

DATE OF ISSUE : 2011. 04. 13

# SPECIFICATION

MODEL : SPMWHT5225D5WAW0S0

Approved rank :  $V_F$ (A1, A2, A3, A4, A5),  
CIE(V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG),  
 $I_V$ (S1, S2)



## 5630 CRI80 WHITE LED W0 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 (  $\Delta\theta$  : 120 °)
- . GaN/Al<sub>2</sub>O<sub>3</sub> Chip & Long Time Reliability

## 2) Applications

- . Indoor, Outdoor Display and etc.

# 2. Absolute Maximum Rating

| Parameter                           | Symbol              | Rating           | Condition                   |
|-------------------------------------|---------------------|------------------|-----------------------------|
| Operating temperature range         | T <sub>op</sub>     | −40 ~ +85 °C     |                             |
| Storage temperature range           | T <sub>stg</sub>    | −40 ~ +100 °C    |                             |
| Junction Temperature                | T <sub>j</sub>      | 110 °C           |                             |
| Forward current                     | I <sub>F</sub>      | 150 mA           |                             |
| Peak Pulsed Forward Current         | I <sub>FP</sub>     | 300 mA           | Duty 1/10 Pulse Width 10 ms |
| Reverse Voltage                     | V <sub>R</sub>      | 0.7 ~ 1.2 V      | IR = 5 mA                   |
| Thermal resistance, Junction to PCB | R <sub>th, JS</sub> | < 40 K/W         |                             |
| Assembly Process Temp.              |                     | 260 °C, < 10 sec |                             |
| ESD                                 |                     | 5 kV             | HBM                         |

# 3. Characteristics

## Electrical / Optical Characteristics

( Ta : 25 °C )

| Item                | Symbol         | Conditions             | Rank | Min. | Typ. | Max. | Unit |
|---------------------|----------------|------------------------|------|------|------|------|------|
| Forward Voltage (*) | V <sub>F</sub> | I <sub>F</sub> = 50 mA | WA   | A1   | 2.8  | -    | 2.9  |
|                     |                |                        |      | A2   | 2.9  | -    | 3.0  |
|                     |                |                        |      | A3   | 3.0  | -    | 3.1  |
|                     |                |                        |      | A4   | 3.1  | -    | 3.2  |
|                     |                |                        |      | A5   | 3.2  | -    | 3.3  |
| Reverse Voltage     | V <sub>r</sub> | I <sub>F</sub> = 5 mA  | -    | 0.7  | -    | 1.2  | V    |
| Color Rendering     | R <sub>a</sub> | I <sub>F</sub> = 50 mA | 5    | 80   | -    | -    | -    |

## Luminous Intensity / Luminous Flux

( Ta : 25 °C )

| Symbol         | Conditions             | Model Name         | Rank | Min. | Typ.  | Max. | Unit  |
|----------------|------------------------|--------------------|------|------|-------|------|-------|
| I <sub>v</sub> | I <sub>F</sub> = 50 mA | SPMWHT5225D5WAW0S0 | S0   | S1   | 4.89  | -    | 5.64  |
|                |                        |                    |      | S2   | 5.64  | -    | 6.58  |
| Φ <sub>v</sub> | I <sub>F</sub> = 50 mA | SPMWHT5225D5WAW0S0 | S0   | S1   | 14.62 | -    | 16.86 |
|                |                        |                    |      | S2   | 16.86 | -    | 19.67 |

\* Luminous Flux (Φ<sub>v</sub>) : Only reference data.

## Chromaticity Coordinate

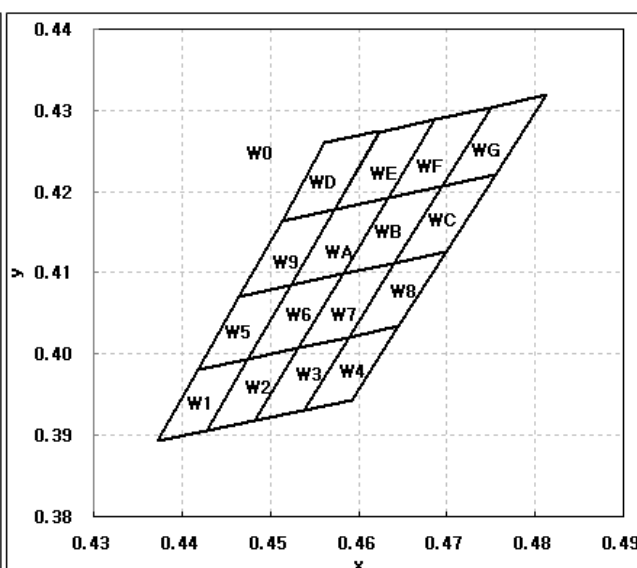
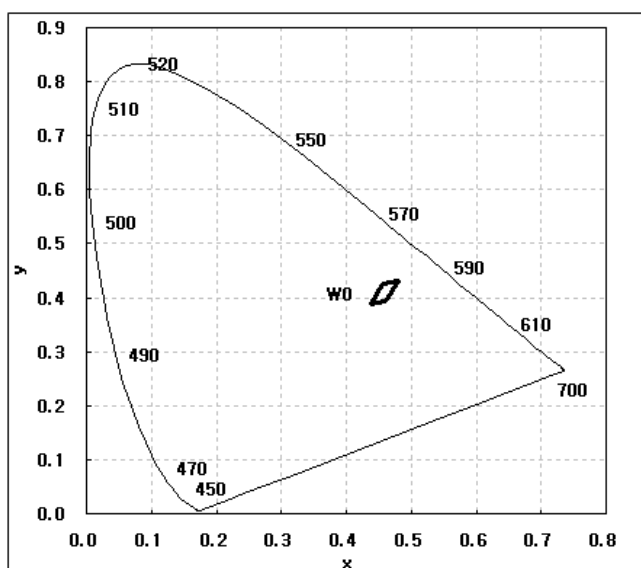
( Ta : 25 °C )

