



FUJIAN LIGHTNING OPTOELECTRONIC CO. LTD.

LIGHTNING

AUTOMOTIVE LIGHT

汽车照明

SPECIFICATIONS FOR TS3 SERIES

TS3 系列规格书

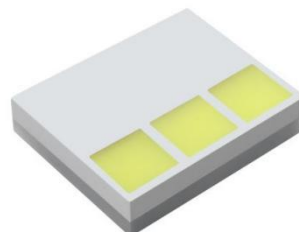
Model / 型号: F3831

Part No / 产品型号: TS361631N-V58U1A

www.tdled.com

Rev.2.0

AUTOMOTIVE LIGHT 汽车照明



Features 特性:

- * Top view white LED 顶部发光 LED
- * High luminous Intensity output 高亮度输出
- * High current capability 耐热设计
- * Compact Package Size 紧凑型封装尺寸
- * 120° viewing angle 120°发光角度
- * AEC-Q102 Qualified 符合 AEC-Q102
- * ESD: 8 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 3B) 抗静电能力: 8 kV 标准 ANSI/ESDA/JEDEC JS-001 (HBM, Class 3B)
- * The product itself will remain within RoHS and REACH compliant 符合 RoHS & REACH 标准

Applications 应用

- * Daytime Running Lights 日行灯
- * Headlight 头灯

SPECIFICATIONS

(1) Absolute Maximum Ratings 绝对极限参数

Item	Symbol	Absolute Maximum Rating	Unit
Forward current 正向电流	IF max	1500	mA
	IF min	50	mA
Pulse Forward current 脉冲电流	IFP	2000	mA
ESD Withstand Voltage (HBM)	VESD	8.0	kV
Power Dissipation 功率	Pd	15.0	W
Operating Temperature 操作温度	Ts.opr	-40~+125	°C
Storage Temperature 储存温度	Tstg	-40~+125	°C
Junction Temperature 结温温度	Tj	150	°C
Soldering Temperature 焊盘温度	Tsld	Reflow Soldering: 260°C for 10sec	

* Absolute Maximum Ratings at Ts=25°C

绝对极限参数在Ts=25°C的环境下测试得到

* IFP condition with Pulse: Width≤100μs, Duty cycles≤1/10

脉冲电流条件: 宽度≤100μs, 占空比≤1/10

* LED's properties might be different from suggested values like above and below tables if operation condition will

be exceeded our parameter range. Care is to be taken that power dissipation does not exceed the absolute maximum rating of the product

当操作条件超出我们的参数范围时, LED的允用可能与上/下表格内的建议值不同。请注意功率不要超出产品的绝对最大值建议

* All measurements were made under the standardized environment of Lightning LED

所有测试均在天电LED标准测试环境中进行

SPECIFICATIONS

(2) Initial Electrical/Optical Characteristics 光电特性

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Voltage 正向电压	V_F	-	9.5	10.0	V	IF = 1000mA
Luminous Flux 光通量	Φ	-	1315	-	lm	IF = 1000mA
Viewing Angle 发光角度	$2\theta_{1/2}$	-	120	-	°	IF = 1000mA
Thermal Resistance 真实热阻	(Rth _{js-real})	-	2.5	3.1	°C/W	IF = 1000mA
Thermal Resistance 电热阻 电光转换效率 $\eta_e=41\%$	(Rth _{js-elec.})	-	1.5	1.8	°C/W	IF = 1000mA

- * Characteristics at $T_s=25^\circ\text{C}$
- * 光电特性在 $T_s=25^\circ\text{C}$ 的环境下测试得到
- * Tolerance of measurements of the Forward Voltage is $\pm 0.1\text{V}$
- * 电压的测试误差 $\pm 0.1\text{V}$
- * Tolerance of measurements of the Luminous Flux is $\pm 7\%$
- * 光通量测试误差 $\pm 7\%$
- * $2\theta_{1/2}$ is the off-axis where the luminous intensity is 1/2 of the peak intensity
- * 发光角度 $2\theta_{1/2}$ 即为光通量强度为峰值强度1/2的角度（轴偏移）
- * Thermal resistance = Rth JS : Junction/solder point . Rth max is based on statistic values
热阻= Rth JS结/焊点。热阻最大值基于统计值

RANKS

Item	Rank	Min	Max	Unit
Forward Voltage 正向电压	VD2	8.8	9.4	V
	VD3	9.4	10.0	

Item	Rank	Min	Max	Unit
Luminous Flux 光通量	BE7	1175	1225	lm
	BE8	1225	1275	
	BE9	1275	1325	
	BF1	1325	1380	
	BF2	1380	1435	
	BF3	1435	1490	

* Forward Voltage Tolerance: $\pm 0.1V$

电压允许范围误差 $\pm 0.1V$

* Luminous Intensity Tolerance: $\pm 7\%$

亮度允许误差 $\pm 7\%$ 内

Color Ranks

	Rank AW 53			
x	0.3300	0.3296	0.3455	0.3440
y	0.3308	0.3526	0.3670	0.3435

	Rank AW57			
x	0.3221	0.3207	0.3376	0.3366
y	0.3261	0.3462	0.3616	0.3369

	Rank AW60			
x	0.3163	0.3138	0.3296	0.3300
y	0.3181	0.3381	0.3526	0.3308

	Rank BE 3			
x	0.3100	0.3065	0.3218	0.3232
y	0.2928	0.3145	0.3304	0.3095

	Rank BE 4			
x	0.3210	0.3190	0.3340	0.3340
y	0.3060	0.3280	0.3420	0.3230

	Rank BE 5			
x	0.3270	0.3270	0.3420	0.3410
y	0.3140	0.3360	0.3490	0.3320

	Rank BE 6			
x	0.3340	0.3340	0.3480	0.3480
y	0.3231	0.3420	0.3535	0.3410

* Ranking at $T_s=25^{\circ}\text{C}$

颜色范围在 $T_s=25^{\circ}\text{C}$ 下测试得到

* Forward Voltage Tolerance: $\pm 0.1\text{V}$

电压允许范围误差 $\pm 0.1\text{V}$

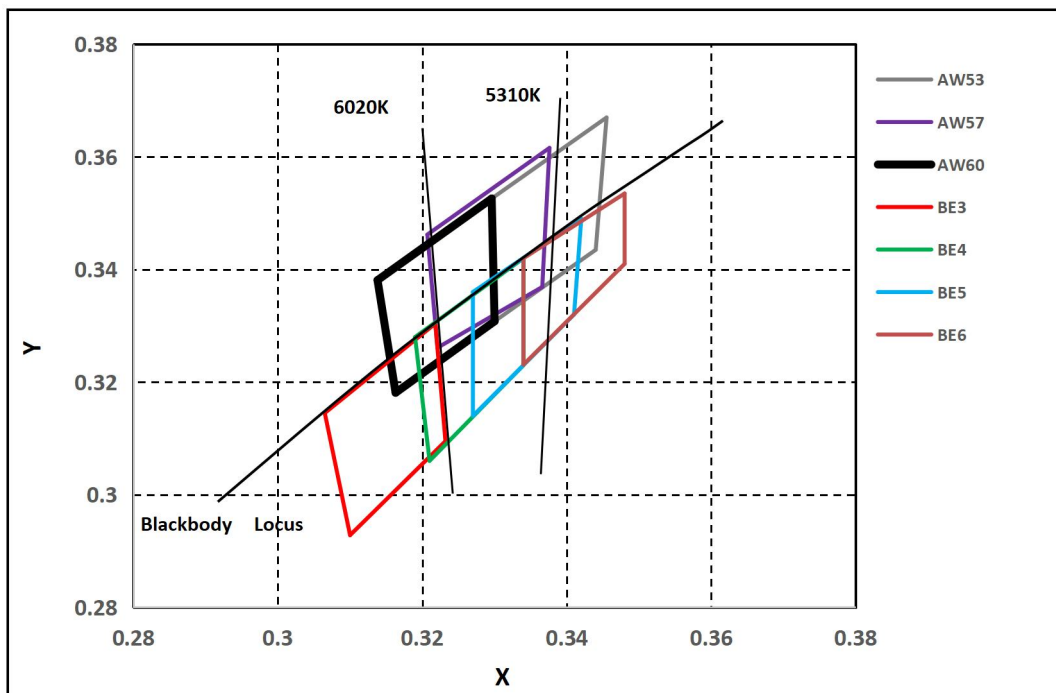
* Luminous Intensity Tolerance: $\pm 7\%$

