Middle Power LED Series
Flip Chip Package

LM101A

LM101A opens up a new world of lighting design with its high output and small form factors

Features & Benefits

- Greater freedom of design with compact package size
- High degree of reliability with plastic-free structure
- Low thermal resistance
- High efficiency providing optimized solution
- Compact footprint (1.18 x 1.18 mm)

Table of Contents

1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Operating Temperature	T_a	-40 ~ +85	ºC	-
Storage Temperature	T_{stg}	-40 ~ +120	ºC	-
LED Junction Temperature	T_j	125	ºC	-
Forward Current	I_F	450	mA	-
Assembly Process Temperature	-	260 <10	℃ s	-
ESD (HBM)	-	±2	kV	-

b) Electro-optical Characteristics (I_F = 150 mA, T_s = 85 °C)

Item	Unit	Rank	Bin	Min.	Typ.	Max.
Forward Voltage (V_F)	V	6E	6A	2.7	-	2.9
			AE	2.9	-	3.1
Reverse Voltage (@ -10 µA)	V			-10.0	-	-
Color Rendering Index (R_a)	-	8		80	-	-
Special CRI (R9)	-			0	-	-
Thermal Resistance (junction to chip point)	K/W			-	2	-
Beam Angle	°			-	150	-

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

c) Luminous Flux Characteristics (I_F = 150 mA, T_s = 85 °C)

Item	CRI	Nominal CCT (K)	SY		SZ		SA		SB		SC		SD		SE		SF		SG	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
			35	39	39	43	43	47	47	51	51	55	55	59	59	63	63	67	67	71
Luminous Flux (Φv)	70	3000																		
		3500																		
		4000																		
		5000																		
		5700																		
		6500																		
	80	2700																		
		3000																		
		3500																		
		4000																		
		5000																		
		5700																		
		6500																		
	90	2700																		
		3000																		
		3500																		

Note:

1) The LM101A is tested in pulsed condition at rated test current (10 ms pulse width)
2) Calculated flux values are for reference only
3) Samsung maintains measurement tolerance of: luminous flux = ±5 %

2. Product Code Information (I_F = 150 mA, T_s = 85 °C)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
S	C	P	8	W	T	7	8	H	P	L	1	W	L	S	0	6	E

Digit	PKG Information	Code	Specification
1 2 3	Samsung Chip	**SCP**	
4	CRI	**7**	Min. 70
		8	Min. 80
		9	Min. 90
5	CCT (K)	**W**	2700
		V	3000
		U	3500
		T	4000
		R	5000
		Q	5700
		P	6500
6	Chip Shape	**T**	Square
7 8 9	Chip Size (μm)	**78H**	780x780x170μm
10 11 12	Product Purpose	**PL1**	PoC for Lighting
13	CCT (K)	**W**	2700K
		V	3000K
		U	3500K
		T	4000K
		R	5000K
		Q	5700K
		P	6500K
14	MacAdam Step	**L**	Full Bin for for MacAdam 5-step — L(Full Bin)
		K	Kitting Bin for MacAdam 3-step — U(Center Bin), N, P, Q, R, S, T
15 16	Luminous Flux (lm)	**S0**	Bin Code: SY, SZ, SA, SB, SC, SD, SE, SF, SG
17 18	Forward Voltage (V)	**6E**	2.7~3.1 — Bin Code: 6A 2.7~2.9; AE 2.9~3.1

a) Luminous Flux Bins (I_F = 150 mA, T_s = 85 °C)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	Flux Bin	Flux Range (Φ_v, lm)
70	3000	SCP7VT78HPL1V☆S06E	SD	55 ~ 59
			SE	59 ~ 63
			SF	63 ~ 67
	3500	SCP7UT78HPL1U☆S06E	SD	55 ~ 59
			SE	59 ~ 63
			SF	63 ~ 67
	4000	SCP7TT78HPL1T☆S06E	SE	59 ~ 63
			SF	63 ~ 67
			SG	67 ~ 71
	5000	SCP7RT78HPL1R☆S06E	SE	59 ~ 63
			SF	63 ~ 67
			SG	67 ~ 71
	5700	SCP7QT78HPL1Q☆S06E	SE	59 ~ 63
			SF	63 ~ 67
			SG	67 ~ 71
	6500	SCP7PT78HPL1P☆S06E	SE	59 ~ 63
			SF	63 ~ 67
			SG	67 ~ 71

Note: "☆" can be "L" (Full bin for MacAdam 5-step), "K" (Kitting bin for MacAdam 3-step)

a) Luminous Flux Bins (I_F = 150 mA, T_s = 85 °C)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	Flux Bin	Flux Range (Φ_v, lm)
80	2700	SCP8WT78HPL1W☆S06E	SB	47 ~ 51
			SC	51 ~ 55
			SD	55 ~ 59
	3000	SCP8VT78HPL1V☆S06E	SC	51 ~ 55
			SD	55 ~ 59
			SE	59 ~ 63
	3500	SCP8UT78HPL1U☆S06E	SC	51 ~ 55
			SD	55 ~ 59
			SE	59 ~ 63
	4000	SCP8TT78HPL1T☆S06E	SD	55 ~ 59
			SE	59 ~ 63
			SF	63 ~ 67
	5000	SCP8RT78HPL1R☆S06E	SD	55 ~ 59
			SE	59 ~ 63
			SF	63 ~ 67
	5700	SCP8QT78HPL1Q☆S06E	SC	51 ~ 55
			SD	55 ~ 59
			SE	59 ~ 63
	6500	SCP8PT78HPL1P☆S06E	SC	51 ~ 55
			SD	55 ~ 59
			SE	59 ~ 63

Note: "☆" can be "L" (Full bin for MacAdam 5-step), "K" (Kitting bin for MacAdam 3-step)

a) Luminous Flux Bins (I_F = 150 mA, T_s = 85 °C)

CRI (R_a) Min.	Nominal CCT (K)	Product Code	Flux Bin	Flux Range (Φ_v, lm)
90	2700	SCP9WT78HPL1W☆S06E	SY	35 ~ 39
			SZ	39 ~ 43
			SA	43 ~ 47
	3000	SCP9VT78HPL1V☆S06E	SY	35 ~ 39
			SZ	39 ~ 43
			SA	43 ~ 47
	3500	SCP9UT78HPL1U☆S06E	SZ	39 ~ 43
			SA	43 ~ 47
			SB	47 ~ 51

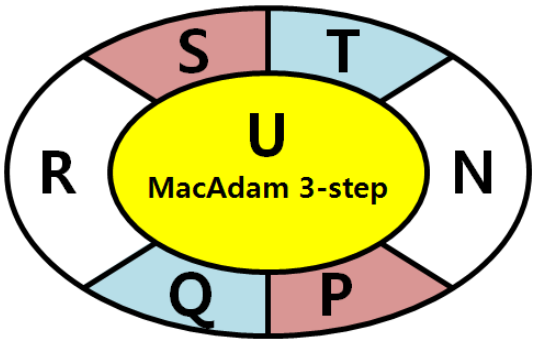
Note: "☆" can be "L" (Full bin for MacAdam 5-step), "K" (Kitting bin for MacAdam 3-step)

b) Kitting rule

■ Kitting (for MacAdam 3-step) Concept

1. Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (Color).
2. A Chromaticity Coordinates of kitting bins is mixed by kitting procedure. (below kitting simulation)

[Kitting example]



[Binning Information]

	BIN #1	BIN #2
CIE	N	R
	P	S
	Q	T

c) Color Bins (I_F = 150 mA, T_s = 85 °C)

