RoHS



STW8Q14C – Mid-Power LED



Enabling the best Im/W in Mid Power Range

Mid-Power LED - 5630 Series

STW8Q14C (Cool, Neutral, Warm)

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|-------|

Product Brief

Description

- This White Colored surface-mount LED comes in standard package dimension. Package Size: 5.6x3.0x0.75mm
- It has a substrate made up of a molded plastic reflector sitting on top of a lead frame.
- The die is attached within the reflector cavity and the cavity is encapsulated by silicone.
- The package design coupled with careful selection of component materials allow these products to perform with high reliability.



- The Best Efficacy in Mid Power LEDs
- Market Standard 5630 Package Size
- High Color Quality, CRI Min. 80
- Wide CCT range 2600~7000K
- ANSI & MacAdam 3 Step compliant
- RoHS compliant

Key Applications

- Interior lighting
- General lighting
- Indoor and outdoor displays
- Architectural / Decorative lighting

Table 1. Product Selection Table

| Part Number | | ССТ | | |
|-------------|---------------|-------|-------|-------|
| Part Number | Color | Min. | Тур. | Max. |
| STW8Q14C | Cool White | 4700K | 5600K | 7000K |
| STW8Q14C | Neutral White | 3700K | 4200K | 4700K |
| STW8Q14C | Warm White | 2600K | 3000K | 3700K |





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STW8Q14C - Mid-Power LED

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Performance Characteristics

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| | ССТ (К) [1] | | Luminous | Intensity [2] | Luminou | IS Flux ^[3] | CRI |
|-------------|-------------|------|------------------|---------------|---------|------------------------|------|
| Part Number | | RANK | l _v (| cd) | Φν | (Im) | Ra |
| | Тур. | | Min | Max | Min | Max | Min. |
| | | U7 | 11.7 | 12.5 | 36.3 | 38.8 | 80 |
| | 6500 - | V5 | 12.5 | 13.5 | 38.8 | 41.9 | 80 |
| | 0000 | W5 | 13.5 | 14.5 | 41.9 | 45.0 | 80 |
| | | X5 | 14.5 | 15.2 | 45.0 | 47.1 | 80 |
| | _ | U7 | 11.7 | 12.5 | 36.3 | 38.8 | 80 |
| | 5600 - | V5 | 12.5 | 13.5 | 38.8 | 41.9 | 80 |
| | 5000 | W5 | 13.5 | 14.5 | 41.9 | 45.0 | 80 |
| | | X5 | 14.5 | 15.2 | 45.0 | 47.1 | 80 |
| | _ | U7 | 11.7 | 12.5 | 36.3 | 38.8 | 80 |
| | 5000 - | V5 | 12.5 | 13.5 | 38.8 | 41.9 | 80 |
| | 5000 | W5 | 13.5 | 14.5 | 41.9 | 45.0 | 80 |
| | | X5 | 14.5 | 15.2 | 45.0 | 47.1 | 80 |
| | | U7 | 11.7 | 12.5 | 35.7 | 38.1 | 80 |
| | 4500 - | V5 | 12.5 | 13.5 | 38.1 | 41.2 | 80 |
| | 4500 - | W5 | 13.5 | 14.5 | 41.2 | 44.2 | 80 |
| STW8Q14C | | X5 | 14.5 | 15.2 | 44.2 | 46.4 | 80 |
| | | U7 | 11.7 | 12.5 | 35.7 | 38.1 | 80 |
| | 4000 - | V5 | 12.5 | 13.5 | 38.1 | 41.2 | 80 |
| | 4000 - | W5 | 13.5 | 14.5 | 41.2 | 44.2 | 80 |
| | - | X5 | 14.5 | 15.2 | 44.2 | 46.4 | 80 |
| - | | U7 | 11.7 | 12.5 | 35.1 | 37.5 | 80 |
| | 3500 | V5 | 12.5 | 13.5 | 37.5 | 40.5 | 80 |
| | - | W5 | 13.5 | 14.5 | 40.5 | 43.5 | 80 |
| | | U0 | 11 | 11.7 | 33.0 | 35.1 | 80 |
| | - | U7 | 11.7 | 12.5 | 35.1 | 37.5 | 80 |
| | 3000 - | V5 | 12.5 | 13.5 | 37.5 | 40.5 | 80 |
| | - | W5 | 13.5 | 14.5 | 40.5 | 43.5 | 80 |
| | | U0 | 11 | 11.7 | 33.0 | 35.1 | 80 |
| | - | U7 | 11.7 | 12.5 | 35.1 | 37.5 | 80 |
| | 2700 - | V5 | 12.5 | 13.5 | 37.5 | 40.5 | 80 |
| | - | W5 | 13.5 | 14.5 | 40.5 | 43.5 | 80 |

Table 2. Electro Optical Characteristics, I_F =100mA, T_j = 25°C, RH30%

Notes :

- (1) Correlated Color Temperature is derived from the CIE 1931 Chromaticity diagram.
- (2) Seoul Semiconductor maintains a tolerance of ±7% on Intensity and power measurements. The luminous intensity IV was measured at the peak of the spatial pattern which may not be aligned with the mechanical axis of the LED package.
- (3) The lumen table is only for reference.



Performance Characteristics

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| | - | | | |
|------------------------|---|---|---|---|
| Sumbol | | Value | | Unit |
| Symbol | Min. | Тур. | Max. | |
| ١ _F | - | 100 | 160 | mA |
| V _F (100mA) | 2.8 | - | 3.4 | V |
| V _r | - | 0.9 | 1.2 | V |
| I _v (100mA) | - | 14 (43) | - | cd |
| I _v (100mA) | - | 12.7 (38.1) | - | - (lm) |
| Ra | 80 | 83 | 90 | - |
| 2Ø _{1/2} | | 120 | | |
| P _d | - | - | 560 | mW |
| Tj | - | - | 125 | ٥C |
| T _{opr} | - 40 | - | + 85 | °C |
| T _{stg} | - 40 | - | + 100 | ٥C |
| Rθ _{J-S} | - | 18 | - | °C/W |
| - | - | - | 5000 | V |
| | $V_{F}(100mA) \\ V_{r} \\ I_{v} (100mA) \\ I_{v} (100mA) \\ Ra \\ 2\Theta_{1/2} \\ P_{d} \\ T_{j} \\ T_{opr} \\ T_{stg} \\ \end{bmatrix}$ | Min. I_F - $V_F(100mA)$ 2.8 V_r - I_v (100mA) - I_v (100mA) - I_v (100mA) - Ra 80 $2\Theta_{1/2}$ - P_d - T_j - T_{opr} -40 T_{stg} -40 | Symbol Min. Typ. I_F - 100 V_F (100mA) 2.8 - V_r - 0.9 V_r - 0.9 I_v (100mA) - 14 (43) I_v (100mA) - 12.7 (38.1) Ra 80 83 $2\Theta_{1/2}$ 120 P_d - T_j - T_{opr} -40 T_{stg} -40 | SymbolMin.Typ.Max. I_F -100160 $V_F(100mA)$ 2.8-3.4 V_r -0.91.2 I_v (100mA)-14 (43)- I_v (100mA)-12.7 (38.1)- I_v (100mA)-12.7 (38.1)- Ra 808390 $2\Theta_{1/2}$ 120120 P_d T_{j} -125 T_{opr} -40-+ 85 T_{stg} -40-+ 100 $R\theta_{J-S}$ -18- |

Table 3. Absolute Maximum Ratings, I_F =100mA, T_i = 25°C, RH30%

Notes :

- (1) Tolerance : VF :±0.1V, IV :±7%, Ra :±2, x,y :±0.005
- (2) $\Theta_{1/2}$ is the off-axis where the luminous intensity is 1/2 of the peak intensity
- (3) Thermal resistance : Rth_{JS} (Junction / solder)
- (4) A zener diode is included for ESD Protection.
- LED's properties might be different from suggested values like above and below tables if operation condition will be exceeded our parameter range. Care is to be taken that power dissipation does not exceed the absolute maximum rating of the product.
- All measurements were made under the standardized environment of Seoul Semiconductor.



Characteristics Graph

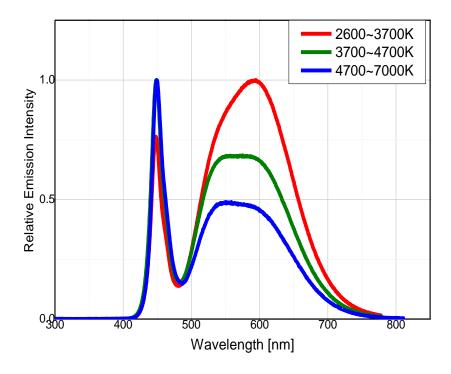
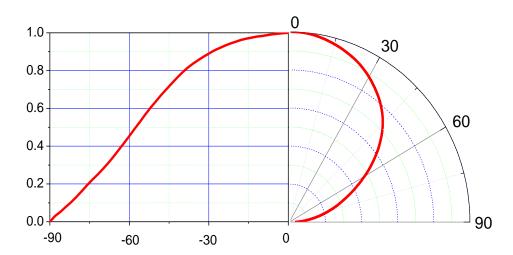


Fig 1. Color Spectrum, $I_F = 100$ mA, $T_j = 25$ °C, RH30%

Fig 2. Viewing Angle Distribution, $I_F = 100 \text{mA}$





Characteristics Graph

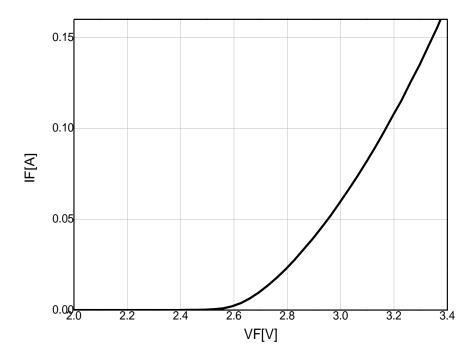
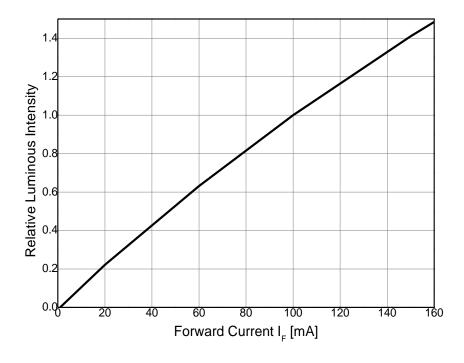


