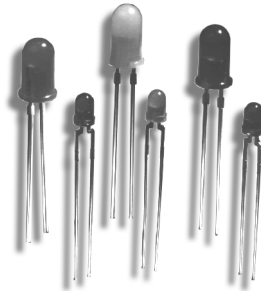


Agilent T-1³/₄ (5 mm), T-1 (3 mm), 5 Volt, 12 Volt, Integrated Resistor LED Lamps Data Sheet



**HLMP-1600, HLMP-1601, HLMP-1620, HLMP-1621
HLMP-1640, HLMP-1641, HLMP-3600, HLMP-3601
HLMP-3650, HLMP-3651, HLMP-3680, HLMP-3681**

Description

The 5 volt and 12 volt series lamps contain an integral current limiting resistor in series with the LED. This allows the lamp to be driven from a 5 volt/12 volt

source without an external current limiter. The red LEDs are made from GaAsP on a GaAs substrate. The High Efficiency Red and Yellow devices use GaAsP on a GaP substrate.

Features

- **Integral current limiting resistor**
- **TTL compatible**
Requires no external current Limiter with 5 volt/12 volt supply
- **Cost effective**
Saves space and resistor cost
- **Wide viewing angle**
- **Available in all colors**
Red, High Efficiency Red, Yellow, and High Performance Green in T-1 and T-1³/₄ packages

The green devices use GaP on a GaP substrate. The diffused lamps provide a wide off-axis viewing angle.

Package Dimensions

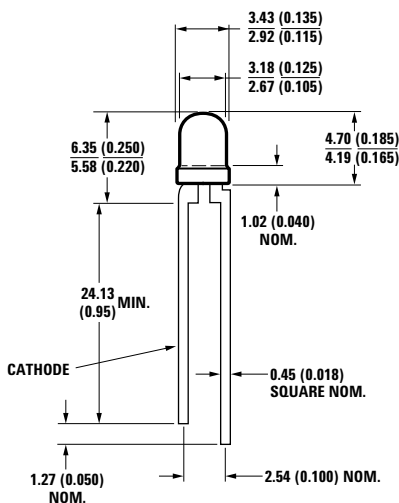


Figure A. T-1 package.

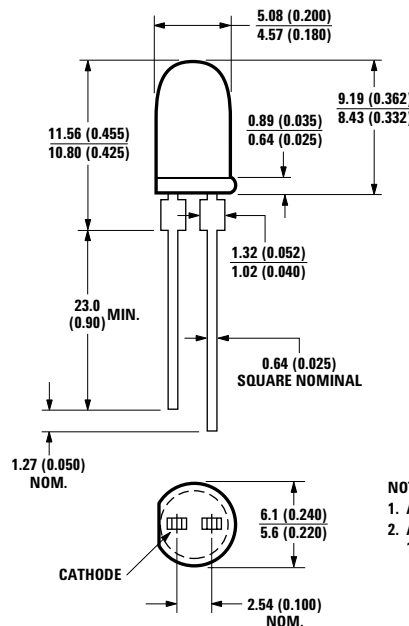


Figure B. T-1³/₄ package.

The T-1³/₄ lamps are provided with sturdy leads suitable for wire wrap applications. The T-1³/₄ lamps may be front panel mounted by using the HLMP-0103 clip and ring.

- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES).
 2. AN EPOXY MENISCUS MAY EXTEND ABOUT 1 mm (0.040") DOWN THE LEADS.