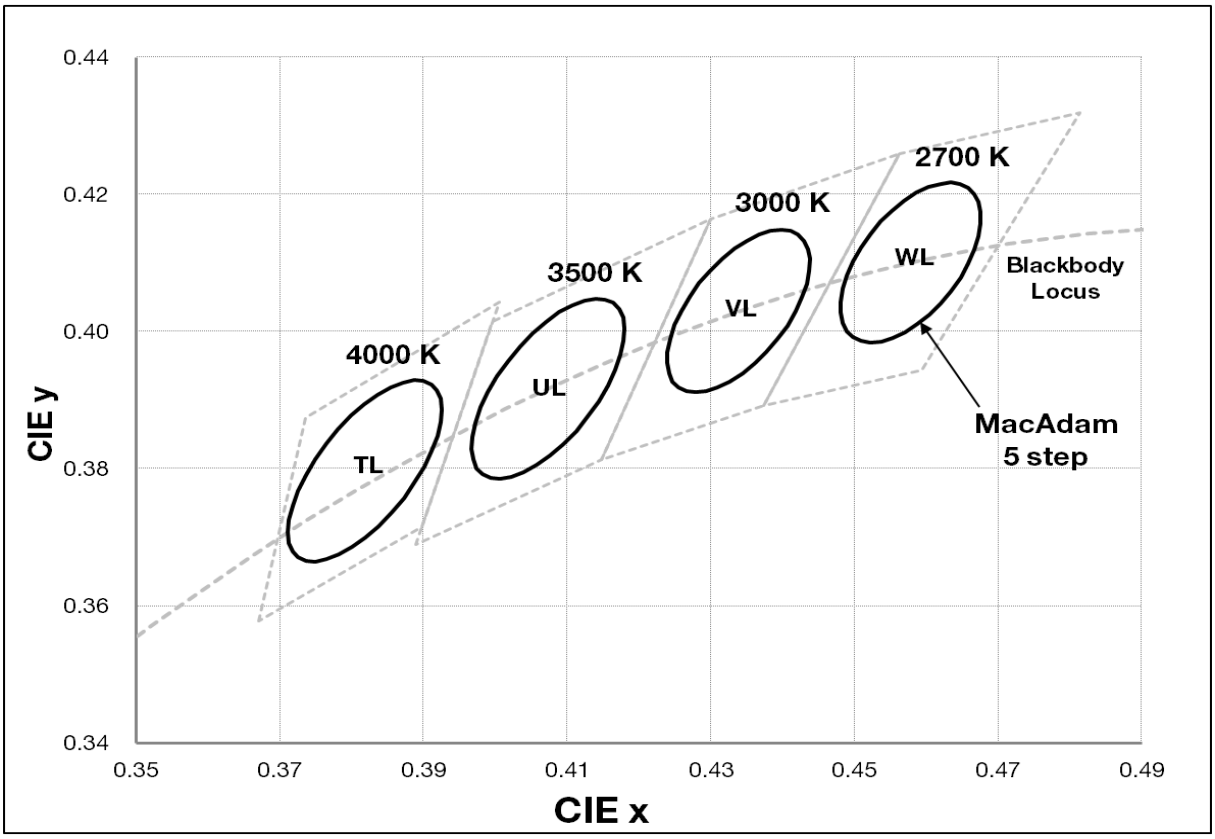
CRI Min.	Nominal CCT (K)	Product Code	Color Rank	Chromaticity Bins
70	3000	SCP7VT78HPL1V☆S06E	VL	VL
			VK	VN, VP, VQ, VR, VS, VT, VU
	3500	SCP7UT78HPL1U☆S06E	UL	UL
			UK	UN, UP, UQ, UR, US, UT, UU
	4000	SCP7TT78HPL1T☆S06E	TL	TL
			TK	TN, TP, TQ, TR, TS, TT, TU
	5000	SCP7RT78HPL1R☆S06E	RL	RL
			RK	RN, RP, RQ, RR, RS, RT, RU
	5700	SCP7QT78HPL1Q☆S06E	QL	QL
			QK	QN, QP, QQ, QR, QS, QT, QU
	6500	SCP7PT78HPL1P☆S06E	PL	PL
			PK	PN, PP, PQ, PR, PS, PT, PU
80	2700	SCP8WT78HPL1W☆S06E	WL	WL
			WK	WN, WP, WQ, WR, WS, WT, WU
	3000	SCP8VT78HPL1V☆S06E	VL	VL
			VK	VN, VP, VQ, VR, VS, VT, VU
	3500	SCP8UT78HPL1U☆S06E	UL	UL
			UK	UN, UP, UQ, UR, US, UT, UU
	4000	SCP8TT78HPL1T☆S06E	TL	TL
			TK	TN, TP, TQ, TR, TS, TT, TU
	5000	SCP8RT78HPL1R☆S06E	RL	RL
			RK	RN, RP, RQ, RR, RS, RT, RU
	5700	SCP8QT78HPL1Q☆S06E	QL	QL
			QK	QN, QP, QQ, QR, QS, QT, QU
	6500	SCP8PT78HPL1P☆S06E	PL	PL
			PK	PN, PP, PQ, PR, PS, PT, PU
90	2700	SCP9WT78HPL1W☆S06E	WL	WL
			WK	WN, WP, WQ, WR, WS, WT, WU
	3000	SCP9VT78HPL1V☆S06E	VL	VL
			VK	VN, VP, VQ, VR, VS, VT, VU
	3500	SCP9UT78HPL1U☆S06E	UL	UL
			UK	UN, UP, UQ, UR, US, UT, UU

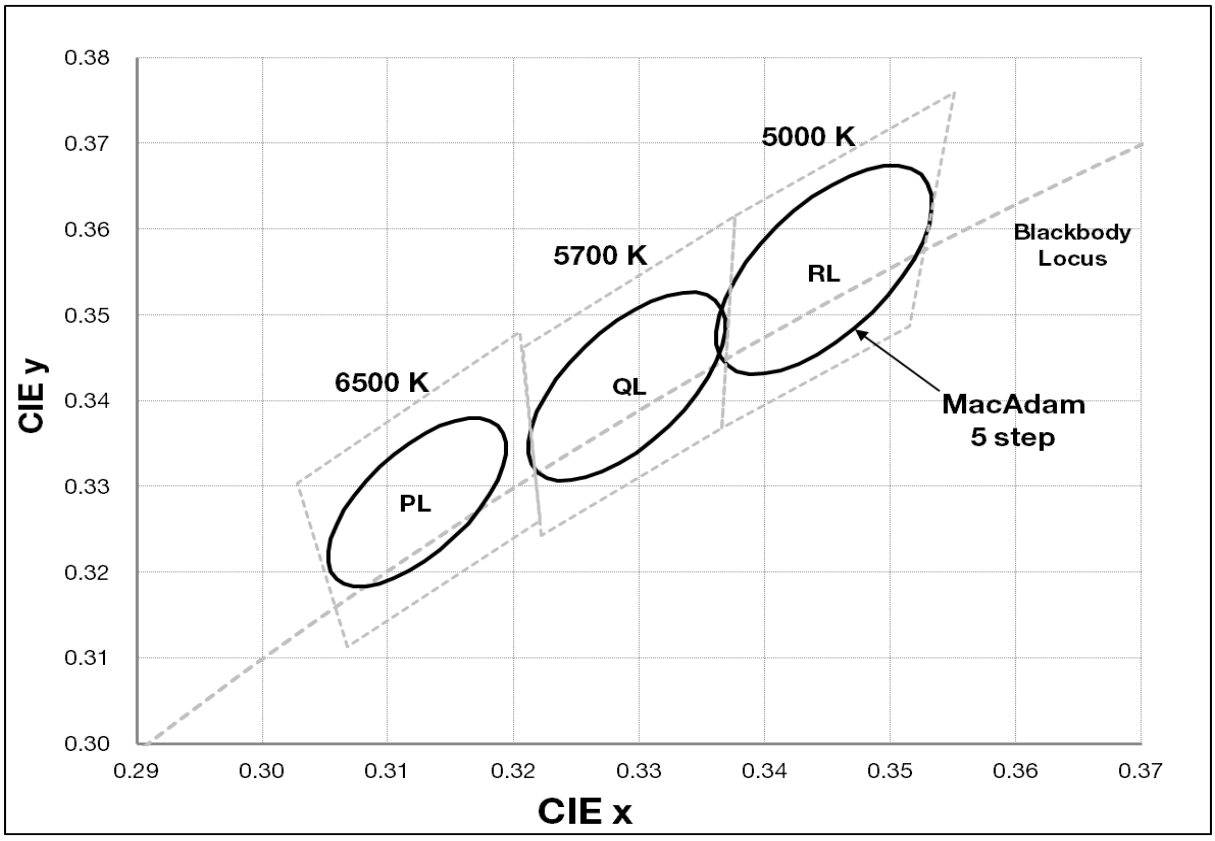
Note: "☆" can be "L" (Full bin for MacAdam 5-step), "K" (Kitting bin for MacAdam 3-step)

