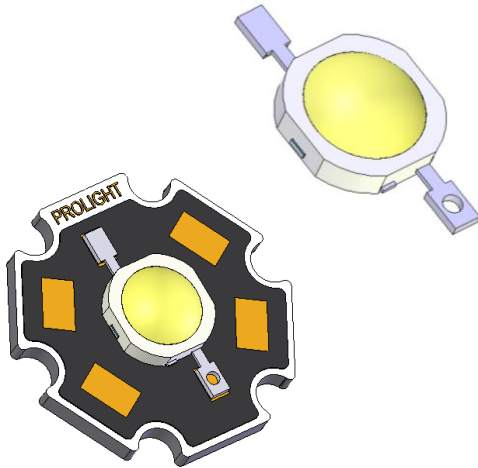




*ProLight Opto*  
Technology Corporation



**ProLight PGD1-4LVx-01  
4W Warm White HV LED  
Technical Datasheet  
Version: 1.6**

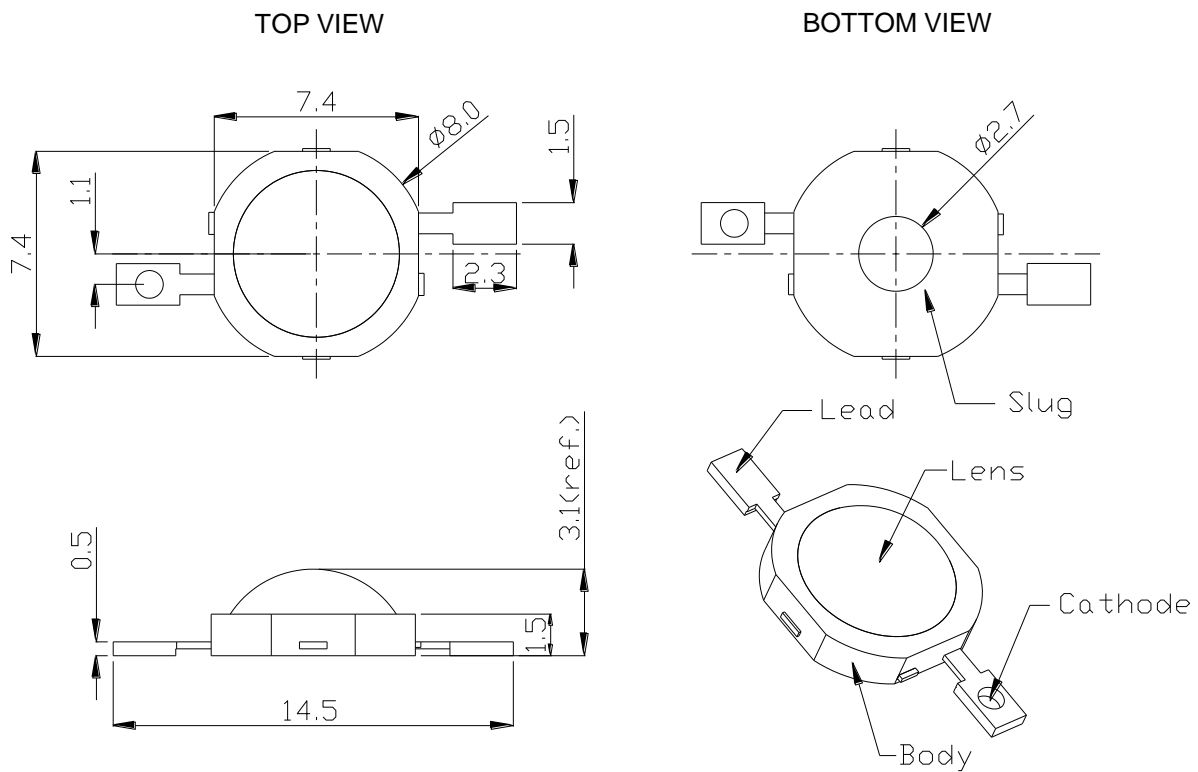
## Features

- High Color rendering index (CRI Typ. 80)
- High flux per LED
- Good color uniformity
- Moisture sensitivity level - JEDEC Level 2a  
4 week floor life without reconditioning
- RoHS compliant
- More energy efficient than incandescent and most halogen lamps
- Instant light (less than 100ns)
- No UV

