Federal EC Series

3030 3W 80° Red Automotive Lighting

Datasheet

2FV003RX0080A001

Features :

- Package : ceramic
- Maximum drive current : 1,000 mA
- With an electrically isolated thermal pad structure
- Level 2a of JEDEC moisture sensitivity analysis
- Superior reliability performance and lifetime
- RoHS compliant

Typical Applications :

- Automotive lighting
- Rear fog lamps
- Warning lights
- Architecture Lighting

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General Information

Introduction

Federal 3030 is a surface mount, compact, high brightness LED that is built for various illumination needs. The small physical dimension can free customers from any constrains or limitations in these fields of applications. Furthermore, the reflow-solderable nature of Federal 3030 provides an easy path towards the optimum thermal management to achieve a promising reliability. In conclusion, Federal 3030 offers you an extraordinary LED experience.

Order Code Format

2	F	V0	03	RX	00	80	x	xxx
X1	X2	X3-X4	X5-X6	X7-X8	X9-X10	X11-X12	X13	X14-X16

X1 Type		X2 Emitter		X3-X4 Series		X5-X6 Wattage	
2	Emitter	F	Federal	V0	3030	03	3W

X7-X8 Color		X9-X10 Ra		X11-X12 View Angle		X13 Internal Code		X14-X16 Serial Number	
RX	Red	00	Single Color	80	80°	-	-	-	-

Package	Luminous Intensity, Iv [lm] IF = 350mA	Order Code
Federal 3030	70	2FV003RX0080A001

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Absolute Maximum Ratings

(T_J = 25°C)

Parameter	Symbol	Value	Units
DC Forward Current	I_F	1,000	mA
Reverse Voltage[1]	V_R	Note 1	V
LED Junction Temperature[2]	T_J	125	°C
LED Operating Temperature	-	-40 ~ +85	°C
LED Storage Temperature	-	-40 ~ +85	°C
HBM ESD Sensitivity (class 3B)	-	8	KV
Allowable Reflow Cycles	-	3	cycles
Soldering Temperature	-	260	°C

Notes:
1. LEDs are not designed to drive in reverse bias.
2. Proper current derating must be observed to maintain junction temperature below the maximum.

Characteristics

(I_F = 350mA;T_J = 25°C)

Parameter		Symbol	Value	Units
Forward Voltage	(Typ.)	V_F	1.9	V
Luminous Flux	(Typ.)	-	70	lm
Viewing Angle[1]	(Typ.)	$2\Theta_{1/2}$	80	Degree
Wavelength	(Typ.)	-	625	nm
JEDEC Moisture Sensitivity		-	Level 2a **Floor Life** Conditions: ≤30°C / 70% RH **Soak Requirements(Standard)** Time (hours): 168+5/-0 Conditions: 60°C / 30% RH	-

Note:
1. Tolerance of viewing angle: ±10%.

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Luminous Flux BIN Codes

(I_F = 350mA ; T_J = 25°C)

Color	Code	Min. (lm)	Max. (lm)	Order Code
Red	RC	60	75	2FV003RX0080A001
	RD	75	90	
	RE	90	105	

Note:
The luminous flux performance is guaranteed within published operating conditions. Edison Opto maintains a tolerance of ±10% on flux measurements.

Wavelength BIN Code

(I_F = 350mA ; T_J = 25°C)

Color	Code	Min. Wd (nm)	Max. Wd (nm)
Red	RX0	619	630

Note:
Dominant wavelengh measurement allowance is ± 1nm.

Voltage BIN Codes

(I_F = 350mA ; T_J = 25°C)

Code	Min. Voltage (V)	Max. Voltage (V)
R02	1.9	2.1
R03	2.1	2.3

Note:
Forward voltage measurement allowance is ± 0.06V.

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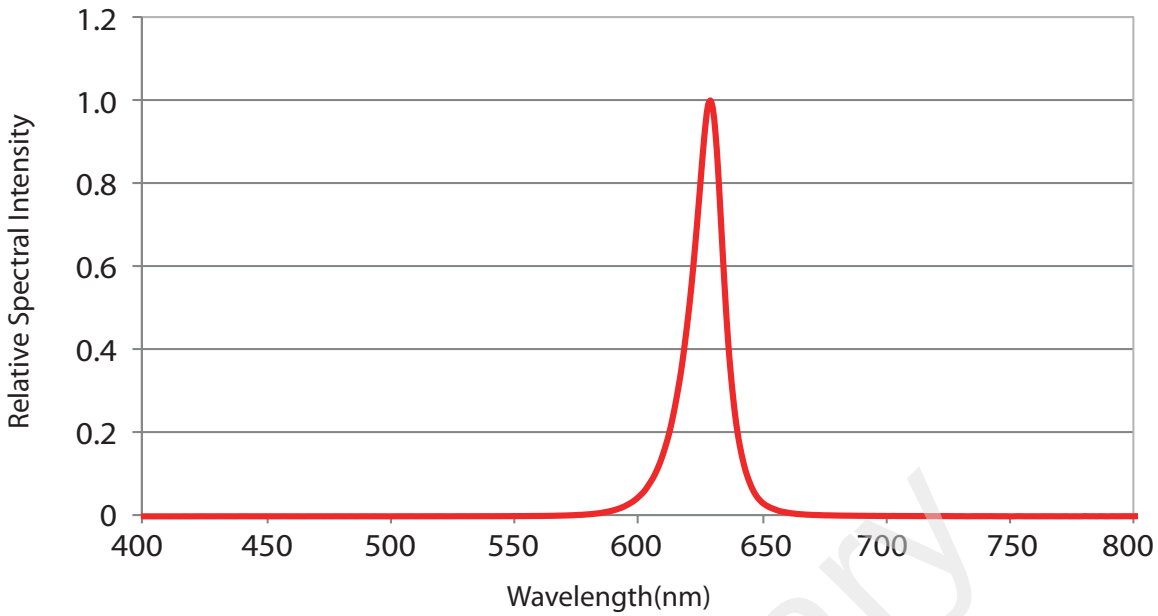
Characteristic Curve

