BROADCOM®

Data Sheet

HLMP-Pxxx Series, HLMP-Qxxx Series, HLMP-6xxx Series, HLMP-70xx Series

Subminiature LED Lamps

Description

Flat-Top Package

The Broadcom® HLMP-Pxxx Series flat-top lamps use an untinted, nondiffused, 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 Broadcom 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.

Resistor Lamps

The Broadcom HLMP-6xxx Series 5V 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-in.) and 5.08-mm (0.200-in.) center spacing are available for through-hole mounting. For more information, refer to the Standard SMT and Through-Hole Lead Bend Options for Subminiature LED Lamps data sheet.

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
- TTL and LSTTL-compatible 5V resistor lamps
- Available in six colors
- Ideal for space-limited applications
- Axial leads
- Available with lead configurations for surface-mount and through-hole PCB mounting

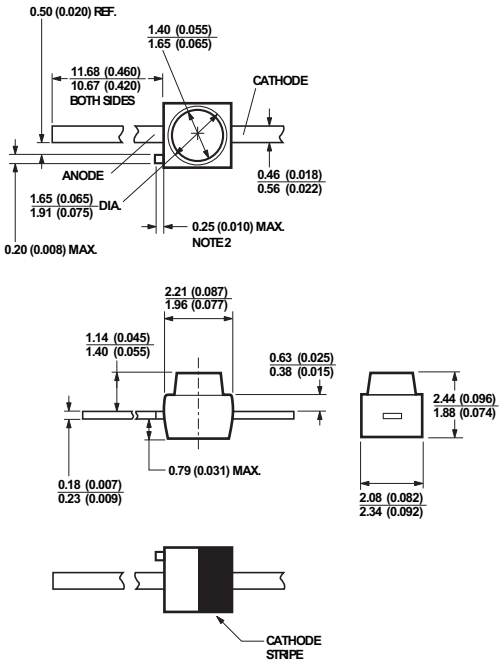
Device Selection Guide

Part Number: HLMP-xxxx

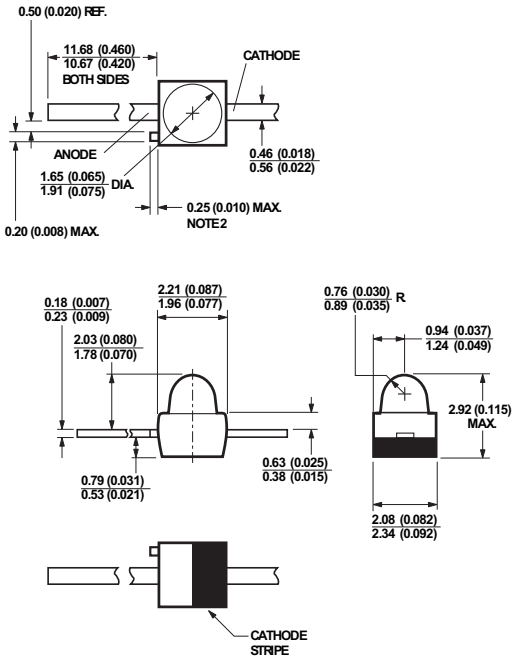
Standard Red	DH AS AlGaAs Red	High Efficiency Red	Orange	Yellow	High Perf. Green	Emerald Green	Device Description	Device Outline Drawing
P005	P105	P205	P405	P305	P505	P605	Untinted, Nondiffused, Flat Top	A
—	P102	P202	P402	P302	P502	—	Untinted, Diffused, Flat Top	A
6000	Q100	6300	Q400	6400	6500	Q600	Tinted, Diffused	B
—	Q105	6305	Q405	6405	6505	Q605	Untinted, Nondiffused, High Brightness	B
—	Q150	7000	—	7019	7040	—	Tinted, Diffused, Low Current	B
—	Q155	—	—	—	—	—	Nondiffused, Low Current	B
—	—	6600	—	—	6800	—	Tinted, Diffused, Resistor, 5V, 10 mA	B
—	—	6620	—	6720	6820	—	Diffused, Resistor, 5V, 4 mA	B

