

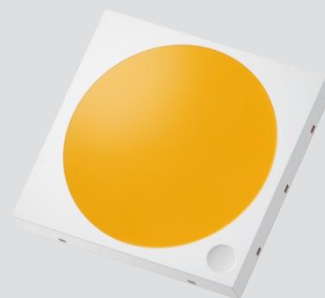


**THE DATASHEET OF  
SPHWH1L5N405XEV5A1**



## High Power LED Series

# LH508A



High efficacy and lumen makes the LH508A suitable use in a broad range of applications

### Features & Benefits

- Operates at a maximum current of up to 0.24A (XE rank) / 0.96A (GB rank)
- Uniform light distribution under any beam angle
- CIE Hot binning @ 85 °C



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## 1. Characteristics

### a) Absolute Maximum Rating

| Item                       | Symbol    | Rating     | Unit    | Condition                                         |
|----------------------------|-----------|------------|---------|---------------------------------------------------|
| Operating Temperature      | $T_{opr}$ | -40 ~ +85  | °C      |                                                   |
| Storage Temperature        | $T_{stg}$ | -40 ~ +85  | °C      | -                                                 |
| LED Junction Temperature   | $T_j$     | 125        | °C      | -                                                 |
| Forward Current            | $I_F$     | 240 (24V)  | mA      | XE Rank, 8 chips in series                        |
|                            |           | 960 (6V)   |         | GB Rank, 2 chips in series<br>4 chips in parallel |
| Peak Pulse Forward Current | $I_{FP}$  | 300 (24V)  | mA      | Duty cycle ≤ 1/10, pulse width<br>100µm           |
|                            |           | 1200 (6V)  |         |                                                   |
| Soldering Temperature      |           | 260<br><10 | °C<br>s | -                                                 |

### b) Electro-optical Characteristics( $T_j = 25\text{ °C}$ )

| Item                                        | Unit | Rank | Min. | Typ. | Max. |
|---------------------------------------------|------|------|------|------|------|
| Forward Voltage ( $V_f$ )                   | V    | XE   | 23.5 | 24.5 | 26.5 |
|                                             |      | GB   | 5.8  | 6.1  | 6.7  |
| Color Rendering Index ( $R_a$ )             | -    | 3    | 70   | -    | -    |
|                                             |      | 5    | 80   |      |      |
|                                             |      | 7    | 90   |      |      |
| Thermal Resistance (junction to chip point) | °C/W |      | -    | 1.9  | -    |
| Beam Angle                                  | °    |      | -    | 116  | -    |
| Nominal Power                               | W    |      |      | 3.9  |      |
| ESD (HBM)                                   | kV   |      |      | ±4   |      |

#### Notes:

- 1) Samsung maintains measurement tolerance of: luminous flux =  $\pm 7\%$ , forward voltage =  $\pm 0.1\text{ V}$
- 2) Characteristics @ 25 °C are for reference only

**c) Luminous Flux Characteristics (  $I_F = 160 \text{ mA}^{(3)}$  /  $640 \text{ mA}^{(3)}$  )**

| CRI (R <sub>s</sub> )<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux<br>Bin | Flux @ T <sub>J</sub> = 25 °C (lm) |      |      |
|-------------------------------|--------------------|--------------|-------------|------------------------------------|------|------|
|                               |                    |              |             | Min.                               | Typ. | Max. |
| 70                            | 3000K              | -            | -           | 521                                | 572  | -    |
|                               | 4000K              | -            | -           | 558                                | 610  | -    |
|                               | 5000K              | -            | -           | 558                                | 610  | -    |
|                               | 5700K              | -            | -           | 558                                | 610  | -    |
|                               | 6500K              | -            | -           | 558                                | 610  | -    |
| 80                            | 2700K              | -            | -           | 459                                | 504  | -    |
|                               | 3000K              | -            | -           | 473                                | 520  | -    |
|                               | 4000K              | -            | -           | 521                                | 550  | -    |
|                               | 5000K              | -            | -           | 521                                | 550  | -    |
|                               | 5700K              | -            | -           | 521                                | 550  | -    |
| 90                            | 6500K              | -            | -           | 521                                | 550  | -    |
|                               | 2700K              | -            | -           | 402                                | 429  | -    |
|                               | 3000K              | -            | -           | 416                                | 444  | -    |
|                               | 4000K              | -            | -           | 443                                | 473  | -    |

**Notes:**

- 1) The LED is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 25 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1
- 3) If=160mA is for XE rank, and If=640mA for GB rank.

## 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 | 1 | L | 5 | N | 4  | 0  | 3  | X  | E  | W  | 3  | A  | 1  |

| Digit | PKG Information            | Code       | Specification   |
|-------|----------------------------|------------|-----------------|
| 1 2 3 | Samsung Package High Power | <b>SPH</b> |                 |
| 4 5   | Color                      | <b>WH</b>  | White           |
| 6     | Product Version            | <b>1</b>   |                 |
| 7 8   | Form Factor                | <b>L5</b>  | 5050 size       |
| 9     | Lens Type                  | <b>N</b>   | No lens         |
| 10    | Wattage or Model           | <b>4</b>   | LH508A          |
| 11    | Internal Code              | <b>0</b>   |                 |
| 12    | CRI & Sorting Temperature  | <b>3</b>   | Min. 70 (25°C)  |
|       |                            | <b>5</b>   | Min. 80 (25°C)  |
|       |                            | <b>7</b>   | Min. 90 (25°C)  |
| 13 14 | Forward Voltage (V)        | <b>XE</b>  | 23.5~26.5V      |
|       |                            | <b>GB</b>  | 5.8~6.7         |
| 15    | CCT (K)                    | <b>W</b>   | 2700K           |
|       |                            | <b>V</b>   | 3000K           |
|       |                            | <b>U</b>   | 3500K           |
|       |                            | <b>T</b>   | 4000K           |
|       |                            | <b>R</b>   | 5000K           |
|       |                            | <b>Q</b>   | 5700K           |
|       |                            | <b>P</b>   | 6500K           |
| 16    | MacAdam Step               | <b>3</b>   | MacAdam 3-step  |
| 17 18 | Luminous Flux              | <b>A1</b>  | A1 Flux binning |

a) Binning Structure (I<sub>F</sub> = 160 mA)

| CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Product Code       | V <sub>F</sub><br>Rank<br>(T <sub>J</sub> =25°C) | Chrom.<br>Bin<br>(T <sub>J</sub> =85°C) | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm)<br>(T <sub>J</sub> =25°C) |      |
|-------------------------------|--------------------|--------------------|--------------------------------------------------|-----------------------------------------|--------------|---------------------------------------------------------------|------|
| 90                            | 2700               | SPHWH1L5N407XEW3A1 | XE                                               | W3                                      | A1           | 402~                                                          |      |
|                               |                    | SPHWH1L5N407XEW5A1 |                                                  | W5                                      |              |                                                               |      |
|                               | 3000               | SPHWH1L5N407XEV3A1 | XE                                               | V3                                      | A1           | 416~                                                          |      |
|                               |                    | SPHWH1L5N407XEV5A1 |                                                  | V5                                      |              |                                                               |      |
|                               | 4000               | SPHWH1L5N407XET3A1 | XE                                               | T3                                      | A1           | 443~                                                          |      |
|                               |                    | SPHWH1L5N407XET5A1 |                                                  | T5                                      |              |                                                               |      |
| 80                            | 2700               | SPHWH1L5N405XEW3A1 | XE                                               | W3                                      | A1           | 459~                                                          |      |
|                               |                    | SPHWH1L5N405XEW5A1 |                                                  | W5                                      |              |                                                               |      |
|                               | 3000               | SPHWH1L5N405XEV3A1 | XE                                               | V3                                      | A1           | 473~                                                          |      |
|                               |                    | SPHWH1L5N405XEV5A1 |                                                  | V5                                      |              |                                                               |      |
|                               | 4000               | SPHWH1L5N405XET3A1 | XE                                               | T3                                      | A1           | 521~                                                          |      |
|                               |                    | SPHWH1L5N405XET5A1 |                                                  | T5                                      |              |                                                               |      |
|                               | 5000               | SPHWH1L5N405XER3A1 | XE                                               | R3                                      | A1           | 521~                                                          |      |
|                               |                    | SPHWH1L5N405XER5A1 |                                                  | R5                                      |              |                                                               |      |
|                               | 5700               | SPHWH1L5N403XEQ3A1 | XE                                               | Q3                                      | A1           | 521~                                                          |      |
|                               |                    | SPHWH1L5N403XEQ5A1 |                                                  | Q5                                      |              |                                                               |      |
|                               | 6500               | SPHWH1L5N403XEP3A1 | XE                                               | P3                                      | A1           | 521~                                                          |      |
|                               |                    | SPHWH1L5N403XEP5A1 |                                                  | P5                                      |              |                                                               |      |
|                               | 70                 | 3000               | SPHWH1L5N403XEV3A1                               | XE                                      | V3           | A1                                                            | 521~ |
|                               |                    |                    | SPHWH1L5N403XEV5A1                               |                                         | V5           |                                                               |      |
|                               |                    | 4000               | SPHWH1L5N403XET3A1                               | XE                                      | T3           | A1                                                            | 558~ |
|                               |                    |                    | SPHWH1L5N403XET5A1                               |                                         | T5           |                                                               |      |
|                               |                    | 5000               | SPHWH1L5N403XER3A1                               | XE                                      | R3           | A1                                                            | 558~ |
|                               |                    |                    | SPHWH1L5N403XER5A1                               |                                         | R5           |                                                               |      |
| 5700                          |                    | SPHWH1L5N403XEQ3A1 | XE                                               | Q3                                      | A1           | 558~                                                          |      |
|                               |                    | SPHWH1L5N403XEQ5A1 |                                                  | Q5                                      |              |                                                               |      |
| 6500                          |                    | SPHWH1L5N403XEP3A1 | XE                                               | P3                                      | A1           | 558~                                                          |      |
|                               |                    | SPHWH1L5N403XEP5A1 |                                                  | P5                                      |              |                                                               |      |

b) Binning Structure (I<sub>F</sub> = 640 mA)

| CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Product Code       | V <sub>F</sub><br>Rank<br>(T <sub>J</sub> =25°C) | Chrom.<br>Bin<br>(T <sub>J</sub> =85°C) | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm)<br>(T <sub>J</sub> =25°C) |
|-------------------------------|--------------------|--------------------|--------------------------------------------------|-----------------------------------------|--------------|---------------------------------------------------------------|
| 90                            | 2700               | SPHWH1L5N407GBW3A1 | GB                                               | W3                                      | A1           | 402~                                                          |
|                               |                    | SPHWH1L5N407GBW5A1 |                                                  | W5                                      |              |                                                               |
|                               | 3000               | SPHWH1L5N407GBV3A1 | GB                                               | V3                                      | A1           | 416~                                                          |
|                               |                    | SPHWH1L5N407GBV5A1 |                                                  | V5                                      |              |                                                               |
|                               | 4000               | SPHWH1L5N407GBT3A1 | GB                                               | T3                                      | A1           | 443~                                                          |
|                               |                    | SPHWH1L5N407GBT5A1 |                                                  | T5                                      |              |                                                               |
| 80                            | 2700               | SPHWH1L5N405GBW3A1 | GB                                               | W3                                      | A1           | 459~                                                          |
|                               |                    | SPHWH1L5N405GBW5A1 |                                                  | W5                                      |              |                                                               |
|                               | 3000               | SPHWH1L5N405GBV3A1 | GB                                               | V3                                      | A1           | 473~                                                          |
|                               |                    | SPHWH1L5N405GBV5A1 |                                                  | V5                                      |              |                                                               |
|                               | 4000               | SPHWH1L5N405GBT3A1 | GB                                               | T3                                      | A1           | 521~                                                          |
|                               |                    | SPHWH1L5N405GBT5A1 |                                                  | T5                                      |              |                                                               |
|                               | 5000               | SPHWH1L5N405GBR3A1 | GB                                               | R3                                      | A1           | 521~                                                          |
|                               |                    | SPHWH1L5N405GBR5A1 |                                                  | R5                                      |              |                                                               |
|                               | 5700               | SPHWH1L5N403GBQ3A1 | GB                                               | Q3                                      | A1           | 521~                                                          |
|                               |                    | SPHWH1L5N403GBQ5A1 |                                                  | Q5                                      |              |                                                               |
|                               | 6500               | SPHWH1L5N403GBP3A1 | GB                                               | P3                                      | A1           | 521~                                                          |
|                               |                    | SPHWH1L5N403GBP5A1 |                                                  | P5                                      |              |                                                               |
| 70                            | 3000               | SPHWH1L5N403GBV3A1 | GB                                               | V3                                      | A1           | 521~                                                          |
|                               |                    | SPHWH1L5N403GBV5A1 |                                                  | V5                                      |              |                                                               |
|                               | 4000               | SPHWH1L5N403GBT3A1 | GB                                               | T3                                      | A1           | 558~                                                          |
|                               |                    | SPHWH1L5N403GBT5A1 |                                                  | T5                                      |              |                                                               |
|                               | 5000               | SPHWH1L5N403GBR3A1 | GB                                               | R3                                      | A1           | 558~                                                          |
|                               |                    | SPHWH1L5N403GBR5A1 |                                                  | R5                                      |              |                                                               |
|                               | 5700               | SPHWH1L5N403GBQ3A1 | GB                                               | Q3                                      | A1           | 558~                                                          |
|                               |                    | SPHWH1L5N403GBQ5A1 |                                                  | Q5                                      |              |                                                               |
|                               | 6500               | SPHWH1L5N403GBP3A1 | GB                                               | P3                                      | A1           | 558~                                                          |
|                               |                    | SPHWH1L5N403GBP5A1 |                                                  | P5                                      |              |                                                               |

