Data Sheet

ASCKCW01-Nxxxxxxxx02

1608 DFN-2 Surface-Mount LED

Overview

The Broadcom® ASCKCW01 surface-mount LEDs use InGaN chips in a small-form-factor DFN-2 package. The LEDs are designed with high-reliability performance to work under a wide range of environmental conditions. The small-form-factor package enables flexibility in product design. The LEDs are ideal for a wide range of applications.

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

Features

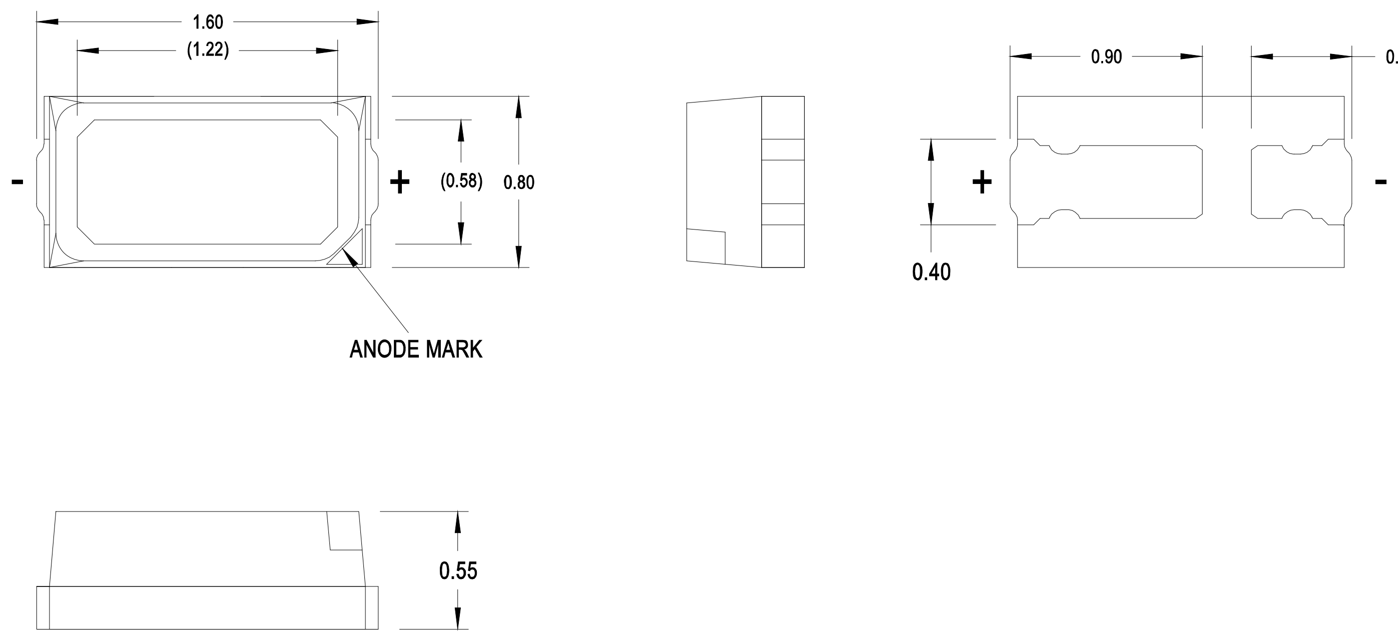
- High-reliability package with enhanced silicone resin encapsulation
- Enhanced corrosion resistance
- Available in white color
- Wide 120° viewing angle
- Low package profile and large emitting area for better uniformity in linear lighting

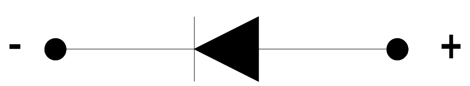
Applications

- Status indicators
- Indoor information signs and displays
- Wearables and portable devices
- Office automation, home appliances, industrial equipment
  - Front-panel backlighting
  - Push-button backlighting
  - Display backlighting
  - Keypad backlighting
  - Symbol backlighting
  - Scanner lighting

CAUTION! This LED is ESD sensitive. Please observe appropriate precautions during handling and processing. Refer to Application Note 1142 for additional details.

