



# THE DATASHEET OF SPHWHAHDNL251ZT2D3



High Voltage LED Series  
Chip on Board

# COB D-Gen.3



High efficacy COB LED package  
well-suited for use in spotlight applications

## Features & Benefits

- Chip on Board (COB) solution makes it easy to design in
- Simple assembly reduces manufacturing cost
- Low thermal resistance
- InGaN/GaN MQW LED with long time reliability

## Applications

- Spotlight / Downlight
- LED Retrofit Bulbs
- Outdoor Illumination



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## 1. Characteristics

### a) Absolute Maximum Rating

| Item                                | Symbol      | Model  | Rating       | Unit   | Condition |
|-------------------------------------|-------------|--------|--------------|--------|-----------|
| Ambient / Operating Temperature     | $T_a$       | -      | -40 ~ +105   | °C     | -         |
| Storage Temperature                 | $T_{stg}$   | -      | -40 ~ +120   | °C     | -         |
| LED Junction Temperature            | $T_J$       | -      | 150          | °C     | -         |
| Case Temperature                    | $T_c$       | -      | 115          | °C     | -         |
|                                     |             | LC003D | 230 / 8.8    |        | -         |
|                                     |             | LC006D | 460 / 17.5   |        | -         |
|                                     |             | LC009D | 690 / 26.3   |        | -         |
|                                     |             | LC013D | 920 / 35.0   |        | -         |
|                                     |             | LC016D | 1150 / 43.8  |        | -         |
| Forward Current / Power Dissipation | $I_F / P_D$ | LC019D | 1380 / 52.6  | mA / W | -         |
|                                     |             | LC026D | 1840 / 70.1  |        | -         |
|                                     |             | LC033D | 2300 / 87.6  |        | -         |
|                                     |             | LC040D | 2760 / 105.1 |        | -         |
|                                     |             | LC060D | 2760 / 157.7 |        | -         |
|                                     |             | LC080D | 4140 / 231.3 |        | -         |
| ESD (HBM)                           | -           | -      | ±2           | kV     | -         |

b) Electro-optical Characteristics ( $I_F$  = Sorting Current,  $T_J = 85\text{ }^\circ\text{C}$ )

| Item  | Unit               | Model     | Rank | Min. | Typ.        | Max. |      |
|---|--------------------|-----------|------|------|-------------|------|------|
| Forward Voltage ( $V_F$ )                     | V                  | All model | YZ   | 31.0 | 34.0        | 37.0 |      |
|   |                    |           | 1Z   | 60W  | 46.8        | 51.0 | 55.2 |
|   |                    |           |      | 80W  | 46.8        | 50.0 | 52.5 |
| Color Rendering Index ( $R_a$ )               | -                  | All model | 3    | 70   | -           | -    |      |
|   |                    |           | 5    | 80   | -           | -    |      |
|   |                    |           | 7    | 90   | -           | -    |      |
| Beam Angle                                    | $^\circ$           | -         | -    | -    | 115         | -    |      |
| Nominal Power / Sorting Current               | W / mA             | LC003D    | -    | -    | 3.1 / 90    | -    |      |
|   |                    | LC006D    | -    | -    | 6.1 / 180   | -    |      |
|   |                    | LC009D    | -    | -    | 9.2 / 270   | -    |      |
|   |                    | LC013D    | -    | -    | 12.2 / 360  | -    |      |
|   |                    | LC016D    | -    | -    | 15.3 / 450  | -    |      |
|   |                    | LC019D    | -    | -    | 18.4 / 540  | -    |      |
|   |                    | LC026D    | -    | -    | 24.5 / 720  | -    |      |
|   |                    | LC033D    | -    | -    | 30.6 / 900  | -    |      |
|   |                    | LC040D    | -    | -    | 36.7 / 1080 | -    |      |
|   |                    | LC060D    | -    | -    | 55.1 / 1080 | -    |      |
|   |                    | LC080D    | -    | -    | 81.0 / 1620 | -    |      |
| Thermal Resistance<br>(Junction to chip case) | $^\circ\text{C/W}$ | LC003D    | -    | -    | 2.43        | -    |      |
|   |                    | LC006D    | -    | -    | 1.41        | -    |      |
|   |                    | LC009D    | -    | -    | 0.94        | -    |      |
|   |                    | LC013D    | -    | -    | 0.81        | -    |      |
|   |                    | LC016D    | -    | -    | 0.64        | -    |      |
|   |                    | LC019D    | -    | -    | 0.57        | -    |      |
|   |                    | LC026D    | -    | -    | 0.45        | -    |      |
|   |                    | LC033D    | -    | -    | 0.38        | -    |      |
|   |                    | LC040D    | -    | -    | 0.30        | -    |      |
|   |                    | LC060D    | -    | -    | 0.23        | -    |      |
|   |                    | LC080D    | -    | -    | 0.15        | -    |      |

**Notes:**

- 1) The COB is tested in pulsed condition at rated test current (10 ms pulse width) and rated temperature ( $T_J = T_C = T_a = 85\text{ }^\circ\text{C}$ )
- 2) Samsung maintains measurement tolerance of: forward voltage =  $\pm 5\%$ , CRI =  $\pm 1$
- 3) Refer to the derating curve, '3. Typical Characteristics Graph'designed within the range.

**c) Luminous Flux Characteristics (I<sub>F</sub> = Sorting Current)**

| Model  | CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux@ T <sub>J</sub> = 85 °C (lm) |      |      |   |
|--------|-------------------------------|--------------------|--------------|-----------------------------------|------|------|---|
|        |                               |                    |              | Min.                              | Typ. | Max. |   |
| LC003D | 80                            | 2700               | D3           | 451                               | 475  | -    |   |
|        |                               | 3000               | D3           | 474                               | 499  | -    |   |
|        |                               | 3500               | D3           | 488                               | 514  | -    |   |
|        |                               | 4000               | D3           | 498                               | 524  | -    |   |
|        |                               | 5000               | D3           | 502                               | 529  | -    |   |
|        |                               | 5700               | D3           | 502                               | 529  | -    |   |
|        |                               | 6500               | D3           | 498                               | 524  | -    |   |
|        | 90                            | 2700               | D3           | 386                               | 407  | -    |   |
|        |                               | 3000               | D3           | 406                               | 428  | -    |   |
|        |                               | 3500               | D3           | 419                               | 441  | -    |   |
|        |                               | 4000               | D3           | 427                               | 450  | -    |   |
|        |                               | 5000               | D3           | 431                               | 453  | -    |   |
|        |                               | 80                 | 2700         | D3                                | 898  | 946  | - |
|        |                               |                    | 3000         | D3                                | 944  | 994  | - |
| 3500   | D3                            |                    | 972          | 1023                              | -    |      |   |
| 4000   | D3                            |                    | 991          | 1043                              | -    |      |   |
| 5000   | D3                            |                    | 1000         | 1052                              | -    |      |   |
| 5700   | D3                            |                    | 1000         | 1052                              | -    |      |   |
| 6500   | D3                            |                    | 991          | 1043                              | -    |      |   |
| LC006D | 90                            | 2700               | D3           | 769                               | 809  | -    |   |
|        |                               | 3000               | D3           | 809                               | 851  | -    |   |
|        |                               | 3500               | D3           | 833                               | 877  | -    |   |
|        |                               | 4000               | D3           | 850                               | 895  | -    |   |
|        |                               | 5000               | D3           | 857                               | 902  | -    |   |

**Notes:**

- 1) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

| Model  | CRI (Ra)<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux@ T <sub>J</sub> = 85 °C (lm) |      |      |
|--------|------------------|--------------------|--------------|-----------------------------------|------|------|
|        |                  |                    |              | Min.                              | Typ. | Max. |
| LC009D | 70               | 3000               | D3           | 1515                              | 1594 | -    |
|        |                  | 4000               | D3           | 1543                              | 1624 | -    |
|        |                  | 5000               | D3           | 1571                              | 1653 | -    |
|        | 80               | 2700               | D3           | 1334                              | 1405 | -    |
|        |                  | 3000               | D3           | 1402                              | 1476 | -    |
|        |                  | 3500               | D3           | 1443                              | 1519 | -    |
|        |                  | 4000               | D3           | 1472                              | 1550 | -    |
|        |                  | 5000               | D3           | 1485                              | 1563 | -    |
|        |                  | 5700               | D3           | 1485                              | 1563 | -    |
|        |                  | 6500               | D3           | 1472                              | 1550 | -    |
|        |                  | 2700               | D3           | 1142                              | 1202 | -    |
|        |                  | 3000               | D3           | 1201                              | 1264 | -    |
|        | 90               | 3500               | D3           | 1237                              | 1302 | -    |
|        |                  | 4000               | D3           | 1263                              | 1329 | -    |
|        |                  | 5000               | D3           | 1273                              | 1340 | -    |
| 70     |                  | 3000               | D3           | 1989                              | 2094 | -    |
|        |                  | 4000               | D3           | 2026                              | 2133 | -    |
|        | 5000             | D3                 | 2063         | 2171                              | -    |      |
|        | 80               | 2700               | D3           | 1753                              | 1845 | -    |
|        |                  | 3000               | D3           | 1842                              | 1939 | -    |
|        |                  | 3500               | D3           | 1896                              | 1996 | -    |
| 4000   |                  | D3                 | 1934         | 2036                              | -    |      |
| 5000   |                  | D3                 | 1950         | 2053                              | -    |      |
| 5700   |                  | D3                 | 1950         | 2053                              | -    |      |
| 90     | 6500             | D3                 | 1934         | 2036                              | -    |      |
|        | 2700             | D3                 | 1500         | 1579                              | -    |      |
|        | 3000             | D3                 | 1578         | 1661                              | -    |      |
|        | 3500             | D3                 | 1625         | 1710                              | -    |      |
|        | 4000             | D3                 | 1658         | 1745                              | -    |      |
|        | 5000             | D3                 | 1672         | 1760                              | -    |      |

