Edixeon® RGB series

RGB Edixeon® emitters are one of the highest flux LEDs in the world by Edison Opto. It is designed to satisfy applications of Solid-State lighting. It is designed to have three chips in one package. It has various colors for choice and can be independently controlled. More importantly, it can pass reflow process.

Features

- Three chips (colors) in one package
- Various colors for choice
- Independent control of each color
- More energy efficient than incandescent and most halogen lamps
- Low voltage operation
- Instant light
- Long operating life
- IR reflow process compatible

Typical Applications

- Up-lighters and Down-lighters
- Contour lights
- Ceiling lights
- Garden lighting
- Architectural lighting
- Beacon lights

Table of Contents

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® RGB series nomenclature >

E D E RTB - 1 G A 1 - A B 16

X1 X2 X3 X4 X5 X6 X7 X8 X9 X10

X1 LED Item		X2 Module		X3 Emitting Color		X4 Power		X5 Lens Item		X6 Housing Item	
Code	Type	Code	Type	Code	Type	Code	Type	Code	Type	Code	Type
ED	Edixeon®	E	Emitter	RTB	RGB 3 chips	1	1 W	L	Lambertian (140°)	A	White-1
		S	Star					G	Low Slug with Lambertian	C	Black-2
								E	Low Slug with Flat Lens		

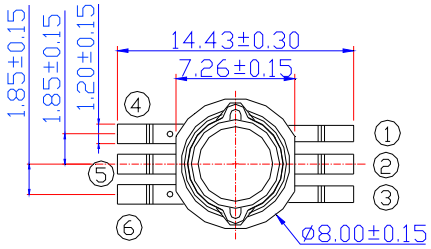
X7 Material	X8 Shape Item		X9 Al PCB Color		X10 Thickness	
	Code	Type	Code	Type	Code	Type
	A	Star	W	White	10	1.0mm
	B	Square(25*25mm)	G	Green	16	1.6mm
	C	Square(30*30mm)	B	Black	20	2.0mm

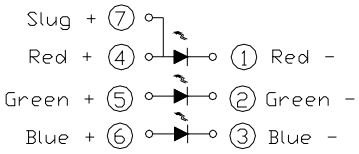
Environmental Compliance

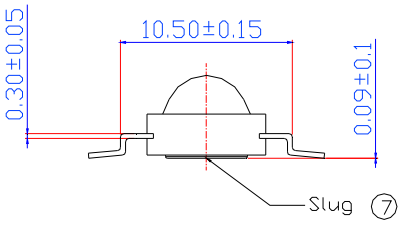
Edixeon® RGB series are compliant to the Restriction of Hazardous Substances Directive or RoHS. The restricted materials including lead, mercury cadmium hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) are not used in Edixeon® RGB series to provide an environmentally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

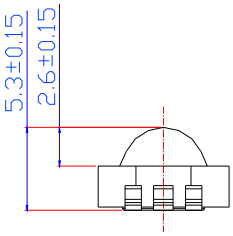
LED Package Dimension and Polarity

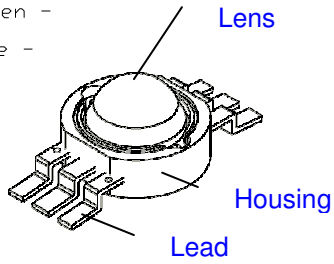
EDERTB-1LC6



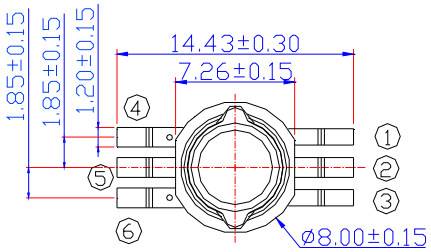


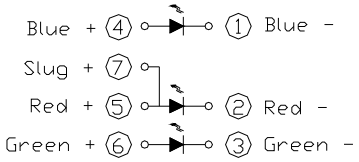


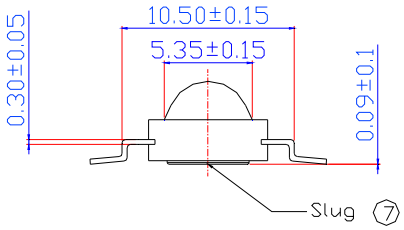


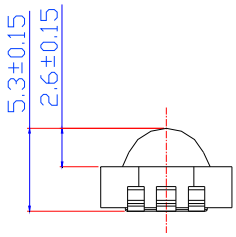


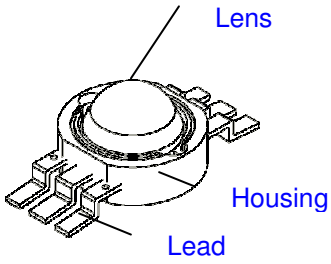
EDERTB-1GA1 / EDERTB-1LA1



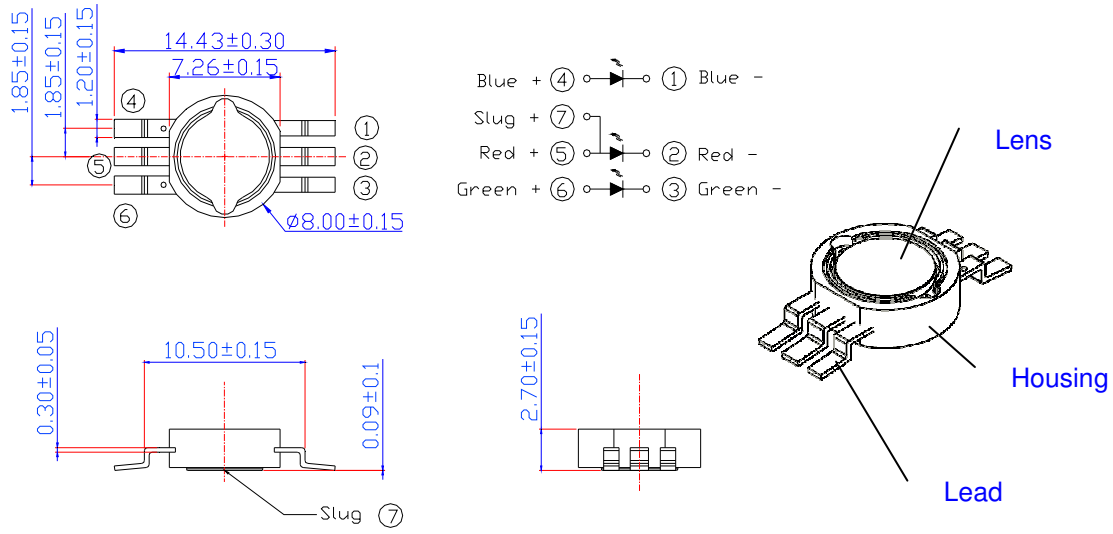








EDERTB-1EA1



< Figure 1 Edixeon® RGB series dimensions >

Notes:

1. All dimensions are in mm.
2. Lambertian and side emitting series slug has polarity as anode.
3. It is important that the slug can't contact aluminum surface. It is strongly recommended that there should coat a uniform electrically isolated heat dissipation film on the aluminum surface.

