

LM561B – 5630 Middle Power LED for High CRI



Introduction

Features

- Beam Angle: 120°
- Precondition : JEDEC Level 2a
- Dimension : 5.6 x 3.0 x 0.8 mm
- ESD withstand Voltage : up to ± 5KV [HBM]

Applications

- INDOOR LIGHTING : Ambient Light, LED tube, Down light, LED bulb and Ceiling Light

SAMSUNG ELECTRONICS

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



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1. Product Code Information

1) Luminous Flux Bins ($T_s = 25^\circ\text{C}$)

Nominal CCT	Product Code	Flux Rank	Sorting Condition Im @65mA
			Flux Range (Φ_v , Im)
2700K	SPMWHT541MD7WAW☆S0	SY	20.0 ~ 22.0
		SZ	22.0 ~ 24.0
		S1	24.0 ~ 26.0
3000K	SPMWHT541MD7WAV☆S0	SY	20.5 ~ 22.5
		SZ	22.5 ~ 24.5
		S1	24.5 ~ 26.5
3500K	SPMWHT541MD7WAU☆S0	SY	22.0 ~ 24.0
		SZ	24.0 ~ 26.0
		S1	26.0 ~ 28.0
4000K	SPMWHT541MD7WAT☆S0	SY	23.0 ~ 25.0
		SZ	25.0 ~ 27.0
		S1	27.0 ~ 29.0

Notes:

- 1) SAMSUNG ELECTRONICS maintains a tolerance of ±5% on Luminous Flux measurements.
- 2) Warm white : "☆" can be "0"(Whole Bin), "H"(Half Bin) or "M"(Quarter Bin) of the color binning.

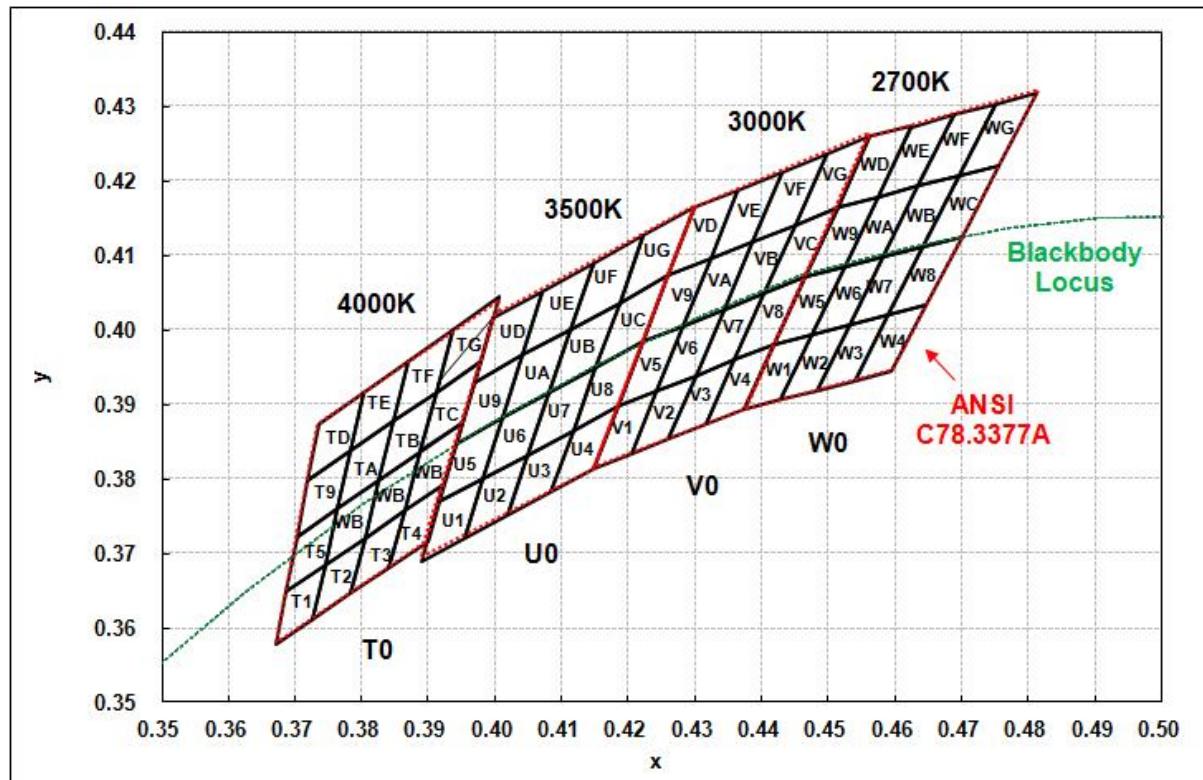


2) Color Bins ($T_s = 25^\circ\text{C}$)

2-1) Color Binning

Nominal CCT	Product Code	Color Rank	Chromaticity Bins
2700K	SPMWHT541MD7WAW0S0	W0(Whole bin)	W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG
	SPMWHT541MD7WAWHS0	WH(Half bin)	W5, W6, W7, W8 W9, WA, WB, WC
	SPMWHT541MD7WAWMS0	WM(Quarter bin)	W6, W7, WA, WB
3000K	SPMWHT541MD7WAV0S0	V0(Whole bin)	V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG
	SPMWHT541MD7WAVHS0	VH(Half bin)	V5, V6, V7, V8 V9, VA, VB, VC
	SPMWHT541MD7WAVMS0	VM(Quarter bin)	V6, V7, VA, VB
3500K	SPMWHT541MD7WAV0S0	U0(Whole bin)	U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG
	SPMWHT541MD7WAVHS0	UH(Half bin)	U5, U6, U7, U8 U9, UA, UB, UC
	SPMWHT541MD7WAVMS0	UM(Quarter bin)	U6, U7, UA, UB
4000K	SPMWHT541MD7WAT0S0	T0(Whole bin)	T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG
	SPMWHT541MD7WATHS0	TH(Half bin)	T5, T6, T7, T8, T9, TA, TB, TC
	SPMWHT541MD7WATMS0	TM(Quarter bin)	T6, T7, TA, TB

2-2) Chromaticity Region & Coordinates



2-3) Chromaticity Region & Coordinates

Region	CIE X	CIE Y	Region	CIE X	CIE Y
W rank (2700K)					
W1	0.4373	0.3893	W9	0.4465	0.4071
	0.4418	0.3981		0.4513	0.4164
	0.4475	0.3994		0.4573	0.4178
	0.4428	0.3906		0.4523	0.4085
W2	0.4428	0.3906	WA	0.4523	0.4085
	0.4475	0.3994		0.4573	0.4178
	0.4532	0.4008		0.4634	0.4193
	0.4483	0.3919		0.4582	0.4099
W3	0.4483	0.3919	WB	0.4582	0.4099
	0.4532	0.4008		0.4634	0.4193
	0.4589	0.4021		0.4695	0.4207
	0.4538	0.3931		0.4641	0.4112
W4	0.4538	0.3931	WC	0.4641	0.4112
	0.4589	0.4021		0.4695	0.4207
	0.4646	0.4034		0.4756	0.4221
	0.4593	0.3944		0.4700	0.4126
W5	0.4418	0.3981	WD	0.4513	0.4164
	0.4465	0.4071		0.4562	0.4260
	0.4523	0.4085		0.4624	0.4274
	0.4475	0.3994		0.4573	0.4178
W6	0.4475	0.3994	WE	0.4573	0.4178
	0.4523	0.4085		0.4624	0.4274
	0.4582	0.4099		0.4687	0.4289
	0.4532	0.4008		0.4634	0.4193
W7	0.4532	0.4008	WF	0.4634	0.4193
	0.4582	0.4099		0.4687	0.4289
	0.4641	0.4112		0.4750	0.4304
	0.4589	0.4021		0.4695	0.4207
W8	0.4589	0.4021	WG	0.4695	0.4207
	0.4641	0.4112		0.4750	0.4304
	0.4700	0.4126		0.4813	0.4319
	0.4646	0.4034		0.4756	0.4221

Region	CIE X	CIE Y	Region	CIE X	CIE Y
V rank (3000K)					
V1	0.4147	0.3814	V9	0.4221	0.3984
	0.4183	0.3898		0.4259	0.4073
	0.4242	0.3919		0.4322	0.4096
	0.4203	0.3833		0.4281	0.4006
V2	0.4203	0.3833	VA	0.4281	0.4006
	0.4242	0.3919		0.4322	0.4096
	0.4300	0.3939		0.4385	0.4119
	0.4259	0.3853		0.4342	0.4028
V3	0.4259	0.3853	VB	0.4342	0.4028
	0.4300	0.3939		0.4385	0.4119
	0.4359	0.3960		0.4449	0.4141
	0.4316	0.3873		0.4403	0.4049
V4	0.4316	0.3873	VC	0.4403	0.4049
	0.4359	0.3960		0.4449	0.4141
	0.4418	0.3981		0.4513	0.4164
	0.4373	0.3893		0.4465	0.4071
V5	0.4183	0.3898	VD	0.4259	0.4073
	0.4221	0.3984		0.4299	0.4165
	0.4281	0.4006		0.4364	0.4188
	0.4242	0.3919		0.4322	0.4096
V6	0.4242	0.3919	VE	0.4322	0.4096
	0.4281	0.4006		0.4364	0.4188
	0.4342	0.4028		0.4430	0.4212
	0.4300	0.3939		0.4385	0.4119
V7	0.4300	0.3939	VF	0.4385	0.4119
	0.4342	0.4028		0.4430	0.4212
	0.4403	0.4049		0.4496	0.4236
	0.4359	0.3960		0.4449	0.4141
V8	0.4359	0.3960	VG	0.4449	0.4141
	0.4403	0.4049		0.4496	0.4236
	0.4465	0.4071		0.4562	0.4260
	0.4418	0.3981		0.4513	0.4164

2) Chromaticity Region & Coordinates (Continued)

Region	CIE X	CIE Y	Region	CIE X	CIE Y
U rank (3500K)					
U1	0.3889	0.3690	U9	0.3941	0.3848
	0.3915	0.3768		0.3968	0.3930
	0.3981	0.3800		0.4040	0.3966
	0.3953	0.3720		0.4010	0.3882
U2	0.3953	0.3720	UA	0.4010	0.3882
	0.3981	0.3800		0.4040	0.3966
	0.4048	0.3832		0.4113	0.4001
	0.4017	0.3751		0.4080	0.3916
U3	0.4017	0.3751	UB	0.4080	0.3916
	0.4048	0.3832		0.4113	0.4001
	0.4116	0.3865		0.4186	0.4037
	0.4082	0.3782		0.4150	0.3950
U4	0.4082	0.3782	UC	0.4150	0.3950
	0.4116	0.3865		0.4186	0.4037
	0.4183	0.3898		0.4259	0.4073
	0.4147	0.3814		0.4221	0.3984
U5	0.3915	0.3768	UD	0.3968	0.3930
	0.3941	0.3848		0.3996	0.4015
	0.4010	0.3882		0.4071	0.4052
	0.3981	0.3800		0.4040	0.3966
U6	0.3981	0.3800	UE	0.4040	0.3966
	0.4010	0.3882		0.4071	0.4052
	0.4080	0.3916		0.4146	0.4089
	0.4048	0.3832		0.4113	0.4001
U7	0.4048	0.3832	UF	0.4113	0.4001
	0.4080	0.3916		0.4146	0.4089
	0.4150	0.3950		0.4222	0.4127
	0.4116	0.3865		0.4186	0.4037
U8	0.4116	0.3865	UG	0.4186	0.4037
	0.4150	0.3950		0.4222	0.4127
	0.4221	0.3984		0.4299	0.4165
	0.4183	0.3898		0.4259	0.4073

Region	CIE X	CIE Y	Region	CIE X	CIE Y
T rank (4000K)					
T1	0.367	0.3578	T9	0.3702	0.3722
	0.3726	0.3612		0.3763	0.376
	0.3744	0.3685		0.3782	0.3837
	0.3686	0.3649		0.3719	0.3797
T2	0.3726	0.3612	TA	0.3763	0.3760
	0.3783	0.3646		0.3825	0.3798
	0.3804	0.3721		0.3847	0.3877
	0.3744	0.3685		0.3782	0.3837
T3	0.3783	0.3646	TB	0.3825	0.3798
	0.3840	0.3681		0.3887	0.3836
	0.3863	0.3758		0.3912	0.3917
	0.3804	0.3721		0.3847	0.3877
T4	0.384	0.3681	TC	0.3887	0.3837
	0.3898	0.3716		0.395	0.3875
	0.3924	0.3794		0.3978	0.3958
	0.3863	0.3758		0.3912	0.3917
T5	0.3686	0.3649	TD	0.3719	0.3797
	0.3744	0.3685		0.3782	0.3837
	0.3763	0.376		0.3802	0.3916
	0.3702	0.3722		0.3736	0.3874
T6	0.3744	0.3685	TE	0.3782	0.3837
	0.3804	0.3721		0.3847	0.3877
	0.3825	0.3798		0.3869	0.3958
	0.3763	0.376		0.3802	0.3916
T7	0.3804	0.3721	TF	0.3847	0.3877
	0.3863	0.3758		0.3912	0.3917
	0.3887	0.3836		0.3937	0.4001
	0.3825	0.3798		0.3869	0.3958
T8	0.3863	0.3758	TG	0.3912	0.3917
	0.3924	0.3794		0.3978	0.3958
	0.395	0.3875		0.4006	0.4044
	0.3887	0.3836		0.3937	0.4001

Notes: SAMSUNG ELECTRONICS maintains ± 0.005 tolerance of Cx, Cy



2. Characteristics

1) Absolute Maximum Rating

Item	Symbol	Rating	Condition
Operating temperature range	T_{op}	-40°C ~ +85°C	-
Storage temperature range	T_{stg}	-40°C ~ +120°C	-
LED junction temperature	T_J	110°C	-
Forward Current	I_F	150 mA	-
Peak Pulsed Forward Current	I_{FP}	300 mA	Duty 1/10 pulse width 10ms
Thermal resistance	$R_{th, j-s}$	16°C/W	Junction to solder point
Assembly Process Temperature	-	260°C, < 10sec	-
ESD	-	5kV	HBM

