CUSTOMER :

DATE : 2015. 06. 09.

REV : REV 3.0

SPECIFICATIONS FOR APPROVAL

3535 Ceramic Type PC-amber LED

MODEL NAME : LEAMA31W00AM0000

RoHS Compliant

Halogen Compliant

APPROVAL	REMARK	APPENDIX

DESIGNED	CHECKED	APPROVED
2015.06.09	2015.06.09	2015.06.09
Y.M.MOON	J.J.CHOI	J.J.YOON

LG Innotek

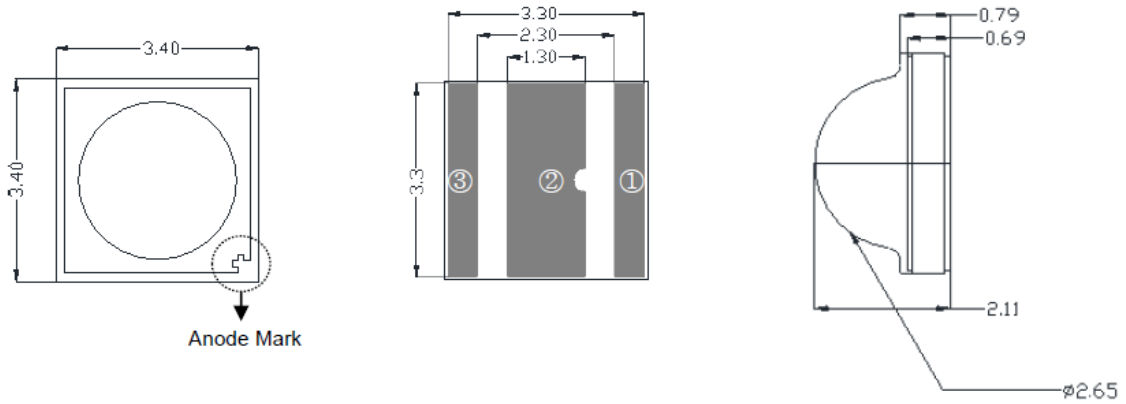
CONTENTS

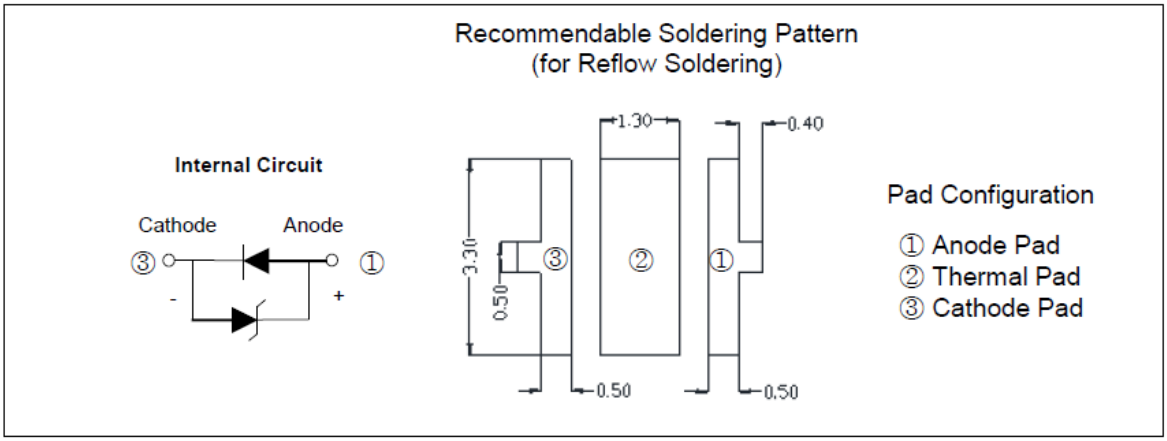
1. Features

- Lighting Color : Amber
- Ceramic Type LED Package [unit : mm] : 3.4 x 3.4 x 2.11 (L x W x H)
- Viewing Angle : 117˚
- Chip Material : InGaN
- Soldering Methods : Reflow Soldering
- Taping : 12 mm conductive black carrier tape & antistatic clear cover tape
  1,000 pcs/reel, Φ178 mm Reel

2. Outline Dimensions

(Unit : mm)





▪ Tolerance unless dimension ± 0.13mm

3. Applications

- Turn Signal for Automotive Exterior

4. Absolute Maximum Ratings

(Ta = 25℃)

Items	Symbols	Ratings	Unit
Forward Current	If	1,000	mA
Operating Temperature	Topr	-40 ~ +125	℃
Storage Temperature	Tstg	-40 ~ +125	℃
Junction Temperature	Tj	150	℃
Soldering Temperature	JEDEC-J-STD-020D		
ESD Classification	Class 3B (JESD22-A114)		

※ The stresses beyond those listed under absolute maximum ratings may cause permanent damages to the device. These or any other conditions beyond those indicated under recommended operating conditions are not implied. The exposure to the absolute maximum rated conditions may affect device reliability.

※ LEDs are not designed to be driven in reverse voltage.

