Absolute Maximum Ratings [1]

Parameter	AlGaAs Red HLCP-J100	HER HDSP-4830	Yellow HDSP-4840	Green HDSP-4850
Average PowerDissipation per LED (T_A = 25°C)	37 mW	87 mW	50 mW	105 mW
Peak Forward Current per LED	45 mA[3]	90 mA[4]	60 mA[4]	90 mA[4]
DC Forward Current per LED	15 mA[5]	30 mA[6]	20 mA[6]	30 mA[6]
Operating Temperature Range	-20°C to +100°C	-40°C to +85°C		-20°C to +85°C
Storage Temperature Range	-55°C to +100°C	-40°C to +85°C		
Reverse Voltage* per LED	5.0 V	3.0 V		
Lead Solder Dipping Temperature (1.59 mm (1/16 inch) below seating plane) [7]	260°C for 5 seconds [8]			
Wave Soldering Temperature (at 2 mm distance from the body)	250°C for 3 seconds			

* reverse voltage is for LED testing purposes and is not recommended to be used as an application condition.

Notes:
1. Absolute maximum ratings for HER, Yellow, and Green elements of the multicolor arrays are identical to the HDSP-4830/4840/4850 maximum ratings.
2. See Figure 1 to establish pulsed operating conditions. Maximum pulse width is 1.5 ms.
3. See Figure 2 to establish pulsed operating conditions. Maximum pulse width is 1.5 ms.
4. See Figure 8 to establish pulsed operating conditions. Maximum pulse width is 2 ms.
5. Derate maximum DC current for Red above T_A = 62°C at 0.79 mA/°C, and AlGaAs Red above T_A = 91°C at 0.8 mA/°C. See Figure 3.
6. Derate maximum DC current for HER above T_A = 48°C at 0.58 mA/ °C, Yellow above T_A = 70°C at 0.66 mA/°C, and Green above T_A = 37°C at 0.48 mA/°C. See Figure 9.
7. Clean only in water, isopropanol, ethanol, Freon TF or TE (or equivalent), or Genesolve DI-15 (or equivalent).
8. Maximum tolerable component side temperature is 134°C during solder process.

Internal Circuit Diagram
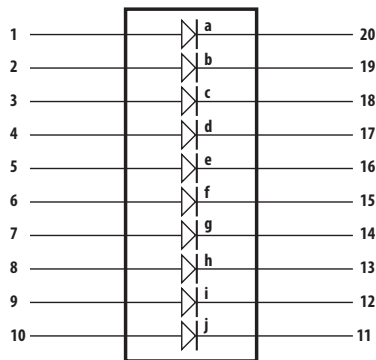
Pin	Function	Pin	Function
1	Anode a	11	Cathode j
2	Anode b	12	Cathode l
3	Anode c	13	Cathode h
4	Anode d	14	Cathode g
5	Anode e	15	Cathode f
6	Anode f	16	Cathode e
7	Anode g	17	Cathode d
8	Anode h	18	Cathode c
9	Anode i	19	Cathode b
10	Anode j	20	Cathode a

Multicolor Array Segment Colors

Segment	HDSP-4832 Segment Color	HDSP-4836 Segment Color
a	HER	HER
b	HER	HER
c	HER	Yellow
d	Yellow	Yellow
e	Yellow	Green
f	Yellow	Green
g	Yellow	Yellow
h	Green	Yellow
i	Green	HER
j	Green	HER

2

Electrical/Optical Characteristics at $T_A = 25°C$[4]

AlGaAs Red HLCP-J100

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Luminous Intensity per LED	I_V	600	1000		μcd	$I_F = 1$ mA
(Unit Average) [1]			5200			$I_F = 20$ mA Pk; 1 of 4 Duty Factor
Peak Wavelength	λ_{PEAK}		645		nm	
Dominant Wavelength[2]	λ_d		637		nm	
Forward Voltage per LED	V_F		1.6		V	$I_F = 1$ mA
			1.8	2.2		$I_F = 20$ mA
Reverse Voltage per LED[5]	V_R	5	1.5		V	$I_R = 100$ μA
Temperature Coefficient V_F per LED	$\Delta V_F/°C$		-2.0		mV/°C	
Thermal Resistance LED Junction-to-Pin	$R\theta_{J-PIN}$		300		°C/W/LED	

