ProLight AL6A-xA1EF-x
0.5W Power LED
Technical Datasheet
Version: 1.7

ProLight Opto AL6A Series

Features

- Moisture Sensitivity : JEDEC Level 2
- RoHS compliant
- Lead free reflow soldering

Main Applications

- Backlighting
- Signaling
- Exterior Automotive Lighting
- Automotive Interior Lighting

Automotive

Introduction

·AL6A offer red color solution to meet the needs of backlighting, signaling, exterior automotive lighting, and automotive interior lighting. Alone with high-quality materials, AL6A bring not only high performance but also good reliability to fulfil customer's requirements.

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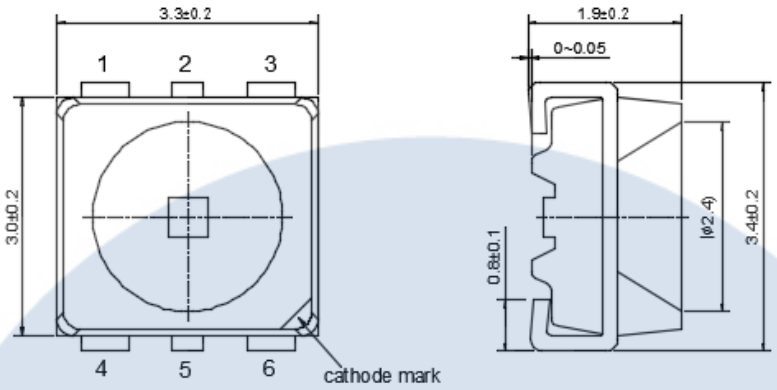
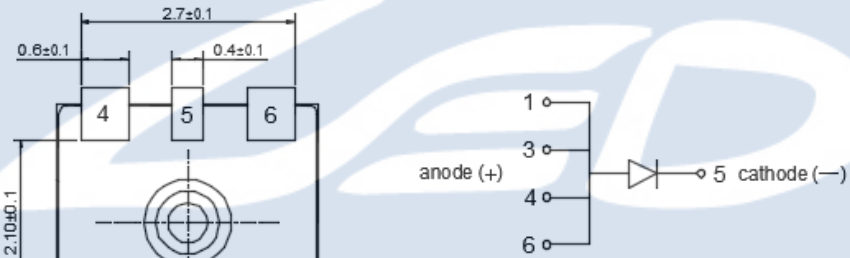
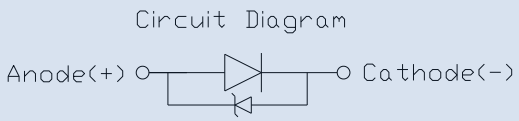
Emitter Mechanical Dimensions





Circuit Diagram



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 ± 0.10mm.
5. Please do not solder the emitter by manual hand soldering, otherwise it will damage the emitter.

*The appearance and specifications of the product may be modified for improvement without notice.

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Flux Characteristics at 140mA, T_J = 25°C

Radiation Pattern	Color	Part Number Emitter	Luminous Intensity (cd) Minimum	Typical
Lambertian	White	AL6A-WA1EF-2	11.2	16.0
	Neutral White	AL6A-NA1EF-4	11.2	14.5
	PC Amber	AL6A-PA1EF-A	9	11.5
	Green	AL6A-GA1EF	4.5	9.0
	Blue	AL6A-BA1EF	2.24	3.5

- 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 140mA, T_J = 25°C

Color	Forward Voltage V_F (V) Min.	Typ.	Max.	Thermal Resistance Junction to Slug (°C/ W)
White	2.60	3.10	3.80	35
Neutral White	2.60	3.10	3.80	35
PC Amber	2.60	3.10	3.80	35
Green	2.60	3.25	4.10	30
Blue	2.60	3.10	3.80	29

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

Optical Characteristics at 140mA, 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) $2\theta_{1/2}$
Lambertian	White	4310 K	7160 K	10010 K	160	120
	Neutral White	3600 K	4050 K	4500 K	160	120
	PC Amber	589.2 nm	590.8 nm	592.3 nm	160	120
	Green	513 nm	525 nm	543 nm	160	120
	Blue	464 nm	470 nm	476 nm	160	120

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

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Absolute Maximum Ratings

Parameter	White/Neutral White/ PC Amber/Green/Blue
Max DC Forward Current (mA)	250
Peak Pulsed Forward Current (mA)	350 (less than 1/10 duty cycle@1KHz)
LED Junction Temperature	125˚C
Operating Board Temperature at Maximum DC Forward Current	-40˚C - 110˚C
Storage Temperature	-40˚C - 110˚C
Soldering Temperature	JEDEC 020c 260˚C
Allowable Reflow Cycles	3
Reverse Voltage	not designed for reverse operation
ESD withstand voltage(kV) (acc. to IEC 61000-4-2-air discharge)	2

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Photometric Luminous Flux Bin Structure

Color	Bin Code	Minimum Luminous Intensity (cd)	Maximum Luminous Intensity (cd)	Typical Luminous Flux Φ_V (lm)	Available Color Bins
White	K	11.2	14.0	37.8	All
	L	14.0	17.5	47.3	All
	M	17.5	21.8	59.0	【1】
Neutral White	K	11.2	14.0	47.8	All
	L	14.0	17.5	47.3	All
	M	17.5	21.8	59.0	【1】
PC Amber	J	9.0	11.2	30.3	All
	K	11.2	14.0	37.8	All
Green	F	4.5	5.6	15.2	All
	G	5.6	7.1	19.1	All
	H	7.1	9.0	24.2	All
	J	9.0	11.2	30.3	【1】
	K	11.2	14.0	37.8	【1】
Blue	B	2.24	2.8	7.6	All
	D	2.8	3.55	9.5	【1】
	E	3.55	4.5	12.1	【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.

Dominant Wavelength Bin Structure

Color	Bin Code	Minimum Dominant Wavelength (nm)	Maximum Dominant Wavelength (nm)
Green	2	513	519
	3	519	525
	4	525	531
	5	531	537
	6	537	543
Blue	3	464	468
	4	468	472
	5	472	476

- 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.