2) Electro-optical Characteristics

Item	Unit	Nominal CCT	Product Code	Rank	Min	Typ	Max	
Forward Voltage (V_F) (@65 mA, $T_s = 25^\circ C$)	V	-	-	WA	AZ	2.70	-	2.80
					A1	2.80	-	2.90
					A2	2.90	-	3.00
					A3	3.00	-	3.10
					A4	3.10	-	3.20
Luminous Flux (Φ_v) (@65 mA, $T_s = 25^\circ C$)	lm	2700K (W★)	*WAW★S0	SY	20.0	-	22.0	
					SZ	22.0	-	24.0
				S1	24.0	-	26.0	
		3000K (V★)	*WAV★S0	SY	20.5	-	22.5	
					SZ	22.5	-	24.5
				S1	24.5	-	26.5	
		3500K (U★)	*WAU★S0	SY	22.0	-	24.0	
					SZ	24.0	-	26.0
				S1	26.0	-	28.0	
		4000K (T★)	*WAT★S0	SY	23.0	-	25.0	
					SZ	25.0	-	27.0
				S1	27.0	-	29.0	
Reverse Voltage (@5 mA, $T_s = 25^\circ C$)	V	-	-	-	0.7	-	1.2	
Color Rendering Index(R_a)	-	-	-	7	90	-	-	
Special CRI (R9)	-	-	-	-	50	-	-	

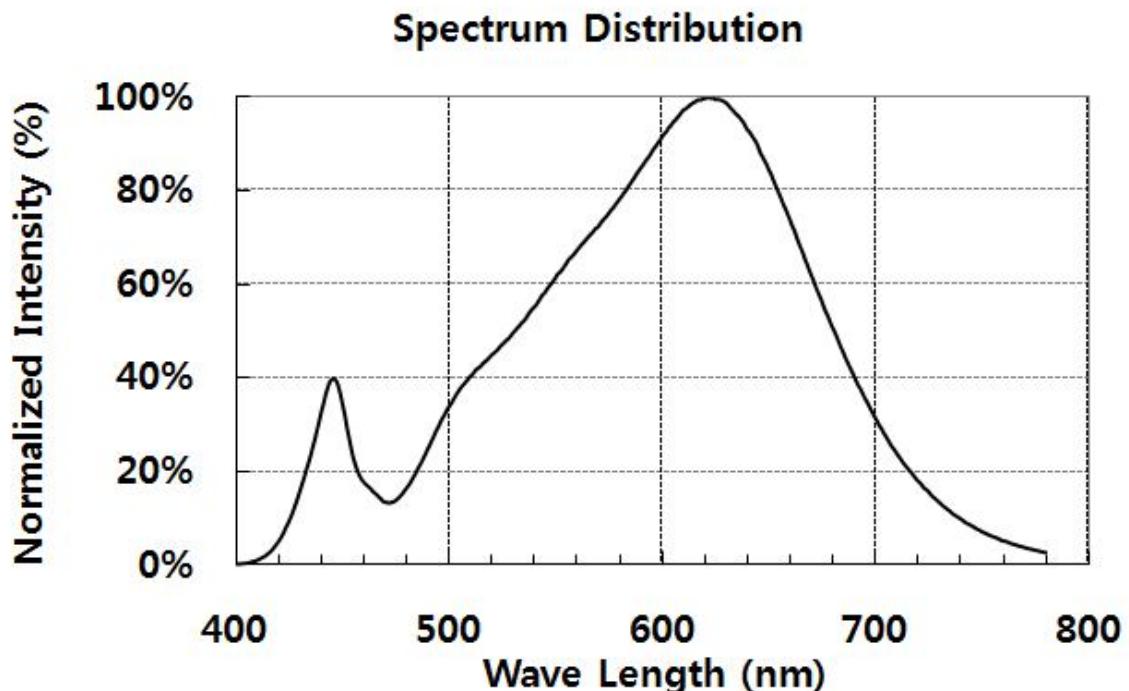
Notes:

- 1) SAMSUNG ELECTRONICS maintains a tolerance of $V_F \pm 0.1$ V, $\Phi_v \pm 5\%$, $R_a \pm 3.0$, $R9 \pm 6.5$ on measurements
- 2) " * " is Product Code of "SPMWH◆541MD7".

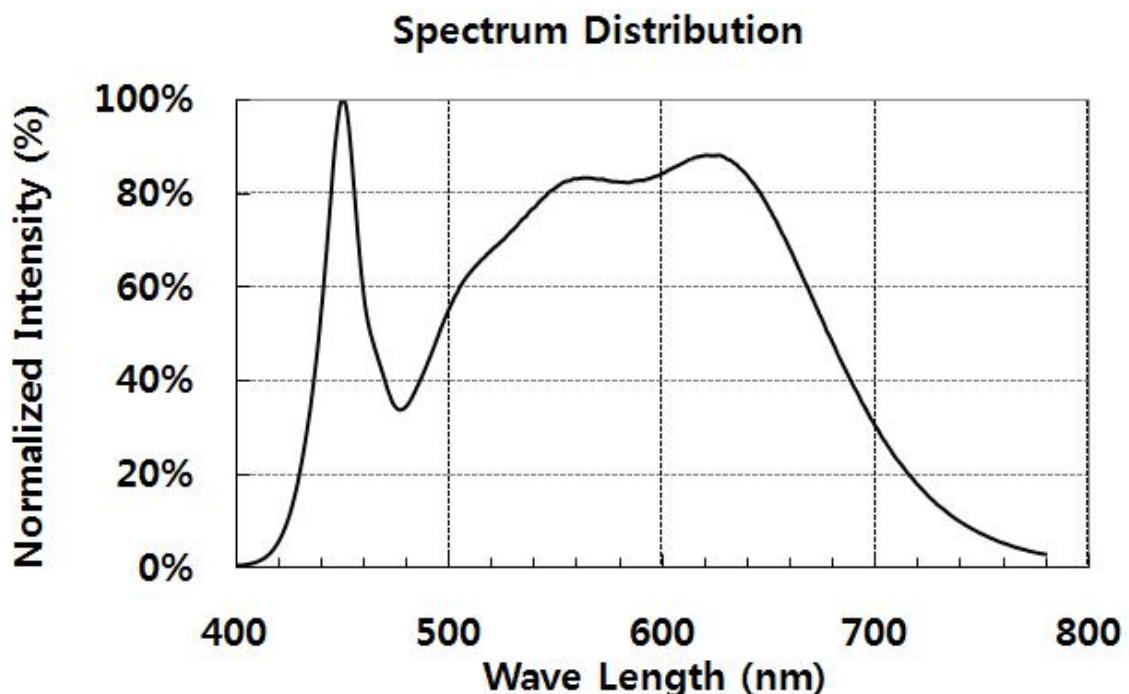
3. Typical Characteristics Graph ($T_s = 25^\circ\text{C}$)

1) Spectrum Distribution

[CCT : 2700K & 3000K]



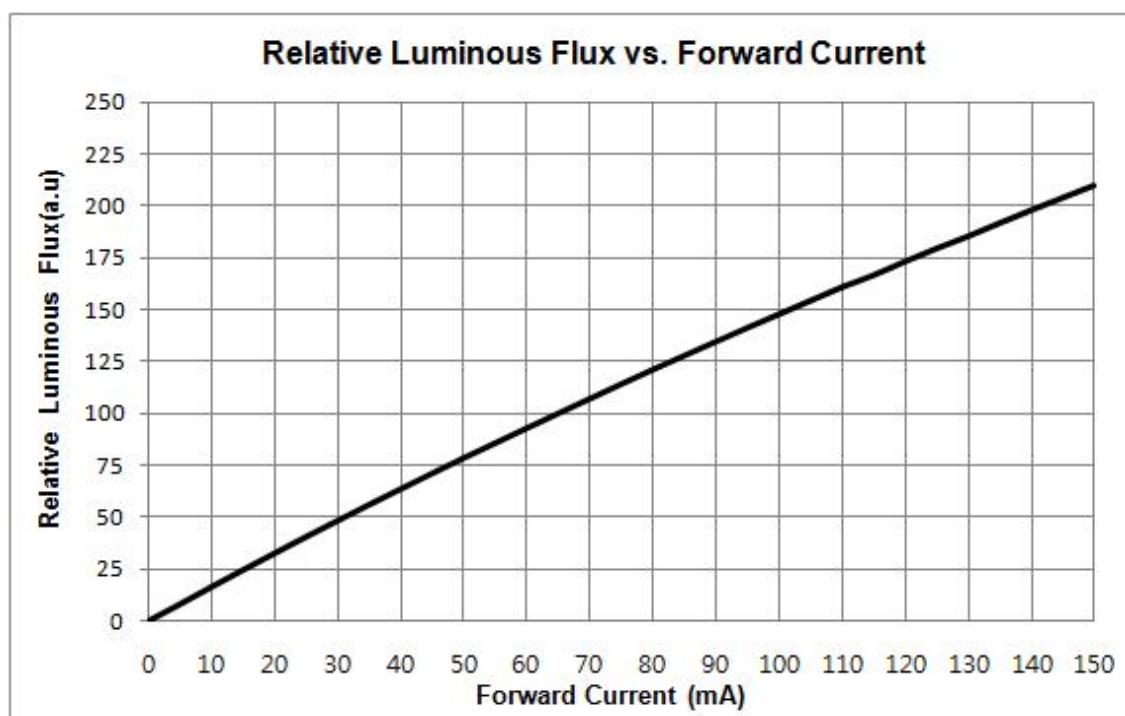
[CCT : 3500K & 4000K]



2) Forward Current Characteristics

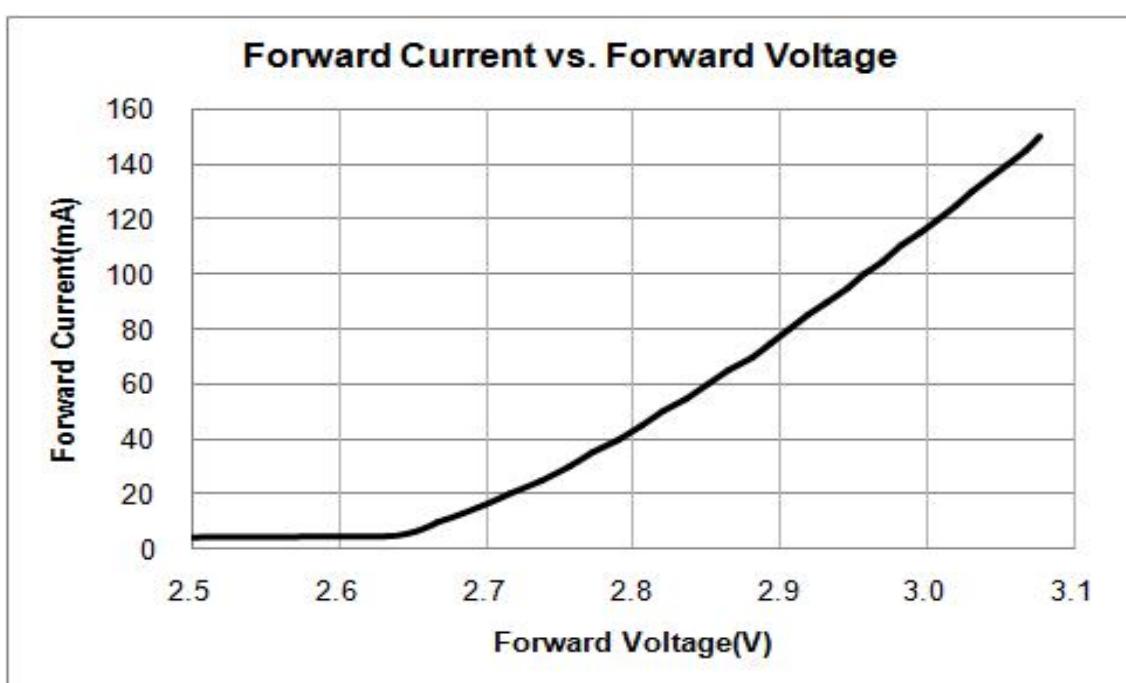
[Relative Luminous Flux vs. Forward Current]

($T_s = 25^\circ\text{C}$)



[Forward Current vs. Forward Voltage]

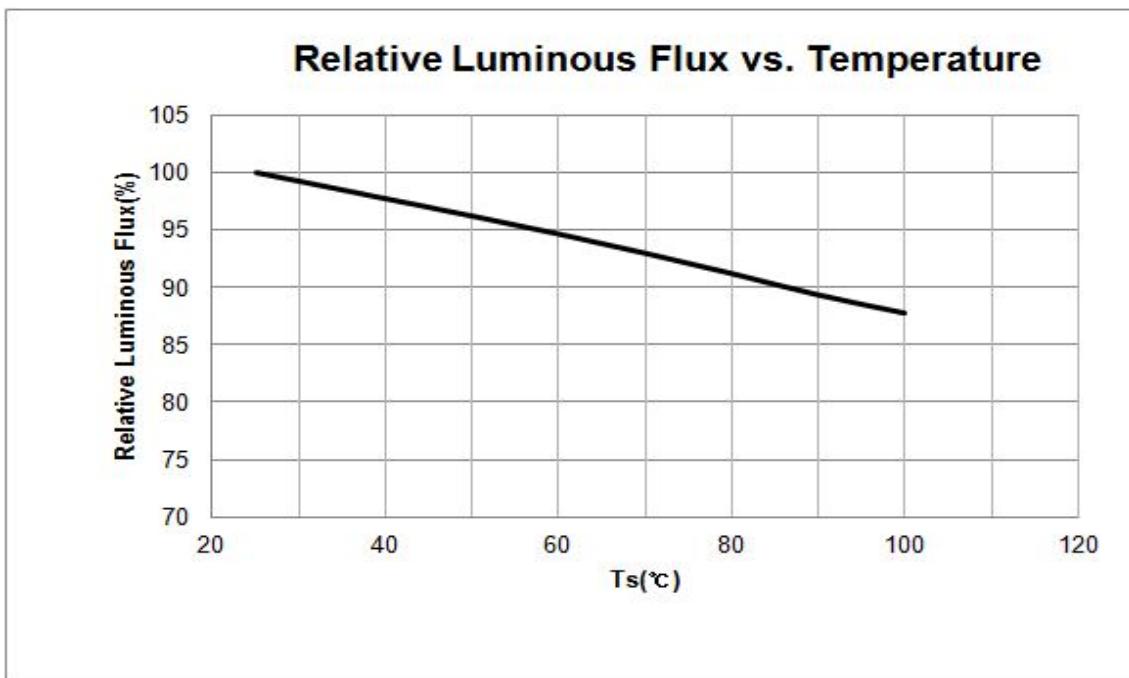
($T_s = 25^\circ\text{C}$)



