BROADCOM®

Data Sheet

HSMx-C120, HSMx-C177, HSMx-C197, and HSMx-C265

High-Performance ChipLED

Description

These Broadcom® chipLEDs utilize Aluminium Indium Galium Phosphide (AlInGaP) material technology. The AlInGaP material has a very high luminous efficiency, capable of producing high light output over a wide range of drive currents. The available colors in this surface-mount series are 592-nm amber, 605-nm orange, 626-nm red, and 639-nm deep red.

All packages are binned by both color and intensity, except for the red and deep red colors.

These ChipLEDs come in low-profile top-emitting packages (HSMx-C177/C197), in a side-emitting package (HSMx-C120) or in a reverse-mount package (HSMx-C265). The right-angle ChipLED is suitable for applications such as LCD backlighting. The top-emitting ChipLEDs with wide viewing angle are suitable for light piping and direct backlighting of keypads and panels. The reverse-mount ChipLED is suitable for applications where space saving is of importance.

To facilitate pick-and-place operation, these ChipLEDs are shipped in tape and reel, with 4000 units per reel for HSMx-C120/C177/C197 and 3000 units per reel for HSMx-C265.

These packages are compatible with IR the soldering process.

Features

- High-brightness AlInGaP material
- 0805 or 0603 industry-standard footprint with 0.4-mm height for top-emitting packages
- Also available in right-angle-emitting and reverse-mounting packages
- Diffused optics
- Operating temperature range: –40°C to +85°C
- Compatible with IR soldering
- Available in four colors: amber, orange, red, and deep red
- Available in 8-mm tape on 7-in. diameter reels
- Reel sealed in zip-locked moisture barrier bags

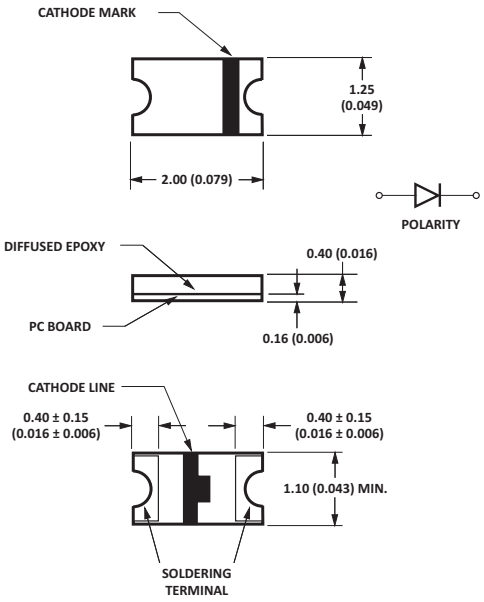
Applications

- Membrane switch indicator
- LCD backlighting
- Push button backlighting
- Front panel indicator
- Symbol backlighting
- Keypad backlighting
- Microdisplays
- Small message panel signage

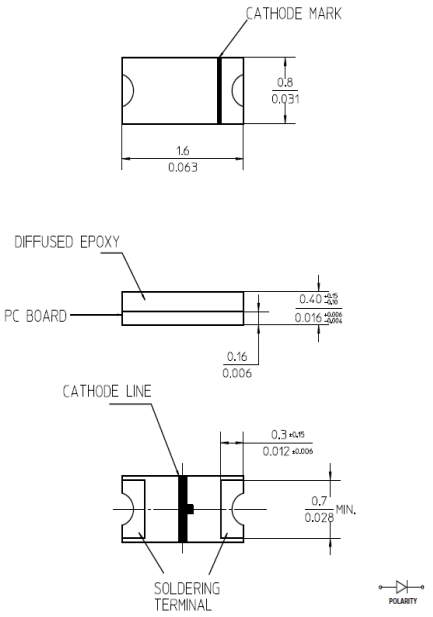
CAUTION! These LEDs are Class 1A ESD sensitive per JESD22-A114C.01. Observe appropriate precautions during handling and processing. Refer to Broadcom Application Note 1142 for additional details.

