BROADCOM®

Data Sheet

HLMP-132x Series, HLMP-142x Series, HLMP-152x Series

T-1 (3 mm) High Intensity LED Lamps

Description

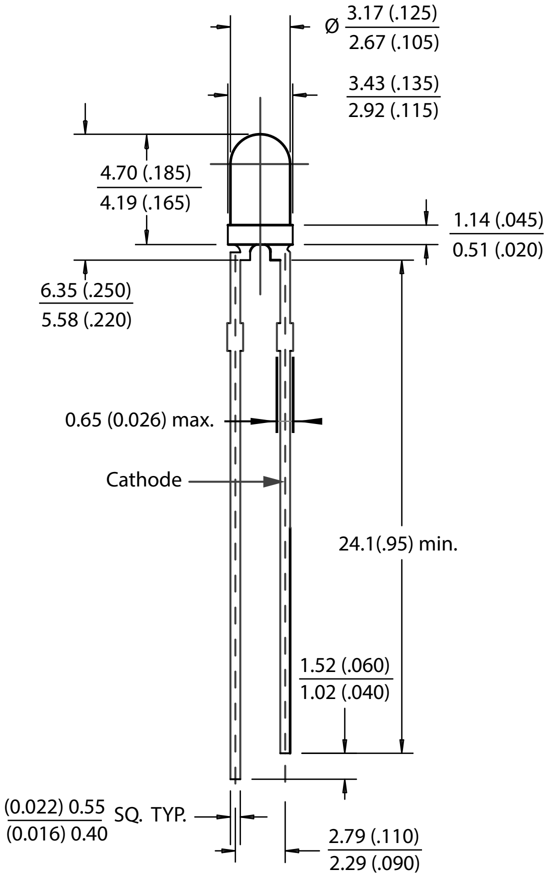
The Broadcom® family of T-1 lamps is specially designed for applications requiring higher on-axis intensity than is achievable with a standard lamp. The light generated is focused to a narrow beam to achieve this effect.

Features

- High intensity
- Choice of 3 bright colors
  - Red
  - Yellow
  - Green
- Popular T-1 diameter package
- Narrow viewing angle
- General purpose leads
- Reliable and rugged
- Available on tape and reel

For more information, refer to the *Tape and Reel Option Data Sheet.*

Package Dimensions



NOTE:

1. All dimensions are in millimeters (in.).
2. An epoxy meniscus may extend about 1 mm (0.40 in.) down the leads.
3. For PCB hole recommendations, see Precautions.

Device Selection Guide

Part Number	Package Description	Material/Color	Luminous Intensity Iv (mcd) at 10 mA	
			Min.	Max.
HLMP-1321	Tinted, Non-diffused	AlInGaP Red	8.6	—
HLMP-1321-G00xx			8.6	—
HLMP-1420	Microtinted, Non-diffused	AlInGaP Yellow	9.2	—
HLMP-1421	Tinted, Non-diffused		9.2	—
HLMP-1421-F00xx			9.2	—
HLMP-1520	Microtinted, Non-diffused	AlInGaP Green	6.7	—
HLMP-1521	Tinted, Non-diffused		6.7	—
HLMP-1521-E00xx			6.7	—

Absolute Maximum Ratings at T_A = 25°C

Parameter	Red	Yellow	Green	Units
Peak Forward Current	90	60	90	mA
Average Forward Current[a]	25	20	25	mA
DC Current[b]	30	20	30	mA
Power Dissipation[c]	135	85	135	mW
Reverse Voltage (I_R = 100 µA)	5	5	5	V
LED Junction Temperature	110	110	110	°C
Operating Temperature Range	–40 to +100	–40 to +100	–20 to +100	°C
Storage Temperature Range	–40 to +100	–40 to +100	–40 to +100	

a. See Figure 4 (Red), Figure 8 (Yellow), or Figure 12 (Green) to establish pulsed operating conditions.

b. For Red and Green series, derate linearly from 50°C at 0.5 mA/°C. For Yellow series, derate linearly from 50°C at 0.2 mA/°C.

c. For Red and Green series, derate power linearly from 25°C at 1.8 mW/°C. For Yellow series, derate power linearly from 50°C at 1.6 mW/°C.

