

**APPROVAL SHEET**

AOT MODEL NAME	SMD LED : Blue Color
AOT PART NUMBER	AOT-0603BL31A-N0-N-3-M
CUSTOMER NAME	General Customer
DATE	2007/August
VERSION	1

MAKER			CUSTOMER			
Prepared	Checked	Approved				

**AOT HEAD QUARTER**  
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## AOT-0603BL31A-N0-N-3-M

### Dimension

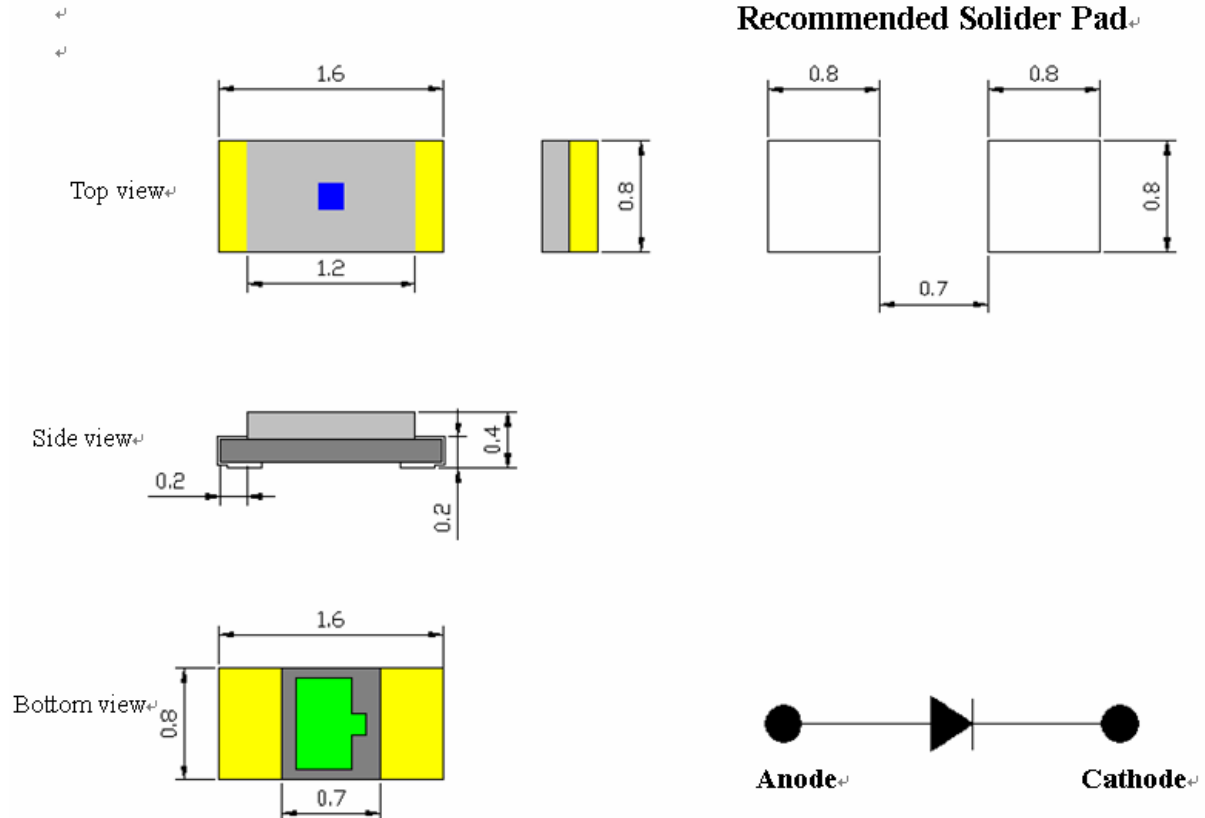
Type : 0603 PCB

Unit : mm

### Recommended Soldering PCB Pattern

Unit : mm

Tolerance : +/- 0.1



- Single blue chip.
- Super high brightness of surface mount LED.
- Sorting for  $I_v$  and  $V_f$  @ 5mA of  $I_f$
- Compact package outline (LxWxT) of 1.6 mm x 0.8 mm x 0.4 mm.
- Compatible to IR reflow soldering.