Figure 1: Package Drawing





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 = 20 mA)

Part Number	Luminous Intensity, I_V (mcd)[a, b]		Luminous Flux, ϕ_V (lm)[c]
	Min.	Max.	Typ.
ASCKCW01-NW3X3F1H302	1125	2100	5.2
ASCKCW01-NW4X4J1M302	1320	2450	6.2
ASCKCW01-NW5X5N1Q302	1540	2850	7.1

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 might not be aligned with the axis.

b. The luminous intensity tolerance is ±12%.

c. For reference only.

Absolute Maximum Ratings

Parameters	ASCKCW01	Unit
DC Forward Current[a]	30	mA
Peak Forward Current[b]	100	mA
Power Dissipation	108	mW
Reverse Voltage	Not designed 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 11 and Figure 12.

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

Optical and Electrical Characteristics (T_J = 25°C, I_F = 20 mA)

Parameters	Min.	Typ.	Max.	Unit
Viewing Angle, $2\theta_{1/2}$[a]	—	120	—	°
Forward Voltage, V_F[b]	2.6	3.0	3.6	V
Reverse Current, I_R, at V_R = 5V[c]	—	—	10	µA
Thermal Resistance, $R_{\theta J\text{-}S}$[d]	—	80	—	°C/W

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

b. The forward voltage tolerance is ±0.1V.

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

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

Part Numbering System

A	S	C	K	C	W	0	1	-	N	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	0	2

Code	Description	Option	
x_1 x_2	Minimum Intensity Bin	See the Intensity Bin Limits (CAT) table.	
x_3 x_4	Maximum Intensity Bin		
x_5 x_6 x_7 x_8	Color Bins	F1H3	Bin F1, F2, F3, G1, G2, G3, H1, H2, H3
		J1M3	Bin J1, J2, J3, K1, K2, K3, L1, L2, L3, M1, M2, M3
		N1Q3	Bin N1, N2, N3, P1, P2, P3, Q1, Q2, Q3

Part Number Example

ASCKCW01-NW3X3F1H302

x_1 x_2 : W3 – Minimum intensity bin W3
x_3 x_4 : X3 – Maximum intensity bin X3
x_5 x_6 x_7 x_8 : F1H3 – Color bins F1, F2, F3, G1, G2, G3, H1, H2, H3

Bin Information

Intensity Bin Limits (CAT)

Bin ID	Luminous Intensity, I_V (mcd)	
	Min.	Max.
W3	1125	1320
W4	1320	1540
W5	1540	1800
X3	1800	2100
X4	2100	2450
X5	2450	2850

Tolerance = ±12%

Forward Voltage Bin Limits (V_F)

Bin ID	Forward Voltage, V_F (V)	
	Min.	Max.
F04	2.6	2.8
F05	2.8	3.0
F06	3.0	3.2
F07	3.2	3.4
F08	3.4	3.6

