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Technical Notes

Contents

I. Bin Codes

SunLED products are bin sorted for intensity and wavelength to ensure consistency in optical output. Refer to below tables for the binning methodology and reference below section (III. Application Notes [Additional Remarks]) for identification of bin codes on parts.

Intensity Bin Codes (back to top)

Intensity Bin Codes for High Intensity LEDs (IF=20mA, Ta=25°C, Tolerance=±15%)

Bin Code	Intensity in mcd		Bin Code	Intensity in mcd		Bin Code	Intensity in mcd	
	Min.	Max.		Min.	Max.		Min.	Max.
A	2	3	T	700	1000	ZH	9000	11000
B	3	5	U	1000	1300	ZM	11000	14000
C	5	8	V	1300	1600	ZN	14000	18000
D	8	12	W	1600	1900	ZP	18000	22000
E	12	20	X	1900	2300	ZQ	22000	27000
F	20	40	Y	2300	2700	ZR	27000	35000
G	40	55	Z	2700	3100	ZS	35000	43000
H	55	80	ZA	3100	3600	ZT	43000	55000
M	80	120	ZB	3600	4200	ZU	55000	75000
N	120	200	ZC	4200	5000	ZV	75000	130000
P	200	300	ZD	5000	6000	ZW	130000	200000
Q	300	400	ZE	6000	7000	ZX	200000	320000
R	400	500	ZF	7000	8000	ZY	320000	490000
S	500	700	ZG	8000	9000	ZZ	490000	800000

Intensity Bin Codes for Standard LEDs (IF=10mA, Ta=25°C, Tolerance=±15%)

Bin Code	Intensity in mcd		Bin Code	Intensity in mcd		Bin Code	Intensity in mcd	
	Min.	Max.		Min.	Max		Min.	Max.
F	0.1	0.2	R	15	20	ZB	550	700
G	0.2	0.35	S	20	30	ZC	700	1000
H	0.35	0.5	T	30	50	ZD	1000	1600
I	0.5	0.8	U	50	80	ZE	1600	2200
K	0.8	1.2	V	80	120	ZF	2200	2800
L	1.2	2	W	120	180	ZG	2800	3400
M	2	4	X	180	250	ZH	3400	4300
N	4	6	Y	250	320	ZM	4300	5200
P	6	10	Z	320	450	ZN	5200	6300
Q	10	15	ZA	450	550	ZP	6300	7400

Intensity Bin Codes cont'd (back to top)

Intensity Bin Codes for High Powered LEDs (Ta=25°C, Tolerance=±15%)

Bin Code	Luminous Flux in lm		Bin Code	Luminous Flux in lm		Bin Code	Luminous Flux in lm	
	Min.	Max.		Min.	Max.		Min.	Max.
A1	0.5	0.6	B1	10	12	C4	160	180
A2	0.6	0.7	B2	12	14	C5	180	210
A3	0.7	0.8	B3	14	17	C6	210	240
A4	0.8	1	B4	17	20	C7	240	280
A5	1	1.2	B5	20	24	C8	280	320
A6	1.2	1.4	B6	24	29	C9	320	370
A7	1.4	1.7	B7	29	35	C10	370	430
A8	1.7	2	B8	35	42	C11	430	490
A9	2	2.4	B9	42	50	C12	490	560
A10	2.4	2.9	B10	50	60	C13	560	640
A11	2.9	3.5	B11	60	70	C14	640	740
A12	3.5	4.2	B12	70	80	C15	740	850
A13	4.2	5	B13	80	90	C16	850	1000
A14	5	6	B14	90	100	D1	1000	1200
A15	6	7.2	C1	100	120	D2	1200	1400
A16	7.2	8.6	C2	120	140	D3	1400	1600
A17	8.6	10	C3	140	160	D4	1600	1800

Intensity Bin Codes for LED Displays (IF=10mA, Ta=25°C, Tolerance=±15%)

Bin Code	Intensity in ucd		Bin Code	Intensity in ucd		Bin Code	Intensity in ucd	
	Min.	Max.		Min.	Max.		Min.	Max.
C	70	140	L	3600	5600	T	88000	150000
D	140	240	M	5600	9000	U	150000	255000
E	240	360	N	9000	14000	V	255000	433000
F	360	560	P	14000	21000	W	433000	736000
G	560	900	Q	21000	31000	X	736000	1251000
H	900	1400	R	31000	52000	Y	1251000	2126000
I	1400	2200	S	52000	88000	Z	2126000	3614000
K	2200	3600						

Intensity Bin Codes cont'd (back to top)

Intensity Bin Codes for Infrared Emitting Diodes (IF=20mA, Ta=25°C, Tolerance=±15%)

Bin Code	Intensity in mW/sr		Bin Code	Intensity in mW/sr		Bin Code	Intensity in mW/sr	
	Min.	Max.		Min.	Max.		Min.	Max.
AK	0.8	1.2	C	5	8	F	20	40
AL	1.2	2	D	8	12	G	40	55
A	2	3	E	12	20	H	55	80
B	3	5						

Bin Codes for NPN Phototransistors (Ta=25°C, Tolerance=±15%)

Bin Code	Photocurrent in mA		Bin Code	Photocurrent in mA		Bin Code	Photocurrent in mA	
	Min.	Max.		Min.	Max.		Min.	Max.
F	0.1	0.2	I	0.5	0.8	M	2	4
G	0.2	0.35	K	0.8	1.2	N	4	6
H	0.35	0.5	L	1.2	2	P	6	10

Wavelength Bin Codes (back to top)

Wavelength (λD) Bin Codes for Yellow LEDs (Ta=25°C, Tolerance=±1nm)

Bin Code	Wavelength in nm		Bin Code	Wavelength in nm		Bin Code	Wavelength in nm	
	Min.	Max.		Min.	Max.		Min.	Max.
1	581	584	4	588	590	7	594	597
2	584	586	5	590	592	8	597	600
3	586	588	6	592	594			

