BROADCOM®

HSMx-C680

Right Angle Surface-Mount ChipLEDs

Description

The Broadcom® HSMx-C680 series of chip-type LEDs is designed to illuminate at a right angle to the direction of mounting. When mounted on a PC board, these devices emit light in a direction parallel to the board.

The small 3.0 mm × 1.0 mm × 2.0 mm footprint of the HSMx-C680 is designed for applications where space is limited. These devices are available in four colors and use untinted, nondiffused optics.

The HSMx-C680 series of parts are compatible with only the IR reflow soldering process.

Features

- Right angle mounting
- Compatible with IR reflow soldering process
- Available in a wide variety of colors
- Available in 8-mm tape on 178-mm (7-in.) diameter reels

Applications

- LCD backlighting
- Keypad side/backlighting
- Light piping
- Right angle indicator

Device Selection Guide

Part Number	Parts per Reel	Color
HSMA-C680	3000	AlInGaP Amber
HSMC-C680	3000	AlInGaP Red
HSMG-C680	3000	AlInGap Green
HSML-C680	3000	AlInGaP Orange
HSMS-C680	3000	AlInGaP Red
HSMY-C680	3000	AlInGaP Yellow

CAUTION! HSMx-C680 LEDs are Class 1A ESD sensitive per JESD22-A114C.01 standard. Observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

Package Dimensions
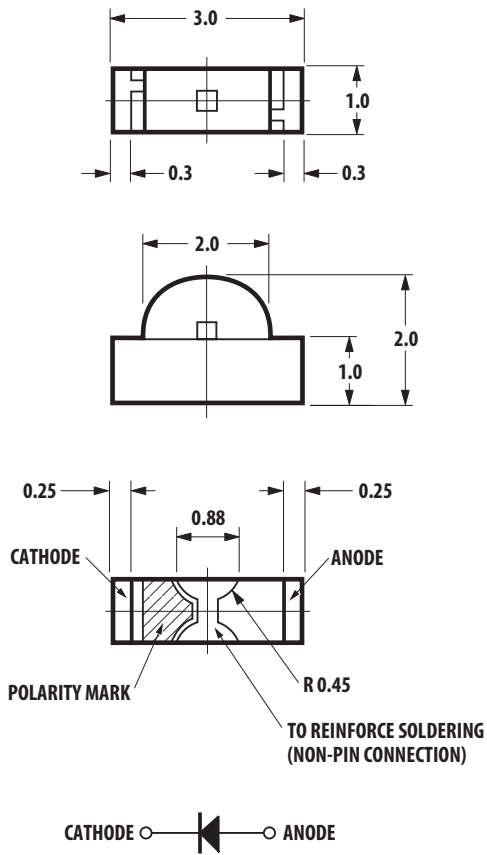
Absolute Maximum Ratings at T_A = 25°C

Parameter	HSMA-C680 HSMC-C680 HSML-C680	HSMG-C680 HSMS-C680 HSMY-C680	Unit
DC Forward Current	30	25	mA
Power Dissipation	72	65	mW
Reverse Voltage (I_R Max. 10 µA)	5	5	V
LED Junction Temperature	95	95	°C
Operating and Storage Temperature Range	−40 to 85		°C
Soldering Temperature	See reflow soldering profile (Figure 6 and Figure 7)		

Electrical Characteristics at T_A = 25°C, I_F = 20 mA

| Part Number | Forward Voltage, V_F (V) | | | Reverse Current, I_R (µA) at V_R = 5V | Thermal Resistance $R\theta_{J-S}$ (°C/W) |
	Min.	Typ.	Max.	Max.	Typ.
HSMA-C680	1.60	2.00	2.40	10	500
HSMC-C680	1.60	2.00	2.40	10	500
HSMG-C680	1.60	2.20	2.60	10	300
HSML-C680	1.60	2.00	2.40	10	500
HSMS-C680	1.60	2.00	2.60	10	300
HSMY-C680	1.60	2.10	2.60	10	300

Optical Characteristics at T_A = 25°C, I_F = 20 mA

| Part Number | Luminous Intensity, I_V[a] (mcd) | | Dominant Wavelength, λ_d[b] (nm) | Peak Wavelength, λ_p (nm) | Viewing Angle $2\theta_{1/2}$[c] (Degrees) |
	Min.	Typ.	Typ.	Typ.	Typ.
HSMA-C680	28.50	76.90	591	594	115
HSMC-C680	28.50	62.30	630	643	115
HSMG-C680	4.50	13.30	573	568	125
HSML-C680	28.50	108.60	604	611	115
HSMS-C680	2.80	5.10	621	636	125
HSMY-C680	2.80	9.30	589	588	125

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 may not be aligned with the axis.

