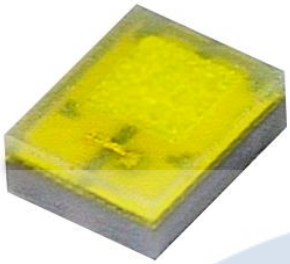


ProLight AF2N-xA1JF-x
High Power LED
Technical Datasheet
Version: 1.9

ProLight Opto Automotive Series

Features

- Small &compact size with high flux density
- Good color uniformity
- More than 8KV ESD protection
- Best Moisture Sensitivity: JEDEC Level 1
- Pb free / RoHS compliant
- AEC-Q102 Qualified

Main Applications

- Exterior Automotive Lighting
- Front Fog
- Daytime Running Lights
- Head Light
- Turn Light

Automotive

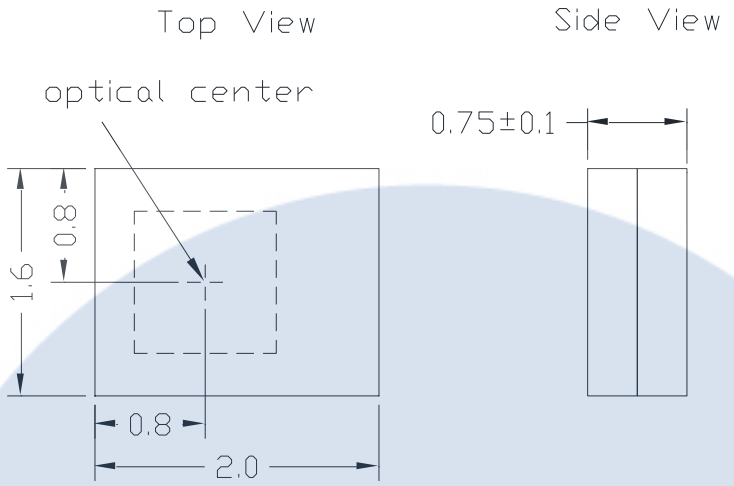
Introduction

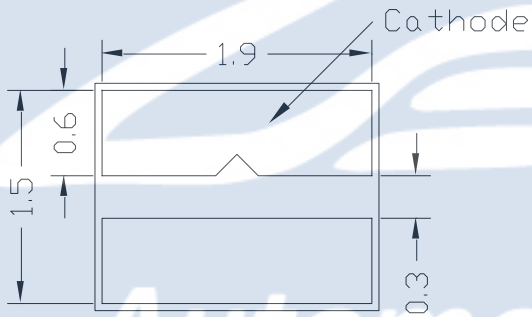
ProLight automotive LEDs provides design flexibility and advanced functionality. These products, with their miniaturized form factor, are designed to support daytime running lights, front fog and low and high beam applications. It also designed with innovative spray coating technology to provide high intensity and color uniformity.

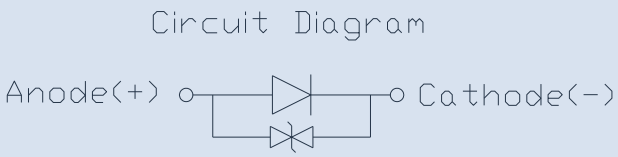
ProLight antomotive LEDs qualifies as the Moisture sensitivity level (MSL) JEDEC Level 1 and provide with more than 8KV ESD protection which is suitable for SMD process, Pb_free reflow soldering capability, and full compliance with EU Reduction of Hazardous Substances (RoHS) legislation.

Emitter Mechanical Dimensions

Unit : mm







Notes:
1. Drawing not to scale.
2. All dimensions are in millimeters.
3. Unless otherwise indicated, tolerances are ± 0.1mm.
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 0.3kgf impact or pressure on the lens of the LED, otherwise it will cause a catastrophic failure.**

Flux Characteristics at 1000mA, T_J = 25˚C

Radiation Pattern	Color	Part Number Emitter	Luminous Flux Φ_V (lm) Minimum	Typical
Flat	White	AF2N-WA1JF-2	200	250
	PC Amber	AF2N-PA1JF-A	160	200

- 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 at 1000mA, T_J = 25˚C

Color	Forward Voltage V_F (V) Min.	Typ.	Max.	Thermal Resistance Junction to Slug (˚C/ W)
White	3.2	3.5	3.8	6
PC Amber	3.2	3.5	3.8	6

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

Optical Characteristics at 1000mA, T_J = 25˚C

Radiation Pattern	Color	Dominant Wavelength λ_D or Color Temperature CCT Min.	Typ.	Max.	Total included Angle (degrees) $\theta_{0.90V}$	Viewing Angle (degrees) $2\theta_{1/2}$
Flat	White	5380 K	5610 K	5850 K	-	125
		5610 K	5850 K	6100 K	-	125
		5850 K	6100 K	6370 K	-	125
		6100 K	6370 K	6680 K	-	125
		6380 K	6650 K	7060 K	-	125
	PC Amber	-	-	-	-	125

- ProLight maintains a tolerance of ± 1nm for dominant wavelength measurements.
- ProLight maintains a tolerance of ± 5% for CCT measurements.

