RoHS | Pb Free | IR Reflow

ProLight PBEE-40F4E-NRBGPG
40W Power LED
Technical Datasheet
Version: 1.3

ProLight Opto ProEngine Series

Features

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

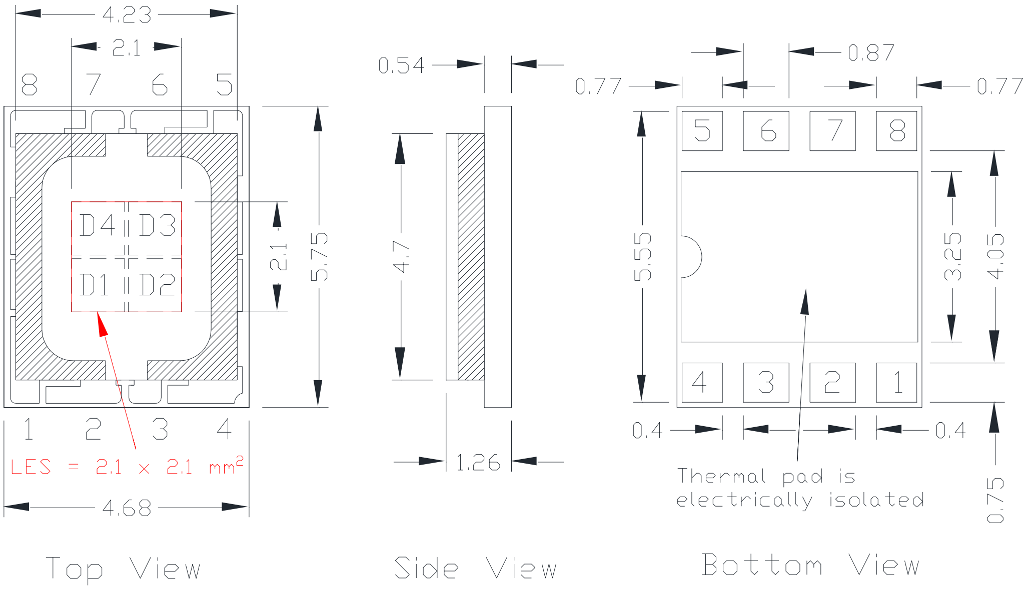
Main Applications

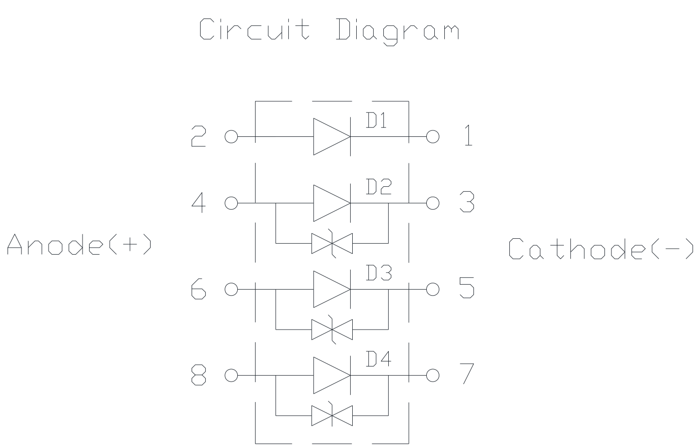
- Entertainment lighting (Stage lighting)
- Architectural lighting
- Mood lighting
- Outdoor lighting
- Indoor lighting

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





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 ± 0.15mm.
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, $T_J = 25^{\circ}C$

Color	Part Number Emitter	Luminous Flux or Radiometric Power @1000mA Minimum	Luminous Flux or Radiometric Power @1000mA Typical	Refer @2500mA Typical
Red	PBEE-40F4E-NRBGPG	110 lm	150 lm	307 lm
Blue		1080 mW	1310 mW	2630 mW
Green		190 lm	270 lm	453 lm
PC Green		275 lm	365 lm	780 lm

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

Electrical Characteristics, $T_J = 25^{\circ}C$

Color	Forward Voltage V_F (V) @1000mA Min.	@1000mA Typ.	@1000mA Max.	Refer @2500mA Typ.	Thermal Resistance Junction to Slug (°C/ W)
Red	2.00	2.30	2.55	2.90	1.1
Blue	2.70	3.00	3.40	3.27	
Green	2.70	3.00	3.40	3.70	
PC Green	2.70	3.00	3.40	3.27	

- ProLight maintains a tolerance of ± 0.1V for Voltage measurements.

Optical Characteristics at 1000mA, $T_J = 25^{\circ}C$

Radiation Pattern	Color	Dominant Wavelength λD Min.	Dominant Wavelength λD Typ.	Dominant Wavelength λD Max.	Total included Angle (degrees) $\theta_{0.90V}$	Viewing Angle (degrees) $2\,\theta_{1/2}$
Flat	Red	620 nm	624 nm	630 nm	160	120
	Blue	450 nm	453 nm	455 nm	160	120
	Green	523 nm	527 nm	530 nm	160	120
	PC Green	566 nm	567.5 nm	569 nm	160	120

- ProLight maintains a tolerance of ± 1nm for dominant wavelength measurements.

Absolute Maximum Ratings

Parameter	Red	Blue	Green	PC Green
DC Forward Current (4 chips operation, $T_{Thermal\ Pad}$ = 25°C)	40 - 2500 mA	40 - 2500 mA	40 - 2500 mA	40 - 2500 mA
DC Forward Current (Single chip operation, $T_{Thermal\ Pad}$ = 25°C)	40 - 3000 mA	40- 3000 mA	40- 3000 mA	40- 3000 mA
ESD withstand voltage 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 1000mA

Color	Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)
Red	A	110	135
	B	135	165
	C	165	200
Green	A	190	230
	B	230	275
	C	275	330
	D	330	400
PC Green	A	275	330
	B	330	390
	C	390	460