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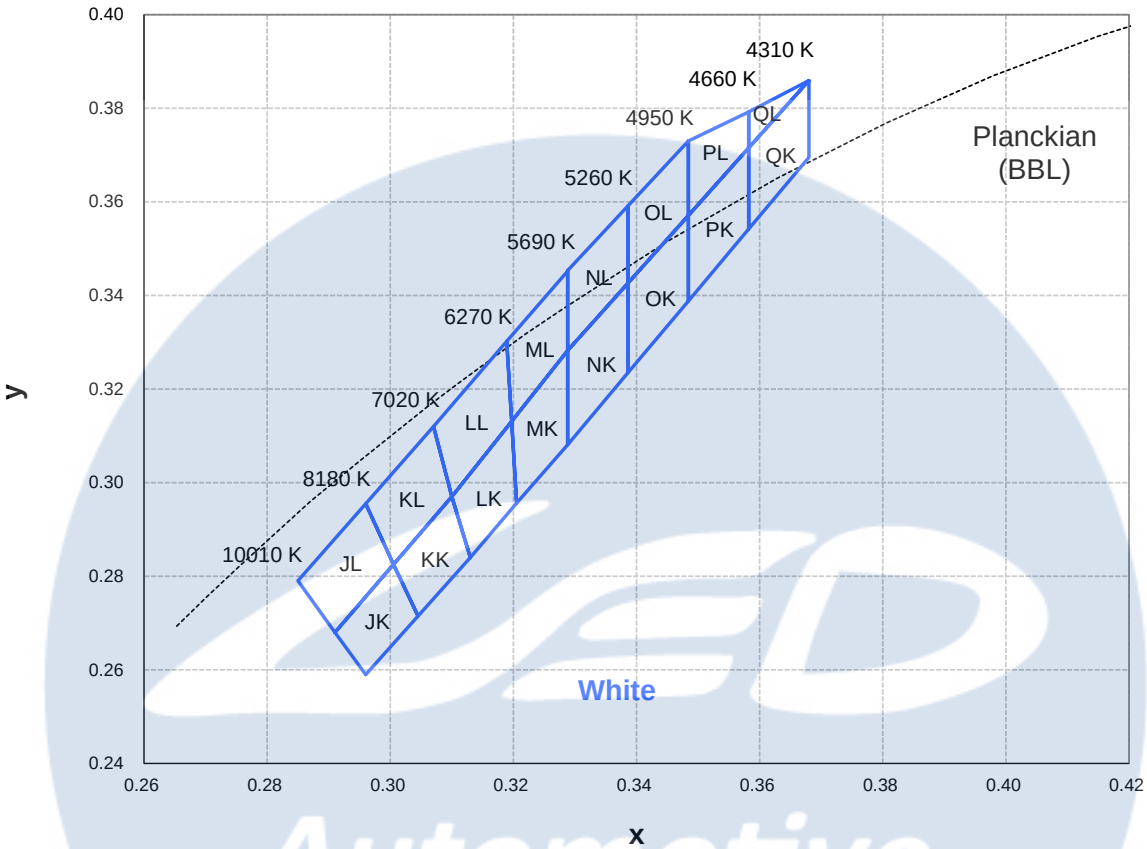
Color Bin

White Binning Structure Graphical Representation



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Color Bin

White Binning Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
QL	0.3582	0.3715	4485	ML	0.3189	0.3302	5980
	0.3582	0.3792			0.3197	0.3131	
	0.3680	0.3859			0.3288	0.3282	
	0.3582	0.3715			0.3288	0.3452	
QK	0.3582	0.3715	4485	MK	0.3197	0.3131	5980
	0.3582	0.3542			0.3205	0.2956	
	0.3680	0.3695			0.3288	0.3081	
	0.3680	0.3859			0.3288	0.3282	
PL	0.3484	0.3730	4805	LL	0.3100	0.2970	6645
	0.3484	0.3571			0.3070	0.3120	
	0.3582	0.3715			0.3189	0.3302	
	0.3582	0.3792			0.3197	0.3131	
PK	0.3484	0.3571	4805	LK	0.3130	0.2840	6645
	0.3484	0.3388			0.3100	0.2970	
	0.3582	0.3542			0.3197	0.3131	
	0.3582	0.3715			0.3205	0.2956	
OL	0.3386	0.3591	5105	KL	0.3005	0.2825	7600
	0.3386	0.3426			0.2960	0.2955	
	0.3484	0.3571			0.3070	0.3120	
	0.3484	0.3730			0.3100	0.2970	
OK	0.3386	0.3426	5105	KK	0.3045	0.2715	7600
	0.3386	0.3235			0.3005	0.2825	
	0.3484	0.3388			0.3100	0.2970	
	0.3484	0.3571			0.3130	0.2840	
NL	0.3288	0.3453	5475	JL	0.2910	0.2680	9095
	0.3288	0.3282			0.2850	0.2790	
	0.3386	0.3426			0.2960	0.2955	
	0.3386	0.3591			0.3005	0.2825	
NK	0.3288	0.3282	5475	JK	0.2960	0.2590	9095
	0.3288	0.3081			0.2910	0.2680	
	0.3386	0.3235			0.3005	0.2825	
	0.3386	0.3426			0.3045	0.2715	