Wavelength (λD) Bin Codes for Green LEDs (Ta=25°C, Tolerance=±1nm)

Bin Code	Wavelength in nm		Bin Code	Wavelength in nm		Bin Code	Wavelength in nm	
	Min.	Max.		Min.	Max.		Min.	Max.
0	556	559	3	563	565	6	569	571
1	559	561	4	565	567	7	571	573
2	561	563	5	567	569	8	573	575

Wavelength (λD) Bin Codes for True Green LEDs (Ta=25°C, Tolerance=±1nm)

Bin Code	Wavelength in nm		Bin Code	Wavelength in nm		Bin Code	Wavelength in nm	
	Min.	Max.		Min.	Max.		Min.	Max.
0	510	515	2	520	525	4	530	535
1	515	520	3	525	530	5	535	540

Wavelength Bin Codes cont'd (back to top)

Wavelength (λD) Bin Codes for Aqua Green LEDs (Ta=25°C, Tolerance=±1nm)

Bin Code	Wavelength in nm		Bin Code	Wavelength in nm		Bin Code	Wavelength in nm	
	Min.	Max.		Min.	Max.		Min.	Max.
1	497	501	4	506	508	6	510	512
2	501	504	5	508	510	7	512	515
3	504	506						

Wavelength (λD) Bin Codes for Blue LEDs (Ta=25°C, Tolerance=±1nm)

Bin Code	Wavelength in nm		Bin Code	Wavelength in nm		Bin Code	Wavelength in nm	
	Min.	Max.		Min.	Max.		Min.	Max.
1	445	450	2A	466	469	4B	477	479
2	450	455	2B	469	471	5A	479	481
3	455	460	3A	471	473	5B	481	483
1A	460	463	3B	473	475	5C	483	486
1B	463	466	4A	475	477			

CIE 1931 Chromaticity Diagram (back to top)

SunLED white LEDs are color sorted based on either CIE (coordinates) or CCT (Kelvin). Refer to below diagram (*Fig. 1*).

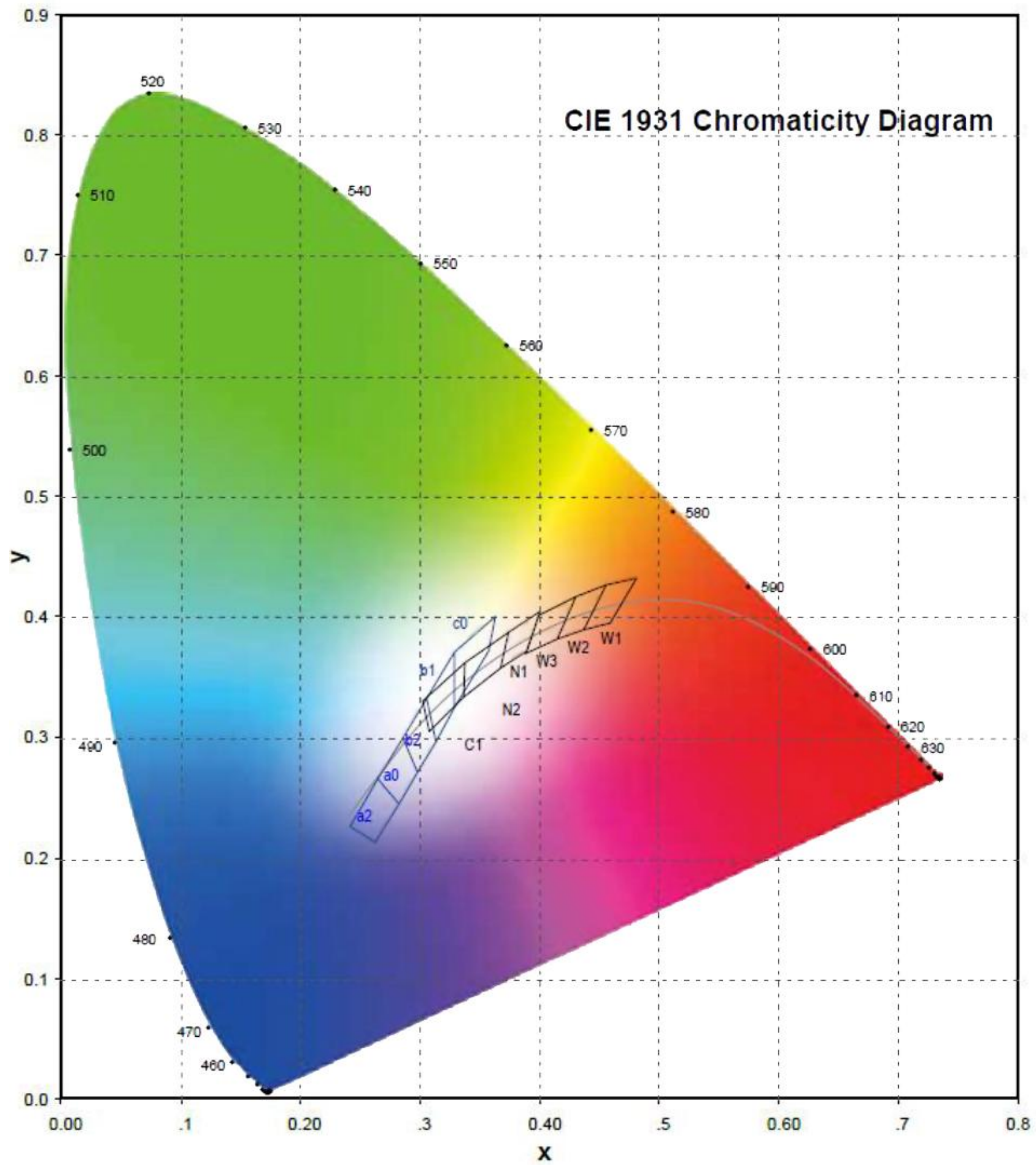


Fig. 1

CIE 1931 Chromaticity Diagram cont'd (back to top)

Refer to below tables for color coordinates and temperatures based on the bin codes indicated on the above CIE 1931 diagram. Note that these are the general binning methodology used by SunLED. Always refer to the latest datasheets for each specific part for most accurate binning data.

