

CUSTOMER : \_\_\_\_\_.

DATE : Nov. 04, 2015 .

REV : REV. 4.0 .

# PRODUCT FAMILY DATA SHEET



## ***3528 A101 Series***

MODEL NAME : LEMWS28Q80 Series

**RoHS**  
Compliant

**Halogen**  
Compliant

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## 1. Features

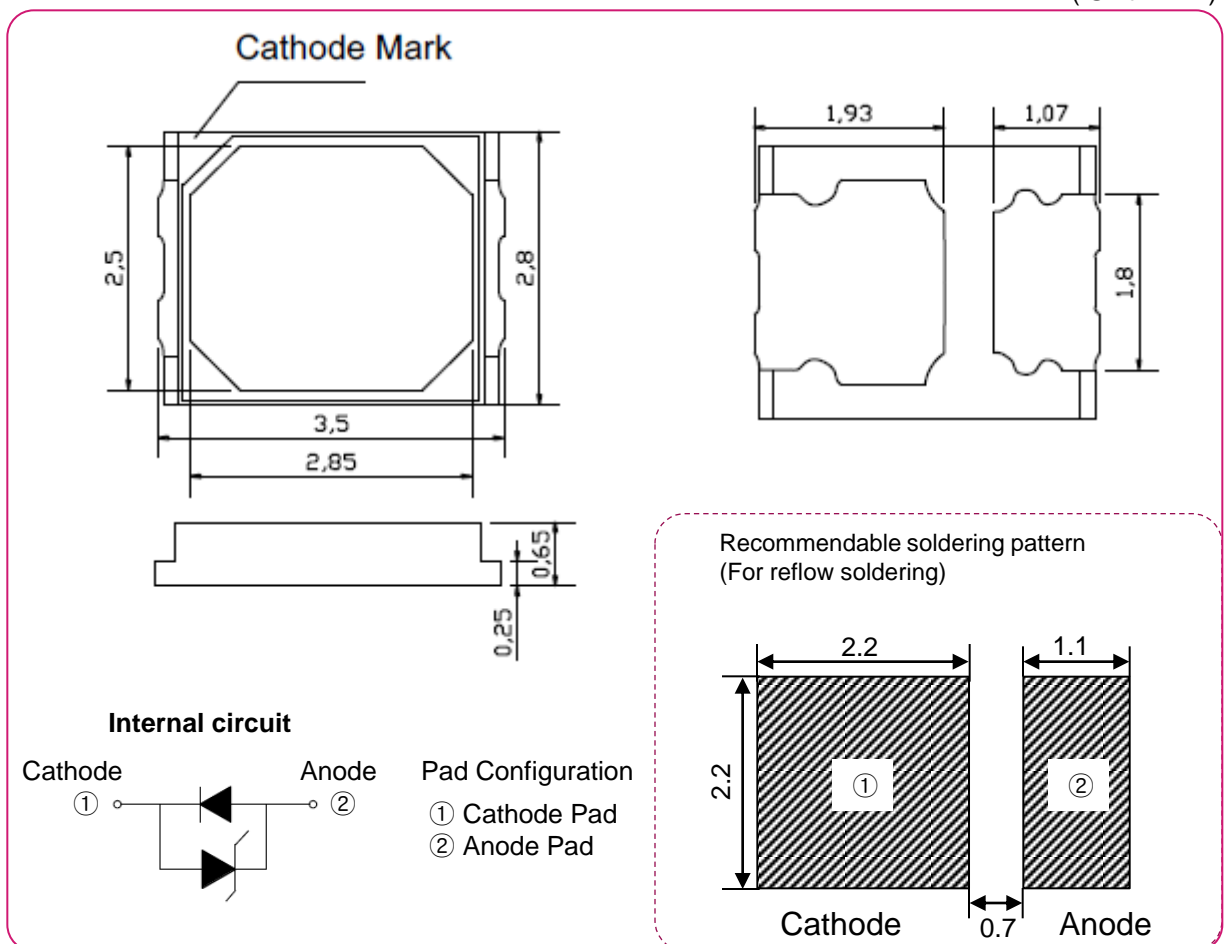
- Lighting Color : White
- Lead Frame Type LED Package : 2.8 x 3.5 x 0.65 (L x W x H) [Unit : mm]
- Viewing Angle : 120°
- Chip Material : InGaN
- Soldering Methods : Reflow soldering
- Taping : 8 mm conductive black carrier tape and antistatic clear cover tape  
3,500 pcs/reel,  $\Phi$ 178 mm reel

## 2. Applications

- Interior Illumination

## 3. Outline Dimensions

( Unit : mm )



Tolerances unless otherwise mentioned are  $\pm 0.10$  mm

## 4. Absolute Maximum Ratings

( Ta = 25℃ )

Item	Symbol	Rating	Unit
Forward Current	If	90	mA
Peak Pulse Forward Current*1)	I <sub>fp</sub>	150	mA
Operating Temperature	T <sub>opr</sub>	-40 ~ +85	℃
Storage Temperature	T <sub>stg</sub>	-40 ~ +100	℃
Junction Temperature	T <sub>j</sub>	110	℃
Soldering Temperature	JEDEC-J-STD-020D		

\*1) Pulse width ≤ 10ms and duty cycle ≤ 10%

※ Operating the LED beyond the listed maximum ratings may affect device reliability and cause permanent damage. 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.

※ The LEDs are not designed to be driven in reverse bias.

## 5. Electro - Optical Characteristics

( Ta = 25℃, If = 60mA )

Item	Symbol	CCT	Min.	Typ.	Max.	Unit
Luminous Flux	Φ <sub>v</sub>	6500 (F)	23.3	25.1	26.8	lm
		5700 (G)	23.3	25.5	26.8	
		5000 (H)	23.3	25.1	26.8	
		4000 (J)	23.3	25.2	26.8	
		3500 (K)	22.4	25.2	25.8	
		3000 (L)	21.4	23.8	24.7	
		2700 (M)	20.5	22.8	23.6	
Forward Voltage	V <sub>f</sub>	All	2.9	3.05	3.2	V
Color	C <sub>x</sub> / C <sub>y</sub>	All	Refer to 'Chromaticity Bins'			-
Viewing Angle	2Θ <sub>1/2</sub>	All	-	120	-	deg
Color Rendering Index (Ra)	-	All	80	-	-	-
Thermal Resistance, Junction to Solder Point	R <sub>th j-s</sub>	All	-	30	-	℃/W
Typical Temperature Coefficient of Forward Voltage*1)	ΔV <sub>f</sub> / ΔT <sub>j</sub>	All	-1.0	-	-3.0	mV/℃

\*1) Measured at Ta between 25℃ and 85℃.

※ These values are measured by the LG Innotek optical spectrum analyzer within the following tolerances. Luminous Flux (Φ<sub>v</sub>) : ± 7%, Forward Voltage (V<sub>f</sub>) : ± 0.1V, Color Value : ± 0.005, CRI Value : ± 2,

※ 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

CCT	If (mA)	Vf (V)	Power (W)	$\Phi_v$ (lm)	lm/W
6500K (F)	50	2.99	0.150	21.5	143
	60 (Typ.)	3.05	0.183	25.1	137
	70	3.10	0.217	28.5	132
	80	3.14	0.251	31.7	126
	90	3.19	0.287	35.0	122
5700K (G)	50	2.99	0.150	21.8	146
	60 (Typ.)	3.05	0.183	25.5	140
	70	3.10	0.217	29.2	135
	80	3.14	0.251	32.6	130
	90	3.19	0.287	35.9	125
5000K (H)	50	2.99	0.150	21.5	143
	60 (Typ.)	3.05	0.183	25.1	137
	70	3.10	0.217	28.6	132
	80	3.14	0.251	32.0	127
	90	3.19	0.287	35.2	123
4000K (J)	50	2.99	0.150	21.6	144
	60 (Typ.)	3.05	0.183	25.2	138
	70	3.10	0.217	28.8	133
	80	3.14	0.251	32.1	128
	90	3.19	0.287	35.3	123
3500K (K)	50	2.99	0.150	21.5	144
	60 (Typ.)	3.05	0.183	25.2	138
	70	3.10	0.217	28.6	132
	80	3.14	0.251	31.8	127
	90	3.19	0.287	35.1	122
3000K (L)	50	2.99	0.150	20.4	136
	60 (Typ.)	3.05	0.183	23.8	130
	70	3.10	0.217	27.1	125
	80	3.14	0.251	30.3	120
	90	3.19	0.287	33.2	116
2700K (M)	50	2.99	0.150	19.6	131
	60 (Typ.)	3.05	0.183	22.8	125
	70	3.10	0.217	25.9	120
	80	3.14	0.251	28.9	115
	90	3.19	0.287	31.8	111

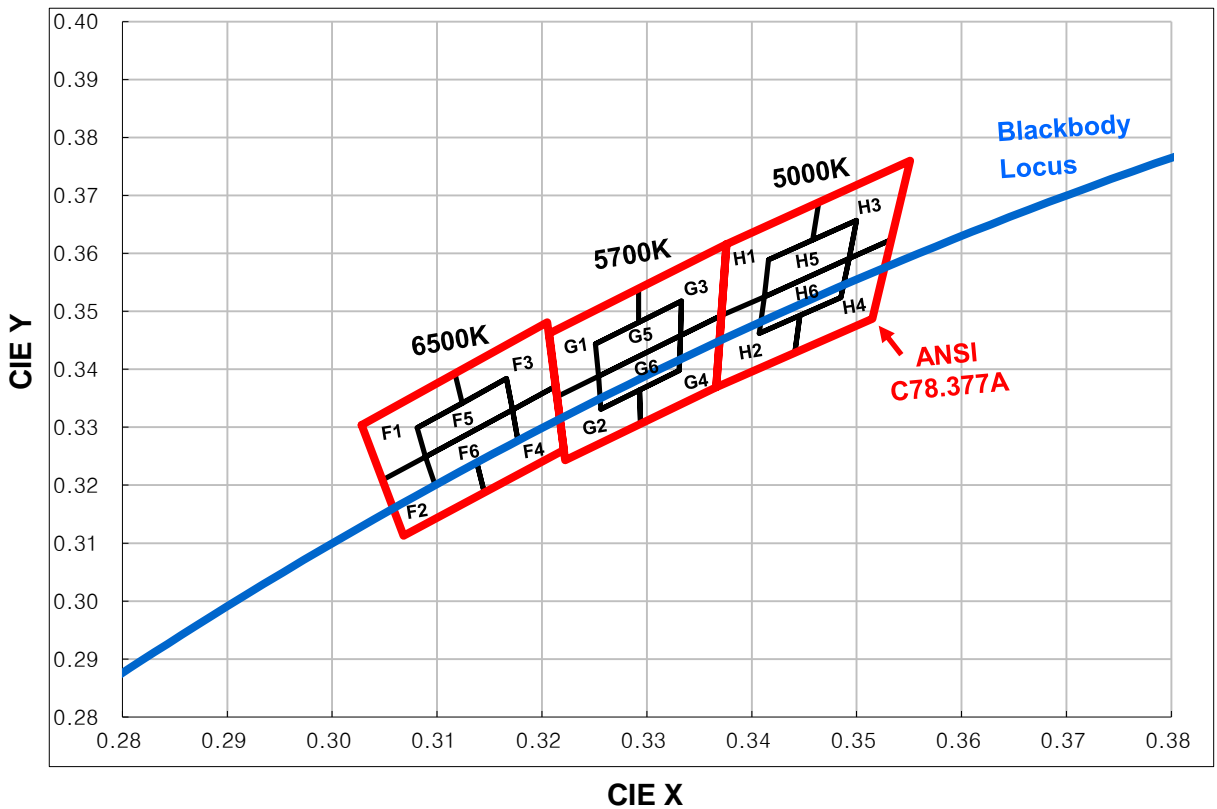
## 6. Flux Characteristics and Order Code

