



**ProLight PBLB-5LFE**  
**5W 3 in 1 RGB Power LED**  
**Technical Datasheet**  
**Version: 1.3**

# ProLight Opto ProEngine Series

## Features

- Compact light source
- R, G, B three color in one package
- Maximum drive current: 400mA per LED die
- Lead free reflow soldering
- RoHS compliant

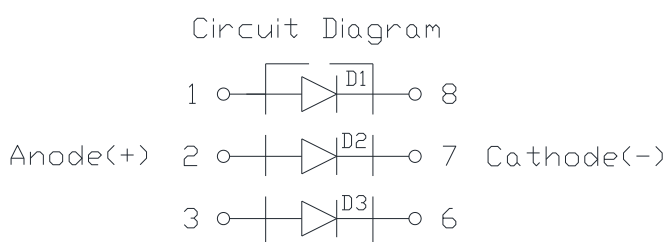
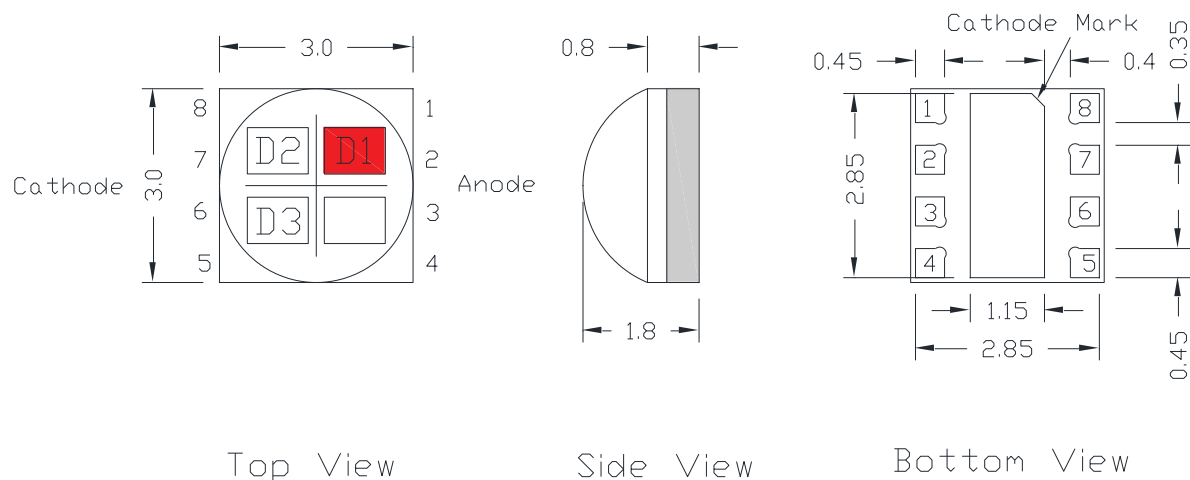
## Main Applications

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

## Introduction

- ProLight PBLB colorful series is a color changeable LED with maximum 3 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



**Color**  
D1 : Red  
D2 : Green  
D3 : Blue

### 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 350mA, $T_j = 25^{\circ}\text{C}$

Color	Part Number Emitter	Luminous Flux $\Phi_v$ (lm)	
		Minimum	Typical
Red	PBLB-5LFE	45	55
Green		90	115
Blue		14	18.5

- 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 at 350mA, $T_j = 25^{\circ}\text{C}$

Color	Forward Voltage $V_F$ (V)			Thermal Resistance Junction to Slug ( $^{\circ}\text{C}/\text{W}$ )
	Min.	Typ.	Max.	
Red	1.9	2.3	2.7	10
Green	2.8	3.3	3.7	
Blue	2.8	3.3	3.7	

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

## Optical Characteristics at 350mA, $T_j = 25^{\circ}\text{C}$

Radiation Pattern	Color	Dominant Wavelength $\lambda_D$			Total included Angle (degrees) $\theta_{0.90V}$	Viewing Angle (degrees) $2\theta_{1/2}$
		Min.	Typ.	Max.		
Lambertian	Red	619 nm	622 nm	629 nm	170	155
	Green	520 nm	525 nm	530 nm		
	Blue	449 nm	452 nm	455 nm		

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

## Absolute Maximum Ratings

Parameter	Red/Green/Blue
DC Forward Current (mA)	400
Peak Pulsed Forward Current (mA)	500 (less than 1/10 duty cycle@1KHz)
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	> $\pm 500V$
LED Junction Temperature	120°C
Operating Board Temperature at Maximum DC Forward Current	-40°C - 85°C
Storage Temperature	-40°C - 120°C
Soldering Temperature	JEDEC 020c 260°C
Allowable Reflow Cycles	3
Reverse Voltage	Not designed to be driven in reverse bias

