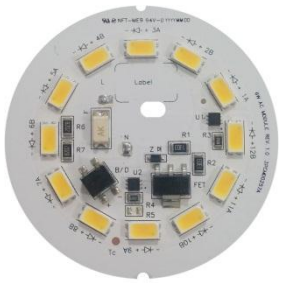
CUSTOMER : Standard

DATE : 2014. 09. 29

REV : 0.2

SPECIFICATIONS FOR APPROVAL



6W AC Module_3000K

CCT(K)	Model Name	Customer P/N
3000K	LLBML04-06C201A	-
5000K	LLBML04-06C601A	-

RoHS Compliant

APPROVAL	REMARK	APPENDIX

DESIGNED	CHECKED	APPROVED
2014.09.29	2014.09.29	2014.09.29
K. T. Joo	J. O. Kwak	K. I. Kong

LG Innotek

TABLE OF CONTENTS

1. Features

- These specifications are the description related to all electrical and structural specifications and reliable for 9W AC Module

- Model Name
  :LLBML04-06C201A(3000K)
  :LLBML04-06C601A(5000K)
  ※ “A” means internal revision code by customer

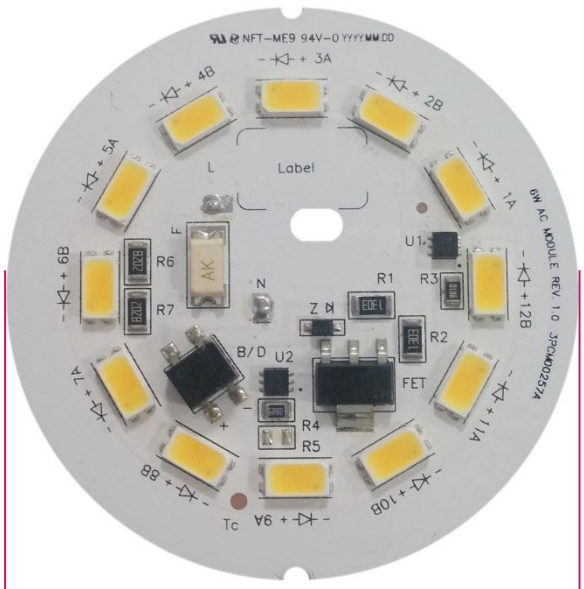
2. Applications

- Indoor Illumination

3. Outline Dimensions and Product composition

3-1. Outline Dimensions

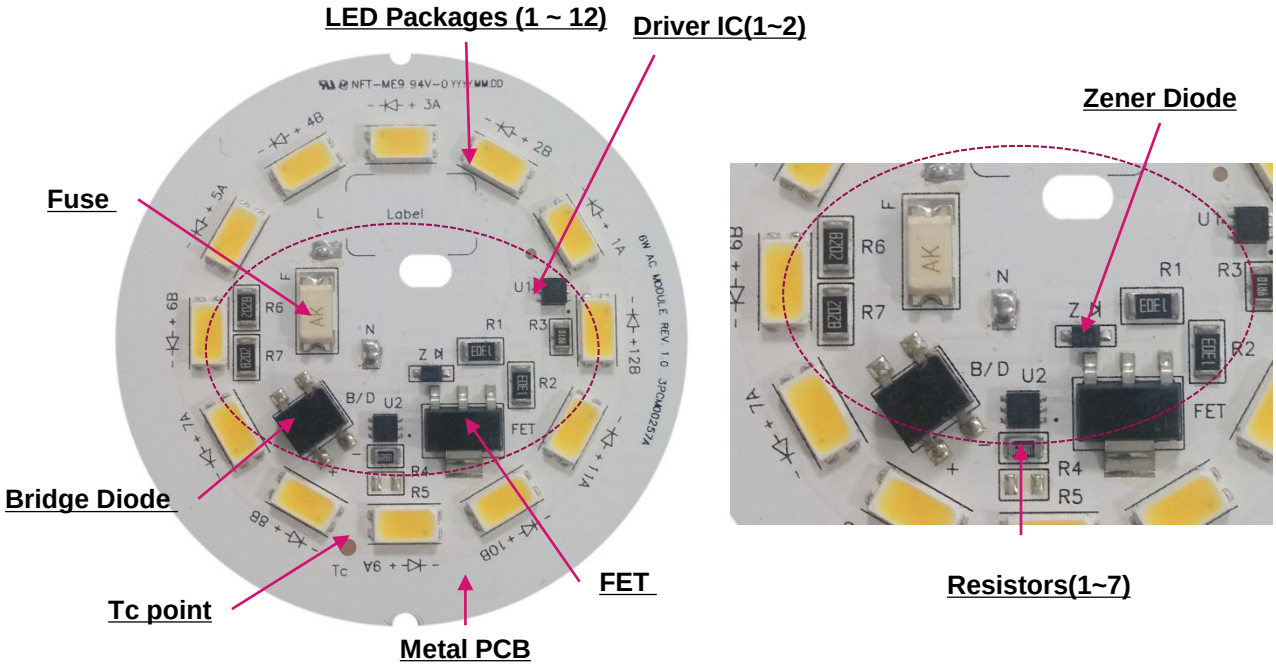
(Unit : mm)



