BROADCOM®

Data Sheet

ASCQxx60 Series

Mono Color Top Mount Lens PLCC-4

Description

The Broadcom® ASCQxx60 series is a PLCC-4 package with a 3.5 mm x 3.15 mm footprint. The LEDs are made with an advanced optical grade epoxy for superior performance in outdoor sign applications. The black outer appearance enables better display contrast without sacrificing the brightness.

To facilitate easy pick-and-place assembly, the LEDs are packed in tape and reel form. Every reel is shipped in single intensity and color bin to ensure uniformity.

Features

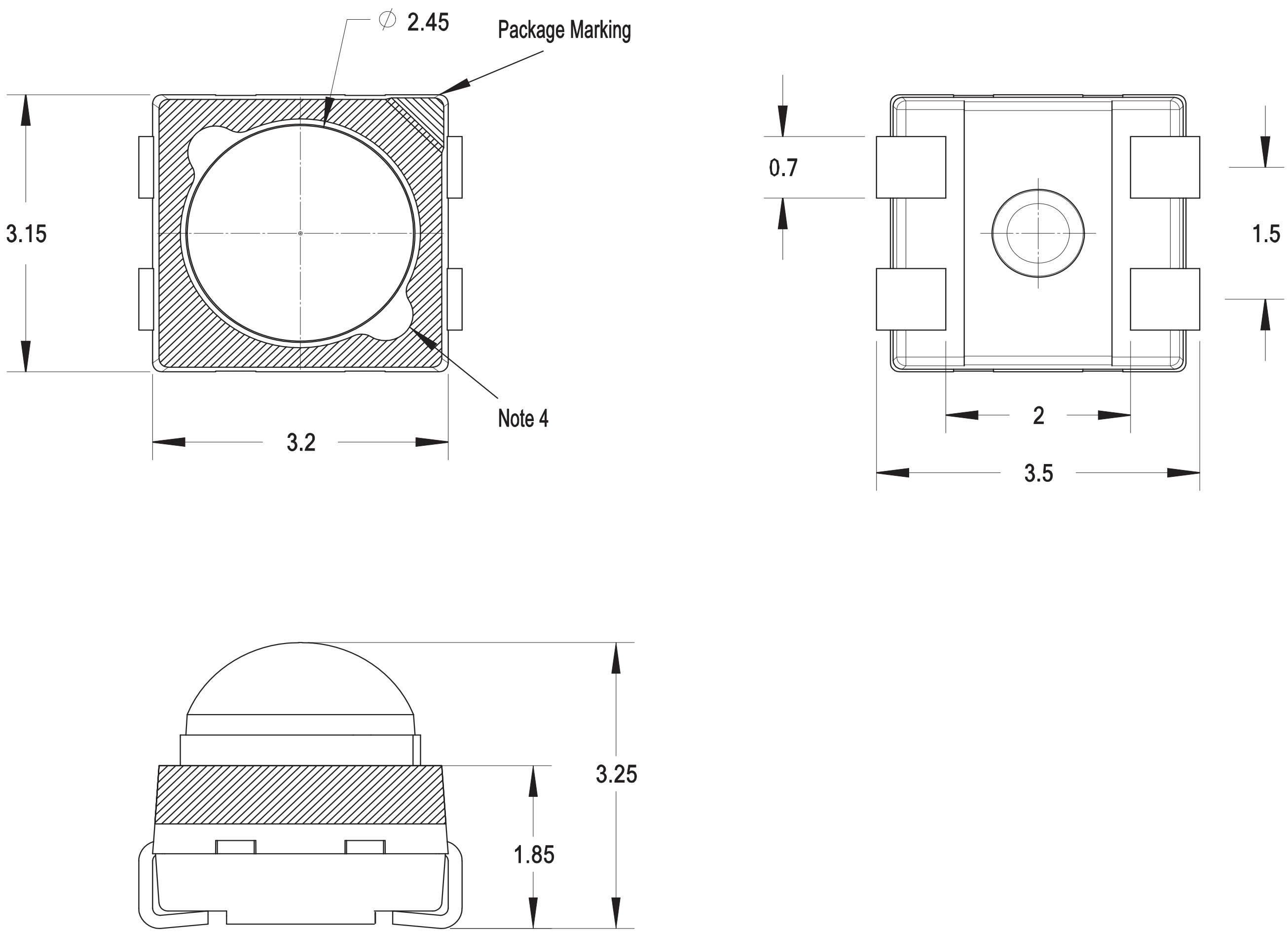
- Available in Red and Amber
- Nominal viewing angle: 55°
- Frosted lens with white surface and black outer appearance
- MSL 3

Applications

- Sign and symbol display
- Variable message signs

CAUTION! This LED is ESD sensitive. Please observe appropriate precautions during handling and processing. Refer to application note AN-1142 for additional details.

