DATE OF ISSUE : **2011. 10. 19**

# SPECIFICATION

MODEL : SPMWHT5225D5WAR0S0

**Approved rank :**

**$V_F$(A1, A2, A3, A4, A5)**

**CIE(R1, R2, R3, R4, R5, R6, R7, R8)**

**$I_V$(S1, S2, S3)**

## 5630 CRI80+ WHITE LED R0 RANK

| CUSTOMER : | |
|---|---|
| CHECKED | APPROVED |
| | |

| SAMSUNG LED | | | |
|---|---|---|---|
| DRAWN | CHECKED | | APPROVED |
| | SALES | QUALITY | |
| | | | |

***SAMSUNG LED CO., LTD.***

**314. MAETAN 3-DONG, YEONGTONG-GU,**
**SUWON-SI,GYEONGGI-DO,KOREA,443-743**

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# 1. Product Outline

1) Feature

. Lead Frame Type LED Package ( 5.6 * 3.0 * t 0.95 mm )

. Beam Angle ( △θ : 120 ˚)

. GaN/$Al_2O_3$ Chip & Long Time Reliability

2) Applications

. Indoor, Outdoor Display and etc.

# 2. Absolute Maximum Rating

| Parameter | Symbol | Rating | Condition |
|---|---|---|---|
| Operating temperature range | $T_{op}$ | -40 ~ +85℃ | |
| Storage temperature range | $T_{stg}$ | –40 ~ +100℃ | |
| Junction Temperature | $T_j$ | 110℃ | |
| Forward current | $I_F$ | 150 ㎃ | |
| Peak Pulsed Forward Current | $I_{FP}$ | 300 ㎃ | Duty 1/10 Pulse Width 10 ㎳ |
| Reverse Voltage | $V_R$ | 0.7 ~ 1.2 V | $I_R$ = 5 ㎃ |
| Thermal resistance, Junction to Solder Point | $R_{th}$, JS | 17.7℃/W | |
| Assembly Process Temp. | | 260℃, < 10 sec | |
| ESD | | 5 kV | HBM |

# 3. Characteristics

## Electrical / Optical Characteristics

( Ts : 25 ℃ )

| Item | Symbol | Conditions | Rank | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Forward Voltage (*) | $V_F$ | $I_F$ = 50 ㎃ | WA | A1 | 2.8 | - | 2.9 | V |
| | | | | A2 | 2.9 | - | 3.0 | |
| | | | | A3 | 3.0 | - | 3.1 | |
| | | | | A4 | 3.1 | - | 3.2 | |
| | | | | A5 | 3.2 | - | 3.3 | |
| Reverse Voltage | $V_r$ | $I_F$ = 5 ㎃ | - | | 0.7 | - | 1.2 | V |
| Color Rendering | $R_a$ | $I_F$ = 50 ㎃ | 5 | | 80 | - | - | - |

## Luminous Intensity / Luminous Flux

( Ts : 25 ℃ )

| Symbol | Conditions | Model Name | Rank | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| $I_v$ | $I_F$ = 50 ㎃ | SPMWHT5225D5WAR0S0 | S0 | S1 | 5.30 | - | 6.24 | cd |
| | | | | S2 | 6.24 | - | 7.18 | |
| | | | | S3 | 7.18 | - | 8.12 | |
| $\Phi_v$ | $I_F$ = 50 ㎃ | SPMWHT5225D5WAR0S0 | S0 | S1 | 15.87 | - | 18.69 | lm |
| | | | | S2 | 18.69 | - | 21.50 | |
| | | | | S3 | 21.50 | - | 24.32 | |

*** Luminous Flux ($\Phi_v$) : Only reference data.**

## Electro-Optical Characteristics

| If (mA) | Vf(V) | Power(W) | Flux(lm) | Lm/W |
|---|---|---|---|---|
| 50 (Sorting Current) | 2.91 | 0.15 | 18.7 | 129 |
| 60 | 2.95 | 0.18 | 22.3 | 126 |
| 65 | 2.97 | 0.19 | 23.8 | 123 |
| 70 | 2.99 | 0.21 | 25.5 | 122 |
| 80 | 3.03 | 0.24 | 29.2 | 121 |
| 90 | 3.07 | 0.28 | 32.6 | 118 |
| 100 | 3.10 | 0.31 | 35.9 | 116 |
| 110 | 3.14 | 0.35 | 39.1 | 113 |
| 120 | 3.17 | 0.38 | 42.3 | 111 |
| 130 | 3.21 | 0.42 | 45.4 | 109 |
| 140 | 3.24 | 0.45 | 48.4 | 107 |
| 150 | 3.27 | 0.49 | 51.4 | 105 |

※ lm values are representative references only.

## Chromaticity Coordinate

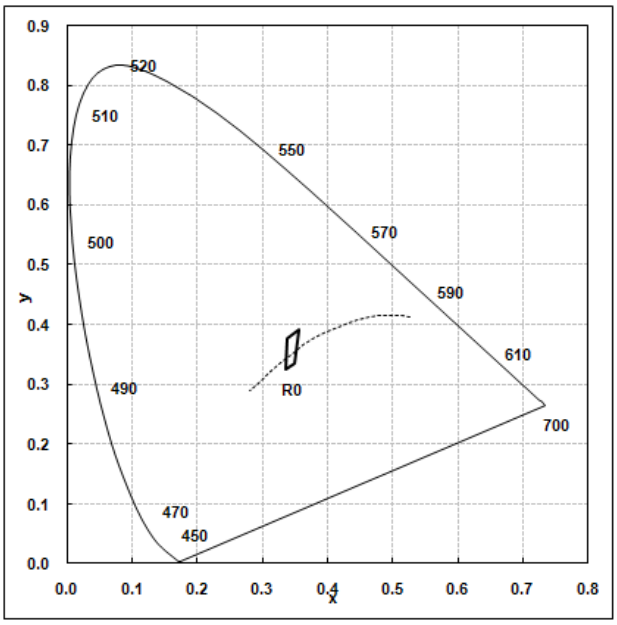
( Ts : 25 ℃ )

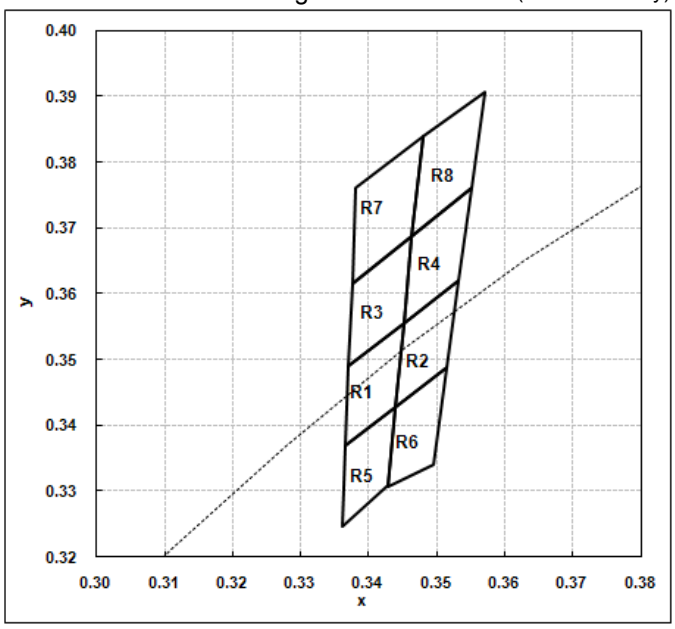
| Condition | Rank | | x | | | | y | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $I_F$ = 50 mA | R0 | R1 | 0.3366 | 0.3440 | 0.3451 | 0.3371 | 0.3369 | 0.3427 | 0.3554 | 0.3490 |
| | | R2 | 0.3440 | 0.3515 | 0.3533 | 0.3451 | 0.3427 | 0.3487 | 0.3620 | 0.3554 |
| | | R3 | 0.3371 | 0.3451 | 0.3463 | 0.3376 | 0.3490 | 0.3554 | 0.3687 | 0.3616 |
| | | R4 | 0.3451 | 0.3533 | 0.3551 | 0.3463 | 0.3554 | 0.3620 | 0.3760 | 0.3687 |
| | | R5 | 0.3361 | 0.3429 | 0.3440 | 0.3366 | 0.3245 | 0.3308 | 0.3428 | 0.3369 |
| | | R6 | 0.3429 | 0.3495 | 0.3515 | 0.3440 | 0.3307 | 0.3339 | 0.3487 | 0.3428 |
| | | R7 | 0.3376 | 0.3463 | 0.3480 | 0.3381 | 0.3616 | 0.3687 | 0.3840 | 0.3762 |
| | | R8 | 0.3463 | 0.3551 | 0.3571 | 0.3480 | 0.3687 | 0.3760 | 0.3907 | 0.3840 |

