

**ProLight PBEE-40FTE-RBGV**  
**40W Power LED**  
**Technical Datasheet**  
**Version: 1.6**

# ProLight Opto ProEngine Series

## Features

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

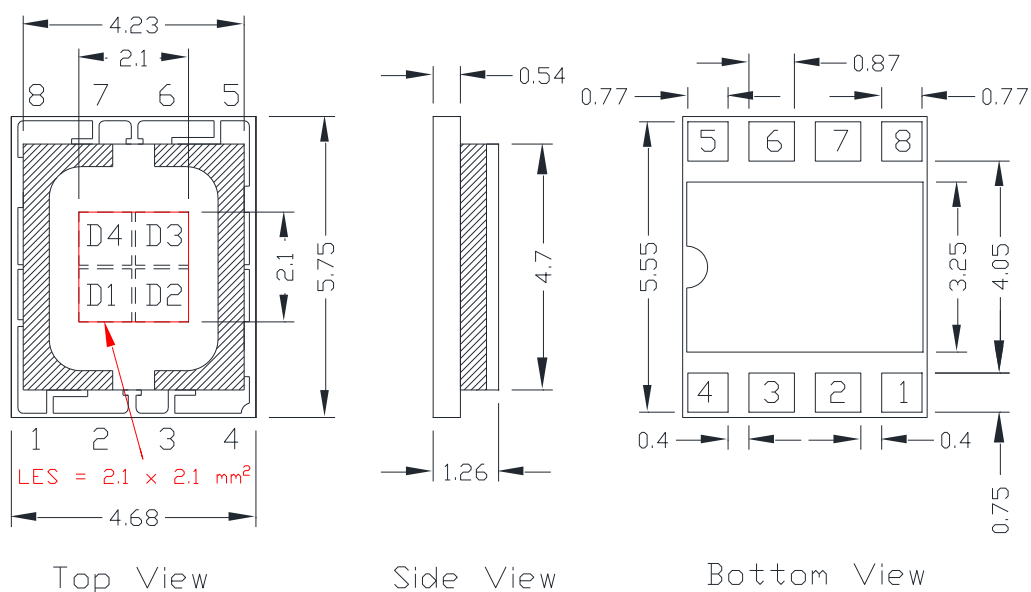
## Main Applications

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

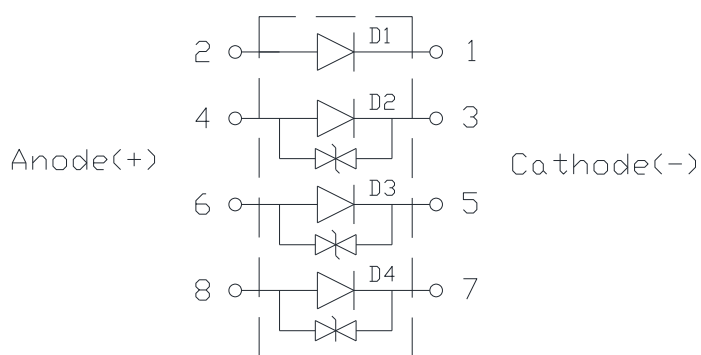
## Introduction

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

## Emitter Mechanical Dimensions



Circuit Diagram



Color

D1 : Red  
D2 : Blue  
D3 : Green  
D4 : Warm 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 |         |                          | CRI<br>Min. |
|------------|------------------------|------------------------------------|---------|--------------------------|-------------|
|            |                        | @1000mA                            |         | Refer @2500mA<br>Typical |             |
|            |                        | Minimum                            | Typical |                          |             |
| Red        | PBEE-40FTE-RBGV        | 140 lm                             | 154 lm  | 309 lm                   | -           |
| Blue       |                        | 1235 mW                            | 1300 mW | 2640 mW                  | -           |
| Green      |                        | 195 lm                             | 225 lm  | 372 lm                   | -           |
| Warm White |                        | 135 lm                             | 160 lm  | 312 lm                   | 90          |

● **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 Resistance<br>Junction to Slug ( $^\circ\text{C/W}$ ) |
|------------|---------------------------|-----------------|------|-----------------------|---|
|            | Min.                      | @1000mA<br>Typ. | Max. | Refer @2500mA<br>Typ. |   |
| Red        | 1.85                      | 2.30            | 2.80 | 2.90                  | 1.1   |
| Blue       | 2.70                      | 3.00            | 3.40 | 3.27                  |   |
| Green      | 3.00                      | 3.40            | 4.10 | 4.08                  |   |
| Warm White | 2.70                      | 3.00            | 3.40 | 3.27                  |   |

- 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)<br>$\theta_{0.90\text{V}}$ | Viewing<br>Angle<br>(degrees)<br>$2\theta_{1/2}$ |
|----------------------|------------|---|--------|--------|--|--|
|                      |            | Min.  | Typ.   | Max.   |  |  |
| Flat                 | Red        | 620 nm  | 624 nm | 630 nm | 160  | 120  |
|                      | Blue       | 450 nm  | 453 nm | 455 nm | 160  | 120  |
|                      | Green      | 520 nm  | 525 nm | 530 nm | 160  | 120  |
|                      | Warm White | 2770 K  | 2870 K | 2970 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  | Blue         | Green        | Warm White   |
|--|--|--------------|--------------|--------------|
| DC Forward Current<br>(4 chips operation, $T_{Board} = 25^{\circ}\text{C}$ )     | 40 - 2500 mA                               | 40 - 2500 mA | 40 - 2500 mA | 40 - 2500 mA |
| DC Forward Current<br>(Single chip operation, $T_{Board} = 25^{\circ}\text{C}$ ) | 40 - 2500 mA                               | 40 - 3000 mA | 40 - 3000 mA | 40 - 2500 mA |
| ESD Sensitivity<br>(HBM per MIL-STD-883E Method 3015.7)                          | $\pm 4000\text{V}$ (Class III)             |              |              |              |
| LED Junction Temperature   | $125^{\circ}\text{C}$                      |              |              |              |
| Operating Board Temperature  | $-40^{\circ}\text{C} - 85^{\circ}\text{C}$ |              |              |              |
| Storage Temperature  | $-40^{\circ}\text{C} - 85^{\circ}\text{C}$ |              |              |              |
| Soldering Temperature  | JEDEC 020c $260^{\circ}\text{C}$           |              |              |              |
| 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) |
|------------|----------|----------------------------------|----------------------------------|
| Red        | A        | 140                              | 170                              |
|            | B        | 170                              | 210                              |
| Green      | A        | 195                              | 235                              |
|            | B        | 235                              | 285                              |
| Warm White | A        | 135                              | 165                              |
|            | B        | 165                              | 200                              |

- 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.

