

GuangTu LED™

SPECIFICATION

Customer		Product	TOP Full-color LED
Customer No.		Type	GT-3528URGB-RS



Tel: 0755-23609023

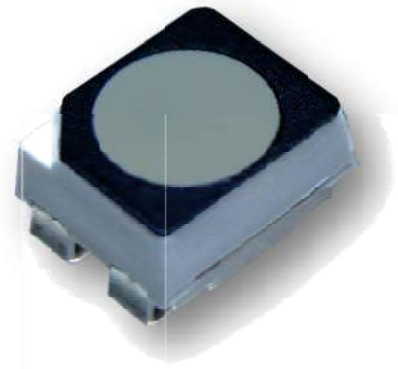
Fax: 0755-82591159

Code: 518000

R&D. RGB. NATIONSTAR			CUSTOMER
APPROVE	CHECK	DRAW	CONFIRM
Version NO: A4			
Release Date: 2015.04.20			

20150420TYBA4

3528-RGB-RS



These SMD LEDs are packaged in an industry standard PLCC4 package. These high reliability and high brightness LEDs are designed to work in a wide range of environmental conditions. A wide viewing angle and high brightness make these LEDs suitable for indoor screen, decorative lighting and amusement applications.

Features	Applications
<ul style="list-style-type: none">White Frame with Black SurfaceMultiple WaterproofSemi-glossy SurfaceHigh Luminous Intensity & High ReliabilityRoHS CompliantPb-free Reflow Soldering Application	<ul style="list-style-type: none">Indoor Full-color Video ScreenDecorative LightingAmusement

1 . SPECIFICATIO NS

1.1 Absolut e Maxim um Ratin gs (T_A=25 °C)

Item		Ra ing			Unit
		Red	Green	Blue	
Forward Current	I _F	30	20	20	mA
Pulse Forward Current [*]	I _{FP}	50			mA
Reverse Voltage	V _R	5			V
Powe r Dissipation	P _D	72	68	72	mW
Total Po wer Dissipation	P _{TOT}	90			mW
Operatin g Temperat ure	T _{OP R}	-30 +85			°C
Storage Temperature	T _{ST G}	-40~+100			°C
Total Junction Temperature	T _J	100			°C

* Note: Pulse Width ≤10ms, Duty cycle≤1/10

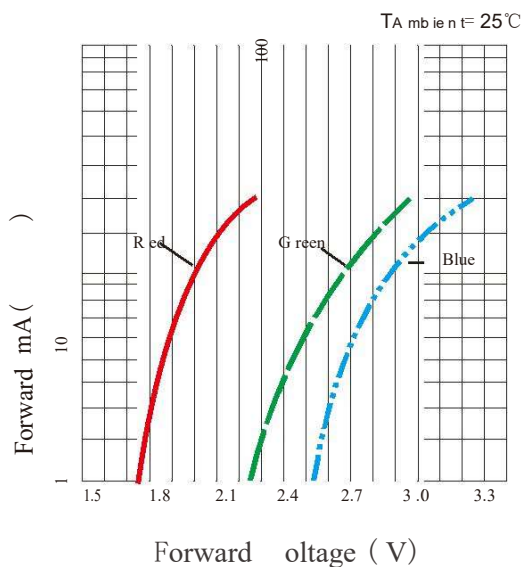
1.2 Initial Electrical /Optical C haracteristics (T_A =25°C)

Item	Symbol	Condition	Color	Min.	Typ .	Max.	U nit
Reverse Cu rrent	I _R	V _R =5V	-	-	-	50	μ A
Forward Vo ltage	V _F	I _F =20mA	Red	1.8	2.0	2.4	V
		I _F =12mA	Green	2.4	2.6	3.4	
		I _F =12mA	Blue	2.6	2.8	3.6	
D ominant Wavelength	λ _D	I _F =20mA	Red	615	620	630	nm
		I _F =12mA	Green	515	520	535	
		I _F =12mA	Blue	465	470	480	
Spectrum Ra diation Bandwid th	Δλ	I _F =20mA	Red	-	-	24	nm
		I _F =12mA	Green	-	-	38	
		I _F =12mA	Blue	-	-	28	
Luminous Intensity	I _v	I _F =20mA	Red	475	690	990	m cd
		I _F =12mA	Green	830	1200	1750	
		I _F =12mA	Blue	165	240	350	
View Angle	2θ _{1/2}	-	-	-	110	-	deg

