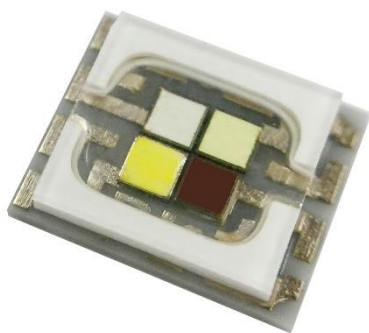




**ProLight PBED-20FTE-S**  
**20W Power LED**  
**Technical Datasheet**  
**Version: 1.3**

# ProLight Opto ® ProEngine Series

## Features

- Compact light source
- R, G, B, W four color in one package
- Lead free reflow soldering
- Superior ESD protection
- RoHS compliant

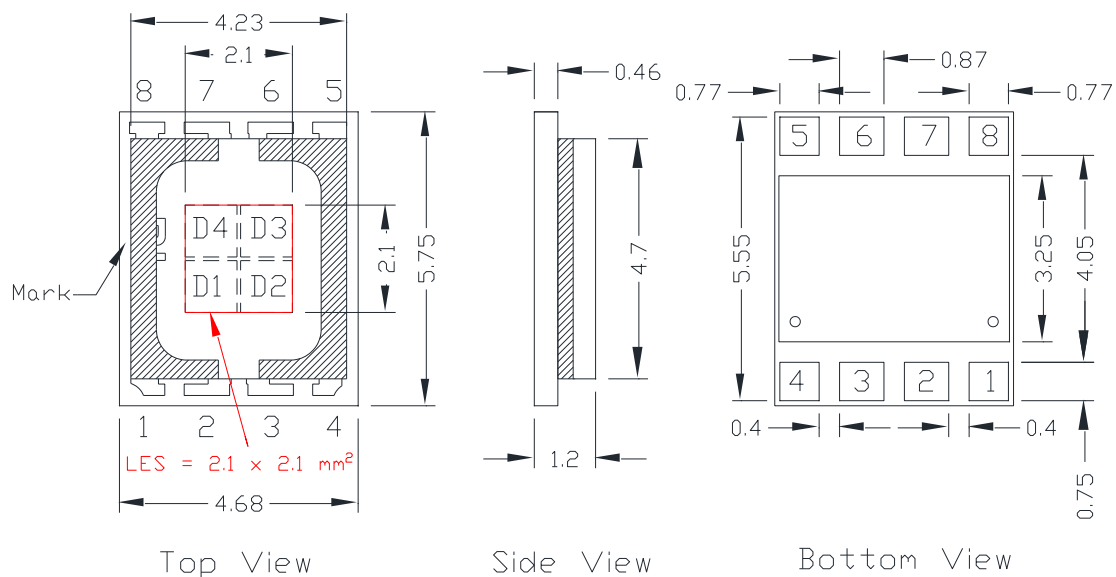
## Main Applications

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

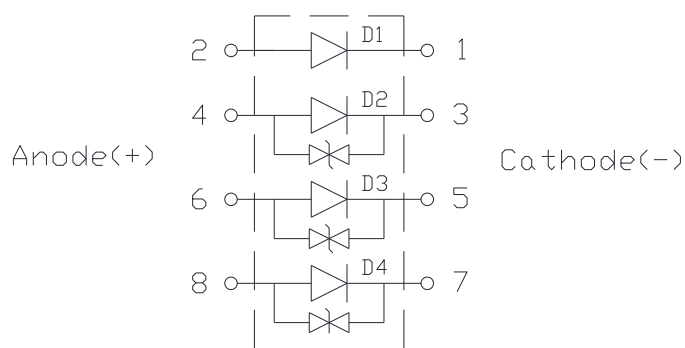
## Introduction

- 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



Circuit Diagram



Color

D1 : Red  
D2 : Green  
D3 : Blue  
D4 : White

### Notes:

1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are  $\pm 0.15\text{mm}$ .
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, $T_j = 25^\circ\text{C}$

| Color | Part Number<br>Emitter | Luminous Flux or Radiometric Power |         |               |
|-------|------------------------|------------------------------------|---------|---------------|
|       |                        | @1000mA                            |         | Refer @1500mA |
|       |                        | Minimum                            | Typical | Typical       |
| Red   | PBED-20FTE-S           | 100 lm                             | 120 lm  | 167 lm        |
| Green |                        | 205 lm                             | 245 lm  | 307 lm        |
| Blue  |                        | 1100 mW                            | 1200 mW | 1650 mW       |
| White |                        | 280 lm                             | 315 lm  | 427 lm        |

- **Do not use below 40mA.**
- ProLight maintains a tolerance of  $\pm 7\%$  on flux and power measurements.
- Please do not drive at rated current more than 1 second without proper heat sink.

## Electrical Characteristics, $T_j = 25^\circ\text{C}$

| Color | Forward Voltage $V_F$ (V) |      |                                            | Thermal<br>Resistance<br>Junction to<br>Slug ( $^\circ\text{C/W}$ ) |
|-------|---------------------------|------|--------------------------------------------|---------------------------------------------------------------------|
|       | @1000mA                   |      | Forward Voltage $V_F$ (V)<br>Refer @1500mA |                                                                     |
|       | Min.                      | Typ. | Typ.                                       |                                                                     |
| Red   | 2.20                      | 2.60 | 3.10                                       | 1.8                                                                 |
| Green | 2.70                      | 3.20 | 3.70                                       |                                                                     |
| Blue  | 2.80                      | 3.20 | 3.70                                       |                                                                     |
| White | 2.80                      | 3.20 | 3.70                                       |                                                                     |

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

## Optical Characteristics at 1000mA, $T_j = 25^\circ\text{C}$

| Radiation<br>Pattern | Color | Dominant Wavelength $\lambda_D$ ,<br>or Color Temperature CCT |        |        | Total<br>included<br>Angle<br>(degrees) | Viewing<br>Angle<br>(degrees) |
|----------------------|-------|---------------------------------------------------------------|--------|--------|-----------------------------------------|-------------------------------|
|                      |       | Min.                                                          | Typ.   | Max.   | $\theta_{0.90V}$                        | $2\theta_{1/2}$               |
|                      |       |                                                               |        |        |                                         |                               |
| Lambertian           | Red   | 620 nm                                                        | 624 nm | 630 nm | 160                                     | 120                           |
|                      | Green | 520 nm                                                        | 526 nm | 532 nm | 160                                     | 120                           |
|                      | Blue  | 452 nm                                                        | 455 nm | 457 nm | 160                                     | 120                           |
|                      | White | 5760 K                                                        | 6500 K | 7250 K | 160                                     | 120                           |

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

## Absolute Maximum Ratings

| Parameter                                               | Red/Green/Blue/White                      |
|---------------------------------------------------------|-------------------------------------------|
| DC Forward Current                                      | 40 - 1500 mA                              |
| Peak Pulsed Forward Current (mA)                        | 1650 (less than 1/10 duty cycle@1KHz)     |
| ESD Sensitivity<br>(HBM per MIL-STD-883E Method 3015.7) | ±4000V (Class III)                        |
| LED Junction Temperature                                | 135°C                                     |
| Operating Board Temperature                             | -40°C - 85°C                              |
| Storage Temperature                                     | -40°C - 85°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 1000mA

| Color                                                                              | Bin Code | Minimum<br>Photometric Flux (lm) | Maximum<br>Photometric Flux (lm) |
|------------------------------------------------------------------------------------|----------|----------------------------------|----------------------------------|
|  | A        | 100                              | 120                              |
|                                                                                    | B        | 120                              | 145                              |
|  | A        | 205                              | 245                              |
|                                                                                    | B        | 245                              | 295                              |
|  | A        | 280                              | 340                              |
|                                                                                    | B        | 340                              | 410                              |

- ProLight maintains a tolerance of  $\pm 7\%$  on flux and power measurements.
- The flux bin of the product may be modified for improvement without notice.

