

Middle Power LED Series  
3030

# LM301H EVO



## Features & Benefits

- High efficacy and reliability LED package for Horticultural lighting.
- Mold 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 ~ +120 | °C      | -                           |
| LED Junction Temperature        | $T_j$     | 110        | °C      | -                           |
| Forward Current                 | $I_F$     | 200        | mA      | -                           |
| Pulse Forward Current           | $I_{FP}$  | 300        | mA      | Duty 1/10, pulse width 10ms |
| Assembly Process Temperature    | -         | 260<br><10 | °C<br>s | -                           |
| ESD (HBM)                       | -         | 5          | kV      | -                           |

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

| Item   | Unit              | Rank | Bin            | Min.  | Typ. | Max.  |
|--|-------------------|------|----------------|-------|------|-------|
| Forward Voltage ( $V_F$ )                        | V                 | XA   | AY             | 2.6   | -    | 2.7   |
|  |                   |      | AZ             | 2.7   | -    | 2.8   |
|  |                   |      | A1             | 2.8   | -    | 2.9   |
| PPF  | $\mu\text{mol/s}$ |      | 3000K          | 0.494 | -    | 0.557 |
|  |                   |      | 4000K          | 0.507 | -    | 0.572 |
|  |                   |      | 5000K          | 0.520 | -    | 0.587 |
|  |                   |      | 6500K          | 0.520 | -    | 0.587 |
|  |                   |      | Mint White(MA) | 0.520 | -    | 0.587 |
|  |                   |      | Mint White(MB) | 0.528 | -    | 0.595 |
| Reverse Voltage<br>(@ 5 mA)                      | V                 |      |                | 0.7   | -    | 1.2   |
| Thermal Resistance<br>(junction to solder point) | °C/W              |      |                | -     | 7.5  | -     |
| Beam Angle                                       | °                 |      |                | -     | 120  | -     |

**Note:** Samsung maintains measurement tolerance of: forward voltage =  $\pm 0.1 \text{ V}$ , PPF =  $\pm 5 \%$ ,

c) Electro-optical Characteristics ( $I_F = 65 \text{ mA}$ ,  $T_s = 25^\circ\text{C}$ )

| Item                         | Nominal CCT (K) | Min   | Max   | Current |
|------------------------------|-----------------|-------|-------|---------|
| PPF<br>( $\mu\text{mol/s}$ ) | 3000K           | 0.494 | 0.557 | 65mA    |
|                              | 4000K           | 0.507 | 0.572 |         |
|                              | 5000K           | 0.520 | 0.587 |         |
|                              | 6500K           | 0.520 | 0.587 |         |
|                              | Mint white (MA) | 0.520 | 0.587 |         |
|                              | Mint white (MB) | 0.528 | 0.595 |         |

**Note:** Samsung maintains measurement tolerance of: forward voltage = PPF =  $\pm 5\%$

## 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 | D | 3 | 2 | A | M  | H  | 0  | X  | A  | R  | 0  | P  | R  |

| Digit | PKG Information              | Code | Specification               |              |                                |  |
|-------|------------------------------|------|-----------------------------|--------------|--------------------------------|--|
| 1 2 3 | Samsung Package Middle Power | SPM  |                             |              |                                |  |
| 4 5   | Color                        | WH   | White                       |              |                                |  |
| 6     | Product Version              | D    | Dispensing                  |              |                                |  |
| 7 8 9 | Form Factor                  | 32A  | 3.0 x 3.0 x 0.8 mm; 2 pads; |              |                                |  |
| 10    | Sorting Current (mA)         | M    | 65 mA                       |              |                                |  |
| 11    | Chromaticity Coordinates     | H    | Horticulture                |              |                                |  |
| 12    | CRI                          | 0    | Free                        |              |                                |  |
| 13 14 | Forward Voltage (V)          | XA   | 2.6~2.9V                    | AY 2.6 ~ 2.7 |                                |  |
|       |                              |      |                             | AZ 2.7 ~ 2.8 |                                |  |
|       |                              |      |                             | A1 2.8 ~ 2.9 |                                |  |
| 15 16 | CCT                          | V0   | 3000K                       | Bin Code:    | VE, VF, VG, VH, VJ, VK, VL, VM |  |
|       |                              | TO   | 4000K                       |              | TE, TF, TG, TH, TJ, TK, TL, TM |  |
|       |                              | RO   | 5000K                       |              | RE, RF, RG, RH, RJ, RK, RL, RM |  |
|       |                              | PO   | 6500K                       |              | PE, PF, PG, PH, PJ, PK, PL, PM |  |
|       |                              | MA   | Mint White                  |              | M1                             |  |
|       |                              | MB   |                             |              | M2                             |  |
| 17 18 | PPF (μmol/s)                 | PV   | 3000K                       | Bin Code     | PV 0.494 ~ 0.557               |  |
|       |                              | PT   | 4000K                       |              | PT 0.507 ~ 0.572               |  |
|       |                              | PR   | 5000K                       |              | PR 0.520 ~ 0.587               |  |
|       |                              | PP   | 6500K                       |              | PR 0.520 ~ 0.587               |  |
|       |                              | PL   | Mint White                  |              | PL 0.520 ~ 0.587               |  |
|       |                              | PM   | Mint White                  |              | PM 0.528 ~ 0.595               |  |

### a) PPF Bins( $I_F = 65 \text{ mA}$ , $T_s = 25^\circ\text{C}$ )

| Nominal CCT (K) | Product Code       | PPF Bin | PPF Range (μmol/s) |
|-----------------|--------------------|---------|--------------------|
| 3000K           | SPMWHD32AMH0XAV0PV | PV      | 0.494 ~ 0.557      |
| 4000K           | SPMWHD32AMH0XATOPT | PT      | 0.507 ~ 0.572      |
| 5000K           | SPMWHD32AMH0XAR0PR | PR      | 0.520 ~ 0.587      |
| 6500K           | SPMWHD32AMH0XAP0PP | PP      | 0.520 ~ 0.587      |
| Mint White      | SPMWHD32AMH0XAMAPL | PL      | 0.520 ~ 0.587      |
|                 | SPMWHD32AMH0XAMBPM | PM      | 0.528 ~ 0.595      |

b) Color Bins ( $I_f = 65 \text{ mA}$ ,  $T_s = 25^\circ\text{C}$ )