Fig 3. Forward Voltage vs. Forward Current, $T_j = 25^{\circ}C$

Fig 4. Forward Current vs. Relative Luminous Flux, $T_j = 25^{\circ}C$





Characteristics Graph

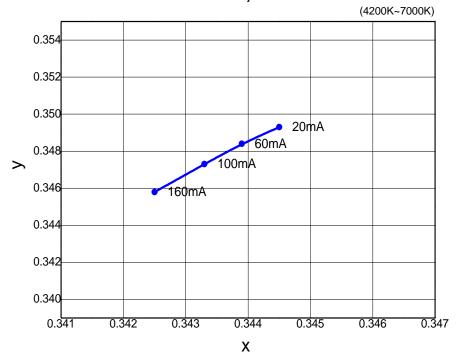
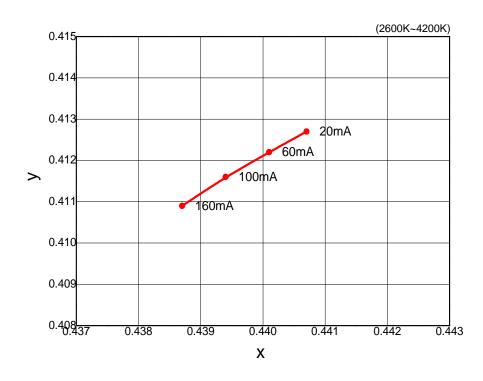


Fig 5. Forward Current vs. CIE X, Y Shift, $T_j = 25^{\circ}C$





Characteristics Graph

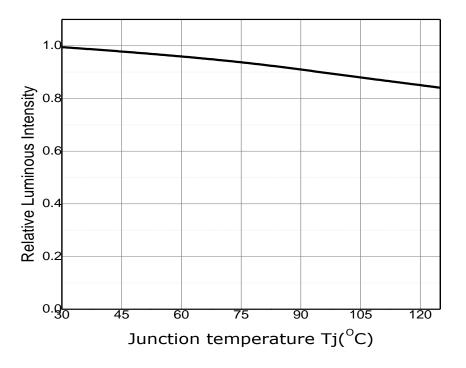
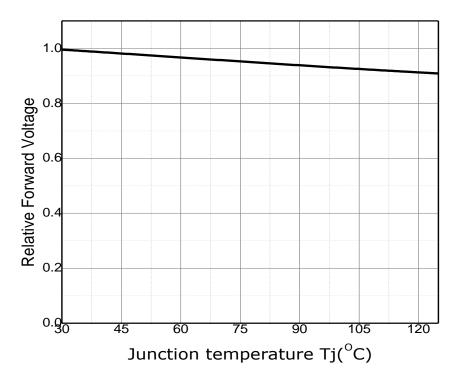


Fig 6. Relative Light Output vs. Junction Temperature, $I_F = 100 \text{mA}$

Fig 7. Junction Temperature vs. Relative Forward Voltage, $I_F = 100 \text{mA}$





Characteristics Graph

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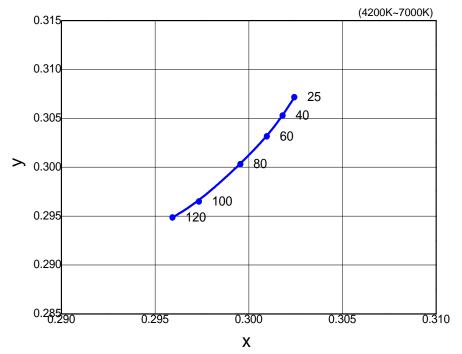
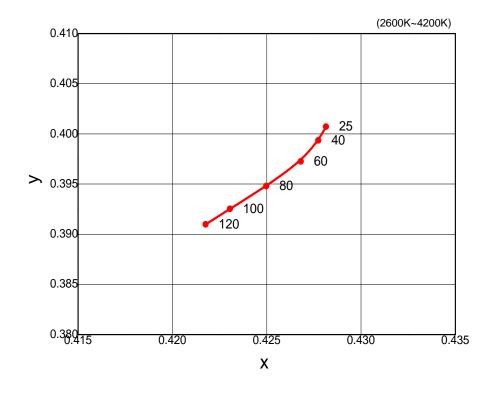


Fig 8. Chromaticity Coordinate vs. Junction Temperature, $I_F = 100 \text{mA}$



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Characteristics Graph

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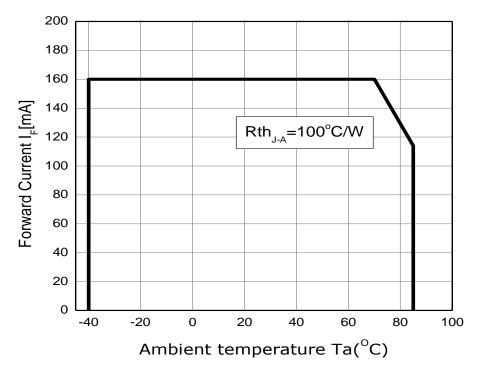


Fig 9. Maximum Forward Current vs. Ambient Temperature



Color Bin Structure

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Table 4. Bin Code description, $I_F = 100 \text{mA}$

| Part Number | Lumino | us Intensity | / (cd) | Color Chromaticity | Typical Forward Voltage (| | tage (V _f) |
|-------------|----------|--------------|--------|-----------------------|---------------------------|------|------------------------|
| | Bin Code | Min. | Max. | Coordinate | Bin Code | Min. | Max. |
| | U0 | 11.0 | 11.7 | | Y2 | 2.8 | 2.9 |
| | U7 | 11.7 | 12.5 | | Y3 | 2.9 | 3.0 |
| CTW00440 | V5 | 12.5 | 13.5 | Defente nom 10 | Z1 | 3.0 | 3.1 |
| STW8Q14C | W5 | 13.5 | 14.5 | Refer to page.12 | Z2 | 3.1 | 3.2 |
| | X5 | 14.5 | 15.2 | | Z3 | 3.2 | 3.3 |
| | J15 | 15.2 | 16 | | A1 | 3.3 | 3.4 |

Table 5. Intensity rank distribution

| ССТ | CIE | | | IV Rank | | |
|----------------|-----|----|----|---------|----|----|
| 6,000 ~ 7,000K | А | UO | U7 | V5 | W5 | X5 |
| 5,300 – 6,000K | В | U0 | U7 | V5 | W5 | X5 |
| 4,700 ~ 5,300K | С | U0 | U7 | V5 | W5 | X5 |
| 4,200 ~ 4,700K | D | UO | U7 | V5 | W5 | X5 |
| 3,700 ~ 4,200K | Е | UO | U7 | V5 | W5 | X5 |
| 3,200 ~ 3,700K | F | UO | U7 | V5 | W5 | X5 |
| 2,900 ~ 3,200K | G | U0 | U7 | V5 | W5 | X5 |
| 2,600 ~ 2,900K | Н | U0 | U7 | V5 | W5 | X5 |

*Notes :

(1) All measurements were made under the standardized environment of Seoul Semiconductor In order to ensure availability, single color rank will not be orderable.

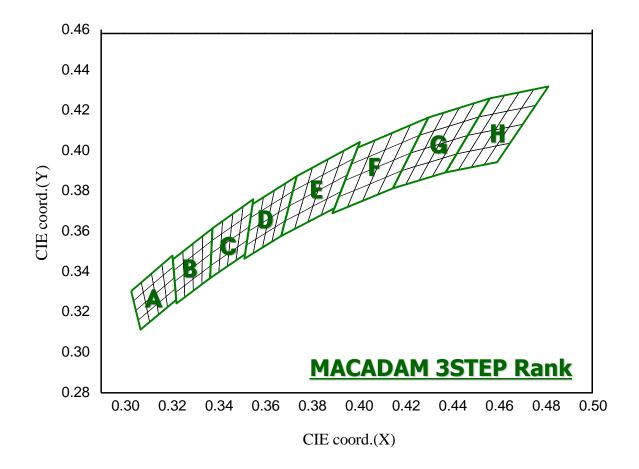
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Available ranks Not yet available ranks



Color Bin Structure

CIE Chromaticity Diagram, $I_F = 100 \text{mA}, T_j = 25^{\circ}\text{C}$



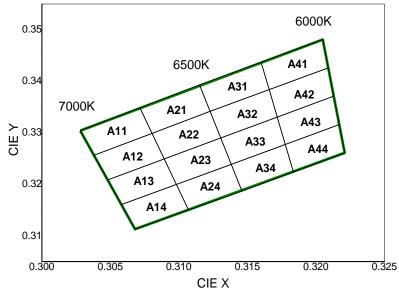
*Notes :

- Energy Star binning applied to all 2600~7000K.
- Measurement Uncertainty of the Color Coordinates : $\pm \ 0.005$



Color Bin Structure

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CIE Chromaticity Diagram (Cool White), $I_F = 100$ mA, $T_j = 25^{\circ}$ C

