BROADCOM®

Data Sheet

HDSP-301x/303x Series
HDSP-561x/563x Series

10-mm and 13-mm Slim Font Seven-Segment Displays

Description

The Broadcom® HDSP-301x/303x Series and HDSP-561x/563x Series slim font seven-segment displays incorporate a slim font character design. This slim font features narrow width, specially mitered segments to give a fuller appearance to the illuminated character. Faces of these displays are painted a neutral gray for enhanced on/off contrast.

All devices are available in either common anode or common cathode configuration with right hand decimal point.

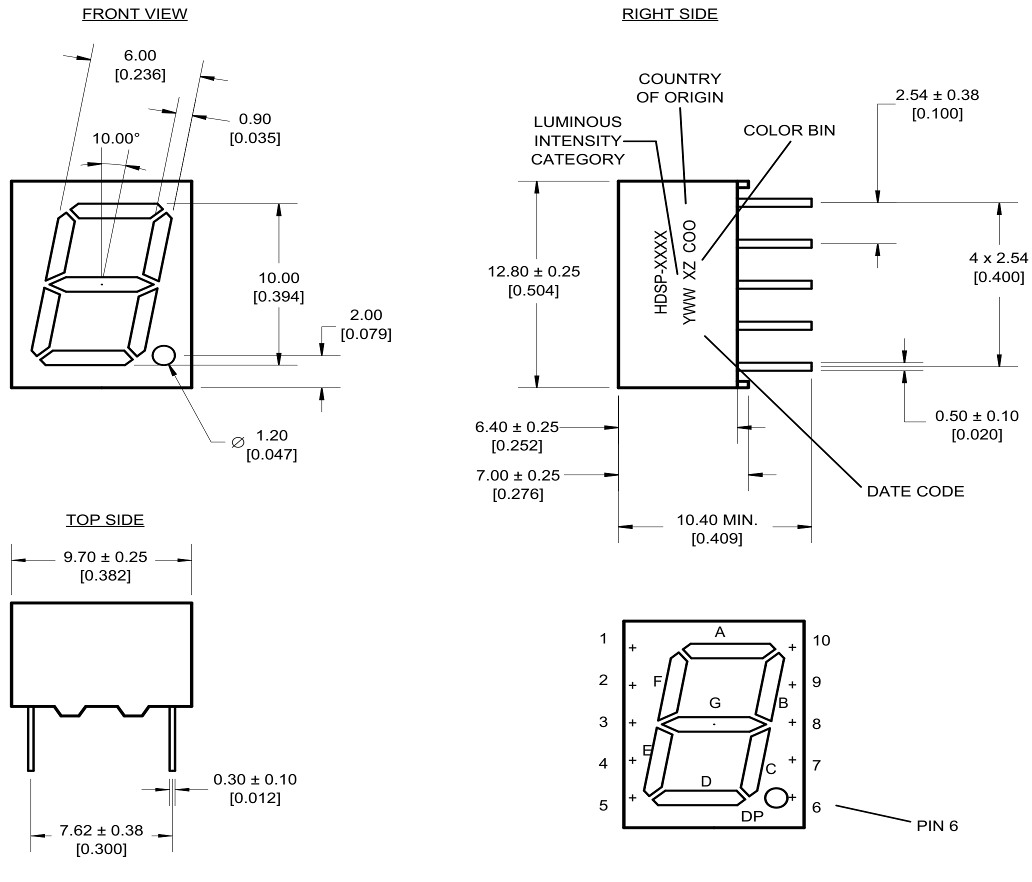
Features

- Excellent appearance
- Slim font design
- Mitered corners, evenly illuminated segments
- Gray face for optimum on/off contrast
- Choice of colors: AlInGaP Red, AlInGaP Green, AlInGaP Yellow, and AlInGaP Deep Red
- Choice of character size: 10 mm and 13 mm
- Characterized for luminous intensity

Ordering Information

AlInGaP Red HDSP-	AlInGaP Green HDSP-	AlInGaP Yellow HDSP-	AlInGaP Deep Red HDSP-	Description
301E	301G	301Y	301A	Common Anode, 10-mm Display
303E	303G	303Y	303A	Common Cathode, 10-mm Display
561E	561G	561Y	561A	Common Anode, 13-mm Display
563E	563G	563Y	563A	Common Cathode, 13-mm Display