亮度允许误差 $\pm 7\%$ 内

* Chromaticity Coordinate Tolerance: ± 0.005

色点的误差范围 ± 0.005

CHROMATICITY DIAGRAM

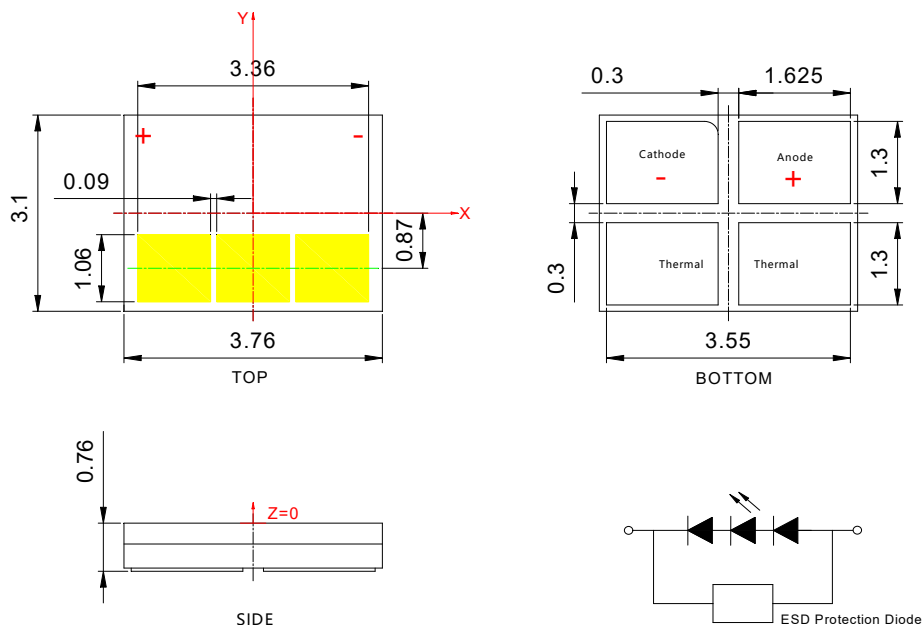


OUTLINE DIMENSIONS

本产品符合ROHS指令

This product complies with RoHS Directive

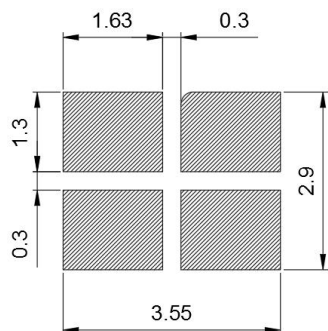
(单位 Unit: mm, 公差 Tolerance: ± 0.1)



项目 Item	内容 Description
封装材质 Package Materials	陶瓷 Ceramics
荧光体材质 Phosphor Sheet Materials	荧光玻璃 Phosphor Glass
封装树脂材质 Encapsulating Materials	硅胶树脂 Silicone Resin
电极材质 Electrodes Materials	Copper Alloy (Gold Plated)

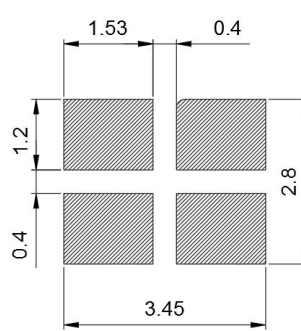
Recommended Soldering Pad Pattern

建议焊盘设计



Recommended Metal Solder Stencil Aperture

建议钢网设计



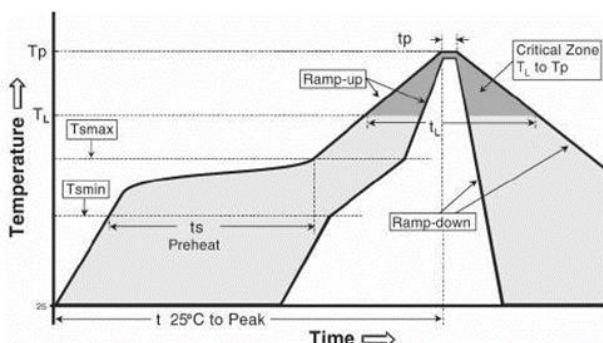
* The soldering pad pattern and Metal Solder Stencil Aperture is only for reference and can be modified according to actual requirements.

焊盘和钢网推荐仅供参考，可根据实际应用进行修正（单位 Unit:mm, 公差 Tolerance: 0.1mm）。

SOLDERING

- Recommended Reflow Soldering Condition(Lead-free Solder)

推荐回流焊条件（无铅锡膏）



Reflow soldering	
Temperature Min (Tsmmin)	150° C
Temperature Max (Tsmmax)	200° C
Time(ts)from (Tsmmin to Tsmmax)	60-120 seconds.
Ramp-up rate (TL to Tp)	3° C/seconds max.
Liquidous temperature(TL)	217° C
Time(tL) maintained above TL	60-150 seconds
Peak package body temperature(Tp)	260° C max
Time (tp) within 5° C of the specified classification temperature (Tc).	30 seconds max
Ramp-down rate (Tp to TL)	6° C/second max
Time 25° C to peak temperature	8 min max

- * The soldering pad pattern and Metal Solder Stencil Aperture is only for reference and can be modified according to actual requirements.

焊盘和钢网推荐仅供参考，可根据实际应用进行修正。

- * This LED is designed to be reflow soldered to a PCB. If dip soldered, Lightning will not guarantee its reliability.

此LED为使用回流焊贴片PCB设计的LED，如果进行浸锡焊接，天电将不保证可靠性。

- * Reflow soldering must not be performed more than twice. Hand soldering must not be performed more than once.

回流焊接不得超过两次，手动焊接不得超过一次。

- * When cooling the LEDs from the peak temperature a gradual cooling slope is recommended; do not cool the LEDs rapidly.

当从峰值温度冷却LED时，建议采用渐变冷却；不要进行快速冷却。

- * During reflow soldering, the heat and atmosphere in the reflow oven may cause the optical characteristics to degrade. In particular, reflow soldering performed with an air atmosphere may have a greater negative effect on the optical characteristics than if a nitrogen atmosphere is used; Lightning recommends using a nitrogen reflow atmosphere.

在回流焊接期间，回流炉中的热量和空气可能导致光学特性退化。而使用氮气相比，在空气中进行的回流焊对光学特性的负面影响更大，天电建议使用氮气回流气氛。

- * This LED uses a silicone resin for the encapsulating resin; the silicone resin is soft. If pressure is applied to the silicone resin, it may cause the resin to be damaged, chipped, delaminated and/or deformed. If the resin is damaged, chipped, delaminated and/or deformed, it may cause the wire to break causing a catastrophic failure (i.e. the LED not to illuminate) and/or reliability issues (e.g. the LED to corrode and/or to become dimmer, the color/directivity to change, etc.). Ensure that pressure is not applied to the encapsulating resin.

该LED使用硅胶作为封装胶，硅胶很软。如果对硅胶施加压力，可能导致胶体损坏、碎裂、分层或变形。如果树脂损坏、碎裂、分层或变形，可能会导致线材断裂，导致严重故障（即LED不亮）和或可靠性问题（例如LED腐蚀、变暗、颜色、变形等）。确保不对封装硅胶加压力。

SOLDERING

- * Once the LEDs have been soldered to a PCB, it should not be repaired/reworked. If it must be done, using a double-head soldering iron is strongly recommended. Ensure that sufficient verification is performed prior to use to ensure that the repair/rework has not caused the LED characteristics to deteriorate.

LED一旦被焊接到PCB上，就不应该进行维修与返工。如果必须这样做，强烈建议使用双头烙铁。确保在使用前进行充分的验证，以确保维修后不会导致LED损坏。

- * When soldering, do not apply stress to the LED while the LED is hot.