Package Dimensions

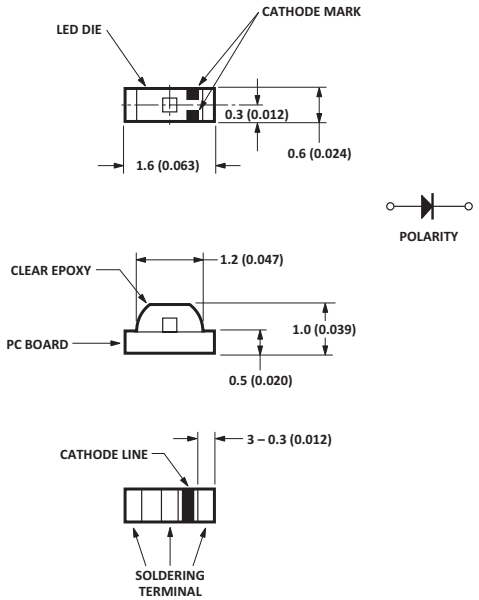
HSMx-C177



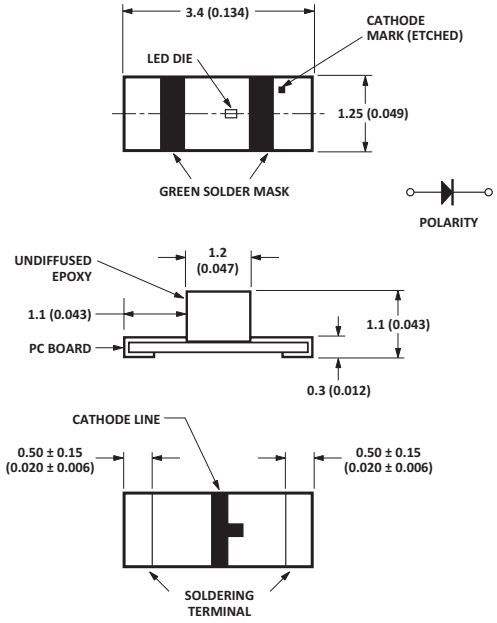
HSMx-C197



HSMx-C120



HSMx-C265



NOTE:

1. All dimensions are in millimeters (inches).
2. Tolerance is ± 0.1 mm (± 0.004 in.) unless otherwise noted.

Device Selection Guide

Package Dimension (mm)[a, b]	Amber	Red	Orange	Deep Red	Package Description
1.6 (L) × 1.0 (W) × 0.6 (H)	HSMA-C120	HSMC-C120	HSML-C120	—	Untinted, non-diffused
2.0 (L) × 1.25 (W) × 0.4 (H)	HSMA-C177	HSMC-C177	HSML-C177	HSMT-C177	Untinted, diffused
1.6 (L) × 0.8 (W) × 0.4 (H)	HSMA-C197	HSMC-C197	HSML-C197	HSMT-C197	Untinted, diffused
3.4 (L) × 1.25 (W) × 1.1(H)	HSMA-C265	HSMC-C265	HSML-C265	HSMT-C265	Untinted, non-diffused

a. Dimensions are in mm.

b. Tolerance is ±0.1 mm unless otherwise noted.

Absolute Maximum Ratings at T_A = 25°C

Parameter	HSMx-Cxxx	Units
DC Forward Current[a]	25	mA
Power Dissipation	60	mW
Reverse Voltage (I_R = 100 µA)	5	V
LED Junction Temperature	95	°C
Operating Temperature Range	–40 to +85	°C
Storage Temperature Range	–40 to +85	°C
Soldering Temperature	See reflow soldering profile (Figure 9 and Figure 10)	

a. Derate linearly as shown in Figure 4.

Electrical Characteristics at T_A = 25°C

	Forward Voltage, V_F (V) at I_F = 20 mA[a]		Reverse Breakdown, V_R (V) I_R = 100 µA	Capacitance, C (pF) V_F = 0, f = 1 MHz	Thermal Resistance $R\theta_{J\text{-}PIN}$ (°C/W)
Part Number	**Typ.**	**Max.**	**Min.**	**Typ.**	**Typ.**
HSMA-C120	1.9	2.4	5	11	400
HSMA-C177/197	1.9	2.4	5	11	300
HSMA-C265	1.9	2.4	5	11	550
HSMC-C120	1.9	2.4	5	15	400
HSMC-C177/197	1.9	2.4	5	15	300
HSMC-C265	1.9	2.4	5	15	550
HSML-C120	1.9	2.4	5	20	400
HSML-C177/197	1.9	2.4	5	20	300
HSML-C265	1.9	2.4	5	20	550
HSMT-C177/197	1.9	2.4	5	15	300
HSMT-C265	1.9	2.4	5	15	550

a. V_F tolerance = ±0.1V.