## Photometric Luminous Flux Bin Structure

Color	Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
Red	A	45	58
	B	58	75
Green	A	90	115
	B	115	147
Blue	A	14	18.5
	B	18.5	24.5

- 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)
Red	4	619	629
Green	1	520	530
Blue	A	449	455

- 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

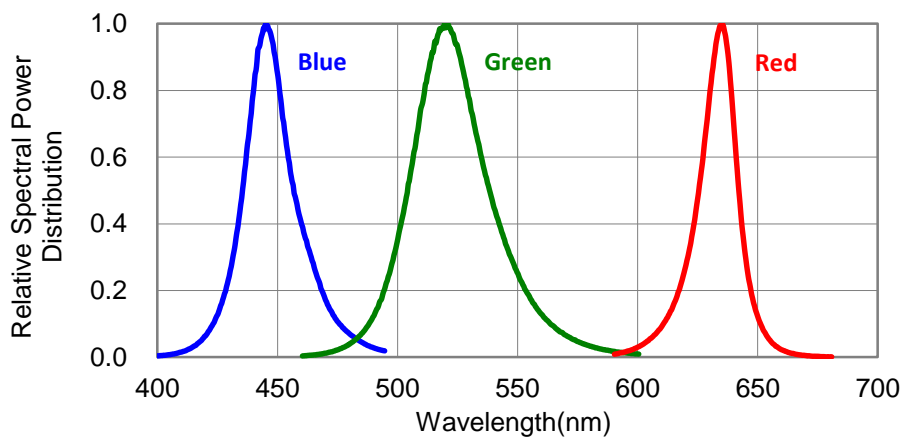
Color	Bin Code	Minimum Voltage (V)	Maximum Voltage (V)
Red	0	1.9	2.7
Green	0	2.8	3.7
Blue	0	2.8	3.7

- 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.

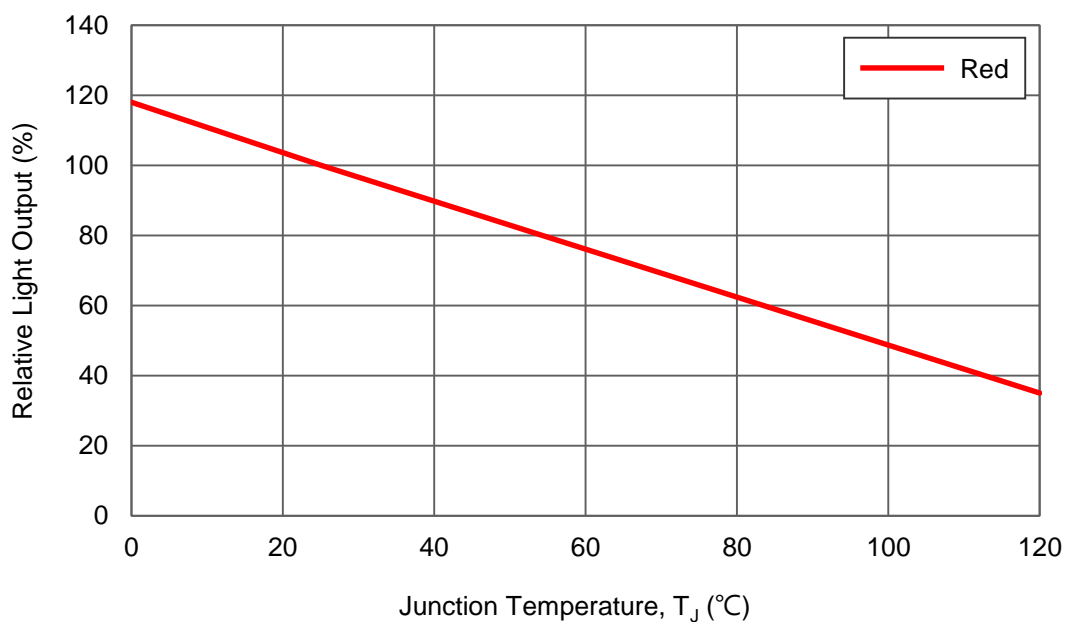
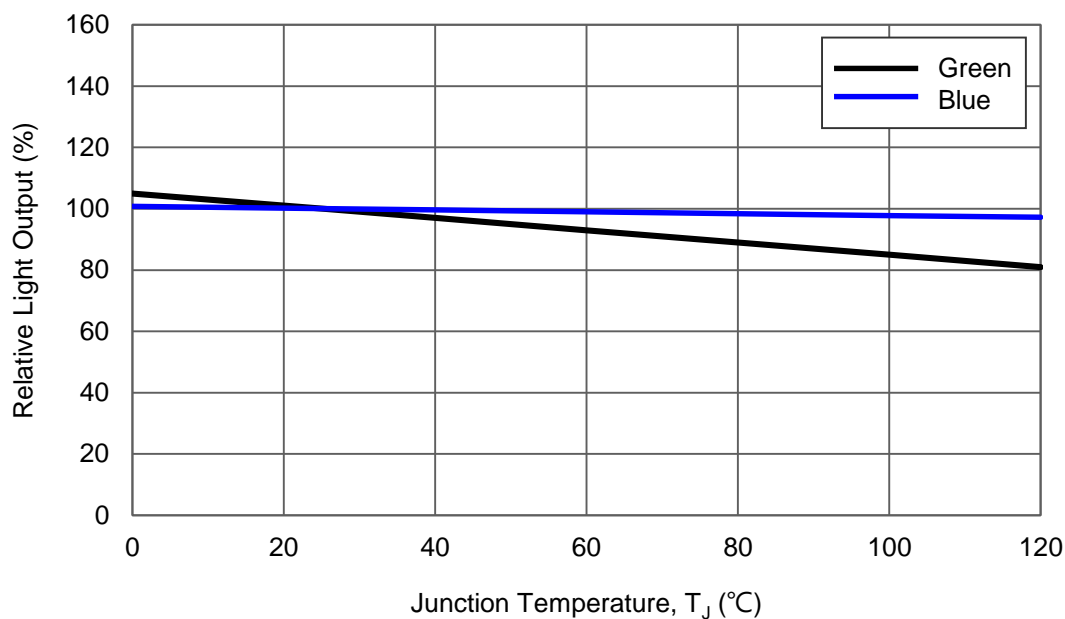
## Color Spectrum, $T_j = 25^{\circ}\text{C}$

