



**ProLight PS2N-FFxE
PS2N-FFxE-R8
0.5W Power LED
Technical Datasheet
Version: 1.9**

ProLight Opto ® PS2N Series

Features

- Good color uniformity
- Industry's first lighting-class LED
- Low Voltage DC operated
- Instant light (less than 100ns)
- No UV

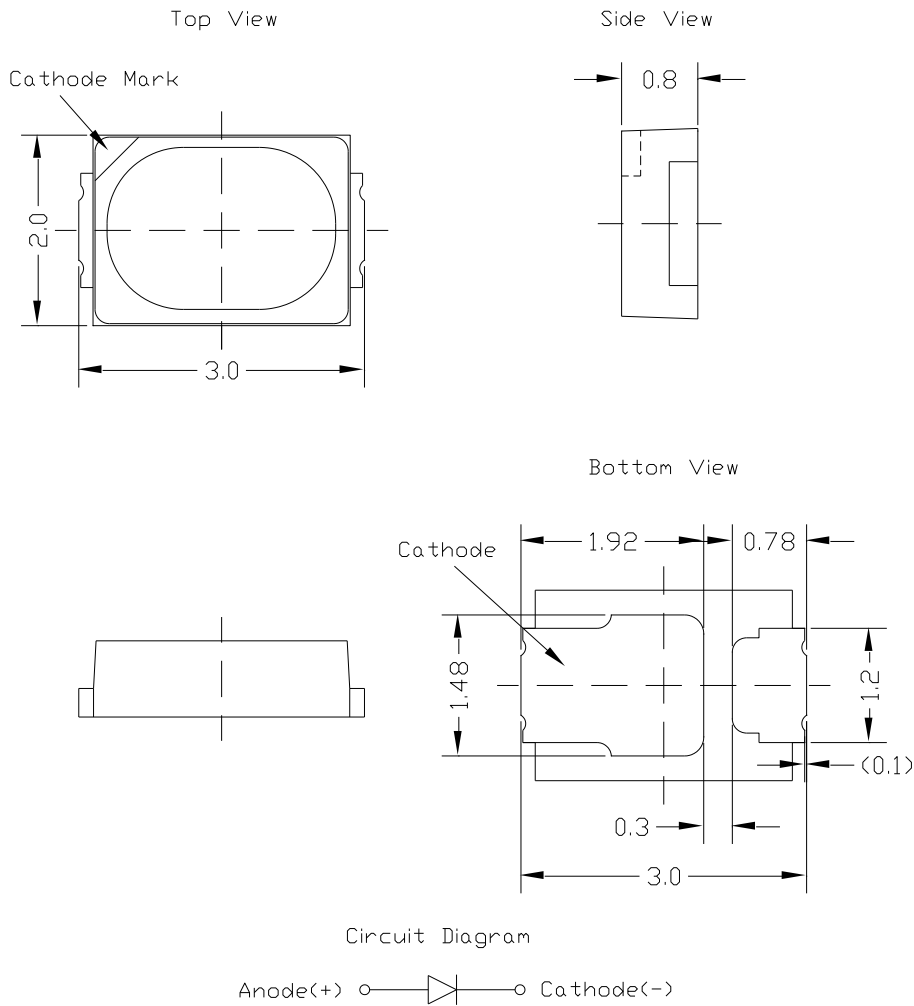
Main Applications

- T8/T5 tube
- LED bulb
- Indoor/Outdoor Commercial and Residential Architectural

Introduction

·PS2N 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. Drawing not to scale.
3. All dimensions are in millimeters.
4. Unless otherwise indicated, tolerances are $\pm 0.10\text{mm}$.
5. Please do not solder the emitter by manual hand soldering, otherwise it will damage the emitter.
6. **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 at 150mA, T_j = 25°C

Radiation Pattern	Color	Part Number Emitter	Luminous Flux Φ _v (lm)		CRI Minimum
			Minimum	Typical	
Lambertian	White	PS2N-FFWE	55	66	70
	Neutral White	PS2N-FFNE	55	64	70
	Warm White	PS2N-FFVE	50	61	70
	White	PS2N-FFWE-R8	50	59	80
	Neutral White	PS2N-FFNE-R8	50	58	80
	Warm White	PS2N-FFVE-R8	45	55	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 at 150mA, T_j = 25°C

Color	Forward Voltage V _F (V)			Thermal Resistance Junction to Slug (°C/ W)
	Min.	Typ.	Max.	
White	2.8	3.2	3.6	25
Neutral White	2.8	3.2	3.6	25
Warm White	2.8	3.2	3.6	25

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

Optical Characteristics at 150mA, T_j = 25°C

Radiation Pattern	Color	Color Temperature CCT			Total included Angle (degrees) θ _{0.90v}	Viewing Angle (degrees) 2 θ _{1/2}
		Min.	Typ.	Max.		
Lambertian	White	4745 K	5850 K	6950 K	160	120
	Neutral White	3700 K	3975 K	4250 K	160	120
	Warm White	2580 K	2900 K	3250 K	160	120

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

Electro-Optical Characteristics, $T_j = 25^{\circ}\text{C}$

I_F (mA)	V_F (V)	Power (W)	PS2N-FFWE		PS2N-FFNE		PS2N-FFVE	
			Flux (lm)	lm/W	Flux (lm)	lm/W	Flux (lm)	lm/W
60	2.92	0.17	30.5	174.4	29.6	169.1	28.2	161.2
80	2.99	0.24	39.3	164.4	38.1	159.4	36.3	151.9
100	3.05	0.31	47.5	155.5	46.0	150.8	43.9	143.7
120	3.11	0.37	55.2	147.8	53.5	143.3	51.0	136.6
140	3.17	0.44	62.6	140.9	60.7	136.6	57.8	130.2
150	3.20	0.48	66.0	137.5	64.0	133.3	61.0	127.1

I_F (mA)	V_F (V)	Power (W)	PS2N-FFWE-R8		PS2N-FFNE-R8		PS2N-FFVE-R8	
			Flux (lm)	lm/W	Flux (lm)	lm/W	Flux (lm)	lm/W
60	2.92	0.17	27.3	155.9	26.8	153.3	25.4	145.4
80	2.99	0.24	35.1	146.9	34.5	144.4	32.7	137.0
100	3.05	0.31	42.4	139.0	41.7	136.7	39.6	129.6
120	3.11	0.37	49.4	132.1	48.5	129.9	46.0	123.1
140	3.17	0.44	55.9	125.9	55.0	123.8	52.1	117.4
150	3.20	0.48	59.0	122.9	58.0	120.8	55.0	114.6

● All values are reference only.