Package Dimensions

A. Flat Top Lamps

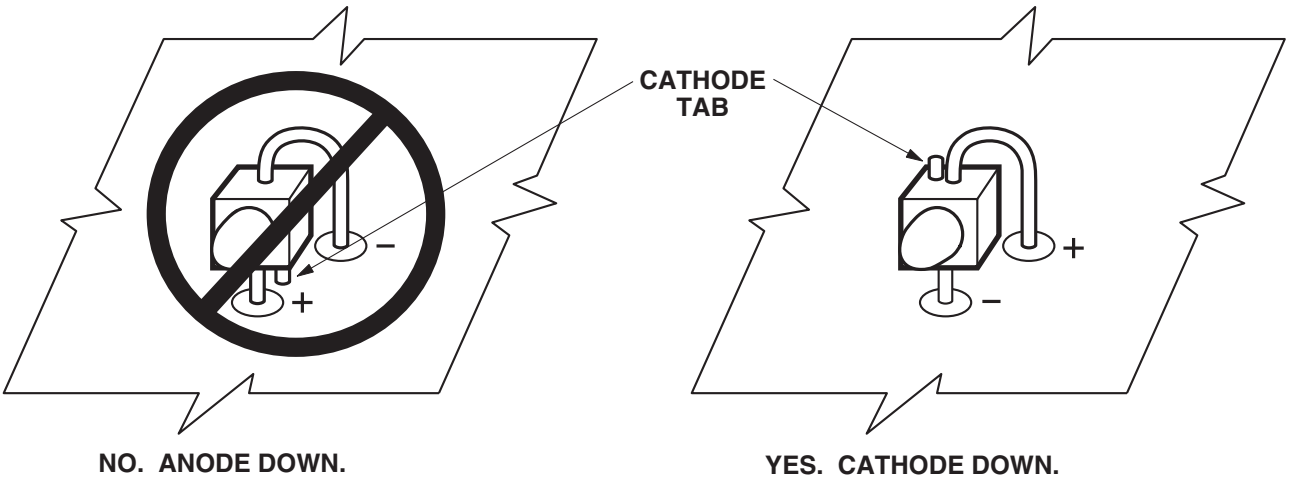


B. Diffused and Nondiffused



Notes:
All dimensions are in millimeters (inches).
Protruding support tab is connected to cathode lead.
Lead polarity for ALGaAs lamps is opposite to the lead polarity of subminiature lamps using other technologies.

Figure 1: Proper Right Angle Mounting to a PCB to Prevent Protruding Cathode Tab from Shorting to Anode Connection



Absolute Maximum Ratings (T_A = 25°C)

Parameter	Standard Red	DH AS AlGaAs Red	High Eff. Red	Orange	Yellow	High Perf. Green	Emerald Green	Unit
DC Forward Current[a]	50	30	30	30	20	30	30	mA
Peak Forward Current[b]	1000	300	90	90	60	90	90	mA
DC Forward Voltage (Resistor Lamps Only)	—	—	6	—	6	6	6	V
Reverse Voltage (I_R = 100 µA)	5	5	5	5	5	5	5	V
Transient Forward Current[c] (10-µs Pulse)	2000	500	500	500	500	500	500	mA
Operating Temperature Range								°C
Nonresistor Lamps	–55 to +100	–40 to +100	–55 to +100	–55 to +100	–55 to +100	–40 to +100	–20 to +100	
Resistor Lamps	–40 to +85	–40 to +85	–40 to +85	–40 to +85	–40 to +85	–20 to +85	–20 to +85	
Storage Temperature Range	–55 to +100							
For Through Hole Devices: Wave Soldering Temperature [1.6 mm (0.063 in.) from body]	260°C for 5 seconds							
For Surface Mount Devices: Reflow Soldering Temperature	260°C for 20 seconds							

a. See Figure 6 for current derating vs. ambient temperature. Derating is not applicable to resistor lamps.