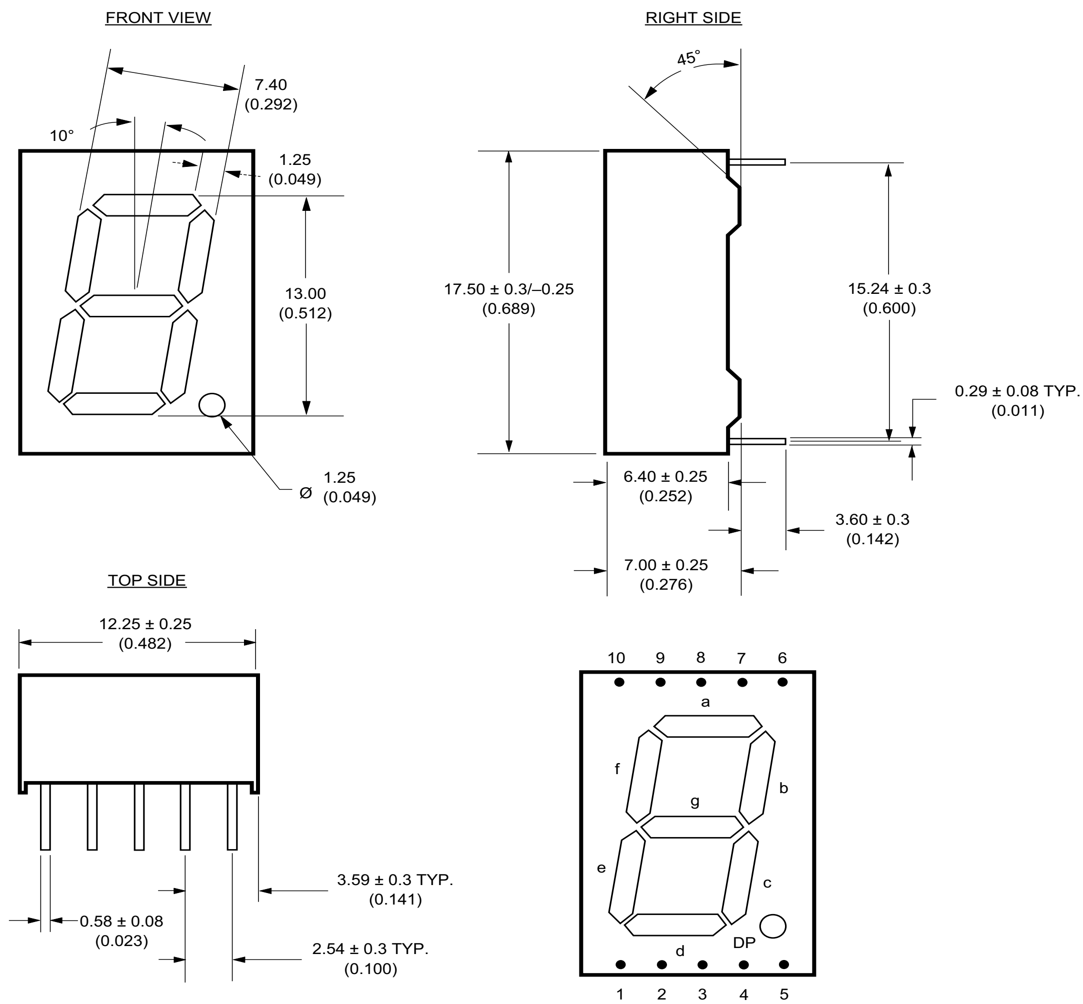
Figure 1: HDSP-301x/303x Series



Notes:
All dimensions are in millimeters (inches).
Tolerance is 0.25 mm (0.01 inch) unless otherwise stated.

Pin	Function
1	G
2	F
3	Common A/C
4	E
5	D
6	DP
7	C
8	Common A/C
9	B
10	A

Figure 2: HDSP-561x/563x Series



Notes:
All dimensions are in millimeters (inches).
Tolerance is 0.25 mm (0.01 inch) unless otherwise stated.

