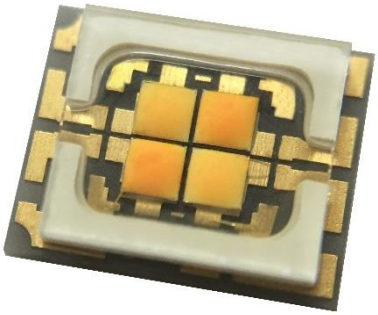


**ProLight PBED-10FQE-WVWVR95**
**10W Power LED**
**Technical Datasheet**
**Version: 1.3**

# ProLight Opto ProEngine Series

## Features

- Compact light source
- High R9 color rendering value
- High Color rendering index
- Lead free reflow soldering
- Superior ESD protection
- RoHS compliant

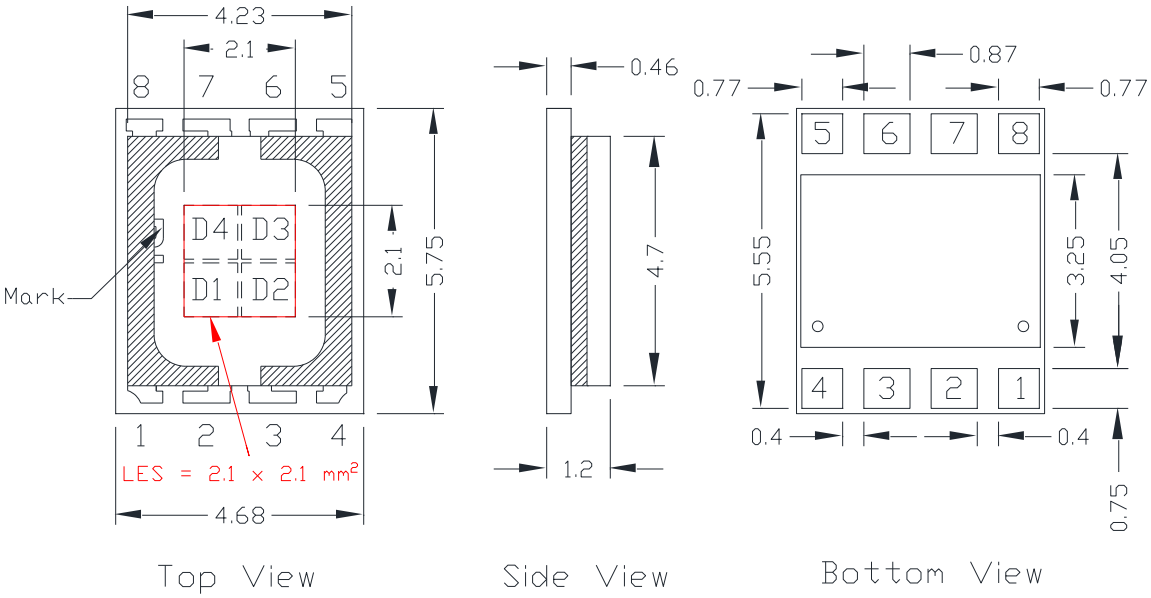
## Main Applications

- Surgical lighting
- Entertainment lighting (Stage lighting)
- Architectural lighting
- Mood lighting
- Outdoor lighting
- Indoor lighting

## Introduction

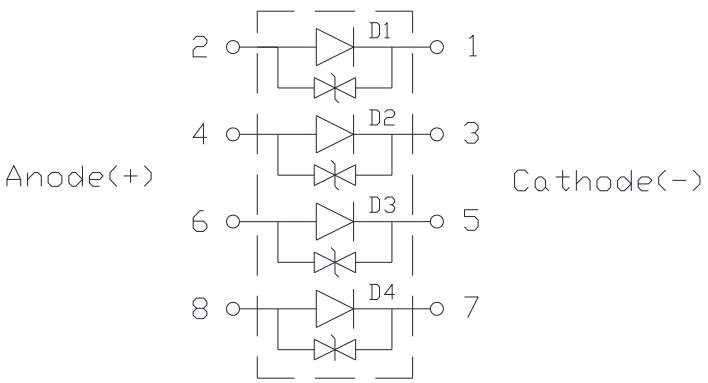
- ProLight PBED colorful series is a color changeable LED with maximum 4 color chips in one package. Compared to discrete LEDs, PBED series reduce the distance between LED die, creating a small optical source for excellent optical control and efficient color mixing. ProLight PBED series is much suitable for the application of color-changing lighting, especially for entertainment lighting.

# Emitter Mechanical Dimensions




Top View　　Side View　　Bottom View

Circuit Diagram




Color

D1 : White
D2 : Warm White
D3 : White
D4 : Warm White

Notes:
1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are ± 0.15mm.
4. Please do not solder the emitter by manual hand soldering, otherwise it will damage the emitter.
5. **Please do not use a force of over 1kgf 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

| | Color | Part Number Emitter | Luminous Flux $\Phi_V$ (lm) @700mA Min. | @700mA Typ. | Refer @350mA Typ. | CRI Typ. | R9 Min. |
|---|---|---|---|---|---|---|---|
| D1 | White | PBED-10FQE-WVWVR95 | 120 | 160 | 85 | 95 | 80 |
| D2 | Warm White | | 90 | 117 | 60 | | |
| D3 | White | | 120 | 160 | 85 | | |
| D4 | Warm White | | 90 | 117 | 60 | | |

- ProLight maintains a tolerance of ± 7% on flux and power measurements.
- ProLight maintains a tolerance of ± 3 on R9 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. | @700mA Typ. | @700mA Max. | Refer @350mA Typ. |
|---|---|---|---|---|---|
| D1 | White | 2.8 | 3.1 | 3.8 | 2.8 |
| D2 | Warm White | 2.8 | 3.1 | 3.8 | 2.8 |
| D3 | White | 2.8 | 3.1 | 3.8 | 2.8 |
| D4 | Warm White | 2.8 | 3.1 | 3.8 | 2.8 |

- ProLight maintains a tolerance of ± 0.5V for Voltage measurements.

