



佛山市国星光电股份有限公司

FOSHAN NATIONSTAR OPTOELECTRONICS CO., LTD

# SPECIFICATION

Customer		Product	TOP LED
Customer No.		Type	FM-3528UGK-520D

## APPROVED SIGNATURES

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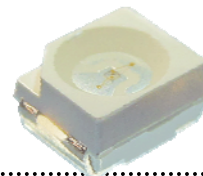
Research & Development Center		
APPROVE	CHECK	DRAW
Version NO: B1		
Release Date: 2012-03-20		

# FM-3528UGK-520D

## Top Light Emitting Diode

### Technical Data Sheet

This product is generally used as indicator and illuminant for electronic equipment such as household appliance, communication equipment, and dashboard.



#### Features:

- Material: InGaN
- Encapsulation: Resin
- Emitting Color: Green
- Reflow Solderable
- High Luminous Intensity and Low Power Dissipation
- Good Reliability and Long Life
- Complied With RoHS Directive

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\*The Specifications of the product may be modified for improvement without notice.\*

## Electrical-Optical Characteristics

### ✧ Absolute Maximum Ratings (Temperature=25°C):

Parameter	Symbol	Rating	Unit
Forward Current	$I_F$	25	mA
Pulse Forward Current <sup>*</sup>	$I_{FP}$	100	mA
Reverse Voltage	$V_R$	5	V
Operating Temperature	$T_{OPR}$	-30 ~ +85	°C
Storage Temperature	$T_{stg}$	-40 ~ +100	°C
Power Dissipation	$P_D$	90	mW
Electrostatic Discharge Threshold (HBM)		1000	V

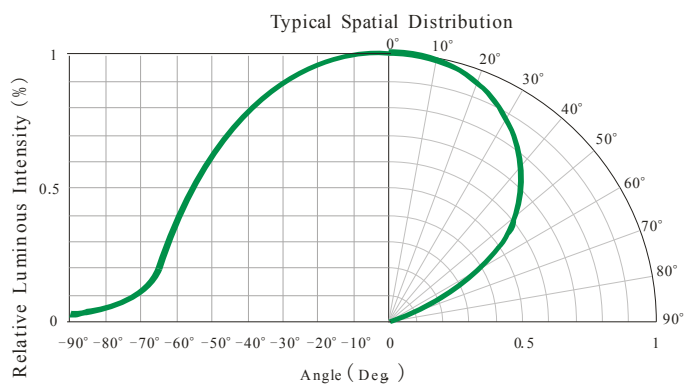
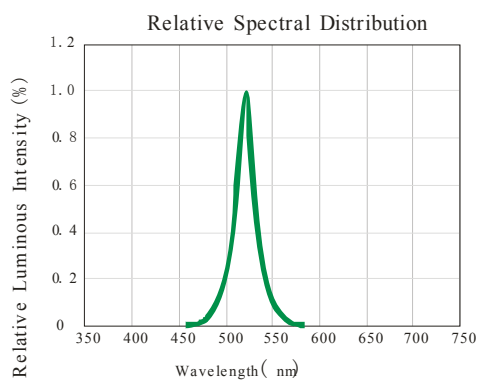
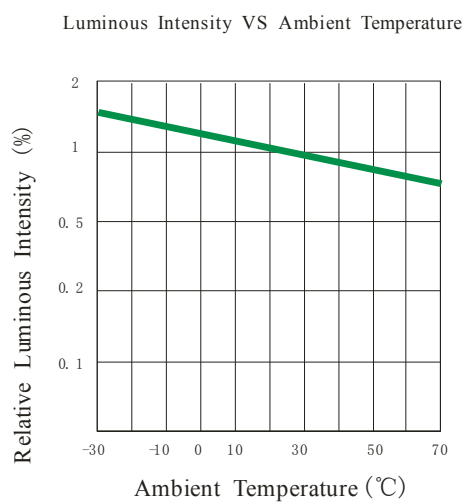
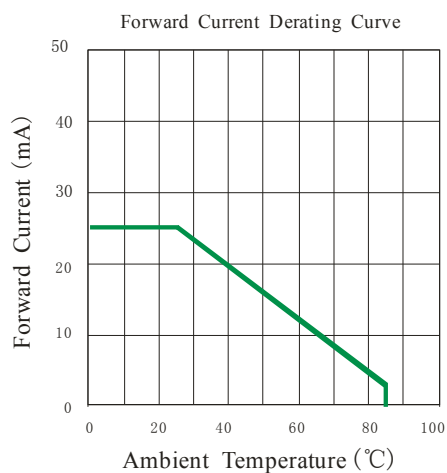
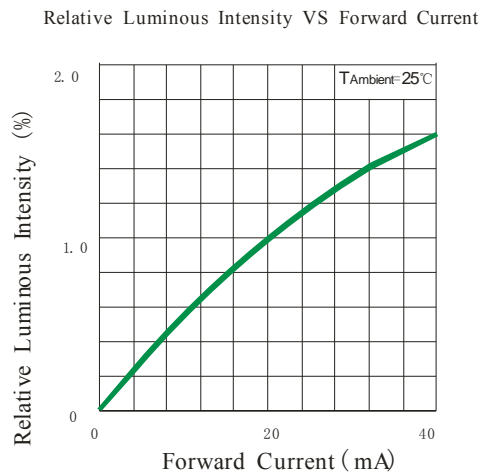
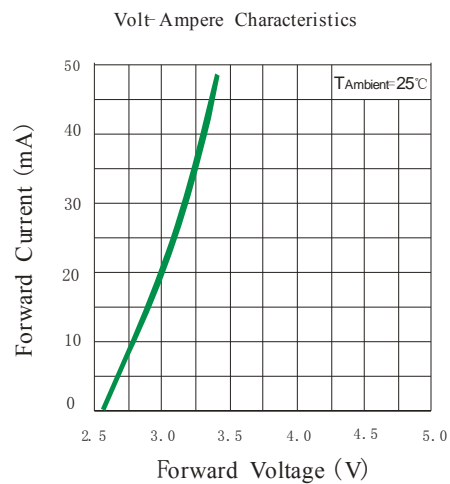
\* Note: Pulse width  $\leq 0.1\text{ms}$ , Duty  $\leq 1/10$ \*