b. Refer to Figure 7 showing Maximum Tolerable Peak Current vs. Pulse Duration to establish pulsed operating conditions.

c. The transient peak current is the maximum nonrecurring 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.	Unit	Test Conditions
6000-E00xx	Luminous Intensity	I_V	0.63	1.2	—	mcd	I_F = 10 mA
6000-G00xx			1.60	3.2	—		
P005-F00xx			1.0	2.5	—		
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
6000	Included Angle Between Half Intensity Points	$2\theta_{1/2}$	—	90	—	deg.	
P005			—	125	—		
All	Peak Wavelength	λ_{PEAK}	—	655	—	nm	
	Dominant Wavelength	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	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	65	—	lm/W	

DH AS AlGaAs Red

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
P102-F00xx	Luminous Intensity	I_V	1.0	20.0	—	mcd	I_F = 20 mA
P105-L00xx			10.0	30.0	—		
P105-NP000			25	—	80		
Q100-M00xx			16	45	—		
Q100-N00xx			25.0	45.0	—		
Q100-PQ000			40	—	125		
Q105-P00xx			40	200	—		
Q105-ST000			160	—	500		I_F = 1 mA
Q150-F00xx			1.0	1.8	—		
Q155-F00xx			1.0	4.0	—		
Q100	Forward Voltage	V_F	—	1.8	2.2	V	I_F = 20 mA
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	$2\theta_{1/2}$	—	125	—	deg.	
Q100/Q150			—	90	—		
Q105/Q155			—	28	—		
All	Peak Wavelength	λ_{PEAK}	—	645	—	nm	Measured at Peak
	Dominant Wavelength	λ_d	—	637	—	nm	
	Spectral Line Half Width	$\Delta\lambda_{1/2}$	—	20	—	nm	
	Speed of Response	τ_s	—	30	—	ns	Exponential Time Constant; $e^{-t/ts}$
	Capacitance	C	—	30	—	pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	80	—	lm/W	

High Efficiency Red

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
P202-F00xx	Luminous Intensity	I_V	1.0	5.0	—	mcd	
P205-F00xx			1.0	8.0	—		I_F = 10 mA
6300-F00xx			1.0	10.0	—		
6300-KL000			6.3	—	20.0		
6305-L00xx			10.0	40.0	—		
7000-D00xx			0.4	1.0	—		I_F = 2 mA
6600-G00xx			1.6	5.0	—		V_F = 5.0V
6620-F00xx			1.0	2.0	—		
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 = 5.0V
5620			—	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	$2\theta_{1/2}$	—	125	—	deg.	
6305			—	28	—		
All Diffused			—	90	—		
All	Peak Wavelength	λ_{PEAK}	—	635	—	nm	Measured at Peak
	Dominant Wavelength	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	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	145	—	lm/W	

Orange

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
P402-F00xx	Luminous Intensity	I_V	1.0	4.0	—	mcd	I_F = 10 mA
P405-F00xx			1.0	6	—		
P405-JK000			4.0	—	12.5		
Q400-F00xx			1.0	8	—		
Q405-H00xx			2.5	14	—		
All	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
P40x	Included Angle Between Half Intensity Points	$2\theta_{1/2}$	—	125	—	deg.	
Q40x			—	90	—		
All	Peak Wavelength	λ_{PEAK}	—	600	—	nm	
	Dominant Wavelength	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	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	380	—	lm/W	

Yellow

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
P302-F00xx	Luminous Intensity	I_V	1.0	3.0	—	mcd	I_F = 10 mA
P305-F00xx			1.0	4.0	—		
6400-F00xx			1.0	9.0	12.5		
6400-JK000			4.0	—	—		
6405-J00xx			3.6	20	—		
6405-MN0xx			16	—	50		
7019-D00xx			0.4	0.6	—		I_F = 2 mA
6720-F00xx			0.9	2.0	—		
All	Forward Voltage (Nonresistor Lamps)	V_F	—	2.0	2.4	V	I_F = 10 mA
6720	Forward Current (Resistor Lamps)	I_F	—	3.5	5.0	mA	V_F = 5V
All	Reverse Breakdown Voltage	V_R	5.0	50.0	—	V	
P305	Included Angle Between Half Intensity Points	2θ½	—	125	—	deg.	
6405			—	28	—		
All Diffused			—	90	—		
All	Peak Wavelength	λ_{PEAK}	—	583	—	nm	Measured at Peak
	Dominant Wavelength	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	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	500	—	lm/W	