Absolute Maximum Ratings

Parameter	White/Neutral White/Warm White
DC Forward Current (mA)	150
Peak Pulsed Forward Current (mA)	220 (less than 1/10 duty cycle@1KHz)
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	> $\pm 500\text{V}$
LED Junction Temperature	120°C
Operating Board Temperature at Maximum DC Forward Current	$-40^{\circ}\text{C} - 90^{\circ}\text{C}$
Storage Temperature	$-40^{\circ}\text{C} - 120^{\circ}\text{C}$
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)	Available Color Bins
PS2N-FFWE	S2	55	60	All
	S3	60	65	All
	S4	65	70	All
	T1	70	80	[1]
PS2N-FFNE	S2	55	60	All
	S3	60	65	All
	S4	65	70	All
	T1	70	80	[1]
PS2N-FFVE	S1	50	55	All
	S2	55	60	All
	S3	60	65	Nx [1]
	S4	65	70	[1]
PS2N-FFWE-R8	S1	50	55	All
	S2	55	60	All
	S3	60	65	All
	S4	65	70	[1]
PS2N-FFNE-R8	S1	50	55	All
	S2	55	60	All
	S3	60	65	[1]
	S4	65	70	[1]
PS2N-FFVE-R8	R2	45	50	All
	S1	50	55	All
	S2	55	60	Nx [1]
	S3	60	65	[1]

- 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.
- ^[1] The rest of color bins are not 100% ready for order currently. Please ask for quote and order Possibility.

Forward Voltage Bin Structure

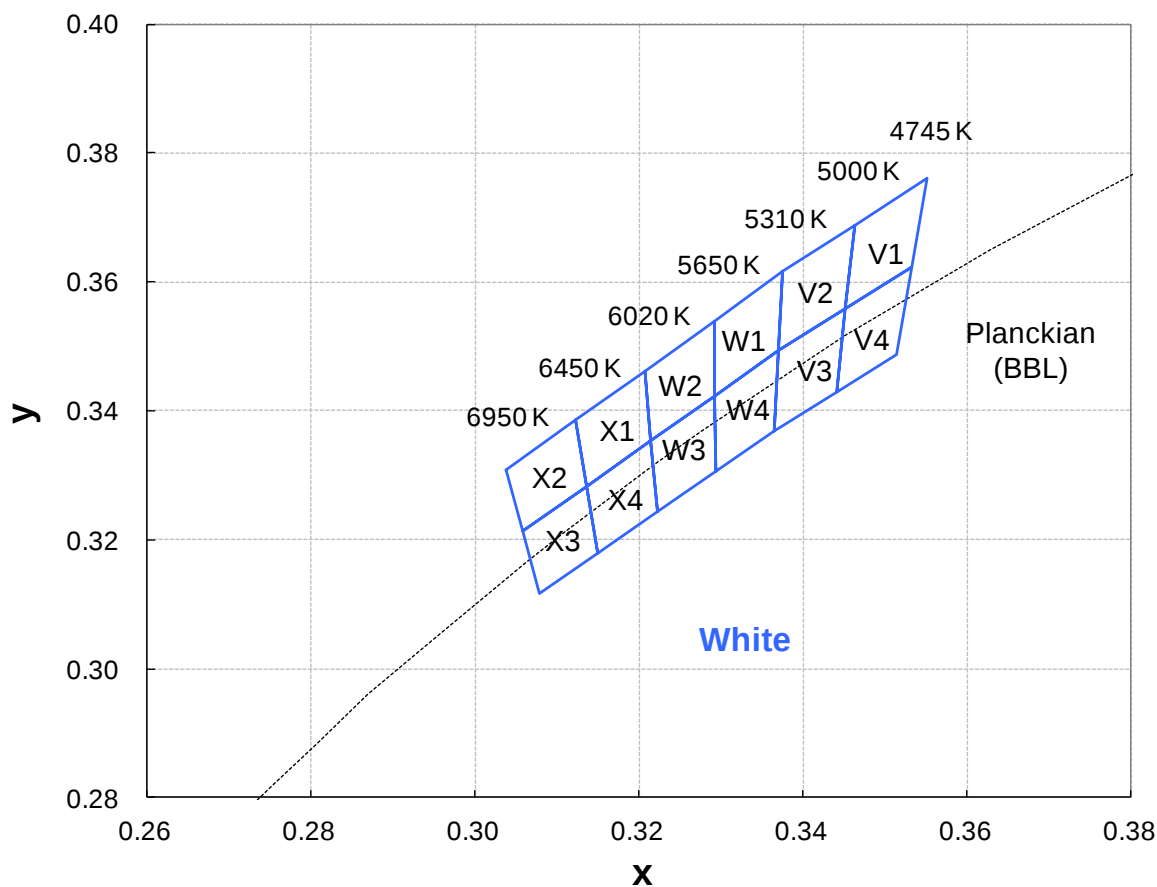
Color	Bin Code	Minimum Voltage (V)	Maximum Voltage (V)
White	A	2.8	3.0
	B	3.0	3.2
	D	3.2	3.4
	E	3.4	3.6
Neutral White	A	2.8	3.0
	B	3.0	3.2
	D	3.2	3.4
	E	3.4	3.6
Warm White	A	2.8	3.0
	B	3.0	3.2
	D	3.2	3.4
	E	3.4	3.6

- ProLight maintains a tolerance of $\pm 0.1V$ 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



