BROADCOM®

Data Sheet

HSMx-A46x-xxxxx

SMT LED Surface Mount LED Indicator

Description

The Broadcom® Power PLCC-4 SMT LEDs with lens are high-performance PLCC-4 package-size SMT LEDs targeted mainly in automotive and electronics signs and signals (ESS) markets. These top-mount single-chip packages with focused radiation offer high brightness in beam direction and are excellent for interior automotive, indoor and outdoor sign, and industrial applications. With additional lens in 50° variants, these products are especially fitting to applications for mono-color text display, CHMSL, and displays.

The PLCC-4 package family can dissipate heat better compared to the PLCC-2 packages. In proportion to this increase in driving current, this family of LEDs is able to produce higher light output compared to the conventional PLCC-2 SMT LEDs.

As an extension of the standard flat-top PLCC-4 SMT LEDs, the Power PLCC-4 with lens device can provide focused beams within narrow viewing angles (50°), meeting the market's requirements for focused radiation and high brightness in beam directions.

The Power PLCC-4 SMT LED with 50° is ideal for panel, push button, general backlighting, automotive interior and exterior (cluster backlighting, side repeaters, brake lights), sign and symbol illumination, office equipment, industrial equipment, and home appliances applications. This package design, coupled with careful selection of component materials, allows the Power PLCC-4 SMT LED with lens to perform with higher reliability in a larger temperature range of –40°C to 100°C. This high-reliability feature is crucial to allow the Power PLCC-4 SMT LED with lens to do well in harsh environments, such as its target automotive and ESS markets.

Features

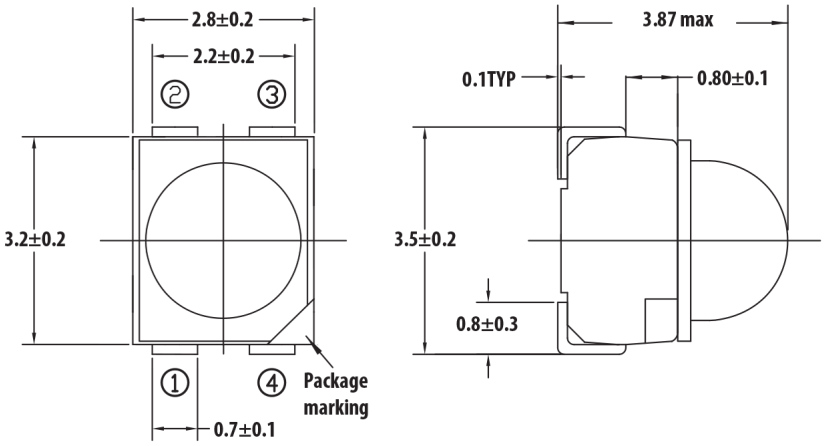
- Industry standard PLCC-4
- High-reliability LED package
- High brightness using AlInGaP dice technologies
- High optical efficiency
- Narrow viewing angle at 50°
- Available in 12-mm carrier tape on a 13-in. reel

Applications

- Interior automotive
  - Instrument panel backlighting
  - Central console backlighting
  - Cabin backlighting
  - Navigation and audio system
  - Dome lighting
  - Push button backlighting
- Exterior automotive
  - Turn signals
  - CHMSL
  - Rear combination lamp
  - Side repeaters
- Office automation, home appliances, industrial equipment
  - Front panel backlighting
  - Push button backlighting
  - Display backlighting

Package Drawing

Figure 1: Package Drawing



Pin	HSMx-A46x Lead Configuration
1	Cathode
2	Anode
3	Cathode
4	Cathode

NOTE:

1. All dimensions are in millimeters.
2. Terminal finish = silver plating.
3. Electrical connection between all cathodes is recommended.

