

# **HDSP-511x, HDSP-513x, and HDSP-515A**

## **14.22-mm (0.56-in.) General-Purpose Seven-Segment Display**



### **Description**

This 14.22-mm (0.56-in.) LED seven-segment display uses industry-standard size package and pinout. The device is available in either common anode or common cathode. The choice of colors includes High Efficiency Red (HER), Green, AlGaAs Red, and Yellow. The displays are suitable for indoor use.

### **Applications**

- Suitable for indoor use
- Not recommended for industrial application, that is, operating temperature requirements exceeding +85°C or below –25°C (for additional details, contact your local Broadcom® sales office or an authorized distributor)
- Extreme temperature cycling not recommended

### **Features**

- Industry standard size
- Industry standard pinout  
14.22-mm (0.56-in.) DIP lead on 2.54 mm
- Choice of colors  
High Efficiency Red (HER), Green, AlGaAs Red, and Yellow
- Excellent appearance  
Evenly lighted segments package gives optimum contrast  
± 50° viewing angle
- Design flexibility  
Common anode or common cathode  
Single digit  
Right-hand decimal point
- Categorized for luminous intensity  
Green and yellow categorized for color

### **Devices**

| HER       | Green     | AlGaAs Red | Yellow    | Description                                       |
|-----------|-----------|------------|-----------|---------------------------------------------------|
| HDSP-511E | HDSP-511G | HDSP-511A  | HDSP-511Y | Common Anode, Gray Surface, Right-Hand Decimal    |
| HDSP-513E | HDSP-513G | HDSP-513A  | HDSP-513Y | Common Cathode, Gray Surface, Right-Hand Decimal  |
| —         | —         | HDSP-515A  | —         | Common Cathode, Black Surface, Right-Hand Decimal |

## Part Numbering System

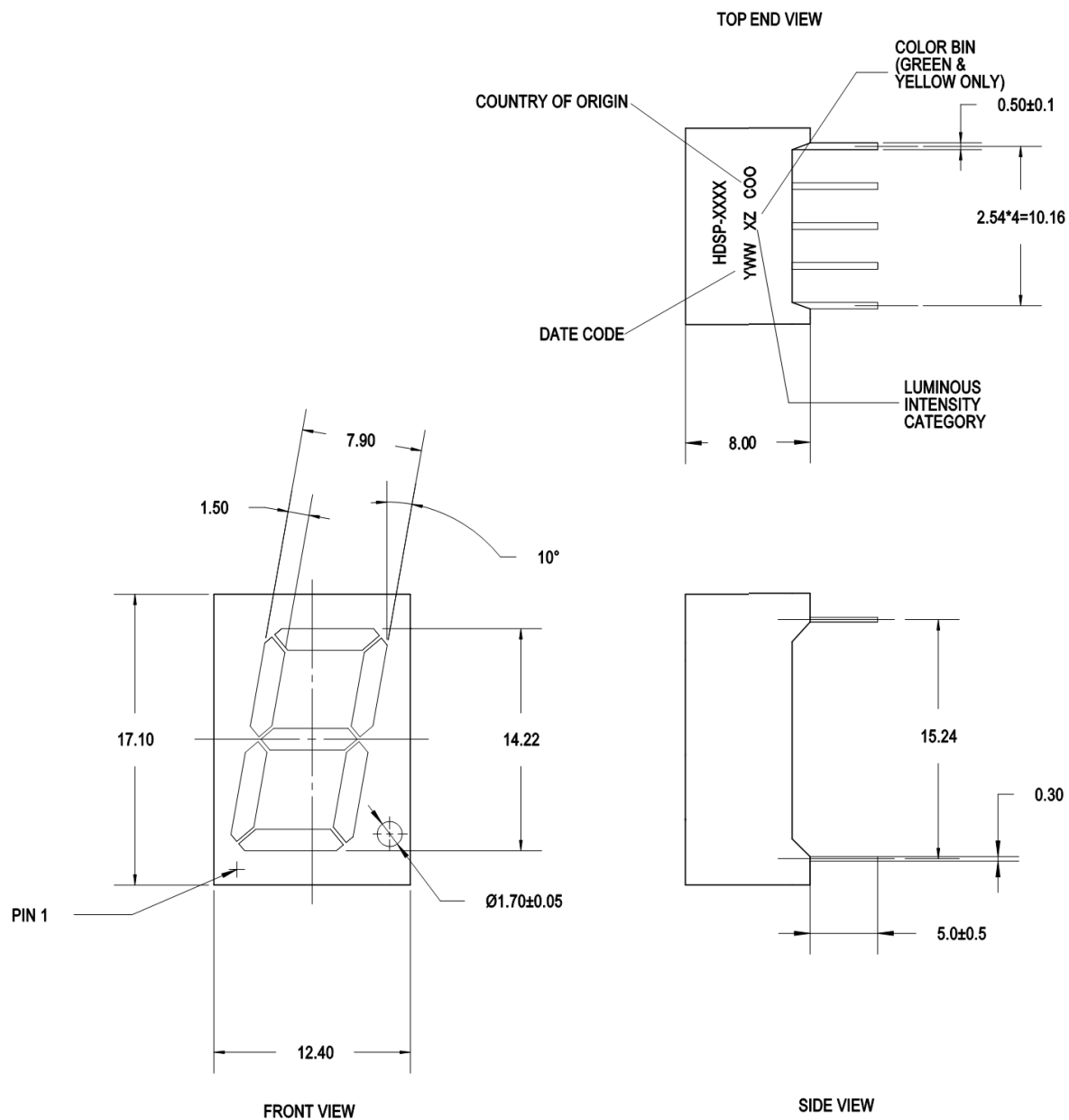
5 0 8 2 - x<sub>1</sub> x<sub>2</sub> x<sub>3</sub> x<sub>4</sub> - x<sub>5</sub> x<sub>6</sub> x<sub>7</sub> x<sub>8</sub> x<sub>9</sub>