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

| Radiation Pattern | Color | Color Temperature CCT Min. | Typ. | Max. | Total included Angle (degrees) $\theta_{0.90V}$ | Viewing Angle (degrees) $2\theta_{1/2}$ |
|---|---|---|---|---|---|---|
| Flat | White | 4780 K | 5180 K | 5580 K | 160 | 120 |
| | Warm White | 2790 K | 2910 K | 3030 K | 160 | 120 |

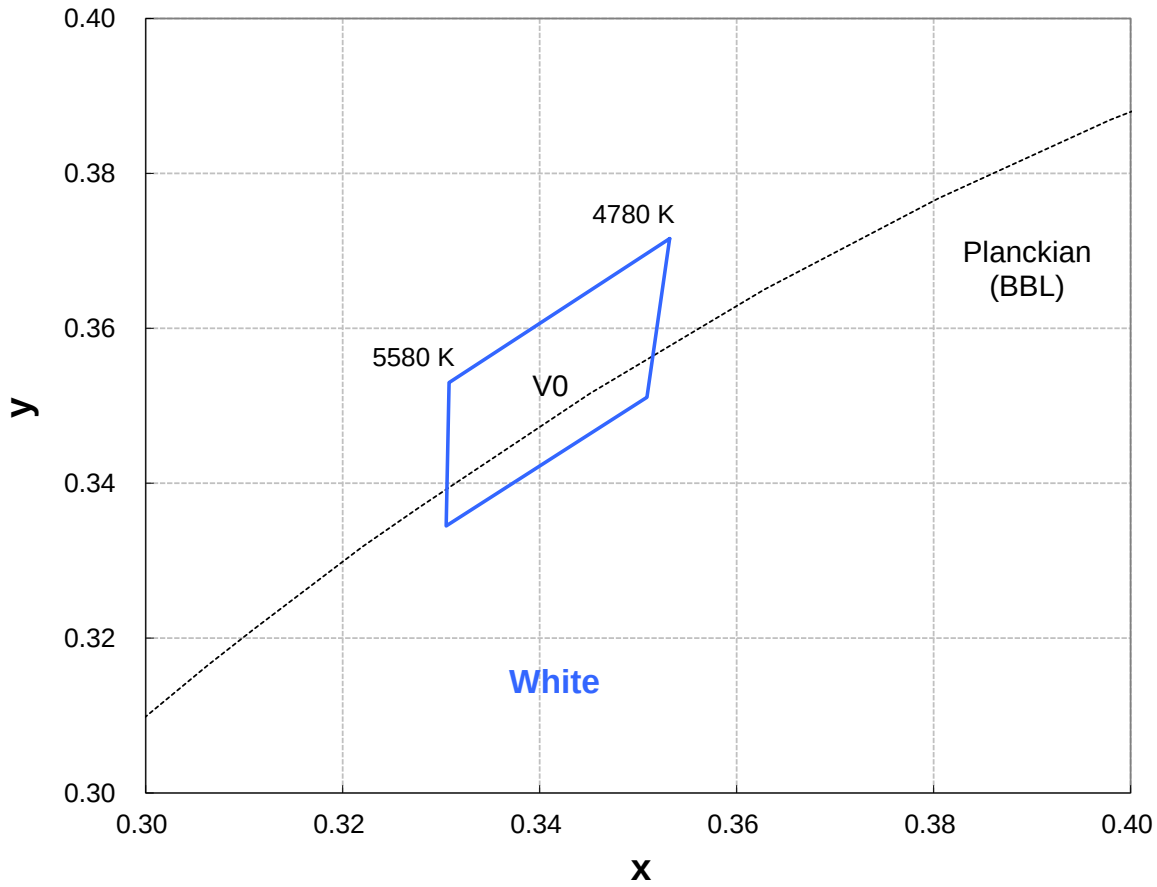
- ProLight maintains a tolerance of ± 5% for CCT measurements.

# Absolute Maximum Ratings

| Parameter | White/Warm White |
|---|---|
| DC Forward Current (mA) | 700 |
| Peak Pulsed Forward Current (mA) | 1500 (less than 1/10 duty cycle@1KHz) |
| ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7) | ±4000V (Class III) |
| LED Junction Temperature | 135°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 |

