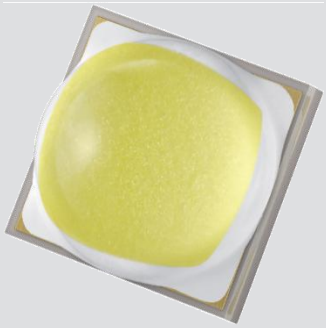
High Power LED Series
3535 Ceramic Hot Binning

LH351D

For High TLCI



High efficacy and high quality color rendering makes the LH351D suitable use in a broad range of applications

Features & Benefits

- Operates at a maximum current of up to 3.0 A
- Uniform light distribution under any beam angle
- 90 CRI makes it well suited for most applications
- Hot binning @ 85 ºC

Applications

- Indoor Lighting: Spotlight, Downlight
- Outdoor Lighting: Street Light, Tunnel Light, Security Light, Area Light, Stadium/Arena Light
- Industrial Lighting: High Bay Light, Low Bay Light
- Consumer Lighting: Torch Light

SAMSUNG

Table of Contents

1. Characteristics

a) Absolute Maximum Rating

Item	Symbol	Rating	Unit	Condition
Operating Temperature	T_{opr}	-40 ~ +105	ºC	Note 1)*
Storage Temperature	T_{stg}	-40 ~ +120	ºC	-
LED Junction Temperature	T_j	150	ºC	Note 1)*
Forward Current	I_F	3000	mA	-
Peak Pulse Forward Current	I_{FP}	5000	mA	Duty 1/10 pulse width 10ms
Assembly Process Temperature		260 <10	ºC s	-
ESD (HBM)	-	±8	kV	-

Notes:

1) Refer to the derating curve, '3. Typical Characteristics Graph', for proper driving current that maintained below maximum junction temperature.

b) Electro-optical Characteristics

Item	Unit	Nominal CCT (K)	Condition		Value Typ.
			I_F (mA)	T_j (°C)	
Luminous Flux (Φ_v)	Lm	5700 (90 CRI)	350	85	153
			700	85	290
			1050	25	455
			1050	85	414
			1500	85	558
			2000	85	700
			3000	85	930
Forward Voltage (V_F)	V		350	85	2.72
			700	85	2.81
			1050	25	2.96
			1050	85	2.90
			1500	85	3.00
			2000	85	3.10
			3000	85	3.28
Reverse Voltage (@ 5 mA)	V			25	14~19.5
Thermal Resistance (junction to solder point)	ºC/W			25	2.2
Beam Angle	º		1050	25	128

Notes:

1) Samsung maintains measurement tolerance of: luminous flux = ±7 %, forward voltage = ±0.1 V
2) Characteristics @ 25 °C are for reference only

c) Luminous Flux Characteristics (T_j = 85 °C)

Sorting @ 1050 mA (lm)			Calculated Minimum Flux[2] (lm)					
Flux Rank	Flux Range[1]	Sub Rank	@ 350 mA	@ 700 mA	@ 1050 mA	@ 1500 mA	@ 2000 mA	@ 3000 mA
S6	*380 ~ 440*	*S2, T2, U2*	*140*	*266*	*380*	*513*	*643*	*854*

Notes:

1) Samsung maintains measurement tolerance of: luminous flux = ±7 %, CRI = ±3
2) Calculated minimum flux values are for reference only

2. Product Code Information

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

Digit	PKG Information	Code	Specification
1 2 3	Samsung Package High Power	SPH	
4 5	Color	WH	White
6	Product Version	T	
7 8	Product	L3	LH351 Series
9	Lens Type	D	Dome lens
10	Internal Code	A	LH351D
11	Not Defined	0	Default
12	CRI & Sorting Temperature	T	Min. 90, For TLCI
13 14	Forward Voltage (V)	F 4	2.6~3.2 Bin Code: U2 2.6~2.8 / V2 2.8~3.0 / W2 3.0~3.2
15 16	CCT (K)	Q T	5700 Bin Code: Q1, Q2, Q3, Q4
17 18	Luminous Flux (lm)	S 6	380~440 S2 380~400 / T2 400~420 / U2 420~440 (S 6)
			Digit 17: Min. spec. Digit 18: The number of higher bin(s) from min. spec. e.g.: S6 = 380~440 lm, S2 = 380~400 lm

a) Luminous Flux Bins (I_F = 1050 mA, T_j = 85 °C)

CRI/ Nominal CCT (K)		Flux rank											
		K2	M2	N2	P2	Q2	R2	S2	T2	U2	V2	W2	Y2
	(min. flux)	260	280	300	320	340	360	380	400	420	440	460	480
90	5700							*SPHWHTL3DA0TV4QTS6*					

