Middle Power LED Series
2835 0.2W Ra80

LM281BA+

S3 rank, 2Vf, Mac3 only

Designed for better lm/$ (Ambient, Linear)

Features & Benefits

- 0.2W Class mid power LED
- Standard form factor for design flexibility (2.8 × 3.5 x 0.65mm)

SAMSUNG

Table of Contents

1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Ambient / Operating Temperature	T_a	-40 ~ +80	ºC	-
Storage Temperature	T_{stg}	-40 ~ +80	ºC	-
LED Junction Temperature	T_j	115	ºC	-
Forward Current	I_F	80	mA	-
Peak Pulsed Forward Current	I_{Fp}	140	mA	Duty 1/10, pulse width 10ms
Assembly Process Temperature	-	260 <10	ºC s	-
ESD (HBM)	-	2	KV	

Note:

Proper current derating must be observed to maintain junction temperature below the maximum at all time.

ESD (HBM) rating means PASS with 80% probability.

b) Electro-optical Characteristics (I_F = 60 mA, T_s = 25 ºC)

Item	Unit	Rank	Bin	Min.	Typ.	Max.
Forward Voltage (VF)	V	WN	A1	2.8	-	2.9
			A2	2.9	-	3.0
Color Rendering Index (Ra)	-	5		80	-	-
Thermal Resistance (junction to solder point)	ºC/W			-	25	-
Beam Angle	º			-	120	-

Note:

Samsung maintains measurement tolerance of: forward voltage = ±0.1 V, CRI = ±3

b) Electro-optical Characteristics (I_F = 60 mA, T_s = 25 ºC)

Item	CRI (R_a) Min.	Nominal CCT (K)	Bin	60mA	
				Min.	Max.
Luminous Flux (Φv)	80	2700	S3	25.5	27.5
		3000	S3	26.5	28.5
		3500	S3	27.0	29.0
		4000	S3	28.0	30.0
		5000	S3	28.5	30.5
		5700	S3	28.0	30.0
		6500	S3	28.0	30.0

Note:

Samsung maintains measurement tolerance of: forward voltage = ±0.1V, luminous flux = ±5 %, CRI = ±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	2	2	2	8	6	D	5	W	N	R	U	S	3

Digit	PKG Information	Code	Specification			
1 2 3	Samsung Package Middle Power	SPM	Middle power			
4 5	Color	WH	White			
6	Product Version	2	2nd version			
7 8 9	Form Factor	228	2.8 x 3.5 x 0.65 mm; 2 pads; 1chip;			
10	Sorting Current (mA)	6	60 mA			
11	Chromaticity Coordinates	D	ANSI Standard			
12	CRI	5	Min. 80			
13 14	Forward Voltage (V)	WN	2.8 ~ 3.0	Bin code	A1 A2	2.8 ~ 2.9 2.9 ~ 3.0
15 16	CCT (K)	WU VU UU TU RU QU PU	2700 3000 3500 4000 5000 5700 6500	Bin Code:	WU VU UU TU RU QU PU	
17 18	Luminous Flux	S3		Bin Code	S3	

a) Luminous Flux Bins (I_F = 60 mA, T_s= 25°C)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	Flux Bin	Flux Range (Φ_v, lm)
80	2700	SPMWH22286D5WNWUS3	S3	25.5~27.5
	3000	SPMWH22286D5WNVUS3	S3	26.5~28.5
	3500	SPMWH22286D5WNUUS3	S3	27.0~29.0
	4000	SPMWH22286D5WNTUS3	S3	28.0~30.0
	5000	SPMWH22286D5WNRUS3	S3	28.5~30.5
	5700	SPMWH22286D5WNQUS3	S3	28.0~30.0
	6500	SPMWH22286D5WNPUS3	S3	28.0~30.0

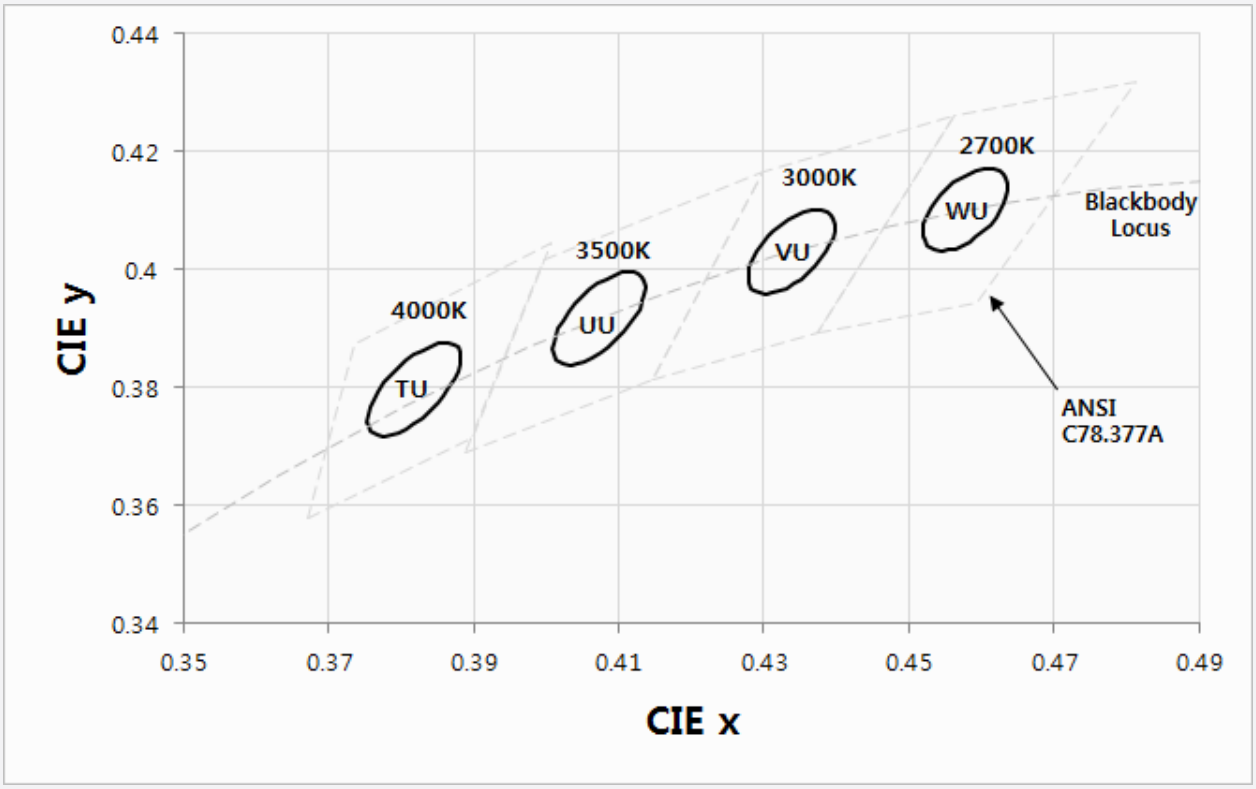
b) Color Bins (I_F = 60 mA, T_s= 25 °C)

