HEWLETT PACKARD

Subminiature Solid State Lamps

Technical Data

HLMP-PXXX Series
HLMP-Q1XX Series
HLMP-6XXX Series
HLMP-70XX Series

Features

- **Subminiature Flat Top Package**
  Ideal for Backlighting and Light Piping Applications
- **Subminiature Dome Package**
  Diffused Dome for Wide Viewing Angle
  Nondiffused Dome for High Brightness
- **Arrays**
- **TTL and LSTTL Compatible 5 Volt Resistor Lamps**
- **Available in Six Colors**
- **Ideal for Space Limited Applications**
- **Axial Leads**
- **Available with Lead Configurations for Surface Mount and Through Hole PC Board Mounting**

Description

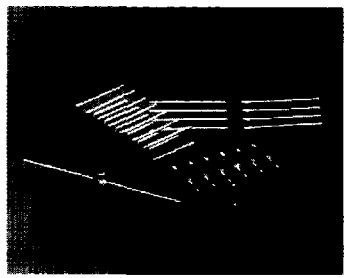
Flat Top Package
The HLMP-PXXX Series flat top lamps use an untinted, non-diffused, truncated lens to provide a wide radiation pattern that is necessary for use in backlighting applications. The flat top lamps are also ideal for use as emitters in light pipe applications.

Dome Packages
The HLMP-6XXX Series dome lamps for use as indicators use a tinted, diffused lens to provide a wide viewing angle with a high on-off contrast ratio. High brightness lamps use an untinted, nondiffused lens to provide a high luminous intensity within a narrow radiation pattern.

Arrays
The HLMP-66XX Series subminiature lamp arrays are available in lengths of 3 to 8 elements per array. The luminous intensity is matched within an array to assure a 2.1 to 1.0 ratio.

Resistor Lamps
The HLMP-6XXX Series 5 volt subminiature lamps with built in current limiting resistors are for use in applications where space is at a premium.

Lead Configurations
All of these devices are made by encapsulating LED chips on axial lead frames to form molded epoxy subminiature lamp packages. A variety of package configuration options is available. These include special surface mount lead configurations, gull wing, yoke lead or Z-bend. Right angle lead bends at 2.54 mm (0.100 inch) and 5.08 mm (0.200 inch) center spacing are available for through hole mounting.



Device Selection Guide
Part Number: HLMP-XXXX

Standard Red	DH AS AlGaAs Red	High Efficiency Red	Orange	Yellow	High Performance Green	Device Description[1]		Device Outline Drawing
P005	P105	P205	P405	P305	P505	Nondiffused, Flat Top		A
6000/6001	Q101	6300	Q400	6400	6500	Diffused		B
	Q105	6305		6405	6505	Nondiffused, High Brightness		
	Q150	7000		7019	7040	Diffused, Low Current		
	Q155					Nondiffused, Low Current		
		6600		6700	6800	Diffused, Resistor, 5 V, 10 mA		
		6620		6720	6820	Diffused, Resistor, 5 V, 4 mA		
6203		6653		6753	6853	3 Element	Matched Array, Diffused	C
6204		6654		6754	6854	4 Element		
6205		6655		6755	6855	5 Element		
6206		6656		6766	6856	6 Element		
6208		6658		6768	6858	8 Element		

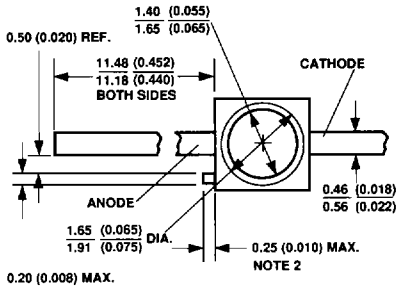
Package Configuration Options

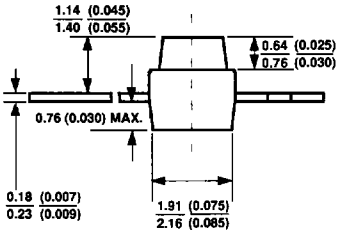
Option Code	Package Configuration Description			Package Outline Drawing
011	Gull Wing Lead, Tape and Reel[2]		Surface Mount Lead Configurations	D, L, P
012	Gull Wing Lead, Bulk Packaging[3]			
013	Gull Wing Lead, Arrays, Shipping Tube			E, M
021	Yoke Lead, Tape and Reel[2]			F, N, P
022	Yoke Lead, Bulk Packaging[3]			
031	Z-Bend, Tape and Reel[2]			G, O, P
032	Z-Bend, Bulk Packaging[3]			
1L1	2.54 mm (0.100 inch) Center Lead Spacing	Long Leads; 10.4 mm (0.410 in.)	Right Angle Lead Bends for Through Hole Mounting	H
1S1		Short Leads; 3.7 mm (0.145 in.)		I
2L1	5.08 mm (0.200 inch) Center Lead Spacing	Long Leads; 9.2 mm (0.364 in.)		J
2S1		Short Leads; 3.7 mm (0.145 in.)		K

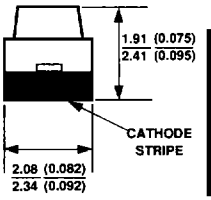
Notes:
1. Diffused lamps have tinted lenses. Nondiffused lamps have untinted lenses.
2. Lamps are supplied in 12 mm embossed tape on 178 mm (7 inch) diameter reels, with 1500 lamps per reel. Minimum order quantity and order increment are in quantity of reels only.
3. Vapor barrier bags are used for bulk packaging.