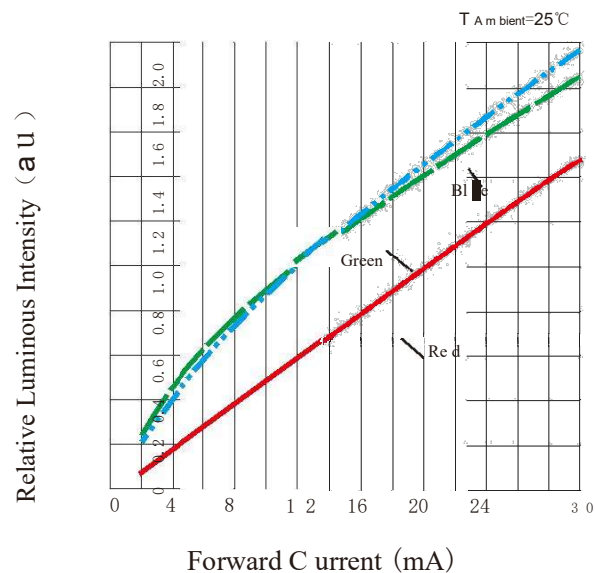
* Note: The above data are only for reference, they come from the standard testing system of NationStar.

2 . TYPICAL CHARACTERISTICS CURVES(1)

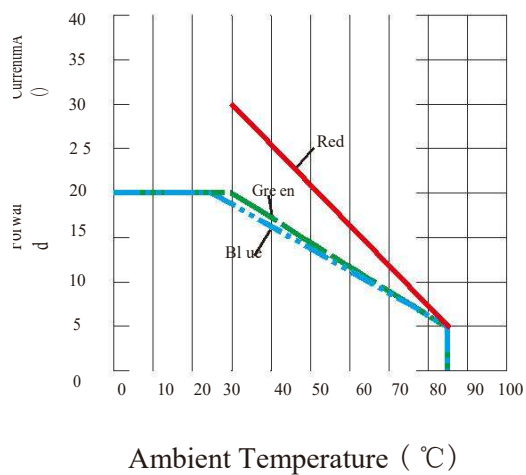
Volt -Ampere Characteristics



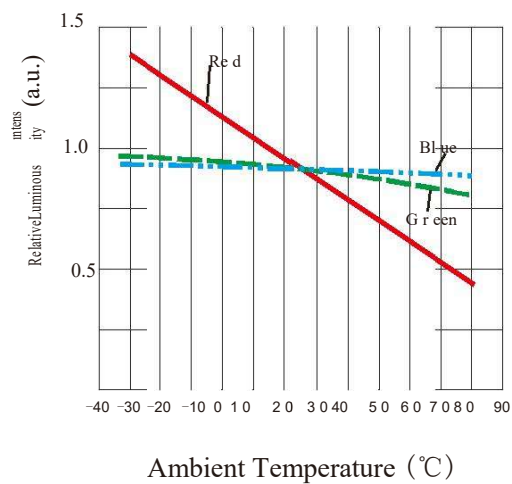
Relative Luminous Intensity VS Forward Current



Forward Current Derating Curve

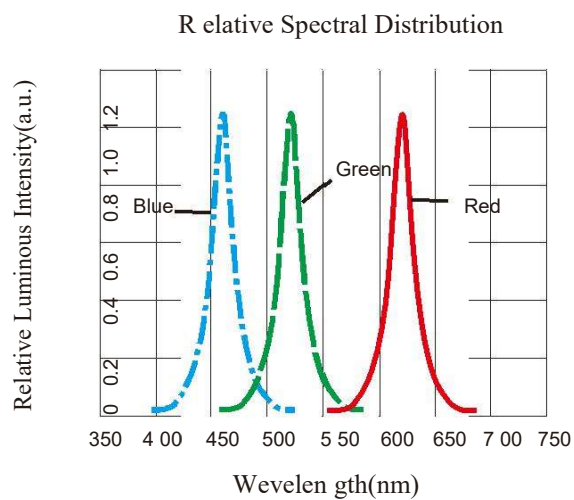
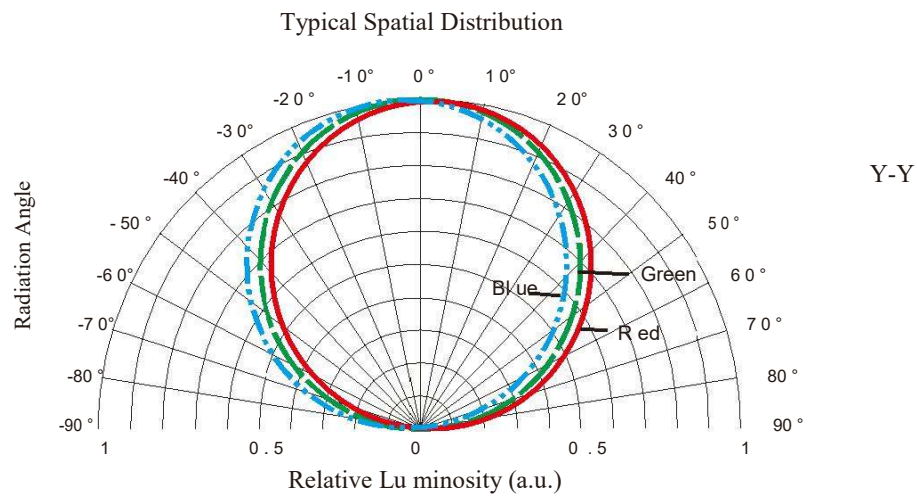
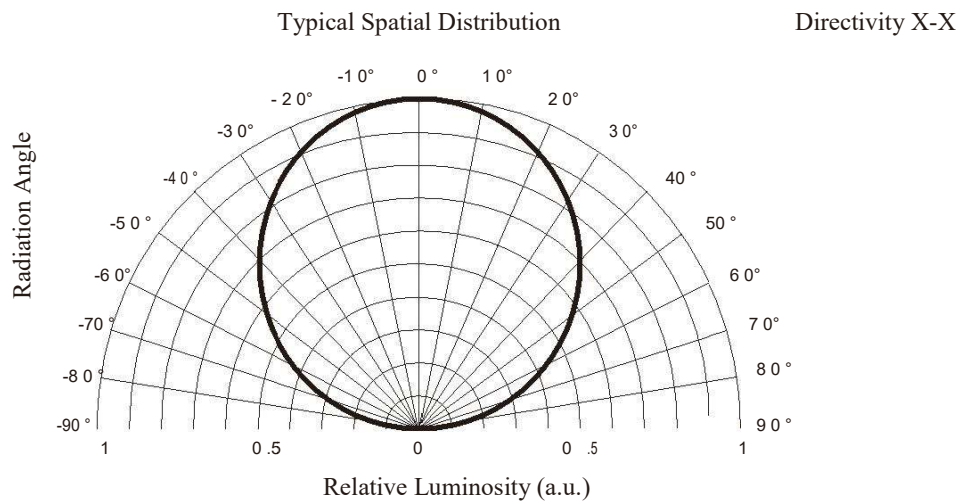


