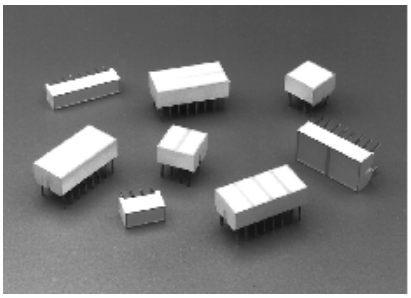
Data Sheet

# HLCP-A100/-B100/-C100/-D100/-E100/-G100/-H100, HLMP-2300/-2350/-2400/-2450/-2500/-2550, HLMP-2600/-2620/-2655/-2670/-2685, HLMP-2700/-2720/-2755/-2770/-2785, HLMP-2800/-2820/-2855/-2870/-2885, HLMP-2950/-2965
# LED Light Bars



## Description

The Broadcom® HLCP-x100 and HLMP-2xxx series light bars are rectangular light sources designed for a variety of applications where a large bright source of light is required. These light bars are configured in single-in-line and dual-in-line packages that contain either single or segmented light-emitting areas.

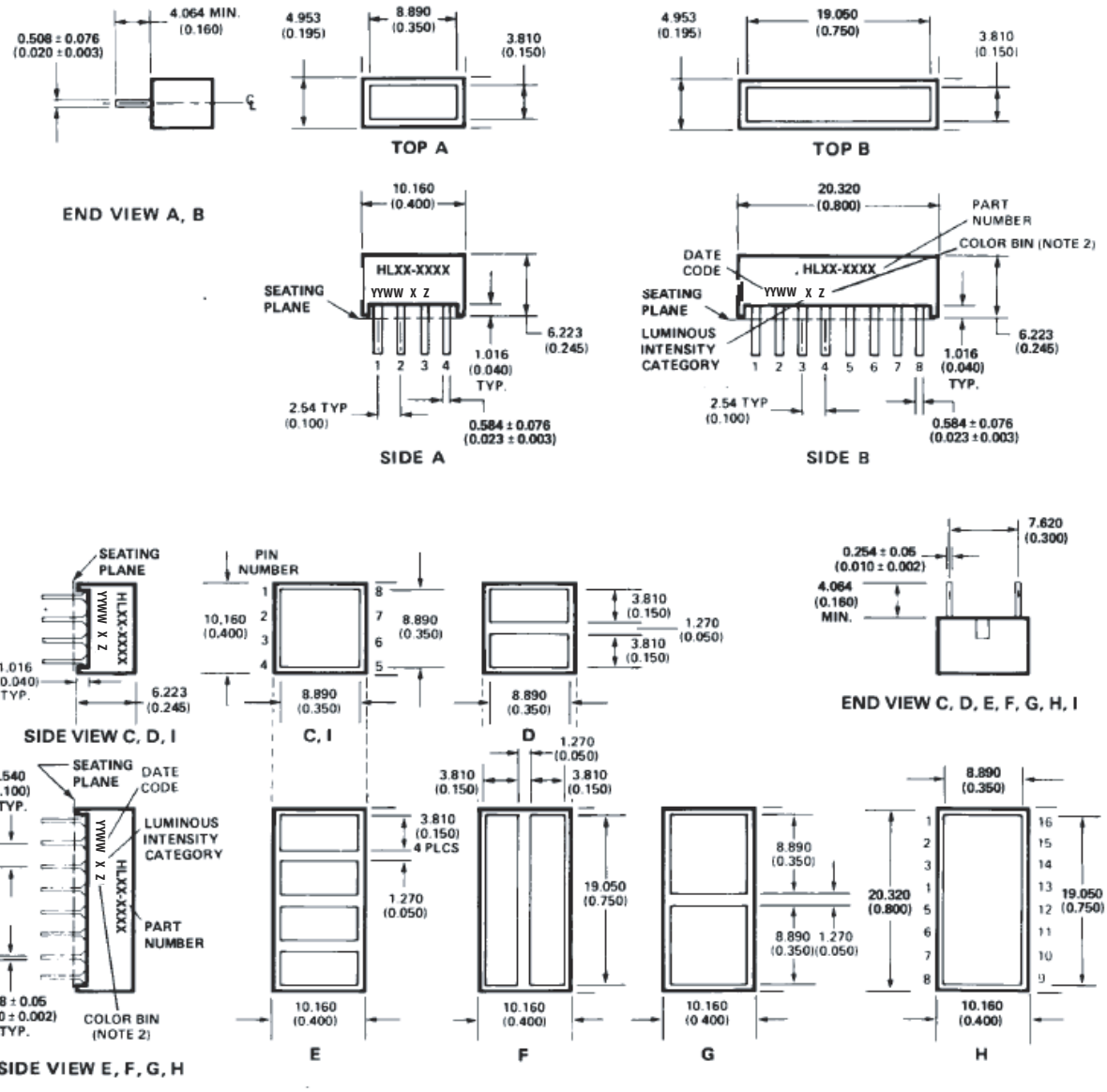
## Features

- Large bright, uniform light-emitting areas
- Choice of colors
- Categorized for light output
- Yellow and green categorized for dominant wavelength
- Excellent ON-OFF contrast
- X-Y stackable
- Flush mountable
- Can be used with panel and legend mounts
- Light-emitting surface suitable for legend attachment per Application Note 1012
- HLCP-x100 series designed for low current operation
- Bicolor devices available

