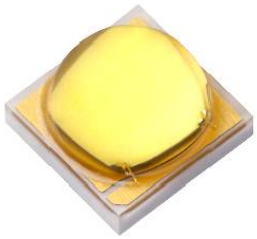
CUSTOMER : .

DATE : 2016. 7.29 .

REV : Rev 1.1 .

PRODUCT FAMILY DATA SHEET



High Power LED series

3535 Ceramic

MODEL NAME : LEMW**A332** *** *****

RoHS Compliant

Halogen Free

APPROVAL	REMARK	APPENDIX

DESIGNED	CHECKED	APPROVED

LG Innotek

TABLE OF CONTENTS

1. Features

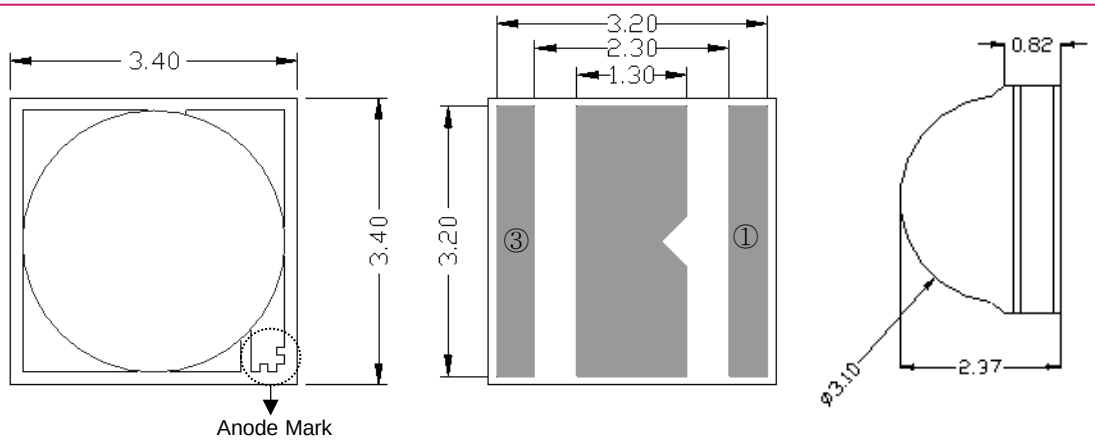
- Lighting Color : White
- Ceramic Type LED Package : 3.40 x 3.40 x 2.37 (L x W x H) [Unit : mm]
- Viewing Angle : 120˚
- Chip Material : InGaN
- Soldering Methods : Reflow soldering
- ESD Withstand Voltage : Up to 8kV According to JS-001

2. Applications

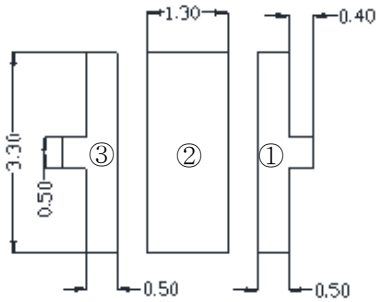
- Interior and Exterior Illumination

3. Outline Dimensions

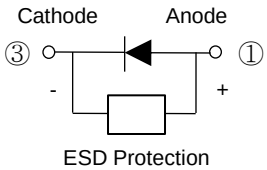
(Unit : mm)



Recommendable Soldering Pattern
(for Reflow Soldering)



Internal Circuit



Pad Configuration

① Anode Pad
② Thermal Pad
③ Cathode Pad

Tolerances unless otherwise mentioned are ± 0.13 mm

4. Absolute Maximum Ratings

(Ta=25℃)

Item	Symbol	Rating	Unit
Forward Current	If	1800	mA
Operating Temperature	Topr	-40 ~ +85	℃
Storage Temperature	Tstg	-40 ~ +100	℃
Junction Temperature	Tj	150	℃
Soldering Temperature	JEDEC-J-STD-020		
ESD Classification	Class 3B (JS-001)		

※ 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

(Tj=85℃, 700mA)

Item	Symbol	White Color	Min.	Typ.	Max.	Unit
Luminous Flux	Φv	Cool	-	265	-	lm
		Neutral	-	250	-	lm
		Warm	-	220	-	lm
Forward Voltage	Vf	All	2.60	2.86	3.10	V
Color Coordinate	Cx / Cy	-	Refer to 'Chromaticity Bins'			-
Viewing Angle	2Θ1/2	All	-	120	-	deg
Color Rendering Index (CRI)	Ra	Cool	70/ 80	-	-	-
		Neutral	70	-	-	-
		Warm	80	-	-	-
Thermal Resistance, Junction to Solder Point	Rth j-s	All	-	4	-	°C/W
Typical Temperature Coefficient of Forward Voltage*1)	ΔVf / ΔTj	All	-1.0	-	-4.0	mV/°C

*1) Measured at Ta between 25℃ and 150℃.

※ 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, 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 (Continued)

(Tj=85℃)

CCT	CRI	If (mA)	Vf (V)	Power (W)	Φv (lm)	lm/W
4500~6500K (Cool White)	70	350	2.74	0.96	167	174
		700	2.86	2.00	308	154
		1000	2.93	2.93	417	142
		1500	3.06	4.59	581	127
		1800	3.13	5.63	696	124
	80	350	2.74	0.96	153	159
		700	2.86	2.00	281	141
		1000	2.93	2.93	380	130
		1500	3.06	4.59	529	115
		1800	3.13	5.63	635	113
4000K (J)	70	350	2.74	0.96	159	166
		700	2.86	2.00	293	147
		1000	2.93	2.93	396	135
		1500	3.06	4.59	552	120
		1800	3.13	5.63	661	117
3000K (L)	70	350	2.74	0.96	153	159
		700	2.86	2.00	282	141
		1000	2.93	2.93	382	130
		1500	3.06	4.59	531	116
		1800	3.13	5.63	637	113
	80	350	2.74	0.96	144	150
		700	2.86	2.00	263	132
		1000	2.93	2.93	362	124
		1500	3.06	4.59	487	106
		1800	3.13	5.63	579	103

※ All the values in this table are for representative references only.

5. Electro - Optical Characteristics (Continued)

(Tj=25℃)

CCT	CRI	If (mA)	Vf (V)	Power (W)	Φv (lm)	lm/W
4500~6500K (Cool White)	70	350	2.84	0.99	180	181
		700	2.97	2.08	332	160
		1000	3.05	3.05	448	147
		1500	3.18	4.77	624	130
		1800	3.25	5.85	749	127
	80	350	2.84	0.99	166	166
		700	2.97	2.08	302	145
		1000	3.05	3.05	409	134
		1500	3.18	4.77	569	119
		1800	3.25	5.85	683	117
4000K (J)	70	350	2.84	0.99	171	172
		700	2.97	2.08	315	152
		1000	3.05	3.05	426	140
		1500	3.18	4.77	593	124
		1800	3.25	5.85	711	122
3000K (L)	70	350	2.84	0.99	163	165
		700	2.97	2.08	300	144
		1000	3.05	3.05	406	133
		1500	3.18	4.77	565	118
		1800	3.25	5.85	678	116
	80	350	2.84	0.99	155	157
		700	2.97	2.08	282	136
		1000	3.05	3.05	388	127
		1500	3.18	4.77	522	109
		1800	3.25	5.85	621	106

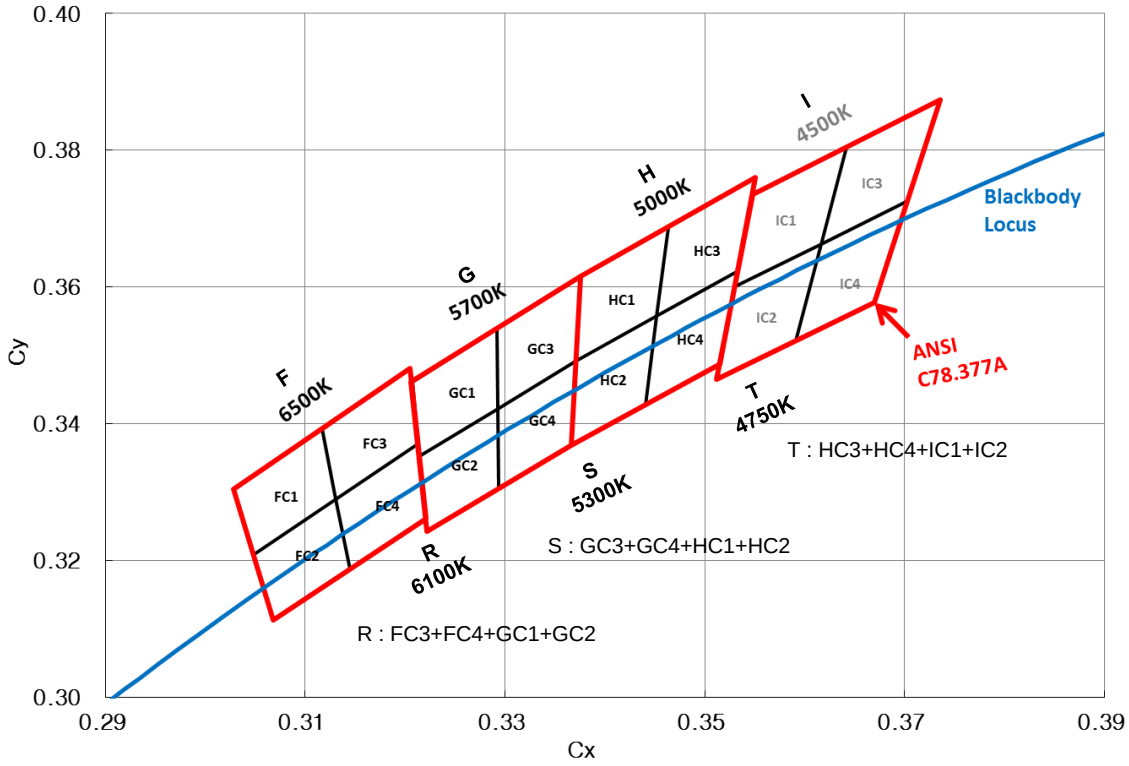
※ All the values in this table are for representative references only.

