

# Edixeon<sup>®</sup> ARC Series



Edixeon<sup>®</sup> ARC series emitters are one of the high power LEDs packaged by Edison-Opto delivering high luminous flux in the world. With its advanced packaging process, Edixeon<sup>®</sup> ARC is introduced to satisfy various solid-state lighting application such as automotive headlamp, decorative wall washer and general lighting. Edixeon<sup>®</sup> ARC series emitters have a typical luminous output of 100 lumens at 350mA, and are built specifically for reflow process. Unlike most fluorescent sources, Edixeon<sup>®</sup> ARC series contains no mercury and is more energy efficient than incandescent and halogen light source.

## Features

- Various colors
- More energy efficient than incandescent and most halogen lamps
- Low voltage operation
- Instant light
- Long operating life
- Reflow process compatible

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## Product Nomenclature

The following table describes the available color, power, and lens type. For more flux and forward voltage information, please consult the Bin Group document.

< Table 1 Edixeon<sup>®</sup> ARC series nomenclature >

E		D		E		W		- 1		L		S		5		- B		1		- A		B		16	
X1		X2		X3		X4		X5		X6		X7		X8		X9		X10		X11		X12			
LED Item		Module		Emitting Color		Power		Lens Item		Housing Item															
Code	Type	Code	Type	Code	Type	Code	Type	Code	Type	Code	Type														
ED	Edixeon <sup>®</sup>	E	Emitter	W	Cool White	1	1 W	L	Lambertian	S	White-2														
		S	Star	H	Neutra White	3	3 W																		
				X	Warm White																				

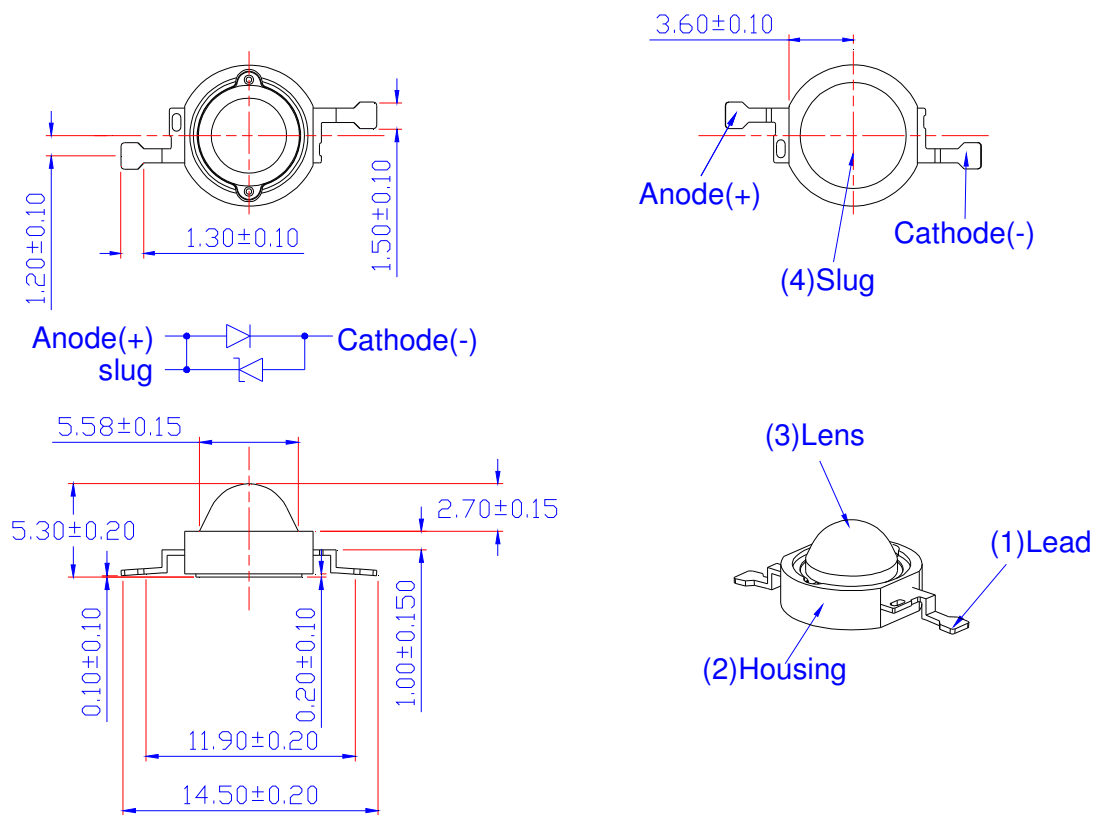
  

X7		X8		X9		X10		X11		X12	
Material	Phosphor Item	Testing Current		Shape Item		Al PCB Color		Thickness			
		Code	Type	Code	Type	Code	Type	Code	Type		
		1	350mA	A	Star	W	White	10	1.0mm		
		3	700mA	B	Square(25*25mm)	G	Green	16	1.6mm		
				C	Square(30*30mm)	B	Black	20	2.0mm		

### Environmental Compliance

Edixon® ARC series are compliant to the Restriction of Hazardous Substances Directive or RoHS. The restricted materials including lead, mercury cadmium hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) are not used in Edixon® ARC series to provide an environmentally friendly product to the customers.

## LED Package Dimensions and Polarity



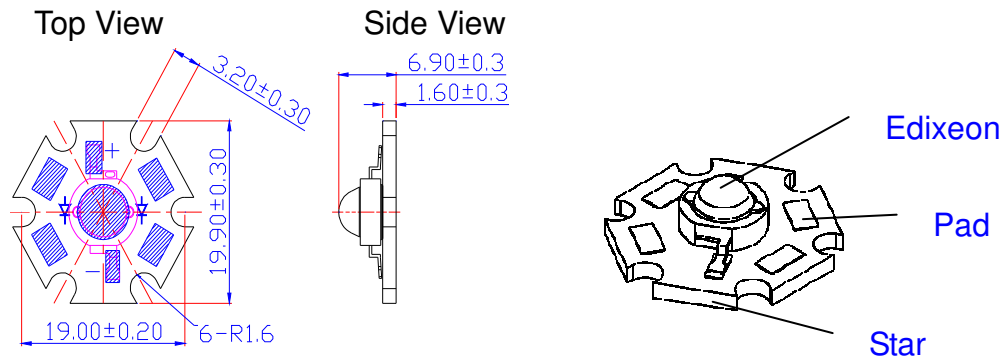
< Figure 1 Edixeon<sup>®</sup> ARC series dimensions >

### Notes:

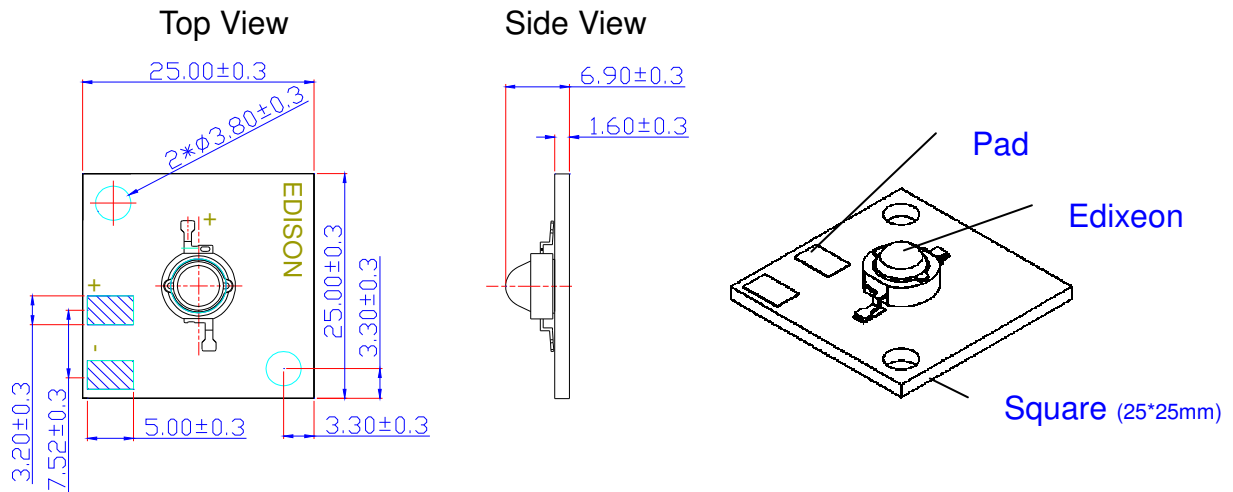
1. All dimensions are measured in mm.
2. Drawings are not to scale.
3. It is strongly recommended to apply on electrically isolated heat conducting film between the slug and contact surfaces.

## LED Package with Star Dimensions and Polarity

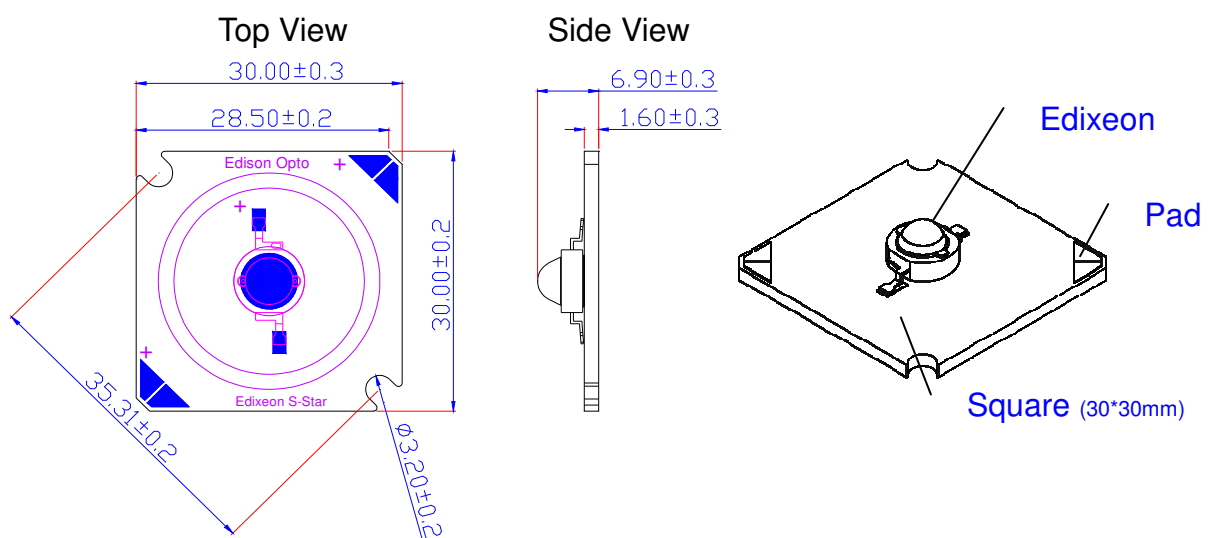
### EDSx-xLSx-xx-Ax16



### EDSx-xLSx-xx-Bx16



### EDSx-xLSx-xx-Cx16



<Figure 2 Edixeon® star dimensions>

#### Notes:

- 1.All Dimensions are in mm.

## Absolute Maximum Ratings

The following tables describe the characteristics of Edixon® ARC series under various current.

