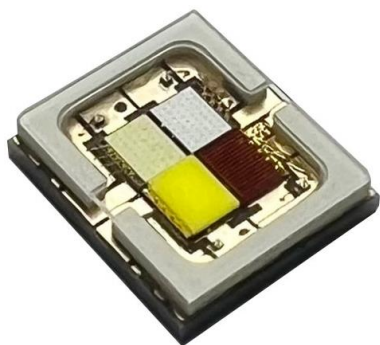




**ProLight PBEB-60F4E-NRBGPG**  
**60W Power LED**  
**Technical Datasheet**  
**Version: 1.0**

# ProLight Opto ProEngine Series

## Features

- Compact light source
- R, B, G, PC Green four color in one package
- Maximum drive current: 5000mA per LED die
- Lead free reflow soldering
- Superior ESD protection
- RoHS compliant

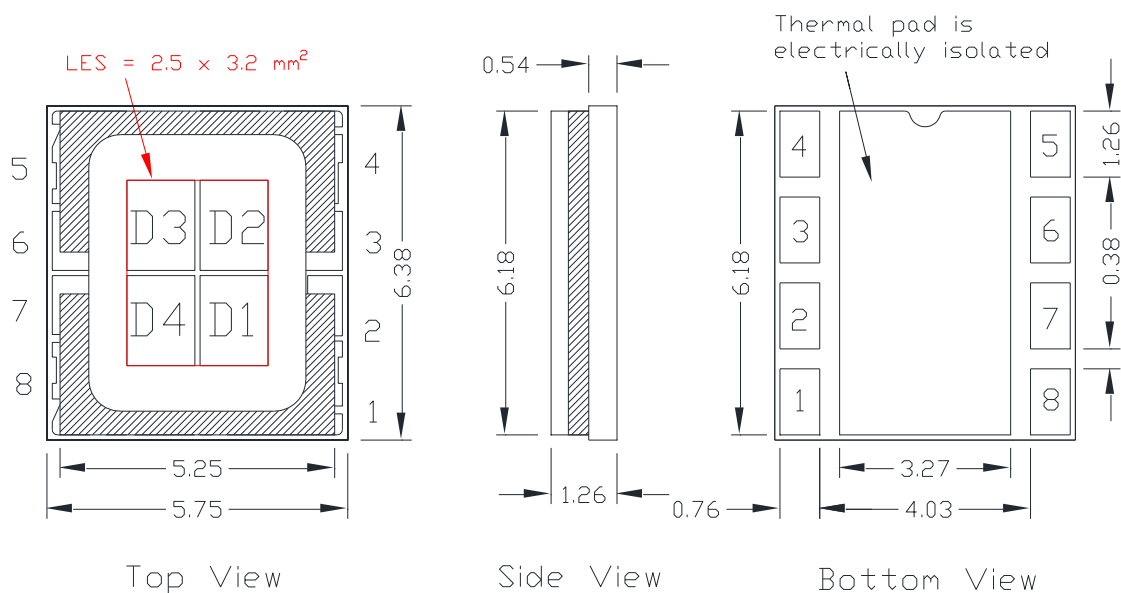
## Main Applications

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

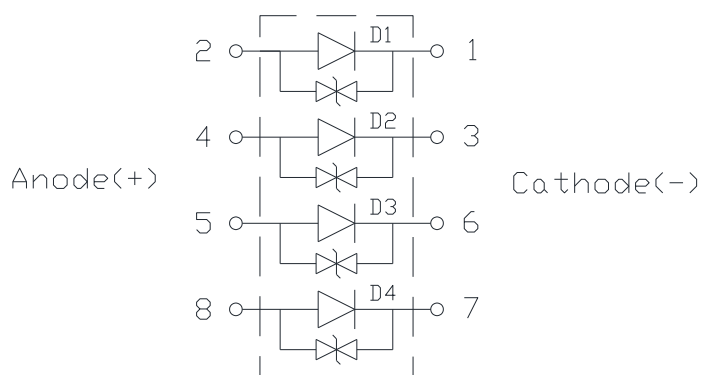
## Introduction

- ProLight PBEB colorful series is a color changeable LED with maximum 4 color chips in one package. Compared to discrete LEDs, PBEB series reduce the distance between LED die, creating a small optical source for excellent optical control and efficient color mixing. ProLight PBEB 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 : PC Green

### 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 |         |               |
|----------|------------------------|------------------------------------|---------|---------------|
|          |                        | @1400mA                            |         | Refer @5000mA |
|          |                        | Minimum                            | Typical | Typical       |
| Red      | PBEB-60F4E-NRBGPG      | 165 lm                             | 215 lm  | 548 lm        |
| Blue     |                        | 1930 mW                            | 2090 mW | 5560 mW       |
| Green    |                        | 420 lm                             | 460 lm  | 934 lm        |
| PC Green |                        | 525 lm                             | 585 lm  | 1486 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 Resistance<br>Junction to Slug ( $^\circ\text{C}/\text{W}$ ) |
|----------|---------------------------|-----------------|------|-----------------------|----------------------------------------------------------------------|
|          | Min.                      | @1400mA<br>Typ. | Max. | Refer @5000mA<br>Typ. |                                                                      |
| Red      | 1.90                      | 2.20            | 2.70 | 2.90                  | 0.5                                                                  |
| Blue     | 2.80                      | 3.00            | 3.50 | 3.70                  |                                                                      |
| Green    | 2.60                      | 2.80            | 3.30 | 3.45                  |                                                                      |
| PC Green | 2.80                      | 3.00            | 3.50 | 3.70                  |                                                                      |

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

## Optical Characteristics at 1400mA, $T_j = 25^\circ\text{C}$

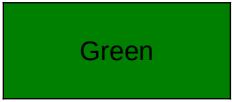
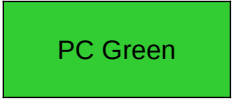
| Radiation<br>Pattern | Color    | Dominant Wavelength $\lambda_D$ |          |        | Viewing<br>Angle<br>(degrees)<br>$2\theta_{1/2}$ |
|----------------------|----------|---------------------------------|----------|--------|--------------------------------------------------|
|                      |          | Min.                            | Typ.     | Max.   |                                                  |
| Lambertian           | Red      | 620 nm                          | 623 nm   | 630 nm | 120                                              |
|                      | Blue     | 450 nm                          | 452 nm   | 455 nm | 120                                              |
|                      | Green    | 525 nm                          | 528 nm   | 532 nm | 120                                              |
|                      | PC Green | 566 nm                          | 567.5 nm | 569 nm | 120                                              |