Color Bin

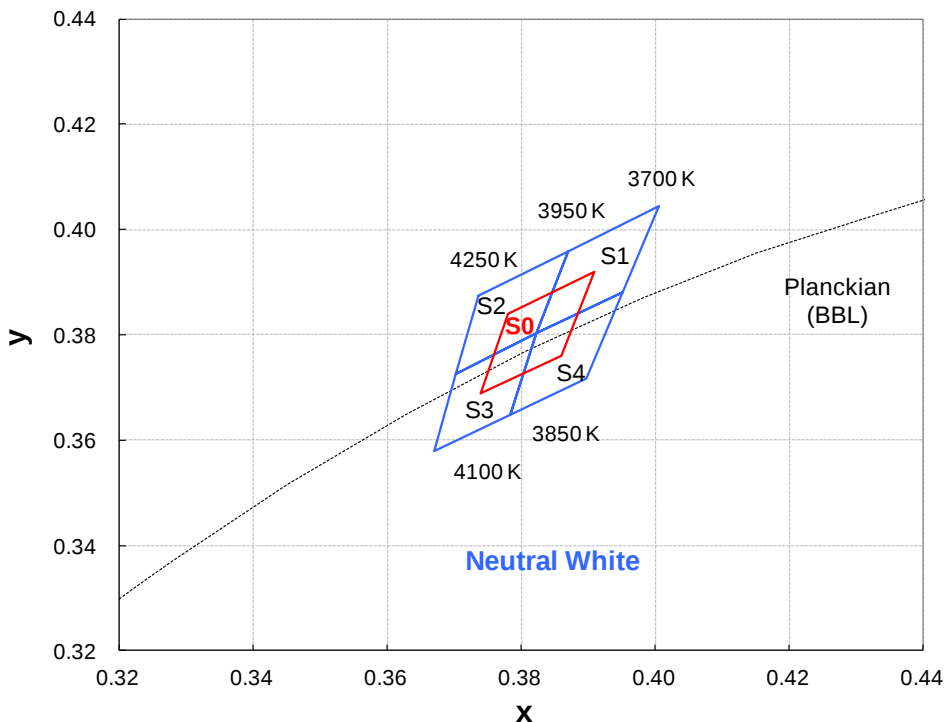
White Bin Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
V1	0.3464	0.3688	4870	W2	0.3207	0.3462	5830
	0.3551	0.3760			0.3292	0.3539	
	0.3533	0.3624			0.3293	0.3423	
	0.3452	0.3558			0.3215	0.3353	
V4	0.3452	0.3558	4870	W3	0.3215	0.3353	5830
	0.3533	0.3624			0.3293	0.3423	
	0.3515	0.3487			0.3294	0.3306	
	0.3441	0.3428			0.3222	0.3243	
V2	0.3376	0.3616	5155	X1	0.3123	0.3385	6240
	0.3464	0.3688			0.3207	0.3462	
	0.3452	0.3558			0.3215	0.3353	
	0.3371	0.3493			0.3136	0.3283	
V3	0.3371	0.3493	5155	X4	0.3136	0.3283	6240
	0.3452	0.3558			0.3215	0.3353	
	0.3441	0.3428			0.3222	0.3243	
	0.3366	0.3369			0.3150	0.3180	
W1	0.3292	0.3539	5475	X2	0.3038	0.3308	6700
	0.3376	0.3616			0.3123	0.3385	
	0.3371	0.3493			0.3136	0.3283	
	0.3293	0.3423			0.3058	0.3213	
W4	0.3293	0.3423	5475	X3	0.3058	0.3213	6700
	0.3371	0.3493			0.3136	0.3283	
	0.3366	0.3369			0.3150	0.3180	
	0.3294	0.3306			0.3078	0.3117	

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

Color Bin

Neutral White Binning Structure Graphical Representation



Neutral White Bin Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
S1	0.3871	0.3959	3825	S2	0.3736	0.3874	4100
	0.4006	0.4044			0.3871	0.3959	
	0.3952	0.3880			0.3823	0.3803	
	0.3823	0.3803			0.3703	0.3726	
S4	0.3823	0.3803	3825	S3	0.3703	0.3726	4100
	0.3952	0.3880			0.3823	0.3803	
	0.3898	0.3716			0.3784	0.3647	
	0.3784	0.3647			0.3670	0.3578	
S0	0.3740	0.3690	3975				
	0.3780	0.3840					
	0.3910	0.3920					
	0.3860	0.3760					

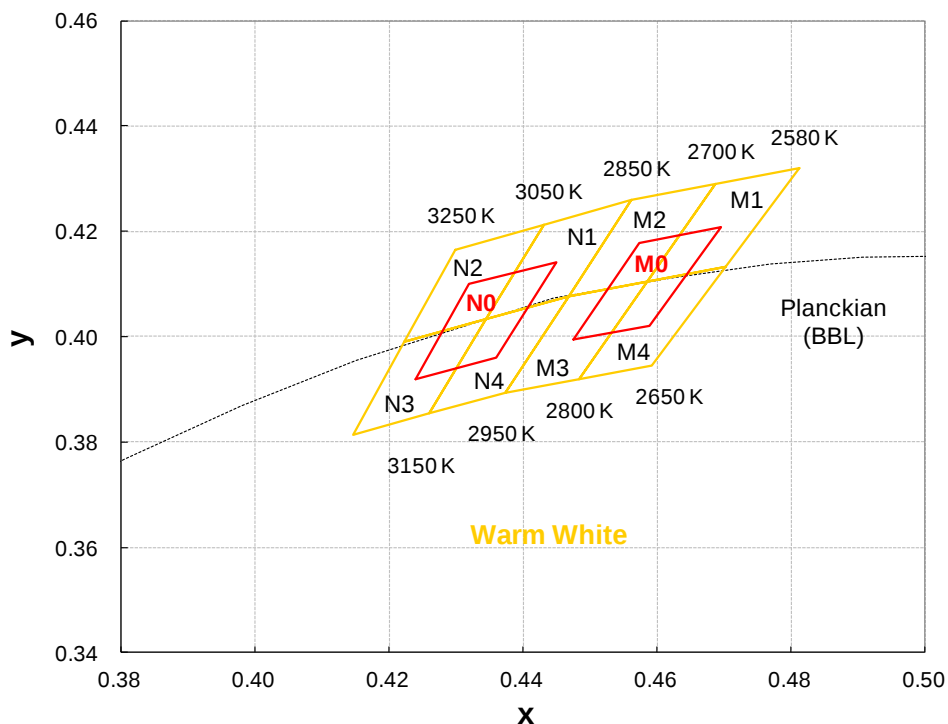
- Tolerance on each color bin (x , y) is ± 0.005

