

# SPECIFICATIONS FOR T20 SERIES

## WHITE LED

Model: 2016

Part No: T20\*\*\*21A-\*\*\*\*\*

## Features:

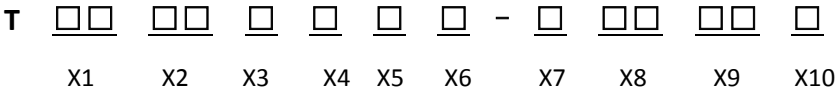
- \* Top view white LED
- \* Thermally Enhanced Package Design
- \* High luminous flux output
- \* High current capability
- \* Compact Package Size
- \* Wide viewing angle
- \* Pb-free Reflow Soldering Application
- \* The product itself will remain within RoHS compliant version



## Applications

- \* Interior lighting
- \* Retrofits (replacement)
- \* General lighting
- \* Architectural / Decorative lighting

Part Numbering System



| Item Number Code | Description          | Content                                                                                                                                             |
|------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| X1               | Type code            | 1S:1010; 1A:1919; 20:2016; 3B:3014; 28:2835<br>34:3020; 3C:3030; 5C:5050; 7C:7070; 1D:100100;<br>19:Ceramic 3535; 15:Ceramic 5050; 11:Ceramic 1616. |
| X2               | CCT code             | 2700K:27; 3000K:30; 4000K:40;<br>5000K:50; 5700K:57; 6500K:65.                                                                                      |
| X3               | Color Rendering      | Ra70:7; Ra80:8; Ra90:9.                                                                                                                             |
| X4               | No. of serial chip   | 1-Z.                                                                                                                                                |
| X5               | No. of parallel chip | 1-Z.                                                                                                                                                |
| X6               | Component code       | A-Z.                                                                                                                                                |
| X7               | Color Code           | M:ANSI; F:ERP; R:85℃ ANSI; T:105℃ ANSI; B:Backlighting;<br>Q:Others;AT:Tospo                                                                        |
| X8               | Internal code1       | \                                                                                                                                                   |
| X9               | Internal code2       | \                                                                                                                                                   |
| X10              | Spare code           | \                                                                                                                                                   |

Electro Optical Characteristics, IF = 80mA, Tj=25℃

| CCT   | Color Rendering | Luminous Flux |     |
|-------|-----------------|---------------|-----|
|       | Min             | Typ           | Min |
| 2700K | 80              | 60            | 55  |
|       | 90              | 55            | 51  |
| 3000K | 80              | 63            | 58  |
|       | 90              | 58            | 53  |
| 3500K | 80              | 64            | 60  |
|       | 90              | 59            | 55  |
| 4000K | 80              | 66            | 63  |
|       | 90              | 61            | 58  |
| 5000K | 80              | 66            | 63  |
|       | 90              | 61            | 58  |
| 5700K | 80              | 66            | 63  |
|       | 90              | 61            | 58  |
| 6500K | 80              | 66            | 63  |
|       | 90              | 61            | 58  |

\* Tolerance of measurements of the Luminous Flux is ±7%.

\* Ra measurement tolerance is ±2.

### Absolute Maximum Ratings at Tj=25°C

| Item                  | Symbol          | Absolute Maximum Rating                    | Unit |
|-----------------------|-----------------|--------------------------------------------|------|
| Forward current       | I <sub>F</sub>  | 100                                        | mA   |
| Pulse Forward current | I <sub>FP</sub> | 150                                        | mA   |
| Power Dissipation     | P <sub>D</sub>  | 640                                        | mW   |
| Reverse Voltage       | V <sub>R</sub>  | 5                                          | V    |
| Operating Temperature | Topr            | -40~+105                                   | °C   |
| Storage Temperature   | Tstg            | -40~+85                                    | °C   |
| Junction Temperature  | Tj              | 120                                        | °C   |
| Soldering Temperature | Tsld            | Reflow Soldering: 230°C or 260°C for 10sec |      |

\* I<sub>FP</sub> condition with Pulse: Width≤100μs, Duty cycle≤1/10.

