Data Sheet

ASMD-FWG3-Nxxx6

0.2W 3014 Surface-Mount LED

Overview

The Broadcom® ASMD-FWG3-Nxxx6 surface-mount LEDs use InGaN chip technology with superior package design to enable them to produce higher light output production with better flux performance. The product can be driven at high current and is able to dissipate heat more efficiently, resulting in better performance with reliability.

These LEDs can operate under a wide range of environmental conditions, making them ideal for various applications including fluorescent replacement, under cabinet lighting, retail display lighting, and panel lights.

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

Features

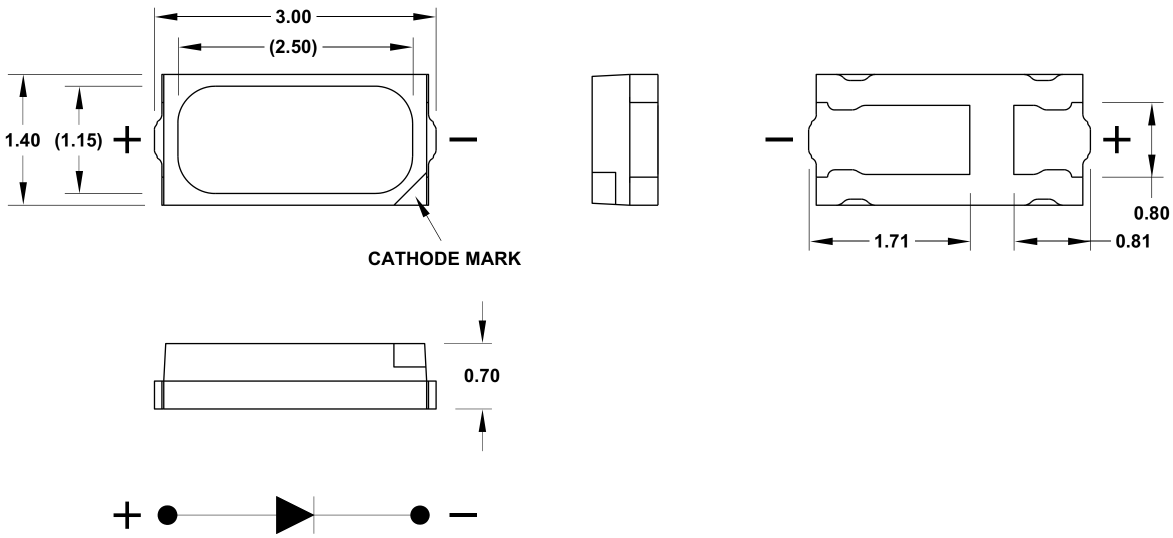
- High-reliability package with enhanced silicone resin encapsulation
- Available in 4000K, 5000K, 5700K, 6200K, 6500K, and 6800K CCT
- Low thermal resistance at 28°C/W
- Wide viewing angle at 120°
- Low package profile and large emitting area for better uniformity in linear lighting
- JEDEC MSL 3

Applications

- For lightings and luminaires
- Electronic signs and signals
  - Channel lettering
  - Contour lighting
  - Advertisement board backlighting
- Office automations, home appliances, industrial equipment
  - Front-panel backlighting
  - Push-button backlighting
  - Display backlighting
  - Scanner lighting

CAUTION! ASMD-FWG3-Nxxx6 LEDs are ESD sensitive. Please observe appropriate precautions during handling and processing. Refer to Broadcom Application Note AN-1142 for additional details.

Figure 1: Package Drawing



NOTE:

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

Device Selection Guide at 60 mA (T_J = 25°C)

Part Number	Correlated Color Temperature, CCT (Kelvin)	Luminous Flux Φ_V (lm)[a, b]			Luminous Efficiency (lm/W)	Dice Technology
	Typ.	Min.	Typ.	Max.		
ASMD-FWG3-NPTD6	4000	20.0	24.5	30.0	143.3	InGaN
ASMD-FWG3-NPTE6	5000	20.0	24.5	30.0	143.3	InGaN
ASMD-FWG3-NPTF6	5700	20.0	24.5	30.0	143.3	InGaN
ASMD-FWG3-NPTG6	6200	20.0	24.5	30.0	143.3	InGaN
ASMD-FWG3-NPTH6	6500	20.0	24.5	30.0	143.3	InGaN
ASMD-FWG3-NPTJ6	6800	20.0	24.5	30.0	143.3	InGaN

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

b. Flux tolerance is ±12%.

