



**ProLight PBLB-3LTE-RGBVR9**  
**3-4W 4 in 1 RGBV Power LED**  
**Technical Datasheet**  
**Version: 1.1**

# ProLight Opto ® ProEngine Series

## Features

- Compact light source
- R, G, B, V four color in one package
- Maximum drive current: 300mA per LED die
- Lead free reflow soldering
- RoHS compliant

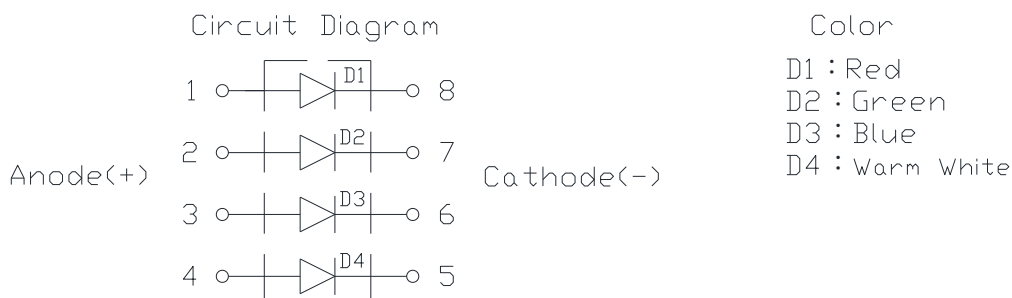
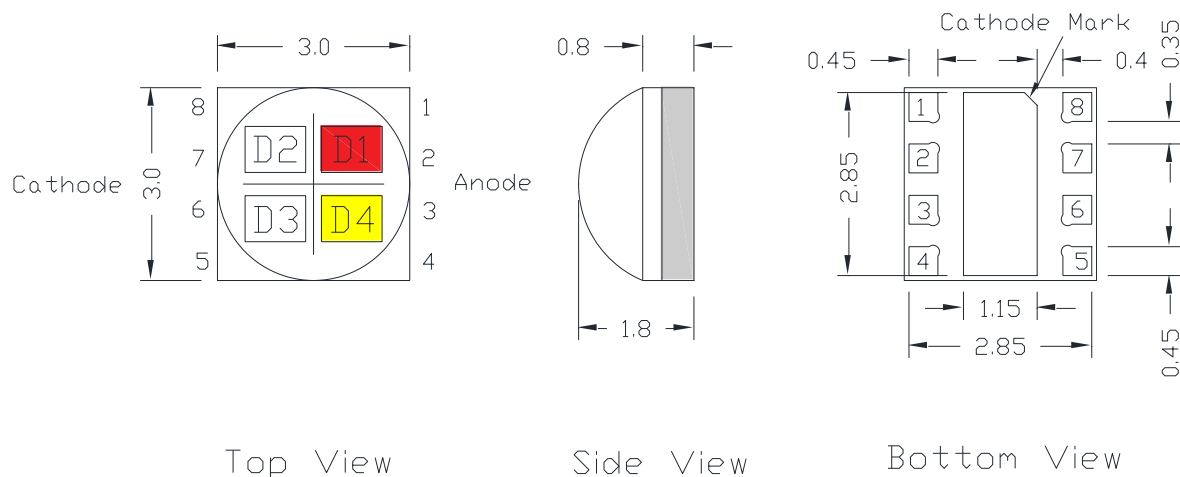
## Main Applications

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

## Introduction

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

## Emitter Mechanical Dimensions



### 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 at 250mA, T<sub>j</sub> = 25°C

| Color      | Part Number<br>Emitter | Luminous Flux $\Phi_v$ (lm) |         | CRI<br>Minimum |
|------------|------------------------|-----------------------------|---------|----------------|
|            |                        | Minimum                     | Typical |                |
| Red        | PBLB-3LTE-RGBVR9       | 30                          | 36      | -              |
| Green      |                        | 40                          | 52      | -              |
| Blue       |                        | 8                           | 11      | -              |
| Warm White |                        | 24                          | 32      | 90             |

- ProLight maintains a tolerance of  $\pm 7\%$  on flux and power measurements.
- ProLight maintains a tolerance of  $\pm 2$  on CRI measurements.
- Please do not drive at rated current more than 1 second without proper heat sink.

## Electrical Characteristics at 250mA, T<sub>j</sub> = 25°C

| Color      | Forward Voltage V <sub>F</sub> (V) |      |      | Thermal Resistance<br>Junction to Slug (°C/ W) |
|------------|------------------------------------|------|------|------------------------------------------------|
|            | Min.                               | Typ. | Max. |                                                |
| Red        | 1.90                               | 2.25 | 2.60 | 10                                             |
| Green      | 3.00                               | 3.45 | 3.80 |                                                |
| Blue       | 2.90                               | 3.30 | 3.70 |                                                |
| Warm White | 2.90                               | 3.30 | 3.70 |                                                |

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

## Optical Characteristics at 250mA, T<sub>j</sub> = 25°C

| Radiation<br>Pattern | Color      | Dominant Wavelength $\lambda_D$ ,<br>or Color Temperature CCT |        |        | Total<br>included<br>Angle<br>(degrees)<br>$\theta_{0.90V}$ | Viewing<br>Angle<br>(degrees)<br>$2\theta_{1/2}$ |
|----------------------|------------|---------------------------------------------------------------|--------|--------|-------------------------------------------------------------|--------------------------------------------------|
|                      |            | Min.                                                          | Typ.   | Max.   |                                                             |                                                  |
| Lambertian           | Red        | 620 nm                                                        | 623 nm | 630 nm | 170                                                         | 155                                              |
|                      | Green      | 518 nm                                                        | 522 nm | 528 nm |                                                             |                                                  |
|                      | Blue       | 453 nm                                                        | 457 nm | 460 nm |                                                             |                                                  |
|                      | Warm White | 2870 K                                                        | 3000 K | 3220 K |                                                             |                                                  |