## Applications

- Business machine message annunciators
- Telecommunications indicators
- Front panel process status indicators
- PC board identifiers
- Bar graphs

# Package Drawing

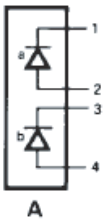



**NOTES:**

**1. DIMENSIONS IN MILLIMETRES (INCHES). TOLERANCES ±0.25 mm (±0.010 IN.) UNLESS OTHERWISE INDICATED.**

**2. FOR YELLOW AND GREEN DEVICES ONLY.**

# Internal Circuit Diagram

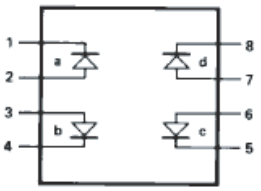



A

| PIN FUNCTION | | |
|---|---|---|
| PIN | A -2300/-2400 -2500/A100 | B -2350/-2450 -2550/B100 |
| 1 | CATHODE a | CATHODE a |
| 2 | ANODE a | ANODE a |
| 3 | CATHODE b | CATHODE b |
| 4 | ANODE b | ANODE b |
| 5 | | CATHODE c |
| 6 | | ANODE c |
| 7 | | CATHODE d |
| 8 | | ANODE d |

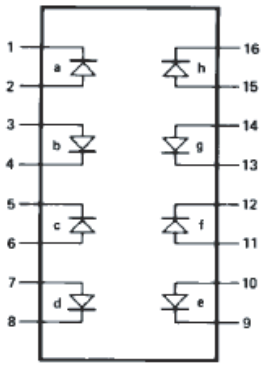



B

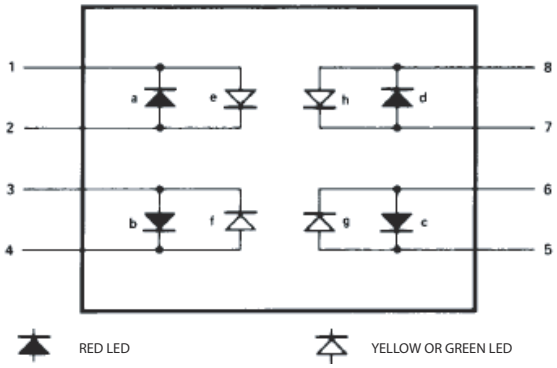



C,D

| PIN | PIN FUNCTION | |
|---|---|---|
| | C, D | E, F, G, H |
| 1 | CATHODE a | CATHODE a |
| 2 | ANODE a | ANODE a |
| 3 | ANODE b | ANODE b |
| 4 | CATHODE b | CATHODE b |
| 5 | CATHODE c | CATHODE c |
| 6 | ANODE c | ANODE c |
| 7 | ANODE d | ANODE d |
| 8 | CATHODE d | CATHODE d |
| 9 | | CATHODE e |
| 10 | | ANODE e |
| 11 | | ANODE f |
| 12 | | CATHODE f |
| 13 | | CATHODE g |
| 14 | | ANODE g |
| 15 | | ANODE h |
| 16 | | CATHODE h |




E,F,G,H




| PIN | PIN FUNCTION | |
|---|---|---|
| | RED | YELLOW/ GREEN |
| 1 | CATHODE a | ANODE e |
| 2 | ANODE a | CATHODE e |
| 3 | ANODE b | CATHODE f |
| 4 | CATHODE b | ANODE f |
| 5 | CATHODE c | ANODE g |
| 6 | ANODE c | CATHODE g |
| 7 | ANODE d | CATHODE h |
| 8 | CATHODE d | ANODE h |

# Device Selection Guide

| Light Bar Part Number | | | | Size of Light Emitting Areas | Number of Light Emitting Areas | Package Outline |
|---|---|---|---|---|---|---|
| HLCP- | HLMP- | | | | | |
| AlInGaP Deep Red | AlInGaP Red | AlInGaP Yellow | AlInGaP Green | | | |
| A100 | 2300 | 2400 | 2500 | 8.89 mm × 3.81 mm (0.350 in. × 0.150 in.) | 1 | A |
| B100 | 2350 | 2450 | 2550 | 19.05 mm × 3.81 mm (0.750 in. × 0.150 in.) | 1 | B |
| D100 | 2600 | 2700 | 2800 | 8.89 mm × 3.81 mm (0.350 in. × 0.150 in.) | 2 | D |
| E100 | 2620 | 2720 | 2820 | 8.89 mm × 3.81 mm (0.350 in. × 0.150 in.) | 4 | E |
| C100 | 2655 | 2755 | 2855 | 8.89 mm × 8.89 mm (0.350 in. × 0.350 in.) | 1 | C |
| G100 | 2670 | 2770 | 2870 | 8.89 mm × 8.89 mm (0.350 in. × 0.350 in.) | 2 | G |
| H100 | 2685 | 2785 | 2885 | 8.89 mm × 19.05 mm (0.350 in. × 0.750 in.) | 1 | H |
| | 2950 | 2950 | — | 8.89 mm × 8.89 mm (0.350 in. × 0.350 in.) | Bicolor | I |
| | 2965 | — | 2965 | 8.89 mm × 8.89 mm (0.350 in. × 0.350 in.) | Bicolor | I |

