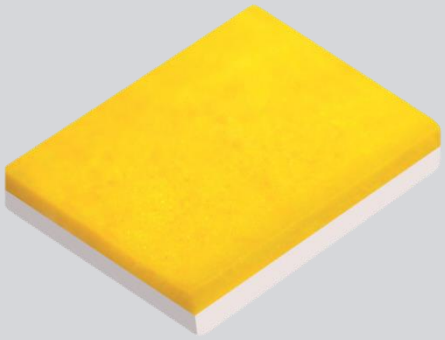
# THE DATASHEET OF

# SCP7TT93KEL1TLN36E

# High Power LED Series
# Chip Scale Package

# LH151B



## Use of Samsung's Chip Scale Package technology
## **provide high performance and energy conserving**

### Features & Benefits

- Utilizes Samsung TF chip technology
- Suitable for use in indoor and outdoor lighting
- Operates at a maximum current of up to 0.7 A
- Compact footprint (1.7 x 1.7 mm)

### Applications

- Indoor Lighting: Spotlight, Downlight, MR, PAR
- Outdoor Lighting: Street Light, Tunnel Light, Security Light, Parking Lot 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 |
|---|---|---|---|---|
| Ambient / Operating Temperature | $T_a$ | -40 ~ +100 | ºC | Note 1) |
| Storage Temperature | $T_{stg}$ | -40 ~ +125 | ºC | - |
| LED Junction Temperature | $T_j$ | 135 | ºC | - |
| Forward Current | $I_F$ | 700 | mA | Note 1) |
| Peak Pulse Forward Current | $I_{FP}$ | 1000 | mA | Duty 1/10 pulse width 10ms |
| Assembly Process Temperature | - | 255<br><20 | ºC<br>s | - |
| ESD (HBM) | - | ±2 | kV | - |

**Note:**

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 ($\Phi_v$) | lm | 4000 (70 CRI) | 150 | 85 | 75 |
| | | | 350 | 25 | 175 |
| | | | 350 | 85 | 160 |
| | | | 500 | 85 | 215 |
| | | | 700 | 85 | 277 |
| Forward Voltage ($V_F$) | V | | 150 | 25 | 2.68 |
| | | | 350 | 25 | 2.96 |
| | | | 350 | 85 | 2.84 |
| | | | 500 | 85 | 2.94 |
| | | | 700 | 85 | 3.05 |
| Thermal Resistance (junction to solder point) | K/W | | | | 2 |
| Beam Angle | ° | | | | 120 |

**Note:**

Samsung maintains measurement tolerance of: luminous flux = ±7%, forward voltage = ±0.1 V

## c) Luminous Flux Characteristics ($T_s$ = 85 °C)

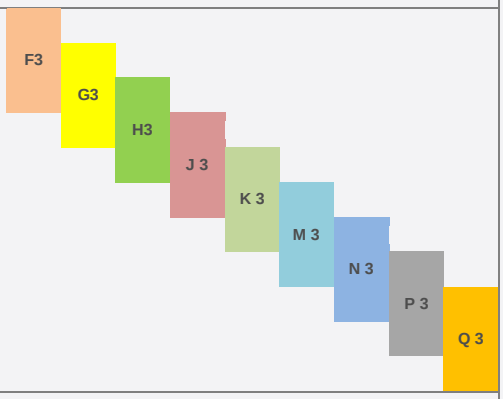
| Sorting @ 350 mA (lm) | | | Calculated Minimum Flux[2] (lm) | | | |
|---|---|---|---|---|---|---|
| Flux Rank | Flux Range[1] | Sub Rank | @ 150 mA | @ 350 mA | @ 500 mA | @ 700 mA |
| E3 | 80 ~ 110 | E1, F1, G1 | 37 | 80 | 108 | 139 |
| F3 | 90 ~ 120 | F1, G1, H1 | 42 | 90 | 121 | 156 |
| G3 | 100 ~ 130 | G1, H1, J1 | 47 | 100 | 135 | 173 |
| H3 | 110 ~ 140 | H1, J1, K1 | 51 | 110 | 148 | 191 |
| J3 | 120 ~ 150 | J1, K1, M1 | 56 | 120 | 161 | 208 |
| K3 | 130 ~ 160 | K1, M1, N1 | 61 | 130 | 175 | 225 |
| M3 | 140 ~ 170 | M1, N1, P1 | 65 | 140 | 188 | 242 |
| N3 | 150 ~ 180 | N1, P1, Q1 | 70 | 150 | 202 | 260 |
| P3 | 160 ~ 190 | P1, Q1, R1 | 75 | 160 | 215 | 277 |
| Q3 | 170 ~ 200 | Q1, R1, S1 | 79 | 170 | 229 | 294 |
| R3 | 180 ~ 210 | R1, S1, T1 | 84 | 180 | 242 | 312 |
| S3 | 190 ~ 220 | S1, T1, U1 | 89 | 190 | 256 | 329 |
| T3 | 200 ~ 230 | T1, U1, V1 | 93 | 200 | 269 | 346 |
| U3 | 210 ~ 240 | U1, V1, W1 | 98 | 210 | 282 | 364 |
| V3 | 220 ~ 250 | V1, W1, X1 | 103 | 220 | 296 | 381 |
| W3 | 230 ~ 260 | W1, X1, Y1 | 107 | 230 | 309 | 398 |
| X3 | 240 ~ 270 | X1, Y1, Z1 | 112 | 240 | 323 | 416 |
| Y3 | 250 ~ 280 | Y1, Z1, 11 | 117 | 250 | 336 | 433 |
| Z3 | 260 ~ 290 | Z1, 11, 21 | 121 | 260 | 350 | 450 |