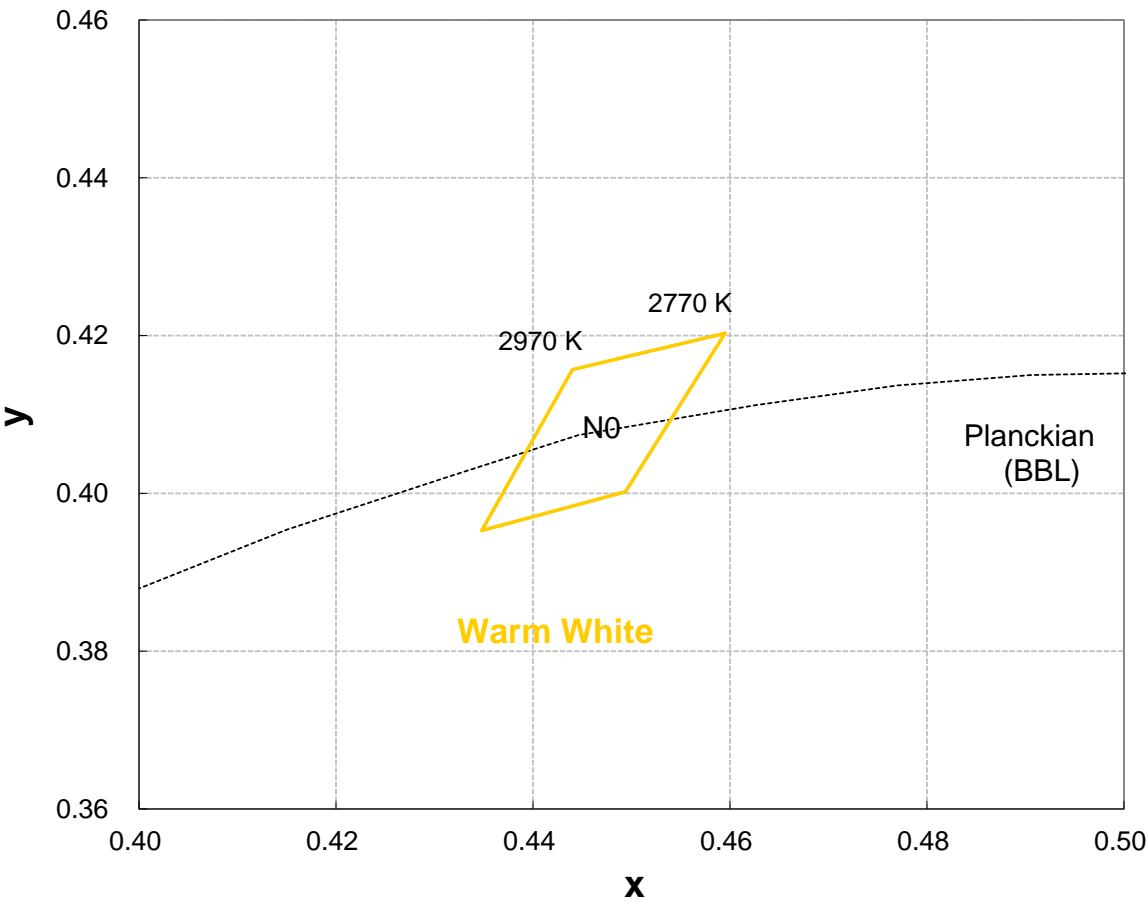
## Radiometric Power Bin Structure at 1000mA

| Color | Bin Code | Minimum<br>Radiometric Power (mW) | Maximum<br>Radiometric Power (mW) |
|-------|----------|-----------------------------------|-----------------------------------|
| Blue  | A        | 1235                              | 1400                              |
|       | B        | 1400                              | 1600                              |

- 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

Warm White Binning Structure Graphical Representation



Warm White Bin Structure

| Bin Code | x      | y      | Typ. CCT (K) |
|----------|--------|--------|--------------|
| N0       | 0.4595 | 0.4203 | 2870         |
|          | 0.4440 | 0.4157 |              |
|          | 0.4348 | 0.3953 |              |
|          | 0.4494 | 0.4002 |              |

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

## Dominant Wavelength Bin Structure

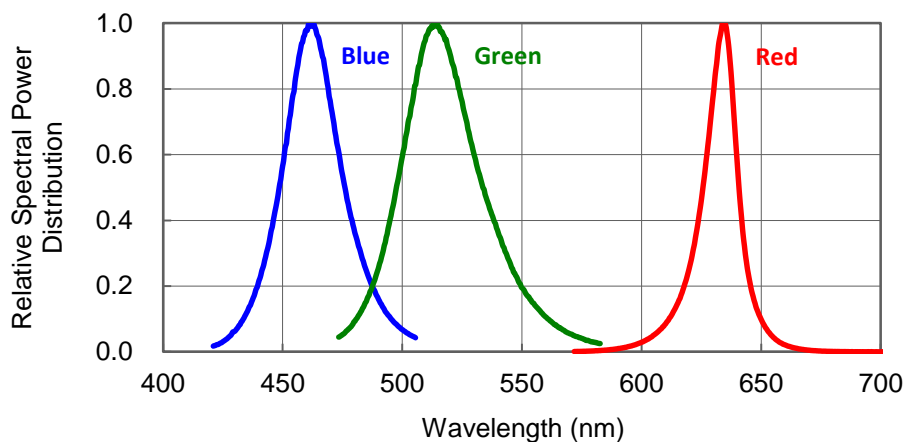
| Color | Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|-------|----------|----------------------------------|----------------------------------|
| Red   | 4        | 620                              | 630                              |
| Blue  | 5        | 450                              | 455                              |
| Green | 1        | 520                              | 525                              |
|       | 2        | 525                              | 530                              |

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

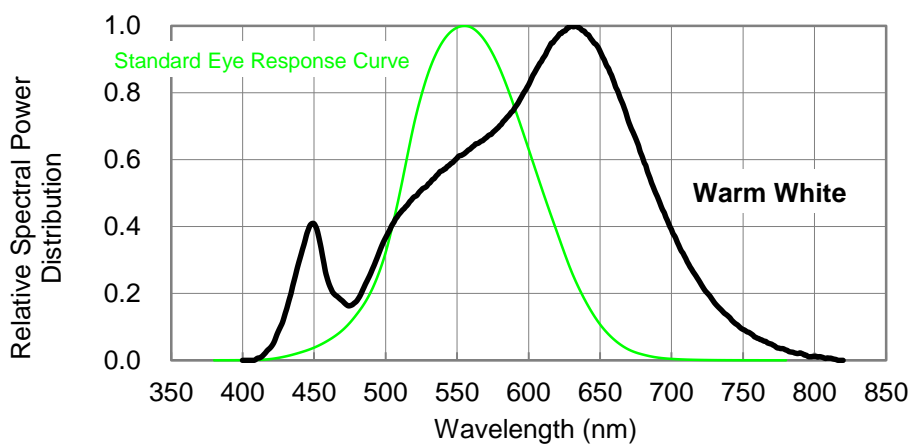
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