5. Electro - Optical Characteristics

(Ta = 25℃)

Items	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	Vf	If = 350mA	2.80	2.98	3.10	V
Luminous Flux	Φv	If = 350mA	80	-	100	lm
Color	Cx / Cy	If = 350mA	Refer to '6. Color Bins'			-
Viewing Angle	2Θ1/2	If = 350mA	-	117	-	deg
Dominant Wavelength	Nm	If = 350mA	587.8	590	590.5	-
Thermal Resistance	Rth j-s	If = 350mA	-	6	-	℃/W
Typical Temperature Coefficient of Forward Voltage*1)	ΔVf/ΔTj	If = 350mA	-1.0	-	-4.0	mV/℃

*1) Measured between Ta = 25 and 125℃ at If = 350mA

※ These values are measured by the LG Innotek optical spectrum analyzer within the following tolerances. Luminous Flux (Φv) : ±7%, Forward Voltage (Vf) : ±0.1V, Color Value : ±0.005, Viewing Angle : ±5°

※ Although all LEDs are tested by LG Innotek equipment, some values may vary slightly depending on the conditions of the test equipment.

5. Electro - Optical Characteristics

If (mA)	Vf (V)	Power (W)	Φv (lm)	lm/W
350 (Typ.)	3.02	1.06	100.0	94
700	3.23	2.26	176.4	78
1,000	3.37	3.37	225.0	67

※ Φv values are for representative references only.

6. Bin Structure

▪ Luminous Flux Bins

Bin	Φv (lm, @ 350mA)		
	Min.	Typ.	Max.
W2	80.0	-	90.0
W3	90.0	-	100.0

▪ Color Bin (@ 350mA)

Bin	Cx	Cy
AM	0.5480	0.4235
	0.5622	0.4372
	0.5800	0.4195
	0.5625	0.4137

▪ Forward Voltage Bins

Bin	Vf (V, @ 350mA)		
	Min.	Typ.	Max.
0	2.80	-	3.00
1	3.00	-	3.10

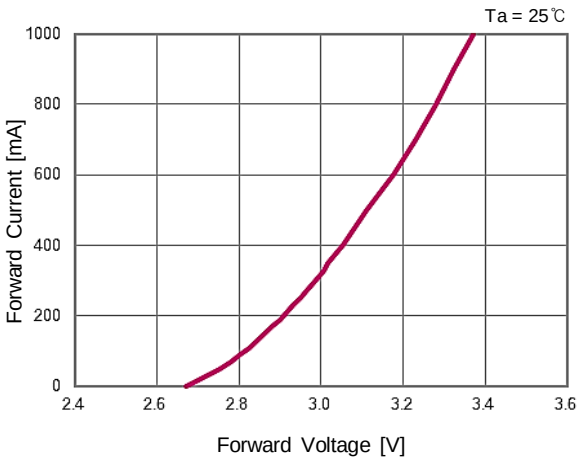
▪ Dominant Wavelength Bins

Bin	Wd (nm, @ 350mA)		
	Min.	Typ.	Max.
590	587.8	-	590.5

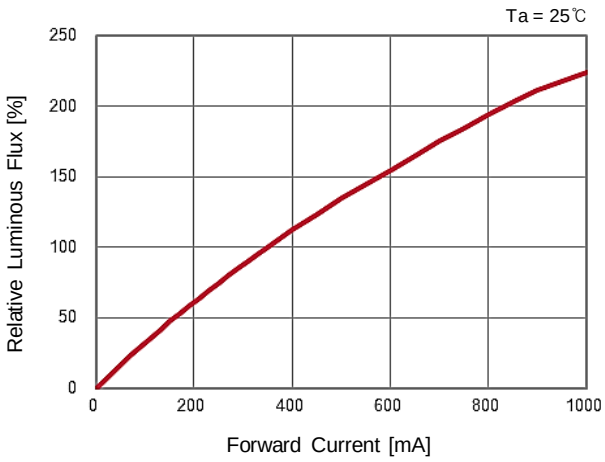
※ Bin Structure : Please refer to the following example.
Bin Code : W3 - AM - 1
(Φv Bin = W3, Color Bin = AM, Vf Bin = 1)

7. Typical Characteristic Curves

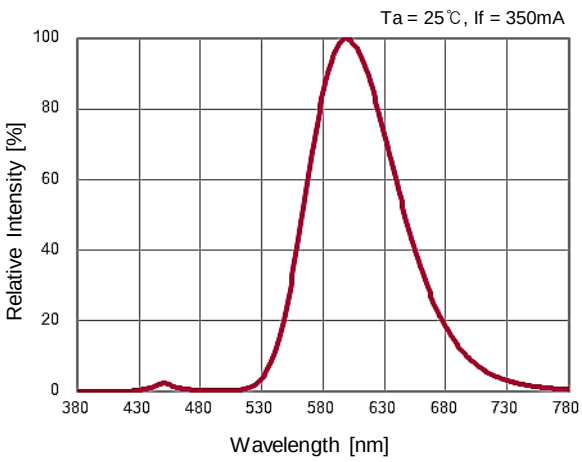
▪ Forward Current vs. Forward Voltage



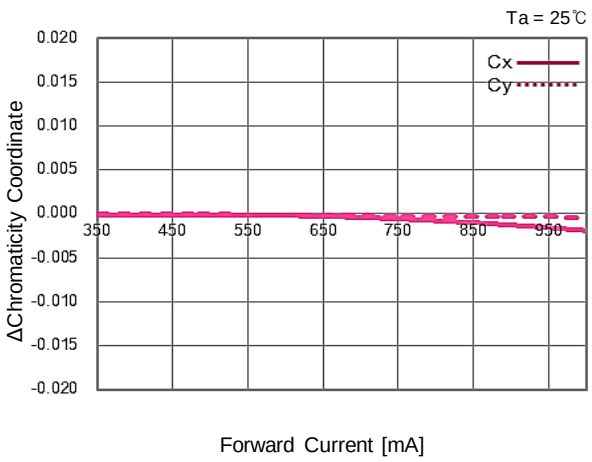
▪ Relative Luminous Flux vs. Forward Current



