Data Sheet

ASM3-Sxx2-NxxxH

3W 3535 Surface-Mount LED

Overview

The Broadcom® 3535 surface-mount LEDs are energy-efficient, high-current LEDs with efficient heat dissipation, resulting in better reliability and performance. Their low-profile design addresses a wide variety of applications where superior robustness and high efficiency are required.

The LEDs are compatible with reflow soldering and feature silicone encapsulation for product superiority and longevity. They are packed in tape and reel to facilitate easy pick-and-place assembly. Each reel is shipped in a single flux and color bin for close uniformity.

Features

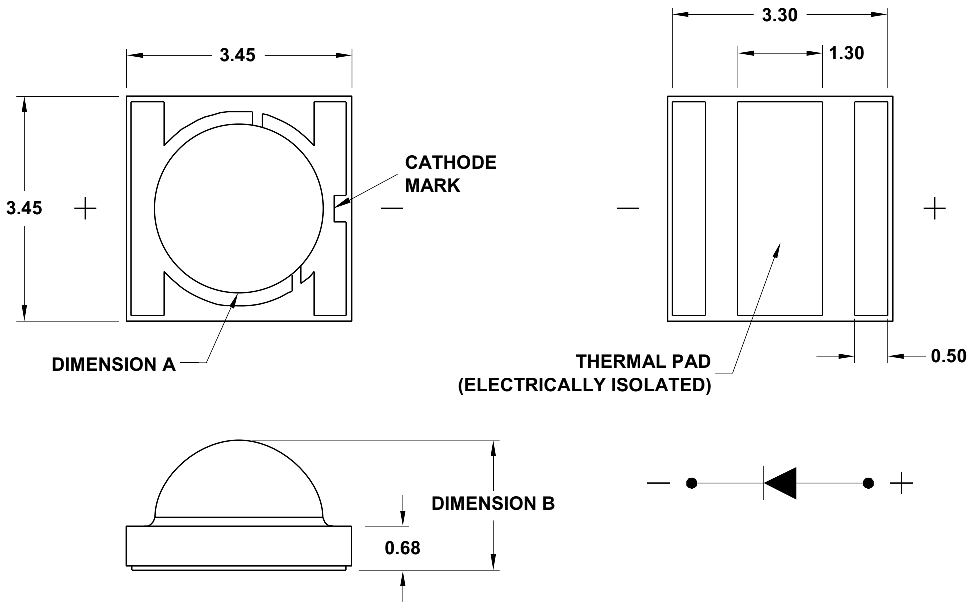
- High reliability package with enhanced silicone resin encapsulation
- Available in Red, Red-Orange, and Amber
- Available in 90° and 120° viewing angle
- Compatible with reflow soldering process
- JEDEC MSL 3

Applications

- Horticulture lighting
- Commercial lighting
- Architecture lighting
- Specialty lighting

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



Part Number	Dimension A (mm)	Dimension B (mm)
ASM3-SxC2-AxxxH	2.60	2.00
ASM3-Sx92-AxxxH	2.20	2.23

NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.
3. Encapsulation = silicone.
4. Terminal finish = silver plating.
5. Dimensions in parentheses are for reference only.

Device Selection Guide (T_J = 25°C, I_F = 350 mA)

Part Number	Color	Viewing Angle, $2\theta_{1/2}$[a]	Luminous Flux, ϕ_V (lm)[b, c]			PPF, ϕ_P (µmol/s)[d, e]	PPF/W (µmol/J)	Dice Technology
		Typ.	Min.	Typ.	Max.	Typ.	Typ.	
ASM3-SR92-ALN0H	Red	90	78	90	115	1.95	2.65	AlInGaP
ASM3-SH92-ALN0H	Red-Orange	90	78	92	115	1.80	2.45	AlInGaP
ASM3-SA92-AJL0H	Amber	90	58	68	90.5	0.67	0.80	AlInGaP
ASM3-SRC2-ALN0H	Red	120	78	90	115	1.95	2.65	AlInGaP
ASM3-SHC2-ALN0H	Red-Orange	120	78	92	115	1.80	2.45	AlInGaP
ASM3-SAC2-AJL0H	Amber	120	58	68	90.5	0.67	0.80	AlInGaP

a. $\theta_{1/2}$ is the off-axis angle where the luminous intensity is half of the peak intensity.

