Data Sheet

AUV4-Sxx1-0xx0J

3W 3535 Surface-Mount UV LED

Description

The Broadcom® 3535 surface-mount UV LEDs are energy-efficient LEDs that can be driven at high driving current and are able to dissipate heat efficiently resulting in a better performance in reliability. Their low-profile package design addresses a wide variety of applications where superior robustness and high efficiency are required. In addition to being compatible with the reflow soldering process, the silicone encapsulation ensures product superiority and longevity.

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

Features

- High-reliability package with enhanced silicone resin encapsulation
- High radiant flux output using InGaN dice technology
- Available in 360-nm to 400-nm wavelength ranges
- Available in 60° and 130° viewing angles
- Compatible with the reflow soldering process
- JEDEC MSL 3

Applications

- Industrial curing
- Photocatalyst purification

CAUTION! This LED is ESD sensitive. Observe appropriate precautions during handling and processing. Refer to the *Premium InGaN LEDs: Safety Handling Fundamentals ESD Application Note*, AN-1142, for additional details.

Figure 1: Package Drawing for AUV4-Sx61-0xx0J

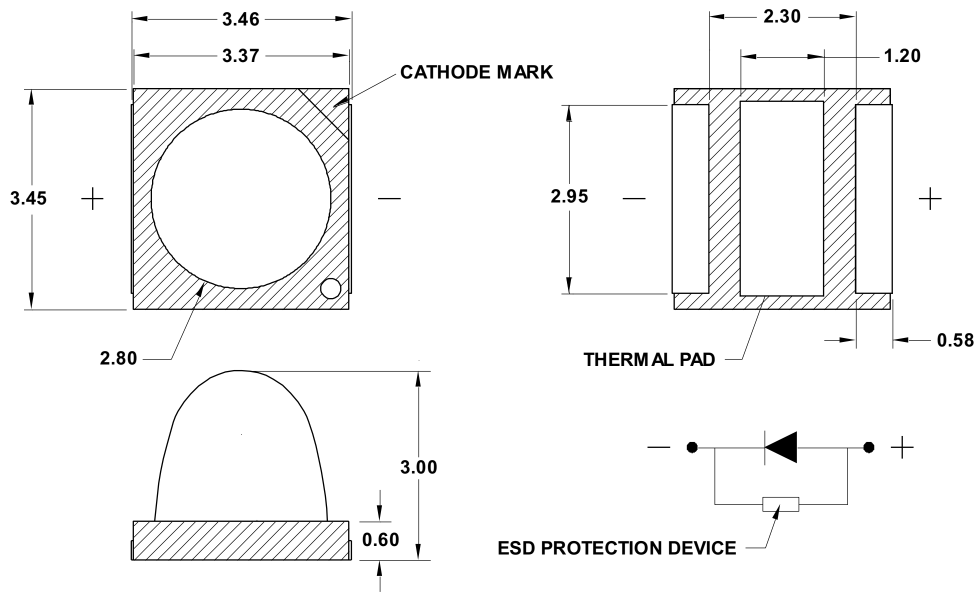
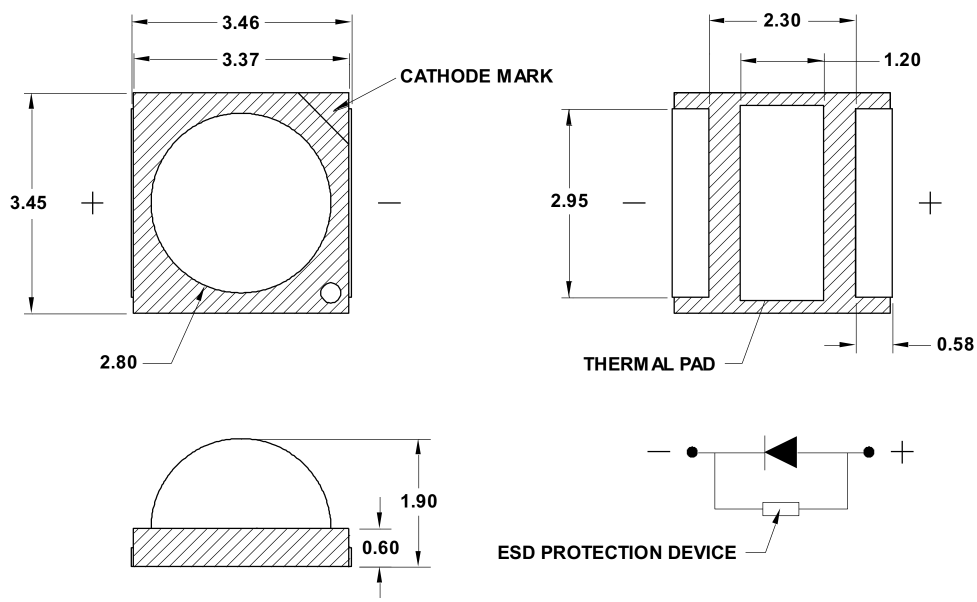