< Table 2 Absolute maximum ratings for Edixon® ARC series >

Parameter	Rating(1W)	Rating(3W)	Unit	Symbol
DC Forward Current(1W)	350	700	mA	I <sub>F</sub>
Peak pulse current;(tp ≤ 100μs, Duty cycle=0.25)	500	1,000	mA	
Reverse Voltage	5	5	V	V <sub>R</sub>
Drive Voltage	7	7	V	V <sub>D</sub>
LED junction Temperature	125	125	°C	T <sub>j</sub>
Operating Temperature	-30 ~ +110	-30 ~ +110	°C	
Storage Temperature	-40 ~ +120	-40 ~ +120	°C	
Soldering Temperature	260	260	°C	
ESD Sensitivity	4,000	4,000	V	V <sub>B</sub>
Manual Soldering Time at 260°C (Max.)	5	5	Sec.	

### Notes:

1. Proper current derating must be observed to maintain junction temperature below the maximum at all time.
2. LEDs are not designed to be driven in reverse bias.
3. Allowable reflow cycles are 3 times for each LED.
4. tp: Pulse width time

The following tables describe thermal resistance of Edixon® ARC series under various current and different color.

< Table 3 Temperature Coefficient of Forward Voltage & Thermal Resistance Junction to Case

Characteristics at T<sub>j</sub>=25°C for Edixon® ARC series >

Part Name	Color	ΔV <sub>F</sub> /ΔT		Rθ <sub>J-B</sub>	
		Typ.	Units	Typ.	Unit
EDEX-1LSx	--	-2	mV/°C	13	°C/W
EDEX-3LSx	--	-2	mV/°C	13	°C/W

### Luminous Flux Characteristics

The following tables describe flux of Edixeon<sup>®</sup> ARC series under various current and different color.

< Table 4 Luminous flux characteristics at  $I_F=350\text{mA}$  and  $T_J=25^\circ\text{C}$ : for 1W Edixeon<sup>®</sup> ARC series >

Part Name	Color	Flux			Unit
		Min.	Typ.	Max.	
EDEW-1LS1	Cool White	55.0	75.0	--	lm
EDEW-1LS5-B1	Cool White	80.0	100.0	--	lm
EDEH-1LS1-E1	Neutral White	45.0	55.0	--	lm
EDEH-1LS5-E1	Neutral White	60.0	80.0	--	lm
EDEX-1LS1-E1	Warm White	40.0	45.0	--	lm
EDEX-1LS5-E1	Warm White	50.0	65.0	--	lm
EDEW-1LS5-D1	Cool White	30.3	45.0	--	lm
EDEH-1LS5-D1	Neutral White	23.3	35.0	--	lm
EDEX-1LS5-D1	Warm White	23.3	30.0	--	lm

< Table 5 Luminous flux characteristics at  $I_F=700\text{mA}$  and  $T_J=25^\circ\text{C}$ : for 3W Edixeon<sup>®</sup> ARC series >

Part Name	Color	Flux			Unit
		Min.	Typ.	Max.	
EDEW-3LS5-B3	Cool White	120.0	170.0	--	lm
EDEH-3LS5-E3	Neutral White	90.0	100.0	--	lm
EDEX-3LS5-E3	Warm White	80.0	90.0	--	lm
EDEW-3LS5-D3	Cool White	51.2	70.0	--	lm
EDEH-3LS5-D3	Neutral White	39.4	60.0	--	lm
EDEX-3LS5-D3	Warm White	39.4	55.0	--	lm

**Notes:**

1. Flux is measured with an accuracy of  $\pm 10\%$ .
2. Cool white 、 neutral white 、 warm white emitters are built with InGaN



< Table 6 Edixeon<sup>®</sup> ARC series photometric luminous flux group for 1W & 3W >

<b>Group</b>	<b>Min.</b>	<b>Max.</b>
R	39.4	51.2
S1	51.2	58.8
S2	58.8	66.5
T1	66.5	70.0
T2	70.0	80.0
T3	80.0	86.5
U1	86.5	90.0
U2	90.0	100.0
U3	100.0	112.5
V	112.5	146.2
W	146.2	190.0
X	190.0	247.1
Y	247.1	321.2
Z	321.2	417.5

## Forward Voltage Characteristics

The following tables describe forward voltage of Edixeon® ARC series emitter under various current.

< Table 7 Forward voltage characteristics at  $I_F=350\text{mA}$  and  $T_J=25^\circ\text{C}$  for 1W Edixeon® ARC series >

Part Name	Color	$V_F$		Unit
		Min.	Max.	
EDEW-1LS1	Cool White	3.1	4.0	V
EDEW-1LS5-x1	Cool White	3.1	4.0	V
EDEH-1LS5-x1	Neutral White	3.1	4.0	V
EDEX-1LS5-x1	Warm Whit	3.1	4.0	V

< Table 8 Forward voltage characteristics at  $I_F=700\text{mA}$  and  $T_J=25^\circ\text{C}$  for 3W Edixeon® ARC series >

Part Name	Color	$V_F$		Unit
		Min.	Max.	
EDEW-3LS5-x3	Cool White	3.1	4.3	V
EDEH-3LS5-x3	Neutral White	3.1	4.3	V
EDEX-3LS5-x3	Warm White	3.1	4.3	V

## JEDEC Information

JEDEC moisture sensitivity classification is used to determine what classification level should be used for initial reliability qualification. Once identified, the LEDs can be properly packaged, stored and handled to avoid subsequent thermal and mechanical damage during the assembly solder reflow attachment and/or repair operation. The present moisture sensitivity standard contains six levels, the lower the level, the longer the devices floor life. Edixeon<sup>®</sup> ARC series are certified at level 2a. This means Edixeon<sup>®</sup> ARC series have a floor life of 4 weeks before Edixeon<sup>®</sup> ARC series need to re-baked.

< Table 9 JEDEC characteristics at T<sub>J</sub>=25°C for Edixeon<sup>®</sup> ARC series >

Level	Floor Life		Soak Requirements				
			Standard		Accelerated Equivalent		
					eV 0.40~0.48	eV 0.30~0.39	Condition
Time	Condition	Time(hours)	Condition	Time(hours)	Time(hours)		
4	72 hours	≤30°C/60% RH	96 <sup>1</sup> +5/-0	30°C/60% RH	20 +5/-0	24 +5/-0	60°C/60% RH

Level	Floor Life		Soak Requirements				
			Standard		Accelerated Equivalent		
					eV 0.40~0.48	eV 0.30~0.39	Condition
Time	Condition	Time(hours)	Condition	Time(hours)	Time(hours)		
1	Unlimited	≤30°C/85% RH	168 +5/-0	85°C/85% RH	NA	NA	NA
2	1 year	≤30°C/60% RH	168 +5/-0	85°C/60% RH	NA	NA	NA
2a	4 weeks	≤30°C/60% RH	696 <sup>1</sup> +5/-0	30°C/60% RH	120 +1/-0	168 +1/-0	60°C/60% RH
3	168 hours	≤30°C/60% RH	192 <sup>1</sup> +5/-0	30°C/60% RH	40 +5/-0	52 +5/-0	60°C/60% RH
4	72 hours	≤30°C/60% RH	96 <sup>1</sup> +5/-0	30°C/60% RH	20 +5/-0	24 +5/-0	60°C/60% RH
5	48 hours	≤30°C/60% RH	72 <sup>1</sup> +5/-0	30°C/60% RH	15 +5/-0	20 +5/-0	60°C/60% RH
5a	24 hours	≤30°C/60% RH	48 <sup>1</sup> +5/-0	30°C/60% RH	10 +5/-0	13 +5/-0	60°C/60% RH
6	Time on label (TOL)	≤30°C/60% RH	TOL	30°C/60% RH	NA	NA	NA

### Notes:

1. The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag, and includes the maximum time allowed out of the bag at the distributor's facility.
2. Joint Electron Devices Engineering Councils (JEDEC) is the leading developer of standards for the solid-state industry. Almost 3100 participants, appointed by some 290 companies work together in 50 JEDEC committees to meet the needs of every segment of the industry, manufacturers and consumers alike. The publications and standards that they generate are accepted throughout the world.  
(<http://www.jedec.org>)

## Reliability Items and Failure Measures

### Reliability test

The following table describes operating life, mechanical, and environmental tests performed on Edixeon<sup>®</sup> ARC series package.

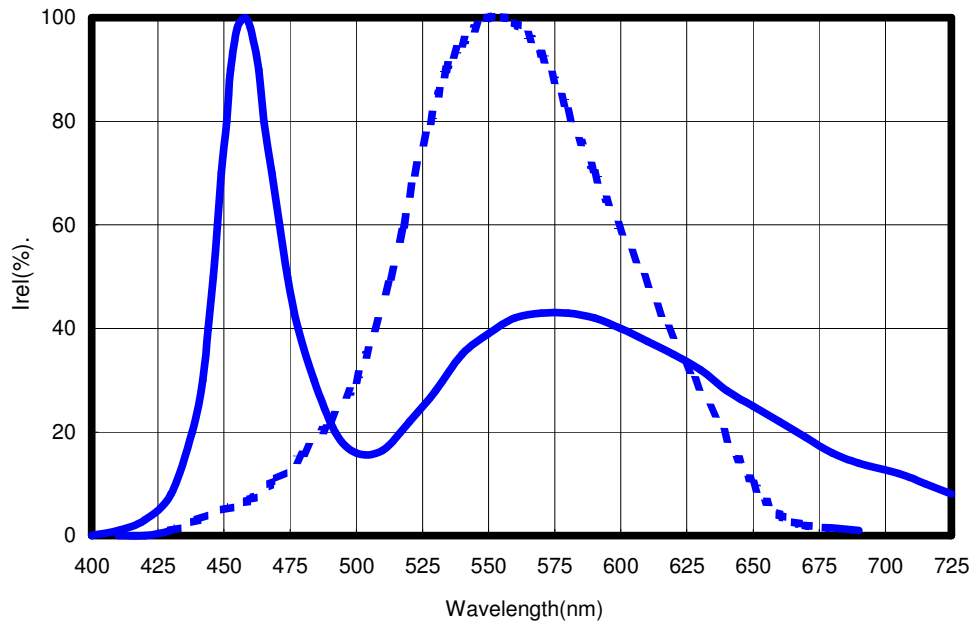
< Table 10 Operating life, mechanical, and environmental characteristics and  $T_J=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series >

Stress Test	Stress Conditions	Stress Duration	Failure Criteria
Room Temperature Operating Life	$25^{\circ}\text{C}$ , $I_F = I_{F \text{ Max DC}}$ (Note 1)	1,000 hours	Note 2
High Temperature High Humidity Storage Life	$85^{\circ}\text{C}$ / 85%RH	1,000 hours	Note 2
High Temperature Storage Life	$110^{\circ}\text{C}$	1,000 hours	Note 2
Low Temperature Storage Life	$-40^{\circ}\text{C}$	1,000 hours	Note 2
Thermal Shock	$-40 / 125^{\circ}\text{C}$ , 15 min dwell / < 10 sec transfer	500 cycles	No catastrophics
Mechanical Shock	1500 G, 0.5 msec pulse, 5 shocks each of 6 axis		No catastrophics
Natural Drop	On concrete from 1.2 m, 3X		No catastrophics
Variable Vibration Frequency	10-2000-10 Hz, log or linear sweep rate, 20 G about 1 min, 1.5 mm, 3X/axis		No catastrophics
Solder Heat Resistance (SHR)	$260^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , 10 sec		No catastrophics