3) Temperature Characteristics

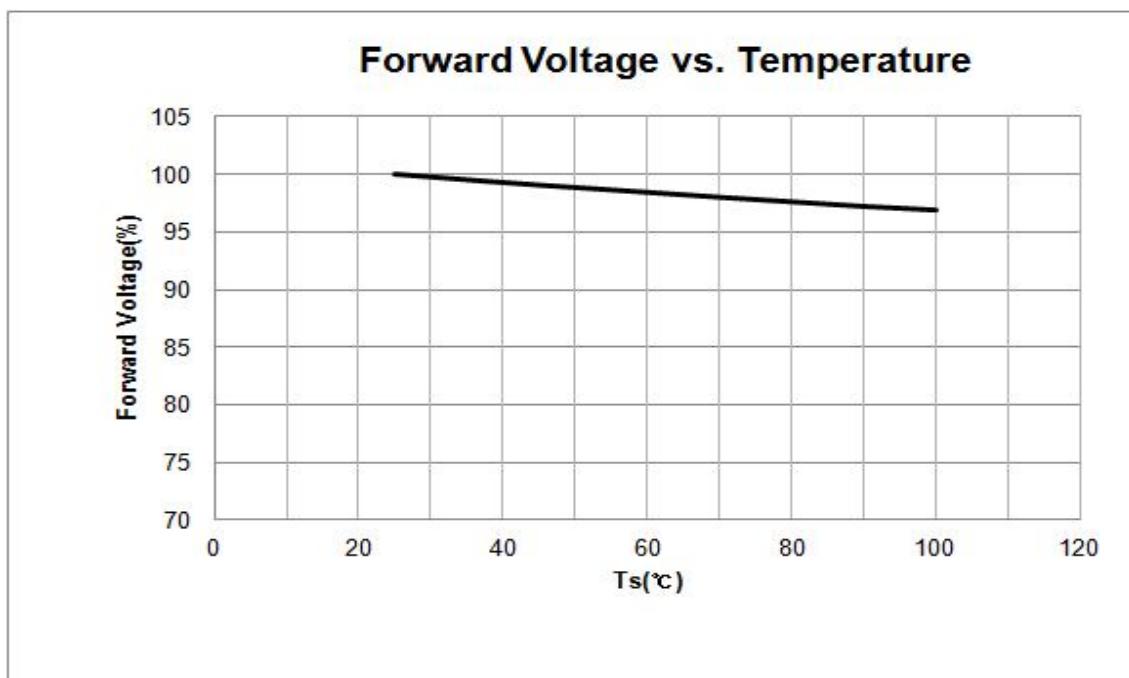
[Relative Luminous Flux vs. Ts]

($I_F = 65mA$)



[Forward Voltage vs. Ts]

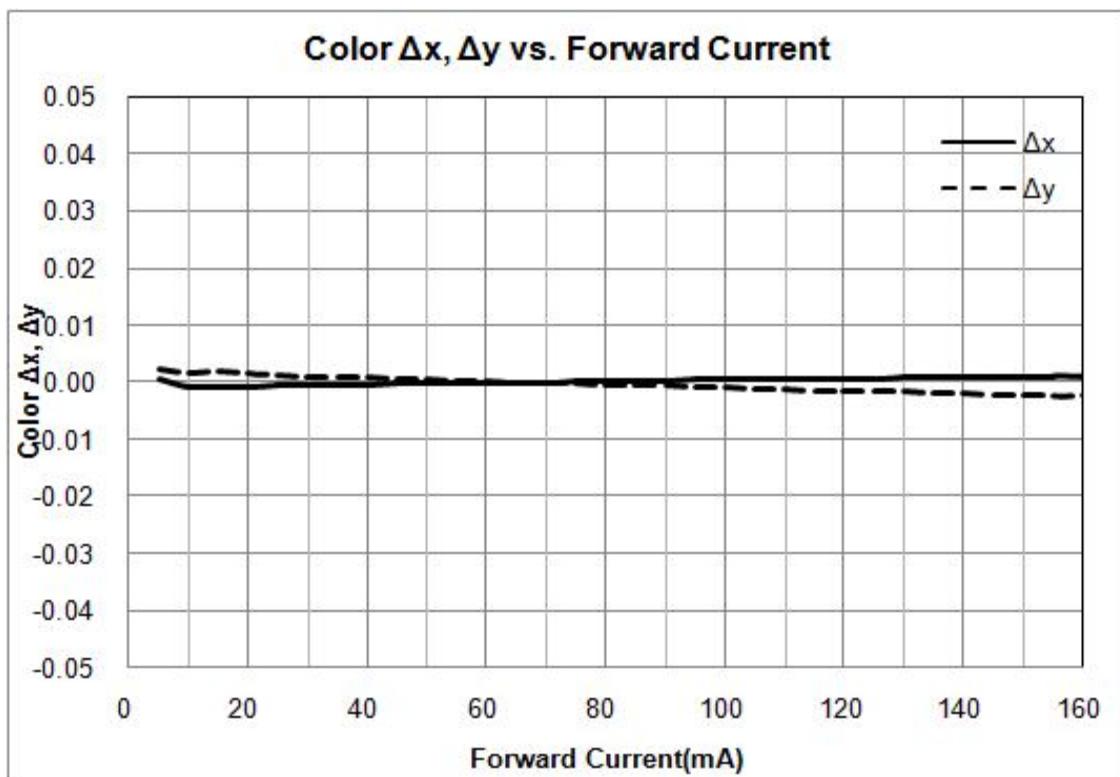
($I_F = 65mA$)



4) Color shift Characteristics

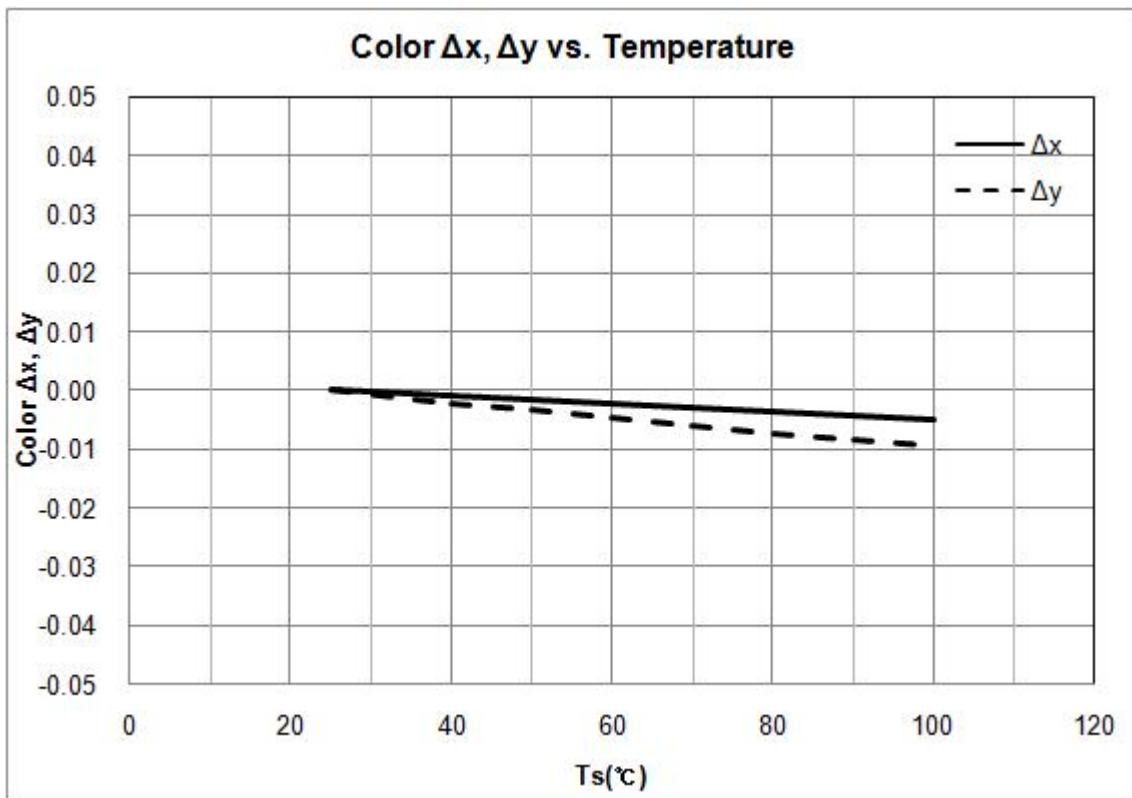
[Color Δx , Δy vs. Forward Current]

($T_s = 25^\circ\text{C}$)

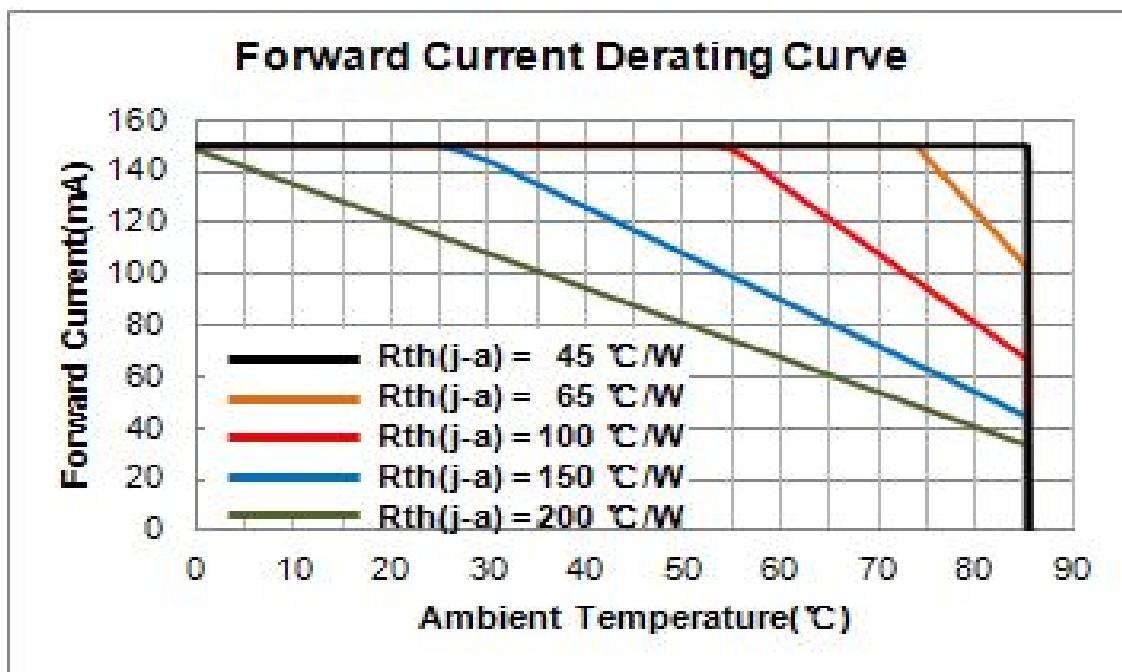


[Color Δx , Δy vs. T_s]

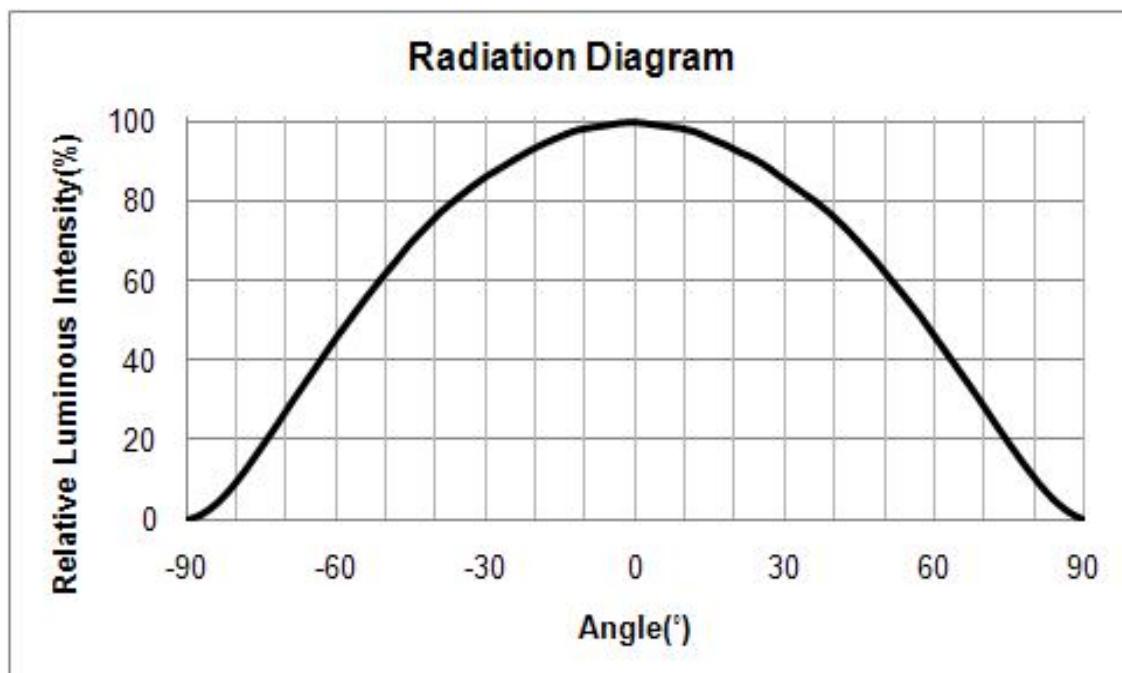
($I_F = 65\text{mA}$)