CIE Bin Codes

Bin Code	Coordinates X	Coordinates Y	CCT
a2	0.263	0.213	15000K
	0.282	0.245	
	0.265	0.265	
	0.242	0.226	
a0	0.282	0.245	9000 – 15000K
	0.298	0.271	
	0.286	0.299	
	0.265	0.265	
b2	0.298	0.271	6800 – 9000K
	0.313	0.296	
	0.306	0.332	
	0.286	0.299	
b1	0.313	0.296	5600 – 6800K
	0.329	0.325	
	0.329	0.371	
	0.306	0.332	
c0	0.329	0.325	4600 – 5600K
	0.358	0.372	
	0.363	0.400	
	0.329	0.371	

CCT Bin Codes

Bin Code	CCT	Coordinates X	Coordinates Y
W1	2580 – 2870K	0.4373	0.3893
		0.4593	0.3944
		0.4813	0.4319
		0.4562	0.4260
W2	2870 – 3220K	0.4147	0.3814
		0.4373	0.3893
		0.4562	0.4260
		0.4299	0.4165
W3	3220 – 3710K	0.3889	0.3690
		0.4147	0.3814
		0.4299	0.4165
		0.3996	0.4015
N1	3710 – 4260K	0.3670	0.3578
		0.3898	0.3716
		0.4006	0.4044
		0.3736	0.3874
N2	4260 – 5310K	0.3361	0.3328
		0.3670	0.3578
		0.3736	0.3874
		0.3376	0.3616
C1	5310 - 7040K	0.3081	0.3049
		0.3364	0.3328
		0.3376	0.3616
		0.3028	0.3304

II. Reliability Tests

SunLED products undergo a full range of stringent tests to ensure reliability standards are met. SMD LEDs, LED Lamps, and Displays are subject to tests which conform to engineering standards. Refer to below tables for details.

SMD LEDs (back to top)

Test Criteria	Test Conditions	Description	Engineering Standard
Continuous operating	IF=Max Ta=25°C RH=75%RH T=1000hrs	To determine the resistance of the device when operating under electrical stress	EIAJ ED-4701 100 101
High temperature storage	Ta=100°C T=1000hrs	To evaluate the product durability after long-term storage in high temperature	EIAJ ED-4701 200 201
Low temperature storage	Ta=-40°C T=1000hrs	To evaluate the product durability after long-term storage in low temperature	EIAJ ED-4701 200 202
High temperature & humidity storage	Ta=60°C T=1000hrs RH=90%RH	To evaluate the product durability under long-term high temperature and high humidity storage	EIAJ ED-4701 100 103
High temperature & humidity operating	IF=Max RH=90%RH Ta=60°C T=1000hrs	To determine the resistance of the device under electrical and thermal stress	EIAJ ED-4701 100 102
Solderability	Ta=245°C T=5sec	To evaluate solderability on leads of the device	EIAJ ED-4701 300 303
Soldering resistance	Ta=260°C T=10sec	To determine the thermal resistance characteristics of the device to sudden exposures at extreme changes in temperature during Tin-dipping	EIAJ ED-4701 300 302
Temperature cycling	Ta=-40 to 25 to 100 to 25°C T=(30~5~30~5min) x 10 cycles	To determine the resistance of the device for storage under extreme temperature for hours	EIAJ ED-4701 100 105
Temperature cycling operating	Ta=-40 to 25 to 100 to 25°C T=(30~5~30~5min) x 10 cycles IF=Max	To determine the resistance of the device under extreme temperature for hours	/
Thermal shock	Ta=0 to 100°C T=(5~5min) x 100 cycles	To determine the resistance of the device to sudden extreme changes in high and low temperature	EIAJ ED-4701 300 307

LED Lamps (back to top)

Test Criteria	Test Conditions	Description	Engineering Standard
Continuous operating	IF=Max Ta=25°C RH=75%RH T=1000hrs	To determine the resistance of the device when operating under electrical stress	EIAJ ED-4701 100 101
High temperature storage	Ta=100°C T=1000hrs	To evaluate the product durability after long-term storage in high temperature	EIAJ ED-4701 200 201
Low temperature storage	Ta=-40°C T=1000hrs	To evaluate the product durability after long-term storage in low temperature	EIAJ ED-4701 200 202
High temperature & humidity storage	Ta=60°C T=1000hrs RH=90%RH	To evaluate the product durability after long-term high temperature and high humidity storage	EIAJ ED-4701 100 103
High temperature & humidity operating	IF=Max RH=90RH Ta=60°C T=1000hrs	To determine the resistance of the device under electrical and thermal stress	EIAJ ED-4701 100 102
Lead frame bending	T=3 Cycles T=Bend 90°	To evaluate the product durability against mechanical stress applied to the leads	/
Lead frame pulling	T=30sec W=1kg	To evaluate the product durability against mechanical stress	/
Solderability	Ta=245°C T=5sec	To evaluate solderability on leads of device	EIAJ ED-4701 300 303
Soldering resistance	Ta=260°C T=10sec	To determine the thermal resistance characteristics of the device to sudden exposures at extreme changes in temperature during Tin-dipping	EIAJ ED-4701 300 302
Temperature cycling	Ta=-40 to 25 to 100 to 25°C T=(30~5~30~5min) x 10 cycles	To determine the resistance of the device for storage under extreme temperature for hours	EIAJ ED-4701 100 105
Temperature cycling operating	Ta=-40 to 25 to 100 to 25°C T=(30~5~30~5min) x 10 cycles IF=Max	To determine the resistance of the device under extreme temperature for hours	/
Thermal shock	Ta=0 to 100°C T=(5~5min) x 100 cycles	To determine the resistance of the device to sudden extreme changes in high and low temperature	EIAJ ED-4701 300 307

LED Displays (back to top)