6. Flux Characteristics and Order Code

Color	CCT (K)	CRI (85℃)	Vf	Luminous Flus [lm]							Order Code
			700mA 85℃	**Bin Code**	350mA 25℃	700mA 25℃	1000mA 25℃	350mA 85℃	**700mA 85℃**	1000mA 85℃	
	Typ	Min	Typ		Min	Min	Min	Min	**Min**	Min	
Cool	5000K	70<	**2.86 V**	**18**	154	284	384	144	**265**	359	LEMWA33270H*****
				19	163	300	406	152	**280**	379	
				20	171	316	428	160	**295**	399	
				21	180	332	449	168	**310**	420	
	5000 K	80<		**16**	137	251	341	128	**235**	318	LEMWA33280H*****
				17	145	268	362	136	**250**	339	
				18	154	284	384	144	**265**	359	
				19	163	300	406	152	**280**	379	
Neutral	4000 K	70<		**17**	145	268	362	136	**250**	339	LEMWA33270J*****
				18	154	284	384	144	**265**	359	
				19	163	300	406	152	**280**	379	
				20	171	316	428	160	**295**	399	
				21	180	332	449	168	**310**	420	
Warm	3000 K	80<		**15**	128	235	319	119	**220**	298	LEMWA33280L*****
				16	137	251	341	128	**235**	318	
				17	145	268	362	136	**250**	339	
				18	154	284	384	144	**265**	359	

7. Chromaticity Bins

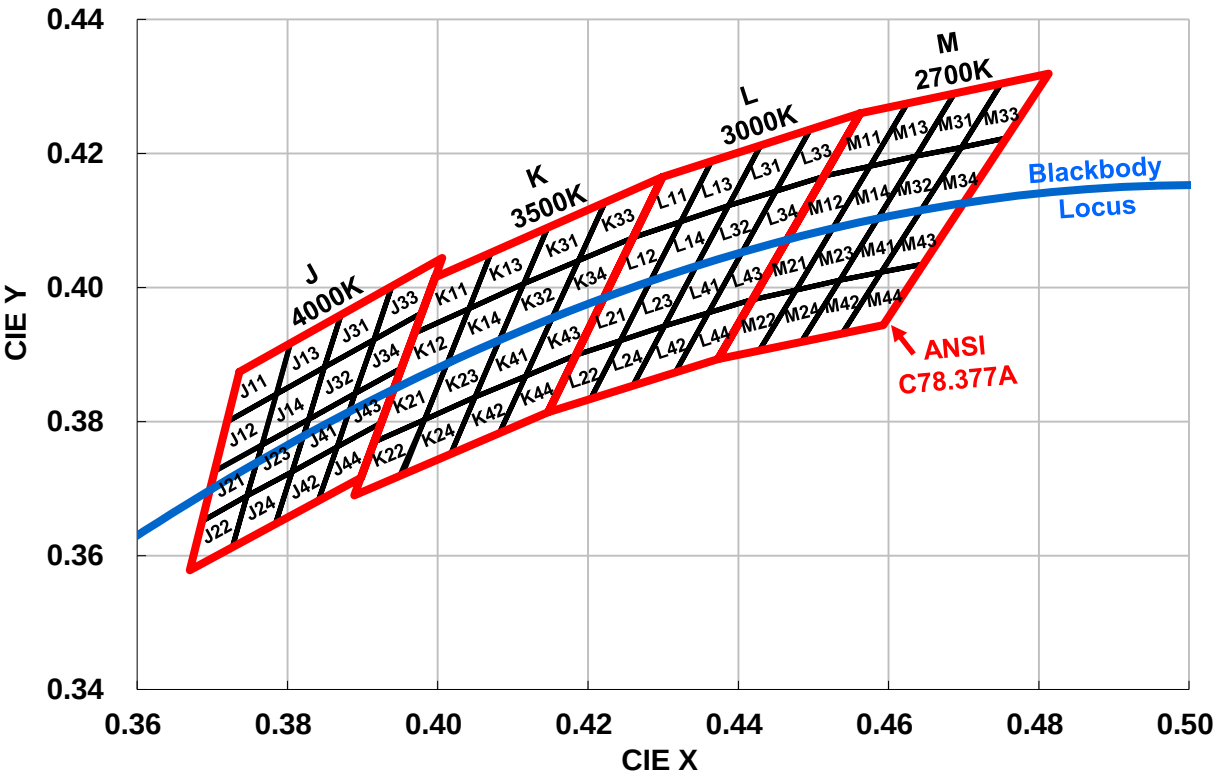
LG Innotek complies with the ANSI C78.377A standard for its chromaticity bin structure. For each ANSI quadrangle for the CCT range of 4500K to 6500K, LG Innotek provides 4 micro bins.



Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
FC1	0.3028	0.3304	GC1	0.3207	0.3462	HC1	0.3376	0.3616	IC1	0.3548	0.3736
	0.3117	0.3393		0.3292	0.3539		0.3464	0.3688		0.3642	0.3805
	0.3131	0.3290		0.3293	0.3423		0.3452	0.3558		0.3617	0.3663
	0.3048	0.3209		0.3215	0.3353		0.3371	0.3493		0.3530	0.3601
FC2	0.3048	0.3209	GC2	0.3215	0.3353	HC2	0.3371	0.3493	IC2	0.3530	0.3601
	0.3131	0.3290		0.3293	0.3423		0.3452	0.3558		0.3617	0.3663
	0.3145	0.3187		0.3294	0.3306		0.3441	0.3428		0.3591	0.3522
	0.3068	0.3113		0.3222	0.3243		0.3366	0.3369		0.3512	0.3465
FC3	0.3117	0.3393	GC3	0.3292	0.3539	HC3	0.3464	0.3688	IC3	0.3642	0.3805
	0.3205	0.3481		0.3376	0.3616		0.3551	0.3760		0.3736	0.3874
	0.3213	0.3371		0.3371	0.3493		0.3533	0.3624		0.3703	0.3726
	0.3131	0.3290		0.3293	0.3423		0.3452	0.3558		0.3617	0.3663
FC4	0.3131	0.3290	GC4	0.3293	0.3423	HC4	0.3452	0.3558	IC4	0.3617	0.3663
	0.3213	0.3371		0.3371	0.3493		0.3533	0.3624		0.3703	0.3726
	0.3221	0.3261		0.3366	0.3369		0.3515	0.3487		0.3670	0.3578
	0.3145	0.3187		0.3294	0.3306		0.3441	0.3428		0.3591	0.3522

7. Chromaticity Bins (Continued)

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 3500K and the CCT 4000K, LG Innotek provides 16 micro bins.



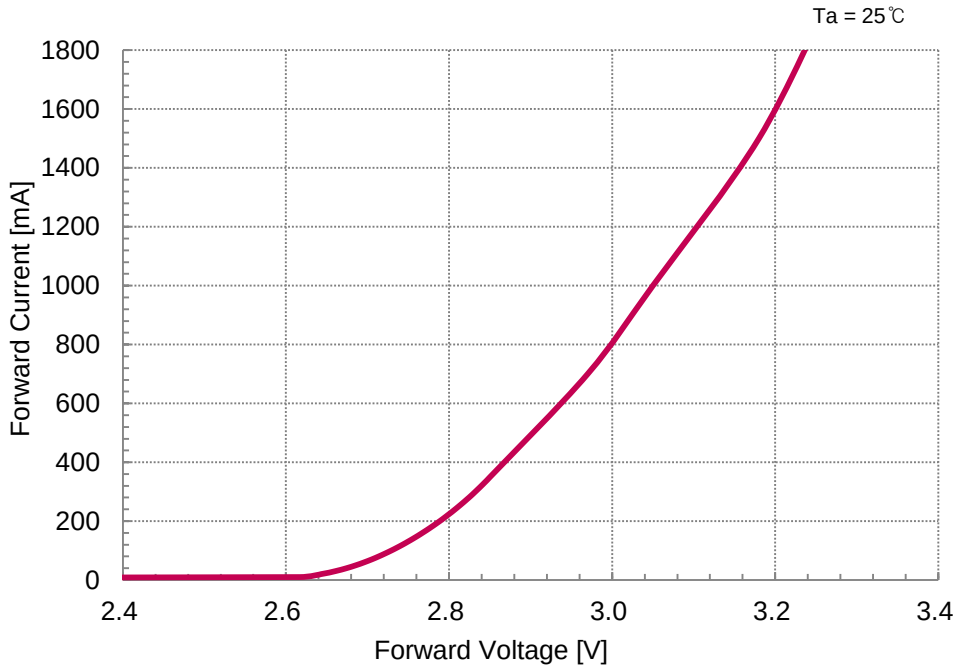
Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
	0.3736	0.3874		0.3996	0.4015		0.4299	0.4165		0.4562	0.4260
	0.3804	0.3917		0.4071	0.4052		0.4364	0.4189		0.4625	0.4275
J11	0.3785	0.3841	K11	0.4041	0.3969	L11	0.4323	0.4098	M11	0.4575	0.4181
	0.3720	0.3800		0.3969	0.3932		0.4260	0.4075		0.4513	0.4166
	0.3720	0.3800		0.3969	0.3932		0.4260	0.4075		0.4513	0.4166
	0.3785	0.3841		0.4041	0.3969		0.4323	0.4098		0.4575	0.4181
J12	0.3766	0.3765	K12	0.4012	0.3885	L12	0.4282	0.4008	M12	0.4525	0.4087
	0.3703	0.3726		0.3941	0.3848		0.4221	0.3984		0.4465	0.4071
	0.3804	0.3917		0.4071	0.4052		0.4364	0.4189		0.4625	0.4275
	0.3871	0.3959		0.4146	0.4089		0.4430	0.4212		0.4687	0.4289
J13	0.3849	0.3881	K13	0.4114	0.4005	L13	0.4387	0.4122	M13	0.4637	0.4196
	0.3785	0.3841		0.4041	0.3969		0.4323	0.4098		0.4575	0.4181
	0.3785	0.3841		0.4041	0.3969		0.4323	0.4098		0.4575	0.4181
	0.3849	0.3881		0.4114	0.4005		0.4387	0.4122		0.4637	0.4196
J14	0.3828	0.3803	K14	0.4082	0.3922	L14	0.4344	0.4032	M14	0.4586	0.4103
	0.3766	0.3765		0.4012	0.3885		0.4282	0.4008		0.4525	0.4087