5) Derating Curve



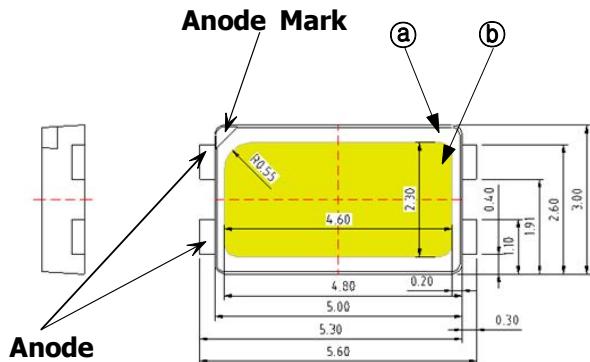
6) Beam Angle Characteristics



4. Outline Drawing & Dimension

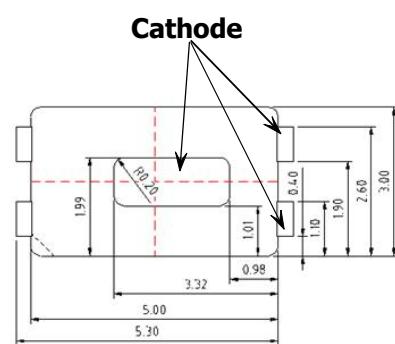
1. Tolerance is ± 0.10 mm
2. The maximum compressing force is 15N on the body ①
3. Do not place pressure on the encapsulation resin ②

Left Side View

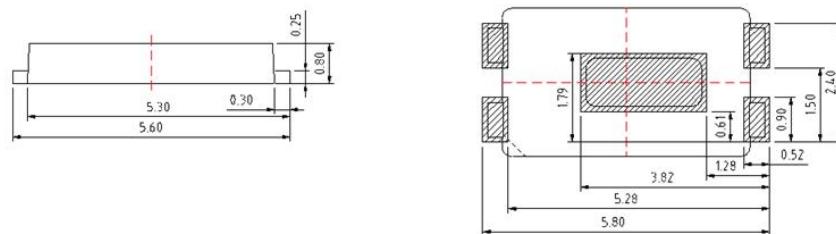


Top View

Bottom View



Front View



Recommended Land Pattern

Notes:

- 1) This LED has built-in ESD protection device(s) connected in parallel to LED Chip(s).
- 2) Ts point & measurement method
 - ① Measure the nearest point to the thermal pad. If necessary, remove PSR of PCB to reach Ts point.
 - ② Thermal pad must be soldered to the PCB to dissipate heat properly. Otherwise, LED can be damaged.
- 3) Precautions
 - ① The pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid the strong pressure on the LEDs. Do not put stress on the LEDs during heating.
 - ② Re-soldering should not be done after the LEDs have been soldered. If re-soldering is unavoidable, LED's characteristics should be carefully checked before and after such repair.
 - ③ Do not stack assembled PCBs together. Since materials of LEDs is soft, abrasion between two PCB assembled with LED might cause catastrophic failure of the LEDs.

5. Reliability Test Items and Conditions

1) Test Items

Test Item	Test Conditions		Test Hours/Cycles	Sample No
MSL Test	125 °C 24hrs drying → 60 °C, 60 %RH 120hrs → 260 °C 10sec 3 cycles		1 cycle	11
Room Temperature life test	25 °C±3 °C, DC150 mA		1,000 hrs	22
High Temperature life test	85 °C±3 °C, DC150 mA		1,000 hrs	22
High Temperature humidity life test	85 °C±3 °C, 85 %±2 %RH, DC150 mA		1,000 hrs	22
Low Temperature life test	-40 °C±3 °C, DC150 mA		1,000 hrs	22
Powered Temperature Cycle test	-45°C/20 min ↔ 85°C/20 min, Sweep 100min cycle on/off: each 5 min, DC 150mA		100 cycle	22
Thermal Shock	-45 °C/15 min ↔ 125 °C/15 min → Hot plate 180 °C		500 cycle	100
High Temperature Storage	Ta=120 °C±3 °C		1000 hrs	11
Low Temperature Storage	Ta=-40 °C±3 °C		1000 hrs	11
ESD(HBM)		R1:10 MΩ, R2:1.5 kΩ, C:100 pF, V = ±5 kV	5 times	5
ESD(MM)		R1:10 MΩ, R2: 0, C:200 pF, V = ±0.5 kV	5 times	5
Vibration Test	20~2000~20 Hz 200 m/SZ, Sweep 4 min X, Y, Z 3 direction, each 1 cycle		4 cycles	11
Mechanical Shock Test	1500G, 0.5 ms, 3 shocks each X-Y-Z axis		5 cycles	11

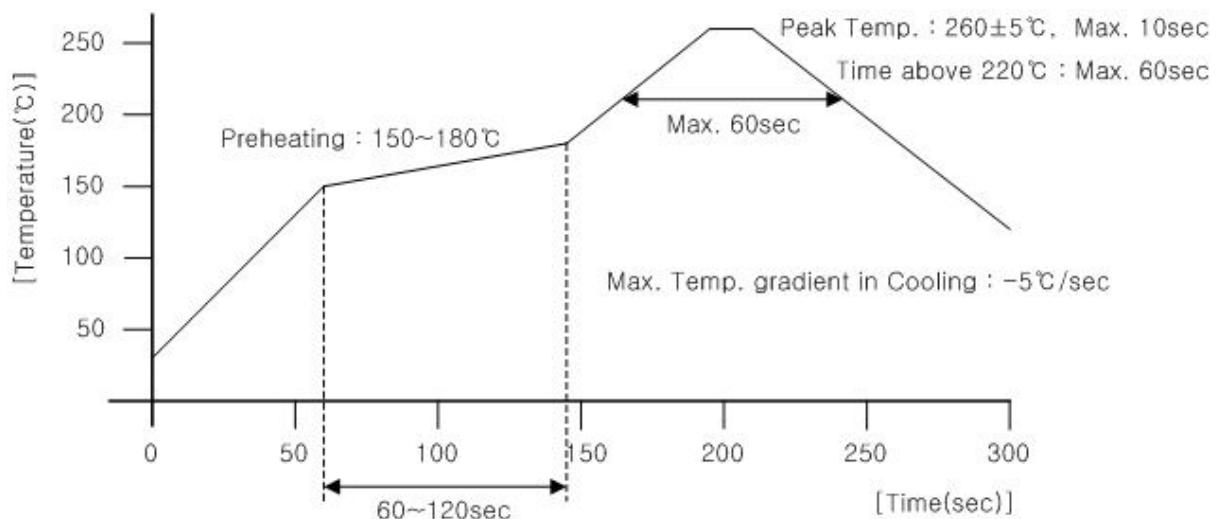
2) Criteria for Judging the Damage

Item	Symbol	Test Condition	Limit	
			Min	Max
Forward Voltage	V_F	$I_F = 65 \text{ mA}$	Init. Value*0.9	Init. Value*1.1
Luminous Flux	Φ_v	$I_F = 65 \text{ mA}$	Init. Value*0.7	Init. Value*1.2

6. Solder Conditions

1) Reflow Conditions (Pb Free)

Reflow Frequency : 2 times max.

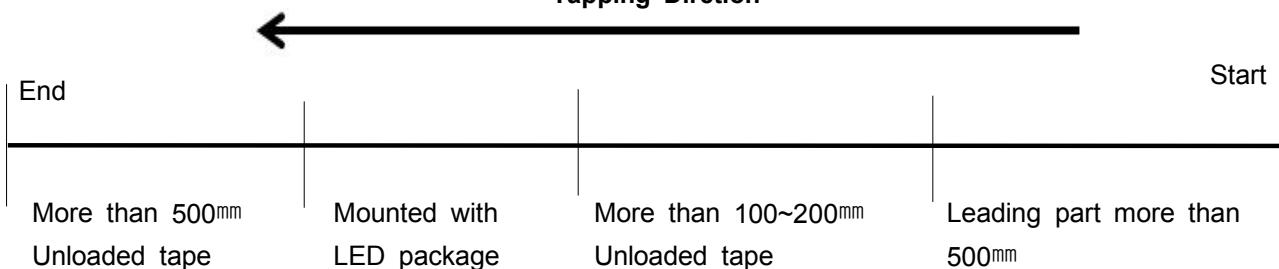
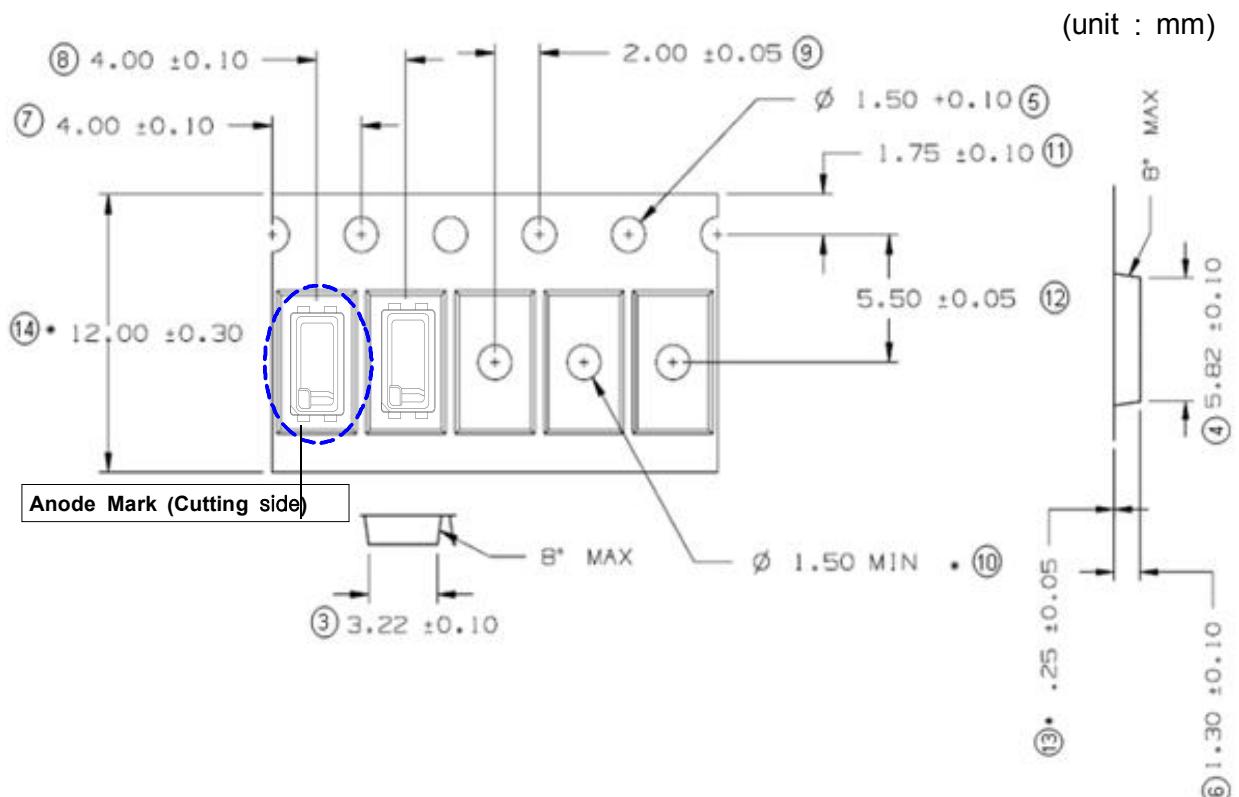


2) For Manual Soldering

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

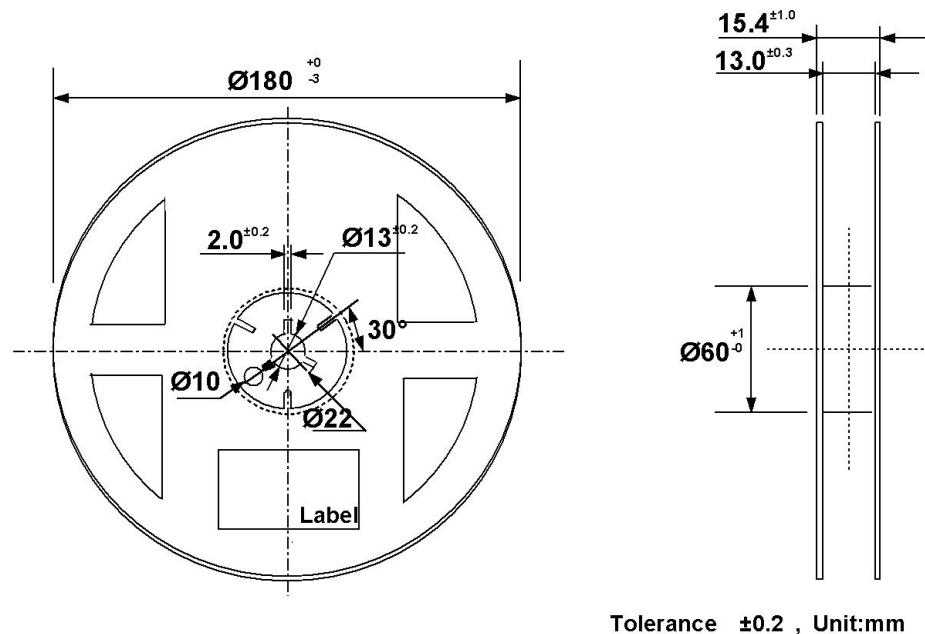
7. Tape & Reel

1) Taping Dimension



2) Reel

1) Reel Dimension (max 2,500 pcs)



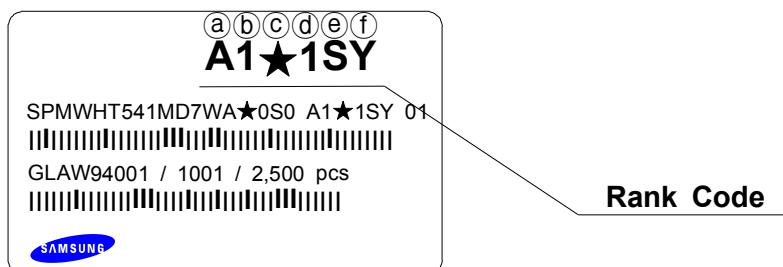
Tolerance ± 0.2 , Unit:mm

- (1) Quantity : The quantity/Reel to be 2,500 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°C 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



N.B) Denoted rank is the only example.

