ProLight Opto
Technology Corporation

**ProLight PM2E-3LxE-xxx**
**3W High CRI Power LED**
**Technical Datasheet**
**Version: 1.4**

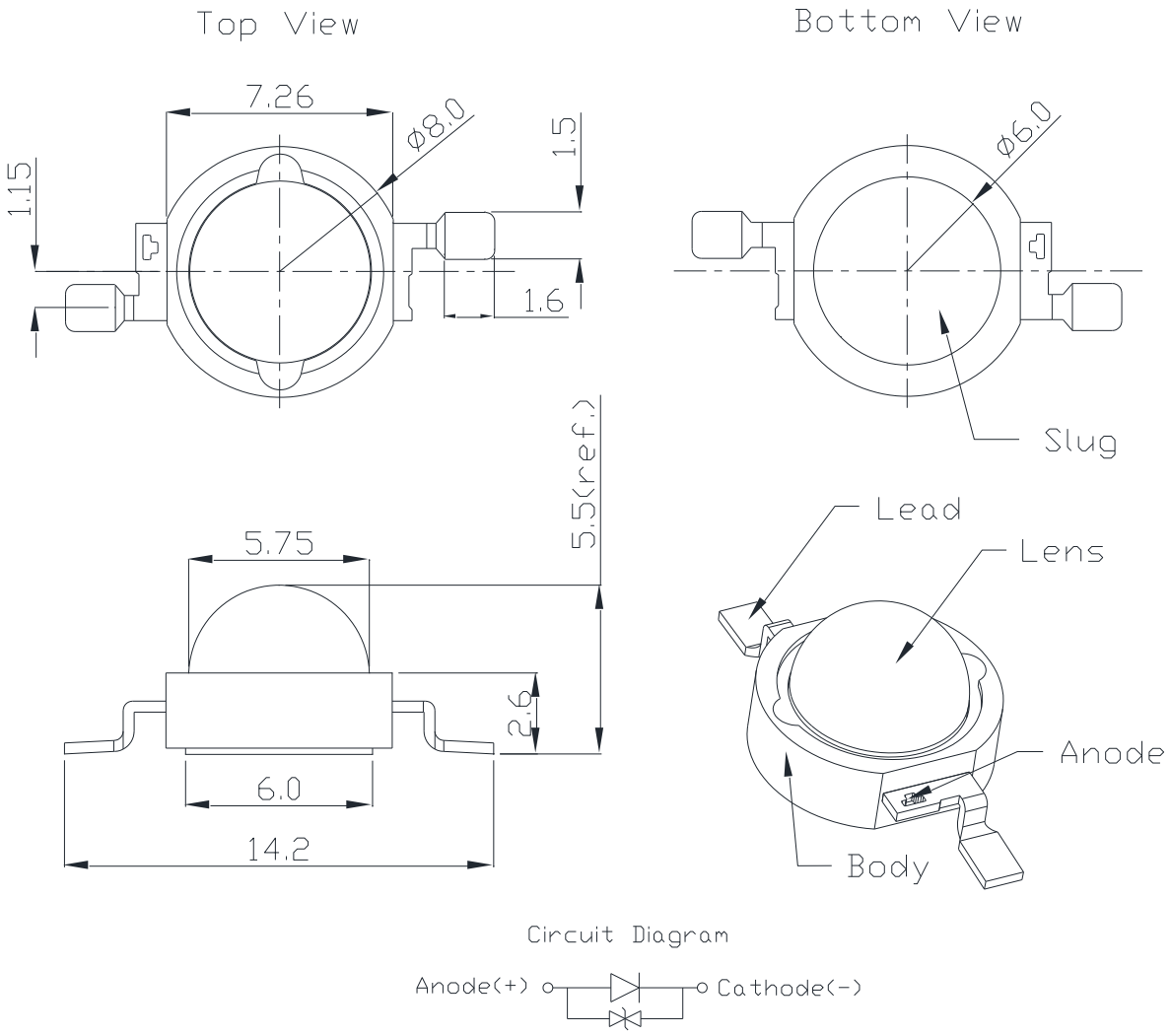
## Features

- Good color uniformity
- Industry best moisture sensitivity level - JEDEC Level 1
- 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 Anode 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 ± 0.20mm.
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.

