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| A-TZ-008-00 | 2008/9/10 | 1/10 | C-00 |

# LED SPECIFICATION

**PART NO. : EOZ-ZTYRCD0-KK**

**PART DESCRIPTION : 90° Yellow Super Flux LED**

## Product Description

Super Flux LEDs are made with super high brightness LED chips and low thermal resistance package. The package with low thermal resistance allows the lighting designers to drive these LEDs at higher current than the conventional through-hole LEDs. The advanced AlInGaP technology provides extremely high and stable light output over long period of time. With qualified advanced designed AlInGaP chips, EOI Super Flux LEDs can generate the same level of optical performance as it is by Lumileds' TS grade Piranha. Because Super Flux LED can emit more light, uniform and unique illuminated appearance, it allows the lighting designer to reduce the number of LEDs required through the efficient optical design and high-current electrical design.

Excellence opto. Inc. uses the brightest Red, Amber, Blue, and Green LED chips in this product family. The designers can select the most suitable color for many lighting applications, such as automobile signals, garden lightings, special lightings for building and electronic signs, and etc.



| EOI      |                      |                  | CUSTOMER APPROVED |
|----------|----------------------|------------------|-------------------|
| ACTION   | NAME                 | DATE             |                   |
| PREPARED | <i>Calhy Huang</i>   | <i>2008/9/10</i> |                   |
| CHECKED  | <i>Vincent Huang</i> | <i>2008/9/10</i> |                   |
| APPROVED | <i>Ader Wu</i>       | <i>2008/9/10</i> |                   |

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## Features

- ◆ High Luminance / High Light Output
- ◆ Low Thermal Resistance
- ◆ Low Profile
- ◆ Meet SAE/ECE/JIS Automotive Color Requirements
- ◆ Design for High Current Operation
- ◆ Pb free & RoHS Compliant Product

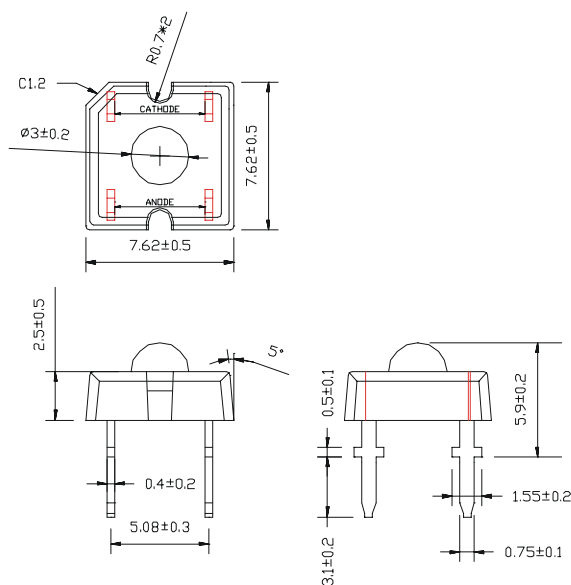
## Applications

- ◆ Automotive Exterior Lighting
- ◆ Electronic Signs and Signals
- ◆ Specialty Lighting
- ◆ Decoration
- ◆ Channel Letter

## Benefits

- ◆ Fewer LED Requirement
- ◆ Lower Application Cost

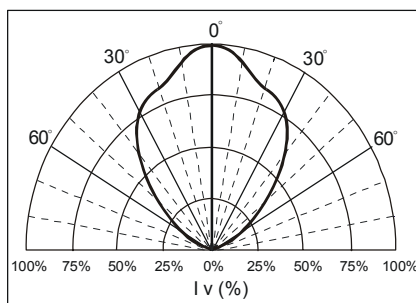
## Outline Drawings



## Notes:

1. All dimensions are in millimeter.
2. Tolerance is  $\pm 0.20$  mm unless otherwise noted.
3. Protruded resin under bottom surface of epoxy is 1.5 mm max.
4. Lead spacing is measured where the leads emerge from the package.