### 1. Blue 、 Green 、 Red



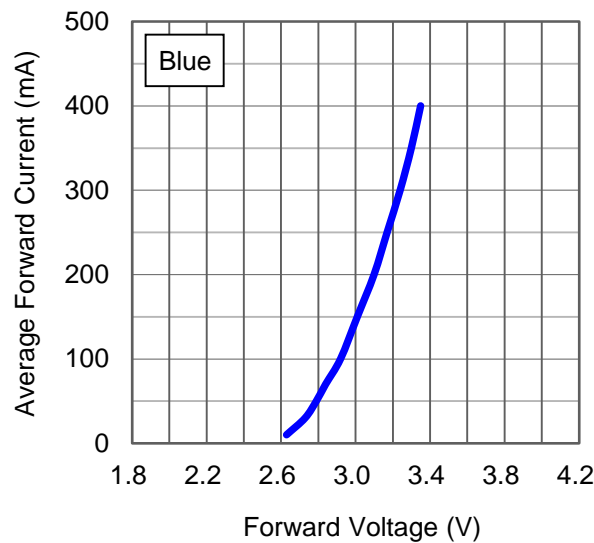
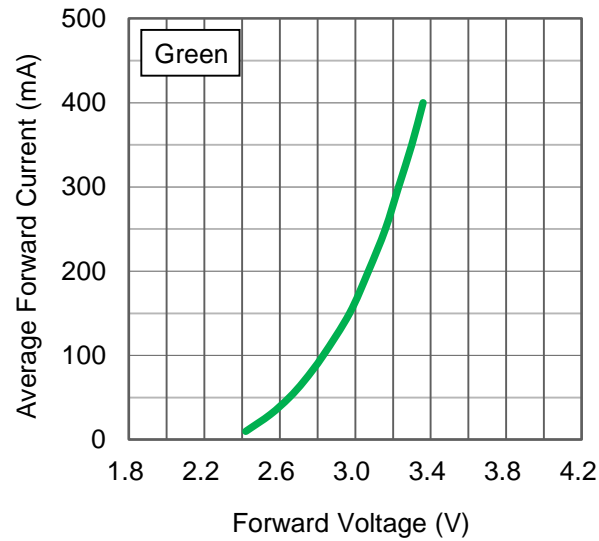
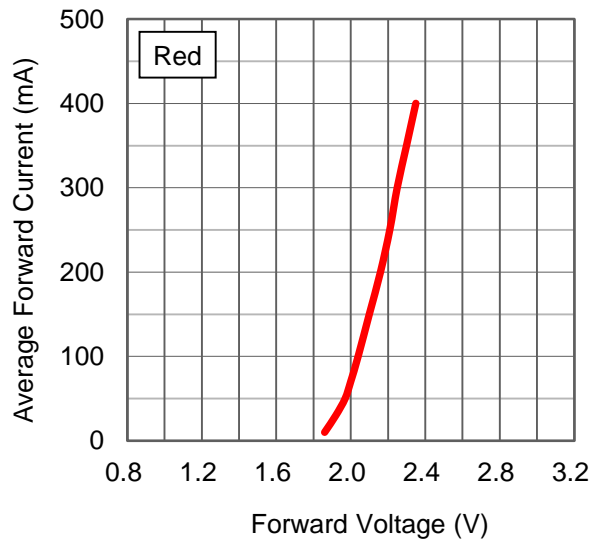
## Light Output Characteristics