H D S P - x<sub>1</sub> x<sub>2</sub> x<sub>3</sub> x<sub>4</sub> - x<sub>5</sub> x<sub>6</sub> x<sub>7</sub> x<sub>8</sub> x<sub>9</sub>

| Placeholder                   | Description                   | Option | Setting                             | Notes |
|-------------------------------|-------------------------------|--------|-------------------------------------|-------|
| x <sub>1</sub>                | Package                       |        |                                     | a     |
| x <sub>2</sub> x <sub>3</sub> | Device Specific Configuration |        |                                     | a     |
| x <sub>4</sub>                | Device Configuration/Color    | A      | AlGaAs Red                          | a     |
|                               |                               | E      | High Efficiency Red                 |       |
|                               |                               | G      | Green                               |       |
|                               |                               | Y      | Yellow                              |       |
| x <sub>5</sub>                | Minimum Intensity Bin         | 0      | No minimum intensity bin limitation | a, b  |
| x <sub>6</sub>                | Maximum Intensity Bin         | 0      | No maximum intensity bin limitation | a, b  |
| x <sub>7</sub>                | Color Bin Options             | 0      | No color bin limitation             | a, b  |
| x <sub>8</sub> x <sub>9</sub> | Mechanical Options            | 00     | No mechanical option                | a     |

