Middle Power LED Series
3030

# LM301D

## CRI 80

### Features & Benefits

- 0.3 W class middle power LED
- Mold resin for high reliability
- Standard form factor for design flexibility (3.0 × 3.0 mm)

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## Table of Contents



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# 1. Characteristics

## a) Absolute Maximum Rating

| Item | Symbol | Rating | Unit | Condition |
|---|---|---|---|---|
| Ambient / Operating Temperature | $T_a$ | -40 ~ +85 | ℃ | - |
| Storage Temperature | $T_{stg}$ | -40 ~ +100 | ℃ | - |
| LED Junction Temperature | $T_j$ | 125 | ℃ | - |
| Forward Current | $I_F$ | 400 | mA | - |
| Pulse Forward Current | $I_{FP}$ | 600 | mA | Duty 1/10, pulse width 10ms |
| Assembly Process Temperature | - | 260<br><10 | ℃<br>s | - |
| ESD (HBM) | - | 5 | kV | - |

## b) Electro-optical Characteristics ($I_F$ = 65 mA, Ts = 25℃)

| Item | Unit | Rank | Bin | Min. | Typ. | Max. |
|---|---|---|---|---|---|---|
| Forward Voltage (VF) | V | WA or KA | AY | 2.57 | - | 2.67 |
| | | | AZ | 2.67 | - | 2.77 |
| | | | A1 | 2.77 | - | 2.87 |
| | | WZ or KZ | AZ | 2.67 | - | 2.77 |
| Reverse Voltage (@ 5 mA) | V | | | 0.7 | - | 1.2 |
| Color Rendering Index ($R_a$) | - | 5 | | 80 | - | - |
| Thermal Resistance (junction to solder point) | ℃/W | | | - | 12 | - |
| Beam Angle | ○ | | | - | 120 | - |

**Note:**

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

## 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 | 3 | 3 | 2 | 6 | M | S | 5 | W | A | V | 0 | S | D |

| Digit | PKG Information | Code | Specification | | |
|---|---|---|---|---|---|
| 1 2 3 | Samsung Package Middle Power | SPM | Middle power | | |
| 4 5 | Color | WH | White | | |
| 6 | Product Version | 3 | Zener-in | | |
| 7 8 9 | Form Factor | 326 | 3.0 x 3.0 x 0.65 mm; 2 pads | | |
| 10 | Sorting Current | M | 65 mA | | |
| 11 | Chromaticity Coordinates | S | MacAdam | | |
| 12 | CRI | 5 | Min. 80 | | |
| 13 14 | Forward Voltage (V) | WA or KA | 2.57~2.87 | Bin Code | AY 2.57~2.67<br>AZ 2.67~2.77<br>A1 2.77~2.87 |
| | | WZ or KZ | 2.67~2.77 | Bin Code | AZ 2.67~2.77 |
| | | | "WA or WZ" (4,000ea per reel) , "KA or KZ" (16,000ea per reel) | | |
| 15 16 | CCT (K) | W☆ | 2700 | | WN, WP, WQ, WR, WS, WT, WU |
| | | V☆ | 3000 | | VN, VP, VQ, VR, VS, VT, VU |
| | | U☆ | 3500 | | UN, UP, UQ, UR, US, UT, UU |
| | | T☆ | 4000 | Bin Code | TN, TP, TQ, TR, TS, TT, TU |
| | | R☆ | 5000 | | RN, RP, RQ, RR, RS, RT, RU |
| | | Q☆ | 5700 | | QN, QP, QQ, QR, QS, QT, QU |
| | | P☆ | 6500 | | PN, PP, PQ, PR, PS, PT, PU |
| | | | ☆ : "0" (Whole Bin) or "Y"(Y Kitting) or "3"(MacAdam 3 step) | | |
| 17 18 | Luminous Flux (lm) | SD | | Bin Code | SD |

### a) Luminous Flux Bins($I_F$ = 65 mA, $T_s$= 25℃)

| Nominal CCT (K) | CRI Min. | Product Code | Flux Bin | Flux Range ($\Phi_v$, lm) |
|---|---|---|---|---|
| 2700 | 80 | SPMWH3326MS5◆★W☆SD | SD | 31.5 ~ 34.5 |
| 3000 | 80 | SPMWH3326MS5◆★V☆SD | SD | 32.5 ~ 35.5 |
| 3500 | 80 | SPMWH3326MS5◆★U☆SD | SD | 33.5 ~ 36.5 |
| 4000 | 80 | SPMWH3326MS5◆★T☆SD | SD | 34.5 ~ 37.5 |
| 5000 | 80 | SPMWH3326MS5◆★R☆SD | SD | 35.0 ~ 38.0 |
| 5700 | 80 | SPMWH3326MS5◆★Q☆SD | SD | 34.5 ~ 37.5 |
| 6500 | 80 | SPMWH3326MS5◆★P☆SD | SD | 34.5 ~ 37.5 |

**Note:**

“★” can be “A”(Whole bin), “Z”(AZ Single bin), “☆” can be “0” (Whole bin), “3” (MacAdam 3-step), "Y" (Kitting).

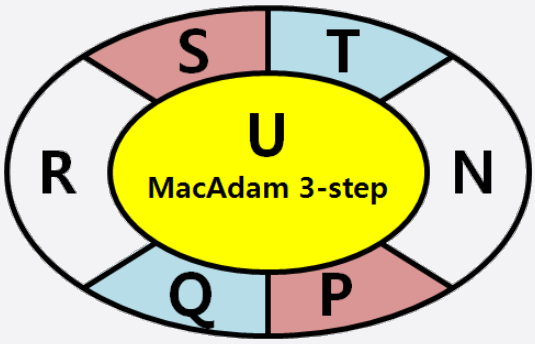
"◆" can be "W" (4,000pcs) or "K" (16,000pcs) of reel taping.

### b) Kitting Rule

#### 1) Y Kitting Bin Concept

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

[Kitting example]




[Binning Information]

| Item | Bin #1 | Bin #2 |
|---|---|---|
| VF | AY | AY |
| | AZ | AZ |
| | A1 | A1 |
| CIE | U | U |
| | N | R |
| | P | S |
| | Q | T |
| IV | SD | SD |

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### c) Color Bins ($I_F$ = 65 mA, Ts= 25℃)

