HEWLETT® PACKARD

# T-1¾ Super Ultra-Bright LED Lamps

## Technical Data

**HLMP-8115 HLMP-8109**
**HLMP-8205 HLMP-8209**
**HLMP-8305 HLMP-8309**
**HLMP-8405 HLMP-8409**
**HLMP-8505 HLMP-8509**
**HLMP-8605**

### Features

- **Very High Intensity**
- **Narrow and Medium Viewing Angles**
- **Untinted, Nondiffused Lens**
- **Choice of Five Colors**
- **Sturdy Leads with Seating Plane Tabs**

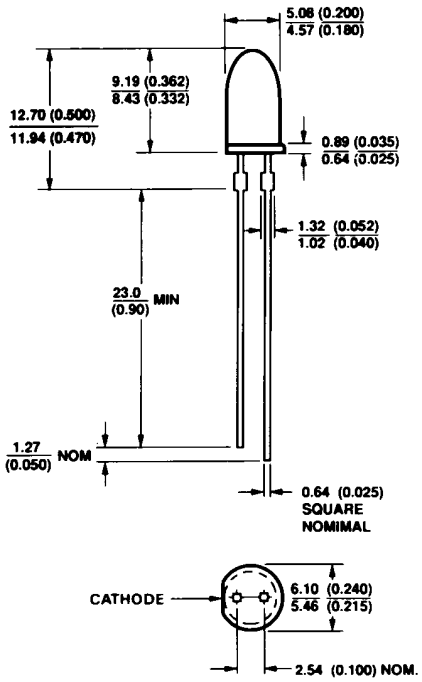
### Description

These untinted, nondiffused solid state lamps are designed with special internal optics to give a very high luminous intensity within a well defined viewing angle. The LED materials used within these devices is specifically grown to assure the high light output performance these lamps provide.

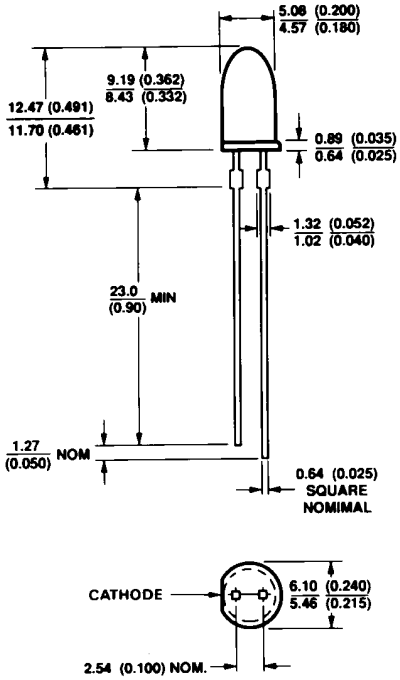
### Device Selection Guide

| LED Color | Part Number | Typical Luminous Intensity (mcd @ 20 mA dc) | 2θ½ Viewing Angle |
|---|---|---|---|
| DH AS AlGaAs | HLMP-8115<br>HLMP-8109 | 1000<br>500 | 10°<br>20° |
| High Efficiency Red | HLMP-8205<br>HLMP-8209 | 350<br>260 | 10°<br>20° |
| Yellow | HLMP-8305<br>HLMP-8309 | 350<br>260 | 10°<br>20° |
| Orange | HLMP-8405<br>HLMP-8409 | 350<br>260 | 10°<br>20° |
| High Performance Green | HLMP-8505<br>HLMP-8509 | 400<br>300 | 10°<br>20° |
| Emerald Green | HLMP-8605 | 75 | 10° |

## Package Dimensions




HLMP-8115/-8X05




HLMP-8X09

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
2. THE LEADS ARE MILD STEEL, SOLDER DIPPED.
3. AN EPOXY MENISCUS MAY EXTEND ABOUT 1 mm (0.040") DOWN THE LEADS.