## Beam Pattern



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## Absolute Maximum Ratings at $T_A=25^{\circ}\text{C}$

| Parameter                                                | Symbol            | MAX.                                            | Unit                   |
|----------------------------------------------------------|-------------------|-------------------------------------------------|------------------------|
| Average Forward Current <sup>[a] [c]</sup>               | $I_F$             | 70                                              | mA                     |
| Peak Forward Current <sup>[b]</sup>                      | $I_{\text{peak}}$ | 100                                             | mA                     |
| Reverse Voltage                                          | $V_R$             | 10                                              | V                      |
| Power Dissipation                                        | $P_D$             | 210                                             | mW                     |
| Current Linearity vs. Ambient Temperature                | $TC_I$            | - 0.87                                          | mA/ $^{\circ}\text{C}$ |
| LED Junction Temperature                                 | $T_J$             | 125                                             | $^{\circ}\text{C}$     |
| Operating Temperature Range <sup>[c]</sup>               | $T_{\text{OPR}}$  | $-40^{\circ}\text{C} \sim +100^{\circ}\text{C}$ | $^{\circ}\text{C}$     |
| Storage Temperature Range                                | $T_{\text{STO}}$  | $-40^{\circ}\text{C} \sim +100^{\circ}\text{C}$ | $^{\circ}\text{C}$     |
| Lead Soldering Condition<br>[4mm(.157") away from epoxy] | $T_{\text{SOL}}$  | 260 $^{\circ}\text{C}$ / 5 seconds              |                        |

**Note:** [a] Design of heat dissipation should be considered.

[b] Duty Ratio=1/10,Pulse Width=0.1ms.

[c] The allowable operating current at different operation temperature, please take reference from Fig 4 page 4.

## Electrical and Optical Characteristics at $T_A=25^{\circ}\text{C}$

| Parameter                           | Symbol          | Min. | Typ. | Max. | Unit                        | Test Condition    |
|-------------------------------------|-----------------|------|------|------|-----------------------------|-------------------|
| Total Luminous Flux                 | $\Phi_v$        | 3850 | 6000 | ---  | mlm                         | $I_F=70\text{mA}$ |
| Luminous Intensity / Total Flux     | $I_v / \Phi_v$  | ---  | 0.65 | ---  | mcd / mlm                   | $I_F=70\text{mA}$ |
| Viewing Angle                       | $2\theta_{1/2}$ | ---  | 90   | ---  | Deg                         | $I_F=70\text{mA}$ |
| Total Included Angle <sup>[1]</sup> | $\theta_{0.9}$  | ---  | 120  | ---  | Deg                         | $I_F=70\text{mA}$ |
| Dominant Wavelength                 | $\lambda_d$     | 585  | 589  | 595  | nm                          | $I_F=70\text{mA}$ |
| Spectral Half Width                 | $\Delta\lambda$ | ---  | 25   | ---  | nm                          | $I_F=70\text{mA}$ |
| Forward Voltage                     | $V_F$           | 2.0  | 2.4  | 3.0  | V                           | $I_F=70\text{mA}$ |
| Reverse Current                     | $I_R$           | ---  | ---  | 100  | $\mu\text{A}$               | $V_R=10\text{V}$  |
| Thermal Resistance $\theta_{j-a}$   | 300 (Typ.)      |      |      |      | $^{\circ}\text{C}/\text{W}$ | $I_F=70\text{mA}$ |
| Thermal Resistance $\theta_{j-pin}$ | 125 (Typ.)      |      |      |      | $^{\circ}\text{C}/\text{W}$ | $I_F=70\text{mA}$ |

## Ranks Combination

| Dominant Wavelength<br>$\lambda_D$ (nm) @ $I_F=70\text{mA}$ |     |      | Total Flux<br>$\Phi_v$ (mlm) @ $I_F=70\text{mA}$ |       |      | Forward Voltage<br>$V_F$ (v) @ $I_F=70\text{mA}$ |     |      |     |     |      |
|-------------------------------------------------------------|-----|------|--------------------------------------------------|-------|------|--------------------------------------------------|-----|------|-----|-----|------|
| min                                                         | max | Code | min                                              | max   | Code | min                                              | max | Code | min | max | Code |
| 585                                                         | 589 | Y3   | 3850                                             | 5400  | 2F   | 2.0                                              | 2.2 | B    | 2.6 | 2.8 | E    |
| 589                                                         | 592 | Y4   | 5400                                             | 7600  | 2G   | 2.2                                              | 2.4 | C    | 2.8 | 3.0 | F    |
| 592                                                         | 595 | Y5   | 7600                                             | 10000 | 2H*  | 2.4                                              | 2.6 | D    | -   | -   | -    |