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

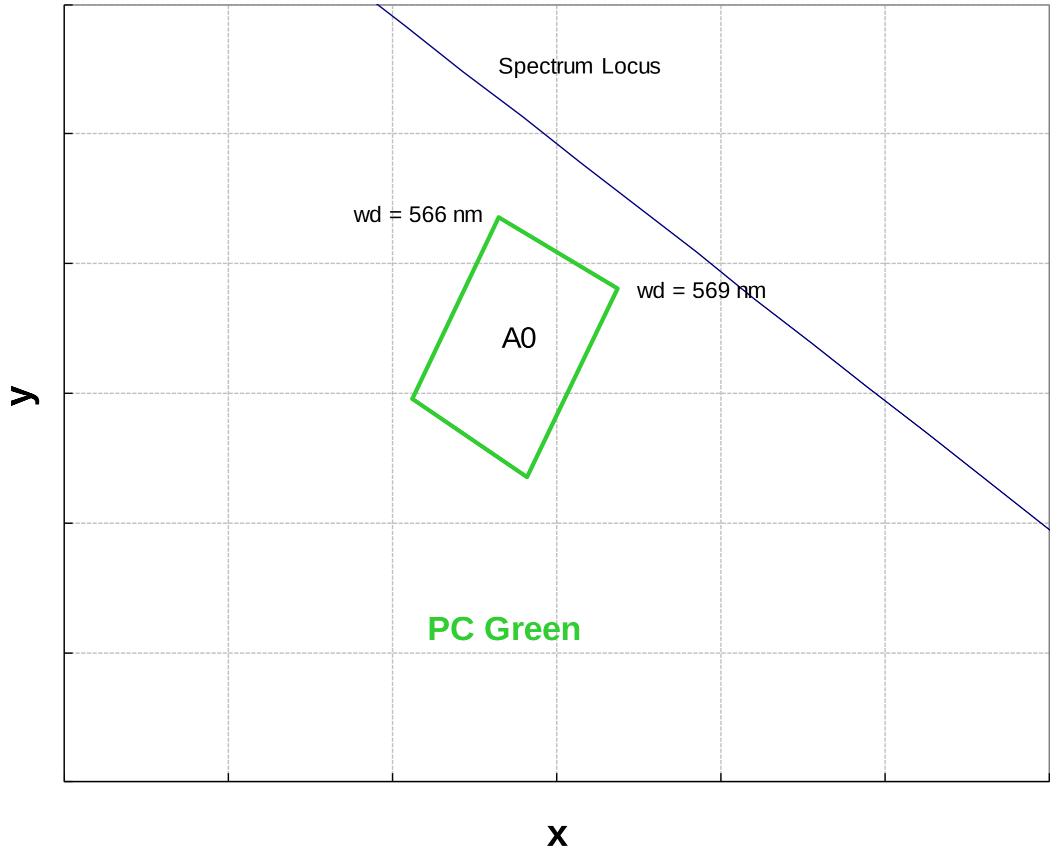
Radiometric Power Bin Structure at 1000mA

Color	Bin Code	Minimum Radiometric Power (mW)	Maximum Radiometric Power (mW)
Blue	A	1080	1230
	B	1230	1400
	C	1400	1600

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

Color Bin

PC Green Binning Structure Graphical Representation



Dominant Wavelength Bin Structure

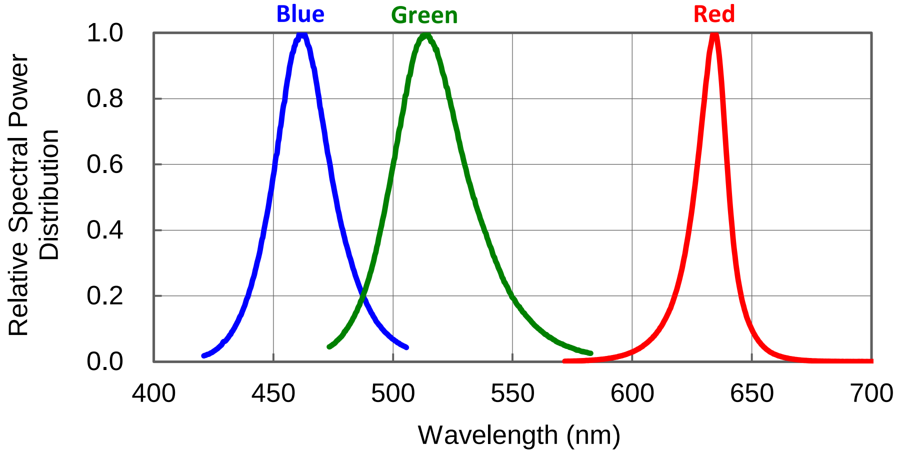
Color	Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
Red	4	620	630
Blue	5	450	455
Green	1 2	523 525	528 530

- ProLight maintains a tolerance of ± 1nm for dominant wavelength measurements.

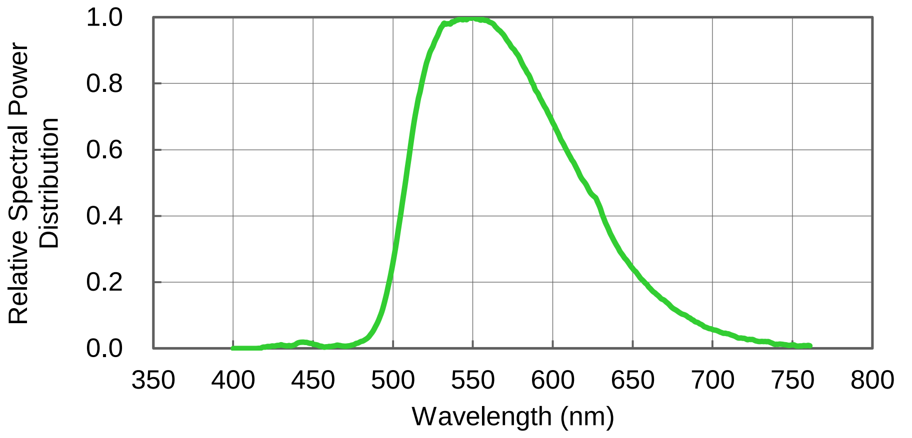
Note: Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.

