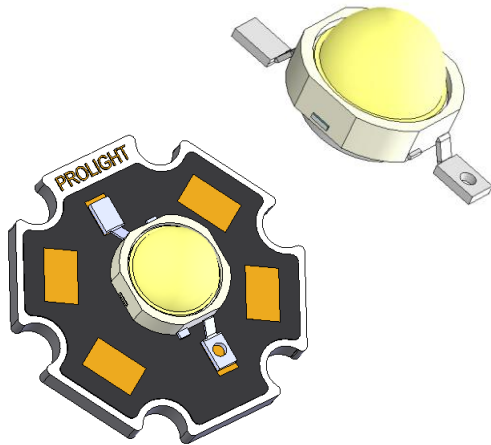




ProLight Opto
Technology Corporation



**ProLight PG1A-1Dxx
1W Power LED
Technical Datasheet
Version: 4.1**

Features

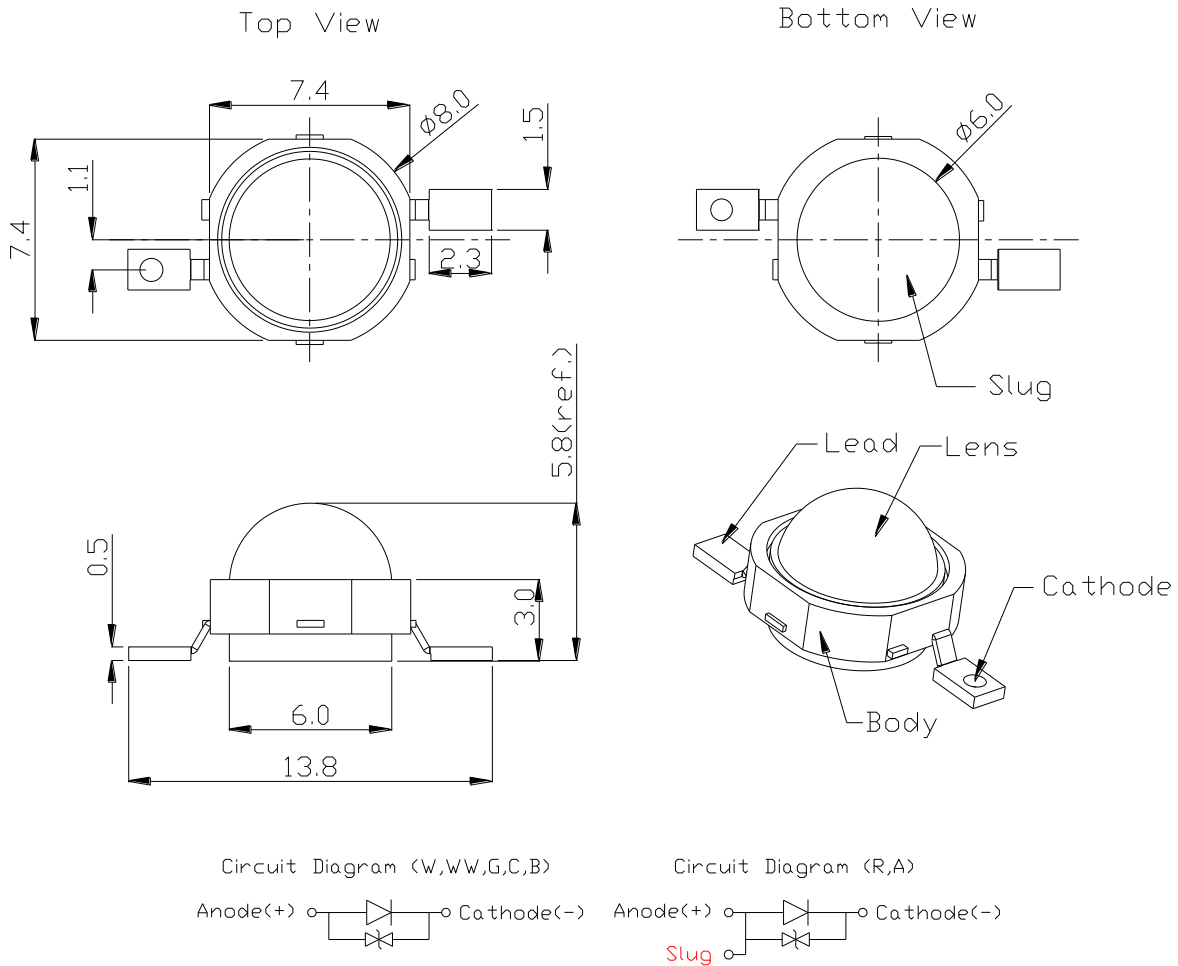
- High flux per LED
- Various colors
- Good color uniformity
- Moisture sensitivity level - JEDEC Level 2a
4 week floor life without reconditioning
- Low-temp. & lead free reflow soldering
- RoHS compliant
- More energy efficient than incandescent and most halogen lamps
- Low Voltage DC operated
- Instant 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

