ProLight PK2N-4LxE-SBVR8B
4W High CRI Power LED
Technical Datasheet
Version: 1.5

ProLight Opto PK2N Series

Features

- Best thermal material solution of the world
- Best Moisture Sensitivity: JEDEC Level 1
- RoHS compliant

Main Applications

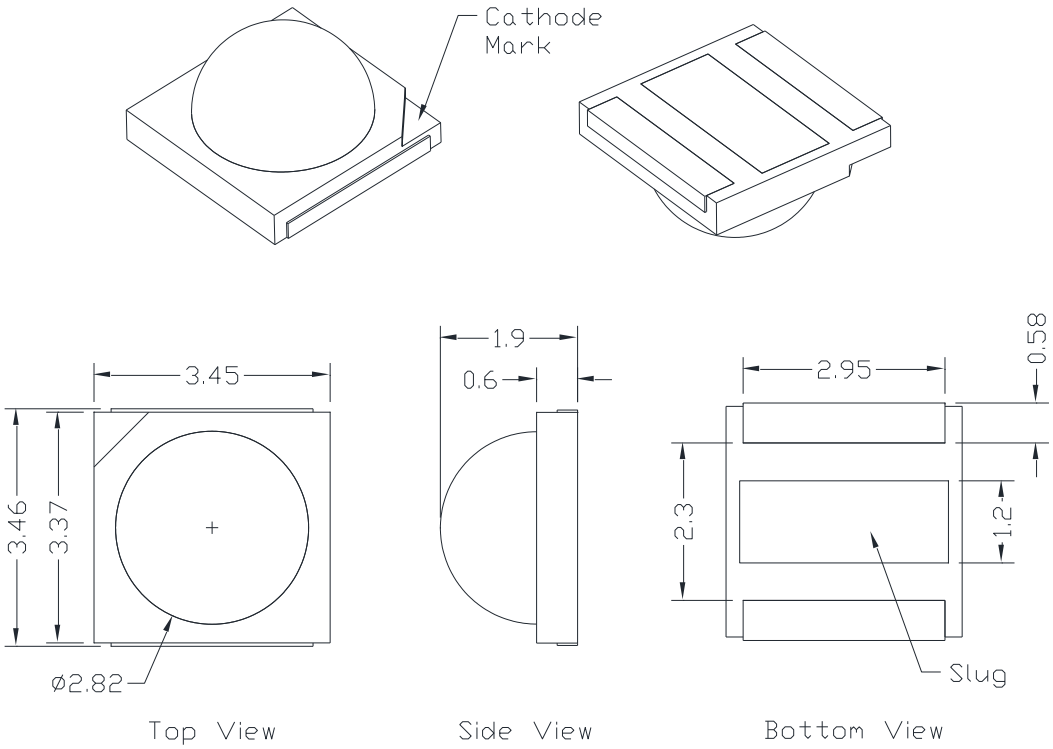
- Entertainment Lighting
- Commercial Lighting
- Indoor Lighting
- Outdoor Lighting

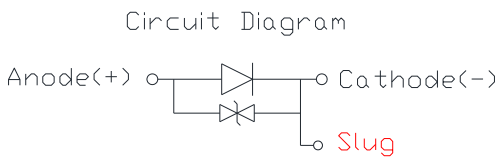
Introduction

·ProLight Phenix 3535, is one of the smallest high power LED footprint available by ProLight Opto, has offered extended solid-state lighting design possibilities. ProLight Phenix 3535 is designed with ProLight own Patents and using copper leadframe, the best thermal material of the world.

·Phenix 3535 qualifies as the JEDEC Level 1 MSL sensitivity level and suitable for SMD process, Pb_free reflow soldering capability, and full compliance with EU Reduction of Hazardous Substances (RoHS) legislation.

Emitter Mechanical Dimensions





Notes:
1. The cathode side of the device is denoted by the chamfer on the part body.
2. Electrical insulation between the case and the board is required. Do not electrically connect either the anode or cathode to the slug.
3. Drawing not to scale.
4. All dimensions are in millimeters.
5. Unless otherwise indicated, tolerances are ± 0.1mm.
6. Please do not solder the emitter by manual hand soldering, otherwise it will damage the emitter.
7. **Please do not use a force of over 0.3kgf 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˚C

Part Number Emitter	Luminous Flux Φ_V (lm) @350mA Min.	@350mA Typ.	Refer @700mA Typ.	Refer @1000mA Typ.	CRI Min.
PK2N-4LWE-SBVR8B	120	145	254	334	80
PK2N-4LNE-SBVR8B	120	145	254	334	80
PK2N-4LVE-SBVR8B	110	140	245	322	80

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

Electrical Characteristics, T_J = 25˚C

Color	Forward Voltage V_F (V) @350mA Min.	@350mA Typ.	@350mA Max.	Refer @700mA Typ.	Refer @1000mA Typ.	Thermal Resistance Junction to Slug (˚C/ W)
White	2.70	2.95	3.30	3.11	3.22	7
Neutral White	2.70	2.95	3.30	3.11	3.22	7
Warm White	2.70	2.95	3.30	3.11	3.22	7

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

Optical Characteristics at 350mA, T_J = 25˚C

Color	Bin Code	Color Temperature CCT Min.	Color Temperature CCT Typ.	Color Temperature CCT Max.	Total included Angle (degrees) $\theta_{0.90V}$	Viewing Angle (degrees) $2\theta_{1/2}$
White	V0	4750 K	5000 K	5340 K	160	130
	W0	5330 K	5700 K	6030 K	160	130
Neutral White	Qa + Qb	3360 K	3500 K	3570 K	160	130
	Sa + Sb	3840 K	4000 K	4120 K	160	130
Warm White	Ma + Mb	2660 K	2700 K	2790 K	160	130
	Na + Nb	2970 K	3000 K	3120 K	160	130

- ProLight maintains a tolerance of ± 5% for CCT measurements.

Electro-Optical Characteristics, T_J = 25°C

I_F (mA)	V_F (V)	Power (W)	PK2N-4LWE-SBVR8B Flux (lm)	PK2N-4LNE-SBVR8B Flux (lm)	PK2N-4LVE-SBVR8B Flux (lm)
250	2.90	0.73	108.6	108.6	104.9
300	2.93	0.88	127.3	127.3	122.9
350	2.95	1.03	145.0	145.0	140.0
400	3.00	1.20	162.0	162.0	156.3
500	3.04	1.52	194.5	194.5	187.8
600	3.08	1.85	225.2	225.2	217.5
700	3.11	2.18	254.0	254.0	245.2
800	3.16	2.53	282.1	282.1	272.3
900	3.19	2.87	307.5	307.5	296.9
1000	3.22	3.22	333.9	333.9	322.4

- All values are reference only.