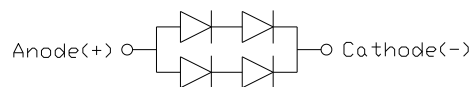
## Typical Applications

- Candle Light

## Emitter Mechanical Dimensions



Circuit Diagram

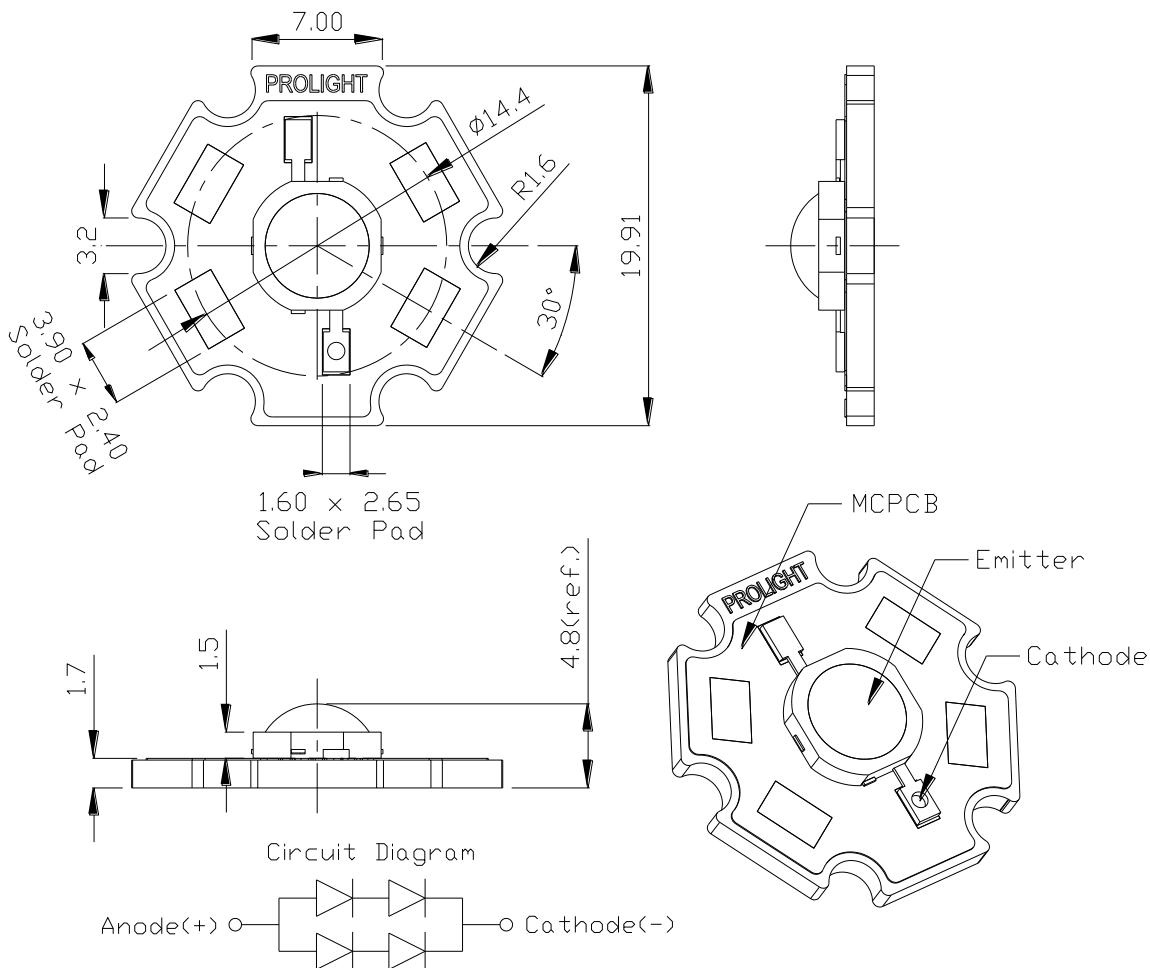


### Notes:

1. The cathode side of the device is denoted by a hole in the lead frame.
2. Electrical insulation between the case and the board is required. Do not electrically connect either the anode or cathode to the slug.
3. Drawing not to scale.
4. All dimensions are in millimeters.
5. Unless otherwise indicated, tolerances are  $\pm 0.20$ mm.
6. Please do not bend the leads of the LED, otherwise it will damage the LED.
7. **Please do not use a force of over 3kgf impact or pressure on the lens of the LED, otherwise it will cause a catastrophic failure.**

\*The appearance and specifications of the product may be modified for improvement without notice.

# Star Mechanical Dimensions



## Notes:

1. Slots in aluminum-core PCB for M3 or #4 mounting screw.
2. Electrical interconnection pads labeled on the aluminum-core PCB with "+" and "-" to denote positive and negative, respectively. All positive pads are interconnected, as are all negative pads, allowing for flexibility in array interconnection.
3. Drawing not to scale.
4. All dimensions are in millimeters.
5. Unless otherwise indicated, tolerances are  $\pm 0.20$ mm.
6. **Please do not use a force of over 3kgf impact or pressure on the lens of the LED, otherwise it will cause a catastrophic failure.**

\*The appearance and specifications of the product may be modified for improvement without notice.

## Flux Characteristics at 40mA, T<sub>J</sub> = 25°C

Radiation Pattern	Color	Part Number		Lumious Flux $\Phi_v$ (lm)		CRI Typical
		Emitter	Star	Minimum	Typical	
Lambertian	Warm White	PGD1-4LVE-01	PGD1-4LVS-01	249.6	325	82

- ProLight maintains a tolerance of  $\pm 10\%$  on flux and power measurements.
- Please do not drive at rated current more than 1 second without proper heat sink.

## Optical Characteristics at 40mA, T<sub>J</sub> = 25°C

Color	Color Temperature CCT			Total included Angle (degrees) $\theta_{0.90V}$	Viewing Angle (degrees) $2 \theta_{1/2}$	Thermal Resistance Junction to Board ( $^{\circ}C/W$ )
	Min.	Typ.	Max.			
Warm White	2580 K	2900 K	3220 K	160	140	5

- ProLight maintains a tolerance of  $\pm 5\%$  for CCT measurements.

## Electrical Characteristics at 40mA, T<sub>J</sub> = 25°C

Color	Forward Voltage V <sub>F</sub> (V)		
	Min.	Typ.	Max.
Warm White	85	102	120

- ProLight maintains a tolerance of  $\pm 1V$  for Voltage measurements.