Absolute Maximum Ratings

Parameter	White/PC Amber
DC Forward Current (mA)	1000
ESD Sensitivity (HBM per MIL-STD-883E Method 3015.7)	> 8KV
LED Junction Temperature	125°C
Operating Board Temperature at Maximum DC Forward Current	-40°C - 105°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)	Available Color Bins
White	A	200	250	All【1】
	B	250	300	
PC Amber	A	160	200	All【1】
	B	200	240	

- 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

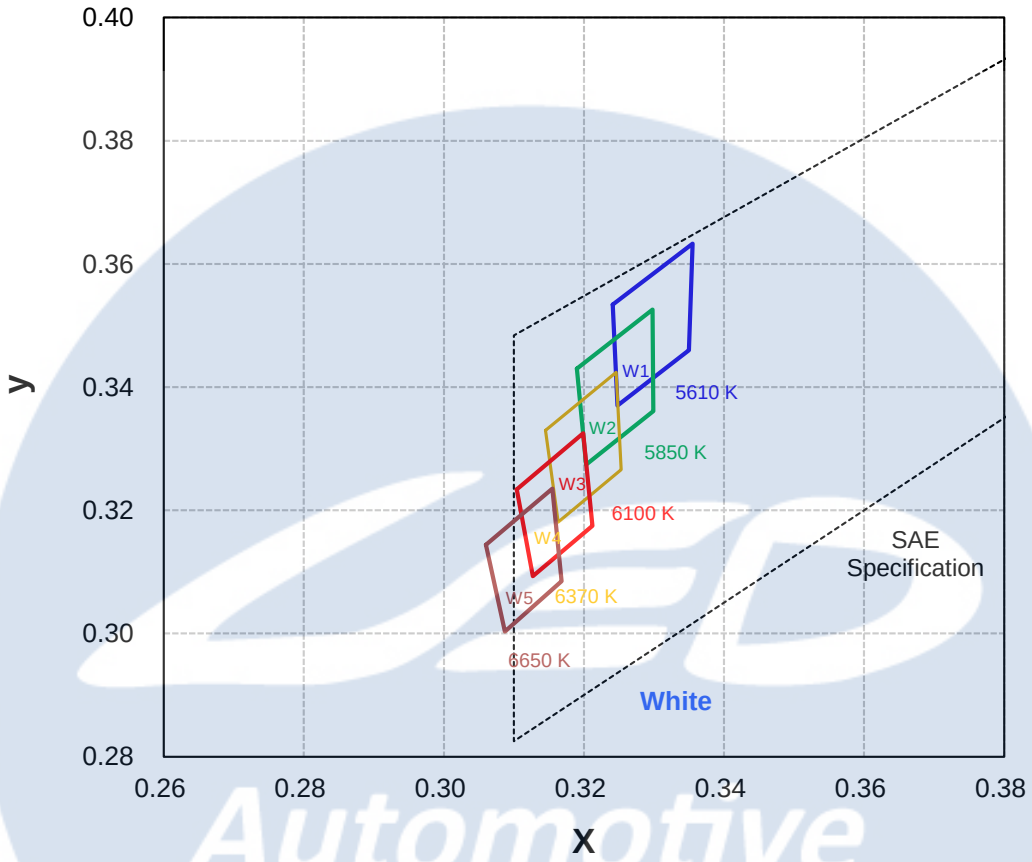
Color	Bin Code	Minimum Voltage (V)	Maximum Voltage (V)
White	A	3.2	3.4
	B	3.4	3.6
	D	3.6	3.8
PC Amber	A	3.2	3.4
	B	3.4	3.6
	D	3.6	3.8

- 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



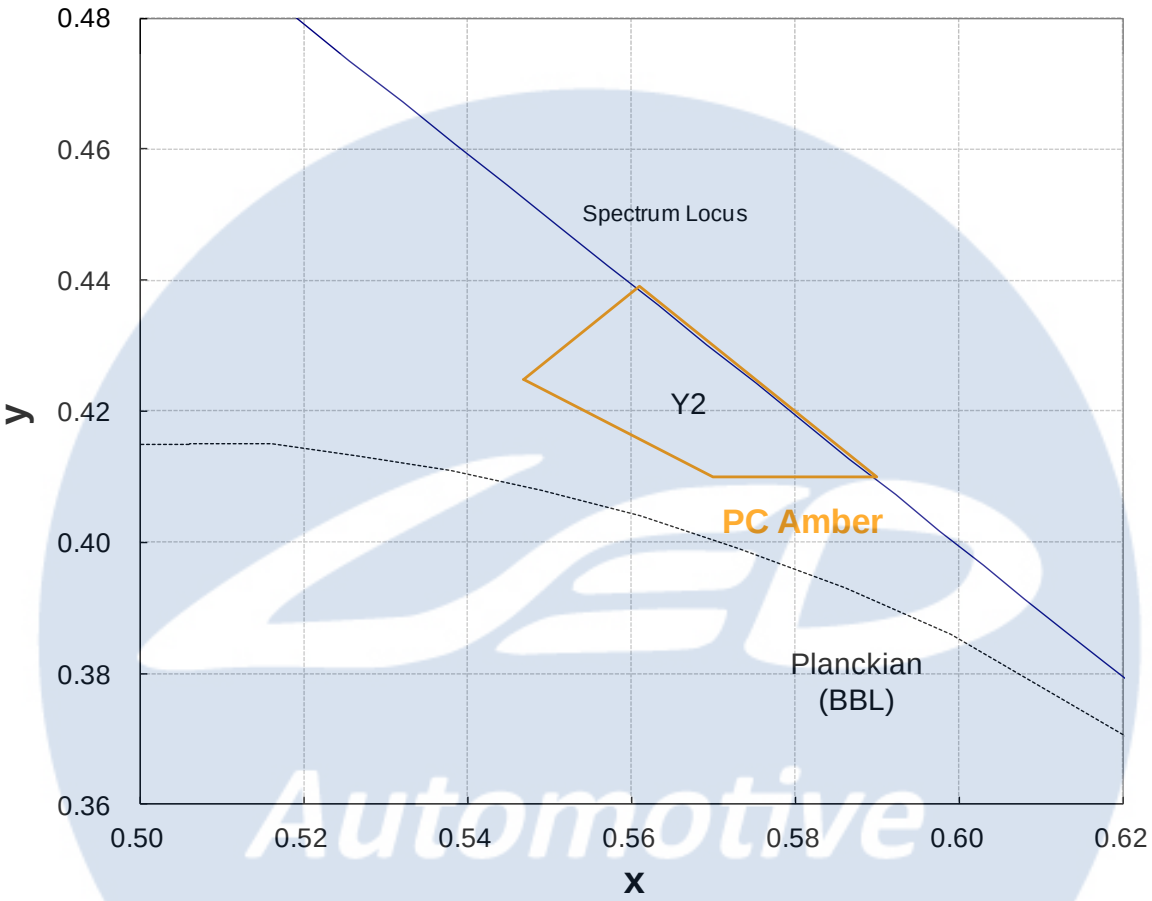
White Bin Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
W1	0.3241	0.3534	5610	W4	0.3104	0.3234	6370
	0.3248	0.3370			0.3127	0.3093	
	0.3350	0.3460			0.3212	0.3175	
	0.3355	0.3633			0.3199	0.3325	
W2	0.3190	0.3430	5850	W5	0.3060	0.3144	6650
	0.3203	0.3274			0.3087	0.3003	
	0.3299	0.3361			0.3168	0.3085	
	0.3298	0.3526			0.3155	0.3235	
W3	0.3145	0.3330	6100				
	0.3163	0.3181					
	0.3253	0.3266					
	0.3246	0.3424					

