

## SunPower Series

HLMP-ELxx, HLMP-EHxx,

HLMP-EJxx, HLMP-EGxx

T-1<sup>3</sup>/<sub>4</sub> (5 mm) Precision Optical Performance

AllnGaP LED Lamps



## Data Sheet

### Description

These Precision Optical Performance AllnGaP LEDs provide superior light output for excellent readability in sunlight and are extremely reliable. AllnGaP LED technology provides extremely stable light output over long periods of time. Precision Optical Performance lamps utilize the aluminum indium gallium phosphide (AllnGaP) technology.

These LED lamps are untinted, nondiffused, T-1<sup>3</sup>/<sub>4</sub> packages incorporating second generation optics producing well defined spatial radiation patterns at specific viewing cone angles.

These lamps are made with an advanced optical grade epoxy, offering superior high temperature and high moisture resistance performance in outdoor signal and sign applications. The high maximum LED junction temperature limit of +130°C enables high temperature operation in bright sunlight conditions. The package epoxy contains both uv-a and uv-b inhibitors to reduce the effects of long term exposure to direct sunlight.

These lamps are available in two package options to give the designer flexibility with device mounting.

### Features

- Well defined spatial radiation patterns
- Viewing angles: 8°, 15°, 23°, 30°
- High luminous output
- Colors:
  - 590 nm amber
  - 605 nm orange
  - 615 nm reddish-orange
  - 626 nm red
- High operating temperature: T<sub>J LED</sub> = +130°C
- Superior resistance to moisture
- Package options:
  - With or without lead stand-offs

### Benefits

- Viewing angles match traffic management sign requirements
- Colors meet automotive and pedestrian signal specifications
- Superior performance in outdoor environments
- Suitable for autoinsertion onto PC boards

### Applications

- Traffic management:
  - Traffic signals
  - Pedestrian signals
  - Work zone warning lights
  - Variable message signs
- Commercial outdoor advertising:
  - Signs
  - Marquees
- Automotive:
  - Exterior and interior lights

## Device Selection Guide

Typical Viewing Angle $2\theta_{1/2}$ (Deg.) <sup>[4]</sup>	Color and Dominant Wavelength (nm), Typ. <sup>[3]</sup>	Lamps without Standoffs on Leads (Outline Drawing A)	Lamps with Standoffs on Leads (Outline Drawing B)	Luminous Intensity I <sub>v</sub> (mcd) <sup>[1,2,5]</sup> @ 20 mA	
				Min.	Max.
8°	Amber 590	HLMP-EL08-T0000	HLMP-EL10-T0000	2500	–
		HLMP-EL08-VY000	HLMP-EL10-VY000	4200	12000
		HLMP-EL08-VYK00		4200	12000
		HLMP-EL08-WZ000	HLMP-EL10-WZ000	5500	16000
		HLMP-EL08-X1K00	HLMP-EL10-X1K00	7200	21000
		HLMP-EL08-X1000	HLMP-EL10-X1000	7200	21000
	Orange 605	HLMP-EJ08-WZ000		5500	16000
		HLMP-EJ08-X1000	HLMP-EJ10-X1000	7200	21000
		HLMP-EJ08-Y2000		9300	27000
	Red-Orange 615	HLMP-EH08-UX000	HLMP-EH10-UX000	3200	9300
		HLMP-EH08-WZ000	HLMP-EH10-WZ000	5500	16000
		HLMP-EH08-X1000	HLMP-EH10-X1000	7200	21000
		HLMP-EH08-Y2000	HLMP-EH10-Y2000	9300	27000
	Red 626	HLMP-EG08-T0000	HLMP-EG10-T0000	2500	–
		HLMP-EG08-VY000		4200	12000
		HLMP-EG08-WZ000	HLMP-EG10-WZ000	5500	16000
		HLMP-EG08-X1000	HLMP-EG10-X1000	7200	21000
		HLMP-EG08-YZ000		9300	16000
		HLMP-EG08-Y2000	HLMP-EG10-Y2000	9300	27000

### Notes:

1. The luminous intensity is measured on the mechanical axis of the lamp package.
2. The optical axis is closely aligned with the package mechanical axis.
3. The dominant wavelength,  $\lambda_d$ , is derived from the CIE Chromaticity Diagram and represents the color of the lamp.
4.  $\theta_{1/2}$  is the off-axis angle where the luminous intensity is half the on-axis intensity.
5. Tolerance for each intensity bin limit is  $\pm 15\%$ .

