



**THE DATASHEET OF  
SPMWHT541ML5XAP0S5**



Middle Power LED Series  
5630

LM561C  
CRI80



LM561C is highest performance and lm/W for fluorescent replacement



#### Features & Benefits

- 0.3 W class middle power LED
- Mold resin for high reliability
- Standard form factor for design flexibility (5.6 × 3.0 mm)

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## 1. Characteristics

### a) Absolute Maximum Rating

| Item                            | Symbol    | Rating     | Unit    | Condition                    |
|---------------------------------|-----------|------------|---------|------------------------------|
| Ambient / Operating Temperature | $T_a$     | -40 ~ +85  | °C      | -                            |
| Storage Temperature             | $T_{stg}$ | -40 ~ +120 | °C      | -                            |
| LED Junction Temperature        | $T_j$     | 110        | °C      | -                            |
| Forward Current                 | $I_F$     | 200        | mA      | -                            |
| Peak Pulsed Forward Current     | $I_{fp}$  | 300        | mA      | Duty 1/10, pulse width 10 ms |
| Assembly Process Temperature    | -         | 260<br><10 | °C<br>s | -                            |
| ESD (HBM)                       | -         | ±5         | kV      | -                            |

b) Electro-optical Characteristics ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )

| Item   | Unit | CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Rank     | Bin | Min. | Typ. | Max. |
|--|------|-------------------------------|--------------------|----------|-----|------|------|------|
| Forward Voltage (V <sub>F</sub> )                | V    |                               |                    | XA<br>XK | AY  | 2.6  | -    | 2.7  |
|  |      |                               |                    |          | AZ  | 2.7  | -    | 2.8  |
|  |      |                               |                    |          | A1  | 2.8  | -    | 2.9  |
| Luminous Flux (Φ <sub>v</sub> )                  | lm   | 80                            | 2700               |          | S4  | 30.0 |      | 32.0 |
|  |      |                               |                    |          | S5  | 32.0 |      | 34.0 |
|  |      |                               | 3000               |          | S5  | 32.5 |      | 34.5 |
|  |      |                               |                    |          | S6  | 34.5 |      | 36.5 |
|  |      |                               | 3500               |          | S5  | 33.0 |      | 35.0 |
|  |      |                               |                    |          | S6  | 35.0 |      | 37.0 |
|  |      |                               | 4000               |          | S5  | 34.0 |      | 36.0 |
|  |      |                               |                    |          | S6  | 36.0 |      | 38.0 |
|  |      |                               | 5000               |          | S5  | 35.0 |      | 37.0 |
|  |      |                               |                    |          | S6  | 37.0 |      | 39.0 |
|  |      |                               | 5700               |          | S5  | 34.5 |      | 36.5 |
|  |      |                               |                    |          | S6  | 36.5 |      | 38.5 |
| 6500   | S5   | 34.0                          |                    | 36.0     |     |      |      |      |
|  | S6   | 36.0                          |                    | 38.0     |     |      |      |      |
| Reverse Voltage<br>(@ 5 mA)                      | V    |                               |                    |          |     | 0.7  | -    | 1.2  |
| Color Rendering Index (R <sub>a</sub> )          | -    |                               |                    |          |     | 80   | -    | -    |
| Special CRI (R9)                                 | -    |                               |                    |          |     | 0    | -    | -    |
| Thermal Resistance<br>(junction to solder point) | °C/W |                               |                    |          |     | -    | 12   | 16-  |
| Beam Angle                                       | °    |                               |                    |          |     | -    | 120  | -    |

**Note:**

Samsung maintains measurement tolerance of: forward voltage =  $\pm 0.1 \text{ V}$ , luminous flux =  $\pm 5 \%$ , CRI =  $\pm 3$ , R9 =  $\pm 6.5$

## 2. Product Code Information

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| S | P | M | W | H | T | 5 | 4 | 1 | M  | L  | 5  | X  | A  | R  | K  | S  | 0  |

| Digit | PKG Information              | Code              | Specification   |
|-------|------------------------------|-------------------|---|
| 1 2 3 | Samsung Package Middle Power | <b>SPM</b>        |   |
| 4 5   | Color                        | <b>WH</b>         | White   |
| 6     | Product Version              | <b>T</b>          |   |
| 7 8 9 | Form Factor                  | <b>541</b>        | 5.6 x 3.0 x 0.7 mm; 4 pads; LM561C  |
| 10    | Sorting Current (mA)         | <b>M</b>          | 65 mA   |
| 11    | Chromaticity Coordinates     | <b>L</b>          | ANSI Standard   |
| 12    | CRI                          | <b>5</b>          | Min. 80   |
| 13 14 | Forward Voltage (V)          | <b>XA</b>         | 2.6~2.9 (2,500 pcs/ Reel)   |
|       |                              | <b>XK</b>         | 2.6~2.9 (10,000 pcs/ Reel)  |
| 15 16 | CCT (K)                      | <b>W</b> ☆        | 2700 W1, W2, W3, W4, W5, W6, W7, W8, W9, WA, WB, WC, WD, WE, WF, WG           |
|       |                              | <b>V</b> ☆        | 3000 V1, V2, V3, V4, V5, V6, V7, V8, V9, VA, VB, VC, VD, VE, VF, VG           |
|       |                              | <b>U</b> ☆        | 3500 U1, U2, U3, U4, U5, U6, U7, U8, U9, UA, UB, UC, UD, UE, UF, UG           |
|       |                              | <b>T</b> ☆        | 4000 Bin Code: T1, T2, T3, T4, T5, T6, T7, T8, T9, TA, TB, TC, TD, TE, TF, TG |
|       |                              | <b>R</b> ☆        | 5000 R1, R2, R3, R4, R5, R6, R7, R8, R9, RA, RB, RC, RD, RE, RF, RG           |
|       |                              | <b>Q</b> ☆        | 5700 Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, QA, QB, QC, QD, QE, QF, QG           |
|       |                              | <b>P</b> ☆        | 6500 P1, P2, P3, P4, P5, P6, P7, P8, P9, PA, PB, PC, PD, PE, PF, PG           |
|       |                              | ☆ "0" (Whole bin) | "M" (Quarter bin) "K" (K Kitting) or "S" (S Kitting)                          |
| 17 18 | Luminous Flux                | <b>S0</b>         | S4, S5, S6  |
|       |                              | <b>S4</b>         | Bin Code: S4 (Only 2700K)   |
|       |                              | <b>S5</b>         | S5  |
|       |                              | <b>S6</b>         | S6 (Except 2700K)   |

a) Luminous Flux Bins ( $I_F = 65 \text{ mA}$ ,  $T_s = 25^\circ\text{C}$ )

| CRI (R <sub>a</sub> )<br>Min. | Nominal CCT<br>(K) | Product Code       | Flux Bin | Flux Range<br>( $\Phi_v$ , lm) |
|-------------------------------|--------------------|--------------------|----------|--------------------------------|
| 80                            | 2700               | SPMWHT541ML5X◆W☆S0 | S4       | 30.0 ~32.0                     |
|                               |                    | SPMWHT541ML5X◆W☆S4 | S4       | 30.0 ~32.0                     |
|                               |                    | SPMWHT541ML5X◆W☆S5 | S5       | 32.0 ~34.0                     |
|                               |                    | SPMWHT541ML5X◆V☆S0 | S5       | 32.5 ~ 34.5                    |
|                               | 3000               | SPMWHT541ML5X◆V☆S5 | S5       | 32.5 ~ 34.5                    |
|                               |                    | SPMWHT541ML5X◆V☆S6 | S6       | 34.5 ~ 36.5                    |
|                               |                    | SPMWHT541ML5X◆U☆S0 | S5       | 33.0 ~ 35.0                    |
|                               | 3500               | SPMWHT541ML5X◆U☆S5 | S5       | 33.0 ~ 35.0                    |
|                               |                    | SPMWHT541ML5X◆U☆S6 | S6       | 35.0 ~ 37.0                    |
|                               |                    | SPMWHT541ML5X◆T☆S0 | S5       | 34.0 ~ 36.0                    |
|                               | 4000               | SPMWHT541ML5X◆T☆S5 | S5       | 34.0 ~ 36.0                    |
|                               |                    | SPMWHT541ML5X◆T☆S6 | S6       | 36.0 ~ 38.0                    |
|                               |                    | SPMWHT541ML5X◆R☆S0 | S5       | 35.0 ~ 37.0                    |
|                               | 5000               | SPMWHT541ML5X◆R☆S5 | S5       | 35.0 ~ 37.0                    |
|                               |                    | SPMWHT541ML5X◆R☆S6 | S6       | 37.0 ~ 39.0                    |
|                               |                    | SPMWHT541ML5X◆Q☆S0 | S5       | 34.5 ~ 36.5                    |
|                               | 5700               | SPMWHT541ML5X◆Q☆S5 | S5       | 34.5 ~ 36.5                    |
|                               |                    | SPMWHT541ML5X◆Q☆S6 | S6       | 36.5 ~ 38.5                    |
|                               |                    | SPMWHT541ML5X◆P☆S0 | S5       | 34.0 ~ 36.0                    |
|                               | 6500               | SPMWHT541ML5X◆P☆S5 | S5       | 34.0 ~ 36.0                    |
|                               |                    | SPMWHT541ML5X◆P☆S6 | S6       | 36.0 ~ 38.0                    |