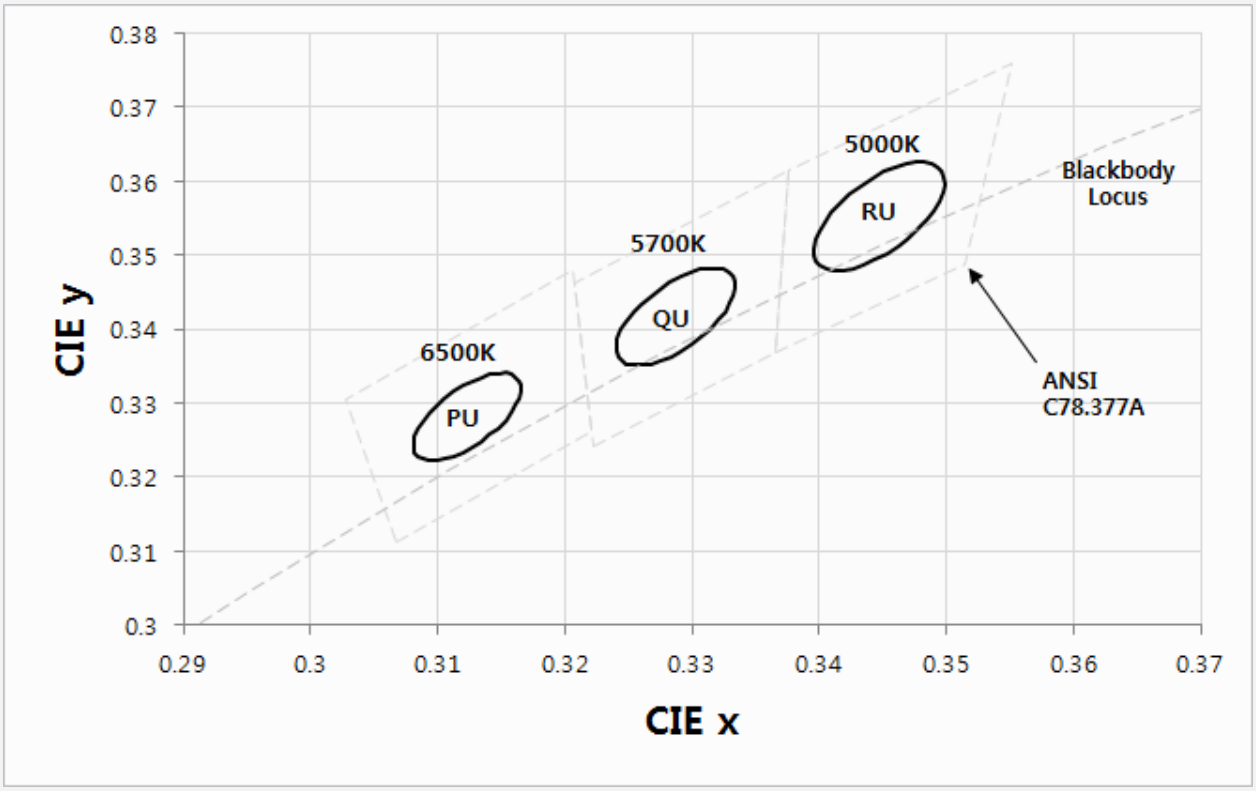
CRI (R_a) Min.	Nominal CCT (K)	Product Code	Color Rank	Chromaticity Bins
80	2700	SPMWH22286D5WNWUS3	WU (MacAdam 3-step only)	WU
	3000	SPMWH22286D5WNVUS3	VU (MacAdam 3-step only)	VU
	3500	SPMWH22286D5WNUUS3	UU (MacAdam 3-step only)	UU
	4000	SPMWH22286D5WNTUS3	TU (MacAdam 3-step only)	TU
	5000	SPMWH22286D5WNRUS3	RU (MacAdam 3-step only)	RU
	5700	SPMWH22286D5WNQUS3	QU (MacAdam 3-step only)	QU
	6500	SPMWH22286D5WNPUS3	PU (MacAdam 3-step only)	PU

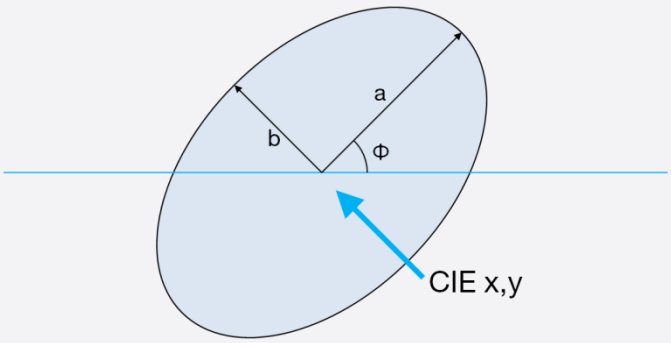
c) Voltage Bins (I_F = 60 mA, T_s = 25 °C)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	WN	A1	2.8 ~ 2.9
				A2	2.9 ~ 3.0

d) Chromaticity Region & Coordinates (I_F = 60 mA, T_s = 25 °C)