Test Criteria	Test Conditions	Description	Engineering Standard
Continuous operating	IF=Max Ta=25°C RH=75%RH T=1000hrs	To determine the resistance of the device when operating under electrical stress	EIAJ ED-4701 100 101
High temperature storage	Ta=100°C T=1000hrs	To evaluate the product durability after long-term storage in high temperature	EIAJ ED-4701 200 201
Low temperature storage	Ta=-40°C T=1000hrs	To evaluate the product durability after long-term storage in low temperature	EIAJ ED-4701 200 202
High temperature & humidity storage	Ta=60°C T=1000hrs RH=90%RH	To evaluate the product durability after long-term high temperature and high humidity storage	EIAJ ED-4701 100 103
Solderability	Ta=245°C T=5sec	To evaluate solderability on leads of device	EIAJ ED-4701 300 303
Soldering resistance	Ta=260°C T=10sec	To determine the thermal resistance characteristics of the device to sudden exposures at extreme changes in temperature during Tin-dipping	EIAJ ED-4701 300 302
Temperature cycling	Ta=-40 to 25 to 100 to 25°C T=(30~5~30~5min) x 10 cycles	To determine the resistance of the device for storage under extreme temperature for hours	EIAJ ED-4701 100 105
Thermal shock	Ta=0 to 100°C T=(5~5min) x 100 cycles	To determine the resistance of the device to sudden extreme changes in high and low temperature	EIAJ ED-4701 300 307

III. Application Notes

Storage, MSL, and Humidity Conditions (back to top)

SMD LEDs are considered moisture sensitive and storage/usage precautions must be taken to prevent damage to the internal materials. Excess moisture trapped within the component may cause internal vapor pressure during solder reflow leading to possible delamination of the die or wire bond.

1. Do not store LEDs in an environment where high levels of moisture or corrosive gases are present and keep away from rapid transitions in ambient temperature. Recommended storage conditions for each type of LED product as per below:

Product Type	Temperature	Humidity
SMD LED	< 40°C	< 90%RH
Through-hole LED	≤ 30°C	< 60%RH
LED Displays	5°C to 30°C	< 60%RH

Note: Above conditions are based on products in original sealed packaging

2. All SMD LEDs are packaged in moisture barrier bags (MBB) with a label indicating the moisture sensitivity level (MSL).
2. Storage conditions for unopened MBB: Temperature < 40°C, Humidity < 90%RH
3. Floor life for opened MBB follows the corresponding MSL as per below:

IPC/JEDEC J-STD-020

MSL	Floor Life	
	Time	Conditions
1	Unlimited	≤30°C / 85%RH
2	1 Year	≤30°C / 60%RH
2a	4 Weeks	≤30°C / 60%RH
3	168 Hours	≤30°C / 60%RH
4	72 Hours	≤30°C / 60%RH
5	48 Hours	≤30°C / 60%RH
5a	24 Hours	≤30°C / 60%RH
6	Time indicated on label	≤30°C / 60%RH

4. All SMD LEDs are packaged with desiccants and a humidity indicator card (HIC). If the LEDs are not used within the specific floor life or if the HIC has indicated presence of moisture, the following baking procedure must be taken:

Condition	Temperature	Humidity	Bake Duration
LEDs inside carrier tape	60°C ± 3°C	<5% RH	100 hours
LEDs outside carrier tape	110°C	-	10 hours

Cleaning (back to top)

1. Do not use harsh organic solvents such as acetone, trichloroethylene, Chlorsan, and/or diflon solvent for cleaning as they may cause damage or hazing to the LED lens.
2. Recommended solvents for cleaning: deionized water or isopropyl alcohol.
3. Special attention should be taken if other chemicals are used for cleaning as they may damage the epoxy lens or housing.
4. Any cleaning should take place at room temperature and the wash duration should not exceed one minute.
5. Use forced-air drying immediately following water wash to remove excess moisture.

Lead Forming (back to top)

1. Any lead forming or bending must be done prior to soldering.
2. Avoid bending leads at the same point more than once as it may compromise the integrity of the leads.
3. Minimum clearance of 3mm is required between the base of the LED lens and the bend location. Refer to below diagram (*Fig. 2*).

Fig. 2

4. Lead forming should only be done with proper tools such as a jig and/or radio pliers. The upper section of the leads should be secured firmly such that the bending force is not exerted on the LED body. Refer to below diagram (*Fig. 3*) for recommended lead bending method.

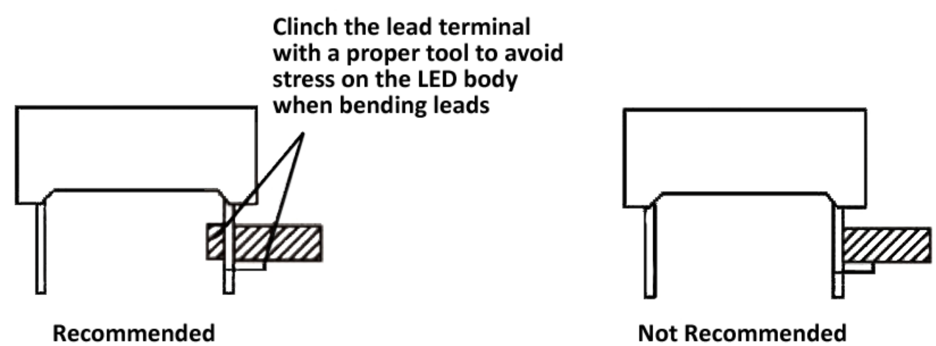


Fig. 3

Mounting Methods (back to top)

1. The LED mounting process should avoid stress applied to the lead terminals.
2. When mounting components for assembly, ensure the terminal pitch matches the hole pitch of the PCB to prevent pressure applied to the LED body due to spreading or pinching of the lead terminals. Refer to below diagram (*Fig. 4*) for recommended LED mounting method.