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

c. Luminous flux, ϕ_V, tolerance is ±10%.

d. Photosynthetic photon flux (PPF), ϕ_V, is the measurement of Photosynthetically Active Radiation (PAR) ranging from 400 nm to 700 nm.

e. Values are calculated and for reference only.

Absolute Maximum Ratings

Parameters	Red	Red-Orange	Amber	Unit
DC Forward Current[a]	1000	1000	700	mA
Peak Forward Current[b]	2000	2000	2000	mA
Power Dissipation	2800	2800	1960	mW
Reverse Voltage	Not designed for reverse bias operation.			
LED Junction Temperature	125			°C
Operating Temperature Range	–40 to +120			°C
Storage Temperature Range	–40 to +120			°C

a. Derate linearly as shown in Figure 12, Figure 13, Figure 14, and Figure 15.

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

Optical and Electrical Characteristics (T_J = 25°C, I_F = 350 mA)

Color	Dominant Wavelength, λ_d (nm)			Forward Voltage, V_F (V)[a]			Thermal Resistance, $R_{\theta J\text{-}S}$ (°C/W)[b]
	Min.	Typ.	Max.	Min.	Typ.	Max.	Typ.
Red	617	622	635	1.8	2.1	2.8	4.5
Red-Orange	611	615	620	1.8	2.1	2.8	4.5
Amber	583	590	595	1.8	2.4	2.8	10.0

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

b. Thermal resistance from LED junction to solder point.

Performance Characteristics (T_J = 25°C, I_F = 700 mA)

Part Number	Color	Viewing Angle, $2\theta_{1/2}$ (°)	Luminous Flux, Φ_V (lm)	PPF, Φ_P (µmol/s)	Forward Voltage, V_F (V)
	Typ.	Typ.	Typ.	Typ.	Typ.
ASM3-SR92-ALN0H	Red	90	166.5	3.61	2.31
ASM3-SH92-ALN0H	Red-Orange	90	170.2	3.33	2.31
ASM3-SA92-AJL0H	Amber	90	125.8	1.24	2.78
ASM3-SRC2-ALN0H	Red	120	166.5	3.61	2.31
ASM3-SHC2-ALN0H	Red-Orange	120	170.2	3.33	2.31
ASM3-SAC2-AJL0H	Amber	120	125.8	1.24	2.78

Part Numbering System

A	S	M	3	-	S	x_1	x_2	2	-	N	x_3	x_4	x_5	x_6

Code	Description	Option	
x_1	Viewing Angle	R	Red
		H	Red-Orange
		A	Amber
x_2	Viewing Angle	9	90°
		C	120°
x_3	Minimum Flux Bin	See Luminous Flux Bin Limits (CAT) table.	
x_4	Maximum Flux Bin		
x_5	Color Bin Option	0	Full distribution
x_6	Test Option	H	Test current = 350 mA

Part Number Example

ASM3-SR92-ALN0H

x_1 : R	–	Red color
x_3 : 9	–	90° viewing angle
x_4 : L	–	Minimum radiant flux bin L
x_5 : N	–	Maximum radiant flux bin N
x_6 : H	–	Test current = 350 mA

Bin Information

Luminous Flux Bin Limits (CAT)

Bin ID	Luminous Flux, ϕ_V (lm)	
	Min.	**Max.**
J	58.0	67.3
K	67.3	78.0
L	78.0	90.5
M	90.5	105.0
N	105.0	115.0

Tolerance = ±10%

Color Bin Limits (BIN)

Bin ID	Dominant Wavelength, λ_d (nm)	
	Min.	**Max.**
Amber		
2	583	586
3	586	589
4	589	592
5	592	595
Red-Orange		
1	611	616
2	616	620
3	620	625
Red		
—	617	635

Tolerance = ±1.0 nm

Forward Voltage Limits (V_F)

