



**APEX OPTO
CORP**

**HIGH POWER LIGHT
RGB RC Series**



RGB RC Series are one of the highest flux LEDs in the world by Apex 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 important, it can be pass reflow process.

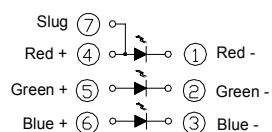
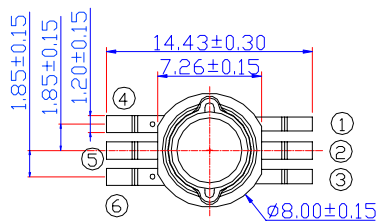
Features

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

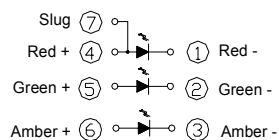
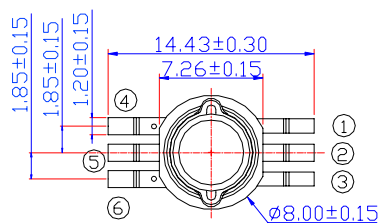
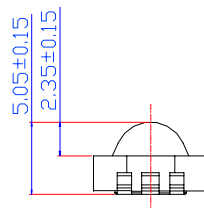
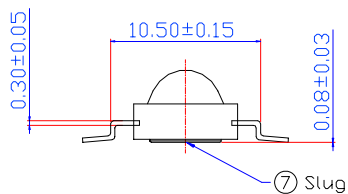
Typical Applications

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

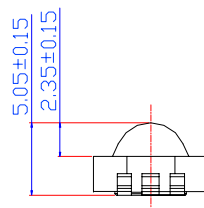
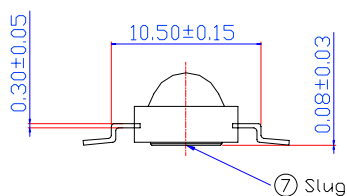
Package Outlines



AOL-ERTB-1LC6



AOL-ERTA-1LC6



Notes:

1. All dimensions are in mm.
2. Drawings are not to scale.
3. It is strongly recommended that the temperature of lead be not higher than 55°C.
4. It is important that the slug can't be contact aluminum surface, It is strongly recommended that there should coat a uniform electrically isolated heat dissipation film on the aluminum surface.
5. Slug is short to red anode.

Absolute Maximum Ratings

| Parameter | Symbol | Rating | Units |
|--|-------------|------------|---------|
| DC Forward Current for each color | I_F | 350 | mA |
| Peak pulse current;(tp ≤ 100μs, Duty cycle=0.25) | I_{pulse} | 500 | mA |
| Total Wattage | W | 3 | W |
| Reverse Voltage | V_R | 5 | V |
| Forward Contact Voltage for all colors | V_{FC} | 16 | V |
| LED junction Temperature | T_j | 150 | °C |
| Operating Temperature | T_{opr} | -30 ~ +130 | °C |
| Storage Temperature | T_{stg} | -40 ~ +150 | °C |
| Soldering Temperature | JEDEC 020c | 260 | °C |
| ESD Sensitivity | V_B | 500 | V |
| Manual Soldering Time at 260°C (Max.) | T_{sol} | 5 | seconds |

Notes:

1. Proper current derating must be observed to maintain junction temperature below the maximum.
2. LEDs are not designed to be driven in reserve bias.
3. Allowable reflow cycles are 3 times for each LED.