d) Voltage Bins (I_F = 150 mA, T_s = 85 °C)

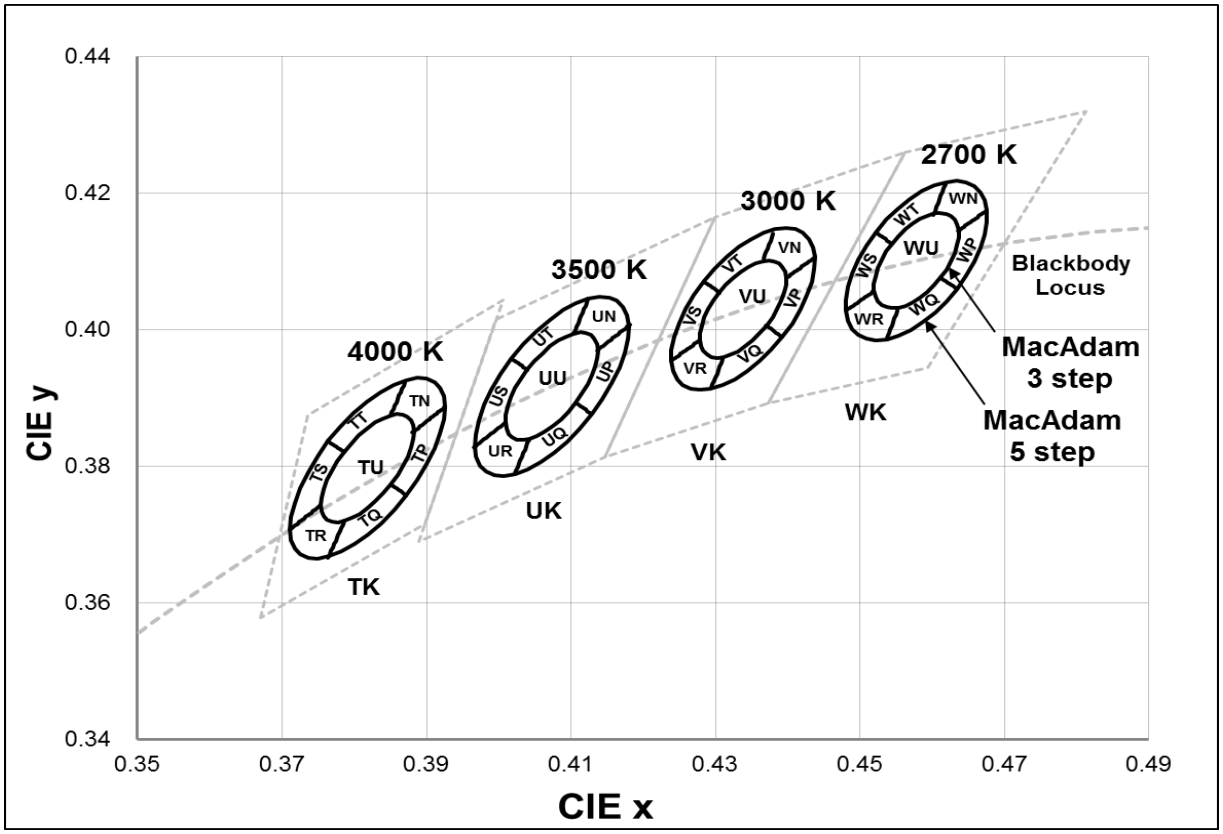
Nominal CCT (K)	CRI Min.	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
			6E	6A	2.7 ~ 2.9
				AE	2.9 ~ 3.1

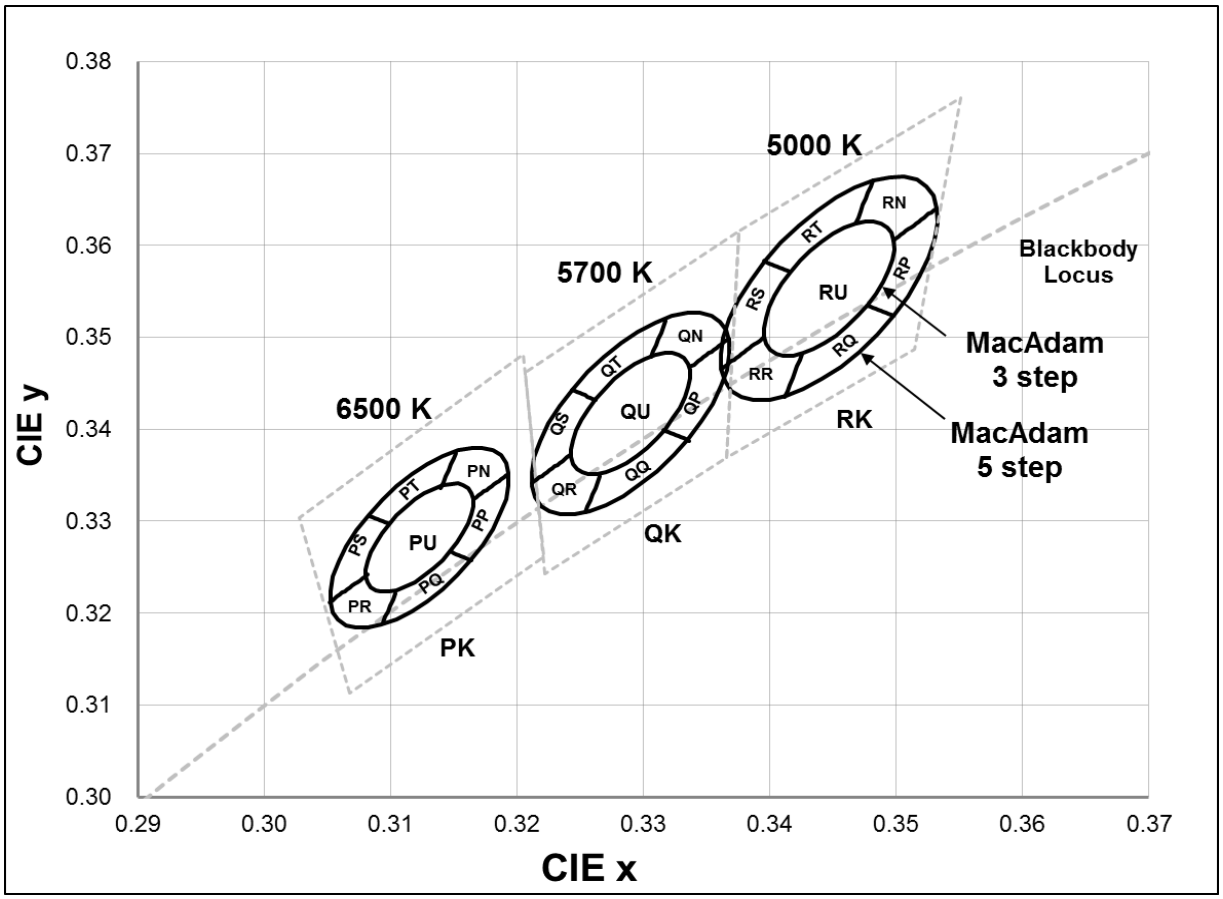
e) Chromaticity Region & Coordinates (I_F = 150 mA, T_s = 85 °C) : "L" (Full bin for MacAdam 5-step)