Relative Light Output vs. Junction Temperature at 400mA



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

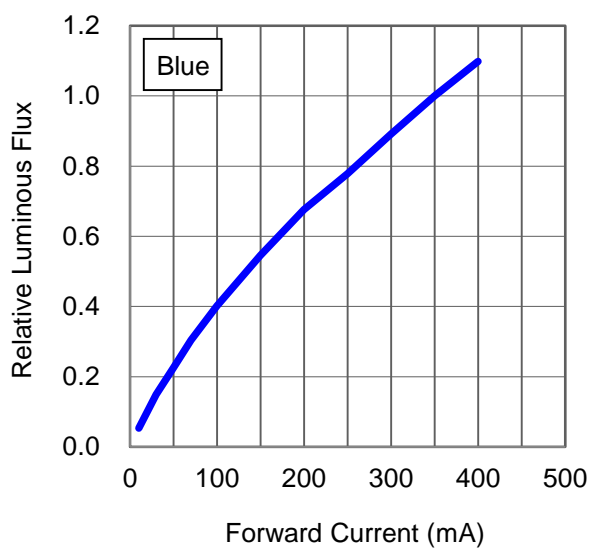
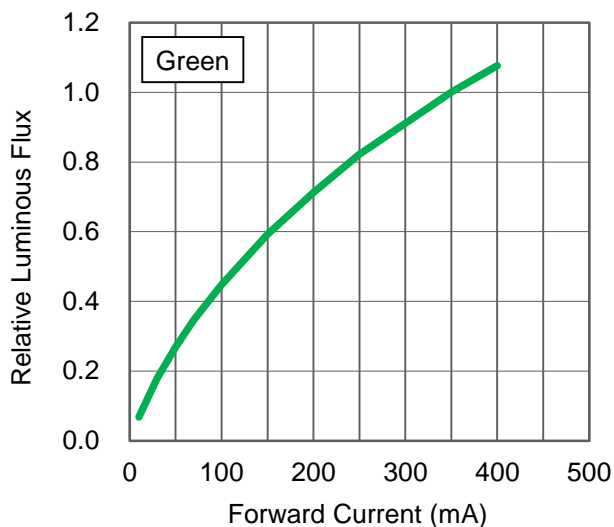
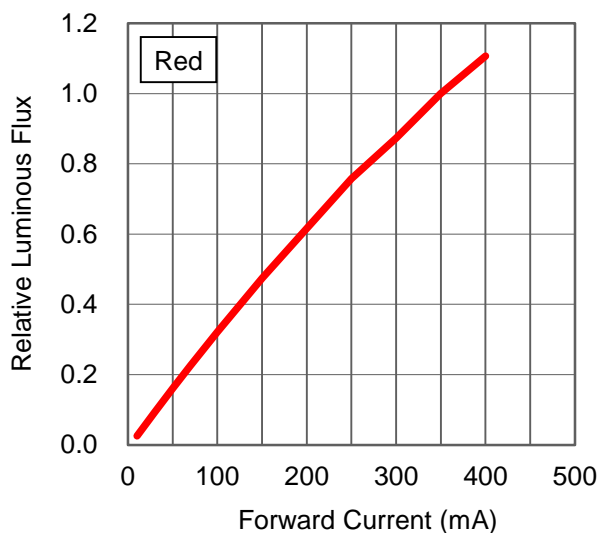
## 1. Forward Voltage vs. Forward Current





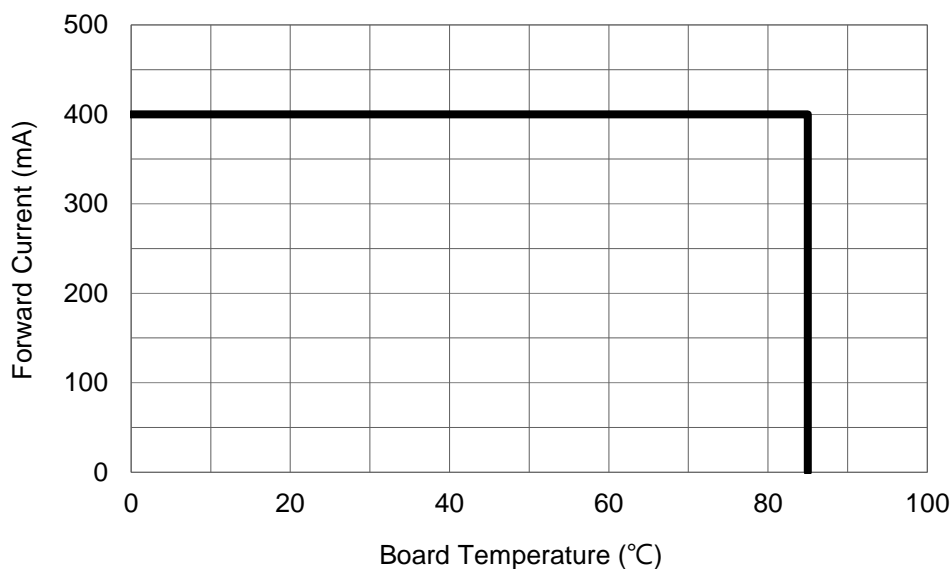
# Forward Current Characteristics, $T_j = 25^\circ\text{C}$