**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 | C | P | 7 | T | T | 9 | 3 | K | E | L | 1 | T | L | N | 3 | 6 | E |

| Digit | PKG Information | Code | Specification |
|---|---|---|---|
| 1 2 3 | Samsung Chip Scale Package | SCP | |
| 4 | CRI | 7 | CRI 70 |
| | | 8 | CRI 80 |
| | | 9 | CRI 90 |
| 5 | CCT(K) | W | 2700K |
| | | V | 3000K |
| | | U | 3500K |
| | | T | 4000K |
| | | R | 5000K |
| | | Q | 5700K |
| | | P | 6500K |
| 6 | Chip Shape | T | Square type |
| 7 8 9 | Product | 93K | Chip version |
| 10 11 12 | Product Purpose | EL1 | FEC 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 MacAdam 5-Step |
| | | U | Full Bin for MacAdam 3-Step |
| 15 16 | Luminous Flux | F 3 | 90- 120 |
| | | G 3 | 100- 130 |
| | | H 3 | 110- 140 |
| | | J 3 | 120- 150 |
| | | K 3 | 130~160 |
| | | M 3 | 140~170 |
| | | N 3 | 150~180 |
| | | P 3 | 160~190 |
| | | Q 3 | 170~200 |
| | | F1 | 90-100 |
| | | G1 | 100-110 |
| | | H1 | 110- 120 |
| | | J1 | 120- 130 |
| | | K1 | 130~140 |
| | | M1 | 140~150 |
| | | N1 | 150~160 |
| | | P1 | 160~170 |
| | | Q1 | 170~180 |
| | | |   |
| | | | Digit 15: Min. spec<br>Digit 16: The number of higher bin(s) from min. spec.<br>e.g.: K1 = 130~140 lm, K3 = 130~160 lm |
| 17 18 | Forward Voltage (Vf) | 6 E | 2.7 ~ 3.1 V<br>Bin 6A 2.7~2.9<br>Code AE 2.9~3.1 |

## a) Luminous Flux Bins ($I_F$ = 350 mA, $T_S$ = 85 °C)

| CRI/ Nominal CCT (K) | | Flux rank | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E1 | F1 | G1 | H1 | J1 | K1 | M1 | N1 | P1 | Q1 | R1 |
| | (min. flux) | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 |
| 70 | 2700 | | | | | SCP7WT93KEL1W◇J36E | | | | | | |
| | 3000 | | | | | | SCP7VT93KEL1V◇K36E | | | | | |
| | 3500 | | | | | | | SCP7UT93KEL1U◇M36E | | | | |
| | 4000 | | | | | | | | SCP7TT93KEL1T◇N36E | | | |
| | 5000 | | | | | | | | SCP7RT93KEL1R◇N36E | | | |
| | 5700 | | | | | | | SCP7QT93KEL1Q◇M36E | | | | |
| | 6500 | | | | | | | SCP7PT93KEL1P◇M36E | | | | |
| 80 | 2700 | | | | | SCP8WT93KEL1W◇J36E | | | | | | |
| | 3000 | | | | | SCP8VT93KEL1V◇J36E | | | | | | |
| | 3500 | | | | | | SCP8UT93KEL1U◇K36E | | | | | |
| | 4000 | | | | | | SCP8TT93KEL1T◇K36E | | | | | |
| | 5000 | | | | | | | SCP8RT93KEL1R◇M36E | | | | |
| | 5700 | | | | | | | SCP8QT93KEL1Q◇M36E | | | | |
| | 6500 | | | | | | SCP8PT93KEL1P◇K36E | | | | | |
| 90 | 2700 | | | SCP9WT93KEL1W◇G36E | | | | | | | | |
| | 3000 | | | SCP9VT93KEL1V◇G36E | | | | | | | | |
| | 3500 | | | | SCP9UT93KEL1U◇H36E | | | | | | | |
| | 4000 | | | | | SCP9TT93KEL1T◇J36E | | | | | | |
| | 5000 | | | | | SCP9RT93KEL1R◇J36E | | | | | | |

**Notes:**

1) ◇ : MacAdam step code, L(MacAdam 5-step) / U(MacAdam 3-step)

## b) Color Bins ($I_F$ = 350 mA, $T_S$= 85 ºC)

| Nominal CCT (K) | CRI ($R_a$) | Color Rank | Chromaticity Bins |
|---|---|---|---|
| 2700, 3000, 3500, 4000, 5000, 5700, 6500 | 70 | | |
| 2700, 3000, 3500, 4000, 5000, 5700, 6500 | 80 | L (Full Bin for MacAdam 5-step) | ☆L |
| | | U (Full Bin for MacAdam 3-step) | ☆U |
| 2700, 3000, 3500, 4000, 5000, | 90 | | |