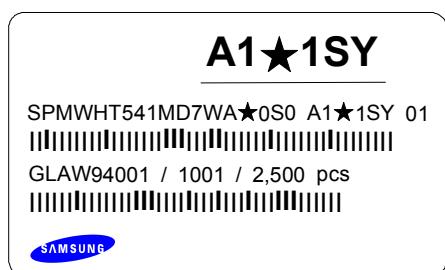
'★' means All kind of Chromaticity Coordinate Rank.

Rank Code

- ⓐⓑ : Forward Voltage(V_F) Rank (refer to page. 7)
- ⓒⓓ : Chromaticity Coordinate Rank (refer to page. 5~6)
- ⓔⓕ : Luminous Flux(Φ_v , lm) Rank (refer to page. 3)

2) LOT Number

The Lot number is composed of the following characters



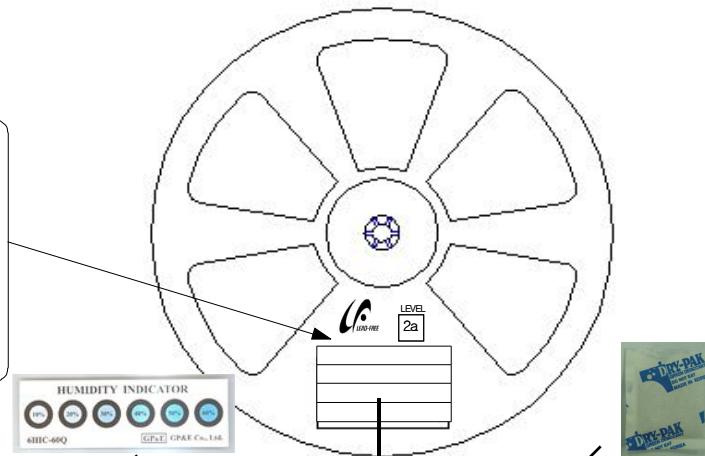
①②③④⑤⑥⑦⑧⑨ / 1ⓐⓑⓒ / 2,500 PCS

- ① : Production Site (S:SAMSUNG ELECTRONICS, G:TIAJIN CHINA)
- ② : L (LED)
- ③ : Product State (A:Normality, B:Bulk, C:First Production, R:Reproduction, S:Sample)
- ④ : Year (V:2011, W:2012, X:2013...)
- ⑤ : Month (1 ~ 9, A, B)
- ⑥ : Day (1 ~ 9, A, B ~ V)
- ⑦⑧⑨ : SAMSUNG ELECTRONICS LED Product number (1 ~ 999)
- ⓐⓑⓒ : Reel Number (1 ~ 999)

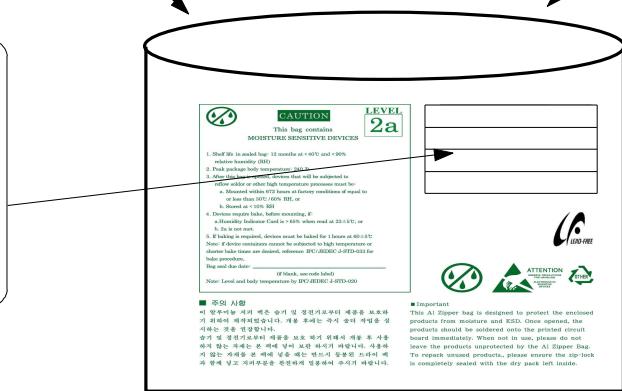
9. Packing Structure

1) Packing Process (The quantity of PKG on the Reel to be Max 2,500 pcs)

Reel



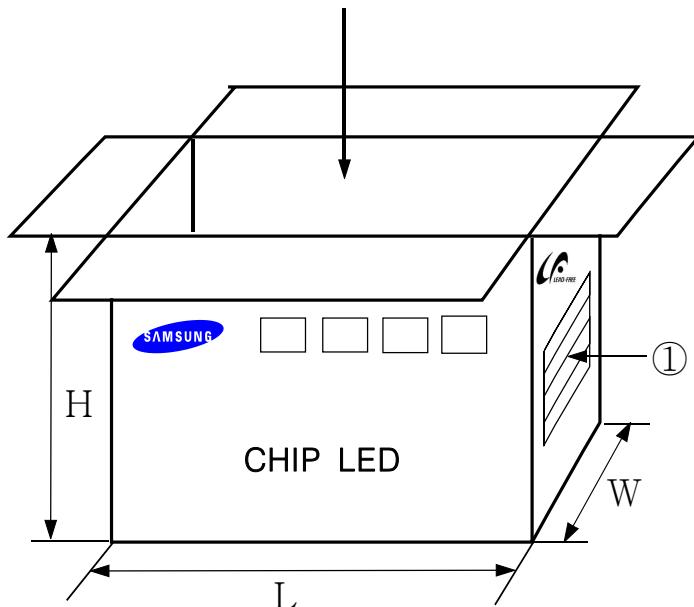
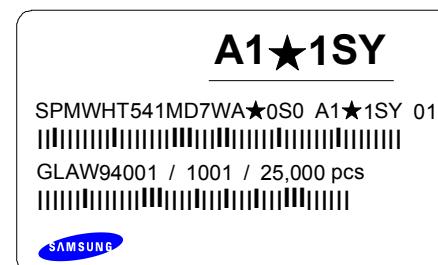
Aluminum Vinyl Bag



Material : Paper(SW3B(B))

TYPE	SIZE(mm)		
	L	W	H
7inch	245±5	220±5	182±5

① SIDE



2) Aluminum Packing Bag

 **CAUTION**

This bag contains
MOISTURE SENSITIVE DEVICES

LEVEL 2a

1. Shelf life in sealed bag: 12 months at < 40°C and < 90% 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 < 10% RH
 4. Devices require bake, before mounting, if:
 a. Humidity Indicator Card is > 65% when read at 23±5°C, or
 b. 2a is not met.
 5. If baking is required, devices must be baked for 1 hours at 60±5°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

A1★1SY

SPMWHT541MD7WA★0S0 A1★1SY 01

GLAW94001 / 1001 / 2,500 pcs







ATTENTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES



OTHER

■ 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.

Silica gel & Humidity Indicator Card in Aluminum Vinyl Bag



10. Precaution for use

- 1) For over-current-proof function, customers are recommended to apply resistors to prevent sudden change of the current caused by slight shift of the voltage.
과전류 방지를 위해 전압의 미세한 이동에 의해 야기되는 전류의 순간 변화를 방지하기 위해 저항 등의 설치를 권장함.
- 2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When washing is required, IPA is recommended to use.
제품은 물, 오일, 유기물과 같은 액체 타입에서의 사용은 제한되며, 세정이 필요할 시에는 IPA 사용을 권장함.
- 3) When the LEDs illuminate, operating current should be decided after considering the ambient maximum temperature.
LED의 발광 시, 동작 전류는 주변 최고온도를 고려하여 결정되어야 함.
- 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 by a sealed container with nitrogen gas injected.(Shelf life of sealed bags: 12 months, temp. ~40°C, ~90%RH)
LED의 보관은 청정한 환경에서 보존되어져야 하며, 만약 삼성전자로부터 공급받는 후 3개월 또는 그 이상 보관이 필요하다면 질소 가스를 동봉한 보존용기에 보관되어야 함.
(보존 bag의 수명 : 12 개월, 보존 온도 ~40°C, 습도 ~90%RH)
- 5) After storage bag is open, device subjected to soldering, solder reflow, or other high temperature processes must be:
보존 Bag이 개봉된 후에, 납땜이나 reflow등의 높은 온도에 노출되는 제품은 다음의 사항에 부합되어야 함.
 - a. Mounted within 672 hours(28 days) at an assembly line with a condition of no more than 30°C/60%RH,
a. 제품은 30°C/60%RH보다 같거나 낮은 조립조건에서 672시간(28일)이내에 조립해야 함.
 - b. Stored at <10%RH.
b. 10% 이하의 상대습도에서 보관되어야 함.
- 6) Repack unused Products with anti-moisture packing, fold to close any opening and then store in a dry place.
사용하지 않은 제품은 방습팩에 넣어 개봉 부위를 닫아서 다시 포장한 후, 건조한 장소에서 보관할 것을 권장함.

7) Devices require baking before mounting, if humidity card reading is >60% at 23±5°C.
만약 습도표시카드의 수치가 23±5°C에서 60% 이상이라면, 제품 실장 전 baking해야 함.

8) Devices must be baked for 1 hour at 60±5°C, if baking is required.
만약 baking이 필요하다면, 제품은 60±5°C에서 1시간 정도 baking 되어야 함.

9) The LEDs are sensitive to the static electricity and surge. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs.
LED는 정전기 및 서지에 민감한 제품이므로, LED 제품을 다룰 시에는 정전기 방지장갑이나 손목밴드를 사용하기를 권장함.

If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices.

만약 절대 허용치를 초과하는 전압이 LED에 가해지면, LED 소자는 파괴되거나 손상될 수 있음.

Damaged LEDs may show some unusual characteristics such as increase in leak current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.
손상된 제품은 누설전류의 증가, Turn on 전압의 저하, 저 전류에서의 점등불량 등의 이상 거동을 보일 수 있음.

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 encapsualnt when they expose to heat or light.

VOCs(휘발성 유기 화합물)는 등기구에 사용되는 접착제, Flux, 경화제, 유기물 첨가제에서 발생하여 LED 실리콘 봉지제를 투과하고, 빛 또는 열에 노출되었을 때 변색이 발생 할 수 있음.

This phenomenon can cause a significant loss of light emitted(output) from the luminaires(fixtures).

이러한 현상은 등기구로부터 나오는 빛의 중대한 손실을 줄 수 있음.

In order to prevent these problems, we recommend you to know the physical properties of the materials used in luminaires, They must be selected carefully.

이러한 문제 발생 방지를 위해서, 등기구에 사용되는 자재에 대한 물성을 알고 주의하여 선택 되어야함.



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.

삼성전자의 LED는 Ag(은)을 도금한 리드프레임을 사용함. 이 리드프레임의 표면이 황(S), 염소(Cl), 또는 다른 할로겐 화합물들에 노출시 Ag(은)은 검정(또는 어두운색)으로 바뀔 수 있음.

Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution.

리드 프레임의 황화(Sulfurization)는 광량 저하, 색좌표 변화 및 심한 경우 LED 무등(Open) 불량을 일으킬 수도 있으니 주의가 필요함.

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.

리드 프레임 황화(Sulfurization)의 근원이 될 수 있으니 LED는 아래의 목록으로 만들어진 산화성 물질들과 함께 저장, 사용이 불가함 : 고무, 일반 종이, 납땜 크림 등



11. Hazard Substance Analysis

1) RoHS



Test Report No. F690101/LF-CTSAYAA13-34757

Issued Date: 2013. 07. 25 Page 1 of 7

To: SAMSUNG ELECTRONICS CO., LTD.
129, Samsung-ro
Youngtong-gu
Suwon-si
Gyeonggi-do
Korea

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

SGS File No.	: AYAA13-34757
Product Name	: 5630 G2 CR180
Item No./Part No.	: N/A
Received Date	: 2013. 07. 18
Test Period	: 2013. 07. 19 to 2013. 07. 25
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.

SGS Korea Co., Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung / Testing Person

Jeff Jang / Chemical Lab Mgr

* It is measured by the Company added in the Control Committee of 2nd tier which control products or material or component of the merchandise to be analyzed. It is also measured by the client, based committee, added in the Control Committee of 2nd tier which control products or material or component of the merchandise to be analyzed. In other word, the test result is measured by the client who is the manufacturer of the merchandise. The test result is measured by the Company's testing of the same as the test result only one from the test of Client's test results. The Company, which responsibility is to do Client's test 100% measured, does not a result public. In however, there is a case of that right one of the 100% are of high risk, then the test result measured by 10% is used instead of the test result measured by 100%. In case of the result measured by 100% is not a result measured by 10%, but up and down only in the sampling, then the test result measured by 100% is used.

SGS Korea Co., Ltd.

522, Pae O valley, 535-9, Hapjeong-dong, Dongjak-gu, Anyang-si, Gyeonggi-do, Korea 421-030
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F052 Version5

Member of the SGS Group (Société Générale de Surveillance)

**Test Report No.** F690101/LF-CTSAYAA13-34757

Issued Date: 2013.07.25 Page 2 of 7

Sample No. : AYAA13-34757.001

Sample Description : 5630 G2 CR190

Item No./Part No. : N/A

Materials : N/A

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.
Antimony(Sb)	mg/kg	With reference to EPA3052(1996), US EPA 6010B(1996), ICP	10	N.D.
Arsenic (As)	mg/kg	With reference to EPA3052(1996), US EPA 6010B(1996), ICP	10	N.D.
Beryllium (Be)	mg/kg	With reference to EPA3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.

Flame Retardants-P BBs/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.

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-extraction:

Negative = Absence of CrVI coating

Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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FDS2 Version 6

Member of the SGS Group (SGS & Gammatech Surveilance)

Test Report No. F690101/LF-CTSAYAA13-34757

Issued Date: 2013. 07. 25 Page 3 of 7

Sample No. : AYAA13-34757.001

Sample Description : 5630 G2 CR190

Item No./Part No. : N/A

Materials : N/A

Flame Retardants-P BBs/PBDEs

Test Item	Unit	Test Method	MDL	Results
Heptabromodiphenyl ether	mg/kg	With reference to IEC62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC62321:2008, GC-MS	5	N.D.

Halogen Content

Test Item	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	BS EN 14682:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	BS EN 14682:2007 , IC	30	N.D.
Fluorine(F)	mg/kg	BS EN 14682:2007 , IC	30	68
Iodine(I)	mg/kg	BS EN 14682:2007 , IC	50	N.D.

Organotin Compounds

Test Item	Unit	Test Method	MDL	Results
Tributyltin (TBT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Triphenyltin (TPhT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Diisobutyltin (DBT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Diocetyltin(DOT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Monobutyltin (MBT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Bis (tributyltin)oxide (TBTO)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Monoocetyltin(MOT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.
Tetrabutyltin (TeBT)	mg/kg	DIN 38407-13 , GC/MS	1	N.D.