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

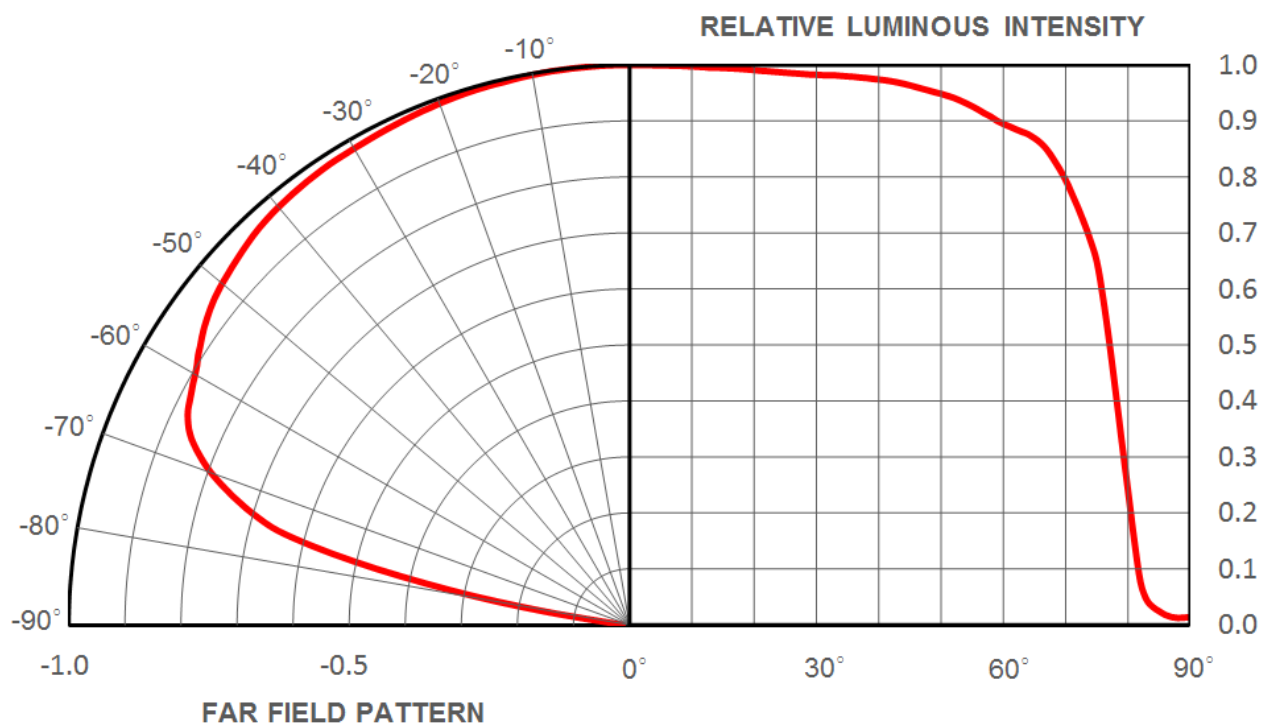


## Board Temperature vs. Maximum Forward Current

Maximum Forward Current for 4 chip operated



## Typical Representative Spatial Radiation Pattern



## Moisture Sensitivity Level – JEDEC Level 1

Level	Floor Life		Soak Requirements			
			Standard		Accelerated Environment	
	Time	Conditions	Time (hours)	Conditions	Time (hours)	Conditions
1	Unlimited	≤30°C / 85% RH	168 +5/-0	85°C / 85% RH	NA	NA