# Absolute Maximum Ratings

| Parameter | Deep Red HLCP-x100 Series | Red HLMP-2300/ 2600/29xx Series | Yellow HLMP-2400/ 2700/2950 Series | Green HLMP-2500/ 2800/2965 Series | Unit |
|---|---|---|---|---|---|
| Power Dissipation per LED Chip | 37.5 | 78 | 65 | 78 | mW |
| Peak Forward Current per LED Chip[a] | 90 | 90 | 60 | 90 | mA |
| DC Forward Current per LED Chip[b] | 15 | 30 | 25 | 30 | mA |
| Reverse Voltage per LED Chip[c] | 5 | 6 | 6 | 6 | V |
| Operating Temperature Range | –20 to +100 | –40 to +85 | –40 to +85 | –20 to +85 | °C |
| Storage Temperature Range | –40 to +85 | | | | °C |
| Wave Soldering Temperature for 3s (1.60 mm [0.063 in.] below body) | 250 | | | | °C |

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

b. Derate linearly as shown in Figure 4 (deep red), Figure 8 (red), Figure 12 (yellow), and Figure 16 (green).

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

# Electrical/Optical Characteristics ($T_A$ = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| **Deep Red, Device Series HLCP-x100** | | | | | | |
| Luminous Intensity per Lighting-Emitting Area[a, b] | $I_V$ | | — | | mcd | — |
| HLCP-A100/D100/E100 | | 3 | 12 | — | | $I_F$ = 3 mA |
| HLCP-B100/C100/G100 | | 6 | 24 | — | | |
| HLCP-H100 | | 20 | 53 | — | | |
| Peak Wavelength | $\lambda_p$ | — | 656 | — | nm | — |
| Dominant Wavelength[c] | $\lambda_d$ | — | 639 | — | nm | — |
| Forward Voltage per LED[d] | $V_F$ | — | 2.1 | 2.5 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage per LED[e] | $V_R$ | 5 | — | — | V | $I_R$ = 100 µA |
| **Red, Device Series HLMP-2300/2600/2900** | | | | | | |
| Luminous Intensity per Lighting-Emitting Area[a, b] | $I_V$ | | — | | mcd | — |
| HLMP-2300/2600/2620 | | 10 | 50 | — | | $I_F$ = 20 mA |
| HLMP-2350/2655/2670/2950[f] | | 19 | 90 | — | | |
| HLMP-2965[g] | | 19 | 90 | — | | |
| HLMP-2685 | | 33 | 210 | — | | |
| Peak Wavelength | $\lambda_p$ | — | 631 | — | nm | — |
| Dominant Wavelength[c] | $\lambda_d$ | — | 622 | — | nm | — |
| Forward Voltage per LED[d] | $V_F$ | — | 2.05 | 2.6 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage per LED[e] | $V_R$ | 6 | — | — | V | $I_R$ = 100 µA |
| **Yellow, Device Series HLMP-2400/2700/2950** | | | | | | |
| Luminous Intensity per Lighting-Emitting Area[a, b] | $I_V$ | | — | | mcd | — |
| HLMP-2400/2700/2720 | | 6 | 23 | — | | $I_F$ = 20 mA |
| HLMP-2450/2755/2770/2950[f] | | 13 | 45 | — | | |
| HLMP-2785 | | 26 | 90 | — | | |
| Peak Wavelength | $\lambda_p$ | — | 591 | — | nm | — |
| Dominant Wavelength[c] | $\lambda_d$ | — | 588 | — | nm | — |
| Forward Voltage per LED[d] | $V_F$ | — | 2.0 | 2.6 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage per LED[e] | $V_R$ | 6 | — | — | V | $I_R$ = 100 µA |
| **Green, Device Series HLMP-2500/2800/2965** | | | | | | |
| Luminous Intensity per Lighting-Emitting Area[a, b] | $I_V$ | | — | | mcd | — |
| HLMP-2500/2800/2820 | | 8 | 60 | — | | $I_F$ = 20 mA |
| HLMP-2550/2855/2870 | | 17 | 120 | — | | |
| HLMP-2965[g] | | 25 | 120 | — | | |
| HLMP-2885 | | 50 | 300 | — | | |

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Peak Wavelength | $\lambda_p$ | — | 572 | — | nm | — |
| Dominant Wavelength[c] | $\lambda_d$ | — | 571 | — | nm | — |
| Forward Voltage per LED[d] | $V_F$ | — | 2.1 | 2.6 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage per LED[e] | $V_R$ | 6 | — | — | 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. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the device.

d. Forward voltage tolerance is ±0.1V.

e. Typical specification for reference only. Do not exceed absolute maximum ratings, and long-term reverse bias is not recommended.

f. This is a Red/Yellow bicolor light bar. Red electrical/optical characteristics are shown in the Red table. Yellow electrical/optical characteristics are shown in the Yellow table.

g. This is a Red/Green bicolor light bar. Red electrical/optical characteristics are shown in the Red table. Green electrical/optical characteristics are shown in the Green table.