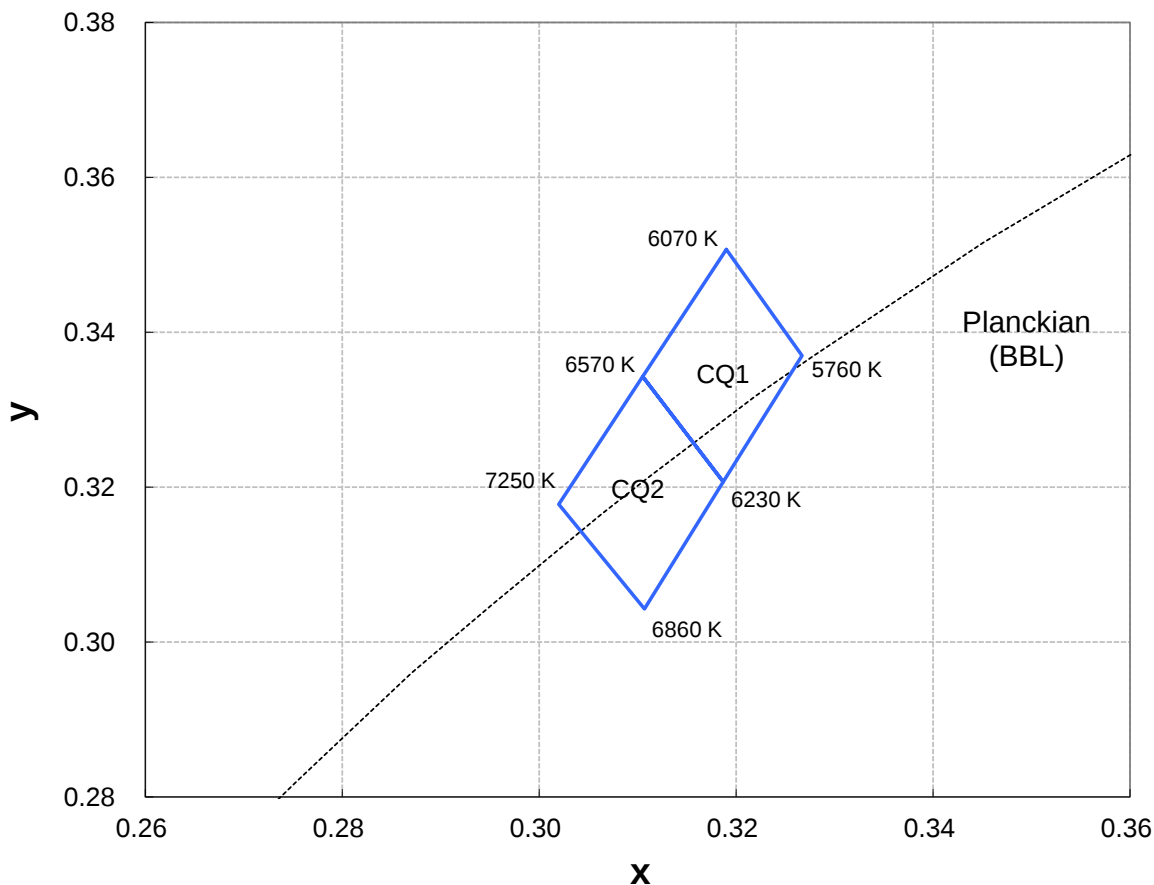
## Radiometric Power Bin Structure at 1000mA

| Color                                                                              | Bin Code | Minimum<br>Radiometric Power (mW) | Maximum<br>Radiometric Power (mW) |
|------------------------------------------------------------------------------------|----------|-----------------------------------|-----------------------------------|
|  | A        | 1100                              | 1250                              |
|                                                                                    | B        | 1250                              | 1450                              |

- ProLight maintains a tolerance of  $\pm 7\%$  on flux and power measurements.
- The flux bin of the product may be modified for improvement without notice.

## Color Bin

### White Binning Structure Graphical Representation



### White Bin Structure

| Bin Code | x      | y      | Typ. CCT (K) | Bin Code | x      | y      | Typ. CCT (K) |
|----------|--------|--------|--------------|----------|--------|--------|--------------|
| CQ1      | 0.3190 | 0.3507 | 6150         | CQ2      | 0.3105 | 0.3343 | 6750         |
|          | 0.3267 | 0.3370 |              |          | 0.3187 | 0.3207 |              |
|          | 0.3187 | 0.3207 |              |          | 0.3107 | 0.3043 |              |
|          | 0.3105 | 0.3343 |              |          | 0.3020 | 0.3178 |              |

- Tolerance on each color bin (x , y) is  $\pm 0.005$

## Dominant Wavelength Bin Structure

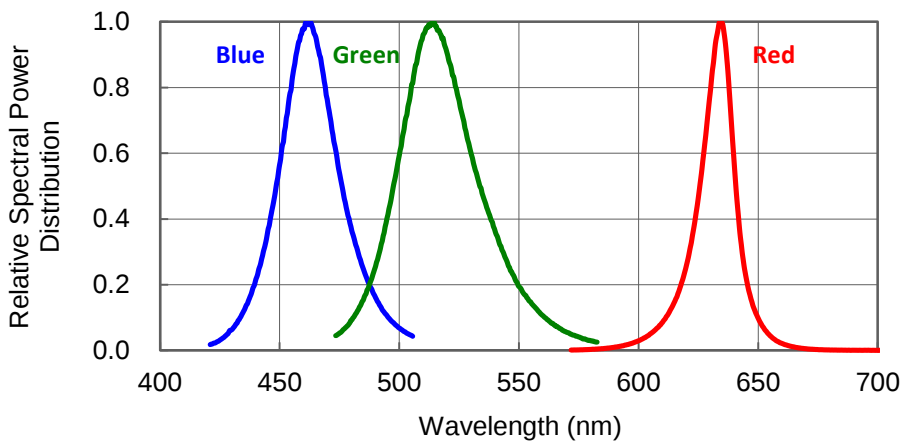
| Color | Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|-------|----------|----------------------------------|----------------------------------|
| Red   | 4        | 620                              | 630                              |
| Green | 1        | 520                              | 526                              |
|       | 2        | 526                              | 532                              |
| Blue  | 6        | 452                              | 457                              |

- ProLight maintains a tolerance of  $\pm 1\text{nm}$  for dominant wavelength measurements.