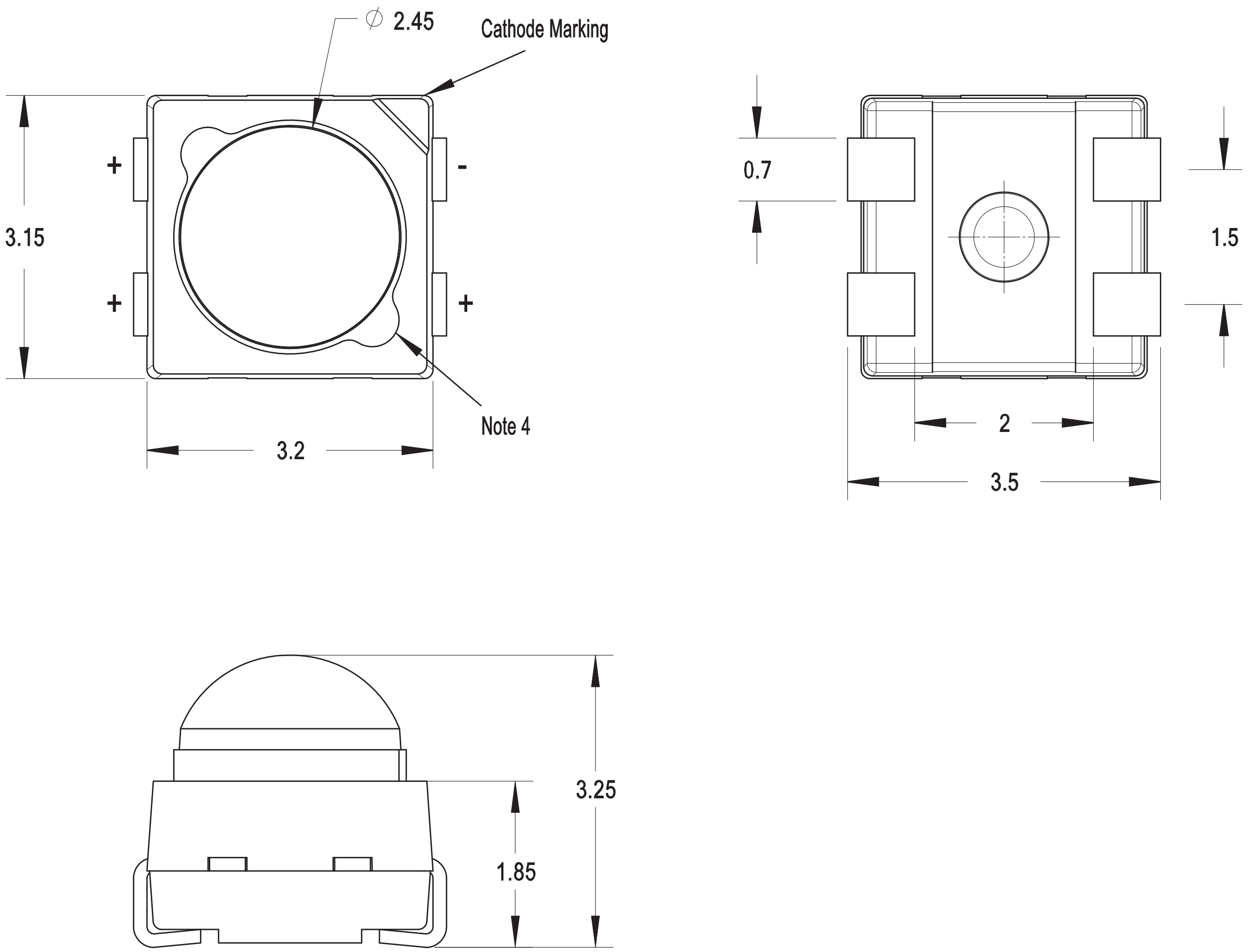
Figure 1: Package Drawing for Black Outer Appearance (BOA) ASCQFx60 Series



NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.
3. Terminal finish = silver plating.
4. The molding feature can be either on the left or right side of the lens.