ProLight

Emitter Mechanical Dimensions

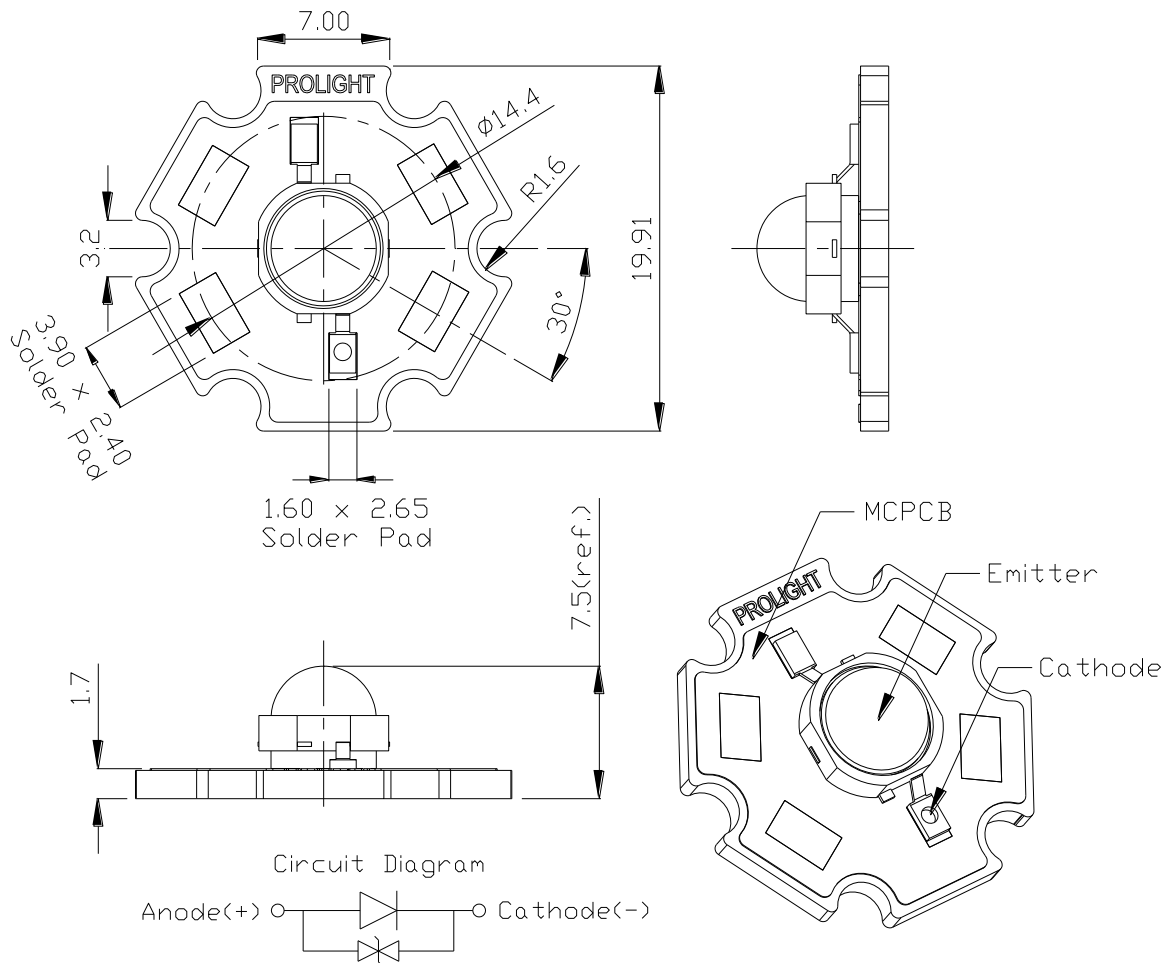


Notes:

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. 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 $\pm 0.20\text{mm}$.
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 ± 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.

ProLight

Flux Characteristics at 350mA, T_J = 25°C

| Radiation Pattern | Color | Part Number | | Lumious Flux Φ_V (lm) | |
|-------------------|------------|-------------|-----------|----------------------------|---------|
| | | Emitter | Star | Minimum | Typical |
| Dome | White | PG1A-1DWE | PG1A-1DWS | 87.4 | 123 |
| | Warm White | PG1A-1DVE | PG1A-1DVS | 87.4 | 118 |
| | Red | PG1A-1DRE | PG1A-1DRS | 39.8 | 47 |
| | Amber | PG1A-1DAE | PG1A-1DAS | 39.8 | 53 |
| | Green | PG1A-1DGE | PG1A-1DGS | 67.2 | 87 |
| | Cyan | PG1A-1DCE | PG1A-1DCS | 58.9 | 68 |
| | Blue | PG1A-1DBE | PG1A-1DBS | 18.1 | 21 |

- 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.

Electrical Characteristics at 350mA, T_J = 25°C

| Color | Forward Voltage V _F (V) | | | Thermal Resistance Junction to Slug (°C/ W) | Thermal Resistance Junction to Board (°C/ W) |
|------------|------------------------------------|------|------|---|--|
| | Min. | Typ. | Max. | | |
| White | 2.85 | 3.3 | 4.1 | 10 | 13 |
| Warm White | 2.85 | 3.3 | 4.1 | 10 | 13 |
| Red | 1.75 | 2.2 | 3.0 | 10 | 13 |
| Amber | 1.75 | 2.2 | 3.0 | 10 | 13 |
| Green | 2.85 | 3.4 | 4.1 | 10 | 13 |
| Cyan | 2.85 | 3.4 | 4.1 | 10 | 13 |
| Blue | 2.85 | 3.4 | 4.1 | 10 | 13 |

- ProLight maintains a tolerance of $\pm 0.1V$ for Voltage measurements.

Optical Characteristics at 350mA, T_J = 25°C

| Color | Dominant Wavelength λ_D , or Color Temperature CCT | | | Total included Angle (degrees) $\theta_{0.90V}$ | Viewing Angle (degrees) $2\theta_{1/2}$ |
|------------|--|--------|---------|---|---|
| | Min. | Typ. | Max. | | |
| White | 4100 K | 5500 K | 10000 K | 90 | 70 |
| Warm White | 2700 K | 3300 K | 4100 K | 90 | 70 |
| Red | 613.5 nm | 623 nm | 631 nm | 90 | 70 |
| Amber | 587 nm | 592 nm | 597 nm | 90 | 70 |
| Green | 515 nm | 525 nm | 535 nm | 90 | 70 |
| Cyan | 495 nm | 505 nm | 515 nm | 90 | 70 |
| Blue | 455 nm | 465 nm | 475 nm | 90 | 70 |

- ProLight maintains a tolerance of $\pm 1nm$ for dominant wavelength measurements.
- ProLight maintains a tolerance of $\pm 5\%$ for CCT measurements.

ProLight

Absolute Maximum Ratings

| Parameter | White/Warm White/ Red/Amber/Green/Cyan/Blue |
|--|--|
| DC Forward Current (mA) | 350 |
| Peak Pulsed Forward Current (mA) | 500 (less than 1/10 duty cycle@1KHz) |
| Average Forward Current (mA) | 350 |
| ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7) | ±4000V (Class III) |
| LED Junction Temperature | 120°C |
| Operating Board Temperature at Maximum DC Forward Current | -40°C - 105°C |
| Storage Temperature | -40°C - 120°C |
| Soldering Temperature | JEDEC 020c 235°C |
| Allowable Reflow Cycles | 3 |
| Reverse Voltage | Not designed to be driven in reverse bias |

