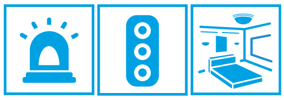
Federal LC Series Datasheet (EN)

Federal 3535 3W Blue

2FX003BX00F02008
2FX001BX00F02001



Features:

- High lumen performance
- High efficiency package
- Standard 3535 package with existing design
- Level 1 on JEDEC moisture sensitivity analysis
- Maximum driving current: 700mA
- RoHS compliant

Typical Applications:

- Portable camera-phone
- Digital compact camera
- Personal digital assistant
- Caution lights

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General Information

Introduction

Federal 3535 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 3535 provides an easy path towards the optimum thermal management to achieve a promising reliability. In conclusion, Federal 3535 offers you an extraordinary LED experience.

Order Code Format

2	F	X0	03	BX	xx	F02	xxx
X1	X2	X3	X4	X5	X6	X7	X8

X1		X2		X3		X4		X5	
Type		Component		Series		Wattage		Color	
2	Emitter	F	Federal	X0	3535	01	1W	BX	Blue
						03	3W		

X6		X7		X8	
Internal code		PCB Board		Serial Number	
-	-	F02	3535	-	-

Absolute Maximum Ratings

(T_J = 25°C)

Parameter	Symbol	Value	Units
DC Forward Current[1]	I_F	700	mA
Reverse Voltage[2]	V_R	Note 2	V
LED Junction Temperature	T_J	125	°C
Operating Temperature	-	-40 ~ +85	°C
Storage Temperature	-	-40 ~ +85	°C
ESD Sensitivity (HBM)	-	8	KV
Allowable Reflow Cycles	-	3	Cycles
Soldering Temperature	-	260	°C

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

Characteristics

(I_F = 350mA ; T_J = 25°C)

Parameter	Symbol	Value	Units
Viewing Angle (typ.)	$2\Theta_{1/2}$	115	Degree
Thermal Resistance (typ.)	R_{th}	4	°C/W
Wavelength	-	460~480	nm
JEDEC Moisture Sensitivity	-	Level 1 **Floor Life** Conditions: ≤30˚C / 85% RH **Soak Requirements(Standard)** Time (hours): 168+5/-0 Conditions: 85˚C / 85% RH	-

Notes:
1. Edison maintains a tolerance of ±1nm on wavelength measurement.
2. Viewing angle is measured with accuracy of ±10%.

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Luminous Flux Bin Codes

($T_J = 25°C$)

Code	Luminous Flux @350mA (lm)		Luminous Flux @700mA (lm)		Order Code
	min	max	min	max	
BA	15	30	25.0	50.5	2FX003BX00F02008
BB	30	45	50.5	75.5	
N0	17.9	23.3	29.5	38.5	2FX001BX00F02001
P0	23.3	30.3	38.5	50	
Q0	30.3	39.4	50	65.5	

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

Forward Voltage Bin Codes

($I_F = 350mA$; $T_J = 25°C$)

Code	(Min.) Forward Voltage (V)	(Max.) Forward Voltage (V)	Order Code
V00	2.5	2.8	2FX003BX00F02008 2FX001BX00F02001
V01	2.8	3.1	
V02	3.1	3.4	
V03	3.4	3.7	

Note:
Forward voltage measurement allowance is ±0.06V.

Wavelength Bin Codes

($I_F = 350mA$; $T_J = 25°C$)

Code	(Min.) Domain Wavelength [nm]	(Max.) Domain Wavelength [nm]	Order Code
BY0	470	475	2FX003BX00F02008
BZ0	475	480	
BW0	460	465	2FX001BX00F02001
BX0	465	470	

Note :
Dominant wavelengh measurement allowance is ± 1nm.

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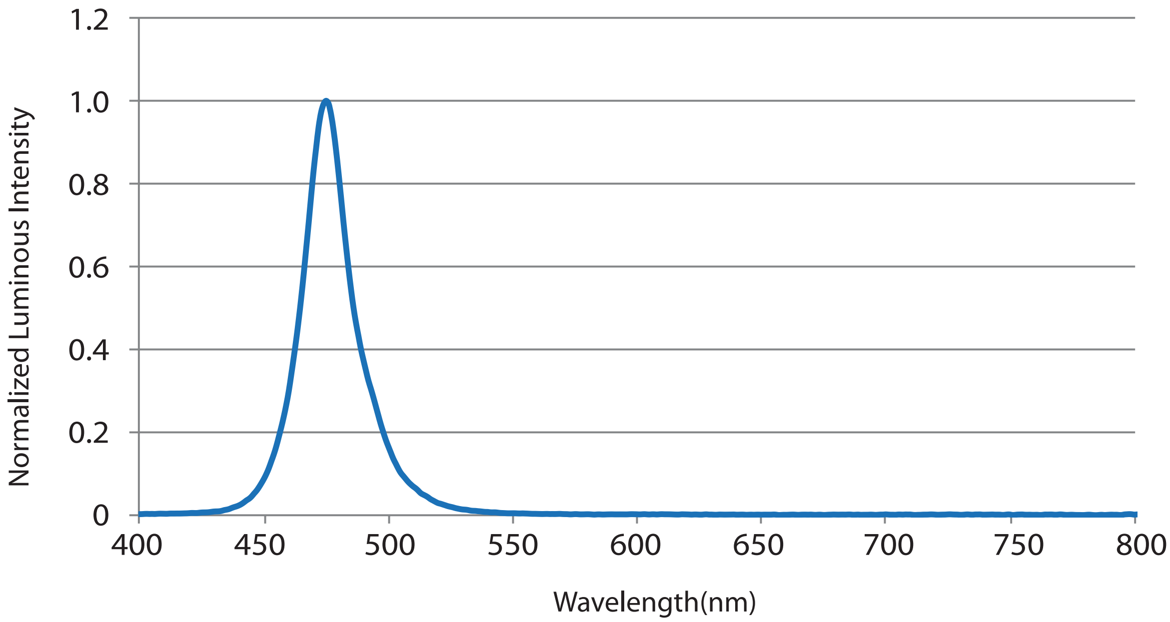
Characteristic Curves