Luminous Intensity VS Ambient Temperature



* Note: The above data are collected from statistical figures that do not necessarily correspond to the actual parameters of each single LED.

2 . TYPICAL CHARACTERISTICS CURVES(2)



3 . RELIA BILITY

3.1 Test It em

Ite m	Reference Stan dard	Test Conditio ns	Test Duration	Faile d/ Test ed
Resistance to Soldering Heat [*]	JEITA E D-4701 300 301	$T_{sld}= 260\pm5)^{\circ}\text{C}$, 10sec, Preconditi on:30°C, 70 %RH,168hr	3 reflow s	0/1 00
Thermal Shock	MIL-STD -202G	-40°C(30 min) \longleftrightarrow 100°C(30min)	300 cycles	0/1 00
Moisture Re sistance	JEITA E D-4701 200 203	-10~65°C, 0~90%RH, 24hr/cycle	10 cycles	0/1 00
Hi gh Temperature Storage	JEITA E D-4701 200 201	$T_A=100^{\circ}\text{C}$	1000h	0/1 00
Low Temperature Storage	JEITA E D-4701 200 202	$T_A=-40^{\circ}\text{C}$	1000h	0/1 00
Te mperature & Humidity Storage	JEITA E D-4701 100 103	$T_A= 85^{\circ}\text{C}$, RH= 85%	1000h	0/1 00
Room Tem perature Operatin g Life	JESD22- A108D	$T_A=25^{\circ}\text{C}$, $I_{FR}=30\text{mA}$, $I_{FG}=15\text{mA}$, $I_{FB}=15\text{mA}$	1000h	0/1 00
Low Temperature Operatin g Life	JESD22- A108D	$T_A=-40^{\circ}\text{C}$, $I_{FR}=30\text{mA}$, $I_{FG}=15\text{mA}$, $I_{FB}=15\text{mA}$	1000h	0/1 00
Te mperature & Humidity Operatin g Life	JEITA E D-4701 100 102	$T_A=60^{\circ}\text{C}$, RH=90%, $I_{FR}=20\text{mA}$, $I_{FG}= 12\text{mA}$, $I_{FB}= 12\text{mA}$	500 h	0/1 00
Water Pro of Test	IEC 6052 9:2001	Imme rsing in 1m water	24h	0/1 00
E lectrostatic Discharge Test	AEC(Q10 1-001)	Human body model 1000 V, (Forward and reverse each 1time)	1 cycle	0/1 00