Package Dimensions

(A) Flat Top Lamps

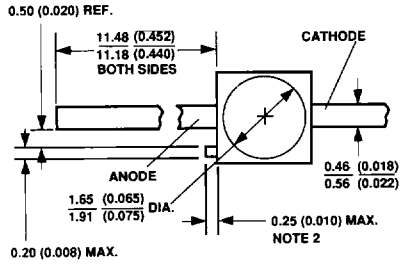


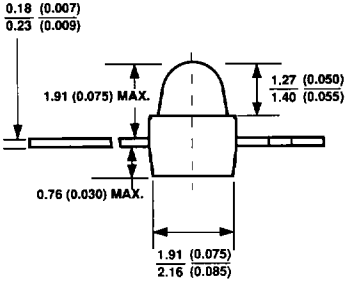


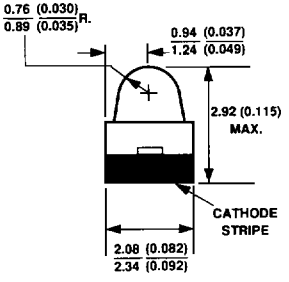


NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
2. PROTRUDING SUPPORT TAB IS CONNECTED TO CATHODE LEAD.

(B) Diffused and Nondiffused

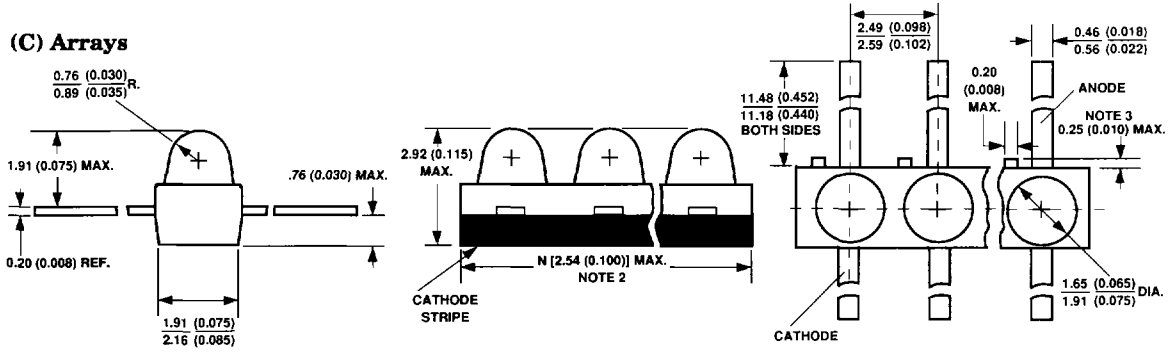






NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
2. PROTRUDING SUPPORT TAB IS CONNECTED TO CATHODE LEAD.

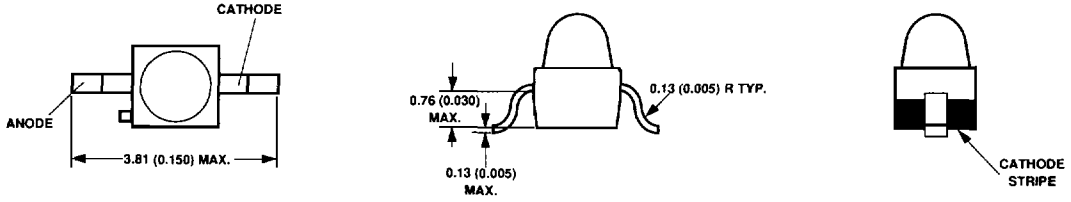
(C) Arrays



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
2. OVERALL LENGTH IS THE NUMBER OF ELEMENTS TIMES 2.54 mm (0.100 IN.).
3. PROTRUDING SUPPORT TAB IS CONNECTED TO CATHODE LEAD.

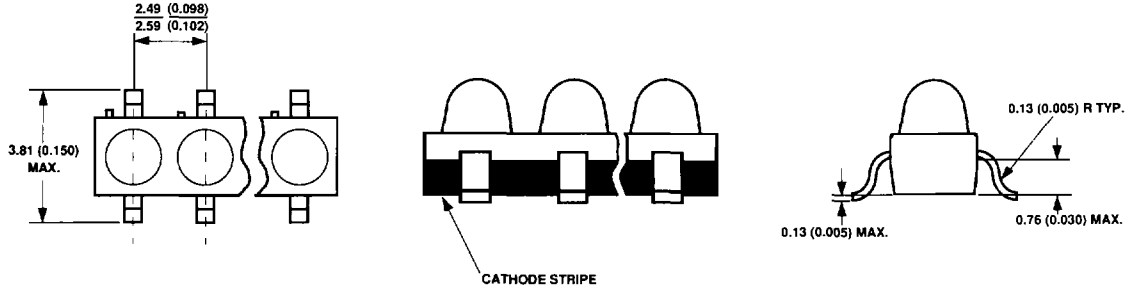
Package Dimensions, Lead Bend Options

(D) Individual Lamp, Gull Wing Lead, Option 011 and 012



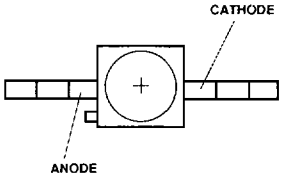
ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

(E) Subminiature Array, Gull Wing Lead, Option 013

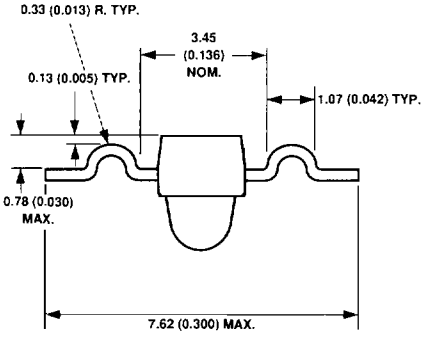


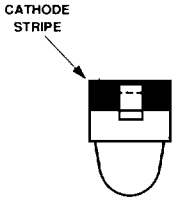
ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