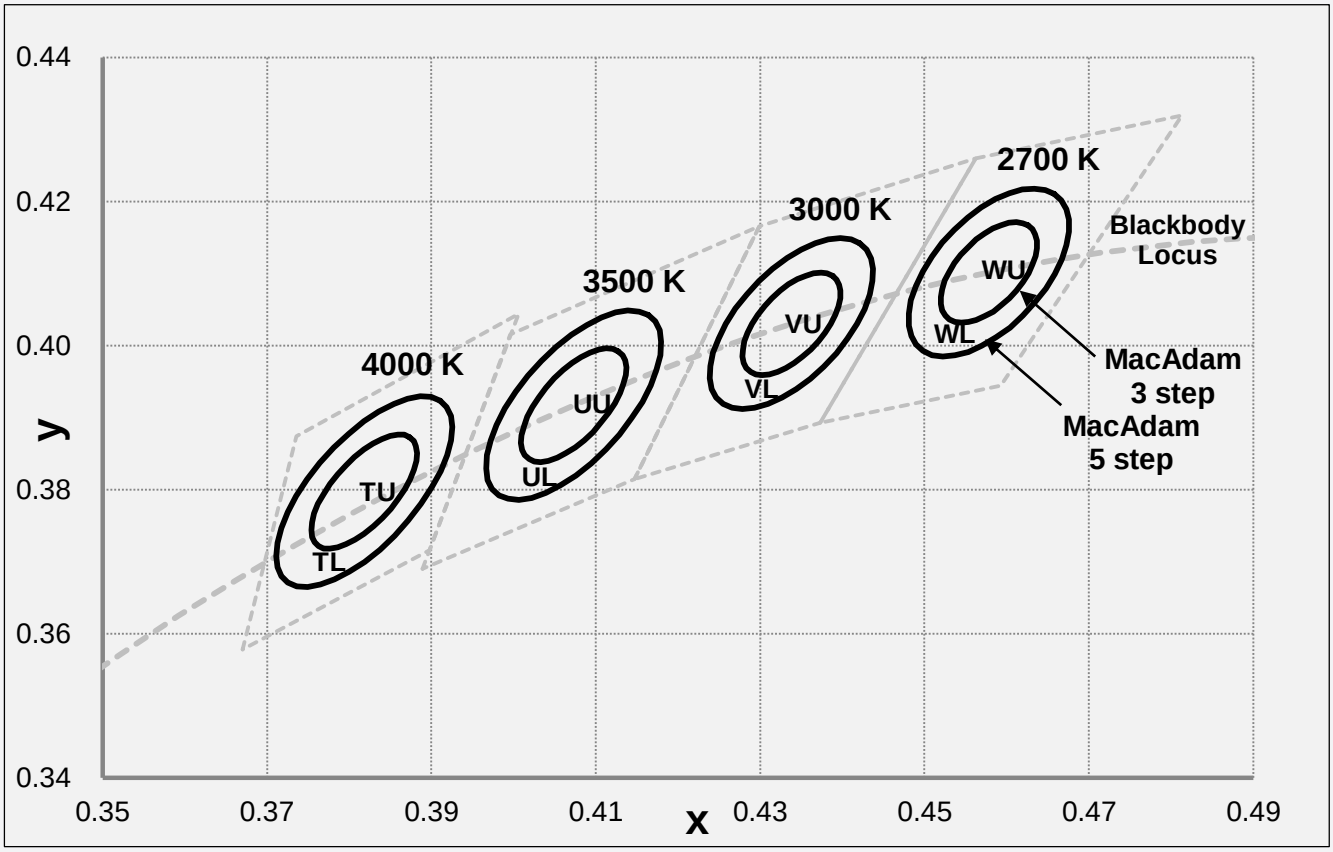
**Notes:**

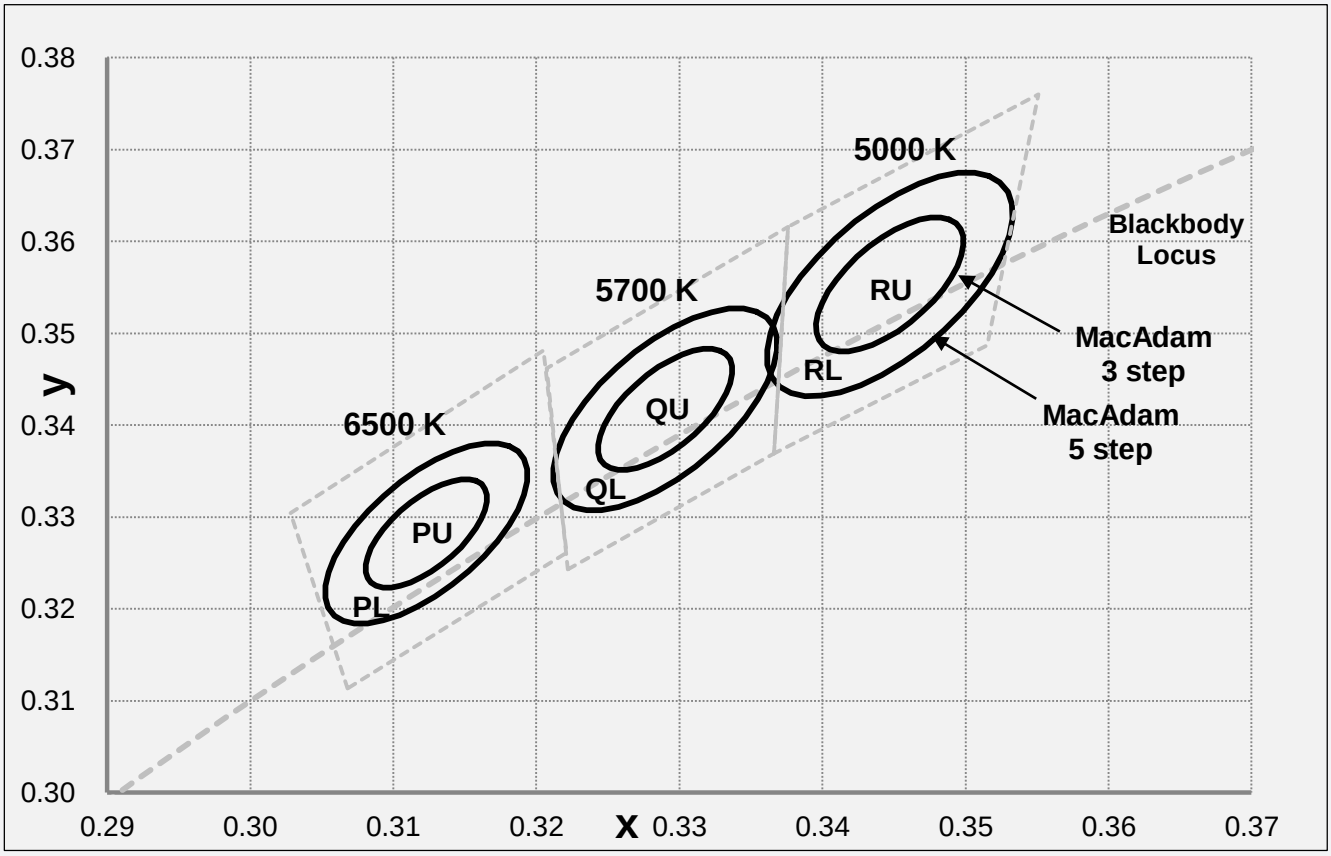
1) ☆ : Nominal CCT code, W(2700)/V(3000K)/U(3500K)/T(4000K)/R(5000K)/Q(5700K)/P(6500K)

## c) Voltage Bins ($I_F$ = 350 mA, $T_S$ = 85 ºC)

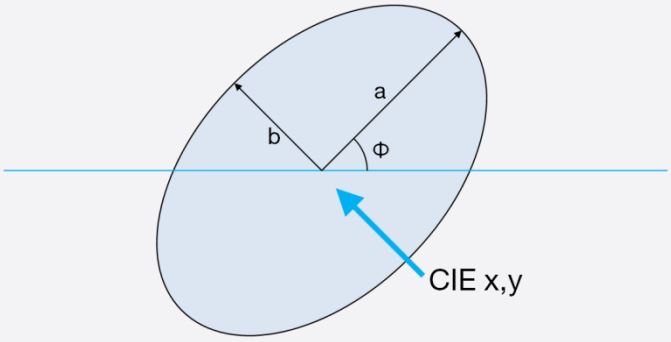
| CRI ($R_a$) | Nominal CCT (K) | Product Code | Voltage Rank | Voltage Bin | Voltage Range (V) |
|---|---|---|---|---|---|
| | | | 6E | 6A | 2.7 ~ 2.9 |
| | | | | AE | 2.9 ~ 3.1 |