Absolute Maximum Ratings

Parameter	White/Neutral White/Warm White
DC Forward Current (mA)	1200
Peak Pulsed Forward Current (mA)	1500 (less than 1/10 duty cycle@1KHz)
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	±4000V (Class III)
LED Junction Temperature	120°C
Operating Board Temperature at Maximum DC Forward Current	-40°C - 90°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 at 350mA

Color	Bin Code	Minimum Photometric Flux (lm)	Maximum Photometric Flux (lm)	Available Color Bins
White	V2	120	130	【1】
	W1	130	140	All
	W2	140	155	All
	X1	155	170	【1】
Neutral White	V2	120	130	Qa,Qb 【1】
	W1	130	140	All
	W2	140	155	Sa,Sb 【1】
	X1	155	170	【1】
Warm White	V1	110	120	Ma,Mb 【1】
	V2	120	130	All
	W1	130	140	Na,Nb 【1】
	W2	140	155	【1】

- ProLight maintains a tolerance of ± 7% on flux and power measurements.
- The flux bin of the product may be modified for improvement without notice.
- 【1】The rest of color bins are not 100% ready for order currently. Please ask for quote and order possibility.

Forward Voltage Bin Structure at 350mA

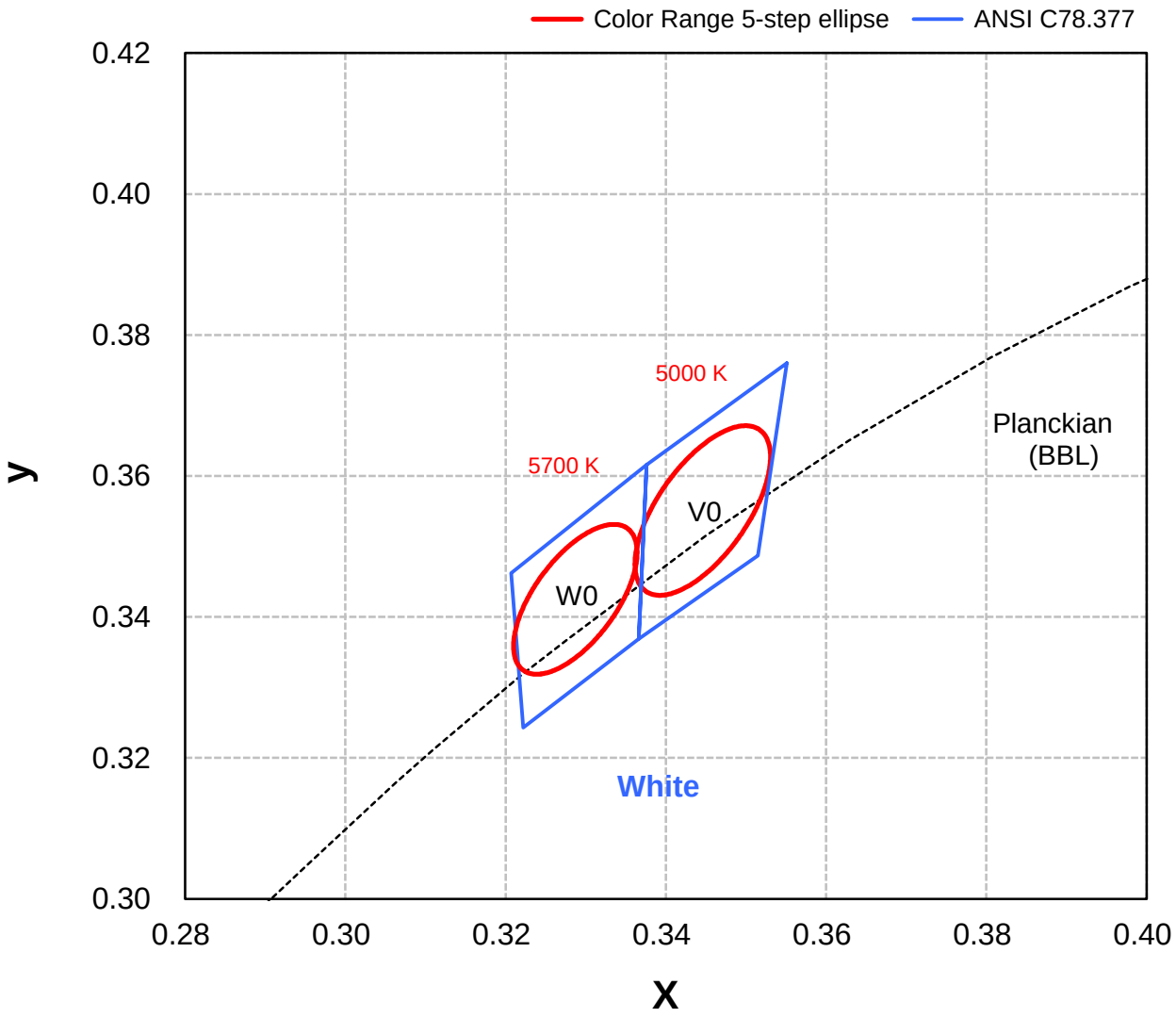
Color	Bin Code	Minimum Voltage (V)	Maximum Voltage (V)
White	A	2.7	2.9
	B	2.9	3.1
	D	3.1	3.3
Neutral White	A	2.7	2.9
	B	2.9	3.1
	D	3.1	3.3
Warm White	A	2.7	2.9
	B	2.9	3.1
	D	3.1	3.3

- ProLight maintains a tolerance of ± 0.1V 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 Bin