(F) Individual Lamp, "Yoke" Lead, Options 021 and 022

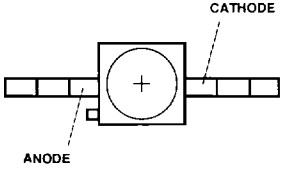


ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

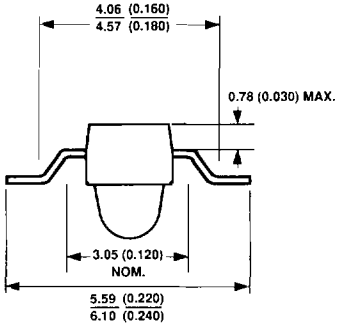


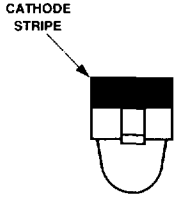


(G) Individual Lamp, Z-Bend Lead, Options 031 and 032

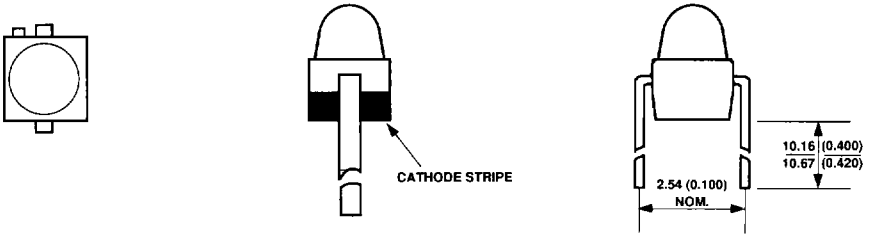


ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)



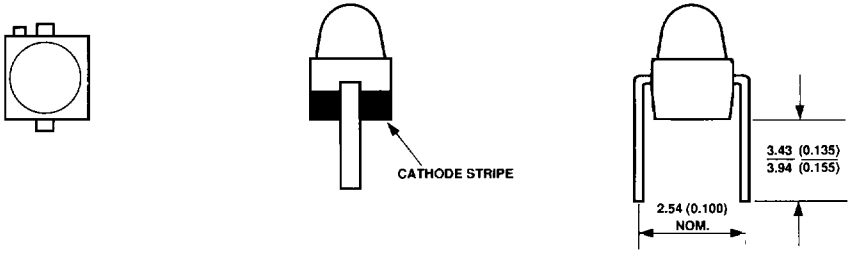


(H) Individual Lamp or Array, Rt. Angle Bend Option 1L1



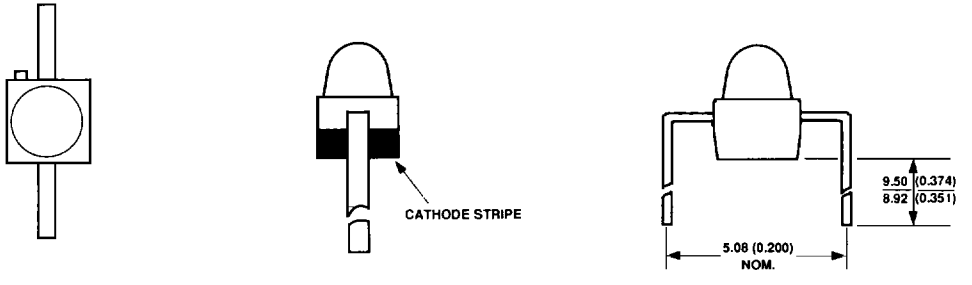
ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

(I) Individual Lamp or Array, Rt. Angle Bend Option 1S1



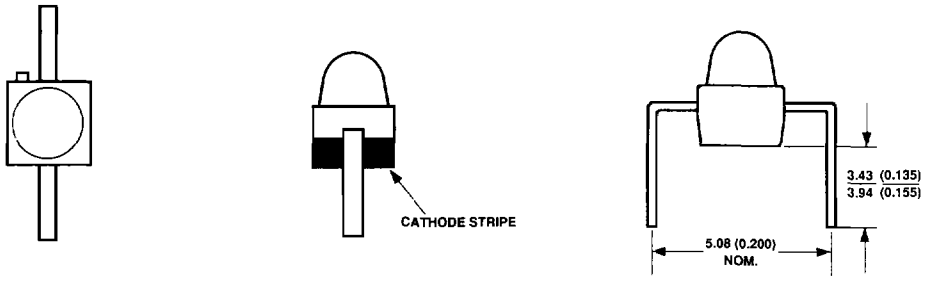
ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

(J) Individual Lamp or Array, Rt. Angle Bend Option 2L1



ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

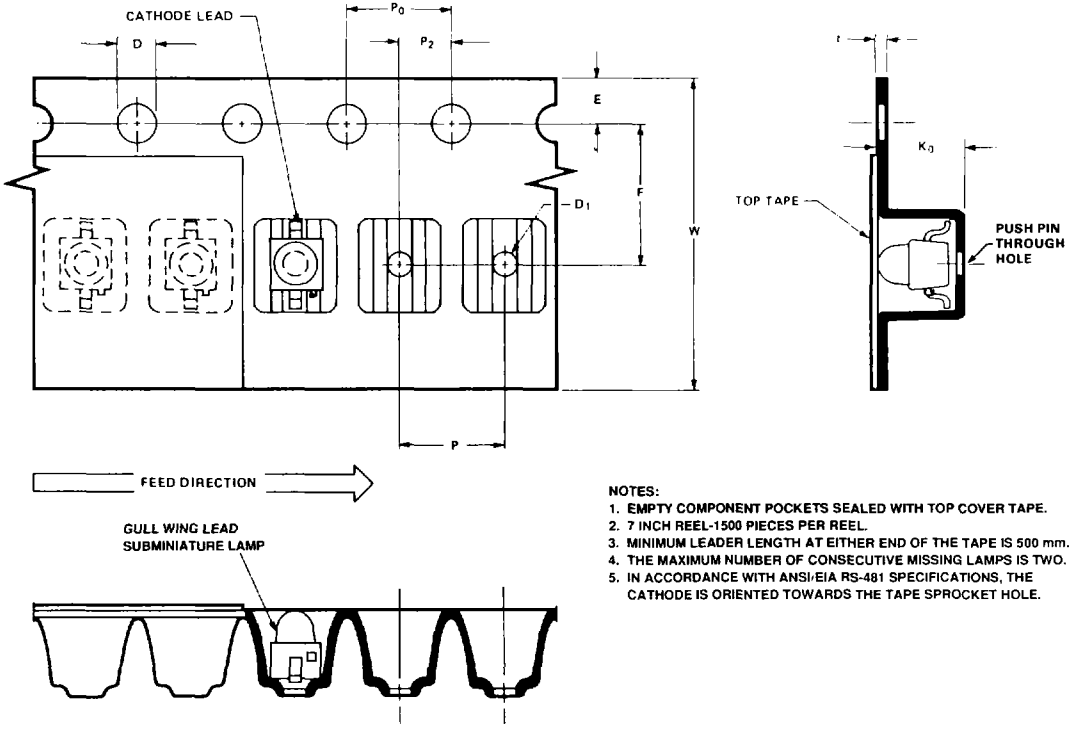
(K) Individual Lamp or Array, Rt. Angle Bend Option 2S1