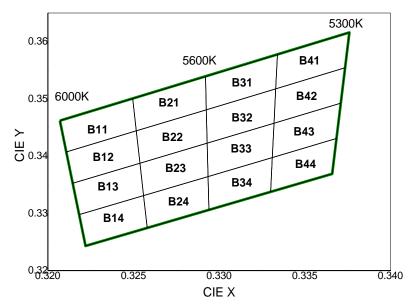
| A | 11 | A | 21 | A | 31 | A | 41 |
|---|--|--|--|--|--|--|--|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3028 | 0.3304 | 0.3072 | 0.3349 | 0.3115 | 0.3393 | 0.3160 | 0.3437 |
| 0.3038 | 0.3256 | 0.3080 | 0.3299 | 0.3123 | 0.3342 | 0.3166 | 0.3384 |
| 0.3080 | 0.3299 | 0.3123 | 0.3342 | 0.3166 | 0.3384 | 0.3209 | 0.3426 |
| 0.3072 | 0.3349 | 0.3115 | 0.3393 | 0.3160 | 0.3437 | 0.3205 | 0.3481 |
| A | 12 | A | 22 | A3 | 32 | A | 42 |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3038 | 0.3256 | 0.3080 | 0.3299 | 0.3123 | 0.3342 | 0.3166 | 0.3384 |
| 0.3048 | 0.3209 | 0.3089 | 0.3249 | 0.3131 | 0.3290 | 0.3172 | 0.3331 |
| 0.3089 | 0.3249 | 0.3131 | 0.3290 | 0.3172 | 0.3331 | 0.3213 | 0.3371 |
| | | | | | | | |
| 0.3080 | 0.3299 | 0.3123 | 0.3342 | 0.3166 | 0.3384 | 0.3209 | 0.3426 |
| 0.3080 A´ | | 0.3123 A | | 0.3166 A3 | | 0.3209 A4 | |
| | | | | | | | |
| A | 13 | A | 23 | A | 33 | A | 43 |
| A' CIE X | 13 CIE Y | A: CIE X | 23 CIE Y | A3 CIE X | CIE Y | A4 CIE X | 43 CIE Y |
| A ² CIE X 0.3048 | 13 CIE Y 0.3209 | A CIE X 0.3089 | 23 CIE Y 0.3249 | A3 CIE X 0.3131 | CIE Y 0.3290 | A4 CIE X 0.3172 | 43 CIE Y 0.3331 |
| A ⁴ CIE X 0.3048 0.3058 | 13 CIE Y 0.3209 0.3161 | CIE X 0.3089 0.3098 | 23 CIE Y 0.3249 0.3200 | A3 CIE X 0.3131 0.3138 | CIE Y 0.3290 0.3239 | CIE X 0.3172 0.3178 | 43 CIE Y 0.3331 0.3277 |
| A [*] CIE X 0.3048 0.3058 0.3098 | 13 CIE Y 0.3209 0.3161 0.3200 0.3249 | CIE X 0.3089 0.3098 0.3138 0.3131 | 23 CIE Y 0.3249 0.3200 0.3239 | A3 CIE X 0.3131 0.3138 0.3178 | CIE Y 0.3290 0.3239 0.3277 0.3331 | A4 CIE X 0.3172 0.3178 0.3217 | 43 CIE Y 0.3331 0.3277 0.3316 0.3371 |
| A ⁴ CIE X 0.3048 0.3058 0.3098 0.3089 | 13 CIE Y 0.3209 0.3161 0.3200 0.3249 | CIE X 0.3089 0.3098 0.3138 0.3131 | 23 CIE Y 0.3249 0.3200 0.3239 0.3290 | A3 CIE X 0.3131 0.3138 0.3178 0.3172 | CIE Y 0.3290 0.3239 0.3277 0.3331 | CIE X 0.3172 0.3178 0.3217 0.3213 | 43 CIE Y 0.3331 0.3277 0.3316 0.3371 |
| A ⁴ CIE X 0.3048 0.3058 0.3098 0.3089 A ⁴ | 13 CIE Y 0.3209 0.3161 0.3200 0.3249 14 | At CIE X 0.3089 0.3098 0.3138 0.3131 At | 23 CIE Y 0.3249 0.3200 0.3239 0.3290 24 | A3 CIE X 0.3131 0.3138 0.3178 0.3172 A3 | 33 CIE Y 0.3290 0.3239 0.3277 0.3331 | A4 CIE X 0.3172 0.3178 0.3217 0.3213 A4 | 43 CIE Y 0.3331 0.3277 0.3316 0.3371 44 |
| CIE X 0.3048 0.3058 0.3098 0.3089 CIE X | 13 CIE Y 0.3209 0.3161 0.3200 0.3249 14 CIE Y | CIE X 0.3089 0.3098 0.3138 0.3131 CIE X | 23 CIE Y 0.3249 0.3200 0.3239 0.3290 24 CIE Y | A3 CIE X 0.3131 0.3138 0.3178 0.3172 A3 CIE X | 33 CIE Y 0.3290 0.3239 0.3277 0.3331 34 CIE Y | CIE X 0.3172 0.3178 0.3217 0.3213 A4 CIE X | 43 CIE Y 0.3331 0.3277 0.3316 0.3371 44 CIE Y |
| CIE X 0.3048 0.3058 0.3098 0.3089 CIE X O.3058 | 13 CIE Y 0.3209 0.3161 0.3200 0.3249 14 CIE Y 0.3161 | CIE X 0.3089 0.3098 0.3138 0.3131 CIE X 0.3098 | 23 CIE Y 0.3249 0.3200 0.3239 0.3290 24 CIE Y 0.3200 | A3 CIE X 0.3131 0.3138 0.3178 0.3172 A3 CIE X 0.3138 | 33 CIE Y 0.3290 0.3239 0.3277 0.3331 34 CIE Y 0.3239 | CIE X 0.3172 0.3178 0.3217 0.3213 AA CIE X 0.3178 | 43 CIE Y 0.3331 0.3277 0.3316 0.3371 44 CIE Y 0.3277 |

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Color Bin Structure

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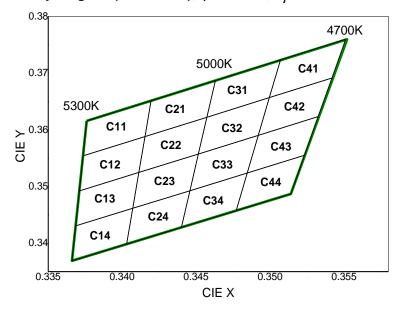
CIE Chromaticity Diagram (Cool White), $I_F = 100$ mA, $T_j = 25^{\circ}$ C

| B | 11 | B | 21 | B3 | 31 | B | 41 |
|--|--|--|--|--|--|---|--|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3207 | 0.3462 | 0.3250 | 0.3501 | 0.3292 | 0.3539 | 0.3334 | 0.3578 |
| 0.3211 | 0.3407 | 0.3252 | 0.3444 | 0.3293 | 0.3481 | 0.3333 | 0.3518 |
| 0.3252 | 0.3444 | 0.3293 | 0.3481 | 0.3333 | 0.3518 | 0.3374 | 0.3554 |
| 0.3250 | 0.3501 | 0.3292 | 0.3539 | 0.3334 | 0.3578 | 0.3376 | 0.3616 |
| B | 12 | B | 22 | B3 | 32 | B | 42 |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3211 | 0.3407 | 0.3252 | 0.3444 | 0.3293 | 0.3481 | 0.3333 | 0.3518 |
| 0.3215 | 0.3353 | 0.3254 | 0.3388 | 0.3293 | 0.3423 | 0.3332 | 0.3458 |
| 0.3254 | 0.3388 | 0.3293 | 0.3423 | 0.3332 | 0.3458 | 0.3371 | 0.3493 |
| 0.3252 | 0.3444 | 0.3293 | 0.3481 | 0.3333 | 0.3518 | 0.3374 | 0.3554 |
| | | | | | | | |
| B | 13 | B | 23 | B3 | 33 | B | 43 |
| B' CIE X | 13 CIE Y | B: CIE X | 23 CIE Y | B3 CIE X | CIE Y | B [,] CIE X | 43 CIE Y |
| | | | | | | | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| CIE X 0.3215 | CIE Y 0.3353 | CIE X 0.3254 | CIE Y 0.3388 | CIE X 0.3293 | CIE Y 0.3423 | CIE X 0.3332 | CIE Y 0.3458 |
| CIE X 0.3215 0.3218 | CIE Y 0.3353 0.3298 | CIE X 0.3254 0.3256 | CIE Y 0.3388 0.3331 | CIE X 0.3293 0.3294 | CIE Y 0.3423 0.3364 | CIE X 0.3332 0.3331 | CIE Y 0.3458 0.3398 |
| CIE X 0.3215 0.3218 0.3256 0.3254 | CIE Y 0.3353 0.3298 0.3331 | CIE X 0.3254 0.3256 0.3294 0.3293 | CIE Y 0.3388 0.3331 0.3364 | CIE X 0.3293 0.3294 0.3331 | CIE Y 0.3423 0.3364 0.3398 0.3458 | CIE X 0.3332 0.3331 0.3369 | CIE Y 0.3458 0.3398 0.3431 0.3493 |
| CIE X 0.3215 0.3218 0.3256 0.3254 | CIE Y 0.3353 0.3298 0.3331 0.3388 | CIE X 0.3254 0.3256 0.3294 0.3293 | CIE Y 0.3388 0.3331 0.3364 0.3423 | CIE X 0.3293 0.3294 0.3331 0.3332 | CIE Y 0.3423 0.3364 0.3398 0.3458 | CIE X 0.3332 0.3331 0.3369 0.3371 | CIE Y 0.3458 0.3398 0.3431 0.3493 |
| CIE X 0.3215 0.3218 0.3256 0.3254 B' | CIE Y 0.3353 0.3298 0.3331 0.3388 14 | CIE X 0.3254 0.3256 0.3294 0.3293 B | CIE Y 0.3388 0.3331 0.3364 0.3423 24 | CIE X 0.3293 0.3294 0.3331 0.3332 B3 | CIE Y 0.3423 0.3364 0.3398 0.3458 | CIE X 0.3332 0.3331 0.3369 0.3371 B | CIE Y 0.3458 0.3398 0.3431 0.3493 44 |
| CIE X 0.3215 0.3218 0.3256 0.3254 B ⁻ CIE X | CIE Y 0.3353 0.3298 0.3331 0.3388 14 CIE Y | CIE X 0.3254 0.3256 0.3294 0.3293 B CIE X | CIE Y 0.3388 0.3331 0.3364 0.3423 24 CIE Y | CIE X 0.3293 0.3294 0.3331 0.3332 B3 CIE X | CIE Y 0.3423 0.3364 0.3398 0.3458 34 CIE Y | CIE X 0.3332 0.3331 0.3369 0.3371 B CIE X | CIE Y 0.3458 0.3398 0.3431 0.3493 44 CIE Y |
| CIE X 0.3215 0.3218 0.3256 0.3254 B' CIE X 0.3218 | CIE Y 0.3353 0.3298 0.3331 0.3388 14 CIE Y 0.3298 | CIE X 0.3254 0.3256 0.3294 0.3293 CIE X 0.3256 | CIE Y 0.3388 0.3331 0.3364 0.3423 24 CIE Y 0.3331 | CIE X 0.3293 0.3294 0.3331 0.3332 B3 CIE X 0.3294 | CIE Y 0.3423 0.3364 0.3398 0.3458 34 CIE Y 0.3364 | CIE X 0.3332 0.3331 0.3369 0.3371 B CIE X 0.3331 | CIE Y 0.3458 0.3398 0.3431 0.3493 44 CIE Y 0.3398 |
| CIE X 0.3215 0.3218 0.3256 0.3254 B' CIE X 0.3218 0.3222 | CIE Y 0.3353 0.3298 0.3331 0.3388 14 CIE Y 0.3298 0.3243 | CIE X 0.3254 0.3256 0.3294 0.3293 B: CIE X 0.3256 0.3258 | CIE Y 0.3388 0.3331 0.3364 0.3423 24 CIE Y 0.3331 0.3275 | CIE X 0.3293 0.3294 0.3331 0.3332 B3 CIE X 0.3294 0.3294 | CIE Y 0.3423 0.3364 0.3398 0.3458 84 CIE Y 0.3364 0.3306 | CIE X 0.3332 0.3331 0.3369 0.3371 B CIE X 0.3331 0.3330 | CIE Y 0.3458 0.3398 0.3431 0.3493 44 CIE Y 0.3398 0.3338 |