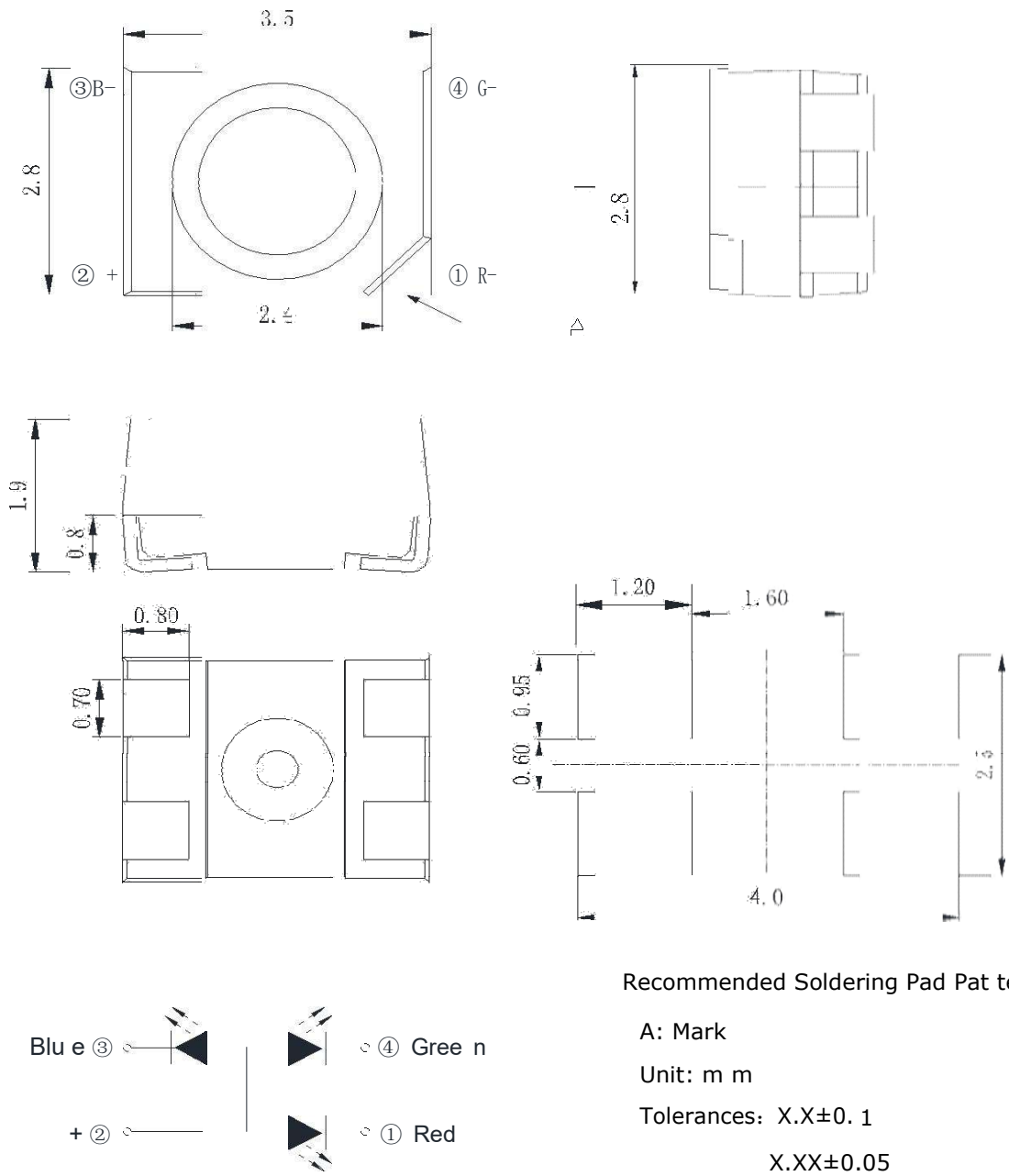
3.2 Failure Criteria(Value for single color)

Test Item s	Sym bol	Test Conditions	Failure Cr iteria
F orward Volta ge	V_F	I_F	$>USL \times 1.1$
Reverse Curr ent	I_R	V_R	$>USL \times 2$
Luminous Intensity	I_V	I_F	$<LSL \times 0.7$
*	-	-	Dead lamps and v sual damage

Note: Measure ments are p erformed af ter allowing the LEDs to return to room temperature.

USL: Upper Specific ation limit. LSL: Low er Specification Limit.

