High Power LED

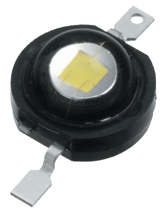
Power LED is an energy efficient and ultra compact new light source, combing the lifetime and reliability advantages of Light Emitting Diode (LED) with the brightness of conventional lighting.

The power LED Emitter is a kind of power LED package which is a point light source with more energy efficient than incandescent and most halogen lamps. It gives you total design freedom and unmatched brightness, creating a new opportunities for solid state lighting to displace conventional lighting technologies.

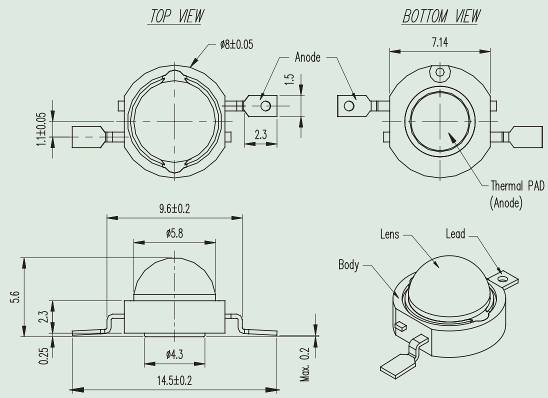
Power LED Emitters can be purchased in reels for high volume assembly. For high volume applicatons, custom power LED source are available upon request, to meet you specific needs.

High Power LED

1W / 3W / 5W Emitter (P01 Series)



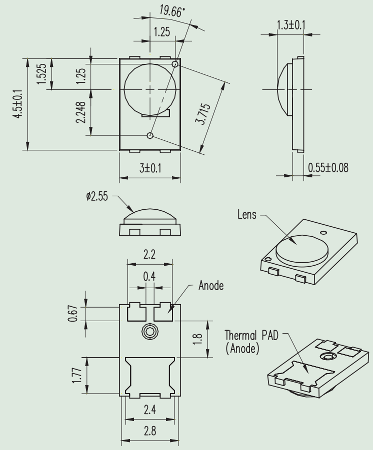
14.5 x 8.0 x 5.6 (mm)



Part No.	Luminous Flux Bin	Color	Lens Color	Typical Luminous Flux (lm)			Rth (j-e) (°C/W)	Typical Viewing Angle	Typical Forward Voltage @ 350mA(V)
				@350mA	@700mA	@1000mA			
LTPL-P011A	-	Amber (590nm)	Water Clear	38	-	-	5	140°	2.3
LTPL-P011B	-	Blue (465nm)	Water Clear	14	-	-	9	130°	3.7
LTPL-P011C	-	Cyan (505nm)	Water Clear	50	-	-	9	140°	3.7
LTPL-P011G	-	Green (525nm)	Water Clear	65	-	-	9	140°	3.7
LTPL-P011H	-	Red-Orange (617nm)	Water Clear	38	-	-	5	130°	2.3
LTPL-P011R	-	Red (625nm)	Water Clear	38	-	-	5	130°	2.3
LTPL-P011MS	-	Warm White (3000K)	Water Clear	38	-	-	9	120°	3.7
LTPL-P011NS	-	Neutral White (4000K)	Water Clear	52	-	-	9	120°	3.7
LTPL-P011WS	S0	Cool White (5500K)	Water Clear	59	-	-	9	120°	3.7
LTPL-P011WS	T1	Cool White (5500K)	Water Clear	72			9	120°	3.7
LTPL-P013MS	S0	Warm White (3000K)	Water Clear	59	94		6.5	120°	3.2
LTPL-P013NS	S0	Neutral White(4000K)	Water Clear	59	94		6.5	120°	3.2
LTPL-P013NS	T1	Neutral White(4000K)	Water Clear	72	115		6.5	120°	3.2
LTPL-P013NS	T2	Neutral White (4000K)	Water Clear	82	131		6.5	120°	3.2
LTPL-P013WS	T1	Cool White (5500K)	Water Clear	72	122		6.5	120°	3.2
LTPL-P013WS	T2	Cool White (5500K)	Water Clear	82	140		6.5	120°	3.2
LTPL-P013WS	U1	Cool White (5500K)	Water Clear	94	159		6.5	120°	3.2
LTPL-P013WS	U2	Cool White (5500K)	Water Clear	107	182		6.5	120°	3.2
LTPL-P014MS	S0	Warm White (3000K)	Water Clear	59	103	130	6	120°	3.4
LTPL-P014NS	T1	Neutral White (4000K)	Water Clear	72	129	165	6	120°	3.4
LTPL-P014NS	T2	Neutral White (4000K)	Water Clear	82	148	189	6	120°	3.4
LTPL-P014WS	T2	Cool White (5500K)	Water Clear	82	148	189	6	120°	3.4
LTPL-P014WS	U1	Cool White (5500K)	Water Clear	94	169	215	6	120°	3.4
LTPL-P014WS	U2	Cool White (5500K)	Water Clear	107	192	246	6	120°	3.4