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

## Absolute Maximum Ratings

| Parameter                                                    | Red/Green/Blue/Warm White                 |
|--------------------------------------------------------------|-------------------------------------------|
| DC Forward Current (mA)                                      | 300                                       |
| Peak Pulsed Forward Current (mA)                             | 330 (less than 1/10 duty cycle@1KHz)      |
| ESD Sensitivity<br>(HBM per MIL-STD-883E Method 3015.7)      | > $\pm 500V$                              |
| LED Junction Temperature                                     | 120°C                                     |
| Operating Board Temperature<br>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 |

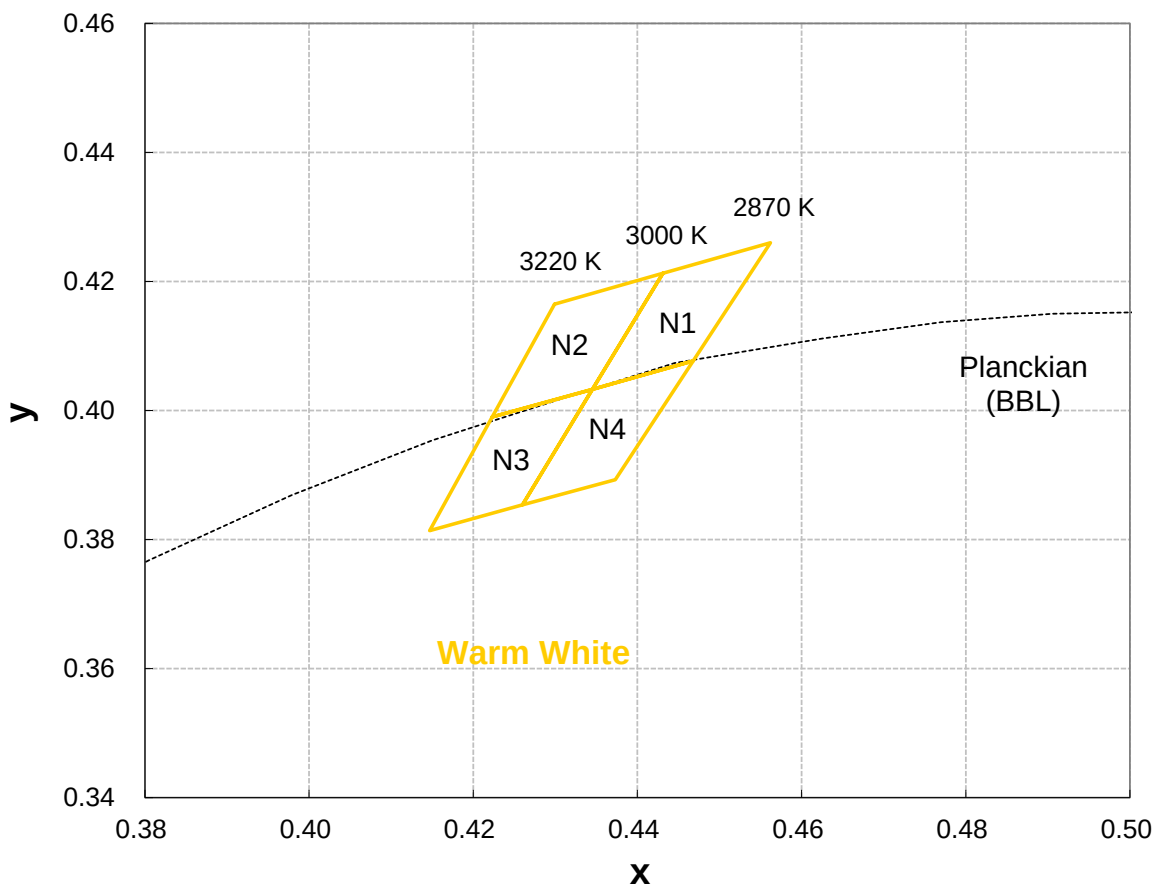
## Photometric Luminous Flux Bin Structure

| Color                                                                              | Bin Code | Minimum<br>Photometric Flux (lm) | Maximum<br>Photometric Flux (lm) |
|------------------------------------------------------------------------------------|----------|----------------------------------|----------------------------------|
|   | A        | 30                               | 37                               |
|                                                                                    | B        | 37                               | 46                               |
|  | A        | 40                               | 52                               |
|                                                                                    | B        | 52                               | 66                               |
|  | A        | 8                                | 10.4                             |
|                                                                                    | B        | 10.4                             | 13.6                             |
|  | A        | 24                               | 30                               |
|                                                                                    | B        | 30                               | 38                               |

- 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) | Bin Code | x      | y      | Typ. CCT (K) |
|----------|--------|--------|--------------|----------|--------|--------|--------------|
| N1       | 0.4431 | 0.4213 | 2950         | N2       | 0.4299 | 0.4165 | 3100         |
|          | 0.4562 | 0.4260 |              |          | 0.4431 | 0.4213 |              |
|          | 0.4468 | 0.4077 |              |          | 0.4345 | 0.4033 |              |
|          | 0.4345 | 0.4033 |              |          | 0.4223 | 0.3990 |              |
| N4       | 0.4345 | 0.4033 | 2950         | N3       | 0.4223 | 0.3990 | 3100         |
|          | 0.4468 | 0.4077 |              |          | 0.4345 | 0.4033 |              |
|          | 0.4373 | 0.3893 |              |          | 0.4260 | 0.3854 |              |
|          | 0.4260 | 0.3854 |              |          | 0.4147 | 0.3814 |              |

- 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        | 518                              | 528                              |
| Blue  | A        | 453                              | 460                              |

- 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.