## d) Chromaticity Region & Coordinates ($I_F$ = 350 mA, $T_s$ = 85 °C)



## e) Chromaticity Region & Coordinates ($I_F$ = 350 mA, $T_S$ = 85 ºC)




| | 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 |
| 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 |

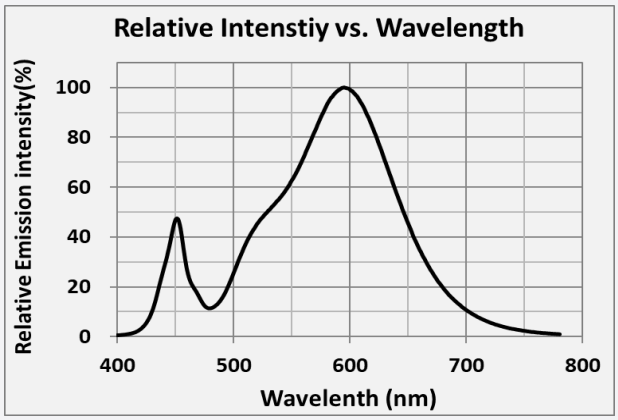
**Note:**

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

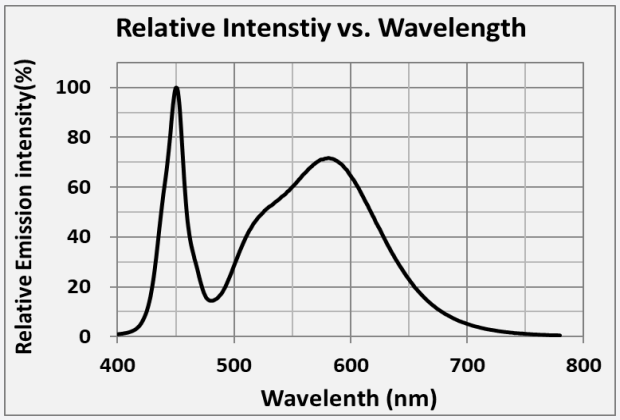
## 3. Typical Characteristics Graphs

### a) Spectrum Distribution ($I_F$ = 350 mA, $T_S$ = 85 ºC)

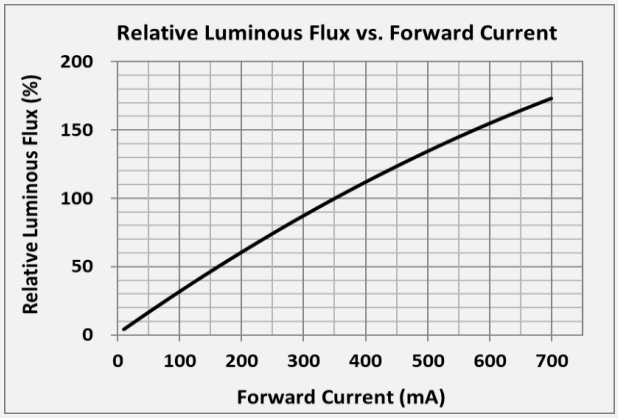