1W / 3W / 5W COB (C02 Series)

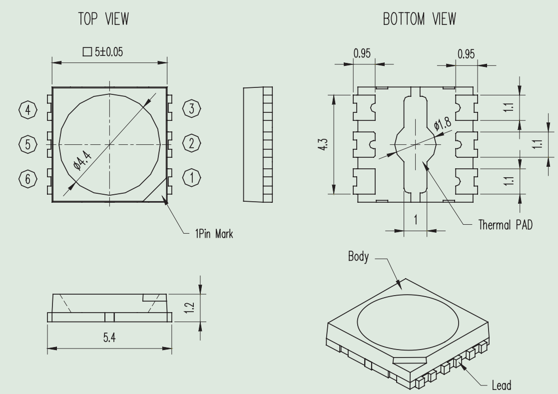
4.49 x 3.05 x 1.975 (mm)



Part No.	Luminous Flux Bin	Color	Lens Color	Typical Luminous Flux (lm)			Rth (j-e) (°C/W)	Typical Viewing Angle	Typical Forward Voltage @ 350mA(V)
				@350mA	@700mA	@1000mA			
LTPL-C021A	-	Amber (590nm)	Water Clear	38	-	-	7.5	140°	2.3
LTPL-C021B	-	Blue (465nm)	Water Clear	14	-	-	11.5	130°	3.7
LTPL-C021C	-	Cyan (505nm)	Water Clear	50	-	-	11.5	140°	3.7
LTPL-C021G	-	Green (525nm)	Water Clear	65	-	-	11.5	140°	3.7
LTPL-C021H	-	Red-Orange (617nm)	Water Clear	38	-	-	7.5	130°	2.3
LTPL-C021R	-	Red (625nm)	Water Clear	38	-	-	7.5	130°	2.3
LTPL-C021MS	-	Warm White (3000K)	Water Clear	38	-	-	11.5	120°	3.7
LTPL-C021NS	-	Neutral White (4000K)	Water Clear	52	-	-	11.5	120°	3.7
LTPL-C021WS	S0	Cool White (5500K)	Water Clear	59	-	-	11.5	120°	3.7
LTPL-C021WS	T1	Cool White (5500K)	Water Clear	72			11.5	120°	3.7
LTPL-C023MS	S0	Warm White (3000K)	Water Clear	59	94		9	120°	3.2
LTPL-C023NS	S0	Neutral White(4000K)	Water Clear	59	94		9	120°	3.2
LTPL-C023NS	T1	Neutral White(4000K)	Water Clear	72	115		9	120°	3.2
LTPL-C023NS	T2	Neutral White (4000K)	Water Clear	82	131		9	120°	3.2
LTPL-C023WS	T1	Cool White (5500K)	Water Clear	72	122		9	120°	3.2
LTPL-C023WS	T2	Cool White (5500K)	Water Clear	82	140		9	120°	3.2
LTPL-C023WS	U1	Cool White (5500K)	Water Clear	94	159		9	120°	3.2
LTPL-C023WS	U2	Cool White (5500K)	Water Clear	107	182		9	120°	3.2
LTPL-C024MS	S0	Warm White (3000K)	Water Clear	59	103	130	8.5	120°	3.4
LTPL-C024NS	T1	Neutral White (4000K)	Water Clear	72	129	165	8.5	120°	3.4
LTPL-C024NS	T2	Neutral White (4000K)	Water Clear	82	148	189	8.5	120°	3.4
LTPL-C024WS	T2	Cool White (5500K)	Water Clear	82	148	189	8.5	120°	3.4
LTPL-C024WS	U1	Cool White (5500K)	Water Clear	94	169	215	8.5	120°	3.4
LTPL-C024WS	U2	Cool White (5500K)	Water Clear	107	192	246	8.5	120°	3.4

