HEWLETT PACKARD

7.6 mm (0.3 inch)/10.9 mm (0.43 inch) Seven Segment Displays

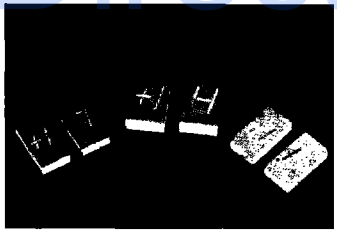
Technical Data

5082-7610, 7611, 7613, 7616, 7620, 7621, 7623, 7626, 7650, 7651, 7653, 7656, 7660, 7661, 7663, 7666, 7730, 7731, 7736, 7740, 7750, 7751, 7756, 7760

HDSP-3600, 3601, 3603, 3606, 4600, 4601, 4603, 4606, E150, E151, E153, E156

Features

- **Industry Standard Size**
- **Industry Standard Pinout**
  7.62 mm (0.300 inch) DIP Leads on 2.54 mm (0.100 inch) Centers
- **Choice of Colors**
  Red, AlGaAs Red, High Efficiency Red, Yellow, Green
- **Excellent Appearance**
  Evenly Lighted Segments
  Gray Package Gives Optimum Contrast
  ±50° Viewing Angle
- **Design Flexibility**
  Common Anode or Common Cathode
  Single Digits
  Left or Right Hand Decimal Point
  ±1. Overflow Character
- **Categorized for Luminous Intensity**
  Yellow and Green Categorized for Color
  Use of Like Categories Yields a Uniform Display
- **High Light Output**
- **High Peak Current**
- **Excellent for Long Digit String Multiplexing**
- **Intensity and Color Selection Available**
  See Intensity and Color Selected Displays Data Sheet
- **Sunlight Viewable AlGaAs**



Description

The 7.6 mm (0.3 inch) and 10.9 mm (0.43 inch) LED seven segment displays are designed for viewing distances up to 3 metres (10 feet) and 5 metres (16 feet). These devices use an industry standard size package and pinouts. All devices are available as either common anode or common cathode.

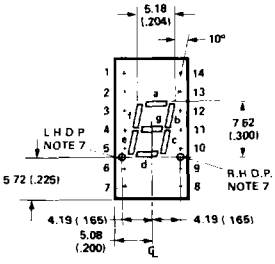
Devices

Red 5082-	AlGaAs[1] Red HDSP-	HER[1] 5082-	Yellow 5082-	Green HDSP-	Description	Package Drawing
7730		7610	7620	3600	7.6 mm Common Anode Left Hand Decimal	A
7731		7611	7621	3601	7.6 mm Common Anode Right Hand Decimal	B
7740		7613	7623	3603	7.6 mm Common Cathode Right Hand Decimal	C
7736		7616	7626	3606	7.6 mm Universal ±1. Overflow Right Hand Decimal[2]	D
7750	E150	7650	7660	4600	10.9 mm Common Anode Left Hand Decimal	E
7751	E151	7651	7661	4601	10.9 mm Common Anode Right Hand Decimal	F
7760	E153	7653	7663	4603	10.9 mm Common Cathode Right Hand Decimal	G
7756	E156	7656	7666	4606	10.9 mm Universal ±1. Overflow Right Hand Decimal[2]	H

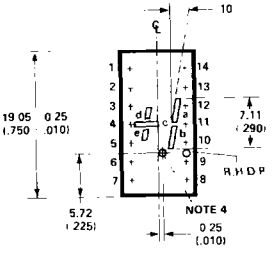
Notes:
1. These displays are recommended for high ambient light operation. Please refer to the HDSP-E10X AlGaAs and HDSP-335X HER data sheet for low current operation.
2. Universal pinout brings the anode and cathode of each segment's LED out to separate pins. See internal diagram H.

These displays are ideal for most applications. Pin for pin equivalent displays are also available in a low current or high light ambient design. The low current displays are ideal for portable applications. The high light ambient displays are ideal for high light ambients or long string lengths. For additional information see the Low Current Seven Segment Displays, or High Light Ambient Seven Segment Displays data sheets.