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

### 1. Blue 、 Green 、 Red

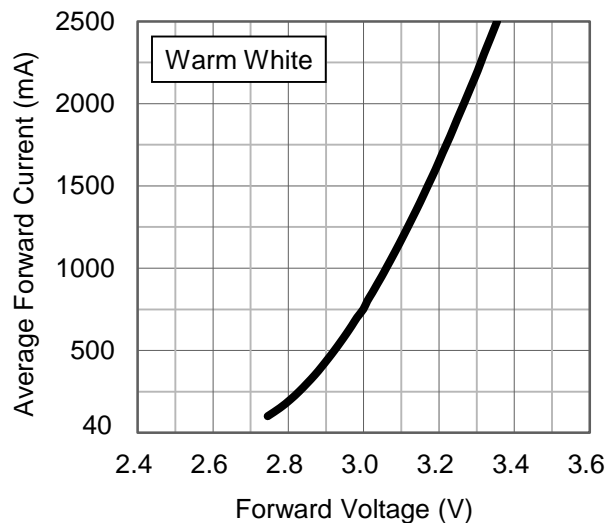
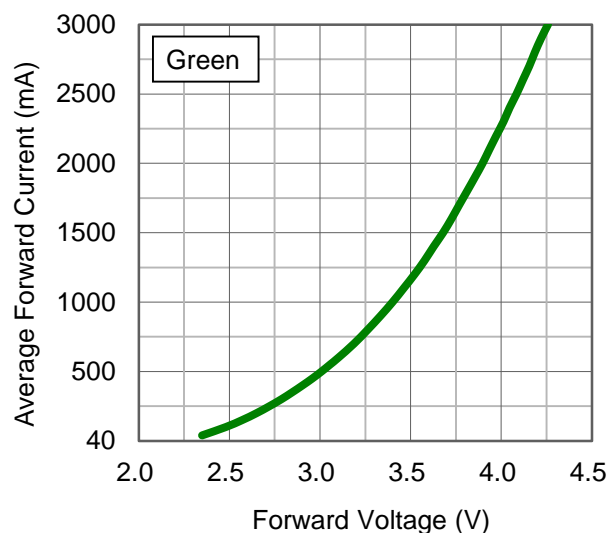
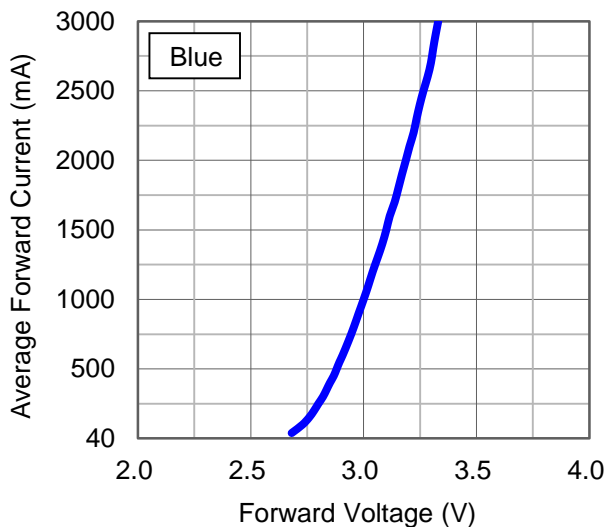
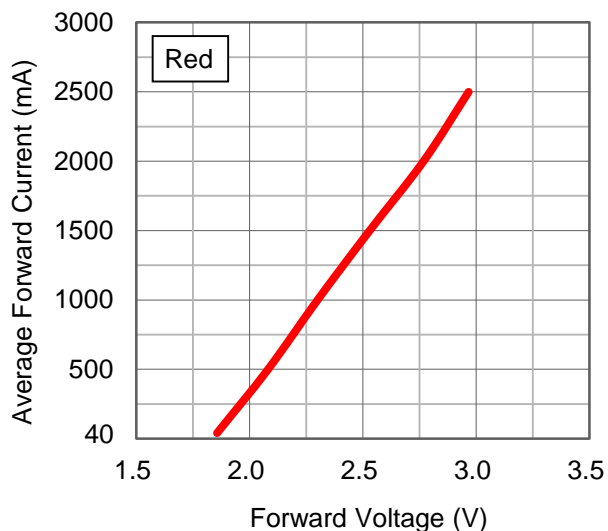


### 2. Warm White



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

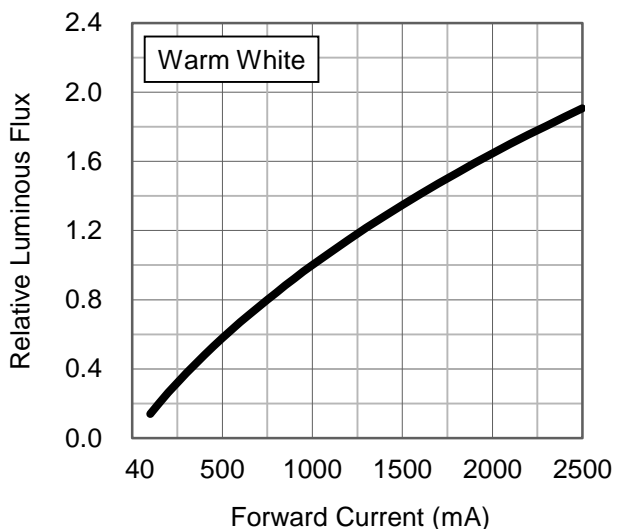
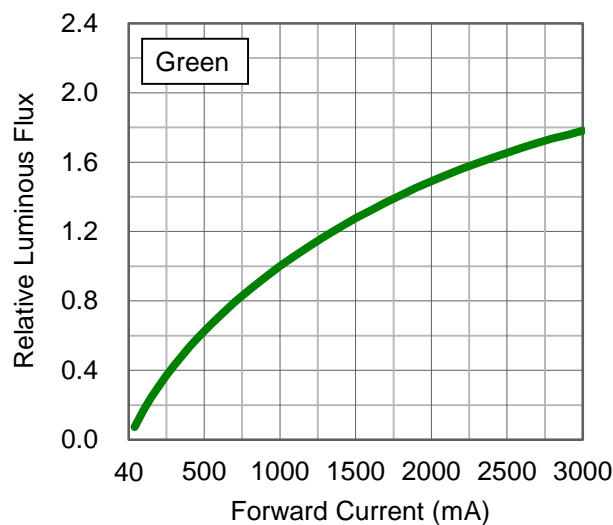
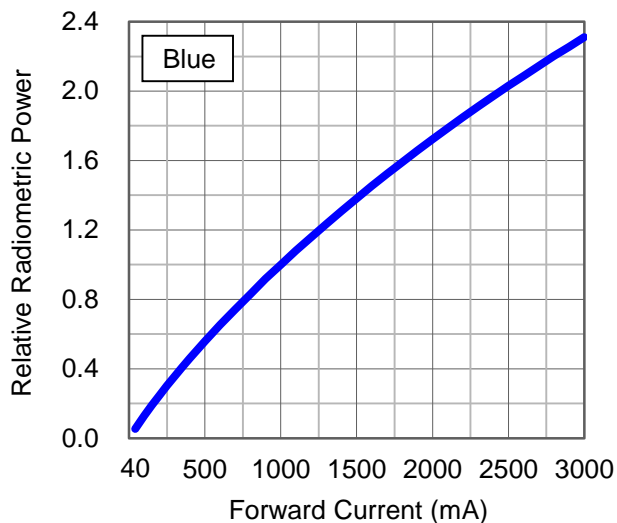
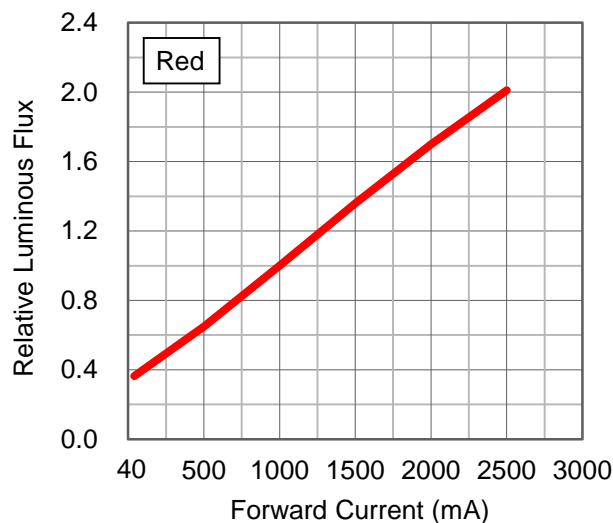
## 1. Forward Voltage vs. Forward Current





