

PLCC Series

ET-3528R-Y-136W

Datasheet

Ultra high luminous efficacy, combined with the flexibility in design due to its slim and miniature size, PLCC LED Series are optimized to be used as lighting for signboard or automotive signal lighting designs.



Features :

- High luminous Intensity and high efficiency
- Based on Red : AlGaInP technology
- Wide viewing angle : 120°
- Excellent performance and visibility
- Suitable for all SMT assembly methods
- IR reflow process compatible
- Environmental friendly; RoHS compliance

Typical Applications

- Signal and Symbol Luminaire
- Indoor and Outdoor Displays
- Backlighting (illuminated advertising, general lighting)
- Interior Automotive Lighting



Lighting Design Manufacturing Service

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Lighting Design Manufacturing Service

Product Nomenclature

The following table describes the available color, package size, and chip quantity.

E T - 3528 R - 1 3 6 W

X1 X2 X3 X4 X5 X6 X7

X1 LED Item		X2 Package		X3 Emitting Color		X4 Chip Quantity		X5~X6 Serial No.	X7 Feature	
Code	Type	Code	Type	Code	Type	Code	Type		Code	Type
ET	Edison Top LED	3528	3.5x2.8mm	R	Red	1	1pcs		W	White surface
				Y	Yellow (590nm)					

Figure 1. PLCC 3528 series Nomenclature

Environmental Compliance

PLCC 3528 series are compliant to the Restriction of Hazardous Substances Directive or RoHS. The restricted materials including lead, mercury cadmium hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE) are not used in PLCC 3528 series to provide an environmentally friendly product to the customers.

LED Package Dimension and Polarity

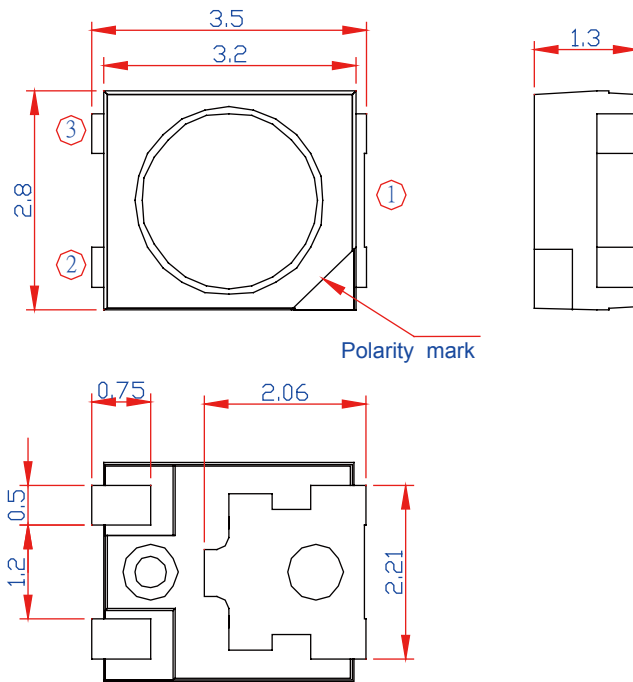


Figure 2. PLCC 3528 series Dimension

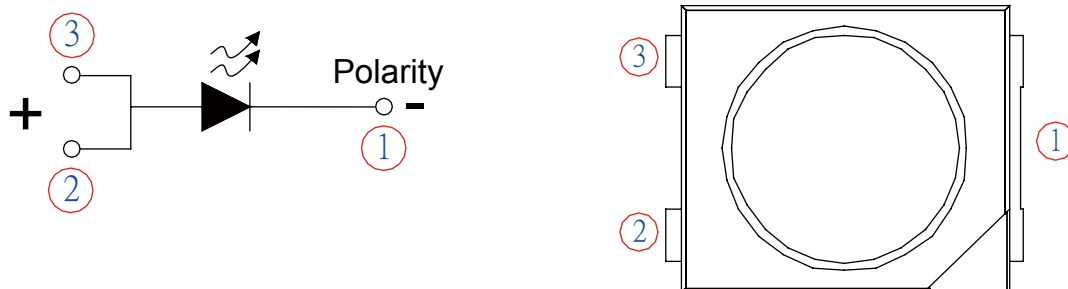


Figure 3. PLCC 3528 series circuit diagram

Notes:

1. All dimensions are measured in mm.
2. Tolerance : ± 0.20 mm

Absolute Maximum Ratings

The following table describe absolute maximum ratings of PLCC 3528 series.