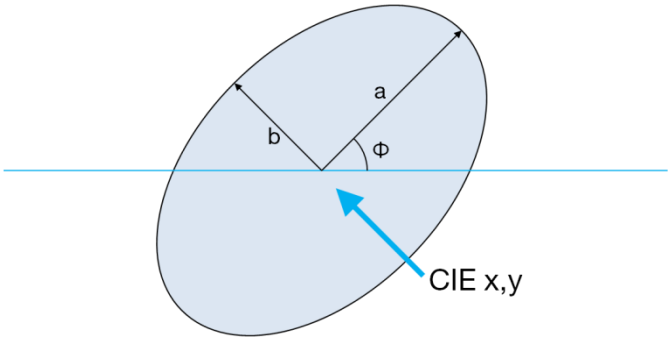


e) Chromaticity Region & Coordinates (I_F = 150 mA, T_s = 85 °C) : "K" (Kitting for MacAdam 3-step)





e) Chromaticity Region & Coordinates (I_F = 150 mA, T_s = 85 °C)



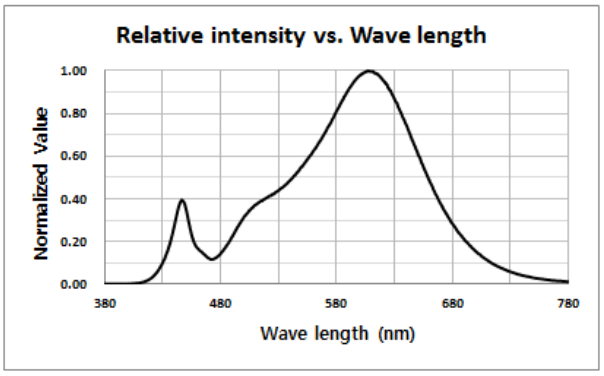
	CCT (K)	Center point		Major-axis	Minor-axis	Rotation
		CIE x	CIE y	a	b	Φ
5 step	2700	0.4578	0.4101	0.0135	0.0070	53.70
	3000	0.4338	0.4030	0.0138	0.0068	53.22
	3500	0.4073	0.3917	0.0155	0.0068	54.00
	4000	0.3818	0.3797	0.0157	0.0067	53.72
	5000	0.3447	0.3553	0.0137	0.0058	59.62
	5700	0.3287	0.3417	0.0125	0.0053	59.10
	6500	0.3123	0.3282	0.0112	0.0048	58.57

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

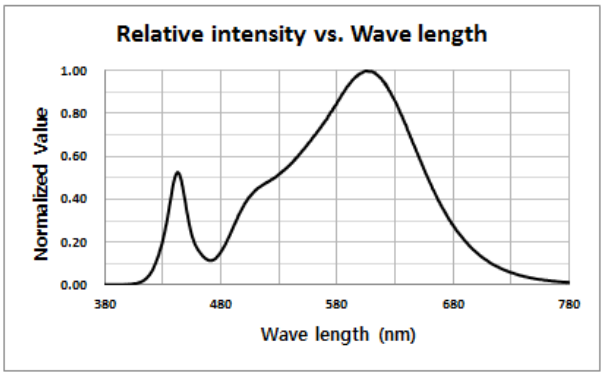
3. Typical Characteristics Graphs

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

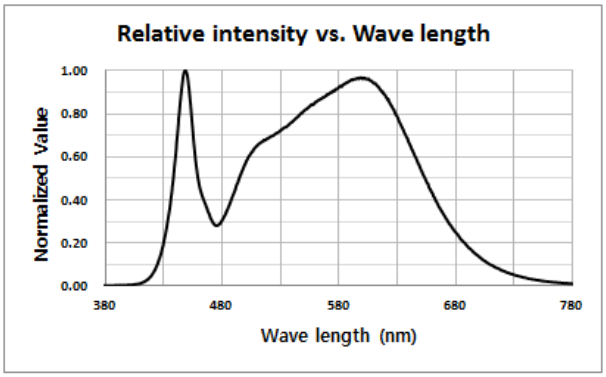
CCT: 2700 K



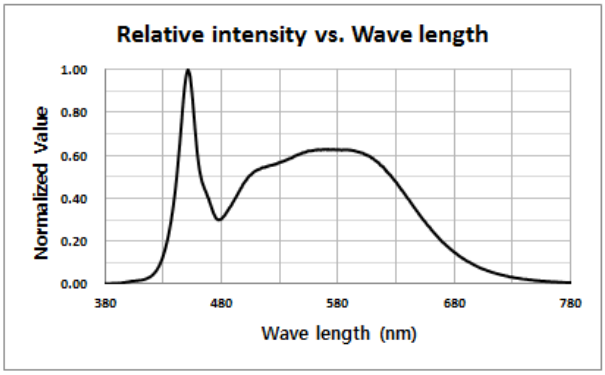
CCT: 3000 K



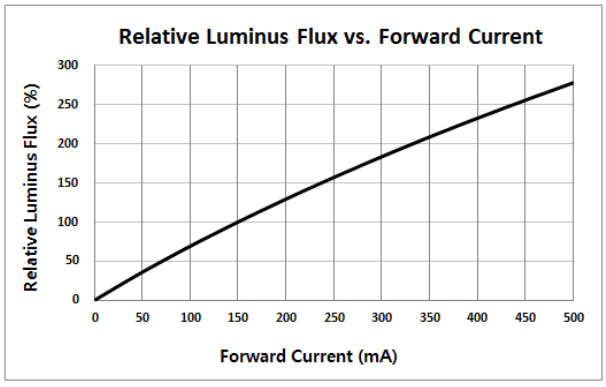
CCT: 4000 K

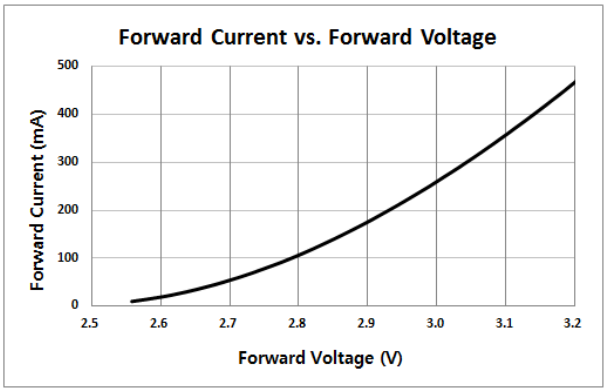


CCT: 5000 K

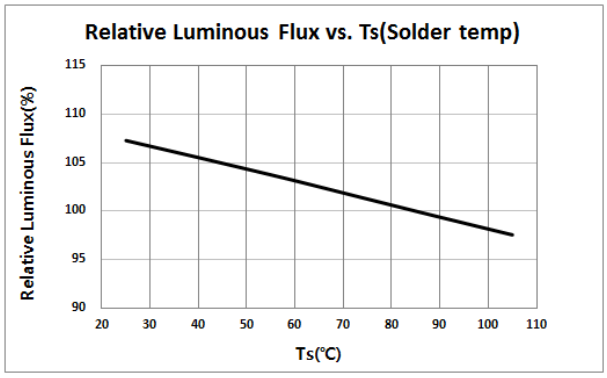


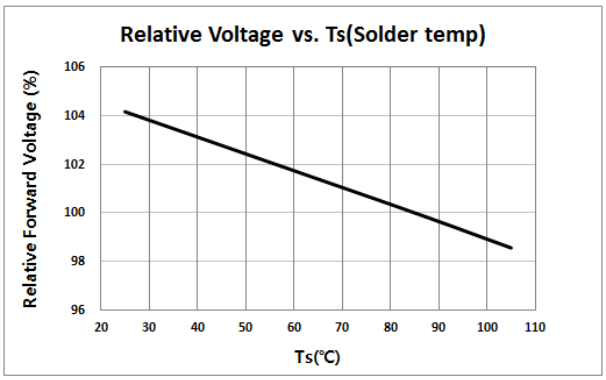
b) Forward Current Characteristics (T_S = 25 °C)



