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LC8808 LED SERIES

SPECIFICIFATION

INTEGRATED LIGHT SOURCE INTELLIGENT CONTROL SMD LED

Document No.: SPC/ LC8808 LED

Model No.: LC8808

Description: 5.5x5.0x1.6mm Intelligent control SMD LED

1.General Descriptions

The LC8808 is a 3-channel constant current LED drive with resumable data transfers and internal display patterns. There are three open-drain constant current outputs, with a build-in PWM of grayscale. The range of input power is from +9V to +15V, and voltage-endurance of LED port is +12V. There is a built-in 12bits GAMMA correction module. PWM maximum refresh frequency is 8kHz. The LC8808 use the e-RZ (extended return to zero code) as the signal transmission mode, which can control the output current channel by channel and cascade infinitely. LC8808 provides two-signal data input as redundant control, which ensures the transmission of the signal if any single chip damages. In the absence of signal input, LC8808 displays the built-in display patterns that is suitable for those applications without a controller. There is the built-in power-on and power-off protection in the drive, which can enhance the service life of the chip. It also has the automatic test function while power on, which is convenient for the customer to test. The LC8808 provides SOP8 packaging, working environment is from -40 ° C to + 85 ° C.

2.Features

·12v operating supply voltage with 7805 module inside
·Default 17.5mA constant current output, the minimum is 11mA
·Use e-RZ code, serial data frequency 800kHz
·8bits data transfer, 12bits build-in GAMMA correction of PWM display
·Built-in PWM technology, supports 8kHz PWM refresh rate
·With resumable data transfer function, single chip damage does not infect data transmission
·Built-in display pattern for the applications without a controller
·Built-in automatic test mode, power-on and power-off protection
·ESD：2kV
·working environment is from -40 ° C to + 85 ° C
·Packaging：SOP8

3.Applications

- LED Display
- LED lighting/light engineering

4.Product Naming

LC8808 mean white surface ,12-14ma/channel ,capacitor integrated in 5050 (standard version)

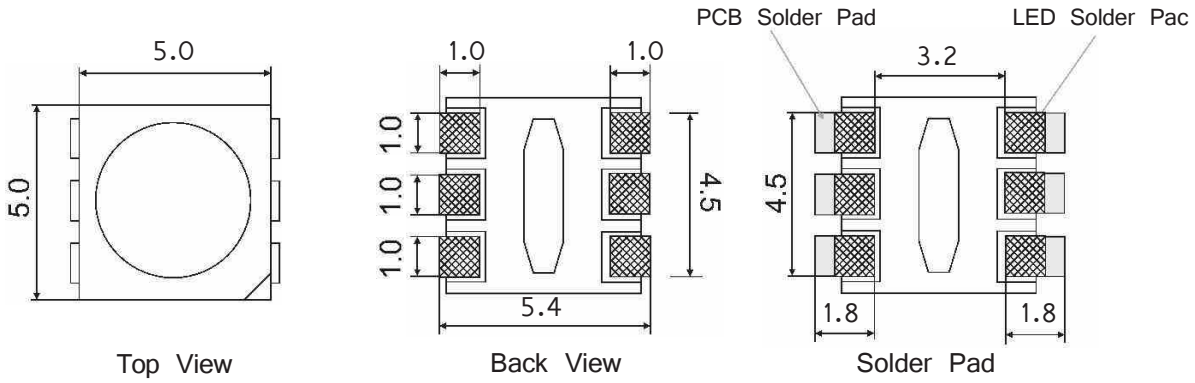
LC8808B mean white surface,12-14ma/channel, without capacitor intergrated in 5050

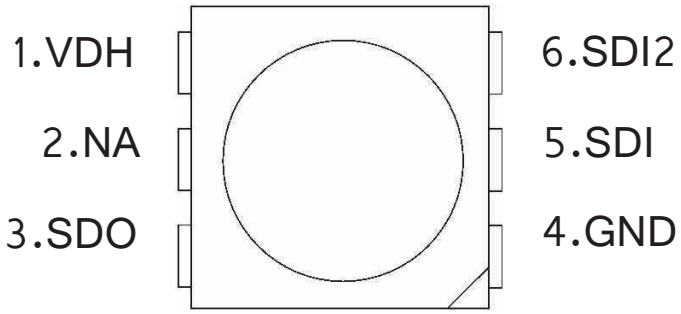
LC8808-B mean black surface ,12-14ma/channel ,capacitor integrated in 5050

LC8808B-B mean black surface,12-14ma/channel, without capacitor intergrated in 5050

