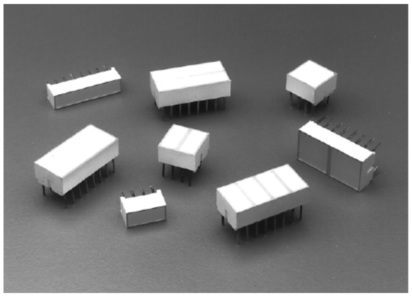
Data Sheet

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.

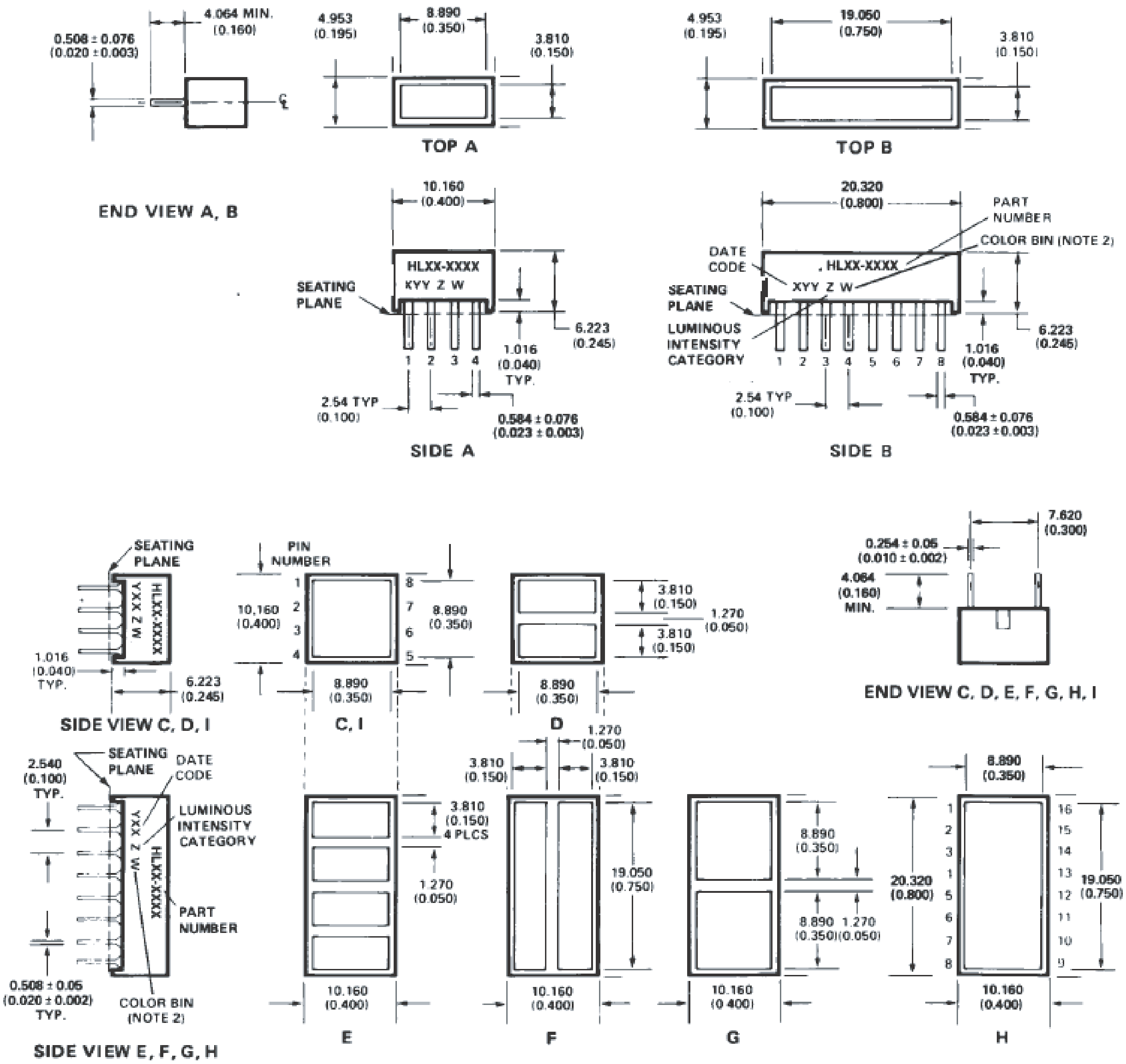
Features

- 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

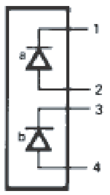
Package Drawing



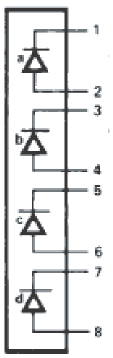
NOTES:

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

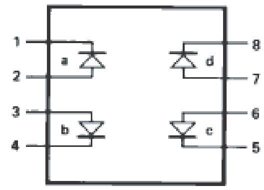


A

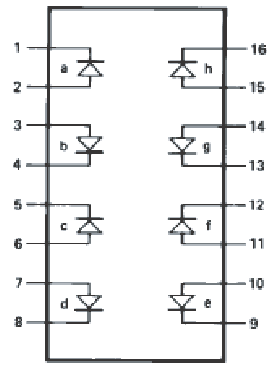


B

PIN	PIN FUNCTION 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

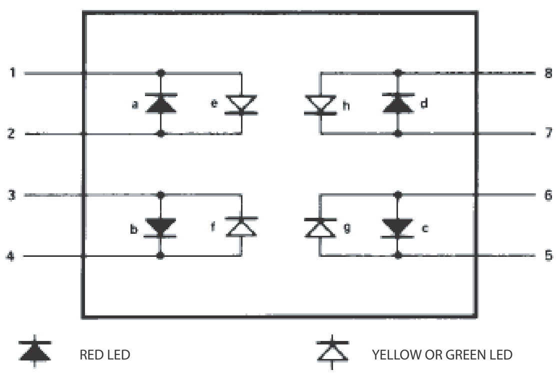


C,D



E,F,G,H

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



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	λ_p	—	656	—	nm	—
Dominant Wavelength[c]	λ_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	λ_p	—	631	—	nm	—
Dominant Wavelength[c]	λ_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	λ_p	—	591	—	nm	—
Dominant Wavelength[c]	λ_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	λ_p	—	572	—	nm	—
Dominant Wavelength[c]	λ_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, λ_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: AllnGaP 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