Figure 2: Package Drawing for AUV4-SxD1-0xx0J



NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ± 0.20 mm unless otherwise specified.
3. Thermal pad is electrically isolated.
4. Encapsulation = Silicone.
5. Terminal finish = Silver plating

Device Selection Guide (T_J = 25°C, I_F = 500 mA)

Part Number	Viewing Angle, $2\theta_{½}$ (°)[a]	Peak Wavelength, λ_p (nm)			Radiant Flux, Φ_e (mW)[b, c]			Dice Technology
	Typ.	Min.	Typ.	Max.	Min.	Typ.	Max.	
AUV4-SQ61-0QS0J	60	360	365	370	830	960	1100	InGaN
AUV4-SS61-0QT0J	60	380	385	390	830	980	1210	InGaN
AUV4-ST61-0RT0J	60	390	395	400	910	1000	1210	InGaN
AUV4-SQD1-0RT0J	130	360	365	370	910	1030	1210	InGaN
AUV4-SSD1-0RU0J	130	380	385	390	910	1050	1330	InGaN
AUV4-STD1-0SU0J	130	390	395	400	1000	1080	1330	InGaN

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

b. Radiant flux, Φ_e, is the total output measured with an integrating sphere at a single current pulse condition

c. Tolerance is ± 10%.

Absolute Maximum Ratings

Parameters	365 nm	385 nm	395 nm	Units
DC Forward Current[a]	500	700	700	mA
Power Dissipation	2000	2660	2660	mW
Reverse Voltage	Not designed for reverse bias operation			
LED Junction Temperature	90			°C
Operating Temperature Range	–40 to +100			°C
Storage Temperature Range	–40 to +100			°C

a. Derate linearly as shown in Figure 13, Figure 14, Figure 15, and Figure 16.

Optical and Electrical Characteristics (T_J = 25°C, I_F = 500 mA)

Parameters	Min.	Typ.	Max.	Units
Spectral Half-Width, $\Delta\lambda_{½}$			—	nm
365 nm	—	11	—	
385 nm	—	11	—	
395 nm	—	12	—	
Forward Voltage, V_F[a]				V
365 nm	3.20	3.55	4.00	
385 nm	3.00	3.35	3.80	
395 nm	3.00	3.35	3.80	
Thermal Resistance, $R_{\theta J\text{-}S}$[b]	—	4	—	°C/W

a. Forward voltage, V_F tolerance is ± 0.1V.

b. Thermal resistance from the LED junction to the solder point.

Part Numbering System

A	U	V	4	-	S	x_1	x_2	1	-	0	x_3	x_4	x_5	x_6

Code	Description	Option	
x_1	Nominal Peak Wavelength	Q	365 nm
		S	385 nm
		T	395 nm
x_2	Viewing Angle	6	60°
		D	130°
x_3	Minimum Radiant Flux Bin	Refer to Radiant Flux Bin Limits (CAT)	
x_4	Maximum Radiant Flux Bin		
x_5	Color Bin Option	0	Full Distribution
x_6	Test Option	J	Test Current = 500 mA

Part Number Example

AUV4-SQ61-0QS0J

x_1: S – Nominal peak wavelength = 365 nm
x_2: 6 – Viewing angle = 60°
x_3: Q – Minimum radiant flux bin Q
x_4: S – Maximum radiant flux bin S
x_5: 0 – Full distribution color bin
x_6: J – Test current = 500 mA

Bin Information

Radiant Flux Bin Limits (CAT)

Bin ID	Radiant Flux, Φe (mW)	
	Min.	**Max.**
Q	830	910
R	910	1000
S	1000	1100
T	1100	1210
U	1210	1330

Tolerance = ± 10%.

