

ProLight PBEF-15F7E-A
15W Power LED
Technical Datasheet
Version: 1.3

ProLight Opto ProStar Series

Features

- Compact light source
- Seven colors in one package
- Lead free reflow soldering
- Superior ESD protection
- RoHS compliant

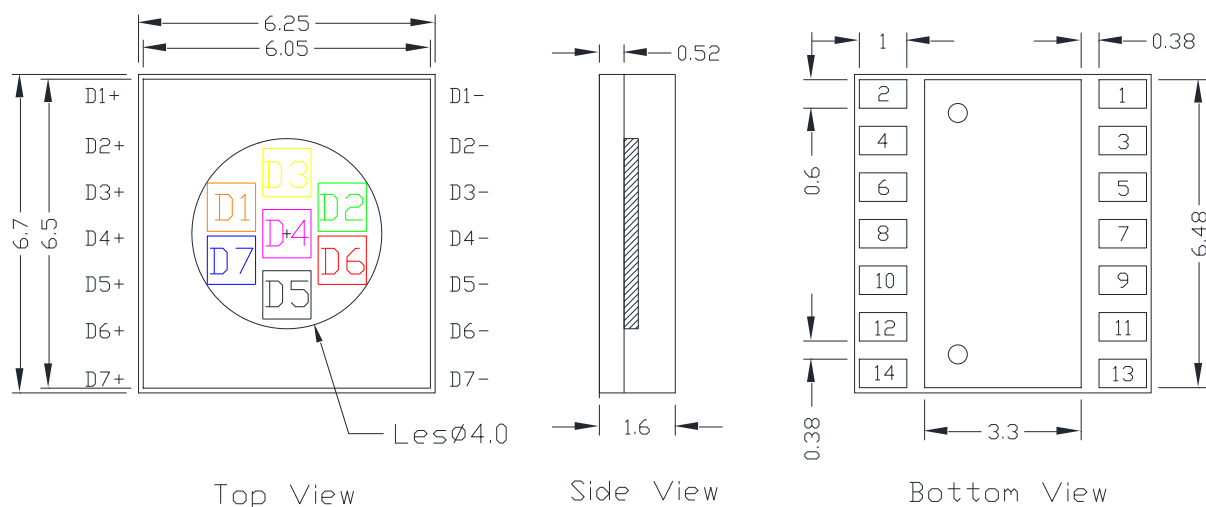
Main Applications

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

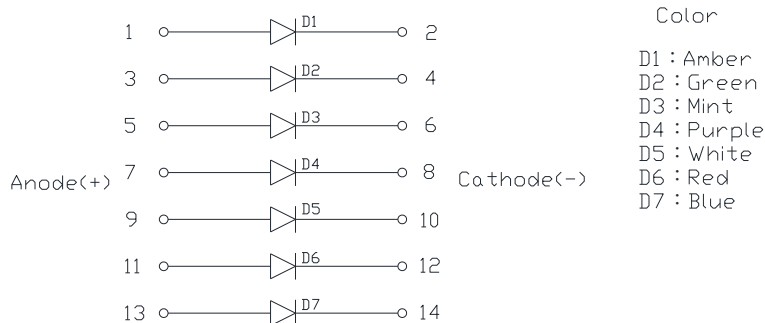
Introduction

- ProLight PBEF colorful series is a color changeable LED with maximum 7 color chips in one package. Compared to discrete LEDs, PBEF series reduce the distance between LED die, creating a small optical source for excellent optical control and efficient color mixing. ProLight PBEF series is much suitable for the application of color-changing lighting, especially for entertainment lighting.

Emitter Mechanical Dimensions



Circuit Diagram



Notes:

1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are ± 0.15 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 Emitter	Luminous Flux or Radiometric Power		
		@350mA		Refer @700mA
		Min.	Typ.	Typ.
Amber	PBEF-15F7E-A	38 lm	45 lm	72 lm
Green		56 lm	70 lm	109 lm
Mint		77 lm	85 lm	160 lm
Purple		360 mW	430 mW	830 mW
White		76 lm	90 lm	165 lm
Red		34 lm	40 lm	62 lm
Blue		10 lm	12 lm	20 lm

- 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 Junction to Slug ($^\circ\text{C}/\text{W}$)
	Min.	@350mA Typ.	Max.	Refer @700mA Typ.	
Amber	1.8	2.2	2.8	2.6	3.5
Green	2.4	2.8	3.4	3.2	
Mint	2.4	2.8	3.3	3.2	
Purple	2.8	3.3	4.0	3.5	
White	2.4	2.8	3.3	3.2	
Red	1.7	2.0	2.6	2.5	
Blue	2.4	2.8	3.3	3.0	

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

Optical Characteristics at 350mA, T_j = 25°C

Radiation Pattern	Color	Dominant Wavelength λ_D , Peak Wavelength ^[1] λ_P , or Color Temperature CCT			Total included Angle (degrees) $\theta_{0.90V}$	Viewing Angle (degrees) $2\theta_{1/2}$
		Min.	Typ.	Max.		
Lambertian	Amber	586 nm	592 nm	596 nm	160	120
	Green	525 nm	527 nm	530 nm	160	120
	Mint	562 nm	567 nm	570 nm	160	120
	Purple ^[1]	397 nm	402 nm	407 nm	160	120
	White	5650 K	6300 K	6960 K	160	120
	Red	618 nm	623 nm	628 nm	160	120
	Blue	455 nm	457 nm	460 nm	160	120