## Absolute Maximum Ratings at $T_A$ = 25°C

| Parameter | DH AS AlGaAs Red | High Efficiency Red and Orange | Yellow | High Performance Green/Emerald Green | Units |
|---|---|---|---|---|---|
| DC Forward Current[1] | 30 | 30 | 20 | 30 | mA |
| Peak Forward Current[2] | 300 | 90 | 60 | 90 | mA |
| Average Forward Current[2] | 20 | 25 | 20 | 25 | mA |
| Transient Forward Current[3] (10 µs Pulse) | 500 | 500 | 500 | 500 | mA |
| Reverse Voltage ($I_R$ = 100 µA) | 5 | 5 | 5 | 5 | V |
| LED Junction Temperature | 110 | 110 | 110 | 110 | °C |
| Operating Temperature Range | -20 to +100 | -55 to +100 | | -20 to +100 | °C |
| Storage Temperature Range | -55 to +100 | | | | °C |
| Lead Soldering Temperature [1.6 mm (0.063 in.) from body] | 260°C for 5 seconds | | | | |

**Notes:**
1. See Figure 5 for maximum current derating vs. ambient temperature.
2. See Figure 6 for maximum peak current vs. pulse duration and allowable duty factor.
3. The transient peak current is the maximum non-recurring peak current the device can withstand without damaging the LED die and wire bond. Do not operate these lamps at peak currents above the Absolute Maximum Peak Forward Current.

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

**DH AS AlGaAs HLMP-8115/8109**

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Luminous Intensity<br>HLMP-8115<br>HLMP-8109 | $I_v$ | <br>500<br>200 | <br>1000<br>500 | | mcd | $I_F$ = 20 mA |
| Forward Voltage | $V_F$ | | 1.8 | 2.2 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage | $V_R$ | 5.0 | 15.0 | | V | $I_R$ = 100 µA |
| Included Angle Between Half Intensity Points<br>HLMP-8115<br>HLMP-8109 | $2\theta_{1/2}$ | | <br>10<br>20 | | Deg. | |
| Total Luminous Flux | $\phi_d$ | | 120 | | mlm | $I_F$ = 20 mA |
| Peak Wavelength | $\lambda_{PEAK}$ | | 645 | | nm | Measured at Peak |
| Dominant Wavelength[1] | $\lambda_d$ | | 637 | | nm | |
| Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 20 | | nm | |
| Speed of Response | $\tau_s$ | | 30 | | ns | Time Constant, $e^{-t/\tau}$ s |
| Capacitance | C | | 30 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\theta_{J\text{-}LEAD}$ | | 210 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[2] | $\eta_v$ | | 80 | | lm/W | |

**High Efficiency Red HLMP-8205/8209**

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Luminous Intensity<br>HLMP-8205<br>HLMP-8209 | $I_v$ | <br>200<br>90 | <br>350<br>260 | | mcd | $I_F$ = 20 mA |
| Forward Voltage | $V_F$ | | 1.9 | 2.6 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage | $V_R$ | 5.0 | 30.0 | | V | $I_R$ = 100 µA |
| Included Angle Between Half Intensity Points<br>HLMP-8205<br>HLMP-8209 | $2\theta_{1/2}$ | | <br>10<br>20 | | Deg. | |
| Total Luminous Flux | $\phi_v$ | | 45 | | mlm | $I_F$ = 20 mA |
| Peak Wavelength | $\lambda_{PEAK}$ | | 635 | | nm | Measured at Peak |
| Dominant Wavelength[1] | $\lambda_d$ | | 626 | | nm | |
| Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 40 | | nm | |
| Speed of Response | $\tau_s$ | | 90 | | ns | |
| Capacitance | C | | 11 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\theta_{J\text{-}LEAD}$ | | 210 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[2] | $\eta_v$ | | 145 | | lm/W | |