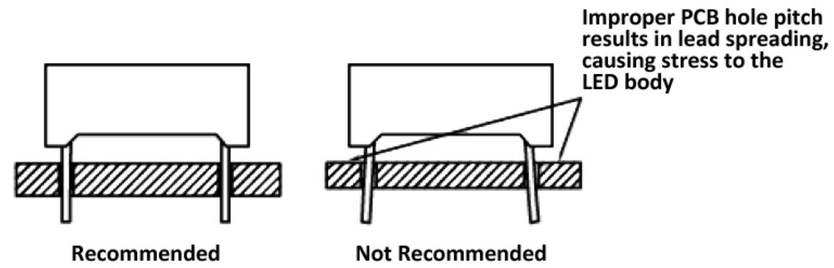


Fig. 4

3. To ensure proper mounting, lead forming may be required based upon PCB design layout. All lead forming procedures should follow the lead forming notes as described above. Refer to below diagram (*Fig. 5*) for examples of proper lead forming.

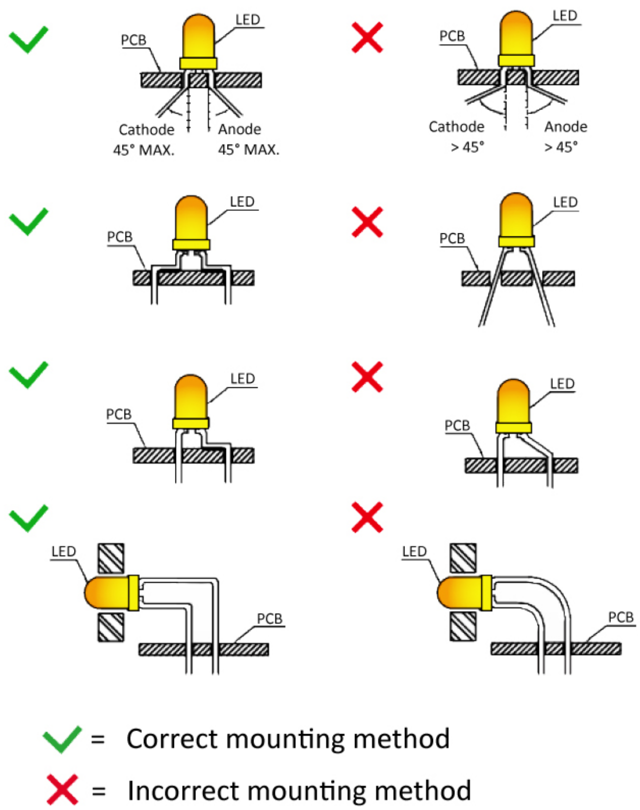


Fig. 5

Mounting Methods cont'd (back to top)

4. Avoid additional lead forming after LEDs have been mounted on the PCB.
5. Stand-offs or spacers should be used if the LED is required to be mounted at a certain height above the PCB.

Soldering (back to top)

1. Manual soldering operations should only be for repairs and reworks unless otherwise noted on product specifications.
2. Maximum soldering iron temperatures for manual soldering:
   a. Pb-Sn solder: 300°C
   b. Pb-Free solder: 350°C
   c. All LEDs using InGaN material (Blue, Green, White): 280°C
3. The soldering iron should never touch the epoxy lens. Contact duration with the component should not exceed 3 seconds.
4. Do not apply stress or pressure to the leads when the component is heated above 80°C as possible damage to the internal wire bonds may occur.
5. During soldering, component covers and holders should leave enough clearance to avoid any stress applied to the LED. Refer to below diagram (*Fig. 6*) for examples of proper method.

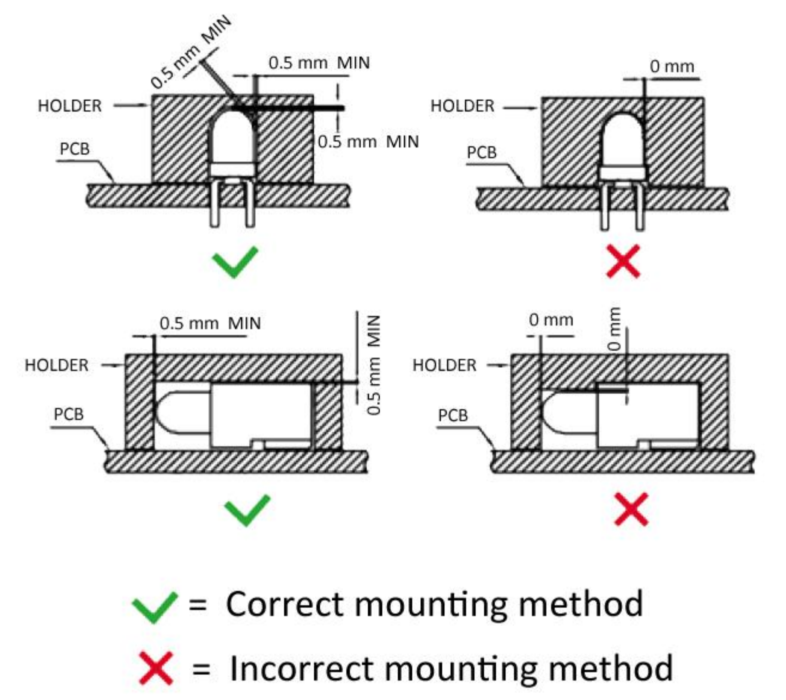
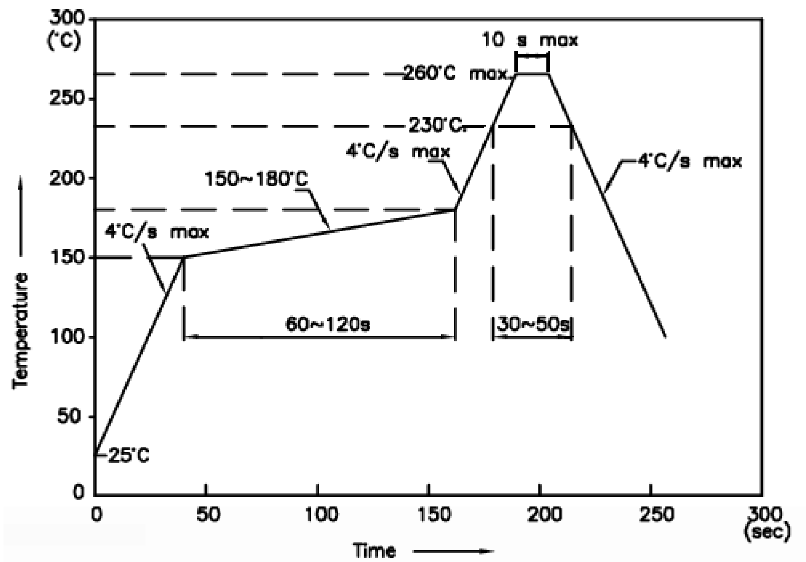