White Binning Structure Graphical Representation



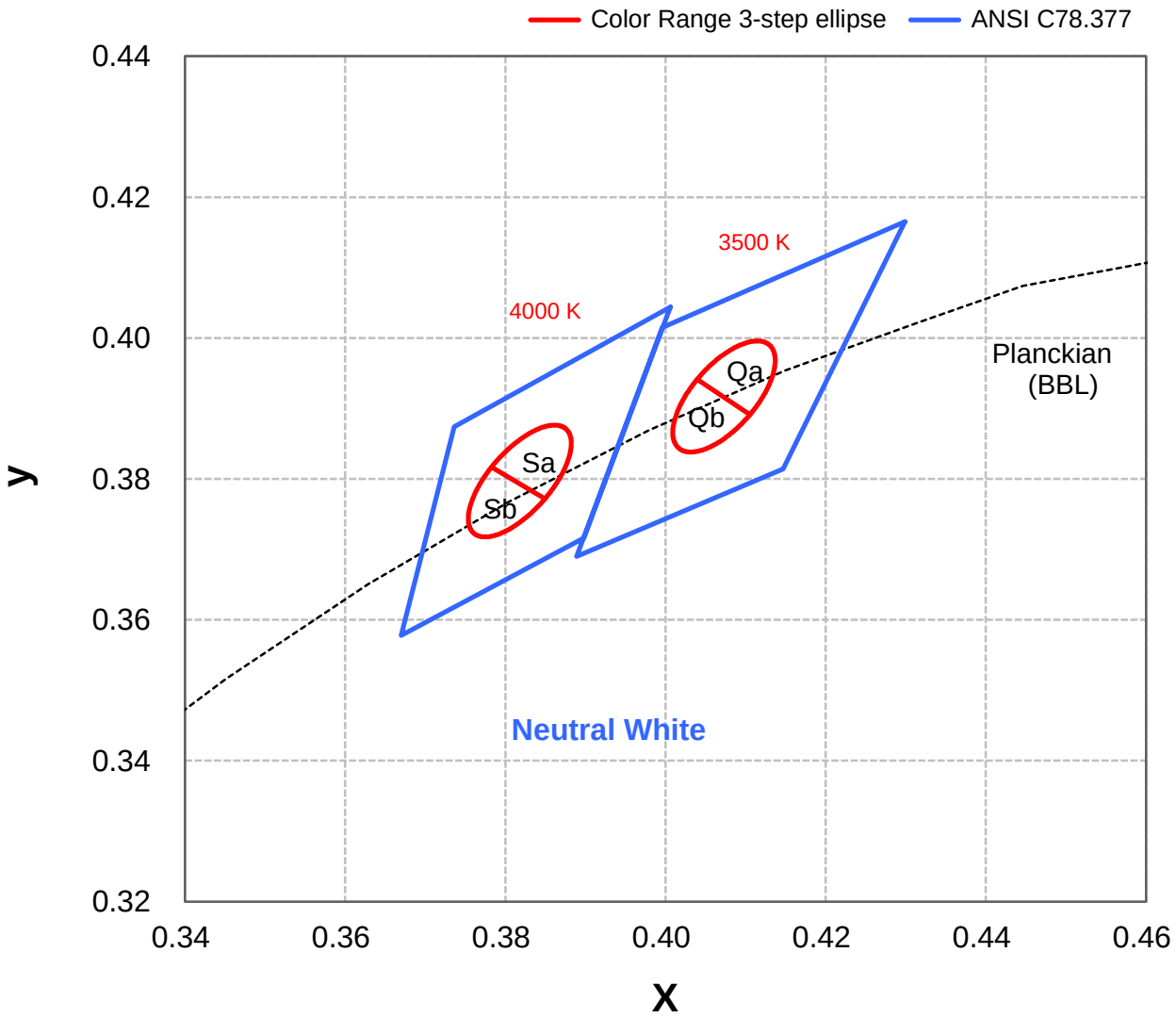
White Bin Structure

Bin Code		Center	Oval parameter		Typ. CCT (K)	Bin Code		Center	Oval parameter		Typ. CCT (K)
V0	x	0.3446	a	0.01350	5000	W0	x	0.3287	a	0.01200	5700
	y	0.3551	b	0.00583			y	0.3425	b	0.00533	
			ɵ°	59.80					ɵ°	58.80	

- Color range stay within MacAdam “5-step” ellipse from the chromaticity center.
- The chromaticity center refers to ANSI C78.377.
- Tolerance on each color bin (x , y) is ± 0.005

