

# 10 mm and 13 mm Slim Font Seven Segment Displays

## Technical Data

**HDSP-315X Series**  
**HDSP-316X Series**  
**HDSP-515X Series**  
**HDSP-516X Series**

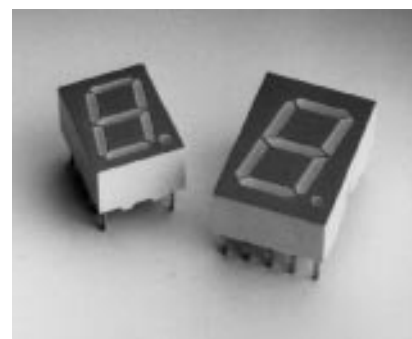
### Features

- **Excellent Appearance**
- **Slim Font Design**
- **Mitered Corners, Evenly Illuminated Segments**
- **Gray Face for Optimum On/Off Contrast**
- **Choice of Colors: Standard Red, DH AlGaAs Red, High Efficiency Red (HER), Yellow, and Green**
- **Low Current Available, AlGaAs Red and HER Choice of Character Size: 10 mm and 13 mm**
- **$\pm 50^\circ$  Viewing Angle**
- **Characterized for Luminous Intensity**

### Description

The HDSP-31XX-51XX Series of displays incorporates a new slim font character design. This slim font features narrow width, specially mitered segments to give a fuller appearance to the illuminated character. Faces of these displays are painted a neutral gray for enhanced on/off contrast.

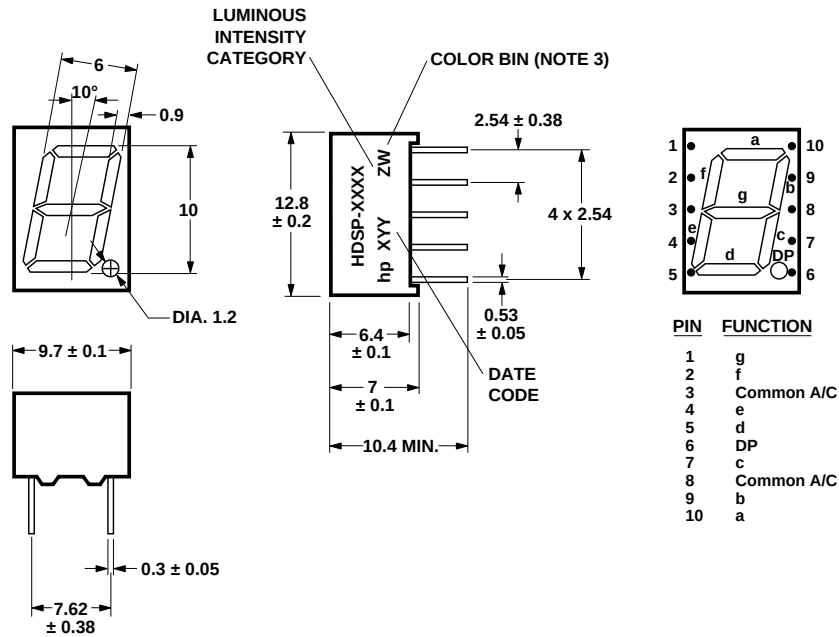
All devices are available in either common anode or common cathode configuration with right hand decimal point. Low current versions are available in either AlGaAs red or HER.