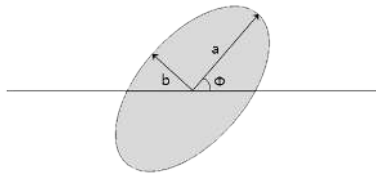
| Nominal CCT (K) | Product Code       | Color Rank        |                                |
|-----------------|--------------------|-------------------|--------------------------------|
| 3000K           | SPMWHD32AMH0XAV0PV | V0<br>(Whole bin) | VE, VF, VG, VH, VJ, VK, VL, VM |
| 4000K           | SPMWHD32AMH0XAT0PT | T0<br>(Whole bin) | TE, TF, TG, TH, TJ, TK, TL, TM |
| 5000K           | SPMWHD32AMH0XAR0PR | R0<br>(Whole bin) | RE, RF, RG, RH, RJ, RK, RL, RM |
| 6500K           | SPMWHD32AMH0XAP0PP | P0<br>(Whole bin) | PE, PF, PG, PH, PJ, PK, PL, PM |
| Mint White      | SPMWHD32AMH0XAMAPL | MA                | M1, M2                         |
|                 | SPMWHD32AMH0XAMBPM | MB                | M3, M4                         |

c) Voltage Bins ( $I_f = 65 \text{ mA}$ ,  $T_s = 25^\circ\text{C}$ )

| Nominal CCT                                    | Product Code   | Voltage Rank | Voltage Bin | Voltage Range |
|--|--|--------------|-------------|---------------|
| 3000K<br>4000K<br>5000K<br>6500K<br>Mint white | SPMWHD32AMH0XAV0PV<br>SPMWHD32AMH0XAT0PT<br>SPMWHD32AMH0XAR0PR<br>SPMWHD32AMH0XAP0PP<br>SPMWHD32AMH0XAMAPL<br>SPMWHD32AMH0XAMBPM | XA           | AY          | 2.6~2.7       |
|  |  |              | AZ          | 2.7~2.8       |
|  |  |              | A1          | 2.8~2.9       |



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



| MacAdam Ellipse (V5) |        |        |          |         |         |
|----------------------|--------|--------|----------|---------|---------|
| Step                 | CIE x  | CIE y  | $\theta$ | a       | b       |
| 5-step               | 0.4338 | 0.4030 | 53.22    | 0.01390 | 0.00680 |

| MacAdam Ellipse (R5) |        |        |          |         |         |
|----------------------|--------|--------|----------|---------|---------|
| Step                 | CIE x  | CIE y  | $\theta$ | a       | b       |
| 5-step               | 0.3447 | 0.3553 | 59.62    | 0.01370 | 0.00590 |

| MacAdam Ellipse (T5) |        |        |          |         |         |
|----------------------|--------|--------|----------|---------|---------|
| Step                 | CIE x  | CIE y  | $\theta$ | a       | b       |
| 5-step               | 0.3818 | 0.3797 | 53.72    | 0.01565 | 0.00670 |

| MacAdam Ellipse (P5) |        |        |          |         |         |
|----------------------|--------|--------|----------|---------|---------|
| Step                 | CIE x  | CIE y  | $\theta$ | a       | b       |
| 5-step               | 0.3123 | 0.3282 | 58.57    | 0.01115 | 0.00475 |

|            | Rank | X1     | Y1     | X2     | Y2     | X3     | Y3     | X4     | Y4     |
|------------|------|--------|--------|--------|--------|--------|--------|--------|--------|
| V<br>3000K | VW   | 0.4221 | 0.3984 | 0.4299 | 0.4165 | 0.4430 | 0.4212 | 0.4342 | 0.4028 |
|            | VX   | 0.4342 | 0.4028 | 0.4430 | 0.4212 | 0.4562 | 0.4260 | 0.4465 | 0.4071 |
|            | VY   | 0.4259 | 0.3853 | 0.4342 | 0.4028 | 0.4465 | 0.4071 | 0.4373 | 0.3893 |
|            | VZ   | 0.4147 | 0.3814 | 0.4221 | 0.3984 | 0.4342 | 0.4028 | 0.4259 | 0.3853 |
| T<br>4000K | TW   | 0.3702 | 0.3722 | 0.3825 | 0.3798 | 0.3869 | 0.3958 | 0.3736 | 0.3874 |
|            | TX   | 0.3825 | 0.3798 | 0.3950 | 0.3875 | 0.4006 | 0.4044 | 0.3869 | 0.3958 |
|            | TY   | 0.3783 | 0.3646 | 0.3898 | 0.3716 | 0.3950 | 0.3875 | 0.3825 | 0.3798 |
|            | TZ   | 0.3670 | 0.3578 | 0.3783 | 0.3646 | 0.3825 | 0.3798 | 0.3702 | 0.3722 |
| R<br>5000K | RW   | 0.3376 | 0.3616 | 0.3463 | 0.3687 | 0.3451 | 0.3554 | 0.3371 | 0.3490 |
|            | RX   | 0.3463 | 0.3687 | 0.3551 | 0.3760 | 0.3533 | 0.3620 | 0.3451 | 0.3554 |
|            | RY   | 0.3451 | 0.3554 | 0.3533 | 0.3620 | 0.3515 | 0.3487 | 0.3440 | 0.3427 |
|            | RZ   | 0.3371 | 0.3490 | 0.3451 | 0.3554 | 0.3440 | 0.3427 | 0.3366 | 0.3369 |
| P<br>6500K | PW   | 0.3048 | 0.3207 | 0.3130 | 0.3290 | 0.3115 | 0.3391 | 0.3028 | 0.3304 |
|            | PX   | 0.3130 | 0.3290 | 0.3213 | 0.3373 | 0.3205 | 0.3481 | 0.3115 | 0.3391 |
|            | PY   | 0.3144 | 0.3186 | 0.3221 | 0.3261 | 0.3213 | 0.3373 | 0.3130 | 0.3290 |
|            | PZ   | 0.3068 | 0.3113 | 0.3144 | 0.3186 | 0.3130 | 0.3290 | 0.3048 | 0.3207 |
|            | VW   | 0.4221 | 0.3984 | 0.4299 | 0.4165 | 0.4430 | 0.4212 | 0.4342 | 0.4028 |

|           | Rank | X1     | Y1     | X2     | Y2     | X3     | Y3     | X4     | Y4     |
|-----------|------|--------|--------|--------|--------|--------|--------|--------|--------|
| M<br>Mint | M1   | 0.3064 | 0.4403 | 0.3236 | 0.4337 | 0.3104 | 0.3994 | 0.2933 | 0.4060 |
|           | M2   | 0.2933 | 0.4060 | 0.3104 | 0.3994 | 0.2973 | 0.3651 | 0.2801 | 0.3717 |
|           | M3   | 0.2801 | 0.3717 | 0.2973 | 0.3651 | 0.2841 | 0.3307 | 0.2669 | 0.3373 |
|           | M4   | 0.2669 | 0.3373 | 0.2841 | 0.3307 | 0.2709 | 0.2964 | 0.2538 | 0.3030 |