5. Mechanical Dimensions:

Mechanical Dimensions:mm

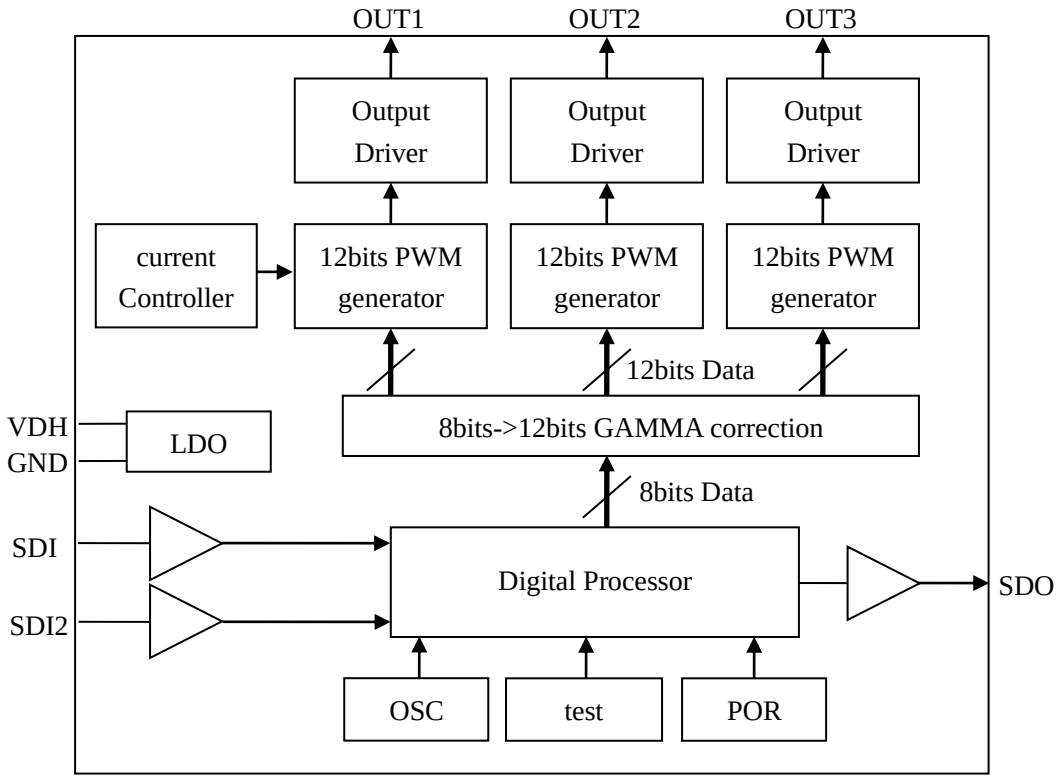




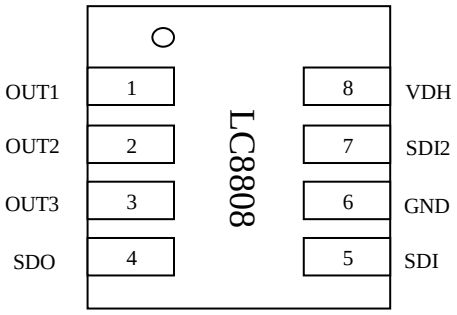
Notes:

1. All dimensions are in millimeters.
2. Tolerance is ±0.1mm unless otherwise noted

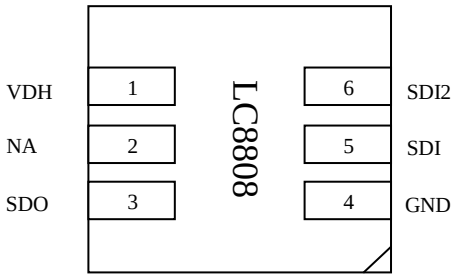
6.Block Diagram



7.Pin Configuration



Pin Configuration with LED

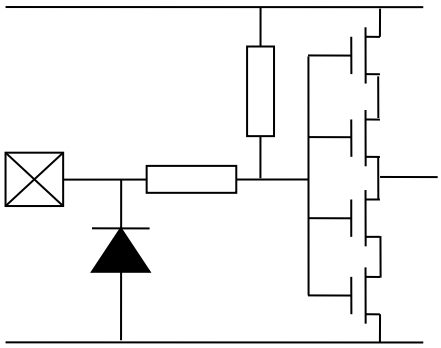


8.Pin Description

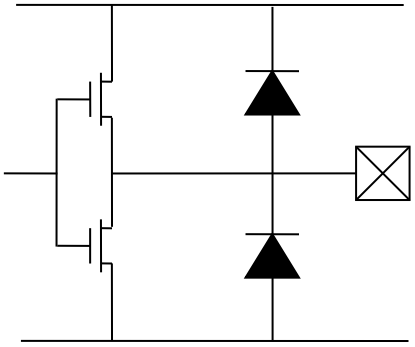
Pin name	type	Function
VDH	P	12V Power Supply
GND	P	Chip Ground
OUT1……OUT3	OUT	Constant-current outputs, connected to LED
SDI	IN	Series data input
SDI2	IN	Redundant series data input
SDO	OUT	Series data output

9.Equivalent Circuits of Input and Output

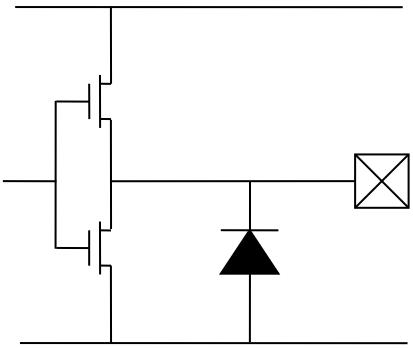
1 SDI/SDI2



2 SDO



3 OUT1、OUT2、OUT3



10.Maximum Ratings

Characteristic	Symbol	Maximum Working Range	Unit.
Power Source	VDH	-0.4～15V	V
On-chip Power Source	VCC	-0.4～6V	V
Input Logic Voltage	SDI	-0.5～VDH+0.5	V
Maximum output current	IOUT	18	mA
Output voltage-endurance	VDS	15	V
Ground current	IGND	55	mA
Power dissipation	Pd	400	mW
Working temperature	TOP	-40～85	ºC
Storage temperature	Tstg	-55～150	ºC
ESD	HBM	2000	V

（1）Stresses above there ratings may cause permanent damage. Exposure to absolute maximum condition for extended periods may degrade device reliability. These are stress ratings only and functional operation of the device at these or any other condition beyond those specified is not supported.

