

# Black Surface Seven Segment Displays

## Technical Data

**HDSP-AX11/-AX13 Series**  
**HDSP-FX11/-FX13 Series**  
**HDSP-GX11/-GX13 Series**  
**HDSP-HX11/-HX13 Series**  
**HDSP-KX11/-KX13 Series**

### Features

- **Black Surface and Color Tinted Epoxy**
- **Industry Standard Size**
- **Industry Standard Pinout**
- **Choice of Character Size**  
7.6 mm (0.30 in.), 10 mm (0.40 in.), 14.2 mm (0.56 in.)
- **Choice of Colors**  
Red, AlGaAs Red, High Efficiency Red (HER), Green
- **Excellent Appearance**  
Evenly Lighted Segments  
± 50° Viewing Angle

- **Design Flexibility**  
Common Anode or Common Cathode  
Single and Two Digit
- **Categorized for Luminous Intensity**  
Categorized for Color: Green  
Use of Like Categories Yields a Uniform Display
- **Excellent for Long Digit String Multiplexing**

### Description

These devices use industry standard size package and pinout. Available with black surface



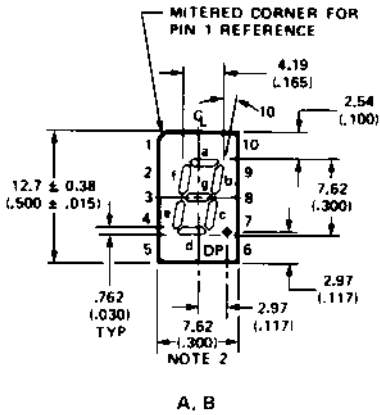
finish. All devices are available as either common anode or common cathode.

Typical applications include appliances, channel indicators of TV, CATV converters, game machines, and point of sale terminals.

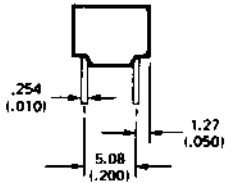
### Devices

Red HDSP-	AlGaAs Red HDSP-	HER HDSP-	Green HDSP-	Description	Package Drawing
A011	A111	A211	A511	7.6 mm Common Anode Right Hand Decimal	A
A013	A113	A213	A513	7.6 mm Common Cathode Right Hand Decimal	B
F011	F111	F211	F511	10 mm Common Anode Right Hand Decimal	C
F013	F113	F213	F513	10 mm Common Cathode Right Hand Decimal	D
G011	G111	G211	G511	10 mm Two Digit Common Anode Right Hand Decimal	E
G013	G113	G213	G513	10 mm Two Digit Common Cathode Right Hand Decimal	F
H011	H111	H211	H511	14.2 mm Common Anode Right Hand Decimal	G
H013	H113	H213	H513	14.2 mm Common Cathode Right Hand Decimal	H
K011	K111	K211	K511	14.2 mm Two Digit Common Anode Right Hand Decimal	I
K013	K113	K213	K513	14.2 mm Two Digit Common Cathode Right Hand Decimal	J

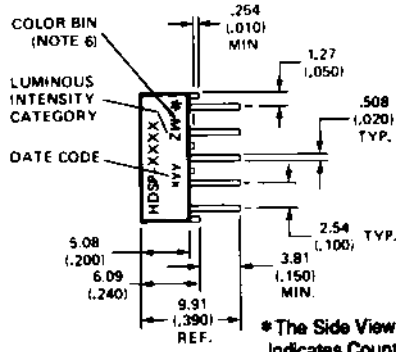
### Package Dimensions (7.6 mm Series)



A, B



A, B

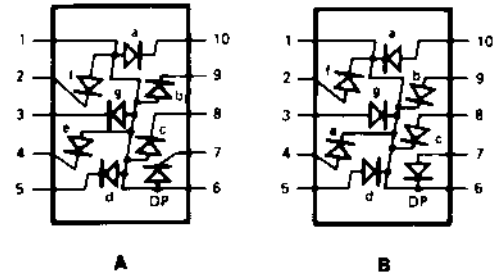


\*The Side View of package indicates Country of Origin.

PIN	FUNCTION	
	A	B
1	ANODE <sup>[4]</sup>	CATHODE <sup>[5]</sup>
2	CATHODE f	ANODE f
3	CATHODE g	ANODE g
4	CATHODE e	ANODE e
5	CATHODE d	ANODE d
6	ANODE <sup>[4]</sup>	CATHODE <sup>[5]</sup>
7	CATHODE DP	ANODE DP
8	CATHODE c	ANODE c
9	CATHODE b	ANODE b
10	CATHODE a	ANODE a

- NOTES:
1. ALL DIMENSIONS IN MILLIMETERS (INCHES).
  2. MAXIMUM.
  3. ALL UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.
  4. REDUNDANT ANODES.
  5. REDUNDANT CATHODES.
  6. FOR HDSP-A511/-A513 ONLY.