Fig. 6

Soldering cont'd (back to top)

6. Refer to below diagrams for recommended soldering profiles.
   a. SMD LEDs: Reflow Soldering – Pb-Free Solder (*Fig. 7*) | Pb-Sn Solder (*Fig. 8*)
      - No more than two soldering passes except SMD CBIs which should not exceed one pass
   b. Through-hole LEDs: Wave Soldering – Pb-Free Solder (*Fig. 9*) | Pb-Sn Solder (*Fig. 10*)
      - No more than one soldering pass

Reflow Soldering Profile (Pb-Free Solder)



Notes:
1. Maximum soldering temperature should not exceed 260°C
2. Recommended reflow temperature: 245°C to 260°C
3. Do not apply stress to the epoxy resin during high temperature conditions

Fig. 7

Reflow Soldering Profile (Pb-Sn Solder)

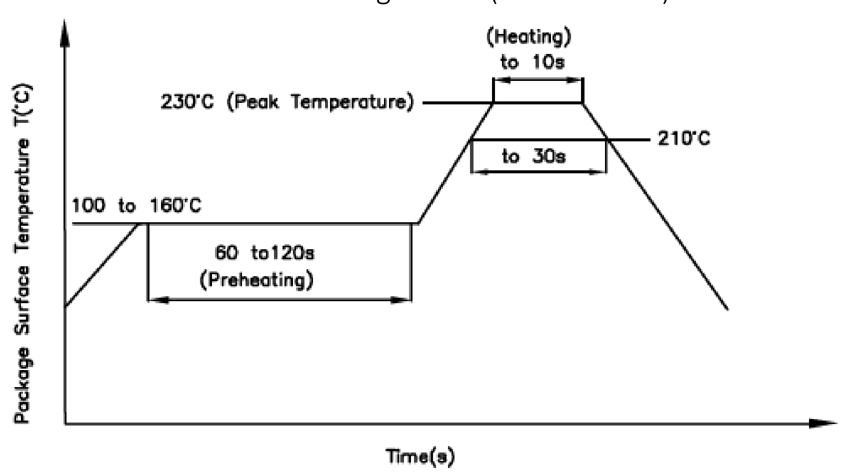
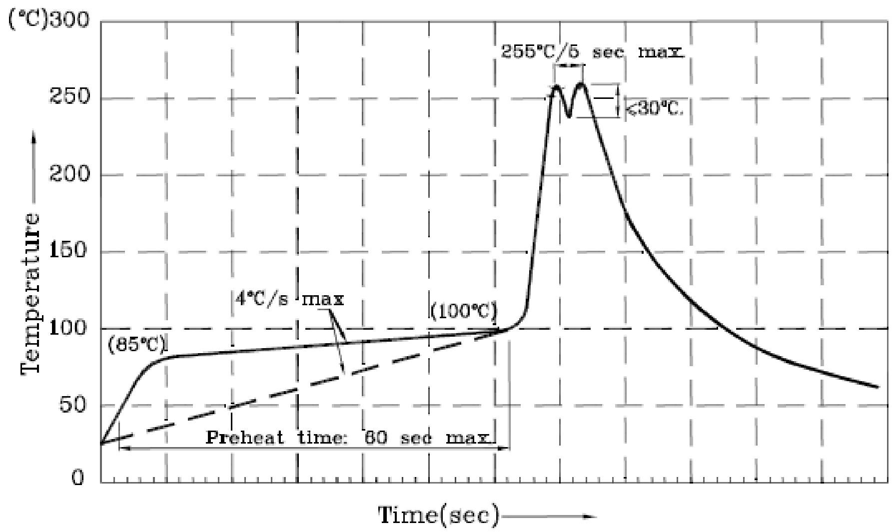


Fig. 8

Soldering cont'd (back to top)

Wave Soldering Profile (Pb-Free Solder)



Notes:

1. Recommend pre-heat temperature of 105°C or less prior to immersion in solder wave. Maximum solder bath temperature: 260°C
2. Peak wave soldering temperature: 245°C to 255°C for 3s (5s max)
3. Do not apply stress to the epoxy resin while temperature is above 85°C
4. SAC 305 solder alloy recommended and no more than one wave soldering pass

Fig. 9

Wave Soldering Profile (Pb-Sn Solder)

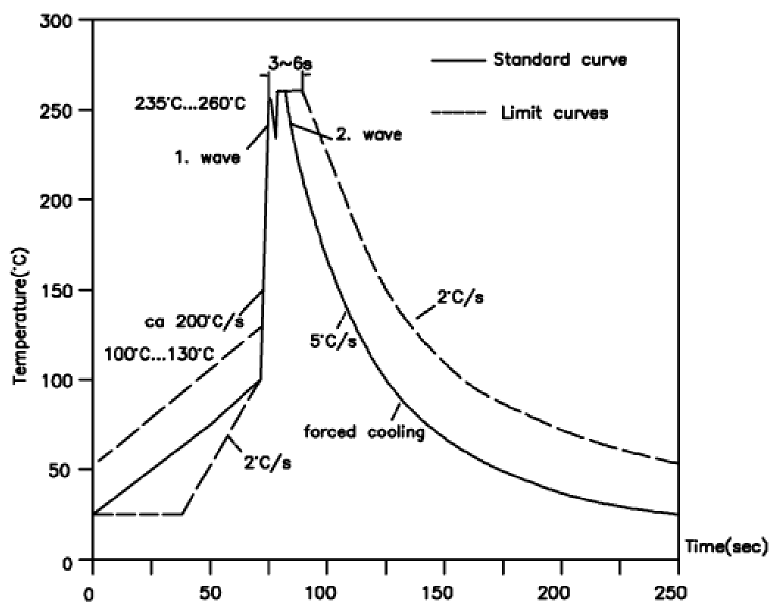


Fig. 10

Soldering cont'd (back to top)