Optical Characteristics at T_A = 25°C

Part Number	Color	Luminous Intensity, I_V (mcd) at 20 mA[a]		Color Peak Wavelength, λ_{PEAK} (nm)	Dominant Wavelength, λ_d (nm)[b]	Viewing Angle, $2\theta_{½}$ (°)[c]	Luminous Efficacy, η_V (lm/w)
		Min.	Typ.	Typ.	Typ.	Typ.	Typ.
HSMA-C120	Amber	28.5	90	595	592	155	480
HSMA-C177/197	Amber	28.5	90	595	592	130	480
HSMA-C265	Amber	28.5	75	595	592	150	480
HSMC-C120	Red	28.5	90	637	626	155	155
HSMC-C177/197	Red	28.5	90	637	626	130	155
HSMC-C265	Red	28.5	75	637	626	150	155
HSML-C120	Orange	28.5	90	609	605	155	370
HSML-C177/197	Orange	28.5	90	609	605	130	370
HSML-C265	Orange	28.5	75	609	605	150	370
HSMT-C177/197	Deep Red	11.2	30	660	639	130	70
HSMT-C265	Deep Red	11.2	25	660	639	150	70

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

b. The dominant wavelength, λ_d, is derived from the CIE Chromaticity Diagram and represents the perceived color of the device.

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

Bin Information

Bin categories are established for classification of products. Products may not be available in all categories. Contact your Broadcom representative for information on currently available bins.

Light Intensity (I_V) Bin Limits

The I_V binning specification setup is for lowest allowable I_V binning only. There are no upper I_V bin limits.

Bin ID	Intensity (mcd)	
	Min.	Max.
A	0.11	0.18
B	0.18	0.29
C	0.29	0.45
D	0.45	0.72
E	0.72	1.10
F	1.10	1.80
G	1.80	2.80
H	2.80	4.50
J	4.50	7.20
K	7.20	11.20
L	11.20	18.00
M	18.00	28.50
N	28.50	45.00
P	45.00	71.50
Q	71.50	112.50
R	112.50	180.00
S	180.00	285.00
T	285.00	450.00
U	450.00	715.00
V	715.00	1125.00
W	1125.00	1800.00
X	1800.00	2850.00
Y	2850.00	4500.00

Tolerance: ±15%

Color Bin Limits

Orange

Bin ID	Dominant Wavelength (nm)	
	Min.	Max.
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
F	612.0	615.0

Tolerance: ±1 nm.

Amber

Bin ID	Dominant Wavelength (nm)	
	Min.	Max.
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

Tolerance: ±1 nm.

Red

Bin ID	Dominant Wavelength (nm)	
	Min.	Max.
—	620.0	635.0

Tolerance: ±1 nm.