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

Color Bin

PC Amber Binning Structure Graphical Representation



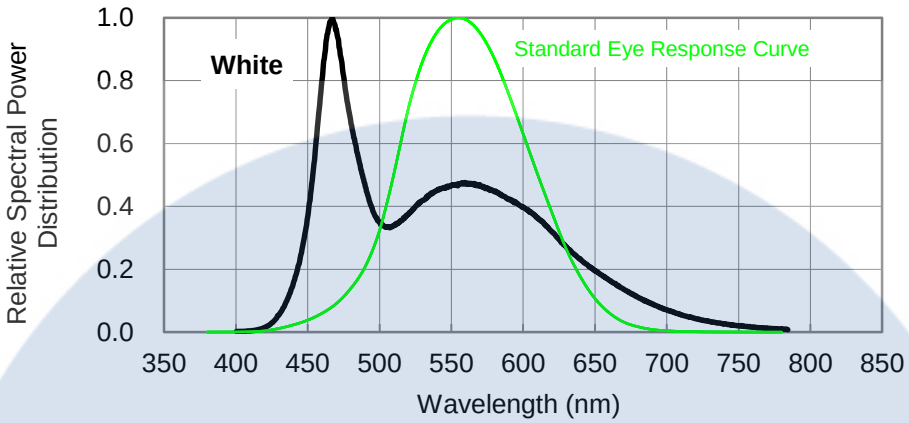
PC Amber Bin Structure

Bin Code	x	y
Y2	0.5469	0.4249
	0.5700	0.4100
	0.5900	0.4100
	0.5610	0.4390

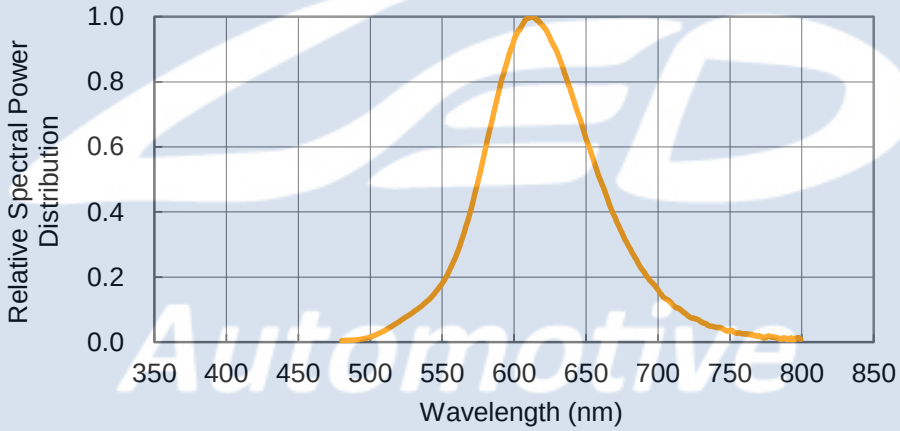
- Tolerance on each color bin (x , y) is ± 0.005

Color Spectrum, T_J = 25˚C

1. White



2. PC Amber



Case Temperature Relative Characteristics

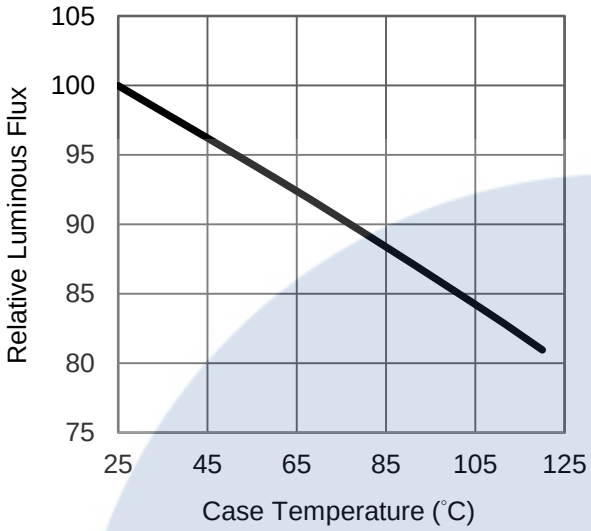


Fig 1. Case Temperature vs. Relative Luminous Flux at 1000mA.