Luminous Flux Characteristics at $I_F=350mA(T_j=25^\circ C)$:

| Part Name | Color | Flux | | | Units |
|---------------|------------|------|------|------|-------|
| | | Min. | Typ. | Max. | |
| AOL-ERTB-1LC6 | Red | 13.8 | 22 | -- | lm |
| | True Green | 30.3 | 45 | -- | lm |
| | Blue | 4.8 | 8 | -- | lm |
| AOL-ERTA-1LC6 | Red | 13.8 | 22 | -- | lm |
| | True Green | 30.3 | 45 | -- | lm |
| | Amber | 13.8 | 22 | -- | lm |

Forward Voltage Characteristics at $I_F=350\text{mA}(T_j=25^\circ\text{C})$:

| Part Name | Color | V_F | | | Units |
|---------------|------------|-------|------|------|-------|
| | | Min. | Typ. | Max. | |
| AOL-ERTB-1LC6 | Red | -- | 2.5 | -- | V |
| | True Green | -- | 3.8 | -- | V |
| | Blue | -- | 3.8 | -- | V |
| AOL-ERTA-1LC6 | Red | -- | 2.5 | -- | V |
| | True Green | -- | 3.8 | -- | V |
| | Amber | -- | 2.5 | -- | V |

Dominant Wavelength Characteristics at $I_F=350\text{mA}(T_j=25^\circ\text{C})$:

| Part Name | Color | λ_d | | | Units |
|---------------|------------|-------------|------|------|-------|
| | | Min. | Typ. | Max. | |
| AOL-ERTB-1LC6 | Red | 620 | -- | 630 | nm |
| | True Green | 515 | -- | 525 | nm |
| | Blue | 460 | -- | 470 | nm |
| AOL-ERTA-1LC6 | Red | 620 | -- | 630 | nm |
| | True Green | 515 | -- | 525 | nm |
| | Amber | 585 | -- | 595 | nm |

Temperature coefficient of forward voltage Thermal Resistance Junction to Case at $I_F=350\text{mA}(T_j=25^\circ\text{C})$:

| Lens Item | Color | $\Delta V_F/\Delta T$ | | $R\theta_{J-B}$ | |
|---------------|------------|-----------------------|-------|-----------------|-------|
| | | Typ. | Units | Typ. | Units |
| AOL-ERTB-1LC6 | Red | -2 | mV/°C | 15 | °C/W |
| | True Green | -2 | mV/°C | | °C/W |
| | Blue | -2 | mV/°C | | °C/W |
| AOL-ERTA-1LC6 | Red | -2 | mV/°C | 15 | °C/W |
| | True Green | -2 | mV/°C | | °C/W |
| | Amber | -2 | mV/°C | | °C/W |

Note

1. Flux is measured with an accuracy of $\pm 10\%$.
2. Forward Voltage is measured with an accuracy of $\pm 0.1\text{V}$
3. Wavelength is measured with an accuracy of $\pm 0.5\text{nm}$
5. All True green and blue emitters are built with InGaN
6. All red, red-orange and amber emitters are built with AlGaInP

JEDEC Moisture Sensitivity:

| Level | Floor Life | | Soak Requirements | | | |
|-------|------------|-----------------|-------------------|---------------|-------------------------|---------------|
| | Time | Conditions | Standard | | Accelerated Environment | |
| | | | Time (hours) | Conditions | Time (hours) | Conditions |
| 2a | 4 weeks | ≤ 30°C / 60% RH | 696 +5/-0 | 30°C / 60% RH | 120 +1/-0 | 60°C / 60% RH |

| LEVEL | FLOOR LIFE | | SOAK REQUIREMENTS | | | |
|-------|---------------------|--------------|---------------------------|-------------|-------------------------------------|-------------|
| | | | STANDARD | | ACCELERATED EQUIVALENT ¹ | |
| | TIME | CONDITIONS | TIME (hours) | CONDITIONS | TIME (hours) | CONDITIONS |
| 1 | Unlimited | ≤30°C/85% RH | 168 +5/-0 | 85°C/85% RH | | |
| 2 | 1 year | ≤30°C/80% RH | 168 +5/-0 | 85°C/80% RH | | |
| 2a | 4 weeks | ≤30°C/80% RH | 696 ² +5/-0 | 30°C/80% RH | 120 +1/-0 | 60°C/80% RH |
| 3 | 168 hours | ≤30°C/80% RH | 192 ² +5/-0 | 30°C/80% RH | 40 +1/-0 | 60°C/80% RH |
| 4 | 72 hours | ≤30°C/80% RH | 96 ² +2/-0 | 30°C/80% RH | 20 +0.5/-0 | 60°C/80% RH |
| 5 | 48 hours | ≤30°C/80% RH | 72 ² +2/-0 | 30°C/80% RH | 15 +0.5/-0 | 60°C/80% RH |
| 5a | 24 hours | ≤30°C/80% RH | 48 ² +2/-0 | 30°C/80% RH | 10 +0.5/-0 | 60°C/80% RH |
| 6 | Time on Label (TOL) | ≤30°C/80% RH | TOL | 30°C/80% RH | | |