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Color Bin Structure



C11 C21 C31 C41 CIE X CIE Y CIE X CIE Y CIE X CIE Y CIE X CIE Y 0.3376 0.3616 0.3420 0.3652 0.3463 0.3687 0.3507 0.3724 0.3374 0.3415 0.3657 0.3554 0.3588 0.3457 0.3622 0.3500 0.3415 0.3588 0.3457 0.3622 0.3500 0.3657 0.3542 0.3692 0.3420 0.3652 0.3463 0.3687 0.3507 0.3724 0.3551 0.3760 C12 C22 C32 C42 CIE X CIE Y CIE X CIE Y CIE X CIE Y CIE X CIE Y 0.3415 0.3374 0.3554 0.3588 0.3457 0.3622 0.3500 0.3657 0.3525 0.3371 0.3411 0.3452 0.3558 0.3591 0.3493 0.3492 0.3452 0.3591 0.3533 0.3411 0.3525 0.3558 0.3492 0.3624 0.3415 0.3588 0.3457 0.3622 0.3500 0.3657 0.3542 0.3692 C13 C23 C33 C43 CIE X CIE Y CIE X CIE Y CIE X CIE Y CIE X CIE Y 0.3371 0.3411 0.3558 0.3493 0.3525 0.3452 0.3492 0.3591 0.3369 0.3431 0.3407 0.3462 0.3446 0.3493 0.3485 0.3524 0.3407 0.3462 0.3446 0.3493 0.3485 0.3524 0.3523 0.3555 0.3411 0.3525 0.3452 0.3558 0.3492 0.3591 0.3533 0.3624 C24 C44 C14 C34 CIE X CIE Y CIE X CIE Y CIE X CIE Y CIE X CIE Y 0.3369 0.3431 0.3407 0.3462 0.3446 0.3493 0.3485 0.3524 0.3366 0.3369 0.3403 0.3399 0.3440 0.3428 0.3477 0.3458 0.3403 0.3399 0.3440 0.3428 0.3477 0.3458 0.3514 0.3487 0.3407 0.3462 0.3446 0.3493 0.3485 0.3524 0.3523 0.3555

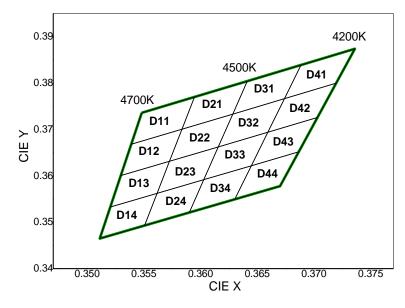
CIE Chromaticity Diagram (Cool White), $I_F = 100$ mA, $T_i = 25$ °C

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Color Bin Structure

SEOUL



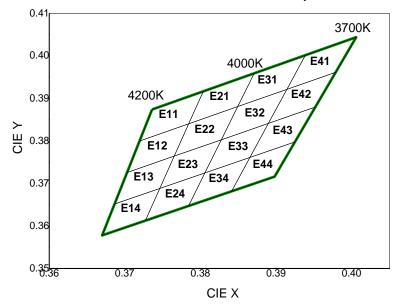
CIE Chromaticity Diagram (Neutral White), $I_F = 100 \text{mA}$, $T_j = 25^{\circ}\text{C}$

| D | 11 | D | 21 | Da | 31 | D | 41 |
|---|--|--|--|--|--|--|--|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3548 | 0.3736 | 0.3595 | 0.3770 | 0.3641 | 0.3804 | 0.3689 | 0.3839 |
| 0.3539 | 0.3668 | 0.3584 | 0.3701 | 0.3628 | 0.3733 | 0.3674 | 0.3767 |
| 0.3584 | 0.3701 | 0.3628 | 0.3733 | 0.3674 | 0.3767 | 0.3720 | 0.3800 |
| 0.3595 | 0.3770 | 0.3641 | 0.3804 | 0.3689 | 0.3839 | 0.3736 | 0.3874 |
| D | 12 | D | 22 | D3 | 32 | D | 42 |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3539 | 0.3668 | 0.3584 | 0.3701 | 0.3628 | 0.3733 | 0.3674 | 0.3767 |
| 0.3530 | 0.3601 | 0.3573 | 0.3632 | 0.3616 | 0.3663 | 0.3659 | 0.3694 |
| 0.3573 | 0.3632 | 0.3616 | 0.3663 | 0.3659 | 0.3694 | 0.3703 | 0.3726 |
| 0.3584 | 0.3701 | 0.3628 | 0.3733 | 0.3674 | 0.3767 | 0.3720 | 0.3800 |
| D | | | | | 20 | | 10 |
| ע | 13 | D | 23 | D | 55 | D [,] | 43 |
| CIE X | 13 CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | 43 CIE Y |
| | | | | | | | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| CIE X 0.3530 | CIE Y 0.3601 | CIE X 0.3573 | CIE Y 0.3632 | CIE X 0.3616 | CIE Y 0.3663 | CIE X 0.3659 | CIE Y 0.3694 |
| CIE X 0.3530 0.3520 | CIE Y 0.3601 0.3533 | CIE X 0.3573 0.3562 | CIE Y 0.3632 0.3562 | CIE X 0.3616 0.3603 | CIE Y 0.3663 0.3592 | CIE X 0.3659 0.3645 | CIE Y 0.3694 0.3622 |
| CIE X 0.3530 0.3520 0.3562 | CIE Y 0.3601 0.3533 0.3562 0.3632 | CIE X 0.3573 0.3562 0.3603 0.3616 | CIE Y 0.3632 0.3562 0.3592 | CIE X 0.3616 0.3603 0.3645 | CIE Y 0.3663 0.3592 0.3622 0.3694 | CIE X 0.3659 0.3645 0.3687 | CIE Y 0.3694 0.3622 0.3652 0.3726 |
| CIE X 0.3530 0.3520 0.3562 0.3573 | CIE Y 0.3601 0.3533 0.3562 0.3632 | CIE X 0.3573 0.3562 0.3603 0.3616 | CIE Y 0.3632 0.3562 0.3592 0.3663 | CIE X 0.3616 0.3603 0.3645 0.3659 | CIE Y 0.3663 0.3592 0.3622 0.3694 | CIE X 0.3659 0.3645 0.3687 0.3703 | CIE Y 0.3694 0.3622 0.3652 0.3726 |
| CIE X 0.3530 0.3520 0.3562 0.3573 | CIE Y 0.3601 0.3533 0.3562 0.3632 14 | CIE X 0.3573 0.3562 0.3603 0.3616 D: | CIE Y 0.3632 0.3562 0.3592 0.3663 24 | CIE X 0.3616 0.3603 0.3645 0.3659 D3 | CIE Y 0.3663 0.3592 0.3622 0.3694 | CIE X 0.3659 0.3645 0.3687 0.3703 | CIE Y 0.3694 0.3622 0.3652 0.3726 |
| CIE X 0.3530 0.3520 0.3562 0.3573 D ⁻ CIE X | CIE Y 0.3601 0.3533 0.3562 0.3632 14 CIE Y | CIE X 0.3573 0.3562 0.3603 0.3616 D: CIE X | CIE Y 0.3632 0.3562 0.3592 0.3663 24 CIE Y | CIE X 0.3616 0.3603 0.3645 0.3659 D3 CIE X | CIE Y 0.3663 0.3592 0.3622 0.3694 34 CIE Y | CIE X 0.3659 0.3645 0.3687 0.3703 D/ CIE X | CIE Y 0.3694 0.3622 0.3652 0.3726 44 CIE Y |
| CIE X 0.3530 0.3520 0.3562 0.3573 D CIE X 0.3520 | CIE Y 0.3601 0.3533 0.3562 0.3632 14 CIE Y 0.3533 | CIE X 0.3573 0.3562 0.3603 0.3616 D: CIE X 0.3562 | CIE Y 0.3632 0.3562 0.3592 0.3663 24 CIE Y 0.3562 | CIE X 0.3616 0.3603 0.3645 0.3659 D3 CIE X 0.3603 | CIE Y 0.3663 0.3592 0.3622 0.3694 34 CIE Y 0.3592 | CIE X 0.3659 0.3645 0.3687 0.3703 D CIE X 0.3645 | CIE Y 0.3694 0.3622 0.3652 0.3726 44 CIE Y 0.3622 |
| CIE X 0.3530 0.3520 0.3562 0.3573 D CIE X 0.3520 0.3511 | CIE Y 0.3601 0.3533 0.3562 0.3632 14 CIE Y 0.3533 0.3465 | CIE X 0.3573 0.3562 0.3603 0.3616 D: CIE X 0.3562 0.3551 | CIE Y 0.3632 0.3562 0.3592 0.3663 24 CIE Y 0.3562 0.3493 | CIE X 0.3616 0.3603 0.3645 0.3659 D3 CIE X 0.3603 0.3590 | CIE Y 0.3663 0.3592 0.3622 0.3694 34 CIE Y 0.3592 0.3521 | CIE X 0.3659 0.3645 0.3687 0.3703 D4 CIE X 0.3645 0.3630 | CIE Y 0.3694 0.3622 0.3652 0.3726 44 CIE Y 0.3622 0.3550 |