Note:

1. 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.
2. ProLight **SmartBin** is working to make the color bin smarter, by selecting that intelligence is infused into major **S0** bin with minor S1-S4 bins and processes that make assembly easily

Color Bin

Warm White Binning Structure Graphical Representation



Color Bin

Warm White Bin Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
M1	0.4813	0.4319	2650	N1	0.4431	0.4213	2950
	0.4688	0.4290			0.4562	0.4260	
	0.4585	0.4104			0.4468	0.4077	
	0.4703	0.4132			0.4345	0.4033	
M4	0.4703	0.4132	2650	N4	0.4345	0.4033	2950
	0.4585	0.4104			0.4468	0.4077	
	0.4483	0.3919			0.4373	0.3893	
	0.4593	0.3944			0.4260	0.3854	
M0	0.4475	0.3994	2700	N0	0.4240	0.3920	3050
	0.4573	0.4178			0.4320	0.4100	
	0.4695	0.4207			0.4450	0.4140	
	0.4589	0.4021			0.4360	0.3960	
M2	0.4688	0.4290	2800	N2	0.4299	0.4165	3150
	0.4562	0.4260			0.4431	0.4213	
	0.4468	0.4077			0.4345	0.4033	
	0.4585	0.4104			0.4223	0.3990	
M3	0.4585	0.4104	2800	N3	0.4223	0.3990	3150
	0.4468	0.4077			0.4345	0.4033	
	0.4373	0.3893			0.4260	0.3854	
	0.4483	0.3919			0.4147	0.3814	

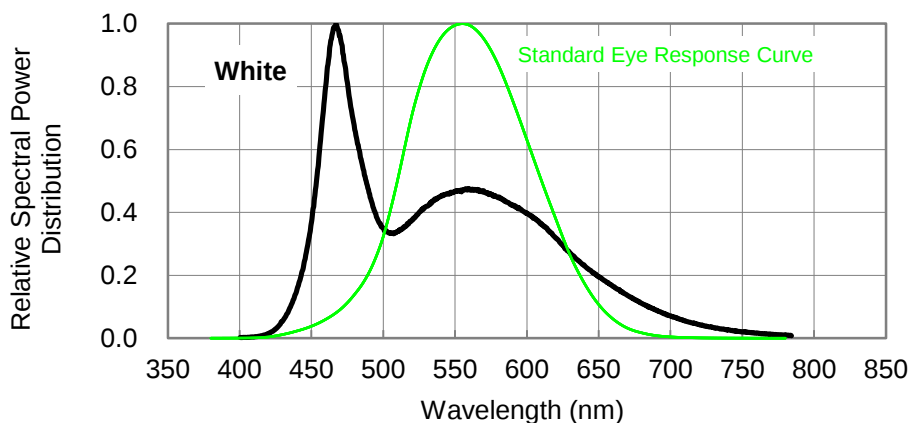
- Tolerance on each color bin (x , y) is ± 0.005

Note:

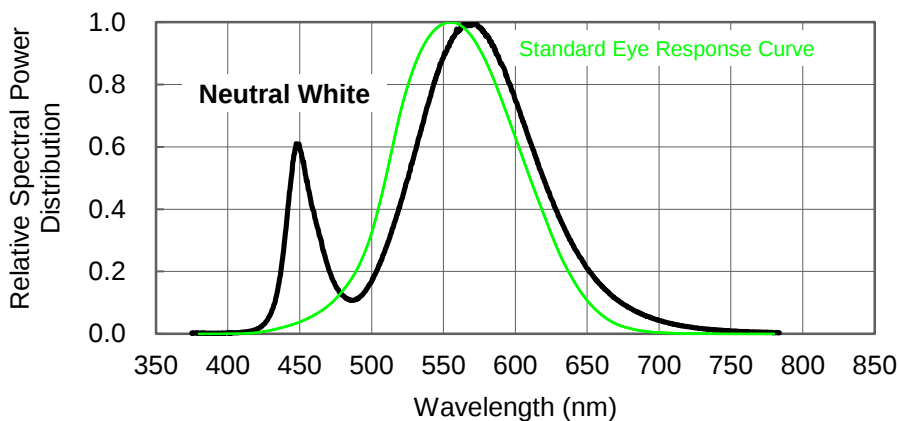
1. Although several bins are outlined, product availability in a particular bin varies by production run and by product performance. Not all bins are available in all colors.
2. ProLight **SmartBin** is working to make the color bin smarter, by selecting that intelligence is infused into major **M0 , N0** bin with minor M1-M4 , N1-N4 bins and processes that make assembly easily