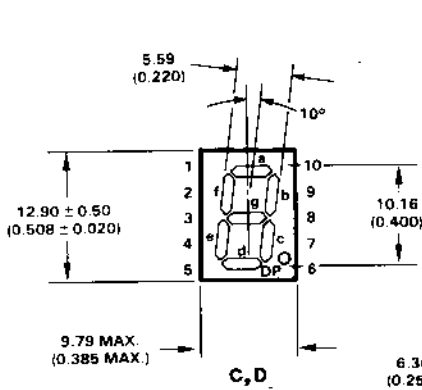
### Internal Circuit Diagram



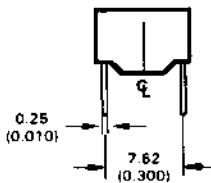
A

B

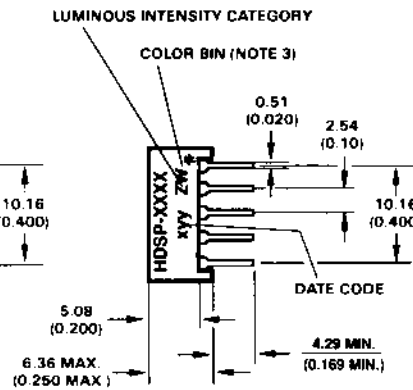
### Package Dimensions (10 mm Series: Single)



C, D



C, D

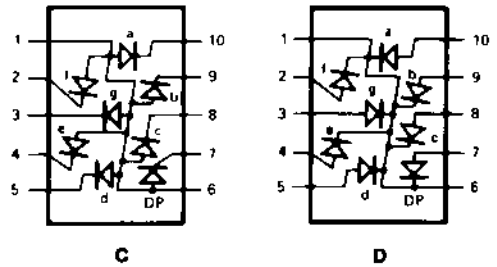


\*The Side View of package indicates Country of Origin.

PIN	FUNCTION	
	C	D
1	ANODE <sup>[4]</sup>	CATHODE <sup>[5]</sup>
2	CATHODE f	ANODE f
3	CATHODE g	ANODE g
4	CATHODE e	ANODE e
5	CATHODE d	ANODE d
6	ANODE <sup>[4]</sup>	CATHODE <sup>[5]</sup>
7	CATHODE DP	ANODE DP
8	CATHODE c	ANODE c
9	CATHODE b	ANODE b
10	CATHODE a	ANODE a

- NOTES:
1. ALL DIMENSIONS IN MILLIMETERS (INCHES).
  2. ALL UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.
  3. FOR HDSP-F511/-F513 ONLY.
  4. REDUNDANT ANODES.
  5. REDUNDANT CATHODES.

