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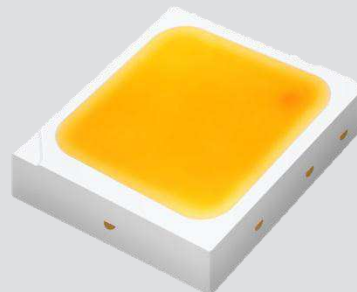
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Middle Power LED Series  
3030

# LM302A CRI 70



LM302A leads lighting design trend with high performance and efficacy

## Features & Benefits

- 1 W class middle-high power LED
- EMC resin for high reliability
- Standard form factor for design flexibility
- High performance and efficacy



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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 ~ +100	°C	-
LED Junction Temperature	$T_j$	125	°C	-
Forward Current	$I_F$	200	mA	-
Peak Pulsed Forward Current	$I_{fp}$	400	mA	Duty 1/10, pulse width 10 ms
Assembly Process Temperature	-	260 <10	°C s	-
ESD (HBM)	-	5	kV	-

**b) Electro-optical Characteristics ( $I_F = 150 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )**

Item	Nominal CCT (K)	Rank	Bin	Min.	Typ.	Max.	Unit
Forward Voltage ( $V_f$ )		GB	BZ	5.8	-	6.0	V
			B1	6.0	-	6.2	
			B2	6.2	-	6.4	
			B3	6.4	-	6.6	
			B4	6.6	-	6.8	
Luminous Flux ( $\Phi_v$ )	3000	S0	S3	112	-	120	lm
			S4	120	-	128	
	4000	S0	S3	117	-	125	
			S4	125	-	133	
	5000	S0	S3	121	-	129	
			S4	129	-	137	
	5700	S0	S3	119	-	127	
			S4	127	-	135	
Reverse Voltage (@ 5 mA)				0.7	-	1.2	V
Color Rendering Index ( $R_a$ )		3		70	-	-	-
Thermal Resistance (junction to solder point)				-	12	-	$^\circ\text{C/W}$
Beam Angle				-	120	-	$^\circ$

**Note:**

Samsung maintains measurement tolerance of: forward voltage =  $\pm 0.1 \text{ V}$ , luminous flux =  $\pm 5 \%$ , CRI =  $\pm 3$

## 2. 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	3	2	7	F	D	3	G	B	V	0	S	0

Digit	PKG Information	Code	Specification
1 2 3	Samsung Package Middle Power	<b>SPM</b>	
4 5	Color	<b>WH</b>	White
6	Product Version	<b>T</b>	
7 8 9	Form Factor	<b>327</b>	3.0 x 3.0 x 0.65 mm; 2 pads; LM302
10	Sorting Current	<b>F</b>	150 mA
11	Chromaticity Coordinates	<b>D</b>	ANSI Standard
12	CRI	<b>3</b>	Min. 70 25°C
13 14	Forward Voltage (V)	<b>G B</b>	5.8~6.8 Bin Code: <b>BZ</b> 5.8~6.0 <b>B1</b> 6.0~6.2 <b>B2</b> 6.2~6.4 <b>B3</b> 6.4~6.6 <b>B4</b> 6.6~6.8
15 16	CCT (K)	<b>V★</b> <b>T★</b> <b>R★</b> <b>Q★</b>	3000 V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG 4000 T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG 5000 R1, R2, R3, R4, R5, R6, R7, R8, R9, RA 5700 Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, QA ★ : "0" (Whole bin) or "M" (Quarter bin)
17 18	Luminous Flux (lm)	<b>S 0</b>	Bin Code: S3, S4

**a) Luminous Flux Bins ( $I_f = 150 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )**

Nominal CCT (K)	CRI Min.	Product Code	Flux Bin	Flux Range ( $\Phi_v$ , lm)
3000	70	SPMWHT327FD3GBV☆S0	S0	112 ~ 120
			S3	120 ~ 128
		SPMWHT327FD3GBV☆S3	S3	112 ~ 120
			S4	120 ~ 128
4000	70	SPMWHT327FD3GBT☆S0	S0	117 ~ 125
			S3	125 ~ 133
		SPMWHT327FD3GBT☆S3	S3	117 ~ 125
			S4	125 ~ 133
5000	70	SPMWHT327FD3GBR☆S0	S0	121 ~ 129
			S3	129 ~ 137
		SPMWHT327FD3GBR☆S3	S3	121 ~ 129
			S4	129 ~ 137
5700	70	SPMWHT327FD3GBQ☆S0	S3	119 ~ 127
			S4	127 ~ 135
		SPMWHT327FD3GBQ☆S3	S3	119 ~ 127
			S4	127 ~ 135

**Note:**

"☆" can be "0" (Whole bin) or "M" (Quarter bin) of the color binning

**b) Color Bins** ( $I_F = 150 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )

Nominal CCT (K)	CRI Min.	Product Code	Color Rank	Chromaticity Bins
3000	70	SPMWHT327FD3GBV0S★	V0 (Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
		SPMWHT327FD3GBVMS★	VM (Quarter bin)	V6, V7, VA, VB
4000	70	SPMWHT327FD3GBT0S★	T0 (Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
		SPMWHT327FD3GBTMS★	TM (Quarter bin)	T6, T7, TA, TB
5000	70	SPMWHT327FD3GBR0S★	R0 (Whole bin)	R1, R2, R3, R4, R5 R6, R7, R8, R9, RA
		SPMWHT327FD3GBRMS★	RM (Quarter bin)	R1, R2, R3, R4, R5, R6
5700	70	SPMWHT327FD5GBQ0S★	Q0 (Whole bin)	Q1, Q2, Q3, Q4, Q5 Q6, Q7, Q8, Q9, QA
		SPMWHT327FD5GBQMS★	QM (Quarter bin)	Q1, Q2, Q3, Q4, Q5, Q6

