BROADCOM®

Data Sheet

ARE6-x5x1-0xx00

High-Power Infrared Emitting Diodes

Description

The Broadcom® high-power IR LEDs are available in 855-nm and 945-nm peak wavelength ranges, appropriate for specific devices, such as infrared illumination, surveillance systems, CCTV, and gesture recognition.

Packaged in a 3.45-mm × 3.45-mm surface-mount platform, together with viewing angles of 50° lens optics options, the high-power IR LEDs are suitable for a wide variety of applications.

The package is compatible with the reflow soldering process. To facilitate easy pick-and-place assembly, the LEDs are packed in tape and reel.

Features

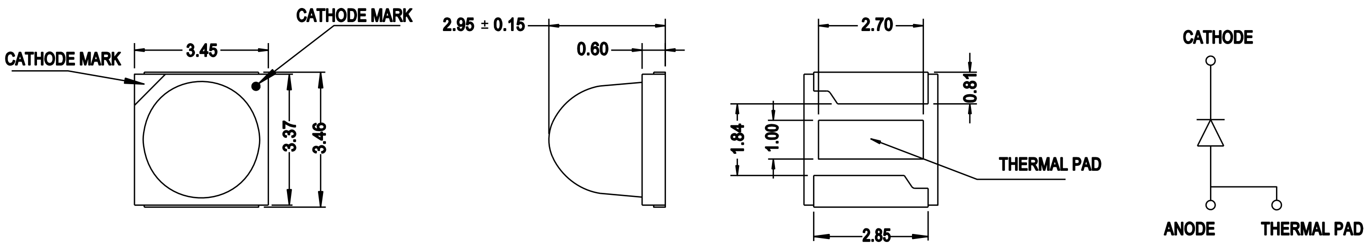
- Available in peak wavelengths 855 nm and 945 nm
- High radiant intensity
- High radiant power
- Low forward voltage
- Typical viewing angle: 50°
- Compatible with industrial reflow soldering process
- MSL 1

Applications

- Light curtain
- Infrared illumination for cameras
- Surveillance systems
- Machine vision systems
- Eye tracking systems

CAUTION! This device is ESD sensitive per the ANSI/ESDA/JEDEC JS-001 Standard. Observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

Figure 1: Package Drawing



NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ± 0.1 mm unless otherwise specified.

Device Selection Guide (T_J = 25°C, I_F = 1A)

Part Number	Peak Wavelength, λ_{peak} (nm)	Radiant Intensity, I_e (mW/sr)[a, b]		Radiant Flux, Φ_e (mW)[c]	Viewing Angle, $2\theta_{½}$ (°)[d]
		Min.	Max.	Typ.	Typ.
ARE6-85C1-0JL00	855	710	1400	780	50
ARE6-85D1-0HK00	855	560	1120	870	50
ARE6-8531-0JL00	855	710	1400	1270	50
ARE6-95D1-0HK00	945	560	1120	700	50
ARE6-9531-0KM00	945	900	1750	1390	50

a. The radiant intensity, I_e, is measured at the mechanical axis of the package and it is tested with a single current pulse condition (t_p = 10 ms). The actual peak of the spatial radiation pattern may not be aligned with the axis.

b. Tolerance is ±15%.

c. The radiant flux, Φ_e, is the total flux output as measured with an integrating sphere at a single current pulse condition (t_p = 10 ms).

d. $\theta_{½}$ is the off-axis angle where the radiant intensity is half of the peak intensity.

Absolute Maximum Ratings

Parameters	ARE6-85C1	ARE6-85D1	ARE6-8531	ARE6-95D1	ARE6-9531	Unit
DC Forward Current[a]	1000	2000	1500	1000	1500	mA
Peak Forward Current[b, c]	3000	3000	3000	3000	3000	mA
Power Dissipation	2000	4000	5025	2300	4725	mW
Reverse Voltage	Not designed for reverse bias operation					
LED Junction Temperature	145	145	145	145	145	°C
Operating Temperature Range	–40 to +120	–40 to +120	–40 to +120	–40 to +120	–40 to +120	°C
Storage Temperature Range	–40 to +120	–40 to +120	–40 to +120	–40 to +120	–40 to +120	°C

a. Derate linearly as shown in Figure 8, Figure 9, Figure 10, Figure 11, and Figure 12.

b. Duty factor = 10%, frequency = 1 kHz.

c. Solder point temperature, T_S = 25°C.