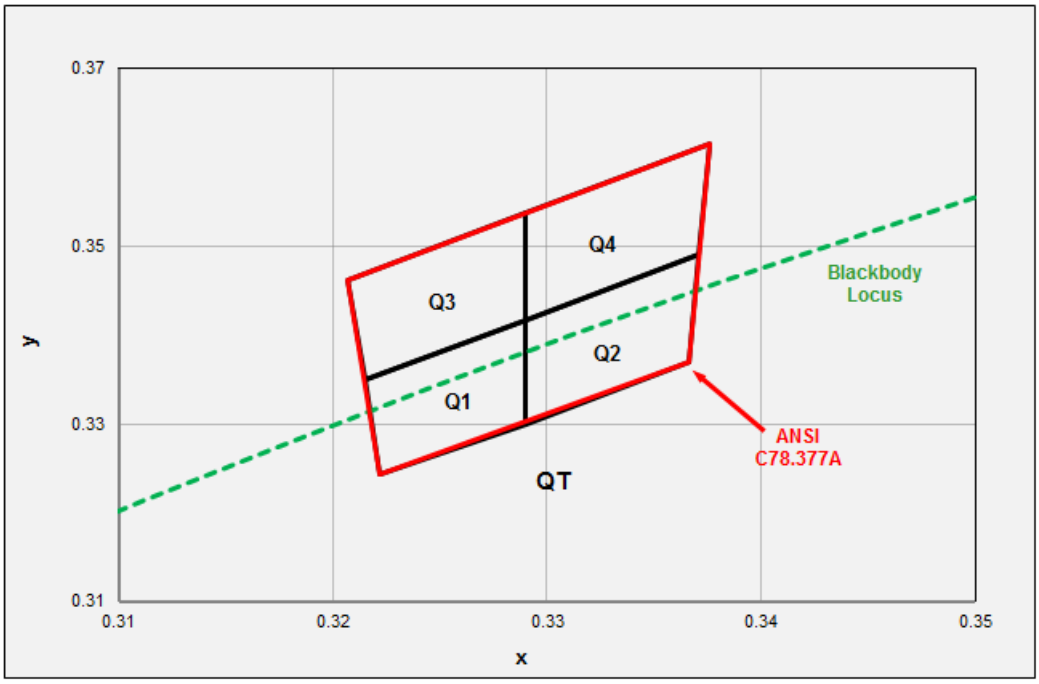
b) Color Bins (I_F = 1050 mA, T_j = 85 °C)

Nominal CCT (K)	CRI (R_a)	Color Rank	Chromaticity Bins
5700	90	QT (ANSI bin)	Q1, Q2, Q3, Q4

c) Voltage Bins (I_F = 1050 mA, T_j = 85 °C)

Nominal CCT (K)	CRI (R_a) Min.	Product Code	Voltage Rank	Voltage Bin	Voltage Range (V)
-	-	-	V4	U2	2.6 ~ 2.8
				V2	2.8 ~ 3.0
				W2	3.0 ~ 3.2

d) Chromaticity Region & Coordinates (I_F = 1050 mA, T_j = 85 ºC)



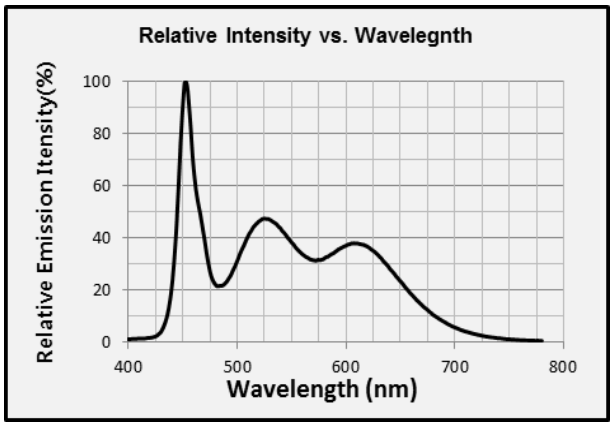
Region	CIE x	CIE y	Region	CIE x	CIE y
QT rank (5700 K)					
Q1	0.3215	0.3350	Q3	0.3207	0.3462
	0.3290	0.3417		0.3290	0.3538
	0.3290	0.3300		0.3290	0.3417
	0.3222	0.3243		0.3215	0.3350
Q2	0.3290	0.3417	Q4	0.3290	0.3538
	0.3371	0.3490		0.3376	0.3616
	0.3366	0.3369		0.3371	0.3490
	0.3290	0.3300		0.3290	0.3417

Note:

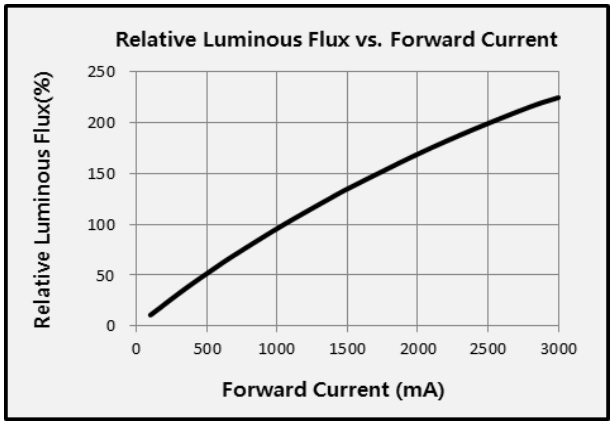
Samsung maintains measurement tolerance of: Cx, Cy = ±0.005