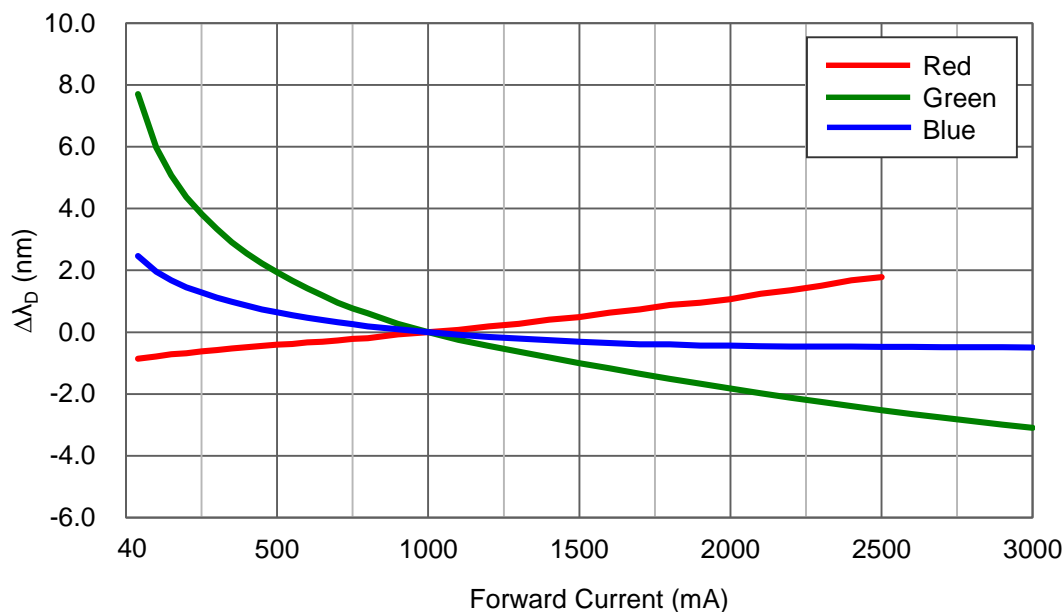
# Forward Current Characteristics, $T_j = 25^{\circ}\text{C}$