# Color Bin

**White Binning Structure Graphical Representation**



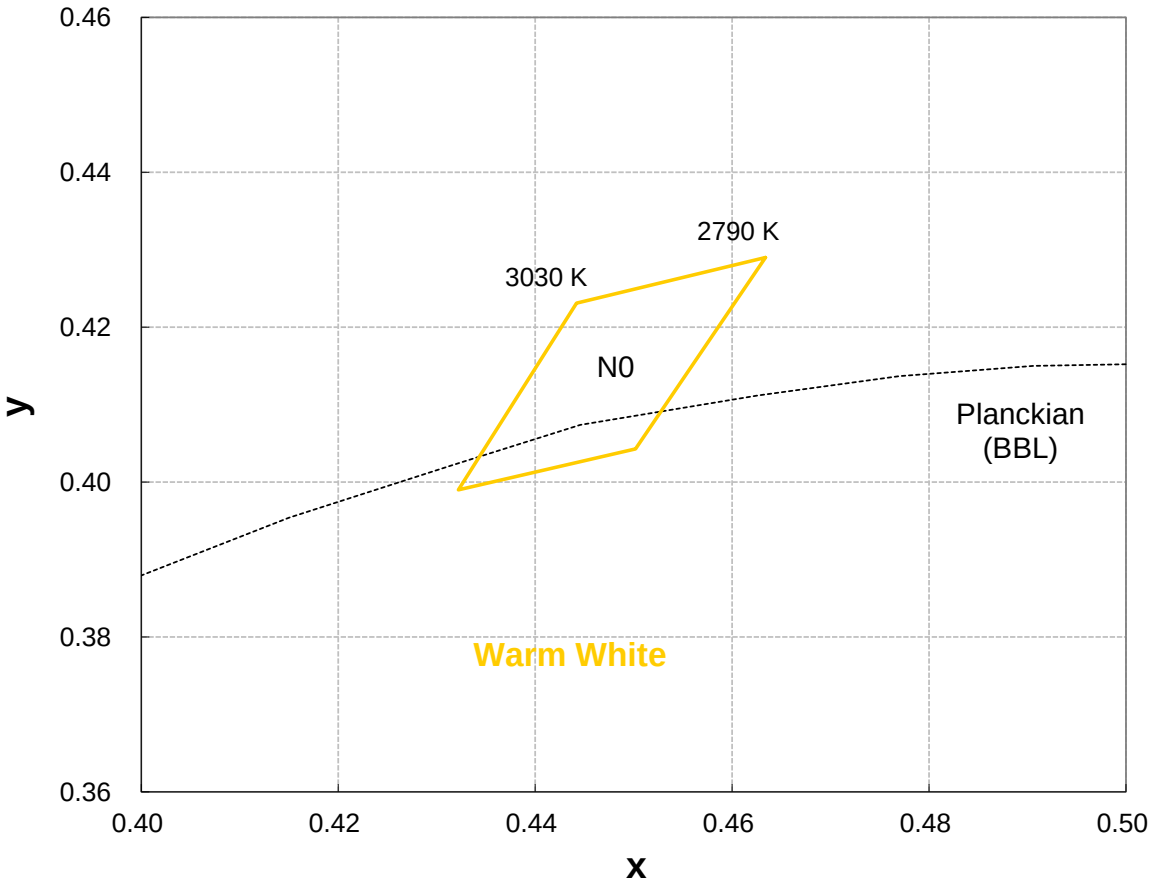

**White Bin Structure**

| Bin Code | x | y | Typ. CCT (K) |
|---|---|---|---|
| V0 | 0.3532 | 0.3716 | 5180 |
| | 0.3308 | 0.3530 | |
| | 0.3305 | 0.3345 | |
| | 0.3509 | 0.3511 | |

- Tolerance on each color bin (x , y) is ± 0.005

# Color Bin

**Warm White Binning Structure Graphical Representation**



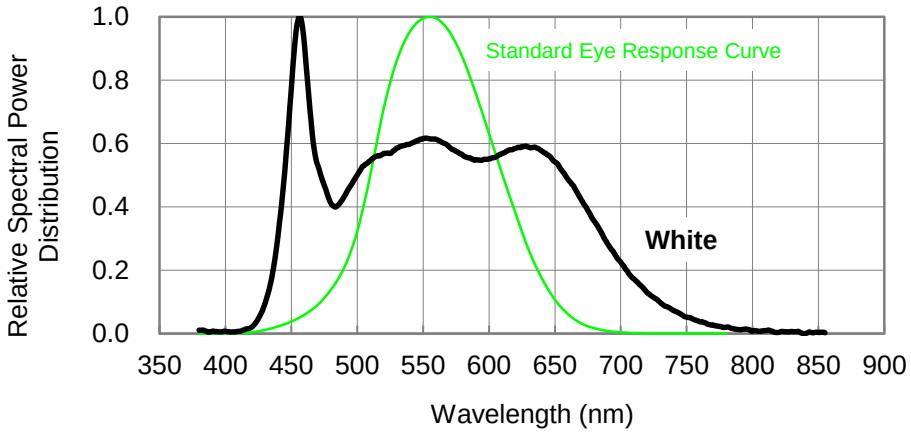

**Warm White Bin Structure**

| Bin Code | x | y | Typ. CCT (K) |
|---|---|---|---|
| N0 | 0.4634 | 0.4290 | 2910 |
| | 0.4442 | 0.4231 | |
| | 0.4322 | 0.3990 | |
| | 0.4502 | 0.4043 | |

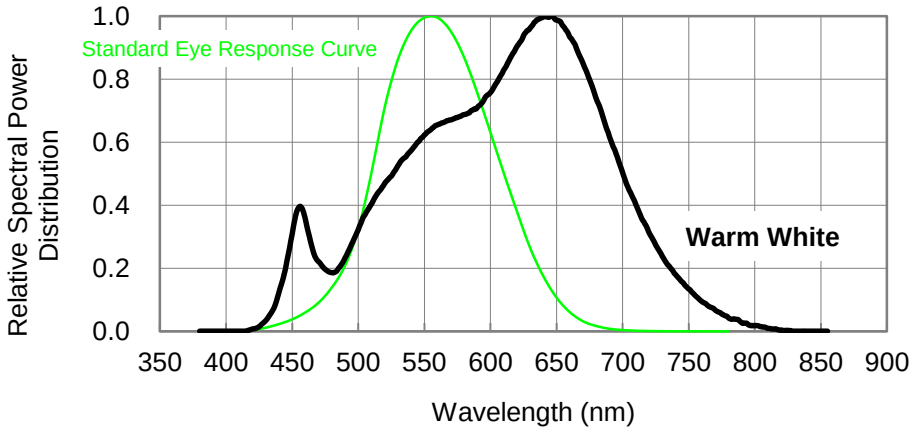
- Tolerance on each color bin (x , y) is ± 0.005