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

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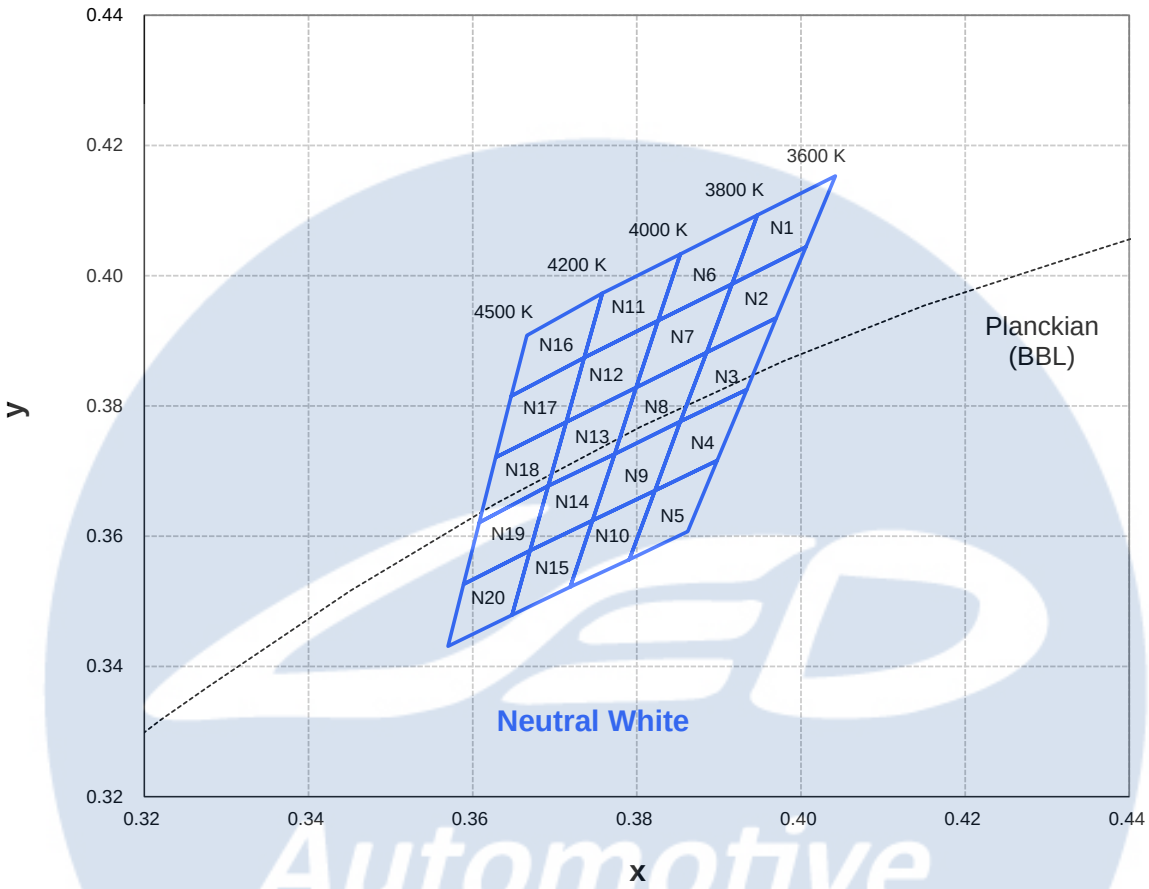
Color Bin

Neutral White Binning Structure Graphical Representation



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Color Bin

Neutral White Binning Structure

Bin Code	x	y	Typ. CCT (K)	Bin Code	x	y	Typ. CCT (K)
N1	0.3916	0.3987	3700	N11	0.3736	0.3874	4100
	0.3947	0.4093			0.3758	0.3973	
	0.4042	0.4153			0.3853	0.4033	
	0.4006	0.4044			0.3826	0.3931	
N2	0.3885	0.3882	3700	N12	0.3714	0.3775	4100
	0.3916	0.3987			0.3736	0.3874	
	0.4006	0.4044			0.3826	0.3931	
	0.3970	0.3935			0.3799	0.3828	
N3	0.3853	0.3776	3700	N13	0.3692	0.3677	4100
	0.3885	0.3882			0.3714	0.3775	
	0.3970	0.3935			0.3799	0.3828	
	0.3934	0.3825			0.3773	0.3726	
N4	0.3822	0.3670	3700	N14	0.3670	0.3578	4100
	0.3853	0.3776			0.3692	0.3677	
	0.3934	0.3825			0.3773	0.3726	
	0.3898	0.3716			0.3746	0.3624	
N5	0.3791	0.3564	3700	N15	0.3648	0.3479	4100
	0.3822	0.3670			0.3670	0.3578	
	0.3898	0.3716			0.3746	0.3624	
	0.3862	0.3607			0.3719	0.3522	
N6	0.3826	0.3931	3900	N16	0.3736	0.3874	4350
	0.3853	0.4033			0.3758	0.3973	
	0.3947	0.4093			0.3666	0.3908	
	0.3916	0.3987			0.3647	0.3815	
N7	0.3799	0.3828	3900	N17	0.3714	0.3775	4350
	0.3826	0.3931			0.3736	0.3874	
	0.3916	0.3987			0.3647	0.3815	
	0.3885	0.3882			0.3628	0.3721	
N8	0.3773	0.3726	3900	N18	0.3714	0.3775	4350
	0.3799	0.3828			0.3692	0.3677	
	0.3885	0.3882			0.3608	0.3621	
	0.3853	0.3776			0.3628	0.3721	
N9	0.3746	0.3624	3900	N19	0.3670	0.3578	4350
	0.3773	0.3726			0.3692	0.3677	
	0.3853	0.3776			0.3608	0.3621	
	0.3822	0.3670			0.3589	0.3526	
N10	0.3719	0.3522	3900	N20	0.3670	0.3578	4350
	0.3746	0.3624			0.3648	0.3479	
	0.3822	0.3670			0.3570	0.3431	
	0.3791	0.3564			0.3589	0.3526	