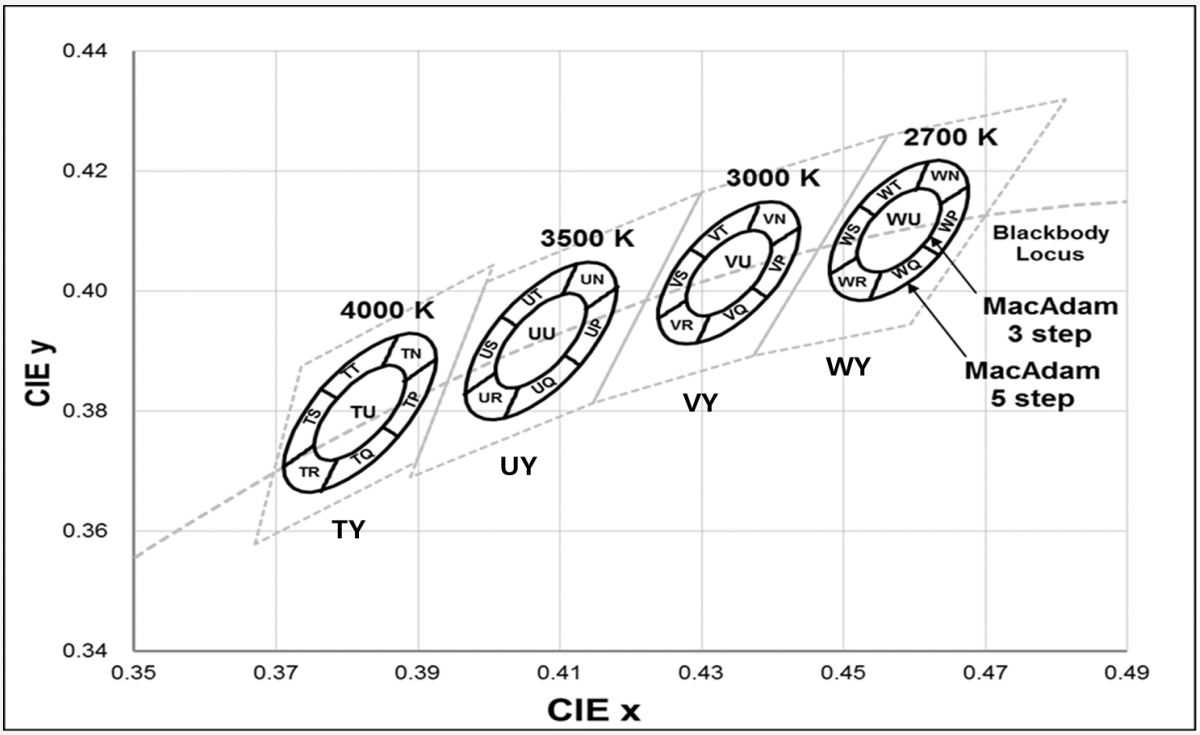
| min. CRI (Ra) | Nominal CCT (K) | Product Code | | Color Rank | Chromaticity Bins |
|---|---|---|---|---|---|
| 80 | 2700 | SPMWH3326MS5W★W0SD | W0 | Whole bin | WN, WP, WQ, WR, WS, WT, WU |
| | | SPMWH3326MS5W★W3SD | W3 | MacAdam 3-step ellipse bin | WU |
| | | SPMWH3326MS5W★WYSD | WY | Y Kitting | WN, WP, WQ, WR, WS, WT, WU |
| | 3000 | SPMWH3326MS5W★V0SD | V0 | Whole bin | VN, VP, VQ, VR, VS, VT, VU |
| | | SPMWH3326MS5W★V3SD | V3 | MacAdam 3-step ellipse bin | VU |
| | | SPMWH3326MS5W★VYSD | VY | Y Kitting | VN, VP, VQ, VR, VS, VT, VU |
| | 3500 | SPMWH3326MS5W★U0SD | U0 | Whole bin) | UN, UP, UQ, UR, US, UT, UU |
| | | SPMWH3326MS5W★U3SD | U3 | MacAdam 3-step ellipse bin | UU |
| | | SPMWH3326MS5W★UYSD | UY | Y Kitting | UN, UP, UQ, UR, US, UT, UU |
| | 4000 | SPMWH3326MS5W★T0SD | T0 | Whole bin | TN, TP, TQ, TR, TS, TT, TU |
| | | SPMWH3326MS5W★T3SD | T3 | MacAdam 3-step ellipse bin | TU |
| | | SPMWH3326MS5W★TYSD | TY | Y Kitting | TN, TP, TQ, TR, TS, TT, TU |
| | 5000 | SPMWH3326MS5W★R0SD | R0 | Whole bin | RN, RP, RQ, RR, RS, RT, RU |
| | | SPMWH3326MS5W★R3SD | R3 | MacAdam 3-step ellipse bin | RU |
| | | SPMWH3326MS5W★RYSD | RY | Y Kitting | RN, RP, RQ, RR, RS, RT, RU |
| | 5700 | SPMWH3326MS5W★Q0SD | Q0 | Whole bin | QN, QP, QQ, QR, QS, QT, QU |
| | | SPMWH3326MS5W★Q3SD | Q3 | MacAdam 3-step ellipse bin | QU |
| | | SPMWH3326MS5W★QYSD | QY | Y Kitting | QN, QP, QQ, QR, QS, QT, QU |
| | 6500 | SPMWH3326MS5W★P0SD | P0 | Whole bin | PN, PP, PQ, PR, PS, PT, PU |
| | | SPMWH3326MS5W★P3SD | P3 | MacAdam 3-step ellipse bin | PU |
| | | SPMWH3326MS5W★PYSD | PY | Y Kitting | PN, PP, PQ, PR, PS, PT, PU |

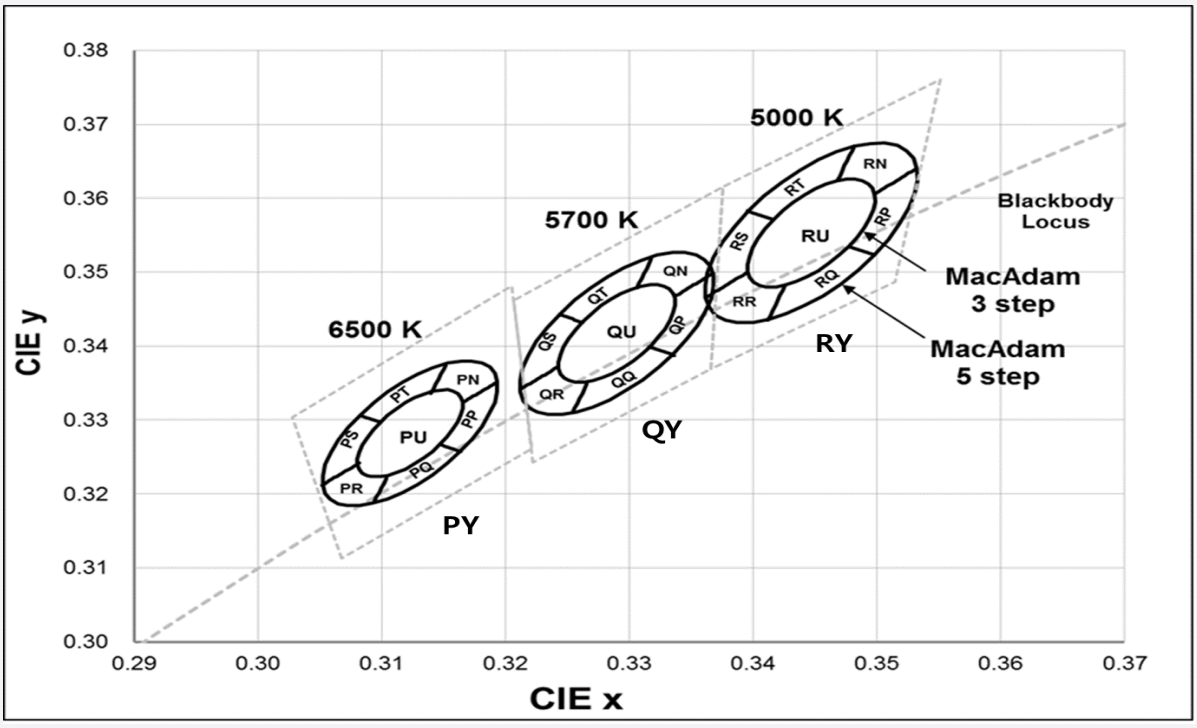
**Note:** "★" can be "A"(Whole bin), "Z"(AZ Single bin),

### d) Voltage Bins ($I_F$ = 65 mA, $T_s$ = 25℃)

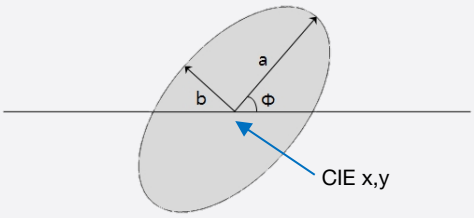
| CRI ($R_a$) Min. | Nominal CCT (K) | Product Code | Voltage Rank | Voltage Bin | Voltage Range (V) |
|---|---|---|---|---|---|
| - | - | - | WA or KA | AY | 2.57 ~ 2.67 |
| | | | | AZ | 2.67 ~ 2.77 |
| | | | | A1 | 2.77 ~ 2.87 |
| | | | WZ or KZ | AZ | 2.67 ~ 2.77 |

e) Chromaticity Region & Coordinates ($I_F$ = 65 mA, $T_s$ = 25℃)