**Yellow HLMP-8305/8309**

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Luminous Intensity<br>HLMP-8305<br>HLMP-8309 | $I_v$ | <br>212<br>96 | <br>350<br>260 | | mcd | $I_F$ = 20 mA |
| Forward Voltage | $V_F$ | | 2.1 | 2.6 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage | $V_R$ | 5.0 | 30.0 | | V | $I_R$ = 100 µA |
| Included Angle Between Half Intensity Points<br>HLMP-8305<br>HLMP-8309 | $2\theta_{1/2}$ | | <br>10<br>20 | | Deg. | |
| Total Luminous Flux | $\phi_v$ | | 45 | | mlm | $I_F$ = 20 mA |
| Peak Wavelength | $\lambda_{PEAK}$ | | 583 | | nm | Measured at Peak |
| Dominant Wavelength[1] | $\lambda_d$ | | 585 | | nm | |
| Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 36 | | nm | |
| Speed of Response | $\tau_s$ | | 90 | | ns | |
| Capacitance | C | | 15 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\theta_{J\text{-}LEAD}$ | | 210 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[2] | $\eta_v$ | | 500 | | lm/W | |

**Orange HLMP-8405/8409**

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Luminous Intensity<br>HLMP-8405<br>HLMP-8409 | $I_v$ | <br>200<br>90 | <br>350<br>260 | | mcd | $I_F$ = 20 mA |
| Forward Voltage | $V_F$ | | 1.9 | 2.6 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage | $V_R$ | 5.0 | 30.0 | | V | $I_R$ = 100 µA |
| Included Angle Between Half Intensity Points<br>HLMP-8405<br>HLMP-8409 | $2\theta_{1/2}$ | | <br>10<br>20 | | Deg. | |
| Total Luminous Flux | $\phi_v$ | | 45 | | mlm | $I_F$ = 20 mA |
| Peak Wavelength | $\lambda_{PEAK}$ | | 600 | | nm | Measured at Peak |
| Dominant Wavelength[1] | $\lambda_d$ | | 602 | | nm | |
| Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 40 | | nm | |
| Speed of Response | $\tau_s$ | | 280 | | ns | |
| Capacitance | C | | 4 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\theta_{J\text{-}LEAD}$ | | 210 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[2] | $\eta_v$ | | 380 | | lm/W | |

### High Performance Green HLMP-8505/8509

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Luminous Intensity<br>HLMP-8505<br>HLMP-8509 | $I_v$ | <br>170<br>111 | <br>400<br>300 | | mcd | $I_F$ = 20 mA |
| Forward Voltage | $V_F$ | | 2.2 | 3.0 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage | $V_R$ | 5.0 | 30 | | V | $I_R$ = 100 μA |
| Included Angle Between | | | | | | |
| Half Intensity Points<br>HLMP-8505<br>HLMP-8509 | $2\theta_{1/2}$ | | <br>10<br>20 | | Deg. | |
| Total Luminous Flux | $\phi_v$ | | 115 | | mlm | $I_F$ = 20 mA |
| Peak Wavelength | $\lambda_{PEAK}$ | | 568 | | nm | Measured at Peak |
| Dominant Wavelength[1] | $\lambda_d$ | | 570 | | nm | |
| Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 28 | | nm | |
| Speed of Response | $\tau_s$ | | 260 | | ns | |
| Capacitance | C | | 18 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\theta_{J\text{-}LEAD}$ | | 210 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[2] | $\eta_v$ | | 595 | | lm/W | |

**Notes:**
1. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the device.
2. 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.

### Emerald Green HLMP-8605[1]

| Parameter | Symbol | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| Luminous Intensity<br>HLMP-8605 | $I_v$ | 69 | 75 | | mcd | $I_F$ = 20 mA |
| Forward Voltage | $V_F$ | | 2.2 | 3.0 | V | $I_F$ = 20 mA |
| Reverse Breakdown Voltage | $V_R$ | 5.0 | 30 | | V | $I_R$ = 100 μA |
| Included Angle Between Half Intensity Points<br>HLMP-8605 | $2\theta_{1/2}$ | | 10 | | Deg. | |
| Peak Wavelength | $\lambda_{PEAK}$ | | 558 | | nm | Measured at Peak |
| Dominant Wavelength[2] | $\lambda_d$ | | 560 | | nm | |
| Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 24 | | nm | |
| Speed of Response | $\tau_s$ | | 3100 | | ns | |
| Capacitance | C | | 35 | | pF | $V_F$ = 0, f = 1 MHz |
| Thermal Resistance | $R\theta_{J\text{-}LEAD}$ | | 210 | | °C/W | LED Junction-to-Cathode Lead |
| Luminous Efficacy[3] | $\eta_v$ | | 656 | | lm/W | |