**Note:**

◆ can be "A" (2,500pcs) or "K" (10,000pcs) of reel taping

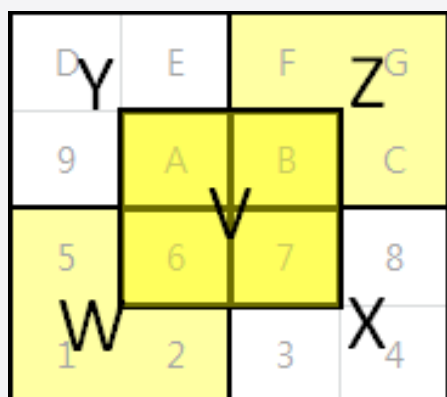
☆ can be "0" (Whole bin), "M" (Quarter bin), "K" (K Kitting) or "S" (S Kitting) of the color binning

## b) Kitting rule

### 1) K Kitting bin Concept

1. Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (VF, Color, lm).
2. A forward voltage (VF) of kitting bin is combined by a pair of same VF rank such as (A1+A1), (AY+AY) or (AZ+AZ).
3. A Chromaticity Coordinates of kitting bin is mixed by kitting procedure. (below kitting simulation)
4. A luminous flux(lm) of kitting bin is combined by a pair of IV rank such as (S4+S4), (S5+S5) or (S6+S6).

#### [Kitting example]



#### [Binning Information]

|     | Bin #1         | Bin #2         | Priority     |
|-----|----------------|----------------|--------------|
| VF  | AY             | AY             |              |
|     | AZ             | AZ             |              |
|     | A1             | A1             |              |
| CIE | W (1, 2, 5, 6) | Z (B, C, F, G) |              |
|     | V (6, 7, A, B) | V (6, 7, A, B) |              |
|     | X (3, 4, 7, 8) | Y (9, A, D, E) |              |
| IV  | S4             | S4             | Only 2700K   |
|     | S5             | S5             |              |
|     | S6             | S6             | Except 2700K |

※ Each of V, W, X, Y and Z can be one bin without details division.

## 2) S Kitting bin Concept

1. Under agreement between customer and SAMSUNG ELECTRONICS, SAMSUNG can supply kitting bin (VF, Color, lm).
2. A forward voltage (VF) of kitting bin is combined by a pair of same VF rank such as (A1+A1), (AY+AY) or (AZ+AZ).
3. A Chromaticity Coordinates of kitting bin is mixed by kitting procedure. (below kitting simulation)
4. A luminous flux(lm) of kitting bin is combined by a pair of IV rank such as (S4+S4), (S5+S5) or (S6+S6).

### [Kitting example]



### [Binning Information]

|     | Bin #1         | Bin #2         | Priority     |
|-----|----------------|----------------|--------------|
| VF  | AY             | AY             |              |
|     | AZ             | AZ             |              |
|     | A1             | A1             |              |
| CIE | W (1, 2, 5)    | B              | 1            |
|     | X (3, 4, 8)    | A              | 1            |
|     | Y (9, D, E)    | 7              | 1            |
|     | Z (C, F, G)    | 6              | 1            |
|     | 6              | 6              | 2            |
|     | 7              | 7              | 2            |
|     | A              | A              | 2            |
|     | B              | B              | 2            |
|     | V (6, 7, A, B) | V (6, 7, A, B) | 3            |
| IV  | S4             | S4             | Only 2700K   |
|     | S5             | S5             |              |
|     | S6             | S6             | Except 2700K |

※ Each of V, W, X, Y and Z can be one bin without details division.

c) Color Bins ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )

| CRI ( $R_a$ )<br>Min. | Nominal CCT<br>(K) | Product Code        | Color Rank  | Chromaticity Bins   |
|-----------------------|--------------------|---------------------|---|---|
| 80                    | 2700               | SPMWHT541ML5XAW0S0  | W0<br>(Whole bin)   | W1, W2, W3, W4, W5, W6, W7, W8,<br>W9, WA, WB, WC, WD, WE, WF, WG |
|                       |                    | SPMWHT541ML5XAWMS0  | WM<br>(Quarter bin)   | W6, W7, WA, WB  |
|                       |                    | SPMWHT541ML5XAWSS0  | WS<br>(S Kitting)   | W6, W7, WA, WB, WV, WW, WX, WY, WZ                                |
|                       |                    | SPMWHT541ML5XAWKS0  | WK<br>(K Kitting)   | WV, WW, WX, WY, WZ  |
|                       | 3000               | SPMWHT541ML5XAV0S0  | V0<br>(Whole bin)   | V1, V2, V3, V4, V5, V6, V7, V8,<br>V9, VA, VB, VC, VD, VE, VF, VG |
|                       |                    | SPMWHT541ML5XAVMS0  | VM<br>(Quarter bin)   | V6, V7, VA, VB  |
|                       |                    | SPMWHT541ML5XAVSS0  | VS<br>(S Kitting)   | V6, V7, VA, VB, VV, VW, VX, VY, VZ                                |
|                       |                    | SPMWHT541ML5XAVKS0  | VK<br>(K Kitting)   | VV, VW, VX, VY, VZ  |
|                       | 3500               | SPMWHT541ML5XAU0S0  | U0<br>(Whole bin)   | U1, U2, U3, U4, U5, U6, U7, U8,<br>U9, UA, UB, UC, UD, UE, UF, UG |
|                       |                    | SPMWHT541ML5XAUMS0  | UM<br>(Quarter bin)   | U6, U7, UA, UB  |
|                       |                    | SPMWHT541ML5XAUSS0  | US<br>(S Kitting)   | U6, U7, UA, UB, UV, UW, UX, UY, UZ                                |
|                       |                    | SPMWHT541ML5XAUKS0  | UK<br>(K Kitting)   | UV, UW, UX, UY, UZ  |
| 4000                  | SPMWHT541ML5XAT0S0 | T0<br>(Whole bin)   | T1, T2, T3, T4, T5, T6, T7, T8,<br>T9, TA, TB, TC, TD, TE, TF, TG |   |
|                       | SPMWHT541ML5XATMS0 | TM<br>(Quarter bin) | T6, T7, TA, TB  |   |
|                       | SPMWHT541ML5XATSS0 | TS<br>(S Kitting)   | T6, T7, TA, TB, TV, TW, TX, TY, TZ                                |   |
|                       | SPMWHT541ML5XATKS0 | TK<br>(K Kitting)   | TV, TW, TX, TY, TZ  |   |
| 5000                  | SPMWHT541ML5XAR0S0 | R0<br>(Whole bin)   | R1, R2, R3, R4, R5, R6, R7, R8,<br>R9, RA, RB, RC, RD, RE, RF, RG |   |
|                       | SPMWHT541ML5XARMS0 | RM<br>(Quarter bin) | R6, R7, RA, RB  |   |
|                       | SPMWHT541ML5XARSS0 | RS<br>(S Kitting)   | R6, R7, RA, RB, RV, RW, RX, RY, RZ                                |   |
|                       | SPMWHT541ML5XARKS0 | RK<br>(K Kitting)   | RV, RW, RX, RY, RZ  |   |

### c) Color Bins ( $I_F = 65 \text{ mA}$ , $T_s = 25 \text{ }^\circ\text{C}$ )

| CRI ( $R_a$ )<br>Min. | Nominal CCT<br>(K) | Product Code       | Color Rank          | Chromaticity Bins   |
|-----------------------|--------------------|--------------------|---------------------|---|
| 80                    | 5700               | SPMWHT541ML5XAQ0S0 | Q0<br>(Whole bin)   | Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8,<br>Q9, QA, QB, QC, QD, QE, QF, QG |
|                       |                    | SPMWHT541ML5XAQMS0 | QM<br>(Quarter bin) | Q6, Q7, QA, QB  |
|                       |                    | SPMWHT541ML5XAQSS0 | QS<br>(S Kitting)   | Q6, Q7, QA, QB, QV, QW, QX, QY, QZ                                |
|                       |                    | SPMWHT541ML5XAQKS0 | QK<br>(K Kitting)   | QV, QW, QX, QY, QZ  |
|                       | 6500               | SPMWHT541ML5XAP0S0 | P0<br>(Whole bin)   | P1, P2, P3, P4, P5, P6, P7, P8,<br>P9, PA, PB, PC, PD, PE, PF, PG |
|                       |                    | SPMWHT541ML5XAPMS0 | PM<br>(Quarter bin) | P6, P7, PA, PB  |
|                       |                    | SPMWHT541ML5XAPSS0 | PS<br>(S Kitting)   | P6, P7, PA, PB, PV, PW, PX, PY, PZ                                |
|                       |                    | SPMWHT541ML5XAPKS0 | PK<br>(K Kitting)   | PV, PW, PX, PY, PZ  |