High Efficiency Red HDSP-4830

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Luminous Intensity per LED (Unit Average)[1,4]	I_V	900	3500		μcd	$I_F = 10$ mA
Peak Wavelength	λ_{PEAK}		635		nm	
Dominant Wavelength[2]	λ_d		626		nm	
Forward Voltage per LED	V_F		2.1	2.5	V	$I_F = 20$ mA
Reverse Voltage per LED[5]	V_R	3	30		V	$I_R = 100$ μA
Temperature Coefficient V_F per LED	$\Delta V_F/°C$		-2.0		mV/°C	
Thermal Resistance LED Junction-to-Pin	$R\theta_{J-PIN}$		300		°C/W/LED	

Yellow HDSP-4840

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Luminous Intensity per LED (Unit Average)[1,4]	I_V	600	1900		μcd	$I_F = 10$ mA
Peak Wavelength	λ_{PEAK}		583		nm	
Dominant Wavelength[2,3]	λ_d	581	585	592	nm	
Forward Voltage per LED	V_F		2.2	2.5	V	$I_F = 20$ mA
Reverse Voltage per LED[5]	V_R	3	40		V	$I_R = 100$ μA
Temperature Coefficient V_F per LED	$\Delta V_F/°C$		-2.0		mV/°C	
Thermal Resistance LED Junction-to-Pin	$R\theta_{J-PIN}$		300		°C/W/LED	

Green HDSP-4850

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Luminous Intensity per LED (Unit Average)[1,4]	I_V	600	1900		μcd	$I_F = 10$ mA
Peak Wavelength	λ_{PEAK}		566		nm	
Dominant Wavelength[2,3]	λ_d		571	577	nm	
Forward Voltage per LED	V_F		2.1	2.5	V	$I_F = 20$ mA
Reverse Voltage per LED[5]	V_R	3	50		V	$I_R = 100$ μA
Temperature Coefficient V_F per LED	$\Delta V_F/°C$		-2.0		mV/°C	
Thermal Resistance LED Junction-to-Pin	$R\theta_{J-PIN}$		300		°C/W/LED	

Notes:
1. The bar graph arrays are categorized for luminous intensity. The category is designated by a letter located on the side of the package.
2. The dominant wavelength, λ_d, is derived from the CIE chromaticity diagram and is that single wavelength which defines the color of the device.
3. The HDSP-4832/-4836/-4840/-4850 bar graph arrays are categorized by dominant wavelength with the category designated by a number adjacent to the intensity category letter. Only the yellow elements of the HDSP-4832/-4836 are categorized for color.
4. Electrical/optical characteristics of the High-Efficiency Red elements of the HDSP-4832/-4836 are identical to the HDSP-4830 characteristics. Characteristics of Yellow elements of the HDSP-4832/-4836 are identical to the HDSP-4840. Characteristics of Green elements of the HDSP-4832/-4836 are identical to the HDSP-4850.
5. Reverse voltage per LED should be limited to 3.0 V max. for the HDSP-4830/-4840/-4850/-4832/-4836 and 5.0 V max. for the HLCP-J100.
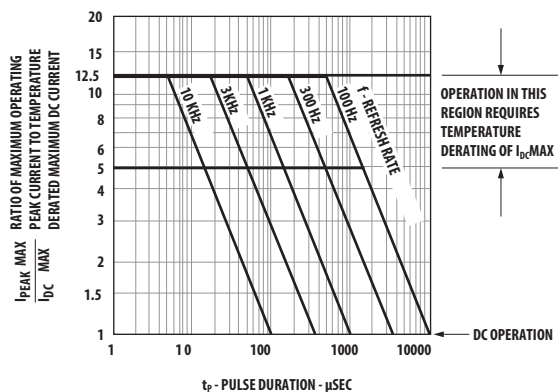
3

Red, AlGaAs Red

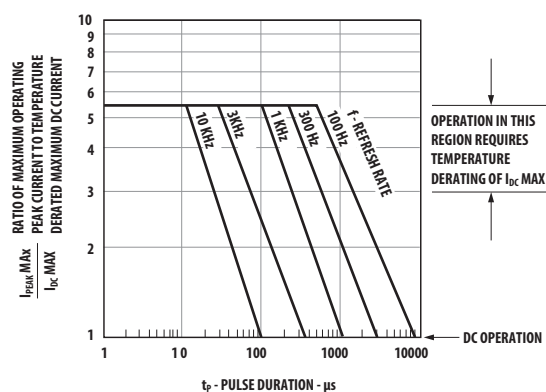**Figure 1. Maximum Tolerable Peak Current vs. Pulse Duration – Red.**

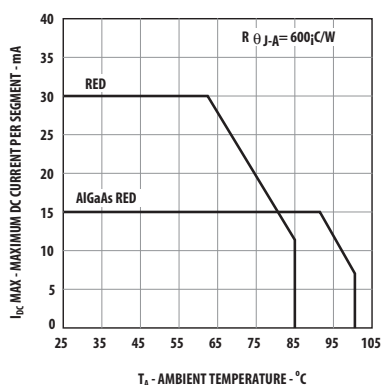**Figure 2. Maximum Tolerable Peak Current vs. Pulse Duration – AlGaAs Red.**