Figure 1: Relative Intensity vs. Wavelength

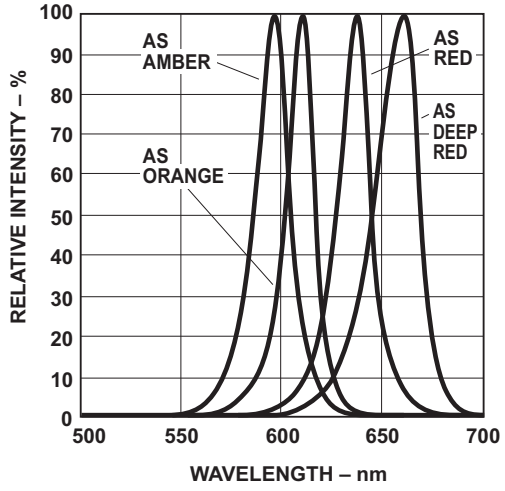


Figure 2: Forward Current vs. Forward Voltage

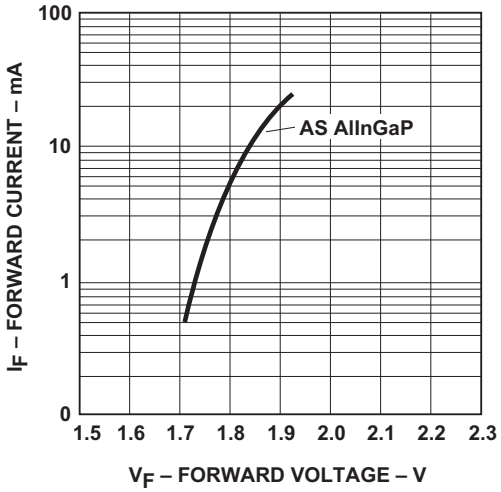


Figure 3: Luminous Intensity vs. Forward Current

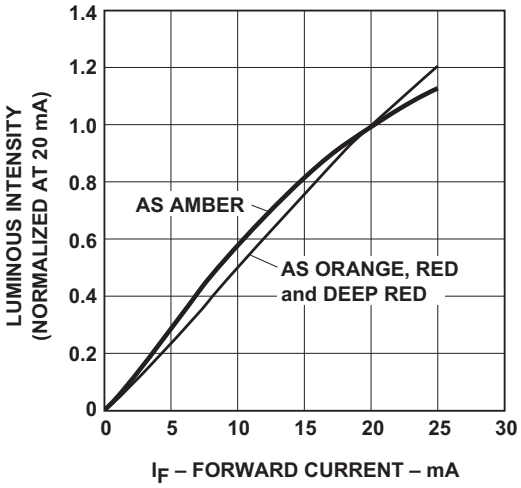


Figure 4: Maximum Forward Current vs. Ambient Temperature

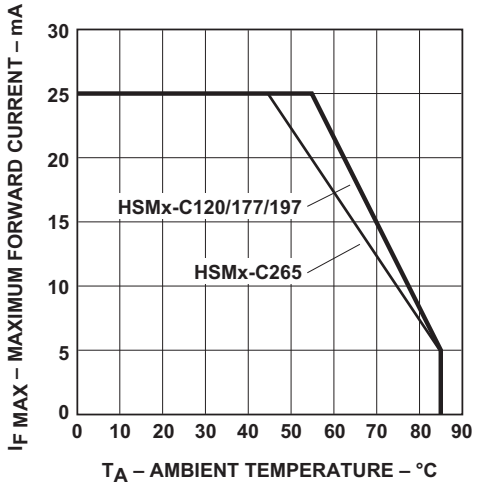


Figure 5: Relative Intensity vs. Angle for HSMx-C120

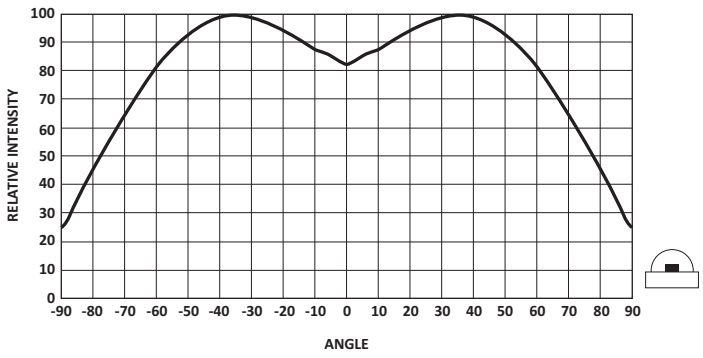


Figure 6: Relative Intensity vs. Angle for HSMx-C120

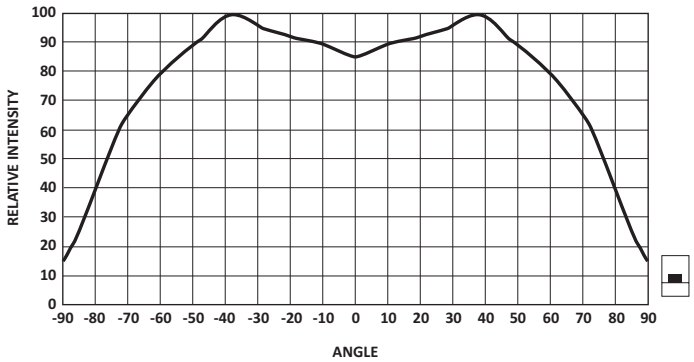


Figure 7: Relative Intensity vs. Angle for HSMx-C177/C197

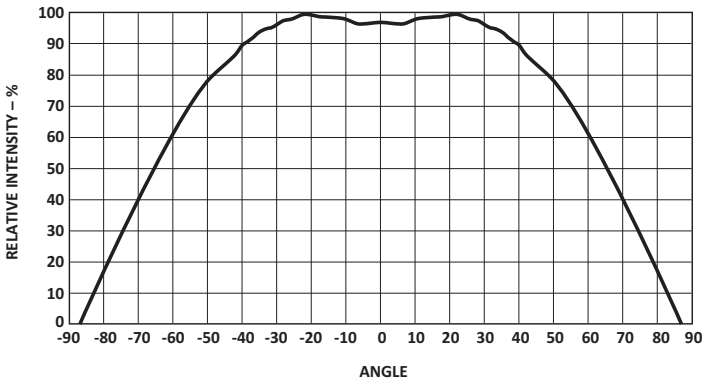


Figure 8: Relative Intensity vs. Angle for HSMx-C265