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

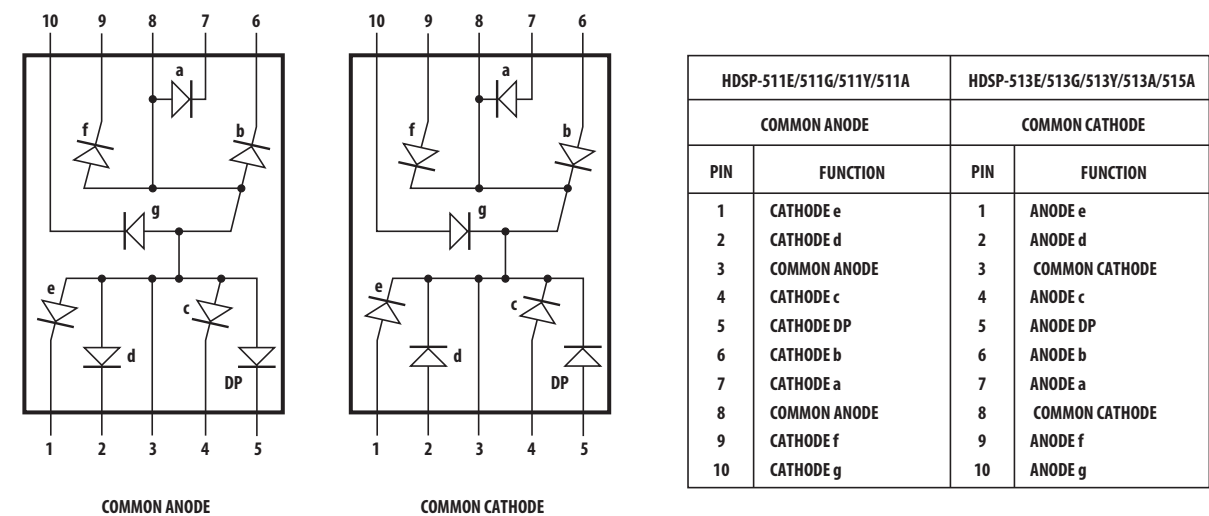
# Package Dimensions



## NOTE:

1. All dimensions are in millimeters (mm).
2. Tolerance is  $\pm 0.25$  mm unless otherwise specified.

Internal Circuit Diagram



Absolute Maximum Ratings at T<sub>A</sub> = 25°C

| Description                                                                 | HER<br>HDSP-51xE | Green<br>HDSP-51xG | AlGaAs Red<br>HDSP-51xA | Yellow<br>HDSP-51xY | Units |
|-----------------------------------------------------------------------------|------------------|--------------------|-------------------------|---------------------|-------|
| Power Dissipation Segment                                                   | 60               | 65                 | 30                      | 52                  | mW    |
| Forward Current Segment                                                     | 25 <sup>a</sup>  | 25 <sup>b</sup>    | 15 <sup>c</sup>         | 20 <sup>d</sup>     | mA    |
| Peak Forward Current per Segment<br>(1/10 Duty Factor at 10 kHz)            | 100              | 100                | 80                      | 80                  | mA    |
| Operating Temperature Range                                                 | −35 to +85       | −35 to +85         | −35 to +85              | −35 to +85          | °C    |
| Storage Temperature Range                                                   | −35 to +85       | −35 to +85         | −35 to +85              | −35 to +85          | °C    |
| Reverse Voltage per Segment or DP                                           | 5                | 5                  | 5                       | 5                   | V     |
| Wavesoldering Temperature for 3 seconds<br>(at 2-mm distance from the body) | 250              | 250                | 250                     | 250                 | °C    |

- a. Derate above 25°C at 0.33 mA/°C.
- b. Derate above 25°C at 0.33 mA/°C.
- c. Derate above 25°C at 0.2 mA/°C.
- d. Derate above 25°C at 0.27 mA/°C.

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

### High Efficiency Red (HER)

| Device<br>HDSP- | Parameter                  | Symbol                  | Min.  | Typ.  | Max. | Units | Test Conditions                |
|-----------------|----------------------------|-------------------------|-------|-------|------|-------|--------------------------------|
| 511E<br>513E    | Luminous Intensity/Segment | $I_V$                   | —     | 1.73  | —    | mcd   | $I_F = 5\text{ mA}$            |
|                 |                            |                         | 2.001 | 4.100 | —    | mcd   | $I_F = 10\text{ mA}$           |
|                 | Forward Voltage            | $V_F$                   | —     | 2.05  | 2.40 | V     | $I_F = 20\text{ mA}$           |
|                 | Peak Wavelength            | $\lambda_{\text{PEAK}}$ | —     | 635   | —    | nm    |                                |
|                 | Dominant Wavelength        | $\lambda_d$             | —     | 620   | —    | nm    |                                |
|                 | Reverse Voltage            | $V_R$                   | 5     | —     | —    | V     | $I_R = 100\text{ }\mu\text{A}$ |

### Green

| Device<br>HDSP- | Parameter                  | Symbol                  | Min.  | Typ.  | Max. | Units | Test Conditions                |
|-----------------|----------------------------|-------------------------|-------|-------|------|-------|--------------------------------|
| 511G<br>513G    | Luminous Intensity/Segment | $I_V$                   | 2.001 | 4.100 | —    | mcd   | $I_F = 10\text{ mA}$           |
|                 | Forward Voltage            | $V_F$                   | —     | 2.06  | —    | V     | $I_F = 10\text{ mA}$           |
|                 |                            |                         | 1.80  | 2.25  | 2.60 | V     | $I_F = 20\text{ mA}$           |
|                 | Peak Wavelength            | $\lambda_{\text{PEAK}}$ | —     | 568   | —    | nm    |                                |
|                 | Dominant Wavelength        | $\lambda_d$             | —     | 573   | —    | nm    |                                |
|                 | Reverse Voltage            | $V_R$                   | 5     | —     | —    | V     | $I_R = 100\text{ }\mu\text{A}$ |

### AlGaAs Red

| Device<br>HDSP-      | Parameter                  | Symbol                  | Min.  | Typ.  | Max. | Units | Test Conditions                |
|----------------------|----------------------------|-------------------------|-------|-------|------|-------|--------------------------------|
| 511A<br>513A<br>515A | Luminous Intensity/Segment | $I_V$                   | —     | 4.93  | —    | mcd   | $I_F = 5\text{ mA}$            |
|                      |                            |                         | 3.201 | 6.500 | —    | mcd   | $I_F = 10\text{ mA}$           |
|                      | Forward Voltage            | $V_F$                   | —     | 1.85  | 2.00 | V     | $I_F = 20\text{ mA}$           |
|                      | Peak Wavelength            | $\lambda_{\text{PEAK}}$ | —     | 660   | —    | nm    |                                |
|                      | Dominant Wavelength        | $\lambda_d$             | —     | 643   | —    | nm    |                                |
|                      | Reverse Voltage            | $V_R$                   | 5     | —     | —    | V     | $I_R = 100\text{ }\mu\text{A}$ |

## Yellow

| Device<br>HDSP- | Parameter                  | Symbol           | Min.  | Typ.  | Max. | Units | Test Conditions         |
|-----------------|----------------------------|------------------|-------|-------|------|-------|-------------------------|
| 511Y<br>513Y    | Luminous Intensity/Segment | $I_V$            | —     | 1.03  | —    | mcd   | $I_F = 5 \text{ mA}$    |
|                 |                            |                  | 1.251 | 2.600 | —    | mcd   | $I_F = 10 \text{ mA}$   |
|                 | Forward Voltage            | $V_F$            | —     | 2.15  | 2.60 | V     | $I_F = 20 \text{ mA}$   |
|                 | Peak Wavelength            | $\lambda_{PEAK}$ | —     | 595   | —    | nm    |                         |
|                 | Dominant Wavelength        | $\lambda_d$      | —     | 590   | —    | nm    |                         |
|                 | Reverse Voltage            | $V_R$            | 5     | —     | —    | V     | $I_R = 100 \mu\text{A}$ |