## Optoelectronic Characteristics at Ta=25°C.

Parameter	Symbol	Condition	Value	Unit
Forward Voltage	$V_F$	$I_F = 5 \text{ mA}$	2.6 ~ 3.2	V
Wavelength	$\lambda_d$	$I_F = 5 \text{ mA}$	465 ~ 475	nm
Luminous Intensity*	$I_o$	$I_F = 5 \text{ mA}$	9 ~ 37	mcd
Operating Temperature	$T_{OPR}$		-40 ~ +85	°C
Storage Temperature	$T_C$		-40 ~ +85	°C
Leakage current	$I_r$	-5V	≤100	uA

\*  $V_f$  tolerance: ±0.05V

\* Dominant wavelength tolerance: ±1nm

\* Luminous intensity is NIST reading. Luminous intensity tolerance:±10%

## Absolute Maximum Ratings.

	Maximum Value	Unit
DC forward current per chip	30	mA
Peak pulse current; (1/10 duty cycle, 0.1ms pulse width)	100	mA
Reverse voltage.	5	V
LED junction temperature.	125	°C
Operating temperature.	-40 ~ +85	°C
Storage temperature.	-40 ~ +85	°C
Power dissipation ( at room temperature )	108	mW

### Group Definition of forward voltage

Rank	Vf @ 5mA
1	2.6 ~ 2.7
2	2.7 ~ 2.8
3	2.8 ~ 2.9
4	2.9 ~ 3.0
5	3.0 ~ 3.1
6	3.1 ~ 3.2

### Group Definition of wavelength

Rank	$\lambda_d$ @ 5mA
W	465-470
X	470-475

### Group Definition of brightness

Rank	Iv @ 5mA
A	9 ~ 11
B	11 ~ 14
C	14 ~ 18
D	18 ~ 23
E	23 ~ 29
F	29 ~ 37

\*One delivery would be included 72 different ranks of the luminous intensity , wavelength and Vf depend on customer request.

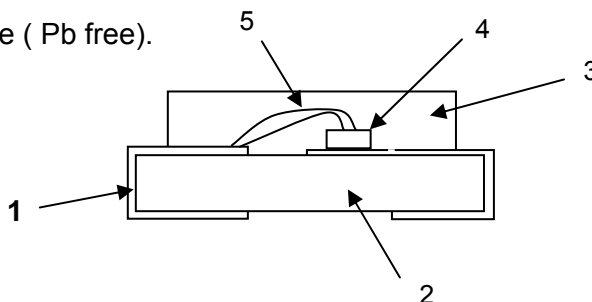
\* The quantity ratio of the different intensity and wavelength ranks in one delivery is decided by AOT.

\* The reel of LED shows the number of definition of LEDs on reel label.

### Material

	Material
1. Lead-frame. / Soldering Leads	Cu Alloy With Ni, Au Plating.
2. PCB	BT Resin.
3. Encapsulation	Epoxy Resin.
4. Die	InGaN based
5. Bonding wire	Au Chip : Ball Bonding / PCB : Ball Bonding

Note: Product is lead-free ( Pb free).