Bin ID	Forward Voltage, V_F (V)	
	Min.	**Max.**
1	1.8	2.0
2	2.0	2.2
3	2.2	2.4
4	2.4	2.6
5	2.6	2.8

Tolerance = ±0.1V

Example of bin information on reel and packaging label:

CAT : J	–	Luminous Flux bin J
BIN : 2	–	Color bin 2
VF : 2	–	Forward Voltage bin 2

Figure 2: Spectral Power Distribution

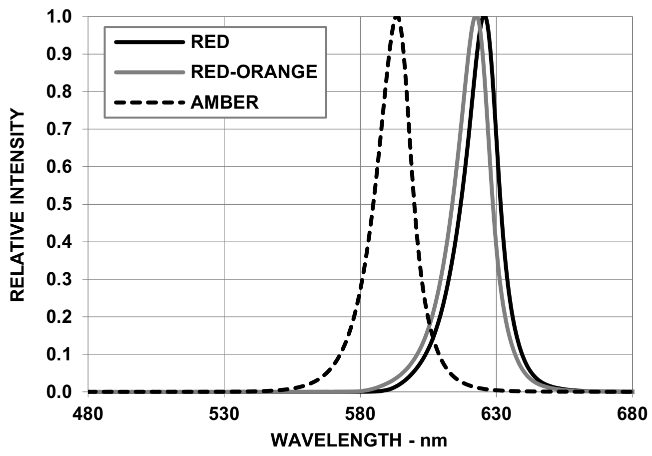


Figure 3: Forward Current vs. Forward Voltage

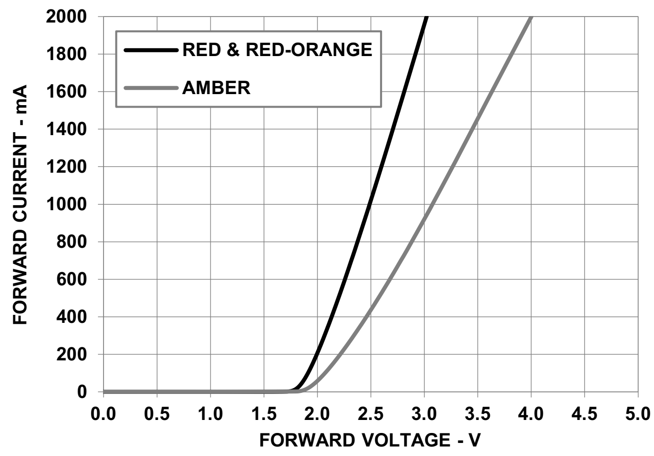


Figure 4: Relative Luminous Flux vs. Mono Pulse Current – Red and Red-Orange