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

# Absolute Maximum Ratings

| Parameter                                                                                     | Red                                       | Blue             | Green        | PC Green     |
|-----------------------------------------------------------------------------------------------|-------------------------------------------|------------------|--------------|--------------|
| DC Forward Current<br>(4 chips operation, $T_{\text{Thermal Pad}} = 25^{\circ}\text{C}$ )     | 40 - 5000 mA                              | 40 - 5000 mA     | 40 - 5000 mA | 40 - 5000 mA |
| DC Forward Current<br>(Single chip operation, $T_{\text{Thermal Pad}} = 25^{\circ}\text{C}$ ) | 40 - 5000 mA                              | 40 - 5000 mA     | 40 - 5000 mA | 40 - 5000 mA |
| ESD withstand voltage<br>acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)                        |                                           | 2000V            |              |              |
| LED Junction Temperature                                                                      |                                           | 125°C            |              |              |
| Operating 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 1400mA

| Color                                                                            | Bin Code | Minimum Photometric Flux (lm) | Maximum Photometric Flux (lm) |
|----------------------------------------------------------------------------------|----------|-------------------------------|-------------------------------|
|  | A        | 165                           | 200                           |
|                                                                                  | B        | 200                           | 245                           |
|                                                                                  | C        | 245                           | 300                           |
|  | A        | 420                           | 530                           |
|                                                                                  | B        | 530                           | 670                           |
|                                                                                  | C        | 670                           | 840                           |
|  | A        | 525                           | 640                           |
|                                                                                  | B        | 640                           | 780                           |
|                                                                                  | C        | 780                           | 950                           |

- 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 1400mA

| Color                                                                              | Bin Code | Minimum Radiometric Power (mW) | Maximum Radiometric Power (mW) |
|------------------------------------------------------------------------------------|----------|--------------------------------|--------------------------------|
|  | A        | 1930                           | 2160                           |
|                                                                                    | B        | 2160                           | 2420                           |
|                                                                                    | C        | 2420                           | 2700                           |

- 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.

## Dominant Wavelength Bin Structure

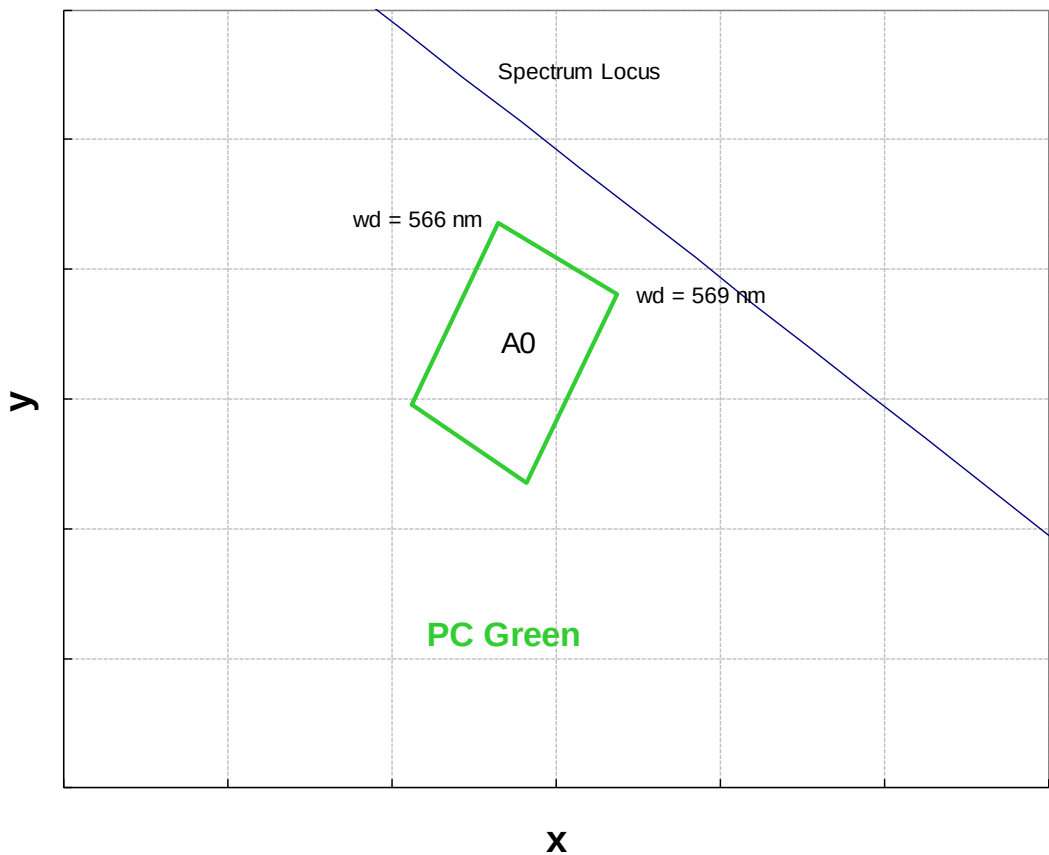
| Color                                                                              | Bin Code | Minimum Dominant Wavelength (nm) | Maximum Dominant Wavelength (nm) |
|------------------------------------------------------------------------------------|----------|----------------------------------|----------------------------------|
|  | 4        | 620                              | 630                              |
|  | 5        | 450                              | 455                              |
|  | 2        | 525                              | 530                              |
|                                                                                    | 3        | 527                              | 532                              |

- 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.