High Performance Green

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
P502-F00xx	Luminous Intensity	I_V	1.0	3.0	—	mcd	
P505-G00xx			1.6	6.3	—		I_F = 10 mA
6500-F00xx			1.0	7.0	—		
6505-L00xx			10.0	40.0	—		
7040-D00xx			0.4	0.6	—		I_F = 2 mA
6800-G00xx			1.6	5.0	—		V_F = 5V
6820-F00xx			1.0	2.0	—		
All	Forward Voltage (Nonresistor Lamps)	V_F	—	2.1	2.7	V	I_F = 10 mA
6800	Forward Current (Resistor Lamps)	I_F	—	9.6	13.0	mA	V_F = 5V
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	$2\theta_{1/2}$	—	125	—	deg.	
6505			—	28	—		
All Diffused			—	90	—		
All	Peak Wavelength	λ_{PEAK}	—	565	—	nm	
	Dominant Wavelength	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	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	595	—	lm/W	

High Performance Green[1]

Device HLMP-	Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
P605-F00xx	Luminous Intensity	I_V	1.0	1.5	—	mcd	I_F = 10 mA
Q600-F00xx			1.0	1.5	—		
Q605-F00xx			1.0	7.5	—		
All	Forward Voltage	V_F	—	2.2	3.0	V	I_F = 10 mA
	Reverse Breakdown Voltage	V_R	5.0	—	—	V	I_R = 100 µA
P605	Included Angle Between Half Intensity Points	$2\theta_{1/2}$	—	125	—	deg.	
Q60x			—	90	—		
All	Peak Wavelength	λ_{PEAK}	—	558	—	nm	
	Dominant Wavelength	λ_d	—	560	—	nm	Measured at Peak
	Spectral Line Half Width	$\Delta\lambda_{1/2}$	—	24	—	nm	
	Speed of Response	τ_s	—	3100	—	ns	
	Capacitance	C	—	35	—	pF	V_F = 0; f = 1 MHz
	Thermal Resistance	$R\theta_{J\text{-}PIN}$	—	170	—	°C/W	Junction-to-Cathode Lead
	Luminous Efficacy	η_v	—	656	—	lm/W	

1. For information comparing standard green and emerald green light output degradation, refer to the *Luminous Intensity Degradation Data for Emerald Green LEDs (560 nm) vs. Degradation Data for Standard Green LEDs (569 nm) Application Note*.

Figure 2: Relative Intensity vs. Wavelength

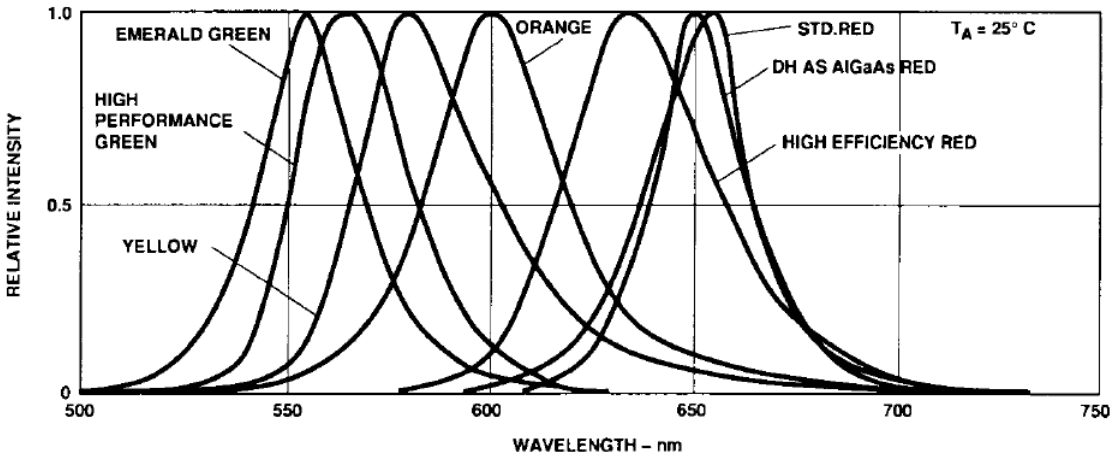
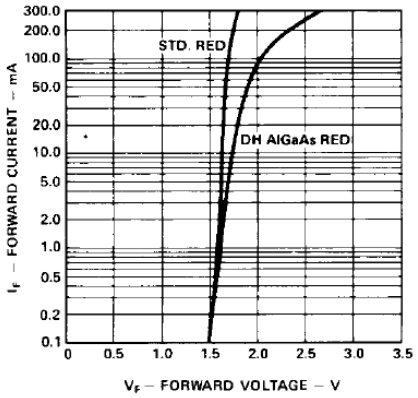