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

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

Color Bin Limits[1]

AlInGaP Amber/Yellow

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
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.

AlInGaP Red

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
—	620.0	635.0

Tolerance: ± 1 nm.

AlInGaP Green

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
A	561.5	564.5
B	564.5	567.5
C	567.5	570.5
D	570.5	573.5
E	573.5	576.5

Tolerance: ± 1 nm.

AlInGaP Orange

Bin ID	Dominant Wavelength (nm)	
	Minimum	Maximum
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.

Light Intensity (I_V) Bin Limits

Bin ID	Intensity (mcd)	
	Minimum	Maximum
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%.

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1. Bin categories are established for classification of products. Products may not be available in all categories. Contact your Broadcom representative for information on current available bins.
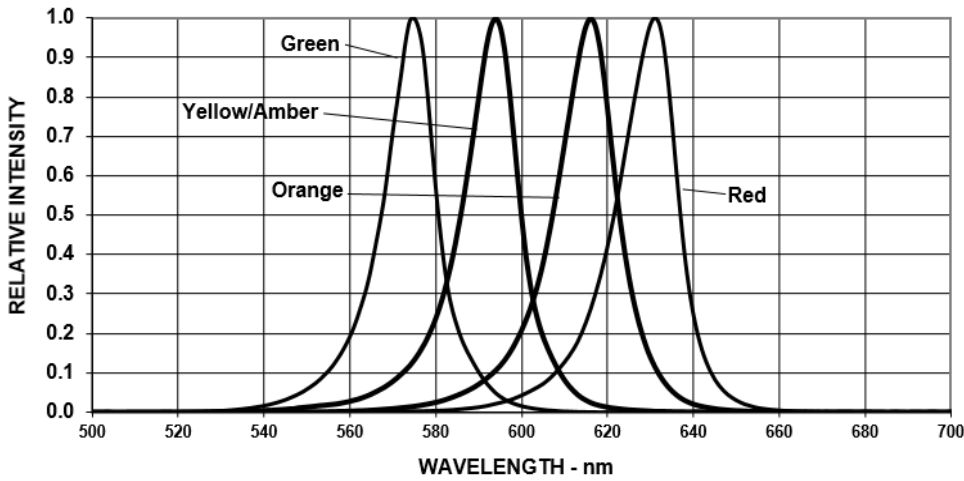
Figure 1: Relative Intensity vs. Wavelength
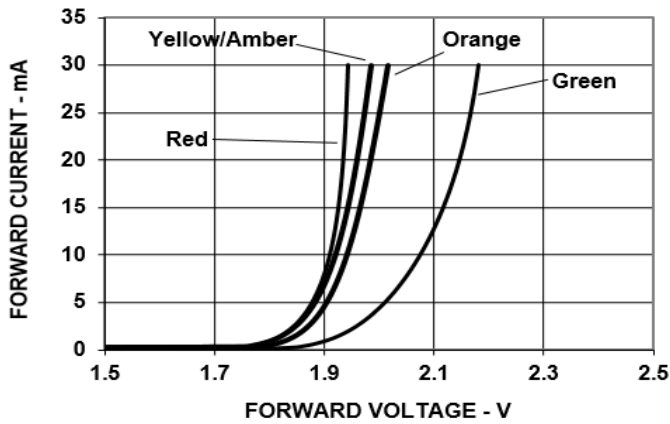