# Color Spectrum, $T_J$ = 25˚C

**1. White**

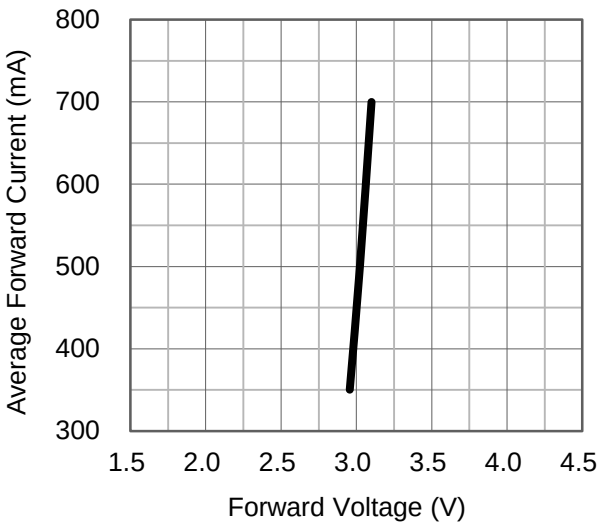



**2. Warm White**

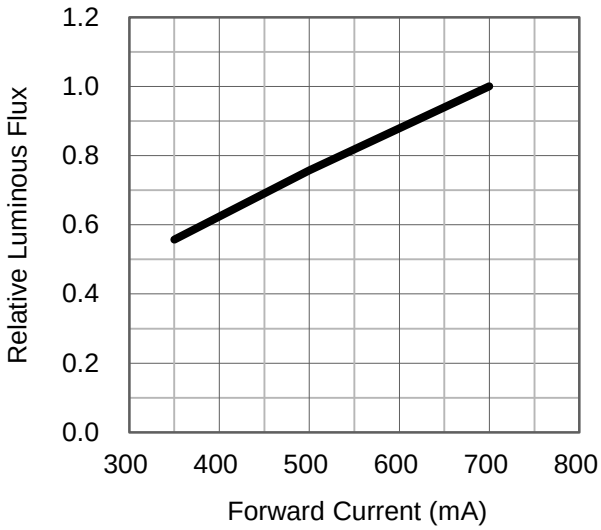


# Forward Current Characteristics, $T_J$ = 25˚C

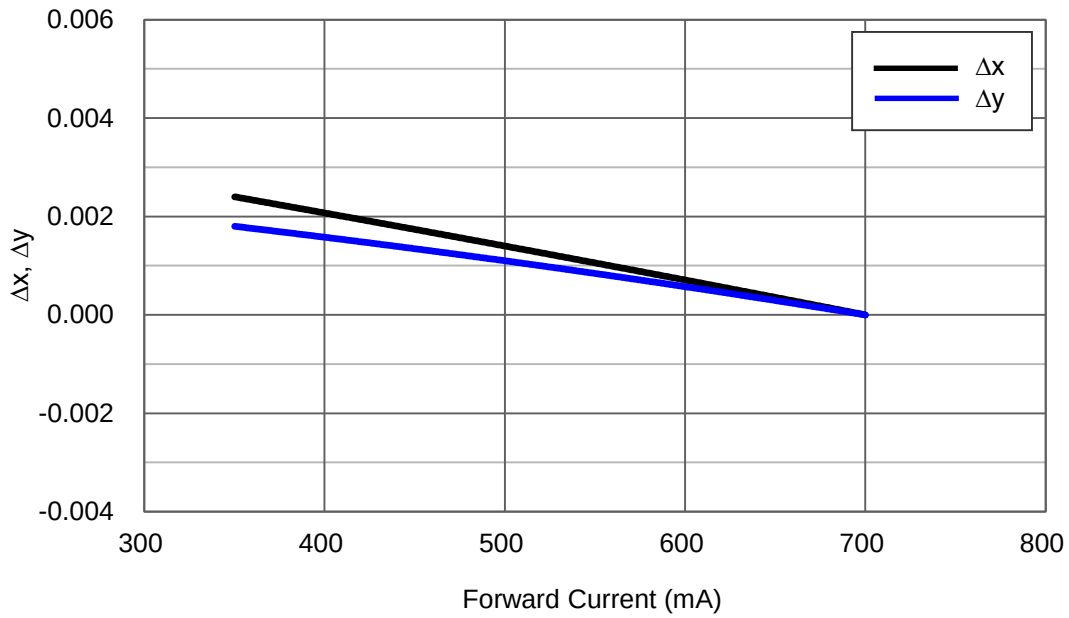
1. Forward Voltage vs. Forward Current