ALL DIMENSIONS ARE IN MILLIMETRES (INCHES)

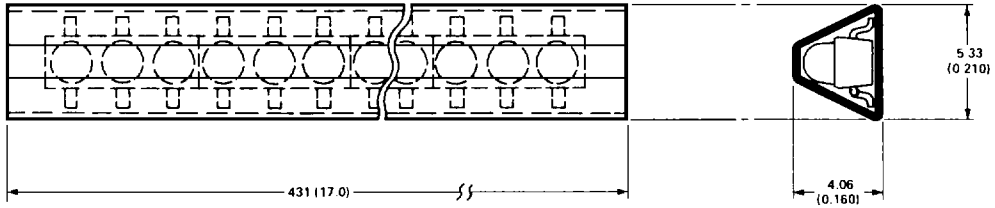
Package Dimensions: Surface Mount Tape and Reel Options

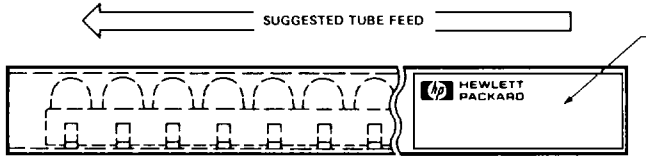
(L) 12 mm Tape and Reel, Gull Wing Lead, Option 011



NOTES:
1. EMPTY COMPONENT POCKETS SEALED WITH TOP COVER TAPE.
2. 7 INCH REEL-1500 PIECES PER REEL.
3. MINIMUM LEADER LENGTH AT EITHER END OF THE TAPE IS 500 mm.
4. THE MAXIMUM NUMBER OF CONSECUTIVE MISSING LAMPS IS TWO.
5. IN ACCORDANCE WITH ANSI/EIA RS-481 SPECIFICATIONS, THE CATHODE IS ORIENTED TOWARDS THE TAPE SPROCKET HOLE.

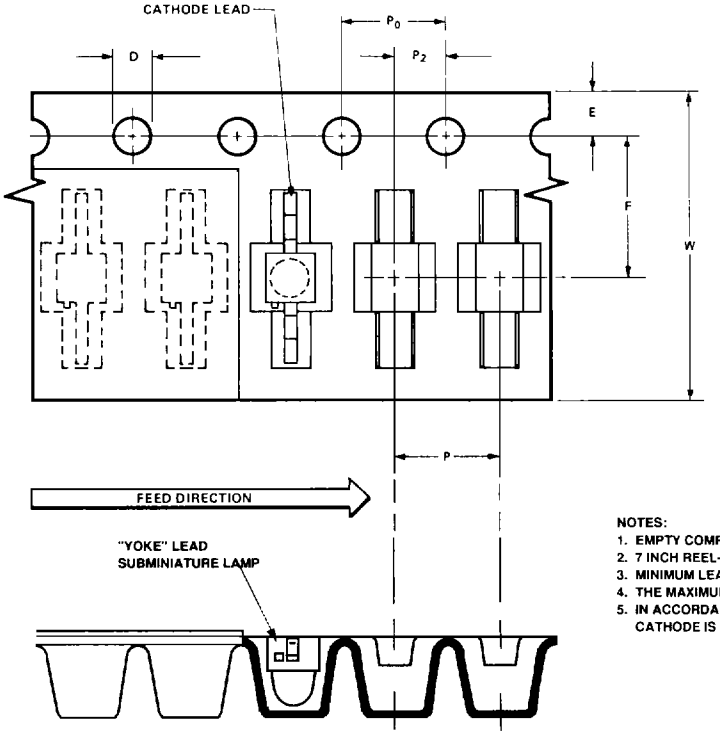
(M) Array Shipping Tube, Gull Wing Lead, Option 013

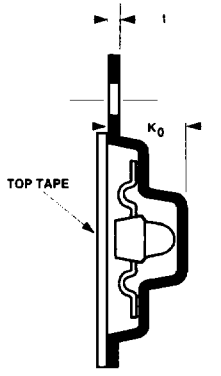




HLMP-	NO. OF LAMP ELEMENTS PER ARRAY	QUANTITY OF ARRAYS PER TUBE
6XX3	3	53
6XX4	4	40
6XX5	5	32
6XX6	6	26
6XX8	8	20

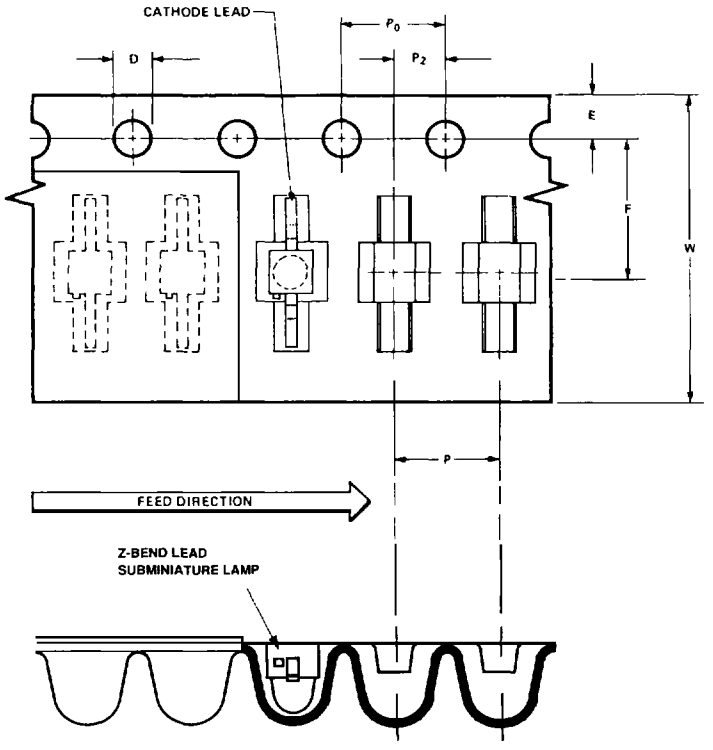
(N) 12 mm Tape and Reel, "Yoke" Lead, Option 021