Table 1. Absolute maximum ratings for PLCC 3528 series

Parameter	Rating (R/Y)	Units	Symbol
Forward Current	70	mA	I_F
Pulse Forward Current (Duty 1/10@1KHz)	200	mA	I_{FP}
Power Dissipation	200	mW	
Reverse Voltage	12	V	V_R
Forward Voltage	5	V	V_F
LED Junction Temperature	125	°C	T_J
Operating Temperature	-40 ~ +100	°C	
Storage Temperature	-40 ~ +110	°C	
Thermal Resistance	500	K/W	$R_{th\ J-A}$
	300		$R_{th\ J-S}$
Soldering Temperature	255~260	°C	
Manual Soldering at 350°C(Max.)	3	Sec	
ESD(HBM)	2,000	V	ESD_{HBM}

Notes:

1. Proper current derating must be observed to maintain junction temperature below the maximum at all time.
2. LEDs are not designed to be driven in reverse bias.

Luminous Intensity Characteristics

The following table describes luminous intensity of PLCC 3528 series.

Table 2. Luminous intensity characteristics at $I_f=70\text{mA}$ and $T_a=25^\circ\text{C}$ for PLCC 3528 series

Part Name	Color	Luminous intensity(mcd)			Luminous Flux Typ.(lm)
		Min.	Typ.	Max.	
ET-3528R-136W	Red	2,800	3,400	--	10
ET-3528Y-136W	Yellow	2,800	3,400	--	10

Note:

Luminous intensity is measured with an accuracy of $\pm 10\%$

Forward Voltage Characteristics

The following table describes forward voltage of PLCC 3528 series.

Table 3. Forward voltage characteristics at $I_f=70\text{mA}$ and $T_a=25^\circ\text{C}$ for PLCC 3528

Part Name	Color	Luminous intensity(mcd)			Luminous Flux Typ.(lm)
		Min.	Typ.	Max.	
ET-3528R-136W	Red	1.8	2.4	2.8	V
ET-3528Y-136W	Yellow	1.8	2.4	2.8	

Note:

Forward Voltage is measured with an accuracy of $\pm 0.1\text{V}$

JEDEC Information

JEDEC is used to determine what classification level should be used for initial reliability qualification. Once identified, the LEDs can be properly packaged, stored and handled to avoid subsequent thermal and mechanical damage during the assembly solder attachment and/or repair operation. The present moisture sensitivity standard contains six levels, the lower the level, the longer the devices floor life. PLCC 3528 series are certified at level 2a. This means PLCC 3528 series have a floor life of 4 weeks before PLCC 3528 series need to re-baked.

Table 4. JEDEC characteristics for PLCC3528

Level	Floor Life		Soak Requirements			
	Time	Conditions	Standard		Accelerated Environment	
			Time (hours)	Conditions	Time (hours)	Conditions
2a	4 weeks	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	696 +5/-0	$30^{\circ}\text{C} / 60\% \text{ RH}$	120 +1/-0	$60^{\circ}\text{C} / 60\% \text{ RH}$

Leve	Floor Life		Soak Requirements			
	Time	Condition	Standard		Accelerated Environment	
			Time (hours)	Condition	Time (hours)	Condition
1	Unlimited	$\leq 30^{\circ}\text{C} / 85\% \text{ RH}$	168 +5/-0	$85^{\circ}\text{C} / 85\% \text{ RH}$		
2	1 year	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	168 +5/-0	$85^{\circ}\text{C} / 60\% \text{ RH}$		
2a	4 weeks	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	696 ¹ +5/-0	$30^{\circ}\text{C} / 60\% \text{ RH}$	120 +1/-0	$60^{\circ}\text{C} / 60\% \text{ RH}$
3	168 hours	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	192 ¹ +5/-0	$30^{\circ}\text{C} / 60\% \text{ RH}$	40 +5/-0	$60^{\circ}\text{C} / 60\% \text{ RH}$
4	72 hours	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	96 ¹ +5/-0	$30^{\circ}\text{C} / 60\% \text{ RH}$	20 +5/-0	$60^{\circ}\text{C} / 60\% \text{ RH}$
5	48 hours	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	72 ¹ +5/-0	$30^{\circ}\text{C} / 60\% \text{ RH}$	15 +5/-0	$60^{\circ}\text{C} / 60\% \text{ RH}$
5a	24 hours	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	48 ¹ +5/-0	$30^{\circ}\text{C} / 60\% \text{ RH}$	10 +5/-0V	$60^{\circ}\text{C} / 60\% \text{ RH}$
6	Time on tabel (TOL)	$\leq 30^{\circ}\text{C} / 60\% \text{ RH}$	TOL	$30^{\circ}\text{C} / 60\% \text{ RH}$		