*3000K/CRI70*

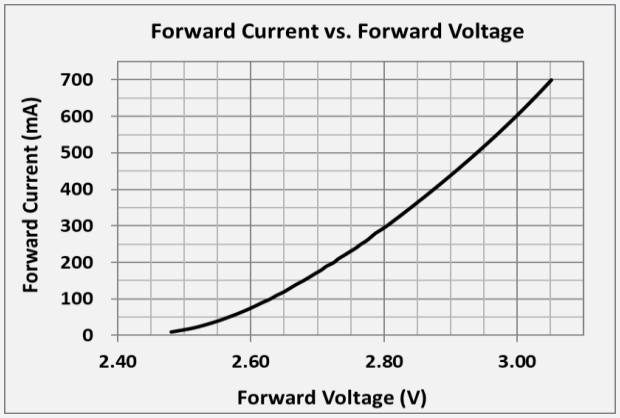



*5000K/CRI70*

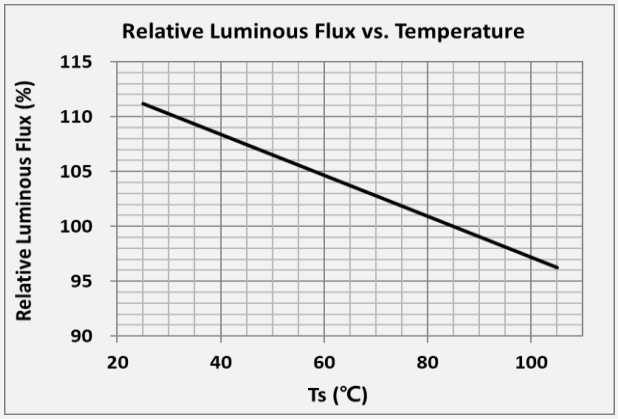


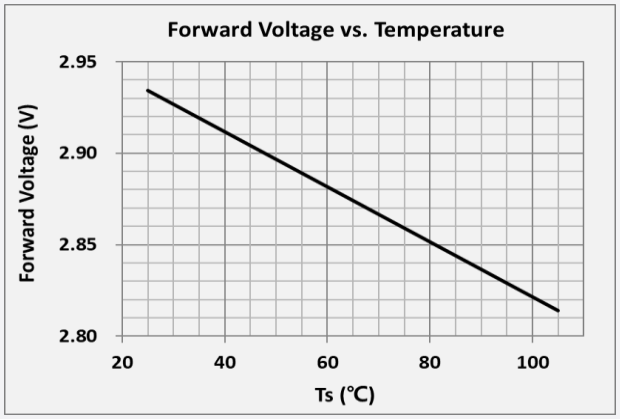

### b) Forward Current Characteristics ($T_S$ = 85 ºC)



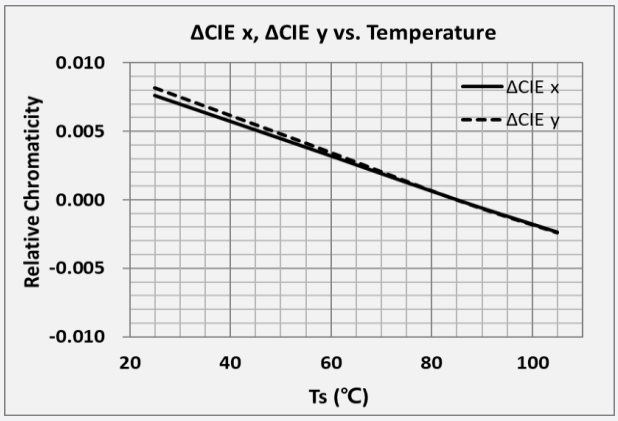



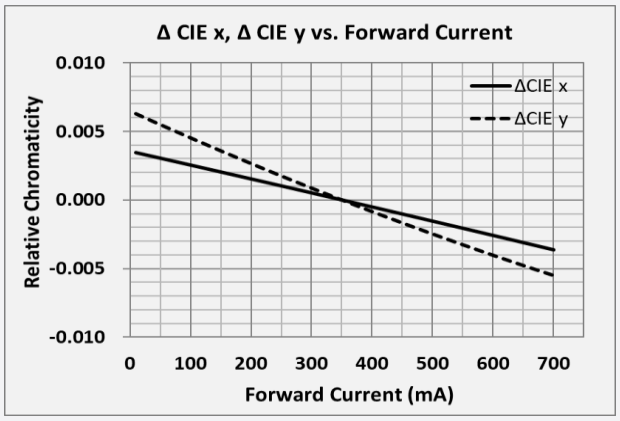

### c) Temperature Characteristics ($I_F$ = 350 mA)



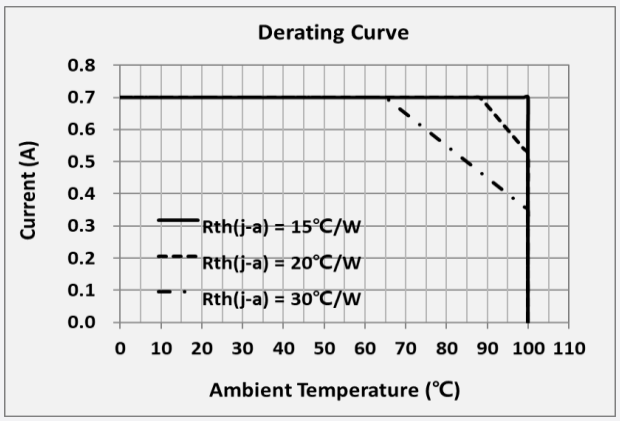



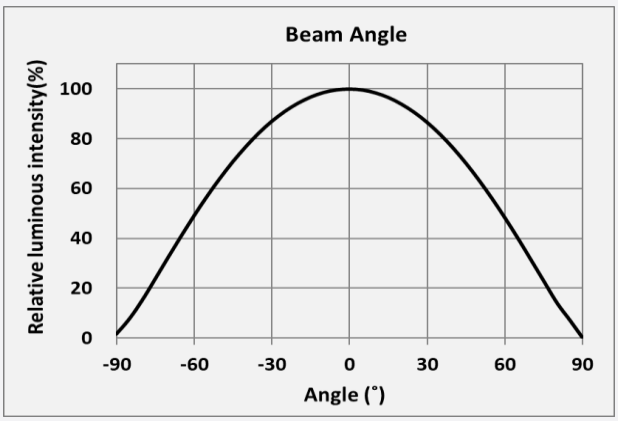
## d) Color Shift Characteristics ($I_F$ = 350 mA, $T_s$ = 85 ºC)