## ESD Test

<b>Product</b> : AOT-0603BL31A-N0-N-3-M	
<b>Testing Item</b> : ESD-HBM	<b>Testing Item</b> : ESD-MM
<b>Test Method</b> : MIL-STD-883D Method 3015.7	<b>Test Method</b> : MIL-STD-883D Method 3015.7
<b>Failure Criteria</b> : FOR V CHANGE AT 1 $\mu$ A $\pm$ 30%	<b>Failure Criteria</b> : FOR V CHANGE AT 1 $\mu$ A $\pm$ 30%
<b>Test Voltage</b> : 500V ~ 3000V, Step : 250V	<b>Test Voltage</b> : 25~400, Step : 25V

### Test Equipment:

KEYTEK ZAPMASTER

### Environmental Condition of Laboratory:

Temperature: 25 $^{\circ}$ C $\pm$ 5 $^{\circ}$ C

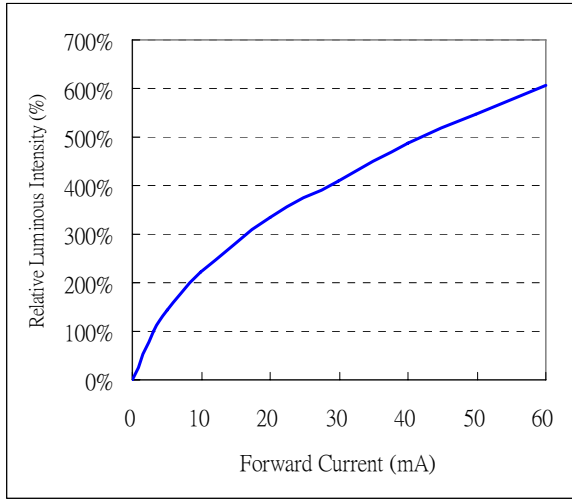
Humidity: 55% $\pm$ 10% RH

MODEL: HBM	ESD SENSITIVITY PASS: <u><math>\pm</math>2000V</u>		<b>NOTE:</b>
PIN COMBINATION	SAMPLE SIZE	PASSED VOLTS	
VDD (+) vs. VSS	5	$\geq$ +2000V	
VDD (-) vs. VSS	5	$\geq$   -2000V	

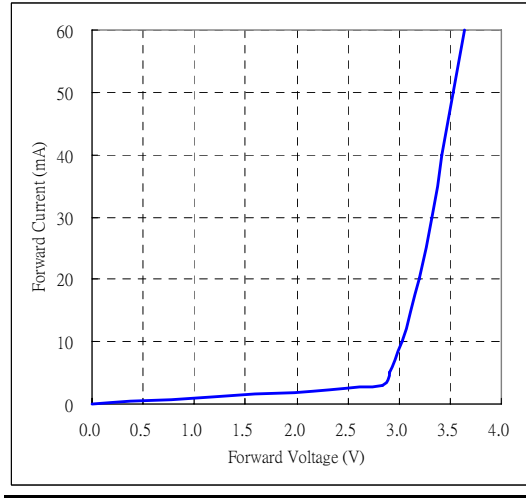
MODEL: MM	ESD SENSITIVITY PASS: <u><math>\pm</math>200V</u>		<b>NOTE:</b>
PIN COMBINATION	SAMPLE SIZE	PASSED VOLTS	
VDD (+) vs. VSS	5	$\geq$ +200V	
VDD (-) vs. VSS	5	$\geq$   -200V	

## Optical and electrical characteristics

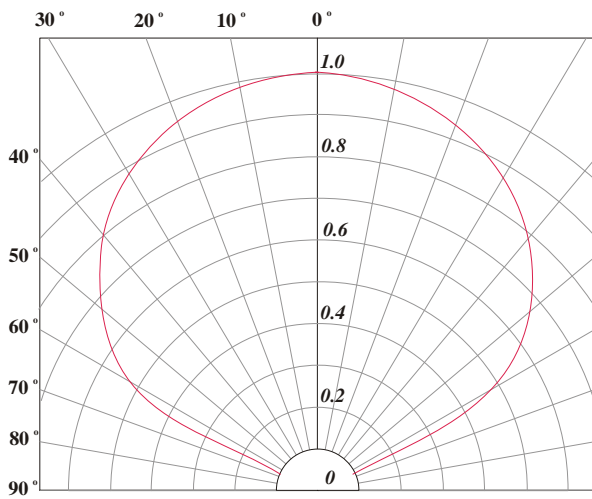
**Relative luminous intensity vs. forward current.**