4 . OUTLINE DIMENSIONS

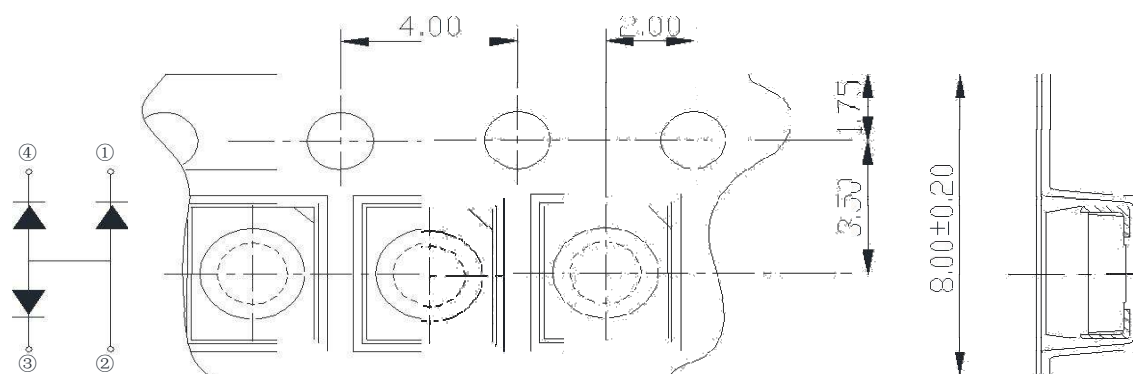


Item	Description
Package Materials	Heat-resistant Polymer
Encapsulating Resin Materials	Epoxy Resin(with diffuser)
Electrodes Materials	Ag-plated Copper Alloy

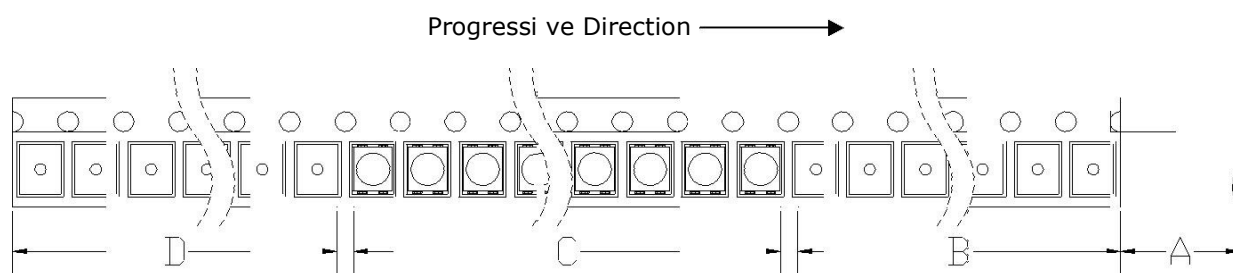
5 . PACKAGING

Unit: mm, Tolerance: ± 0.1 mm

5.1 Tape

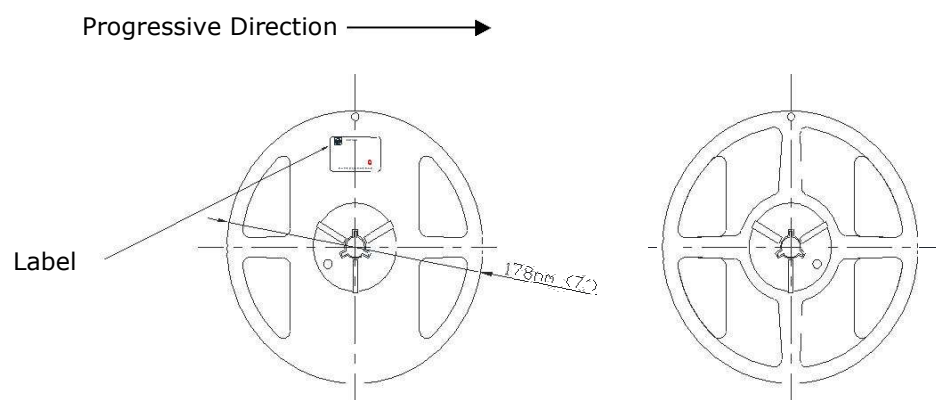


5.2 Trailer and Leader

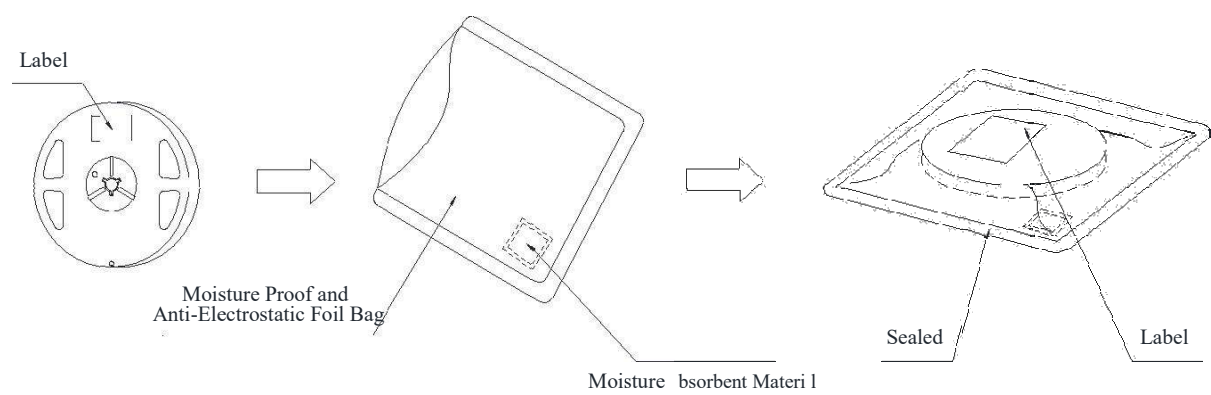


D: Trailer, Empty, 100mm ; C: 2000 LEDs Loaded; B: Leader, Empty: 100mm ; A: Top Cover Tape: 200mm;

