



**THE DATASHEET OF  
SPMWH3326MD7WAUYSA**



Middle Power LED Series  
3030

LM301Z  
CRI 90



#### Features & Benefits

- 0.3 W class middle power LED
- EMC resin for high reliability
- Standard form factor for design flexibility (3.0 × 3.0 mm)



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## 1. Characteristics

### a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	$T_a$	-40 ~ +85	°C	-
Storage Temperature	$T_{stg}$	-40 ~ +100	°C	-
LED Junction Temperature	$T_j$	125	°C	-
Forward Current	$I_F$	400	mA	-
Pulse Forward Current	$I_{FP}$	600	mA	Duty 1/10, pulse width 10 ms
Assembly Process Temperature	-	260 <10	°C s	-
ESD (HBM)	-	5	kV	-

### b) Electro-optical Characteristics ( $I_F = 65 \text{ mA}$ , $T_s = 25 \text{ °C}$ )

Item	Nominal CCT (K)	Rank	Bin	Min.	Typ.	Max.	Unit
Forward Voltage ( $V_F$ )		WA	AY	2.6	-	2.7	V
			AZ	2.7	-	2.8	
			A1	2.8	-	2.9	
Reverse Voltage (@ 5 mA)				0.7	-	1.2	V
Color Rendering Index ( $R_a$ )		5		80	-	-	-
Special CRI (R9)				-	-	-	-
Thermal Resistance (junction to solder point)				-	12	-	°C/W
Beam Angle				-	120	-	°

#### Note:

Samsung maintains measurement tolerance of: forward voltage =  $\pm 0.1 \text{ V}$ , luminous flux =  $\pm 5 \%$ , CRI =  $\pm 3$ , R9 =  $\pm 6.5$

## 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	3	3	2	6	M	D	7	W	A	V	0	S	A

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>3</b>	Zener version																					
7 8 9	Form Factor	<b>326</b>	3.0 x 3.0 x 0.65 mm; 2 pads																					
10	Sorting Current	<b>M</b>	65 mA																					
11	Chromaticity Coordinates	<b>D</b>	MacAdam																					
12	CRI	<b>7</b>	Min. 90																					
13 14	Forward Voltage (V)	<b>WA</b>	<table> <tr> <td><b>AY</b></td><td>2.6~2.7</td></tr> <tr> <td>Bin Code: <b>AZ</b></td><td>2.7~2.8</td></tr> <tr> <td><b>A1</b></td><td>2.8~2.9</td></tr> </table>	<b>AY</b>	2.6~2.7	Bin Code: <b>AZ</b>	2.7~2.8	<b>A1</b>	2.8~2.9															
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15 16	CCT (K)	<table> <tr> <td><b>W</b>☆</td><td>2700</td><td>WN, WP, WQ, WR, WS, WT, WU</td></tr> <tr> <td><b>V</b>☆</td><td>3000</td><td>VN, VP, VQ, VR, VS, VT, VU</td></tr> <tr> <td><b>U</b>☆</td><td>3500</td><td>UN, UP, UQ, UR, US, UT, UU</td></tr> <tr> <td><b>T</b>☆</td><td>4000</td><td>Bin Code: TN, TP, TQ, TR, TS, TT, TU</td></tr> <tr> <td><b>R</b>☆</td><td>5000</td><td>RN, RP, RQ, RR, RS, RT, RU</td></tr> <tr> <td><b>Q</b>☆</td><td>5700</td><td>QN, QP, QQ, QR, QS, QT, QU</td></tr> <tr> <td><b>P</b>☆</td><td>6500</td><td>PN, PP, PQ, PR, PS, PT, PU</td></tr> </table> <p>☆ : "0" (Whole Bin) "3" (MacAdam 3- step) "Y" (Kitting)</p>	<b>W</b> ☆	2700	WN, WP, WQ, WR, WS, WT, WU	<b>V</b> ☆	3000	VN, VP, VQ, VR, VS, VT, VU	<b>U</b> ☆	3500	UN, UP, UQ, UR, US, UT, UU	<b>T</b> ☆	4000	Bin Code: TN, TP, TQ, TR, TS, TT, TU	<b>R</b> ☆	5000	RN, RP, RQ, RR, RS, RT, RU	<b>Q</b> ☆	5700	QN, QP, QQ, QR, QS, QT, QU	<b>P</b> ☆	6500	PN, PP, PQ, PR, PS, PT, PU	
<b>W</b> ☆	2700	WN, WP, WQ, WR, WS, WT, WU																						
<b>V</b> ☆	3000	VN, VP, VQ, VR, VS, VT, VU																						
<b>U</b> ☆	3500	UN, UP, UQ, UR, US, UT, UU																						
<b>T</b> ☆	4000	Bin Code: TN, TP, TQ, TR, TS, TT, TU																						
<b>R</b> ☆	5000	RN, RP, RQ, RR, RS, RT, RU																						
<b>Q</b> ☆	5700	QN, QP, QQ, QR, QS, QT, QU																						
<b>P</b> ☆	6500	PN, PP, PQ, PR, PS, PT, PU																						
17 18	Luminous Flux (lm)	<b>SA</b>	<table> <tr> <td>Bin Code:</td><td>SA</td></tr> </table>	Bin Code:	SA																			
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**a) Luminous Flux Bins ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ °C}$ )**