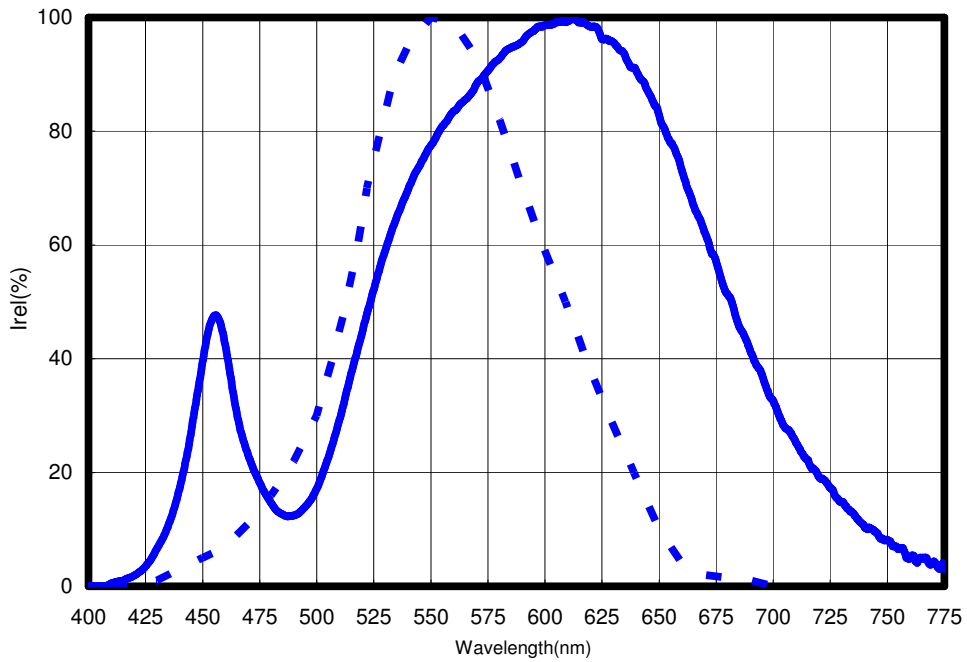
#### Notes:

1. Depending on the maximum derating curve.
2. Failure Criteria:
  - Electrical failures
    - $V_F$  shift  $\geq 10\%$
  - Light Output Degradation
    - %  $I_v$  shift  $\geq 30\%$  @ 1,000hrs or 200cycle
  - Visual failures
    - Broken or damaged package or lead
    - Solderability < 95% wetting
    - Dimensions out of tolerance

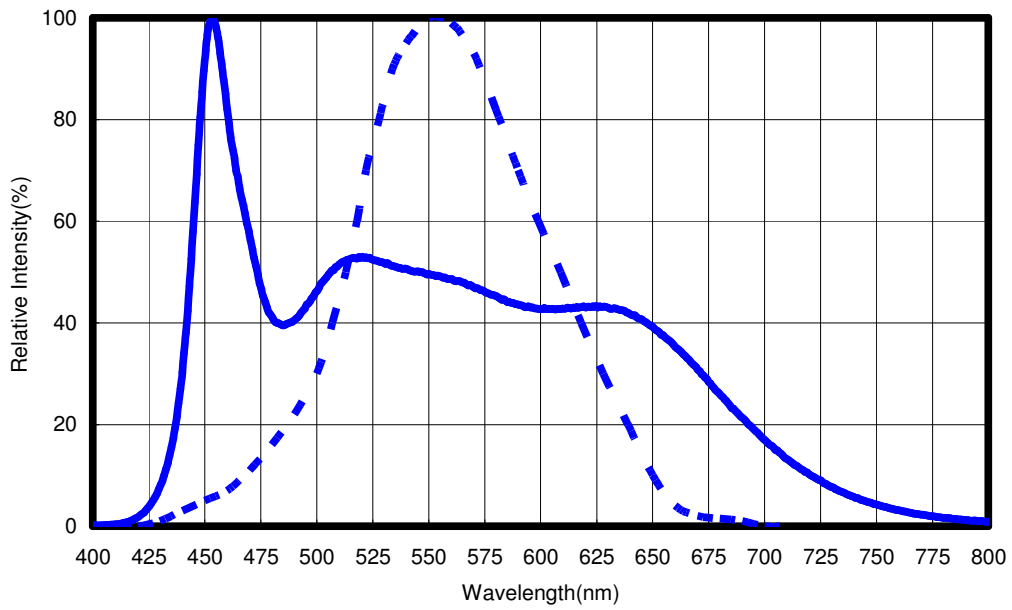
### Color Spectrum and Radiation Pattern



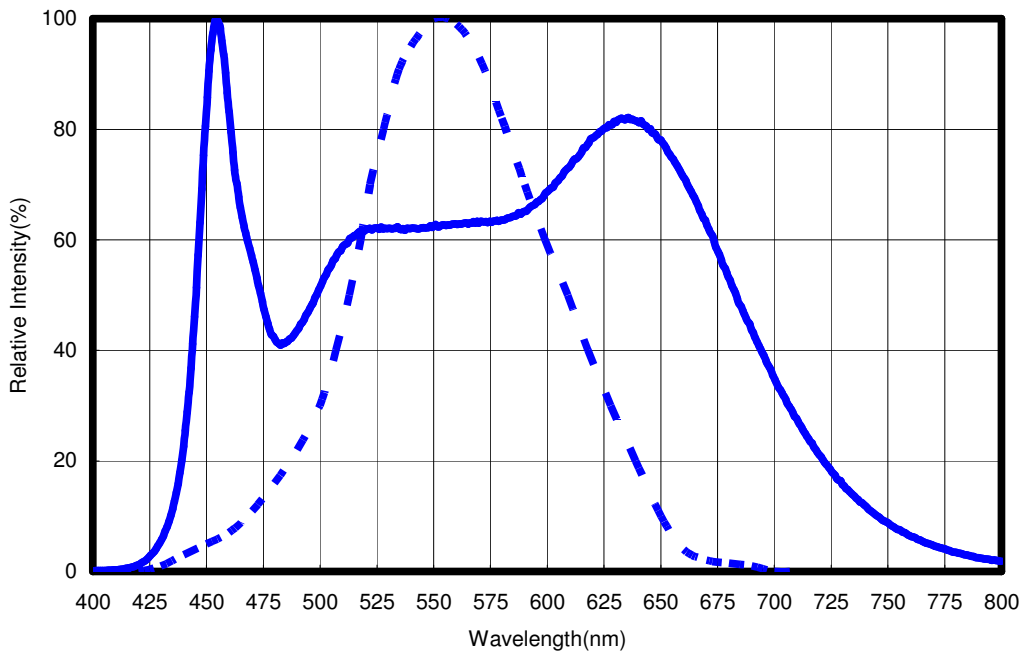
<Figure 3. Cool white color spectrum at  $T_J = 25^\circ\text{C}$ .for Edixeon<sup>®</sup> ARC series >



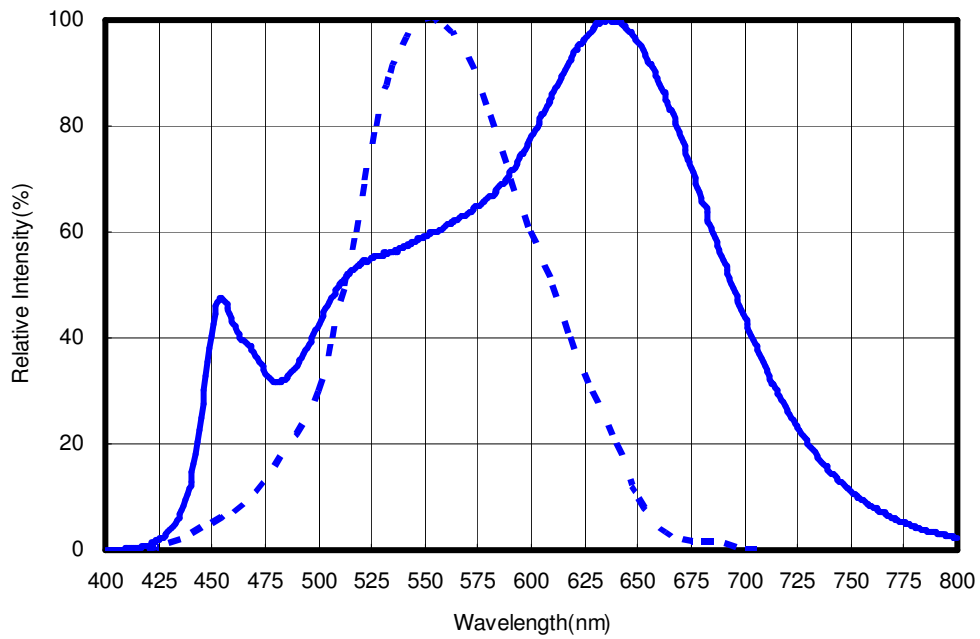
< Figure 4. Neutral White 、 Warm white color spectrum at  $T_J = 25^\circ\text{C}$ .for Edixeon<sup>®</sup> ARC series >



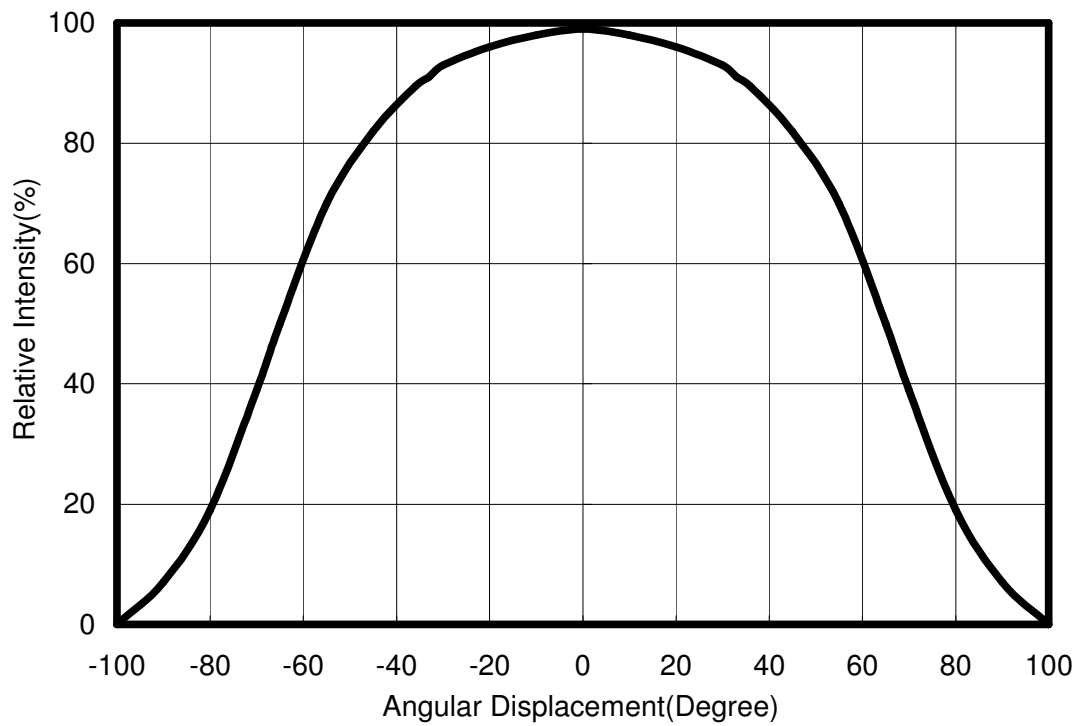
< Figure 5. Cool white color spectrum at  $T_j = 25^\circ\text{C}$  .for Edixeon<sup>®</sup> ARC series EDEW-xLS5-Dx >