Color Spectrum, T_J = 25°C

1. Blue、Green、Red

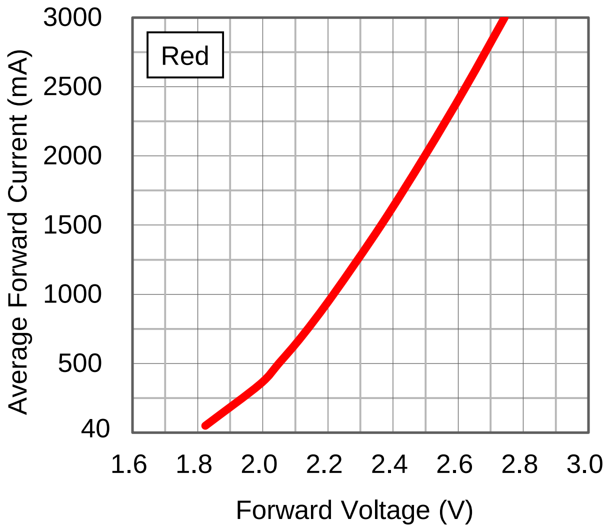


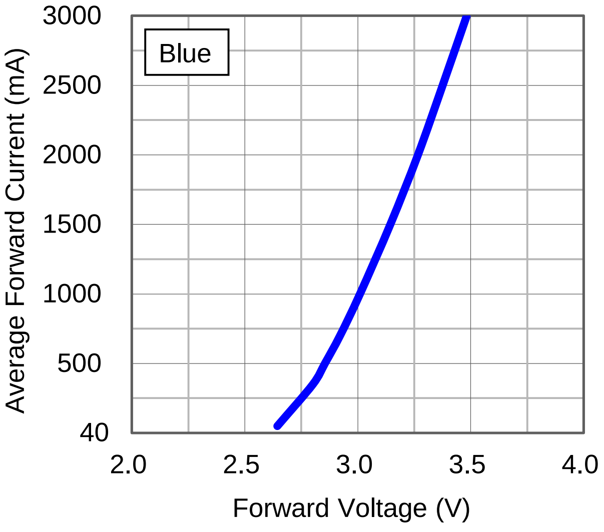
2. PC Green

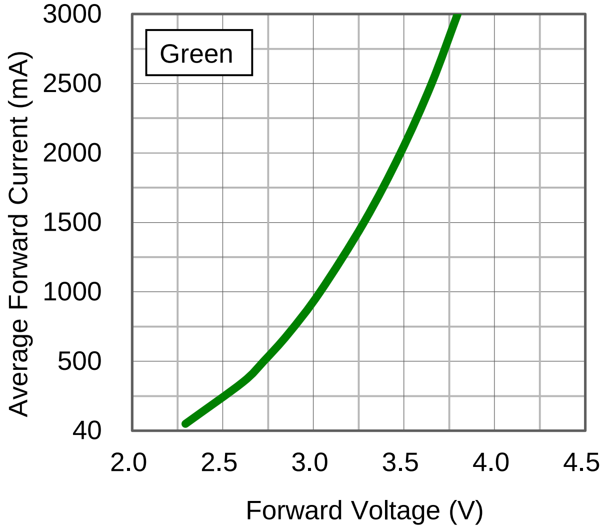


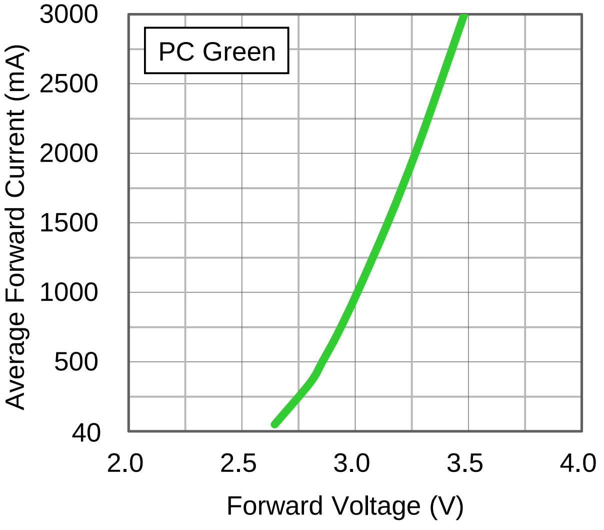
Forward Current Characteristics, T_J = 25°C

1. Forward Voltage vs. Forward Current



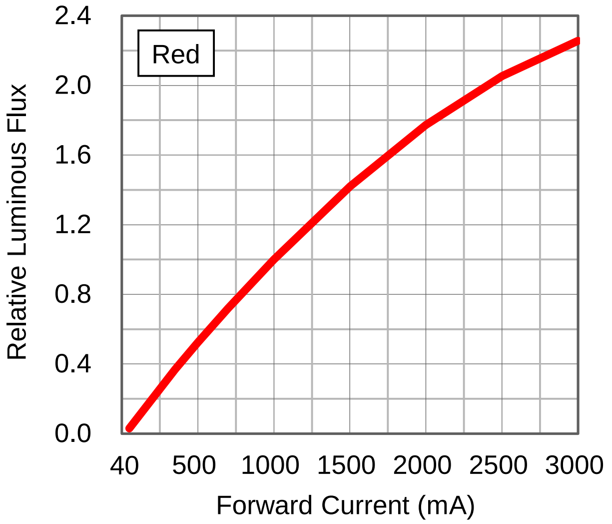


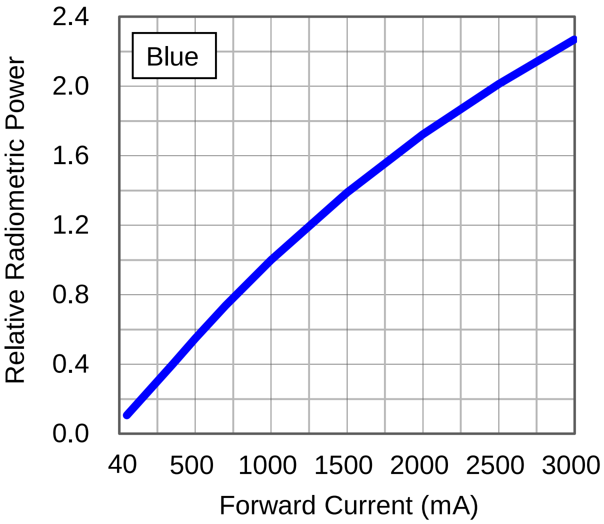


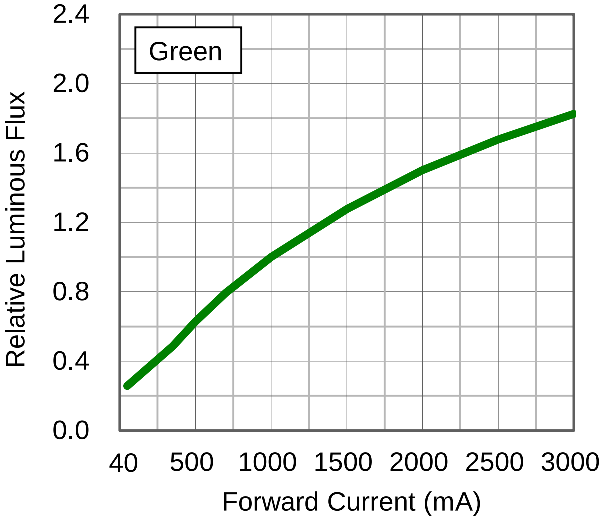


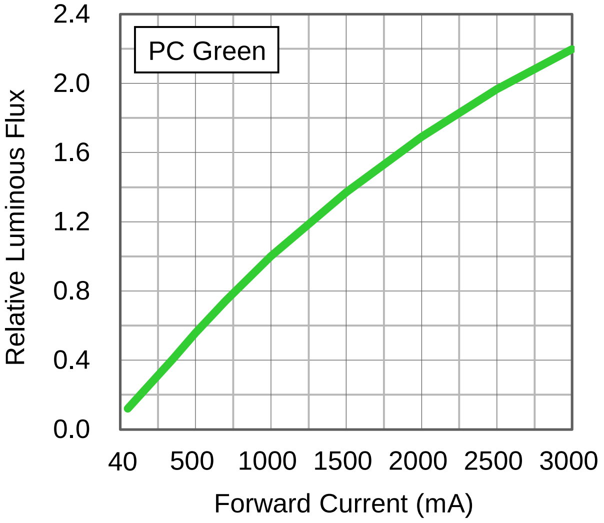
Forward Current Characteristics, T_J = 25°C