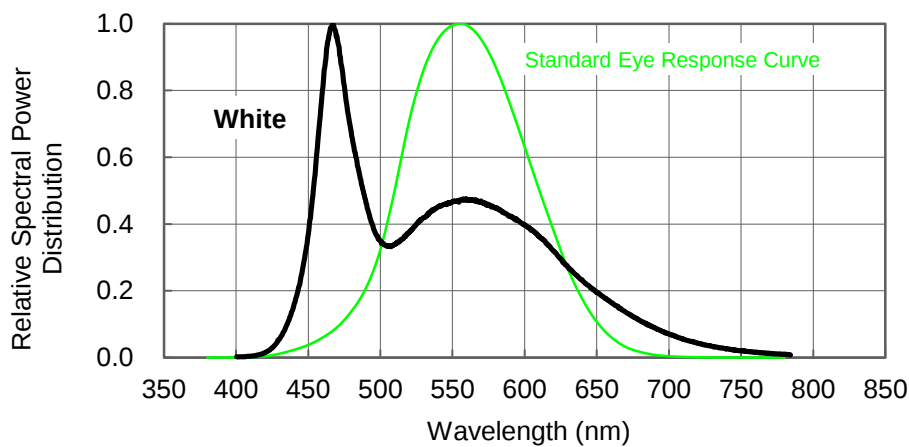
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

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

### 1. Blue 、 Green 、 Red

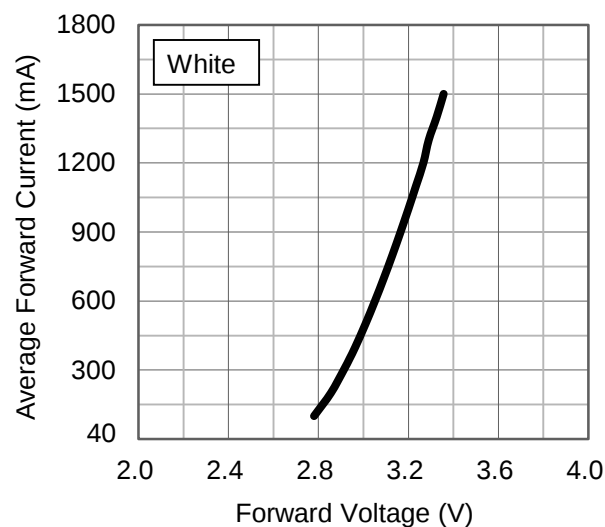
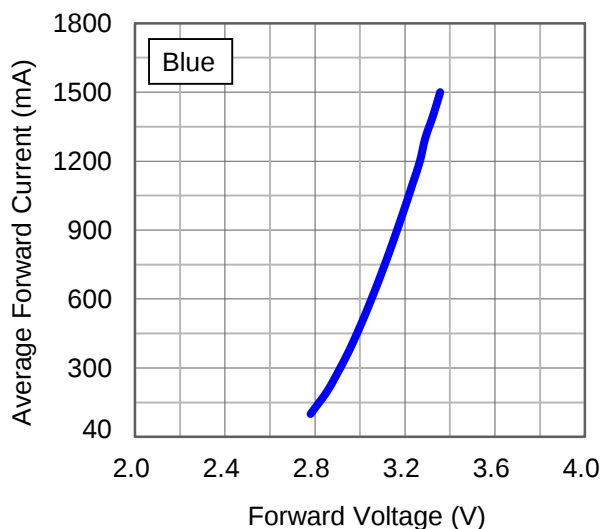
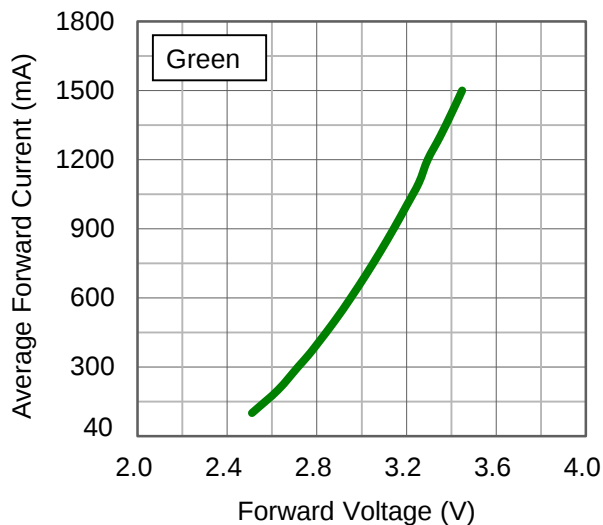
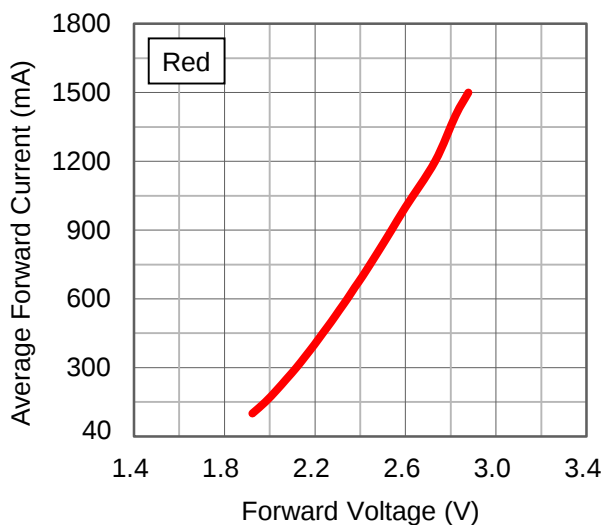


