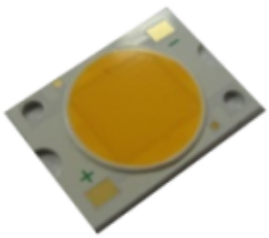
CUSTOMER : .

DATE : 2012. 04. 19.

# SPECIFICATIONS FOR APPROVAL



## 13W MCP (Warm White/ 3,000K)

MODEL NAME : LEMWM18680LG00

| APPROVAL | REMARK | APPENDIX |
|---|---|---|
| | | |

| Designed | Checked | Approved |
|---|---|---|
| | | |

LG Innotek

| SPECIFICATION | | | |
|---|---|---|---|
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## Change History of Revision

| Revision | Date | Contents of Revision Change | Remark |
|---|---|---|---|
| Rev. 0.0 | ‘12.04.19 | New establishment | |
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| SPECIFICATION | | | |
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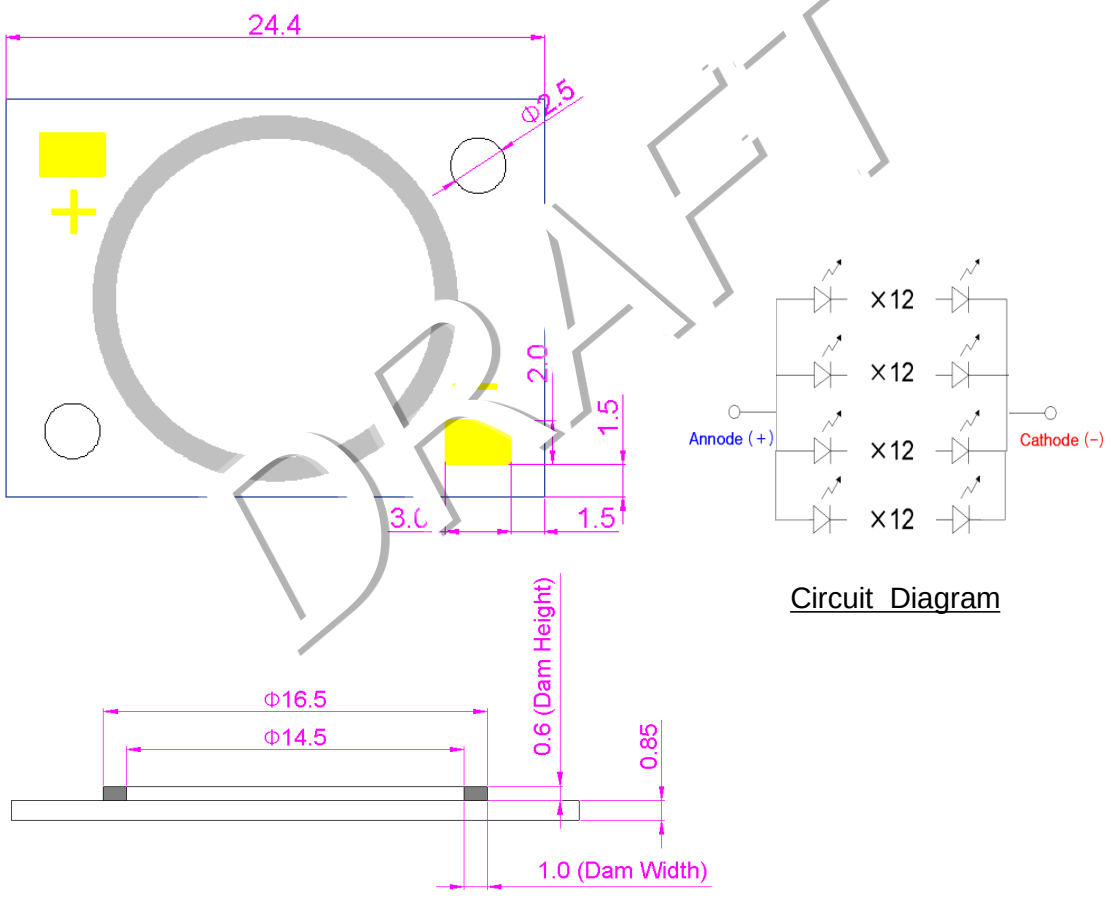
## 1. Features

- High flux power LED COB module
- Compact design (18.0mmX24.0mmX1.5Tmm)
-110˚ light distribution pattern, uniform illumination
- Low thermal resistance Rth,j-board < 2.0 K/W (25℃)

## 2. Outline Dimensions

( unit : mm )




Circuit Diagram

◆Tolerances Unless otherwise specified : ±0.2mm

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## 3. Applications

- Indoor Lighting ( Bulb, Down light, Spot light )

## 4. Characteristics

( Ta=25℃ )

| Items | Symbol | Min | **Typ** | Max | Unit |
|---|---|---|---|---|---|
| All data for Ta=25℃, IF=340mA | | | | | |
| Forward Voltage *1) | VF | 36.5 | 38.0 | 39.5 | V |
| Luminance Flux *1) | $\Phi_V$ | 1,180 | 1,290 | | lm |
| Luminous Efficacy | lm/W | 90 | 100 | - | lm/W |
| Color Temperature *1) | CCT | 2,870 | 3,045 | 3,220 | K |
| Color Rendering Index *1) | Ra | 80 | 83 | - | - |
| Viewing Angle *1) | 2Θ1/2 | - | 115 | - | deg |
| Thermal Resistance *2) | Rth j-c | - | 2.0 | - | ℃/W |

※ These values measured by Optical Spectrum Analyzer of LG Innotek Co., LTD
Tolerances are followings as below
- Luminous Flux (lm) : ±20%, CIE Value : ±0.01, CRI : ±2

※ Rj-c = Thermal Resistance (Junction – Case)
If the maximum temperature limits are exceeded, the life of the module will be greatly reduced or the module may be damaged

*1) These values measured without heat sink
*2) These values is allowed to measure with a heat sink of aluminum



## 5. Absolute Maximum Ratings

( Ta=25℃ )

| Items | Symbol | Rating | Unit |
|---|---|---|---|
| Input Power | Pi | 30 | W |
| Forward Current | IF | 680 | mA |
| Operating Temperature | Topr | -30 ~ +85 | ℃ |
| Storage Temperature | Tstg | -40 ~ +100 | ℃ |
| Case Temperature *2) | Tc | 100 | ℃ |
| Junction Temperature *3) | Tj | 150 | ℃ |