Color Bin

Neutral White Binning Structure Graphical Representation



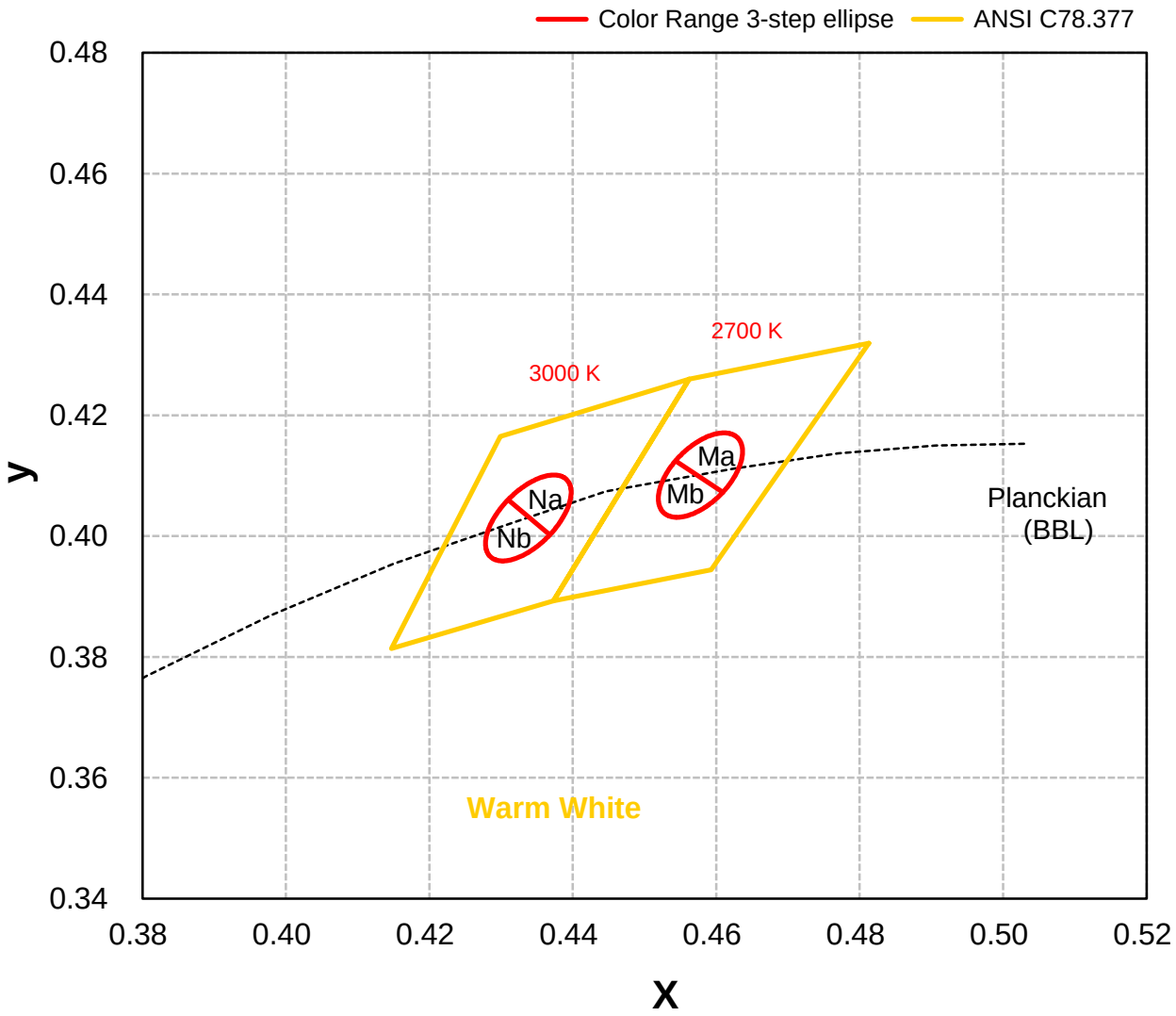
Neutral White Bin Structure

Bin Code		Center	Oval parameter		Typ. CCT (K)	Bin Code		Center	Oval parameter		Typ. CCT (K)
Qa + Qb	x	0.4073	a	0.00927	3500	Sa + Sb	x	0.3818	a	0.00939	4000
	y	0.3917	b	0.00414			y	0.3797	b	0.00402	
			θ˚	54.00					θ˚	53.72	

- Color range stay within MacAdam “3-step” ellipse from the chromaticity center.
- The chromaticity center refers to ANSI C78.377.
- Tolerance on each color bin (x , y) is ± 0.005

Color Bin

Warm White Binning Structure Graphical Representation



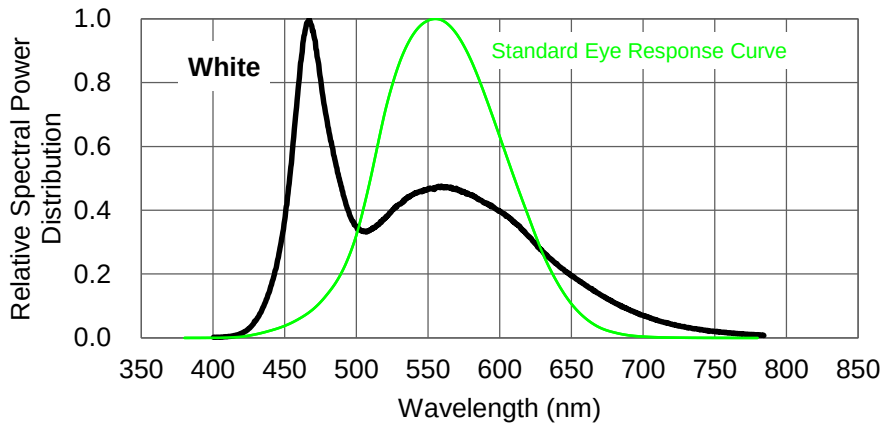
Warm White Bin Structure

Bin Code		Center	Oval parameter		Typ. CCT (K)	Bin Code		Center	Oval parameter		Typ. CCT (K)
Ma + Mb	x	0.4578	a	0.00810	2700	Na + Nb	x	0.4338	a	0.00834	3000
	y	0.4101	b	0.00420			y	0.4030	b	0.00408	
			θ˚	53.70					θ˚	53.22	

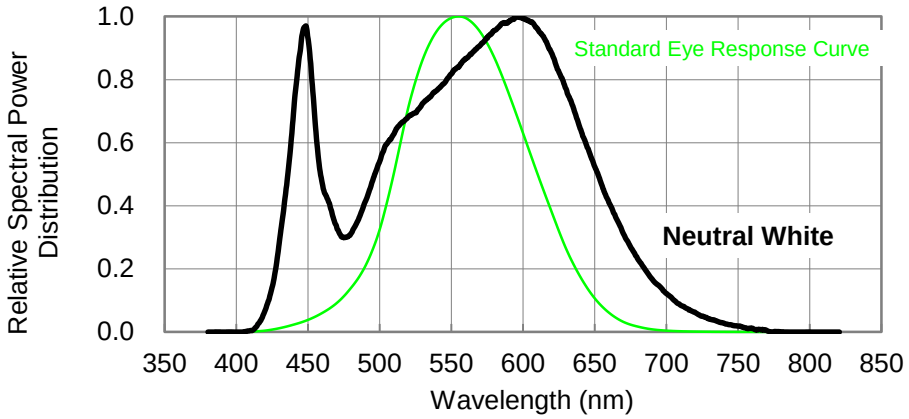
- Color range stay within MacAdam “3-step” ellipse from the chromaticity center.
- The chromaticity center refers to ANSI C78.377.
- Tolerance on each color bin (x , y) is ± 0.005