< Figure 6. Neutral white color spectrum at  $T_j = 25^\circ\text{C}$  .for Edixeon<sup>®</sup> ARC series EDEH-xLS5-Dx >



< Figure 7. Warm white color spectrum at  $T_j = 25^\circ\text{C}$ .for Edixeon<sup>®</sup> ARC series EDEX-xLS5-Dx >



<Figure 8.Lambertian at  $T_j = 25^\circ\text{C}$  for Cool White · Neutral White · Warm white.>

### Emission Angle Characteristics

< Table 11 Emission angle Characteristics at  $T_j=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series >

Part Name	Color	2 $\Theta$ $\frac{1}{2}$ (Typ.)	Unit
		Lambertian	
EDEW-xLS5-xx	Cool White	130	Deg.
EDEH-xLS5-xx	Neutral White	130	Deg.
EDEX-xLS5-xx	Warm White	130	Deg.

**Notes:**

1. Emission is measured with an accuracy of  $\pm 10$  Degree.

### Color Temperature Characteristics $T_j=25^{\circ}\text{C}$

< Table 12 Color Temperature Characteristics at  $T_j=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series >

Part Name	Color	CCT		Unit
		Min.	Max.	
EDEW-xLS5-xx	Cool White	5,000	10,000	K
EDEH-xLS5-xx	Neutral White	3,800	5,000	K
EDEX-xLS5-xx	Warm White	2,670	3,800	K

**Notes:**

1. CCT is measured with an accuracy of  $\pm 200\text{K}$

### Color Temperature Characteristics $T_j=25^{\circ}\text{C}$

< Table 13 Color Rendering Index Characteristics at  $T_j=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series >

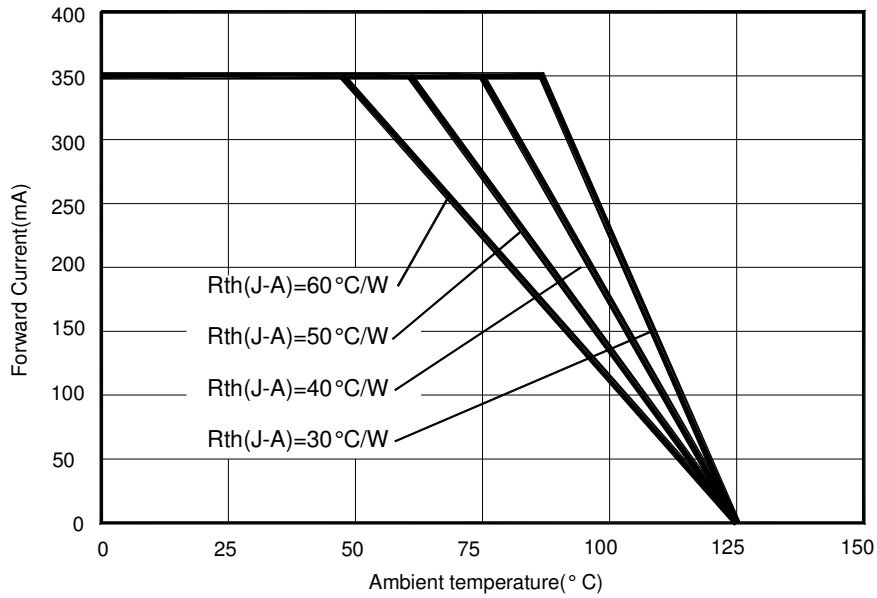
Part Name	Color	CRI
		Typ
EDEW-xLS5-Bx	Cool White	65
EDEH-xLS5-Ex	Neutral White	75
EDEX-xLS5-Ex	Warm White	75
EDEW-xLS5-Dx	Cool White	90
EDEH-xLS5-Dx	Neutral White	90
EDEX-xLS5-Dx	Warm White	90

**Notes:**

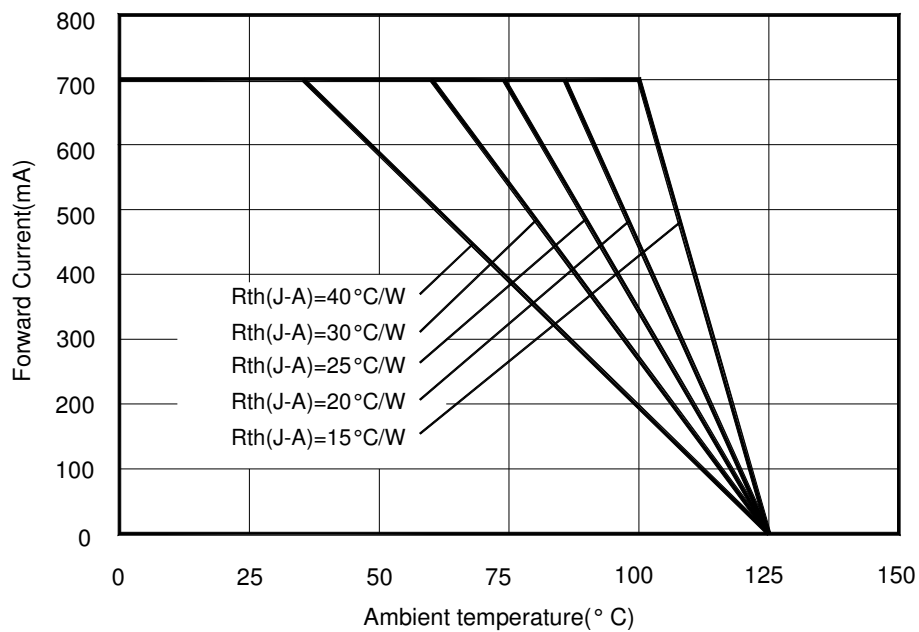
1. CRI is measured with an accuracy of  $\pm 5$



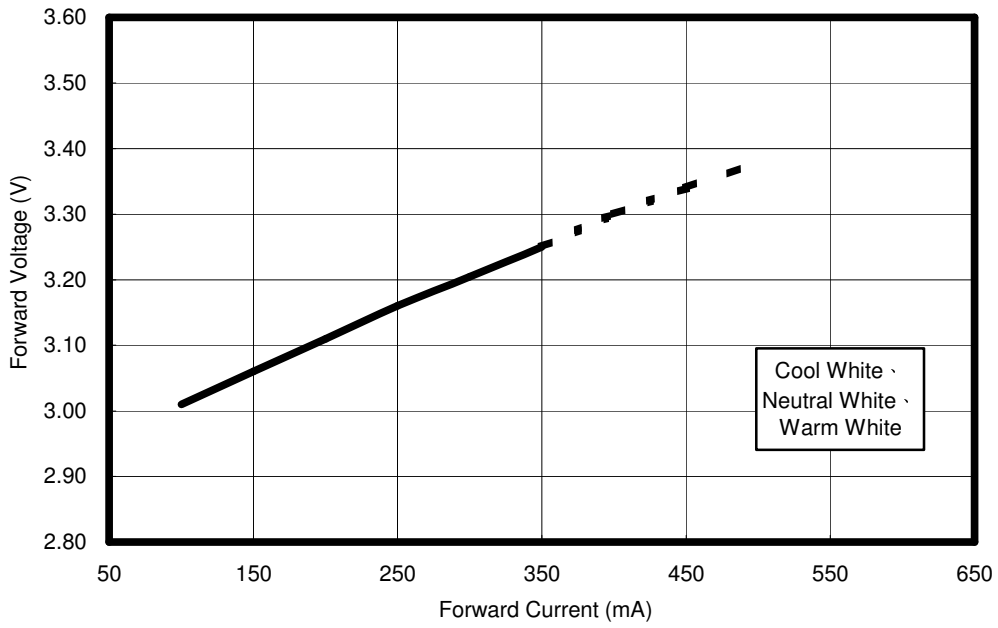
## Optical & Electrical Characteristics



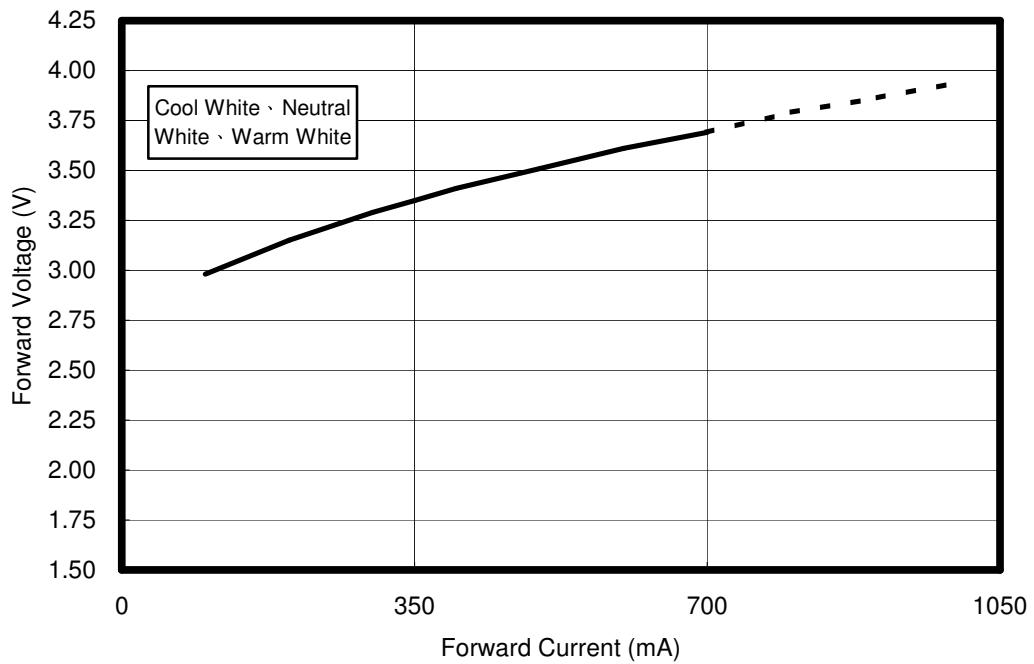
< Figure 9 Operating Current & Ambient Temperature for 1W Edixeon<sup>®</sup> ARC series >