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.

Operating life, mechanical, and environmental tests performed on APEX package:

| Stress Test | Stress Conditions | Stress Duration | Failure Criteria |
|---------------------------------|--|-----------------|-------------------------|
| Room Temperature Operating Life | 25°C, I _F = max DC (Note 1) | 1000 hours | Note 2 |
| High Temperature High Humidity | 85°C / 85%RH | 1000 hours | Note 2 |
| Temperature Cycle | -40°C/100°C ,30 min dwell / < 5min transfer | 200 cycles | Note 2 |
| High Temperature Storage Life | 110°C | 1000 hours | Note 2 |
| Low Temperature Storage Life | -55°C | 1000 hours | Note 2 |
| Thermal Shock | -40 / 120°C, 20 min dwell / < 20 sec transfer | 200 cycles | No catastrophics |
| Mechanical Shock | 1500 G, 0.5 msec pulse, 5 shocks each 6 | | 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°C ± 5°C, 10 sec | | No catastrophics |
| Solderability | Steam age for 16 hr, then solder dip at 260°C for 5 sec | | Solder coverage on lead |

Note

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

Electrical failures

V_F shift >=10%

I_R<50uA @V_r=5V

Light Output Degradation

% I_v shift >= 30% @1000hrs or 200cycle

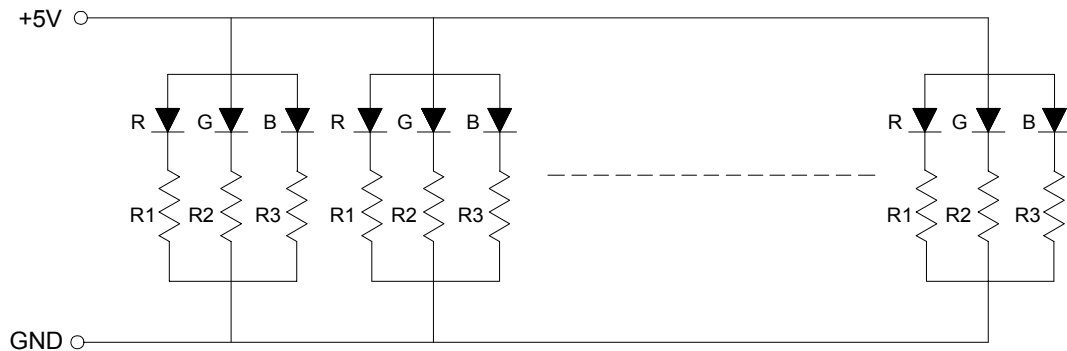
Visual failures

Broken or damaged package or lead

Solderability < 95% wetting

Dimension out of tolerance

Burn-in Condition RC Series Reliability(I_F=350mA)



When we talk about MTBF of APEX, we can provide a formula for customers.

$$\log(\text{Life}) = \frac{1600}{T_j(^{\circ}\text{C}) + 273}$$

Life means the time light output becomes 70%

| T _j (°C) | Life (hours) | T _j (°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 |

When we talk about MTBF of APEX, we can provide a formula for customers

MTBF 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°C is giving 0.01%(100ppm) at 10,000hrs

if there is 1 failure of 10 emitters in a system

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

if there is 1 failure of 1 emitter in a system

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

if there is 1 failure of 10 emitters in a system

Tj=75°C is giving 0.5%(5,000ppm) at 50,000hrs if there are 10 emitters

How to Know Tj in Your Application?