在焊接时，不允许LED尚且还在热的状况下，对其进行按压。

- * When using an automatic pick-and-place machine, choose an appropriate nozzle for this LED. Using a pick-and-place nozzle with a smaller diameter than the size of the LED's emitting surface will cause damage to the emitting surface causing a catastrophic failure (i.e. the LED not to illuminate).

当使用自动贴片机时，请为此LED选择适当的吸嘴。若使用直径小于LED发光表面尺寸的吸嘴进行拾取和放置LED，会导致发光表面损坏，导致LED损坏（即LED未点亮）。

- * The soldering pad pattern above is a general recommendation for LEDs to be mounted without issues; if a high degree of precision is required for the chosen application (i.e. high-density mounting), ensure that the soldering pad pattern is optimized.

上述建议焊盘是一般LED贴片的建议；如果所选应用需要高精度（即高密度安装），请确保将焊盘图优化。

- * Consider factors such as the reflow soldering temperature, hand soldering temperature, etc. when choosing the solder.

- * 选择锡膏时要考虑回流焊温度、手工焊温度等因素。

- * When flux is used, it should be a halogen free flux. Ensure that the manufacturing process is not designed in a manner where the flux will come in contact with the LEDs.

使用助焊剂时，应为无卤元素的助焊剂。确保制造工艺时不会使焊剂与LED密切接触。

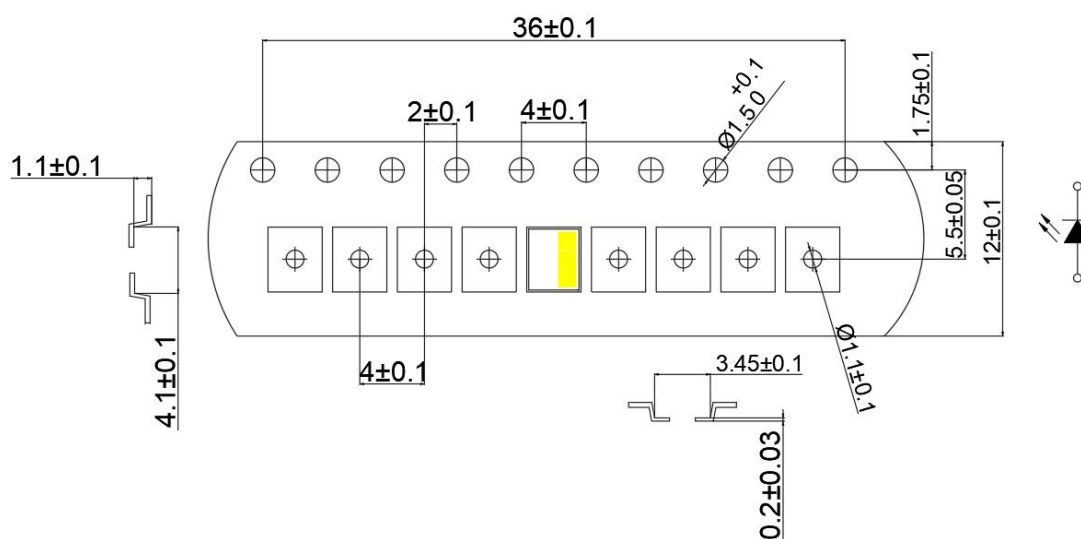
- * Ensure that there are no issues with the type and amount of solder that is being used.

确保使用的锡膏的类型以及用量正确。

TAPE AND REEL DIMENSIONS

Package Dimensions of Tape

载带尺寸



* Quantity : Max 3500pcs/Reel / 数量: 最大3.5K/卷

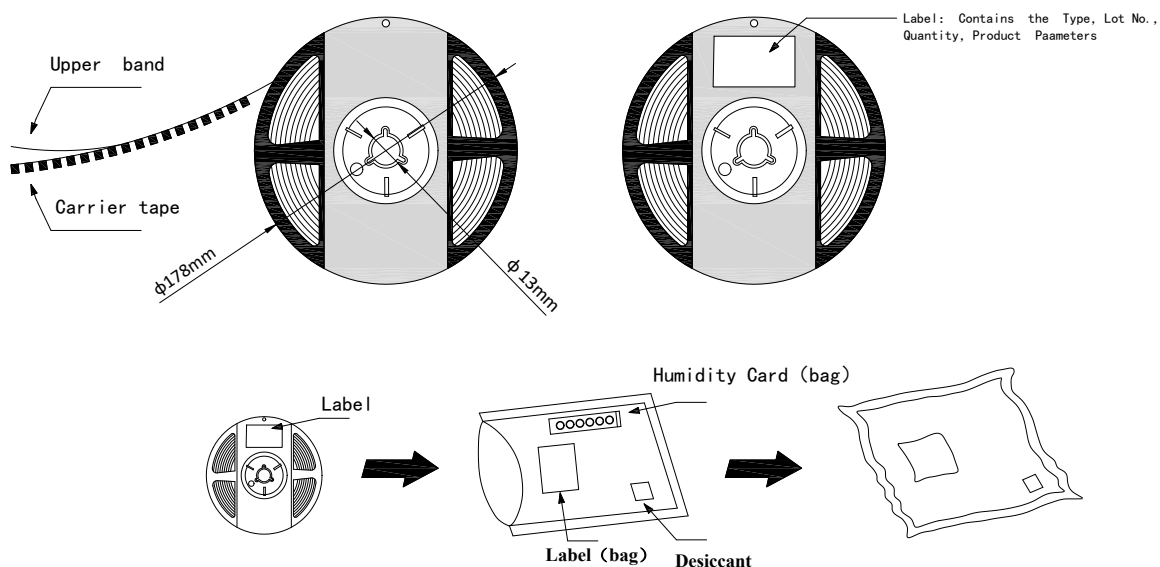
* Cumulative Tolerance : Cumulative Tolerance/10 pitches to be $\pm 0.2\text{mm}$ / 累计误差: 10颗最多 $\pm 0.2\text{mm}$

* Package : P/N, Manufacturing data Code No. and Quantity to be indicated on a damp proof Package

* unit = mm 包装: P/N, 制造日期代码和数量被标明在防潮包装上

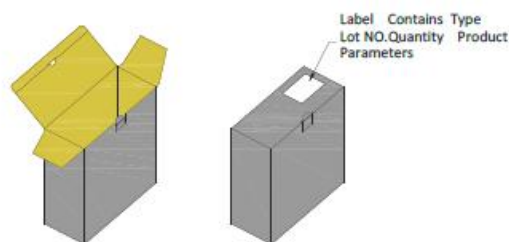
Package Dimensions of Reel

卷盘包装尺寸



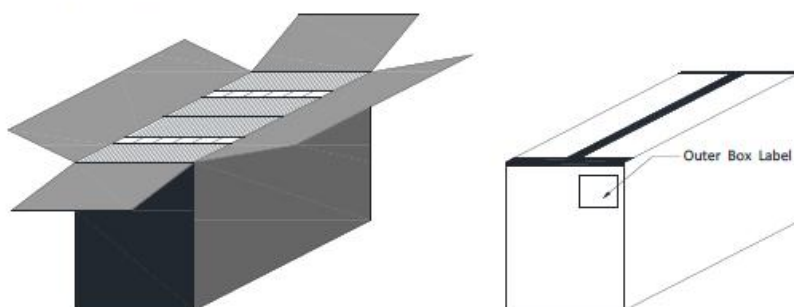
PACKAGING - TAPE & REEL

• Package Box / 包装盒



* Capacity 10 reels per box.

Outer Box



* Capacity 30 or 60 reels per box.