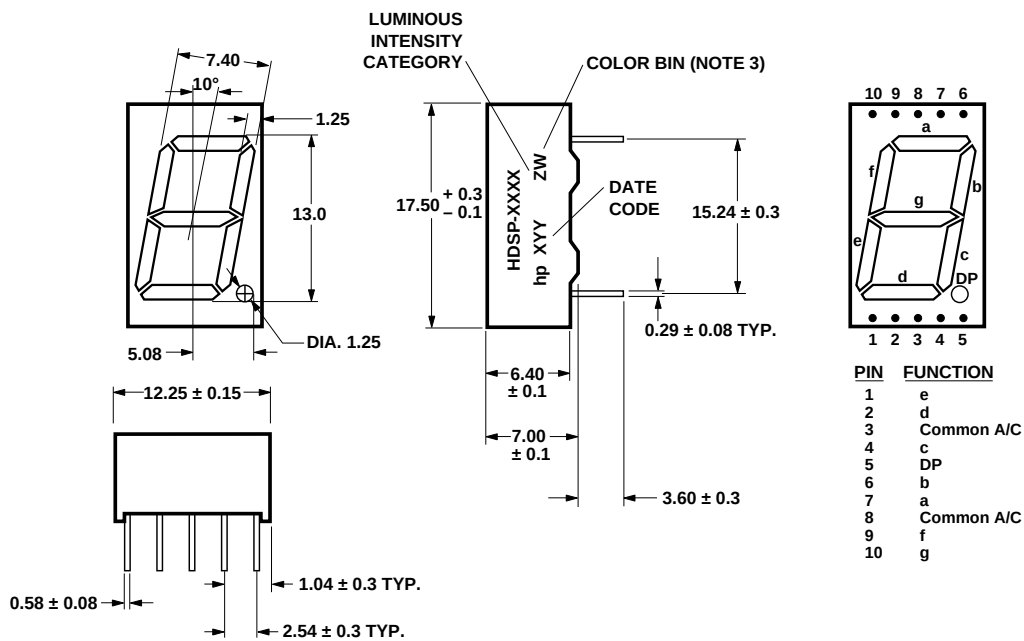
### Devices

| Red Std. Current HDSP- | AlGaAs Red Low Current HDSP- | HER Std. Current HDSP- | HER Low Current HDSP- | Yellow Std. Current HDSP- | Green Std. Current HDSP- | Description                   | Package Drawing |
|------------------------|------------------------------|------------------------|-----------------------|---------------------------|--------------------------|-------------------------------|-----------------|
| 315R                   | 315H                         | 315E                   | 315L                  | 315Y                      | 315G                     | Common Anode, 10 mm Display   | A               |
| 316R                   | 316H                         | 316E                   | 316L                  | 316Y                      | 316G                     | Common Cathode, 10 mm Display | B               |
| 515R                   | 515H                         | 515E                   | 515L                  | 515Y                      | 515G                     | Common Anode, 13 mm Display   | A               |
| 516R                   | 516H                         | 516E                   | 516L                  | 516Y                      | 516G                     | Common Cathode, 13 mm Display | B               |

## HDSP-315X/316X Series



## HDSP-515X/516X Series



**NOTES:** 1. PACKAGE DIMENSIONS IN MILLIMETERS.  
2. UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.  
3. FOR YELLOW AND GREEN DEVICES ONLY.

## Absolute Maximum Ratings

| Description                                                        | Standard Red       | AlGaAs Red Low Current | HER               | HER Low Current   | Yellow            | Green              | Units |
|--------------------------------------------------------------------|--------------------|------------------------|-------------------|-------------------|-------------------|--------------------|-------|
| Average Power per Segment or DP                                    | 82                 | 37                     | 105               | 52                | 105               | 105                | mW    |
| Peak Forward Current per Segment or DP                             | 150 <sup>[1]</sup> | 45                     | 90 <sup>[4]</sup> | 45                | 90 <sup>[7]</sup> | 90 <sup>[9]</sup>  | mA    |
| DC Forward Current per Segment or DP                               | 25 <sup>[2]</sup>  | 15 <sup>[3]</sup>      | 30 <sup>[5]</sup> | 15 <sup>[6]</sup> | 30 <sup>[8]</sup> | 30 <sup>[10]</sup> | mA    |
| Operating Temperature Range                                        | -40 to +100        | -20 to 100             | -40 to +100       |                   |                   |                    | °C    |
| Storage Temperature Range                                          | -40 to +100        |                        |                   |                   |                   |                    | °C    |
| Reverse Voltage per Segment or DP                                  | 3.0                |                        |                   |                   |                   |                    | V     |
| Lead Solder Temperature for 3 seconds 1.59 mm. below seating plane | 260                |                        |                   |                   |                   |                    | °C    |