Optical and Electrical Characteristics (T_J = 25°C)

Parameters	Min.	Typ.	Max.	Units	Test Condition
Forward Voltage, V_F[a]				V	I_F = 1A
ARE6-85C1	1.50	1.70	2.00		
ARE6-85D1	1.40	1.65	2.00		
ARE6-8531	2.80	3.05	3.35		
ARE6-95D1	1.60	1.90	2.30		
ARE6-9531	2.70	2.95	3.15		
Reverse Voltage, V_R	Not designed for reverse bias				
Thermal Resistance, $R_{\theta J\text{-}S}$[b]	—	8	—	°C/W	LED junction to solder point

a. Forward voltage tolerance is ±0.1V.

b. Thermal resistance from LED junction to solder point.

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Radiant Intensity, I_e (mW/sr)	
	Min.	Max.
H	560	710
J	710	900
K	900	1120
L	1120	1400
M	1400	1750

Tolerance = ±15%.

Figure 2: Spectral Power Distribution

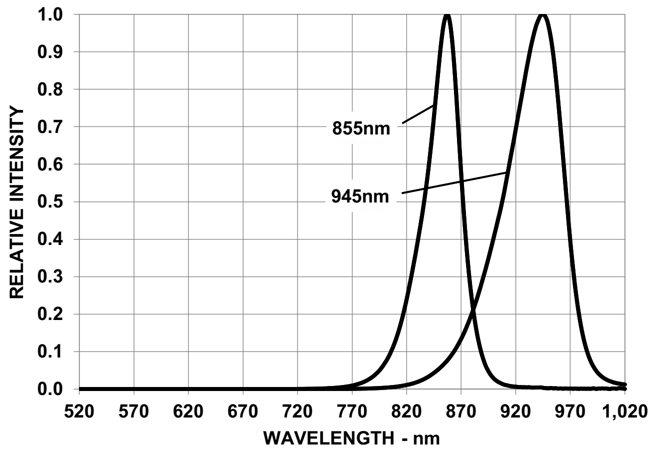


Figure 3: Forward Current vs. Forward Voltage

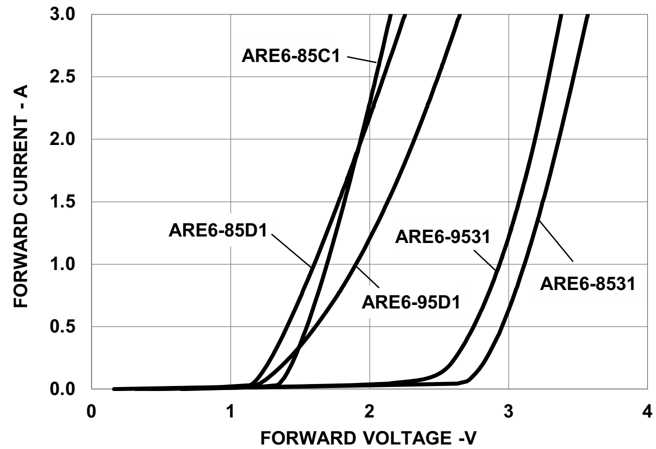


Figure 4: Relative Radiant Flux vs. Mono Pulse Current

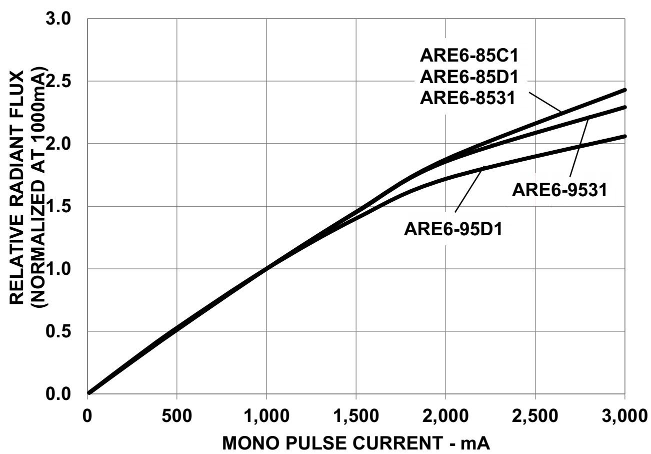


Figure 5: Relative Light Output vs. Junction Temperature

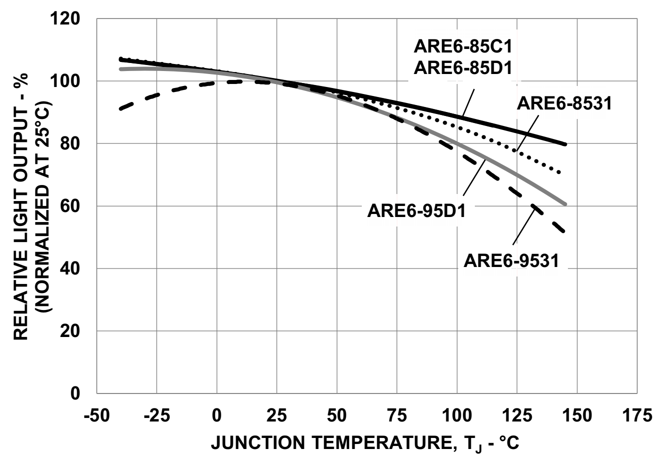


