HEWLETT PACKARD

JAN Qualified Ultra-Bright Hermetic Solid State Lamps*

Technical Data

1N6609
JAN1N6609
JANTX1N6609
1N6610
JAN1N6610
JANTX1N6610
1N6611
JAN1N6611
JANTX1N6611

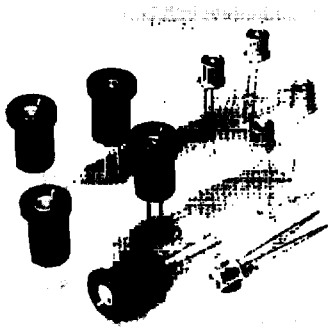
Features

- **Military Qualified**
- **Listed on MIL-S-19500 QPL**
- **Sunlight Viewable with Proper Contrast Enhancement Filter**
- **Hermetically Sealed**
- **Choice of Three Colors**
  High Efficiency Red
  Yellow
  High Performance Green
- **Low Power Operation**
- **IC Compatible**
- **Long Life/Reliable/Rugged**
- **Panel Mount Configuration**

Description

The 1N6609, 1N6610, and 1N6611 are hermetically sealed solid state lamps in a TO-18 package with a clear glass lens. These hermetic lamps provide improved brightness over conventional hermetic LED lamps, excellent on-off contrast, and high axial luminous intensity. These LED indicators are designed for use in applications requiring readability in bright sunlight. With a proper contrast enhancement filter, these LED indicators are readable in sunlight ambients, see Application Note 1015 *Contrast Enhancement Techniques for LED Displays*. The panel mount versions consist of an LED unit permanently mounted in an anodized aluminum sleeve.

The 1N6609 utilizes a high efficiency red GaAsP on GaP LED chip. The 1N6610 uses a yellow GaAsP on GaP LED chip. The 1N6611 uses a green GaP LED chip.



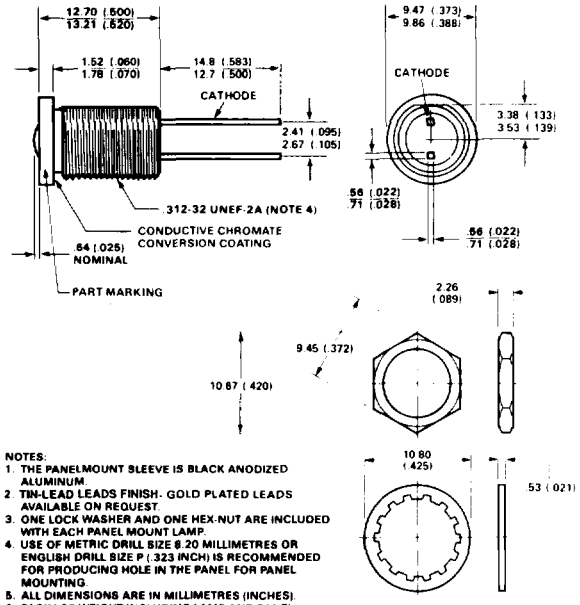
*Panel Mount versions of all of the above are available per the selection matrix on the next page.

Selection Guide

COLOR – PART NUMBER – LAMP AND PANEL MOUNT MATRIX				
Description	**Standard Product**	**With JAN Qualification[1]**	**JAN Plus TX Testing[2]**	**Controlling MIL-S-19500 Document[4]**
TABLE A. Hermetic TO-18 Part Number System				
High Efficiency Red	1N6609	JAN1N6609	JANTX1N6609	/519
Yellow	1N6610	JAN1N6610	JANTX1N6610	/520
Green	1N6611	JAN1N6611	JANTX1N6611	/521
TABLE B. Panel Mountable Part Number System[3]				
High Efficiency Red	HLMP-0364	HLMP-0365 (JANM19500/51903)	HLMP-0366 (JANTXM19500/51904)	/519
Yellow	HLMP-0464	HLMP-0465 (JANM19500/52003)	HLMP-0466 (JANTXM19500/52004)	/520
Green	HLMP-0564	HLMP-0565 (JANM19500/52103)	HLMP-0566 (JANTXM19500/52104)	/521

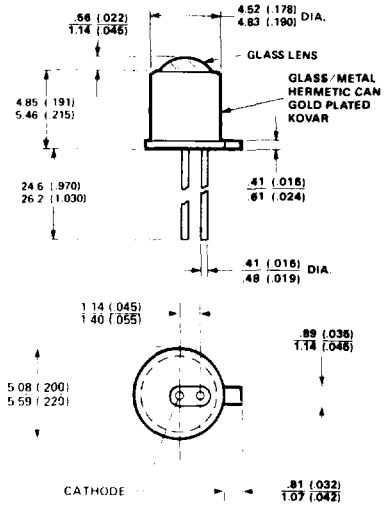
Notes:
1. Parts are marked with JAN part number.
2. Parts are marked with JANTX/JTX part number.
3. Panel mountable packaging incorporates the Table A TO-18 part into a panel mount enclosure.
4. JAN and JANTX parts only.