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

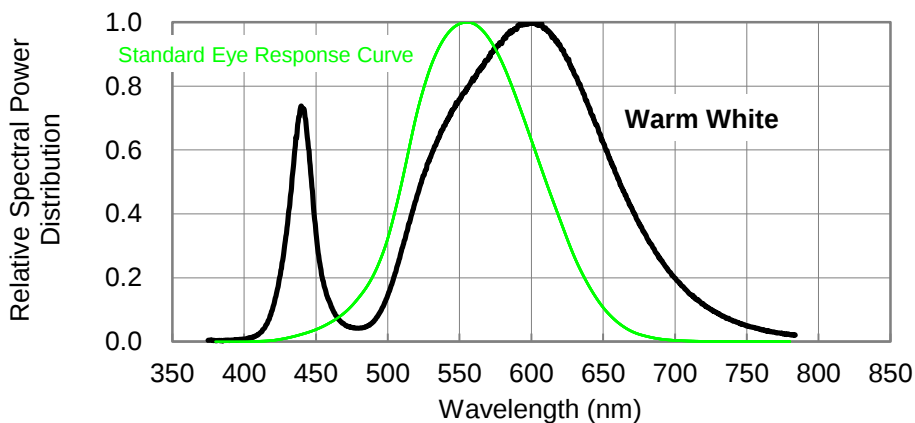
1. White



2. Neutral White

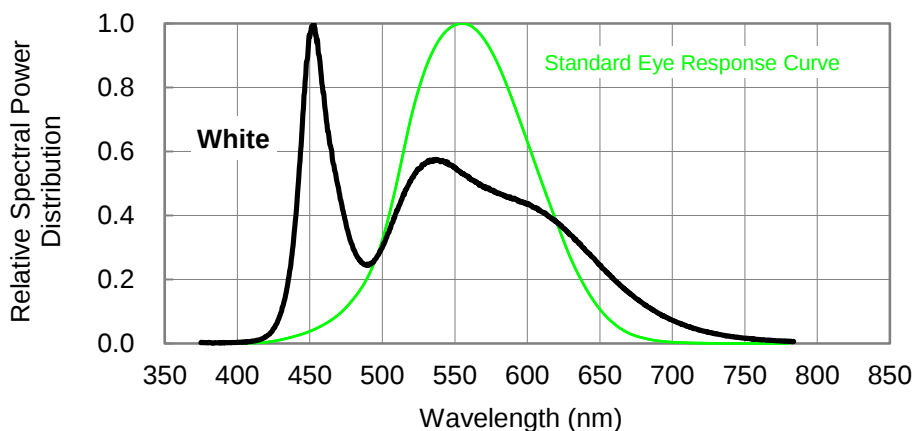


3. Warm White

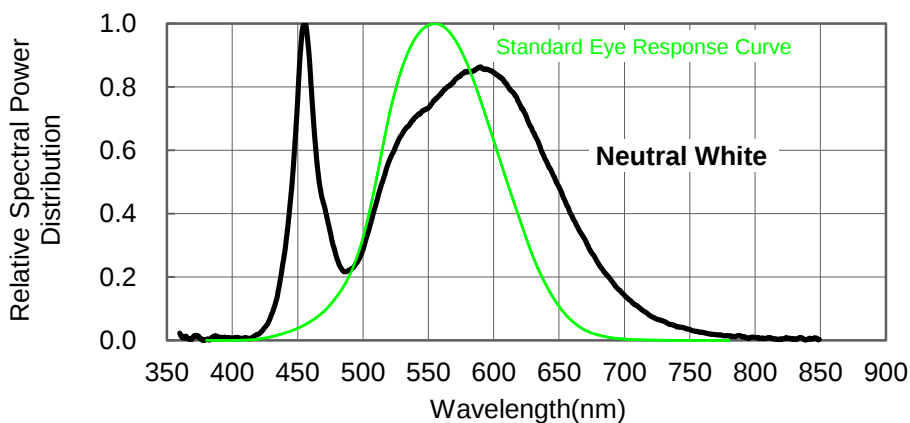


Color Spectrum, $T_1 = 25^{\circ}\text{C}$

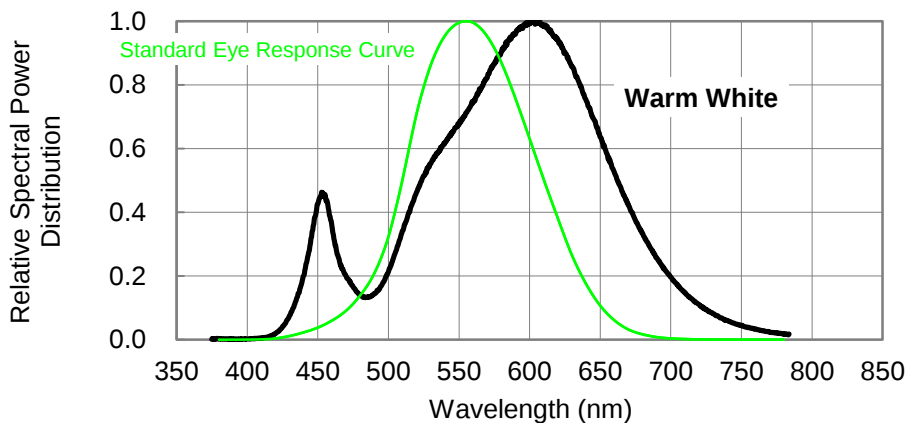
1. White For R8



2. Neutral White For R8

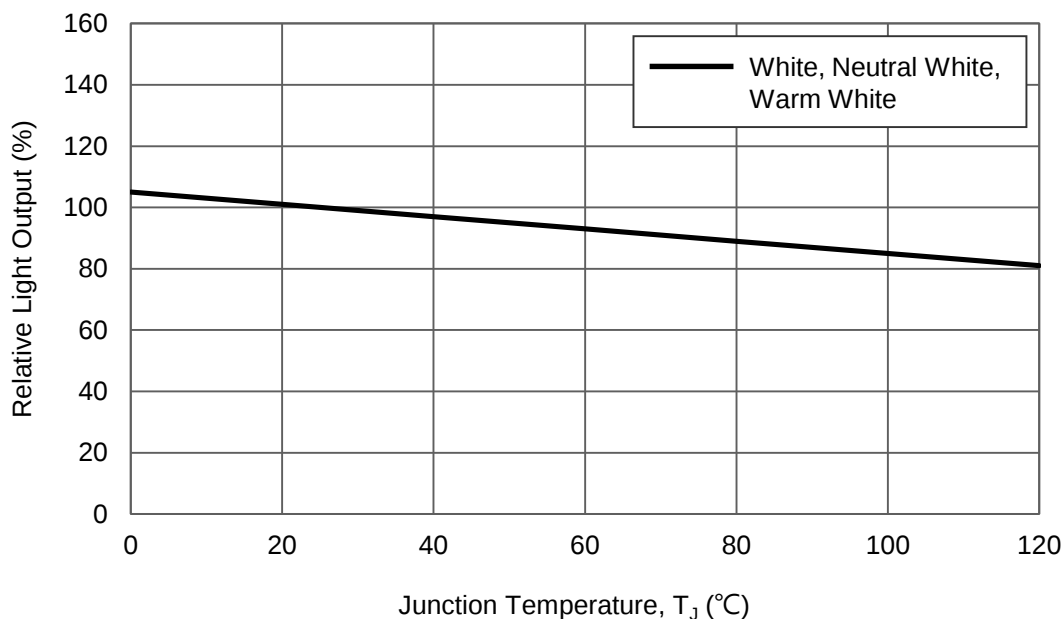