## Absolute Maximum Ratings

Parameter	Warm White
DC Forward Current (mA)	40
Average Forward Current (mA)	40
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	> ±500V
LED Junction Temperature	≤115°C
Operating Board Temperature at Maximum DC Forward Current	-40°C - 85°C
Storage Temperature	-40°C - 120°C
Soldering Temperature	JEDEC 020c 260°C
Allowable Reflow Cycles	3
Reverse Voltage	Not designed to be driven in reverse bias

## Photometric Luminous Flux Bin Structure

Color	Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)	Available Color Bins
Warm White	Y1	249.6	284.5	All
	Y2	284.5	324.5	All
	Z1	324.5	369.9	[1]

- ProLight maintains a tolerance of ± 10% on flux and power measurements.
- The flux bin of the product may be modified for improvement without notice.
- <sup>[1]</sup> The rest of color bins are not 100% ready for order currently. Please ask for quote and order possibility.

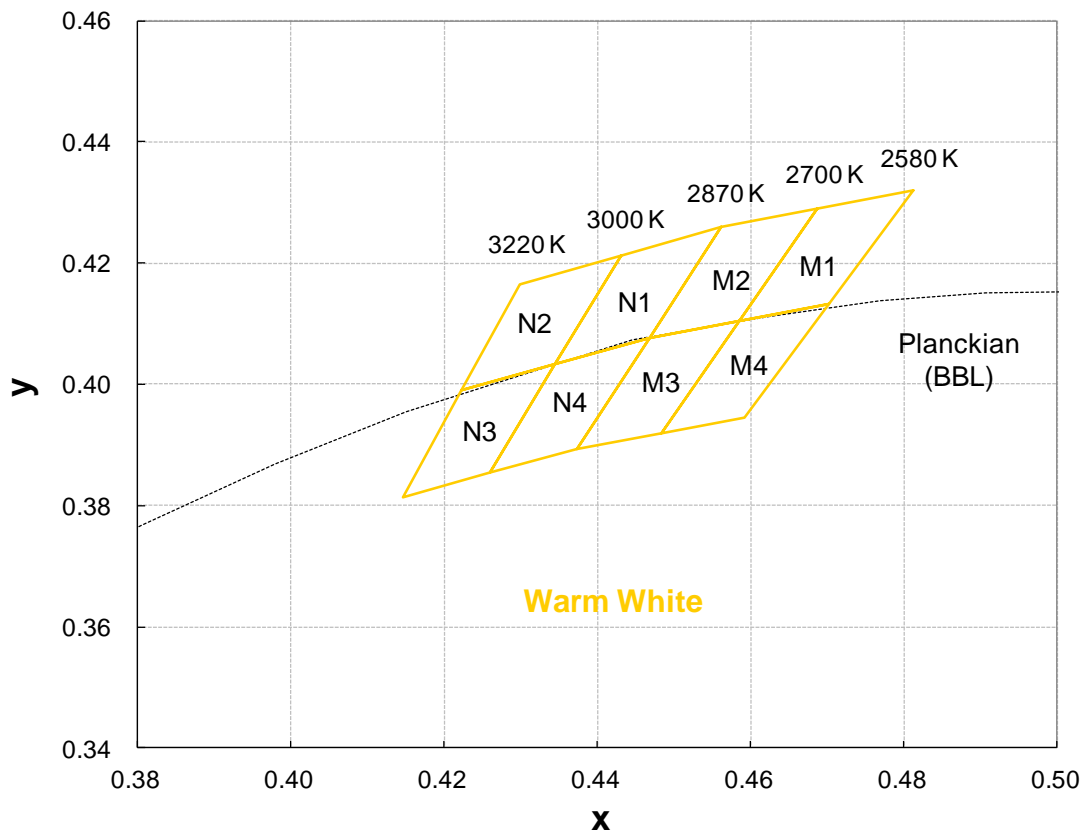
## Forward Voltage Bin Structure

Color	Bin Code	Minimum Voltage (V)	Maximum Voltage (V)
Warm White	B	85	90
	D	90	95
	E	95	100
	F	100	105
	G	105	110
	H	110	115
	J	115	120

- ProLight maintains a tolerance of ± 1V for Voltage measurements.
- Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