Color	CRI	CCT	Vf @ 60mA [V]	Luminous Flux [lm] @ 60mA			Order Code
				Bin Code	Min.	Max.	
Cool	80	6500 (F)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	23.3	26.8	LEMWS28Q80FSZ2xx
Cool	80	5700 (G)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	23.3	26.8	LEMWS28Q80GSZ2xx
Cool	80	5000 (H)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	23.3	26.8	LEMWS28Q80HSZ2xx
Neutral	80	4000 (J)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	23.3	26.8	LEMWS28Q80JSZ2xx
Warm	80	3500 (K)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	22.4	25.8	LEMWS28Q80KSZ2xx
Warm	80	3000 (L)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	21.4	24.7	LEMWS28Q80LSZ2xx
Warm	80	2700 (M)	2.90 ~ 3.00 (0) 3.00 ~ 3.10 (1) 3.10 ~ 3.20 (2)	Q	20.5	23.6	LEMWS28Q80MSZ2xx

※ Φv values are for representative references only.

## 7. Chromaticity Bins

LG Innotek complies with the ANSI C78.377A standard for its chromaticity bin structure. For each ANSI quadrangle for the CCT range of 2700K to 6500K, LG Innotek provides 6 micro bins.

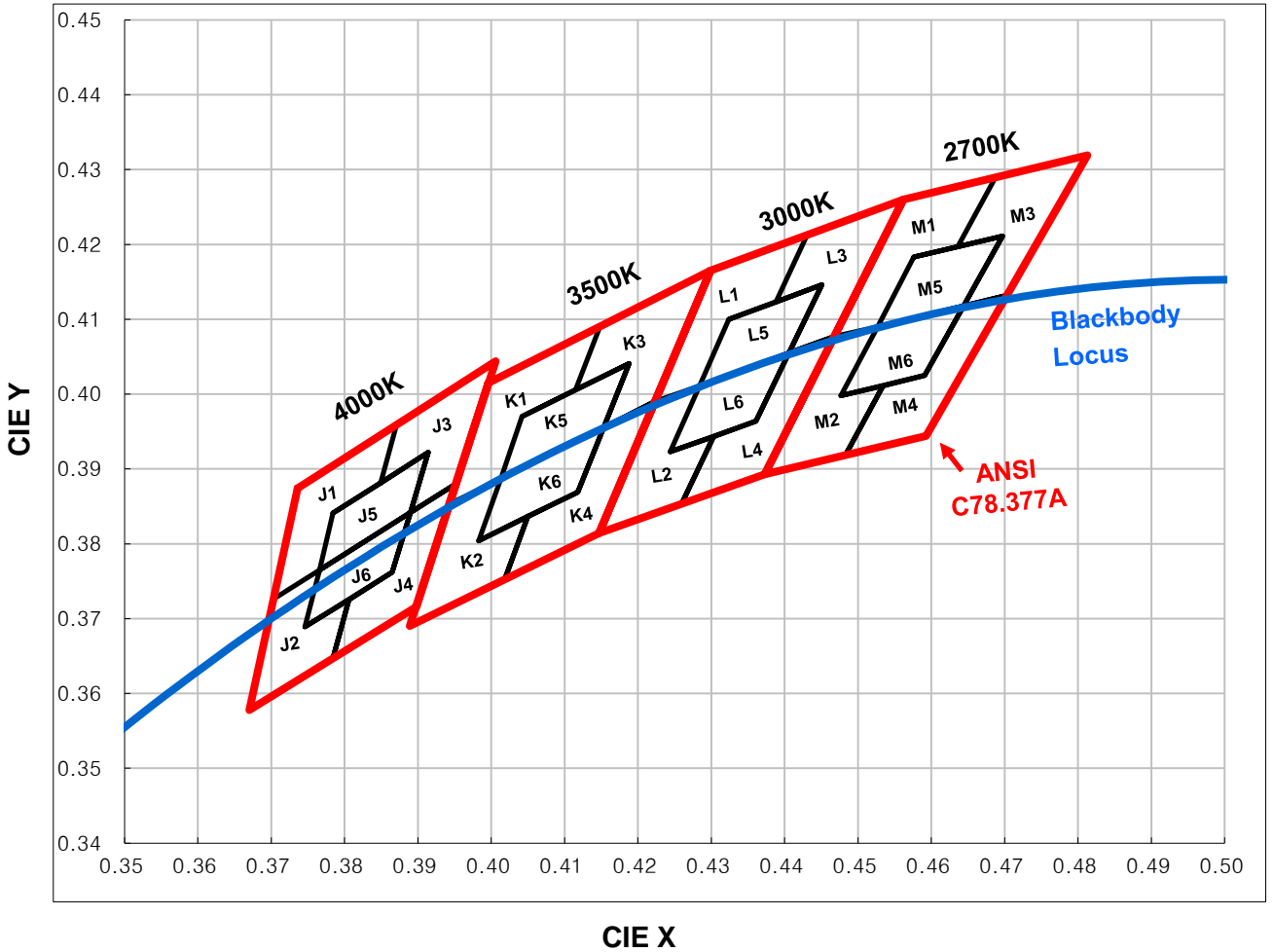


Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
F1	0.3048	0.3209	G1	0.3215	0.3353	H1	0.3371	0.3493
	0.3028	0.3304		0.3207	0.3462		0.3376	0.3616
	0.3117	0.3393		0.3292	0.3539		0.3464	0.3688
	0.3124	0.3341		0.3292	0.3481		0.3458	0.3623
	0.3081	0.3299		0.3251	0.3444		0.3416	0.3589
	0.3089	0.3249		0.3254	0.3388		0.3412	0.3525
F2	0.3068	0.3113	G2	0.3222	0.3243	H2	0.3366	0.3369
	0.3048	0.3209		0.3215	0.3353		0.3371	0.3493
	0.3089	0.3249		0.3254	0.3388		0.3412	0.3525
	0.3098	0.3200		0.3256	0.3331		0.3407	0.3462
	0.3138	0.3238		0.3293	0.3364		0.3446	0.3493
	0.3145	0.3187		0.3294	0.3306		0.3441	0.3428

## 7. Chromaticity Bins (Continued)

Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
<b>F3</b>	0.3117	0.3393	<b>G3</b>	0.3292	0.3539	<b>H3</b>	0.3464	0.3688
	0.3205	0.3481		0.3376	0.3616		0.3551	0.3760
	0.3213	0.3371		0.3371	0.3493		0.3533	0.3624
	0.3172	0.3330		0.3332	0.3458		0.3493	0.3591
	0.3166	0.3384		0.3333	0.3518		0.3500	0.3657
	0.3124	0.3341		0.3292	0.3481		0.3458	0.3623
<b>F4</b>	0.3145	0.3187	<b>G4</b>	0.3294	0.3306	<b>H4</b>	0.3441	0.3428
	0.3138	0.3238		0.3293	0.3364		0.3446	0.3493
	0.3177	0.3277		0.3331	0.3398		0.3485	0.3524
	0.3172	0.3330		0.3332	0.3458		0.3493	0.3591
	0.3213	0.3371		0.3371	0.3493		0.3533	0.3624
	0.3221	0.3261		0.3366	0.3369		0.3515	0.3487
<b>F5</b>	0.3081	0.3299	<b>G5</b>	0.3251	0.3444	<b>H5</b>	0.3416	0.3589
	0.3166	0.3384		0.3333	0.3518		0.3500	0.3657
	0.3172	0.3330		0.3332	0.3458		0.3493	0.3591
	0.3089	0.3249		0.3254	0.3388		0.3412	0.3525
<b>F6</b>	0.3089	0.3249	<b>G6</b>	0.3254	0.3388	<b>H6</b>	0.3412	0.3525
	0.3172	0.3330		0.3332	0.3458		0.3493	0.3591
	0.3177	0.3277		0.3331	0.3398		0.3485	0.3524
	0.3098	0.3200		0.3256	0.3331		0.3407	0.3462

## 7. Chromaticity Bins (Continued)



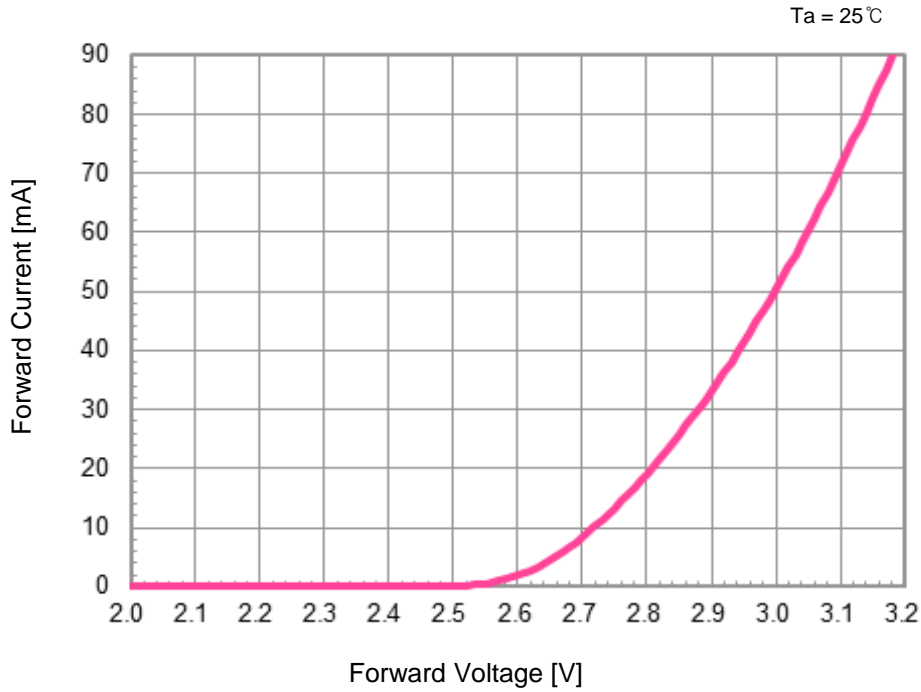
Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
J1	0.3703	0.3726	K1	0.3943	0.3853	L1	0.4223	0.3990	M1	0.4468	0.4077
	0.3736	0.3874		0.3996	0.4015		0.4299	0.4165		0.4562	0.4260
	0.3871	0.3959		0.4148	0.4090		0.4431	0.4213		0.4688	0.4290
	0.3849	0.3881		0.4115	0.4006		0.4388	0.4123		0.4636	0.4197
	0.3784	0.3841		0.4042	0.3970		0.4324	0.410		0.4576	0.4183
	0.3766	0.3765		0.4013	0.3887		0.4284	0.4011		0.4527	0.4090
J2	0.3670	0.3578	K2	0.3889	0.369	L2	0.4147	0.3814	M2	0.4373	0.3893
	0.3703	0.3726		0.3943	0.3853		0.4223	0.3990		0.4468	0.4077
	0.3766	0.3765		0.4013	0.3887		0.4284	0.4011		0.4527	0.4090
	0.3746	0.3689		0.3983	0.3804		0.4244	0.3923		0.4477	0.3998
	0.3806	0.3725		0.4050	0.3837		0.4303	0.3943		0.4534	0.4011
	0.3784	0.3647		0.4018	0.3752		0.4260	0.3854		0.4483	0.3919

