

LH351B – 3535 Ceramic LED @85°C



Introduction

Features

- Package : Ceramic Substrate LED Package
- View Angle: 120 °
- Precondition : JEDEC Level 2a
- Dimension : 3.5 x 3.5 x 1.93 mm
- ESD withstand Voltage : up to ± 5 KV [HBM]
- Reliability Test : IES-LM-80-08 qualified

Applications

- INDOOR LIGHTING : Spot light, Down light
- OUTDOOR LIGHTING : Street light, Security light, Tunnel light, Parking lots light
- INDUSTRIAL LIGHTING : High-bay light, Low-bay light
- CONSUMER LIGHTING : Torch light

SAMSUNG ELECTRONICS

95, Samsung2-Ro, Giheung-Gu,
Yongin-City, Gyeonggi-Do 446-711, KOREA



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1. Luminous Flux Characteristics (T_j= 85°C)

Nominal CCT	Minimum CRI ¹⁾	Sorting condition Flux ²⁾ @350mA		Calculated Minimum Flux ³⁾			Product Code	BIN Structure
		Rank	Min Flux ²⁾	@700mA	@1000mA	@1500mA		
2700K	80	F3 (G3)	90 (100)	162 (177)	213 (233)	283 (309)	SPHWH1L3D30ED4W0F3	Whole
							SPHWH1L3D30ED4WPF3	Quarter
							SPHWH1L3D30ED4WMF3	M3
		G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)	SPHWH1L3D30ED4W0G3	Whole
							SPHWH1L3D30ED4WPG3	Quarter
							SPHWH1L3D30ED4WMG3	M3
3000K	80	G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)	SPHWH1L3D30ED4V0G3	Whole
							SPHWH1L3D30ED4VPG3	Quarter
							SPHWH1L3D30ED4VMG3	M3
3500K	80	G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)	SPHWH1L3D30ED4U0G3	Whole
							SPHWH1L3D30ED4UPG3	Quarter
							SPHWH1L3D30ED4UMG3	M3
4000K	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)	SPHWH1L3D30CD4T0J3	Whole
							SPHWH1L3D30CD4TPJ3	Quarter
							SPHWH1L3D30CD4TMJ3	M3
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)	SPHWH1L3D30CD4T0K3	Whole
							SPHWH1L3D30CD4TPK3	Quarter
							SPHWH1L3D30CD4TMK3	M3
	80	G3 (H3)	100 (110)	180 (197)	237 (259)	314 (343)	SPHWH1L3D30ED4T0G3	Whole
							SPHWH1L3D30ED4TPG3	Quarter
							SPHWH1L3D30ED4TMG3	M3

()* : Minimum luminous flux @ 25°C

Notes:

- 1) SAMSUNG ELECTRONICS maintains a tolerance of ±3.0 on CRI measurements.
- 2) SAMSUNG ELECTRONICS maintains a tolerance of ±7% on flux measurements.
- 3) Calculated flux values are for reference only.



1. Luminous Flux Characteristics (T_j= 85°C)

Nominal CCT	Minimum CRI ⁽¹⁾	Sorting condition Flux ⁽²⁾ @350mA		Calculated Minimum Flux ⁽³⁾			Product Code	BIN Structure
		Rank	Min Flux ⁽²⁾	@700mA	@1000mA	@1500mA		
5000K	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)	SPHWH1L3D30CD4RTJ3	half
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)	SPHWH1L3D30CD4RTK3	half
	75	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)	SPHWH1L3D30DD4RTJ3	half
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)	SPHWH1L3D30DD4RTK3	half
5700K	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)	SPHWH1L3D30CD4QTJ3	half
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)	SPHWH1L3D30CD4QTK3	half
	75	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)	SPHWH1L3D30DD4QTJ3	half
		K3 (M3)	130 (140)	234 (253)	308 (333)	408 (441)	SPHWH1L3D30DD4QTK3	half
6500K	70	J3 (K3)	120 (130)	216 (234)	284 (308)	377 (408)	SPHWH1L3D30CD4PTJ3	half

()* : Minimum luminous flux @ 25°C

Notes:

- 1) SAMSUNG ELECTRONICS maintains a tolerance of ±3.0 on CRI measurements.
- 2) SAMSUNG ELECTRONICS maintains a tolerance of ±7% on flux measurements.
- 3) Calculated flux values are for reference only.

2. Characteristics

1) Electro-optical Characteristics

Item	Unit	Min	Typ	Max
Forward voltage ¹⁾ (@350 mA, T _j = 85°C)	V	2.60	2.85	3.00
Forward voltage ¹⁾ (@700 mA, T _j = 85°C)	V		3.02	
Forward voltage ¹⁾ (@1000 mA, T _j = 85°C)	V		3.13	
Forward voltage ¹⁾ (@1500 mA, T _j = 85°C)	V		3.29	
Operation forward current (T _j = 85°C)	mA	–	–	1500
Thermal resistance, junction to solder point	°C/W	–	4	6
LED junction temperature T _j	°C	–	–	150
Operating temperature range T _{opr}	°C	–40	–	85
Storage temperature range T _{stg}	°C	–40	–	120
Viewing Angle	°	–	120	–

Item	Unit	3000K	5000K
Forward voltage ¹⁾ (@350 mA, T _j = 25°C)	V	2.95	
Forward voltage ¹⁾ (@350 mA, T _j = 85°C)	V	2.85	
Luminous flux ²⁾ (@350 mA, T _j = 25°C)	lm	118	144
Luminous flux ²⁾ (@350 mA, T _j = 85°C)	lm	108	133
Luminous flux ²⁾ (@700 mA, T _j = 85°C)	lm	194	239
Luminous flux ²⁾ (@1000 mA, T _j = 85°C)	lm	256	315
Luminous flux ²⁾ (@1500 mA, T _j = 85°C)	lm	339	418

Notes:

- 1) SAMSUNG ELECTRONICS maintains a tolerance of $\pm 0.1V$ on forward voltage measurements.
- 2) Characteristics @ 25°C are for reference only.

2) Vf Rank

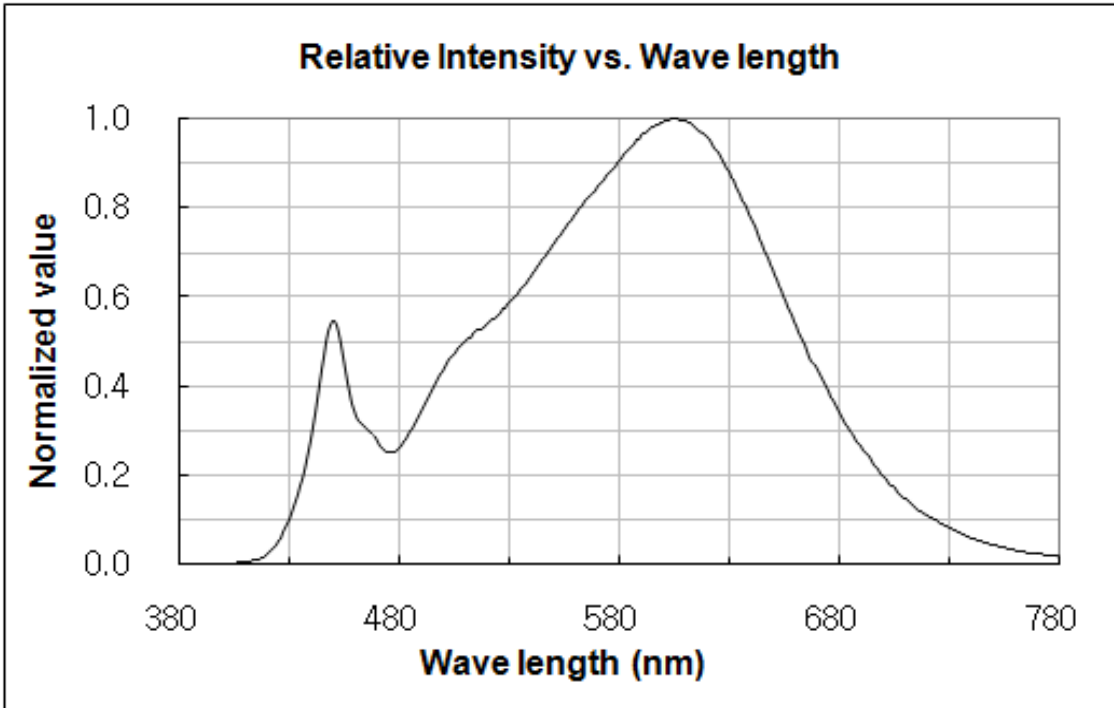
Parameter	Symbol	Condition	Rank	Min.	Typ.	Max.
Forward Voltage	V _F	I _F = 350mA	D4	2.60	–	3.00