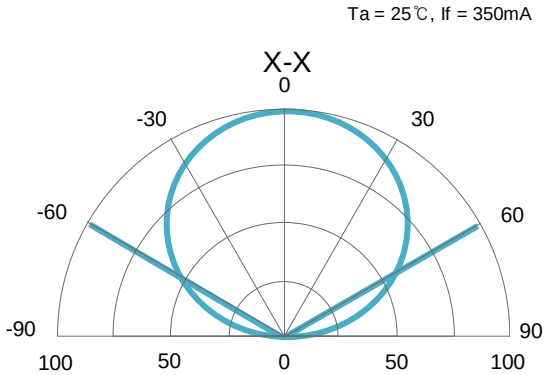
▪ Spectrum

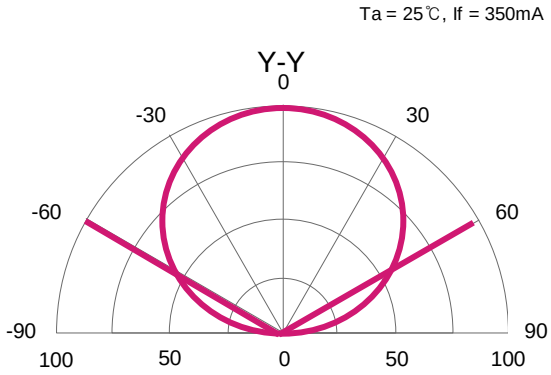


▪ Chromaticity Coordinate vs. Forward Current



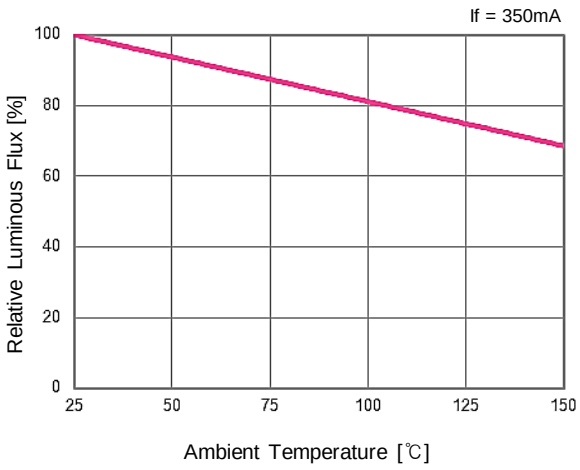
▪ Radiation Characteristics



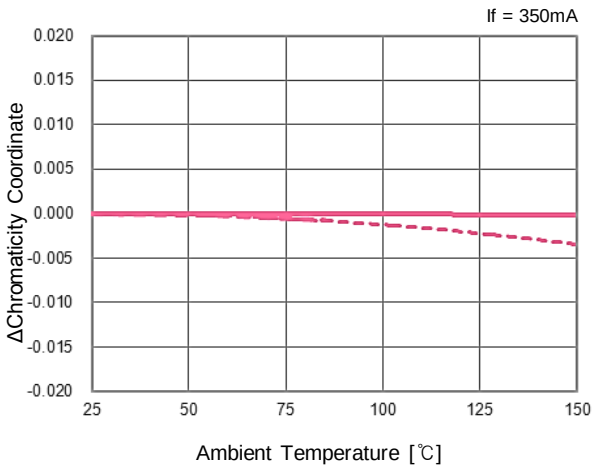


7. Typical Characteristic Curves

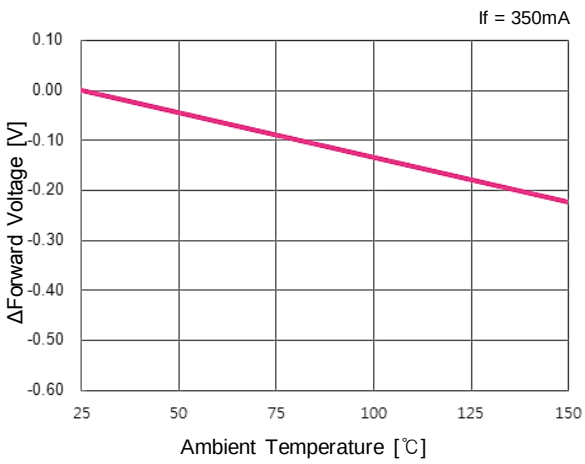
▪ Luminous Flux vs. Temperature



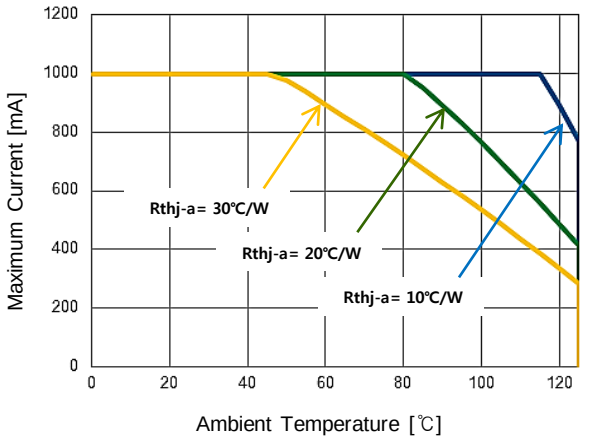
▪ Chromaticity Coordinate vs. Temperature



▪ Forward Voltage vs. Temperature



▪ Derating Curve



※ The ambient temperatures for each graph are based on the LG Innotek equipment.