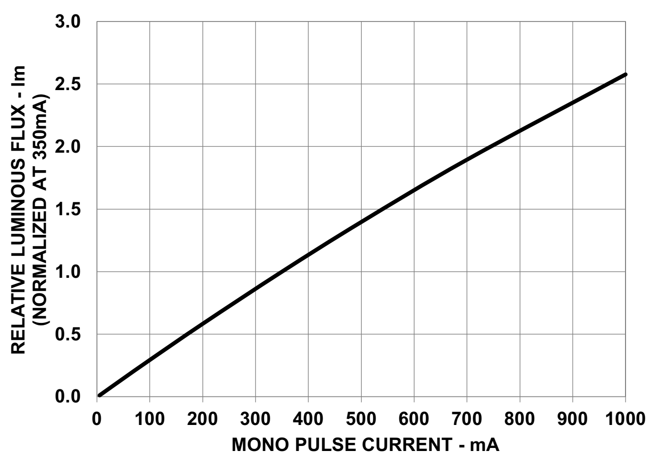


Figure 5: Relative Luminous Flux vs. Mono Pulse Current – Amber

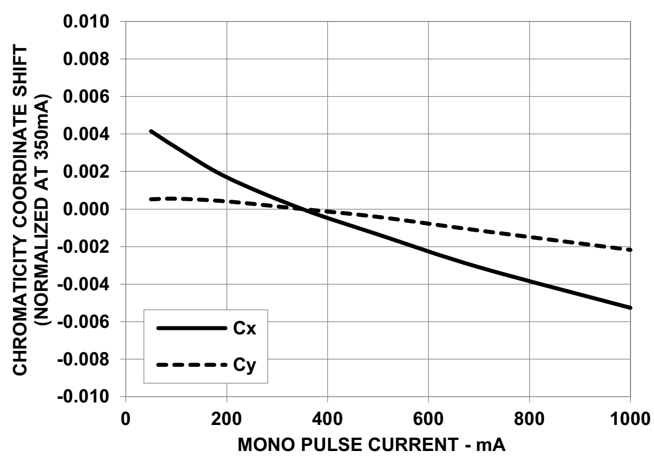


Figure 6: Dominant Wavelength Shift vs. Mono Pulse

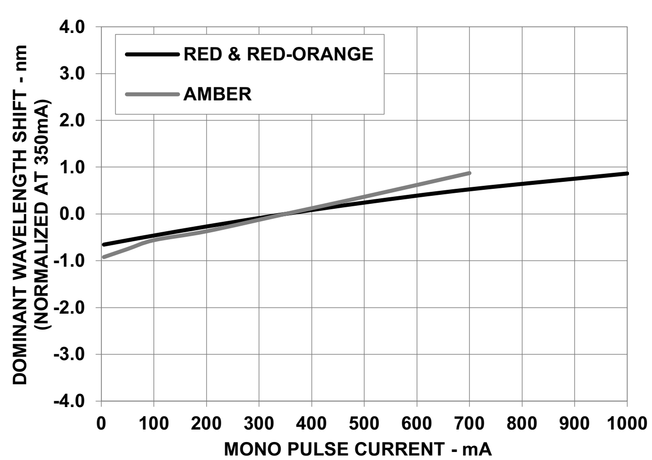


Figure 7: Relative Light Output vs. Junction Temperature

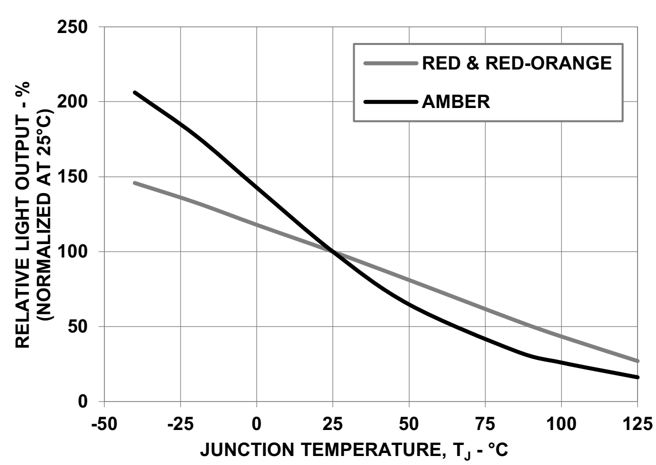


Figure 8: Forward Voltage Shift vs. Junction Temperature

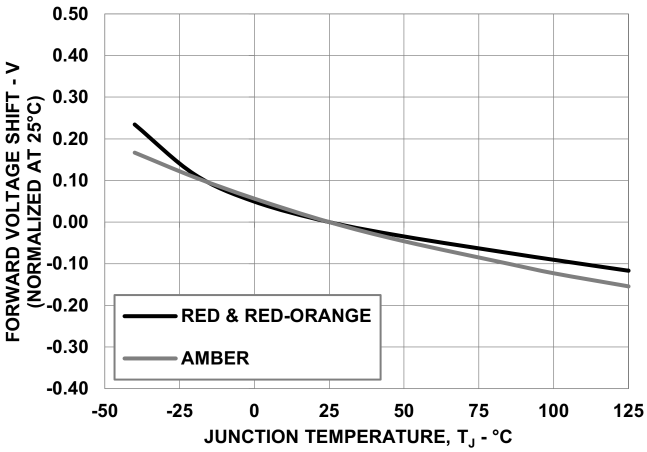


Figure 9: Dominant Wavelength Shift vs. Junction Temperature