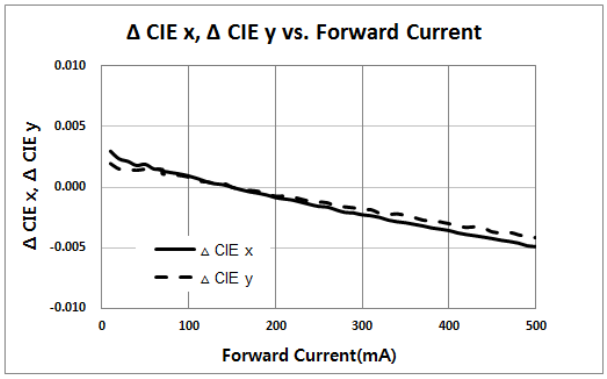


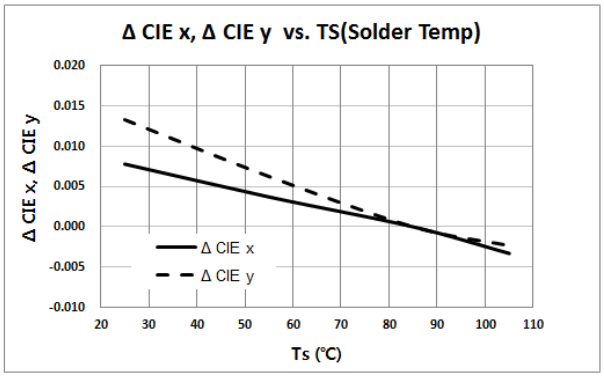
c) Temperature Characteristics (I_F = 150 mA)



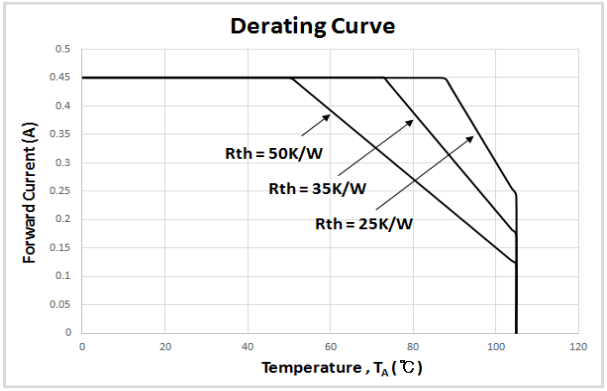


d) Color Shift Characteristics T_s = 25 ℃ I_F = 150 mA





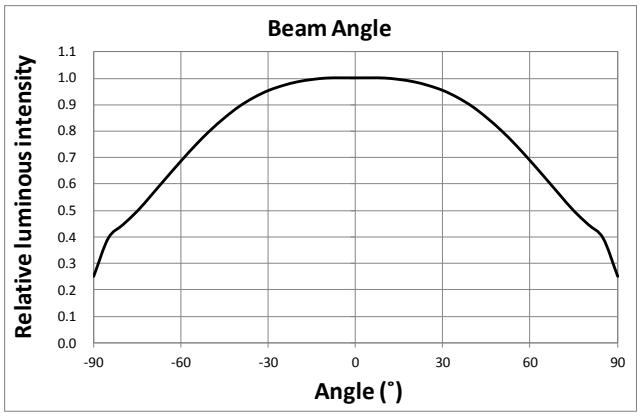
e) Derating Curve



R_{th} is measured after soldering of LED chip on the metal based substrate.

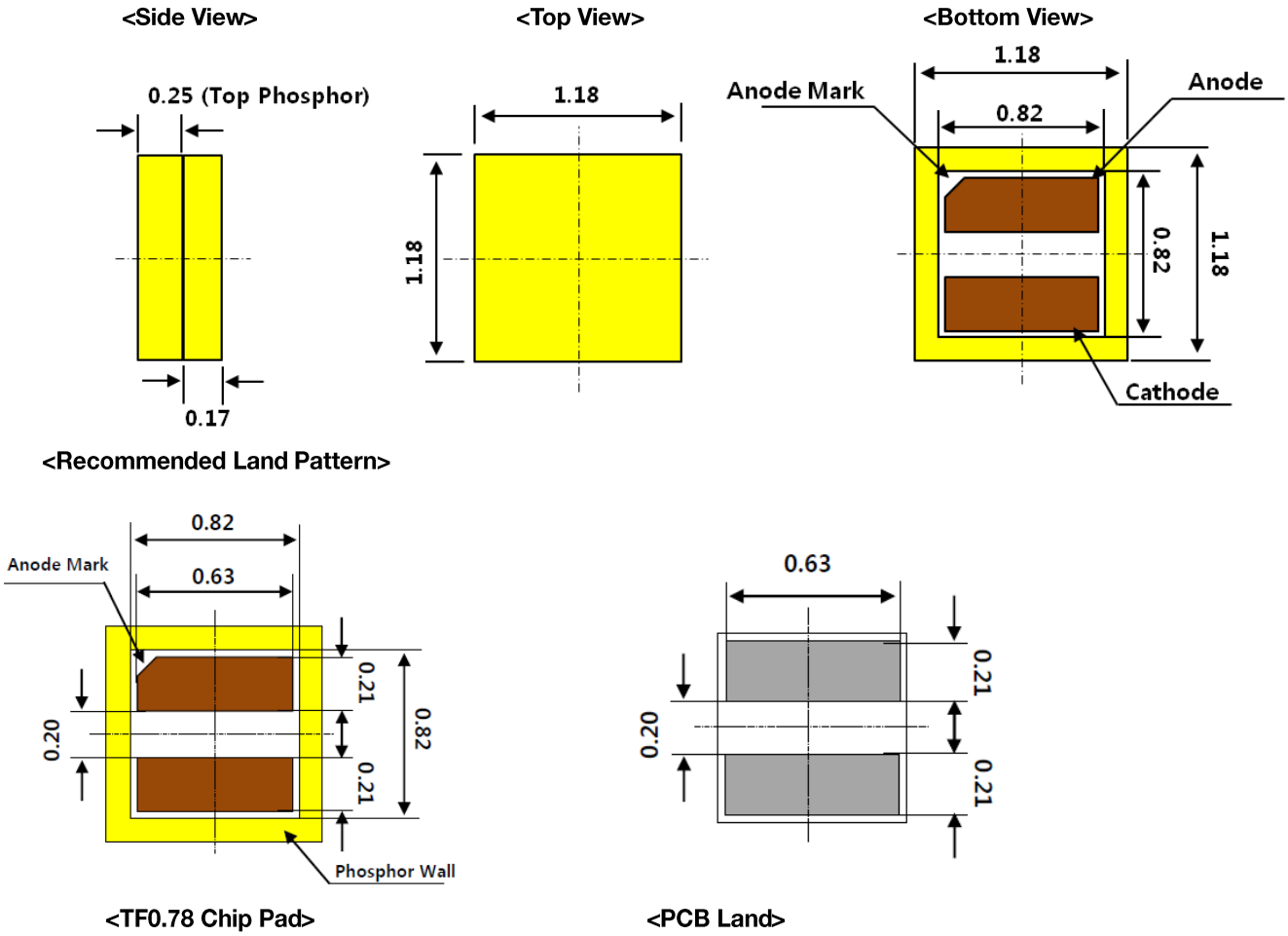
*metal: aluminum (refer to page 17)

f) Beam Angle Characteristics (I_F = 150 mA)