\* LED's properties might be different from suggested values like above and below tables if operation condition will be exceeded our parameter range. Care is to be taken that power dissipation does not exceed the absolute maximum rating of the product.

\* All measurements were made under the standardized environment of Lightning LED.

### Electrical/Optical Characteristics at Tj=25°C

| Item                    | Symbol                 | Min  | Typ | Max | Unit | Condition            |
|-------------------------|------------------------|------|-----|-----|------|----------------------|
| Forward Voltage         | V <sub>F</sub>         | -    | 5.9 | 6.4 | V    | I <sub>F</sub> =80mA |
| Reverse Current         | I <sub>R</sub>         | -    | -   | 10  | μA   | V <sub>R</sub> =5V   |
| View Angle              | 2θ <sub>1/2</sub>      | -    | 120 | -   | °    | I <sub>F</sub> =80mA |
| Thermal resistance      | (Rth <sub>j-sp</sub> ) | -    | 25  | -   | °C/W | I <sub>F</sub> =80mA |
| Electrostatic Discharge | ESD                    | 1000 | -   | -   | V    | HBM                  |

\* Tolerance of measurements of the Forward Voltage is ±0.2V.

\* 2θ<sub>1/2</sub> is the off-axis where the luminous intensity is 1/2 of the peak intensity.

\* Rth<sub>j-sp</sub> is the thermal resistance from LED junction to solder point on MCPCB with electrical power.

Bin Structure

Luminous Flux Ranks, IF = 80mA, Tj = 25°C

| CCT                         | Color Rendering |      | Luminous Flux |     |     |
|-----------------------------|-----------------|------|---------------|-----|-----|
|                             | Min.            | Typ. | Code          | Min | Max |
| 2700K                       | 80              | 82   | E8            | 58  | 62  |
|                             |                 |      | E9            | 62  | 66  |
|                             |                 |      | F1            | 66  | 70  |
|                             | 90              | 92   | E5            | 46  | 50  |
|                             |                 |      | E6            | 50  | 54  |
|                             |                 |      | E7            | 54  | 58  |
| 3000K/3500K                 | 80              | 82   | E8            | 58  | 62  |
|                             |                 |      | E9            | 62  | 66  |
|                             |                 |      | F1            | 66  | 70  |
|                             | 90              | 92   | E6            | 50  | 54  |
|                             |                 |      | E7            | 54  | 58  |
|                             |                 |      | E8            | 58  | 62  |
| 4000K/5000K/<br>5700K/6500K | 80              | 82   | E9            | 62  | 66  |
|                             |                 |      | F1            | 66  | 70  |
|                             |                 |      | F2            | 70  | 74  |
|                             | 90              | 92   | E7            | 54  | 58  |
|                             |                 |      | E8            | 58  | 62  |
|                             |                 |      | E9            | 62  | 64  |

\* Tolerance of measurements of the Luminous Flux is ±7%.

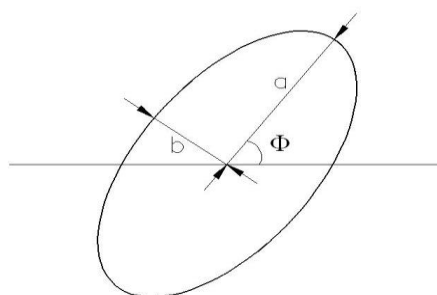
\* Ra measurement tolerance is ±2.

## Forward Voltage Ranks, IF = 80mA, Tj = 25°C

| Code | Min | Max | Unit |
|------|-----|-----|------|
| Z3   | 5.6 | 5.8 | V    |
| A4   | 5.8 | 6.0 | V    |
| B4   | 6.0 | 6.2 | V    |
| C4   | 6.2 | 6.4 | V    |

\* Tolerance of measurements of the Forward Voltage is  $\pm 0.2V$ .