**Notes:**
1. Please refer to Application Note 1061 for information comparing standard green and emerald green light output degradation.
2. The dominant wavelength, $\lambda_d$, is derived from the CIE Chromaticity Diagram and represents the color of the device.
3. 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.

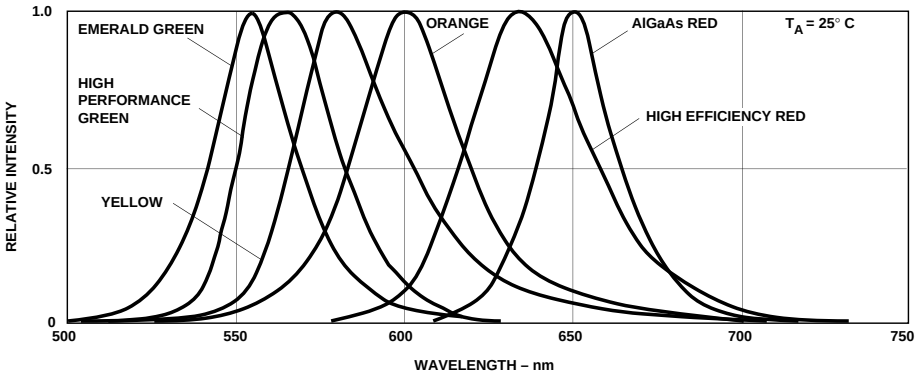



**Figure 1. Relative Intensity vs. Wavelength.**

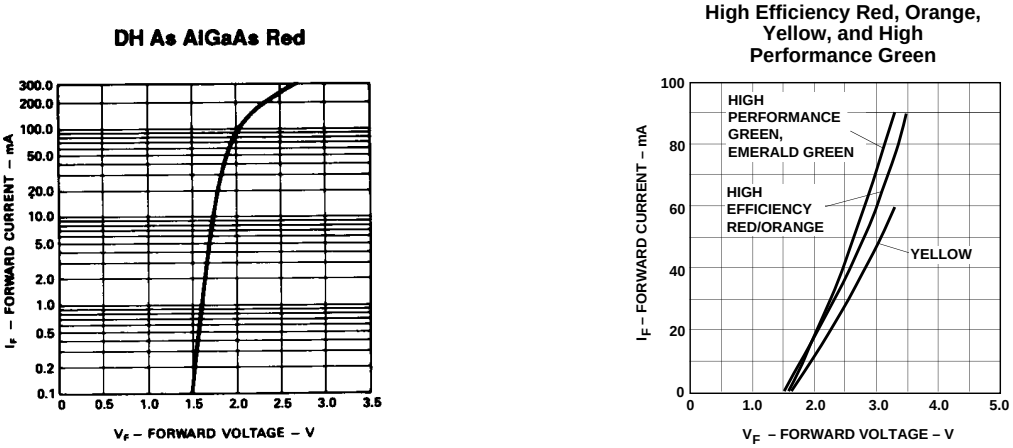