## Device Selection Guide

Typical Viewing Angle $2\theta_{1/2}$ (Deg.) <sup>[4]</sup>	Color and Dominant Wavelength (nm), Typ. <sup>[3]</sup>	Lamps without Standoffs on Leads (Outline Drawing A)	Lamps with Standoffs on Leads (Outline Drawing B)	Luminous Intensity I <sub>v</sub> (mcd) <sup>[1,2,5]</sup> @ 20 mA	
				Min.	Max.
15°	Amber 590		HLMP-EL17-M0000	520	–
		HLMP-EL15-PS000		880	2500
		HLMP-EL15-QSK00		1150	2500
		HLMP-EL15-QT000		1150	3200
		HLMP-EL15-RU000		1500	4200
		HLMP-EL15-TW000	HLMP-EL17-TW000	2500	7200
		HLMP-EL15-TWK00		2500	7200
		HLMP-EL15-UX000	HLMP-EL17-UX000	3200	9300
		HLMP-EL15-VY000	HLMP-EL17-VY000	4200	12000
		HLMP-EL15-VYK00		4200	12000
	HLMP-EL15-VW000		4200	7200	
	Orange 605		HLMP-EJ17-QT000	1150	3200
		HLMP-EJ15-PS000		880	2500
		HLMP-EJ15-RU000		1500	4200
		HLMP-EJ15-SV000	HLMP-EJ17-SV000	1900	5500
	Red-Orange 615	HLMP-EH15-QT000		1150	3200
		HLMP-EH15-RU000		1500	4200
		HLMP-EH15-TW000	HLMP-EH17-TW000	2500	7200
		HLMP-EH15-UX000	HLMP-EH17-UX000	3200	9300
	Red 626	HLMP-EG15-N0000	HLMP-EG17-N0000	680	–
		HLMP-EG15-PS000		880	2500
		HLMP-EG15-QT000	HLMP-EG17-QT000	1150	3200
		HLMP-EG15-RU000	HLMP-EG17-RU000	1500	4200
		HLMP-EG15-UX000	HLMP-EG17-UX000	3200	9300
		HLMP-EG15-TW000	HLMP-EG17-TW000	2500	7200

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Typical Viewing Angle $2\theta_{1/2}$ (Deg.) <sup>[4]</sup>	Color and Dominant Wavelength (nm), Typ. <sup>[3]</sup>	Lamps without Standoffs on Leads (Outline Drawing A)	Lamps with Standoffs on Leads (Outline Drawing B)	Luminous Intensity I <sub>v</sub> (mcd) <sup>[1,2,5]</sup> @ 20 mA	
				Min.	Max.
23°	Amber 590	HLMP-EL24-L0000	HLMP-EL26-L0000	400	–
		HLMP-EL24-MQ000		520	1500
		HLMP-EL24-NR000		680	1900
		HLMP-EL24-PS000	HLMP-EL26-PS000	880	2500
		HLMP-EL24-QR000		1150	1900
		HLMP-EL24-QRK00		1150	1900
		HLMP-EL24-QS400		1150	2500
		HLMP-EL24-QT000	HLMP-EL26-QT000	1150	3200
		HLMP-EL24-RU000	HLMP-EL26-RU000	1150	4200
		HLMP-EL24-RUK00		1150	4200
		HLMP-EL24-SV000	HLMP-EL26-SV000	1900	5500
		HLMP-EL24-SUK00		1900	4200
		HLMP-EL24-SU400		1900	4200
		HLMP-EL24-SVK00		1900	5500
		HLMP-EL24-TW000	HLMP-EL26-TW000	2500	7200
		HLMP-EL24-TWK00		2500	7200
	Orange 605	HLMP-EJ24-QT000		1150	3200
	Red-Orange 615	HLMP-EH24-PS000	HLMP-EH26-PS000	880	2500
		HLMP-EH24-QT000		1150	3200
		HLMP-EH24-RU000		1500	4200
		HLMP-EH24-SV000	HLMP-EH26-SV000	1900	5500
	Red 626	HLMP-EG24-M0000	HLMP-EG26-M0000	520	–
		HLMP-EG24-PS000	HLMP-EG26-PS000	880	2500
		HLMP-EG24-QT000		1150	4200
		HLMP-EG24-RU000	HLMP-EG26-RU000	1500	4200

### Notes:

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3. The dominant wavelength,  $\lambda_d$ , is derived from the CIE Chromaticity Diagram and represents the color of the lamp.
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5. Tolerance for each intensity bin limit is  $\pm 15\%$ .