Pin	Function
1	E
2	D
3	Common A/C
4	C
5	DP
6	B
7	A
8	Common A/C
9	F
10	G

Absolute Maximum Ratings

Description	Red	Green	Yellow	Deep Red	Unit
Power Dissipation per Segment or DP	62.5	62.5	50	52	mW
Peak Forward Current per Segment or DP[a]	90	90	60	60	mA
DC Forward Current per Segment or DP[b]	25	25	20	20	mA
Operating Temperature Range	–40 to +85	–40 to +85	–40 to +85	–40 to +85	°C
Storage Temperature Range	–40 to +85	–40 to +85	–40 to +85	–40 to +85	°C
Reverse Voltage per Segment or DP[c]	5				
Wave Soldering Temperature for 3 Seconds 1.59 mm Below Body	250	250	250	250	°C

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

b. Derate linearly as shown in Figure 6 (Red), Figure 10 (Green), Figure 14 (Deep Red), and Figure 18 (Yellow).

c. 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.	Unit	Test Conditions
Red **Device Series HDSP-301/303E**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	1.80	3.60	—	mcd	I_F = 10 mA
Forward Voltage/Segment[d]	V_F	—	1.95	2.50	V	I_F = 20 mA
Peak Wavelength	λ_p	—	633	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	622	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5V
Red **Device Series HDSP-561/563E**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	5.05	8.00	—	mcd	I_F = 10 mA
Forward Voltage/Segment[d]	V_F	—	1.95	2.50	V	I_F = 20 mA
Peak Wavelength	λ_p	—	633	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	622	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5V
Green **Device Series HDSP-301/303G**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	2.80	4.30	—	mcd	I_F = 10 mA
Forward Voltage/Segment[d]	V_F	—	2.10	2.50	V	I_F = 20 mA
Peak Wavelength	λ_p	—	572	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	570	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Green **Device Series HDSP-561/563G**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	5.05	8.00	—	mcd	I_F = 10 mA
Forward Voltage/Segment[d]	V_F	—	2.10	2.50	V	I_F = 20 mA
Peak Wavelength	λ_p	—	572	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	570	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5V
Yellow **Device Series HDSP-301/303Y**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	1.10	1.90	—	mcd	I_F = 10 mA
Forward Voltage/Segment[d]	V_F	—	2.10	2.50	V	I_F = 20 mA
Peak Wavelength	λ_p	—	592	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	588	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5V
Yellow **Device Series HDSP-561/563Y**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	1.80	2.80	—	mcd	I_F = 10 mA
Forward Voltage/Segment[d]	V_F	—	2.10	2.50	V	I_F = 20 mA
Peak Wavelength	λ_p	—	592	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	588	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5V
Deep Red **Device Series HDSP-301/303A**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	0.28	0.45	—	mcd	I_F = 1 mA
Forward Voltage/Segment[d]	V_F	—	2.00	2.60	V	I_F = 20 mA
Peak Wavelength	λ_p	—	660	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	640	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5 V
Deep Red **Device Series HDSP-561/563A**						
Luminous Intensity/Segment (Digit Average)[a,b,c]	I_V	0.28	0.45	—	mcd	I_F = 1 mA
Forward Voltage/Segment[d]	V_F	—	2.00	2.60	V	I_F = 20 mA
Peak Wavelength	λ_p	—	660	—	nm	I_F = 20 mA
Dominant Wavelength[e]	λ_d	—	640	—	nm	I_F = 20 mA
Reverse Current[f]	I_R	—	—	100	µA	V_R = 5 V

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 product final test condition. Long-term reverse bias is not recommended.

Intensity Bin Limits (mcd)

Red (HDSP-30xE)/Yellow (HDSP-56xY)

IV Bin Category	Min.	Max.
K	1.800	3.600
L	2.800	5.600
M	4.500	9.000

Yellow (HDSP-30xY)

IV Bin Category	Min.	Max.
I	1.100	2.200
K	1.800	3.600
L	2.800	5.600

Green (HDSP-30xG)

IV Bin Category	Min.	Max.
L	2.800	5.600
M	4.500	9.000
N	7.000	15.000

Deep Red (HDSP-30xA/HDSP-56xA)

IV Bin Category	Min.	Max.
F	0.280	0.560
G	0.450	0.900
H	0.700	1.400

Red (HDSP-56xE)/Green (HDSP-56xG)

IV Bin Category	Min.	Max.
M	5.050	8.000
N	8.001	12.650
O	12.651	20.000

Tolerance for each bin limit is ±15%.