- The standard soak time includes a default value of 24 hours for semiconductor 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	≤30°C / 85% RH	168 +5/-0	85°C / 85% RH	NA	NA
2	1 year	≤30°C / 60% RH	168 +5/-0	85°C / 60% RH	NA	NA
2a	4 weeks	≤30°C / 60% RH	696 +5/-0	30°C / 60% RH	120 +1/-0	60°C / 60% RH
3	168 hours	≤30°C / 60% RH	192 +5/-0	30°C / 60% RH	40 +1/-0	60°C / 60% RH
4	72 hours	≤30°C / 60% RH	96 +2/-0	30°C / 60% RH	20 +0.5/-0	60°C / 60% RH
5	48 hours	≤30°C / 60% RH	72 +2/-0	30°C / 60% RH	15 +0.5/-0	60°C / 60% RH
5a	24 hours	≤30°C / 60% RH	48 +2/-0	30°C / 60% RH	10 +0.5/-0	60°C / 60% RH
6	Time on Label (TOL)	≤30°C / 60% RH	Time on Label (TOL)	30°C / 60% RH	NA	NA

## Qualification Reliability Testing

Stress Test	Stress Conditions	Stress Duration	Failure Criteria
Room Temperature Operating Life (RTOL)	25°C, $I_F = \text{max DC}$ (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

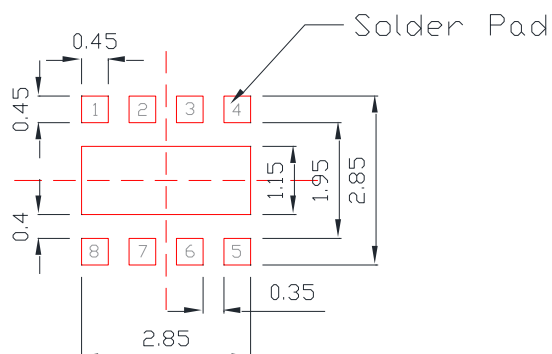
Item	Test Condition	Criteria for Judgement	
		Min.	Max.
Forward Voltage ( $V_F$ )	$I_F = \text{max DC}$	--	Initial Level x 1.1
Luminous Flux or Radiometric Power ( $\Phi_V$ )	$I_F = \text{max DC}$	Initial Level x 0.7	--
Reverse Current ( $I_R$ )	$V_R = 5V$	--	50 $\mu A$

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

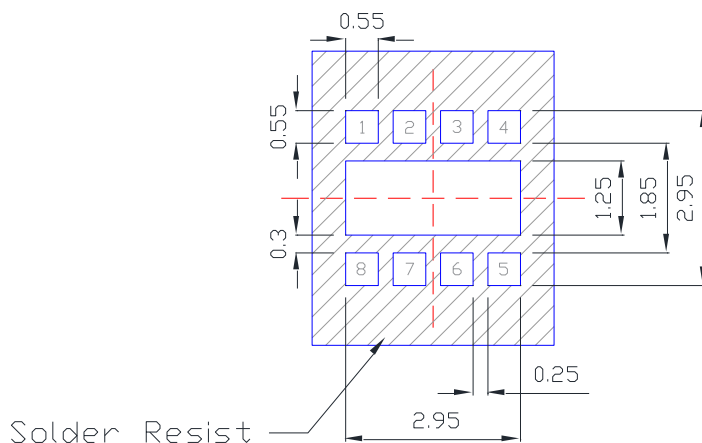
3. A failure is an LED that is open or shorted.