| Condition              | Rank | x  |        |        |        | y      |        |        |        |        |
|------------------------|------|----|--------|--------|--------|--------|--------|--------|--------|--------|
| I <sub>F</sub> = 50 mA | W0   | W1 | 0.4373 | 0.4428 | 0.4475 | 0.4418 | 0.3893 | 0.3906 | 0.3994 | 0.3981 |
|                        |      | W2 | 0.4428 | 0.4483 | 0.4532 | 0.4475 | 0.3906 | 0.3919 | 0.4008 | 0.3994 |
|                        |      | W3 | 0.4483 | 0.4538 | 0.4589 | 0.4532 | 0.3919 | 0.3931 | 0.4021 | 0.4008 |
|                        |      | W4 | 0.4538 | 0.4593 | 0.4646 | 0.4589 | 0.3931 | 0.3944 | 0.4034 | 0.4021 |
|                        |      | W5 | 0.4418 | 0.4475 | 0.4523 | 0.4465 | 0.3981 | 0.3994 | 0.4085 | 0.4071 |
|                        |      | W6 | 0.4475 | 0.4532 | 0.4582 | 0.4523 | 0.3994 | 0.4008 | 0.4099 | 0.4085 |
|                        |      | W7 | 0.4532 | 0.4589 | 0.4641 | 0.4582 | 0.4008 | 0.4021 | 0.4112 | 0.4099 |
|                        |      | W8 | 0.4589 | 0.4646 | 0.4700 | 0.4641 | 0.4021 | 0.4034 | 0.4126 | 0.4112 |
|                        |      | W9 | 0.4465 | 0.4523 | 0.4573 | 0.4513 | 0.4071 | 0.4085 | 0.4178 | 0.4164 |
|                        |      | WA | 0.4523 | 0.4582 | 0.4634 | 0.4573 | 0.4085 | 0.4099 | 0.4193 | 0.4178 |
|                        |      | WB | 0.4582 | 0.4641 | 0.4695 | 0.4634 | 0.4099 | 0.4112 | 0.4207 | 0.4193 |
|                        |      | WC | 0.4641 | 0.4700 | 0.4756 | 0.4695 | 0.4112 | 0.4126 | 0.4221 | 0.4207 |
|                        |      | WD | 0.4513 | 0.4573 | 0.4624 | 0.4562 | 0.4164 | 0.4178 | 0.4274 | 0.4260 |
|                        |      | WE | 0.4573 | 0.4634 | 0.4687 | 0.4624 | 0.4178 | 0.4193 | 0.4289 | 0.4272 |
|                        |      | WF | 0.4634 | 0.4695 | 0.4750 | 0.4687 | 0.4193 | 0.4207 | 0.4304 | 0.4289 |
|                        |      | WG | 0.4695 | 0.4756 | 0.4813 | 0.4750 | 0.4207 | 0.4221 | 0.4319 | 0.4304 |

\* Tolerance : V<sub>F</sub>:±0.1 V, I<sub>v</sub>:±5 %, x,y:±0.01, R<sub>a</sub> :±3.0

\* Luminous Intensity measuring equipment : CAS140CT

## 4. Chromaticity Diagram



\* W0 = W1+W2+W3+W4+W5+W6+W7+W8+W9+WA+WB+WC+WD+WE+WF+WG

| V <sub>F</sub>     | CIE  | I <sub>v</sub> |
|--------------------|--|----------------|
| A1, A2, A3, A4, A5 | W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG | S1, S2         |

\* Each reel contains only one of the A1, A2, A3, A4 or A5 a segment (1/5) of the V<sub>F</sub> rank.