## Device Selection Guide

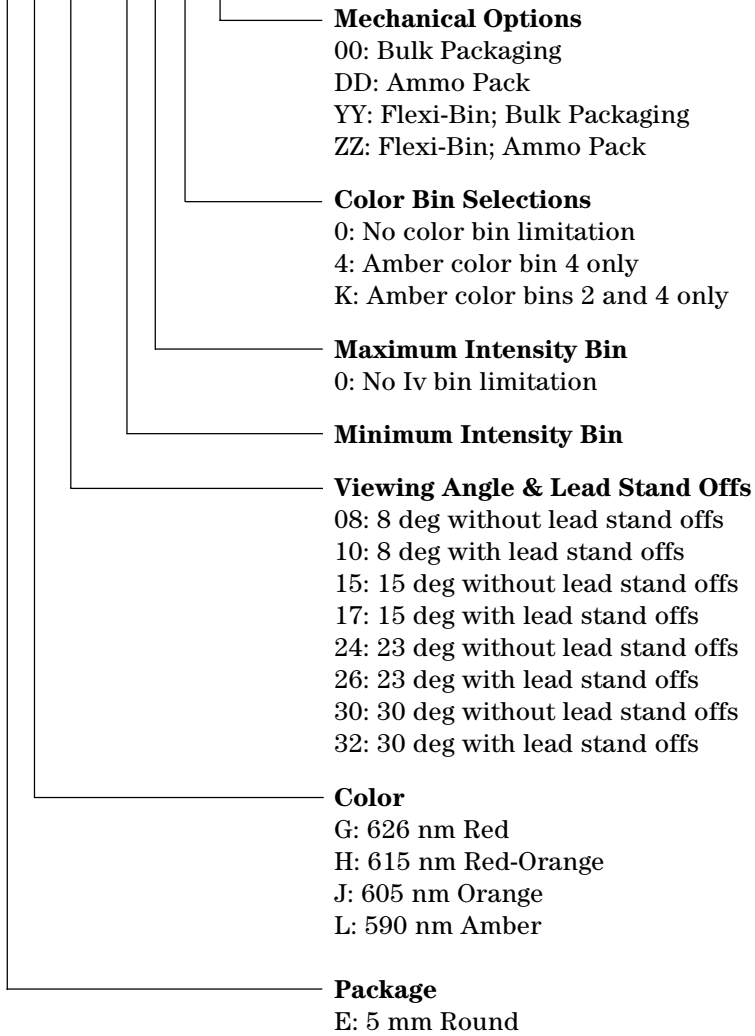
Typical Viewing Angle $2\theta_{1/2}$ (Deg.) <sup>[4]</sup>	Color and Dominant Wavelength (nm), Typ. <sup>[3]</sup>	Lamps without Standoffs on Leads (Outline Drawing A)	Lamps with Standoffs on Leads (Outline Drawing B)	Luminous Intensity I <sub>v</sub> (mcd) <sup>[1,2,5]</sup> @ 20 mA	
				Min.	Max.
30°	Amber 590	HLMP-EL30-K0000	HLMP-EL32-K0000	310	–
		HLMP-EL30-MQ000		520	1500
			HLMP-EL32-NR000	680	1900
		HLMP-EL30-PQ000		880	1500
		HLMP-EL30-PR400		880	1900
		HLMP-EL30-PS000	HLMP-EL32-PS000	880	2500
		HLMP-EL30-PSK00		880	2500
		HLMP-EL30-QT000	HLMP-EL32-QT000	1150	3200
		HLMP-EL30-QTK00		1150	3200
		HLMP-EL30-ST000		1900	3200
		HLMP-EL30-SU400		1900	4200
		HLMP-EL30-SUK00		1900	4200
		HLMP-EL30-STK00		1900	3200
		HLMP-EL30-SV000	HLMP-EL32-SV000	1900	5500
	HLMP-EL30-SVK00		1900	5500	
	Orange 605	HLMP-EJ30-NR000		680	1900
		HLMP-EJ30-PS000	HLMP-EJ32-PS000	880	2500
	Red-Orange 615	HLMP-EH30-MQ000	HLMP-EH32-MQ000	520	1500
		HLMP-EH30-NR000	HLMP-EH32-NR000	680	1900
		HLMP-EH30-PS000	HLMP-EH32-PS000	880	2500
		HLMP-EH30-QT000	HLMP-EH32-QT000	1150	4200
		HLMP-EH30-RU000	HLMP-EH32-RU000	1500	4200
	Red 626	HLMP-EG30-K0000	HLMP-EG32-K0000	270	–
		HLMP-EG30-KN000		310	880
		HLMP-EG30-MQ000	HLMP-EG32-MQ000	520	1500
		HLMP-EG30-NQ000		680	1500
		HLMP-EG30-NR000	HLMP-EG32-NR000	680	1900
		HLMP-EG30-PQ000		880	1500
		HLMP-EG30-PR000		880	1900
		HLMP-EG30-PS000		880	2500
	HLMP-EG30-QT000	HLMP-EG32-QT000	1150	3200	

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5. Tolerance for each intensity bin limit is  $\pm 15\%$ .