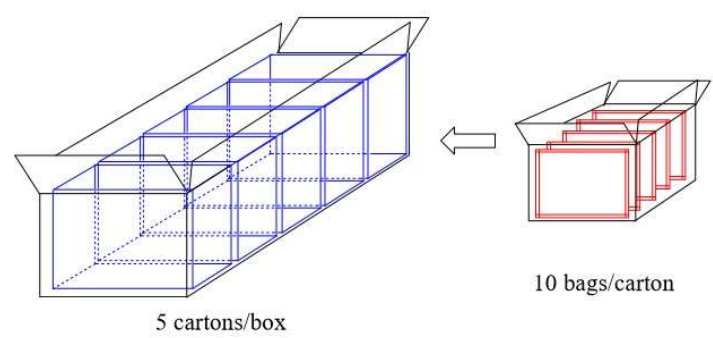
5.3 Reel



5 .4 Moisture-Proof & Antistatic Foil Ba g



5 .5 Cardboard Box



* Note: Do not drop or expose the box to external forces as it may damage the products. Do not expose to water. The box is not water-resistant. Using the original package material or equivalent in transit is recommended.

5 .6 Label Explanation

TYPE: QTY:
Quantity BIN :
Rank SC: Bin
Code
LOT: Lot Number
Wavelength Range IV: Lum
inous Intensity Range VF:
Forward Voltage Range IF:
Test Current

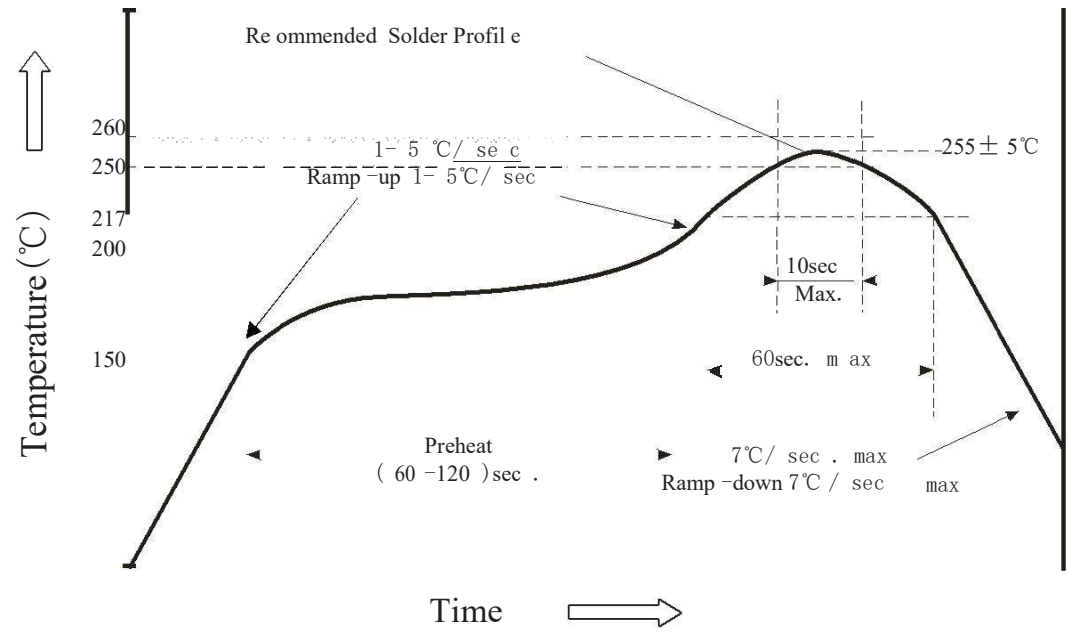
6 . GUIDE LINE F OR SOL DERING

6.1 Recom mended H and Soldering Con dition

Temperature	315°C M ax
cSoldering Time	2sec Max

- The package materials of the LED s hould not contact the soldering tool.
- When Sold ering, do not apply stres s to the surface resin.
- Hand soldering must n ot be perfor med more than once.

6.2 Recom mended R eflow Soldering C ondition(Lead-free Solder):



- This LED is designed to be reflow soldered on to PCB. If di p soldered, we cannot guarantee its reliability.
- Reflow soldering must not be performed more than twice.
- Stress on t he LEDs should be avoid ed during heating in soldering process.
- When solde ring, do not apply stress to the LED while the LED is hot.
- Nitrogen reflow solderi ng is recomm ended. Air flow solderin g condition s can cause optical degr adation, caused by heat or atmosphere.
- Repairing should not be done after t he LEDs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used.(It s hould be con firmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairin g.)
- When using a pick and place mach ne, choose an appropri ate nozzle fo r this product.
- This produc t can differ in optical characteristics depending on both the number of reflow cycles and reflow temperature conditions.