3. Typical Characteristics Graph

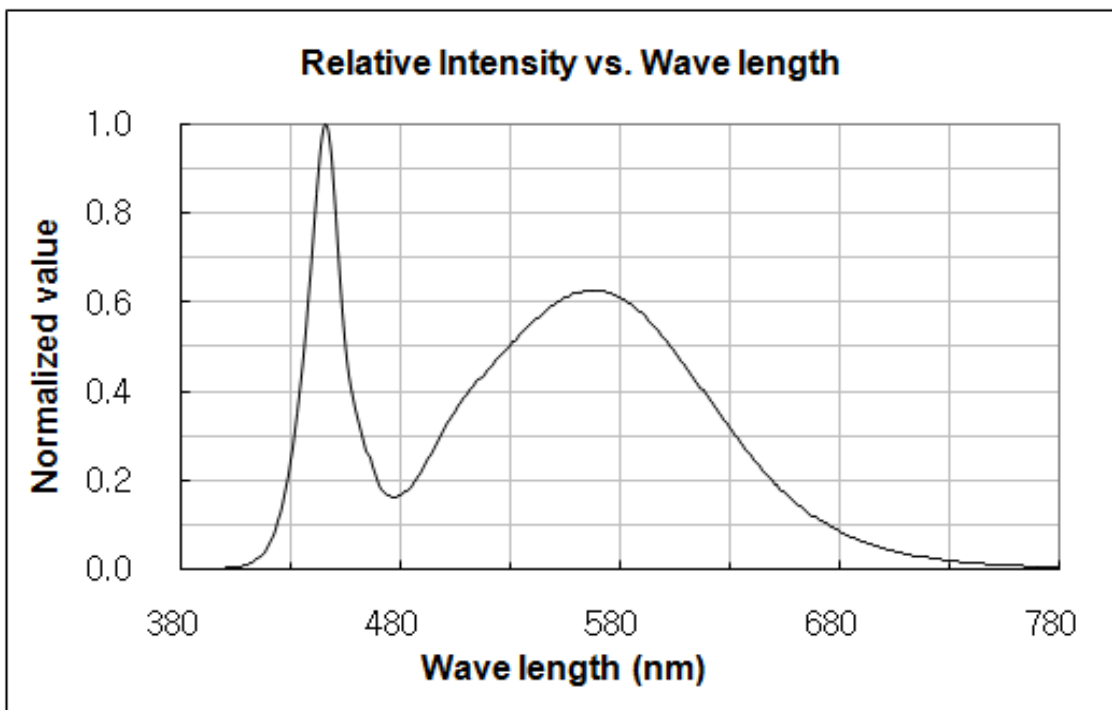
1) Spectrum Distribution

2700K(CRI 80) & 3000K(CRI 80)

(T_j = 85°C)



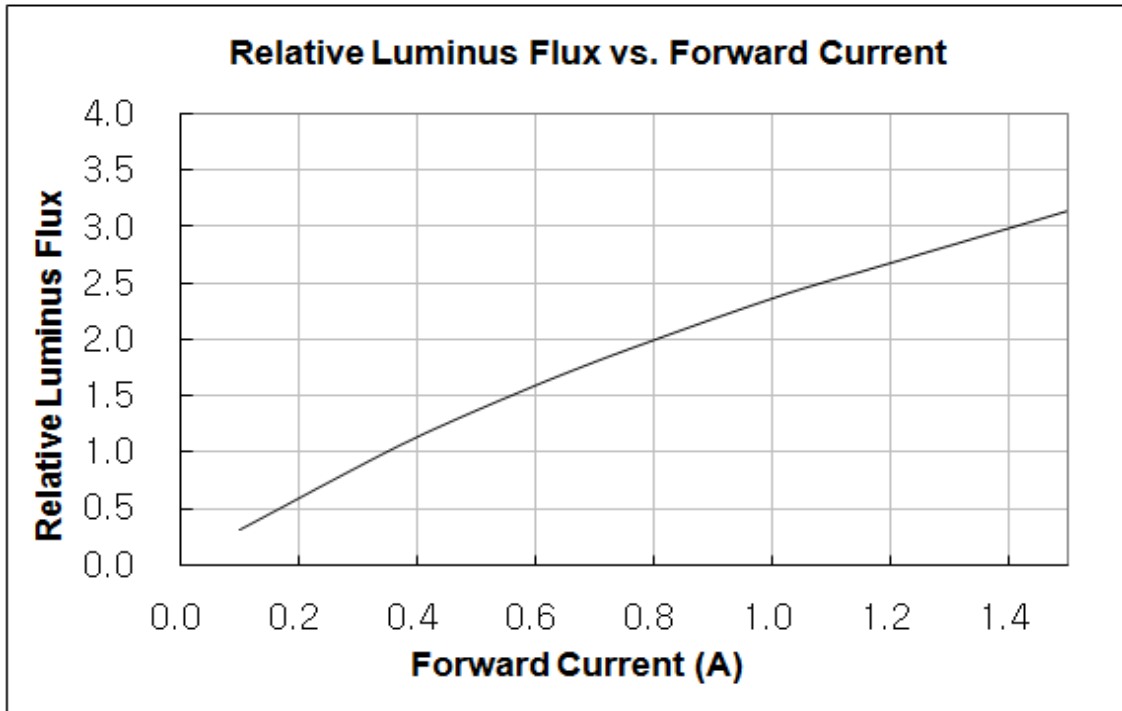
5000K(CRI 70) & 5700K(CRI 70)



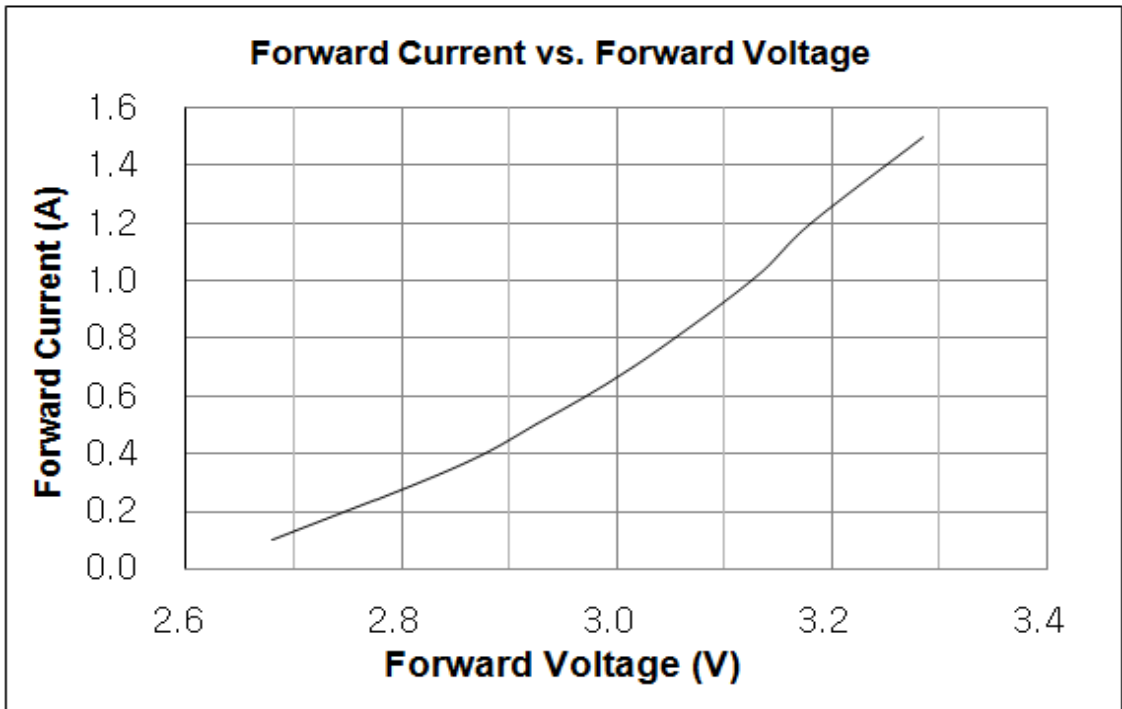
2) Forward Current Characteristics

Relative Flux vs. Forward Current

($T_j = 85^\circ\text{C}$)