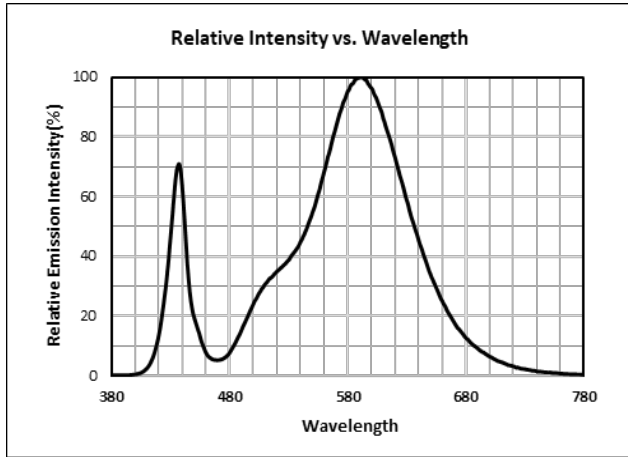
Note: Samsung maintains measurement tolerance of:  $C_x, C_y = \pm 0.005$



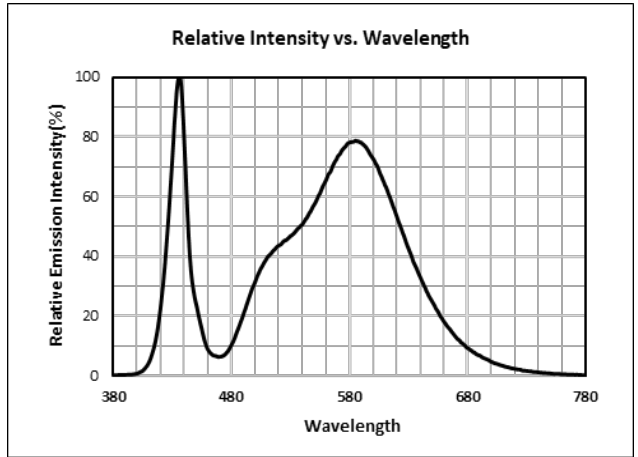
### 3. Typical Characteristics Graphs

a) Spectrum Distribution ( $I_f = 65 \text{ mA}$ ,  $T_s = 25^\circ\text{C}$ )