Absolute Maximum Ratings

Parameters	ASMD-FWG3-Nxxx6	Unit
DC Forward Current[a]	150	mA
Peak Forward Current[b]	300	mA
Power Dissipation	465	mW
Reverse Voltage	Not designed for reverse bias operation	
Junction Temperature	120	°C
Operating Temperature	–40 to +100	°C
Storage Temperature	–40 to +100	°C

a. Derate linearly as shown in Figure 13 and Figure 14.

b. Duty Factor = 10%, Frequency = 1 kHz.

Optical and Electrical Characteristics at 60 mA (T_J = 25°C)

Parameters	Min.	Typ.	Max.	Unit
Viewing Angle, $2\theta_{1/2}$[a]	—	120	—	°
Forward Voltage, V_F[b]	2.70	2.85	3.10	V
Color Rendering Index, CRI	80	—	—	V
Thermal Resistance, $R_{\theta J\text{-}S}$	—	28	—	°C/W

a. θ½ is the off-axis angle where the luminous intensity is half of the peak intensity.

b. Forward voltage tolerance is ±0.1V.

Performance Characteristics (T_J = 25°C)

Forward Current (mA)	Relative Luminous Flux (Normalized at 60 mA)	Luminous Flux, Φ_V (lm)	Forward Voltage, V_F (V)	Luminous Efficiency (lm/W)
		Typ.	Typ.	Typ.
4000K, 5000K, 5700K, 6200K, 6500K, and 6800K				
5	0.10	2.4	2.59	181.9
10	0.19	4.7	2.63	177.1
20	0.37	9.0	2.69	168.3
30	0.54	13.2	2.73	160.8
60	1.00	24.5	2.85	143.3
90	1.43	35.0	2.94	132.3
120	1.87	45.8	3.02	126.5
150	2.36	57.9	3.08	125.3

Part Numbering System

A	S	M	D	-	F	W	x_1	3	-	N	x_2	x_3	x_4	x_5

Code	Description	Option
x_1	Color Rendering Index	G – CRI ≥80
x_2	Minimum Flux Bin	Refer to Flux Bin Limits (CAT) table
x_3	Maximum Flux Bin	
x_4	Correlated Color Temperature	D – 4000K
		E – 5000K
		F – 5700K
		G – 6200K
		H – 6500K
		J – 6800K
x_5	Test Option	6 – Test Current = 60 mA

Part Number Example

ASMD-FWG3-NPTH6

x_1: G – CRI ≥80

x_2: P – Minimum flux bin P

x_3: T – Maximum flux bin T

x_4: H – Color bin CCT 6500K with bin ID 64S

x_5: 6 – Test current = 60 mA

Bin Information

Flux Bin Limits (CAT)

Bin ID	Luminous Flux, Φ_V (lm) at 60 mA	
	Min.	Max.
Q	22	24
R	24	26
S	26	28
T	28	30

Tolerance: ±12%.

Forward Voltage Bin Limits (VF)

Bin ID	Forward Voltage, V_F (V) at 60 mA	
	Min.	Max.
G02	2.7	2.8
G03	2.8	2.9
G04	2.9	3.0
G05	3.0	3.1

Tolerance: ±0.1V.

Example of bin information on reel and packaging label:

CAT: S – Flux bin S

BIN: 64S – Color bin 64S

VF: G05 – VF bin G05

Color Bin Limits (BIN)

CCT	Bin ID	Chromaticity Coordinates	
		x	y
4000K	41S	0.3699	0.3646
		0.3743	0.3846
		0.3885	0.3934
		0.3835	0.3741
5000K	50S	0.3372	0.3449
		0.3378	0.3596
		0.3496	0.3694
		0.3478	0.3533
5700K	58G	0.3220	0.3280
		0.3209	0.3425
		0.3330	0.3533
		0.3329	0.3375
6200K	62G	0.3133	0.3214
		0.3113	0.3350
		0.3208	0.3444
		0.3219	0.3296
6500K	64S	0.3079	0.3274
		0.3068	0.3354
		0.3181	0.3467
		0.3192	0.3387
6800K	68G	0.3061	0.3145
		0.3035	0.3272
		0.3113	0.3350
		0.3133	0.3214

Tolerance: ±0.01.