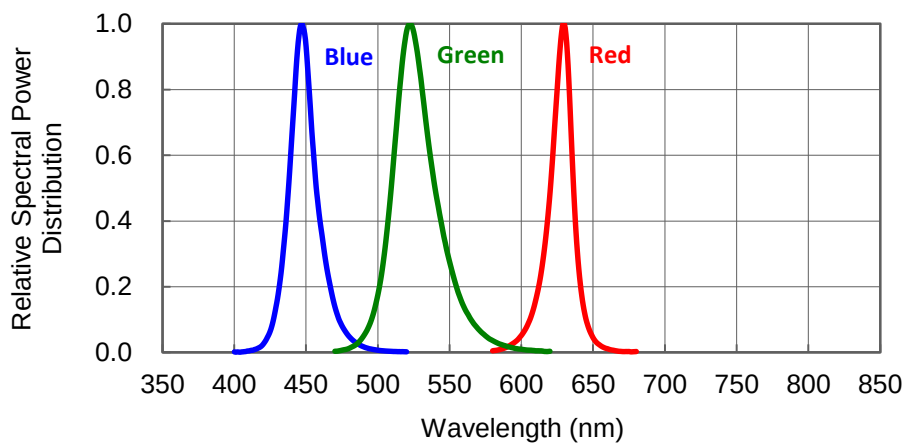
# Color Bin

PC Green Binning Structure Graphical Representation

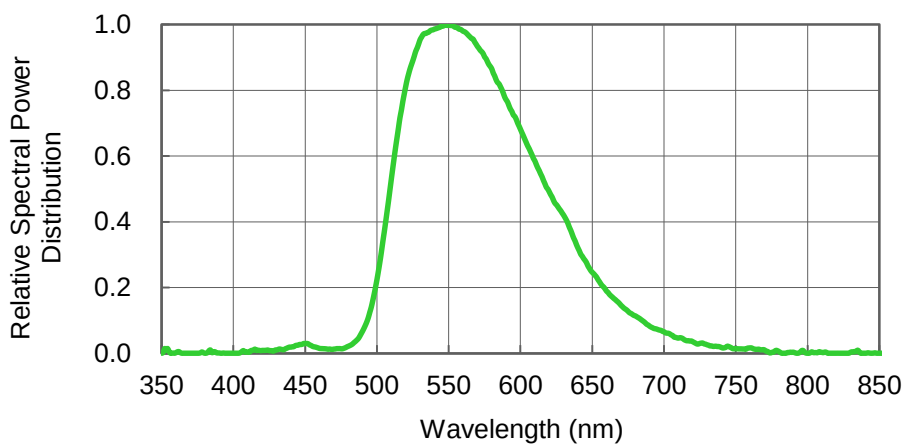


## Color Spectrum, $T_j = 25^\circ\text{C}$

### 1. Blue 、 Green 、 Red

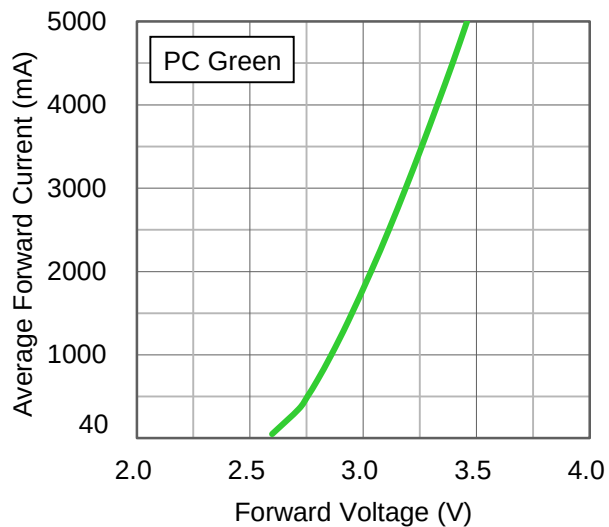
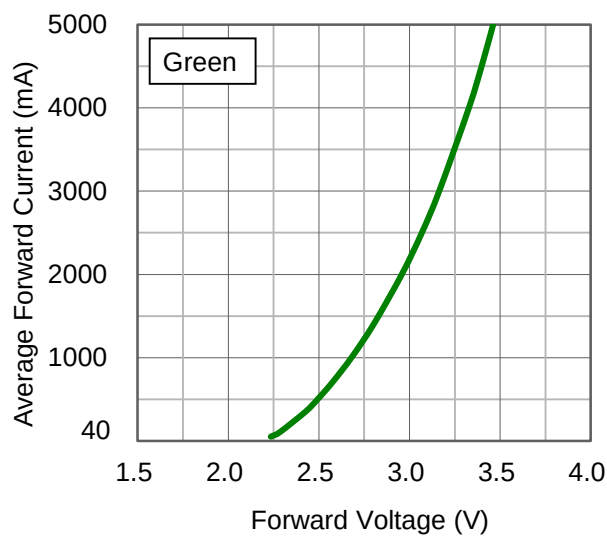
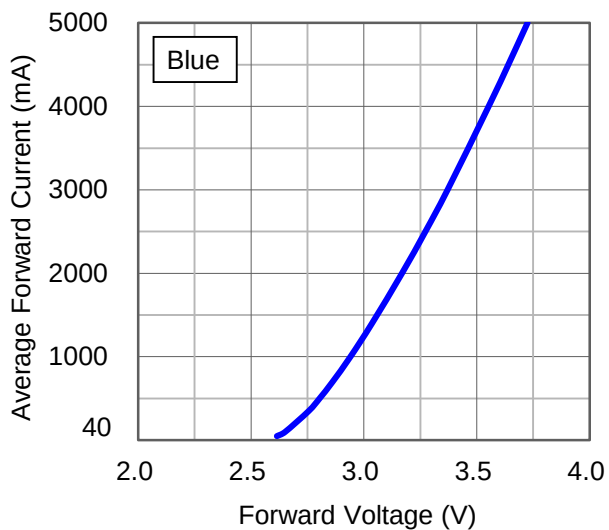
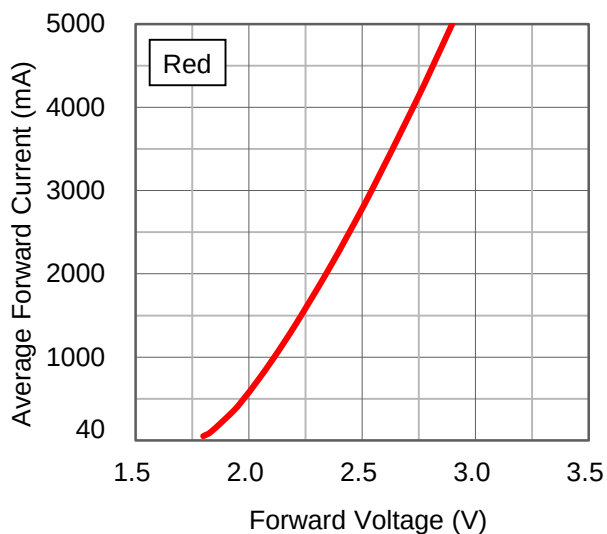


### 2. PC Green



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

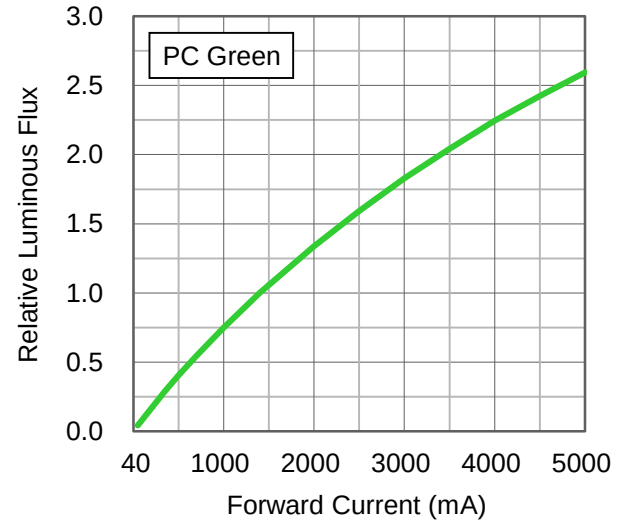
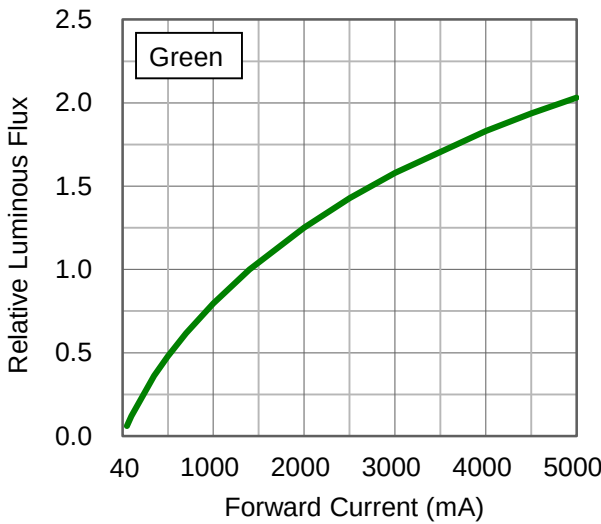
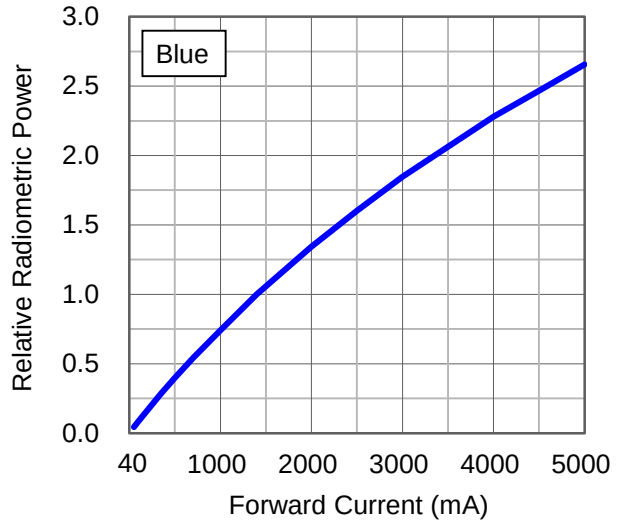
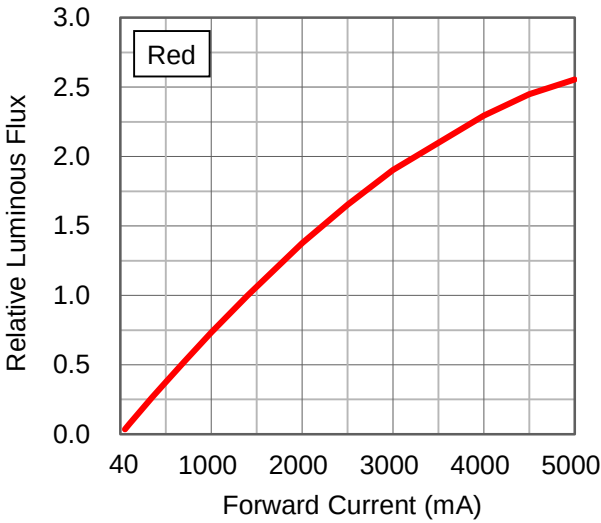
## 1. Forward Voltage vs. Forward Current