## Flux Characteristics, $T_J$ = 25°C

| Radiation Pattern | Color | Part Number Emitter | Luminous Flux $\Phi_V$ (lm) @700mA Minimum | @700mA Typical | Refer @350mA Typical | CRI Typical |
|---|---|---|---|---|---|---|
| Lambertian | White | PM2E-3LWE-SD | 218.9 | 274 | 153 | 74 |
| | Warm White | PM2E-3LVE-R7 | 192 | 226 | 126 | 77 |
| | White | PM2E-3LWE-R8 | 192 | 244 | 136 | 84 |
| | Warm White | PM2E-3LVE-R8 | 192 | 221 | 123 | 80 |
| | Warm White | PM2E-3LVE-R95 | 147.7 | 181 | 101 | 95 |

- ProLight maintains a tolerance of ± 7% on flux and power measurements.
- Please do not drive at rated current more than 1 second without proper heat sink.

## Electrical Characteristics, $T_J$ = 25°C

| Color | Forward Voltage $V_F$ (V) @700mA Min. | Typ. | Max. | Refer @350mA Typ. | Thermal Resistance Junction to Slug (°C/ W) |
|---|---|---|---|---|---|
| White | 3.1 | 3.5 | 4.1 | 3.1 | 8 |
| Warm White | 3.1 | 3.5 | 4.1 | 3.1 | 8 |

- ProLight maintains a tolerance of ± 0.1V for Voltage measurements.

## Optical Characteristics at 700mA, $T_J$ = 25°C

| Color | Color Temperature CCT Min. | Typ. | Max. | Total included Angle (degrees) $\theta_{0.90V}$ | Viewing Angle (degrees) $2\theta_{1/2}$ |
|---|---|---|---|---|---|
| White | 4100 K | 5500 K | 10000 K | 180 | 130 |
| Warm White | 2700 K | 3300 K | 4100 K | 180 | 130 |

- ProLight maintains a tolerance of ± 5% for CCT measurements.

## Electro-Optical Characteristics, $T_J$ = 25°C

| $I_F$ (mA) | $V_F$ (V) | Power (W) | PM2E-3LWE-SD Flux (lm) | PM2E-3LVE-R7 Flux (lm) | |
|---|---|---|---|---|---|
| 250 | 3.02 | 0.76 | 112.6 | 92.9 | |
| 300 | 3.08 | 0.92 | 133.2 | 109.8 | |
| 350 | 3.14 | 1.10 | 152.8 | 126.0 | |
| 400 | 3.19 | 1.28 | 171.8 | 141.7 | |
| 500 | 3.30 | 1.65 | 208.2 | 171.7 | |
| 600 | 3.40 | 2.04 | 242.1 | 199.7 | |
| 700 | 3.50 | 2.45 | 274.0 | 226.0 | |
| 800 | 3.60 | 2.88 | 304.2 | 250.9 | |
| **$I_F$ (mA)** | **$V_F$ (V)** | **Power (W)** | **PM2E-3LWE-R8 Flux (lm)** | **PM2E-3LVE-R8 Flux (lm)** | **PM2E-3LVE-R95 Flux (lm)** |
| 250 | 3.02 | 0.76 | 100.2 | 90.8 | 74.4 |
| 300 | 3.08 | 0.92 | 118.6 | 107.4 | 88.0 |
| 350 | 3.14 | 1.10 | 136.1 | 123.2 | 100.9 |
| 400 | 3.19 | 1.28 | 153.0 | 138.6 | 113.5 |
| 500 | 3.30 | 1.65 | 185.4 | 167.9 | 137.5 |
| 600 | 3.40 | 2.04 | 215.6 | 195.3 | 159.9 |
| 700 | 3.50 | 2.45 | 244.0 | 221.0 | 181.0 |
| 800 | 3.60 | 2.88 | 270.9 | 245.3 | 200.9 |

- All values are reference only.

## Absolute Maximum Ratings

| Parameter | White/Warm White |
|---|---|
| DC Forward Current (mA) | 700 |
| Peak Pulsed Forward Current (mA) | 1000 (less than 1/10 duty cycle@1KHz) |
| 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 - 90°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 at 700mA