Figure 3: Forward Current vs. Forward Voltage (Nonresistor Lamp)

Standard Red and DH AS AlGaAs Red



High Efficiency Red, Orange, Yellow, High Performance Green, and Emerald Green

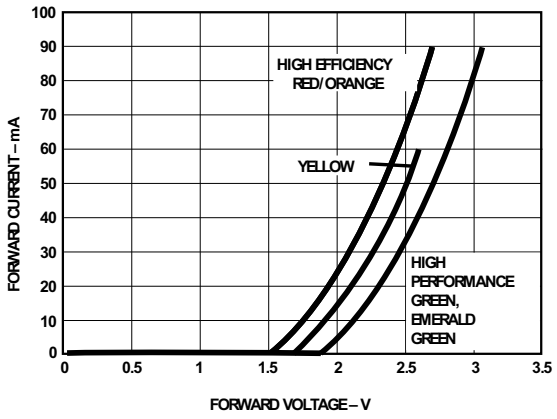
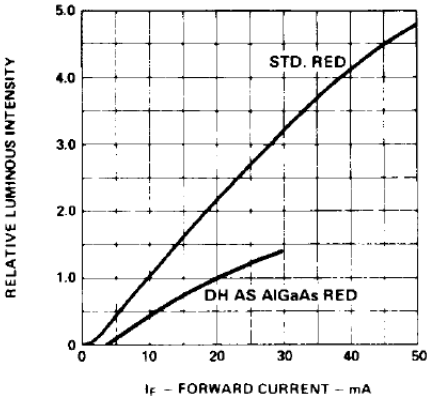
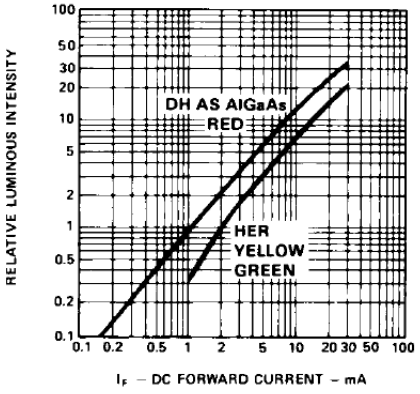


Figure 4: Relative Luminous Intensity vs. Forward Current (Nonresistor Lamp)