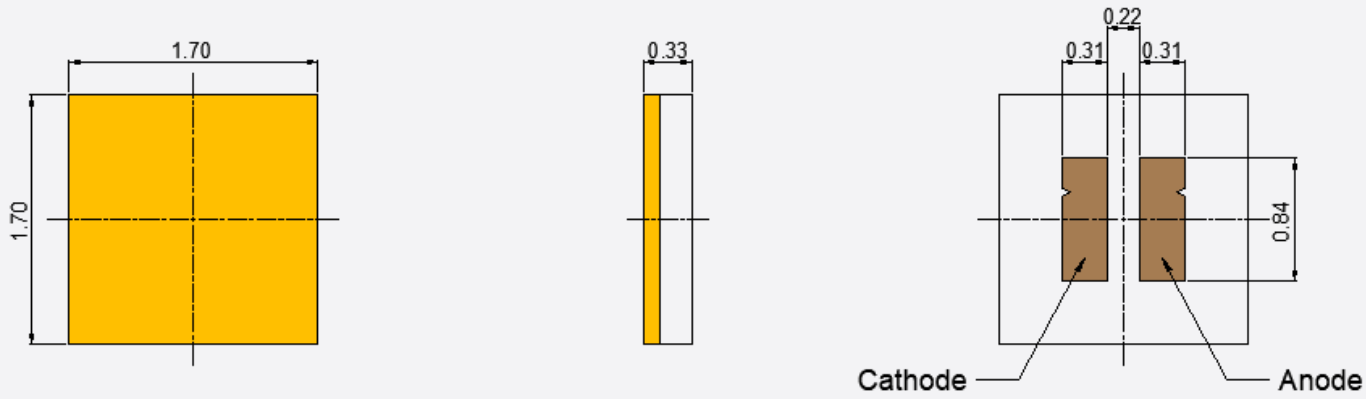

## e) Derating Curve and Beam Angle Characteristics ($I_F$ = 350 mA, $T_s$ = 25 ºC)



## 4. Outline Drawing & Dimension

<Top View> <Side View> <Bottom View>



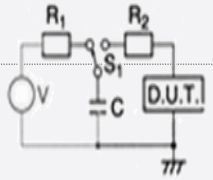

- Measurement unit: mm
- Tolerance: ±0.13 mm

**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 |
|---|---|---|
| Room Temperature Life Test | 25 ºC, Derated maximum current | 1000 h |
| High Temperature Life Test | 85 ºC, Derating maximum current | 1000 h |
| High Temperature Humidity Life Test | 60 ºC, 90% RH, Derating maximum current | 1000 h |
| Low Temperature Life Test | -40 ºC, Derating maximum current | 1000 h |
| Temperature Humidity Cycle Test | -10 ºC ↔25 ºC /Dry, 25 ºC ↔ 65 ºC /95% R.H. Derating maximum current | 10 cycles |
| Thermal Shock | -40 ºC ↔ 125 ºC, each 15 min Transfer time within 5 min | 500 cycles |
| High Temperature Storage | 120 ºC | 1000 h |
| Low Temperature Storage | -40 ºC | 1000 h |
| ESD (HBM) |  $R_1$: 10 MΩ<br>$R_2$: 1.5 kΩ | 5 times |
| ESD (MM) | $R_1$: 10 MΩ<br>$R_2$: 0<br>C: 200 pF<br>V: ±0.2 kV | 5 times |
| Vibration Test | 20~2000~20 Hz, 200 m/s², sweep 4 min X, Y, Z 3 direction, each 1 cycle | 4 cycles |
| Mechanical Shock Test | 1500 g, 0.5 ms 3 shocks each X-Y-Z axis | 5 cycles |

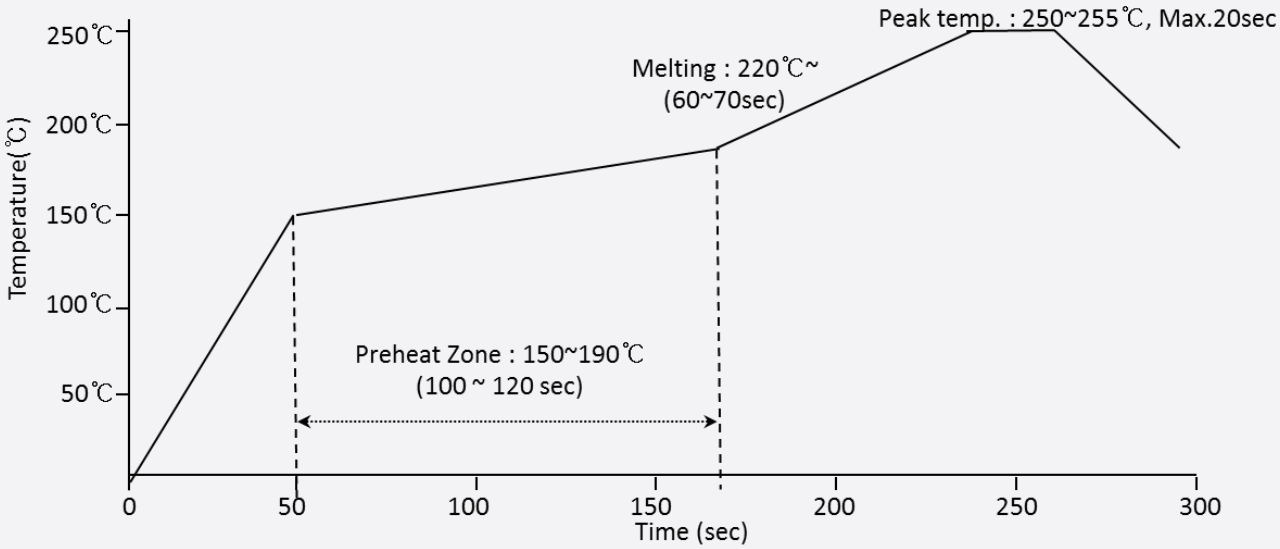
## b) Criteria for Judging the Damage

| Item | Symbol | Test Condition ($T_s$ = 25 ºC) | Limit | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Forward Voltage | $V_F$ | $I_F$ = 350 mA | Init. Value * 0.9 | Init. Value * 1.1 |
| Luminous Flux | $\Phi_v$ | $I_F$ = 350 mA | Init. Value * 0.7 | Init. Value * 1.1 |

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.