Selection Guide

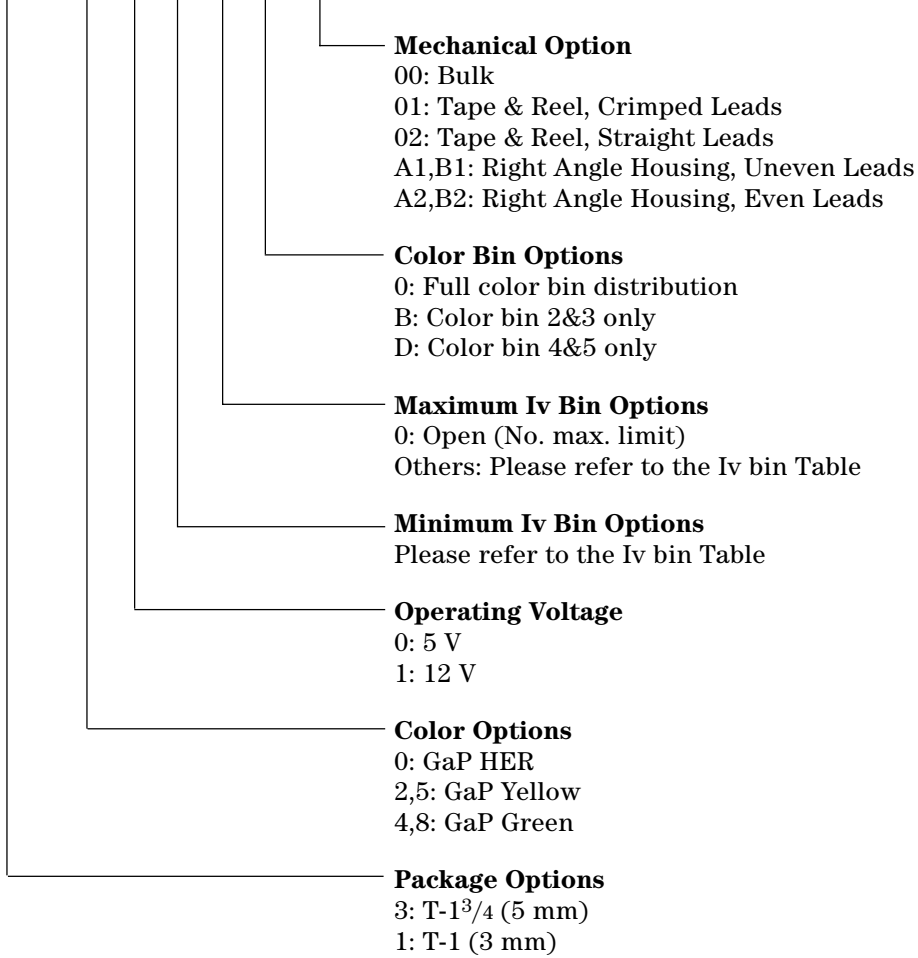
Color	Package Description	Package Outline	$2\theta_{1/2}^{[1]}$	Operating Voltage (V)	Part Number HLMP-	Luminous Intensity Iv (mcd)	
						Min.	Max.
Red	T-1 Tinted Diffused	A	60	5	1600	2.1	-
					1600-D00xx	2.1	-
			60	12	1601	2.1	-
					1601-D00xx	2.1	-
	T-1 3/4 Tinted Diffused	B	60	5	1601-GH0xx	8.6	27.6
					3600	2.1	-
			60	12	3600-D00xx	2.1	-
					3601	2.1	-
Yellow	T-1 Tinted Diffused	A	60	5	3601-D00xx	2.1	-
					1620	2.2	-
			60	12	1620-C00xx	2.2	-
					1620-C0Bxx	2.2	-
	T-1 3/4 Tinted Diffused	B	60	5	1620-EFBxx	3.4	10.8
					1621	2.2	-
			60	12	1621-C00xx	2.2	-
					3650	2.2	-
T-1 3/4 Tinted Diffused	B	60	5	3650-C00xx	2.2	-	
				3651	2.2	-	
		60	12	3651-C00xx	2.2	-	
				3651	2.2	-	
Green	T-1 Tinted Diffused	A	60	5	1640	1.6	-
					1640-B00xx	1.6	-
			60	12	1640-B0Dxx	1.6	-
					1640-DE0xx	4.2	13.4
	T-1 3/4 Tinted Diffused	B	60	5	1641	1.6	-
					1641-B00xx	1.6	-
			60	12	3680	1.6	-
					3680-B00xx	1.6	-
60	12	3681	1.6	-			
		3681-B00xx	1.6	-			

Note:

1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is 1/2 the axial luminous intensity.