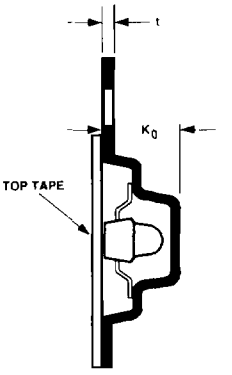




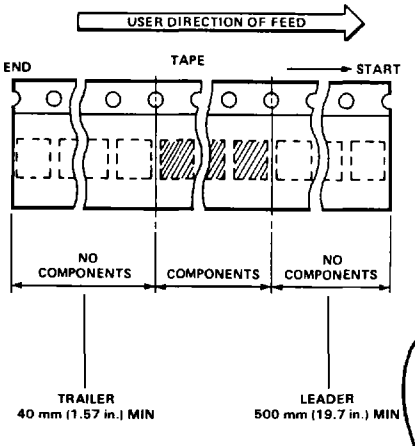
NOTES:
1. EMPTY COMPONENT POCKETS SEALED WITH TOP COVER TAPE.
2. 7 INCH REEL-1500 PIECES PER REEL.
3. MINIMUM LEADER LENGTH AT EITHER END OF THE TAPE IS 500 mm.
4. THE MAXIMUM NUMBER OF CONSECUTIVE MISSING LAMPS IS TWO.
5. IN ACCORDANCE WITH ANSI/EIA RS-481 SPECIFICATIONS, THE CATHODE IS ORIENTED TOWARDS THE TAPE SPROCKET HOLE.

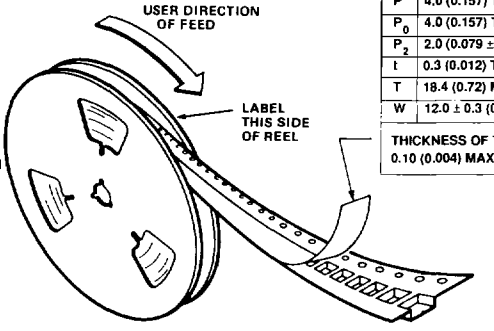
(O) 12 mm Tape and Reel, Z-Bend Lead, Option





(P) 12 mm Tape and Reel



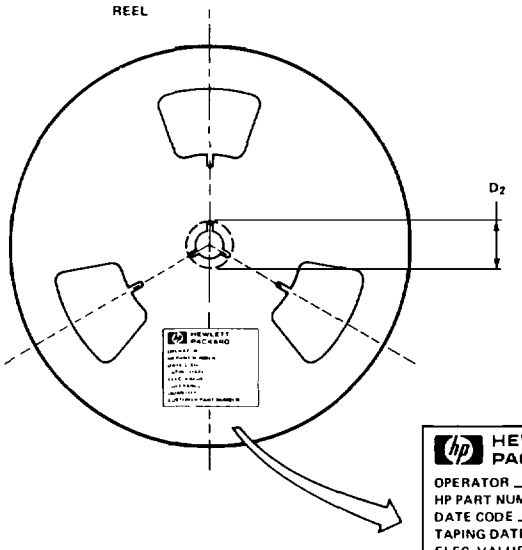


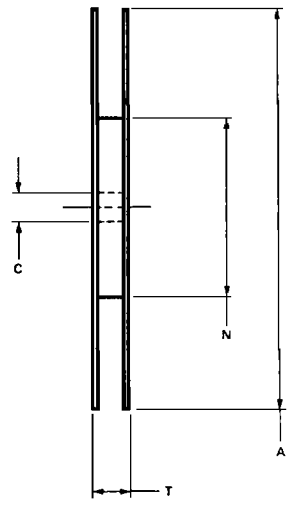
DIMENSIONS PER ANSI/EIA STANDARD RS-481.
ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).

A	178.0 ± 2.0 (7.0 ±0.08) DIA.
C	13.0 (0.512) DIA. TYP.
D	1.55 (0.061 ± 0.002) DIA.
D_1	1.0 (0.039) DIA. MIN.
D_2	20.2 (0.795) DIA. MIN.
E	1.75 ± 0.1 (0.069)
F	5.50 (0.127 ± 0.002)
K_0	3.05 ± 0.1 (0.120) TYP.
N	50.0 (1.970) MIN.
P	4.0 (0.157) TYP.
P_0	4.0 (0.157) TYP.
P_2	2.0 (0.079 ± 0.002) TYP.
t	0.3 (0.012) TYP.
T	18.4 (0.72) MAX.
W	12.0 ± 0.3 (0.472 ± 0.012)

THICKNESS OF TOP COVER TAPE
0.10 (0.004) MAX.