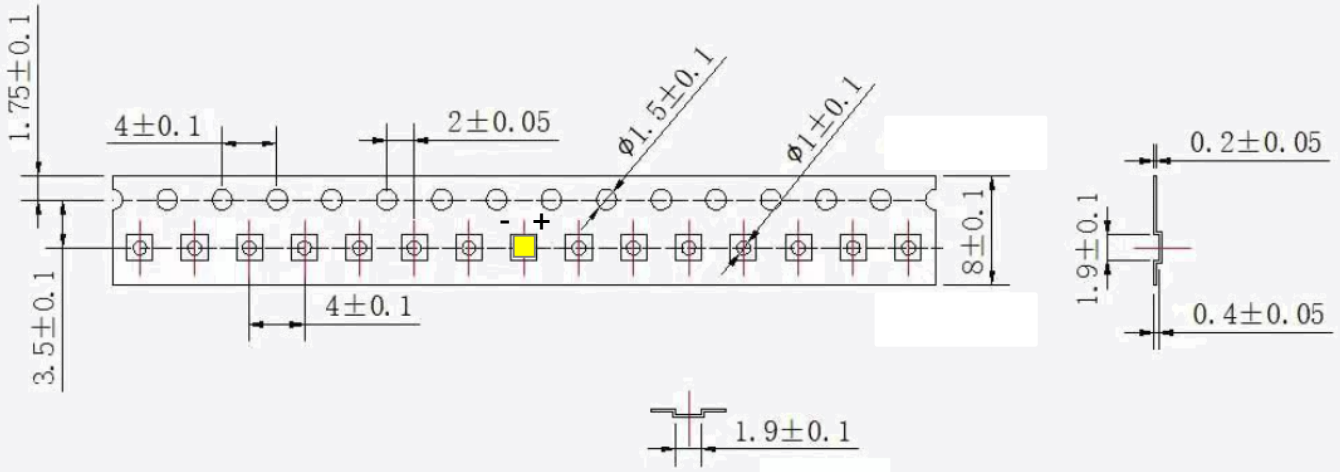


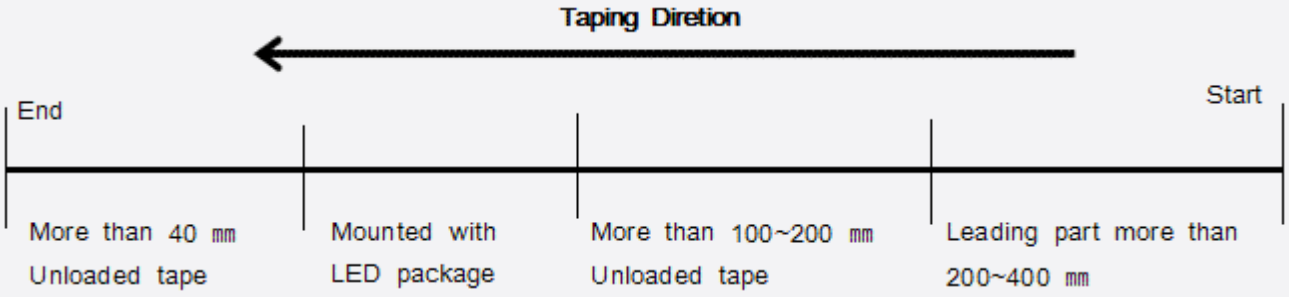

### b) Manual Soldering Conditions

No more than 5 seconds @ max. 300 ºC, under soldering iron.

## 7. Tape & Reel

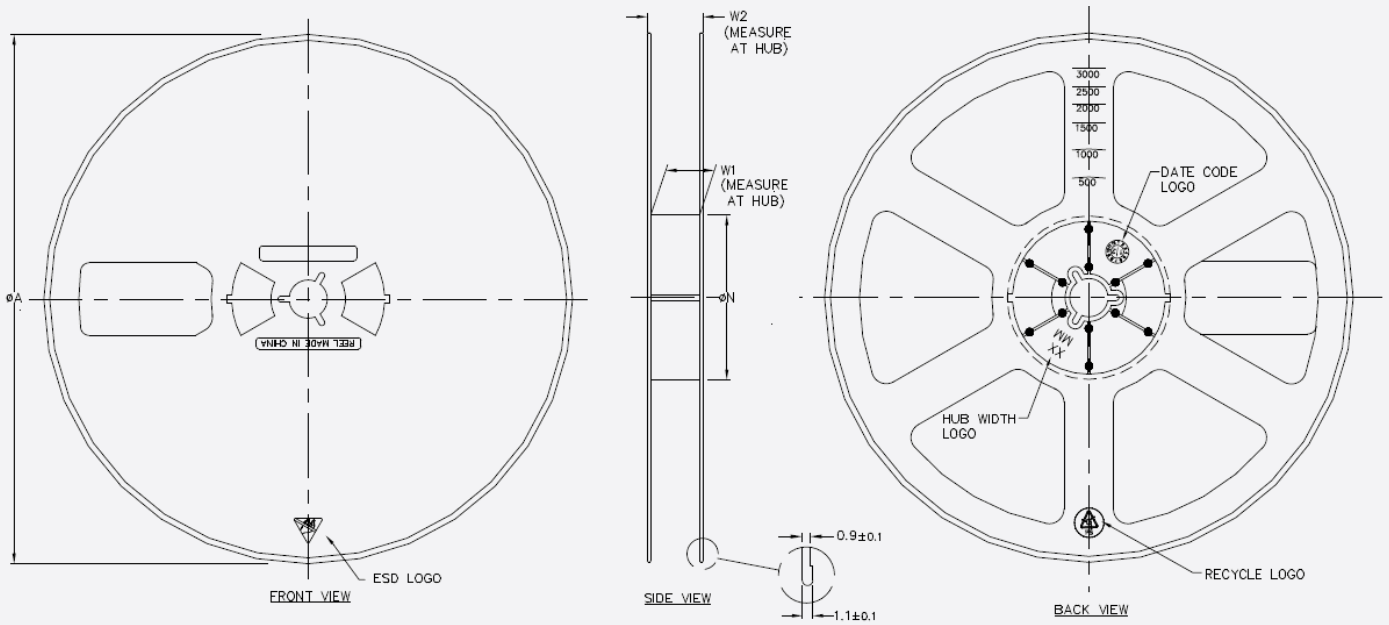
### a) Taping Dimension

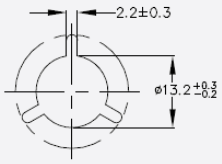


## b) Reel Dimension

(unit: mm)




ARBOR HOLE
DETAIL A
SCALE 2:1

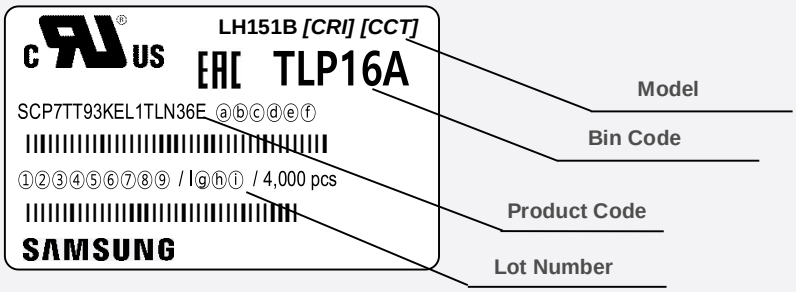
| PRODUCT SPECIFICATIONS | | | | |
|---|---|---|---|---|
| TAPE WIDTH | øA ±1.0 | øN ±0.5 | W1 ±0.5 | W2 (MAX) |
| 08MM | ø178.0 | 54.0 | 9.5 | 15.0 |
| 12MM | ø178.0 | 54.0 | 13.5 | 19.0 |

**Notes:**

1) Quantity: 4,000 Qty/reel
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:

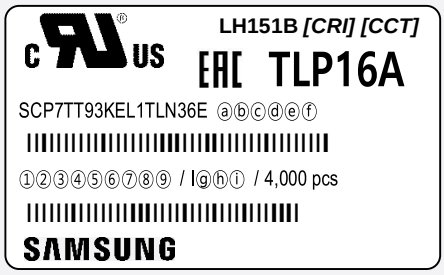
ⓐⓑ : Chromaticity bin (refer to page 9-10)

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

ⓔⓕ : Forward Voltage bin (refer to page 8)

