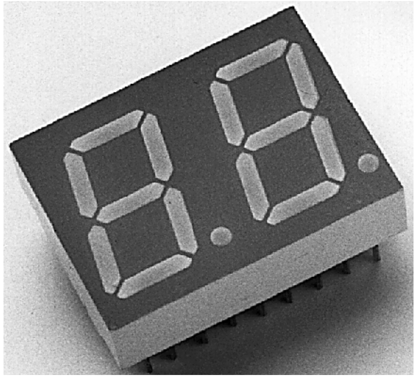
Data Sheet

HDSP-52xE Series, HDSP-52xG Series, HDSP-52xY Series

14.2-mm (0.56-inch) General-Purpose Two-Digit Seven-Segment Displays



Description

These Broadcom® 14.2-mm (0.56-inch) two-digit displays use an industry-standard size and pinout. The devices are available as either common anode or common cathode. These gray-faced displays are available in a choice of red, green, or yellow colors. The HDSP-521x and HDSP-523x are suitable for indoor use.

Applications

- Suitable for indoor use
- Not recommended for industrial applications
- Extreme temperature cycling not recommended

NOTE: For additional details, contact your local Broadcom sales office or an authorized distributor.

Features

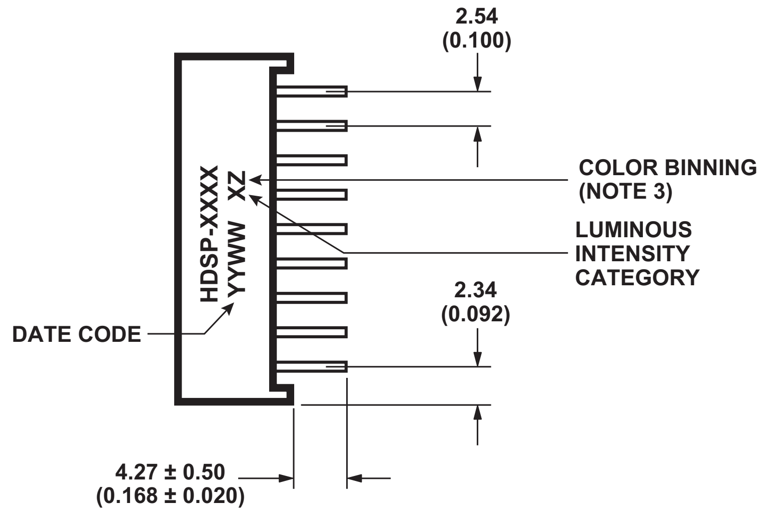
- Industry-standard size
- Industry-standard pinout:
  - 14.2 mm (0.56 inch)
  - DIP leads on 2.54-mm (0.1-in.) centers
- Choice of colors:
  - Red, green, and yellow
- Excellent appearance:
  - Mitered font
  - Mitered corners on segments
  - Gray-face paint: Gray package gives optimum contrast
  - ±50° viewing angle
- Design flexibility:
  - Common anode or common cathode
- Categorized for luminous intensity:
  - Green and yellow categorized for color