### 2. White



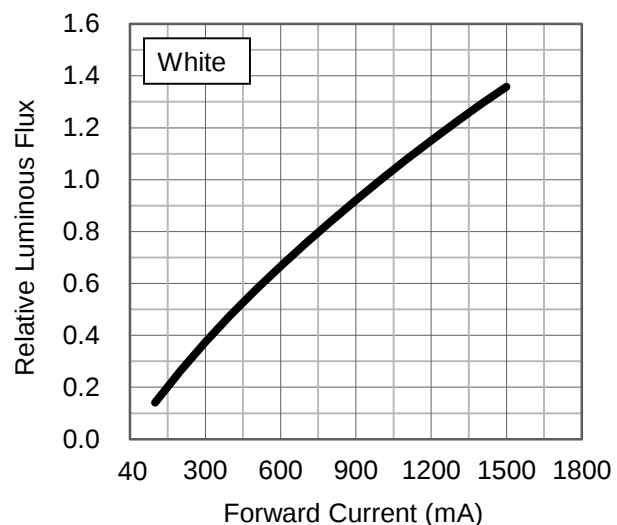
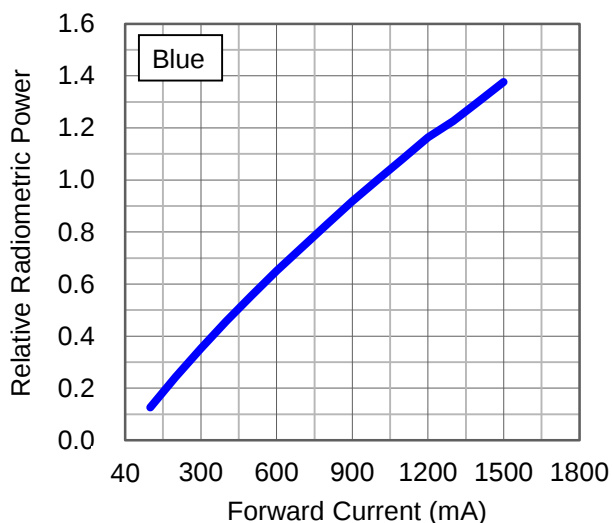
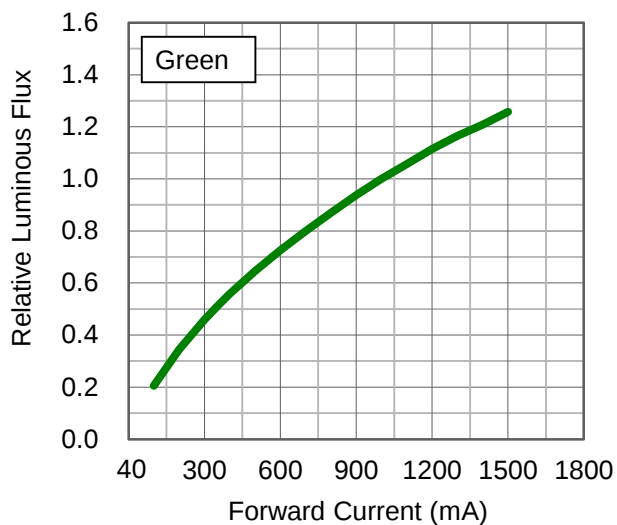
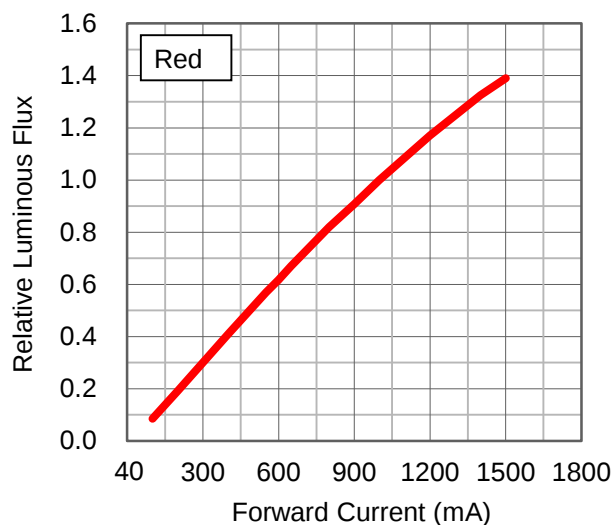
## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

### 1. Forward Voltage vs. Forward Current



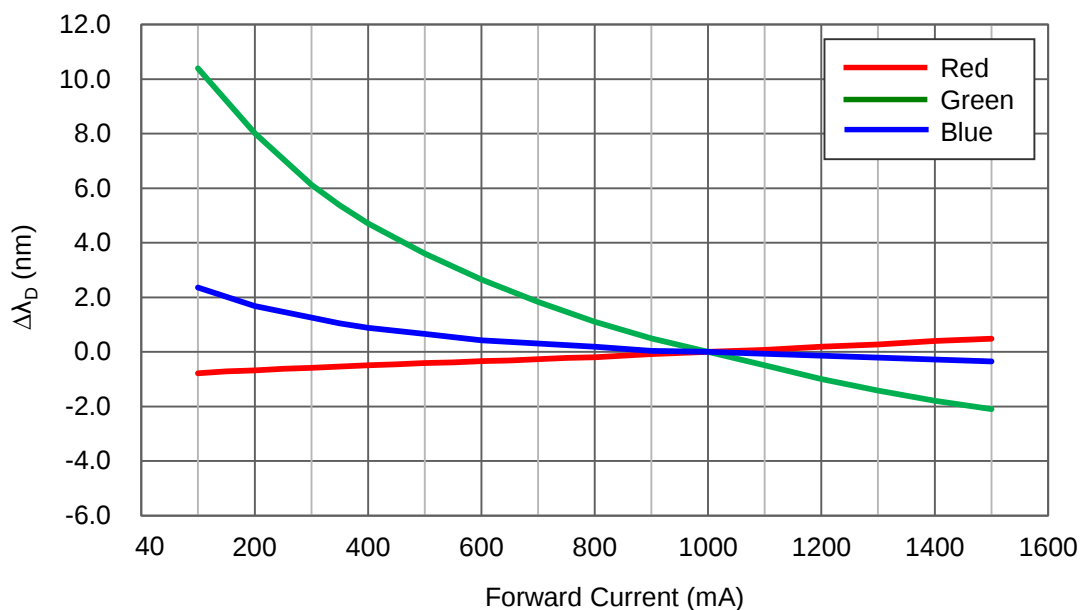
## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