Color Spectrum, T_J = 25˚C

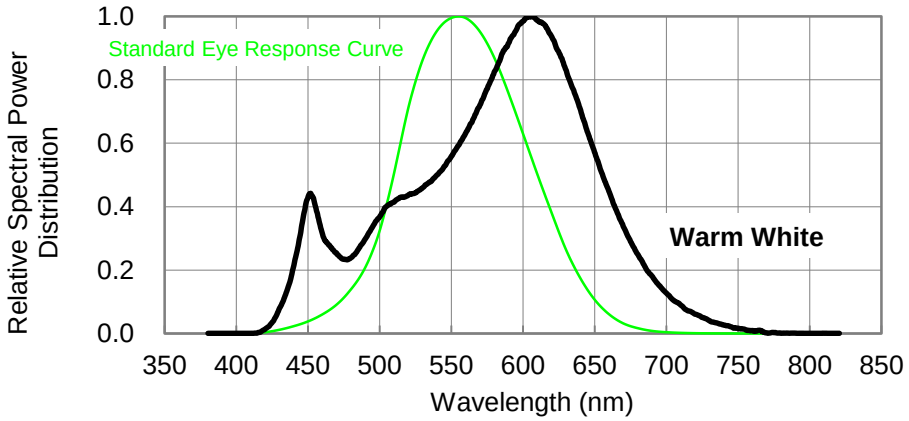
1. White



2. Neutral White

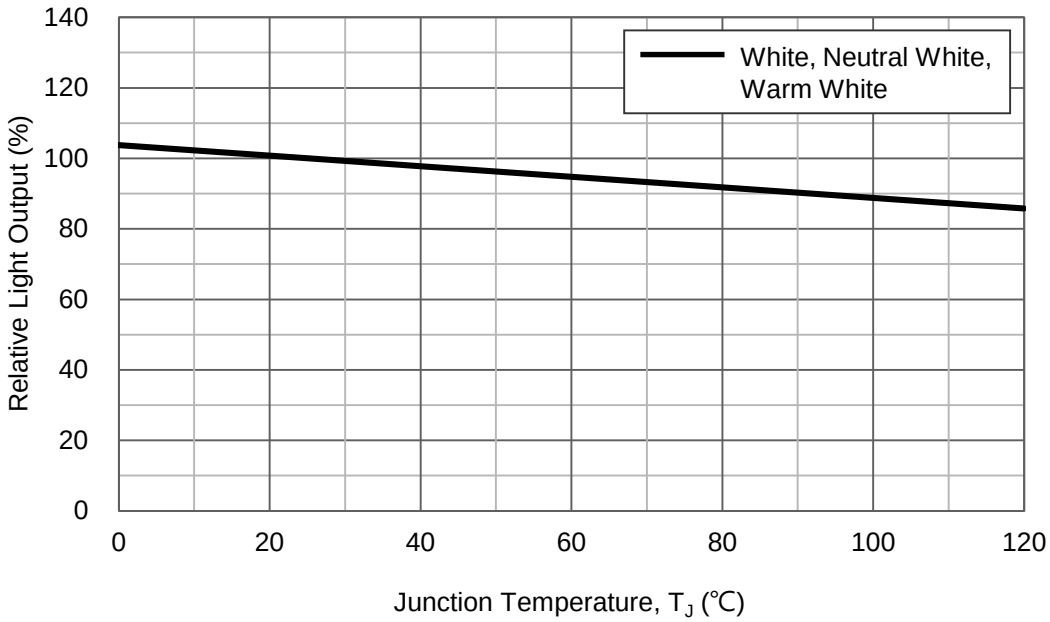


3. Warm White



Light Output Characteristics

Relative Light Output vs. Junction Temperature at 1200mA



Forward Current Characteristics, T_J = 25˚C

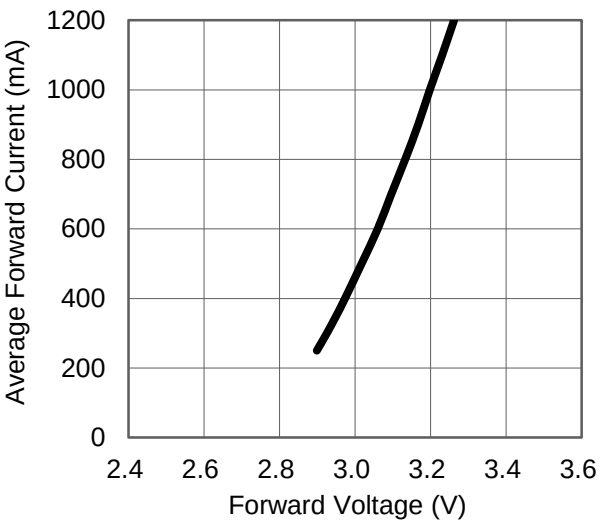


Fig 1. Forward Current vs. Forward Voltage for White, Neutral White, Warm White.

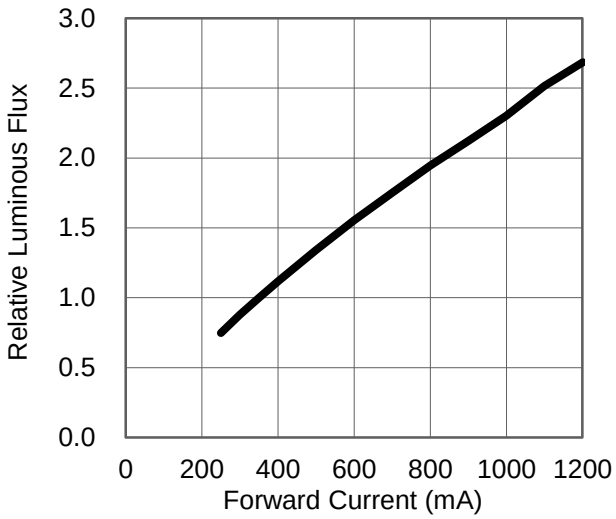
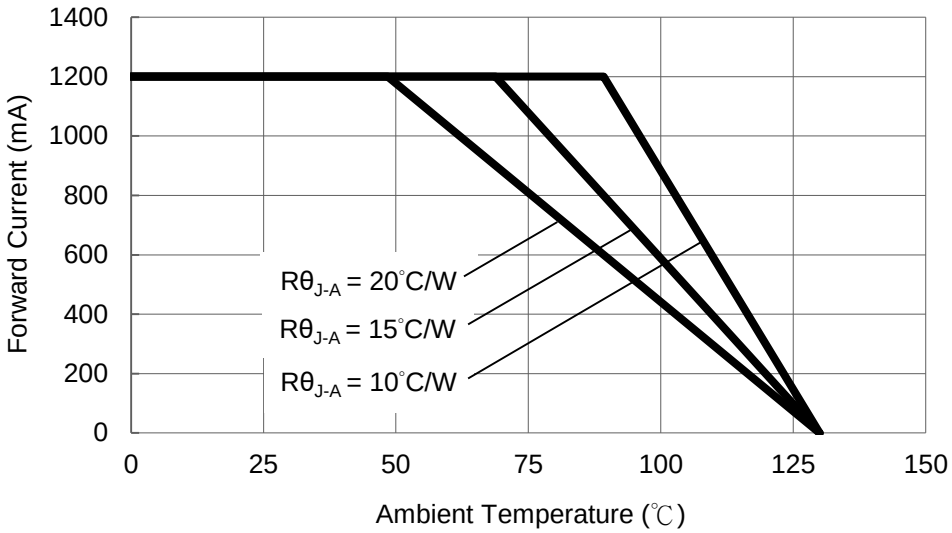