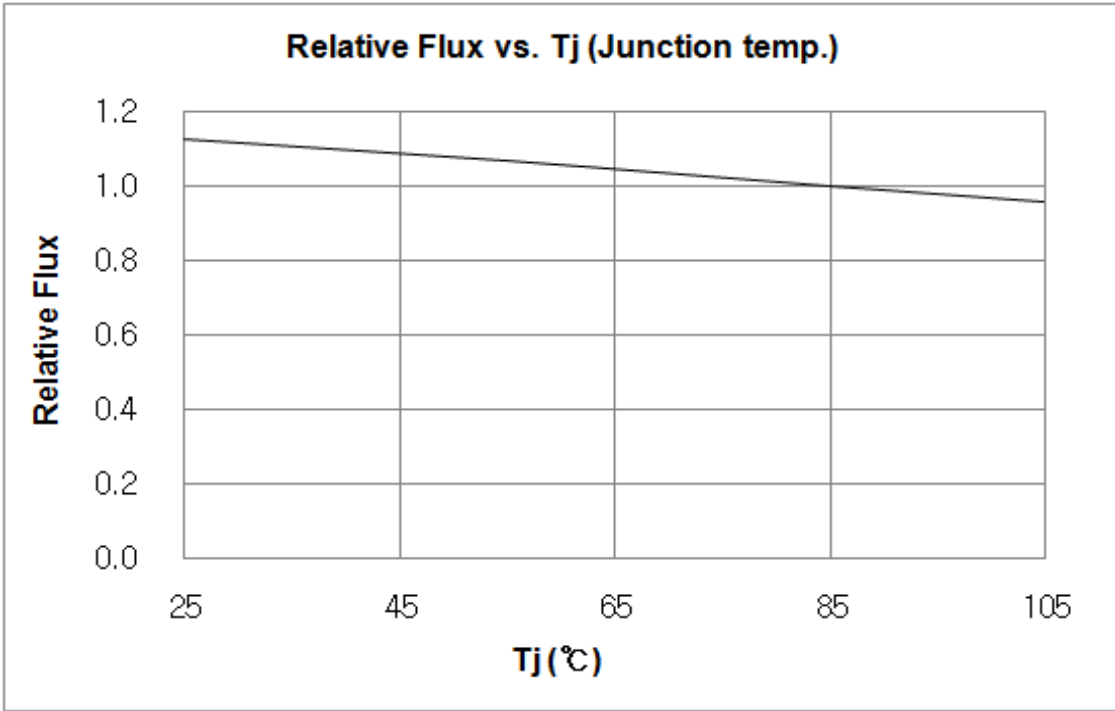
Forward Current vs. Forward Voltage



3) Temperature Characteristics

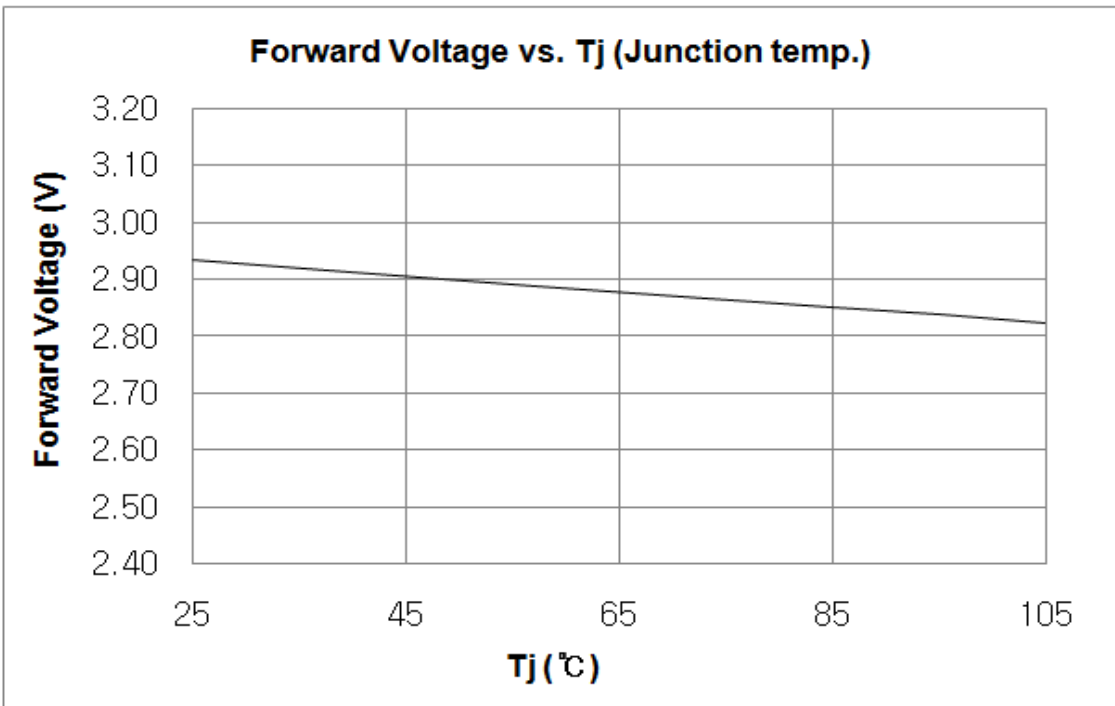
Relative Flux vs. T_j(Junction temp.)

(I_F = 350mA)



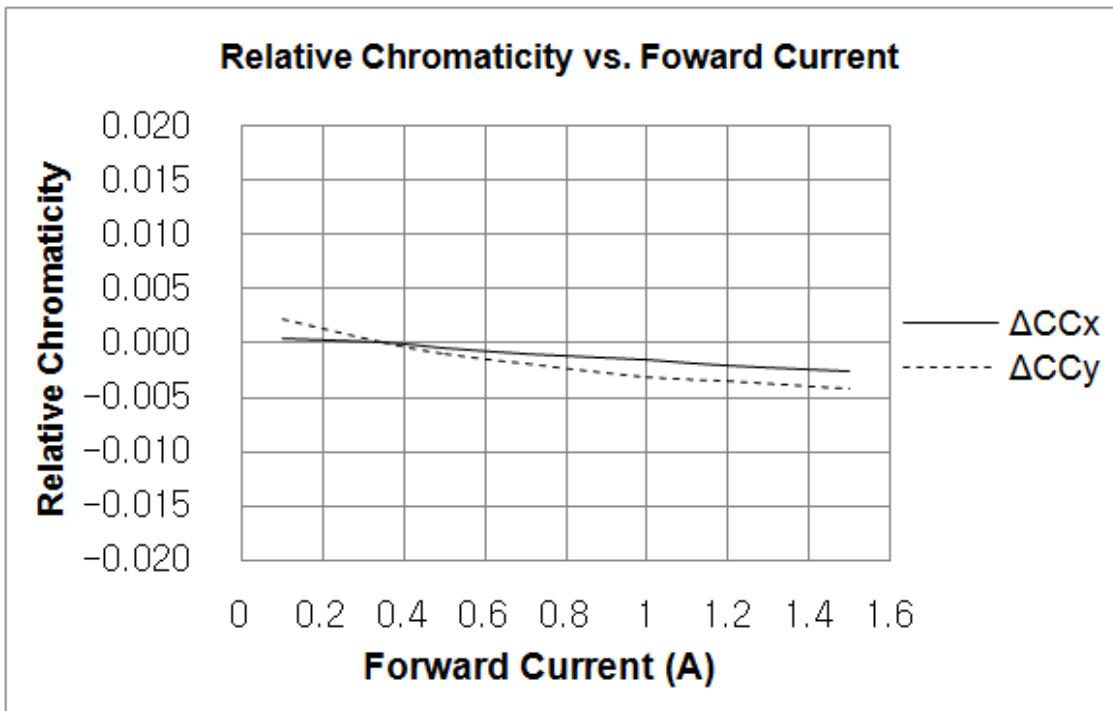
Forward Voltage vs. T_j(Junction temp.)