### d) Voltage Bins ( $I_F = 65 \text{ mA}$ , $T_s = 25 \text{ }^\circ\text{C}$ )

| CRI ( $R_a$ )<br>Min. | Nominal CCT<br>(K) | Product Code | Voltage Rank | Voltage Bin | Voltage Range<br>(V) |
|-----------------------|--------------------|--------------|--------------|-------------|----------------------|
| 80                    | -                  | -            | XA<br>(XK)   | AY          | 2.6 ~ 2.7            |
|                       |                    |              |              | AZ          | 2.7 ~ 2.8            |
|                       |                    |              |              | A1          | 2.8 ~ 2.9            |

e) Chromaticity Region & Coordinates ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )



## e) Chromaticity Region &amp; Coordinates (IF = 65 mA, Ts = 25 °C)

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>W rank (2700 K)</b> |        |        |        |        |        |
| 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  |
|------------------------|--------|--------|--------|--------|--------|
| <b>V rank (3000 K)</b> |        |        |        |        |        |
| 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 |

e) Chromaticity Region & Coordinates

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>U rank (3500 K)</b> |        |        |        |        |        |
| 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  |
|------------------------|--------|--------|--------|--------|--------|
| <b>T rank (4000 K)</b> |        |        |        |        |        |
| T1                     | 0.3670 | 0.3578 | T9     | 0.3702 | 0.3722 |
|                        | 0.3726 | 0.3612 |        | 0.3763 | 0.3760 |
|                        | 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                     | 0.3840 | 0.3681 | TC     | 0.3887 | 0.3837 |
|                        | 0.3898 | 0.3716 |        | 0.3950 | 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 | 0.3760 |        | 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 |
|                        | 0.3950 | 0.3875 |        | 0.4006 | 0.4044 |
|                        | 0.3887 | 0.3836 |        | 0.3937 | 0.4001 |

## e) Chromaticity Region &amp; Coordinates

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>R rank (5000 K)</b> |        |        |        |        |        |
| R1                     | 0.3366 | 0.3369 | R9     | 0.3371 | 0.3490 |
|                        | 0.3369 | 0.3430 |        | 0.3374 | 0.3553 |
|                        | 0.3407 | 0.3460 |        | 0.3415 | 0.3587 |
|                        | 0.3403 | 0.3398 |        | 0.3411 | 0.3522 |
| R2                     | 0.3403 | 0.3398 | RA     | 0.3411 | 0.3522 |
|                        | 0.3407 | 0.3460 |        | 0.3415 | 0.3587 |
|                        | 0.3446 | 0.3491 |        | 0.3457 | 0.3621 |
|                        | 0.3440 | 0.3427 |        | 0.3451 | 0.3554 |
| R3                     | 0.3440 | 0.3427 | RB     | 0.3451 | 0.3554 |
|                        | 0.3446 | 0.3491 |        | 0.3457 | 0.3621 |
|                        | 0.3485 | 0.3522 |        | 0.3500 | 0.3655 |
|                        | 0.3478 | 0.3457 |        | 0.3492 | 0.3587 |
| R4                     | 0.3478 | 0.3457 | RC     | 0.3492 | 0.3587 |
|                        | 0.3485 | 0.3522 |        | 0.3500 | 0.3655 |
|                        | 0.3524 | 0.3554 |        | 0.3542 | 0.3690 |
|                        | 0.3515 | 0.3487 |        | 0.3533 | 0.3620 |
| R5                     | 0.3369 | 0.3430 | RD     | 0.3374 | 0.3553 |
|                        | 0.3371 | 0.3490 |        | 0.3376 | 0.3616 |
|                        | 0.3411 | 0.3522 |        | 0.3420 | 0.3652 |
|                        | 0.3407 | 0.3460 |        | 0.3415 | 0.3587 |
| R6                     | 0.3407 | 0.3460 | RE     | 0.3415 | 0.3587 |
|                        | 0.3411 | 0.3522 |        | 0.3420 | 0.3652 |
|                        | 0.3451 | 0.3554 |        | 0.3463 | 0.3687 |
|                        | 0.3446 | 0.3491 |        | 0.3457 | 0.3621 |
| R7                     | 0.3446 | 0.3491 | RF     | 0.3457 | 0.3621 |
|                        | 0.3451 | 0.3554 |        | 0.3463 | 0.3687 |
|                        | 0.3492 | 0.3587 |        | 0.3507 | 0.3724 |
|                        | 0.3485 | 0.3522 |        | 0.3500 | 0.3655 |
| R8                     | 0.3485 | 0.3522 | RG     | 0.3500 | 0.3655 |
|                        | 0.3492 | 0.3587 |        | 0.3507 | 0.3724 |
|                        | 0.3533 | 0.3620 |        | 0.3551 | 0.3760 |
|                        | 0.3524 | 0.3554 |        | 0.3542 | 0.3690 |

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>Q rank (5700 K)</b> |        |        |        |        |        |
| Q1                     | 0.3218 | 0.3298 | Q9     | 0.3211 | 0.3407 |
|                        | 0.3222 | 0.3243 |        | 0.3215 | 0.3353 |
|                        | 0.3258 | 0.3275 |        | 0.3254 | 0.3388 |
|                        | 0.3256 | 0.3331 |        | 0.3252 | 0.3444 |
| Q2                     | 0.3256 | 0.3331 | QA     | 0.3252 | 0.3444 |
|                        | 0.3258 | 0.3275 |        | 0.3254 | 0.3388 |
|                        | 0.3294 | 0.3306 |        | 0.3293 | 0.3423 |
|                        | 0.3294 | 0.3364 |        | 0.3293 | 0.3481 |
| Q3                     | 0.3294 | 0.3364 | QB     | 0.3293 | 0.3481 |
|                        | 0.3294 | 0.3306 |        | 0.3293 | 0.3423 |
|                        | 0.333  | 0.3338 |        | 0.3332 | 0.3458 |
|                        | 0.3331 | 0.3398 |        | 0.3333 | 0.3518 |
| Q4                     | 0.3331 | 0.3398 | QC     | 0.3333 | 0.3518 |
|                        | 0.333  | 0.3338 |        | 0.3332 | 0.3458 |
|                        | 0.3366 | 0.3369 |        | 0.3371 | 0.3493 |
|                        | 0.3369 | 0.3431 |        | 0.3374 | 0.3554 |
| Q5                     | 0.3215 | 0.3353 | QD     | 0.3207 | 0.3462 |
|                        | 0.3218 | 0.3298 |        | 0.3211 | 0.3407 |
|                        | 0.3256 | 0.3331 |        | 0.3252 | 0.3444 |
|                        | 0.3254 | 0.3388 |        | 0.325  | 0.3501 |
| Q6                     | 0.3254 | 0.3388 | QE     | 0.325  | 0.3501 |
|                        | 0.3256 | 0.3331 |        | 0.3252 | 0.3444 |
|                        | 0.3294 | 0.3364 |        | 0.3293 | 0.3481 |
|                        | 0.3293 | 0.3423 |        | 0.3292 | 0.3539 |
| Q7                     | 0.3293 | 0.3423 | QF     | 0.3292 | 0.3539 |
|                        | 0.3294 | 0.3364 |        | 0.3293 | 0.3481 |
|                        | 0.3331 | 0.3398 |        | 0.3333 | 0.3518 |
|                        | 0.3332 | 0.3458 |        | 0.3334 | 0.3578 |
| Q8                     | 0.3332 | 0.3458 | QG     | 0.3334 | 0.3578 |
|                        | 0.3331 | 0.3398 |        | 0.3333 | 0.3518 |
|                        | 0.3369 | 0.3431 |        | 0.3374 | 0.3554 |
|                        | 0.3371 | 0.3493 |        | 0.3376 | 0.3616 |