## Color Bins

### Warm White Binning Structure Graphical Representation



## Color Bins

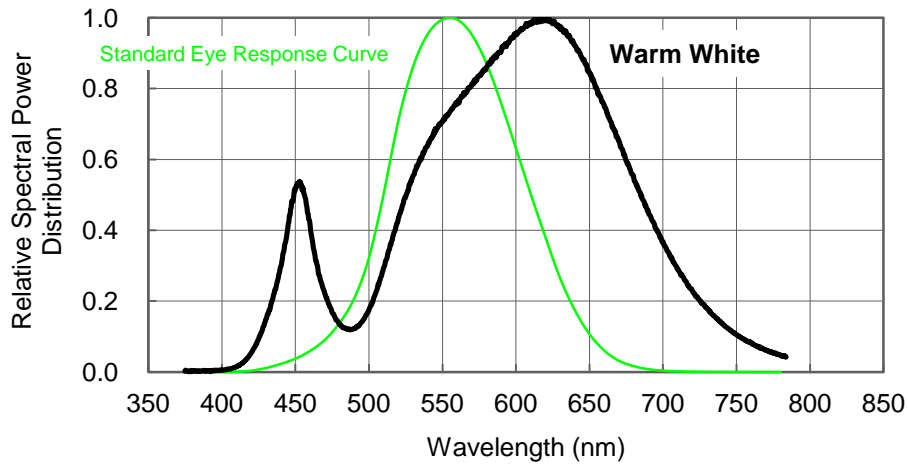
### Warm White Bin Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
M1	0.4813	0.4319	2650	N1	0.4562	0.4260	2950
	0.4688	0.4290			0.4431	0.4213	
	0.4585	0.4104			0.4345	0.4033	
	0.4703	0.4132			0.4468	0.4077	
M4	0.4703	0.4132	2650	N4	0.4468	0.4077	2950
	0.4585	0.4104			0.4345	0.4033	
	0.4483	0.3919			0.4260	0.3854	
	0.4593	0.3944			0.4373	0.3893	
M2	0.4688	0.4290	2800	N2	0.4431	0.4213	3100
	0.4562	0.4260			0.4299	0.4165	
	0.4468	0.4077			0.4223	0.3990	
	0.4585	0.4104			0.4345	0.4033	
M3	0.4585	0.4104	2800	N3	0.4345	0.4033	3100
	0.4468	0.4077			0.4223	0.3990	
	0.4373	0.3893			0.4147	0.3814	
	0.4483	0.3919			0.4260	0.3854	

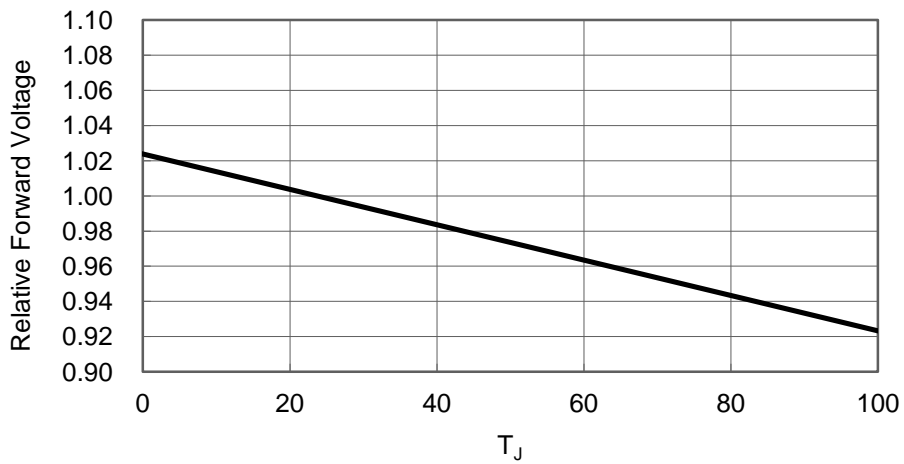
● Tolerance on each color bin (x , y) is ± 0.01