Part Numbering System

HLMX-X 6 X X X X X XX



Absolute Maximum Ratings at T_A = 25°C

	Red/HER/Yellow 5 Volt Lamps	Red/HER/Yellow 12 Volt Lamps	Green 5 Volt Lamps	Green 12 Volt Lamps
DC Forward Voltage (T _A = 25°C)	7.5 Volts ^[2]	15 Volts ^[3]	7.5 Volts ^[2]	15 Volts ^[3]
Reverse Voltage (I _R = 100 μA)	5 Volts	5 Volts	5 Volts	5 Volts
Operating Temperature Range	-40°C to 85°C	-40°C to 85°C	-20°C to 85°C	-20°C to 85°C
Storage Temperature Range	-55°C to 100°C	-55°C to 100°C	-55°C to 100°C	-55°C to 100°C
Wave Soldering Temperature [1.59 mm (0.063 in.) from Body]	250°C for 3 seconds			
Solder Dipping Temperature [1.59 mm (0.063 in.) from Body]	260°C for 5 seconds			

Notes:

- Derate from T_A = 50°C at 0.071 V/°C, see Figure 3.
- Derate from T_A = 50°C at 0.086 V/°C, see Figure 4.

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

Symbol	Description	High Efficiency Red			Yellow			Green			Unit	Test Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
λ_p	Peak Wavelength		635			583			565		nm	
λ_d	Dominant Wavelength		626			585			569		nm	Note 4
$\Delta\lambda^{1/2}$	Spectral Line Halfwidth		40			36			28		nm	
$R\theta_{J-PIN}$	Thermal Resistance		290			290			290		$^\circ\text{C}/\text{W}$	Junction to Cathode Lead (Note 6)
$R\theta_{J-PIN}$	Thermal Resistance		210			210			210		$^\circ\text{C}/\text{W}$	Junction to Cathode Lead (Note 7)
I_F	Forward Current 12 V Devices		13	20		13	20		13	20	mA	$V_F = 12\text{ V}$
I_F	Forward Current 5 V Devices		10	15		10	15		10	15	mA	$V_F = 5\text{ V}$
η_V	Luminous Efficacy		145			500			595		lumen/Watt	Note 2
V_R	Reverse Breakdown Voltage	5.0			5.0			5.0			V	$I_R = 100\ \mu\text{A}$

Notes:

- The dominant wavelength, λ_d , is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
- Radiant intensity, I_e , in watts/steradian, may be found 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.
- For Figure A package type.
- For Figure B package type.

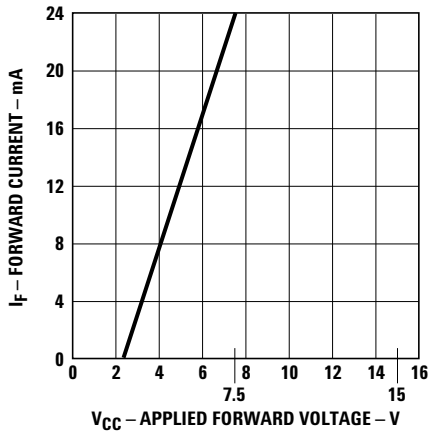


Figure 1. Forward current vs. applied forward voltage. 5 volt devices.

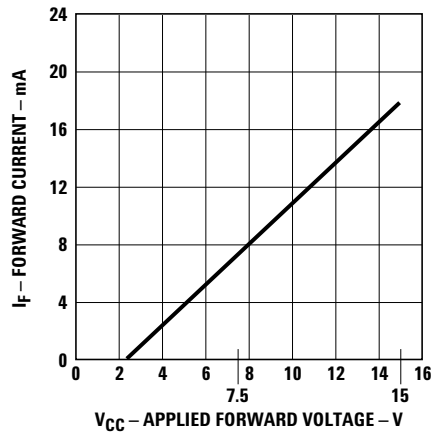


Figure 2. Forward current vs. applied forward voltage. 12 volt devices.