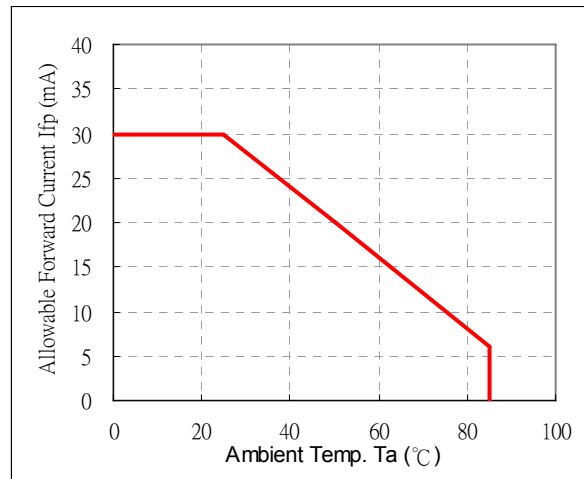
**Forward current vs. forward voltage.**



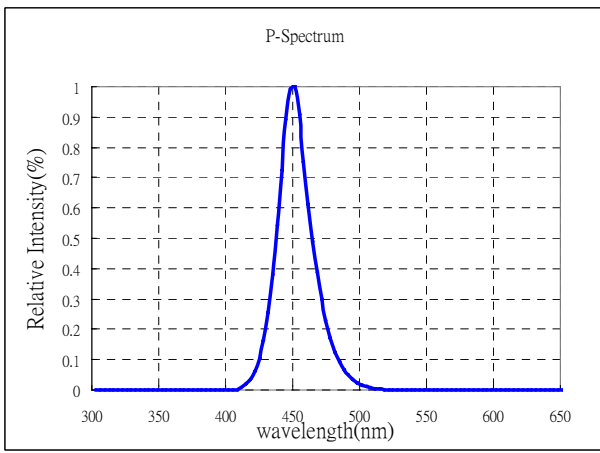
**Radiation pattern.**



**Allowable Forward Current vs. Ambient Temperature**



**5mA Spectrum**



## Recommended Soldering Temperature – Time Profile (Reflow Soldering)

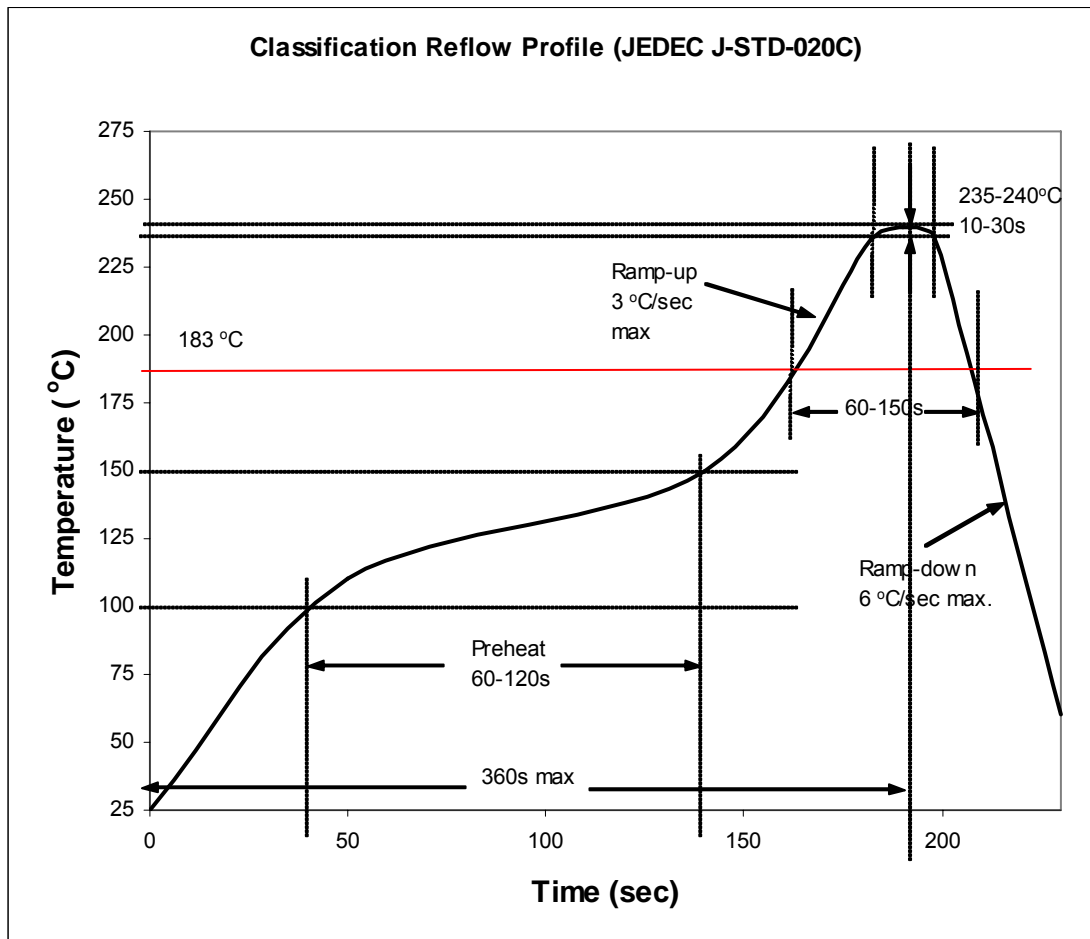
### Surface Mounting Condition

In automatic mounting of the SMD LEDs on printed circuit boards, any bending, expanding and pulling forces or shock against the SMD LEDs should be kept min. to prevent them from electrical failures and mechanical damages of the devices.