# Color Spectrum, $T_J = 25^\circ\text{C}$

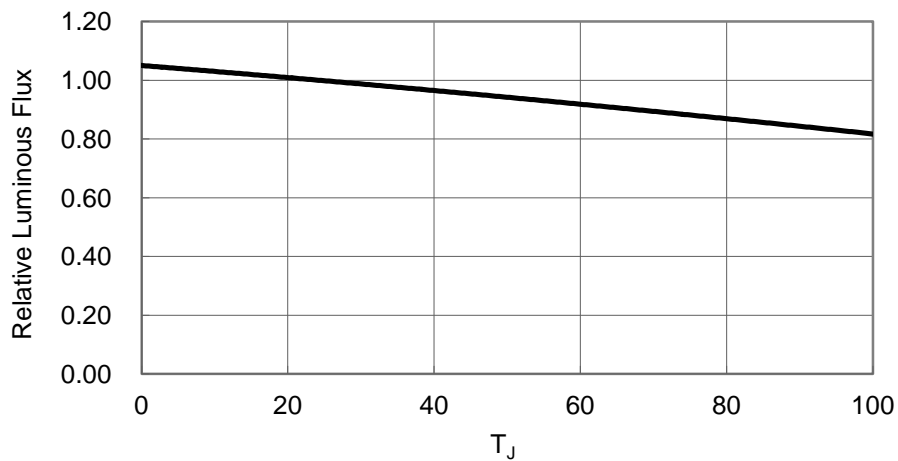
## 1. Warm White



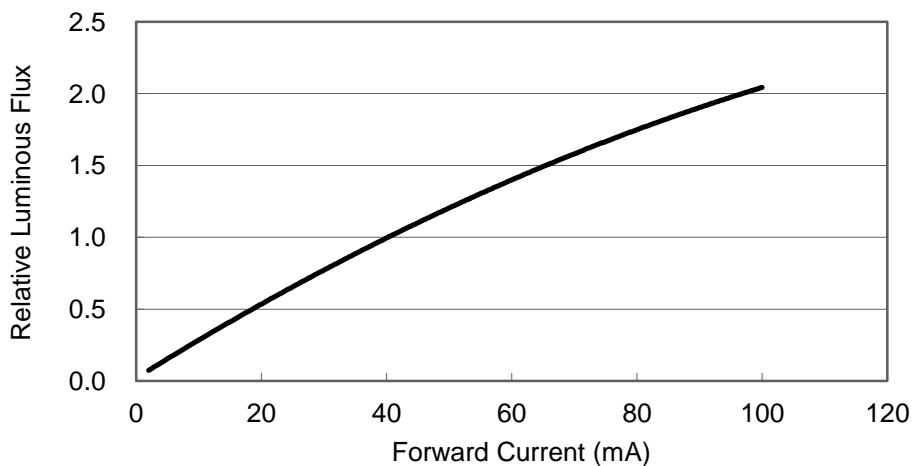
## $T_J$ VS Relative Forward Voltage



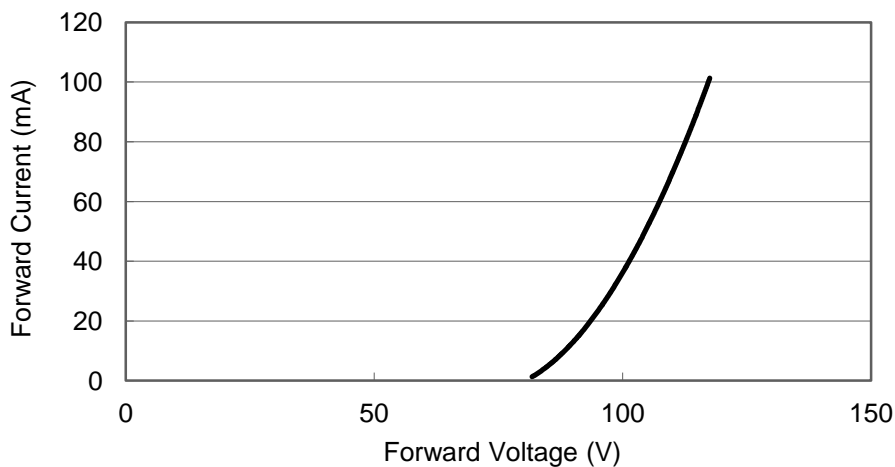
## $T_J$ VS Relative Luminous Flux



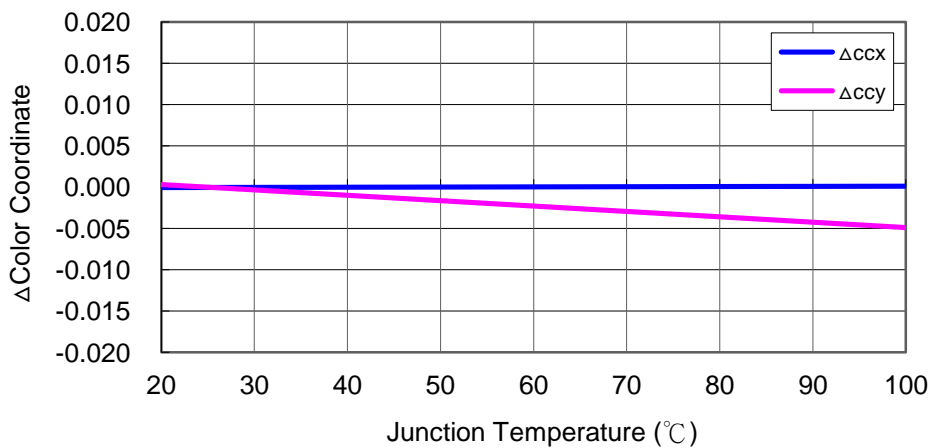
### Forward Current VS Relative Luminous Flux



### Forward Current VS Relative Forward Voltage



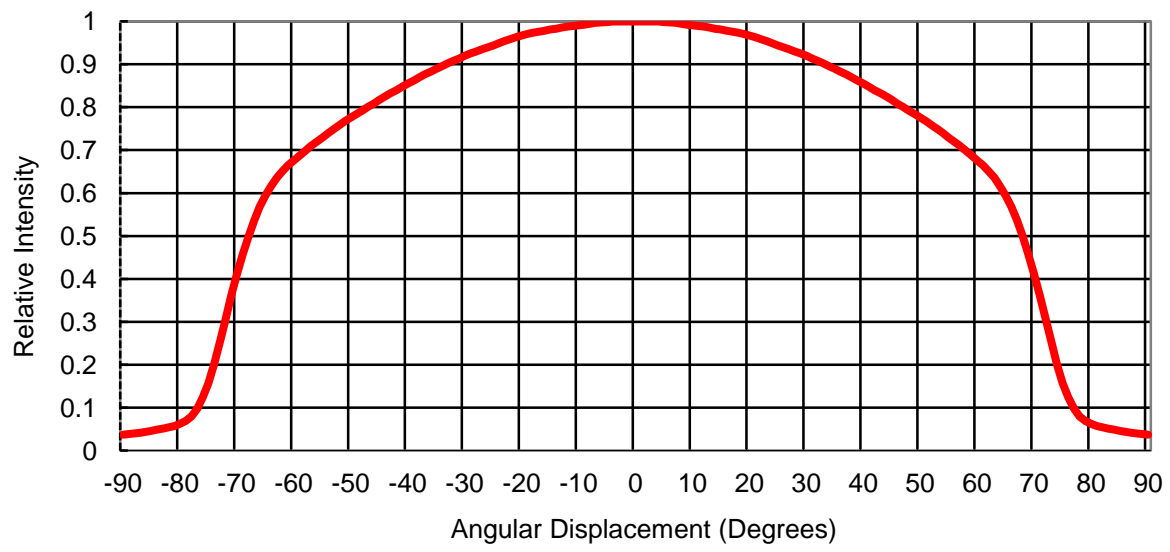
### Color Coordinate VS Junction Temperature





# Typical Representative Spatial Radiation Pattern

## Lambertian Radiation Pattern



## Moisture Sensitivity Level - JEDEC Level 2a

Level	Floor Life		Soak Requirements			
			Standard		Accelerated Environment	
	Time	Conditions	Time (hours)	Conditions	Time (hours)	Conditions
2a	4 weeks	≤30°C / 60% RH	696 +5/-0	30°C / 60% RH	120 +1/-0	60°C / 60% RH

- The standard soak time includes a default value of 24 hours for semiconductor manufacture's exposure time (MET) between bake and bag and includes the maximum time allowed out of the bag at the distributor's facility.
- Table below presents the moisture sensitivity level definitions per IPC/JEDEC's J-STD-020C.