### b) Lot Number

*The lot number is composed of the following characters:*




①②③④⑤⑥⑦⑧⑨ / Ⅰⓐⓑⓒ / 4,000 pcs

①② : Production site (GB: Nanchang China)

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

④ : Year (Z: 2015, A: 2016, E:2020 …)

⑤ : Month (1~9, A, B, C)

⑥ : Day (1~9, A, B~V)

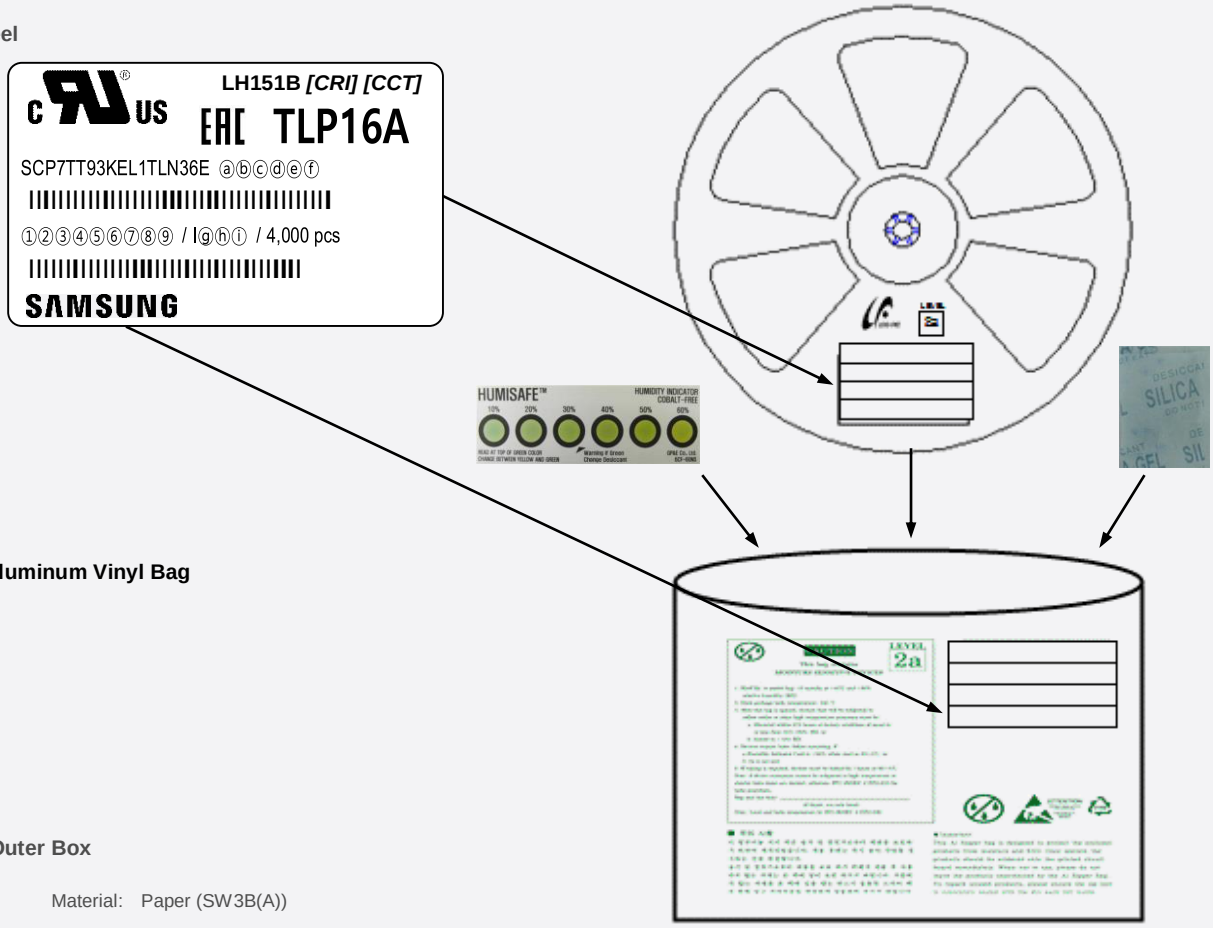
⑦⑧⑨ : Product serial number (001 ~ 999)

ⓖⓗⓘ : Reel number (001 ~ 999) or (AAA ~ ZZZ)

# 9. Packing Structure

## a) Packing Process

**Reel**

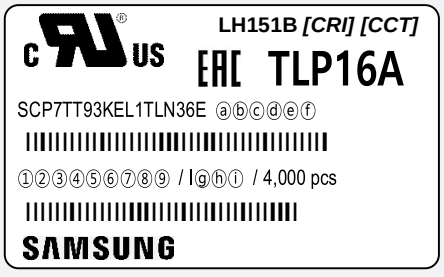


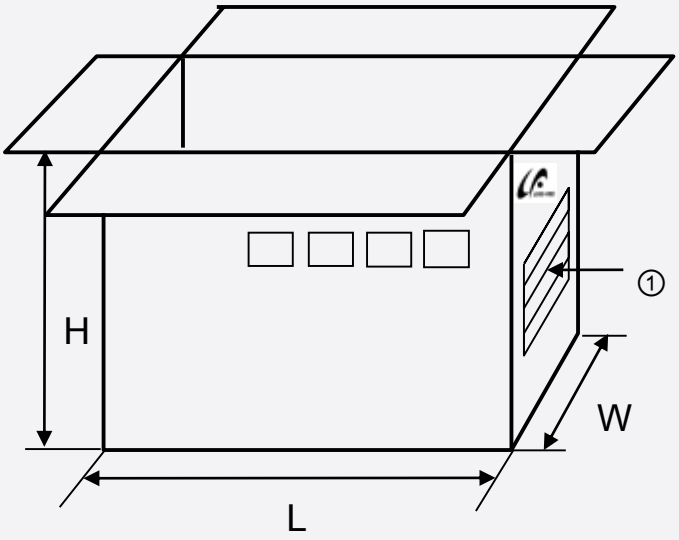

**Outer Box**

Material: Paper (SW3B(A))

| Type | Size (mm) | | | Note |
|---|---|---|---|---|
| | L | W | H | |
| 7 inch | 295 ± 5 | 290 ± 5 | 260 ± 5 | Max 10 reels |

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 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.
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.

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

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