7. Chromaticity Bins (Continued)

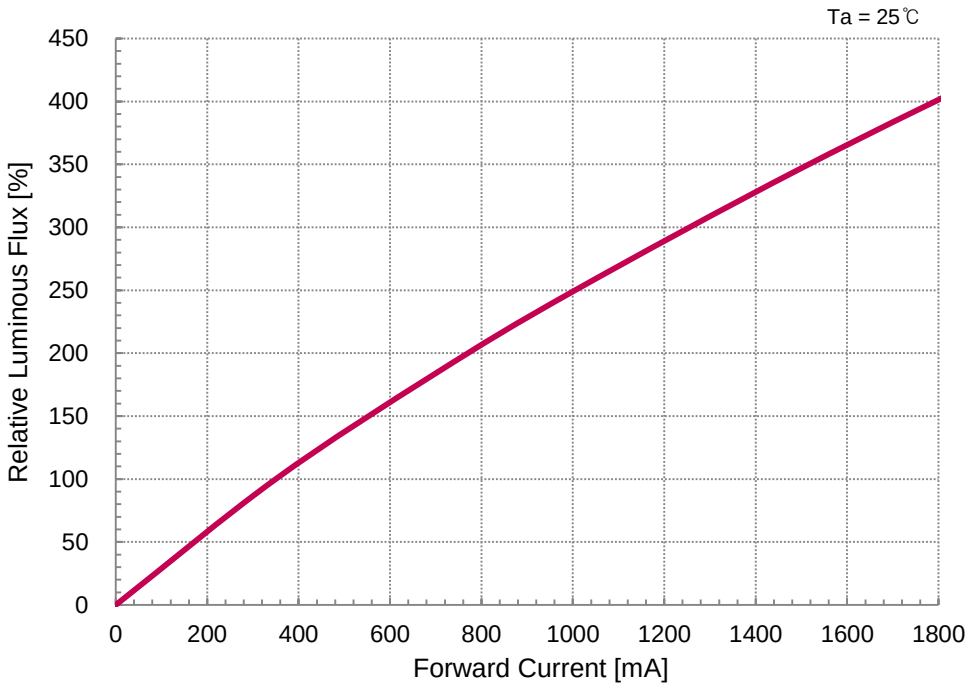
Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y	Bin	CIE X	CIE Y
J21	0.3703	0.3726	K21	0.3941	0.3848	L21	0.4221	0.3984	M21	0.4465	0.4071
	0.3766	0.3765		0.4012	0.3885		0.4282	0.4008		0.4525	0.4087
	0.3746	0.3689		0.3982	0.3803		0.4243	0.3921		0.4477	0.3996
	0.3687	0.3652		0.3915	0.3769		0.4184	0.3899		0.4419	0.3982
J22	0.3687	0.3652	K22	0.3915	0.3769	L22	0.4184	0.3899	M22	0.4419	0.3982
	0.3746	0.3689		0.3982	0.3803		0.4243	0.3921		0.4477	0.3996
	0.3727	0.3613		0.3950	0.3721		0.4203	0.3834		0.4428	0.3906
	0.3670	0.3578		0.3889	0.3690		0.4147	0.3814		0.4373	0.3893
J23	0.3766	0.3765	K23	0.4012	0.3885	L23	0.4282	0.4008	M23	0.4525	0.4087
	0.3828	0.3803		0.4082	0.3922		0.4344	0.4032		0.4586	0.4103
	0.3806	0.3725		0.4050	0.3837		0.4302	0.3943		0.4535	0.4011
	0.3746	0.3689		0.3982	0.3803		0.4243	0.3921		0.4477	0.3996
J24	0.3746	0.3689	K24	0.3982	0.3803	L24	0.4243	0.3921	M24	0.4477	0.3996
	0.3806	0.3725		0.4050	0.3837		0.4302	0.3943		0.4535	0.4011
	0.3784	0.3647		0.4017	0.3752		0.4260	0.3853		0.4483	0.3918
	0.3727	0.3613		0.3953	0.3721		0.4203	0.3834		0.4428	0.3906
J31	0.3871	0.3959	K31	0.4146	0.4089	L31	0.4430	0.4212	M31	0.4687	0.4289
	0.3939	0.4002		0.4223	0.4127		0.4496	0.4236		0.4750	0.4304
	0.3915	0.3922		0.4187	0.4040		0.4450	0.4144		0.4697	0.4209
	0.3849	0.3881		0.4114	0.4005		0.4387	0.4122		0.4637	0.4196
J32	0.3849	0.3881	K32	0.4114	0.4005	L32	0.4387	0.4122	M32	0.4637	0.4196
	0.3915	0.3922		0.4187	0.4040		0.4450	0.4144		0.4697	0.4209
	0.3890	0.3842		0.4151	0.3953		0.4404	0.4052		0.4643	0.4115
	0.3828	0.3803		0.4082	0.3922		0.4344	0.4032		0.4586	0.4103
J33	0.3939	0.4002	K33	0.4223	0.4127	L33	0.4496	0.4236	M33	0.4750	0.4304
	0.4006	0.4044		0.4299	0.4165		0.4562	0.4260		0.4813	0.4319
	0.3979	0.3962		0.4260	0.4075		0.4513	0.4166		0.4756	0.4223
	0.3915	0.3922		0.4187	0.4040		0.4450	0.4144		0.4697	0.4209
J34	0.3915	0.3922	K34	0.4187	0.4040	L34	0.4450	0.4144	M34	0.4697	0.4209
	0.3979	0.3962		0.4260	0.4075		0.4513	0.4166		0.4756	0.4223
	0.3952	0.3880		0.4221	0.3984		0.4465	0.4071		0.4700	0.4126
	0.3890	0.3842		0.4151	0.3953		0.4404	0.4052		0.4643	0.4115
J41	0.3828	0.3803	K41	0.4082	0.3922	L41	0.4344	0.4032	M41	0.4586	0.4103
	0.3890	0.3842		0.4151	0.3953		0.4404	0.4052		0.4643	0.4115
	0.3866	0.3762		0.4117	0.3868		0.4360	0.3962		0.4590	0.4023
	0.3806	0.3725		0.4050	0.3837		0.4302	0.3943		0.4535	0.4011
J42	0.3806	0.3725	K42	0.4050	0.3837	L42	0.4302	0.3943	M42	0.4535	0.4011
	0.3866	0.3762		0.4117	0.3868		0.4360	0.3962		0.4590	0.4023
	0.3841	0.3682		0.4082	0.3783		0.4316	0.3873		0.4538	0.3931
	0.3784	0.3647		0.4017	0.3752		0.4260	0.3853		0.4483	0.3918
J43	0.3890	0.3842	K43	0.4151	0.3953	L43	0.4404	0.4052	M43	0.4643	0.4115
	0.3952	0.3880		0.4221	0.3984		0.4465	0.4071		0.4700	0.4126
	0.3925	0.3798		0.4184	0.3899		0.4419	0.3982		0.4646	0.4035
	0.3866	0.3762		0.4117	0.3868		0.4360	0.3962		0.4590	0.4023
J44	0.3866	0.3762	K44	0.4117	0.3868	L44	0.4360	0.3962	M44	0.4590	0.4023
	0.3925	0.3798		0.4184	0.3899		0.4419	0.3982		0.4646	0.4035
	0.3898	0.3716		0.4147	0.3814		0.4373	0.3893		0.4593	0.3944
	0.3841	0.3682		0.4082	0.3783		0.4316	0.3873		0.4538	0.3931