### Notes:

1. See Figure 1 to establish pulsed conditions.
2. Derate above 80°C at 0.63 mA/°C.
3. Derate above 91°C at 0.53 mA/°C.
4. See Figure 9 to establish pulsed conditions.
5. Derate above 53°C at 0.45 mA/°C.
6. Derate above 80°C at 0.38 mA/°C.
7. See Figure 10 to establish pulsed conditions.
8. Derate above 81°C at 0.52 mA/°C.
9. See Figure 11 to establish pulsed conditions.
10. Derate above 39°C at 0.37 mA/°C.

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

### Standard Red

| Device Series<br>HDSP- | Parameter                                                      | Symbol                  | Min. | Typ. | Max. | Units          | Test Conditions                |
|------------------------|----------------------------------------------------------------|-------------------------|------|------|------|----------------|--------------------------------|
| 315/316R<br>515/516R   | Luminous Intensity/Segment <sup>[1,2]</sup><br>(Digit Average) | $I_V$                   | 180  | 650  |      | $\mu\text{cd}$ | $I_F = 10\text{ mA}$           |
|                        | Forward Voltage/Segment or DP                                  | $V_F$                   |      | 1.6  | 2.1  | V              | $I_F = 10\text{ mA}$           |
|                        | Peak Wavelength                                                | $\lambda_{\text{PEAK}}$ |      | 655  |      | nm             |                                |
|                        | Dominant Wavelength <sup>[3]</sup>                             | $\lambda_d$             |      | 640  |      | nm             |                                |
|                        | Reverse Voltage/Segment or DP <sup>[4]</sup>                   | $V_R$                   | 3    | 12   |      | V              | $I_R = 100\text{ }\mu\text{A}$ |
|                        | Thermal Resistance LED Junction-to-Pin                         | $R_{\theta_{J-PIN}}$    |      | 200  |      | °C/W/Seg       |                                |

**AlGaAs Red Low Current**

| <b>Device Series HDSP-</b> | <b>Parameter</b>                                               | <b>Symbol</b>            | <b>Min.</b> | <b>Typ.</b> | <b>Max.</b> | <b>Units</b>             | <b>Test Conditions</b>  |
|----------------------------|----------------------------------------------------------------|--------------------------|-------------|-------------|-------------|--------------------------|-------------------------|
| 315/316H<br>515/516H       | Luminous Intensity/Segment <sup>[1,2]</sup><br>(Digit Average) | $I_V$                    | 180         | 650         |             | $\mu\text{cd}$           | $I_F = 1 \text{ mA}$    |
|                            | Forward Voltage/Segment or DP                                  | $V_F$                    |             | 1.8         | 2.2         | V                        | $I_F = 1 \text{ mA}$    |
|                            | Peak Wavelength                                                | $\lambda_{\text{PEAK}}$  |             | 645         |             | nm                       |                         |
|                            | Dominant Wavelength <sup>[3]</sup>                             | $\lambda_d$              |             | 637         |             | nm                       |                         |
|                            | Reverse Voltage/Segment or DP <sup>[4]</sup>                   | $V_R$                    | 3           | 15          |             | V                        | $I_R = 100 \mu\text{A}$ |
|                            | Thermal Resistance LED<br>Junction-to-Pin                      | $R\theta_{\text{J-PIN}}$ |             | 255         |             | $^{\circ}\text{C/W/Seg}$ |                         |