## Intensity Bin Limits (mcd at 10 mA)

| Bin<br>Name | HER/Green         |                   | Yellow            |                   | AlGaAs Red        |                   |
|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|             | Min. <sup>a</sup> | Max. <sup>a</sup> | Min. <sup>a</sup> | Max. <sup>a</sup> | Min. <sup>a</sup> | Max. <sup>a</sup> |
| H           | N/A               | N/A               | 1.251             | 2.000             | N/A               | N/A               |
| I           | 2.001             | 3.200             | 2.001             | 3.200             | N/A               | N/A               |
| J           | 3.201             | 5.050             | 3.201             | 5.050             | 3.201             | 5.050             |
| K           | 5.051             | 8.000             | N/A               | N/A               | 5.051             | 8.000             |
| L           | N/A               | N/A               | N/A               | N/A               | 8.001             | 12.650            |

a. Tolerance for each bin limit is  $\pm 10\%$ .

## Color Bin Limits (nm)

| Color  | Dominant Wavelength (nm) |                   |                   |
|--------|--------------------------|-------------------|-------------------|
|        | Bin                      | Min. <sup>a</sup> | Max. <sup>a</sup> |
| Green  | 3                        | 569.1             | 571.0             |
|        | 4                        | 571.1             | 573.0             |
|        | 5                        | 573.1             | 575.0             |
| Yellow | 1                        | 585.5             | 588.5             |
|        | 2                        | 588.5             | 591.5             |
|        | 3                        | 591.5             | 594.5             |

a. Tolerance for each bin limit is 1 nm.