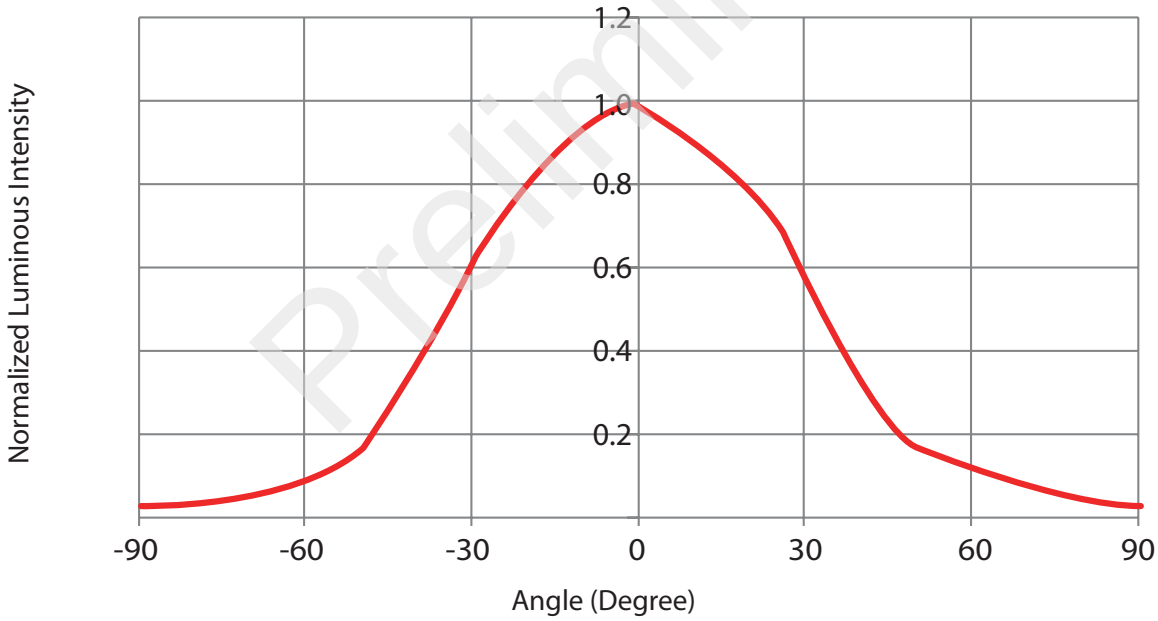
Color Spectrum

($I_{rel} = f(\lambda)$; $I_F = 350mA$; $T_J = 25°C$)



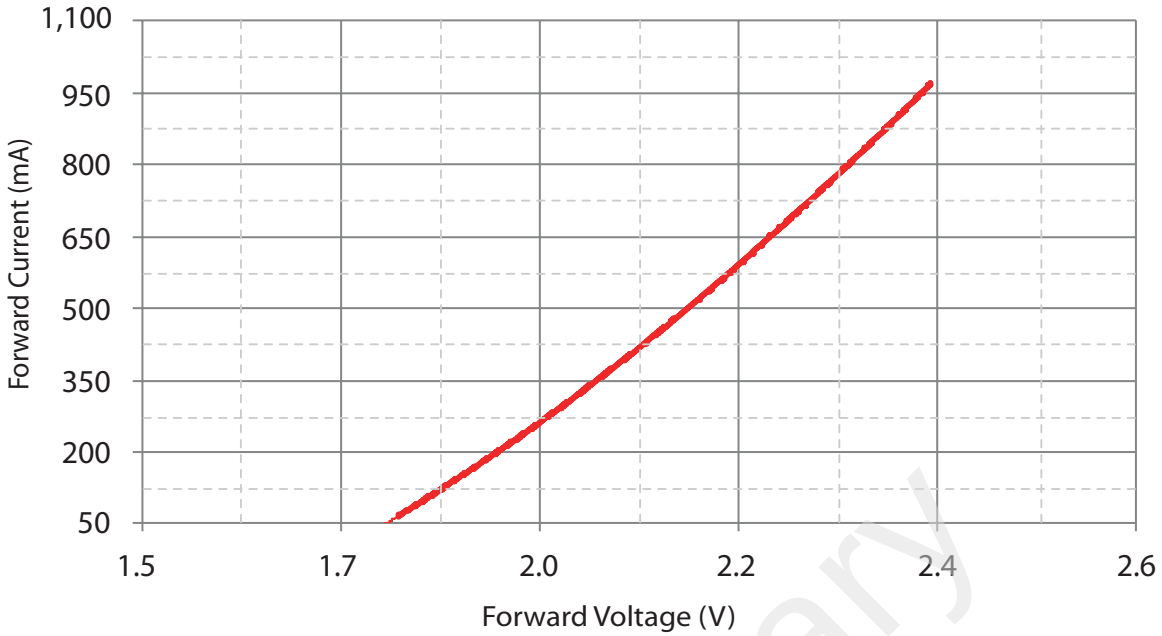
Beam Pattern

($I_F = 350mA$; $T_J = 25°C$)



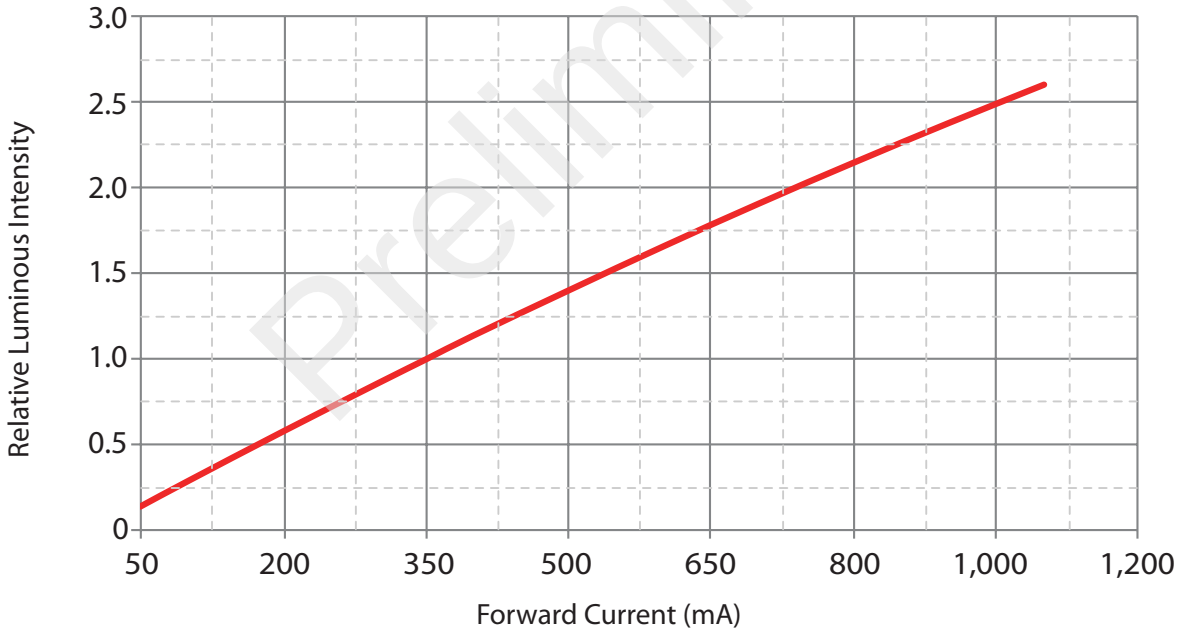
Forward Current vs. Forward Voltage

($I_F = f(V_F)$; $T_J = 25°C$)