| Part Number | Bin Code | Minimum Photometric Flux (lm) | Maximum Photometric Flux (lm) | Available Color Bins |
|---|---|---|---|---|
| PM2E-3LWE-SD | X2 | 218.9 | 249.6 | All |
| | Y1 | 249.6 | 284.5 | All |
| | Y2 | 284.5 | 324.5 | 【1】 |
| PM2E-3LVE-R7 | X1 | 192 | 218.9 | All |
| | X2 | 218.9 | 249.6 | All |
| | Y1 | 249.6 | 284.5 | 【1】 |
| PM2E-3LWE-R8 | X1 | 192 | 218.9 | All |
| | X2 | 218.9 | 249.6 | All |
| | Y1 | 249.6 | 284.5 | 【1】 |
| PM2E-3LVE-R8 | X1 | 192 | 218.9 | All |
| | X2 | 218.9 | 249.6 | 【1】 |
| | Y1 | 249.6 | 284.5 | 【1】 |
| PM2E-3LVE-R95 | W1 | 147.7 | 168.4 | All |
| | W2 | 168.4 | 192 | All |
| | X1 | 192 | 218.9 | 【1】 |

- ProLight maintains a tolerance of ± 7% 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.

## Forward Voltage Bin Structure at 700mA

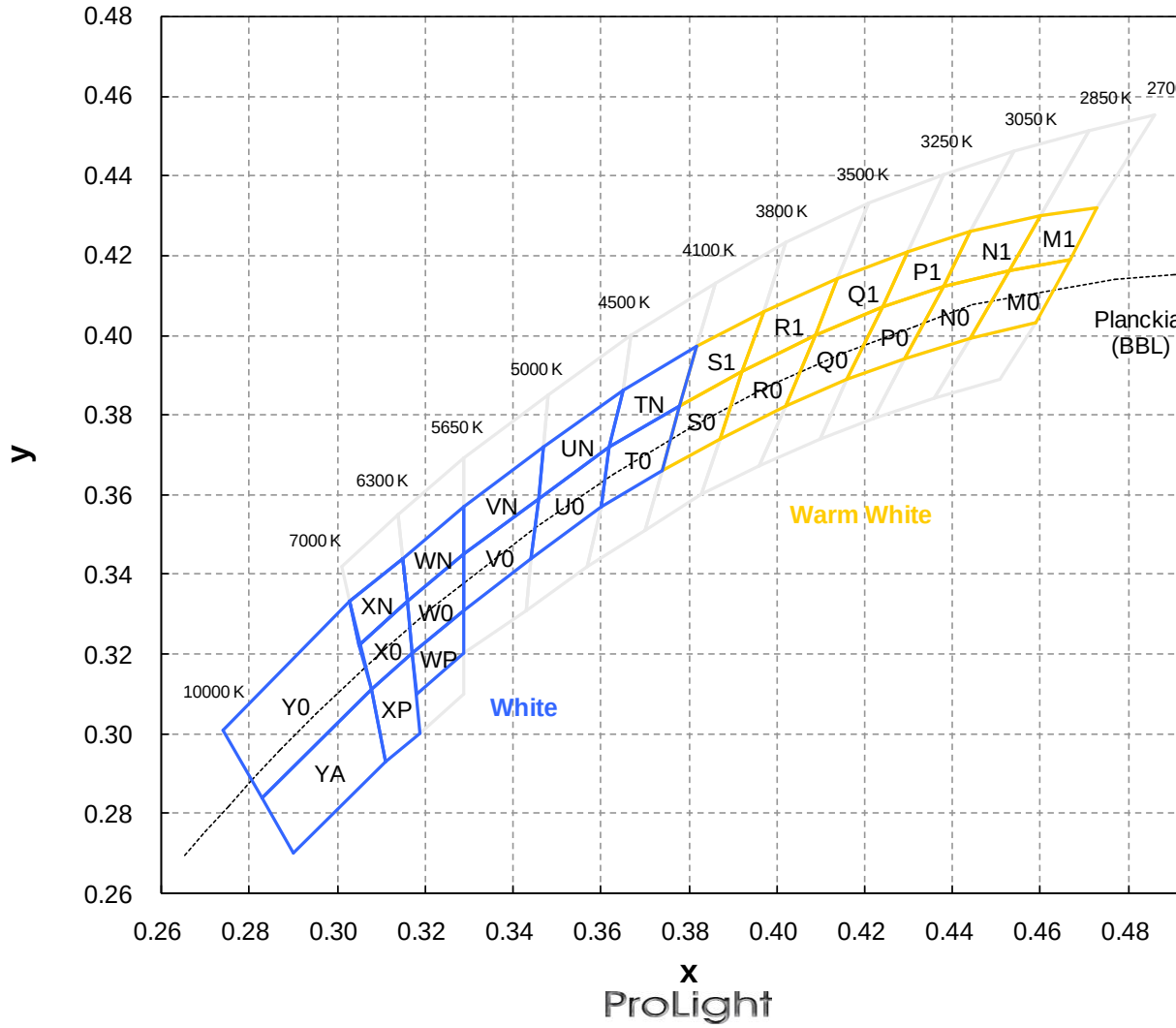
| Color | Bin Code | Minimum Voltage (V) | Maximum Voltage (V) |
|---|---|---|---|
| White | B | 3.10 | 3.35 |
| | D | 3.35 | 3.60 |
| | E | 3.60 | 3.85 |
| | F | 3.85 | 4.10 |
| Warm White | B | 3.10 | 3.35 |
| | D | 3.35 | 3.60 |
| | E | 3.60 | 3.85 |
| | F | 3.85 | 4.10 |