# High Efficiency Red (HER)

Figure 1: Maximum Allowable Average or DC Current vs. Ambient Temperature

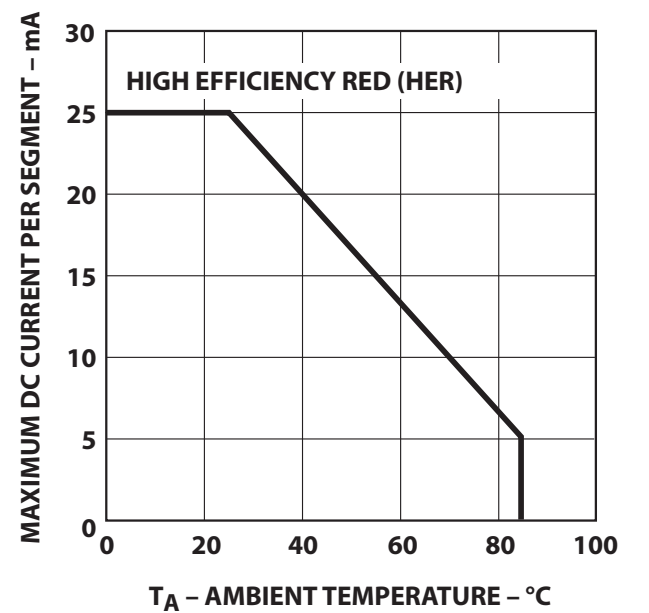


Figure 2: Forward Current vs. Forward Voltage

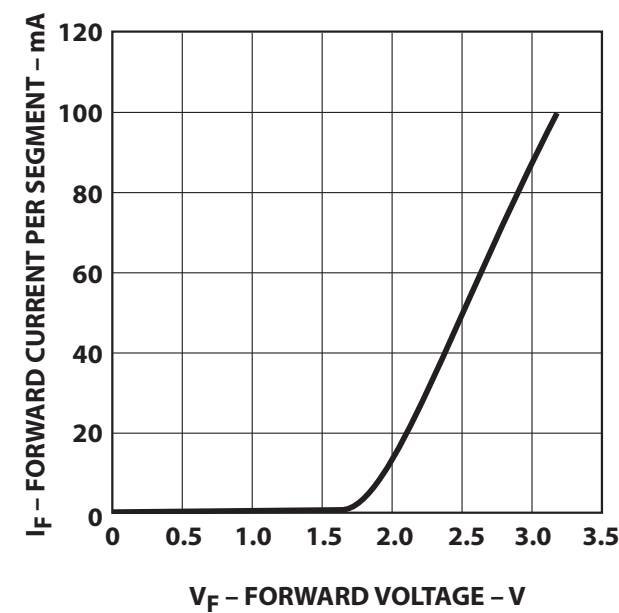


Figure 3: Relative Luminous Intensity vs. DC Forward Current

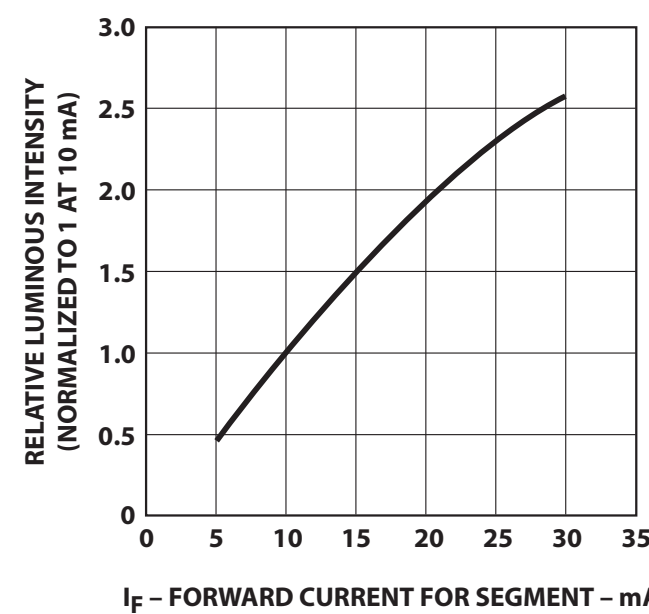
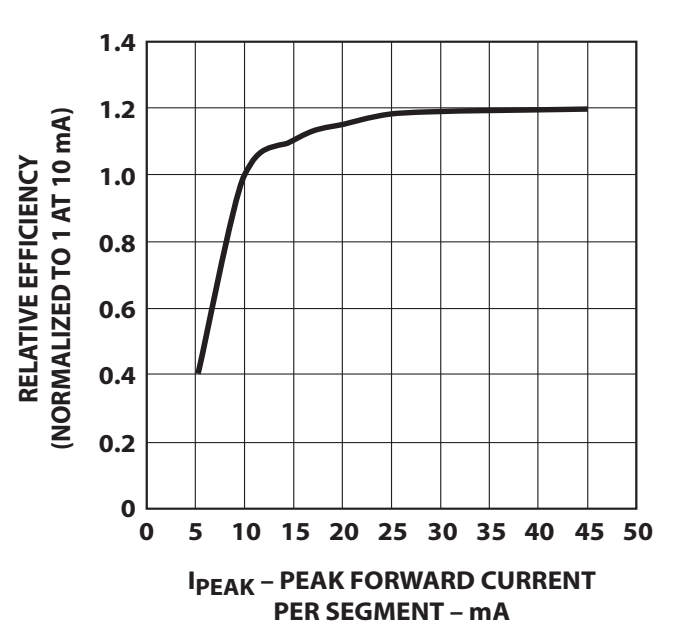