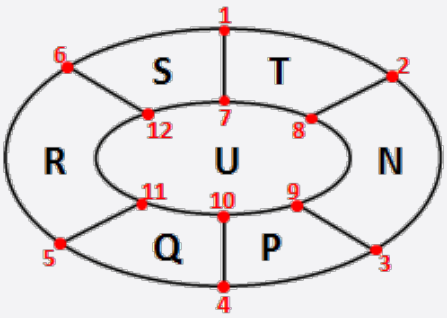
## f) Chromaticity Region & Coordinates ($I_F$ = 65 mA, $T_s$ = 25℃)




| MacAdam | 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

## g) Chromaticity Region & Coordinates



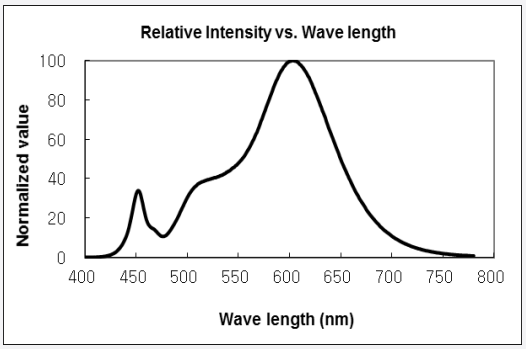

| Region | 2700K | | 3000K | | 3500K | | 4000K | |
|---|---|---|---|---|---|---|---|---|
| | CIE x | CIE y | CIE x | CIE y | CIE x | CIE y | CIE x | CIE y |
| 1 | 0.4521 | 0.4142 | 0.4283 | 0.4071 | 0.4018 | 0.3957 | 0.3764 | 0.3837 |
| 2 | 0.4619 | 0.4216 | 0.4382 | 0.4146 | 0.4125 | 0.4046 | 0.3871 | 0.3926 |
| 3 | 0.4675 | 0.4175 | 0.4437 | 0.4105 | 0.4180 | 0.4005 | 0.3925 | 0.3887 |
| 4 | 0.4634 | 0.4059 | 0.4393 | 0.3989 | 0.4128 | 0.3877 | 0.3872 | 0.3758 |
| 5 | 0.4537 | 0.3986 | 0.4293 | 0.3913 | 0.4022 | 0.3788 | 0.3765 | 0.3668 |
| 6 | 0.4481 | 0.4028 | 0.4239 | 0.3954 | 0.3966 | 0.3828 | 0.3711 | 0.3707 |
| 7 | 0.4544 | 0.4126 | 0.4305 | 0.4054 | 0.4040 | 0.3941 | 0.3786 | 0.3821 |
| 8 | 0.4603 | 0.4170 | 0.4364 | 0.4100 | 0.4104 | 0.3994 | 0.3850 | 0.3874 |
| 9 | 0.4636 | 0.4145 | 0.4397 | 0.4075 | 0.4137 | 0.3970 | 0.3882 | 0.3851 |
| 10 | 0.4612 | 0.4076 | 0.4371 | 0.4005 | 0.4106 | 0.3893 | 0.3850 | 0.3773 |
| 11 | 0.4553 | 0.4032 | 0.4311 | 0.3960 | 0.4042 | 0.3840 | 0.3786 | 0.3720 |
| 12 | 0.4520 | 0.4057 | 0.4279 | 0.3984 | 0.4009 | 0.3864 | 0.3754 | 0.3743 |

| Region | 5000K | | 5700K | | 6500K | |
|---|---|---|---|---|---|---|
| | CIE x | CIE y | CIE x | CIE y | CIE x | CIE y |
| 1 | 0.3397 | 0.3583 | 0.3242 | 0.3445 | 0.3082 | 0.3307 |
| 2 | 0.3482 | 0.3670 | 0.3320 | 0.3524 | 0.3153 | 0.3377 |
| 3 | 0.3532 | 0.3640 | 0.3365 | 0.3496 | 0.3194 | 0.3352 |
| 4 | 0.3497 | 0.3524 | 0.3333 | 0.3390 | 0.3164 | 0.3257 |
| 5 | 0.3412 | 0.3436 | 0.3254 | 0.3310 | 0.3093 | 0.3187 |
| 6 | 0.3362 | 0.3465 | 0.3209 | 0.3338 | 0.3052 | 0.3212 |
| 7 | 0.3417 | 0.3571 | 0.3260 | 0.3434 | 0.3098 | 0.3297 |
| 8 | 0.3468 | 0.3623 | 0.3307 | 0.3481 | 0.3141 | 0.3339 |
| 9 | 0.3498 | 0.3605 | 0.3334 | 0.3464 | 0.3166 | 0.3324 |
| 10 | 0.3477 | 0.3535 | 0.3314 | 0.3401 | 0.3148 | 0.3267 |
| 11 | 0.3426 | 0.3483 | 0.3267 | 0.3353 | 0.3105 | 0.3225 |
| 12 | 0.3396 | 0.3500 | 0.3240 | 0.3369 | 0.3080 | 0.3240 |