- ProLight maintains a tolerance of ± 0.1V 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 Bin

### White and Warm White Binning Structure Graphical Representation




ProLight

## 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 ± 0.005

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

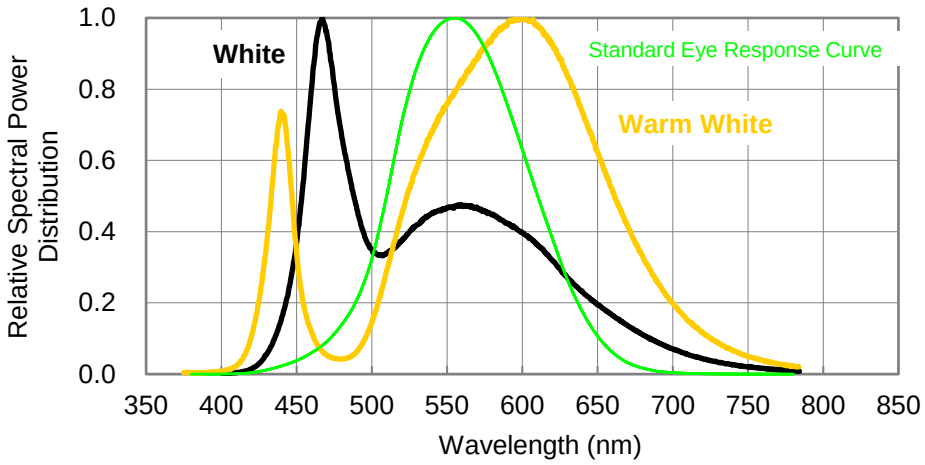
| Bin Code | x | y | Typ. CCT (K) | Bin Code | x | y | Typ. CCT (K) |
|---|---|---|---|---|---|---|---|
| M0 | 0.453 | 0.416 | 2770 | Q0 | 0.409 | 0.400 | 3370 |
| | 0.444 | 0.399 | | | 0.402 | 0.382 | |
| | 0.459 | 0.403 | | | 0.416 | 0.389 | |
| | 0.467 | 0.419 | | | 0.424 | 0.407 | |
| M1 | 0.460 | 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 ± 0.005

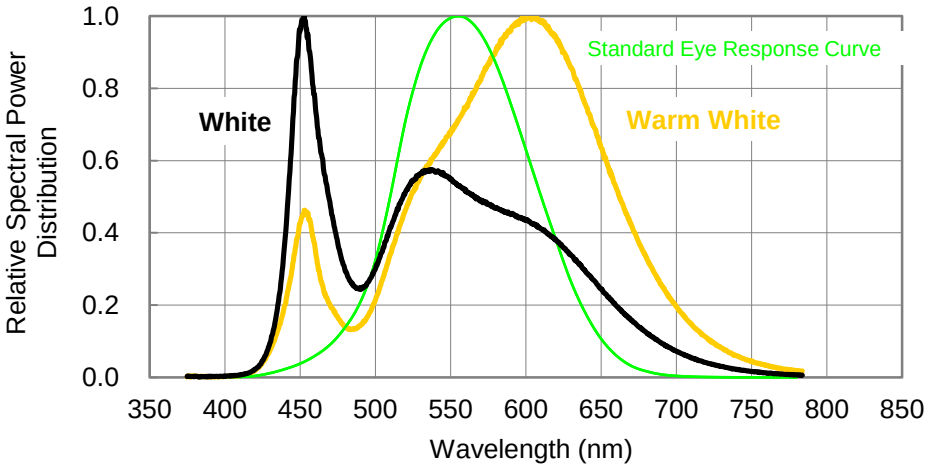
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