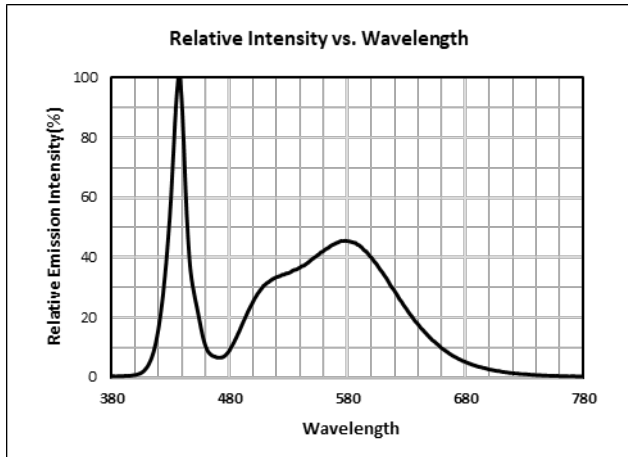
CCT : 3000K



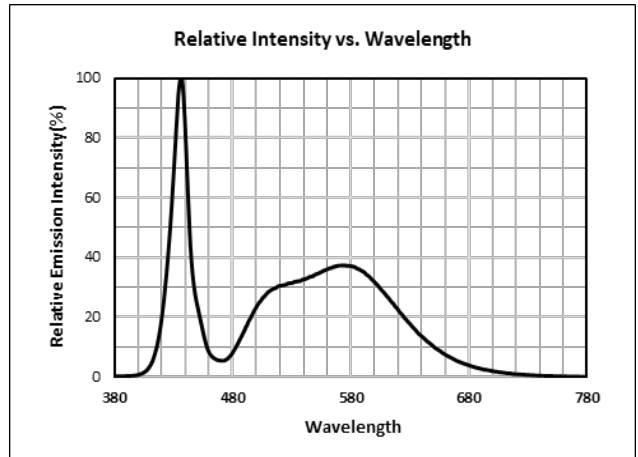
CCT : 4000K



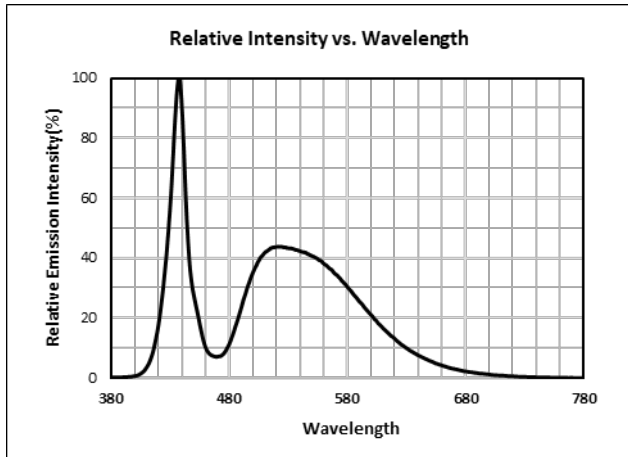
CCT : 5000K



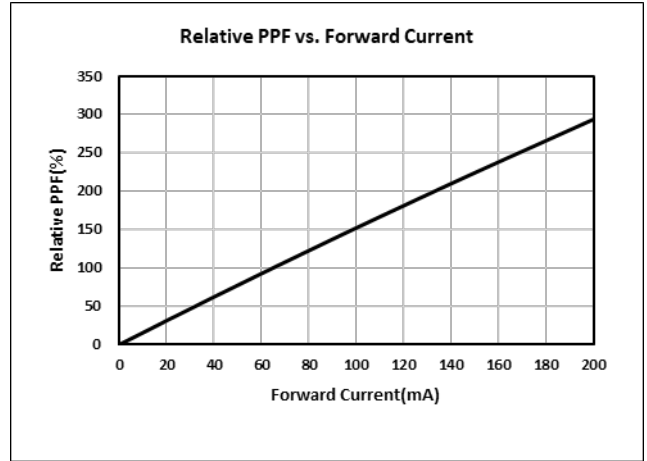
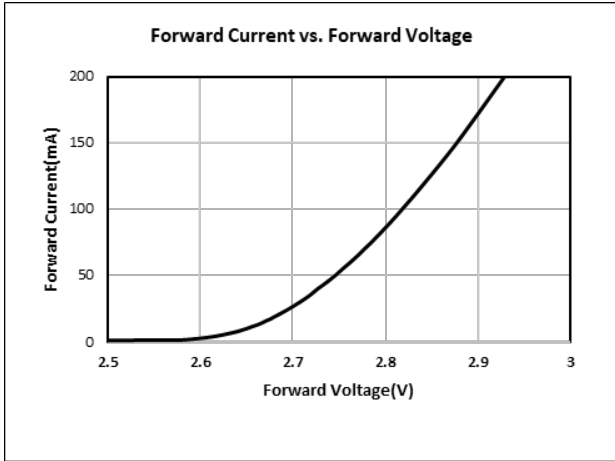
CCT : 6500K



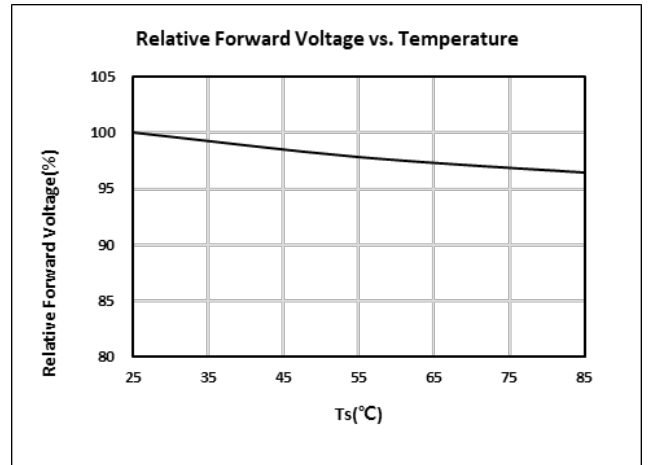
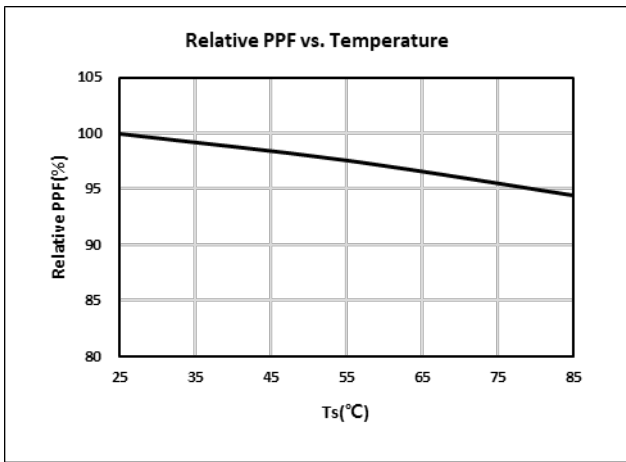
CCT : Mint White



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

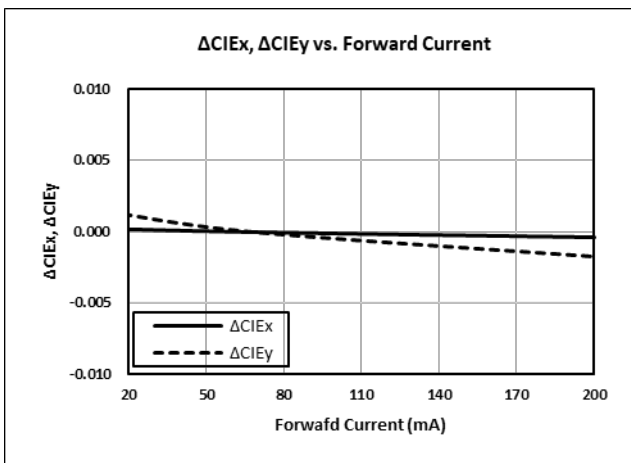


c) Temperature Characteristics ( $I_f = 65\text{ mA}$ )

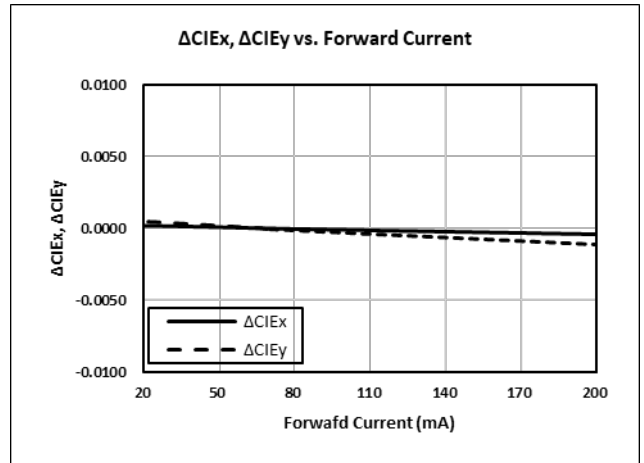


d) Color Shift Characteristics,  $T_s = 25^\circ\text{C}$ ,  $I_f = 65\text{ mA}$