Figure 3. Maximum Allowable DC Current vs. Ambient Temperature.
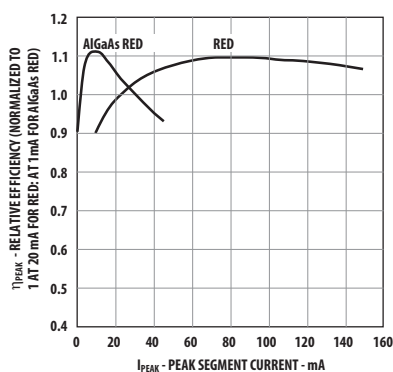$T_{JMAX} = 100°C$ for Red and $T_{JMAX} = 110°C$ for AlGaAs Red.

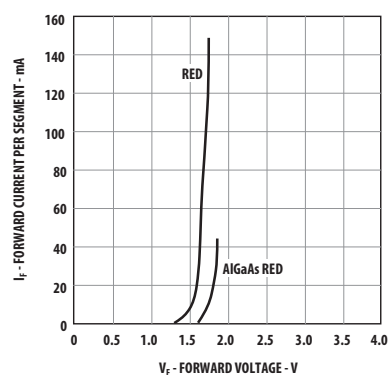**Figure 4. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.**
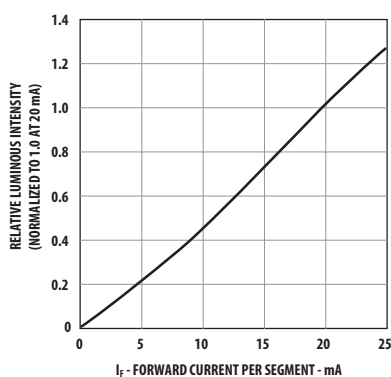

Figure 5. Forward Current vs. Forward Voltage.

Figure 6. Relative Luminous Intensity vs. DC Forward Current – Red.
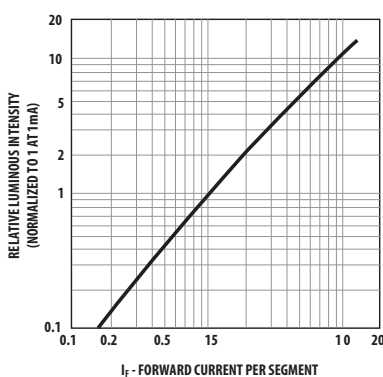
Figure 7. Relative Luminous Intensity vs. DC Forward Current – AlGaAs.

For a Detailed Explanation on the Use of Data Sheet Information and Recommended Soldering Procedures, See Application Note 1005.
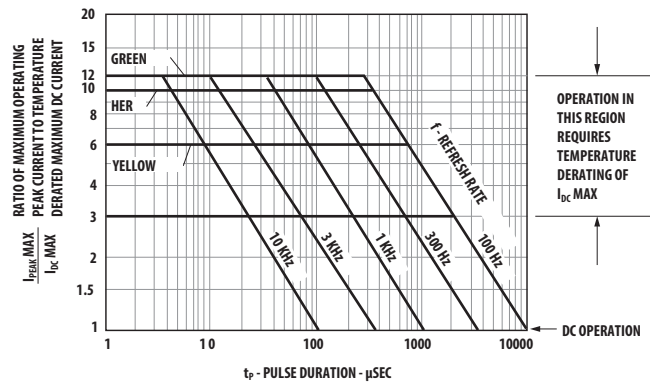
4

HER, Yellow, Green

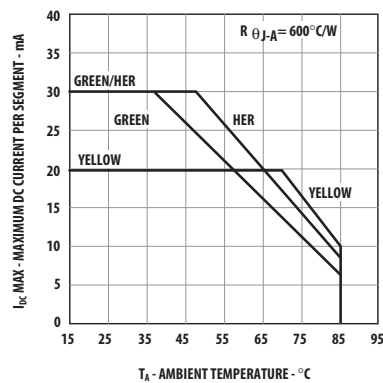**Figure 8. Maximum Tolerable Peak Current vs. Pulse Duration –**

HER/Yellow/Green.