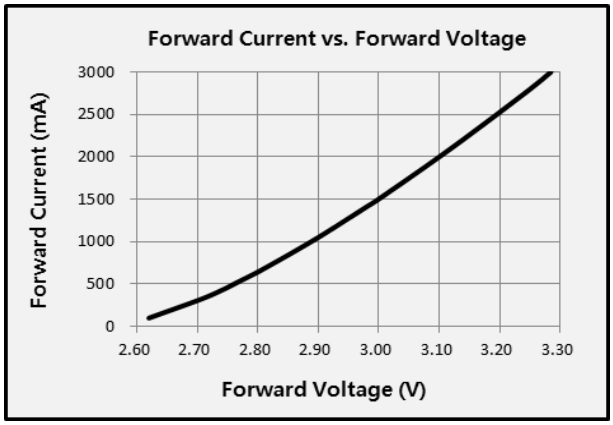
3. Typical Characteristics Graphs

a) Spectrum Distribution (I_F = 1050 mA, T_j = 85 ºC)

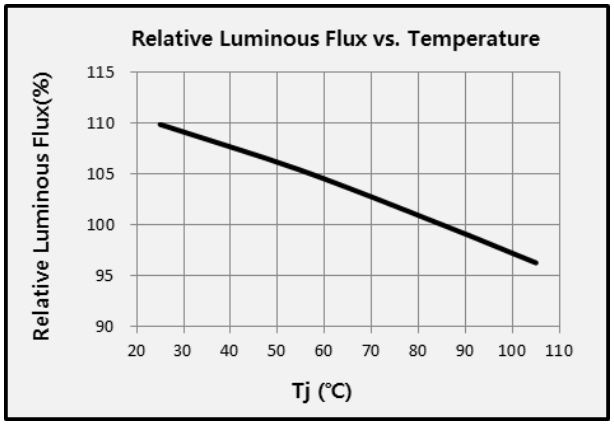


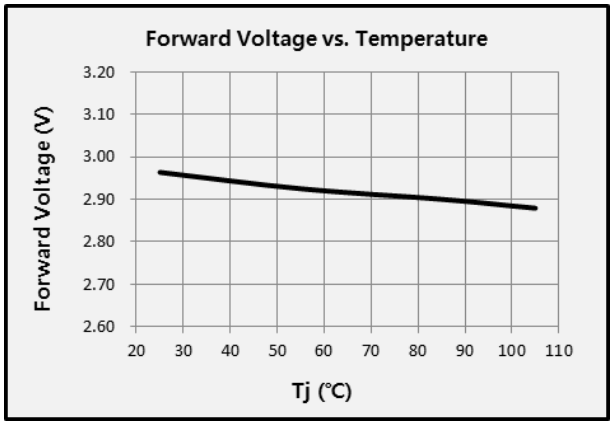
b) Forward Current Characteristics (T_j = 85 ºC)



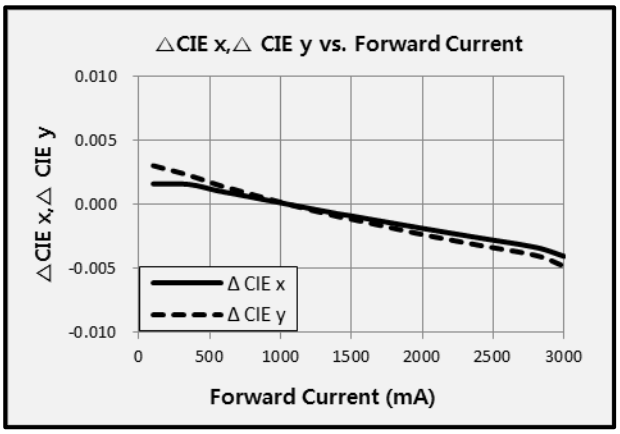


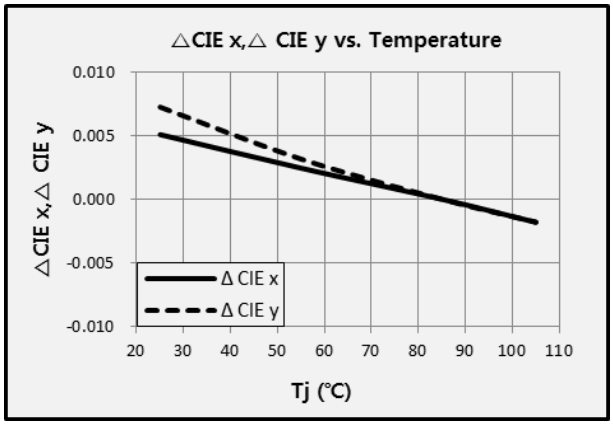
c) Temperature Characteristics (I_F = 1050 mA)



