



**THE DATASHEET OF
SPHWH1L5N603XEQ3A2**



High Power LED Series

LH508C

General

Preliminary



High efficacy and lumen makes

The LH508C suitable for Streetlight and High-bay applications

Features & Benefits

- Operates at a maximum current of up to 220mA
- Uniform light distribution under any beam angle
- Color binning @ 85°C



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1. Characteristics

a) Absolute Maximum Rating

| Item | Symbol | Rating | Unit | Condition |
|----------------------------|-----------|------------|------|-------------------------------------|
| Operating Temperature | T_{opr} | -40 ~ +85 | °C | |
| Storage Temperature | T_{stg} | -40 ~ +100 | °C | - |
| LED Junction Temperature | T_j | 125 | °C | - |
| Forward Current | I_F | 220 | mA | - |
| Peak Pulse Forward Current | I_{FP} | 300 | mA | Duty cycle ≤ 1/10, pulse width 10ms |
| Soldering Temperature | | 260 <10 | °C | - |

b) Electro-optical Characteristics ($I_F = 160 \text{ mA}$, $T_j = 25^\circ\text{C}$)

| Item | Unit | Rank | Min. | Typ. | Max. |
|---|------|------|------|------|------|
| Forward Voltage (V_F) | V | XE | 23.5 | 24.5 | 26.5 |
| | | 3 | 70 | - | - |
| Color Rendering Index (R_a) | - | 5 | 80 | - | - |
| | | 7 | 90 | - | - |
| Thermal Resistance (junction to chip point) | °C/W | | - | 3 | - |
| Beam Angle | ° | | - | 120 | - |
| ESD (HBM) | kV | | | ±4 | |

Notes:

Samsung maintains measurement tolerance of: luminous flux = $\pm 7\%$, forward voltage = $\pm 0.1 \text{ V}$

c) Luminous Flux Characteristics (I_F = 160 mA)

| CRI (R _a) Min. | Nominal CCT (K) | Flux Rank | Flux @ T _J = 25 °C (lm) | | |
|-------------------------------|--------------------|--------------|------------------------------------|------|------|
| | | | Min. | Typ. | Max. |
| 70 | 2700K | A2 | 590 | | |
| | 3000K | A2 | 620 | | |
| | 3500K | A2 | 640 | | |
| | 4000K | A2 | 660 | | |
| | 5000K | A2 | 660 | | |
| | 5700K | A2 | 650 | | |
| | 6500K | A2 | 640 | | |
| 80 | 2700K | A2 | 545 | | |
| | 3000K | A2 | 570 | | |
| | 3500K | A2 | 585 | | |
| | 4000K | A2 | 600 | | |
| | 5000K | A2 | 600 | | |
| | 5700K | A2 | 600 | | |
| | 6500K | A2 | 590 | | |
| 90 | 2700K | A2 | 460 | - | - |
| | 3000K | A2 | 585 | - | - |
| | 3500K | A2 | 500 | - | - |
| | 4000K | A2 | 510 | - | - |
| | 5000K | A2 | 510 | - | - |
| | 5700K | A2 | 510 | - | - |
| | 6500K | A2 | 510 | - | - |

Notes:

- 1) Tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

2. Product Code Information

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|

S P H W H 1 L 5 N 6 0 3 X E T 5 A 2

| Digit | PKG Information | Code | Specification | | |
|-------|----------------------------|------|-----------------|--------------------|--------------------|
| 1 2 3 | Samsung Package High Power | SPH | High Power PKG | | |
| 4 5 | Color | WH | White | | |
| 6 | Product Version | 1 | 1 | | |
| 7 8 | Form Factor | L5 | 5050 size | | |
| 9 | Lens Type | N | No lens | | |
| 10 | Model | 6 | LH508C | | |
| 11 | Internal Code | 0 | | | |
| 12 | CRI | 3 | Min. 70 (25°C) | | |
| | | 5 | Min. 80 (25°C) | | |
| | | 7 | Min. 90 (25°C) | | |
| 13 14 | Forward Voltage (V) | XE | Bin code | D1 | 23.5 – 24.5 |
| | | | E1 | 24.5 – 25.5 | |
| | | | F1 | 25.5 – 26.5 | |
| 15 | CCT (K) | W | 2700K | | |
| | | V | 3000K | | |
| | | U | 3500K | | |
| | | T | 4000K | | |
| | | R | 5000K | | |
| | | Q | 5700K | | |
| | | P | 6500K | | |
| 16 | MacAdam Step | 3 | MacAdam 3-Step | | |
| | | 5 | MacAdam 5-Step | | |
| 17 18 | Luminous Flux (lm) | A2 | | | |

a) Luminous flux Rank ($I_f = 160 \text{ mA}$, $T_j = 25^\circ\text{C}$)