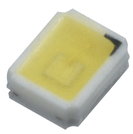
0.5W Power LED (P00 Series)

5.4 x 5.0 x 1.2 (mm)

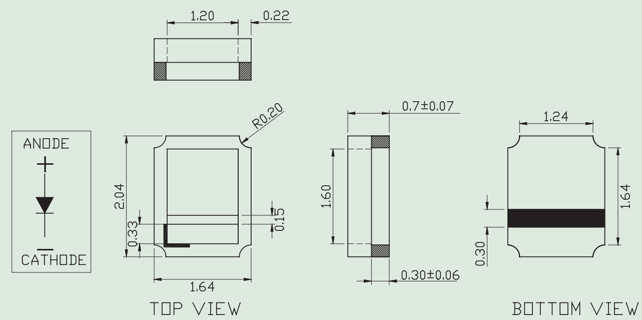


Part No.	Color	Lens Color	Typical Luminous Flux (lm)			Rth (J-A) (°C/W)	Typical Viewing Angle	Typical Forward Voltage @ 40*2mA(V)	Typical Forward Voltage @ 75*2mA(V)	Typical Forward Voltage @ 150mA(V)
			@40*2 mA	@75*2 mA	@150 mA					
LTPL-P00DWS	Cool White (6000K)	N/A	21	37	-	50	120°	3.0	3.2	-
LTPL-P00DNS	Neutral White (3750K)	N/A	17	29	-	50	120°	3.0	3.2	-
LTPL-P00DMS	Warm White (2850K)	N/A	16	27	-	50	120°	3.0	3.2	-
LTPL-P00SWS	Cool White (6000K)	N/A	-	-	42	50	120°	-	-	3.1
LTPL-P00SVS	Cool White (6000K)	N/A	-	-	36	50	120°	-	-	3.1
LTPL-P00SNS	Neutral White (3750K)	N/A	-	-	33	50	120°	-	-	3.1
LTPL-P00SMS	Warm White (2850K)	N/A	-	-	30	50	120°	-	-	3.1

Power Flash LED (C01 Series)



2.04 x 1.64 x 0.7 (mm)



Part No.	Color	Lens Color	Typical Luminous Flux (lm)				Rth (j-e) (°C/W)	Typical Viewing Angle	Typical Forward Voltage @ 350mA(V)
			@175mA	@350mA	@700mA	@1000mA			
LTPL-C011W	☐ Cool White (6500K)	N/A	27	46	-	-	22	120°	3.5
LTPL-C013W	☐ Cool White (6500K)	N/A	25	42	72	93	22	120°	3.5
LTPL-C014W	☐ Cool White (6500K)	N/A	37	63	110	141	22	120°	3.3

Application Note

Cautions for Power LED

Storage

- The storage ambient should not exceed 30°C temperature or 70% relative humidity.
- For extended storage out of their original packaging, it is recommended that the LEDs be stored in a sealed container with appropriate desiccant, or in a desiccators with nitrogen ambient.
- It is recommended that LEDs out of their original packaging are soldered within 4 weeks.
- LEDs stored out of their original packaging for more than 4 weeks should be baked at about 60 deg C for at least 24 hours before solder assembly.

Assemble Consideration

This section provides you the requirements to mount LTPL Emitters onto Metal Core Printed Circuit Board (MCPCB) for optimal heat-dissipation efficiency, for reliable operations of your products and for the optimal performance you need.

- **Design rules during LTPL Emitter array and its assembly procedure**

  1. Thermal resistance from the LTPL Emitters to the ambient environment must be kept at minimum level as possible.Any heat barrier will prevent LTPL Emitters from running at optimum light output performance.
  2. Electrical insulation between the contacts other than electros of LTPL Emitters and the MCPCB is required. The exposed metal part of a LTPL Emitters is not electrically neutral. Do not electrically connect this area to any electrical traces or pads on your MCPCB.
  3. If you want to minimize thermal resistance between LTPL Emitters and your MCPCB, use thermally conductive adhesive in-between.
  4. LTPL Emitters can be soldered in infrared (IR), hot bar soldering, fiber focused IR, or hand soldering.