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

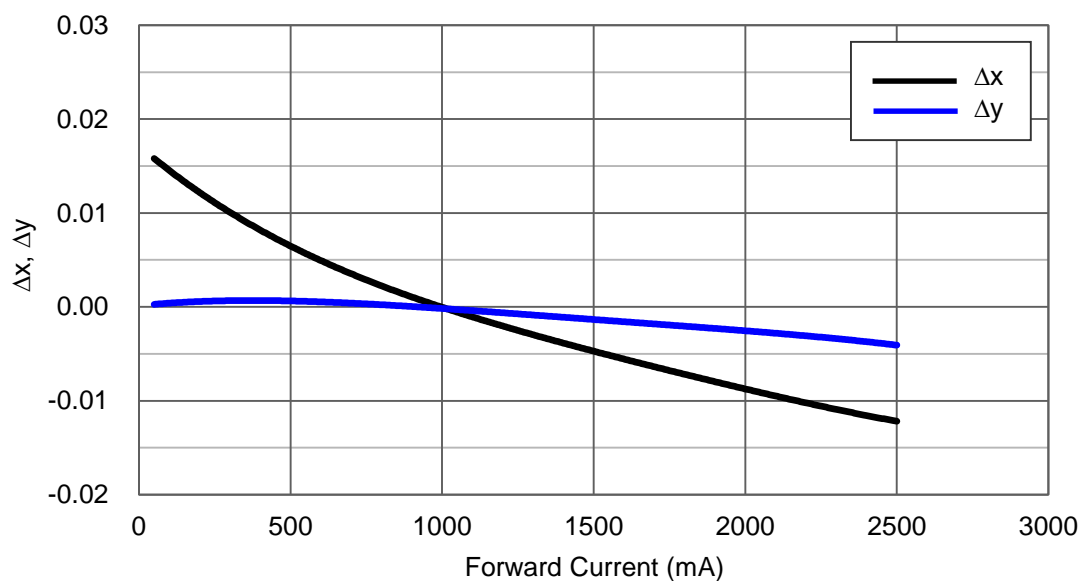


## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

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

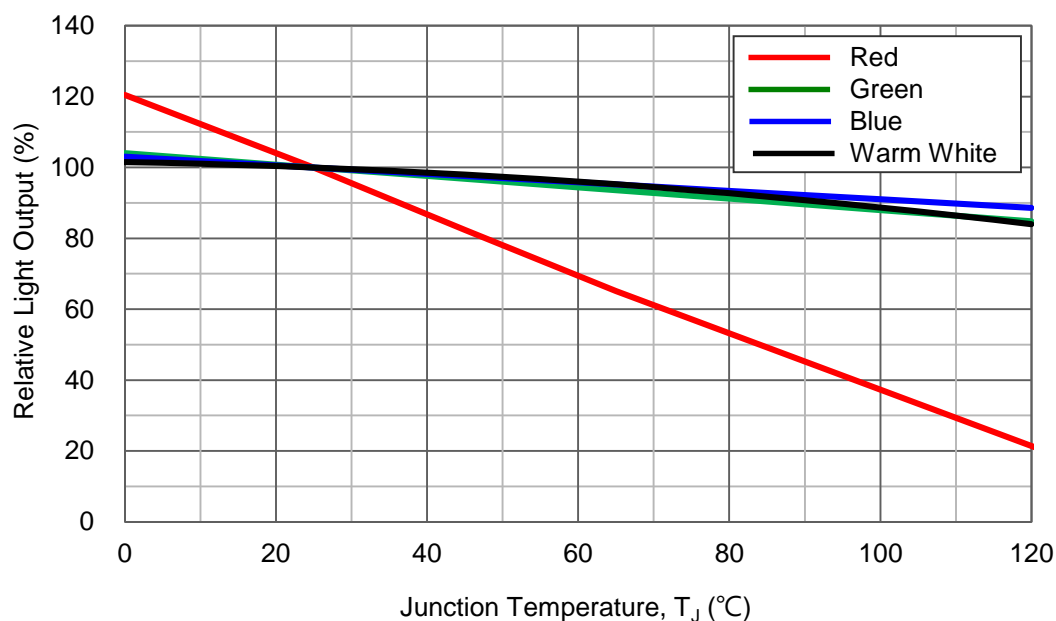


### 4. Forward Current vs. Chromaticity Coordinate Shift

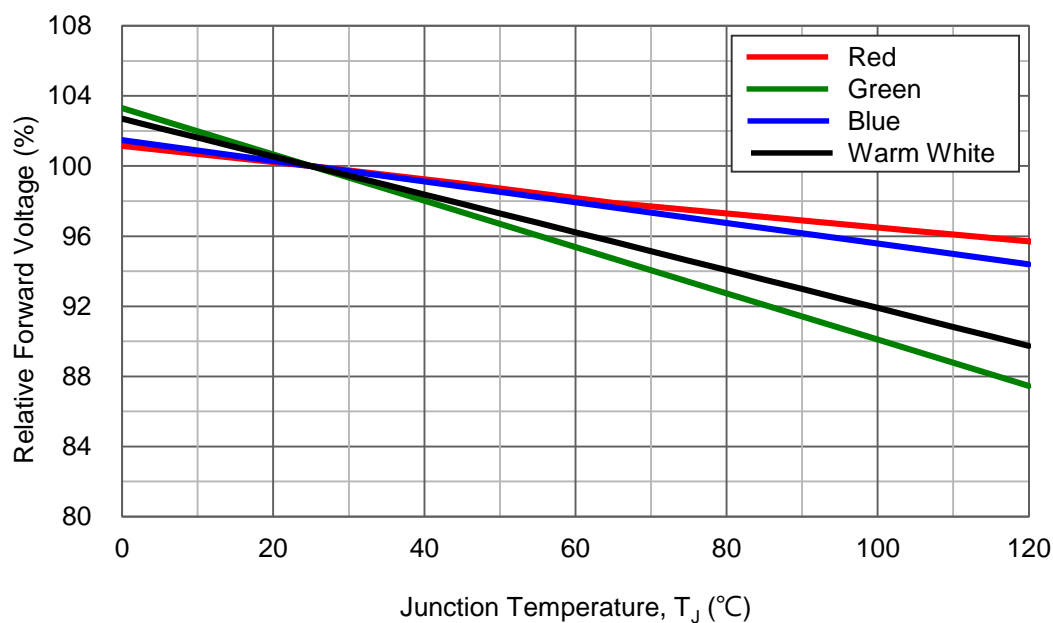


# Junction Temperature Relative Characteristics

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

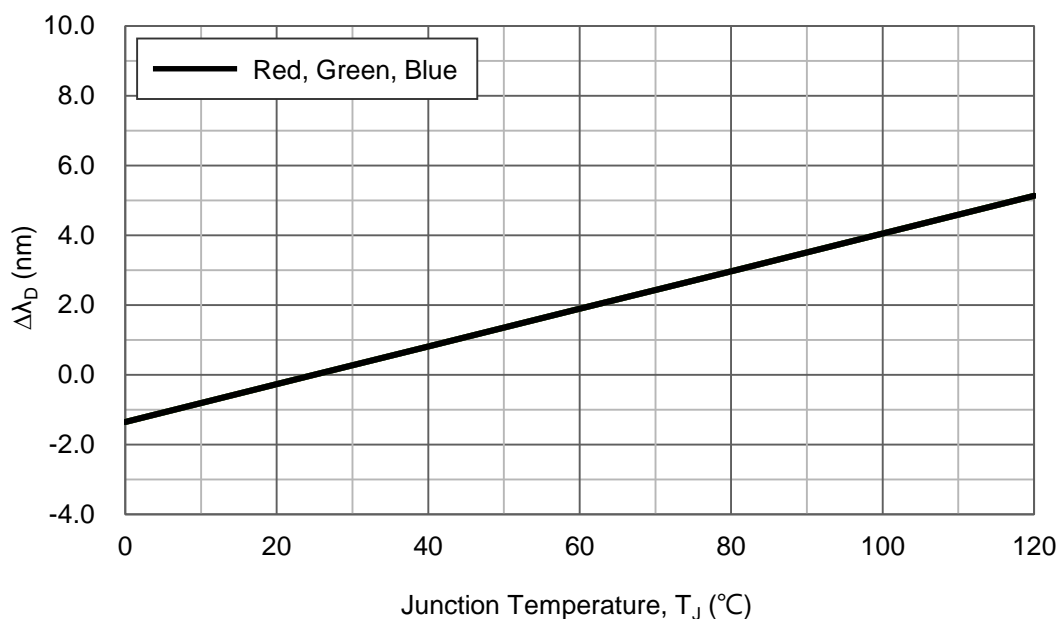


## 2. Junction Temperature vs. Relative Forward Voltage at 1000mA

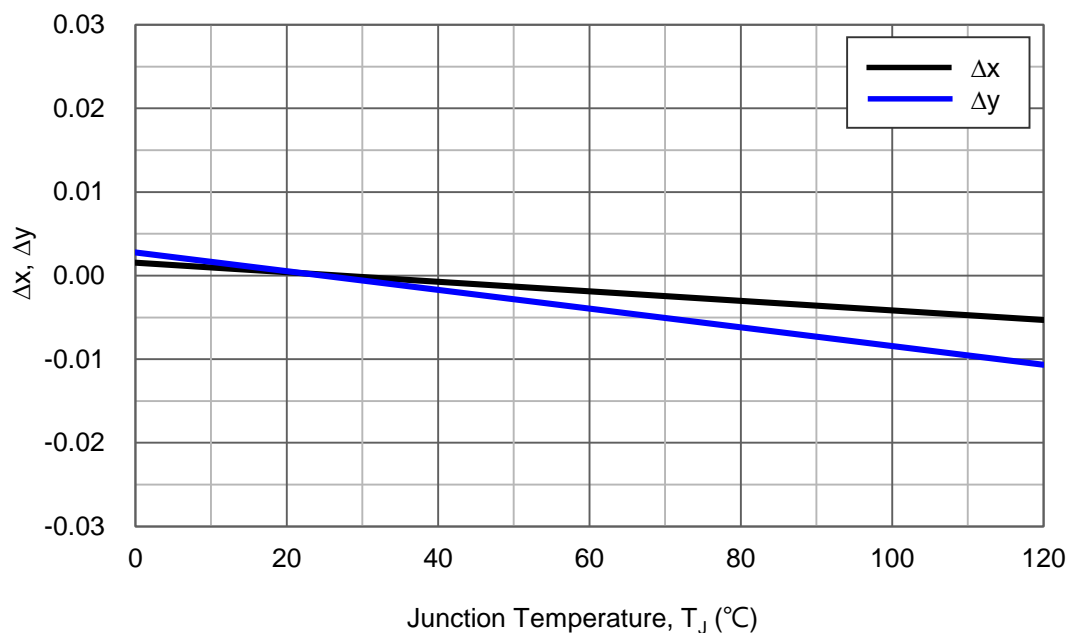


## Junction Temperature Relative Characteristics

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

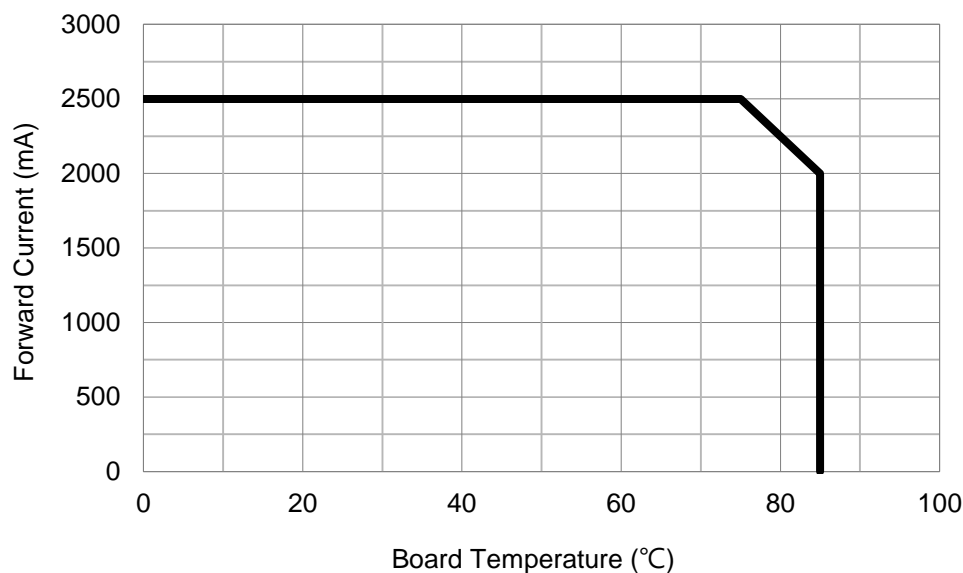


### 4. Junction Temperature vs. Chromaticity Coordinate Shift at 1000mA

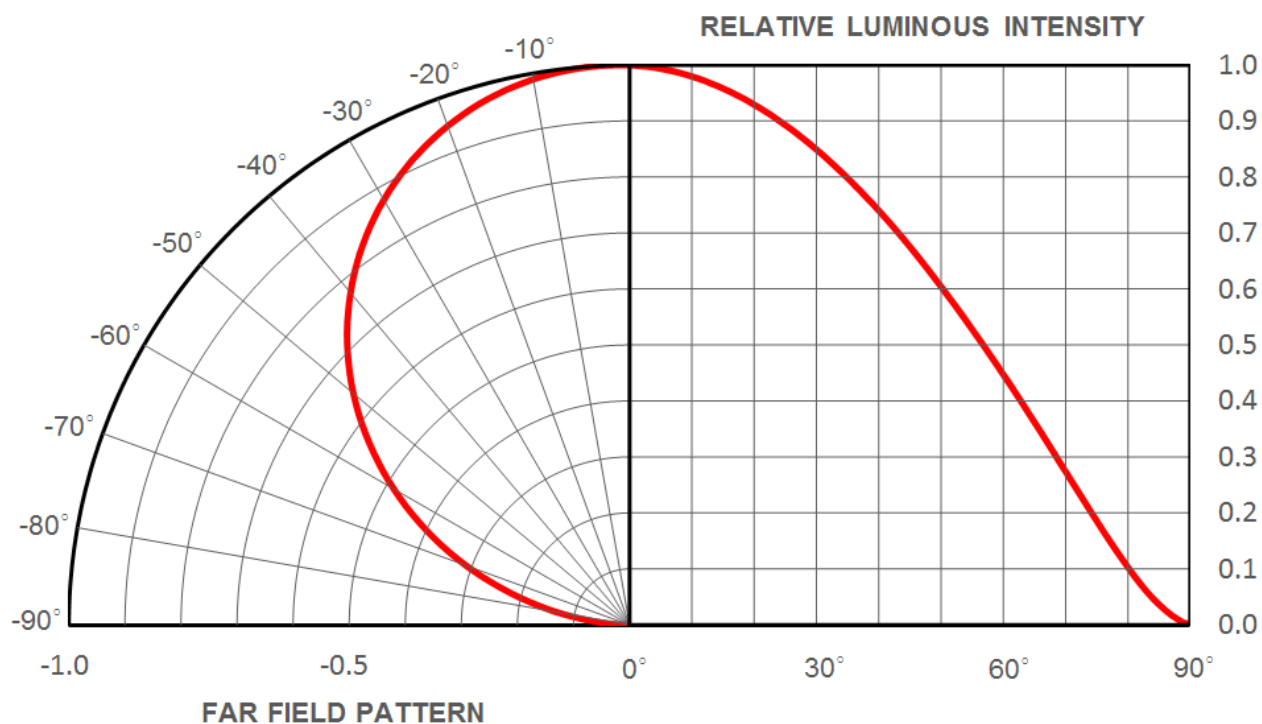


## Board Temperature vs. Maximum Forward Current

Maximum Forward Current for 4 chip operated



## Typical Representative Spatial Radiation Pattern



## Moisture Sensitivity Level - JEDEC Level 1

| Level | Floor Life |                                    | Soak Requirements |                               |                         |            |
|-------|------------|------------------------------------|-------------------|-------------------------------|-------------------------|------------|
|       |            |                                    | Standard          |                               | Accelerated Environment |            |
|       | Time       | Conditions                         | Time (hours)      | Conditions                    | Time (hours)            | Conditions |
| 1     | Unlimited  | $\leq 30^{\circ}\text{C}$ / 85% RH | 168 +5/-0         | $85^{\circ}\text{C}$ / 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           | $\leq 30^{\circ}\text{C}$ / 85% RH | 168 +5/-0           | $85^{\circ}\text{C}$ / 85% RH | NA                      | NA                            |