3. Warm White For R8

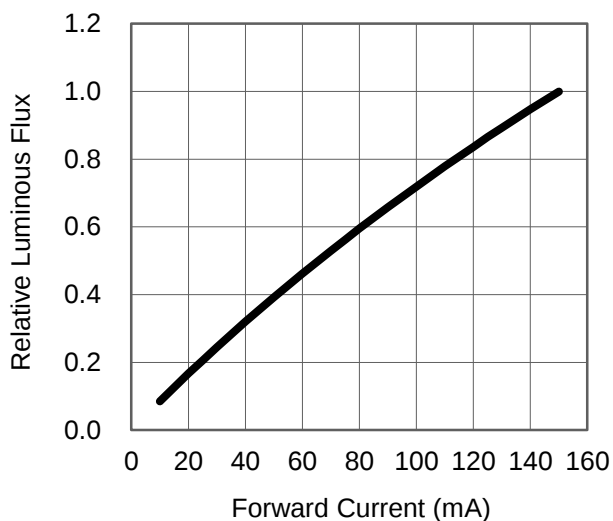
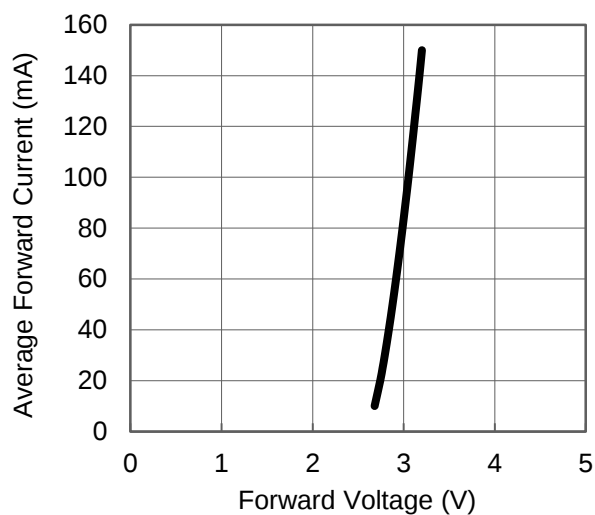


Light Output Characteristics

Relative Light Output vs. Junction Temperature at 150mA

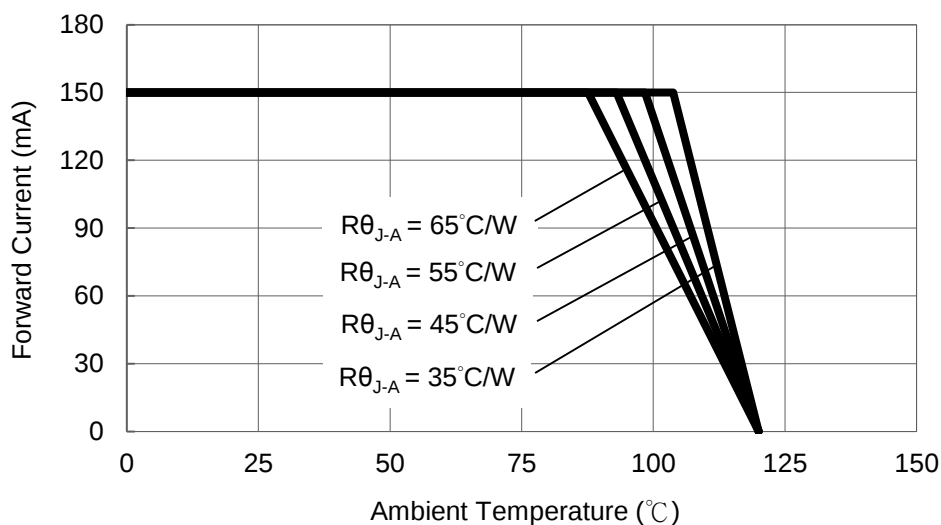


Forward Current Characteristics, $T_j = 25^\circ\text{C}$



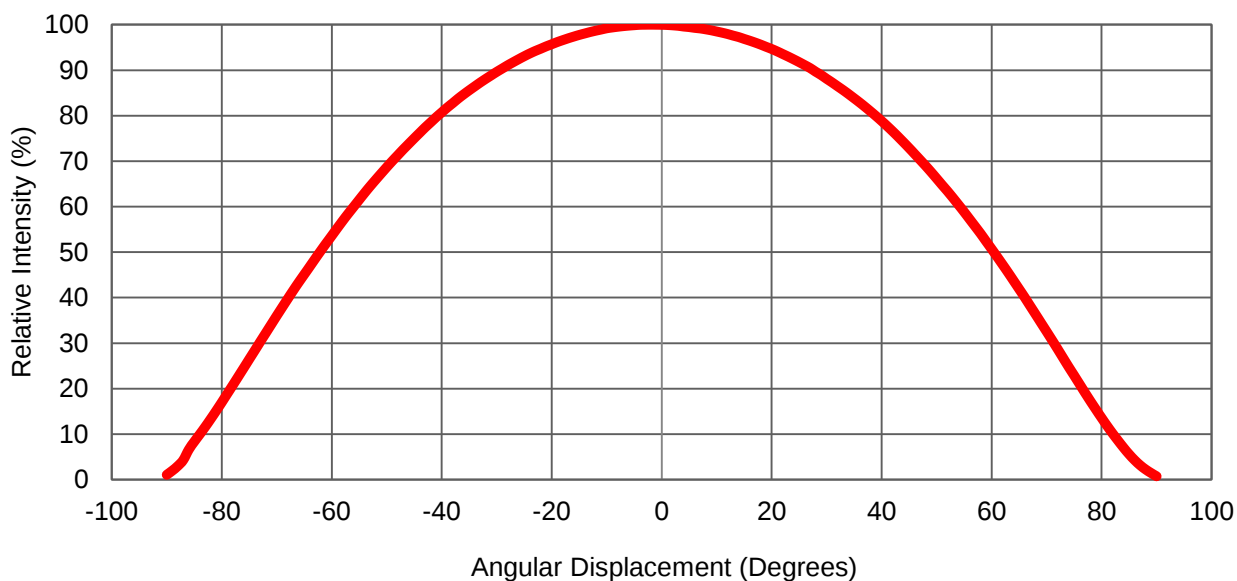
Ambient Temperature vs. Maximum Forward Current