## 7. Chromaticity Bins (Continued)

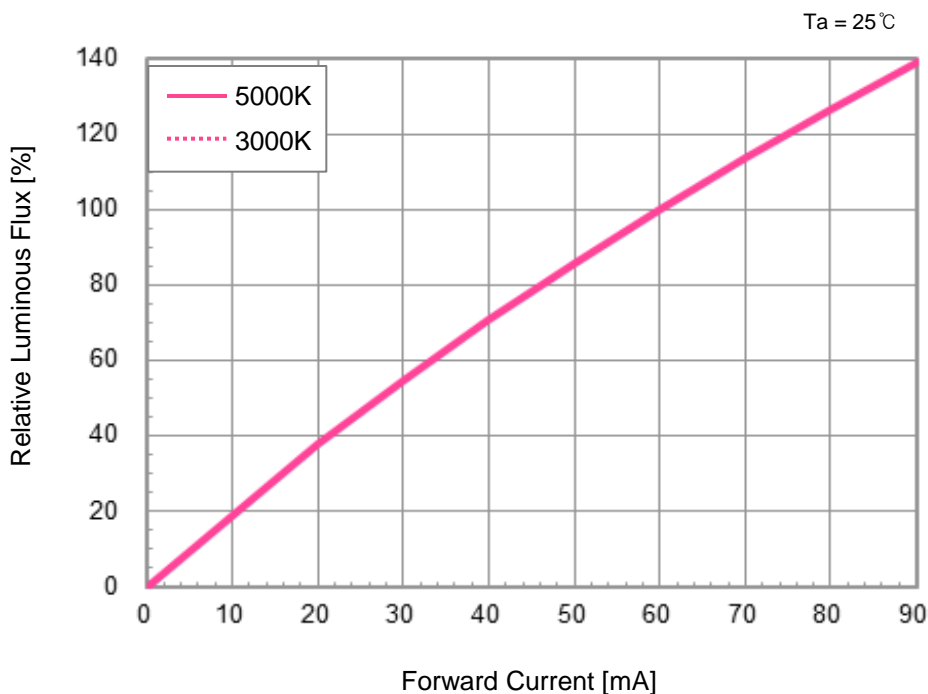
Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
<b>J3</b>	0.3871	0.3959	<b>K3</b>	0.4148	0.409	<b>L3</b>	0.4431	0.4213	<b>M3</b>	0.4688	0.4290
	0.4006	0.4044		0.4299	0.4165		0.4562	0.4260		0.4813	0.4319
	0.3952	0.3880		0.4223	0.3990		0.4468	0.4077		0.4703	0.4132
	0.3890	0.3842		0.4153	0.3955		0.4406	0.4055		0.4644	0.4118
	0.3914	0.3922		0.4188	0.4041		0.4451	0.4146		0.4697	0.4211
	0.3849	0.3881		0.4115	0.4006		0.4388	0.4123		0.4636	0.4197
<b>J4</b>	0.3784	0.3647	<b>K4</b>	0.4018	0.3752	<b>L4</b>	0.4260	0.3854	<b>M4</b>	0.4483	0.3919
	0.3806	0.3725		0.4050	0.3837		0.4303	0.3943		0.4534	0.4011
	0.3865	0.3762		0.4118	0.3869		0.4361	0.3964		0.4591	0.4025
	0.3890	0.3842		0.4153	0.3955		0.4406	0.4055		0.4644	0.4118
	0.3952	0.3880		0.4223	0.3990		0.4468	0.4077		0.4703	0.4132
	0.3898	0.3716		0.4147	0.3814		0.4373	0.3893		0.4593	0.3944
<b>J5</b>	0.3784	0.3841	<b>K5</b>	0.4042	0.3970	<b>L5</b>	0.4324	0.4100	<b>M5</b>	0.4576	0.4183
	0.3914	0.3922		0.4188	0.4041		0.4451	0.4146		0.4697	0.4211
	0.3890	0.3842		0.4153	0.3955		0.4406	0.4055		0.4644	0.4118
	0.3766	0.3765		0.4013	0.3887		0.4284	0.4011		0.4527	0.4090
<b>J6</b>	0.3766	0.3765	<b>K6</b>	0.4013	0.3887	<b>L6</b>	0.4284	0.4011	<b>M6</b>	0.4527	0.4090
	0.3890	0.3842		0.4153	0.3955		0.4406	0.4055		0.4644	0.4118
	0.3865	0.3762		0.4118	0.3869		0.4361	0.3964		0.4591	0.4025
	0.3746	0.3689		0.3983	0.3804		0.4244	0.3923		0.4477	0.3998

## 8. Typical Characteristic Curves

- Forward Current vs. Forward Voltage



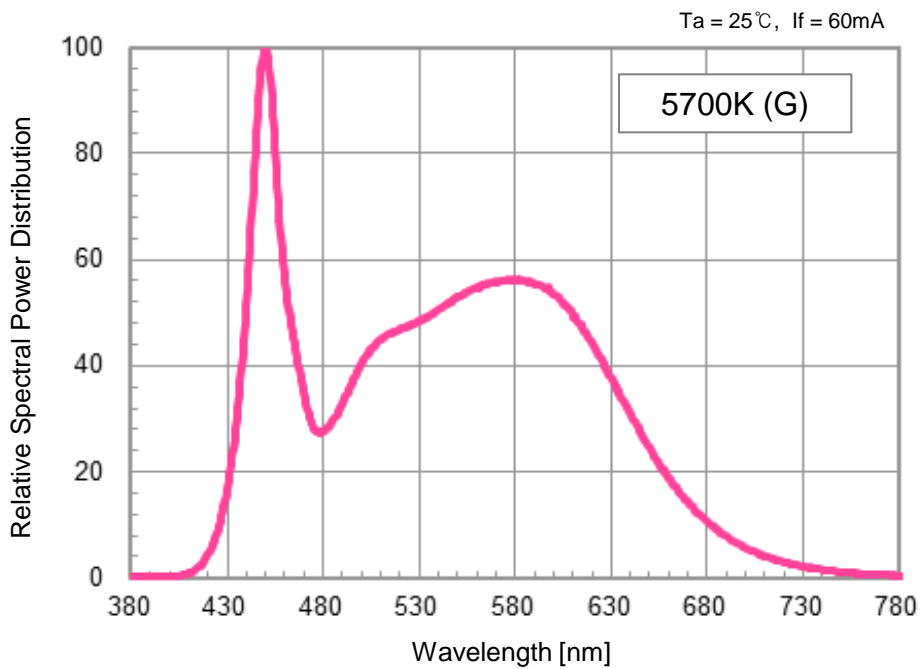
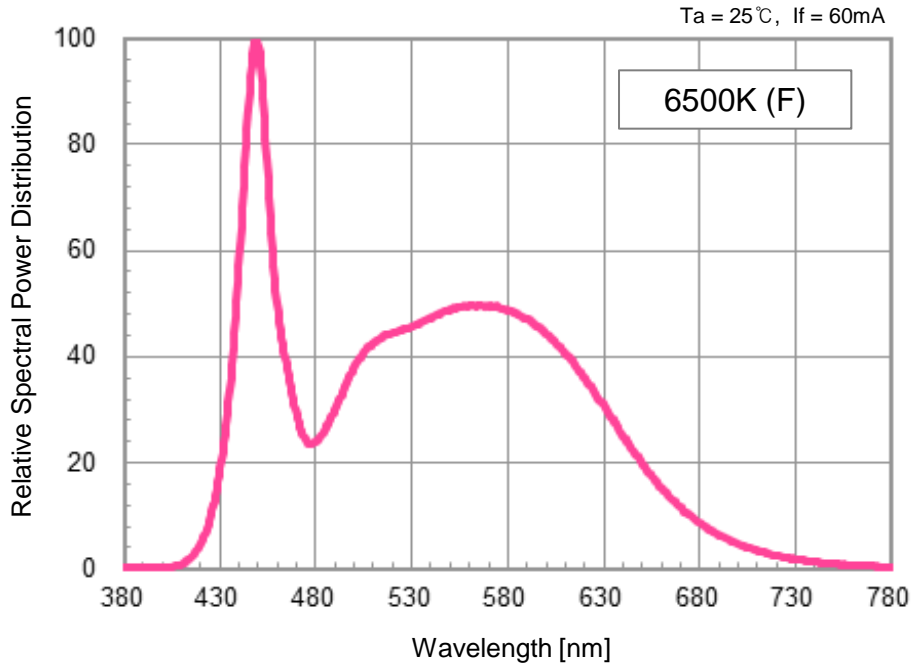
- Relative Luminous Flux vs. Forward Current



※ 5000K CCT data also applies to 5700K and 6500K CCTs and 3000K data also applies to 2700K, 3500K and 4000K CCTs.