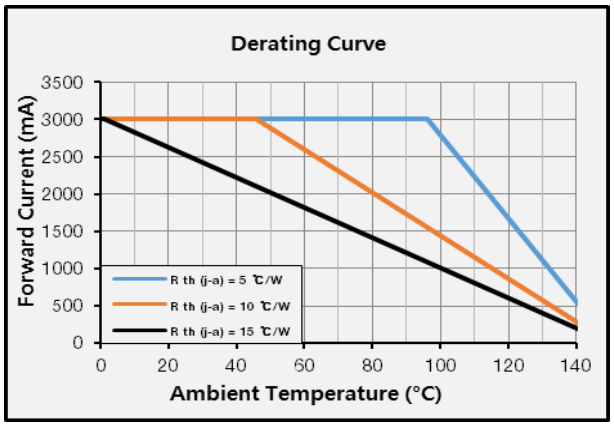


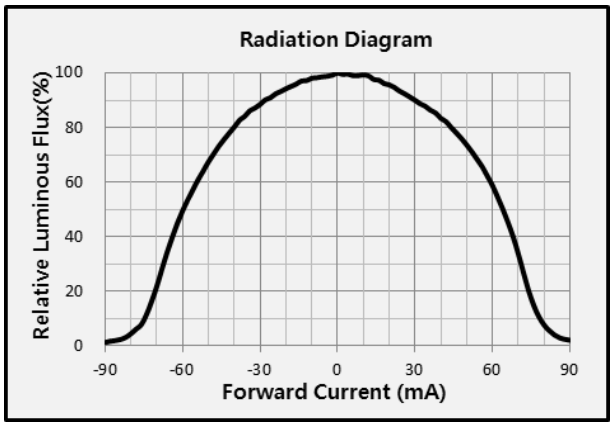
d) Color Shift Characteristics (I_F = 1050 mA, T_j = 85 ºC)



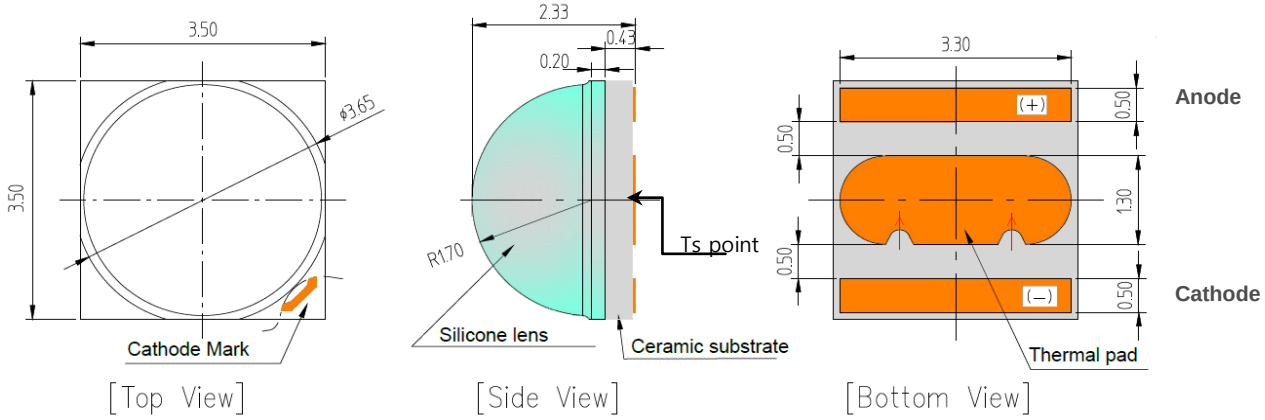


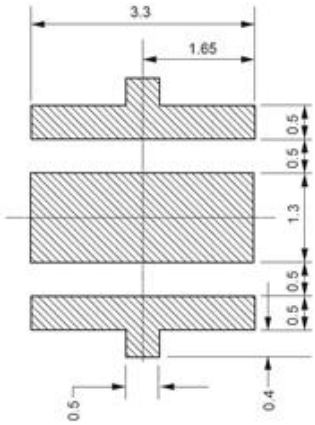
e) Derating Curve and Beam Angle Characteristics (I_F = 1050 mA, T_j = 25 ºC)





4. Outline Drawing & Dimension





- Measurement unit: mm
- Tolerance: ±0.13 mm

Recommended Soldering Pattern

Notes:

