

ProLight PG1C-4Lxx-SD
4W White/ Warm White Power LED
Technical Datasheet
Version: 3.2

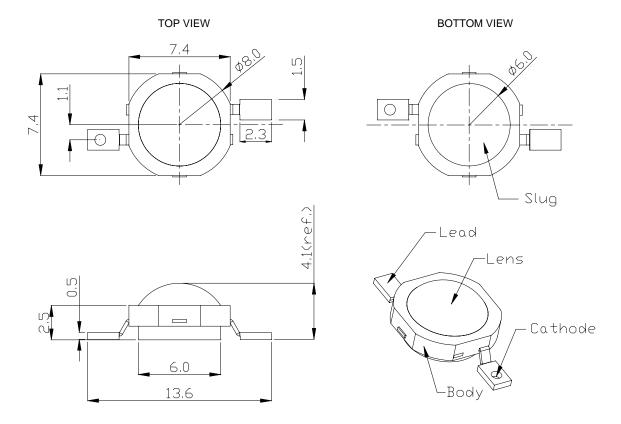
Features

- High flux per LED
- Very long operating life(up to 100k hours)
- Good color uniformity
- Industry best moisture sensitivity level JEDEC 2a
 4 week floor life without reconditioning
- Low-temp. & lead free reflow soldering
- RoHS compliant
- More energy efficient than incandescent and most halogen lamps
- Low Voltage DC operated
- Instant light (less than 100ns)
- No UV
- Superior ESD protection

Typical Applications

- Reading lights (car, bus, aircraft)
- Portable (flashlight, bicycle)
- Uplighters/Downlighters
- Decorative/Entertainment
- Bollards/Security/Garden
- Cove/Undershelf/Task
- Indoor/Outdoor Commercial and Residential Architectural
- Automotive Ext (Stop-Tail-Turn, CHMSL, Mirror Side Repeat)
- LCD backlights

Emitter Mechanical Dimensions

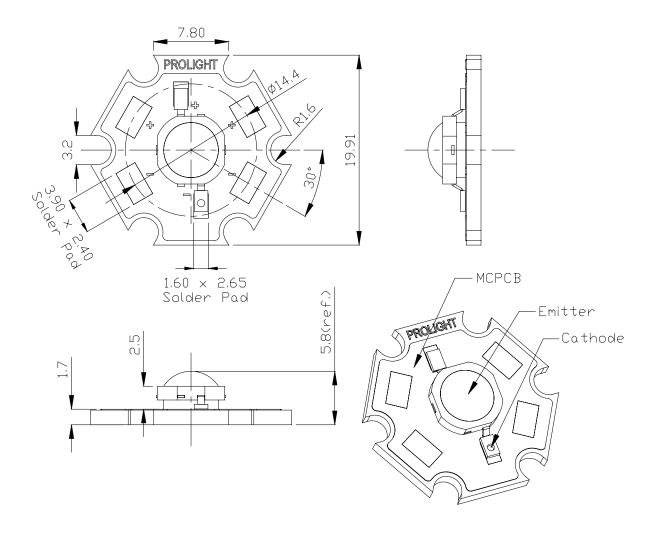


Notes:

- 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 --- slug of device is not electrically neutral. Do not electrically connect either the anode or cathode to the slug.
- 3. Drawing not to scale.
- 4. All dimensions are in millimeters.
- 5. All dimendions without tolerances are for reference only.
- 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. All dimendions without tolerances are for reference only.
- 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.

Part Number

Radiation Pattern	Color	Emitter	Star
Lambertian	White	PG1C-4LWE-SD	PG1C-4LWS-SD
	Warm White	PG1C-4LVE-SD	PG1C-4LVS-SD

Flux Characteristics, $T_J = 25$ °C

Radiation	Color	Typical Lumious Flux $Φ_V$ (lm)				
Pattern	30101	Test @1000mA	Refer @700mA	Refer @350mA		
Lambertian	White Warm White	200 180	150 135	85 77		

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

Electrical Characteristics at 1000mA, T_J = 25°C

	Forwa	rd Voltage	V _F (V)	Dynamic	Temperature Coefficient of V _F (mV/ °C)	Thermal Resistance Junction to
Color	Min.	Тур.	Max.	Resistance (Ω)	$\Delta V_F / \Delta T_J$	Slug (°C/W)
White	3.3	3.8	4.5	1.0	-2.0	8
Warm White	3.3	3.8	4.5	1.0	-2.0	8