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

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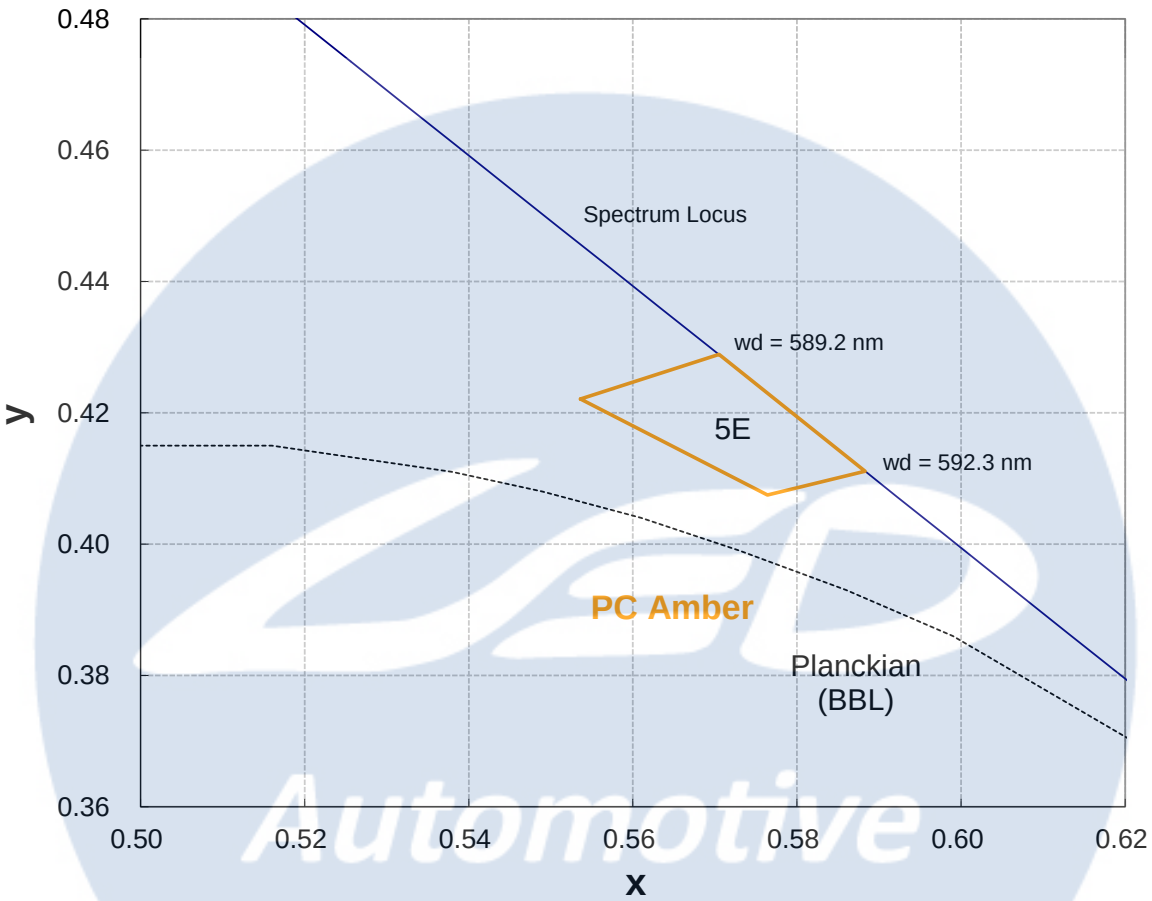
Color Bin

PC Amber Binning Structure Graphical Representation



PC Amber Bin Structure

Bin Code	x	y
5E	0.5536	0.4221
	0.5705	0.4289
	0.5883	0.4111
	0.5764	0.4075

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

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Forward Voltage Bin Structure

Color	Bin Code	Minimum Voltage (V)	Maximum Voltage (V)
White	A	2.60	2.90
	B	2.90	3.20
	D	3.20	3.50
	E	3.50	3.80
Neutral White	A	2.60	2.90
	B	2.90	3.20
	D	3.20	3.50
	E	3.50	3.80
PC Amber	A	2.60	2.90
	B	2.90	3.20
	D	3.20	3.50
	E	3.50	3.80
Green	A	2.60	2.90
	B	2.90	3.20
	D	3.20	3.50
	E	3.50	3.80
	F	3.80	4.10
Blue	A	2.60	2.90
	B	2.90	3.20
	D	3.20	3.50
	E	3.50	3.80

- 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.

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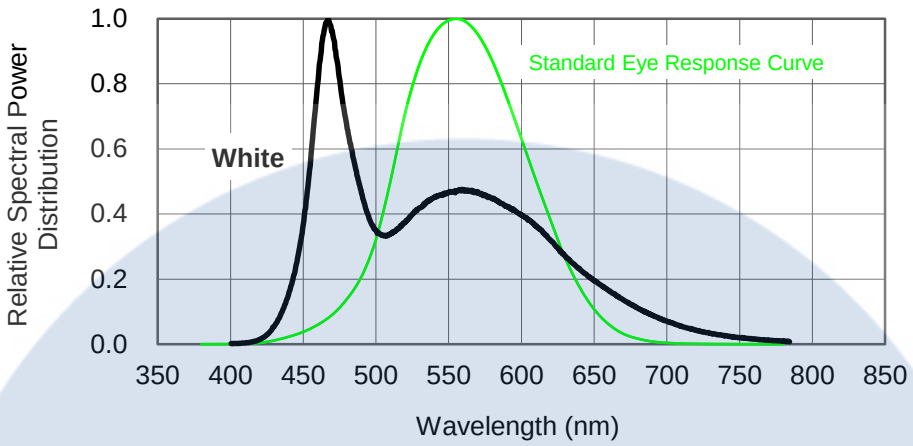
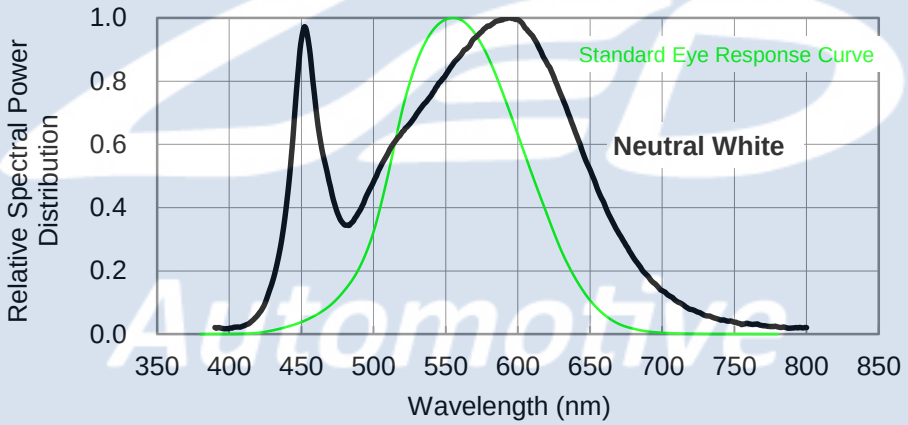
Color Spectrum, T_J = 25˚C