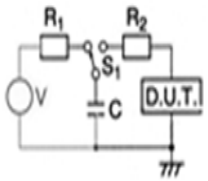
1) This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).
2) The thermal pad is electrically isolated from the anode and cathode contact pads.
3) T_s point and measurement method:
   ① Measure the nearest point to thermal pad as shown above. If necessary, remove PSR of PCB 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 Size
Room Temperature Life Test	25 ºC, Maximum Rated Drive Current	1000 h	11
High Temperature Life Test	85 ºC, Maximum Rated Drive Current	1000 h	22
High Temperature Humidity Life Test	85 ºC, 85 % R.H., Maximum Rated Drive Current	1000 h	22
Low Temperature Life Test	-40 ºC, Maximum Rated Drive Current	1000 h	22
Powered Temperature Cycle	-40 ºC / 10 min ↔ 85 ºC / 10 min, sweep 20 min cycle on/off: each 5 min, Maximum Rated Drive Current	1000 h	18
Damp Heat Cycling	-10 ºC ↔ 25 ºC/Dry ↔ 65 ºC /95 % RH , 24 h / 1 cycle	10 cycles	11
Temperature Cycling	-45 ºC / 15 min ↔ 125 ºC / 15 min temperature change within 5 min	500 cycles	100
High Temperature Storage	120 ºC	1000 h	11
High Temperature Humidity Storage	85 ºC, 85 % R.H.	1000 h	11
ESD (HBM)	 R_1: 10 MΩ R_2: 1.5 kΩ C: 100 pF V: ±8 kV	5 times	30
ESD (MM)	R_1: 10 MΩ R_2: 0 C: 200 pF V: ±0.5 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

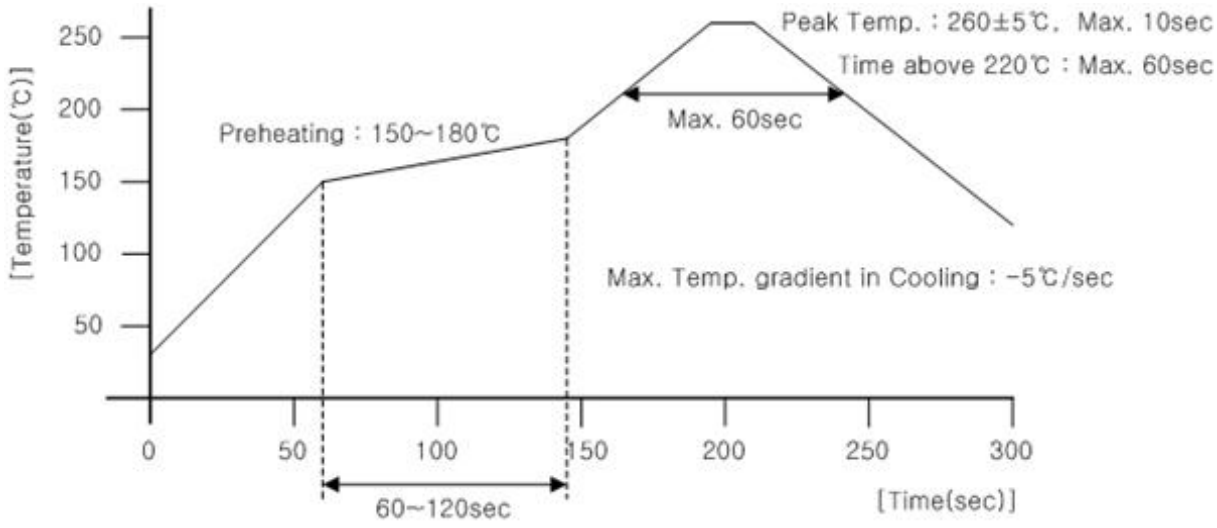
b) Criteria for Judging the Damage

Item	Symbol	Test Condition (T_j = 25 ºC)	Limit	
			Min.	Max.
Forward Voltage	V_F	I_F = 1050 mA	Init. Value * 0.9	Init. Value * 1.1
Luminous Flux	Φ_v	I_F = 1050 mA	Init. Value * 0.7	Init. Value * 1.1