Note:

The standard soak time includes a default value of 24 hours for semiconductor manufacturer's exposure time (MET) between bake and bag, and includes the maximum time allowed out of the bag at the distributor's facility.

Reliability Test Items

The following table describes operating life, mechanical, and environmental tests performed on PLCC 3528 series.

Table 5. Reliability Test 1

Stress Tes	Stress Conditions	Stress Duration	Failure Criteria
Temperature and Humidity	60°C / 60%RH	120 hours	No catastrophics
IR Reflow	Peak temp.=255~260°C*3 times	3 times	

Table 6. Reliability Test 2

Stress Tes	Stress Conditions	Stress Duration	Failure Criteria
Low Temperature Storage	-40°C	1000 hours	No catastrophics
High Temperature and high Humidity Storage	85°C / 85%RH	1000 hours	
Ambient Temperature Life	25°C, $I_F = 70$ mA	1000 hours	
Temperature Cycle	-40°C/100°C, 30 min dwell <15min transfer	200 cycles	
Thermal Shock	-40 °C/ 100°C, 15 min dwell<10 sec transfer	200 cycles	

Notes:

1. Reliability test 2 is performed after reliability test 1.
2. Depending on the maximum derating curve.
3. Failure Criteria:
Electrical failures
 V_F Shift $\geq 10\%$
Luminous Intensity
 I_V Decay $\geq 35\%$

Color Spectrum and Radiation Pattern

Emission Angle Characteristics

Table 7. Emission angle Characteristics at $I_f=70\text{mA}$ and $T_a=25^\circ\text{C}$ for PLCC 3528 series

Part Name	Color	$2\theta_{1/2}$ (Typ.) Lambertian	Unit
ET-3528x-136W	-	120	Deg.