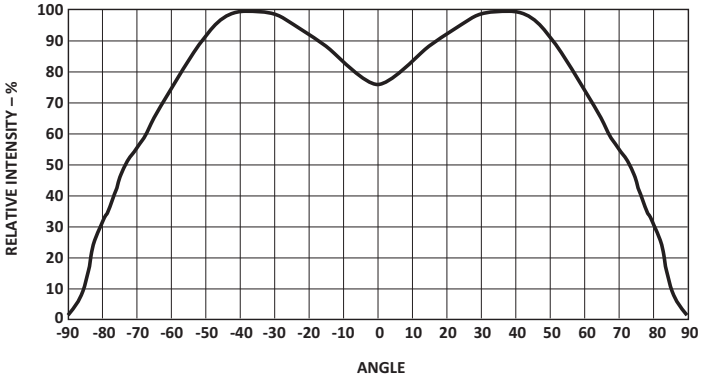


Figure 9: Recommended Reflow Soldering Profile

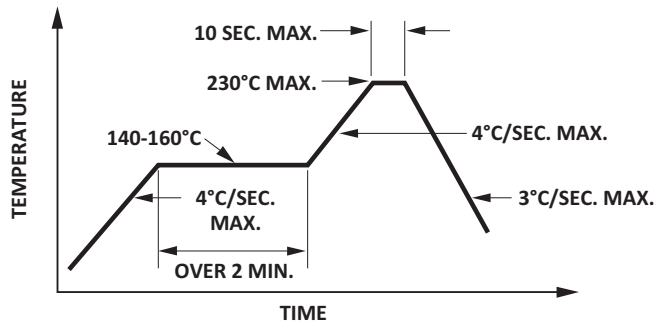


Figure 10: Recommended Lead-Free Reflow Soldering Profile

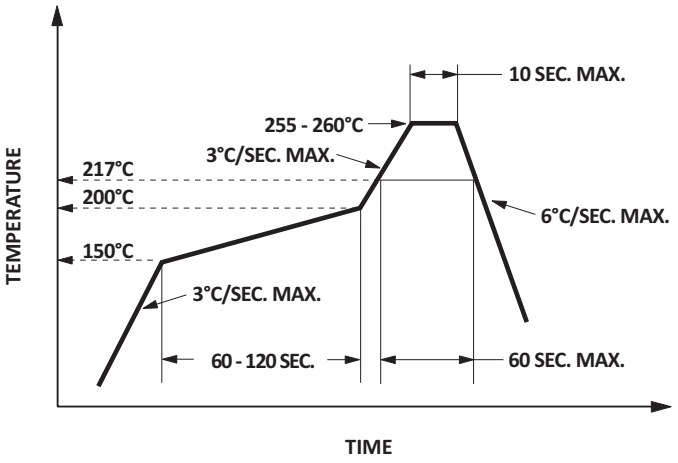


Figure 11: Recommended Soldering Pattern for HSMx-C177

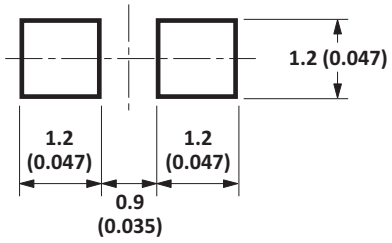
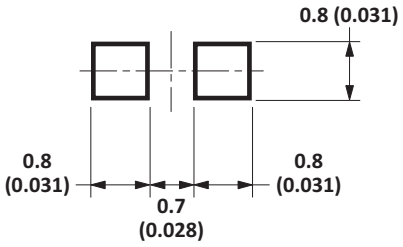


Figure 12: Recommended Soldering Pattern for HSMx-C197



NOTE: All dimensions are in millimeters (inches).

Figure 13: Recommended Soldering Pattern for HSMx-C120

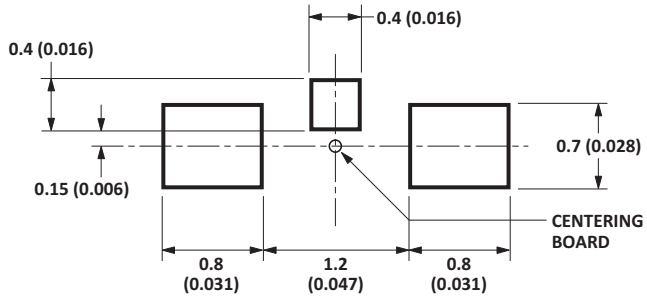
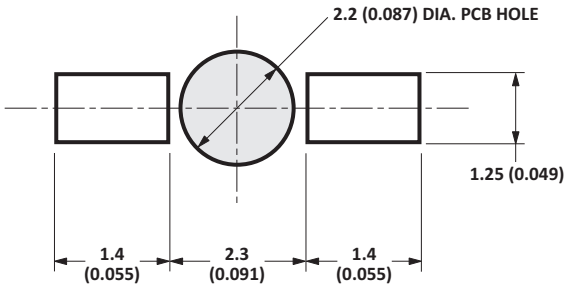


Figure 14: Recommended Soldering Pattern for HSMx-C265



NOTE: All dimensions are in millimeters (inches).