Φ48.0±0.3mm

※ Size: Φ48mm ±0.3mm
※ Height : 1.15mm ±0.1mm (PCB Height) / Max. 2.0mm ±0.1mm(with Bridge Diode)
※ The visual inspection of the Product complies the internal standards of LG Innotek Co., LTD

3-2. Product Composition



3.2.1. LLBML04-06C201A(3000K)

Part name	Qty.	Description
LED Package	12	HV 5630 LED 3000K
U1,U2(Driver IC)	2	Vak=80V, Iak=150mA
FET(MOSFET)	1	600V, 1.5A
B/D(Bridge Diode)	1	0.8A, 600V
Z(Zener Diode)	1	24V
F(Fuse)	1	250V, 3A
R3(Resistor)	1	9.1Ω, ±1(F)%, 1/8W, 2012
R4(Resistor)	1	6.8Ω, ±1(F)%, 1/8W, 2012
R1,R2(Resistor)	2	130KΩ, ±1(F)%, 1/4W, 3216
R6,R7(Resistor)	2	82KΩ, ±1(F)%, 1/4W, 3216

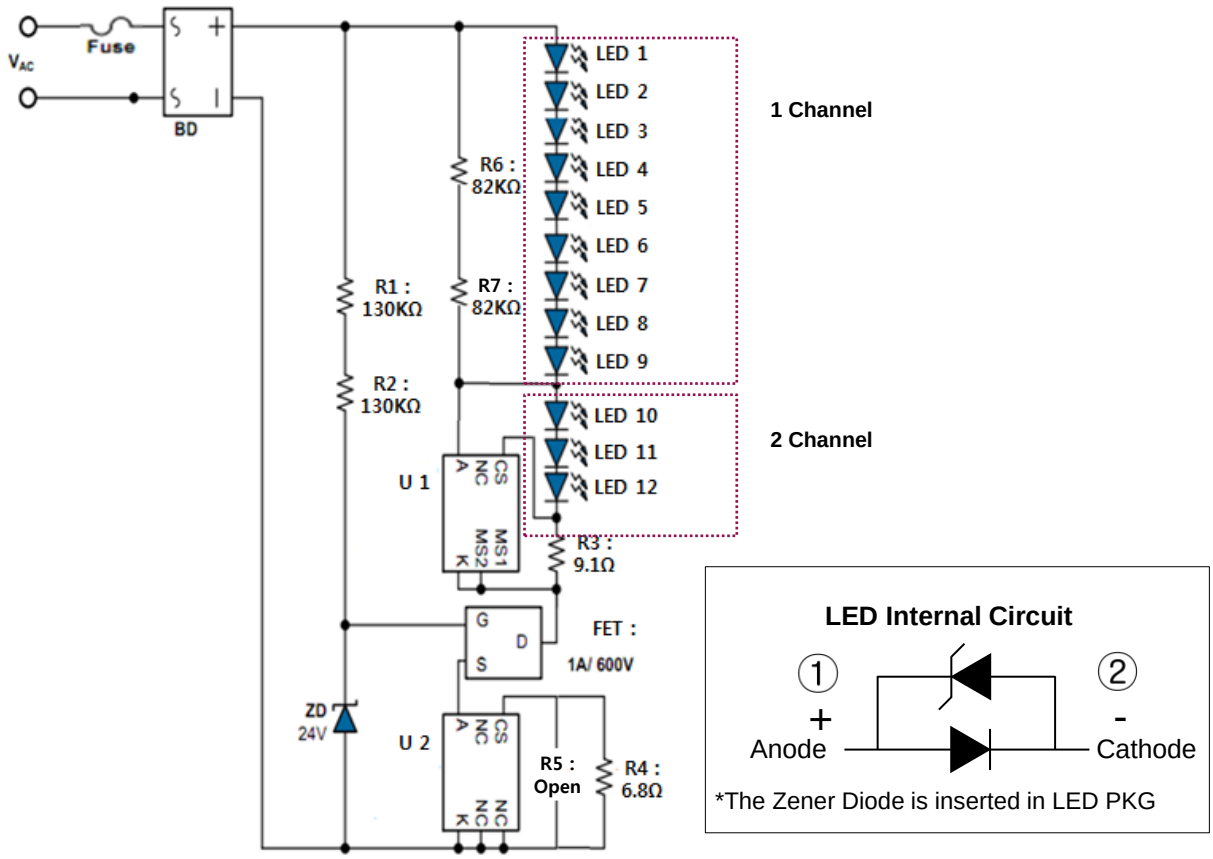
3.2.2. LLBML04-06C601A(5000K)

Part name	Qty.	Description
LED Package	12	HV 5630 LED 5000K
U1,U2(Drive IC)	2	Vak=80V, Iak=150mA
FET(MOSFET)	1	600V, 1.5A
B/D(Bridge Diode)	1	0.8A, 600V
Z(Zener Diode)	1	24V
F(Fuse)	1	250V, 3A
R3(Resistor)	1	9.1Ω, ±1(F)%, 1/8W, 2012
R4(Resistor)	1	6.8Ω, ±1(F)%, 1/8W, 2012
R1,R2(Resistor)	2	130KΩ, ±1(F)%, 1/4W, 3216
R6,R7(Resistor)	2	82KΩ, ±1(F)%, 1/4W, 3216