### ✧ Electro-Optical Characteristics (Temperature=25°C):

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reverse Current	$I_R$	$V_R=5\text{V}$			10	$\mu\text{A}$
Forward Voltage	$V_F$	$I_F=20\text{mA}$	2.6	3.2	3.6	V
Peak Wavelength	$\lambda_P$			515		nm
Dominant Wavelength	$\lambda_D$		515	520	535	nm
Spectrum Radiation Bandwidth	$\Delta\lambda$			35		nm
Luminous Intensity*	$I_V$		900	1200	1800	mcd
View Angle	201/2			110		deg.

\*Note: Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve. \*

## Typical Characteristics Curves



## Reliability Test Items And Conditions

ESD-damaged LEDs will exhibit abnormal characteristics such as high reverse leakage current, low forward voltage, or “no lightup” at low current.

To verify for ESD damage, check for “lightup” and  $V_F$  of the suspect LEDs at low currents.

The  $V_F$  of “good” LEDs should be  $> 2.0V@0.1mA$  for InGaP product and  $> 1.4V@0.1mA$  for AlInGaP product.

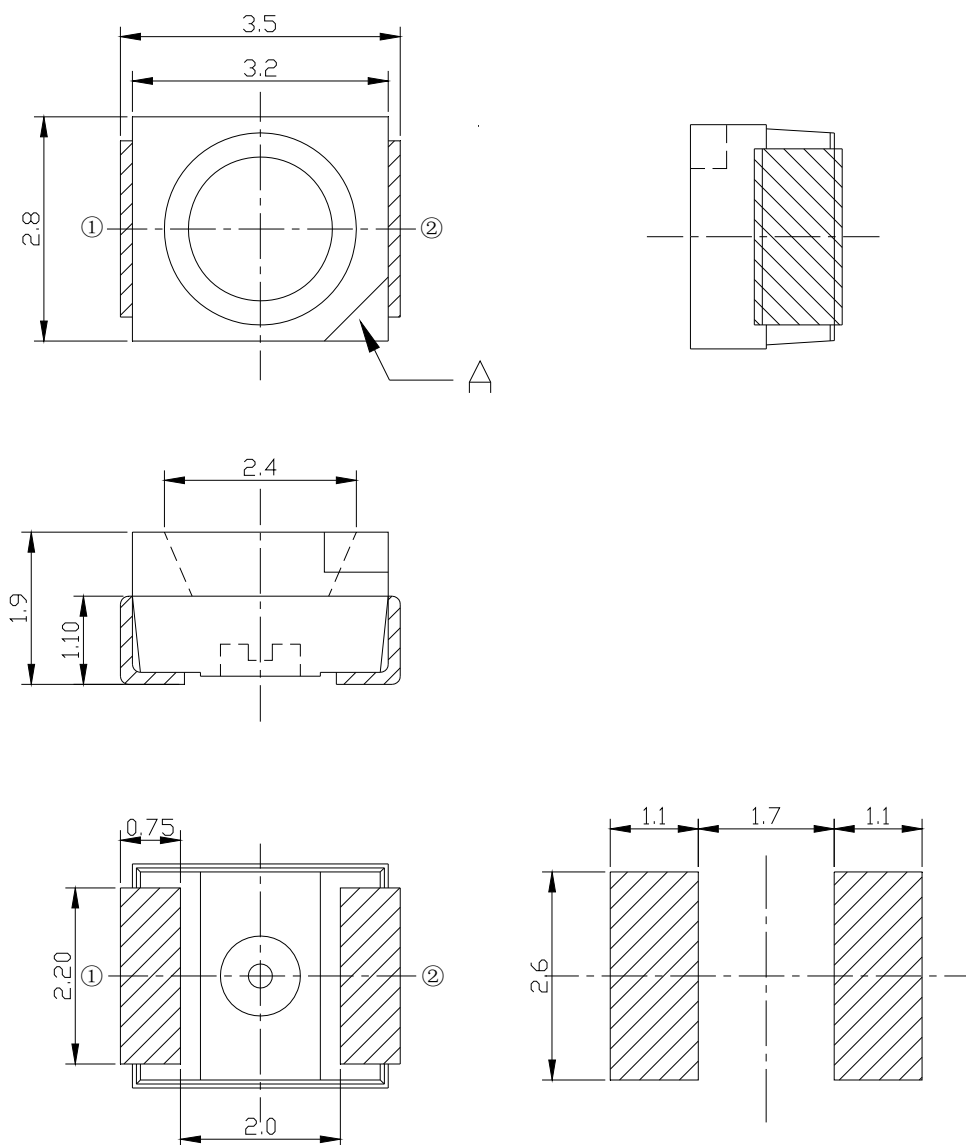