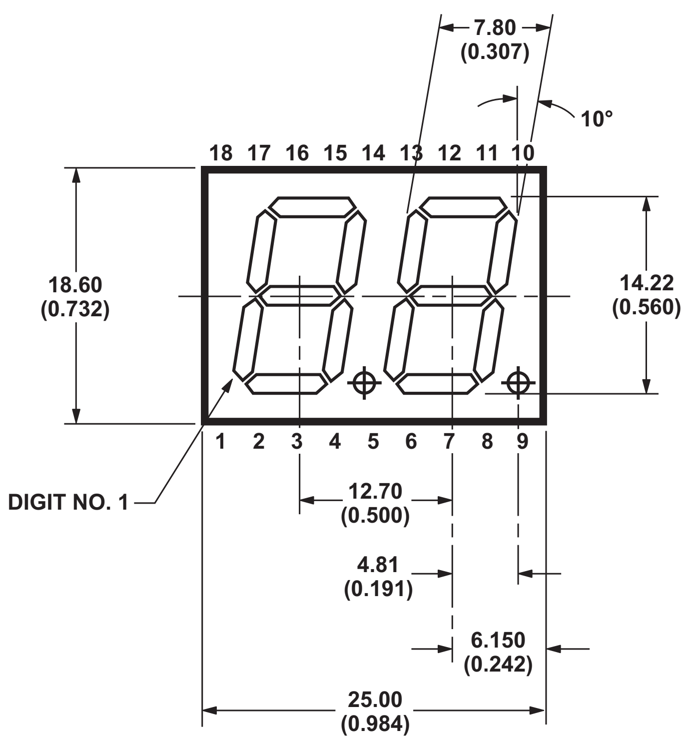
Devices

Red	Green	Yellow	Description
HDSP-521E	HDSP-521G	HDSP-521Y	Common Anode Right-Hand Decimal
HDSP-523E	HDSP-523G	HDSP-523Y	Common Cathode Right-Hand Decimal

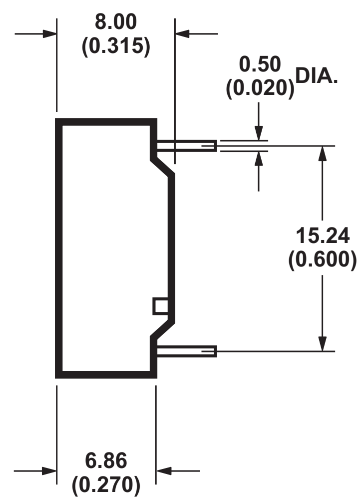
Package Dimensions

TOP-END VIEW





FRONT VIEW



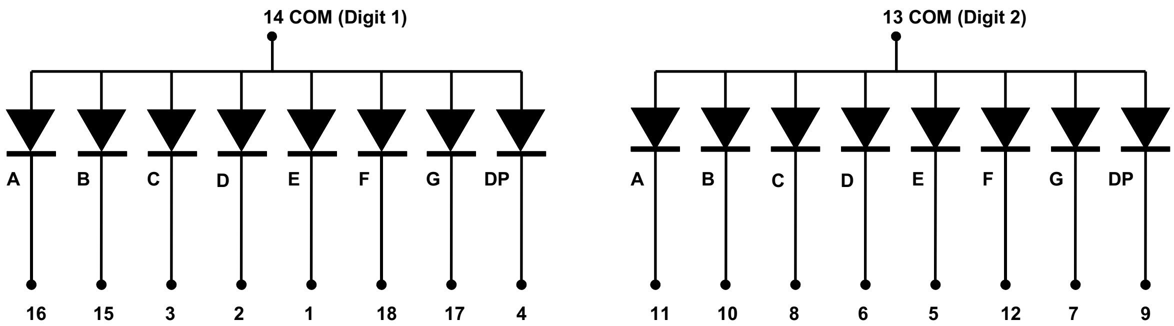
SIDE VIEW

NOTE:

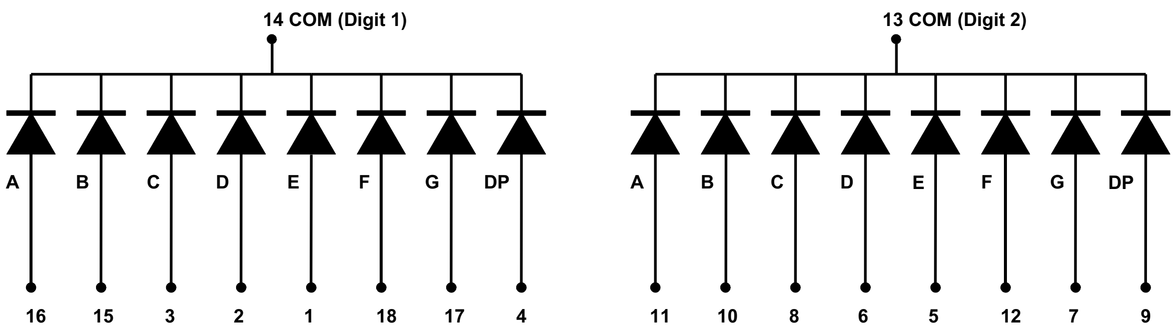
1. All dimensions are in millimeters (inches).
2. The tolerance is 0.25 mm (0.01 in.) unless otherwise stated.
3. For green and yellow only.