Package Dimensions

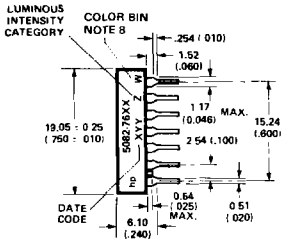


A,B,C

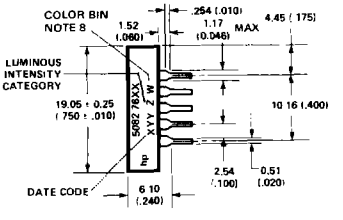


D

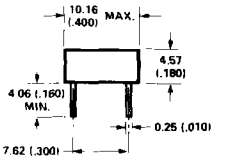
	FUNCTION			
PIN	A	B	C	D
1	CATHODE-a	CATHODE-a	NO PIN	ANODE-d
2	CATHODE-f	CATHODE-f	CATHODE[6]	NO PIN
3	ANODE[3]	ANODE[3]	ANODE-f	CATHODE-d
4	NO PIN	NO PIN	ANODE-g	CATHODE-c
5	NO PIN	NO PIN	ANODE-e	CATHODE-e
6	CATHODE-dp	NO CONN.[5]	ANODE-d	ANODE-e
7	CATHODE-d	CATHODE-e	NO PIN	ANODE-c
8	CATHODE-d	CATHODE-d	NO PIN	ANODE-dp
9	NO CONN.[5]	CATHODE-dp	CATHODE[6]	NO PIN
10	CATHODE-c	CATHODE-c	ANODE-dp	CATHODE-dp
11	CATHODE-g	CATHODE-g	ANODE-c	CATHODE-b
12	NO PIN	NO PIN	ANODE-b	CATHODE-a
13	CATHODE-b	CATHODE-b	ANODE-a	ANODE-a
14	ANODE[3]	ANODE[3]	NO PIN	ANODE-b



A,B,D SIDE



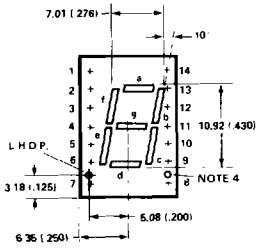
C SIDE



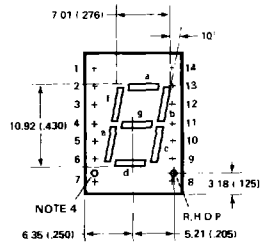
A,B,C,D END

NOTES;

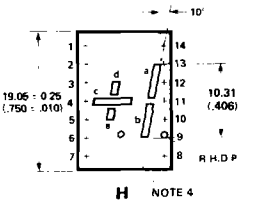
1. DIMENSIONS IN MILLIMETRES AND (INCHES).
2. ALL UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY.
3. REDUNDANT ANODES.
4. UNUSED DP POSITION.
5. SEE INTERNAL CIRCUIT DIAGRAM.
6. REDUNDANT CATHODE.
7. SEE PART NUMBER TABLE FOR L.H.D.P. AND R.H.D.P. DESIGNATION.
8. FOR YELLOW AND GREEN DEVICES ONLY.