*1) Input Power and Forward current are the values when the LED is used within the range of the derating curve in this data sheet.
*2) Refer to 2. Outline dimensions for Tc measurement point
*3) D.C Current: $Tj = Tc + Rj\text{-}c \times Pi$

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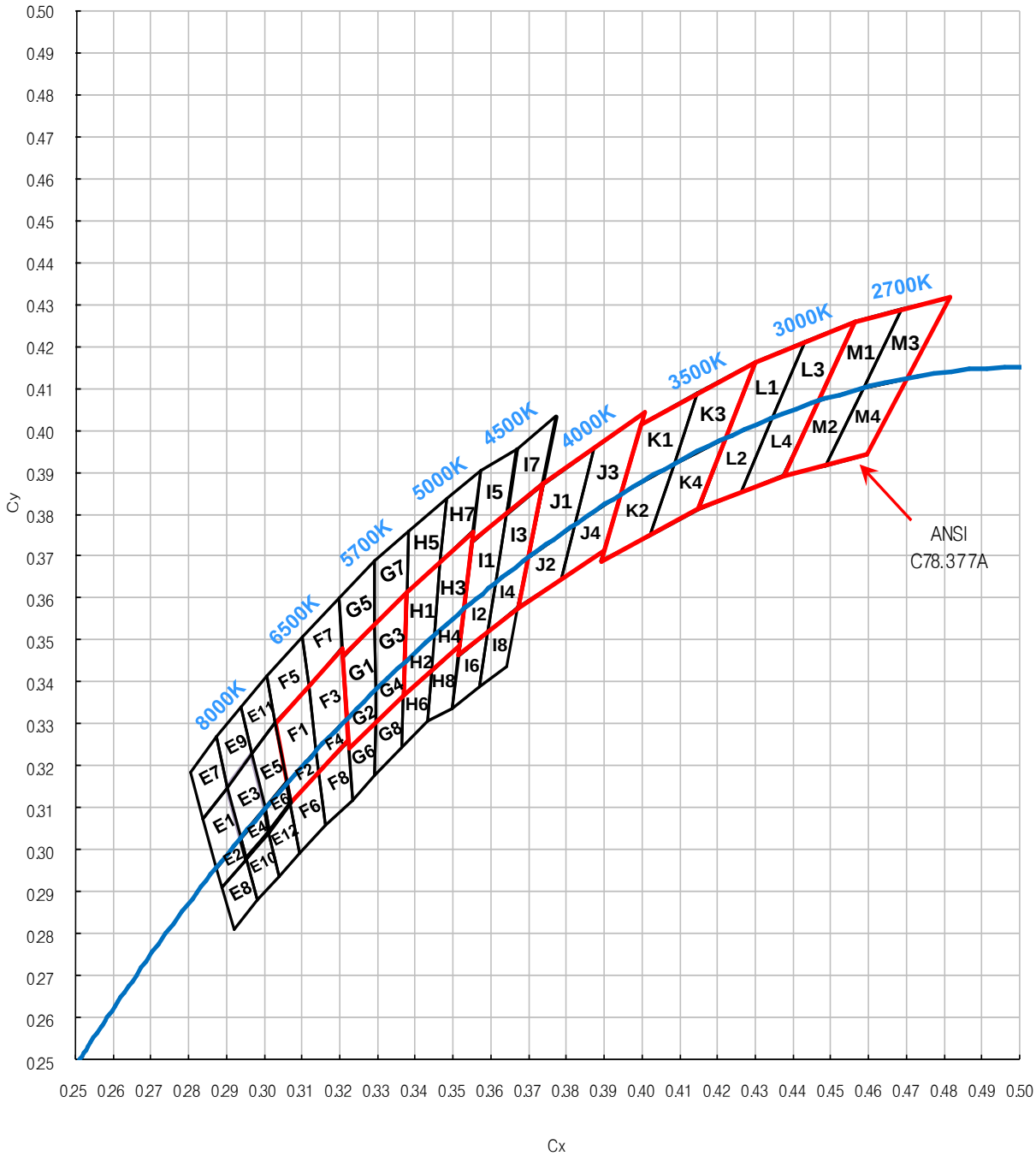
## 6. Chromaticity on the 1931 CIE Curve




•Chromaticity coordinate groups are tested at a current pulse duration of 300 ms and a tolerance of ±0.01.

•ANSI Cool/Neutral/Warm white

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## 7. Performance Group - Chromaticity

Rank of CIE Value (@400mA)