### Soldering Reflow

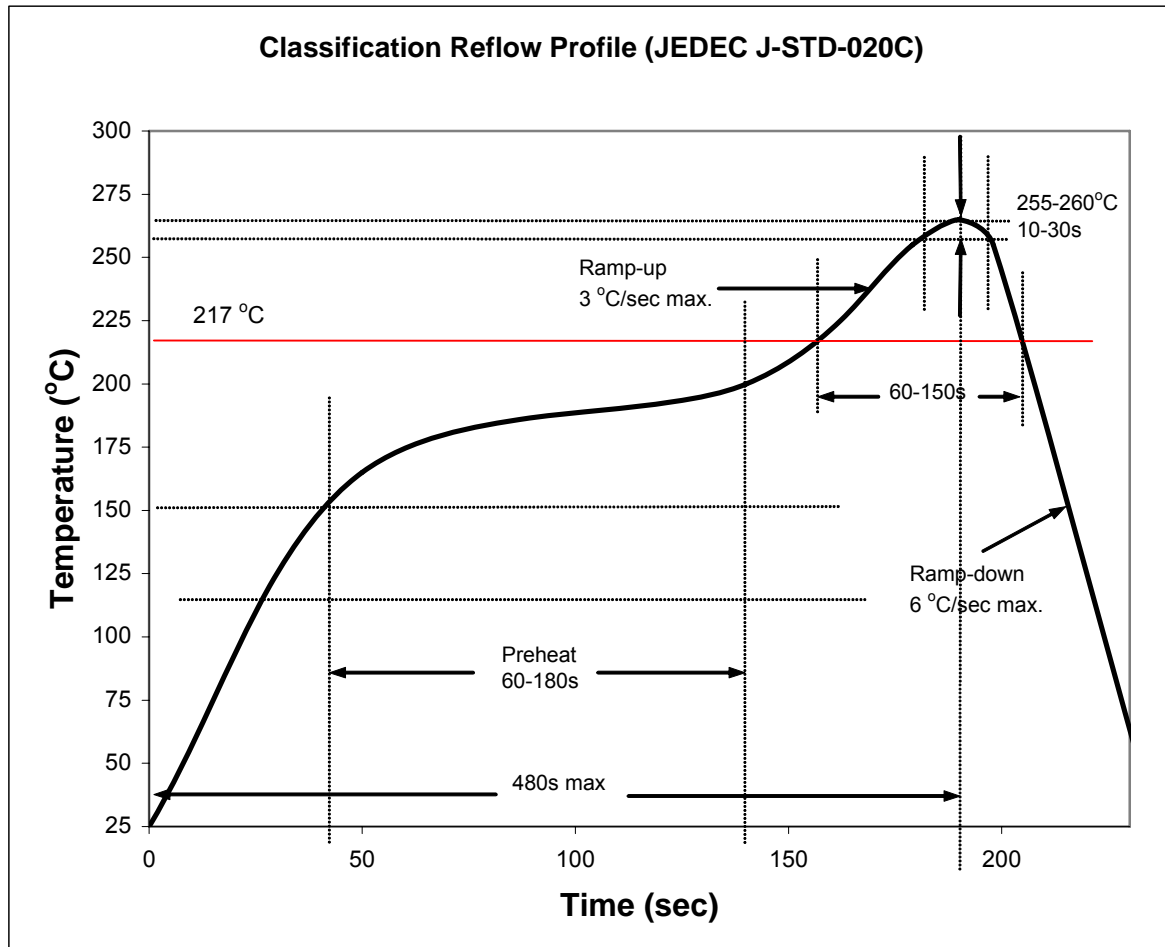
- Soldering of the SMD LEDs should conform to the soldering condition in the individual specifications.
- SMD LEDs are designed for Reflow Soldering.
- In the reflow soldering, too high temperature and too large temperature gradient such as rapid heating/cooling may cause electrical & optical failures and damages of the devices.
- AOT cannot guarantee the LEDs after they have been assembled using the solder dipping method.

### 1) Lead Solder





## 2) Lead-Free Solder



## 3) Manual Soldering conditions.

- Lead Solder  