**Notes:**

- 2) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

| Model  | CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux@ T <sub>J</sub> = 85 °C (lm) |      |      |
|--------|-------------------------------|--------------------|--------------|-----------------------------------|------|------|
|        |                               |                    |              | Min.                              | Typ. | Max. |
| LC016D | 70                            | 3000               | D3           | 2562                              | 2697 | -    |
|        |                               | 4000               | D3           | 2609                              | 2747 | -    |
|        |                               | 5000               | D3           | 2657                              | 2797 | -    |
|        | 80                            | 2700               | D3           | 2257                              | 2376 | -    |
|        |                               | 3000               | D3           | 2372                              | 2497 | -    |
|        |                               | 3500               | D3           | 2442                              | 2570 | -    |
|        |                               | 4000               | D3           | 2490                              | 2622 | -    |
|        |                               | 5000               | D3           | 2511                              | 2644 | -    |
|        |                               | 5700               | D3           | 2511                              | 2644 | -    |
|        |                               | 6500               | D3           | 2490                              | 2622 | -    |
|        |                               | 2700               | D3           | 1932                              | 2033 | -    |
|        |                               | 3000               | D3           | 2032                              | 2139 | -    |
|        | 90                            | 3500               | D3           | 2093                              | 2203 | -    |
|        |                               | 4000               | D3           | 2136                              | 2248 | -    |
|        |                               | 5000               | D3           | 2154                              | 2267 | -    |
| 70     |                               | 3000               | D3           | 3059                              | 3220 | -    |
|        |                               | 4000               | D3           | 3116                              | 3280 | -    |
|        | 5000                          | D3                 | 3172         | 3339                              | -    |      |
| LC019D | 80                            | 2700               | D3           | 2695                              | 2837 | -    |
|        |                               | 3000               | D3           | 2833                              | 2982 | -    |
|        |                               | 3500               | D3           | 2916                              | 3069 | -    |
|        |                               | 4000               | D3           | 2974                              | 3130 | -    |
|        |                               | 5000               | D3           | 2999                              | 3157 | -    |
|        |                               | 5700               | D3           | 2999                              | 3157 | -    |
|        | 90                            | 6500               | D3           | 2974                              | 3130 | -    |
|        |                               | 2700               | D3           | 2307                              | 2428 | -    |
|        |                               | 3000               | D3           | 2426                              | 2554 | -    |
|        |                               | 3500               | D3           | 2499                              | 2630 | -    |
|        |                               | 4000               | D3           | 2550                              | 2684 | -    |
|        |                               | 5000               | D3           | 2572                              | 2707 | -    |

**Notes:**

- 3) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

| Model  | CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux@ T <sub>J</sub> = 85 °C (lm) |      |      |   |
|--------|-------------------------------|--------------------|--------------|-----------------------------------|------|------|---|
|        |                               |                    |              | Min.                              | Typ. | Max. |   |
| LC026D | 70                            | 3000               | D3           | 4019                              | 4230 | -    |   |
|        |                               | 4000               | D3           | 4093                              | 4308 | -    |   |
|        |                               | 5000               | D3           | 4167                              | 4387 | -    |   |
|        | 80                            | 2700               | D3           | 3541                              | 3727 | -    |   |
|        |                               | 3000               | D3           | 3721                              | 3917 | -    |   |
|        |                               | 3500               | D3           | 3830                              | 4032 | -    |   |
|        |                               | 4000               | D3           | 3907                              | 4112 | -    |   |
|        |                               | 5000               | D3           | 3939                              | 4147 | -    |   |
|        |                               | 5700               | D3           | 3939                              | 4147 | -    |   |
|        |                               | 6500               | D3           | 3907                              | 4112 | -    |   |
|        |                               | 90                 | 2700         | D3                                | 3030 | 3190 | - |
|        |                               |                    | 3000         | D3                                | 3187 | 3355 | - |
|        | 3500                          |                    | D3           | 3282                              | 3455 | -    |   |
|        | LC033D                        | 70                 | 4000         | D3                                | 3350 | 3526 | - |
|        |                               |                    | 5000         | D3                                | 3379 | 3556 | - |
| 3000   |                               |                    | D3           | 4973                              | 5235 | -    |   |
| 80     |                               | 4000               | D3           | 5065                              | 5332 | -    |   |
|        |                               | 5000               | D3           | 5157                              | 5429 | -    |   |
|        |                               | 2700               | D3           | 4382                              | 4612 | -    |   |
|        |                               | 3000               | D3           | 4605                              | 4847 | -    |   |
|        |                               | 3500               | D3           | 4740                              | 4989 | -    |   |
|        |                               | 4000               | D3           | 4834                              | 5089 | -    |   |
|        |                               | 5000               | D3           | 4875                              | 5132 | -    |   |
|        |                               | 5700               | D3           | 4875                              | 5132 | -    |   |
|        |                               | 6500               | D3           | 4834                              | 5089 | -    |   |
| 90     |                               | 2700               | D3           | 3750                              | 3947 | -    |   |
|        |                               | 3000               | D3           | 3944                              | 4152 | -    |   |
|        |                               | 3500               | D3           | 4062                              | 4276 | -    |   |
|        | 4000                          | D3                 | 4146         | 4364                              | -    |      |   |
|        | 5000                          | D3                 | 4181         | 4401                              | -    |      |   |

**Notes:**

- 4) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

| Model  | CRI (R <sub>a</sub> )<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux@ T <sub>J</sub> = 85 °C (lm) |      |      |
|--------|-------------------------------|--------------------|--------------|-----------------------------------|------|------|
|        |                               |                    |              | Min.                              | Typ. | Max. |
| LC040D | 70                            | 3000               | D3           | 6118                              | 6440 | -    |
|        |                               | 4000               | D3           | 6232                              | 6560 | -    |
|        |                               | 5000               | D3           | 6345                              | 6679 | -    |
|        | 80                            | 2700               | D3           | 5391                              | 5675 | -    |
|        |                               | 3000               | D3           | 5665                              | 5963 | -    |
|        |                               | 3500               | D3           | 5831                              | 6138 | -    |
|        |                               | 4000               | D3           | 5948                              | 6261 | -    |
|        |                               | 5000               | D3           | 5998                              | 6313 | -    |
|        |                               | 5700               | D3           | 5998                              | 6313 | -    |
|        | 90                            | 6500               | D3           | 5948                              | 6261 | -    |
|        |                               | 2700               | D3           | 4614                              | 4856 | -    |
|        |                               | 3000               | D3           | 4853                              | 5108 | -    |
|        |                               | 3500               | D3           | 4997                              | 5260 | -    |
|        |                               | 4000               | D3           | 5100                              | 5369 | -    |
|        | LC060D                        | 70                 | 5000         | D3                                | 5144 | 5415 |
| 3000   |                               |                    | D3           | 9042                              | 9518 | -    |
| 4000   |                               |                    | D3           | 9209                              | 9694 | -    |
| 80     |                               | 5000               | D3           | 9377                              | 9870 | -    |
|        |                               | 2700               | D3           | 7967                              | 8386 | -    |
|        |                               | 3000               | D3           | 8372                              | 8813 | -    |
|        |                               | 3500               | D3           | 8617                              | 9071 | -    |
|        |                               | 4000               | D3           | 8790                              | 9253 | -    |
|        |                               | 5000               | D3           | 8864                              | 9330 | -    |
| 90     |                               | 5700               | D3           | 8864                              | 9330 | -    |
|        |                               | 6500               | D3           | 8790                              | 9253 | -    |
|        |                               | 2700               | D3           | 6818                              | 7177 | -    |
|        |                               | 3000               | D3           | 7172                              | 7549 | -    |
|        |                               | 3500               | D3           | 7385                              | 7774 | -    |
|        |                               |                    | 4000         | D3                                | 7537 | 7934 |
|        |                               | 5000               | D3           | 7602                              | 8002 | -    |