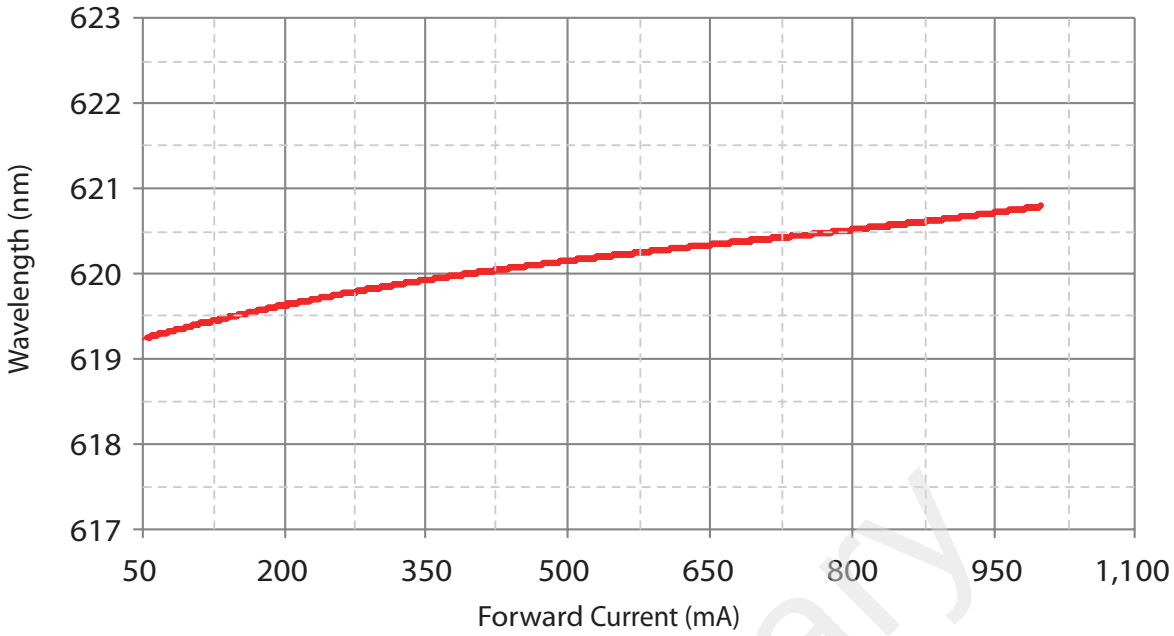
Relative Luminous Intensity vs. Forward Current

($IV/IV(350mA) = f(I_F)$; $T_J = 25°C$)



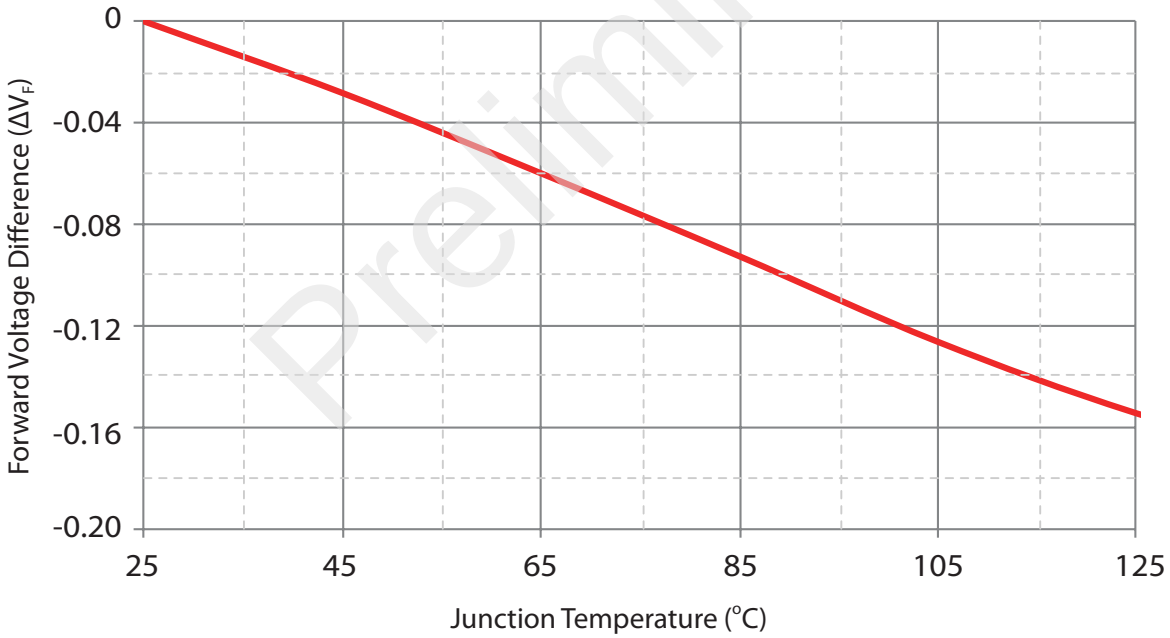
Wavelength vs. Forward Current

($W_D = f(I_F)$; T_J = 25°C)