**HER**

| <b>Device Series HDSP-</b> | <b>Parameter</b>                                               | <b>Symbol</b>            | <b>Min.</b> | <b>Typ.</b> | <b>Max.</b> | <b>Units</b>             | <b>Test Conditions</b>  |
|----------------------------|----------------------------------------------------------------|--------------------------|-------------|-------------|-------------|--------------------------|-------------------------|
| 315/316E<br>515/516E       | Luminous Intensity/Segment <sup>[1,2]</sup><br>(Digit Average) | $I_V$                    | 450         | 2600        |             | $\mu\text{cd}$           | $I_F = 10 \text{ mA}$   |
|                            | Forward Voltage/Segment or DP                                  | $V_F$                    |             | 1.9         | 2.5         | V                        | $I_F = 10 \text{ mA}$   |
|                            | Peak Wavelength                                                | $\lambda_{\text{PEAK}}$  |             | 635         |             | nm                       |                         |
|                            | Dominant Wavelength <sup>[3]</sup>                             | $\lambda_d$              |             | 626         |             | nm                       |                         |
|                            | Reverse Voltage/Segment or DP <sup>[4]</sup>                   | $V_R$                    | 3           | 30          |             | V                        | $I_R = 100 \mu\text{A}$ |
|                            | Thermal Resistance LED<br>Junction-to-Pin                      | $R\theta_{\text{J-PIN}}$ |             | 200         |             | $^{\circ}\text{C/W/Seg}$ |                         |

**HER Low Current**

| <b>Device Series HDSP-</b> | <b>Parameter</b>                                               | <b>Symbol</b>            | <b>Min.</b> | <b>Typ.</b> | <b>Max.</b> | <b>Units</b>             | <b>Test Conditions</b>  |
|----------------------------|----------------------------------------------------------------|--------------------------|-------------|-------------|-------------|--------------------------|-------------------------|
| 315/316L<br>515/516L       | Luminous Intensity/Segment <sup>[1,2]</sup><br>(Digit Average) | $I_V$                    | 180         | 370         |             | $\mu\text{cd}$           | $I_F = 2 \text{ mA}$    |
|                            | Forward Voltage/Segment or DP                                  | $V_F$                    |             | 2.1         | 2.5         | V                        | $I_F = 2 \text{ mA}$    |
|                            | Peak Wavelength                                                | $\lambda_{\text{PEAK}}$  |             | 635         |             | nm                       |                         |
|                            | Dominant Wavelength <sup>[3]</sup>                             | $\lambda_d$              |             | 626         |             | nm                       |                         |
|                            | Reverse Voltage/Segment or DP <sup>[4]</sup>                   | $V_R$                    | 3           | 30          |             | V                        | $I_R = 100 \mu\text{A}$ |
|                            | Thermal Resistance LED<br>Junction-to-Pin                      | $R\theta_{\text{J-PIN}}$ |             | 200         |             | $^{\circ}\text{C/W/Seg}$ |                         |

### Yellow

| Device Series HDSP-  | Parameter                                                      | Symbol                   | Min. | Typ. | Max. | Units                    | Test Conditions                |
|----------------------|----------------------------------------------------------------|--------------------------|------|------|------|--------------------------|--------------------------------|
| 315/316Y<br>515/516Y | Luminous Intensity/Segment <sup>[1,2]</sup><br>(Digit Average) | $I_V$                    | 450  | 1800 |      | $\mu\text{cd}$           | $I_F = 10\text{ mA}$           |
|                      | Forward Voltage/Segment or DP                                  | $V_F$                    |      | 2.0  | 2.5  | V                        | $I_F = 10\text{ mA}$           |
|                      | Peak Wavelength                                                | $\lambda_{\text{PEAK}}$  |      | 583  |      | nm                       |                                |
|                      | Dominant Wavelength <sup>[3]</sup>                             | $\lambda_d$              |      | 586  |      | nm                       |                                |
|                      | Reverse Voltage/Segment or DP <sup>[4]</sup>                   | $V_R$                    | 3    | 50   |      | V                        | $I_R = 100\text{ }\mu\text{A}$ |
|                      | Thermal Resistance LED<br>Junction-to-Pin                      | $R_{\theta\text{J-PIN}}$ |      | 200  |      | $^{\circ}\text{C/W/Seg}$ |                                |