Figure 4: Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current



Green

Figure 5: Maximum Allowable Average or DC Current vs. Ambient Temperature

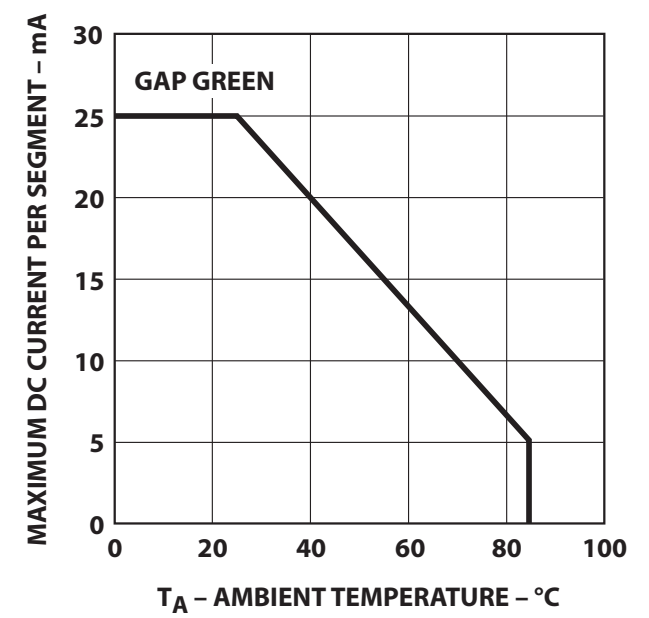


Figure 6: Forward Current vs. Forward Voltage

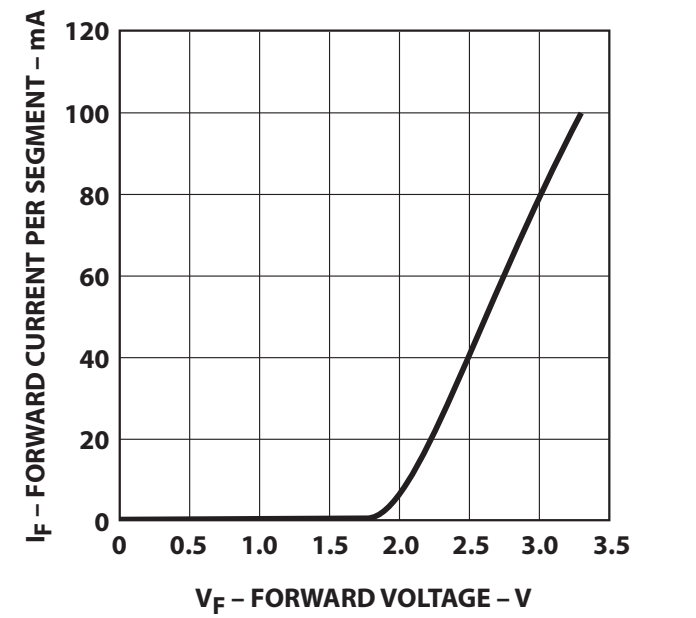


Figure 7: Relative Luminous Intensity vs. DC Forward Current

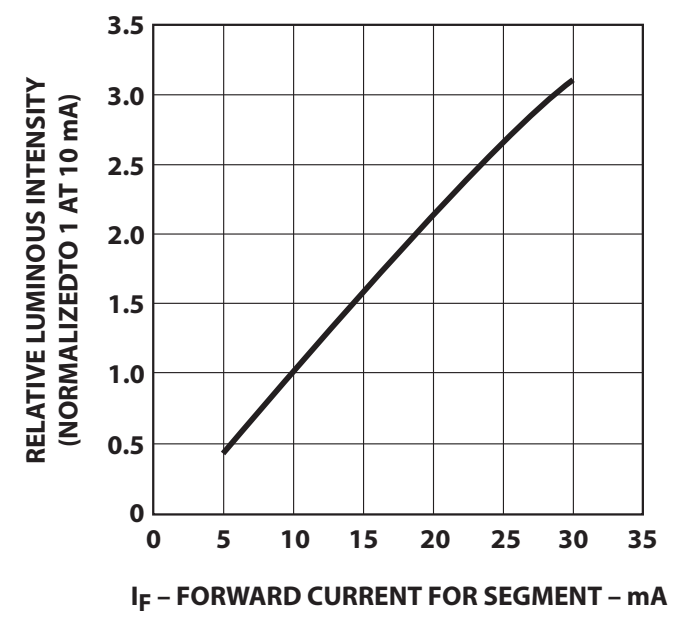
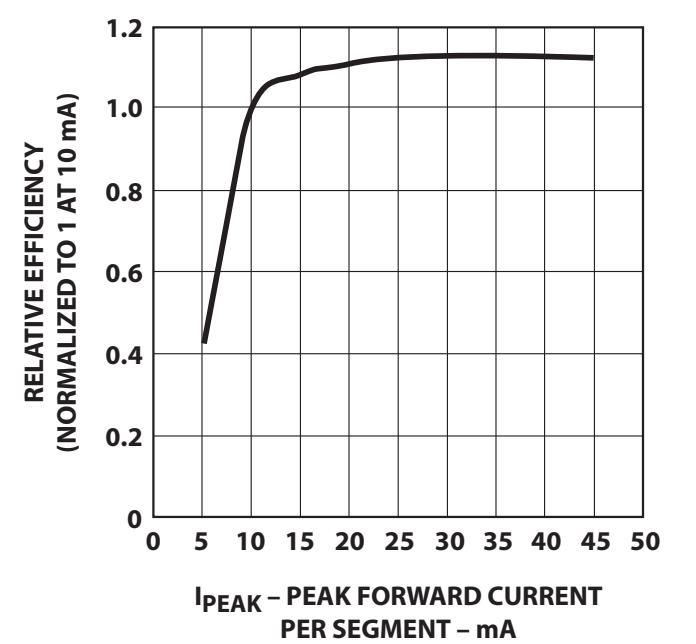