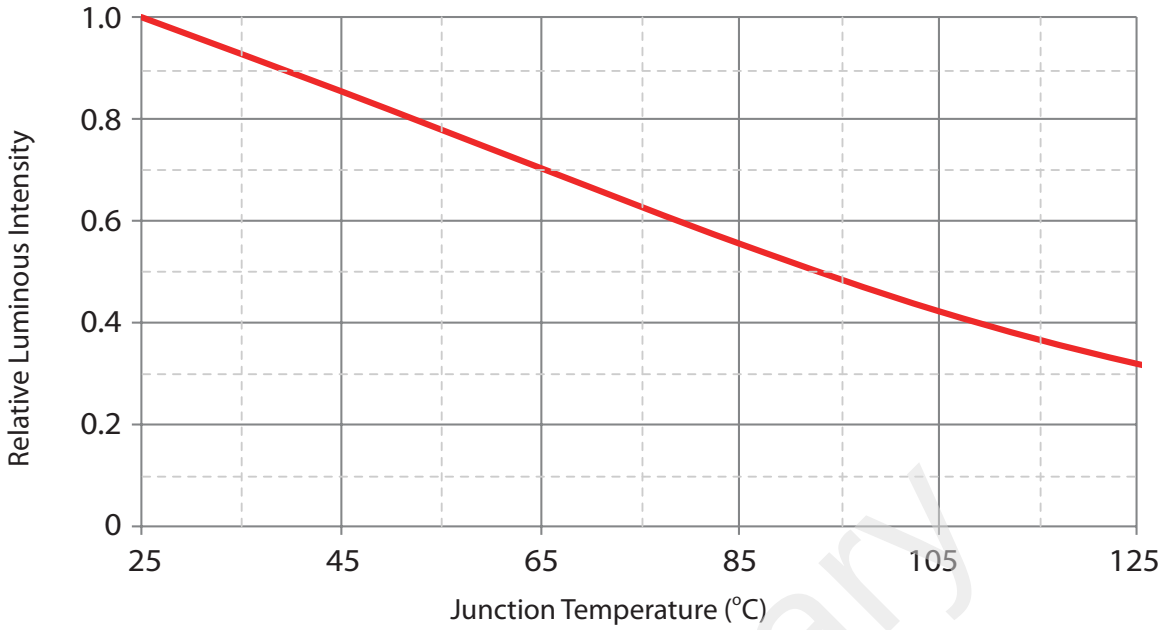
Forward Voltage Difference vs. Junction Temperature

($\Delta V_F = V_F - V_F(25^oC) = f(T_J)$; I_F=350mA)



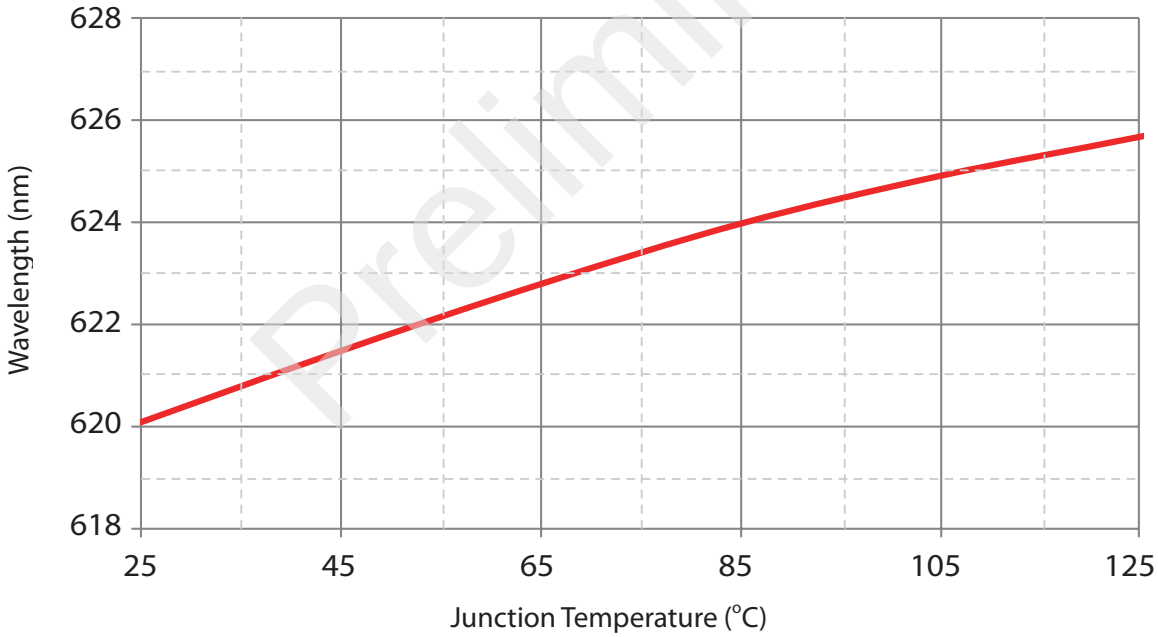
Relative Luminous Intensity vs. Junction Temperature

(IV/IV(25°C) = f(T_J) ; I_F = 350mA)



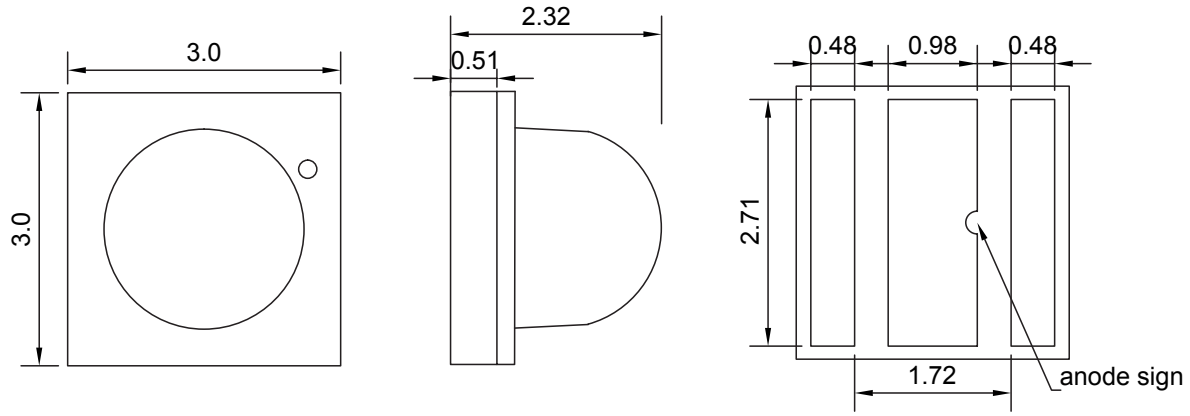
Wavelength vs. Junction Temperature

(W_D = f(T_J) ; I_F = 350mA)



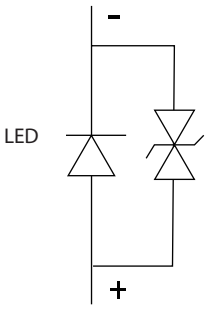
Mechanical Dimensions

Component

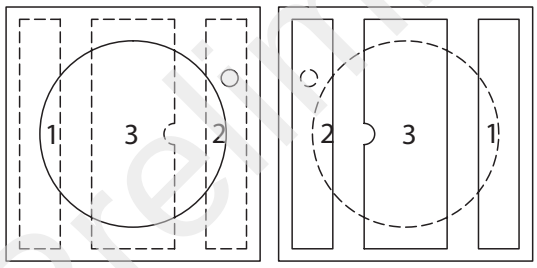


Note :
1. Unless otherwise specified tolerance: ±0.20.
2. Unit: mm.
3. Drawings are not to scale.