1. White, Neutral White, Warm White ($T_{JMAX} = 120^{\circ}\text{C}$)



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	$\leq 30^{\circ}\text{C}$ / 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	$\leq 30^{\circ}\text{C}$ / 85% RH	168 +5/-0	85°C / 85% RH	NA	NA
2	1 year	$\leq 30^{\circ}\text{C}$ / 60% RH	168 +5/-0	85°C / 60% RH	NA	NA
2a	4 weeks	$\leq 30^{\circ}\text{C}$ / 60% RH	696 +5/-0	30°C / 60% RH	120 +1/-0	60°C / 60% RH
3	168 hours	$\leq 30^{\circ}\text{C}$ / 60% RH	192 +5/-0	30°C / 60% RH	40 +1/-0	60°C / 60% RH
4	72 hours	$\leq 30^{\circ}\text{C}$ / 60% RH	96 +2/-0	30°C / 60% RH	20 +0.5/-0	60°C / 60% RH
5	48 hours	$\leq 30^{\circ}\text{C}$ / 60% RH	72 +2/-0	30°C / 60% RH	15 +0.5/-0	60°C / 60% RH
5a	24 hours	$\leq 30^{\circ}\text{C}$ / 60% RH	48 +2/-0	30°C / 60% RH	10 +0.5/-0	60°C / 60% RH
6	Time on Label (TOL)	$\leq 30^{\circ}\text{C}$ / 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 Operating Life (WHTOL)	85°C/60%RH, $I_F = \text{max DC}$ (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	--
Reverse Current (I_R)	$V_R = 5V$	--	50 μA

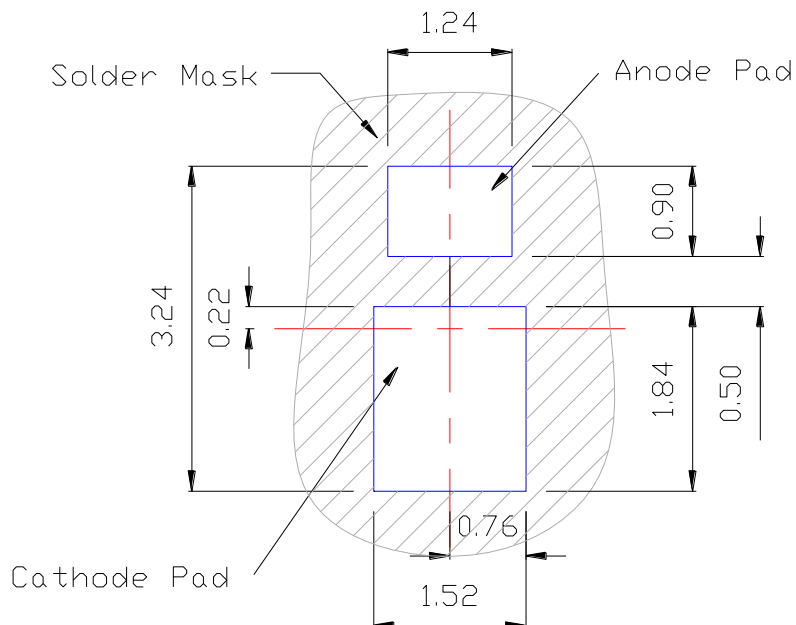
* The test is performed after the LED is cooled down to the room temperature.

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

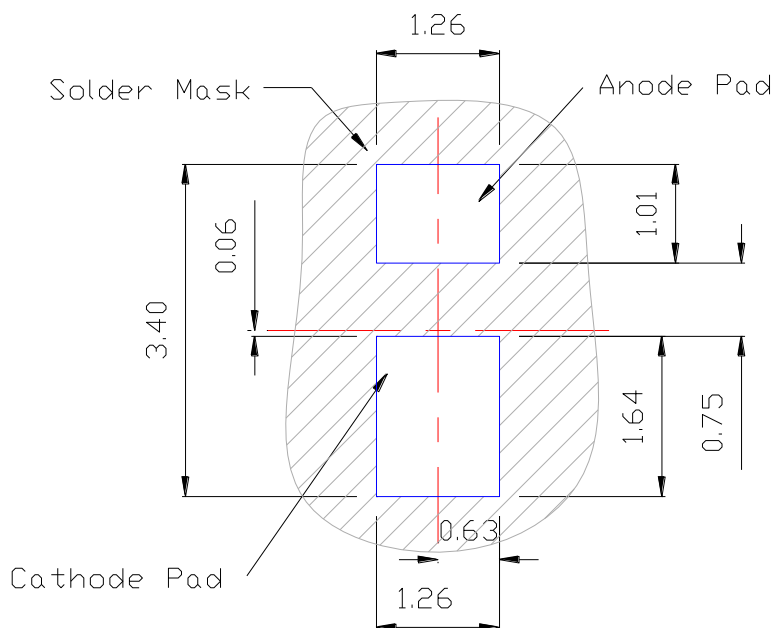
Recommended Solder Pad Design

Standard Emitter

TYPE A.