## Color Spectrum, $T_J$ = 25°C

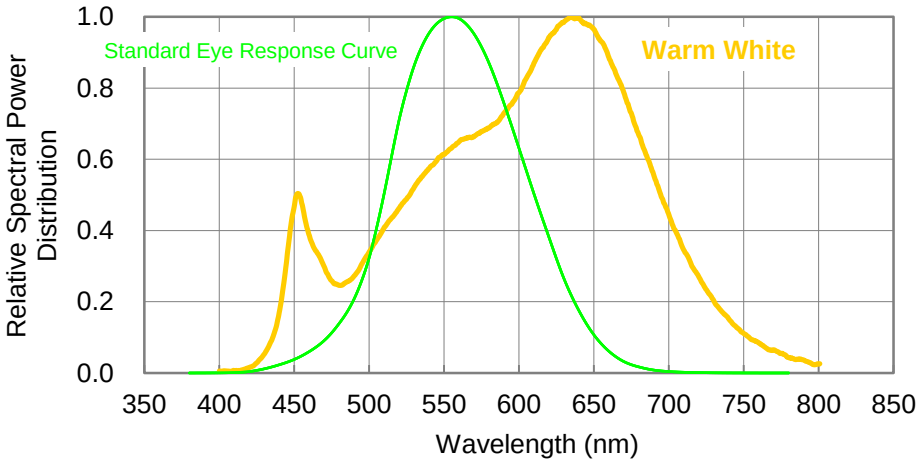
### 1. PM2E-3LWE-SD、PM2E-3LVE-R7




### 2. PM2E-3LWE-R8、PM2E-3LVE-R8

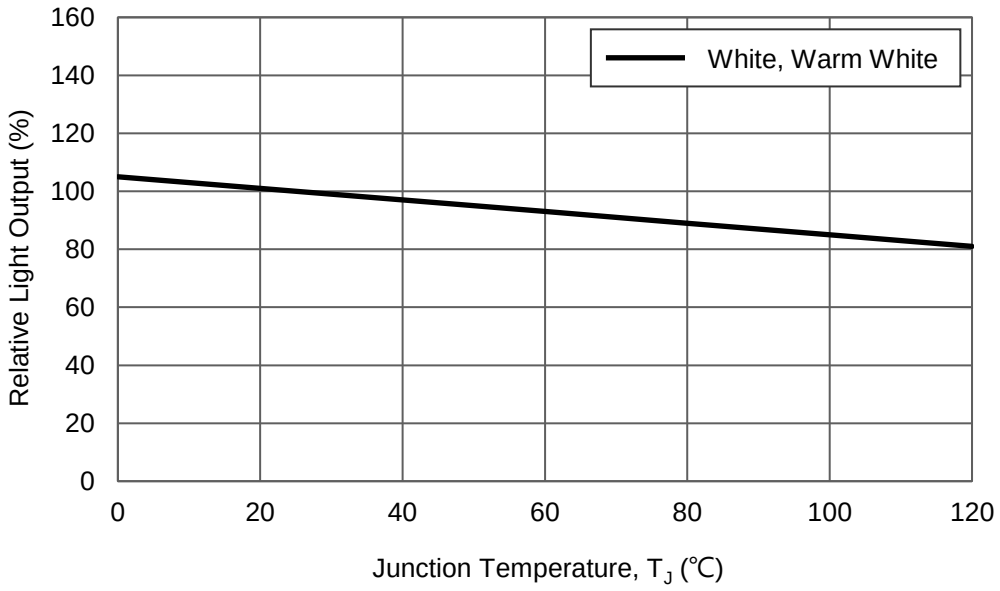



### 3. PM2E-3LVE-R95



## Light Output Characteristics

### Relative Light Output vs. Junction Temperature at 700mA




## Forward Current Characteristics, $T_J$ = 25°C

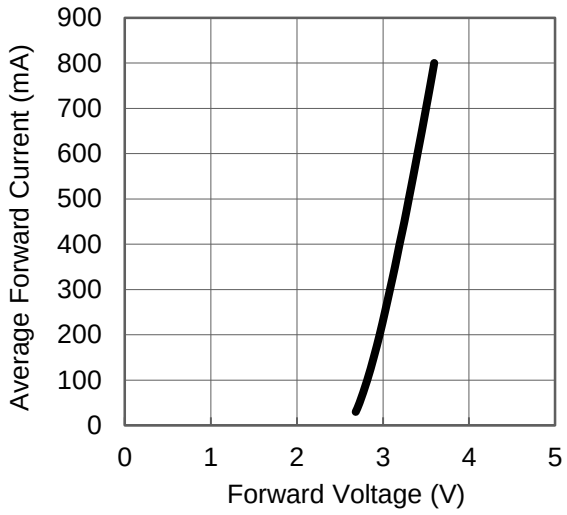



Fig 1. Forward Current vs. Forward Voltage for White, Warm White.