(I_F = 350mA)

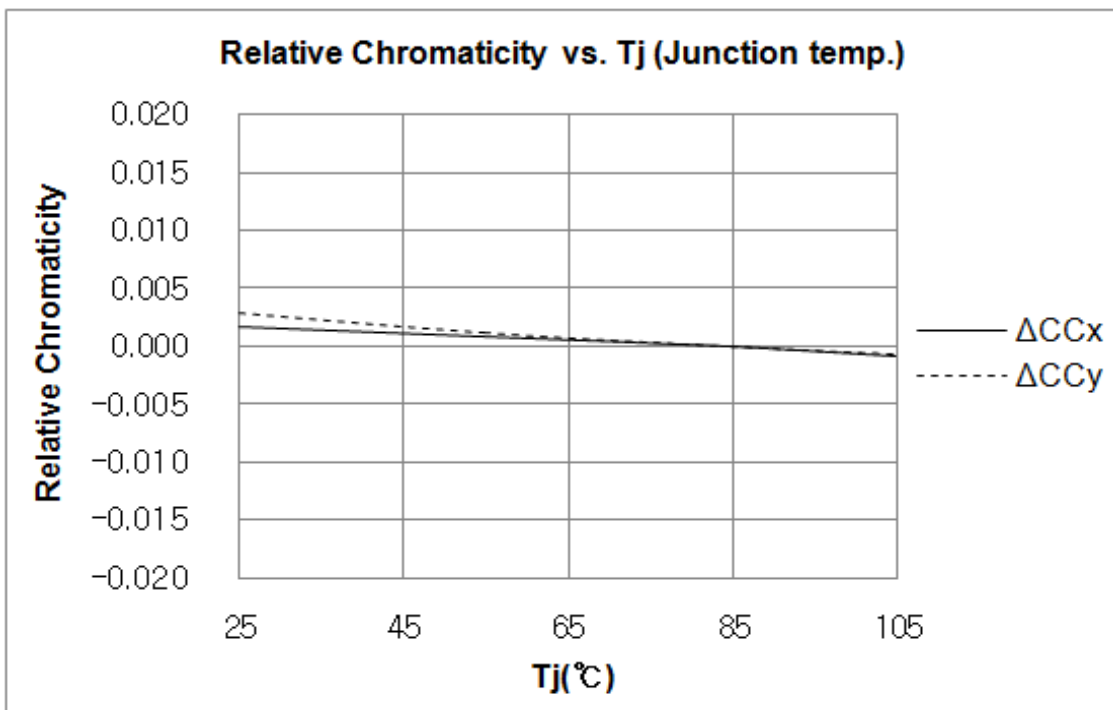


4) Color shift Characteristics

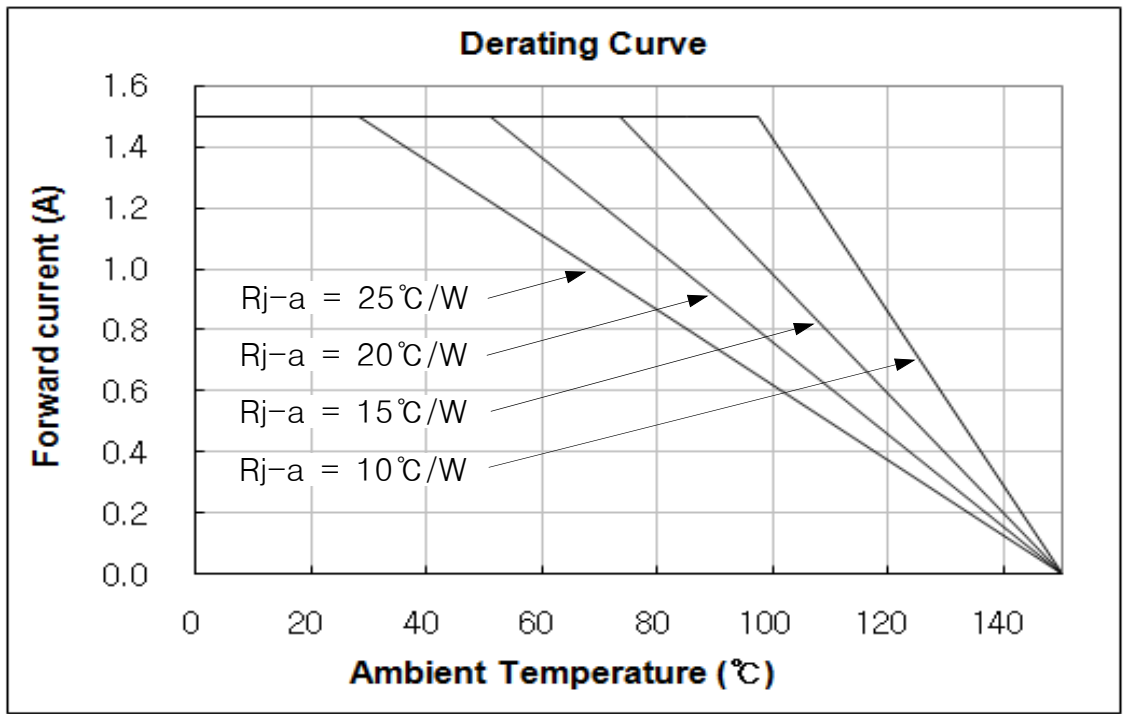
Color x,y vs. Forward Current [Cool White]



Color x,y vs. T_j (Junction temp.) [Cool White]