8. Reliability Test Items and Conditions

8-1. Criteria for Judging Damage

Items	Symbols	Test Conditions	Limits	
			Min.	Max.
Forward Voltage	Vf	If = 350mA	-	Initial Value × 1.2
Luminous Flux	Φv	If = 350mA	Initial Value × 0.8	-

8-2. Reliability Test Items and Conditions

No	Test Item	Test Condition	Hours/ Cycles	Sample Size	Ac/Re
1	Room Temperature Operating Life (RT)	Ta = 25℃, If = 1,000mA	1,000 Hours	77	0/1
2	High Humidity High Temp. Operating Life (H3TOL)	Ta = 85℃, RH = 85%, If = 1,000mA	1,000 Hours	77	0/1
3	High Temperature Operating Life (HTOL)	Ta = 125℃, If = 400mA	1,000 Hours	77	0/1
4	Low Temperature Operating Life (LTOL)	Ta = -40℃, If = 1,000mA	1,000 Hours	77	0/1
5	High Temperature Storage Life (HTSL)	Ta = 125℃	1000 Hours	77	0/1
6	Low Temperature Storage Life (LTSL)	Ta = -40℃	1000 Hours	77	0/1
7	Power Temperature Cycle (PTC)	Ta = -40℃ ~ 125℃, If = 400mA, 10 min dwell/20 min transition, On/Off 2 min	500 Cycles	77	0/1
8	Thermal Shock (TS)	Ta = -40℃ ~ 125℃, 15 min dwell, < 10sec transfer	1000 Cycles	77	0/1
9	Mechanical Shock (MS)	1500G, 0.5ms pulse, 5 shocks each 6 axis	3 Times	30	0/1
10	Pulse Life Test (PLT)	Ta = 25℃, If = 700mA (Duty 3.3/100 Pulse Width(T) 3.03msec)	1000 Hours	22	0/1
11	Resistance to Solder Heat (RSH)	Test for solder conditions 260℃ for 10 sec on solder pads with solder iron	3 Times	30	0/1
12	ESD Characterization	Human Body Model (HBM) : ±8kV (R1 : 10MΩ, R2 : 1.5kΩ, C : 100pF)	3 Times	30	0/1
		Machine Model (MM) : ±0.5kV (R1 : 10MΩ, R2 : 0kΩ, C : 200pF)	3 Times	30	0/1
13	Vibration Variable Frequency (VVF)	100~2000~100Hz 20G, 20m/s^2, Sweep time 5min, X,Y,Z each axis	3 Times	30	0/1

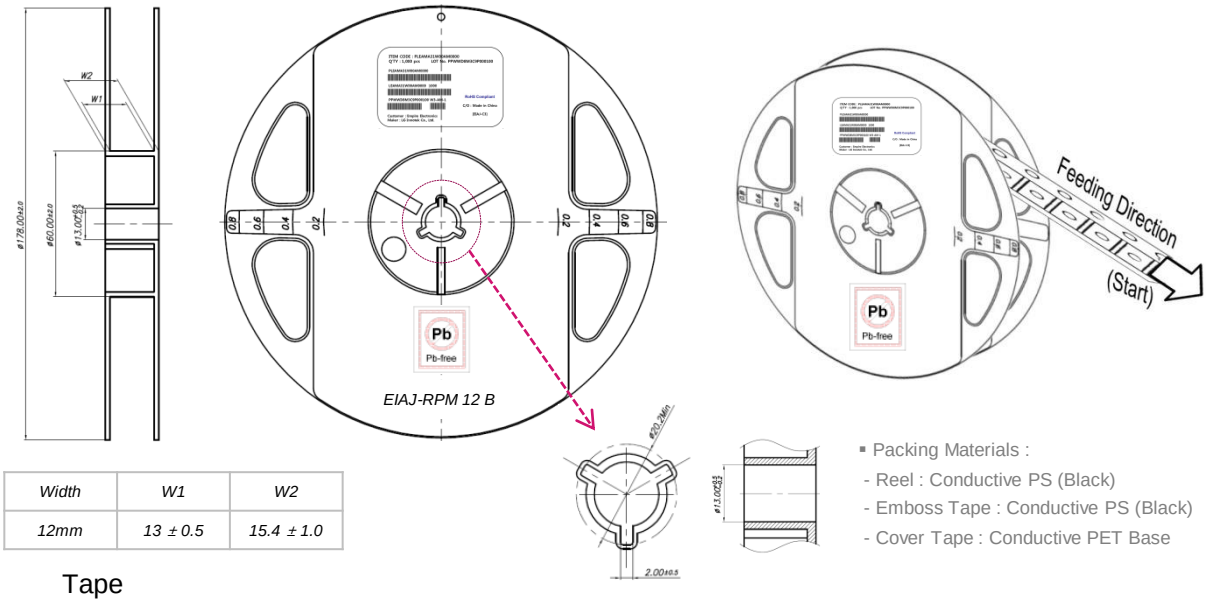
※ All samples must pass each test item and all test items must be satisfied.