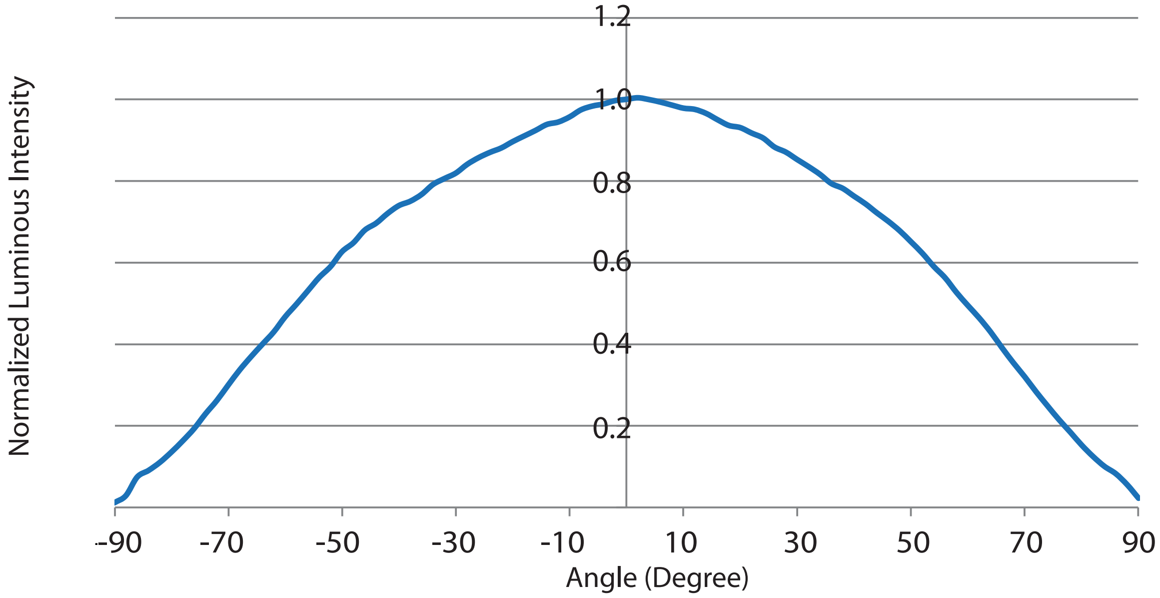
Color Spectrum

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



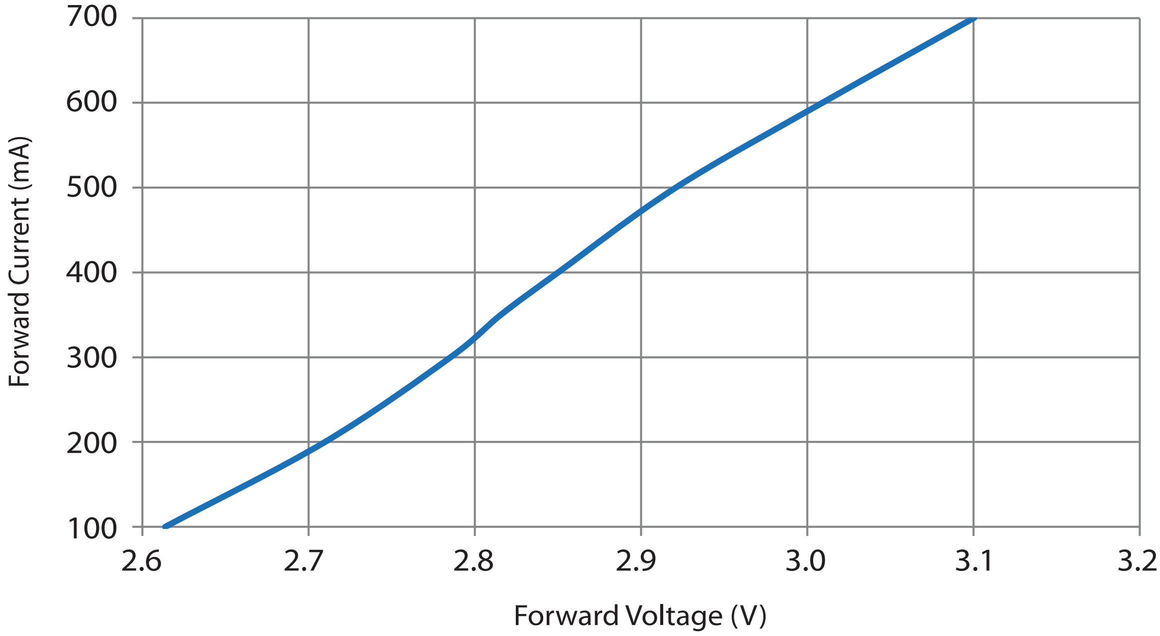
Beam Pattern

(I_F = 350mA ; T_J = 25°C)