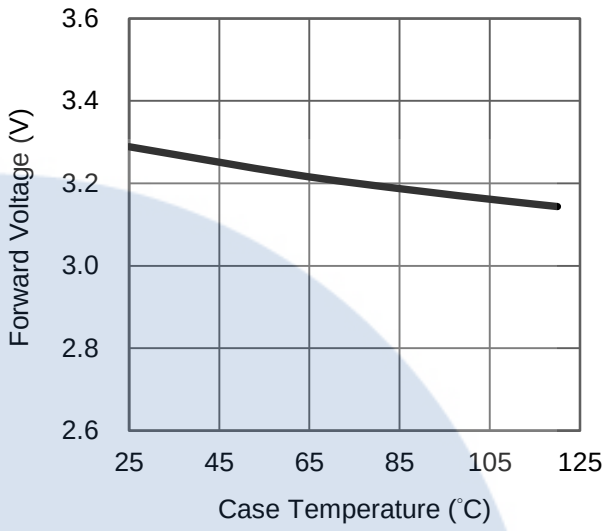


Fig 2. Case Temperature vs. Forward Voltage at 1000mA.

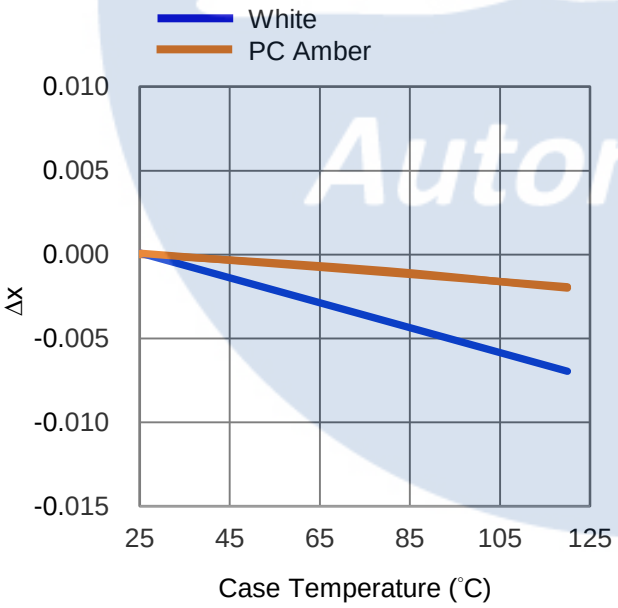


Fig 3. Case Temperature vs. Chromaticity Coordinate Δx at 1000mA.

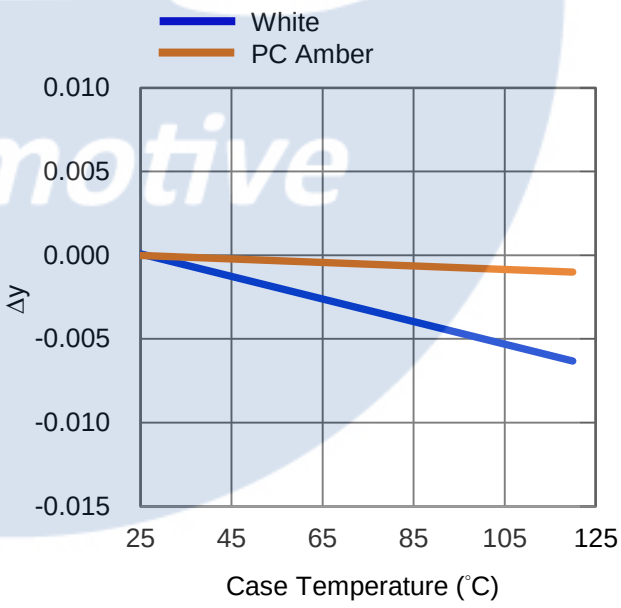


Fig 4. Case Temperature vs. Chromaticity Coordinate Δy at 1000mA.

Forward Current Relative Characteristics

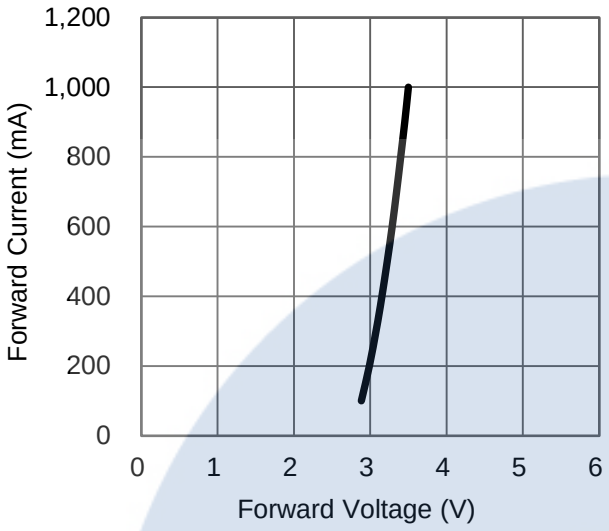


Fig 5. Forward Current vs. Forward Voltage at T_C=25°C.