Optical Characteristics at 1000mA, $T_J = 25$ °C

						Temperature Coefficient of	Total	
Radiation			nt Wavele Temperat	O 5,	Spectral Half-width (nm)	Dominant Wavelength (nm/ °C)	included Angle (degrees)	Viewing Angle (degrees)
Pattern	Color	Min.	Тур.	Max.	Δλ _{1/2}	$\dot{\Delta}\lambda_{D}/\Delta T_{J}^{'}$	θ _{0.90V}	2 θ _{1/2}
Lambertian	White	4100 K	5500 K	10000 K			160	140
	Warm White	2700 K	3300 K	4100 K			160	140

[•] ProLight maintains a tolerance of ± 5% for CCT measurements.

Absolute Maximum Ratings

Parameter	White/Warm White	
DC Forward Current (mA)	1000	
Peak Pulsed Forward Current (mA)	1250	
Average Forward Current (mA)	1000	
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	±4000V (Class III)	
LED Junction Temperature (°C)	135	
Aluminum-core PCB Temperature (°C)	100	
Storage & Operating Temperature (°C)	-40 to +100	
Soldering Temperature(°C)	235°C	

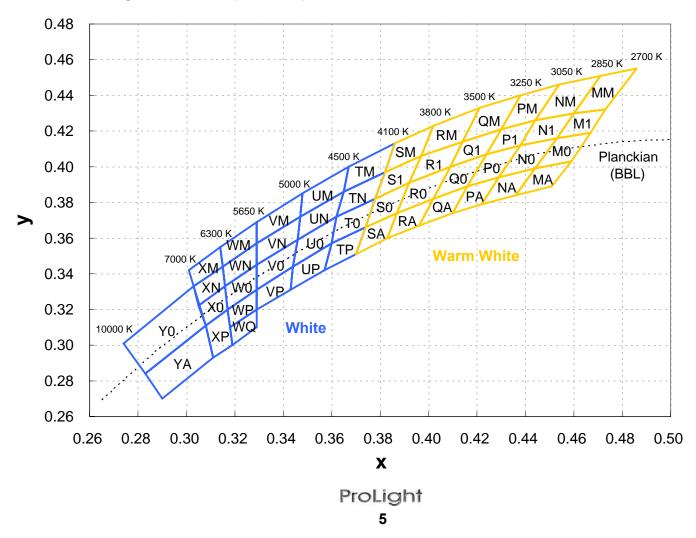
Photometric Luminous Flux Bin Structure

Color	Bin Code	Minimum Photometric Flux (Im)	Maximum Photometric Flux (Im)
	W1	147.7	168.4
White	W2	168.4	192.0
	X1	192.0	218.9
	W1	147.7	168.4
Warm White	W2	168.4	192.0
	X1	192.0 CCT is less than 3050K, X1 bin is not ava	218.9 ailable.

- ullet ProLight maintains a tolerance of \pm 10% on flux and power measurements.
- The flux bin of the product may be modified for improvement without notice.

Color Bin

White and Warm White Binning Structure Graphical Representation



Color Bins

White Bin Structure

TO	Bin Code	x	у	Typ. CCT (K)	Bin Code	x	у	Typ. CCT (K)
10							0.345	
0.360	TO			4300	WO			5970
O.382 O.397 O.329 O.345 TO TN 0.378 0.382 4300 WN 0.315 0.344 5970 0.365 0.386 0.329 0.357 0.357 0.366 0.329 0.331 0.357 0.370 0.351 4300 WP 0.329 0.320 5970 0.357 0.342 4300 WP 0.318 0.310 5970 0.360 0.357 0.342 0.318 0.310 3020 5970 0.386 0.413 0.329 0.320 5970 30329 0.320 5970 0.386 0.413 0.329 0.310 5970 30329 0.320 5970 0.367 0.400 0.318 0.310 5970 5970 30329 0.360 357 4750 WM 0.329 0.357 5970 5970 3036 3030 5970 3036 3031 3031 3031 3031 3031 3031 <td>10</td> <td></td> <td></td> <td>1000</td> <td>****</td> <td></td> <td></td> <td>0070</td>	10			1000	****			0070
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VM 0.329 0.369 5320 0.348 0.385								
0.348 0.385	\ / 4			E220				
	VIVI			5320				
		0.347						