Figure 2: Chromaticity Diagram

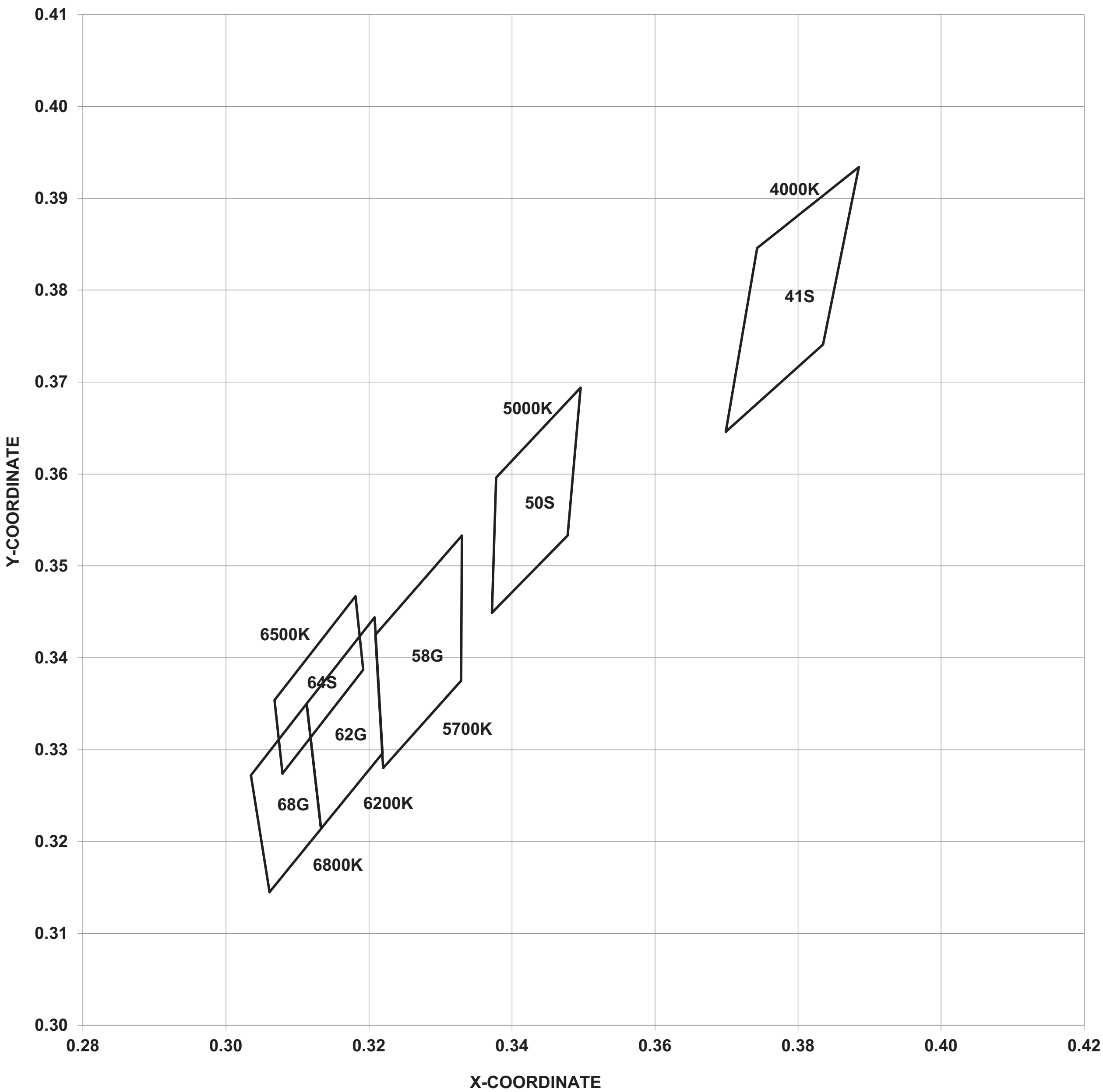


Figure 3: Spectral Power Distribution

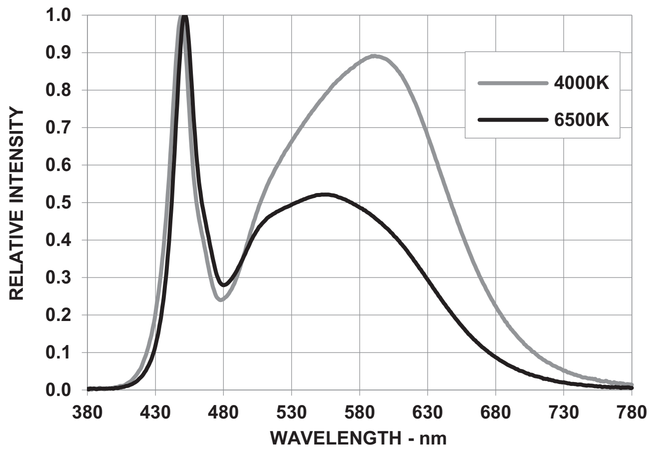


Figure 4: Forward Current vs. Forward Voltage

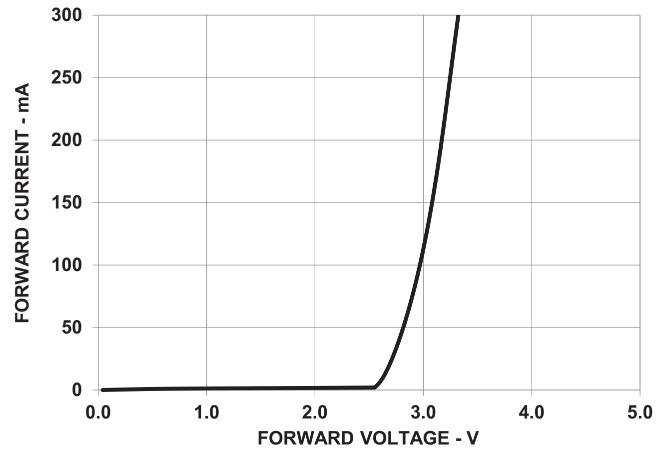


Figure 5: Relative Luminous Flux vs. Mono Pulse Current