8. Typical Characteristic Curves

▪ Forward Current vs. Forward Voltage

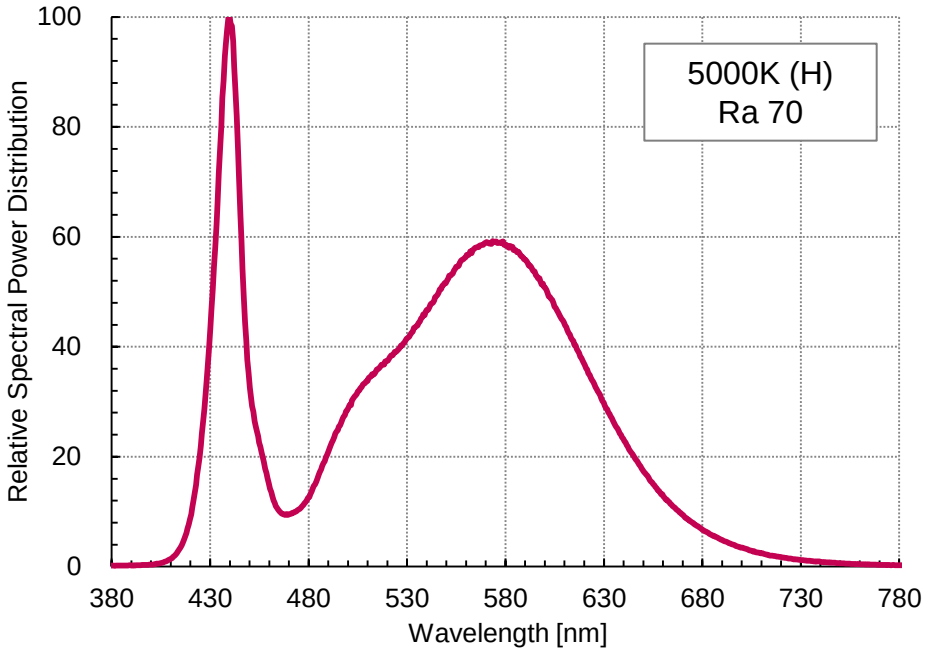


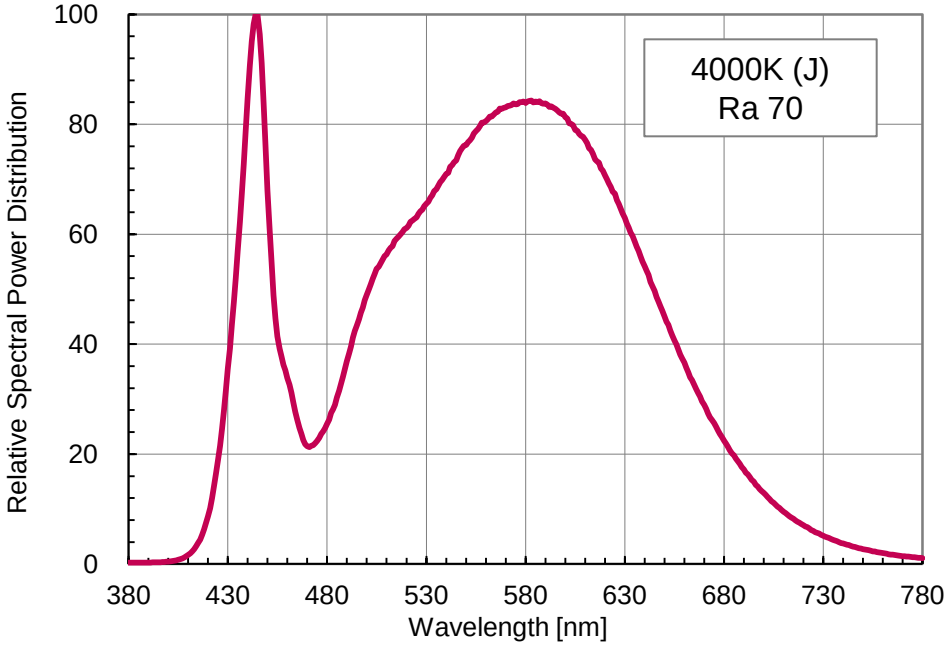
▪ Relative Luminous Flux vs. Forward Current