## CIE Chromaticity Diagram, IF = 80mA, Tj = 25°C



The color ranks have chromaticity ranges within 5-step MacAdam ellipse

| Color Code | Center |        | Radius   |         | Angle(deg) |
|------------|--------|--------|----------|---------|------------|
|            | x      | y      | a        | b       | Φ          |
| 27M5       | 0.4582 | 0.4099 | 0.013500 | 0.00700 | 53.42      |
| 30M5       | 0.4342 | 0.4028 | 0.013900 | 0.00680 | 53.13      |
| 40M5       | 0.3825 | 0.3798 | 0.015650 | 0.00670 | 53.43      |
| 50M5       | 0.3451 | 0.3554 | 0.013700 | 0.00590 | 59.37      |
| 57M5       | 0.3290 | 0.3417 | 0.011175 | 0.00550 | 58.35      |
| 65M5       | 0.3130 | 0.3290 | 0.011150 | 0.00475 | 58.34      |

\* Energy Star binning applied to all 2600~7000K.

\* Tolerance of measurements of the chromaticity Coordinate is  $\pm 0.005$ .

Fig 1. Color Spectrum,  $T_j = 25^\circ\text{C}$ ,  $R_a = 80$

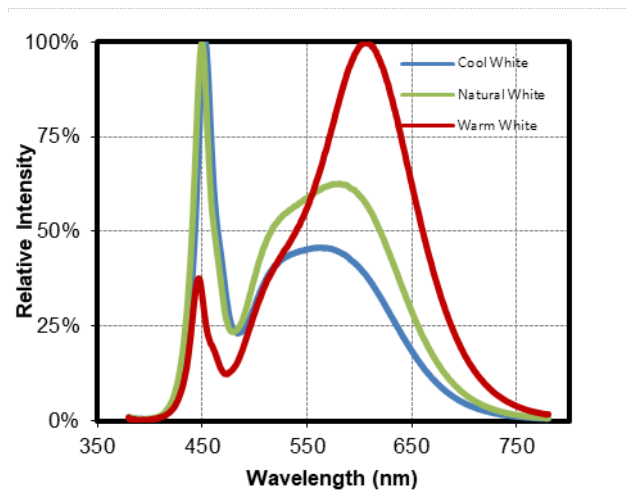


Fig 2. Color Spectrum,  $T_j = 25^\circ\text{C}$ ,  $R_a = 90$

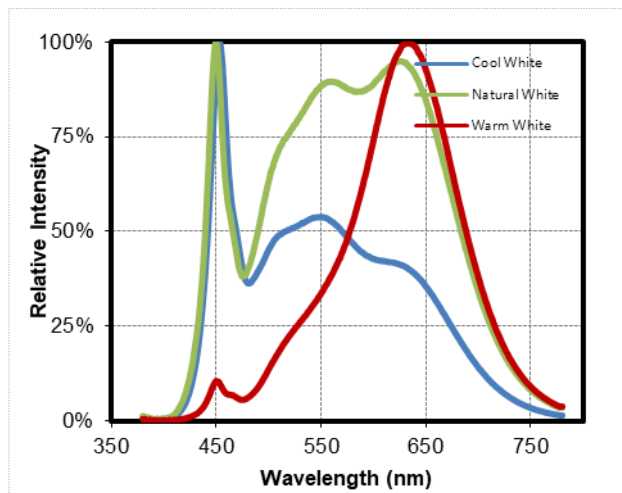


Fig 3. Viewing Angle Distribution,  $T_j = 25^\circ\text{C}$

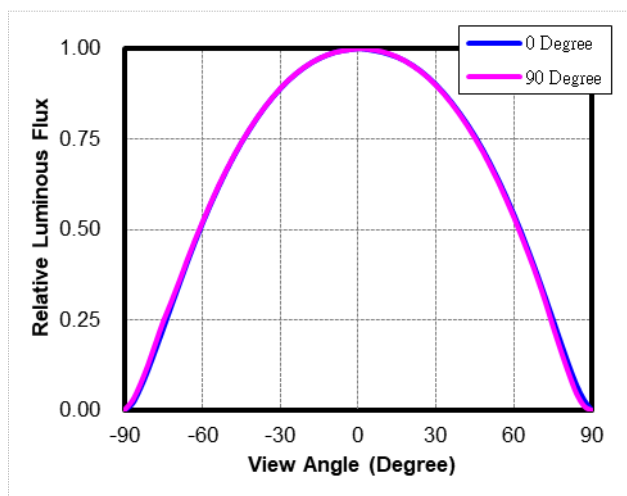


Fig4. Forward Current vs. Relative Intensity,  $T_j = 25^\circ\text{C}$

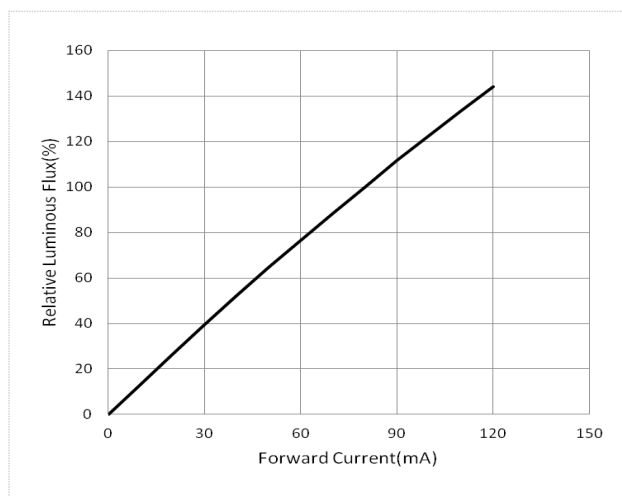


Fig 5. Forward Current vs. Forward Voltage,  $T_j = 25^\circ\text{C}$

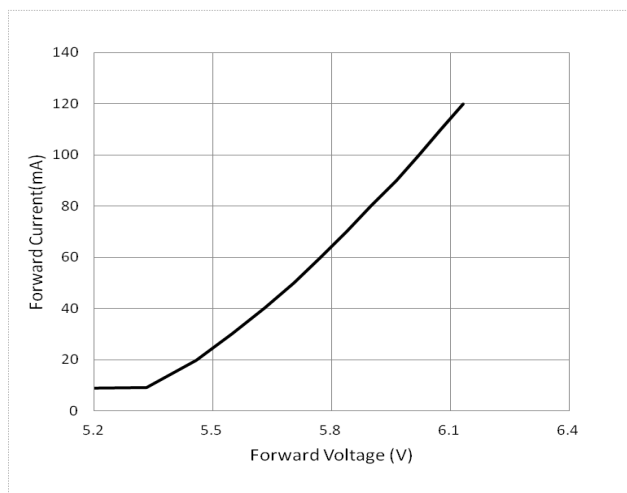
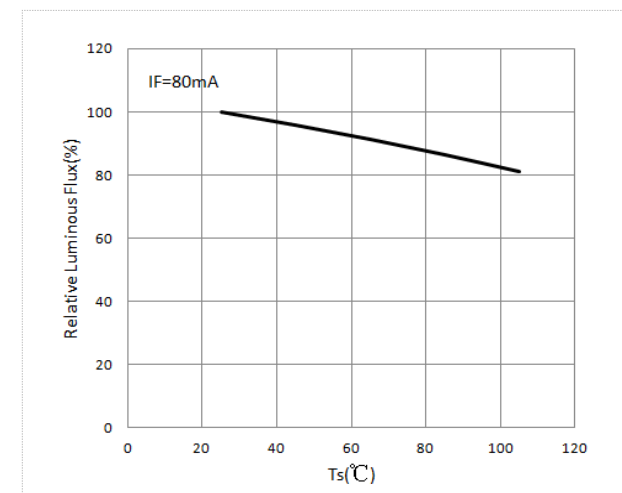
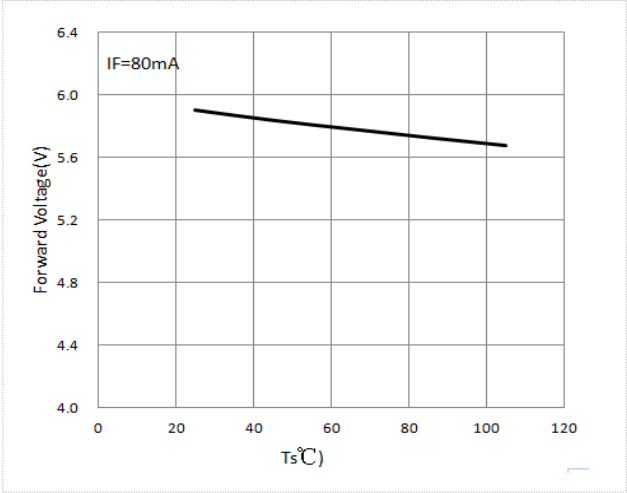