- **MCPCB Selection**

  To select a suitable MCPCB is the first step in assemble LTPL emitters. A MCPCB consists of several layers that provide both electrical connections and a low thermal resistance path to external heat sinks applied. Standard LTPL Emitter arrays use aluminates MCPCB that consists of the following layers:

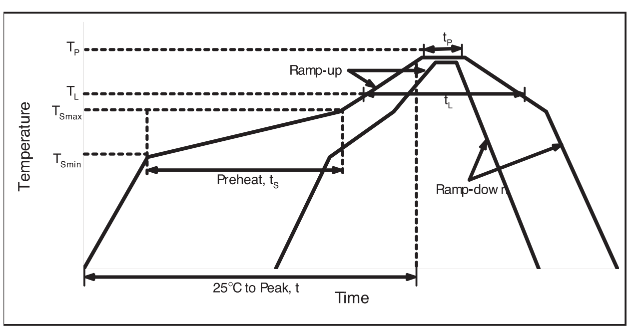
  1. Aluminum Base (type:1050, thickness:1.5 ± 0.1 mm)
  2. Electrical Insulation Layer (Dielectric/Epoxy thickness: 100 μm)
  3. Copper Layer (Copper thickness: 35 μm)
  4. Solder Mask (Solder paste thickness after reflow process: 90 ~ 115 μm)

Soldering Process

Followings are a recommend process flows to build LTPL Emitters into Power Light Sources. Please mount entire respective surface mount devices (SMD), if any, on your MCPCB designated before LTPL Emitters assembly process.

- **For Reflow Process**

  Reflow soldering temperature profile



Profile Feature	Lead Free Assembly
Average Ramp-Up Rate (T_{Smax} to T_P)	3°C / second max
Preheat Temperature Min (T_{Smin})	150°C
Preheat Temperature Max (T_{Smax})	200°C
Preheat Time (t_{Smin} to t_{Smax})	60 – 180 seconds
Time Maintained Above Temperature (T_L)	217°C
Time Maintained Above Time (t_L)	60 – 150 seconds
Peak / Classification Temperature (T_P)	260°C
Time Within 5°C of Actual Peak Temperature (t_P)	5 seconds
Ramp – Down Rate	6°C / second max
Time 25°C to Peak Temperature	8 minutes max

Application Note

▪ For Hot Bar

Step 1 Dispense Thermal Conductive Agent and Solder Flux

Use solder flux for good heat transfer during soldering of the LTPL Emitter terminals to reduce required soldering time. Note that the spread of flux compound should be restricted to the solder pad areas. You may want to optimize your soldering process by adjusting the amount of flux.

Step 2 Placement of LTPL Emitter

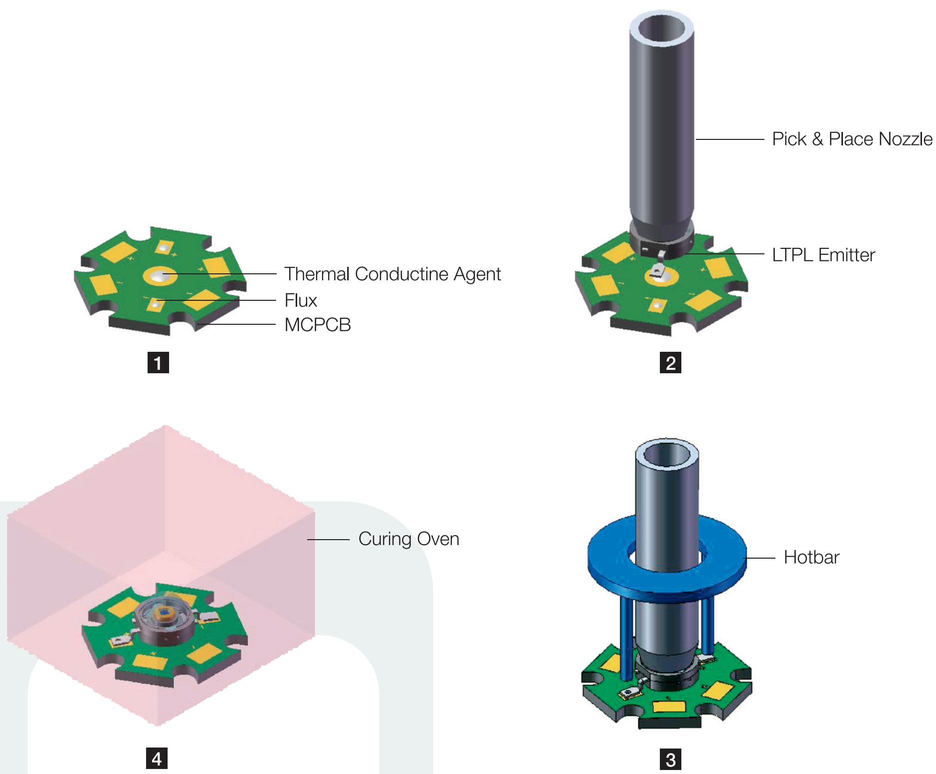
It is recommended to use automated pick-and-place equipment to place LTPL Emitters onto MCPCB. The pick-and-place mechanism shall not touch the lens or the leads of LTPL Emitters.