Figure 2: Forward Current vs. Forward Voltage

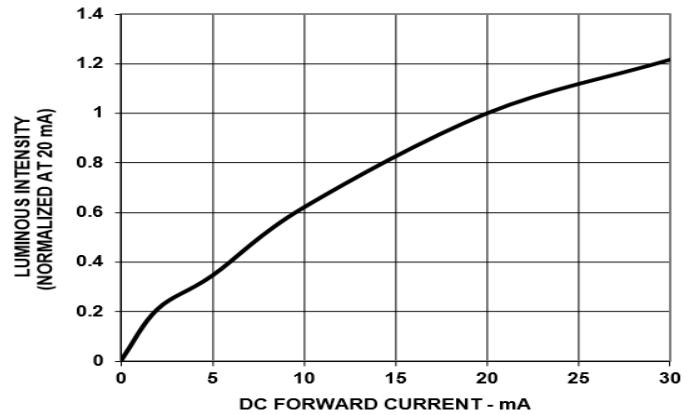**Figure 3: Luminous Intensity vs. Forward Current**

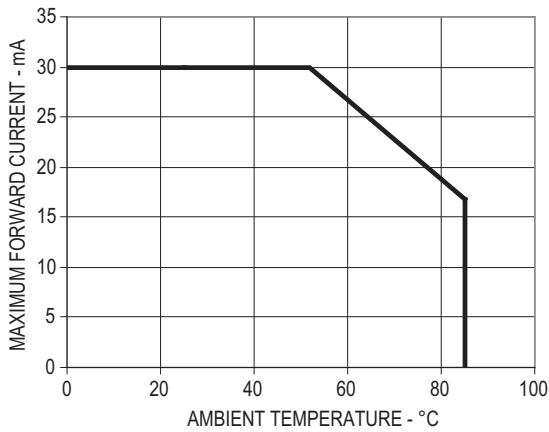**Figure 4: Maximum Forward Current vs. Ambient Temperature, HSMA-C680, HSMC-C680, HSML-C680**

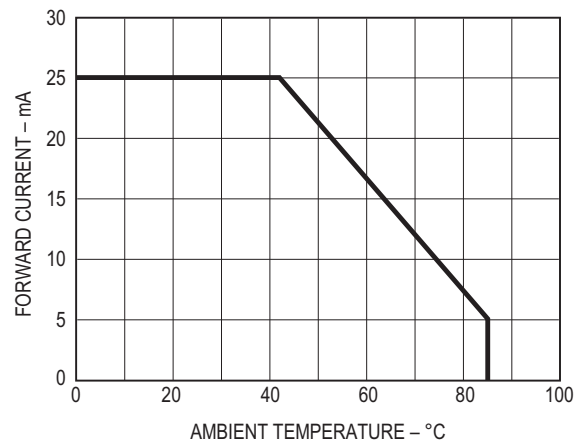**Figure 5: Maximum Forward Current vs. Ambient Temperature, HSMG-C680, HSMS-C680, HSMY-C680**
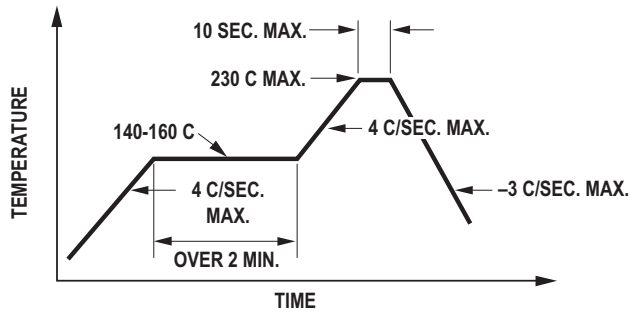
Figure 6: Recommended Reflow Soldering Profile