Standard Red, DH As AlGaAs Red



Low Current



HER, Orange, Yellow, and High Performance Green, and Emerald Green

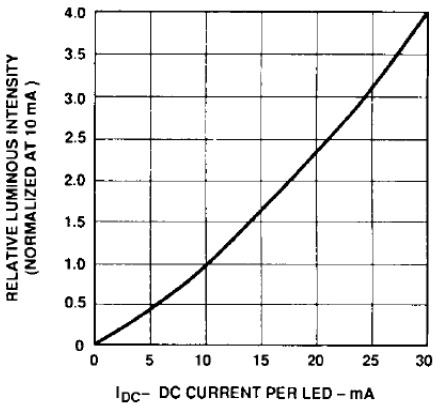
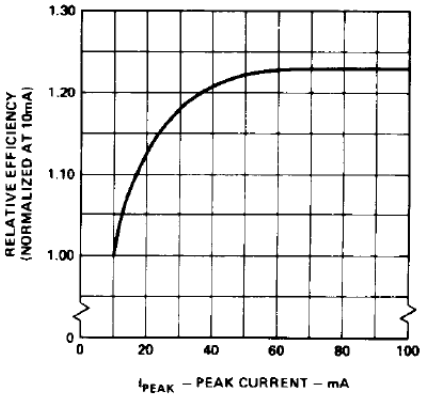
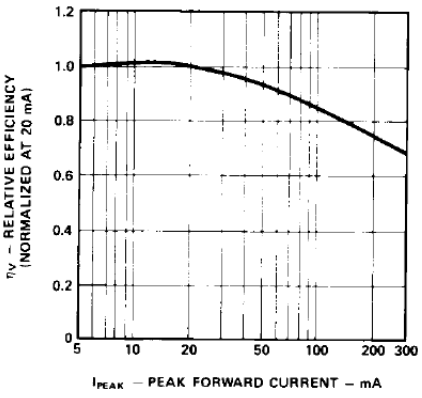


Figure 5: Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current (Nonresistor Lamps)

Standard Red



DH As AlGaAs Red



HER, Orange, Yellow, and High Performance Green, and Emerald Green

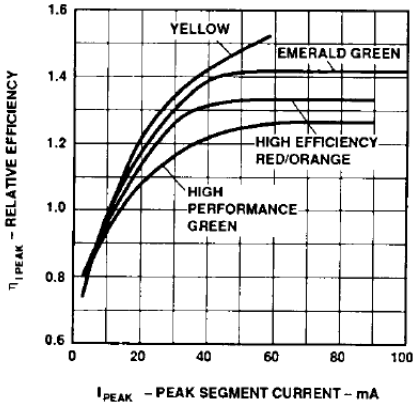
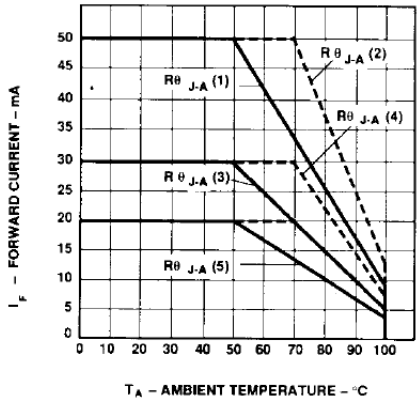


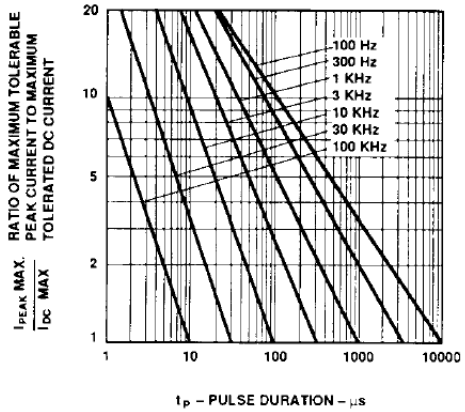
Figure 6: Maximum Forward DC Current vs. Ambient Temperature (Derating Based on TJ Max. = 110°C [Nonresistor Lamps])



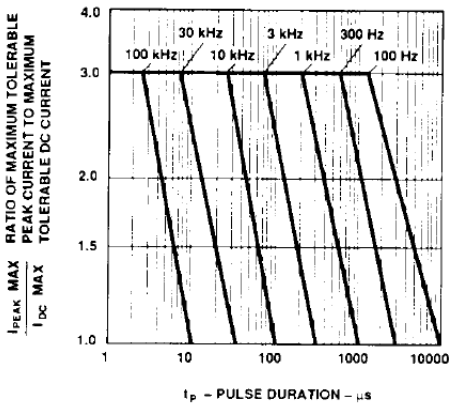
$R\theta_{J-A}$ (X)	STD RED	AlGaAs RED	HI-EFF RED	ORANGE	YELLOW	GREEN	UNITS
1	600						°C/W LED JUNCTION TO AMBIENT
2	400						
3		689	444	444	470	444	
4		559	296	296		296	
5					705		