Figure 2: Package Drawing for White Surface ASCQDx60 Series



NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.
3. Terminal finish = silver plating.
4. The molding feature can be either on the left or right side of the lens.

Device Selection Guide (T_J = 25°C)

Part Number	Appearance	Color	Luminous Intensity, I_V (mcd)[a,b]		Dominant Wavelength, λ_d (nm)[c]		Test Current (mA)
			Min.	Max.	Min.	Max.	
ASCQFR60-BZ211R0R105	Black Outer Surface	Red	5600	9000	618	628	50
ASCQFA60-B1112A2A305	Black Outer Surface	Amber	7150	11250	587	593	50
ASCQDR60-BZ211R0R105	White Surface	Red	5600	9000	618	628	50
ASCQDA60-B1112A2A305	White Surface	Amber	7150	11250	587	593	50

a. The luminous intensity, I_V is measured at the mechanical axis of the package and it is tested with a single current pulse condition. The actual peak of the spatial radiation pattern may not be aligned with the axis.

b. Tolerance is ±12%.

c. The dominant wavelength, λ_d is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.

Absolute Maximum Ratings

Parameters	Red	Amber	Units
DC Forward Current[a]	70	70	mA
Peak Forward Current[b]	100	100	mA
Power Dissipation	185.5	192.5	mW
Reverse Voltage	Not recommended for reverse bias operation		
LED Junction Temperature	110		°C
Operating Temperature Range	–40 to +100		°C
Storage Temperature Range	–40 to +100		°C

a. Derate linearly as shown in Figure 9.

b. Duty factor = 10%, frequency = 1 kHz, T_A = 25°C.

Optical and Electrical Characteristics (T_J = 25°C)

Parameters	Min.	Typ.	Max.	Unit	Test Condition
Dominant Wavelength, λ_d[a]				nm	
Red	618	623	628		I_F = 50 mA
Amber	587	590	593		I_F = 50 mA
Peak Wavelength, λ_P				nm	
Red	—	632	—		I_F = 50 mA
Amber	—	593	—		I_F = 50 mA
Forward Voltage, V_F[b]				V	
Red	2.00	2.20	2.65		I_F = 50 mA
Amber	2.10	2.40	2.75		I_F = 50 mA
Reverse Voltage, V_R[c]	4	—	—	V	I_R = 10 µA
Thermal Resistance, $R_{\theta J\text{-}P}$[d]				°C/W	LED junction to pin
Red	—	150	—		
Amber	—	150	—		

a. The dominant wavelength, λ_d is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.

b. Forward voltage tolerance is ±0.1V.

c. Indicates product final test condition. Long term reverse bias is not recommended.

d. Thermal resistance from the LED junction to the pin.

Part Numbering System

A S C Q x_1 x_2 6 0 - x_3 x_4 x_5 x_6 x_7 x_8 x_9 x_{10} x_{11} x_{12} x_{13}

Code	Description	Option	
x_1	Appearance	D	White Surface
		F	Black Outer Appearance (BOA)
x_2	Color	A	Amber
		R	Red
x_3	Die Technology	B	AlInGaP
x_4 x_5	Minimum Intensity Bin	Refer to Intensity Bin Table	
x_6 x_7	Maximum Intensity Bin	Refer to Intensity Bin Table	
x_8 x_9	Minimum Color Bin	Refer to Color Bin Table	
x_{10} x_{11}	Maximum Color Bin	Refer to Color Bin Table	
x_{12}	Forward Voltage Bin	0	Full Distribution
x_{13}	Test Current	5	50 mA

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
Z2	5600	7150
11	7150	9000
12	9000	11250

Tolerance = ±12%.