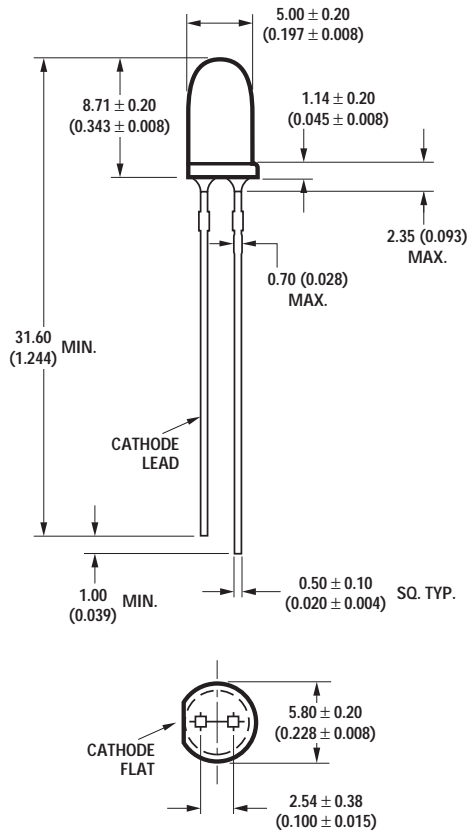
# Part Numbering System

HLMP - x x xx - x x x xx

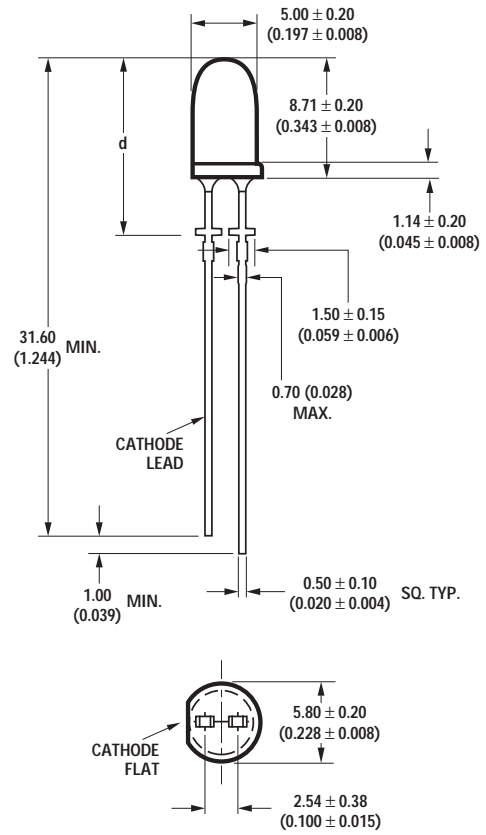


# Package Dimensions

A



B



**NOTES:**

1. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES).
2. LEADS ARE MILD STEEL, SOLDER DIPPED.
3. TAPERS SHOWN AT TOP OF LEADS (BOTTOM OF LAMP PACKAGE) INDICATE AN EPOXY MENISCUS THAT MAY EXTEND ABOUT 1 mm (0.040 in.) DOWN THE LEADS.
4. FOR DOME HEIGHTS ABOVE LEAD STAND-OFF SEATING PLANE, d, LAMP PACKAGE B, SEE TABLE.

PART NO.	d
HLMP-XX10	12.37 ± 0.25 (0.487 ± 0.010)
HLMP-XX17	12.42 ± 0.25 (0.489 ± 0.010)
HLMP-XX26	12.52 ± 0.25 (0.493 ± 0.010)
HLMP-XX32	11.96 ± 0.25 (0.471 ± 0.010)

## Absolute Maximum Ratings at $T_A = 25^\circ\text{C}$

DC Forward Current <sup>[1,2,3]</sup> .....	50 mA
Peak Pulsed Forward Current <sup>[2,3]</sup> .....	100 mA
Average Forward Current <sup>[3]</sup> .....	30 mA
Reverse Voltage ( $I_R = 100 \mu\text{A}$ ) .....	5 V
LED Junction Temperature .....	130°C
Operating Temperature .....	-40°C to +100°C
Storage Temperature .....	-40°C to +120°C

### Notes:

- Derate linearly as shown in Figure 4.
- For long term performance with minimal light output degradation, drive currents between 10 mA and 30 mA are recommended. For more information on recommended drive conditions, please refer to Application Brief I-024.
- Operating at currents below 1 mA is not recommended. Please contact your local representative for further information.