## e) Chromaticity Region &amp; Coordinates

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>P rank (6500 K)</b> |        |        |        |        |        |
| P1                     | 0.3068 | 0.3113 | P9     | 0.3048 | 0.3207 |
|                        | 0.3106 | 0.3150 |        | 0.3089 | 0.3249 |
|                        | 0.3098 | 0.3199 |        | 0.3080 | 0.3298 |
|                        | 0.3058 | 0.3160 |        | 0.3038 | 0.3256 |
| P2                     | 0.3106 | 0.3150 | PA     | 0.3089 | 0.3249 |
|                        | 0.3144 | 0.3186 |        | 0.3130 | 0.3290 |
|                        | 0.3137 | 0.3238 |        | 0.3123 | 0.3341 |
|                        | 0.3098 | 0.3199 |        | 0.3080 | 0.3298 |
| P3                     | 0.3144 | 0.3186 | PB     | 0.3130 | 0.3290 |
|                        | 0.3183 | 0.3224 |        | 0.3172 | 0.3332 |
|                        | 0.3177 | 0.3278 |        | 0.3166 | 0.3384 |
|                        | 0.3137 | 0.3238 |        | 0.3123 | 0.3341 |
| P4                     | 0.3183 | 0.3224 | PC     | 0.3172 | 0.3332 |
|                        | 0.3221 | 0.3261 |        | 0.3213 | 0.3373 |
|                        | 0.3217 | 0.3317 |        | 0.3209 | 0.3427 |
|                        | 0.3177 | 0.3278 |        | 0.3166 | 0.3384 |
| P5                     | 0.3058 | 0.3160 | PD     | 0.3038 | 0.3256 |
|                        | 0.3098 | 0.3199 |        | 0.3080 | 0.3298 |
|                        | 0.3089 | 0.3249 |        | 0.3072 | 0.3348 |
|                        | 0.3048 | 0.3207 |        | 0.3028 | 0.3304 |
| P6                     | 0.3098 | 0.3199 | PE     | 0.3080 | 0.3298 |
|                        | 0.3137 | 0.3238 |        | 0.3123 | 0.3341 |
|                        | 0.3130 | 0.3290 |        | 0.3115 | 0.3391 |
|                        | 0.3089 | 0.3249 |        | 0.3072 | 0.3348 |
| P7                     | 0.3137 | 0.3238 | PF     | 0.3123 | 0.3341 |
|                        | 0.3177 | 0.3278 |        | 0.3166 | 0.3384 |
|                        | 0.3172 | 0.3332 |        | 0.3160 | 0.3436 |
|                        | 0.3130 | 0.3290 |        | 0.3115 | 0.3391 |
| P8                     | 0.3177 | 0.3278 | PG     | 0.3166 | 0.3384 |
|                        | 0.3217 | 0.3317 |        | 0.3209 | 0.3427 |
|                        | 0.3213 | 0.3373 |        | 0.3205 | 0.3481 |
|                        | 0.3172 | 0.3332 |        | 0.3160 | 0.3436 |

**Note:**

Samsung maintains measurement tolerance of: Cx, Cy =  $\pm 0.005$

f) Kitting Chromaticity Region & Coordinates (IF = 65 mA, Ts = 25 °C)



f) Kitting Chromaticity Region & Coordinates ( $I_f = 65 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>W rank (2700 K)</b> |        |        |        |        |        |
| WV                     | 0.4475 | 0.3994 |        |        |        |
|                        | 0.4589 | 0.4021 |        |        |        |
|                        | 0.4695 | 0.4207 |        |        |        |
|                        | 0.4573 | 0.4178 |        |        |        |
| WW                     | 0.4373 | 0.3893 | WY     | 0.4465 | 0.4071 |
|                        | 0.4483 | 0.3919 |        | 0.4582 | 0.4099 |
|                        | 0.4582 | 0.4099 |        | 0.4687 | 0.4289 |
|                        | 0.4465 | 0.4071 |        | 0.4562 | 0.4260 |
| WX                     | 0.4483 | 0.3919 | WZ     | 0.4582 | 0.4099 |
|                        | 0.4593 | 0.3944 |        | 0.4700 | 0.4126 |
|                        | 0.4700 | 0.4126 |        | 0.4813 | 0.4319 |
|                        | 0.4582 | 0.4099 |        | 0.4687 | 0.4289 |

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>V rank (3000 K)</b> |        |        |        |        |        |
| VV                     | 0.4242 | 0.3919 |        |        |        |
|                        | 0.4359 | 0.3960 |        |        |        |
|                        | 0.4449 | 0.4141 |        |        |        |
|                        | 0.4322 | 0.4096 |        |        |        |
| VW                     | 0.4147 | 0.3814 | VY     | 0.4221 | 0.3984 |
|                        | 0.4259 | 0.3853 |        | 0.4342 | 0.4028 |
|                        | 0.4342 | 0.4028 |        | 0.4430 | 0.4212 |
|                        | 0.4221 | 0.3984 |        | 0.4299 | 0.4165 |
| VX                     | 0.4259 | 0.3853 | VZ     | 0.4342 | 0.4028 |
|                        | 0.4373 | 0.3893 |        | 0.4465 | 0.4071 |
|                        | 0.4465 | 0.4071 |        | 0.4562 | 0.4260 |
|                        | 0.4342 | 0.4028 |        | 0.4430 | 0.4212 |

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>U rank (3500 K)</b> |        |        |        |        |        |
| UV                     | 0.3981 | 0.3800 |        |        |        |
|                        | 0.4116 | 0.3865 |        |        |        |
|                        | 0.4186 | 0.4037 |        |        |        |
|                        | 0.4040 | 0.3966 |        |        |        |
| UW                     | 0.3889 | 0.3690 | UY     | 0.3941 | 0.3848 |
|                        | 0.4017 | 0.3751 |        | 0.4080 | 0.3916 |
|                        | 0.4080 | 0.3916 |        | 0.4146 | 0.4089 |
|                        | 0.3941 | 0.3848 |        | 0.3996 | 0.4015 |
| UX                     | 0.4017 | 0.3751 | UZ     | 0.4080 | 0.3916 |
|                        | 0.4147 | 0.3814 |        | 0.4221 | 0.3984 |
|                        | 0.4221 | 0.3984 |        | 0.4299 | 0.4165 |
|                        | 0.4080 | 0.3916 |        | 0.4146 | 0.4089 |

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>T rank (4000 K)</b> |        |        |        |        |        |
| TV                     | 0.3744 | 0.3685 |        |        |        |
|                        | 0.3863 | 0.3758 |        |        |        |
|                        | 0.3912 | 0.3917 |        |        |        |
|                        | 0.3782 | 0.3837 |        |        |        |
| TW                     | 0.3670 | 0.3578 | TY     | 0.3702 | 0.3722 |
|                        | 0.3783 | 0.3646 |        | 0.3825 | 0.3798 |
|                        | 0.3825 | 0.3798 |        | 0.3869 | 0.3958 |
|                        | 0.3702 | 0.3722 |        | 0.3736 | 0.3874 |
| TX                     | 0.3783 | 0.3646 | TZ     | 0.3825 | 0.3798 |
|                        | 0.3898 | 0.3716 |        | 0.3950 | 0.3875 |
|                        | 0.3950 | 0.3875 |        | 0.4006 | 0.4044 |
|                        | 0.3825 | 0.3798 |        | 0.3869 | 0.3958 |

## f) Kitting Chromaticity Region &amp; Coordinates

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>R rank (5000 K)</b> |        |        |        |        |        |
| RV                     | 0.3407 | 0.3460 |        |        |        |
|                        | 0.3485 | 0.3524 |        |        |        |
|                        | 0.3500 | 0.3655 |        |        |        |
|                        | 0.3415 | 0.3588 |        |        |        |
| RW                     | 0.3366 | 0.3369 | RY     | 0.3371 | 0.3493 |
|                        | 0.3440 | 0.3427 |        | 0.3451 | 0.3554 |
|                        | 0.3451 | 0.3554 |        | 0.3463 | 0.3687 |
|                        | 0.3371 | 0.3493 |        | 0.3376 | 0.3616 |
| RX                     | 0.3440 | 0.3428 | RZ     | 0.3457 | 0.3621 |
|                        | 0.3514 | 0.3487 |        | 0.3500 | 0.3655 |
|                        | 0.3533 | 0.3620 |        | 0.3492 | 0.3587 |
|                        | 0.3451 | 0.3554 |        | 0.3533 | 0.3620 |