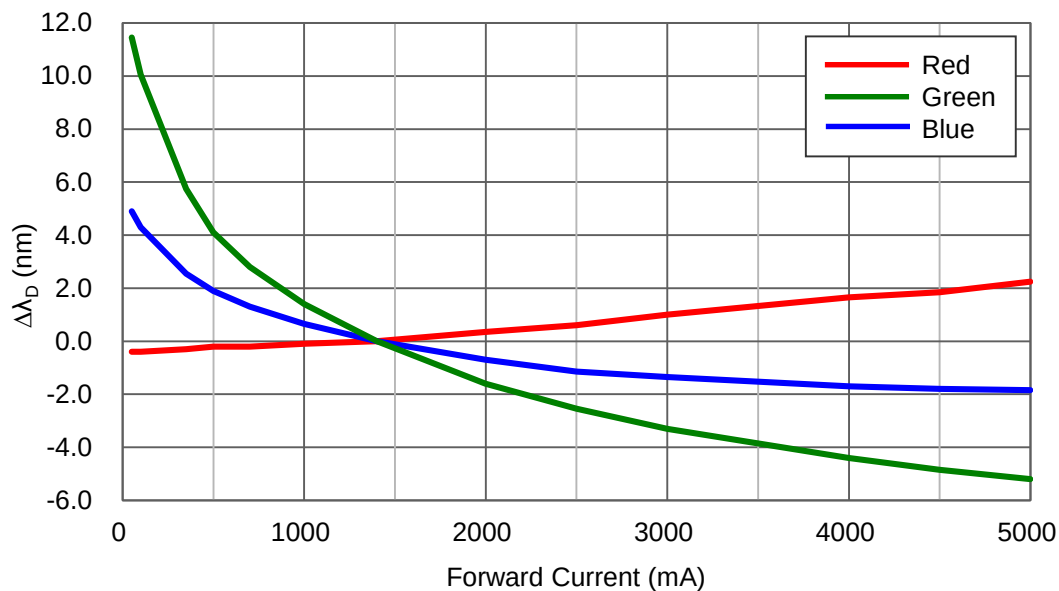
# Forward Current Characteristics, $T_j = 25^{\circ}\text{C}$