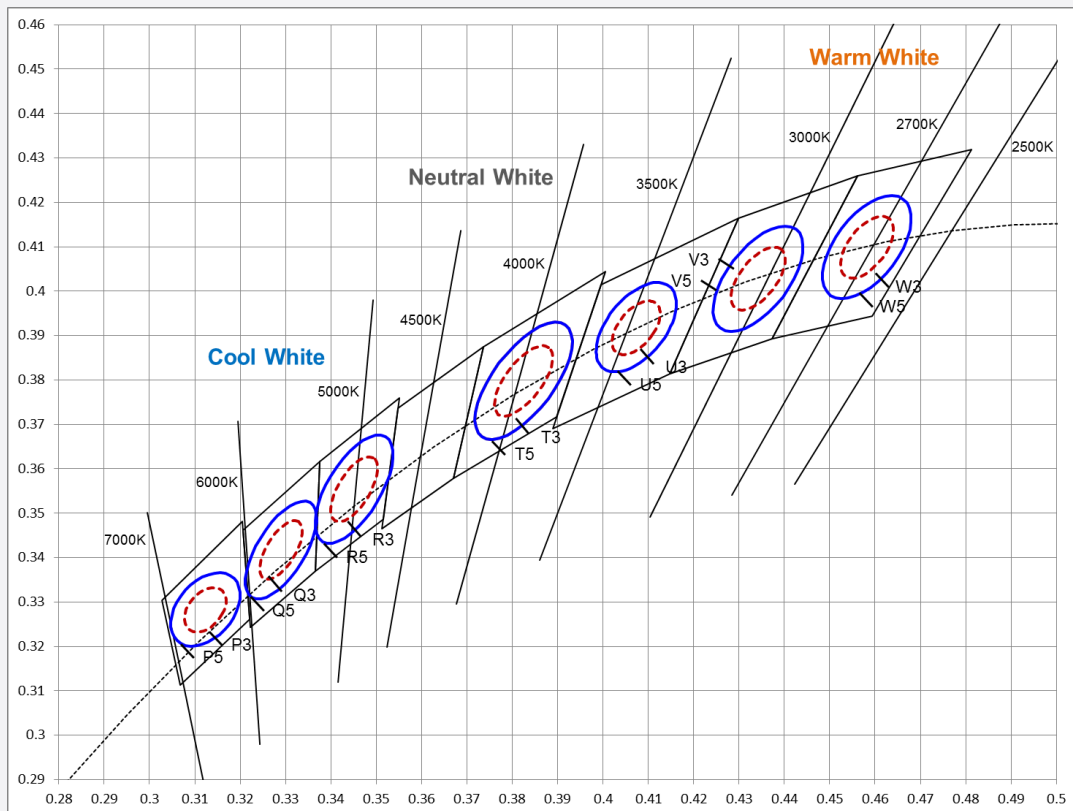
| CRI (R _a) Min. | Nominal CCT(K) | Product Code | VF Rank | Chrom Rank (Bins) | Flux | | Flux Range (Φ _v , lm) |
|-------------------------------|-------------------|--------------------|---------|----------------------|------|------|-------------------------------------|
| | | | | | Rank | Bins | |
| 70 | 2700 | SPHWH1L5N603XEW3A2 | XE | W3, W5 | A2 | 59 | 590-630 |
| | | SPHWH1L5N603XEW5A2 | | | | 63 | 630-670 |
| | 3000 | SPHWH1L5N603XEV3A2 | | V3, V5 | | 61 | 610-650 |
| | | SPHWH1L5N603XEV5A2 | | | | 65 | 650-690 |
| | 3500 | SPHWH1L5N603XEU3A2 | | U3, U5 | | 64 | 640-680 |
| | | SPHWH1L5N603XEU5A2 | | | | 68 | 680-720 |
| | 4000 | SPHWH1L5N603XET3A2 | | T3, T5 | | 66 | 660-700 |
| | | SPHWH1L5N603XET5A2 | | | | 70 | 700-740 |
| | 5000 | SPHWH1L5N603XER3A2 | | R3, R5 | | 66 | 660-700 |
| | | SPHWH1L5N603XER5A2 | | | | 70 | 700-740 |
| | 5700 | SPHWH1L5N603XEQ3A2 | | Q3, Q5 | | 65 | 650-690 |
| | | SPHWH1L5N603XEQ5A2 | | | | 69 | 690-730 |
| | 6500 | SPHWH1L5N603XEP3A2 | | P3, P5 | | 64 | 640-680 |
| | | SPHWH1L5N603XEP5A2 | | | | 68 | 680-720 |
| 80 | 2700 | SPHWH1L5N605XEW3A2 | XE | W3, W5 | A2 | 54 | 540-580 |
| | | SPHWH1L5N605XEW5A2 | | | | 58 | 580-620 |
| | 3000 | SPHWH1L5N605XEV3A2 | | V3, V5 | | 56 | 560-600 |