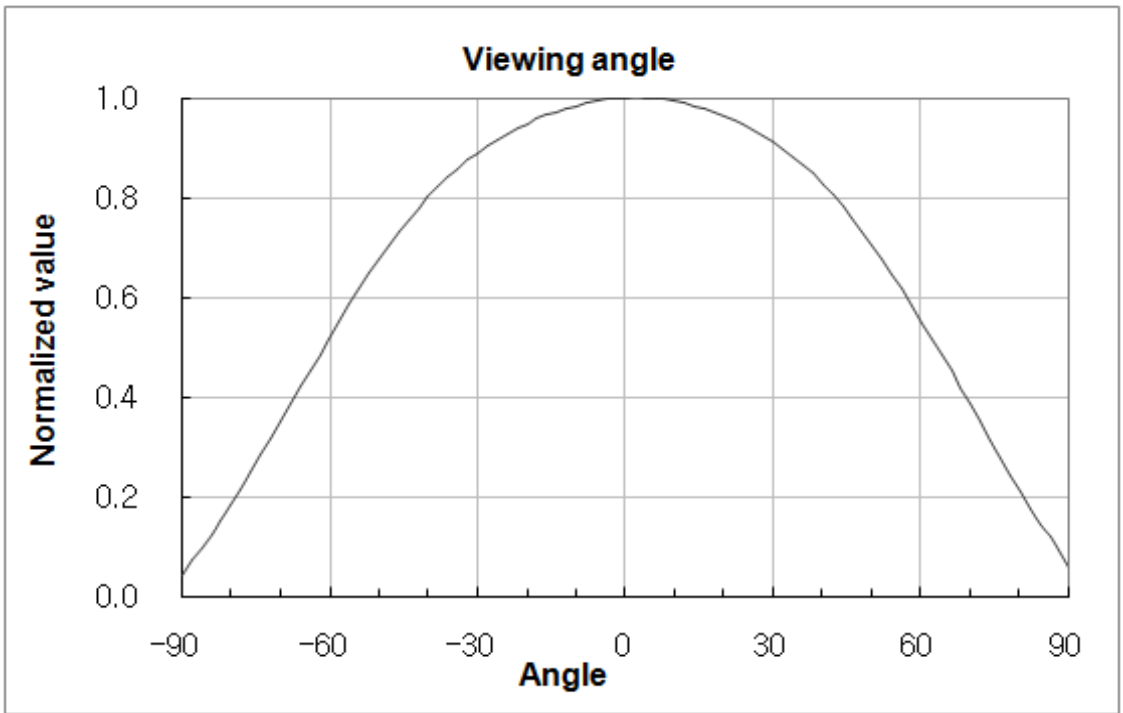


5) Derating Curve

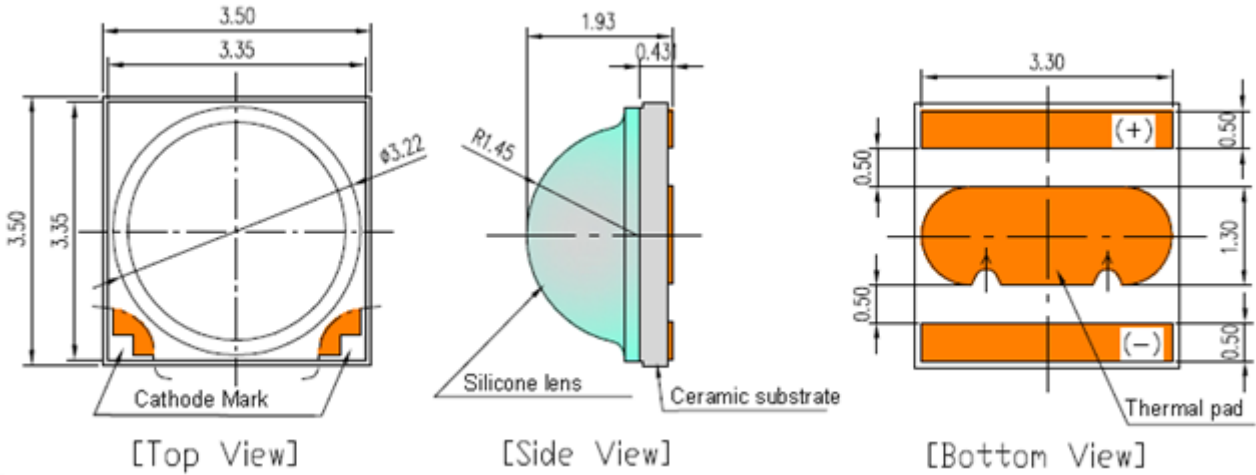


6) Viewing angle Characteristics

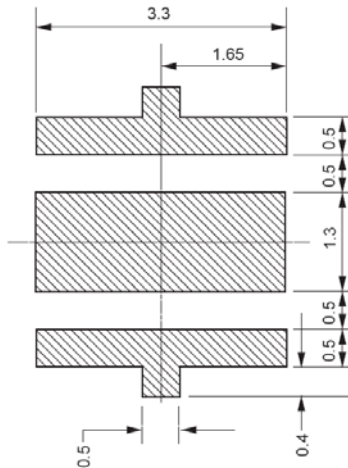
Viewing angle



4. Outline Drawing & Dimension



Recommended Land Pattern



unit : mm

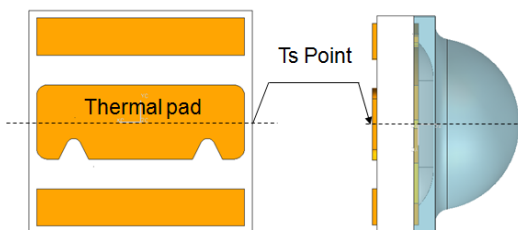
Tolerance : ± 0.13

- * This LED has built-in ESD protection device(s) connected in parallel to LED Chip(s).
- * The thermal pad is electrically isolated from the anode and cathode contact pads.

Ts Point & Measurement Method

- * Measure the nearest point to the thermal pad as shown below. If necessary, remove PSR of PCB to reach Ts point.
- * Thermal pad must be soldered to the PCB to dissipate heat properly. Otherwise, LED can be damaged.

[Bottom view]



5. Reliability Test Items and Conditions

1) Test Items and Results

Test Items	Test Conditions	Test Hours/Cycles	n
Room Temperature Life Test	25℃, DC 1000 mA	1000 Hr	22
High Temperature humidity Life Test	85℃, 85%, DC 1000 mA	1000 Hr	22
High Temperature Life Test	85℃, DC 1000 mA	1000 Hr	22
Low Temperature Life Test	-40℃, DC 1000 mA	1000 Hr	22
Temperature Humidity Cycle	-10℃ ↔ 25℃ 95%RH ↔ 85℃ 95%RH 1000mA, 95%RH, 24hrs/1cycle	10 Cycles	11
Thermal Shock	-45 ℃/15 min ↔ 125 ℃/ 15 min. Temp.change within 5min.	500 Cycles	100
High Temperature Storage	Ta=120℃	1000 Hr	11
Low Temperature Storage	Ta=-40℃	1000 Hr	11
ESD(HBM)	Q1=10MΩ, R2=1.5KΩ, C=100pF, V=±5KV, 5Times	5 Times (±5kV)	5

2) Criteria for Judging the Damage

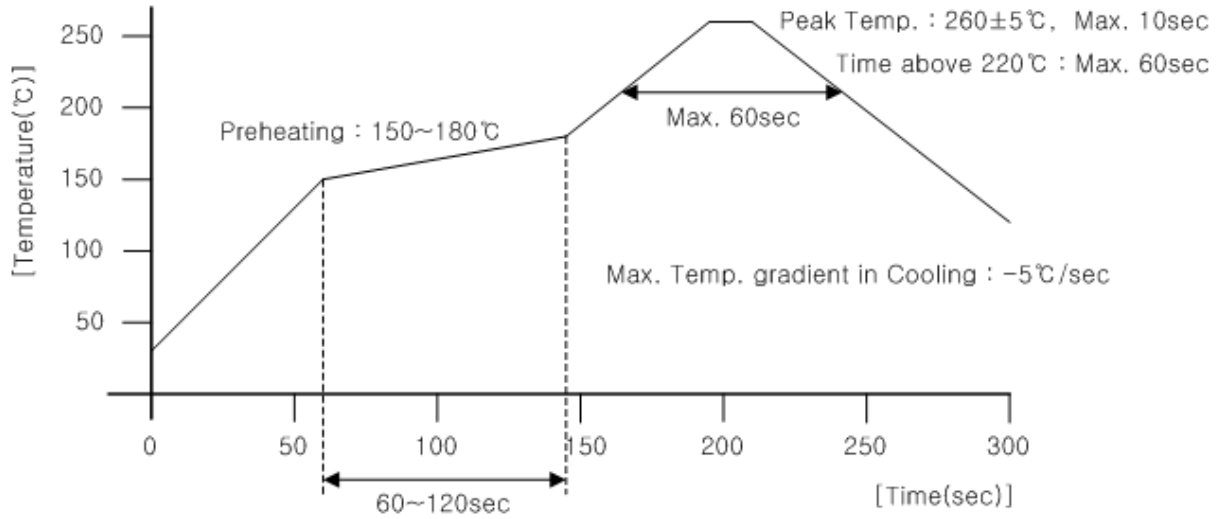
Item	Symbol	Test Condition [T _a = 25℃]	Limit	
			Min.	Max.
Forward Voltage	V _F	350 mA	L.S.L. * 0.9	U.S.L. * 1.1
Luminous flux	Im	350 mA	L.S.L. * 0.7	U.S.L. * 1.1

* U.S.L. : Upper Standard Level L.S.L. : Lower Standard Level

6. Solder Conditions

1) Reflow Conditions (Pb Free)