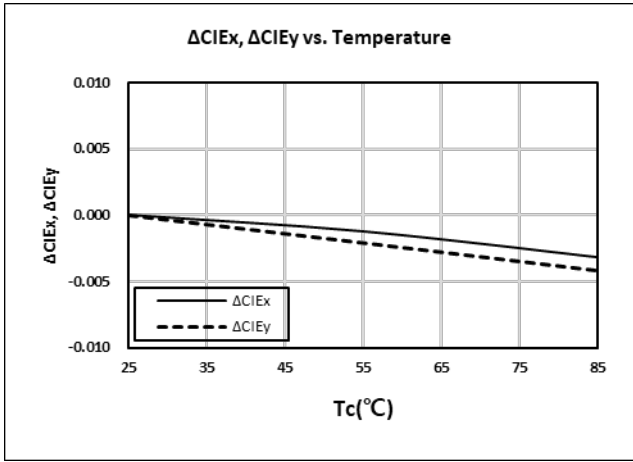
CCT : Full White



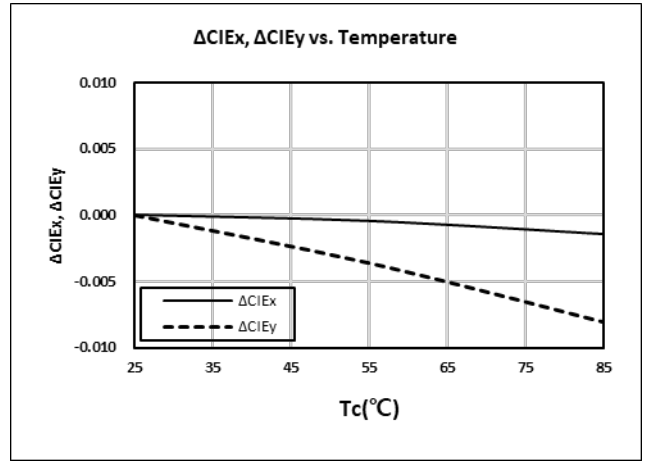
CCT : Mint White



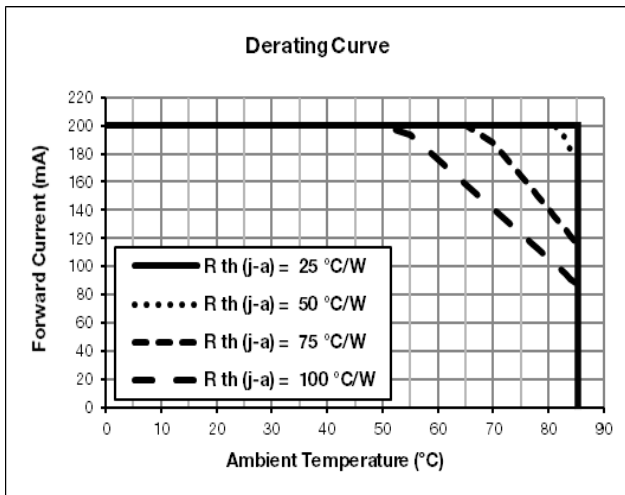
CCT : Full White



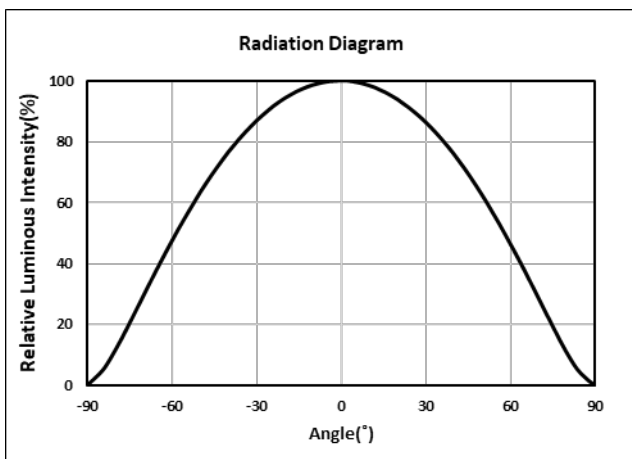
CCT : Mint White



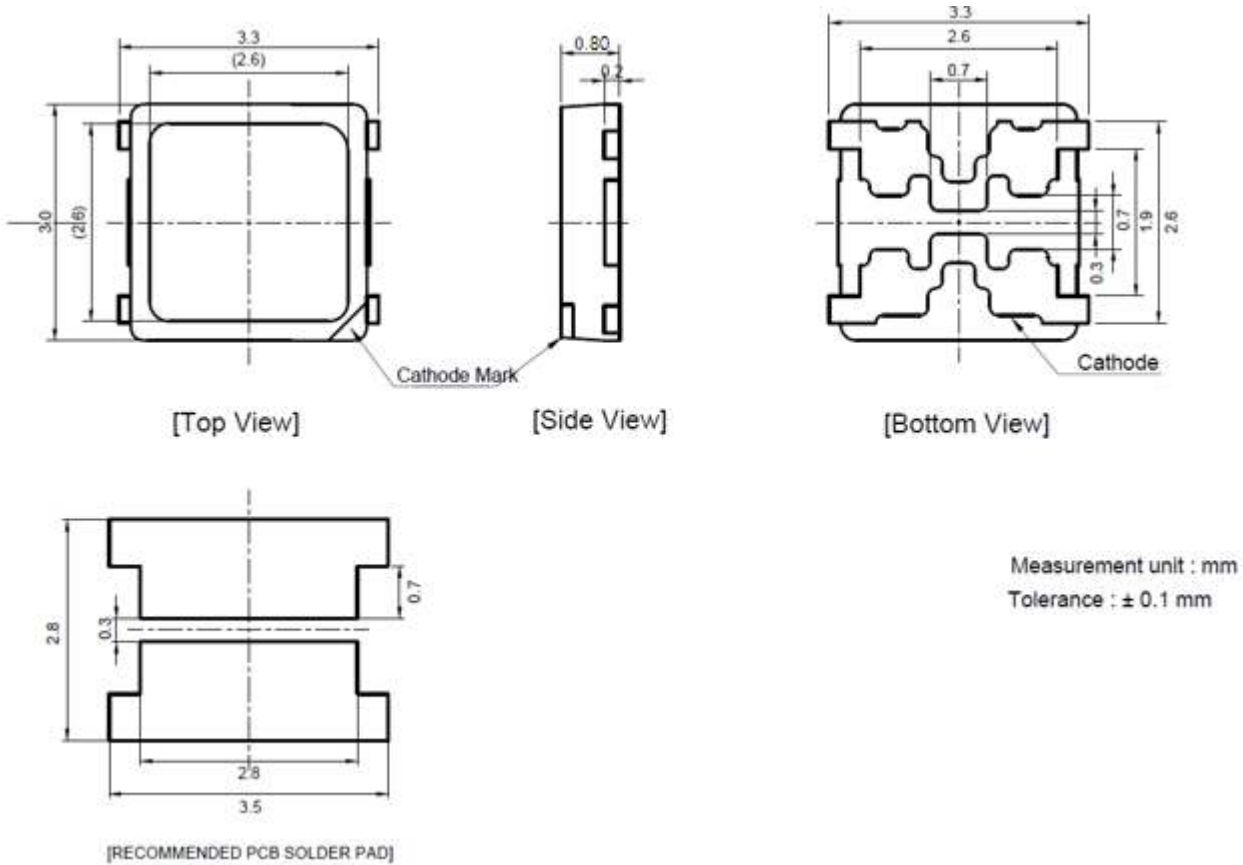
e) Derating Curve



f) Beam Angle Characteristics (T<sub>s</sub> = 25°C, I<sub>f</sub> = 65 mA)