HLMP-0364, 0464, 0564



NOTES:
1. THE PANELMOUNT SLEEVE IS BLACK ANODIZED ALUMINUM.
2. TIN-LEAD LEADS FINISH. GOLD PLATED LEADS AVAILABLE ON REQUEST.
3. ONE LOCK WASHER AND ONE HEX-NUT ARE INCLUDED WITH EACH PANEL MOUNT LAMP.
4. USE OF METRIC DRILL SIZE 8.20 MILLIMETRES OR ENGLISH DRILL SIZE P (.323 INCH) IS RECOMMENDED FOR PRODUCING HOLE IN THE PANEL FOR PANEL MOUNTING.
5. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
6. PACKAGE WEIGHT INCLUDING LAMP AND PANEL MOUNT IS 1.2 - 1.8 GRAMS. NUT AND WASHER IS AN EXTRA .6 - 1.0 GRAM.

1N6609, 1N6610, 1N6611



OUTLINE TO-18

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES (INCHES).
2. GOLD-PLATED KOVAR LEADS.
3. PACKAGE WEIGHT OF LAMP ALONE IS .25 - .40 GRAMS.

Absolute Maximum Ratings at T_A = 25°C

Parameter	High Efficiency Red 1N6609 HLMP-0364	Yellow 1N6610 HLMP-0464	Green 1N6611 HLMP-0564	Units
Power Dissipation (derate linearly from 50°C at 1.6 mW/°C)	120	120	120	mW
DC Forward Current	35[1]	35[1]	35[1]	mA
Peak Forward Current	60 See Fig. 5	60 See Fig. 10	60 See Fig. 15	mA
Operating and Storage Temperature	-65°C to +100°C			
Lead Soldering Temperature [1.6 mm (0.063 in.) from body]	260°C for 7 seconds.			

Note:
1. Derate from 50°C at 0.5 mA/°C.

Electrical/Optical Characteristics at T_A = 25°C

Symbol	Description	1N6609 HLMP-0364			1N6610 HLMP-0464			1N6611 HLMP-0564			Units	Test Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
I_{V1}	Axial Luminous Intensity	20	50		20	50		20	50		mcd	I_F = 20 mA Figs. 3, 8, 13 θ = 0°
								At I_F = 25 mA				
$2\theta_{1/2}$	Included Angle Between Half Luminous Intensity Points[1]		18			18			18		deg.	Figures 6, 11, 16
λ_{PEAK}	Peak Wavelength	590	635	695	550	583	660	525	565	600	nm	Measurement at Peak
λ_d	Dominant Wavelength[2]		626			585			570		nm	
τ_s	Speed of Response		200			200			200		ns	
C	Capacitance		35	100		35	100		35	100	pF	V_F = 0; f = 1 MHz
$R\theta_{J\text{-}PIN}$	Thermal Resistance*[3]		425			425			425		°C/W	
$R\theta_{J\text{-}PIN}$	Thermal Resistance**[3]		550			550			550		°C/W	
V_F	Forward Voltage		2.0	3.0		2.0	3.0		2.1	3.0	V	I_F = 20 mA Figures 2, 7, 12,
								At I_F = 25 mA				
I_R	Reverse Current			1.0			1.0			1.0	µA	V_R = 3 V
BV_R	Reverse Breakdown Voltage	5.0			5.0			5.0			V	I_R = 100 µA
η_v	Luminous Efficacy[4]		140			455			600		lm/W	

Notes:

1. $\theta_{1/2}$ is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
2. The dominant wavelength, λ_d, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
3. Junction to Cathode Lead with 3.18 mm (0.125 inch) of leads exposed between base of flange and heat sink.
4. 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.

*Panel mount.
**TO-18.

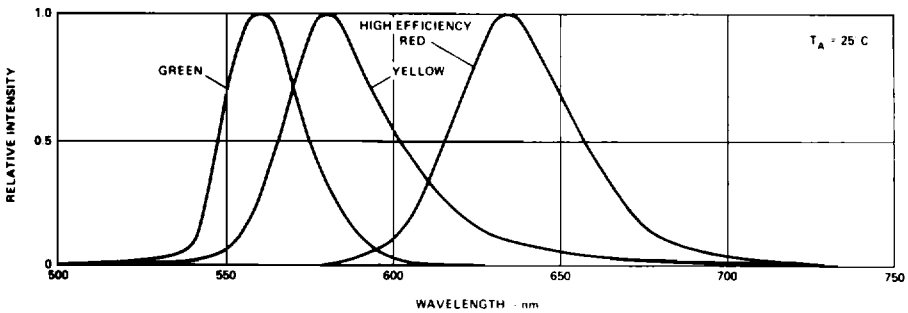


Figure 1. Relative Intensity vs. Wavelength.