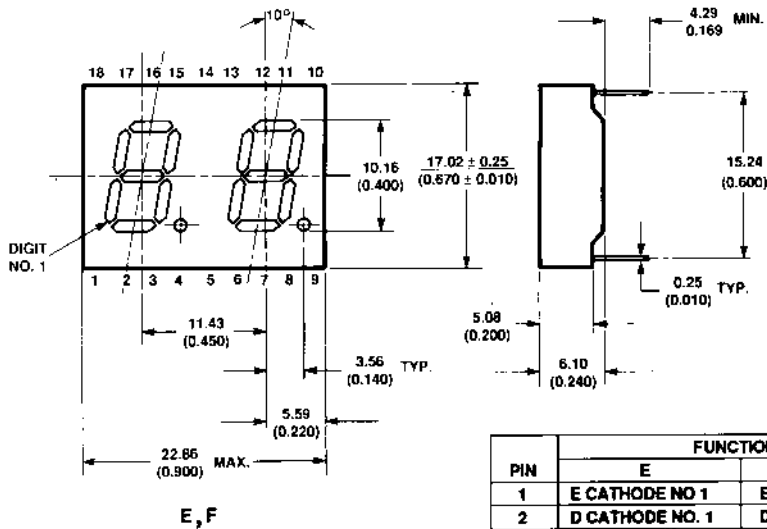
### Internal Circuit Diagram



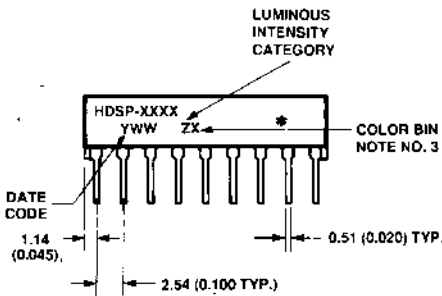
C

D

### Package Dimensions (10 mm Series: Two Digit)



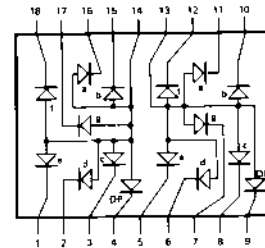
E, F



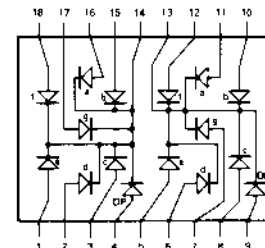
E, F

\* The Side View of package indicates Country of Origin.

### Internal Circuit Diagram



E

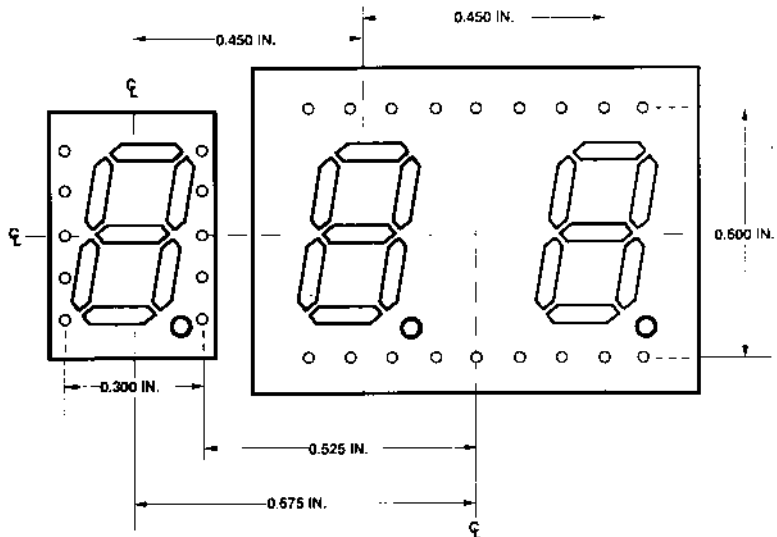


F

PIN	FUNCTION	
	E	F
1	E CATHODE NO. 1	E ANODE NO. 1
2	D CATHODE NO. 1	D ANODE NO. 1
3	C CATHODE NO. 1	C ANODE NO. 1
4	DP CATHODE NO. 1	DP ANODE NO. 1
5	E CATHODE NO. 2	E ANODE NO. 2
6	D CATHODE NO. 2	D ANODE NO. 2
7	G CATHODE NO. 2	G ANODE NO. 2
8	C CATHODE NO. 2	C ANODE NO. 2
9	CP CATHODE NO. 2	DP ANODE NO. 2
10	B CATHODE NO. 2	B ANODE NO. 2
11	A CATHODE NO. 2	A ANODE NO. 2
12	F CATHODE NO. 2	F ANODE NO. 2
13	DIGIT NO. 2 ANODE	DIGIT NO. 2 CATHODE
14	DIGIT NO. 1 ANODE	DIGIT NO. 1 CATHODE
15	B CATHODE NO. 1	B ANODE NO. 1
16	A CATHODE NO. 2	A ANODE NO. 1
17	G CATHODE NO. 1	G ANODE NO. 1
18	F CATHODE NO. 1	F ANODE NO. 1

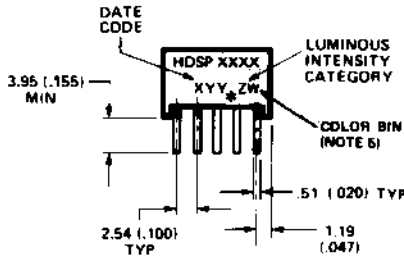
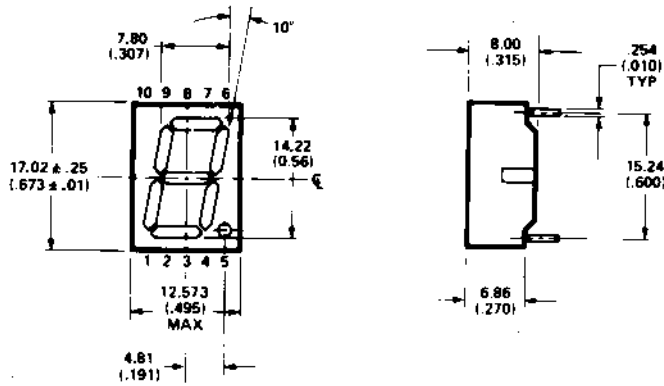
**NOTES:**

1. DIMENSIONS ARE IN MILLIMETERS (INCHES).
2. ALL UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.
3. FOR HDSP-G511/-G513 ONLY.