Electrical/Optical Characteristics at $T_A = 25°C$

Symbol	Description	Device HLMP-	Min.	Typ.	Max.	Units	Test Conditions
$2\theta_{1/2}$	Including Angle Between Half Luminous Intensity Points	All	—	45	—	Deg.	I_F = 10 mA, see Note [a]
λ_{PEAK}	Peak Wavelength	132x	—	632	—	nm	Measurement at Peak
		142X	—	590	—		
		152X	—	570	—		
$\Delta\lambda_{1/2}$	Spectral Line Halfwidth	132x	—	14	—	nm	
		142X	—	12	—		
		152X	—	13	—		
λ_d	Dominant Wavelength	132x	—	626	—	nm	See Note [b]
		142X	—	589	—		
		152X	—	569	—		
τ_S	Speed of Response	132x	—	90	—	ns	
		142X	—	90	—		
		152X	—	500	—		
C	Capacitance	132x	—	11	—	pF	$V_F = 0$; f = 1 MHz
		142X	—	15	—		
		152X	—	18	—		
$R\theta_{J\text{-}PIN}$	Thermal Resistance	All	—	290	—	°C/W	Junction to Cathode Lead
V_F	Forward Voltage	132x	—	1.9	2.4	V	I_F = 10 mA
		142X	—	1.9	2.4		
		152X	—	2.0	2.7		
V_R	Reverse Breakdown Voltage	All	5.0	—	—	V	I_R = 100 µA
η_V	Luminous Efficacy	132x	—	180	—	lm/W	See Note [c]
		142X	—	500	—		
		152X	—	640	—		

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

b. The dominant wavelength, λ_d, is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.

c. 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.

Part Numbering System

H L M P - x_1 x_2 x_3 x_4 - x_5 x_6 x_7 x_8 x_9

Code	Description	Option	
x_1	Package type	1	T-1 (3 mm)
x_2	Color	3	Red
		4	Yellow
		5	Green
x_3 x_4	Lens Appearance	20	Untinted or Micro Tinted, Non-diffused
		21	Tinted, Non-diffused
x_5	Minimum intensity bin	See Intensity Bin Limits	
x_6	Maximum intensity bin		
x_7	Color bin selection	0	Full range
x_8 x_9	Packaging option	00	Bulk packaging
		01	Tape and Reel, Crimped Leads
		02	Tape and Reel, Straight Leads
		A1	Right Angle Housing, Uneven Leads
		A2	Right Angle Housing, Even Leads

Intensity Bin Limits

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Red	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
Yellow	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

Color	Bin	Intensity Range (mcd)	
		Min.	Max.
Green	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	Category Number	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
Yellow	1	582.0	584.5
	3	584.5	587.0
	2	587.0	589.5
	4	589.5	592.0
	5	592.0	593.0

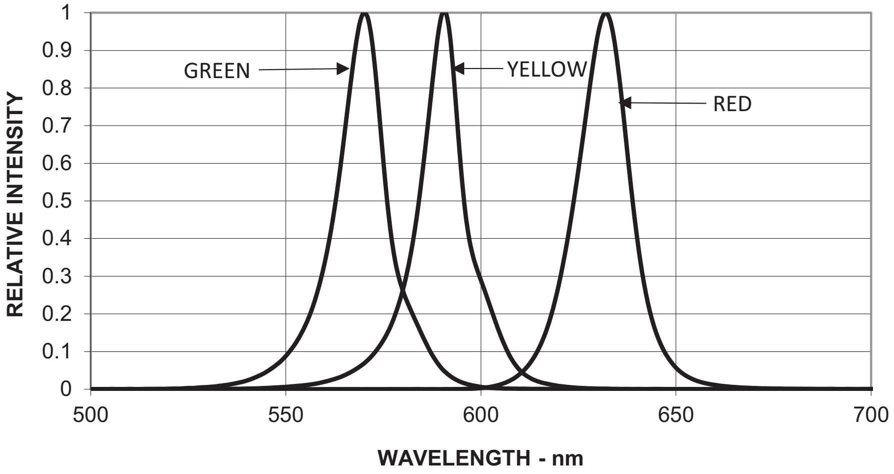
Tolerance for each bin limit is ± 0.5 nm.