9. Packing and Labeling of Products

9-1. Taping Outline Dimensions

Reel

(Unit : mm)

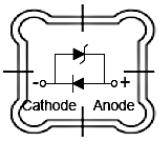


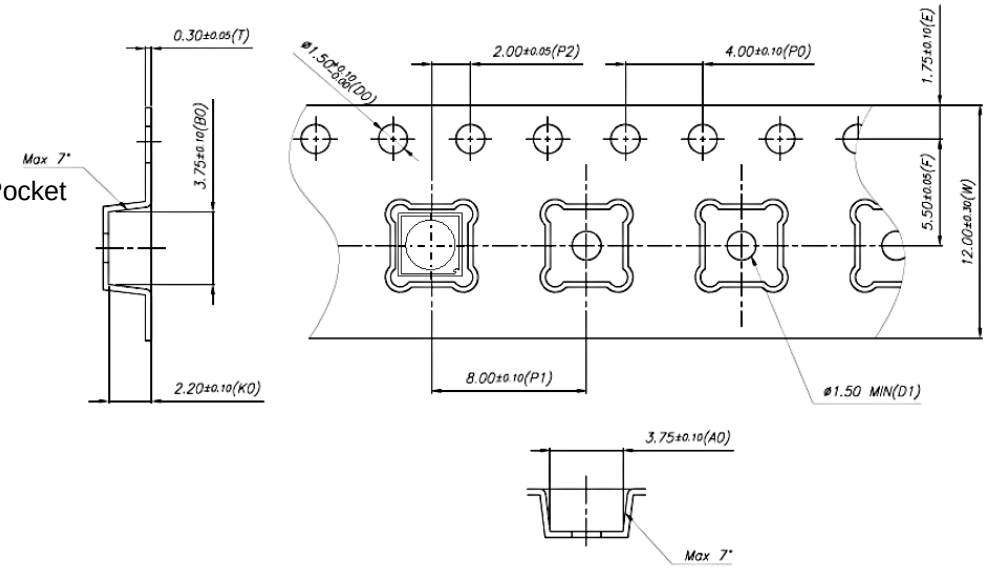
Width	W1	W2
12mm	13 ± 0.5	15.4 ± 1.0

- Packing Materials :
  - Reel : Conductive PS (Black)
  - Emboss Tape : Conductive PS (Black)
  - Cover Tape : Conductive PET Base