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Color Bin Structure



CIE Chromaticity Diagram (Neutral White), $I_F = 100 \text{mA}$, $T_j = 25^{\circ}\text{C}$

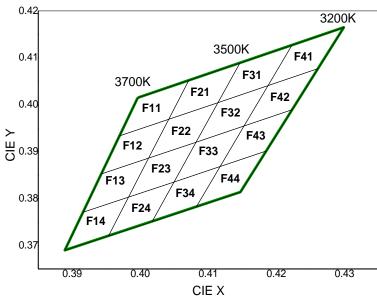
| E | 11 | E | 21 | E3 | 31 | E4 | 41 |
|--|--|--|--|--|--|--|--|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3736 | 0.3874 | 0.3804 | 0.3917 | 0.3871 | 0.3959 | 0.3939 | 0.4002 |
| 0.3720 | 0.3800 | 0.3784 | 0.3841 | 0.3849 | 0.3881 | 0.3914 | 0.3922 |
| 0.3784 | 0.3841 | 0.3849 | 0.3881 | 0.3914 | 0.3922 | 0.3979 | 0.3962 |
| 0.3804 | 0.3917 | 0.3871 | 0.3959 | 0.3939 | 0.4002 | 0.4006 | 0.4044 |
| E | 12 | E | 22 | E3 | 32 | E4 | 42 |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3720 | 0.3800 | 0.3784 | 0.3841 | 0.3849 | 0.3881 | 0.3914 | 0.3922 |
| 0.3703 | 0.3726 | 0.3765 | 0.3765 | 0.3828 | 0.3803 | 0.3890 | 0.3842 |
| 0.3765 | 0.3765 | 0.3828 | 0.3803 | 0.3890 | 0.3842 | 0.3952 | 0.3880 |
| 0.3784 | 0.3841 | 0.3849 | 0.3881 | 0.3914 | 0.3922 | 0.3979 | 0.3962 |
| E | 10 | E | 22 | - | | E | 12 |
| | 13 | E, | 23 | E3 | 55 | E. | +5 |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| | | | | | | | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| CIE X 0.3703 | CIE Y 0.3726 | CIE X 0.3765 | CIE Y 0.3765 | CIE X 0.3828 | CIE Y 0.3803 | CIE X 0.3890 | CIE Y 0.3842 |
| CIE X 0.3703 0.3687 | CIE Y 0.3726 0.3652 | CIE X 0.3765 0.3746 | CIE Y 0.3765 0.3689 | CIE X 0.3828 0.3806 | CIE Y 0.3803 0.3725 | CIE X 0.3890 0.3865 | CIE Y 0.3842 0.3762 |
| CIE X 0.3703 0.3687 0.3746 | CIE Y 0.3726 0.3652 0.3689 0.3765 | CIE X 0.3765 0.3746 0.3806 | CIE Y 0.3765 0.3689 0.3725 0.3803 | CIE X 0.3828 0.3806 0.3865 | CIE Y 0.3803 0.3725 0.3762 0.3842 | CIE X 0.3890 0.3865 0.3925 | CIE Y 0.3842 0.3762 0.3798 0.3880 |
| CIE X 0.3703 0.3687 0.3746 0.3765 | CIE Y 0.3726 0.3652 0.3689 0.3765 | CIE X 0.3765 0.3746 0.3806 0.3828 | CIE Y 0.3765 0.3689 0.3725 0.3803 | CIE X 0.3828 0.3806 0.3865 0.3890 | CIE Y 0.3803 0.3725 0.3762 0.3842 | CIE X 0.3890 0.3865 0.3925 0.3952 | CIE Y 0.3842 0.3762 0.3798 0.3880 |
| CIE X 0.3703 0.3687 0.3746 0.3765 E ⁴ | CIE Y 0.3726 0.3652 0.3689 0.3765 | CIE X 0.3765 0.3746 0.3806 0.3828 | CIE Y 0.3765 0.3689 0.3725 0.3803 24 | CIE X 0.3828 0.3806 0.3865 0.3890 E3 | CIE Y 0.3803 0.3725 0.3762 0.3842 | CIE X 0.3890 0.3865 0.3925 0.3952 E4 | CIE Y 0.3842 0.3762 0.3798 0.3880 |
| CIE X 0.3703 0.3687 0.3746 0.3765 E ⁻ CIE X | CIE Y 0.3726 0.3652 0.3689 0.3765 14 CIE Y | CIE X 0.3765 0.3746 0.3806 0.3828 CIE X | CIE Y 0.3765 0.3689 0.3725 0.3803 24 CIE Y | CIE X 0.3828 0.3806 0.3865 0.3890 E3 CIE X | CIE Y 0.3803 0.3725 0.3762 0.3842 0.3842 CIE Y | CIE X 0.3890 0.3865 0.3925 0.3952 E4 CIE X | CIE Y 0.3842 0.3762 0.3798 0.3880 44 CIE Y |
| CIE X 0.3703 0.3687 0.3746 0.3765 E CIE X 0.3687 | CIE Y 0.3726 0.3652 0.3689 0.3765 14 CIE Y 0.3652 | CIE X 0.3765 0.3746 0.3806 0.3828 CIE X 0.3746 | CIE Y 0.3765 0.3689 0.3725 0.3803 24 CIE Y 0.3689 | CIE X 0.3828 0.3806 0.3865 0.3890 E3 CIE X 0.3806 | CIE Y 0.3803 0.3725 0.3762 0.3842 34 CIE Y 0.3725 | CIE X 0.3890 0.3865 0.3925 0.3952 E ² CIE X 0.3865 | CIE Y 0.3842 0.3762 0.3798 0.3880 44 CIE Y 0.3762 |
| CIE X 0.3703 0.3687 0.3746 0.3765 E ² CIE X 0.3687 0.3670 | CIE Y 0.3726 0.3652 0.3689 0.3765 14 CIE Y 0.3652 0.3578 | CIE X 0.3765 0.3746 0.3806 0.3828 CIE X 0.3746 0.3727 | CIE Y 0.3765 0.3689 0.3725 0.3803 24 CIE Y 0.3689 0.3613 | CIE X 0.3828 0.3806 0.3865 0.3890 E3 CIE X 0.3806 0.3784 | CIE Y 0.3803 0.3725 0.3762 0.3842 44 CIE Y 0.3725 0.3647 | CIE X 0.3890 0.3865 0.3925 0.3952 CIE X 0.3865 0.3841 | CIE Y 0.3842 0.3762 0.3798 0.3880 44 CIE Y 0.3762 0.3682 |

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Color Bin Structure

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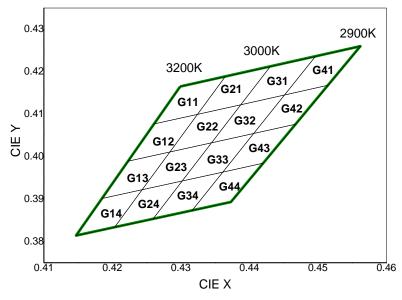
CIE Chromaticity Diagram (Warm White), $I_F = 100$ mA, $T_j = 25^{\circ}$ C

| F1 | 11 | F | 21 | F3 | 31 | F4 | 41 |
|---|---|---|---|--|--|---|---|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3996 | 0.4015 | 0.4071 | 0.4052 | 0.4146 | 0.4089 | 0.4223 | 0.4127 |
| 0.3969 | 0.3934 | 0.4042 | 0.3969 | 0.4114 | 0.4005 | 0.4187 | 0.4041 |
| 0.4042 | 0.3969 | 0.4114 | 0.4005 | 0.4187 | 0.4041 | 0.4261 | 0.4077 |
| 0.4071 | 0.4052 | 0.4146 | 0.4089 | 0.4223 | 0.4127 | 0.4299 | 0.4165 |
| Fí | 12 | F | 22 | F3 | 32 | F4 | 42 |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.3969 | 0.3934 | 0.4042 | 0.3969 | 0.4114 | 0.4005 | 0.4187 | 0.4041 |
| 0.3943 | 0.3853 | 0.4012 | 0.3886 | 0.4082 | 0.3920 | 0.4152 | 0.3955 |
| 0.4012 | 0.3886 | 0.4082 | 0.3920 | 0.4152 | 0.3955 | 0.4223 | 0.3990 |
| 0.4042 | 0.3969 | 0.4114 | 0.4005 | 0.4187 | 0.4041 | 0.4261 | 0.4077 |
| Fí | 13 | F | 23 | F3 | 3 | F4 | 43 |
| | | | | | | | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| CIE X 0.3943 | CIE Y 0.3853 | CIE X 0.4012 | CIE Y 0.3886 | CIE X 0.4082 | CIE Y 0.3920 | CIE X 0.4152 | CIE Y 0.3955 |
| | | | | | | | - |
| 0.3943 | 0.3853 | 0.4012 | 0.3886 | 0.4082 | 0.3920 | 0.4152 | 0.3955 |
| 0.3943 0.3916 | 0.3853 0.3771 | 0.4012 0.3983 | 0.3886 0.3803 | 0.4082 0.4049 | 0.3920 0.3836 | 0.4152 0.4117 | 0.3955 0.3869 |
| 0.3943 0.3916 0.3983 | 0.3853 0.3771 0.3803 0.3886 | 0.4012 0.3983 0.4049 | 0.3886 0.3803 0.3836 0.3920 | 0.4082 0.4049 0.4117 | 0.3920 0.3836 0.3869 0.3955 | 0.4152 0.4117 0.4185 | 0.3955 0.3869 0.3902 0.3990 |
| 0.3943 0.3916 0.3983 0.4012 | 0.3853 0.3771 0.3803 0.3886 | 0.4012 0.3983 0.4049 0.4082 | 0.3886 0.3803 0.3836 0.3920 | 0.4082 0.4049 0.4117 0.4152 | 0.3920 0.3836 0.3869 0.3955 | 0.4152 0.4117 0.4185 0.4223 | 0.3955 0.3869 0.3902 0.3990 |
| 0.3943 0.3916 0.3983 0.4012 | 0.3853 0.3771 0.3803 0.3886 | 0.4012 0.3983 0.4049 0.4082 | 0.3886 0.3803 0.3836 0.3920 24 | 0.4082 0.4049 0.4117 0.4152 F3 | 0.3920 0.3836 0.3869 0.3955 | 0.4152 0.4117 0.4185 0.4223 | 0.3955 0.3869 0.3902 0.3990 44 |
| 0.3943 0.3916 0.3983 0.4012 F [*] CIE X | 0.3853 0.3771 0.3803 0.3886 14 CIE Y | 0.4012 0.3983 0.4049 0.4082 F2 CIE X | 0.3886 0.3803 0.3836 0.3920 24 CIE Y | 0.4082 0.4049 0.4117 0.4152 F3 CIE X | 0.3920 0.3836 0.3869 0.3955 44 CIE Y | 0.4152 0.4117 0.4185 0.4223 Fz CIE X | 0.3955 0.3869 0.3902 0.3990 44 CIE Y |
| 0.3943 0.3916 0.3983 0.4012 F ⁷ CIE X 0.3916 | 0.3853 0.3771 0.3803 0.3886 14 CIE Y 0.3771 | 0.4012 0.3983 0.4049 0.4082 F2 CIE X 0.3983 | 0.3886 0.3803 0.3836 0.3920 24 CIE Y 0.3803 | 0.4082 0.4049 0.4117 0.4152 F3 CIE X 0.4049 | 0.3920 0.3836 0.3869 0.3955 4 CIE Y 0.3836 | 0.4152 0.4117 0.4185 0.4223 F4 CIE X 0.4117 | 0.3955 0.3869 0.3902 0.3990 44 CIE Y 0.3869 |
| 0.3943 0.3916 0.3983 0.4012 F CIE X 0.3916 0.3889 | 0.3853 0.3771 0.3803 0.3886 14 CIE Y 0.3771 0.3690 | 0.4012 0.3983 0.4049 0.4082 F2 CIE X 0.3983 0.3953 | 0.3886 0.3803 0.3836 0.3920 24 CIE Y 0.3803 0.3721 | 0.4082 0.4049 0.4117 0.4152 F3 CIE X 0.4049 0.4017 | 0.3920 0.3836 0.3869 0.3955 4 CIE Y 0.3836 0.3751 | 0.4152 0.4117 0.4185 0.4223 F CIE X 0.4117 0.4082 | 0.3955 0.3869 0.3902 0.3990 44 CIE Y 0.3869 0.3783 |