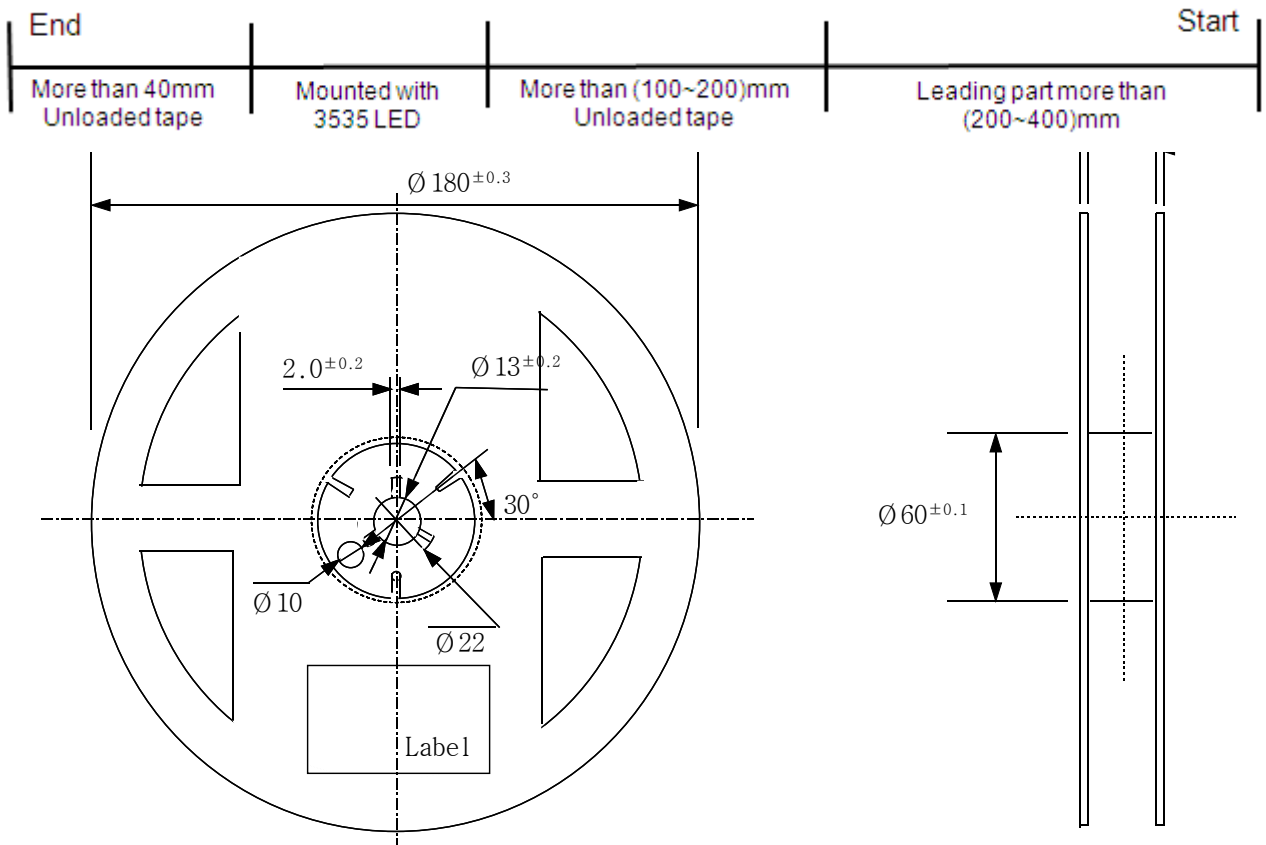
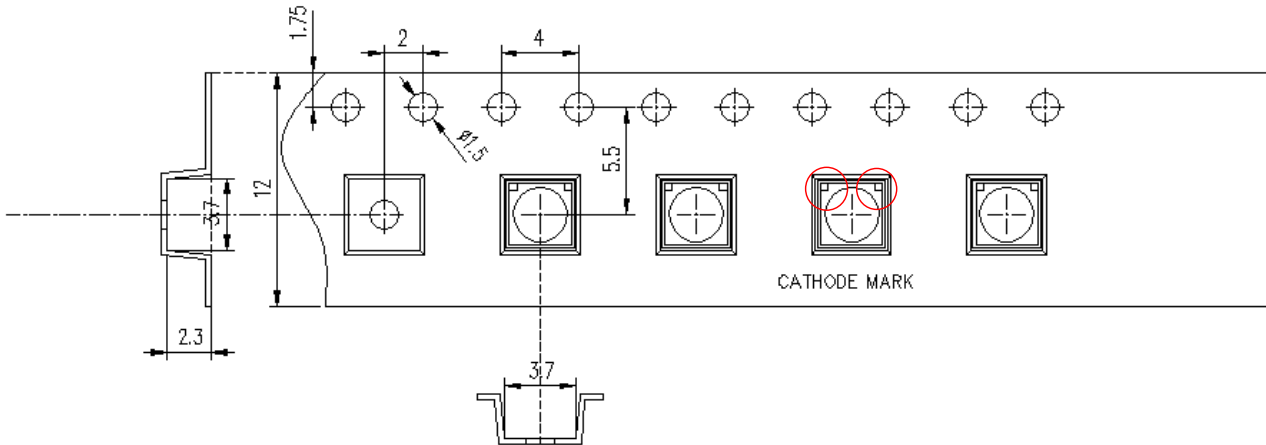
Reflow Frequency : 2 times max.



2) For Manual Soldering

Not more than 5 seconds @Max. 300°C, under soldering iron.

7. Tape And Reel

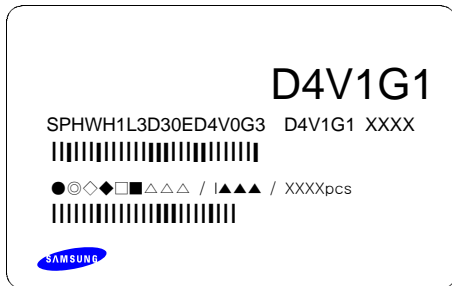


- (1) Quantity : The quantity/reel to be 1,000 pcs.
- (2) Cumulative Tolerance : Cumulative tolerance/10 pitches to be ± 0.2 mm
- (3) Adhesion Strength of Cover Tape : Adhesion strength to be 0.1-0.7N when the cover tape is turned off from the carrier tape at 10° angle to be the carrier tape.
- (4) Packaging : P/N, Manufacturing data code no. and quantity to be indicated on a damp proof package.



8. Label Structure

1) Label Structure



Rank Code

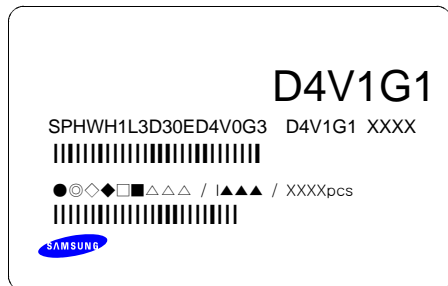
/D4/ : VF Rank

/V1/ : Color Rank

/G1/ : Flux Bin

2) LOT Number

The Lot number is composed of the following characters



●◎◇◆□■△△△ / |▲▲▲ / 1000PCS

● : Production Site (S:SAMSUNG ELECTRONICS, G:Gosin China)

◎ : L (LED)

◇ : Product State (A:Normality, B:Bulk, C:First Production, R:Reproduction, S:Sample)

◆ : Year (S:2008, T:2009, U:2010...)

□ : Month (1 ~ 9, A, B)

■ : Day (1 ~ 9, A, B ~ V)

△ : SAMSUNG ELECTRONICS Product Number (1 ~ 999)

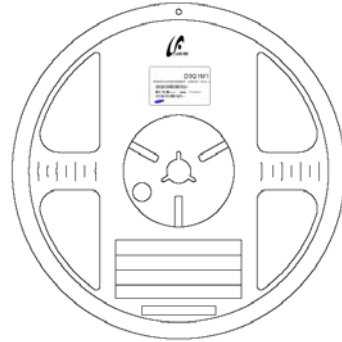
▲ : Reel Number (1 ~ 999)



9. Packing Structure

1) Packing Process

Reel



Aluminum Vinyl Bag



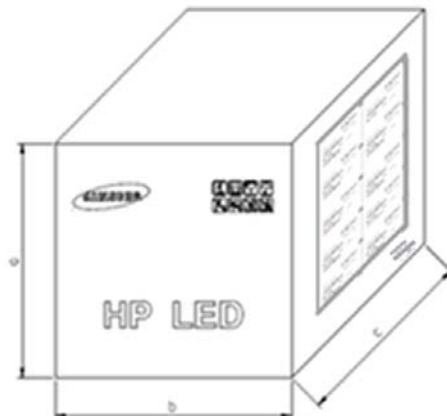
Out Box (Max. 7 Aluminum Vinyl Bag)



Material :

Paper(DW2A/DW(AB))

TYPE	SIZE(mm)		
	a	b	c
7inch	250	225	190



2) Aluminum Packing Bag

CAUTION

This bag contains
MOISTURE SENSITIVE DEVICES

LEVEL

2a

1. Shelf life in sealed bag: 12 months at <math> < 40^{\circ}\text{C}</math> and <math> < 90\%</math> relative humidity (RH)
2. Peak package body temperature: 240 °C
3. After this bag is opened, devices that will be subjected to reflow solder or other high temperature processes must be:
 - a. Mounted within 672 hours at factory conditions of equal to or less than 30°C / 60% RH, or
 - b. Stored at <math> < 10\%</math> RH
4. Devices require bake, before mounting, if:
 - a. Humidity Indicator Card is > 65% when read at $23 \pm 5^{\circ}\text{C}$, or
 - b. 2a is not met.
5. If baking is required, devices must be baked for 1 hours at $60 \pm 5^{\circ}\text{C}$