Nominal CCT (K)	CRI Min.	Product Code	Flux Bin	Flux Range ( $\Phi_v$ , lm)
2700	90	SPMWH3326MD7WAW☆SA	SA	24.0 - 27.0
3000	90	SPMWH3326MD7WAV☆SA	SA	24.5 - 27.5
3500	90	SPMWH3326MD7WAU☆SA	SA	25.5 - 28.5
4000	90	SPMWH3326MD7WAT☆SA	SA	26.0 - 29.0
5000	90	SPMWH3326MD7WAR☆SA	SA	26.5 - 29.5
5700	90	SPMWH3326MD7WAQ☆SA	SA	26.5 - 29.5
6500	90	SPMWH3326MD7WAP☆SA	SA	26.0 - 29.0

**Note:**

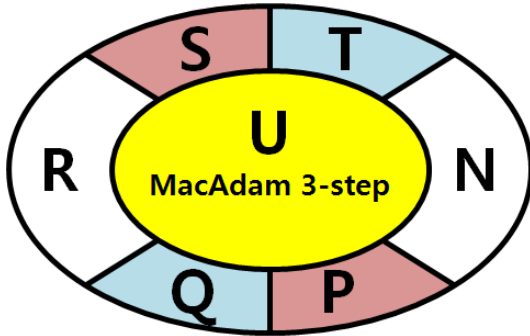
"☆" can be "0" (Whole Bin), "3" (MacAdam 3-step), "Y" (Kitting)

## b) Kitting Rule

### 1) Y Kitting bin Concept

1. Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (VF, Color, Im).
2. A forward voltage (VF) of kitting bin is combined by a pair of same VF rank such as (A2+A2) or (A3+A3).
3. A Chromaticity Coordinates of kitting bin is mixed by kitting procedure.(below kitting simulation)