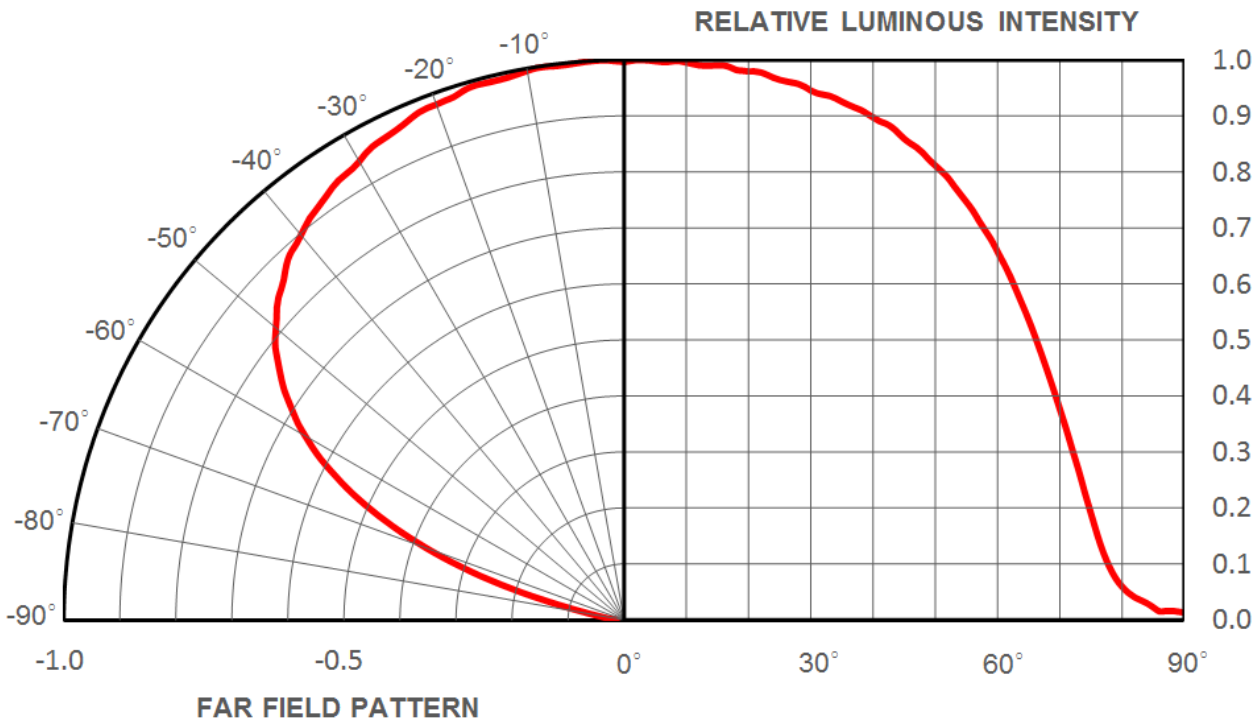
Fig 2. Relative Luminous Flux vs. Forward Current for White, Neutral White, Warm White at T_J=25 maintained.

Ambient Temperature vs. Maximum Forward Current

1. White, Neutral White, Warm White (T_{JMAX} = 120°C)



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
Wet High Temperature Operating Life (WHTOL)	85°C/60%RH, I_F = 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 ± 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	--
Reverse Current (I_R)	V_R = 5V	--	50 μA

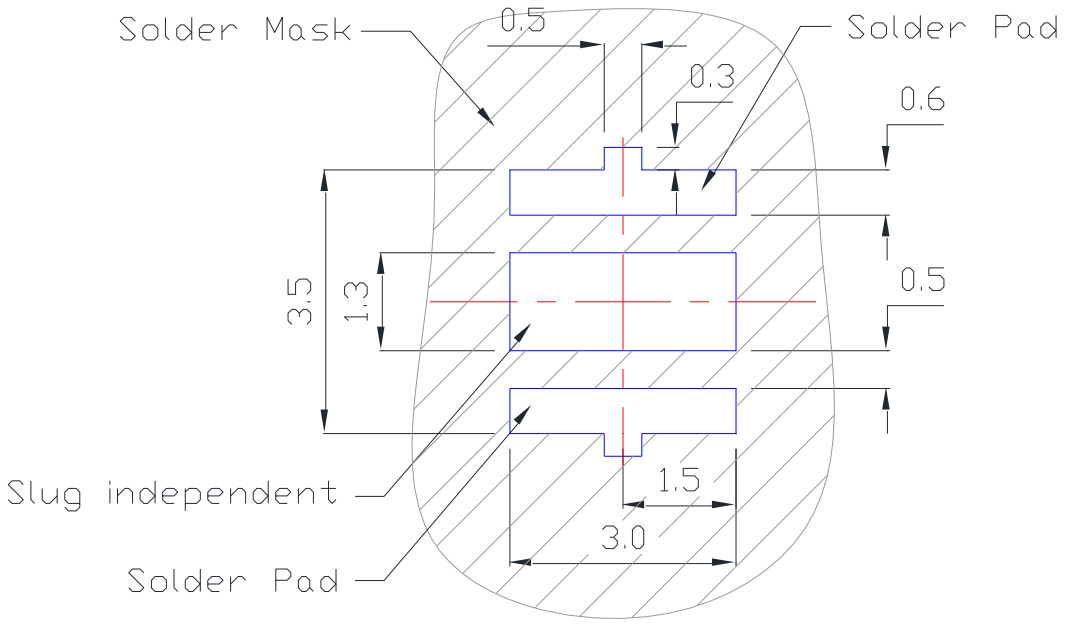
* The test is performed after the LED is cooled down to the room temperature.