Color Categories

Color	Bin	Dominant Wavelength (nm)	
		Min.	Max.
Green	3	570.00	574.50
	4	567.00	571.50
Yellow	2	586.50	590.00
	3	584.00	587.50

Red

Figure 3: Relative Intensity vs. Wavelength

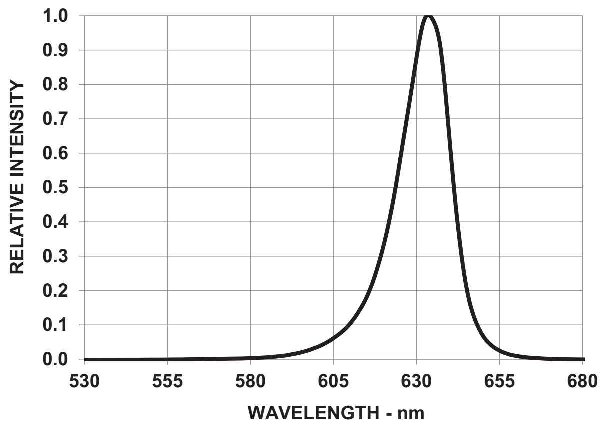


Figure 4: Forward Current vs. Forward Voltage

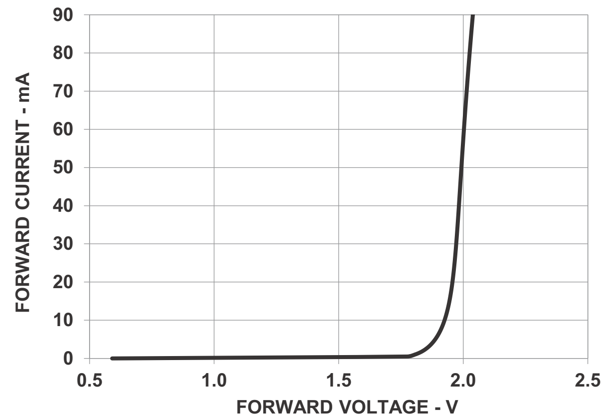


Figure 5: Relative Luminous Intensity vs. Forward Current

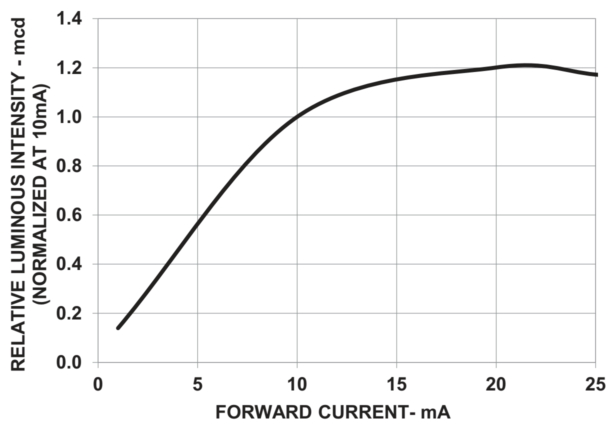
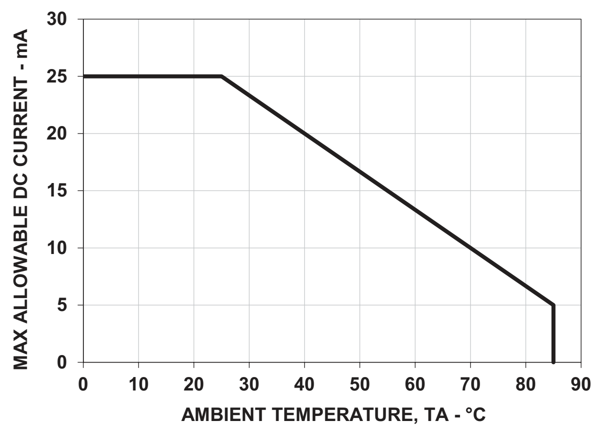