#### [Kitting example]



#### [Binning Information]

	Bin #1	Bin #2
VF	AY	AY
	AZ	AZ
	A1	A1
CIE	U	U
	N	R
	P	S
	Q	T

**c) Color Bins ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ °C}$ )**

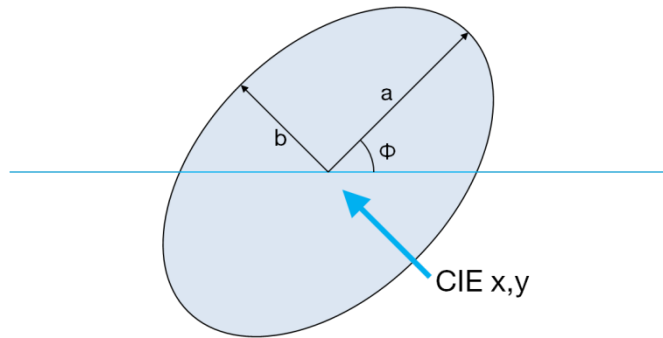
Nominal CCT (K)	CRI	Product Code	Color Rank	Chromaticity Bins
2700	90	SPMWH3326MD7WAW0SA	W0 (Whole Bin)	WN, WP, WQ, WR, WS, WT, WU
		SPMWH3326MD7WAW3SA	W3 (MacAdam 3-step)	WU
		SPMWH3326MD7WAWYSA	WY (Kitting)	WN, WP, WQ, WR, WS, WT, WU
3000	90	SPMWH3326MD7WAV0SA	V0 (Whole Bin)	VN, VP, VQ, VR, VS, VT, VU
		SPMWH3326MD7WAV3SA	V3 (MacAdam 3-step)	VU
		SPMWH3326MD7WAVYSA	VY (Kitting)	VN, VP, VQ, VR, VS, VT, VU
3500	90	SPMWH3326MD7WAU0SA	U0 (Whole Bin)	UN, UP, UQ, UR, US, UT, UU
		SPMWH3326MD7WAU3SA	U3 (MacAdam 3-step)	UU
		SPMWH3326MD7WAUYSA	UY (Kitting)	UN, UP, UQ, UR, US, UT, UU
4000	90	SPMWH3326MD7WAT0SA	T0 (Whole Bin)	TN, TP, TQ, TR, TS, TT, TU
		SPMWH3326MD7WAT3SA	T3 (MacAdam 3-step)	TU
		SPMWH3326MD7WATYSA	TY (Kitting)	TN, TP, TQ, TR, TS, TT, TU
5000	90	SPMWH3326MD7WAR0SA	R0 (Whole Bin)	RN, RP, RQ, RR, RS, RT, RU
		SPMWH3326MD7WAR3SA	R3 (MacAdam 3-step)	RU
		SPMWH3326MD7WARYSA	RY (Kitting)	RN, RP, RQ, RR, RS, RT, RU
5700	90	SPMWH3326MD7WAQ0SA	Q0 (Whole Bin)	QN, QP, QQ, QR, QS, QT, QU
		SPMWH3326MD7WAQ3SA	Q3 (MacAdam 3-step)	QU
		SPMWH3326MD7WAQYSA	QY (Kitting)	QN, QP, QQ, QR, QS, QT, QU
6500	90	SPMWH3326MD7WAP0SA	P0 (Whole Bin)	PN, PP, PQ, PR, PS, PT, PU
		SPMWH3326MD7WAP3SA	P3 (MacAdam 3-step)	PU
		SPMWH3326MD7WAPYSA	PY (Kitting)	PN, PP, PQ, PR, PS, PT, PU

**d) Voltage Bins ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ °C}$ )**

Nominal CCT (K)	CRI Min.	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	WA	AY	2.6 ~ 2.7
-	-	-	WA	AZ	2.7 ~ 2.8
-	-	-	WA	A1	2.8 ~ 2.9



f) Chromaticity Region & Coordinates ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )

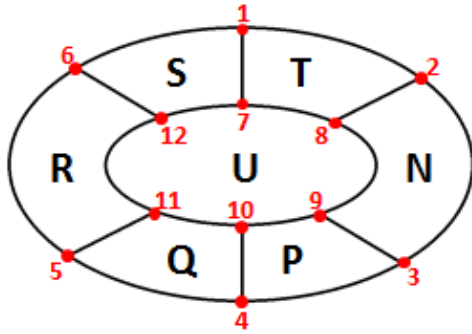


MacAdam	CCT (K)	Center point		Major-axis	Minor-axis	Rotation
		CIE x	CIE y	a	b	$\phi$
3 step	2700	0.4578	0.4101	0.0081	0.0042	53.70
	3000	0.4338	0.4030	0.0083	0.0041	53.22
	3500	0.4073	0.3917	0.0093	0.0041	54.00
	4000	0.3818	0.3797	0.0094	0.0040	53.72
	5000	0.3447	0.3553	0.0082	0.0035	59.62
	5700	0.3287	0.3417	0.0075	0.0032	59.10
	6500	0.3123	0.3282	0.0067	0.0029	58.57
5 step	2700	0.4578	0.4101	0.0135	0.0070	53.70
	3000	0.4338	0.4030	0.0138	0.0068	53.22
	3500	0.4073	0.3917	0.0155	0.0068	54.00
	4000	0.3818	0.3797	0.0157	0.0067	53.72
	5000	0.3447	0.3553	0.0137	0.0058	59.62
	5700	0.3287	0.3417	0.0125	0.0053	59.10
	6500	0.3123	0.3282	0.0112	0.0048	58.57

Note:

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

e) Chromaticity Region & Coordinates



CCT	Region	CIE x	CIE y
2700K	1	0.4521	0.4142
	2	0.4619	0.4216
	3	0.4675	0.4175
	4	0.4634	0.4059
	5	0.4537	0.3986
	6	0.4481	0.4028
	7	0.4544	0.4126
	8	0.4603	0.417
	9	0.4636	0.4145
	10	0.4612	0.4076
	11	0.4553	0.4032
	12	0.452	0.4057

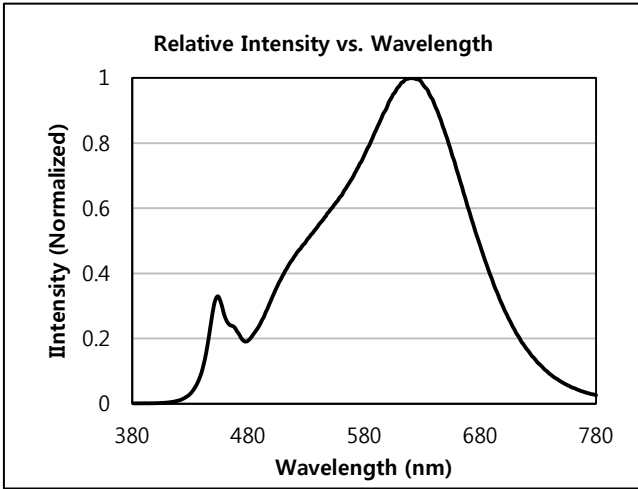
CCT	Region	CIE x	CIE y	CCT	Region	CIE x	CIE y	CCT	Region	CIE x	CIE y
3000K	1	0.4283	0.4071	3500K	1	0.4018	0.3957	4000K	1	0.3764	0.3837
	2	0.4382	0.4146		2	0.4125	0.4046		2	0.3871	0.3926
	3	0.4437	0.4105		3	0.418	0.4005		3	0.3925	0.3887
	4	0.4393	0.3989		4	0.4128	0.3877		4	0.3872	0.3758
	5	0.4293	0.3913		5	0.4022	0.3788		5	0.3765	0.3668
	6	0.4239	0.3954		6	0.3966	0.3828		6	0.3711	0.3707
	7	0.4305	0.4054		7	0.404	0.3941		7	0.3786	0.3821
	8	0.4364	0.41		8	0.4104	0.3994		8	0.385	0.3874
	9	0.4397	0.4075		9	0.4137	0.397		9	0.3882	0.3851
	10	0.4371	0.4005		10	0.4106	0.3893		10	0.385	0.3773
	11	0.4311	0.396		11	0.4042	0.384		11	0.3786	0.372
	12	0.4279	0.3984		12	0.4009	0.3864		12	0.3754	0.3743
5000K	1	0.3397	0.3583	5700K	1	0.3242	0.3445	6500K	1	0.3082	0.3307
	2	0.3482	0.367		2	0.332	0.3524		2	0.3153	0.3377
	3	0.3532	0.364		3	0.3365	0.3496		3	0.3194	0.3352
	4	0.3497	0.3524		4	0.3333	0.339		4	0.3164	0.3257
	5	0.3412	0.3436		5	0.3254	0.331		5	0.3093	0.3187
	6	0.3362	0.3465		6	0.3209	0.3338		6	0.3052	0.3212
	7	0.3417	0.3571		7	0.326	0.3434		7	0.3098	0.3297
	8	0.3468	0.3623		8	0.3307	0.3481		8	0.3141	0.3339
	9	0.3498	0.3605		9	0.3334	0.3464		9	0.3166	0.3324
	10	0.3477	0.3535		10	0.3314	0.3401		10	0.3148	0.3267

11	0.3426	0.3483	11	0.3267	0.3353	11	0.3105	0.3225
12	0.3396	0.35	12	0.324	0.3369	12	0.308	0.324