| 2     | 1 year              | $\leq 30^{\circ}\text{C}$ / 60% RH | 168 +5/-0           | $85^{\circ}\text{C}$ / 60% RH | NA                      | NA                            |
| 2a    | 4 weeks             | $\leq 30^{\circ}\text{C}$ / 60% RH | 696 +5/-0           | $30^{\circ}\text{C}$ / 60% RH | 120 +1/-0               | $60^{\circ}\text{C}$ / 60% RH |
| 3     | 168 hours           | $\leq 30^{\circ}\text{C}$ / 60% RH | 192 +5/-0           | $30^{\circ}\text{C}$ / 60% RH | 40 +1/-0                | $60^{\circ}\text{C}$ / 60% RH |
| 4     | 72 hours            | $\leq 30^{\circ}\text{C}$ / 60% RH | 96 +2/-0            | $30^{\circ}\text{C}$ / 60% RH | 20 +0.5/-0              | $60^{\circ}\text{C}$ / 60% RH |
| 5     | 48 hours            | $\leq 30^{\circ}\text{C}$ / 60% RH | 72 +2/-0            | $30^{\circ}\text{C}$ / 60% RH | 15 +0.5/-0              | $60^{\circ}\text{C}$ / 60% RH |
| 5a    | 24 hours            | $\leq 30^{\circ}\text{C}$ / 60% RH | 48 +2/-0            | $30^{\circ}\text{C}$ / 60% RH | 10 +0.5/-0              | $60^{\circ}\text{C}$ / 60% RH |
| 6     | Time on Label (TOL) | $\leq 30^{\circ}\text{C}$ / 60% RH | Time on Label (TOL) | $30^{\circ}\text{C}$ / 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                     |
| 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,<br><5 min. transfer                             | 200 cycles      | Note 2                     |
| Mechanical Shock                       | 1500 G, 0.5 msec. pulse,<br>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,<br>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<br>at 260°C for 5 sec.                  |                 | Solder coverage<br>on lead |