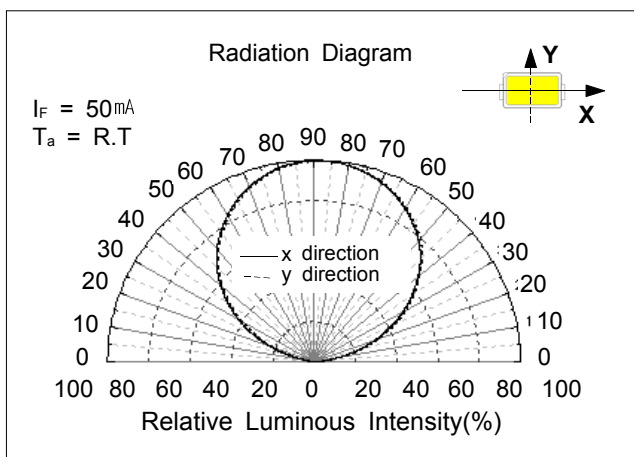
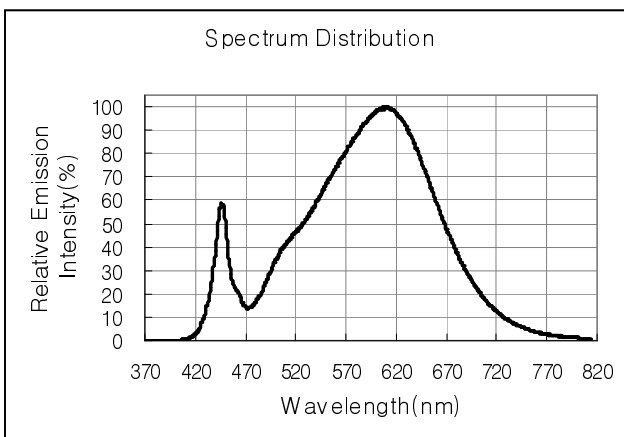
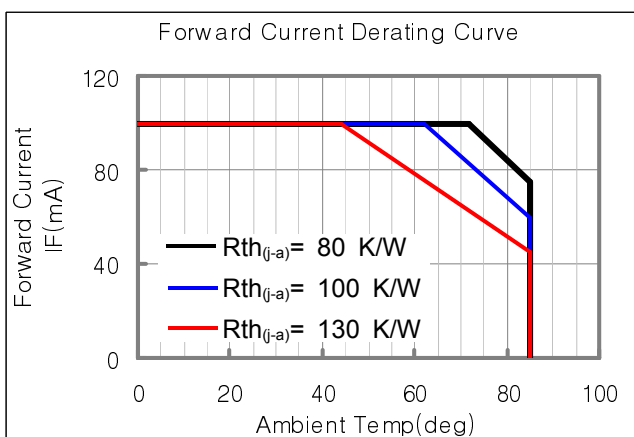
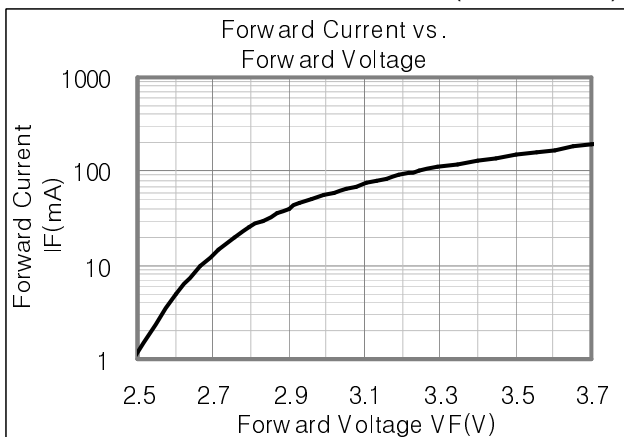
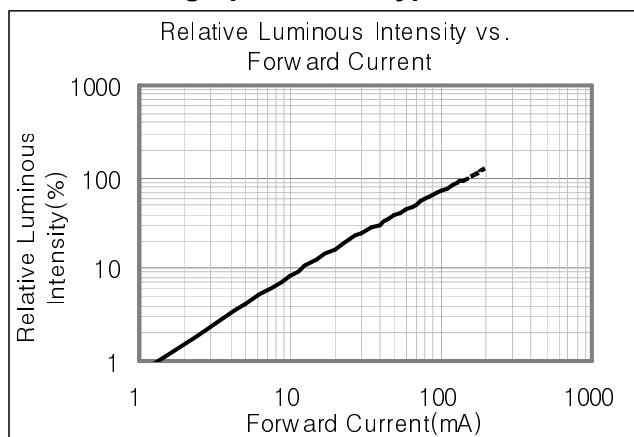
\* Each reel contains only one of the W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF or WG a segment (1/16) of the CIE rank.

\* Each reel contains only one of the S1 or S2 a segment (1/2) of the I<sub>v</sub> rank.

## 5. Typical Characteristics Graph

\* These graphs show typical values.

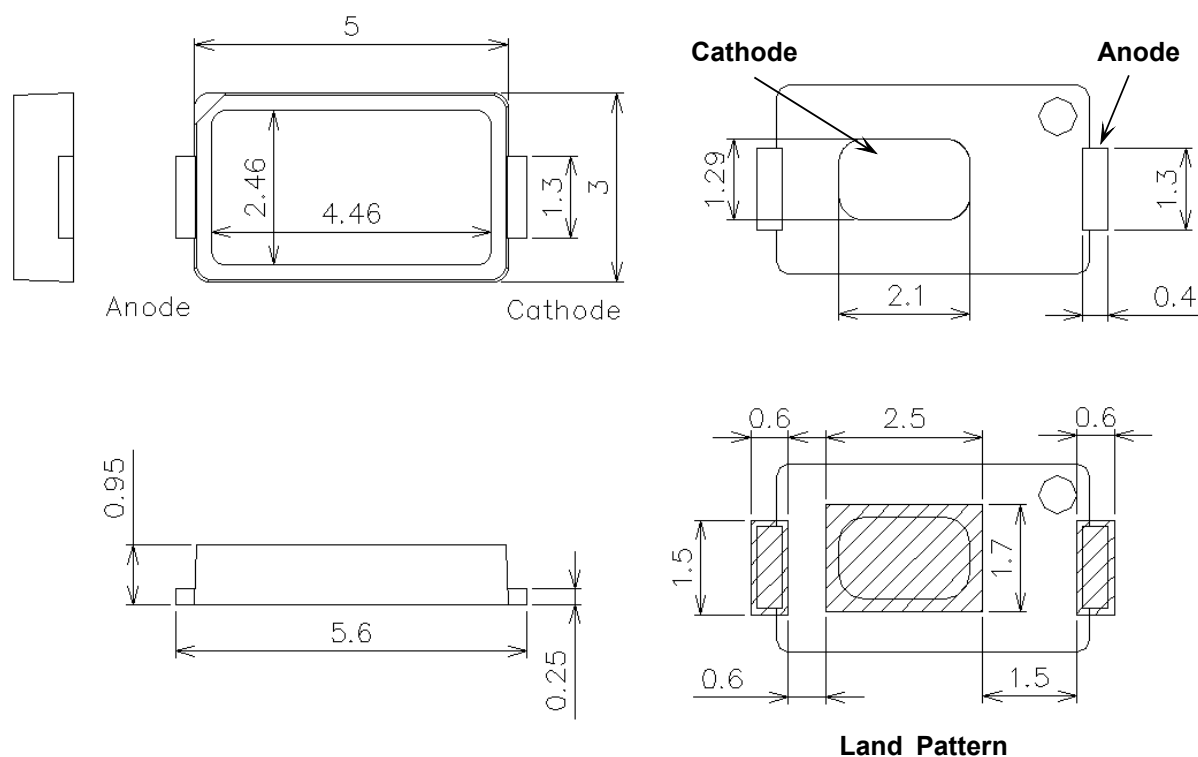
(  $T_a$  : 25 °C )