Forward Voltage Bin Limits (VF)

Bin ID	Forward Voltage, V_F (V)	
	Min.	**Max.**
C	3.0	3.2
D	3.2	3.4
E	3.4	3.6
F	3.6	3.8
G	3.8	4.0

Tolerance = ± 0.1V.

Color Bin Limits (BIN)

Bin ID	Peak Wavelength, λ_p (nm)	
	Min.	**Max.**
Q1	360	365
Q2	365	370
S1	380	385
S2	385	390
T1	390	395
T2	395	400

Tolerance = ± 1.0 nm.

Example of bin information on reel and packaging label:

CAT: S – Radiant flux bin S
BIN: S1 – Color bin S1
VF: E – Forward voltage bin E

Figure 3: Spectral Power Distribution

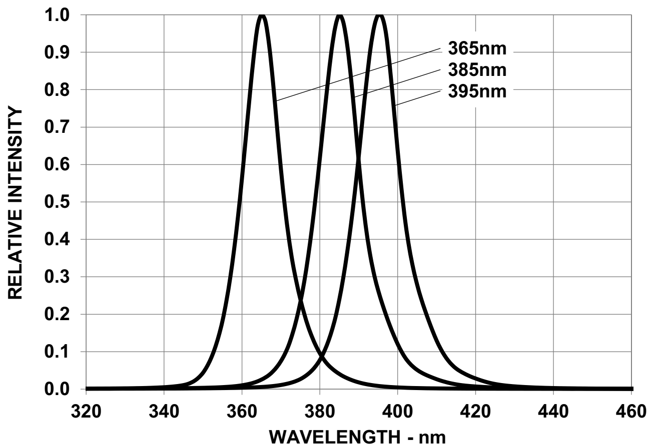


Figure 4: Forward Current vs. Forward Voltage

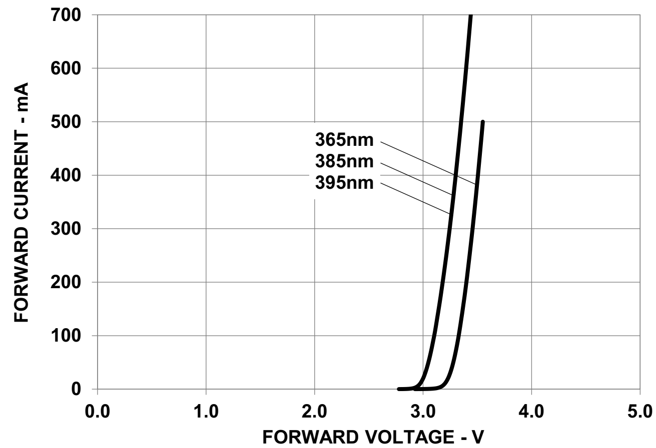


Figure 5: Relative Radiant Flux vs. Mono Pulse Current – 365 nm

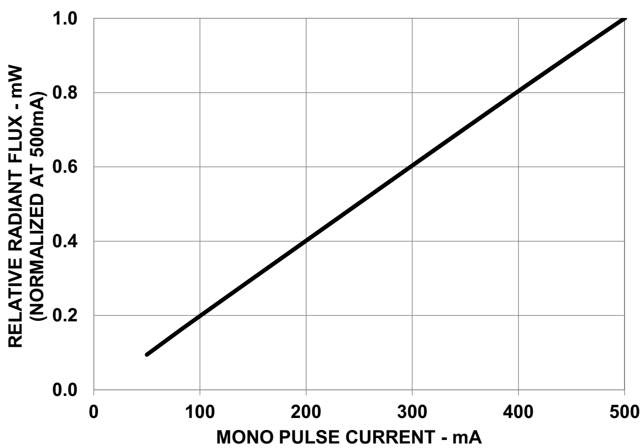


Figure 6: Relative Radiant Flux vs. Mono Pulse Current – 385 nm and 395 nm

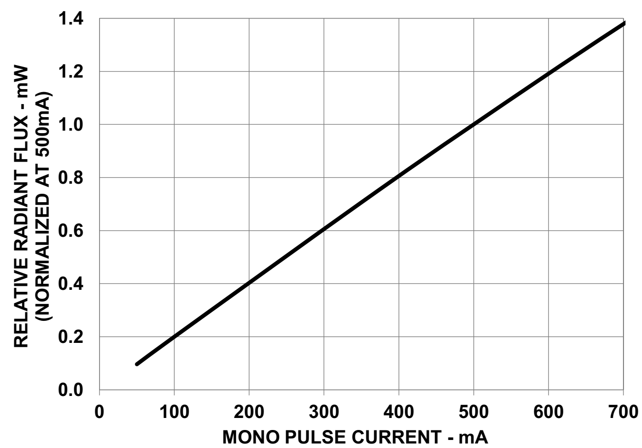


Figure 7: Peak Wavelength Shift vs. Mono Pulse Current – 365 nm