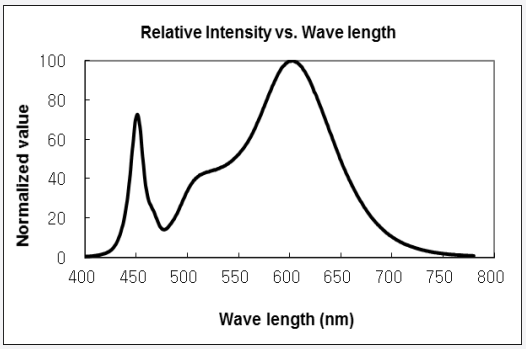
## 3. Typical Characteristics Graphs

### a) Spectrum Distribution ($I_F$ = 65 mA, $T_s$ = 25 °C)

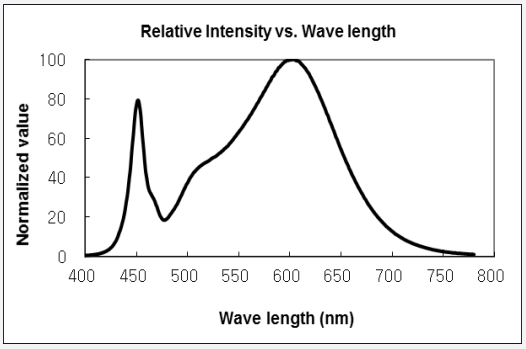
*CCT : 2700K (80 CRI)*



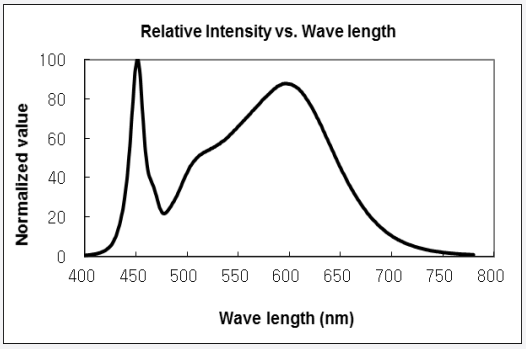

*CCT : 3000K (80 CRI)*



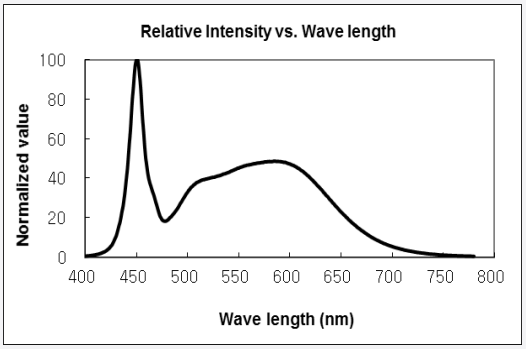

*CCT : 3500K (80 CRI)*



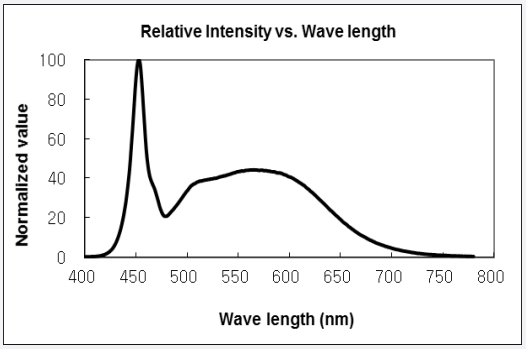

*CCT : 4000K (80 CRI)*



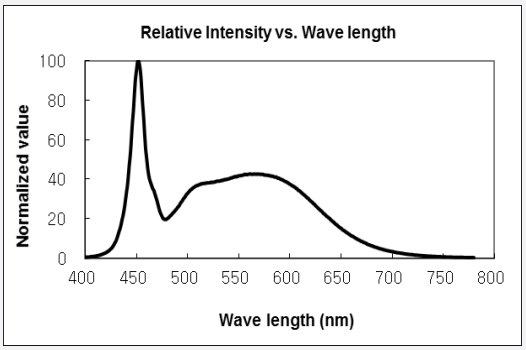

*CCT : 5000K (80 CRI)*



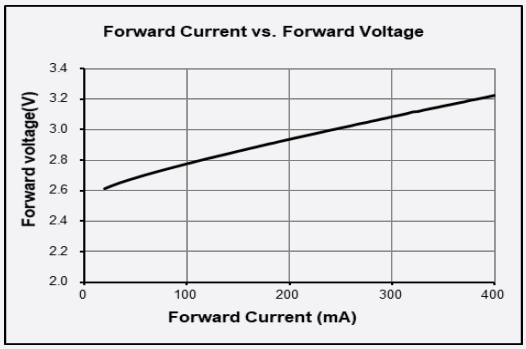

*CCT : 5700K (80 CRI)*

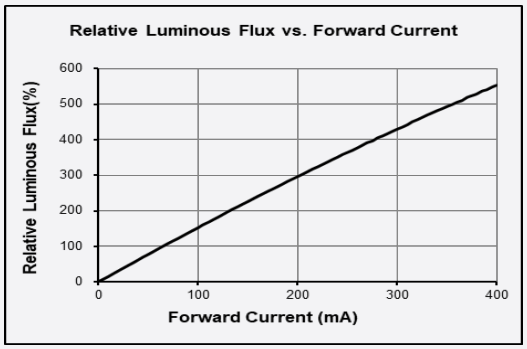



*CCT : 6500K (80 CRI)*

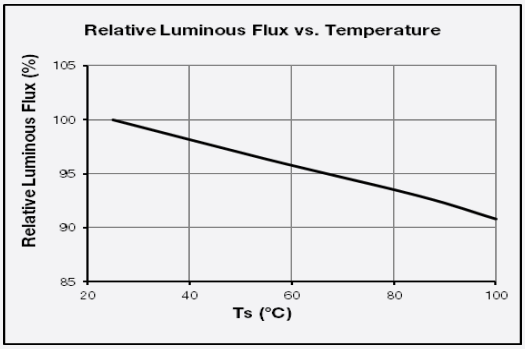


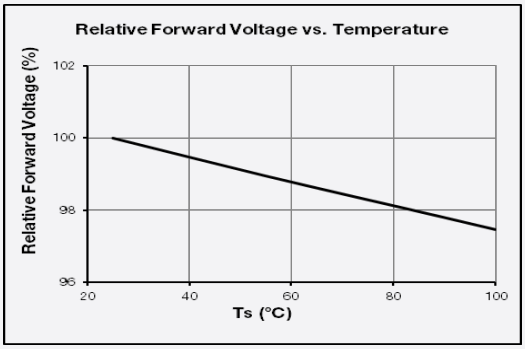
## b) Forward Current Characteristics ($I_F$ = 65 mA, $T_s$ = 25 ºC)



