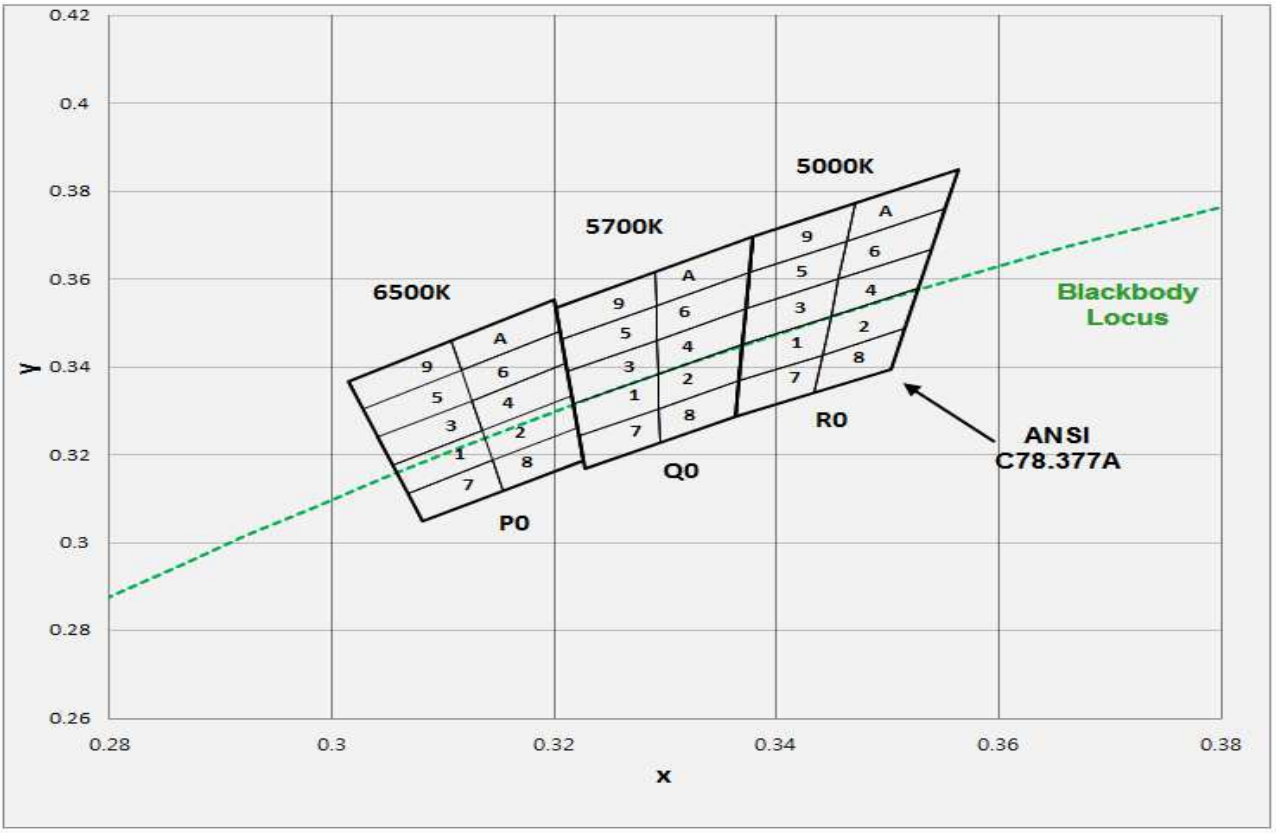
Nominal CCT(K)	CRI (R_a) Min.	Product Code	Color Rank	Chromaticity Bins
2700	80	SPMWHT228FD5BAW0S0	W0 (Whole bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG
3000	80	SPMWHT228FD5BAV0S0	V0 (Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
3500	80	SPMWHT228FD5BAU0S0	U0 (Whole bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG
4000	80	SPMWHT228FD5BAT0S0	T0 (Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
5000	80	SPMWHT228FD5BAR0S0	R0 (Whole bin)	R1, R2, R3, R4, R5, R6, R7, R8, R9,RA
5700	80	SPMWHT228FD5BAQ0S0	Q0 (Whole bin)	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9,QA
6500	80	SPMWHT228FD5BAP0S0	P0 (Whole bin)	P1, P2, P3, P4, P5, P6, P7, P8, P9,PA

c) Voltage Bins (I_F = 150 mA, T_s = 25 °C)

Nominal CCT (K)	CRI (R_a) Min.	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	80	SPMWHT228FD5	BA	A2	2.9 ~ 3.0
				A3	3.0 ~ 3.1
				A4	3.1 ~ 3.2
				A5	3.2 ~ 3.3
				A6	3.3 ~ 3.4

c) Chromaticity Region &Coordinates (I_F = 150 mA, T_s = 25 °C)





c) Chromaticity Region & Coordinates (I_F = 150 mA, T_s = 25 °C)

Region	CIE x	CIE y	Region	CIE x	CIE y
W rank (2700K)					
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 (3000K)					
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

c) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
U rank (3500K)					
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 (4000K)					
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	0.376		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

c) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
R rank (5000K)					
R1	0.3366	0.3369	R6	0.3456	0.3601
	0.3441	0.3428		0.3539	0.3669
	0.3449	0.3515		0.3551	0.3760
	0.3369	0.3451		0.3464	0.3688
R2	0.3441	0.3428	R7	0.3363	0.3287
	0.3515	0.3487		0.3433	0.3341
	0.3527	0.3578		0.3441	0.3428
	0.3449	0.3515		0.3366	0.3369
R3	0.3369	0.3451	R8	0.3433	0.3341
	0.3449	0.3515		0.3503	0.3396
	0.3456	0.3601		0.3515	0.3487
	0.3373	0.3534		0.3441	0.3428
R4	0.3449	0.3515	R9	0.3376	0.3616
	0.3527	0.3578		0.3464	0.3688
	0.3539	0.3669		0.3471	0.3775
	0.3456	0.3601		0.3379	0.3698
R5	0.3373	0.3534	RA	0.3464	0.3688
	0.3456	0.3601		0.3551	0.3760
	0.3464	0.3688		0.3564	0.3851
	0.3376	0.3616		0.3471	0.3775