**Notes:**

- 5) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 2) Samsung maintains measurement tolerance of: Luminous flux = ±7 %, CRI = ±1

| Model  | CRI (Ra)<br>Min. | Nominal<br>CCT (K) | Flux<br>Rank | Flux@ T <sub>J</sub> = 85 °C (lm) |       |      |
|--------|------------------|--------------------|--------------|-----------------------------------|-------|------|
|        |                  |                    |              | Min.                              | Typ.  | Max. |
| LC080D | 70               | 3000               | D3           | 13409                             | 14115 | -    |
|        |                  | 4000               | D3           | 13657                             | 14376 | -    |
|        |                  | 5000               | D3           | 13906                             | 14637 | -    |
|        | 80               | 2700               | D3           | 11815                             | 12437 | -    |
|        |                  | 3000               | D3           | 12416                             | 13069 | -    |
|        |                  | 3500               | D3           | 12779                             | 13452 | -    |
|        |                  | 4000               | D3           | 13035                             | 13721 | -    |
|        |                  | 5000               | D3           | 13144                             | 13836 | -    |
|        |                  | 5700               | D3           | 13144                             | 13836 | -    |
|        |                  | 6500               | D3           | 13035                             | 13721 | -    |
|        |                  | 2700               | D3           | 10111                             | 10643 | -    |
|        |                  | 3000               | D3           | 10635                             | 11195 | -    |
|        | 90               | 3500               | D3           | 10952                             | 11529 | -    |
|        |                  | 4000               | D3           | 11178                             | 11766 | -    |
|        |                  | 5000               | D3           | 11273                             | 11867 | -    |

**Notes:**

- 6) The COB is tested in pulsed operating condition at rated test current (10 ms pulse width) and rated temperature (T<sub>J</sub> = T<sub>C</sub> = 85 °C).
- 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 | A | H | D | N | G  | 2  | 5  | Y  | Z  | W  | 3  | D  | 3  |

| Digit | PKG Information            | Code   | Specification  |
|-------|----------------------------|--|--|
| 1 2 3 | Samsung Package High Power | <b>SPH</b>   |  |
| 4 5   | Color                      | <b>WH</b>  | White  |
| 6     | Product Version            | <b>A</b>   |  |
| 7 8   | Form Factor                | <b>HD</b>  | COB  |
| 9     | Lens Type                  | <b>N</b>   | No lens  |
| 10    | Wattage or Model           | <b>A</b><br><b>B</b><br><b>C</b><br><b>D</b><br><b>E</b><br><b>F</b><br><b>G</b><br><b>H</b><br><b>K</b><br><b>L</b><br><b>M</b> | LC003D<br>LC006D<br>LC009D<br>LC013D<br>LC016D<br>LC019D<br>LC026D<br>LC033D<br>LC040D<br>LC060D<br>LC080D |
| 11    | Internal Code              | <b>2</b>   |  |
| 12    | CRI & Sorting Temperature  | <b>3</b><br><b>5</b><br><b>7</b>   | Min. 70 (85°C)<br>Min. 80 (85°C)<br>Min. 90 (85°C)   |
| 13 14 | Forward Voltage (V)        | <b>YZ</b><br><b>1Z</b>   | 31.0~37.0<br>46.8~55.2 (60W)<br>46.8~52.5 (80W)  |
| 15    | CCT (K)                    | <b>W</b><br><b>V</b><br><b>U</b><br><b>T</b><br><b>R</b><br><b>Q</b><br><b>P</b>   | 2700K<br>3000K<br>3500K<br>4000K<br>5000K<br>5700K<br>6500K  |
| 16    | MacAdam Step               | <b>1</b><br><b>2</b><br><b>3</b>   | MacAdam 1-step<br>MacAdam 2-step<br>MacAdam 3-step   |
| 17 18 | Luminous Flux (Lm)         | <b>D3</b>  | COB D-series Gen.3 level   |

## a) Binning Structure

※ LC<sub>o3</sub>D(I<sub>F</sub> = 90 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code      | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |       |
|------------------------------|-------------------|-------------------|------------------------|---------------|--------------|-------------------------------------|-------|
| 80                           | 2700              | SPHWAHDNA25YZW1D3 | YZ                     | W1            | D3           | 451 ~                               |       |
|                              |                   | SPHWAHDNA25YZW2D3 |                        | W2            |              |                                     |       |
|                              | 3000              | SPHWAHDNA25YZV1D3 | YZ                     | V1            | D3           | 474 ~                               |       |
|                              |                   | SPHWAHDNA25YZV2D3 |                        | V2            |              |                                     |       |
|                              | 3500              | SPHWAHDNA25YZU1D3 | YZ                     | U1            | D3           | 488 ~                               |       |
|                              |                   | SPHWAHDNA25YZU2D3 |                        | U2            |              |                                     |       |
|                              | 4000              | SPHWAHDNA25YZT1D3 | YZ                     | T1            | D3           | 498 ~                               |       |
|                              |                   | SPHWAHDNA25YZT2D3 |                        | T2            |              |                                     |       |
|                              | 5000              | SPHWAHDNA25YZR2D3 | YZ                     | R2            | D3           | 502 ~                               |       |
|                              |                   | SPHWAHDNA25YZR3D3 |                        | R3            |              |                                     |       |
|                              | 5700              | SPHWAHDNA25YZQ2D3 | YZ                     | Q2            | D3           | 502 ~                               |       |
|                              |                   | SPHWAHDNA25YZQ3D3 |                        | Q3            |              |                                     |       |
|                              | 6500              | SPHWAHDNA25YZP2D3 | YZ                     | P2            | D3           | 498 ~                               |       |
|                              |                   | SPHWAHDNA25YZP3D3 |                        | P3            |              |                                     |       |
|                              | 90                | 2700              | SPHWAHDNA27YZW1D3      | YZ            | W1           | D3                                  | 386 ~ |
|                              |                   |                   | SPHWAHDNA27YZW2D3      |               | W2           |                                     |       |
| 3000                         |                   | SPHWAHDNA27YZV1D3 | YZ                     | V1            | D3           | 406 ~                               |       |
|                              |                   | SPHWAHDNA27YZV2D3 |                        | V2            |              |                                     |       |
| 3500                         |                   | SPHWAHDNA27YZU1D3 | YZ                     | U1            | D3           | 419 ~                               |       |
|                              |                   | SPHWAHDNA27YZU2D3 |                        | U2            |              |                                     |       |
| 4000                         |                   | SPHWAHDNA27YZT1D3 | YZ                     | T1            | D3           | 427 ~                               |       |
|                              |                   | SPHWAHDNA27YZT2D3 |                        | T2            |              |                                     |       |
| 5000                         |                   | SPHWAHDNA27YZR2D3 | YZ                     | R2            | D3           | 431 ~                               |       |
|                              |                   | SPHWAHDNA27YZR3D3 |                        | R3            |              |                                     |       |

※ LCoo6D(I<sub>F</sub> = 180 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code      | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |       |
|------------------------------|-------------------|-------------------|------------------------|---------------|--------------|-------------------------------------|-------|
| 80                           | 2700              | SPHWAHDNB25YZW1D3 | YZ                     | W1            | D3           | 898 ~                               |       |
|                              |                   | SPHWAHDNB25YZW2D3 |                        | W2            |              |                                     |       |
|                              | 3000              | SPHWAHDNB25YZV1D3 | YZ                     | V1            | D3           | 944 ~                               |       |
|                              |                   | SPHWAHDNB25YZV2D3 |                        | V2            |              |                                     |       |
|                              | 3500              | SPHWAHDNB25YZU1D3 | YZ                     | U1            | D3           | 972 ~                               |       |
|                              |                   | SPHWAHDNB25YZU2D3 |                        | U2            |              |                                     |       |
|                              | 4000              | SPHWAHDNB25YZT1D3 | YZ                     | T1            | D3           | 991 ~                               |       |
|                              |                   | SPHWAHDNB25YZT2D3 |                        | T2            |              |                                     |       |
|                              | 5000              | SPHWAHDNB25YZR2D3 | YZ                     | R2            | D3           | 1000 ~                              |       |
|                              |                   | SPHWAHDNB25YZR3D3 |                        | R3            |              |                                     |       |
|                              | 5700              | SPHWAHDNB25YZQ2D3 | YZ                     | Q2            | D3           | 1000 ~                              |       |
|                              |                   | SPHWAHDNB25YZQ3D3 |                        | Q3            |              |                                     |       |
|                              | 6500              | SPHWAHDNB25YZP2D3 | YZ                     | P2            | D3           | 991 ~                               |       |
|                              |                   | SPHWAHDNB25YZP3D3 |                        | P3            |              |                                     |       |
|                              | 90                | 2700              | SPHWAHDNB27YZW1D3      | YZ            | W1           | D3                                  | 769 ~ |
|                              |                   |                   | SPHWAHDNB27YZW2D3      |               | W2           |                                     |       |
| 3000                         |                   | SPHWAHDNB27YZV1D3 | YZ                     | V1            | D3           | 809 ~                               |       |
|                              |                   | SPHWAHDNB27YZV2D3 |                        | V2            |              |                                     |       |
| 3500                         |                   | SPHWAHDNB27YZU1D3 | YZ                     | U1            | D3           | 833 ~                               |       |
|                              |                   | SPHWAHDNB27YZU2D3 |                        | U2            |              |                                     |       |
| 4000                         |                   | SPHWAHDNB27YZT1D3 | YZ                     | T1            | D3           | 850 ~                               |       |
|                              |                   | SPHWAHDNB27YZT2D3 |                        | T2            |              |                                     |       |
| 5000                         |                   | SPHWAHDNB27YZR2D3 | YZ                     | R2            | D3           | 857 ~                               |       |
|                              |                   | SPHWAHDNB27YZR3D3 |                        | R3            |              |                                     |       |