• Label / 标签

福建天电光电有限公司

FUJIAN LIGHTNING OPTOELECTRONIC CO.LTD

型号Type: T*****_*****



光通量Φ@ *** mA: *** - *** [LM]

色区Color Bin@*** mA: ****

电压Vf@ ***mA: ** - ** [V]

显指Ra@*** mA: ** (MIN)

Lot No.: A*****_*_*****

Bin Code: ****

数量QTY:**** PCS



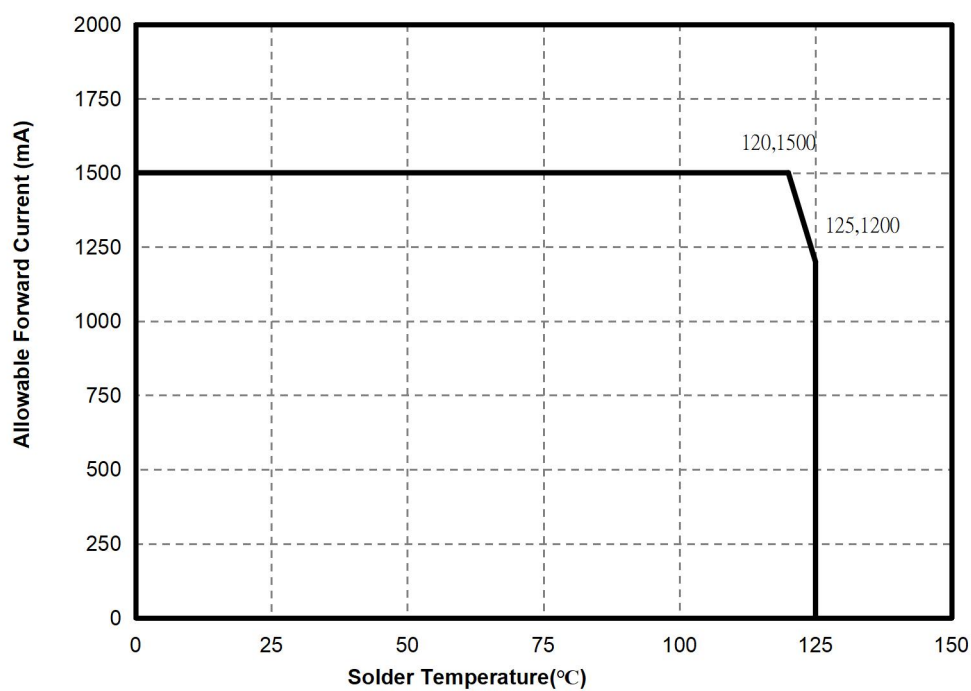
DERATING CHARACTERISTICS

*All characteristics shown are for reference only and are not guaranteed

所有特性曲线仅供参考

Solder Temperature(Cathode Side) vs Allowable Forward Current/最大正向电流-焊盘温度

$$I_F = f(T)$$



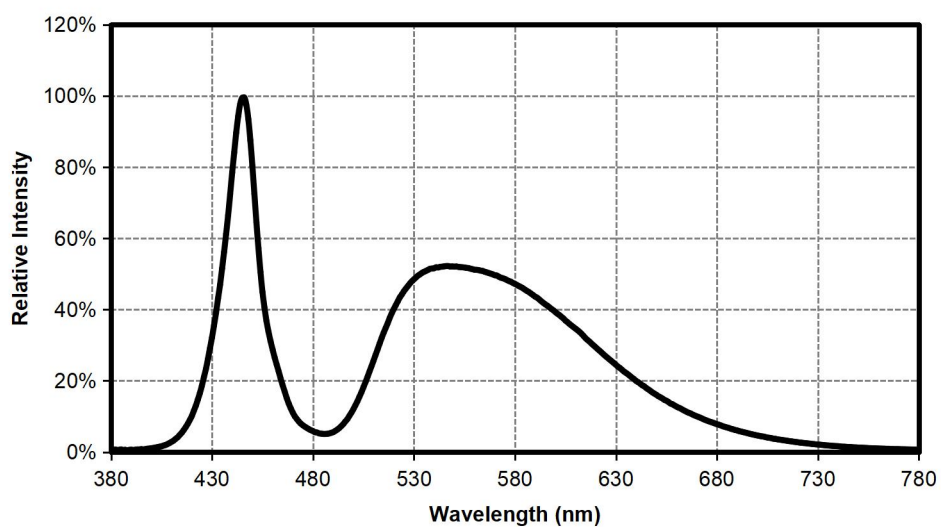
OPTICAL CHARACTERISTICS

*All characteristics shown are for reference only and are not guaranteed

所有特性曲线仅供参考

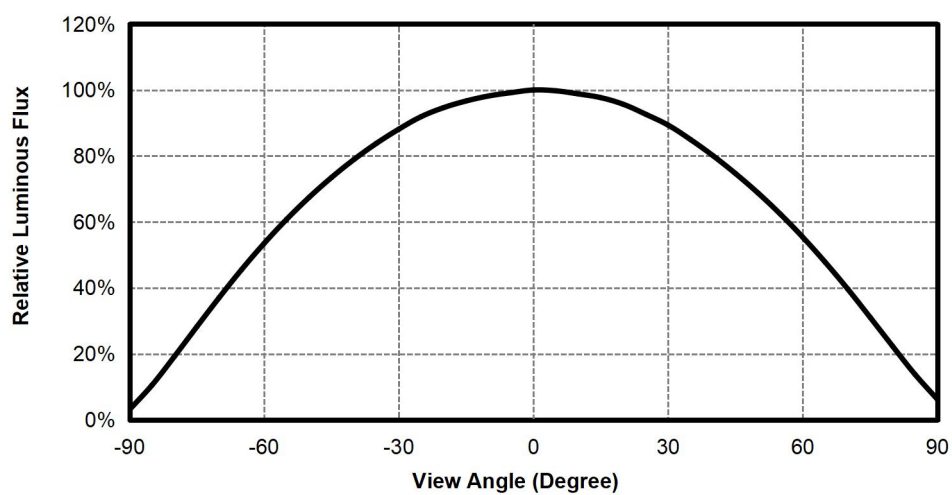
Spectrum/光谱

$$\Phi_v = f(\lambda) \quad I_f=1000\text{mA} \quad T_s=25^\circ\text{C}$$



Directivity/指向特性

$$I = f(\phi) \quad I_f=1000\text{mA} \quad T_s=25^\circ\text{C}$$



FORWARD CURRENT CHARACTERISTICS/ TEMPERATURE

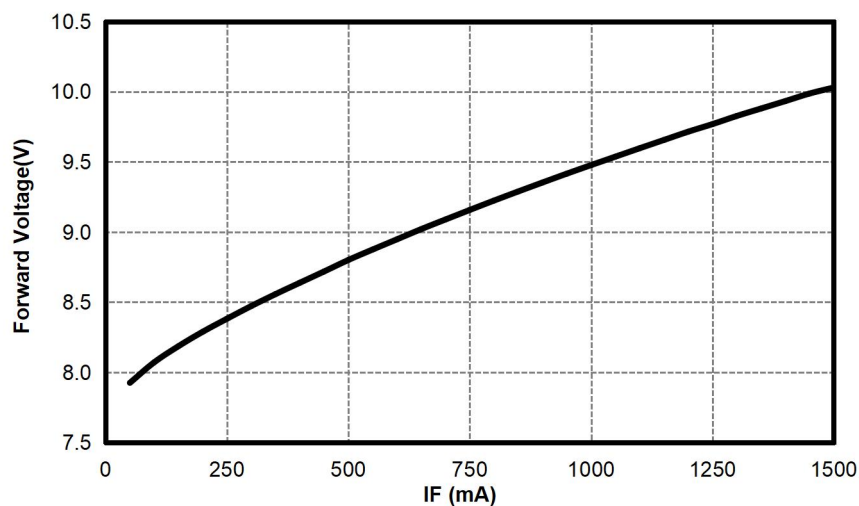
CHARACTERISTICS

*All characteristics shown are for reference only and are not guaranteed

所有特性曲线仅供参考

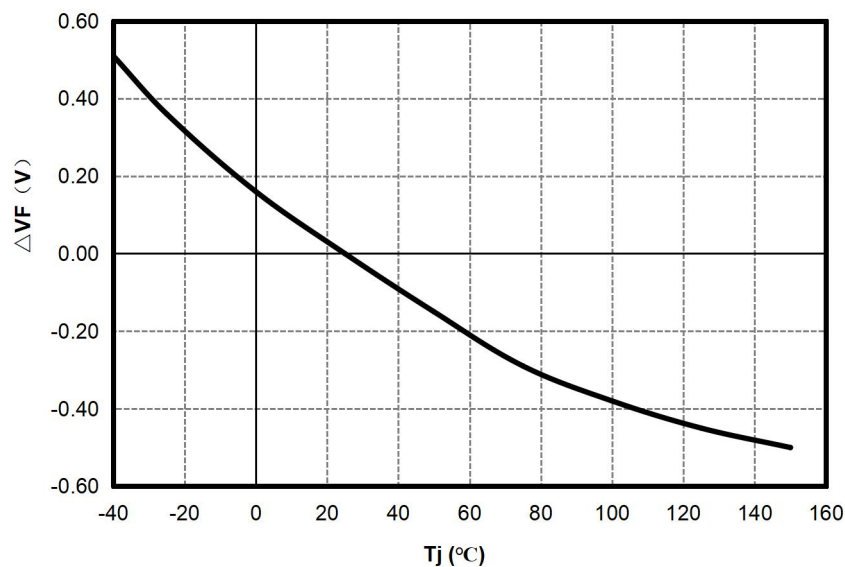
Forward Voltage vs Forward Current/电压-电流特性曲线