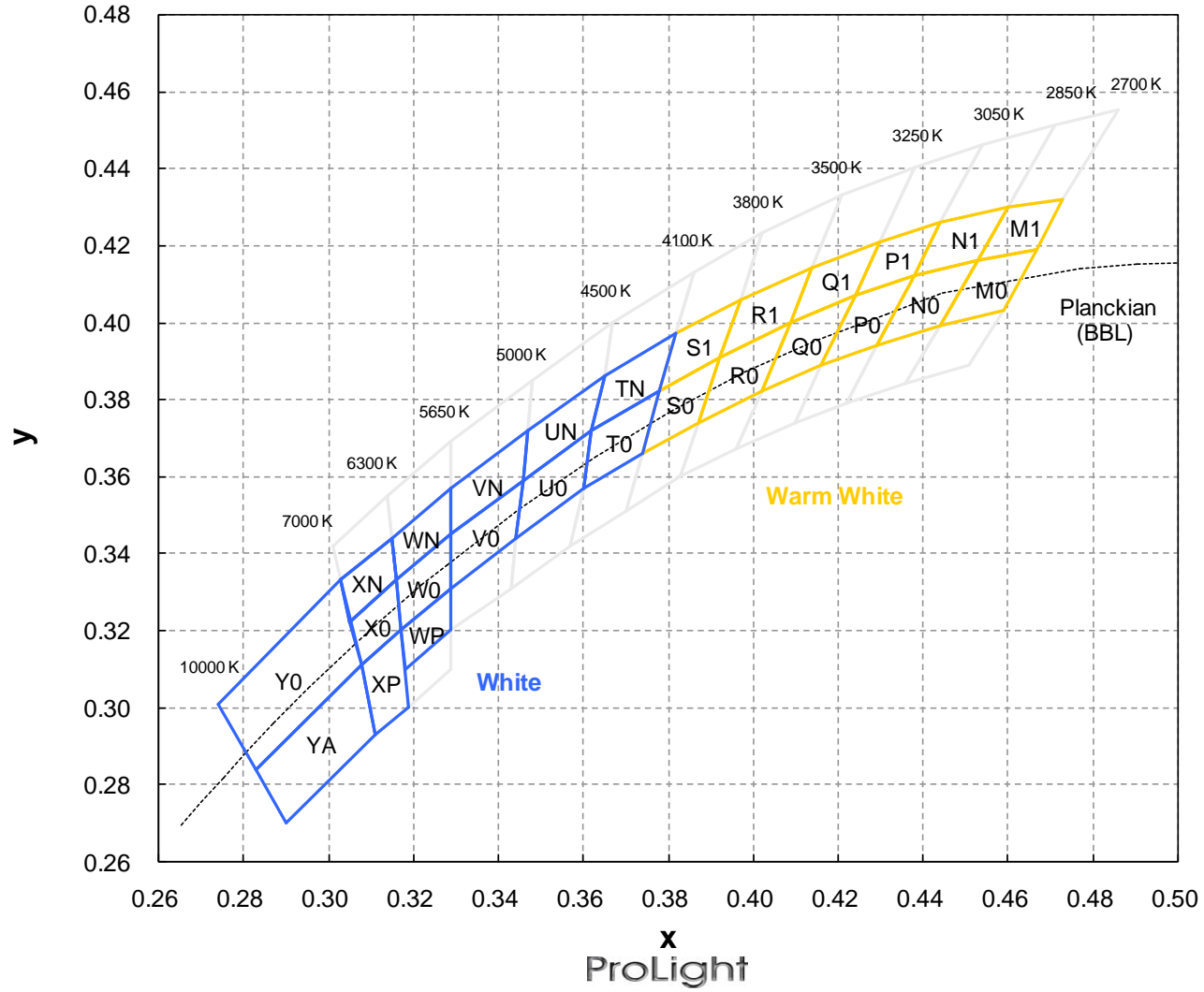
Photometric Luminous Flux Bin Structure

| Color | Bin Code | Minimum Photometric Flux (lm) | Maximum Photometric Flux (lm) | Available Color Bins |
|------------|----------|-------------------------------|-------------------------------|-----------------------|
| White | U1 | 87.4 | 99.6 | All |
| | U2 | 99.6 | 113.6 | All |
| | V1 | 113.6 | 129.5 | All |
| | V2 | 129.5 | 147.7 | [¹] |
| Warm White | U1 | 87.4 | 99.6 | All |
| | U2 | 99.6 | 113.6 | All |
| | V1 | 113.6 | 129.5 | All |
| | V2 | 129.5 | 147.7 | [¹] |
| Red | R | 39.8 | 51.7 | All |
| | S1 | 51.7 | 58.9 | [¹] |
| Amber | R | 39.8 | 51.7 | All |
| | S1 | 51.7 | 58.9 | [¹] |
| | S2 | 58.9 | 67.2 | [¹] |
| Green | T1 | 67.2 | 76.6 | All |
| | T2 | 76.6 | 87.4 | All |
| | U1 | 87.4 | 99.6 | All |
| | U2 | 99.6 | 113.6 | [¹] |
| Cyan | S2 | 58.9 | 67.2 | All |
| | T1 | 67.2 | 76.6 | All |
| | T2 | 76.6 | 87.4 | [¹] |
| Blue | N | 18.1 | 23.5 | A, 1 [¹] |
| | P | 23.5 | 30.6 | A, 1 [¹] |
| | Q | 30.6 | 39.8 | [¹] |

- 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.
- [¹] The rest of color bins are not 100% ready for order currently. Please ask for quote and order possibility.

Color Bin

White and Warm White Binning Structure Graphical Representation



Color Bins

White Bin Structure

| Bin Code | x | y | Typ. CCT (K) | Bin Code | x | y | Typ. CCT (K) |
|----------|-------|-------|--------------|----------|-------|-------|--------------|
| T0 | 0.378 | 0.382 | 4300 | WN | 0.329 | 0.345 | 5970 |
| | 0.374 | 0.366 | | | 0.316 | 0.333 | |
| | 0.360 | 0.357 | | | 0.315 | 0.344 | |
| | 0.362 | 0.372 | | | 0.329 | 0.357 | |
| TN | 0.382 | 0.397 | 4300 | WP | 0.329 | 0.331 | 5970 |
| | 0.378 | 0.382 | | | 0.329 | 0.320 | |
| | 0.362 | 0.372 | | | 0.318 | 0.310 | |
| | 0.365 | 0.386 | | | 0.317 | 0.320 | |
| U0 | 0.362 | 0.372 | 4750 | X0 | 0.308 | 0.311 | 6650 |
| | 0.360 | 0.357 | | | 0.305 | 0.322 | |
| | 0.344 | 0.344 | | | 0.316 | 0.333 | |
| | 0.346 | 0.359 | | | 0.317 | 0.320 | |
| UN | 0.365 | 0.386 | 4750 | XN | 0.305 | 0.322 | 6650 |
| | 0.362 | 0.372 | | | 0.303 | 0.333 | |
| | 0.346 | 0.359 | | | 0.315 | 0.344 | |
| | 0.347 | 0.372 | | | 0.316 | 0.333 | |
| V0 | 0.329 | 0.331 | 5320 | XP | 0.308 | 0.311 | 6650 |
| | 0.329 | 0.345 | | | 0.317 | 0.320 | |
| | 0.346 | 0.359 | | | 0.319 | 0.300 | |
| | 0.344 | 0.344 | | | 0.311 | 0.293 | |
| VN | 0.329 | 0.345 | 5320 | Y0 | 0.308 | 0.311 | 8000 |
| | 0.329 | 0.357 | | | 0.283 | 0.284 | |
| | 0.347 | 0.372 | | | 0.274 | 0.301 | |
| | 0.346 | 0.359 | | | 0.303 | 0.333 | |
| W0 | 0.329 | 0.345 | 5970 | YA | 0.308 | 0.311 | 8000 |
| | 0.329 | 0.331 | | | 0.311 | 0.293 | |
| | 0.317 | 0.320 | | | 0.290 | 0.270 | |
| | 0.316 | 0.333 | | | 0.283 | 0.284 | |