Packaging Option Matrix

Packaging Option Code	Definition
00	Bulk Packaging, minimum increment 500 pieces/bag
01	Tape and Reel, crimped leads, minimum increment 1800 pieces/reel
02	Tape and Reel, straight leads, minimum increment 1800 pieces/reel
A1	Right Angle Housing, uneven leads, minimum increment 500 pieces/bag
A2	Right Angle Housing, even leads, minimum increment 500 pieces/bag

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

Figure 1: Relative Intensity vs. Wavelength



T-1 Red Non-Diffused

Figure 2: Forward Current vs. Forward Voltage

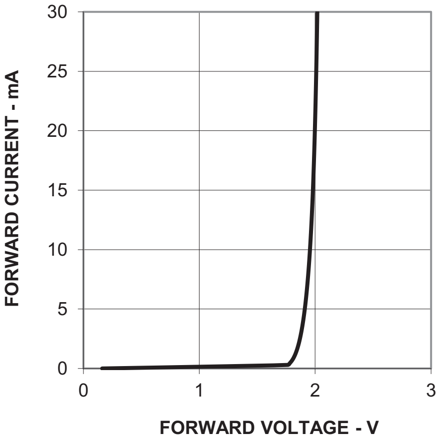


Figure 3: Relative Luminous Intensity vs. DC Forward Current

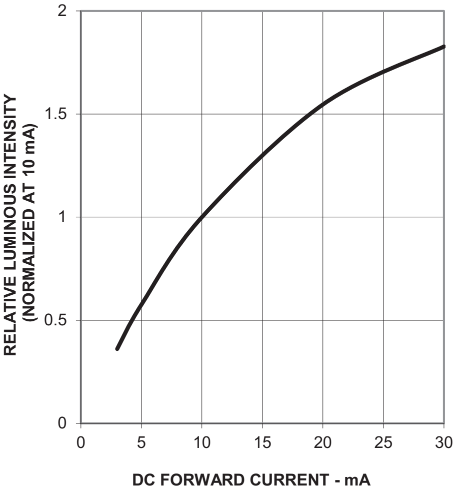


Figure 4: Maximum Tolerable Peak Current vs. Pulse Duration (I_{DC} MAX as per MAX Ratings)

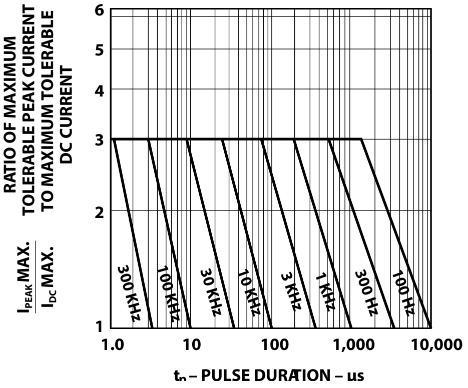
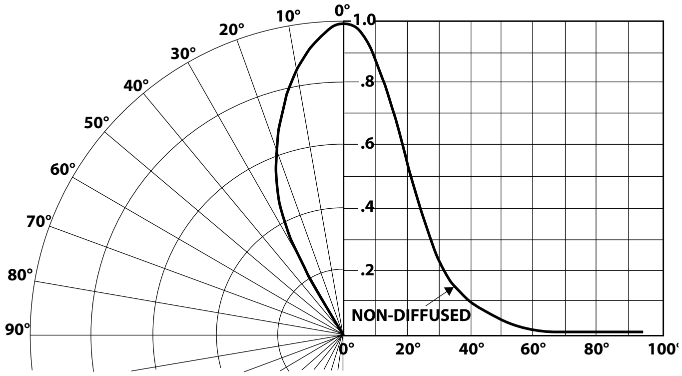