* Tolerance : $V_F$:±0.1 V, $I_v$:±5 %, x,y:±0.01, $R_a$ :±3.0
* Luminous Intensity measuring equipment : CAS140CT

# 4. Chromaticity Diagram

* CCT Range : 5028K±283K (reference only)



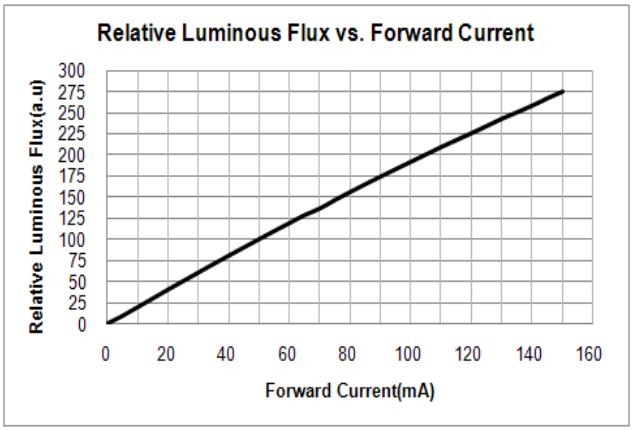

* R0 = R1+R2+R3+R4+R5+R6+R7+R8

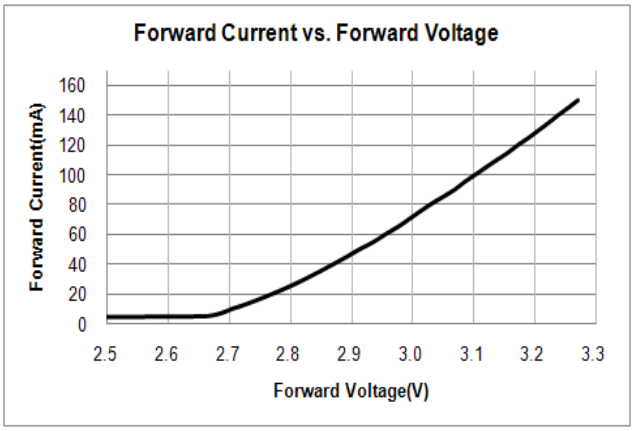
| $V_F$ | CIE | $I_v$ |
|---|---|---|
| A1, A2, A3, A4, A5 | R1, R2, R3, R4, R5, R6, R7, R8 | S1, S2, S3 |

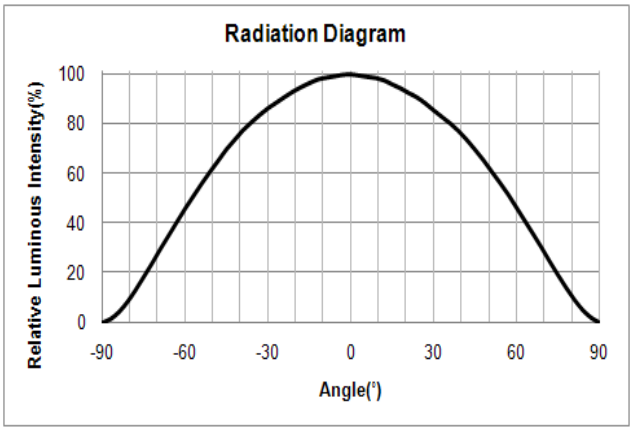
* Each reel contains only one of the A1, A2, A3, A4 or A5 a segment (1/5) of the $V_F$ rank.
* Each R1, R2, R3, R4, R5, R6, R7 or R8 a segment (1/8) of the CIE rank.
* Each reel contains only one of the S1, S2 or S3 a segment (1/3) of the $I_v$ rank.

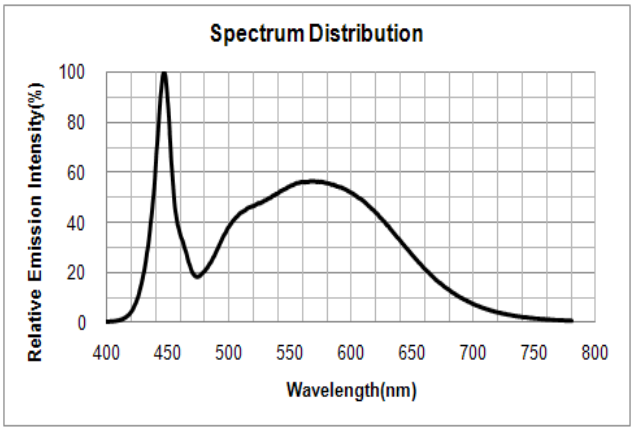
# 5. Typical Characteristics Graph

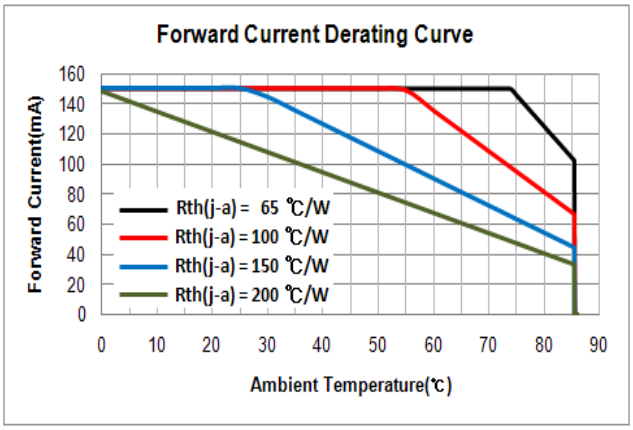
*** These graphs show typical values.** ( Ts : 25 ℃ )