#### 4. Outline Drawing & Dimension



#### Notes:

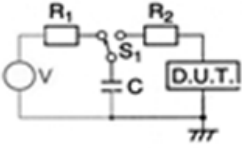
- 1) This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).
- 2)  $T_s$  point and measurement method:
  - ① Measure one point at the cathode pad, if necessary remove PSR of PCB to reach  $T_s$  point.
  - ② All pads must be soldered to the PCB to dissipate heat properly, 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. |
|-------------------------------------|--|-------------------|------------|
| High Temperature Life Test          | 85°C, DC 200 mA  | 1000 h            | 22         |
| High Temperature Humidity Life Test | 85°C, 85 % RH, DC 200 mA   | 1000 h            | 22         |
| Low Temperature Life Test           | -40°C, DC 200 mA   | 1000 h            | 22         |
| Thermal Cycle                       | -45°C / 15 min ↔ 125°C / 15 min<br>→ 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)                           |  <p> <math>R_1</math>: 10 M<math>\Omega</math><br/> <math>R_2</math>: 1.5 k<math>\Omega</math><br/> <math>C</math>: 100 pF<br/> <math>V</math>: <math>\pm 5</math> kV         </p> | 5 times           | 30         |

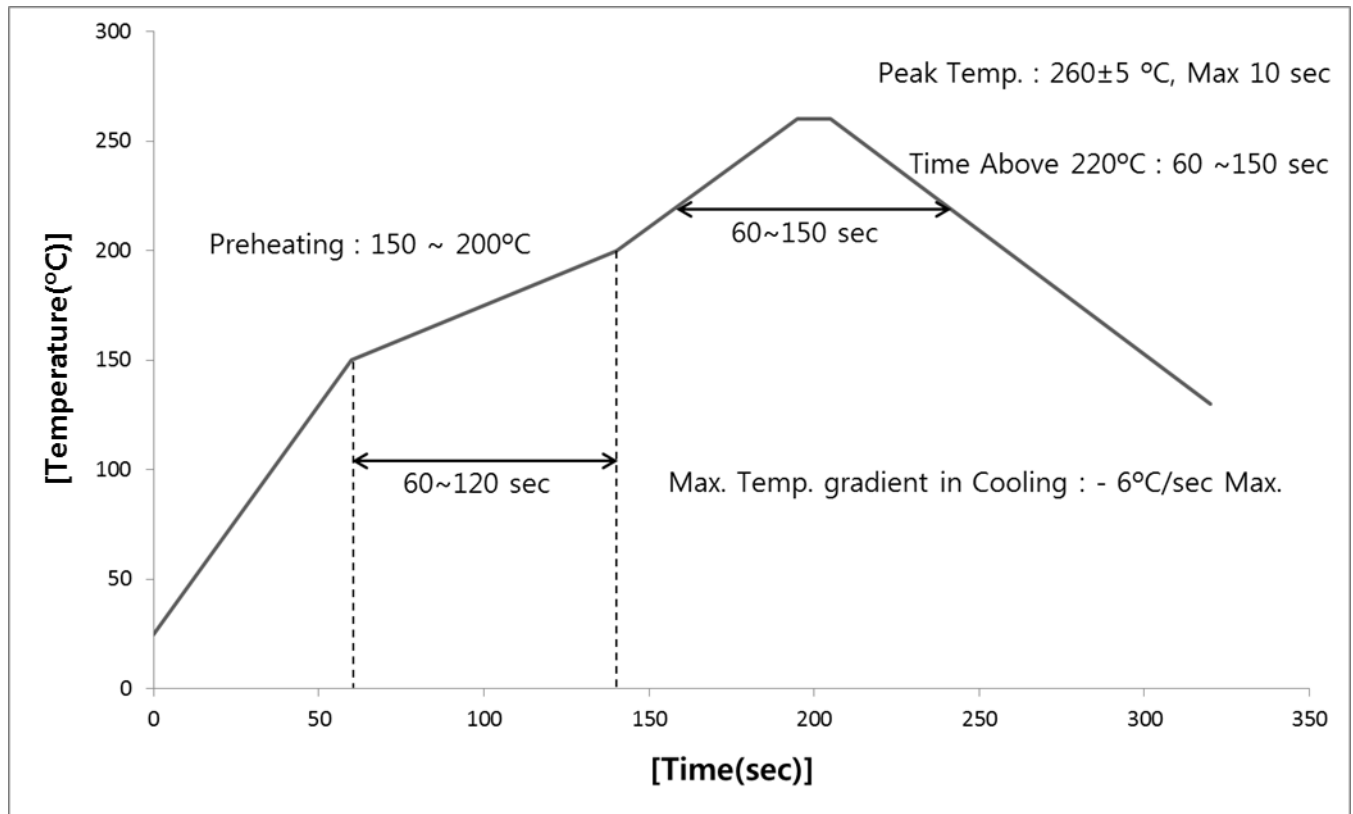
### b) Criteria for Judging the Damage

| Item            | Symbol            | Test Condition<br>( $T_s = 25^\circ\text{C}$ ) | Limit             |                   |
|-----------------|-------------------|--|-------------------|-------------------|
|                 |                   |  | Min               | Max               |
| Forward Voltage | $V_F$             | $I_F = 65$ mA                                  | Init. Value * 0.9 | Init. Value * 1.1 |
| PPF             | $\mu\text{mol/s}$ | $I_F = 65$ mA                                  | Init. Value * 0.7 | Init. Value * 1.1 |