**HOLE PATTERN FOR PCB LAYOUT TO ACHIEVE UNIFORM 0.450 DIGIT TO DIGIT PITCH. FOR HDSP-FXXX TO HDSP-GXXX.**

### Package Dimensions (14.2 mm Series: Single)



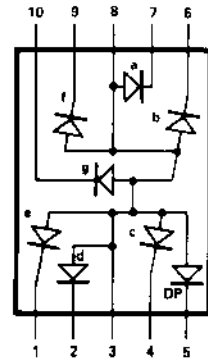
G, H

\*The End View of package indicates Country of Origin.

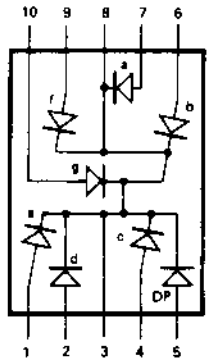
PIN	FUNCTION	
	G	H
1	CATHODE a	ANODE a
2	CATHODE d	ANODE d
3	ANODE f	CATHODE f
4	CATHODE c	ANODE c
5	CATHODE DP	ANODE DP
6	CATHODE b	ANODE b
7	CATHODE e	ANODE e
8	ANODE g	CATHODE g
9	CATHODE f	ANODE f
10	CATHODE g	ANODE g

- NOTES:  
 1. ALL DIMENSIONS IN MILLIMETERS (INCHES).  
 2. ALL UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.  
 3. REDUNDANT ANODES.  
 4. REDUNDANT CATHODES.  
 5. FOR HDSP-H511/H513 ONLY.

### Internal Circuit Diagram

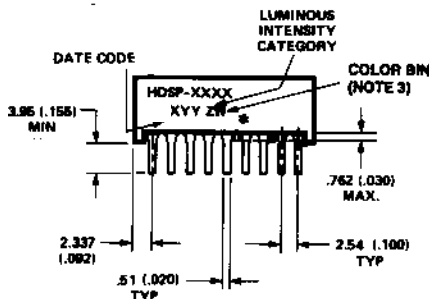
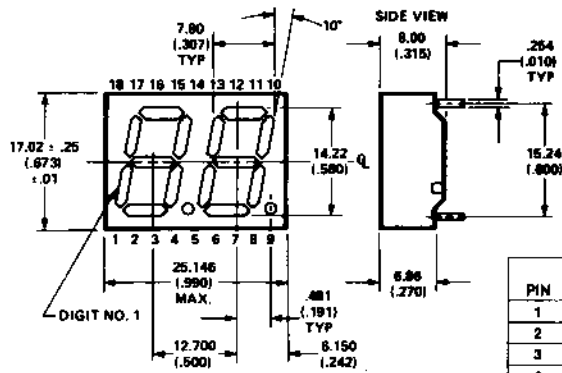


G



H

### Package Dimensions (14.2 mm Series: Two Digit)



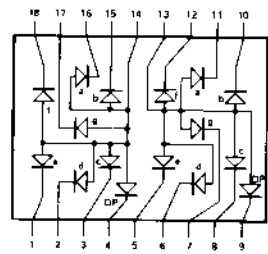
I, J

\*The Side View of package indicates Country of Origin.

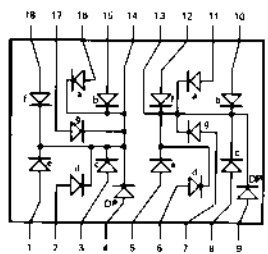
PIN	FUNCTION	
	I	J
1	E CATHODE NO. 1	E ANODE NO. 1
2	D CATHODE NO. 1	D ANODE NO. 1
3	C CATHODE NO. 1	C ANODE NO. 1
4	DP CATHODE NO. 1	DP ANODE NO. 1
5	E CATHODE NO. 1	E ANODE NO. 2
6	D CATHODE NO. 2	D ANODE NO. 2
7	G CATHODE NO. 2	G ANODE NO. 2
8	C CATHODE NO. 2	C ANODE NO. 2
9	DP CATHODE NO. 2	DP ANODE NO. 2
10	B CATHODE NO. 2	B ANODE NO. 2
11	A CATHODE NO. 2	A ANODE NO. 2
12	F CATHODE NO. 2	F ANODE NO. 2
13	DIGIT NO. 2 ANODE	DIGIT NO. 2 CATHODE
14	DIGIT NO. 1 ANODE	DIGIT NO. 2 CATHODE
15	B CATHODE NO. 2	B ANODE NO. 1
16	A CATHODE NO. 1	A ANODE NO. 1
17	G CATHODE NO. 1	G ANODE NO. 1
18	F CATHODE NO. 1	F ANODE NO. 1

- NOTES:  
 1. ALL DIMENSIONS IN MILLIMETERS (INCHES).  
 2. ALL UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.  
 3. FOR HDSP-K511/K513 ONLY.