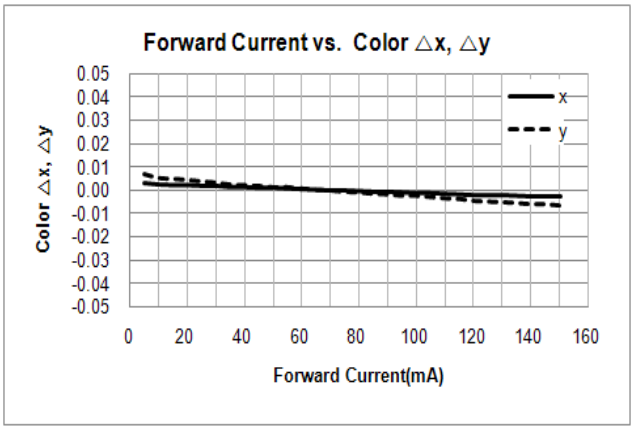


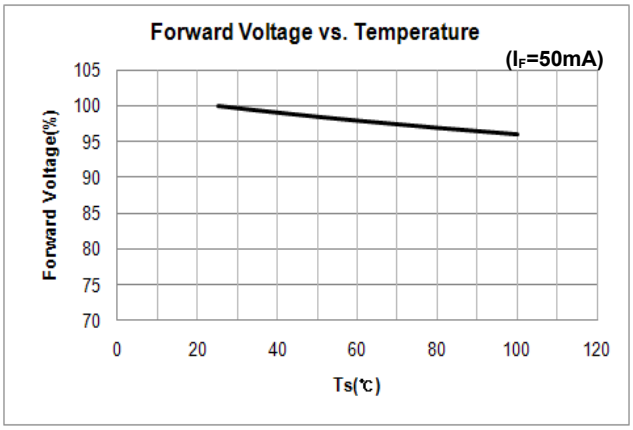



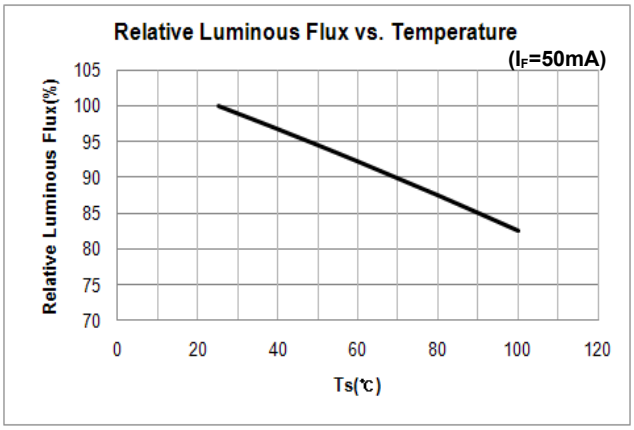



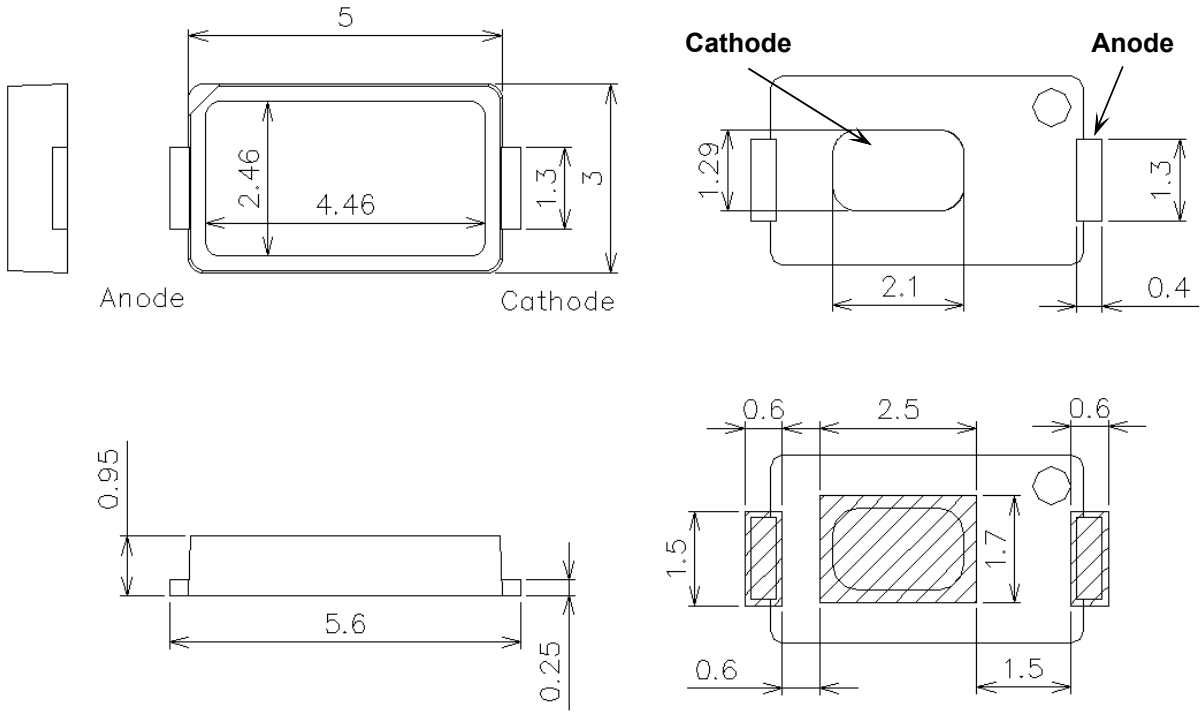



# 6. LED Package Outline Dimensions

unit:mm
Tolerance:±0.1




**Land Pattern**

*** This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).**

## Precautions

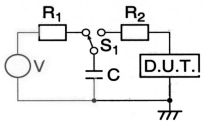
① The pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid the strong pressure on the LEDs. Do not put stress on the LEDs during heating.

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.

# 7. Reliability Test Items and Conditions

## 1) Test Items

| Test Item | Test Conditions | Test Hours/Cycles | Sample No |
|---|---|---|---|
| MSL Test | 125 ℃ 24hrs drying → 60 ℃, 60 %RH 120hrs → 260 ℃ 10sec 3 cycles | 1 cycle | 50 |
| Room Temperature life test | 25 ℃±3 ℃, DC150 ㎃ | 1,000 hrs | 50 |
| High Temperature life test | 85 ℃±3 ℃, DC110 ㎃ | 1,000 hrs | 50 |
| High Temperature humidity life test | 60 ℃±3 ℃, 95 %±2 %RH, DC150 ㎃ | 1,000 hrs | 50 |
| High Temperature humidity On/Off test | 85 ℃±3 ℃, 85 %±2 %RH, DC150 ㎃, On/2 sec, Off/5 sec | 100,000 cycles | 50 |
| Low Temperature life test | -40 ℃±3 ℃, DC100 ㎃ | 1,000 hrs | 50 |
| Temperature humidity Cycle | -10 ℃ ~ 25 ℃,95 %RH ~ 65 ℃,95 %RH DC100 ㎃, 24 hrs/1 cycle | 10 cycles | 50 |
| Thermal Shock | -45 ℃/15 min ↔ 125 ℃/15 min, 150 Cycle => Reflow 260 ℃ → Hot plate 180 ℃ | 1 cycle | 100 |
| High Temperature Storage | Ta=100 ℃±3 ℃ | 1000 hrs | 11 |
| Low Temperature Storage | Ta=-40 ℃±3 ℃ | 1000 hrs | 11 |
| Temperature humidity Cycle | -10 ℃ ~ 25 ℃, 95 %RH ~ 65 ℃, 95 %RH 24 hrs/ 1 cycle | 10 cycles | 11 |
| ESD(HBM) |   R1:10 ㏁, R2:1.5 ㎏, C:100 ㎊, V = ±5 kV | 5 times | 5 |
| ESD(MM) | -R1:10 ㏁, R2:0, C:200 ㎊, V = ±0.2 kV | 5 times | 5 |
| Vibration Test | 100~2000~100 Hz, 200 m/s², Sweep 4 min, 48 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