（2）All voltage values are with respect to ground terminal.

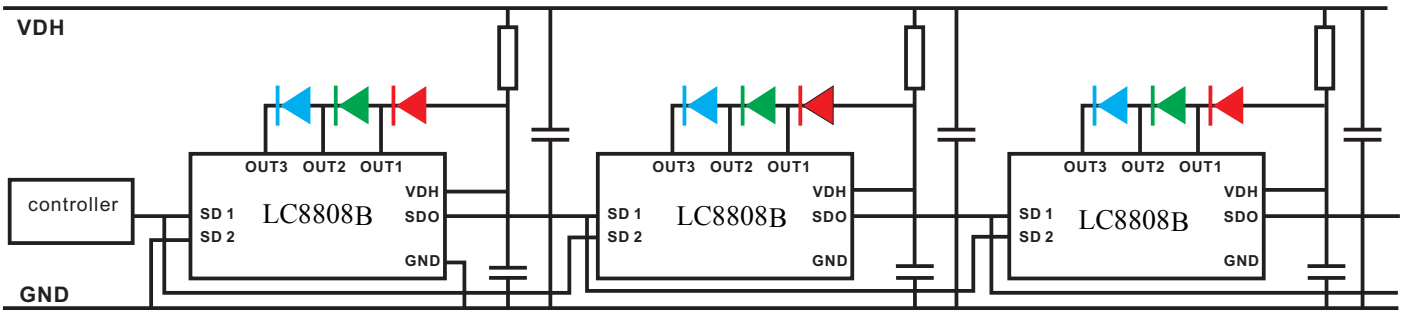
11.Electrical Characteristics

Characteristic	Symbol	Measuring condition	Min	Typical	Max	Unit.
Power supply	VDH		9	12	15	V
internal Power supply	VCC		4	5	6	V
High Input Logic Voltage	VIH		4			V
Low Input Logic Voltage	VIL				1	V
Output current	IOUT	VDH=12V	11	15		mA
Static current	Ichip			2.5		mA
Power dissipation	Pd				150	mW
Current variation(channel)	dIOUT	$I_{out} = 15mA$, $V_{out} = 1.2V$		$\pm 1.5\%$	$\pm 3\%$	%
Current variation(chip)	dIOUT2			$\pm 3\%$	$\pm 6\%$	%
Current offset VS Power Source				NA		
Voltage range of outputs	VOUT			1.2	12	V
External Power Res	Rvdh	VDH=12V		50		ohm
External Power Cap	Cvdh		0.1			uF

12.Switching Characteristics

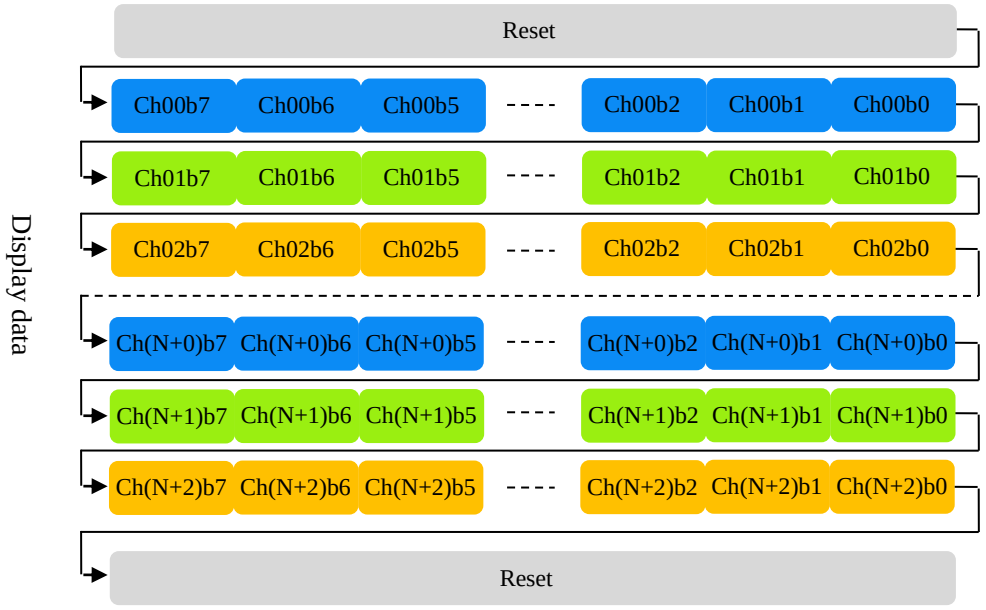
Characteristic	Symbol	Measuring condition	Min	Typical	Max	Unit.
Internal Oscillator Frequency	OSC			25		MHz
PWM refresh rate				8		kHz
Data refresh rate				30	1017	Hz
Data refresh delay time		1024 points		700		us
Internal program data refresh rate				100		Hz
Channel output delay time				80		ns
Current output rising time		18mA，VOUT=1V		40		ns
Current output falling time				40		ns
PWM pulse duration				240		ns
RZ data frequency			400k	800k	1M	Hz