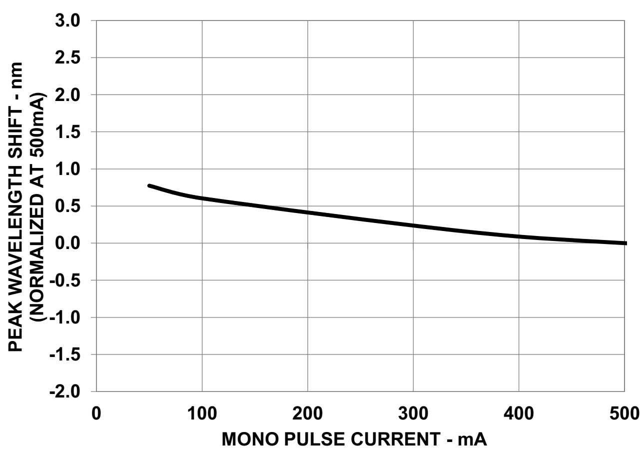


Figure 8: Peak Wavelength Shift vs. Mono Pulse Current – 385 nm and 395 nm

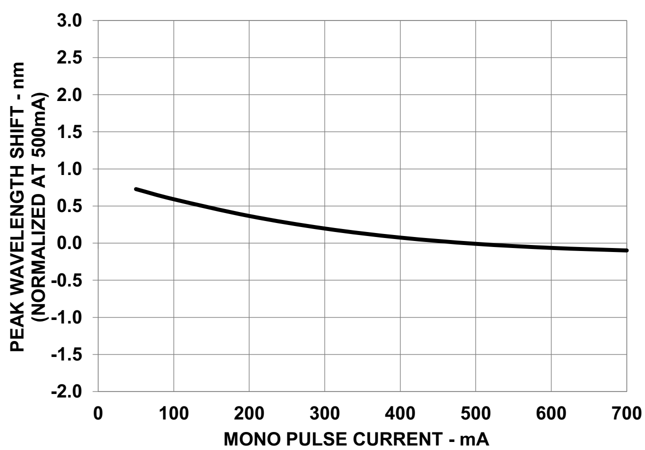


Figure 9: Radiation Pattern – 60°

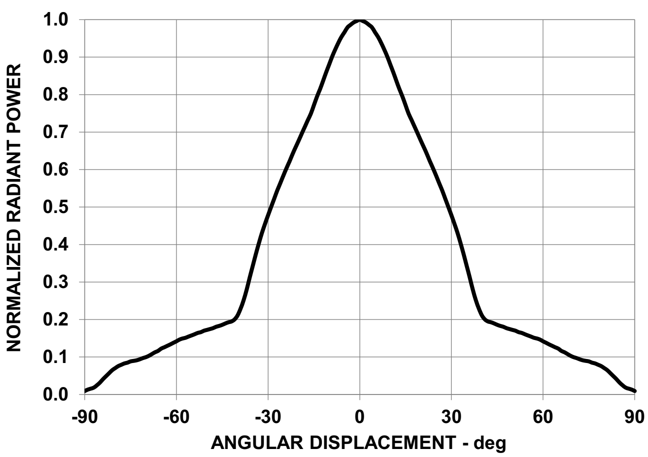


Figure 10: Radiation Pattern – 130°

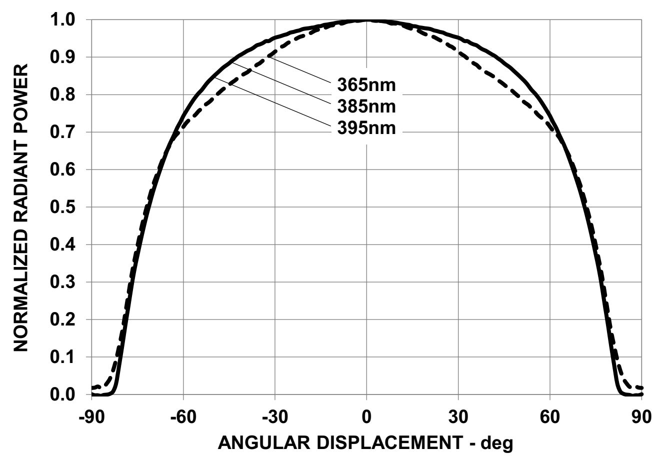


Figure 11: Forward Voltage Shift vs. Junction Temperature

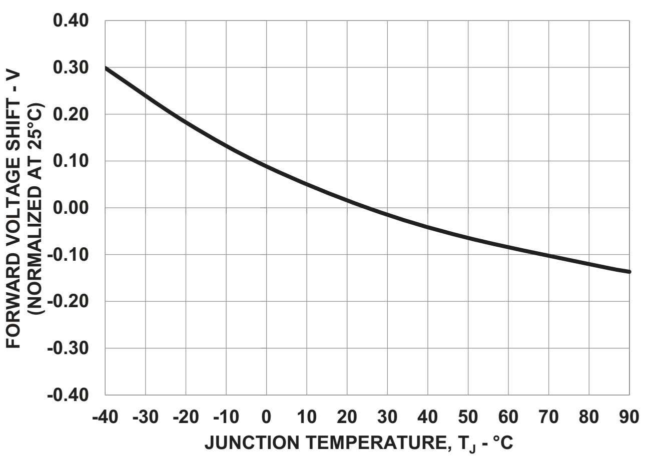


Figure 12: Peak Wavelength Shift vs. Junction Temperature