| | | SPHWH1L5N605XEV5A2 | | | | 60 | 600-640 |
| | 3500 | SPHWH1L5N605XEU3A2 | | U3, U5 | | 58 | 580-620 |
| | | SPHWH1L5N605XEU5A2 | | | | 62 | 620-660 |
| | 4000 | SPHWH1L5N605XET3A2 | | T3, T5 | | 60 | 600-640 |
| | | SPHWH1L5N605XET5A2 | | | | 64 | 640-680 |
| | 5000 | SPHWH1L5N605XER3A2 | | R3, R5 | | 60 | 600-640 |
| | | SPHWH1L5N605XER5A2 | | | | 64 | 640-680 |
| | 5700 | SPHWH1L5N605XEQ3A2 | | Q3, Q5 | | 60 | 600-640 |
| | | SPHWH1L5N605XEQ5A2 | | | | 64 | 640-680 |
| | 6500 | SPHWH1L5N605XEP3A2 | | P3, P5 | | 59 | 590-630 |
| | | SPHWH1L5N605XEP5A2 | | | | 63 | 630-670 |
| 90 | 2700 | SPHWH1L5N607XEW3A2 | XE | W3, W5 | A2 | 45 | 450-490 |
| | | SPHWH1L5N607XEW5A2 | | | | 49 | 490-530 |
| | 3000 | SPHWH1L5N607XEV3A2 | | V3, V5 | | 47 | 470-510 |
| | | SPHWH1L5N607XEV5A2 | | | | 51 | 510-550 |
| | 3500 | SPHWH1L5N607XEU3A2 | | U3, U5 | | 49 | 490-530 |
| | | SPHWH1L5N607XEU5A2 | | | | 53 | 530-570 |
| | 4000 | SPHWH1L5N607XET3A2 | | T3, T5 | | 50 | 500-540 |
| | | SPHWH1L5N607XET5A2 | | | | 54 | 540-580 |
| | 5000 | SPHWH1L5N607XER3A2 | | R3, R5 | | 50 | 500-540 |
| | | SPHWH1L5N607XER5A2 | | | | 54 | 540-580 |
| | 5700 | SPHWH1L5N607XEQ3A2 | | Q3, Q5 | | 50 | 500-540 |
| | | SPHWH1L5N607XEQ5A2 | | | | 54 | 540-580 |