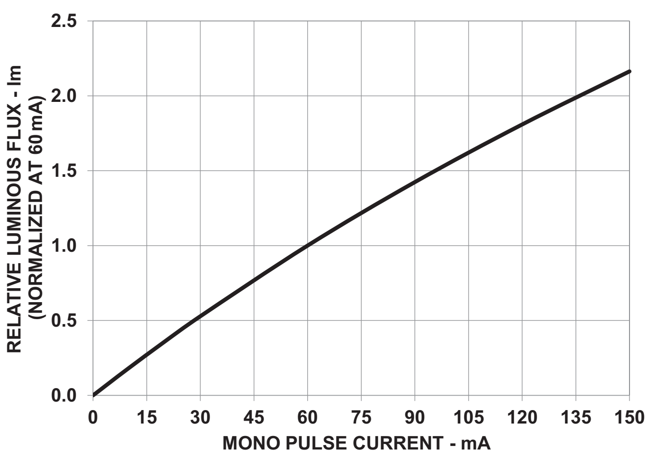


Figure 6: Radiation Pattern

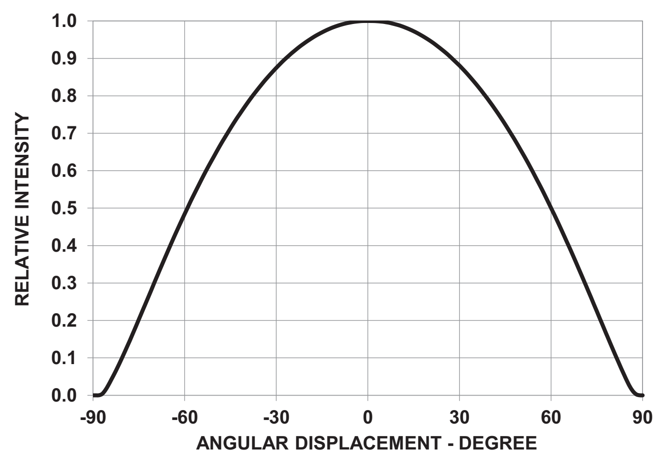


Figure 7: Chromaticity Coordinate Shift vs. Mono Pulse Current for 4000K

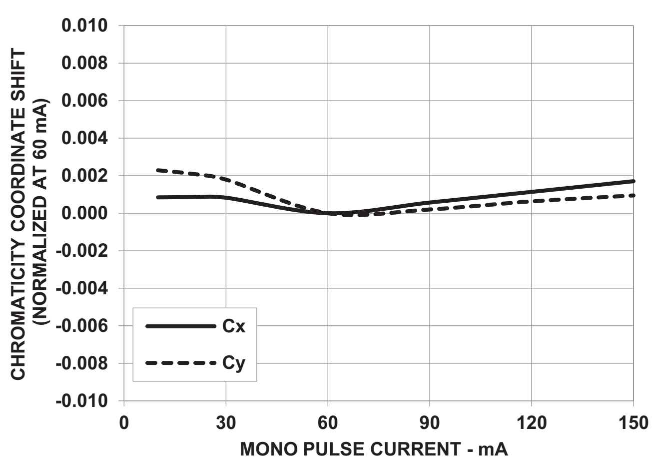


Figure 8: Chromaticity Coordinate Shift vs. Mono Pulse Current for 6500K