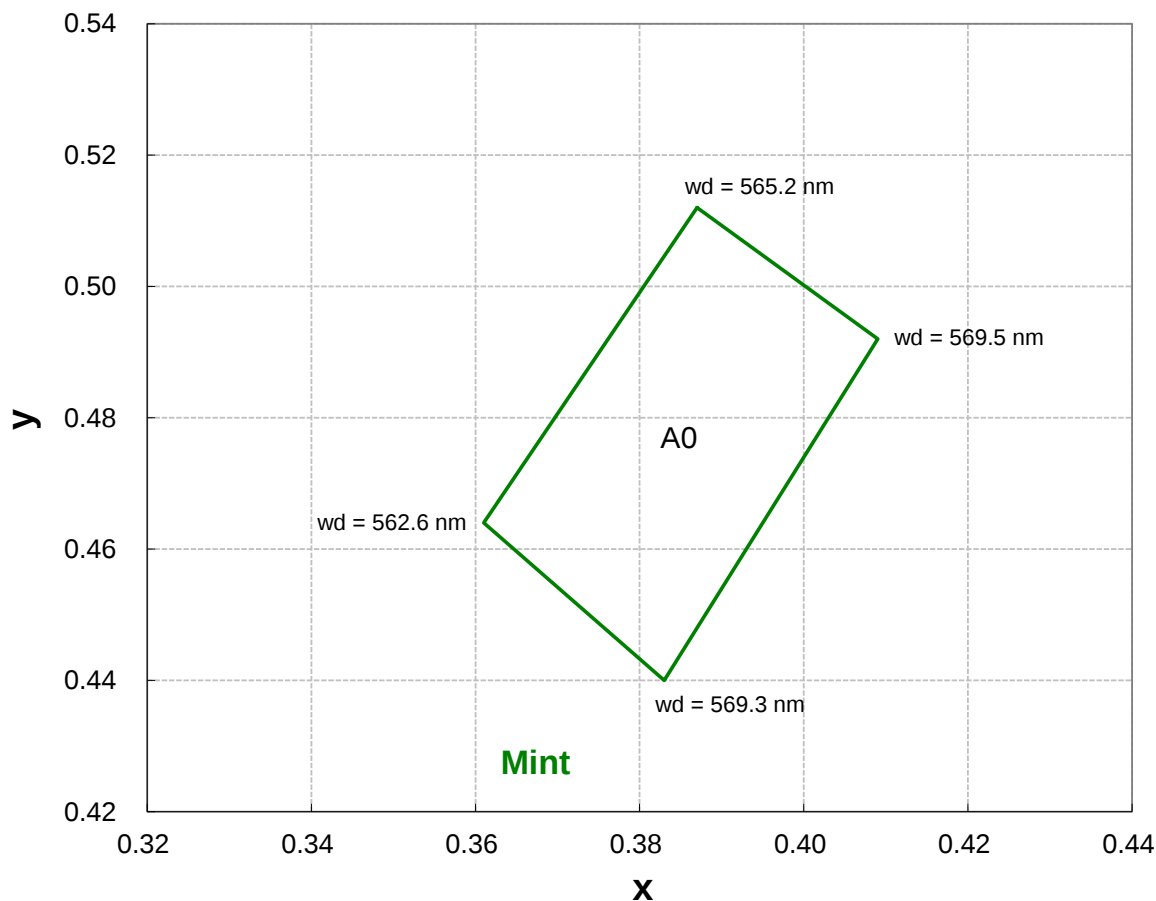
- ProLight maintains a tolerance of $\pm 1\text{nm}$ for dominant wavelength measurements.
- ProLight maintains a tolerance of $\pm 5\%$ for CCT measurements.
- ^[1] Purple product is binned by peak wavelength rather than dominant wavelength.

Absolute Maximum Ratings

Parameter	Amber/Green/Mint/ Purple/White/Red/Blue
DC Forward Current (mA)	700
Peak Pulsed Forward Current (mA)	1000 (less than 1/10 duty cycle@1KHz)
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	$\pm 4000\text{V}$ (Class III)
LED Junction Temperature	125°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