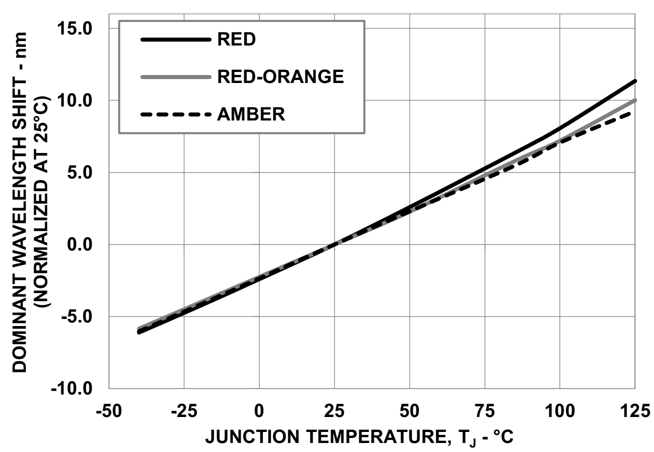


Figure 10: Radiation Pattern – 90°

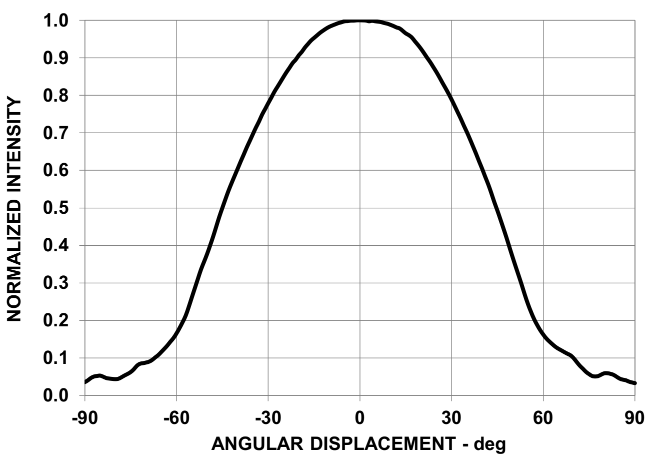


Figure 11: Radiation Pattern – 120°

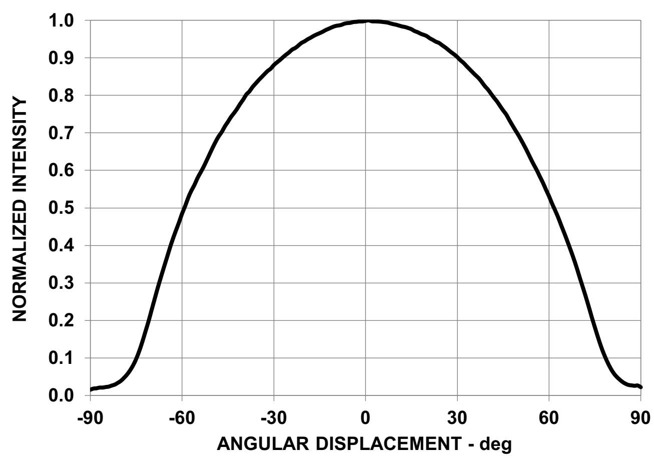


Figure 12: Maximum Forward Current vs. Ambient Temperature – Red and Red-Orange

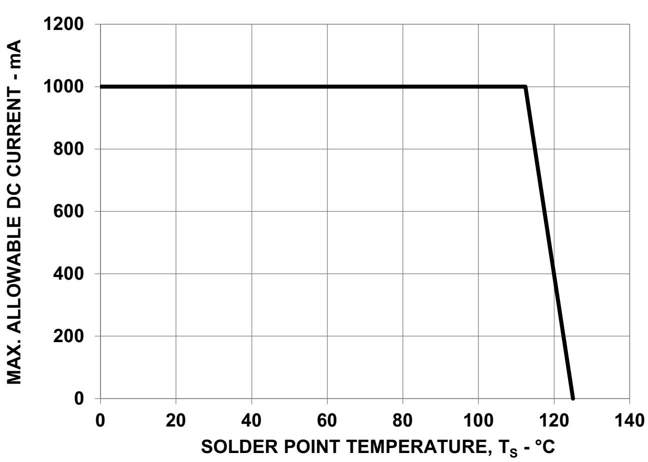


Figure 13: Maximum Forward Current vs. Ambient Temperature – Amber

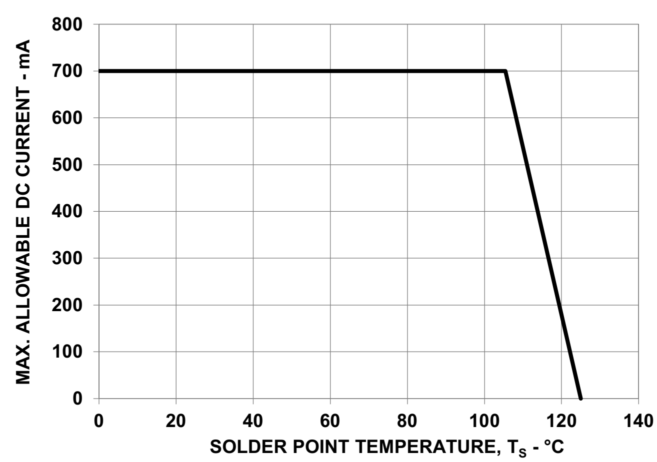


Figure 14: Maximum Forward Current vs. Solder Point Temperature – Red and Red-Orange