1. White



2. Neutral White



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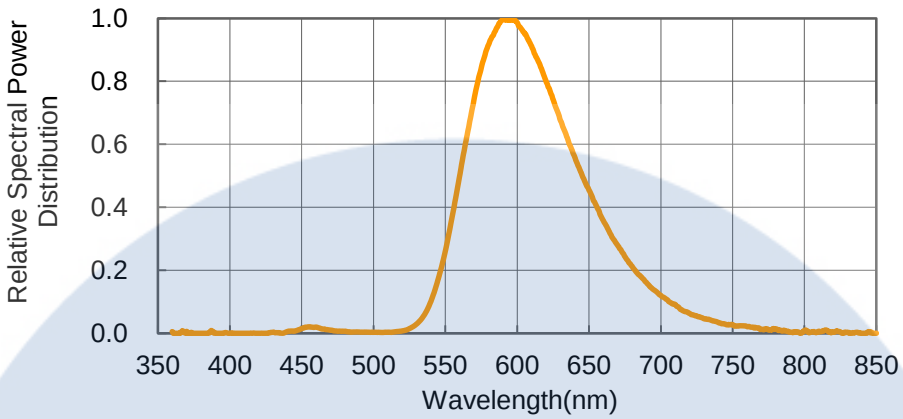
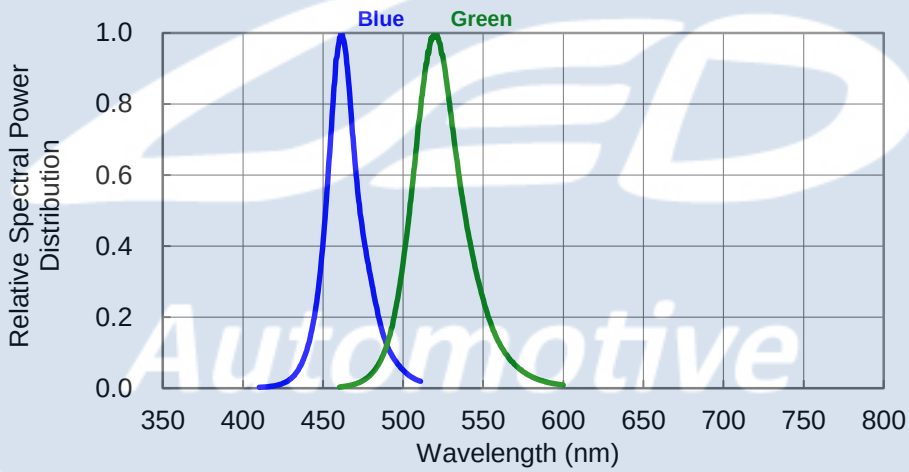
Color Spectrum, T_J = 25˚C

3. PC Amber



4. Blue、Green



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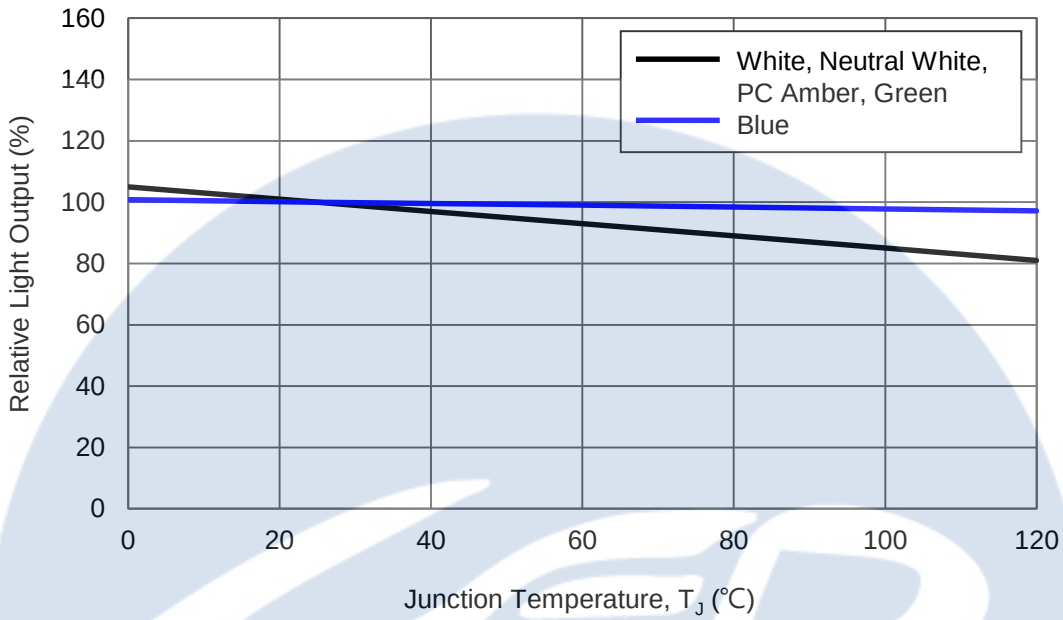
Light Output Characteristics

Relative Light Output vs. Junction Temperature at 150mA



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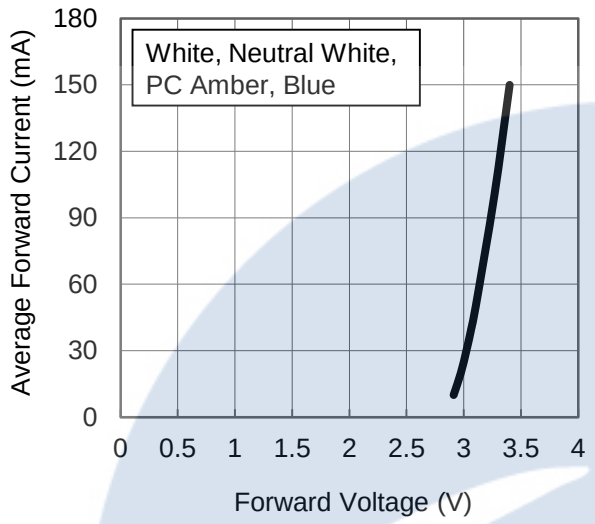
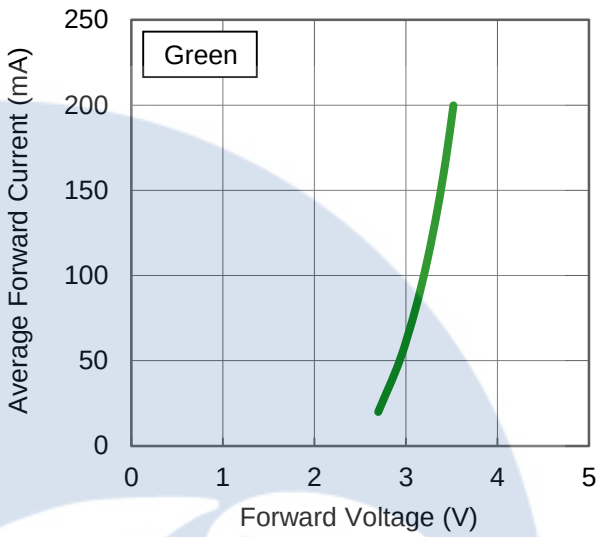
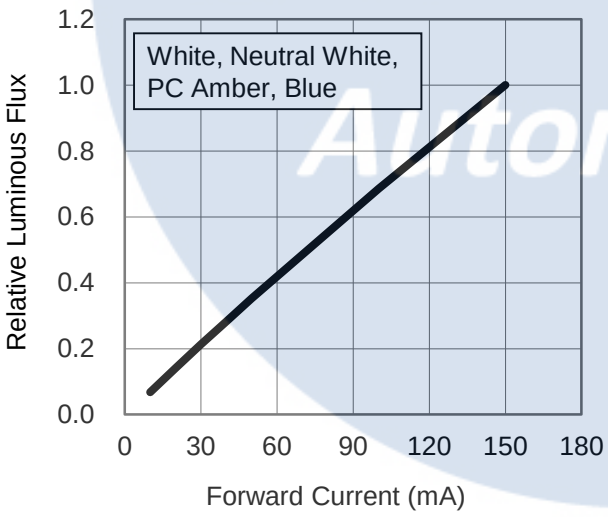
Forward Current Characteristics, T_J = 25°C