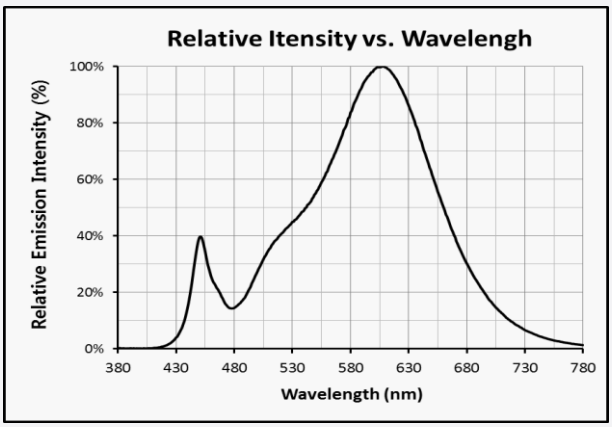
MacAdam	CCT (K)	Center point		Major-axis	Minor-axis	Rotation
		CIE x	CIE y	a	b	Φ
3 step	2700	0.4578	0.4101	0.0081	0.0042	53.70
	3000	0.4338	0.4030	0.0083	0.0041	53.22
	3500	0.4073	0.3917	0.0093	0.0041	54.00
	4000	0.3818	0.3797	0.0094	0.0040	53.72
	5000	0.3447	0.3553	0.0082	0.0035	59.62
	5700	0.3287	0.3417	0.0075	0.0032	59.10
	6500	0.3123	0.3282	0.0067	0.0029	58.57

Note: Samsung maintains measurement tolerance of: Cx, Cy = ±0.005

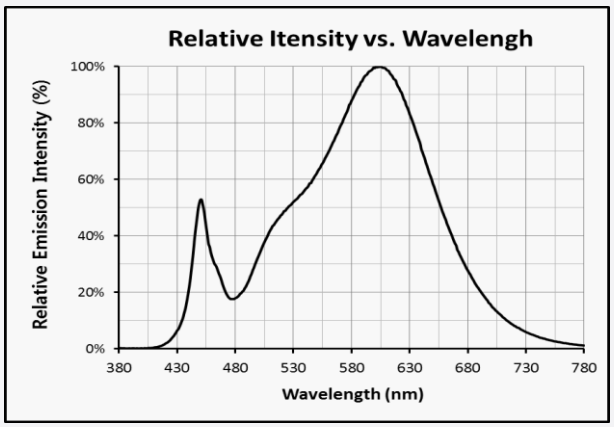
3. Typical Characteristics Graphs

a) Spectrum Distribution (I_F = 60 mA, T_s = 25 °C)

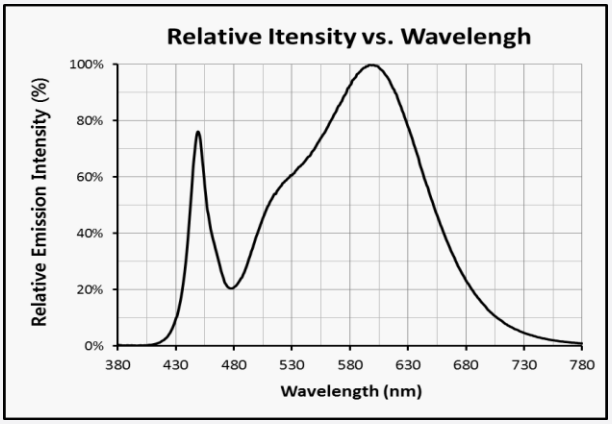
CCT: 2700 K (80 CRI)



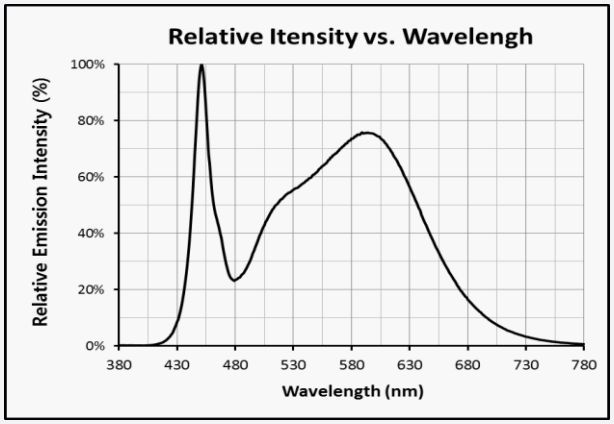
CCT: 3000 K (80 CRI)



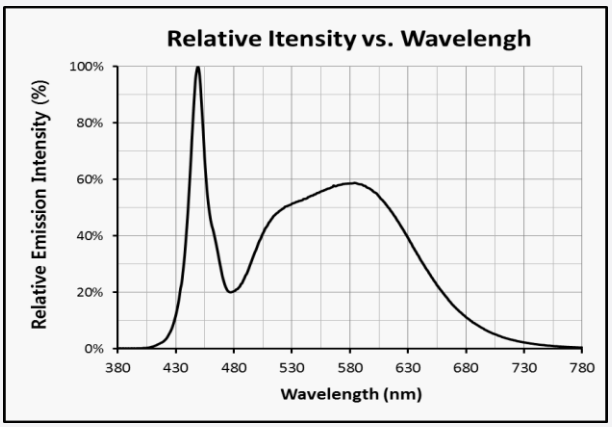
CCT: 3500 K (80 CRI)



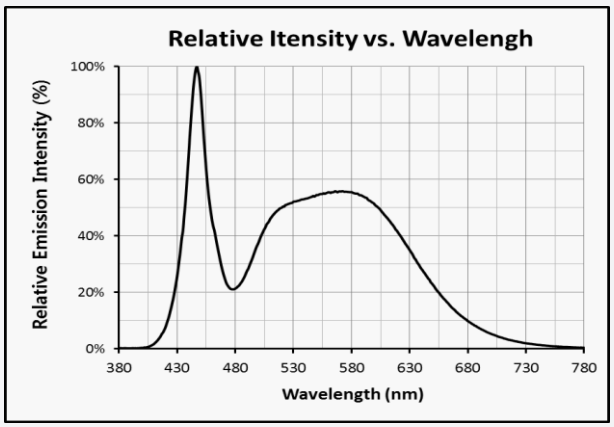
CCT: 4000 K (80 CRI)



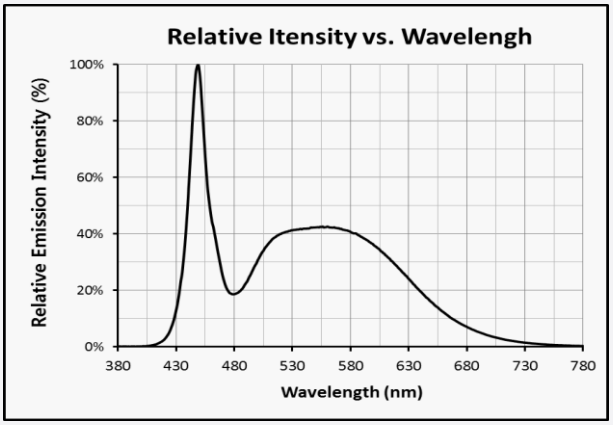
CCT: 5000 K (80 CRI)