2. Forward Current vs. Normalized Relative Luminous Flux

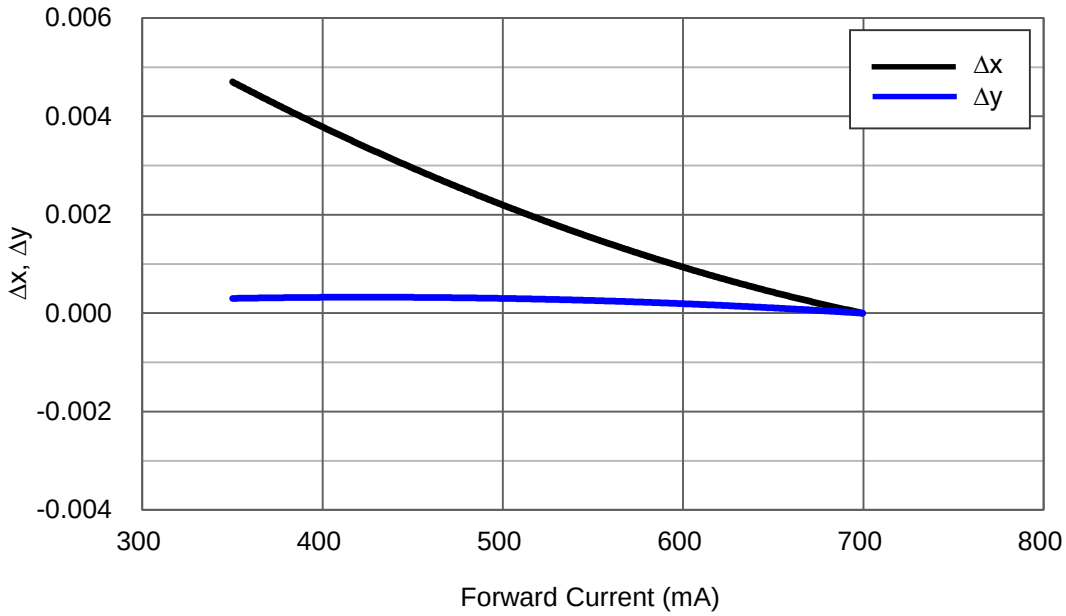



3. White Forward Current vs. Chromaticity Coordinate Shift



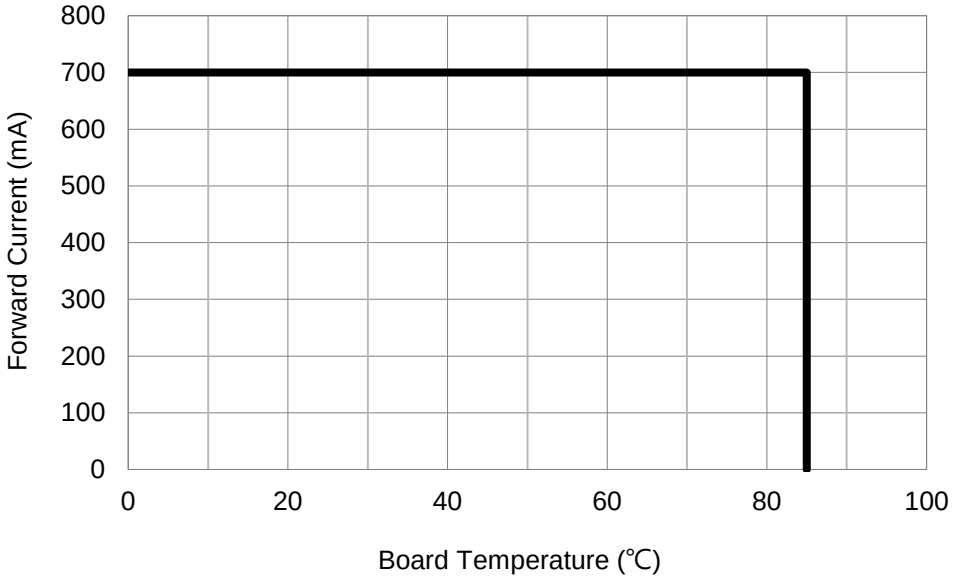
# Forward Current Characteristics, $T_J$ = 25˚C