Color Bin

Mint Binning Structure Graphical Representation



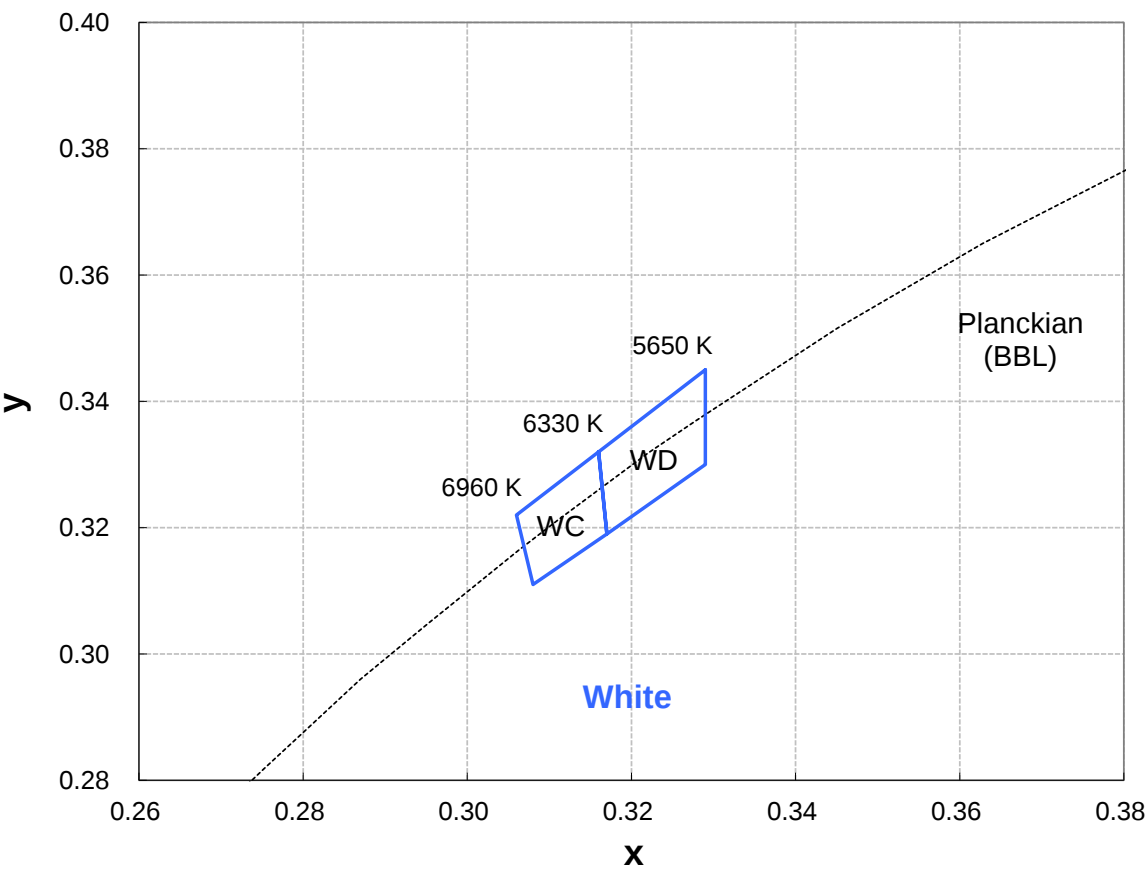
Mint Bin Structure

Bin Code	x	y
A0	0.3870	0.5120
	0.3610	0.4640
	0.3830	0.4400
	0.4090	0.4920

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

Color Bin

White Binning Structure Graphical Representation



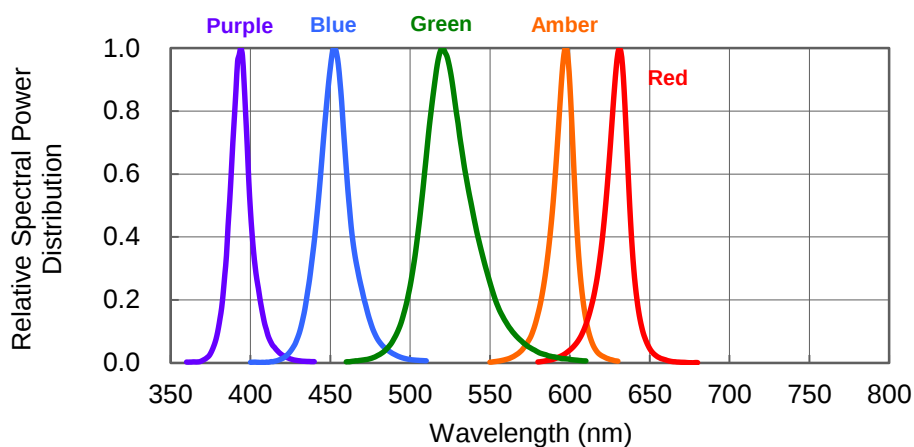
White Bin Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
WD	0.3290	0.3450	5990	WC	0.3160	0.3320	6640
	0.3290	0.3300			0.3170	0.3190	
	0.3170	0.3190			0.3080	0.3110	
	0.3160	0.3320			0.3060	0.3220	

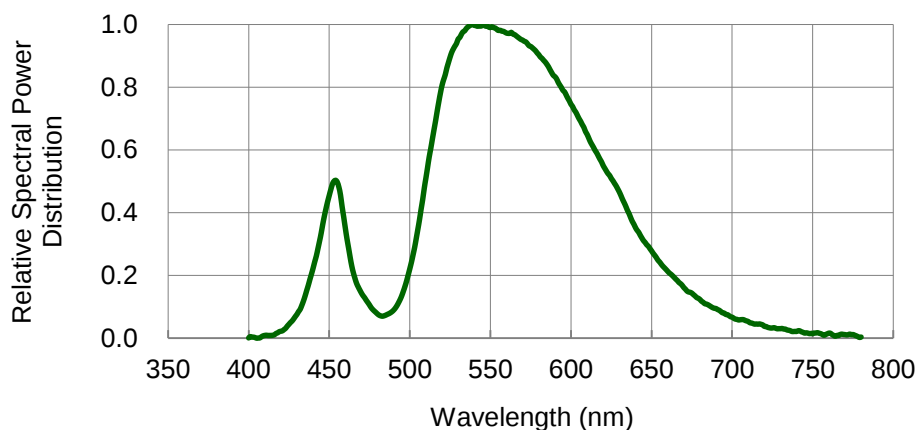
- Tolerance on each color bin (x , y) is ± 0.005