## Electrical/Optical Characteristics at $T_A = 25^\circ\text{C}$

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Forward Voltage						$I_F = 20 \text{ mA}$
Amber ( $\lambda_d = 590 \text{ nm}$ )			2.02			
Orange ( $\lambda_d = 605 \text{ nm}$ )	$V_F$		1.98	2.4	V	
Red-Orange ( $\lambda_d = 615 \text{ nm}$ )			1.94			
Red ( $\lambda_d = 626 \text{ nm}$ )			1.90			
Reverse Voltage	$V_R$	5	20		V	$I_F = 100 \mu\text{A}$
Peak Wavelength:						Peak of Wavelength of Spectral Distribution at $I_F = 20 \text{ mA}$
Amber ( $\lambda_d = 590 \text{ nm}$ )			592			
Orange ( $\lambda_d = 605 \text{ nm}$ )	$\lambda_{PEAK}$		609		nm	
Red-Orange ( $\lambda_d = 615 \text{ nm}$ )			621			
Red ( $\lambda_d = 626 \text{ nm}$ )			635			
Spectral Halfwidth	$\Delta\lambda_{1/2}$		17		nm	Wavelength Width at Spectral Distribution $1/2$ Power Point at $I_F = 20 \text{ mA}$
Speed of Response	$\tau_s$		20		ns	Exponential Time Constant, $e^{-t/\tau_s}$
Capacitance	C		40		pF	$V_F = 0, f = 1 \text{ MHz}$
Thermal Resistance	$R\theta_{J-PIN}$		240		$^\circ\text{C}/\text{W}$	LED Junction-to-Cathode Lead
Luminous Efficacy <sup>[1]</sup>						Emitted Luminous Power/Emitted Radiant Power
Amber ( $\lambda_d = 590 \text{ nm}$ )			480			
Orange ( $\lambda_d = 605 \text{ nm}$ )	$\eta_v$		370		lm/W	
Red-Orange ( $\lambda_d = 615 \text{ nm}$ )			260			
Red ( $\lambda_d = 626 \text{ nm}$ )			150			
Luminous Flux			500		mlm	$I_F = 20 \text{ mA}$
Luminous Efficiency						Emitted Luminous Flux/Electrical Power
Amber			12		lm/W	
Orange			13			
Red-Orange			13			
Red			13			

### Note:

- The radiant intensity,  $I_e$ , in watts per steradian, may be found from the equation  $I_e = I_v/\eta_v$ , where  $I_v$  is the luminous intensity in candelas and  $\eta_v$  is the luminous efficacy in lumens/watt.