6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



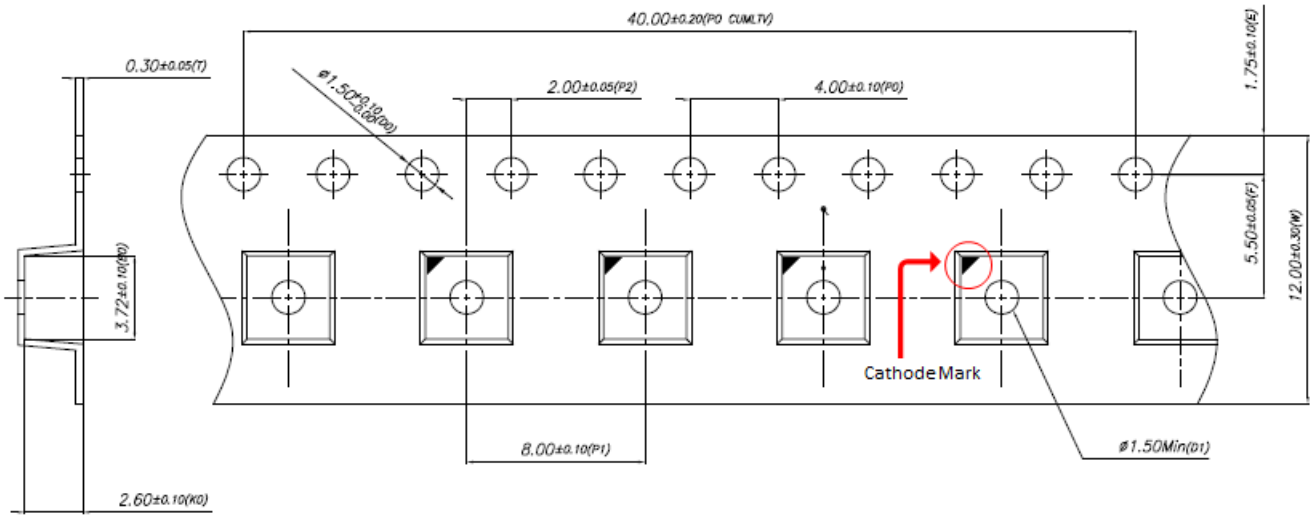
b) Manual Soldering Conditions

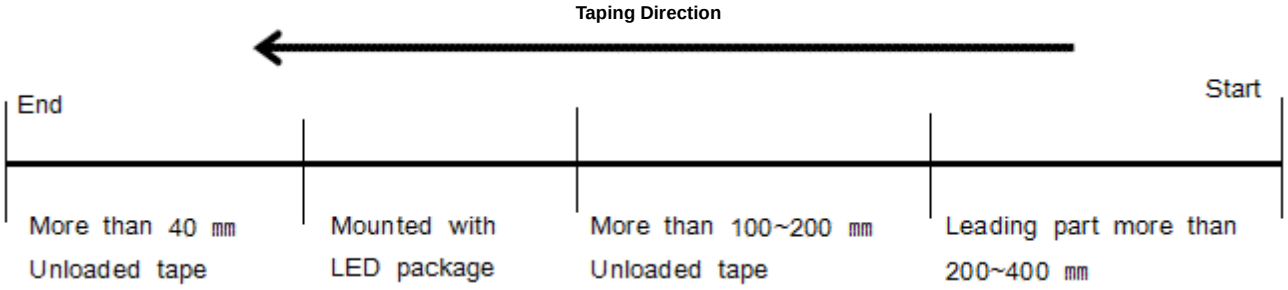
Not more than 5 seconds @ max. 300 ºC, under soldering iron.

7. Tape & Reel

a) Taping Dimension

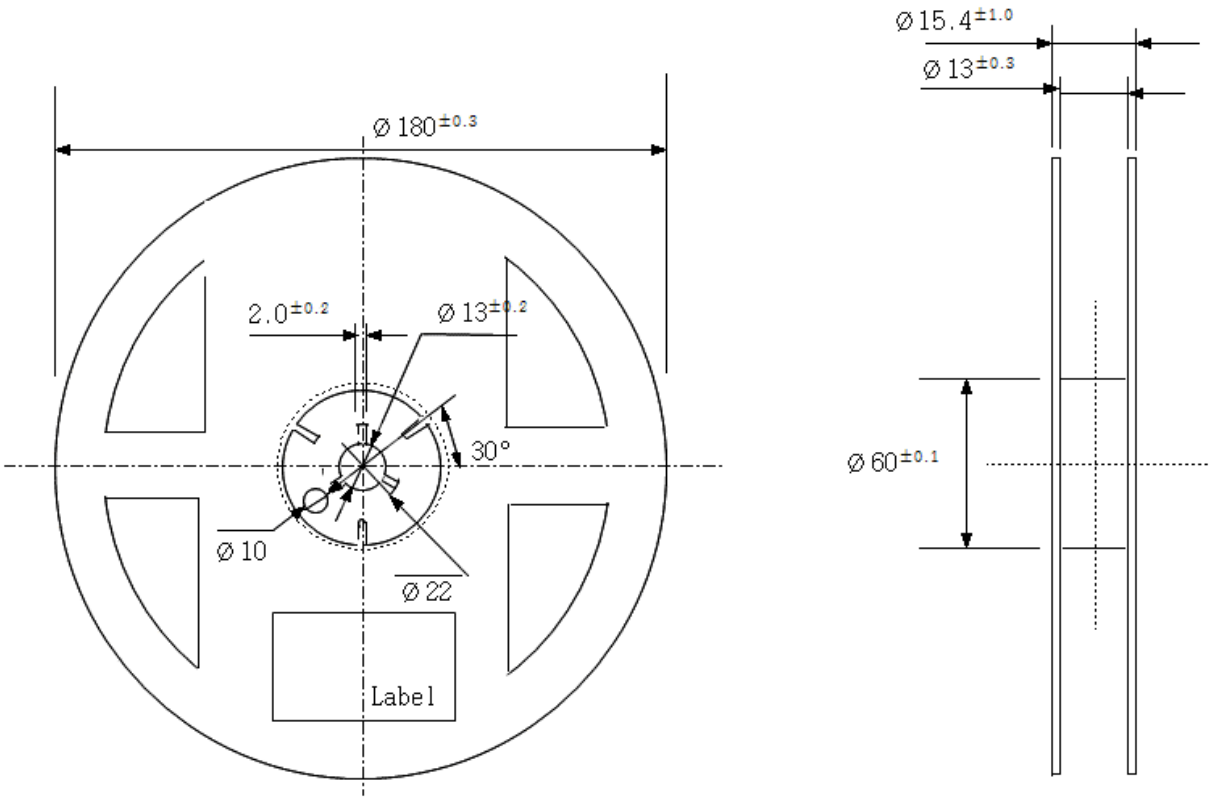
(unit: mm)