### Internal Circuit Diagram



I



J

### Absolute Maximum Ratings

Description	Red HDSP-X01X Series	AlGaAs Red HDSP-X11X Series	HER HDSP-X21X Series	Green HDSP-X51X Series	Units
Average Power per Segment or DP	82	37	105	105	mW
Peak Forward Current per Segment or DP	150 <sup>[1]</sup>	45	90 <sup>[3]</sup>	90 <sup>[5]</sup>	mA
DC Forward Current per Segment or DP	25 <sup>[2]</sup>	15 <sup>[7]</sup>	30 <sup>[4]</sup>	30 <sup>[6]</sup>	mA
Operating Temperature Range	-40 to +100	-20 to +100	-40 to +100		°C
Storage Temperature Range	-55 to +100				°C
Reverse Voltage per Segment or DP	3.0				V
Lead Solder Temperature for 3 Seconds (1.60 mm [0.063 in.] below seating plane)	260				°C

**Notes:**

1. See Figure 1 to establish pulsed conditions.
2. Derate above 80°C at 0.63 mA/°C (see Figure 2).
3. See Figure 10 to establish pulsed conditions.
4. Derate above 53°C at 0.45 mA/°C (see Figure 12).
5. See Figure 11 to establish pulsed conditions.
6. Derate above 39°C at 0.37 mA/°C (see Figure 12).
7. Derate above 91°C at 0.53 mA/°C (see Figure 6).

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

### Red

Device Series HDSP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
A01X	Luminous Intensity/Segment <sup>[1,2]</sup> (Digit Average)	$I_V$	600	1100		$\mu\text{cd}$	$I_F = 20\text{ mA}$
				500			$I_F = 10\text{ mA}$
F01X, G01X			650	1200			$I_F = 20\text{ mA}$
H01X, K01X			600	1300			$I_F = 20\text{ mA}$
				1400			$I_F = 100\text{ mA Peak:}$ $1/5\text{ Duty Factor}$
All Devices	Forward Voltage/Segment or DP	$V_F$		1.6	2.0	V	$I_F = 20\text{ mA}$
	Peak Wavelength	$\lambda_{\text{PEAK}}$		655		nm	
	Dominant Wavelength <sup>[3]</sup>	$\lambda_d$		640		nm	
	Reverse Voltage/Segment or DP <sup>[4]</sup>	$V_R$	3.0	12		V	$I_R = 100\ \mu\text{A}$
	Temperature Coefficient of $V_F$ /Segment or DP	$\Delta V_F/^\circ\text{C}$		-2		$\text{mV}/^\circ\text{C}$	
A01X	Thermal Resistance LED Junction-to-Pin	$R\theta_{\text{J-PIN}}$		200		$^\circ\text{C}/\text{W}/$ Seg.	
F01X, G01X				320			
H01X, K01X				345			

### AlGaAs Red

Device Series HDSP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions	
A11X	Luminous Intensity/Segment <sup>[1,2]</sup> (Digit Average)	$I_V$	315	600		$\mu\text{cd}$	$I_F = 1\text{ mA}$	
				3600			$I_F = 5\text{ mA}$	
F11X, G11X			330	650			$I_F = 1\text{ mA}$	
				3900			$I_F = 5\text{ mA}$	
H11X, K11X			400	700			$I_F = 1\text{ mA}$	
				4200			$I_F = 5\text{ mA}$	
All Devices	Forward Voltage/Segment or DP	$V_F$		1.6	2.0	V	$I_F = 1\text{ mA}$	
				1.7			$I_F = 5\text{ mA}$	
				1.8	22		$I_F = 20\text{ mA Peak}$	
	Peak Wavelength	$\lambda_{\text{PEAK}}$		645		nm		
	Dominant Wavelength <sup>[3]</sup>	$\lambda_d$		637		nm		
	Reverse Voltage/Segment or DP <sup>[4]</sup>	$V_R$	3.0	15		V	$I_R = 100\ \mu\text{A}$	
A11X	Thermal Resistance LED Junction-to-Pin	$R\theta_{\text{J-PIN}}$		255		$^\circ\text{C}/\text{W}/$ Seg.		
			F11X, G11X		320			
			H11X, K12X		400			