ullet Tolerance on each color bin (x , y) is \pm 0.01

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 Bin Structure

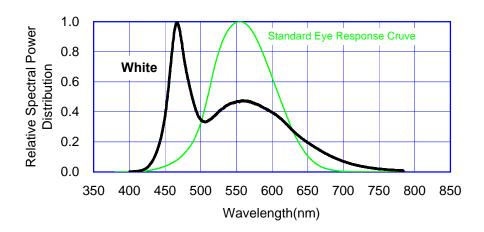
Bin Code	x	у	Typ. CCT (K)	Bin Code	x	у	Typ. CCT (K)
	0.453	0.416			0.409	0.400	
MO	0.444	0.399	2770	Q0	0.402	0.382	3370
	0.459	0.403 0.419			0.416	0.389	
	0.467 0.460	0.430			0.424 0.414	0.407 0.414	
	0.453	0.430			0.414	0.414	
M1	0.467	0.419	2770	Q1	0.424	0.407	3370
	0.473	0.432			0.430	0.421	
	0.459	0.403			0.416	0.389	
MA	0.444	0.399	2770	QA	0.402	0.382	3370
IVIA	0.436	0.384	2110	QA	0.396	0.367	3370
	0.451	0.389			0.410	0.374	
	0.471	0.451			0.421	0.433	
MM	0.460	0.430	2770	QM	0.414	0.414	3370
	0.473	0.432		Δ	0.430	0.421	33.3
	0.486	0.455			0.438	0.440	
	0.438	0.412			0.392	0.391	
N0	0.429 0.444	0.394 0.399	2950	R0	0.387 0.402	0.374 0.382	3650
	0.444	0.399			0.402	0.362	
	0.444	0.416			0.414	0.414	
	0.444	0.426			0.414	0.414	
N1	0.453	0.412	2950	R1	0.409	0.391	3650
	0.460	0.430			0.397	0.406	
	0.444	0.399			0.387	0.374	
NIA	0.429	0.394	2050	DΛ	0.383	0.360	2050
NA	0.422	0.379	2950	RA	0.396	0.367	3650
	0.436	0.384			0.402	0.382	
	0.454	0.446			0.421	0.433	
NM	0.444	0.426	2950	RM	0.414	0.414	3650
1 4141	0.460	0.430	2000	TXIVI	0.397	0.406	0000
	0.471	0.451			0.402	0.423	
	0.424	0.407			0.392	0.391	
P0	0.416	0.389	3150	S0	0.387	0.374	3950
	0.429	0.394 0.412			0.374	0.366 0.382	
	0.438				0.378		
	0.430 0.424	0.421 0.407			0.397 0.392	0.406 0.391	
P1	0.424	0.407	3150	S1	0.392	0.381	3950
	0.444	0.426			0.382	0.397	
	0.429	0.394			0.387	0.374	
DA	0.416	0.389	0450	0.4	0.383	0.360	2050
PA	0.410	0.374	3150	SA	0.370	0.351	3950
	0.422	0.379			0.374	0.366	
	0.438	0.440			0.402	0.423	
PM	0.430	0.421	3150	SM	0.397	0.406	3950
	0.444	0.426	0.00	Civi	0.382	0.397	3300
	0.454	0.446			0.386	0.413	

 $[\]bullet$ Tolerance on each color bin (x , y) is \pm 0.01

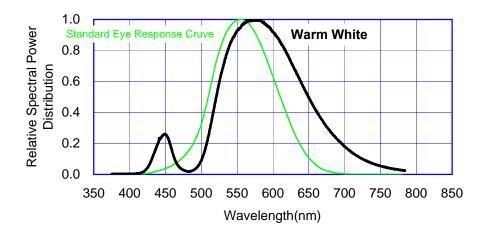
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

Color Spectrum, T_J = 25°C

1. White

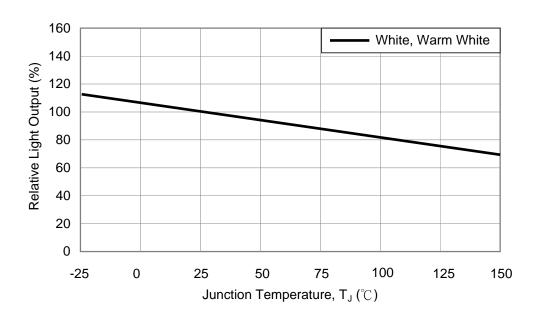


2. Warm White



Light Output Characteristics

Relative Light Output vs. Junction Temperature at 1000mA



Forward Current Characteristics, Tj=25°C

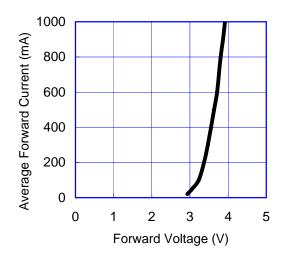


Fig 1. Forward Current vs. Forward Voltage for White and Warm White.