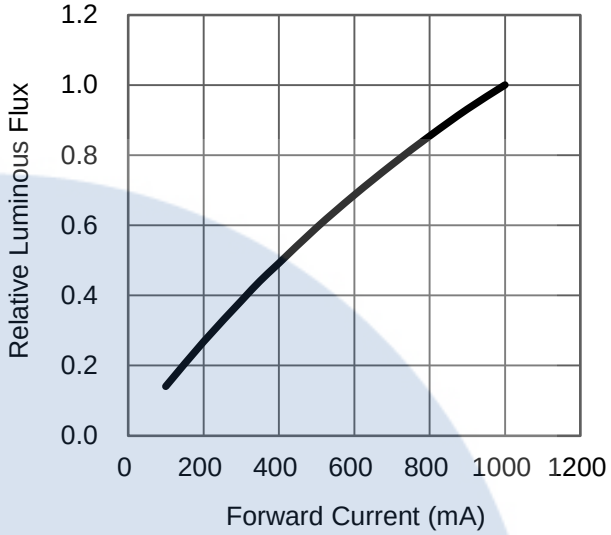


Fig 6. Forward Current vs. Relative Luminous Flux at T_C=25°C.

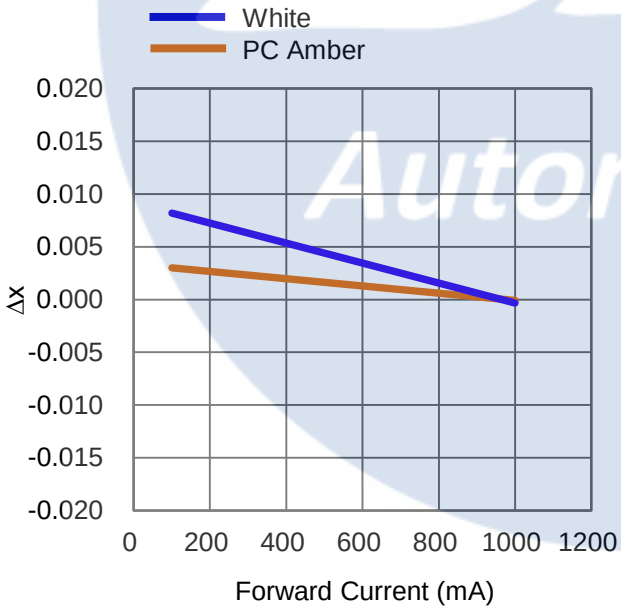


Fig 7. Forward Current vs. Chromaticity Coordinate Δx at T_C=25°C.

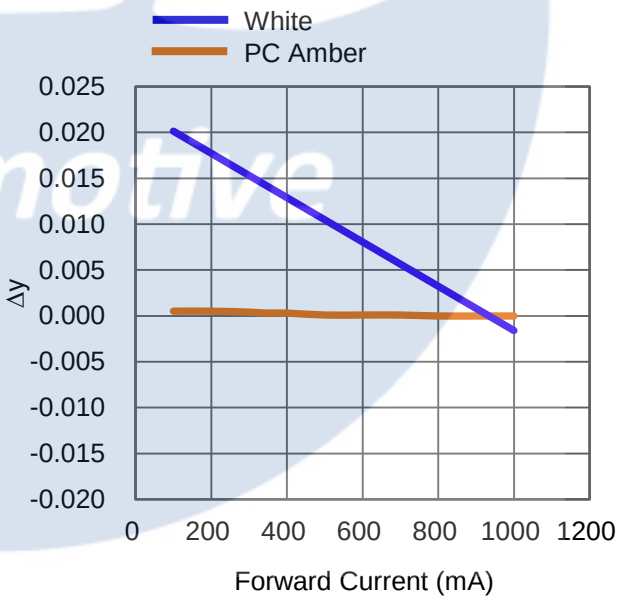
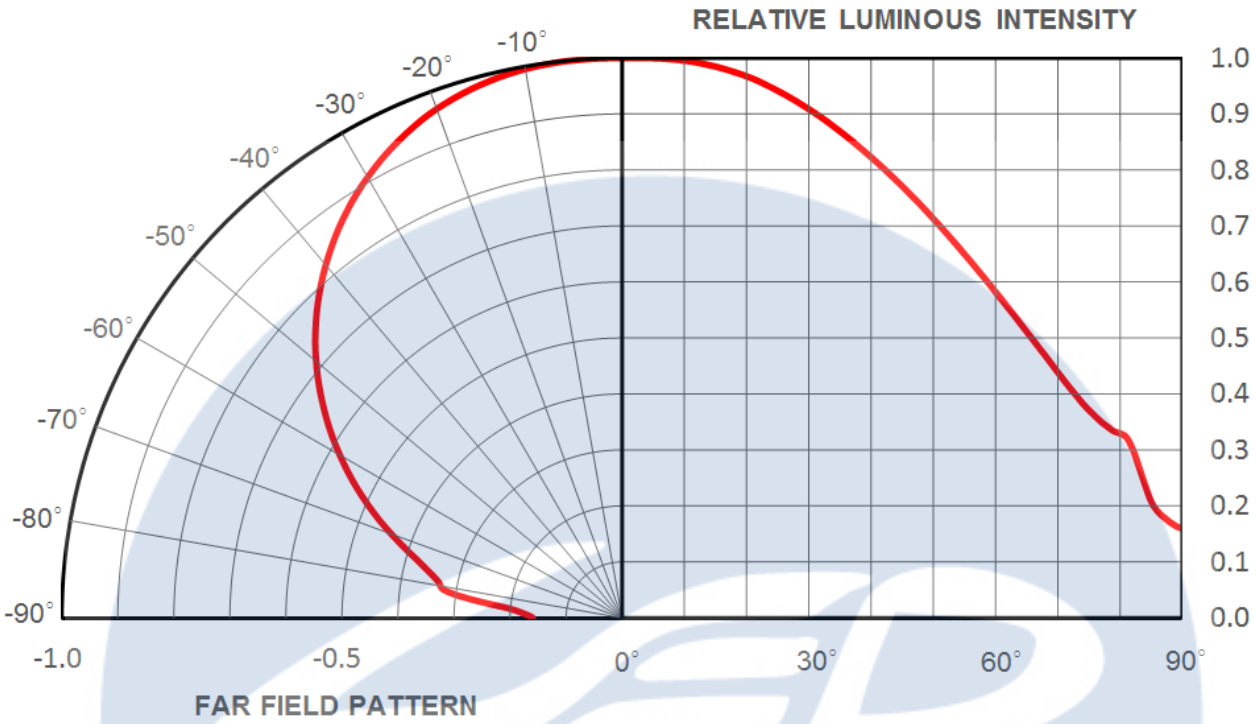