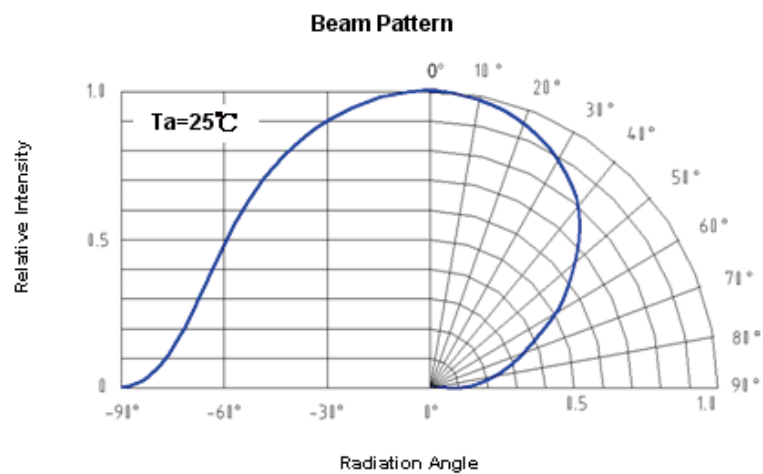


Figure 4. Beam pattern diagram for PLCC 3528 series

Wavelength Characteristics

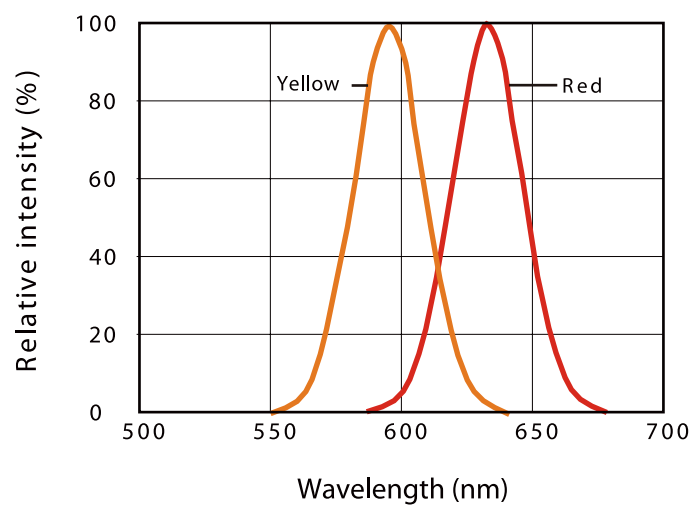


Figure 5. Wavelength & relative intensity for PLCC 3528 series

Optical and Electric Characteristics

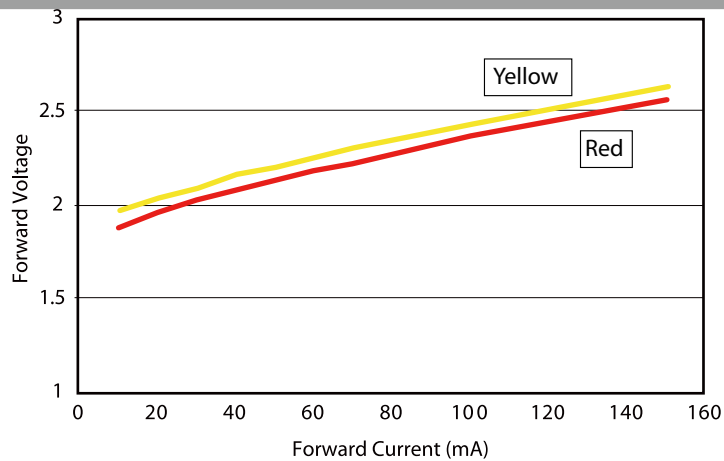


Figure 6. Forward current & relative intensity for PLCC 3528 series

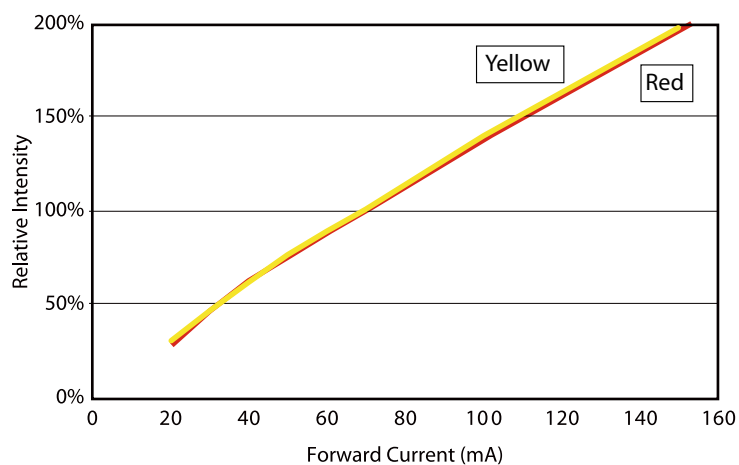


Figure 7. Relative Intensity & forward current for PLCC 3528 series