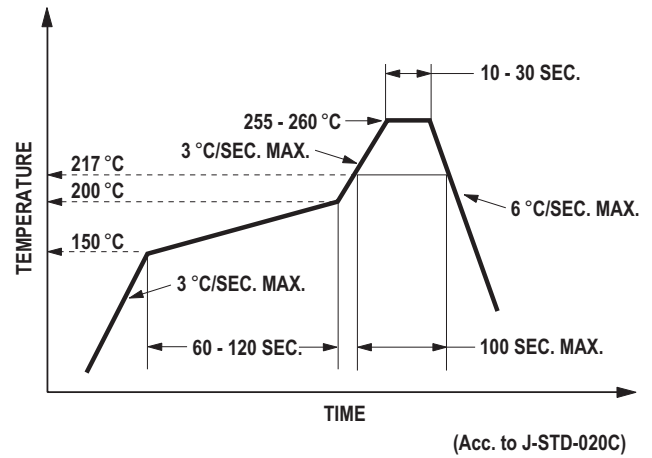**Figure 7: Recommended Pb-Free Reflow Soldering Profile**

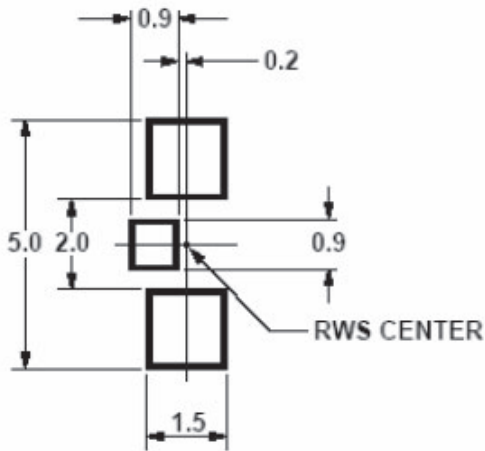
(Acc. to J-STD-020C)

Figure 8: Recommended Soldering Land Pattern

EMITTED DIRECTION
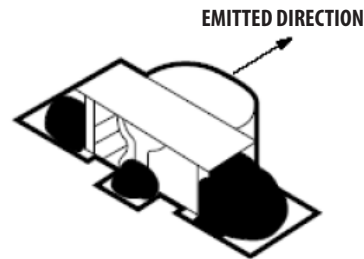
NOTE:

1. All dimensions are in millimeters (inches).
2. Tolerance is ± 0.1 mm (± 0.004 in.) unless otherwise specified.
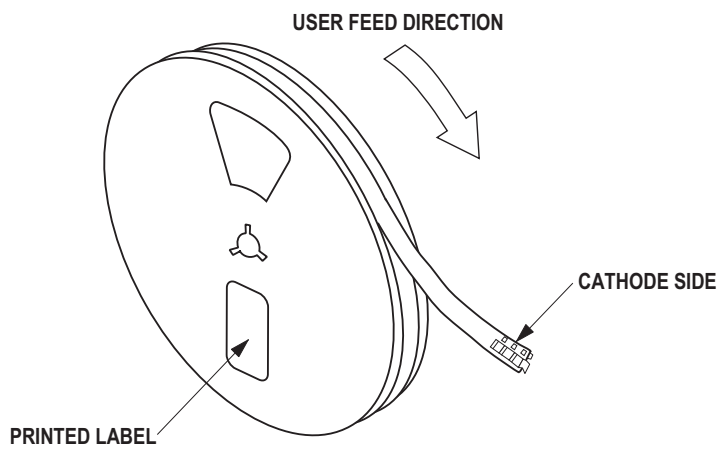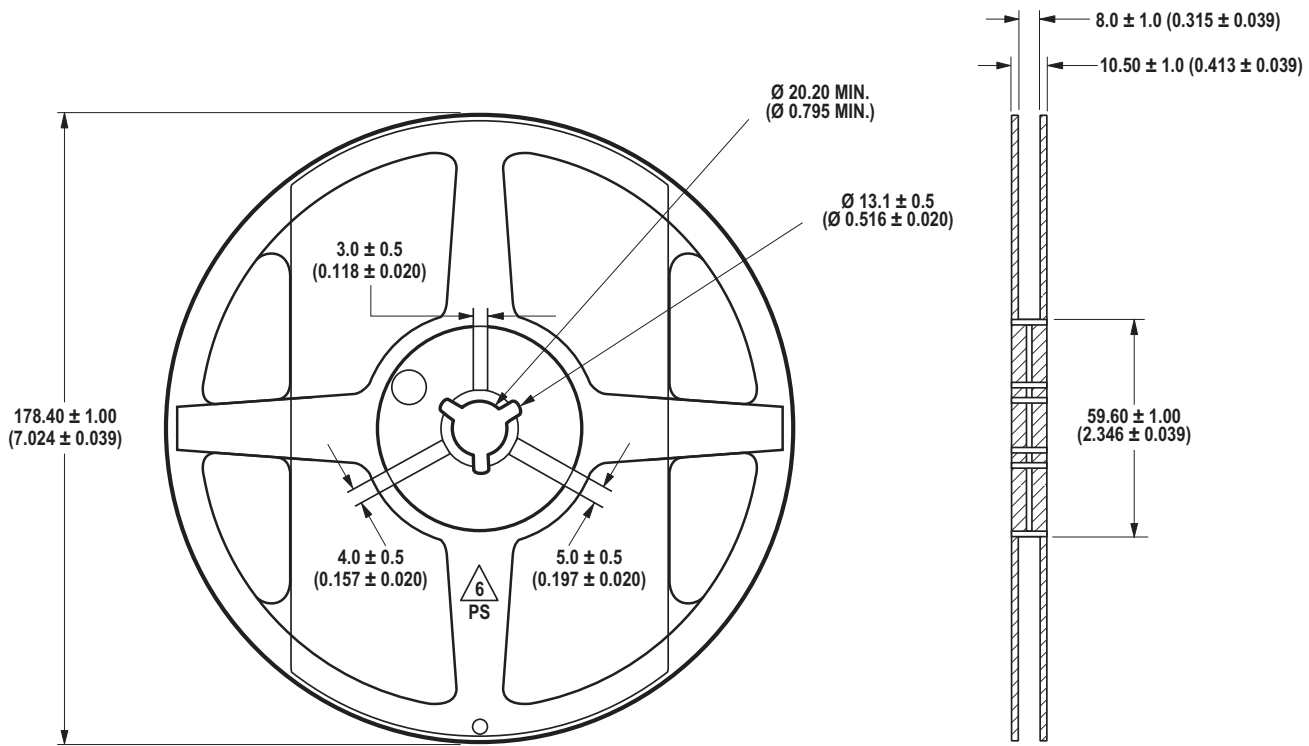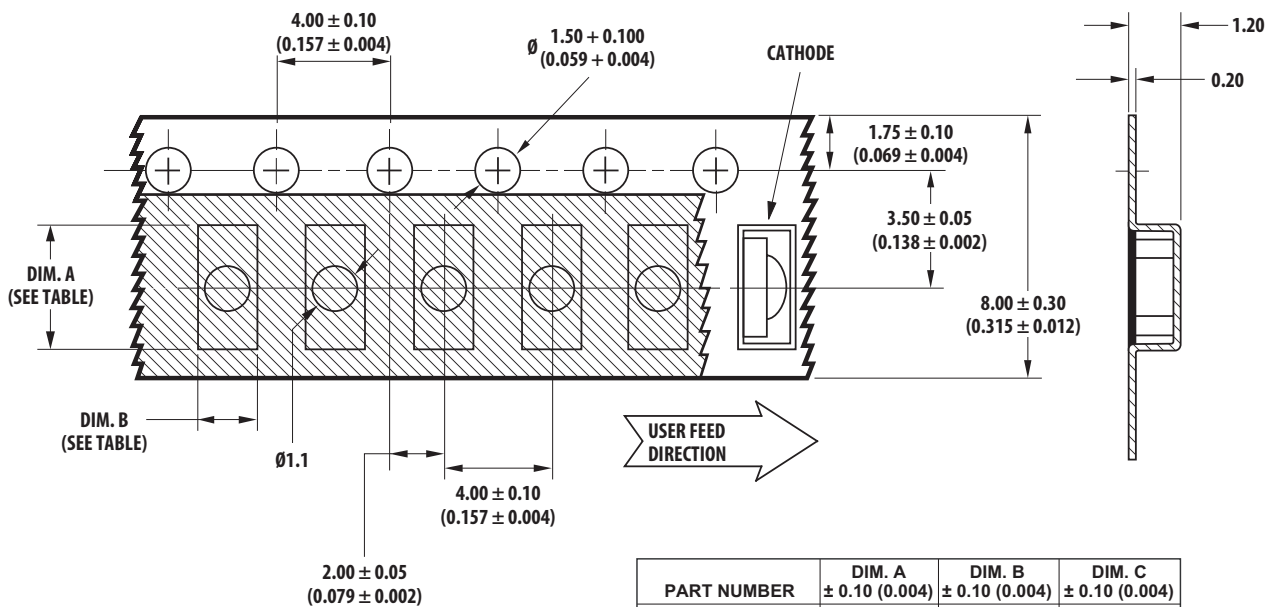
Figure 9: Reeling Orientation