Figure 7: Maximum Tolerable Peak Current vs. Pulse Duration (I_{DC} Max. as per Max. Ratings) (Nonresistor Lamps)

Standard Red



HER, Orange, Yellow, and High Performance Green



DH As AlGaAs Red

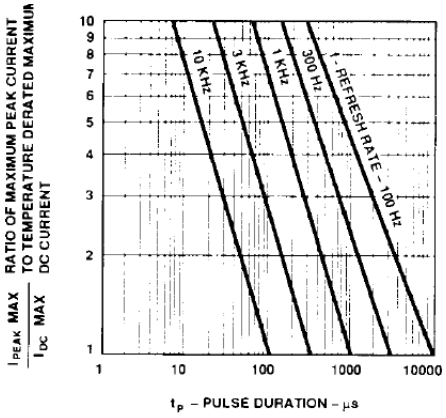


Figure 8: Resistor Lamp Forward Current vs. Forward Voltage

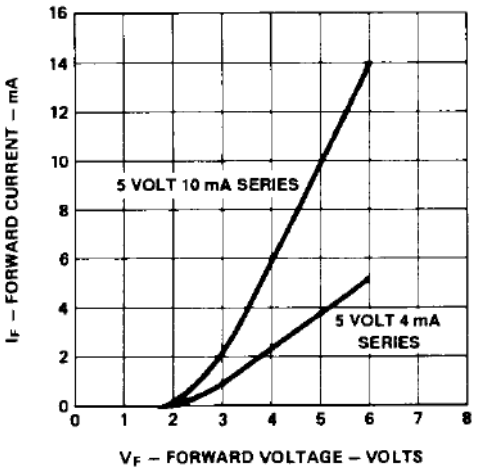


Figure 9: Resistor Lamp Luminous Intensity vs. Forward Voltage

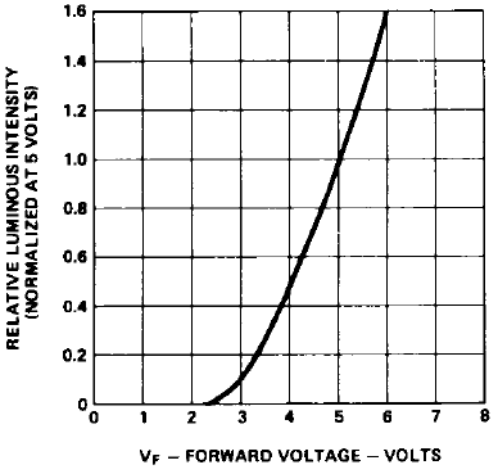
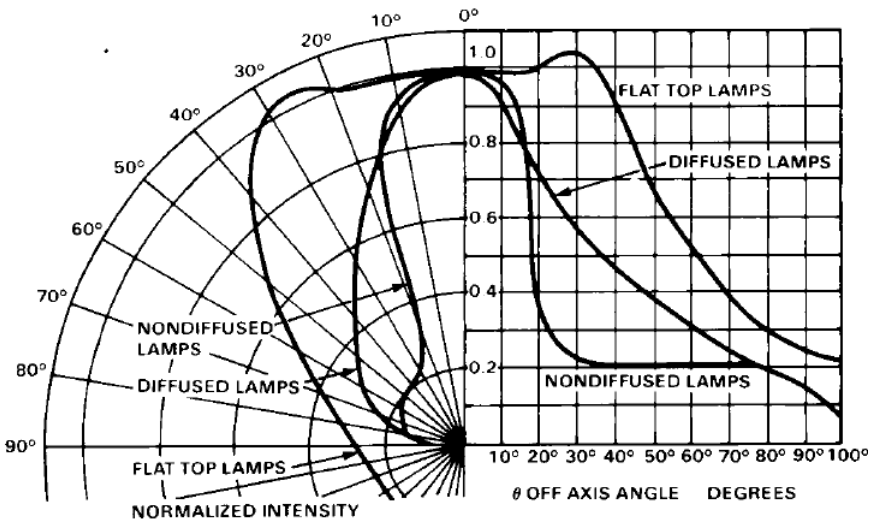