## Forward Voltage Bin Structure

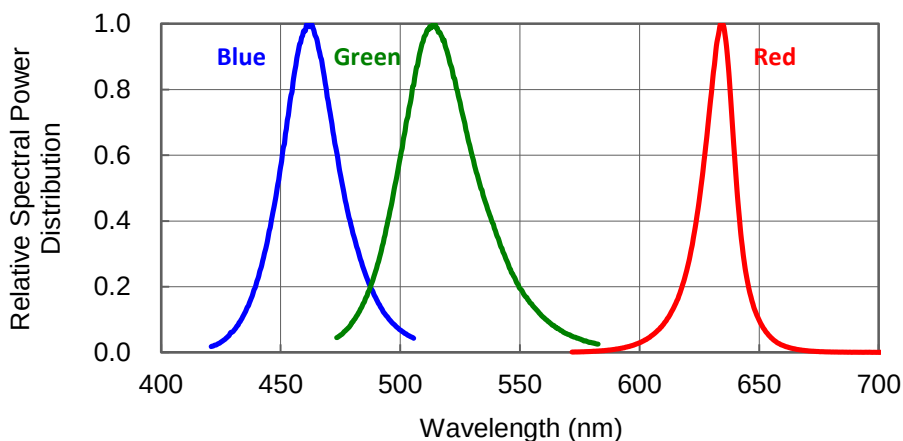
| Color      | Bin Code | Minimum Voltage (V) | Maximum Voltage (V) |
|------------|----------|---------------------|---------------------|
| Red        | 0        | 1.9                 | 2.6                 |
| Green      | 0        | 3.0                 | 3.8                 |
| Blue       | 0        | 2.9                 | 3.7                 |
| Warm White | 0        | 2.9                 | 3.7                 |

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

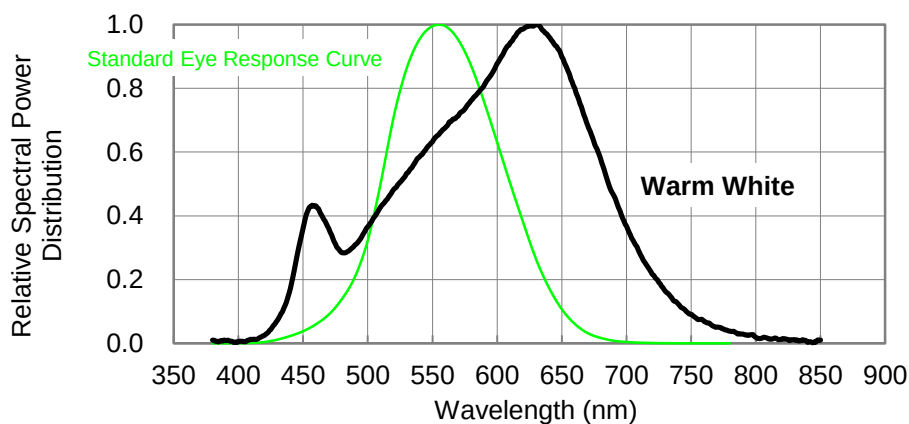
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

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

### 1. Blue 、 Green 、 Red

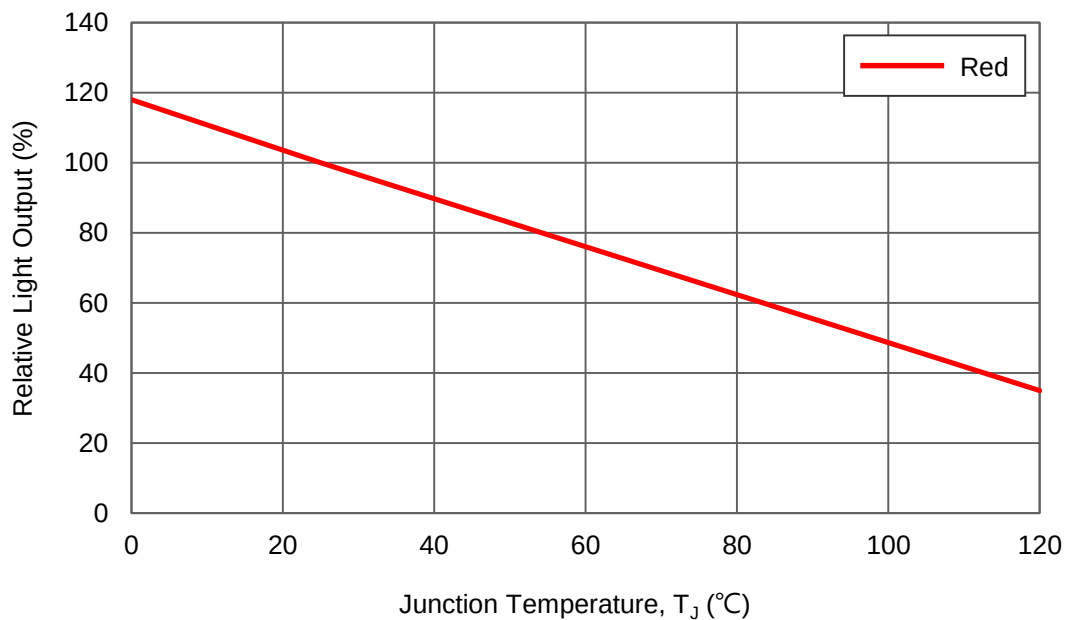
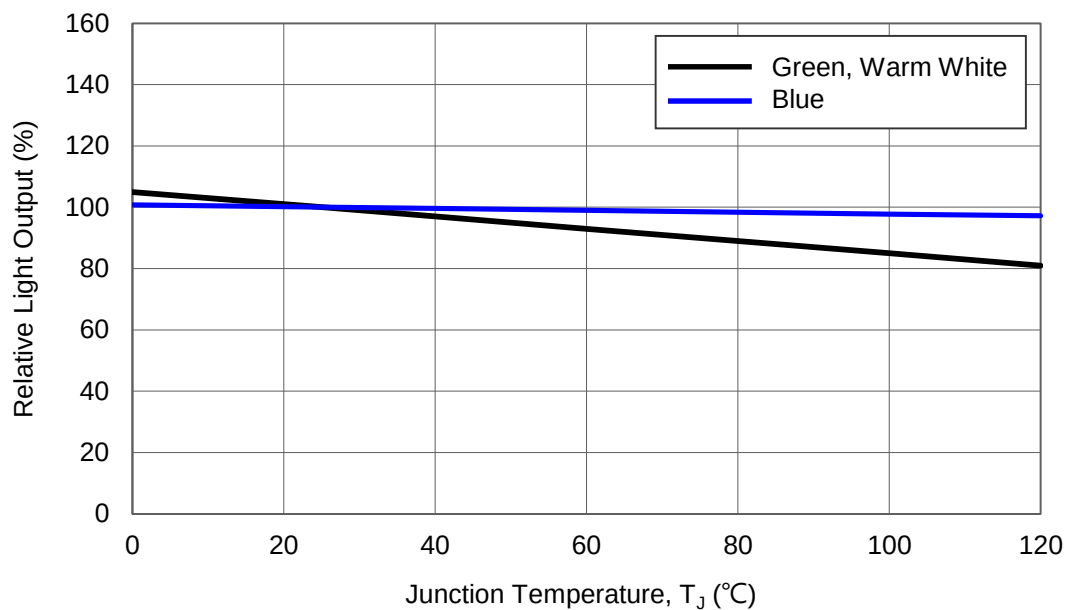