Circuit



Ceramic Layout



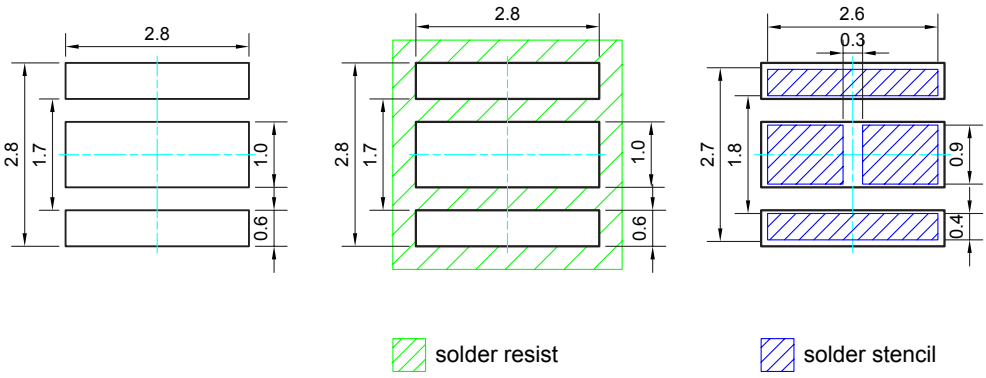
Top View Bottom View

Pad Configuration

Pad	Function
1	Cathode
2	Anode
3	Thermal

Note :
The thermal pad is electrically isolated from anode and cathode.

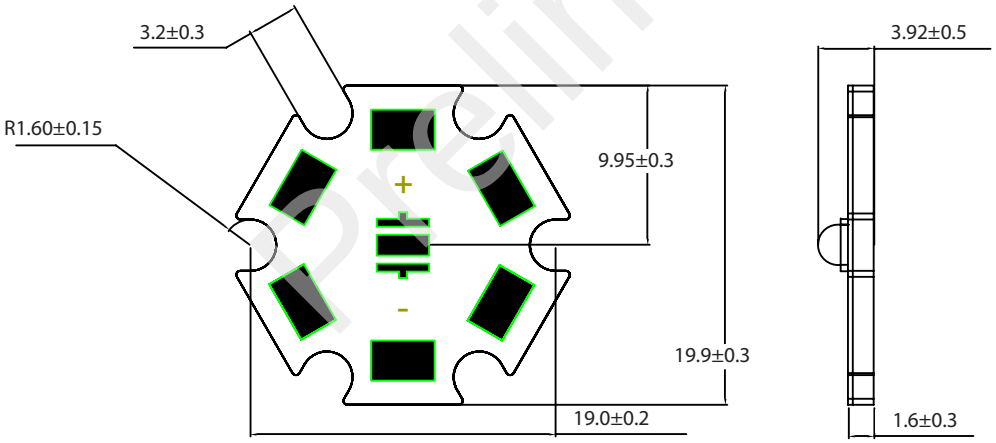
Recommended Solder Pad



Notes:
1. Unit: mm.
2. Drawings are not to scale.

Recommended PCB

Recommended Star PCB



Notes:
1. Unit: mm.
2. Drawings are not to scale.

Lighting Design Manufacturing Service

Handling Manual

1. Do not press the product; even a slight pressure may damage the product.

2. Should flock, dirt and flux appear on the surface of LED component (silicone lens), cotton swabs dipped in a slight amount of IPA can be used to clean the component surface (no water, oil, organic solvent can be used) and awareness must be implemented on whether or not there is residual flock. In addition, no ultrasonic wave can be used to clean the component, so internal damage to the component can be prevented.

3. When manually handling the LED, please use the plastic tweezers instead of the metal one. Avoid contacting to the silicon lens structure which will cause damage to the package.

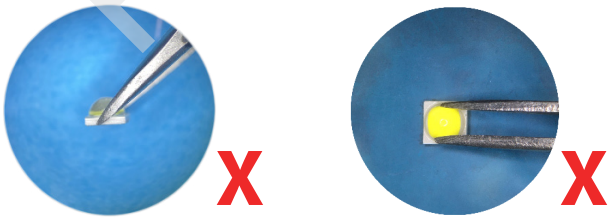
4. Do not use adhesives or dissipation paste to attach the LED that outgas organic vapor.

5. Do not use any product with materials containing sulfur.

6. Do not assemble in humid environment or the conditions of containing oxidizing gas such as Cl, H2S, NH3, SO2, NOX, etc.

• Plastic Tweezers

• Metal Tweezers



Thermal Management

A high temperature operation condition always easily causes the decrease of flux and the decay of LED dies. The highest operation temperature of a component is able to be found by the indication of junction temperature in its datasheet. The power dissipation ability, the ambient temperature of LED junction, environment, thermal path and its thermal resistance are the main parameters which affect the performance of a LED device. Therefore, the limitation of junction temperature has become an important issue when designing a LED product.

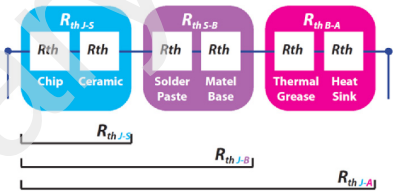
The following paragraphs describe how to determine the junction temperature and a simple ideal to heat sink design.

Thermal resistance is the temperature difference across a structure when a unit of heat energy flows through in unit time. For LEDs, temperature difference presents the temperature between a die's PN junction and package substrate. For the same package structure and operating condition, the smaller thermal resistance a LED has, the lower temperature of this LED. With lower operation temperature, a LED would keep its original performance for longer.

By estimating the PN junction temperature, users may be aware that the thermal management had been well designed.