**4. Warm White Forward Current vs. Chromaticity Coordinate Shift**

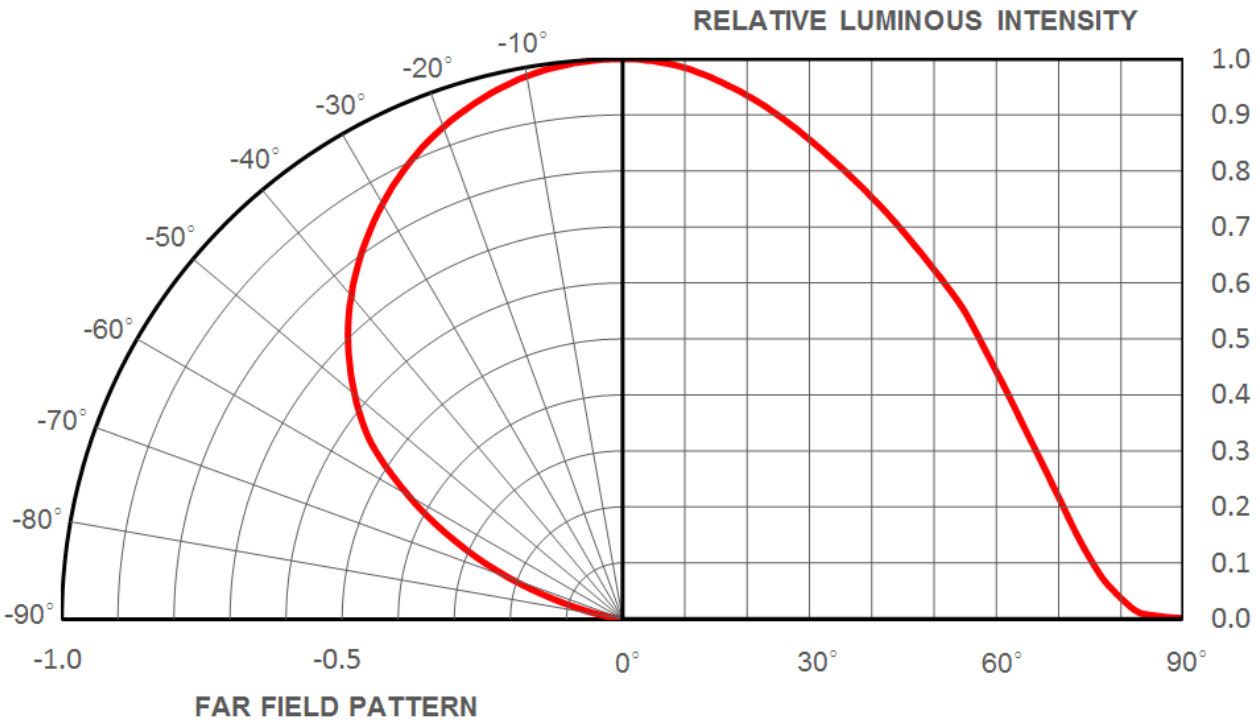



# Board Temperature vs. Maximum Forward Current

**Maximum Forward Current for 4 chip operated**



# 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 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 |
| 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

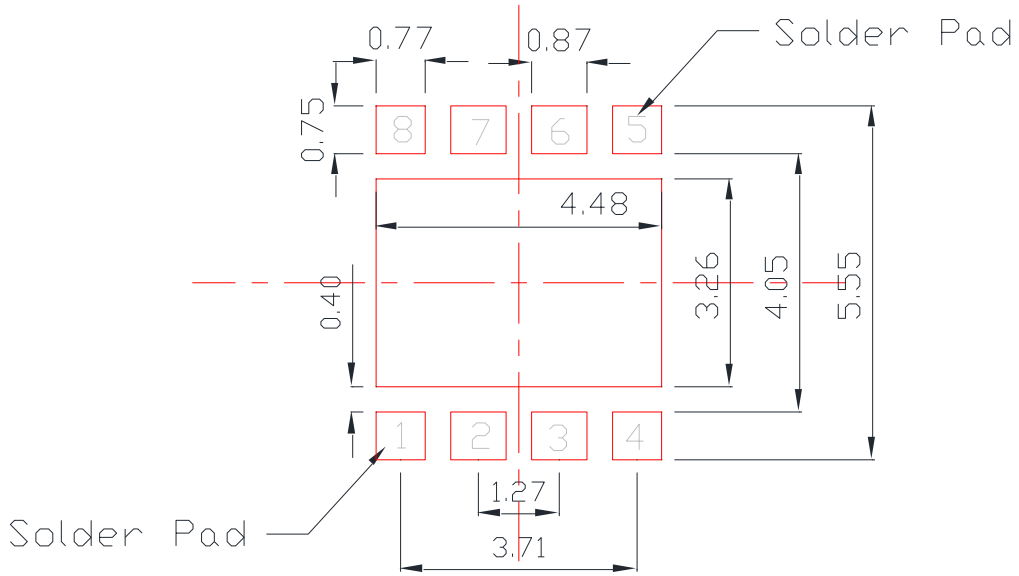
| Item | Test Condition | Criteria for Judgement | |
|---|---|---|---|
| | | Min. | Max. |
| Forward Voltage ($V_F$) | $I_F$ = max DC | -- | Initial Level x 1.1 |
| Luminous Flux or Radiometric Power ($\Phi_V$) | $I_F$ = max DC | Initial Level x 0.7 | -- |
| Reverse Current ($I_R$) | $V_R$ = 5V | -- | 50 μA |

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

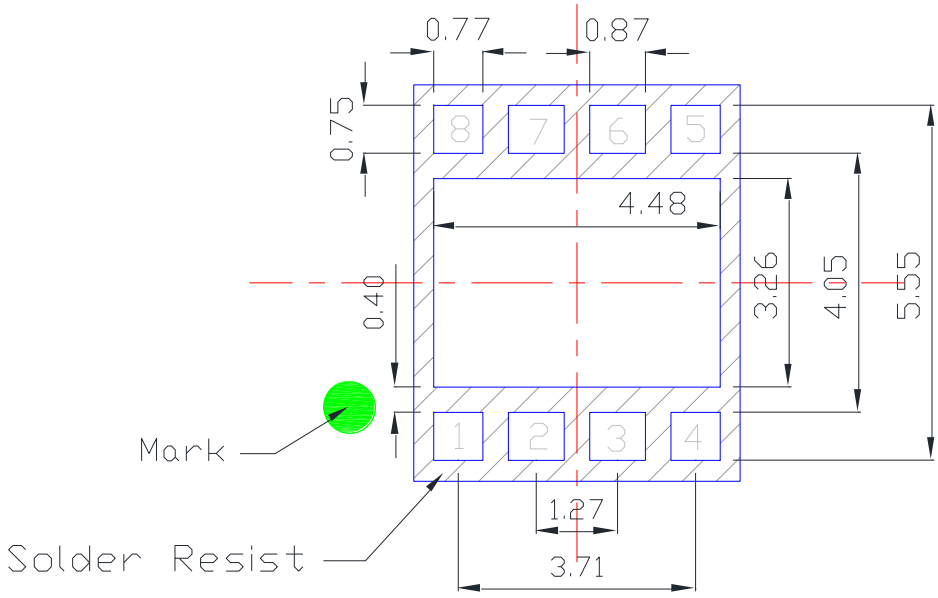
3. A failure is an LED that is open or shorted.