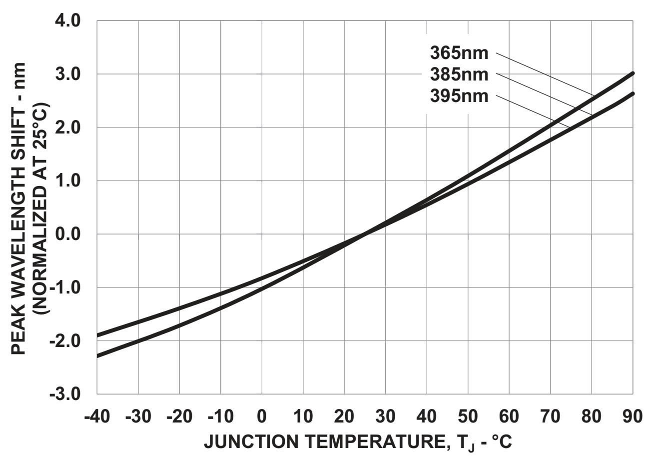


Figure 13: Maximum Forward Current vs. Ambient Temperature – 365 nm

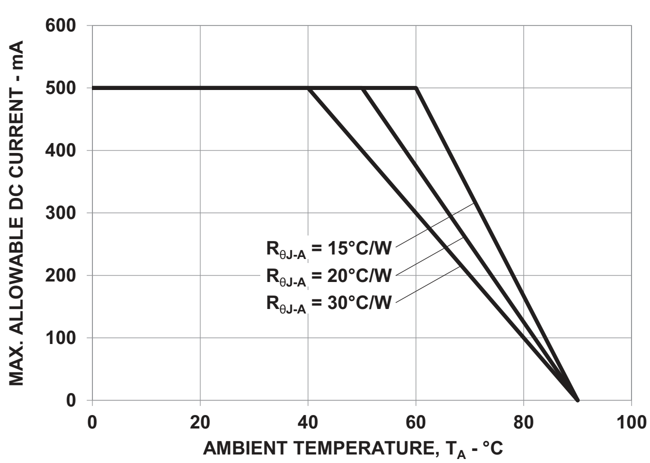


Figure 14: Maximum Forward Current vs. Solder Point Temperature – 365 nm

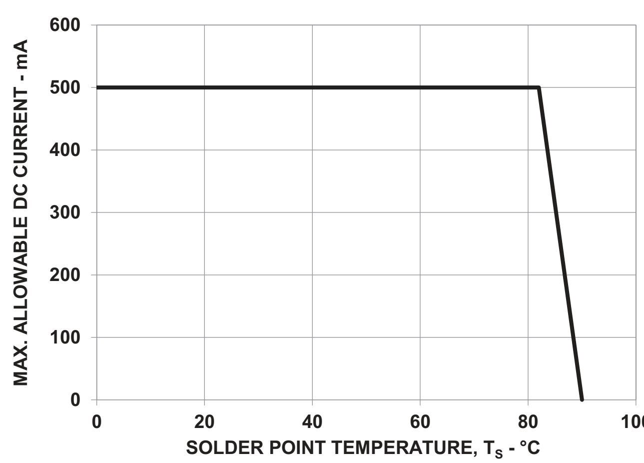


Figure 15: Maximum Forward Current vs. Ambient Temperature – 385 nm and 395 nm

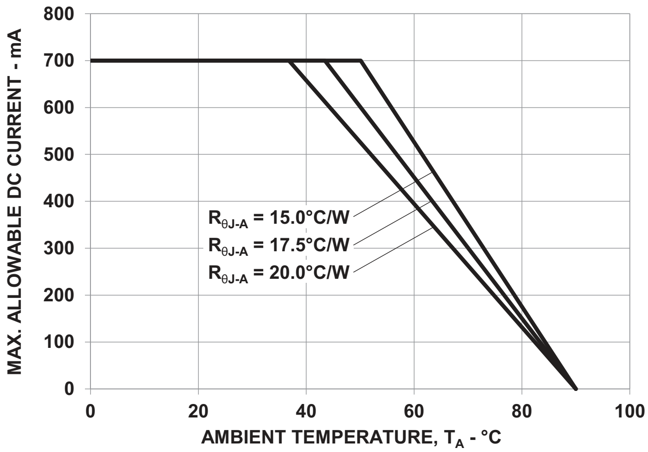


Figure 16: Maximum Forward Current vs. Solder Point Temperature – 385 nm and 395 nm