**Figure 2. Forward Current vs. Forward Voltage (Non-Resistor Lamp).**

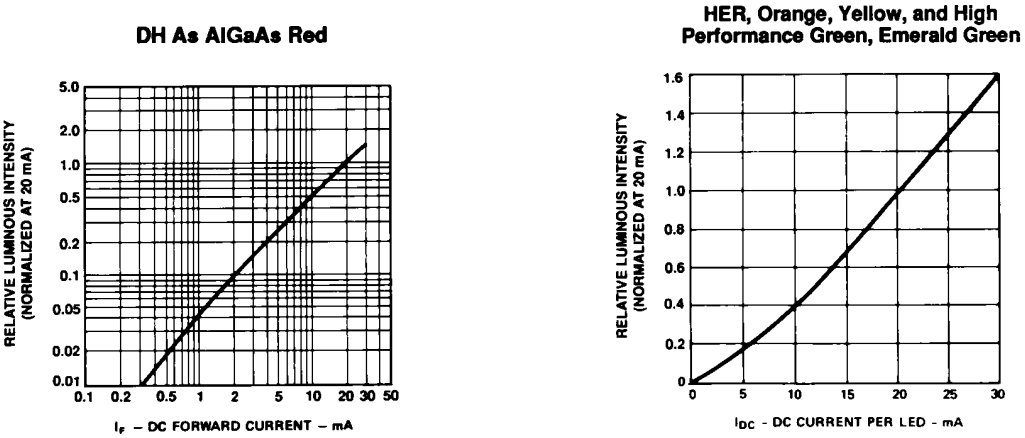



**Figure 3. Relative Luminous Intensity vs. Forward Current.**

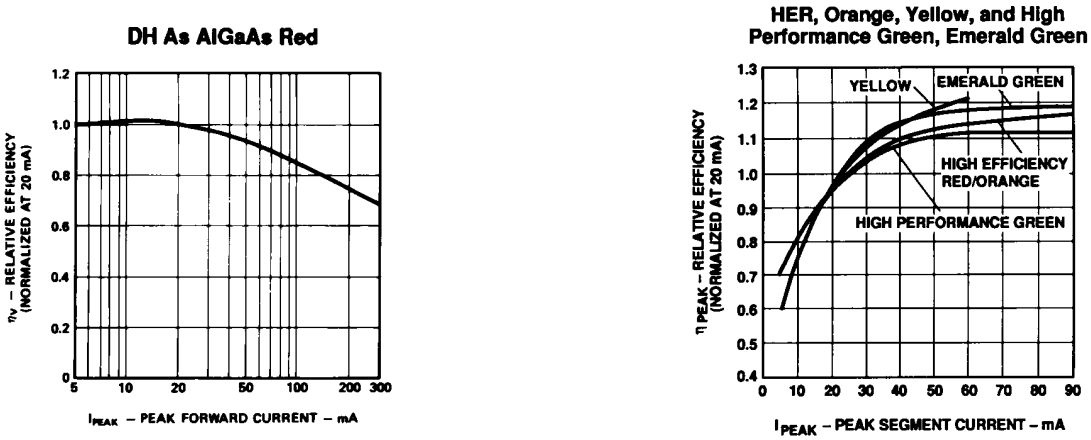



**Figure 4. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.**

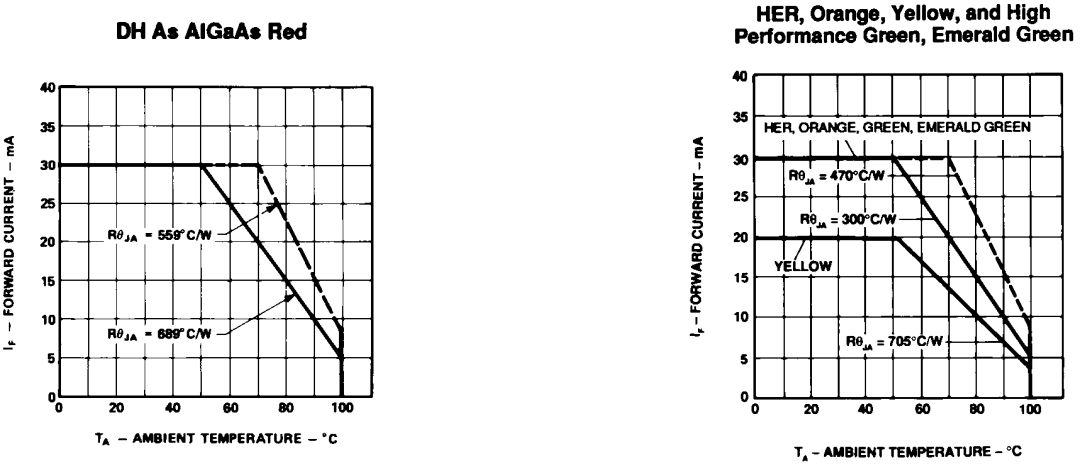



**Figure 5. Maximum Forward dc Current vs. Ambient Temperature. Derating Based on $T_J$ MAX = 110 °C.**

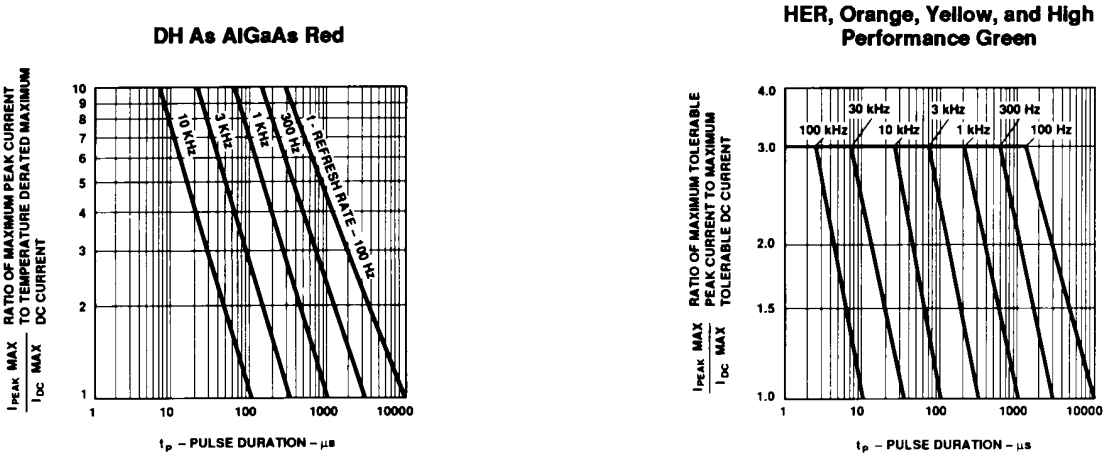