Internal Circuit Diagram

Common Anode



Common Cathode



Common Anode		Common Cathode	
Pin	**Function**	**Pin**	**Function**
1	E CATHODE NO. 1	1	E ANODE NO. 1
2	D CATHODE NO. 1	2	D ANODE NO. 1
3	C CATHODE NO. 1	3	C ANODE NO. 1
4	DP CATHODE NO. 1	4	DP ANODE NO. 1
5	E CATHODE NO. 2	5	E ANODE NO. 2
6	D CATHODE NO. 2	6	D ANODE NO. 2
7	G CATHODE NO. 2	7	G ANODE NO. 2
8	C CATHODE NO. 2	8	C ANODE NO. 2
9	DP CATHODE NO. 2	9	DP ANODE NO. 2
10	B CATHODE NO. 2	10	B ANODE NO. 2
11	A CATHODE NO. 2	11	A ANODE NO. 2
12	F CATHODE NO. 2	12	F ANODE NO. 2
13	DIGIT NO. 2 ANODE	13	DIGIT NO. 2 CATHODE
14	DIGIT NO. 1 ANODE	14	DIGIT NO. 1 CATHODE
15	B CATHODE NO. 1	15	B ANODE NO. 1
16	A CATHODE NO. 1	16	A ANODE NO. 1
17	G CATHODE NO. 1	17	G ANODE NO. 1
18	F CATHODE NO. 1	18	F ANODE NO. 1

Absolute Maximum Ratings at T_A = 25°C

Parameter	Red HDSP-521E HDSP-523E	Green HDSP-521G HDSP-523G	Yellow HDSP-521Y HDSP-523Y	Unit
Power Dissipation per Segment or DP	62.5	62.5	50	mW
Peak Forward Current per Segment or DP[a]	90	90	60	mA
DC Forward Current per Segment or DP	25[b]	25[c]	20[d]	mA
Operating Temperature Range	–40 to +85	–40 to +85	–40 to +85	°C
Storage Temperature Range	–40 to +85	–40 to +85	–40 to +85	°C
Reverse Voltage per Segment or DP[e]	5	5	5	V
Wave Soldering Temperature for 3 Seconds (at a 2-mm distance from the body)	250	250	250	°C

a. Duty factor = 10%, frequency = 1 kHz, T_A = 25°C.

b. Derate linearly as shown in Figure 4.

c. Derate linearly as shown in Figure 8.

d. Derate linearly as shown in Figure 12.

e. Reverse voltage is for LED testing purposes and is not recommended to be used as an application condition.

Electrical/Optical Characteristics at T_A = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Red (HDSP-521E, HDSP-523E)						
Luminous Intensity/Segment (Average per Segment)[a, b, c]	I_V	5.13	7.30	—	mcd	I_F = 10 mA
Forward Voltage/Segment or DP[d]	V_F	—	1.95	2.50	V	I_F = 20 mA
Peak Wavelength	λ_P	—	633	—	nm	—
Dominant Wavelength[e]	λ_d	—	622	—	nm	—
Reverse Voltage/Segment or DP[f]	V_R	5	—	—	V	I_R = 100 µA
Green (HDSP-521G, HDSP-523G)						
Luminous Intensity/Segment (Average per Segment)[a, b, c]	I_V	2.28	4.30	—	mcd	I_F = 10 mA
Forward Voltage/Segment or DP[d]	V_F	—	2.10	2.50	V	I_F = 20 mA
Peak Wavelength	λ_P	—	572	—	nm	—
Dominant Wavelength[e]	λ_d	—	570	—	nm	—
Reverse Voltage/Segment or DP[f]	V_R	5	—	—	V	I_R = 100 µA

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Yellow (HDSP-521Y, HDSP-523Y)						
Luminous Intensity/Segment (Average per Segment)[a, b, c]	I_V	2.28	2.70	—	—	I_F = 10 mA
Forward Voltage/Segment or DP[d]	V_F	—	2.10	2.50	V	I_F = 20 mA
Peak Wavelength	λ_P	—	592	—	nm	—
Dominant Wavelength[e]	λ_d	—	588	—	nm	—
Reverse Voltage/Segment or DP[f]	V_R	5	—	—	V	I_R = 100 µA

a. The luminous intensity, I_V, is measured at the mechanical axis of the package.

b. The optical axis is closely aligned with the mechanical axis of the package.

c. Tolerance is ±15%.

d. Forward voltage tolerance is ±0.1V.