LED Package with Star Dimension and Polarity

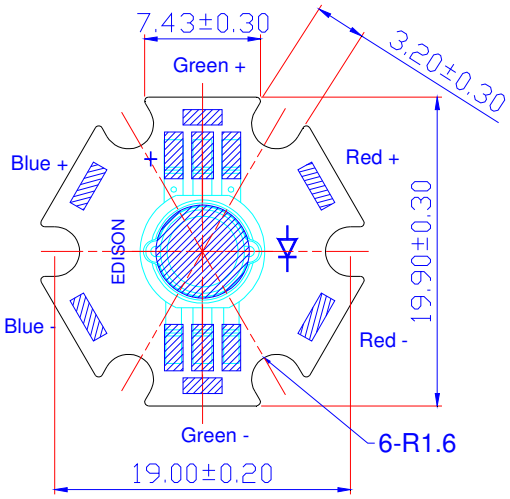
EDSRTB-1LC6-AB16

EDERTB-1GA1-AB16

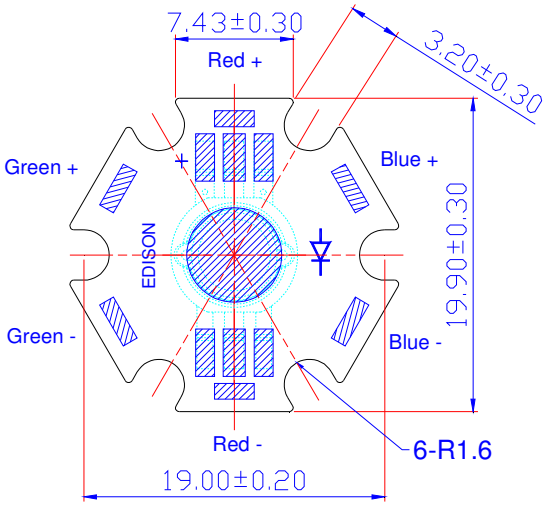
EDERTB-1LA1-AB16

EDERTB-1EA1-AB16

Top View

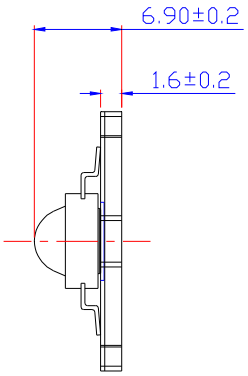


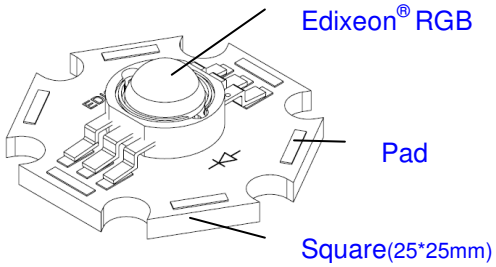
Top View



EDSRTB-1LC6-AB16 / **EDERTB-1GA1-AB16** / **EDERTB-1LA1-AB16**

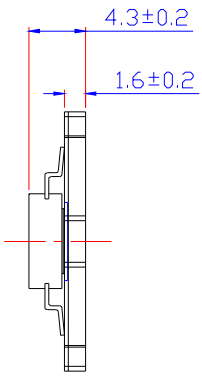
Side View

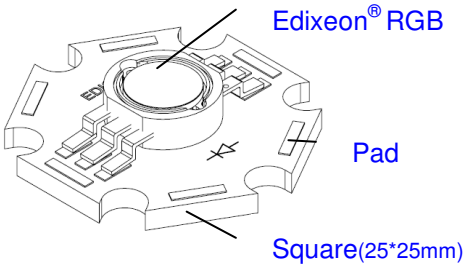




EDERTB-1EA1-AB16

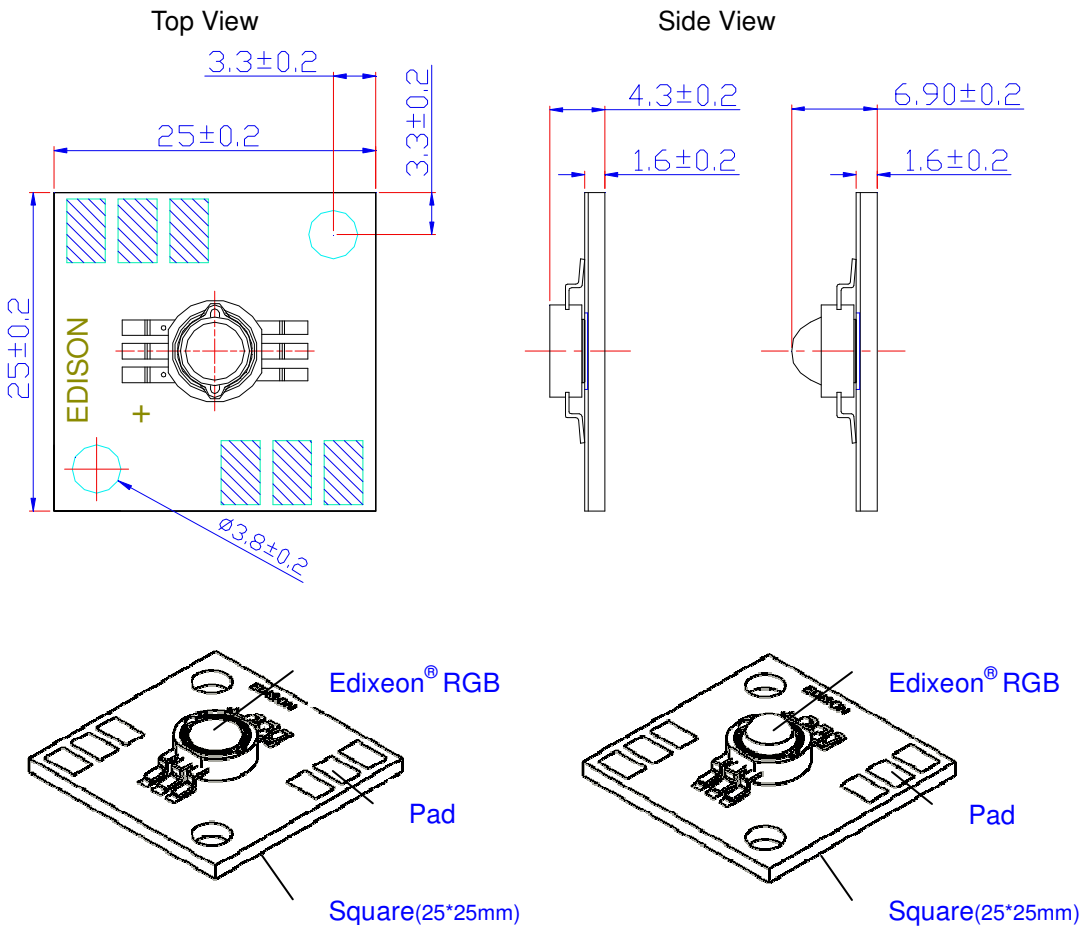
Side View





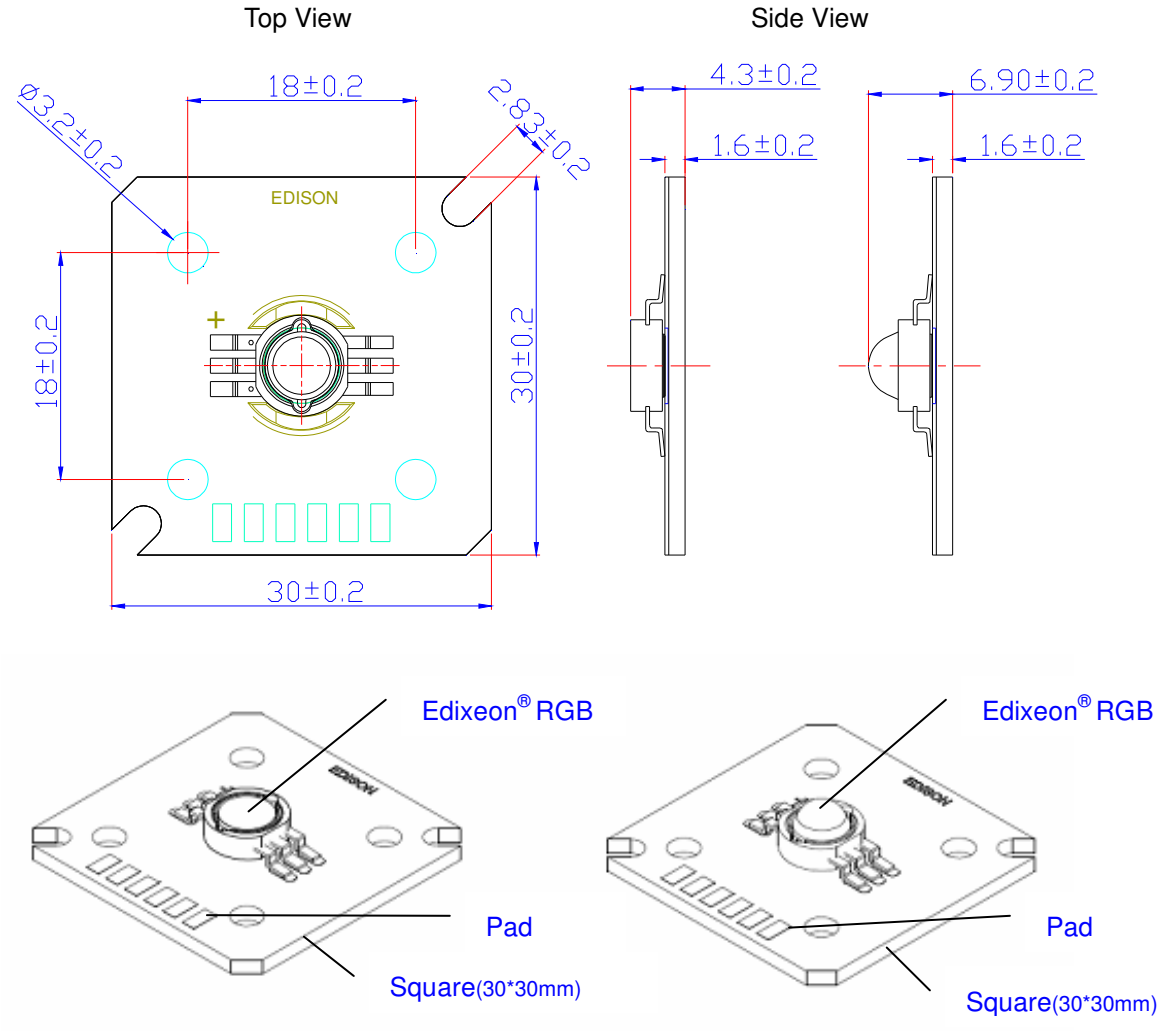
< Figure 2 Edixeon® RGB series star dimensions >

EDSRTB-1xxx-BB16



< Figure 3 Edixeon® RGB series star square dimensions >

EDSRTB-1xxx-CB16



< Figure 4 Edixeon® RGB series star square dimensions >

Notes:

1. All dimensions are in mm.
2. It is strongly recommended that the temperature of lead does not exceed 55℃.

Absolute Maximum Ratings

The following tables describe the characteristics of Edixeon® RGB series under various current and different colors.

< Table 2 Absolute maximum ratings for Edixeon® RGB series >

Parameter	Rating	Unit	Symbol
DC Forward Current for each color	350	mA	I_F
Peak pulse current;(tp≦100μs, Duty cycle=0.25)	500	mA	
Total Wattage	3	W	
Reverse Voltage	5	V	V_R
Forward Voltage (blue, true green)	5	V	V_F
Forward Voltage (red)	3	V	V_F
LED junction Temperature	125	℃	T_J
Operating Temperature	-30 ~ +130	℃	
Storage Temperature	-40 ~ +150	℃	
Soldering Temperature	260	℃	
ESD Sensitivity	500	V	V_B
Manual Soldering Time at 260℃(Max.)	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. tp: Pulse width time

The following table describes thermal resistance of Edixeon® RGB series.

< Table 3 Temperature coefficient of forward voltage & thermal resistance junction to case characteristics at T_J=25℃ for Edixeon® RGB series >

Lens Item	Color	△V_F/△T		Rθ$_{J-B}$	
		Typ.	Unit	Typ.	Unit
EDERTB-1LC6 EDERTB-1LA1	Red	-2	mV/℃	16	℃/W
	True Green		mV/℃	15	℃/W
	Blue		mV/℃	15	℃/W
EDERTB-1GA1	Red	-2	mV/℃	16	℃/W
	True Green		mV/℃	13	℃/W
	Blue		mV/℃	11	℃/W
EDERTB-1EA1	Red	-2	mV/℃	16	℃/W
	True Green		mV/℃	13	℃/W
	Blue		mV/℃	11	℃/W

Luminous Flux Characteristics

The following table describes flux of Edixeon® RGB series under various current and different colors.

< Table 4 Luminous flux characteristics at I_F=350mA and T_J=25℃: for Edixeon® RGB series >

Part Name	Color	Flux			Unit
		Min.	Typ.	Max.	
EDERTB-1LC6	Red	13.8	25.0	--	lm
	True Green	33.3	50.0	--	lm
	Blue	6.3	12.0	--	lm
EDERTB-1GA1	Red	23.3	30.0	--	lm
	True Green	39.4	55.0	--	lm
	Blue	10.6	15.0	--	lm
EDERTB-1LA1	Red	13.8	35.0	--	lm
	True Green	30.3	60.0	--	lm
	Blue	6.2	12.0	--	lm
EDERTB-1EA1	Red	13.8	23.0	--	lm
	True Green	30.3	45.0	--	lm
	Blue	6.2	8.0	--	lm

Notes:

1. Flux is measured with an accuracy of ± 10%.
2. All true green and blue emitters are built with InGaN
3. All red and amber emitters are built with AlGaInP
4. Blue power light source represented here is IEC60825 class 2 for eye safety.
5. Red and true green light source represented here are IE60825 class 1 for eye safety.

Forward Voltage Characteristics

The following table describes forward voltage of Edixeon® RGB series under various current.

< Table 5 Forward voltage characteristics at I_F=350mA and T_J=25℃ for Edixeon® RGB series >

Part Name	Color	V_F			Unit
		Min.	Typ.	Max.	
EDERTB-1LC6	Red	2.0	--	3.0	V
	True Green	3.4	--	4.7	V
	Blue	3.4	--	4.7	V
EDERTB-1GA1	Red	2.0	--	3.0	V
	True Green	3.1	--	4.0	V
	Blue	3.1	--	4.0	V
EDERTB-1LA1	Red	2.0	--	3.0	V
	True Green	3.1	--	4.0	V
	Blue	3.1	--	4.0	V
EDERTB-1EA1	Red	2.0	--	3.0	V
	True Green	3.1	--	4.0	V
	Blue	3.1	--	4.0	V

Note:

1. Forward Voltage is measured with an accuracy of ± 0.1V

JEDEC Information

JEDEC 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 attachment and/or repair operation. The present moisture sensitivity standard contains six levels, the lower the level, the longer the devices floor life. Edixeon® RGB series are certified at level 4. This means Edixeon® RGB series have a floor life of 72 hours before Edixeon® RGB series need to re-baked. If the package has been opened more than 1 week or the color of desiccant changes,components should be dried for 10-12 hours at 60 ± 5℃.