13.Typical Application

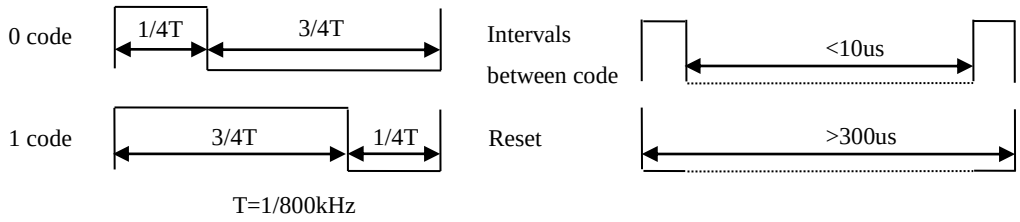


14.Data Format

LC8808 adopts the extended return to zero code (e-RZ) data transmission mode, 8bits data for single channel, each IC supports 3 channel for display. The transmission data is filtered internally to support the data anti-jitter function. The extension type is compatible with the traditional RZ code. So it is suitable for most of the RZ code controller in the market.

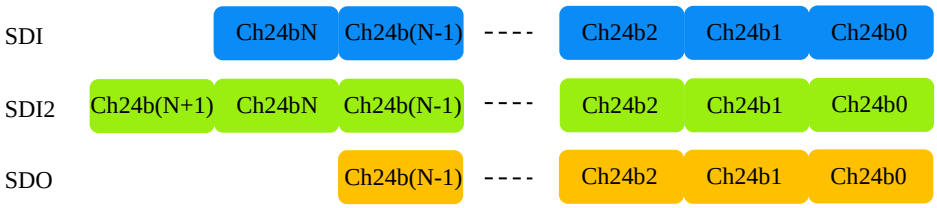


Single code with 1:3 duty cycle and a standard 800kHz transmission speed. The maximum frequency can reach 1MHz. LC8808 re-code the data before transmission. Data delay is less than 0.7us from chip to chip, meets the dynamic image needs.



15.Dual channel redundant control

Dual channel redundant control can be used to effectively avoid the failure of any single device damage, and reduce the damage rate of the driving system to one millionth. The SDI signal is used as the default transmission channel while the system is power on. The transmission channel priority is switched between SDI and SDI2 when the transmission data is abnormal. The device will choose the clear transmission channel after data detection.



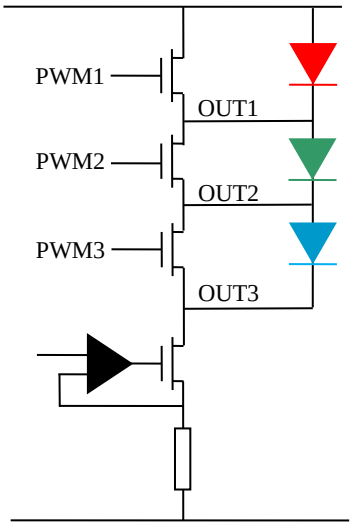
When the external control data is transmitted, SDI uses the 1-24bits received data as the display data, meanwhile, SDI2 will discard the 1-24bits data and use 25-48bits data as the display data.

16.Data channel status testing during production

In the production process, any one of the abnormal data channel will not affect display because the chip uses dual SDI input. It is difficult to detect the problem data channel during the production process, which may cause the dual channel is equivalent to a single channel.

In order to avoid this situation, the status of the data channel can be detected by using the test controller in the external control situation. While any channel appears Weld, short, open or other abnormal communication, the chip will display in white to facilitate the detection of problem position.

17.Working principle of the series structure LED controller



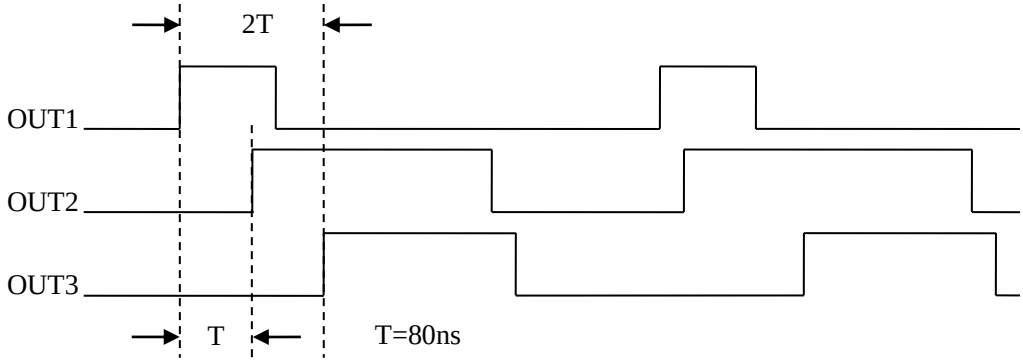
It is RGB LED series structure. Power supply voltage is 12V, and the LED constant current is 18mA. Different to the parallel architecture of 5V power supply and 54mA drive current, the series architecture can provide a better drive ability. The new architecture's total drive current is only 1/3 of the original one, and Vds=4V. The power loading ability is better.