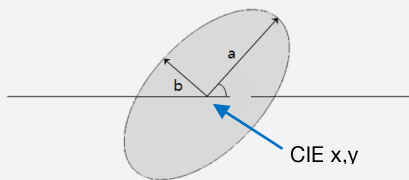
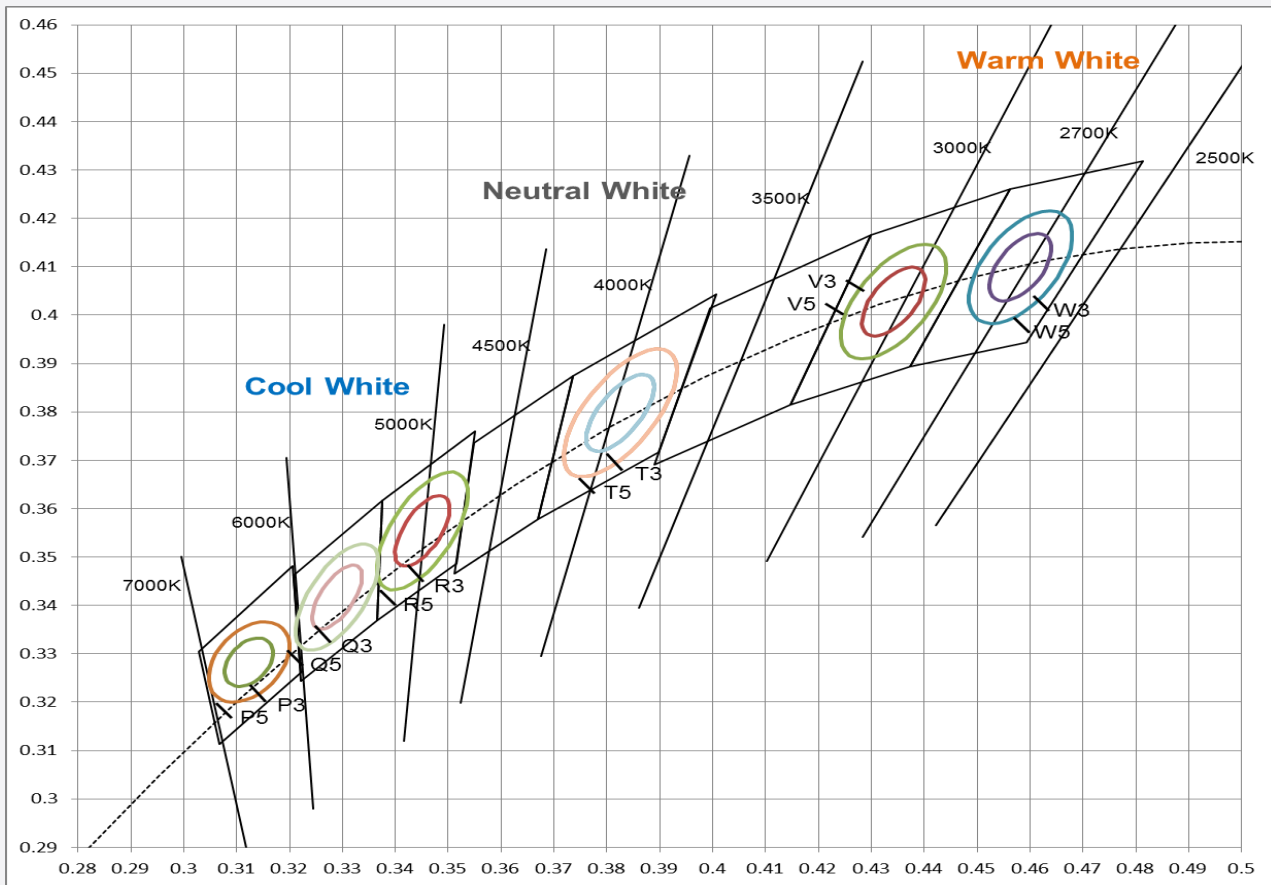
**c) Voltage Bins (  $I_F = 160 \text{ mA}^{(1)}$  /  $640 \text{ mA}^{(1)}$ ,  $T_j = 25 \text{ }^\circ\text{C}$  )**

| Nominal CCT (K) | CRI (R <sub>a</sub> ) Min. | Product Code | Voltage Rank | Voltage Bin | Voltage Range (V) |
|-----------------|----------------------------|--------------|--------------|-------------|-------------------|
| -               | -                          | -            | XE           | D1          | 23.5 ~ 24.5       |
|                 |                            |              |              | E1          | 24.5 ~ 25.5       |
|                 |                            |              |              | F1          | 25.5 ~ 26.5       |
| -               | -                          | -            | GB           | B1          | 5.8 ~ 6.1         |
|                 |                            |              |              | B2          | 6.1 ~ 6.4         |
|                 |                            |              |              | B3          | 6.4 ~ 6.7         |

**Notes:**

- 1)  $I_F=160\text{mA}$  is for XE rank, and  $I_F=640\text{mA}$  for GB rank.
- 2) ☆☆ stands for Vf rank, which can be GB or XE.
- 3) ○ stands for tolerance on chromaticity binning, which can be 3 or 5.

d) Chromaticity Region & Coordinates ( $I_f = 160 \text{ mA}$ ,  $T_J = 85^\circ\text{C}$ )

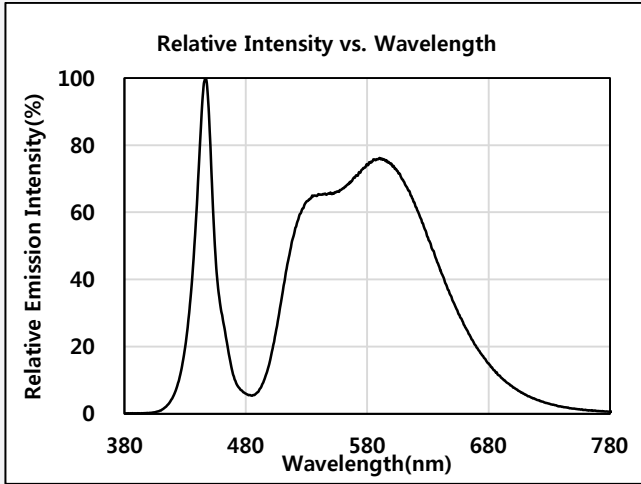


| CRI                        | CCT   | Rank | CIE y  | CIE x  | q    | a      | b      |
|----------------------------|-------|------|--------|--------|------|--------|--------|
| CRI70+<br>CRI80+<br>CRI90+ | 2700K | W3   | 0.4101 | 0.4578 | 53.7 | 0.0081 | 0.0042 |
|                            |       | W5   | 0.4101 | 0.4578 | 53.7 | 0.0135 | 0.0070 |
|                            | 3000K | V3   | 0.4030 | 0.4338 | 53.2 | 0.0083 | 0.0041 |
|                            |       | V5   | 0.4030 | 0.4338 | 53.2 | 0.0138 | 0.0068 |
|                            | 4000K | T3   | 0.3797 | 0.3818 | 53.7 | 0.0094 | 0.0040 |
|                            |       | T5   | 0.3797 | 0.3818 | 53.7 | 0.0157 | 0.0067 |
|                            | 5000K | R3   | 0.3553 | 0.3447 | 59.6 | 0.0082 | 0.0035 |
|                            |       | R5   | 0.3553 | 0.3447 | 59.6 | 0.0137 | 0.0058 |
|                            | 5700K | Q3   | 0.3417 | 0.3287 | 59.1 | 0.0075 | 0.0032 |
|                            |       | Q5   | 0.3417 | 0.3287 | 59.1 | 0.0125 | 0.0053 |
|                            | 6500K | P3   | 0.3282 | 0.3123 | 58.6 | 0.0067 | 0.0029 |
|                            |       | P5   | 0.3282 | 0.3123 | 58.6 | 0.0112 | 0.0048 |

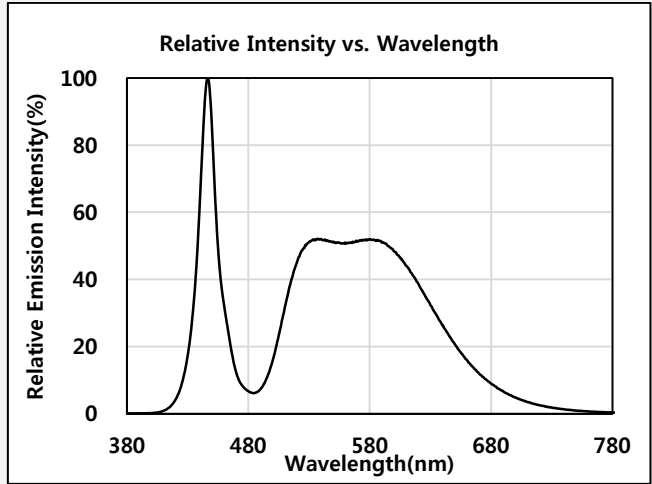
### 3. Typical Characteristic Graphs

#### a) Spectrum Distribution ( $I_f = 160 \text{ mA}$ , $T_j = 25 \text{ }^\circ\text{C}$ )

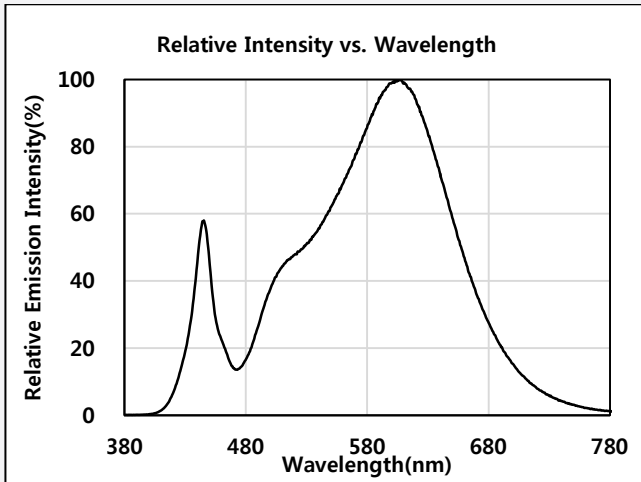
CCT : 4000K (70 CRI)