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

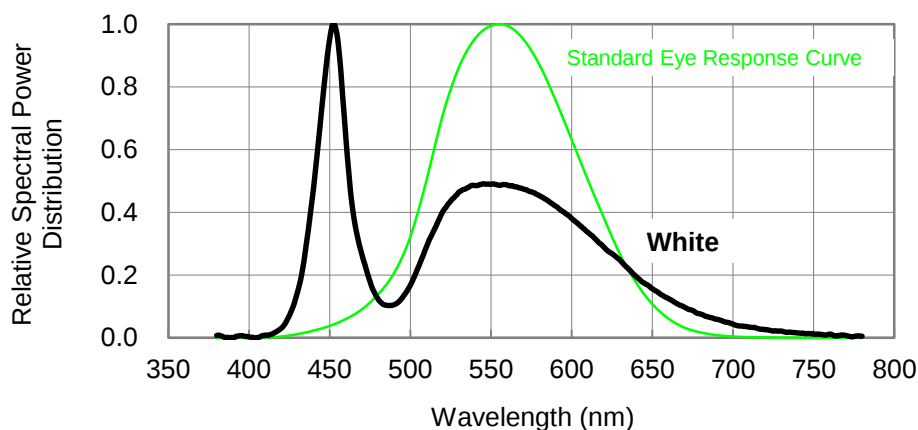
1. Purple 、 Blue 、 Green 、 Amber 、 Red



2. Mint

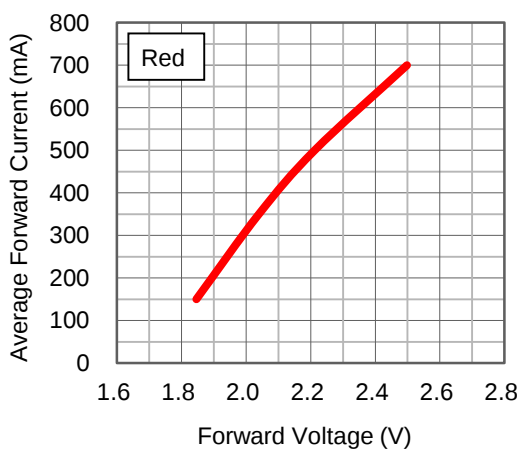
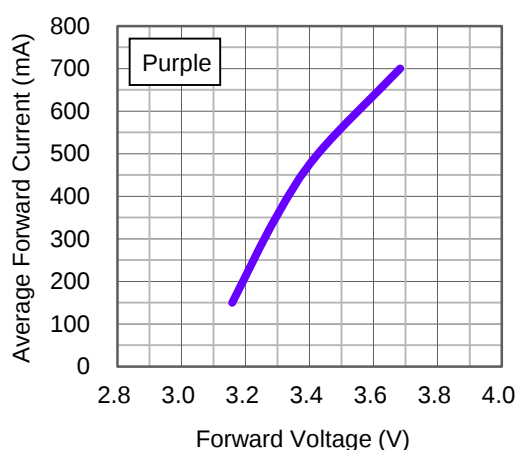
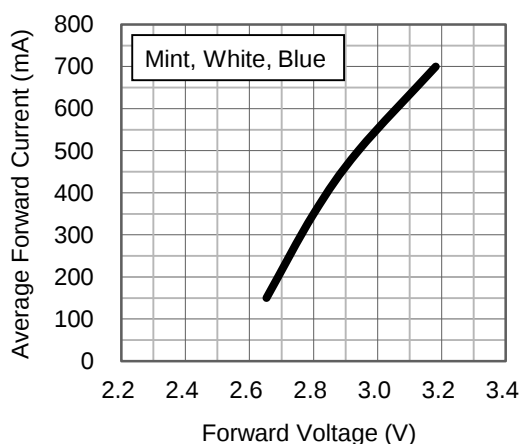
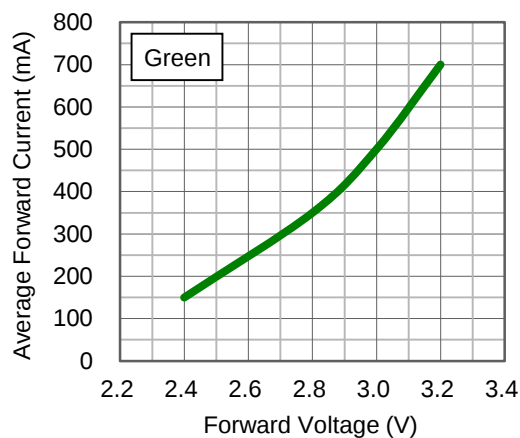
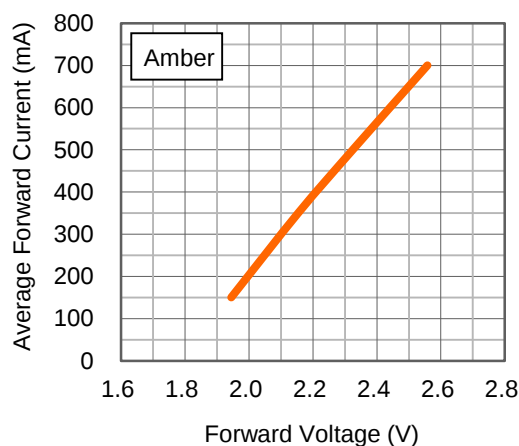