In the series structure mode, when the internal MOS paralleling with the LED is open, the current flow into the LED and the LED lights. When the internal MOS paralleling with the LED is short, the current flow into the MOS device and the LED close. Switching the MOS device by PWM signal can lights on or off the LED.

Because the LED adopts the RGB series mode, the chip LED output must be connected in the order of the diagram. The wrong connection way will cause the LED to not work properly.

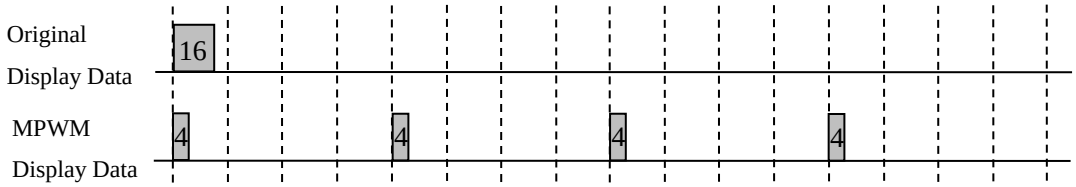
18.Stagger output delay

In order to prevent the large power interference from the LED switching, reduce the power circuit voltage fluctuations, LC8808 has a built-in output hysteresis function. OUT1, OUT2, OUT3 will work in accordance with the 80ns interval sequence, to improve the system's anti-jamming performance. Meanwhile, the current peak output stagger will reduce the system EMI radiation, to meet environmental requirements.



19.MPWM（multi-PWM）

In order to increase the refresh rate of PWM output, MPWM adopts a unique method of dispersibility to distribute the periodic N in the display time, as shown in the figure below. LC8808 adopts MPWM tech nology, and the PWM refresh rate increases to 8kHz, which shows gentle effect and does not affect the accuracy of output current.



20.Internal control patterns

LC8808 gets into RGB test mode right after power on. If the device does not receive the external display data for a long time, the chip will go into the built-in display patterns mode. Pattern on a total of six categories of 32 series, including integral color jump, integral color gradient, meteors, waves, colorful gradient, color jump of water circulation. It is 10 minutes about, and the image refresh frequency is 100hz.

Under the internal display mode, the first chip’s SDI/SDI2 needs to be connected to GND.

21.Power dissipation

When all the three output channels are turned on, the practical power dissipation is determined by the following equation:

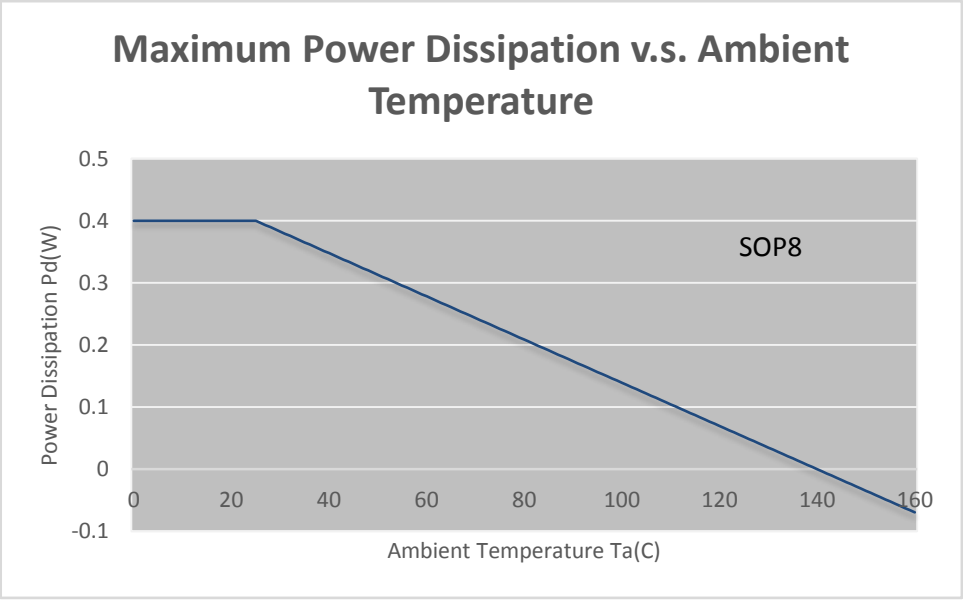
(Vout represents the output terminal voltage when the current is turned on; Duty represents the ratio of the time at which the current is turned on)

$$PD(practical)=VccxIcc+VoutA2xIoutA2xDutyA2+...+VoutD0xIoutD0xDutyD0$$

In secure operating conditions, the power consumption of an integrated chip should be less than the maximum permissible power dissipation which is determined by the package types and ambient temperature. The formula for maximum power dissipation is described as follows:

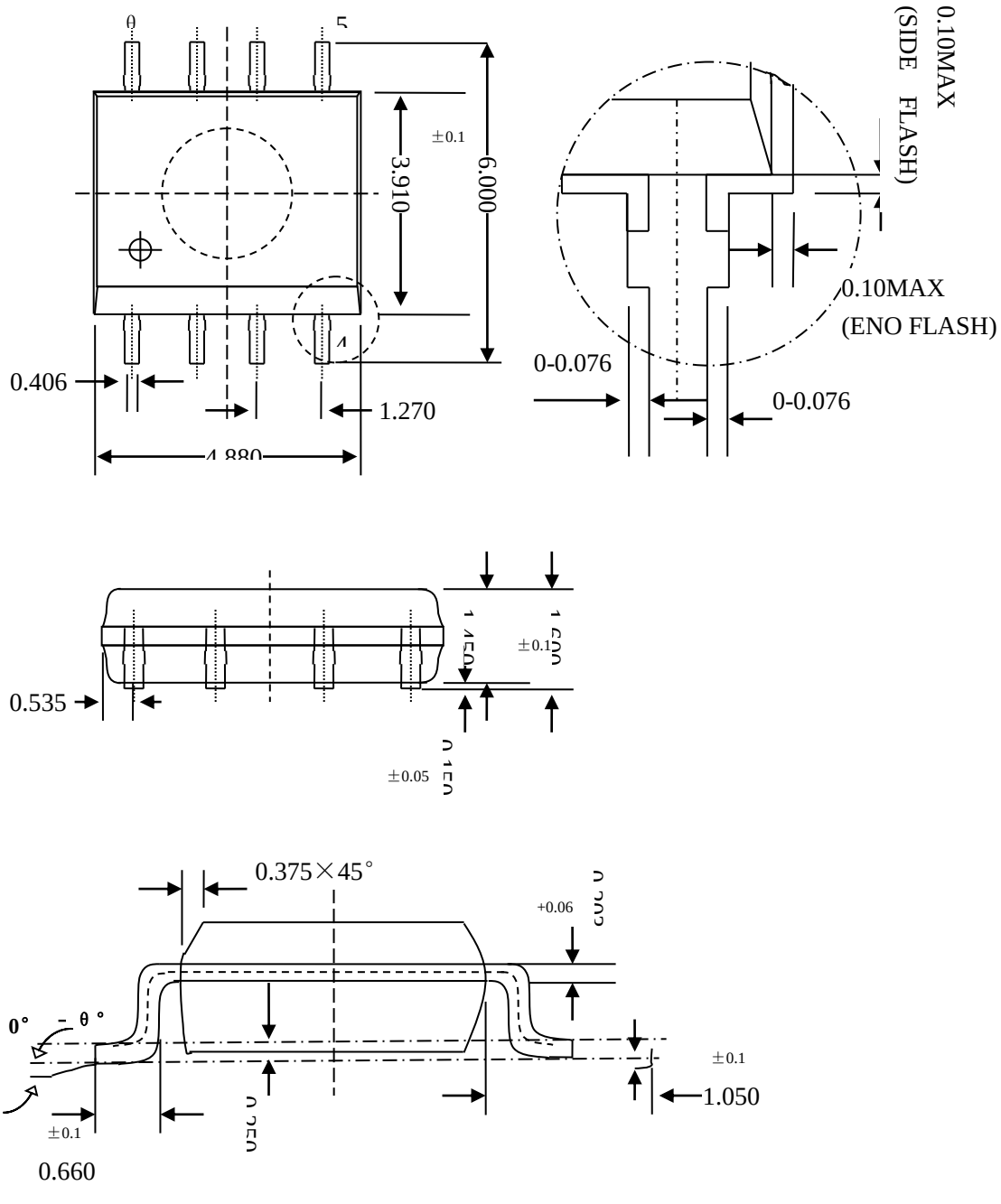
$$PD(\max)=\frac{Tj(\max)(C)-Ta(C)}{Rth(j-a)(C/Watt)}$$

The PD (max) declines as the ambient temperature rises. Therefore, suitable operating conditions should be designed with caution according to the chosen package and the ambient temperature. The following figure illustrates the relation between the maximum power dissipation and the ambient temperature of the SOP8 package.