## 6. LED Package Outline Dimensions

unit:mm

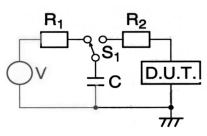
Tolerance:±0.1



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

## 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<br>→ 260 ℃ 10sec 3 cycles                      |   | 1 cycle           | 50        |
| Room Temperature life test            | 25 ℃±3 ℃, DC100 mA  |   | 1,000 hrs         | 50        |
| High Temperature life test            | 85 ℃±3 ℃, DC75 mA   |   | 1,000 hrs         | 50        |
| High Temperature humidity life test   | 60 ℃±3 ℃, 95 %±2 %RH, DC100 mA  |   | 1,000 hrs         | 50        |
| High Temperature humidity On/Off test | 85 ℃±3 ℃, 85 %±2 %RH, DC100 mA<br>DC100 mA, On/2 sec, Off/5 sec                         |   | 100,000 cycles    | 50        |
| Low Temperature life test             | -40 ℃±3 ℃, DC100 mA   |   | 1,000 hrs         | 50        |
| Temperature humidity Cycle            | -10 ℃ ~ 25 ℃,95 %RH ~ 65 ℃,95 %RH<br>DC100 mA, 24 hrs/1 cycle                           |   | 10 cycles         | 50        |
| Thermal Shock                         | -45 ℃/15 min ↔ 125 ℃/15 min, 150 Cycle<br>=> 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<br>24 hrs/ 1 cycle                                  |   | 10 cycles         | 11        |
| ESD(HBM)                              |      | R1:10 MΩ, R2:1.5 kΩ,<br>C:100 pF, V = ±5 kV | 5 times           | 5         |
| ESD(MM)                               |   | -R1:10 MΩ, R2:0,<br>C:200 pF, V = ±0.2 kV   | 5 times           | 5         |
| Vibration Test                        | 100~2000~100 Hz, 200 m/s²,<br>Sweep 4 min, 48 min,<br>X, Y, Z 3 direction, each 1 cycle |   | 4 cycles          | 11        |
| Mechanical Shock Test                 | 1500G, 0.5 ms,<br>3 shocks each X-Y-Z axis  |   | 5 cycles          | 11        |

## 2) Criteria for Judging the Damage

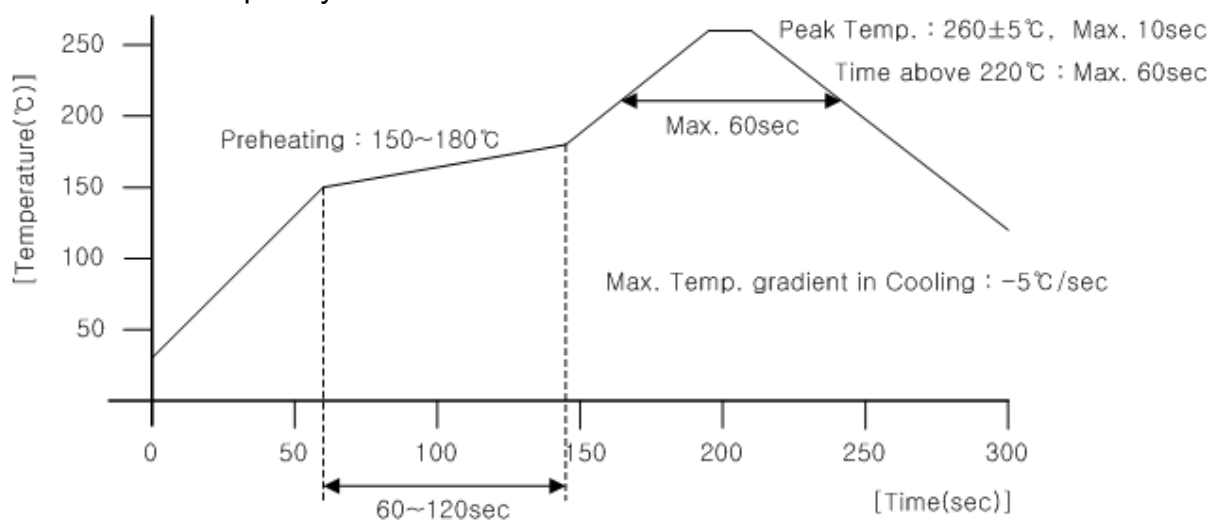
| Item               | Symbol | Test Condition        | Limit           |                 |
|--------------------|--------|-----------------------|-----------------|-----------------|
|                    |        |                       | Min             | Max             |
| Forward Voltage    | $V_F$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