Test Items	Reference	Test Conditions	Time	Quantity	Criterion
Thermal Shock	MIL-STD-202G	$-40^{\circ}C(30min) \leftrightarrow 100^{\circ}C(30min)$	200 cycles	22	0/22
Temperature And Humidity Cyclic	JEITA ED-4701 200 203	$25^{\circ}C \sim 65^{\circ}C$ , 90%RH 24hrs./1cycle	10 cycles	22	0/22
High Temperature Storage	JEITA ED-4701 200 201	$T_a = 100^{\circ}C$	1000h	22	0/22
Low Temperature Storage	JEITA ED-4701 200 202	$T_a = -40^{\circ}C$	1000h	22	0/22
High Temperature High Humidity Storage	JEITA ED-4701 100 103	$T_a = 60^{\circ}C$ , RH=90%	1000h	22	0/22
Life Test	JESD22-A108D	$T_a = 25^{\circ}C$ $I_F = 20mA$	1000h	22	0/22
High Temperature Life Test	JESD22-A108D	$T_a = 80^{\circ}C$ $I_F = 20mA$	1000h	22	0/22
Low Temperature Life Test	JESD22-A108D	$T_a = -40^{\circ}C$ $I_F = 20mA$	1000h	22	0/22
High Temperature High Humidity Life Test	JEITA ED-4701 100 102	$T_a = 60^{\circ}C$ , RH=90% $I_F = 20mA$	1000h	22	0/22
Resistance to Soldering Heat	GB/T 4937, II, 2.2&2.3	$T_{sol} = (240 \pm 5)^{\circ}C$ 10secs.	2 times	22	0/22