**Note:**

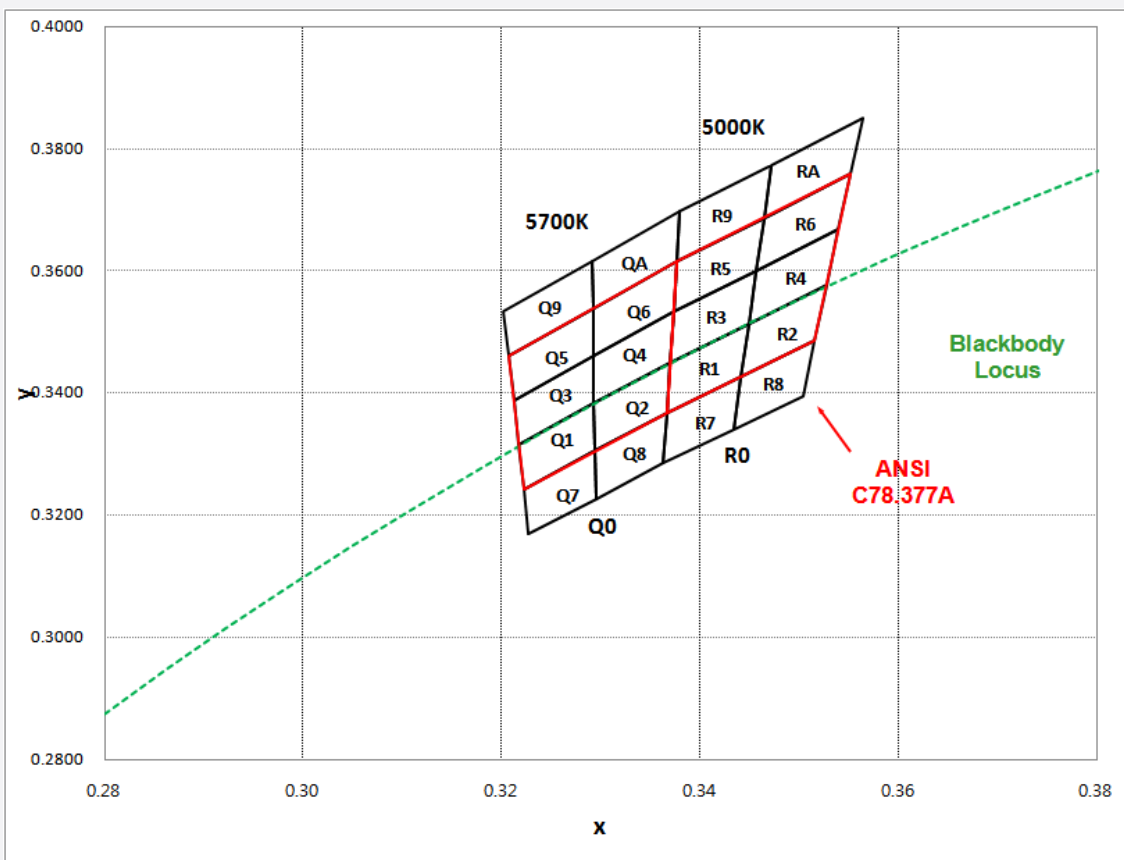
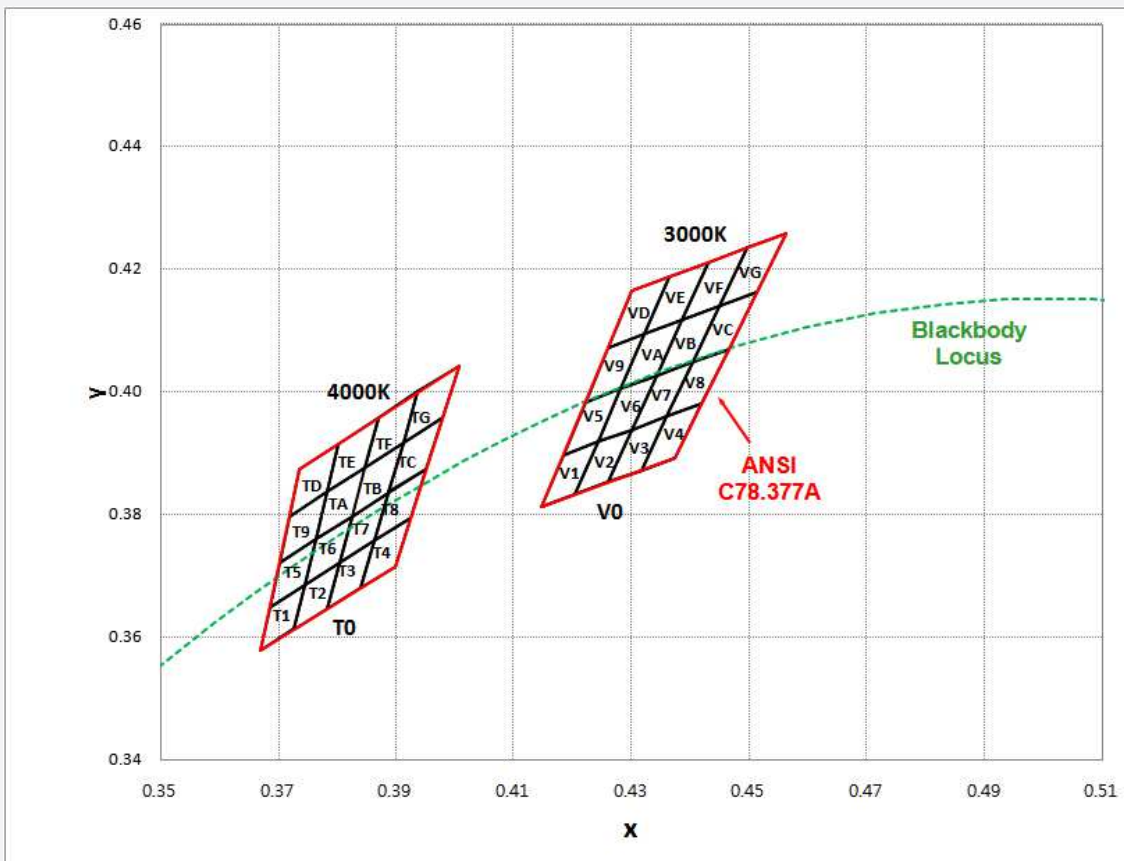
"★" can be "0", "3" or "4" of the luminous flux binning