Figure 8: Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current



AlGaAs Red

Figure 9: Maximum Allowable Average or DC Current vs. Ambient Temperature

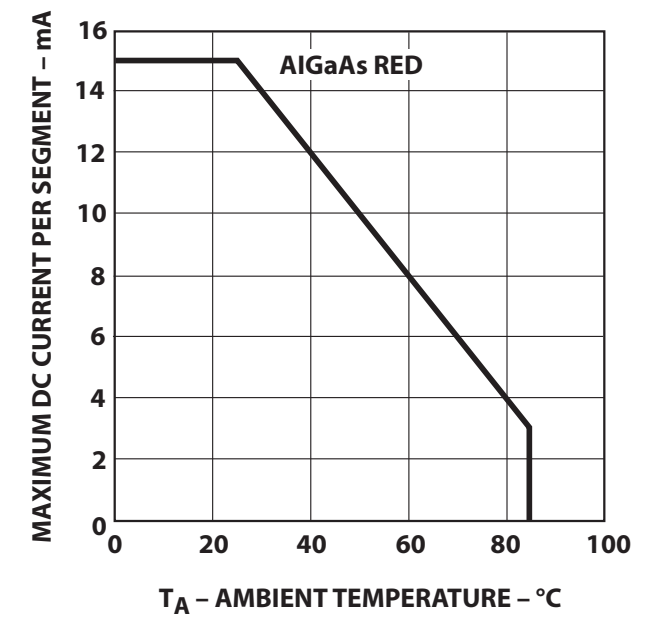


Figure 10: Forward Current vs. Forward Voltage

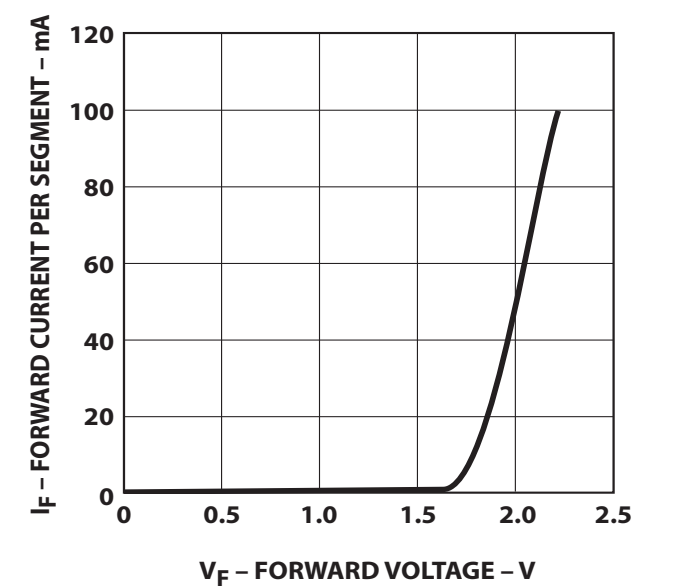


Figure 11: Relative Luminous Intensity vs. DC Forward Current

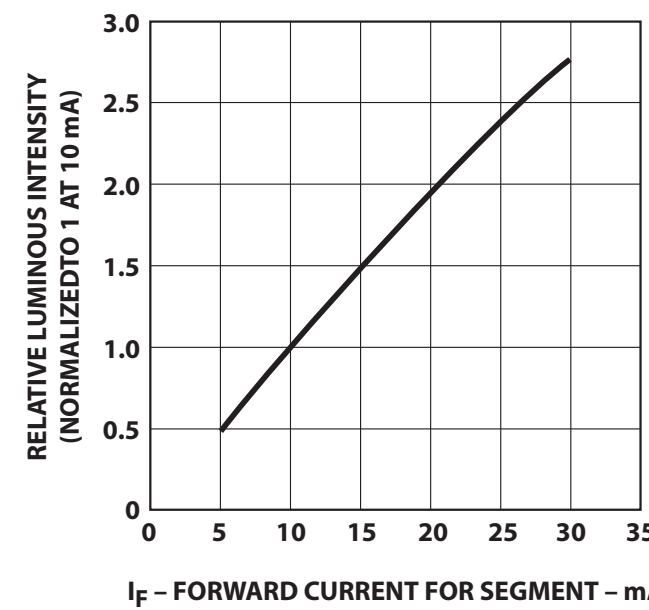
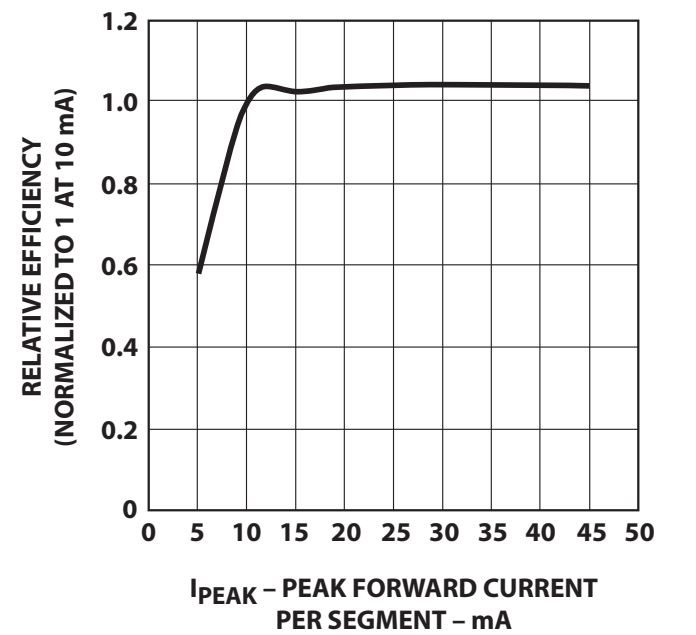