Max. 300°C for Max. 3sec, and only one time.
- Lead-free Solder  
Max. 350°C for Max. 3sec, and only one time.

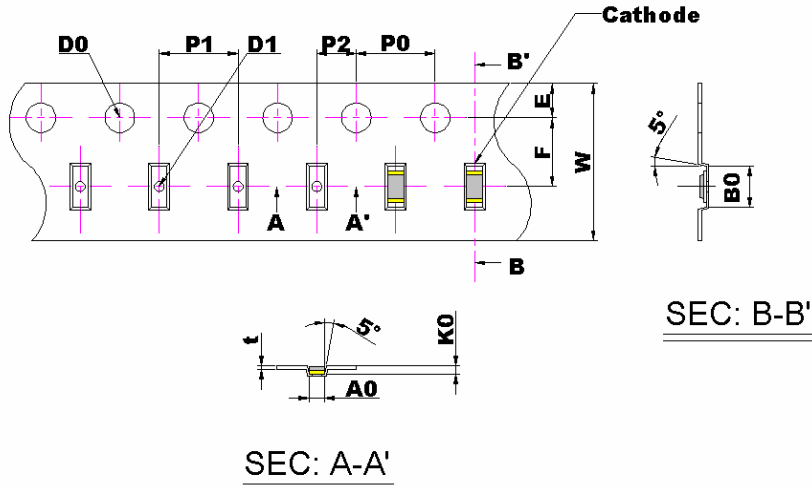
- There is possibility that the brightness of LEDs is decreased, which is influenced by heat or ambient atmosphere during reflow. It is recommended to use the nitrogen reflow method.
- After LEDs have been soldered, repair should not be done. As repair is unavoidable, a double-head soldering iron should be used. It should be confirmed beforehand whether the characteristics of the LEDs will be damaged by repairing or not.
- Reflow soldering should not be done more than two times.