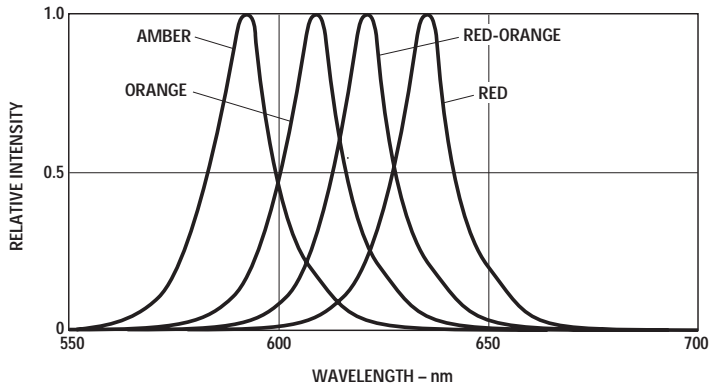


Figure 1. Relative intensity vs. peak wavelength

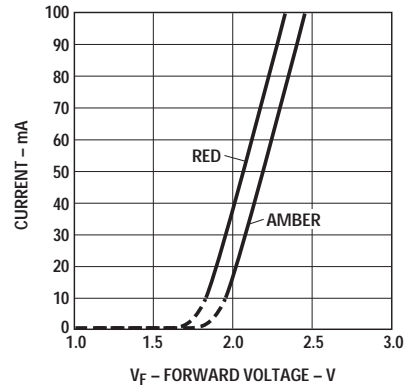


Figure 2. Forward current vs. forward voltage

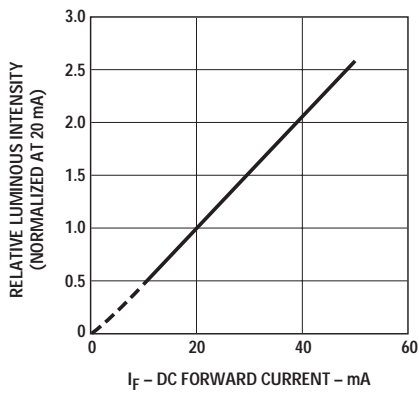


Figure 3. Relative luminous intensity vs. forward current

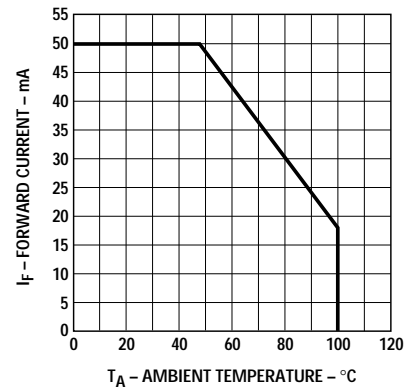


Figure 4. Maximum forward current vs. ambient temperature

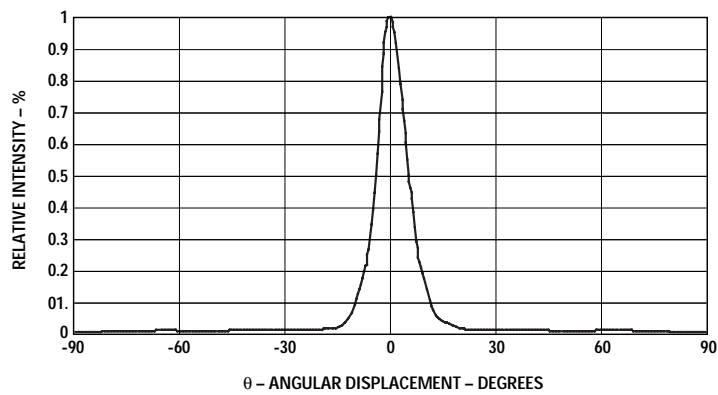


Figure 5. Representative spatial radiation pattern for 8° viewing angle lamps

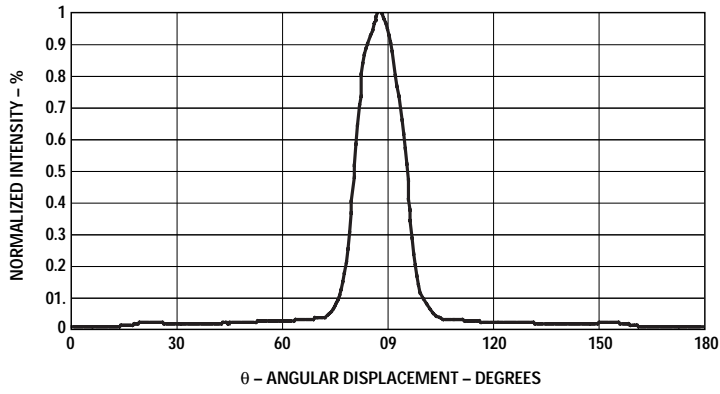


Figure 6. Representative spatial radiation pattern for 15° viewing angle lamps

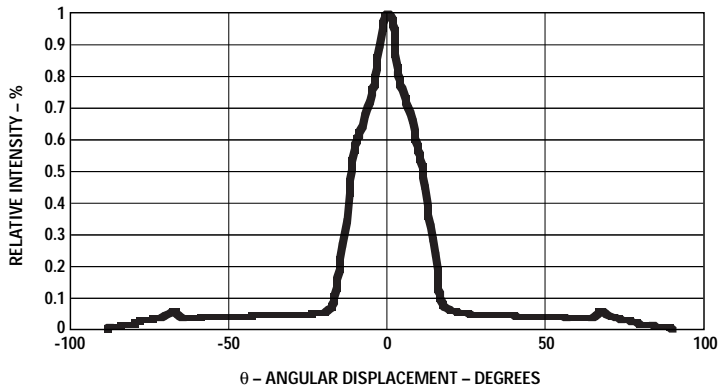


Figure 7. Representative spatial radiation pattern for 23° viewing angle lamps

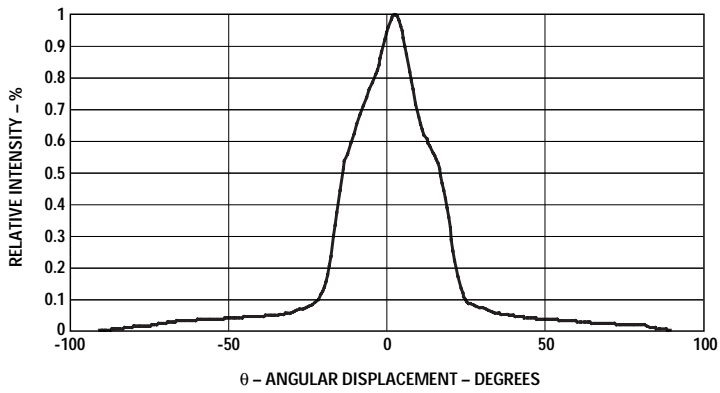


Figure 8. Representative spatial radiation pattern for 30° viewing angle lamps

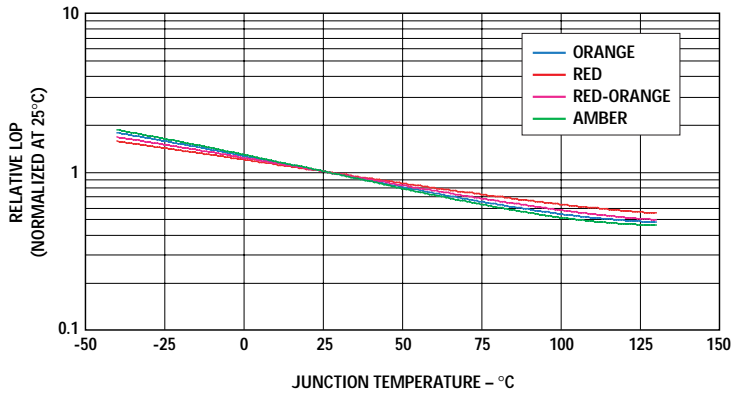


Figure 9. Relative light output vs. junction temperature

### Intensity Bin Limits (mcd at 20 mA)

Bin Name	Min.	Max.
K	310	400
L	400	520
M	520	680
N	680	880
P	880	1150
Q	1150	1500
R	1500	1900
S	1900	2500
T	2500	3200
U	3200	4200
V	4200	5500
W	5500	7200
X	7200	9300
Y	9300	12000
Z	12000	16000
1	16000	21000
2	21000	27000

Tolerance for each bin limit is  $\pm 15\%$ .