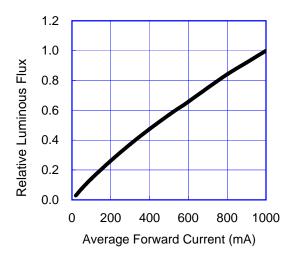
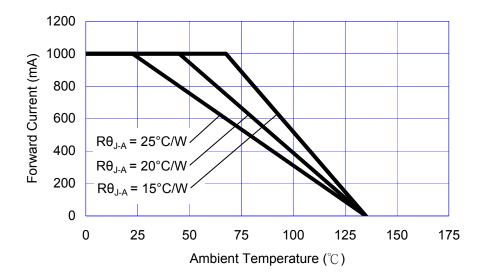


Fig 2. Relative Luminous Flux vs. Forward Current for White and Warm White at T_J =25 maintained.

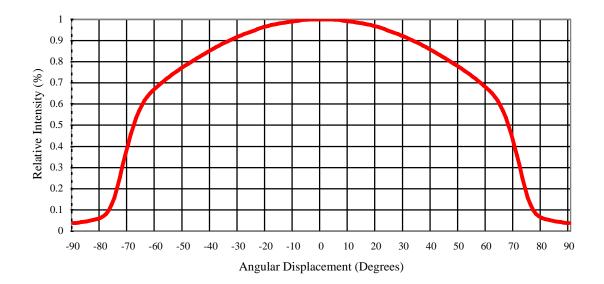
Ambient Temperature vs. Maximum Forward Current

White, Warm White $(T_{JMAX} = 135^{\circ}C)$



Typical Representative Spatial Radiation Pattern

Lambertian Radiation Pattern



Moisture Sensitivity Level - JEDEC 2a

			Soak Requirements			
Level	Floo	r Life	Stan	dard	Accelerated	Environment
	Time	Conditions	Time (hours)	Conditions	Time (hours)	Conditions
2a	4 weeks	≤30°C /	696 +5/-0	30°C /	120 +1/-0	60°C /
Za	4 Weeks	60% RH	090 +5/-0	60% RH	120 +1/-0	60% RH

- The standard soak time includes a default value of 24 hours for semiconductor manufature'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.

			Soak Requirements				
Level	Floor	r Life	Stan	dard	Accelerated	Environment	
	Time	Conditions	Time (hours)	Conditions	Time (hours)	Conditions	
1	Unlimited	≤30°C /	168 +5/-0	85°C /	NA	NA	
		85% RH		85% RH			
2	1 year	≤30°C /	168 +5/-0	85°C /	NA	NA	
	i yeai	60% RH	100 +5/-0	60% RH	INA	INA	
2a	4 weeks	≤30°C /	696 +5/-0	30°C /	120 +1/-0	60°C /	
Za	4 Weeks	60% RH	090 +5/-0	60% RH	120 +1/-0	60% RH	
3	168 hours	≤30°C /	192 +5/-0	30°C /	40 +1/-0	60°C /	
3	100 110015	60% RH	192 +5/-0	60% RH	40 +1/-0	60% RH	
4	72 hours	≤30°C /	96 +2/-0	30°C /	20 +0.5/-0	60°C /	
	72 Hours	60% RH	90 + 2/-0	60% RH	20 +0.5/-0	60% RH	
5	48 hours	≤30°C /	72 +2/-0	30°C /	15 +0.5/-0	60°C /	
3	40 Hours	60% RH	1 Z +2/-0	60% RH	15 +0.5/-0	60% RH	
5a	24 hours	≤30°C /	48 +2/-0	30°C /	10 +0.5/-0	60°C /	
Ja	24 HOUIS	60% RH	40 +2/-0	60% RH	10 +0.5/-0	60% RH	
6	Time on Label	≤30°C /	Time on Label	30°C /	NA	NA	
	(TOL)	60% RH	(TOL)	60% RH	INA	INA	