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

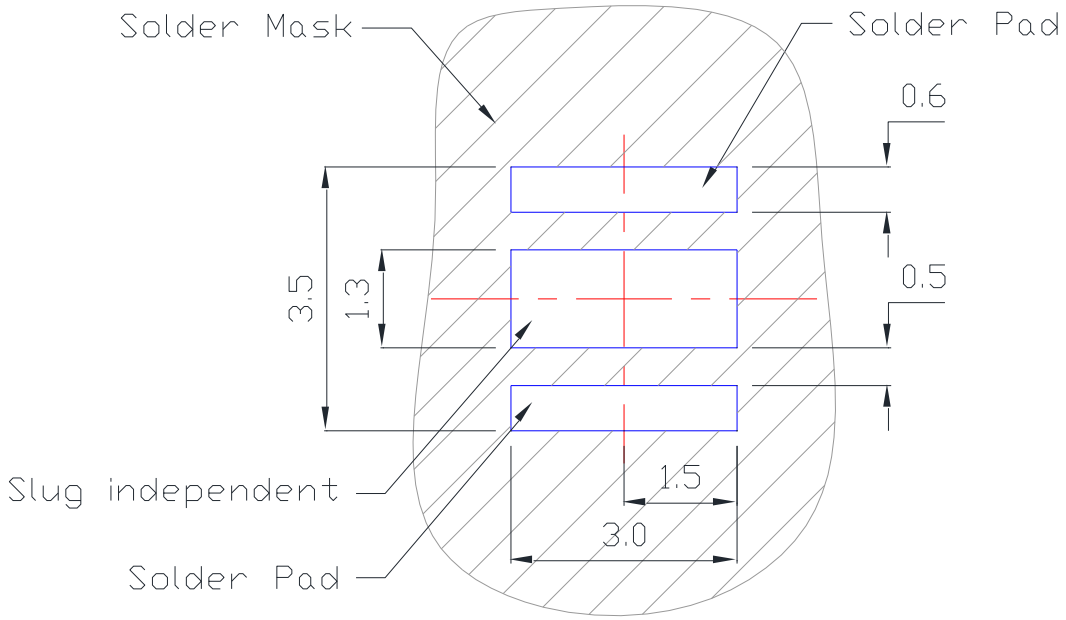
Recommended Solder Pad Design

Standard Emitter

TYPE A.



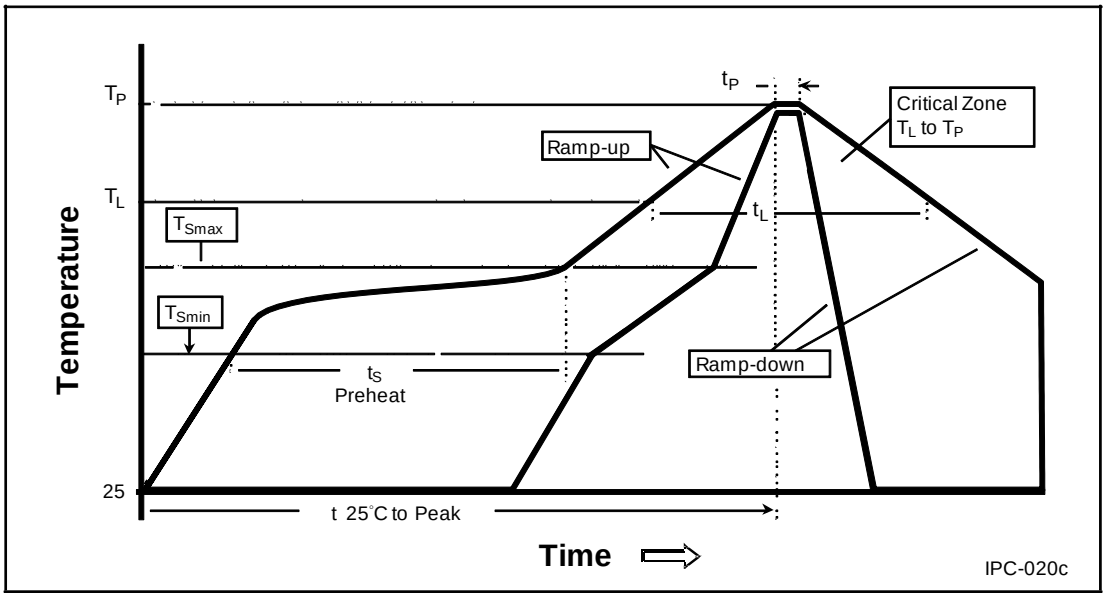
TYPE B.