8. Typical Characteristic Curves

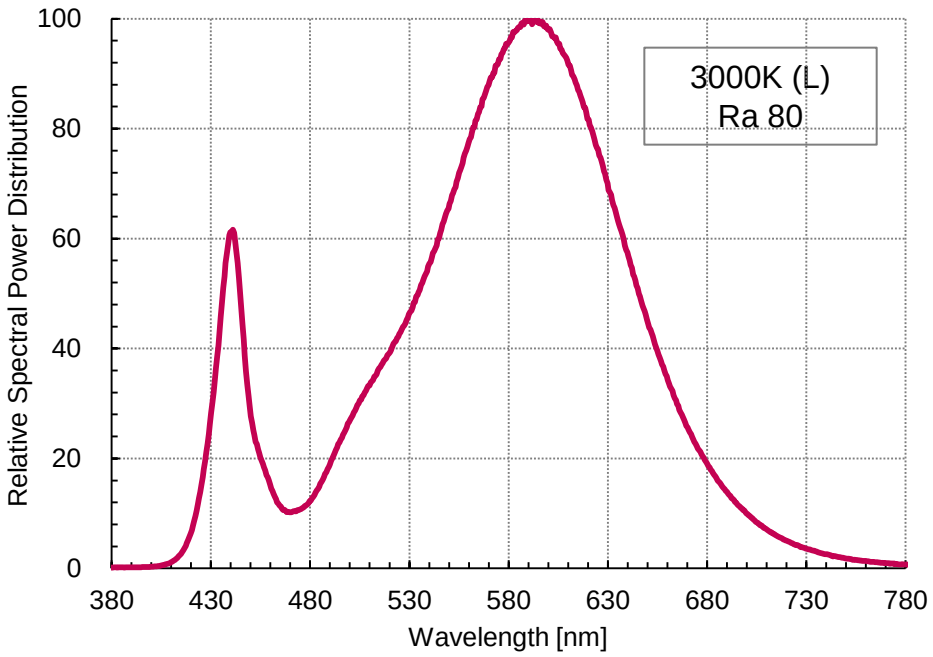
▪ Spectrum





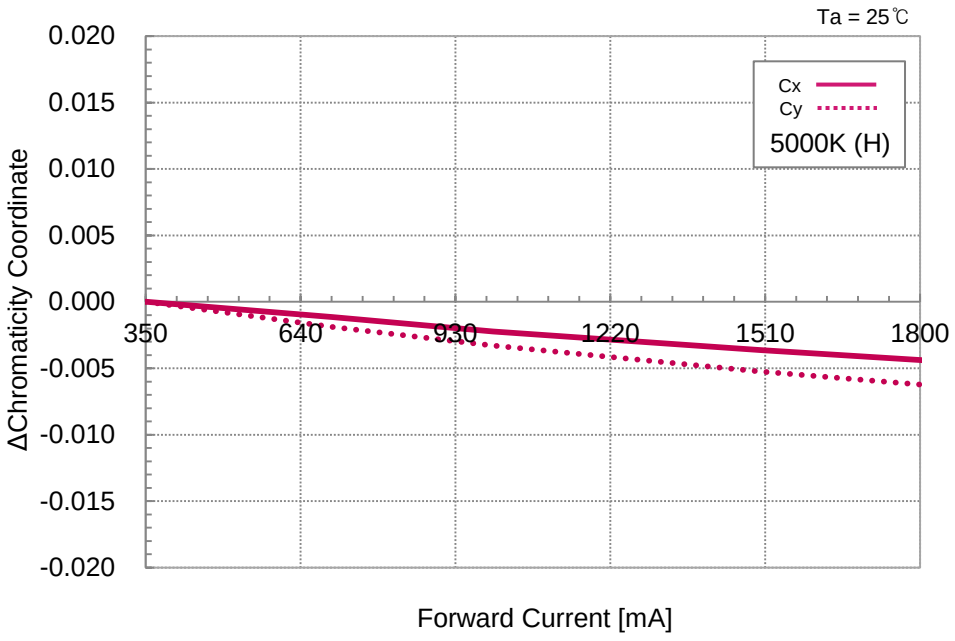
8. Typical Characteristic Curves

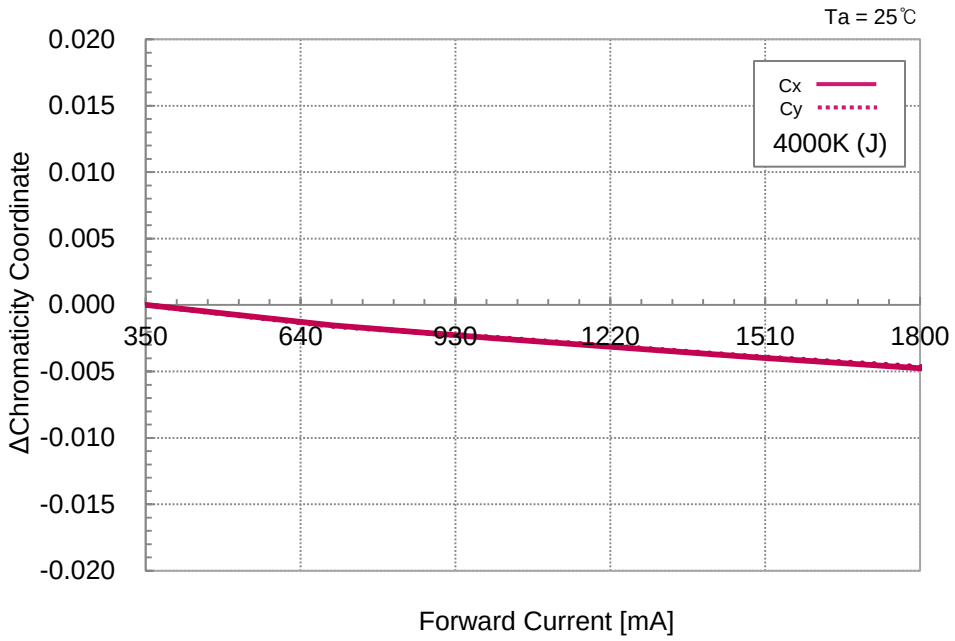
▪ Spectrum



8. Typical Characteristic Curves

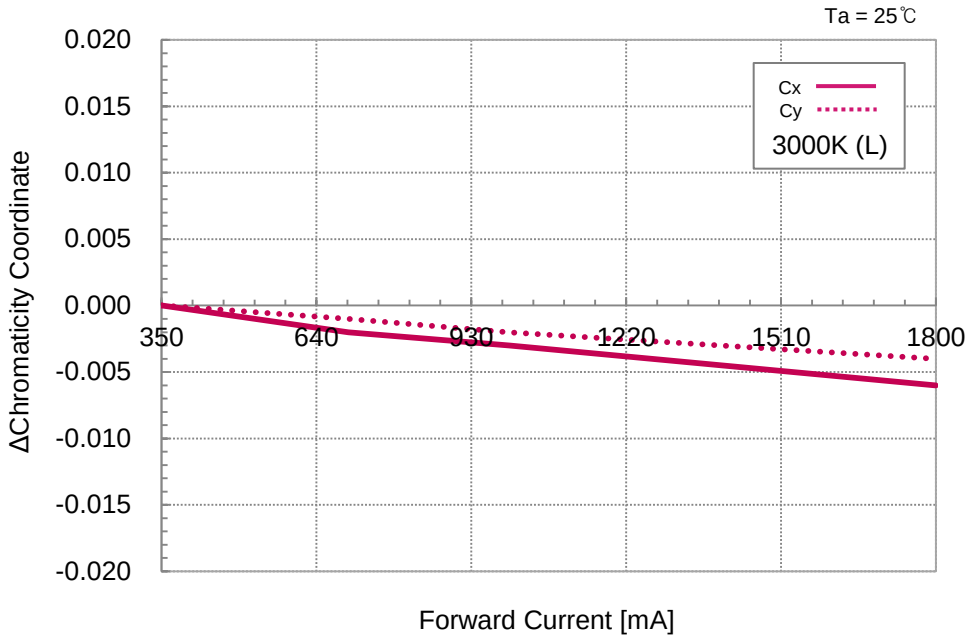
▪ Chromaticity Coordinate vs. Forward Current