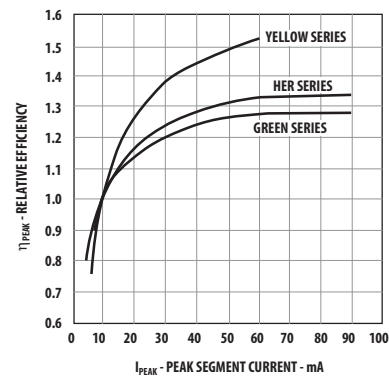**Figure 9. Maximum Allowable DC Current vs. Ambient Temperature. TJMAX = 100°C.**

Figure 10. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.
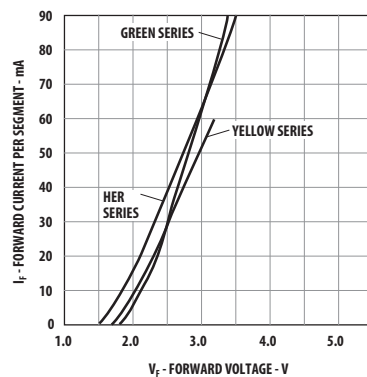
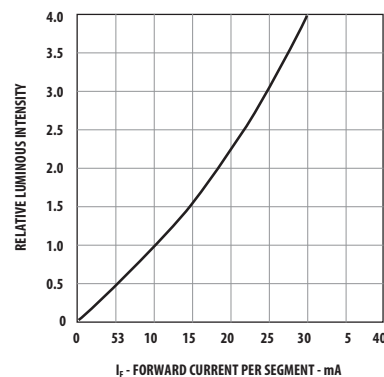**Figure 11. Forward Current vs. Forward Voltage.**

Figure 12. Relative Luminous Intensity vs. DC Forward Current.

For a Detailed Explanation on the Use of Data Sheet Information and Recommended Soldering Procedures, See Application Note 1005.

5

Electrical/Optical

These versatile bar graph arrays are composed of ten light emitting diodes. The light from each LED is optically stretched to form individual elements. The AlGaAs Red (HLCP-J100) bar graph array LEDs use double heterojunction AlGaAs on a GaAs substrate. HER (HDSP-4830) and Yellow (HDSP-4840) bar graph array LEDs use a GaAsP epitaxial layer on a GaP substrate. Green (HDSP-4850) bar graph array LEDs use liquid phase GaP epitaxial layer on a GaP substrate. The multicolor bar graph arrays (HDSP-4832/4836) have HER, Yellow, and Green LEDs in one package. These displays are designed for strobed operation. The typical forward voltage values can be scaled from Figures 5 and 11. These values should be used to calculate the current limiting resistor value and typical power consumption. Expected maximum V_F values for driver circuit design and maximum power dissipation may be calculated using the V_{FMAX} models:

AlGaAs Red HLCP-J100 series
$V_F MAX = 1.8\ V + I_{Peak}\ (20\ \Omega)$
For: $I_{Peak} \leq 20$ mA
$V_F MAX = 2.0\ V + I_{Peak}\ (10\ \Omega)$
For: $I_{Peak} \geq 20$ mA

HER (HDSP-4830) and Yellow (HDSP-4840) series
$V_F MAX = 1.6 + I_{Peak}\ (45\ \Omega)$
For: $5\ mA \leq I_{Peak} \leq 20$ mA
$V_F MAX = 1.75 + I_{Peak}\ (38\ \Omega)$
For: $I_{Peak} \geq 20$ mA

Green (HDSP-4850) series
$V_F MAX = 2.0 + I_{Peak}\ (50\ \Omega)$
For: $I_{Peak} > 5$ mA

Figures 4 and 10 allow the designer to calculate the luminous intensity at different peak and average currents. The following equation calculates intensity at different peak and average currents:

$I_V AVG = (I_F AVG / I_F AVG\ DATA\ SHEET)\eta_{peak})(I_V DATA\ SHEET)$

Where:

$I_V AVG$ is the calculated time averaged luminous intensity resulting from $I_F AVG$.

$I_F AVG$ is the desired time averaged LED current.

$I_F AVG$ DATA SHEET is the data sheet test current for $I_V DATA$ SHEET.

η_{peak} is the relative efficiency at the peak current, scaled from Figure 4 or 10.

I_V DATA SHEET is the data sheet luminous intensity, resulting from $I_F AVG$ DATA SHEET.

For example, what is the luminous intensity of an HDSP-4830 driven at 50 mA peak 1/5 duty factor?

$I_F AVG = (50\ mA)\ (0.2) = 10$ mA

$I_F AVG$ DATA SHEET = 10 mA

$\eta_{peak} = 1.3$

I_V DATA SHEET = 3500 μcd

Therefore

$I_V AVG = (10\ mA/10\ mA)\ (1.3)\ (3500\ mcd) = 4550$ mcd

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