### Criteria For Judging Damage

Test Items	Symbol	Test Conditions	Criteria For Judging Damage
Forward Voltage	$V_F$	$I_F = I_{FT}$	Initial Data $\pm 10\%$
Reverse Current	$I_R$	$V_R = 5V$	$I_R \leq 10\mu A$
Luminous Intensity	$I_V$	$I_F = I_{FT}$	Average $I_V$ degradation $\leq 30\%$ ; Single LED $I_V$ degradation $\leq 50\%$
Resistance to Soldering Heat			Material without internal cracks, no material between stripped, no dead light.

\* Note:  $T_{sol}$ -Temperature of tin liquid;  $I_{FT}$ : Typical current.

## Outline Dimensions



Recomemded Soldering Pad



Polarity

Note:

A : Nick Mark

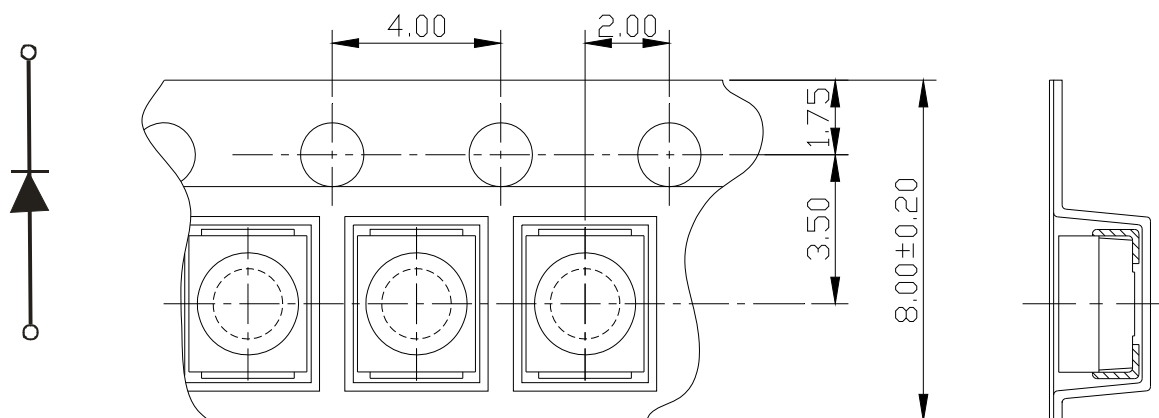
All dimensions in mm.

Tolerances: X.X  $\pm 0.1$  mm

X.XX  $\pm 0.05$  mm

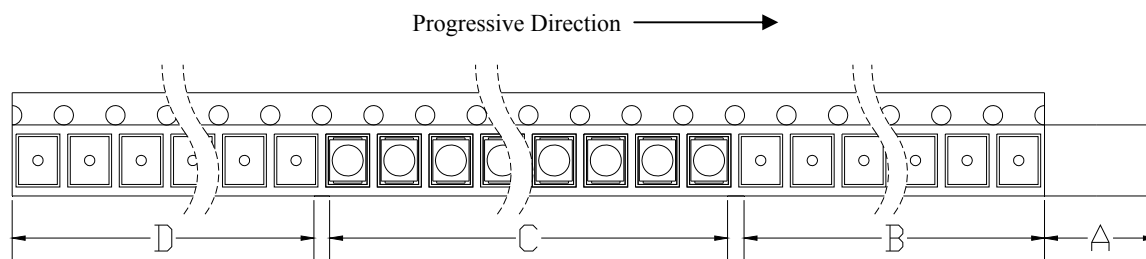
## Packaging (1)