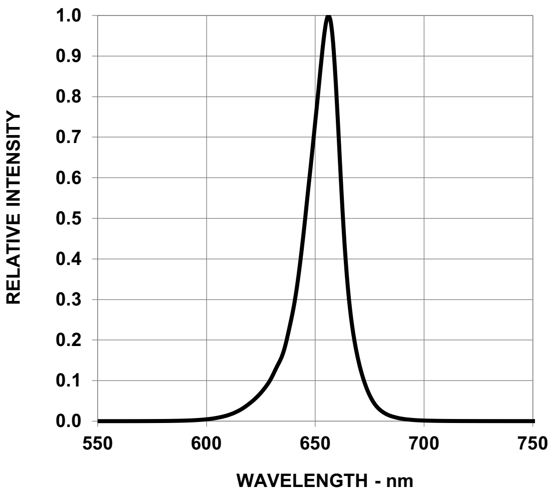


Figure 2: Forward Current vs. Forward Voltage

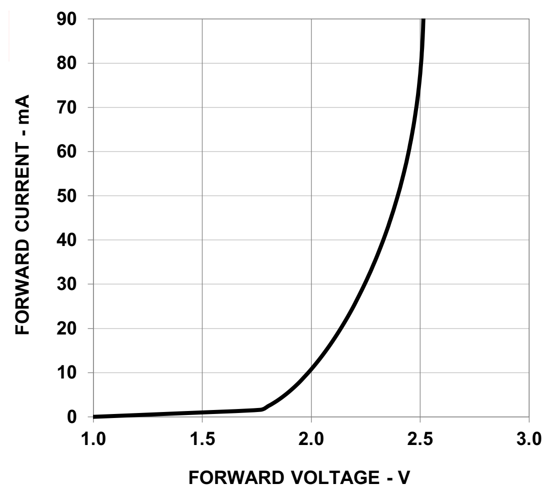


Figure 3: Relative Luminous Intensity vs. Forward Current

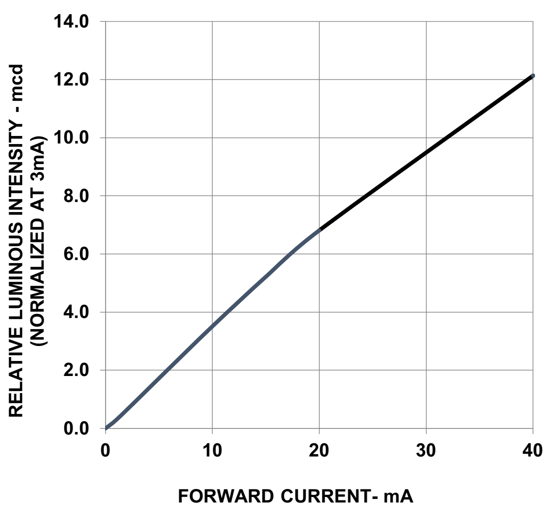
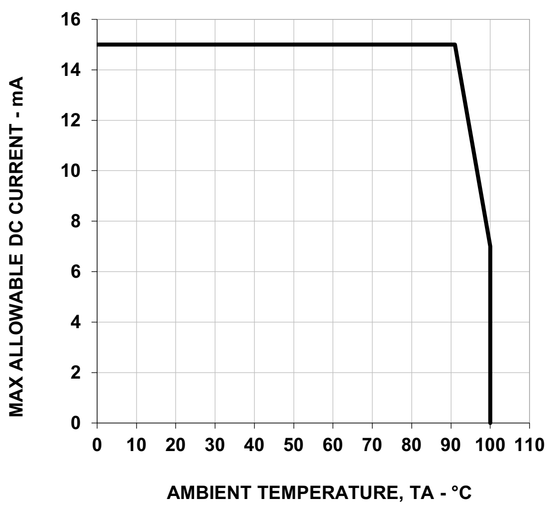


Figure 4: Maximum Forward Current vs. Ambient Temperature



Red Graphs

Figure 5: Relative Intensity vs. Wavelength

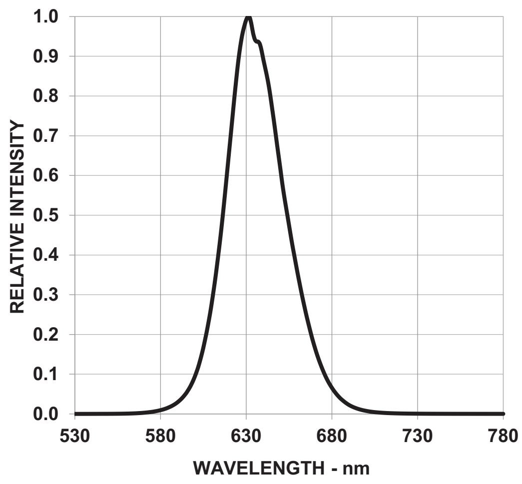


Figure 6: Forward Current vs. Forward Voltage

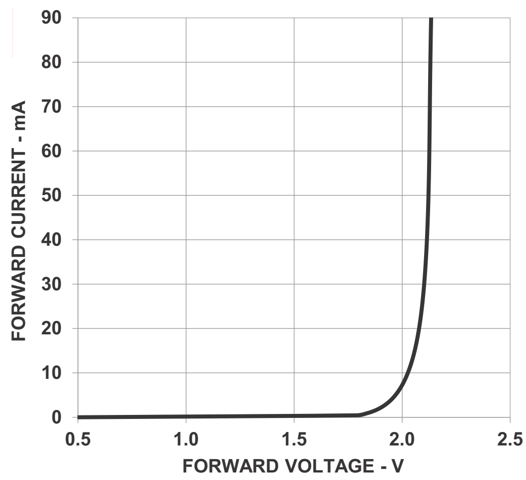


Figure 7: Relative Luminous Intensity vs. DC Forward Current

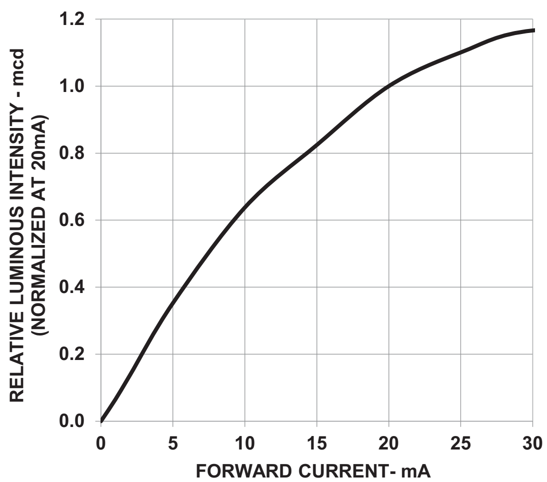
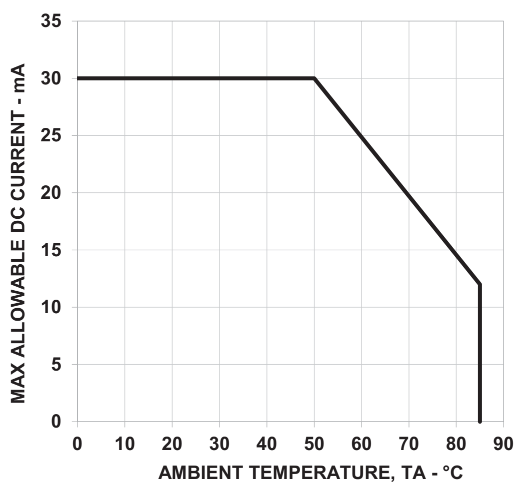