※ LCoogD(I<sub>F</sub> = 270 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWWAHDNC23YZV2D3 | YZ                     | V2            | D3           | 1515 ~                              |        |
|                              |                   | SPHWWAHDNC23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWWAHDNC23YZT2D3 | YZ                     | T2            | D3           | 1543 ~                              |        |
|                              |                   | SPHWWAHDNC23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWWAHDNC23YZR2D3 | YZ                     | R2            | D3           | 1571 ~                              |        |
|                              |                   | SPHWWAHDNC23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWWAHDNC25YZW1D3 | YZ                     | W1            | D3           | 1334 ~                              |        |
|                              |                   | SPHWWAHDNC25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWWAHDNC25YZV1D3 | YZ                     | V1            | D3           | 1402 ~                              |        |
|                              |                   | SPHWWAHDNC25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWWAHDNC25YZU1D3 | YZ                     | U1            | D3           | 1443 ~                              |        |
|                              |                   | SPHWWAHDNC25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWWAHDNC25YZT1D3 | YZ                     | T1            | D3           | 1472 ~                              |        |
|                              |                   | SPHWWAHDNC25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWWAHDNC25YZR2D3 | YZ                     | R2            | D3           | 1485 ~                              |        |
|                              |                   | SPHWWAHDNC25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWWAHDNC25YZQ2D3 | YZ                     | Q2            | D3           | 1485 ~                              |        |
|                              |                   | SPHWWAHDNC25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWWAHDNC25YZP2D3 | YZ                     | P2            | D3           | 1472 ~                              |        |
|                              |                   | SPHWWAHDNC25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700               | SPHWWAHDNC27YZW1D3     | YZ            | W1           | D3                                  | 1142 ~ |
|                              |                   |                    | SPHWWAHDNC27YZW2D3     |               | W2           |                                     |        |
|                              |                   | 3000               | SPHWWAHDNC27YZV1D3     | YZ            | V1           | D3                                  | 1201 ~ |
|                              |                   |                    | SPHWWAHDNC27YZV2D3     |               | V2           |                                     |        |

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|  |      |                   |    |    |    |        |
|--|------|-------------------|----|----|----|--------|
|  |      | SPHWAHDNC27YZU1D3 |    | U1 |    |        |
|  | 3500 | SPHWAHDNC27YZU2D3 | YZ | U2 | D3 | 1237 ~ |
|  |      |                   |    |    |    |        |
|  |      | SPHWAHDNC27YZT1D3 |    | T1 |    |        |
|  | 4000 | SPHWAHDNC27YZT2D3 | YZ | T2 | D3 | 1263 ~ |
|  |      |                   |    |    |    |        |
|  |      | SPHWAHDNC27YZR2D3 |    | R2 |    |        |
|  | 5000 | SPHWAHDNC27YZR3D3 | YZ | R3 | D3 | 1273 ~ |

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90

※ LCo13D(I<sub>F</sub> = 360 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWWAHDND23YZV2D3 | YZ                     | V2            | D3           | 1989 ~                              |        |
|                              |                   | SPHWWAHDND23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWWAHDND23YZT2D3 | YZ                     | T2            | D3           | 2026 ~                              |        |
|                              |                   | SPHWWAHDND23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWWAHDND23YZR2D3 | YZ                     | R2            | D3           | 2063 ~                              |        |
|                              |                   | SPHWWAHDND23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWWAHDND25YZW1D3 | YZ                     | W1            | D3           | 1753 ~                              |        |
|                              |                   | SPHWWAHDND25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWWAHDND25YZV1D3 | YZ                     | V1            | D3           | 1842 ~                              |        |
|                              |                   | SPHWWAHDND25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWWAHDND25YZU1D3 | YZ                     | U1            | D3           | 1896 ~                              |        |
|                              |                   | SPHWWAHDND25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWWAHDND25YZT1D3 | YZ                     | T1            | D3           | 1934 ~                              |        |
|                              |                   | SPHWWAHDND25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWWAHDND25YZR2D3 | YZ                     | R2            | D3           | 1950 ~                              |        |
|                              |                   | SPHWWAHDND25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWWAHDND25YZQ2D3 | YZ                     | Q2            | D3           | 1950 ~                              |        |
|                              |                   | SPHWWAHDND25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWWAHDND25YZP2D3 | YZ                     | P2            | D3           | 1934 ~                              |        |
|                              |                   | SPHWWAHDND25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700               | SPHWWAHDND27YZW1D3     | YZ            | W1           | D3                                  | 1500 ~ |
|                              |                   |                    | SPHWWAHDND27YZW2D3     |               | W2           |                                     |        |
|                              |                   | 3000               | SPHWWAHDND27YZV1D3     | YZ            | V1           | D3                                  | 1578 ~ |
|                              |                   |                    | SPHWWAHDND27YZV2D3     |               | V2           |                                     |        |

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|    |      |                    |    |    |    |        |
|----|------|--------------------|----|----|----|--------|
|    |      | SPHWHAMDND27YZU1D3 |    | U1 |    |        |
|    | 3500 | SPHWHAMDND27YZU2D3 | YZ | U2 | D3 | 1625 ~ |
|    |      |                    |    |    |    |        |
|    |      | SPHWHAMDND27YZT1D3 |    | T1 |    |        |
|    | 4000 | SPHWHAMDND27YZT2D3 | YZ | T2 | D3 | 1658 ~ |
|    |      |                    |    |    |    |        |
|    |      | SPHWHAMDND27YZR2D3 |    | R2 |    |        |
| 90 | 5000 | SPHWHAMDND27YZR3D3 | YZ | R3 | D3 | 1672 ~ |
|    |      |                    |    |    |    |        |

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※ LCo16D(I<sub>F</sub> = 450 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWWAHDNE23YZV2D3 | YZ                     | V2            | D3           | 2562 ~                              |        |
|                              |                   | SPHWWAHDNE23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWWAHDNE23YZT2D3 | YZ                     | T2            | D3           | 2609 ~                              |        |
|                              |                   | SPHWWAHDNE23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWWAHDNE23YZR2D3 | YZ                     | R2            | D3           | 2657 ~                              |        |
|                              |                   | SPHWWAHDNE23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWWAHDNE25YZW1D3 | YZ                     | W1            | D3           | 2257 ~                              |        |
|                              |                   | SPHWWAHDNE25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWWAHDNE25YZV1D3 | YZ                     | V1            | D3           | 2372 ~                              |        |
|                              |                   | SPHWWAHDNE25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWWAHDNE25YZU1D3 | YZ                     | U1            | D3           | 2442 ~                              |        |
|                              |                   | SPHWWAHDNE25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWWAHDNE25YZT1D3 | YZ                     | T1            | D3           | 2490 ~                              |        |
|                              |                   | SPHWWAHDNE25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWWAHDNE25YZR2D3 | YZ                     | R2            | D3           | 2511 ~                              |        |
|                              |                   | SPHWWAHDNE25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWWAHDNE25YZQ2D3 | YZ                     | Q2            | D3           | 2511 ~                              |        |
|                              |                   | SPHWWAHDNE25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWWAHDNE25YZP2D3 | YZ                     | P2            | D3           | 2490 ~                              |        |
|                              |                   | SPHWWAHDNE25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700               | SPHWWAHDNE27YZW1D3     | YZ            | W1           | D3                                  | 1932 ~ |
|                              |                   |                    | SPHWWAHDNE27YZW2D3     |               | W2           |                                     |        |
|                              |                   | 3000               | SPHWWAHDNE27YZV1D3     | YZ            | V1           | D3                                  | 2032 ~ |
|                              |                   |                    | SPHWWAHDNE27YZV2D3     |               | V2           |                                     |        |