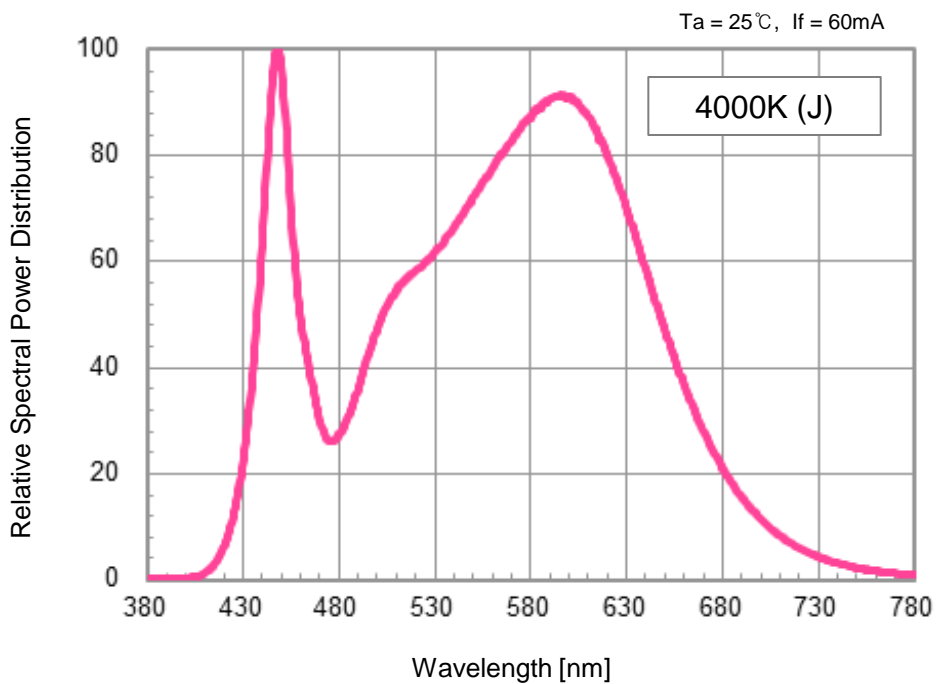
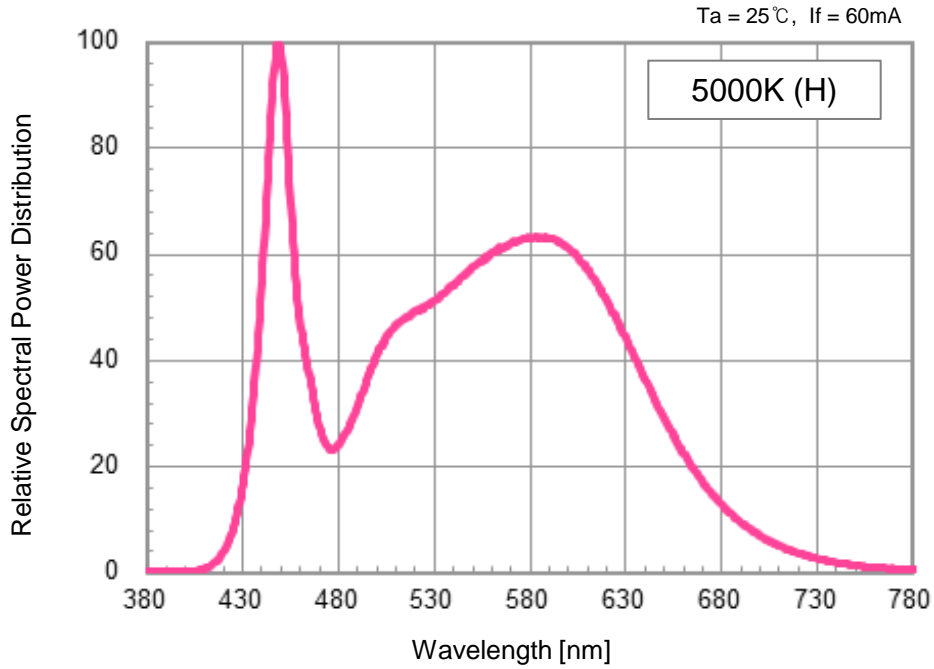
## 8. Typical Characteristic Curves

- Spectrum



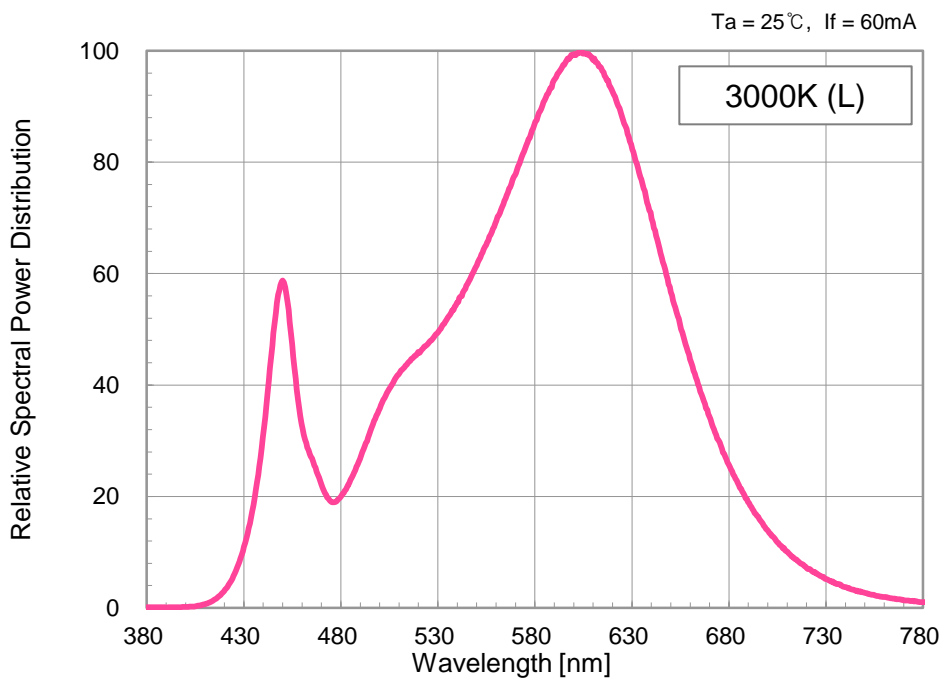
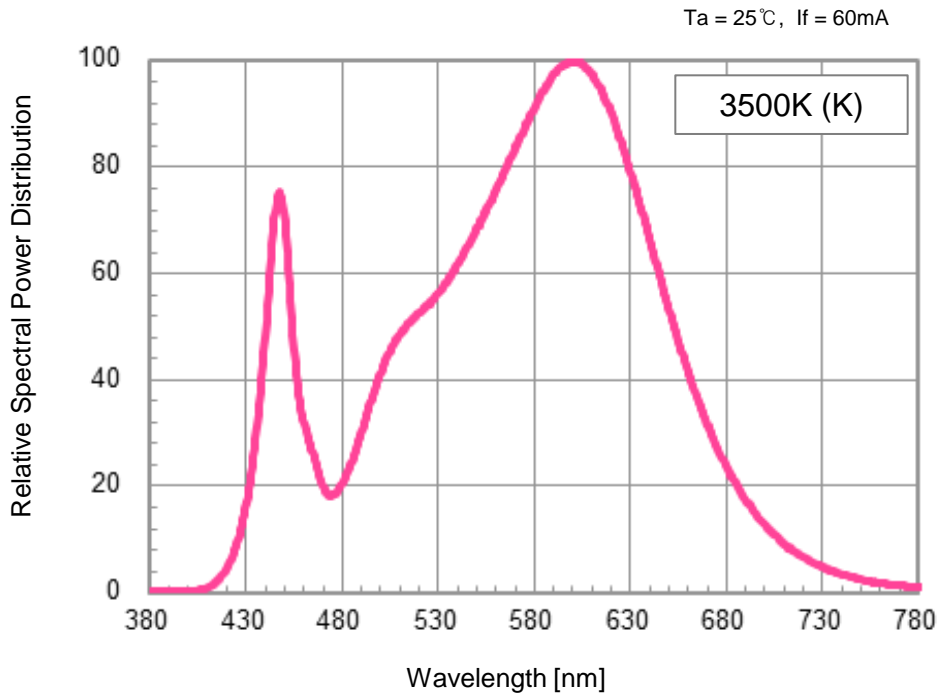
## 8. Typical Characteristic Curves