Figure 6: Forward Voltage Shift vs. Junction Temperature

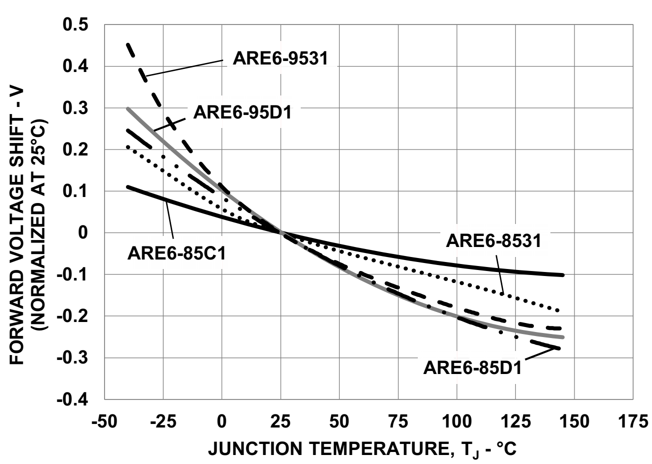


Figure 7: Radiation Pattern

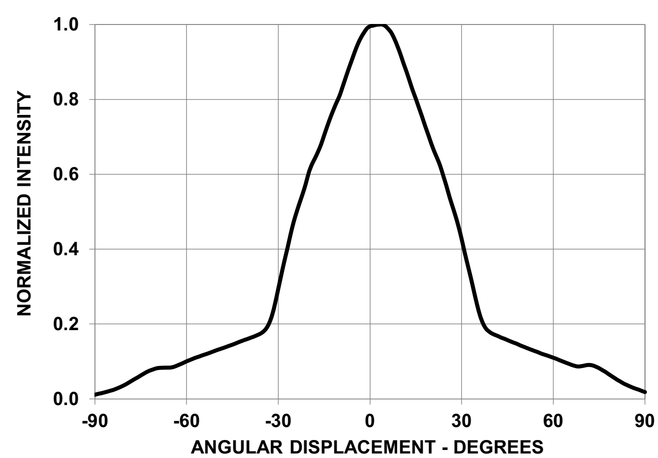


Figure 8: Maximum Forward Current vs. Ambient Temperature for ARE6-85C1

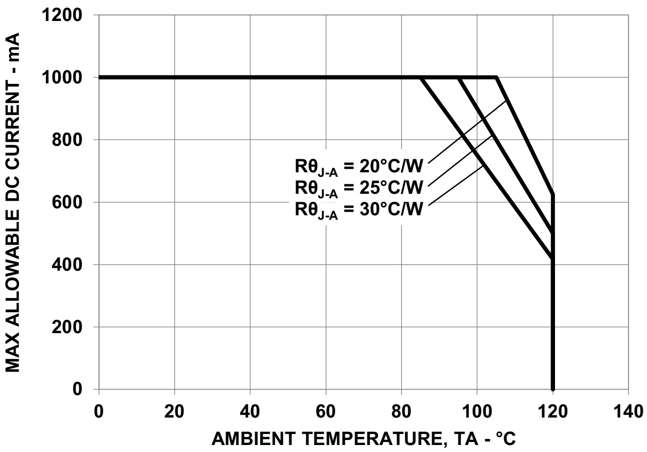


Figure 9: Maximum Forward Current vs. Ambient Temperature for ARE6-85D1

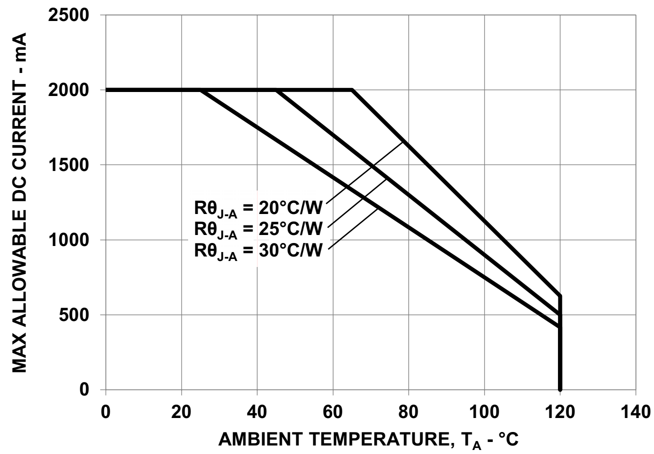


Figure 10: Maximum Forward Current vs. Ambient Temperature for ARE6-8531

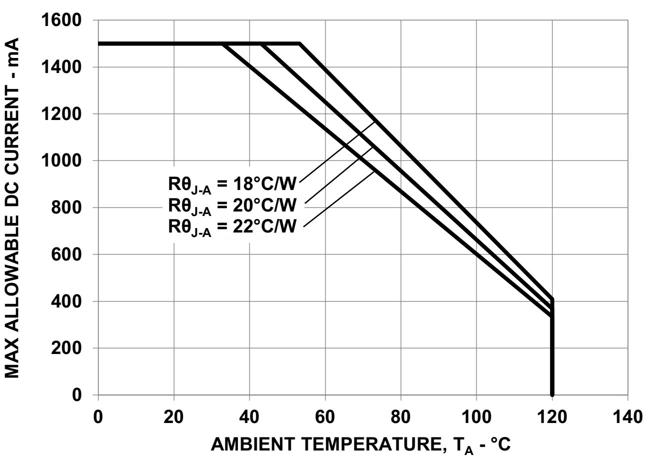