# Part Numbering System

HLCP - xx xx - xx x xx
HLMP - xx xx - xx x xx

**Mechanical Options**[1]
00: No mechanical option

**Color Bin Options**[1,2]
0: No color bin limitation
B: Color bins 2 & 3 (applicable for yellow devices only)
C: Color bins 3 & 4 only (applicable for green devices only)

**Maximum Intensity Bin**[1,2]
0: No maximum intensity bin limitation

**Minimum Intensity Bin**[1,2]
0: No minimum intensity bin limitation

**Device Specific Configuration**[1]
Refer to respective data sheet

**Color**[1]
x1: AlInGaP Deep Red (applicable for HLCP-x100 only)
23: Red
24: Yellow
25: Green
26: Red
27: Yellow
28: Green
29: Bicolor (Red/Yellow) OR (Red/Green)

1. For codes not listed in the figure, refer to the respective data sheet or contact your nearest Broadcom representative for details.
2. Bin options refer to shippable bins for a part number. Color and Intensity Bins are typically restricted to 1 bin per tube (exceptions may apply). Refer to respective data sheet for specific bin limit information.

# Intensity Bin Limits (mcd)

**Table 1: HLMP-2300/2600/2620 Annunciators (0.2 × 0.4 Red), HLCP-A100/D100/E100 (0.2 × 0.4 Deep Red)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| A[a] | 3.00 | 5.60 |
| B | 4.50 | 8.20 |
| C | 6.80 | 12.10 |
| D[b] | 10.10 | 18.50 |
| E | 15.30 | 27.80 |
| F | 22.80 | 45.50 |
| G | 36.90 | 73.80 |
| H | 59.70 | 116.90 |
| I | 95.60 | 187.00 |

a. Minimum category A for Deep Red (-A100/-D100/-E100).

b. Minimum category D for Red (-2300/-2600/-2620).

**Table 2: HLMP-2350/2655/2670 Annunciators (0.2 × 0.8 Red), HLCP-B100/C100/G100 (Deep Red)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| A[a] | 5.40 | 10.90 |
| B | 9.00 | 16.00 |
| C | 13.10 | 24.00 |
| D[b] | 19.70 | 36.10 |
| E | 29.60 | 54.20 |
| F | 44.90 | 88.80 |
| G | 71.90 | 143.80 |
| H | 116.50 | 227.70 |
| I | 186.30 | 364.40 |

a. Minimum category A for Deep Red (-B100/-C100/-G100).

b. Minimum category D for Red (-2350/-2670).

**Table 3: HLMP-2685/HLCP-H100 Annunciators (0.4 × 0.8 Red/ Deep Red)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| A[a] | 10.80 | 22.00 |
| B | 18.00 | 27.10 |
| C | 22.00 | 40.80 |
| D[b] | 33.30 | 61.10 |
| E | 50.00 | 91.80 |
| F | 75.10 | 150.00 |
| G | 121.70 | 243.40 |
| H | 197.10 | 385.40 |
| I | 315.40 | 616.70 |

a. Minimum category A for Deep Red (-H100).

b. Minimum category D for Red (-2685).

**Table 4: HLMP-2400/2700/2720 Annunciators (0.2 × 0.4 Yellow)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| C | 6.10 | 11.20 |
| D | 9.20 | 16.80 |
| E | 13.80 | 25.30 |
| F | 20.70 | 41.40 |
| G | 33.60 | 67.20 |

**Table 5: HLMP-2450/2755/2770 Annunciators (0.2 × 0.8 Yellow and 0.4 x 0.4 Yellow)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| C | 13.00 | 22.00 |
| D | 18.00 | 33.00 |
| E | 27.00 | 50.00 |
| F | 40.50 | 81.00 |
| G | 65.60 | 131.20 |

**Table 6: HLMP-2785 Annunciators (0.4 × 0.8 Yellow)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| C | 26.00 | 44.40 |
| D | 36.00 | 66.00 |
| E | 54.00 | 99.00 |
| F | 81.00 | 162.00 |
| G | 131.40 | 262.80 |

**Table 7: HLMP-2500/2800/2820 Annunciators (0.2 × 0.4 Green)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| D | 8.40 | 15.30 |
| E | 12.60 | 23.10 |
| F | 18.90 | 37.80 |
| G | 30.60 | 61.20 |
| H | 49.50 | 97.90 |
| I | 80.10 | 158.40 |
| J | 129.60 | 253.40 |