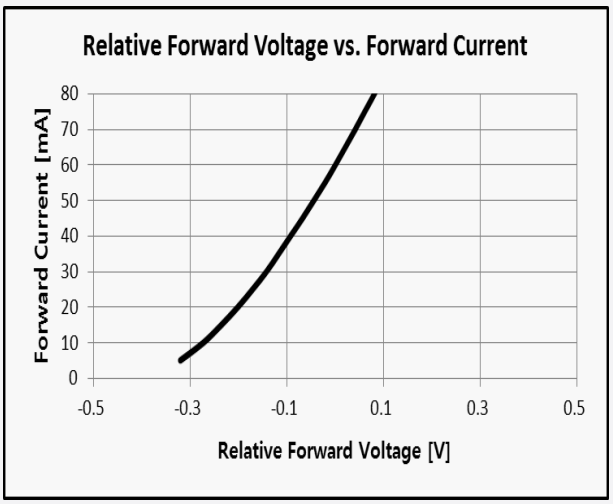
CCT: 5700 K (80 CRI)

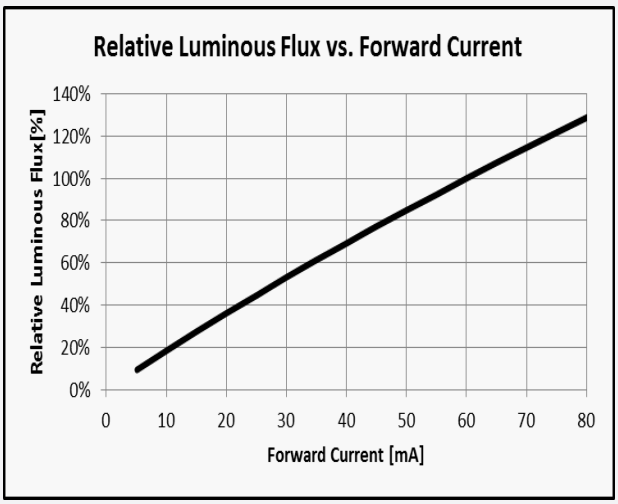


CCT: 6500 K (80 CRI)

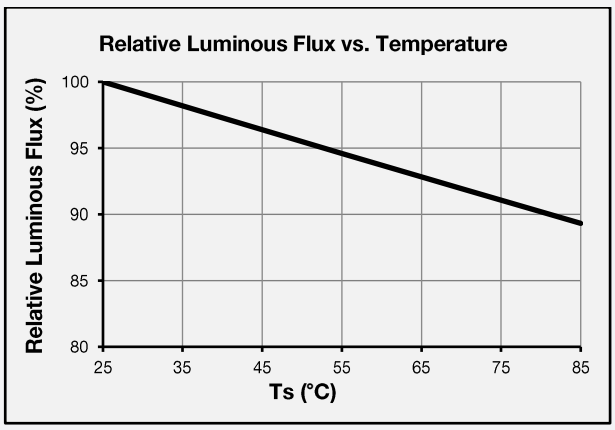


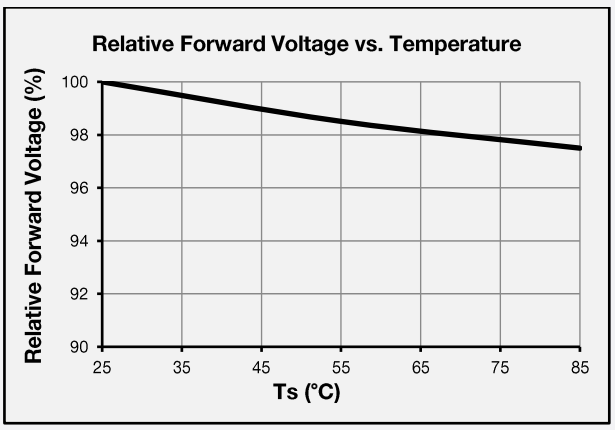
b) Forward Current Characteristics (T_s = 25 °C)



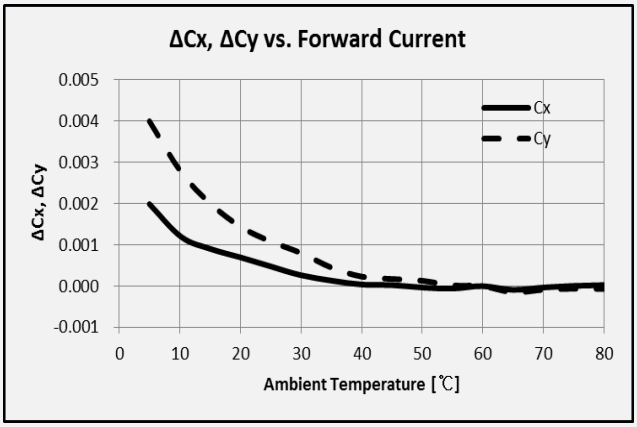


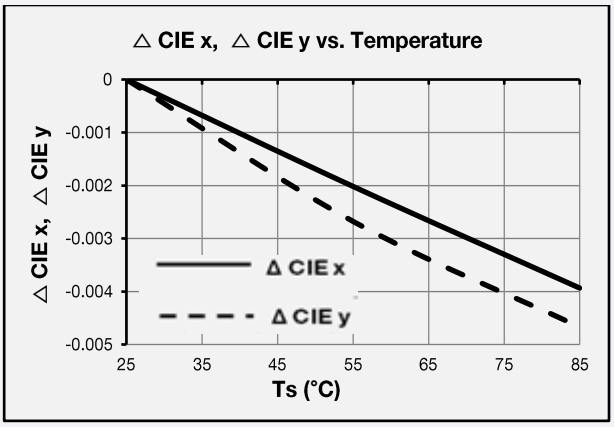
c) Temperature Characteristics (I_F = 60 mA)