< Table 6 JEDEC characteristics at T_J=25℃ for Edixeon® RGB 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℃/60% RH	96[1] +5/-0	30℃/60% RH	20 +5/-0	24 +5/-0	60℃/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℃/85% RH	168 +5/-0	85℃/85% RH	NA	NA	NA
2	1 year	≦30℃/60% RH	168 +5/-0	85℃/60% RH	NA	NA	NA
2a	4 weeks	≦30℃/60% RH	696[1] +5/-0	30℃/60% RH	120 +1/-0	168 +1/-0	60℃/60% RH
3	168 hours	≦30℃/60% RH	192[1] +5/-0	30℃/60% RH	40 +5/-0	52 +5/-0	60℃/60% RH
4	72 hours	≦30℃/60% RH	96[1] +5/-0	30℃/60% RH	20 +5/-0	24 +5/-0	60℃/60% RH
5	48 hours	≦30℃/60% RH	72[1] +5/-0	30℃/60% RH	15 +5/-0	20 +5/-0	60℃/60% RH
5a	24 hours	≦30℃/60% RH	48[1] +5/-0	30℃/60% RH	10 +5/-0	13 +5/-0	60℃/60% RH
6	Time on label (TOL)	≦30℃/60% RH	TOL	30℃/60% RH	NA	NA	NA

Note:

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.

Reliability Items and Failure Measures

Reliability test

The following table describes operating life, mechanical, and environmental tests performed on Edixeon® RGB series package.

< Table 7 Operating life, mechanical, and environmental characteristics and TJ=25℃ for Edixeon® RGB series>

Stress Test	Stress Conditions	Stress Duration	Failure Criteria
Room Temperature Operating Life	25℃, I_F = max DC (Note 1)	1,000 hours	Note 2
High Temperature High Humidity	85℃ / 85%RH	1,000 hours	Note 2
Temperature Cycle	-40℃/100℃ ,30 min dwell /＜5min transfer	500 cycles	Note 2
High Temperature Storage Life	110℃	1,000 hours	Note 2
Low Temperature Storage Life	-40℃	1,000 hours	Note 2
Thermal Shock	-40 / 125℃, 15 min dwell /＜10 sec transfer	500 cycles	No catastrophics
Mechanical Shock	1500 G, 0.5ms pulse, 5 shocks each 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℃ ± 5℃, 10 sec		No catastrophics
Solderability	Steam age for 16 hr, then solder dip at 260℃ for 5 sec		Solder coverage on lead

Notes:

1. Depending on the maximum derating curve.
2. Failure Criteria:

Electrical failures

V_F shift >=10%

Light Output Degradation

% Iv shift >= 30% @1,000hrs or 500cycle

Visual failures

Broken or damaged package or lead

Solderability < 95% wetting

Dimension out of tolerance

Failure Types

Catastrophic failures are failures that result in the LED emitting no light or very little light at normal current levels (e.g. 350 mA). Catastrophic failures are not expected for Edixeon® emitters that are handled and operated within the limits specified in Edixeon® documentation. Please refer to Absolute Maximum Ratings for more information on design limits.

Parametric failures are failures that cause key characteristics to shift outside of acceptable bounds. The most common parametric failure, for a high-power LED, is permanent light output degradation over operating life. Most other light sources experience catastrophic failure at the end of their useful life, providing a clear indication that the light source must be replaced. For instance, the filament of an incandescent light bulb breaks and the bulb ceases to create light. In contrast, high-power LEDs generally do not experience catastrophic failure but simply become too dim to be useful in the intended application. Further discussion of this matter can be found in the Long-Term Lumen Maintenance Testing section of this document.

Another parametric failure common to white LEDs is a large and permanent shift in the exact color of white light output, called the white point or color point. A shift in white point may not be detectable in one LED by itself, but would be obvious in a side-by-side comparison of multiple LEDs. Since each lighting installation commonly uses many high-power LEDs, white point stability is a point of concern for lighting designers. Typically, white high-power LEDs, created by combining blue LEDs with yellow (and sometimes red) phosphor, will shift towards blue over operational life. This shift can be accelerated by high temperatures and high drive currents. For example, a cool white (e.g., 6500K CCT) LED with a white point failure will typically appear light blue instead of white. In some high-power LEDs, this failure mode can occur after just 1,000 hours of operational life.

Just as with fluorescent light sources, all white high-power LEDs will experience shifts in white point over their operating lives. It is possible for the design of the phosphor and packaging systems to minimize these shifts and contain the shifts to be less than what is detectable by the human eye. As with catastrophic failures, parametric failures can be minimized by adhering to limits specified in Edixeon® documentation.

The MTBF of Edixeon® RGB series

Mean time between failures (MTBF) is the mean (average) time between failures of a system, the reciprocal of the failure rate in the special case when the failure rate is constant. Calculations of MTBF assume that a system is "renewed", i.e. fixed, after each failure, and then returned to service immediately after failure. A related term, mean distance between failures, with a similar and more intuitive sense, is widely used in transport industries such as railways and trucking. The average time between failing and being returned to service is termed mean down time (MDT).

The formula of MTBF for Edixeon® RGB series can be

$$\log(\text{Life}) = \frac{1{,}600}{T_J(^{o}C)+273}$$

< Table 8 Relation between junction temperature and life time >

T_J (^{o}C)	Life (hours)	T_J (^{o}C)	Life (hours)
25	*234,000*	*85*	*29,500*
30	*191,000*	*90*	*25,700*
35	*157,000*	*95*	*22,300*
40	*129,000*	*100*	*19,500*
45	*107,000*	*105*	*17,100*
50	*90,000*	*110*	*15,100*
55	*75,000*	*115*	*13,300*
60	*64,000*	*120*	*11,700*
65	*54,000*	*125*	*10,500*
70	*46,000*	*130*	*9,300*
75	*39,600*	*140*	*7,500*
80	*34,000*	*150*	*6,000*

Notes:

1. Life means the time when light output decay to 70%

The MTTF of Edixeon® RGB series

An estimate of the average, or mean time until a design's or component's first failure, or disruption in the operation of the product, process, procedure, or design occurs. Mean time until a failure assumes that the product CAN NOT be repaired and the product CAN NOT resume any of it's normal operations.
Mean time to failure (MTTF) is related to items such as expected and/or operating life or other items that in general are not fixed or replacement even though it sometimes may be.

MTTF is assumed to be 100,000,000
The failure rates at different hours and different systems (LED quantity) are as below:

if there is 1 failure of 1 emitter in a system

Tj=75℃ is giving 0.01%(100ppm) at 10,000hrs

if there is 1 failure of 10 emitters in a system

Tj=75℃ is giving 0.1%(1,000ppm) at 10,000hrs

if there is 1 failure of 1 emitter in a system

Tj=75℃ is giving 0.05%(500ppm) at 50,000hrs

if there is 1 failure of 10 emitters in a system

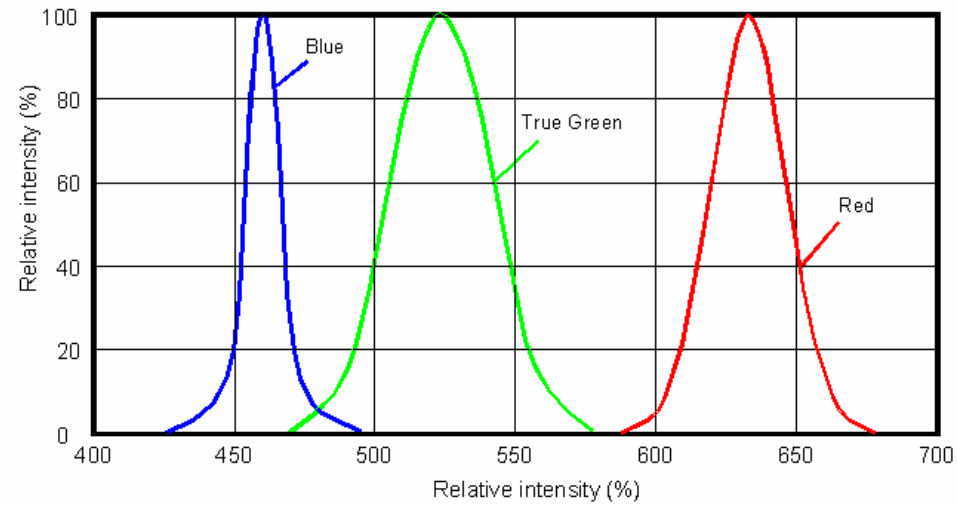
Tj=75℃ is giving 0.5%(5,000ppm) at 50,000hrs