## Recommended Solder Pad Design

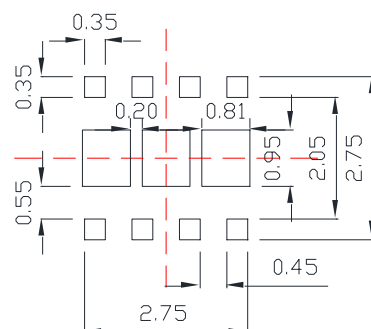
### Solder Pad



### Solder Resist



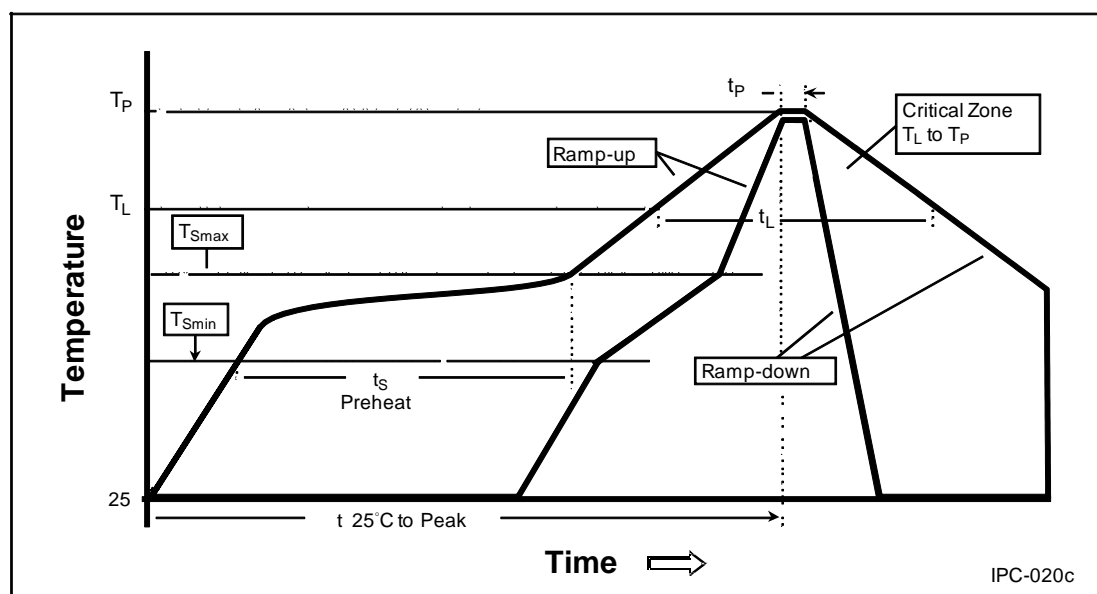
### Solder Stencil



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

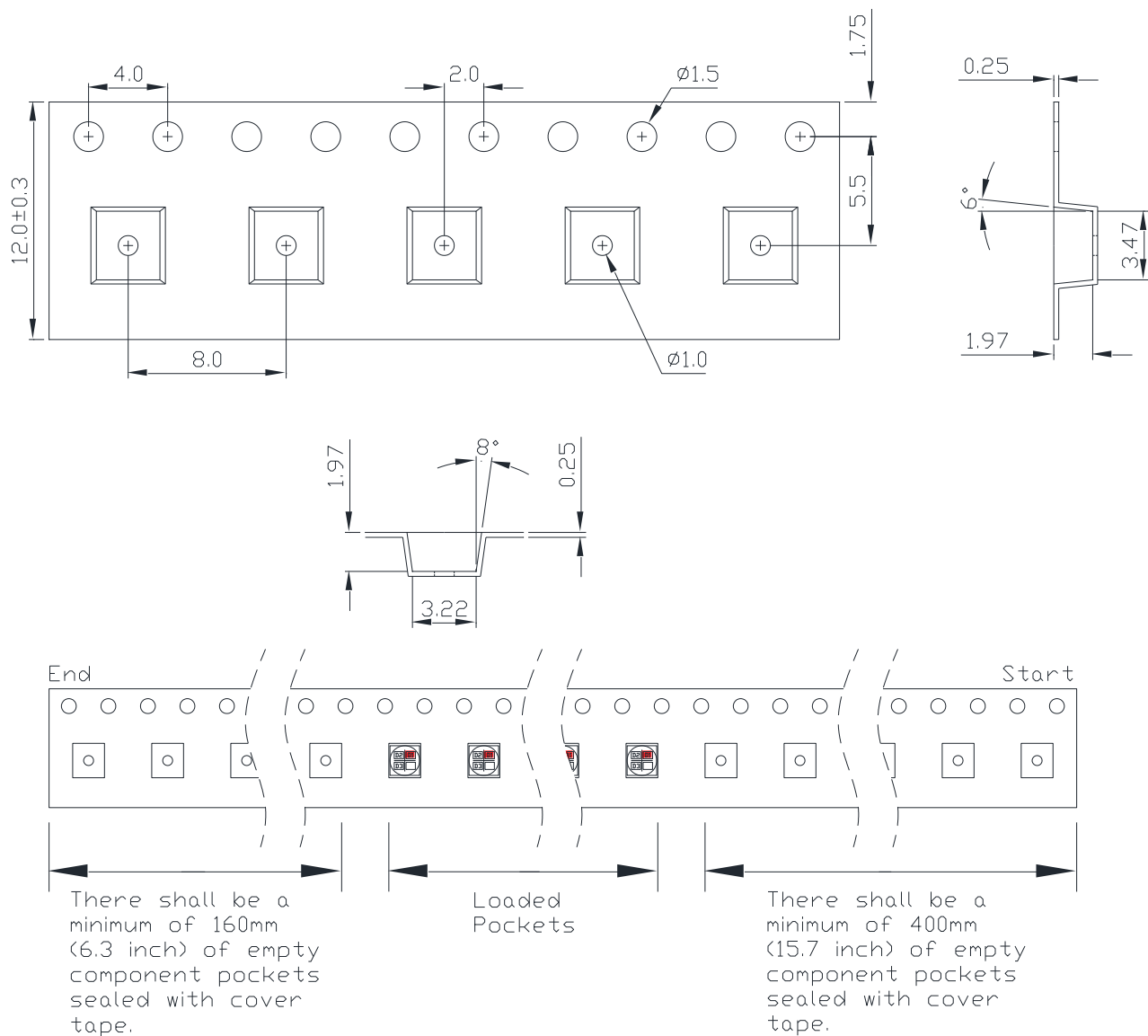
## Reflow Soldering Condition

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate ( $T_{Smax}$ 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 150°C 60-120 seconds	150°C 200°C 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 60-150 seconds	217°C 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.