| CCT | Rank | CIE X | CIE Y | CCT | Rank | CIE X | CIE Y | CCT | Rank | CIE X | CIE Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2700K ( 2725K ±145K ) | M1 | 0.4562 | 0.4260 | 4500K ( 4503K ±243K ) | I1 | 0.3548 | 0.3736 | 5700K ( 5665K ±355K ) | G1 | 0.3207 | 0.3462 |
| | | 0.4687 | 0.4289 | | | 0.3641 | 0.3804 | | | 0.3291 | 0.3538 |
| | | 0.4586 | 0.4103 | | | 0.3611 | 0.3638 | | | 0.3292 | 0.3382 |
| | | 0.4465 | 0.4071 | | | 0.3526 | 0.3575 | | | 0.3217 | 0.3314 |
| | M2 | 0.4465 | 0.4071 | | I2 | 0.3526 | 0.3575 | | G2 | 0.3217 | 0.3314 |
| | | 0.4586 | 0.4103 | | | 0.3611 | 0.3638 | | | 0.3292 | 0.3382 |
| | | 0.4483 | 0.3918 | | | 0.3590 | 0.3521 | | | 0.3293 | 0.3305 |
| | | 0.4373 | 0.3893 | | | 0.3512 | 0.3465 | | | 0.3222 | 0.3243 |
| | M3 | 0.4687 | 0.4289 | | I3 | 0.3641 | 0.3804 | | G3 | 0.3291 | 0.3538 |
| | | 0.4813 | 0.4319 | | | 0.3736 | 0.3874 | | | 0.3376 | 0.3616 |
| | | 0.4700 | 0.4126 | | | 0.3697 | 0.3697 | | | 0.3369 | 0.3449 |
| | | 0.4586 | 0.4103 | | | 0.3611 | 0.3638 | | | 0.3292 | 0.3382 |
| | M4 | 0.4586 | 0.4103 | | I4 | 0.3611 | 0.3638 | | G4 | 0.3292 | 0.3382 |
| | | 0.4700 | 0.4126 | | | 0.3697 | 0.3697 | | | 0.3369 | 0.3449 |
| | | 0.4593 | 0.3944 | | | 0.3670 | 0.3578 | | | 0.3366 | 0.3369 |
| | | 0.4483 | 0.3918 | | | 0.3590 | 0.3521 | | | 0.3293 | 0.3305 |
| 3000K ( 3045K ±175K ) | L1 | 0.4299 | 0.4165 | | I5 | 0.3571 | 0.3907 | | G5 | 0.3196 | 0.3602 |
| | | 0.4430 | 0.4212 | | | 0.3668 | 0.3957 | | | 0.3290 | 0.3690 |
| | | 0.4344 | 0.4032 | | | 0.3641 | 0.3804 | | | 0.3291 | 0.3538 |
| | | 0.4221 | 0.3984 | | | 0.3548 | 0.3736 | | | 0.3207 | 0.3462 |
| | L2 | 0.4221 | 0.3984 | | I6 | 0.3512 | 0.3465 | | G6 | 0.3222 | 0.3243 |
| | | 0.4344 | 0.4032 | | | 0.3590 | 0.3521 | | | 0.3293 | 0.3305 |
| | | 0.4260 | 0.3853 | | | 0.3567 | 0.3389 | | | 0.3290 | 0.3180 |
| | | 0.4147 | 0.3814 | | | 0.3495 | 0.3339 | | | 0.3231 | 0.3120 |
| | L3 | 0.4430 | 0.4212 | | I7 | 0.3668 | 0.3957 | | G7 | 0.3290 | 0.3690 |
| | | 0.4562 | 0.4260 | | | 0.3771 | 0.4034 | | | 0.3381 | 0.3762 |
| | | 0.4465 | 0.4071 | | | 0.3736 | 0.3874 | | | 0.3376 | 0.3616 |
| | | 0.4344 | 0.4032 | | | 0.3641 | 0.3804 | | | 0.3291 | 0.3538 |
| | L4 | 0.4344 | 0.4032 | | I8 | 0.3590 | 0.3521 | | G8 | 0.3293 | 0.3305 |
| | | 0.4465 | 0.4071 | | | 0.3670 | 0.3578 | | | 0.3366 | 0.3369 |
| | | 0.4373 | 0.3893 | | | 0.3640 | 0.3440 | | | 0.3361 | 0.3245 |
| | | 0.4260 | 0.3853 | | | 0.3567 | 0.3389 | | | 0.3290 | 0.3180 |
| 3500K ( 3465K ±245K ) | K1 | 0.3996 | 0.4015 | 5000K ( 5028K ±283K ) | H1 | 0.3376 | 0.3616 | 6500K ( 6530K ±510K ) | F1 | 0.3028 | 0.3304 |
| | | 0.4146 | 0.4089 | | | 0.3463 | 0.3687 | | | 0.3115 | 0.3391 |
| | | 0.4082 | 0.3922 | | | 0.3447 | 0.3513 | | | 0.3136 | 0.3237 |
| | | 0.3941 | 0.3848 | | | 0.3369 | 0.3449 | | | 0.3059 | 0.3160 |
| | K2 | 0.3941 | 0.3848 | | H2 | 0.3369 | 0.3449 | | F2 | 0.3059 | 0.3160 |
| | | 0.4082 | 0.3922 | | | 0.3447 | 0.3513 | | | 0.3136 | 0.3237 |
| | | 0.4017 | 0.3752 | | | 0.3440 | 0.3427 | | | 0.3144 | 0.3186 |
| | | 0.3889 | 0.3690 | | | 0.3366 | 0.3369 | | | 0.3068 | 0.3113 |
| | K3 | 0.4146 | 0.4089 | | H3 | 0.3463 | 0.3687 | | F3 | 0.3115 | 0.3391 |
| | | 0.4299 | 0.4165 | | | 0.3551 | 0.3760 | | | 0.3205 | 0.3481 |
| | | 0.4221 | 0.3984 | | | 0.3526 | 0.3575 | | | 0.3217 | 0.3314 |
| | | 0.4082 | 0.3922 | | | 0.3447 | 0.3513 | | | 0.3136 | 0.3237 |
| | K4 | 0.4082 | 0.3922 | | H4 | 0.3447 | 0.3513 | | F4 | 0.3136 | 0.3237 |
| | | 0.4221 | 0.3984 | | | 0.3526 | 0.3575 | | | 0.3217 | 0.3314 |
| | | 0.4147 | 0.3814 | | | 0.3515 | 0.3487 | | | 0.3221 | 0.3261 |
| | | 0.4017 | 0.3752 | | | 0.3440 | 0.3427 | | | 0.3144 | 0.3186 |
| 4000K ( 3985K ±275K ) | J1 | 0.3736 | 0.3874 | | H5 | 0.3381 | 0.3762 | | F5 | 0.3005 | 0.3415 |
| | | 0.3870 | 0.3958 | | | 0.3480 | 0.3840 | | | 0.3099 | 0.3509 |
| | | 0.3819 | 0.3776 | | | 0.3463 | 0.3687 | | | 0.3115 | 0.3391 |
| | | 0.3697 | 0.3697 | | | 0.3376 | 0.3616 | | | 0.3028 | 0.3304 |
| | J2 | 0.3697 | 0.3697 | | H6 | 0.3366 | 0.3369 | | F6 | 0.3068 | 0.3113 |
| | | 0.3819 | 0.3776 | | | 0.3440 | 0.3427 | | | 0.3144 | 0.3186 |
| | | 0.3783 | 0.3646 | | | 0.3429 | 0.3307 | | | 0.3161 | 0.3059 |
| | | 0.3670 | 0.3578 | | | 0.3361 | 0.3245 | | | 0.3093 | 0.2993 |
| | J3 | 0.3870 | 0.3958 | | H7 | 0.3480 | 0.3840 | | F7 | 0.3099 | 0.3509 |
| | | 0.4006 | 0.4044 | | | 0.3571 | 0.3907 | | | 0.3196 | 0.3602 |
| | | 0.3941 | 0.3848 | | | 0.3551 | 0.3760 | | | 0.3205 | 0.3481 |
| | | 0.3819 | 0.3776 | | | 0.3463 | 0.3687 | | | 0.3115 | 0.3391 |
| | J4 | 0.3819 | 0.3776 | | H8 | 0.3440 | 0.3427 | | F8 | 0.3144 | 0.3186 |
| | | 0.3941 | 0.3848 | | | 0.3515 | 0.3487 | | | 0.3221 | 0.3261 |
| | | 0.3898 | 0.3716 | | | 0.3495 | 0.3339 | | | 0.3231 | 0.3120 |
| | | 0.3783 | 0.3646 | | | 0.3429 | 0.3307 | | | 0.3161 | 0.3059 |