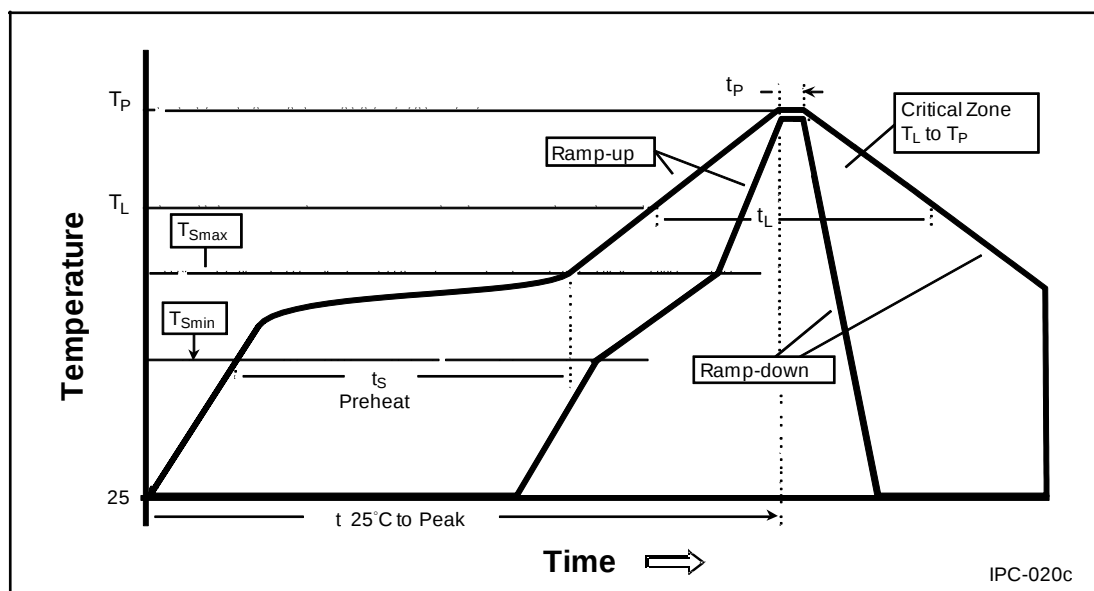
TYPE B.



- All dimensions are in millimeters.

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.



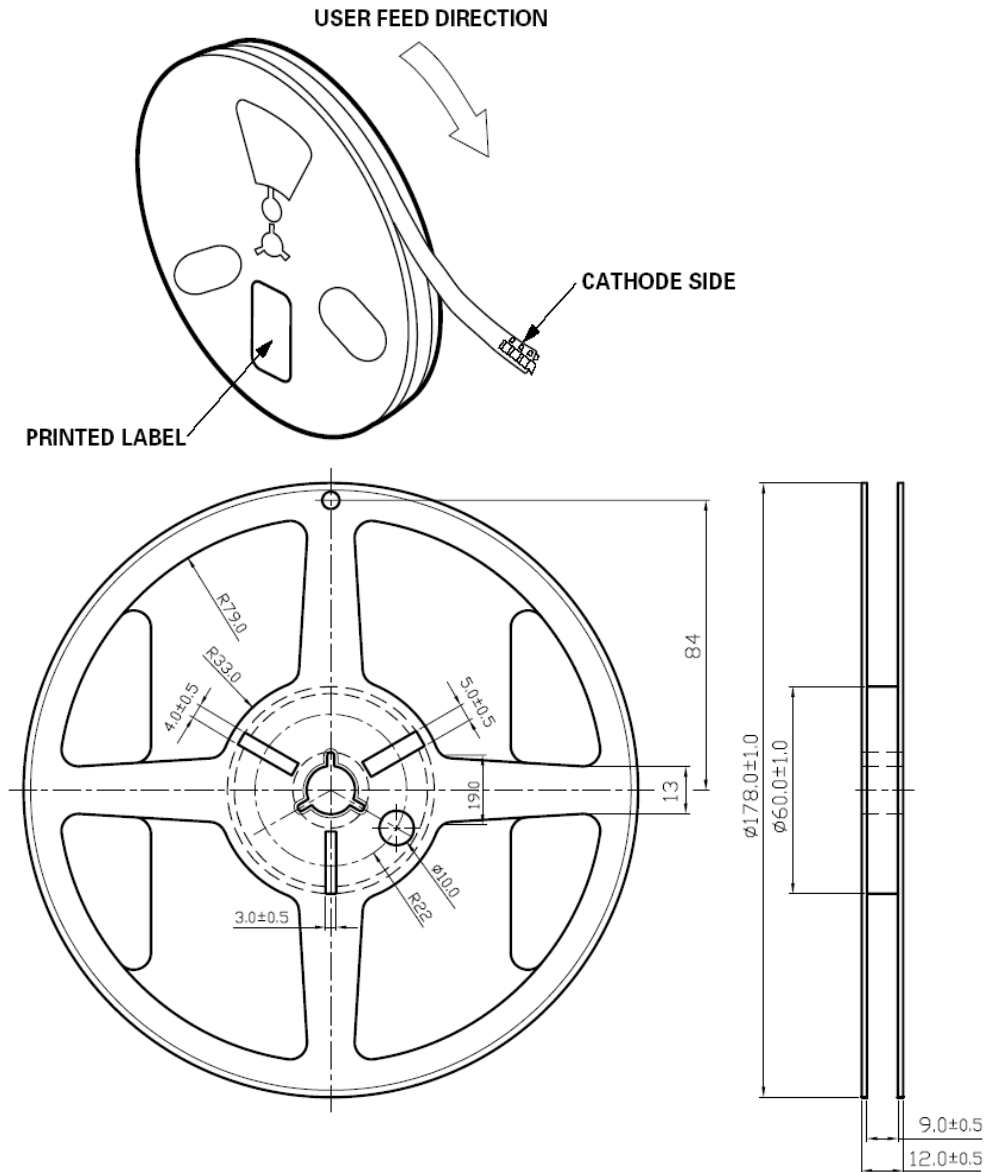
- We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.
- Do not use solder pastes with post reflow flux residue > 47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.
- All temperatures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



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



Emitter Reel Packaging



Notes:

1. Empty component pockets sealed with top cover tape.
2. 3000 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 reseat the MBB.
- The slug 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 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 Silicone LEDs

Notes for handling of silicone LEDs

- Please do not use a force of over 0.3kgf impact or pressure on the silicone, 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 especially by sharp tools such as Tweezers.
- Avoid leaving fingerprints on the silicone.
- 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)