Region	CIE x	CIE y	Region	CIE x	CIE y
Q rank (5700K)					
Q1	0.3222	0.3243	Q6	0.3292	0.3461
	0.3294	0.3306		0.3373	0.3534
	0.3293	0.3384		0.3376	0.3616
	0.3217	0.3316		0.3292	0.3539
Q2	0.3294	0.3306	Q7	0.3227	0.3170
	0.3366	0.3369		0.3295	0.3228
	0.3369	0.3451		0.3294	0.3306
	0.3293	0.3384		0.3222	0.3243
Q3	0.3217	0.3316	Q8	0.3295	0.3228
	0.3293	0.3384		0.3363	0.3287
	0.3292	0.3461		0.3366	0.3369
	0.3212	0.3389		0.3294	0.3306
Q4	0.3293	0.3384	Q9	0.3207	0.3462
	0.3369	0.3451		0.3292	0.3539
	0.3373	0.3534		0.3291	0.3617
	0.3292	0.3461		0.3202	0.3535
Q5	0.3212	0.3389	QA	0.3292	0.3539
	0.3292	0.3461		0.3376	0.3616
	0.3292	0.3539		0.3379	0.3698
	0.3207	0.3462		0.3291	0.3617

c) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
P rank (6500K)					
P1	0.3068	0.3113	P6	0.3126	0.3324
	0.3145	0.3187		0.3210	0.3408
	0.3135	0.3256		0.3205	0.3481
	0.3055	0.3177		0.3117	0.3393
P2	0.3145	0.3187	P7	0.3081	0.3049
	0.3221	0.3261		0.3154	0.3119
	0.3216	0.3334		0.3145	0.3187
	0.3135	0.3256		0.3068	0.3113
P3	0.3055	0.3177	P8	0.3154	0.3119
	0.3135	0.3256		0.3226	0.3188
	0.3126	0.3324		0.3221	0.3261
	0.3041	0.3240		0.3145	0.3187
P4	0.3135	0.3256	P9	0.3028	0.3304
	0.3216	0.3334		0.3117	0.3393
	0.3210	0.3408		0.3107	0.3461
	0.3126	0.3324		0.3015	0.3368
P5	0.3041	0.3240	PA	0.3117	0.3393
	0.3126	0.3324		0.3205	0.3481
	0.3117	0.3393		0.3200	0.3554
	0.3028	0.3304		0.3107	0.3461

Note:

Samsung maintains measurement tolerance of Cx, Cy =±0.005

2. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Operating Temperature	T_a	-40 ~ +85	ºC	-
Storage Temperature	T_{stg}	-40 ~ +100	ºC	-
LED Junction Temperature	T_j	110	ºC	-
Forward Current	I_F	150	mA	-
Peak Pulsed Forward Current	I_{Fp}	300	mA	Duty 1/10, pulse width 10 ms
Assembly Process Temperature	-	260 <10	ºC s	-

b) Electro-optical Characteristics (I_F = 150 mA, T_s = 25 °C)

Item	Unit	Nominal CCT (K)	CRI (R_a) Min.	Rank	Bin	Min.	Typ.	Max.
Forward Voltage (V_F)	V	-	-	BA	A2	2.9		3.0
					A3	3.0		3.1
					A4	3.1		3.2
					A5	3.2		3.3
					A6	3.3		3.4
Luminous Flux (Φ_v)	lm	2700	80	W0	S1	51.0		54.5
					S2	54.5		58.0
					S3	58.0		61.5
		3000	80	V0	S1	52.0		55.5
					S2	55.5		59.0
					S3	59.0		62.5
		3500	80	U0	S1	53.0		56.5
					S2	56.5		60.0
					S3	60.0		63.5
		4000	80	T0	S1	55.5		59.0
					S2	59.0		62.5
					S3	62.5		66.0
		5000	80	R0	S1	57.5		61.0
					S2	61.0		64.5
					S3	64.5		68.0
		5700	80	Q0	S1	56.5		60.0
					S2	60.0		63.5
					S3	63.5		67.0
		6500	80	P0	S1	55.5		59.0
					S2	59.0		62.5
					S3	62.5		66.0
Reverse Voltage (@ 10 uA)	V					10.0	-	
Special CRI (R9)	-					0	-	-
Thermal Resistance (junction to solder point)	°C/W					-	24	-
Beam Angle	°					-	120	-

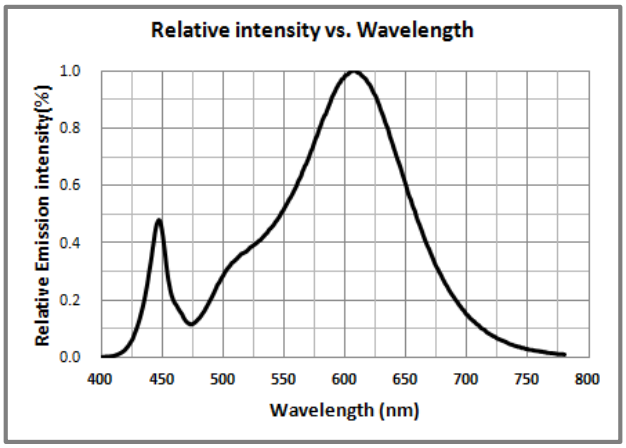
Note:

Samsung maintains measurement tolerance of: forward voltage = ±0.1 V, luminous flux = ±5 %, CRI = ±3, R9 = ±6.5

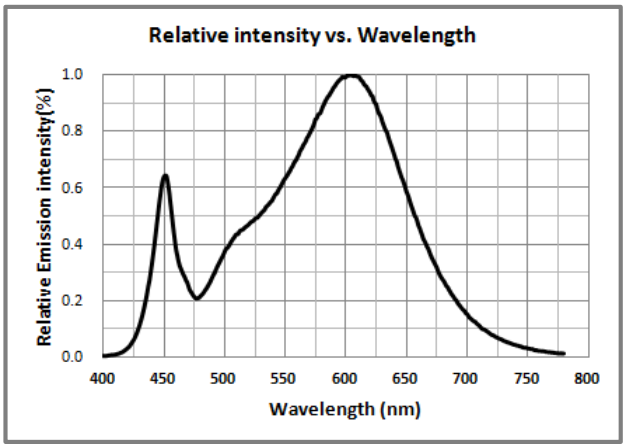
3. Typical Characteristics Graphs

a) Spectrum Distribution (I_F = 150 mA, T_s = 25 °C)

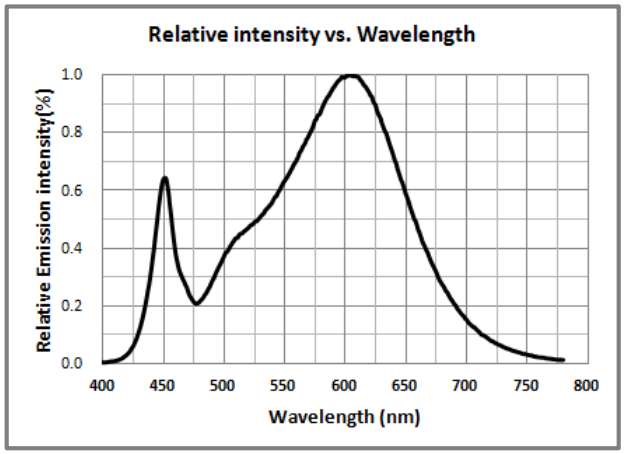
CCT: 2700K (80 CRI)



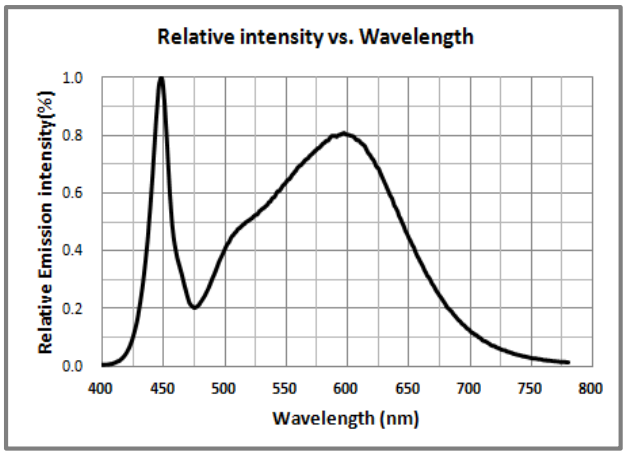
CCT: 3000K (80 CRI)



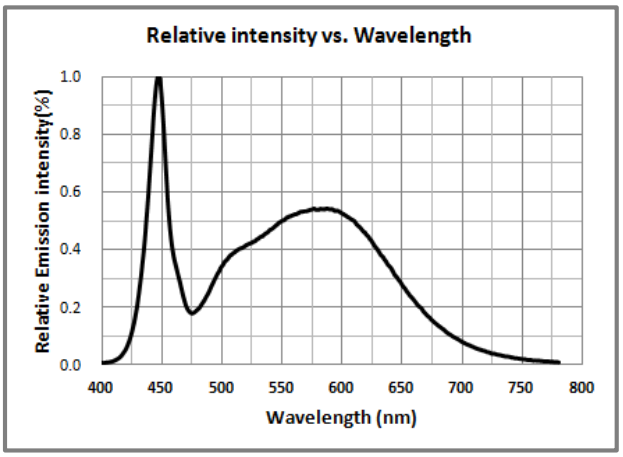
CCT: 3500K (80 CRI)



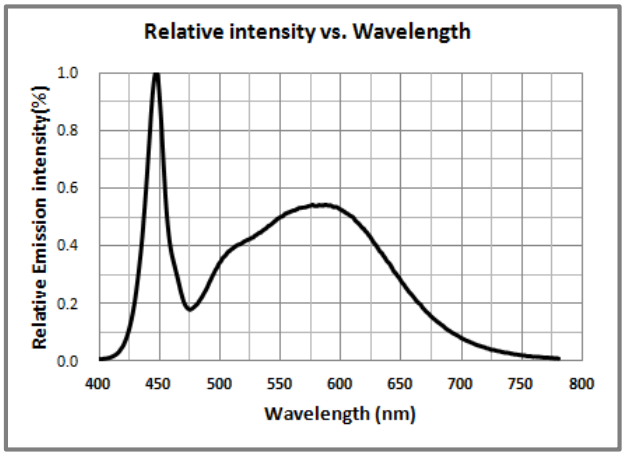
CCT: 4000K (80 CRI)