7. Refer to the appropriate product datasheet for details on specific soldering pay layout. To ensure proper bonding and setting of the LED, solder paste must be evenly applied to each soldering pad. Refer to below diagram (*Fig. 11)* for example of improper solder application.

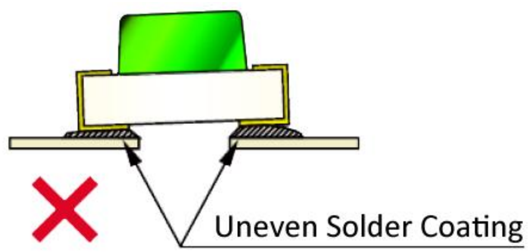


Fig. 11

8. After soldering, allow at least three minutes for the component to cool to room temperature before further processing.
9. Refer to below table for summary of soldering instructions for dip, wave, and manual solder. Note that these are considered general instructions and all soldering notes indicated above should take precedence.

Product Type	Dip Soldering / *Wave Soldering			Iron Soldering (with 1.5mm iron tip)		
	Temp. of solder bath	Maximum solder time	Distance (joint-package)	Temp. of solder iron	Maximum solder time	Distance (joint-package)
Through-hole	≤260°C	3s	≥2mm	≤350°C	3s	≥2mm
	≤260°C	5s	≥5mm	≤350°C	5s	≥5mm
SMD	-	-	-	≤350°C	3s (once)	-
Displays	*≤260°C	*3s	*≥2mm	≤350°C	3s	≥2mm

ESD Precautions (back to top)

InGaN/GaN material LEDs are sensitive to electrostatic discharge (ESD) and other transient voltage spikes. ESD and voltage spikes can affect the component's performance due to increased reverse current and/or decreased forward voltage. This may result in reduced light intensity and/or component failure. Static discharge may occur when static sensitive LEDs come in contact with the user or other conductive devices. ESD sensitive LEDs must incorporate protective circuitry to prevent ESD and to control voltage spikes in order to stay within the maximum voltage specified.

ESD Precautions cont'd (back to top)

SunLED products are stored in anti-static bags for protection during transportation and storage. However, below anti-static measures should always be noted when handling static sensitive components.

1. Operators must wear anti-static wristbands.
2. Operators must wear anti-static suits when entering work areas with conductive machinery and materials.
3. All test instruments and production machinery must be grounded.
4. Avoid static build up by minimizing friction between the LED and its surroundings.
5. Relative Humidity between 40% ~ 60% is recommended in ESD-protected work areas to reduce static build up. Reference JEDEC/J-STD-033 and JEDEC/JESD625-A standards.
6. All workstations that handle ESD sensitive components must maintain an electrostatic condition of 150V or less.
7. All anti-static measures noted above should be periodically checked and inspected to ensure proper functionality.

Design Notes (back to top)

1. Protective current-limiting resistors should be used in conjunction with LEDs to ensure parts are operating within specified current range.
2. The driving circuit should be designed to avoid reverse voltages and transient voltage spikes when the circuit is in both on & off states.
3. When LEDs are mounted in a parallel configuration, there should be individual current-limiting resistors in series with each LED. Refer to below diagram (*Fig. 12*) for an example of a recommended set up.

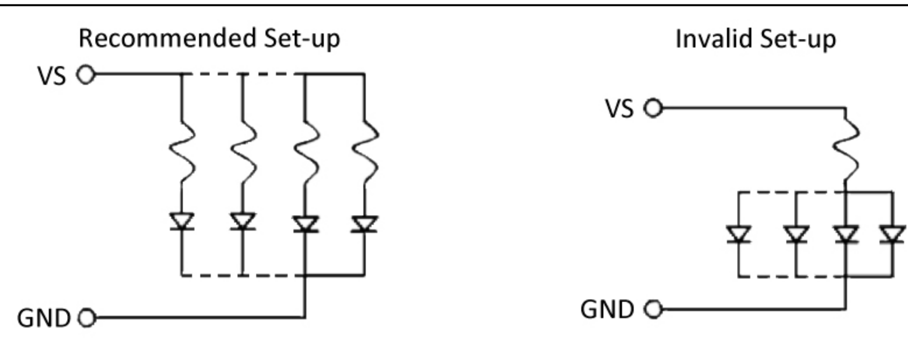


Fig. 12

4. Mounting direction of SMD components should be placed perpendicular to the direction of PCB travel. This will ensure the solder wets on each lead simultaneously during reflow and prevent shifting of LEDs. Refer to below diagram (*Fig. 13*) for examples of recommended mounting direction.