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

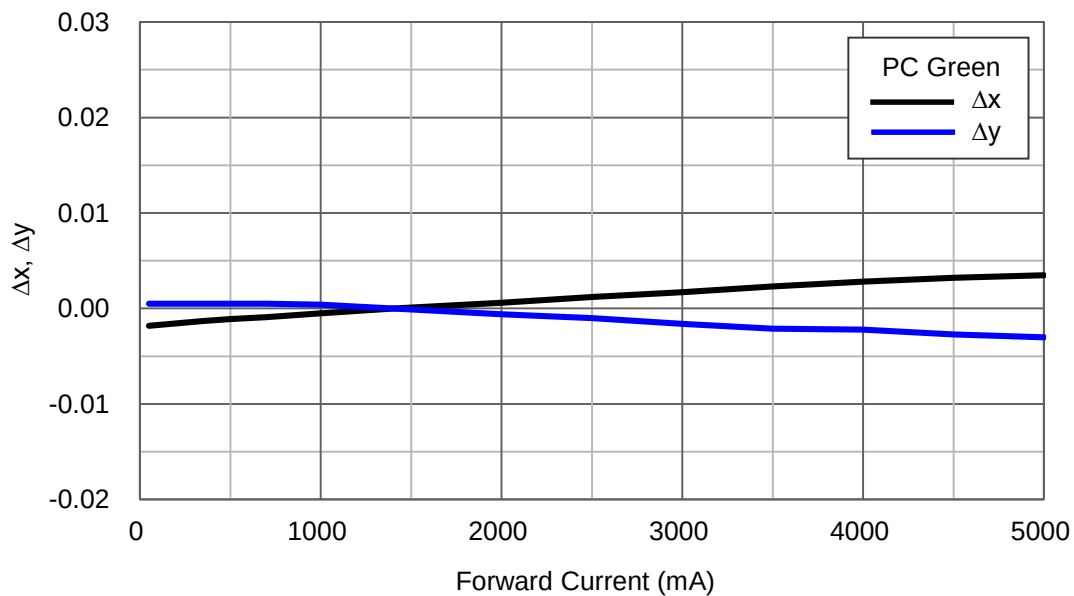


## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

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

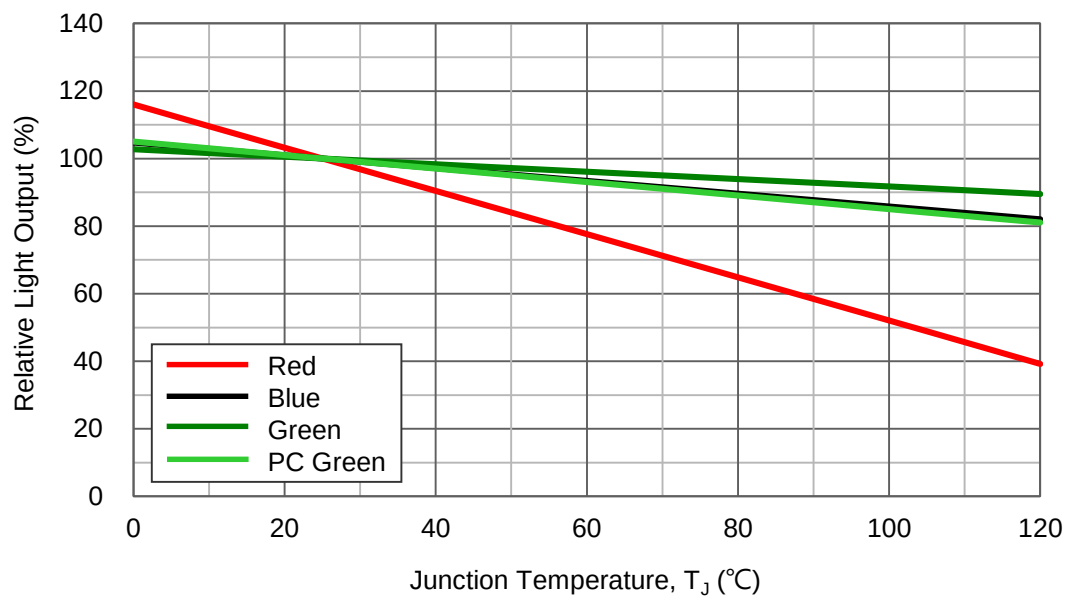


### 4. Forward Current vs. Chromaticity Coordinate Shift

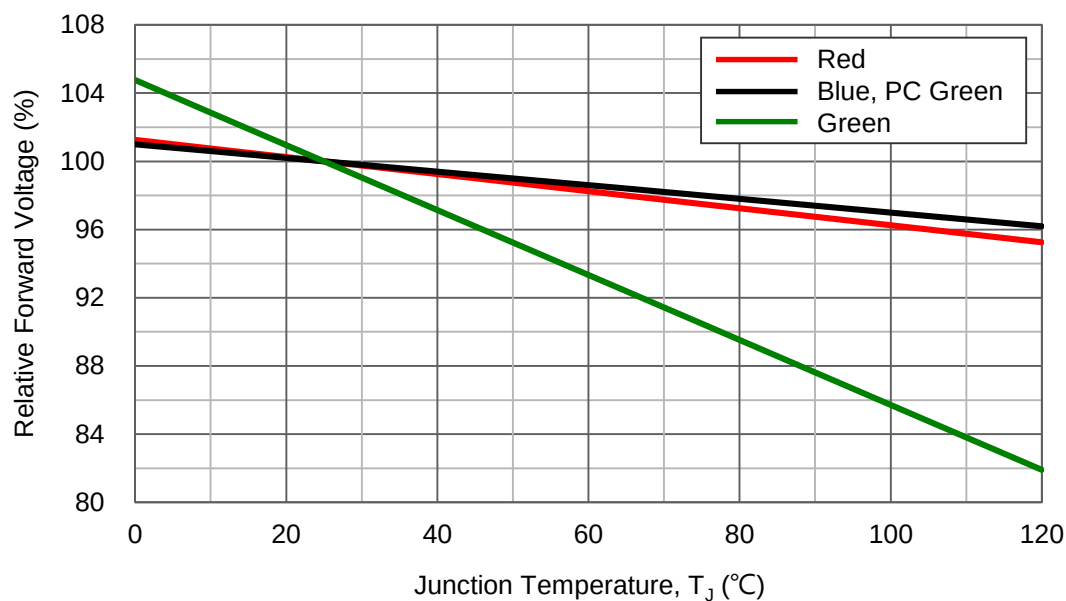


# Junction Temperature Relative Characteristics

## 1. Junction Temperature vs. Relative Light Output at 1400mA

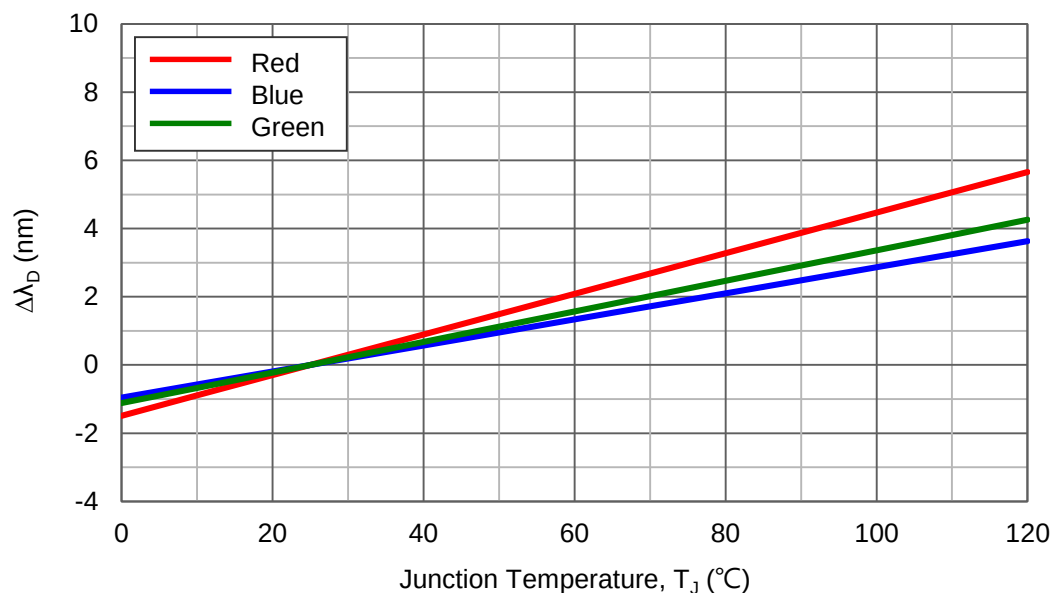


## 2. Junction Temperature vs. Relative Forward Voltage at 1400mA

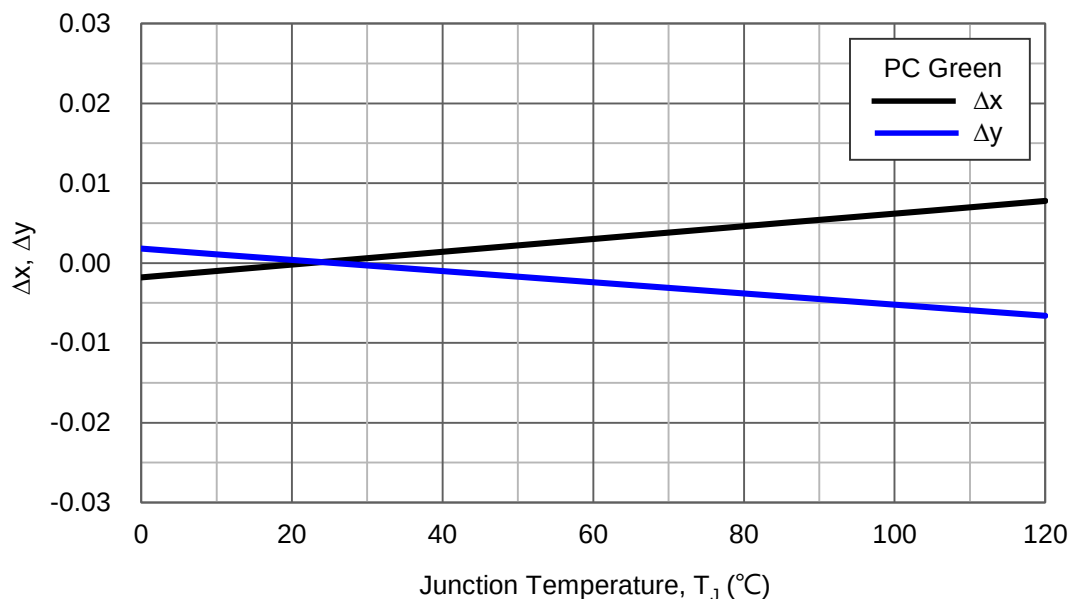


## Junction Temperature Relative Characteristics

### 3. Junction Temperature vs. Dominant Wavelength Shift at 1400mA

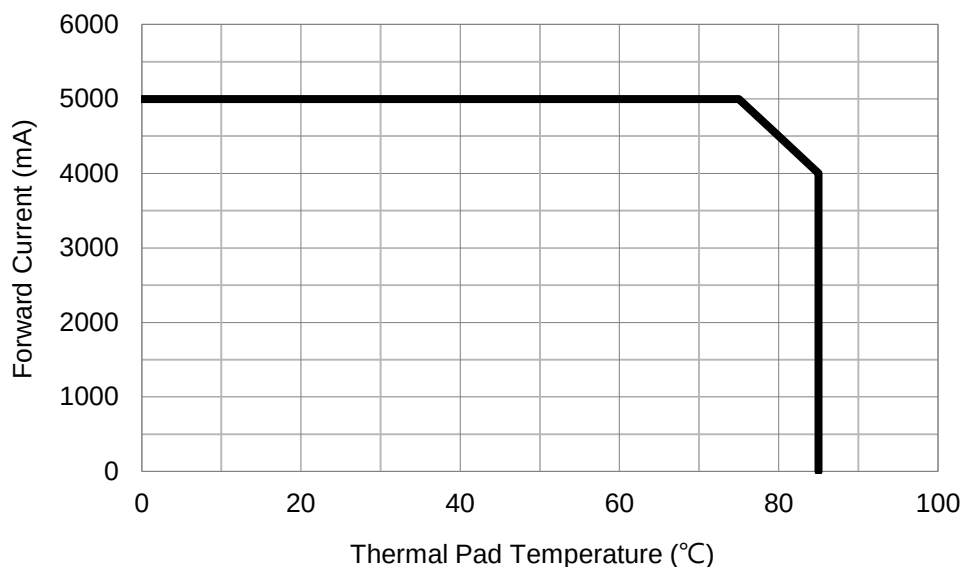


### 4. Junction Temperature vs. Chromaticity Coordinate Shift at 1400mA

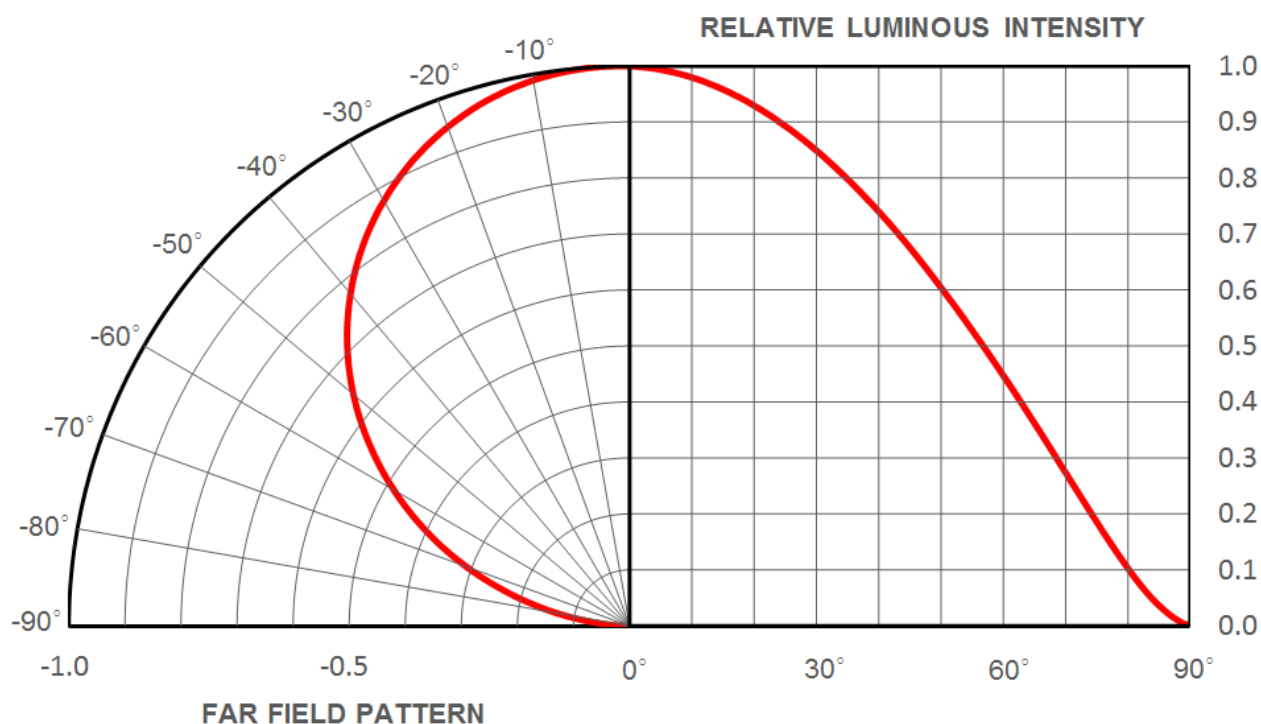