Figure 11: Maximum Forward Current vs. Ambient Temperature for ARE6-95D1

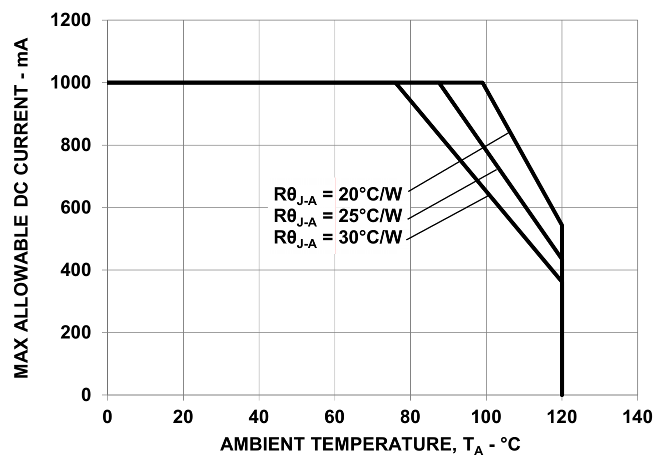


Figure 12: Maximum Forward Current vs. Ambient Temperature for ARE6-9531

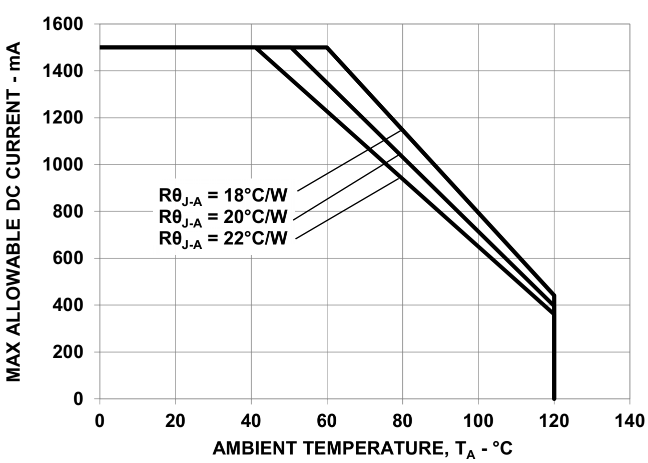


Figure 13: Maximum Forward Current vs. Solder Point Temperature

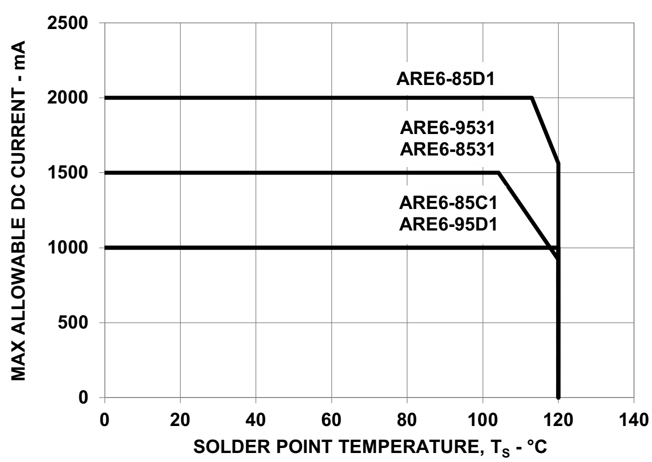
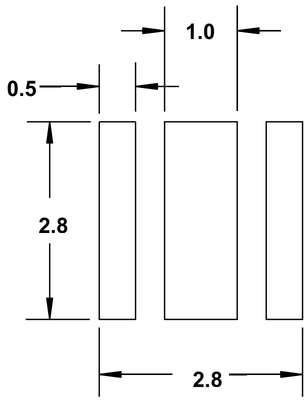
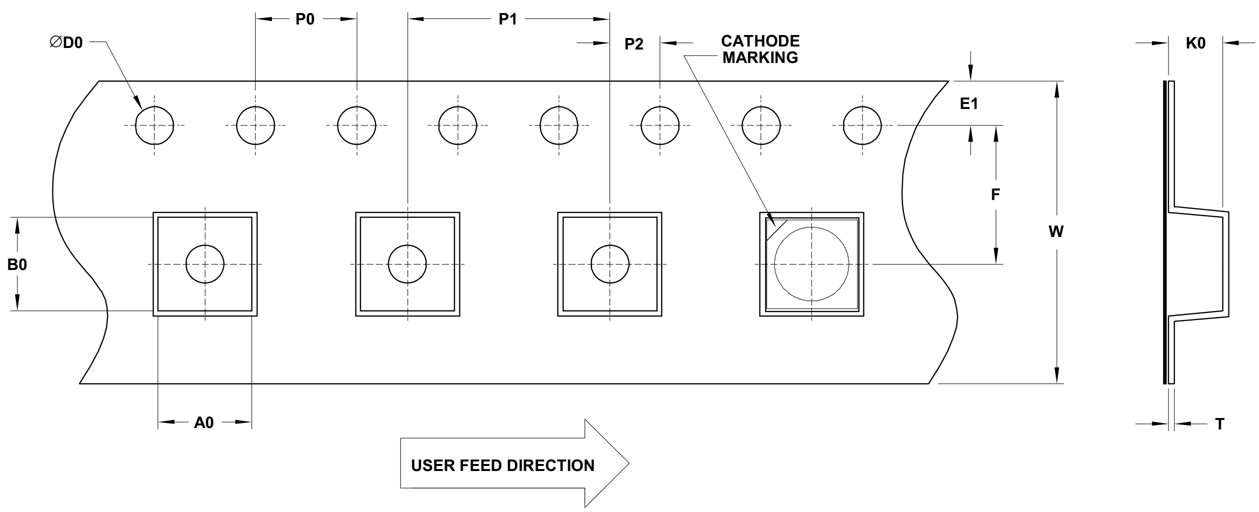


Figure 14: Recommended Soldering Land Pattern



NOTE: All dimensions are in millimeters (mm).