E

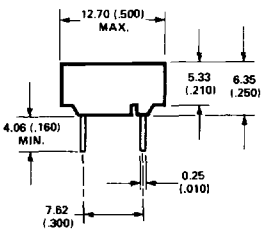


F,G FRONT VIEW

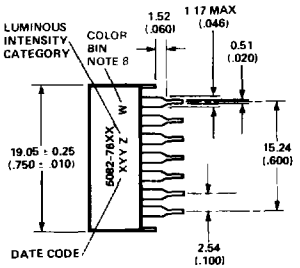


H NOTE 4

	FUNCTION			
PIN	E	F	G	H
1	CATHODE-a	CATHODE-a	ANODE-a	CATHODE-d
2	CATHODE-f	CATHODE-f	ANODE-f	ANODE-d
3	ANODE[3]	ANODE[3]	CATHODE[6]	NO PIN
4	NO PIN	NO PIN	NO PIN	CATHODE-c
5	NO PIN	NO PIN	NO PIN	CATHODE-e
6	CATHODE-dp	NO CONN.[5]	NO CONN.[5]	ANODE-e
7	CATHODE-e	CATHODE-e	ANODE-e	ANODE-c
8	CATHODE-d	CATHODE-d	ANODE-d	ANODE-dp
9	NO CONN.[5]	CATHODE-dp	ANODE-dp	CATHODE-dp
10	CATHODE-c	CATHODE-c	ANODE-c	CATHODE-b
11	CATHODE-g	CATHODE-g	ANODE-g	CATHODE-a
12	NO PIN	NO PIN	NO PIN	NO PIN
13	CATHODE-b	CATHODE-b	ANODE-b	ANODE-a
14	ANODE[3]	ANODE[3]	CATHODE[6]	ANODE-b

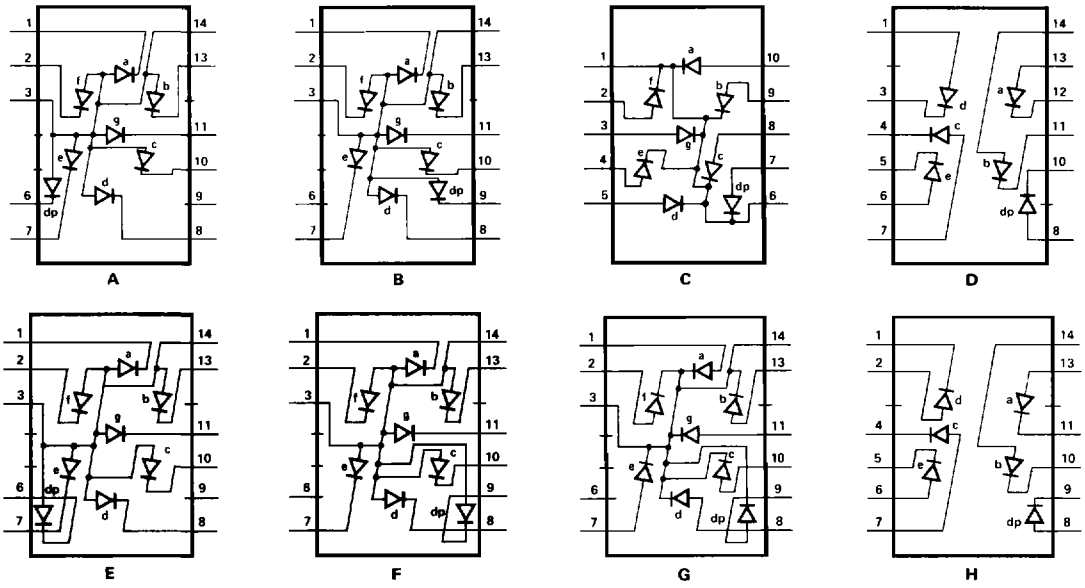


END VIEW



SIDE VIEW

Internal Circuit Diagram



Absolute Maximum Ratings

Description	Red 5082-7700 Series	AlGaAs Red HDSP-E150 Series	HER 5082-7610/ 7650 Series	Yellow 5082-7620/ 7660 Series	Green HDSP-3600/ 4800 Series	Units
Average Power per Segment or DP	82	96	105	80	105	mW
Peak Forward Current per Segment or DP	150[1]	160[3]	90[5]	60[7]	90[9]	mA
DC Forward Current per Segment or DP	25[2]	40[4]	30[6]	20[8]	30[10]	mA
Operating Temperature Range	-40 to +100	-20 to +100[11]	-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 (1.59 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.
3. See Figure 2 to establish pulsed conditions.
4. Derate above 46°C at 0.54 mA/°C.
5. See Figure 7 to establish pulsed conditions.
6. Derate above 53°C at 0.45 mA/°C.
7. See Figure 8 to establish pulsed conditions.
8. Derate above 81°C at 0.52 mA/°C.
9. See Figure 9 to establish pulsed conditions.
10. Derate above 39°C at 0.37 mA/°C.
11. For operation below -20°C, contact your local HP components sales office or an authorized distributor.