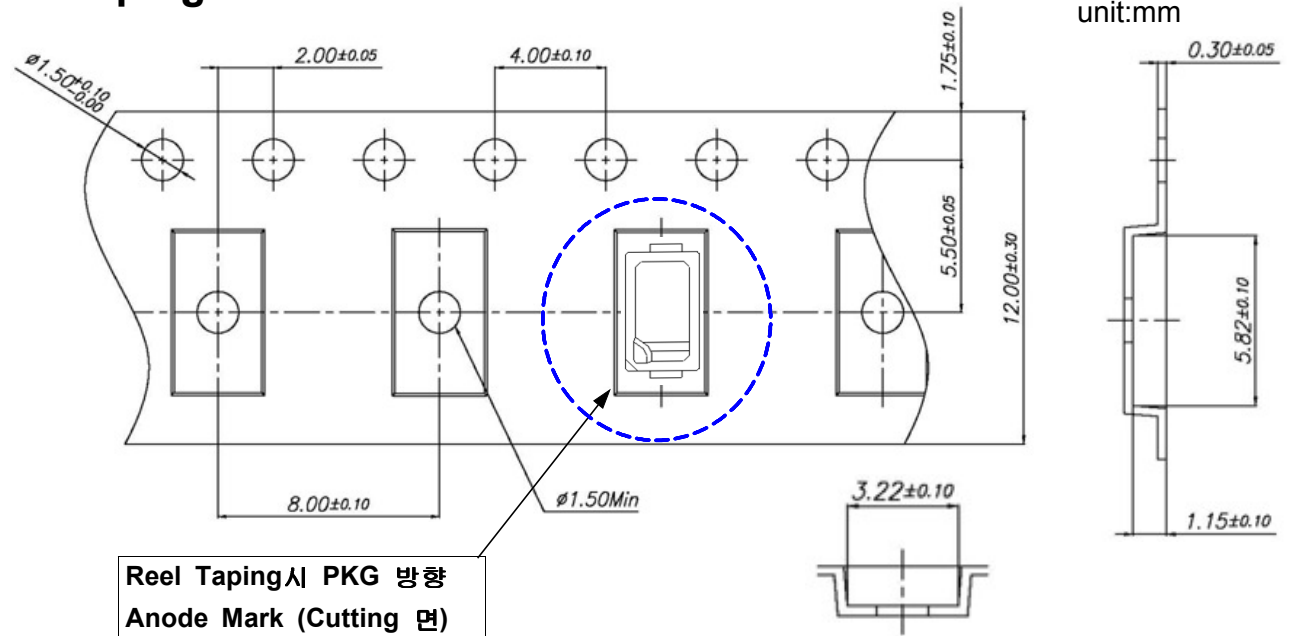


### 2) For Manual Soldering

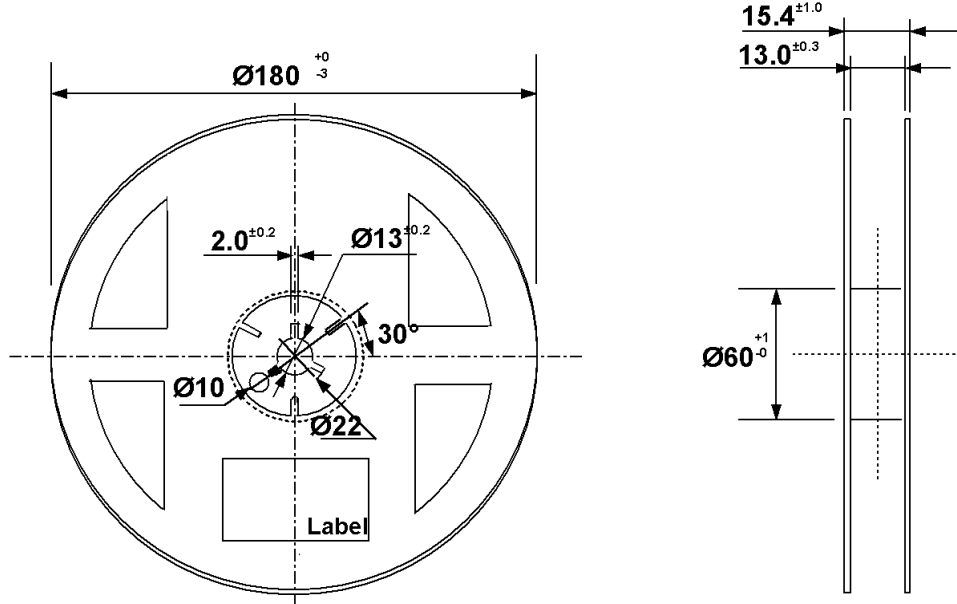
Not more than 5 seconds @MAX300 °C, under soldering iron.



## 9. Taping Dimension



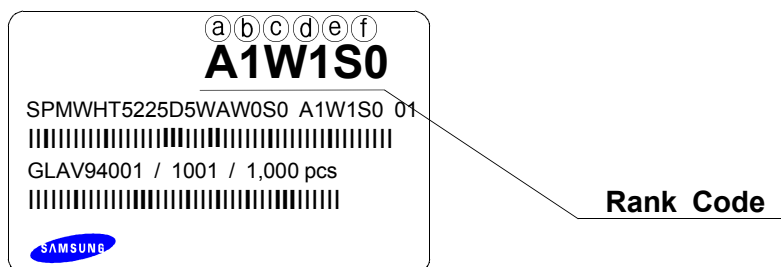
| End                              |                           |                                      |                                 | Start |
|----------------------------------|---------------------------|--------------------------------------|---------------------------------|-------|
| More than 500mm<br>Unloaded tape | Mounted with<br>Flash LED | More than 100~200mm<br>Unloaded tape | Leading part more than<br>500mm |       |



Tolerance  $\pm 0.2$  , Unit:mm

- (1) Quantity : The quantity/Reel to be Max. 1,000 pcs, .
- (2) Cumulative Tolerance : Cumulative tolerance/10 pitches to be  $\pm 0.2$  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.

## 10. Label Structure



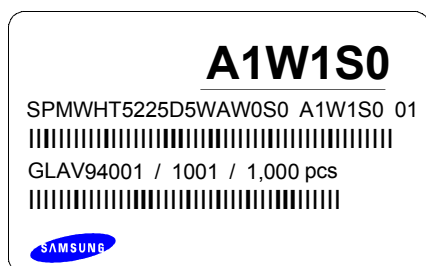
N.B) Denoted rank is the only example.