### Amber Color Bin Limits (nm at 20 mA)

Bin Name	Min.	Max.
1	584.5	587.0
2	587.0	589.5
4	589.5	592.0
6	592.0	594.5

Tolerance for each bin limit is  $\pm 0.5$  nm.

**Note:**

1. Bin categories are established for classification of products. Products may not be available in all bin categories.

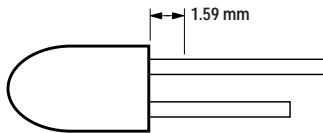
## Precautions

### Lead Forming

- The leads of an LED lamp may be preformed or trimmed to applicable length prior to insertion and soldering on PC board.
- If lead forming is required before soldering, care must be taken to avoid any excessive mechanical stress that is induced into the LED package. Otherwise, trim the leads to applicable length at room temperature after soldering process. The solder joint formed will absorb the mechanical stress, due to the lead cutting, from flowing to the wire bonding area and LED chip die attach.
- For better control, it is recommended to use proper tool to precisely form and cut the leads to applicable length rather than doing it manually.

### Soldering Condition

- Extra care must be taken during PCB assembly and soldering process to prevent damage to the LED component.
- The closest distance of manual soldering from the soldering heat source (soldering iron's tip) to the body is 1.59 mm. Damage might occur if the LED soldering distance is less than 1.59 mm. Please refer to the illustration below.



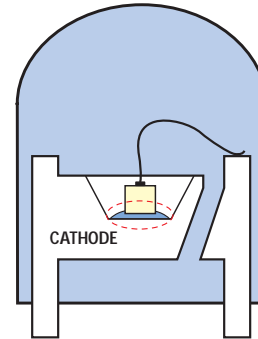
### Recommended Soldering Condition

	Wave Soldering	Manual Solder Dipping
Pre-Heat Temperature	105°C max.	–
Pre-Heat Time	30 sec max.	–
Peak Temperature	250°C max.	260°C max.
Dwell Time	3 sec max.	5 sec max.

- Wave soldering parameter must be set and maintained according to the recommended soldering condition. Customer is advised to daily check on the soldering profile to ensure that the soldering profile is always corresponding to Avago recommended soldering condition.

#### Notes:

1. PCB with different size and design (component density) will have different heat mass (heat capacity). This might cause a change in temperature experienced by the board if same wave soldering setting is used. So, it is recommended to recalibrate the soldering profile again before loading a new type of PCB.
2. Avago Technologies' high brightness LEDs use a high efficiency LED die with single wire bond, as shown below. Customer is advised to take extra precaution during wave soldering to ensure that the maximum wave temperature does not exceed 250°C. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.



**Note:** Electrical connection between bottom surface of LED die and the lead frame material through conductive paste of solder.

- Special attention must be given to board fabrication, solder masking, surface plating and lead holes size and component orientation to assure the solderability.

### Recommended PC Board Plated Through Holes Size for LED Component Leads

LED Component Lead Size	Diagonal	Plated Through Hole Diameter
0.457 x 0.457 mm (0.018 x 0.018 inch)	0.646 mm (0.025 inch)	0.976 to 1.078 mm (0.038 to 0.042 inch)
0.508 x 0.508 mm (0.020 x 0.020 inch)	0.718 mm (0.028 inch)	1.049 to 1.150 mm (0.041 to 0.045 inch)