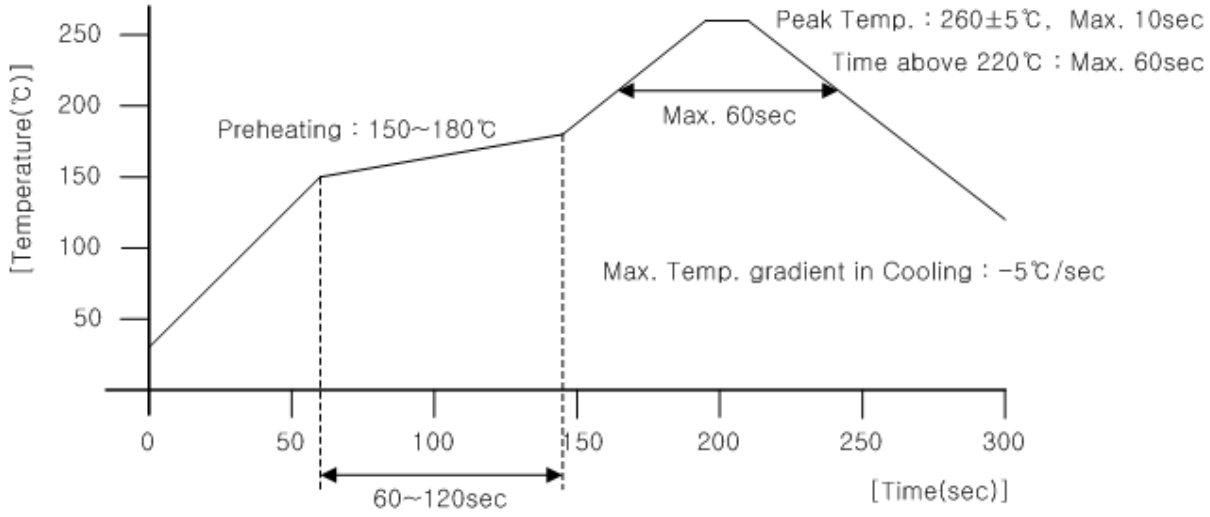
| Item | Symbol | Test Condition | Limit | |
|---|---|---|---|---|
| | | | Min | Max |
| Forward Voltage | $V_F$ | $I_F$ = 50 ㎃ | Init. Value*0.9 | Init. Value*1.1 |
| Luminous Intensity | $I_V$ | $I_F$ = 50 ㎃ | Init. Value*0.8 | Init. Value*1.2 |

* USL : Upper Standard Level LSL : Lower Standard Level

## 8. Solder Conditions

### 1) Reflow Conditions ( Pb Free )

Reflow Frequency : 2 times max.

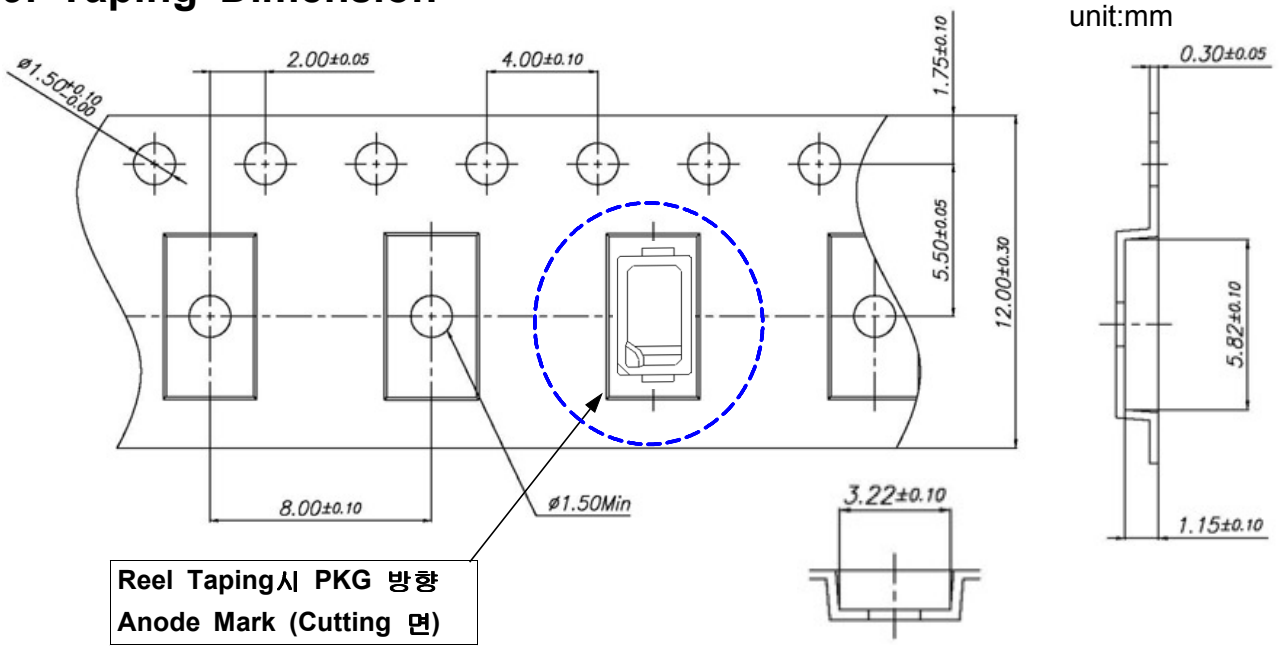


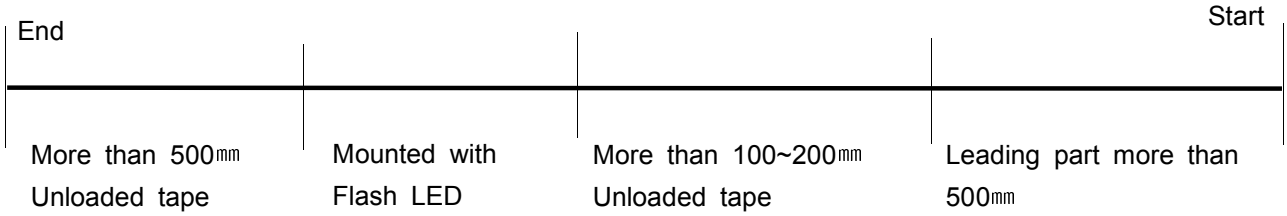

### 2) For Manual Soldering

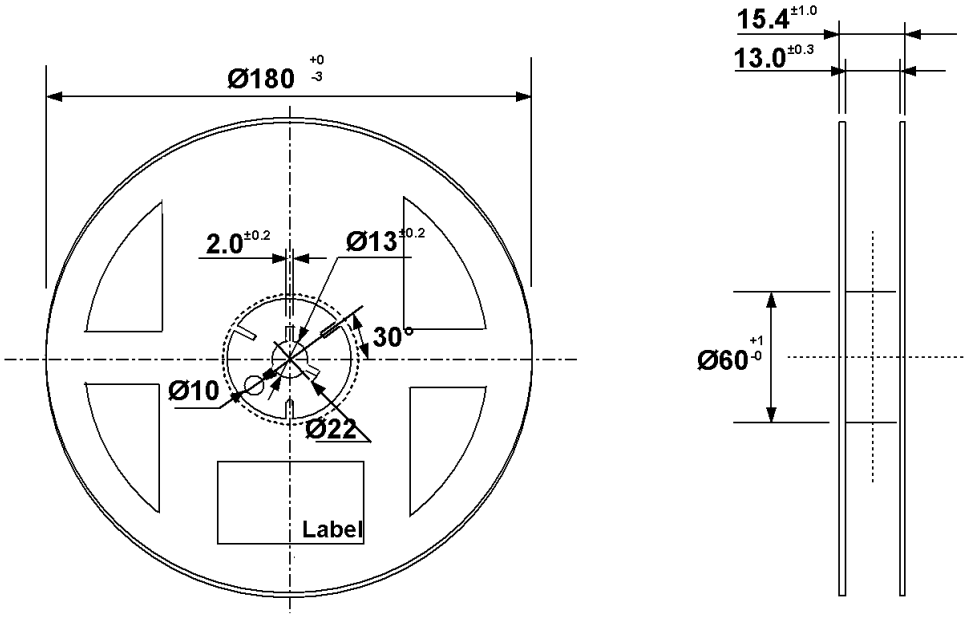
Not more than 5 seconds @MAX300 ℃, under soldering iron.