Device Selection Guide

Color	Part Number	Luminous Intensity, I_V[a, b] (mcd)			Test Current (mA)	Dice Technology
		Min. I_V (mcd)	Typ. I_V (mcd)	Max. I_V (mcd)		
Amber	HSMA-A460-W50M1	1125	2100	3550	50	AlInGaP
Amber	HSMA-A461-X83M1	2240	3300	5600	50	AlInGaP
Amber	HSMA-A461-Y30M1	2850	—	5600	50	AlInGaP
Red	HSMC-A461-V00M1	715	1750	—	50	AlInGaP
Orange	HSML-A461-W40M1	1125	1850	2850	50	AlInGaP
Red Orange	HSMJ-A461-W40M1	1125	1850	2850	50	AlInGaP

a. Tolerance = ± 12%.

b. The luminous intensity, I_V, is measured at the mechanical axis of the lamp package. The actual peak of the spatial radiation pattern may not be aligned with this axis.

Part Numbering System

H S M [x_1] – A [x_2 x_3 x_4] – [x_5 x_6 x_7 x_8 x_9]

Code	Description	Option	
x_1	LED chip color	A	Amber
		C	Red
		J	Red Orange
		L	Orange
x_2	Package type	4	PLCC-4
x_3, x_4	Device-specific configuration	—	
x_5	Minimum intensity bin selection	See Intensity Bin Select (x_5 x_6).	
x_6	Number of intensity bins		
x_7	Color bin selection	See Color Bin Select (x_7).	
x_8, x_9	Packaging option	M1	50 mA test current, top mount, 13-inch reel

Intensity Bin Select (x_5 x_6)

Individual reel will contain parts from one half bin only

x_5	Min IV Bin
x_6	
0	Full Distribution
2	2 half bins starting from $X_5$1
3	3 half bins starting from $X_5$1
4	4 half bins starting from $X_5$1
5	5 half bins starting from $X_5$1
6	2 half bins starting from $X_5$2
7	3 half bins starting from $X_5$2
8	4 half bins starting from $X_5$2
9	5 half bins starting from $X_5$2

Intensity Bin Limits

Bin ID	Min. (mcd)	Max. (mcd)
U1	450.00	560.00
U2	560.00	715.00
V1	715.00	900.00
V2	900.00	1125.00
W1	1125.00	1400.00
W2	1400.00	1800.00
X1	1800.00	2240.00
X2	2240.00	2850.00
Y1	2850.00	3550.00
Y2	3550.00	4500.00
Z1	4500.00	5600.00
Z2	5600.00	7150.00
11	7150.00	9000.00
12	9000.00	11250.00
21	11250.00	14000.00
22	14000.00	18000.00

Tolerance of each bin limit = ± 12%.

Color Bin Select (x_7)

Individual reel will contain parts from one full bin only.

x_7	
0	Full Distribution
Z	A and B only
Y	B and C only
W	C and D only
V	D and E only
U	E and F only
Q	A, B, and C only
P	B, C, and D only
N	C, D, and E only
M	D, E, and F only
1	A, B, C, and D only
3	B, C, D, and E only
4	C, D, E, and F only
5	A, B, C, D and E only
6	B, C, D, E, and F only

Color Bin Limits

Amber	Min. (nm)	Max. (nm)
A	582.0	584.5
B	584.5	587.0
C	587.0	589.5
D	589.5	592.0
E	592.0	594.5
F	594.5	597.0

Orange	Min. (nm)	Max. (nm)
A	597.0	600.0
B	600.0	603.0
C	603.0	606.0
D	606.0	609.0
E	609.0	612.0

Red Orange	Min. (nm)	Max. (nm)
A	611.0	616.0
B	616.0	620.0

Red	Min. (nm)	Max. (nm)
Full Distribution	620.0	635.0

Tolerance of each bin limit = ± 1 nm.

Packaging Option (x_8 x_9)

Option	Test Current	Package Type	Reel Size
M1	50 mA	Top Mount	13

V_F Bin Limits

For HSMA/C/J/L-A46x-xxxxx only

Bin ID	Min.	Max.
VA	1.9	2.2
VB	2.2	2.5

Tolerance of each bin limit = ± 0.1V.