If it is APEX, Rth(junction to case)=15°C/W

The thermal grease is 200um.

K(Aluminum PCB)=2.6 W/mk

Then Rth(case-board)= $\frac{200}{2.6 \times (6.4/2)^2 \pi} = 2.4$

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

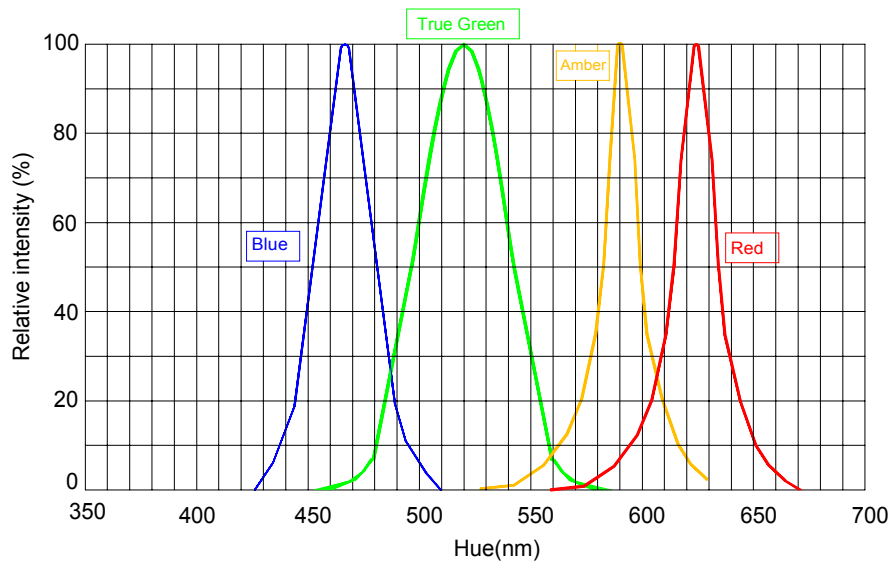
Rth(board-air) = $\frac{500}{\text{Area}(\text{cm}^2)}$

If Area is 30cm² Rth=16.7 there for Rth(junction-air)=(15+2.4+16.7)x3=92.3 °C/3W
 If Area is 60cm² Rth=8.3 there for Rth(junction-air)=(15+2.4+8.3)x3=67.1 °C/3W
 If Area is 90cm² Rth=5.5 there for Rth(junction-air)=(15+2.4+5.5)x3=58.7 °C/3W

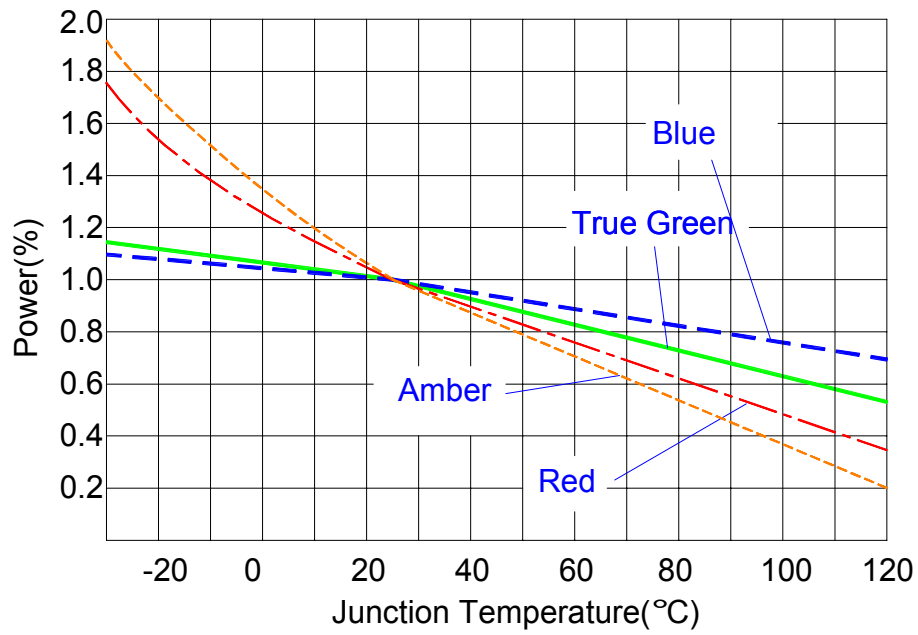
ASSIST FORM about High Power LED Reliability.(Ex:Blue color)