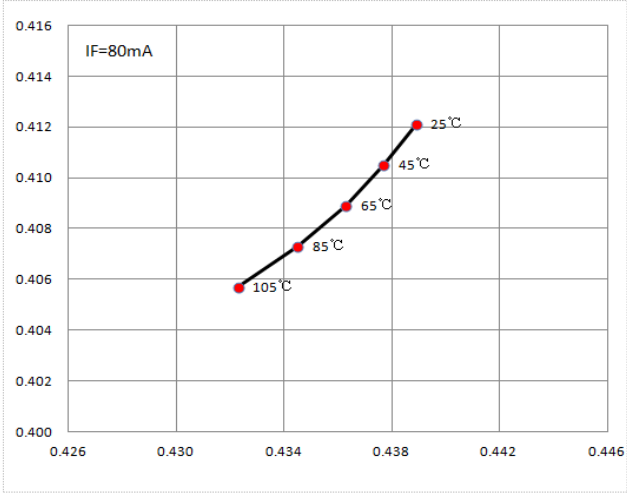
Fig 6. Ambient Temperature vs. Relative Luminous flux ( $I_F=80\text{mA}$ )



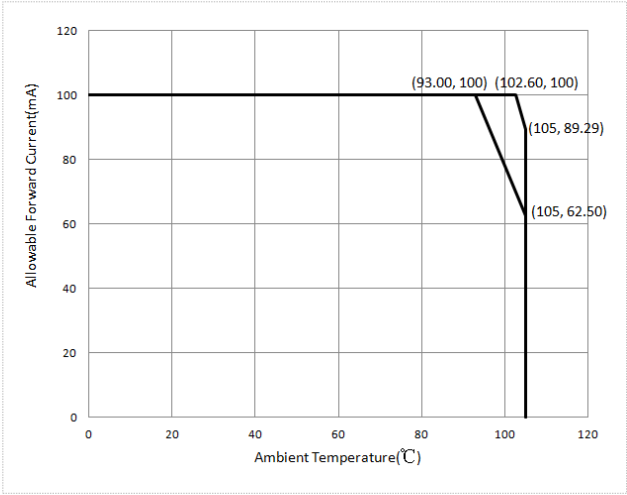
**Fig7. Ambient Temperature vs. Relative Forward Voltage (IF=80mA)**



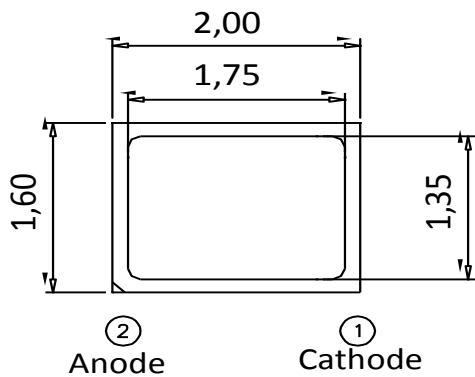
**Fig 8. Chromaticity Coordinates vs. Ambient Temperature (IF=80mA)**



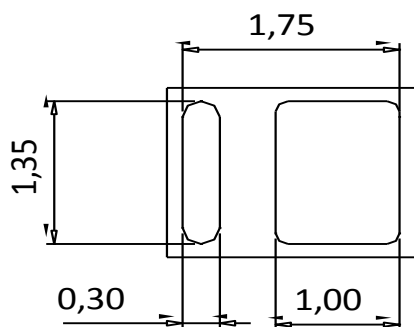
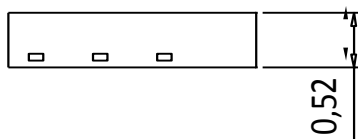
**Fig 9. Allowable Forward Current De-rating Curve**