Electrical/Optical Characteristics at T_A = 25°C

Red

Device Series	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
5082-7730	Luminous Intensity/Segment[1,2] (Digit Average)	I_V	360	770		µcd	I_F = 20 mA
5082-7750			360	1100		µcd	I_F = 20 mA
All	Forward Voltage/Segment or DP	V_F		1.6	2.0	V	I_F = 20 mA
	Peak Wavelength	λ_{PEAK}		655		nm	
	Dominant Wavelength[3]	λ_d		640		nm	
	Reverse Voltage/Segment or DP[4]	V_R	3.0	12		V	I_R = 100 µA
	Temperature Coefficient of V_F/Segment or DP	ΔV_F/°C		-2		mV/°C	
	Thermal Resistance LED Junction-to-Pin	$R\theta_{J\text{-}PIN}$		280		°C/W/Seg	

AlGaAs Red

Device Series	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
HDSP-E150	Luminous Intensity/Segment[1,2,5] (Digit Average)	I_V	8.5	15.0		mcd	I_F = 20 mA
	Forward Voltage/Segment or DP	V_F		1.8		V	I_F = 20 mA
				2.0	3.0	V	I_F = 100 mA
	Peak Wavelength	λ_{PEAK}		645		nm	
	Dominant Wavelength[3]	λ_d		637		nm	
	Reverse Voltage/Segment or DP[4]	V_R	3.0	15		V	I_R = 100 µA
	Temperature Coefficient of V_F/Segment or DP	ΔV_F/°C		-2		mV/°C	
	Thermal Resistance LED Junction-to-Pin	$R\theta_{J\text{-}PIN}$		340		°C/W/Seg	

High Efficiency Red

Device Series	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
5082-7610	Luminous Intensity/Segment[1,2,6] (Digit Average)	I_V	340	800		µcd	I_F = 5 mA
5082-7650			340	1115		µcd	I_F = 5 mA
All	Forward Voltage/Segment or DP	V_F		2.1	2.5	V	I_F = 20 mA
	Peak Wavelength	λ_{PEAK}		635		nm	
	Dominant Wavelength[3]	λ_d		626		nm	
	Reverse Voltage/Segment or DP[4]	V_R	3.0	30		V	I_R = 100 µA
	Temperature Coefficient of V_F/Segment or DP	ΔV_F/°C		-2		mV/°C	
	Thermal Resistance LED Junction-to-Pin	$R\theta_{J\text{-}PIN}$		280		°C/W	

Yellow

Device Series	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
5082-7620	Luminous Intensity/Segment[1,2] (Digit Average)	I_V	205	620		µcd	I_F = 5 mA
5082-7660			290	835		µcd	I_F = 5 mA
All	Forward Voltage/Segment or DP	V_F		2.2	2.5	V	I_F = 20 mA
	Peak Wavelength	λ_{PEAK}		583		nm	
	Dominant Wavelength[3,7]	λ_d	581.5	586	592.5	nm	
	Reverse Voltage/Segment or DP[4]	V_R	3.0	40		V	I_R = 100 µA
	Temperature Coefficient of V_F/Segment or DP	ΔV_F/°C		-2		mV/°C	
	Thermal Resistance LED Junction-to-Pin	$R\theta_{J\text{-}PIN}$		280		°C/W/Seg	

High Performance Green

Device Series	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
HDSP-3600	Luminous Intensity/Segment[1,2] (Digit Average)	I_V	570	1800		µcd	I_F = 10 mA
HDSP-4600			460	1750		µcd	I_F = 10 mA
All	Forward Voltage/Segment or DP	V_F		2.1	2.5	V	I_F = 10 mA
	Peak Wavelength	λ_{PEAK}		566		nm	
	Dominant Wavelength[3,7]	λ_d		571	577	nm	
	Reverse Voltage/Segment or DP[4]	V_R	3.0	50		V	I_R = 100 µA
	Temperature Coefficient of V_F/Segment or DP	ΔV_F/°C		-2		mV/°C	
	Thermal Resistance LED Junction-to-Pin	$R\theta_{J\text{-}PIN}$		280		°C/W/Seg	

Notes:
1. Device case temperature is 25°C prior to the intensity measurement.
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, λ_d, 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.
5. For low current operation, the AlGaAs HDSP-E10X series displays are recommended. They are tested at 1 mA dc/segment and are pin for pin compatible with the HDSP-E15X series.
6. For low current operation, the HER HDSP-335X series displays are recommended. They are tested at 2 mA dc/segment and are pin for pin compatible with the 5082-7650 series.
7. The Yellow (5082-7620/7660) and Green (HDSP-3600/4600) displays are categorized for dominant wavelength. The category is designated by a number adjacent to the luminous intensity category letter.