### 2. Warm White



## Light Output Characteristics

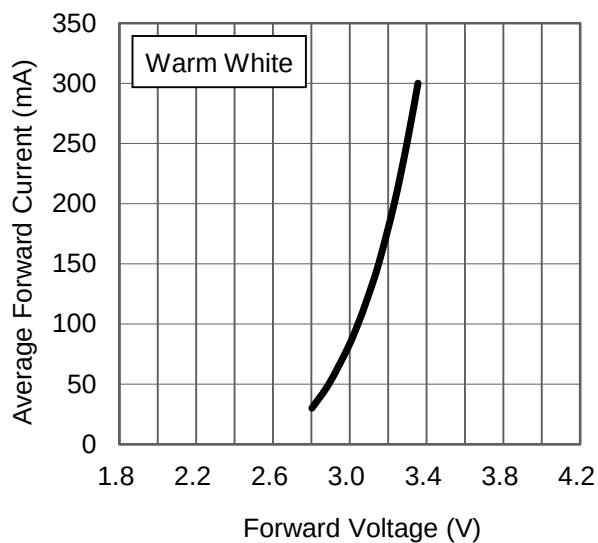
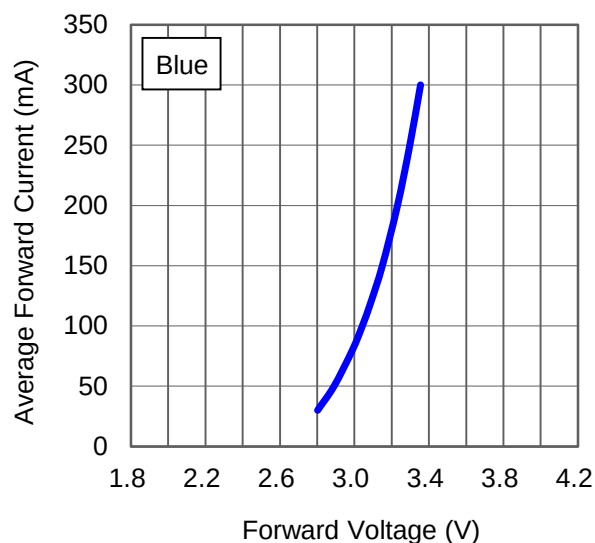
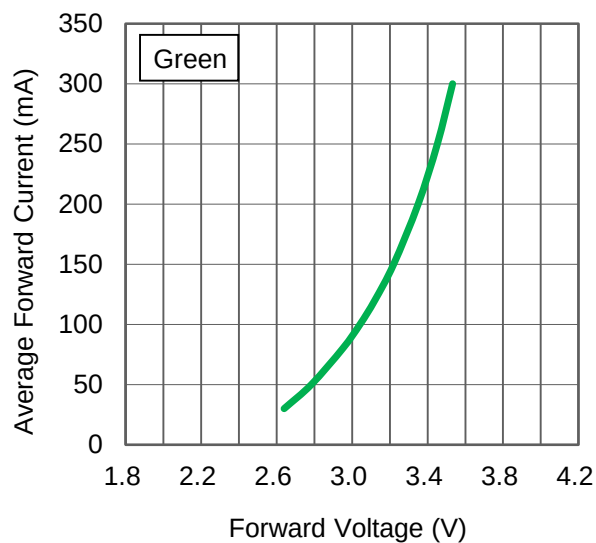
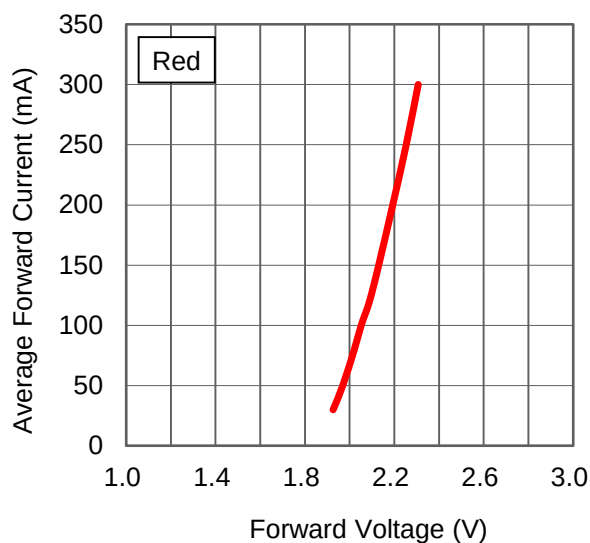
Relative Light Output vs. Junction Temperature at 300mA