Fig 8. Forward Current vs. Chromaticity Coordinate Δy at T_C=25°C.

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

Reliability testing in accordance with AEC-Q102

The development of this product included extensive operational life-time testing and environmental testing. Table 1 summarizes the tests applied and cumulative test results obtained from testing performed in accordance with AEC-Q102.

Table 1. Operating life, mechanical and environmental tests performed on it's package in accordance with AEC-Q102.

Abrb Stress	Conditions	Duration	Failure Criteria	Rejects
TEST Pre- and Post-Stress Electrical Test	T_J = 25°C	N/A	See notes [2]	0
PC Pre-conditioning	JESD22-A113 Soak Tamb = 85°C, RH = 85% Reflow soldering	168 hours 3 cycles	See notes [2]	0
EV External Visual	JESD22 B-101	N/A	See notes [2]	0
HTFB High Temperature Forward Bias	JESD22-A108 Tamb =85°C, IF = max. DC [1]	1000 hours	See notes [2]	0
TC Temperature Cycling	JESD22-A104 -30°C to 80°C	1000 cycles	See notes [2]	0
HTHHB High temp. & High Humidity Bias	JESD22-A101 Tamb = 85°C, RH = 85%, IF = max. DC [1]	1000 hours	See notes [2]	0
PTC Power and Temperature cycle	-30°C to 85°C, 10 minutes dwell, 20 minutes transfer (1 hour cycle), 2 minutes ON/2 minutes OFF, IF = max. DC [1]	1000 hours	See notes [2]	0
ESD	AEC Q101-001	8000V	See notes [2]	0
VVF Vibration Variable Frequency	10-2000-10 Hz, log or linear sweep rate, 20 G about 1 min., 1.5 mm, 3X/axis	--	See notes [3]	0
MS Mechanical Shock	1500 G, 0.5 msec. pulse, 5 shocks each 6 axis	--	See notes [3]	0
RSH Resistance to Solder Heat	JESD22-A111 / JESD22-B106 260 °C ± 5 °C	10 s	See notes [3]	0
SD Solderability	J-STD-002 245 °C ± 5 °C	3 s	See notes [3]	0

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 0.8	--
Reverse Current (I_R)	V_R = 5V	--	50 μA

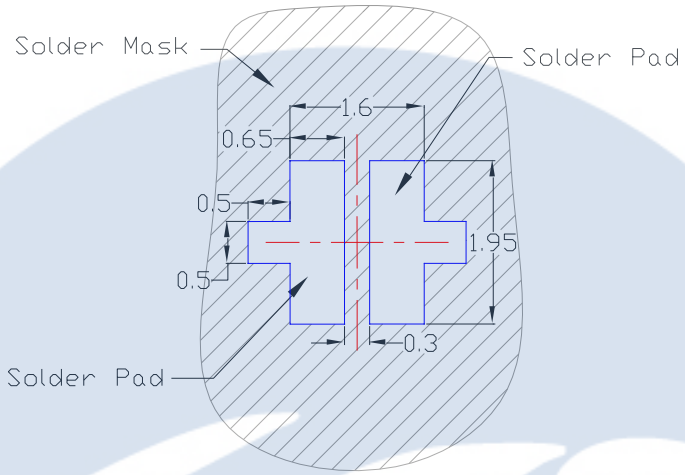
* The test is performed after the LED is cooled down to the room temperature.

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

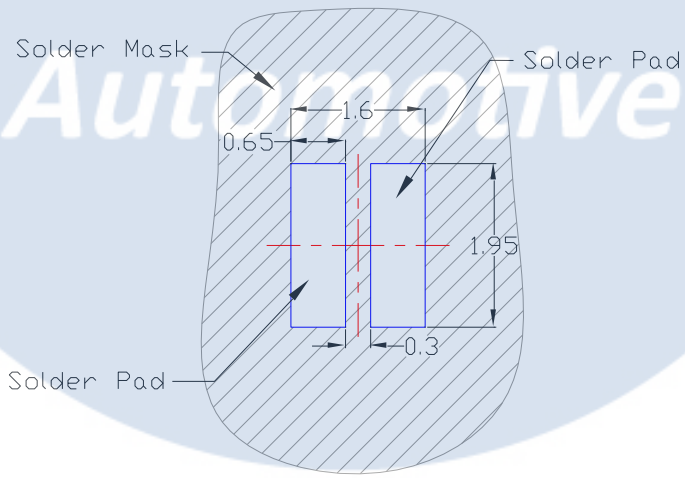
Recommended Solder Pad Design

Standard Emitter

TYPE A.