Design Notes cont'd (back to top)

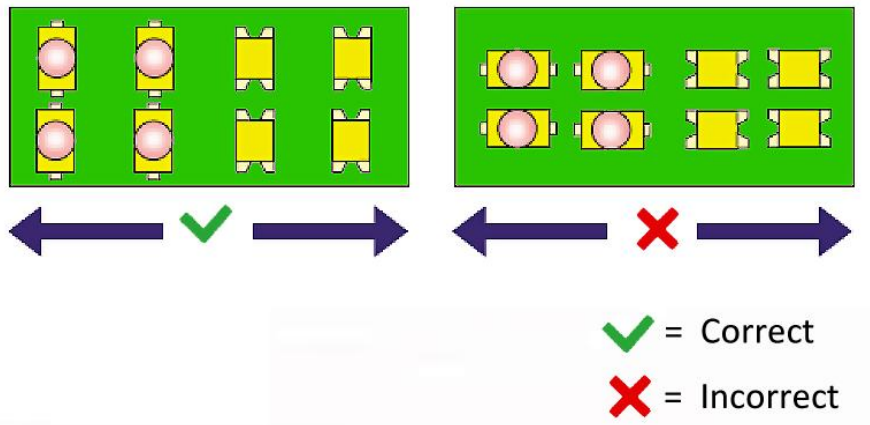


Fig. 13

5. High-power LED devices require optimization of heat dissipation. Increasing the size of metal mounting surface and proper application of thermal conductive paste will help improve heat dissipation. Refer to below diagram (*Fig.* 14) and product datasheets for specific design recommendations.

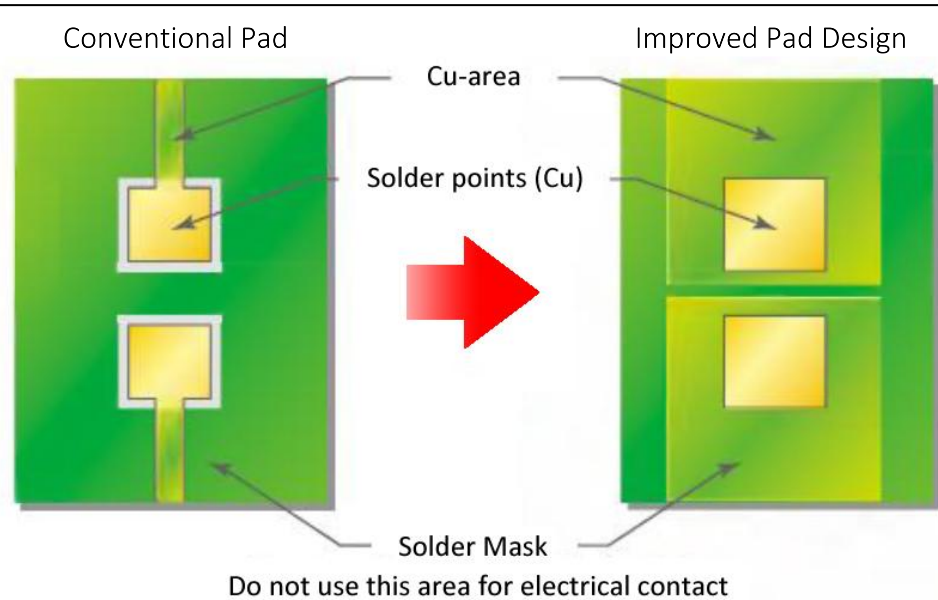


Fig. 14

6. High temperatures may reduce component's performance and reliability. Please refer to individual product datasheets for specific details on operable temperature range and effects of temperature on the LED.

Additional Remarks (back to top)

1. LED devices may contain Gallium Arsenide (GaAs). GaAs dust and fumes are toxic and harmful if ingested. Do not expose LEDs to chemical solvents and/or break open LED components.
2. The light output from UV, blue, and high-power LEDs may cause injury to the human eye when viewed directly.
3. Semiconductor devices can fail or malfunction due to their sensitivity to electrical fluctuation and physical stress. In design development, please make certain that SunLED products are used within the specified operating conditions as indicated on our most current product datasheets. The user is responsible to observe and follow all safety measures to avoid situations where the failure or malfunction of a SunLED product could cause injury, property damage, or the loss of human life.
4. SunLED products are bin sorted for intensity and wavelength. To ensure intensity and color consistency when using multiple LEDs in an array, it is recommended to use parts within the same bin code. Each bag, reel, or tube of LEDs contain a single intensity and wavelength code and is indicated on the part number label. Refer to below diagram (*Fig. 15*) for bin code identification and reference above section (I. Bin Codes) for specification data.

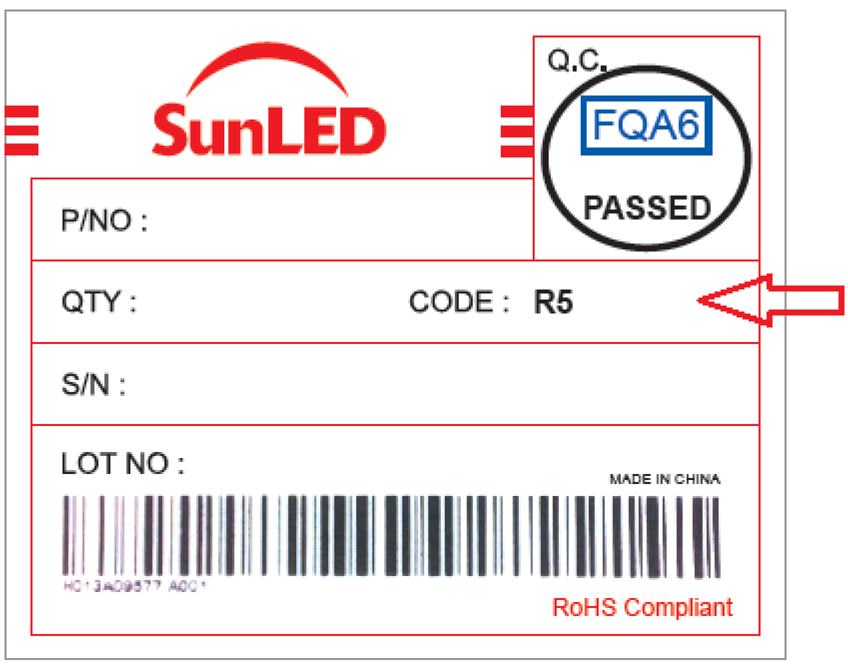


Fig. 15

5. Prolonged reverse bias should be avoided as it could cause metal migration leading to an increase in leakage current or causing a short circuit.
6. Contents within this document are subject to improvement and enhancement changes without notice.