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



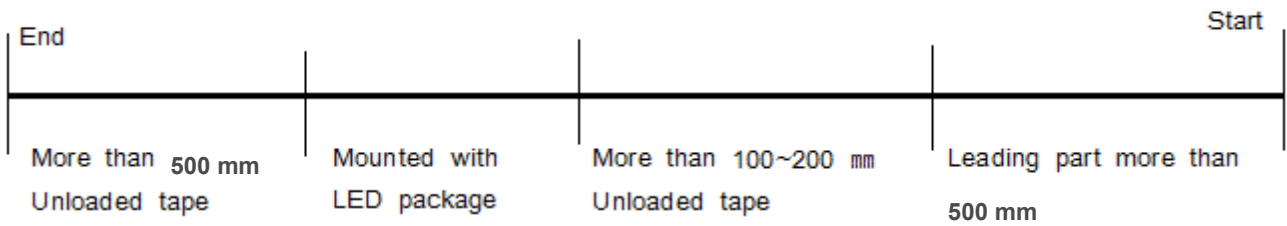
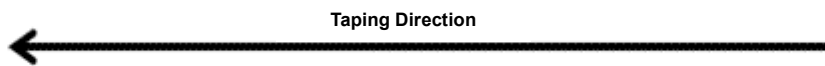
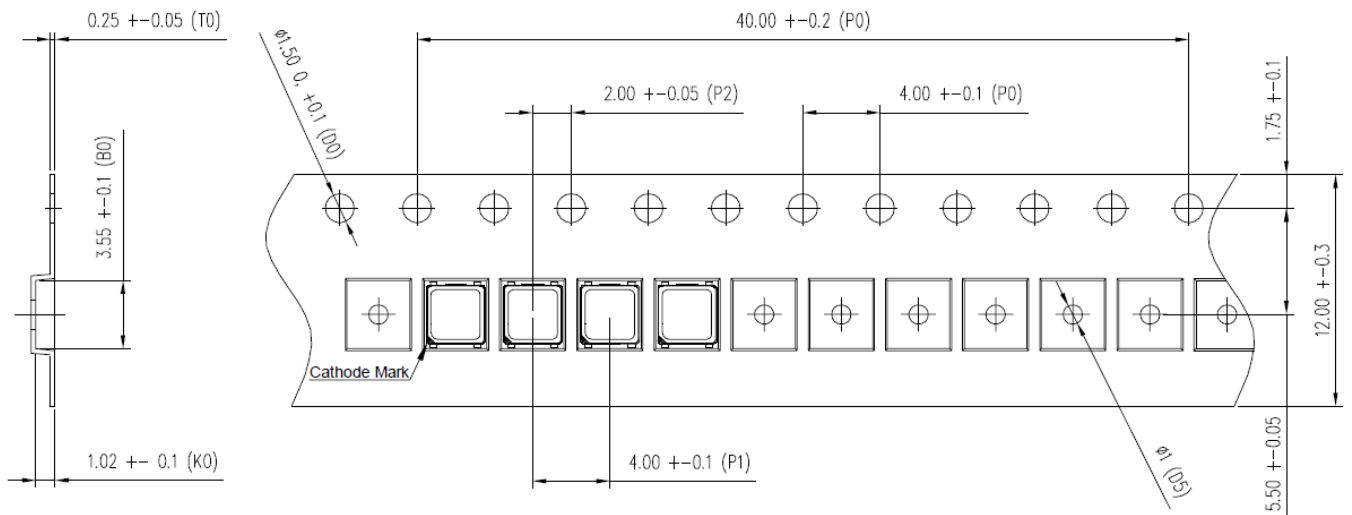
### b) Manual Soldering Conditions

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

7. Tape & Reel

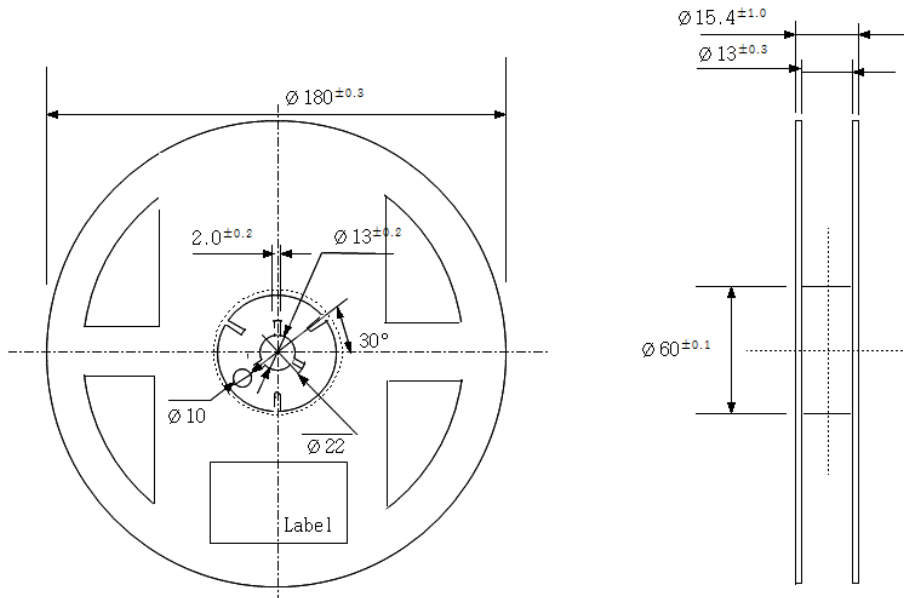
a) Taping Dimension

(unit: mm)



## b) Reel Dimension

(unit: mm)

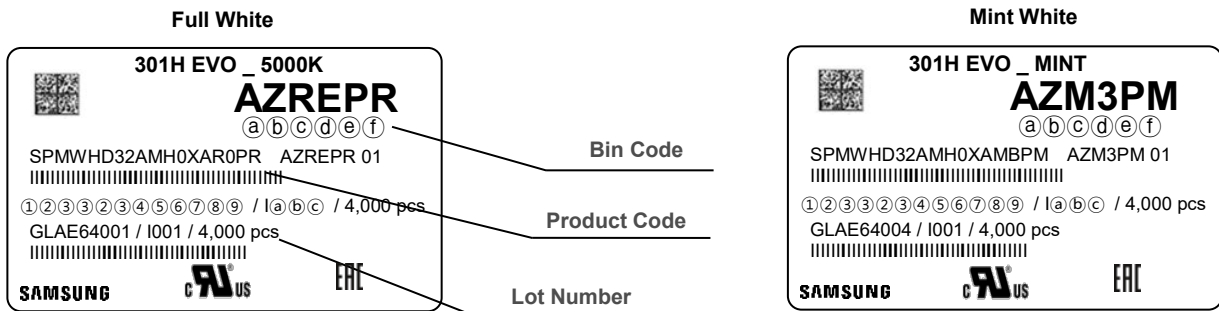
**Notes:**

- 1) Quantity: The quantity/reel is 4,000 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
- ⒸⒹ: Chromaticity bin
- ⒺⒻ: PPF BIN