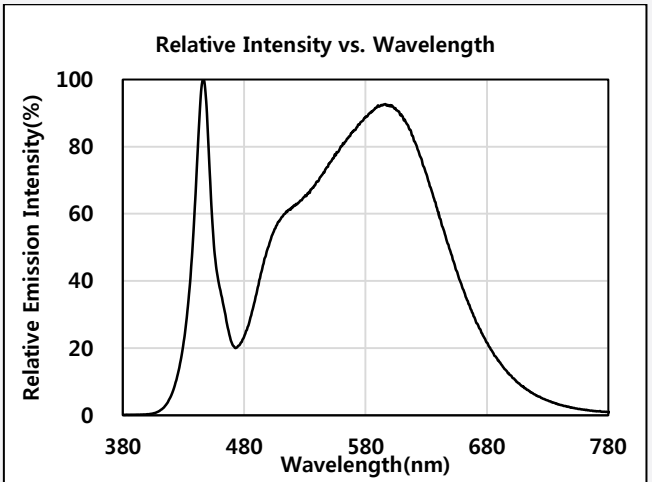
CCT : 5000K (70 CRI)



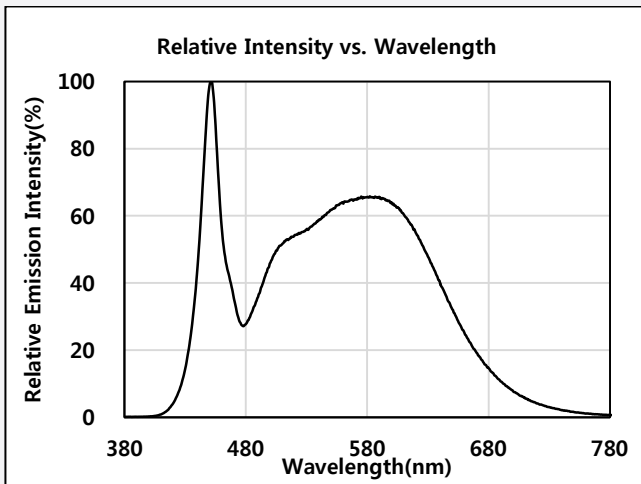
CCT : 3000K (80 CRI)



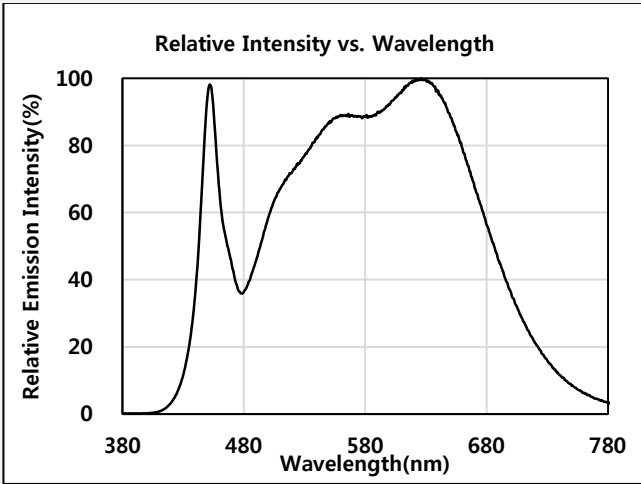
CCT : 4000K (80 CRI)



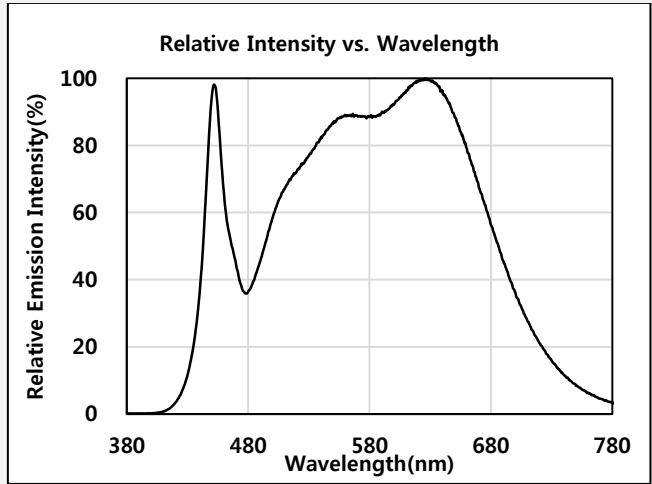
CCT : 5000K (80 CRI)



CCT : 3000K (90 CRI)

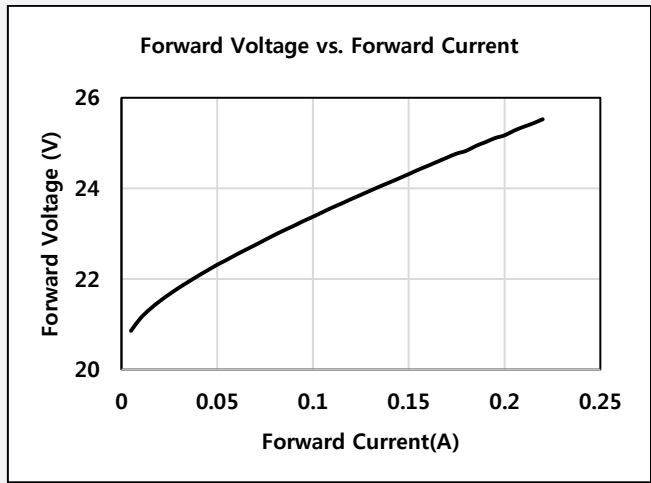
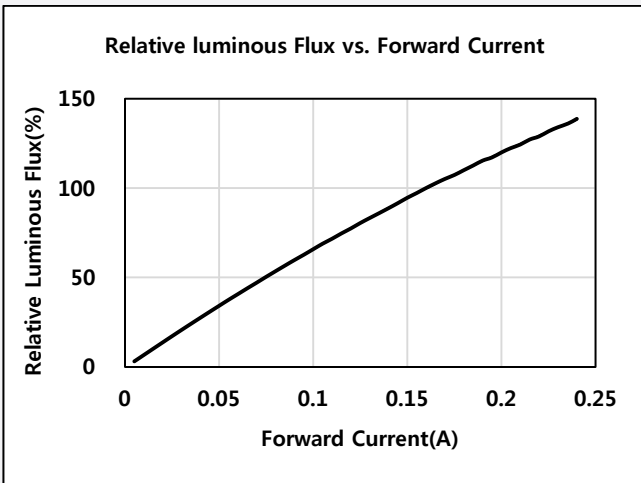


CCT : 4000K (90 CRI)