ASSIST FORM for High Power LED Reliability

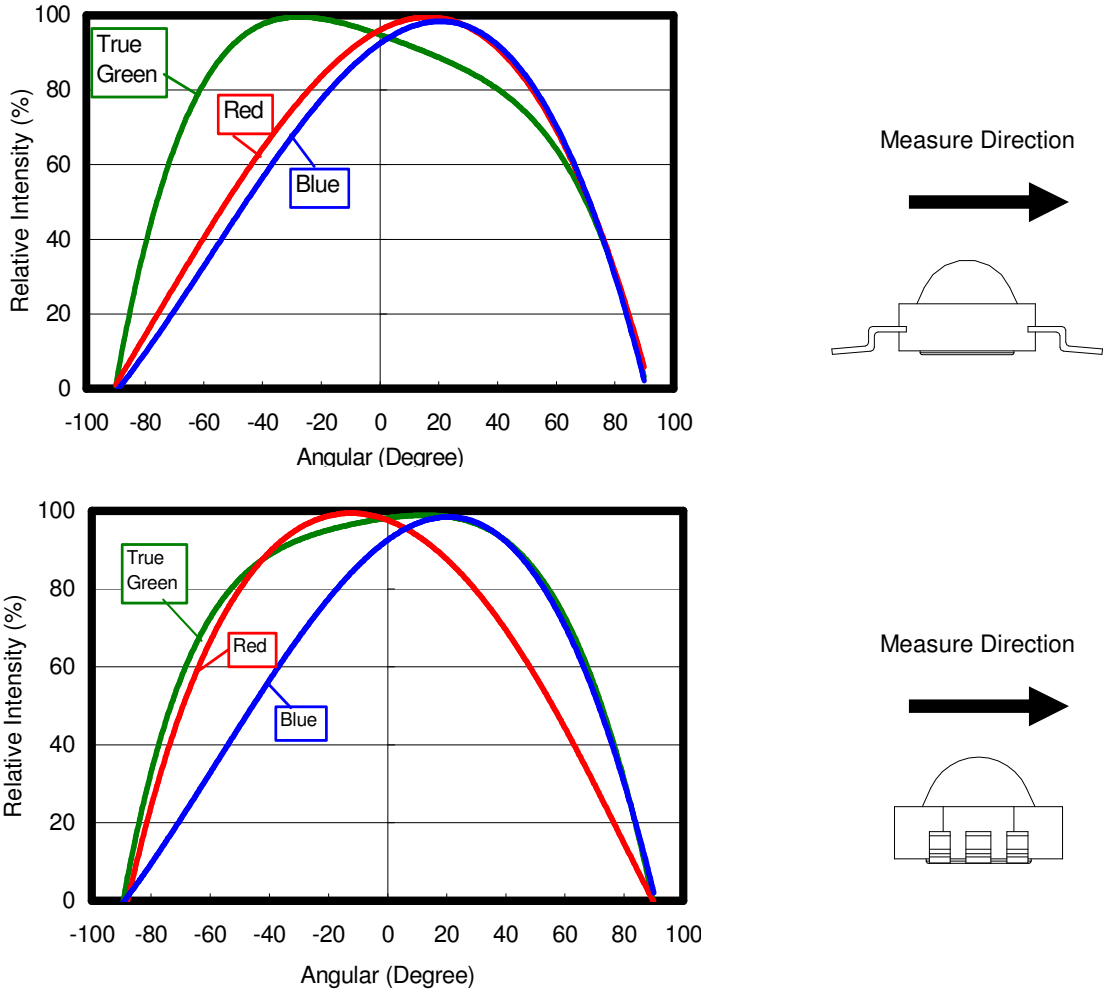
< Table 9 Green chip different junction temperature characteristics of EDERTB-1GA1 green color>

	Ts=45°C	Ts=65°C	Ts=85°C
Voltage	3.5V	3.5V	3.5V
Current	350mA	350mA	350mA
Wattage	1.2w	1.2w	1.2w
Heat	0.92W	0.92W	0.92W
Rth	13 °C/W	13 °C/W	13 °C/W
T_J	57 °C	77 °C	97 °C
$L_{70\%}$	64,000hrs	36,800hrs	20,900hrs

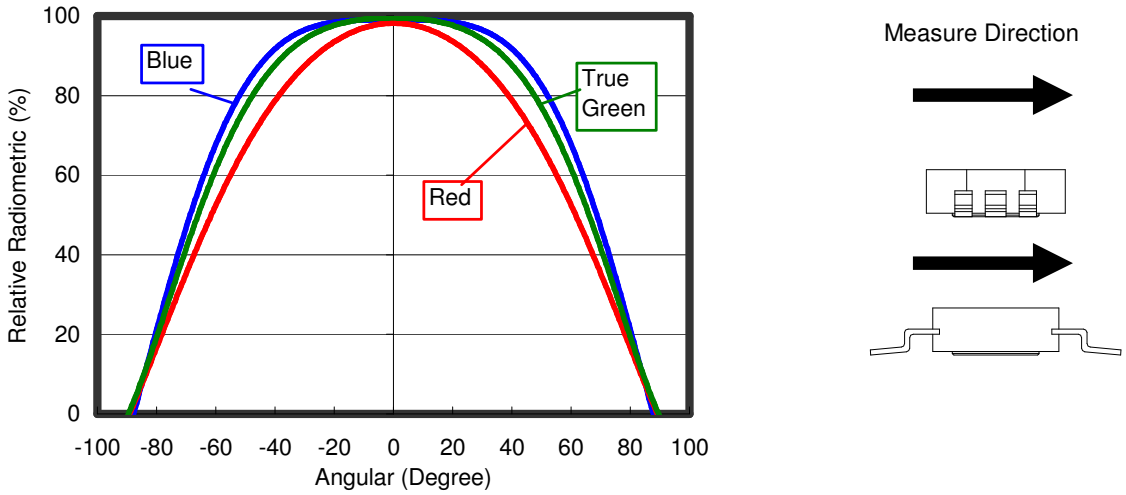
Color Spectrum and Radiation Pattern



<Figure 5.Color spectrum at T_J =25℃.for Edixeon® RGB series >



<Figure 6.Lambertain angle at T_J=25℃ for 1LC6、1GA1 and 1LA1 Edixeon® RGB series.>



<Figure 7.Lambertain angle at T_J=25℃ for 1EA1 Edixeon® RGB series.>

Dominant Wavelength Characteristics T_J=25℃

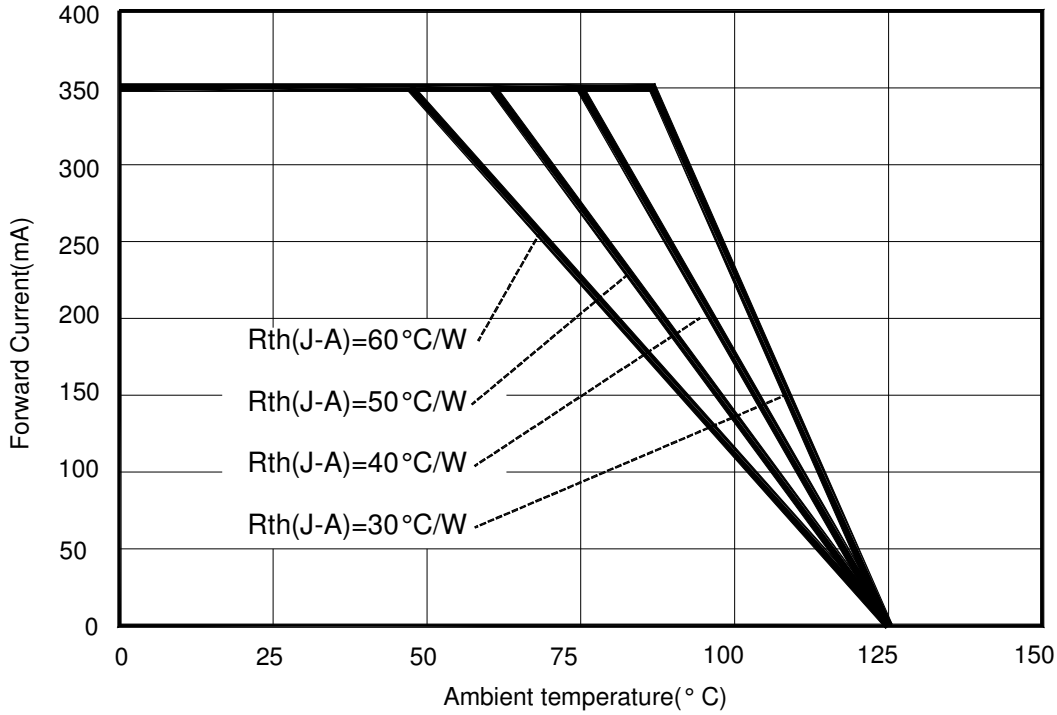
< Table 10 Dominant Wavelength Characteristics at T_J=25℃ for Edixeon® RGB series >

Part Name	Color	λd			Unit
		Min.	Typ.	Max.	
EDERTB-1xxx	Red	620	--	630	nm
	True Green	525	--	535	nm
	Blue	455	--	465	nm

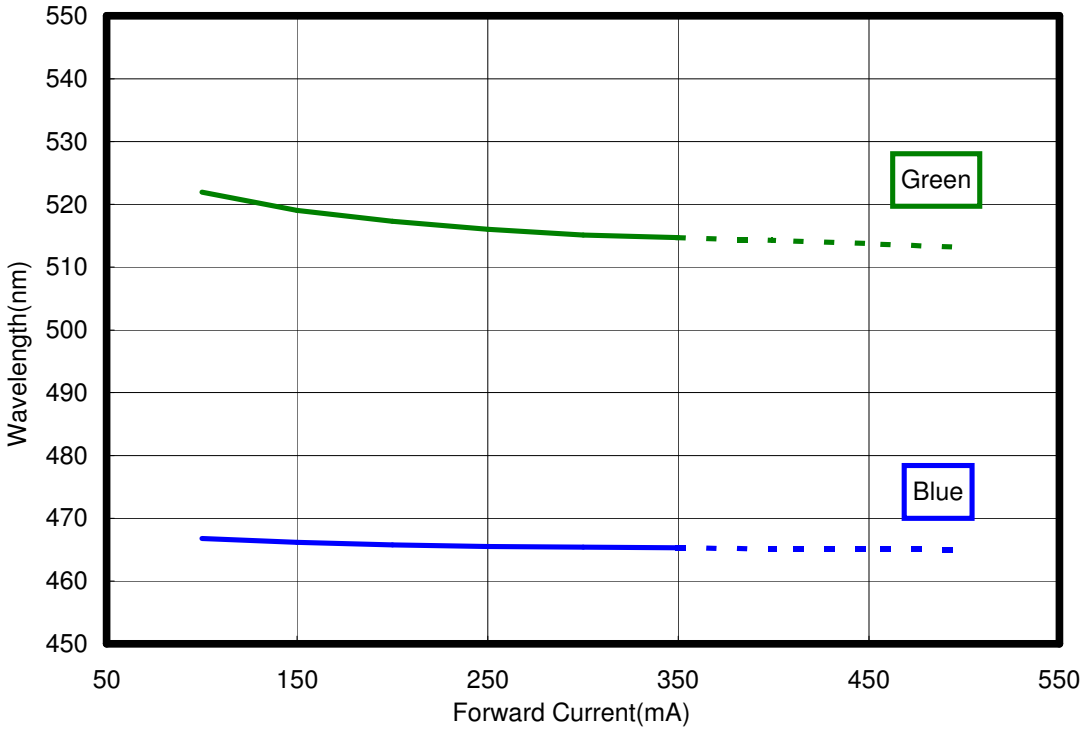
Note:

1. Wavelength is measured with an accuracy of ± 0.5nm

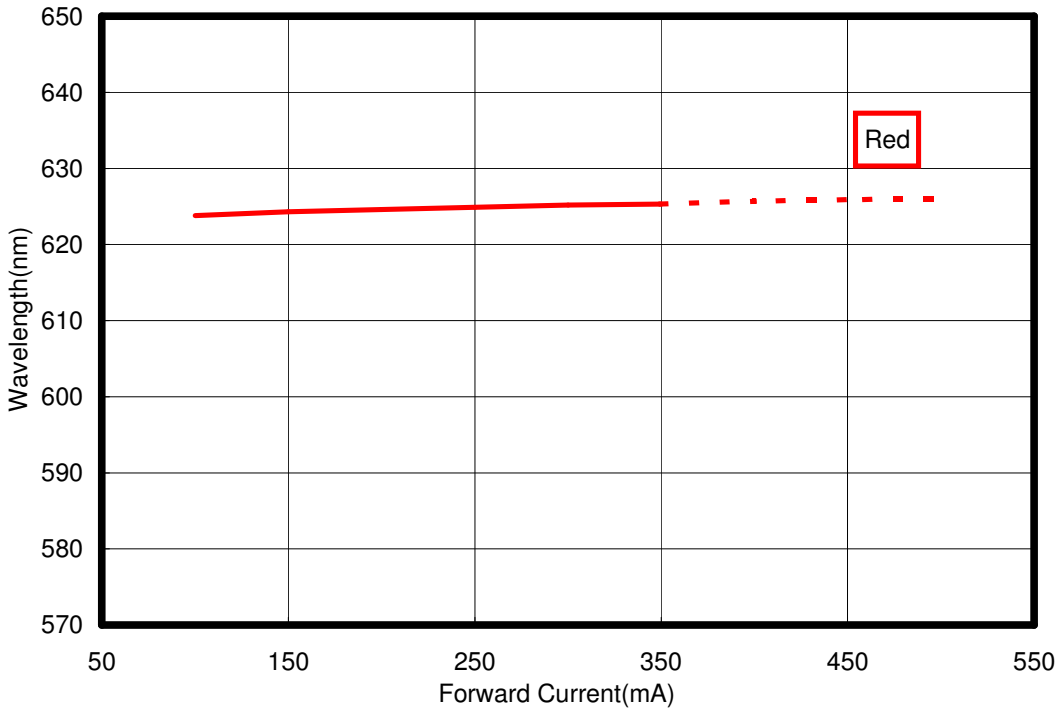
Optical & Electrical Characteristics



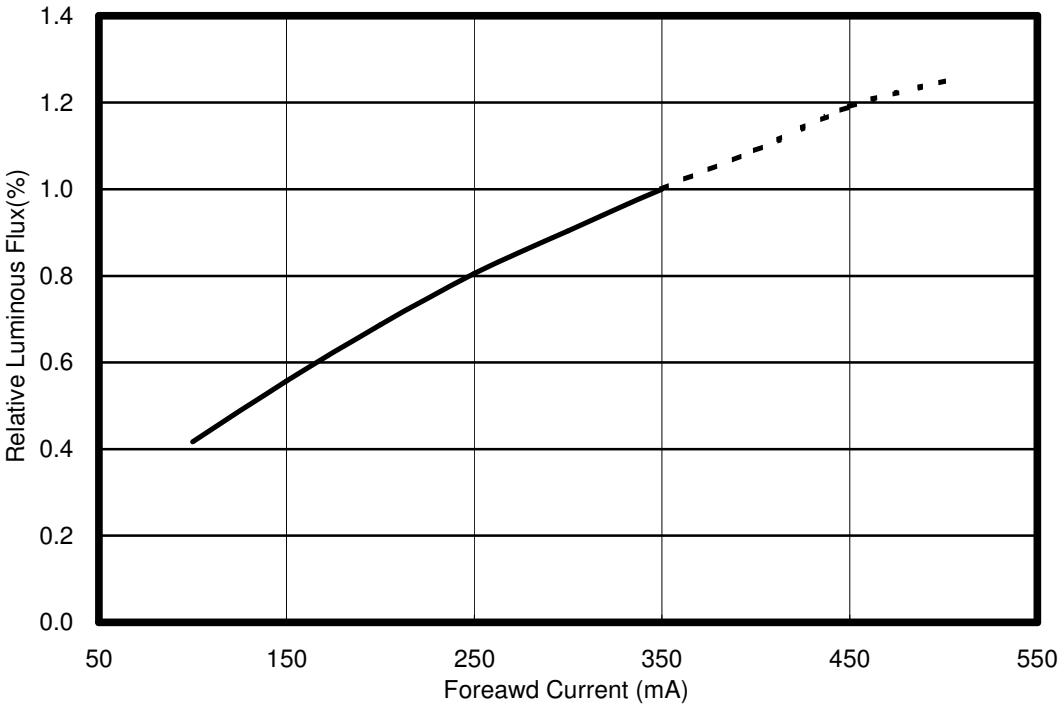
< Figure 8 Operating current & ambient temperature for Edixeon® RGB series >



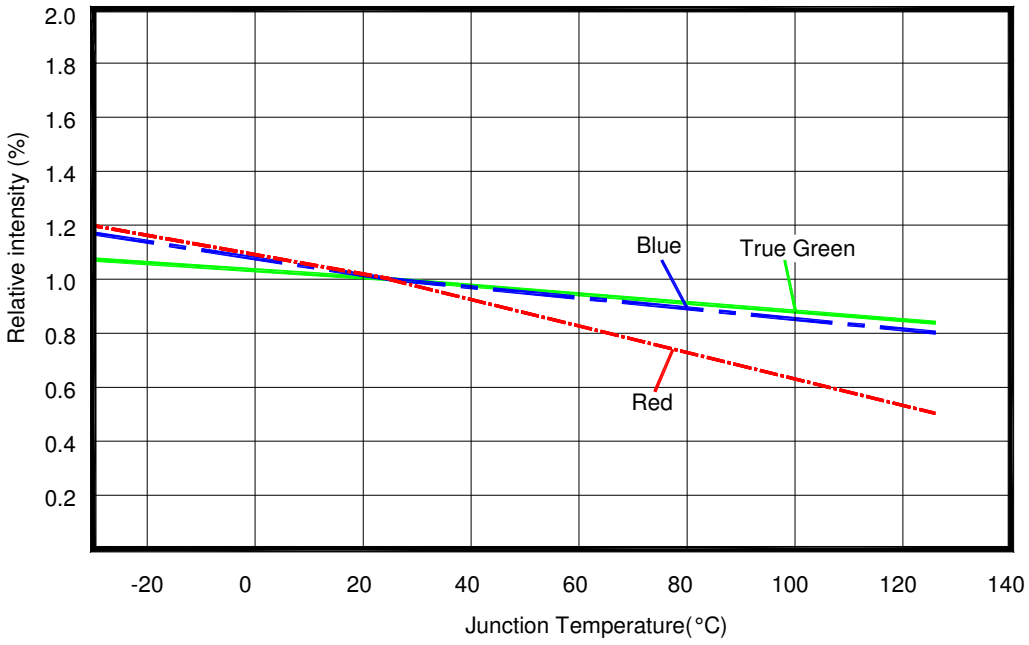
< Figure 9 Wavelength & forward current for true green and blue color Edixeon® RGB series>



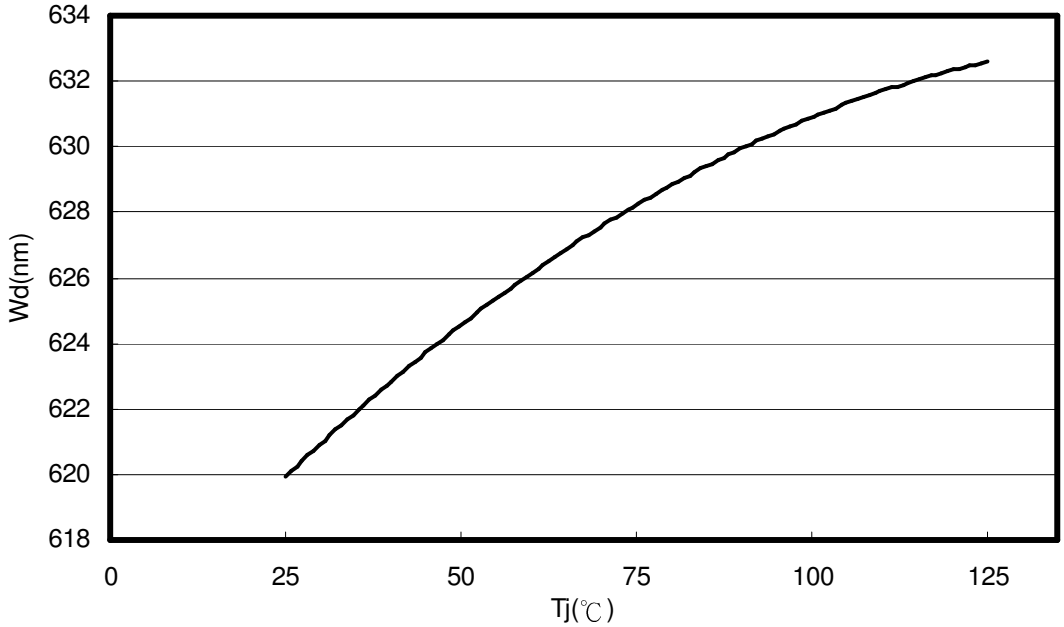
< Figure 10 Wavelength & forward current for red color Edixeon® RGB series >



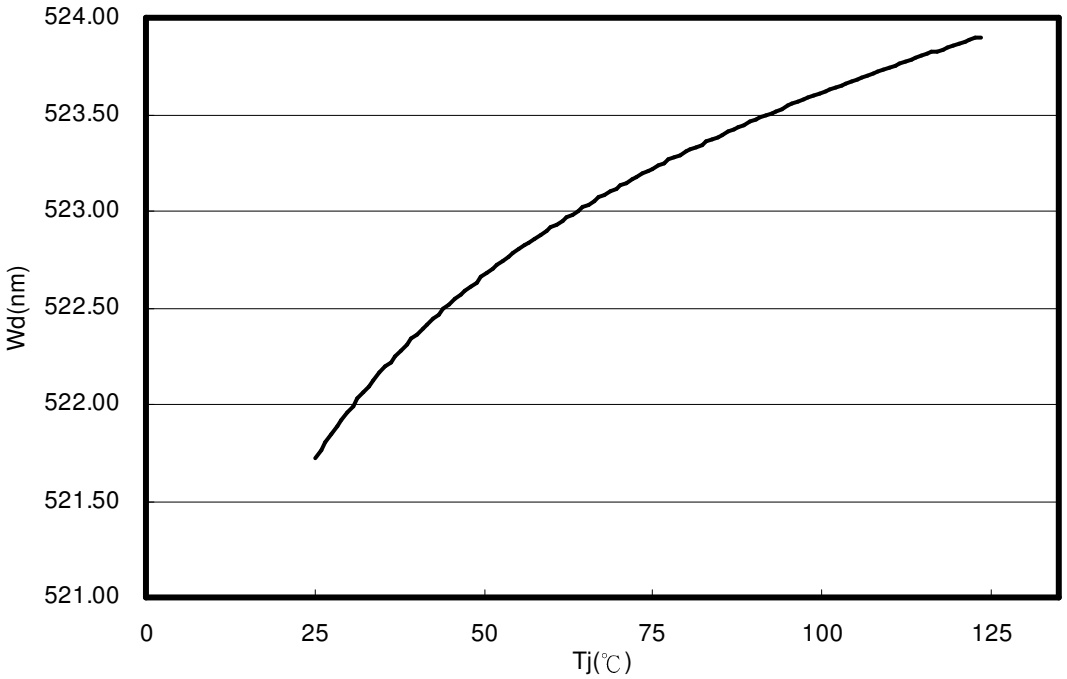
< Figure 11 Forward current & relative luminous at T_J=25℃ for Edixeon® RGB series >