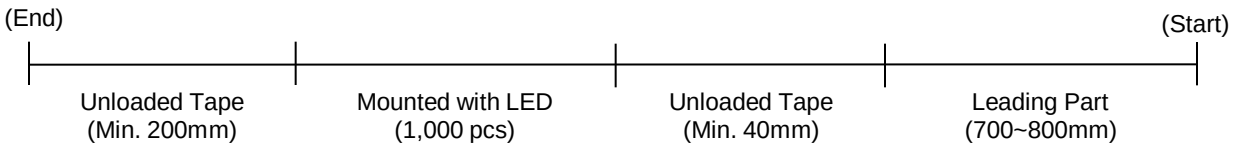
Tape

Polarity Direction in Pocket





Taping Arrangement



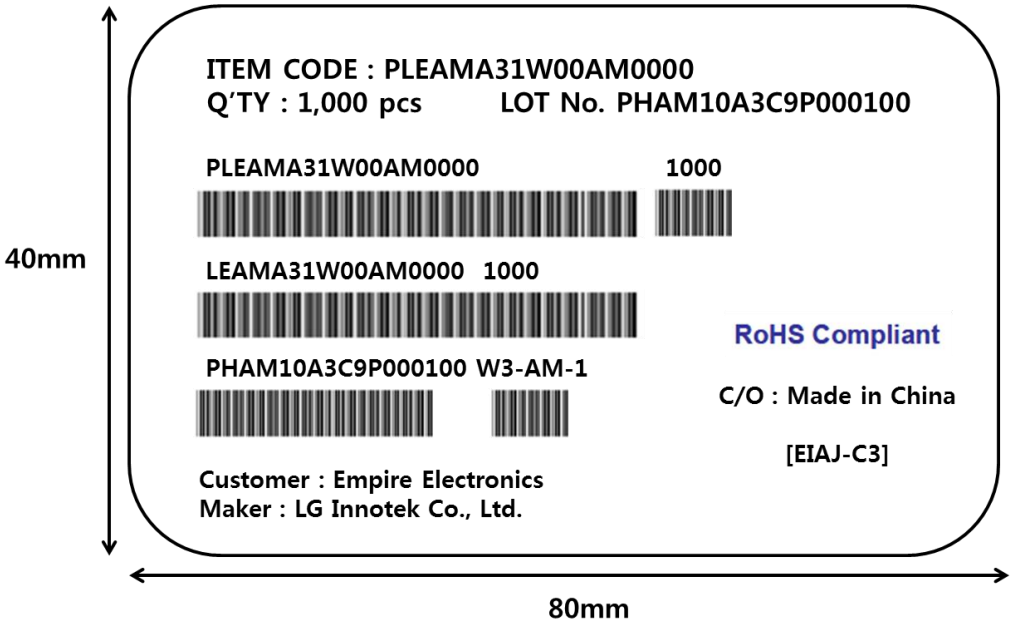
9. Packing and Labeling of Products

9-2. Label Structures

※ Label A

Specifying Customer Model Name, LGIT Model Name, Quantity and Lot ID

<Example>

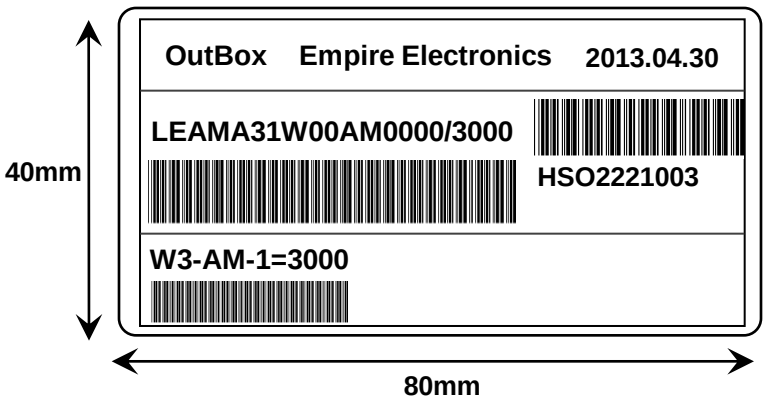


9. Packing and Labeling of Products

※ Label C

Specifying Customer, Model Name, Quantity, Outbox ID, Rank/Rank Q'ty

<Example>



▪ Box ID. indication

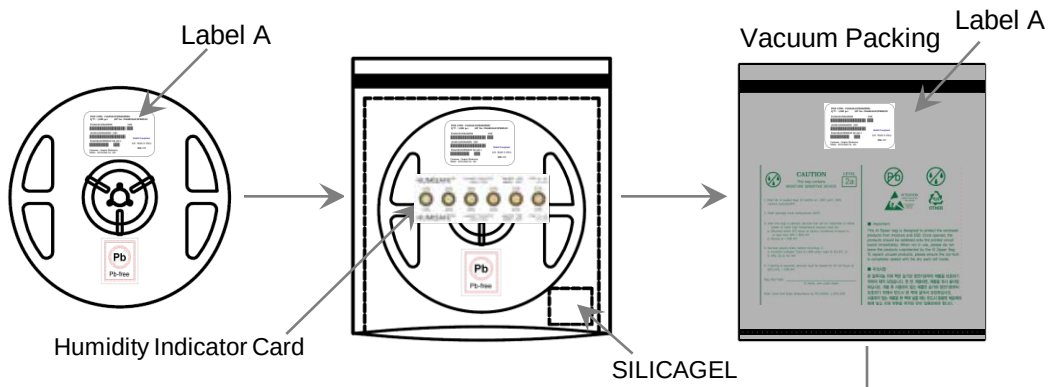
1	2	3	4	5	6	7	8	9	10
Manufacture Site	PKG Site	Box	Year	Month	Date		Serial No		
Paju : P Huizhou : H	PKG : S, P	Inner Box : I Outer Box : O	2012 : 2 2013 : 3 … 2020 : 0 2021 : 1	1~9 : 1~9 10 : A 11 : B 12 : C	(01 ~ 31)		(001 ~ 999)		

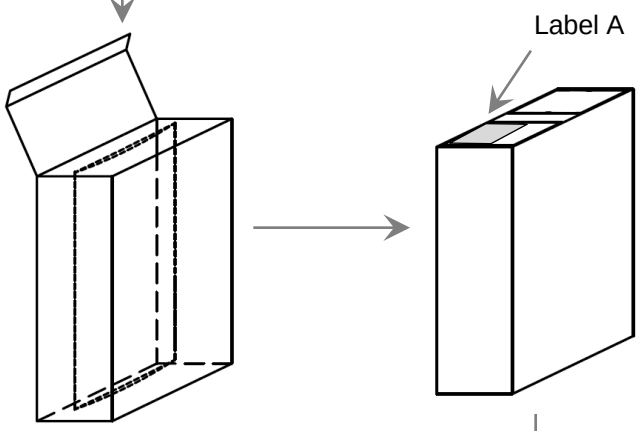
9. Packing and Labeling of Products

9-3. Packing Structures

Reeled products (1,000 pcs per bag) are packed in a sealed-off and moisture-proof aluminum bag with desiccants (Silica Gel) and HIC (Humidity Indicator Card).

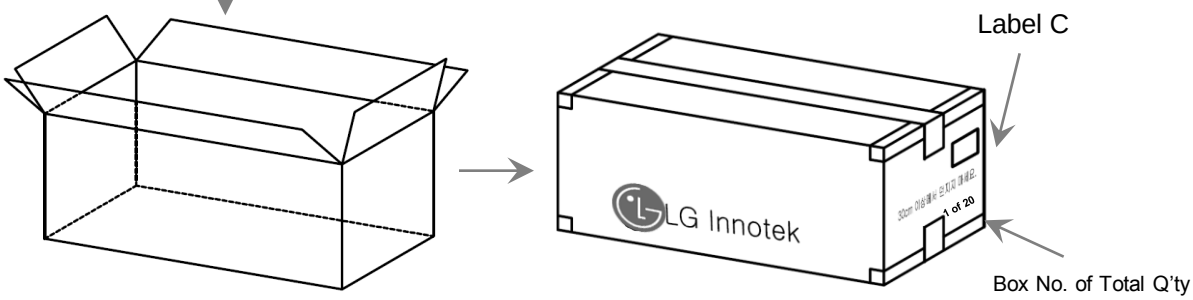
Four aluminum bags (4,000 pcs total per box) are packed in an inner box and six inner boxes are packed in an outer box (24,000 pcs per box) .