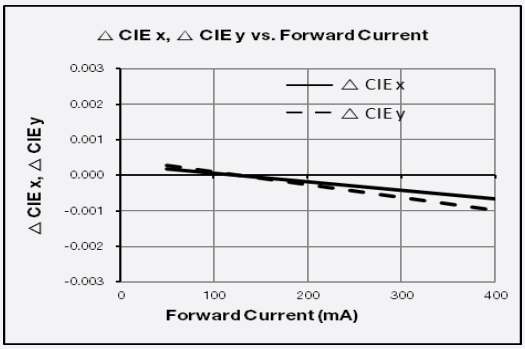



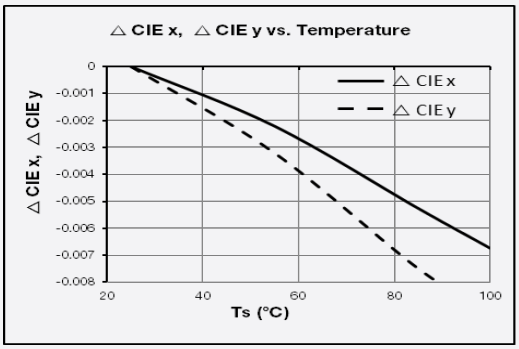

## c) Temperature Characteristics ($I_F$ = 65 mA)



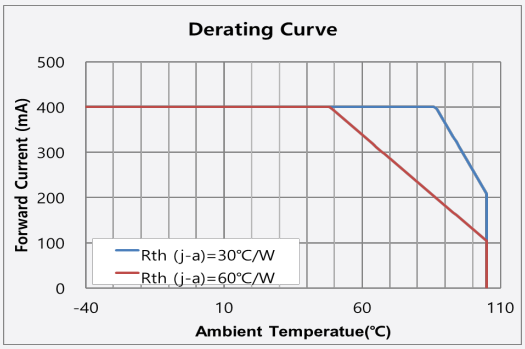




## d) Color Shift Characteristics (Ts = 25 ºC, IF = 65mA)

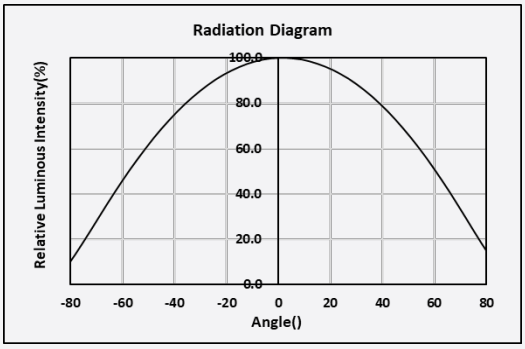


### e) Derating Curve



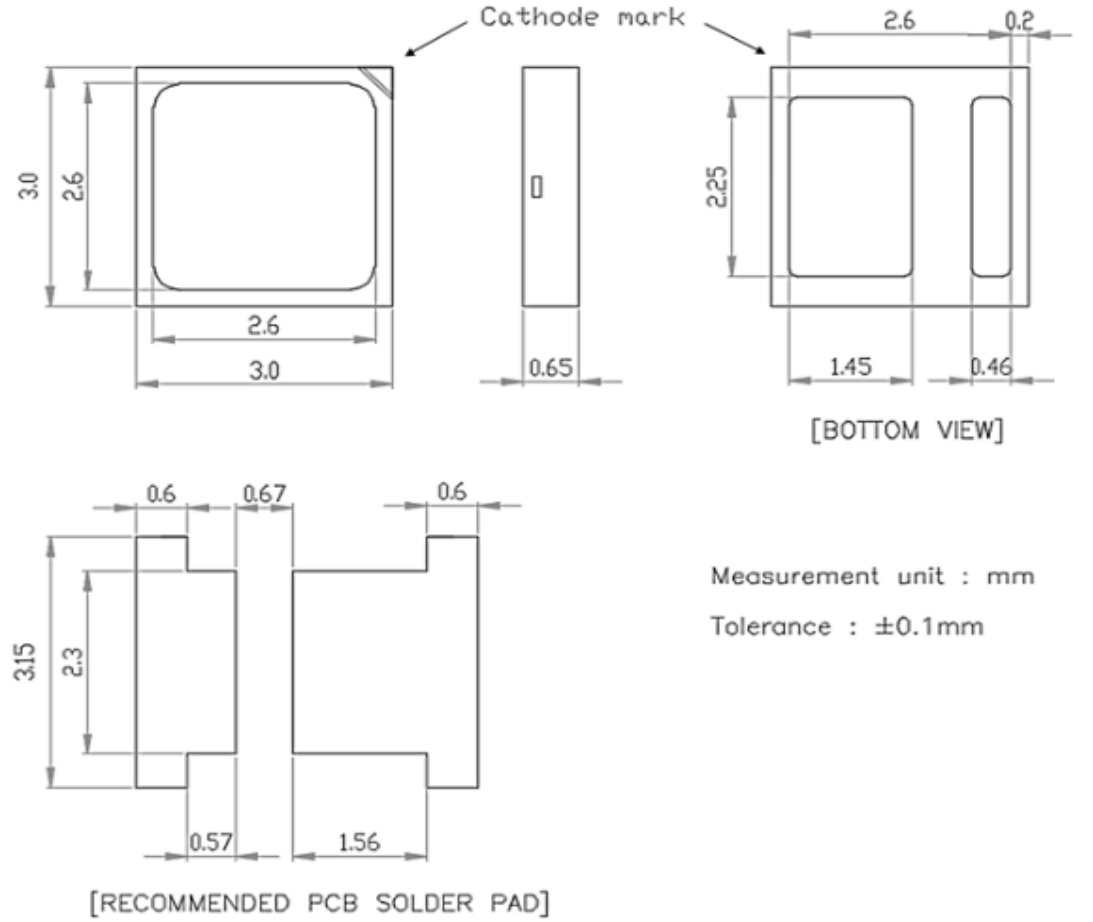

### f) Beam Angle Characteristics (IF=65mA, Ts=25 °C)




**Note:** All characteristics shown are for reference only.

Derating characteristics will meet the criteria as detailed in the Reliability section within this specification.

## 4. Outline Drawing & Dimension




**Notes:**

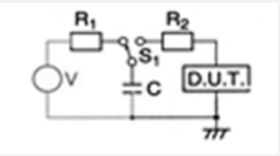
1) This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).
2) $T_s$ point and measurement method:
   ① Measure one point at the cathode pad, if necessary remove PSR of PCB to reach $T_s$ point.
   ② All pads must be soldered to the PCB to dissipate heat properly, otherwise 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 Max current | 1000 h | 22 |
| High Temperature Humidity Life Test | 60 °C, 90 % RH, DC Max current | 1000 h | 22 |
| Low Temperature Life Test | -40 °C, DC Max current | 1000 h | 22 |
| Thermal Cycle | -45 °C / 15 min ↔ 125 °C / 15 min → 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) |   $R_1$: 10 MΩ<br>$R_2$: 1.5 kΩ<br>C: 100 pF<br>V: ±5 kV | 5 times | 30 |

### b) Criteria for Judging the Damage

| Item | Symbol | Test Condition ($T_s$ = 25 °C) | Limit | |
|---|---|---|---|---|
| | | | Min | Max |
| Forward Voltage | $V_F$ | $I_F$ = 65 mA | Init. Value * 0.9 | Init. Value * 1.1 |
| Luminous Flux | v | $I_F$ = 65 mA | Init. Value * 0.7 | Init. Value * 1.1 |

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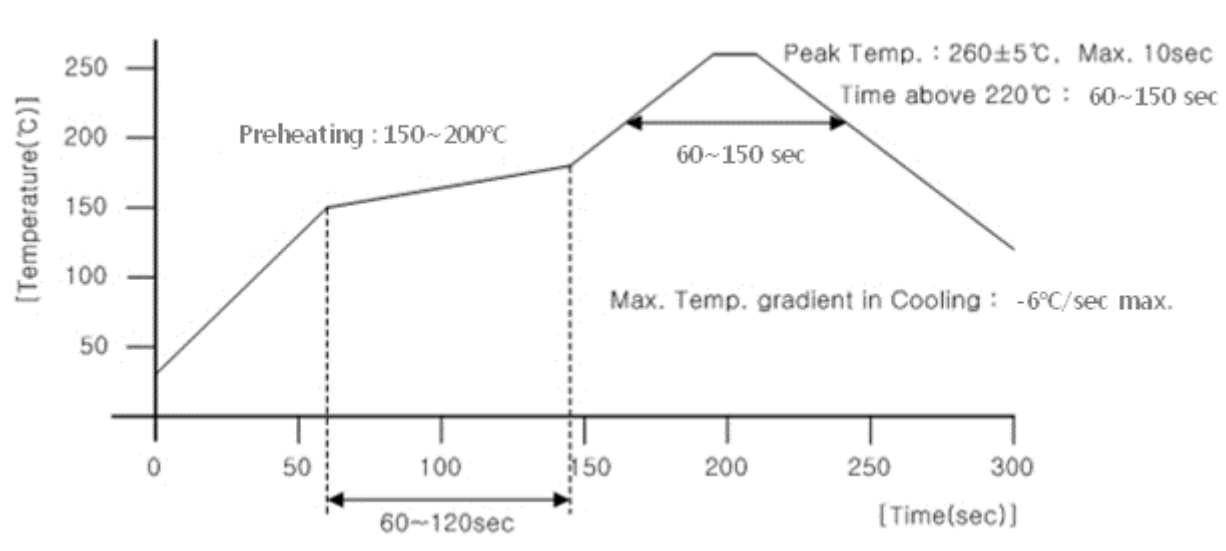
## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



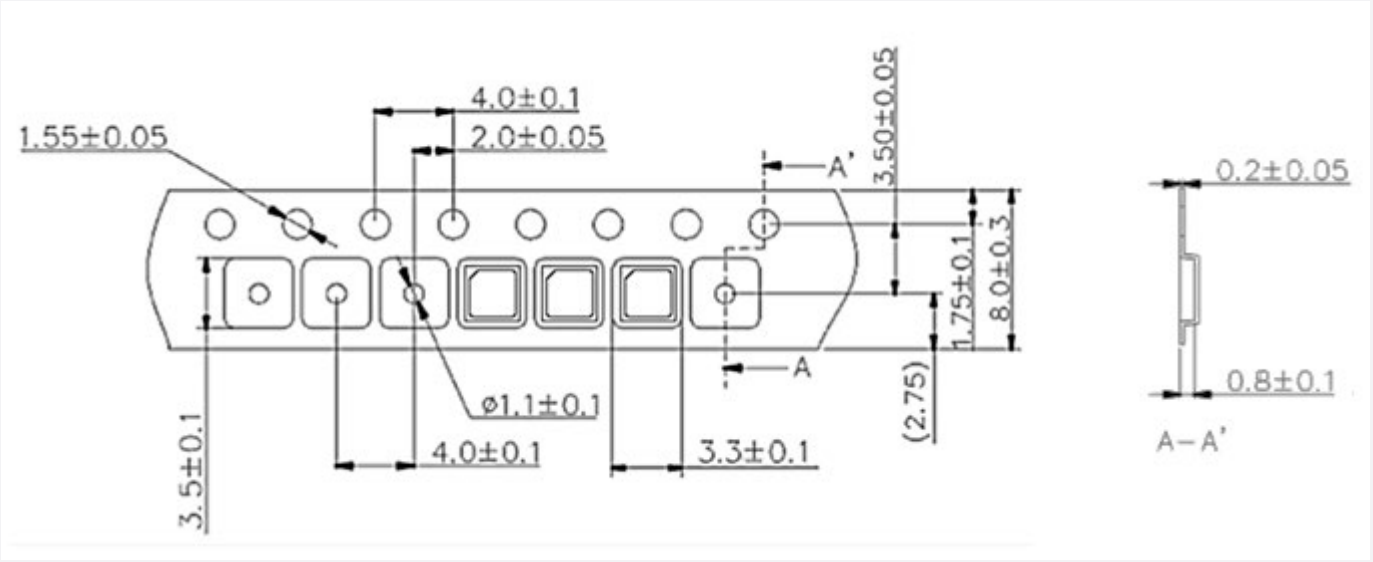

### b) Manual Soldering Conditions

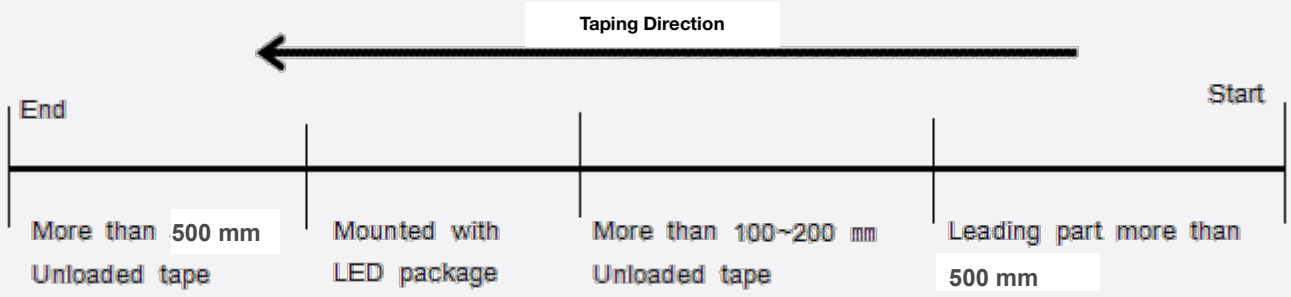
Not more than 5 seconds @ max. 300 °C, under soldering iron.