b) Reel Dimension

(unit: mm)

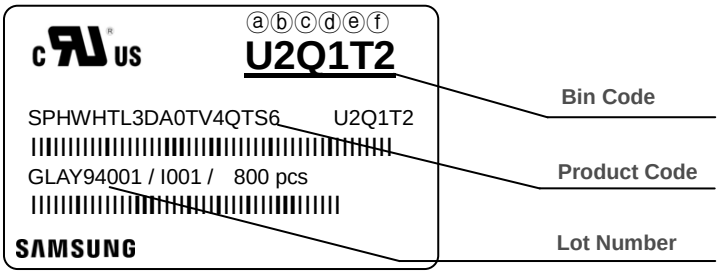


Notes:

1) Quantity: The quantity/reel is 800 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 example (see description on page 7)

Bin Code:

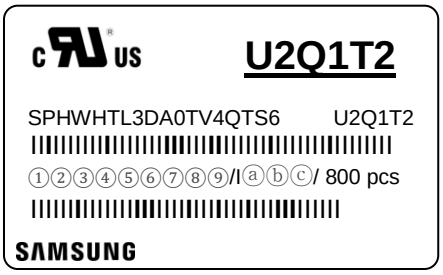
ⓐⓑ: Forward Voltage bin (refer to page 9)

ⓒⓓ: Chromaticity bin (refer to page 10~13)

ⓔⓕ: Luminous Flux bin (refer to page 7-8)

b) Lot Number

The lot number is composed of the following characters:



①②③④⑤⑥⑦⑧⑨ / Ⅰⓐⓑⓒ / 800 pcs

①, ② : Production site (GB : Nanchang, China)

③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)

④ : Year (Y: 2014, Z: 2015, A: 2016, B: 2017, C: 2018, D: 2019 …)

⑤ : Month (1~9, A, B, C)

⑥ : Day (1~9, A, B~V)

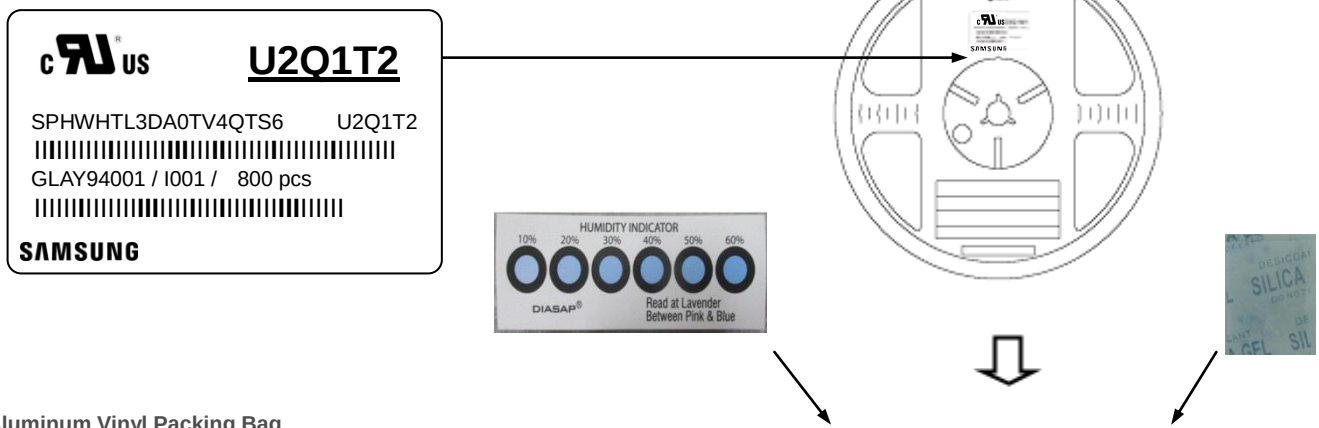
⑦⑧⑨ : Product serial number (001 ~ 999)