c) Voltage Bins ( $I_f = 150 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )

Nominal CCT (K)	CRI Min.	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	GB	BZ	5.8 ~ 6.0
				B1	6.0 ~ 6.2
				B2	6.2 ~ 6.4
				B3	6.4 ~ 6.6
				B4	6.6 ~ 6.8

d) Chromaticity Region & Coordinates ( $I_f = 150 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )



**d) Chromaticity Region & Coordinates ( $I_F = 150 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )**

Region	CIE x	CIE y	Region	CIE x	CIE y
<b>V rank (3000 K)</b>					
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

Region	CIE x	CIE y	Region	CIE x	CIE y
<b>T rank (4000 K)</b>					
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

#### d) Chromaticity Region & Coordinates

Region	CIE x	CIE y	Region	CIE x	CIE y
<b>R rank (5000 K)</b>					
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
<b>Q rank (5700 K)</b>					
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

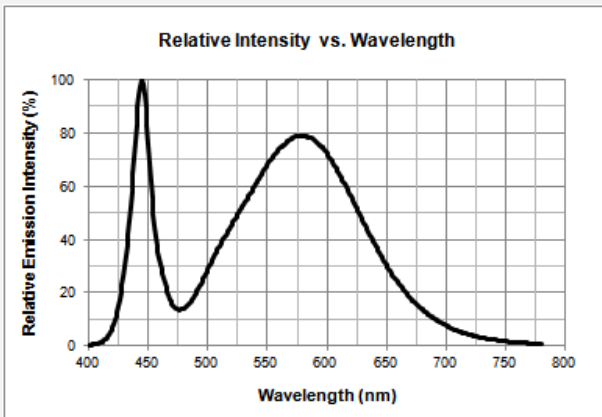
**Note:**

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

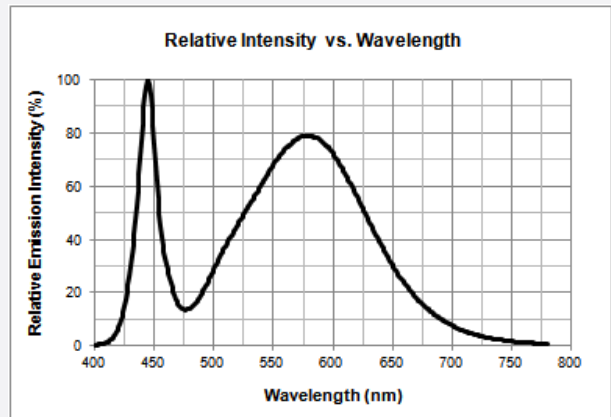
### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_f = 150 \text{ mA}$ , $T_s = 25 \text{ }^\circ\text{C}$ )

