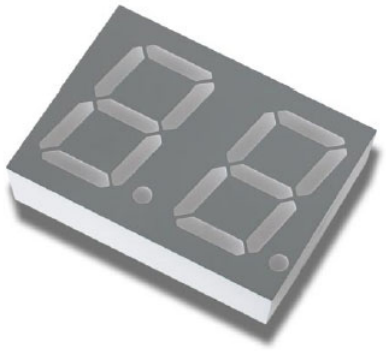
Data Sheet

HDSP-521A/523A

14.22-mm (0.56-in.) Dual-Digit General-Purpose Seven-Segment Display



Description

The Broadcom® 14.22-mm (0.56-in.) LED dual-digit seven-segment displays use an industry-standard size package and pinout. The device is available in either common anode or common cathode. These gray-face displays are suitable for indoor use.

Devices

AlInGaP Deep Red	Description
HDSP-521A	Common Anode Right-Hand Decimal
HDSP-523A	Common Cathode Right-Hand Decimal

Features

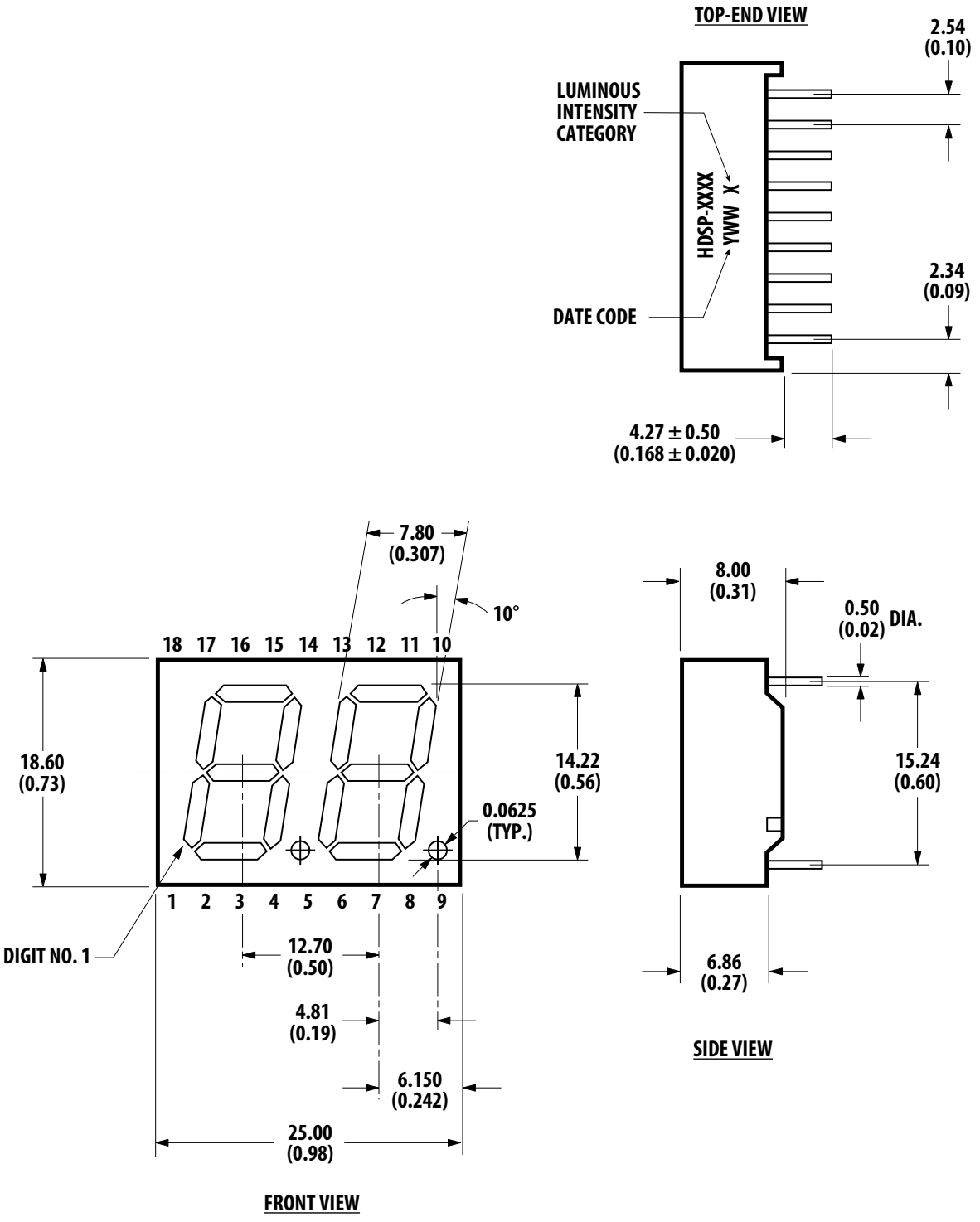
- Industry-standard size
- Industry-standard pinout:
  14.22-mm (0.56-in.) DIP lead on 2.54 mm
- AlInGaP deep red
- Excellent appearance:
  Evenly lighted segments gray package gives an optimum contrast ± 50-ft. viewing angle
- Design flexibility:
  Common anode right-hand decimal point or common cathode right-hand decimal point