2. Forward Current vs. Normalized Relative Luminous Flux



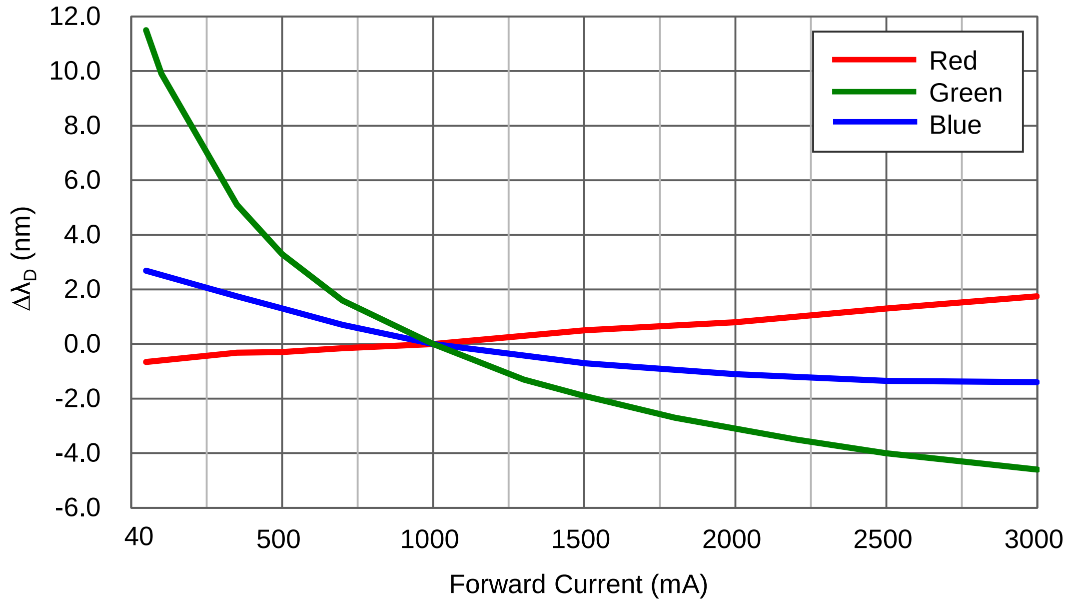




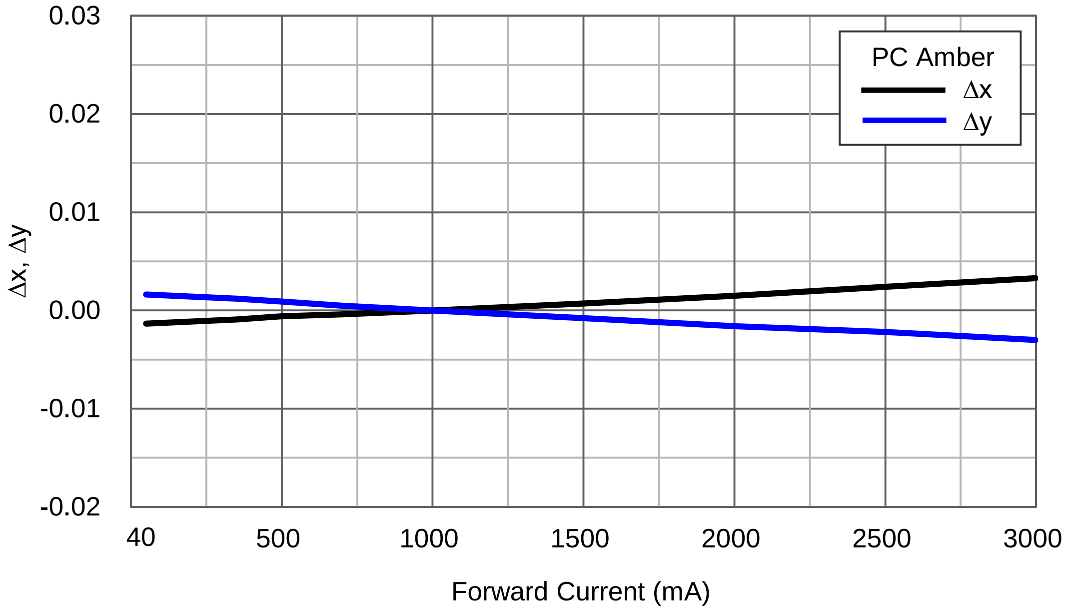


Forward Current Characteristics, T_J = 25°C

3. Forward Current vs. Dominant Wavelength Shift

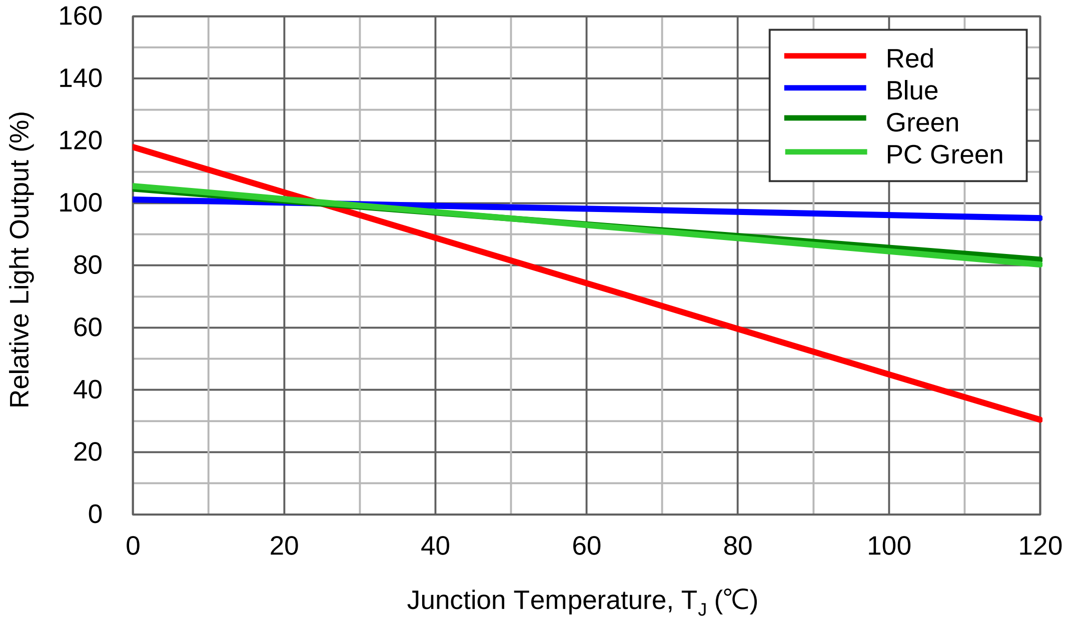


4. Forward Current vs. Chromaticity Coordinate Shift

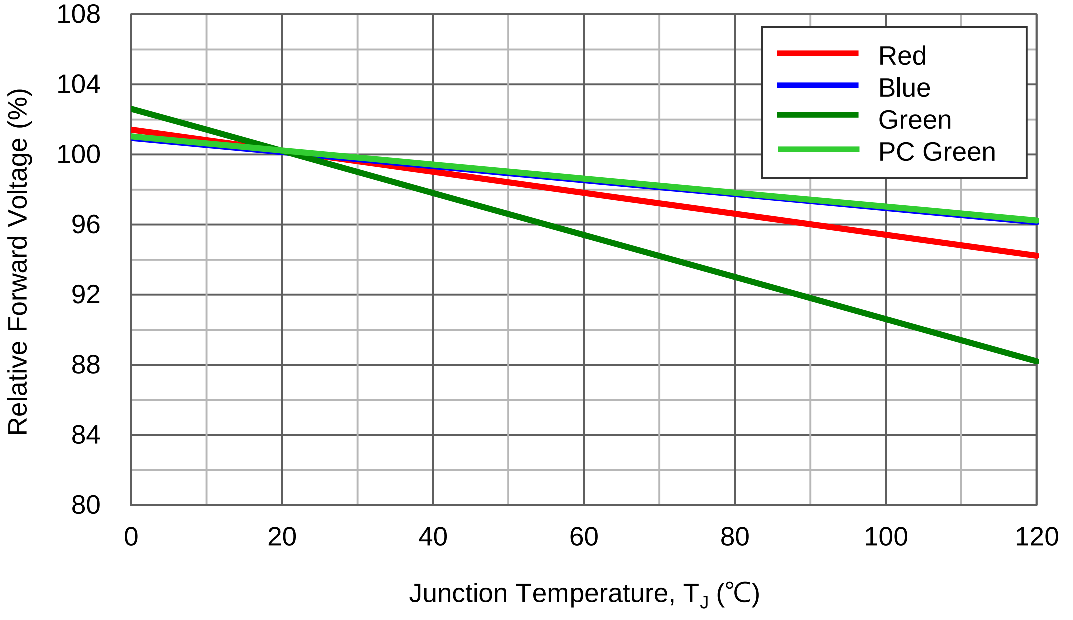


Junction Temperature Relative Characteristics

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

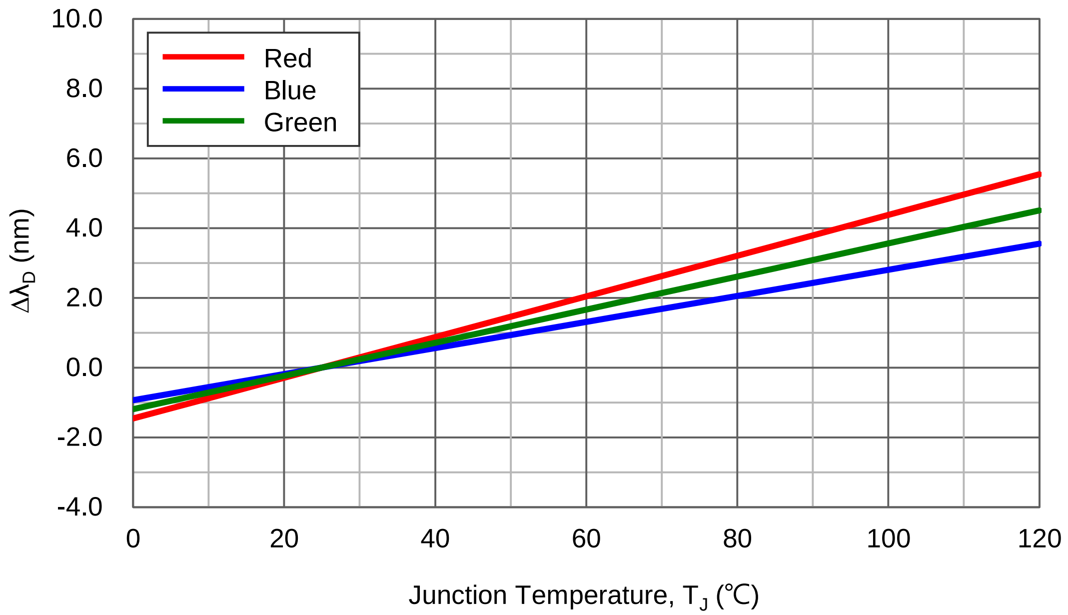


2. Junction Temperature vs. Relative Forward Voltage at 1000mA

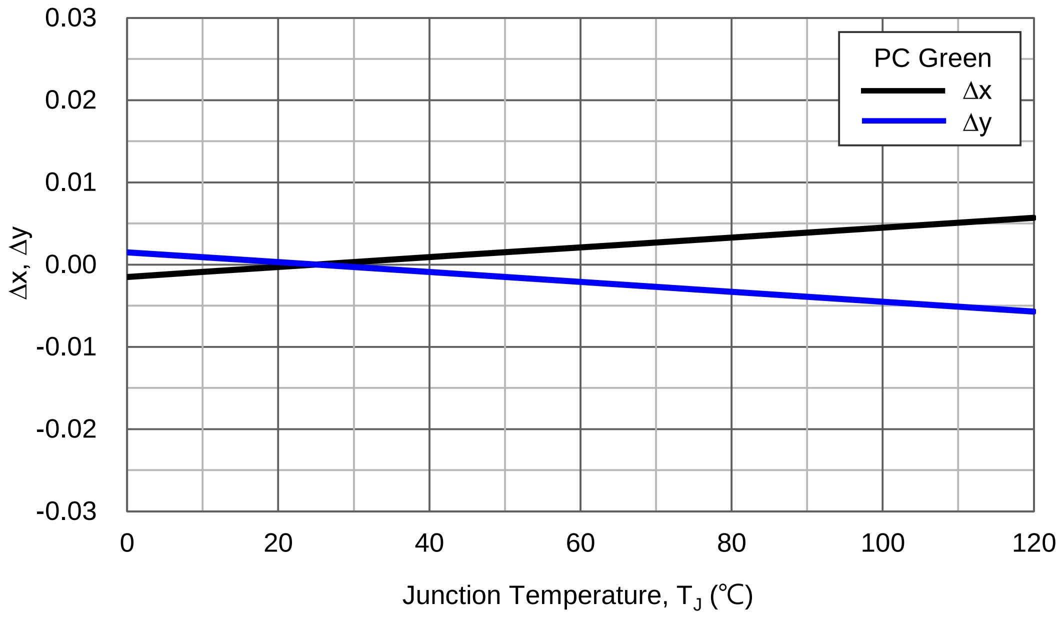


Junction Temperature Relative Characteristics