- Spectrum



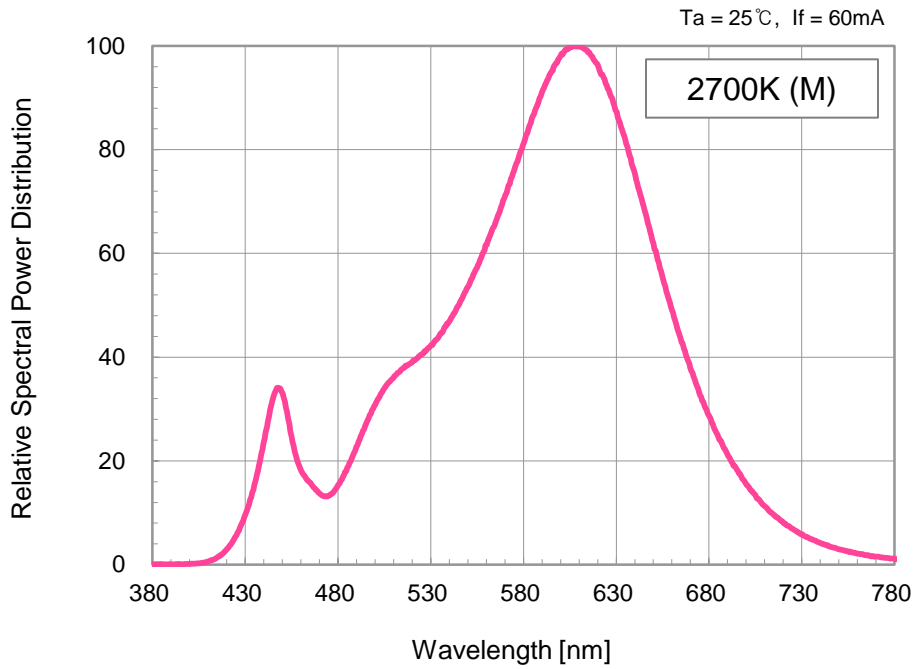
## 8. Typical Characteristic Curves

- Spectrum



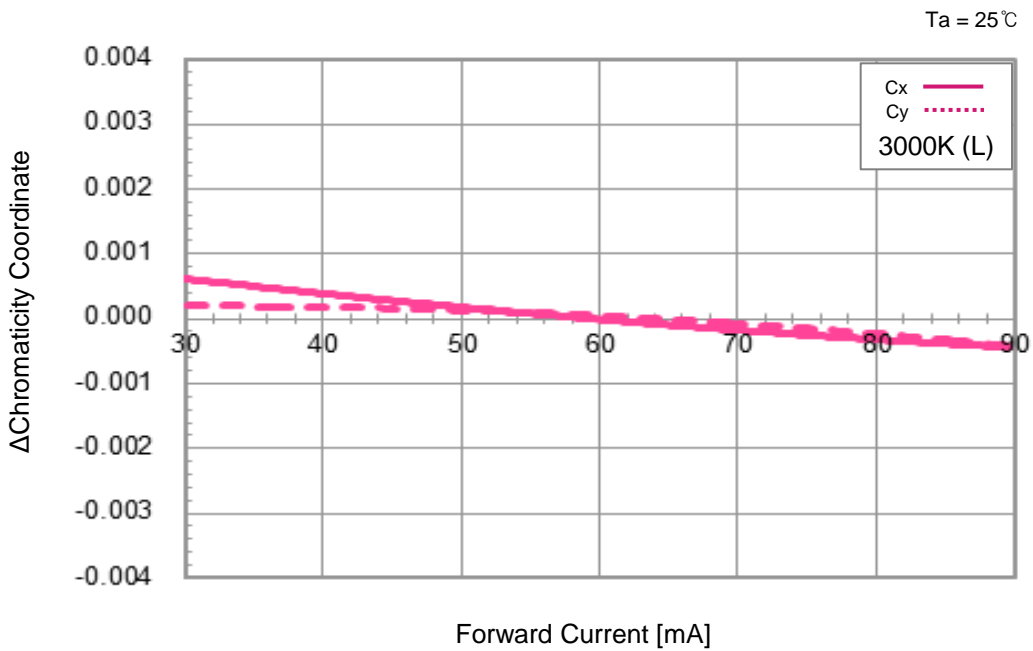
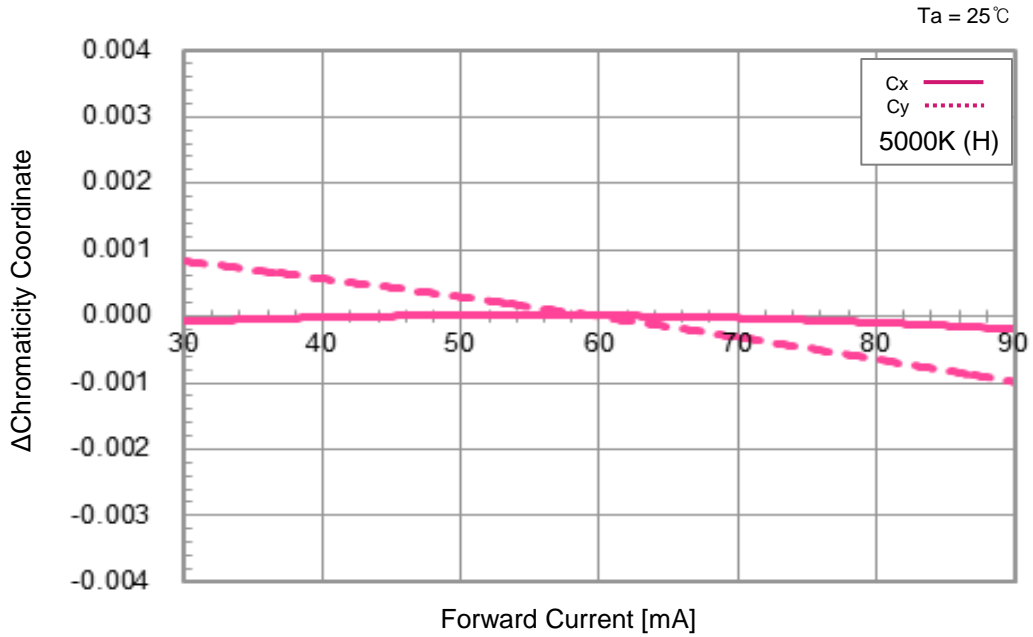
## 8. Typical Characteristic Curves

- Spectrum



## 8. Typical Characteristic Curves

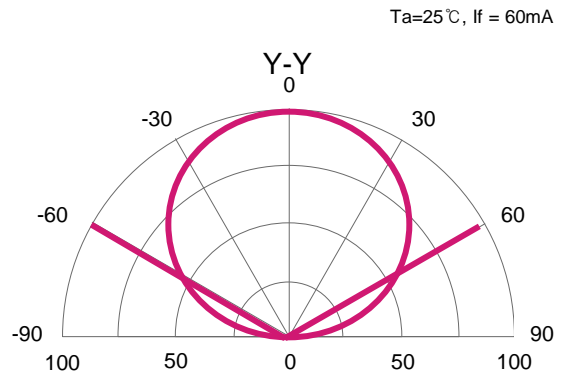
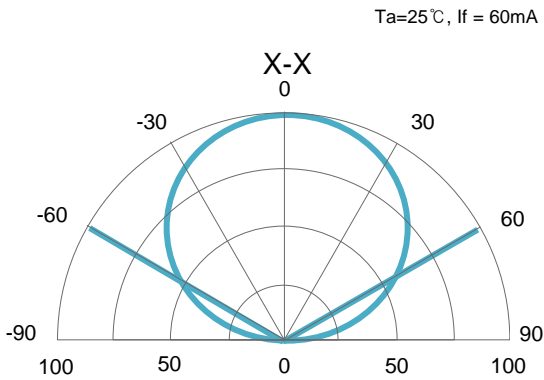
### Chromaticity Coordinate vs. Forward Current



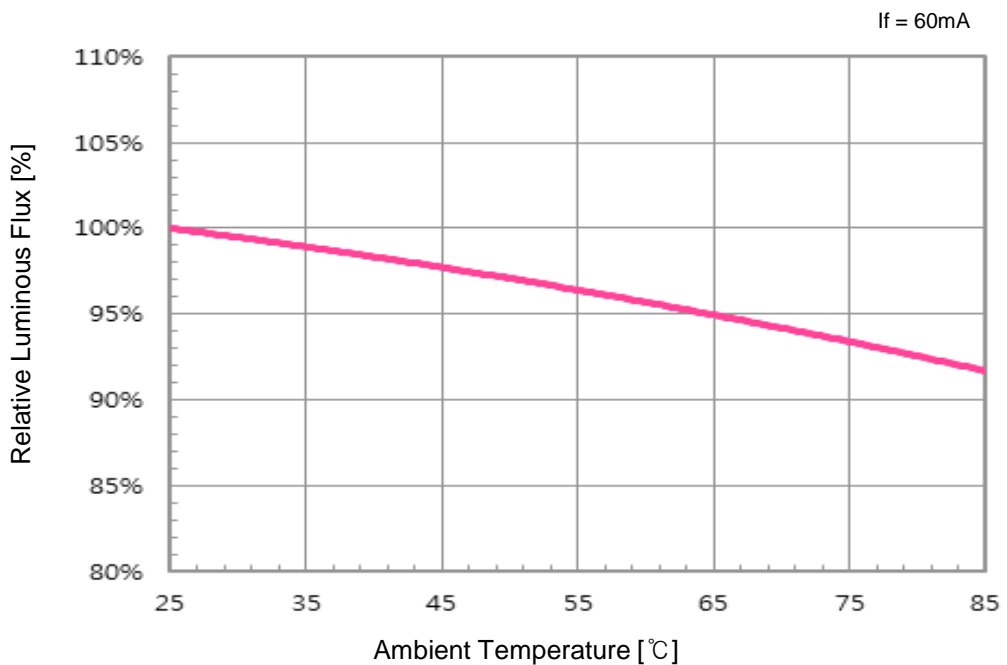
※ 5000K CCT data also applies to 5700K and 6500K CCTs and 3000K data also applies to 2700K, 3500K and 4000K CCTs.

## 8. Typical Characteristic Curves

- Radiation Characteristics

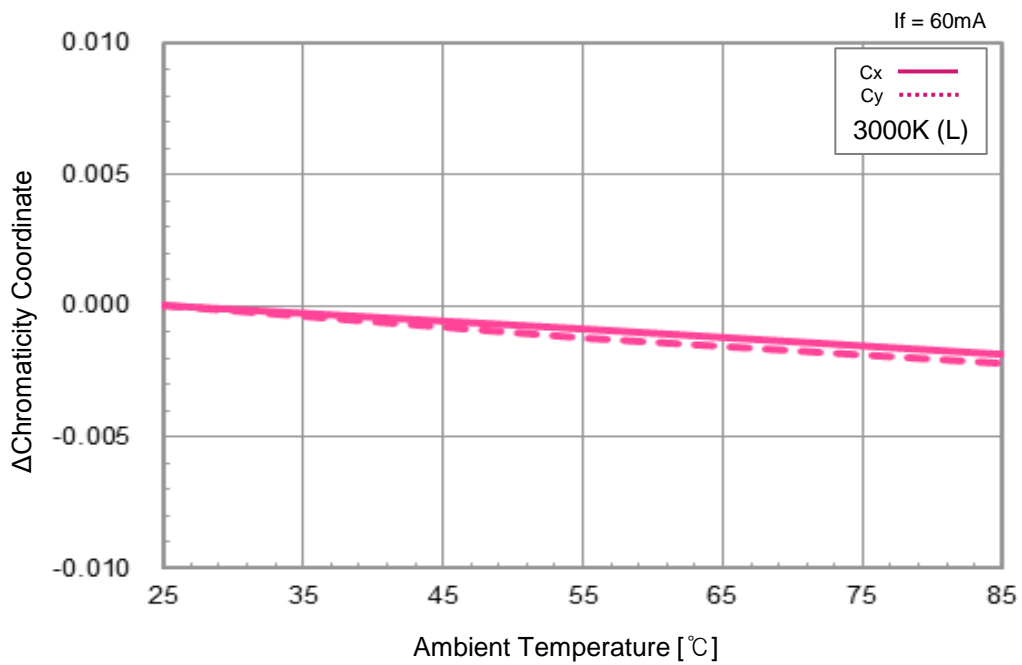
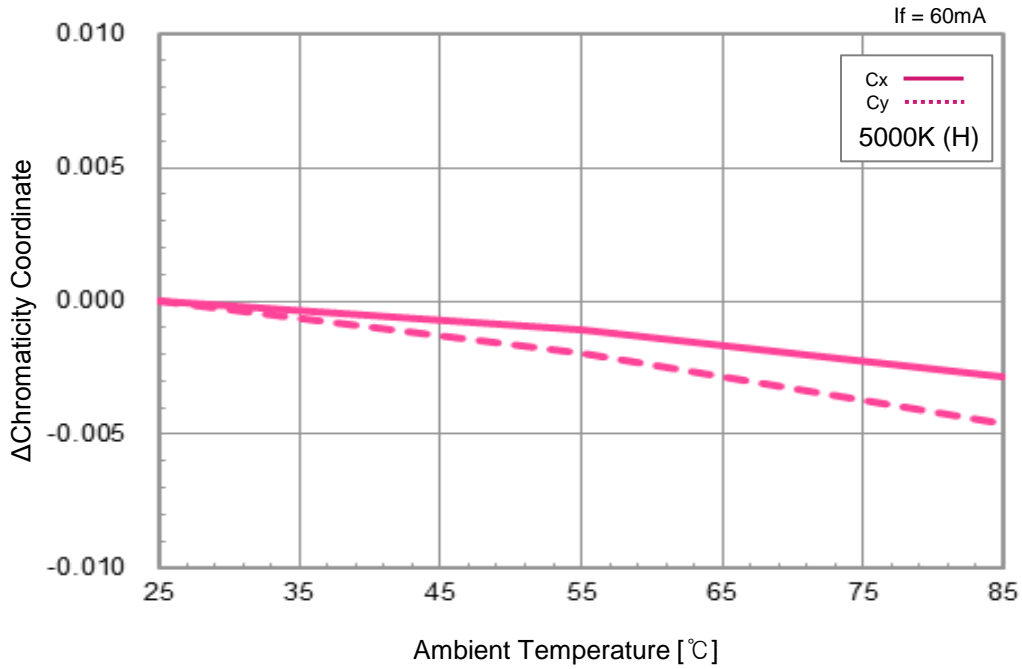