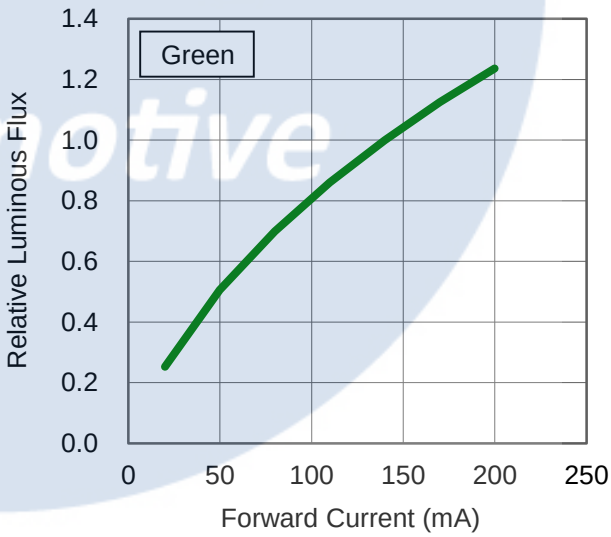
1. Forward Voltage vs. Forward Current





2. Forward Current vs. Normalized Relative Luminous Flux





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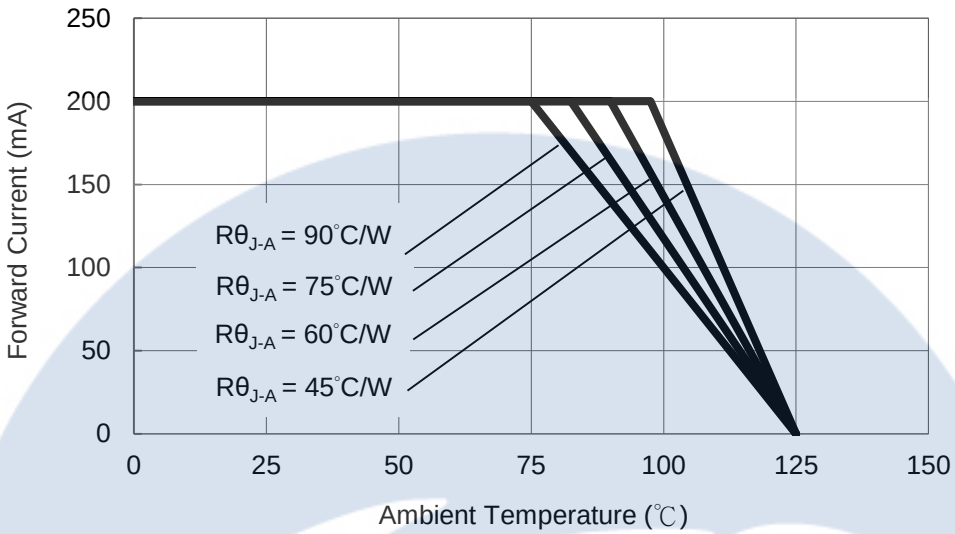
Ambient Temperature vs. Maximum Forward Current

1. White, Neutral White, PC Amber, Green, Blue (T_{JMAX} = 125°C)



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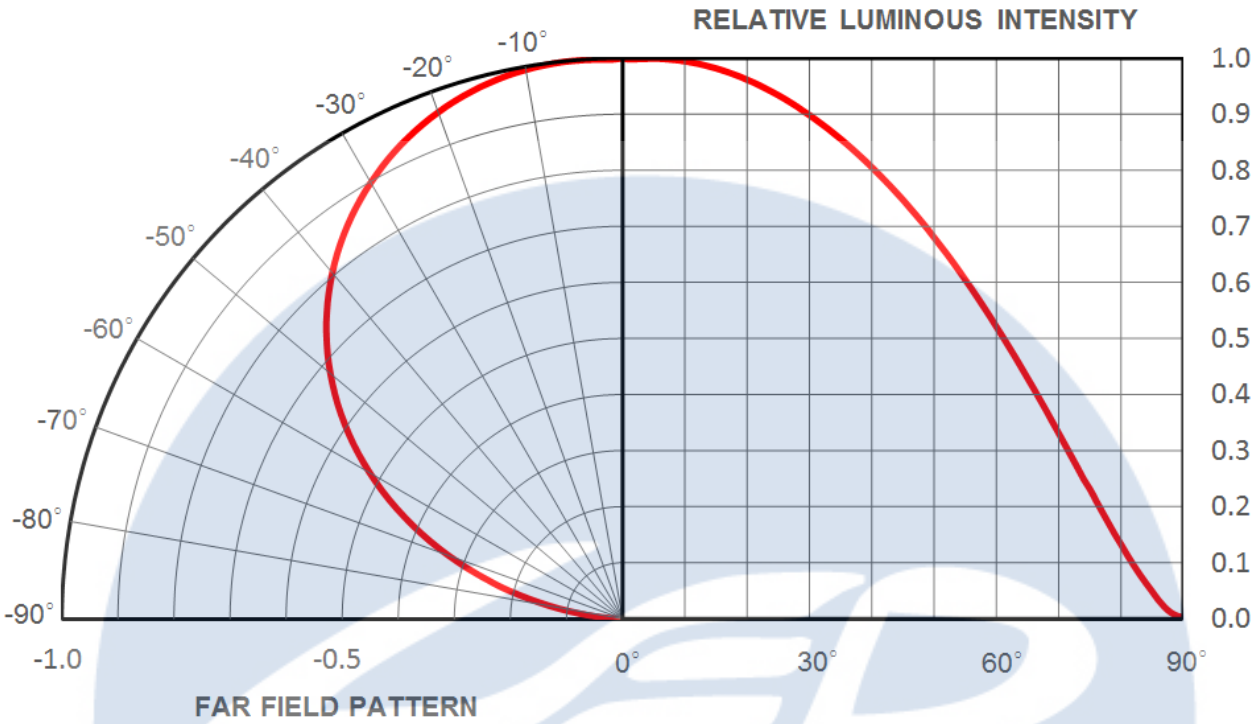
Typical Representative Spatial Radiation Pattern