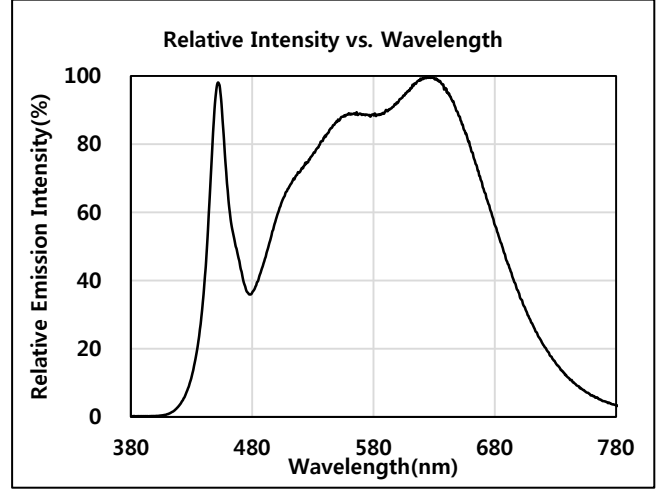
### 3. Typical Characteristics Graphs

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

CCT: 2700 K (90 CRI)



CCT: 4000 K (90 CRI)



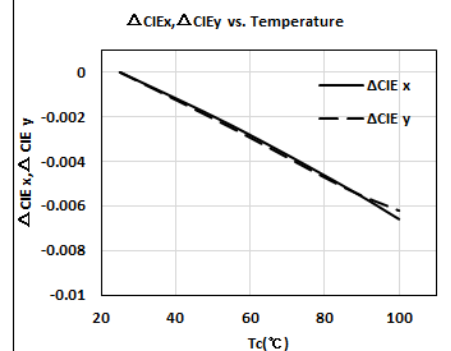
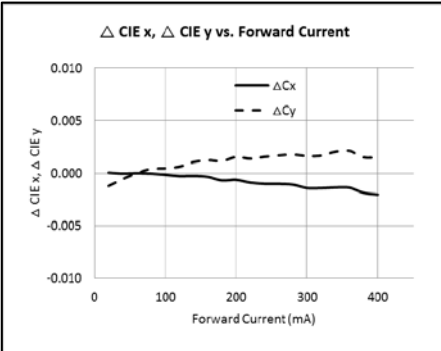
**b) Forward Current Characteristics ( $T_s = 25^\circ\text{C}$ )**



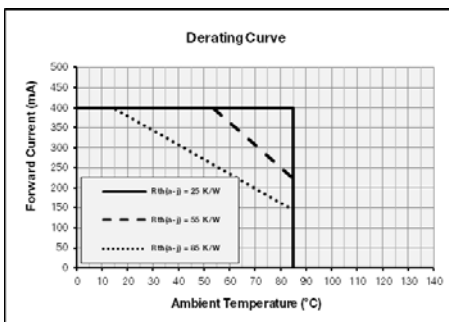
**c) Temperature Characteristics ( $I_F = 65\text{ mA}$ )**



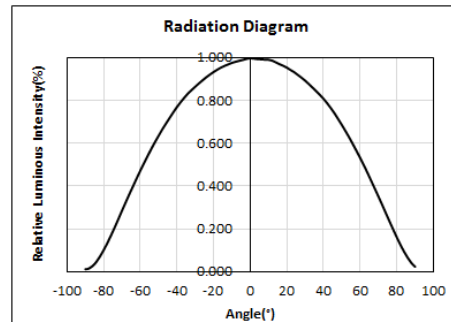
**d) Color Shift Characteristics ( $T_s = 25^\circ\text{C}$ ,  $I_F = 65\text{ mA}$ )**



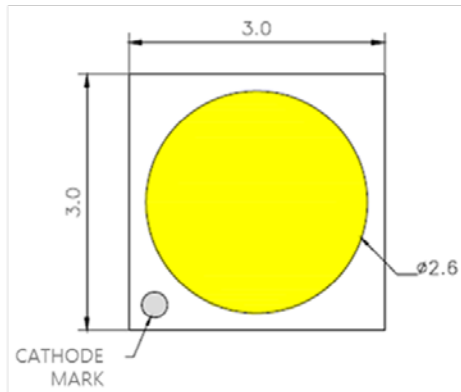
**e) Derating Curve**



**f) Beam Angle Characteristics ( $I_F = 65\text{ mA}$ ,  $T_s = 25^\circ\text{C}$ )**



#### 4. Outline Drawing & Dimension



[TOP VIEW]



[SIDE VIEW]



[BOTTOM VIEW]



[RECOMMENDED PCB SOLDER PAD]