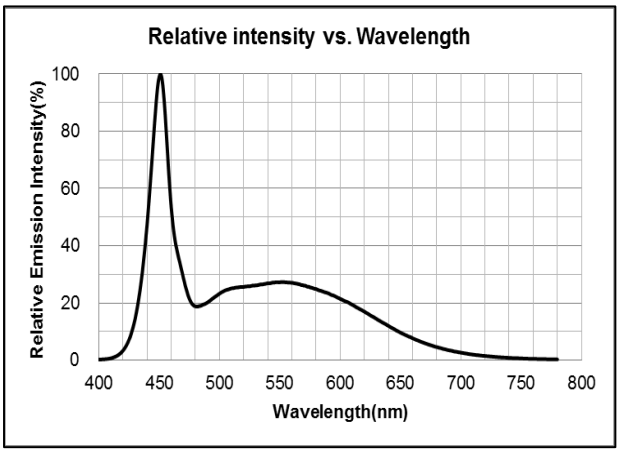
CCT: 5000K (80 CRI)



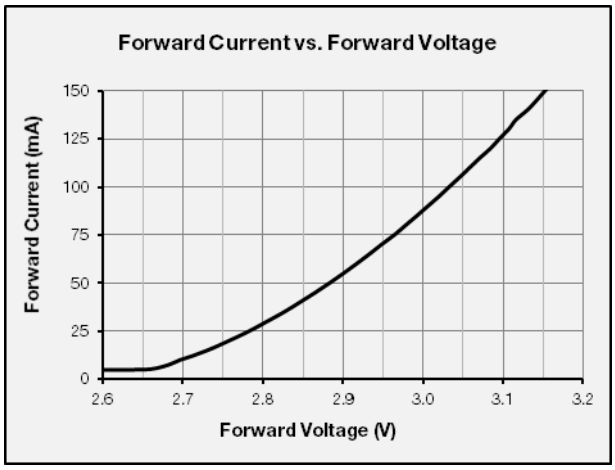
CCT: 5700K (80 CRI)

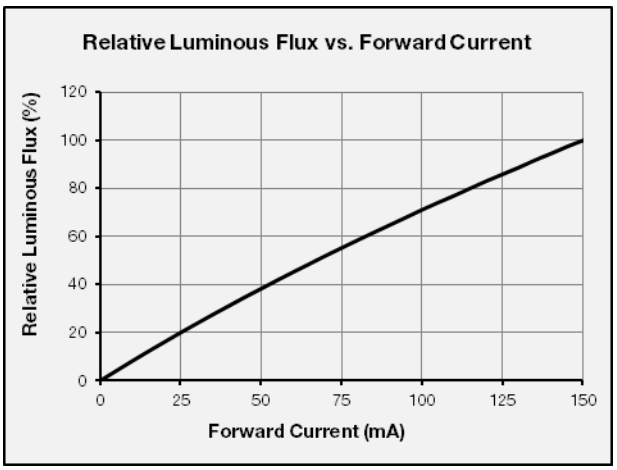


CCT: 6500 K(80 CRI)

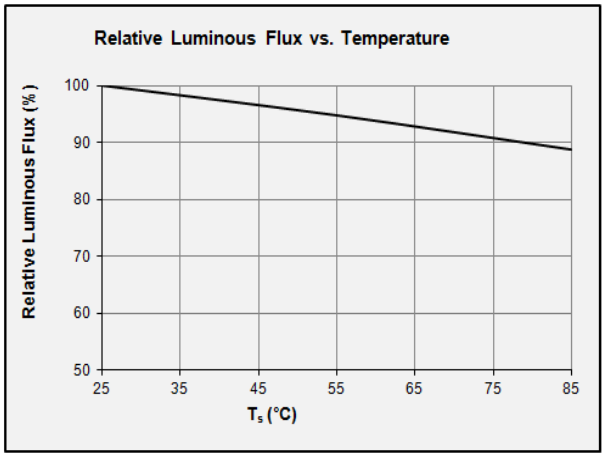


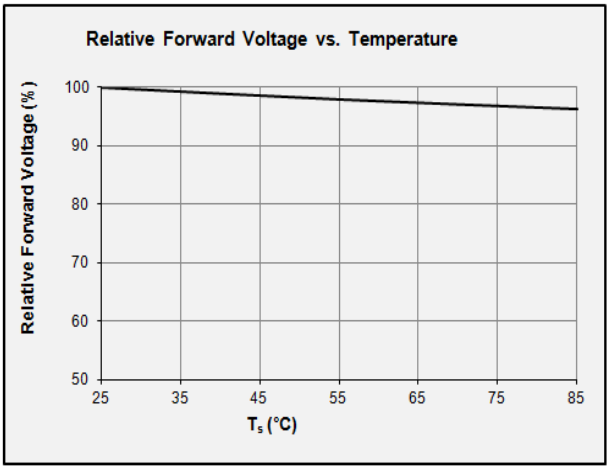
b) Forward Current Characteristics (T_s = 25 ℃)