3. White



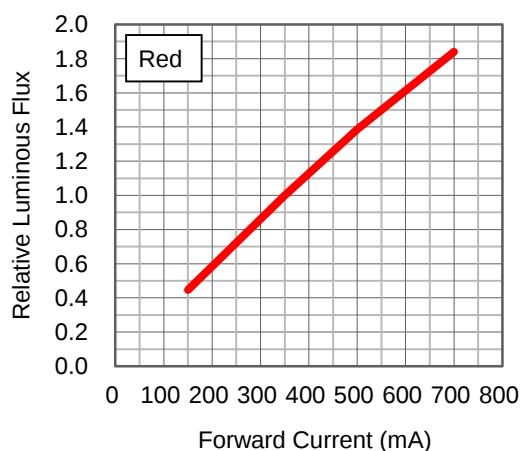
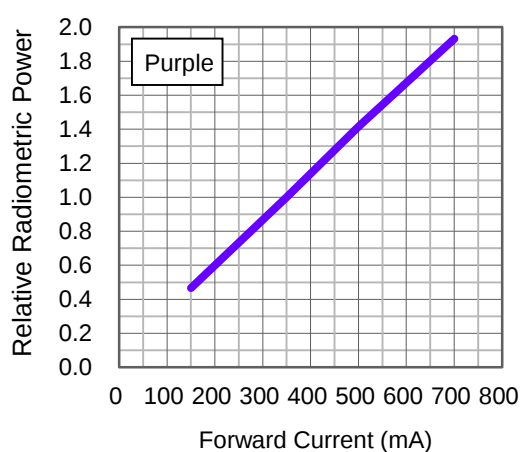
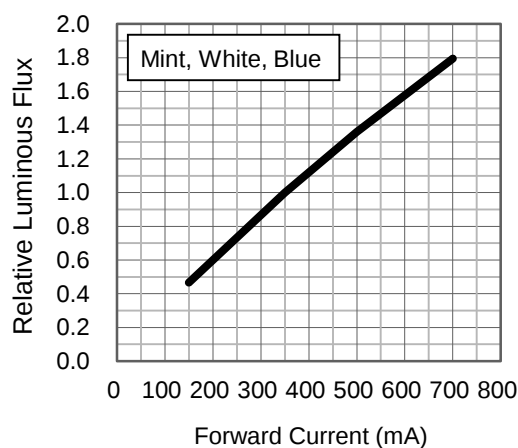
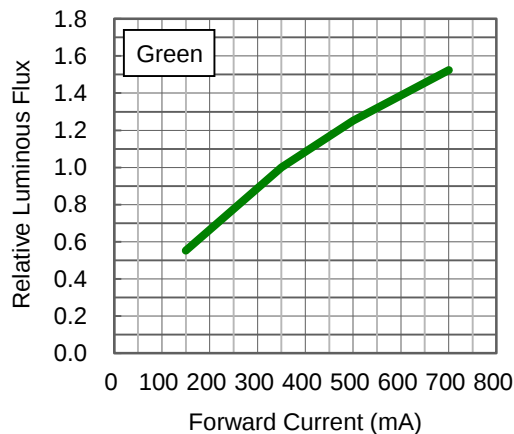
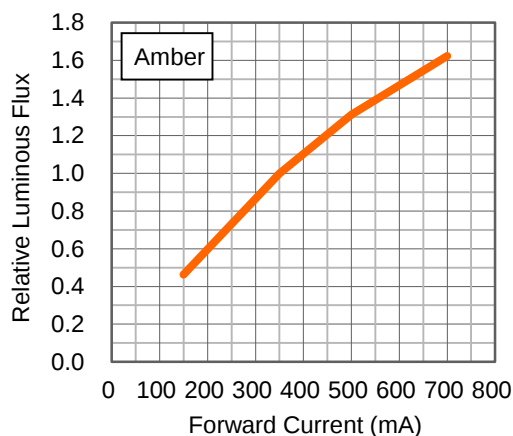
Forward Current Characteristics, $T_j = 25^\circ\text{C}$