Other(s)

Test Item	Unit	Test Method	MDL	Results
PFOS (Perfluorooctane Sulfonates-Acid/Metal Salt/Amide)	mg/kg	US EPA3540C/3550C, LC/MS	1	N.D.

NOTE:

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- (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-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

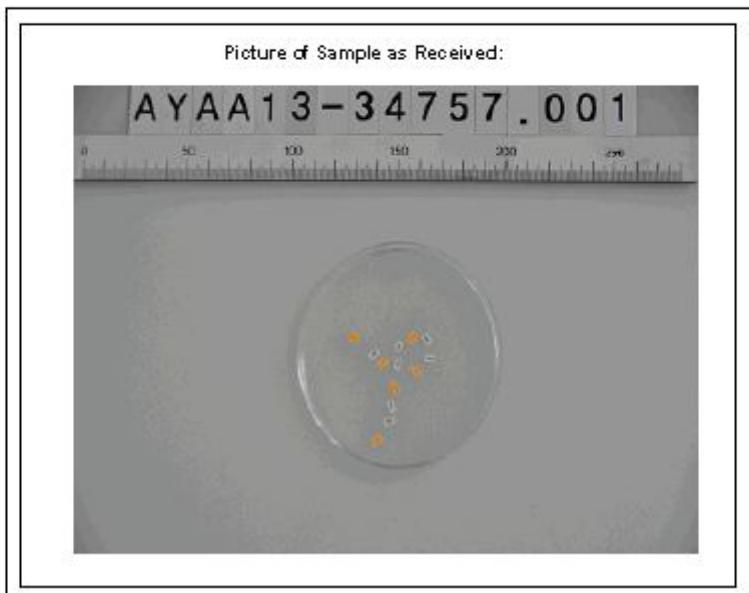
* It is measured by means by the Company subject to the General Conditions of Service which created, available or caused or resulted of the measurement of the test item. ** It is measured by means by the Company subject to the General Conditions of Service which created, available or caused or resulted of the test item. In case that information relating to measurement of the test item is not within the scope of the General Conditions of Service, it is measured by the Company subject to the General Conditions of Service. The test item must be measured except for the test item which is not within the scope of the General Conditions of Service, otherwise the results shown in the table shall not be valid by the company which are used as evidence in the trial.

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F052 Version5

Member of the SGS Group (Société Générale de Surveillance)

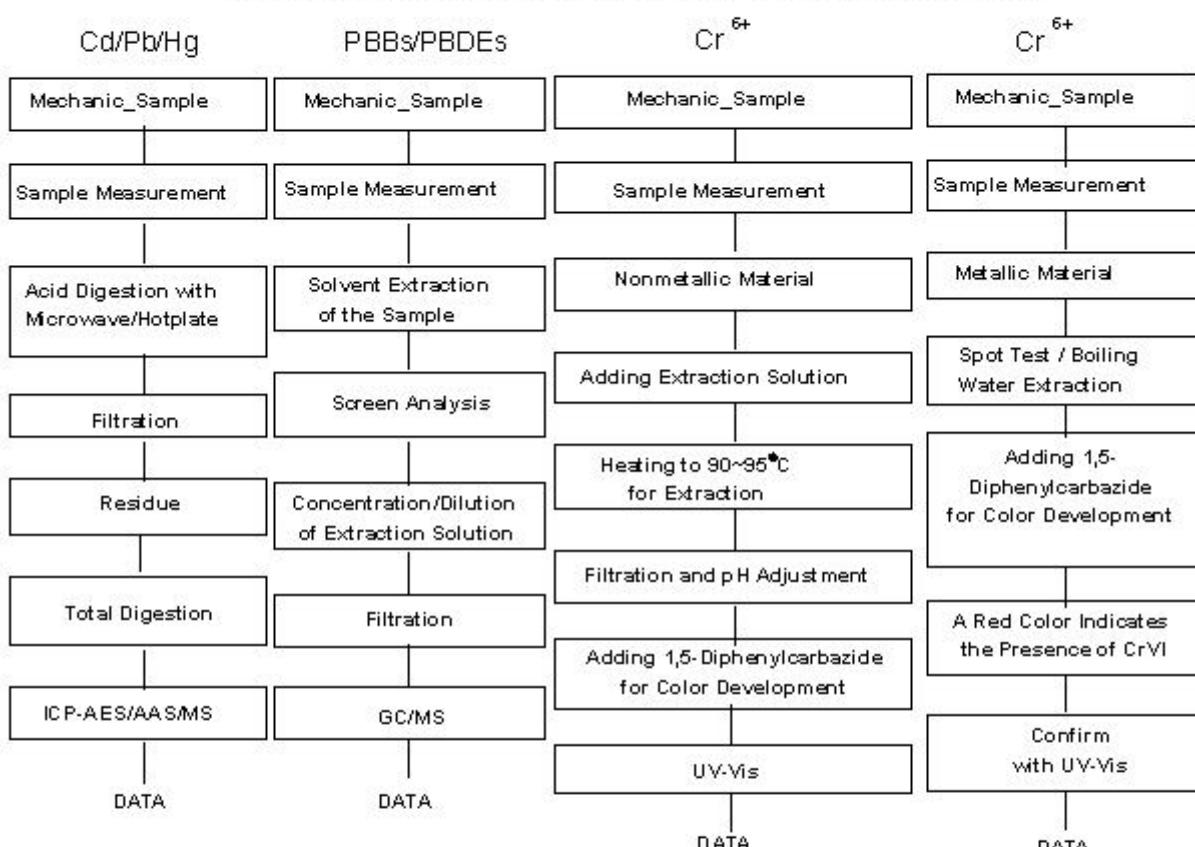
**NOTE:**

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
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Negative = Absence of CrVI coating
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Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing

The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.

Section Chief : Giljae Yi

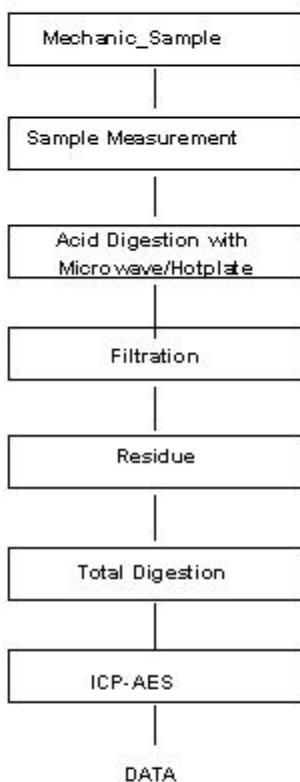
NOTE:

- (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-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

* If a comment is issued by the Company related to the General Condition, or 3rd party, which creates problems or causes or possibility of non-compliance to the applicable laws, regulations or technical standards, subject to laws, we consider to make the comments of the Company's findings or any other information related to our findings. In case of the above matter(s) are within the field of Client's indication, it may be considered as responsibility of the Client, and if a comment is issued by a third party, we will ignore them. In case of the above matter(s), it can be a problem caused by the Client, without giving any consideration to the Company, any comment about the Client, unless otherwise the result shows in the last page of or only in the sampling, unless one can explain a cause for the Client only.

Flow Chart for Inorganic Elements Testing

Inorganic Elements



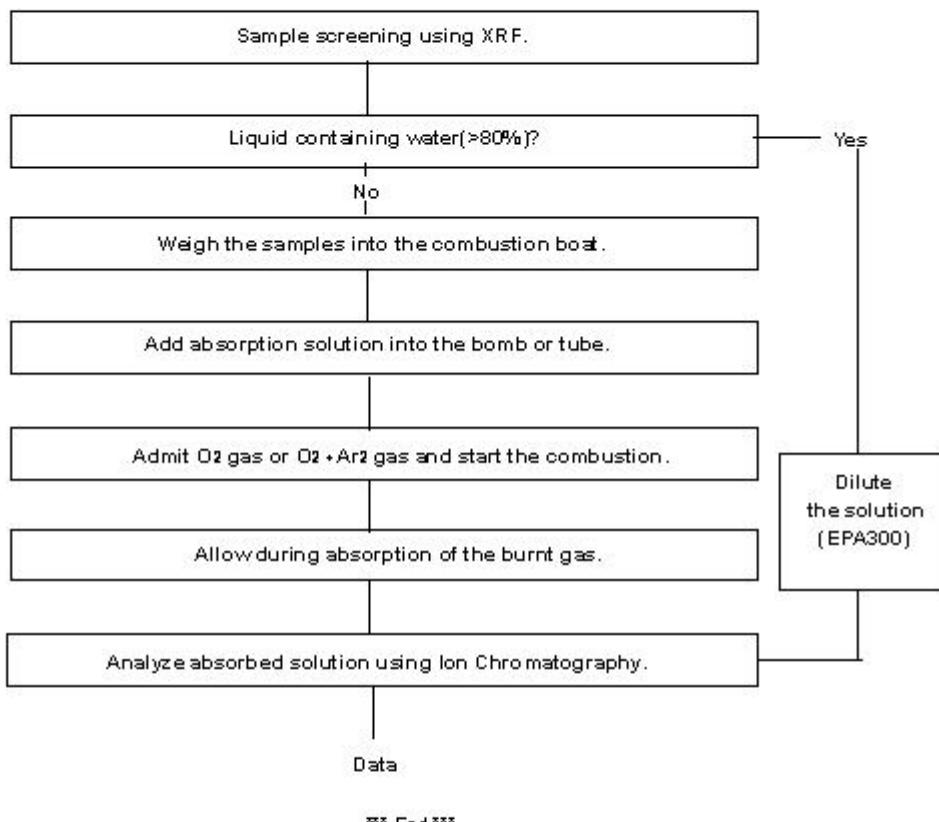
NOTE:

- (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-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

* It is measured by the Company subject to the General Conditions of Service which created, enables or caused or amounts of ~~Microscopic examination~~ or ~~Microscopic examination~~, or to obtain the relevant documents, subject to the terms and conditions of ~~Microscopic examination~~. Neither the party to the contract nor the other party to the contract are liable for damage that may result from failure to meet the obligations of the other party to the contract, except for cases of force majeure. The Company will be responsible if it is found that any of the documents it has provided are false or forged, or if they do not correspond to the information contained in the relevant documents. The company will not be responsible except for cases of gross negligence or wilful intent of the Company, any omission after the time when the relevant documents were issued or if the relevant documents are used or exploited in order to be illegal only.

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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-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

* It is assumed in advance by the Company, subject to the General Conditions of Service which are available or available at www.samsungled.com, to students, research, subject to terms and conditions, subject to the conditions of the Seller at its facility. Transferees are prohibited from selling or reselling any part of the contract without the prior written consent of the Company. The Company's findings of the form of the information or any other matter the Seller's indications, it may not be liable for any damages arising from the use of such information. The Company's findings of the form of the information or any other matter the Seller's indications, it may not be liable for any damages arising from the use of such information. Unless otherwise stated in the results, unless for the sampling, there are no cost to explain or to make it for it may only.

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2) REACH (SVHC)



Test Report No. F690101/LF-CTSAYAA13-34756 Issued Date: 2013. 07. 25 Page 1 of 15

To. **SAMSUNG ELECTRONICS CO., LTD.**
129 Samsung-ro
Youngtong-gu
Suwon-si
Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as-

Product Name : 5630 G2 CRI90
Item/Part Name : N/A
SGS File No. : AYAA13-34756
Received Date : 2013. 07. 18
Test Period : 2013. 07. 19 ~ 2013. 07. 25
Test Performed : SGS Korea tested the sample(s) selected by applicant with following results
Test Requested : One hundred-forty four (144) substances in the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) on June 20, 2013 regarding Regulation (EC) No 1907/2006 concerning the REACH.
Test Method : Please refer to next page(s).
Test Result(s) : Please refer to next page(s).

SGS Korea Co., Ltd

Timothy Jeon
Cindy park
Jinhee Kim
Sophia Kim
/Testing Person

Jeff Jang / Chemical Lab Mgr

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Test Method:

SGS In-House method - Analyzed by ICP-OES, PLM, UVMS, LC/MS, GC/MS and colorimetric method

Remarks:

1. The chemical analysis of specified SVHC is performed by means of currently available analytical techniques against the following SVHC related documents published by ECHA:
<http://echa.europa.eu/web/quest/candidate-list-table>
This list is under evaluation by ECHA and may subject to change in the future.
2. In accordance with Regulation (EC) No 1907/2006, any producer or importer of articles shall notify ECHA, in accordance with paragraph 2 of Article 7, if a substance meets the criteria in Article 57 and is identified in accordance with Article 59(1) of the Regulation, if (a) the substance is present in those articles in quantities totaling over one tonne per producer or importer per year, and (b) the substance is present in those articles above a concentration of **0.1 % weight by weight (w/w)**.
3. Article 33 of Regulation (EC) No 1907/2006 requires supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above **0.1 % weight by weight (w/w)** shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance in the Candidate List.
4. SGS adopts the interpretation of ECHA for SVHC in article unless indicated otherwise. Detail explanation is available at the following link:
http://webstage.contribute.sgs.net/compreach/documents/SGS-CTS_SVHC-paper-EN-11.pdf
5. Test results in this report are based on the tested sample. This report refers to testing result of composite material group by equal weight proportion. The material in each composite test group may come from one article.
6. If a SVHC is found over the reporting limit, client is suggested to identify the component which contains the SVHC and the exact concentration of the SVHC by requesting further quantitative analysis from the laboratory.

This document is issued by the Company subject to the General Conditions of Service published on website <http://www.sgs.com/termsandconditions>. It is also subject to our Terms and Conditions of Sale published on website <http://www.sgs.com/termsandconditions>. It is the sole responsibility of the Client to make sure that the samples sent to us for analysis are suitable for analysis. The Company's Analysis of the Sample(s) referred to in this document is limited to the scope of the Client's instructions. The Company's liability is limited to the amount paid by the Client for the analysis. The Client agrees to indemnify the Company against all claims and expenses arising from any damage, loss or expense suffered by the Company as a result of any negligent or intentional act or omission of the Client or his agents or employees. The Client shall not claim against the Company for any damage, loss or expense suffered by the Client as a result of any negligent or intentional act or omission of the Client or his agents or employees.