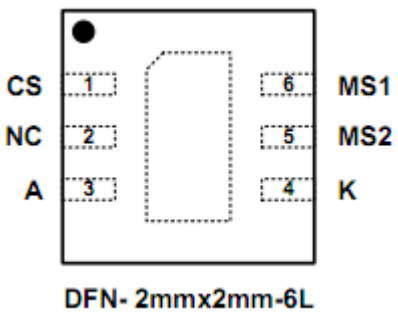
※This BOM list is written as a reference using CCT 3000K / 5000K..

4. Schematic Diagram

4-1. Schematic Diagram



4-2. IC Driver Pin Configuration



Pin No.	Name	Description
1	CS	Current sense pin.
2	A	Regulating current input pin.
3	K	Regulating current output pin.
4	MS2	Mode selection pin 2.
5	MS1	Mode selection pin 1.
6	NC	No Connection

5. Product Characteristics

5-1. Electrical Characteristics

[Ta=25°C]

Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
Frequency	Input Voltage (220Vac / 60Hz)	47	50 / 60	63	Hz	Non Dimmable
Power Consumption		5.1	5.7	6.3	W	
Power Factor		0.9	-	1	PF	

[Ta=25°C]

Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
Frequency	Input Voltage (230Vac / 60Hz)	47	50 / 60	63	Hz	Non Dimmable
Power Consumption		5.7	6.3	6.9	W	
Power Factor		0.9	-	1	PF	

※ Rated input voltage should be 220Vac or 230Vac.
※ Generally available input voltage range would be ±10%, But exceeding the 230Vac can overstress the module

5-2. Optical Characteristics

5-2-1. LLBML04-06C201A(3000K)

[Ta=25°C]

Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
CTQ Luminous Flux	Input Voltage (220Vac / 60Hz)	480	540	600	lm	
CTQ Luminous Efficiency		85	95	105	lm/W	
CCT		2870	3045	3220	K	
Color Consistency (Center Point)				4	SDCM	
		Cx = 0.4304 / Cy = 0.3965				
CRI		80	-	100	Ra	

[Ta=25°C]

Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
CTQ Luminous Flux	Input Voltage (230Vac / 60Hz)	520	580	640	lm	
CTQ Luminous Efficiency		83	93	103	lm/W	
CCT		2870	3045	3220	K	
Color Consistency (Center Point)				4	SDCM	
		Cx = 0.4304 / Cy = 0.3965				
CRI		80	-	100	Ra	

5-2-2. LLBML04-06C601A(5000K)

[Ta=25°C]

Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
CTQ Luminous Flux	Input Voltage (220Vac / 60Hz)	540	600	660	lm	
CTQ Luminous Efficiency		94	105	116	lm/W	
CCT		4745	5028	5311	K	
Color Consistency (Center Point)				4	SDCM	
		Cx = 0.3446 / Cy = 0.3552				
CRI		80	-	100	Ra	

[Ta=25°C]

Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
CTQ Luminous Flux	Input Voltage (230Vac / 60Hz)	580	645	710	lm	
CTQ Luminous Efficiency		92	103	114	lm/W	
CCT		4745	5028	5311	K	
Color Consistency (Center Point)				4	SDCM	
		Cx = 0.3446 / Cy = 0.3552				
CRI		80	-	100	Ra	

1) Measure point : at center point (Refer to 10page)
- No aging (Right after lighting within 2sec) at Ta between 23℃ and 27℃
  ※ These values measured by Optical Spectrum Analyzer of LG Innotek Co., LTD
- Optical Spectrum Analyzer tolerances are followings as below
  - Luminance (lm) : ± 5 %
  - CIE Value : ±0.003
  - CRI: ±2 Ra
  - Power measurement : ±3%

※ AC Direct Module of LEDs are difference in brightness

2) Range of Module CIE : Refer to page 7

5-3. General Characteristics

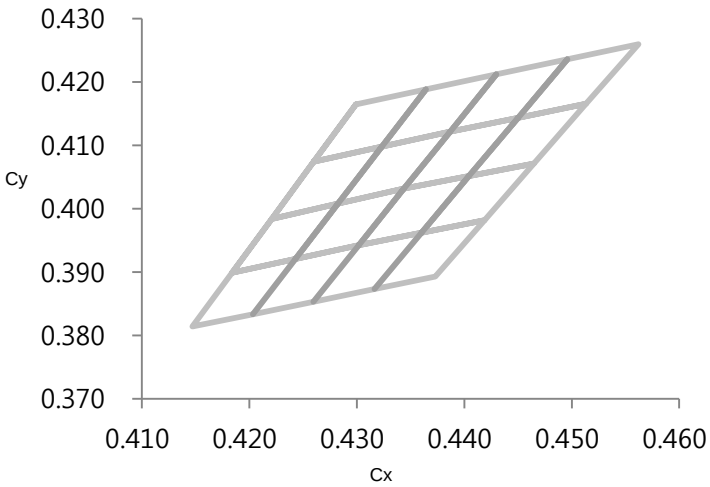
Items	Condition	Spec.			Unit	Note
		Min.	Typ.	Max.		
Maximum Tc	Input Voltage (220Vac or 230Vac / 60Hz)			85	°C	
Operating temp.		-10	-	40	°C	
Storage temp.		-10	-	70	°C	
Weight		5.3	6.3	7.3	g	
RoHS		Compliant			-	
IP		20			-	

1) Tc : Case Temperature at the designated point on the PCB, refer to page 3.