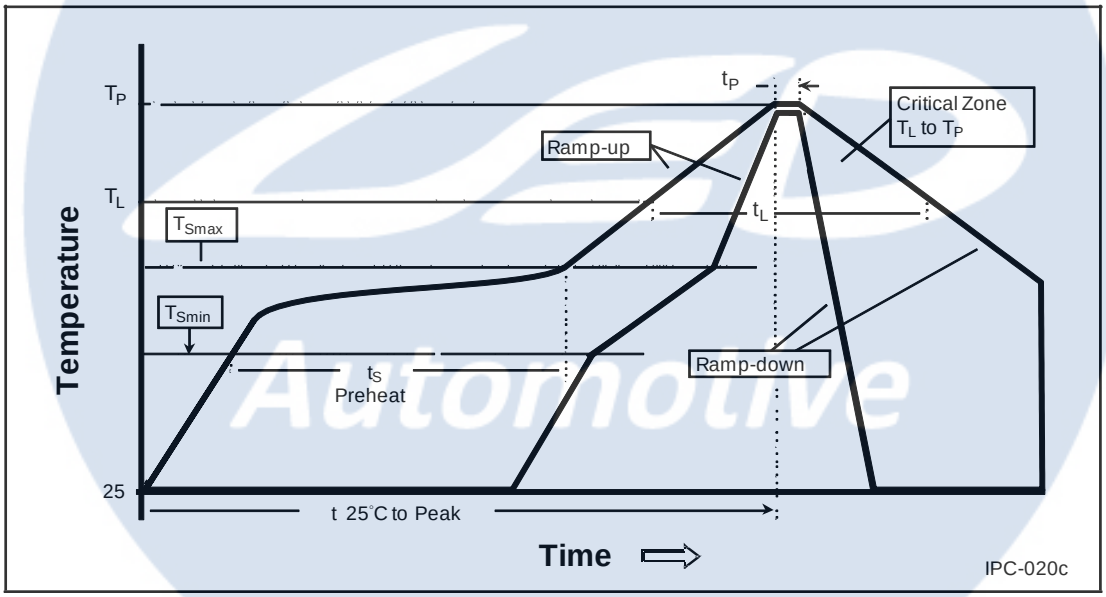
TYPE B.



- All dimensions are in millimeters.