1. Forward Voltage vs. Forward Current



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

2. Forward Current vs. Normalized Relative Luminous Flux



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

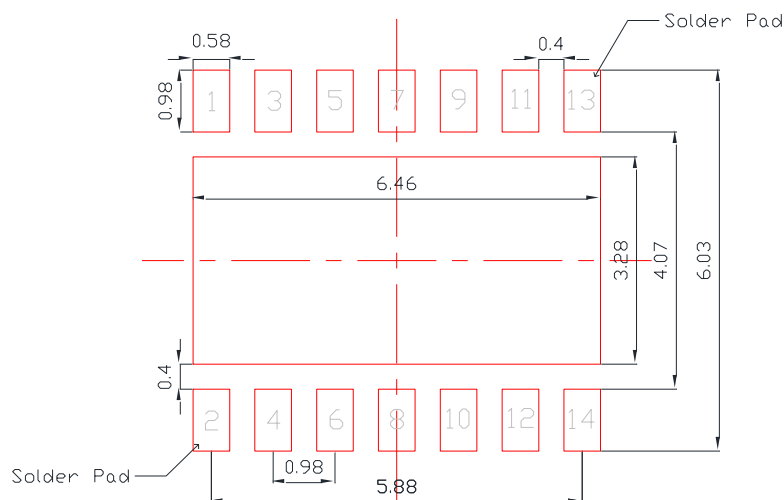
Item	Test Condition	Criteria for Judgement	
		Min.	Max.
Forward Voltage (V_F)	$I_F = \text{max DC}$	--	Initial Level x 1.1
Luminous Flux or Radiometric Power (Φ_V)	$I_F = \text{max DC}$	Initial Level x 0.7	--

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

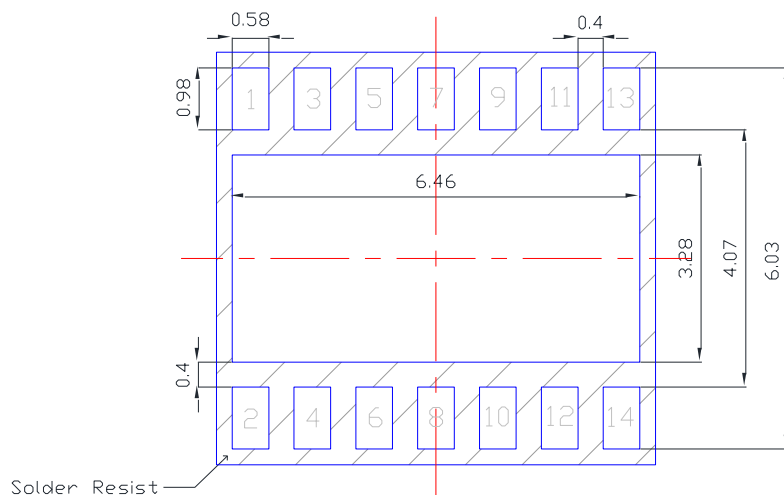
3. A failure is an LED that is open or shorted.