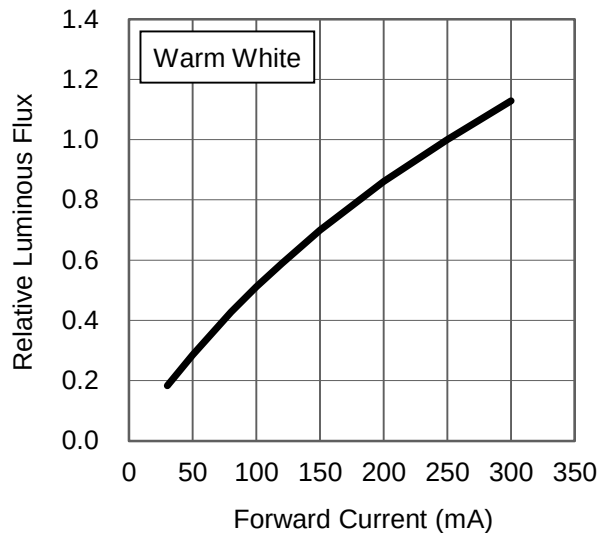
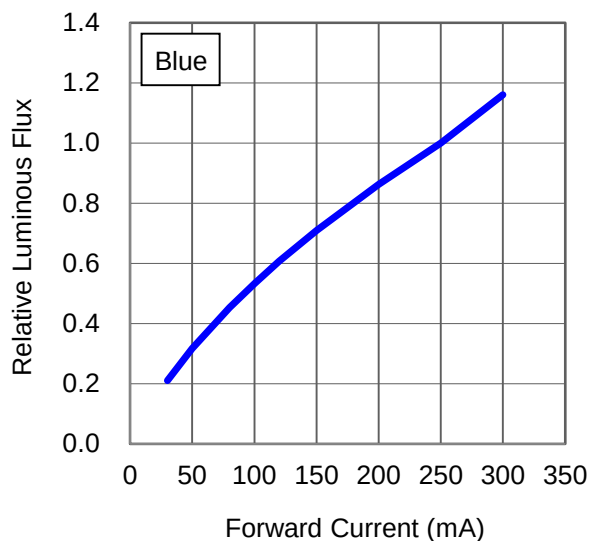
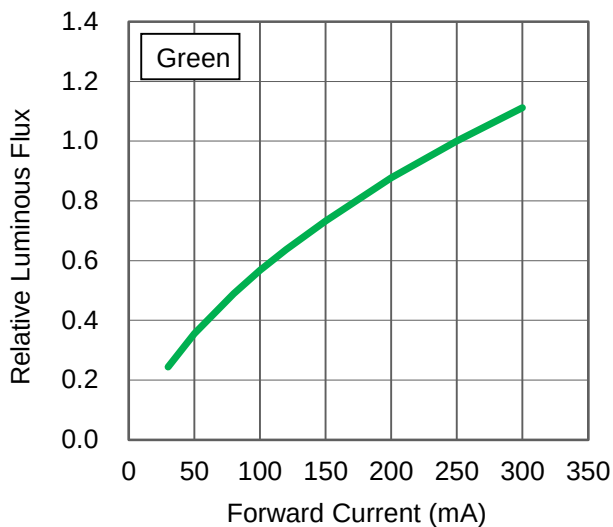
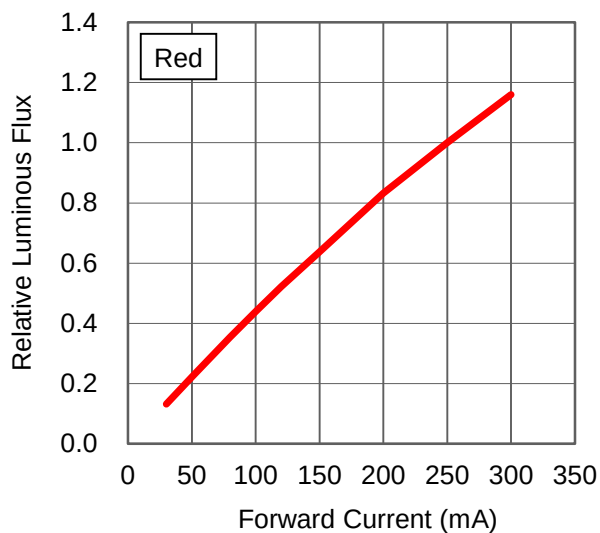
## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