### 2. Forward Current vs. Normalized Relative Luminous Flux

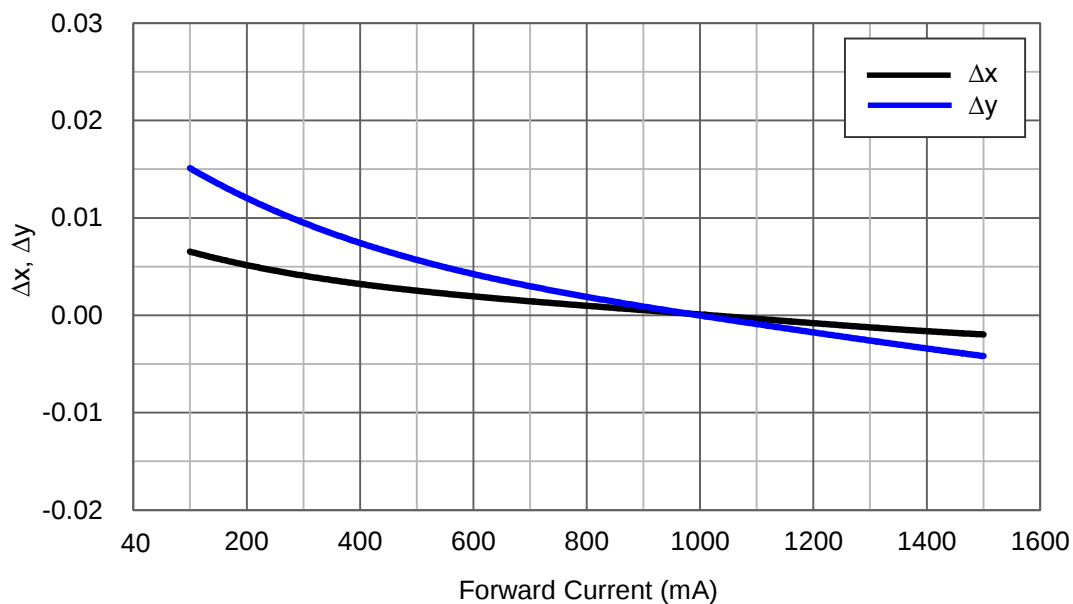


## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

### 3. Forward Current vs. Dominant Wavelength Shift

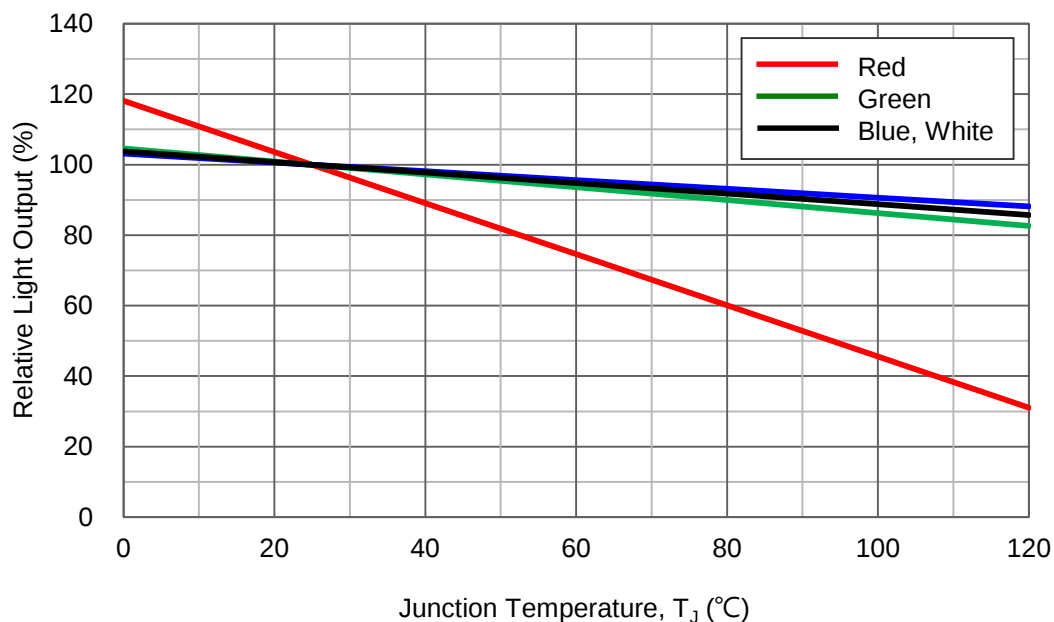


### 4. Forward Current vs. Chromaticity Coordinate Shift

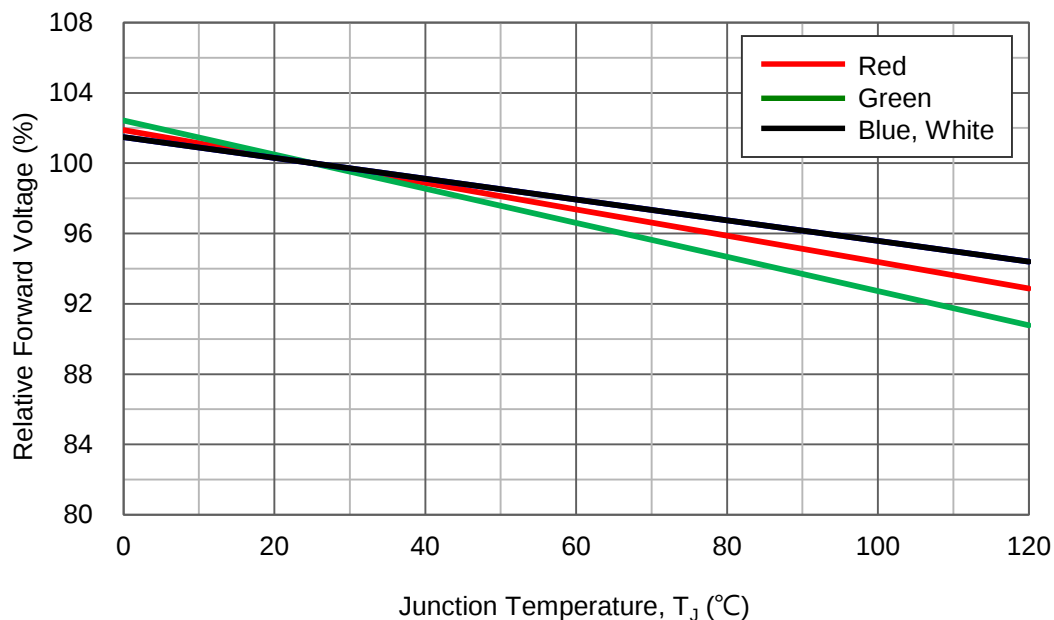


## Junction Temperature Relative Characteristics

### 1. Junction Temperature vs. Relative Light Output at 1000mA

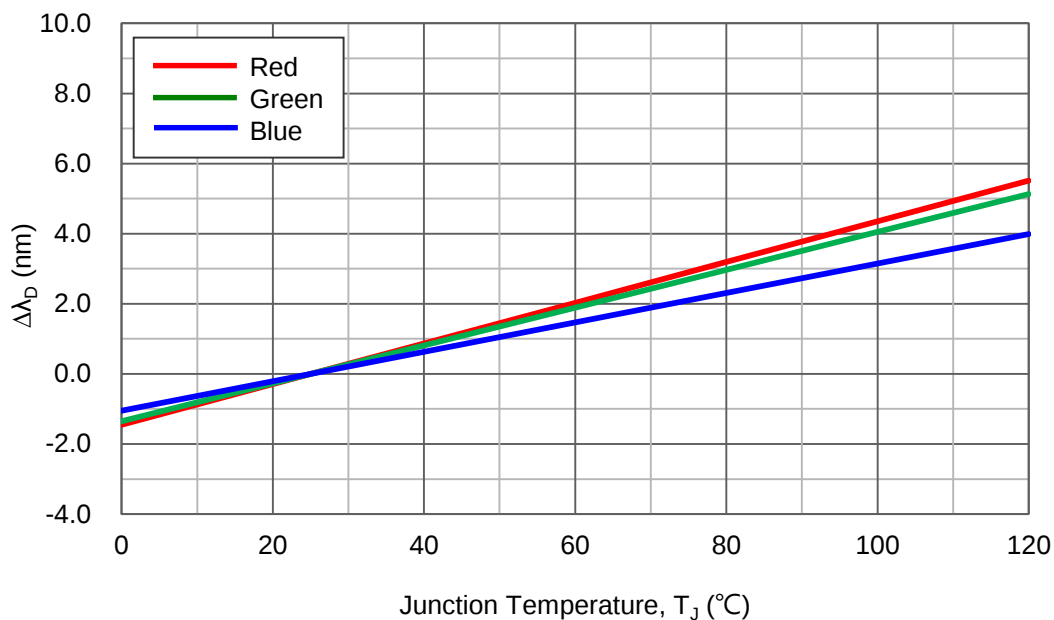


### 2. Junction Temperature vs. Relative Forward Voltage at 1000mA

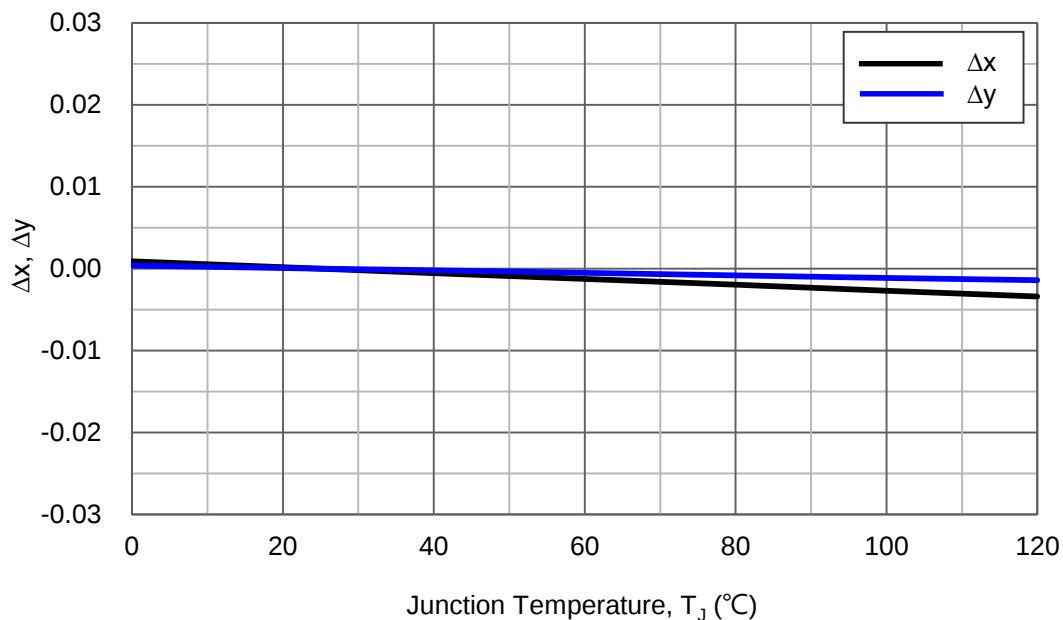


## Junction Temperature Relative Characteristics

### 3. Junction Temperature vs. Dominant Wavelength Shift at 1000mA

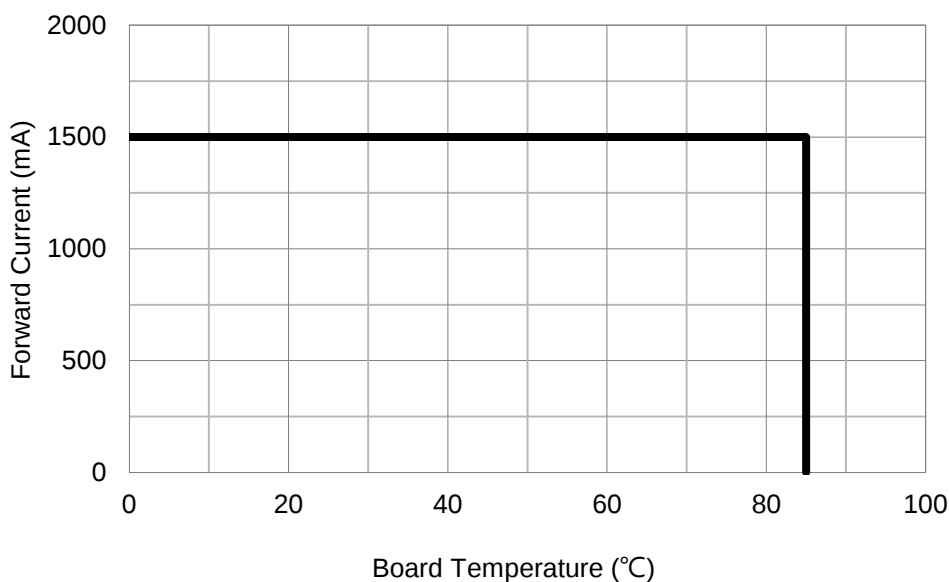


### 4. Junction Temperature vs. Chromaticity Coordinate Shift at 1000mA



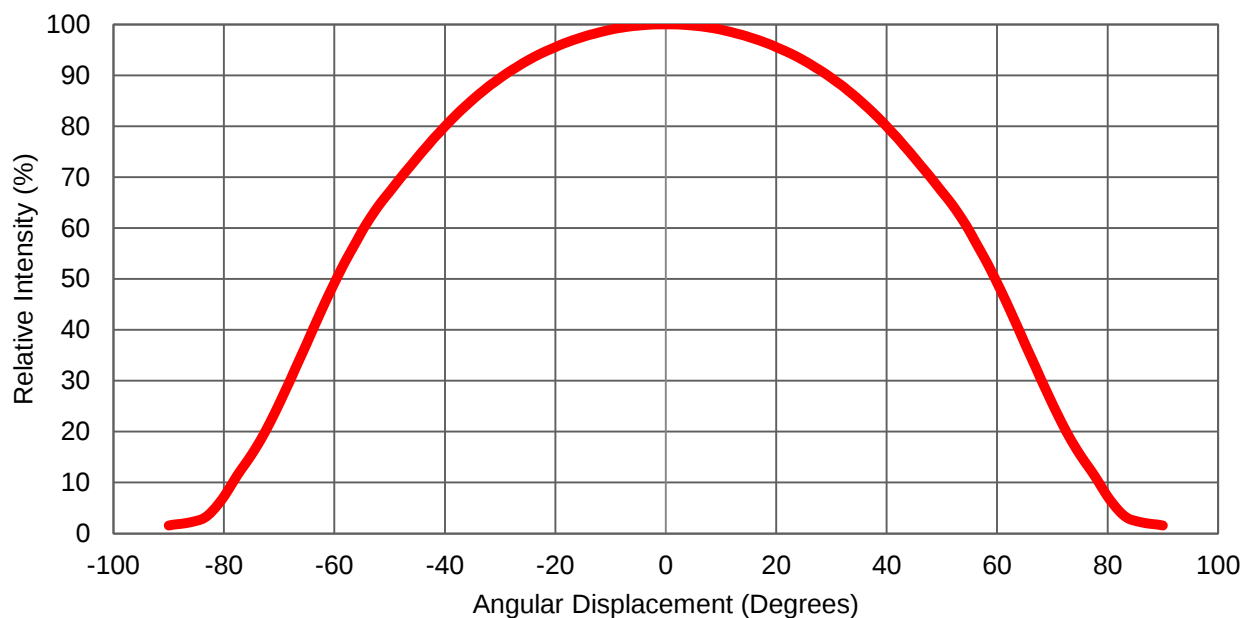
## Board Temperature vs. Maximum Forward Current

Maximum Forward Current for 4 chip operated



## Typical Representative Spatial Radiation Pattern

Lambertian 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  | $\leq 30^{\circ}\text{C}$ /<br>85% RH | 168 +5/-0         | $85^{\circ}\text{C}$ /<br>85% RH | NA                      | NA         |

- 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              | $\leq 30^{\circ}\text{C}$ /<br>85% RH | 168 +5/-0              | $85^{\circ}\text{C}$ /<br>85% RH | NA                      | NA                               |