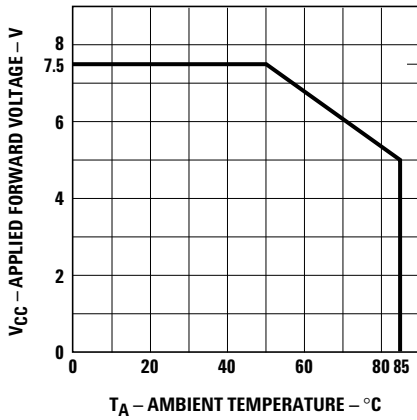


Figure 3. Maximum allowed applied forward voltage vs. ambient temperature $R\theta_{JA} = 175^\circ\text{C}/\text{W}$. 5 volt devices.

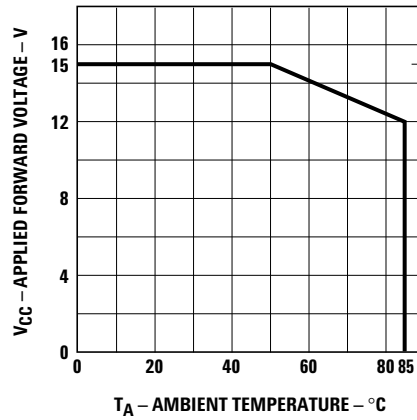


Figure 4. Maximum allowed applied forward voltage vs. ambient temperature $R\theta_{JA} = 175^\circ\text{C}/\text{W}$. 12 volt devices.

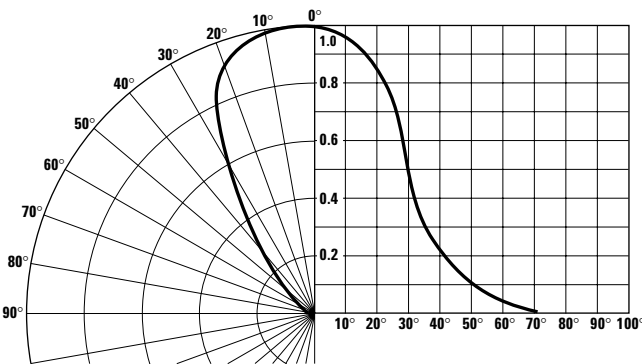


Figure 5. Relative luminous intensity vs. angular displacement for T-1 package.

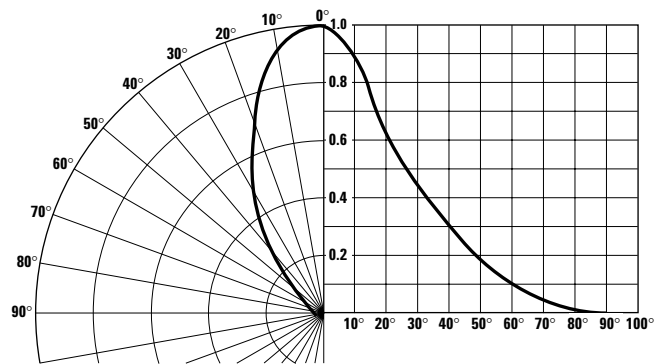


Figure 6. Relative luminous intensity vs. angular displacement for T-13/4 package.

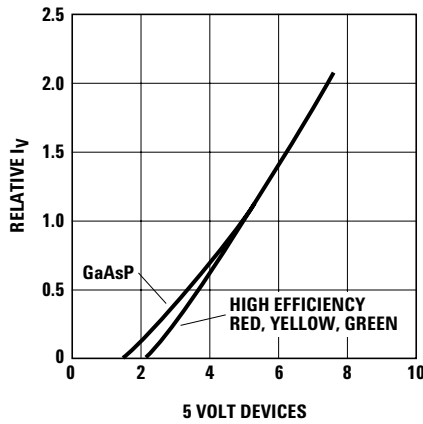


Figure 7. Relative luminous intensity vs. applied forward voltage. 5 volt devices.