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

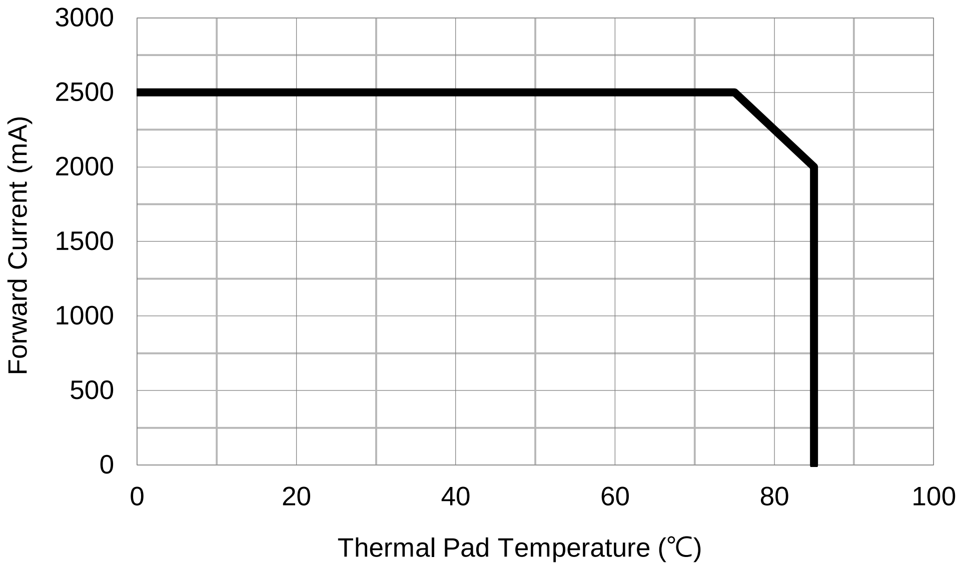


4. Junction Temperature vs. Chromaticity Coordinate Shift at 1000mA

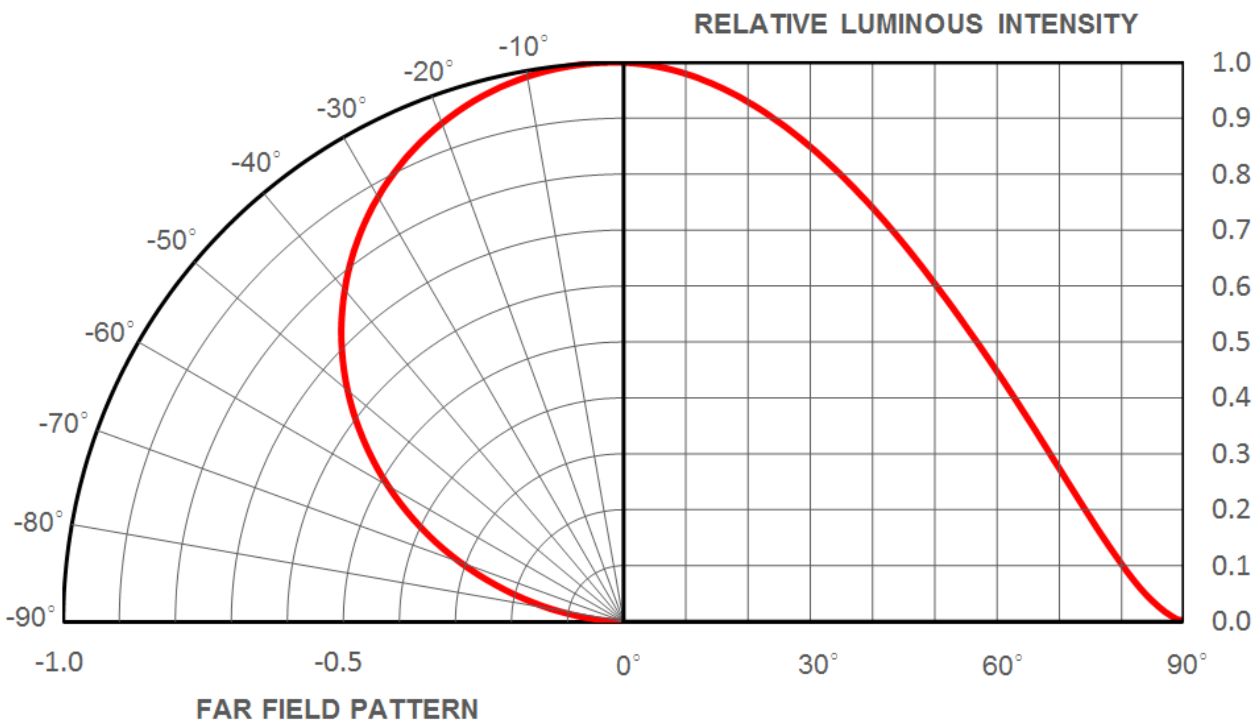


Thermal Pad Temperature vs. Maximum Forward Current

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	≤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 manufature'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 = max DC (Note 1)	1000 hours	Note 2
High Temperature Storage Life (HTSL)	110°C, non-operating	1000 hours	Note 2
Low Temperature Storage Life (LTSL)	-40°C, non-operating	1000 hours	Note 2
Non-operating Temperature Cycle (TMCL)	-40°C to 120°C, 30 min. dwell, <5 min. transfer	200 cycles	Note 2