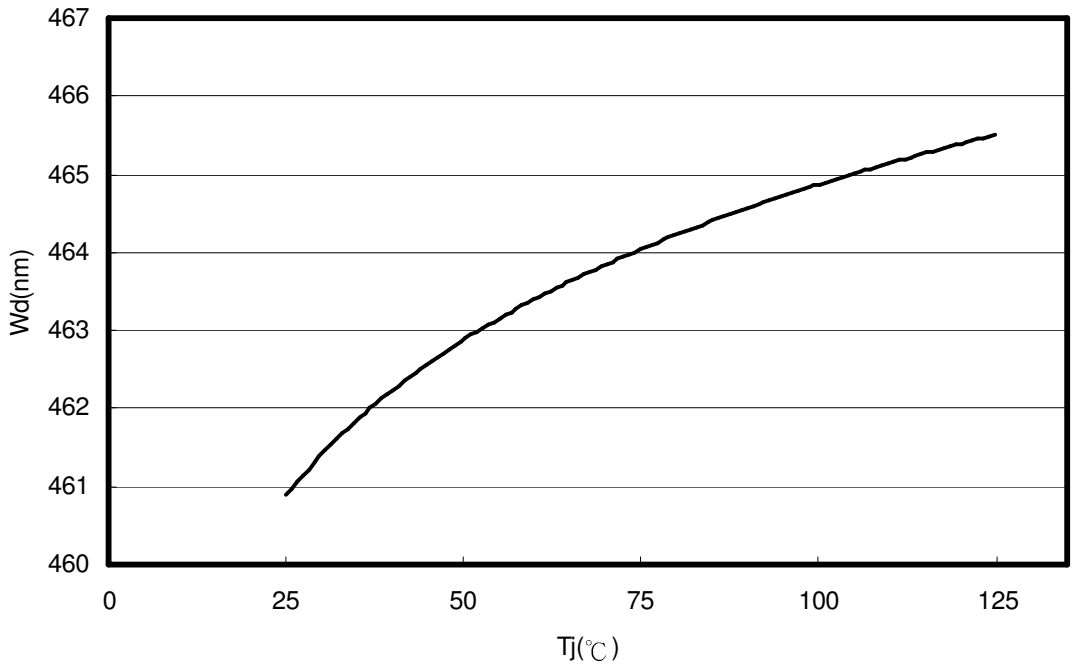
< Figure 12 Junction temperature & power rate for Edixeon® RGB series >



< Figure 13 Wavelength characteristic for Edixeon® RGB red chip >



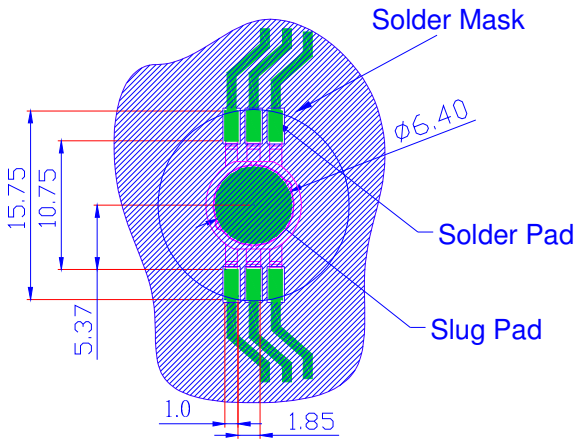
< Figure 14 Wavelength characteristic for Edixeon® RGB green chip >



< Figure 15 Wavelength characteristic for Edixeon® RGB blue chip >

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 16.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® 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 devices 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® RGB series is an electrically neutral heat path that is separate from the LED's electrical contacts. This electrically isolated thermal pad makes Edixeon® emitter perfect for use with either FR4 circuit boards with thermal via or with metal-core printed circuit boards (MCPCB).

Recommend Solder Steps

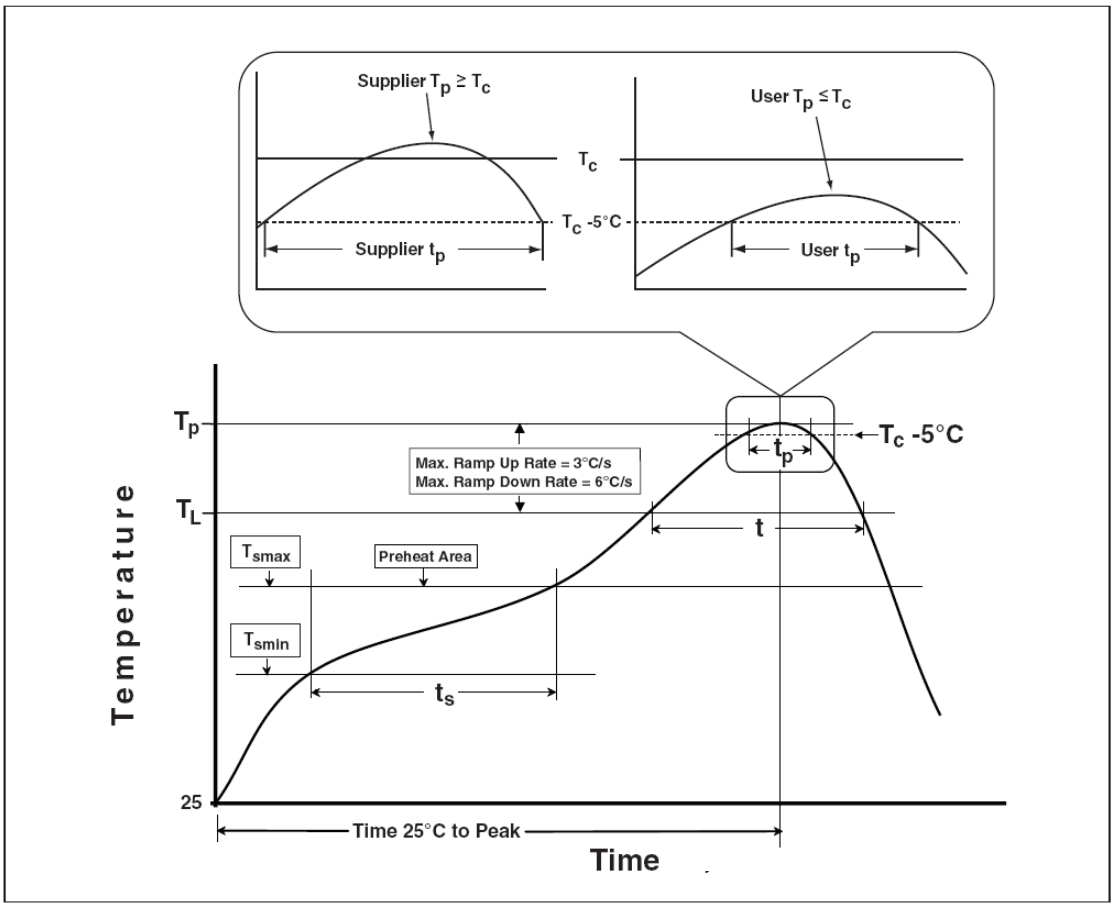
To prevent mechanical failure of LEDs in the soldering process, a carefully controlled pre-heat and post-cooling sequence is necessary. The heating rate in an IR furnace depends on the absorption coefficients of the material surfaces and on the ratio of the component's mass to its irradiated surface. 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® RGB 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 17 Reflow profiles >

Table of Classification Reflow Profiles

< Table 11 Reflow profiles >

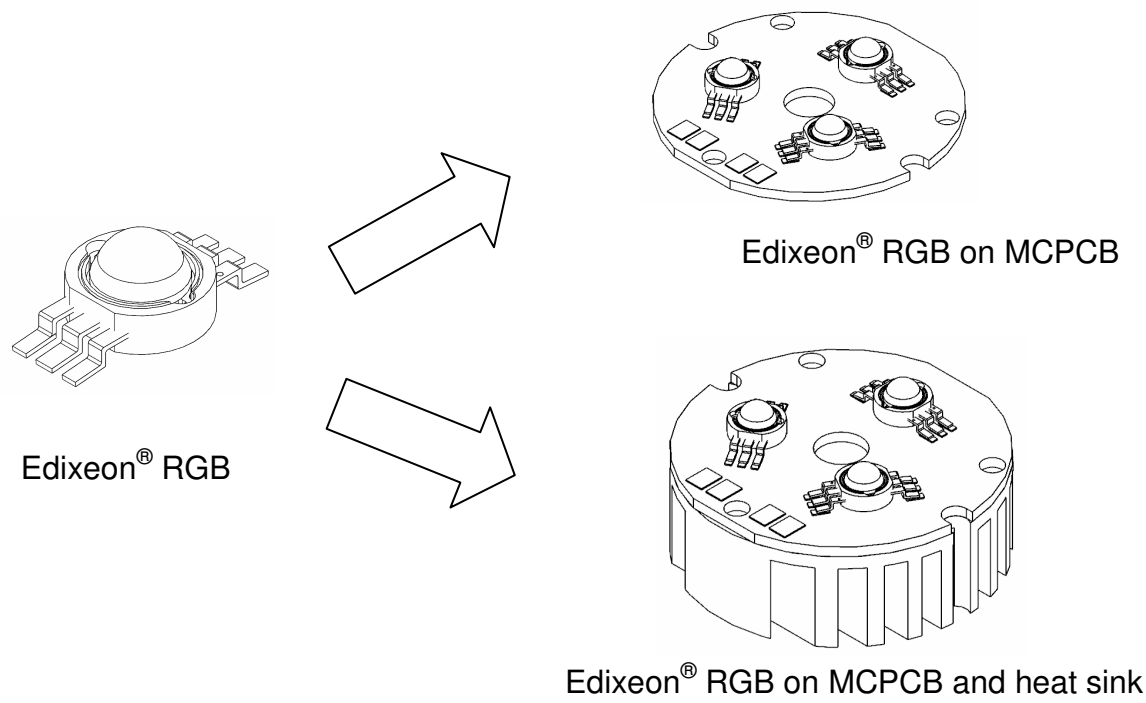
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax) (ts)	100 ℃ 150 ℃ 60-120 seconds	150 ℃ 200 ℃ 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3 ℃/second max.	3 ℃/second max.
Liquidous temperature (TL) Time at liquidous (tL)	183 ℃ 60-150 seconds	217 ℃ 60-150 seconds
Peak package body temperature (Tp)*	230 ℃ ~235 ℃ *	255 ℃ ~260 ℃ *
Classification temperature (Tc)	235 ℃	260 ℃
Time (tp)** within 5 ℃ of the specified classification temperature (Tc)	20** seconds	30** seconds
Average ramp-down rate (Tp to Tsmax)	6 ℃/second max.	6 ℃/second max.
Time 25 ℃ to peak temperature	6 minutes max.	8 minutes max.

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

Product Thermal Application Information

Thermal grease should be evenly speeded with a thickness <100um.