Step 3 Soldering the Electrical Leads by Hot bar Soldering

This process will help transfer heat only on to the leads and solder pad areas and therefore avoid damaging emitter body. To transfer sufficient heat from hot bars to device-leads, it is strongly recommended that the following process parameters must be considered: 1) Amount of flux dispensed onto solder pads, 2) Pressing force of hot bar tips, and 3) Hot bar temperature.

Step 4 Curing for Thermal Conductive Agent

Please follow the curing instructions set forth by manufacturers for the chosen thermal conductive agent.



▪ For Manual Soldering Iron

When manual hand soldering is concerned, it is recommended to hand solder the leads with a solder-tip temperature of 290°C for less than 3 seconds and at least 2 seconds or more intervals during each solder. Furthermore, avoid damaging the emitter or the epoxy layer on MCPCB.

Application Note

Thermal Consideration

▪ Thermal Resistance of LTPL Emitter

Thermal resistance(R_{TH}) is one of the primary tools used in thermal management design. It is defined as the ratio of temperature difference to the corresponding power dissipation. The overall $R_{TH, J\text{-}A}$ (Junction-Ambient) of a LTPL Emitter plus MCPCB is illustrated as follow:

$R_{TH, J\text{-}A}$ (°C/W) = $\Delta T_{J\text{-}A}$ / Pd .... (1)

Where

$\Delta T_{J\text{-}A} = T_{Junction} - T_{Ambient}$ (°C)

Pd (Power dissipated, W) = Forward current (I_F) x Forward voltage (V_F)

In addition, heat generated at the junction of semiconductor die travels along the following path to ambient environment: junction-to-case, case-to-board, board-to-ambient air.

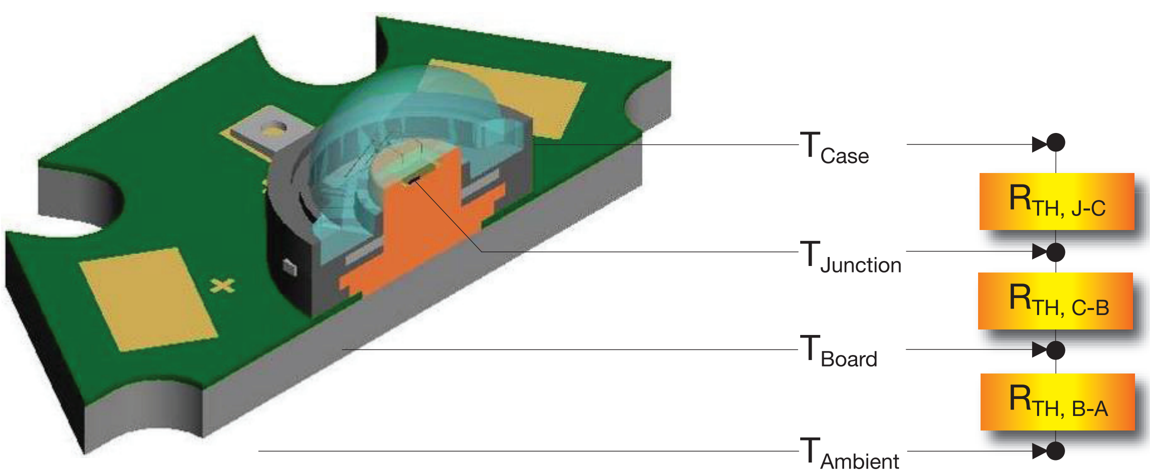


Figure 1. Thermal Resistance in Series

The overall thermal resistance therefore can be expressed as the sum of each individual resistance along above heat-travel path:

$R_{TH, J\text{-}A} = R_{TH, C\text{-}B} + R_{TH, J\text{-}C} + R_{TH, B\text{-}A}$ .... (2)

As $\Delta T_{J\text{-}A}$ = (Pd) x ($R_{TH, J\text{-}A}$) from Equation 1, we have

$T_{Junction} = T_{Ambient}$ + (Pd) x ($R_{TH, J\text{-}A}$) .... (3)

Based on Equation 3. $T_{Junction}$ can be obtained if $T_{Ambient}$, Pd and $R_{TH, J\text{-}A}$ are determined.