Example of bin information on reel and packaging label:

CAT: 11	–	Intensity bin 11
BIN: A3	–	Amber color bin A3

AlInGaP Color Bin Limits (BIN)

Bin ID	Dominant Wavelength, λ_d (nm)	
	Min.	Max.
Red		
R0	618	623
R1	623	628
Amber		
A2	587	590
A3	590	593

Tolerance = ± 1.0 nm

Forward Voltage Bin Limits (V_F) - Red

Bin ID	Forward Voltage, V_F (V)	
	Min.	Max.
VA	2.00	2.15
VB	2.10	2.25
VC	2.20	2.35
VD	2.30	2.45
VE	2.40	2.55
VG	2.50	2.65

Tolerance = ±0.1V

Forward Voltage Bin Limits (V_F) - Amber

Bin ID	Forward Voltage, V_F (V)	
	Min.	Max.
VB	2.10	2.25
VC	2.20	2.35
VD	2.30	2.45
VE	2.40	2.55
VG	2.50	2.65
VH	2.60	2.75

Tolerance = ±0.1V

Figure 3: Spectral Power Distribution

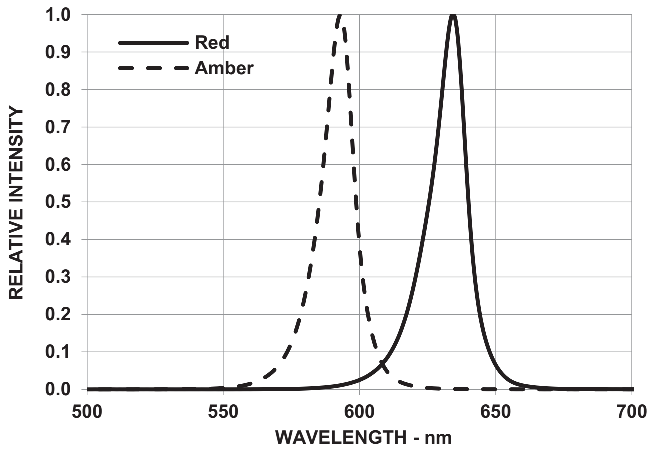


Figure 4: Forward Current vs. Forward Voltage

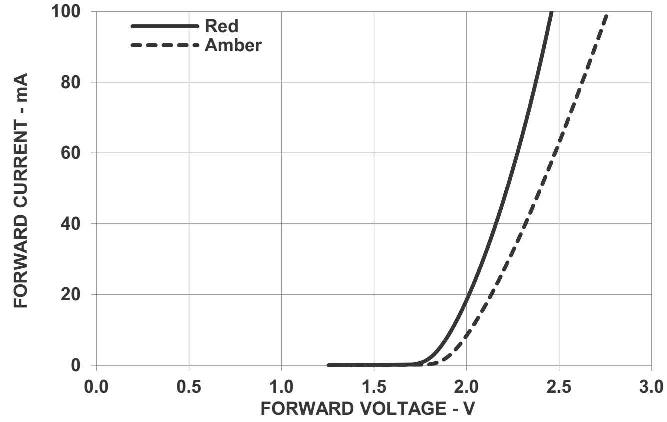


Figure 5: Relative Luminous Intensity vs. Mono Pulse Current

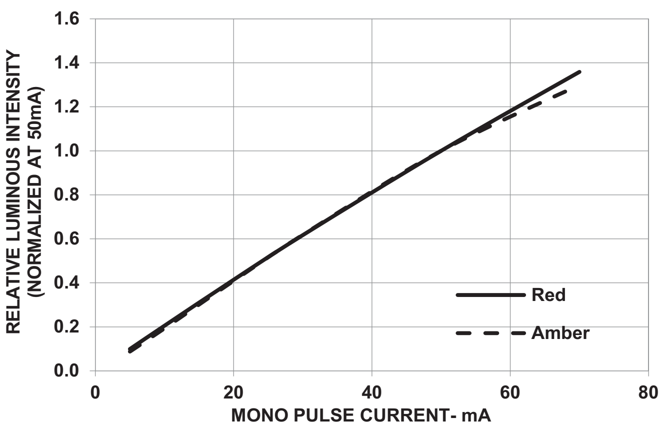


Figure 6: Dominant Wavelength Shift vs. Mono Pulse Current

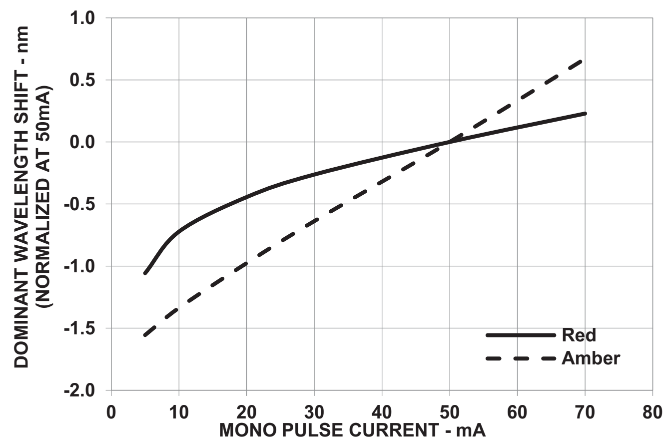


Figure 7: Relative Light Output vs. Junction Temperature