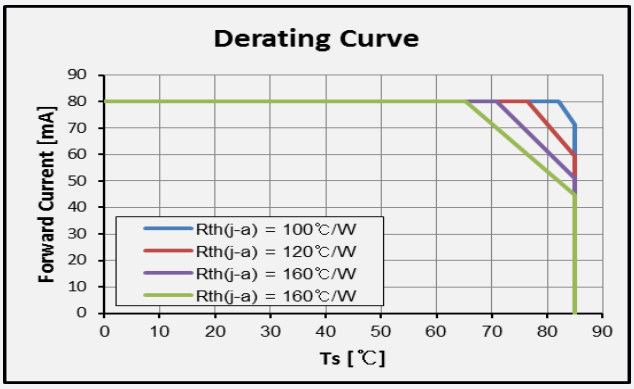


d) Color Shift Characteristics (I_F = 60 mA, T_s = 25 °C)

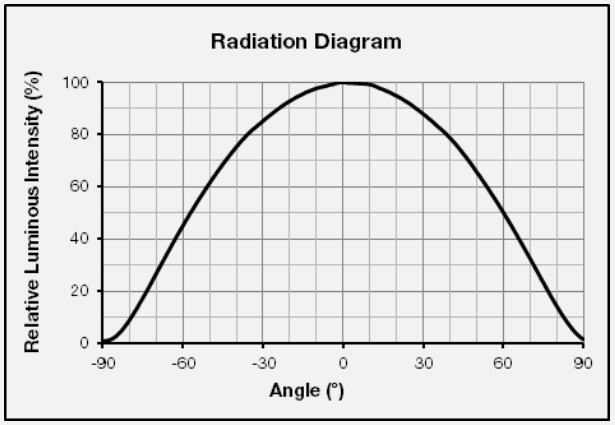




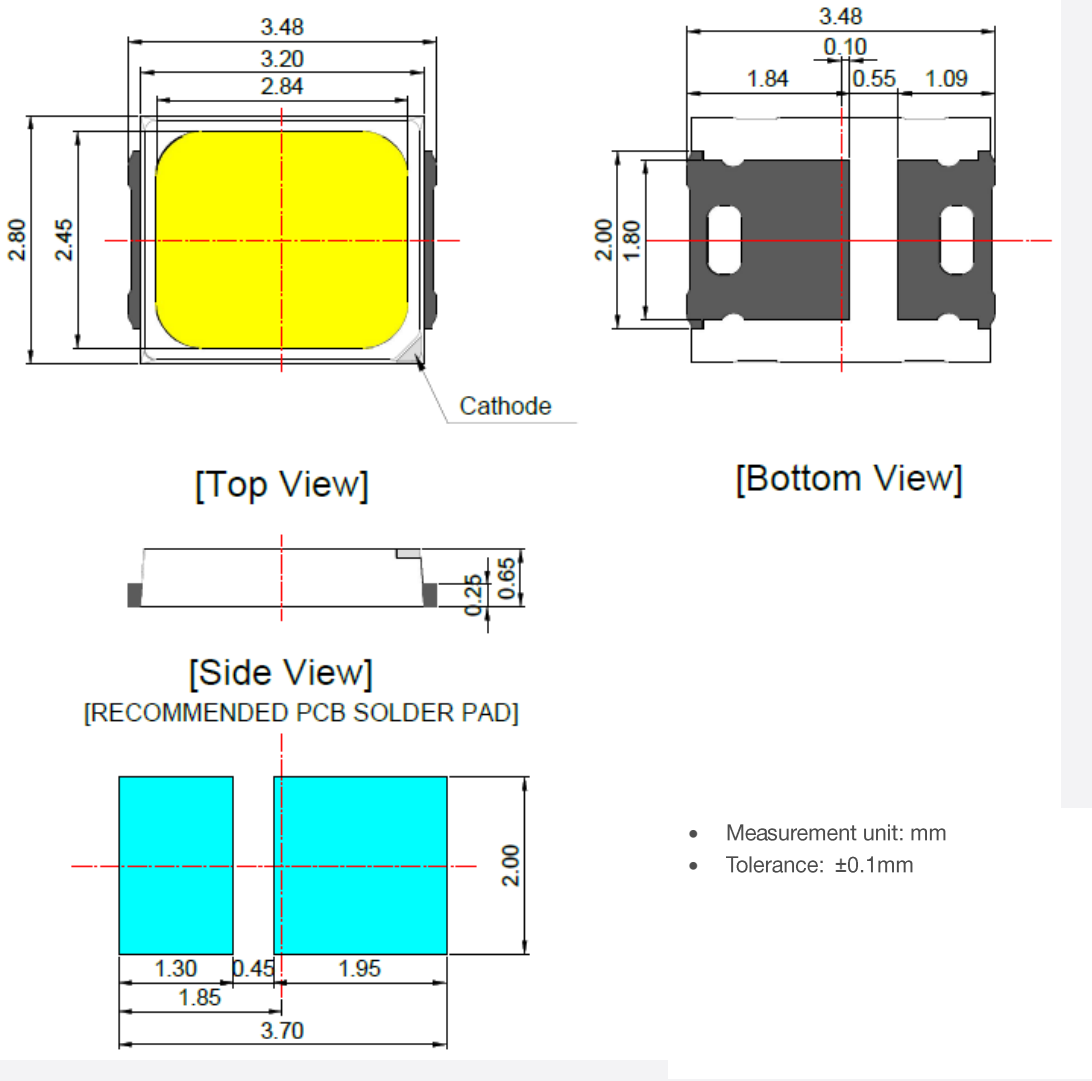
e) Derating Curve



f) Beam Angle Characteristics (I_F = 60 mA, T_s = 25 °C)



4. Outline Drawing & Dimension



Notes:

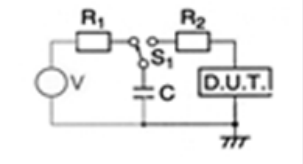
1) T_s point and measurement method:
   - ① Measure one point at the cathode pad, if necessary remove PSR of PCB to reach T_s point.
   - ② All pads must be soldered to the PCB to dissipate heat properly, otherwise the LED can be damaged.