### 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




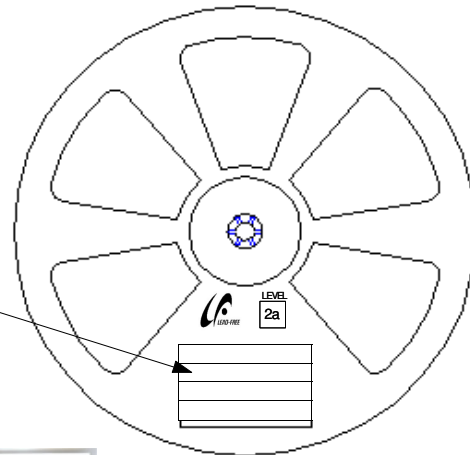
①②③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / 1,000 PCS

- 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


**A1W1S0**  
SPMWHT5225D5WAW0S0 A1W1S0 01  
|||||  
GLAV94001 / 1001 / 1,000 pcs  
|||||  




### Aluminum Vinyl Bag

**A1W1S0**  
SPMWHT5225D5WAW0S0 A1W1S0 01  
|||||  
GLAV94001 / 1001 / 1,000 pcs  
|||||  




**A1W1S0**  
SPMWHT5225D5WAW0S0 A1W1S0 01  
|||||  
GLAV94001 / 1001 / 1,000 pcs  
|||||  


**CAUTION**  
This bag contains  
MOISTURE SENSITIVE DEVICES  
LEVEL 2a

1. Seal this bag in sealed bag, 10 months at +25°C and 60% RH.
2. After the bag is opened, devices that will be subjected to either solder or other high temperature processes must be used within 48 hours of opening.
3. If the bag is opened, devices must be used within 48 hours of opening.
4. Devices must be used within 48 hours of opening.
5. If the bag is opened, devices must be used within 48 hours of opening.
6. If the bag is opened, devices must be used within 48 hours of opening.

■ 주의 사항  
이 봉투는 습기 또는 공기 중 먼지로부터 제품을 보호하기 위해 제작되었습니다. 개봉 후에는 즉시 공기 중의 먼지를 제거하는 것을 권장합니다.  
습기 및 공기 중 먼지로부터 제품을 보호하기 위해 이 봉투를 개봉 후 48시간 이내에 사용해야 합니다. 개봉 후 48시간 이내에 사용하지 않는 제품은 반드시 밀봉하여 보관하십시오. 이 봉투를 개봉 후 48시간 이내에 사용하지 않는 제품은 반드시 밀봉하여 보관하십시오.

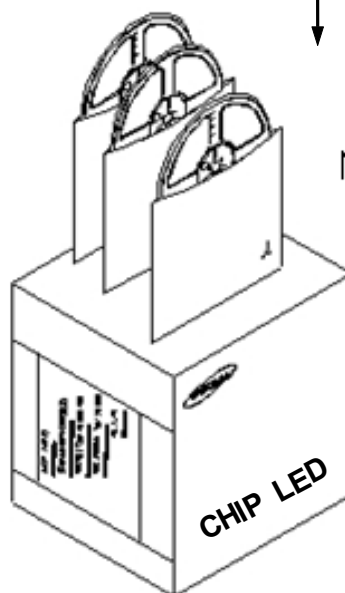
■ Important  
This A1 Zipper bag is designed to protect the enclosed products from moisture and ESD. Once opened, the products should be soldered onto the printed circuit board immediately. When not in use, please do not leave the products unprotected by the A1 Zipper bag. To repair unused products, please ensure the zip-lock is completely sealed with the dry pack left inside.

Material : Paper(SW3B(B))

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

#### ① SIDE

**A1W1S0**  
SPMWHT5225D5WAW0S0 A1W1S0 01  
|||||  
GLAV94001 / 1001 / 10,000 pcs  
|||||  
 [Box Label]



Max. 10,000 pcs

## 13. Aluminum Vinyl Bag


**CAUTION**

This bag contains  
MOISTURE SENSITIVE DEVICES

**LEVEL**  
**2a**

- Shelf life in sealed bag: 12 months at  $<40^{\circ}\text{C}$  and  $<90\%$  relative humidity (RH)
  - Peak package body temperature:  $240^{\circ}\text{C}$
  - After this bag is opened, devices that will be subjected to reflow solder or other high temperature processes must be:
    - Mounted within 672 hours at factory conditions of equal to or less than  $30^{\circ}\text{C}$  /  $60\%$  RH, or
    - Stored at  $<10\%$  RH
  - Devices require bake, before mounting, if:
    - Humidity Indicator Card is  $>65\%$  when read at  $23\pm5^{\circ}\text{C}$ , or
    - 2a is not met.
  - If baking is required, devices must be baked for 1 hours at  $60\pm5^{\circ}\text{C}$
- Note: if device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure,
- Bag seal due date: \_\_\_\_\_

(if blank, see code label)