- Luminous Flux vs. Temperature



## 8. Typical Characteristic Curves

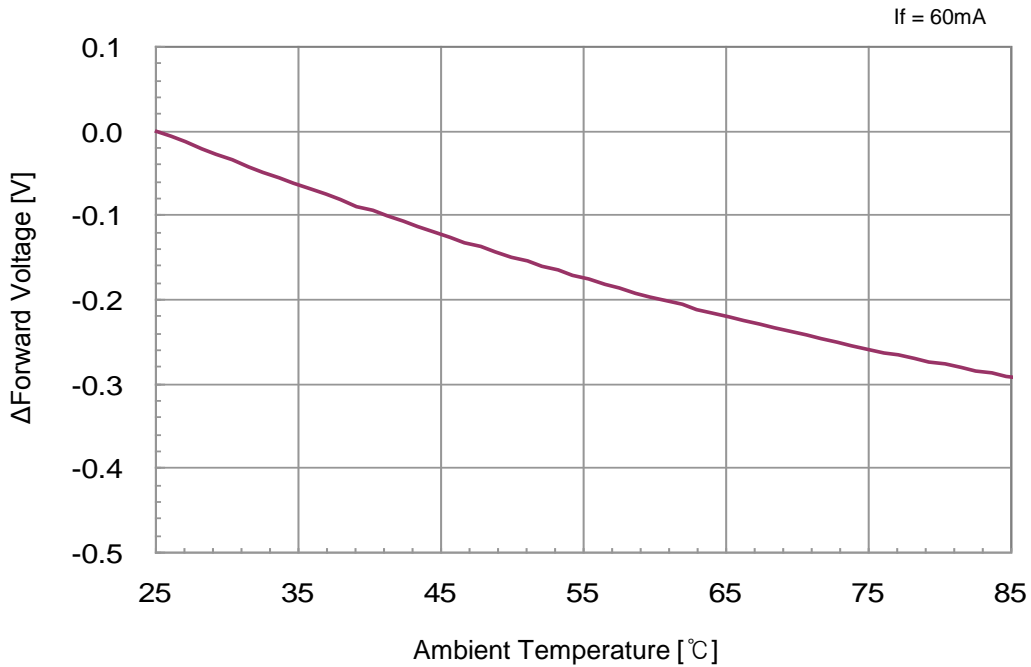
### ▪ Chromaticity Coordinate vs. Temperature



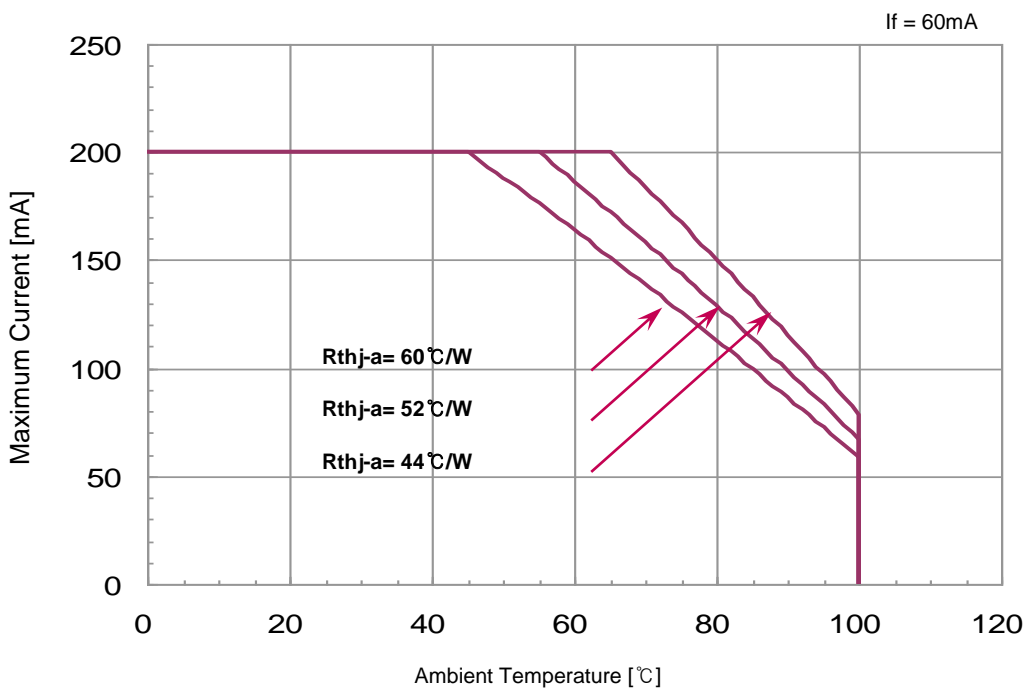
※ 5000K CCT data also applies to 5700K and 6500K CCTs and 3000K data also applies to 2700K, 3500K and 4000K CCTs.

## 8. Typical Characteristic Curves

### ▪ Forward Voltage vs. Temperature



### ▪ Derating Curve



※ The ambient temperature values for each graph are obtained with LG Innotek equipment.

## 9. Reliability Test Items and Conditions

### 9-1. Failure Criteria

Items	Symbols	Test Conditions	Criteria	
			Min.	Max.
Forward Voltage	V <sub>f</sub>	I <sub>f</sub> = 90mA	-	Initial Value × 1.1
Luminous Flux	Φ <sub>v</sub>	I <sub>f</sub> = 90mA	Initial Value × 0.7	-

### 9-2. Reliability Tests

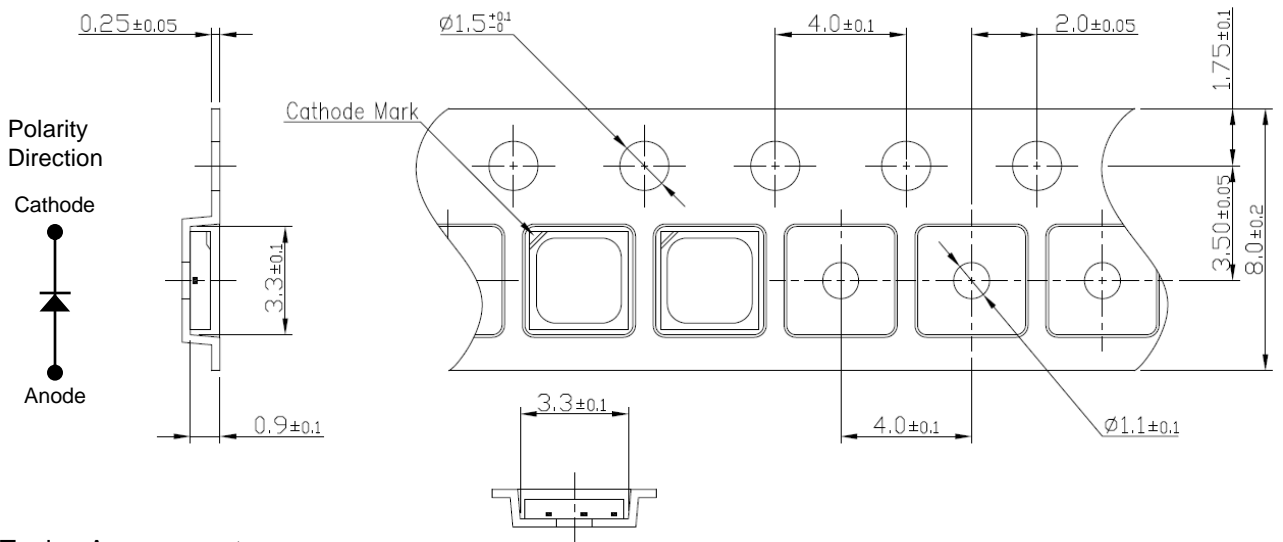
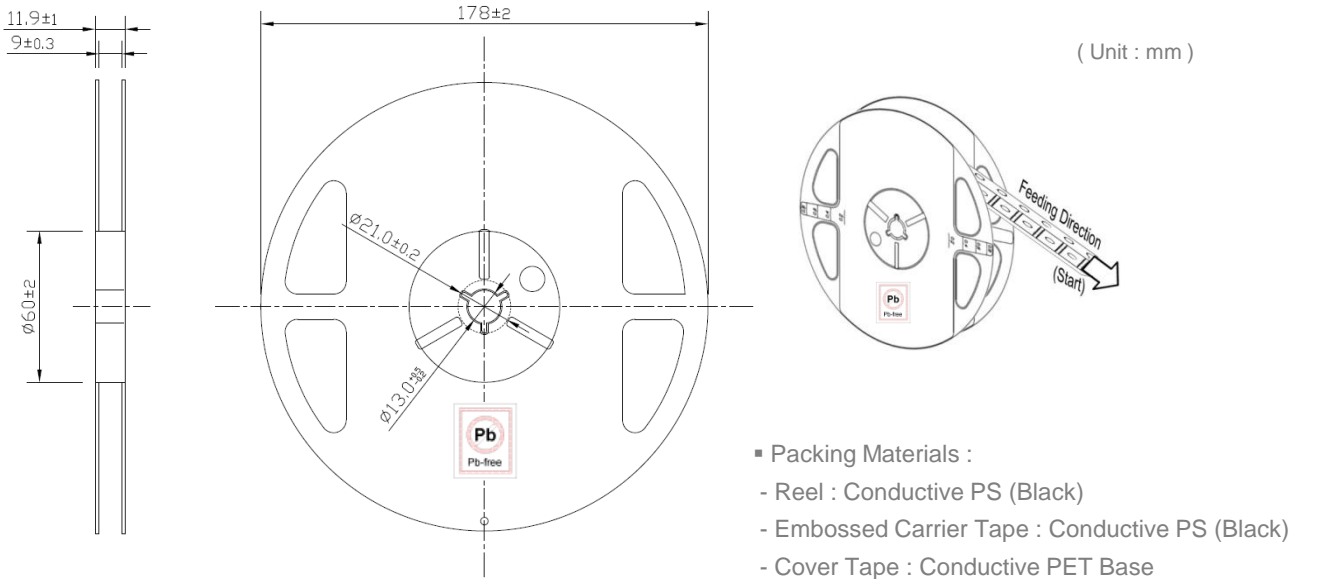
No	Items	Test Conditions	Test Hours /Cycles	Sample Size	Ac/Re
1	Room Temperature Operating Life (RTOL)	T <sub>a</sub> = 25 °C, I <sub>f</sub> = 90mA	1,000 Hours	20 pcs	0/1
2	Wet High Temperature Operating Life (WHTOL)	T <sub>a</sub> = 60 °C, RH = 90% I <sub>f</sub> = 90mA	1,000 Hours	20 pcs	0/1
3	High Temperature Operating Life (HTOL)	T <sub>a</sub> = 85 °C, I <sub>f</sub> = 90mA	1,000 Hours	20 pcs	0/1
4	Low Temperature Operating Life (LTOL)	T <sub>a</sub> = -40 °C, I <sub>f</sub> = 90mA	1,000 Hours	20 pcs	0/1
5	High Temperature Storage Life (HTSL)	T <sub>a</sub> = 100 °C	1,000 Hours	20 pcs	0/1
6	Low Temperature Storage Life (LTSL)	T <sub>a</sub> = -40 °C	1,000 Hours	20 pcs	0/1
7	Wet High Temperature Storage Life (WHTSL)	T <sub>a</sub> = 85 °C, RH = 85%	1,000 Hours	20 pcs	0/1
8	Temperature Cycle (TC)	-40 °C (30min) ~ 100 °C (30min)	100 Cycles	20 pcs	0/1
9	Moisture Sensitivity Level (MSL)	T <sub>sld</sub> = 260 °C (Pre treatment 60 °C, 60% 168 hours)	3 Times	20 pcs	0/1
10	Vibration	100~2000~100Hz Sweep 4min. 200m/s <sup>2</sup> , 3 directions	48 Minutes	20 pcs	0/1

\* All samples are tested using LG Innotek Standard Metal PCB (25x25x1.6 mm<sup>3</sup> (L×W×H)) except MSL test .