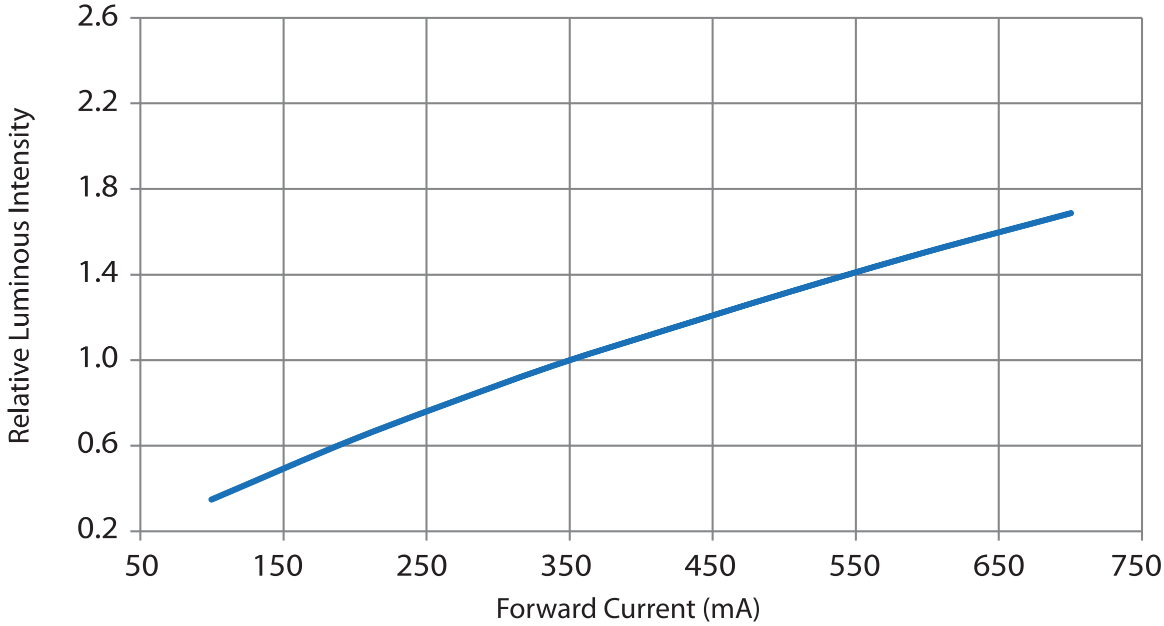
Forward Current vs. Forward Voltage

($I_F = f(V_F)$; $T_J = 25°C$)



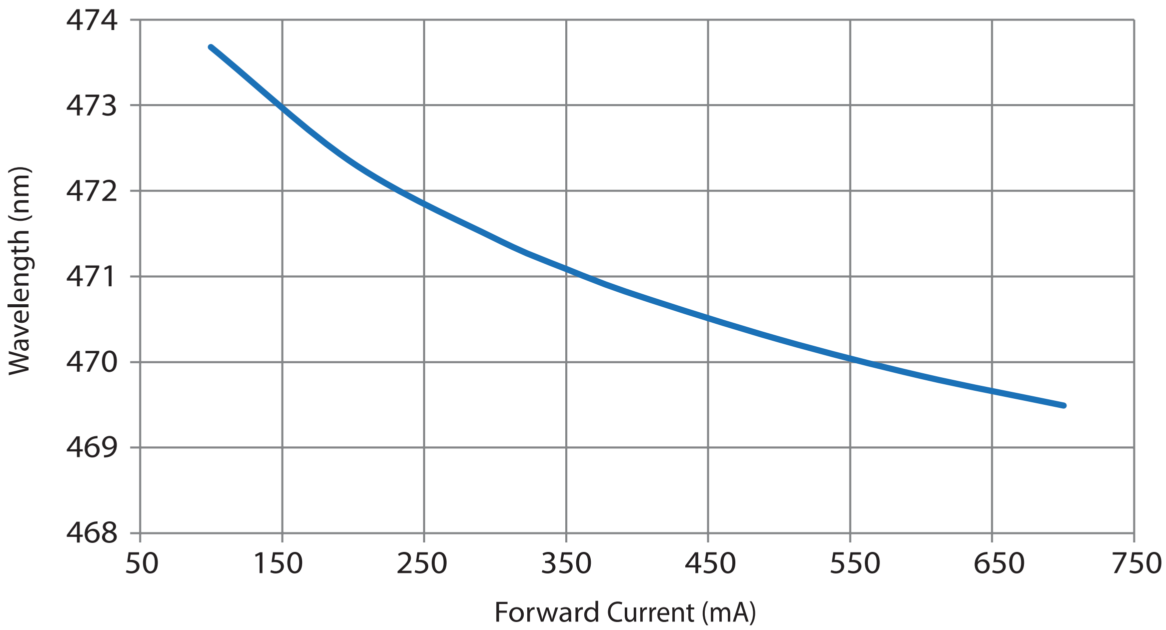
Relative Luminous Intensity vs. Forward Current