5-4. PKG Color Mixing Rule

5-4-1. LLBML04-06C201A(3000K)

▪ Range of Module CIE (@220Vac)



▪ PKG CCT Bins (3000K)

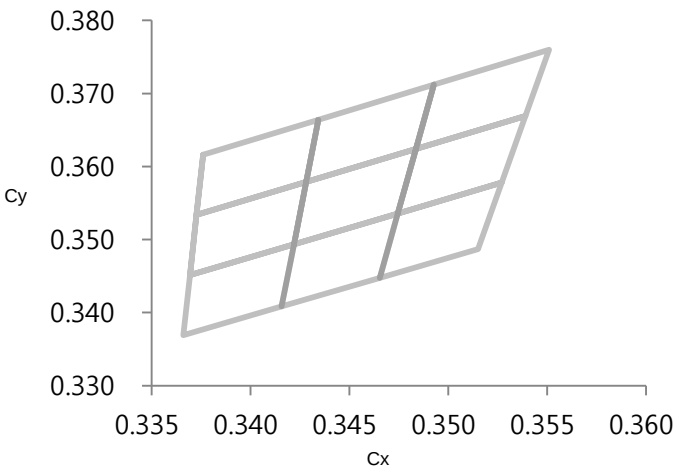
L11	L13	L31	L33
L12	L14	L32	L34
L21	L23	L41	L43
L22	L24	L42	L44

▪ PKG Rank of CIE Value (@20mA)

CIE		A															
		L11	L12	L13	L14	L21	L22	L23	L24	L31	L32	L33	L34	L41	L42	L43	L44
B	L11																
	L12																
	L13																
	L14																
	L21																
	L22																
	L23																
	L24																
	L31																
	L32																
	L33																
	L34																
	L41																
	L42																
	L43																
	L44																

5-4-2. LLBML04-06C601A(5000K)

▪ Range of Module CIE (@220Vac)



▪ PKG CCT Bins (5000K)

HB1	HB4	HB7
HB2	HB5	HB8
HB3	HB6	HB9

▪ PKG Rank of CIE Value (@20mA)

CIE		A								
		HB1	HB2	HB3	HB4	HB5	HB6	HB7	HB8	HB9
B	HB1									
	HB2									
	HB3									
	HB4									
	HB5									
	HB6									
	HB7									
	HB8									
	HB9									

5-5. PKG Flux & Vf Mixing Rule

▪ Flux Mixing Table

Bin		A
		W
B	W	Single

▪ PKG Flux Bins (@20mA)

Bin	Φv (lm)
W	47 ~

▪ Vf Mixing Table

Bin		A			
		2A	2B	2C	2D
B	2A				
	2B				
	2C				
	2D				

▪ PKG Vf Bins (@20mA)

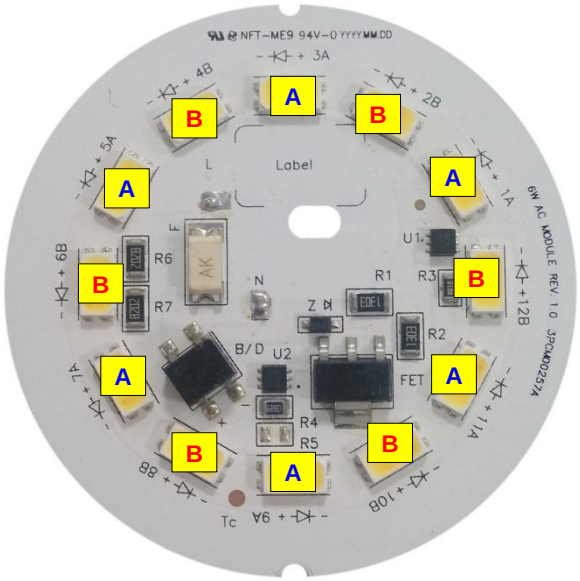
Bin	Vf (V)
2A	20 ~ 21
2B	21 ~ 22
2C	22 ~ 23
2D	23 ~ 24

▪ Priority Table

	Color
Priority 1	Yellow
Priority 2	Green

▪ Example of PKG CIE & Vf & Flux Bin MRM

- The PKG soldering location for MRM is followed by the silk of PCB (A or B)