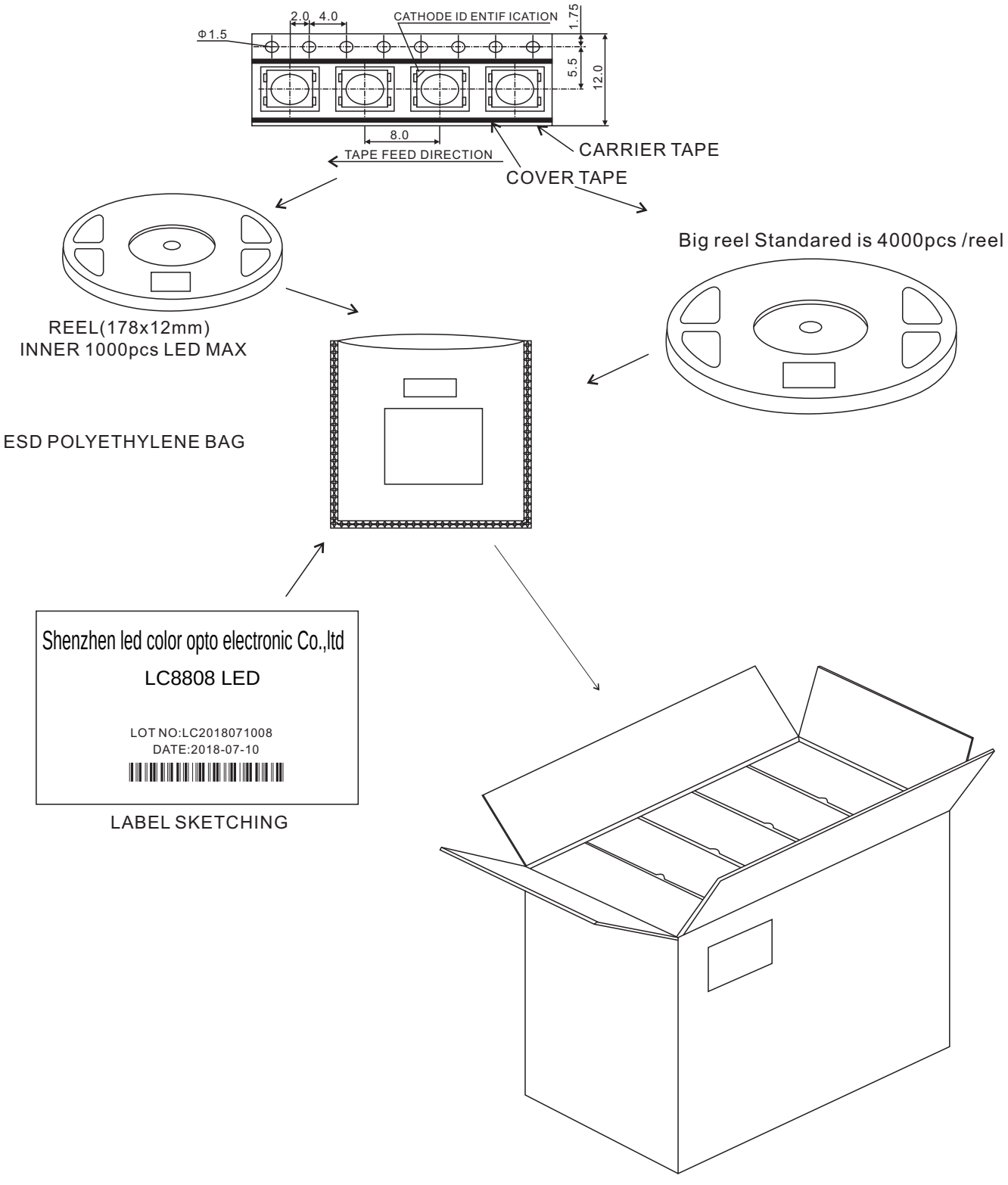


22.Package Outline Dimension

SOP8



23. Packaging Standard:



The reel pack is applied in SMD LED. The LEDs are packed in cardboard boxes after packaging in normal or anti-electrostatic bags. cardboard boxes will be used to protect the LEDs from mechanical shocks during transportation. The boxes are not water resistant and therefore must be kept away from water and moisture.

24. Attention

24.1 Dust & Cleaning

The LED use silicone glue to package the 5050 Surface, silicone surface can protect optical properties and improved anti-aging properties. However, silicone is a softer material and prone to attract dust. While a minimal amount of dust and debris on the LED will not cause significant reduction in illumination.We still need to avoid dust falling on the LED surface. After open the bags it must be used immediately.

When you use trichloroethylene or acetone to clean, sometimes the LED surface will dissolve.

Avoid using organic solvent, it is recommended that isopropyl be used as a solvent for cleaning the LEDs.When using other solvents, it should be confirmed beforehand whether the solvents will dissolve thepackage and the resin of not.

Do not clean the LEDs by the ultrasonic. When it is absolutely necessary, the influence as ultrasonic cleaning on the LEDs depends on factors such as ultrasonic power. Baking time and assembled condition.

Before cleaning, a pre-test should be done to confirm whether any damage to the LEDs will occur.

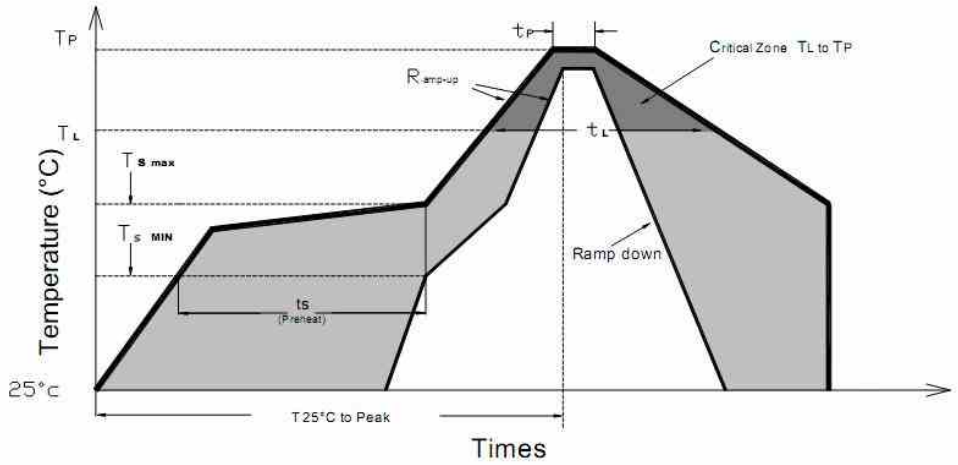
24.2 Dehumidification

LED COLOR smart led are moisture sensitive components, In IPC/JEDEC J-STD-020 MSL Level is 6. **No Matter the Package bag is open or not ,The LED must do dehumidification in the oven for 24 hours at 70 degree before use and used within 4 hours, otherwise it need to be dehumidified again**