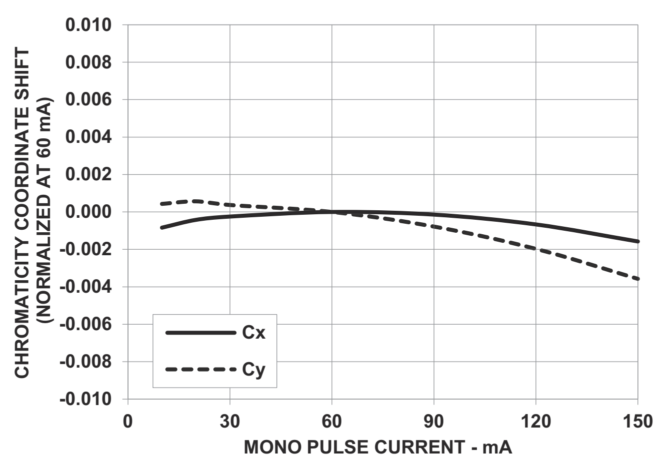


Figure 9: Relative Light Output vs. Junction Temperature

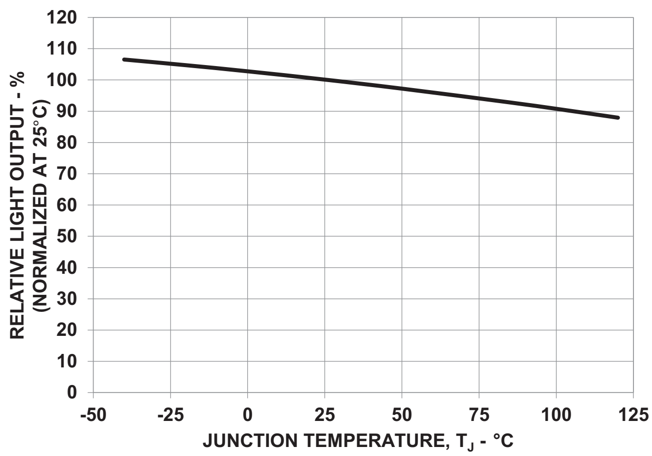


Figure 10: Forward Voltage Shift vs. Junction Temperature

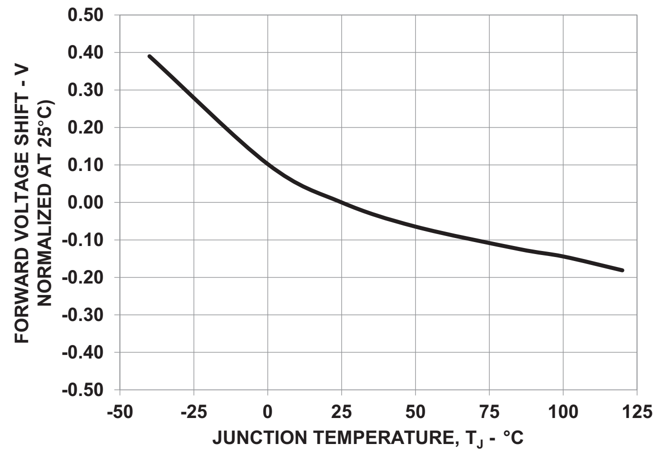