Mechanical Shock	1500 G, 0.5 msec. pulse, 5 shocks each 6 axis		Note 3
Natural Drop	On concrete from 1.2 m, 3X		Note 3
Variable Vibration Frequency	10-2000-10 Hz, log or linear sweep rate, 20 G about 1 min., 1.5 mm, 3X/axis		Note 3
Solder Heat Resistance (SHR)	260°C ± 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

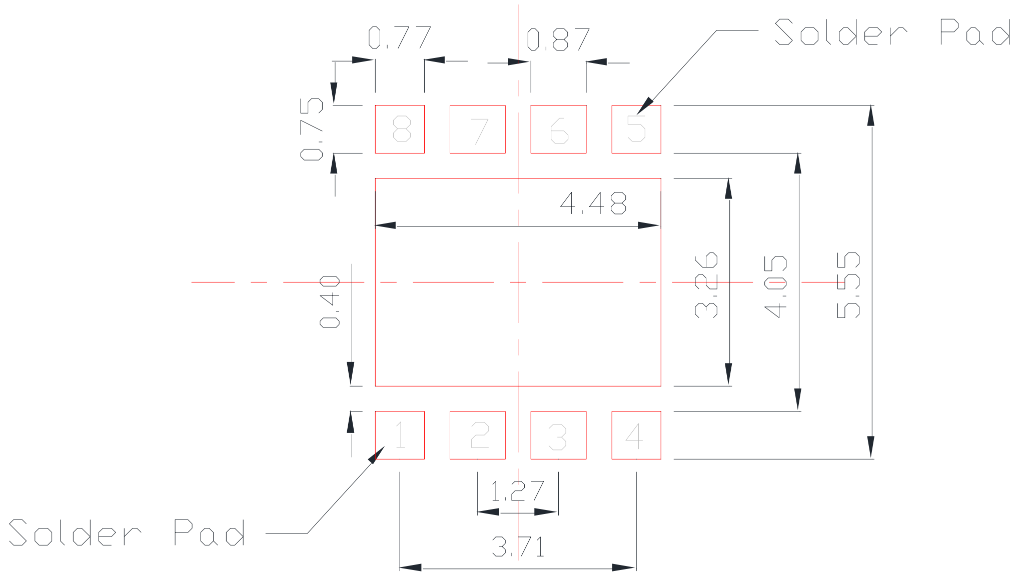
Item	Test Condition	Criteria for Judgement	
		Min.	Max.
Forward Voltage (V_F)	I_F = max DC	--	Initial Level x 1.1
Luminous Flux or Radiometric Power (Φ_V)	I_F = max DC	Initial Level x 0.7	--

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

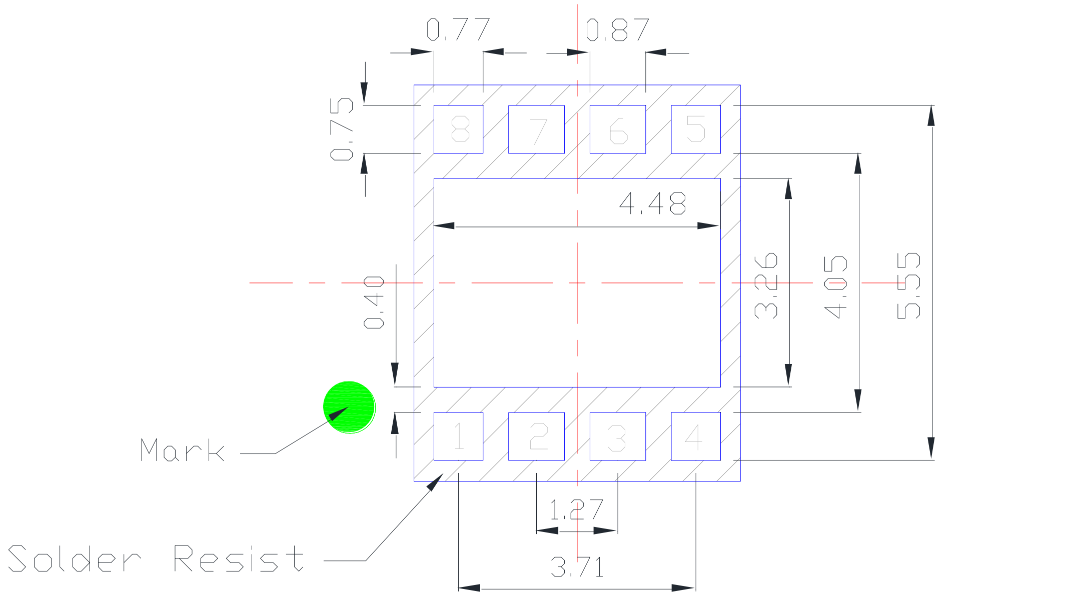
3. A failure is an LED that is open or shorted.