From basic thermal equation for thermal resistance : $Rth_{(J-A)} = \frac{\Delta T_{(J-A)}}{P_D}$

Therefore the junction temperature (T_J) is : $T_J = T_A + Rth_{(J-A)} \times PD$

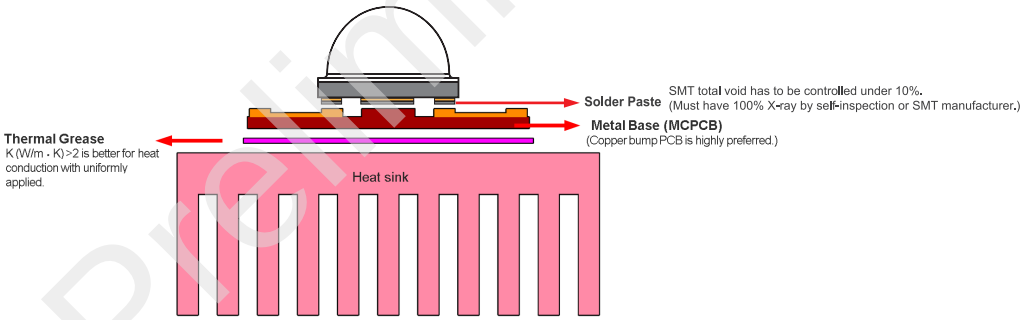


which,

P_D : Power Dissipation = Forward Voltage (V_F) x Forward Current (I_F)

T_A : Ambient Temperature (assume 25°C)

$Rth_{(J-A)}$: Total Thermal Resistance = $Rth_{(J-S)} + Rth_{(S-B)} + Rth_{(B-A)}$



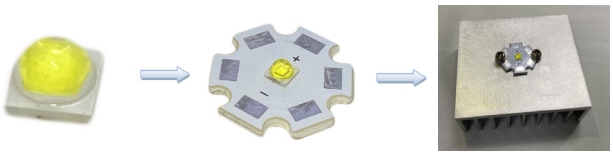
*During lighting design, the temperature T_J upon overall thermal stability shall be ensured not to exceed 125°C and the operating current may not exceed the nominal value.

**While using the LED product, the overall structure for thermal conductivity shall be considered, so uneven paths for thermal conduction or radiator temperature that speeds up product failure can be prevented.

*** The limited temperature of phosphor surface is measured by infrared thermal imaging camera. (It must be specifically stated that the surface temperature of phosphor glass will be easily affected by the machine models and testing methods, tolerance might come with different resolution between cameras which need to be taken into consideration.)

Tips for Thermal Management

Federal products (e.g: 3W) are not recommended to be operating without a heat sink. Through MCPCB, users may realize better performance.



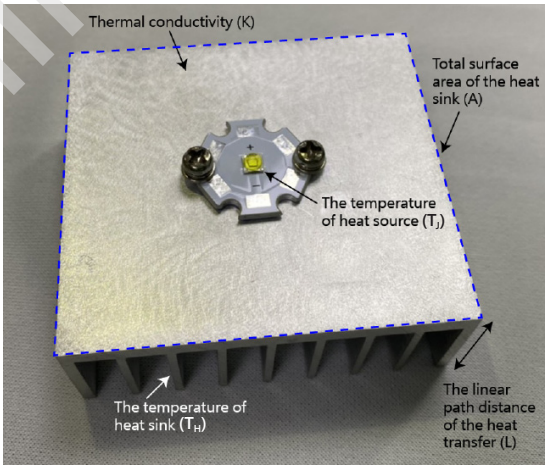
For LEDs, choose an appropriate operation environment and conduct the heat to the air after light on LEDs may maintain the better performance and lifetime. Four major thermal path are as follow:
From heat source (component) to heat sink. (By conduction)
Conduction within the heat sink to its surface. (By conduction)
Transfer from the surface to the surrounding air. (By convection)
Emit heat from the heat sink surface. (By Radiation)

Path1 : The contact surface of the MCPCB and heat sink are not perfectly flat, they are not able to meet each other completely. Air between these two materials will result in high thermal resistance and reduce the effect of heat transfer. To enhance the ability of thermal conduction, one common method is applying thermal grease between the two interfaces and uses the screws to enforce the adhesion between two surfaces.

Path2 : Temperature gradient depends on the time of a heat sink. The total heat flux (Q) consists of:
1. The temperature difference between heat source (T_J) and heat sink (T_H)
2. Thermal conductivity (K) of the heat sink
3. Total surface area of the heat sink (A)
4. The linear path distance of the heat transfer (L)

This is represented by the Fourier's Law as follow:

$$Q = K \times A \times \frac{\Delta T}{L}$$



By choosing a higher thermal conductivity, increasing the surface area of the heat sink (add the number of fins) or shorten the distance of the linear path of heat dissipation may improve the loss of heat flux per unit time. Among all materials, metal is the best choice because of its high thermal conductivity.

List of thermal conductivity for some usual materials

Material	K(W/m·K)
Copper	391
C1100	384
Aluminum	230
5000 Series	225
ADC-12	96.2
Magnesium	156
Air	0.024

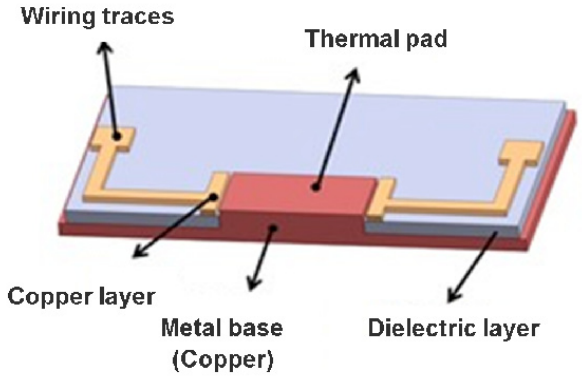
Path3 : Heat dissipation includes convection and radiation. Those two types of transfer are proportional to the surface area of the heat sink. Adding the number of fin may increase the total surface area. However, too many fins may cause inhabitation of convection. There are many other thermal management methods such as install a fan to reach obliged convection. But this design may cause the issues such as noise or circuit design problem.

Path4 : Compare with an unfinished heat sink, the one that covered by high emissivity material, such as ceramic powder or deep color paint, usually has better radiation ability. Both anodizing and etching are also effective to increase the thermal dissipation.