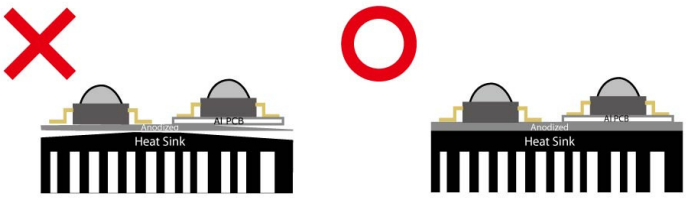
When assembling on MCPCB or heat sink carrier.



<Figure 18 Edixeon® RGB series heat sink application >

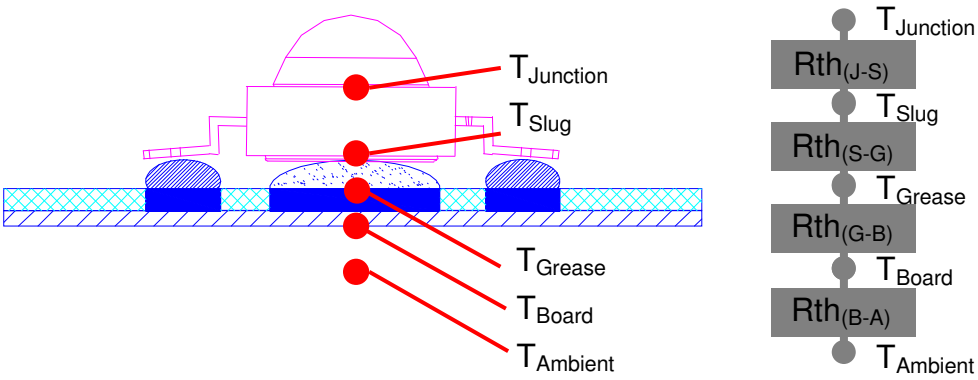
—It is strongly recommanded the heat sink should be anodized.

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



<Figure 19 Edixeon® RGB series assemble with heat sink>

Thermal Resistance Application



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

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

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

<Figure 20 Rth and T_J for Edixeon® RGB 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 12 Specification for Adhesive properties >

Specification	Suggested Properties
Take-free time	3~10 minutes
Specific gravity	< 3 g/cm^2
Thermal conductivity	> 2.5 W/mK
Rth in using	< 1.8 °C/W
Volume resistance	> 1x10^{14}
Lap shear adhesion strength	> 200 N/ cm^2
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 ℃/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 (Rth $_{(J-S)}$)

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 (Rth $_{(S-B)}$) and between board and ambient (Rth $_{(B-A)}$).

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

The following will show how to calculate Rth for each part of LED module.

1. Rth$_{(J-S)}$

Assume Edixeon® Rth$_{(J-S)}$=10 °C/W

2. Rth$_{(S-G)}$

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

Thermal conductivity of thermal grease is 2.6 W/mK.

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

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

3. $Rth_{(G-B)}$

The Rth of standard MCPCB is 1.5 °C /W

4. $Rth_{(B-A)}$

The Rth between board and air is mainly dependent on the total surface area.

Therefore $Rth_{(B-A)} \fallingdotseq \frac{500}{Area(cm)^2}$

If Area is $30cm^2$ Rth=16.7 $Rth_{(J-A)}$ =10+1.2+1.5+16.7 =29.4 °C /W

If Area is $60cm^2$ Rth=8.3 $Rth_{(J-A)}$ =10+1.2+1.5+8.3 =21 °C /W

If Area is $90cm^2$ Rth=5.5 $Rth_{(J-A)}$ =10+1.2+1.5+5.5 =18.2 °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.

$T_{Junctiont} = T_{Ambient} + Rth_{(J-A)} \times P_{Dissipation}$

If one white Edixeon® in room temperature (25ºC) operated 350mA and V_F=3.3V, the $P_{Dissipation}$=0.35 x 3.3=1.155W

And junction temperature is

$T_{Junction}$ = 25ºC+ 18.2 x 1.155 = 46.021 ºC (total surface area =$90cm^2$)

$T_{Junction}$ = 25ºC+ 21 x 1.155 = 49.255 ºC (total surface area =$60cm^2$)

$T_{Junction}$ = 25ºC+ 29.4x 1.155 = 58.957 ºC (total surface area =$30cm^2$)

Example : Junction Temperature Calculation

A LED is used under ambient temperature ($T_{Ambient}$) of 30℃. This LED is soldered on MCPCB (Area=$10cm^2$). Calculate junction temperature.

Assuming a forward voltage of V_F=3.3V at 350mA and total power dissipated is $P_{Dissipation}$=1x 0.35 x 3.3= 1.155 W.

LED $Rth_{(J-S)}$=10 ºC /W.

With good design, $Rth_{(S-G)}$ can be minimized to 1 ºC /W.

$Rth_{(G-B)}$ of a standard MCPCB can be 1.5 ºC /W.

The Rth between board and air is mainly dependent on the total surface area.

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

$Rth_{(B-A)}= \frac{500}{10} = 50\,^{o}C/W.$

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

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

$= 102.187\,^{o}C$

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

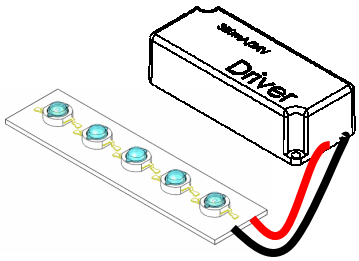
It's strongly recommended to keep the junction temperature under 125 ºC

Or keep the temperature of emitter lead not exceed 55ºC

Product Electrical Application Information

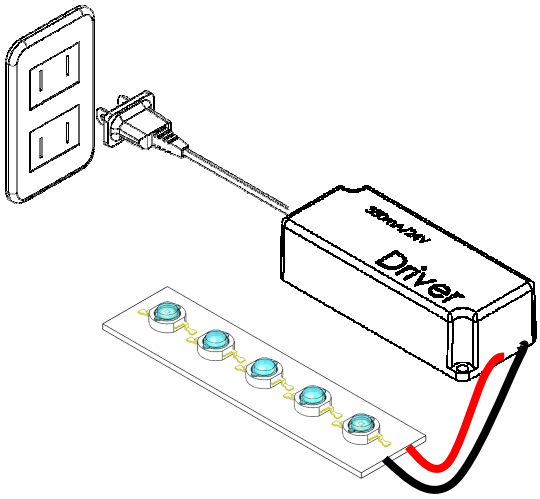
Following graphs and descriptions show how to connect LED or LED module and plug to AC outlet.

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



<Figure 21 LED Module connect to the DC output of the driver>

Step2 : Plug the driver to AC outlet.



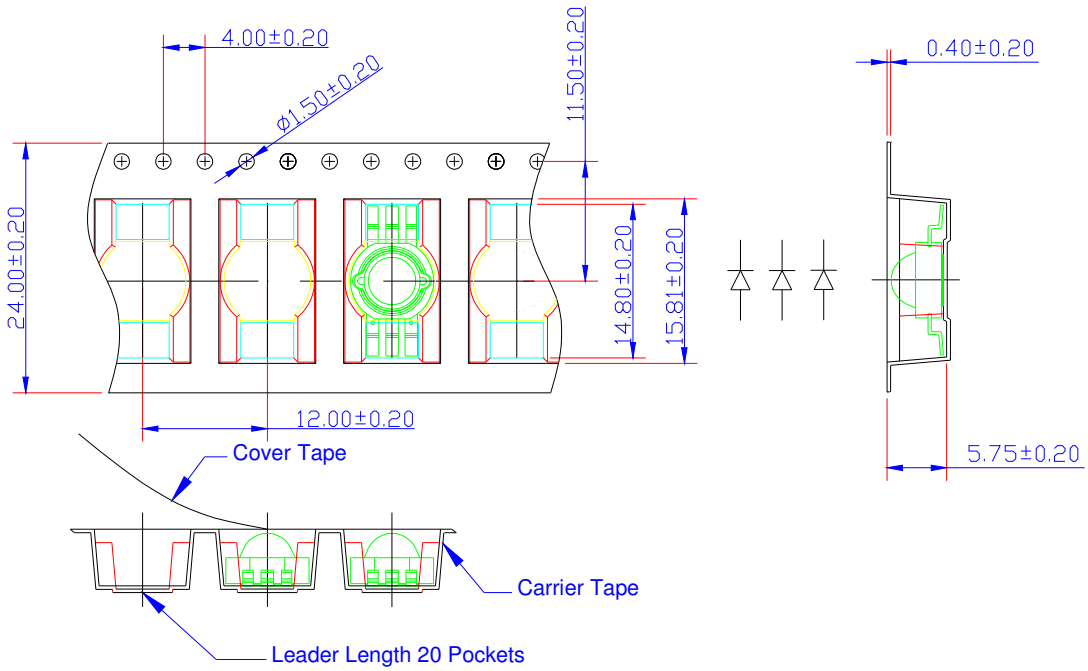
<Figure 22 Plug the AC output of the driver to AC outlet>

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.