**Note:**

- Viewing angle 0.9V is the included angle at which 90% of total luminous flux is captured.
- All of rank combinations which include luminous intensity, dominant wavelength, and forward voltage will be included in every shipment.
- Measurement Uncertainty of the Total flux:  $\pm 15\%$
- Measurement Uncertainty of the Dominant Wavelength:  $\pm 1\text{nm}$
- Measurement Uncertainty of the Voltage:  $\pm 0.05\text{V}$
- [\*] Bin with less distribution

## Typical Electrical / Optical Characteristics Curves

(25°C Ambient Temperature Unless Otherwise Noted)

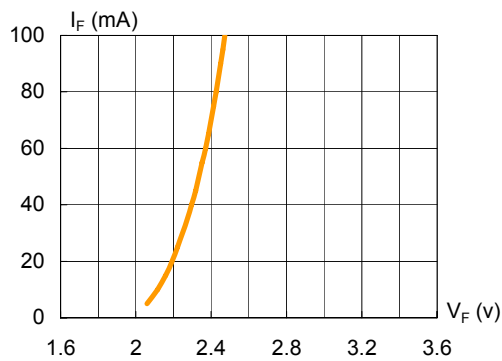


Fig.1 Forward Current vs. Forward Voltage

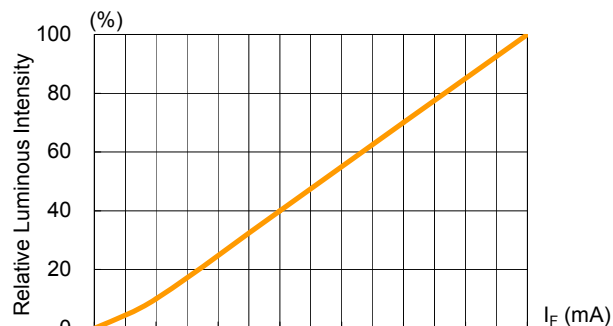


Fig.2 Luminous Intensity vs. Forward Current

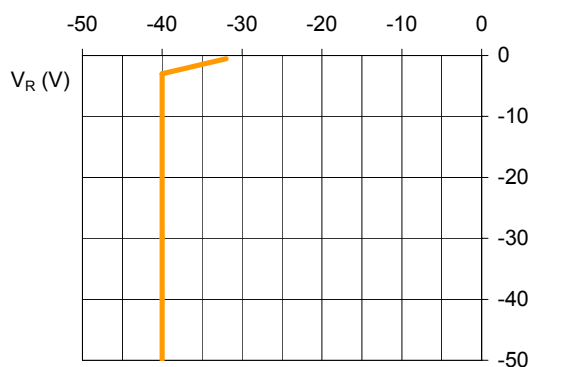


Fig.3 Reverse Current vs. Reverse Voltage

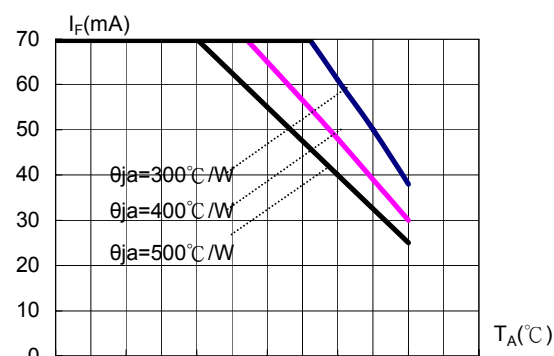


Fig.4 Allowable Forward Current vs. Ambient Temperature

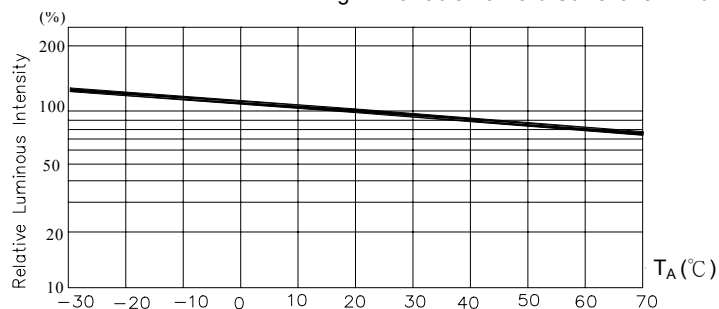


Fig.5 Luminous Intensity at  $I_F=70mA$  vs. Ambient Temperature

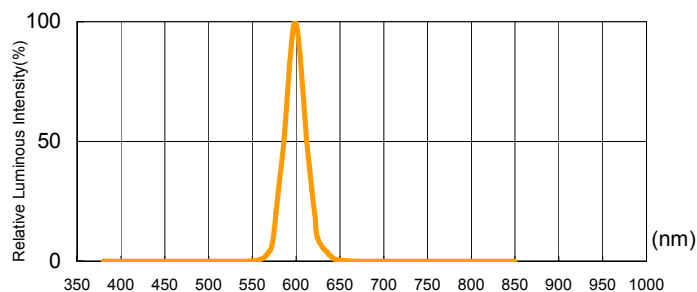


Fig.6 Relative Luminous Intensity vs. Wavelength

**Note:** The data shown above are typical curves. Every LED component may have some variations of characteristics.

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## Reliability Test

EOI's LED lamps are checked by reliability test based on MIL standards.

### 1. Test Conditions, Acceptable Criteria & Results:

| Classification   | Test Item                        | Standard Test Method       | Test Conditions                                                                                                         | Duration   | Unit | Acc / Rej Criteria | Result |
|------------------|----------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------|------------|------|--------------------|--------|
| Life Test        | Operation Life Test (OLT)        | MIL-STD-750D Method 1026.3 | $T_A=25^{\circ}\text{C}$ , $I_F=70\text{mA}$ *                                                                          | 1000 Hrs   | 100  | 0 / 1              | Pass   |