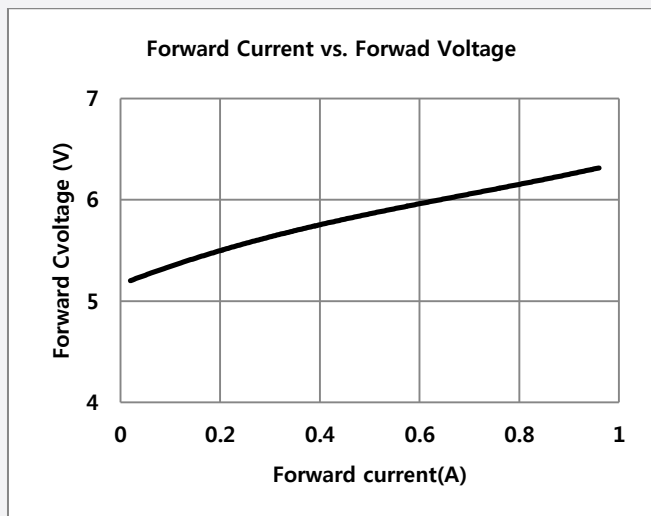
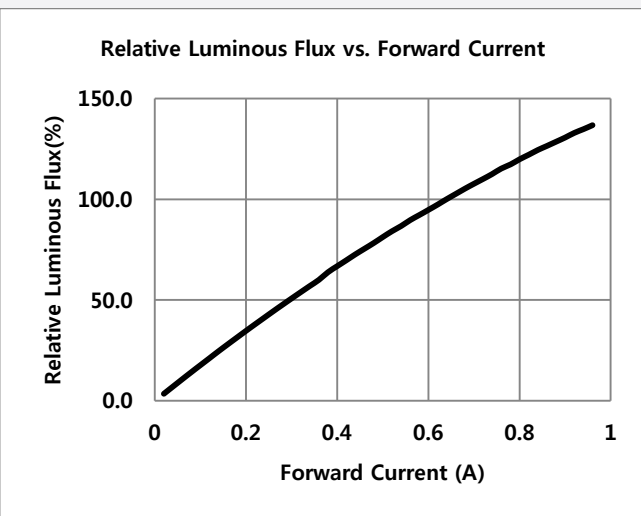


b) Forward Current Characteristics (T<sub>J</sub> = 25 °C)

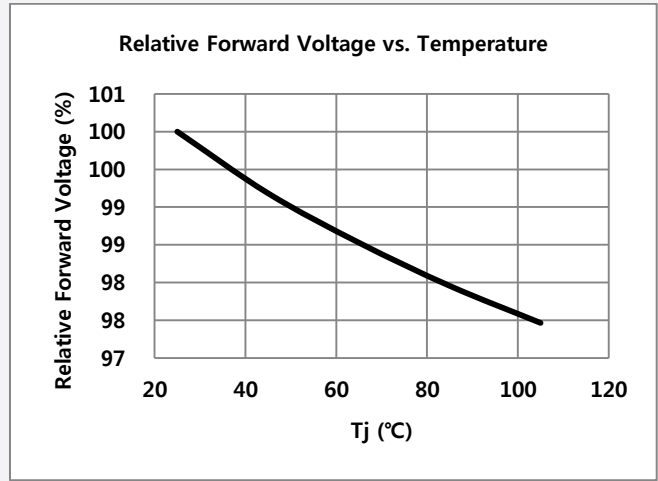
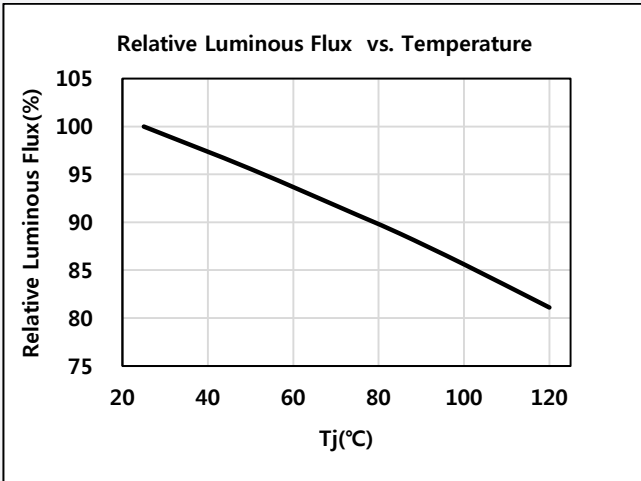
XE Rank : 24V



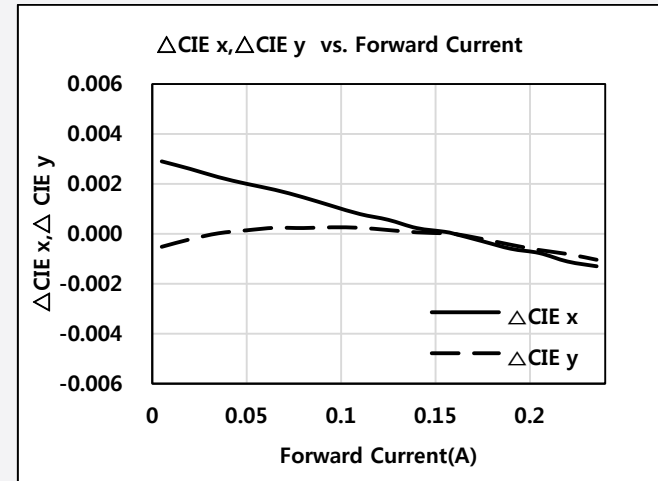
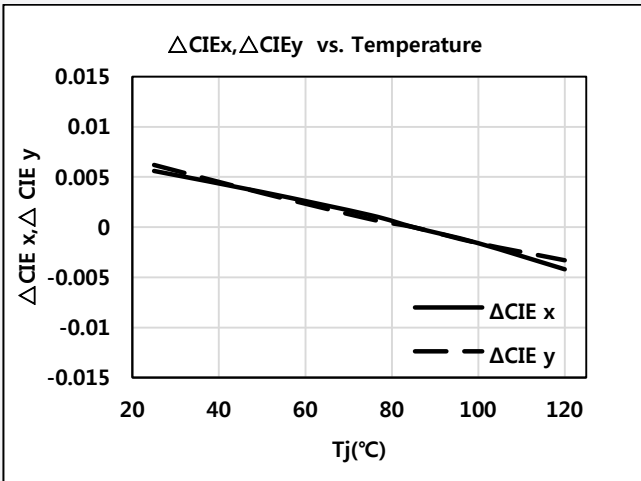
GB Rank : 6V



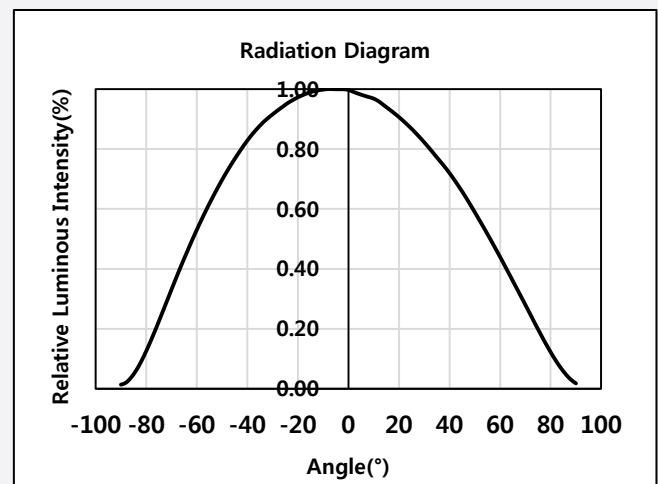
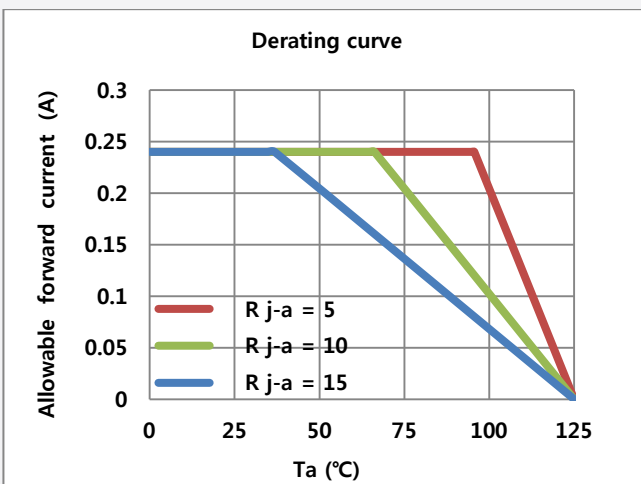
c) Temperature Characteristics ( $I_f = 160 \text{ mA}$ )



d) Color Shift Characteristics ( $I_f = 160 \text{ mA}$ ,  $T_j = 25 \text{ °C}$ )