4. Outline Drawing & Dimension

1. Tolerance is ±0.10 mm
2. Do not place LEDs with pressure

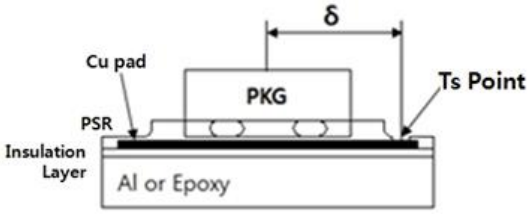


T_s Point & Measurement Method:

Measure nearest point from the center of LED chip (δ) as shown below.

Distance between chip center and T_s point (δ) = 3.5 mm

$T_j = T_s + \text{Power} \times \text{Thermal resistance at } T_s (R_{j\text{-}s})$

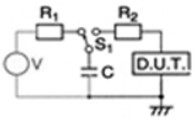


Precautions:

1) This LED chip PKG does not contain built-in ESD protection device.
2) 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.
3) 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.
4) 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
MSL Test	125 °C 24 h drying → 60 °C, 60 % RH 120 h → 260 °C 10 sec 3 cycles	1 cycle	11
Room Temperature Life Test	25 °C, Derated max current	1000 h	22
High Temperature Life Test	85 °C, Derated max current	1000 h	22
High Temperature Humidity Life Test	85 °C, 85 % RH, Derated max current	1000 h	22
Low Temperature Life Test	-40 °C, DC Derated max current	1000 h	22
Powered Temperature Cycle Test	-45 °C / 20 min ↔ 85 °C / 20 min, sweep 100 min cycle on/off: each 5 min, Derated max current	100 cycles	22
Thermal Shock	-45 °C / 15 min ↔ 125 °C / 15 min → Hot plate 180 °C	800 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: ±5 kV	5 times	5
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	5 cycles	11

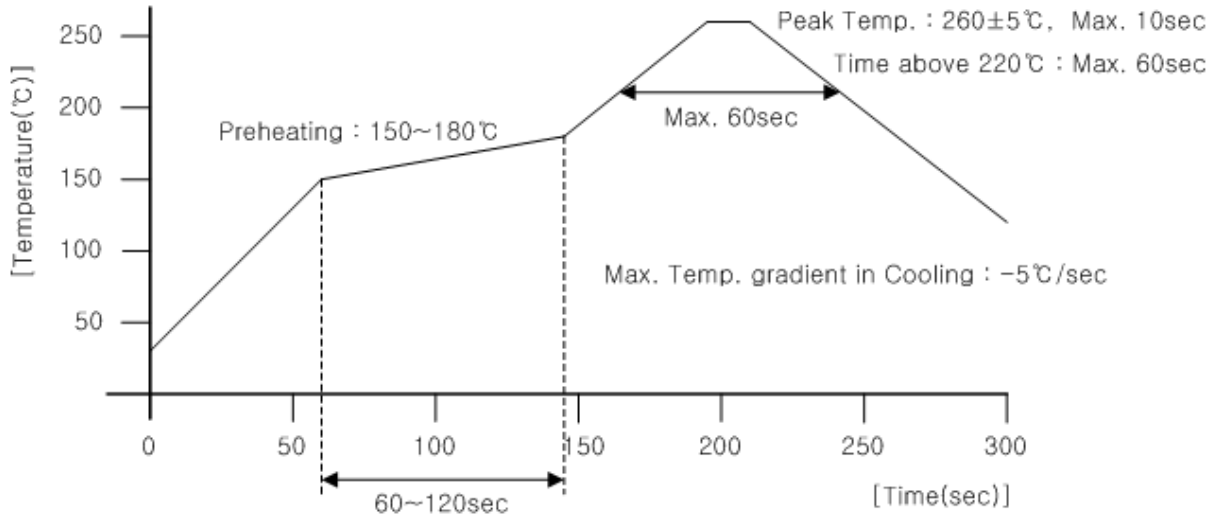
b) Criteria for Judging the Damage

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

6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



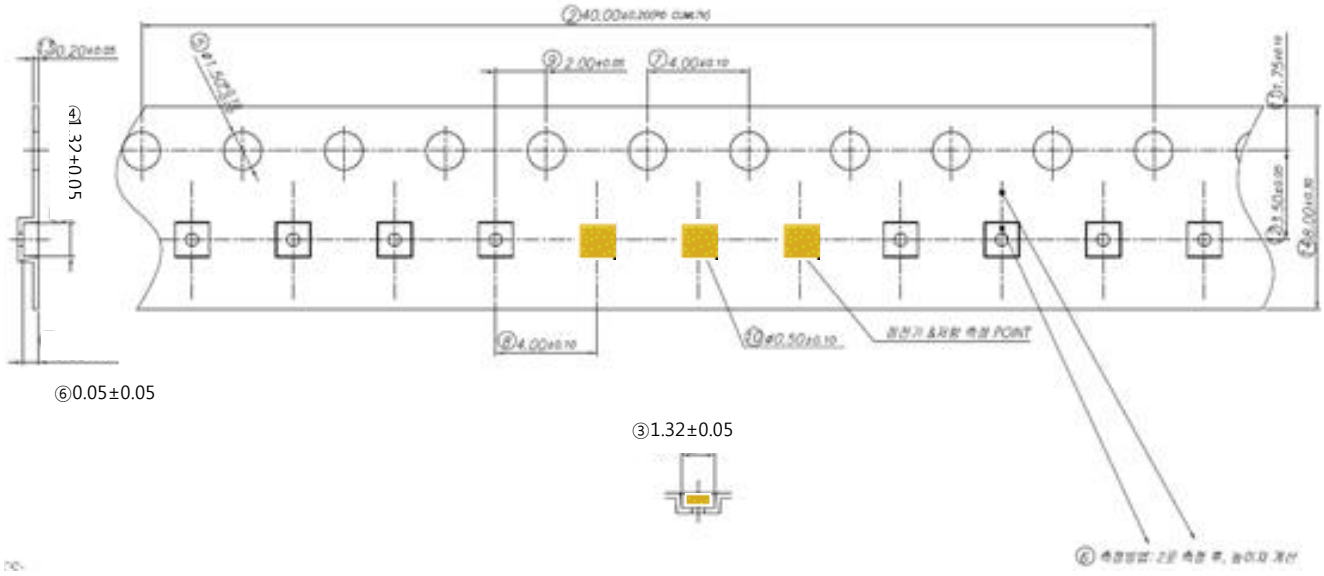
b) Manual Soldering Conditions

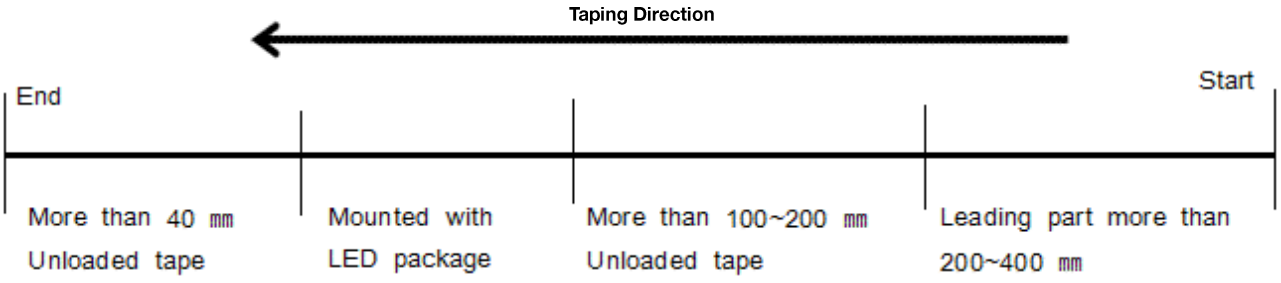
Not more than 5 seconds @ max. 300 °C, under soldering iron