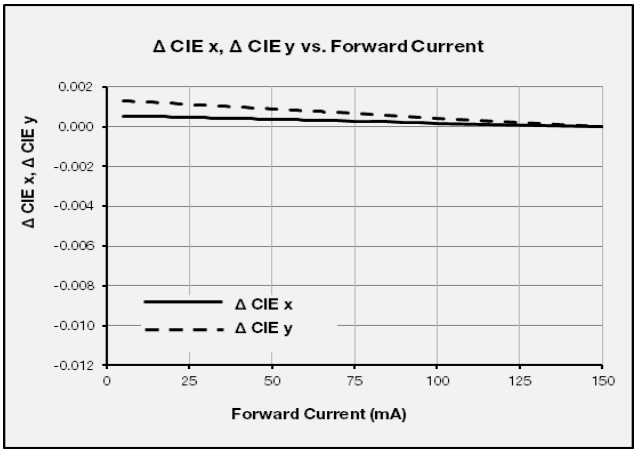


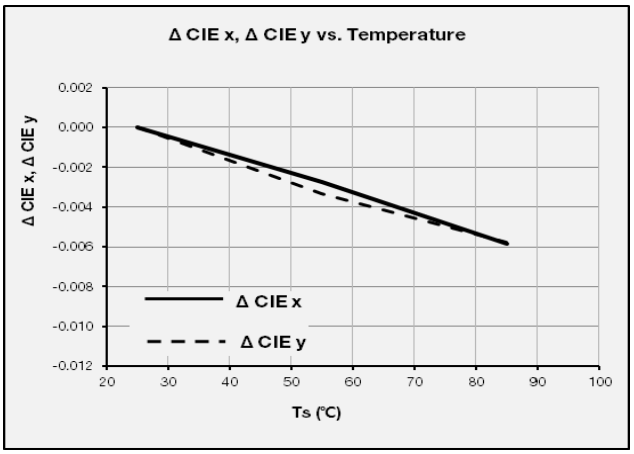
c) Temperature Characteristics (I_F = 150 mA)



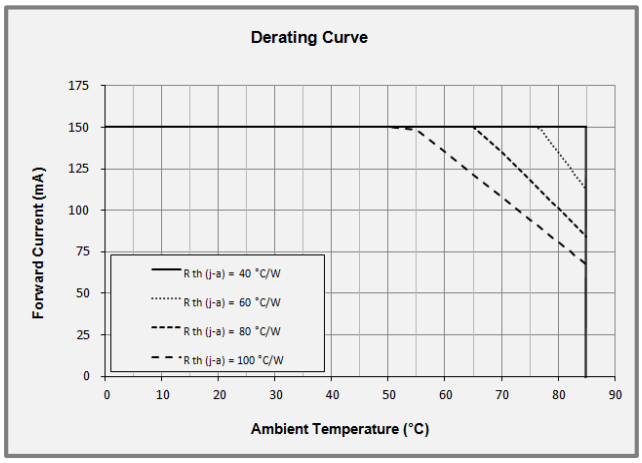


d) Color Shift Characteristics (T_s = 25 °C, I_F = 150 mA)

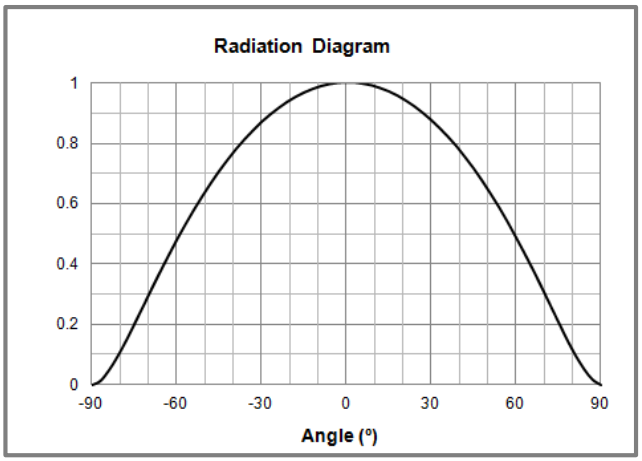




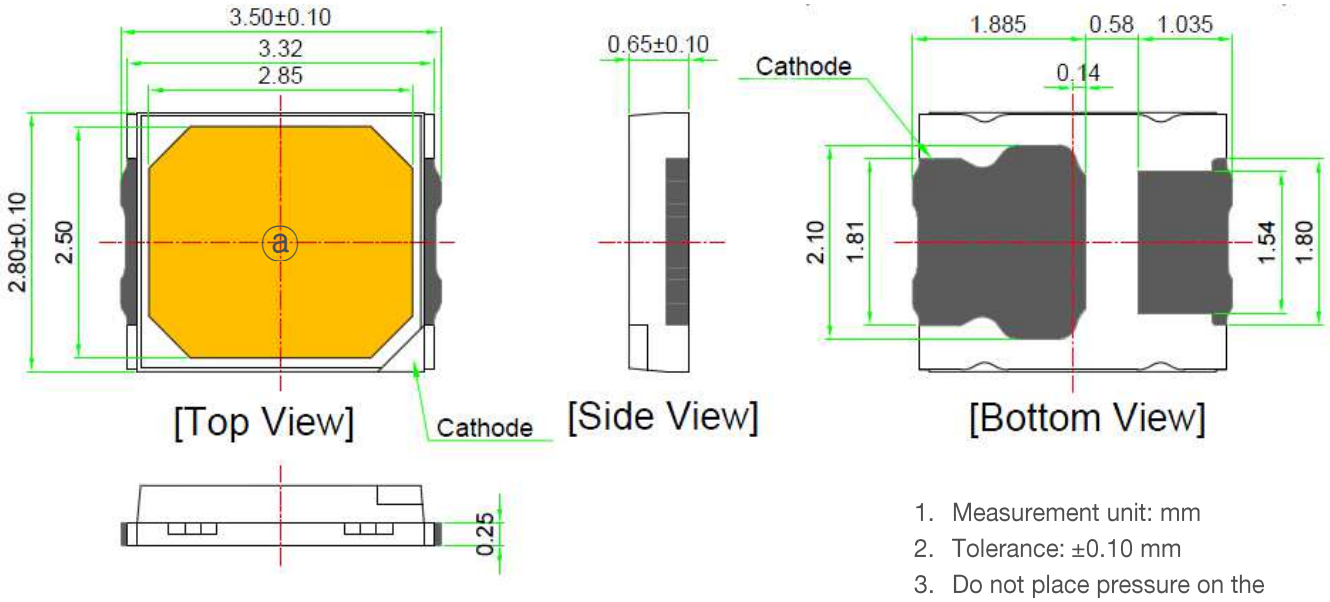
e) Derating Curve



f) Beam Angle Characteristics (I_F = 150 mA, T_s = 25 °C)