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Color Bin Structure



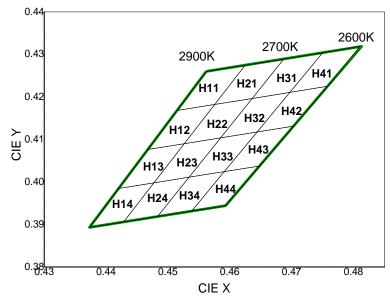
CIE Chromaticity Diagram (Warm White), I_{F} = 100mA, T_{j} = 25°C

| G | 11 | G | 21 | G | 31 | G | 41 |
|--|--|---|--|--|--|--|--|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.4299 | 0.4165 | 0.4364 | 0.4188 | 0.4430 | 0.4212 | 0.4496 | 0.4236 |
| 0.4261 | 0.4077 | 0.4324 | 0.4099 | 0.4387 | 0.4122 | 0.4451 | 0.4145 |
| 0.4324 | 0.4100 | 0.4387 | 0.4122 | 0.4451 | 0.4145 | 0.4514 | 0.4168 |
| 0.4365 | 0.4189 | 0.4430 | 0.4212 | 0.4496 | 0.4236 | 0.4562 | 0.4260 |
| G | G12 | | 22 | G32 | | G42 | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| 0.4261 | 0.4077 | 0.4324 | 0.4100 | 0.4387 | 0.4122 | 0.4451 | 0.4145 |
| 0.4223 | 0.3990 | 0.4284 | 0.4011 | 0.4345 | 0.4033 | 0.4406 | 0.4055 |
| 0.4284 | 0.4011 | 0.4345 | 0.4033 | 0.4406 | 0.4055 | 0.4468 | 0.4077 |
| 0.4324 | 0.4100 | 0.4387 | 0.4122 | 0.4451 | 0.4145 | 0.4515 | 0.4168 |
| | | | | | | | |
| G | 13 | G | 23 | G | 33 | G | 43 |
| G CIE X | 13 CIE Y | G: CIE X | 23 CIE Y | G: CIE X | 33 CIE Y | G4 CIE X | 43 CIE Y |
| | | - | | | | | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y |
| CIE X 0.4223 | CIE Y 0.3990 | CIE X 0.4284 | CIE Y 0.4011 | CIE X 0.4345 | CIE Y 0.4033 | CIE X 0.4406 | CIE Y 0.4055 |
| CIE X 0.4223 0.4185 | CIE Y 0.3990 0.3902 | CIE X 0.4284 0.4243 | CIE Y 0.4011 0.3922 | CIE X 0.4345 0.4302 | CIE Y 0.4033 0.3943 | CIE X 0.4406 0.4361 | CIE Y 0.4055 0.3964 |
| CIE X 0.4223 0.4185 0.4243 | CIE Y 0.3990 0.3902 0.3922 0.4011 | CIE X 0.4284 0.4243 0.4302 | CIE Y 0.4011 0.3922 0.3943 0.4033 | CIE X 0.4345 0.4302 0.4361 | CIE Y 0.4033 0.3943 0.3964 0.4055 | CIE X 0.4406 0.4361 0.4420 | CIE Y 0.4055 0.3964 0.3985 0.4077 |
| CIE X 0.4223 0.4185 0.4243 0.4284 | CIE Y 0.3990 0.3902 0.3922 0.4011 | CIE X 0.4284 0.4243 0.4302 0.4345 | CIE Y 0.4011 0.3922 0.3943 0.4033 | CIE X 0.4345 0.4302 0.4361 0.4406 | CIE Y 0.4033 0.3943 0.3964 0.4055 | CIE X 0.4406 0.4361 0.4420 0.4468 | CIE Y 0.4055 0.3964 0.3985 0.4077 |
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| CIE X 0.4223 0.4185 0.4243 0.4284 CIE X 0.4243 | CIE Y 0.3990 0.3902 0.3922 0.4011 14 CIE Y 0.3922 | CIE X 0.4284 0.4243 0.4302 0.4345 G CIE X 0.4302 | CIE Y 0.4011 0.3922 0.3943 0.4033 24 CIE Y 0.3943 | CIE X 0.4345 0.4302 0.4361 0.4406 CIE X 0.4302 | CIE Y 0.4033 0.3943 0.3964 0.4055 34 CIE Y 0.3943 | CIE X 0.4406 0.4361 0.4420 0.4468 CIE X 0.4361 | CIE Y 0.4055 0.3964 0.3985 0.4077 44 CIE Y 0.3964 |
| CIE X 0.4223 0.4185 0.4243 0.4284 G' CIE X 0.4243 0.4203 | CIE Y 0.3990 0.3902 0.3922 0.4011 14 CIE Y 0.3922 0.3834 | CIE X 0.4284 0.4243 0.4302 0.4345 G CIE X 0.4302 0.4259 | CIE Y 0.4011 0.3922 0.3943 0.4033 24 CIE Y 0.3943 0.3853 | CIE X 0.4345 0.4302 0.4361 0.4406 CIE X 0.4302 0.4259 | CIE Y 0.4033 0.3943 0.3964 0.4055 34 CIE Y 0.3943 0.3853 | CIE X 0.4406 0.4361 0.4420 0.4468 G4 CIE X 0.4361 0.4316 | CIE Y 0.4055 0.3964 0.3985 0.4077 44 CIE Y 0.3964 0.3873 |