### 1. Forward Voltage vs. Forward Current



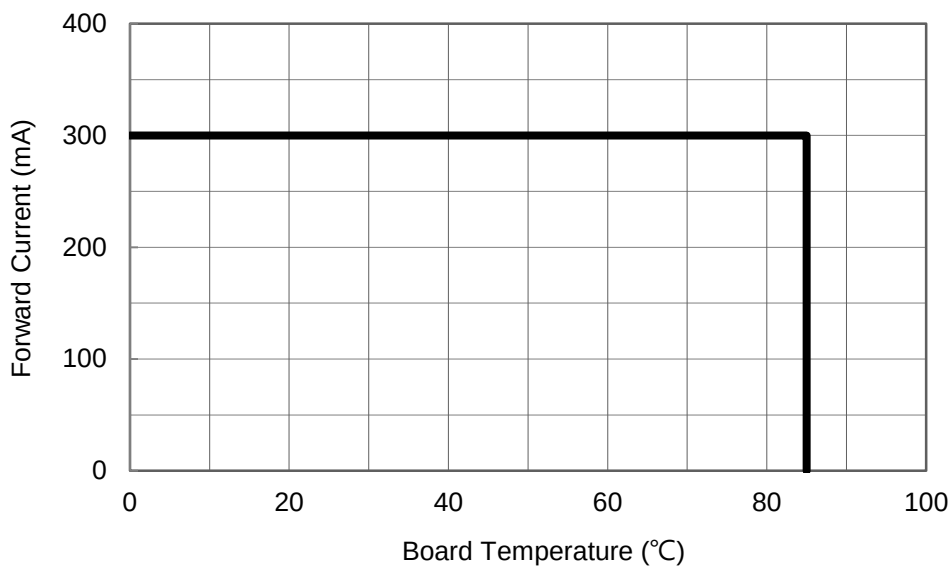
## Forward Current Characteristics, $T_j = 25^\circ\text{C}$

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



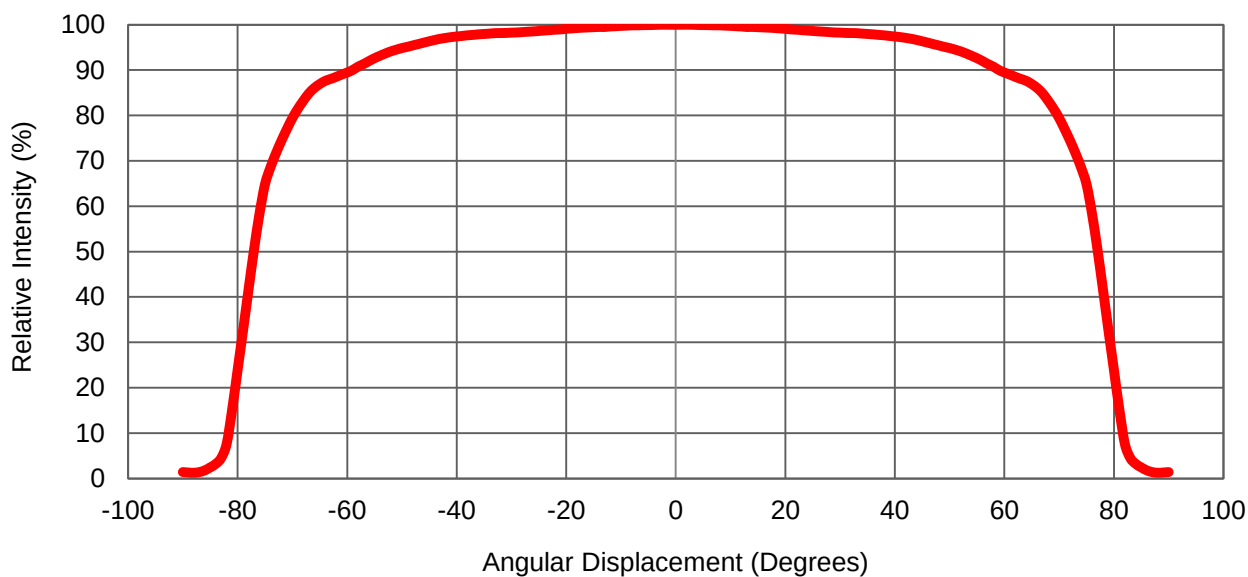
## Board Temperature vs. Maximum Forward Current

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                  |
| 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 $\pm$ 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

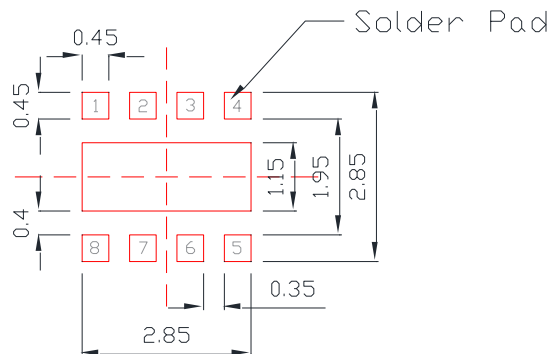
| Item                                            | Test Condition        | Criteria for Judgement |                     |
|-------------------------------------------------|-----------------------|------------------------|---------------------|
|                                                 |   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

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

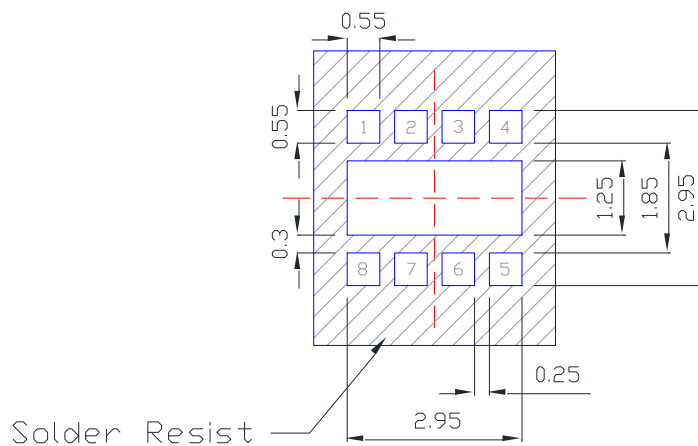
3. A failure is an LED that is open or shorted.