6. Standard Testing Conditions

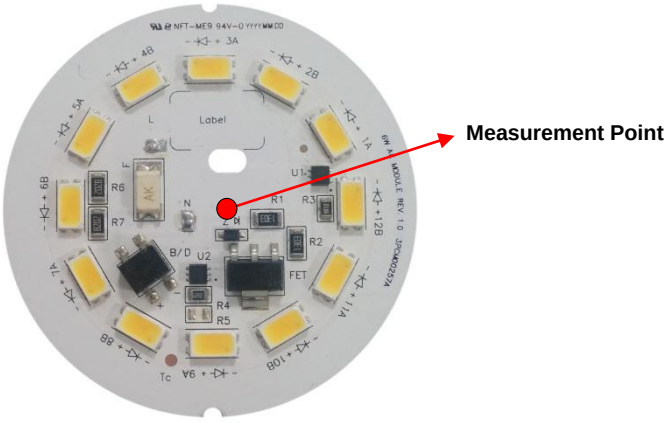
6-1. Standard Testing Environment.

- Temperature : Room Temp. : 25±2℃,
- Humidity : Under 60%RH
- Darkroom Condition : Below 10lux

6-2. Standard Testing Method.

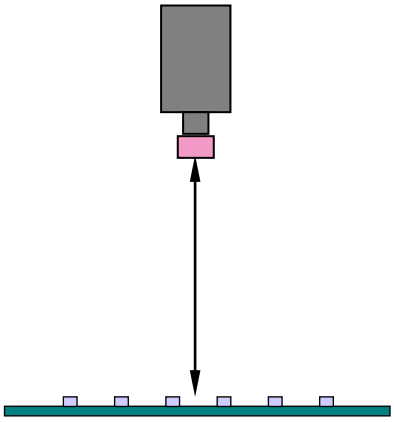
- Operating condition : Typical operating Condition(220Vac, 60Hz)
- Aging : No Aging (Right after lighting within 2 sec.)
- Measuring Point : Center point on the PCB

6-3. Schematic of Measurement System



< Top View >

Optical characteristics measurement equipment



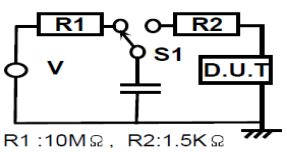
< Side View >

7. Reliability Test Items and Conditions

7-1. Criteria for Judging the Damage

Item	Symbol	Test Condition	Criteria	
			Min.	Max.
Wattage Drop	W	230Vac 60Hz	Initial Value X 0.7	Initial Value X 1.3
Luminous Flux	Φv		Initial Value X 0.7	-
Solder Ability	-	Thermal Shock	No Solder Crack	

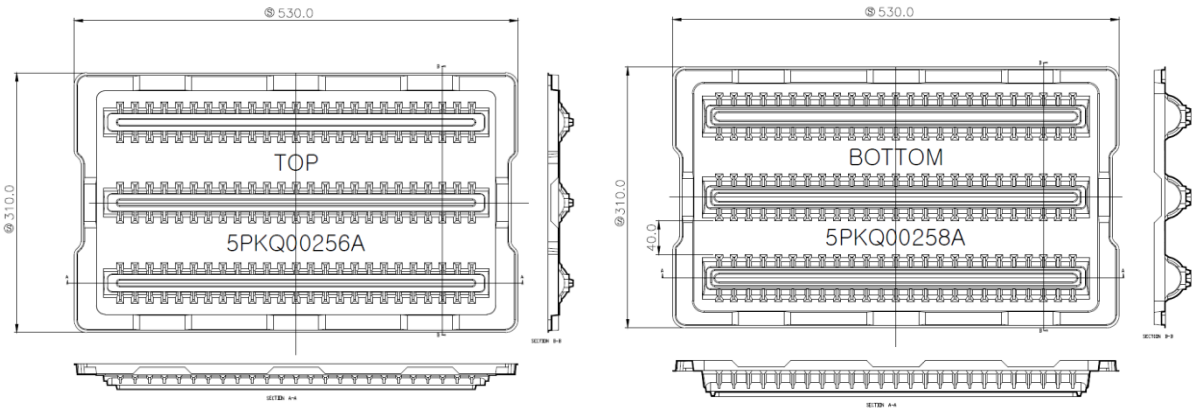
7-2. Reliability Test

No	Test Items	Test Conditions	Test Hours / Cycles	Sample Size	Ac/Re
1	High Temperature Operating Life (HTOL)	Ta = 60℃, 230Vac, 60Hz	1000Hours	5ea	0/1
2	Low Temperature Operating Life (LTOL)	Ta =-30℃, 230Vac, 60Hz	1000Hours	5ea	0/1
3	Room Temperature Operating Life (RTOL)	Ta = 25℃, 230Vac, 60Hz	1000Hours	5ea	0/1
4	Wet High Temperature Operating Life (WHTOL)	Ta = 60℃, RH = 90%, 230Vac, 60Hz	1000Hours	5ea	0/1
5	High Temperature Storage Life (HTSL)	Ta = 100℃	1000Hours	5ea	0/1
6	Low Temperature Storage Life (LTSL)	Ta = -30℃	1000Hours	5ea	0/1
7	Wet High Temperature Storage Life (WHTSL)	Ta = 85℃, RH = 85%	1000Hours	5ea	0/1
8	On / Off test	Ta=25℃ On (10sec) / Off (10sec)	30K Cycles	5ea	0/1
9	Temperature Cycle	-40℃ (30min) ~ 25℃ (5min) ~ 100℃ (30min)	200 Cycles	5ea	0/1
10	Thermal Shock	-45℃ (15min) ~ 25℃ (5min) ~125℃ (15min)	300 Cycles	5ea	0/1
11	ESD (HBM/Contact) Min. ±2KV	 R1 :10MΩ, R2:1.5KΩ C:100pF	3 Times	3ea	0/1