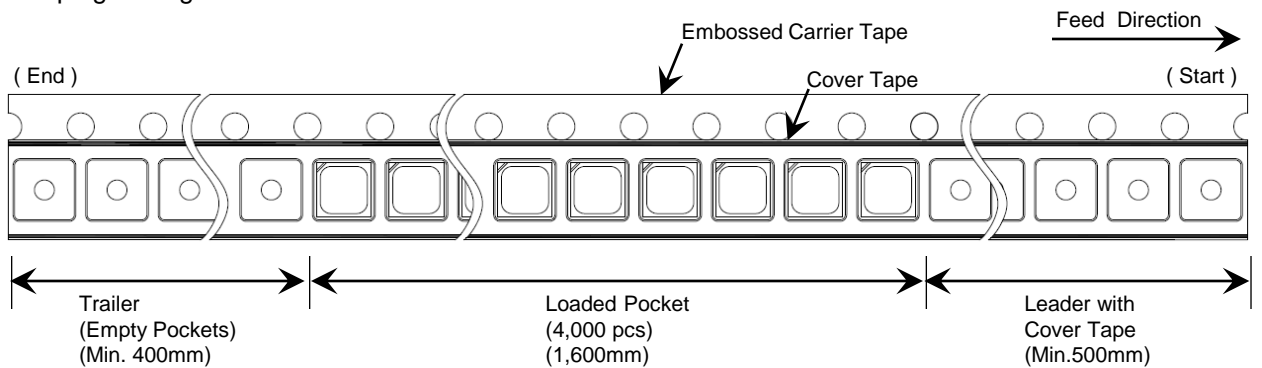
\* All samples must pass each test item and all test items must be satisfied.

# 10. Packing and Labeling of Product

## 10-1. Taping Outline Dimensions



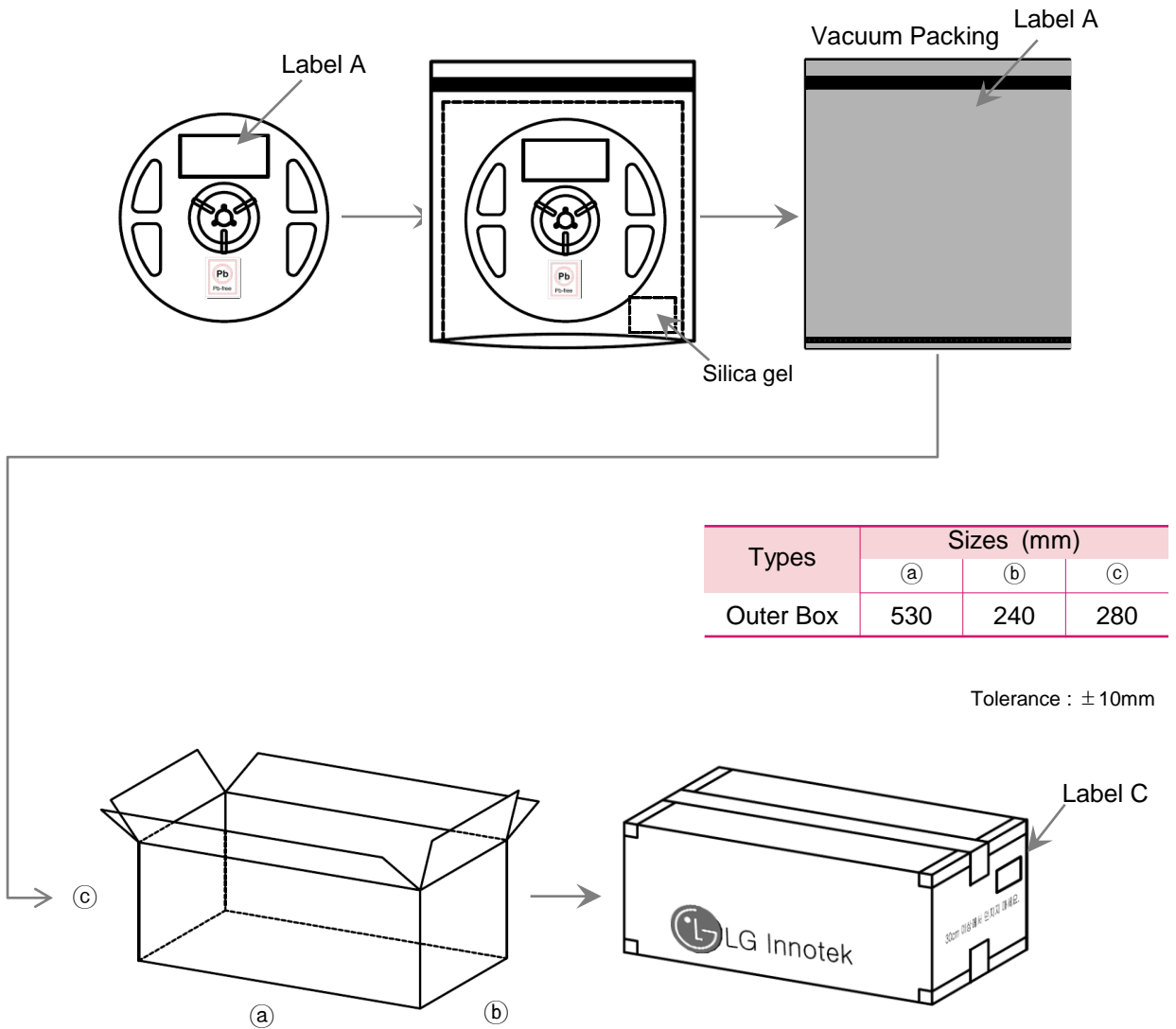
### Taping Arrangement



## 10. Packing and Labeling of Product

### 10-2. Packing Structures

Reeled products are packed in a sealed-off and moisture-proof aluminum bag with desiccants (silica gel). 24 Reels are packed in an outer box.

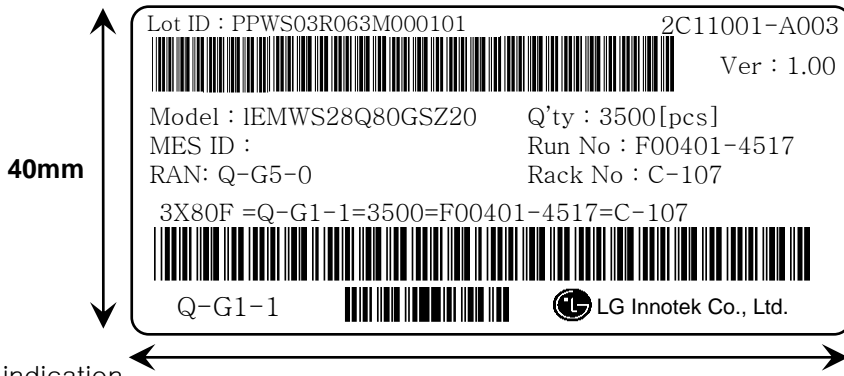


# 10. Packing and Labeling of Product

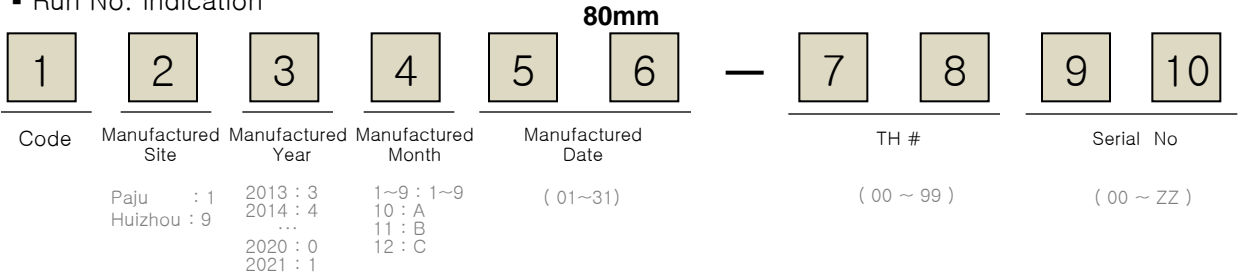
## 10-3. MES Label Structure

### ※ Label A

Specifying Lot ID, 'Model Name', 'MES ID', 'RANK', 'Q'ty', 'Run No.', 'Rack No.'