Figure 5: Relative Luminous Intensity vs. Angular Displacement



T-1 Yellow Non-Diffused

Figure 6: Forward Current vs. Forward Voltage

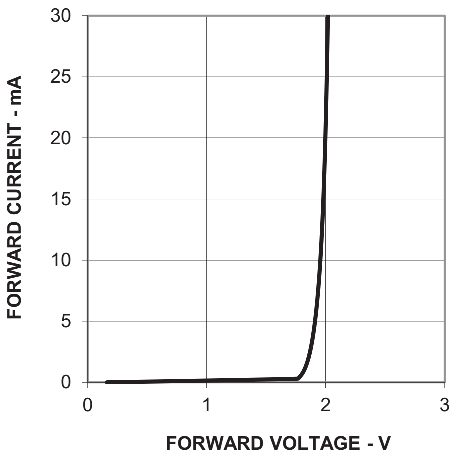


Figure 7: Relative Luminous Intensity vs. DC Forward Current

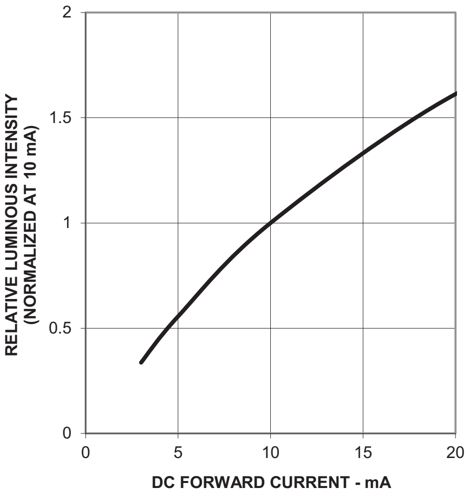


Figure 8: Maximum Tolerable Peak Current vs. Pulse Duration (I_{DC}MAX as per MAX Ratings)

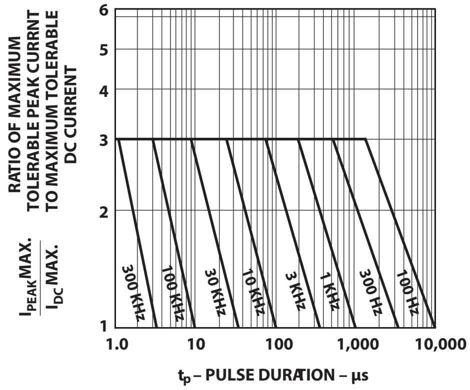
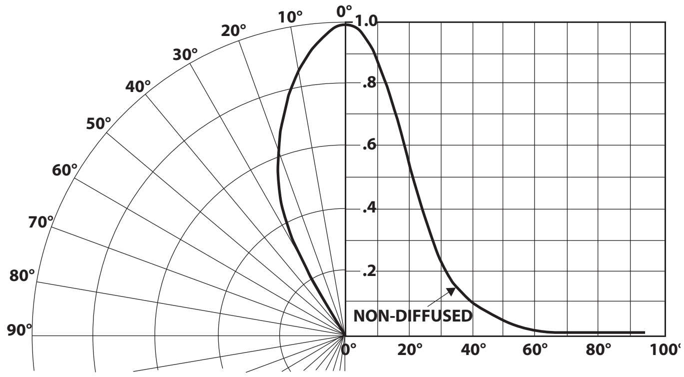