| | <u>Ts=45°C</u> | <u>Ts=65°C</u> | <u>Ts=85°C</u> |
|----------------|----------------|----------------|----------------|
| Voltage | 3.8V | 3.8V | 3.8V |
| Current | 350mA | 350mA | 350mA |
| Wattage | 1.3W | 1.3W | 1.3W |
| Heat | 1.1W | 1.1W | 1.1W |
| Rth | 15 °C/W | 15 °C/W | 15 °C/W |
| Tj | 61.5 °C | 81.5 °C | 101.5°C |
| L70% | 62,000hrs | 33,000hrs | 20,000hrs |

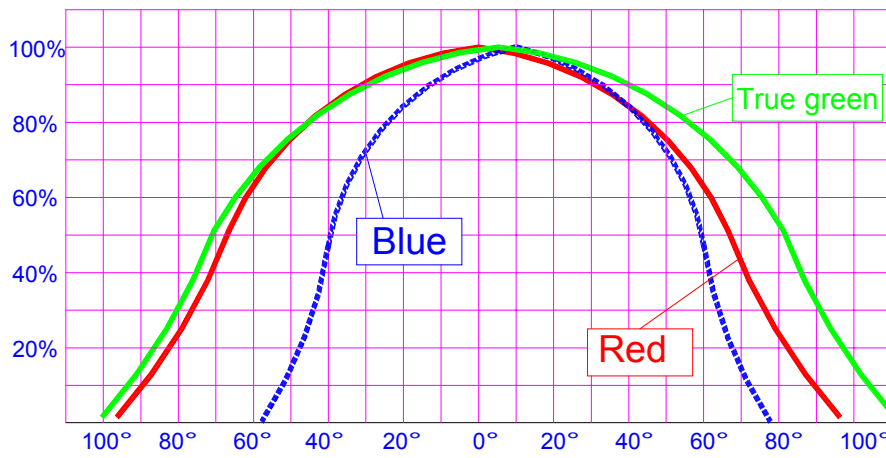
Spectrum



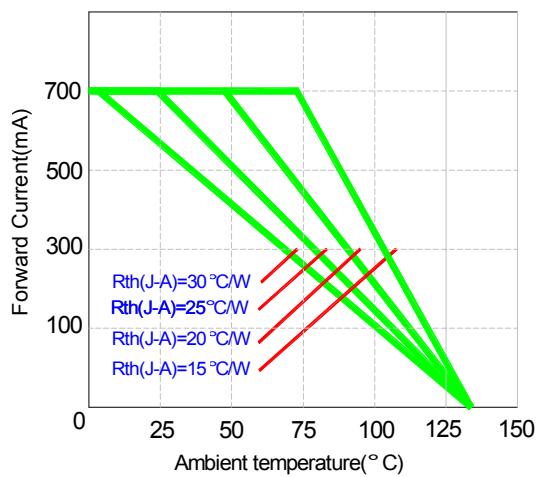
Junction temperature & Relative Flux



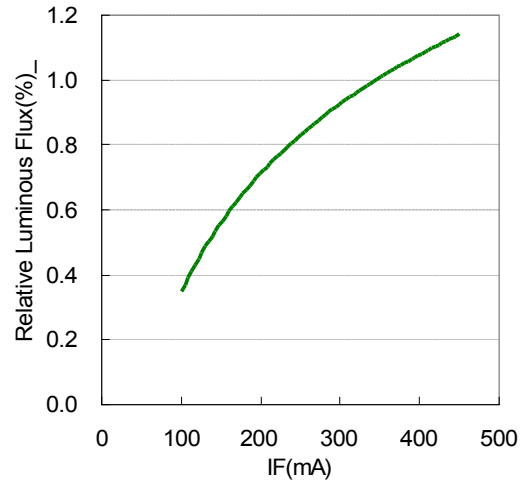
Typical Radiation Pattern for Lambertian