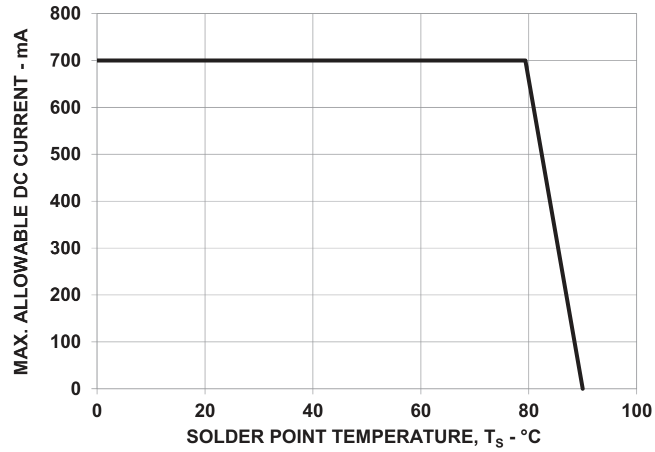
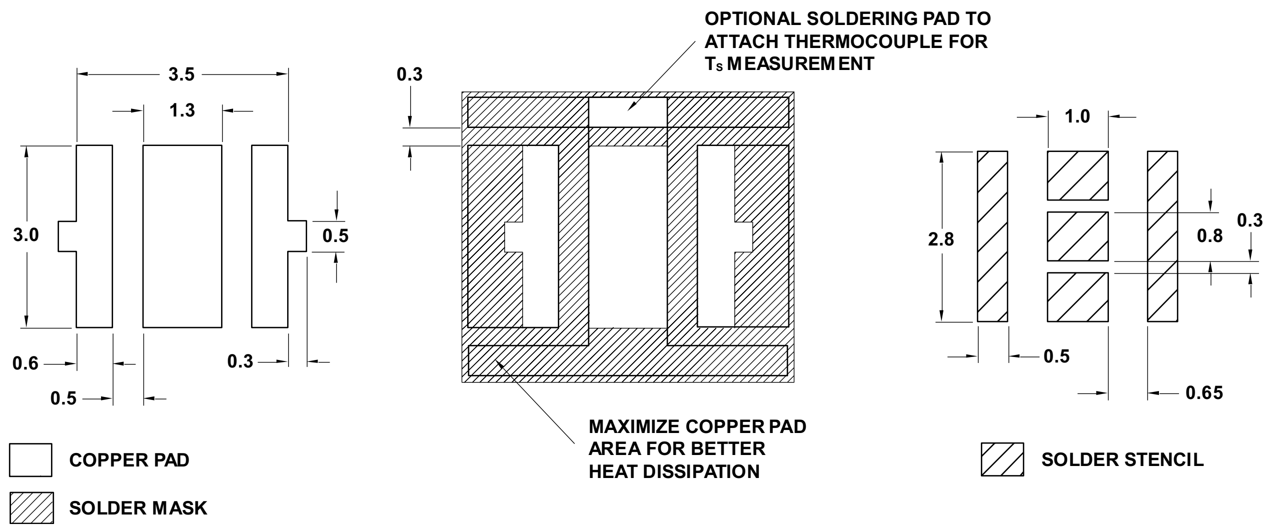
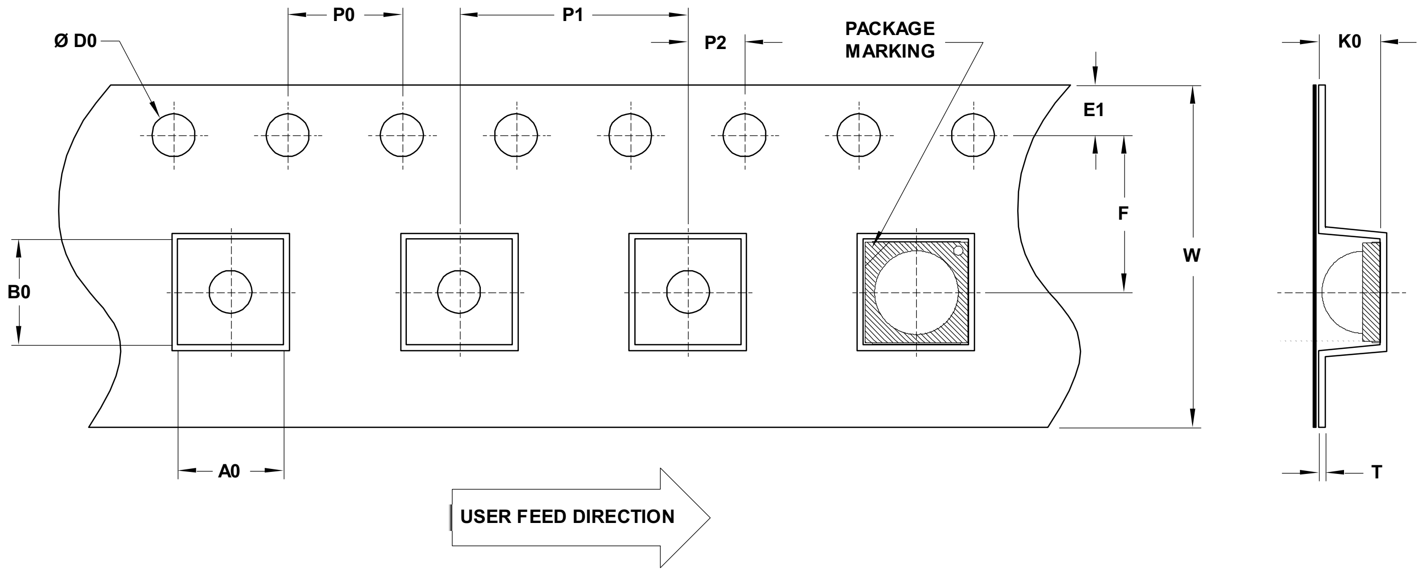


Figure 17: Recommended Soldering Land Pattern



NOTE: All dimensions are in millimeters (mm).