● Tolerance on each color bin (x , y) is ± 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 | y | Typ. CCT (K) | Bin Code | x | y | Typ. CCT (K) |
|----------|-------|-------|--------------|----------|-------|-------|--------------|
| M0 | 0.453 | 0.416 | 2770 | Q0 | 0.409 | 0.400 | 3370 |
| | 0.444 | 0.399 | | | 0.402 | 0.382 | |
| | 0.459 | 0.403 | | | 0.416 | 0.389 | |
| | 0.467 | 0.419 | | | 0.424 | 0.407 | |
| M1 | 0.460 | 0.430 | 2770 | Q1 | 0.414 | 0.414 | 3370 |
| | 0.453 | 0.416 | | | 0.409 | 0.400 | |
| | 0.467 | 0.419 | | | 0.424 | 0.407 | |
| | 0.473 | 0.432 | | | 0.430 | 0.421 | |
| N0 | 0.438 | 0.412 | 2950 | R0 | 0.392 | 0.391 | 3650 |
| | 0.429 | 0.394 | | | 0.387 | 0.374 | |
| | 0.444 | 0.399 | | | 0.402 | 0.382 | |
| | 0.453 | 0.416 | | | 0.409 | 0.400 | |
| N1 | 0.444 | 0.426 | 2950 | R1 | 0.414 | 0.414 | 3650 |
| | 0.438 | 0.412 | | | 0.409 | 0.400 | |
| | 0.453 | 0.416 | | | 0.392 | 0.391 | |
| | 0.460 | 0.430 | | | 0.397 | 0.406 | |
| P0 | 0.424 | 0.407 | 3150 | S0 | 0.392 | 0.391 | 3950 |
| | 0.416 | 0.389 | | | 0.387 | 0.374 | |
| | 0.429 | 0.394 | | | 0.374 | 0.366 | |
| | 0.438 | 0.412 | | | 0.378 | 0.382 | |
| P1 | 0.430 | 0.421 | 3150 | S1 | 0.397 | 0.406 | 3950 |
| | 0.424 | 0.407 | | | 0.392 | 0.391 | |
| | 0.438 | 0.412 | | | 0.378 | 0.382 | |
| | 0.444 | 0.426 | | | 0.382 | 0.397 | |

- Tolerance on each color bin (x , y) is ± 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.

Dominant Wavelength Bin Structure

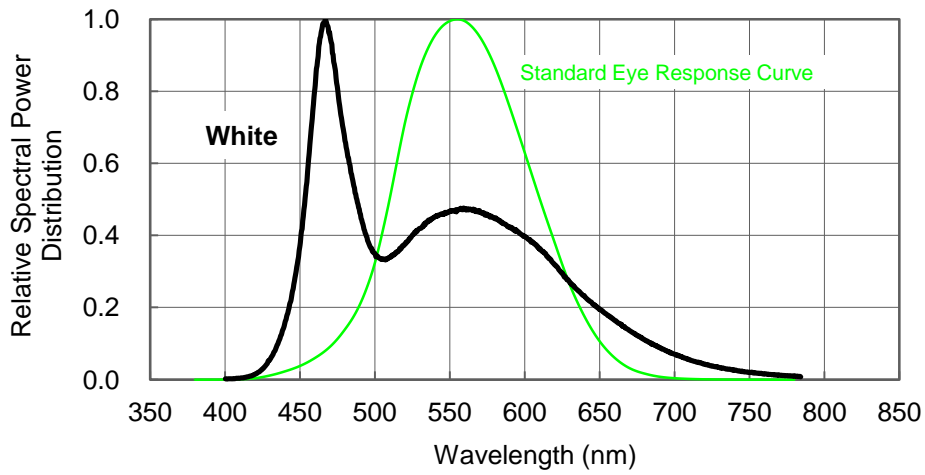
| Color | Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|-------|----------|----------------------------------|----------------------------------|
| Red | 2 | 613.5 | 620.5 |
| | 4 | 620.5 | 631.0 |
| Amber | 2 | 587.0 | 589.5 |
| | 4 | 589.5 | 592.0 |
| | 6 | 592.0 | 594.5 |
| | 7 | 594.5 | 597.0 |
| Green | A | 515 | 520 |
| | 1 | 520 | 525 |
| | 2 | 525 | 530 |
| | 3 | 530 | 535 |
| Cyan | A | 495 | 500 |
| | 1 | 500 | 505 |
| | 2 | 505 | 510 |
| | 3 | 510 | 515 |
| Blue | A | 455 | 460 |
| | 1 | 460 | 465 |
| | 2 | 465 | 470 |
| | 3 | 470 | 475 |

- ProLight maintains a tolerance of ± 1 nm for dominant wavelength measurements.

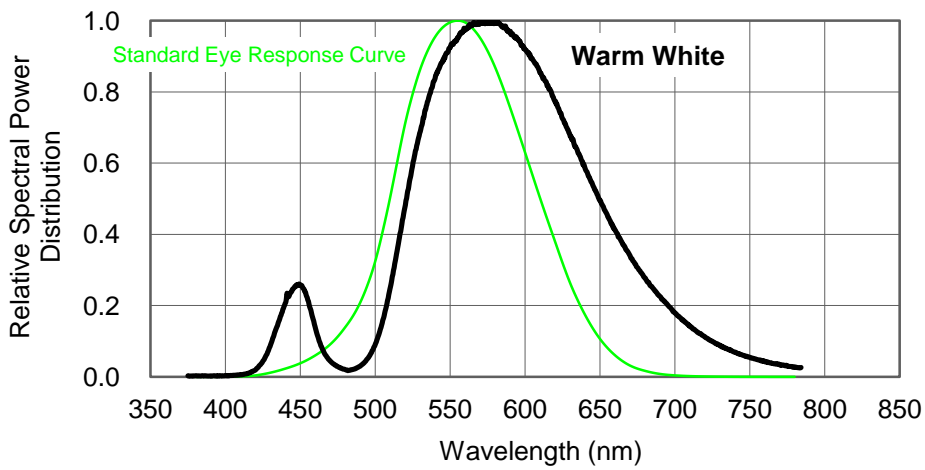
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