| 2     | 1 year                 | $\leq 30^{\circ}\text{C}$ /<br>60% RH | 168 +5/-0              | $85^{\circ}\text{C}$ /<br>60% RH | NA                      | NA                               |
| 2a    | 4 weeks                | $\leq 30^{\circ}\text{C}$ /<br>60% RH | 696 +5/-0              | $30^{\circ}\text{C}$ /<br>60% RH | 120 +1/-0               | $60^{\circ}\text{C}$ /<br>60% RH |
| 3     | 168 hours              | $\leq 30^{\circ}\text{C}$ /<br>60% RH | 192 +5/-0              | $30^{\circ}\text{C}$ /<br>60% RH | 40 +1/-0                | $60^{\circ}\text{C}$ /<br>60% RH |
| 4     | 72 hours               | $\leq 30^{\circ}\text{C}$ /<br>60% RH | 96 +2/-0               | $30^{\circ}\text{C}$ /<br>60% RH | 20 +0.5/-0              | $60^{\circ}\text{C}$ /<br>60% RH |
| 5     | 48 hours               | $\leq 30^{\circ}\text{C}$ /<br>60% RH | 72 +2/-0               | $30^{\circ}\text{C}$ /<br>60% RH | 15 +0.5/-0              | $60^{\circ}\text{C}$ /<br>60% RH |
| 5a    | 24 hours               | $\leq 30^{\circ}\text{C}$ /<br>60% RH | 48 +2/-0               | $30^{\circ}\text{C}$ /<br>60% RH | 10 +0.5/-0              | $60^{\circ}\text{C}$ /<br>60% RH |
| 6     | Time on Label<br>(TOL) | $\leq 30^{\circ}\text{C}$ /<br>60% RH | Time on Label<br>(TOL) | $30^{\circ}\text{C}$ /<br>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                  |
| 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 $\pm$ 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