Level	Floor Life		Soak Requirements			
			Standard		Accelerated Environment	
	Time	Conditions	Time (hours)	Conditions	Time (hours)	Conditions
1	Unlimited	≤30°C / 85% RH	168 +5/-0	85°C / 85% RH	NA	NA
2	1 year	≤30°C / 60% RH	168 +5/-0	85°C / 60% RH	NA	NA
2a	4 weeks	≤30°C / 60% RH	696 +5/-0	30°C / 60% RH	120 +1/-0	60°C / 60% RH
3	168 hours	≤30°C / 60% RH	192 +5/-0	30°C / 60% RH	40 +1/-0	60°C / 60% RH
4	72 hours	≤30°C / 60% RH	96 +2/-0	30°C / 60% RH	20 +0.5/-0	60°C / 60% RH
5	48 hours	≤30°C / 60% RH	72 +2/-0	30°C / 60% RH	15 +0.5/-0	60°C / 60% RH
5a	24 hours	≤30°C / 60% RH	48 +2/-0	30°C / 60% RH	10 +0.5/-0	60°C / 60% RH
6	Time on Label (TOL)	≤30°C / 60% RH	Time on Label (TOL)	30°C / 60% RH	NA	NA

## Qualification Reliability Testing

Stress Test	Stress Conditions	Stress Duration	Failure Criteria
Room Temperature Operating Life (RTOL)	25°C, $I_F = \text{max DC}$ (Note 1)	1000 hours	Note 2
Wet High Temperature Operating Life (WHTOL)	85°C/60%RH, $I_F = \text{max DC}$ (Note 1)	1000 hours	Note 2
Wet High Temperature Storage Life (WHTSL)	85°C/85%RH, non-operating	1000 hours	Note 2
High Temperature Storage Life (HTSL)	110°C, non-operating	1000 hours	Note 2
Low Temperature Storage Life (LTSL)	-40°C, non-operating	1000 hours	Note 2
Non-operating Temperature Cycle (TMCL)	-40°C to 120°C, 30 min. dwell, <5 min. transfer	200 cycles	Note 2
Non-operating Thermal Shock (TMSK)	-40°C to 120°C, 20 min. dwell, <20 sec. transfer	200 cycles	Note 2
Mechanical Shock	1500 G, 0.5 msec. pulse, 5 shocks each 6 axis		Note 3
Natural Drop	On concrete from 1.2 m, 3X		Note 3
Variable Vibration Frequency	10-2000-10 Hz, log or linear sweep rate, 20 G about 1 min., 1.5 mm, 3X/axis		Note 3
Solder Heat Resistance (SHR)	260°C ± 5°C, 10 sec.		Note 3
Solderability	Steam age for 16 hrs., then solder dip at 260°C for 5 sec.		Solder coverage on lead

### Notes:

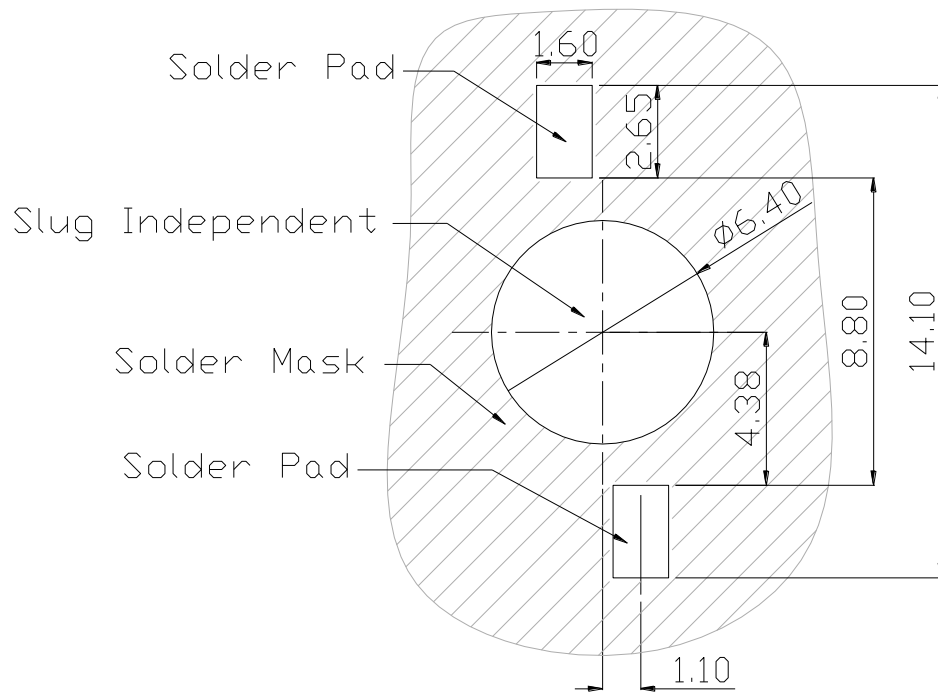
1. Depending on the maximum derating curve.
2. Criteria for judging failure

Item	Test Condition	Criteria for Judgement	
		Min.	Max.
Forward Voltage ( $V_F$ )	$I_F = \text{max DC}$	--	Initial Level x 1.1
Luminous Flux or Radiometric Power ( $\Phi_V$ )	$I_F = \text{max DC}$	Initial Level x 0.7	--

\* The test is performed after the LED is cooled down to the room temperature.