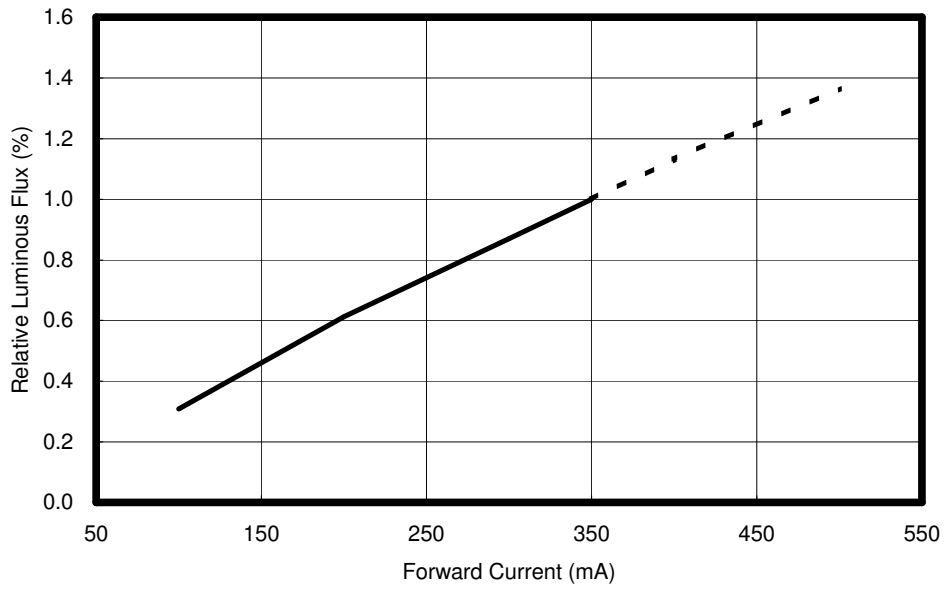
< Figure 10 Operating Current & Ambient Temperature for 3W Edixeon<sup>®</sup> ARC series >



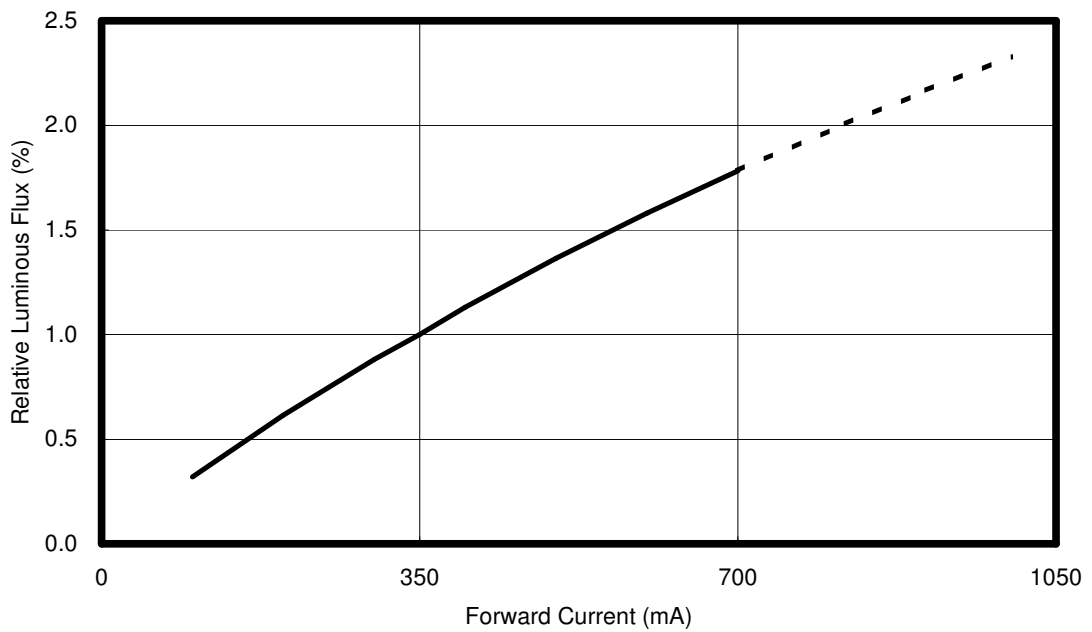
< Figure 11 Forward Current & Forward Voltage at  $T_J=25^{\circ}\text{C}$  for 1W Edixeon<sup>®</sup> ARC series >



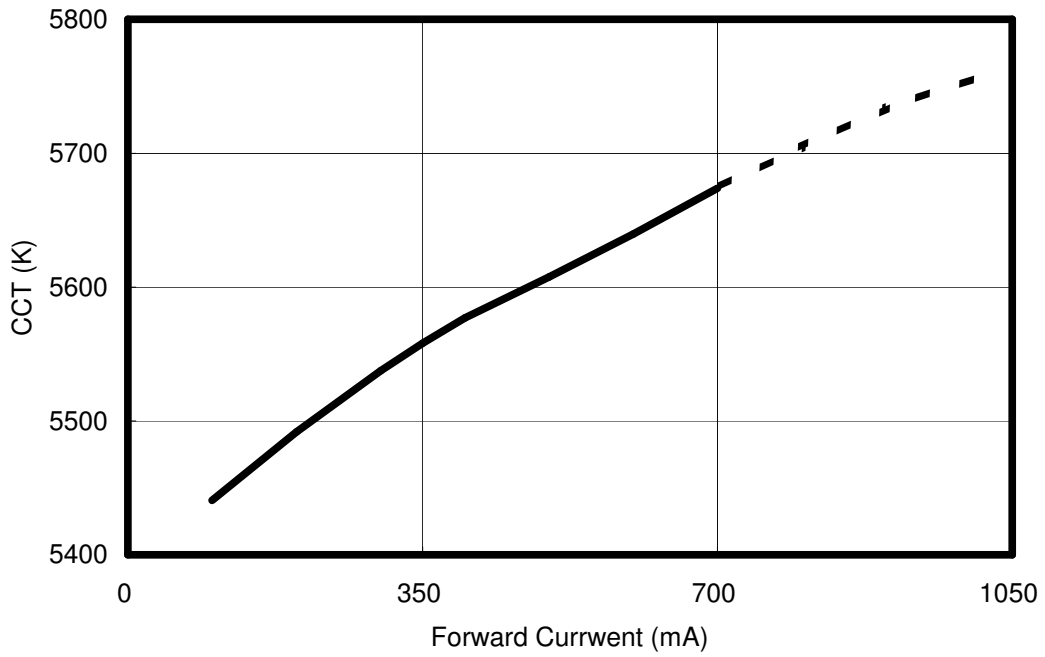
< Figure 12 Forward Current & Forward Voltage at  $T_J=25^{\circ}\text{C}$  for 3W Edixeon<sup>®</sup> ARC series >



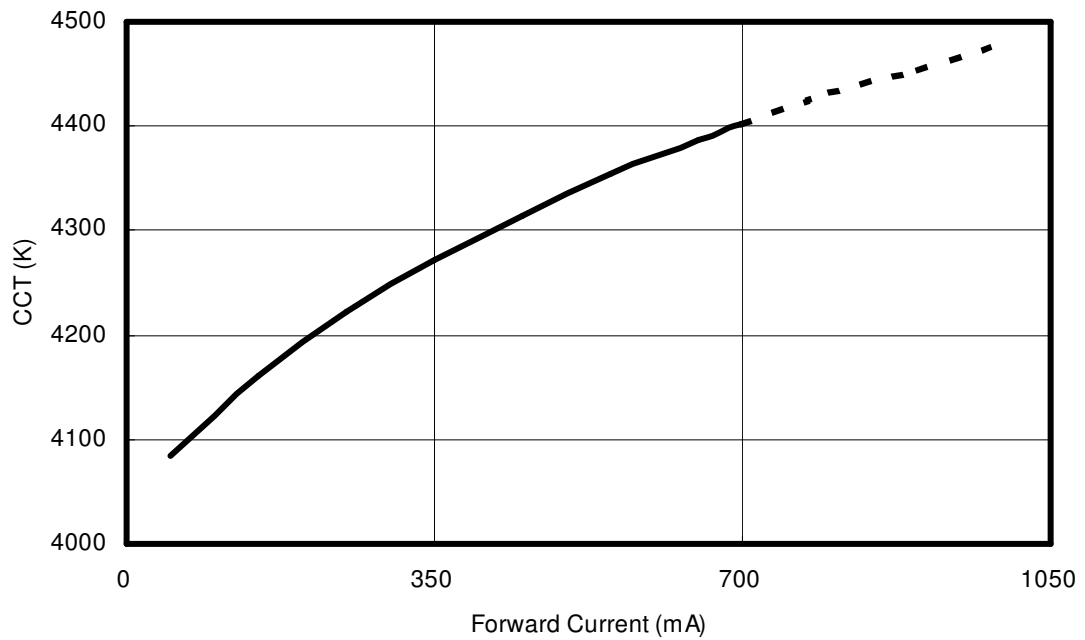
< Figure 13 Forward Current & Relative Luminous at  $T_J=25^\circ\text{C}$  for 1W Edixeon<sup>®</sup> ARC series>



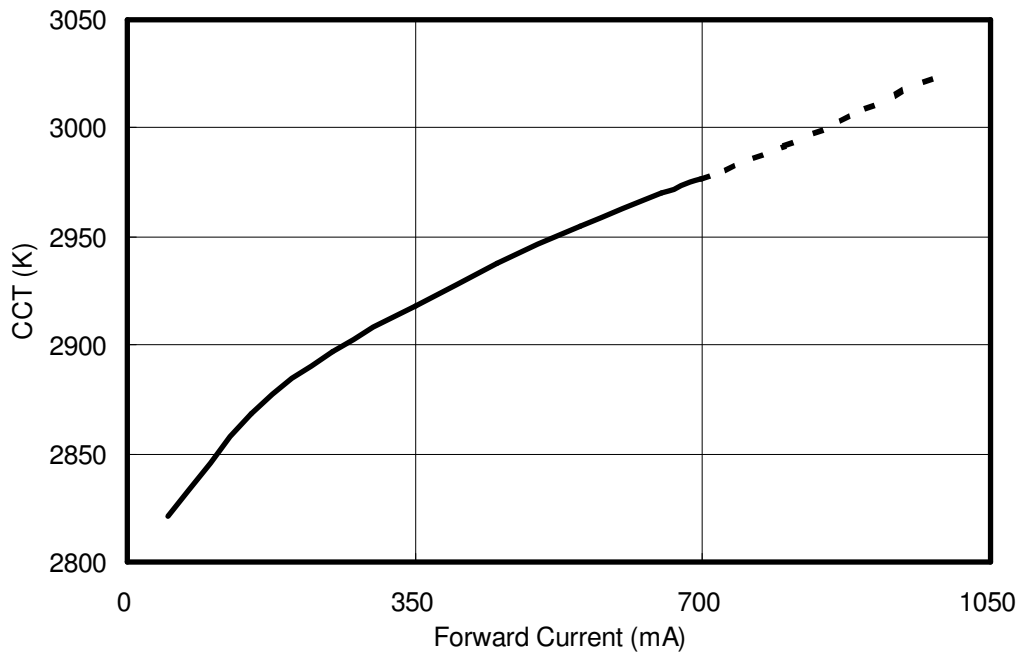
< Figure 14 Forward Current & Relative Luminous at  $T_J=25^\circ\text{C}$  for 3W Edixeon<sup>®</sup> ARC series>