**High Efficiency Red**

Device Series HDSP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
A21X	Luminous Intensity/Segment <sup>[1,2]</sup> (Digit Average)	$I_V$	360	980		$\mu\text{cd}$	$I_F = 5 \text{ mA}$
				5390			$I_F = 20 \text{ mA}$
F21X, G21X			420	1200			$I_F = 5 \text{ mA}$
H21X, K21X			900	2800			$I_F = 10 \text{ mA}$
				3700			$I_F = 60 \text{ mA Peak:}$ $1/6 \text{ Duty Factor}$
All Devices	Forward Voltage/Segment or DP	$V_F$		2.0	2.5	V	$I_F = 20 \text{ mA}$
	Peak Wavelength	$\lambda_{\text{PEAK}}$		635		nm	
	Dominant Wavelength <sup>[3]</sup>	$\lambda_d$		626		nm	
	Reverse Voltage/Segment or DP <sup>[4]</sup>	$V_R$	3.0	30		V	$I_R = 100 \mu\text{A}$
	Temperature Coefficient of $V_F$ /Segment or DP	$\Delta V_F / ^\circ\text{C}$		-2		mV/ $^\circ\text{C}$	
A21X	Thermal Resistance LED Junction-to-Pin	$R\theta_{\text{J-PIN}}$		200		$^\circ\text{C/W/}$ Seg.	
F21X, G21X				320			
H21X, K21X				345			

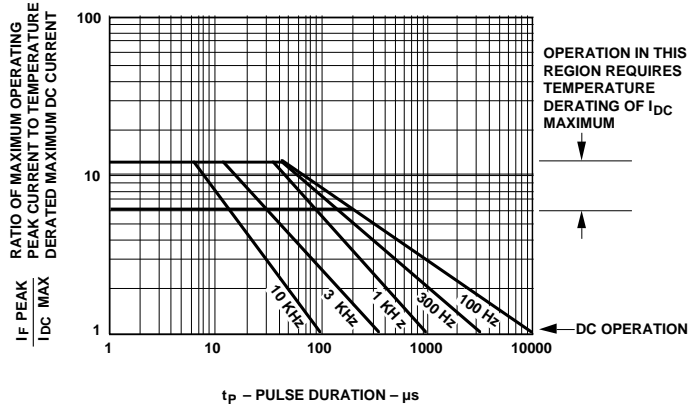
**High Performance Green**

Device Series HDSP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
A51X	Luminous Intensity/Segment <sup>[1,2]</sup> (Digit Average)	$I_V$	860	3000		$\mu\text{cd}$	$I_F = 10 \text{ mA}$
				6800			$I_F = 20 \text{ mA}$
F51X, G51X			1030	3500			$I_F = 10 \text{ mA}$
H51X, K51X			900	2500			$I_F = 10 \text{ mA}$
				3100			$I_F = 60 \text{ mA Peak:}$ $1/6 \text{ Duty Factor}$
All Devices	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>[3,5]</sup>	$\lambda_d$		571	577	nm	
	Reverse Voltage/Segment or DP <sup>[4]</sup>	$V_R$	3.0	50		V	$I_R = 100 \mu\text{A}$
	Temperature Coefficient of $V_F$ /Segment or DP	$\Delta V_F / ^\circ\text{C}$		-2		mV/ $^\circ\text{C}$	
A51X	Thermal Resistance LED Junction-to-Pin	$R\theta_{\text{J-PIN}}$		200		$^\circ\text{C/W/}$ Seg.	
F51X, G51X				320			
H51X, G51X				345			

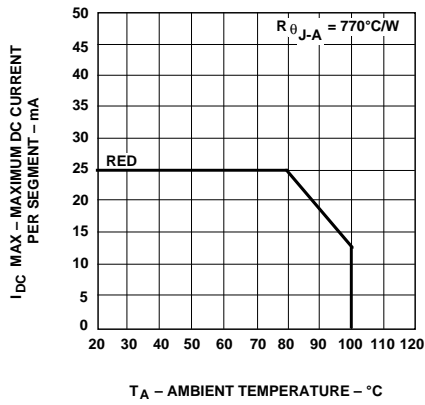
**Notes:**

- Case temperature of device immediately prior to the intensity measurement is 25°C.
- The digits are categorized for luminous intensity. The intensity category is designated by a letter on the side of the package.
- The dominant wavelength,  $\lambda_d$ , is derived from the CIE chromaticity diagram and is that single wavelength which defines the color of the device.
- Typical specification for reference only. Do not exceed absolute maximum ratings.
- Green (HDSP-A51X/F51X/G51X/H512X/K51X) series displays are categorized for dominant wavelength. The category is designated by a number adjacent to the luminous intensity category letter.