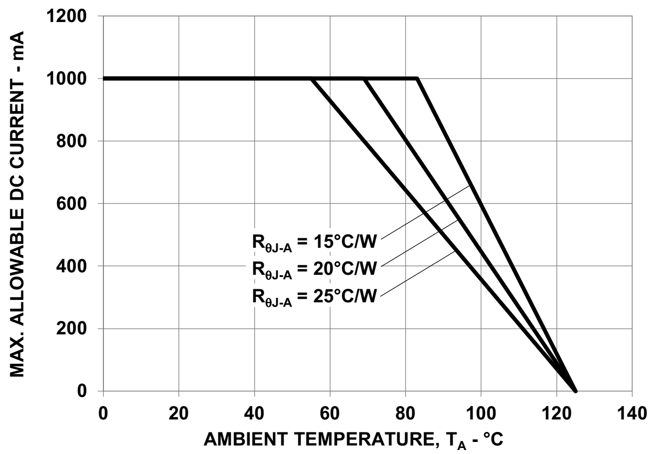


Figure 15: Maximum Forward Current vs. Solder Point Temperature – Amber

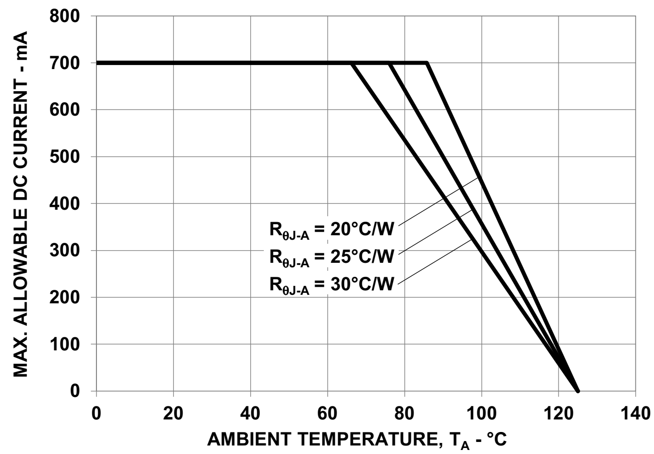