### ✧ Carrier Tape



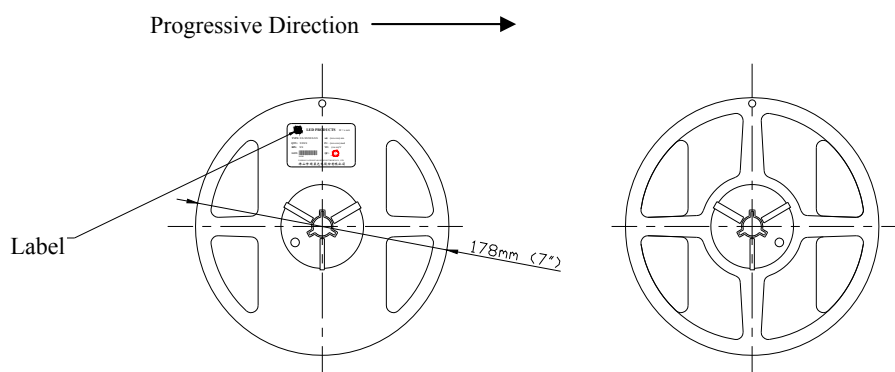
All dimensions in mm, tolerances unless mentioned is  $\pm 0.1$  mm.

### ✧ Details Of Carrier Tape



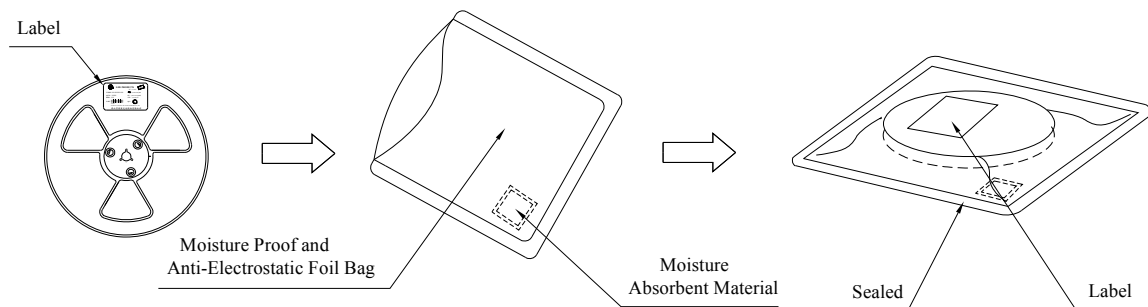
A: Top Cover Tape, 300mm; B: Leader, Empty, 200mm; C: 2000 Lamps Loaded; D: Trailer, Empty, 200mm.

### ✧ Reel Dimension

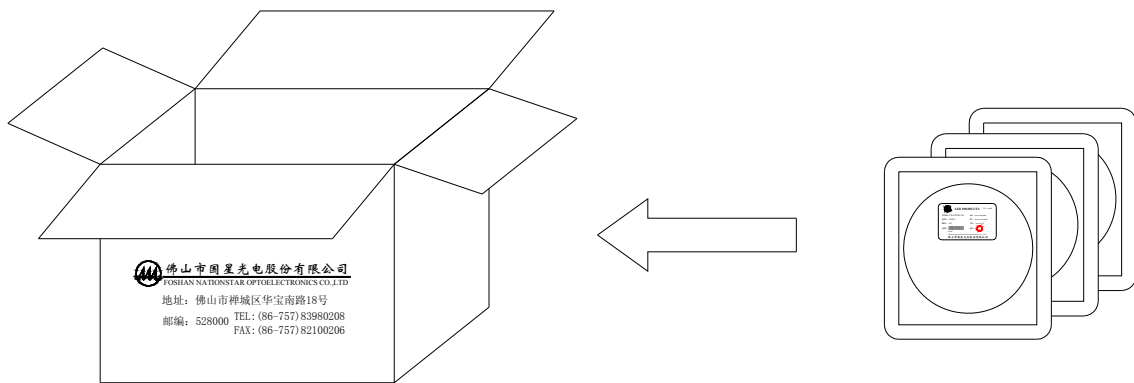


## Packaging (2)

### ✧ Moisture Proof and Anti- Electrostatic Foil Bag



### ✧ Cardboard Box



### ✧ Label Explanation

QTY: Quantity

BIN: Rank



LOT: Lot Number

$\lambda_d$ : Wavelength Range

IV: Luminous Intensity Range

VF: Forward Voltage Range

IF: Testing Current

	<b>TOP LED</b>	IF = x mA
TYPE: XX-XXXXXX-XX	$\lambda_d$ : (xxx-xxx) nm	
QTY: XXXX	IV: (xxx-xxx) mcd	
BIN: XX	VF: (xx-xx) V	
LOT:  XXXX	QC: 	
FOSHAN NATIONSTAR OPTOELECTRONICS CO., LTD 佛山市国星光电股份有限公司		