Family of High Efficiency Red 1N6609/HLMP-0364

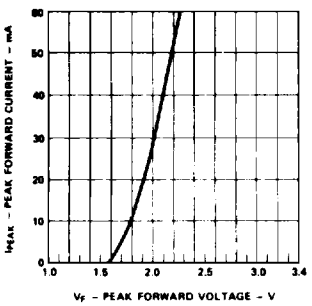


Figure 2. Forward Current vs. Forward Current.

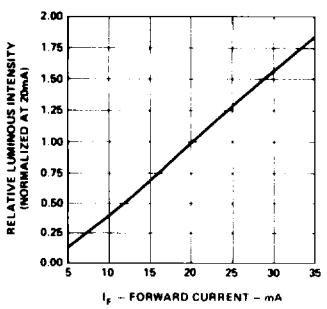


Figure 3. Relative Luminous Intensity vs. Forward Current.

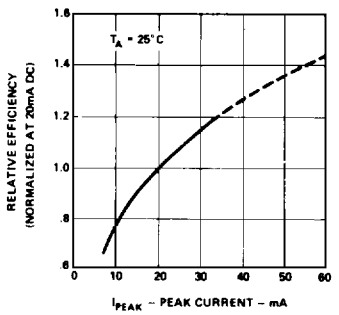


Figure 4. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

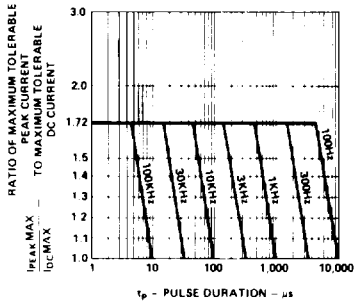


Figure 5. Maximum Tolerable Peak Current vs. Pulse Duration. (I_{DC} MAX as per MAX Ratings).

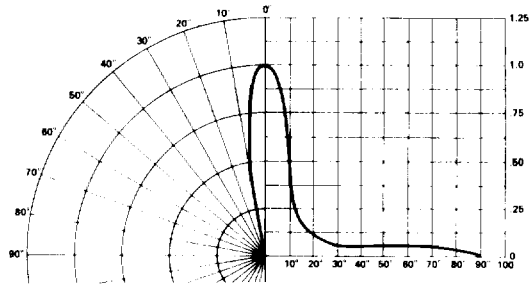


Figure 6. Relative Luminous Intensity vs. Angular Displacement.

Family of Yellow 1N6610/HLMP-0464

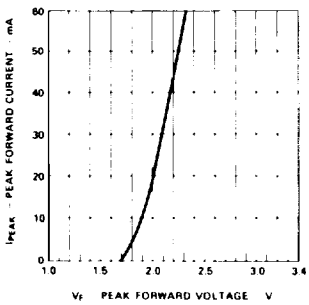


Figure 7. Forward Current vs. Forward Voltage.

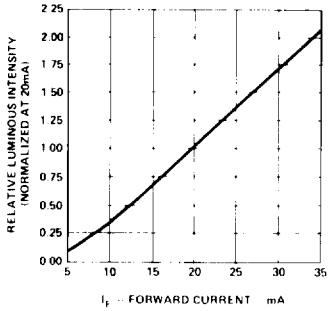


Figure 8. Relative Luminous Intensity vs. Forward Current.

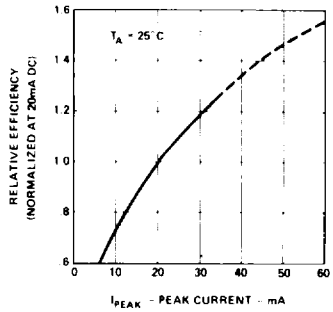


Figure 9. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

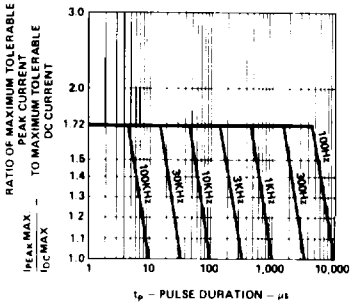


Figure 10. Maximum Tolerable Peak Current vs. Pulse Duration. (I_{DC} MAX as per MAX Ratings).