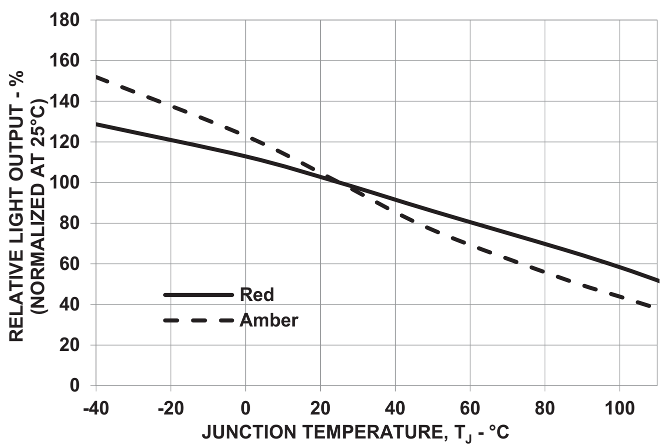


Figure 8: Forward Voltage Shift vs. Junction Temperature

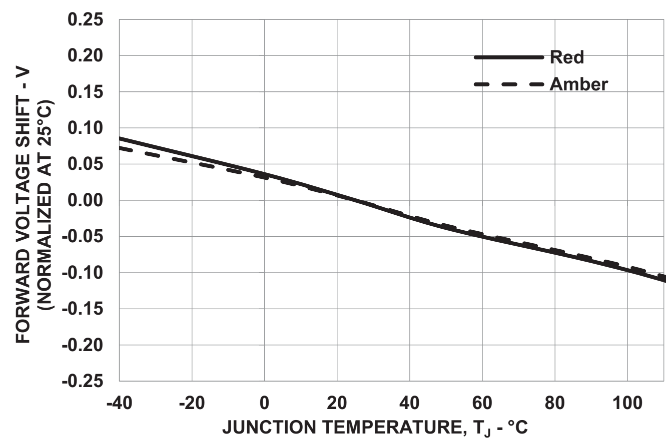


Figure 9: Maximum Forward Current vs. Temperature

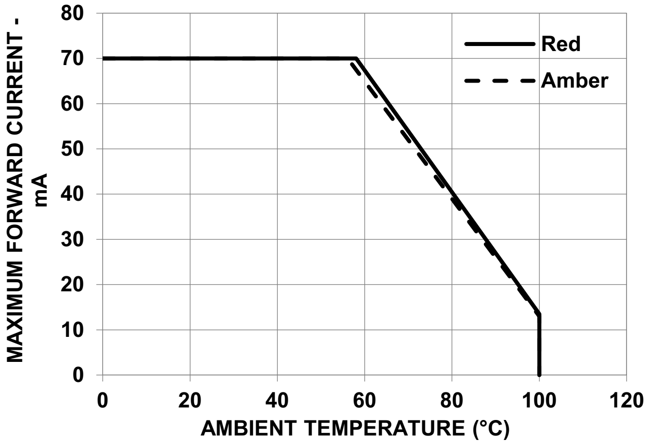


Figure 10: Radiation Pattern

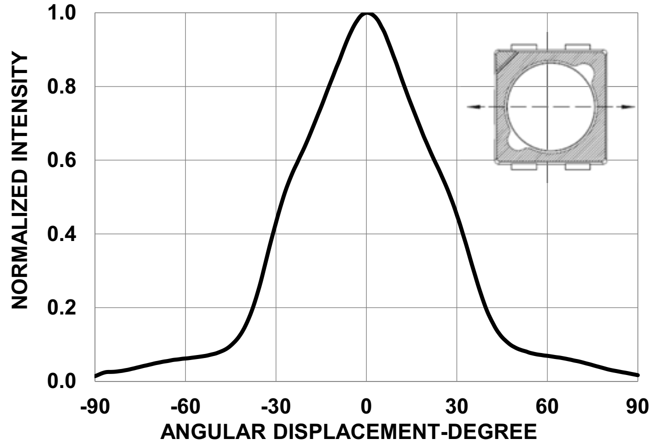
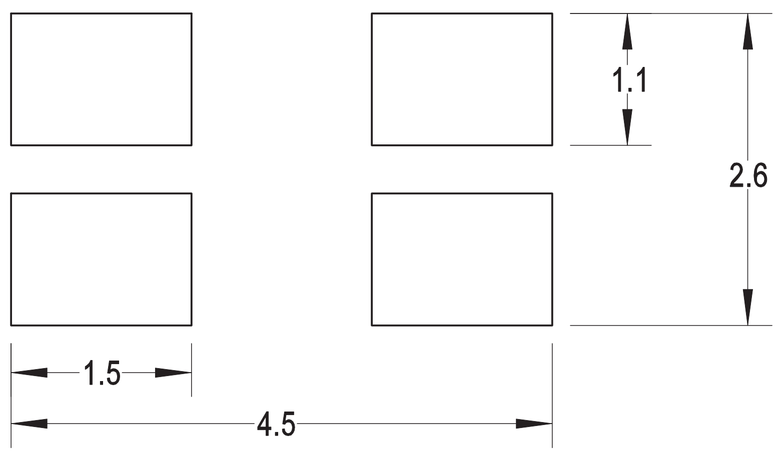


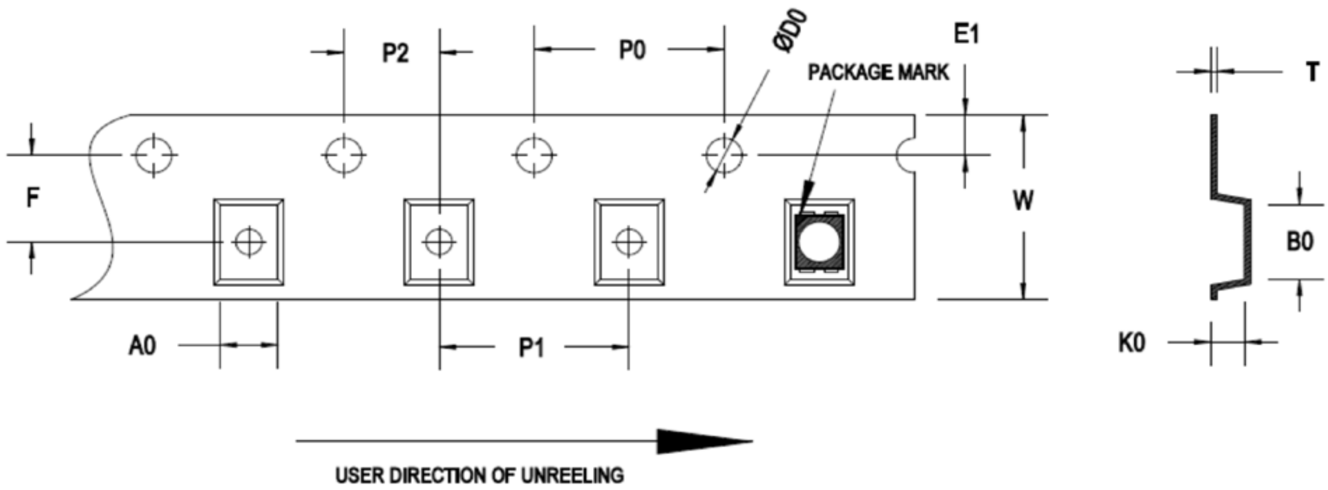
Figure 11: Recommended Soldering Pad Pattern



NOTE:

1. All dimensions are in millimeters (mm).
2. Customer is advised to maximize copper pad area for better heat dissipation.