Key points for thermal management:
1. The contact surface's flatness and smoothness of the component and heat sink.
2. The total surface area of heat sink.
3. The selection of heat sink material.
4. Optimum number of fins. (Aerodynamic optimization)

Recommended PCB Design

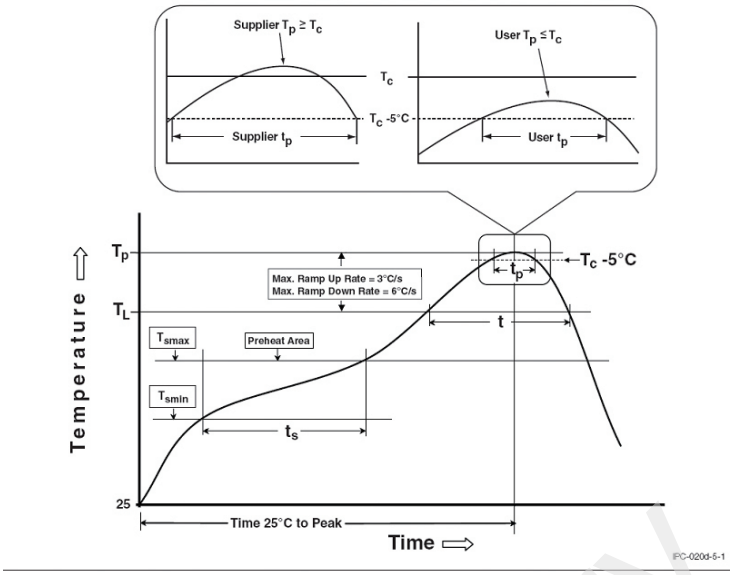
The PCB design can affect the thermal performance of the end product. In order to reduce the thermal resistance of PCB, heat must transfer through metal without dielectric layer. The figure below shows the cross-section of PCB.



Lighting Design Manufacturing Service

Reflow Profile

The following reflow profile is from IPC/JEDEC J-STD-020D which provided here for reference.



Reflow Profiles

Classification Reflow Profiles

Profile Feature	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax) (ts)	 150 °C 200 °C 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3 °C/second max.
Liquidous temperature (TL) Time at liquidous (tL)	217 °C 60-150 seconds
Peak package body temperature (Tp)*	255 °C ~260 °C *
Classification temperature (Tc)	260 °C
Time (tp)** within 5 °C of the specified classification temperature (Tc)	30** seconds
Average ramp-down rate (Tp to Tsmax)	6°C/second max.

Notes:

1. Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum.

2. Tolerance for peak profile temperature (Tp) is defined as a supplier minimum and a user maximum.

3. Maximum temperature of SMT process must be under 300°C, and the duration at 300°C must be within 10 seconds.

4. Prior to the SMT process, the LED component shall be confirmed whether or not there is damping, so that any product failure caused during the SMT process can be prevented. (For more conditions and details of product storage, please refer to the information of product storage).

5. This LED component is applicable for reflow profile onto the PCB board. We will not guarantee the reliability if other methods are implemented.

6. The reflow process of LED component shall not exceed three times.

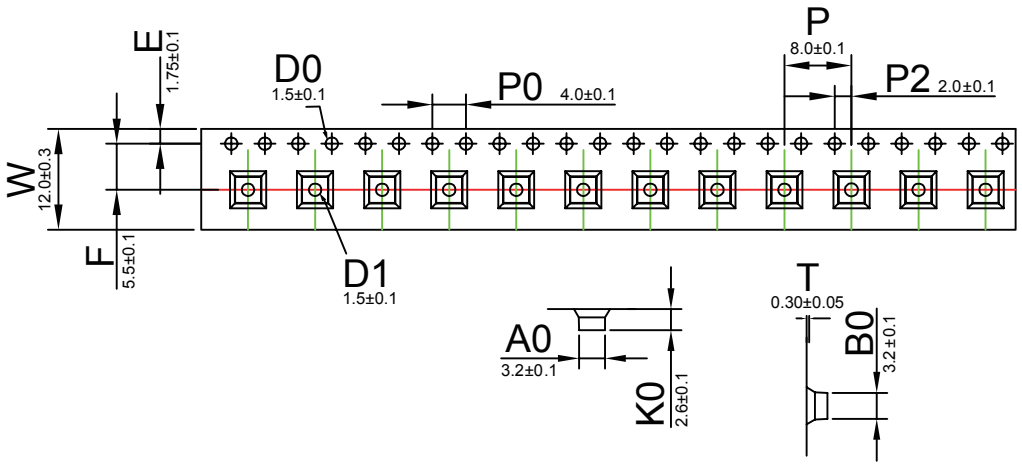
7. Should the LED product require second soldering, the re-work must be implemented with a hot plate. Moreover, the LED product shall be confirmed with well characteristics prior to usage.

8. Should flock, dirt and flux appear on the surface of LED component (silicone lens), cotton swabs dipped in a slight amount of IPA can be used to clean the component surface (no water, oil, organic solvent can be used) and awareness must be implemented on whether or not there is residual flock. In addition, no ultrasonic wave can be used to clean the component, so internal damage to the component can be prevented.

Lighting Design Manufacturing Service

Product Packaging Information

Tapping

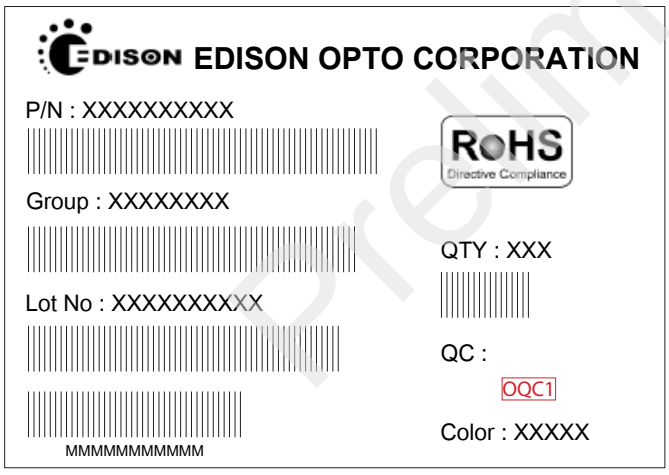


Notes:
1. Unit: mm.
2. Tolerance (unless otherwise specified): ±0.10mm.
3. Drawings are not to scale.