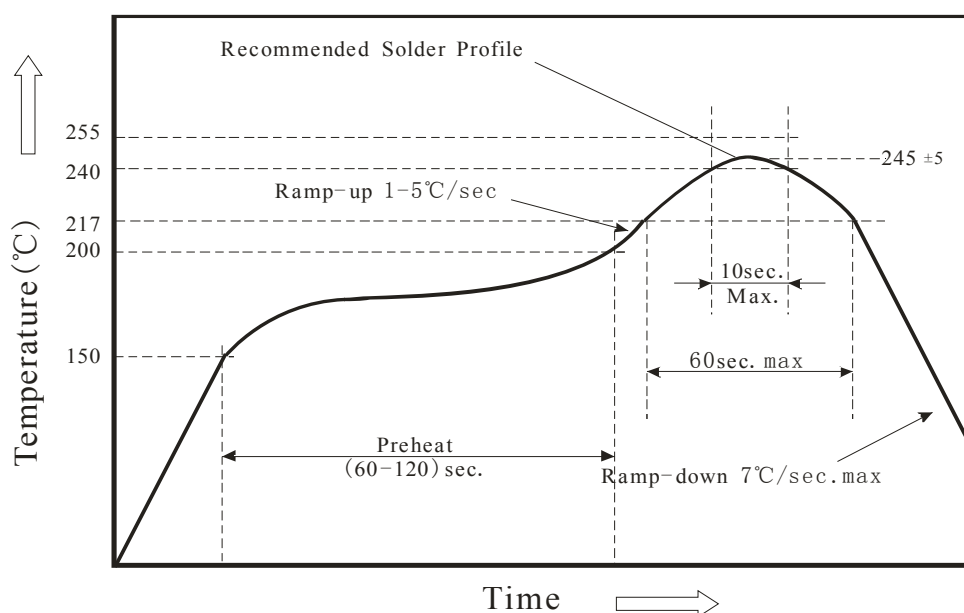
## Guideline for Soldering

### 1. Hand Soldering

A soldering iron of less than 20W is recommended to be used in Hand Soldering. Please keep the temperature of the soldering iron under 360°C while soldering. Each terminal of the LED is to go for less than 3 second and for one time only.

Be careful because the damage of the product is often started at the time of the hand soldering.

### 2. Reflow Soldering: Use the conditions shown in the under Profile of Pb-Free Reflow Soldering.



- Reflow soldering should not be done more than two times.
- Stress on the LEDs should be avoided during heating in soldering process.
- After soldering, do not deal with the product before its temperature drop down to room temperature.

### 3. Cleaning

It is recommended that alcohol be used as a solvent for cleaning after soldering. Cleaning is to go under 30°C for 3 minutes or 50°C for 30 seconds. When using other solvents, it should be confirmed beforehand whether the solvents will dissolve the package and the resin or not.

Ultrasonic cleaning is also an effective way for cleaning. But the influence of Ultrasonic cleaning on LED depends on factors such as ultrasonic power. Generally, the ultrasonic power should not be higher than 300W. Before cleaning, a pre-test should be done to confirm whether any damage to LEDs will occur.

**Note:** This general guideline may not apply to all PCB designs and configurations of all soldering equipment. The technique in practice is influenced by many factors, it should be specialized base on the PCB designs and configurations of the soldering equipment.