### Green

| Device Series HDSP-  | Parameter                                                      | Symbol                   | Min. | Typ. | Max. | Units                    | Test Conditions                |
|----------------------|----------------------------------------------------------------|--------------------------|------|------|------|--------------------------|--------------------------------|
| 315/316E<br>515/516E | Luminous Intensity/Segment <sup>[1,2]</sup><br>(Digit Average) | $I_V$                    | 450  | 5000 |      | $\mu\text{cd}$           | $I_F = 10\text{ mA}$           |
|                      | Forward Voltage/Segment or DP                                  | $V_F$                    |      | 2.1  | 2.5  | V                        | $I_F = 10\text{ mA}$           |
|                      | Peak Wavelength                                                | $\lambda_{\text{PEAK}}$  |      | 566  |      | nm                       |                                |
|                      | Dominant Wavelength <sup>[3]</sup>                             | $\lambda_d$              |      | 571  |      | nm                       |                                |
|                      | Reverse Voltage/Segment or DP <sup>[4]</sup>                   | $V_R$                    | 3    | 50   |      | V                        | $I_R = 100\text{ }\mu\text{A}$ |
|                      | Thermal Resistance LED<br>Junction-to-Pin                      | $R_{\theta\text{J-PIN}}$ |      | 200  |      | $^{\circ}\text{C/W/Seg}$ |                                |

#### Notes:

1. Case temperature of device immediately prior to the intensity measurement is 25°C.
2. The digits are categorized for luminous intensity. The intensity category is designated by a letter on the side of the package.
3. The dominant wavelength,  $\lambda$  is derived from the CIE chromaticity diagram and is that single wavelength which defines the color of the device.
4. Typical specification for reference only. Do not exceed absolute maximum ratings.

### Standard Red

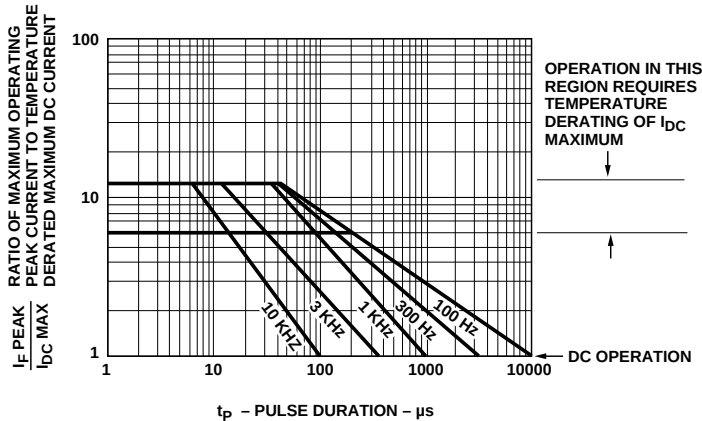


Figure 1. Maximum Tolerable Peak Current vs. Pulse Duration – Red.

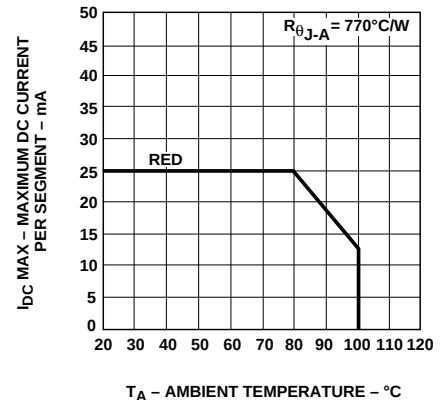


Figure 2. Maximum Allowable DC Current per Segment as a Function of Ambient Temperature.