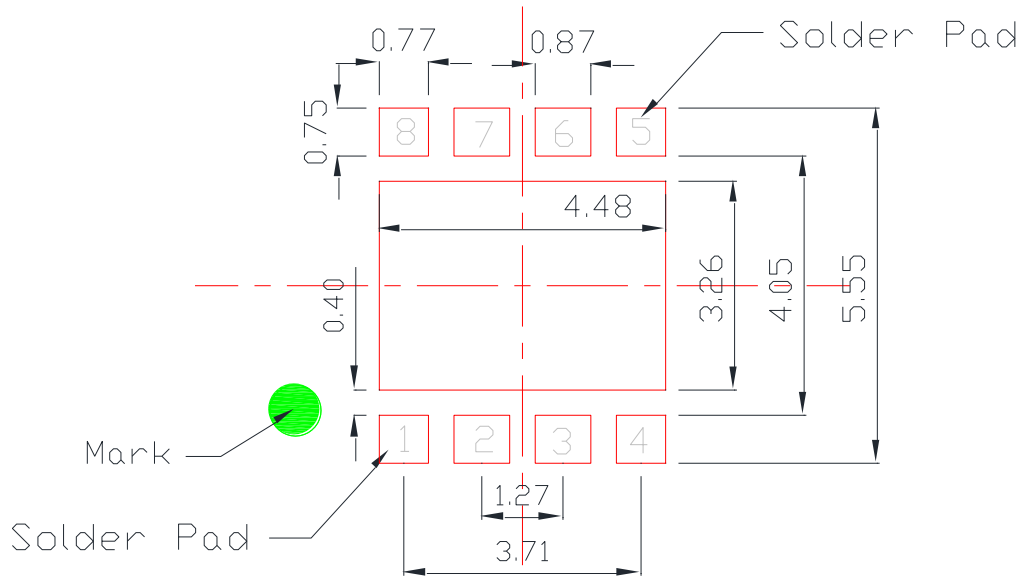
| Item                                            | Test Condition        | Criteria for Judgement |                     |
|-------------------------------------------------|-----------------------|------------------------|---------------------|
|                                                 |                       | 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.

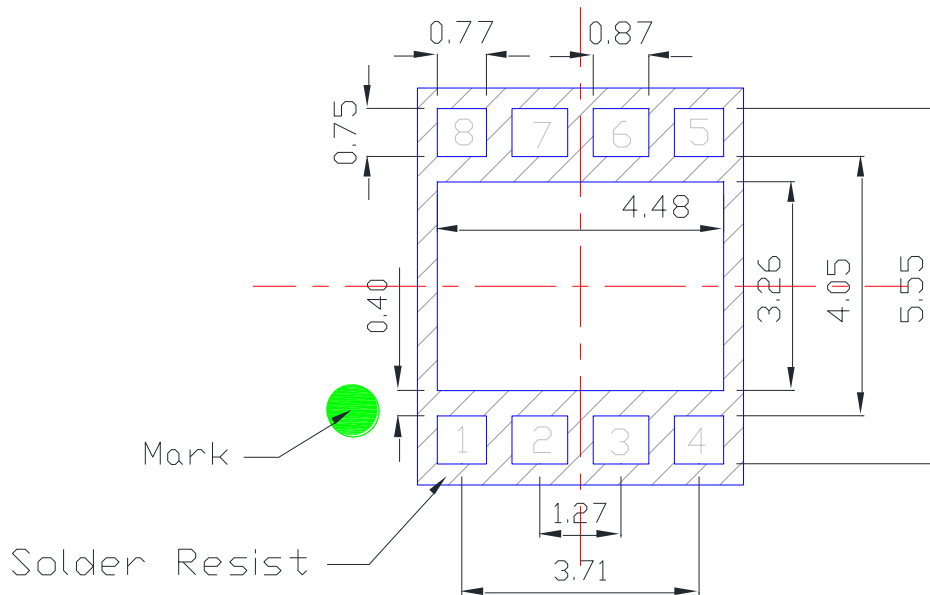
3. A failure is an LED that is open or shorted.