Figure 15: Reeling Orientation

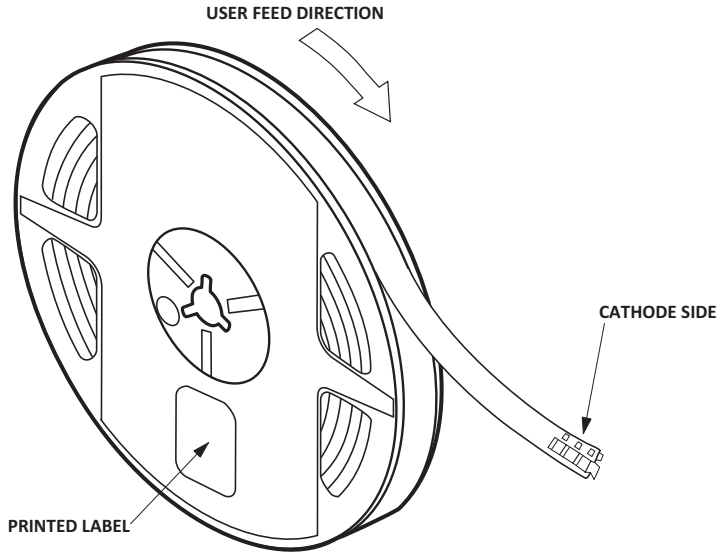
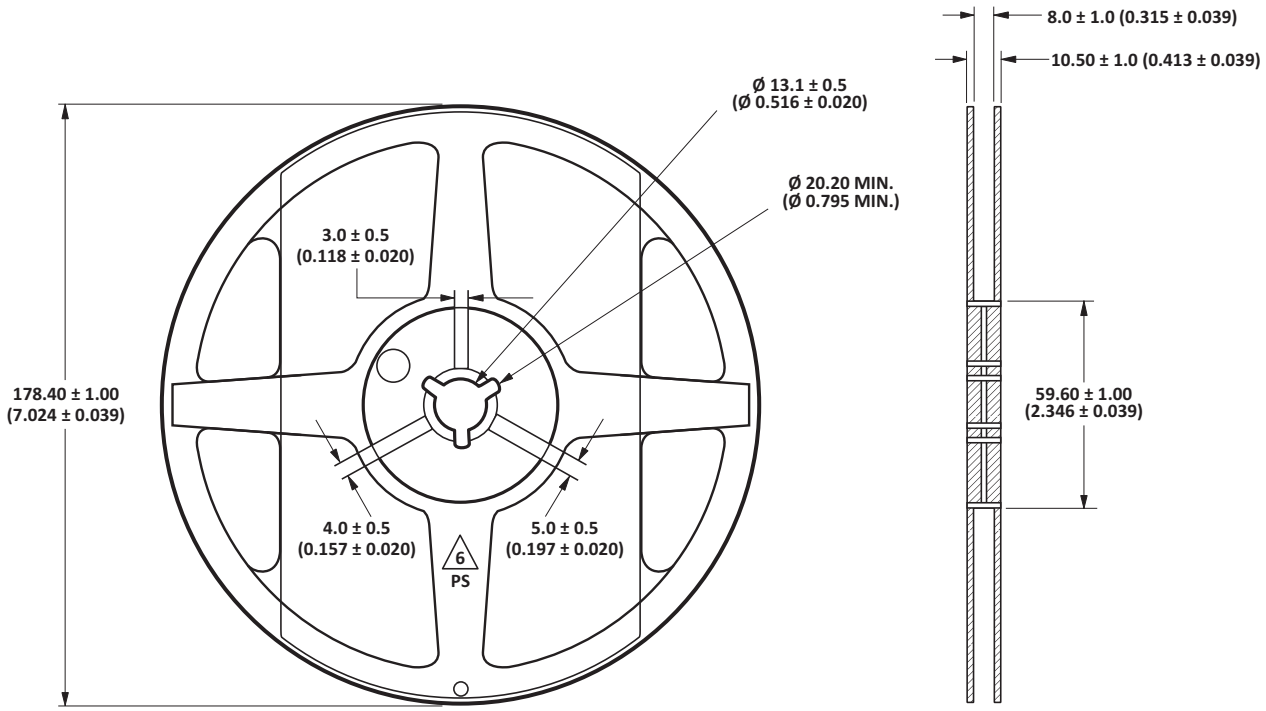


Figure 16: Reel Dimensions



NOTE: All dimensions are in millimeters (inches).