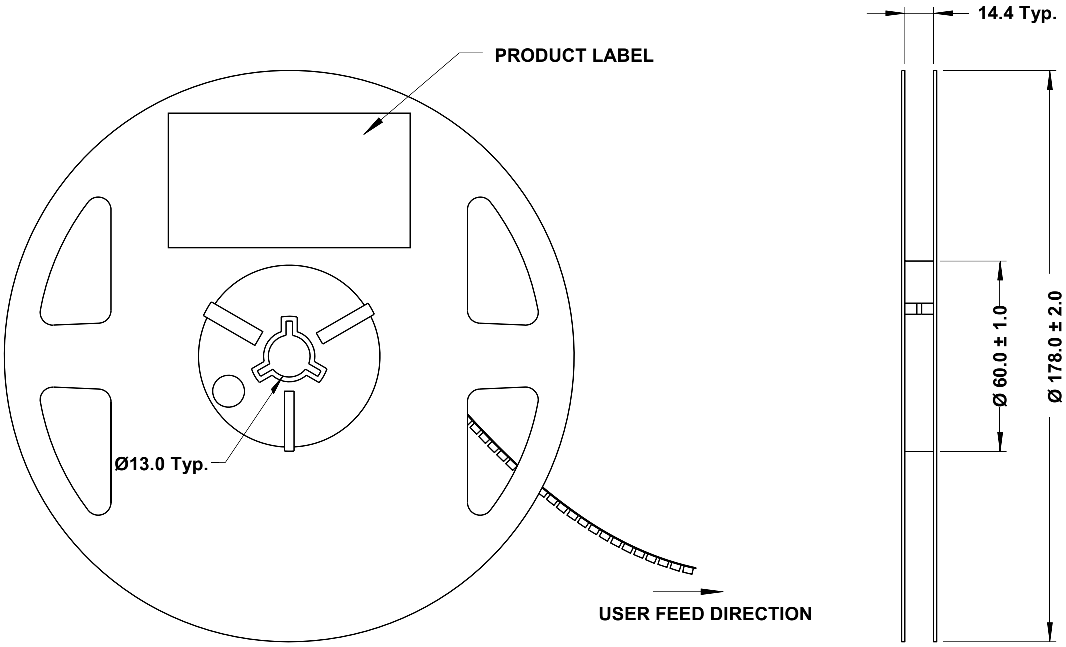
Figure 15: Carrier Tape Dimensions



F	P0	P1	P2	D0	E1	W
5.50 ± 0.10	4.00 ± 0.10	8.00 ± 0.10	2.00 ± 0.10	1.50 ± 0.10	1.75 ± 0.10	12.00 ± 0.30
T	**B0**	**K0**	**A0**			
0.35 ± 0.10	3.70 ± 0.10	3.15 ± 0.10	3.70 ± 0.10			

NOTE: All dimensions are in millimeters (mm).

Figure 16: Reel Dimensions



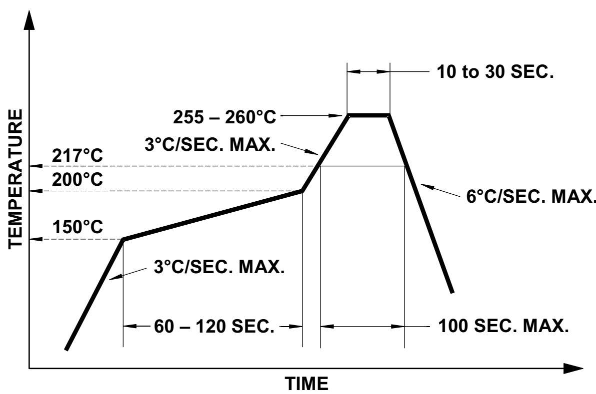
NOTE: All dimensions are in millimeters (mm).

Precautionary Notes

Reflow Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions of handling moisture-sensitive devices as stated in the following section.
- Do not apply any pressure or force on the LED during reflow and after reflow when the LED is still hot.