**Table 8: HLMP-2550/2855/2870 Annunciators (0.2 × 0.8/ 0.4 × 0.4 Green)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| C | 11.30 | 20.60 |
| D | 17.00 | 31.00 |
| E | 25.40 | 46.50 |
| F | 38.10 | 76.20 |
| G | 61.60 | 123.20 |
| H | 99.81 | 197.67 |
| I | 161.73 | 320.21 |
| J | 262.00 | 518.70 |

**Table 9: HLMP-2885 Annunciators (0.4 × 0.8 Green)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| D | 33.40 | 61.20 |
| E | 50.10 | 91.90 |
| F | 75.10 | 150.30 |
| G | 121.10 | 242.20 |
| H | 196.10 | 383.50 |
| I | 313.70 | 613.60 |
| J | 502.00 | 981.60 |

**Table 10: HLMP-2950 Bicolor Annunciators (0.4 × 0.4 Red/Yellow)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| **Red IV Categories** | | |
| C | 13.10 | 24.00 |
| D | 19.70 | 36.10 |
| E | 29.60 | 54.20 |
| F | 44.90 | 88.80 |
| G | 71.90 | 143.80 |
| H | 116.50 | 227.70 |
| **Yellow IV Categories** | | |
| C | 13.00 | 22.00 |
| D | 18.00 | 33.00 |
| E | 27.00 | 50.00 |
| F | 40.50 | 81.00 |
| G | 65.60 | 131.20 |
| H | 106.20 | 207.80 |

**Table 11: HLMP-2965 Bi-Color Annunciators (0.4 × 0.4/0.2 × 0.8 Red/Green)**

| IV Bin Category | Min. | Max. |
|---|---|---|
| **Red IV Categories** | | |
| D | 19.70 | 36.10 |
| E | 29.60 | 54.20 |
| F | 44.90 | 88.80 |
| G | 71.90 | 143.80 |
| H | 116.50 | 227.70 |
| **Green IV Categories** | | |
| D | 17.00 | 31.00 |
| E | 25.40 | 46.50 |
| F | 38.10 | 76.20 |
| G | 61.60 | 123.20 |
| H | 100.00 | 200.00 |
| I | 162.00 | 320.20 |

# Color Categories

| Color | Bin | Dominant Wavelength (nm) | |
|---|---|---|---|
| | | Min. | Max. |
| Yellow | 0 | 579.0 | 582.5 |
| | 1 | 581.5 | 585.0 |
| | 3 | 584.0 | 587.5 |
| | 2 | 586.5 | 590.0 |
| | 4 | 589.0 | 592.5 |
| | 5 | 591.5 | 595.0 |
| Green | 2 | 573.0 | 577.0 |
| | 3 | 570.0 | 574.0 |
| | 4 | 567.0 | 571.0 |
| | 5 | 564.0 | 568.0 |

**NOTE:** All categories are established for classification of products. Products may not be available in all categories. Contact your Broadcom representatives for further clarification or information.