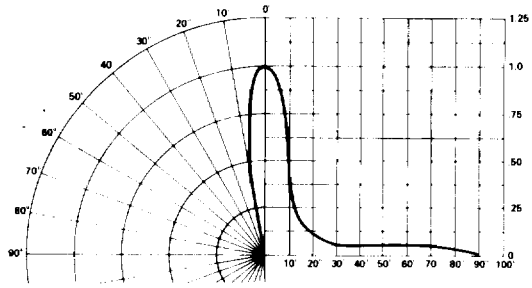


Figure 11. Relative Luminous Intensity vs. Angular Displacement.

Family of Green 1N6611/HLMP-0564

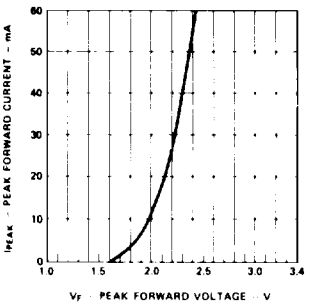


Figure 12. Forward Current vs. Forward Voltage.

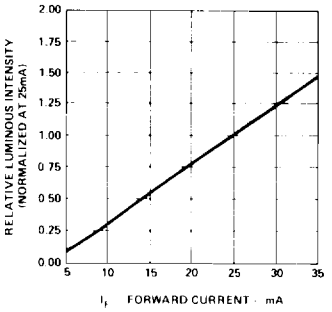


Figure 13. Relative Luminous Intensity vs. Forward Current.

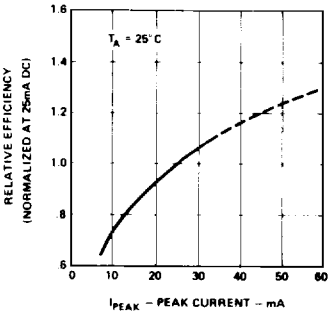


Figure 14. Relative Efficiency (Luminous Intensity per Unit Current) vs. Peak Current.

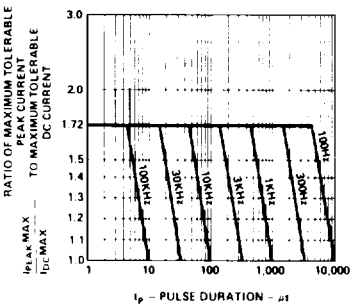


Figure 15. Maximum Tolerable Peak Current vs. Pulse Duration. (I_{DC} MAX as per MAX Ratings).

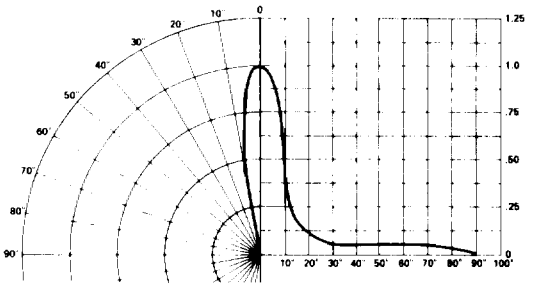


Figure 16. Relative Luminous Intensity vs. Angular Displacement.

JAN PART: Samples of each lot are subjected to Group A and B tests listed below. Every six months, samples from a single lot of each part type are subjected to Group C testing. All tests are to the conditions and limits specified by the appropriate MIL-S-19500 slash sheet specification.

JANTX PART: These devices undergo 100% screening tests as listed below to the conditions and limits specified by the MIL-S-19500 slash sheet specification. The JANTX lot has also been subjected to Group A, B, and C sample tests as for the JAN PART above.

Table I. 100% Screening

Examination or Test	MIL-STD-750	
	Method	Conditions
1. High Temperature Life	1032	T_A = +100°C, Time = 24 hours
2. Temperature Cycling	1051	Condition A, T (high) = +100°C
3. Constant Acceleration	2006	20,000 g's. Y1 Axis
4. Fine Leak	1071	Condition H
5. Gross Leak	1071	Condition K, Test Temperature = +100°C
6. Electrical Test		I_V, V_F, and I_R, T_A = 25°C
7. Burn-In[1]	1015	I_F = 35 mA, T_A = 25°C, Time = 96 hours
8. Final Electrical Test		Same as Step 6
9. Deltas Determinations		ΔI_{V1} = -20%, V_F = ±50 mV
10. External Visual[1]	2071	

Note:
1. MIL-STD-883 Method applies.