Figure 17: Recommended Lead-Free Reflow Soldering Profile



Handling Precautions

The encapsulation material of the LED is made of silicone for better product reliability. Compared to epoxy encapsulant, which is hard and brittle, silicone is softer and flexible. Observe special handling precautions during assembly of silicone encapsulated LED products. Failure to comply might lead to damage and premature failure of the LED. Refer to Broadcom Application Note AN5288, *Silicone Encapsulation for LED: Advantages and Handling Precautions*, for additional information.

- Do not poke sharp objects into the silicone encapsulant. Sharp objects, such as tweezers or syringes, might apply excessive force or even pierce through the silicone and induce failures to the LED die or wire bond.
- Do not touch the silicone encapsulant. Uncontrolled force acting on the silicone encapsulant might result in excessive stress on the wire bond. Hold the LED only by the body.
- Do not stack assembled PCBs together. Use an appropriate rack to hold the PCBs.
- The surface of silicone material attracts dust and dirt easier than epoxy due to its surface tackiness. To remove foreign particles on the surface of silicone, use a cotton bud with isopropyl alcohol (IPA). During cleaning, rub the surface gently without putting too much pressure on the silicone. Do not use ultrasonic cleaning.

Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in the data sheet. Use constant current driving to ensure consistent performance.
- Circuit design must cater to the whole range of forward voltage (V_F) of the LEDs to ensure the intended drive current can always be achieved.
- The LED exhibits slightly different characteristics at different drive currents, which may result in a larger variation of performance (such as intensity, wavelength, and forward voltage). Set the application current as close as possible to the test current to minimize these variations.
- Do not use the LED in the vicinity of material with sulfur content or in environments of high gaseous sulfur compounds and corrosive elements. Examples of material that might contain sulfur are rubber gaskets, room-temperature vulcanizing (RTV) silicone rubber, rubber gloves, and so on. Prolonged exposure to such environments may affect the optical characteristics and product life.
- Avoid rapid change in ambient temperatures, especially in high-humidity environments, because they cause condensation on the LED.
- If the LED is intended to be used in a harsh or an outdoor environment, protect the LED against damages caused by rain water, water, dust, oil, corrosive gases, external mechanical stresses, and so on.

Thermal Management

The optical, electrical, and reliability characteristics of the LED are affected by temperature. Keep the junction temperature (T_J) of the LED below the allowable limit at all times. T_J can be calculated as follows:

$T_J = T_A + R_{\theta J\text{-}A} \times I_F \times V_{Fmax}$

where:

T_A = Ambient temperature (°C)

$R_{\theta J\text{-}A}$ = Thermal resistance from LED junction to ambient (°C/W)

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

The complication of using this formula lies in T_A and $R_{\theta J\text{-}A}$. Actual T_A is sometimes subjective and hard to determine. $R_{\theta J\text{-}A}$ varies from system to system depending on design and is usually not known.

Another way of calculating T_J is by using the solder point temperature, T_S as follows:

$T_J = T_S + R_{\theta J\text{-}S} \times I_F \times V_{Fmax}$

where:

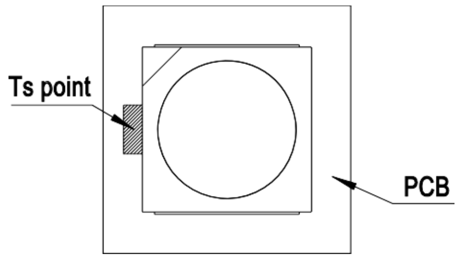
T_S = LED solder point temperature as shown in the following figure (°C)

$R_{\theta J\text{-}S}$ = Thermal resistance from junction to solder point (°C/W)

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 18: Solder Point Temperature on PCB



T_S can be easily measured by mounting a thermocouple on the soldering joint as shown in preceding figure, while $R_{\theta J\text{-}S}$ is provided in the data sheet. Verify the T_S of the LED in the final product to ensure that the LEDs are operating within all maximum ratings stated in the data sheet.

Eye Safety Precautions

LEDs may pose optical hazards when in operation. Do not look directly at operating LEDs because it might be harmful to the eyes. For safety reasons, use appropriate shielding or personal protective equipment.

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