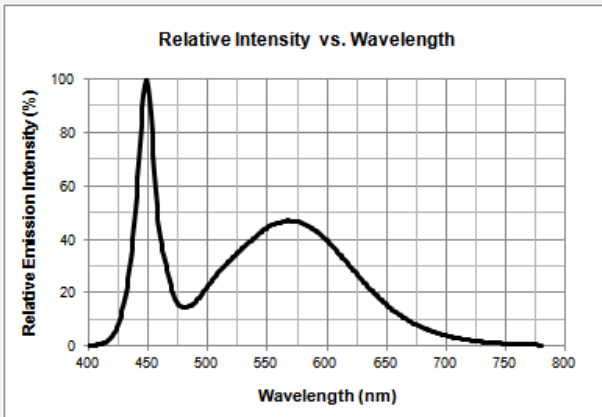
CCT: 3000 K



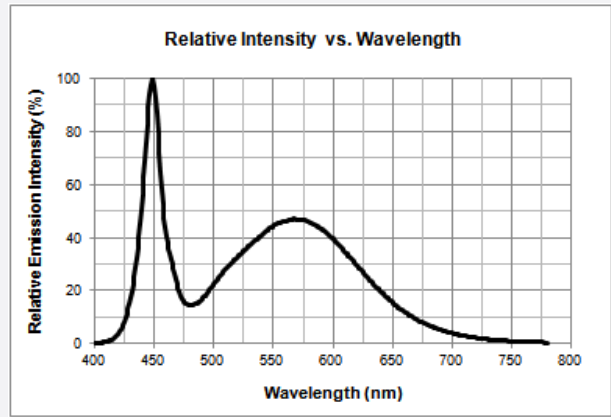
CCT: 4000 K



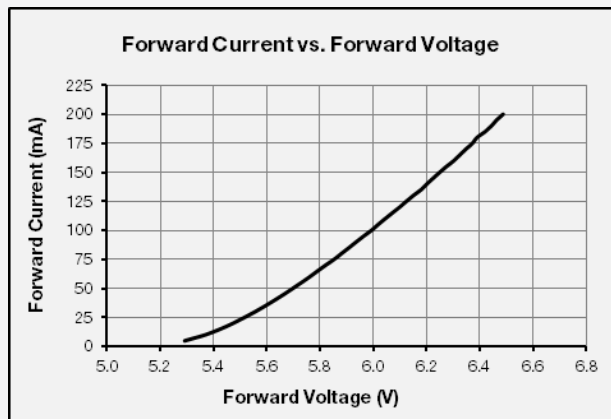
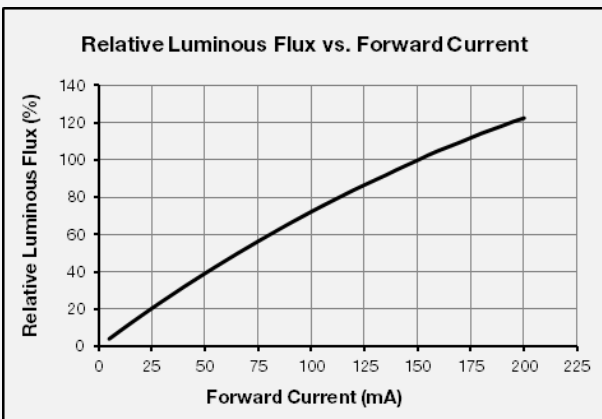
CCT:5000 K



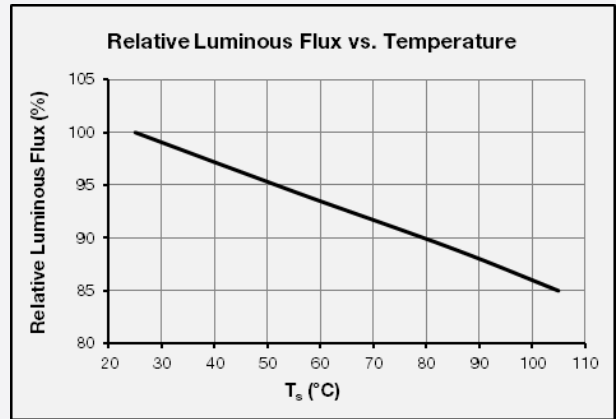
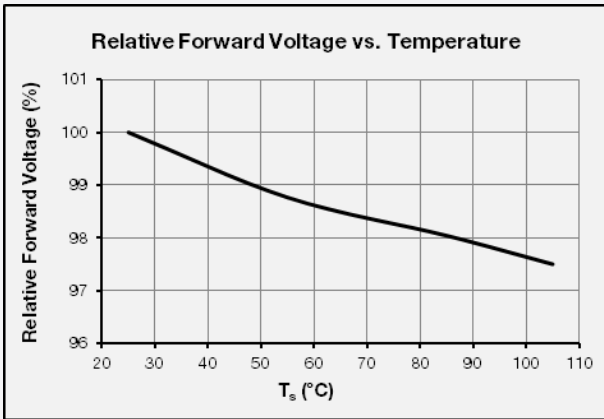
CCT: 5700 K



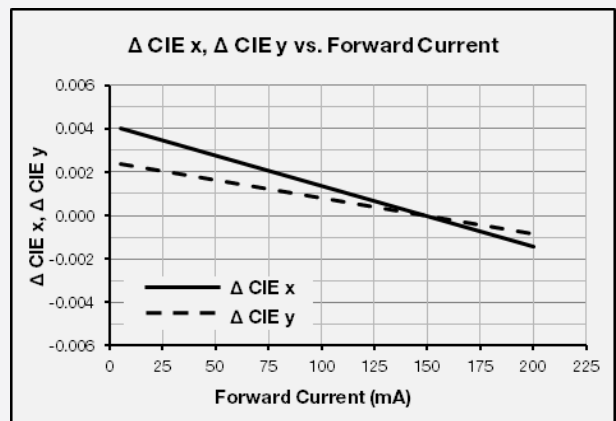
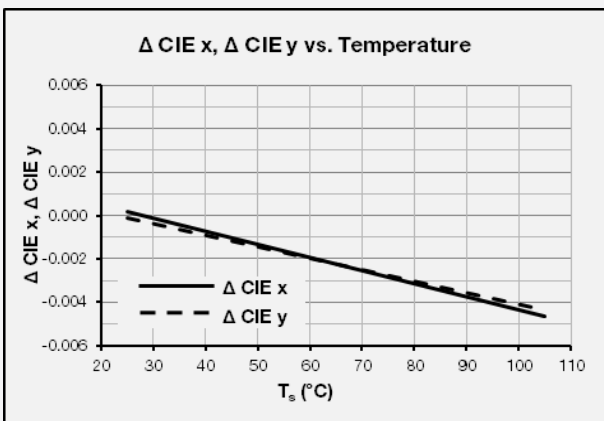
#### b) Forward Current Characteristics ( $T_s = 25 \text{ }^\circ\text{C}$ )