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Moisture Sensitivity Level - JEDEC Level 2

Level	Floor Life		Soak Requirements			
			Standard		Accelerated Environment	
	Time	Conditions	Time (hours)	Conditions	Time (hours)	Conditions
2	1 year	≤30˚C / 60% RH	168 +5/-0	85˚C / 60% 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

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Tel ：+886-3-461-8618 Fax：+886-3-461-8677

Reliability testing in accordance with AEC-Q101 (Rev D1)

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-Q101(Rev D1).

Table 1. Operating life, mechanical and environmental tests performed on it's package in accordance with AEC-Q101 (Rev D1).

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.

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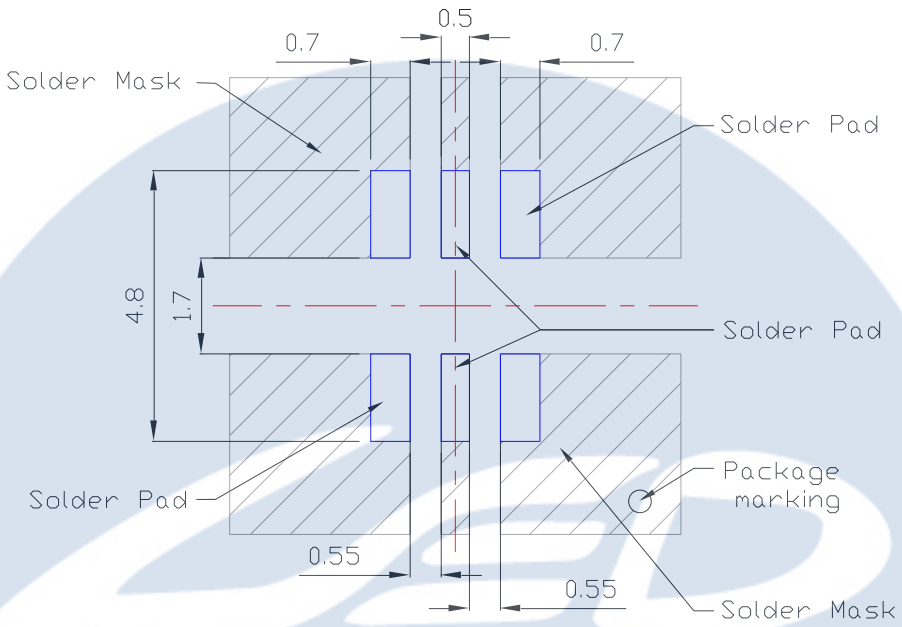
Recommended Solder Pad Design

Solder Pad



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

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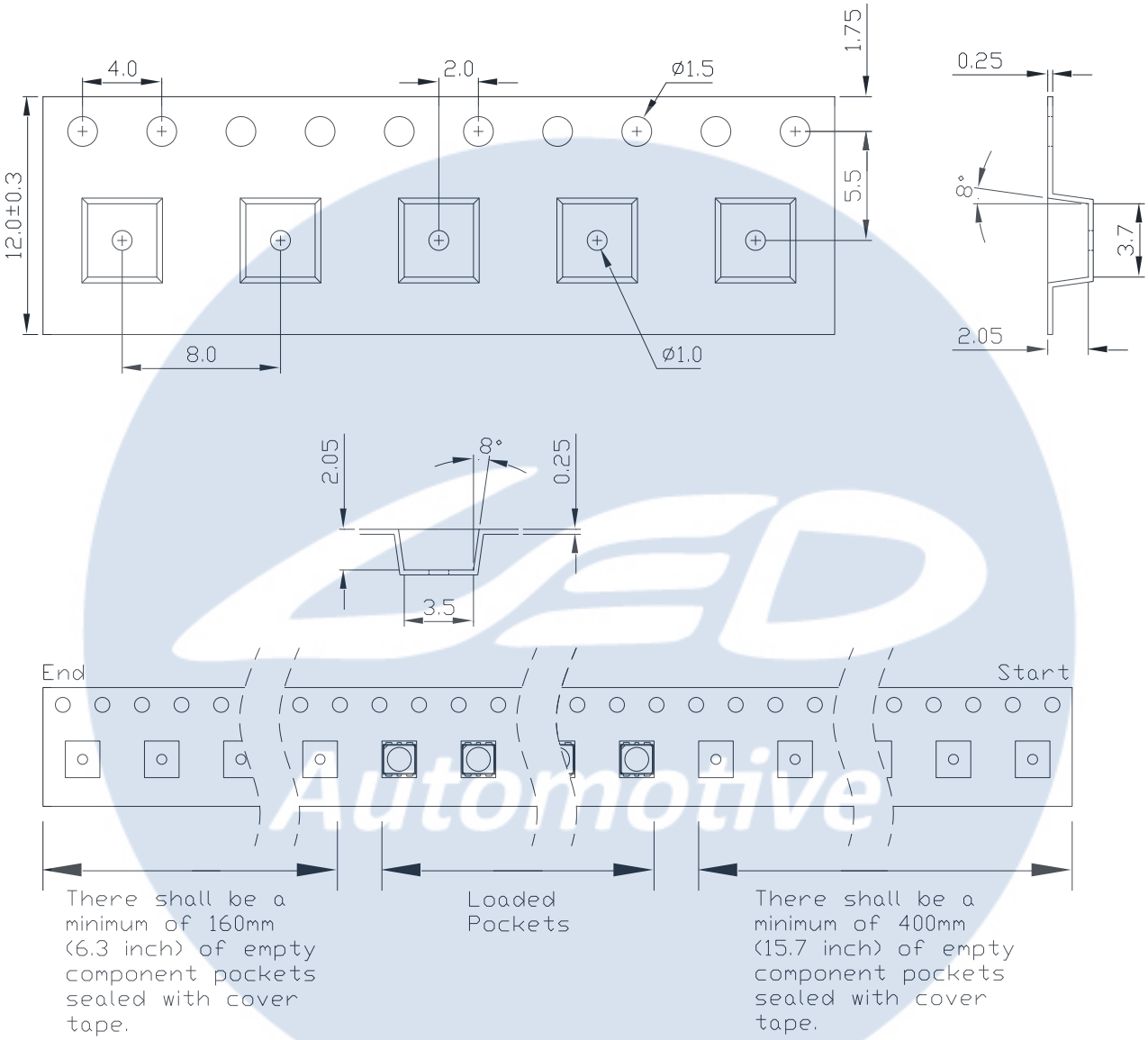
Emitter Reel Packaging