#### 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.

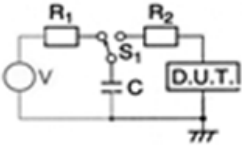
#### Precautions:

- 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 & Conditions

### a) Test Items

Test Item	Test Condition	Test Hour / Cycle	Sample No.	
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	60 °C, 90 % 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 150 mA	100 cycles	22	
Thermal Cycle	-40 °C / 15 min ↔ 100 °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 <sub>1</sub> : 10 MΩ R <sub>2</sub> : 1.5 kΩ C: 100 pF V: ±5 kV	5 times	30
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> = 65 mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φ <sub>v</sub>	I <sub>F</sub> = 65 mA	Init. Value * 0.7	Init. Value * 1.1

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



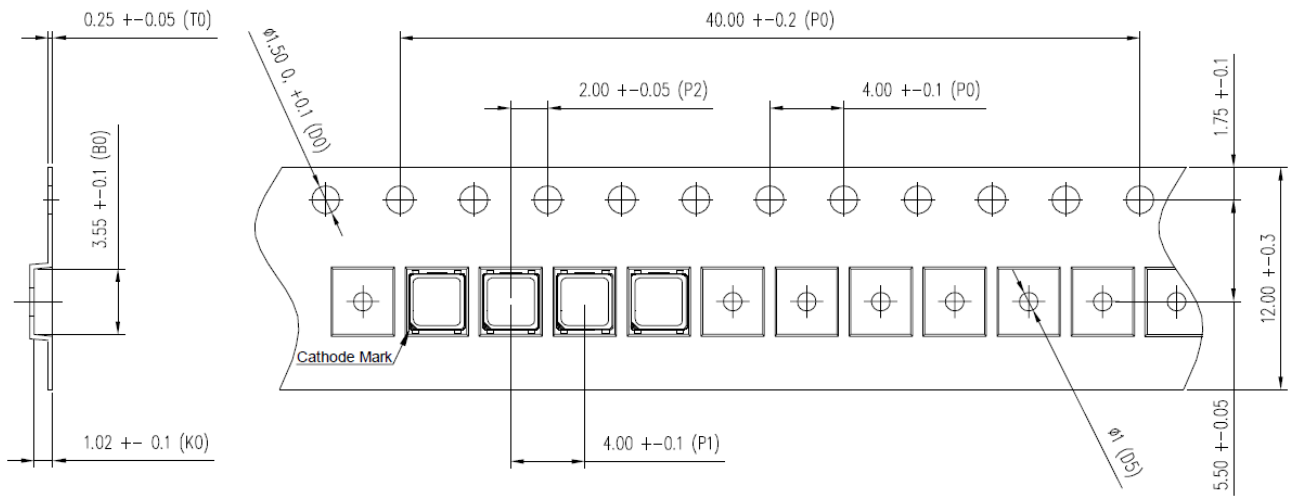
### b) Manual Soldering Conditions

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

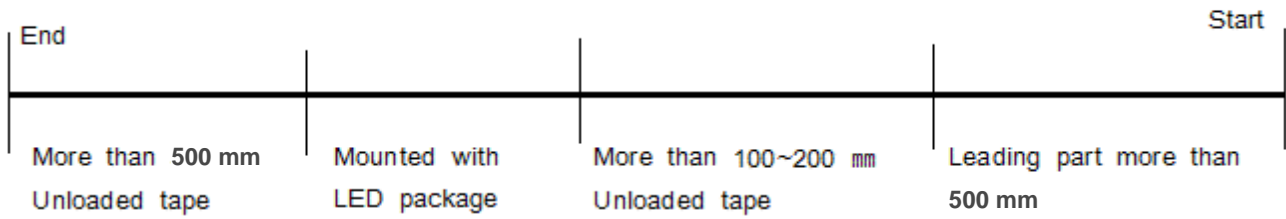
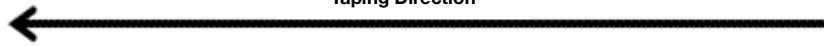
## 7. Tape & Reel

### a) Taping Dimension

(unit: mm)