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 Max Current	1000 h	22
High Temperature Life Test	85 °C, DC Max Current	1000 h	22
High Temperature Humidity Life Test	60 °C, 90 % RH, DC Max Current	1000 h	22
Low Temperature Life Test	-40 °C, DC Max Current	1000 h	22
Powered Temperature Cycle Test	-45 °C ~ 85 °C, each 20 min, on/off 5 min Temp. Change time 100min, DC Max Current	100 cycles	22
Temperature Cycle	-45°C / 15 min ↔ 125 °C / 15 min	200 cycles	100
High Temperature Storage	85 °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

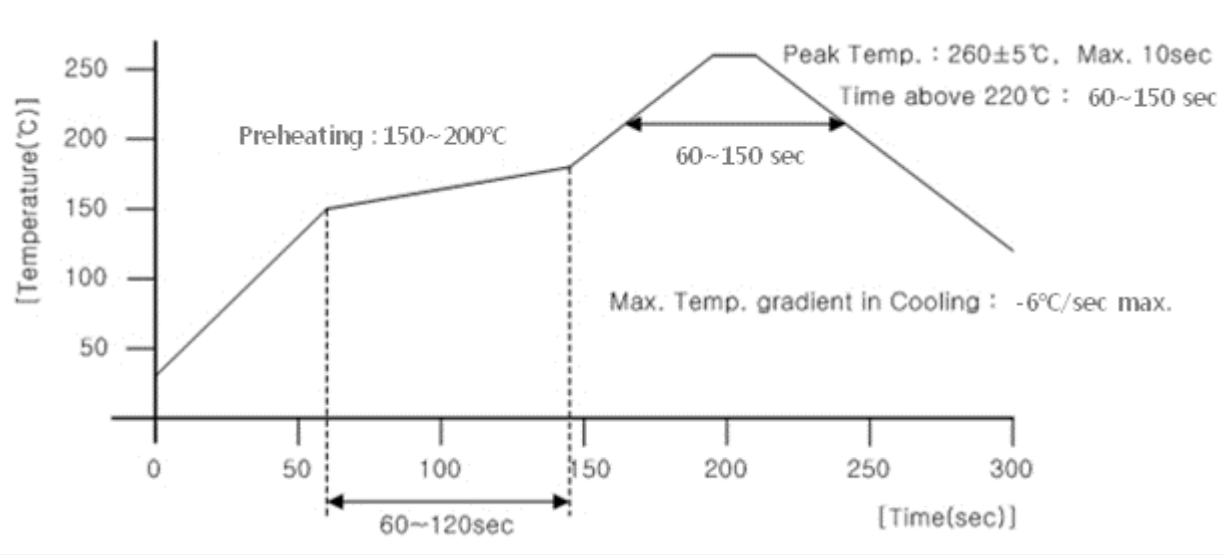
b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T_s = 25 °C)	Limit	
			Min	Max
Forward Voltage	V_F	I_F = 60 mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φv	I_F = 60 mA	Init. Value * 0.7	Init. Value * 1.1