ⓐⓑⓒ : Reel number (001 ~ 999)

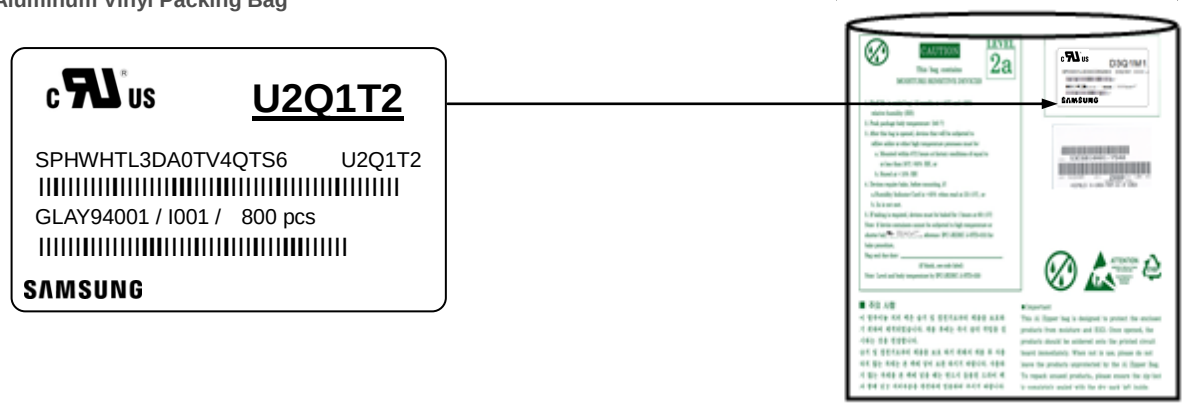
9. Packing Structure

a) Packing Process

Reel



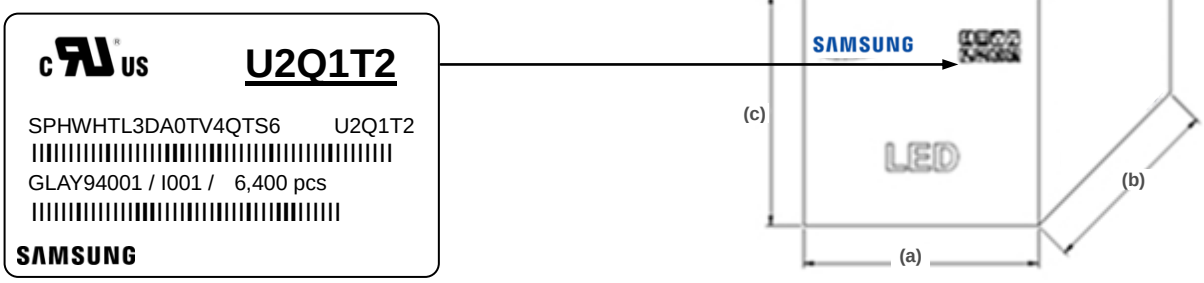
Aluminum Vinyl Packing Bag



Outer Box

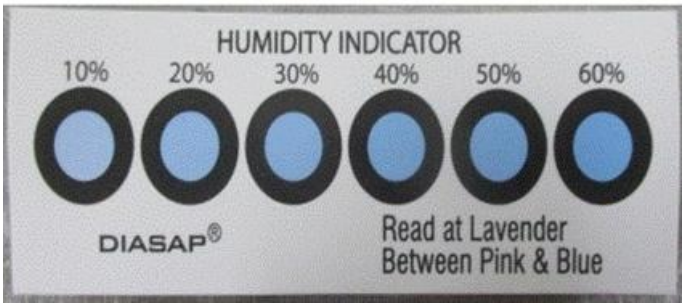
Material: Paper SW(B)

Type	Size (mm)			Note
	(a)	(b)	(c)	
7 inch (L)	245 ± 5	220 ± 5	182 ± 5	Up to 8 reels
7 inch (S)	245 ± 5	220 ± 5	86 ± 5	Up to 4 reels



b) Aluminum Vinyl Packing Bag

c) Silica Gel & 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, or
   b. Stored at <10 % RH
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.

Legal and additional information.

About Samsung Electronics Co., Ltd.

Samsung Electronics Co., Ltd. inspires the world and shapes the future with transformative ideas and technologies, redefining the worlds of TVs, smartphones, wearable devices, tablets, cameras, digital appliances, printers, medical equipment, network systems and semiconductors. We are also leading in the Internet of Things space through, among others, our Digital Health and Smart Home initiatives. We employ 307,000 people across 84 countries. To discover more, please visit our official website at www.samsung.com and our official blog at global.samsungtomorrow.com.

Samsung Electronics Co., Ltd.
1, Samsung ro
Giheung-gu
Yongin-si, Gyeonggi-do, 17113
KOREA

www.samsungled.com

SAMSUNG