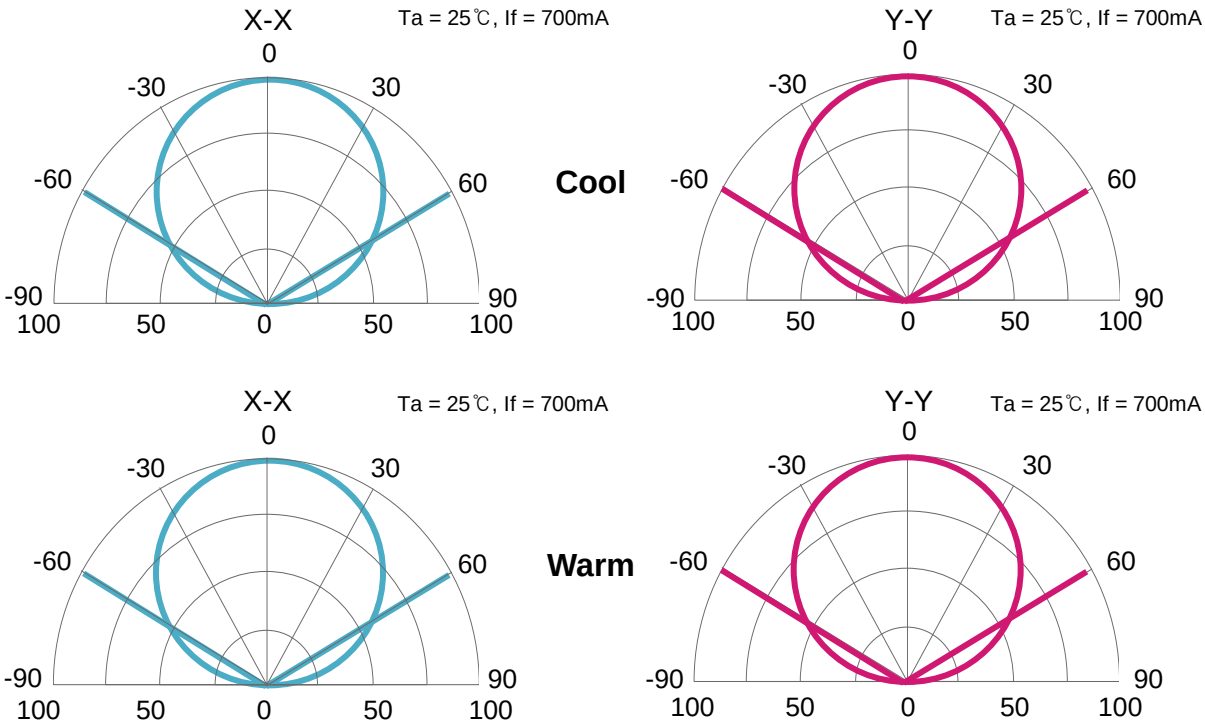
8. Typical Characteristic Curves

▪ Chromaticity Coordinate vs. Forward Current

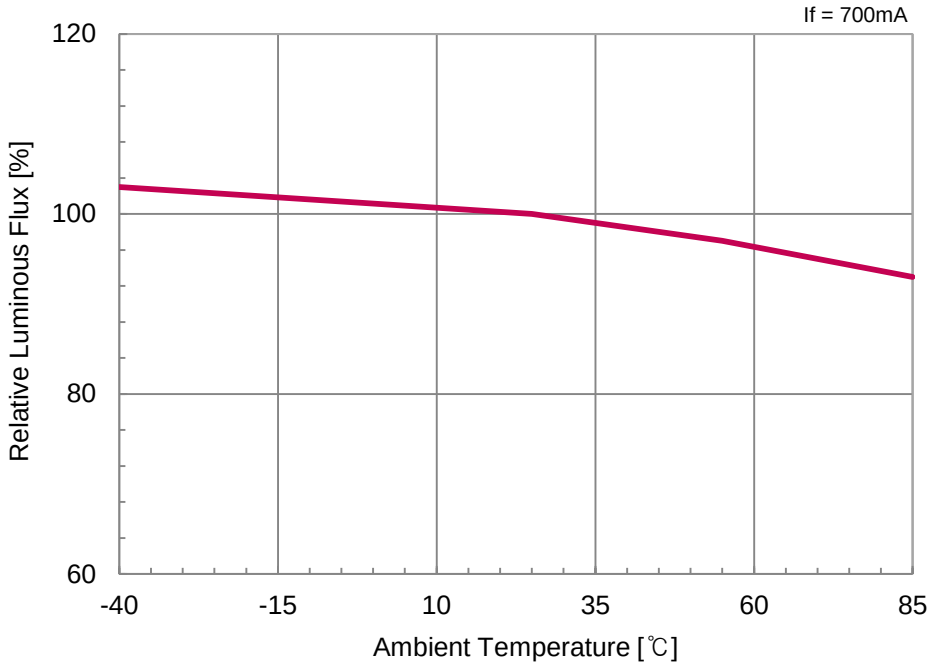


8. Typical Characteristic Curves

▪ Radiation Characteristics

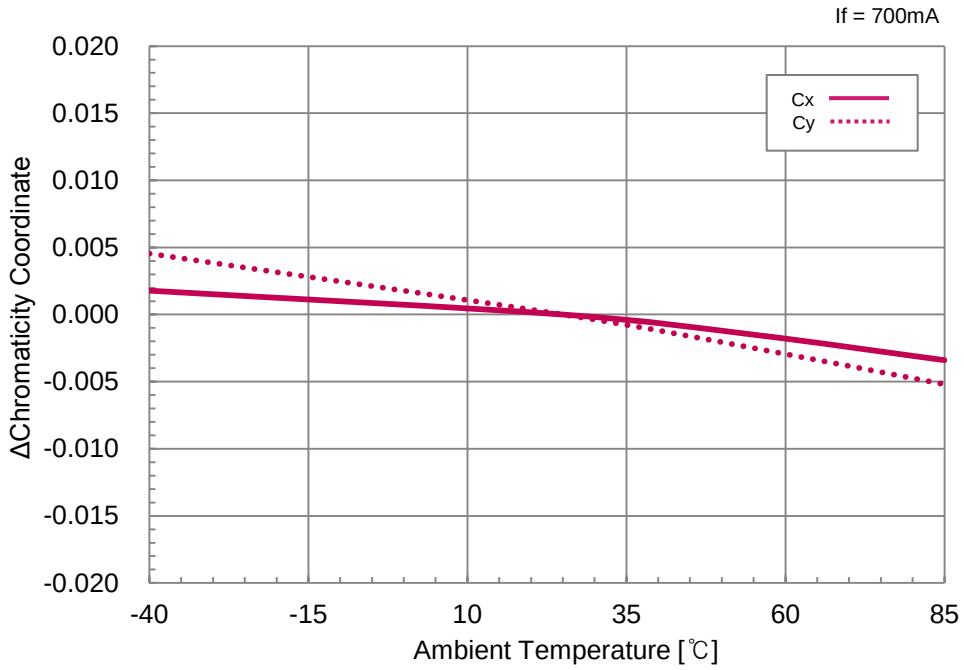


▪ Luminous Flux vs. Temperature

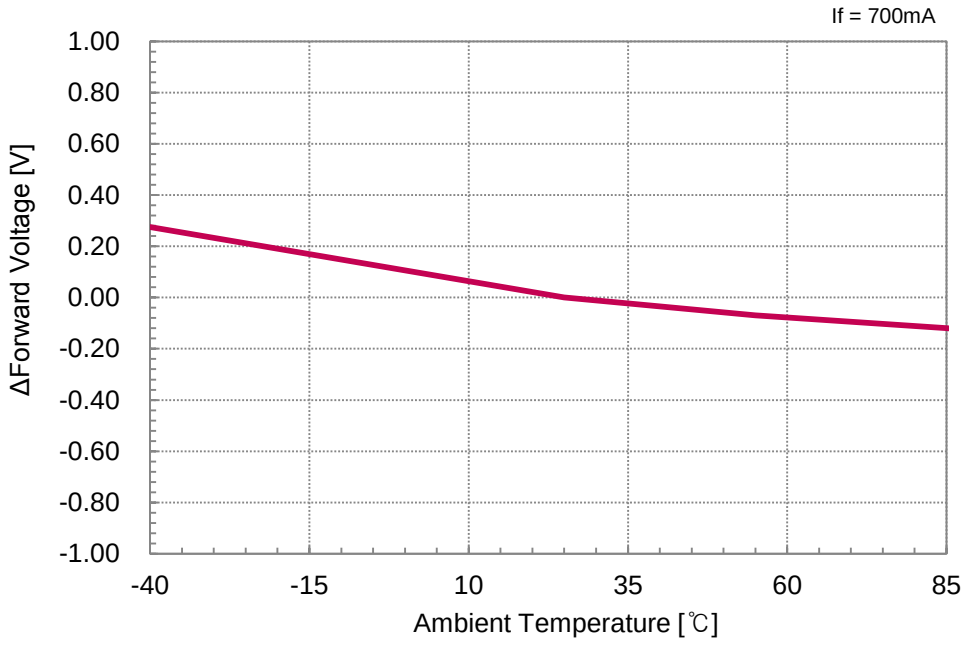


8. Typical Characteristic Curves

▪ Chromaticity Coordinate vs. Temperature

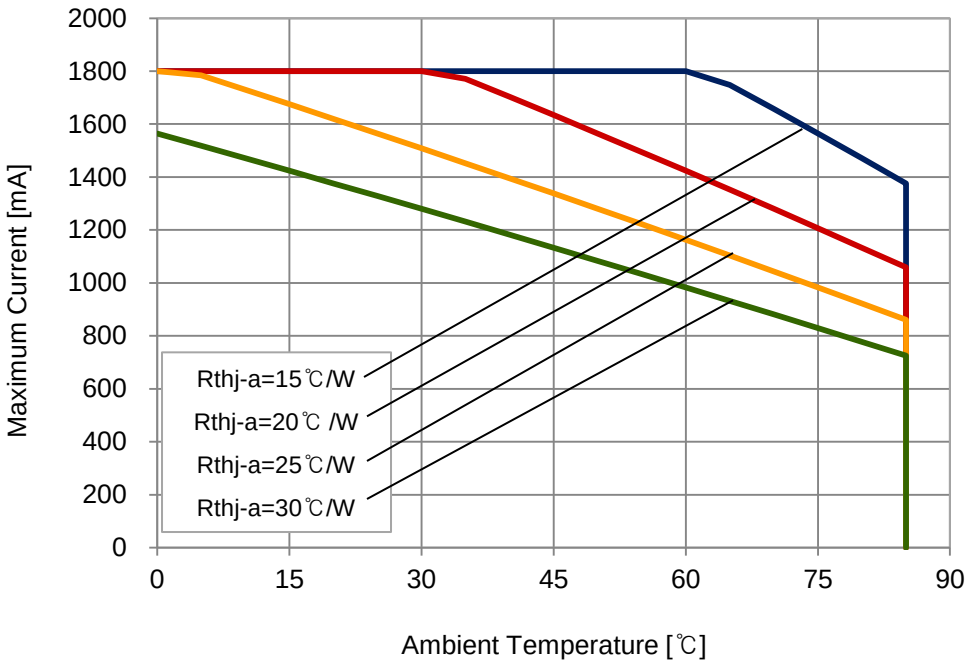


▪ Forward Voltage vs. Temperature



8. Typical Characteristic Curves

▪ Derating Curve



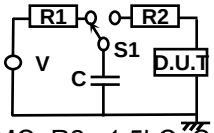
※ The ambient temperature values for each graph are obtained with LG Innotek equipment.

9. Reliability Test Items and Conditions

9-1. Failure Criteria

Items	Symbol	Test Conditions	Criteria	
			Min.	Max.
Forward Voltage	Vf	If = 700mA	-	Initial Value × 1.1
Luminous Flux	Φv	If = 700mA	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)	Ta = 25℃, If = 1,800mA	1,000 Hours	11 pcs	0/1
2	Wet High Temperature Operating Life (WHTOL)	Ta = 85℃, RH = 85% If = 1,000mA (Max Tj=120℃)	500 Hours	11 pcs	0/1
3	High Temperature Operating Life (HTOL)	Ta = 85℃, If = 1,500mA	1,000 Hours	11 pcs	0/1
4	Low Temperature Operating Life (LTOL)	Ta = -40℃, If = 1,500mA	1,000 Hours	11 pcs	0/1
5	High Temperature Storage Life (HTSL)	Ta = 100℃	1,000 Hours	11 pcs	0/1
6	Low Temperature Storage Life (LTSL)	Ta = -40℃	1,000 Hours	11 pcs	0/1
7	Wet High Temperature Storage Life (WHTSL)	Ta = 85℃, RH = 85%	1,000 Hours	11 pcs	0/1
8	Temperature Cycle (TC)	-40℃(30min) ~ 100℃(30min)	100 Cycles	11 pcs	0/1
9	Moisture Sensitivity Level (MSL)	Tsld = 260℃ (Pre treatment 60℃,60% 168 hours)	3 Times	11 pcs	0/1
10	Electrostatic Discharge Test Voltage 8kV (HBM)	 R1 : 10MΩ, R2 : 1.5kΩ, C : 100pF	3 Times	11 pcs	0/1
11	Vibration	100~2000~100Hz Sweep 4min. 200m/s², 3 directions, 4Cycles	48 Minutes	20 pcs	0/1

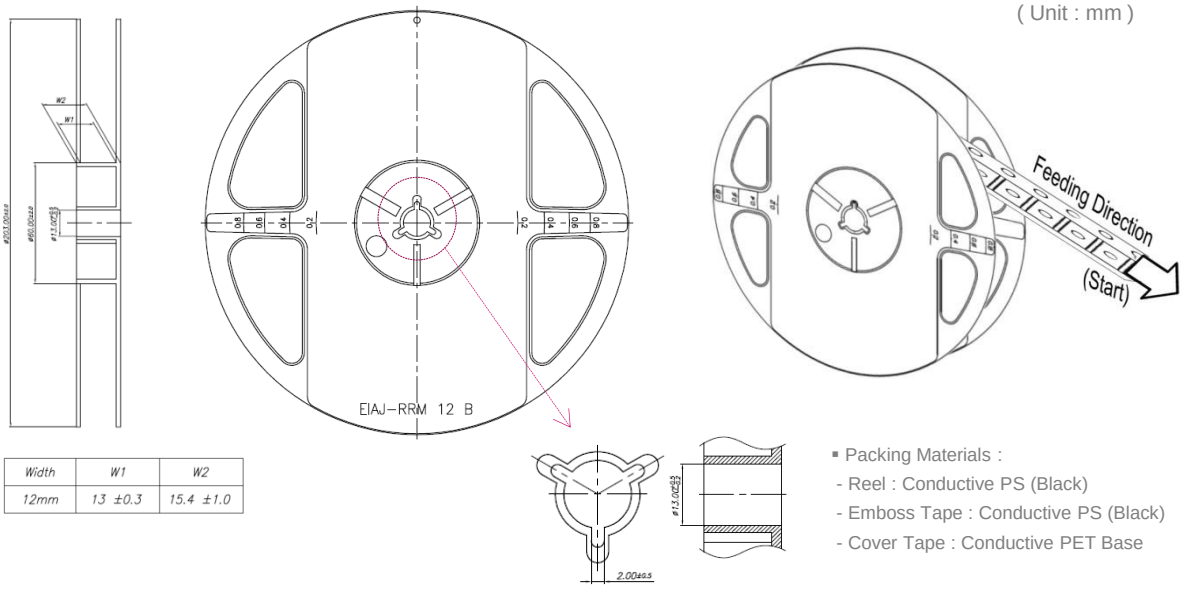
※ All samples are tested using LG Innotek Standard Metal PCB (25x25x1.6 mm^3(L×W×H)) except MSL test .
※ All samples must pass each test item and all test items must be satisfied.