Figure 17: Tape Dimensions

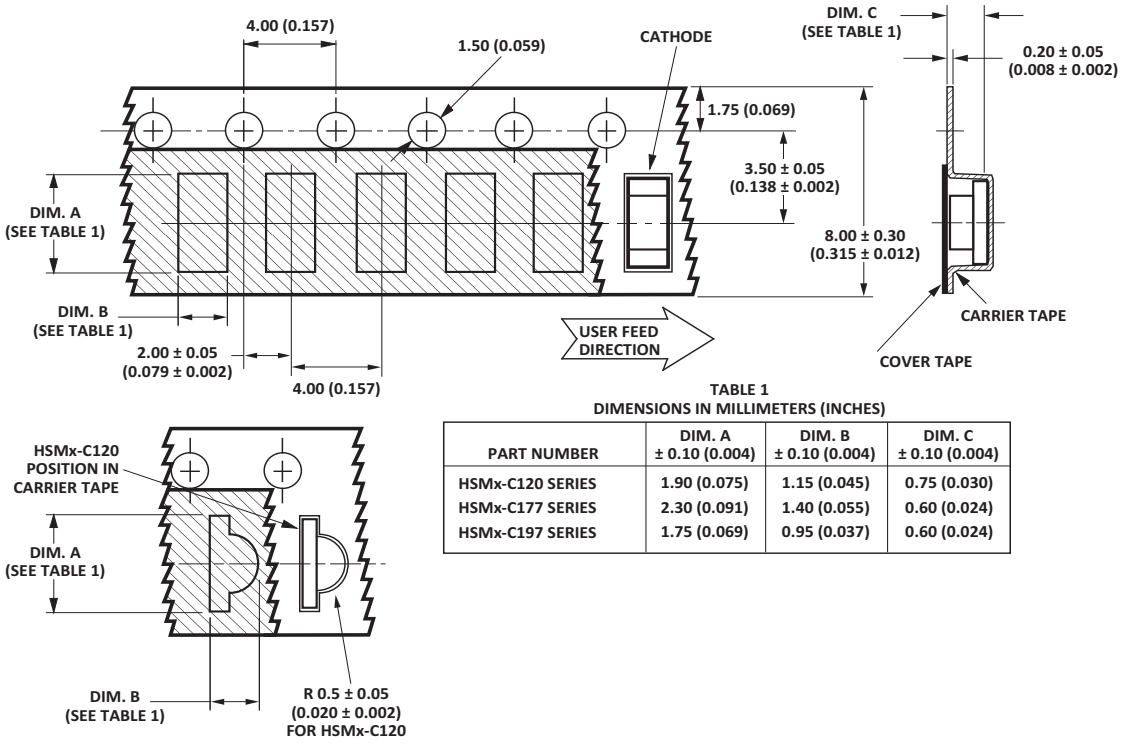


TABLE 1
DIMENSIONS IN MILLIMETERS (INCHES)

PART NUMBER	DIM. A ± 0.10 (0.004)	DIM. B ± 0.10 (0.004)	DIM. C ± 0.10 (0.004)
HSMx-C120 SERIES	1.90 (0.075)	1.15 (0.045)	0.75 (0.030)
HSMx-C177 SERIES	2.30 (0.091)	1.40 (0.055)	0.60 (0.024)
HSMx-C197 SERIES	1.75 (0.069)	0.95 (0.037)	0.60 (0.024)