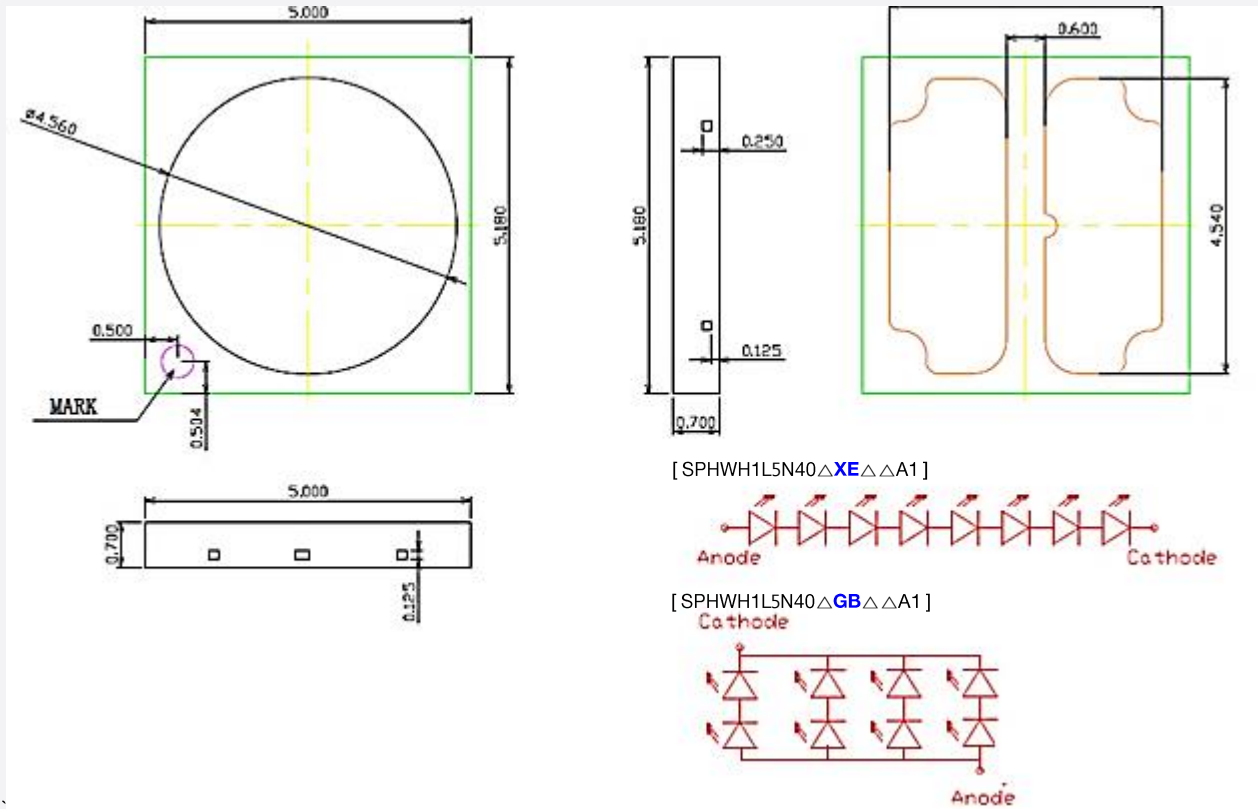


e) Derating Curve and Beam Angle Characteristics ( $I_f = 160 \text{ mA}$ ,  $T_j = 25 \text{ °C}$ )



## 4. Outline Drawing & Dimension

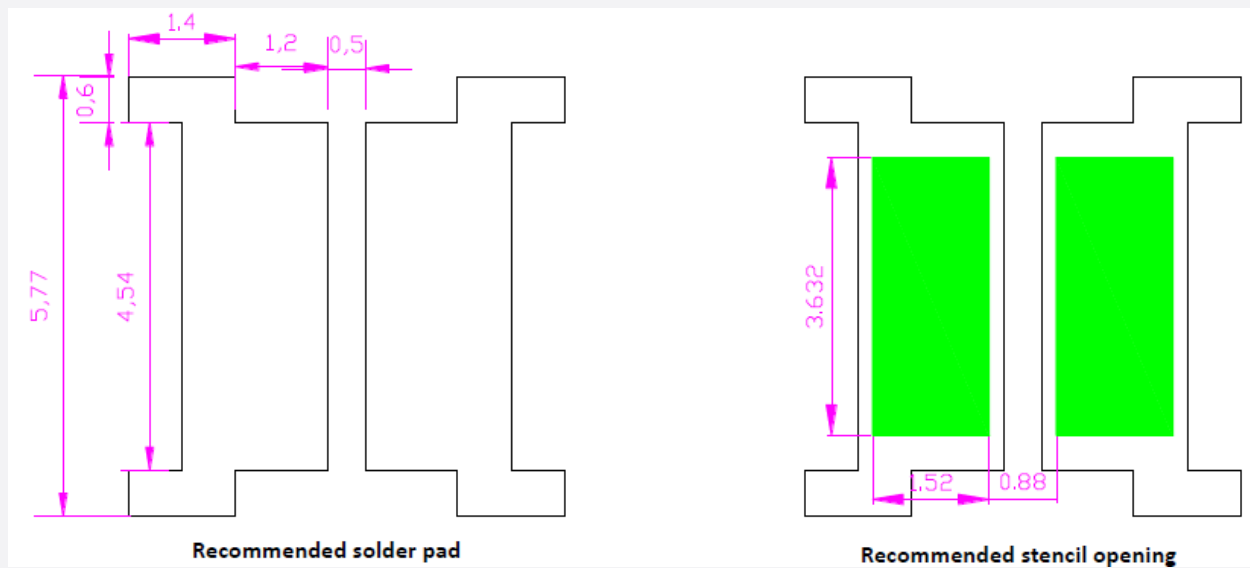
### a) Mechanical Dimensions



#### Notes:

- 1) Mark for the Anode

### b) Recommended Solder Pad



## 5. Reliability Test Items & Conditions

### a) Test Items

| Test Item                           | Test Condition                                                                         | Test Hour / Cycle | Sample Size |
|-------------------------------------|----------------------------------------------------------------------------------------|-------------------|-------------|
| Room Temperature Life Test          | 25 °C, DC 240 mA                                                                       | 1000 h            | 22          |
| High Temperature Life Test          | 85 °C, DC 240 mA                                                                       | 1000 h            | 22          |
| High Temperature Humidity Life Test | 85 °C, 85 % RH, DC 240 mA                                                              | 1000 h            | 22          |
| Low Temperature Life Test           | -40 °C, DC 240 mA                                                                      | 1000 h            | 22          |
| Powered Temperature Cycle Test      | -45 °C / 20 min ↔ 85 °C / 20 min, sweep<br>100 min cycle on/off: each 5 min, DC 240 mA | 100 cycles        | 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)                           |                                                                                        | 5 times           | 30          |
| ESD (MM)                            |                                                                                        |                   |             |
| Vibration Test                      | 20~2000~20 Hz, 200 m/s <sup>2</sup> , sweep 4 min<br>X, Y, Z 3 direction, each 1 cycle | 4 cycles          | 11          |
| Mechanical Shock Test               | 1500 g, 0.5 ms<br>3 shocks each X-Y-Z axis                                             | 5 cycles          | 11          |