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Color Bin Structure



CIE Chromaticity Diagram (Warm White), I_{F} = 100mA, T_{j} = 25°C

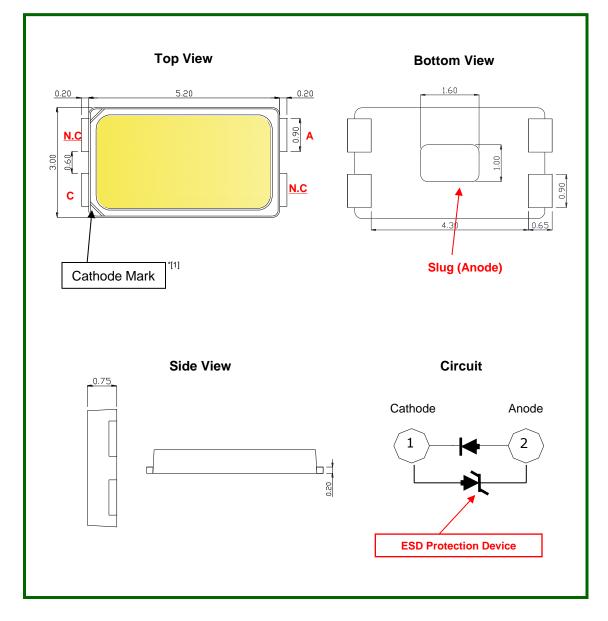
| H1 | 11 | H | 21 | H | 31 | H | 41 | |
|--|--|---|--|---|--|--|--|--|
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | |
| 0.4562 | 0.4260 | 0.4625 | 0.4275 | 0.4687 | 0.4289 | 0.4750 | 0.4304 | |
| 0.4515 | 0.4168 | 0.4575 | 0.4182 | 0.4636 | 0.4197 | 0.4697 | 0.4211 | |
| 0.4575 | 0.4182 | 0.4636 | 0.4197 | 0.4697 | 0.4211 | 0.4758 | 0.4225 | |
| 0.4625 | 0.4275 | 0.4687 | 0.4289 | 0.4750 | 0.4304 | 0.4810 | 0.4319 | |
| H1 | H12 | | 22 | H32 | | H | H42 | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | |
| 0.4515 | 0.4168 | 0.4575 | 0.4182 | 0.4636 | 0.4197 | 0.4697 | 0.4211 | |
| 0.4468 | 0.4077 | 0.4526 | 0.4090 | 0.4585 | 0.4104 | 0.4644 | 0.4118 | |
| 0.4526 | 0.4090 | 0.4585 | 0.4104 | 0.4644 | 0.4118 | 0.4703 | 0.4132 | |
| 0.4575 | 0.4182 | 0.4636 | 0.4197 | 0.4697 | 0.4211 | 0.4758 | 0.4225 | |
| | | | | | | | | |
| H1 | 13 | H | 23 | H | 33 | H4 | 43 | |
| CIE X | I3 CIE Y | H: CIE X | 23 CIE Y | H: CIE X | 33 CIE Y | CIE X | 43 CIE Y | |
| | | | | | | | | |
| CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | CIE X | CIE Y | |
| CIE X 0.4468 | CIE Y 0.4077 | CIE X 0.4526 | CIE Y 0.4090 | CIE X 0.4585 | CIE Y 0.4104 | CIE X 0.4644 | CIE Y 0.4118 | |
| CIE X 0.4468 0.4420 | CIE Y 0.4077 0.3985 | CIE X 0.4526 0.4477 | CIE Y 0.4090 0.3998 | CIE X 0.4585 0.4534 | CIE Y 0.4104 0.4012 | CIE X 0.4644 0.4591 | CIE Y 0.4118 0.4025 | |
| CIE X 0.4468 0.4420 0.4477 | CIE Y 0.4077 0.3985 0.3998 0.4090 | CIE X 0.4526 0.4477 0.4534 | CIE Y 0.4090 0.3998 0.4012 0.4104 | CIE X 0.4585 0.4534 0.4591 | CIE Y 0.4104 0.4012 0.4025 0.4118 | CIE X 0.4644 0.4591 0.4648 | CIE Y 0.4118 0.4025 0.4038 0.4132 | |
| CIE X 0.4468 0.4420 0.4477 0.4526 | CIE Y 0.4077 0.3985 0.3998 0.4090 | CIE X 0.4526 0.4477 0.4534 0.4585 | CIE Y 0.4090 0.3998 0.4012 0.4104 | CIE X 0.4585 0.4534 0.4591 0.4644 | CIE Y 0.4104 0.4012 0.4025 0.4118 | CIE X 0.4644 0.4591 0.4648 0.4703 | CIE Y 0.4118 0.4025 0.4038 0.4132 | |
| CIE X 0.4468 0.4420 0.4477 0.4526 H1 | CIE Y 0.4077 0.3985 0.3998 0.4090 | CIE X 0.4526 0.4477 0.4534 0.4585 H: | CIE Y 0.4090 0.3998 0.4012 0.4104 24 | CIE X 0.4585 0.4534 0.4591 0.4644 H3 | CIE Y 0.4104 0.4012 0.4025 0.4118 34 | CIE X 0.4644 0.4591 0.4648 0.4703 H4 | CIE Y 0.4118 0.4025 0.4038 0.4132 | |
| CIE X 0.4468 0.4420 0.4477 0.4526 H ¹ CIE X | CIE Y 0.4077 0.3985 0.3998 0.4090 14 CIE Y | CIE X 0.4526 0.4477 0.4534 0.4585 H CIE X | CIE Y 0.4090 0.3998 0.4012 0.4104 24 CIE Y | CIE X 0.4585 0.4534 0.4591 0.4644 H3 CIE X | CIE Y 0.4104 0.4012 0.4025 0.4118 34 CIE Y | CIE X 0.4644 0.4591 0.4648 0.4703 H4 CIE X | CIE Y 0.4118 0.4025 0.4038 0.4132 44 CIE Y | |
| CIE X 0.4468 0.4420 0.4477 0.4526 H1 CIE X 0.4420 | CIE Y 0.4077 0.3985 0.3998 0.4090 14 CIE Y 0.3985 | CIE X 0.4526 0.4477 0.4534 0.4585 H CIE X 0.4477 | CIE Y 0.4090 0.3998 0.4012 0.4104 24 CIE Y 0.3998 | CIE X 0.4585 0.4534 0.4591 0.4644 CIE X 0.4534 | CIE Y 0.4104 0.4012 0.4025 0.4118 34 CIE Y 0.4012 | CIE X 0.4644 0.4591 0.4648 0.4703 H4 CIE X 0.4591 | CIE Y 0.4118 0.4025 0.4038 0.4132 44 CIE Y 0.4025 | |
| CIE X 0.4468 0.4420 0.4477 0.4526 H1 CIE X 0.4420 0.4373 | CIE Y 0.4077 0.3985 0.3998 0.4090 14 CIE Y 0.3985 0.3893 | CIE X 0.4526 0.4477 0.4534 0.4585 H CIE X 0.4477 0.4428 | CIE Y 0.4090 0.3998 0.4012 0.4104 24 CIE Y 0.3998 0.3906 | CIE X 0.4585 0.4534 0.4591 0.4644 K CIE X 0.4534 0.4483 | CIE Y 0.4104 0.4012 0.4025 0.4118 84 CIE Y 0.4012 0.3919 | CIE X 0.4644 0.4591 0.4648 0.4703 H4 CIE X 0.4591 0.4538 | CIE Y 0.4118 0.4025 0.4038 0.4132 44 CIE Y 0.4025 0.3932 | |

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STW8Q14C – Mid-Power LED

Mechanical Dimensions



(1) All dimensions are in millimeters.

- (2) Scale : none
- (3) Undefined tolerance is ± 0.1 mm

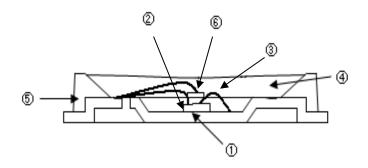
(4) The LED package has two Cathode Marks. *[1]

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STW8Q14C – Mid-Power LED

Material Structure

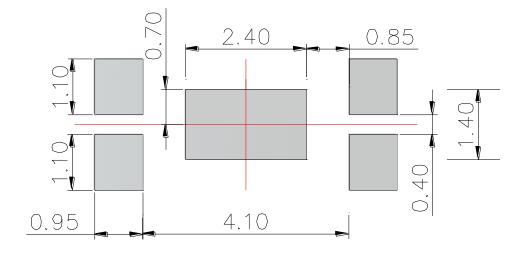


| Parts No. | Name | Description | Materials |
|-----------|---------------|----------------|---------------------------------|
| 1 | LEAD FRAME | Metal | Copper Alloy (Silver Plated) |
| 2 | Chip Source | Blue LED | GaN on Sapphire |
| 3 | Wire | Metal | Gold Wire |
| 4 | Encapsulation | Silicone | +Phosphor |
| 5 | Body | Thermo Plastic | Heat-resistant Polymer |
| 6 | Zener Diode | Si | - |



STW8Q14C – Mid-Power LED

Recommended Solder Pad



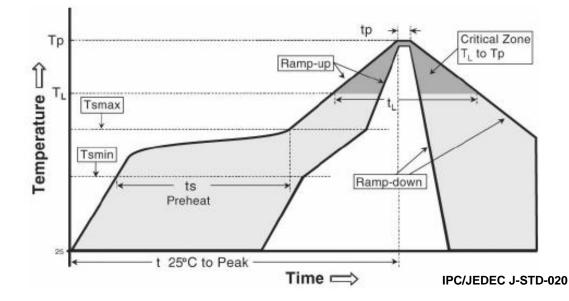
Notes :

- (1) All dimensions are in millimeters.
- (2) Scale : none
- (3) This drawing without tolerances are for reference only.
- (4) Undefined tolerance is ± 0.1 mm.

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STW8Q14C – Mid-Power LED

Reflow Soldering Characteristics



| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|---|----------------------------------|----------------------------------|
| Average ramp-up rate (Tsmax to Tp) | 3° C/second max. | 3° C/second max. |
| Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (Tsmin to Tsmax) (ts) | 100 ℃ 150 ℃ 60-120 seconds | 150 ℃ 200 ℃ 60-180 seconds |
| Time maintained above: - Temperature (TL) - Time (tL) | 183 ℃ 60-150 seconds | 217 °C 60-150 seconds |
| Peak Temperature (Tp) | 215℃ | 260 ℃ |
| Time within 5°C of actual Peak Temperature (tp)2 | 10-30 seconds | 20-40 seconds |
| Ramp-down Rate | 6 °C/second max. | 6 °C/second max. |
| Time 25°C to Peak Temperature | 6 minutes max. | 8 minutes max. |

Caution

- (1) Reflow soldering is recommended not to be done more than two times. In the case of more than 24 hours passed soldering after first, LEDs will be damaged.
- (2) Repairs should not be done after the LEDs have been soldered. When repair is unavoidable, suitable tools must be used.
- (3) Die slug is to be soldered.
- (4) When soldering, do not put stress on the LEDs during heating.
- (5) After soldering, do not warp the circuit board.