## 7. Tape & Reel

### a) Taping Dimension

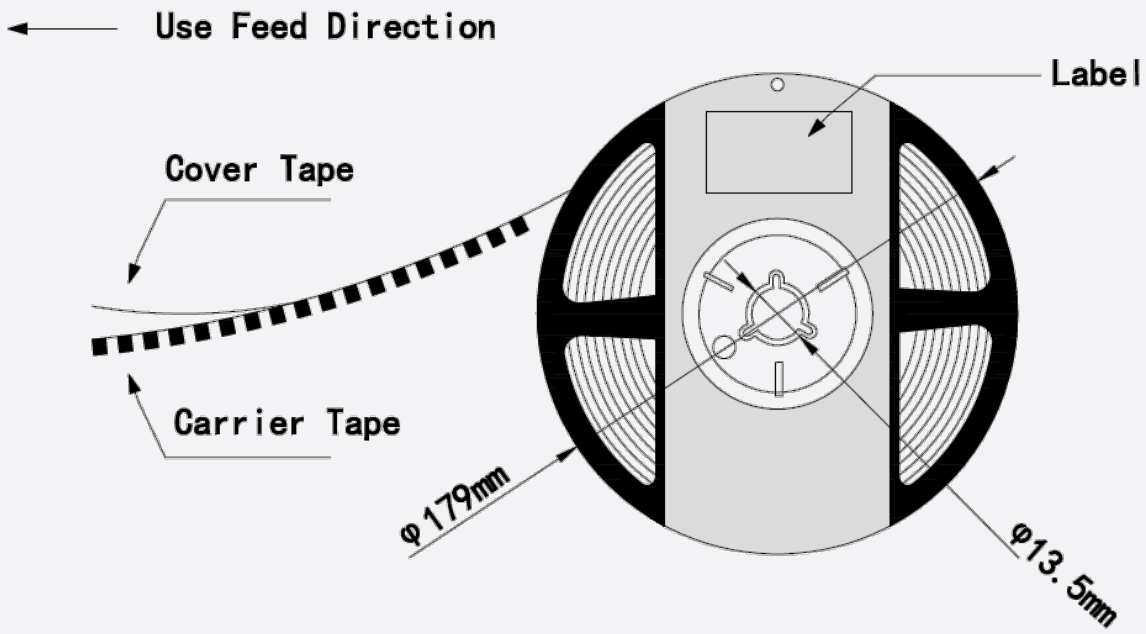
(unit: mm)



### b) Reel Dimension (max 4,000 pcs)

(unit: mm)

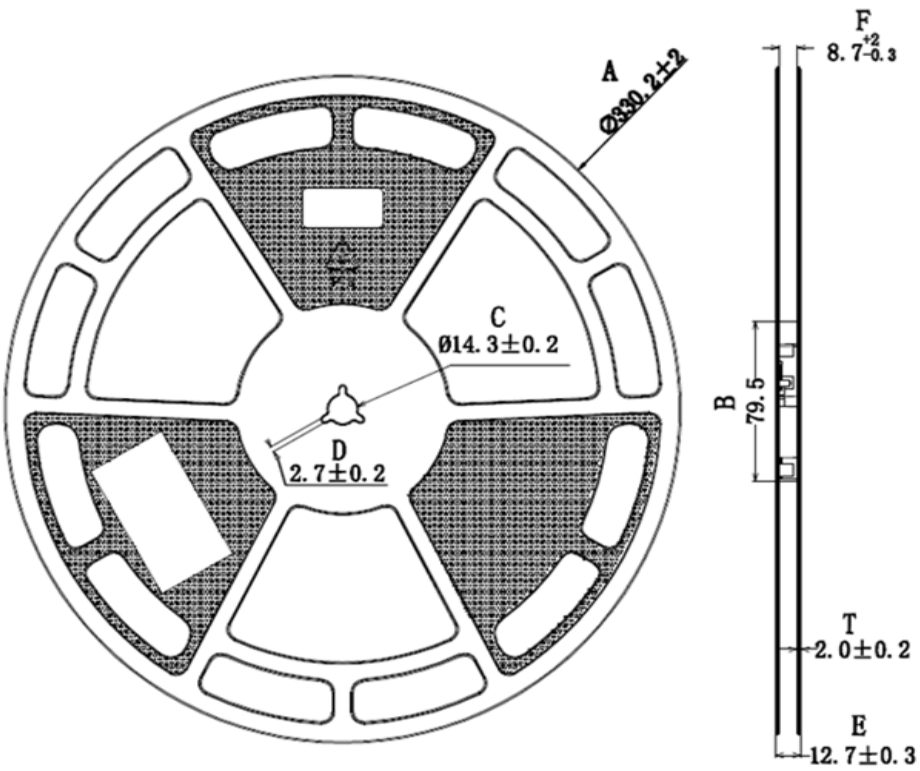



**Notes:**

1) Quantity : The quantity/reel is 4,000 pcs
2) Cumulative Tolerance : Cumulative tolerance / 10 pitches is ±0.2 mm
3) Adhesion Strength of Cover Tape : Adhesion strength is 0.1-0.7 N when the cover tape is turned off from the carrier tape at 10° angle to the carrier tape
4) Packaging : P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag

### c) Reel Dimension (max 16,000 pcs)

(unit: mm)



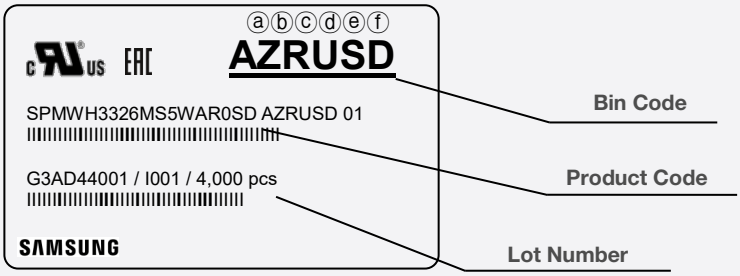

| A±2 | B±0.5 | C±0.2 | D±0.2 | E±0.3 | F+2 -0.3 | T±0.2 |
|---|---|---|---|---|---|---|
| Ø330.2 | Ø79.5 | Ø14.3 | 2.7 | 12.7 | 8.7 | 2.0 |

**Notes:**

1) Quantity: The quantity/reel is 16,000 pcs
2) All dimensions are millimeters (tolerance : ±0.2mm)
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:

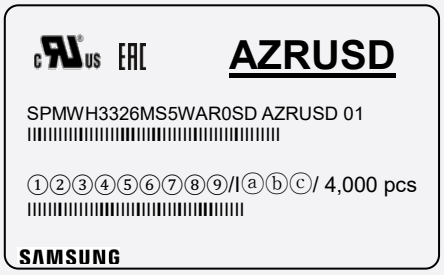
ⓐⓑ: Forward Voltage bin (refer to page 7)

ⓒⓓ: Chromaticity bin (refer to page 8-10)

ⓔⓕ: Luminous Flux bin (refer to page 5)

### b) Lot Number

The lot number is composed of the following characters:




①②③③②③④⑤⑥⑦⑧⑨ / Ⅰⓐⓑⓒ / 4,000 pcs

①② : Production site (G3 : Shenzhen, China)

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)