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



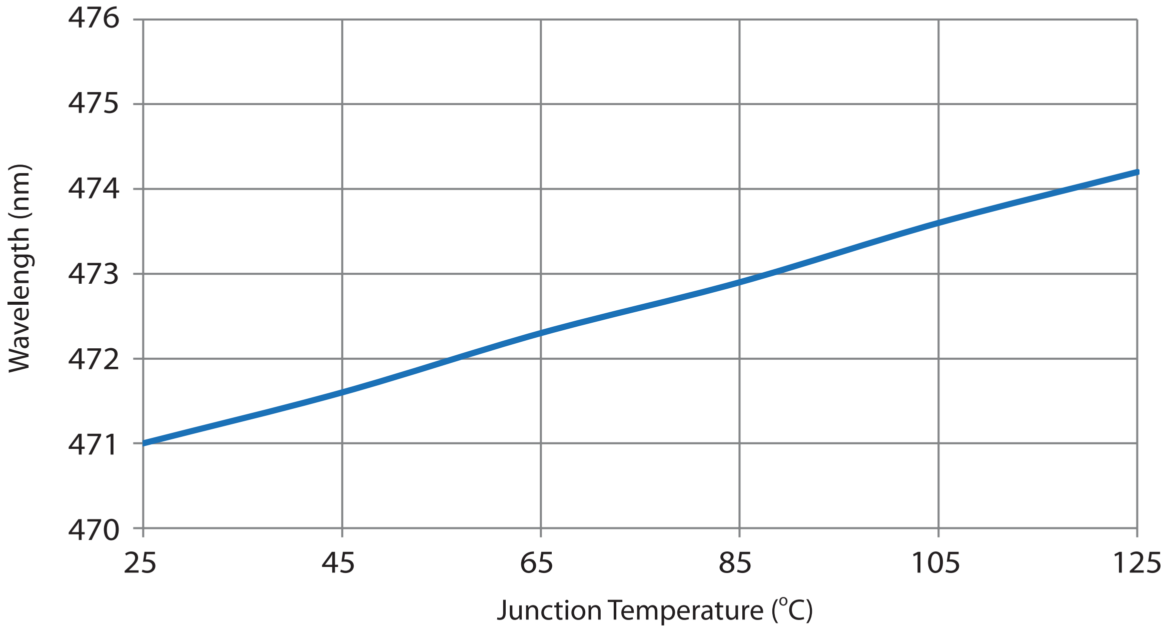
Wavelength vs. Forward Current

(T_J = 25°C)



Wavelength vs. Junction Temperature

(I_F = 350mA)



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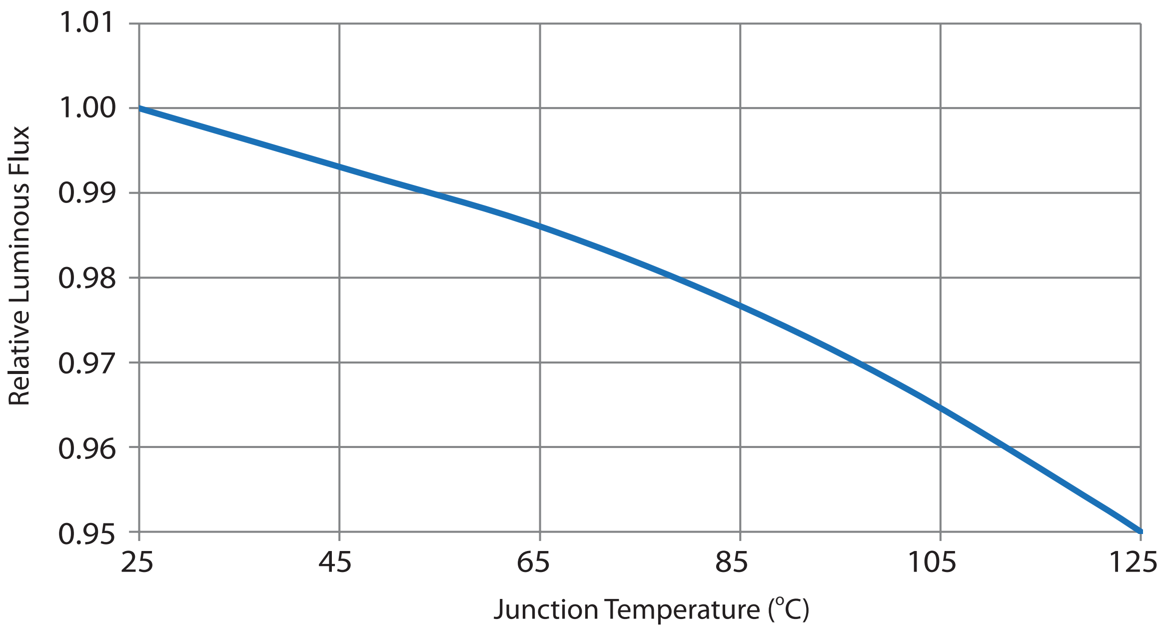
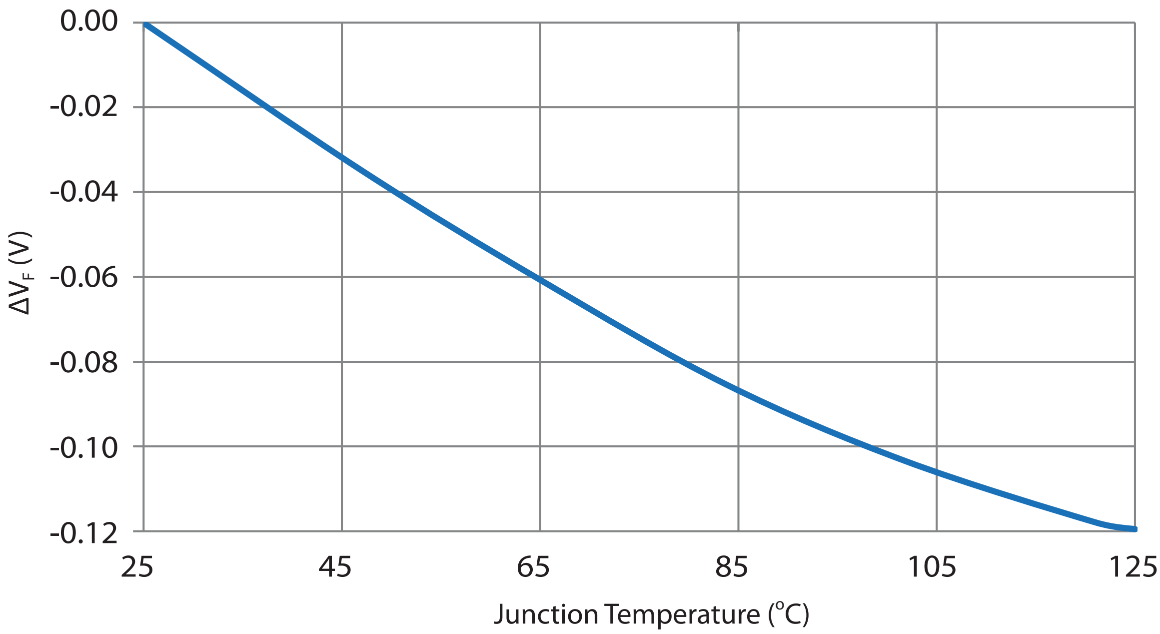
Relative Luminous Flux vs. Junction Temperature