Absolute Maximum Ratings (T_J = 25°C)

Parameters	HSMA/C/L/J
DC Forward Current[a]	70 mA
Peak Forward Current[b]	200 mA
Power Dissipation	180 mW
Reverse Voltage	5V
Junction Temperature	110°C
Operating Temperature	–40°C to +100°C
Storage Temperature	–40°C to +100°C

a. Derate Linearly as shown in Figure 6 and Figure 7.

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

Optical Characteristics (T_J = 25°C)

Color	Part Number	Dice Technology	Peak Wavelength λ_{PEAK} (nm)	Dominant Wavelength λ_D[a] (nm)	Viewing Angle $2\theta_{½}$[b] (Degrees)	Luminous Efficacy η_V[c] (lm/W)	Luminous Efficiency η_e (lm/W)	Total Flux/ Luminous Intensity[d] Φ_V (lm)/IV (cd)
			Typ.	Typ.	Typ.	Typ.	Typ.	Typ.
Amber	HSMA-A46x	AlInGaP	592	590	50	480	22	0.70
Red	HSMC-A46x	AlInGaP	635	626	50	150	19	0.90
Orange	HSML-A46x	AlInGaP	609	605	50	320	23	0.95
Red Orange	HSMJ-A46x	AlInGaP	621	615	50	240	15	0.95

a. The dominant wavelength, λ_D, is derived from the CIE Chromaticity diagram and represents the color of the device.

b. $\theta_{½}$ is the off-axis angle where the luminous intensity is ½ the peak intensity.

c. Radiant intensity, I_e in watts/steradian, may be calculated from the equation $I_e = I_V / \eta_v$, where I_V is the luminous intensity in candelas and η_v is the luminous efficacy in lumens/watt.

d. Φ_V is the total luminous flux output as measured with an integrating sphere at mono pulse conditions.

Electrical Characteristics (T_J = 25°C)

Part Number	Forward Voltage V_F (Volts) at I_F = 50 mA			Reverse Voltage V_R at 100 µA	Thermal Resistance $R\theta_{J-P}$ (°C/W)
	Min.	Typ.	Max.	Min.	
HSMA/C/L/J	1.9	2.2	2.5	5	110