8. Packing of Products

8.1. Tray Information and Dimensions

(Unit : mm)



Top Bottom

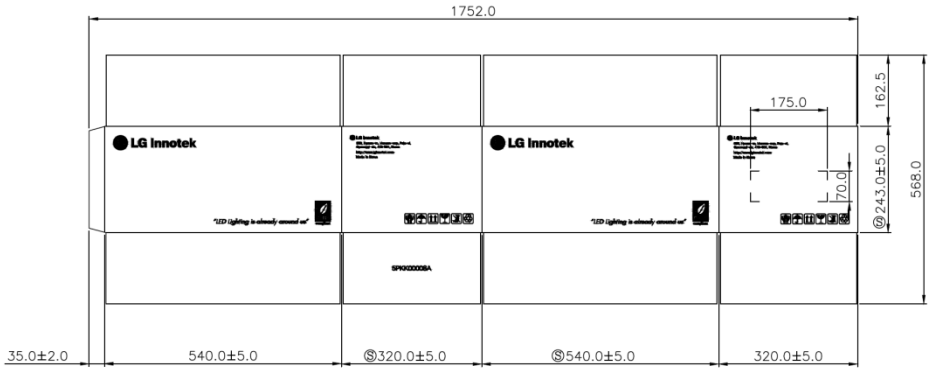
※Tolerances unless specified are ±5mm (for dimensions greater than 300mm)
and ±3mm (for dimensions smaller than 100mm)

Items	Information	Unit	Remark
Dimensions	530 x 310	mm	Assembly height 62mm
Quantity per Tray	150	EA	150 modules per 1 tray
Material	Antistatic PET	-	Thickness 0.9mm
Color	Clear	-	-

8.2. Carton Box Information and Dimensions

(Unit : mm)

[Carton Box]

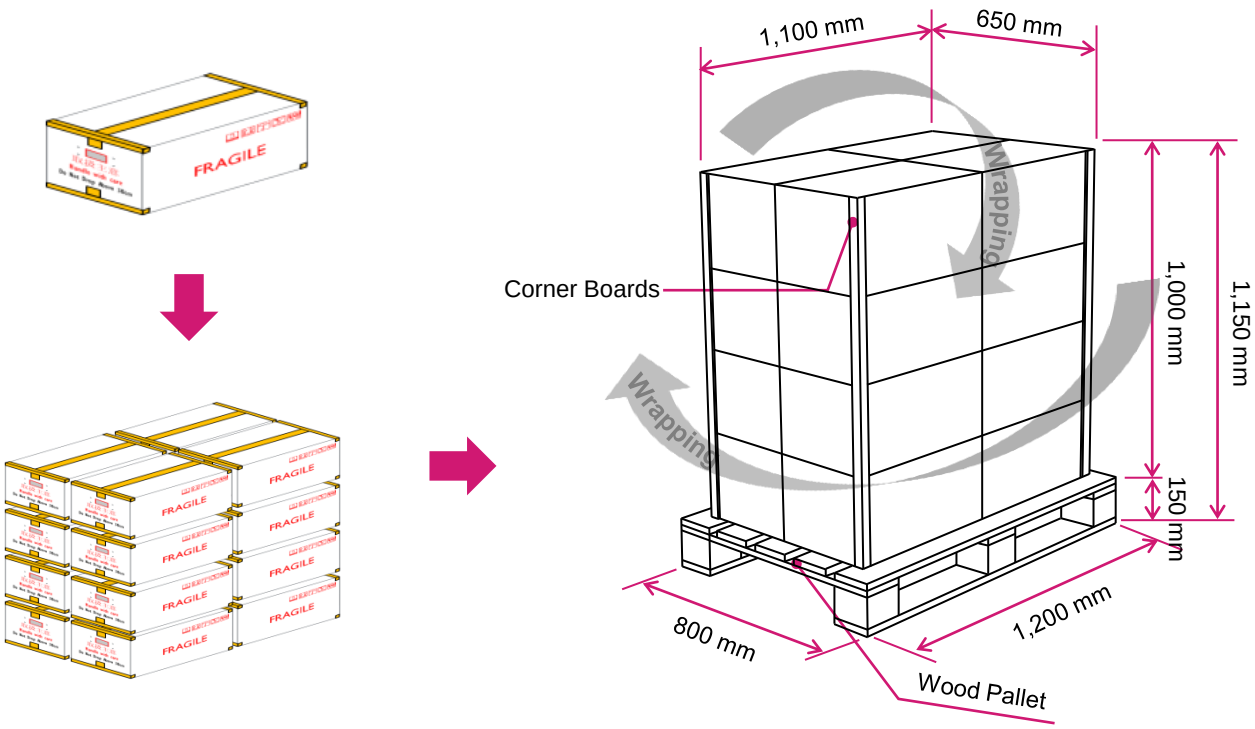


※Tolerances unless specified are ±5mm

Items	Information	Unit	Remark
Dimensions	540 x 320 x 243	mm	-
Tray Quantity per Box	4	EA	600 Modules per 1 Box
Material	Corrugated Cardboard	-	-