7 . CAUTIONS

7.1 Storage

Conditions		Tem perature	Humidity	Time
Storage	B efore Opening Aluminu m Bag	$\leq 30^{\circ}\text{C}$	$\leq 60\%\text{RH}$	Within 1 Yea r form Deliv ery Date
	A fter Openin g Aluminum Bag	$\leq 30^{\circ}\text{C}$	$\leq 60\%\text{RH}$	$\leq 24\text{hours}$
Baking		$80\pm 5^{\circ}\text{C}$	-	12 ± 1 hours

- Product co mplies with EDEC MSL 3 or equival ent, See IPC/JEDEC STD-020 for mo isture-sensitivity details .
- Absorbed moisture in LED packages can vapo rize and expand durin soldering, which can cause interface delaminatio n and resul t in optical performance degradation . Products a re packed i n moisture- proof aluminum bags to min imize moisture absorption during transportatio n and storage. Included silica gel de siccants cha nge from brown to blue if m oisture had penetrated bags.
- After opening the mois ture-proof aluminum bag, the produ cts should g o through the soldering process wit hin the range o f the conditions stated above. Unus ed remainin g LEDs sho uld be store d with silica desiccants in a hermetically sealed con tainer.
- If the alum inum bag has leaked air before opening or the "Period After Openin g" storage time has b een exceeded, the product s should be baked. Baking should only be done once and the reel should out of the aluminum bag when ba king.
- Although th e leads or electrode pads(anode and cathode)of the product are plated w ith Ag, prol onged exposure to corrosive environment might cau se the Ag plated the leads or electr de pads to tarnish, and thus leadin g to difficulties in soldering. If unused LEDs remain , they must be stored in a hermetic ally sealed container.
- Do not use sulfur-conta ining materials in comm ercial prod ucts. Some materials, such as seals and adhesiv es, may contain sulfur. T he contami nated plating of LEDs might cause an open circuit. Silicone rubbe r is recommend ed as a material for se ls.
- To prevent water cond ensation, please avoid large temperature and humidity fluctuations for the storage conditions.
- Do not exp ose the LEDs to direct sunlight and/o r an environ ment where the temperature is high er than nor mal room temperature.

7.2 Directions for Use

- In designing a circuit, the current through each LED die must not exceed the Absolute Maximum Rating current specified for each die. It is recommended that each LED die is driven at a constant current.
- When having the two or more die within this product on at the same time, the total power dissipation for the LED package must be within the absolute maximum value specified in this specification.
- This product should be operated using forward current. Ensure that the product is not subjected to either forward or reverse voltage while it is not in use. In particular, subjecting it to continuous reverse voltage may cause migration, which may cause damage to the LED die. When used in displays that are not used for a long time, the main power supply should be switched off for safety.
- Care must be taken to ensure that the reverse voltage will not exceed the Absolute Maximum Rating when using the LEDs with matrix drive.
- Ensure that excessive voltages such as lightning surges are not applied to the LEDs.
- Aging is recommended for detecting manufacturing and assembly defects. In particular, ensure that excessive current and /or voltage is not applied to the LEDs. This aging should be conducted in environments where water condensation does not occur.
- It is recommended to operate the LEDs at a current greater than 10% of the sorting current to stabilize the LED characteristics.
- This product can be used in indoor applications; however, when the LEDs are used in the following environments, incorporate sufficient measures into the display to prevent debris, water /moisture and gases that will adversely affect the product.
 - where water vapor is abundant, where water condensation is likely to occur
 - where water is likely to splash on to the LEDs
 - where frost is likely to form on the surface of the LEDs(e.g. freezer, ice skating rink, etc)
 - where dust, dirt, debris, loose metallic materials and/or gases that will adversely affect the product are present
- In areas where hydrogen sulfide, which is a sulfide-based gas, is present(e.g. hot springs and volcanic areas), and where salt is abundant(e.g. coastal areas), the life may be shortened.
- When this product is used for displays that will be installed outside: the LEDs should be covered to avoid exposure to outdoor environments in conjunction with sufficient measures against direct sunlight, wet or damp conditions, and salt damage.
- When power is applied for the first time after installation, the display should not be powered at 100% wattage since the LEDs may have absorbed moisture. Before normal use of this display, operate the display at approximately 20% wattage for an initial time period.
- If the display units will be rented, those units should be selected carefully to ensure that the display as a whole will appear the same color and brightness.
- If the display units are loaded onto and/or transported by ship, the damp environment on the vessel will cause condensation; the display units should be packaged to prevent moisture absorption.
- If a display that has been, or is being, used is relocated, it is possible that degradation of the LED has occurred. When transporting this display, provide sufficient protection for the LEDs in addition to the moisture-proof packaging for the display. When this display is reinstalled, ensure to follow the installation instructions for environments and use.