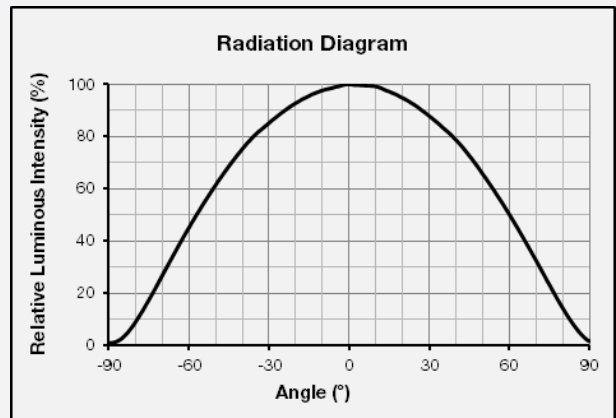
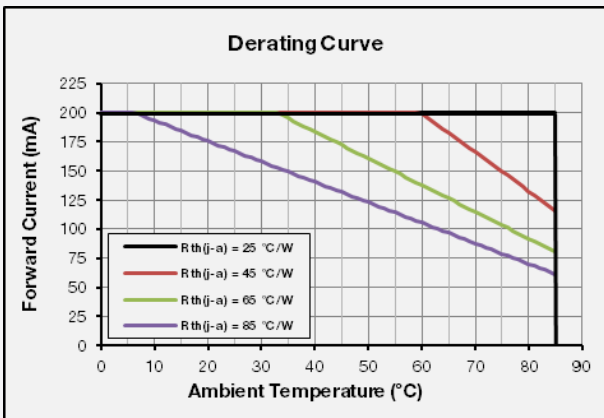
c) Temperature Characteristics ( $I_F = 150 \text{ mA}$ )



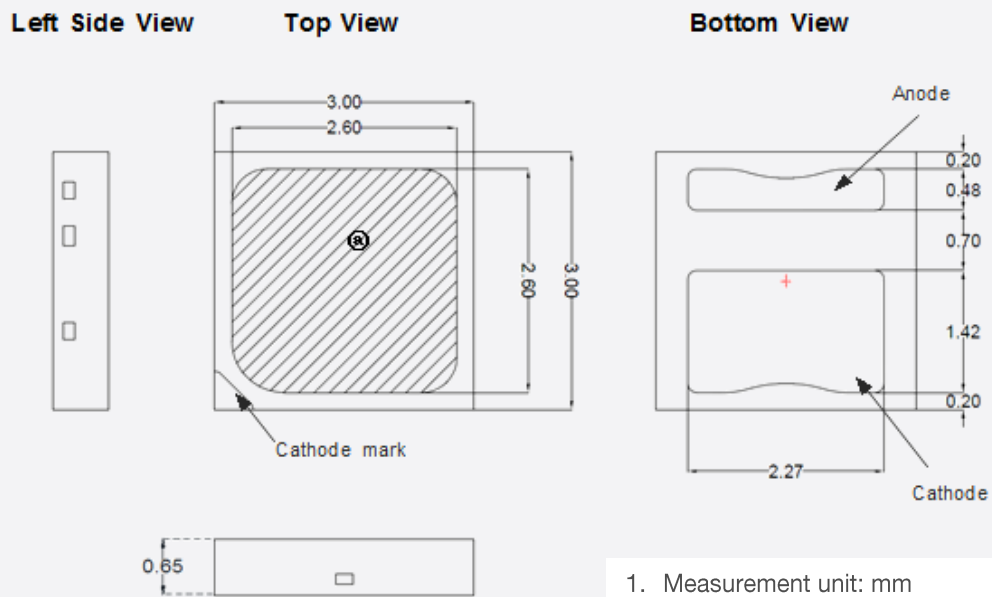
d) Color Shift Characteristics ( $T_s = 25 \text{ °C}$ ,  $I_F = 150 \text{ mA}$ )



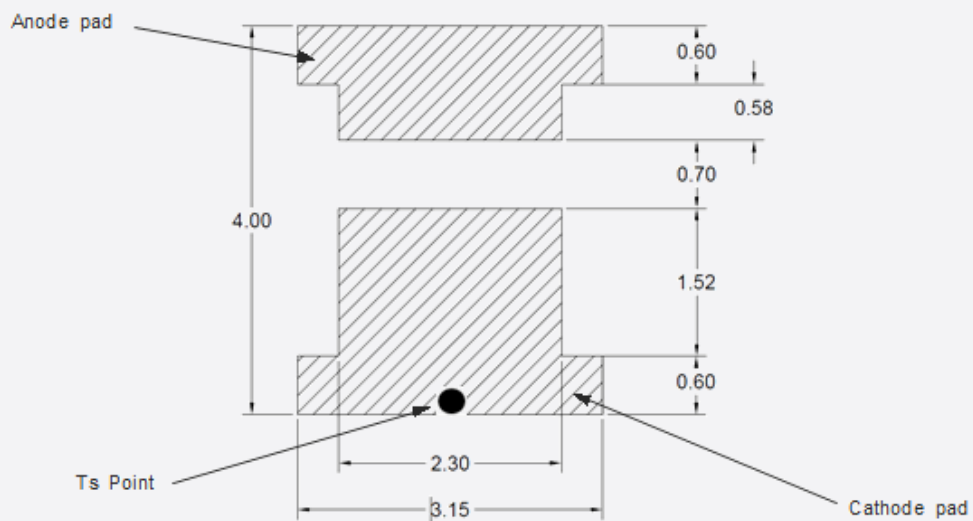
e) Derating Curve and Beam Angle Characteristics ( $I_F = 150 \text{ mA}$ ,  $T_s = 25 \text{ °C}$ )