Figure 11: Chromaticity Coordinate Shift vs. Junction Temperature for 4000K

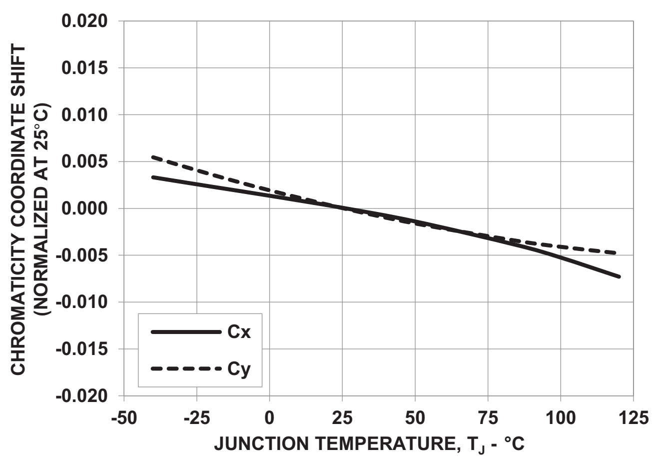


Figure 12: Chromaticity Coordinate Shift vs. Junction Temperature for 6500K

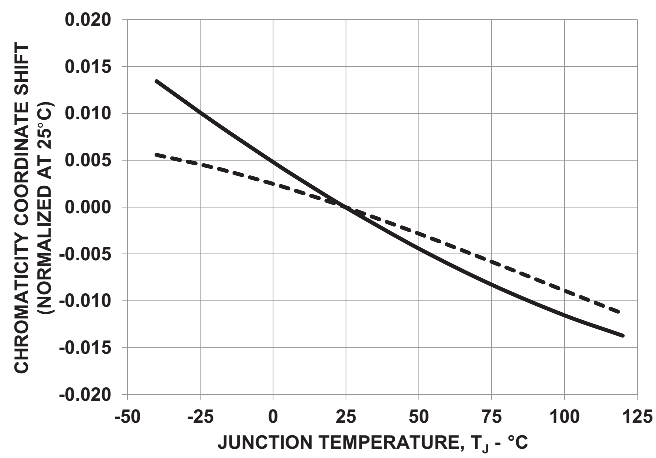


Figure 13: Maximum Forward Current vs. Ambient Temperature

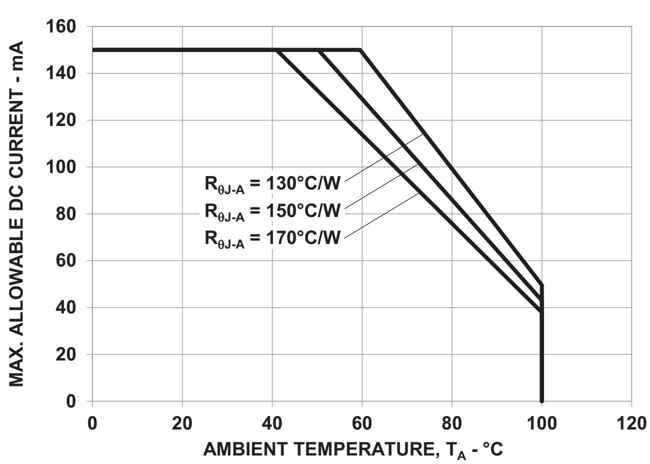