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

f. Reverse voltage is for product testing only. Long-term reverse bias is not recommended for end applications.

Intensity Bin Limits (mcd at 10 mA)

Red

I_V Bin Category	Min.	Max.
I	5.13	7.69
J	7.69	11.54
K	11.54	17.31

Tolerance for each bin limit is ±15%.

Green

I_V Bin Category	Min.	Max.
G	2.28	3.42
H	3.42	5.13
I	5.13	7.69

Tolerance for each bin limit is ±15%.

Yellow

I_V Bin Category	Min.	Max.
G	2.28	3.42
H	3.42	5.13
I	5.13	7.69

Tolerance for each bin limit is ±15%.

Color Categories (Dominant Wavelength)

Color	Bin	Dominant Wavelength (nm)	
		Min.	Max.
Green	3	570.50	573.50
	2	573.50	576.50
Yellow	2	587.00	589.50
	3	584.50	587.00

Tolerance for each bin limit is ±1 nm.

Red

Figure 1: Relative Intensity vs. Wavelength

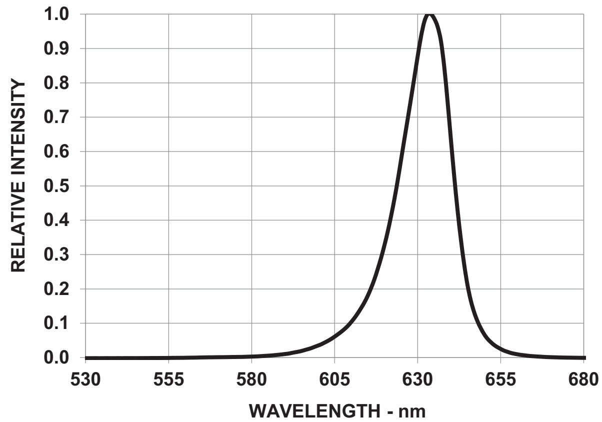


Figure 2: Forward Current vs. Forward Voltage

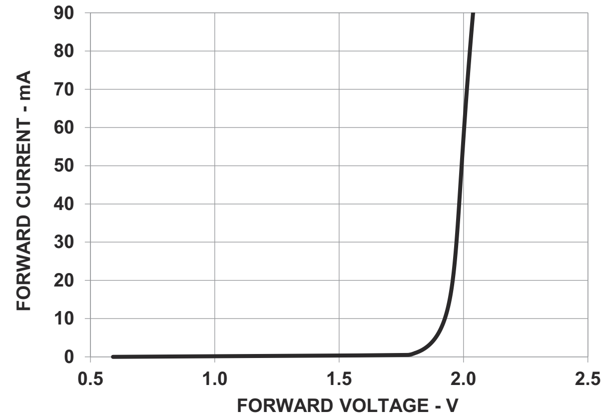


Figure 3: Relative Luminous Intensity vs. Forward Current

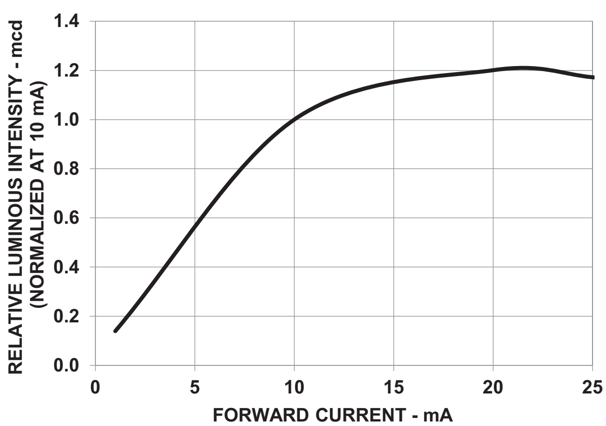
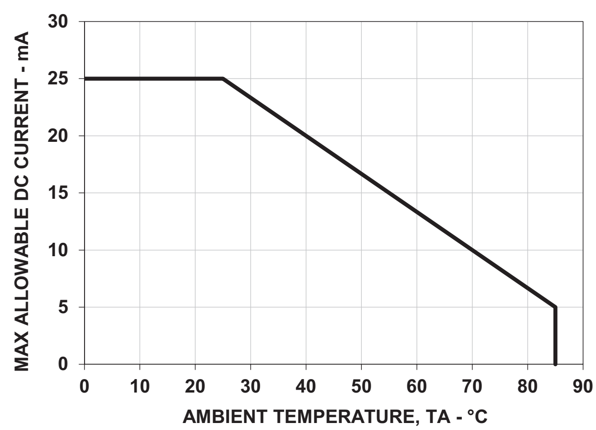


Figure 4: Maximum Forward Current vs. Ambient Temperature



Green

Figure 5: Relative Intensity vs. Wavelength

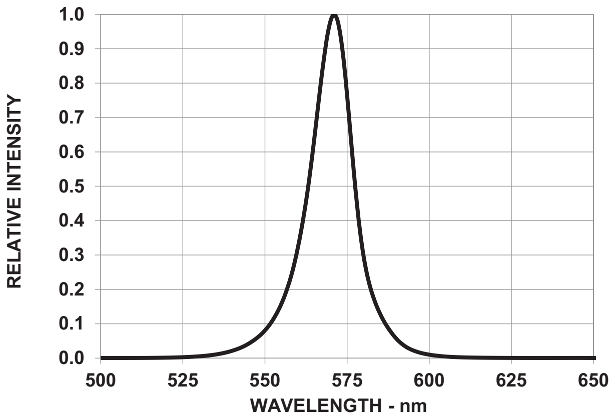


Figure 6: Forward Current vs. Forward Voltage

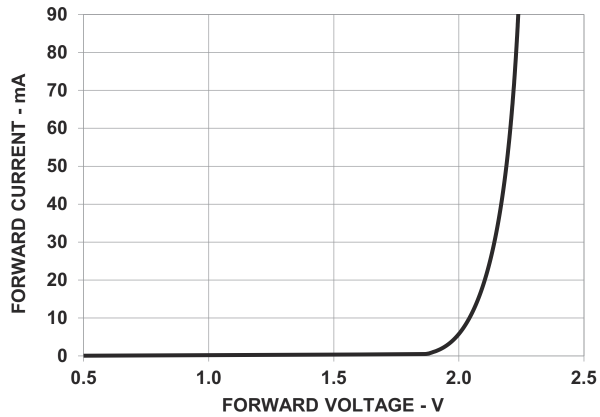


Figure 7: Relative Luminous Intensity vs. Forward Current

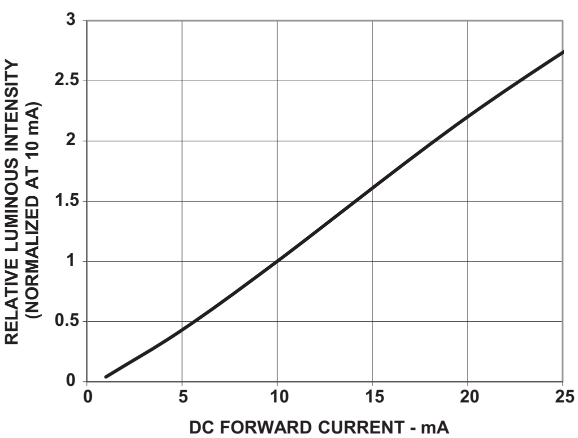
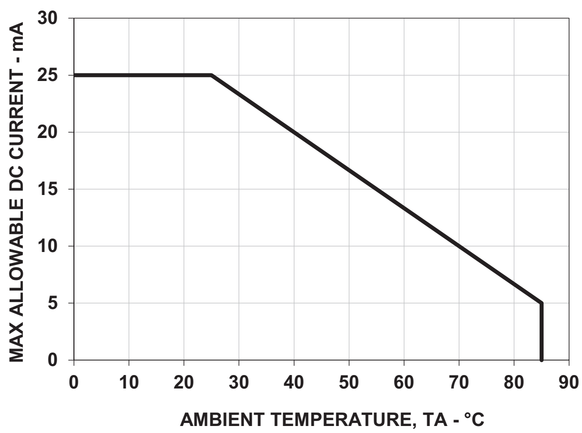