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|    |      |                   |    |       |    |        |
|----|------|-------------------|----|-------|----|--------|
|    |      | SPHWAHDNE27YZU1D3 |    | U1    |    |        |
|    | 3500 | -----             | YZ | ----- | D3 | 2093 ~ |
|    |      | SPHWAHDNE27YZU2D3 |    | U2    |    |        |
|    |      | -----             |    | ----- |    |        |
|    |      | SPHWAHDNE27YZT1D3 |    | T1    |    |        |
| 90 | 4000 | -----             | YZ | ----- | D3 | 2136 ~ |
|    |      | SPHWAHDNE27YZT2D3 |    | T2    |    |        |
|    |      | -----             |    | ----- |    |        |
|    |      | SPHWAHDNE27YZR2D3 |    | R2    |    |        |
|    | 5000 | -----             | YZ | ----- | D3 | 2154 ~ |
|    |      | SPHWAHDNE27YZR3D3 |    | R3    |    |        |

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※ LCo19D(I<sub>F</sub> = 540 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWWAHDNF23YZV2D3 | YZ                     | V2            | D3           | 3059 ~                              |        |
|                              |                   | SPHWWAHDNF23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWWAHDNF23YZT2D3 | YZ                     | T2            | D3           | 3116 ~                              |        |
|                              |                   | SPHWWAHDNF23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWWAHDNF23YZR2D3 | YZ                     | R2            | D3           | 3172 ~                              |        |
|                              |                   | SPHWWAHDNF23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWWAHDNF25YZW1D3 | YZ                     | W1            | D3           | 2695 ~                              |        |
|                              |                   | SPHWWAHDNF25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWWAHDNF25YZV1D3 | YZ                     | V1            | D3           | 2833 ~                              |        |
|                              |                   | SPHWWAHDNF25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWWAHDNF25YZU1D3 | YZ                     | U1            | D3           | 2916 ~                              |        |
|                              |                   | SPHWWAHDNF25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWWAHDNF25YZT1D3 | YZ                     | T1            | D3           | 2974 ~                              |        |
|                              |                   | SPHWWAHDNF25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWWAHDNF25YZR2D3 | YZ                     | R2            | D3           | 2999 ~                              |        |
|                              |                   | SPHWWAHDNF25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWWAHDNF25YZQ2D3 | YZ                     | Q2            | D3           | 2999 ~                              |        |
|                              |                   | SPHWWAHDNF25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWWAHDNF25YZP2D3 | YZ                     | P2            | D3           | 2974 ~                              |        |
|                              |                   | SPHWWAHDNF25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700               | SPHWWAHDNF27YZW1D3     | YZ            | W1           | D3                                  | 2307 ~ |
|                              |                   |                    | SPHWWAHDNF27YZW2D3     |               | W2           |                                     |        |
|                              |                   | 3000               | SPHWWAHDNF27YZV1D3     | YZ            | V1           | D3                                  | 2426 ~ |
|                              |                   |                    | SPHWWAHDNF27YZV2D3     |               | V2           |                                     |        |

|    |      |                    |    |    |    |        |
|----|------|--------------------|----|----|----|--------|
|    |      | SPHWHAHDNF27YZU1D3 |    | U1 |    |        |
|    | 3500 | SPHWHAHDNF27YZU2D3 | YZ | U2 | D3 | 2499 ~ |
|    |      | SPHWHAHDNF27YZT1D3 |    | T1 |    |        |
| 90 | 4000 | SPHWHAHDNF27YZT2D3 | YZ | T2 | D3 | 2550 ~ |
|    |      | SPHWHAHDNF27YZR2D3 |    | R2 |    |        |
|    | 5000 | SPHWHAHDNF27YZR3D3 | YZ | R3 | D3 | 2572 ~ |

※ LCo26D(I<sub>F</sub> = 720 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWWAHDNG23YZV2D3 | YZ                     | V2            | D3           | 4019 ~                              |        |
|                              |                   | SPHWWAHDNG23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWWAHDNG23YZT2D3 | YZ                     | T2            | D3           |                                     |        |
|                              |                   | SPHWWAHDNG23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWWAHDNG23YZR2D3 | YZ                     | R2            | D3           |                                     |        |
|                              |                   | SPHWWAHDNG23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWWAHDNG25YZW1D3 | YZ                     | W1            | D3           | 3541 ~                              |        |
|                              |                   | SPHWWAHDNG25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWWAHDNG25YZV1D3 | YZ                     | V1            | D3           | 3721 ~                              |        |
|                              |                   | SPHWWAHDNG25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWWAHDNG25YZU1D3 | YZ                     | U1            | D3           | 3830 ~                              |        |
|                              |                   | SPHWWAHDNG25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWWAHDNG25YZT1D3 | YZ                     | T1            | D3           | 3907 ~                              |        |
|                              |                   | SPHWWAHDNG25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWWAHDNG25YZR2D3 | YZ                     | R2            | D3           | 3939 ~                              |        |
|                              |                   | SPHWWAHDNG25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWWAHDNG25YZQ2D3 | YZ                     | Q2            | D3           | 3939 ~                              |        |
|                              |                   | SPHWWAHDNG25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWWAHDNG25YZP2D3 | YZ                     | P2            | D3           | 3907 ~                              |        |
|                              |                   | SPHWWAHDNG25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700               | SPHWWAHDNG27YZW1D3     | YZ            | W1           | D3                                  | 3030 ~ |
|                              |                   |                    | SPHWWAHDNG27YZW2D3     |               | W2           |                                     |        |
|                              |                   | 3000               | SPHWWAHDNG27YZV1D3     | YZ            | V1           | D3                                  | 3187 ~ |
|                              |                   |                    | SPHWWAHDNG27YZV2D3     |               | V2           |                                     |        |

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|    |      |                   |    |       |    |        |
|----|------|-------------------|----|-------|----|--------|
|    |      | SPHWAHDNG27YZU1D3 |    | U1    |    |        |
|    | 3500 | .....             | YZ | ..... | D3 | 3282 ~ |
|    |      | SPHWAHDNG27YZU2D3 |    | U2    |    |        |
|    |      | <hr/>             |    |       |    |        |
|    |      | SPHWAHDNG27YZT1D3 |    | T1    |    |        |
| 90 | 4000 | .....             | YZ | ..... | D3 | 3350 ~ |
|    |      | SPHWAHDNG27YZT2D3 |    | T2    |    |        |
|    |      | <hr/>             |    |       |    |        |
|    |      | SPHWAHDNG27YZR2D3 |    | R2    |    |        |
|    | 5000 | .....             | YZ | ..... | D3 | 3379 ~ |
|    |      | SPHWAHDNG27YZR3D3 |    | R3    |    |        |

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※ LCo33D(I<sub>F</sub> = 900 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code      | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|-------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWAHDNH23YZV2D3 | YZ                     | V2            | D3           | 4973 ~                              |        |
|                              |                   | SPHWAHDNH23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWAHDNH23YZT2D3 | YZ                     | T2            | D3           | 5065 ~                              |        |
|                              |                   | SPHWAHDNH23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWAHDNH23YZR2D3 | YZ                     | R2            | D3           | 5157 ~                              |        |
|                              |                   | SPHWAHDNH23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWAHDNH25YZW1D3 | YZ                     | W1            | D3           | 4382 ~                              |        |
|                              |                   | SPHWAHDNH25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWAHDNH25YZV1D3 | YZ                     | V1            | D3           | 4605 ~                              |        |
|                              |                   | SPHWAHDNH25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWAHDNH25YZU1D3 | YZ                     | U1            | D3           | 4740 ~                              |        |
|                              |                   | SPHWAHDNH25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWAHDNH25YZT1D3 | YZ                     | T1            | D3           | 4834 ~                              |        |
|                              |                   | SPHWAHDNH25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWAHDNH25YZR2D3 | YZ                     | R2            | D3           | 4875 ~                              |        |
|                              |                   | SPHWAHDNH25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWAHDNH25YZQ2D3 | YZ                     | Q2            | D3           | 4875 ~                              |        |
|                              |                   | SPHWAHDNH25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWAHDNH25YZP2D3 | YZ                     | P2            | D3           | 4834 ~                              |        |
|                              |                   | SPHWAHDNH25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700              | SPHWAHDNH27YZW1D3      | YZ            | W1           | D3                                  | 3750 ~ |
|                              |                   |                   | SPHWAHDNH27YZW2D3      |               | W2           |                                     |        |
|                              |                   | 3000              | SPHWAHDNH27YZV1D3      | YZ            | V1           | D3                                  | 3944 ~ |
|                              |                   |                   | SPHWAHDNH27YZV2D3      |               | V2           |                                     |        |