Applications

- Suitable for indoor use
- Not recommended for industrial applications, that is operating temperature requirements exceeding +85°C or below –40°C[1]
- Extreme temperature cycling not recommended

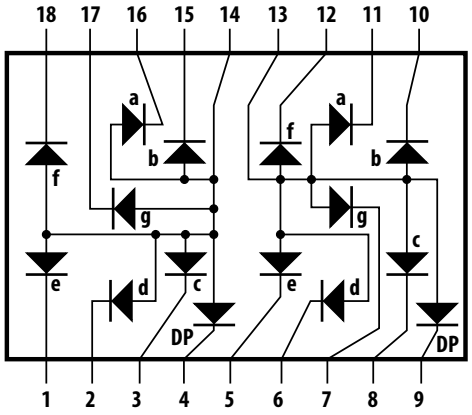
1. For additional details, contact your local Broadcom sales office or an authorized distributor.

Package Dimensions

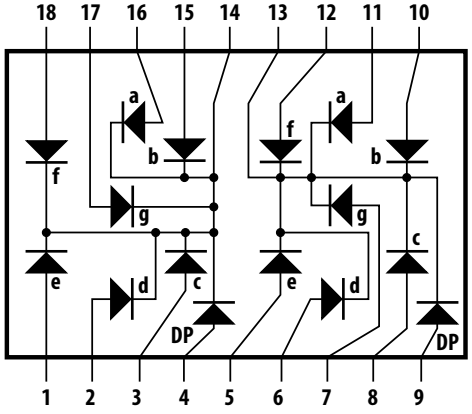


NOTES:
1. **ALL DIMENSIONS ARE IN MILLIMETERS (INCHES).**
2. **TOLERANCE IS 0.25 mm (0.01 INCH) UNLESS OTHERWISE STATED.**

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	Deep Red HDSP-52xA	Units
Power Dissipation Segment	52	mW
Forward Current Segment	20[a]	mA
Peak Forward Current per Segment (Duty Factor = 10%, Frequency = 1 kHz)	60	mA
Operating Temperature Range	–40 to +85	°C
Storage Temperature Range	–40 to +85	°C
Reverse Voltage per Segment or DP	Not designed for reverse bias operation	
Wave Soldering Temperature for 3 seconds[b] (at a 2-mm distance from the body)	250	°C

a. Derate linearly as shown in Figure 4.

b. Not recommended to be soldered more than twice. The minimum interval between solderings is 15 minutes. The total soldering time must not exceed 5 seconds.

Electrical/Optical Characteristics at T_A = 25°C: Deep Red

Device	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
HDSP-521A, HDSP-523A	Luminous Intensity/Segment (Average per Segment)[a, b, c]	I_V	3.201	3.66	—	mcd	I_F = 5 mA
			—	6.500	—	mcd	I_F = 10 mA
	Forward Voltage/Segment[d]	V_F	—	2.0	2.6	V	I_F = 20 mA
	Peak Wavelength	λ_P	—	660	—	nm	
	Dominant Wavelength[e]	λ_d	—	640	—	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. Indicates the product final test condition. Long-term reverse bias is not recommended.

Intensity Bin Limits (mcd at 10 mA)

Bin Name	Deep Red	
	Min.[a]	Max.[a]
J	3.201	5.050
K	5.051	8.000
L	8.001	12.650

a. Tolerance for each bin limit is ± 15%.