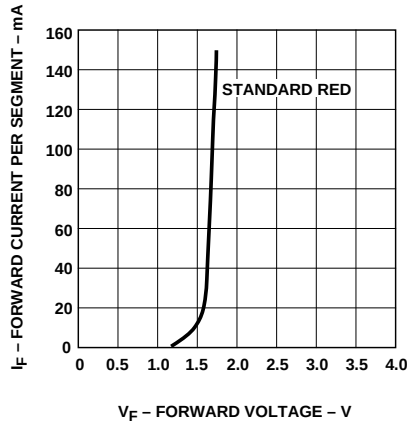


Figure 3. Forward Current vs. Forward Voltage.

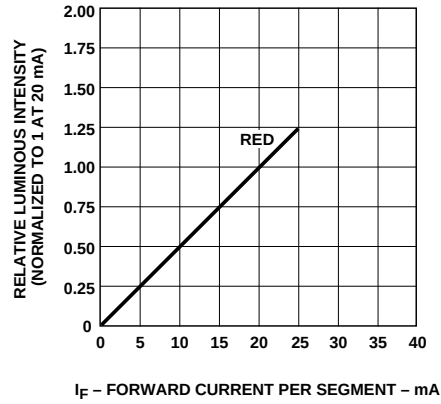


Figure 4. Relative Luminous Intensity vs DC Forward Current.

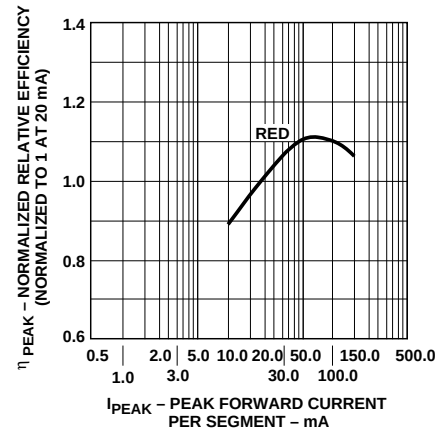


Figure 5. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

## AlGaAs Low Current

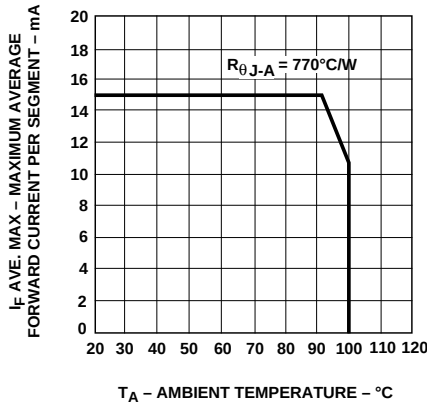


Figure 6. Maximum Allowable Average or DC Current vs. Ambient Temperature.

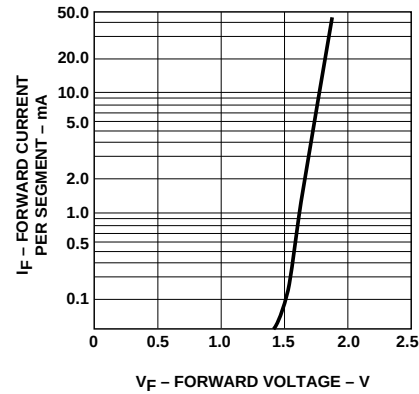


Figure 7. Forward Current vs. Forward Voltage.

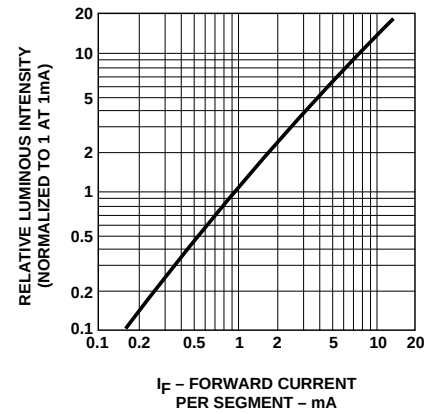


Figure 8. Relative Luminous Intensity vs DC Forward Current.