Figure 2: Relative Intensity vs. Wavelength

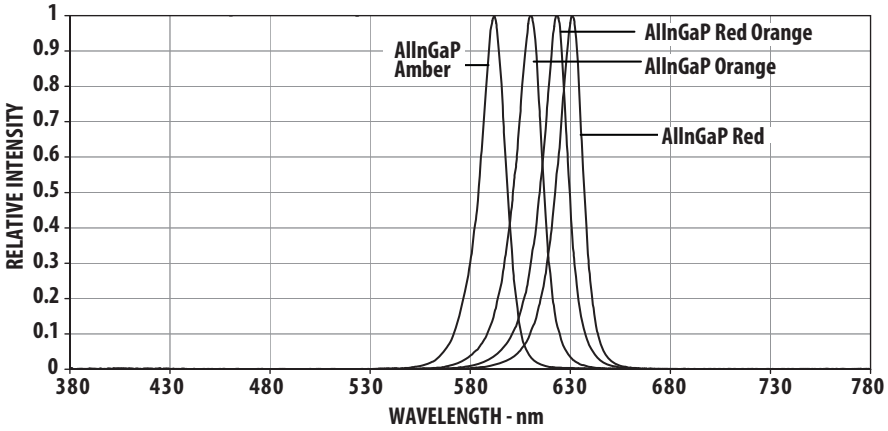


Figure 3: Forward Current vs. Forward Voltage

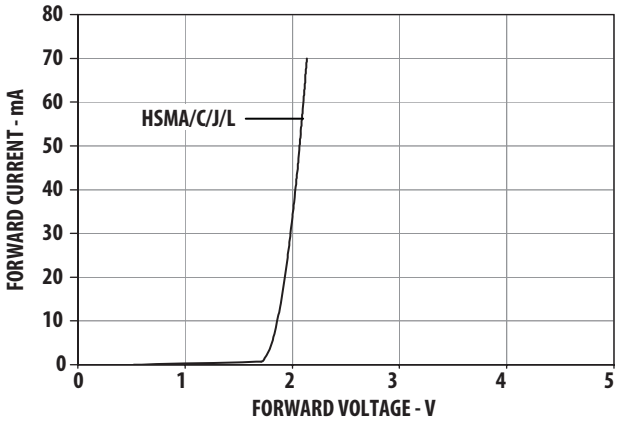


Figure 4: Relative Intensity vs. Forward Current

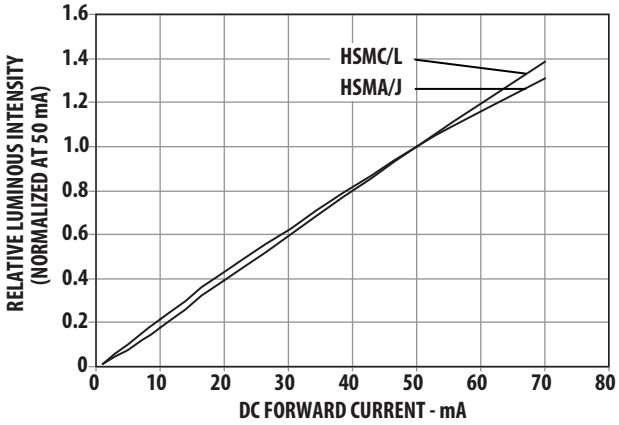


Figure 5: Relative Intensity vs. Temperature

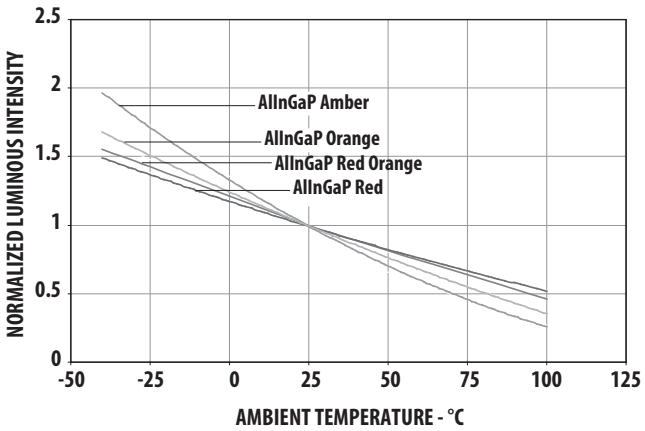


Figure 6: Maximum Forward Current vs. Ambient Temperature. Derated Based on T_{JMAX} = 110°C, $R_{\theta J\text{-}A}$ = 300°C/W, 350°C/W, and 470°C/W (AlInGaP)

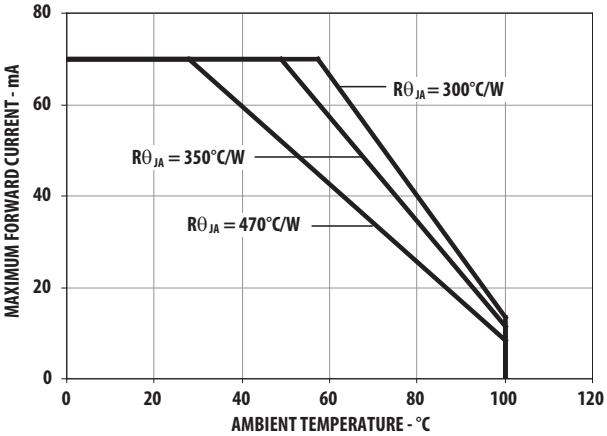


Figure 7: Maximum Forward Current vs. Solder Point Temperature. Derated Based on T_{JMAX} = 110°C, $R_{\theta J-A}$ = 110°C/W