Figure 9: Relative Luminous Intensity vs. Angular Displacement



T-1 Green Non-Diffused

Figure 10: Forward Current vs. Forward Voltage

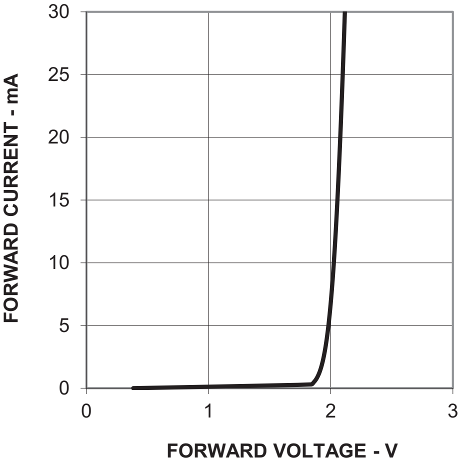


Figure 11: Relative Luminous Intensity vs. DC Forward Current

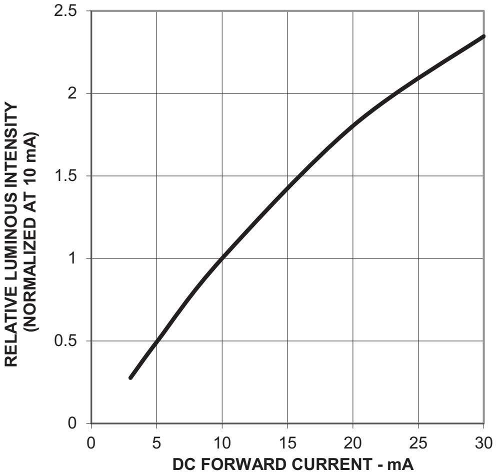


Figure 12: Maximum Tolerable Peak Current vs. Pulse Duration (I_{DC}MAX as per MAX Ratings)

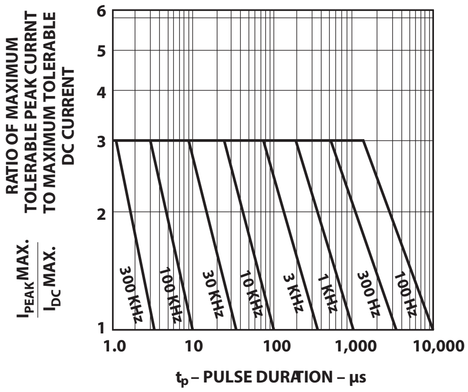
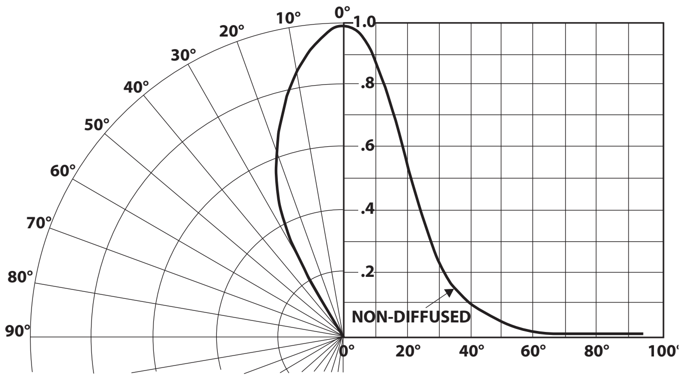


Figure 13: Relative Luminous Intensity vs. Angular Displacement



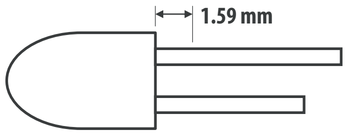
Precautions

Lead Forming

- The leads of an LED lamp may be preformed or cut to length prior to insertion and soldering on PC board.
- For better control, use the proper tool to precisely form and cut the leads to applicable length rather than doing it manually.
- If manual lead cutting is necessary, cut the leads after the soldering process. The solder connection forms a mechanical ground that prevents mechanical stress due to lead cutting from traveling into LED package. Use this method for the hand soldering operation, because the excess lead length also acts as small heat sink.

Soldering and Handling

- Take care during the PCB assembly and soldering process to prevent damage to the LED component.
- LED component may be effectively hand soldered to PCB. However, do this under unavoidable circumstances, such as rework. The closest manual soldering distance of the soldering heat source (soldering iron's tip) to the body is 1.59 mm. Soldering the LED using soldering iron tip closer than 1.59 mm might damage the LED.



- Apply ESD precautions on the soldering station and personnel to prevent ESD damage to the LED component that is ESD sensitive. Refer to Broadcom application note AN 1142 for details. The soldering iron used must have a grounded tip to ensure electrostatic charge is properly grounded.
- Recommended soldering condition.

Wave Soldering[a], [b]	Manual Solder Dipping	
Pre-heat Temperature	105°C max.	—
Pre-heat Time	60s max.	—
Peak Temperature	250°C max.	260°C max.
Dwell Time	3s max.	5s max.

[a] The preceding conditions refer to measurement with a thermocouple mounted at the bottom of the PCB.

[b] Use only bottom pre-heaters to reduce thermal stress experienced by LED.

- Set and maintain wave soldering parameters according to the recommended temperature and dwell time. Perform daily checks on the soldering profile to ensure that it always conforms to the recommended soldering conditions.