6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



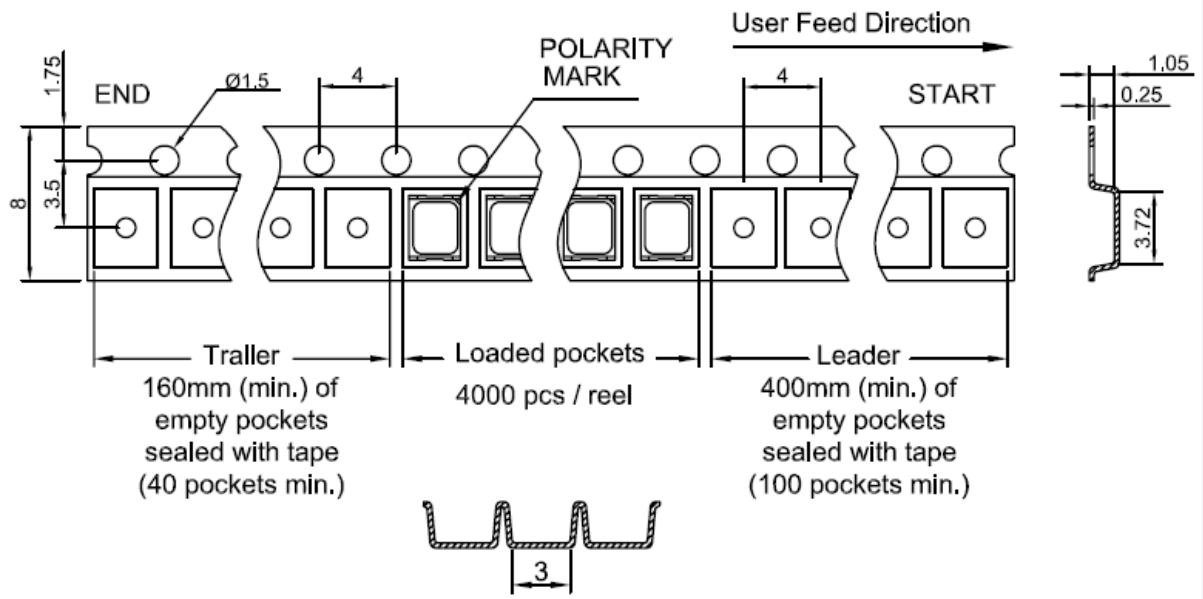
b) Manual Soldering Conditions

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

7. Tape & Reel

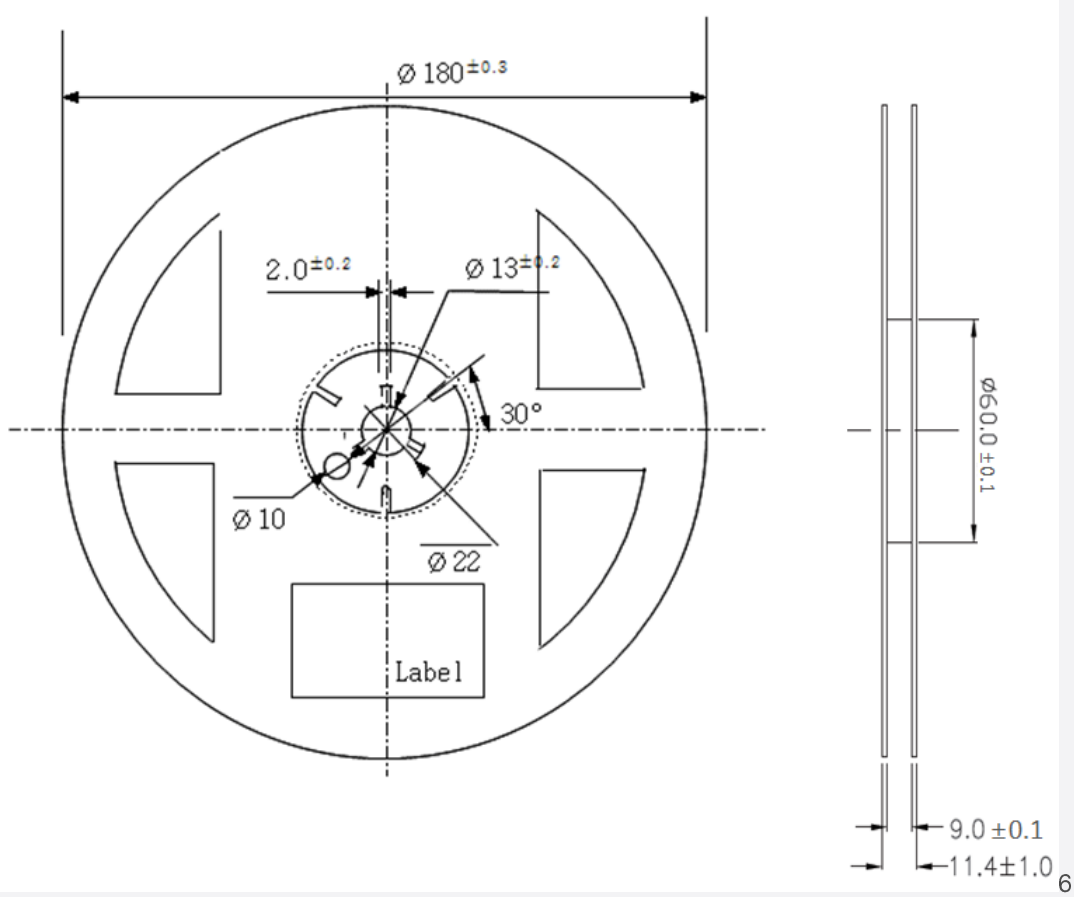
a) Taping Dimension

(unit: mm)



b) Reel Dimension (max 4,000 pcs)

(unit: mm)

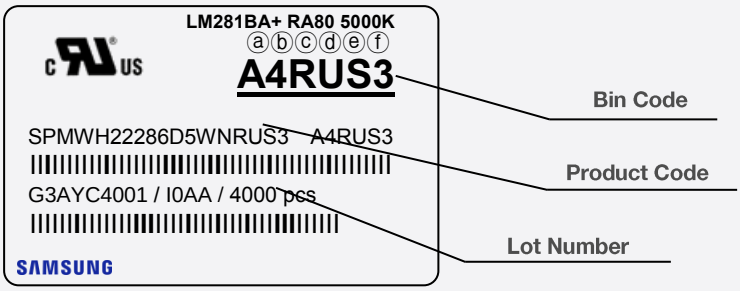


Notes:

1) Quantity: The quantity/reel is 4,000 pcs
2) All dimensions are millimeters (tolerance : ±0.2mm)
3) 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 6)

Bin Code:

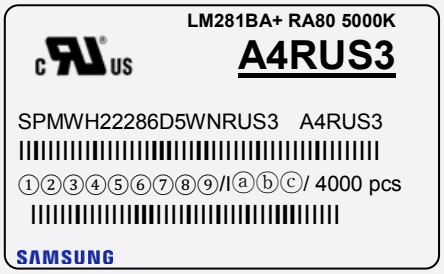
ⓐⓑ: Forward Voltage bin (refer to page 10)

ⓒⓓ: Chromaticity bin (refer to page 11-13)

ⓔⓕ: Luminous Flux bin (refer to page 7)

b) Lot Number

The lot number is composed of the following characters:



①②③④⑤⑥⑦⑧⑨ / Ⅰⓐⓑⓒ / 4,000 pcs

①② : Production site (G3 or GP : Shenzhen, China)

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)

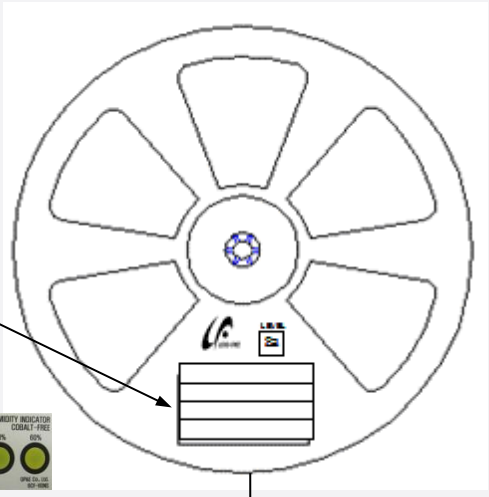
⑦⑧⑨ ⓐⓑⓒ : Product serial number

9. Packing Structure

a) Packing Process (The quantity of PKG on the Reel to be Max 4,000 pcs)

Reel

LM281BA+ RA80 5000K
A4RUS3
SPMWH22286D5WNRUS3 A4RUS3
G3AYC4001 / I0AA / 4000 pcs
SAMSUNG



Aluminum Vinyl Packing Bag

LM281BA+ RA80 5000K
A4RUS3
SPMWH22286D5WNRUS3 A4RUS3
G3AYC4001 / I0AA / 4000 pcs
SAMSUNG

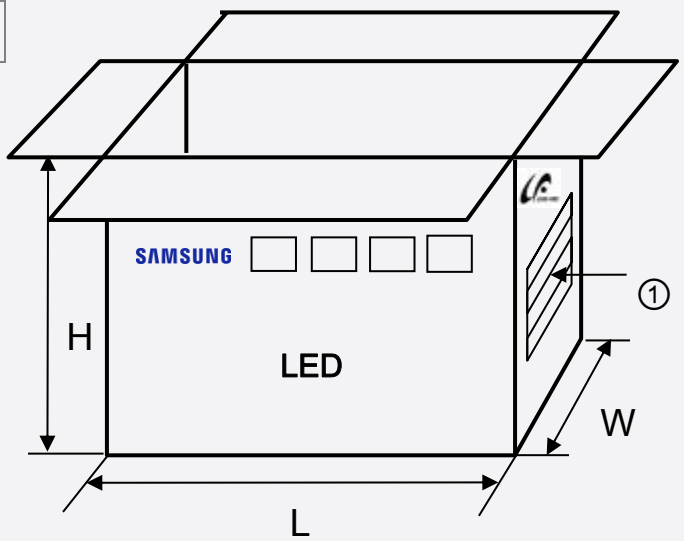
Outer Box

Material: Paper (SW3B(B))