b) Voltage Bins ($I_f = 160 \text{ mA}$, $T_j = 25^\circ\text{C}$)

| Nominal CCT (K) | CRI (R _a) Min. | Product Code | Voltage Rank | Voltage Bin | Voltage Range (V) |
|-----------------|----------------------------|--------------|--------------|-------------|-------------------|
| - | - | - | YE | D1 | 23.5 – 24.5 |
| - | - | - | | E1 | 24.5 – 25.5 |
| - | - | - | | F1 | 25.5 – 26.5 |

PRELIMINARY

c) Chromaticity Region & Coordinates ($I_F = 160 \text{ mA}$, $T_J = 85^\circ\text{C}$)



| CRI | CCT | Rank | CIE x | CIE y | Φ | A | b |
|-----|-------|------|--------|--------|--------|--------|--------|
| 70 | 2700K | W3 | 0.4578 | 0.4101 | 53.7 | 0.0081 | 0.0042 |
| | | W5 | | | | 0.0135 | 0.0070 |
| 80 | 3000K | V3 | 0.4338 | 0.4030 | 53.2 | 0.0083 | 0.0041 |
| | | V5 | | | | 0.0138 | 0.0068 |
| 90 | 3500K | U3 | 0.4073 | 0.3917 | 54.0 | 0.0093 | 0.0041 |
| | | U5 | | | | 0.0155 | 0.0069 |
| 70 | 4000K | T3 | 0.3818 | 0.3797 | 53.7 | 0.0094 | 0.0040 |
| | | T5 | | | | 0.0157 | 0.0067 |
| 80 | 5000K | R3 | 0.3447 | 0.3553 | 59.6 | 0.0082 | 0.0035 |
| | | R5 | | | | 0.0137 | 0.0058 |
| 90 | 5700K | Q3 | 0.3287 | 0.3417 | 59.1 | 0.0094 | 0.0040 |
| | | Q5 | | | | 0.0157 | 0.0067 |
| 70 | 6500K | P3 | 0.3123 | 0.3282 | 58.6 | 0.0067 | 0.0029 |
| | | P5 | | | | 0.0112 | 0.004 |

Note : Samsung maintains measurement tolerance of: $C_x, C_y = \pm 0.005$

3. Typical Characteristic Graphs

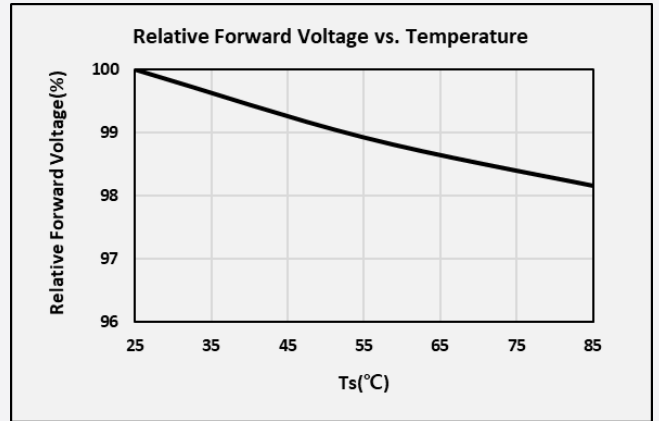
a) Spectral Distribution ($I_F = 160 \text{ mA}$, $T_j = 25^\circ\text{C}$)



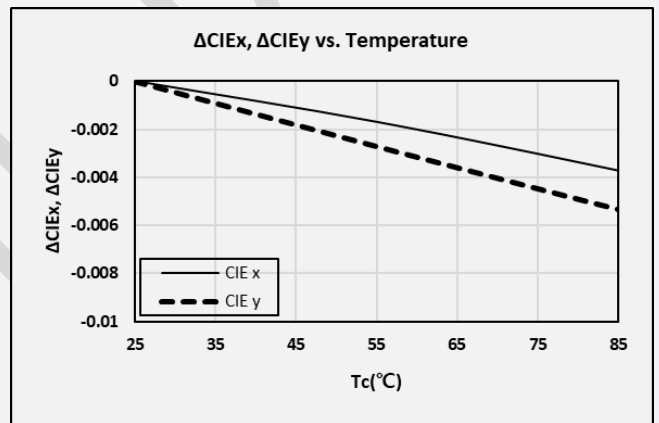
b) Forward Current Characteristics ($T_j = 25^\circ\text{C}$)



c) Temperature Characteristics ($I_f = 160 \text{ mA}$)



d) Color Shift Characteristics ($I_f = 160 \text{ mA}$, $T_j = 25^\circ\text{C}$)



e) Beam Angle Characteristics ($I_f = 640 \text{ mA}$, $T_j = 25^\circ\text{C}$)