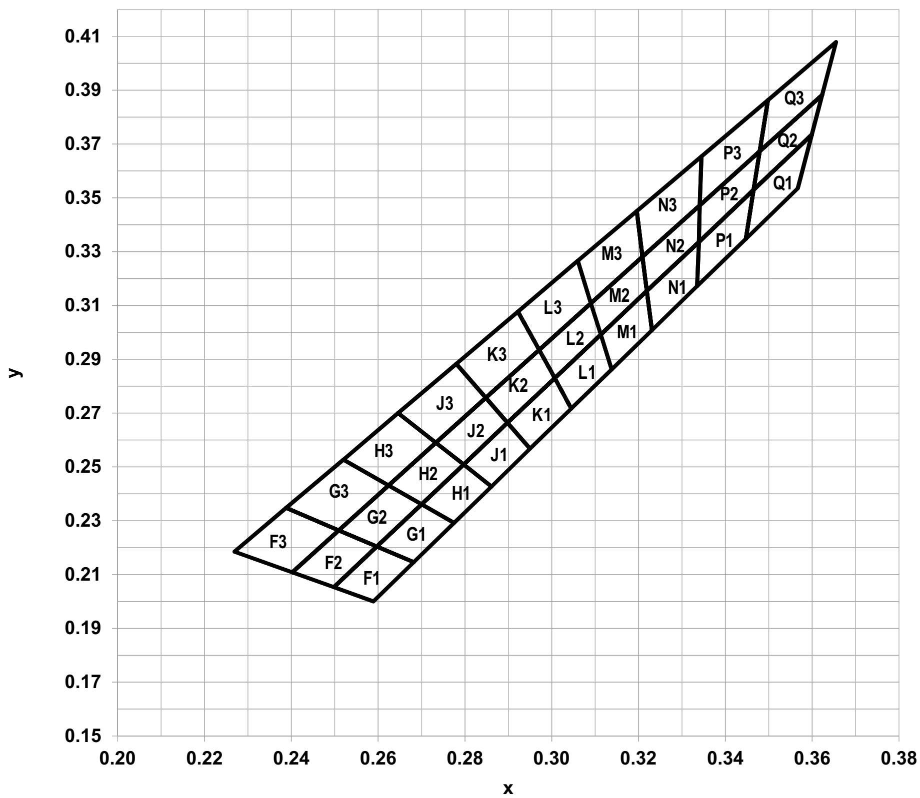
Tolerance = ±0.1V

Color Bin Limits (BIN)

Bin ID	Chromaticity Coordinates		Bin ID	Chromaticity Coordinates		Bin ID	Chromaticity Coordinates		Bin ID	Chromaticity Coordinates		Bin ID	Chromaticity Coordinates	
	x	y		x	y		x	y		x	y		x	y
F1	0.2498	0.2053	H1	0.2700	0.2361	K1	0.2898	0.2664	M1	0.3113	0.2992	P1	0.3339	0.3336
	0.2597	0.2204		0.2797	0.2509		0.3007	0.2830		0.3219	0.3154		0.3465	0.3530
	0.2682	0.2146		0.2861	0.2427		0.3045	0.2717		0.3231	0.3008		0.3447	0.3347
	0.2589	0.2000		0.2775	0.2292		0.2950	0.2568		0.3138	0.2862		0.3335	0.3172
F2	0.2402	0.2108	H2	0.2624	0.2431	K2	0.2848	0.2757	M2	0.3090	0.3108	P2	0.3341	0.3472
	0.2509	0.2264		0.2733	0.2590		0.2971	0.2935		0.3209	0.3281		0.3479	0.3673
	0.2597	0.2204		0.2797	0.2509		0.3007	0.2830		0.3219	0.3154		0.3465	0.3530
	0.2498	0.2053		0.2700	0.2361		0.2898	0.2664		0.3113	0.2992		0.3339	0.3336
F3	0.2269	0.2185	H3	0.2520	0.2527	K3	0.2780	0.2883	M3	0.3060	0.3266	P3	0.3345	0.3654
	0.2388	0.2348		0.2646	0.2700		0.2922	0.3077		0.3196	0.3451		0.3498	0.3863
	0.2509	0.2264		0.2733	0.2590		0.2971	0.2935		0.3209	0.3281		0.3479	0.3673
	0.2402	0.2108		0.2624	0.2431		0.2848	0.2757		0.3090	0.3108		0.3341	0.3472
G1	0.2597	0.2204	J1	0.2797	0.2509	L1	0.3007	0.2830	N1	0.3219	0.3154	Q1	0.3465	0.3530
	0.2700	0.2361		0.2898	0.2664		0.3113	0.2992		0.3339	0.3336		0.3599	0.3735
	0.2775	0.2292		0.2950	0.2568		0.3138	0.2862		0.3335	0.3172		0.3567	0.3535
	0.2682	0.2146		0.2861	0.2427		0.3045	0.2717		0.3231	0.3008		0.3447	0.3347
G2	0.2509	0.2264	J2	0.2733	0.2590	L2	0.2971	0.2935	N2	0.3209	0.3281	Q2	0.3479	0.3673
	0.2624	0.2431		0.2848	0.2757		0.3090	0.3108		0.3341	0.3472		0.3623	0.3882
	0.2700	0.2361		0.2898	0.2664		0.3113	0.2992		0.3339	0.3336		0.3599	0.3735
	0.2597	0.2204		0.2797	0.2509		0.3007	0.2830		0.3219	0.3154		0.3465	0.3530
G3	0.2388	0.2348	J3	0.2646	0.2700	L3	0.2922	0.3077	N3	0.3196	0.3451	Q3	0.3498	0.3863
	0.2520	0.2527		0.2780	0.2883		0.3060	0.3266		0.3345	0.3654		0.3655	0.4079
	0.2624	0.2431		0.2848	0.2757		0.3090	0.3108		0.3341	0.3472		0.3623	0.3882
	0.2509	0.2264		0.2733	0.2590		0.2971	0.2935		0.3209	0.3281		0.3479	0.3673