Figure 14: Maximum Forward Current vs. Solder Point Temperature

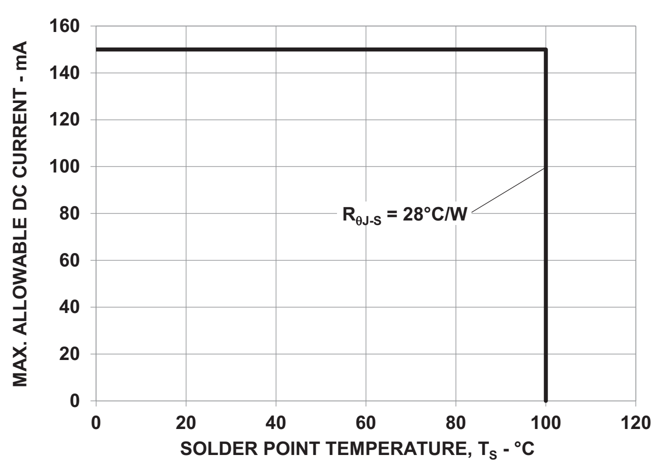
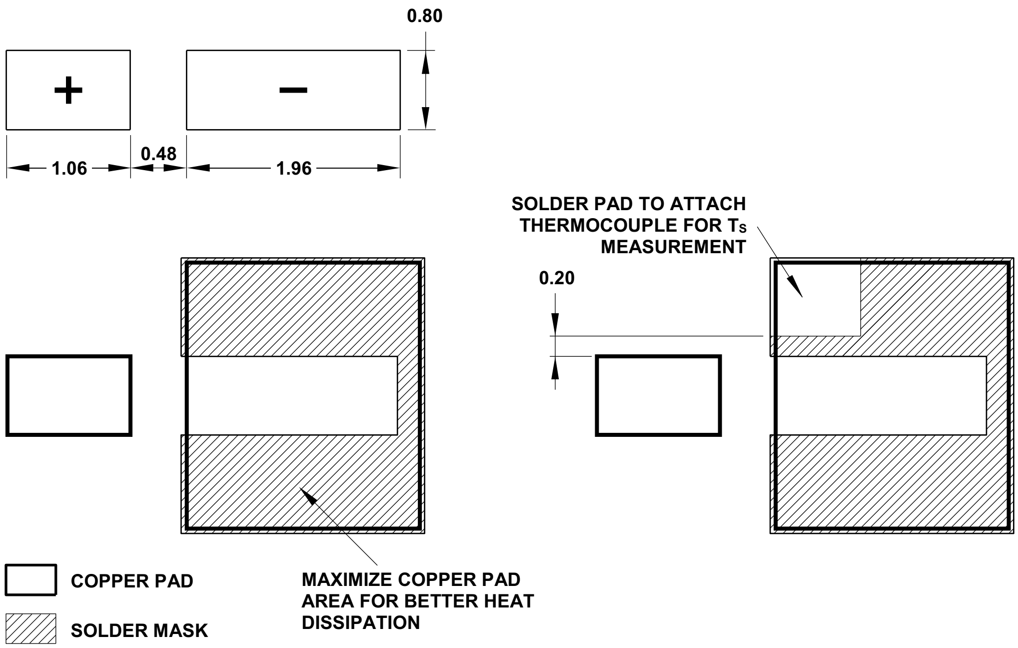
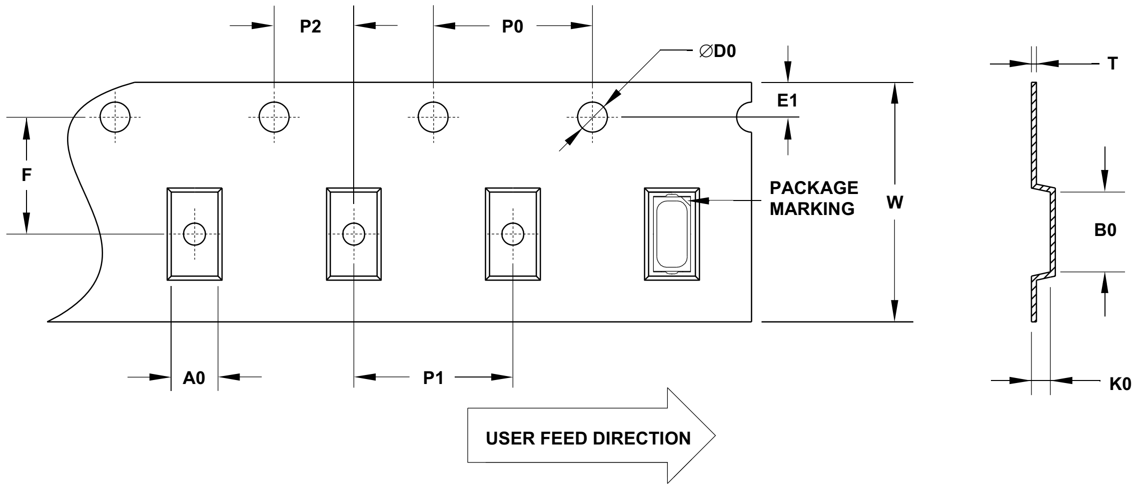


Figure 15: Recommended Soldering Land Pattern



NOTE: All dimensions are in millimeters (mm).