Figure 6: Maximum Forward Current vs. Ambient Temperature



Green

Figure 7: Relative Intensity vs. Wavelength

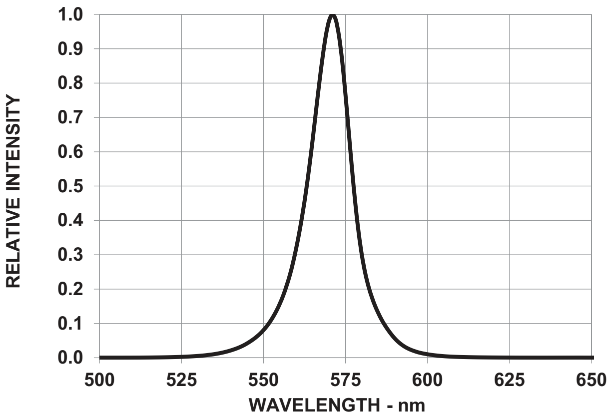


Figure 8: Forward Current vs. Forward Voltage

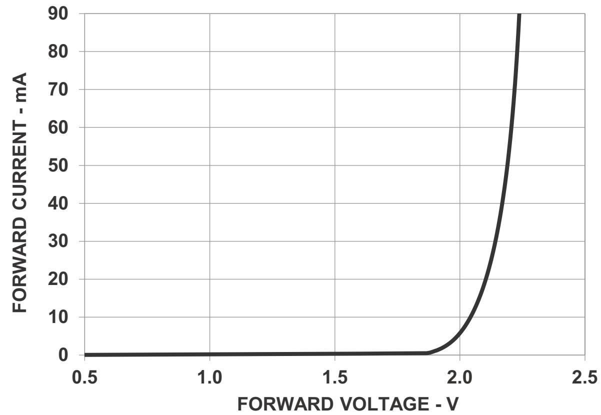


Figure 9: Relative Luminous Intensity vs. Forward Current

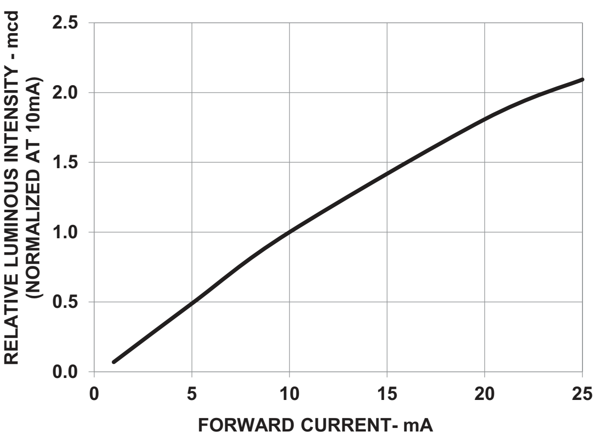
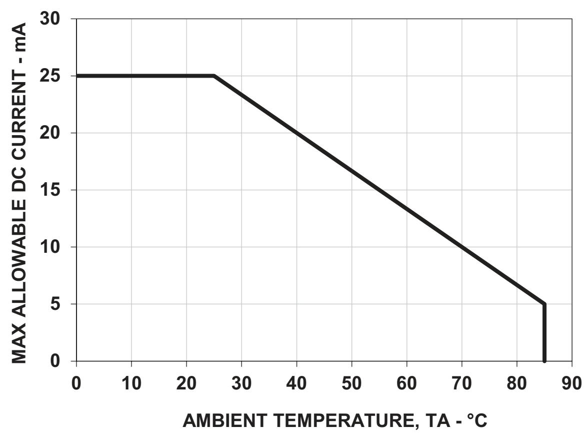