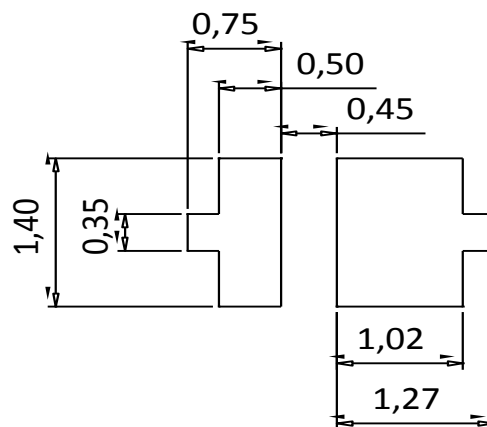
## Package Dimensions



Polarity



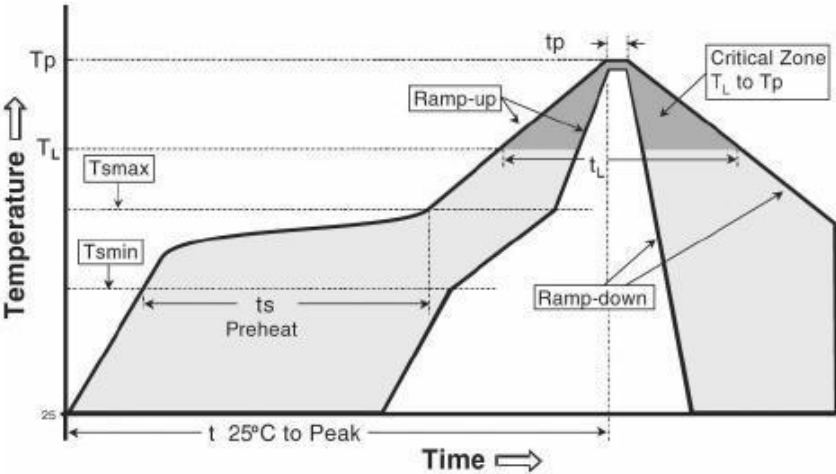
Bot. view



Soldering patterns

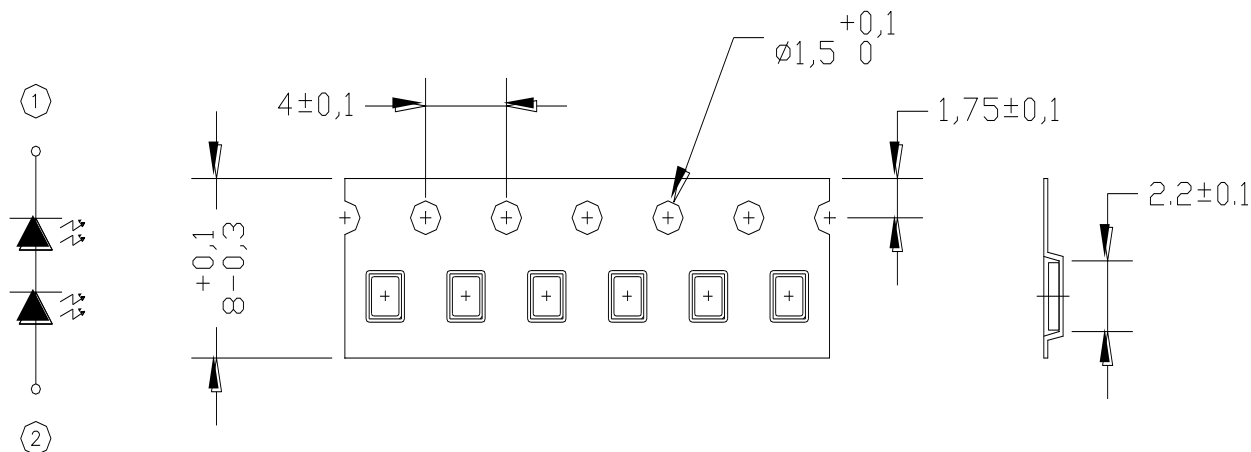
\* The tolerance unless mentioned is  $\pm 0.1\text{mm}$ , unit = mm