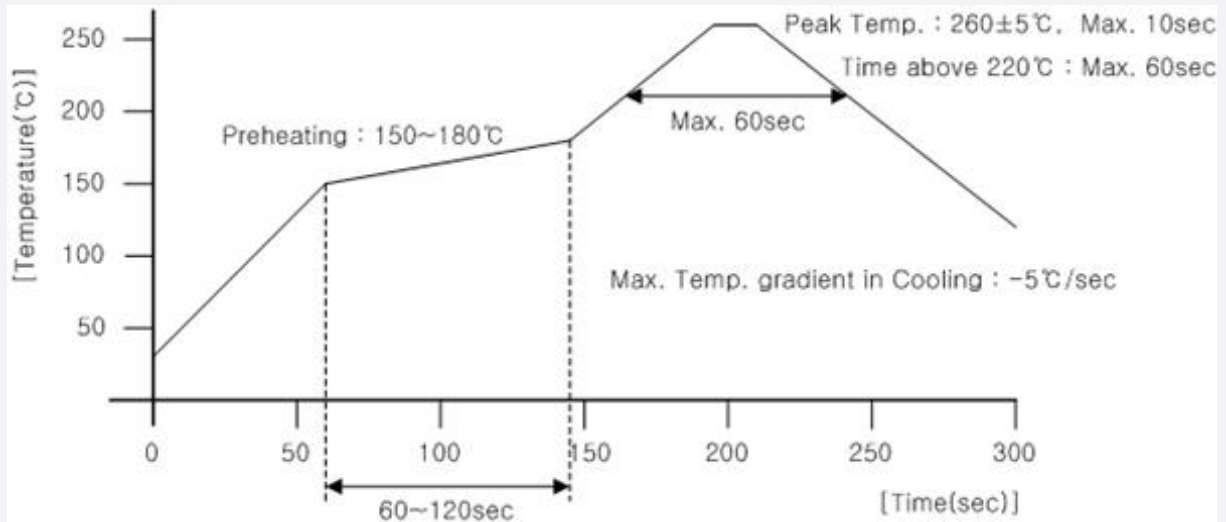
### b) Criteria for Judging the Damage

| Item            | Symbol         | Test Condition<br>(T <sub>s</sub> = 25 °C) | Limit             |                   |
|-----------------|----------------|--------------------------------------------|-------------------|-------------------|
|                 |                |                                            | Min               | Max               |
| Forward Voltage | V <sub>F</sub> | I <sub>F</sub> = 160 mA                    | Init. Value * 0.9 | Init. Value * 1.1 |
| Luminous Flux   | Φ <sub>v</sub> | I <sub>F</sub> = 160 mA                    | Init. Value * 0.7 | Init. Value * 1.1 |

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



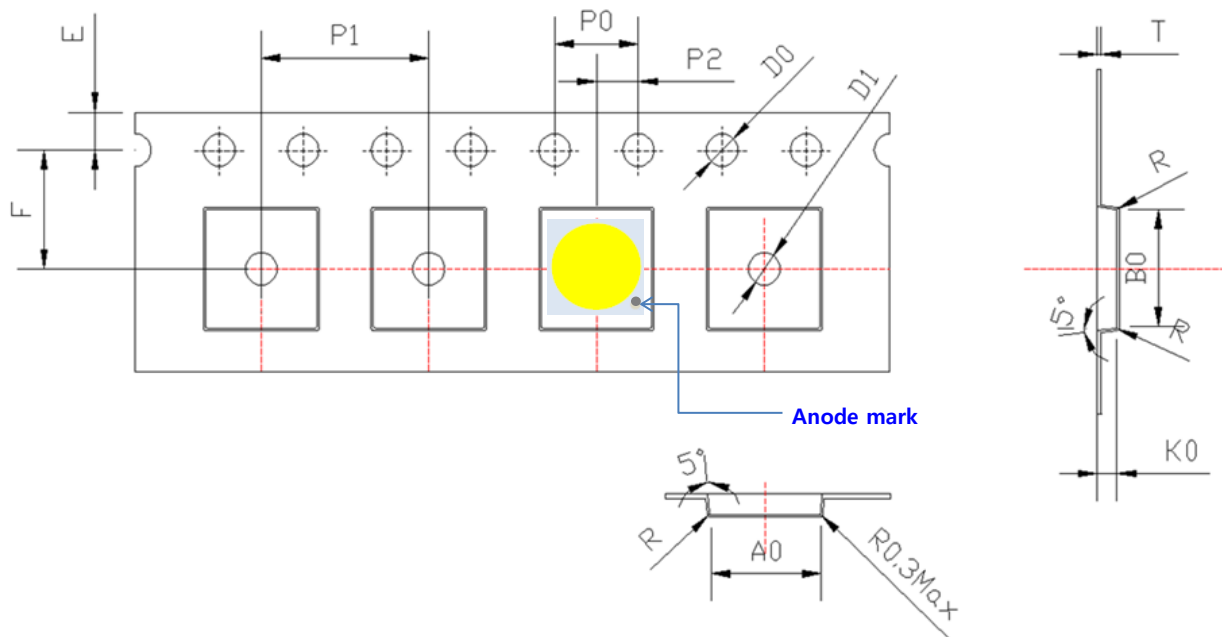
### b) Manual Soldering Conditions

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

## 7. Tape & Reel

### a) Taping Dimension

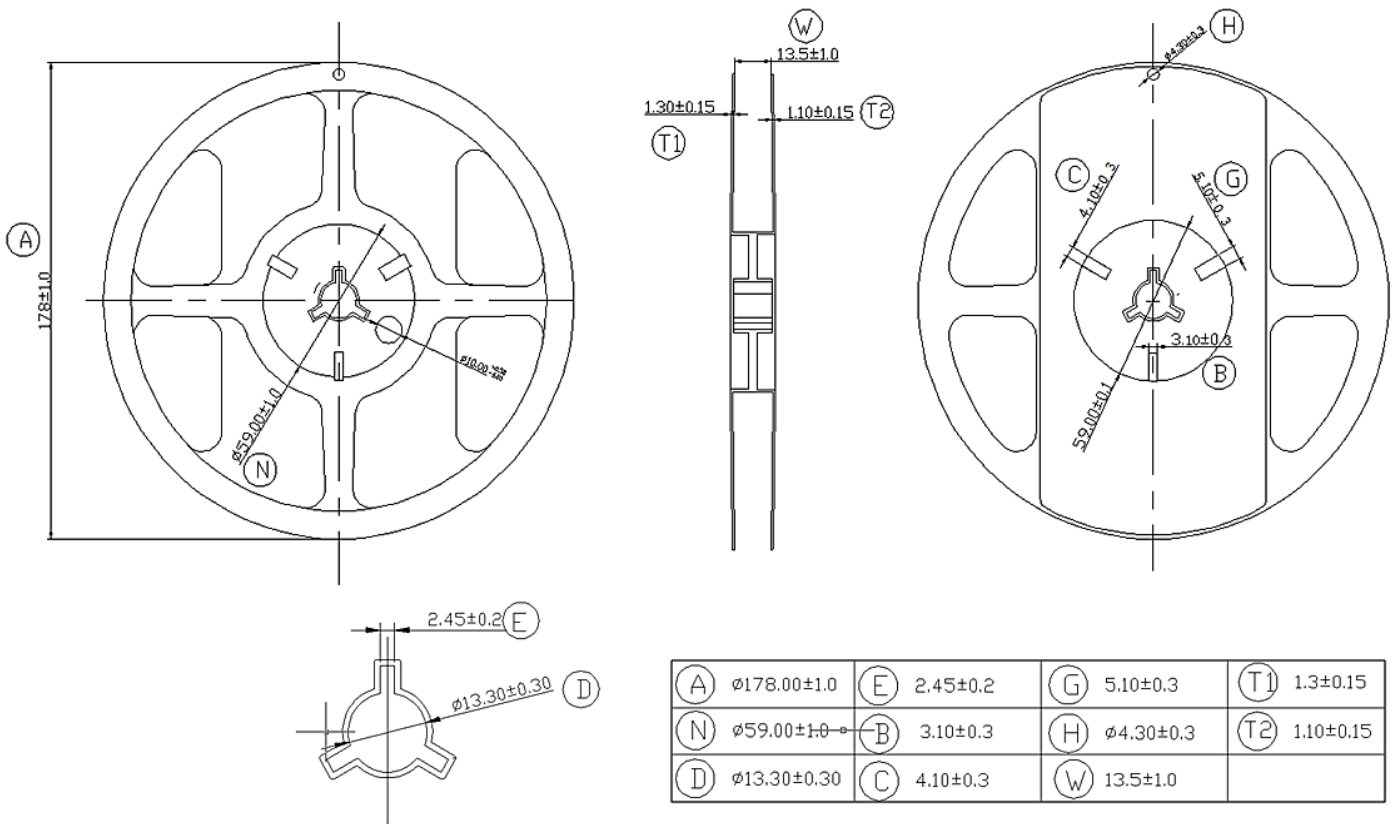
|        |           |           |           |           |             |           |         |
|--------|-----------|-----------|-----------|-----------|-------------|-----------|---------|
| symbol | AO        | BO        | KO        | PO        | P1          | P2        | Length  |
| Spec   | 5.20±0.10 | 5.40±0.10 | 0.95±0.10 | 4.00±0.10 | 8.0±0.10    | 2.0±0.10  | 1010M/R |
| symbol | W         | T         | E         | F         | DO          | D1        |         |
| Spec   | 12.0±0.2  | 0.20±0.05 | 1.75±0.10 | 5.50±0.05 | 1.50+0.1/-0 | 1.50±0.10 |         |