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

**A1W1S0**

SPMWHT5225D5WAW0S0 A1W1S0 01

GLAV94001 / 1001 / 1,000 pcs

SAMSUNG



### 주의 사항

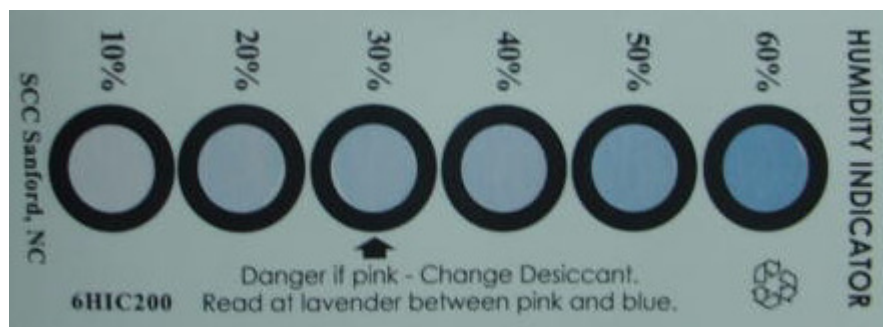
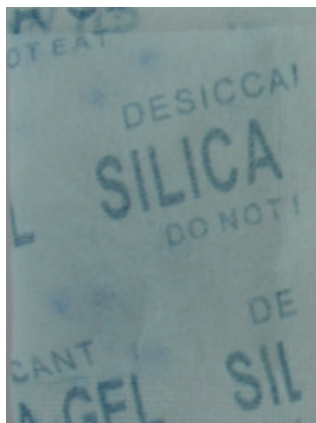
이 알루미늄 지퍼 백은 습기 및 정전기로부터 제품을 보호하기 위하여 제작되었습니다. 개봉 후에는 즉시 솔더 작업을 실시하는 것을 권장합니다.

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. 0~40 °C, 20~70 %RH)

LED의 보관은 청정한 환경에서 보존되어야 하며, 만약 삼성LED로부터 공급받는 후 3개월 또는 그 이상 보관이 필요하다면 질소 가스를 동봉한 보존용기에 보관되어야 함.

(보존 bag의 수명 : 12 개월, 보존 온도 0~40 °C, 습도 20~70 %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 168 hours (7 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 168시간(7일) 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  $23\pm5\text{ }^{\circ}\text{C}$ .

만약 습도표시카드의 수치가  $23\pm5\text{ }^{\circ}\text{C}$ 에서  $60\%$  이상이라면, 제품 실장 전에 baking하여야 함.

- 8) Devices must be baked for 24 hours at  $65\pm5\text{ }^{\circ}\text{C}$ , if baking is required.

만약 baking이 필요하다면, 제품은  $65\pm5\text{ }^{\circ}\text{C}$ 에서 24시간 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


**Test Report No.** F690501/LF-CTSAYAA10-28284

**Issued Date:** August 17, 2010 **Page 1 of 5**

**To:** SAMSUNG LED CO.,LTD.  
314, Maetan-dong  
Yeongtong-gu  
Suwon-city  
GYEONGGI-DO  
Korea

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

**SGS File No.** : AYAA10-28284  
**Product Name** : LED  
**Item No./Part No.** : 5830N2(A) PKG  
**Received Date** : Aug 12, 2010  
**Test Period** : Aug 13, 2010 to Aug 16, 2010  
**Test Performed** : SGS Testing Korea tested the sample(s) selected by applicant with following results  
**Test Results** : For further details, please refer to following page(s)  
**Comments** : By the applicant's specific request, the sampling and testing was performed only for the part indicated in the photo without disassembly.

Timothy Jeon  
Jinhee Kim  
Cindy Park  
Jerry Jung/ Testing Person

SGS Testing Korea Co. Ltd.

Jeff Jang / Chemical Lab Mgr

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Clients of service stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 100 days only.

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322, The C valley, 555-9, Hoggae-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-050  
t +82 (0)31 4605 000 f +82 (0)31 4605 059 <http://www.sgslab.co.kr> / [www.kr.sgs.com/greentlab](http://www.kr.sgs.com/greentlab)

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**Test Report No. F690501/LF-CTSA10-28284**

Issued Date: August 17, 2010 Page 2 of 5

Sample No. : AYAA10-28284.001  
 Sample Description : LED  
 Item No./Part No. : 5630N2(A) PKG

**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.    |

**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.    |
| Hexabromodiphenyl ether  | mg/kg | With reference to IEC 62321:2008, GC-MS | 5   | N.D.    |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5   | N.D.    |
| Octabromodiphenyl ether  | mg/kg | With reference to IEC 62321:2008, GC-MS | 5   | N.D.    |
| Nonabromodiphenyl ether  | mg/kg | With reference to IEC 62321:2008, GC-MS | 5   | N.D.    |
| Decabromodiphenyl ether  | mg/kg | With reference to IEC 62321:2008, GC-MS | 5   | N.D.    |

NOTE: (1) N.D. = Not detected. (<MDL)  
 (2) mg/kg = ppm  
 (3) MDL = Method Detection Limit  
 (4) - = No regulation  
 (5) \*\* = 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 cm<sup>2</sup> sample surface area.

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SGS Testing Korea Co., Ltd.

 322, The G valley, 555-8, Hoge-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-280  
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Item No./Part No. : 5630N2(A) PKG

## 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.    |

Picture of Sample as Received:



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  
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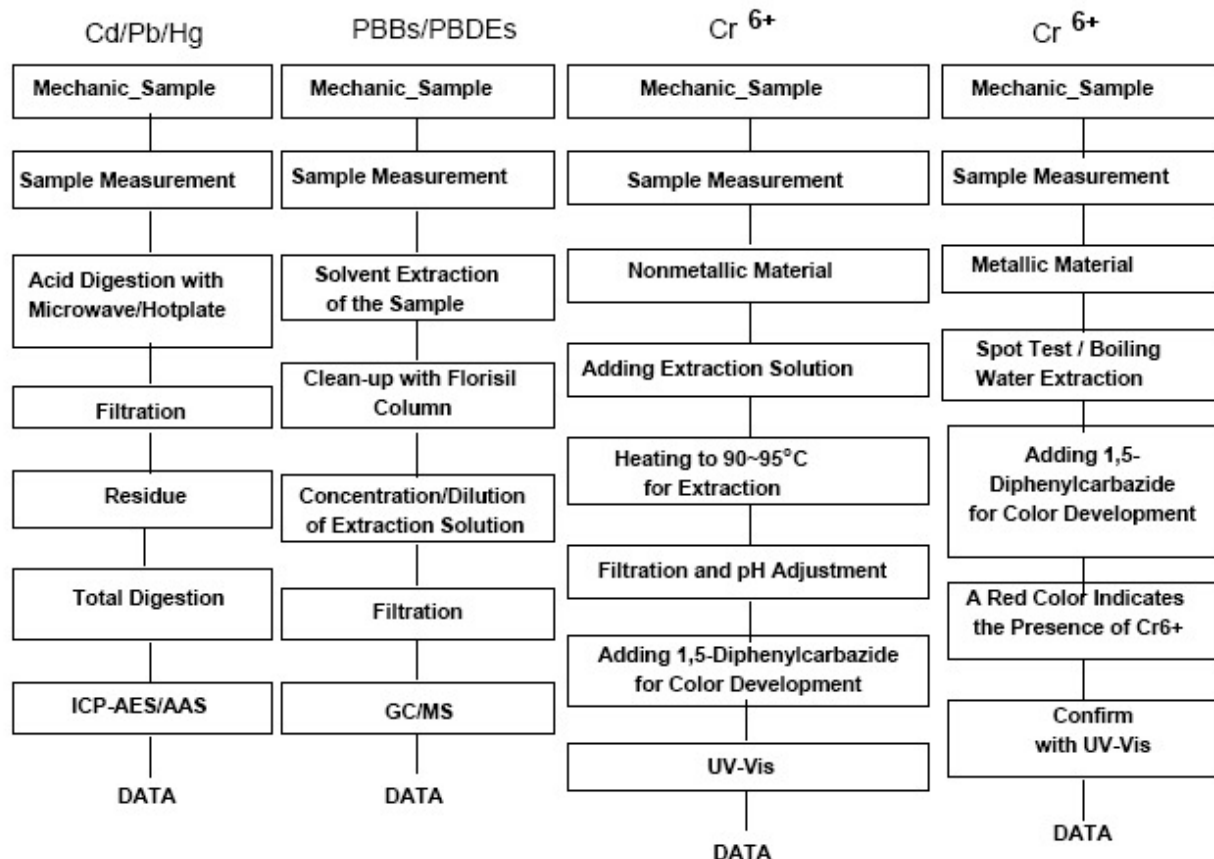
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t +82 (0)31 4808 000 f +82 (0)31 4806 059 <http://www.sgslab.co.kr> [www.kr.sga.com/greenlab](http://www.kr.sga.com/greenlab)

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Test Report No. F690501/LF-CTSAAYAA10-28284

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Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr<sup>6+</sup>/PBBs & PBDEs Testing

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

Section Chief : Gilse Lee

## NOTE:

(1) N.D. = Not detected. (<MDL)

(2) mg/kg = ppm

(3) MDL = Method Detection Limit

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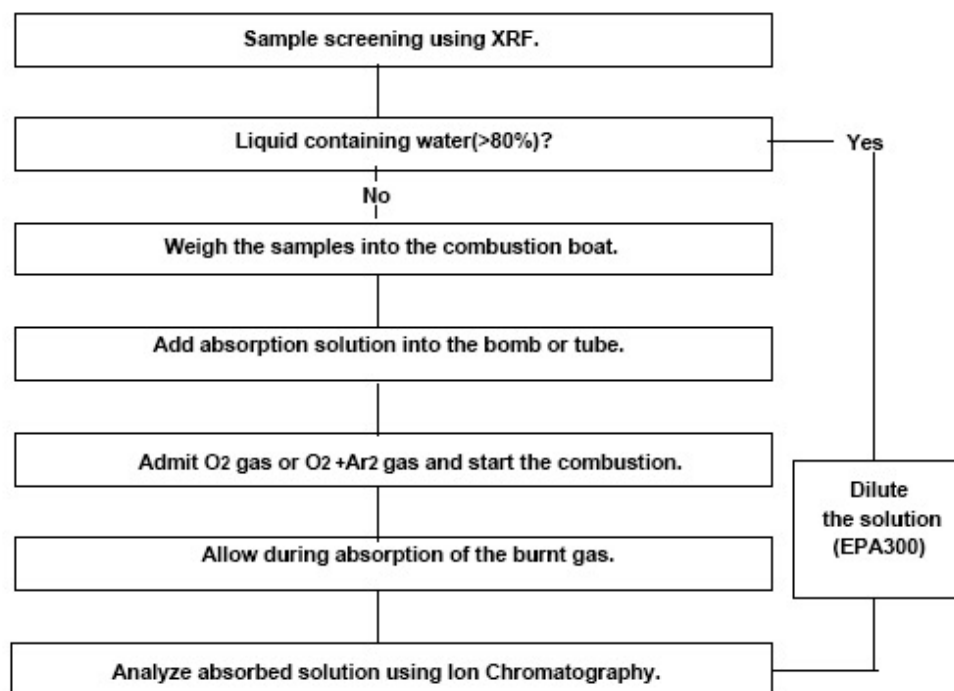


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Issued Date: August 17, 2010

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## Flow Chart for Halogen Test



\*\*\* End \*\*\*

NOTE: (1) N.D. = Not detected.(&lt;MDL)

(2) mg/kg = ppm

(3) MDL = Method Detection Limit

(4) - = No regulation

(5) \*\* = Qualitative analysis (No Unit)

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## Revision History

(Model:SPMWHT5225D5WAW0S0)

[illegible]