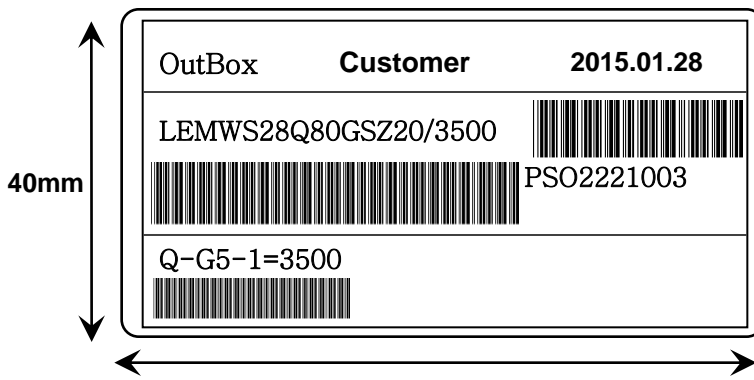


### ▪ Run No. indication

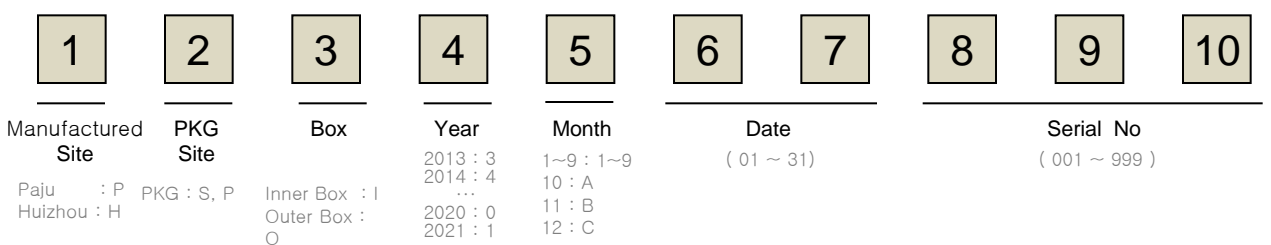


### ※ Label C

Specifying 'Customer', 'Date', 'Model Name', 'Quantity', 'Customer Part no.', 'Outbox ID', 'LGIT internal Model name'



### ▪ Box ID. indication

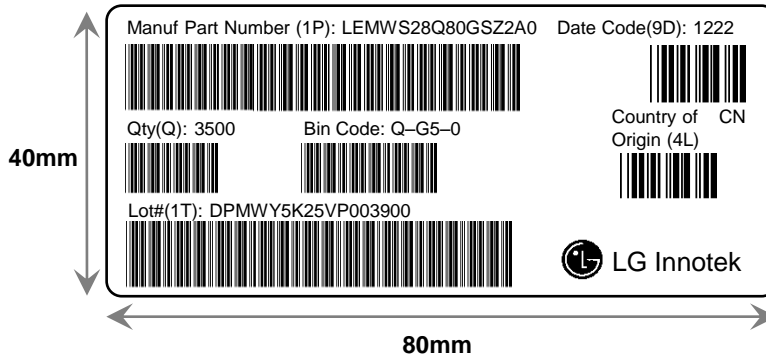


## 10. Packing and Labeling of Product

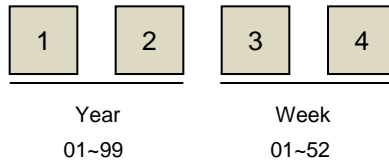
### 10-4. NEDA Label Structure

#### ※ Label A

Specifying 'Manufacturing Part Number', 'Quantity', 'Bin Code', 'Lot', 'Date Code' and 'Country of Origin'



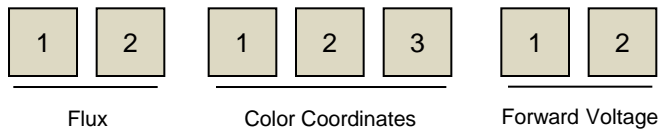
#### ▪ Date Code(9D)



#### ▪ Lot#(1T)

LG Innotek Trace Code

#### ▪ Bin Code

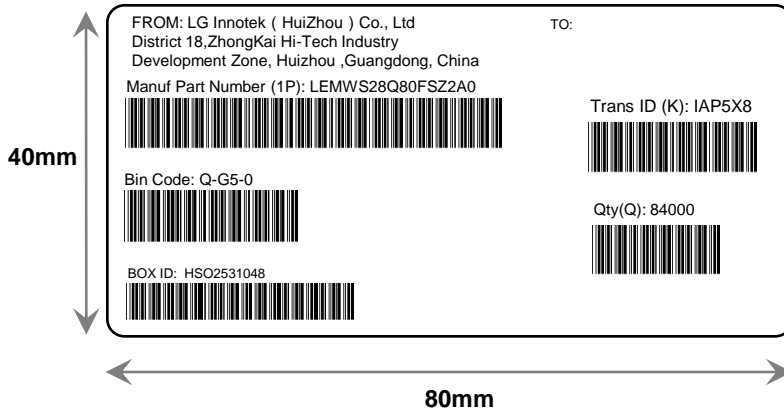


# 10. Packing and Labeling of Product

## 10-4. NEDA Label Structure

### ※ Label C

Specifying 'Manufacturing Site', 'Customer Address', 'Manufacturing Part Number', 'Bin Code', 'Box ID', 'Trans ID' and 'Quantity'



### ▪ Box ID indication

1	2	3	4	5	6	7	8	9	10
Site	Code	Outbox	Year	Month	Date			Serial No	
Paju: P Huizhou: H	S, P	Outbox: O Inbox: I	13 : 3 14 : 4 15 : 5	1~9 : 1~9 10 : A 11 : B 12 : C	( 01 ~ 31 )			( 001 ~ 999 )	

## 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°C ~ 30°C	< 50% RH	Within 1 Year from the Delivery Date
	After Opening Aluminum Bag	5°C ~ 30°C	< 60% RH	≤ 672 Hours
Baking		65 ± 5°C	< 10% RH	10 ~ 24 Hours

### 11-3. During Usage

- The LED should avoid the direct contact with hazardous materials such as sulfur, chlorine, phthalate, etc..
- The metal parts on the LED can rust when exposed to corrosive gases. Therefore, exposure to corrosive gases must be avoided during operation and storage.
- 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.
- 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 recommended solvent for cleaning the LEDs under the following conditions.  
Clearing Condition : IPA, 25°C max. × 60 sec max.
- Ultrasonic cleaning is not recommended.
- Pretests should be conducted with the actual cleaning process to validate that the process will not damage the LEDs.

## 11. Cautions on Use

### 11-5. Thermal Management

- The thermal design of the end product must be seriously considered, particularly at the beginning of the system design process.
- The generation of heat is greatly impacted by the input power, the thermal resistance of the circuit boards and the density of the LED array combined 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.
- Unusual characteristics such as significant increase of current leakage, decrease of turn-on voltage, or non-operation at a low current can occur when the LED is damaged.

### 11-7. Recommended Circuit

- The current through each LED must not exceed the absolute maximum rating when designing the circuits.
- In general, the LED forward voltages can vary. LEDs in parallel that have different forward voltages in combination with a single resistor can result in different forward currents to each LED, which can also 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 luminous flux fluctuations.

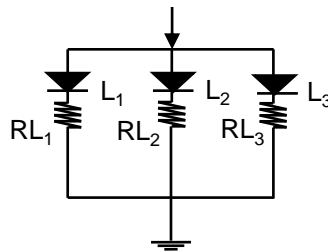


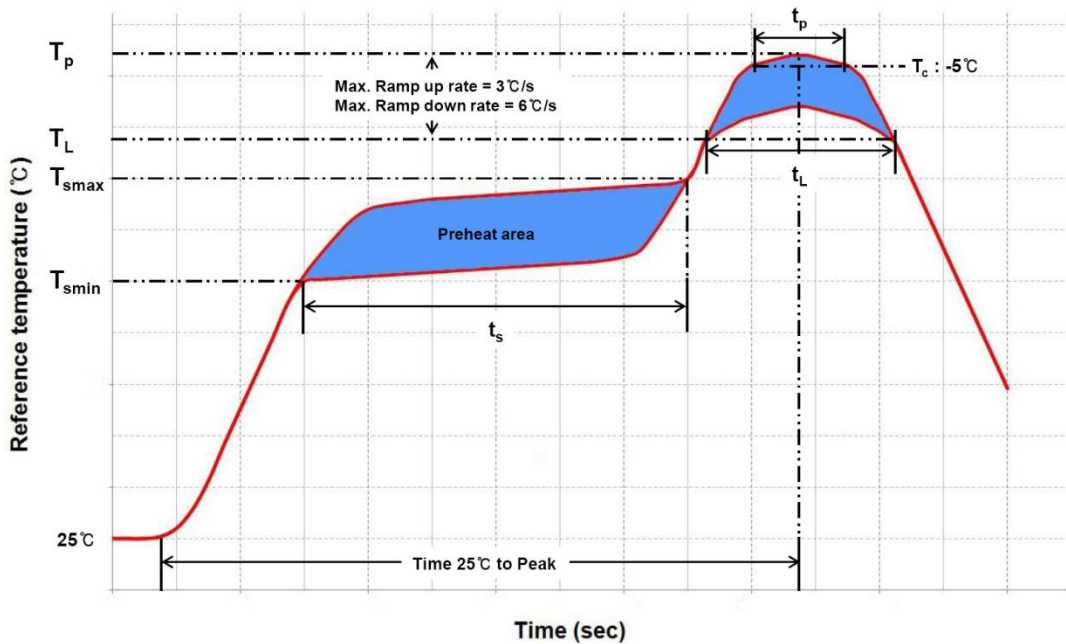
Fig.1 Recommended Circuit in Parallel Mode  
: Separate resistors must be used for each LED.

- The driving circuits must be designed to operate the LEDs by forward bias only.
- Reverse voltages can damage the zener diode, which can cause the LED to fail.
- A constant current LED driver is recommended to power the LEDs.

## 11. Cautions on Use

### 11-8. Soldering Conditions

- Reflow soldering is the recommended method for assembling LEDs on a circuit board.
- LG Innotek does not guarantee the performance of the LEDs assembled by the dip soldering method.
- Recommended Soldering Profile (according to JEDEC J-STD-020D)



Profile Feature	Pb-Free Assembly	Pb-Based Assembly
Preheat/Soak		
Temperature Min( $T_{smin}$ )	150°C	100°C
Temperature Max( $T_{smax}$ )	200°C	150°C
Maximum time( $t_s$ ) from $T_{smin}$ to $T_{smax}$	60~120 seconds	60~120 seconds
Ramp-up rate ( $T_L$ to $T_p$ )	3°C/ second max.	3°C/ second max.
Liquidous temperature ( $T_L$ )	217°C	183°C
Time ( $t_L$ ) maintained above $T_L$	60~150 seconds	60~150 seconds
Maximum peak package body temperature ( $T_p$ )	260°C	235°C
Time( $t_p$ ) within 5°C of the specified temperature ( $T_c$ )	30 seconds	20 seconds
Ramp-down rate ( $T_p$ to $T_L$ )	6°C/second max.	6°C/second max.
Maximum Time 25°C to peak temperature	8 minutes max.	6 minutes 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 silicone encapsulant at the top of the LED package is a soft surface, which can easily be damaged by pressure. Precautions should be taken to avoid strong pressure on the silicone resin when leveraging the pick and place machines.
- Reflow soldering should not be done more than two times.

## 11. Cautions on Use

### 11-9. Soldering Iron

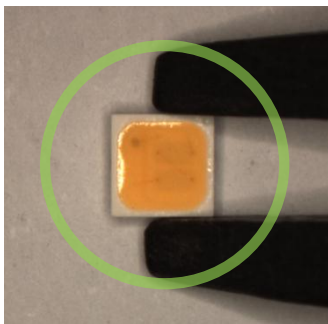
- The recommended condition is less than 5 seconds at 260 °C.
- The time must be shorter for higher temperatures. (+10 °C → -1sec).
- The power dissipation of the soldering iron should be lower than 15W and the surface temperature of the device should be controlled at or under 230 °C.

### 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 Teflon-type tweezers to grab the base of LED and do not apply mechanical pressure on the surface of the encapsulant.



## Appendix. Nomenclature of Package

All LEDs are tested and sorted by color, luminous flux and forward voltage where every LED in a tube has only a single color bin, luminous flux bin and forward voltage bin. However, the forward voltage bin information is not captured in the part number nomenclature.

A 16-digit part number is required when orders are placed. LG Innotek leverages the following part number nomenclature.