Red, AlGaAs Red

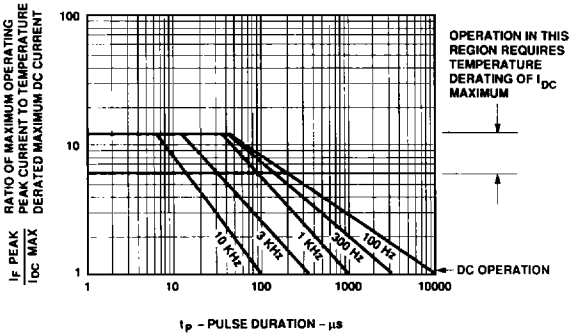


Figure 1. Maximum Tolerable Peak Current vs. Pulse Duration – Red.

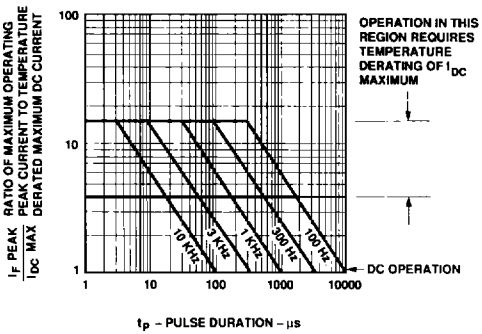


Figure 2. Maximum Allowed Peak Current vs. Pulse Duration – AlGaAs Red.

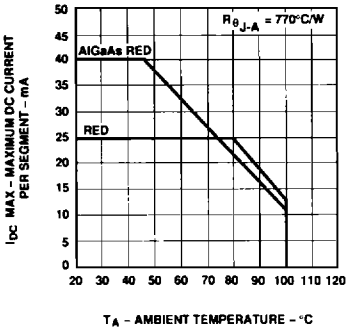


Figure 3. Maximum Allowable DC Current vs. Ambient Temperature.

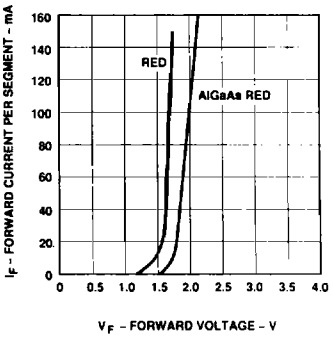


Figure 4. Forward Current vs. Forward Voltage.

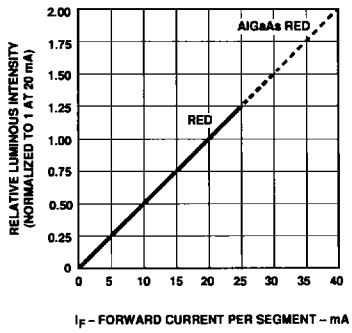


Figure 5. Relative Luminous Intensity vs. DC Forward Current.

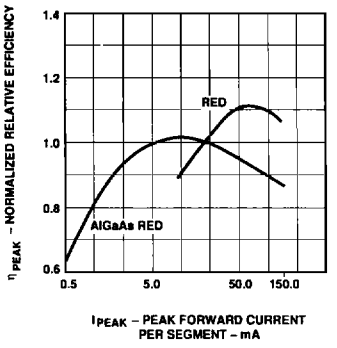


Figure 6. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

HER, Yellow, Green

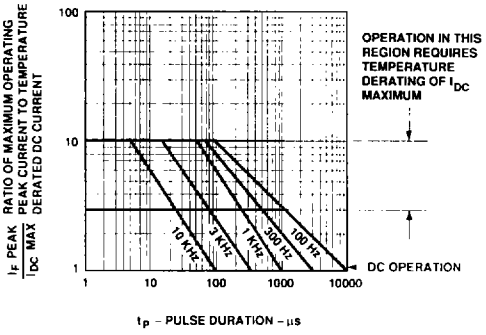


Figure 7. Maximum Tolerable Peak Current vs. Pulse Duration – HER Series.