| Environment Test | High Temperature Storage (HTS)   | MIL-STD-750D Method 1032.1 | $T_A=100^{\circ}\text{C}$                                                                                               | 1000 Hrs   | 100  | 0 / 1              | Pass   |
|                  | Low Temperature Storage (LTS)    | MIL-STD-750D Method 1032.1 | $T_A=-40^{\circ}\text{C}$                                                                                               | 1000 Hrs   | 100  | 0 / 1              | Pass   |
|                  | Temp. & Humidity with Bias (THB) | MIL-STD-750D Method 103B   | $T_A=85^{\circ}\text{C}$ , $\text{Rh}=85\%$<br>$I_F=45\text{mA}$ **                                                     | 500 Hrs    | 100  | 0 / 1              | Pass   |
|                  | Thermal Shock Test (TST)         | MIL-STD-750D Method 1056.1 | $0^{\circ}\text{C} \sim 100^{\circ}\text{C}$<br>2min 2min                                                               | 100 cycles | 100  | 0 / 1              | Pass   |
|                  | Temperature Cycling Test (TCT)   | MIL-STD-750D Method 1051.5 | $-40^{\circ}\text{C} \sim 25^{\circ}\text{C} \sim 100^{\circ}\text{C} \sim 25^{\circ}\text{C}$<br>30min 5min 30min 5min | 100 cycles | 100  | 0 / 1              | Pass   |
| Mechanical Test  | Solderability                    | MIL-STD-750D Method 2026.4 | $235\pm 5^{\circ}\text{C}$ , 5 sec                                                                                      | 1 time     | 20   | 0 / 1              | Pass   |
|                  | Resistance to Soldering Heat     | MIL-STD-750D Method 2031.1 | $260\pm 5^{\circ}\text{C}$ , 5 sec                                                                                      | 1 time     | 20   | 0 / 1              | Pass   |
|                  | Lead Integrity                   | MIL-STD-750D Method 2036.3 | Load 2.5N (0.25kgf)<br>$0^{\circ} \sim 90^{\circ} \sim 0^{\circ}$ , bend                                                | 3 times    | 20   | 0 / 1              | Pass   |