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

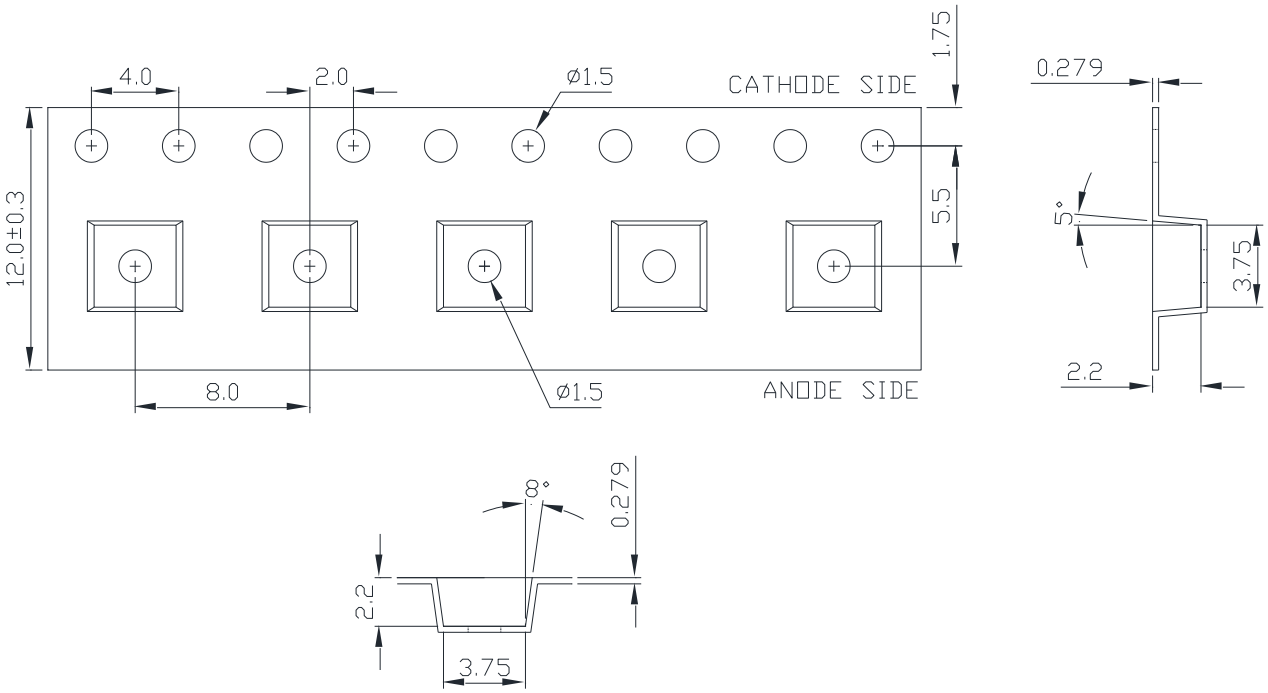
Reflow Soldering Condition

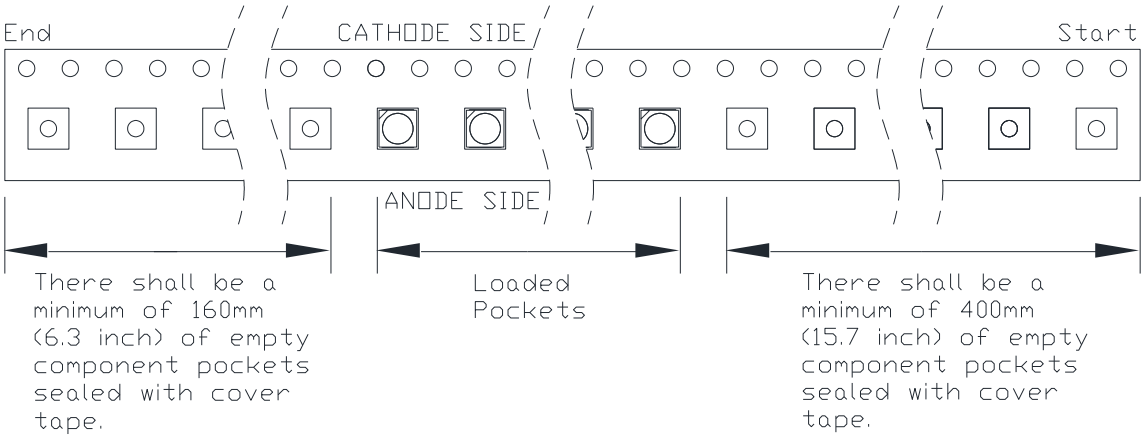
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (T_{Smax} to T_P)	3°C / second max.	3°C / second max.
Preheat – Temperature Min (T_{Smin}) – Temperature Max (T_{Smax}) – Time (t_{Smin} to t_{Smax})	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: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

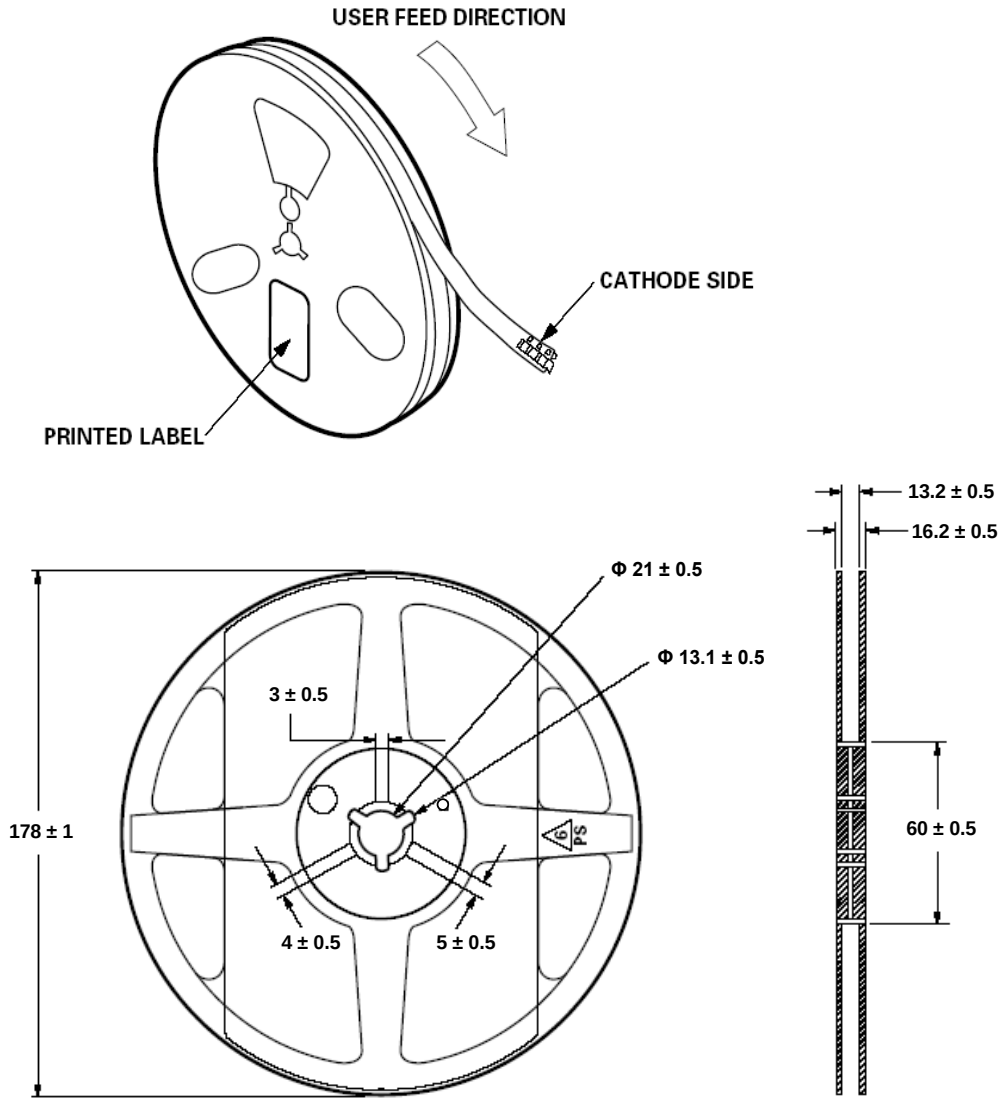
Emitter Reel Packaging





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

Precaution for Use

- Storage
  Please do not open the moisture barrier bag (MBB) more than one week. This may cause the leads of LED discoloration. We recommend storing ProLight's LEDs in a dry box after opening the MBB. The recommended storage conditions are temperature 5 to 30°C and humidity less than 40% RH. It is also recommended to return the LEDs to the MBB and to reseal the MBB.
- The slug is is not electrically neutral. Therefore, we recommend to isolate the heat sink.
- **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 Silicone Lens LEDs

Notes for handling of silicone lens LEDs

- Please do not use a force of over 0.3kgf impact or pressure on the silicone 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 silicone lens especially by sharp tools such as Tweezers.
- Avoid leaving fingerprints on the silicone lens.
- Please store the LEDs away from dusty areas or seal the product against dust.
- When populating boards in SMT production, there are basically no restrictions regarding the form of the pick and place nozzle, except that mechanical pressure on the silicone lens must be prevented.
- Please do not mold over the silicone lens with another resin. (epoxy, urethane, etc)