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

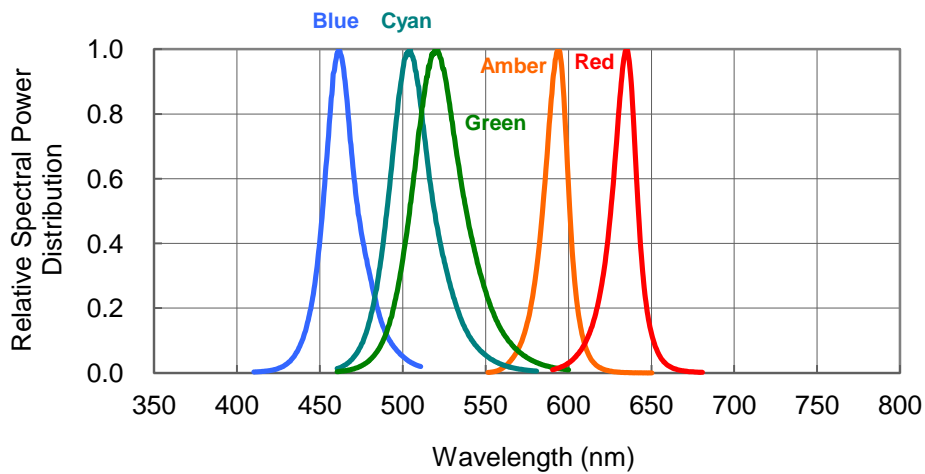
1. White



2. Warm White

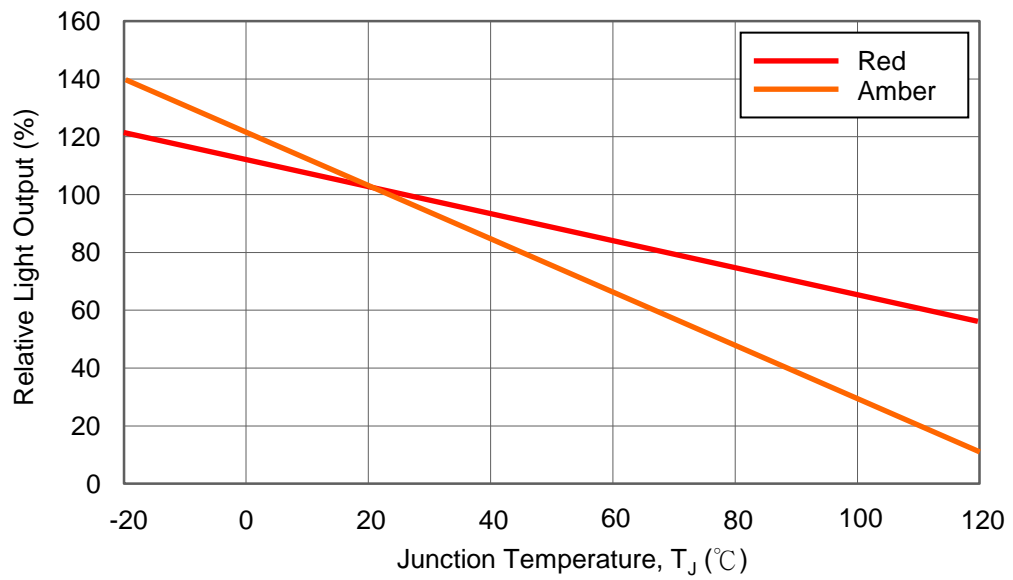
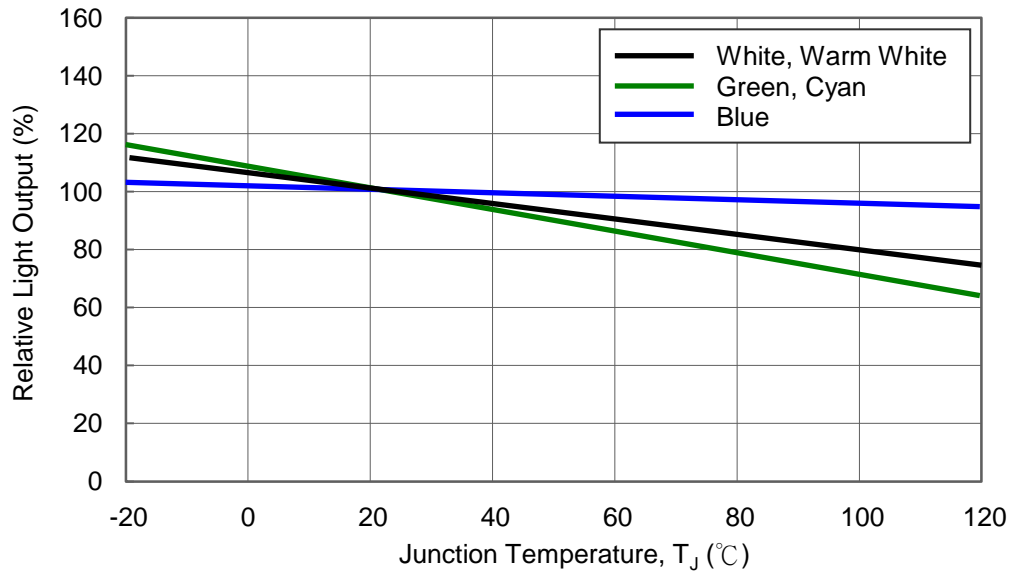