To increase light output efficiency of LEDs, one must increase the dissipation of heat generated by LEDs; in other words, to reduce thermal resistance from LEDs to ambient environment Lite-On has optimized the junction-to-board thermal path of LTPL Emitters to minimize the overall thermal resistance ($R_{TH, J\text{-}B}$) down to 12°C/W.

■ **Thermal Resistance of Multiple LTPL Emitter**

The overall thermal resistance of multiple LTPL Emitters describing your specific application needs can be determined by using parallel thermal resistance model as shown in Figure 2

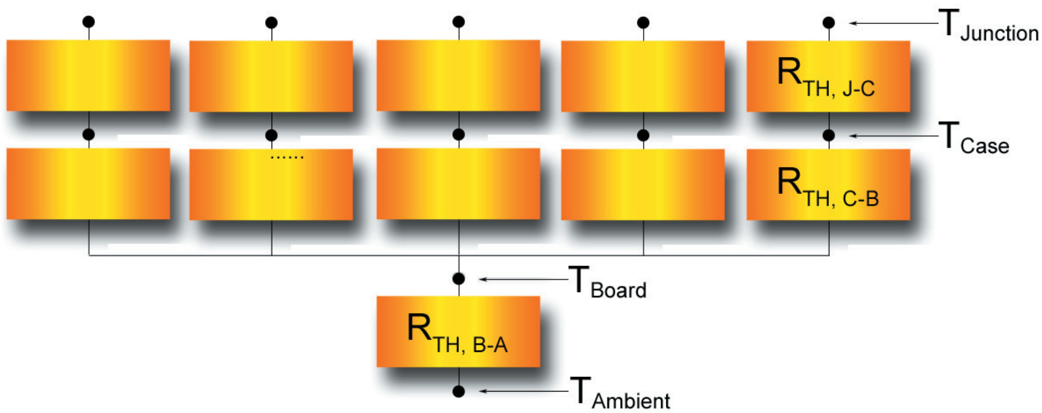


Figure 2. Thermal Resistance Model of Multiple LTPL

By using the parallel resistance equation we can obtain $R_{TH, J-B}$ of above array:

$$\frac{1}{\text{Overall } R_{TH, J-B}} = \frac{1}{LED_1\ R_{TH, J-B}} + \frac{1}{LED_2\ R_{TH, J-B}} + \ldots + \frac{1}{LED_n\ R_{TH, J-B}} \quad \ldots\ (4)$$

Assuming all the parallel resistances are of the same, Equation 4. then becomes:

$$\frac{1}{\text{Overall } R_{TH, J-B}} = \frac{n}{LED_x\ R_{TH, J-B}} \quad \ldots\ (5)$$

or

$$\text{Overall } R_{TH, J-B} = \frac{LED_x\ R_{TH, J-B}}{n} \quad \ldots\ (6)$$

Where

n = Total number of LTPL Emitters in above system

In this case the $T_{Junction}$ of a multi LTPL Emitter system can be described as follow :

$$T_{Junction} = T_{Ambient} + (P_{d\_Total}) \times (\text{Overall\_} R_{TH, J-A}) \quad \ldots\ (7)$$

Where

P_{d_Total} = Total power (W) dissipated from emitter system

$$\text{Overall\_} R_{TH, J-A} = \text{Overall\_} R_{TH, J-B} + R_{TH, B-A} \quad \ldots\ (8)$$

It is strongly recommended that the maximum T Board of LTPL Emitter be considered under 90 °C even for short durations while designing the thermal model for your specific applications.

Application Note

- **ESD**

Static Electricity or power surge will damage the LED. Suggestions to prevent ESD damage :

1. Use of a conductive wrist band or anti-electrostatic glove when handling these LEDs.
2. All devices, equipment, and machinery must be properly grounded
3. Work tables, storage racks, etc. should be properly grounded.
4. Use ion blower to neutralize the static charge which might have built up on surface of the LED's plastic lens as a result of friction between LEDs during storage and handling.

ESD-damaged LEDs will exhibit abnormal characteristics such as high reverse leakage current, low forward voltage, or “no lightup” at low currents.To verify for ESD damage, check for “lightup” and VF of the suspect LEDs at low currents.