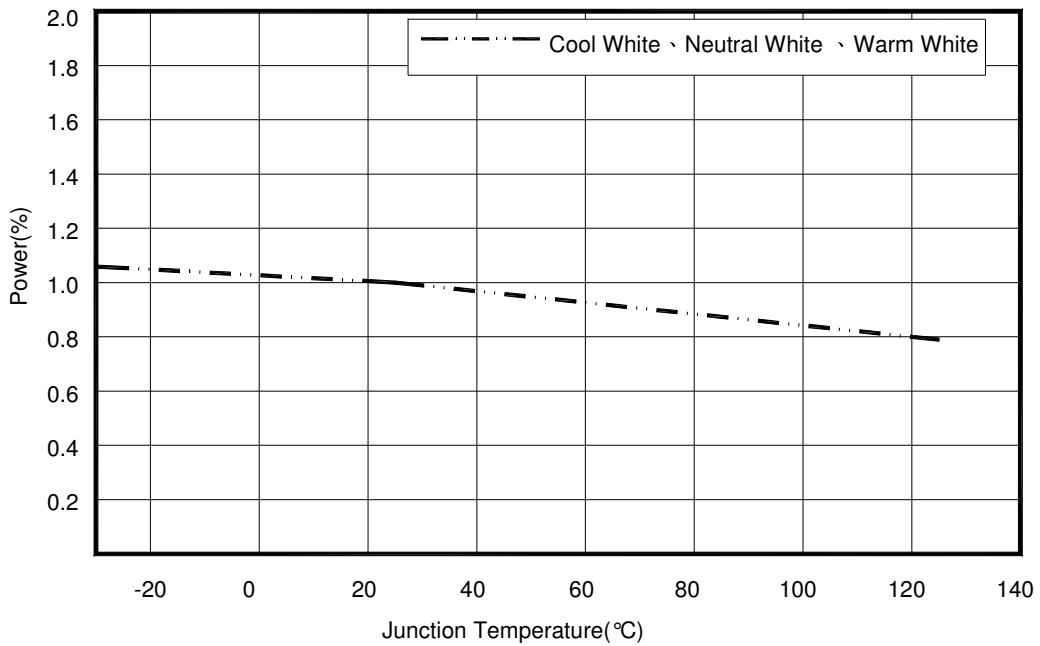
< Figure 15.Forward Current & CCT at  $T_J=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series Cool White>



< Figure 16.Forward Current & CCT at  $T_J=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series Neutral White>



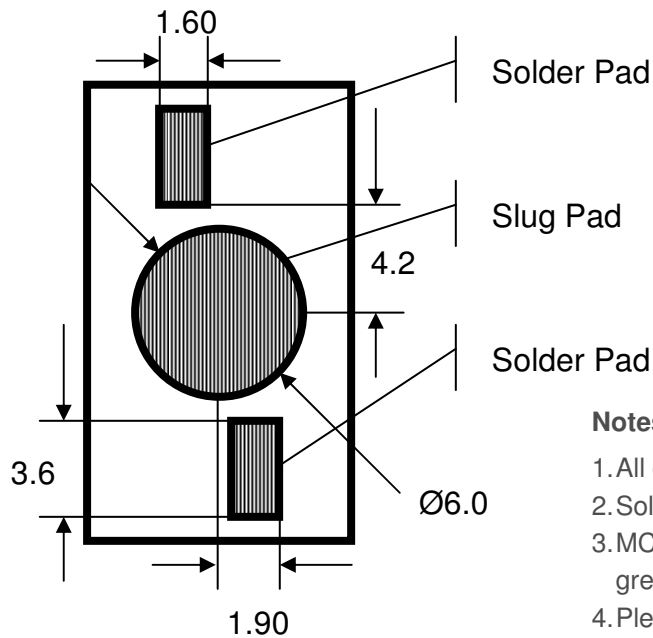
< Figure 17. Forward Current & CCT at  $T_J=25^{\circ}\text{C}$  for Edixeon<sup>®</sup> ARC series Warm White >



< Figure 18. Junction temperature & power rate for Edixeon<sup>®</sup> ARC series >

## Product Soldering Instructions

The central circle pad at the bottom face of the package provides the main path for heat dissipation from the LED to the heat sink (heat sink contact).



< Figure 19. Pad dimensions >

### Notes:

1. All dimensions are measured in mm.
2. Solder pad cannot be connected to slug pad.
3. MCPCB material with a thermal conductivity greater than 3.0 W/mK.
4. Please avoid touching the Edixeon<sup>®</sup> lens during assembly processes. This may cause pollution or scratch on the surface of lens.

The choice of solder and the application method will dictate the specific amount of solder. For most consistent results, an automated dispensing system or a solder stencil printer is recommended.

Positive results will be used solder thickness that results in 50µm. The lamp can be placed on the PCB simultaneously with any other required SMD and reflow completed in a single step. Automated pick-and-place tools are recommended.

The central slug at the bottom face of the package provides the main path for heat dissipation from the LED to the heat sink (heat sink contact). A key feature of Edixeon<sup>®</sup> ARC series is an electrically neutral heat path that is separate from the LED's electrical contacts. This electrically isolated thermal pad makes Edixeon<sup>®</sup> ARC series perfect for use with either FR4 circuit boards with thermal via or with metal-core printed circuit boards (MCPCB).

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### Recommend Solder Steps

To prevent mechanical failure of LEDs in the soldering process, a carefully controlled pre-heat and post-cooling sequence is necessary. The heating rate in an IR furnace depends on the absorption coefficients of the material surfaces and on the ratio of the component's mass to its irradiated surface. The temperature of parts in an IR furnace, with a mixture of radiation and convection, cannot be determined in advance.

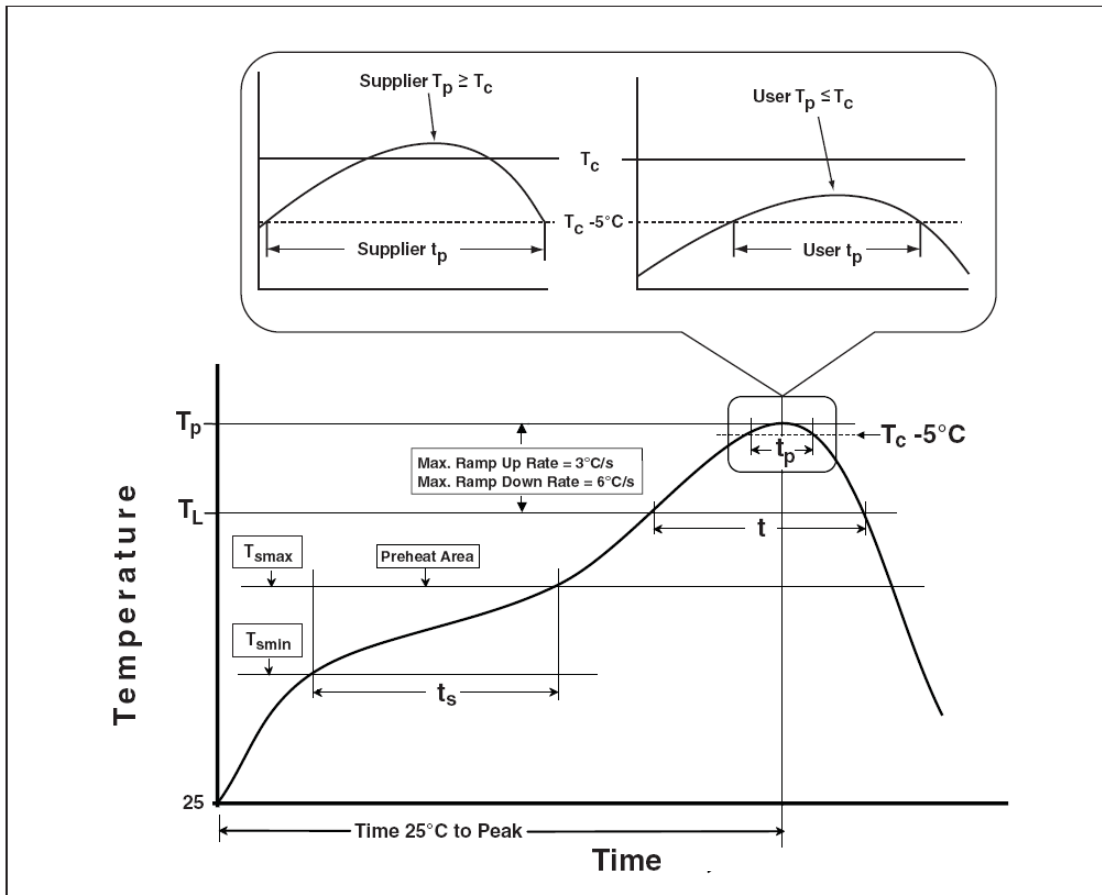
Temperature measurement may be performed by measuring the temperature of a specific component while it is being transported through the furnace. Influencing parameters on the internal temperature of the component are as follows:

- Time and power
- Mass of the component (for Edixeon<sup>®</sup> ARC series on MCPCB)
- Size of the component
- Size of the printed circuit board
- Absorption coefficient of the surfaces and MCPCB
- Packing density

Peak temperatures can vary greatly across the PC board during IR processes. The variables that contribute to this wide temperature range include the furnace type and the size, mass and relative location of the components on the board. Profiles must be carefully tested to determine the hottest and coolest points on the board. The hottest and coolest points should fall within the recommended temperatures. The profile of the reflow system should be based on design needs, the selected solder system and the solder-paste manufacturer's recommended reflow profile.

### Recommended Profile for Reflow Soldering

The following reflow soldering profiles are provided for reference. Edison recommends that users follow the recommended soldering profile provided by the manufacturer of the solder paste used.