### Notes:

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

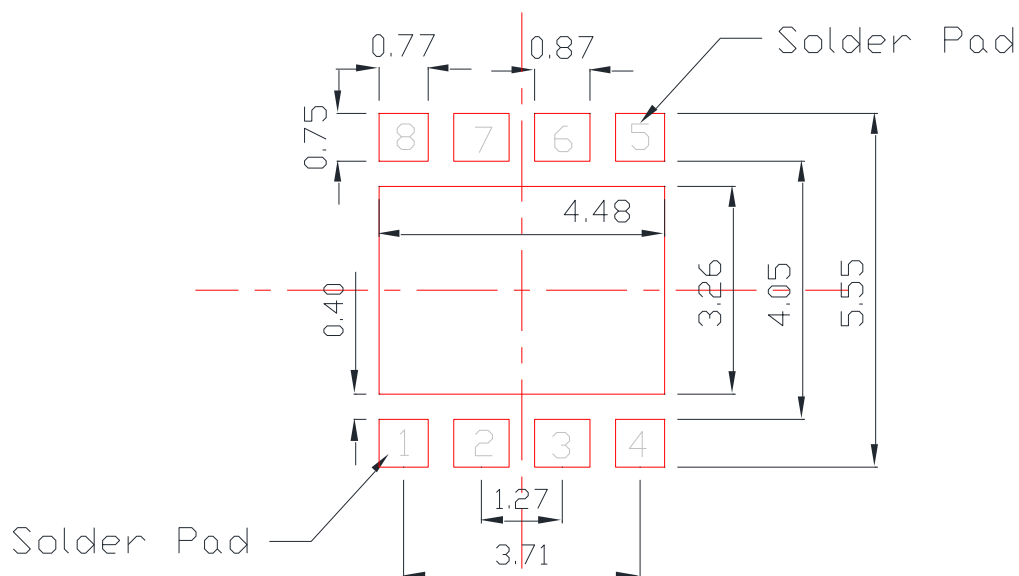
| Item  | Test Condition        | Criteria for Judgement |                     |
|---|-----------------------|------------------------|---------------------|
|   |                       | Min.                   | Max.                |
| Forward Voltage ( $V_F$ )                       | $I_F = \text{max DC}$ | --                     | 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.

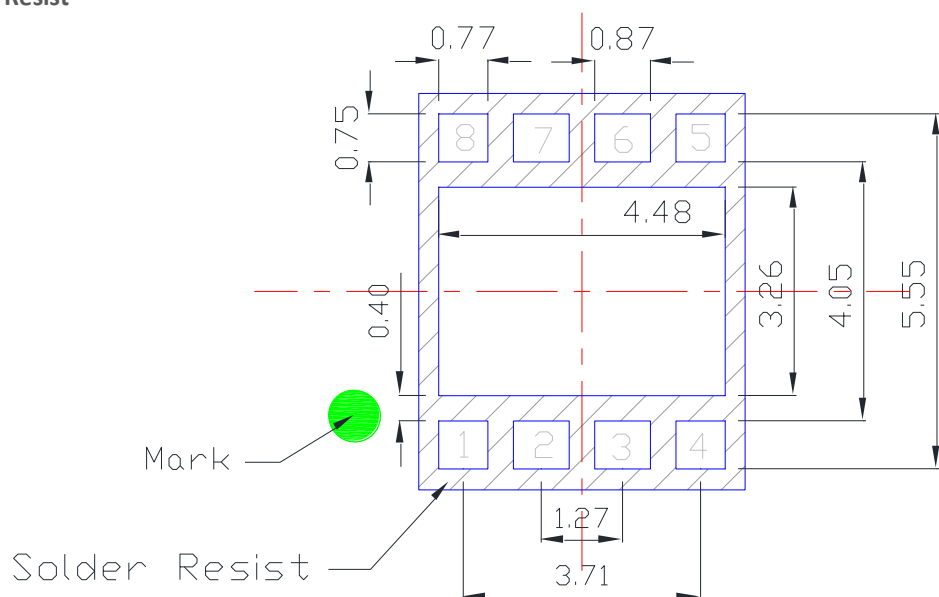
3. A failure is an LED that is open or shorted.

## Recommended Solder Pad Design

### Solder Pad



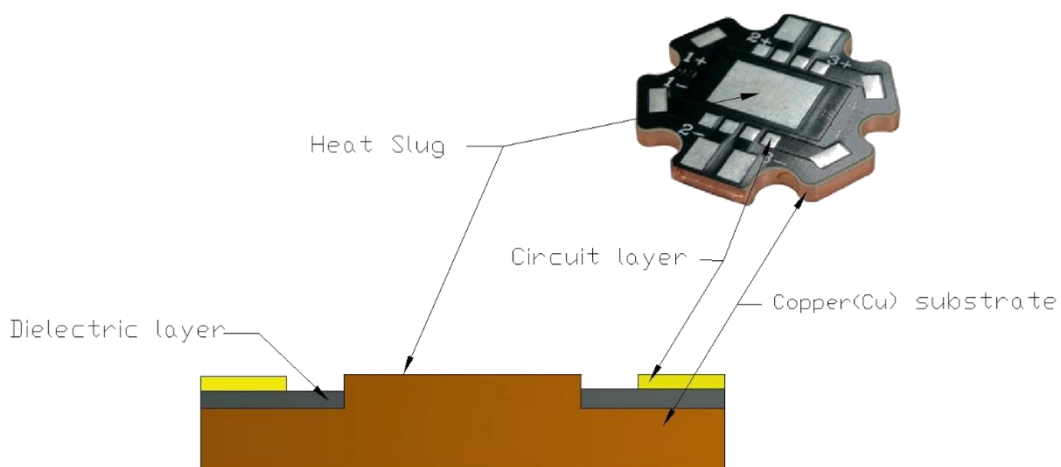
### Solder Resist



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



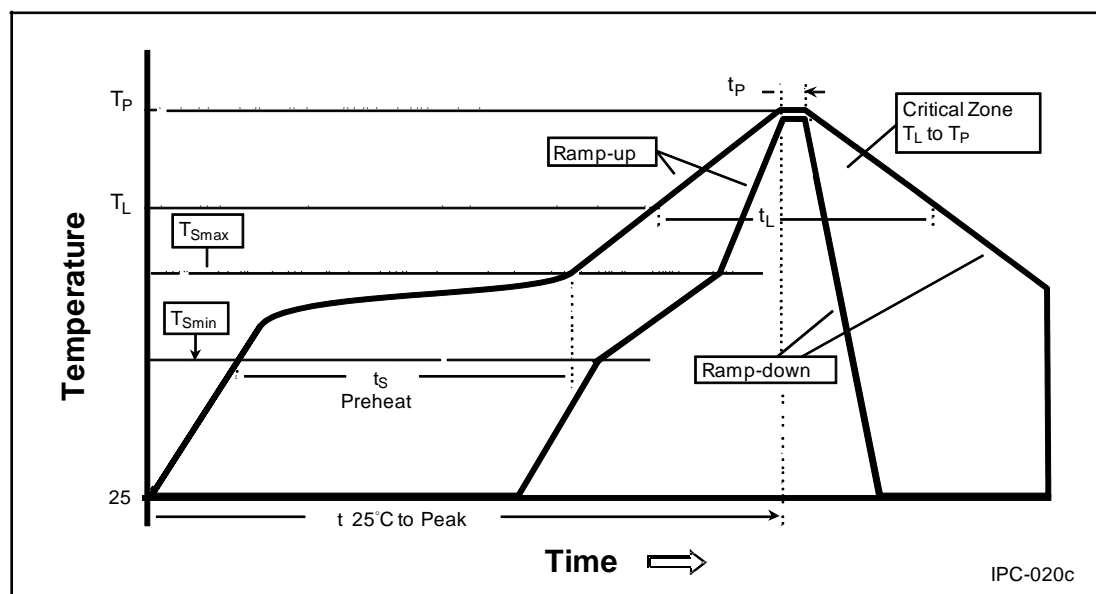
## Recommended MCPCB Design



- Copper(Cu) substrate is recommended.