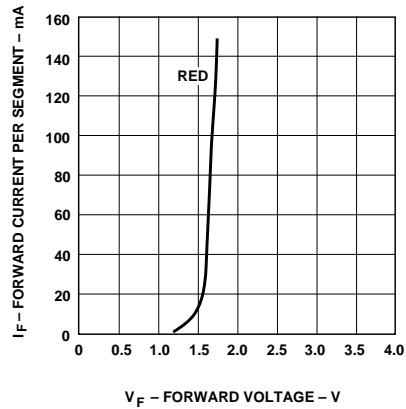
**Red**



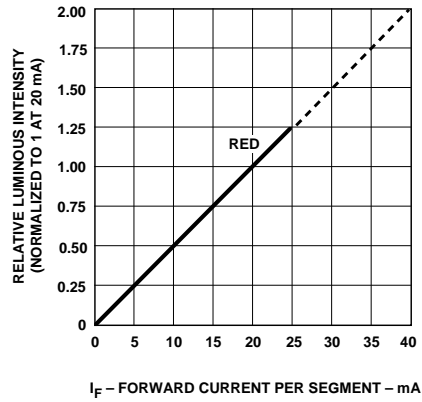
**Figure 1. Maximum Tolerable Peak Current vs. Pulse Duration - Red.**



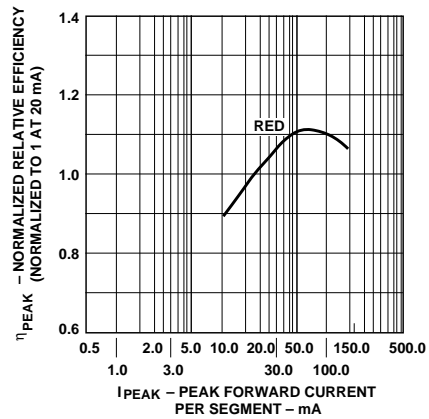
**Figure 2. Maximum Allowable DC Current vs. Ambient Temperature.**



**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 Red

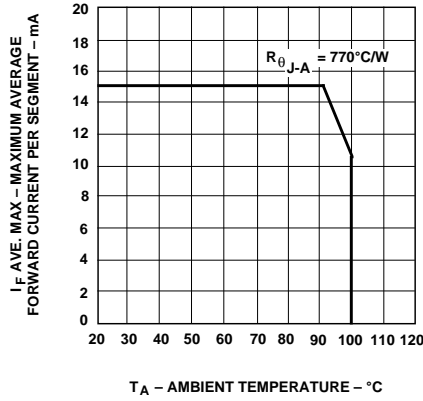


Figure 6. Maximum Allowable Average or DC Current vs. Ambient Temperature.

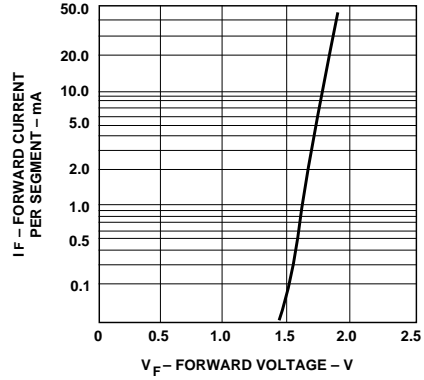


Figure 7. Forward Current vs. Forward Voltage.

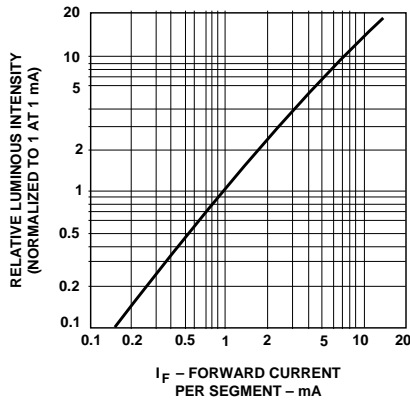


Figure 8. Relative Luminous Intensity vs. DC Forward Current.