24.3 Reflow Soldering Characteristics

In our Test, LED Color comfirm those smart led are compatible with JEDEC J-STD-020C,Customers are required to follow the soldering temperature profile recommended by the solder paste manufacturer used.

Please note that this general guideline may not apply to all PCB design and reflow soldering equipment configurations.



Profile Feature	Lead-Based Solder	Lead-Free Solder
Average Ramp-Up Rate (Ts max to Tp)	3 ℃/second max.	
Preheat: Temperature Min (Ts min)	100℃	150℃
Preheat: Temperature Min (Ts max)	150℃	200℃
Preheat: Time (ts min to ts max)	60-120 seconds	60-180 seconds
Time Maintained Above: Temperature (T L)	183 ℃	217 ℃
Time Maintained Above: Time (t L)	60-150 seconds	60-150 seconds
Peak/Classification Temperature (T P)	215 ℃ ℃	238 ℃ ℃
Time Within 5℃ ℃ of Actual Peak Temperature (tp)	<10 seconds	<10 seconds
Ramp-Down Rate	6 ℃/second max	6 ℃/second max
Time 25 ℃ ℃ to Peak Temperature	<6 minutes max	<6 minutes max

Note: All temperatures refer to topside of the package, measured on the package body surface.

24.4. Anti-static and surge protection for IC devices

Static electricity and surges can damage the LED products of IC devices, so appropriate protective measures must be taken;

The signal input and output ports of IC devices must be connected in series with protective resistors to prevent product failure due to surge or electrostatic shock ports;

In order to protect the LED products of IC devices, whenever you encounter LEDs, wear anti-static straps, anti-static straps and anti-static gloves.

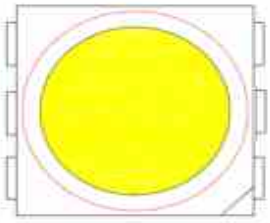
All devices and equipment must be grounded

It is recommended that each product be tested before shipment for relevant electrical tests to select defective products due to static electricity.

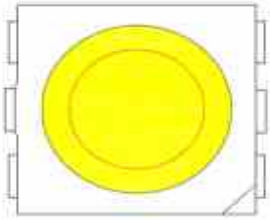
In the design of the circuit, consideration should be given to eliminating the surge to the LED

24.5 Other requirements

SMT nozzle requirements: (red circle refers to the inside diameter of the nozzle)



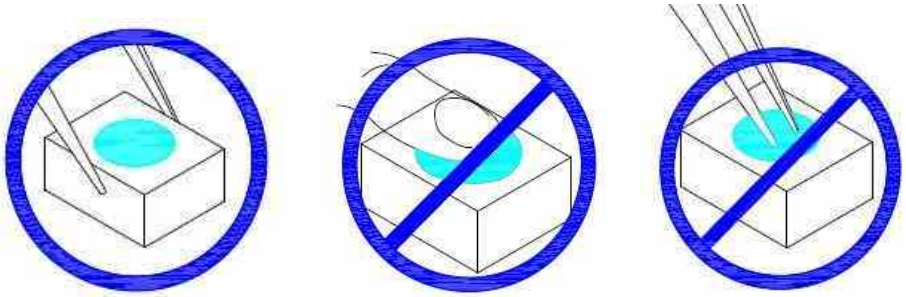
OK (the inside diameter of the nozzle is larger than the light-emitting area of the lamp)



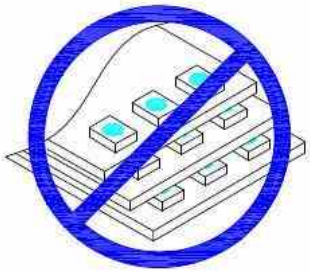
NG (the inside diameter of the nozzle is smaller than the lighting area of the lamp)

Pressing the colloid surface will affect the reliability of LED because the LED is advanced silicone-gel.And therefore precautions should be taken to avoid the strong pressure on the component. It's proper to make the LED be used in safe condition when using a suction nozzle. Silicon packing with soft and elastic, it greatly reduces thermal stresses and unable to bear external mechanical forces. Therefore, preventive measures should be taken in process of manually handling.

① Clip the LED from its side.Neither directly touch the gel surface with the hand or sharp instrument, it may damage its internal circuit.



② Not to be double stacked, it may damage its internal circuit.



③ Can not be stored in or applied in the acidic sites of PH<7.

Modify Records

Item NO.	Rev. No.	Modify Content Summary	Signature	Date
LC8808 RGB	01	Initial Document	Andy Zhu	2018-07-09