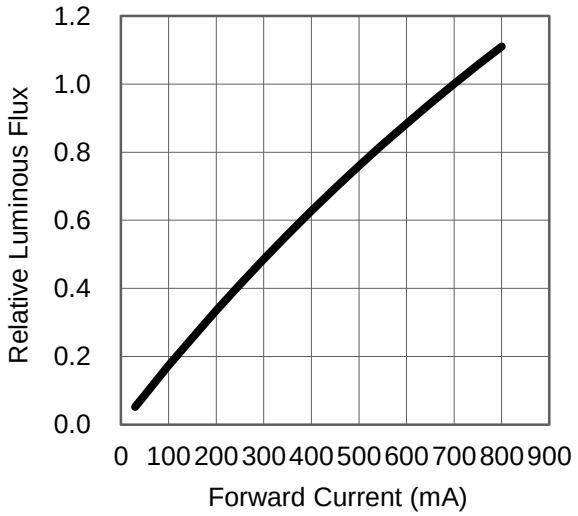
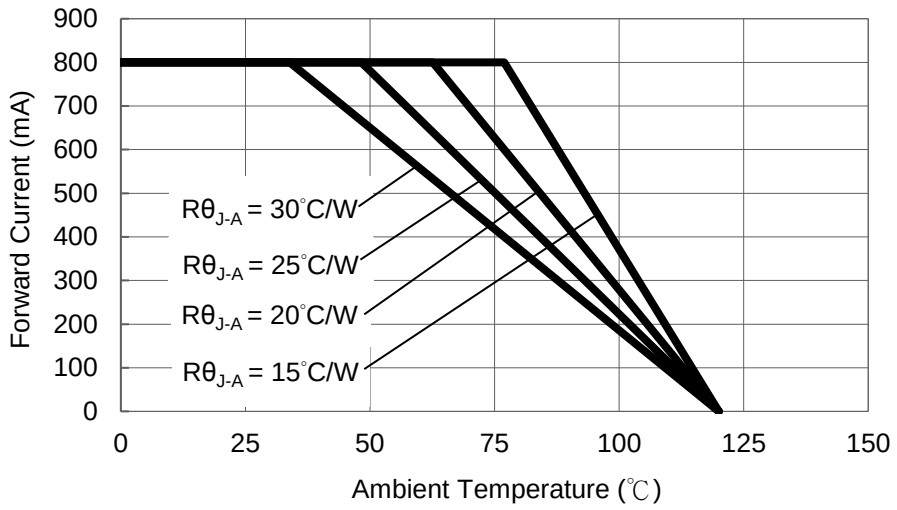