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>Q rank (5700 K)</b> |        |        |        |        |        |
| QV                     | 0.3256 | 0.3331 |        |        |        |
|                        | 0.3331 | 0.3398 |        |        |        |
|                        | 0.3333 | 0.3518 |        |        |        |
|                        | 0.3252 | 0.3444 |        |        |        |
| QW                     | 0.3222 | 0.3243 | QY     | 0.3215 | 0.3353 |
|                        | 0.3294 | 0.3306 |        | 0.3293 | 0.3423 |
|                        | 0.3293 | 0.3423 |        | 0.3292 | 0.3539 |
|                        | 0.3215 | 0.3353 |        | 0.3207 | 0.3462 |
| QX                     | 0.3294 | 0.3306 | QZ     | 0.3293 | 0.3423 |
|                        | 0.3366 | 0.3369 |        | 0.3371 | 0.3493 |
|                        | 0.3371 | 0.3493 |        | 0.3376 | 0.3616 |
|                        | 0.3293 | 0.3423 |        | 0.3292 | 0.3539 |

| Region                 | CIE x  | CIE y  | Region | CIE x  | CIE y  |
|------------------------|--------|--------|--------|--------|--------|
| <b>P rank (6500 K)</b> |        |        |        |        |        |
| PV                     | 0.3098 | 0.3199 |        |        |        |
|                        | 0.3177 | 0.3278 |        |        |        |
|                        | 0.3166 | 0.3384 |        |        |        |
|                        | 0.3080 | 0.3298 |        |        |        |
| PW                     | 0.3068 | 0.3113 | PY     | 0.3048 | 0.3207 |
|                        | 0.3144 | 0.3186 |        | 0.3130 | 0.3290 |
|                        | 0.3130 | 0.3290 |        | 0.3115 | 0.3391 |
|                        | 0.3048 | 0.3207 |        | 0.3028 | 0.3304 |
| PX                     | 0.3144 | 0.3186 | PZ     | 0.3130 | 0.3290 |
|                        | 0.3221 | 0.3261 |        | 0.3213 | 0.3373 |
|                        | 0.3213 | 0.3373 |        | 0.3205 | 0.3481 |
|                        | 0.3130 | 0.3290 |        | 0.3115 | 0.3391 |

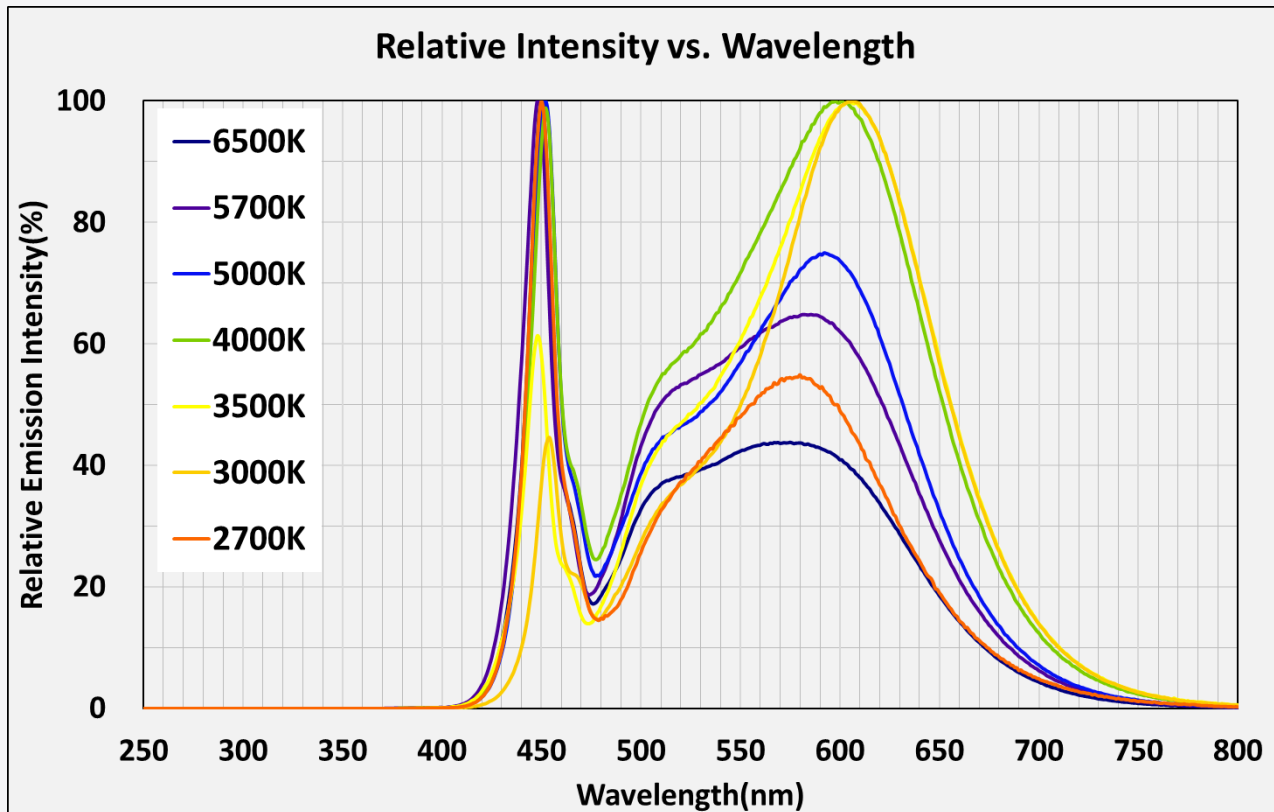
**Note:** Samsung maintains measurement tolerance of:

$$C_x, C_y = \pm 0.005$$

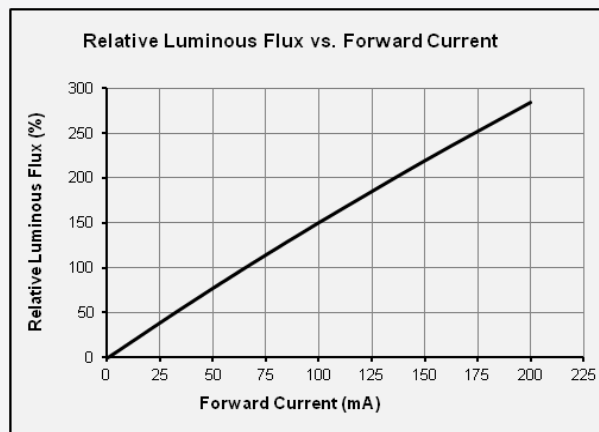
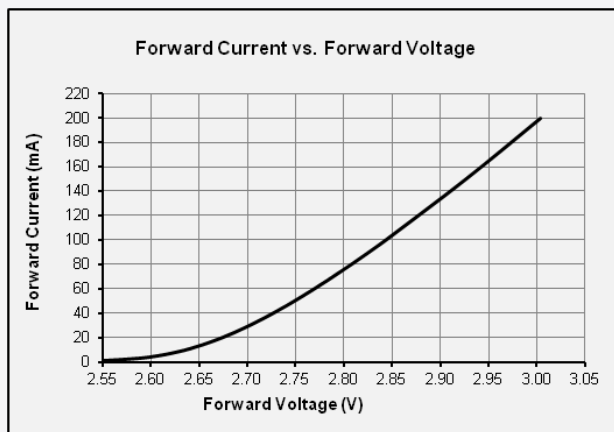
### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_F = 65 \text{ mA}$ , $T_s = 25 \text{ }^\circ\text{C}$ )

CRI Ra 80+



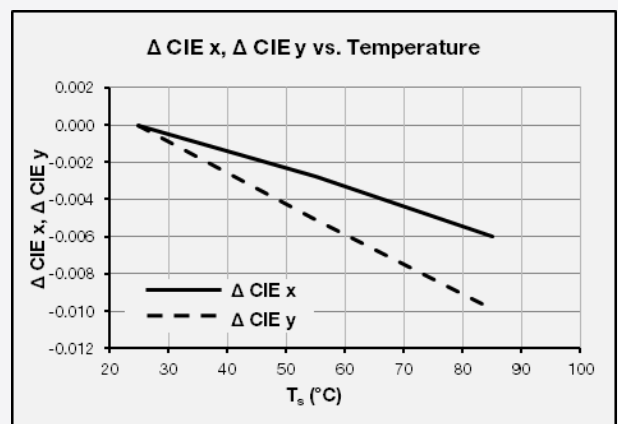
#### b) Forward Current Characteristics ( $T_s = 25 \text{ }^\circ\text{C}$ )



c) Temperature Characteristics ( $I_F = 65 \text{ mA}$ )



d) Color Shift Characteristics ( $T_s = 25 \text{ °C}$ ,  $I_F = 65 \text{ mA}$ )



e) Derating Curve



**f) Beam Angle Characteristics ( $I_F = 65 \text{ mA}$ ,  $T_s = 25 \text{ }^\circ\text{C}$ )**

#### 4. Outline Drawing & Dimension



#### Notes:

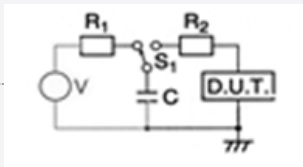
- 1) This LED has built-in ESD protection device(s) connected in parallel to LED chip(s).
- 2)  $T_s$  point and measurement method:
  - ① Measure one point at the cathode pad, if necessary remove PSR of PCB to reach  $T_s$  point.
  - ② All pads must be soldered to the PCB to dissipate heat properly, otherwise the LED can be damaged.