3. Blue 、 Cyan 、 Green 、 Amber 、 Red



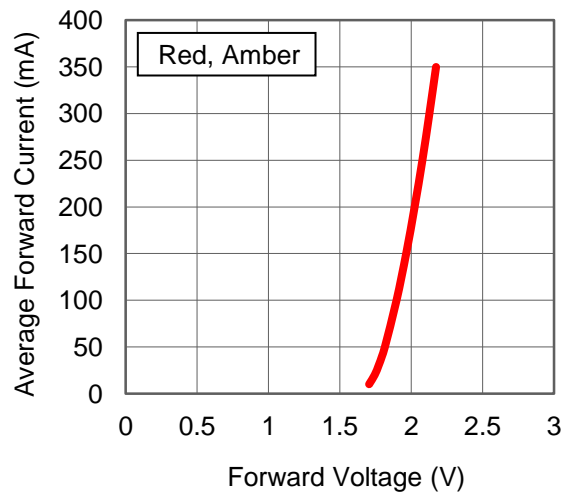
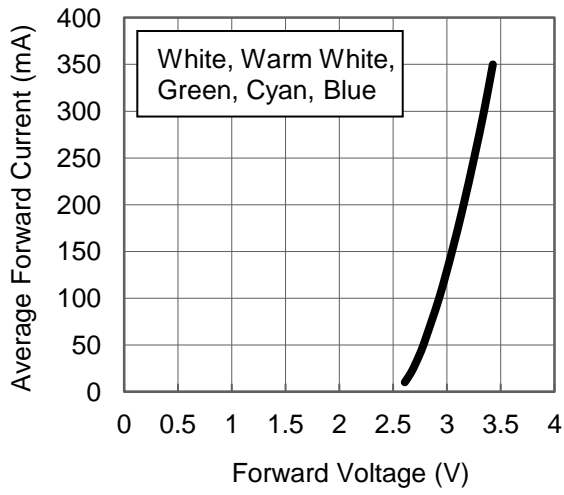
Light Output Characteristics

Relative Light Output vs. Junction Temperature at 350mA

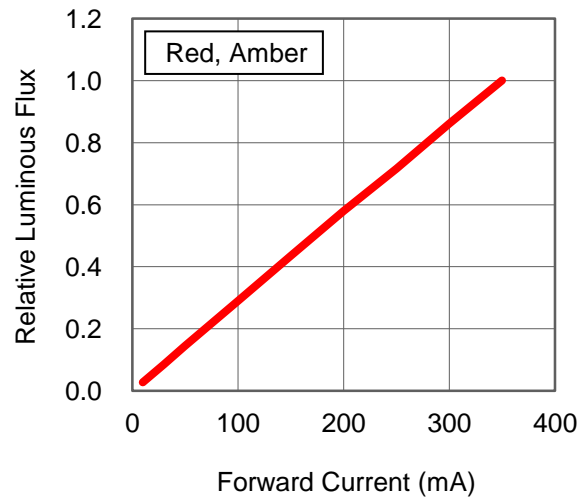
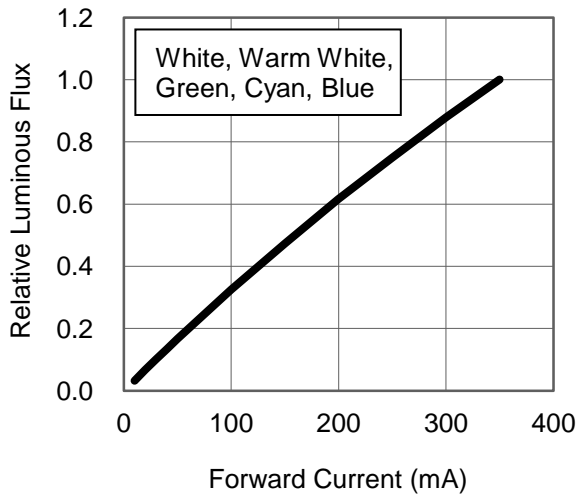