## Precautions (1)

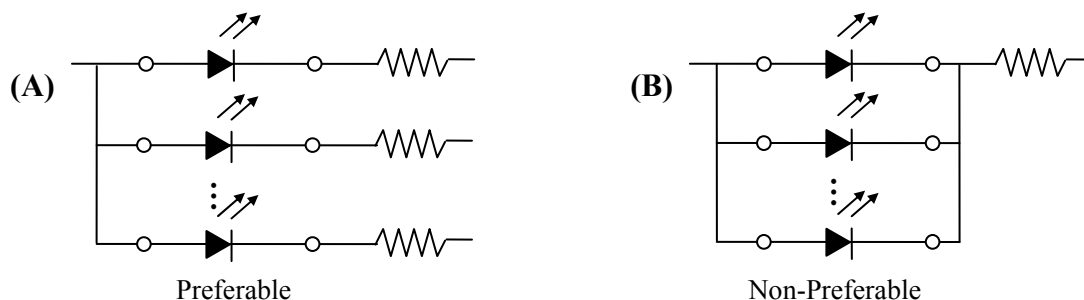
### 1. Storage

- Moisture proof and anti-electrostatic package with moisture absorbent material is used, to keep moisture to a minimum.
- Before opening the package, the product should be kept at 30°C or less and humidity less than 60% RH, and be used within a year.
- After opening the package, the product should be soldered within 24 hours. If not, please store at 30°C or less and humidity less than 10% RH. It is recommended that the product be operated at the workshop condition of 30°C or less and humidity less than 60% RH.
- If the moisture absorbent material has faded away or the LEDs have exceeded the storage time, baking treatment should be performed based on the following condition:  $(80 \pm 5)^{\circ}\text{C}$  for 24 hours.

### 2. Design Consideration

In designing a circuit, the current through each LED must not exceed the absolute maximum rating specified for each LED. In the meanwhile, resistors for protection should be applied, otherwise slight voltage shift will cause big current change, burn out may happen.

It is recommended to use Circuit A which regulates the current flowing through each LED rather than Circuit B. When driving LEDs with a constant voltage in Circuit B, the current through the LEDs may vary due to the variation in Forward Voltage ( $V_F$ ) of the LEDs. In the worst case, some LED may be subjected to stresses in excess of the Absolute Maximum Rating.



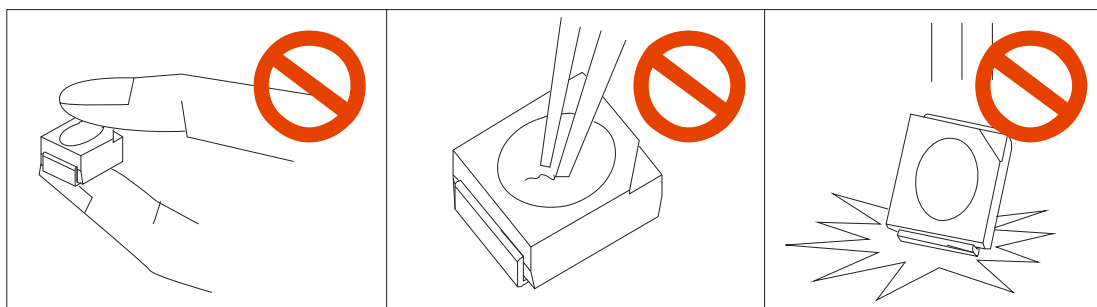
Thermal Design is paramount importance because heat generation may result in the Characteristics decline, such as brightness decreased, Color changed and so on. Please consider the heat generation of the LEDs when making the system design.



## Precautions (2)

### 3. Others

When handling the product, touching the encapsulant with bare hands will not only contaminate its surface, but also affect on its optical characteristics. Excessive force to the encapsulant might result in catastrophic failure of the LEDs due to die breakage or wire deformation. For this reason, please do not put excessive stress on LEDs, especially when the LEDs are heated such as during Reflow Soldering.



The epoxy resin of encapsulant is fragile, so please avoid scratch or friction over the epoxy resin surface. While handling the product with tweezers, do not hold by the epoxy resin, be careful.

### 4. Reverse voltage protection

In generally the reverse current of LED is very small, it can't effect using the component normally, but when it often suffered the reverse voltage which exceed the limits of the component than it will be damaged, the reverse current increases rapidly causing the LED degenerating rapidly so when designing, please pay attention to control the reverse voltage we suggest the reverse voltage less than 10V.