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

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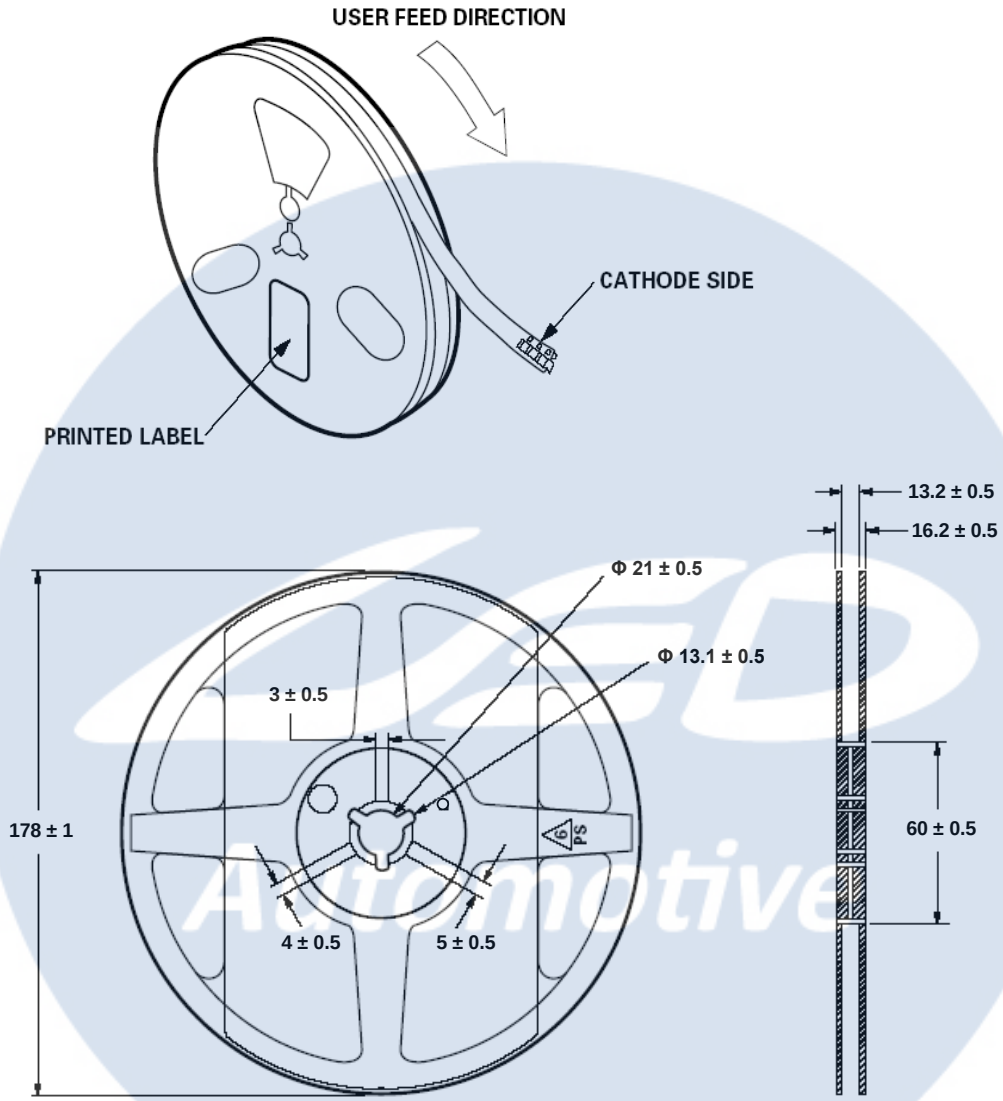

Notes:
1. Empty component pockets sealed with top cover tape.
2. 1000 pieces per reel.
3. Drawing not to scale.
4. All dimensions are in millimeters.

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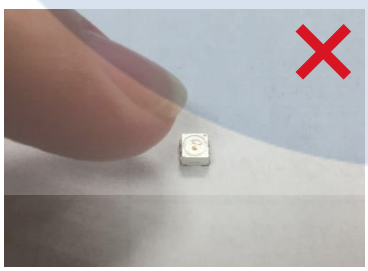
Precaution for Use

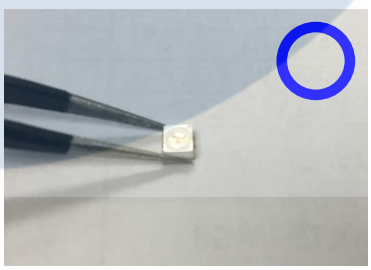
- Storage
  Please do not open the moisture barrier bag (MBB) more than one week. This may cause the leads of LED discoloration. We recommend storing ProLight's LEDs in a dry box after opening the MBB. The recommended storage conditions are temperature 5 to 30°C and humidity less than 40% RH. It is also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

Handling of Silicone LEDs

Notes for handling of silicone lens LEDs

- 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 must be prevented.
- Please do not mold over the silicone with another resin. (epoxy, urethane, etc)





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