Remark : (\*)  $I_F=70\text{mA}$  for AlInGaP chip ;  $I_F=50\text{mA}$  for InGaN chip

(\*\*)  $I_F=45\text{mA}$  for AlInGaP chip ;  $I_F=30\text{mA}$  for InGaN chip

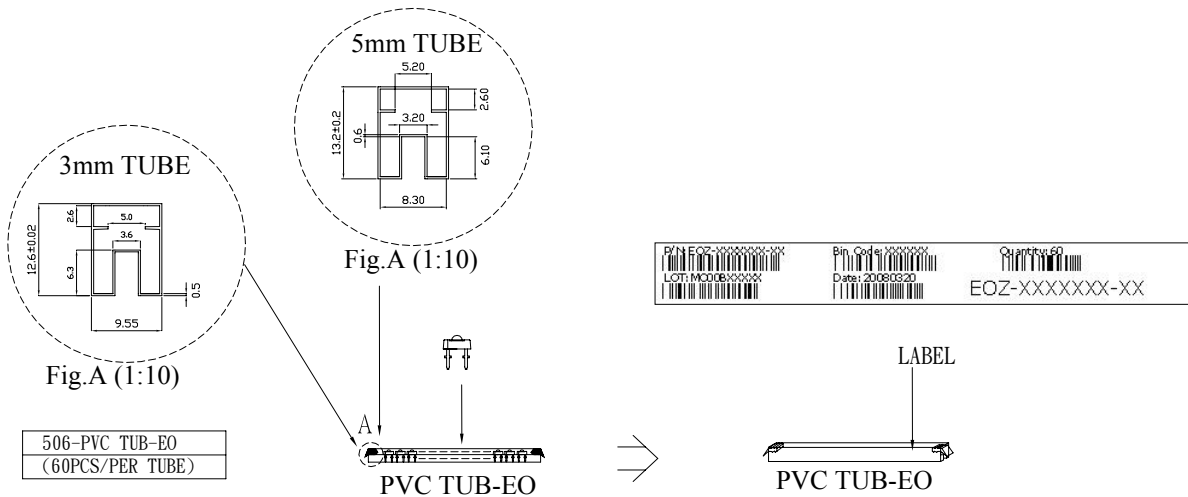
### 2. Failure Criteria ( $T_A=25^{\circ}\text{C}$ ):

| Test Item          | Symbol | Test Conditions    | Criteria for Judgment      |                           |
|--------------------|--------|--------------------|----------------------------|---------------------------|
|                    |        |                    | Min.                       | Max.                      |
| Luminous Intensity | $I_V$  | $I_F=20\text{ mA}$ | $\text{LSL} \times 0.5$ ** |                           |
| Forward Voltage    | $V_F$  | $I_F=20\text{ mA}$ |                            | $\text{USL} \times 1.1$ * |

(\*) USL : Upper Standard Level , (\*\*) LSL : Lower Standard Level

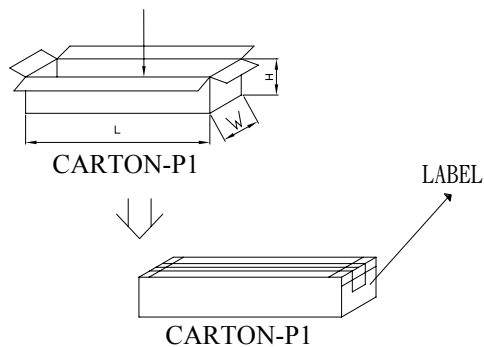
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## Shipment Package