Note: if device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure,

Bag seal due date: _____
(if blank, see code label)

Note: Level and body temperature by IPC/JEDEC J-STD-020

D4V1G1

SPHWH1L3D30ED4V0G3 D4V1G1 XXXX

●◎◇◆□△△△ / ▲▲▲ / XXXXpcs

U/C: S3C6810X01-Y540

LOT: N42KNMC QTY: 2000 U/W: 1201 AS
S3C6810X01-Y540
ASSEMBLED IN KOREA FROM DIE OF KOREA

ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING

ELECTROSTATIC
SENSITIVE
DEVICES

주의 사항

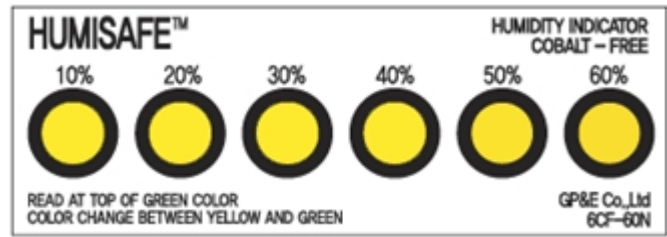
이 알루미늄 지퍼 백은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

습기 및 정전기로부터 제품을 보호 하기 위해서 개봉 후 사용하지 않는 자재는 본 팩에 넣어 보관 하시기 바랍니다. 사용하지 않는 자재를 본 팩에 넣을 때는 반드시 동봉된 드라이 팩과 함께 넣고 지퍼부분을 완전하게 밀봉하여 주시기 바랍니다.

Important

This Al Zipper bag is designed to protect the enclosed products from moisture and ESD. Once opened, the products should be soldered onto the printed circuit board immediately. When not in use, please do not leave the products unprotected by the Al Zipper Bag. To repack unused products., please ensure the zip-lock is completely sealed with the dry pack left inside.

There are Silica Gel and Humidity Indicator Card in the Aluminum Bag



10. Precaution for use

- 1) For over current-protection, customers are recommended to apply resistors connected in series with the LEDs to mitigate sudden change of the forward current caused by shift of the forward voltage.
- 2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When cleaning is required, IPA is recommended as cleaning agent. Solvent-based cleaning agent such as Zestron^(R) may damage the silicone resins used in the device.
- 3) When the device is in operation, the forward current should be carefully determined considering the maximum ambient temperature and the corresponding junction temperature.
- 4) LEDs must be stored in a clean environment. If the LEDs are to be stored for 3 months or more after being shipped from SAMSUNG ELECTRONICS, they should be packed with a nitrogen-filled container.
(Shelf life of sealed bags: 12 months, temp. 0~40°C, 0~90%RH)
- 5) After storage bag is open, device subject to soldering, solder reflow, or other high temperature processes must be:
 - a. Mounted within 672 hours (28 days) at an assembly line with a condition of no more than 30°C/60%RH.
 - b. Stored at <10% RH.
- 6) Repack unused Products with anti-moisture packing, fold to close any opening and then store in a dry place.
- 7) Devices require baking before mounting, if humidity card reading reaches 60% at 23±5°C.
- 8) Devices must be baked for 1hours at 60±5°C, if baking is required.
- 9) The LEDs are sensitive to the static electricity and surge current. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs.
If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices.
Damaged LEDs may show some unusual characteristics such as increase in leakage current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.
- 10) VOCs (volatile organic compounds) can be generated from adhesives, flux, hardener or organic additives used in luminaires (fixtures). Transparent LED silicone encapsulant is permeable to those chemicals and they may lead a discoloration of encapsulant when they expose to heat or light. This phenomenon can cause a significant loss of light emitted(output) from the luminaires(fixture). This phenomenon can give a significant loss of light emitted(output) from the luminaires(fixture). In order to prevent these problems, we recommend you to know the physical properties of materials used in luminaires, They must be selected carefully.



11) Risk of Sulfurization (or Tarnishing)

The LED from Samsung Electronics uses a silver-plated lead frame and its surface color may change to black(or dark colored) when it is exposed to sulfur (S), chlorine (Cl) or other halogen compound. Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution. Due to possible sulfurization of lead frame, LED should not be used and stored together with oxidizing substances made of materials in a following list, : Rubber, plain paper, lead solder cream and so on.



11. Hazard Substance Analysis



Test Report No. P650 101/LF-CTSAVAA13-S1082

Issued Date: 2013. 07. 03 Page 1 of 5

To: SAMSUNG ELECTRONICS CO., LTD
Sam 24, Nonseo-dong
Gijeong-gu
Yongin-si
Gyeonggi-do
Korea

The following merchandise was submitted and identified by the client as :

SGS File No.	: AYAA13-31082
Product Name	: SPHWH1L3D
Item No./Part No.	: Ceramic 3535
Received Date	: 2013. 06. 28
Test Period	: 2013. 07. 01 to 2013. 07. 03
Test Results	: For further details, please refer to following page(s)
Test Performed	: SGS Korea tested the sample(s) selected by applicant with following results.
Job Comments	: By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung / Testing Person

SGS Korea Co., Ltd.
Jeff Jang
Jeff Jang / Chemical Lab Mgr

본 테스트 리포트는 SGS의 테스트 결과에 대한 설명을 제공하며, SGS의 테스트 결과에 대한 책임은 신청자에게 있습니다. 본 리포트는 SGS의 테스트 결과에 대한 설명을 제공하며, SGS의 테스트 결과에 대한 책임은 신청자에게 있습니다. 본 리포트는 SGS의 테스트 결과에 대한 설명을 제공하며, SGS의 테스트 결과에 대한 책임은 신청자에게 있습니다.

P652 Version 2

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Member of the SGS Group (Societe Generale et Simebric)



Test Report No. F650 101/LF-CTSA00A13-31082

Issued Date: 2013.07.03 Page 2 of 5

Sample No. : AYAA13-31082 001
 Sample Description : SPH00H1L3D
 Item No./Part No. : Ceramic 3535
 Material : Al2O3,TiO2,Ag,Silicone,Placipitor

Heavy Metals

Test Item	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-Vis	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Item	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE:

- ① N.D. = Not detected.(= MDL)
- ② mg/kg = ppm
- ③ MDL = Method Detection Limit
- ④ - = No regulation
- ⑤ Negative = Undetectable / Positive = Detectable
- ⑥ * = Quantitative analysis (No Unit)
- ⑦ * = Boiling-water Extraction:
 Negative = Absence of Cr(VI) coating
 Positive = Presence of Cr(VI) coating; the detected concentration in boiling-water extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

SGS reserves the right to modify the test methods and procedures without notice. The test results are for information only and do not constitute a warranty or a guarantee of fitness for any purpose. The test results are subject to the accuracy of the test methods and procedures used. The test results are not valid if the test methods and procedures are not followed. The test results are not valid if the test methods and procedures are not followed. The test results are not valid if the test methods and procedures are not followed.

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F652 Version 5

Member of the SGS Group (Codes for accreditation: 020192010)



Test Report No. P650 101/LF-CTSA/AA13-S1082

Issued Date: 2013. 07. 03 Page 3 of 5

Sample No. : AYAA13-31082.001
 Sample Description : SPHWH1L3D
 Item No./Part No. : Ceramic 3535
 Material : Al2O3, TiO2, Ag, Silicone, Picoceptor

Halogen Content

Test Item	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14582:2007, IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14582:2007, IC	30	N.D.
Fluorine(F)	mg/kg	BS EN 14582:2007, IC	30	N.D.
Iodine(I)	mg/kg	BS EN 14582:2007, IC	50	N.D.



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- ⑦ * = Boiling-water extraction:
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 Positive = Presence of Cr(VI) coating; the detected concentration in boiling-water extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

본 테스트 리포트는 SGS의 SGS 인증을 받은 SGS 검사원이 현장에서 샘플을 채취하고, SGS의 SGS 인증을 받은 SGS 검사실에서 분석한 결과를 나타냅니다. 본 리포트는 SGS의 SGS 인증을 받은 SGS 검사원이 현장에서 샘플을 채취하고, SGS의 SGS 인증을 받은 SGS 검사실에서 분석한 결과를 나타냅니다. 본 리포트는 SGS의 SGS 인증을 받은 SGS 검사원이 현장에서 샘플을 채취하고, SGS의 SGS 인증을 받은 SGS 검사실에서 분석한 결과를 나타냅니다.