## HER, Yellow, and Green

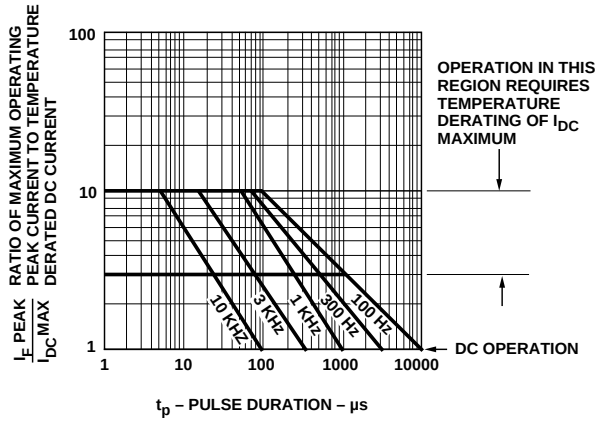


Figure 9. Maximum Tolerable Peak Current vs. Pulse Duration - HER.

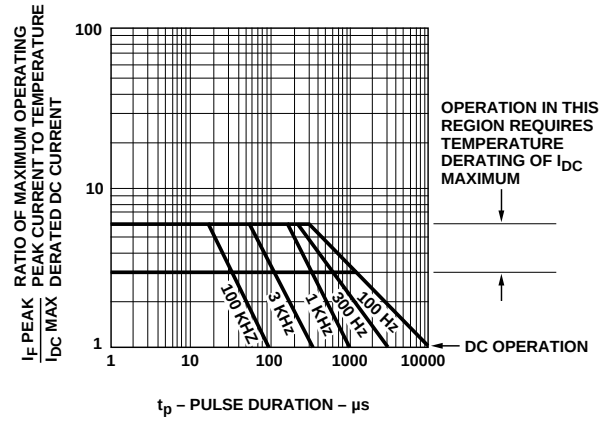


Figure 10. Maximum Tolerable Peak Current vs. Pulse Duration - Yellow.

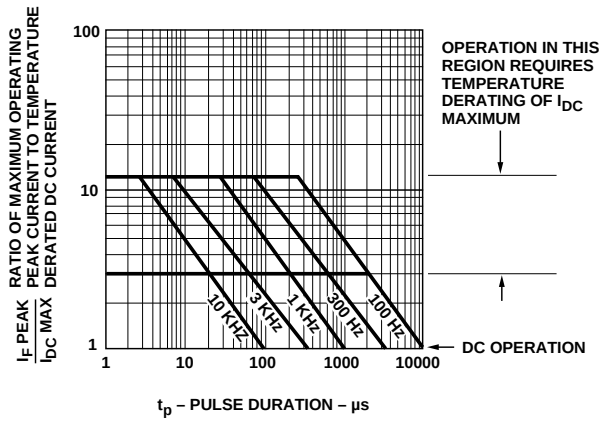


Figure 11. Allowable Peak Current vs. Pulse Duration - Green.

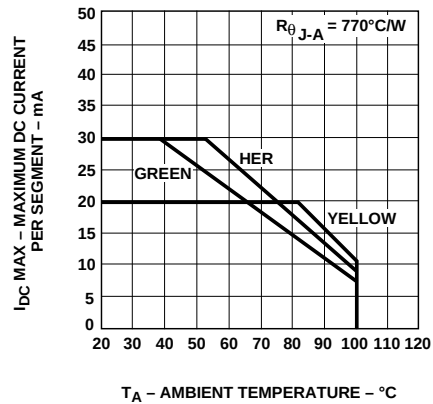


Figure 12. Maximum Allowable DC Current per Segment as a Function of Ambient Temperature.

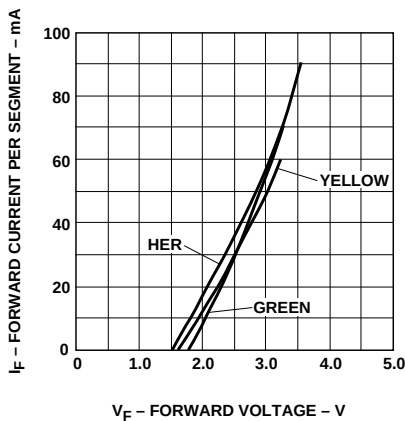


Figure 13. Forward Current vs. Forward Voltage Characteristics.