7. Tape & Reel

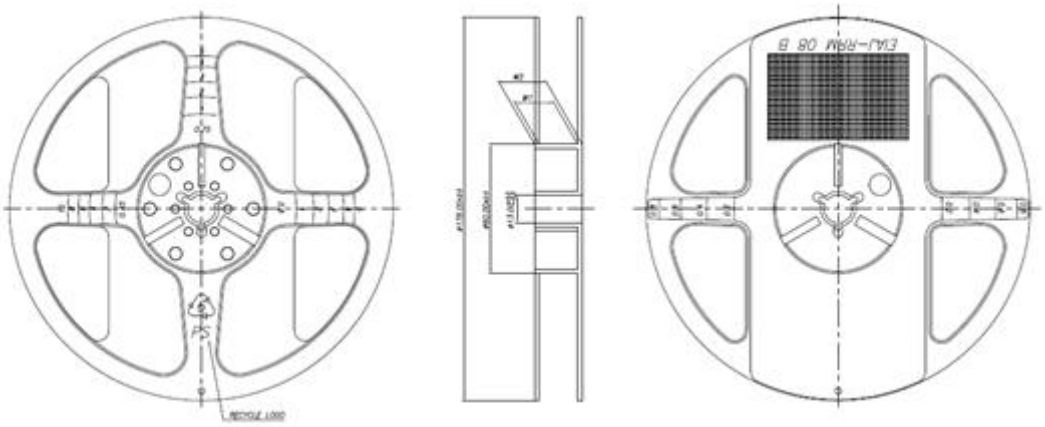
a) Taping Dimension

(unit: mm)





b) Reel Dimension



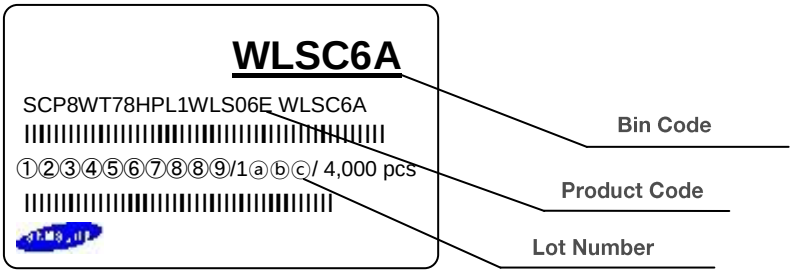
Width	W1	W2
8mm	9 ±0.3	11.9 ±1.0

Notes:

1) Quantity: The quantity/reel is 4,000 pcs
2) Cumulative Tolerance: Cumulative tolerance / 10 pitches is ±0.2 mm
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 product code and bin code above is only an example

Bin Code:

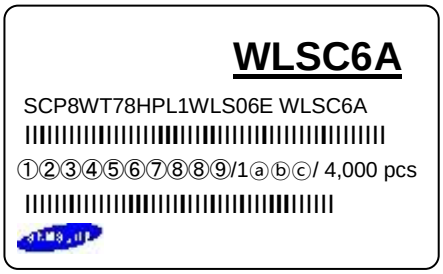
ⓐⓑ: Chromaticity bin (refer to page 10-11)

ⓒⓓ: Luminous Flux bin (refer to page 7-9)

ⓔⓕ: Forward Voltage bin (refer to page 12)

b) Lot Number

The lot number is composed of the following characters:



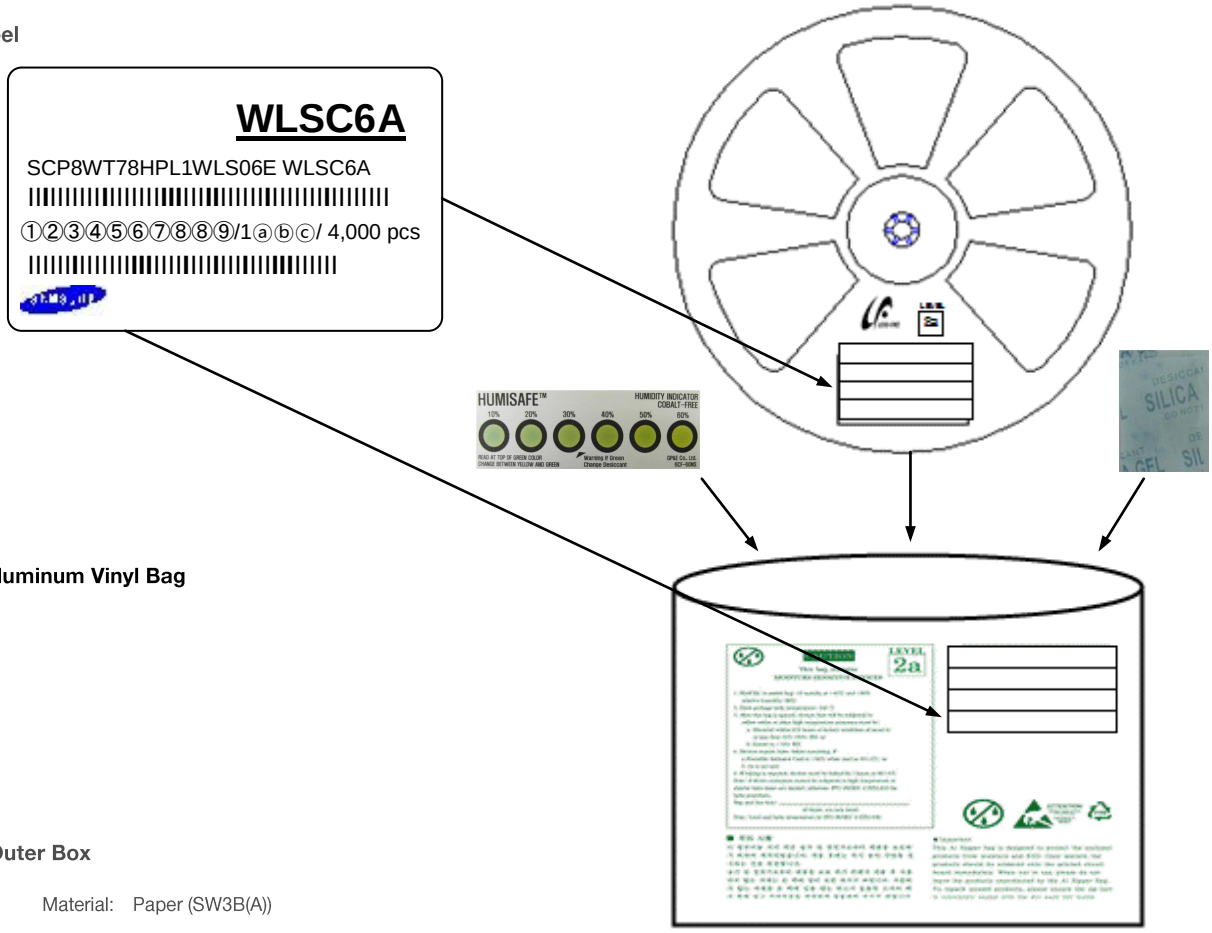
①②③④⑤⑥⑦⑧⑨ / 1ⓐⓑⓒ / 4,000 pcs

①	:	T (Taping)
②	:	Product line (1: KC1)
③	:	Year (E: 2014, F: 2015, …)
④	:	Month (1~9, A, B, C)
⑤	:	Day (1~9, A, B~V)
⑥⑦⑧⑨	:	Product serial number (0001 ~ 0009, A001 ~ ZZZZ)
ⓐⓑⓒ	:	Reel number (001 ~ 999)