Box	Size (mm)		
	W	L	H
Inner	227	82	258
Outer	530	240	280

Tolerance : ±10mm

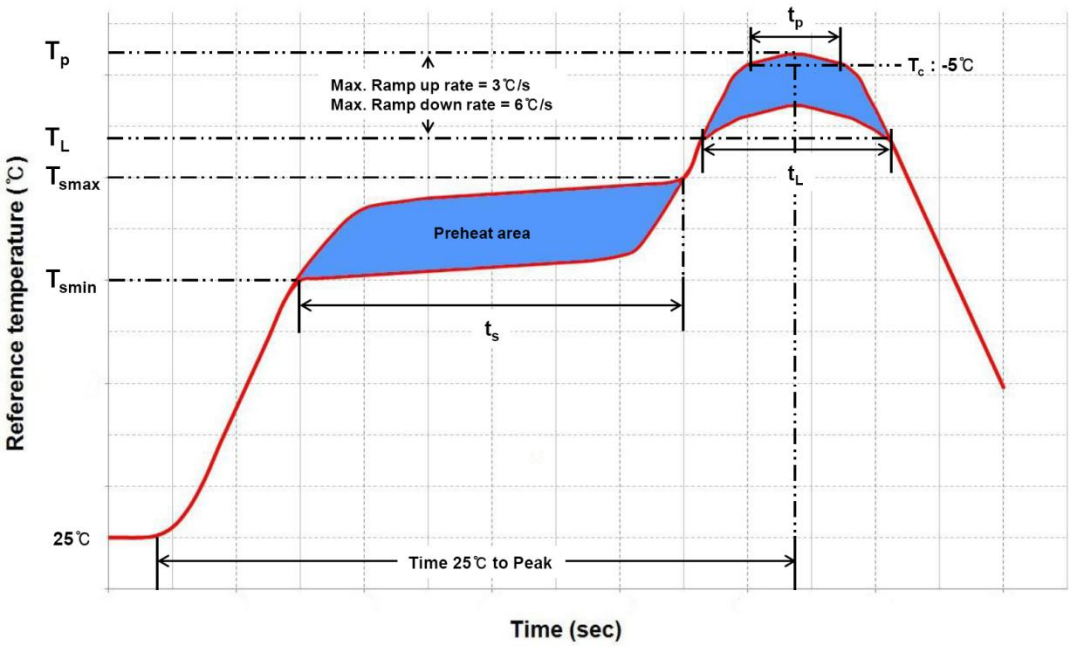


10. Soldering Conditions

-. Reflow soldering method is recommended for LEDs assembly.

-. LG Innotek does not guarantee the performance of the LEDs assembled by dip soldering method.

-. Recommended Soldering Profile (according to JEDEC J-STD-020D)



Profile Feature	Pb-Free Assembly	Pb-Based Assembly
Preheat/Soak Temperature Min(T_{smin}) Temperature Max(T_{smax}) Maximum time(t_s) from T_{smin} to T_{smax}	 150℃ 200℃ 60~120 seconds	 100℃ 150℃ 60~120 seconds
Ramp-up rate (T_L to T_p)	3℃/ second max.	3℃/ second max.
Liquidous temperature (T_L)	217℃	183℃
Time (t_L) maintained above T_L	60~150 seconds	60~150 seconds
Maximum peak package body temperature (T_p)	260℃	235℃
Time(t_p) within 5℃ of the specified temperature (T_c)	30 seconds	20 seconds
Ramp-down rate (T_p to T_L)	6℃/second max.	6℃/second max.
Maximum Time 25℃ to peak temperature	8minutes max.	6minutes max.

-. Reflow or hand soldering at the lowest possible temperature is desirable for the LEDs although the recommended soldering conditions are specified in the above diagrams.

-. A rapid cooling process is not recommended for the LEDs from the peak temperature.

-. The LEDs encapsulate silicone and have soft surfaces on the tops, which can easily damaged by pressure. Precautions should be taken to avoid strong pressure on the encapsulated part when leveraging the pick and place machines. The pick up nozzles should not directly contact the silicone resin of the LEDs.

-. Reflow soldering should not be done more than two times.

11. Cautions on Use

11-1. Moisture Proof Package

-. The moisture in the SMD package may vaporize and expand during soldering.

-. The moisture can damage the optical characteristics of the LEDs due to the encapsulation.

11-2. During Storage

Conditions		Temperature	Humidity	Time
Storage	before Opening Aluminum Bag	5℃ ~ 30℃	< 50%RH	within 1 Year from Delivery Date
	after Opening Aluminum Bag	5℃ ~ 30℃	< 60%RH	≤ 672 hours
Baking		65 ± 5℃	< 10%RH	10 ~ 24 hours

11-3. During Usage

-. LED should avoid the direct contact with exposure to hazardous materials such as sulfur, chlorine, phthalate, etc..

-. The metal parts on LEDs can be rusted when exposed to corrosive gases.

-. The metal parts also can be affected not only by the corrosive gases emitted inside of the end-products but by the gases penetrated from outside environment.

-. The corrosive atmosphere must be avoided during the use and storage.