Qualification Reliability Testing

Stress Test	Stress Conditions	Stress Duration	Failure Criteria
Room Temperature	25°C, I_F = max DC (Note 1)	1000 hours	Note 2
Operating Life (RTOL)	20 0, if max be (Note 1)	1000 110013	14010 2
Wet High Temperature	85°C/60%RH, I _F = max DC (Note 1)	1000 hours	Note 2
Operating Life (WHTOL)	co erecretari, ip max 2 e (trete 1)	1000 110013	14010 2
Wet High Temperature	85°C/85%RH, non-operating	1000 hours	Note 2
Storage Life (WHTSL)	oo creerin in, non operating	1000 110010	11010 2
High Temperature	110°C, non-operating	1000 hours	Note 2
Storage Life (HTSL)	110 G, Holl opolating	1000 110010	11010 2
Low Temperature	-40°C, non-operating	1000 hours	Note 2
Storage Life (LTSL)	To G, Horr operating	1000 Hodio	11010 2
Non-operating	-40°C to 120°C, 30 min. dwell,	200 cycles	Note 2
Temperature Cycle (TMCL)	<5 min. transfer	200 090100	11010 2
Non-operating	-40°C to 120°C, 20 min. dwell,	200 cycles	Note 2
Thermal Shock (TMSK)	<20 sec. transfer	200 Gyoles	14010 2
Mechanical Shock	1500 G, 0.5 msec. pulse,		Note 3
Wiconamodi Chook	5 shocks each 6 axis		14010 0
Natural Drop	On concrete from 1.2 m, 3X		Note 3
Variable Vibration	10-2000-10 Hz, log or linear sweep rate,		
Frequency	20 G about 1 min., 1.5 mm, 3X/axis		Note 3
Solder Heat Resistance			Note 0
(SHR)	260°C ± 5°C, 10 sec.		Note 3
Solderability	Steam age for 16 hrs., then solder dip		Solder coverage
Coldorability	at 260°C for 5 sec.		on lead

Notes:

1. Depending on the maximum derating curve.

2. Criteria for judging failure

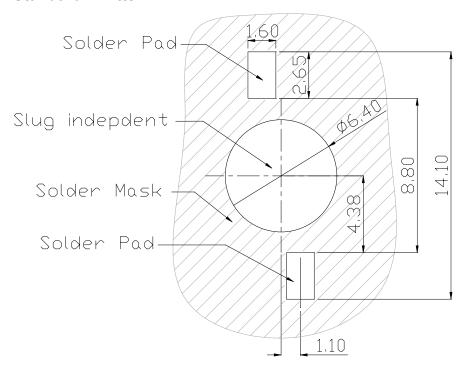
Item	Test Condition	Criteria for Judgement		
item	rest condition	Min.	Max.	
Forward Voltage (V _F)	I _F = max DC	-	Initial Level x 1.1	
Luminous Flux or Radiometric Power (Φ_V)	I _F = max DC	Initial Level x 0.7	-	
Reverse Current (I _R)	V _R = 5V	-	50 μA	

^{*} 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

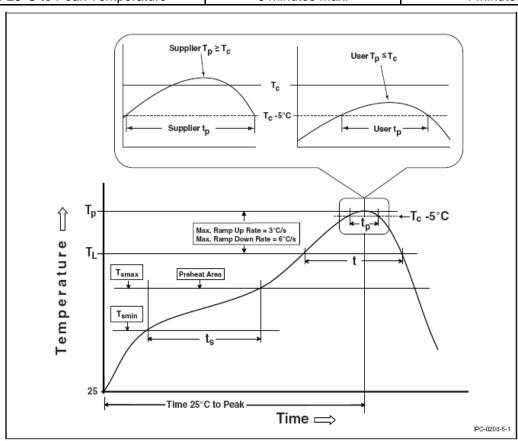
Standard Emitter



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

Reflow Soldering Condition

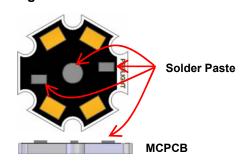
Profile Feature	Sn-Pb Eutectic Assembly	Low-Temp. & Pb-Free Assembly (58Bi-42Sn Eutectic Alloy)
Preheat & Soak		
Temperature min (T _{smin})	100 °C	90 °C
Temperature max (T _{smax})	150 °C	120 °C
Time (T _{smin} to T _{smax})	60-120 seconds	60-120 seconds
Average Ramp-Up Rate (T _{smax} to T _P)	3 °C / second max.	2 °C / second max.
Liquidous temperature (T _L)	183°C	138°C
Time at liquidous (t _L)	60-150 seconds	20-50 seconds
Peak package body temperature (T _P)	235°C	185°C
Time (t _P) within 5°C of the specified	20 seconds	20 seconds
classification temperature (T _C)		
Average ramp-down rate (T _P to T _{smax})	6 °C/second max.	3 °C/second max.
Time 25°C to Peak Temperature	6 minutes max.	4 minutes max.