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## 7. Performance Group – Chromaticity (Continued)

| CCT | Rank | CIE X | CIE Y | CCT | Rank | CIE X | CIE Y | CCT | Rank | CIE X | CIE Y |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8000K ( 8020K ±980K ) | E1 | 0.2835 | 0.3075 | 8000K ( 8020K ±980K) | E7 | 0.2803 | 0.3185 | | | | |
| | | 0.2772 | 0.2992 | | | 0.2735 | 0.3100 | | | | |
| | | 0.2807 | 0.2884 | | | 0.2772 | 0.2992 | | | | |
| | | 0.2870 | 0.2957 | | | 0.2835 | 0.3075 | | | | |
| | E2 | 0.2870 | 0.2957 | | E8 | 0.2885 | 0.2910 | | | | |
| | | 0.2807 | 0.2884 | | | 0.2824 | 0.2840 | | | | |
| | | 0.2824 | 0.2840 | | | 0.2860 | 0.2740 | | | | |
| | | 0.2885 | 0.2910 | | | 0.2920 | 0.2810 | | | | |
| | E3 | 0.2900 | 0.3150 | | E9 | 0.2870 | 0.3270 | | | | |
| | | 0.2835 | 0.3075 | | | 0.2803 | 0.3185 | | | | |
| | | 0.2870 | 0.2957 | | | 0.2835 | 0.3075 | | | | |
| | | 0.2935 | 0.3029 | | | 0.2900 | 0.3150 | | | | |
| | E4 | 0.2935 | 0.3029 | | E10 | 0.2950 | 0.2980 | | | | |
| | | 0.2870 | 0.2957 | | | 0.2885 | 0.2910 | | | | |
| | | 0.2885 | 0.2910 | | | 0.2920 | 0.2810 | | | | |
| | | 0.2950 | 0.2980 | | | 0.2980 | 0.2880 | | | | |
| | E5 | 0.2965 | 0.3230 | | E11 | 0.2938 | 0.3343 | | | | |
| | | 0.2900 | 0.3150 | | | 0.2870 | 0.3270 | | | | |
| | | 0.2935 | 0.3029 | | | 0.2900 | 0.3150 | | | | |
| | | 0.3000 | 0.3100 | | | 0.2965 | 0.3230 | | | | |
| | E6 | 0.3000 | 0.3100 | | E12 | 0.3010 | 0.3045 | | | | |
| | | 0.2935 | 0.3029 | | | 0.2950 | 0.2980 | | | | |
| | | 0.2950 | 0.2980 | | | 0.2980 | 0.2880 | | | | |
| | | 0.3010 | 0.3045 | | | 0.3037 | 0.2937 | | | | |

**※ Model name method: Please refer to the following**

**example Model Name :** LEMWM185 80 LG00

**Spec of Luminous Flux**

**Spec of CRI**

**Spec of CIE**

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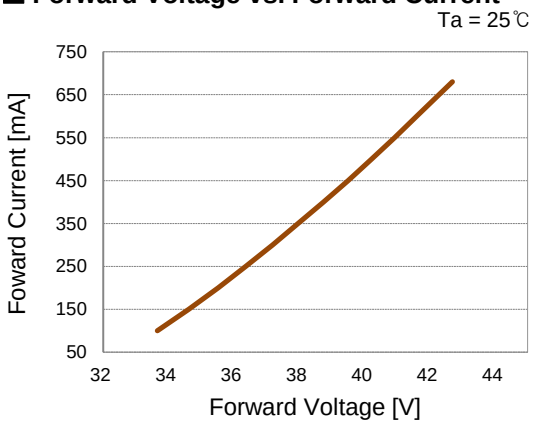
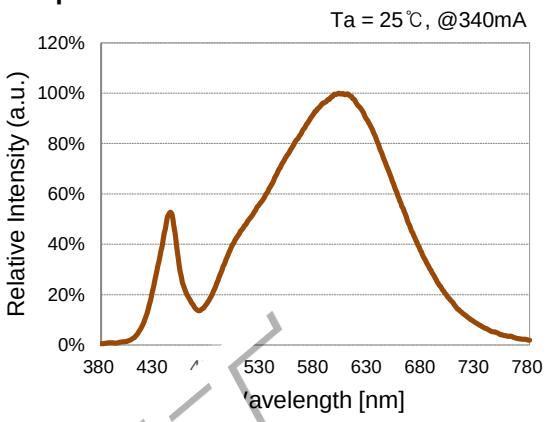
## 8. Typical Characteristic Curves

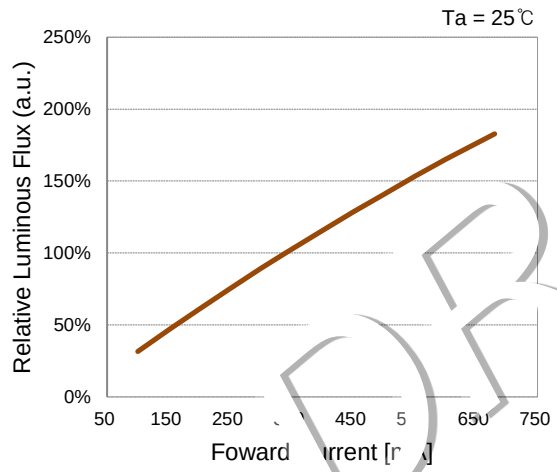
■ **Forward Voltage vs. Forward Current**