**Figure 6. Maximum Tolerable Peak Current vs. Pulse Duration. ($I_{DC}$ MAX as per MAX Ratings).**

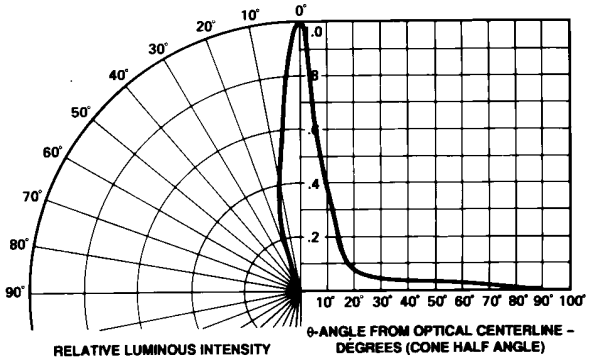



**Figure 7. Relative Luminous Intensity vs. Angular Displacement. HLMP-8115/-8X05.**

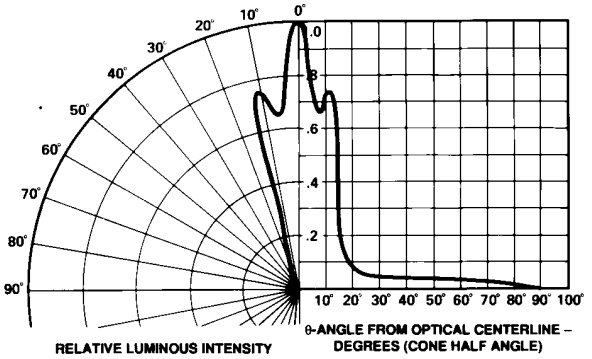



**Figure 8. Relative Luminous Intensity vs. Angular Displacement. HLMP-8X09.**

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