# 9. Taping Dimension

unit:mm




**Tolerance ±0.2 , Unit:mm**

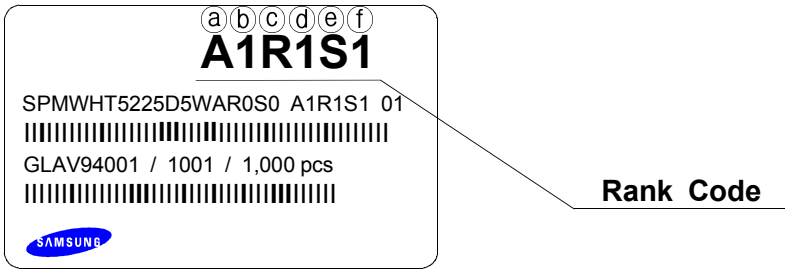
(1) Quantity : The quantity/Reel to be Max. 1,000 pcs, .

(2) Cumulative Tolerance : Cumulative tolerance/10 pitches to be ±0.2 ㎜

(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.

# 10. Label Structure




N.B) Denoted rank is the only example.

## Rank Code

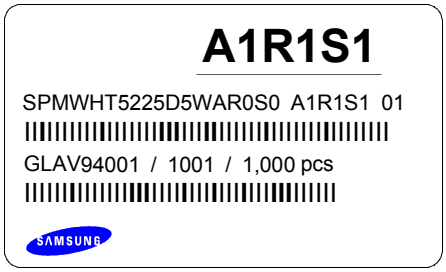
ⓐⓑ : Forward Voltage($V_F$) Rank (refer to page. 3)

ⓒⓓ : Chromaticity Coordinate Rank (refer to page. 4)

ⓔⓕ : Luminous Intensity(cd) Rank (refer to page. 3)

# 11. Lot Number

The Lot number is composed of the following characters




①②③④⑤⑥⑦⑧⑨ / 1ⓐⓑⓒ / 1,000 PCS

① : Production Site (S:SAMSUNG LED, G:GOSIN 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 LED Product number (1 ~ 999)

ⓐⓑⓒ : Reel Number (1 ~ 999)

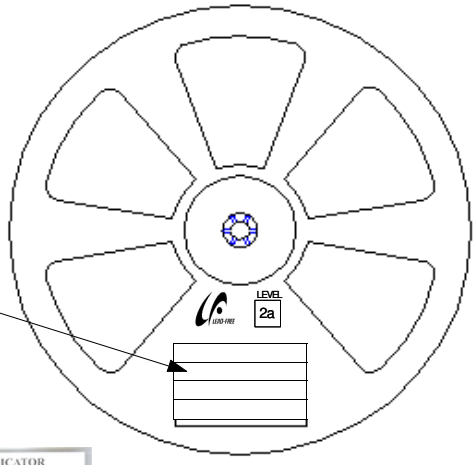
# 12. Reel Packing Structure

## Reel

**A1R1S1**

SPMWHT5225D5WAR0S0 A1R1S1 01

GLAV94001 / 1001 / 1,000 pcs

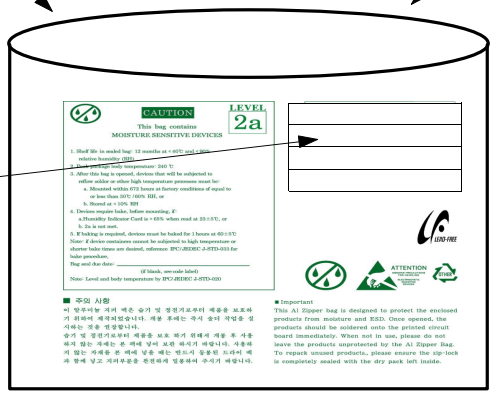



## Aluminum Vinyl Bag

**A1R1S1**

SPMWHT5225D5WAR0S0 A1R1S1 01

GLAV94001 / 1001 / 1,000 pcs




Material : Paper(SW3B(B))

| TYPE | SIZE(mm) | | |
|---|---|---|---|
| | L | W | H |
| 7inch | 245 | 220 | 182 |

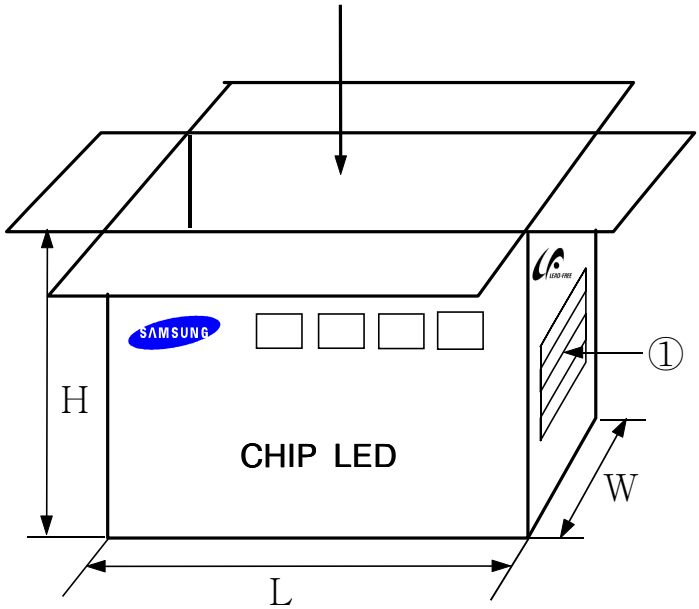
① SIDE

**A1R1S1**

SPMWHT5225D5WAR0S0 A1R1S1 01

GLAV94001 / 1001 / 10,000 pcs

[Box Label]



# 13. Aluminum Vinyl Bag

**CAUTION**

**LEVEL 2a**

This bag contains
MOISTURE SENSITIVE DEVICES

1. Shelf life in sealed bag: 12 months at < 40℃ and < 90% relative humidity (RH)
2. Peak package body temperature: 240 ℃
3. After this bag is opened, devices that will be subjected to reflow soldor or other high temperature processes must be:
   a. Mounted within 672 hours at factory conditions of equal to or less than 30℃ /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℃, or
   b. 2a is not met.
5. If baking is required, devices must be baked for 1 hours at 60±5℃