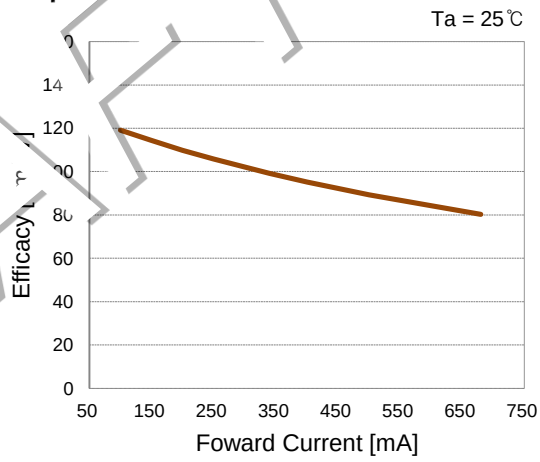

■ **Spectrum**



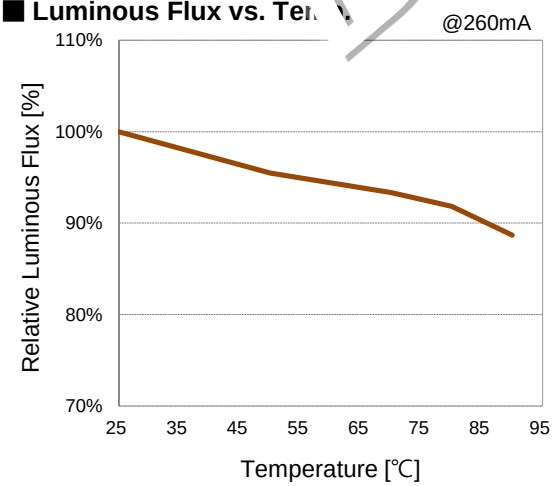

■ **Forward Current vs. Luminous Flux**



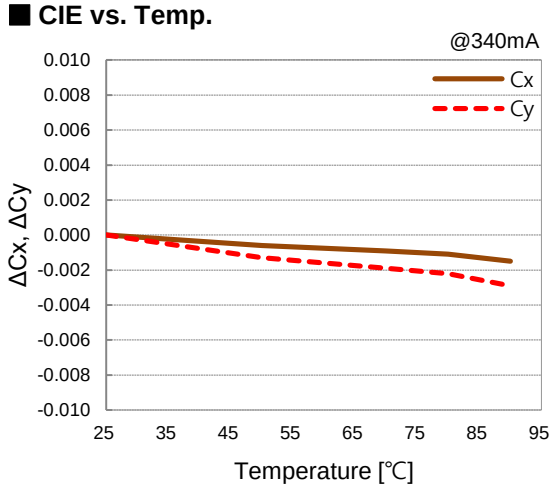

■ **Inpu Watt vs. Lu inance Flux**




■ **Luminous Flux vs. Ter**




■ **CIE vs. Temp.**



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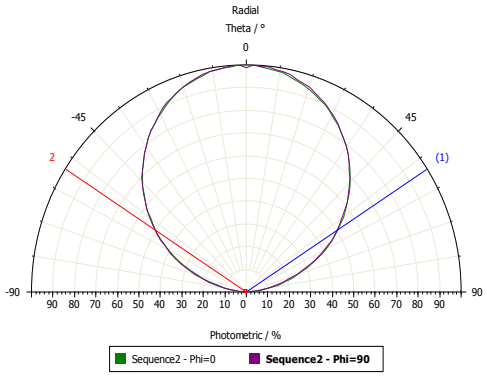
## 8. Typical Characteristic Curves (Continued)

### ■ Viewing Angle

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# 9. Reliability Test Items and Conditions

## 9-1.Criteria for Judging the Damage

| Item | Symbol | Test Condition | Limit | |
|---|---|---|---|---|
| | | | Min | Max |
| Forward Voltage | VF | IF = 340mA | S × 0.80 | S × 1.20 |
| Luminous Flux Ⅰ *1 | $\Phi_V$ | IF = 340mA | S × 0.85 | - |
| Luminous Flux Ⅱ *2 | $\Phi_V$ | IF = 340mA | S × 0.70 | - |

* U.S.L : Upper Spec. Limit, S : Initial Value

## 9-2. Item and Results of Reliability Test

| No | Item | Test Condition | Test Hours/ Cycles | Sample No | Ac/Re |
|---|---|---|---|---|---|
| 1 | Steady State Operating Life*1 | Ta=25℃, $I_F$=340 [mA] | 1000hr | 22 pcs | 0 / 1 |
| 2 | High Temp. Humidity Life*2 | Ta=85℃,85% RH,$I_F$=340 [mA] | 1000hr | 22 pcs | 0 / 1 |
| 3 | Steady State Operating Life of High Temperature*2 | Ta=85℃, $I_F$=340 [mA] | 1000hr | 22 pcs | 0 / 1 |
| 4 | Steady State Operating Life of Low Temperature*2 | Ta= -30℃, $I_F$=340 [mA] | 1000hr | 22 pcs | 0 / 1 |
| 5 | High Temp. Storage*2 | 100℃ | 1000hr | 22 pcs | 0 / 1 |
| 6 | Low Temp. Storage*2 | -40℃ | 1000hr | 22 pcs | 0 / 1 |
| 7 | Temperature Cycle*2 | -40℃(30min) ~ 25℃(5min) ~ 100℃(30min) ~ 25℃(5min) | 100cycle | 22 pcs | 0 / 1 |
| 8 | Thermal Shock*2 | 100℃(30min) ~ -40℃(30min) | 100cycle | 22 pcs | 0 / 1 |
| 9 | Resistance to Soldering Heat *2 (Reflow Soldering) | Tsld = 260℃, 10s (pre treat. 30℃, 70%, 168hr) | 1 times | 22 pcs | 0 / 1 |
| 10 | Vibration*2 | 200m/s$^2$,100~2000Hz(sweep 4min) 48min, 3 directions | 4 times | 22 pcs | 0 / 1 |

*The operating test is allowed with a heat sink of aluminum

| SPECIFICATION | | | |
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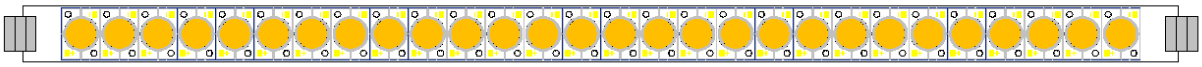
# 10. Package and Marking of Products

( unit : mm )