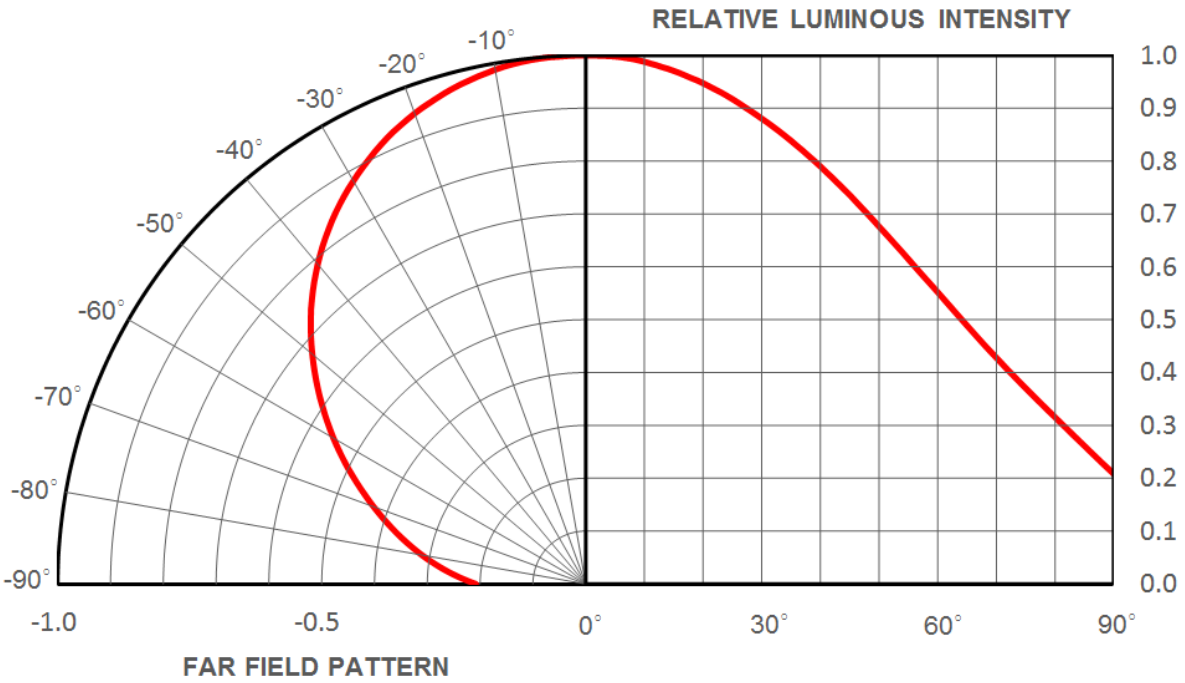

Fig 2. Relative Luminous Flux vs. Forward Current for White, Warm White at $T_J$=25℃ maintained.

## Ambient Temperature vs. Maximum Forward Current

### 1. White, Warm White ($T_{JMAX}$ = 120°C)




## Typical Representative Spatial Radiation Pattern



## Moisture Sensitivity Level - JEDEC Level 1

| 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 |

- 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.

| 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, $I_F$ = max DC (Note 1) | 1000 hours | Note 2 |
| Wet High Temperature Operating Life (WHTOL) | 85°C/60%RH, $I_F$ = 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 |
| 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 |
| 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.