# Deep Red Graphs

**Figure 1: Relative Intensity vs. Wavelength**

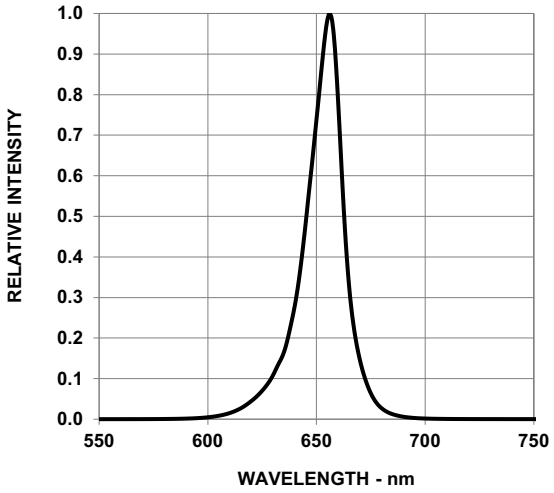



**Figure 2: Forward Current vs. Forward Voltage**

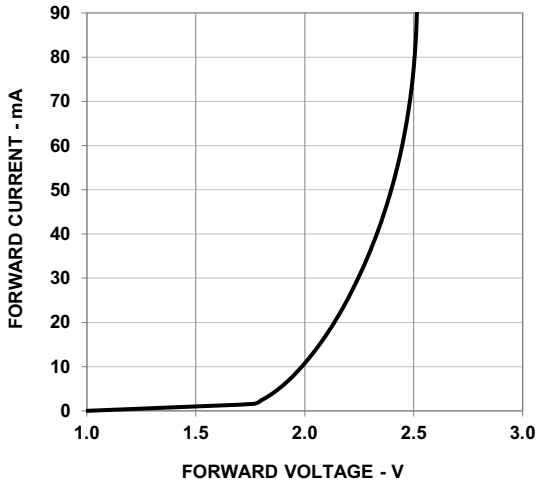



**Figure 3: Relative Luminous Intensity vs. Forward Current**

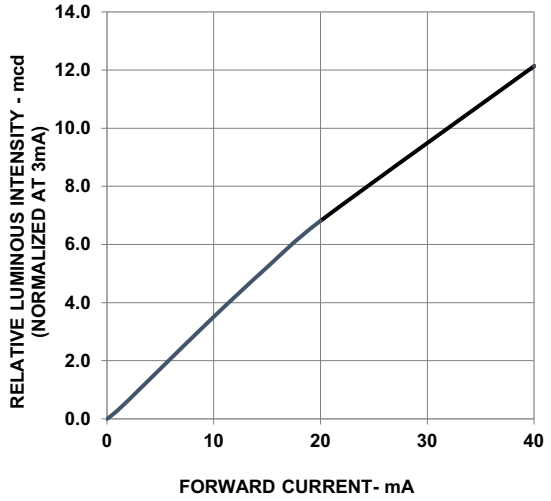
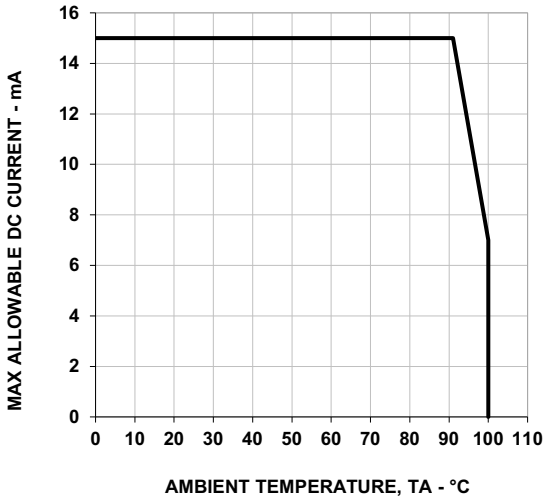



**Figure 4: Maximum Forward Current vs. Ambient Temperature**



# Red Graphs

**Figure 5: Relative Intensity vs. Wavelength**

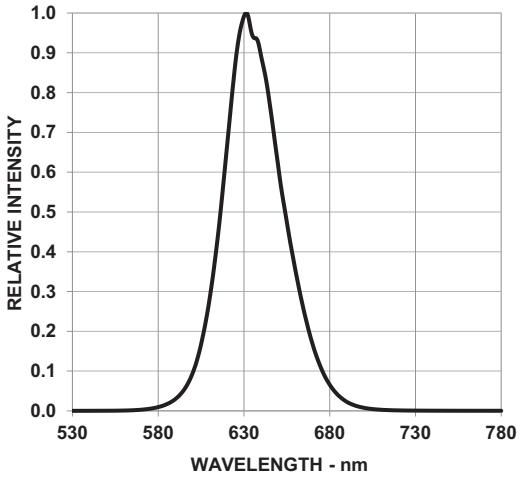



**Figure 6: Forward Current vs. Forward Voltage**

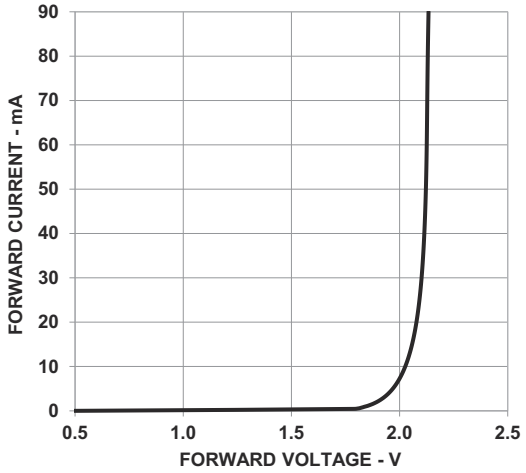



**Figure 7: Relative Luminous Intensity vs. DC Forward Current**

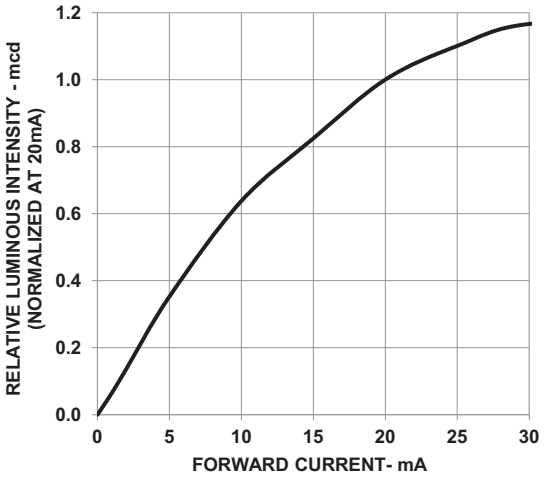
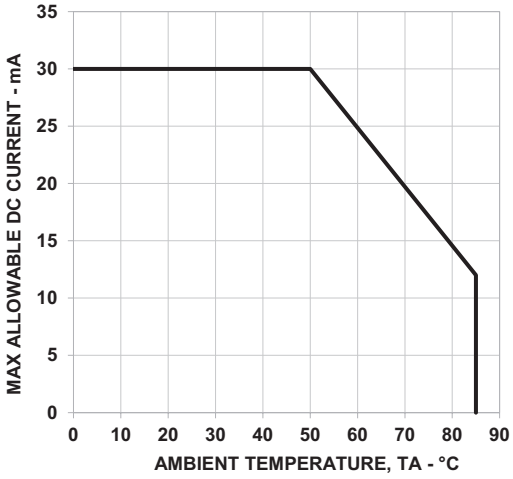