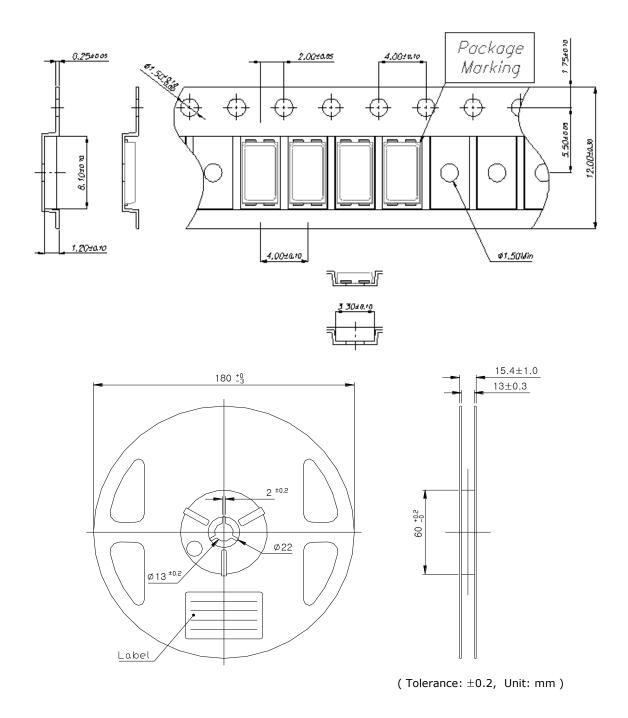
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STW8Q14C – Mid-Power LED

Emitter Tape & Reel Packaging

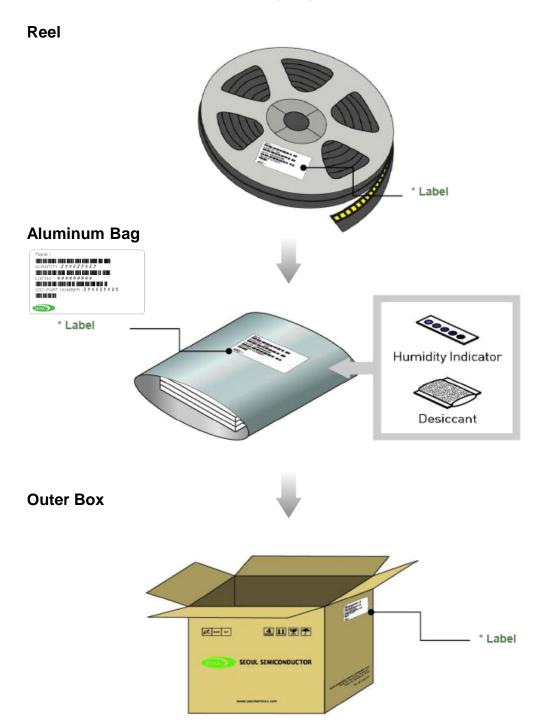


- (1) Quantity : Max 3,500pcs/Reel
- (2) Cumulative Tolerance : Cumulative Tolerance/10 pitches to be \pm 0.2mm
- (3) Adhesion Strength of Cover Tape
- Adhesion strength to be 0.1-0.7N when the cover tape is turned off from the carrier tape at the angle of 10° to the carrier tape.
- (4) Package : P/N, Manufacturing data Code No. and Quantity to be indicated on a damp proof Package.





Emitter Tape & Reel Packaging



Product Nomenclature

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Table 6. Part Numbering System : X₁X₂X₃X₄X₅X₆X₇X₈

| Part Number Code | Description | Part Number | Value |
|-------------------------------|---------------------|-------------|----------|
| X ₁ | Company | S | |
| X ₂ | Top View LED series | Т | |
| X ₃ X ₄ | Color Specification | W8 | CRI 80 |
| X ₅ | Package series | Q | Q series |
| X ₆ X ₇ | Characteristic code | 14 | |
| X ₈ | Revision | С | |

Table 7. Lot Numbering System $:Y_1Y_2Y_3Y_4Y_5Y_6Y_7Y_8Y_9Y_{10}-Y_{11}Y_{12}Y_{13}Y_{14}Y_{15}Y_{16}Y_{17}$

| Lot Number Code | Description | Lot Number | Value |
|--|---------------------|------------|-------|
| Y ₁ Y ₂ | Year | | |
| Y ₃ | Month | | |
| Y ₄ Y ₅ | Day | | |
| Y ₆ | Top View LED series | | |
| Y ₇ Y ₈ Y ₉ Y ₁₀ | Mass order | | |
| $Y_{11}Y_{12}Y_{13}Y_{14}Y_{15}Y_{16}Y_{17}$ | Internal Number | | |

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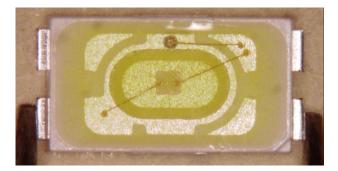
STW8Q14C – Mid-Power LED

Handling of Silicone Resin for LEDs

(1) During processing, mechanical stress on the surface should be minimized as much as possible. Sharp objects of all types should not be used to pierce the sealing compound.



(2) In general, LEDs should only be handled from the side. By the way, this also applies to LEDs without a silicone sealant, since the surface can also become scratched.



(3) When populating boards in SMT production, there are basically no restrictions regarding the form of the pick and place nozzle, except that mechanical pressure on the surface of the resin must be prevented. This is assured by choosing a pick and place nozzle which is larger than the LED's reflector area.

(4) Silicone differs from materials conventionally used for the manufacturing of LEDs. These conditions must be considered during the handling of such devices. Compared to standard encapsulants, silicone is generally softer, and the surface is more likely to attract dust.

As mentioned previously, the increased sensitivity to dust requires special care during processing. In cases where a minimal level of dirt and dust particles cannot be guaranteed, a suitable cleaning solution must be applied to the surface after the soldering of components.

(5) Seoul Semiconductor suggests using isopropyl alcohol for cleaning. In case other solvents are used, it must be assured that these solvents do not dissolve the package or resin. Ultrasonic cleaning is not recommended. Ultrasonic cleaning may cause damage to the LED.

(6) Please do not mold this product into another resin (epoxy, urethane, etc) and do not handle this. product with acid or sulfur material in sealed space.

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STW8Q14C – Mid-Power LED

Precaution for Use

(1) Storage

To avoid the moisture penetration, we recommend store in a dry box with a desiccant. The recommended storage temperature range is 5 \degree to 30 \degree and a maximum humidity of RH50%.

(2) Use Precaution after Opening the Packaging

Use proper SMT techniques when the LED is to be soldered dipped as separation of the lens may affect the light output efficiency.

- Pay attention to the following:
- a. Recommend conditions after opening the package
 - Sealing
 - Temperature : 5 ~ 30 $^\circ\!\! C$ Humidity : less than RH60%
- b. If the package has been opened more than 4 week(MSL_2a) or the color of the desiccant changes, components should be dried for 10-12hr at $60\pm5\,^\circ$ C
- (3) Do not apply mechanical force or excess vibration during the cooling process to normal temperature after soldering.
- (4) Do not rapidly cool device after soldering.
- (5) Components should not be mounted on warped (non coplanar) portion of PCB.
- (6) Radioactive exposure is not considered for the products listed here in.
- (7) Gallium arsenide is used in some of the products listed in this publication.These products are dangerous if they are burned or shredded in the process of disposal.It is also dangerous to drink the liquid or inhale the gas generated by such products when chemically disposed of.
- (8) This device should not be used in any type of fluid such as water, oil, organic solvent and etc. When washing is required, IPA (Isopropyl Alcohol) should be used.
- (9) When the LEDs are in operation the maximum current should be decided after measuring the package temperature.



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- (10) The appearance and specifications of the product may be modified for improvement without notice.
- (11) Long time exposure of sunlight or occasional UV exposure will cause lens discoloration.
- (12) VOCs (Volatile organic compounds) emitted from materials used in the construction of fixtures can penetrate silicone encapsulants of LEDs and discolor when exposed to heat and photonic energy. The result can be a significant loss of light output from the fixture. Knowledge of the properties of the materials selected to be used in the construction of fixtures can help prevent these issues.
- (13) Attaching LEDs, do not use adhesives that outgas organic vapor.
- (14) The driving circuit must be designed to allow forward voltage only when it is ON or OFF. If the reverse voltage is applied to LED, migration can be generated resulting in LED damage.
- (15) Similar to most Solid state devices;

LEDs are sensitive to Electro-Static Discharge (ESD) and Electrical Over Stress (EOS). Below is a list of suggestions that Seoul Semiconductor purposes to minimize these effects.

a. ESD (Electro Static Discharge)

Electrostatic discharge (ESD) is the defined as the release of static electricity when two objects come into contact. While most ESD events are considered harmless, it can be an expensive problem in many industrial environments during production and storage. The damage from ESD to an LEDs may cause the product to demonstrate unusual characteristics such as:

- Increase in reverse leakage current lowered turn-on voltage
- Abnormal emissions from the LED at low current

The following recommendations are suggested to help minimize the potential for an ESD event. One or more recommended work area suggestions:

- Ionizing fan setup
- ESD table/shelf mat made of conductive materials
- ESD safe storage containers

One or more personnel suggestion options:

- Antistatic wrist-strap
- Antistatic material shoes
- Antistatic clothes

Environmental controls:

- Humidity control (ESD gets worse in a dry environment)





Precaution for Use

b. EOS (Electrical Over Stress)

Electrical Over-Stress (EOS) is defined as damage that may occur when an electronic device is subjected to a current or voltage that is beyond the maximum specification limits of the device. The effects from an EOS event can be noticed through product performance like:

- Changes to the performance of the LED package

(If the damage is around the bond pad area and since the package is completely encapsulated the package may turn on but flicker show severe performance degradation.)

- Changes to the light output of the luminaire from component failure
- Components on the board not operating at determined drive power

Failure of performance from entire fixture due to changes in circuit voltage and current across total circuit causing trickle down failures. It is impossible to predict the failure mode of every LED exposed to electrical overstress as the failure modes have been investigated to vary, but there are some common signs that will indicate an EOS event has occurred:

- Damaged may be noticed to the bond wires (appearing similar to a blown fuse)
- Damage to the bond pads located on the emission surface of the LED package
- (shadowing can be noticed around the bond pads while viewing through a microscope)
- Anomalies noticed in the encapsulation and phosphor around the bond wires
- This damage usually appears due to the thermal stress produced during the EOS event

c. To help minimize the damage from an EOS event Seoul Semiconductor recommends utilizing:

- A surge protection circuit
- An appropriately rated over voltage protection device
- A current limiting device



Company Information

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Company Information

Seoul Semiconductor (www.SeoulSemicon.com) manufacturers and packages a wide selection of light emitting diodes (LEDs) for the automotive, general illumination/lighting, Home appliance, signage and back lighting markets. The company is the world's fifth largest LED supplier, holding more than 10,000 patents globally, while offering a wide range of LED technology and production capacity in areas such as "nPola", "Acrich", the world's first commercially produced AC LED, and "Acrich MJT - Multi-Junction Technology" a proprietary family of high-voltage LEDs.

The company's broad product portfolio includes a wide array of package and device choices such as Acrich and Acirch2, high-brightness LEDs, mid-power LEDs, side-view LEDs, and through-hole type LEDs as well as custom modules, displays, and sensors.

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