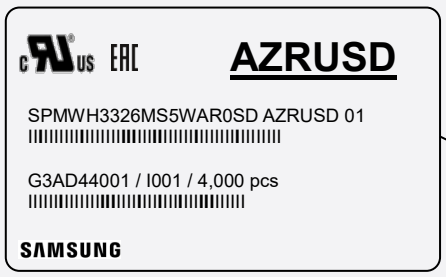
⑦⑧⑨ : Serial number (001 ~ 999)

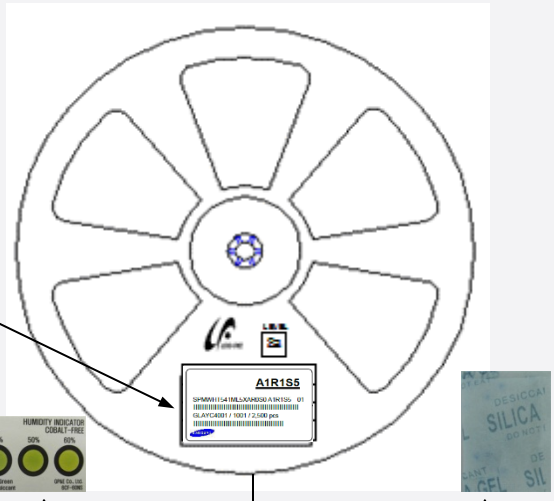
ⓐⓑⓒ : Product serial number (001 ~ 999)

## 9. Packing Structure

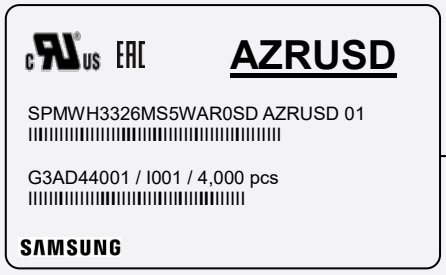
### a) Packing Process (The quantity of PKG on the Reel to be Max 4,000pcs)