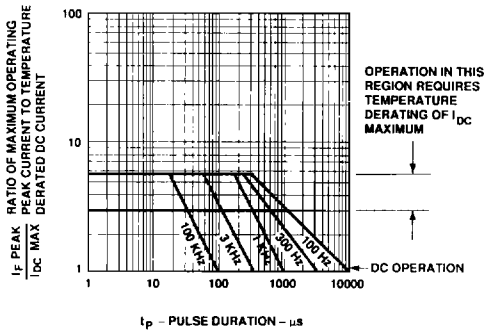


Figure 8. Maximum Tolerable Peak Current vs. Pulse Duration – Yellow Series.

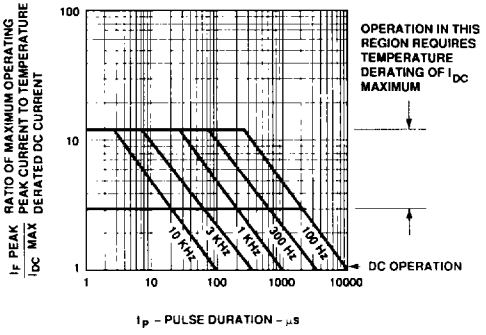


Figure 9. Allowable Peak Current vs. Pulse Duration – Green Series.

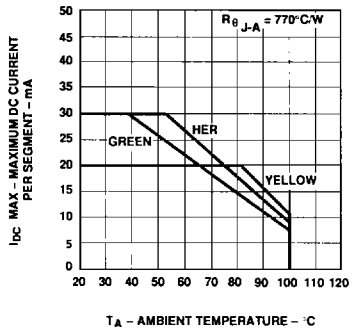


Figure 10. Maximum Allowable DC Current vs. Ambient Temperature.

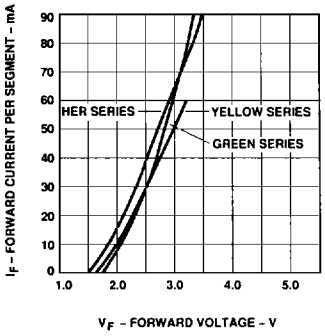


Figure 11. Forward Current vs. Forward Voltage.

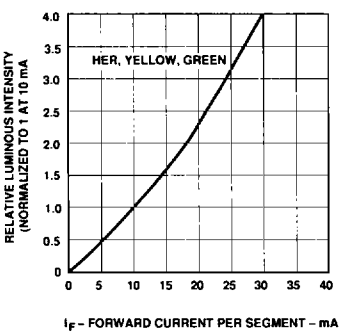


Figure 12. Relative Luminous Intensity vs. DC Forward Current.

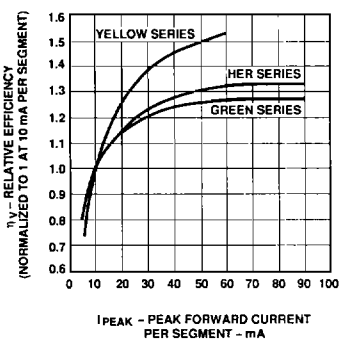


Figure 13. Relative Luminous Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

Electrical/Optical

These displays use light emitting diodes, with the light from each LED optically stretched to form individual segments and decimal points. The Red 5082-7730/7750 series LEDs use a p-n junction diffused into a GaAsP epitaxial layer on a GaAs substrate. The AlGaAs Red HDSP-E150 series LEDs use double heterojunction AlGaAs on a GaAs substrate. HER 5082-7610/7650 and Yellow 5082-7620/7660 series LEDs have their p-n junctions diffused into a GaAsP epitaxial layer on a GaP substrate. The Green HDSP-3600/4600 series LEDs use a liquid phase GaP epitaxial layer on GaP.