(IV/IV(25°C) = f(T_J) ; I_F = 350mA)



Forward Voltage vs. Junction Temperature

(ΔV_F=V_F-V_F(25°C)= f(T_J) ; I_F=350mA)



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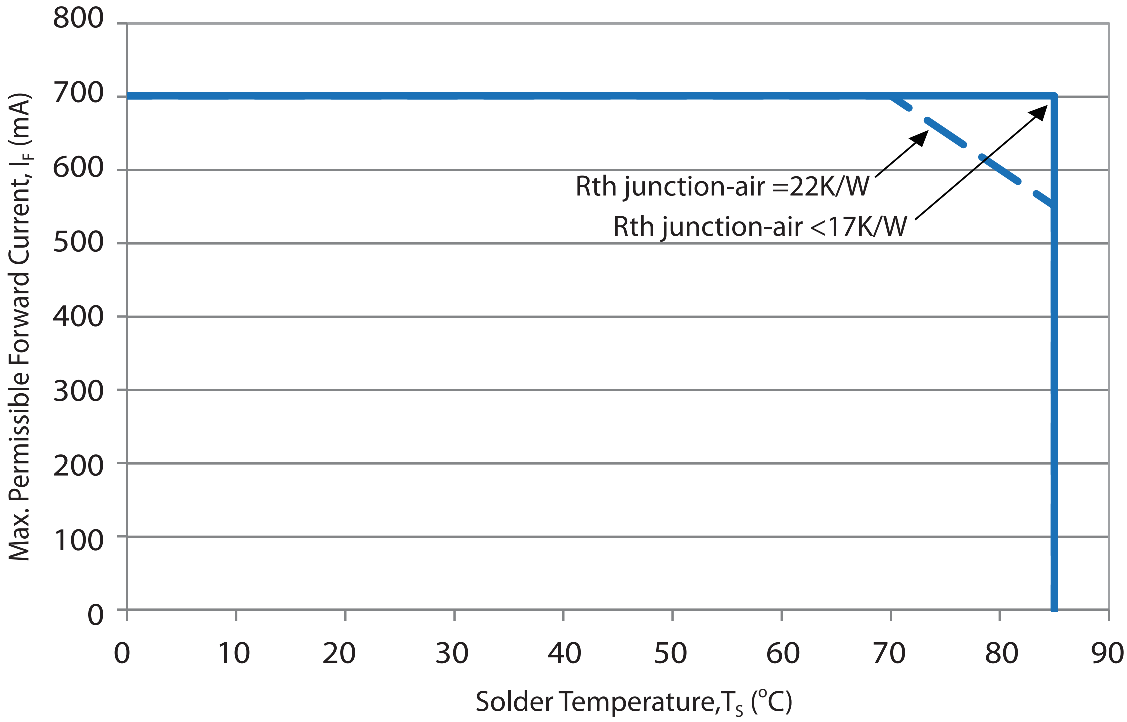
Max. Permissible Forward Current vs. Solder Temperature

$I_F=f(T)$



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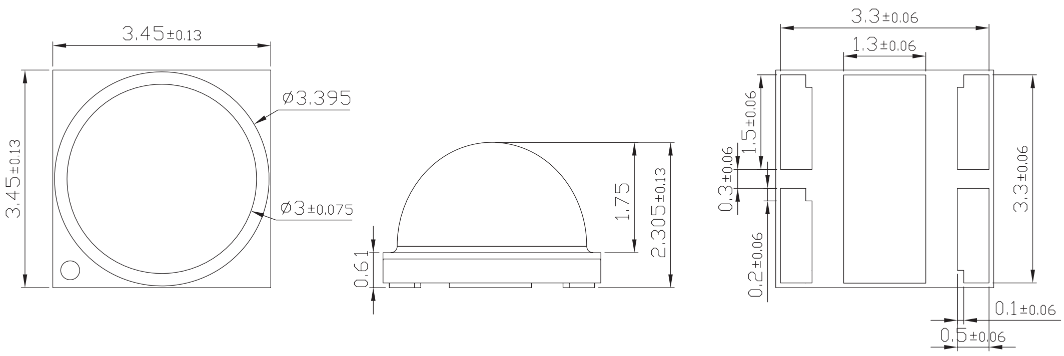
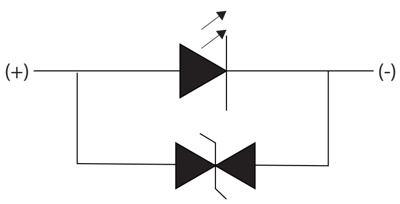
Mechanical Dimensions

Component



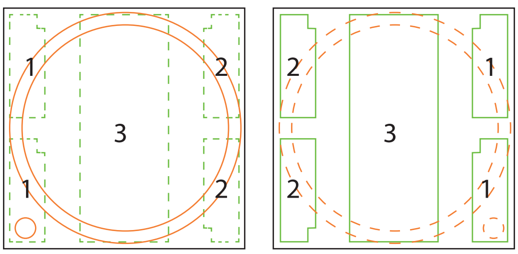
Notes:
1. Unit: mm.
2. Tolerance (unless otherwise specified): ±0.10mm.
3. Drawings are not to scale.