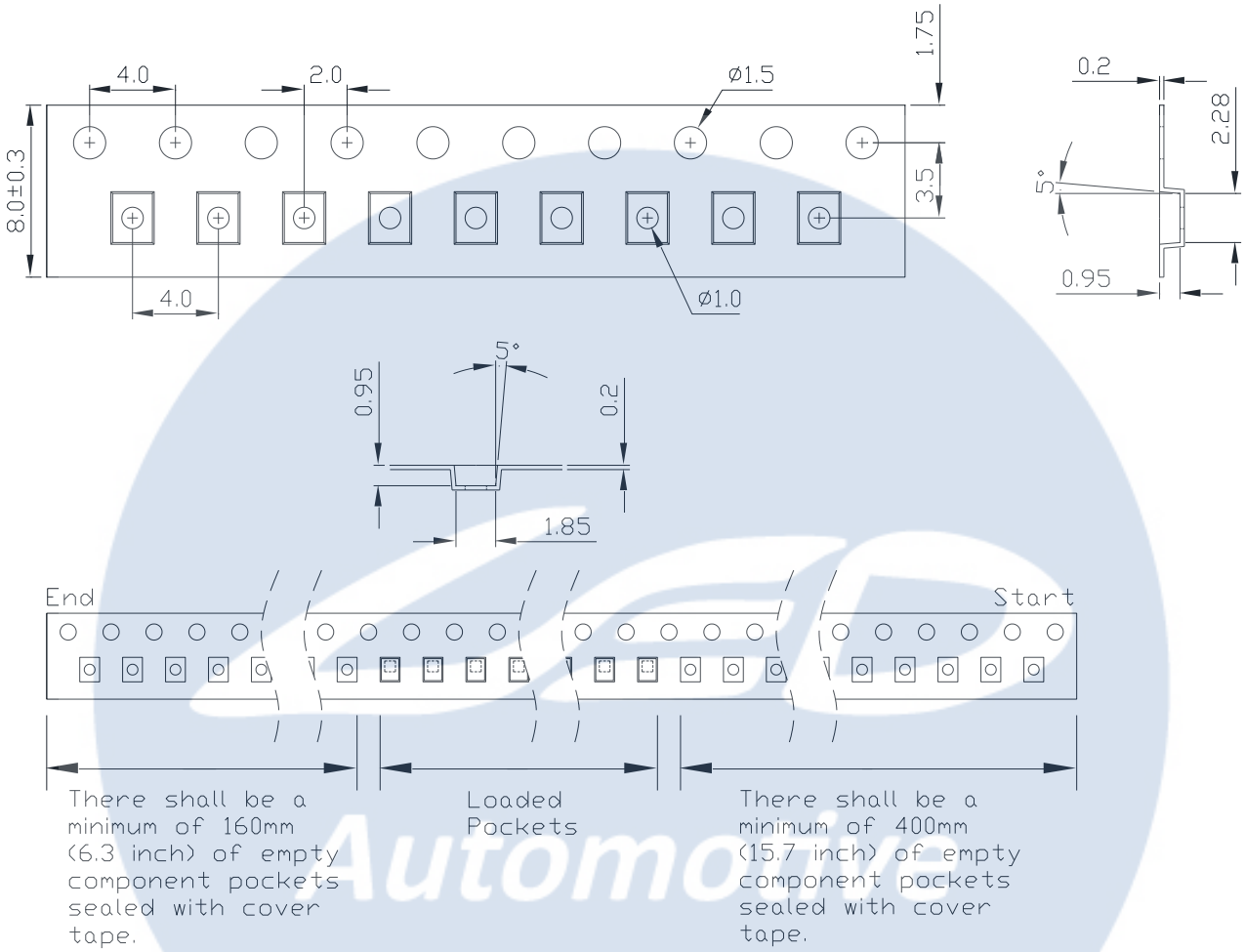
Reflow Soldering Condition

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.



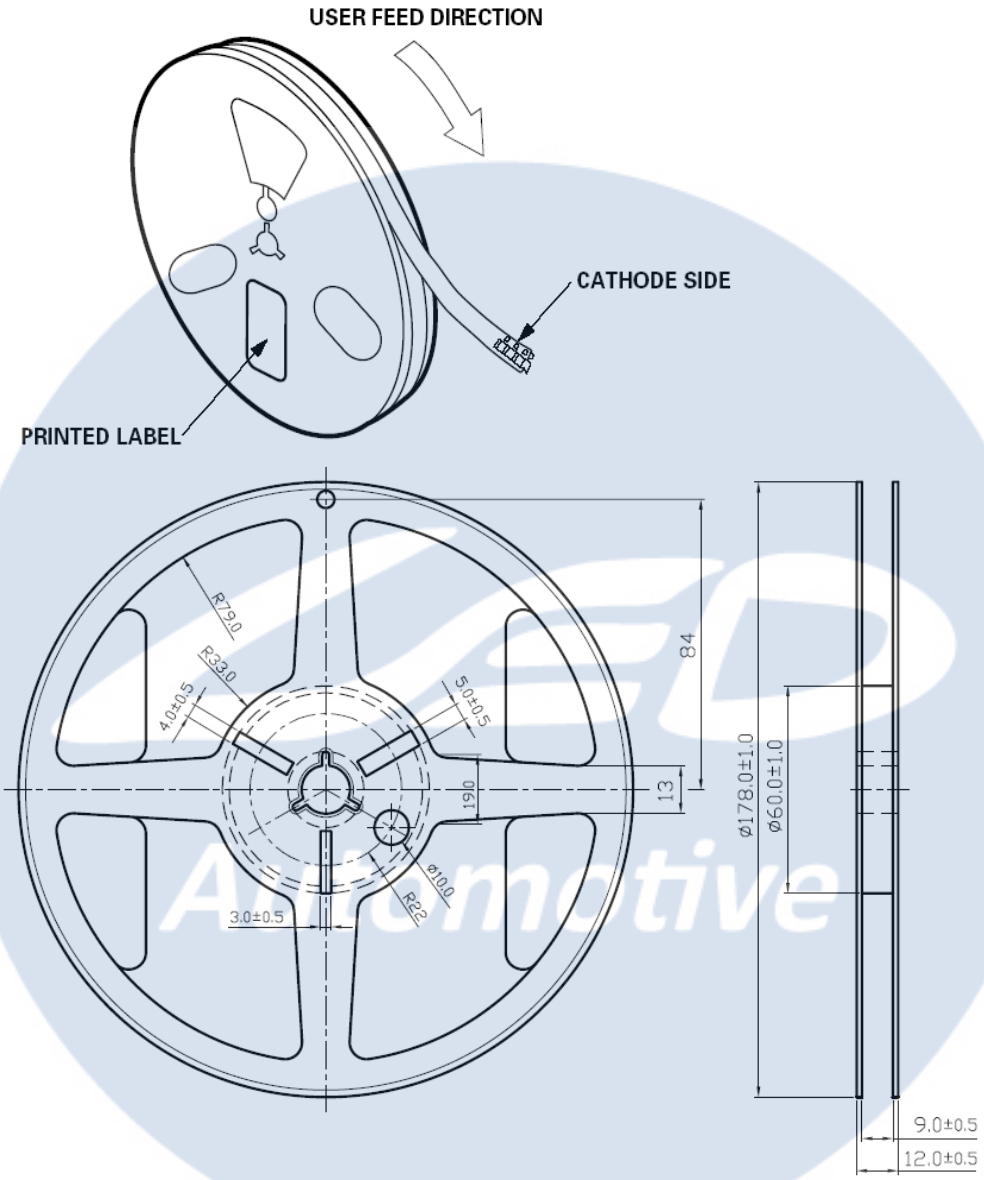
- **We recommend using the M705-S101-S4 solder paste from SMIC (Senju Metal Industry Co., Ltd.) for lead-free soldering.**
- **Do not use solder pastes with post reflow flux residue>47%. (58Bi-42Sn eutectic alloy, etc) This kind of solder pastes may cause a reliability problem to LED.**
- All temperatures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

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. 2000 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 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)