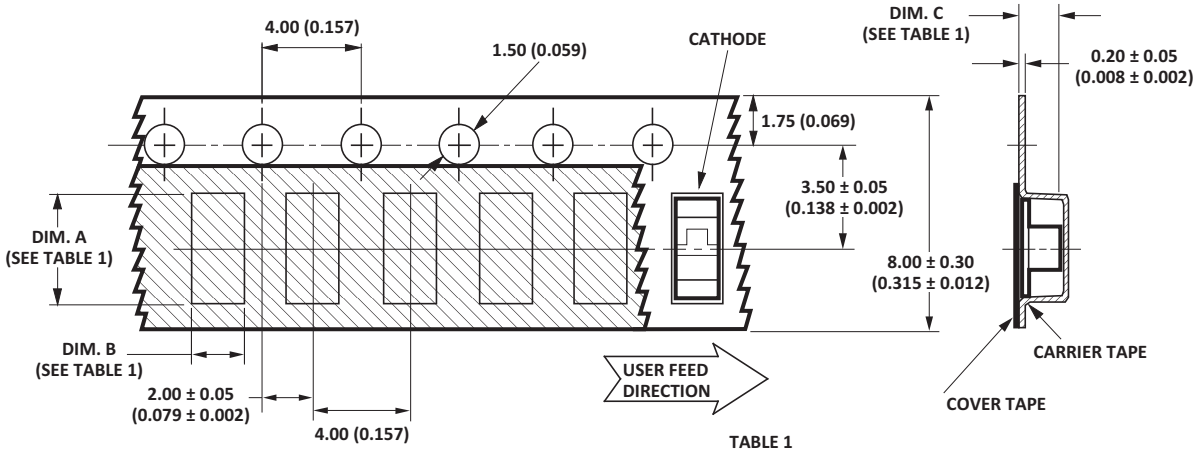


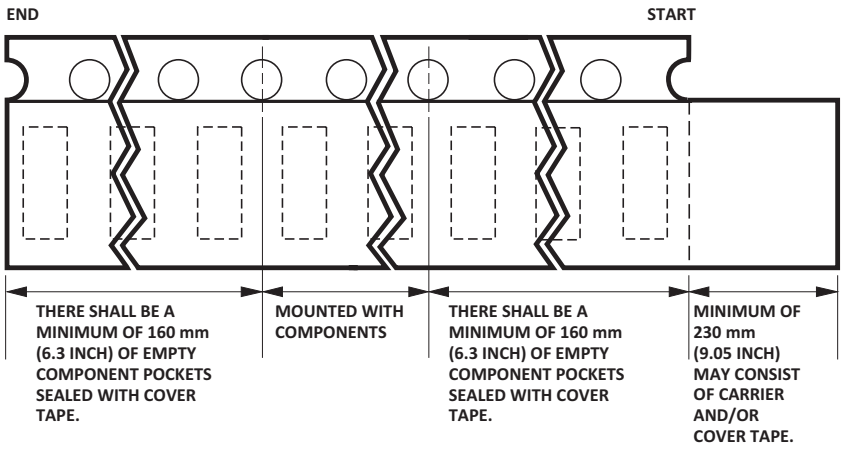
TABLE 1
DIMENSIONS IN MILLIMETERS (INCHES)

PART NUMBER	DIM. A ± 0.10 (0.004)	DIM. B ± 0.10 (0.004)	DIM. C ± 0.10 (0.004)
HSMx-C265 SERIES	3.70 (0.146)	1.45 (0.057)	1.30 (0.051)

NOTE:

1. All dimensions are in millimeters (inches).
2. Tolerance is ±0.1 mm (±0.004 in.) unless otherwise specified.

Figure 18: Tape Leader and Trailer Dimensions

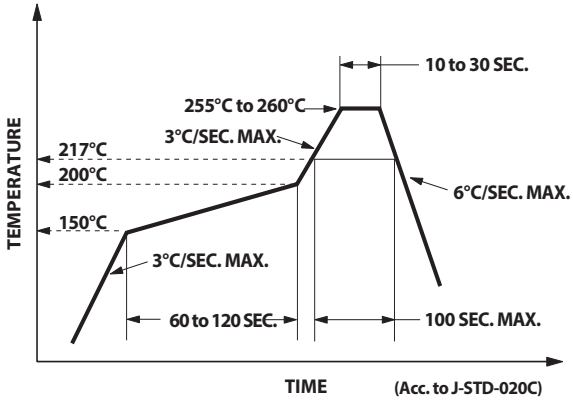


Precautionary Notes

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 following conditions:
  - Soldering iron tip temperature = 310°C maximum
  - Soldering duration = 2 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 19: Recommended Lead-Free Reflow Soldering Profile



Handling Moisture-Sensitive Devices

This product has a Moisture Sensitive Level 2a 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, 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°C/60% RH at all times, and complete all high temperature-related processes, including soldering, curing, or rework, within 672 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 672 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 672 hours.

  The recommended baking condition is 60°C ± 5°C for 20 hours.

  Baking can only be done once.

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 entire 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.
- If the LED is intended to be used along with LEDs of other colors to achieve color mixing, Broadcom does not guarantee the consistency of the resultant color. Contact your Broadcom sales representative for these applications.
- 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.
- 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, dust, oil, corrosive gases, external mechanical stresses, and so on.

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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BROADCOM®

Lead (Pb) Free
RoHS Compliant