4. Outline Drawing & Dimension

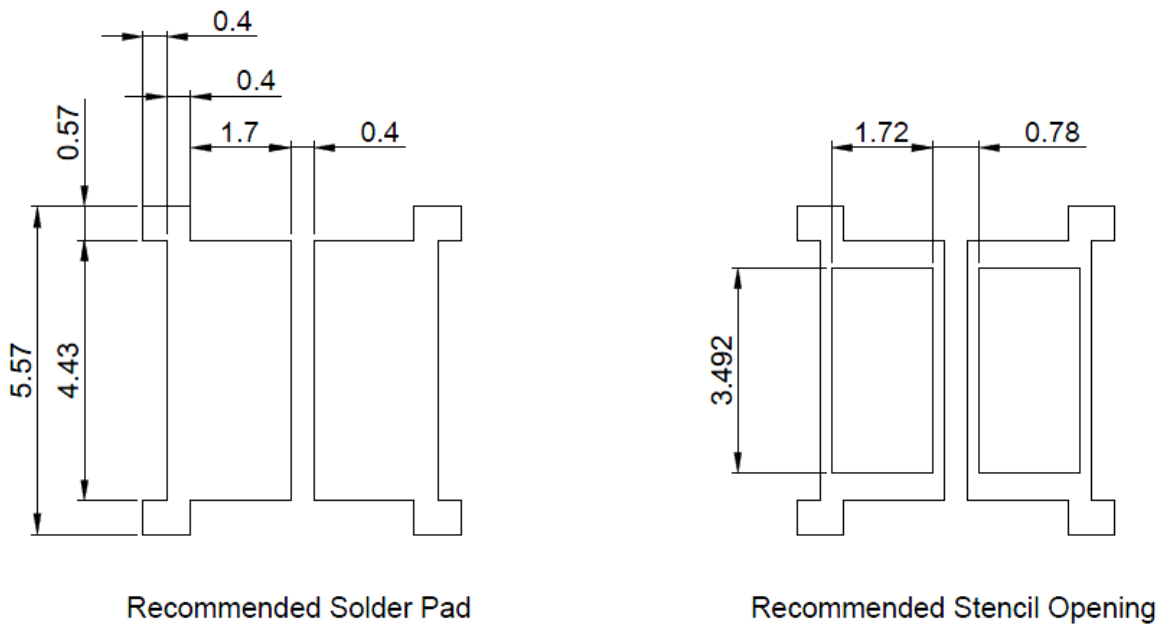
a) Mechanical Dimensions



Notes:

- 1) Mark for the Anode
- 2) Unit : mm
- 3) Tolerance : $\pm 0.1\text{mm}$

b) Recommended Solder Pad



5. Reliability Test Items & Conditions

a) Test Items

| Test Item | Test Condition | Test Hour / Cycle |
|--|--|-------------------|
| High Temperature Operating Life Test | 85°C, DC Derating, I_F | 1000 h |
| Wet High Temperature Operating Life Test | 60°C, 90 % RH, DC Derating, I_F | 1000 h |
| Low Temperature Operating Life Test | -40°C, DC Derating I_F | 1000 h |
| High Temperature Storage | 120°C | 1000 h |
| Low Temperature Storage | -40°C | 1000 h |
| Wet High Temperature Storage | | 1000h |
| Powered Temperature Cycle | | 100 cycles |
| Temperature Cycling | Temperature range / 15min Temperature range within 5min | 500 cycles |
| ESD (HBM) | R ₁ : 10 MΩ R ₂ : 1.5 kΩ C: 100 pF V: ±2 kV | 5 times |
| Vibration Test | 20~ 80 Hz (displacement: 0.06 inch, max. 20 g) 80 ~ 2 kHz (max. 20 g) min. frequency ↔ max. frequency 4 min transfer | 4 times |
| Mechanical Shock Test | 1500g, 0.5 ms each of the 6 surfaces (3 axis x 2 sides) | 5 times |

b) Criteria for Judging the Damage

| Item | Symbol | Test Condition ($T_c = 25^\circ\text{C}$) | Limit | |
|-----------------|----------|--|--------------|--------------|
| | | | Min. | Max. |
| Forward Voltage | V_F | $I_F = \text{Sorting Current}$ | L.S.L. * 0.9 | U.S.L. * 1.1 |
| Luminous Flux | Φ_v | $I_F = \text{Sorting Current}$ | L.S.L. * 0.7 | U.S.L. * 1.3 |