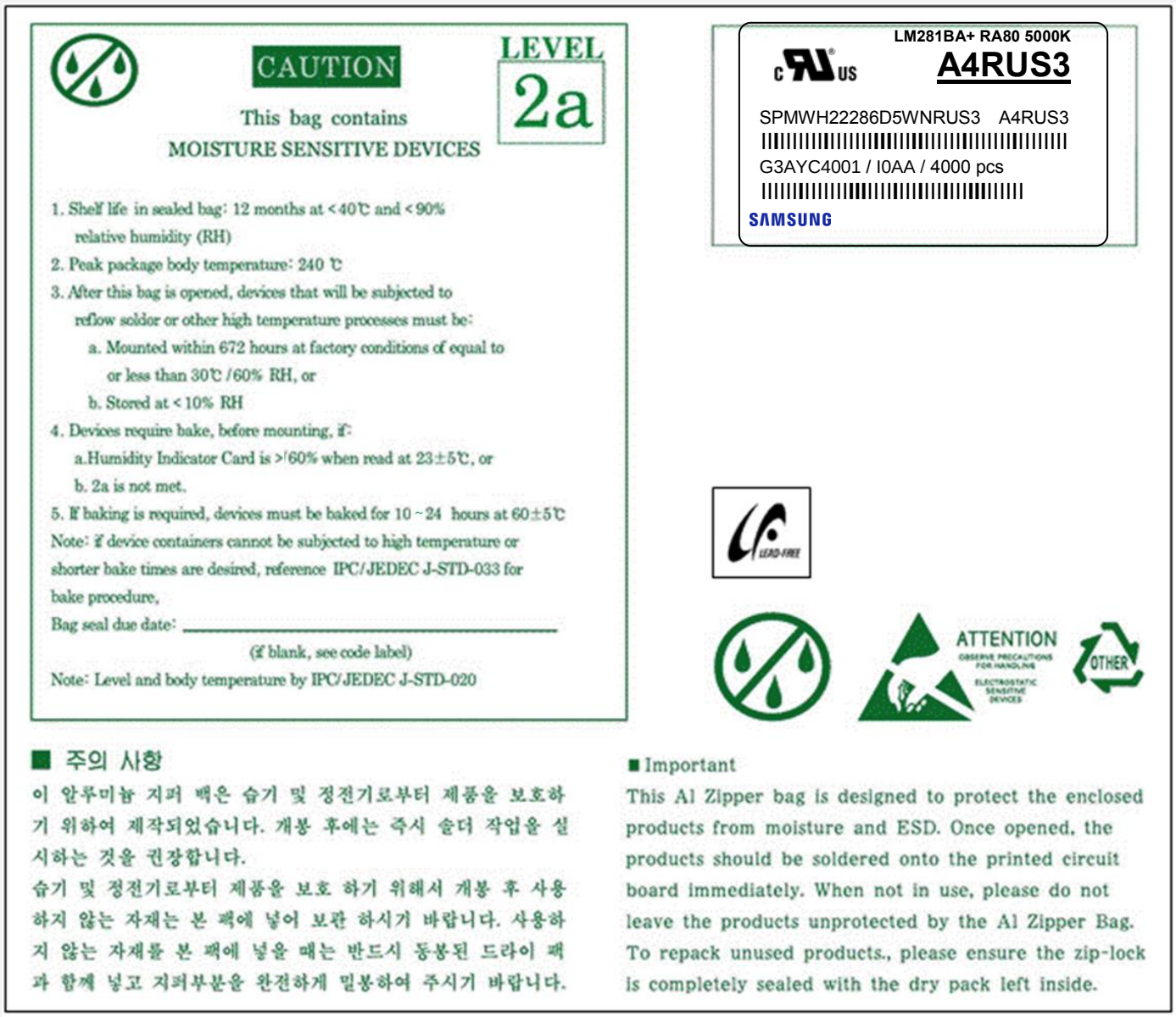
Type	Size (mm)			Note
	L	W	H	
7 inch L	245 ± 5	220 ± 5	182 ± 5	Up to 10 reels
7 inch S	245 ± 5	220 ± 5	86 ± 5	Up to 5 reels

① **Side Label**

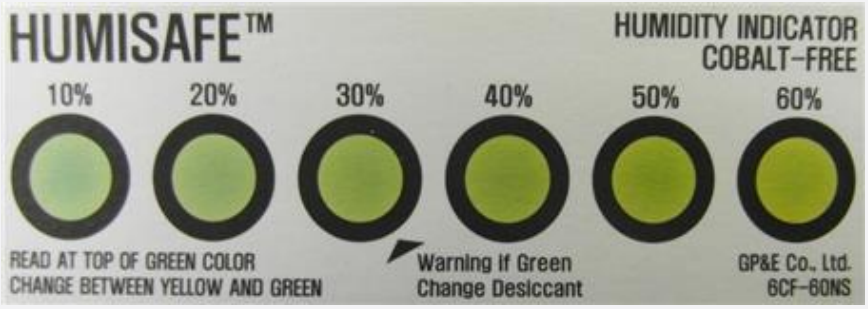
LM281BA+ RA80 5000K
A4RUS3
SPMWH22286D5WNRUS3 A4RUS3
G3AYC4001 / I0AA / 40000 pcs
SAMSUNG



c) Aluminum Vinyl Packing Bag



d) 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 ºC, 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 ºC / 60 % RH*Note 1, or
   b. Mounted within 24 hours (1 day) at an assembly line with a condition of more than 30 ºC / 70 % RH*Note 2, or
   c. Stored at <10 % RH.
   *Note 1, 2: IPC/JEDEC J-STD-033A, Recommended Equivalent Total Floor Life Table

Package Type and Body Thickness	Moisture Sensitivity Level	Maximum Percent Relative Humidity						Temperature
		40%	50%	60%	70%	80%	90%	
Body Thickness <2.1mm	Level 2a	∞	∞	28	1	1	1	30℃
		∞	∞	∞	2	1	1	25℃
		∞	∞	∞	2	2	1	20℃

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 ºC.
8) Devices must be baked for 1 hour at 60 ± 5 ºC, 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.

About Samsung Electronics Co., Ltd.

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