## Recommended Solder Pad Design

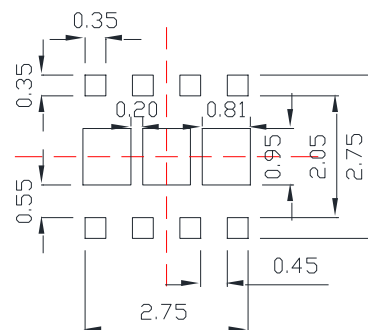
### Solder Pad



### Solder Resist



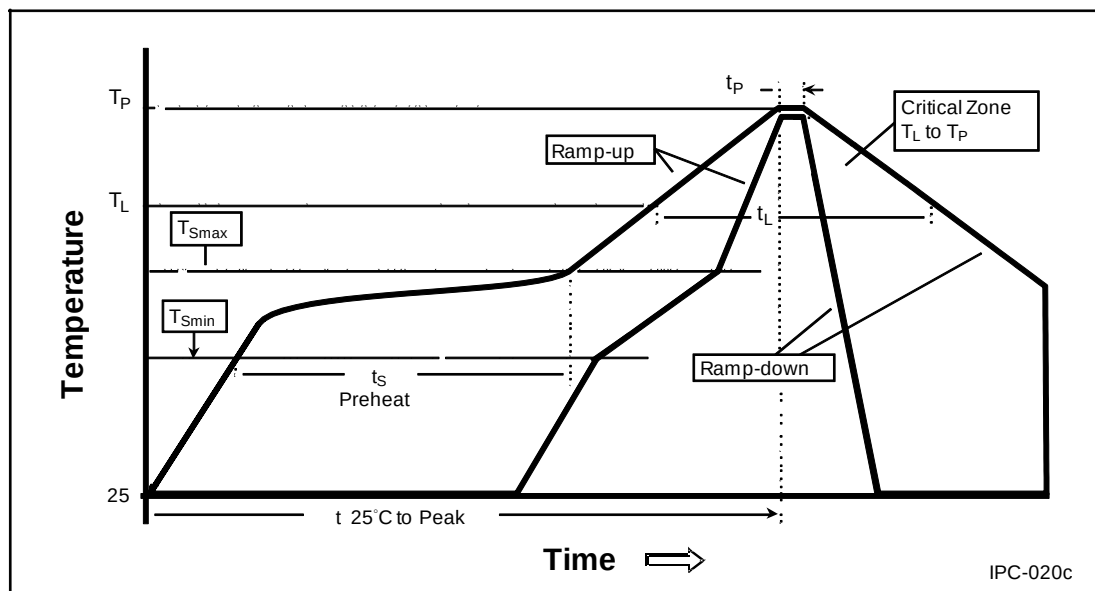
### Solder Stencil



- All dimensions are in millimeters.
- Electrical isolation is required between Slug and Solder Pad.
- Recommended solder stencil thickness is 0.08mm

## Reflow Soldering Condition

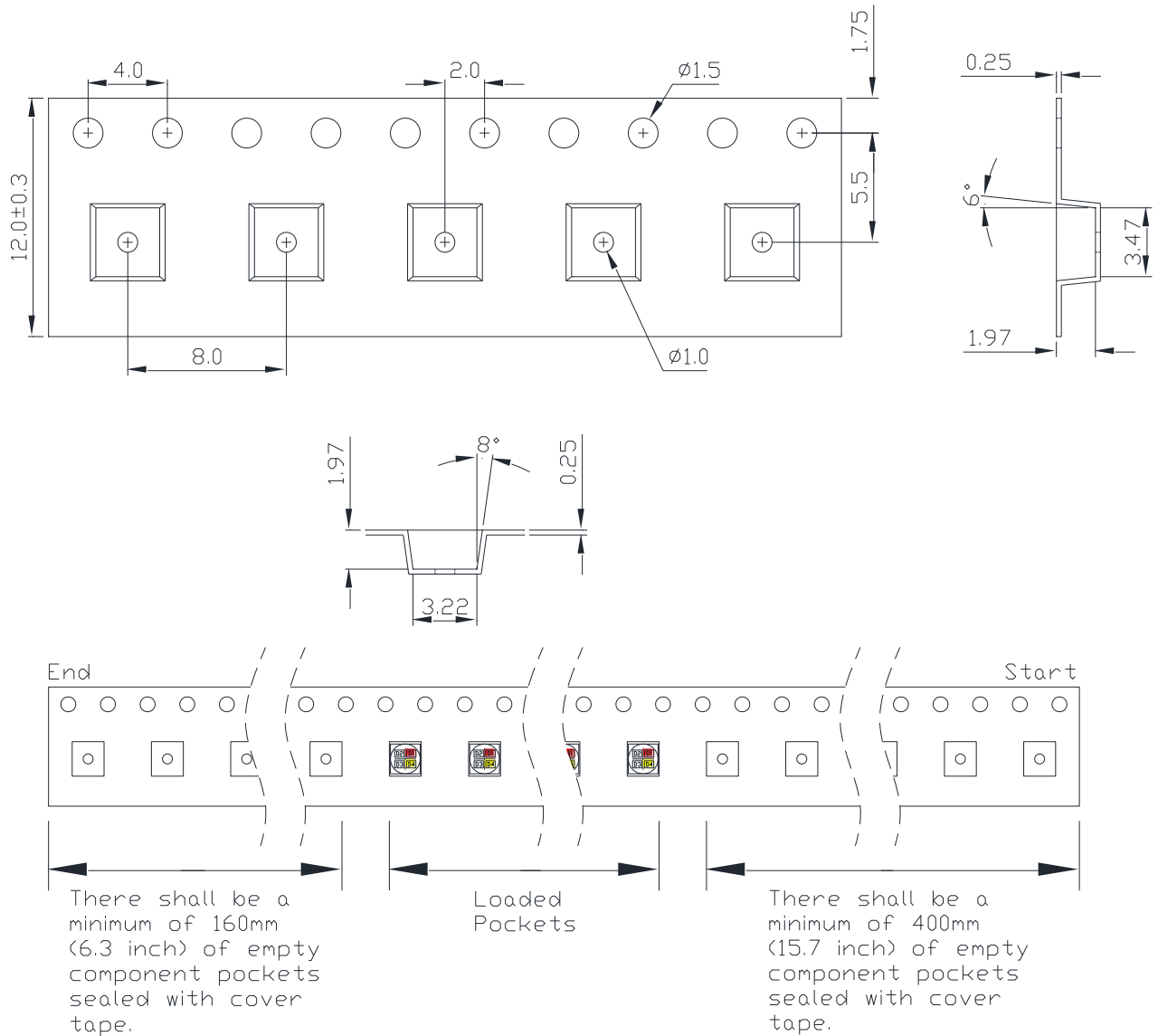
| Profile Feature                                                                                                                                                                                                         | Sn-Pb Eutectic Assembly          | Pb-Free Assembly                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| 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.