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

**A1R1S1**

SPMWHT5225D5WAR0S0 A1R1S1 01

GLAV94001 / 1001 / 1,000 pcs

SAMSUNG

LEAD-FREE

ATTENTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

OTHER

■ 주의 사항

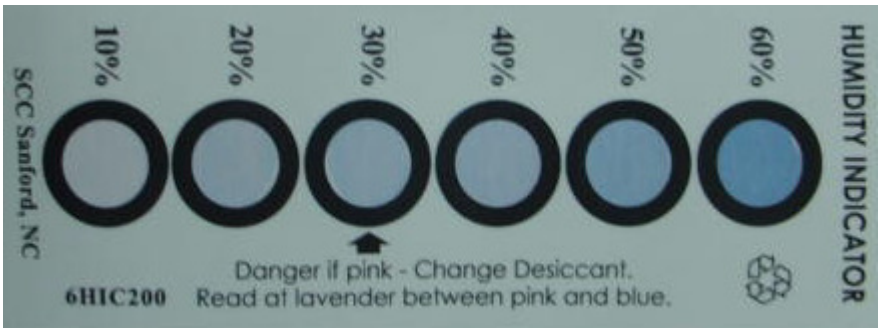
이 알루미늄 지퍼 백은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

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



# 14. Precaution for Use (취급상 주의사항)

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 SLED, they should be packed by a sealed container with nitrogen gas injected.
(Shelf life of sealed bags: 12 months, temp. ~40 ℃, ~90 %RH)
LED의 보관은 청정한 환경에서 보존되어져야 하며, 만약 삼성LED로부터 공급받는 후 3개월 또는 그 이상 보관이 필요하다면 질소 가스를 동봉한 보존용기에 보관되어야 함.
(보존 bag의 수명 : 12 개월, 보존 온도 ~40 ℃, 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 ℃/60 %RH,
a. 제품은 30 ℃/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 >65 % at 23±5 ℃.
만약 습도표시카드의 수치가 23±5 ℃에서 65 % 이상이라면, 제품 실장 전에 baking하여야 함.

8) Devices must be baked for 1 hour at 65±5 ℃, if baking is required.
만약 baking이 필요하다면, 제품은 65±5 ℃에서 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.

# 15. Hazard Substance Analysis - SGS

SGS

**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 1 of 7

To: SAMSUNG LED
#314, Maetan-Dong
Youngtong-Gu
Suwon-si
Gyeonggi-do
Korea

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

| | |
|---|---|
| SGS File No. | : AYAA11-16102 |
| Product Name | : 5630 |
| Item No./Part No. | : N/A |
| Received Date | : 2011. 05. 17 |
| Test Period | : 2011. 05. 18 to 2011. 05. 24 |
| 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. |

SGS Korea Co. Ltd.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

Jeff Jang / Chemical Lab Mgr

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SGS

**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 2 of 7

**Sample No.** : AYAA11-16102.001

**Sample Description** : 5630

**Item No./Part No.** : N/A

## Heavy Metals

| Test Items | 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. |
| Arsenic (As) | mg/kg | With reference to EPA 3052(1996), US EPA 6010B(1996), ICP | 10 | N.D. |
| Sb (Sb2O3) | mg/kg | With reference to EPA 3052(1996), US EPA 6010B(1996), ICP | 10 | N.D. |
| Beryllium (Be) | mg/kg | With reference to EPA 3050B(1996), US EPA 6010B(1996), ICP | 0.5 | N.D. |

## Flame Retardants-PBBs/PBDEs

| Test Items | 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. |

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) ** = Qualitative analysis (No Unit)
(6) * = 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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SGS

**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 3 of 7

**Sample No.** : AYAA11-16102.001

**Sample Description** : 5630

**Item No./Part No.** : N/A

## Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| 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. |

## Phthalates

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| Di-isodecyl phthalate (DIDP) | mg/kg | US EPA 8061A , GC/MS | 50 | N.D. |
| Di-isononyl phthalate (DINP) | mg/kg | US EPA 8061A , GC/MS | 50 | N.D. |
| Di-n-octyl phthalate (DNOP) | mg/kg | US EPA 8061A , GC/MS | 50 | N.D. |
| Di-ethyl phthalate(DEP) | mg/kg | US EPA 8061A , GC/MS | 50 | N.D. |
| Di-methyl phthalate (DMP) | mg/kg | US EPA 8061A , GC/MS | 50 | N.D. |

## Halogen Contents

| Test Items | 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 | 191 |
| Iodine(I) | mg/kg | BS EN 14582:2007 , IC | 50 | N.D. |

## Organotin Compounds

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| Tributyltin (TBT) | mg/kg | DIN 38407-13 , GC/MS | 0.1 | N.D. |

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**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 4 of 7

**Sample No.** : AYAA11-16102.001

**Sample Description** : 5630

**Item No./Part No.** : N/A

## Organotin Compounds

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| Triphenyltin (TPhT) | mg/kg | DIN 38407-13 , GC/MS | 0.1 | N.D. |
| Dibutyltin (DBT) | mg/kg | DIN 38407-13 , GC/MS | 0.1 | N.D. |
| Dioctyltin(DOT) | mg/kg | DIN 38407-13 , GC/MS | 0.1 | N.D. |
| Monobutyltin (MBT) | mg/kg | DIN 38407-13 , GC/MS | 0.1 | N.D. |
| Bis (tributyltin)oxide (TBTO) | mg/kg | DIN 38407-13 , GC/MS | 0.1 | N.D. |

## Other(s)

| Test Items | Unit | Test Method | MDL | Results |
|---|---|---|---|---|
| PFOS(Perfluorooctane Sulfonates-Acid/Metal Salt/Amide) | mg/kg | US EPA 3540C/3550C, LC/MS | 1 | N.D. |

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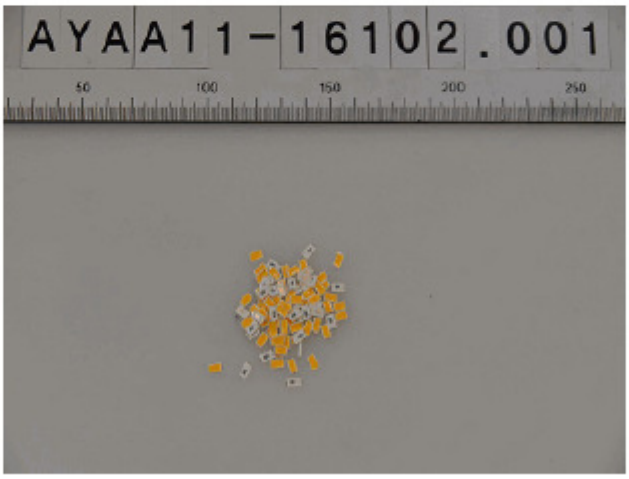
**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 5 of 7