9. Packing Structure

a) Packing Process

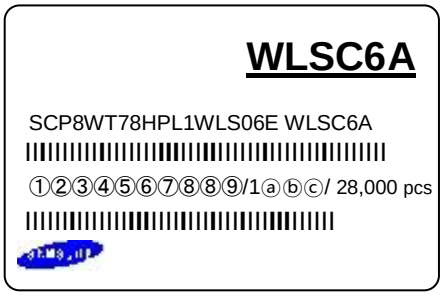
Reel

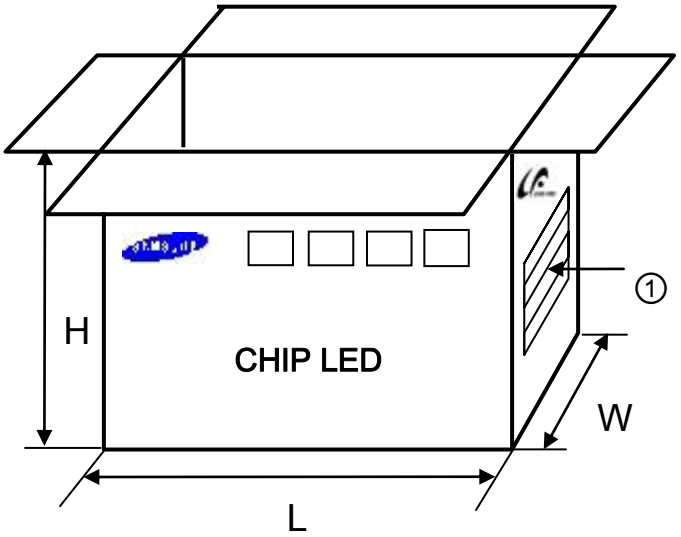


Material: Paper (SW3B(A))

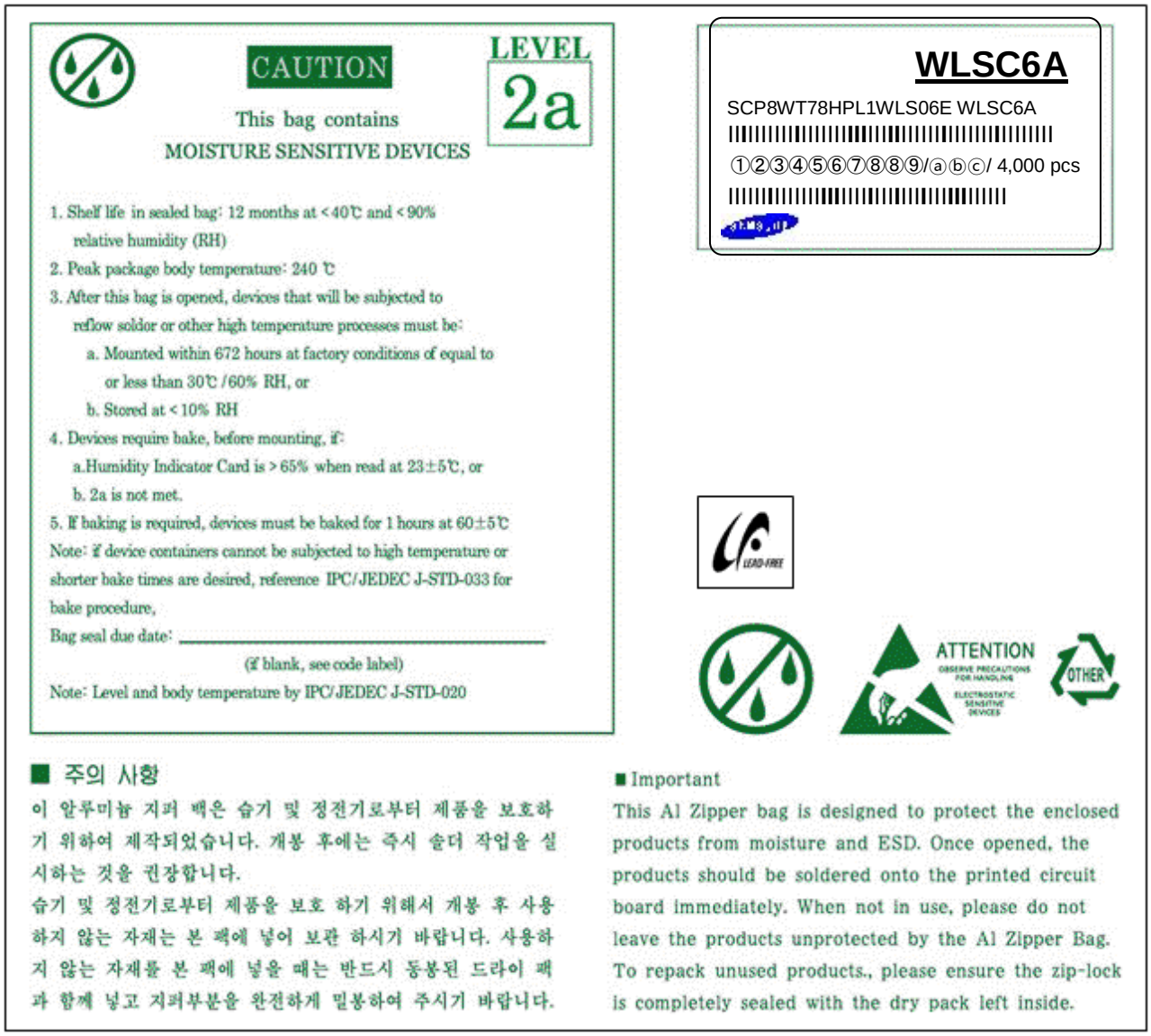
Type	Size (mm)			Note
	L	W	H	
7 inch	295 ± 5	290 ± 5	260 ± 5	Up to 7 reels max.

① Side Label

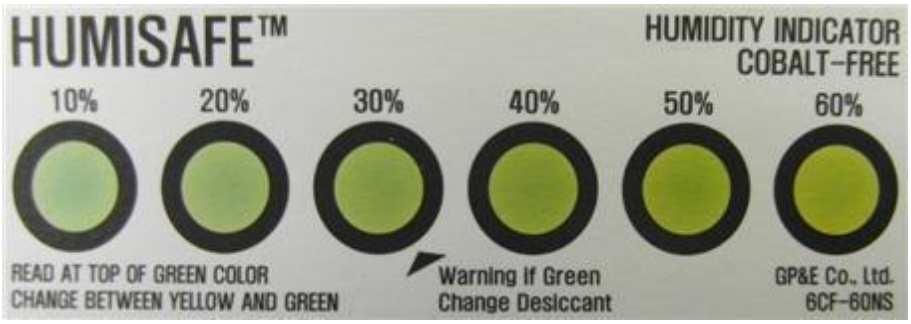




b) Aluminum Vinyl Packing Bag



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 1 hour 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). 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 does not use a silver-plated lead frame but if the LED is attached in silver-plated substrate, the surface color of substrate may change to black (or dark colored) when it is exposed to sulfur (S), chlorine (Cl) or other halogen compound. Sulfurization of substrate may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit, It requires caution. Due to possible sulfurization of substrate, 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.

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