Figure 12: Carrier Tape Drawing



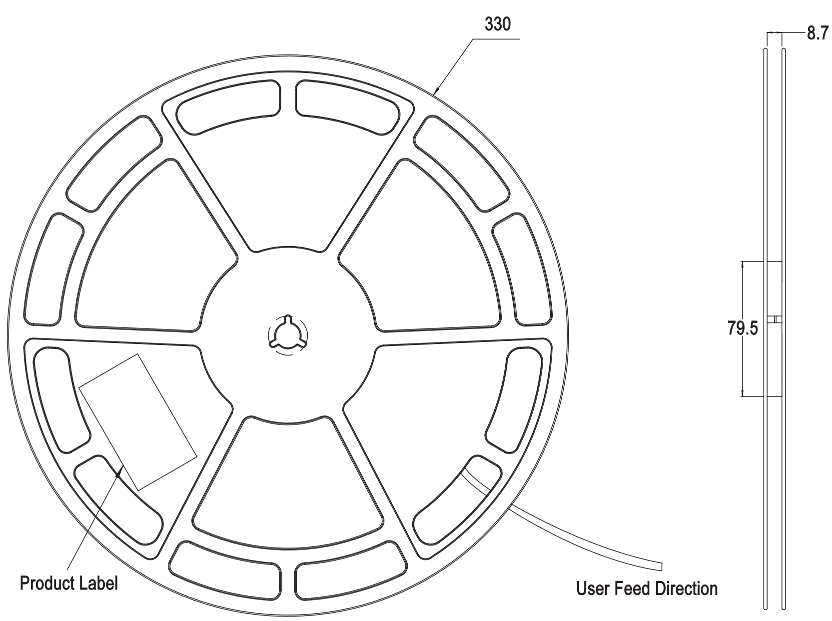
F	E1	P0	P1	P2	D0	W	A0	K0
5.5 ± 0.1	1.75 ± 0.10	4.0 ± 0.10	8.0 ± 0.1	2.0 ± 0.05	1.50 +0.1	12.0 ± 0.30	3.35 ± 0.1	3.30 ± 0.1

B0	T
3.7 ± 0.1	0.3 ± 0.05

NOTE:

1. All dimensions are in millimeters (mm).
2. LED quantity per reel is 2000 pieces.

Figure 13: Reel Drawing



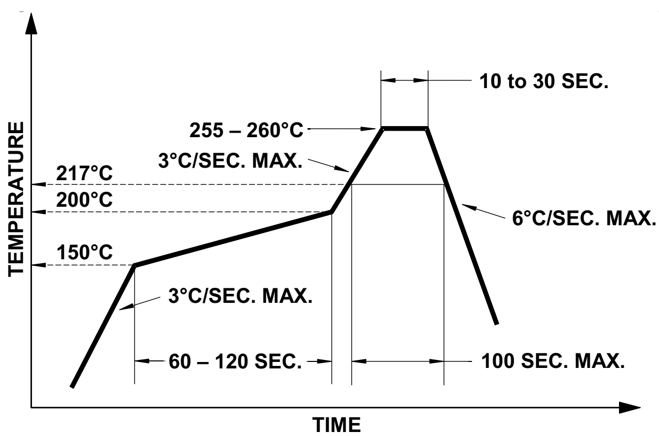
NOTE: All dimensions are in millimeters (mm).

Precautionary Notes

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.
- Use reflow soldering to solder the LED. Use hand soldering only for rework if unavoidable, but it must be strictly controlled to following conditions:
  - Soldering iron tip temperature = 315°C maximum.
  - Soldering duration = 3 seconds maximum.
  - Number of cycles = 1 only.
  - Power of soldering iron = 50W maximum.
- Do not touch the LED package body with the soldering iron except for the soldering terminals, because it may cause damage to the LED.
- Confirm beforehand whether the functionality and performance of the LED is affected by soldering with hand soldering.