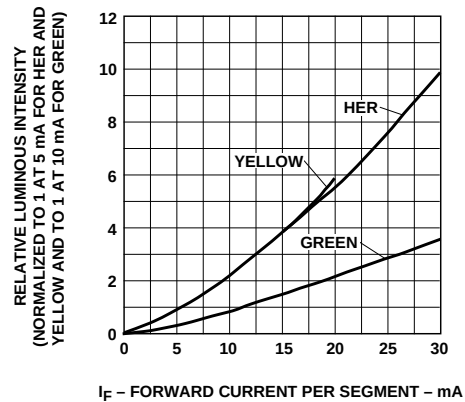
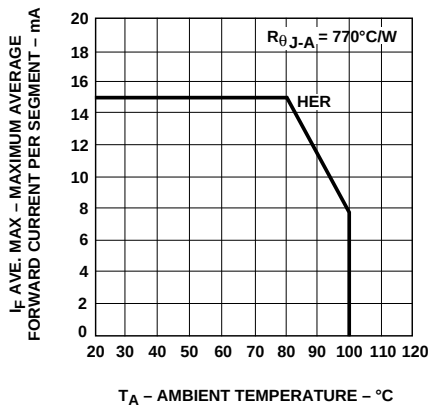
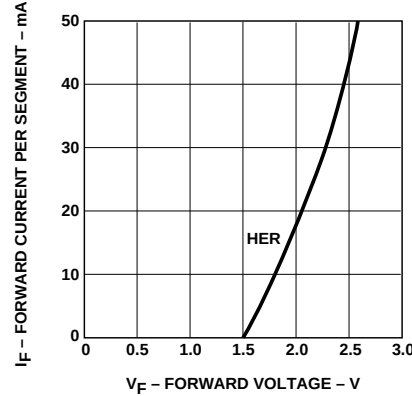


Figure 14. Relative Luminous Intensity vs. DC Forward Current.

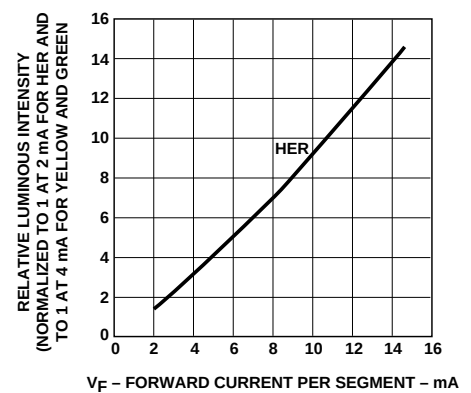
## HER Low Current



**Figure 15. Maximum Allowable Average or DC Current vs. Ambient Temperature.**



**Figure 16. Forward Current vs. Forward Voltage.**



**Figure 17. Relative Luminous Intensity vs. DC Forward Current.**

## Electrical/Optical

For more information on electrical/optical characteristics, please see Application Note 1005.

## Contrast Enhancement

For information on contrast enhancement please see Application Note 1015.

## Soldering/Cleaning

Cleaning agents from the ketone family (acetone, methyl ethyl ketone, etc.) and from the chlorinated hydrocarbon family (methylene chloride, trichloroethylene, carbon tetrachloride, etc.) are not recommended for cleaning LED parts. All of these

various solvents attack or dissolve the encapsulating epoxies used to form the package of plastic LED parts.

For further information on soldering LEDs please refer to Application Note 1027.

[www.hp.com/go/led\\_displays](http://www.hp.com/go/led_displays)

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Data subject to change.

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Obsoletes 5963-6975EE (9/95)

5968-2794E (11/98)