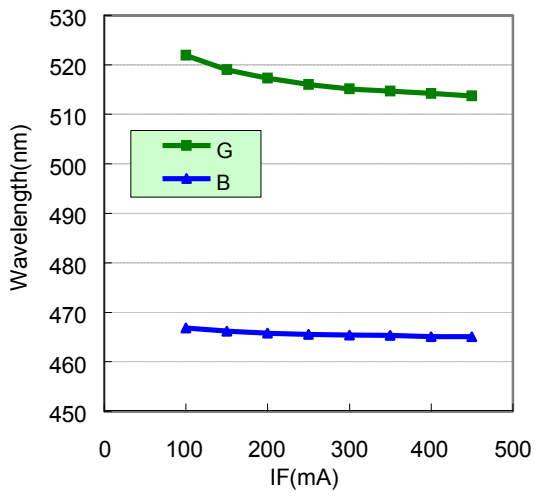
Typical Optical and Electrical Curves



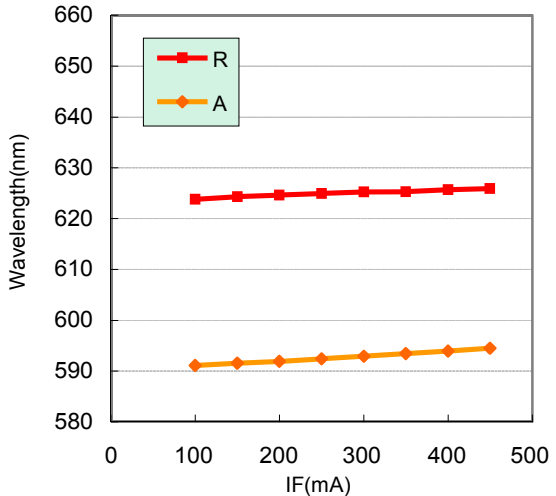
Operating Current & Ambient Temperature



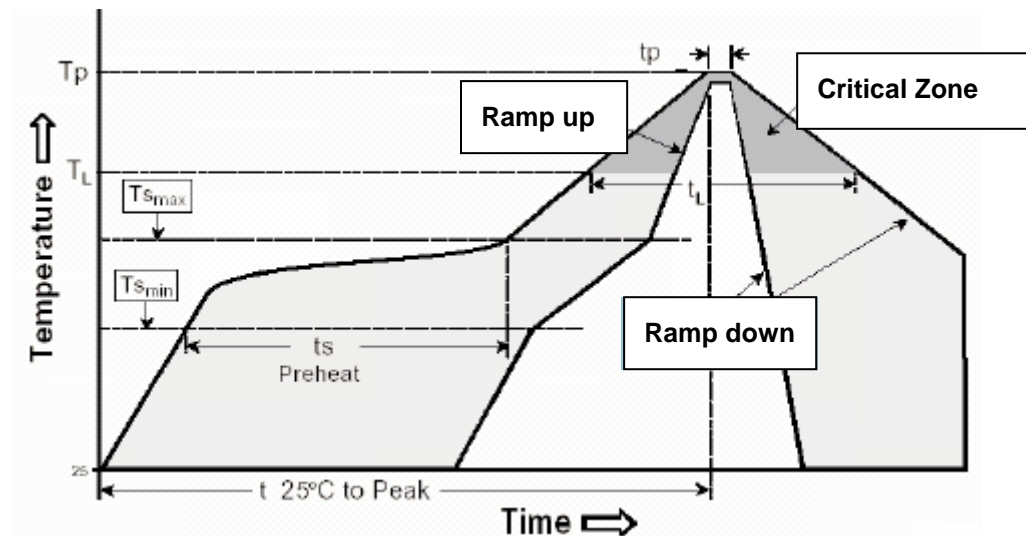
Forward Current & Luminous Flux



Forward Current & Wavelength



Recommended profile for reflow soldering

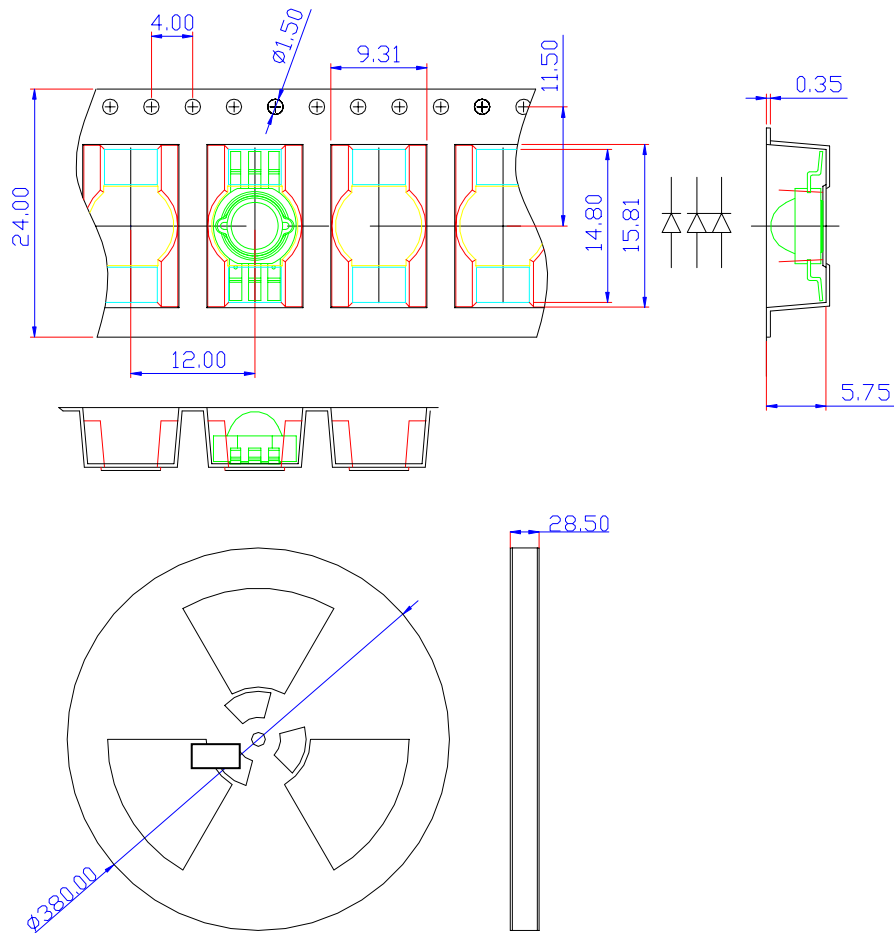


Adhesive for Emitter to MCPCB

Suggestion:

- Ease of use
Non-solvent, One-part
- Fast tack free
3 minutes at 25°C
- No corrosion
Alcohol type of 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

Package Specifications



Notes:

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

| Packing Step | Type | Dimension(mm) | Emitter Q'ty(Max.) |
|--------------|-----------|------------------------|--------------------|
| 1 | Reel | $\Phi 380 \times 28.5$ | 1,000 |
| 2 | Inner Box | 400*385*56 | 2,000 |
| 3 | Outer Box | 425*405*320 | 10,000 |