Figure 18: Carrier Tape Dimensions

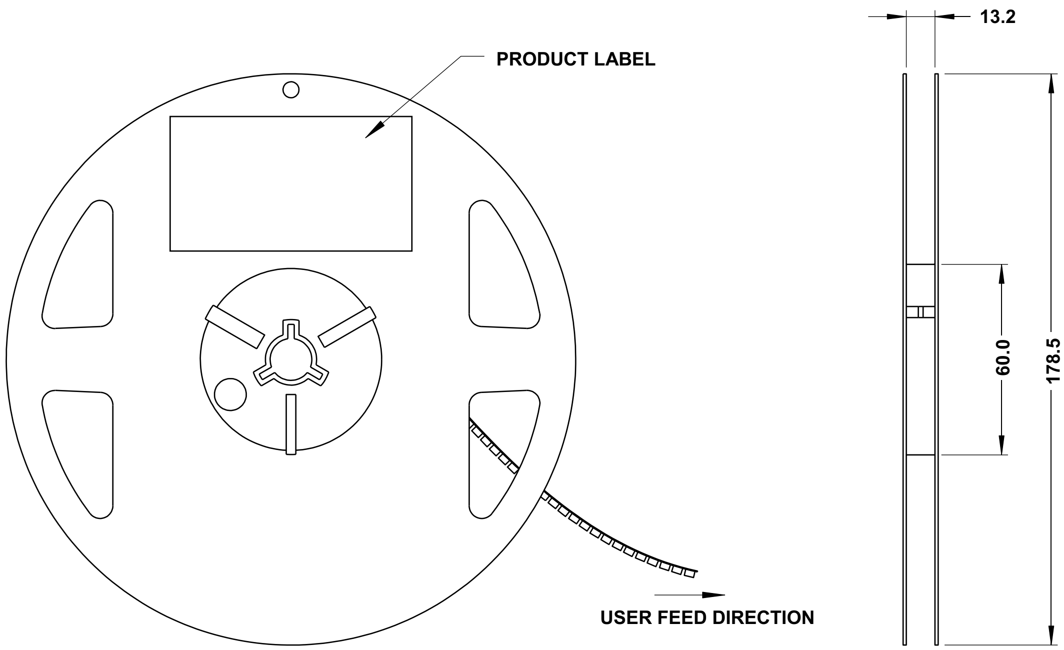


F	P0	P1	P2	D0	E1	W
5.50 ± 0.05	4.00 ± 0.10	8.00 ± 0.10	2.00 ± 0.05	1.50 + 0.1	1.75 ± 0.10	12.00 ± 0.20

Part Number	T	A0	B0	K0
AUV4-SxD1	0.28 ± 0.05	3.75 ± 0.10	3.75 ± 0.10	2.20 ± 0.10
AUV4-Sx61	0.28 ± 0.05	3.75 ± 0.10	3.75 ± 0.10	3.15 ± 0.10

NOTE: All dimensions are in millimeters (mm).

Figure 19: Reel Dimensions



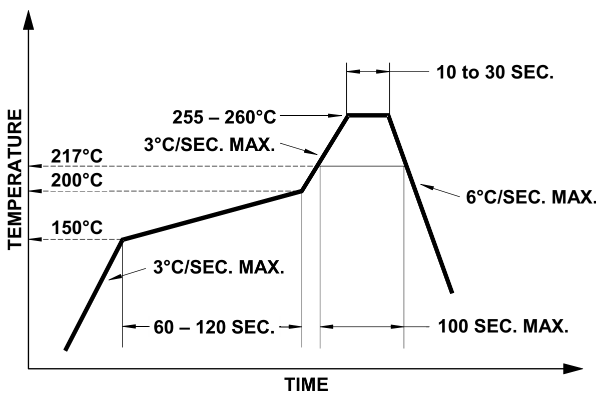
NOTE: All dimensions are in millimeters (mm).

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.

Figure 20: 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 the 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. Ultrasonic cleaning is not recommended.
- For automated pick and place, Broadcom has tested a nozzle size with OD 3.7 mm and ID 3.0 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 will not cause damage to the LED.

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:

- You can store an unopened moisture barrier bag (MBB) 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 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 LED's 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 an ambient environment 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.
- 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 changes in ambient temperature, 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:

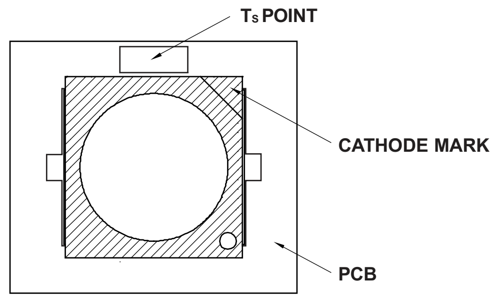
T_S = LED solder point temperature as shown in the following figure (°C)

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

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 21: 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

These devices are UV LEDs that may pose optical hazards when in operation. *Do not* look directly into an emitting UV LED because it might be harmful to human eyes. For safety precautions, use appropriate shielding or personal protective equipment (for example, glasses, gloves, face shield). Use appropriate warning signs and labels to indicate the presence of potential UV radiation hazard.

Disclaimer

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