Recommended Solder Pad Design

Solder Pad

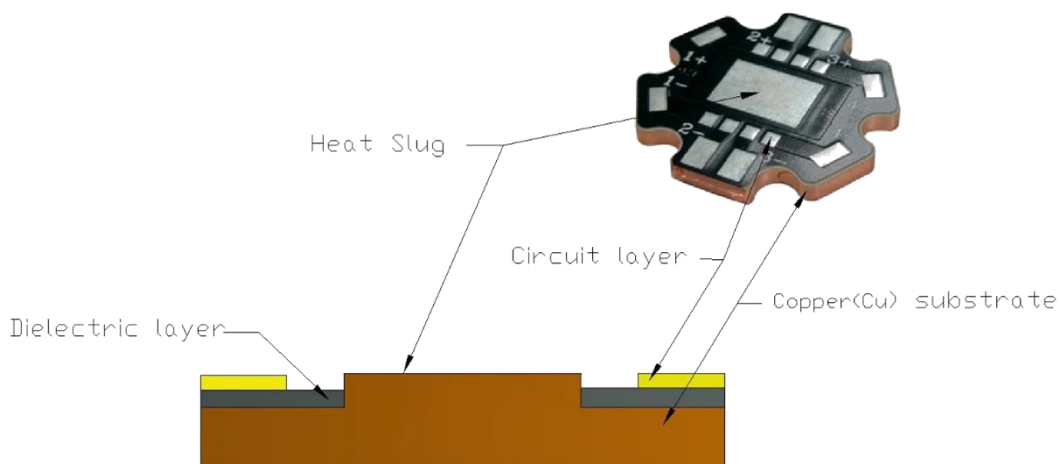


Solder Resist



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

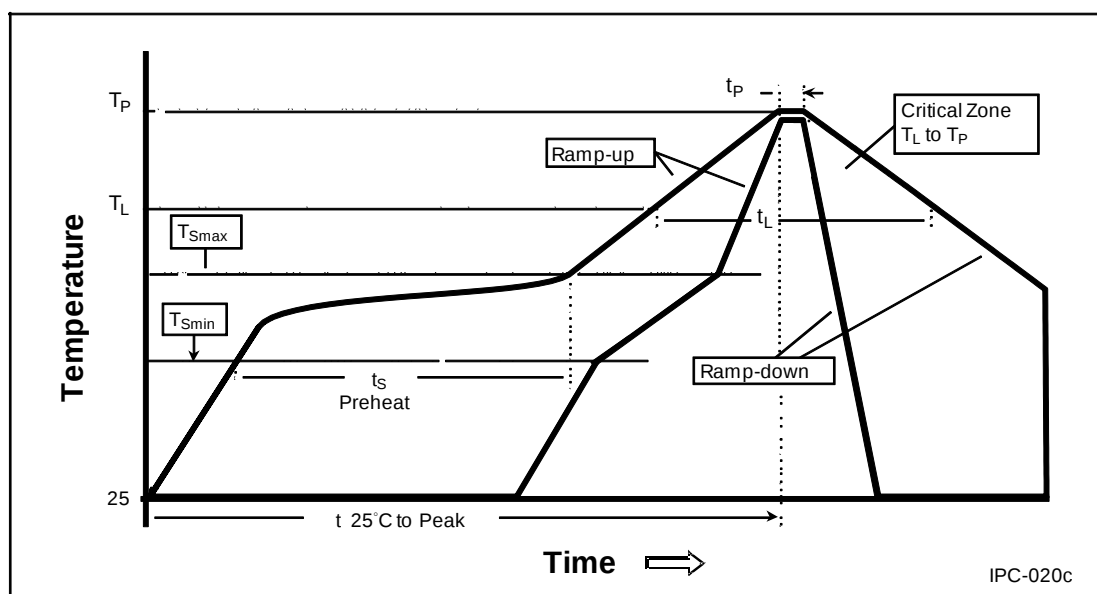
Recommended MCPCB Design



- Copper(Cu) substrate is recommended.

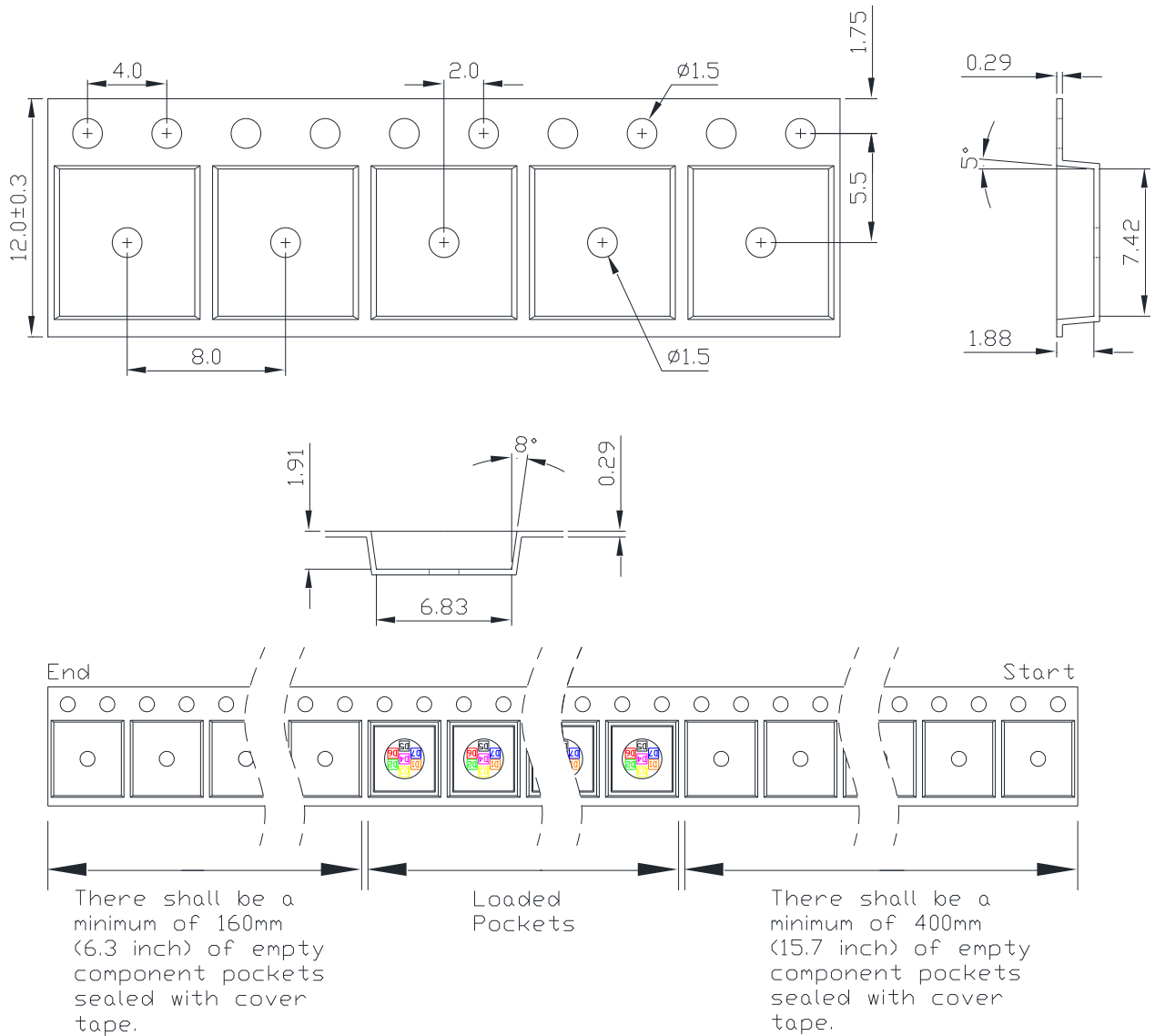
Reflow Soldering Condition

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (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.