10. Packing and Labeling of Products

10-1. Taping Outline Dimensions

▪ Reel

(Unit : mm)

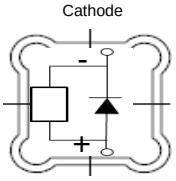


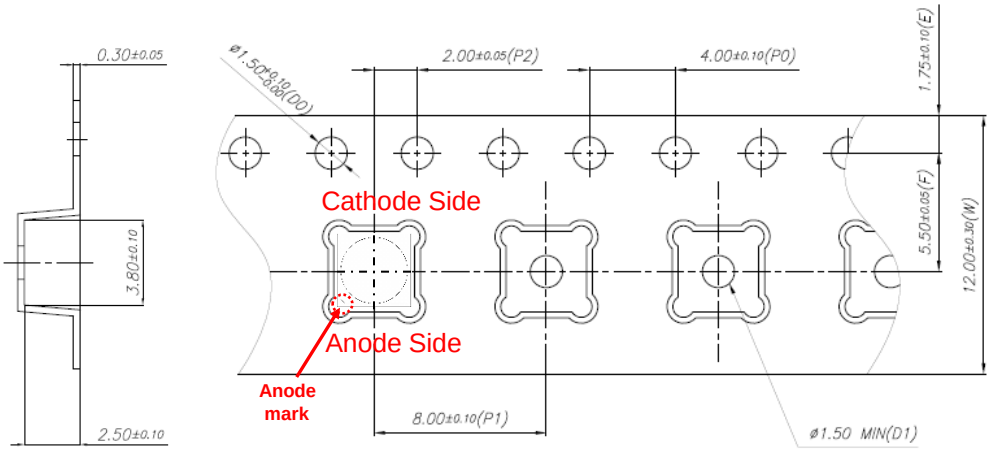
Width	W1	W2
12mm	13 ±0.3	15.4 ±1.0

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

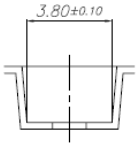
▪ Tape

Polarity Direction in Pocket





▪ Taping Arrangement



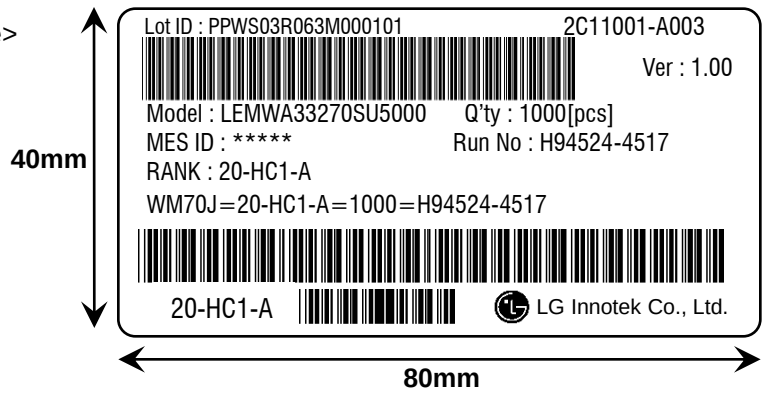
10. Packing and Labeling of Products

10-2. Label Structure

※. Label A

Specifying ‘Lot ID’, ‘Model Name’, ‘MES ID’, ‘RANK’, ‘Q’ty’, ‘Run No’.

<Example>



▪ Run No. indication

1	2	3	4	5	6	—	7	8	9	10
Code	Manufacture Site	Manufacture Year	Manufacture Month	Manufacture Date			Serial No			
	Paju : 1 Huizhou : 9	2015 : 5 … 2020 : 0 2021 : 1	1~9 : 1~9 10 : A 11 : B 12 : C	(01~31)			(00 ~ ZZ)			

10. Packing and Labeling of Products

10-2. Label Structure

※. Label C

Specifying ‘Customer’, ‘Date’, ‘Model Name’, ‘Quantity’, ‘Customer Part no’, ‘Outbox ID’, ‘LGIT Internal Model Name’

<Example>

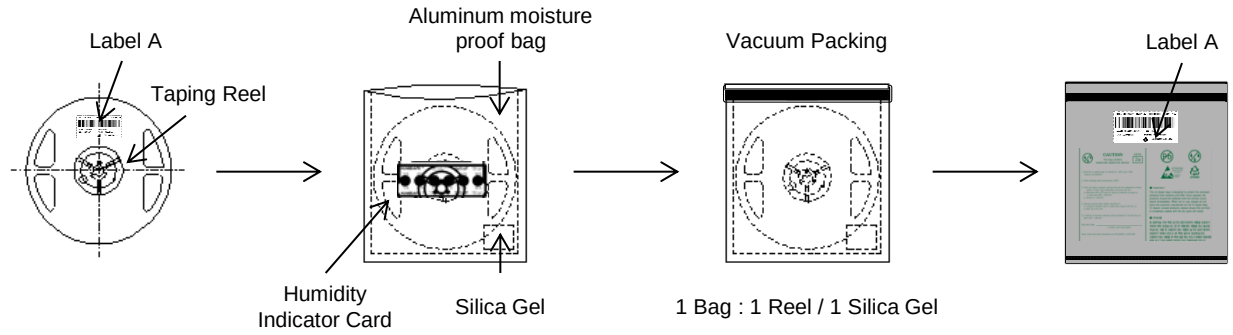
▪ Box ID. indication

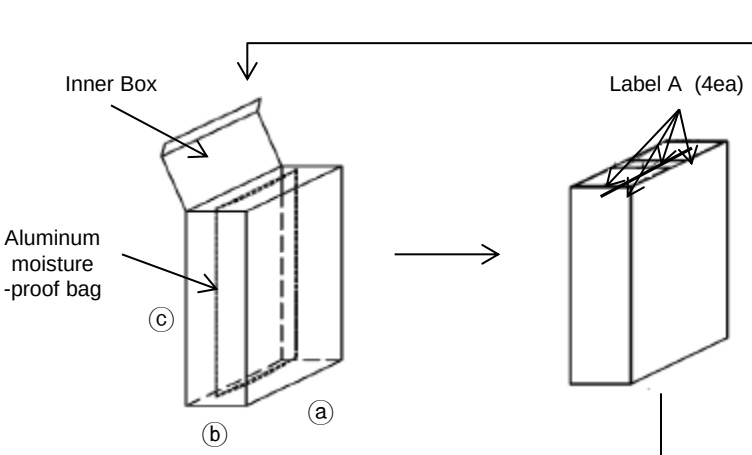
1	2	3	4	5	6	7	8	9	10
Manufacture Site	PKG Site	Box	Year	Month	Date		Serial No		
Paju : P Huizhou : H	PKG : S, P	Inner Box : I Outer Box : O	2015 : 5 … 2020 : 0 2021 : 1	1~9 : 1~9 10 : A 11 : B 12 : C	(01 ~ 31)		(001 ~ 999)		

10. Packing and Labeling of Products

10-3. Packing Structures

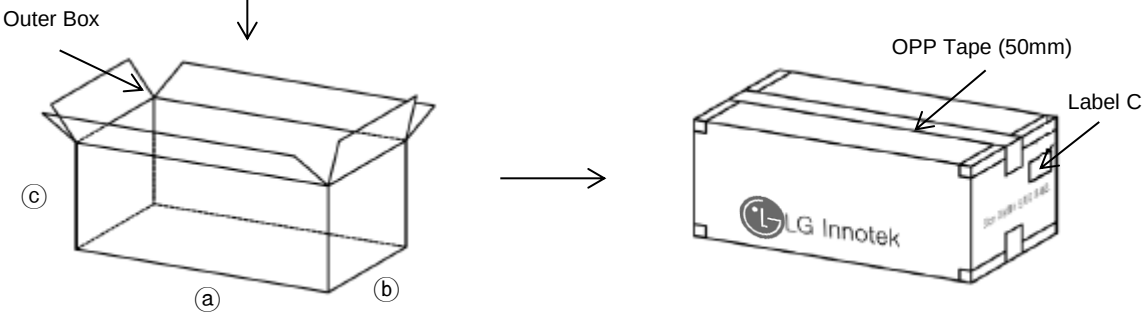
Reeled products(Numbers of products are Max.1000pcs) packed in a sealed-off and moisture-proof aluminum bag with desiccants(Silica Gel) and Humidity Indicator Card(HIC). Maximum four aluminum bags are packed in an inner box and six inner boxes are packed in an outer box. (Total Max. number of products are 24,000pcs)





Types	Sizes (mm)		
	ⓐ	ⓑ	ⓒ
Inner Box	227	82	258
Outer Box	530	240	280

Tolerance : ±10mm



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 the Delivery Date
	After Opening Aluminum Bag	5℃ ~ 30℃	< 60%RH	≤ 672 hours
Baking		65 ± 5℃	< 10%RH	10 ~ 24 hours

-. The LEDs should be stored in a clean environment. If the LEDs are stored for 3 months of more after being shipped from LGIT, a sealed container with a nitrogen gas should be used for storage.