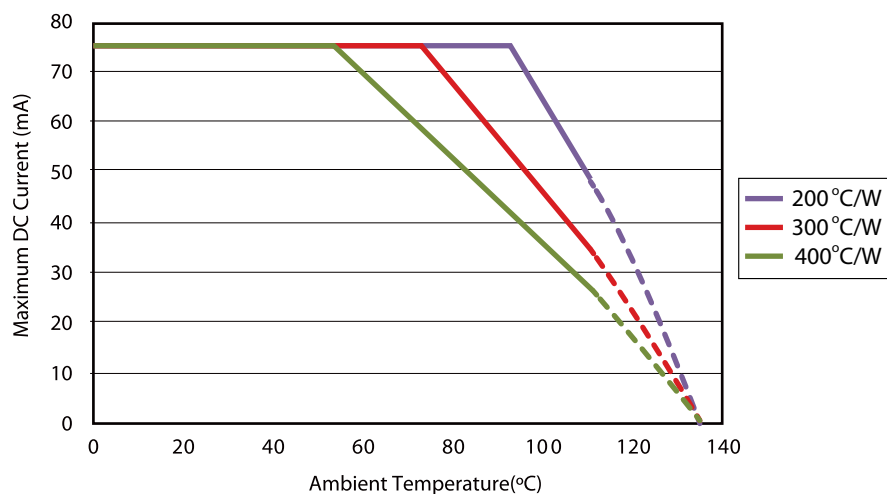


Figure 8. Maximum DC current & ambient temperature for PLCC 3528 series

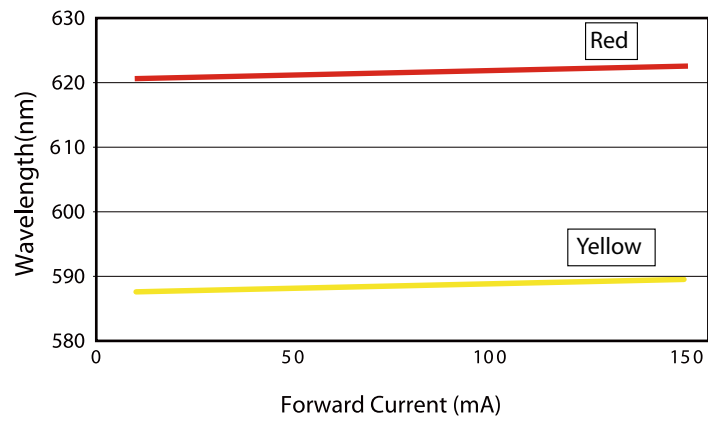


Figure 9. Forward current & wavelength for PLCC 3528 series

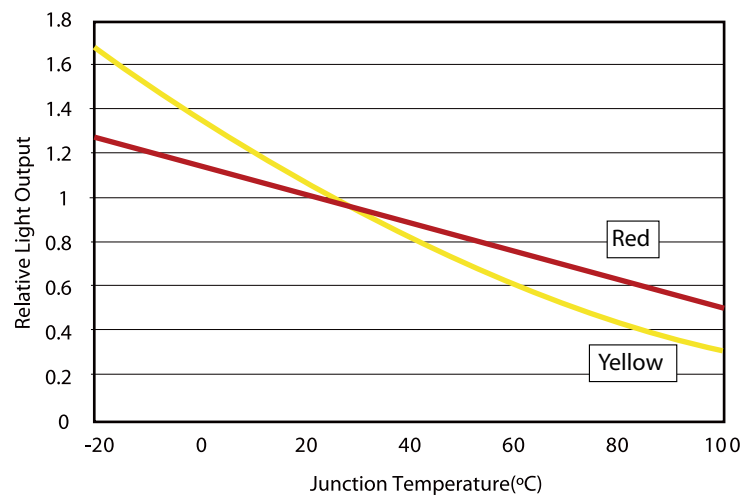


Figure 10. Relative light output & junction temperature for PLCC 3528 series

Product Soldering Instructions

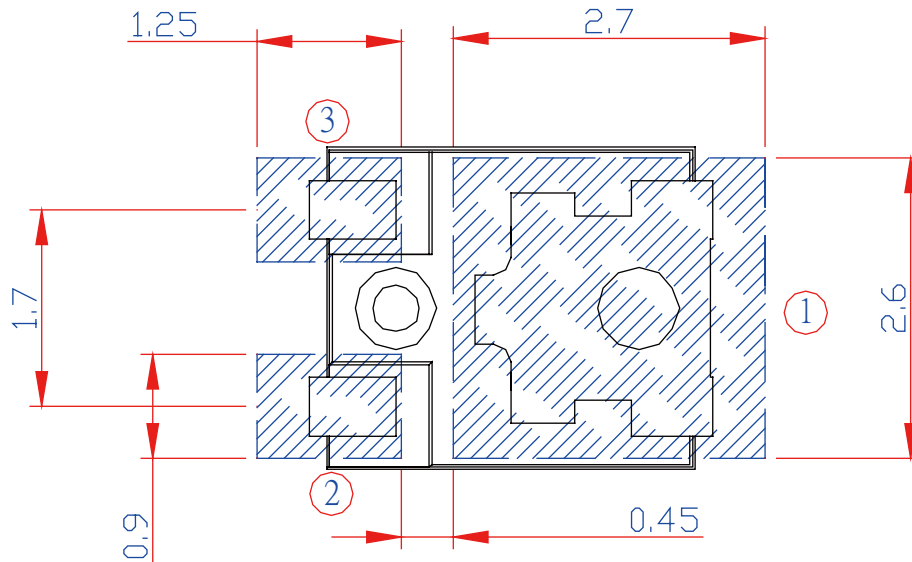


Figure 11. Pad dimension

Notes:

1. All dimensions are measured in mm.
2. Recommended material : MCPCB

Reflow Profile

The following reflow soldering profiles are provided for reference. It is recommended that users follow the recommended soldering profile provided by the manufacturer of the solder paste used

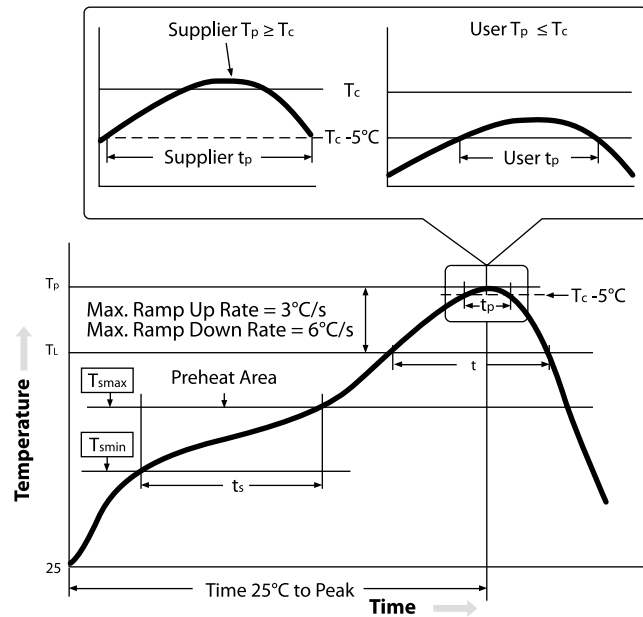


Figure 12. Reflow Profiles

Table 8. Table of Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T _{smin})	100°C	150 °C
Temperature max (T _{smax})	150°C	200 °C
Time (T _{smin} to T _{smax}) (t _s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3 °C/second max.
Liquidous temperature (T _L)	183 °C	217 °C
Time at liquidous (t _L)	60-150 seconds	60-150 seconds
Peak package body temperature (T _p)*	230 °C ~235°C *	255 °C ~260 °C *
Classification temperature (T _c)	235°C	260 °C
Time (t _p)** within 5 °C of the specified classification temperature (T _c)	20** seconds	30** seconds
Average ramp-down rate (T _p to T _{smax})	6°C/second max.	6°C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.

Notes:

* Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

Product Packaging Information

Tapeing Reel

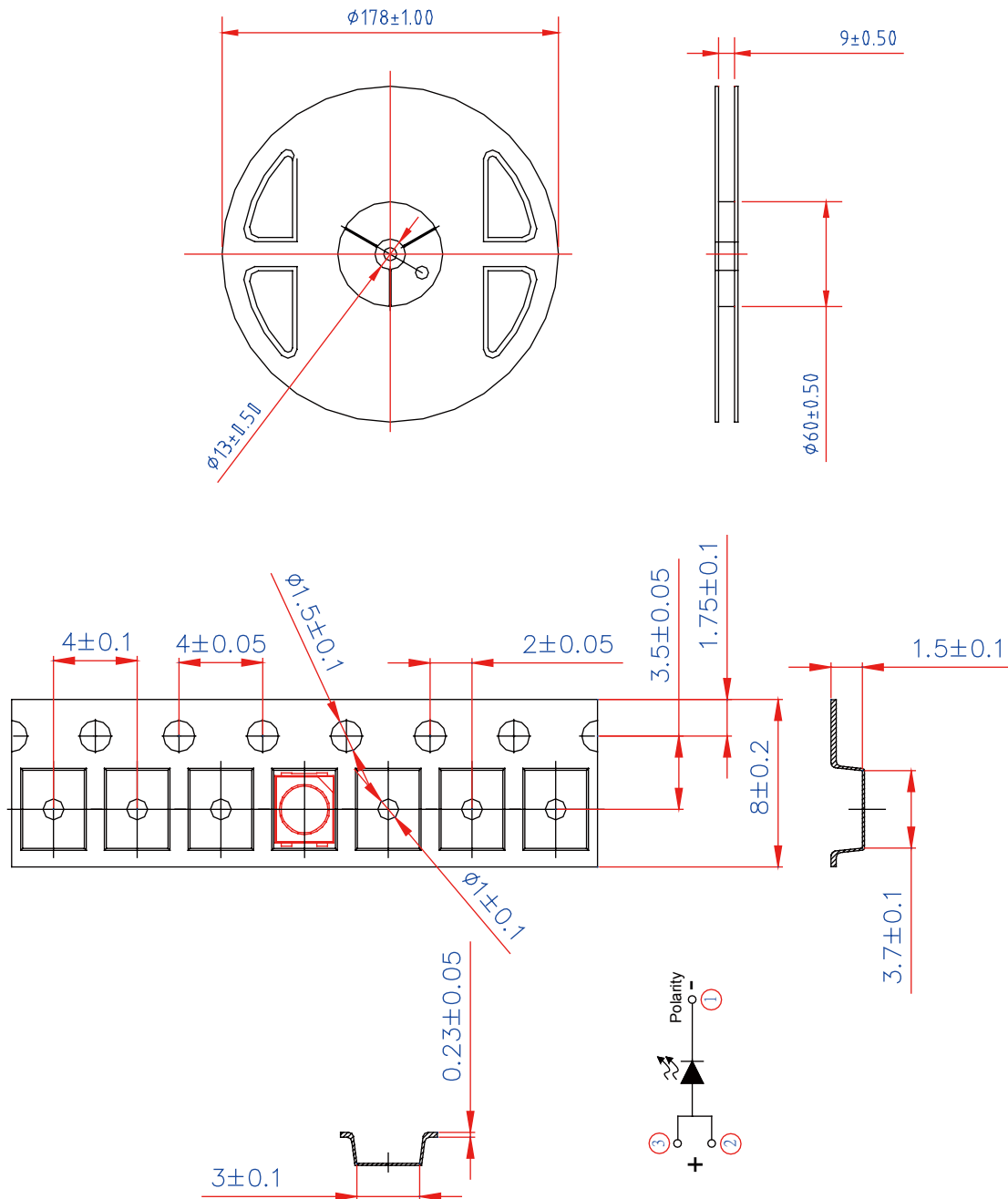


Figure 13. Taping reel dimensions

Packaging

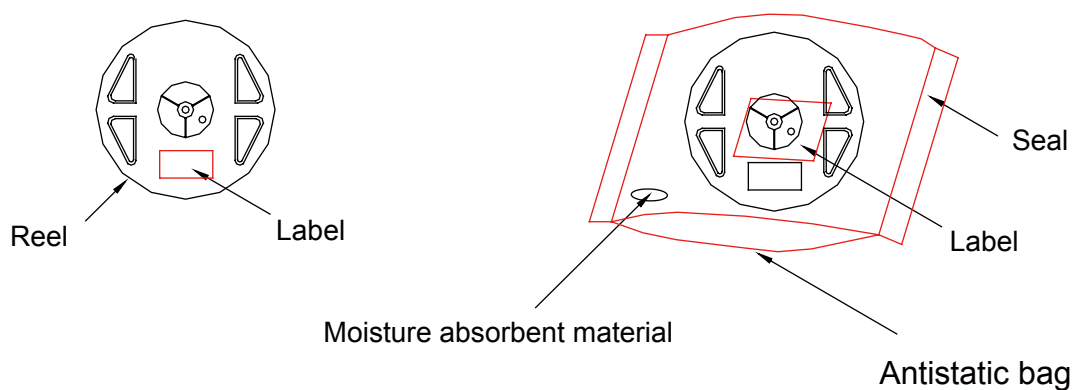


Figure 14. Packaging diagram

Package Label

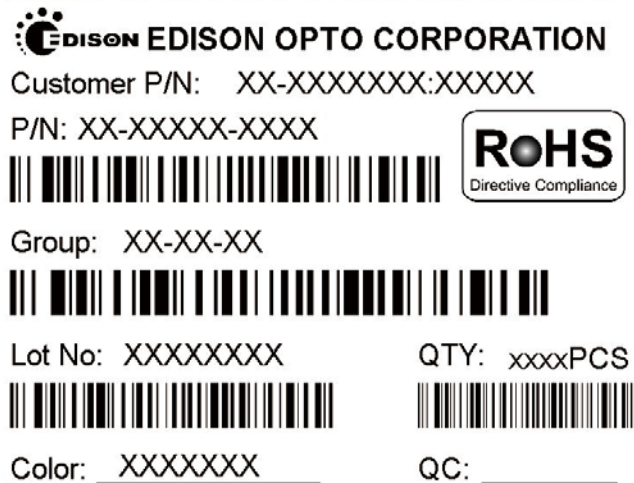


Figure 15. Package label

Table 9. Package dimensions and quantity

Item	Quantity	Total	Dimensions(mm)
Reel	2,000pcs	2,000pcs	Diameter=178
Box	5 reels	10,000pcs	240*235*67
Carton	5 boxes	50,000pcs	353*254*256

Precaution for Use

Storage

1.1 Before opening the package

The LEDs should be kept at $<40^{\circ}\text{C}$ & $<90\%\text{RH}$. The LEDs should be used within a year. When storing the LEDs, moisture proof package with absorbent material (silica gel) is recommended.

1.2 After opening the package

The LEDs should be kept at $\leq 30^{\circ}\text{C}$ & $\leq 60\%\text{RH}$. The LEDs should be soldered within 4 weeks after opening the moisture proof package.

If unused LEDs remain, they should be stored in moisture proof packages, such as sealed containers with moisture proof package within absorbent material (silica gel). It is also recommended to return the unused LEDs to the original moisture proof package and to seal the moisture proof package again.

If the moisture absorbent material (silica gel) vapors or expires the expiration date, baking treatment should be performed by using the following conditions : 60°C for 20 hours.

The LEDs electrode and leadframe comprise a silver plated copper alloy. The silver surface may be affected by environments. Please avoid conditions which may cause the LEDs being corroded or discolored. The corrosion or discoloration might lower solderability or affect optical characteristics.