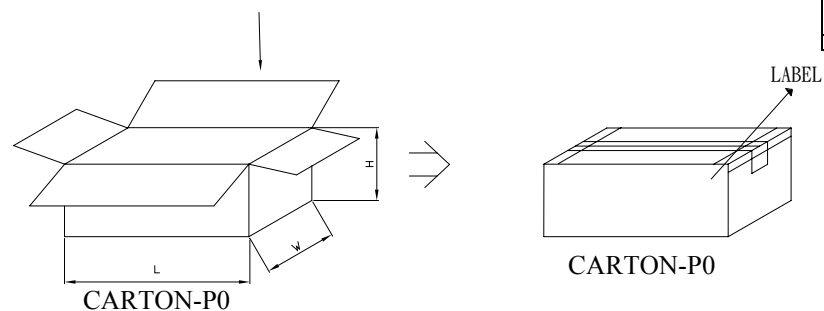


|                  |
|------------------|
| 506-PVC TUB-EO   |
| (60PCS/PER TUBE) |

|                    |
|--------------------|
| 506-CARTON-P1      |
| H : 72mm           |
| L : 492mm          |
| W : 100mm          |
| 3000PCS/PER CARTON |



|                   |
|-------------------|
| 506-CARTAN-P0     |
| H : 245mm         |
| L : 505mm         |
| W : 225mm         |
| 18KPCS/PER CARTON |



|  |          | <b>EXCELLENCE OPTO. INC.</b> |  |  |  |
|---------------------------------------------------------------------------------------|----------|------------------------------|--|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Customer                                                                              |          |                              |  |                                                                                       |                                                                                       |
| P.O.No                                                                                |          |                              |  |                                                                                       |                                                                                       |
| Part No.                                                                              | Bin Code | Q'ty(PCS)                    |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
|                                                                                       |          |                              |  |                                                                                       |                                                                                       |
| Total                                                                                 |          |                              |  |                                                                                       |                                                                                       |

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## Precaution of Application

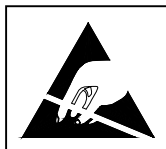
### 1. Circuit layout

Due to the forward voltage of LED will vary with temperature and its driving current, the current-limited protective circuit should be considered in the LED circuit design.

When LEDs are arrayed as parallel circuit, different inherent resistance of LED will cause unbalance current. The unbalanced driving current which exists in every parallel circuit may make LED to be driven at different power. Therefore, the LED driven at higher power may be damaged by over driving current, and the LED driven at lower power may be dimmer than the others.

To solve this situation, a suitable resistor is recommended to put in series with each LED circuit. The resistor will limit and balance the driving current which flows through every parallel circuits.

### 2. Electric Static Discharge (ESD) Protection



All kinds of LED materials, such as GaP, AlGaAs, AlInGaP, GaN, or InGaN chips, are STATIC SENSITIVE device. ESD protection or surge voltages shall be considered and taken care in the initial design stage, and whole production process.

The following protection is recommended:

- (1) A wrist band or an anti-electrostatic glove shall be used when handling the LEDs
- (2) All devices, equipment and machinery must be properly grounded

If LED is damaged by ESD or surge voltage, damaged LED may show some unusual characteristics. It may appear leakage current, and LED does not emit at low current.

And when using microscope to inspect damaged LED chip at low driving current, it may have some black dots within the emitting area.

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### 3. Lead Forming

The leads should not be bent at the point of 3mm or below 3mm from the base of the epoxy bulb while forming the leads. It's recommended to cut or form the lead by tooling made rather than by hand operation.

Do not apply any bending stress to the base of the lead, and don't cause any stress after mounting the LED lamp on PCB. The stress to the base may damage the LED's characteristics, or cause deterioration of the epoxy resin. This will hurt and degrade the LEDs.

### 4. Storage

It's recommended to store the products in the following conditions:

(1) Shelf life in sealed bag: 12 months at  $T_A < 40^\circ\text{C}$  and Hum.  $< 30\%\text{RH}$ .

(2) After the package bag is opened and kept in the following environment, the LED products should be used completely as soon as possible:

Humidity (Hum.) : 60%RH Max.

Temperature ( $T_A$ ) :  $5^\circ\text{C} \sim 30^\circ\text{C}$  (  $41^\circ\text{F} \sim 86^\circ\text{F}$  )

Assembly duration : within 72 hours, after bag is opened.

If the some of LED are not used, they need to be kept at Hum.  $\leq 20\%\text{RH}$  in zip-locked sealed bags.