Tolerance = ±0.01

Figure 2: Chromaticity Diagram



Example of bin information on a reel and packaging label:

CAT: W4	–	Intensity bin W4
BIN: L2	–	Color bin L2
VF: F06	–	VF bin F06

Figure 3: Spectral Power Distribution

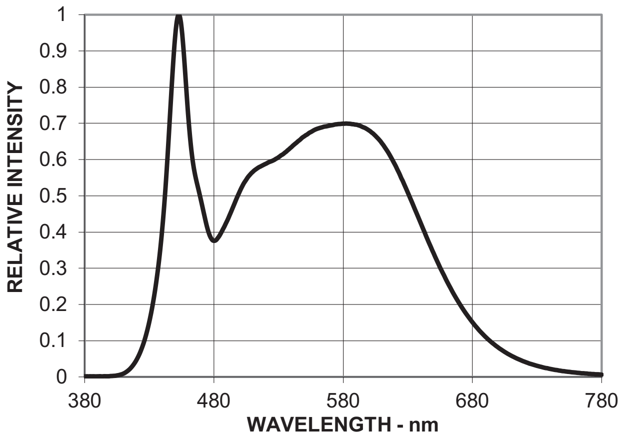


Figure 4: Forward Current vs. Forward Voltage

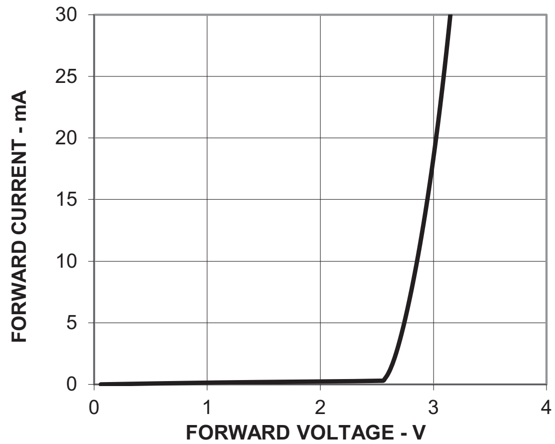


Figure 5: Relative Luminous Intensity vs. Mono Pulse Current

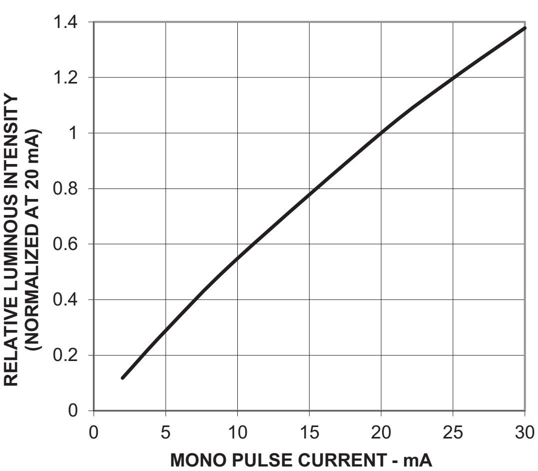


Figure 6: Chromaticity Coordinate Shift vs. Mono Pulse Current

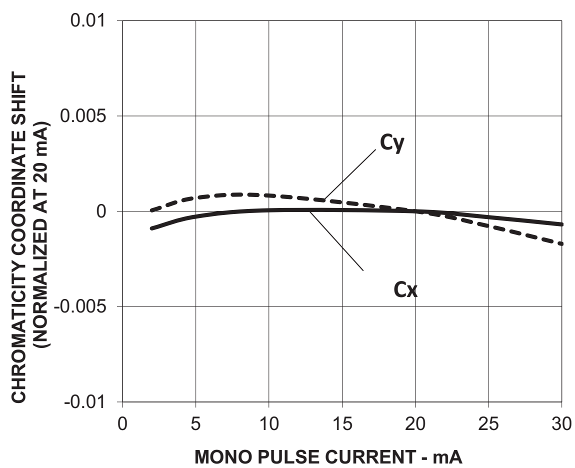


Figure 7: Forward Voltage Shift vs. Junction Temperature