# Recommended Solder Pad Design

**Solder Pad**



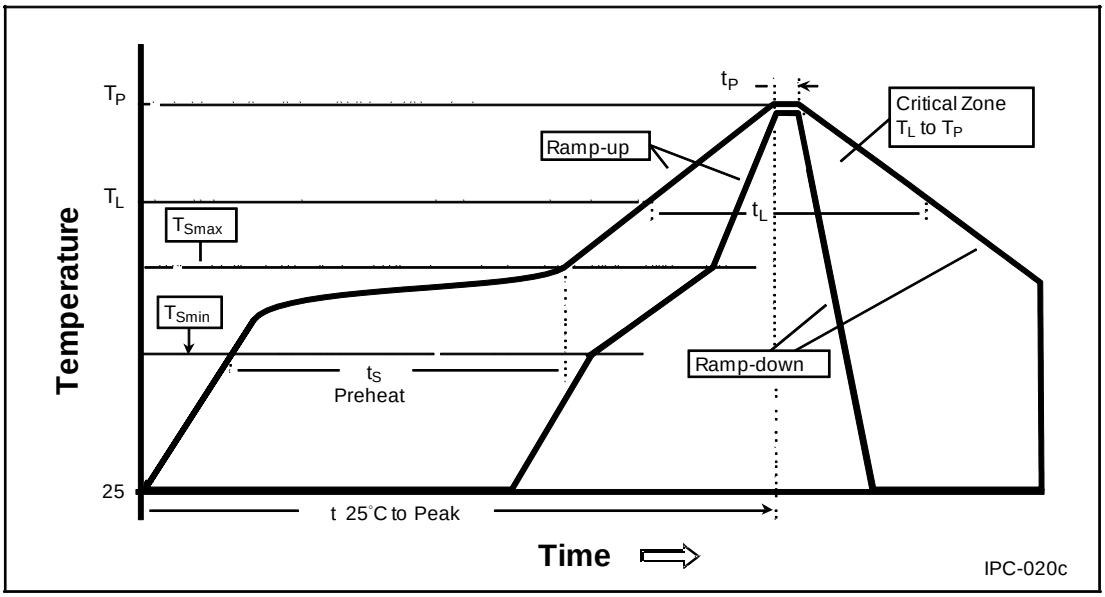

**Solder Resist**




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

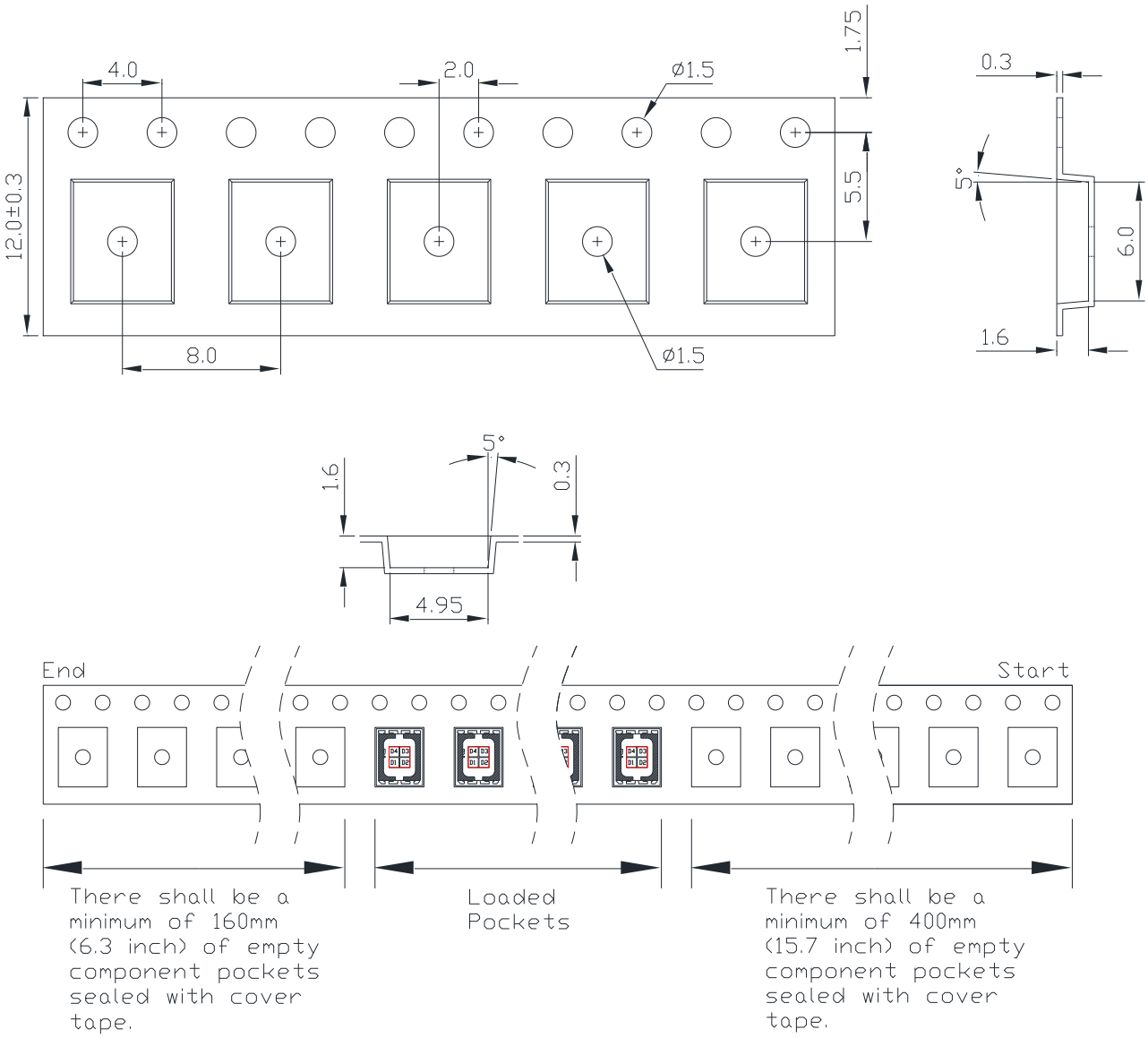
# Reflow Soldering Condition

| 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. |



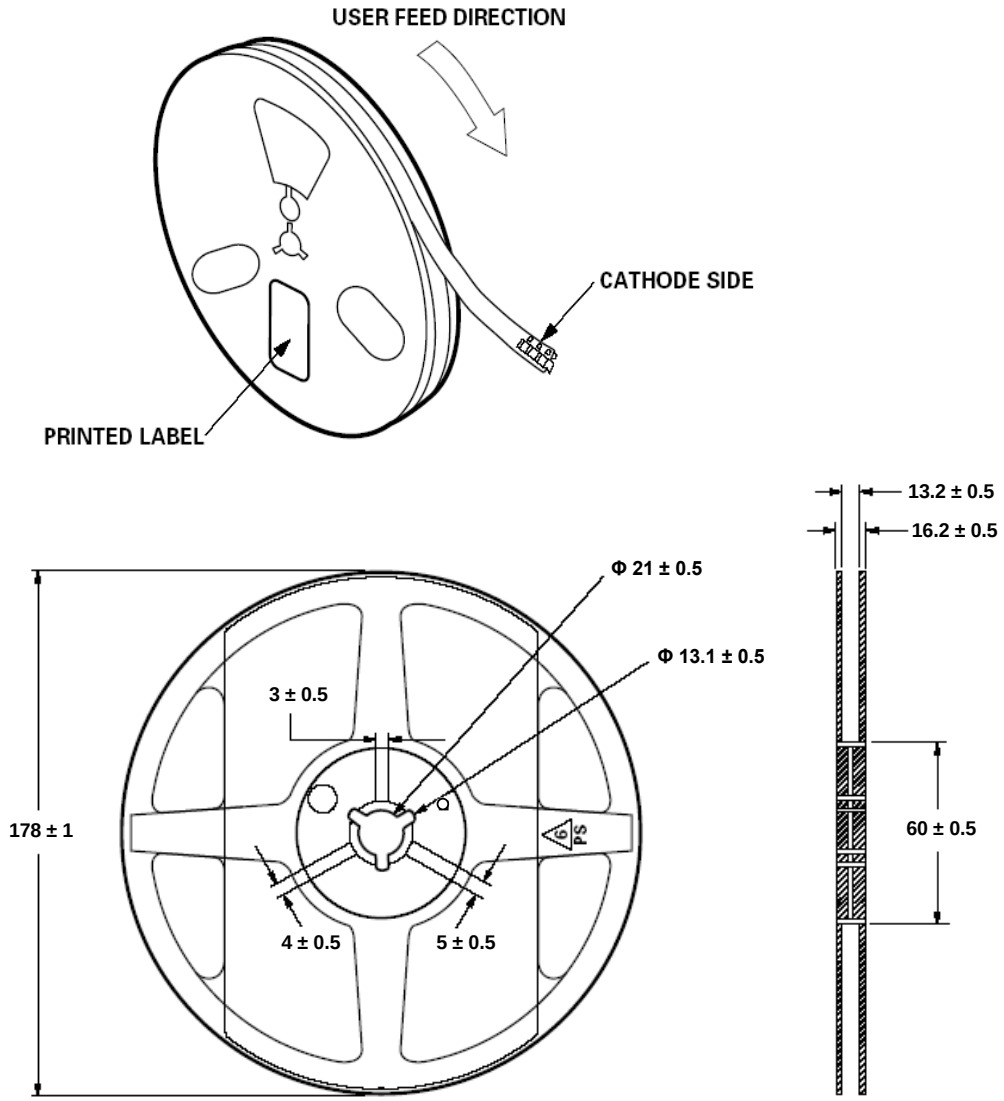

- **We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.**
- **Do not use solder pastes with post reflow flux residue>47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.**
- All temperatures 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 Reel Packaging




Notes:
1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are ± 0.1mm.

# Emitter Reel Packaging




Notes:
1. Empty component pockets sealed with top cover tape.
2. 250 or 500 pieces per reel.
3. Drawing not to scale.
4. All dimensions are in millimeters.

# Precaution for Use

- **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 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 Lens LEDs

Notes for handling of lens LEDs

- Please do not use a force of over 1kgf impact or pressure on the 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 lens especially by sharp tools such as Tweezers.
- Avoid leaving fingerprints on the lens.
- Please store the LEDs away from dusty areas or seal the product against dust.
- Please do not mold over the lens with another resin. (epoxy, urethane, etc)