## Thermal Pad Temperature vs. Maximum Forward Current

Maximum Forward Current for 4 chips operated; current per Chip



## 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  | $\leq 30^{\circ}\text{C}$ /<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                     |
| 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,<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

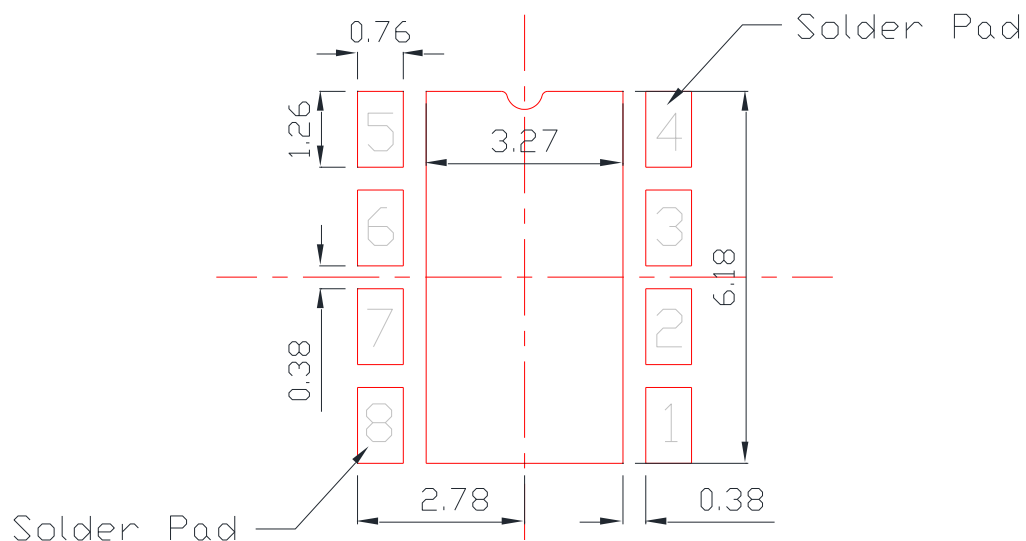
| Item                                            | Test Condition        | Criteria for Judgement |                     |
|-------------------------------------------------|-----------------------|------------------------|---------------------|
|                                                 |                       | 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    | --                  |
| Reverse Current ( $I_R$ )                       | $V_R = 5V$            | --                     | 50 $\mu A$          |