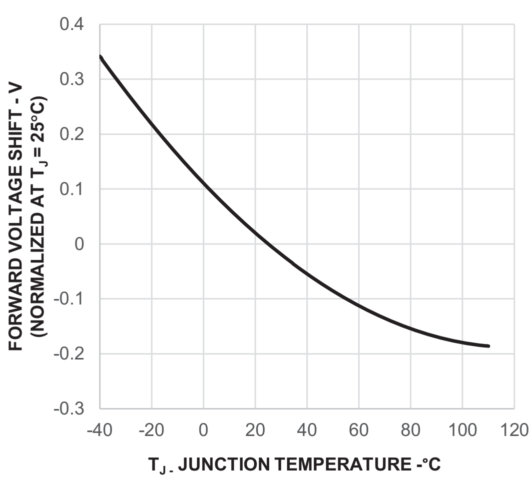


Figure 8: Relative Luminous Intensity vs. Junction Temperature

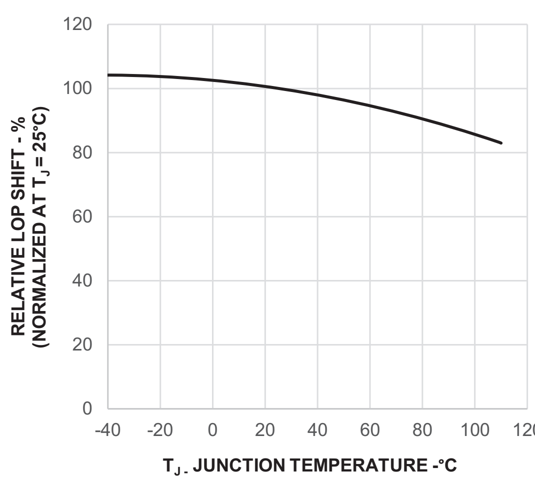


Figure 9: Chromaticity Coordinate Shift vs. Junction Temperature

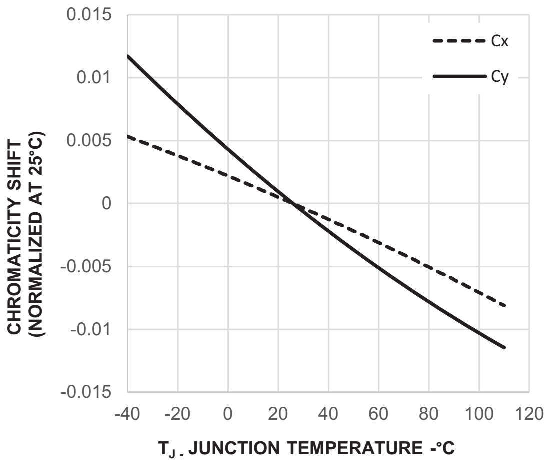


Figure 10: Radiation Pattern

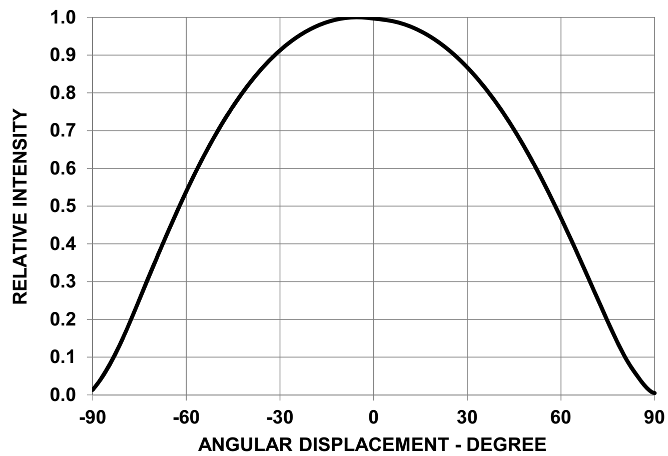


Figure 11: Maximum Forward Current vs. Ambient Temperature. Derated Based on T_{JMAX} = 110°C

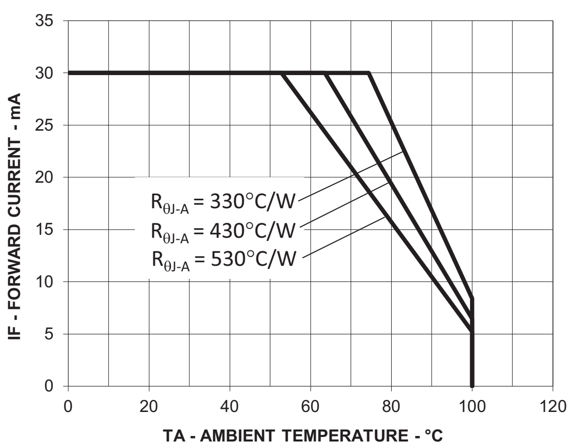


Figure 12: Maximum Forward Current vs. Solder Point Temperature. Derated Based on T_{JMAX} = 110°C, $R_{θJ-S}$ = 80°C/W