## 4. Outline Drawing & Dimension



1. Measurement unit: mm
2. Tolerance:  $\pm 0.10$  mm
3. Do not place pressure on the encapsulation resin ①



**Recommended Land Pattern**

### Notes:

- 1) This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).
- 2)  $T_s$  point and measurement method:
  - ① Measure one point at the cathode pad. If necessary, remove PSR of PCB to reach  $T_s$  point.
  - 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 and Conditions

### a) Test Items

Test Item	Test Condition	Test Hour / Cycle	Sample Size
Room Temperature Life Test	25 °C, DC 200 mA	1000 h	22
High Temperature Life Test	85 °C, DC 200 mA	1000 h	22
High Temperature Humidity Life Test	85 °C, 85 % RH, DC 200 mA	1000 h	22
Low Temperature Life Test	-40 °C, DC 200 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 200 mA	100 cycles	22
Thermal Cycle	-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)		5 times	30
ESD (MM)			
Vibration Test	20~2000~20 Hz, 200 m/s <sup>2</sup> , 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

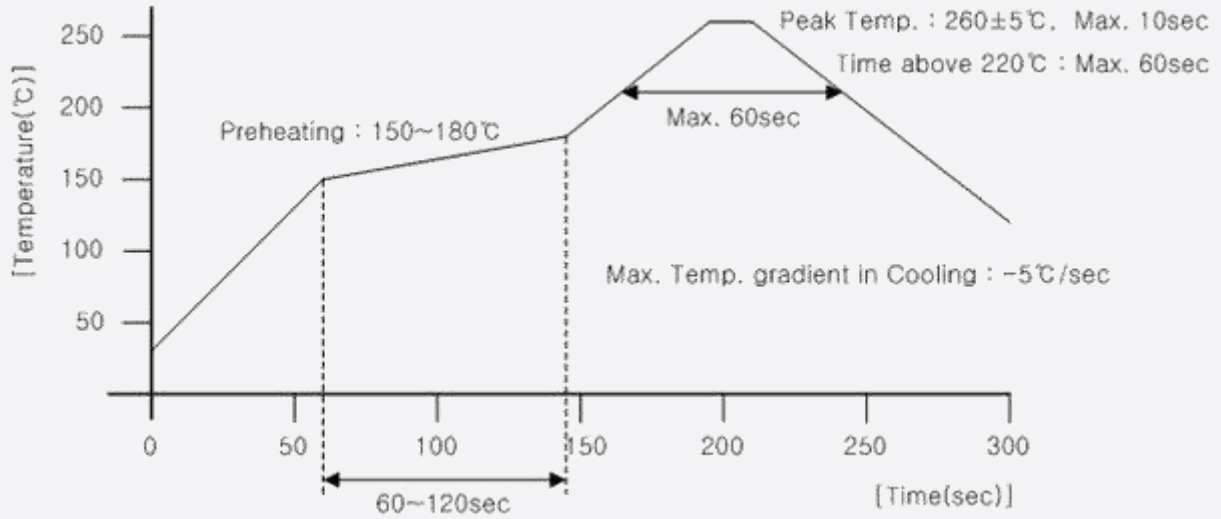
### b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T <sub>s</sub> = 25 °C)	Limit	
			Min.	Max.
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 150 mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φ <sub>v</sub>	I <sub>F</sub> = 150 mA	Init. Value * 0.7	Init. Value * 1.1

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



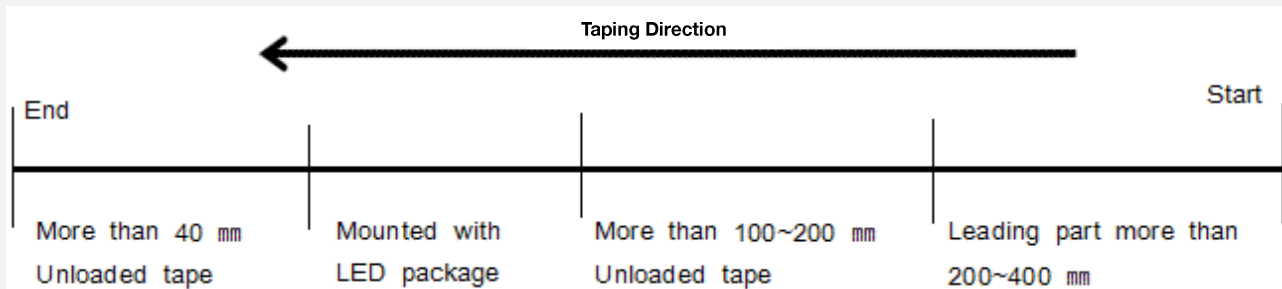
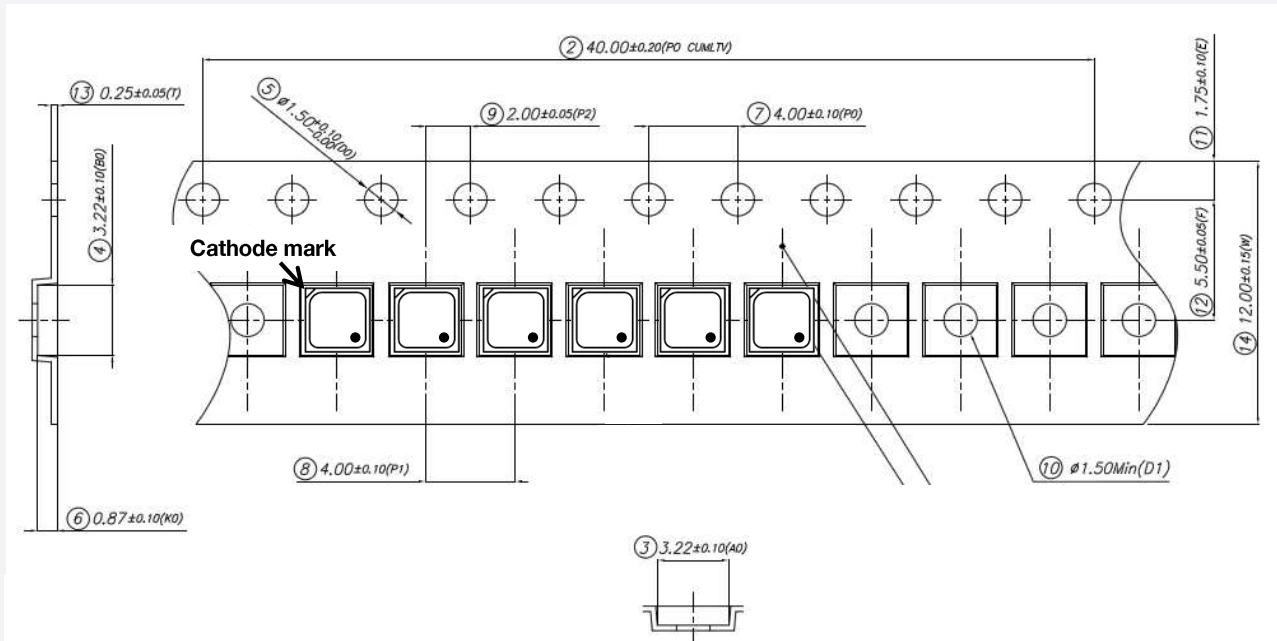
### b) Manual Soldering Conditions