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|    |      |                   |    |       |    |        |
|----|------|-------------------|----|-------|----|--------|
|    |      | SPHWAHDNH27YZU1D3 |    | U1    |    |        |
|    | 3500 | -----             | YZ | ----- | D3 | 4062 ~ |
|    |      | SPHWAHDNH27YZU2D3 |    | U2    |    |        |
|    |      | -----             |    | ----- |    |        |
|    |      | SPHWAHDNH27YZT1D3 |    | T1    |    |        |
| 90 | 4000 | -----             | YZ | ----- | D3 | 4146 ~ |
|    |      | SPHWAHDNH27YZT2D3 |    | T2    |    |        |
|    |      | -----             |    | ----- |    |        |
|    |      | SPHWAHDNH27YZR2D3 |    | R2    |    |        |
|    | 5000 | -----             | YZ | ----- | D3 | 4181 ~ |
|    |      | SPHWAHDNH27YZR3D3 |    | R3    |    |        |

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※ LCo<sub>4</sub>oD(I<sub>F</sub> = 1080 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Color<br>Rank | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWWAHDNK23YZV2D3 | YZ                     | V2            | D3           | 6118 ~                              |        |
|                              |                   | SPHWWAHDNK23YZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWWAHDNK23YZT2D3 | YZ                     | T2            | D3           | 6232 ~                              |        |
|                              |                   | SPHWWAHDNK23YZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWWAHDNK23YZR2D3 | YZ                     | R2            | D3           | 6345 ~                              |        |
|                              |                   | SPHWWAHDNK23YZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWWAHDNK25YZW1D3 | YZ                     | W1            | D3           | 5391 ~                              |        |
|                              |                   | SPHWWAHDNK25YZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWWAHDNK25YZV1D3 | YZ                     | V1            | D3           | 5665 ~                              |        |
|                              |                   | SPHWWAHDNK25YZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWWAHDNK25YZU1D3 | YZ                     | U1            | D3           | 5831 ~                              |        |
|                              |                   | SPHWWAHDNK25YZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWWAHDNK25YZT1D3 | YZ                     | T1            | D3           | 5948 ~                              |        |
|                              |                   | SPHWWAHDNK25YZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWWAHDNK25YZR2D3 | YZ                     | R2            | D3           | 5998 ~                              |        |
|                              |                   | SPHWWAHDNK25YZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWWAHDNK25YZQ2D3 | YZ                     | Q2            | D3           | 5998 ~                              |        |
|                              |                   | SPHWWAHDNK25YZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWWAHDNK25YZP2D3 | YZ                     | P2            | D3           | 5948 ~                              |        |
|                              |                   | SPHWWAHDNK25YZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700               | SPHWWAHDNK27YZW1D3     | YZ            | W1           | D3                                  | 4614 ~ |
|                              |                   |                    | SPHWWAHDNK27YZW2D3     |               | W2           |                                     |        |
|                              |                   | 3000               | SPHWWAHDNK27YZV1D3     | YZ            | V1           | D3                                  | 4853 ~ |
|                              |                   |                    | SPHWWAHDNK27YZV2D3     |               | V2           |                                     |        |

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|    |      |                   |    |       |    |        |
|----|------|-------------------|----|-------|----|--------|
|    |      | SPHWAHDNK27YZU1D3 |    | U1    |    |        |
|    | 3500 | .....             | YZ | ..... | D3 | 4997 ~ |
|    |      | SPHWAHDNK27YZU2D3 |    | U2    |    |        |
|    |      | <hr/>             |    |       |    |        |
|    |      | SPHWAHDNK27YZT1D3 |    | T1    |    |        |
| 90 | 4000 | .....             | YZ | ..... | D3 | 5100 ~ |
|    |      | SPHWAHDNK27YZT2D3 |    | T2    |    |        |
|    |      | <hr/>             |    |       |    |        |
|    |      | SPHWAHDNK27YZR2D3 |    | R2    |    |        |
|    | 5000 | .....             | YZ | ..... | D3 | 5144 ~ |
|    |      | SPHWAHDNK27YZR3D3 |    | R3    |    |        |

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※ LCo6oD(I<sub>F</sub> = 1080 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code      | V <sub>F</sub><br>Rank | Chrom.<br>Bin | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |        |
|------------------------------|-------------------|-------------------|------------------------|---------------|--------------|-------------------------------------|--------|
| 70                           | 3000              | SPHWAHDNL231ZV2D3 | 1Z                     | V2            | D3           | 9042 ~                              |        |
|                              |                   | SPHWAHDNL231ZV3D3 |                        | V3            |              |                                     |        |
|                              | 4000              | SPHWAHDNL231ZT2D3 | 1Z                     | T2            | D3           | 9209 ~                              |        |
|                              |                   | SPHWAHDNL231ZT3D3 |                        | T3            |              |                                     |        |
|                              | 5000              | SPHWAHDNL231ZR2D3 | 1Z                     | R2            | D3           | 9377 ~                              |        |
|                              |                   | SPHWAHDNL231ZR3D3 |                        | R3            |              |                                     |        |
| 80                           | 2700              | SPHWAHDNL251ZW1D3 | 1Z                     | W1            | D3           | 7967 ~                              |        |
|                              |                   | SPHWAHDNL251ZW2D3 |                        | W2            |              |                                     |        |
|                              | 3000              | SPHWAHDNL251ZV1D3 | 1Z                     | V1            | D3           | 8372 ~                              |        |
|                              |                   | SPHWAHDNL251ZV2D3 |                        | V2            |              |                                     |        |
|                              | 3500              | SPHWAHDNL251ZU1D3 | 1Z                     | U1            | D3           | 8617 ~                              |        |
|                              |                   | SPHWAHDNL251ZU2D3 |                        | U2            |              |                                     |        |
|                              | 4000              | SPHWAHDNL251ZT1D3 | 1Z                     | T1            | D3           | 8790 ~                              |        |
|                              |                   | SPHWAHDNL251ZT2D3 |                        | T2            |              |                                     |        |
|                              | 5000              | SPHWAHDNL251ZR2D3 | 1Z                     | R2            | D3           | 8864 ~                              |        |
|                              |                   | SPHWAHDNL251ZR3D3 |                        | R3            |              |                                     |        |
|                              | 5700              | SPHWAHDNL251ZQ2D3 | 1Z                     | Q2            | D3           | 8864 ~                              |        |
|                              |                   | SPHWAHDNL251ZQ3D3 |                        | Q3            |              |                                     |        |
|                              | 6500              | SPHWAHDNL251ZP2D3 | 1Z                     | P2            | D3           | 8790 ~                              |        |
|                              |                   | SPHWAHDNL251ZP3D3 |                        | P3            |              |                                     |        |
|                              | 90                | 2700              | SPHWAHDNL271ZW1D3      | 1Z            | W1           | D3                                  | 6818 ~ |
|                              |                   |                   | SPHWAHDNL271ZW2D3      |               | W2           |                                     |        |
|                              |                   | 3000              | SPHWAHDNL271ZV1D3      | 1Z            | V1           | D3                                  | 7172 ~ |
|                              |                   |                   | SPHWAHDNL271ZV2D3      |               | V2           |                                     |        |

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|    |      |                   |    |       |    |        |
|----|------|-------------------|----|-------|----|--------|
|    |      | SPHWAHDNL271ZU1D3 |    | U1    |    |        |
|    | 3500 | .....             | 1Z | ..... | D3 | 7385 ~ |
|    |      | SPHWAHDNL271ZU2D3 |    | U2    |    |        |
|    |      | <hr/>             |    |       |    |        |
|    |      | SPHWAHDNL271ZT1D3 |    | T1    |    |        |
| 90 | 4000 | .....             | 1Z | ..... | D3 | 7537 ~ |
|    |      | SPHWAHDNL271ZT2D3 |    | U2    |    |        |
|    |      | <hr/>             |    |       |    |        |
|    |      | SPHWAHDNL271ZR2D3 |    | R2    |    |        |
|    | 5000 | .....             | 1Z | ..... | D3 | 7602 ~ |
|    |      | SPHWAHDNL271ZR3D3 |    | R3    |    |        |