6. Soldering Conditions

a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



b) Manual Soldering Conditions

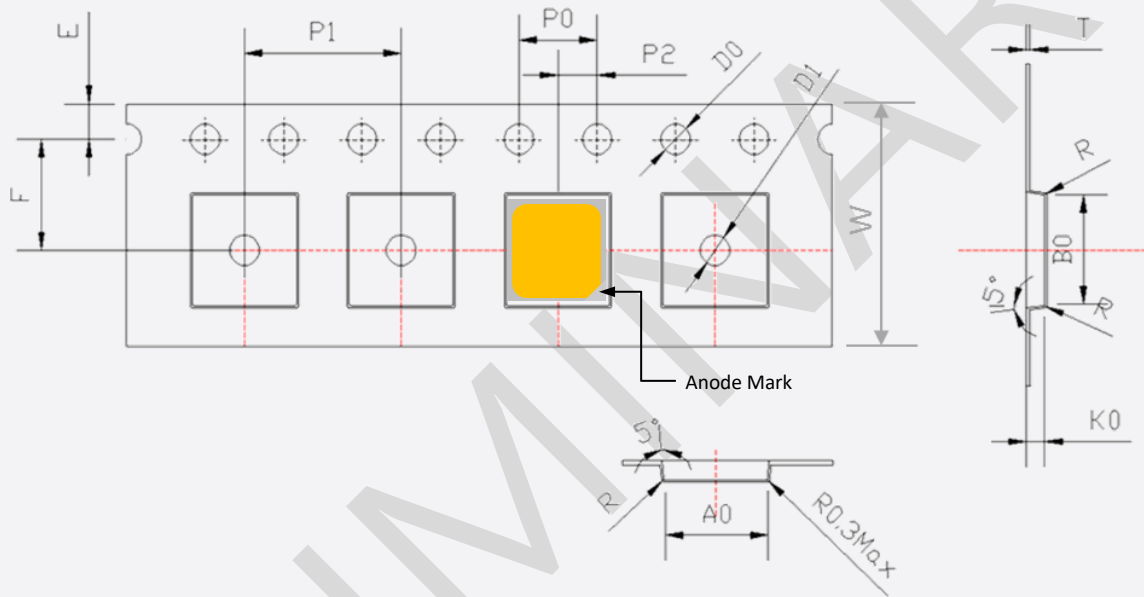
Not more than 5 seconds @ max. 300°C, under soldering iron.

7. Tape & Reel

a) Taping Dimension

(unit: mm)

| | | | | | | |
|--------|-----------|-----------|-----------|-----------|------------|-----------|
| symbol | AO | BO | KO | PO | P1 | P2 |
| Spec | 5.20±0.10 | 5.40±0.10 | 0.95±0.10 | 4.00±0.10 | 8.0±0.10 | 2.0±0.10 |
| symbol | W | T | E | F | DO | D1 |
| Spec | 12.0±0.2 | 0.20±0.05 | 1.75±0.10 | 5.50±0.05 | 150+0.1/-0 | 1.50±0.10 |



Taping Direction



b) Reel Dimension (max 2,000 pcs)

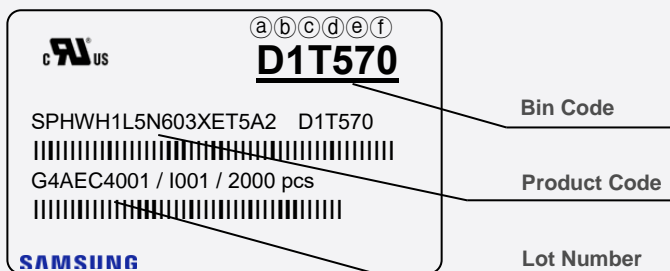
(unit: mm)

**Notes:**

- 1) Quantity: The quantity/reel is 2000 pcs
- 2) All dimensions are millimeters (Tolerance : ± 0.2 mm)
- 3) Packaging : P/N, Manufacturing data code no. and quantity are indicated on the aluminum packing bag.