**Note:** Refer to Application Note AN1027 for more information on soldering LED components.

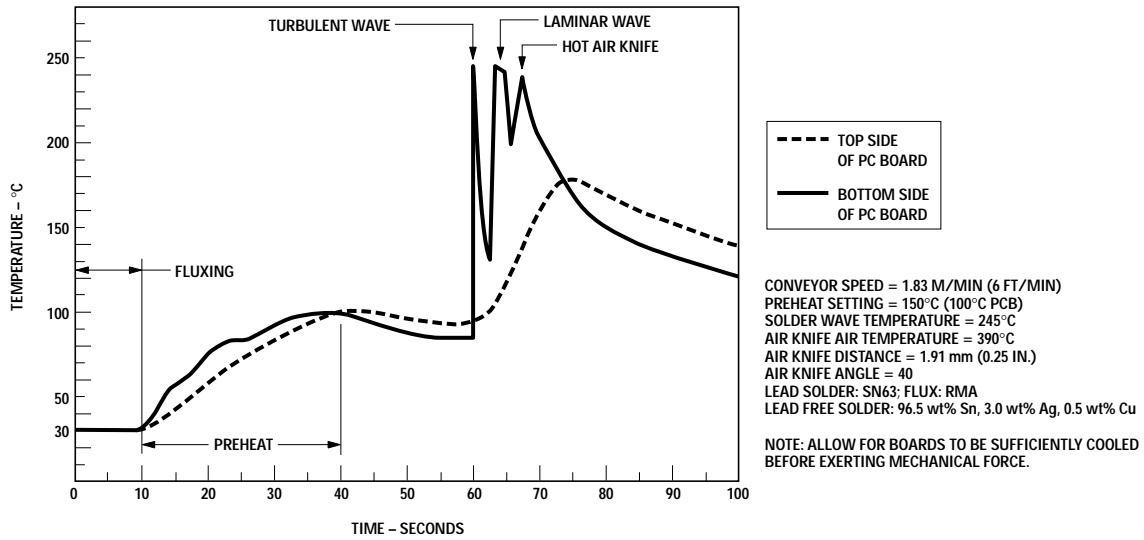
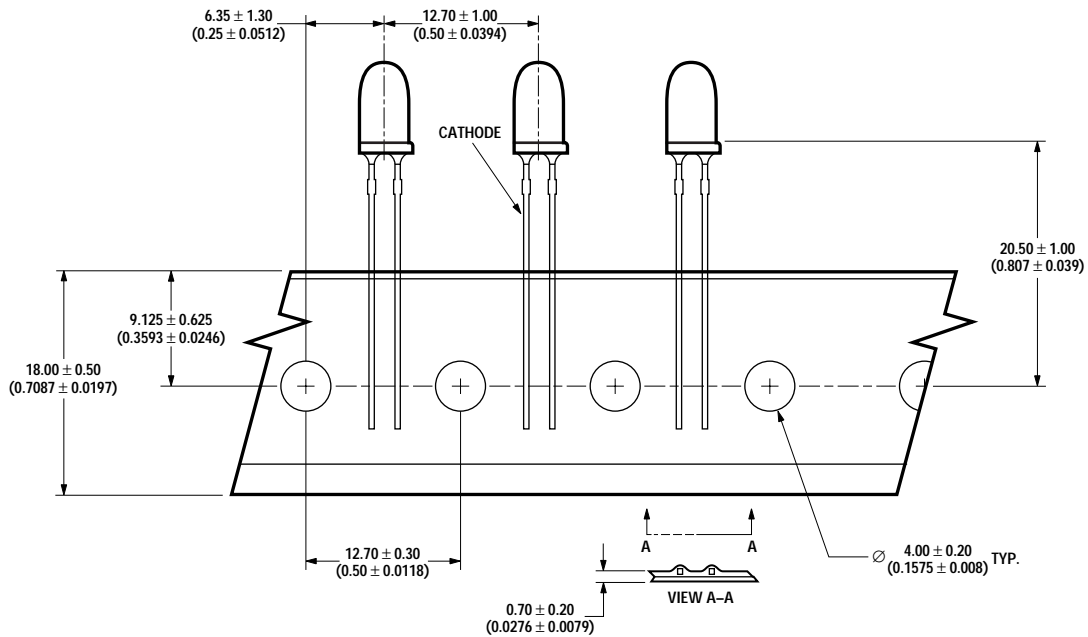


Figure 10. Recommended wave soldering profile

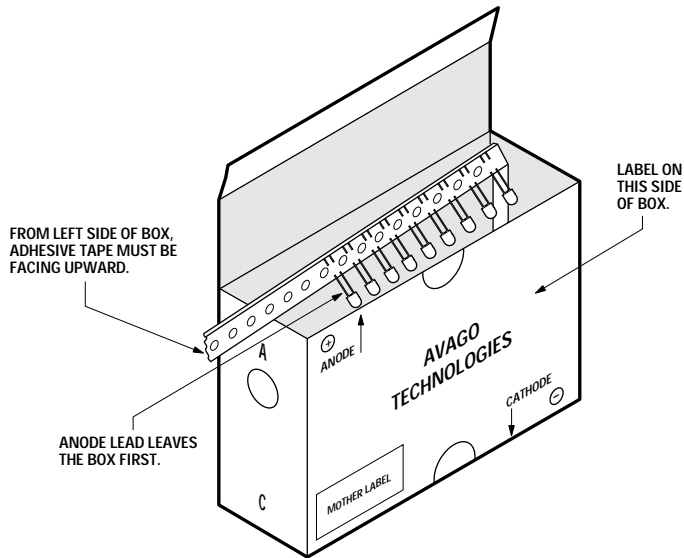
## Ammo Pack Drawing



ALL DIMENSIONS IN MILLIMETERS (INCHES).

NOTE: THE AMMO-PACKS DRAWING IS APPLICABLE FOR PACKAGING OPTION -DD & -ZZ AND REGARDLESS OF STANDOFF OR NON-STANDOFF.

## Packaging Box for Ammo Packs



NOTE:  
THE DIMENSION FOR AMMO PACK IS APPLICABLE FOR THE DEVICE WITH STANDOFF AND WITHOUT STANDOFF.

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