$$V_F = f(I_F) \quad T_s = 25^\circ\text{C}$$



Soldering Temperature vs Forward Voltage/电压-焊盘温度特性曲线

$$\Delta V_F = V_F - V_F(25^\circ\text{C}) = f(T_j) \quad I_F = 1000\text{mA}$$



FORWARD CURRENT CHARACTERISTICS/ TEMPERATURE

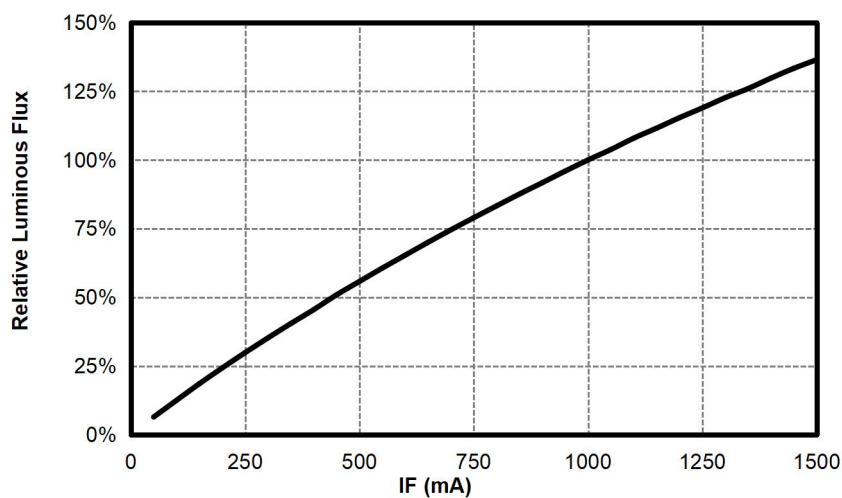
CHARACTERISTICS

*All characteristics shown are for reference only and are not guaranteed

所有特性曲线仅供参考

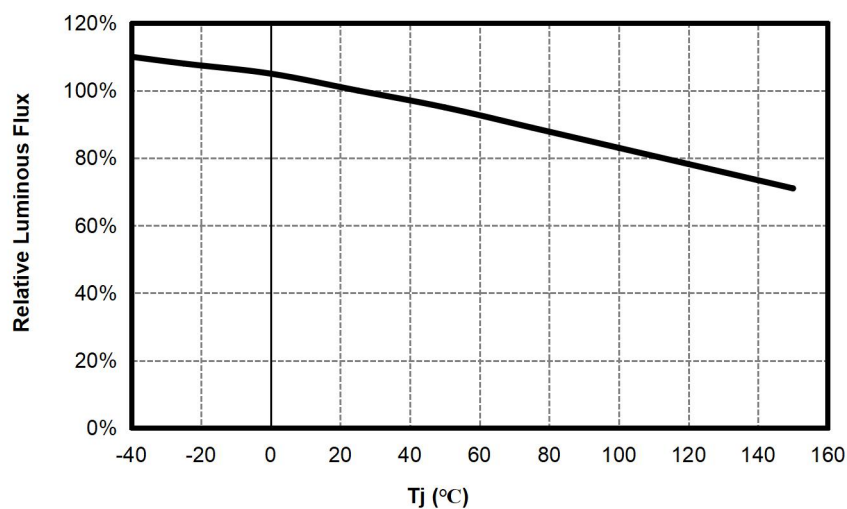
Forward Current vs Relative Luminous Flux/光通量-电流特性曲线

$$\frac{\phi_v}{\phi_v(1000mA)} = f(I_F) \quad T_s = 25^\circ C$$



Soldering Temperature vs Relative Luminous Flux/光通量-焊盘温度特性曲线

$$\frac{\phi_v}{\phi_v(25^\circ C)} = f(T_j) \quad I_F = 1000mA$$



FORWARD CURRENT CHARACTERISTICS/ TEMPERATURE

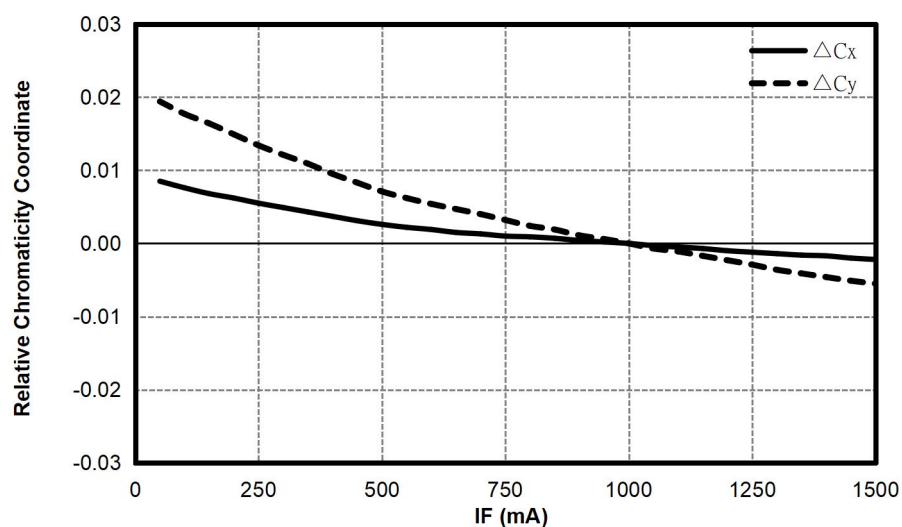
CHARACTERISTICS

*All characteristics shown are for reference only and are not guaranteed

所有特性曲线仅供参考

Forward Current vs Relative Chromaticity Coordinate/色坐标-电流特性曲线

$$\Delta Cx, \Delta Cy = Cx, Cy - Cx, Cy(1000mA) = f(I_F) \quad T_s = 25^\circ C$$

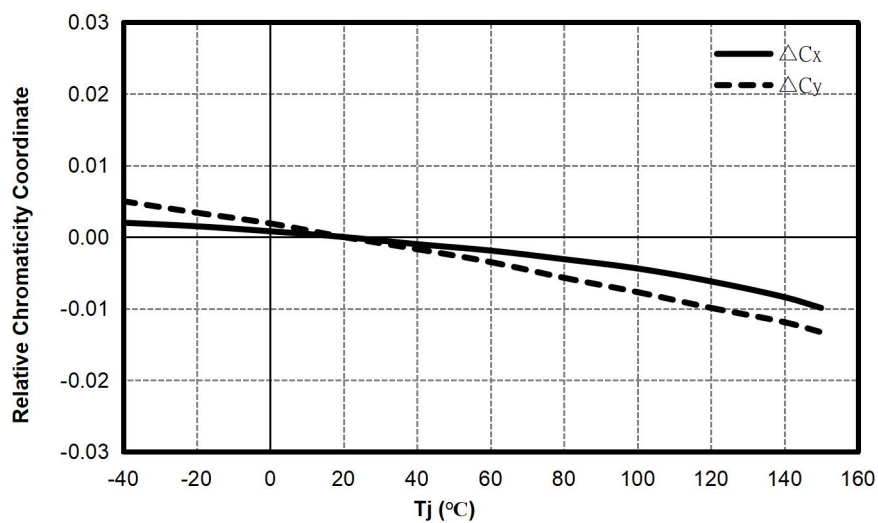


*All characteristics shown are for reference only and are not guaranteed

所有特性曲线仅供参考

Soldering Temperature vs Relative Chromaticity Coordinate/色坐标-焊盘温度特性曲线

$$\Delta Cx, \Delta Cy = Cx, Cy - Cx, Cy(25^\circ C) = f(T_J) \quad I_F = 1000mA$$



CAUTIONS

(1)Storage-储存

Conditions		Temperature	Humidity	Time
Storage	Before Opening Aluminum Bag 开袋前	≤30°C	≤60%RH	Within 1 Year from Delivery Date
	After Opening Aluminum Bag 开袋后	≤30°C	≤60%RH	≤672 hours
Baking 烘烤		65±5°C	-	≥24hours

- The storage/packaging requirements for this LED are comparable to JEDEC Moisture Sensitivity Level (MSL) 2a or equivalent. Lightning used IPC/JEDEC STD-020 as a reference to rate the MSL of this LED.