# Reflow Soldering Characteristics



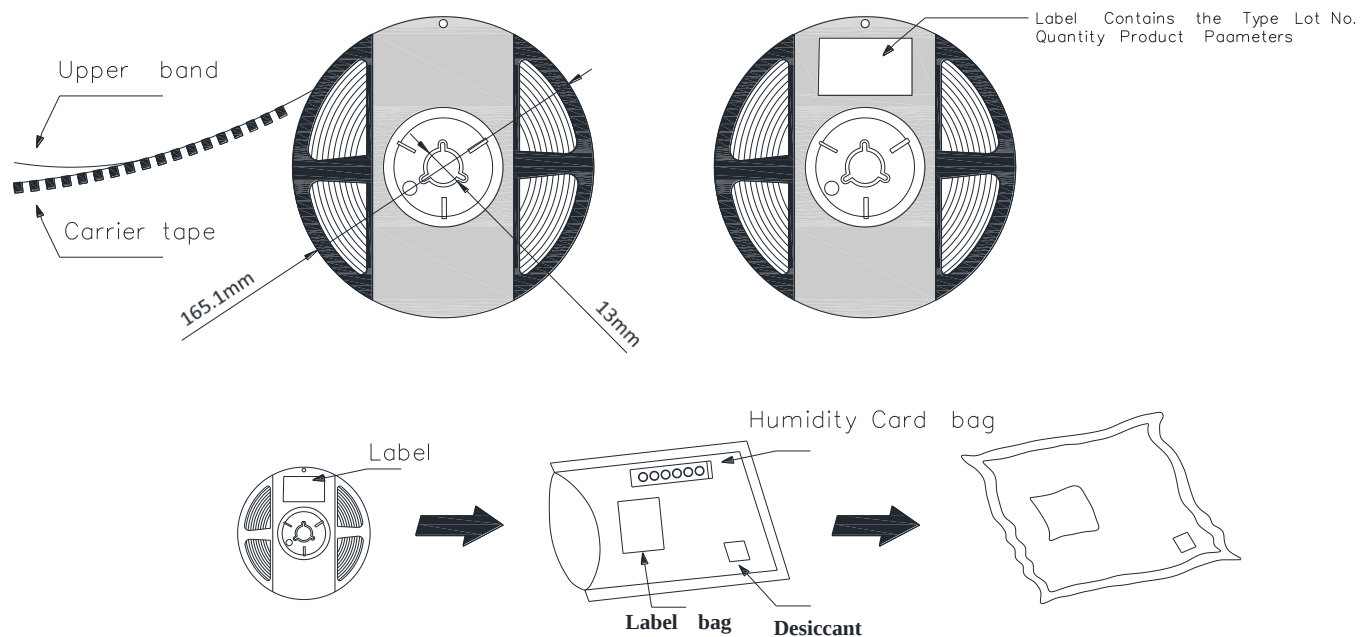
| Reflow soldering                                                        |                   |
|-------------------------------------------------------------------------|-------------------|
| Temperature Min (Tsmín)                                                 | 150° C            |
| Temperature Max (Tsmáx)                                                 | 200° C            |
| Time(ts)from ( Tsmín to Tsmáx)                                          | 60-120 seconds.   |
| Ramp-up rate (TL to Tp)                                                 | 3° C/seconds max. |
| Liquidous temperature( TL)                                              | 217° C            |
| Time(tL) maintained above TL                                            | 60-150 seconds    |
| Peak package body temperature( Tp)                                      | 260° C max        |
| Time (tp) within 5° C of the specified classification temperature (Tc). | 30 seconds max    |
| Ramp-down rate (Tp to TL)                                               | 6° C/second max   |
| Time 25 ° C to peak temperature                                         | 8 min max         |