7.3 Handling Precautions

- Do not handle the LEDs with bare hands as it will contaminate the LED surface and may affect the optical characteristics: it might cause the LED to be deformed and/or the wire to break, which will cause the LED not to illuminate. The lead could also cause an injury.
- When handling the product with tweezers, be careful not to apply excessive force to the resin. Otherwise, the resin can be cut, chipped, delaminated or deformed, causing wire-bond breaks and catastrophic failures.
- Dropping the product may cause damage.
- Do not stack assembled PCBs together. Failure to comply can cause the resin portion of the product to be cut, chipped, delaminated and/or deformed. It may cause wire to break, leading to catastrophic failures.

7.4 Design Consideration

- PCB warpage after mounting the products onto a PCB can cause the package to break. The LED should be placed in a way to minimize the stress on the LEDs due to PCB bow and twist.
- The position and orientation of the LEDs affect how much mechanical stress is exerted on the LEDs placed near the score lines. The LED should be placed in a way to minimize the stress on the LEDs due to board flexing.
- Board separation must be performed using special jigs, not using hands.

7.5 Electrostatic Discharge(ESD)

- The products are sensitive to static electricity or surge voltage. ESD can damage a die and its reliability. When handling the products, the following measures against electrostatic discharge are strongly recommended:
 - Eliminating the charge
 - Grounded wrist strap, ESD footwear, clothes, and floors
 - Grounded workstation equipment and tools
 - ESD table /shelf mat made of conductive materials
- Ensure that tools (e.g. soldering irons), jigs and machines that are being used are properly grounded and that proper grounding techniques are used in work areas. For devices/equipment that mount the LEDs, protection against surge voltages should also be used.
- If tools or equipment contain insulating materials such as glass or plastic, the following measures against electrostatic discharge are strongly recommended:
 - Dissipating static charge with conductive materials
 - Preventing charge generation with moisture
 - Neutralizing the charge with ionizers
- The customer is advised to check if the LEDs are damaged by ESD, when performing the characteristics inspection of the LEDs in the application. Damage can be detected with a forward voltage measurement or a light-up test at low current ($\leq 1\text{mA}$).
- LEDs with ESD-damaged dice (i.e. other than red) may have an increased leakage current, current flow at a low voltage, or no longer illuminate at a low current. Failure criteria: $V_F < 2.0\text{V}$ at $I_F = 0.5\text{mA}$.

7.6 Thermal Management

- Proper thermal management is an important when designing products with LEDs. LED die temperature is affected by PCB thermal resistance and LED spacing on the board. Please design products in a way that the LED die temperature does not exceed the maximum junction temperature (T_J).
- Drive current should be determined for the surrounding ambient temperature (T_A) to dissipate the heat from the product.

7.7 Cleaning

- The LEDs should not be cleaned with water, benzene, and/or thinner.
- If required, isopropyl alcohol (IPA) should be used. Other solvents may cause premature failure to the LEDs due to the damage to the resin portion. The effects of such solvents should be verified prior to use. In addition, the use of CFC's such as Freon is heavily regulated.
- When dust and/or dirt adheres to the LEDs, soak a cloth with Isopropyl alcohol (IPA), then squeeze it before wiping the LEDs.
- Ultrasonic cleaning is not recommended since it may have adverse effects on the LEDs depending on the ultrasonic power and how LED is assembled. If ultrasonic cleaning must be used, the customer is advised to make sure the LEDs will not be damaged prior to cleaning.

7.8 Eye Safety

- Please proceed with caution when viewing directly any LEDs driven at high current, or viewing LEDs with optical instruments which may greatly increase the damages to your eyes.
- Viewing a flashing light may cause eye discomfort. When incorporating the LED in to your product, please be careful to avoid adverse effects on the human body caused by light stimulation.

7.9 Others

- The LEDs described in this brochure are intended to be used for ordinary electronic equipment (such as office equipment, communications equipment, measurement instrument and household appliances). Consult NATIONSTAR's sales staff in advance for information on the applications in which exceptional quality and reliability are required, particularly when the failure or malfunction of the LEDs may directly jeopardize life or health (such as for airplanes, aerospace, submersible repeaters, nuclear reactor control system, automobiles, traffic control equipment, life support systems and safety devices).
- The customer shall not reverse engineer by disassembling or analysis of the LEDs without having prior written consent from NATIONSTAR. When defective LEDs are found, the customer shall inform NATIONSTAR directly before disassembling or analysis.
- The specifications and appearance of this specification. Both the customer and NATIONSTAR will agree on the official specifications of supplied products before the volume production of a program begins.