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Test Report No. F690101/LF-CTSAYAM3-34756 Issued Date: 2013. 07. 25 Page 3 of 15

Test Result(s)

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins)	85535-84-8	287-476-5	N.D.	0.05	PBT
Anthracene	120-12-7	204-371-1	N.D.	0.05	PBT
Benzyl butyl phthalate (BBP)	85-68-7	201-622-7	N.D.	0.05	Toxic for Reproduction
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	204-211-0	N.D.	0.05	Toxic for Reproduction
Bis(tributyltin)oxide	56-35-9	200-268-0	N.D.	0.05	PBT
Cobalt dichloride*	7646-79-9	231-589-4	N.D.	0.005	Carcinogen Toxic for Reproduction
4,4-Diaminodiphenylmethane	101-77-9	202-974-4	N.D.	0.05	Carcinogen
Diarsenic pentaoxide*	1303-28-2	215-116-9	N.D.	0.005	Carcinogen
Diarsenic trioxide*	1327-53-3	215-481-4	N.D.	0.005	Carcinogen
Dibutyl phthalate (DBP)	84-74-2	201-557-4	N.D.	0.05	Toxic for Reproduction
Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α -HBCDD, β -HBCDD, γ -HBCDD)	25637-99-4 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)	247-148-4 221-695-9	N.D.	0.05	PBT
Lead hydrogen arsenate*	7784-40-9	232-064-2	N.D.	0.005	Carcinogen Toxic for Reproduction
Sodium dichromate* (Sodium dichromate, dehydrate)	10588-01-9 (7789-12-0)	234-190-3	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene)	81-15-2	201-329-4	N.D.	0.05	vPvB
Triethyl arsenate*	15606-95-8	427-700-2	N.D.	0.005	Carcinogen

* Note: The substance is known by the Company, published by the Chemical Suppliers of Non-toxic products or not, a similar to our own test or a test made by other laboratories, and the test results of the test are not different from ours. In other words, the same test results as the test results of the substances, as mentioned above, is the results of the SGS Korea Co., Ltd., so there are no substantial differences between the two tests. The test results of the test made by the other laboratories, except for the Company's, will not be provided, as it is considered that it may cause a legal dispute. If it is a test of the Company's, the test results of the test made by the other laboratories, except for the Company's, will be provided. If there is any objection, it will be resolved by the Company's test results. The test results of the test made by the other laboratories, except for the Company's, will not be provided. The test results of the test made by the other laboratories, except for the Company's, will not be provided. The test results of the test made by the other laboratories, except for the Company's, will not be provided.

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Test Report No. F690101/LF-CTSAYAA13-34756 Issued Date: 2013.07.25 Page 4 of 15

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Di-isobutyl phthalate(DIBP)	84-69-5	201-553-2	N.D.	0.05	Toxic for Reproduction
2,4-Dinitrotoluene	121-14-2	204-450-0	N.D.	0.05	Carcinogen
Tris(2-chloroethyl) phosphate	115-96-8	204-118-5	N.D.	0.05	Toxic for Reproduction
Anthracene oil	90640-80-5	292-602-7	N.D.	0.05	PBT; vPvB Carcinogen
Anthracene oil, anthracene paste; distn. Lights	91995-17-4	295-278-5	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Anthracene oil, anthracene paste, anthracene fraction	91995-15-2	295-275-9	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Anthracene oil, anthracene-low	90640-82-7	292-604-8	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Anthracene oil, anthracene paste	90640-81-6	292-603-2	N.D.	0.05	PBT; vPvB Carcinogen Mutagen
Coal tar pitch, high temperature	65996-93-2	266-028-2	N.D.	0.05	PBT; vPvB Carcinogen
Lead sulfochromate yellow (C.I. Pigment Yellow 34)*	1344-37-2	215-693-7	N.D.	0.005	Toxic for Reproduction
Lead chromate molybdate sulfate red (C.I. Pigment Red 104)*	12656-85-8	235-759-9	N.D.	0.005	Carcinogen Toxic for Reproduction
Lead chromate*	7758-97-6	231-846-0	N.D.	0.005	Carcinogen Toxic for Reproduction
Acrylamide	79-06-01	201-173-7	N.D.	0.05	Carcinogen Mutagen

* No measurement was made by the Company related to the General Requirements of 2010 RoHS Directive, applicable or relevant to one or more of the following substances, due to the lack of test methods, subject to future work. Conditions for RoHS Directive of the European Union are not yet fully harmonized in the Member States. The test methods for the substances listed above have not been harmonized. Therefore, the results obtained by the Company's testing of the General Requirements may refer to the test of European Union, and not to the European Union Directive. In the case of RoHS, no measurement results related to the substances listed above are available at present. All such information is subject to change as the harmonization of the General Requirements continues. The Company reserves the right to withdraw from this report if any of the substances listed above are determined to be present in the products under test.

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Boric acid*	10043-35-3 11113-50-1	233-139-2 234-343-4	N.D.	0.005	Toxic for Reproduction
Disodium tetraborate, anhydrous*	1330-43-4 12179-04-3 1303-96-4	215-540-4	N.D.	0.005	Toxic for Reproduction
Tetraboron disodium heptaoxide, hydrate*	12267-73-1	235-541-3	N.D.	0.005	Toxic for Reproduction
Trichloroethylene	79-01-6	201-167-4	N.D.	0.05	Carcinogen
Sodium chromate*	7775-11-3	231-889-5	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
Ammonium dichromate*	7789-09-5	232-143-1	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
Potassium dichromate*	7778-50-9	231-906-6	N.D.	0.005	Carcinogen Mutagen Toxic for Reproduction
Potassium chromate*	7789-00-6	232-140-5	N.D.	0.005	Carcinogen Mutagen

* Not assessed by the Company itself or its Control Engineers. If no risk reduction or risk control measures are made by the Company and/or its Supplier or Manufacturer, it is advised to contact our Engineers. In products derived from other companies, subject to laws, our Engineers, in Products Engineers, will provide advice on how to reduce risks. The User has the ultimate responsibility to determine whether the Company's findings of the health information apply to his/her products. It is the User's responsibility to make any changes to the design of the product to mitigate the risk to health and safety. We do not accept responsibility for the use of information contained in this report to design products. We do not accept responsibility for the use of the information contained in this report to design products. Unless otherwise stated, the results shown in this document apply only to the samples taken and cannot be extrapolated to other products.

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SGS Korea Co., Ltd.

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Cobalt(II) sulphate*	10124-43-3	233-334-2	N.D.	0.005	Carcinogen Toxic for Reproduction
Cobalt(II) dinitrate*	10141-05-6	233-402-1	N.D.	0.005	Carcinogen Toxic for Reproduction
Cobalt(II) carbonate*	513-79-1	208-169-4	N.D.	0.005	Carcinogen Toxic for Reproduction
Cobalt(II) diacetate*	71-48-7	200-755-8	N.D.	0.005	Carcinogen Toxic for Reproduction
2-Methoxyethanol	109-86-4	203-713-7	N.D.	0.05	Toxic for Reproduction
2-Ethoxyethanol	110-80-5	203-804-1	N.D.	0.05	Toxic for Reproduction
Chromium trioxide*	1333-82-0	215-607-8	N.D.	0.005	Carcinogen Mutagen
Acids generated from chromium trioxide and their oligomers:					
Chromic acid Dichromic acid	7738-94-5 13530-68-2	231-801-5 236-881-5 -	N.D.	0.005	Carcinogen
Oligomers of chromic acid and dichromic acid'					
1-methyl-2-pyrrolidone	872-50-4	212-828-1	N.D.	0.05	Toxic for Reproduction
2-ethoxyethyl acetate	111-15-9	203-839-2	N.D.	0.05	Toxic for Reproduction
1,2-benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich	71888-89-6	276-158-1	N.D.	0.05	Toxic for Reproduction
1,2-benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters	68515-42-4	271-084-6	N.D.	0.05	Toxic for Reproduction
1,2,3-trichloropropane	96-18-4	202-486-1	N.D.	0.05	Carcinogen Toxic for Reproduction
Hydrazine	7803-57-8 302-01-2	206-114-9	N.D.	0.05	Carcinogen
Strontium chromate*	7789-06-2	232-142-6	N.D.	0.005	Carcinogen

* The substance listed by the Company is added to the General Catalogue of Samsung products catalog, available on website for members of Samsung Business Partner Program. In accordance to our current, subject to laws, our Catalogue, the Products Catalogue of Samsung Business Partner Program is the basis for the delivery of the products to the customer. The Company's delivery of the products to the customer may differ from the delivery of the Company's catalogues. The Company's catalogues are for information purposes only. It is the customer's responsibility to verify the quality of the products before accepting them. The Company's catalogues do not constitute an offer or an invitation to offer or conclude a contract, unless it is explicitly stated otherwise. The Company's catalogues are not binding in any way.



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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
1,2-Dichloroethane	107-06-2	203-458-1	N.D.	0.05	Carcinogenic
2,2'-dichloro-4,4'-methyleneedianiline (MOCA)	101-14-4	202-918-9	N.D.	0.05	Carcinogenic
2-Methoxyaniline o-Anisidine	90-04-0	201-963-1	N.D.	0.05	Carcinogenic
4-(1,1,3,3-tetramethylbutyl)phenol, (4-tert-Octylphenol)	140-66-9	205-426-2	N.D.	0.05	Equivalent level of concern having probable serious effects to the environment
Aluminosilicate Refractory Ceramic Fibres* (RCF)	650-017-00-8 (Index no.)	-	N.D.	0.005	Carcinogenic
Arsenic acid*	7778-39-4	231-901-9	N.D.	0.005	Carcinogenic
Bis(2-methoxyethyl) ether	111-96-6	203-924-4	N.D.	0.05	Toxic for reproduction
Bis(2-methoxyethyl) phthalate	117-82-8	204-212-6-	N.D.	0.05	Toxic for reproduction
Calcium arsenate*	7778-44-1	231-904-5	N.D.	0.005	Carcinogenic
Dichromium tris(chromate)*	24613-89-6	246-356-2	N.D.	0.005	Carcinogenic
Formaldehyde, oligomeric reaction products with aniline (technical MDA)	25214-70-4	500-036-1	N.D.	0.05	Carcinogenic
Lead diazide*	13424-46-9	236-542-1	N.D.	0.005	Toxic for reproduction
Lead dipicrate*	6477-64-1	229-335-2	N.D.	0.005	Toxic for reproduction
Lead styphnate*	15245-44-0	239-290-2	N.D.	0.005	Toxic for reproduction
N,N-dimethylacetamide (DMAC)	127-19-5	204-826-4	N.D.	0.05	Toxic for reproduction
Pentazinc chromate octahydroxide*	49663-84-5	256-418-0	N.D.	0.005	Carcinogenic
Phenolphthalein	77-09-8	201-004-7	N.D.	0.05	Carcinogenic
Potassium hydroxyoctaoxodizincatedichromate*	11103-86-9	234-329-8	N.D.	0.005	Carcinogenic
Trilead diarsenate*	3687-31-8	222-979-5	N.D.	0.005	Carcinogenic Toxic for reproduction
Zirconia Aluminosilicate Refractory Ceramic Fibres (Zr-RCF)*	650-017-00-8 (Index no.)	-	N.D.	0.005	Carcinogenic

* No substance has been by the Company subject to the General Conditions of Testing and/or evaluated as suitable for inclusion in the list of substances which may be present in the product. In other words, no comments, subject to the General Conditions of Testing and/or evaluation, have been made by the Company on the suitability of the substance for inclusion in the list of substances which may be present in the product. The results of the testing and/or evaluation of the substance have been communicated to the Company's testing at the request of the Company. Information may refer to the test results of the substance or the test results of the sample of the substance. The test results of the sample of the substance may be communicated to the test results of the substance. Unless otherwise stated the results shown in this test report relate only to the sample of the same substance as submitted for testing.

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit(%)	Classification
1,2-bis(2-methoxyethoxy)ethane (TEGDME; triglyme)	112-49-2	203-977-3	N.D.	0.05	Toxic for reproduction
1,2-dimethoxyethane; ethylene glycol dimethyl ether (EGDME)	110-71-4	203-794-9	N.D.	0.05	Toxic for reproduction
Diboron trioxide*	1303-86-2	215-125-8	N.D.	0.005	Toxic for reproduction
Formamide	75-12-7	200-842-0	N.D.	0.05	Toxic for reproduction
Lead(II) bis(methanesulfonate)*	17570-76-2	401-750-5	N.D.	0.005	Toxic for reproduction
TGIC(1,3,5-tris(oxiranyl methyl)-1,3,5-triazine-2,4,6(1H,3H,5H)-trione)	2451-62-9	219-514-3	N.D.	0.05	Mutagenic
β -TGIC (1,3,5-tris[(2S and 2R)-2,3-epoxypropyl]-1,3,5-triazine-2,4,6(1H,3H,5H)-trione)**	59653-74-6	423-400-0	N.D.	0.05	Mutagenic
4,4'-bis(dimethylamino)benzophenone (Michler's ketone)	90-94-8	202-027-5	N.D.	0.05	Carcinogenic
N,N,N',N'-tetramethyl-4,4'-methylenedianiline (Michler's base)	101-61-1	202-959-2	N.D.	0.05	Carcinogenic
[4-[4,4'-bis(dimethylamino)benzhydrylidene]cyclohexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Violet 3)	548-62-9	208-953-6	N.D.	0.05	Carcinogenic
[4-[[4-anilino-1-naphthyl][4-(dimethylamino)phenyl]methylene]cyclhexa-2,5-dien-1-ylidene] dimethylammonium chloride (C.I. Basic Blue 26)	2580-56-5	219-943-6	N.D.	0.05	Carcinogenic
α,α -Bis[4-(dimethylamino)phenyl]-4-(phenylamino)naphthalene-1-methanol (C.I. Solvent Blue 4)	6786-83-0	229-851-8	N.D.	0.05	Carcinogenic
4,4'-bis(dimethylamino)-4''-(methylamino)trityl alcohol	561-41-1	209-218-2	N.D.	0.05	Carcinogenic

* No information is known by the Company or disclosed by the Government authorities of the other party or no reliable, available for our review. It is made of 2,2-bis(2-methoxyethoxy)ethane and dimethylsulfide. **No information is known by the Company or disclosed by the Government authorities of the other party or no reliable, available for our review. It is made of 2,2-bis(2-methoxyethoxy)ethane and 2,3-epoxypropylamine.

Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Bis(pentabromophenyl) ether (DecaBDE)	1163-19-5	214-604-9	N.D.	0.05	PBT vP vB
Pentacosfluorotridecanoic acid	72629-94-8	276-745-2	N.D.	0.05	vP vB
Tricosfluorododecanoic acid	307-55-1	206-203-2	N.D.	0.05	vP vB
Henicosafluoroundecanoic acid	2058-94-8	218-165-4	N.D.	0.05	vP vB
Heptacosfluorotradecanoic acid	376-06-7	206-803-4	N.D.	0.05	vP vB
4-(1,1,3,3-tetramethylbutyl) phenol, ethoxylated - covering well-defined substances and UVCB substances, polymers and homologues	-	-	N.D.	0.05	Equivalent level of concern - probable serious effects on the environment
4-Nonylphenol, branched and linear – substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, covering also UVCB- and well-defined substances which include any of the individual isomers or a combination thereof	-	-	N.D.	0.05	Equivalent level of concern - probable serious effects on the environment
Diazene-1,2-dicarboxamide (C,C'-azodi(formamide))	123-77-3	204-650-8	N.D.	0.05	Equivalent level of concern - probable serious effects on human health
Cyclohexane-1,2-dicarboxylic anhydride (Hexahydrophthalic anhydride - HHPA)	85-42-7	201-604-9	N.D.	0.05	Equivalent level of concern - probable serious effects on human health

This document is issued by the Company subject to its General Conditions of Testing, which can be found at www.samsungled.com. In addition to the terms of the General Conditions, the following specific conditions apply:

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Hexahydromethylphthalic anhydride, Hexahydro-4-methylphthalic anhydride, Hexahydro-1-methylphthalic anhydride, Hexahydro-3-methylphthalic anhydride	25550-51-0, 19438-60-9, 48122-14-1, 57110-29-9	247-094-1, 243-072-0, 256-356-4, 260-566-1	N.D.	0.05	Equivalent level of concern - probable serious effects on human health
Methoxy acetic acid	625-45-6	210-894-6	N.D.	0.05	Toxic for reproduction equivalent level of concern - probable serious effects on human health and the environment
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear	84777-06-0	284-032-2	N.D.	0.05	Toxic for reproduction
Diisopentylphthalate (DIPP)	605-50-5	210-088-4	N.D.	0.05	Toxic for reproduction
N-pentyl-isopentylphthalate	-	-	N.D.	0.05	Toxic for reproduction
1,2-Diethoxyethane	629-14-1	211-076-1	N.D.	0.05	Toxic for reproduction
N,N-dimethylformamide; dimethyl formamide	68-12-2	200-679-5	N.D.	0.05	Toxic for reproduction
Dibutyltin dichloride (DBT)	683-18-1	211-670-0	N.D.	0.05	Toxic for reproduction
Acetic acid, lead salt, basic*	51404-69-4	257-175-3	N.D.	0.005	Toxic for reproduction
Basic lead carbonate (trilead bis(carbonate)dihydroxide)*	1319-46-6	215-290-6	0.0081	0.005	Toxic for reproduction
Lead oxide sulfate (basic lead sulfate)*	12036-76-9	234-853-7	0.0083	0.005	Toxic for reproduction
[Phthalato(2-)]dioxotrilead (dibasic lead phthalate)*	69011-06-9	273-688-5	0.0086	0.005	Toxic for reproduction

* No measurement was made by the Company related to the General Content of 20 other phthalates, available or intended to be available at the time of issuance of this test report. For the substances listed below, no measurement was made by the Company related to the General Content of 20 other phthalates, available or intended to be available at the time of issuance of this test report. In the event that the Company's findings of the General Content of 20 other phthalates are different from the results of this test report, the Company will make a separate report of the Company's findings. In the event that the Company's findings of the General Content of 20 other phthalates are different from the results of this test report, the Company will make a separate report of the Company's findings.

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Dioxobis(stearato)trilead*	12578-12-0	235-702-8	0.0128	0.005	Toxic for reproduction
Fatty acids, C16-18, lead salts*	91031-62-8	292-966-7	0.0243	0.005	Toxic for reproduction
Lead bis(tetrafluoroborate)*	13814-96-5	237-486-0	0.012	0.005	Toxic for reproduction
Lead cyanamidate*	20837-86-9	244-073-9	0.0078	0.005	Toxic for reproduction
Lead dinitrate*	10099-74-8	233-245-9	0.0104	0.005	Toxic for reproduction
Lead oxide (lead monoxide)*	1317-36-8	215-267-0	0.0070	0.005	Toxic for reproduction
Lead tetroxide (orange lead)*	1314-41-6	215-235-6	0.0072	0.005	Toxic for reproduction
Lead titanium trioxide*	12060-00-3	235-038-9	0.0095	0.005	Toxic for reproduction
Lead Titanium Zirconium Oxide*	12626-81-2	235-727-4	N.D.	0.005	Toxic for reproduction
Pentalead tetraoxo sulphate*	12065-90-6	235-067-7	0.0075	0.005	Toxic for reproduction
Pyrochlore, antimony lead yellow*	8012-00-8	232-382-1	N.D.	0.005	Toxic for reproduction
Silicic acid, barium salt, lead-doped*	68784-75-8	272-271-5	N.D.	0.005	Toxic for reproduction
Silicic acid, lead salt*	11120-22-2	234-363-3	0.0089	0.005	Toxic for reproduction
Sulfurous acid, lead salt, dibasic*	62229-08-7	263-467-1	0.0083	0.005	Toxic for reproduction
Tetraethyllead*	78-00-2	201-075-4	N.D.	0.005	Toxic for reproduction
Tetralead trioxide sulphate*	12202-17-4	235-380-9	0.0076	0.005	Toxic for reproduction

* The substance is known by the Company as lead, tin, or zinc, or similar, available or available in amounts of 0.0001% or greater, or, in other inventories, subject to laws, are contained in products of the Company, which may be the subject of claims for liability under environmental laws, or other laws, or other regulations. The Company's findings of the presence of substances are not for the benefit of others, and are not intended to be conclusive. A. Certain of the substances listed above, may be present in amounts less than 0.0001% of the total weight of the article, in which case they are not subject to environmental laws, or other laws, or other regulations. The Company's findings of the presence of substances are not for the benefit of others, and are not intended to be conclusive. B. Certain of the substances listed above, may be present in amounts less than 0.0001% of the total weight of the article, in which case they are not subject to environmental laws, or other laws, or other regulations. The Company's findings of the presence of substances are not for the benefit of others, and are not intended to be conclusive.

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Trilead dioxide phosphonate*	12141-20-7	235-252-2	N.D.	0.005	Toxic for reproduction
Furan	110-00-9	203-727-3	N.D.	0.05	Carcinogenic
Propylene oxide; 1,2-epoxypropane; methyloxirane	75-56-9	200-879-2	N.D.	0.05	Carcinogenic Mutagenic
Diethyl sulphate	64-67-5	200-589-6	N.D.	0.05	Carcinogenic Mutagenic
Dimethyl sulphate	77-78-1	201-058-1	N.D.	0.05	Carcinogenic
3-ethyl-2-methyl-2-(3-methylbutyl)-1,3-oxazolidine	143860-04-2	421-150-7	N.D.	0.05	Toxic for reproduction
Dinoseb	88-85-7	201-861-7	N.D.	0.05	Toxic for reproduction
4,4'-methylenedi-o-toluidine	838-88-0	212-658-8	N.D.	0.05	Carcinogenic
4,4'-oxydianiline and its salts	101-80-4	202-977-0	N.D.	0.05	Carcinogenic Mutagenic
4-Aminoazobenzene; 4-Phenylazoaniline	60-09-3	200-453-6	N.D.	0.05	Carcinogenic
4-methyl-m-phenylenediamine (2,4-toluene-diamine)	95-80-7	202-453-1	N.D.	0.05	Carcinogenic
6-methoxy-m-toluidine (p-cresidine)	120-71-8	204-419-1	N.D.	0.05	Carcinogenic
Biphenyl-4-ylamine	92-67-1	202-177-1	N.D.	0.05	Carcinogenic
o-aminoazotoluene	97-56-3	202-591-2	N.D.	0.05	Carcinogenic
o-Toluidine; 2-Aminotoluene	95-53-4	202-429-0	N.D.	0.05	Carcinogenic
N-methylacetamide	79-16-3	201-182-6	N.D.	0.05	Toxic for reproduction
1-bromopropane; n-propyl bromide	106-94-5	203-445-0	N.D.	0.05	Toxic for reproduction

* No. mentioned above by the Company is subject to the Control of Toxic Substances Act of 2000 (hereinafter referred to as "the Act"). According to the Act, no person shall import or export any substance which is controlled by the Act, without obtaining a permit issued by the Minister of Environment, except as otherwise provided by the Act. In the case of substances which are controlled by the Act, if the importer or exporter does not obtain the permit, he or she shall be liable to a fine of up to 10 million won or imprisonment for up to one year. If the importer or exporter violates the provisions of the Act, he or she shall be liable to a fine of up to 100 million won or imprisonment for up to ten years. If the importer or exporter violates the provisions of the Act, he or she shall be liable to a fine of up to 100 million won or imprisonment for up to ten years.

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Substance Name	CAS number	EC number	Concentration (%)	Reporting Limit (%)	Classification
Cadmium	7440-43-9	231-152-8	N.D.	0.005	Carcinogenic
Cadmium oxide	1306-19-0	215-146-2	N.D.	0.005	Carcinogenic
Dipentyl phthalate (DPP)	131-18-0	205-017-9	N.D.	0.05	Toxic for reproduction
4-Nonylphenol, branched and linear, ethoxylated [substances with a linear and/or branched alkyl chain with a carbon number of 9 covalently bound in position 4 to phenol, ethoxylated covering UVCB- and well-defined substances, polymers and homologues, which include any of the individual isomers and/or combinations thereof]	-	-	N.D.	0.05	Equivalent level of concern having probable serious effects to the environment
Ammonium pentadecafluorooctanoate (APFO)	3825-26-1	223-320-4	N.D.	0.05	Toxic for reproduction
Pentadecafluorooctanoic acid (PFOA)	335-67-1	206-397-9	N.D.	0.05	Toxic for reproduction

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Note:

1. RL = Reporting Limit
2. N.D. = Not detected (lower than RL)
- N.A. = Not applicable for respective material type.

The submitted sample was found to contain significant amount of specific element(s) of SVHC. Upon further test verification and also information provided from client, the possibility that the element(s) content originate from SVHC is very unlikely, even though their presence cannot be exclude entirely. It may be assumed that the detected element(s) have a non-SVHC source.

3. Definition of classification is listed in Appendix A of this report in accordance with 67/548/EEC and Regulation (EC) No 1907/2006. For detail information, Detail explanation is available at the following link:
<http://echa.europa.eu/web/guest/candidate-list-table>
4. *The test result is based on the calculation of selected element(s) / marker(s) and to the worst-case scenario. For detail information, please refer to the SGS REACH website: www.reach.sgs.com/substance-of-very-high-concern-analysis-information-page.htm

The client is advised to review the chemical formulation to ascertain above metal substances present in the article.
 RL = 0.005% is evaluated for element (i.e. cobalt, arsenic, lead, sodium, chromium, chromium(VI), silicon, aluminum, zirconium, boron, and potassium respectively), except molybdenum RL=0.0005%

0.1% (w/w) = 1,000 ppm = 1,000 mg/kg

5. **.β-TGIC is one of the isomers for TGIC compounds and hence, tested together. The reported test result is based the proposed ratio as according to ECHA dossier.



*** End of Report ***

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Appendix A

Classification Definition under 67/548/EEC and Regulation (EC) No 1907/2006

Carcinogen	<u>Substances known to be carcinogenic to man.</u> There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer.
Category 1:	
Carcinogen	<u>Substances which should be regarded as if they are carcinogenic to man.</u> There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer.
Category 2:	Generally on the basis of: - appropriate long-term animal studies - other relevant information.
Mutagen	<u>Substances known to be mutagenic to man.</u> There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage.
Category 1:	
Mutagen	<u>Substances which should be regarded as if they are mutagenic to man.</u> There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of: - appropriate animal studies, - other relevant information.
Category 2:	
Toxic to Reproduction	<u>Substances known to impair fertility in humans.</u> There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility. <u>Substances known to cause developmental toxicity in humans.</u> There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent developmental toxic effects in the progeny.
Category 1:	
Toxic to Reproduction	<u>Substances which should be regarded as if they impair fertility in humans.</u> There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of: - clear evidence in animal studies of impaired fertility in the absence of toxic effects, or, evidence of impaired fertility occurring at around the same dose levels as other toxic effects but which is not a secondary nonspecific consequence of the other toxic effects, - other relevant information.
Category 2:	<u>Substances which should be regarded as if they cause developmental toxicity to humans.</u> There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in developmental toxicity, generally on the basis of: - clear results in appropriate animal studies where effects have been observed in the absence of signs of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not a secondary non-specific consequence of the other toxic effects, - other relevant information.
PBT & vPvB:	Substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) pose a particular challenge to the chemicals safety management. For these substances a "safe" concentration in the environment cannot be established with sufficient reliability.

* No. mentioned is based on the Category assigned by the Council of Corollaries of Chemical products or not, a table for reference is available at [the website of ECHA](http://www.echa.europa.eu). Subject to "new uses Corollary". In "New uses Corollary", if the new uses of the substance are not covered by the existing Corollary, the new uses will be subject to the assessment of the new uses Corollary. The Corollary's findings of the new uses Corollary may affect the classification of the substance under the old Corollary. If any of the new uses of the substance is found to be dangerous, the classification of the substance under the old Corollary may be re-assessed and the classification may be changed. This is called "the effect of the new uses Corollary on the old Corollary".



Revision History

Date	No.	Revision History	Writer	
			Drawn	Approved
2013. 11. 07	01	New Version	W.H Jung	S.B Yun