Figure 10: Maximum Forward Current vs. Ambient Temperature



Deep Red

Figure 11: Spectral Power Distribution

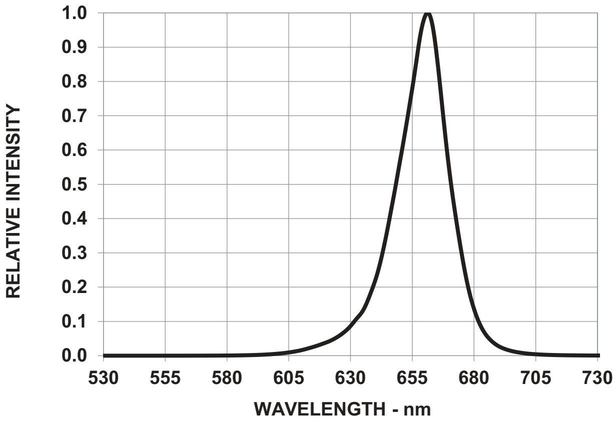


Figure 12: Forward Current vs. Forward Voltage

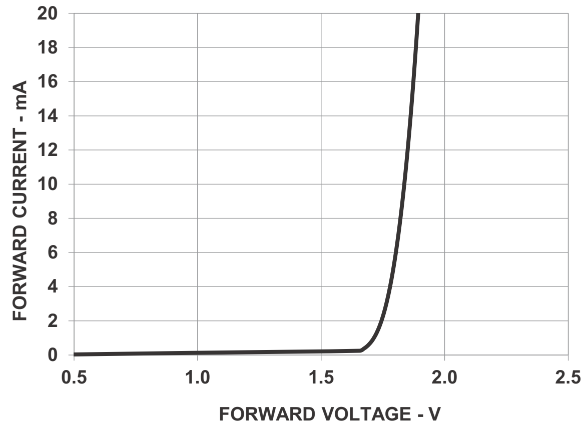


Figure 13: Relative Luminous Intensity vs. Forward Current

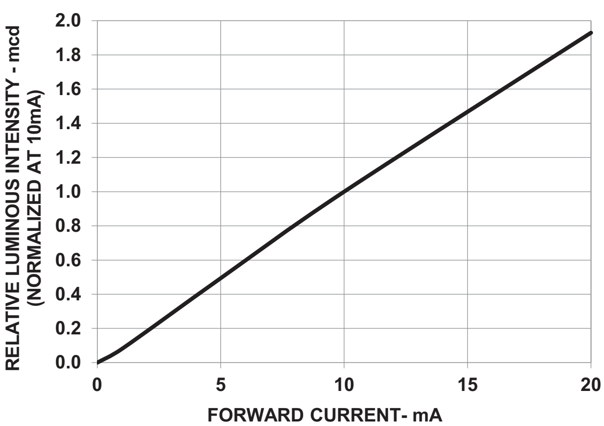
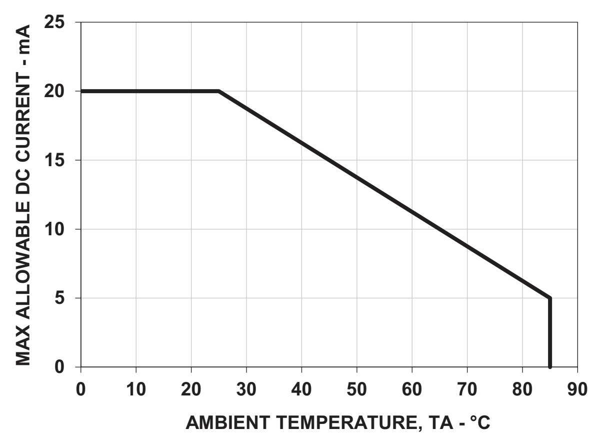