Figure 8: Maximum Forward Current vs. Ambient Temperature



Yellow Graphs

Figure 9: Relative Intensity vs. Wavelength

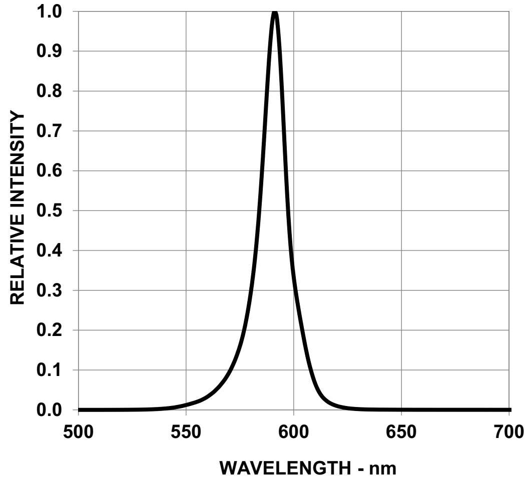


Figure 10: Forward Current vs. Forward Voltage

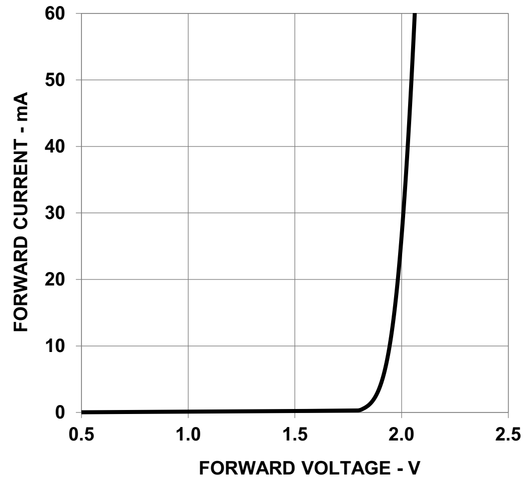


Figure 11: Relative Luminous Intensity vs. Forward Current

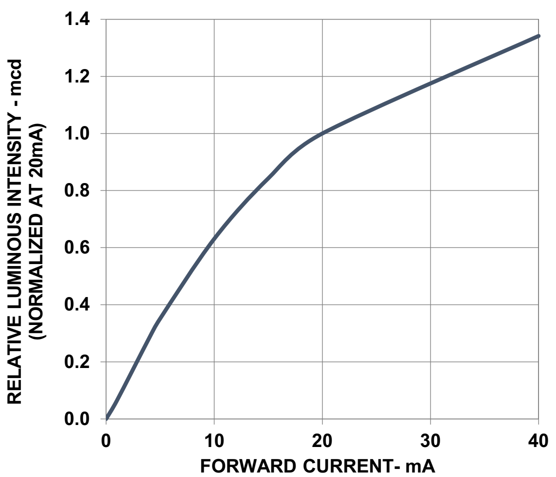
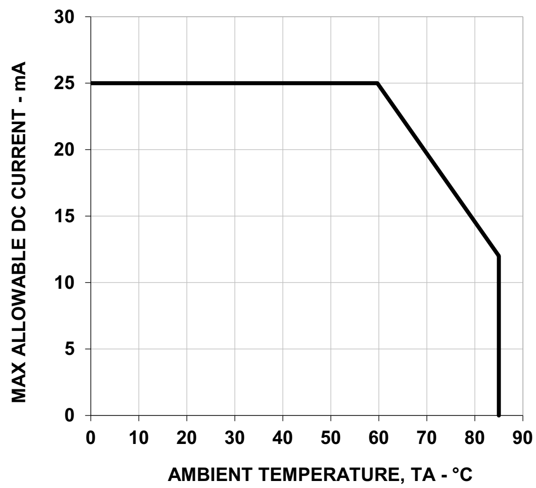