3. A failure is an LED that is open or shorted.

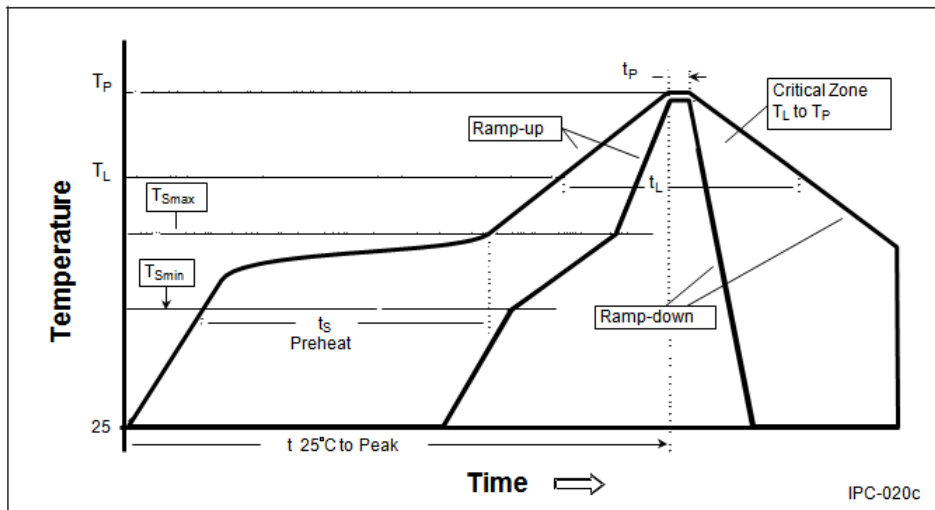
## Recommended Solder Pad Design



- All dimensions are in millimeters.
- Electrical isolation is required between Slug and Solder Pad.

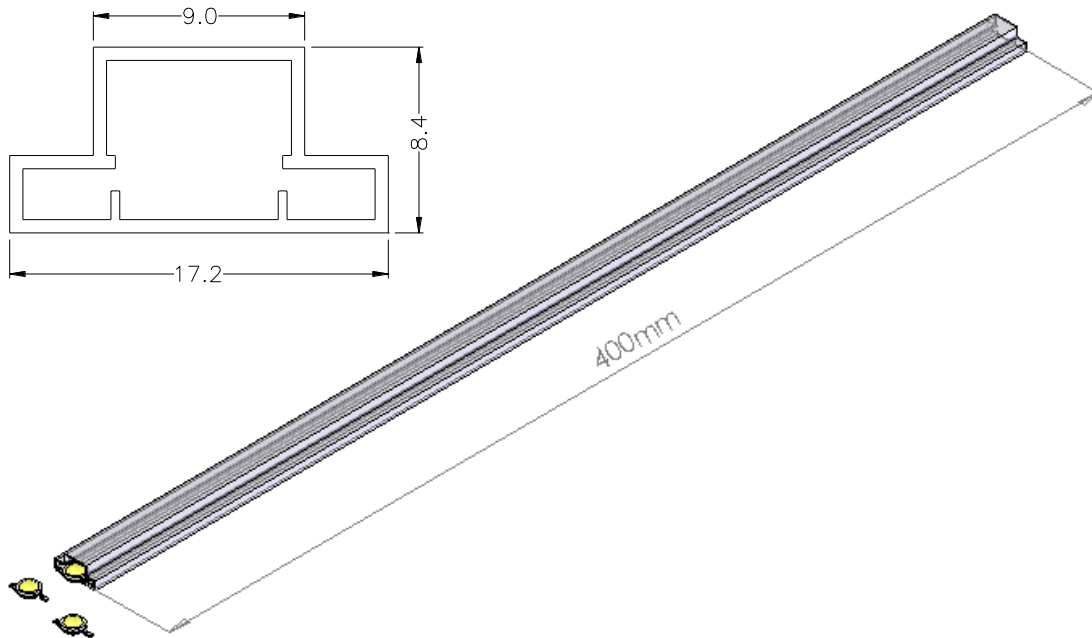
## Reflow Soldering Condition

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate ( $T_{Smax}$ to $T_P$ )	3°C / second max.	3°C / second max.
Preheat <ul style="list-style-type: none"> <li>- Temperature Min (<math>T_{Smin}</math>)</li> <li>- Temperature Max (<math>T_{Smax}</math>)</li> <li>- Time (<math>t_{Smin}</math> to <math>t_{Smax}</math>)</li> </ul>	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: <ul style="list-style-type: none"> <li>- Temperature (<math>T_L</math>)</li> <li>- Time (<math>t_L</math>)</li> </ul>	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classification Temperature ( $T_P$ )	240°C	260°C
Time Within 5°C of Actual Peak Temperature ( $t_P$ )	10-30 seconds	20-40 seconds
Ramp-Down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