Recommended Solder Pad Design

Solder Pad

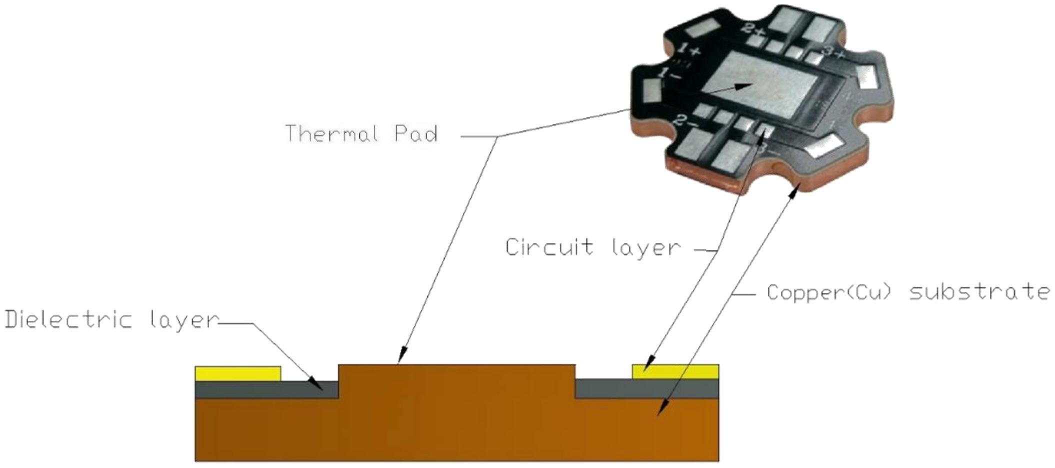


Solder Resist



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

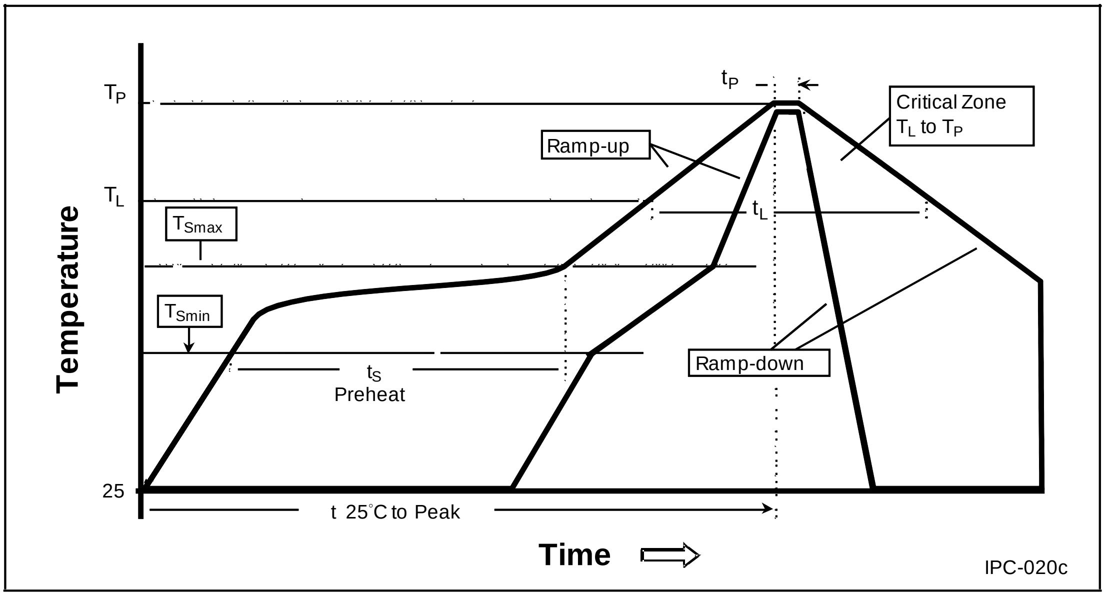
Recommended MCPCB Design



- Copper(Cu) substrate is recommended.

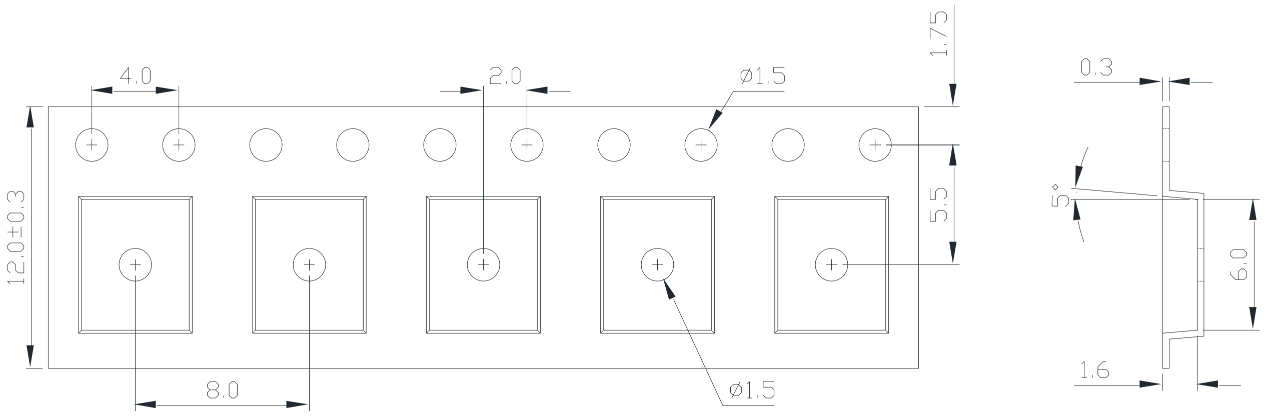
Reflow Soldering Condition

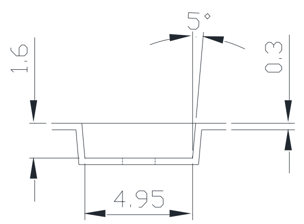
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (T_{Smax} to T_P)	3°C / second max.	3°C / second max.
Preheat – Temperature Min (T_{Smin}) – Temperature Max (T_{Smax}) – Time (t_{Smin} to t_{Smax})	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	 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.