(unit: mm)

b) Reel Dimension (max 2,000 pcs)

(unit: mm)

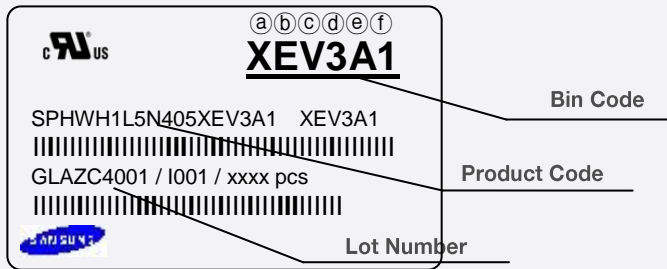


**Notes:**

- 1) Quantity: The quantity/reel is 2000 pcs
- 2) All dimensions are millimeters (tolerance :  $\pm 0.2\text{mm}$ )
- 3) Packaging: P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag.

## 8. Label Structure

### a) Label Structure



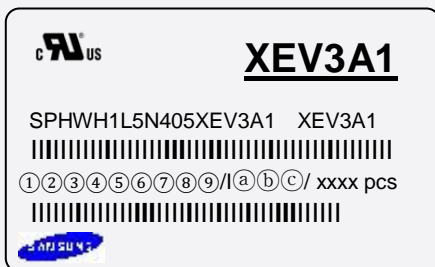
Note: Denoted bin code and product code above is only an example (see description on page 5)

Bin Code:

- ⒶⒷ: Forward Voltage bin (refer to page 7)
- ⒸⒹ: Chromaticity bin (refer to page 8)
- ⒺⒻ: Luminous Flux bin (refer to page 6)

### b) Lot Number

The lot number is composed of the following characters:



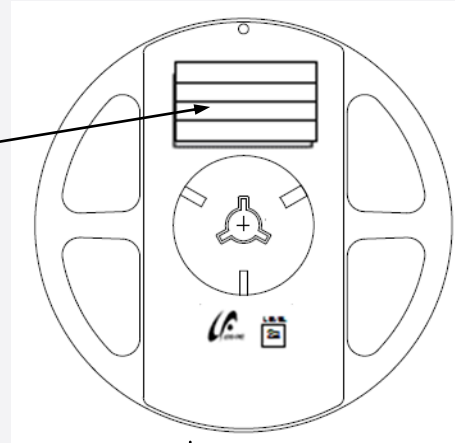
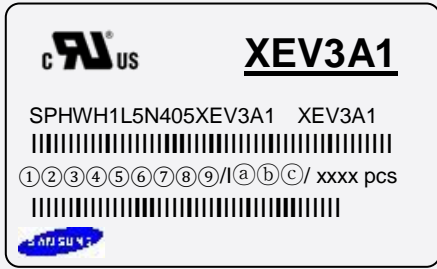
① ③④⑤⑥⑦⑧⑨ / IⒶⒷⒸ / xxxx pcs

- ①② : Production site : G8
- ③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ④ : Year (Z: 2015, A: 2016, B: 2017...)
- ⑤ : Month (1~9, A, B, C)
- ⑥ : Day (1~9, A, B~V)
- ⑦⑧⑨ : Samsung Electronics Product serial number (001 ~ 999)
- ⒶⒷⒸ : Reel number(001 ~ 999)

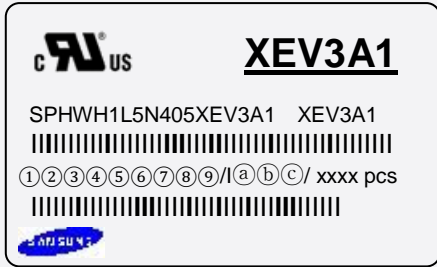
## 9. Packing Structure

a) Packing Process (The quantity of PKG on the Reel to be Max 2,000 pcs)

Reel



Aluminum Vinyl Packing Bag

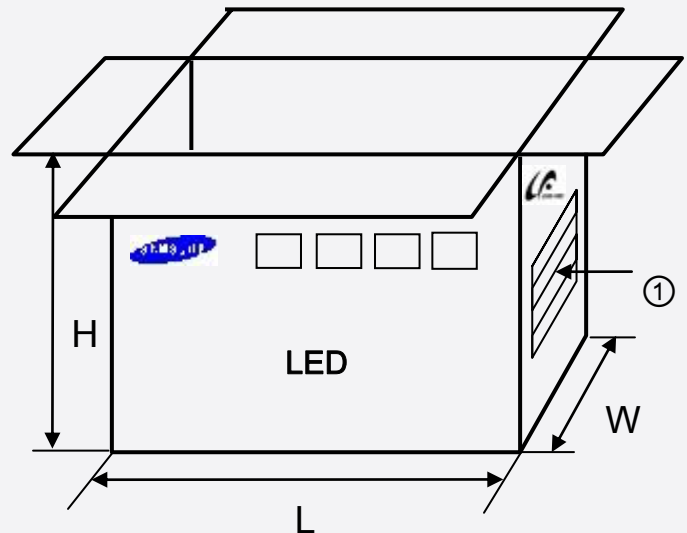
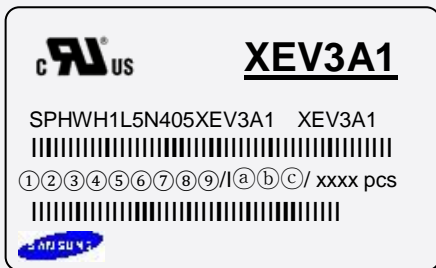


Inner Box

Material: Paper (SW3B(B))

| Type     | Size (mm) |        |         | Note          |
|----------|-----------|--------|---------|---------------|
|          | L         | W      | H       |               |
| 7 inch L | 225 ± 5   | 65 ± 5 | 240 ± 5 | Up to 2 reels |

① Side Label







## 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 °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, 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 °C.
- 8) Devices must be baked for 1 hour 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 Electronics Co., Ltd. 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 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](http://www.samsung.com) and our official blog at [global.samsungtomorrow.com](http://global.samsungtomorrow.com).

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