8. Packing of Products

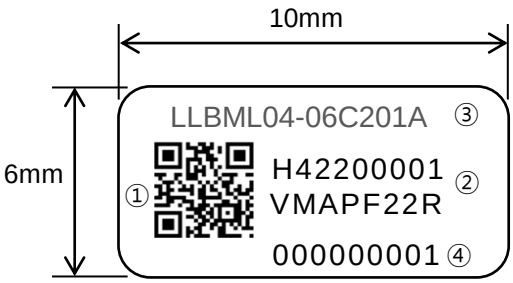
8-3. Pallet Information and Dimensions



Corner Baord	Pictures	Description
GOOD		**Corner Boards Height /Length Requirements** ➢ Corner boards Length - need to extend from top surface of deck board to top surface of highest level carton (flush) or maximum ½" below the top of the carton surface
		
BAD		➢ Minimum Height for Corner Boards Not to be below of top of load by more that ½ "
		➢ Maximum Height for Corner Boards Not to exceed top of load.

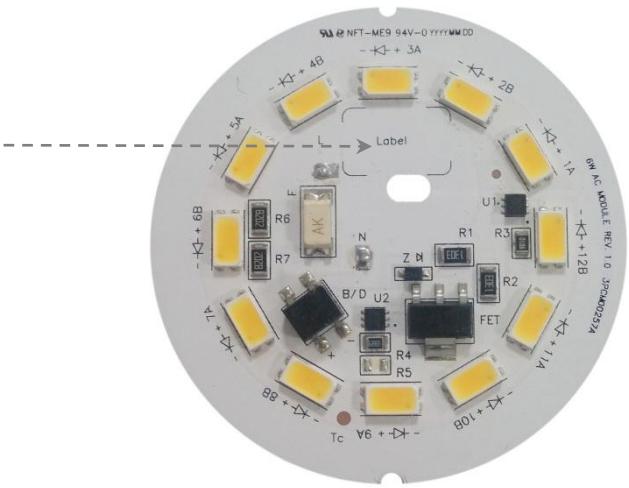
9. Marking of Products

9-1. LED Module Label



< PCB Label >

No	Contents
①	QR-Code
②	Traceability Code
③	Model (LG Innotek Model)
④	Module Serial No.



< PCB drawing >

▪ Traceability Code Table

No	1	2	3	4	5	6	7	8	9	Blank	10	11	12	13	14	15	16	17
Marking	H	4	2	0	5	0	0	0	1		V	M	A	P	F	2	2	R
Meaning	SMT Site	SMT Year/Month/Day				SMT Serial No.					Flux Code	CCT Code	Color MRM Code		Vf Type Code	Vf Rank Code		Repair
Ciphers	1	4				4					1	1	1	1	1	1	1	1
How to Use	S : Sungji	1st:Last no. of Year 2nd:Month (1~9,X,Y,Z) 3rd~4th: Day				Lot Serial No.					PKG 1 Flux	CCT	PKG 1 Color	PKG 2 Color	Vf Type	PKG 1 Vf	PKG 2 Vf	R

9-2. Table for Traceability code

▪ SMT Site

Code	S
SMT Site	Sungji

▪ SMT Year/Month

Code	Year
4	2014
5	2015
6	2016

Code	1	2	3	4	5	6	7	8	9	X
Month	1	2	3	4	5	6	7	8	9	10
Code	Y	Z								
Month	11	12								

▪ SMT Day

Code	1	2	3	4	5	6	7	8	9	10	11	12
Day	1	2	3	4	5	6	7	8	9	10	11	12
Code	13	14	15	16	17	18	19	20	21	22	23	24
Day	13	14	15	16	17	18	19	20	21	22	23	24
Code	25	26	27	28	29	30	31					
Day	25	26	27	28	29	30	31					

▪ CCT Code

Code	30	40	50
CCT(K)	3000	4000	5000

▪ Flux Bin Code

Code	3000K	4000K	5000K.
Flux	V	Q	W

※ Flux sorting current : 20mA

▪ Color Bin Code

LG Innotek PKG Code								(Cool/Warm Bin)
Code	A		B		C		D	
Bin	11	B1	12	B2	13	B3	14	B4
Code	E		F		G		H	
Bin	21	B5	22	B6	23	B7	24	B8
Code	I		J		K		L	
Bin	31	B9	32		33		34	
Code	M		N		O		P	
Bin	41		42		43		44	