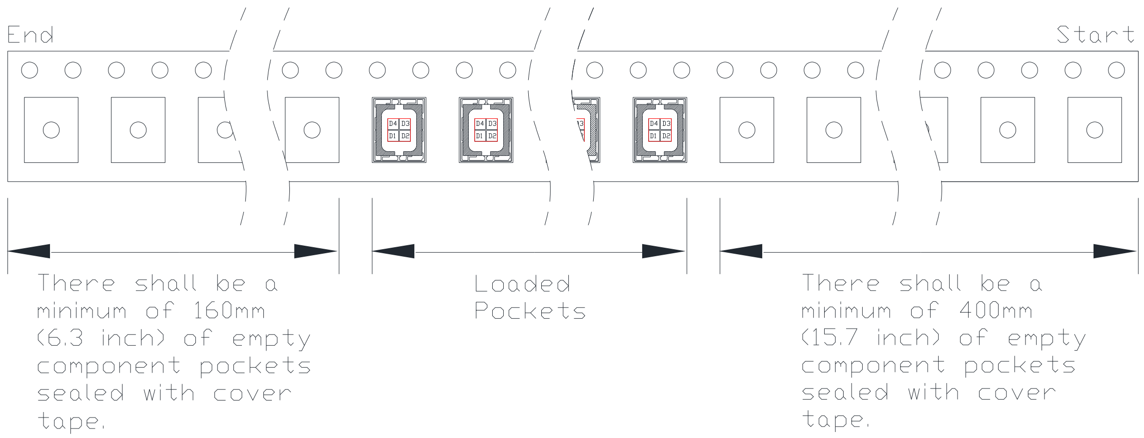


- **We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.**
- **Do not use solder pastes with post reflow flux residue>47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.**
- All temperatures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

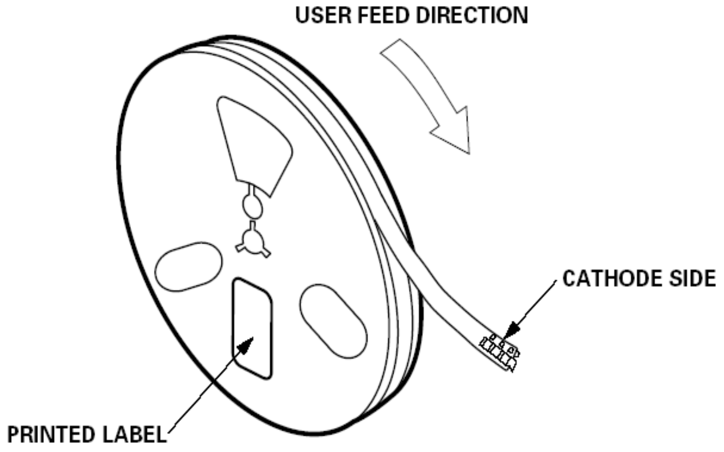


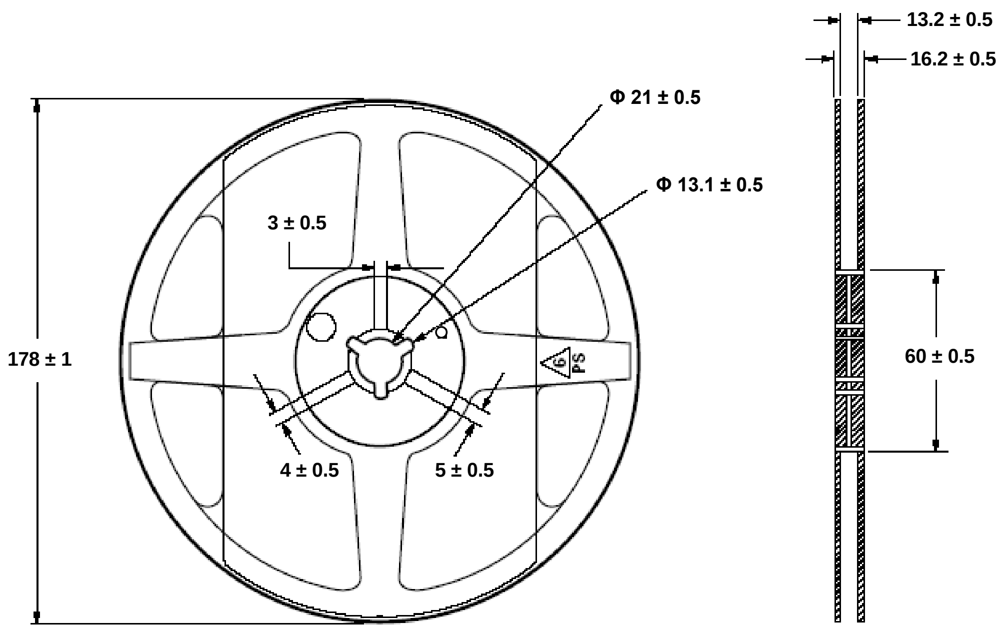




Notes:
1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are ± 0.1mm.

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.

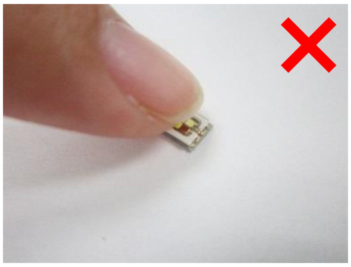
Precaution for Use

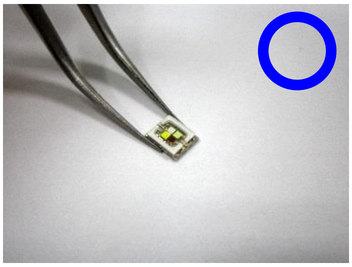
- **We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.**
- **Do not use solder pastes with post reflow flux residue>47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.**
- Any mechanical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

ProLightopto Technology has made every reasonable effort to ensure the accuracy of the information in this datasheet. However, it should be understood that this information is for guidance only and does not constitute any offer or part of a contract.

ProLightopto Technology does not guarantee or accept any legal liability for the accuracy, completeness, or usefulness of any information, product, technology, or process disclosed in this datasheet.
The company reserves the right to make changes or improvements to this datasheet at its discretion.

Unless this datasheet is incorporated into a formal contract, customers should not rely on the information as a binding commitment to any specifications or product parameters by ProLightopto Technology. Customers are advised to verify that the information is current and complete before entering into any contract or acknowledging any purchase order. Therefore, all products described herein are subject to ProLightopto Technology's terms and conditions at the time of order acknowledgment.

Unless agreed upon by contractual agreement, not all parameters of each product are necessarily tested. ProLightopto Technology does not warrant or grant any license, either expressed or implied, under its patent rights or the rights of others.

Reproduction of the information contained herein is permitted only if done without any modifications or alterations. Altering this information and reproducing it is considered an unfair and deceptive business practice. ProLightopto Technology is not responsible or liable for any such altered documentation.

Reselling ProLightopto Technology's products with statements that differ from or exceed the parameters specified by ProLightopto Technology voids all express or implied warranties for the associated product or service and is considered an unfair and deceptive business practice. ProLightopto Technology is not responsible or liable for any such statements.

ProLightopto Technology's products are not authorized for use as critical components in life support devices or systems without explicit written approval from ProLightopto Technology.

For the purposes of this disclaimer：

1. Life support devices or systems are defined as those intended for surgical implant into the body or those that support or sustain life. Their failure, when used according to instructions for use provided in the labeling, can reasonably be expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure can reasonably be expected to cause the failure of the device or system, or to affect its safety or effectiveness.