8. Label Structure

a) Label Structure



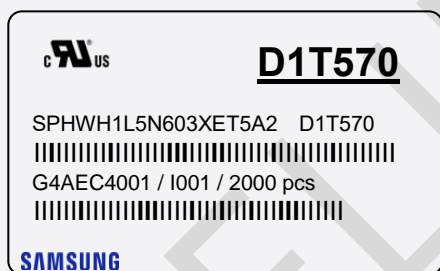
Note: Denoted bin code and product code above is only an example (see description on page 5)

Bin Code:

- ⒶⒷ: Forward Voltage bin (refer to page 8)
- ⒸⒹ: Chromaticity bin (refer to page 9)
- ⒺⒻ: Luminous Flux bin (refer to page 7)

b) Lot Number


The lot number is composed of the following characters:



①②③④⑤⑥⑦⑧⑨ / IⒶⒷⒸ / xxxx pcs

- ①② : Production site (G4 : Guangzhou ,China)
- ③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ④ : Year (D:2019, E:2020, F:2021 ...)
- ⑤ : Month (1-9, A, B, C)
- ⑥ : Day (1-9, A, B-V)
- ⑦⑧⑨ : Samsung Electronics Product serial number (001 - 999)
- ⒶⒷⒸ : Reel number(001 - 999)

b) Aluminum Vinyl 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 > 60% when read at 23±5°C, or
 - b. 2a is not met.
5. If baking is required, devices must be baked for 10 ~ 24 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



D1T570


SPHWH1L5N603XET5A2 D1T570
 |||
 G4AEC4001 / I001 / 2000 pcs
 |||

SAMSUNG

ATTENTION

OBSEVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES



주의 사항

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

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

Important

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

c) Silica Gel & Humidity Indicator Card inside Aluminum Vinyl Bag

(This image is for reference only. Silicagel and humidity indicator shapes may be different.)




HUMISAFE™

10%


20%


30%


40%


50%


60%


READ AT TOP OF GREEN COLOR
CHANGE BETWEEN YELLOW AND GREEN

Warning If Green Change Desiccant

**HUMIDITY INDICATOR
COBALT-FREE**

GP&E Co., Ltd.
6CF-60NS

SAMSUNG

10. Precautions in Handling & Use

- 1) For over-current protection, users are recommended to apply resistors connected in series with the LEDs to mitigate sudden change of the forward current caused by shift of forward voltage.
- 2) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. When cleaning is required, IPA is recommended as the cleaning agent. Some solvent-based cleaning agent may damage the silicone resins used in the device.
- 3) When the device is in operation, the forward current should be carefully determined considering the maximum ambient temperature and corresponding junction temperature.
- 4) LEDs must be stored in a clean environment. If the LEDs are to be stored for three months or more after being shipped from Samsung, they should be packed with a nitrogen-filled container (shelf life of sealed bags is 12 months at temperature 0~40°C, 0~90 % RH).
- 5) After storage bag is opened, device subjected to soldering, solder reflow, or other high temperature processes must be:
 - a. Mounted within 672 hours (28 days) at an assembly line with a condition of no more than 30°C / 60 % RH, or
 - b. Stored at <10 % RH
- 6) Repack unused devices with anti-moisture packing, fold to close any opening and then store in a dry place.
- 7) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5°C
- 8) Devices must be baked for 1 hour at 60 ± 5°C, if baking is required.
- 9) The LEDs are sensitive to the static electricity and surge current. It is recommended to use a wrist band or anti-electrostatic glove when handling the LEDs. If voltage exceeding the absolute maximum rating is applied to LEDs, it may cause damage or even destruction to LED devices. Damaged LEDs may show some unusual characteristics such as increase in leakage current, lowered turn-on voltage, or abnormal lighting of LEDs at low current.
- 10) VOCs (Volatile Organic Compounds) can be generated from adhesives, flux, hardener or organic additives used in luminaires (fixtures). Transparent LED silicone encapsulant is permeable to those chemicals and they may lead to a discoloration of encapsulant when they exposed to heat or light. This phenomenon can cause a significant loss of light emitted (output) from the luminaires. In order to prevent these problems, we recommend users to know the physical properties of materials used in luminaires and they must be carefully selected.
- 11) Risk of sulfurization (or tarnishing)
The LED from Samsung Electronics Co., Ltd. uses a silver-plated lead frame and its surface color may change to black (or dark colored) when it is exposed to sulfur (S), chlorine (Cl) or other halogen compound. Sulfurization of lead frame may cause intensity degradation, change of chromaticity coordinates and, in extreme cases, open circuit. It requires caution. Due to possible sulfurization of lead frame, LED should not be used and stored together with oxidizing substances made of materials such as: rubber, plain paper, lead solder cream, etc.

Legal and additional information.

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