-. Extreme environments such as sudden ambient temperature changes or high humidity that can cause condensation must be avoided.

11-4. Cleaning

-. Do not use brushes for cleaning or organic solvents (i.e. Acetone, TCE, etc..) for washing as they may damage the resin of the LEDs.

-. Isopropyl Alcohol (IPA) is the recommendable solvent for cleaning the LEDs under the following conditions.

Cleaning Condition : IPA, 25℃ max. × 60sec max.

-. Ultrasonic cleaning is not recommended.

-. Pretests must be followed by the actual cleaning processes to avoid any possible damage to the LEDs.

11. Cautions on Use

11-5. Thermal Management

-. The thermal design of the end product must be seriously considered even from the beginning stage.

-. The co-efficiency between the heat generation and the thermal dissipation is affected by the thermal resistance of the circuit boards and the density of the LED placements together with other components.

11-6. Static Electricity

-. Wristbands and anti-electrostatic gloves are strongly recommended and all devices, equipment and machinery must be properly grounded when handling the LEDs which are sensitive against static electricity and surge.

-. Precautions are to be taken against surge voltage to the equipment that mounts the LEDs.

-.Some unusual characteristics such as significant increase of current leakage, decrease of turn-on voltage, or no operation at a low current can occur due to damaged LEDs.

11-7. Recommended Circuit

-. The current through each LED must not exceed the absolute maximum rating when the circuit is designed.

-. In general, there can be various forward voltages for LEDs. Different forward voltages in parallel via a single resistor can result different forward currents to each LED, which also can output different luminous flux values. In the worst case, the currents can exceed the absolute maximum ratings which can stress the LEDs. Matrix circuit with a single resistor for each LED is recommended to avoid the luminous flux fluctuations.

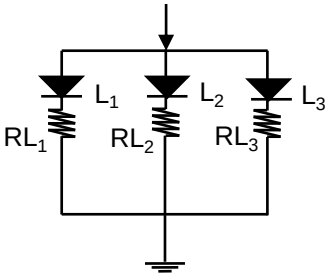


Fig.1 Recommended Circuit in Parallel Mode
: Separate resistors must be used for each LED.

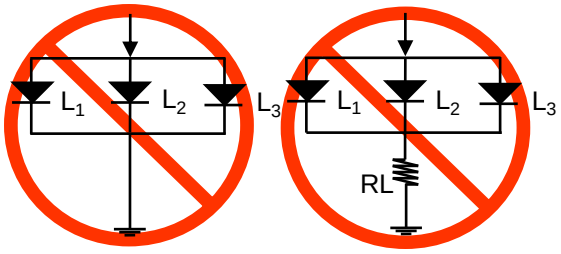


Fig.2. Abnormal Circuit
Circuits to Avoid: The current through the LEDs may vary due to the variation in LED forward voltage.

-. The driving circuits must be designed and operated by forward bias only so that the LEDs are not to be operated by the reverse voltages while turned off, which can damage the LEDs.

-. Reverse voltage can damage the zener diode and cause failures.

-. Constant-current operation by driver IC controller is recommended.

11. Cautions on Use

11-9. Soldering Iron

-. The recommended condition is less than 5 seconds at 260℃.

-. The time must be shorter for the higher temperature. (+10℃ → -1sec).

-. The power dissipation of the soldering iron should be lower than 15W when the surface temperature of the device should be controlled at or under 230℃.

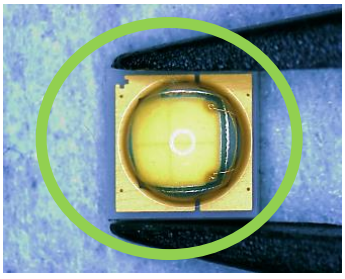
11-10. Eye Safety Guidelines

-. Do not directly look at the light when the LEDs are on.

-. Proceed with caution to avoid the risk of damage to the eyes when examining the LEDs with optical instruments.

11-11. Manual Handling

-. Use anti-electrostatic tweezers to grab base of LED and do not apply mechanical pressure on the surface of the lens.



12. Disclaimers

-. LG Innotek is not responsible for any damages caused by any accidents or operational environments exceeding the absolute maximum ratings.

-. Generally accepted electronic equipment must be used to operate the LEDs in this document.

-. Consultation with LG Innotek is recommended for unassured environments or operations to avoid any possible malfunctions or damages of the products or risk of life or health.

-. Any unauthorized, without prior written consent from LG Innotek, disassembly is prohibited if the purpose is for reverse-engineering. All defect LEDs must be reported to LG Innotek and not to be disassembled or analyzed.

-. The products can be modified and upgraded without prior notice.

SPECIFICATION

MODEL	LEAMA31W00AM0000	DOCUMENT No.	14-ETC-0068
REG.DATE	2013. 04. 15	REV. No.	REV 3.0
REV.DATE	2015. 06. 09	PAGE	17

Change History of Revision

Revision	Date	Contents of Revision	Remark
Rev. 0.0	’14.04.15	New Establishment	
Rev. 1.0	’14.07.29	Modified Color Bin Modified Dominant Wavelength (588 ~ 592nm → 587.8 ~ 590.5nm) Corrected Outline Dimensions	5Page 4~5Page 3Page
Rev. 2.0	’14.09.16	Corrected Rev No. / Date	All
Rev. 3.0	’15.06.09	Changed ‘Label A’ Information (Inserted pcs information per reel)	10Page