USER FEED DIRECTION

CATHODE SIDE

PRINTED LABEL

Figure 10: Reel Dimensions

Ø 20.20 MIN.
(Ø 0.795 MIN.)

8.0 ± 1.0 (0.315 ± 0.039)

10.50 ± 1.0 (0.413 ± 0.039)

Ø 13.1 ± 0.5
(Ø 0.516 ± 0.020)

3.0 ± 0.5
(0.118 ± 0.020)

178.40 ± 1.00
(7.024 ± 0.039)

59.60 ± 1.00
(2.346 ± 0.039)

4.0 ± 0.5
(0.157 ± 0.020)

5.0 ± 0.5
(0.197 ± 0.020)

6
PS

Figure 11: Carrier Tape Dimensions

4.00 ± 0.10
(0.157 ± 0.004)

Ø 1.50 + 0.100
(0.059 + 0.004)

CATHODE

1.20

0.20

1.75 ± 0.10
(0.069 ± 0.004)

3.50 ± 0.05
(0.138 ± 0.002)

DIM. A
(SEE TABLE)

8.00 ± 0.30
(0.315 ± 0.012)

DIM. B
(SEE TABLE)

Ø1.1

USER FEED
DIRECTION

4.00 ± 0.10
(0.157 ± 0.004)

2.00 ± 0.05
(0.079 ± 0.002)

| PART NUMBER	DIM. A ± 0.10 (0.004)	DIM. B ± 0.10 (0.004)	DIM. C ± 0.10 (0.004)
HSMx-C680	3.35 (0.132)	2.30 (0.091)	1.20 (0.047)

DIMENSIONS IN MILLIMETERS (INCHES)

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 is affected by soldering with hand soldering.

Figure 12: Recommended Lead-Free Reflow Soldering Profile
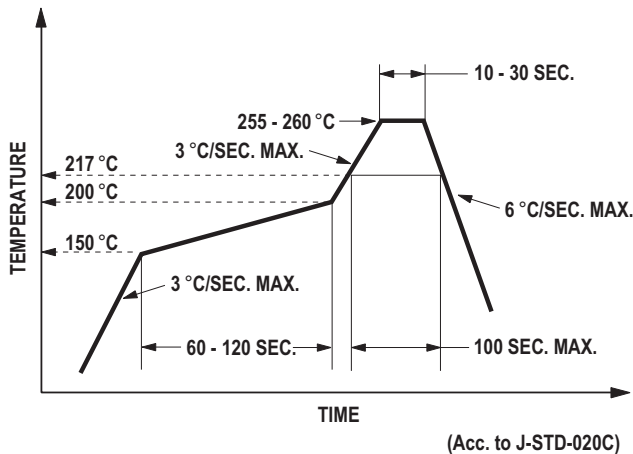
Handling Precautions

This product has a Moisture Sensitive Level 2a 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, 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 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 the following conditions exist:
- 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 672 hours.

The recommended baking condition is: 60°C ± 5ºC 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 the 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 may result in a larger variation of performance (such as intensity, wavelength, and forward voltage). Set the application current as close as possible to the test current to minimize these variations.
- Driving the LED at low current (< 2 mA) does not cause functional failures to the LED (that is, open/short). However, the variation in intensity will be larger than existing intensity bin ratio of 1:1.6.
- 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 temperatures, especially in high-humidity environments, because they cause condensation on the LED.
- If the LED is intended to be used in a harsh or an outdoor environment, protect the LED against damages caused by rain water, water, 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.

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