Figure 12: Maximum Forward Current vs. Ambient Temperature



Green Graphs

Figure 13: Relative Intensity vs. Wavelength

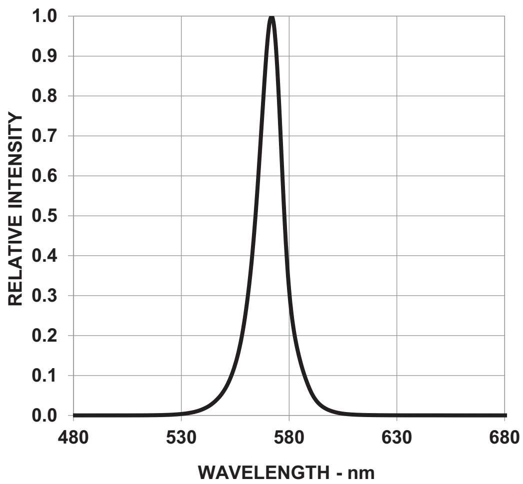


Figure 14: Forward Current vs. Forward Voltage

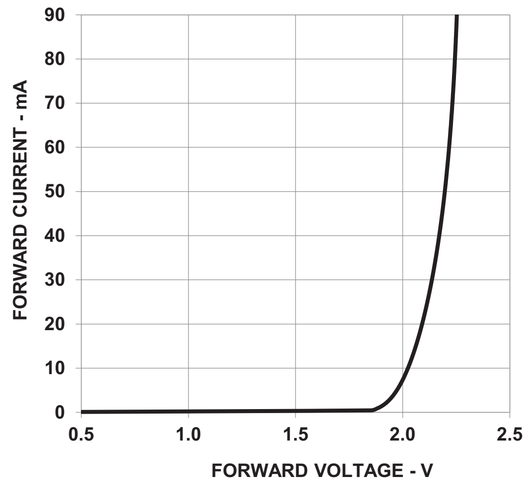


Figure 15: Relative Luminous Intensity vs. Forward Current

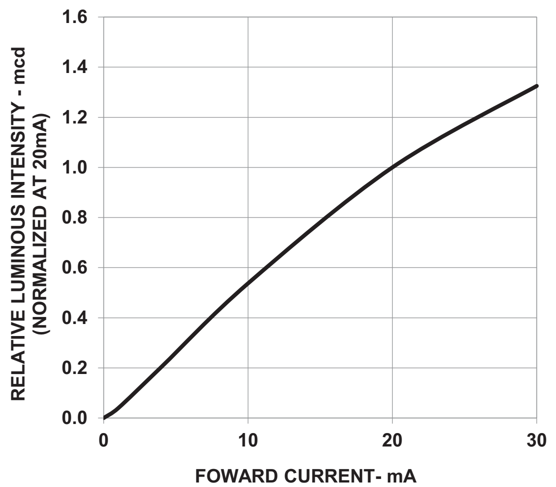
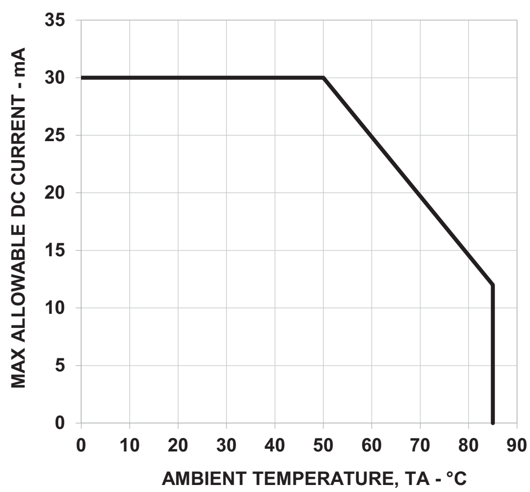


Figure 16: Maximum Forward Current vs. Ambient Temperature

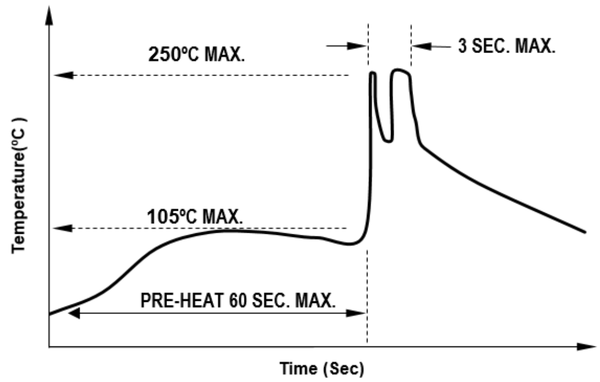


Precautionary Notes

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.