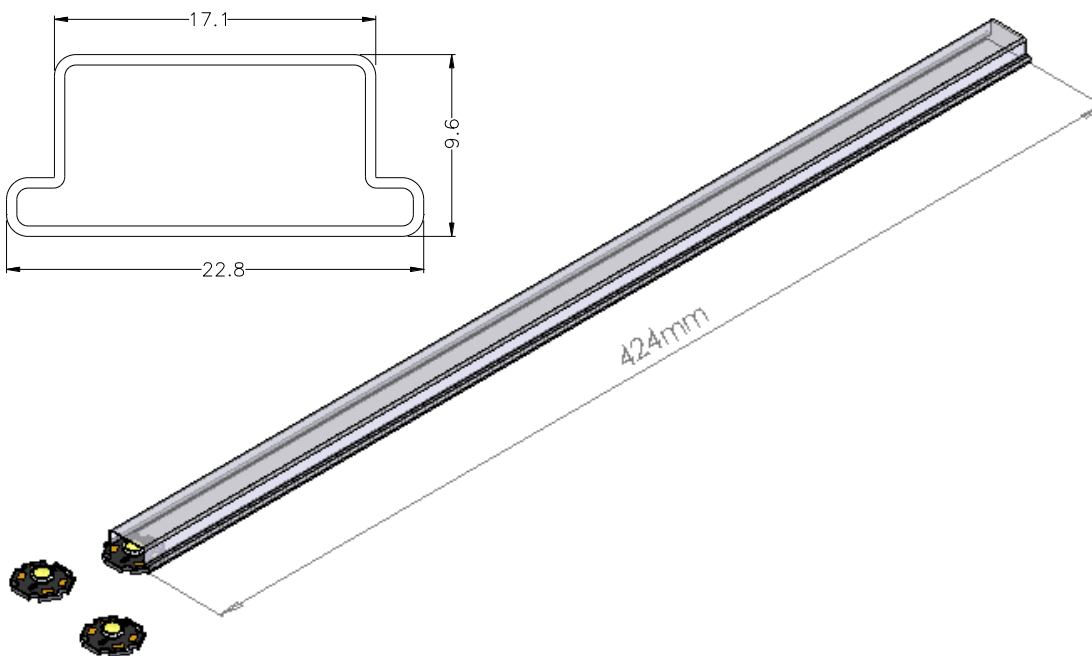


- We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.
- Do not use solder pastes with post reflow flux residue > 47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.
- All temperatures refer to topside of the package, measured on the package body surface.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- Reflow soldering should not be done more than three times.
- When soldering, do not put stress on the LEDs during heating.
- After soldering, do not warp the circuit board.

## Emitter Tube Packaging



## Star Tube Packaging



### Notes:

1. Emitter 50 pieces per tube and Star 20 pieces per tube.
2. Drawing not to scale.
3. All dimensions are in millimeters.
4. All dimensions without tolerances are for reference only.

\*\*Please do not open the moisture barrier bag (MBB) more than one week. This may cause the leads of LED discoloration. We recommend storing ProLight's LEDs in a dry box after opening the MBB. The recommended storage conditions are temperature 5 to 30°C and humidity less than 40% RH.

ProLight

## Precaution for Use

- Storage  
Please do not open the moisture barrier bag (MBB) more than one week. This may cause the leads of LED discoloration. We recommend storing ProLight's LEDs in a dry box after opening the MBB. The recommended storage conditions are temperature 5 to 30°C and humidity less than 40% RH. It is also recommended to return the LEDs to the MBB and to reseal the MBB.
- The slug is not electrically neutral. Therefore, we recommend to isolate the heat sink.
- The LEDs are sensitive to electrostatic discharge. Appropriate ESD protection measures must be taken when working with the LEDs. Non-compliance with ESD protection measures may lead to damage or destruction of the LEDs.
- **We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.**
- **Do not use solder pastes with post reflow flux residue >47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.**
- Any mechanical force or any excess vibration shall not be accepted to apply during cooling process to normal temperature after soldering.
- Please avoid rapid cooling after soldering.
- Components should not be mounted on warped direction of PCB.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a heat plate should be used. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- This device should not be used in any type of fluid such as water, oil, organic solvent and etc. When cleaning is required, isopropyl alcohol should be used.
- When the LEDs are illuminating, operating current should be decided after considering the package maximum temperature.
- The appearance, specifications and flux bin of the product may be modified for improvement without notice. Please refer to the below website for the latest datasheets.  
<http://www.prolightopto.com/>

## Handling of Silicone Lens LEDs

Notes for handling of silicone lens LEDs

- Please do not use a force of over 3kgf impact or pressure on the silicone lens, otherwise it will cause a catastrophic failure.
- The LEDs should only be picked up by making contact with the sides of the LED body.
- Avoid touching the silicone lens especially by sharp tools such as Tweezers.
- Avoid leaving fingerprints on the silicone lens.
- Please store the LEDs away from dusty areas or seal the product against dust.
- When populating boards in SMT production, there are basically no restrictions regarding the form of the pick and place nozzle, except that mechanical pressure on the silicone lens must be prevented.
- Please do not mold over the silicone lens with another resin. (epoxy, urethane, etc)



ProLight