These displays are designed for strobed operation. The typical forward voltage values can be scaled from Figures 4 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 following V_FMAX models:

Red 5082-7730/7750 series

V_FMAX = 1.8 V + I_{Peak} (10 Ω)
For: I_{Peak} > 5 mA

AlGaAs Red HDSP-E150 series

V_FMAX = 1.8 V + I_{Peak} (20 Ω)
For: $I_{Peak} \leq$ 20 mA
V_FMAX = 2.0 V + I_{Peak} (10 Ω)
For: 20 mA ≤ $I_{Peak} \leq$ 100 mA
V_FMAX = 2.27 V + I_{Peak} (7.2 Ω)
For $I_{Peak} \geq$ 100 mA

HER (5082-7610/7650) and Yellow (5082-7620/7660) series

V_FMAX = 1.6 + I_{Peak} (45 Ω)
For: 5 mA ≤ $I_{Peak} \leq$ 20 mA

V_FMAX = 1.75 + I_{Peak} (38 Ω)
For: $I_{Peak} \geq$ 20 mA

Green (HDSP-3600/4600) series

V_FMAX = 2.0 + I_{Peak} (50 Ω)
For: I_{Peak} > 5 mA

Figures 6 and 13 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_VAVG = (I_FAVG/I_FAVG DATA SHEET)(η_{peak})(I_VDATA SHEET)

Where:

I_VAVG is the calculated time averaged luminous intensity resulting from I_FAVG.

I_FAVG is the desired time averaged LED current.

I_FAVG DATA SHEET is the data sheet test current for I_VDATA SHEET.

η_{peak} is the relative efficiency at the peak current, scaled from Figure 6 or 13.

I_V DATA SHEET is the data sheet luminous intensity, resulting from I_FAVG DATA SHEET.

For example, what is the luminous intensity of a 5082-7610 driven at 50 mA peak 1/5 duty factor?

I_FAVG = (50 mA)(0.2) = 10 mA
I_FAVG DATA SHEET = 5 mA
η_{Peak} = 1.62
I_V DATA SHEET = 800 µcd

Therefore

I_VAVG = (10 mA/5 mA) (1.62)(800 µcd)
= 2592 µcd

Contrast Enhancement

The objective of contrast enhancement is to provide good display readability in the end use ambient light. The concept is to employ both luminance and chrominance contrast techniques to enhance the readability. This is accomplished by having the OFF dots blend into the display background and the ON dots stand out vividly against this same background. Therefore, these display devices are assembled with a gray package and matching encapsulating epoxy in the dots.

Contrast enhancement may be achieved by using one of the following suggested filters:

Red and AlGaAs Red (5082-7730/7750/HDSP-E150)
Panelgraphic RUBY RED 60
SGL-Homalite H100-1605 RED
3M Louvered Filter R6310 RED or ND0220 GRAY

HER (5082-7610/7650)
Panelgraphic SCARLET RED 65
SGL-Homalite H100-1670 RED or H100-1250 GRAY
3M Louvered Filter R6310 RED or ND0220 GRAY

Yellow (5082-7620/7660)
Panelgraphic YELLOW 27 or GRAY 10
SGL-Homalite H100-1720 AMBER or H100-1250 GRAY
3M Louvered Filter ND0220 GRAY

Green (HDSP-3600/4600)
Panelgraphic GREEN 48
SGL-Homalite H100-1440 GREEN or H100-1250 GRAY
3M Louvered Filter ND0220 GRAY

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

Mechanical

Specially developed plastics are used to optimize the displays optical performance. These plastics restrict the solvents that may be used for cleaning. Only mixtures of Freon (F113) and alcohol should be used for vapor cleaning processes. Total immersion time in the vapors is two minutes. Some suggested mixtures are Freon TE, Arklone A or K, or Genesolv DES. A 60°C (140°F) water cleaning process may also be used. This process includes a neutralizer rinse (3% ammonia solution or equivalent), a surfactant rinse (1% detergent solution or equivalent), a water rinse, and a thorough air dry. Room temperature cleaning may be done with Freon T-E35 or T-P35, Ethanol, Isopropanol, or water with a mild detergent.

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.