此LED的储存/包装可达到湿度敏感等级（MSL）2a。天电使用IPC/JEDEC STD-020作为参考，对该LED的MSL进行评级。

- This LED uses a package that could absorb moisture; if the package absorbs moisture and is exposed to heat during soldering, it may cause the moisture to vaporize and the package to expand and the resulting pressure may cause internal delamination. This may cause the optical characteristics to degrade. To minimize moisture absorption in storage/transit, moisture-proof aluminum bags are used for the LEDs with a silica gel packet to absorb any air moisture in the bag. The silica gel beads turn blue to red as they absorb moisture.

LED使用了具有吸水的封装材料；如果封装在焊接过程中吸收水分并受热，则可能导致水分蒸发和封装膨胀，由此产生的压力可能导致内部分层。这可能导致光学特性降低。为尽量减少储存及运输过程中的吸湿性，LED采用防潮铝袋，干燥剂以吸收袋中的任何空气水分。湿度卡吸收水分时会由蓝色变为红色。

- Once the moisture-proof aluminum bag is open, ensure that the LED is soldered to a PCB within the range of the conditions above. To store any remaining unused LEDs, use a hermetically sealed container with silica gel desiccants. Lightning recommends placing them back to the original moisture-proof bag and reseal it.

一旦防潮铝袋打开，确保LED在上述条件范围内焊接到PCB上。若要存储剩余的未使用的LED，请使用带有硅胶干燥剂的密封容器。天电建议将它们放回原来的防潮袋中，并重新密封。

- If the “After Opening” storage time has been exceeded or any pink silica gel beads are found, ensure that the LED are baked before use. Baking should only be done once.

如果超过存储时间，或发现粉湿度卡变红色，请确保LED在使用前经过烘烤。烘烤只能做一次。

- This LED has gold-plated electrodes. If the LEDs are exposed to a corrosive environment, it may cause the plated surface to tarnish causing issues (i.e. solderability). Ensure that when storing LEDs, a hermetically sealed container is used. Lightning recommends placing them back to the original moisture-proof bag and reseal it.

这个LED有镀金电极。如果LED暴露在腐蚀性环境中，可能会导致电镀表面失去光泽，从而导致LED出现焊接问题。确保持存LED时使用密封容器。天电建议将它们放回原来的防潮袋中，并重新密封。

- To prevent substances/gases from affecting the plated surface, ensure that the parts/materials used with the LEDs in the same assembly/system do not contain sulfur (e.g. gasket/seal, adhesive, etc.). If the plating is contaminated, it may cause issues (e.g. electric connection failures). If a gasket/seal is used, silicone rubber gaskets/seals are recommended; ensure that this use of silicone does not result in issues (e.g. electrical connection failures) caused by low molecular weight volatile siloxane.

为防止物质/气体影响电镀表面，确保在同一组件或者系统中使用的零件/材料不含硫（例如垫圈/密封件、粘合剂等）。如果镀层受到污染，可能会导致问题（例如电气连接故障）。如果使用垫圈/密封件，建议使用硅橡胶垫圈/密封件；确保硅酮的使用不会导致低分子量挥发性硅氧烷引起的问题（例如电气连接故障）。

- To avoid condensation, the LEDs must not be stored in areas where temperature and humidity fluctuate greatly.

为避免冷凝，LED不得存放在温度和湿度波动较大的区域。

- Do not store the LEDs in a dusty environment.

不要将LED存放在灰尘多的环境中。

- Do not expose the LEDs to direct sunlight and/or an environment over a long period of time where

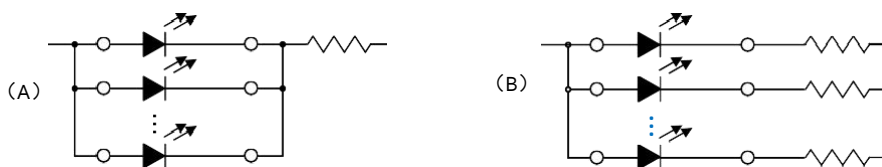
The temperature is higher than normal room temperature.

请勿将LED长期暴露在阳光直射和/或温度高于正常室温的环境中。

(2) Directions for Use/使用说明

- The circuit must be designed to ensure that the Absolute Maximum Ratings are not exceeded for each LED. The LEDs should be operated at a constant current per LED. In the case of operating at a constant voltage, Circuit B is recommended. If Circuit A is used, it may cause the currents flowing through the LEDs to vary due to the variation in the forward voltage characteristics of the LEDs on the circuit.

电路的设计必须确保每个LED不超过绝对最大额定值。每个LED应在恒定电流下工作。如果在恒定电压下工作，建议使用电路B。如果使用电路A，则可能会由于电路LED正向电压特性的变化而导致流过LED的电流发生变化。



- This LED is designed to be operated at a forward current. Ensure that no voltage is applied to the LED in the forward/reverse direction while the LED is off. If the LEDs are used in an environment where reverse voltages are applied to the LED continuously, it may cause electrochemical migration to occur causing the LED to be damaged. When not in use for a long period of time, the system's power should be turned off to ensure that there are no issues/damage.

此LED设计为在正向电流下工作。确保LED熄灭时，正向/反向方向上没有电压施加到LED上。如果LED在持续施加反向电压的环境中使用，则可能导致发生电化学迁移，从而导致LED损坏。长时间不使用时，应关闭系统电源，以确保没有问题/损坏。

- To stabilize the LED characteristics while in use, Lightning recommends that the LEDs are operated at currents $\geq 10\%$ of the sorting current. 为了在使用中稳定LED特性，天电建议LED在分光电流下工作 $\geq 10\%$ 。
- Ensure that transient excessive voltages (e.g. lightning surge) are not applied to the LEDs. 确保不向LED施加瞬态过电压（如雷电冲击）。
- If the LEDs are used for outdoor applications, ensure that necessary measures are taken (e.g. protecting the LEDs from water/salt damage and high humidity). 如果LED用于室外应用，确保采取了必要的措施（例如保护LED免受水/盐损坏和高湿度）。

(3) Handling Precautions/操作注意事项

- Do not handle the LEDs with bare hands. 请勿徒手操作LED。
- This may contaminate the LED surface and have an effect on the optical characteristics. 这可能污染LED表面并影响光学特性。
- This may cause the LED to deform and/or the wire to break causing a catastrophic failure (i.e. the LED not to illuminate). 这可能导致LED变形和/或导线断裂，导致受损（即LED不亮）。
- Ensure that when handling the LEDs with tweezers, excessive force is not applied to the LED. Otherwise, it may cause damage to the resin (e.g. cut, scratch, chip, crack, delamination and deformation) and the wire to break causing a catastrophic failure (i.e. the LED not to illuminate). 确保使用镊子处理LED时，不会对LED施加过大的力。否则，可能会损坏树脂（如切割、划伤、切屑、裂纹、分层和变形）和导线，导致灾难性故障（即LED不亮）。
- Dropping may cause damage to the LED (e.g. deformation). 跌落可能导致LED损坏（例如变形）。
- Do not stack assembled PCBs together. Otherwise, it may cause damage to the resin (e.g. cut, scratch, chip, crack, delamination and deformation) and the wire to break causing a catastrophic failure (i.e. the LED not to illuminate). 不要将组装好的PCB堆叠在一起。否则，可能会损坏树脂（如切割、伤、切屑、裂纹、分层和变形）和导线，导致灾难性故障（即LED不亮）。

(4) Design Consideration/设计考虑

- If the LEDs are soldered to a PCB and the PCB assembly is bent (e.g. PCB depaneling process), it may cause the LED package to break. The PCB layout should be designed to minimize the mechanical stress on the LEDs when the PCB assembly is bent/warped.