Circuit



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

Ceramic Layout



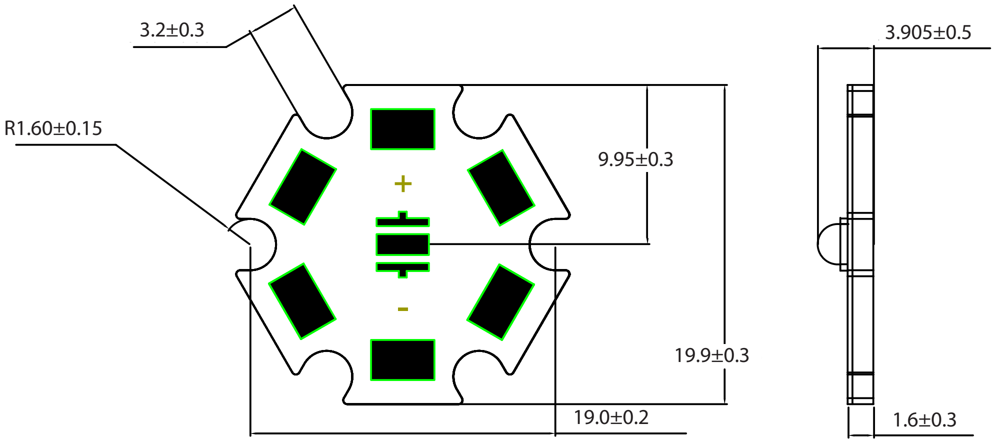
TOP BOTTOM

Pad Configuration

Pad	Function
1	Anode
2	Cathode
3	Thermal

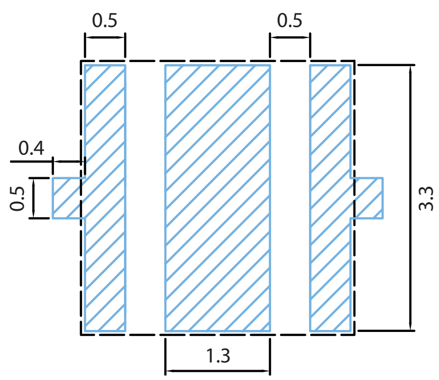
Recommended PCB

Recommended Star



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

Recommended Solder Pad



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

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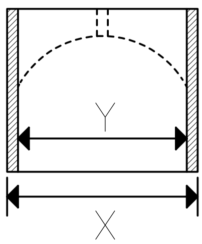
Pick and Place

1. Federal series is compatible for all kind of SMT instrument.
2. Using the recommended nozzle design can be more accurate during the SMT process.
3. The use of following specifications for designing the pick and place are recommended, which can pick and place the LED component more accurately.
4. The emitting surface of the LED component is a piece of silicone, thus the specifications and process.



Recommended Nozzle Specification

Parameter	Spec.
Outside Diameter (x)	Φ 3.5
Inside Diameter (y)	Φ 3.1
Material	Ceramic

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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.

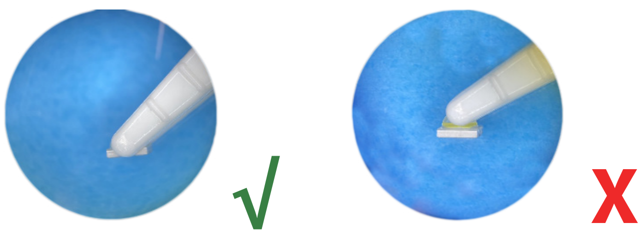
3. When manually handling the LED, please use the plastic tweezers instead of the metal one. Avoid contacting to the silicon lens structure which will cause damage to the package.

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

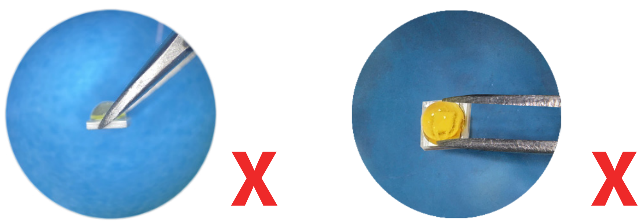
5. Do not use any product with materials containing sulfur.

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.

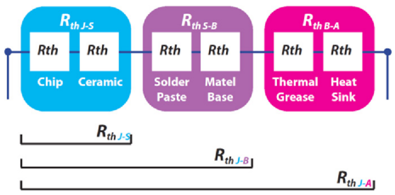
The following paragraphs describe how to determine the junction temperature and a simple ideal to heat sink design.

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 : $Rth_{(J\text{-}A)} = \frac{\Delta T_{(J-A)}}{P_D}$

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

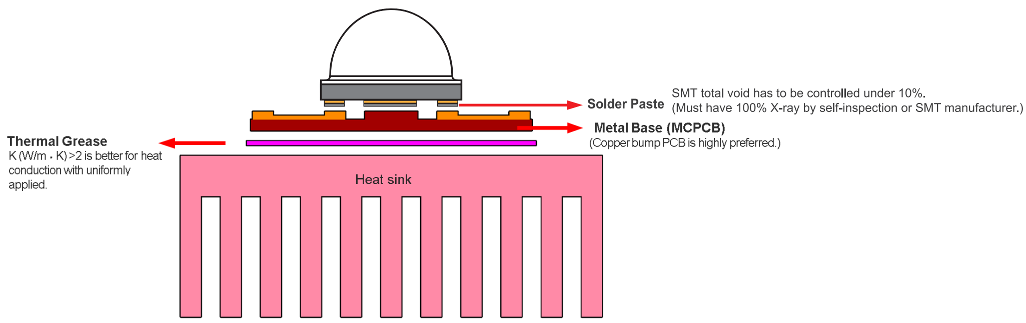


which,

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

T_A : Ambient Temperature (assume 25°C)

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



*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.