Figure 16: Carrier Tape Dimensions



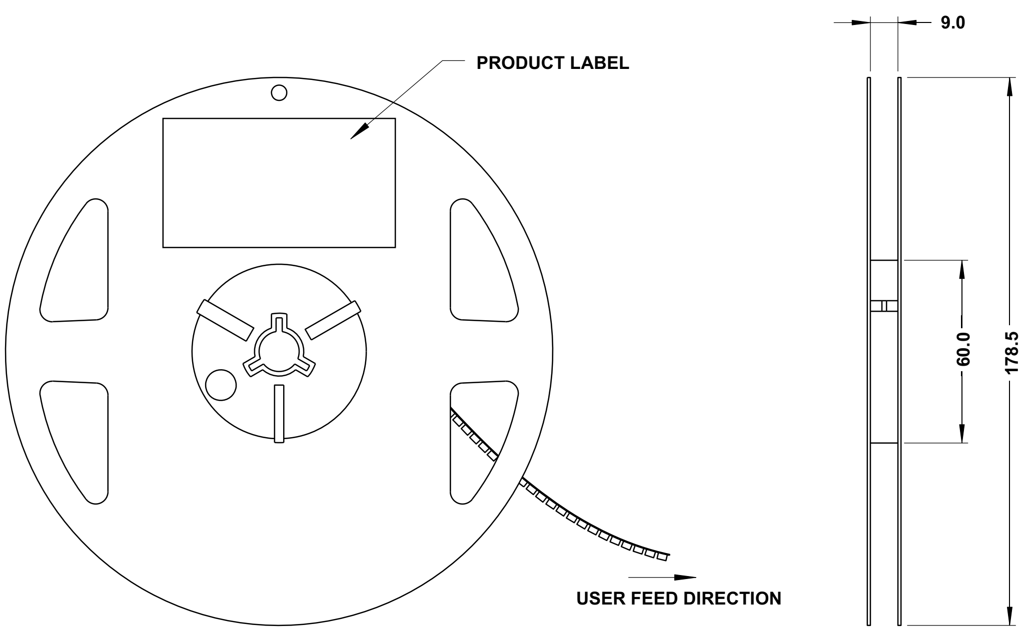
F	P0	P1	P2	D0	E1	W
3.50 ± 0.1	4.00 ± 0.1	4.00 ± 0.1	2.00 ± 0.05	1.60 ± 0.05	1.75 ± 0.1	8.00 ± 0.2

T	B0	K0	A0
0.18 ± 0.05	3.25 ± 0.1	0.95 ± 0.1	1.60 ± 0.1

NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is ±0.20 mm unless otherwise specified.

Figure 17: Reel Dimensions



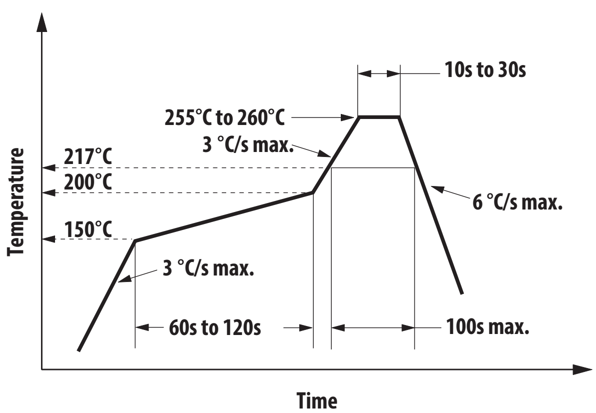
NOTE: All dimensions are in millimeters.

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 the following conditions:
  – Solder iron tip temperature = 315°C max.
  – Solder duration = 3 seconds max.
  – Number of cycles = 1 only
  – Power of soldering iron = 50W max.
- Do not touch the LED package body with the soldering iron except for the soldering terminals, as 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 18: 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 the assembly of silicone encapsulated LED products. Failure to comply may 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 1.5 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:
  – 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, then 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°C/60% RH at all times, and complete all high temperature-related processes, including soldering, curing, or rework, within 168 hours.

- Control for the unfinished reel:

  Store unused LEDs in a sealed MBB with desiccant or 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 apply.

  The recommended baking condition is 60°C ±5°C for 20 hours. Baking should only be done once.
  - 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.
- Storage:

  The soldering terminals of these Broadcom LEDs are silver plated. If the LEDs are exposed in 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 dessicant or in dessicator 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 the 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 (meaning: 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.
- 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 materials 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.
- White LEDs must not be exposed to acidic environments and must not be used in the vicinity of any compound that may 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 a harsh or outdoor environment, protect the LED against damages caused by rain water, water, dust, oil, corrosive gases, external mechanical stress, 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;

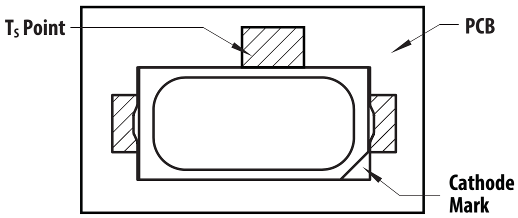
T_S = LED solder point temperature as shown in the following figure (°C)

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

I_F = forward current (A)

V_{Fmax} = maximum forward voltage (V)

Figure 19: Solder Point Temperature on the PCB



T_S can be easily measured by mounting a thermocouple on the soldering joint as shown in the 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.

Disclaimer

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