P652 Version 5

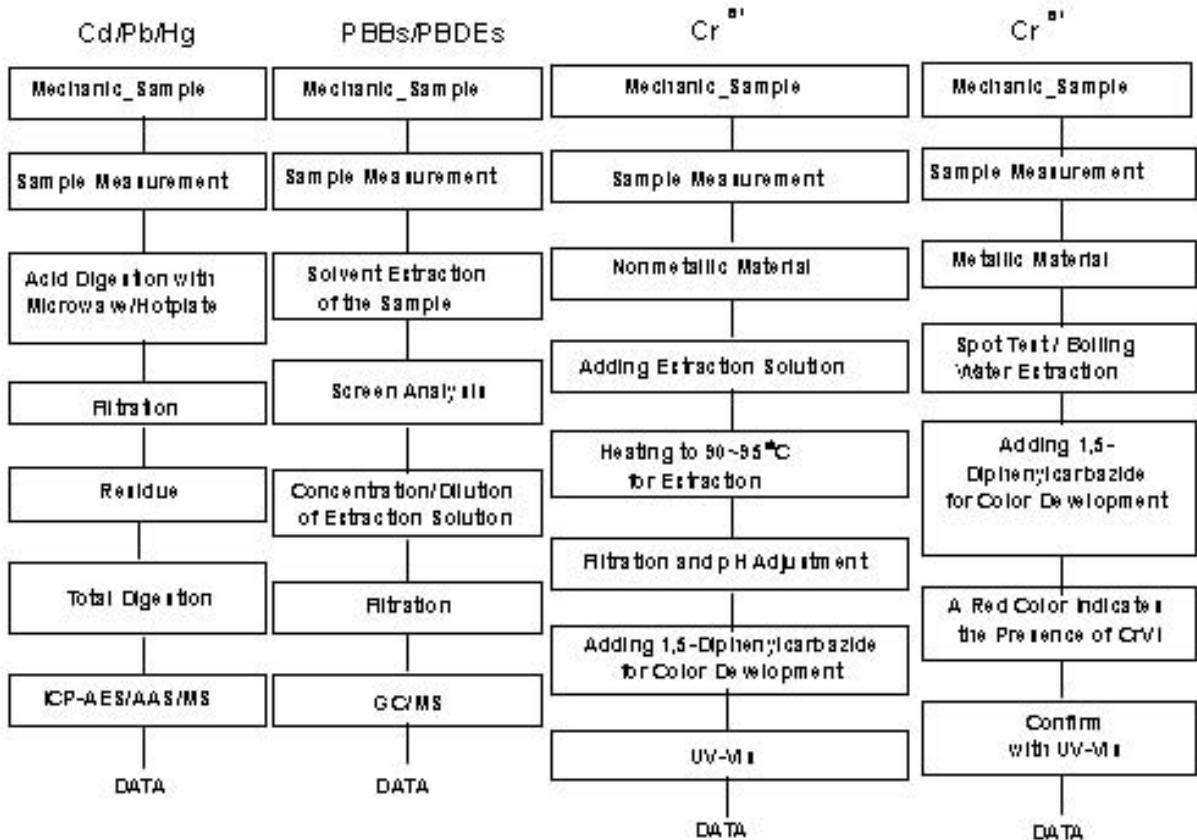
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Member of the SGS Group (Swiss-Group) as a Service Provider



Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr^{VI} /PBBs&PBDEs Testing



The samples were dissolved totally by pre-cooling method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilhae Yi

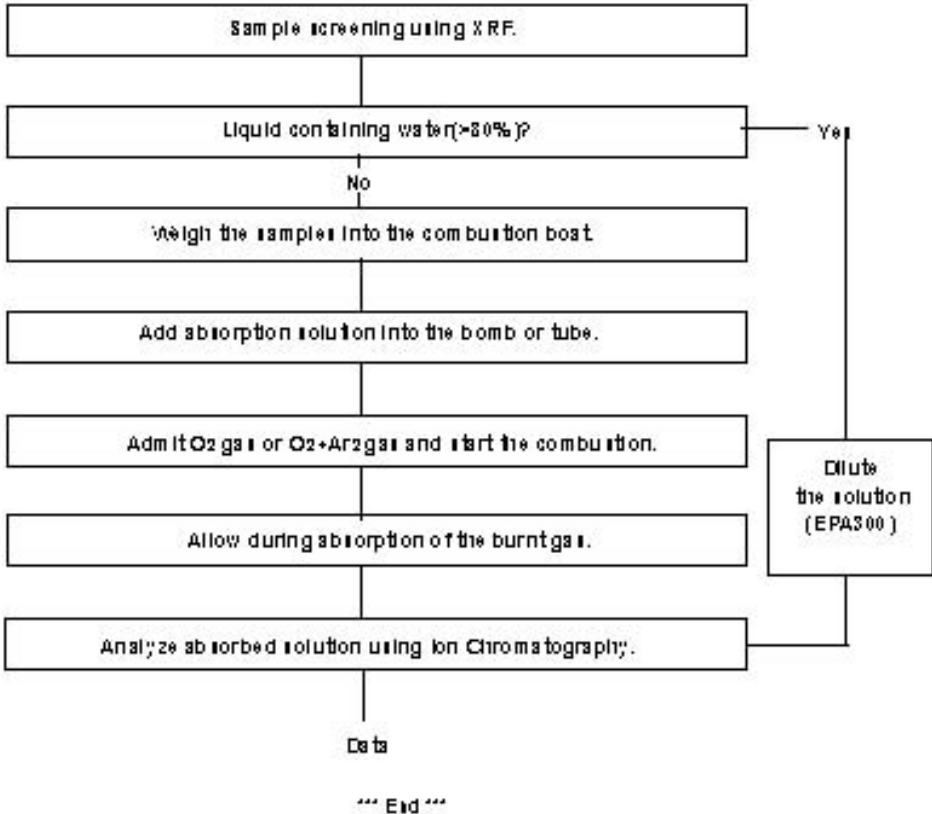
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- ⑦ * = Boiling-water Extractable:
 Negative = Absence of CrVI coating
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본 테스트 리포트는 SGS의 테스트 결과에 대한 설명을 제공하며, SGS는 테스트 결과에 대한 책임이 없습니다. 테스트 결과에 대한 자세한 설명을 위해서는 SGS에 문의하십시오. SGS는 테스트 결과에 대한 책임이 없습니다. 테스트 결과에 대한 자세한 설명을 위해서는 SGS에 문의하십시오.



Flow Chart for Halogen Test



NOTE:

- ① N. D. = Not detected.(<MDL)
- ② mg/kg = ppm
- ③ MDL = Method Detection Limit
- ④ -- = No regulation
- ⑤ Negative = Undetectable / Positive = Detectable
- ⑥ ** = Qualitative analysis (No Unit)
- ⑦ * = Boiling-water extractible:
 Negative = Absence of Cr(VI) coating
 Positive = Presence of Cr(VI) coating; the detected concentration in boiling-water extraction solution is equal or greater than 0.02mg/kg with 50cm² sample surface area.

본 시험은 삼성전기(주)의 영업비밀로, 무단으로 복제, 배포, 전수, 대여, 판매, 또는 기타 방법으로 제3자에게 공개하는 행위는 법적으로 금지되어 있습니다. 본 시험 결과의 정확성을 보장하지 않으며, 본 시험 결과에 대한 책임은 고객에게 있습니다. 본 시험 결과의 사용은 고객에게만 한정되며, 본 시험 결과의 무단 사용에 대해서는 삼성전자가 법적 책임을 지지 않습니다.



Revision History

Date	Revision History	Writer	
		Drawn	Approved
2013.12.03	New version	I.J.PYEON	Y.T.KIM
2013.12.19	<ul style="list-style-type: none">- Added New Flux Rank• 2700K (CRI80) G3 rank• 4000K (CRI70) K3 rank	I.J.PYEON	Y.T.KIM