#### Precautions:

- 1) Pressure on the LEDs will influence to the reliability of the LEDs. Precautions should be taken to avoid 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 & Conditions

### a) Test Items

| Test Item                           | Test Condition   | Test Hour / Cycle  | Sample No. |    |
|-------------------------------------|--|--|------------|----|
| High Temperature Life Test          | 85 °C, DC 200 mA   | 1000 h   | 22         |    |
| High Temperature Humidity Life Test | 60 °C, 90 % RH, DC 200 mA  | 1000 h   | 22         |    |
| Powered Temperature Cycle Test      | -40 °C / 10 min ↔ 85 °C / 10 min, sweep 20 min<br>cycle on/off: each 5 min, DC 200 mA  | 100 cycles   | 22         |    |
| Thermal Cycle                       | -45 °C / 15 min ↔ 125 °C / 15 min<br>→ Hot plate 180 °C                                | 500 cycles   | 100        |    |
| High Temperature Storage            | 120 °C   | 1000 h   | 11         |    |
| Low Temperature Storage             | -40 °C   | 1000 h   | 11         |    |
| ESD (HBM)                           |      | R <sub>1</sub> : 10 MΩ<br>R <sub>2</sub> : 1.5 kΩ<br>C: 100 pF<br>V: ±5 kV | 5 times    | 30 |
| ESD (MM)                            |  |  |            |    |
| Vibration Test                      | 20~2000~20 Hz, 200 m/s <sup>2</sup> , sweep 4 min<br>X, Y, Z 3 direction, each 1 cycle | 4 cycles   | 11         |    |
| Mechanical Shock Test               | 1500 g, 0.5 ms<br>3 shocks each X-Y-Z axis   | 5 cycles   | 11         |    |

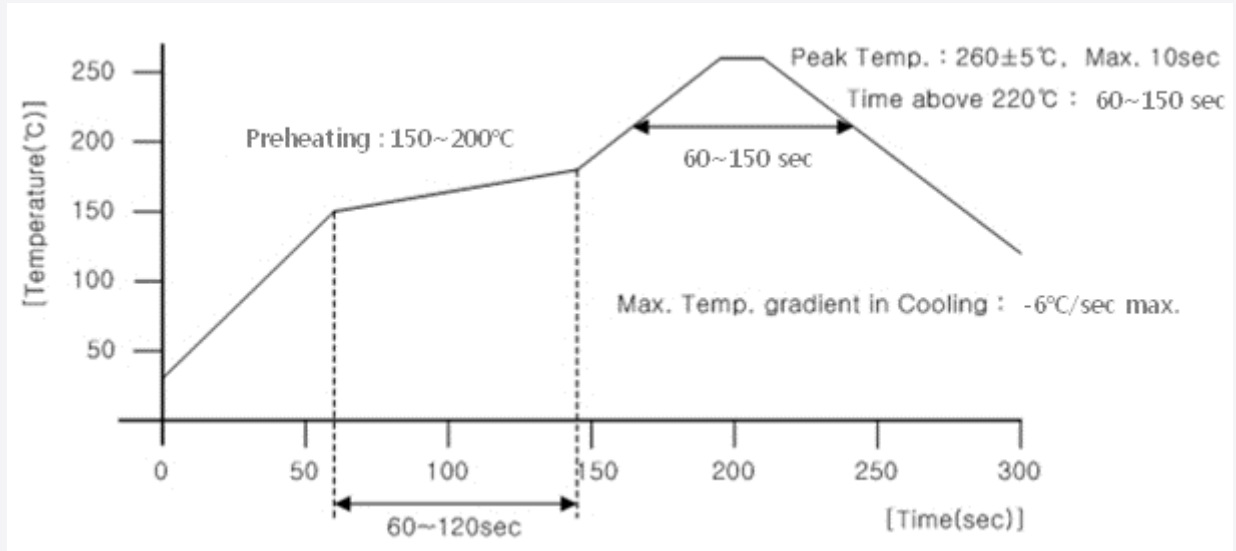
### b) Criteria for Judging the Damage

| Item            | Symbol         | Test Condition<br>(T <sub>s</sub> = 25 °C) | Limit             |                   |
|-----------------|----------------|--|-------------------|-------------------|
|                 |                |  | Min               | Max               |
| Forward Voltage | V <sub>F</sub> | I <sub>F</sub> = 65 mA                     | Init. Value * 0.9 | Init. Value * 1.1 |
| Luminous Flux   | Φ <sub>v</sub> | I <sub>F</sub> = 65 mA                     | Init. Value * 0.7 | Init. Value * 1.1 |

## 6. Soldering Conditions

### a) Reflow Conditions (Pb free)

Reflow frequency: 2 times max.



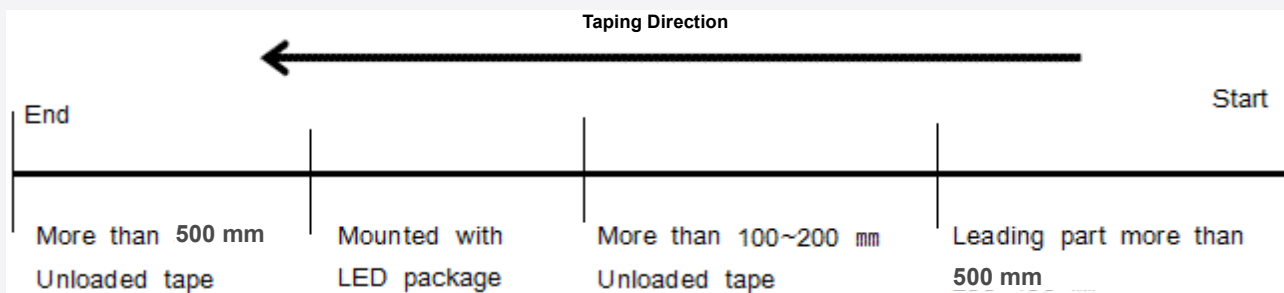
### b) Manual Soldering Conditions

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

7. Tape & Reel

a) Taping Dimension

(unit: mm)



**b-1) Reel Dimension (Max 2,500 pcs)**

(unit: mm)



**b-2) Reel Dimension (Max 10,000 pcs)**



| Symbol   | A      | B    | C      | W1     | W2     |
|----------|--------|------|--------|--------|--------|
| Spec(mm) | Ø330±1 | 80±1 | 13±0.5 | 13±0.3 | 17.5±1 |

**Notes:**

- 1) Quantity: The quantity/reel is 2,500 pcs or 10,000 pcs
- 2) Cumulative Tolerance: Cumulative tolerance / 10 pitches is  $\pm 0.2$  mm
- 3) Adhesion Strength of Cover Tape: Adhesion strength is 0.1-0.7 N when the cover tape is turned off from the carrier tape at 10° angle to the carrier tape
- 4) 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 10)
- ⒸⒹ: Chromaticity bin (refer to page 9-18)
- ⒺⒻ: Luminous Flux bin (refer to page 6)

### b) Lot Number

The lot number is composed of the following characters:



①②③④⑤⑥⑦⑧⑨ / ⒶⒷⒸ / 2,500 pcs

- ①, ② : Production site (GL : Tianjin, China, G3: Shenzhen, China, G4 : Guangzhou, China)
- ③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)
- ④ : Year (F: 2021, G: 2022, H:2023, I: 2023...)
- ⑤ : Month (1~9, A, B, C)
- ⑥ : Day (1~9, A, B~V)
- ⑦⑧⑨ : Serial number (001 ~ 999)
- ⒶⒷⒸ : Reel number (001 ~ 999)

## 9. Packing Structure

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

#### Reel



**A1R1S5**

SPMWHT541ML5XAR0S0 A1R1S5 01  
 |||  
 G4AG4L001 / I001 / 2,500 pcs  
 |||  
**SAMSUNG**  



#### Aluminum Vinyl Packing Bag



**A1R1S5**

SPMWHT541ML5XAR0S0 A1R1S5 01  
 |||  
 G4G4L4001 / I001 / 2,500 pcs  
 |||  
**SAMSUNG**  




#### Outer Box



Material: Paper (SW3B(B))