Figure 8: Maximum Forward Current vs. Ambient Temperature



Yellow

Figure 9: Relative Intensity vs. Wavelength

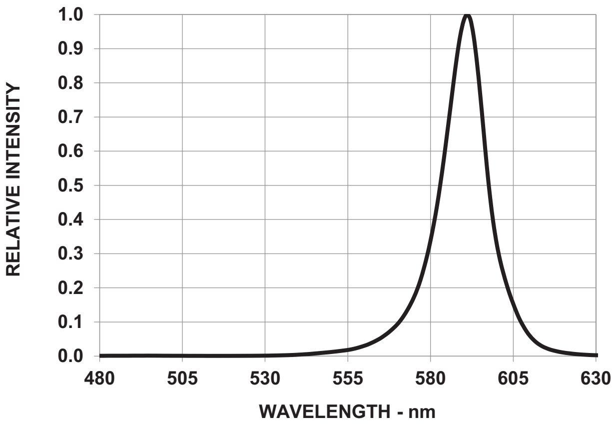


Figure 10: Forward Current vs. Forward Voltage

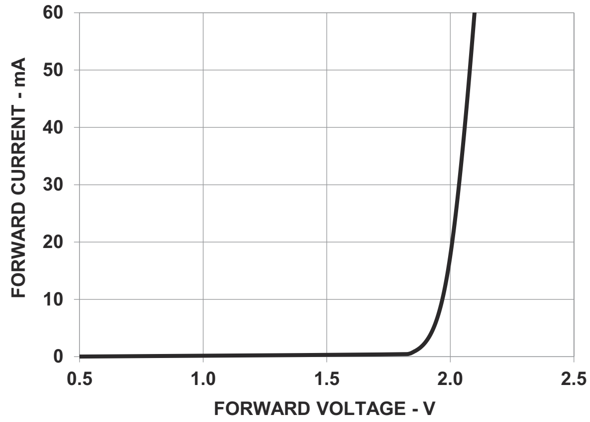


Figure 11: Relative Luminous Intensity vs. Forward Current

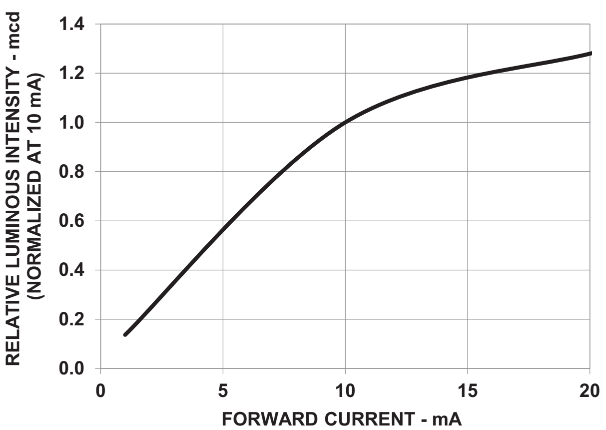
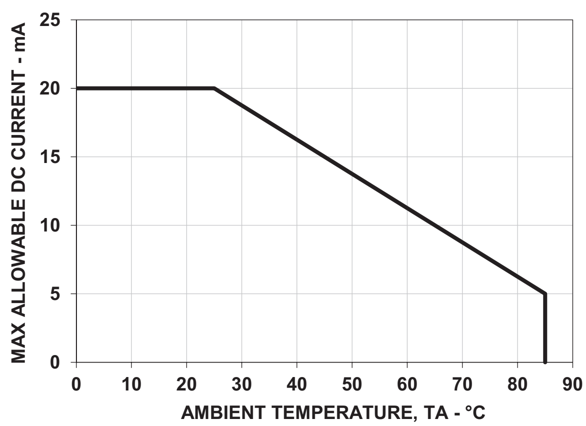