Please avoid rapid transition in ambient temperature, especially in high humidity environments where condensation can occur.

Static electricity

The products are sensitive to static electricity and highly taken care when handling them.

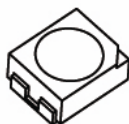
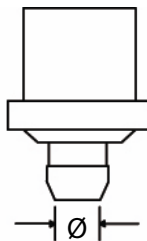
Static electricity or surge voltage will damage the LEDs. It is recommended to wear an anti-electrostatic wristband or an anti-electrostatic glove when handling the LEDs.

All devices, equipments and machinery must be properly grounded. It is recommended that measures be taken against surge voltage to the equipment that mounts the LEDs.

Pick and Place

Recommended conditions: Outer nozzle $\varnothing > 2.4\text{ mm}$

*Avoid direct contact to the encapsulant with picking up nozzle. Failure to comply might result in pick and place processes or damage to encapsulant. In the worst cases, catastrophic failure of the LEDs due to wire deformation and/or breakage.



Notes:

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Forward Voltage Ranks

Table 10. Forward voltage rank at Ta=25°C

Color of Emission	Bin	Min	Max	Unit
Red Yellow	VD	1.8	2.1	V
	VE	2.1	2.4	
	VF	2.4	2.7	
	VG	2.7	3.0	
	VH	3.0	3.3	
	VI	3.3	3.6	

Note:

Forward voltage measurement allowance is $\pm 0.1V$.

Luminous Intensity Ranks

Table 11. Luminous intensity rank at $I_f=70mA$ and Ta=25°C

Color of Emission	Bin	Min	Max	Unit
Red Yellow	U	2,150	2,450	mcd
	V	2,450	2,800	
	W	2,800	3,200	
	X	3,200	3,650	
	Y	3,650	4,150	
	Z	4,150	4,700	
	AA	4,700	5,400	
	AB	5,400	6,300	

Note:

Luminous Intensity Measurement Allowance is $\pm 10\%$

Dominant Wavelength Ranks

Table 12. Dominant Wavelength rank at $I_f=70mA$ and Ta=25°C

Color of Emission	Bin	Min	Max	Unit
Red	F	620	630	nm
	W	585	588	
Yellow	X	588	591	
	Y	591	595	

Note:

Dominant Wavelength is measured with an accuracy of $\pm 1nm$