### b) Lot Number

The lot number is composed of the following characters:



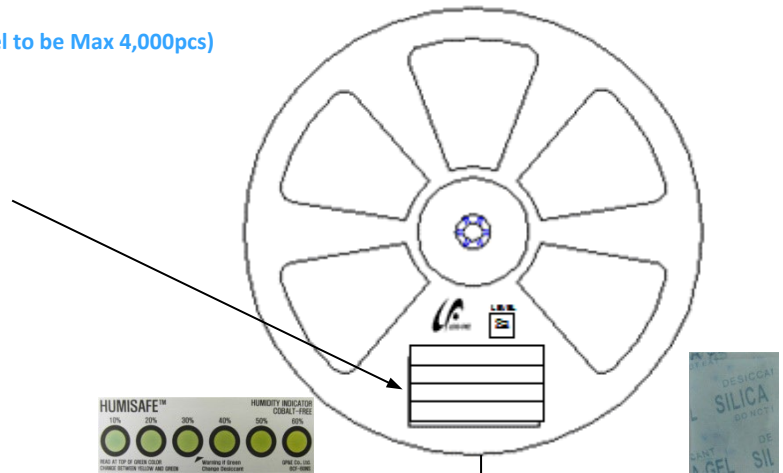
①②③③②③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / 4,000 pcs

- ①② : Production site (GL: Tianjin, China, G4: Guangzhou, China, EH : Hanoi, Vietnam )  
※ Sample product (SL: Kiheung, Korea)
- ③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ④ : Year (C : 2018, D : 2019, E : 2020 ...)
- ⑤ : Month (1~9, A, B, C)
- ⑥ : Day (1~9, A, B~V)
- ⑦⑧⑨ : Serial number (001 ~ 999)
- ⒶⒷⒸ : Reel number (001 ~ 999)

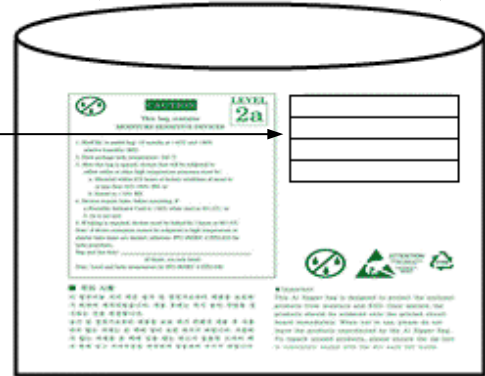
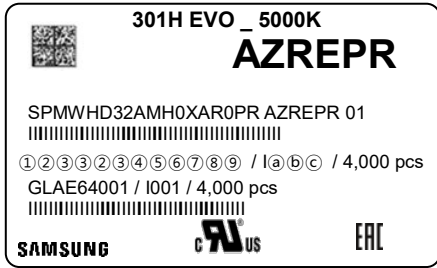
## 9. Packing Structure

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

#### Reel



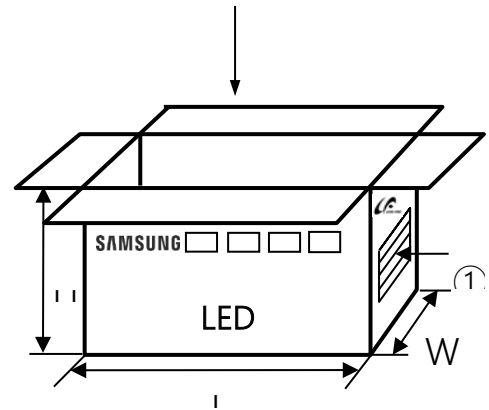
#### Aluminum Vinyl Packing Bag



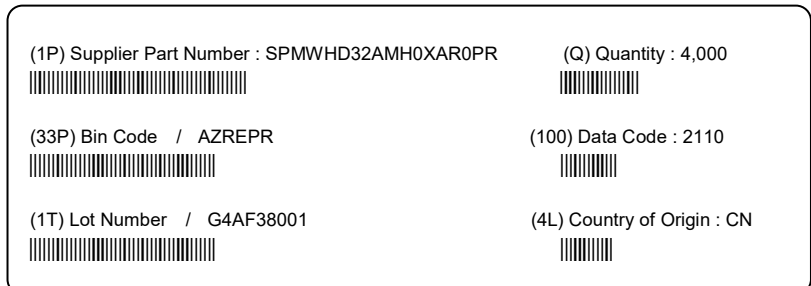
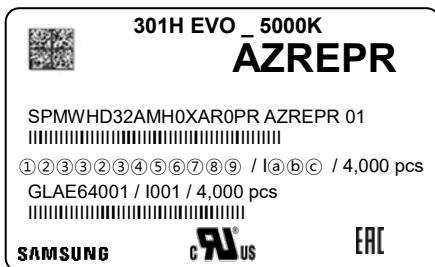
#### Outer Box

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



b) 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

301H EVO\_ 5000K



**AZREPR**

SPMWH32AMH0XAR0PR AZREPR 01  
 ①②③③②③④⑤⑥⑦⑧⑨ / I(a)(b)(c) / 4,000 pcs  
 GLAE64001 / I001 / 4,000 pcs

**SAMSUNG**

**US**

**ERC**






**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

(This image is for reference only. Silica gel and humidity indicator shapes may be different.)

DESICCANT  
**SILICA**  
DO NOT  
DE  
SIL

**HUMISAFE™**      **HUMIDITY INDICATOR COBALT-FREE**

10%  


20%  


30%  


40%  


50%  


60%  


READ AT TOP OF GREEN COLOR CHANGE BETWEEN YELLOW AND GREEN

Warning If Green Change Desiccant

GP&E Co., Ltd.  
6CF-60NS

## 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. Shelf life of sealed bags is 12 months at temperature 0~40 °C, 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 °C / 60 % RH\*<sup>Note 1</sup>, or
  - b. Mounted within 24 hours (1 day) at an assembly line with a condition of more than 30 °C / 70 % RH\*<sup>Note 2</sup>, 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°C        |
|                                 |                            | ∞                                 | ∞   | ∞   | 2   | 1   | 1   | 25°C        |
|                                 |                            | ∞                                 | ∞   | ∞   | 2   | 2   | 1   | 20°C        |

- 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 °C.
- 8) Devices must be baked for 10~24 hours at 60 ± 5 °C, 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.

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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).

“Samsung provides limited warranty for its LED products, the full text of which is available at <https://www.samsung.com/led/support/warranties>”

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