A0	B0	K0	P0	P	P2
3.2±0.1	3.2±0.1	2.6±0.1	4.0±0.1	8.0±0.1	2.0±0.1

W	T	E	F	D0	D1
12.0±0.3	0.30±0.05	1.75±0.1	5.5±0.1	Φ1.5±0.1	Φ1.5±0.1

Product Label



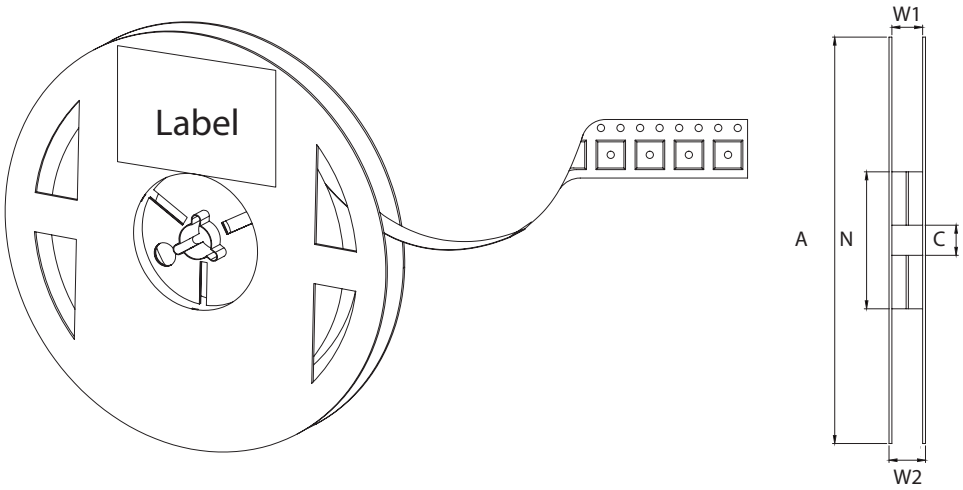
Label information
P/N : Order Code
Group : Bin Group
Lot No : Lot Number
QTY : Packing Quantity

Bin Group Format

XX	XXX	XXX
X1-X2	X3-X5	X6-X8
Luminous Flux Bin Codes	Wavelength BIN Code	Voltage Bin Codes

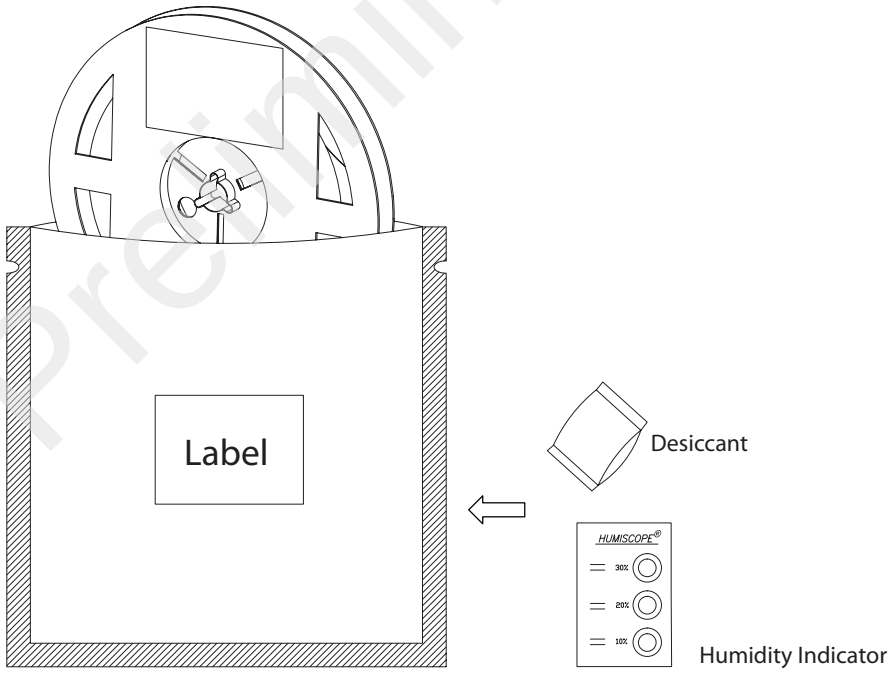
Tape and Reel

Notes:
1. Unit: mm.
2. Drawings are not to scale.



A	C	N	W1	W2	Pieces per Reel
178±1	13.9±0.5	60±0.5	12.5±0.5	13.5+0.5	≦800
Starting with 100pcs empty, and 50pcs empty at the last.					

Static Bag



Storage Information

Conditions	Temperature	Humidity	Time	Remarks
Aluminum foil bag (sealed)	5~30°C	≤90%	Within 1 year from delivery date	The aluminum foil bag is sealed with maintained integrity and there is no sign of vacuum relief.
Aluminum foil bag (unsealed)	5~30°C	≤60%		The environmental conditions for storage shall be monitored.

1. After the aluminum foil bag gets unsealed over a year or discoloration of the drying agents occurs, re-baking is required (preventing ambient temperature and moisture from affecting quality of the components and mounted piece). The entire roll of carrier tape shall be placed into the oven horizontally.
2. The storage environment shall be kept tidy and the environmental conditions for storage shall be monitored.
3. Long time exposure to sunlight or UV should be avoided; otherwise, it may cause the discoloration of materials.
4. The assembled PCB modules may not be stacked together, so broken packaging seal or internal failure of LED can be prevented.
5. Should the moisture card discolor after unsealing (possible vacuum relief to the packaging), the baking of the component is required for preventing impact on the product quality. (With reference to the baking treatment should be performed after unsealing and based on the following condition: 65±5°C for 24 hours or above).
6. Be aware of the storage equipment (i.e., damp-proof cabinet), production environment or ESD protection for the operator. Prevent the component from ESD shock that may cause product failure.

   A. The personnel acquiring the LED component shall be equipped with anti-static bracelet, anti-static shoes, clean-room clothing (bracelet) and earth connection.
   B. The storage equipment (i.e., damp-proof cabinet) where the LED component is placed shall be ensured with an earth connection.
   C. The working area shall be provided with an anti-static desk (earth connection required) and anti-static fans.
   D. After suffering ESD damage, the LED component would cause quality abnormalities such as electrical leakage of the product (Ir), reduction in starting voltage or abnormal lumen decay.

Lighting Design Manufacturing Service

Revision History

Versions	Description	Release Date
0.1	New release	2022/08/04
0.2	Revise the range of bin codes	2022/09/22
0.3	Revise the name of bin codes	2022/12/23
0.4	Revise down the LED amount per reel and modify the empty length from the start of the carrier	2023/06/14

About Edison Opto

Edison Opto is a leading manufacturer of high power LED and a solution provider experienced in LDMS. LDMS is an integrated program derived from the four essential technologies in LED lighting applications- Thermal Management, Electrical Scheme, Mechanical Refinement, Optical Optimization, to provide customer with various LED components and modules. More Information about the company and our products can be found at www.edison-opto.com

www.edison-opto.com

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