## 10-1. Tube Outline Dimension

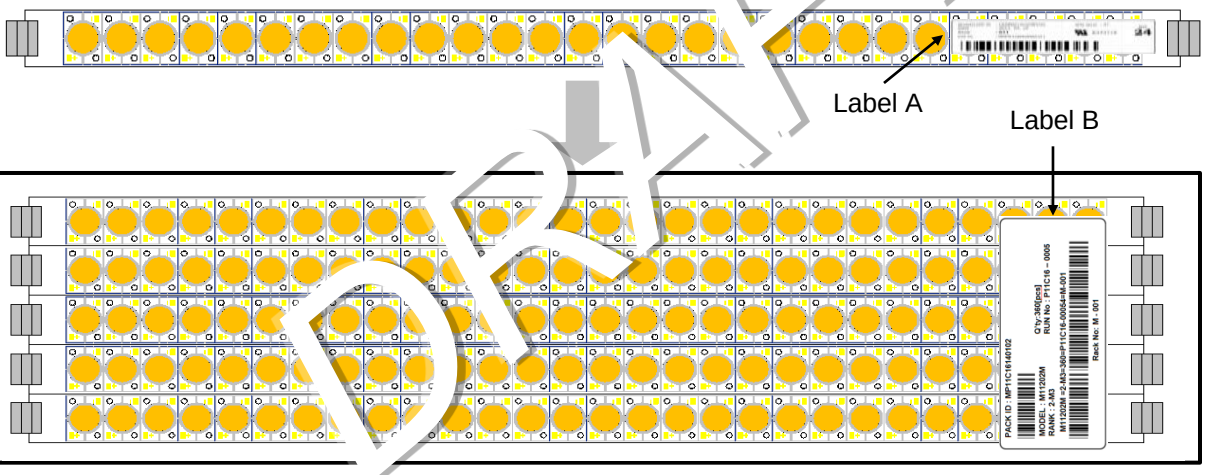
◆ Packing Materials :
- Tube : PET

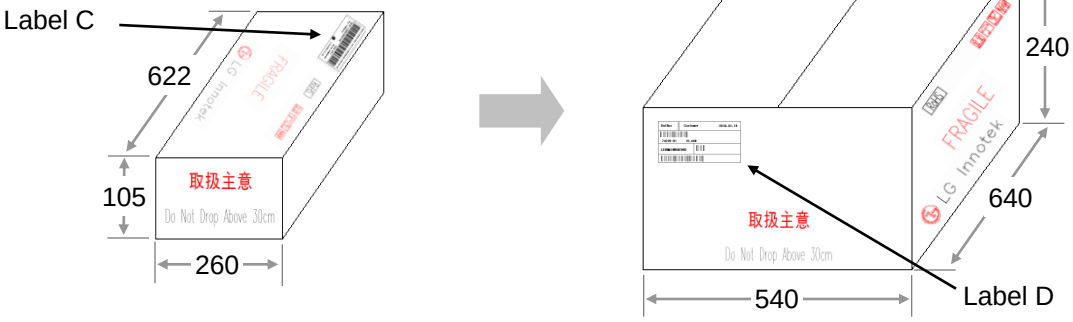


✓ Dimension of Tube : 540 x 26.6 x 5.5
✓ Insert Direction : 28units Per Tube

## 10-2. Packing Specifications

A rubber band ties the 5 Tubes (the number of PKGs are 140 pcs) ar[illegible]n that packed in a vacuum seal off Packing Bag along with desiccants (Silicagel). 8 Packing [illegible]ag (total maximum number of products are 1,120 pcs) packed in an inner box ar[illegible] 4 inner boxe[illegible] are put into an outer box. (total maximum number of products are 4,480 pcs)



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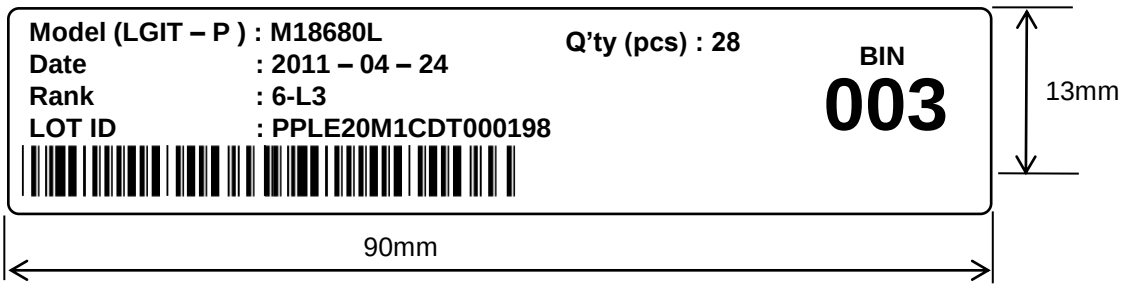
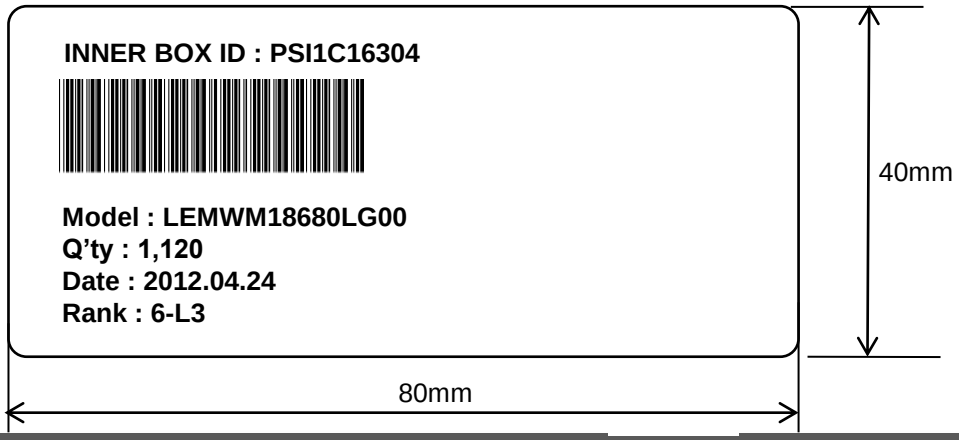
※. Label A (Tube Label)