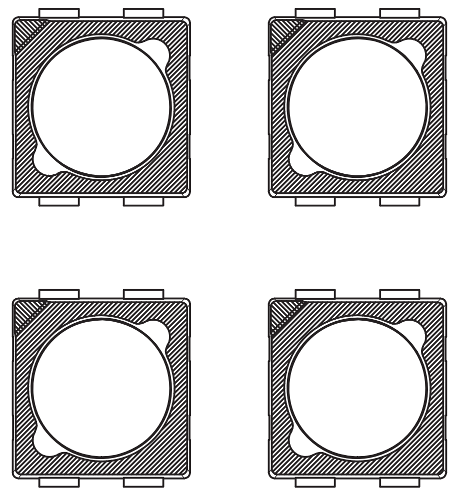
Figure 14: Recommended Lead-Free Reflow Soldering Profile



Handling Precautions

For automated pick and place, Broadcom has tested nozzle size with ID = 2.65 mm to work with this LED. However, due to the possibility of variations in other parameters such as pick-and-place machine maker/model, and other settings of the machine, verify that the selected nozzle performs as per requirements.

Figure 15: Recommended LED Placement



Handling of Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 3 rating per JEDEC J-STD-020. Refer to Broadcom Application Note AN5305, *Handling of Moisture Sensitive Surface Mount Devices*, for additional details and a review of proper handling procedures.

- Before use:
  - An unopened moisture barrier bag (MBB) can be stored at <40°C/90% RH for 12 months. If the actual shelf life has exceeded 12 months and the humidity indicator card (HIC) indicates that baking is not required, it is safe to reflow the LEDs per the original MSL rating.
  - Do not open the MBB prior to assembly (for example, for IQC). If unavoidable, the MBB must be properly resealed with fresh desiccant and HIC. The exposed duration must be taken in as floor life.
- Control after opening the MBB:
  - Read the HIC immediately upon opening of the MBB.
  - Keep the LEDs at <30°/60% RH at all times, and complete all high temperature-related processes, including soldering, curing or rework within 168 hours.
- Control for unfinished reel:

  Store unused LEDs in a sealed MBB with desiccant or a desiccator at <5% RH.
- Control of assembled boards:

  If the PCB soldered with the LEDs is to be subjected to other high-temperature processes, store the PCB in a sealed MBB with desiccant or desiccator at <5% RH to ensure that all LEDs have not exceeded their floor life of 168 hours.
- Baking is required if the following conditions exist:
  - The HIC indicator indicates a change in color for 10% and 5%, as stated on the HIC.
  - The LEDs are exposed to conditions of >30°C/60% RH at any time.
  - The LEDs’ floor life exceeded 168 hours.

  The recommended baking condition is: 60°C ± 5°C for 20 hours.

  Baking can only be done once.
- Storage:

  The soldering terminals of these Broadcom LEDs are silver plated. If the LEDs are exposed in ambient environments for too long, the silver plating might be oxidized, thus affecting its solderability performance. As such, keep unused LEDs in a sealed MBB with desiccant or in a desiccator at <5% RH.

Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in the data sheet. Constant current driving is recommended to ensure consistent performance.
- The circuit design must cater to the entire 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.
- The LED is not intended for reverse bias. Use other appropriate components for such purposes. When driving the LED in matrix form, ensure that the reverse bias voltage does not exceed the allowable limit of the LED.
- Avoid rapid changes 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:

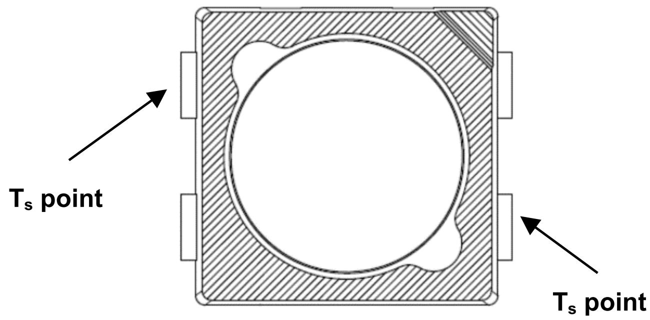
T_S = LED solder point temperature as shown in the following figure (°C)

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

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 16: 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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