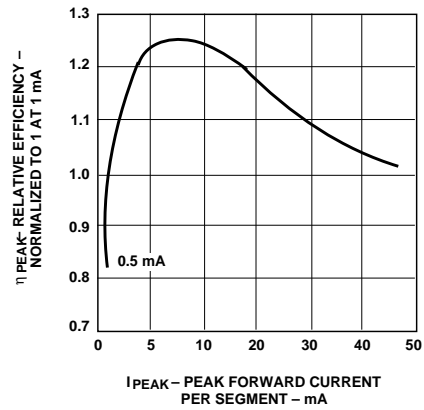


Figure 9. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

### HER, Green

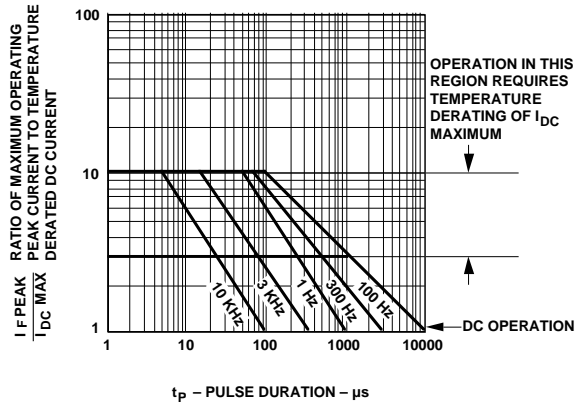


Figure 10. Maximum Tolerable Peak Current vs. Pulse Duration - HER.

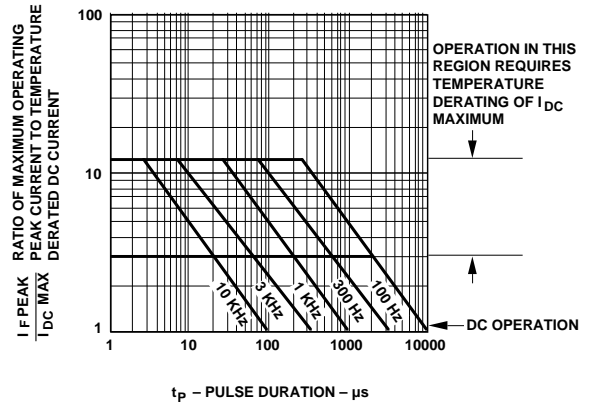
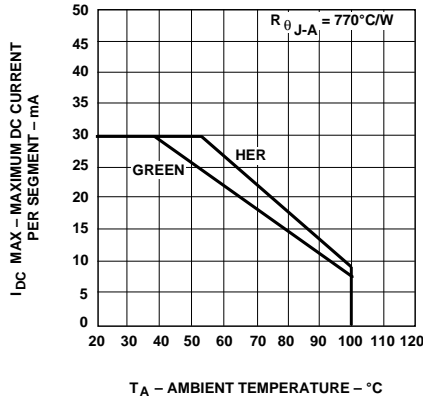
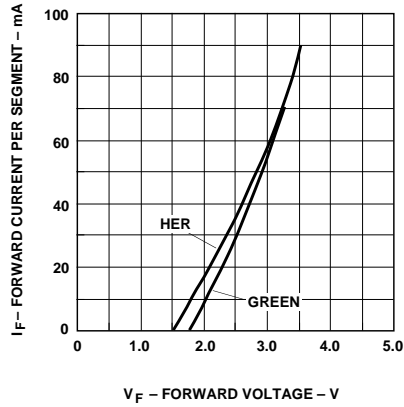


Figure 11. Maximum Tolerable Peak Current vs. Pulse Duration - Green.

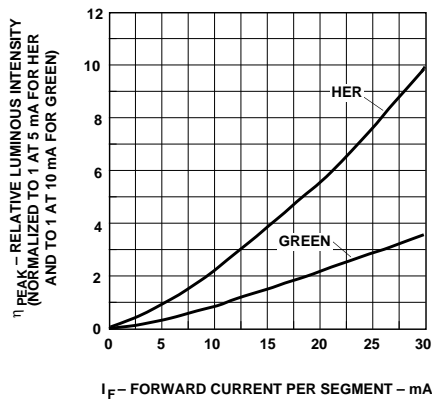
## HER, Green, (cont.)



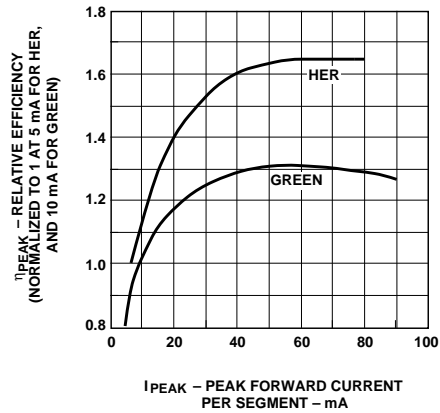
**Figure 12. Maximum Allowable DC Current vs. Ambient Temperature.**



**Figure 13. Forward Current vs. Forward Voltage Characteristics.**



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



**Figure 15. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.**

## Contrast Enhancement

For information on contrast enhancement, please see Application Note 1015.

## Soldering/Cleaning

For information on soldering LEDs please refer to Application Note 1029.

## Electrical/Optical

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