**Picture of Sample as Received:**

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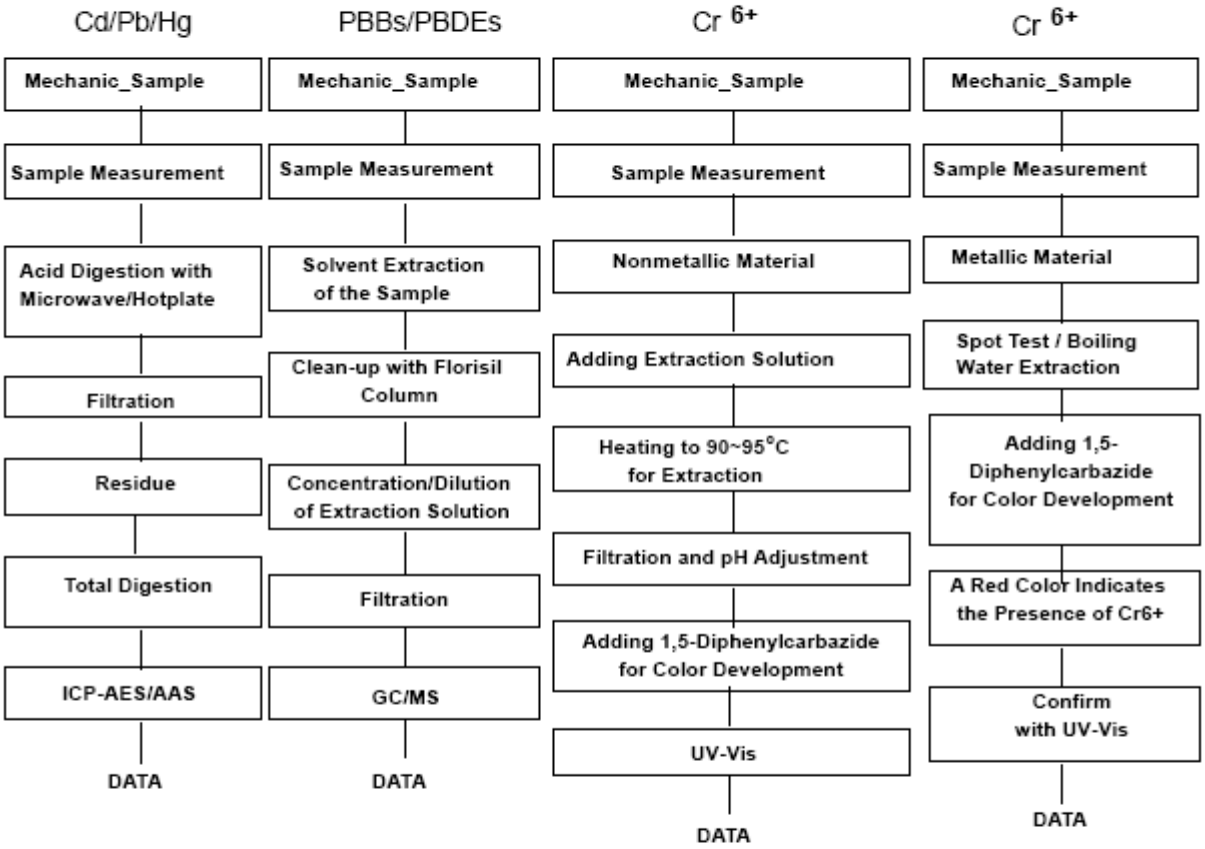
**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 6 of 7

## Flow Chart for RoHS:Cd/Pb/Hg/$Cr^{6+}$/PBBs&PBDEs Testing




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

Section Chief : Gilsae Yi

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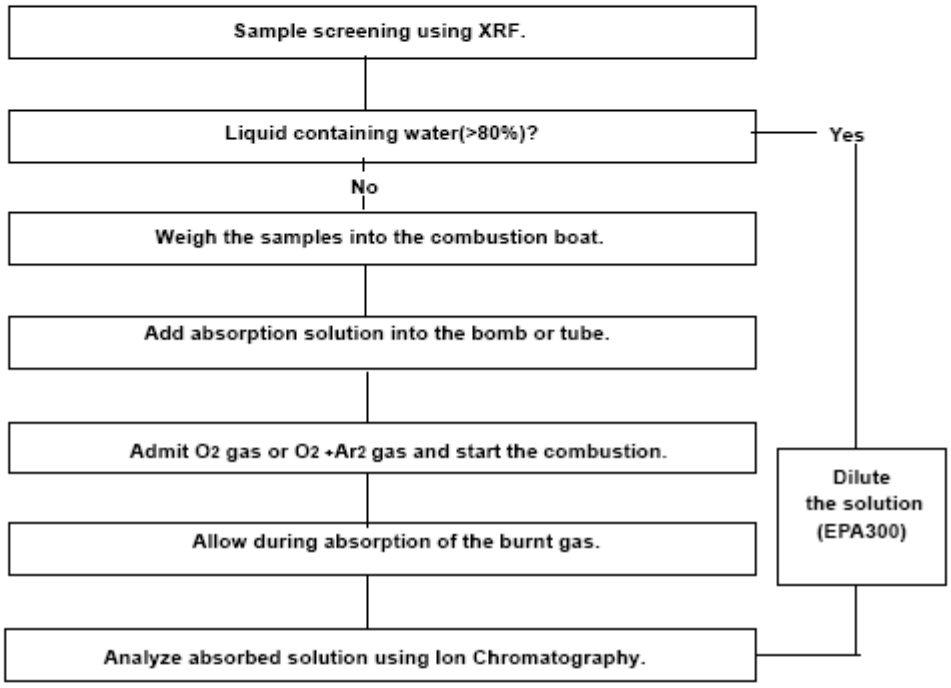
**Test Report No.** F690501/LF-CTSAYAA11-16102 Issued Date: 2011. 05. 24 Page 7 of 7

## Flow Chart for Halogen Test




*** End ***

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# 16. Hazard Substance Analysis - SVHC(REACH)

SGS

**Test Report No.** F690501/LF-CTSAYAA11-16099 Issued Date: May 24, 2011 Page 1 of 8

To: **SAMSUNG LED**
#314, Maetan3-Dong
Yeongtong-gu
Suwon-city
Gyeonggi-do
Korea

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

| | | |
|---|---|---|
| **Product Name** | : | 5630 White |
| **Item/Part Name** | : | N/A |
| **SGS File No.** | : | AYAA11-16099 |
| **Received Date** | : | May 17, 2011 |
| **Test Period** | : | May 18, 2011 ~ May 24, 2011 |
| **Test Performed** | : | SGS Korea tested the sample(s) selected by applicant with following results |
| **Test Requested** | : | Forty-six (46) substances in the Candidate List of Substances of Very High Concern (SVHC) for authorization published by European Chemicals Agency (ECHA) on and before December 15, 2010 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). |
| **Summary** | : | According to the specified scope and analytical technique, concentrations of all SVHC are <0.1% in the submitted sample(s). |

**SGS Korea Co., Ltd**

**Timothy Jeon**
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**Test Report No.** F690501/LF-CTSAYAA11-16099 Issued Date: May 24, 2011 Page 2 of 8

**Test Method:**

SGS In-House method-RSTS-SVHC-102-2, 3 and ZLS standard ZEK 01.2-08. Analyzed by ICP-OES, PLM, UV/VIS, LC/MS and GC/MS.

**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: These lists are under evaluation by ECHA and may subject to change in the future.
   Refer to: http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp
   Refer to: http://echa.europa.eu/news/pr/201012/pr_10_26_svhc_candidate_list_20101215_en.asp
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. 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.