TOLERANCES (UNLESS OTHERWISE SPECIFIED):
.X ± .1; .XX ± .05 [.XXX ± .004]





Absolute Maximum Ratings at T_A = 25°C

Parameter	Standard Red	DH AS AlGaAs Red	High Eff. Red	Orange	Yellow	High Perf. Green	Units
Power Dissipation	100	87	135	135	85	135	mW
DC Forward Current[1]	50	30	30	30	20	30	mA
Peak Forward Current[2]	1000	300	90	90	60	90	mA
DC Forward Voltage (Resistor Lamps Only)			6		6	6	V
Reverse Voltage (I_R = 100 µA)	5	5	5	5	5	5	V
Transient Forward Current[3] (10 µs Pulse)	2000	500	500	500	500	500	mA
Operating Temperature Range: Non-Resistor Lamps	-55 to +100	-20 to +100	-55 to +100			-20 to +100	°C
Resistor Lamps			-40 to +85			-20 to +85	°C
Storage Temperature Range	-55 to +100						°C
Wave Soldering Temperature [1.6 mm (0.063 in.) from body]	260°C for 3 Seconds						
Surface Mount Reflow Soldering: Convective IR	235°C for 90 Seconds						
Vapor Phase	215°C for 3 Minutes						

Notes:
1. See Figure 5 for current derating vs. ambient temperature. Derating is not applicable to resistor lamps.
2. Refer to Figure 6 showing Max. Tolerable Peak Current vs. Pulse Duration to establish pulsed operating conditions.
3. The transient peak current is the maximum non-recurring peak current the device can withstand without failure. Do not operate these lamps at this high current.

Electrical/Optical Characteristics, T_A = 25°C

Standard Red

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
P005	Luminous Intensity[1]	I_v	1.0	2.5		mcd	I_F = 10 mA
6000			0.5	1.2			
6001			1.3	3.2			
6203 to 6208			0.5	1.2			
All	Forward Voltage	V_F	1.4	1.6	2.0	V	I_F = 10 mA
	Reverse Breakdown Voltage	V_R	5.0	12.0		V	I_R = 100 µA
P005	Included Angle Between Half Intensity Points[2]	$2\theta_{1/2}$		125		Deg.	
All Others				90			
All	Peak Wavelength	λ_{PEAK}		655		nm	
	Dominant Wavelength[3]	λ_d		640		nm	
	Spectral Line Half Width	$\Delta\lambda_{1/2}$		24		nm	
	Speed of Response	τ_s		15		ns	
	Capacitance	C		100		pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$		120		°C/W	Junction-to-Cathode Lead
	Luminous Efficacy[4]	η_v		65		lm/W	

DH AS AlGaAs Red

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
P105	Luminous Intensity	I_v	22.0	45.0		mcd	I_F = 20 mA
Q101			22.0	45.0			
Q105			22.0	55.0			
Q150			1.0	1.8			I_F = 1 mA
Q155			2.0	4.0			
Q101	Forward Voltage	V_F		1.8	2.2	V	I_F = 20 mA
P105/Q105				1.8	2.2		
Q150/Q155				1.6	1.8		I_F = 1 mA
All	Reverse Breakdown Voltage	V_R	5.0	15.0		V	I_R = 100 μA
P105	Included Angle Between Half Intensity Points[2]	$2\theta_{1/2}$		125		Deg.	
Q101/Q150				90			
Q105/Q155				28			
All	Peak Wavelength	λ_{PEAK}		645		nm	Measured at Peak
	Dominant Wavelength[3]	λ_d		637		nm	
	Spectral Line Half Width	$\Delta\lambda_{1/2}$		20		nm	
	Speed of Response	τ_s		30		ns	Exponential Time Constant; $e^{-t/\tau}$
	Capacitance	C		30		pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$		220		°C/W	Junction-to Cathode Lead
	Luminous Efficacy[4]	η_v		80		lm/W	

High Efficiency Red

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
P205	Luminous Intensity[1]	I_v	1.0	5.0		mcd	I_F = 10 mA
6300			1.0	3.0			
6305			3.4	12.0			
7000			0.4	0.8			I_F = 2 mA
6600			1.3	5.0			V_F = 5.0 Volts
6620			0.8	2.0			
6653 to 6658			1.0	3.0			I_F = 10 mA
All	Forward Voltage (Nonresistor Lamps)	V_F	1.5	1.8	3.0	V	I_F = 10 mA
6600	Forward Current (Resistor Lamps)	I_F		9.6	13.0	mA	V_F = 5.0 V
6620				3.5	5.0		
All	Reverse Breakdown Voltage	V_R	5.0	30.0		V	I_R = 100 µA
P205	Included Angle Between Half Intensity Points[2]	$2\theta_{1/2}$		125		Deg.	
6305				28			
All Diffused				90			
All	Peak Wavelength	λ_{PEAK}		635		nm	Measured at Peak
	Dominant Wavelength[3]	λ_d		626		nm	
	Spectral Line Half Width	$\Delta\lambda_{1/2}$		40		nm	
	Speed of Response	τ_s		90		ns	
	Capacitance	C		11		pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$		120		°C/W	Junction-to-Cathode Lead
	Luminous Efficacy[4]	η_v		145		lm/W	

Orange

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
P405	Luminous Intensity	I_v	1.0	4.0		mcd	I_F = 10 mA
Q400			1.0	3.0			
P405	Forward Voltage	V_F	1.5	1.9	3.0	V	I_F = 10 mA
	Reverse Breakdown Voltage	V_R	5.0	30.0		V	I_R = 100 µA
P405	Included Angle Between Half Intensity Points[2]	$2\theta_{1/2}$		125		Deg.	
Q400				90			
P405/ Q400	Peak Wavelength	λ_{PEAK}		600		nm	
	Dominant Wavelength[3]	λ_d		602		nm	Measured at Peak
	Spectral Line Half Width	$\Delta\lambda_{1/2}$		40		nm	
	Speed of Response	τ_s		260		ns	
	Capacitance	C		4		pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$		120		°C/W	Junction-to-Cathode Lead
	Luminous Efficacy[4]	η_v		380		lm/W	