## Package Dimensions of Tape

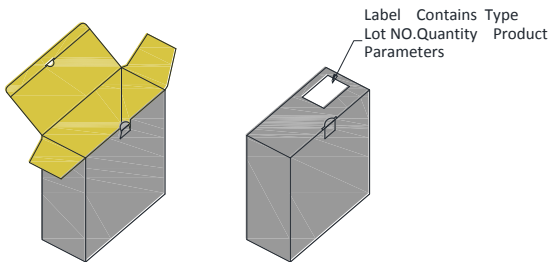


- \* Quantity : Max 5000pcs/Reel
- \* Cumulative Tolerance : Cumulative Tolerance/10 pitches to be  $\pm 0.2$ mm
- \* Package : P/N, Manufacturing data Code No. and Quantity to be indicated on a damp proof Package.
- \* unit = mm

## Package Dimensions of Reel

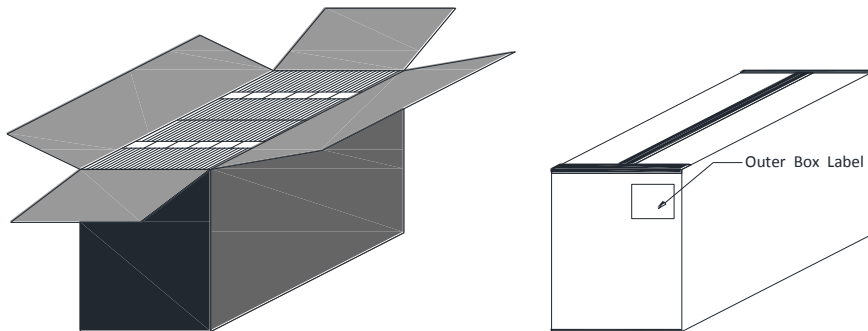


## Package Box



\* Capacity 10 reels per box.

Outer Box



\* Capacity 30 or 60 reels per box.

## Label

|                                                                                     |                |
|-------------------------------------------------------------------------------------|----------------|
| 福建天电光电有限公司                                                                          |                |
| FUJIAN LIGHTNING OPTOELEC TRONIC CO.LTD                                             |                |
| 型号Type: T*****_*****                                                                |                |
|  |                |
| 光通量Φ@ *** mA: *** _ *** [LM]                                                        |                |
| 色区Color Bin@*** mA: ****                                                            |                |
| 电压Vf@ *** mA: ** - ** [V]                                                           |                |
| 显指Ra@*** mA: ** (MIN)                                                               |                |
| Lot No.: A*****_ *_ *****                                                           |                |
| Bin Code: ****                                                                      | 数量QTY:**** PCS |



## Caution

1. Reflow soldering is recommended not to be done more than two times. In the case of more than 24 hours passed soldering after first, LEDs will be damaged.
2. Repairs should not be done after the LEDs have been soldered. When repair is unavoidable, suitable tools must be used.
3. Die slug is to be soldered.
4. When soldering, do not put stress on the LEDs during heating.
5. After soldering, do not warp the circuit board.

## Notes on Lightning EMC Series soldering:

1. Recommend to use reflow machine.
2. Recommend to use heating plate soldering.
3. Manual soldering is not recommended.

## Notes on reflow process:

1. To confirm whether the actual temperature curve in the reflow soldering conditions comply with recommended conditions. LEDs are guaranteed for one time reflow.
2. During reflow process do not apply force on LED active area.
3. After reflow process, PCB board should be cooled down before packing or storage.

## Precaution for use

### Storage

1. Before opening the package: The LED should be kept at 30°C or less and 90%RH or less.
2. After opening the package: The LED's floor life is 168Hrs under 30°C or less and 60%RH or less. If unused LED remain, it should be stored in moisture proof packages JEDEC (MSL 3).
3. If the moisture absorbent material(silica gel) has faded away or the LEDs have exceeded the storage time, baking treatment should be performed using the following conditions:  
Baking treatment: 60±5°C for 24 hours.