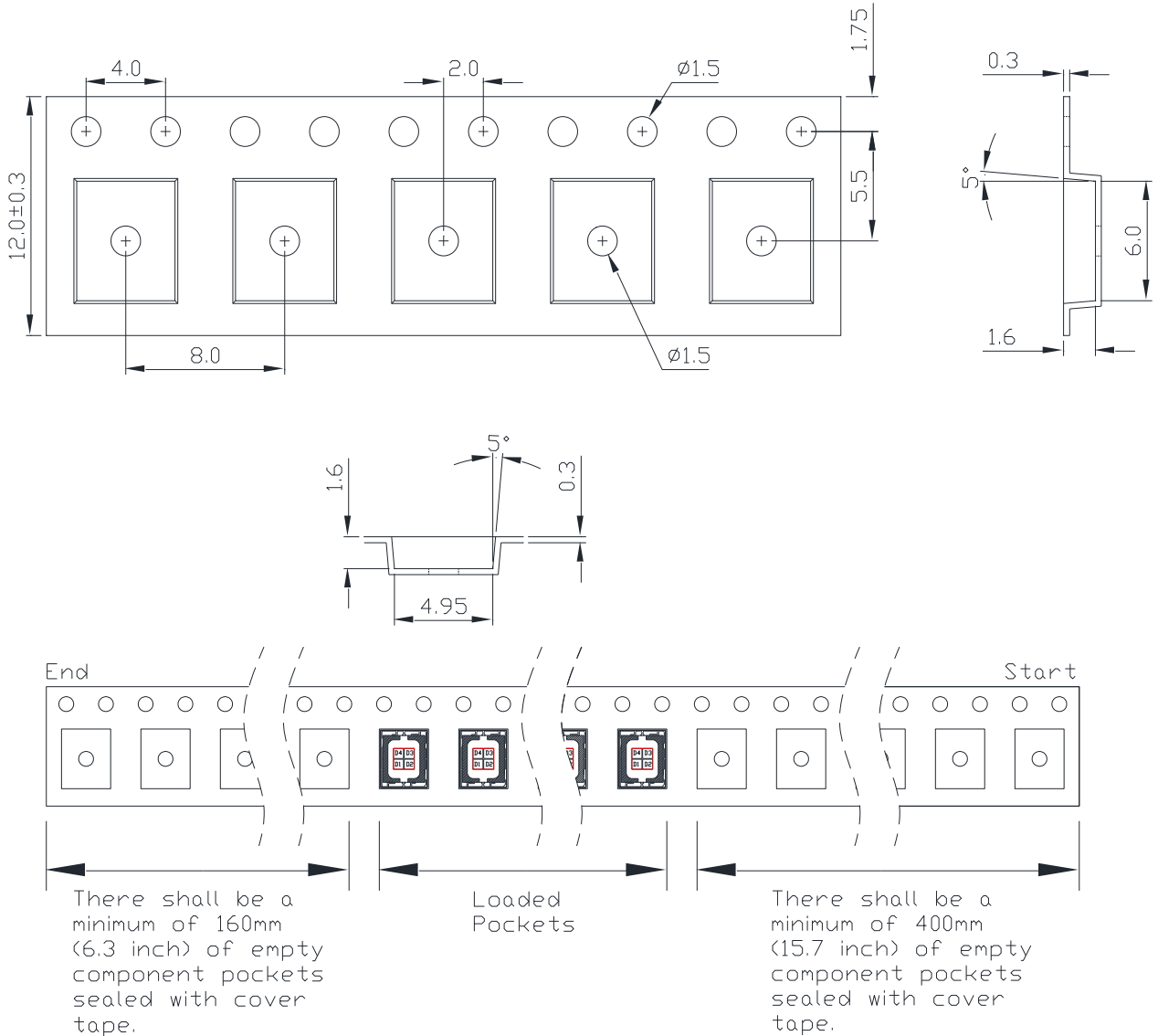
## Reflow Soldering Condition

| 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.

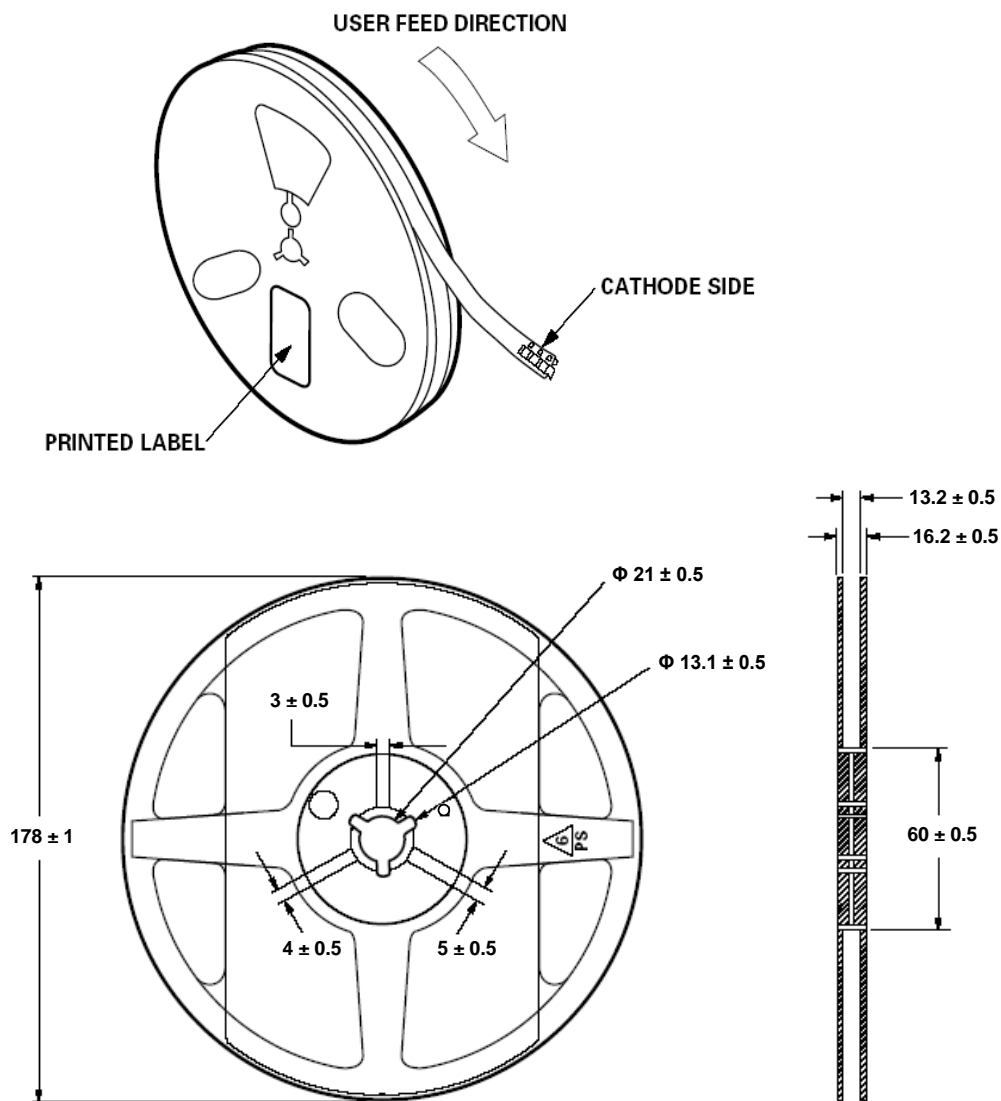
## Emitter Reel Packaging



### Notes:

1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are  $\pm 0.1$ 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 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 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)