Figure 16: Recommended Soldering Land Pattern

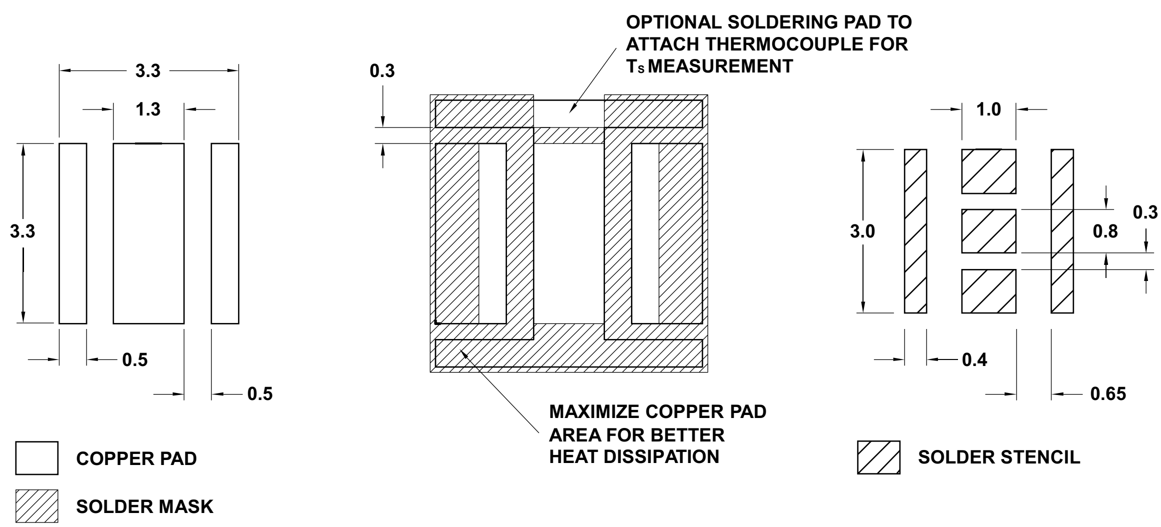
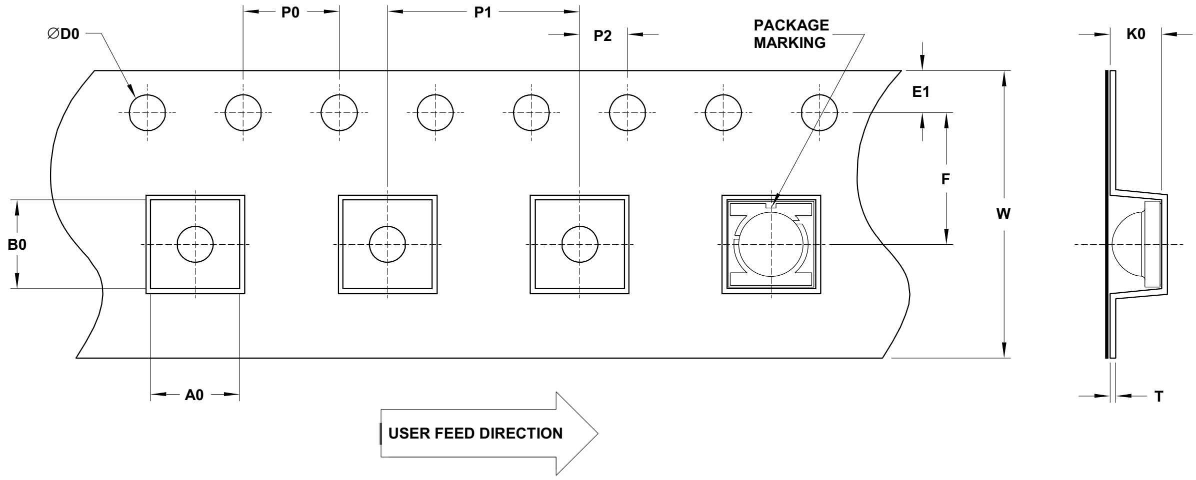