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

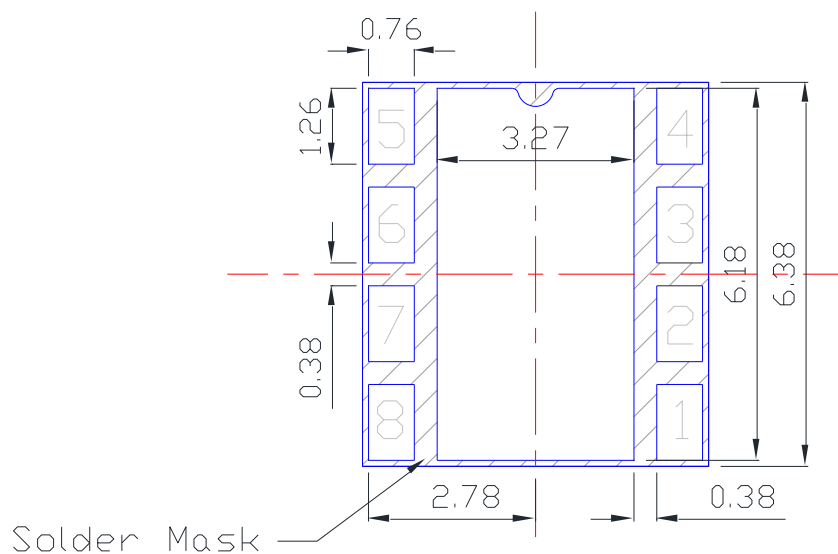
3. A failure is an LED that is open or shorted.

## Recommended Solder Pad Design

Solder Pad



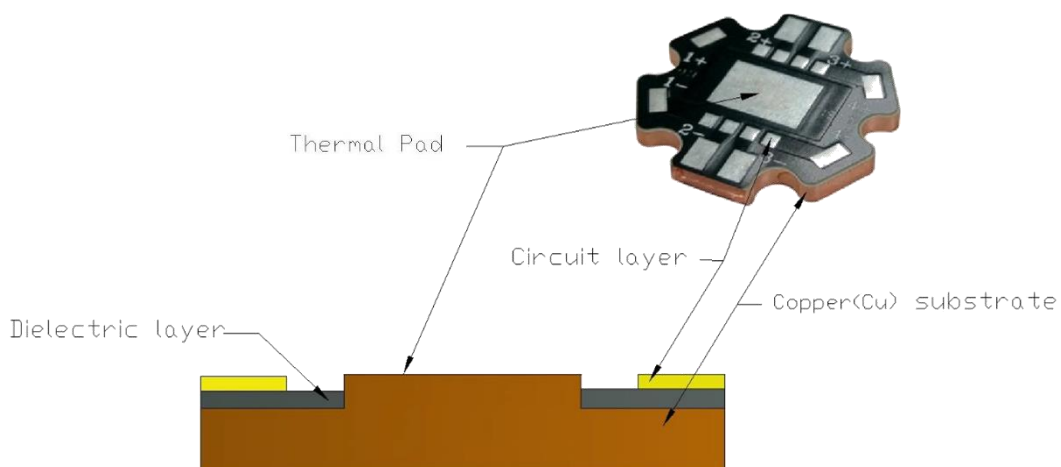
Solder Mask



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



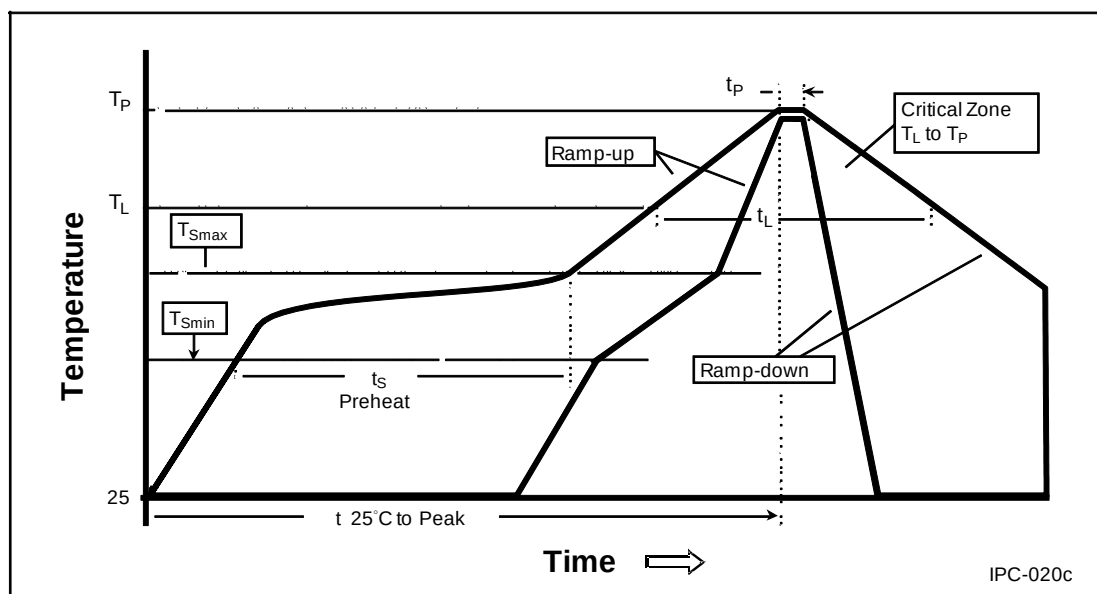
## Recommended MCPCB Design



- Copper(Cu) substrate is recommended.