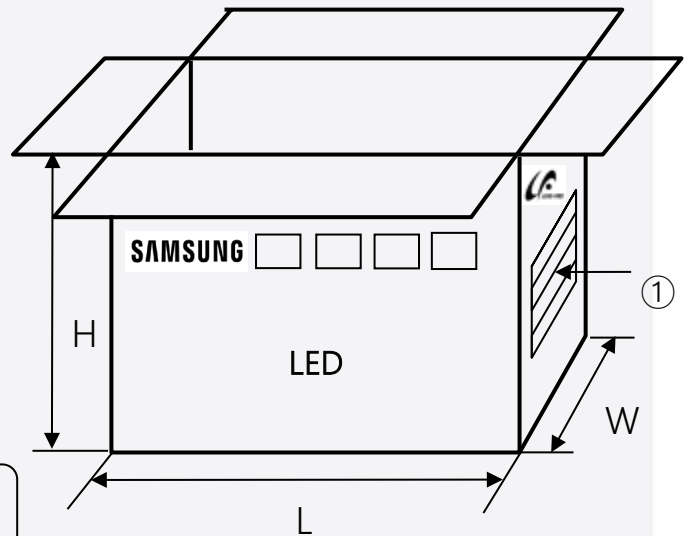
| Type     | Size (mm) |         |         | Note           |
|----------|-----------|---------|---------|----------------|
|          | L         | W       | H       |                |
| 7 inch S | 245 ± 5   | 220 ± 5 | 86 ± 5  | Up to 5 reels  |
| 7 inch L | 245 ± 5   | 220 ± 5 | 182 ± 5 | Up to 10 reels |

#### ① Side Label



**A1R1S5**

SPMWHT541ML5XAR0S0 A1R1S5 01  
 |||  
 G4AG4L001 / I001 / 2,500 pcs  
 |||  
**SAMSUNG**  

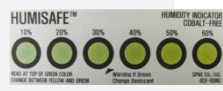
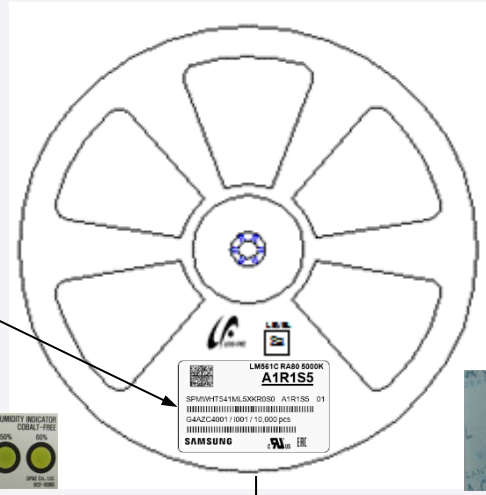


|   |  |
|---|--|
| (1P) Supplier Part Number: SPMWHT541ML5XAR0S0<br>   <br>(33P) Bin Code: A1R1S5<br>   <br>(1T) Lot Number: G4AG4L001<br> | (Q) Quantity: 2,500<br>   <br>(10D) Date Code: 2216<br>   <br>(4L) Country of Origin: CN<br> |
|---|--|

a-2) Packing Process (The quantity of PKG on the Reel to be Max 10,000pcs)

Reel

 **A1R1S5**  
 SPMWHT541ML5XKR0S0 A1R1S5 01  
 G4AG4L001 / I001 / 10,000 pcs  
**SAMSUNG** 



Aluminum Vinyl Packing Bag

 **A1R1S5**  
 SPMWHT541ML5XKR0S0 A1R1S5 01  
 G4AG4L001 / I001 / 10,000 pcs  
**SAMSUNG** 

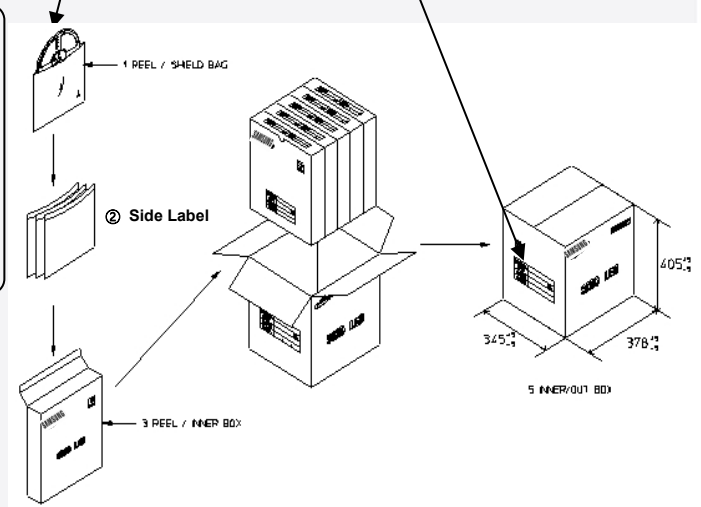


Outer Box.

Material: Paper (SW3B(B))<sup>2</sup>

| Type.     | Size (mm). |          |          | Note.           |
|-----------|------------|----------|----------|-----------------|
|           | L.         | W.       | H.       |                 |
| 13 inch . | 345 ± 5.   | 378 ± 5. | 405 ± 5. | Up to 10 reels. |

 **A1R1S5**  
 SPMWHT541ML5XKR0S0 A1R1S5 01  
 G4AG4L001 / I001 / 150,000 pcs  
**SAMSUNG** 



(1P) Supplier Part Number: SPMWHT541ML5XKR0S0 (Q) Quantity: 150,000  
 (33P) Bin Code: A1R1S5 (10D) Date Code: 2216  
 (1T) Lot Number: G4AG4L001 (4L) Country of Origin: CN

**b-1) Packing Process for kitting (The quantity of PKG on the Reel to be Max 2,500pcs)**

**Reel**

**Kitting 'A'**



**AZ◇WS5**  
 SPMWHT541ML5XA◇KS5 AZ◇WS5 01  
 G4AG4L001 / I001 / 2,500 pcs  
**SAMSUNG**  

**Kitting 'B'**



**AZ◇ZS5**  
 SPMWHT541ML5XA◇KS5 AZ◇ZS5 01  
 G4AG4L001 / I001 / 2,500 pcs  
**SAMSUNG**  

**Aluminum Vinyl Packing Bag**

**Kitting 'A'**



**AZ◇WS5**  
 SPMWHT541ML5XA◇KS5 AZ◇WS5 01  
 G4AG4L001 / I001 / 2,500 pcs  
**SAMSUNG**  

**Kitting 'B'**









**AZ◇ZS5**  
 SPMWHT541ML5XA◇KS5 AZ◇ZS5 01  
 G4AG4L001 / I001 / 2,500 pcs  
**SAMSUNG**  

Note: "◇" can be Nominal CCT code.

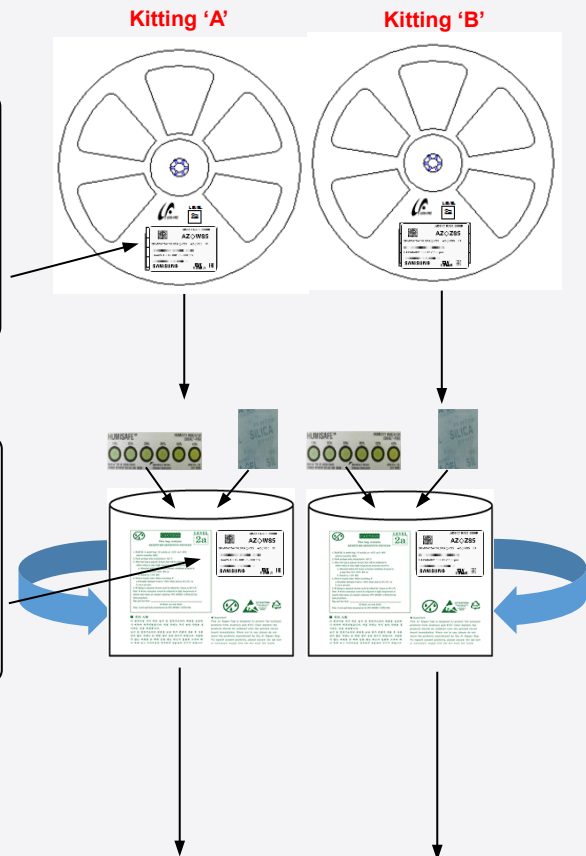
**Outer Box**

Material: Paper (SW3B(B))

| Type     | Size (mm) |         |         | Note           |
|----------|-----------|---------|---------|----------------|
|          | L         | W       | H       |                |
| 7 inch S | 245 ± 5   | 220 ± 5 | 86 ± 5  | Up to 5 reels  |
| 7 inch L | 245 ± 5   | 220 ± 5 | 182 ± 5 | Up to 10 reels |

|   |   |
|---|---|
| (1P) Supplier Part Number: SPMWHT541ML5XARKS5<br> | (Q) Quantity: 12,500<br>       |
| (33P) Bin Code: AZRWS5<br>                        | (10D) Date Code: 2216<br>      |
| (1T) Lot Number: G4AG4L001<br>                    | (4L) Country of Origin: CN<br> |

|   |   |
|---|---|
| (1P) Supplier Part Number: SPMWHT541ML5XARKS5<br> | (Q) Quantity: 12,500<br>       |
| (33P) Bin Code: AZRZS5<br>                        | (10D) Date Code: 2216<br>      |
| (1T) Lot Number: G4AG4L001<br>                    | (4L) Country of Origin: CN<br> |



b-2) Packing Process for kitting (The quantity of PKG on the Reel to be Max 10,000pcs)