Figure 17: Carrier Tape Dimensions



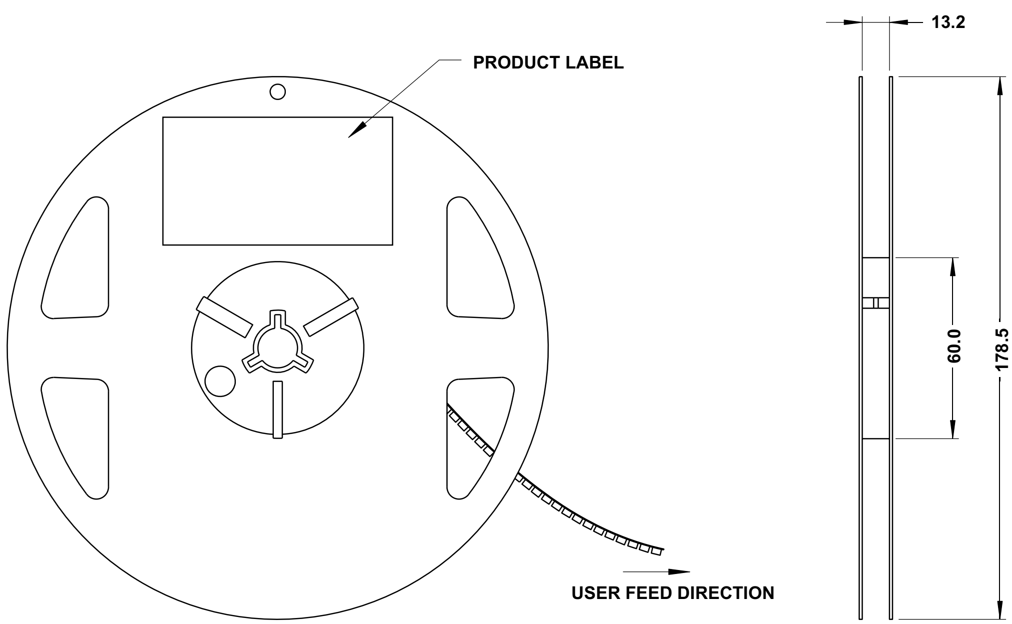
F	P0	P1	P2	D0	E1	W
5.50 ± 0.05	4.00 ± 0.10	8.00 ± 0.10	2.00 ± 0.05	1.55 + 0.05	1.75 ± 0.10	12.00 ± 0.20

T	A0	B0	K0
0.25 ± 0.05	3.80 ± 0.10	3.80 ± 0.10	2.20 ± 0.10

NOTE:

1. All dimensions are in millimeters (mm).
2. LED quantity per reel: 1000 pcs (ASM3-SxC2) and 800 pcs (ASM3-Sx92).

Figure 18: Reel Dimensions



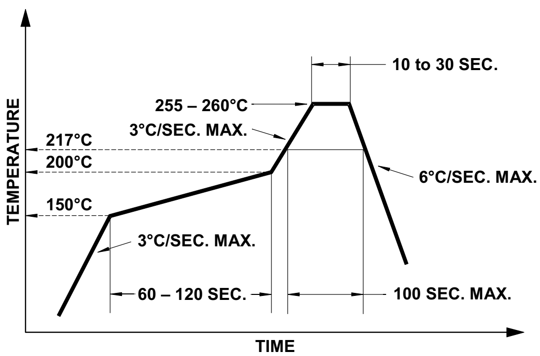
NOTE: All dimensions are in millimeters (mm).

Precautionary Notes

Soldering

- Do not perform reflow soldering more than twice. Observe necessary precautions of handling moisture-sensitive device 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 19: 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. 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.

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 can result in a larger variation of performance (meaning: 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 can affect the optical characteristics and product life.
- White LEDs must not be exposed to acidic environments and must not be used in the vicinity of any compound that can have acidic outgas, such as, but not limited to, acrylate adhesive. These environments have an adverse effect on LED performance.
- Avoid rapid change in ambient temperature, especially in high-humidity environments, because they cause condensation on the LED.
- If the LED is intended to be used in harsh or 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:

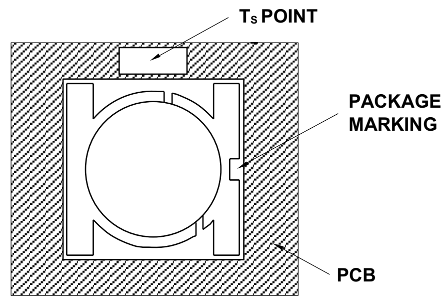
T_S = LED solder point temperature as shown in the following figure (°C)

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

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 20: Solder Point Temperature on the 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 can 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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