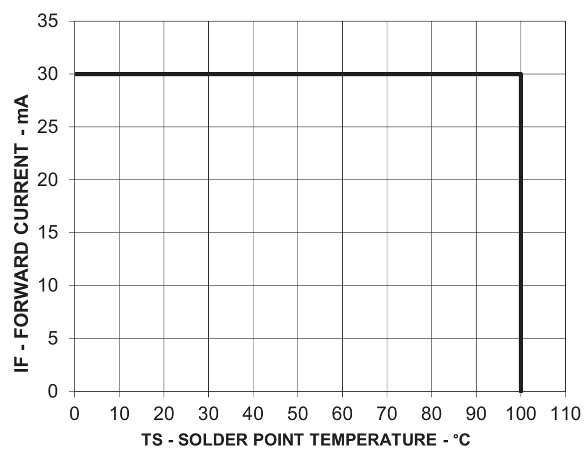
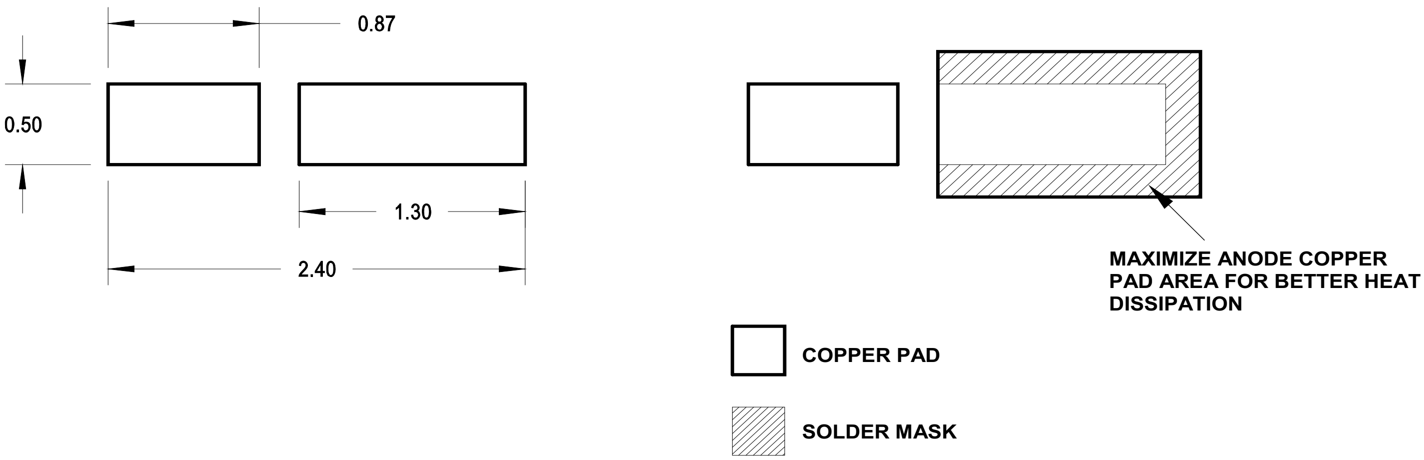
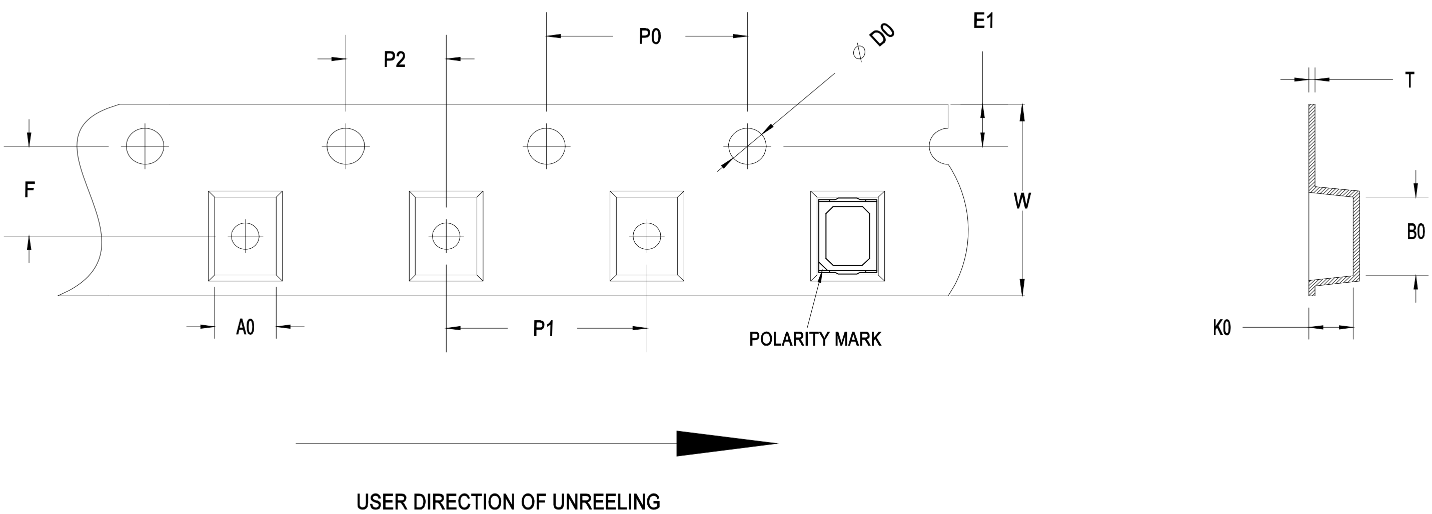