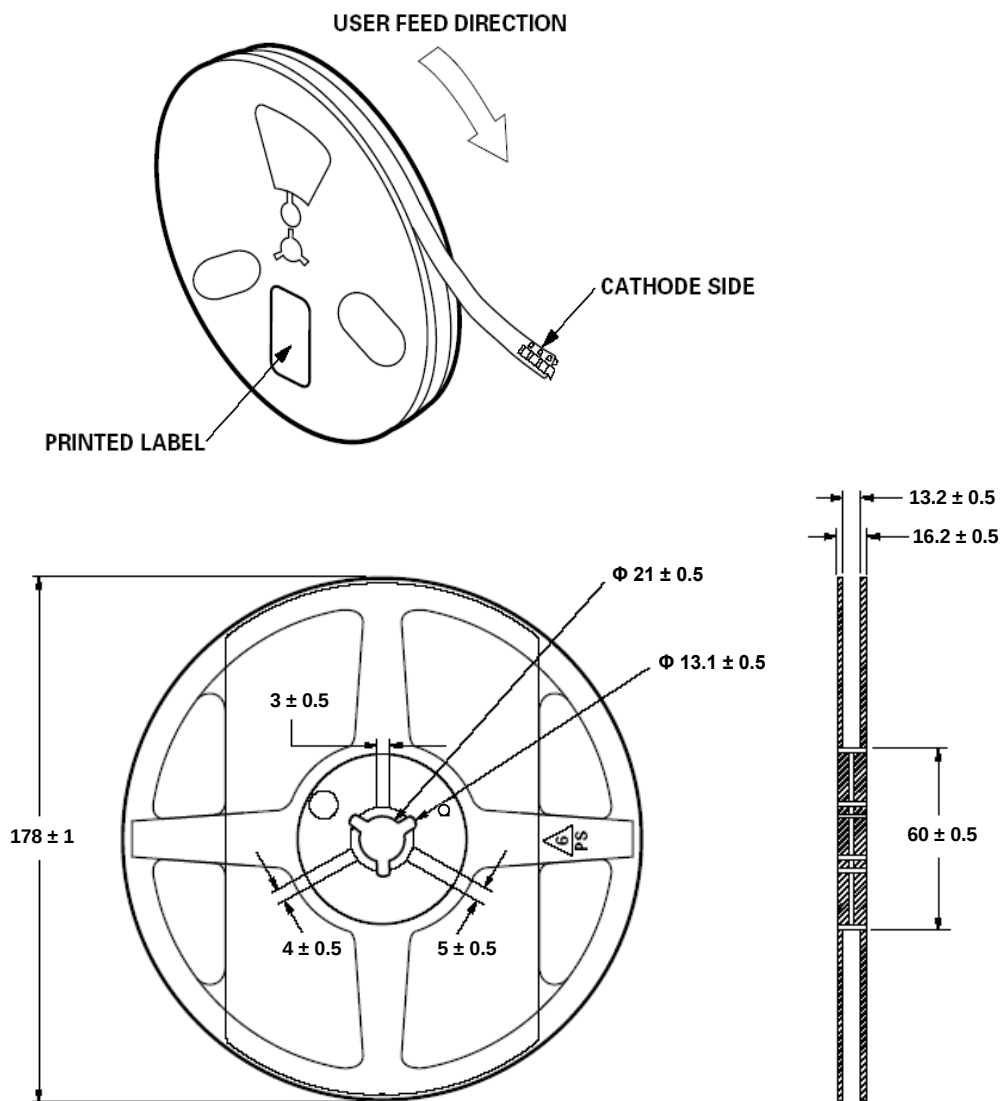
Emitter Reel Packaging



Notes:

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

Emitter Reel Packaging



Notes:

1. Empty component pockets sealed with top cover tape.
2. 250 or 500 pieces per reel.
3. Drawing not to scale.
4. All dimensions are in millimeters.

Precaution for Use

- We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.
- Do not use solder pastes with post reflow flux residue > 47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.
- Any mechanical force or any excess vibration shall not be accepted to apply during cooling process to normal temperature after soldering.
- Please avoid rapid cooling after soldering.
- Components should not be mounted on warped direction of PCB.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a heat plate should be used. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- This device should not be used in any type of fluid such as water, oil, organic solvent and etc. When cleaning is required, isopropyl alcohol should be used.
- When the LEDs are illuminating, operating current should be decided after considering the package maximum temperature.
- The appearance, specifications and flux bin of the product may be modified for improvement without notice. Please refer to the below website for the latest datasheets.
<http://www.prolightopto.com/>

Handling of Lens LEDs

Notes for handling of lens LEDs

- Please do not use a force of over 1kgf impact or pressure on the lens, otherwise it will cause a catastrophic failure.
- The LEDs should only be picked up by making contact with the sides of the LED body.
- Avoid touching the lens especially by sharp tools such as Tweezers.
- Avoid leaving fingerprints on the lens.
- Please store the LEDs away from dusty areas or seal the product against dust.
- Please do not mold over the lens with another resin. (epoxy, urethane, etc)