**Figure 8: Maximum Forward Current vs. Ambient Temperature**



# Yellow Graphs

**Figure 9: Relative Intensity vs. Wavelength**

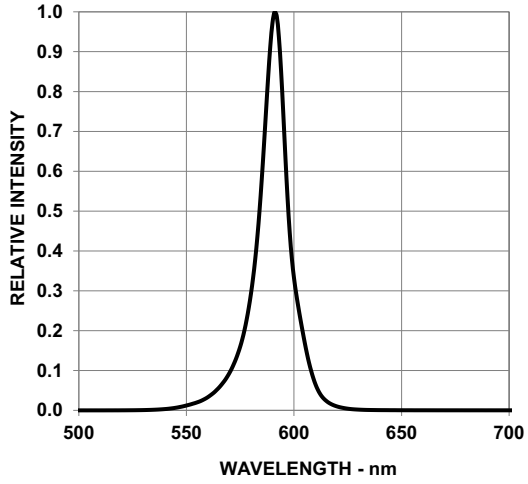



**Figure 10: Forward Current vs. Forward Voltage**

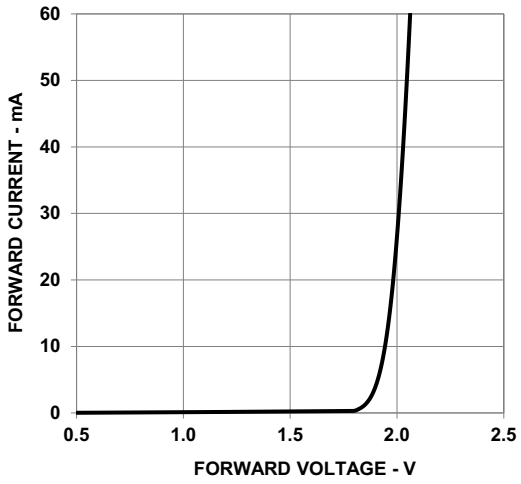



**Figure 11: Relative Luminous Intensity vs. Forward Current**

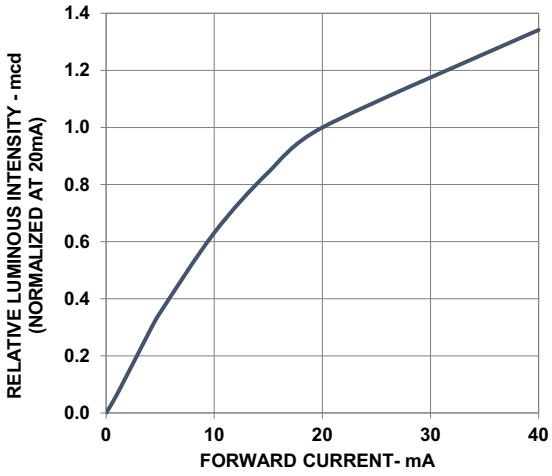
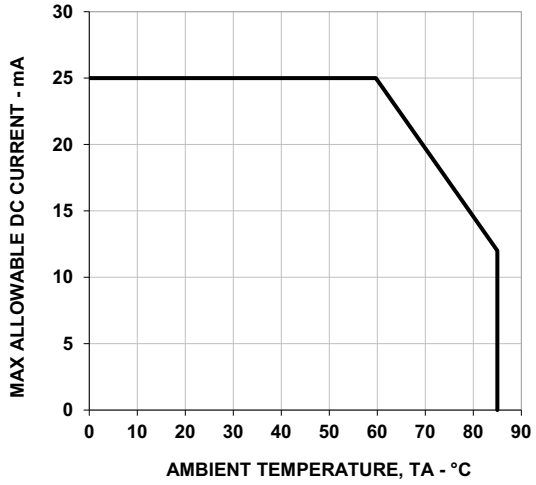