Model(Company's Name - Location of manufacture) , Date, Rank, LOT ID, Quantity




※ Label B (Packing Bag)
PACK ID, MODEL, RANK, Quantity, RUN No, Rack No


※ Label C (Inner Box Label)
INNER BOX ID, MODEL, Quantity, Date, Rank



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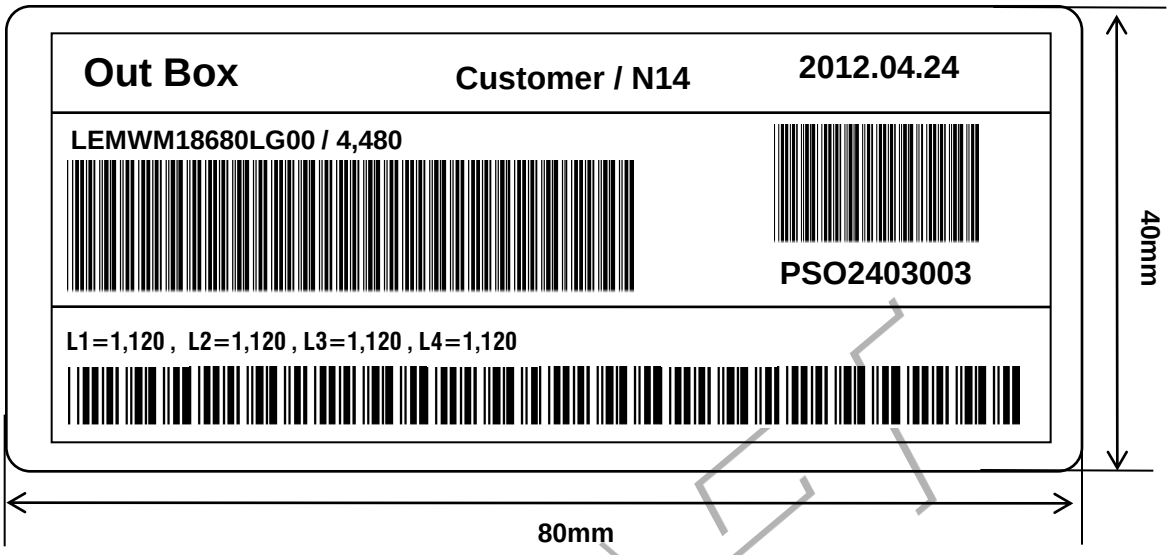
※ Label D (Out Box Label)
Specifying Customer, Date, Model Name, Quantity, Customer Part no, Outbox ID




▪ Outbox ID. indication

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Site | PKG Site | Outbox | Year | Month | Date | | Serial No | | |
| | | | 12 : 2<br>13 : 3<br>14 : 4<br>15 : 5 | 1~9 : 1~9<br>10 : A<br>11 : B<br>12 : C | ( 01 ~ 31) | | ( 001 ~ 999 ) | | |

▪ **Lot No. indication**

| 1 | 2 | 3 | 4 | 5 | — | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Code** | **QA Inspection Year (Last number)** | **QA Inspection Month** | **QA Inspection Date** | | | **Serial No** | |
| | **( 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 )** | **( 1, 2, 3, 4, 5, 6, 7, 8, 9, X, Y, Z )** | **( 01 ~ 31 )** | | | **( 01 ~ 99 )** | |

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## 11. Cautions on use

11-1. Over-current-proof

Customer must apply resistors for protection, others slight voltage shift will cause big current change. ( Burn out will happen )

*LG Innotek* will not be held responsible for any damage to the user that may result from accidents or any other reasons during operation of the user's unit if use to exceed the absolute maximum ratings, or not keep the matters that demand special attention.

11-2. For the Storage

- Proper temperature and RH conditions for storage are : 5 ℃ ~35 ℃ , RH 60%.
- Do not open moisture-proof bag before the products are ready to use.
- Store products in a moisture-proof bag with a desiccant (Silica gel) after open.
- These products should be used within 168 hours after opening the bag based upon storage condition.
- These products must be baked to remove moisture before using them if the Silica gel loses its color. Conditions for baking are 60±5℃, 20% (RH) and 24 hours maximum. (For reeled status without bag)

11-3. For the Usage

- LED PKG should not be used in directly exposed environment containing hazardous substances.
- The LEDs has silver plated metal parts. The silver plating become tarnished when being exposed to an environment which contains corrosive gases.
- After assembly and during use, silver plating can be affected by the corrosive gases emitted by components and materials in close proximity of the LEDs within an end product, and the gases entering into the product from the external atmosphere.
- Do not expose the LEDs to corrosive atmosphere during storage and using.
- Avoid rapid transitions in ambient temperature, especially in high humidity environments where condensation can occur.
- In designed a circuit, the current through each LED must not exceed the absolute maximum rating.

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## 11. Cautions on use (Continued)

11-4. Cleaning

- Please avoid using a brush for cleaning and do not wash the product in organic solvents such as acetone, Organic solvent (TCE, etc..) will damage the surface of LED. Please refer to following olvents and conditions.

  Solvent : alcohol, 25℃ max × 600sec max

11-5. Handling

- Do not exceed 2kgf on top-Lens. (Do not exceed 1kgf side Lens)
- Do not drop above 30cm.

11-6. Heat Generation

- Thermal design of the end product is of paramount importance.
- Please consider the heat generation of the LED when making the system design.
- The coefficient of temperature increase per input electric power is affected by the thermal resistance of the circuit board and density of LED placement on the board. as well as other component.
- It necessary to avoid intense heat generation and operate within the maximum ratings given in the specification.

11-7. Static Electricity

- If over-voltage, which exceeds the absolute maximum rating, is applied to the LEDs, it will damage the LEDs and result in destruction. Since the LEDs are sensitive to the static electricity and surge, it is strongly recommended to use a wristband or anti-electrostatic glove when handling the LEDs and all devices, equipment and machinery must be properly grounded.
- It is recommended that precautions be taken against surge voltage to the equipment the mounts the LEDs.
- Damaged LEDs will show some unusual characteristics such as the leak current remarkably increases, the turn-on voltage becomes lower, or the LEDs do not light at the low current.
- When examining the final product, it is recommended to check whether the assembled LEDs are damaged by static electricity or not. Static-damaged LEDs can easily be found by light-on test or the VF test at a low current.