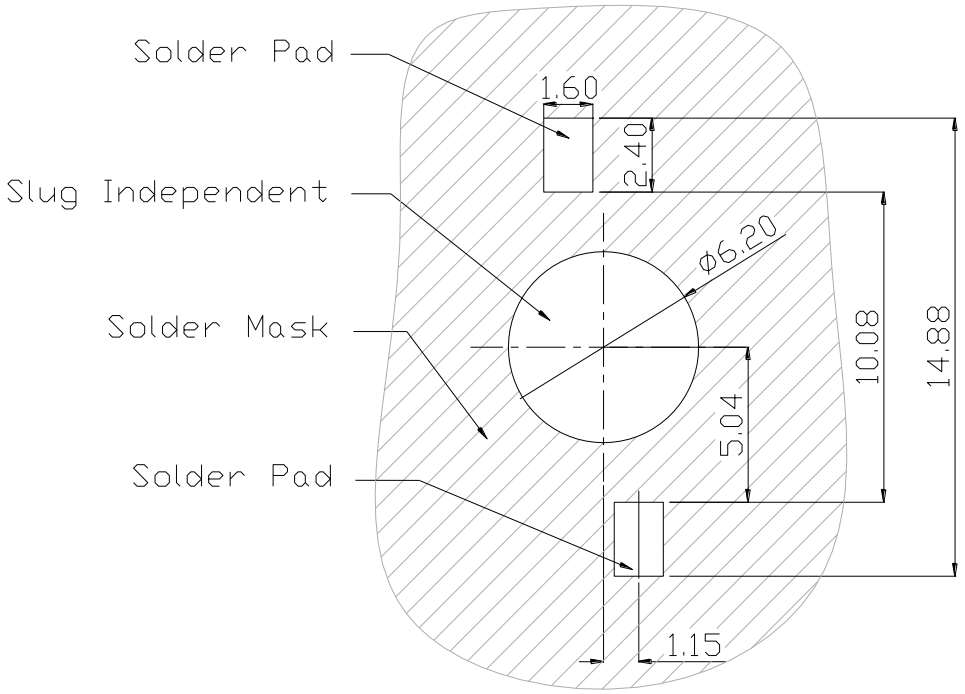
2. Criteria for judging failure

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

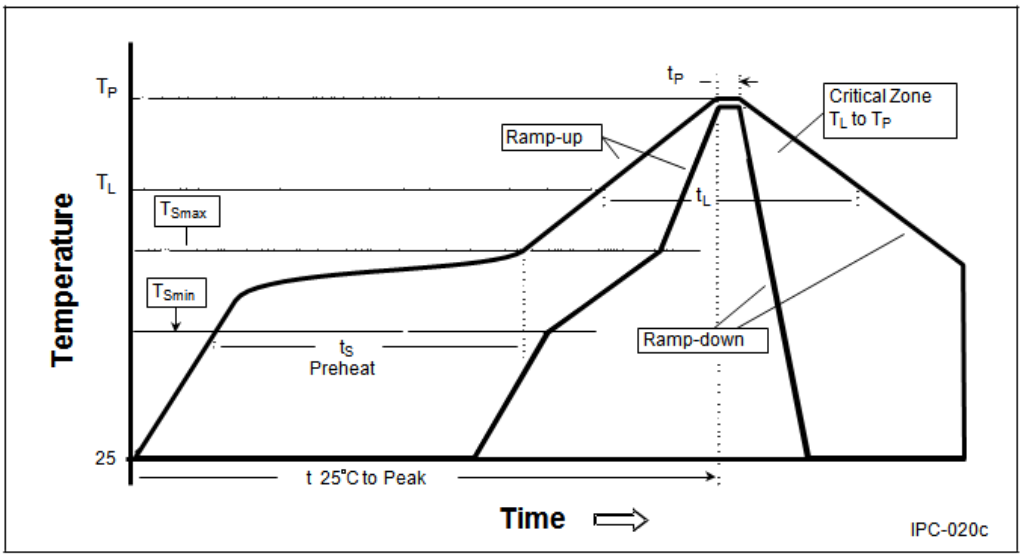
## Recommended Solder Pad Design




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

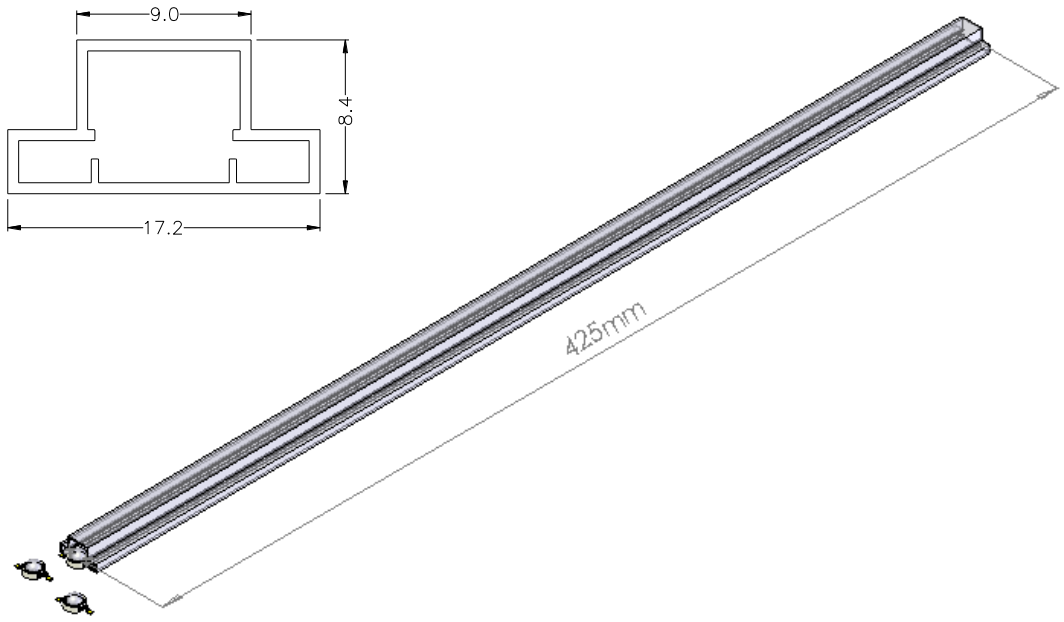
## Reflow Soldering Condition

| 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<br>– Temperature Min ($T_{Smin}$)<br>– Temperature Max ($T_{Smax}$)<br>– Time ($t_{Smin}$ to $t_{Smax}$) | <br>100°C<br>150°C<br>60-120 seconds | <br>150°C<br>200°C<br>60-180 seconds |
| Time maintained above:<br>– Temperature ($T_L$)<br>– Time ($t_L$) | <br>183°C<br>60-150 seconds | <br>217°C<br>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.**
- 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




Notes:
1. 50 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.
- **We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.**
- 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/

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