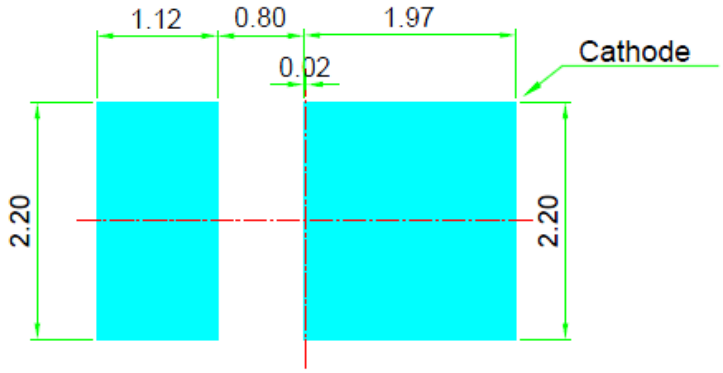


4. Outline Drawing & Dimension



1. Measurement unit: mm
2. Tolerance: ±0.10 mm
3. Do not place pressure on the encapsulation resin ⓐ

[RECOMMENDED PCB SOLDER PAD]



Notes:

1) T_s point and measurement method:

   ① Measure one point at the cathode pad. If necessary, remove PSR of PCB to reach T_s point.

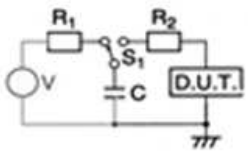
   ②All pads must be soldered to the PCB to dissipate heat properly, otherwise the LED can be damaged.

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 150 mA	1000 h	22
High Temperature Life Test	85 °C, DC 150 mA	1000 h	22
High Temperature Humidity Life Test	85 °C, 85 % RH, DC 150 mA	1000 h	22
Low Temperature Life Test	-40 °C, DC 150 mA	1000 h	22
Powered Temperature Cycle Test	-45 °C / 20 min ↔ 85 °C / 20 min, sweep 100 min cycle on/off: each 5 min, DC 150 mA	1000 h	22
Thermal Cycles	-45 °C / 15 min ↔ 125 °C / 15 min → Hot plate 180 °C	500 cycles	100
High Temperature Storage	120 °C	1000 h	11
Low Temperature Storage	-40 °C	1000 h	11
ESD (HBM)	 R_1: 10 MΩ R_2: 1.5 kΩ C: 100 pF V: ±2 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

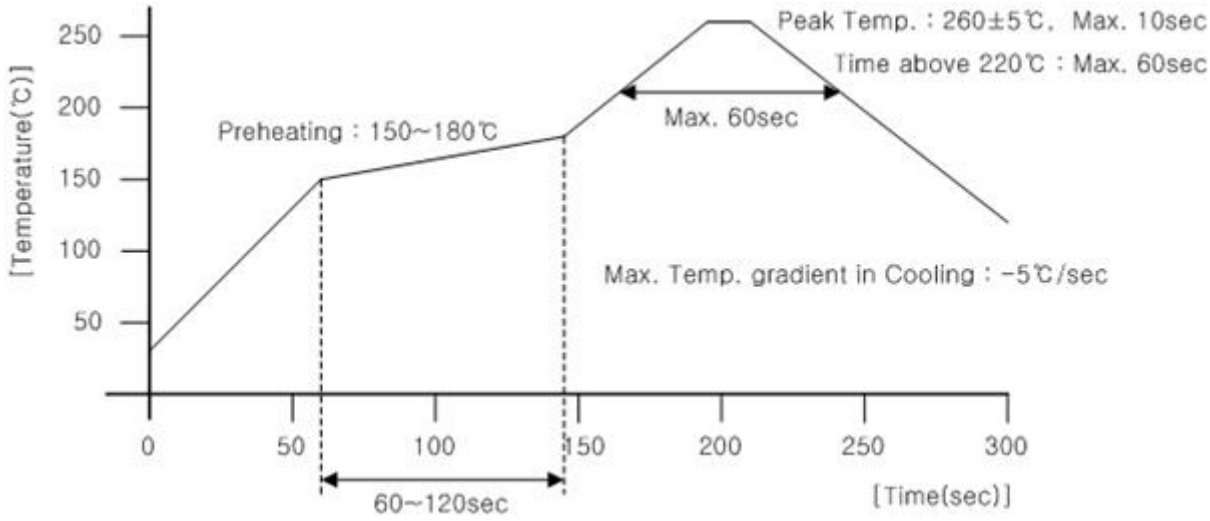
b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T_s = 25 °C)	Limit	
			Min.	Max.
Forward Voltage	V_F	I_F = 150 mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φ_v	I_F = 150 mA	Init. Value * 0.7	Init. Value * 1.1