Taping Direction



## b) Reel Dimension

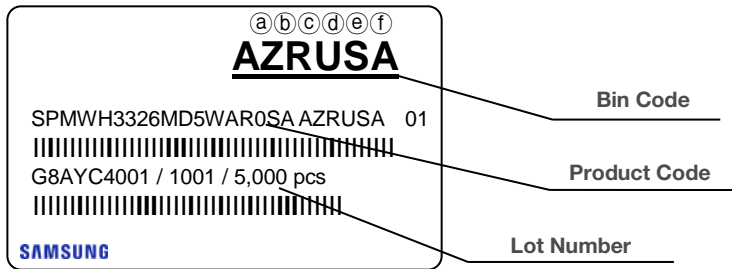
(unit: mm)

**Notes:**

- 1) Quantity: The quantity/reel is 5,000 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



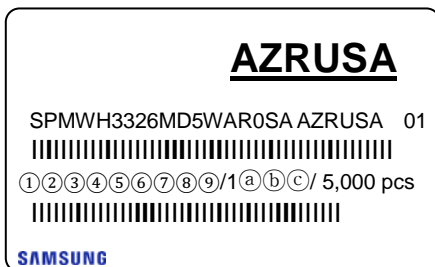
Note: Denoted bin code and product code above is only an example (see description on page 5)

Bin Code:

- ⒶⒷ: Forward Voltage bin (refer to page 8)
- ⒸⒹ: Chromaticity bin (refer to page 10-13)
- ⒺⒻ: Luminous Flux bin (refer to page 8)

### b) Lot Number

The lot number is composed of the following characters:



① ②③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / 5,000 pcs

- ① : Production site (S: Giheung, Korea, G: Tianjin, China)
- ② : 8 (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)
- ⑥⑦⑧⑨ : Day (1~9, A, B~V)
- ⒶⒷⒸ : Product serial number (001 ~ 999)



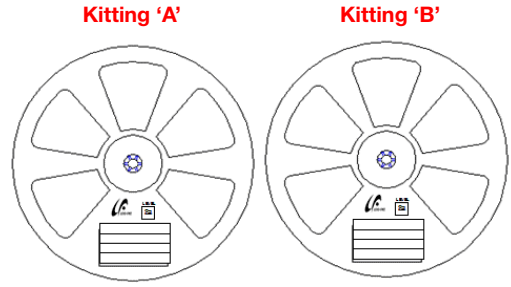
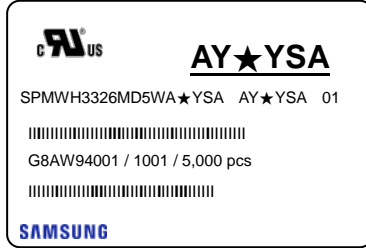
b) Packing Process for kitting (The quantity of PKG on the Reel to be Max 5,000pcs)

Reel

Kitting 'A'

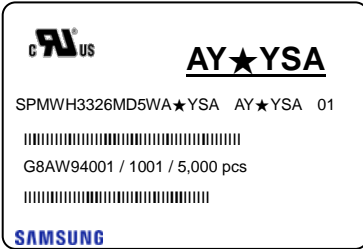


Kitting 'B'

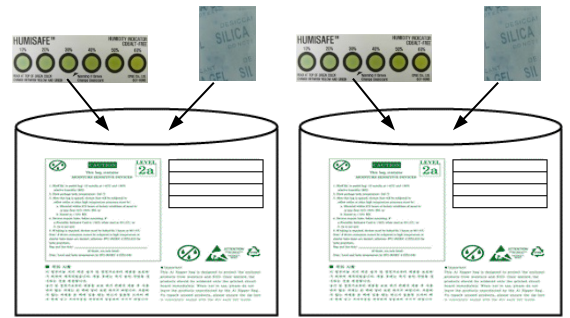
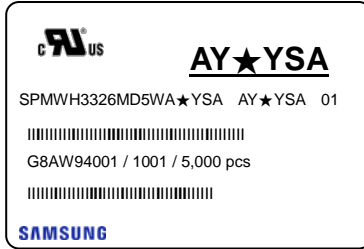


Aluminum Vinyl Packing Bag

Kitting 'A'

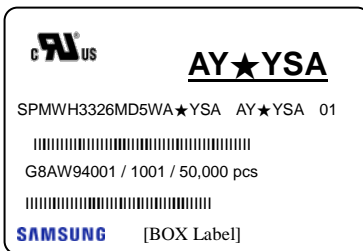


Kitting 'B'