Table II. Group A Inspection for TO-18 Lamps

Examination or Test	MIL-STD-750		LTPD	Sym.	Limits		Unit
	Method	Details			Min.	Max.	
Subgroup 1			5				
Visual and mechanical inspection	2071						
Subgroup 2			5				
Luminous intensity		I_F = 20 mA dc;[1] $\theta = 0°$		I_{V1}	20.0		mcd
Reverse current	4016	DC method; V_R = 3 V dc		I_R		1.0	µA dc
Forward current	4011	DC method; I_F = 20 mA		V_F		3.0	V dc
Subgroup 3			10				
High temperature:		T_A = 100°C					
Reverse current	4016	DC method; V_R = 3 V dc		I_R		1.0	µA dc
Forward voltage	4011	DC method; I_F = 20 mA[1]		V_F		3.0	V dc
Low Temperature:		T_A = -55°C					
Reverse current	4016	DC method; V_R = 3 V dc		I_R		1.0	µA dc
Forward voltage	4011	DC method; I_F = 20 mA[1]		V_F		3.0	V dc
Subgroup 4			5				
Capacitance	4001	V_R = 0; f = 1 MHz		C		100	pF
Subgroups 5, 6, and 7							
Not applicable							

Note:
1. I_F = 25 mA for 1N6611.

Table III. Group B Inspection

Examination or Test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min.	Max.	
Subgroup 1			15				
Solderability	2026						
Resistance to solvents	1022						
Subgroup 2			10				
Thermal shock (temperature cycle)	1051	Test condition A, T (high) = 100°C; 25 cycles					
Hermetic seal	1071	Test condition H					
Fine leak							
Gross Leak		Test condition C or K, leak indicator fluid/ device maintained at 100°C ±5°C					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	20.0		mcd
Subgroup 3			5				
Steady-state-operation life	1027	I_F = 35 mA dc, 340 hours, T_A = 25°C					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	18.0		mcd
Subgroup 4							
Decap internal design verification	2075	Test 1 device/0 failure					
Subgroup 5							
(Not applicable)							
Subgroup 6			7				
High temperature life (nonoperating)	1032	T_A = 100°C, 340 hours					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	18.0		mcd

Note:
1. I_F = 25 mA for 1N6611.

Table IV. Group C Inspection

Examination or Test	MIL-STD-750 Method	MIL-STD-750 Details	LTPD	Symbol	Limits Min.	Limits Max.	Unit
Subgroup 1			15				
Physical dimensions	2066						
Subgroup 2			10				
Thermal shock (glass strain)	1056	Test condition A					
Terminal strength	2036	Test condition E					
Hermetic seal	1071						
Fine leak		Test condition H					
Gross leak		Test condition C or K, indicator fluid/device maintained at 100°C ±5°C					
Moisture resistance	1021	Omit initial conditioning					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	20.0		mcd
Subgroup 3			10				
Shock	2016	Nonoperating, 1500 g's, 0.5 ms, 5 blows in X1, Y1, Z1 orientation.					
Vibration, variable frequency	2056	Nonoperating					
Constant acceleration	2006	20,000 g's; X1, Y1, Z1 orientation					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	20.0		mcd
Subgroup 4			15				
Salt atmosphere (corrosion)	1041						
Subgroup 5 (Not applicable)							
Subgroup 6							
Steady-state-operation life	1027	I_F = 35 mA dc, 1000 hours, T_A = 25°C					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	18.0		mcd

Table IV. Group C Inspection (cont.)

Examination or Test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min.	Max.	
Subgroup 7			10				
Peak forward pulse current (transient)		t_p = 1 µs, pps = 300, total test time = 5 s, I_{ptr} = 1.0 A(pk)					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	18.0		mcd
Subgroup 8			10				
Peak forward pulse current (operating)		t_p = 0.5 ms, $P_{FM} \leq$ 120 mW, T_A = 25°C, I_F = 60 mA, 500 hours					
Electrical test:							
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	18.0		mcd

Note:
1. I_F = 25 mA for 1N6611.

Table V. Group A Inspection for Panel Mount Assemblies

Examination or Test	MIL-STD-750		LTPD	Symbol	Limits		Unit
	Method	Details			Min.	Max.	
Subgroup 1			5				
External visual examination	2071						
Subgroup 2			5				
Luminous intensity		I_F = 20 mA dc,[1] θ = 0°		I_{V1}	20.0		mcd
Forward voltage		DC method: I_F = 20 mA[1]		V_F		3.0	V dc
Reverse current		DC method: V_R = 3 V dc		I_R		1.0	µA dc
Subgroup 3			5				
Resistance to solvents	1022	Omit solution 2.1d					
Subgroup 4			5				
Physical dimensions	2066						

Note:
1. I_F = 25 mA for HLMP-0564.