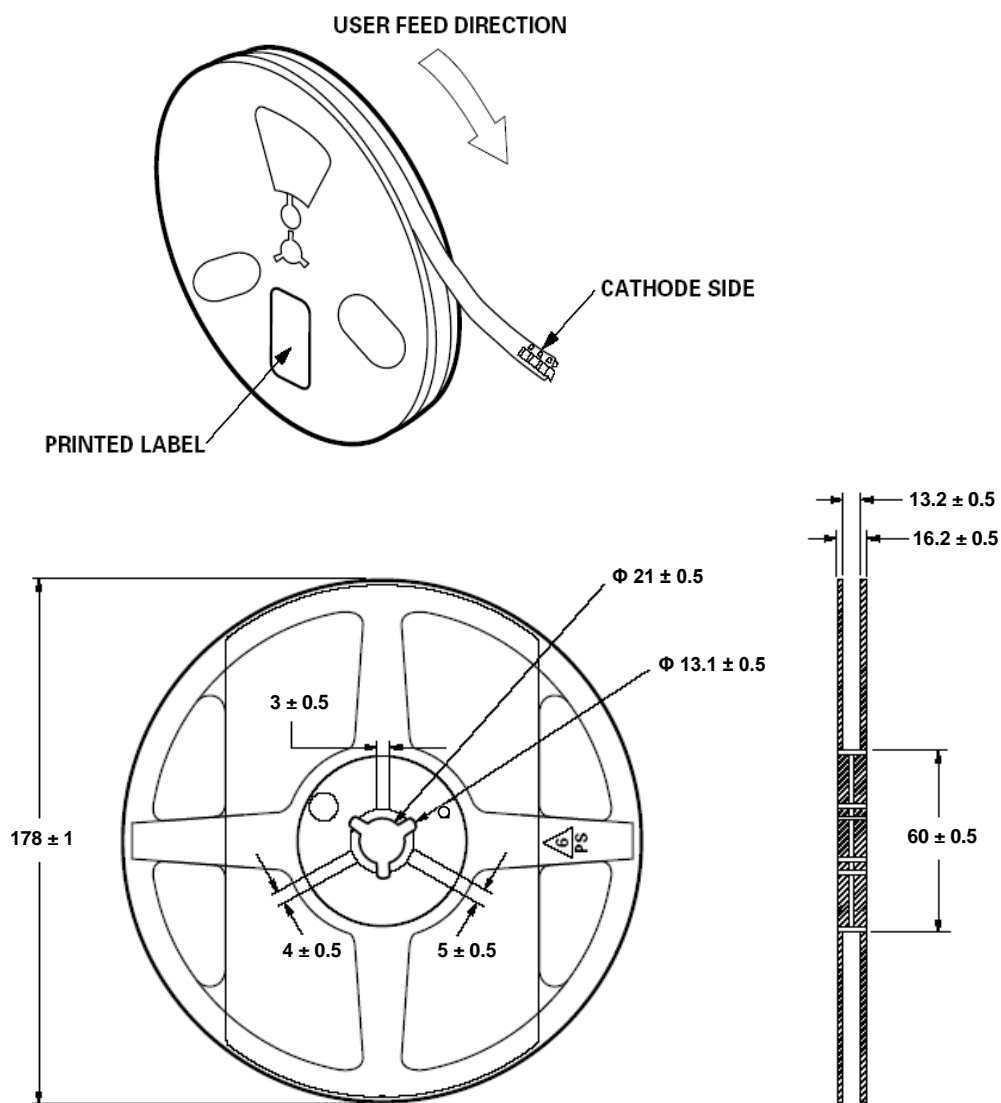
## Emitter Reel Packaging



### 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. 500, 1000 pieces per reel.
3. Drawing not to scale.
4. All dimensions are in millimeters.



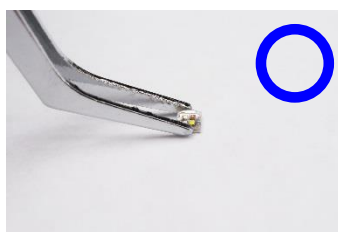
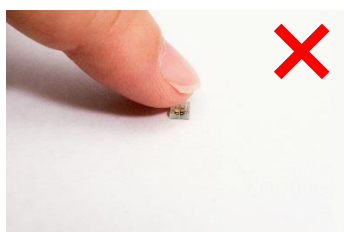
## Precaution for Use

- 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 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)



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