## Recommended Solder Pad Design

### Solder Pad

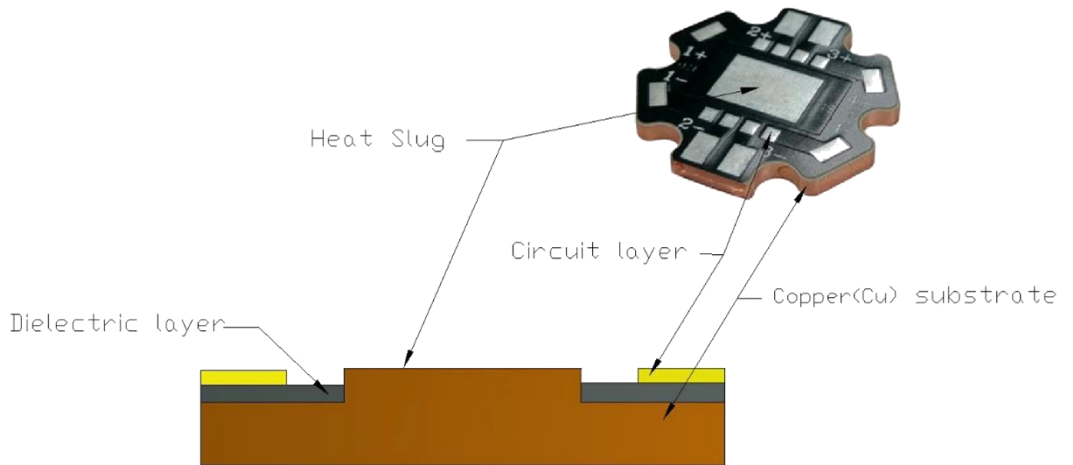


### Solder Resist



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

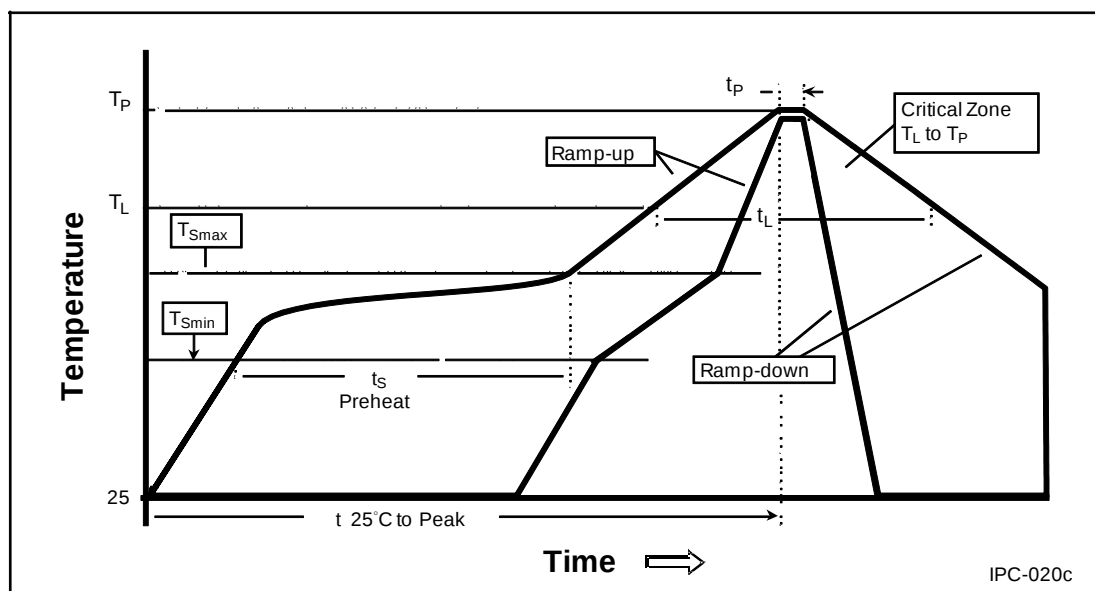
## Recommended MCPCB Design



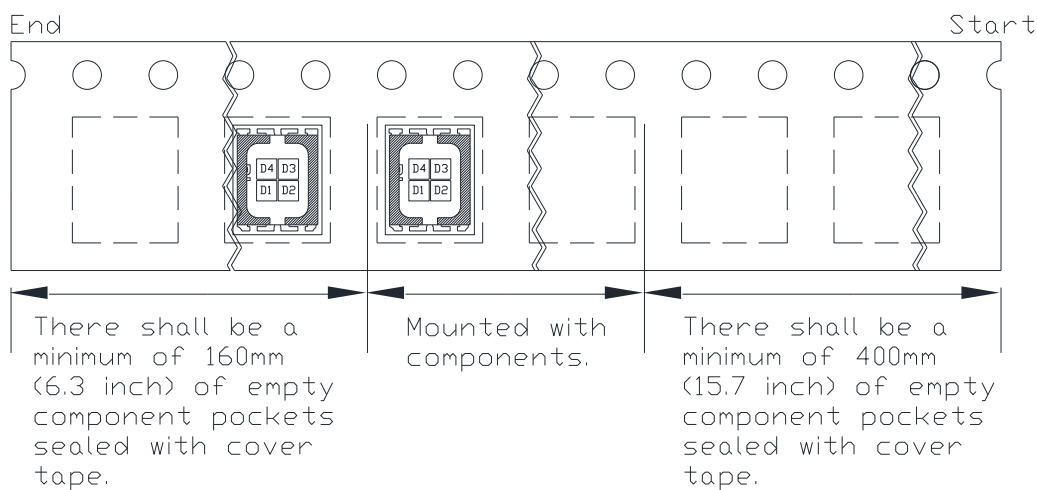
- Copper(Cu) substrate is recommended.

## Reflow Soldering Condition

| Profile Feature                                                                                                                                                                                                         | Sn-Pb Eutectic Assembly          | Pb-Free Assembly                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| Average Ramp-Up Rate<br>( $T_{Smax}$ 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<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>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<br>60-150 seconds          | 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.                   |



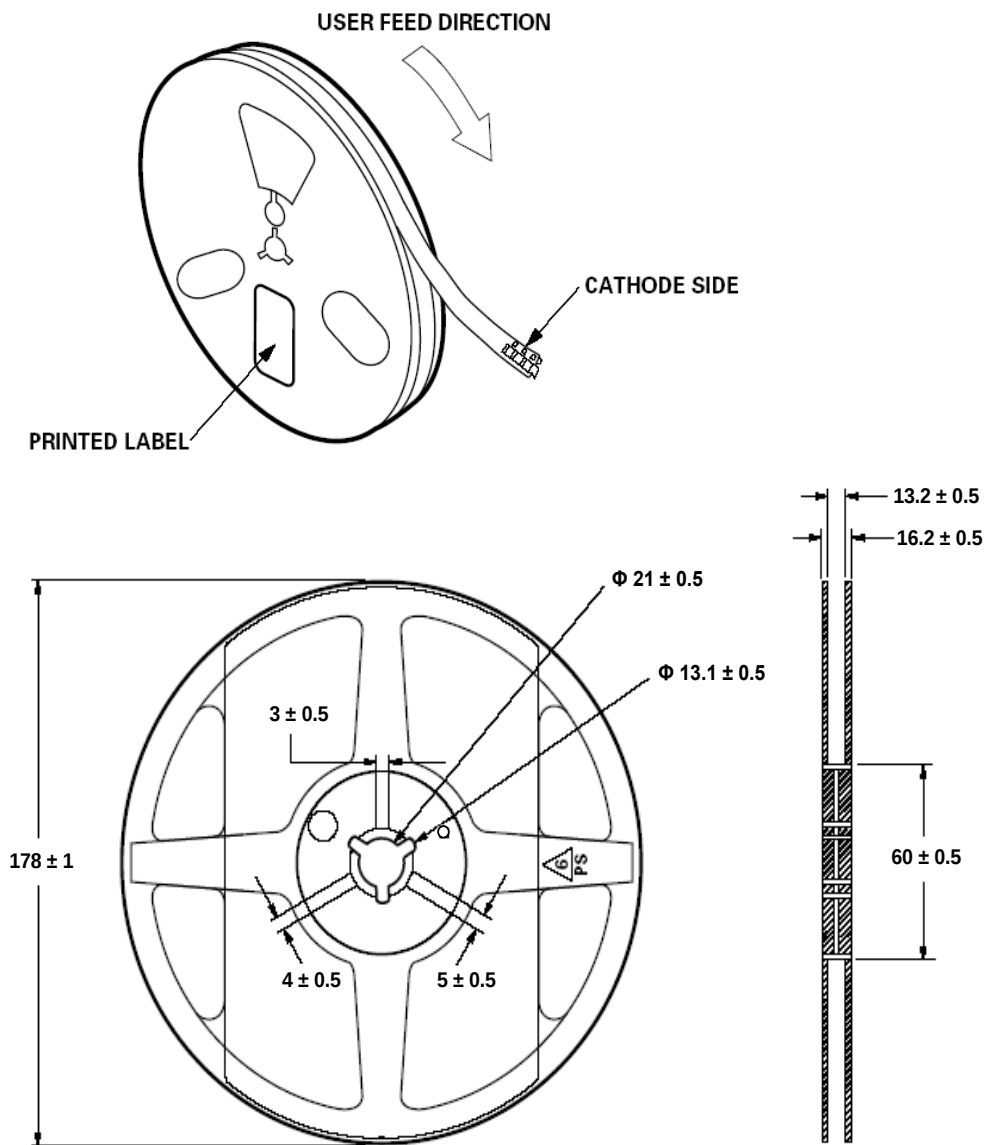
- We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.
- Do not use solder pastes with post reflow flux residue > 47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.
- All temperatures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



1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are  $\pm 0.10\text{mm}$ .



## 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)