Lighting Design Manufacturing Service

Tips for Thermal Management

Federal products are not recommended to be operating without a heat sink. Through MCPCB, users may realize better performance.

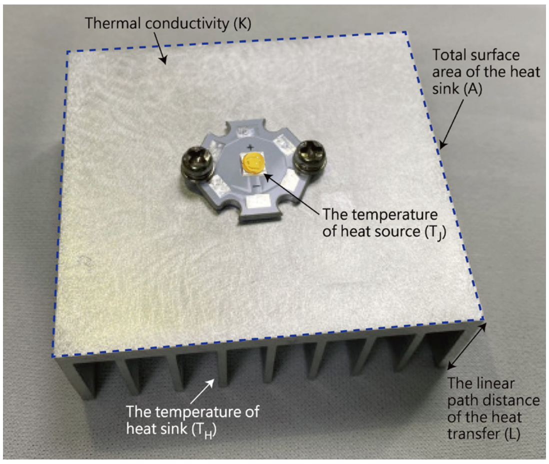
For LEDs, choose an appropriate operation environment and conduct the heat to the air after light on LEDs may maintain the better performance and lifetime. Four major thermal path are as follow:
From heat source (component) to heat sink. (By conduction)
Conduction within the heat sink to its surface.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

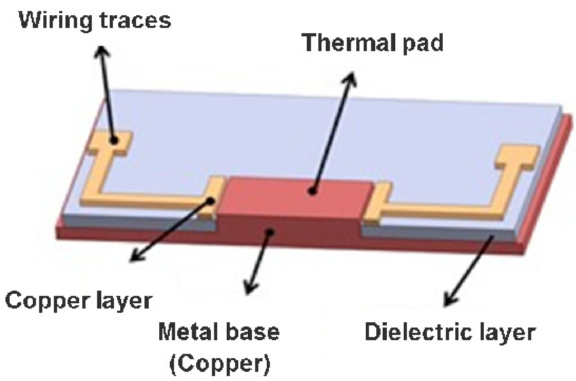
Path3 : Heat dissipation includes convection and radiation. Those two types of transfer are proportional to the surface area of the heat sink. Adding the number of fin may increase the total surface area. However, too many fins may cause inhabitation of convection. There are many other thermal management 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.



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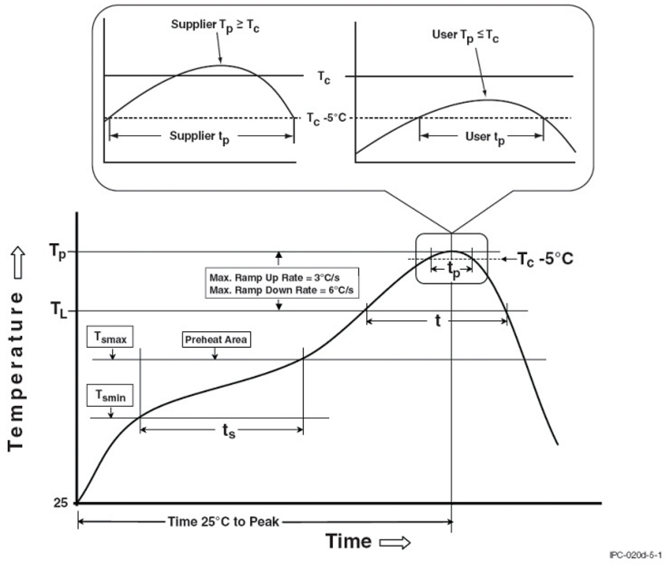
Reflow Profile

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.
Time 25°C to peak temperature	8 minutes max.

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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.

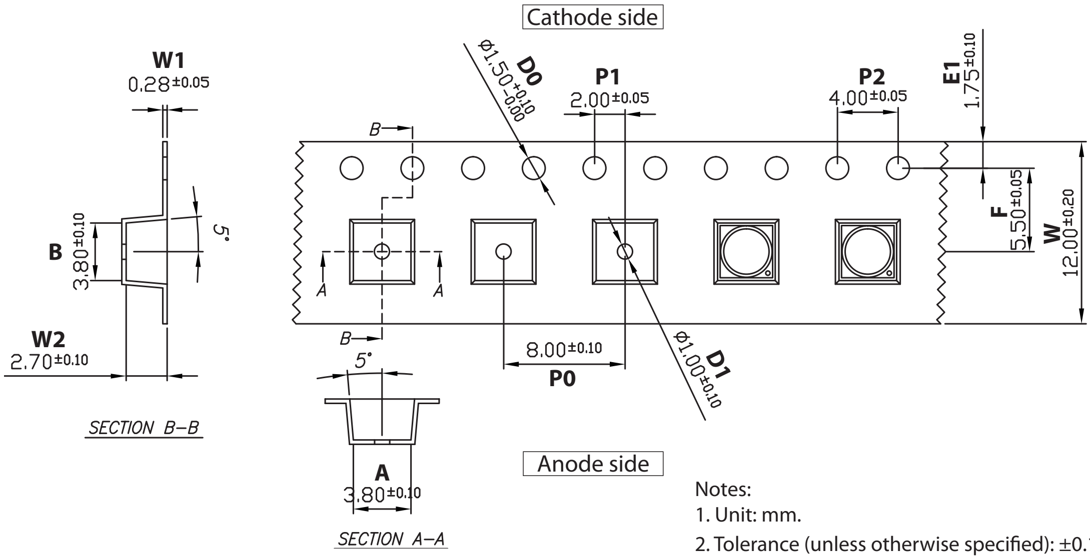
7. Should the LED product require second soldering, the re-work must be implemented with a hot plate. Moreover, the LED product shall be confirmed with well characteristics prior to usage.