Not more than 5 seconds @ max.  $300^\circ\text{C}$ , under soldering iron.

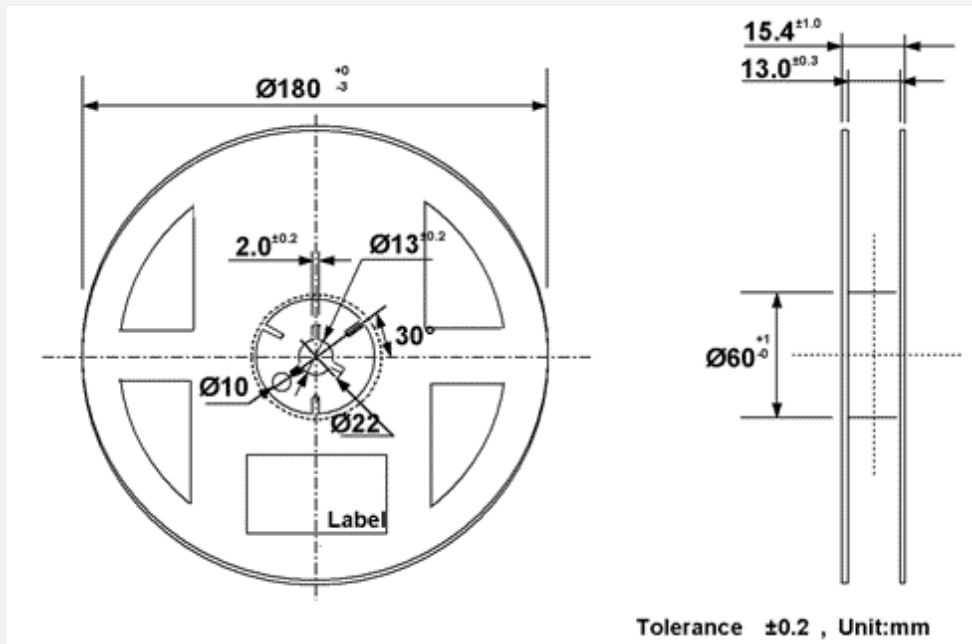
## 7. Tape & Reel

### a) Taping Dimension

(unit: mm)



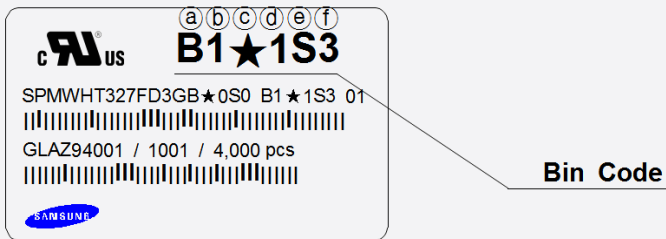
## b) Reel Dimension

**Notes:**

- 1) Quantity: The quantity/reel is 4,000 pcs
- 2) Cumulative tolerance: Cumulative tolerance / 10 pitches is  $\pm 0.2$  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  $10^\circ$  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

'★' means all kind of Chromaticity Coordinate Ranks

Bin Code:

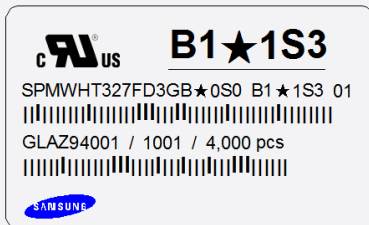
ⒶⒷ: Forward Voltage bin (refer to page 7)

ⒸⒹ: Chromaticity bin (refer to page 9~12)

ⒺⒻ: Luminous Flux bin (refer to page 4-5)

### b) Lot Number

The lot number is composed of the following characters:



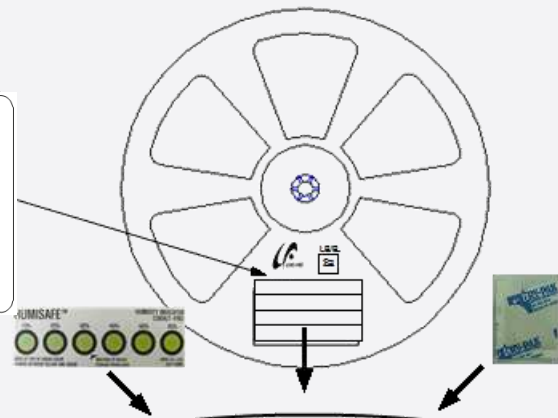
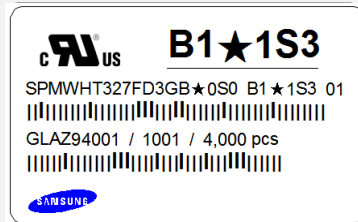
①②③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / 4,000 pcs

- 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)

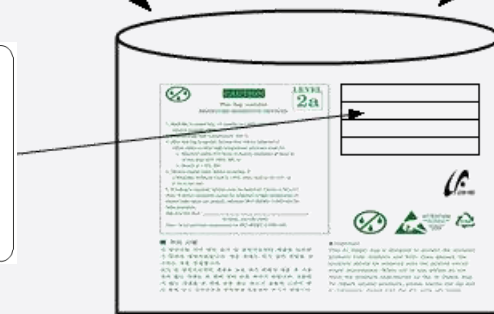
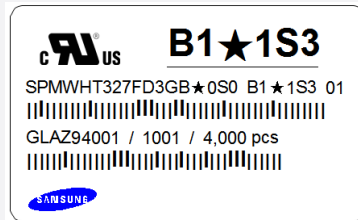
## 9. Packing Structure

### a) Packing Process

Reel



Aluminum Vinyl Packing Bag

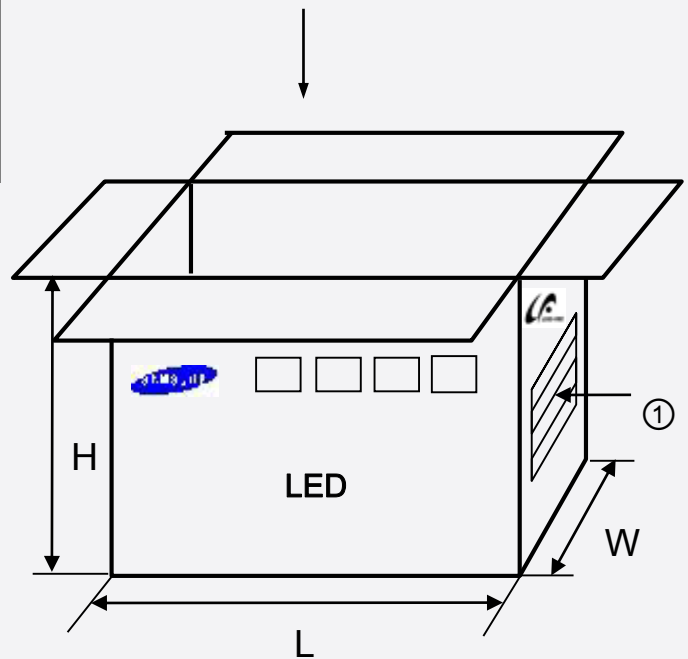
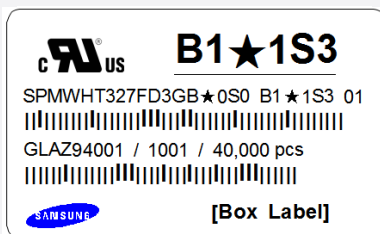


Outer Box

Material: Paper (SW3B(B))

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

① Side Label



b) Aluminum Vinyl Packing Bag



**CAUTION**  
 This bag contains  
**MOISTURE SENSITIVE DEVICES**

**LEVEL**  
2a

1. Shelf life in sealed bag: 12 months at <math>< 40^{\circ}\text{C}</math> and <math>< 90\%</math> relative humidity (RH)
2. Peak package body temperature: <math>240^{\circ}\text{C}</math>
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 <math>30^{\circ}\text{C}</math> / <math>60\%</math> RH, or
  - b. Stored at <math>< 10\%</math> RH
4. Devices require bake, before mounting, if:
  - a. Humidity Indicator Card is ><math>60\%</math> when read at <math>23 \pm 5^{\circ}\text{C}</math>, or
  - b. 2a is not met.
5. If baking is required, devices must be baked for 10 - 24 hours at <math>60 \pm 5^{\circ}\text{C}</math>

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



**B1★1S3**  
 SPMWHT327FD3GB★0S0 B1★1S3 01  
 GLAZ94001 / 1001 / 4,000 pcs  







**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-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  $\sim 40^{\circ}\text{C}$ ,  $\sim 90\%$  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  $30^{\circ}\text{C}$  /  $60\%$  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  $23 \pm 5^{\circ}\text{C}$ .
- 8) Devices must be baked for 10~24 hours at  $60 \pm 5^{\circ}\text{C}$ , 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.



# Legal and additional information.

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Samsung Electronics Co., Ltd. is a global leader in technology, opening new possibilities for people everywhere. Through relentless innovation and discovery, we are transforming the worlds of TVs, smartphones, tablets, PCs, cameras, home appliances, printers, LTE systems, medical devices, semiconductors and LED solutions. We employ 286,000 people across 80 countries with annual sales of US\$216.7 billion. To discover more, please visit [www.samsungled.com](http://www.samsungled.com).

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