## Taping and Orientation.

Quantity: 4,000 units/reel

Diameter 178 mm

General Tolerance :  $\pm 0.1$



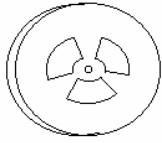
Item	Spec	Tol.(+/-)	Item	Spec	Tol.(+/-)
W	8.00	$\pm 0.20$	P2	2.00	$\pm 0.05$
E	1.75	$\pm 0.10$	t	0.20	$\pm 0.05$
F	3.50	$\pm 0.05$	A0	0.95	$\pm 0.05$
D0	1.50	$\pm 0.10$	B0	1.85	$\pm 0.05$
D1	0.50	$\pm 0.08$	K0	0.50	$\pm 0.05$
P0	4.00	$\pm 0.1$			
P1	4.00	$\pm 0.1$			

Unit : mm

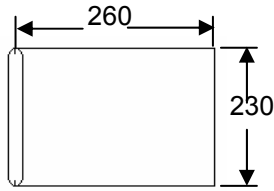
## Materials & Characteristics

Carrier Tape			Cover Tape		
Description	Typical Value	Unit	Description	Typical Value	Unit
Material	PolycarbonAte		Thickness	0.062 $\pm$ 0.013	mm
Tensile Strength(yield)	65	Mpa	Tensile Strength(break)	60	Mpa
Impact strength(notched)	10.2	Kg-cm/cm	Elongation(length)	120	%
Elongation	105	%	Elongation(lateral)	145	%
Shrinkage	<1.0	mm	Tear Strength(length)	0.20	N
Surface resistivity	10E4-10E6	Ohm/sq	Tear Strength(lateral)	0.19	N
Volume resistivity	<10E6	Ohm-cm	Surface resistivity (surface)	<2.0E+09	Ohm/sq
			Surface resistivity (sealing)	<2.0E+09	Ohm/sq

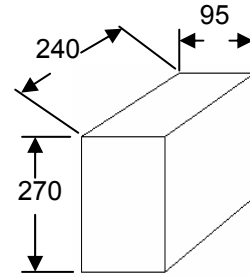
## Packing Formation



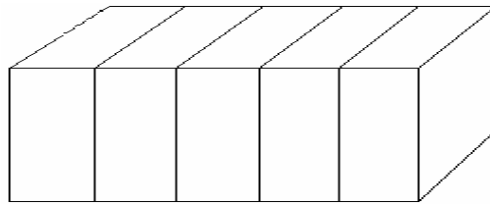
Diameter : 178 mm  
 Width : 12 mm  
 0603⇒ 4,000 pcs/Reel  
 Anti-Static Black Reel



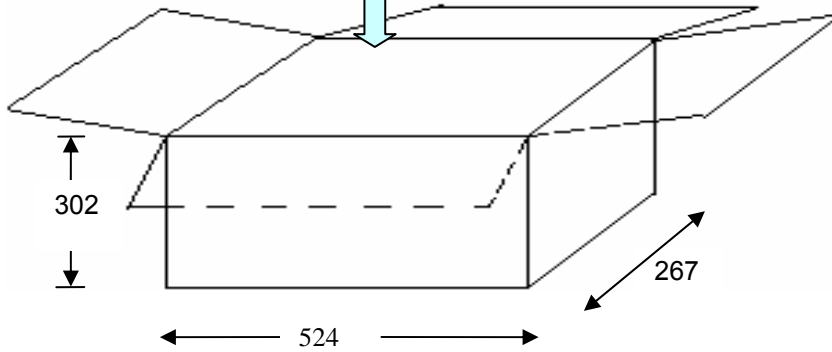
Aluminum Bag, Anti-Static  
 Shielding  
 1 Reel / Bag ( T = 0.1 mm )