Figure 13: Recommended Soldering Land Pattern



NOTE: All dimensions are in millimeters (mm).

Figure 14: Carrier Tape Dimensions

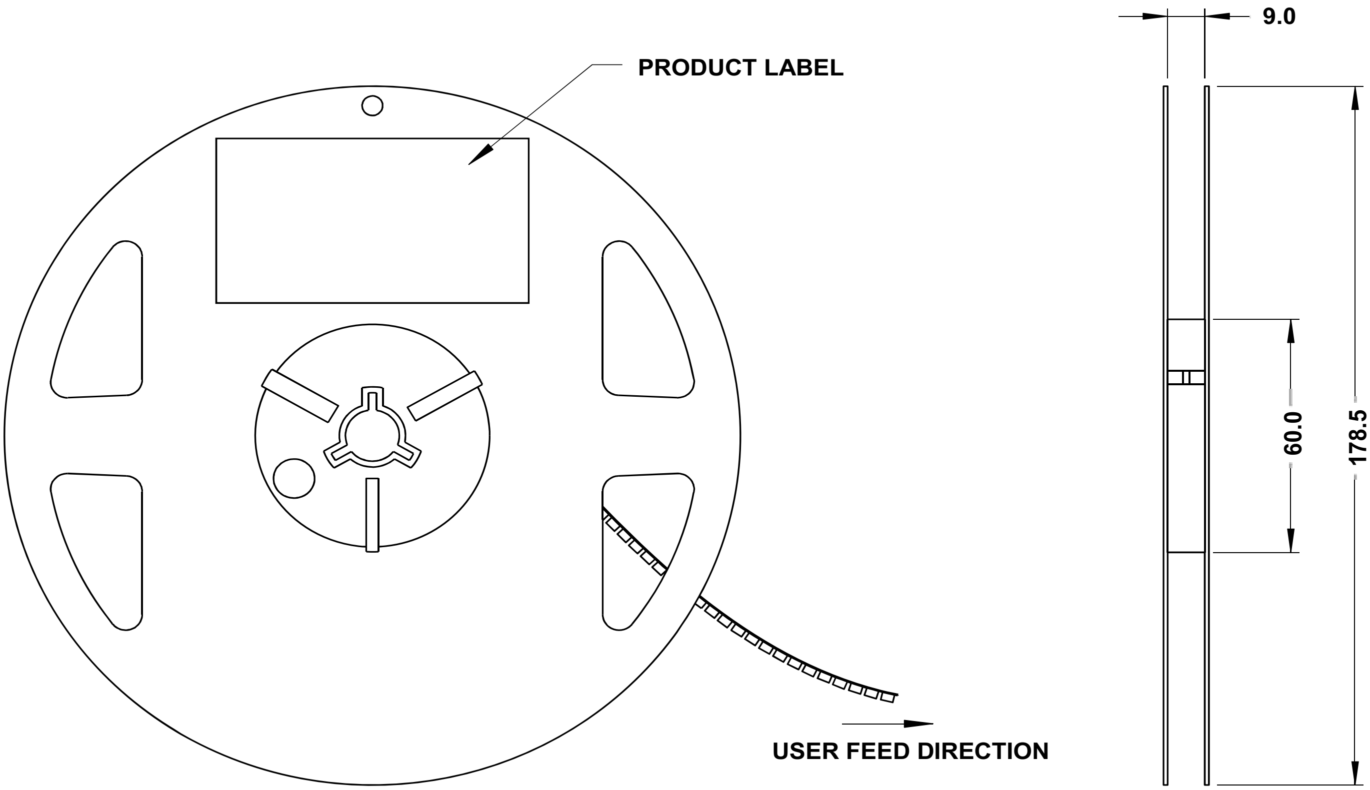


F	P0	P1	P2	D0	E1	W
3.50 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	2.00 ± 0.10	1.55 + 0.05	1.75 ± 0.10	8.00 ± 0.30
T	**B0**	**K0**	**A0**			
0.20 ± 0.05	1.75 ± 0.10	0.68 ± 0.10	0.90 ± 0.10			

NOTE:

1. All dimensions are in millimeters (mm).
2. Quantity per reel: 4000 pieces.

Figure 15: Reel Dimensions



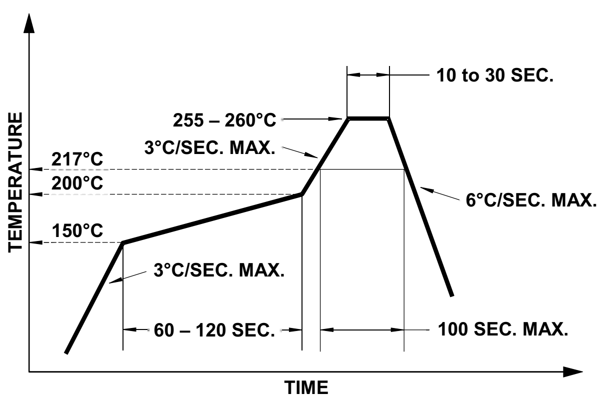
NOTE: All dimensions are in millimeters (mm).

Precautionary Notes

Soldering

- Do not perform reflow soldering more than twice.
- Observe necessary precautions for 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 are affected by soldering with hand soldering.

Figure 16: 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. For additional information, refer to Broadcom Application Note 5288, *Silicone Encapsulation for LED: Advantages and Handling Precautions*.

- 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 by the body only.
- 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 the 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.

Handling Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 3 rating per JEDEC J-STD-020. For additional details and a review of proper handling procedures, refer to Broadcom Application Note 5305, *Handling Moisture-Sensitive Surface-Mount LEDs*.

- 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 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 reels:

  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 a desiccator at <5% RH to ensure that all LEDs have not exceeded their floor life of 168 hours.
- Baking is required if any of these conditions exist:
  - The HIC 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 60ºC ± 5ºC for 20 hours.

  Baking can be done only 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 oxidize, 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 this 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 that 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 in 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 with 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 of the LED.
- 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 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 outdoor environment, protect the LED against damages caused by rainwater, water, dust, oil, corrosive gases, external mechanical stresses, and so on.
- This LED is designed to have enhanced gas corrosion resistance. Its performance has been tested according to the following conditions:
  - IEC 60068-2-43: 25°C/75% RH, H_2S 10 ppm, 500 hours.

  Because actual application conditions might not be exactly similar to the test conditions, users are advised to verify that the LED will not be damaged by prolonged exposure in the intended environment.

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:

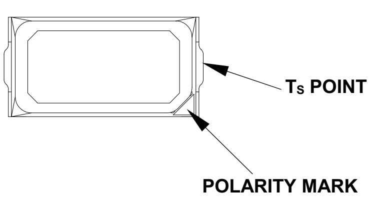
T_S = LED solder point temperature as shown in the following figure (°C)

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

I_F = Forward current (A)

V_{Fmax} = Maximum forward voltage (V)

Figure 17: Solder Point Temperature on PCB



T_S can be easily measured by mounting a thermocouple on the soldering joint as shown in preceding figure, whereas $R_{\theta J\text{-}S}$ is provided in this 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 this 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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