AlInGaP Deep Red

Figure 1: Spectral Power Distribution

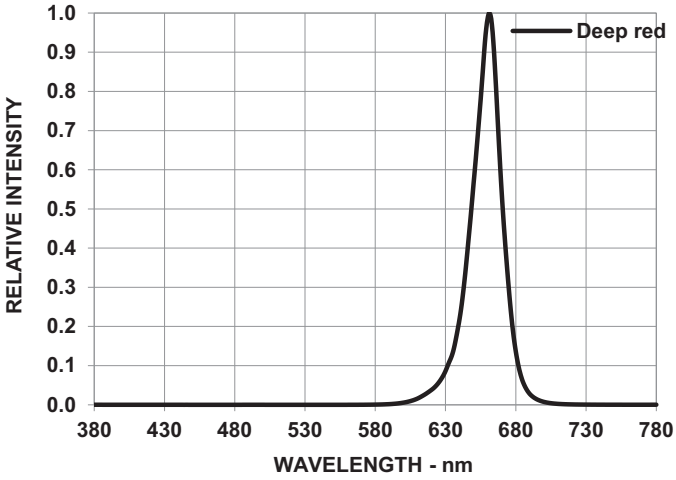


Figure 2: Forward Current vs. Forward Voltage

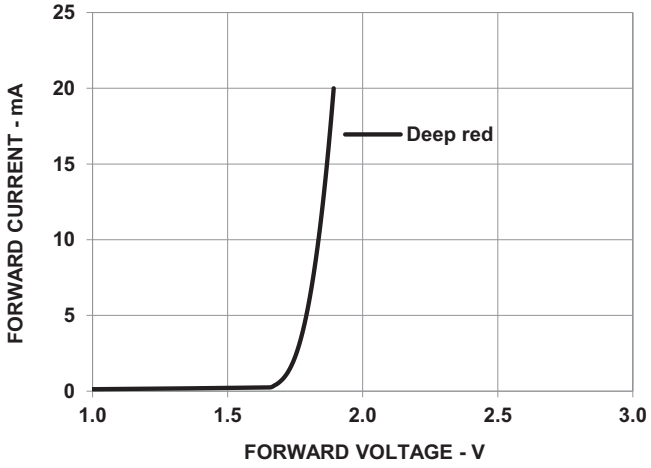


Figure 3: Relative Luminous Intensity vs. Forward Current

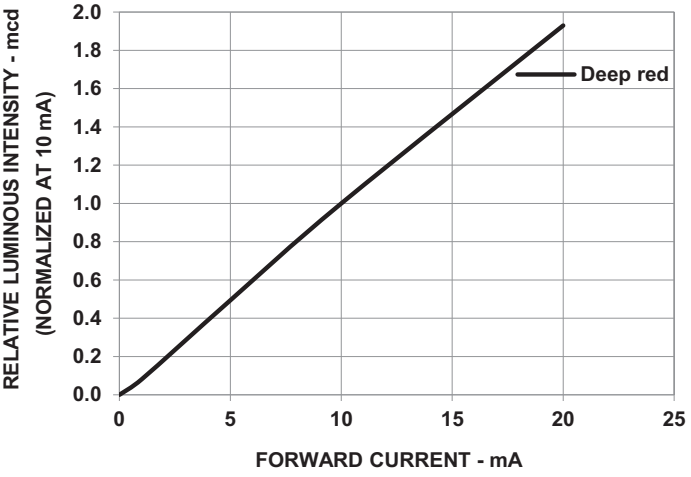
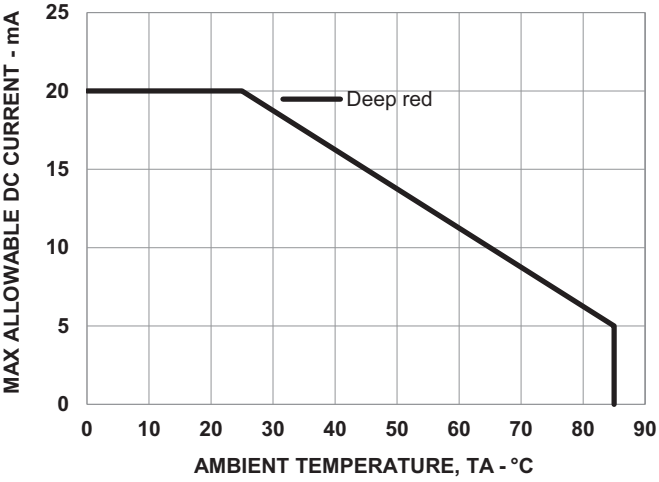


Figure 4: Maximum Forward Current vs. Ambient Temperature

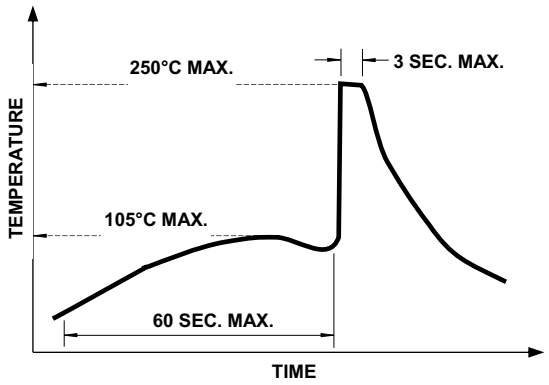


Precautionary Notes

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 temperature experienced by the PCB if the same wave soldering setting is used.
- Do not perform wave soldering more than once.
- Loosely fit any alignment fixture used during wave soldering, and do not apply stress on the LEDs. Use a nonmetal material because it will absorb less heat during the wave soldering process.
- At elevated temperatures, the LEDs are more susceptible to mechanical stress. Allow the PCB to be sufficiently cooled 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 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.
- 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) and 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 cleaning, wash with DI water only. The cleaning process should take place at room temperature only. Clear any water or moisture from the LED display immediately after washing.
- Use *No clean* solder paste for soldering.

Figure 5: Recommended Wave Soldering Profile



NOTE: Refers to measurements 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. Constant current driving is recommended 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 can 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.
- 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.

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RoHS Compliant