如果LED焊接到PCB上并且PCB组件弯曲（例如PCB脱板过程），则可能导致LED封装破裂。PCB布局的设计应使PCB组件弯曲/翘曲时LED上的机械应力最小化。

- The amount of mechanical stress exerted on the LED from depaneling may vary depending on the LED position/orientation on the PCB assembly (e.g. especially in areas near V-groove scores). The PCB layout should be designed to minimize the mechanical stress on the LEDs when the PCB is separated into individual PCB assemblies.

因剥离面板而施加在LED上的机械应力大小可能因PCB组件上LED的位置/方向而异（例如，特别是在靠近V型槽刻痕的区域）。PCB布局的设计应使PCB分离成单独的PCB组件时，LED上的机械应力最小化。

- To separate a PCB populated with the LEDs, use a specially designed tool. Do not break the PCB by hand.

要分离贴有LED的PCB，请使用专门设计的工具。不要用手折断PCB。

- If an aluminum-core PCB is used to operate the LEDs, it may cause thermal stress during operation causing damage to the solder joints (e.g. crack). Ensure that sufficient verification is performed prior to use.

如果使用铝板PCB操作LED，则在操作过程中可能会引起热应力，从而损坏焊点（例如裂纹）。确保在使用前进行了充分的验证。

- Volatile organic compounds that have been released from materials present around the LEDs (e.g. housing, gasket/seal, adhesive, secondary lens, lens cover, etc.) may penetrate the LED lens and/or encapsulating resin. If the LEDs are being used in a hermetically sealed environment, these volatile compounds can discolor after being exposed to heat and/or photon energy and it may greatly reduce the LED light output and/or color shift. In this case, ventilating the environment may improve the reduction in light output and/or color shift. Perform a light-up test of the chosen application for optical evaluation to ensure that there are no issues, especially if the LEDs are planned to be used in a hermetically sealed environment.

从LED周围材料（例如外壳、垫圈/密封件、粘合剂、二次透镜、透镜盖等）释放的挥发性有机化合物可穿透LED透镜和/或封装树脂。

如果LED在密封环境中使用，这些挥发性化合物在暴露于热和/或光子能量后会变色，并且可能会大大降低LED的光输出和/或色移。在这种情况下，对环境通风可以改善光输出和/或色移的减少。对所选的光学评估应用程序执行点亮测试，以确保没有问题，特别是如果LED计划在密封环境中使用。

(5) Electrostatic Discharge (ESD)/静电防护

- This LED is sensitive to transient excessive voltages (e.g. ESD, lightning surge). If this excessive voltage occurs in the circuit, it may cause the LED to be damaged causing issues (e.g. the LED to become dimmer or not to illuminate [i.e. catastrophic failure]). Ensure that when handling the LEDs, necessary measures are taken to protect them from an ESD discharge. The following examples are recommended measures to eliminate the charge:

该LED对瞬时高电压（如ESD、雷电冲击）敏感。如果电路中出现过大电压，可能会导致LED损坏，从而导致问题（例如LED变暗或不亮[即灾难性故障]）。确保在处理LED时，采取了必要的措施来保护其免受ESD放电的影响。以下示例是建议的消除费用的措施：

-Grounded wrist strap, ESD footwear, clothes, and floors.

静电手环、防静电鞋、防静电衣服和地板。

-Grounded workstation equipment and tools.

工作站设备和工具接地。

-ESD table/shelf mat made of conductive materials.

导电材料制成的ESD桌/架垫。

- Ensure that all necessary measures are taken to prevent the LEDs from being exposed to transient excessive voltages (e.g. ESD, lightning surge):

确保采取了所有必要措施，以防止LED暴露在瞬态过电压下（例如ESD、雷电浪涌）：

-tools (e.g. soldering irons), jigs, and machines that are used are properly grounded.

使用的工具（如烙铁）、夹具和机器正确接地。

-appropriate ESD materials/equipment are used in the work area.

在工作区域使用适当的ESD材料/设备。

-the system/assembly is designed to provide ESD protection for the LEDs.

系统/组件设计LED提供ESD保护。

- If the tool/equipment used is an insulator (e.g. glass cover, plastic, etc.), ensure that necessary measures have been taken to protect the LED from transient excessive voltages (e.g. ESD). The following examples are recommended measures to eliminate the charge:

如果使用的工具/设备是绝缘体（如玻璃罩、塑料等），确保已采取必要措施保护LED免受瞬态过电压（如ESD）的影响。以下示例是建议的消除费用的措施：

-Dissipating static charge with conductive materials.

用导电材料消散静电。

-Preventing charge generation with moisture.

防止湿气产生电荷。

-Neutralizing the charge with ionizers.

采用电离器。

- To detect if an LED was damaged by transient excess voltages (i.e. an ESD event during the system's assembly process), perform a characteristics inspection (e.g. forward voltage measurement, light-up test) at low current ($\leq 1\text{mA}$).

要检测LED是否因瞬态过电压（即系统装配过程中的ESD事件）而损坏，请在低电流下执行特性检查（如正向电压测量、点亮测试） $\leq 1\text{mA}$ 。

- If the LED is damaged by transient excess voltages (e.g. ESD), it will cause:

如果LED被瞬态过电压（如ESD）损坏，将导致：

-the Forward Voltage (VF) to decrease.

正向电压（VF）降低。

-the LED not to illuminate at a low current.

LED在低电流下不亮。

(6) Thermal Management/热量管理

- The Absolute Maximum Junction Temperature (T_J) must not be exceeded under any circumstances. The increase in the temperature of an LED while in operation may vary depending on the PCB thermal resistance and the density of LEDs on the PCB assembly. Ensure that when using the LEDs for the chosen application, heat is not concentrated in an area and properly managed in the system/assembly.

在任何情况下都不得超过绝对最高结温（ T_J ）。发光二极管工作时的温度升高可能因PCB热阻和PCB组件上发光二极管的密度而异。确保在为所选应用程序使用LED时，热量不会集中在某个区域，并在系统/组件中得到适当管理。

- The operating current should be determined by considering the temperature conditions surrounding the LED (i.e. T_A). Ensure that when operating the LED, proper measures are taken to dissipate the heat.

工作电流应通过考虑LED周围的温度条件（即 T_S ）来确定。确保在操作LED时，采取适当的散热措施。

- The following two equations can be used to calculate the LED junction temperature:

以下两个方程式可用于计算LED结温度：

$$1) T_J = T_A + R_{\theta JA} \cdot W$$

$$2) T_J = T_S + R_{\theta JS} \cdot W$$

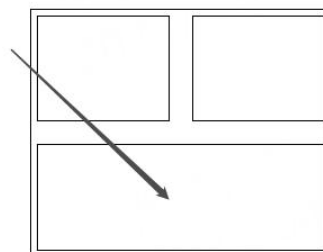
* T_J =LED Junction Temperature: $^{\circ}\text{C}$ T_A =Ambient

Temperature: $^{\circ}\text{C}$

T_S =Soldering Temperature (Cathode Side): $^{\circ}\text{C}$ $R_{\theta JA}$ =Thermal Resistance from Junction to Ambient: $^{\circ}\text{C}/\text{W}$

$R_{\theta JS}$ =Thermal Resistance from Junction to T_S Measurement Point: $^{\circ}\text{C}/\text{W}$ W =Input Power($I_F \times V_F$): W

T_S Measurement Point



(7) Cleaning/清洁

- Do not clean the LEDs with water, benzene and/or thinner.