< Figure 20 Reflow profiles >



### Table of Classification Reflow Profiles

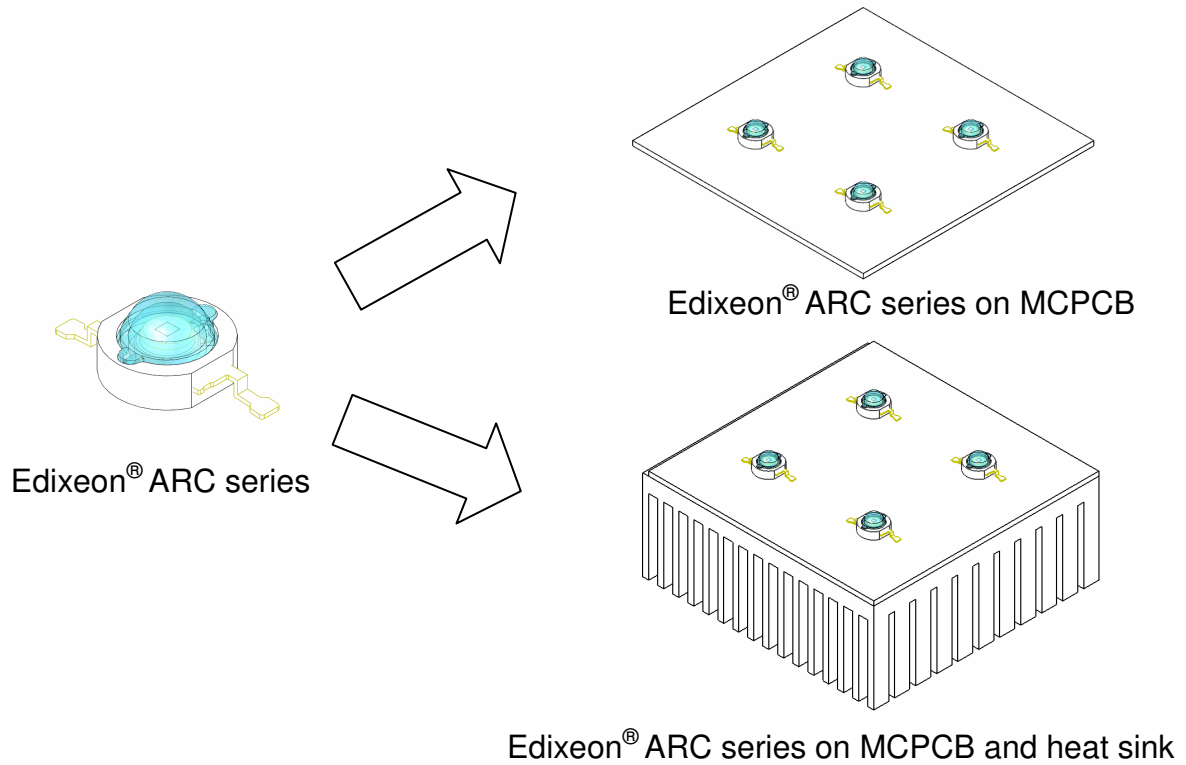
< Table 14 Reflow profiles >

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b> Temperature min (T <sub>min</sub> ) Temperature max (T <sub>max</sub> ) Time (T <sub>min</sub> to T <sub>max</sub> ) (ts)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate (T <sub>max</sub> to T <sub>p</sub> )	3 °C/second max.	3 °C/second max.
Liquidous temperature (TL) Time at liquidous (tL)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body temperature (T <sub>p</sub> )*	230 °C ~235 °C *	255 °C ~260 °C *
Classification temperature (T <sub>c</sub> )	235 °C	260 °C
Time (t <sub>p</sub> )** within 5 °C of the specified classification temperature (T <sub>c</sub> )	20** seconds	30** seconds
Average ramp-down rate (T <sub>p</sub> to T <sub>max</sub> )	6 °C/second max.	6 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile temperature (T <sub>p</sub> ) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t <sub>p</sub> ) is defined as a supplier minimum and a user maximum.		

## Product Thermal Application Information

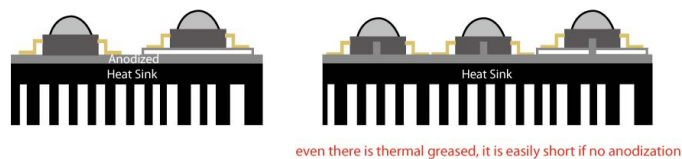
Thermal grease should be evenly spreaded with a thickness <math>< 100\mu\text{m}</math>.

When assembling on MCPCB or heat sink carrier.



< Figure 21 Edixeon<sup>®</sup> ARC series heatsink application >

—It is strongly recommended the heat sink should be anodized.

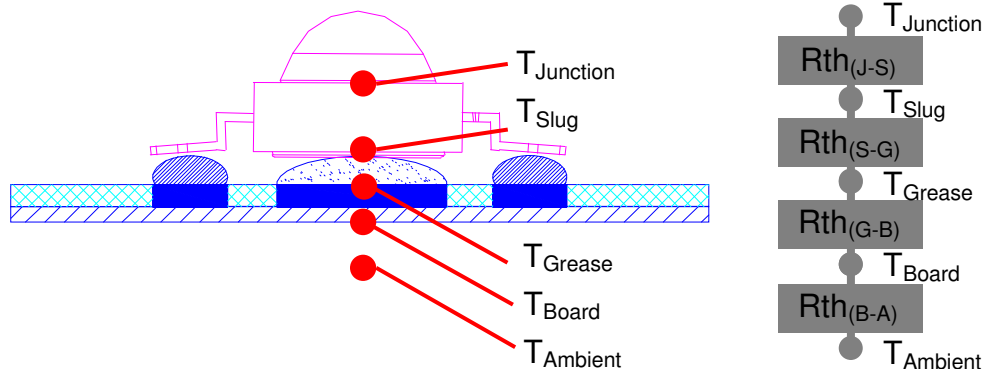


—Please ensure the heat sink is flat enough to prevent the bad heat conductivity.



<Figure 22 Edixeon<sup>®</sup> ARC series assemble with heatsink>

## Thermal Resistance Application



$$R_{th(J-A)} = R_{th(J-S)} + R_{th(S-G)} + R_{th(G-B)} + R_{th(B-A)}$$

$$T_{Junction} = T_{Ambient} + R_{th(J-A)} \times P_{Dissipation}$$

$$(T_J = T_A + R_{th(J-A)} \times P_{Dissipation})$$

<Figure 23 Rth and T<sub>J</sub> for Edixeon<sup>®</sup> ARC series >

## Suggested Adhesive for Selection(such as thermal grease)

- Ease of use
- Non-solvent, One-part
- Fast tack free
  - 3 minutes at 25°C
- No corrosion
  - Alcohol type of room temperature vulcanization (RTV)
- Low volatility
  - Low weight loss of silicone volatiles
- Adhesion
  - Excellent adhesion to most materials without use of a primer
- Dielectric properties
  - Cured rubber exhibits good dielectric properties
- Excellent thermal stability and cold resistance
  - Cured rubber provides wide service temperature range

< Table 15 Specification for adhesive properties >

Specification	Suggested Properties
Take-free time	3~10 minutes
Specific gravity	< 3 g/cm <sup>2</sup>
Thermal conductivity	> 2.5 W/mK
Rth in using	< 1.8 °C/W
Volume resistance	> 1x10 <sup>14</sup>
Lap shear adhesion strength	> 200 N/ cm <sup>2</sup>
Tensile strength	> 4 Mpa

### Thermal Resistance Calculation

The thermal resistance between two points is defined as the ratio of the difference in temperature to the power dissipated. For calculations in the following units used are °C/W. In the case of LEDs, the resistance of two important thermal paths affects the junction temperature:

From the LED junction to the thermal contact at the bottom of the package, this thermal resistance is governed by the package design. It is referred to as the thermal resistance between junction and slug ( $R_{th (J-S)}$ )

From the thermal contact to ambient conditions, this thermal resistance is defined by the path between the slug ,board ,and ambient. It is referred to as the thermal resistance between slug and board ( $R_{th (S-B)}$ ) and between board and ambient ( $R_{th (B-A)}$ ).

The overall thermal resistance between the LED junction and ambient ( $R_{th (J-A)}$ ) can be modeled as the sum of the series resistances  $R_{th (J-S)}$  ,  $R_{th (S-B)}$ ., and  $R_{th (B-A)}$ .

The following will show how to calculate  $R_{th}$  for each part of LED module.

#### 1. $R_{th(J-S)}$

Assume Edixeon®  $R_{th(J-S)}=10\text{ °C/W}$

#### 2. $R_{th(S-G)}$

If the thickness of thermal grease is 100um and area is  $(6.4/2)^2\pi\text{ mm}^2$ .

Thermal conductivity of thermal grease is 2.6 W/mK.

The Formula of  $R_{th}$  is 
$$\frac{\text{Thickness(um)}}{\text{Thermal Conductivity (W/mK) x Area(mm}^2\text{)}}$$

Therefore  $R_{th(S-G)} = \frac{100}{2.6 \times (6.4/2)^2 \pi} = 1.2 \text{ }^\circ\text{C/W}$

### 3. $R_{th(G-B)}$

The  $R_{th}$  of standard MCPCB is  $1.5 \text{ }^\circ\text{C/W}$

### 4. $R_{th(B-A)}$

The  $R_{th}$  between board and air is mainly dependent on the total surface area.

Therefore  $R_{th(B-A)} \doteq \frac{500}{\text{Area}(\text{cm})^2}$

If Area is  $30\text{cm}^2$   $R_{th}=16.7$        $R_{th(J-A)} = 10+1.2+1.5+16.7 = 29.4 \text{ }^\circ\text{C/W}$

If Area is  $60\text{cm}^2$   $R_{th}=8.3$        $R_{th(J-A)} = 10+1.2+1.5+8.3 = 21 \text{ }^\circ\text{C/W}$

If Area is  $90\text{cm}^2$   $R_{th}=5.5$        $R_{th(J-A)} = 10+1.2+1.5+5.5 = 18.2 \text{ }^\circ\text{C/W}$

## Junction Temperature Calculation

The total power dissipated by the LED is the product of the forward voltage ( $V_F$ ) and the forward current ( $I_F$ ) of the LED.

The temperature of the LED junction is the sum of the ambient temperature and the product of the thermal resistance from junction to ambient and the power dissipated.

$$T_{\text{Junction}} = T_{\text{Air}} + R_{th(J-A)} \times P_{\text{Dissipation}}$$

If one white Edixeon<sup>®</sup> in room temperature ( $25^\circ\text{C}$ ) operated  $350\text{mA}$  and  $V_F=3.3\text{V}$ , the  $P_{\text{Dissipation}}=0.35 \times 3.3=1.155\text{W}$

And junction temperature is

$$T_{\text{Junction}} = 25^\circ\text{C} + 18.2 \times 1.155 = 46.021^\circ\text{C} \text{ (total surface area } = 90\text{cm}^2\text{)}$$

$$T_{\text{Junction}} = 25^\circ\text{C} + 21 \times 1.155 = 49.255^\circ\text{C} \text{ (total surface area } = 60\text{cm}^2\text{)}$$

$$T_{\text{Junction}} = 25^\circ\text{C} + 29.4 \times 1.155 = 58.957^\circ\text{C} \text{ (total surface area } = 30\text{cm}^2\text{)}$$

## Example : Junction Temperature Calculation

*One white LED is used under ambient temperature ( $T_{\text{Ambient}}$ ) of  $30^\circ\text{C}$ . This LED is soldered on MCPCB (Area= $10\text{cm}^2$ ). Calculate junction temperature.*

Assuming a forward voltage of  $V_F=3.3\text{V}$  at  $350\text{mA}$  and total power dissipated is

$$P_{\text{Dissipation}} = 1 \times 0.35 \times 3.3 = 1.155 \text{ W.}$$

$$\text{LED } R_{th(J-S)} = 10 \text{ }^\circ\text{C/W.}$$

With good design,  $R_{th(S-G)}$  can be minimized to  $1 \text{ }^\circ\text{C/W}$ .

$R_{th(G-B)}$  of a standard MCPCB can be  $1.5 \text{ }^\circ\text{C/W}$ .

The  $R_{th}$  between board and air is mainly dependent on the total surface area.