NOTE:

1. PCBs with different size and design (component density) will have a different heat mass (heat capacity). This might cause a change in temperature experienced by the board if the same wave soldering setting is used. Therefore, re-calibrate the soldering profile again before loading a new type of PCB.
2. Take extra precautions during wave soldering to ensure that the maximum wave temperature does not exceed 250°C and the solder contact time does not exceed 3s. Over-stressing the LED during the soldering process might cause premature failure to the LED due to delamination.

- Loosely fit any alignment fixture that is being applied during wave soldering and do not apply weight or force on the LED. Use non-metal material because it will absorb less heat during the wave soldering process.
- At elevated temperature, LED is more susceptible to mechanical stress. Therefore, allow the PCB to cool down to room temperature prior to handling, which includes removal of alignment fixture or pallet.
- If PCB board contains both through-hole (TH) LED and other surface-mount components, solder surface-mount components on the top side of the PCB. If the surface mount must be on the bottom side, solder these components using reflow soldering prior to the insertion of the TH LED.
- The recommended PC board plated through holes (PTH) size for LED component leads follows.

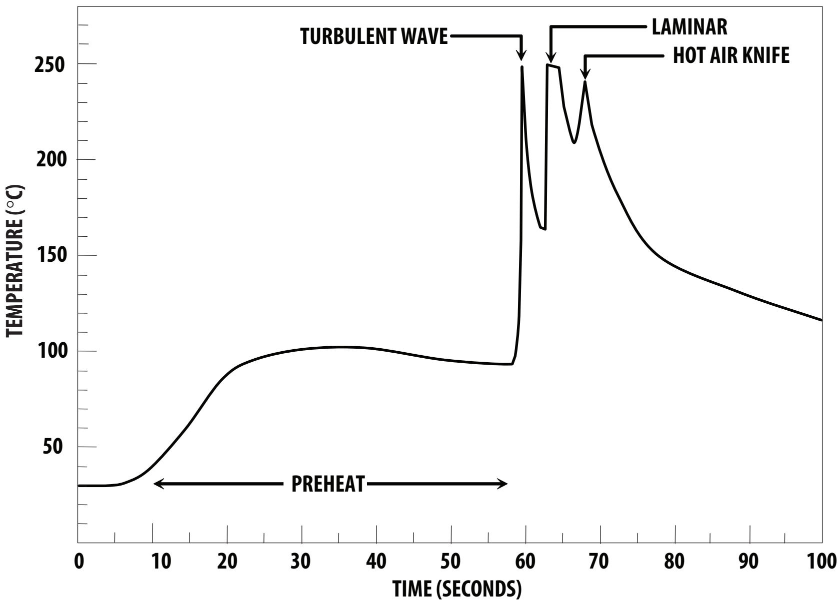
	LED Component Lead Size	Diagonal	Plated Through-Hole Diameter
Lead size (typ.)	0.45 × 0.45 mm (0.018 × 0.018 in.)	0.636 mm (0.025 in.)	0.98 to 1.08 mm (0.039 to 0.043 in.)
Dambar shear-off area (max.)	0.65 mm (0.026 in.)	0.919 mm (0.036 in.)	
Lead size (typ.)	0.50 × 0.50 mm (0.020 × 0.020 in.)	0.707 mm (0.028 in.)	1.05 to 1.15 mm (0.041 to 0.045 in.)
Dambar shear-off area (max.)	0.70 mm (0.028 in.)	0.99 mm (0.039 in.)	

NOTE: Refer to application note AN1027 for more information on soldering LED components.

- Over-sizing the PTH can lead to twisted LED after clinching. On the other hand, under-sizing the PTH can cause difficulty inserting the TH LED.

Refer to application note AN5334 for more information about soldering and handling of TH LED lamps.

Figure 14: Example of Wave Soldering Temperature Profile for TH LED



Recommended solder:
Sn63 (Leaded solder alloy)
SAC305 (Lead-free solder alloy)

Flux: Rosin flux

Solder bath temperature:
245°C ± 5 °C (maximum peak temperature = 250°C)

Dwell time: 1.5s – 3.0s (maximum = 3 seconds)

Note: Allow for board to be sufficiently cooled to room temperature before you exert mechanical force.

Lead (Pb) Free
RoHS Compliant