Figure 12: Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current



Yellow

Figure 13: Maximum Allowable Average or DC Current vs. Ambient Temperature

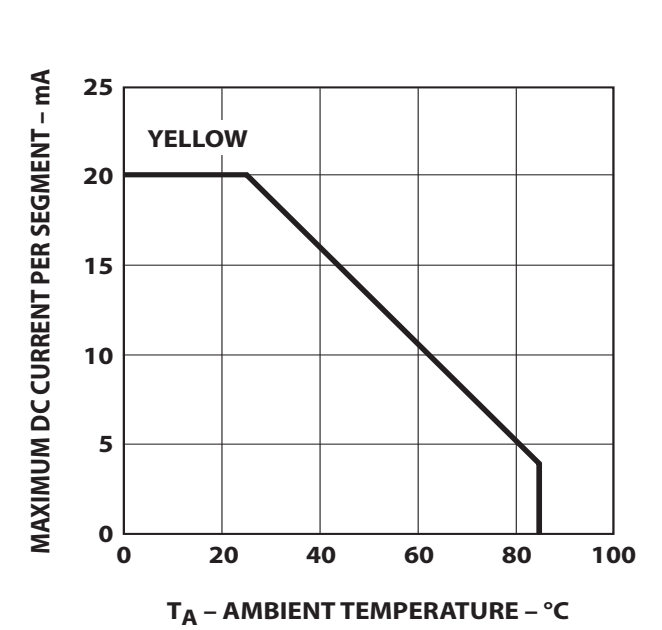


Figure 14: Forward Current vs. Forward Voltage

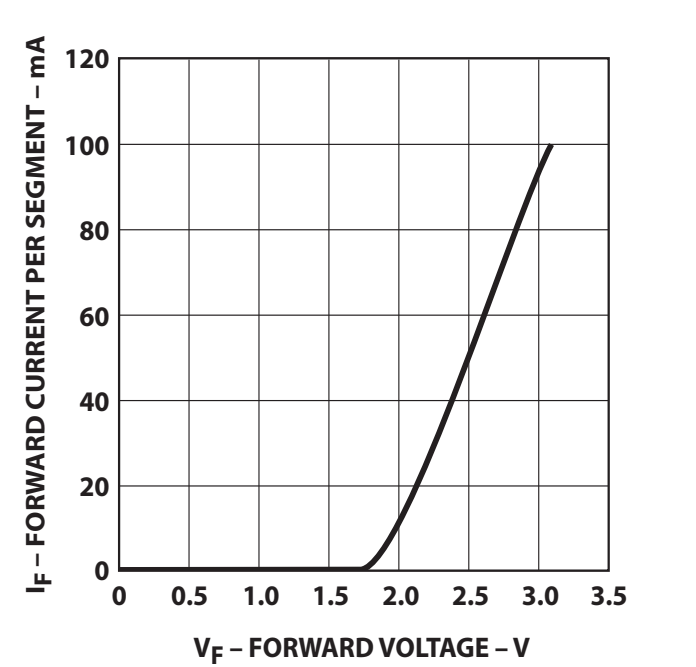


Figure 15: Relative Luminous Intensity vs. DC Forward Current

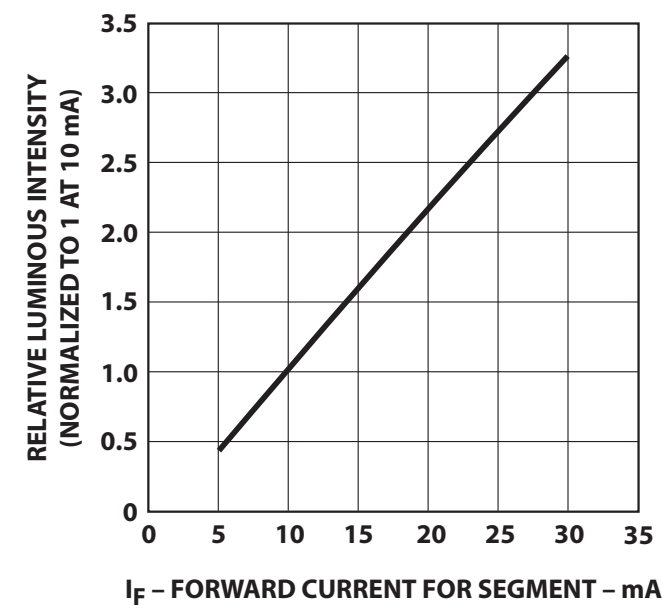
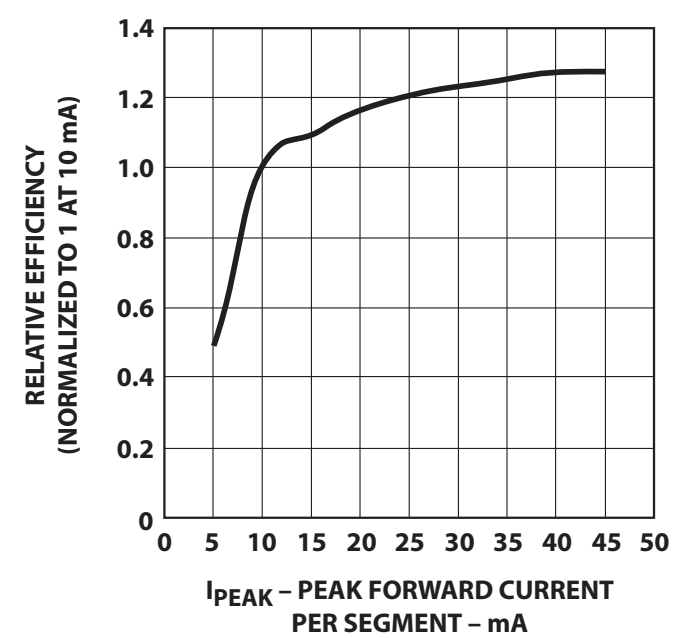


Figure 16: Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current



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