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.

![EDISON Lighting Design Manufacturing Service]

Product Packaging Information

Tapping

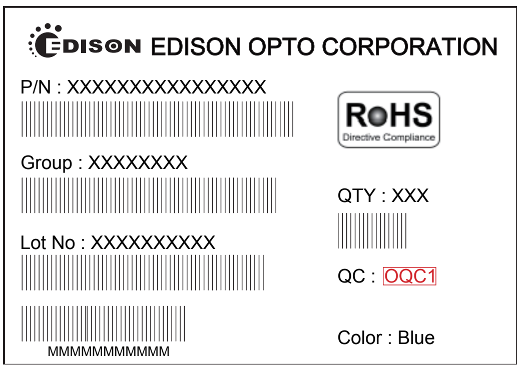


Notes:
1. Unit: mm.
2. Tolerance (unless otherwise specified): ±0.10mm.
3. Drawings are not to scale.

A	B	D0	D1	E1	F
3.80± 0.10	3.80±0.10	Φ1.50+0.10/-0.00	1.00±0.10	1.75±0.10	5.50±0.05

P0	P1	P2	W	W1	W2
8.00±0.10	2.00±0.05	4.00±0.05	12.00±0.20	0.28±0.05	2.7±0.10

Product Label



Label information
P/N : Order Code
Group : Bin Code
Serial No : LOT Number
QTY : Packing Quantity
Color : LED Color

Bin Group Format

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

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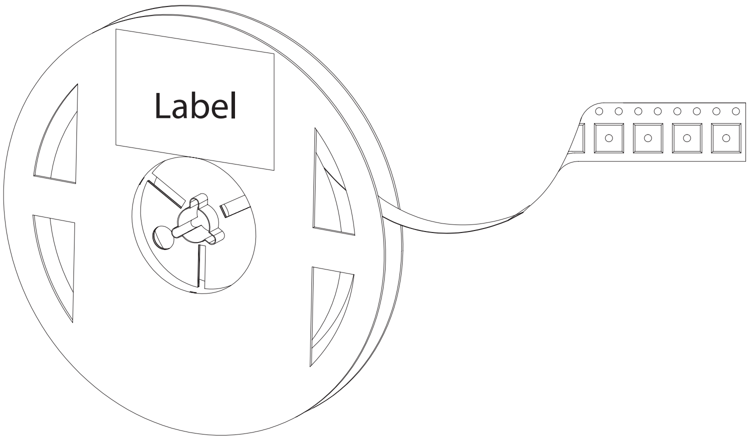
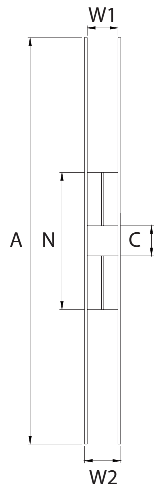
Tape and Reel

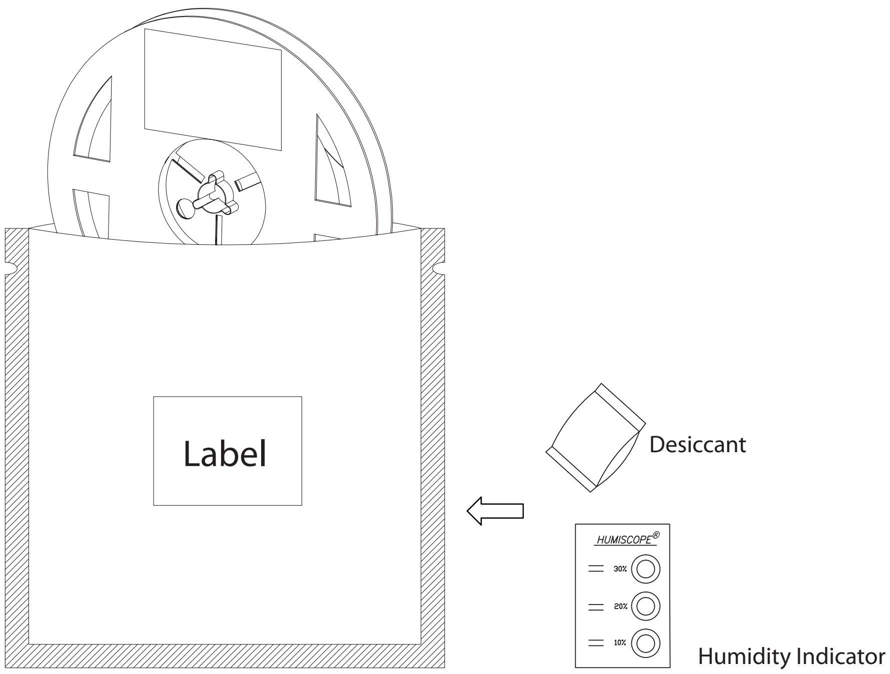
Notes:
1. Unit: mm.
2. Drawings are not to scale.





A	C	N	W1	W2	Pieces per Reel
178±1.0	13.3±0.3	59±1.0	13.5±1.0	16.1+0.5/-0	≦ 500
Starting with 50pcs empty, and 50pcs empty at the last.					

Static Bag



Lighting Design Manufacturing Service

Revision History

Versions	Description	Release Date
1	Establish order code information	2020/07/14
2	Revise Color Spectrum	2021/10/20
3	1. Format revision 2. Add application notes 3. Revise product packaging information 4. Add bin group format of label	2024/03/28

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

For general assistance please contact:
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LED.Detective@edison-opto.com.tw