Kitting 'A'

Kitting 'B'

Reel


Kitting 'A'

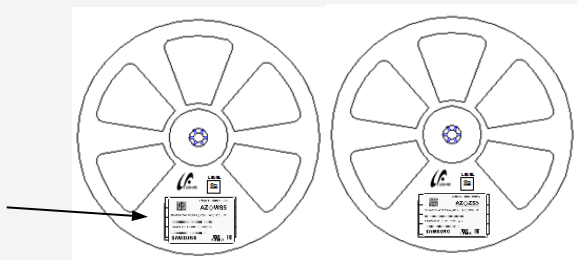


**AZ◇WS5**  
 SPMWHT541ML5XK◇KS5 AZ◇WS5 01  
 G4AG4L001 / I001 / 10,000 pcs  
**SAMSUNG**  

Kitting 'B'



**AZ◇ZS5**  
 SPMWHT541ML5XK◇KS5 AZ◇ZS5 01  
 G4AG4L001 / I001 / 10,000 pcs  
**SAMSUNG**  



Aluminum Vinyl Packing Bag

Kitting 'A'

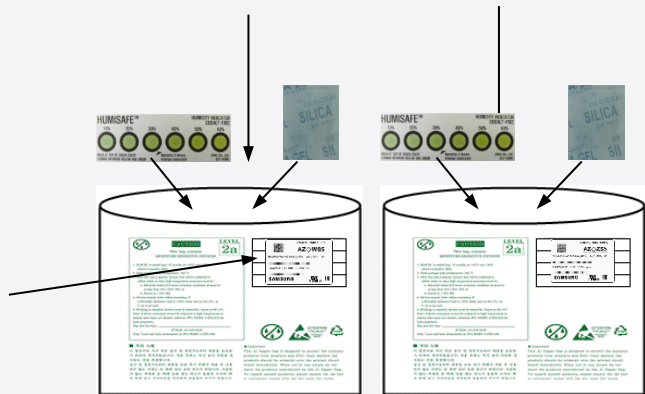


**AZ◇WS5**  
 SPMWHT541ML5XK◇KS5 AZ◇WS5 01  
 G4AG4L001 / I001 / 10,000 pcs  
**SAMSUNG**  

Kitting 'B'



**AZ◇ZS5**  
 SPMWHT541ML5XK◇KS5 AZ◇ZS5 01  
 G4AG4L001 / I001 / 10,000 pcs  
**SAMSUNG**  



Note: "◇" can be Nominal CCT code.

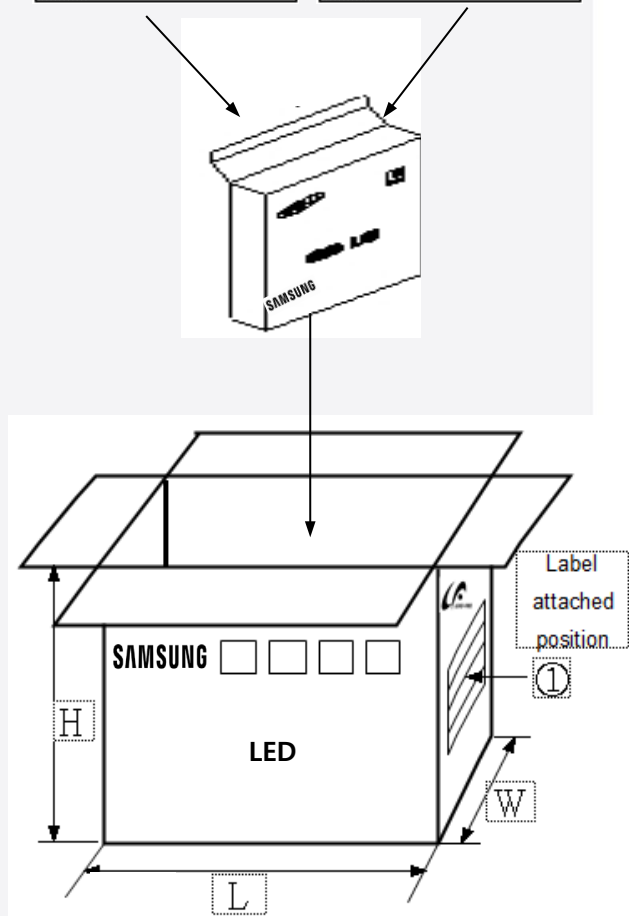
Outer Box

Material: Paper (SW3B(B))

| Type    | Size (mm) |         |         | Note           |
|---------|-----------|---------|---------|----------------|
|         | L         | W       | H       |                |
| 13 inch | 345 ± 5   | 378 ± 5 | 405 ± 5 | Up to 10 reels |

(1P) Supplier Part Number: SPMWHT541ML5XKRKS5 (Q) Quantity: 10,000  
 (33P) Bin Code: AZRWS5 (10D) Date Code: 2216  
 (1T) Lot Number: G4AG4L001 (4L) Country of Origin : CN

(1P) Supplier Part Number: SPMWHT541ML5XKRKS5 (Q) Quantity : 2,500  
 (33P) Bin Code: AZRWS5 (10D) Date Code: 2216  
 (1T) Lot Number: G4AG4L001 (4L) Country of Origin: CN



c) 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



A1R1S5

SPMWHT541ML5XKR0S0 A1R1S5 01  
 G4AG4L001 / I001 / 10,000 pcs

**SAMSUNG** 






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**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.

d) 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

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

## 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) In order to obtain stable performance of LED, higher than 10% of the sorting current is recommended for operation.
- 5) LEDs must be stored in a clean environment. Shelf life of sealed bags is 12 months at temperature 0~40 °C, 0~90 % RH.
- 6) 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\*<sup>Note 1</sup>, or
  - b. Mounted within 24 hours (1 day) at an assembly line with a condition of more than 30 °C / 70 % RH\*<sup>Note 2</sup>, or
  - c. Stored at <10 % RH.

\*Note 1, 2: IPC/JEDEC J-STD-033A, Recommended Equivalent Total Floor Life Table

| Package Type and Body Thickness | Moisture Sensitivity Level | Maximum Percent Relative Humidity |     |     |     |     |     | Temperature |
|---------------------------------|----------------------------|-----------------------------------|-----|-----|-----|-----|-----|-------------|
|                                 |                            | 40%                               | 50% | 60% | 70% | 80% | 90% |             |
| Body Thickness <2.1mm           | Level 2a                   | ∞                                 | ∞   | 28  | 1   | 1   | 1   | 30°C        |
|                                 |                            | ∞                                 | ∞   | ∞   | 2   | 1   | 1   | 25°C        |
|                                 |                            | ∞                                 | ∞   | ∞   | 2   | 2   | 1   | 20°C        |

- 7) Repack unused devices with anti-moisture packing, fold to close any opening and then store in a dry place.
- 8) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5 °C.
- 9) Devices must be baked for 10~24 hours at 60 ± 5 °C, if baking is required.
- 10) 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.
- 11) 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.
- 12) Risk of sulfurization (or tarnishing)
 

The LED from Samsung 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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Samsung inspires the world and shapes the future with transformative ideas and technologies.

The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, and memory, system LSI, foundry and LED solutions.

For the latest news, please visit the Samsung Newsroom at [news.samsung.com](https://news.samsung.com).

"Samsung provides limited warranty for its LED products, the full text of which is

available at <https://www.samsung.com/led/support/warranties>"

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Giheung-gu

Yongin-si, Gyeonggi-do, 446-711

KOREA

[www.samsungled.com](https://www.samsungled.com)

**SAMSUNG**

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- ⊖ [Samsung Information](#)

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- ✓ Global Sourcing Solution
- ✓ Obsolete Management
- ✓ Cost Control Management
- ✓ Shortage Management
- ✓ Alternative Solution
- ✓ Excess Inventory Management