-. When storing the LEDs after opening aluminum bag, reseal with a moisture absorbent material inside

11-3. During Usage

-. The LED should be avoided direct contact with hazardous materials such as sulfur, chlorine, phthalate, acid, solvent, etc. These materials(S, Cl, VOCs, etc) may cause sulfurization of silver lead-frame or encapsulant silicone discoloration in LED.
VOCs(Volatile Organic Compounds) can be generated from adhesives glue, cleaning flux, molding hardener or organic additive which used in luminaires fixtures and they(VOCs) may cause a significant lumen degradation of LED in luminaires when they exposed to heat or light.
To prevent this phenomenon, materials used in luminaires must be carefully selected by users.

-. 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 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. Cleaning Condition : IPA, 25℃ max. × 60sec 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, there can be various forward voltages for LEDs. Different forward voltages in parallel via a single resistor can result in 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.

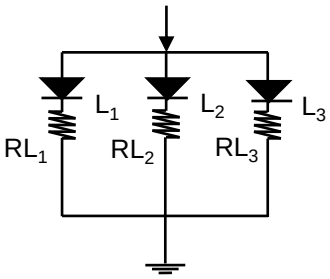


Fig.1 Recommended Circuit in Parallel Mode
: Separate resistors must be used for each LED.

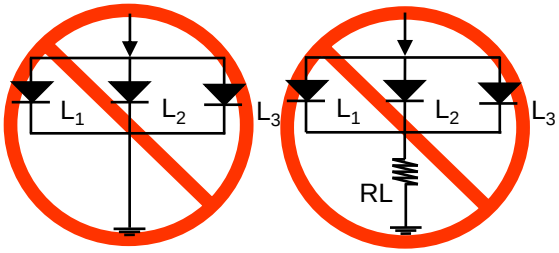


Fig.2 Abnormal Circuit
Circuits to Avoid : The current through the LEDs may vary due to the variation in LED forward voltage.

-. The driving circuits must be designed 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.

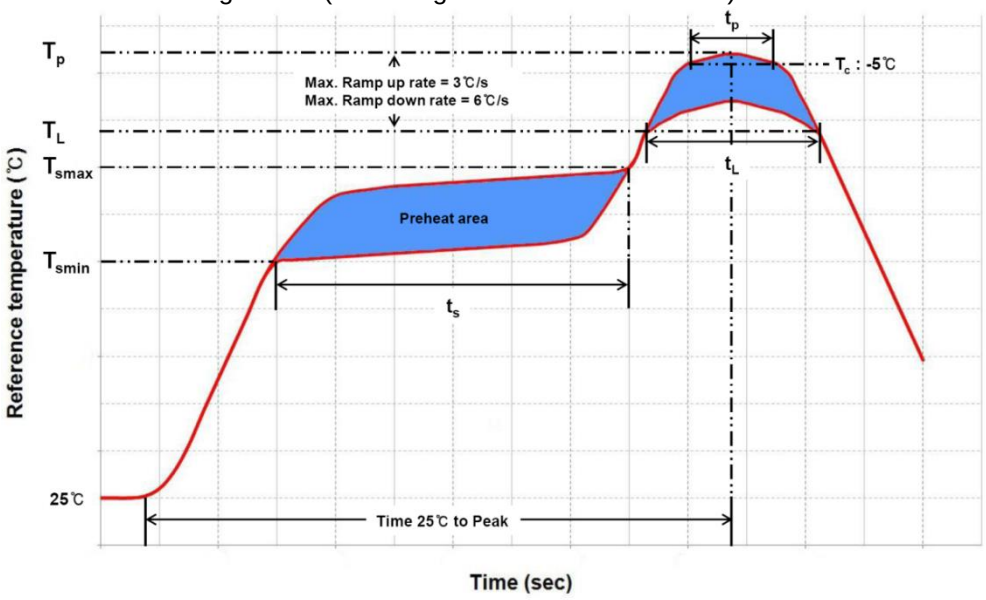
11. Cautions on Use

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}) 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.
Liquidus 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	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

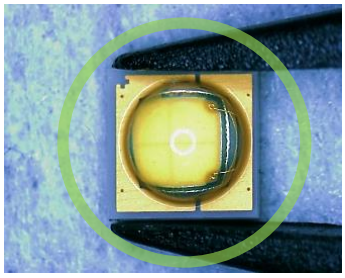
-. The recommended condition is less than 5 seconds at 260℃.
-. The time must be shorter for higher temperatures. (+10℃ → -1sec).
-. The power dissipation of the soldering iron should be lower than 15W and the surface temperature of the device should be controlled at or under 230℃.

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 the LED and do not apply mechanical pressure on the surface of the encapsulant.



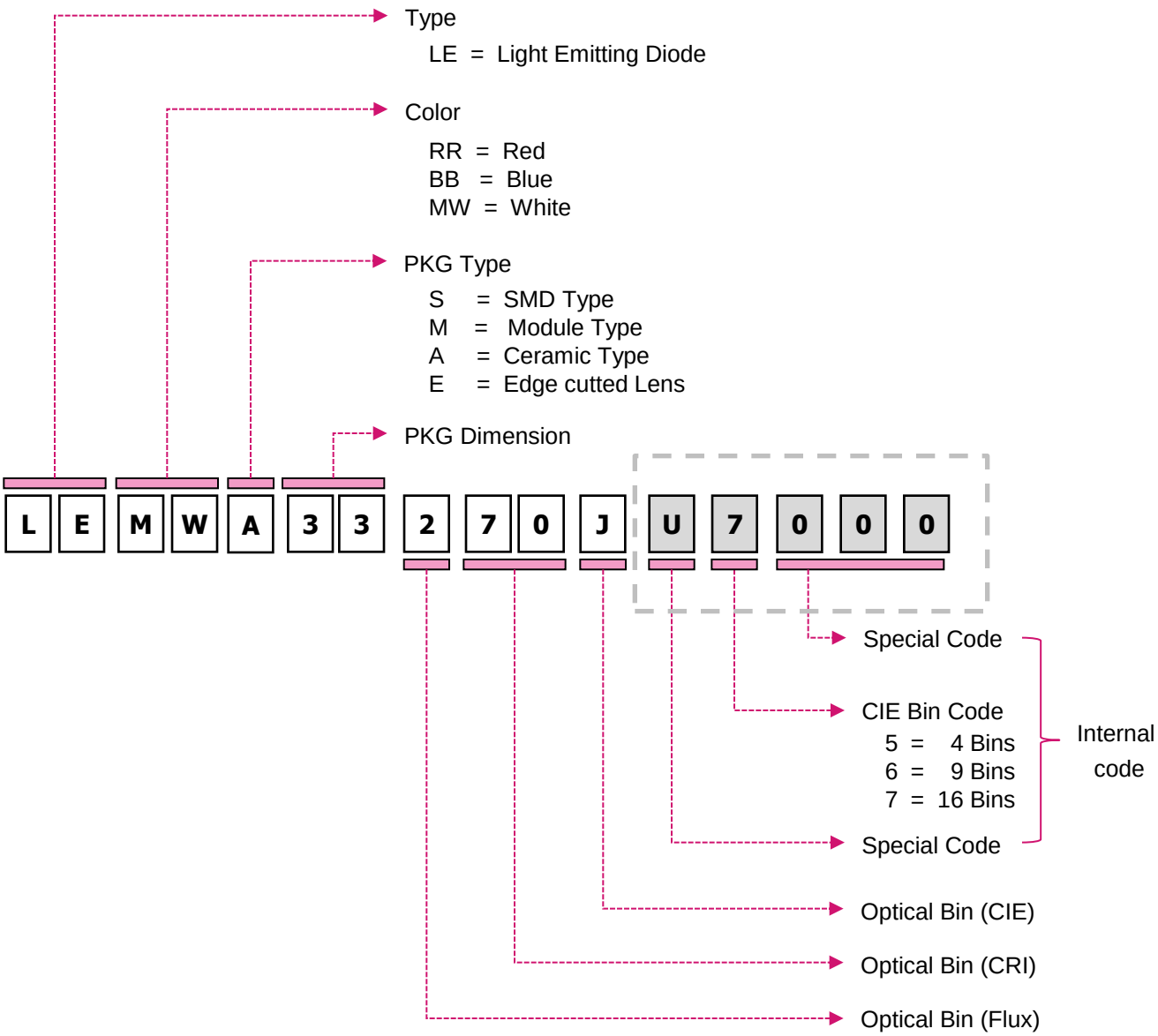
12. Disclaimers

-. LG Innotek is not responsible for any damages or accidents caused if the operating or storage conditions exceed the absolute maximum ratings recommended in this document.
-. The LEDs described in this document are intended to be operated by ordinary electronic equipment.
-. The LEDs should not be used at any lighting products together with the other LEDs, which has a different part number. If required, please contact any sales person.
-. It is recommended to consult with LG Innotek when the environment or the LED operation is non-standard in order to avoid any possible malfunctions or damage to product or risk of life or health.
-. Disassembly of the LED products for the purpose of reverse engineering is prohibited without prior written consent from LG Innotek. All defected LEDs must be reported to LG Innotek and are not to be disassembled or analyzed.
-. The product information can be modified and upgraded without prior notice.

13. Package Nomenclature

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.



SPECIFICATION			
MODEL	LEMWA332OOOOOOOO	DOCUMENT No.	
REG. DATE	1.0	REV. No.	1.1
REV. DATE	2015.10.20	PAGE	

Change History of Revision

Revision	Date	Contents of Revision Change	Remark
Rev. 1.0	15.10.20	New Establishment	
Rev. 1.1	16.07.29	Change of Flux Bins	P 6