Although the leads of LED lamp is platted with pure tin to protect leads from corrosion, devices should be subjected to wave soldering, or equivalent process as soon as possible, after the bag is opened.

Please avoid rapid transitions in ambient temperature, especially in high humidity environment where condensation can occur.

### 5. Soldering

Soldering heat may damage the LED. Careful attention should be paid during soldering process and PCB assembly. In order to eliminate the stress of heat shock, please solder the LEDs no close than 3mm form the base of the epoxy bulb.

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Recommended soldering condition:

|                      | Wave Soldering | Manual Solder Dipping | Hand soldering by iron |
|----------------------|----------------|-----------------------|------------------------|
| Pre-heat Temperature | 105°C Max.     | -                     |                        |
| Pre-heat Time        | 30sec Max.     | -                     |                        |
| Peak Temperature     | 250°C Max.     | 260°C Max.            | 350°C Max.             |
| Dwell Time           | 3sec Max.      | 5sec Max.             | 3sec Max.              |

Never take next process until the component is cooled down to room temperature after soldering. It's banned to load any stress on the resin during soldering. If it's necessary to clamp the LED bulbs to help soldering, it is important to minimize the mechanical stress on the LEDs.

The manual soldering process is not recommended for quality consideration. When it is absolutely necessary, the LEDs may be mounted in this fashion but the user will assume responsibility for any problems.

### 6. Cleaning

An alcohol-based solvent such as isopropyl alcohol (IPA) is recommended to clean the LED bulbs, after soldering process, if cleaning is necessary. Before cleaning, a pre-test should be done to confirm whether any damage to the LEDs will occur.

It is not recommended to use unspecified chemical liquids as cleaning material for cleaning the LED. It's also not recommended to use ultrasonic power to clean the LED device. The chemical and ultrasonic power could harm the LED devices.

### 7. Others

- (1) The light output of LED might injure human eyes, directly look at the LED without protection is prohibited.
- (2) LED lamp is very sensitive to heat. Thermal design of the end product will decide the performance of LED lamps. It's necessary to avoid intense heat generation and operate within the maximum ratings given in this specification.
- (3) Every piece of LED will be sorted and LEDs with the same binning grade will be taped into the same reel or put into the same bag. It is recommended to use the same bin-grade LED to assembly the unit module. This will ensure the LED unit module with good uniformity of brightness, hue, and so on.

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## Terms and Conditions

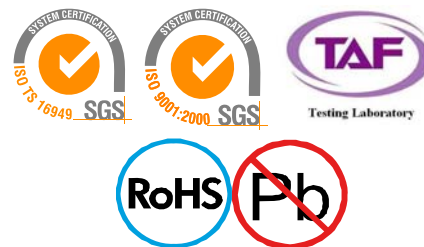
1. EOI warrants all sold LEDs which conform to the specifications approved by the customers.
2. Any LED supplied by EOI is found not conform to the specifications that both parties agreed upon, customer should claim within 90days of receipt. EOI will repair or replace the LEDs at EOI's option.
3. EOI will not hold any responsibility for the failed LEDs, which are caused by mishandling or misusing the LEDs exceeding the operating conditions that EOI suggested.
4. EOI's LED products are designed and manufactured for general electronic equipment (such as household appliances, communication equipment, office equipment, electronic instrumentation and so on). If customer's application requires exceptional quality or reliability, which might concern human safety, it is recommended to consult with EOI in advance.
5. All the information published is considered to be reliable. However, EOI does not assume any liability arising out of the application or use of any product described herein. EOI's liability for defective LED lamps shall only be limited to replacement, in no event shall EOI be liable for consequential damages or loss.
6. EOI and customer shall both confirm the specifications herein, and all quality related matters will base on the specifications both parties agreed upon.
7. Any modification of the design or manufacturing process taken place, which will affect the characteristics, performance or reliability of LED, customer's approval will be required.
8. This specification approval sheet is an agreement of shipment specification. Please sign it back and keep the copies in two parties. If customers don't sign it back, it is regarded as completely agree with the terms and conditions and also approve of this approval sheet.

## Company Information

### Headquarters

#### Excellence Opto. Inc.

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