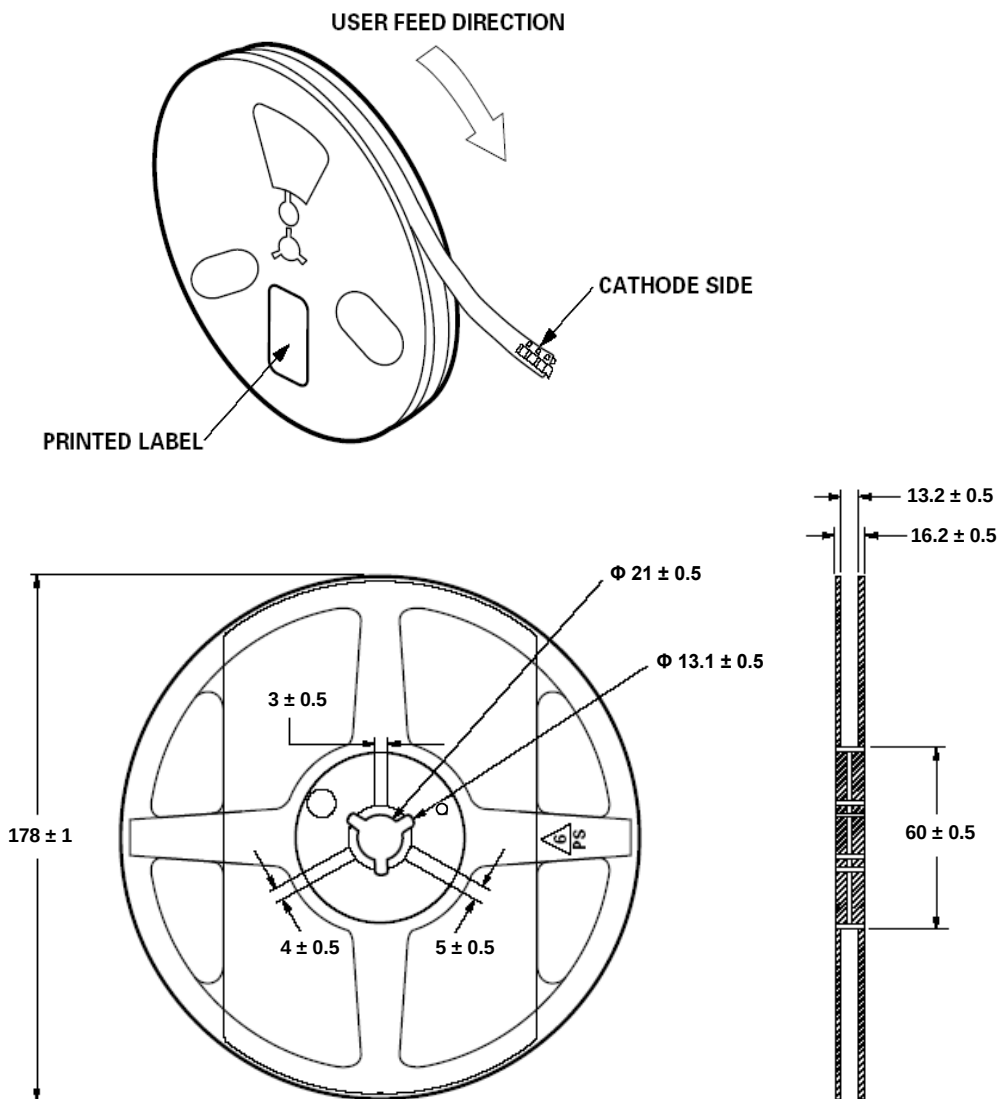
## Emitter Reel Packaging



### Notes:

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





**Notes:**

1. Empty component pockets sealed with top cover tape.
2. 250, 500 and 1000 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.
- Electric Static Discharge (ESD) Protection  
The LEDs are STATIC SENSITIVE device. ESD protection or surge voltages shall be considered and taken care in the initial design stage, and whole production process. The following protection is recommended:  
(1) A wrist band or an anti-electrostatic glove shall be used when handling the LEDs.  
(2) All devices, equipment and machinery must be properly grounded.
- 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)