▪ Vf Bin Code

Code	Vf Type
3	30.5V

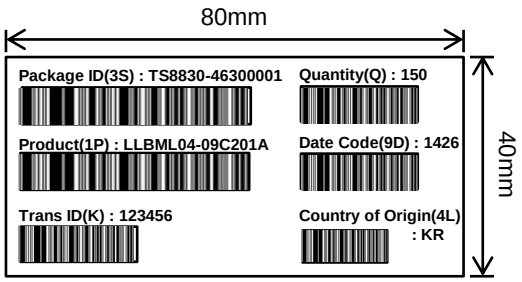
※ Flux sorting current : 20mA

▪ Vf Bin Code

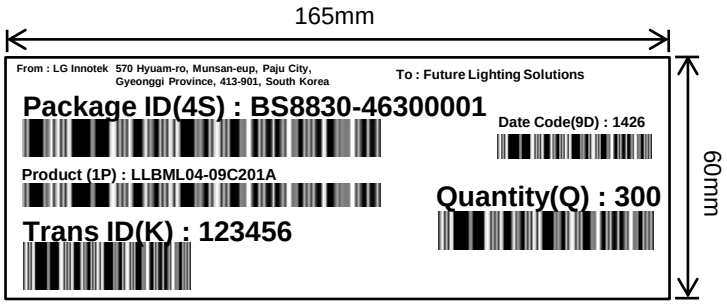
Code	Vf Bin	Min.	Max.
A	A	29.0	30.5
B	B	30.5	32.0
C	C	32.0	33

※ Vf sorting current : 20mA

9-3. Tray and Outer Box Label



< Tray Label Example >



< Box Label Example >

9-3-1. Package ID(3S or 4S)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Item	SMT Site	PCB Size		CCT Code		Hyphen	Packing Date (Y/M/D)				Packing Serial NO.			

9-3-2. Table for Packing ID(3S or 4S) Code

▪ TYPE

Code	T	B
Item	TRAY	BOX

▪ SMT Site

Code	S
SMT Site	Sungji

▪ PCB Size

Code	48
Size	Φ48

▪ CCT Code

Code	30	40	50
CCT(K)	3000	4000	5000

▪ Packing Year/Month

Code	Year
4	2014
5	2015
6	2016

Code	1	2	3	4	5	6
Month	1	2	3	4	5	6
Code	7	8	9	X	Y	Z
Month	7	8	9	10	11	12

▪ Packing Day

Code	01	02	03	04	05	06	07	08	09	10	11	12
Day	1	2	3	4	5	6	7	8	9	10	11	12
Code	13	14	15	16	17	18	19	20	21	22	23	24
Day	13	14	15	16	17	18	19	20	21	22	23	24
Code	25	26	27	28	29	30	31					
Day	25	26	27	28	29	30	31					

9-3-3. Code

- Product (1P) : Model Name
- Trans ID(K) : P.O Number (Refer to Customer's Purchase Order)
- Date Code(9D) : First two digits → last two digits of year / Last two digits → week number of year
  : 1426 : 14 → 2014 / 26 → 26th Week of the year (Based on the packing date)
- Quantity(Q) : Number of products in a tray or box
- Country of Origin (4L) : KR(Korea)
- From / To : Address of Shipping Site / Address of Arrival Site

※ Identification Marks(3S, 4S, 1P, K, Q, 9D, 4L) should be positioned at the first place in the bar code. (Code 128)

10. Cautions on Use

10-1. 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

10-2. During Storage

When storing this products for a long time (over one week)

- Store them in a dark place. Do not expose these product to sunlight
- Keep the humidity 5% ~ 85% during transportation and storage for a short time
- Keep the temperature -10 ℃ ~ 70 ℃ at normal humidity 60%
  based on the RA test (TMCL + 85/85 & Low temp Storage)
- Do not keep it in environment exposed to Sulfur gas or Sulfur-contained material.

10-3. During Usage

- LED should avoid the direct contact with exposure to hazardous materials such as sulfur, chlorine, phthalate, etc.
- The silver-plated metal parts on LEDs can be rusted when exposed to corrosive gases
- The silver-plated 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
- Use only under the rated voltage(Refer to 5page)
- Do not use with sensor luminaires
- Do not use with dimmer system, only use on non dimmable luminaires
- Do not disassemble or renovate at one’s option

10-4. 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
- IPA is the recommendable solvent for cleaning the LEDs under the following conditions
  Clearing Condition : IPA, 25℃ max. × 60sec max
- Ultrasonic cleaning is not recommended
- Pretests must be followed by the actual cleaning processes to avoid any possible damages to the LEDs

10-5. Thermal Design

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

10-6. Static Electricity

- Wristbands and anti-electrostatic gloves are strongly recommended and all devices, equipment and machineries 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 be occurred by damaged LEDs

10-7. 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. 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 consents from LG Innotek, disassembly is prohibited if purposed for reverse-engineering. All defected LEDs must be reported to LG Innotek and not to be disassembled or analyzed
- The product information can be modified and upgraded without prior notice

SPECIFICATION			
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Change History of Revision

Revision	Date	Contents of Revision Change	Remark
0.0	2014.04.30	New Established	-
0.1	2014.09.05	Change BOM to prevent of low lights	3page
0.2	2014.09.29	Change the PCB Silk	2,3,9,10,14page