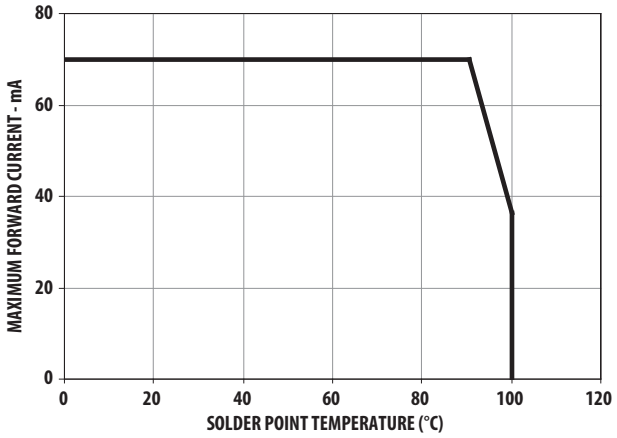


Figure 8: Dominant Wavelength vs. Forward Current

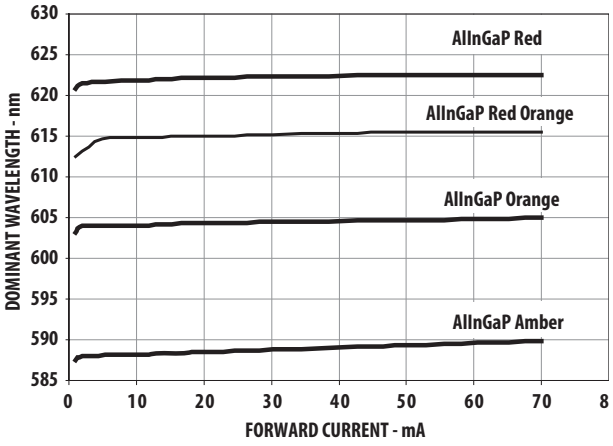


Figure 9: Forward Voltage Shift vs. Temperature

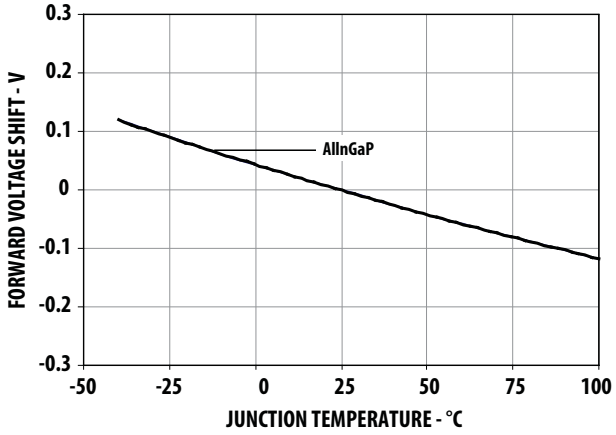


Figure 10: Radiation Pattern

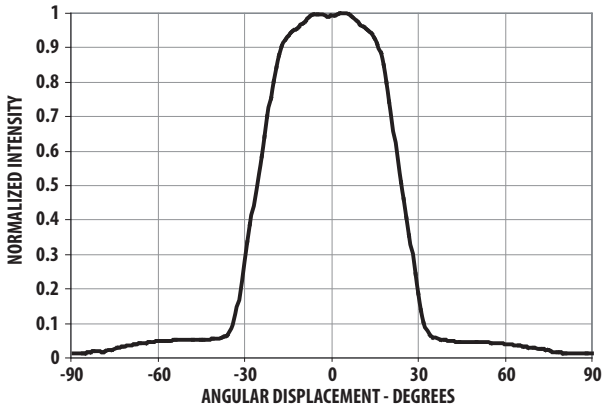
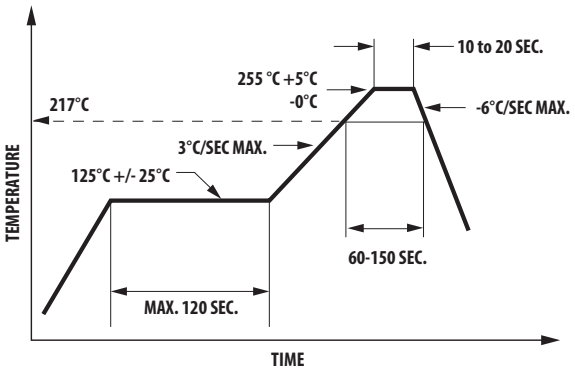
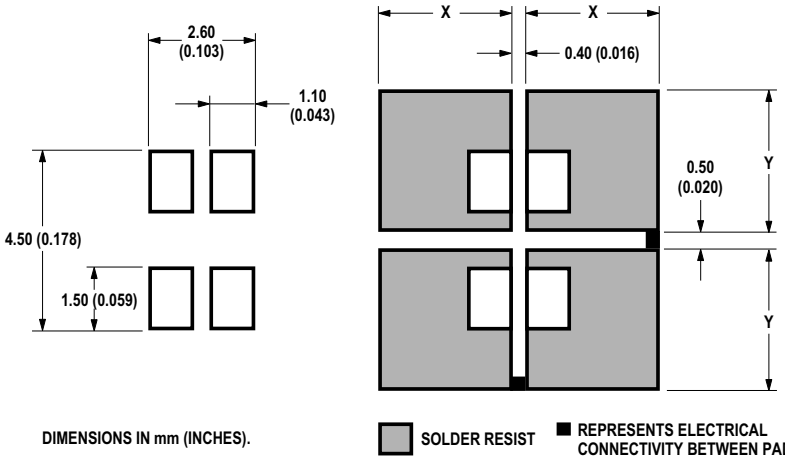


Figure 11: Recommended Pb-free Reflow Soldering Profile



For detailed information on reflow soldering of Broadcom surface mount LEDs, refer to Broadcom Application Note AN 1060, *Surface Mounting SMT LED Indicator Components*.

Figure 12: Recommended Soldering Pad Pattern



Thermal Resistance	Solder pad area (xy)
300°C/W	>16mm^2
350°C/W	>12mm^2
470°C/W	>8mm^2

Figure 13: Soft Tip Vacuum Pick-up Tool for extracting SMT LED Components from Carrier Tape