6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



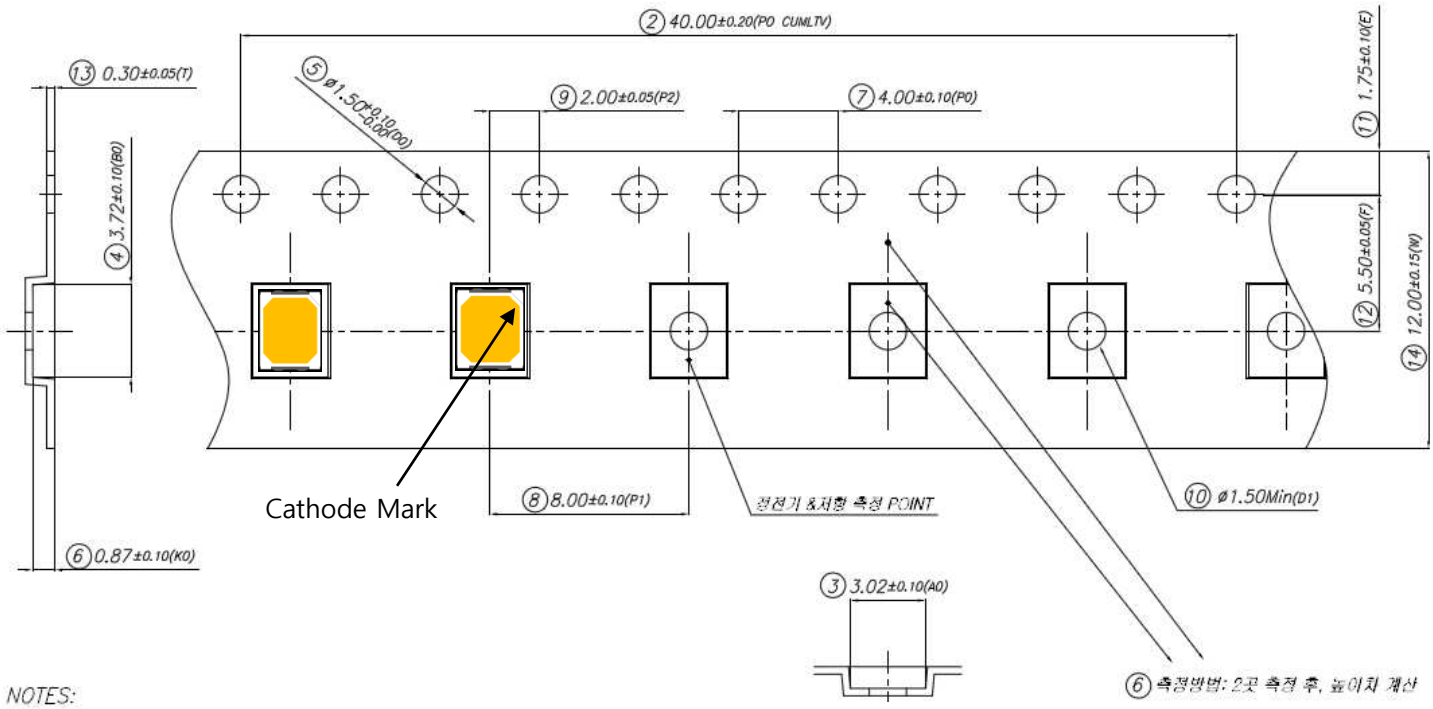
b) Manual Soldering Conditions

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

7. Tape & Reel

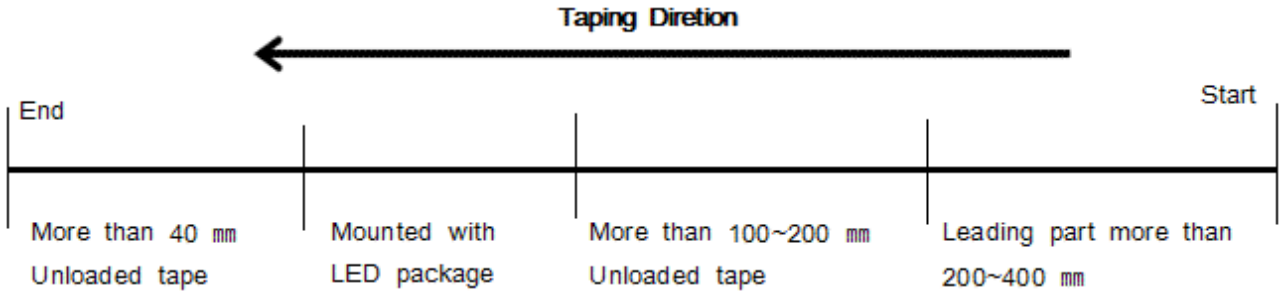
a) Taping Dimension

(unit: mm)

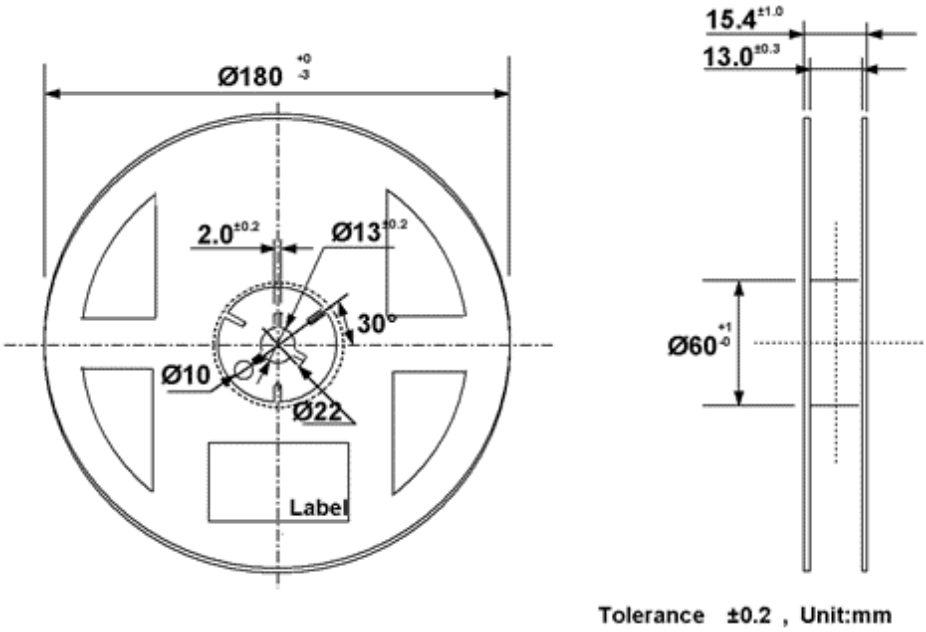


NOTES:

1. 10 sprocket hole pitch cumulative tolerance ±0.2
2. Camber not to exceed 1mm in 250mm
3. Material: Black conductive Polystyrene
4. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
6. Pocket center and pocket hole center must be same position.
7. Surface resistivity : MAX 10E+7 OHMS/SQ



b) Reel Dimension

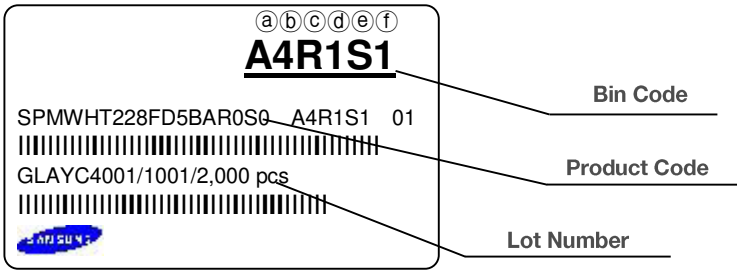


Notes:

1) Quantity: The quantity/reel is 2,000 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 Sample

'★' means all kind of Chromaticity Coordinate Ranks

Bin Code:

ⓐⓑ:Forward Voltage bin(refer to page 6)

ⓒⓓ: Chromaticity bin (refer to page 7~11)

ⓔⓕ: Luminous Flux bin (refer to page 4)

b) Lot Number

The lot number is composed of the following characters:

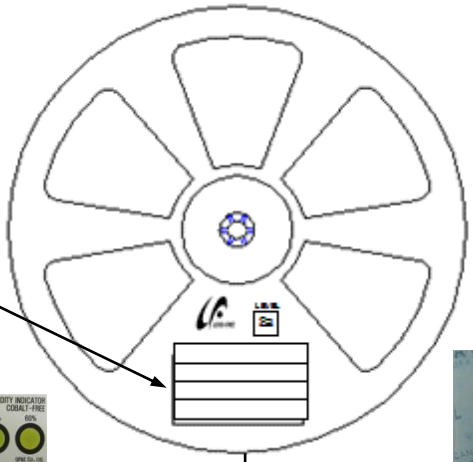
①②③④⑤⑥⑦⑧⑨ / 1ⓐⓑⓒ / 4,000 pcs

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 (Z: 2015, A: 2016, B: 2017…)
⑤	: Month (1~9, A, B, C)
⑥	: Day (1~9, A, B~V)
⑦⑧⑨	: Product serial number (001 ~ 999)
ⓐⓑⓒ	: Reel number (001 ~ 999)

9. Packing Structure

a) Packing Process

Reel



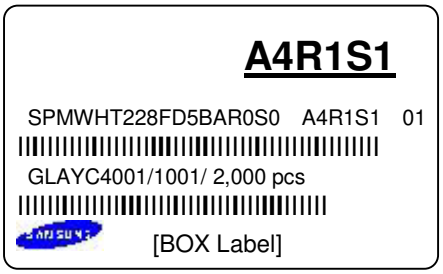
Aluminum Vinyl Packing Bag

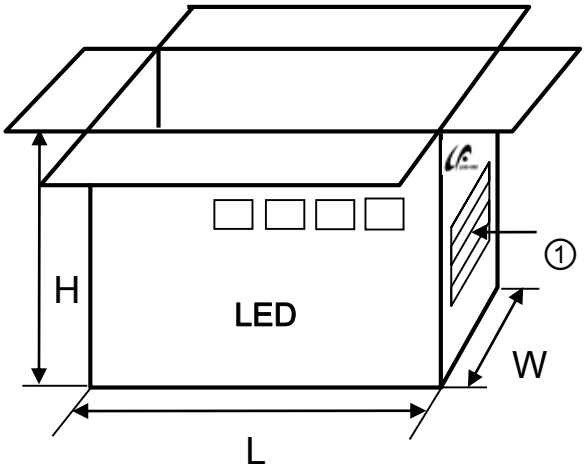
Outer Box

Material: Paper (SW3B(B))

Type	Size (mm)			Note
	L	W	H	
7 inch L	245± 5	220± 5	182± 5	Up to 10reels
7 inch S	245 ± 5	220 ± 5	86 ± 5	Up to 5 reels

① **Side Label**





b) Aluminum Vinyl Packing Bag

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

10. Precautions in Handling & Use

1) For over-current-proof function, customers are recommended to apply resistors to prevent sudden change of the current caused by slight shift of the voltage.
2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When washing is required, IPA is recommended to use.
3) When the LEDs illuminate, operating current should be decided after considering the ambient maximum 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 by a sealed container with nitrogen gas injected (shelf life of sealed bags: 12 months, temperature ~40 ºC, ~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 ºC / 60 % RH, or
   b. Stored at <10 % RH
6) Repack unused products 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 ºC.
8) Devices must be baked for 10~24 hours at 60 ± 5 ºC, if baking is required.
9) The LEDs are sensitive to the static electricity and surge. 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 leak 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 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 (fixtures). In order to prevent these problems, we recommend users to know the physical properties of the materials used in luminaires, and they must be selected carefully.
11) Risk of sulfurization (or tarnishing)
    The LED from Samsung Electronics Co., Ltd. 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.
12) This LED (Lighting area or Non lighting area) Particle or Dust size under 50,000um2 is permitted.