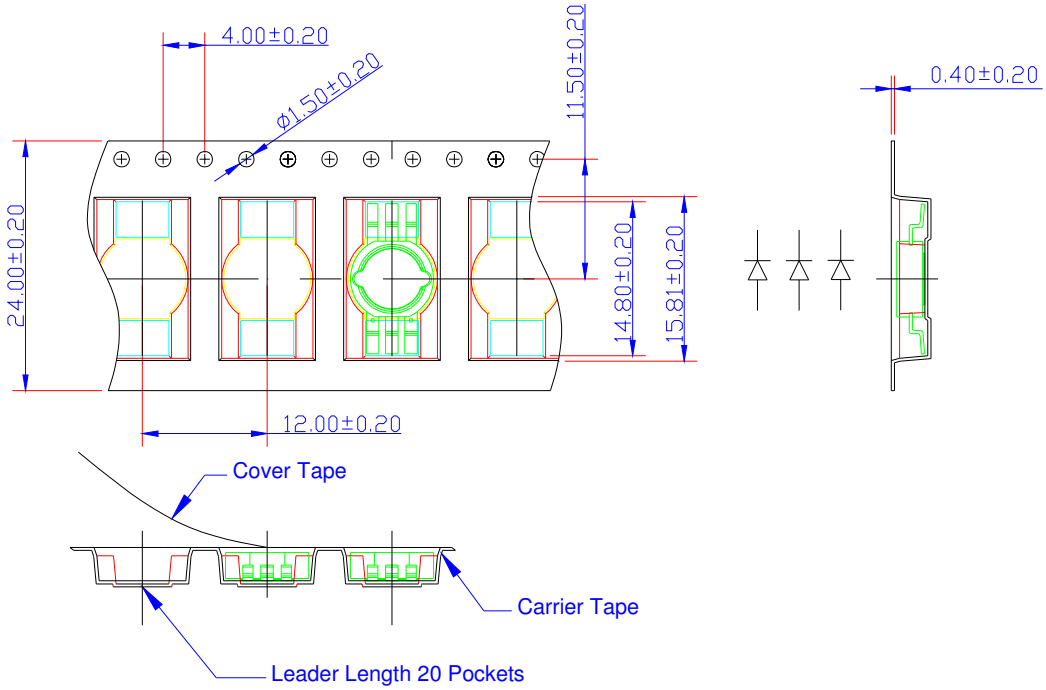
Product Packaging Information

Package Specifications

EDERTB-1GA1、EDERTB-1LC6、EDERTB-1LA1 Carrier

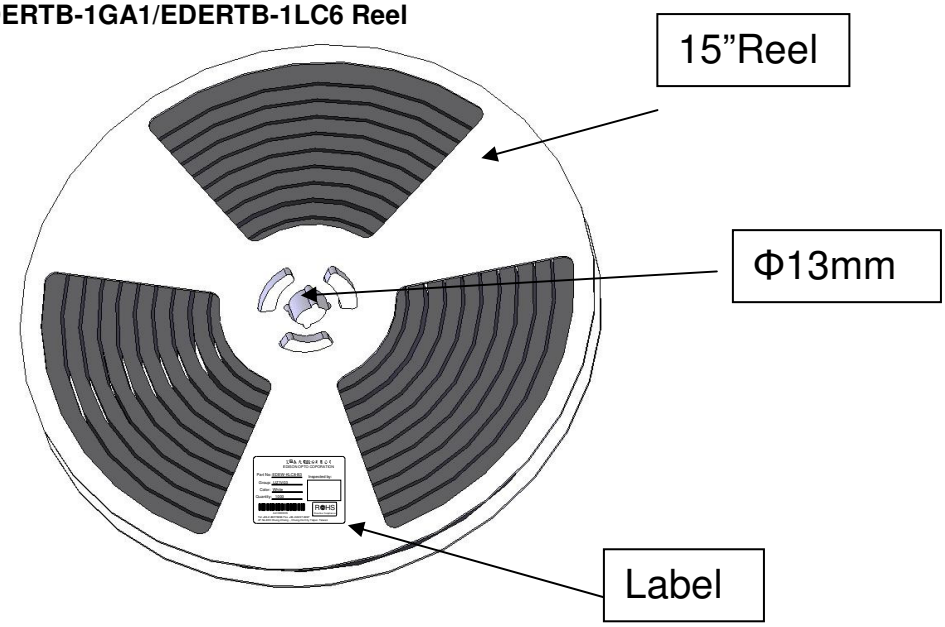


EDERTB-1EA1 Carrier

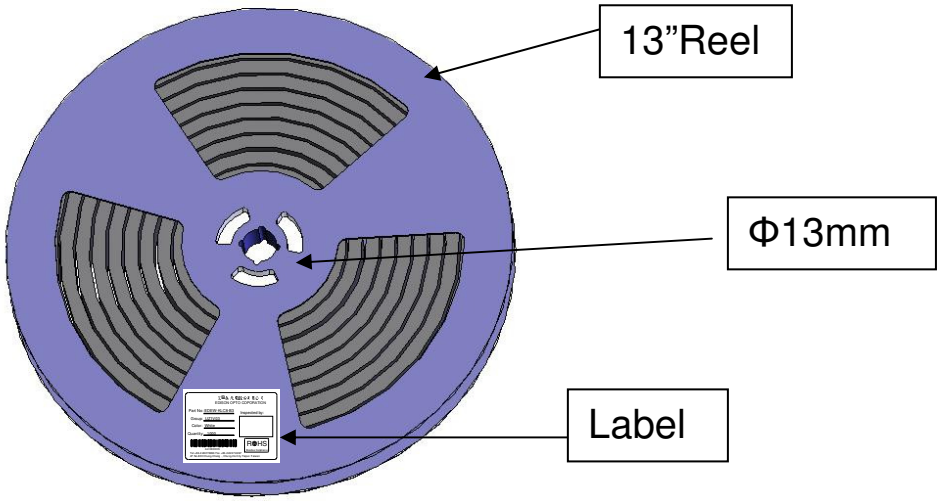


< Figure 23 Packaging steps and dimensions >

EDERTB-1GA1/EDERTB-1LC6 Reel



EDERTB-1EA1 Reel

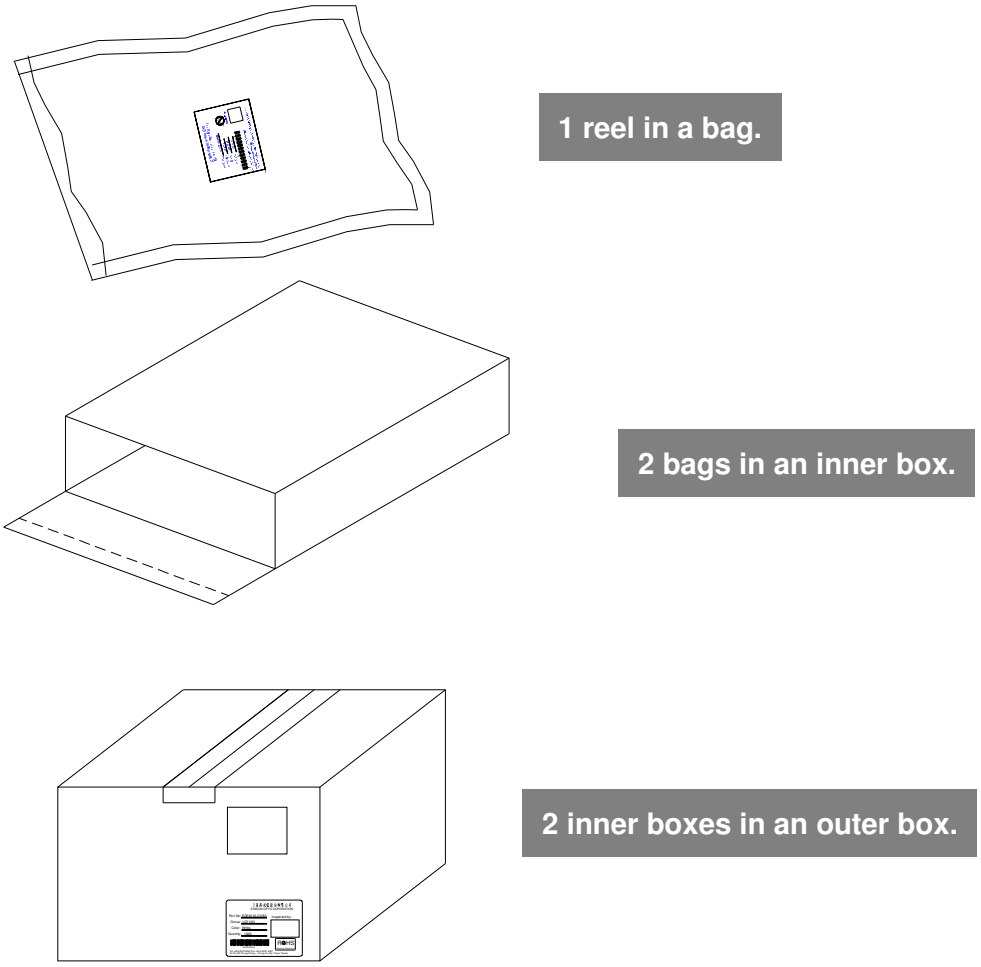


< Figure 24 Taping reel >

The Label

< Figure 25 Label on taping reel >

Packaging Step:



<Figure 26 Packaging steps>

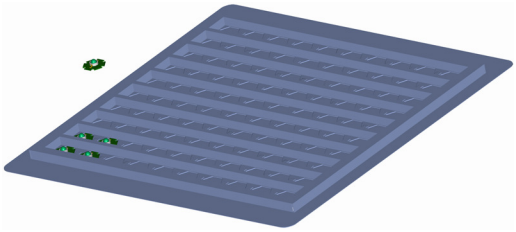
Notes:

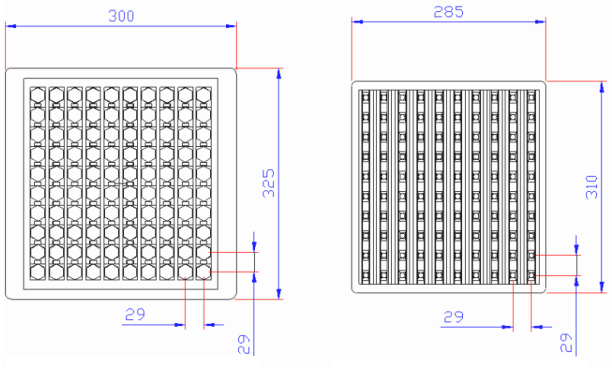
1. All dimensions are in mm.
2. There are 1000pcs emitters in a full reel.
3. There is one reel in a bag.
4. There are 2 bags in an inner box.
5. There are 2 inner boxes in an outer box.
6. A bag contains one humidity indicator card and drying agent.

< Table 13 Package dimensions and quanity >

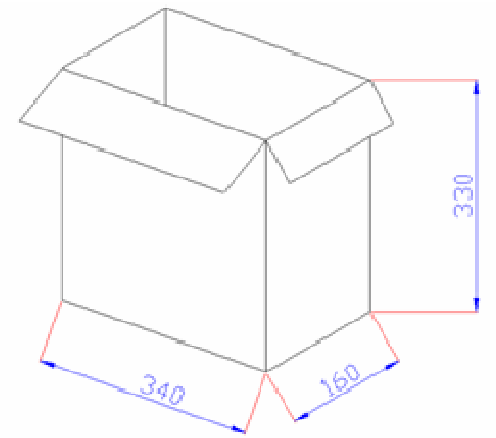
Packing Step	Type	Dimension(mm)	Emitter Q'ty(Max.)
1	Reel	*Φ380*28.5*	*1,000*
2	Inner Box	*400*385*56*	*2,000*
3	Outer Box	*425*405*320*	*4,000*

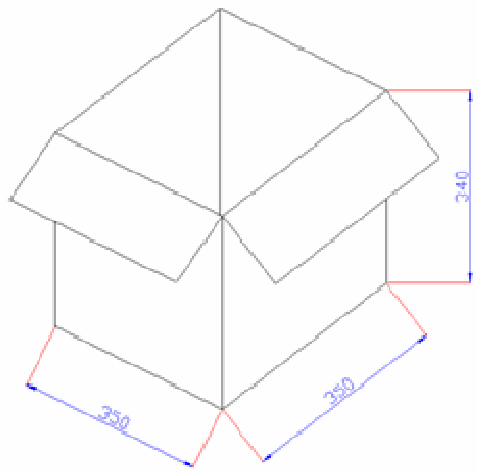
Star Product Packaging Information





Tray Cover





Inner box Outer box

<Figure 27 Edixeon® RGB atar package and dimensions >

Notes:

1. All dimensions are in mm.
2. There are 100pcs stars in a tray.(Tray+Cover)
3. There are 10 trays in an inner box.
4. There are 2 inner boxes in an outer box.