Forward Current Characteristics, $T_J = 25^\circ\text{C}$

1. Forward Voltage vs. Forward Current

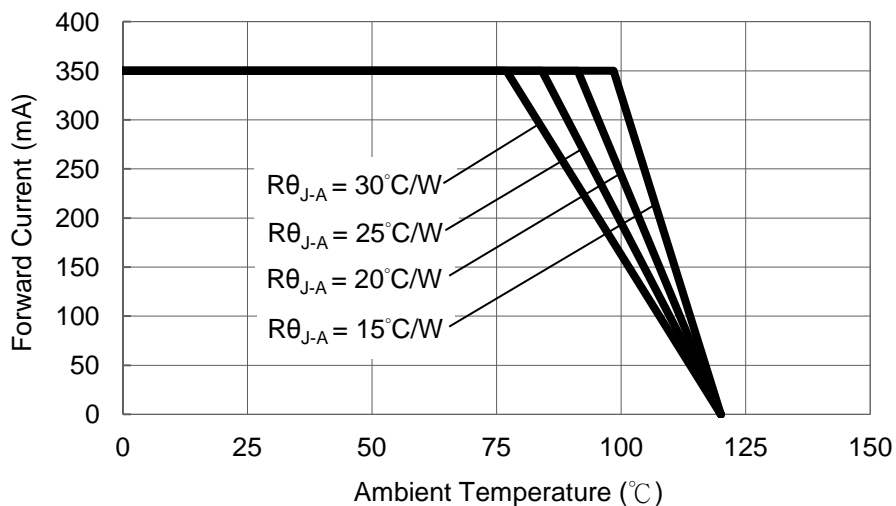


2. Forward Current vs. Normalized Relative Luminous Flux

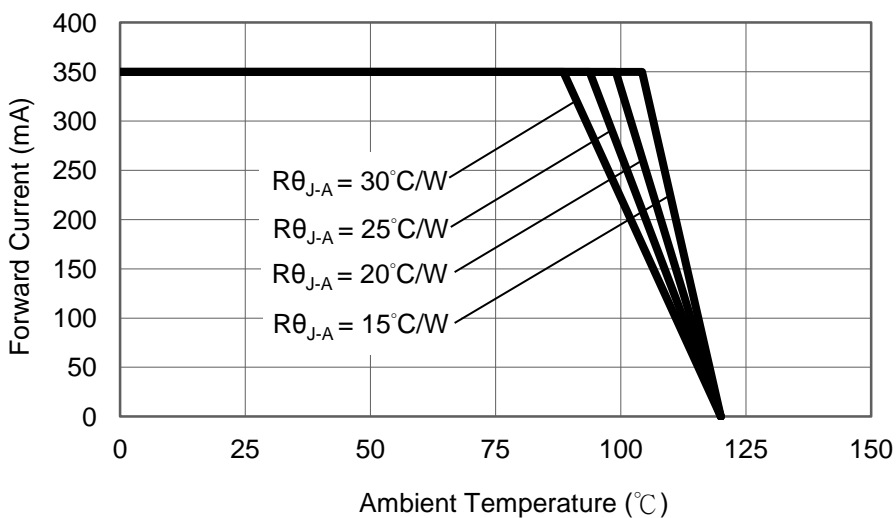


Ambient Temperature vs. Maximum Forward Current

1. White, Warm White, Green, Cyan, Blue ($T_{JMAX} = 120^{\circ}C$)

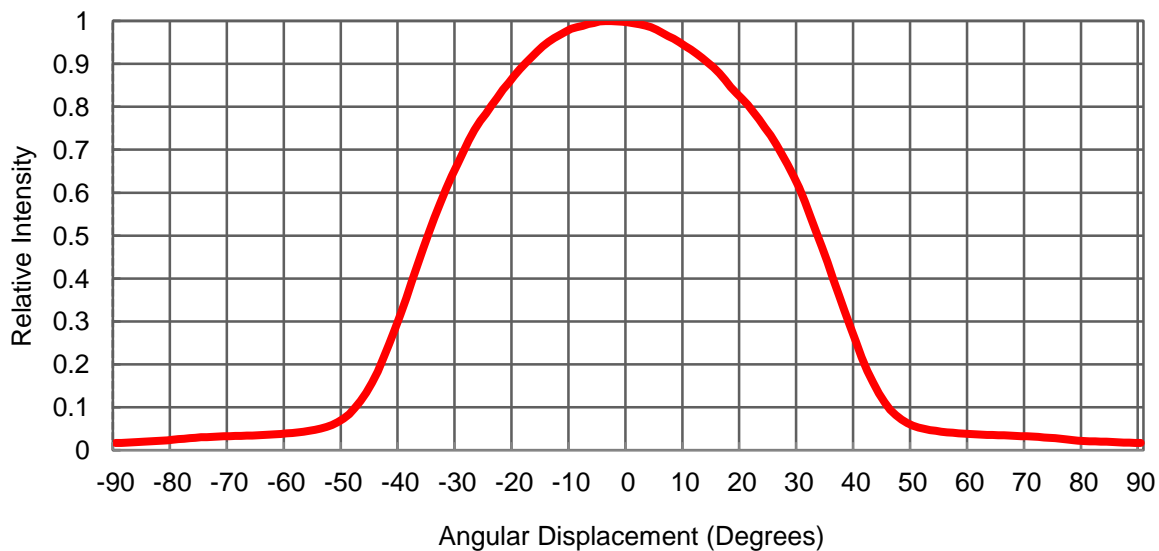


2. Red, Amber ($T_{JMAX} = 120^{\circ}C$)



Typical Representative Spatial Radiation Pattern

Dome 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:

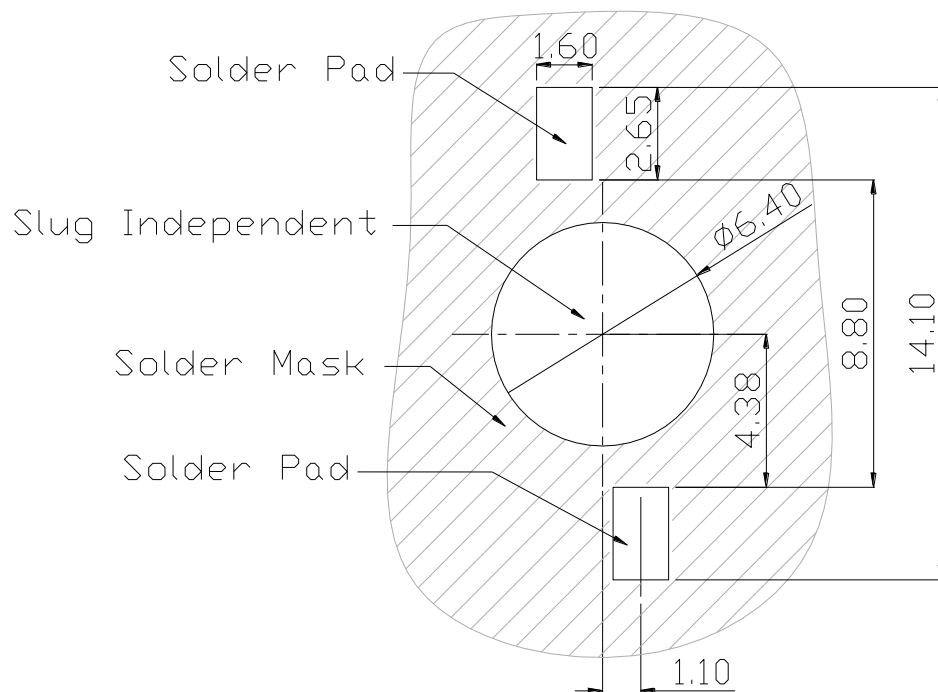
1. Depending on the maximum derating curve.
2. Criteria for judging failure

| 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 (Φ_V) | $I_F = \text{max DC}$ | 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.