Therefore it can be calculated in formula  $\frac{500}{\text{Area(cm)}^2}$

$$R_{th(B-A)} = \frac{500}{10} = 50 \text{ } ^\circ\text{C/W}.$$

Following the formula  $T_{\text{Junction}} = T_{\text{Ambient}} + R_{th(J-A)} \times P_{\text{Dissipation}}$

$$T_{\text{Junction}} = 30 \text{ } ^\circ\text{C} + (10 \text{ } ^\circ\text{C/W} + 1 \text{ } ^\circ\text{C/W} + 1.5 \text{ } ^\circ\text{C/W} + 50 \text{ } ^\circ\text{C/W}) \times 1.155\text{W}$$
$$= 102.1875 \text{ } ^\circ\text{C}$$

That means this LED emitter is operated under good condition ( $T_{\text{Junction}} < 125 \text{ } ^\circ\text{C}$ ).

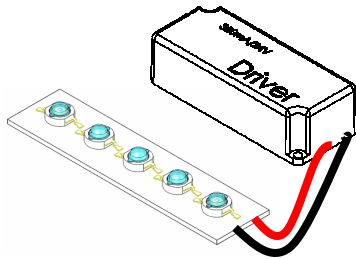
It's strongly recommended to keep the junction temperature under  $125 \text{ } ^\circ\text{C}$

Or keep the temperature of emitter lead not exceed  $55 \text{ } ^\circ\text{C}$

## Product Electrical Application Information

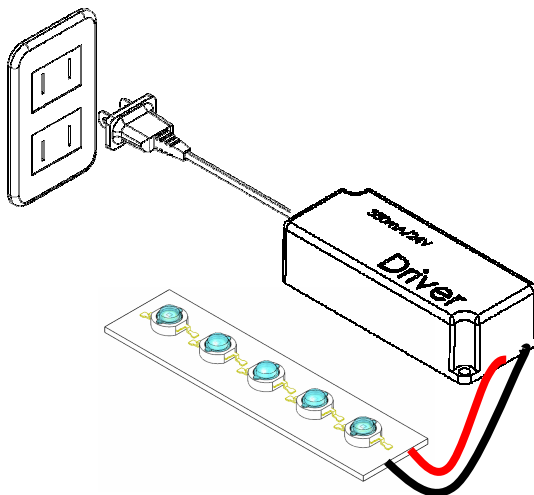
Following graphs and descriptions show how to connect LED or LED module and plug to AC outlet.

Step1: Connect the wires of LED Module to the DC output of the driver.



<Figure 24 LED Module connect to the DC output of the driver>

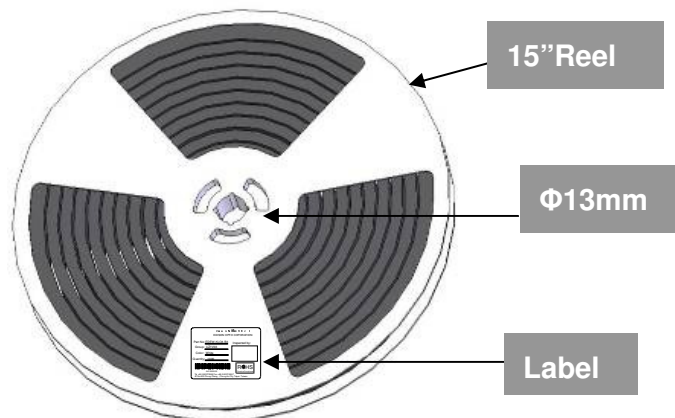
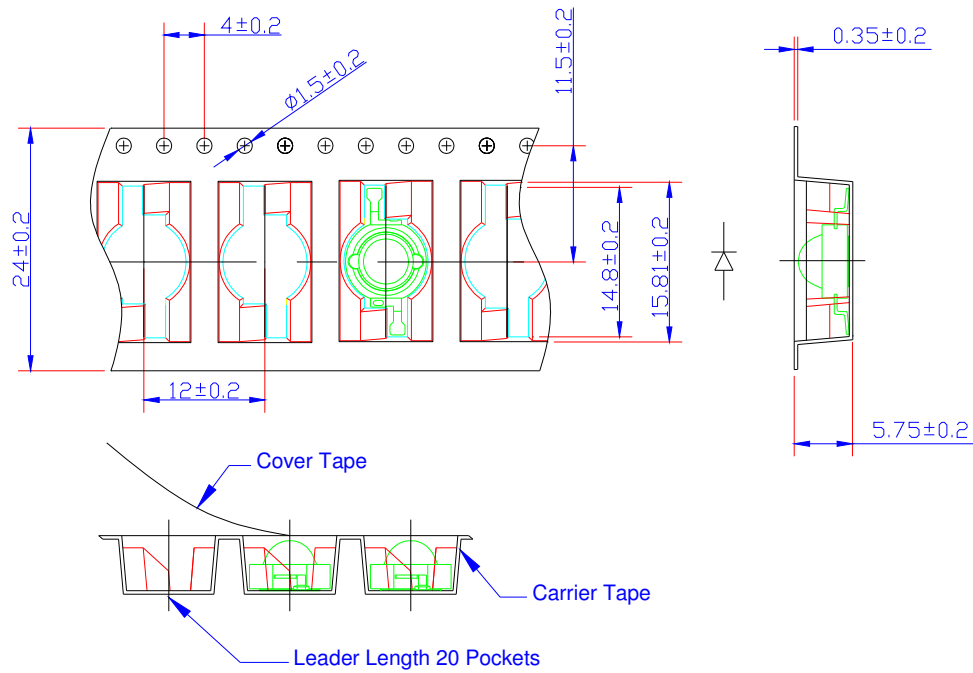
Step2 : Plug the driver to AC outlet.



<Figure 25 Plug the AC output of the driver to AC outlet>

Caution: Never plug the driver to AC outlet before the LED Module is properly connected as this may generate transient voltage damage the LEDs permanently with a short or open circuit.

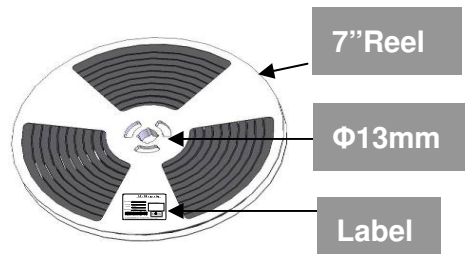
### Emitter Product Packaging Information



Item	Quantity	Total	Dimensions(mm)
15" Reel	1,000pcs	1,000pcs	Diameter=380
Inner box	2 reels	2,000pcs	390*390*170
Outer box	2 inner boxes	4,000pcs	425*405*350

<Figure 26 Taping reel dimensions>

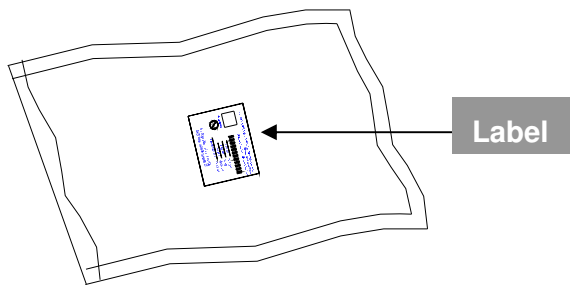




Item	Quantity	Total	Dimensions(mm)
7" Reel	200pcs	200pcs	Diameter=178
Inner box	2 reels	400pcs	240*235*67
Outer box	5 inner boxes	2,000pcs	353*254*256

<Figure 27 Taping reel dimensions>

The Label

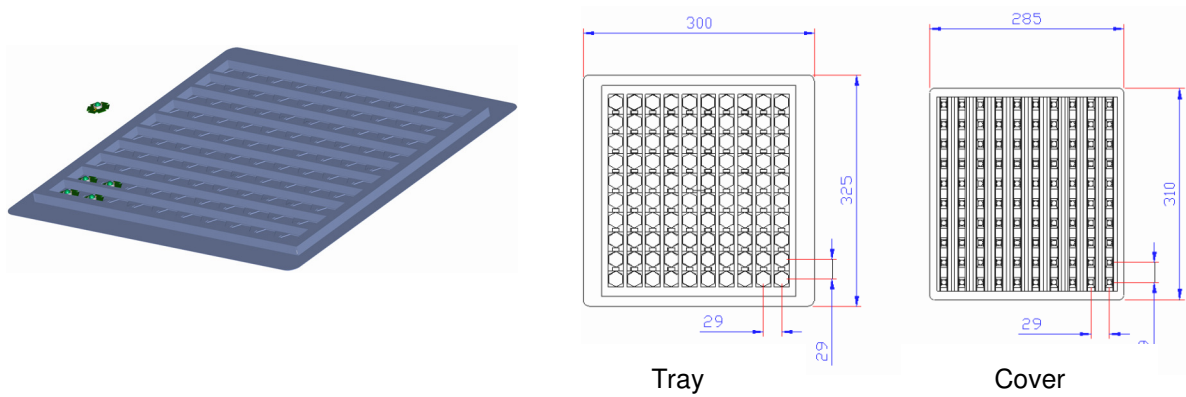


< Figure 28 Label on taping reel >

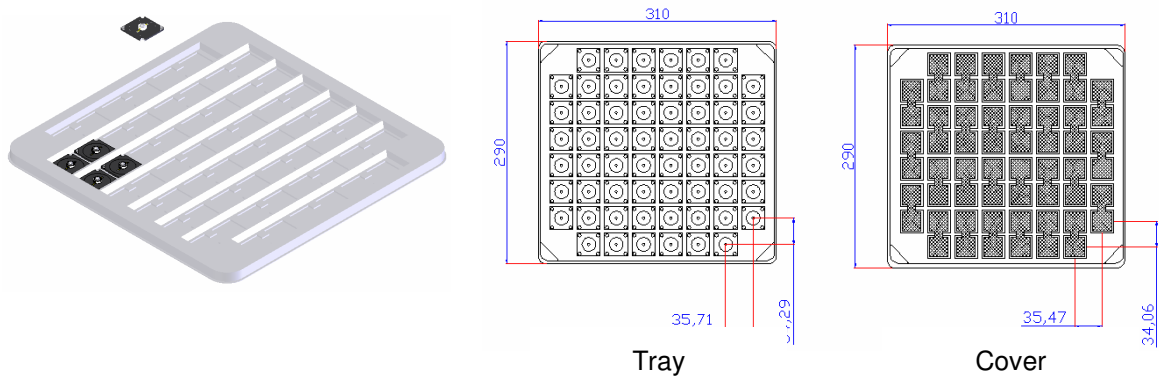


< Figure 29 Label on taping reel >

## Star Product Packaging Information



Item	Quantity	Total	Dimensions(mm)
Tray	100pcs	100pcs	325*300
Inner box	10 Tray	1,000pcs	340*330*160
Outer box	2 inner boxes	2,000pcs	350*350*340



Item	Quantity	Total	Dimensions(mm)
Tray	60pcs	60pcs	310*290
Inner box	10 Tray	600pcs	340*330*160
Outer box	2 inner boxes	1200pcs	350*350*340

<Figure 30 Edixeon® Star Package>