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※ LCo8oD(I<sub>F</sub> = 1620 mA, T<sub>J</sub> = 85 °C)

| CRI(R <sub>a</sub> )<br>Min. | Nominal<br>CCT(K) | Product Code       | V <sub>F</sub><br>Rank | Chrom.<br>Bin | Flux<br>Rank | Flux Range<br>(Φ <sub>v</sub> , lm) |         |
|------------------------------|-------------------|--------------------|------------------------|---------------|--------------|-------------------------------------|---------|
| 70                           | 3000              | SPHWWAHDNM231ZV2D3 | 1Z                     | V2            | D3           | 13409 ~                             |         |
|                              |                   | SPHWWAHDNM231ZV3D3 |                        | V3            |              |                                     |         |
|                              | 4000              | SPHWWAHDNM231ZT2D3 | 1Z                     | T2            | D3           | 13657 ~                             |         |
|                              |                   | SPHWWAHDNM231ZT3D3 |                        | T3            |              |                                     |         |
|                              | 5000              | SPHWWAHDNM231ZR2D3 | 1Z                     | R2            | D3           | 13906 ~                             |         |
|                              |                   | SPHWWAHDNM231ZR3D3 |                        | R3            |              |                                     |         |
| 80                           | 2700              | SPHWWAHDNM251ZW1D3 | 1Z                     | W1            | D3           | 11815 ~                             |         |
|                              |                   | SPHWWAHDNM251ZW2D3 |                        | W2            |              |                                     |         |
|                              | 3000              | SPHWWAHDNM251ZV1D3 | 1Z                     | V1            | D3           | 12416 ~                             |         |
|                              |                   | SPHWWAHDNM251ZV2D3 |                        | V2            |              |                                     |         |
|                              | 3500              | SPHWWAHDNM251ZU1D3 | 1Z                     | U1            | D3           | 12779 ~                             |         |
|                              |                   | SPHWWAHDNM251ZU2D3 |                        | U2            |              |                                     |         |
|                              | 4000              | SPHWWAHDNM251ZT1D3 | 1Z                     | T1            | D3           | 13035 ~                             |         |
|                              |                   | SPHWWAHDNM251ZT2D3 |                        | T2            |              |                                     |         |
|                              | 5000              | SPHWWAHDNM251ZR2D3 | 1Z                     | R2            | D3           | 13144 ~                             |         |
|                              |                   | SPHWWAHDNM251ZR3D3 |                        | R3            |              |                                     |         |
|                              | 5700              | SPHWWAHDNM251ZQ2D3 | 1Z                     | Q2            | D3           | 13144 ~                             |         |
|                              |                   | SPHWWAHDNM251ZQ3D3 |                        | Q3            |              |                                     |         |
|                              | 6500              | SPHWWAHDNM251ZP2D3 | 1Z                     | P2            | D3           | 13035 ~                             |         |
|                              |                   | SPHWWAHDNM251ZP3D3 |                        | P3            |              |                                     |         |
|                              | 90                | 2700               | SPHWWAHDNM271ZW1D3     | 1Z            | W1           | D3                                  | 10111 ~ |
|                              |                   |                    | SPHWWAHDNM271ZW2D3     |               | W2           |                                     |         |
|                              |                   | 3000               | SPHWWAHDNM271ZV1D3     | 1Z            | V1           | D3                                  | 10635 ~ |
|                              |                   |                    | SPHWWAHDNM271ZV2D3     |               | V2           |                                     |         |

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|    |      |                    |    |    |    |         |
|----|------|--------------------|----|----|----|---------|
|    | 3500 | SPHWWAHDNM271ZU1D3 | 1Z | U1 | D3 | 10952 ~ |
|    |      | SPHWWAHDNM271ZU2D3 |    | U2 |    |         |
| 90 | 4000 | SPHWWAHDNM271ZT1D3 | 1Z | T1 | D3 | 11178 ~ |
|    |      | SPHWWAHDNM271ZT2D3 |    | T2 |    |         |
|    | 5000 | SPHWWAHDNM271ZR2D3 | 1Z | R2 | D3 | 11273 ~ |
|    |      | SPHWWAHDNM271ZR3D3 |    | R3 |    |         |

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b) Chromaticity Region & Coordinates ( $I_f$  = Sorting Current,  $T_j$  = 85 °C)



| MacAdam Ellipse (W1, W2) |        |        |          |        |        |
|--------------------------|--------|--------|----------|--------|--------|
| Step                     | CIE x  | CIE y  | $\theta$ | a      | b      |
| 1-step                   | 0.4578 | 0.4101 | 53.70    | 0.0027 | 0.0014 |
| 2-step                   | 0.4578 | 0.4101 | 53.7     | 0.0054 | 0.0028 |

| MacAdam Ellipse (V1, V2, V3) |        |        |          |        |        |
|------------------------------|--------|--------|----------|--------|--------|
| Step                         | CIE x  | CIE y  | $\theta$ | a      | b      |
| 1-step                       | 0.4338 | 0.4030 | 53.22    | 0.0028 | 0.0014 |
| 2-step                       | 0.4338 | 0.4030 | 53.22    | 0.0056 | 0.0027 |
| 3-step                       | 0.4338 | 0.4030 | 53.22    | 0.0083 | 0.0041 |

| MacAdam Ellipse (U1, U2, U3) |        |        |          |        |        |
|------------------------------|--------|--------|----------|--------|--------|
| Step                         | CIE x  | CIE y  | $\theta$ | a      | b      |
| 1-step                       | 0.4073 | 0.3917 | 54.00    | 0.0031 | 0.0014 |
| 2-step                       | 0.4073 | 0.3917 | 54.00    | 0.0062 | 0.0028 |
| 3-step                       | 0.4073 | 0.3917 | 54.00    | 0.0093 | 0.0041 |

| MacAdam Ellipse (T1, T2, T3) |        |        |          |        |        |
|------------------------------|--------|--------|----------|--------|--------|
| Step                         | CIE x  | CIE y  | $\theta$ | a      | b      |
| 1-step                       | 0.3818 | 0.3797 | 53.72    | 0.0031 | 0.0013 |
| 2-step                       | 0.3818 | 0.3797 | 53.72    | 0.0063 | 0.0027 |
| 3-step                       | 0.3818 | 0.3797 | 53.72    | 0.0094 | 0.0040 |

| MacAdam Ellipse (R2, R3) |        |        |          |        |        |
|--------------------------|--------|--------|----------|--------|--------|
| Step                     | CIE x  | CIE y  | $\theta$ | a      | b      |
| 2-step                   | 0.3447 | 0.3553 | 59.62    | 0.0055 | 0.0024 |
| 3-step                   | 0.3447 | 0.3553 | 59.62    | 0.0082 | 0.0035 |

| MacAdam Ellipse (Q2, Q3) |        |        |          |        |        |
|--------------------------|--------|--------|----------|--------|--------|
| Step                     | CIE x  | CIE y  | $\theta$ | a      | b      |
| 2-step                   | 0.3287 | 0.3417 | 59.10    | 0.0050 | 0.0021 |
| 3-step                   | 0.3287 | 0.3417 | 59.10    | 0.0075 | 0.0032 |

| MacAdam Ellipse (P2, P3) |        |        |          |        |        |
|--------------------------|--------|--------|----------|--------|--------|
| Step                     | CIE x  | CIE y  | $\theta$ | a      | b      |
| 2-step                   | 0.3123 | 0.3282 | 58.57    | 0.0045 | 0.0019 |
| 3-step                   | 0.3123 | 0.3282 | 58.57    | 0.0067 | 0.0029 |

**Note:**

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

### 3. Typical Characteristics Graphs

#### a) Spectrum Distribution ( $I_f$ = Sorting Current, $T_j$ = 85 °C)

CRI Ra 80+



CRI Ra 90+



CRI Ra 70+



b) Forward Current Characteristics ( $T_J = 85\text{ }^\circ\text{C}$ )

## 1) LC003D



## 2) LC006D



## 3) LC009D



## 4) LC013D



## 5) LC016D



## 6) LC019D



## 7) LC026D



## 8) LC033D



## 9) LC040D



## 10) LC060D



## 11) LC080D



c) Temperature Characteristics ( $I_F$  = Sorting Current)



d) Color Shift Characteristics ( $T_J = 85$  °C,  $I_F$  = Sorting Current, CRI = 80+)



e) Beam Angle Characteristics ( $I_F$  = Sorting Current,  $T_J = 85$  °C)



## f) Derating Characteristics

1) LC003D



2) LC006D



3) LC009D4) LC0013D



5) LC016D



6) LC0019D



7) LC026D



8) LC0033D



9) LC040D



10) LC060D



11) LC080D



4. Outline Drawing & Dimension

※ Model : LC003D, LC006D, LC009D, LC013D



- 1. Unit: mm
- 2. Tolerance: ± 0.3 mm

| Item         | Dimension              | Tolerance | Unit |
|--------------|------------------------|-----------|------|
| Length       | 13.5                   | ±0.15     | mm   |
| Width        | 13.5                   | ±0.15     | mm   |
| Height       | Dam                    | ±0.20     | mm   |
|              | Substrate              | ±0.10     | mm   |
| LES Diameter | Light Emitting Surface | ±0.30     | mm   |

Note: Denoted product information above is only an example  
(LC013D38030 :LC013D, Gen3, Ra80, 3000K)

※ Model : LC016D, LC019D, LC026D, LC033D



- 1. Unit: mm
- 2. Tolerance: ± 0.3 mm

| Item         | Dimension              | Tolerance | Unit  |
|--------------|------------------------|-----------|-------|
| Length       | 19.0                   | ±0.15     | mm    |
| Width        | 19.0                   | ±0.15     | mm    |
| Height       | Dam                    | 0.5       | ±0.20 |
|              | Substrate              | 1.0       | ±0.10 |
| LES Diameter | Light Emitting Surface | 14.5      | ±0.30 |