**Reel**




**Aluminum Vinyl Packing Bag**

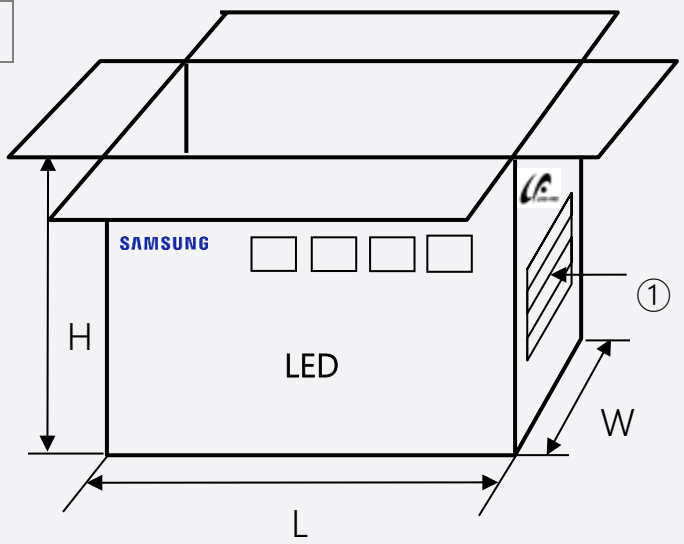




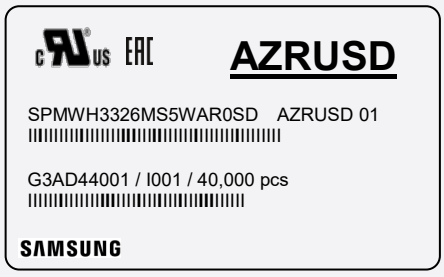
**Outer Box**

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 |

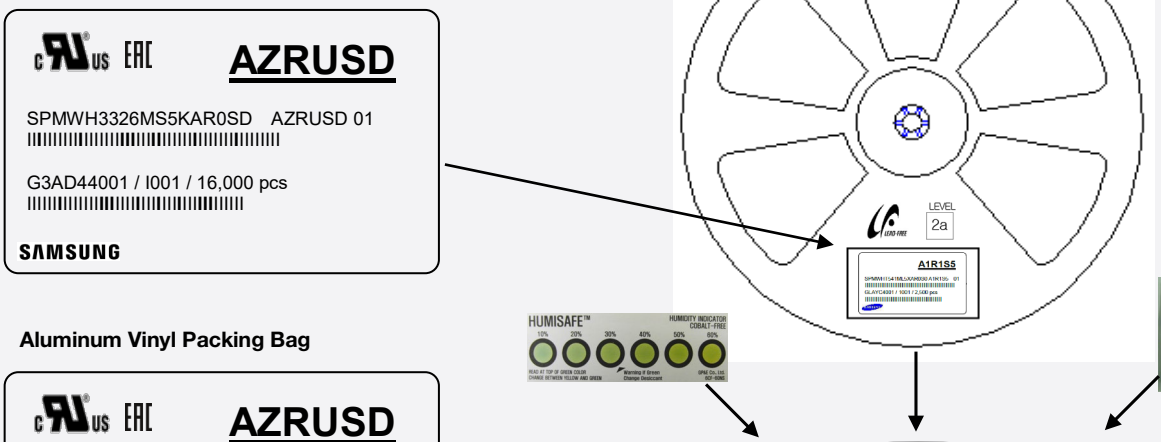



① **Side Label**

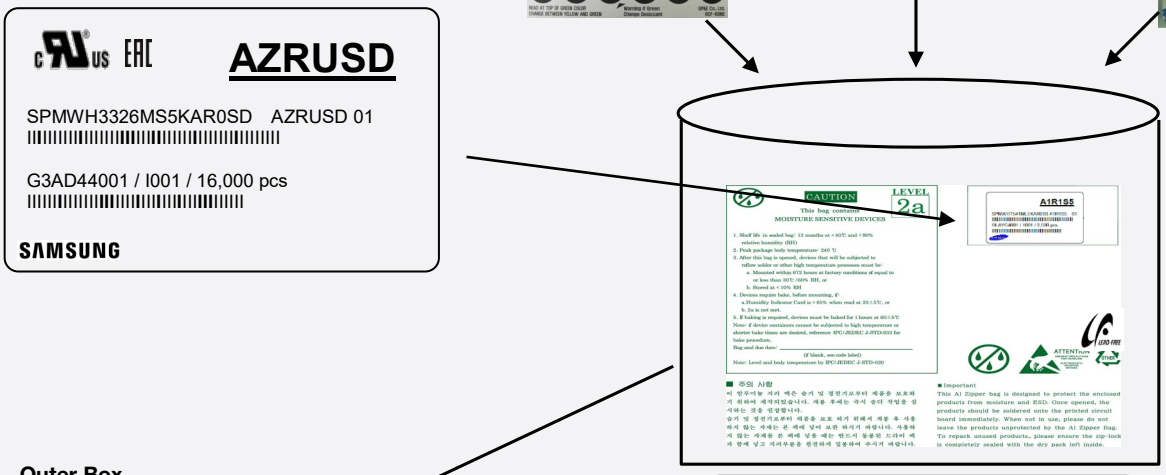


## b) Packing Process (The quantity of PKG on the Reel to be Max 16,000 pcs)

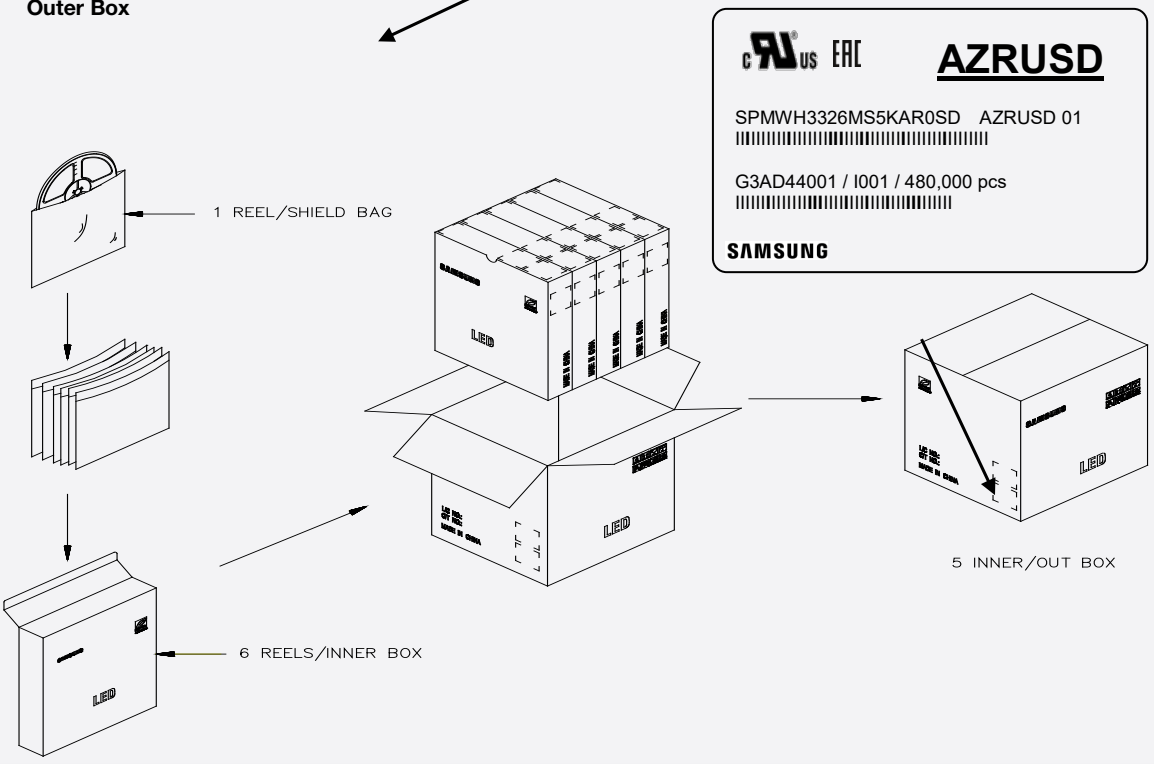
**Reel**




**Aluminum Vinyl Packing Bag**




**Outer Box**



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

**Kitting 'A'**

AZ★NSD

SPMWH3326MS5WA★YSD AZ★NSD 01

G3AD44001 / I001 / 4,000 pcs

SAMSUNG

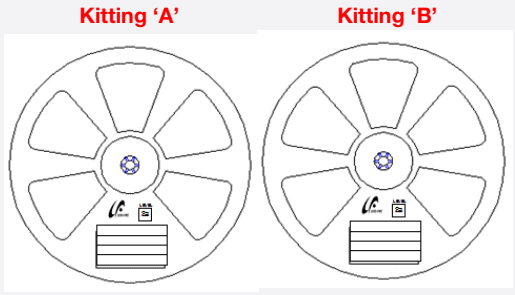
**Kitting 'B'**

AZ★RSD

SPMWH3326MS5WA★YSD AZ★RSD 01

G3AD44001 / I001 / 4,000 pcs

SAMSUNG




**Aluminum Vinyl Packing Bag**

**Kitting 'A'**

AZ★NSD

SPMWH3326MS5WA★YSD AZ★NSD 01

G3AD44001 / I001 / 4,000 pcs

SAMSUNG

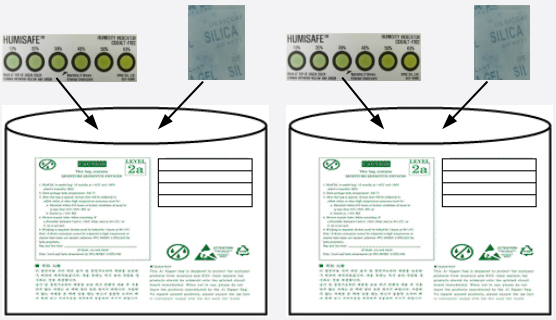
**Kitting 'B'**

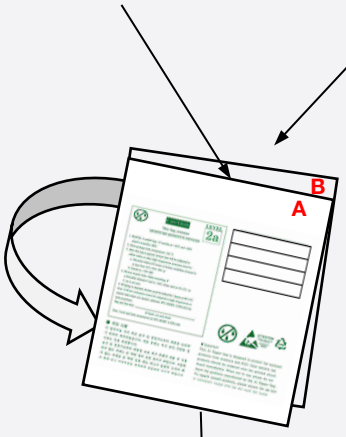
AZ★RSD

SPMWH3326MS5WA★YSD AZ★RSD 01

G3AD44001 / I001 / 4,000 pcs

SAMSUNG






**Outer Box**

**Kitting 'A'**

AZ★NSD

SPMWH3326MS5WA★YSD AZ★NSD 01

G3AD44001 / I001 / 40,000 pcs

SAMSUNG [BOX Label]

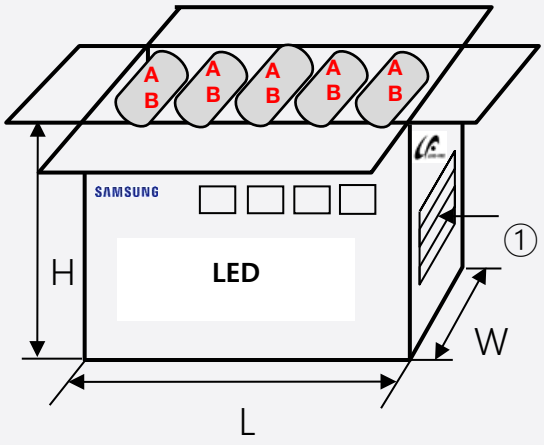
**Kitting 'B'**

AZ★RSD

SPMWH3326MS5WA★YSD AZ★RSD 01

G3AD44001 / I001 / 40,000 pcs

SAMSUNG [BOX Label]




**Note: "★" can be Nominal CCT code.**

**Material: Paper (SW3B(B))**

| Type | Size (mm) | | | Note |
|---|---|---|---|---|
| | L | W | H | |
| 7 inch L | 245 ± 5 | 220 ± 5 | 182 ± 5 | Up to 10 reels |

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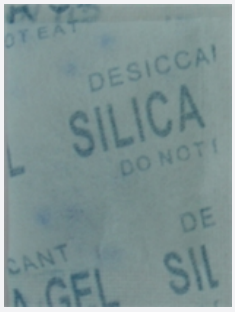
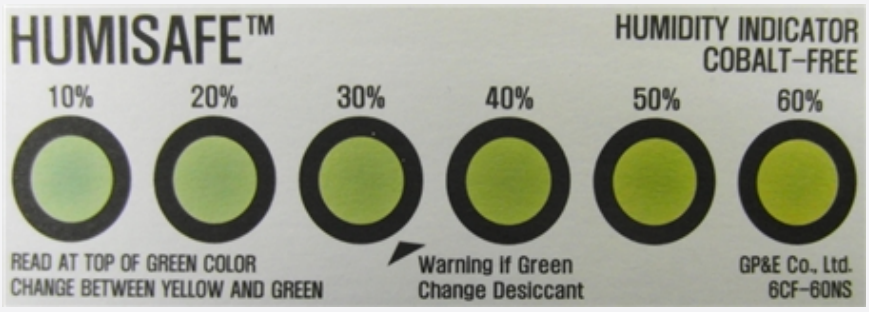
d) Aluminum Vinyl Packing Bag


d) Silica Gel & Humidity Indicator Card inside Aluminum Vinyl Bag

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



## 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 ºC, 0~90 % RH.

5) After storage bag is opened, device subjected to soldering, solder reflow, or other high temperature processes must be:
a. Mounted within 672 hours (28 days) at an assembly line with a condition of no more than 30 ºC / 60 % RH*Note 1, or
b. Mounted within 24 hours (1 day) at an assembly line with a condition of more than 30 ºC / 70 % RH*Note 2, 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℃ |
| | | ∞ | ∞ | ∞ | 2 | 1 | 1 | 25℃ |
| | | ∞ | ∞ | ∞ | 2 | 2 | 1 | 20℃ |

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 10~24 hours 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.

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.

About Samsung Electronics Co., Ltd.

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.



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