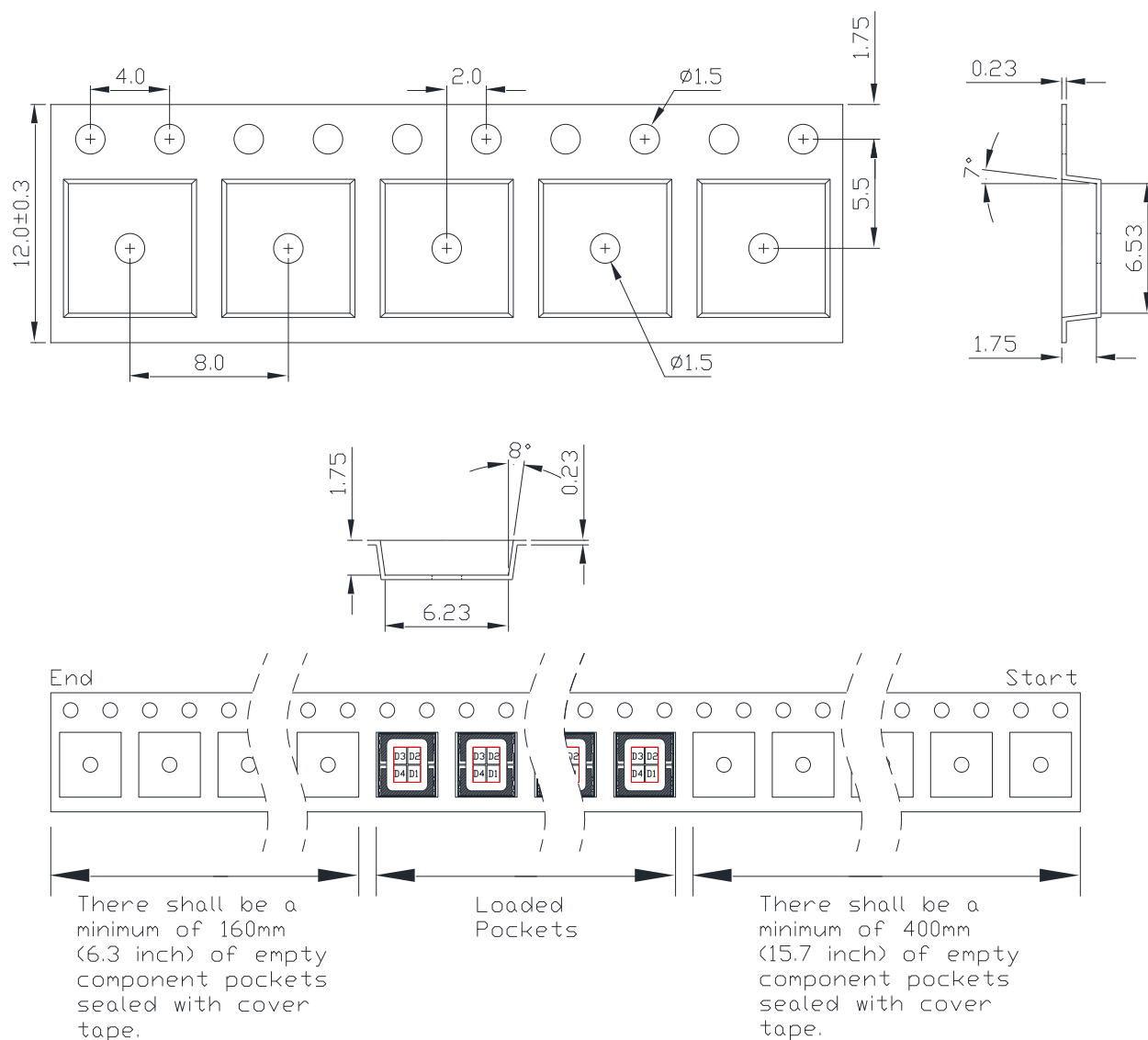
## Reflow Soldering Condition

| 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.

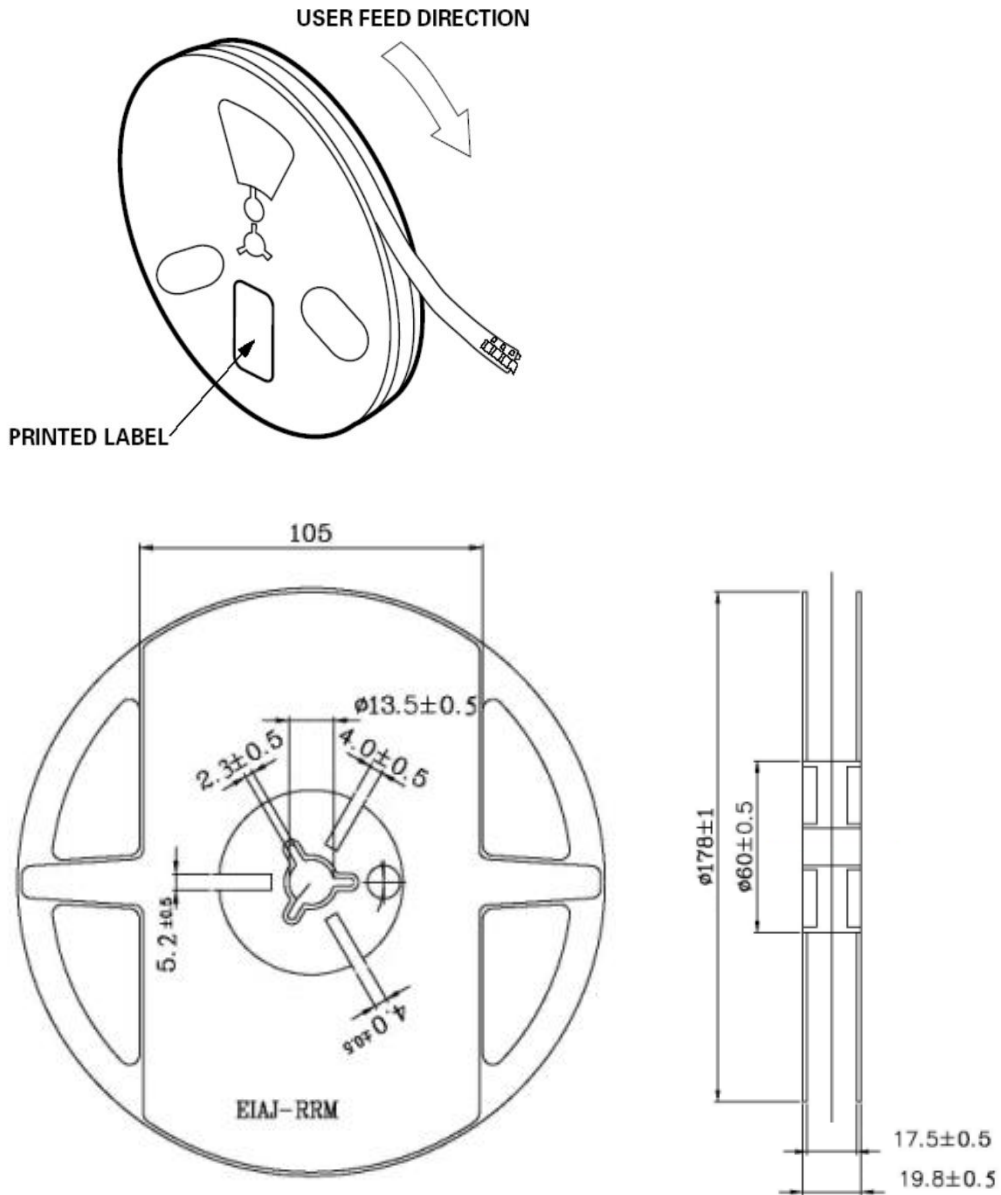
## Emitter Reel Packaging



### 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.

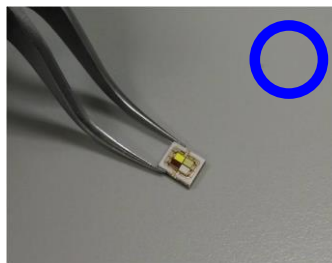
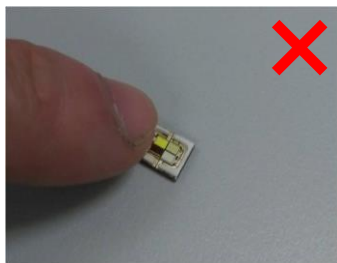
## Precaution for Use

- 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 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)



## Disclaimers

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