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**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 to Reproduction Category 2 |
| Bis (2-ethylhexylphthalate) (DEHP) | 117-81-7 | 204-211-0 | N.D. | 0.05 | Toxic to Reproduction Category 2 |
| 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 Category 2 |
| 4,4Diaminodiphenylmethane | 101-77-9 | 202-974-4 | N.D. | 0.05 | Carcinogen Category 2 |
| Diarsenic pentaoxide* | 1303-28-2 | 215-116-9 | N.D. | 0.005 | Carcinogen Category 1 |
| Diarsenic trioxide* | 1327-53-3 | 215-481-4 | N.D. | 0.005 | Carcinogen Category 1 |
| Dibutyl phthalate (DBP) | 84-74-2 | 201-557-4 | N.D. | 0.05 | Toxic to Reproduction Category 2 |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α-HBCDD, β-HBCDD, γ-HBCDD) | 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8) | 247-148-4 and 221-695-9 | N.D. | 0.05 | PBT |
| Lead hydrogen arsenate* | 7784-40-9 | 232-064-2 | N.D. | 0.005 | Carcinogen Category 1; Toxic to Reproduction Category 1 |
| Sodium dichromate* (Sodium dichromate, dehydrate) | 10588-01-9 (7789-12-0) | 234-190-3 | N.D. | 0.005 | Carcinogen Category 2; Mutagen Category 2; Toxic to Reproduction Category 2 |
| 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 Category 1 |

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| 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 to Reproduction Category 2 |
| 2,4-Dinitrotoluene | 121-14-2 | 204-450-0 | N.D. | 0.05 | Carcinogen Category 2 |
| Tris(2-chloroethyl) phosphate | 115-96-8 | 204-118-5 | N.D. | 0.05 | Toxic to Reproduction Category 2 |
| Anthracene oil | 90640-80-5 | 292-602-7 | N.D. | 0.05 | PBT; vPvB Carcinogen Category 2 |
| Anthracene oil, anthracene paste; distn. Lights | 91995-17-4 | 295-278-5 | N.D. | 0.05 | PBT; vPvB; Carcinogen Category 2; Mutagen Category 2 |
| Anthracene oil, anthracene paste, anthracene fraction | 91995-15-2 | 295-275-9 | N.D. | 0.05 | PBT; vPvB; Carcinogen Category 2; Mutagen Category 2 |
| Anthracene oil, anthracene-low | 90640-82-7 | 292-604-8 | N.D. | 0.05 | PBT; vPvB; Carcinogen Category 2; Mutagen Category 2 |
| Anthracene oil, anthracene paste | 90640-81-6 | 292-603-2 | N.D. | 0.05 | PBT; vPvB; Carcinogen Category 2; Mutagen Category 2 |
| Coal tar pitch, high temperature | 65996-93-2 | 266-028-2 | N.D. | 0.05 | PBT; vPvB; Carcinogen Category 2 |
| Aluminosilicate, Refractory Ceramic Fibres* | - | 650-017-00-8 (Index no.) | N.D. | 0.005 | Carcinogen Category 2 |
| Zirconia Aluminosilicate, Refractory Ceramic Fibres* | - | 650-017-00-8 (Index no.) | N.D. | 0.005 | Carcinogen Category 2 |
| Lead sulfochromate yellow (C.I. Pigment Yellow 34)* | 1344-37-2 | 215-693-7 | N.D. | 0.005 | Carcinogen Category 2; Toxic to Reproduction Category 1 |
| Lead chromate molybdate sulfate red (C.I. Pigment Red 104)* | 12656-85-8 | 235-759-9 | N.D. | 0.005 | Carcinogen Category 2; Toxic to Reproduction Category 1 |
| Lead chromate* | 7758-97-6 | 231-846-0 | N.D. | 0.005 | Carcinogen Category 2; Toxic to Reproduction Category 1 |
| Acrylamide | 79-06-01 | 201-173-7 | N.D. | 0.05 | Carcinogen Category 2; Mutagen Category 2 |

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F052 Version4

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

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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 Category 2; Toxic to Reproduction Category 2 |
| Cobalt(II) dinitrate # | 10141-05-6 | 233-402-1 | N.D. | 0.005 | Carcinogen Category 2; Toxic to Reproduction Category 2 |
| Cobalt(II) carbonate # | 513-79-1 | 208-169-4 | N.D. | 0.005 | Carcinogen Category 2; Toxic to Reproduction Category 2 |
| Cobalt(II) diacetate # | 71-48-7 | 200-755-8 | N.D. | 0.005 | Carcinogen Category 2; Toxic to Reproduction Category 2 |
| 2-Methoxyethanol | 109-86-4 | 203-713-7 | N.D. | 0.05 | Toxic to Reproduction Category 2 |
| 2-Ethoxyethanol | 110-80-5 | 203-804-1 | N.D. | 0.05 | Toxic to Reproduction Category 2 |
| Chromium trioxide ^ | 1333-82-0 | 215-607-8 | N.D. | 0.005 | Carcinogen Category 1; Mutagen Category 2 |
| Acids generated from chromium trioxide and their oligomers:<br><br>Chromic acid<br>Dichromic acid<br><br>Oligomers of chromic acid and dichromic acid ^ | <br><br><br>7738-94-5<br>13530-68-2<br>- | <br><br><br>231-801-5<br>236-881-5<br>- | N.D. | 0.005 | Carcinogen Category 2 |

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**Note:**

1. RL = Reporting Limit
2. ND = Not detected (lower than RL)

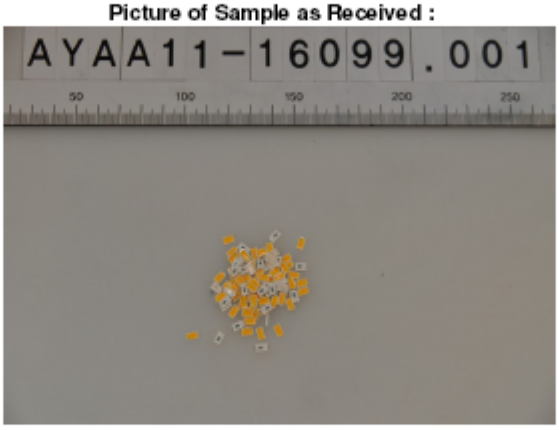
   NA = Not applicable for respective material type.

   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.. *.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

   # Calculated concentration of boric acid, disodium tetraborate, anhydrous and tetraboron disodium heptaoxide, hydrate are based on the total/water extractive boron by ICP-OES.Calculated concentrations of cobalt(II) sulphate, cobalt(II) dinitrate, cobalt(II) carbonate, cobalt(II) diacetate are based on the total/water extractive cobalt by ICP-OES.

   ˆCalculated concentrations of chromium trioxide, chromic acid and dichromic acid are based on the identified chromium(VI) by UV-Vis.
4. Test result of anthracene oil and coal tar are calculated as per selected identifiers of the SVHC. The value is reported in aggregate per anthracene oil or coal tar and based on the worst-case scenario.
5. 0.1% (w/w) = 1,000 ppm = 1,000 mg/kg

**Picture of Sample as Received :**




*** End of Report ***

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**Appendix A**

| Classification | Definition under 67/548/EEC and Regulation (EC) No 1907/2006 |
|---|---|
| Carcinogen Category 1: | Substances known to be carcinogenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer. |
| Carcinogen Category 2: | Substances which should be regarded as if they are carcinogenic to man. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer.<br>Generally on the basis of:<br>- appropriate long-term animal studies<br>- other relevant information. |
| Mutagen Category 1: | Substances known to be mutagenic to man. There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage. |
| Mutagen Category 2: | Substances which should be regarded as if they are mutagenic to man. 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:<br>- appropriate animal studies,<br>- other relevant information. |
| Toxic to Reproduction Category 1: | Substances known to impair fertility in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility.<br>Substances known to cause developmental toxicity in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent developmental toxic effects in the progeny. |
| Toxic to Reproduction Category 2: | Substances which should be regarded as if they impair fertility in humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of:<br>- 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,<br>- other relevant information.<br>Substances which should be regarded as if they cause developmental toxicity to humans. 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:<br>- 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,<br>- 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. |

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# Revision History
# (Model:SPMWHT5225D5WAR0S0)

| Date | Revision History | Writer | |
|---|---|---|---|
| | | Drawn | Approved |
| 2011.04.13 | New Version | T.J Kim | Y.H Song |
| 2011.07.20 | p.3 IV(cd)&Flux(lm) spec. change | T.J Kim | Y.H Song |
| 2011.10.19 | p.4 Electro-Optical Characteristics add | T.J Kim | Y.H Song |
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