**Figure 12: Maximum Forward Current vs. Ambient Temperature**



# Green Graphs

**Figure 13: Relative Intensity vs. Wavelength**

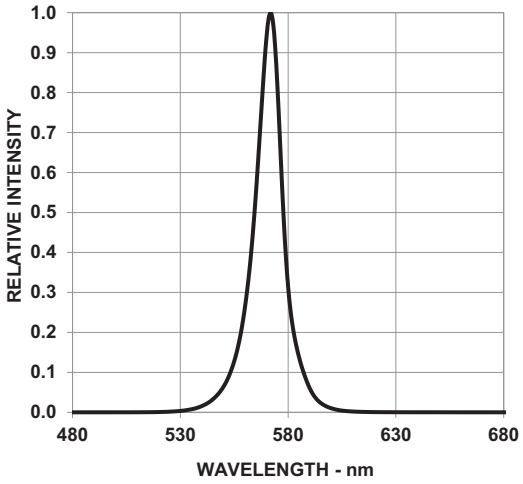



**Figure 14: Forward Current vs. Forward Voltage**

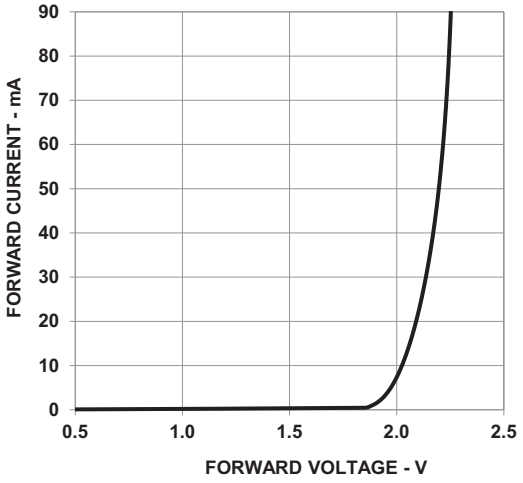



**Figure 15: Relative Luminous Intensity vs. Forward Current**

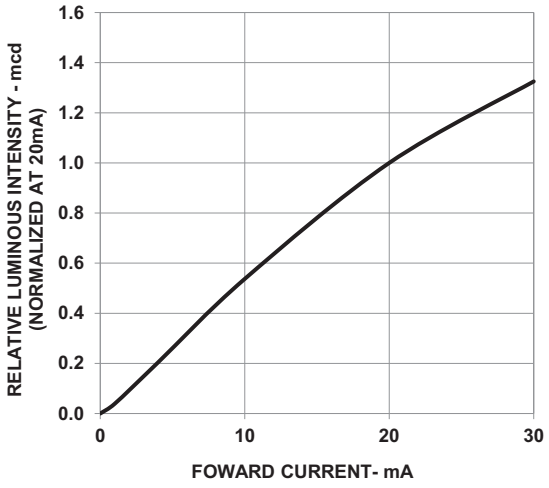
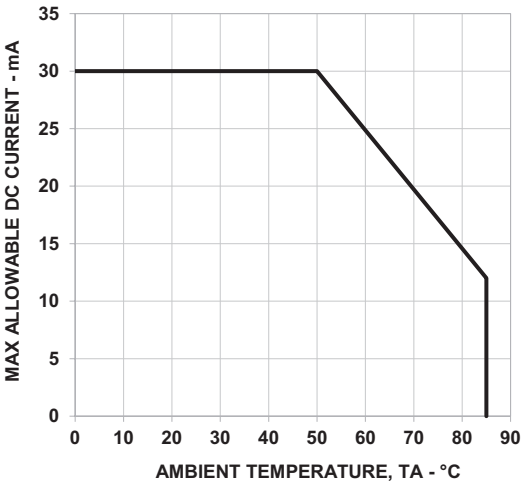



**Figure 16: Maximum Forward Current vs. Ambient Temperature**

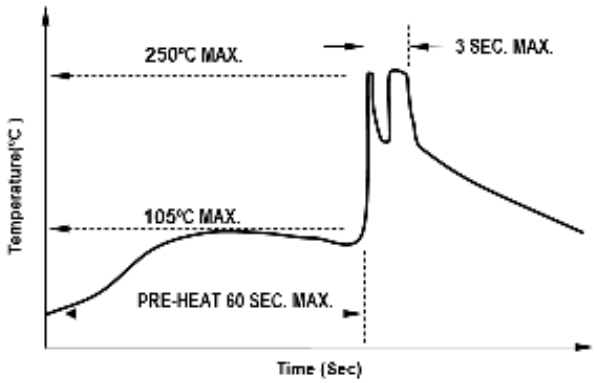


# Precautionary Notes

## 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 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 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 17: Recommended Wave Soldering Profile**




**NOTE:** Figure 17 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.

**Disclaimer**

Broadcom 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.

Copyright © 2005–2024 Broadcom. All Rights Reserved. The term “Broadcom” refers to Broadcom Inc. and/or its subsidiaries. For more information, go to www.broadcom.com. All trademarks, trade names, service marks, and logos referenced herein belong to their respective companies.

Broadcom reserves the right to make changes without further notice to any products or data herein to improve reliability, function, or design. Information furnished by Broadcom is believed to be accurate and reliable. However, Broadcom does not assume any liability arising out of the application or use of this information, nor the application or use of any product or circuit described herein, neither does it convey any license under its patent rights nor the rights of others.

BROADCOM®

Lead (Pb) Free
RoHS Compliant