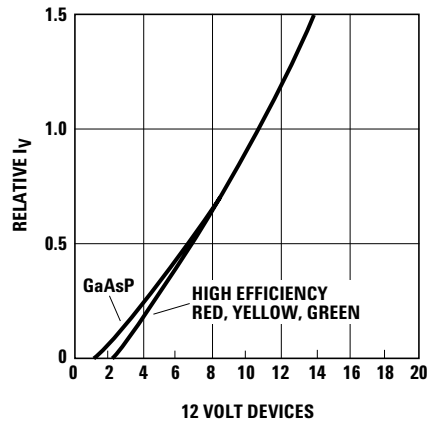


Figure 8. Relative luminous intensity vs. applied forward voltage. 12 volt devices.

Intensity Bin Limit

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Red	D	2.4	3.8
	E	3.8	6.1
	F	6.1	9.7
	G	9.7	15.5
	H	15.5	24.8
	I	24.8	39.6
	J	39.6	63.4
	K	63.4	101.5
	L	101.5	162.4
	M	162.4	234.6
	N	234.6	340.0
	O	340.0	540.0
	P	540.0	850.0
	Q	850.0	1200.0
	R	1200.0	1700.0
	S	1700.0	2400.0
	T	2400.0	3400.0
	U	3400.0	4900.0
	V	4900.0	7100.0
	W	7100.0	10200.0
X	10200.0	14800.0	
Y	14800.0	21400.0	
Z	21400.0	30900.0	

(Cont'd)

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Yellow	C	2.5	4.0
	D	4.0	6.5
	E	6.5	10.3
	F	10.3	16.6
	G	16.6	26.5
	H	26.5	42.3
	I	42.3	67.7
	J	67.7	108.2
	K	108.2	173.2
	L	173.2	250.0
	M	250.0	360.0
	N	360.0	510.0
	O	510.0	800.0
	P	800.0	1250.0
	Q	1250.0	1800.0
	R	1800.0	2900.0
	S	2900.0	4700.0
	T	4700.0	7200.0
	U	7200.0	11700.0
V	11700.0	18000.0	
W	18000.0	27000.0	

(Cont'd)

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Green	B	1.8	2.9
	C	2.9	4.7
	D	4.7	7.6
	E	7.6	12.0
	F	12.0	19.1
	G	19.1	30.7
	H	30.7	49.1
	I	49.1	78.5
	J	78.5	125.7
	K	125.7	201.1
	L	201.1	289.0
	M	289.0	417.0
	N	417.0	680.0
	O	680.0	1100.0
	P	1100.0	1800.0
	Q	1800.0	2700.0
	R	2700.0	4300.0
	S	4300.0	6800.0
	T	6800.0	10800.0
U	10800.0	16000.0	
V	16000.0	25000.0	
W	25000.0	40000.0	

Maximum tolerance for each bin limit is ±18%.

Color Categories

Color	Cat #	Lambda (nm)	
		Min.	Max.
Green	6	561.5	564.5
	5	564.5	567.5
	4	567.5	570.5
	3	570.5	573.5
	2	573.5	576.5
	1	582.0	584.5
Yellow	3	584.5	587.0
	2	587.0	589.5
	4	589.5	592.0
	5	592.0	593.0

Tolerance for each bin limit is ± 0.5 nm.

Mechanical Option Matrix

Mechanical Option Code	Definition
00	Bulk Packaging, minimum increment 500 pcs/bag
01	Tape & Reel, crimped leads, minimum increment 1300 pcs/bag
02	Tape & Reel, straight leads, minimum increment 1300 pcs/bag
A1	T-1, Right Angle Housing, uneven leads, minimum increment 500 pcs/bag
A2	T-1, Right Angle Housing, even leads, minimum increment 500 pcs/bag
B1	T-1 ³ / ₄ Angle Housing, uneven lead, minimum increment 500 pcs/bag
B2	T-1 ³ / ₄ Angle Housing, even leads, minimum increment 500 pcs/bag

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