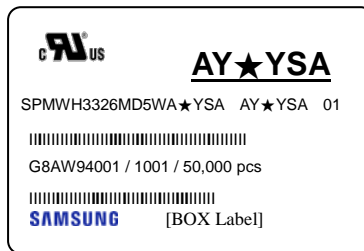


Outer Box

Kitting 'A'



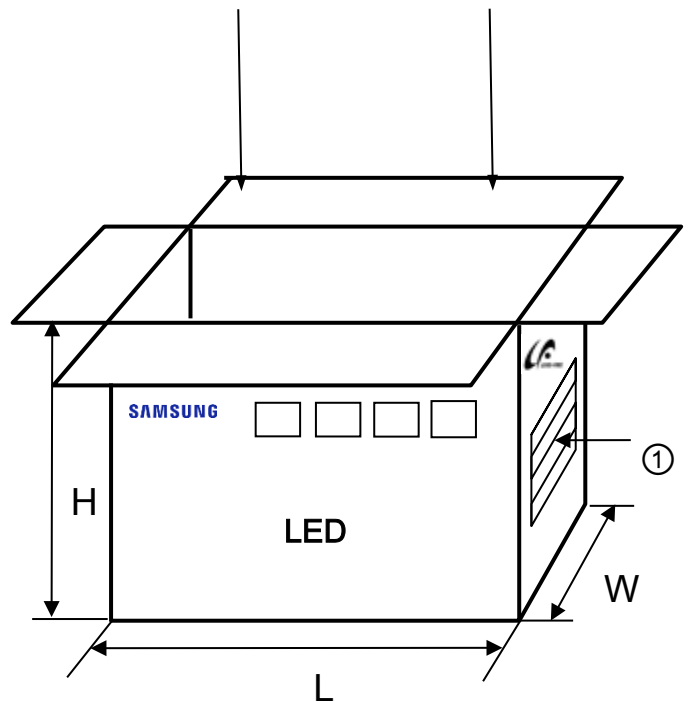
Kitting 'B'




Note: "★" can be Nominal CCT code.

Material: Paper (SW3B(B))

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



c) 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 >/60% when read at 23±5°C, or
  - b. 2a is not met.
5. If baking is required, devices must be baked for 10 ~ 24 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

AZRUSA

SPMWH3326MD5WAR0SA AZRUSA 01  
 |||  
 GLAYC4001 / 1001 / 5,000 pcs  
 |||

**SAMSUNG**






**■ 주의 사항**

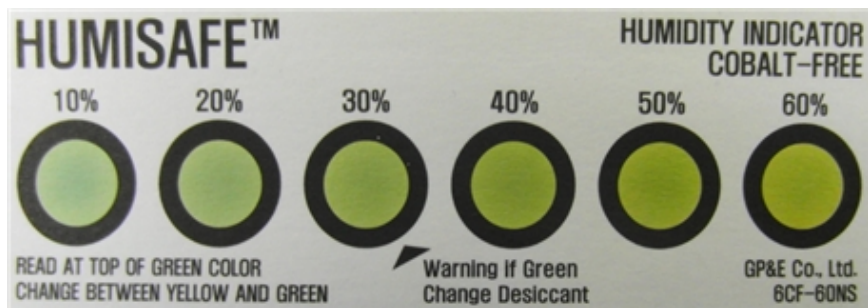
이 알루미늄 지퍼 백은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

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  $\sim 40\text{ }^{\circ}\text{C}$ ,  $\sim 90\text{ \% RH}$ ).
- 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  $30\text{ }^{\circ}\text{C}$  /  $60\text{ \% RH}$ , or
  - b. Stored at  $<10\text{ \% RH}$
- 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  $>60\text{ \%}$  at  $23 \pm 5\text{ }^{\circ}\text{C}$ .
- 8) Devices must be baked for 10~24 hours at  $60 \pm 5\text{ }^{\circ}\text{C}$ , 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 inspires the world and shapes the future with transformative ideas and technologies.

The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, and memory, system LSI, foundry and LED solutions. For the latest news, please visit the Samsung Newsroom at [news.samsung.com](http://news.samsung.com).

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KOREA

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