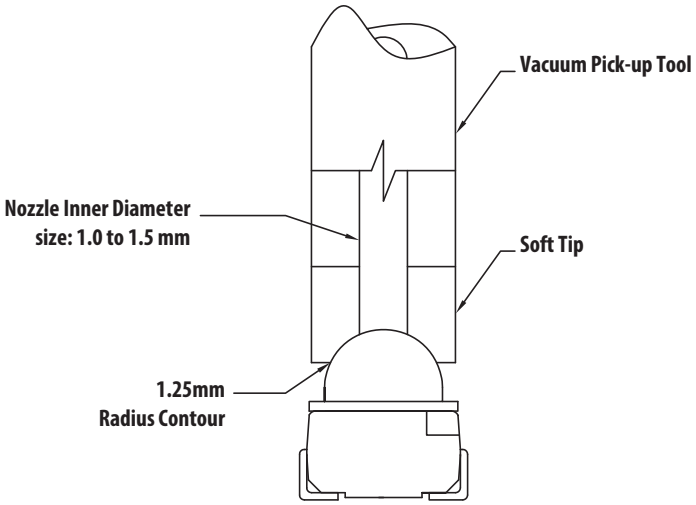


Figure 14: Tape Leader and Trailer Dimensions

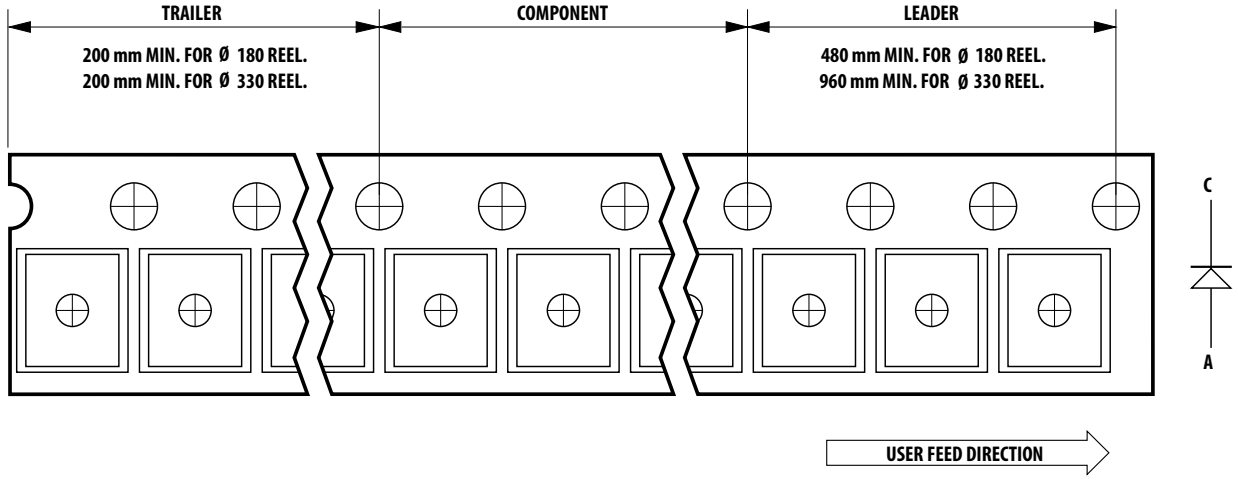


Figure 15: Tape Dimensions

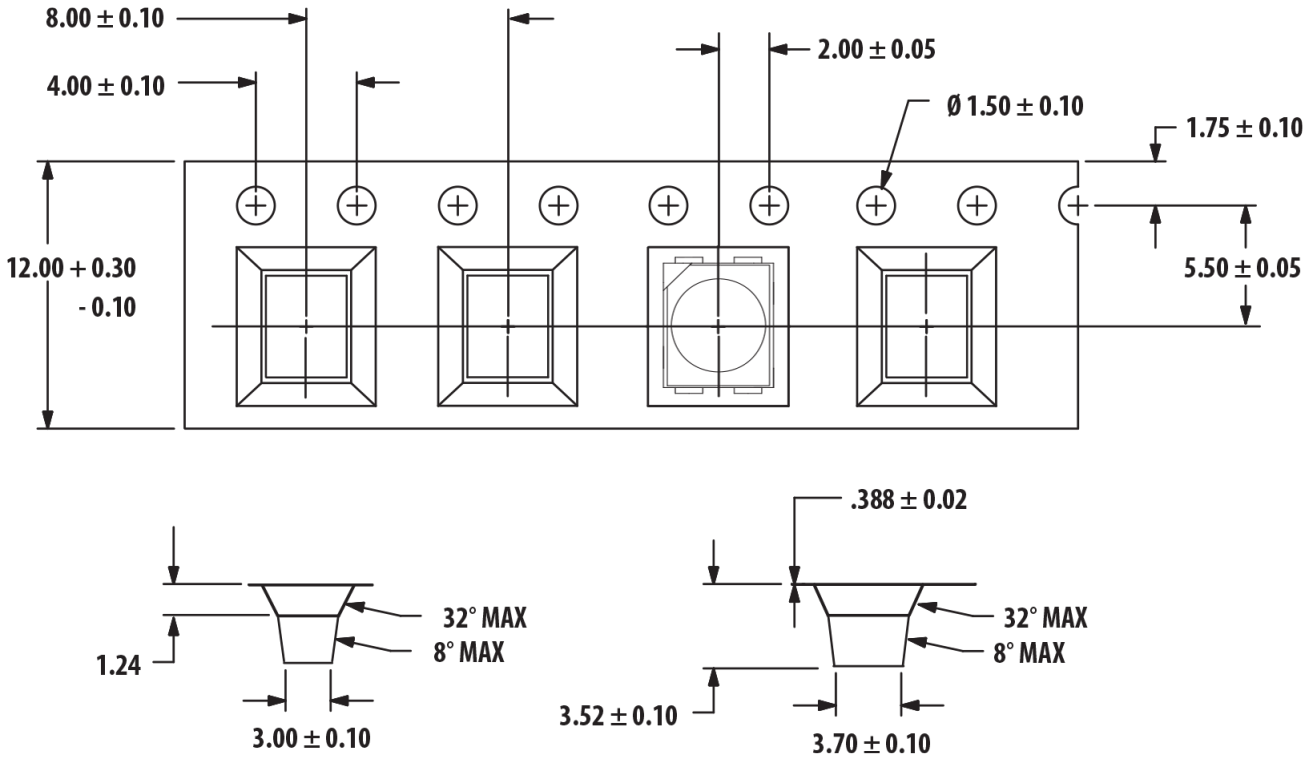
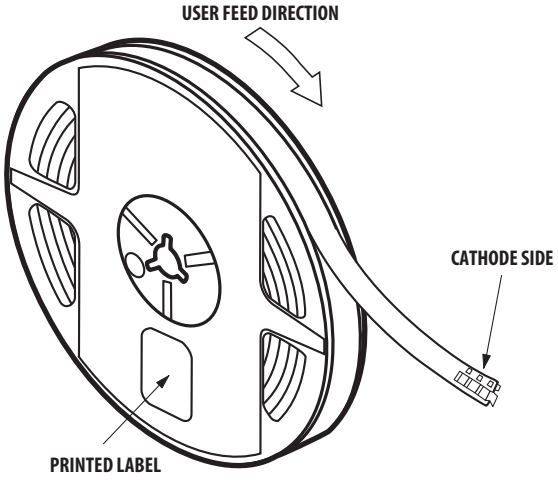


Figure 16: Reeling Orientation



Moisture Sensitivity

This product is qualified as Moisture Sensitive Level 2a per JEDEC J-STD-020. Precautions when handling this mois- ture sensitive product is important to ensure the reliability of the product. Refer to Broadcom Application Note AN5305, *Handling of Moisture Sensitive Surface Mount Devices*, for details.

Storage 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).

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 all high temperature-related processes, including soldering, curing, or rework, must be completed within 672 hours.

Control for unfinished reel:

Any unused LEDs must be stored 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, the PCB must be stored in a sealed MBB with desiccant or desiccator at <5% RH to ensure no LEDs have exceeded their floor life of 672 hours.

Baking is required if the following conditions exist:

- The 10% HIC indicator is not blue and the 5% HIC indicator turns pink.
- The LEDs are exposed to conditions of >30°C / 60% RH at any time.
- The LEDs' floor life exceeded 672 hours.

Recommended baking condition: 60°C ± 5°C for 20 hours.

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HSMC-A400-S30M1 HSMC-A401-T40M1 HSMC-A401-T60M1 HSMC-A401-T80M1 HSMC-A430-W50M1 HSMA-A460-W50M1 HSMA-A461-X83M1 HSMC-A460-U30M1 HSMC-A461-V00M1 HSME-A460-R01M1 HSME-A460-T52M1 HSMJ-A461-W40M1 HSML-A461-W40M1