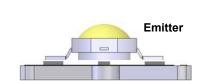
- All temperatures refer to topside of the package, measured on the package body surface.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a heat plate should be used. It should be confirmed beforehand whether the characteristics of LEDs will or will not be damaged by repairing.
- Reflow soldering should not be done more than two times.
- When soldering, do not put stress on the LEDs during heating.
- After soldering, do not warp the circuit board.

Heat Plate Soldering Condition

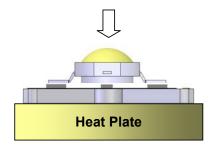
(1) Soldering Process for Solder Paste



Use Solder Mask to print Solder Paste on MCPCB.



Place Emitter on MCPCB.

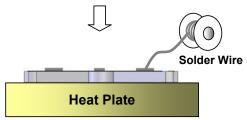


Put MCPCB on Heat Plate until Solder Paste melt. The Solder Paste sould be melted within 10 seconds. Take out MCPCB out from Heat Plate within 15 seconds.

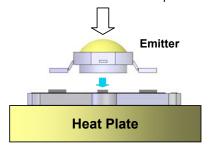
(2) Soldering Process for Solder Wire



Put MCPCB on Heat Plate.



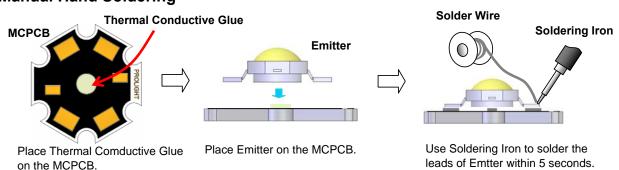
Place Solder Wire to the solder pad of MCPCB.



Put Emitter on MCPCB. Take the MCPCB out from Heat Plate within 10 seconds.

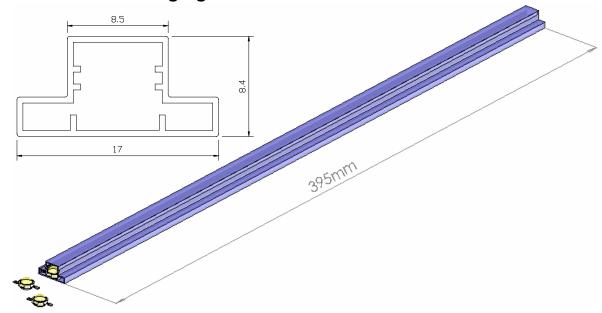
- Heat plate temperature: 230°C max for Lead Solder and 230°C max for Lead-Free Solder.
- We recommend using the 58Bi-42Sn eutectic alloy for low-temp. and lead free soldering (melting point = 138 °C).
- When soldering, do not put stress on the LEDs during heating.
- After soldering, do not warp the circuit board.

Manual Hand Soldering

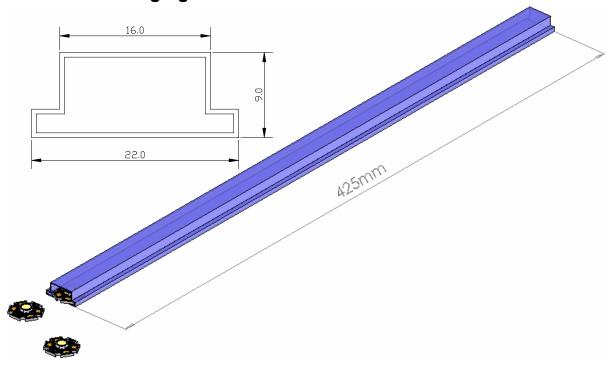


- For prototype builds or small series production runs it possible to place and solder the emitters by hand.
- Solder tip temperature: 230°C max for Lead Solder and 260°C max for Lead-Free Solder.
- Avoiding damage to the emitter or to the MCPCB dielectric layer. Damage to the epoxy layer can cause a short circuit in the array.
- Do not let the solder contact from solder pad to back-side of MCPCB. This one will cause a short circuit and damage emitter.

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 dimendions 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.

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 is not electrically neutral. Therefore, we recommend to isolate the heat sink.
- The slug is to be soldered. If not, please use the heat conductive adhesive.
- 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 decide 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)