请勿用水、汽油和/或稀释剂清洁LED。

- To clean the LEDs, use isopropyl alcohol (IPA). If another solvent is used, it may cause the LED package/resin to be damaged causing issues; ensure that sufficient verification is performed prior to use. Additionally, ensure that the solvent being used does not cause any other issues (e.g.

CFC-based solvents are heavily regulated).

要清洁LED，请使用异丙醇（IPA）。如果使用其他溶剂，可能导致LED封装/树脂损坏，导致问题；确保在使用前进行充分的验证。此外，确保所使用的溶剂不会引起任何其他问题（例如，基于CFC的溶剂受到严格管制）。

- If an LED is contaminated (e.g. dust/dirt), use a cloth soaked with isopropyl alcohol (IPA). Ensure that the cloth is firmly squeezed before wiping the LED.

如果LED受到污染（例如灰尘/污垢），请使用浸有异丙醇（IPA）的布。在擦拭LED前，确保布被紧紧挤压。

- Do not clean the LEDs with an ultrasonic cleaner. If cleaning must be done, ensure that sufficient verification is performed by using a finished assembly with LEDs to determine cleaning conditions (e.g. ultrasonic power, LED position on the PCB assembly) that do not cause an issue.

不要用超声波清洁剂清洁LED。如果必须进行清洁，确保使用带LED的成品组件进行充分验证，以确定不会导致问题的清洁条件（例如超声波功率、PCB组件上的LED位置）。

(8) Eye Safety/眼睛安全

- There may be two important international specifications that should be noted for safe use of the LEDs: IEC 62471:2006 Photobiological safety of lamps and lamp systems and IEC 60825-1:2001 (i.e. Edition 1.2) Safety of Laser Products - Part 1: Equipment Classification and Requirements. Ensure that when using the LEDs, there are no issues with the following points:

关于LED的安全使用，这里可能有两个重要的国际规范：IEC 62471:2006灯和灯系统的光生物安全和IEC 60825-1:2001（即1.2版）激光产品的安全-第1部分：设备分类和要求。确保使用LED时，以下几点没有问题：

-LEDs have been removed from the scope of IEC 60825-1 since IEC 60825-1:2007 (i.e. Edition 2.0) was published. However, depending on the country/region, there are cases where the requirements of the IEC 60825-1:2001 specifications or equivalent must be adhered to.

IEC 60825-1:2007（即2.0版）发布以来，LED已从IEC 60825-1的范围中删除。但是，根据国家/地区的不同，有时必须遵守IEC 60825-1:2001规范或同等规范的要求。

-LEDs have been included in the scope of IEC 62471:2006 since the release of the specification in 2006.

自2006年IEC 62471:2006规范发布以来，LED已包含在IEC 62471:2006的范围内。

- Most Lightning LEDs will be classified as the Exempt Group or Risk Group 1 according to IEC 62471:2006. However, in the case of high-power LEDs containing blue wavelengths in the emission spectrum, there are LEDs that will be classified as Risk Group 2 depending on the characteristics (e.g. radiation flux, emission spectrum, directivity, etc.).

根据IEC 62471:2006，大多数天电LED将被归类为豁免组或风险组1。但是，对于发射光谱中含有蓝色波长的高功率LED，根据特性（例如辐射通量、发射光谱、方向性等），也有LED将被归类为风险组2。

- If the LED is used in a manner that produces an increased output or with an optic to collimate the light from the LED, it may cause damage to the human eye.

如果LED的使用方式能够产生更高的输出，或者使用光学元件来准直LED发出的光，则可能会对人眼造成损害。

- If an LED is operated in a manner that emits a flashing light, it may cause health issues (e.g. visual stimuli causing eye discomfort). The system should be designed to ensure that there are no harmful effects on the human body.

如果LED以发出闪光的方式工作，可能会导致健康问题（例如视觉刺激导致眼睛不适）。系统的设计应确保对人体没有有害影响。

(9) Miscellaneous/其他

- Lightning warrants that the discrete LEDs will meet the requirements/criteria as detailed in the Reliability section within this specification. If the LEDs are used under conditions/environments deviating from or inconsistent with those described in this specification, the resulting damage and/or injuries will not be covered by this warranty.

天电保证LED将满足本规范可靠性部分详述的要求/标准。如果LED在偏离或不符合本规范所述的条件/环境下使用，由此造成的损坏和/或伤害将不在本保修范围内。

- Lightning warrants that the discrete LEDs manufactured and/or supplied by Lightning will meet the requirements/criteria as detailed in the Reliability section within this specification; it is the customer's responsibility to perform sufficient verification prior to use to ensure that the lifetime and other quality characteristics required for the intended use are met.

天电保证，天电所供应的LED将满足本规范可靠性部分详述的要求/标准；客户有责任在使用前进行充分的验证，以确保达到预期用途所需的寿命和其他质量特性。

www.tdled.com

- The applicable warranty period is one year from the date that the LED is delivered. In the case of any incident that appears to be in breach of this

warranty, the local Lightning sales representative should be notified to discuss instructions on how to proceed while ensuring that the LED in question is not disassembled or removed from the PCB if it has been attached to the PCB. If a breach of this warranty is proved, Lightning will provide the replacement for the non-conforming LED or an equivalent item at Nichia's discretion. FOREGOING ARE THE EXCLUSIVE REMEDIES AVAILABLE TO THE CUSTOMER IN RESPECT OF THE BREACH OF THE WARRANTY CONTAINED HEREIN, AND IN NO EVENT SHALL Lightning BE RESPONSIBLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL LOSSES AND/OR EXPENSES (INCLUDING LOSS OF PROFIT) THAT MAY BE SUFFERED BY THE CUSTOMER ARISING OUT OF A BREACH OF THE WARRANTY.

保修期为LED交付之日起二年。如果发生任何违反本保修条款的事件，应通知当地天电销售代表讨论如何进行操作的说明，同时确保相关LED未被拆卸或从PCB上移除（如果已连接到PCB上）。如果证明违反本保修，天电将自行决定更换不合格LED或同等产品。上述是客户对违反本协议所载保修的唯一补救措施，在任何情况下，天电不会客户因违反保修所遭受的任何直接、附带或后果性损失和费用（包括利润损失）负责。

- This LED is intended to be used for general lighting, household appliances, electronic devices (e.g. mobile communication devices) and automobiles; it is not designed or manufactured for use in applications that require safety critical functions (e.g. aircraft, combustion equipment, life support systems, nuclear reactor control system, safety devices, spacecraft, submarine repeaters, traffic control equipment, trains, vessels, etc.). If the LEDs are planned to be used for these applications, unless otherwise detailed in the specification, Lightning will neither guarantee that the LED is fit for that purpose nor be responsible for any resulting property damage, injuries and/or loss of life/health.

此LED用于一般照明、家用电器、电子设备（如移动通信设备）和汽车；其设计或制造不适用于需要安全关键功能的应用（如飞机、燃烧设备、生命支持系统、核反应堆控制系统、安全装置、航天器、潜艇中继器、交通控制设备、列车、船舶等）。如果LED计划用于这些应用，除非规范中另有详细说明，否则天电将不保证LED适用于该用途，也不对此造成的任何财产损失、伤害和/或生命/健康损失负责。

- The customer will not reverse engineer, disassemble or otherwise attempt to extract knowledge/design information from the LED.

不允许客户对LED进行拆解或以其他方式试图从LED中提取设计信息。

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未经天电事先书面许可，不得以任何形式或方式复制本规范的任何部分。

- Both the customer and Lightning will agree on the official specifications for the supplied LEDs before any programs are officially launched. Without this agreement in writing (i.e. Customer Specific Specification), changes to the content of this specification may occur without notice (e.g. changes to the foregoing specifications and appearance, discontinuation of the LEDs, etc.).

客户天电将在正式启动任何程序之前就所提供LED的官方规范达成一致。如果没有本书面协议（即客户特定规范），本规范内容的更改不另行通知（如上述规范和外观的更改、LED的停用）。

Revision record				
Version	Page	Chapter	Content of change	Date record
2.0	8、11	/	Update Product images and the quantity of packaging	2025-06-23