Yellow

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
P305	Luminous Intensity[1]	I_v	1.0	4.0		mcd	I_F = 10 mA
6400			1.0	3.0			
6405			3.6	12			
7019			0.4	0.6			I_F = 2 mA
6700			1.4	5.0			V_F = 5.0 Volts
6720			0.9	2.0			
6753 to 6758			1.0	3.0			I_F = 10 mA
All	Forward Voltage (Nonresistor Lamps)	V_F	1.5	2.0	3.0	V	I_F = 10 mA
6700	Forward Current (Resistor Lamps)	I_F		9.6	13.0	mA	V_F = 5.0 V
6720				3.5	5.0		
All	Reverse Breakdown Voltage	V_R	5.0	50.0		V	
P305	Included Angle Between Half Intensity Points[2]	$2\theta_{1/2}$		125		Deg.	
6405				28			
All Diffused				90			
All	Peak Wavelength	λ_{PEAK}		583		nm	Measured at Peak
	Dominant Wavelength[3]	λ_d		585		nm	
	Spectral Line Half Width	$\Delta\lambda_{1/2}$		36		nm	
	Speed of Response	τ_s		90		ns	
	Capacitance	C		15		pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$		120		°C/W	Junction-to-Cathode Lead
	Luminous Efficacy[4]	η_v		500		lm/W	

High Performance Green

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
P505	Luminous Intensity[1]	I_v	1.0	5.0		mcd	I_F = 10 mA
6500			1.0	3.0			
6505			4.2	12.0			
7040			0.4	0.6			I_F = 2 mA
6800			1.6	5.0			V_F = 5.0 Volts
6820			0.8	2.0			
6853 to 6858			1.0	3.0			I_F = 10 mA
All	Forward Voltage (Nonresistor Lamps)	V_F	1.5	2.0	3.0	V	I_F = 10 mA
6800	Forward Current (Resistor Lamps)	I_F		9.6	13.0	mA	V_F = 5.0 V
6820				3.5	5.0		
All	Reverse Breakdown Voltage	V_R	5.0	50.0		V	I_R = 100 µA
P505	Included Angle Between Half Intensity Points[2]	$2\theta_{1/2}$		125		Deg.	
6505				28			
All Diffused				90			
All	Peak Wavelength	λ_{PEAK}		565		nm	
	Dominant Wavelength[3]	λ_d		569		nm	
	Spectral Line Half Width	$\Delta\lambda_{1/2}$		28		nm	
	Speed of Response	τ_s		500		ns	
	Capacitance	C		18		pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$		120		°C/W	Junction-to-Cathode Lead
	Luminous Efficacy[4]	η_v		595		lm/W	

Notes:
1. The luminous intensity for arrays is tested to assure a 2.1 to 1.0 matching between elements. The average luminous intensity for an array determines its light output category bin. Arrays are binned for luminous intensity to allow I_v matching between arrays.
2. $\theta_{1/2}$ is the off-axis angle where the luminous intensity is half the on-axis value.
3. Dominant wavelength, λ_d, is derived from the CIE Chromaticity Diagram and represents the single wavelength that defines the color of the device.
4. Radiant intensity, I_e, in watts/steradian, may be calculated from the equation $I_e = I_v/\eta_v$, where I_v is the luminous intensity in candelas and η_v is the luminous efficacy in lumens/watt.

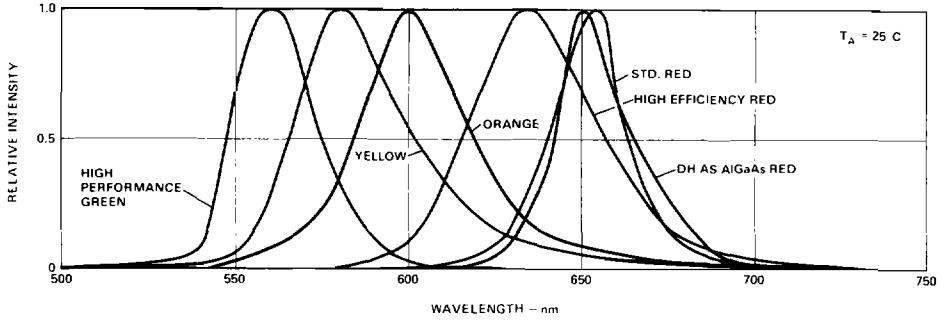


Figure 1. Relative Intensity vs. Wavelength.

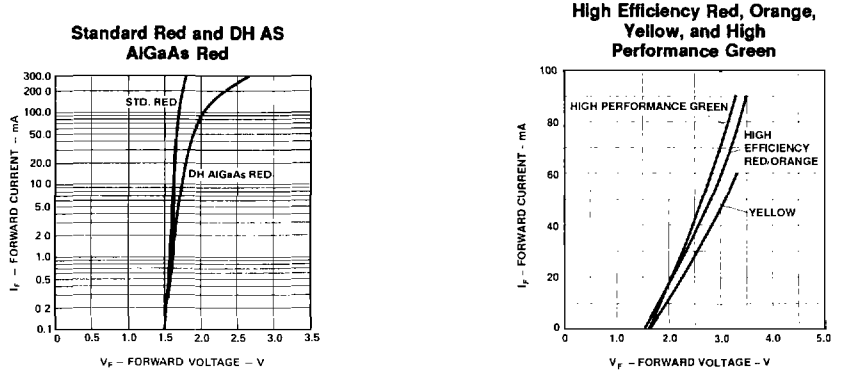


Figure 2. Forward Current vs. Forward Voltage (Non-Resistor Lamp).

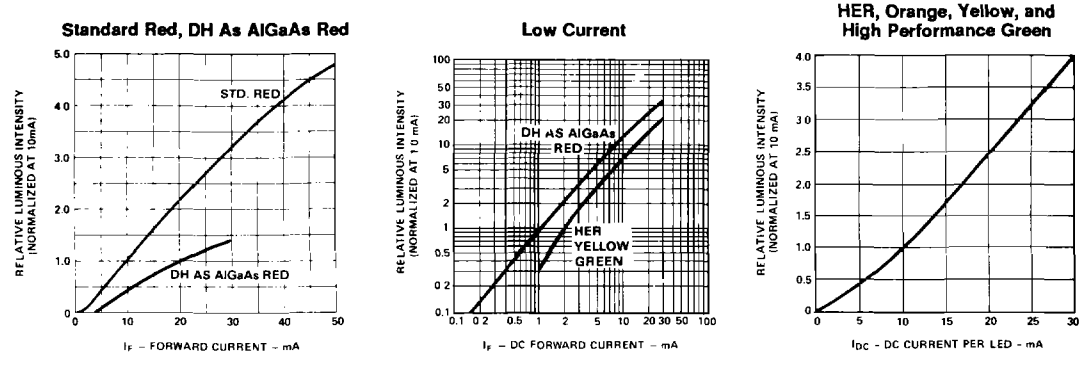


Figure 3. Relative Luminous Intensity vs. Forward Current (Non-Resistor Lamp).