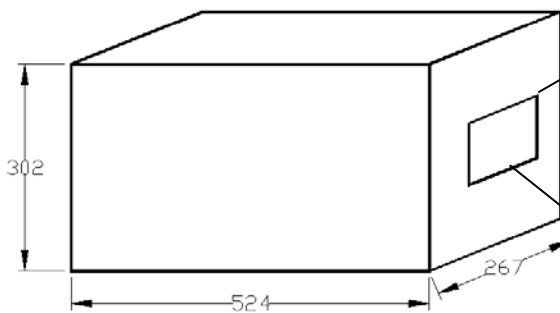
5 Bags / 1 Inner Box  
 0603⇒ 20,000 pcs/ 1 Inner Box



5 Inner Box/1 Carton  
 0603⇒ 100,000 pcs/ 1Carton



## Package Outlook:



Customer	
Part Number	
Quantity	
Date	
Remark	

## Reel Label Definition

SMD LED, Blue 0603 (Group ab)
Part Number : AOT-0603BL31A-N0-N-3-M
Brightness : c - d mcd
Wavelength : e - f nm
Quantity : nn ea
Serial No : SHyymmddxxx

a : Group of brightness, A for 9~11, B for 11~14 mcd , C for 14~18mcd ,  
D for 18~23 mcd \ E for 23~29 mcd \ F for 29~37 mcd

b : Group of Vf sorting every 0.1Vf , 1 ~ 6

c, d : lower and higher brightness range

e, f : lower and higher wavelength range

nn : Quantity of LED

SHyymmddxxx : yy : year, mm : month, dd : day, xxx : reel no

**Reliability Test :**

	Test Item	Test Conditions	Time	Test Q'ty	Fail Q'ty	O.K
1	Thermal Cycle Test (168 cycles)	H:+75°C 30 min ~ L:-35°C 30 min	168 Hrs	20	0	Pass
2	Thermal Shock Test (84 cycles, Rate= 5min)	H:+85°C (Holding 1 hr) ~ L:-40°C (Holding 1 hr)	168 Hrs	20	0	Pass
3	High Temp. Storage Test	Temp.:100°C	168 Hrs	20	0	Pass
4	Low Temp. Storage Test	Temp.: -40°C	168 Hrs	20	0	Pass
5	High Temp. High Humidity Test	85°C/85%RH,	168 Hrs	20	0	Pass
6	Press Cook Test	T=121°C, P=2atms H=100%RH	168 Hrs	20	0	Pass
7	Operating Life Test	IF=20 mA, 25°C	168 Hrs	20	0	Pass
8	IR-Reflow Test	Max 260°C (Pb free condition)	2 Times	10	0	Pass

**Conclusions:**

The reliability tests were designed to evaluate both package integrity as well as workability of product performance over time.

All samples have done well by completed test requirement and passed all the qualification criteria with zero failure. From design standpoint, the package is robust enough to meet its datasheet conditions.

Based on the good result shows on the above test, this product is qualified and released for market.

## **Cautions:**

1. After open the package, the LED should be kept at 30°C, 60%RH or less. The LED should be soldered within 168 hours (7 days) after opening the package.
2. Heat generation must be taken into design consideration when using the LED.
3. Power must be applied resistors for protection, over current would be caused the optic damage to the devices and wavelength shift.
4. Manual tip solder may cause the damage to Chip devices, so advised that heat of iron should be lower than 15W with temperature control under 5 seconds at 230-260 deg. C. ( The device would be got damage in re working process, recommended under 5 seconds at 230-260 deg. C)
5. All equipments and machinery must be properly grounded. It is recommended to use a wristband or anti-electrostatic glove when handing the LED.
6. Use IPA as a solvent for cleaning the LED. The other solvent may dissolve the LED package and the epoxy, Ultrasonic cleaning should not be done.
7. Damaged LED will show unusual characteristics such as leak current remarkably increases, turn-on voltage becomes lower and the LED gets unlight at low current.

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## **NOTE.**

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