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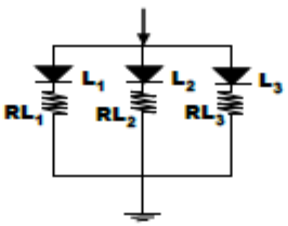
## 11. Cautions on use (Continued)

11-9. Recommended Circuit

- In designed a circuit, the current through each LED must not exceed the absolute maximum rating specified for each LED.
- In general, the LEDs have a variation of forward voltage. Using LEDs with different forward voltages in a circuit with on resistor for the complete circuit causes different forward currents for each LED. This may lead to a variation in brightness. In the worst case, some LED may be subjected to the stresses in excesses of the absolute maximum rating. To avoid brightness variation of LEDs, the use of matrix circuit with one resistor for each LED is recommended.




Pic.1 Recommended Circuit in parallel mode
: Separate resistor must be used in each LED


2. Abno al Circuit
The rrent th gh the LEDs may vary due to
e va n in ward voltage ($V_F$) of the LEDs.

- LED should be operated in forw bias. drivin Circuit must be designed so that the LED is not subjected to either forward or rev se wh it is off. In particular, if a reverse voltage is continuously applied t D, su operation can cause migration resulting in LED damage.
- If reverse voltage is pplied to e LE s, it will damage the Zener diode and LEDs and result in destruction.

11-10. Application limits of L Driver IC controller

- GaN based LED is relatively weak to electrical damage (such as static electricity and over current stress). Forward leakage of LED occurred by such damage in the forward low current region may result in turn-on-delay of Lighting Module, which is dependent on a specific function of driver IC.
- For reasons mentioned above, minimum current level (source start-up current) of LED driver IC must be more than 0.3 mA. LGIT cannot make a guarantee on the LED using in Driver IC with start up current level of < 0.3 mA.
- When parallel circuit LED driver IC is applied in Lighting Module, Hot spot may occur in low current operation region (dimming mode) by difference of LED voltage in low current region. So, driver IC with Individual LED controller is recommended.

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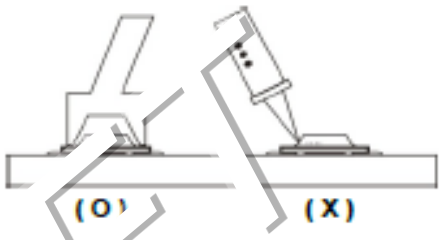
## 11. Cautions on use (Continued)

11-11. Repair

- Repairing should not be done after the LEDs have been soldered.
- When repairing is unavoidable, a double-head soldering iron should be used.
- If should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- When Soldering, do not put stress on the LEDs during heating customer must finish rework within 5sec. under 245℃.
- The head of Iron can not touch copper foil.
- Twin-head type is preferred.




11-12. Safety Guideline for Human Eyes.

- Users should be cautioned not to st… at … ligh… his LED product.
- Great care should be taken whe… iewing … rectly … e LED driven at high current or the LED with optical instruments, which may gre… … incre… the hazard to your eyes.

11-13. Handling of static …lectricity

- These products are se…itive to s…atic electricity charge. Please take measures to prevent any static electricity being pr… uce… such as the wearing of wristband or anti-static gloves when handling this product, and …stall circuit protection device to drive circuit, if necessary.
- All devices, equipment and machinery must be properly grounded. It is recommended that precautions be taken against surge voltage to the equipment that mounts the LEDs.
- When inspecting the final products in which LEDs were assembled, it is recommended to check whether the assembled LEDs are damaged by static electricity or not
- It is easy to find static-damaged LEDs by a light-on test.

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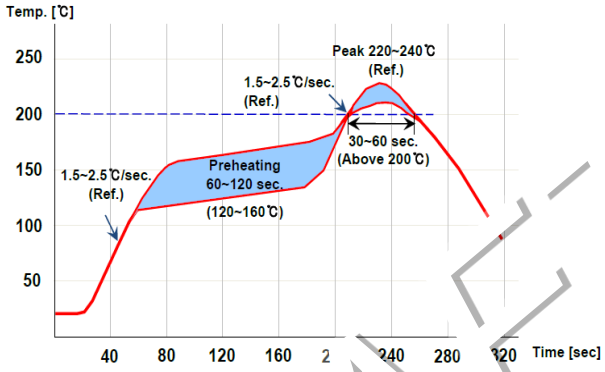
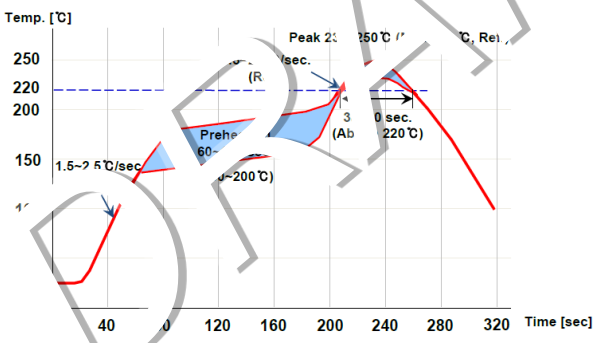
## 12. Reflow Soldering Characteristics

12-1. Soldering Conditions.

- The LEDs can be soldered in place using the reflow soldering method.
- LG Innotek cannot make a guarantee on the LEDs after they have been assembled using dip soldering method.
- Recommended soldering conditions.
- Pb Solder




- Pb-free Solder






- Although the recommende[illegible]oldering conditions are specified in the above diagram, reflow or hand soldering at the lowest possible temperature is desirable for the LEDs.
- A rapid-rate process is not recommended for cooling the LEDs down from the peak temperature.
- Occasionally there is a brightness decrease caused by the influence of heat of ambient atmosphere during air reflow. It is recommended that the customer use the nitrogen reflow method.
- The encapsulated material of the LEDs is silicone, Therefore the LEDs have a soft surface on the top of the package. The pressure to the surface will be influence to the reliability of the LEDs. Precautions should be taken to avoid the strong pressure on the encapsulated part. So When using the chip mounter, the picking up nozzle that does not affect the silicone resin should be used.
- Reflow soldering should not be done more than two times.

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## 12. Reflow Soldering Characteristics

### 12-2. Soldering Iron

Basic spec is ≤3sec when 350℃. If temperature is higher, time shorter (+10℃ → -1sec). Power dissipation of Iron should be smaller than 15W, and temperature should be controllable. Surface temperature of the device should be under 230℃.