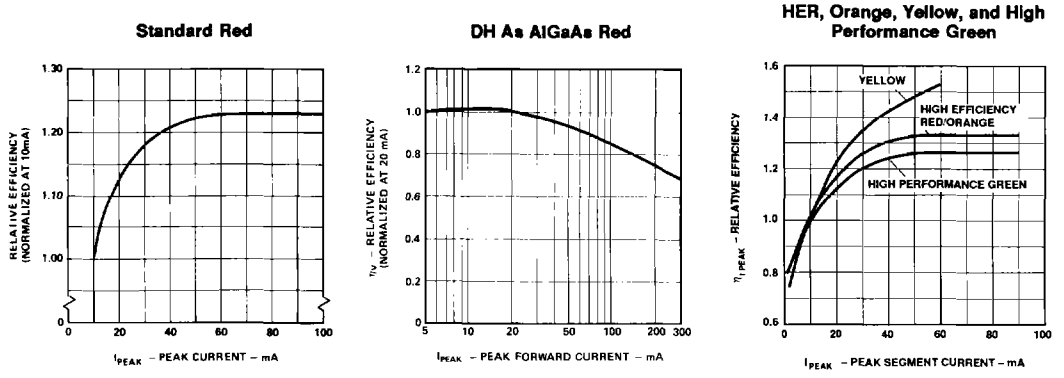
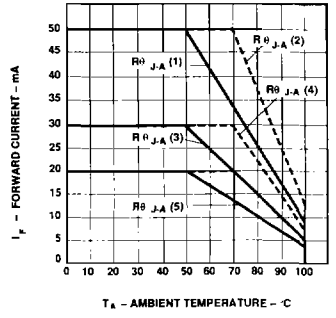


Figure 4. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current (Non-Resistor Lamps).



$R\theta_{J-A}$ (X)	STD RED	AlGaAs RED	HI-EFF RED	ORANGE	YELLOW	GREEN	UNITS
1	600						°C/W LED JUNCTION TO AMBIENT
2	400						
3		689	444	444	470	444	
4		559	296	296		296	
5					705		

Figure 5. Maximum Forward dc Current vs. Ambient Temperature. Derating Based on T_J MAX = 110°C (Non-Resistor Lamps).

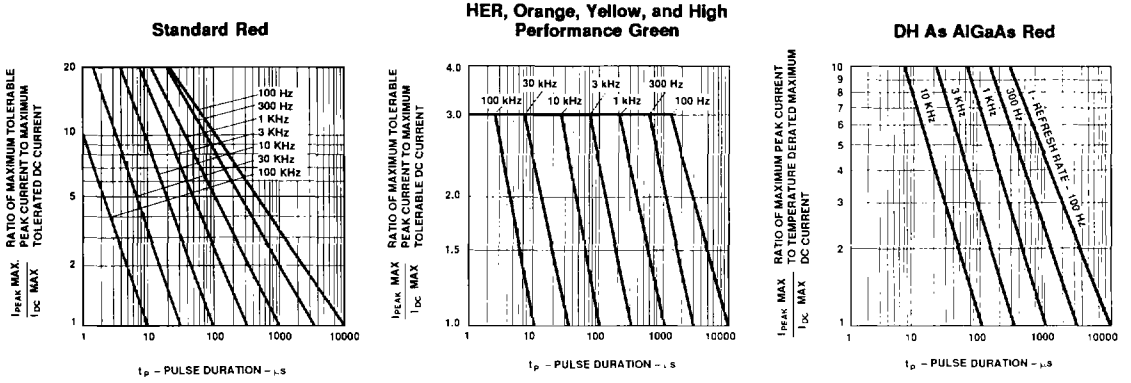


Figure 6. Maximum Tolerable Peak Current vs. Pulse Duration. (I_{DC} MAX as per MAX Ratings) (Non-Resistor Lamps).

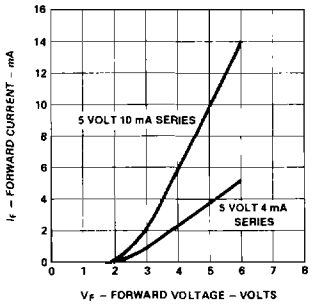


Figure 7. Resistor Lamp Forward Current vs. Forward Voltage.

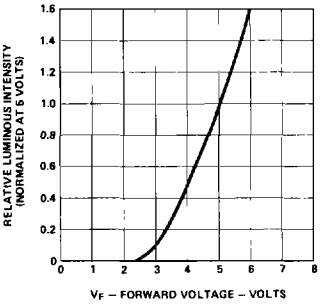


Figure 8. Resistor Lamp Luminous Intensity vs. Forward Voltage.

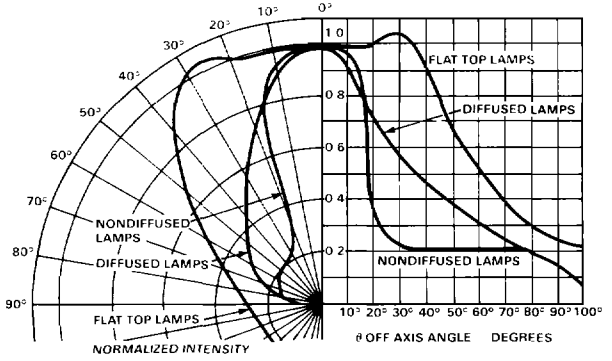


Figure 9. Relative Intensity vs. Angular Displacement.