Figure 12: Maximum Forward Current vs. Ambient Temperature

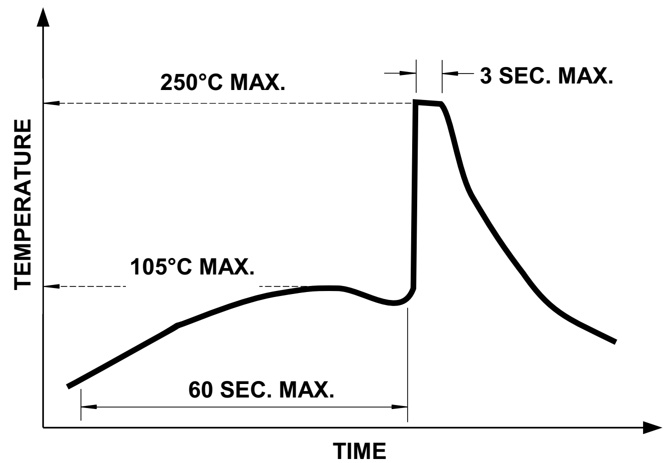


Precautionary Notes

Soldering and Handling Precautions

- Set and maintain the wave soldering parameters according to the recommended temperature and dwell time. Perform daily checks on the profile to ensure that it conforms to the recommended conditions. Exceeding these conditions will overstress the LEDs and cause premature failures.
- Use only bottom preheaters to reduce thermal stress experienced by the LEDs.
- Recalibrate the soldering profile before loading a new type of PCB. A PCB with a different size and design (component density) will have a different heat capacity and might cause a change in the temperature experienced by the PCB if the same wave soldering setting is used.
- Do not perform wave soldering more than once.
- Any alignment fixture used during wave soldering must be loosely fitted and must not apply stress on the LEDs. Use a nonmetal material as it absorbs less heat during the wave soldering process.
- At elevated temperatures, the LEDs are more susceptible to mechanical stress. Allow the PCB to sufficiently cool to room temperature before handling. Do not apply stress to the LED when it is hot.
- Use wave soldering to solder the LED. Use hand soldering only for rework or touch-up if unavoidable, but it must be strictly controlled to following conditions:
  - Soldering iron tip temperature = 315°C maximum
  - Soldering duration = 2 seconds maximum
  - Number of cycles = 1 only
  - Power of soldering iron = 50W maximum
- For ESD sensitive devices, apply proper ESD precautions at the soldering station. Use only an ESD-safe soldering iron.
- 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 are affected by hand soldering.
- Keep the heat source at least 1.6 mm away from the LED body during soldering.
- Design an appropriate hole size to avoid problems during insertion.
- Do not use cleaning agents from the ketone family (acetone, methyl ethylketone, and so on) or from the chlorinated hydrocarbon family (methylene chloride, trichloroethylene, carbon tetrachloride, and so on) to clean the LED displays. All of these solvents attack or dissolve the encapsulating epoxies used to form the package of plastic LED parts.
- For the purposes of cleaning, wash with DI water only. Perform the cleaning process at room temperature only. Clear any water or moisture from the LED display immediately after washing.
- Use *No clean* solder paste for soldering.

Figure 13: Recommended Wave Soldering Profile



NOTE: The measurements are performed with a thermocouple mounted at the bottom of the PCB.

Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperature as stated in this data sheet. Use constant current driving to ensure consistent performance.
- The circuit design must cater to the entire 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 may result in a larger variation in performance (such as 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.
- 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 rain, water, dust, oil, corrosive gases, external mechanical stresses, and so on.

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.

Disclaimer

Broadcom's products and software are not specifically designed, manufactured, or authorized for sale as parts, components, or assemblies for the planning, construction, maintenance, or direct operation of a nuclear facility or for use in medical devices or applications. The customer is solely responsible, and waives all rights to make claims against Broadcom or its suppliers, for all loss, damage, expense, or liability in connection with such use.

BROADCOM®

Lead (Pb) Free
RoHS Compliant