Figure 14: Maximum Forward Current vs. Ambient Temperature



Yellow

Figure 15: Relative Intensity vs. Wavelength

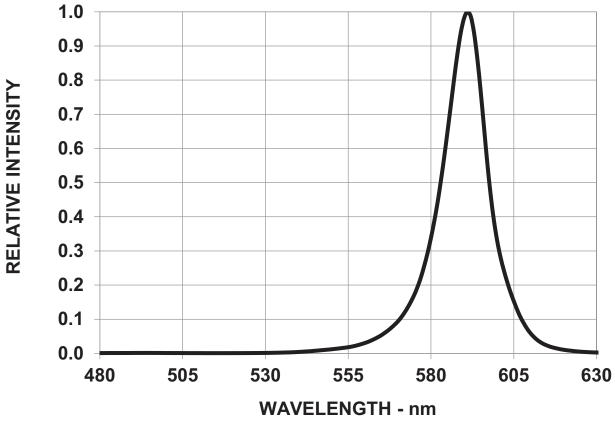


Figure 16: Forward Current vs. Forward Voltage

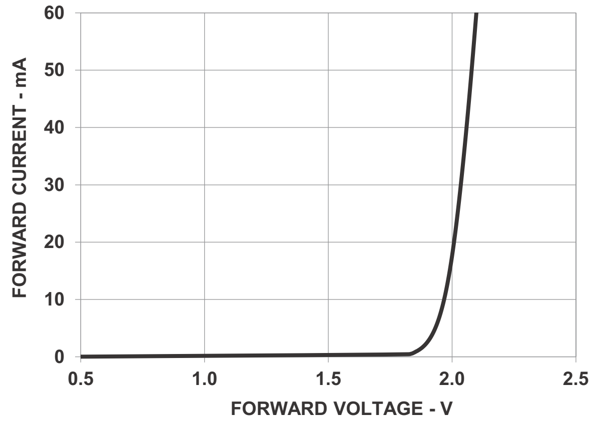


Figure 17: Relative Luminous Intensity vs. Forward Current

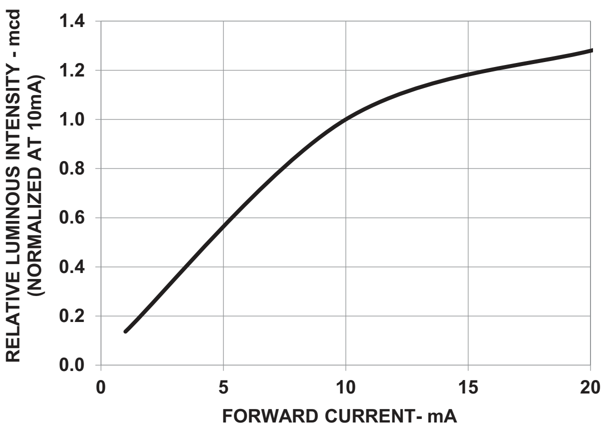
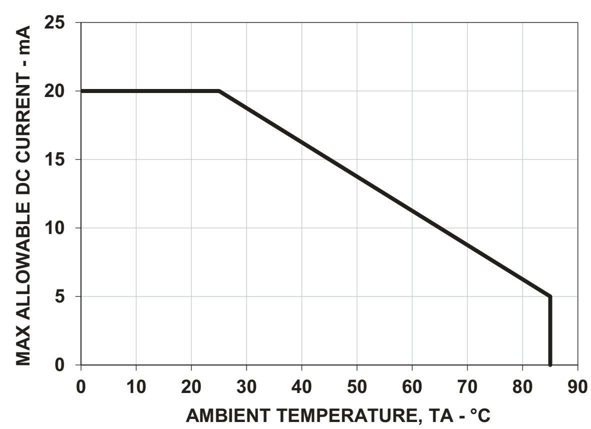


Figure 18: Maximum Forward Current vs. Ambient Temperature

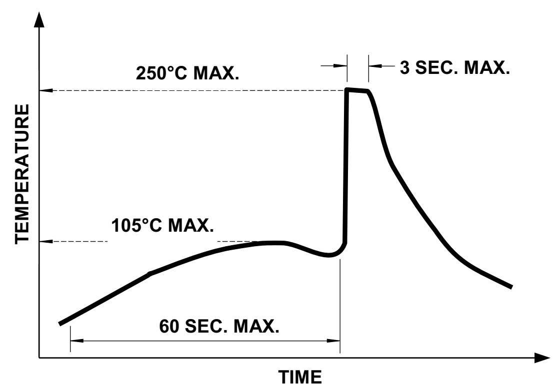


Precautionary Notes

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 is always conforming to the recommended conditions. Exceeding these conditions will over-stress 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 a PCB. PCBs with different sizes and designs (component density) will have different heat capacities 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.
- Any alignment fixture used during wave soldering must be loosely fitted and must not apply stress on the LEDs. Use non-metal 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 cycle = 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 is 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.
- 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) are not recommended for cleaning the LED displays. All of these various solvents attack or dissolve the encapsulating epoxies used to form the package of plastic LED parts.
- For the purpose of 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 of *No clean* solder paste is recommended for soldering.

Figure 19: Recommended Wave Soldering Profile



NOTE: Figure 19 refers to measurements with thermocouple mounted at the bottom of the PCB.

Application Precautions

- The drive current of the LED must not exceed the maximum allowable limit across temperatures as stated in the data sheet. Constant current driving is recommended to ensure consistent performance.
- Circuit design must cater to the whole 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.
- 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 change 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 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 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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