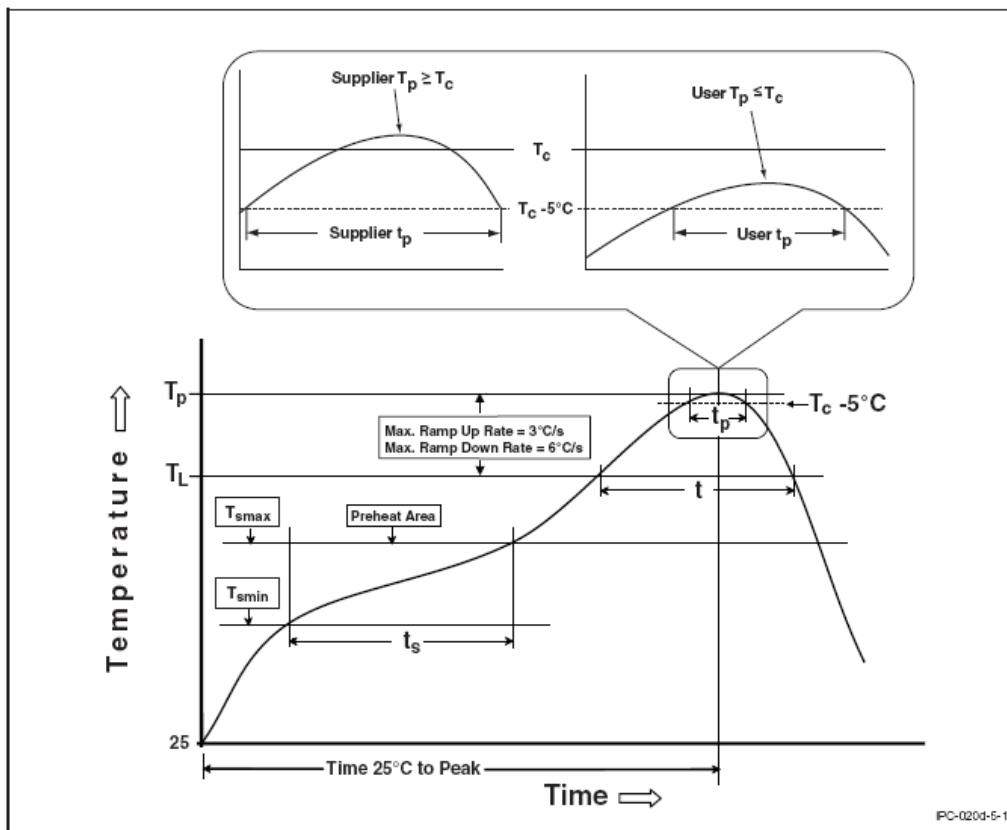
Recommended Solder Pad Design



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

Reflow Soldering Condition

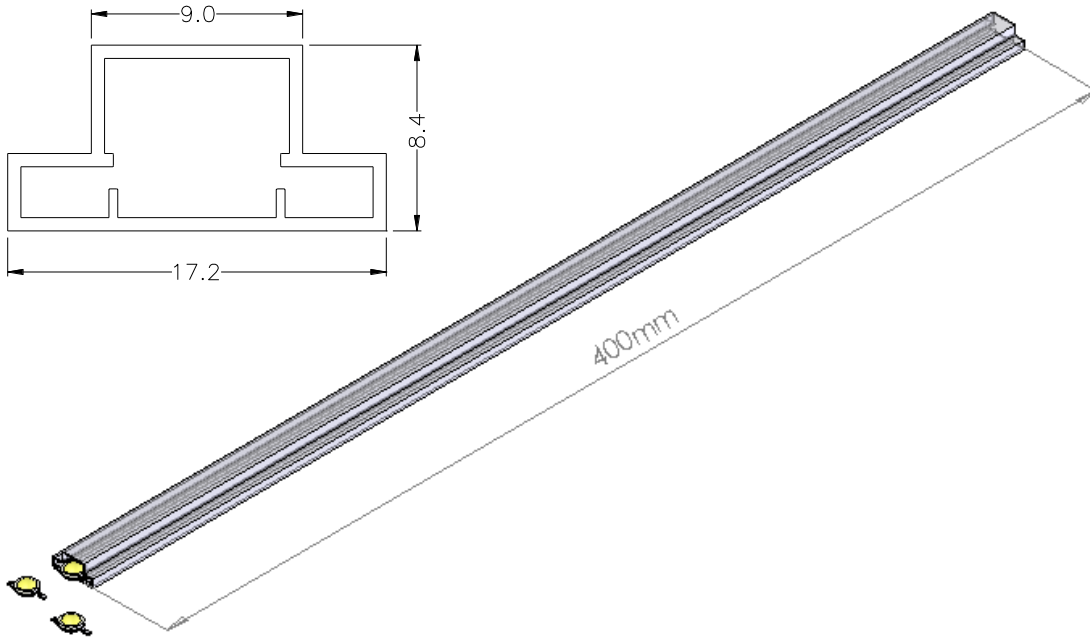
| Profile Feature | Sn-Pb Eutectic Assembly | Low-Temp. & Pb-Free Assembly (58Bi-42Sn Eutectic Alloy) |
|---|-------------------------|--|
| Preheat & Soak | | |
| Temperature min (T_{smin}) | 100 °C | 90 °C |
| Temperature max (T_{smax}) | 150 °C | 120 °C |
| Time (T_{smin} to T_{smax}) | 60-120 seconds | 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 classification temperature (T_C) | 20 seconds | 20 seconds |
| 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. |



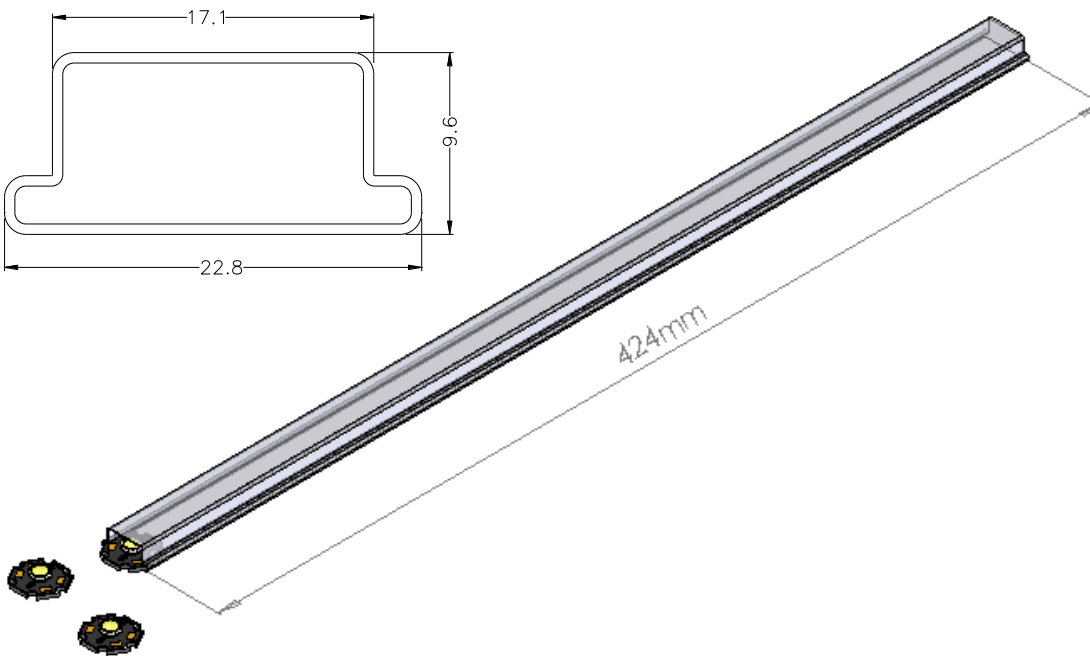
- All temperatures refer to topside of the package, measured on the package body surface.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a heat plate should be used. It should be confirmed beforehand whether the characteristics of LEDs will or will not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

ProLight

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.

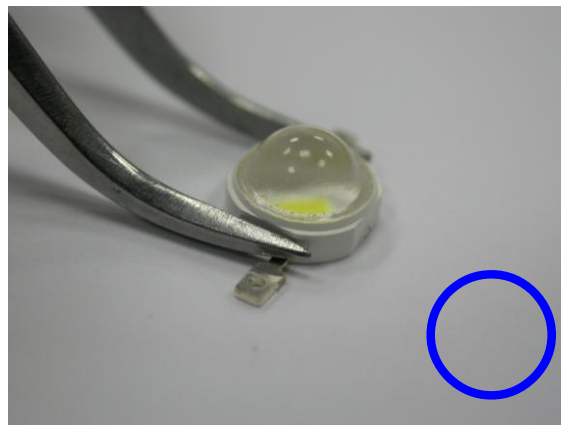
Precaution for Use

- 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.
- 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)



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