Figure 10: Relative Intensity vs. Angular Displacement



Part Numbering System

H	L	M	x	—	X	X	X	X	—	X_1	X_2	X_3	X_4	X_5

Number	Description
HLMx-XXXX	4 x 4 Product Part Number
X_1	Minimum I_V Bin Options
X_2	Maximum I_V Bin Options
X_3	Color Bin Selection
X_4, X_5	Packaging Option

Intensity Bin Limits

Bin	Min.	Max.
A	0.10	0.20
B	0.16	0.32
C	0.25	0.50
D	0.40	0.80
E	0.63	1.25
F	1.00	2.00
G	1.60	3.20
H	2.50	5.00
J	4.00	8.00
K	6.30	12.50
L	10.00	20.00
M	16.00	32.00
N	25.00	50.00
P	40.00	80.00
Q	63.00	125.00
R	100.00	200.00
S	160.00	320.00
T	250.00	500.00
U	400.00	800.00
V	630.00	1250.00
W	1000.00	2000.00
X	1600.00	3200.00
Y	2500.00	5000.00

Color Bin Limits

Package	Bin	Min.	Max.
Emerald Green	0	Full Distribution	
	9	552	556
	8	555	559
	7	558	562
	6	561	565
Green	0	Full Distribution	
	6	561	565
	5	564	568
	4	567	571
	3	570	574
	2	573	577
Yellow	0	Full Distribution	
	1	581.5	585.0
	2	584.0	587.5
	3	586.5	590.0
	4	589.0	592.5
	5	591.5	593.5
	6	591.5	595.0
	7	594.0	597.5
Orange	0	Full Distribution	
	1	596.5	600.0
	2	599.0	602.5
	3	601.5	604.0
	4	603.8	608.2
	5	606.8	611.2
	6	609.8	614.2
	7	612.8	617.2
	8	615.8	620.2

Mechanical Option

00	Straight Leads, Bulk Packaging, Quantity of 500 Parts
10	Right Angle Housing, Bulk Packaging, Quantity of 500 Parts
11	Gull Wing Leads, 12-mm Tape on 7-in. Diameter Reel, 1500 Parts per Reel
12	Gull Wing Lead, Bulk Packaging, Quantity of 500 Parts
14	Gull Wing Leads, 12-mm Tape on 13-in. Diameter Reel, 6000 Parts per Reel
21	Yoke Leads, 12-mm Tape on 7-in. Diameter Reel, 1500 Parts per Reel
22	Yoke Leads, Bulk Packaging, Quantity of 500 Parts
24	Yoke Leads, 12-mm Tape on 13-in. Diameter Reel, 6000 Parts per Reel
31	Z-Bend Leads, 12-mm Tape on 7-in. Diameter Reel, 1500 Parts per Reel
32	Z-Bend Leads, Bulk Packaging, Quantity of 500 Parts
34	Z-Bend Leads, 12-mm Tape on 13-in. Diameter Reel, 6000 Parts per Reel
1L	2.54-mm (0.100-in.) Center Lead Spacing, Long Leads; 10.4 mm (0.410 in.)
1S	2.54-mm (0.100-in.) Center Lead Spacing, Short Leads; 3.7 mm (0.145 in.)
2L	5.08-mm (0.200-in.) Center Lead Spacing, Long Leads; 10.4 mm (0.410 in.)
2S	5.08-mm (0.200-in.) Center Lead Spacing, Short Leads; 3.7 mm (0.145 in.)

NOTE: All categories are established for classification of products. Products might not be available in all categories. Contact your Broadcom representative for further clarification/information.

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