Note: Denoted product information above is only an example  
 ( LC026D38030 : LC026D, Gen3, CRI80+, 3000K )

※ Model : LC040D, LC060D, LC080D



- 1. Unit: mm
- 2. Tolerance: ± 0.3 mm

| Item         | Dimension              | Tolerance | Unit |
|--------------|------------------------|-----------|------|
| Length       | 28.0                   | ±0.15     | mm   |
| Width        | 28.0                   | ±0.15     | mm   |
| Height       | Dam                    | ±0.20     | mm   |
|              | Substrate              | ±0.10     | mm   |
| LES Diameter | Light Emitting Surface | ±0.30     | mm   |

Note: Denoted product information above is only an example  
 ( LC040D38030 : LC040D, Gen3, CRI80+, 3000K )

## 5. Reliability Test Items & Conditions

### a) Test Items

| Test Item  | Test Condition  | Test Hour / Cycle |
|--|---|-------------------|
| Wet High Temperature Operating Life Test (WHTOL) | 60 °C, 90 % RH,, DC Derating, I <sub>F</sub>  | 1000 h            |
| High Temperature Operating Life Test (HTOL)      | 85 °C, DC Derating, I <sub>F</sub>  | 1000 h            |
| Low Temperature Operating Life Test (LTOL)       | -40 °C, DC,DeratingI <sub>F</sub>   | 1000 h            |
| High Temperature Storage                         | 110 °C  | 1000 h            |
| Low Temperature Storage                          | -40 °C  | 1000 h            |
| Wet High Temperature Storage Test                | 85°C, 85% RH  | 1000h             |
| Temperature Cycling                              | -45 °C / 15min ~ 125 °C / 15min<br>Temperature change within 5min   | 500 cycle         |
| Powered Temperature Cycle (PTC)                  | -40 °C/ 85 °C each 10 min, 20 min transfer<br>power on/off each 5 min, DC Derating, I <sub>F</sub> = max                  | 100 cycles        |
| ESD (HBM)  | R <sub>1</sub> : 10 MΩ<br>R <sub>2</sub> : 1.5 kΩ<br>C: 100 pF<br>V: ±2 kV  | 5 times           |
| Vibrations Variable Frequency                    | 20~ 80 Hz (displacement: 0.06 inch, max. 20 g)<br>80 ~ 2 kHz (max. 20 g)<br>min. frequency ↔max. frequency 4 min transfer | 4 times           |
| Mechanical Shock Test                            | 1500g, 0.5 ms<br>each of the 6 surfaces (3 axis x 2 sides)  | 5 times           |
| Hydrogen Sulphide(H <sub>2</sub> S)              | 25 °C 75%R.H. H <sub>2</sub> S concentration 15ppm  | 504h              |

### b) Criteria for Judging the Damage

| Item            | Symbol         | Test Condition<br>(T <sub>c</sub> = 25 °C) | Limit        |              |
|-----------------|----------------|--|--------------|--------------|
|                 |                |  | Min.         | Max.         |
| Forward Voltage | V <sub>F</sub> | I <sub>F</sub> = <b>Sorting Current</b>    | L.S.L. * 0.9 | U.S.L. * 1.1 |
| Luminous Flux   | Φ <sub>v</sub> | I <sub>F</sub> = <b>Sorting Current</b>    | L.S.L * 0.7  | U.S.L * 1.3  |

## 6. Label Structure

### a) Label Structure



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

Bin Code:

ⒶⒷ: Forward Voltage bin (refer to page 9)

ⒸⒹ: Chromaticity bin (refer to page 21)

ⒺⒻ: Luminous Flux bin (refer to page 5-8)

### b) Lot Number

The lot number is composed of the following characters:



① ③④⑤⑥⑦⑧⑨ / 1ⒶⒷⒸ / xxxx pcs

① : Production site (S: Giheung, Korea, G: Tianjin, China)

② : 4(LED)

③ : Product state (A: Normal, B: Bulk, C: First Production, R: Reproduction, S: Sample)

④ : Year (Z: 2015, A: 2016, B: 2017...)

⑤ : Month (1~9, A, B, C)

⑥⑦⑧⑨ : Day (1~9, A, B~V)

ⒶⒷⒸ : Product serial number (001 ~ 999)

## 7. Packing Structure

※ Model : L003D, LC006D, LC009D, LC013D

| Packing material   | Max. quantity in pcs of COB | Dimension(mm) |       |        |           |
|--------------------|-----------------------------|---------------|-------|--------|-----------|
|                    |                             | Length        | Width | Height | Tolerance |
| Tray               | 50                          | 200           | 200   | 8      | 1         |
| Anti-Static Bag    | 250 (5 trays)               | 320           | 270   | -      | +/- 0.5   |
| Outer Box (Small)  | 500 (2 bags)                | 225           | 225   | 65     | 5         |
| Outer Box (Middle) | 1000 (4 bags)               | 225           | 225   | 130    | 5         |

### a) Packing Structure



### b) Tray



※ Model : LC016D, LC019D, LC026D, LC033D

| Packing material   | Max. quantity in pcs of COB | Dimension(mm) |       |        |           |
|--------------------|-----------------------------|---------------|-------|--------|-----------|
|                    |                             | Length        | Width | Height | Tolerance |
| Tray               | 25                          | 200           | 200   | 8      | 1         |
| Anti-Static Bag    | 125 (5 trays)               | 320           | 270   | -      | +/- 0.5   |
| Outer Box (Small)  | 250 (2 bags)                | 225           | 225   | 65     | 5         |
| Outer Box (Middle) | 500 (4 bags)                | 225           | 225   | 130    | 5         |

a) Packing Structure



※ Small Box

※ Middle Box

b) Tray



※ Small Box

※ Middle Box

※ Model : LC040D, LC060D, LC080D

| Packing material          | Max. quantity in pcs of COB | Dimension(mm) |       |        |           |
|---------------------------|-----------------------------|---------------|-------|--------|-----------|
|                           |                             | Length        | Width | Height | Tolerance |
| <b>Tray</b>               | 16                          | 200           | 200   | 8      | 1         |
| <b>Anti-Static Bag</b>    | 80 (5 trays)                | 320           | 270   | -      | +/- 0.5   |
| <b>Outer Box (Small)</b>  | 160 (2 bags)                | 225           | 225   | 65     | 5         |
| <b>Outer Box (Middle)</b> | 320 (4 bags)                | 225           | 225   | 130    | 5         |

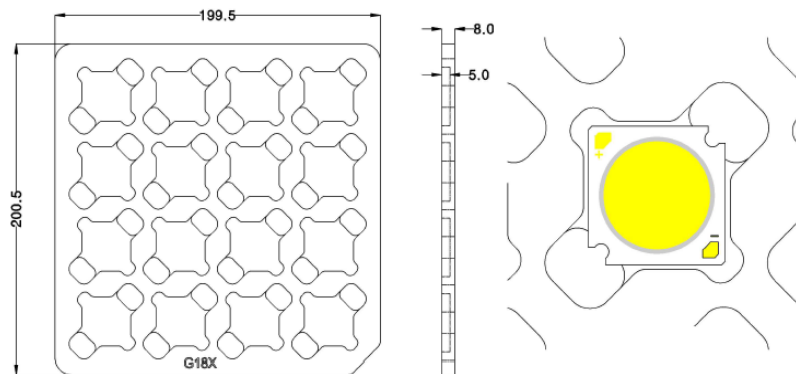
a) Packing Structure



※ Small Box

※ Middle Box

b) Tray



※ Small Box

※ Middle Box

## 8. Precautions in Handling & Use

- 1) This device should not be used in any type of fluid such as water, oil, organic solvent, etc. Some solvent-based cleaning agent may damage the silicone resins used in the device.
- 2) LEDs must be stored in a clean environment. Shelf life of sealed bags is 12 months at temperature 0~40 °C, 0~90 % RH.
- 3) After storage bag is opened, device subjected to soldering (wiring), 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
- 4) Repack unused products with anti-moisture packing, fold to close any opening and then store in a dry place.
- 5) Devices require baking before mounting, if humidity card reading is >60 % at 23 ± 5 °C.
- 6) Devices must be baked for 1 hour at 60 ± 5 °C, if baking is required.
- 7) 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.
- 8) The thermal management is one of the most critical factors for the LED lighting system. Especially the LED junction temperature should not exceed the absolute maximum rating while operation of LED lighting system.  
For more information, please refer to Application Note 'Mechanical & Thermal Guide for COB'.
- 9) In case of driving LEDs around the minimum current level ( $I_{f\_min}$ ), chips might exhibit different brightness due to the variation in I-V characteristics of each one. This is normal and does not adversely affect the performance of product.
- 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) The resin area is very sensitive, please do not handle, press, touch, rub, clean, or pick by with tweezers on it. Instead, please pick at the handling area as indicated below.



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