**ALLIX Co., Ltd.**
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Jeollabuk-do, South Korea/ Postal Code : 54853
Tel : +82-63-214-8517/ E-Mail : allix@allixs.com



### Features

* External Dimensions : 17.85 x 17.85 x 1.5
* Internal Structure : Aluminum Base
* Luminous Flux : 2,150 lm @ 580 mA
* CRI : Typ. 96
* Thermal Resistance : 1.51 ℃/W

### Benefits

* MacAdam 3 step available including ANSI.
* Multi-chip Power Top View is ideal light sources for common illumination applications, customized solutions, and high performance lights.

### Applications

* Lighting Fixtures
* Industrial Lighting
* Architectural Lighting
* Interior Lighting

## COB Multi-chip Power Top View
## AM18CW-P20-A□□□□□

### Table of Contents





Document Revision V2. 2016.12.15

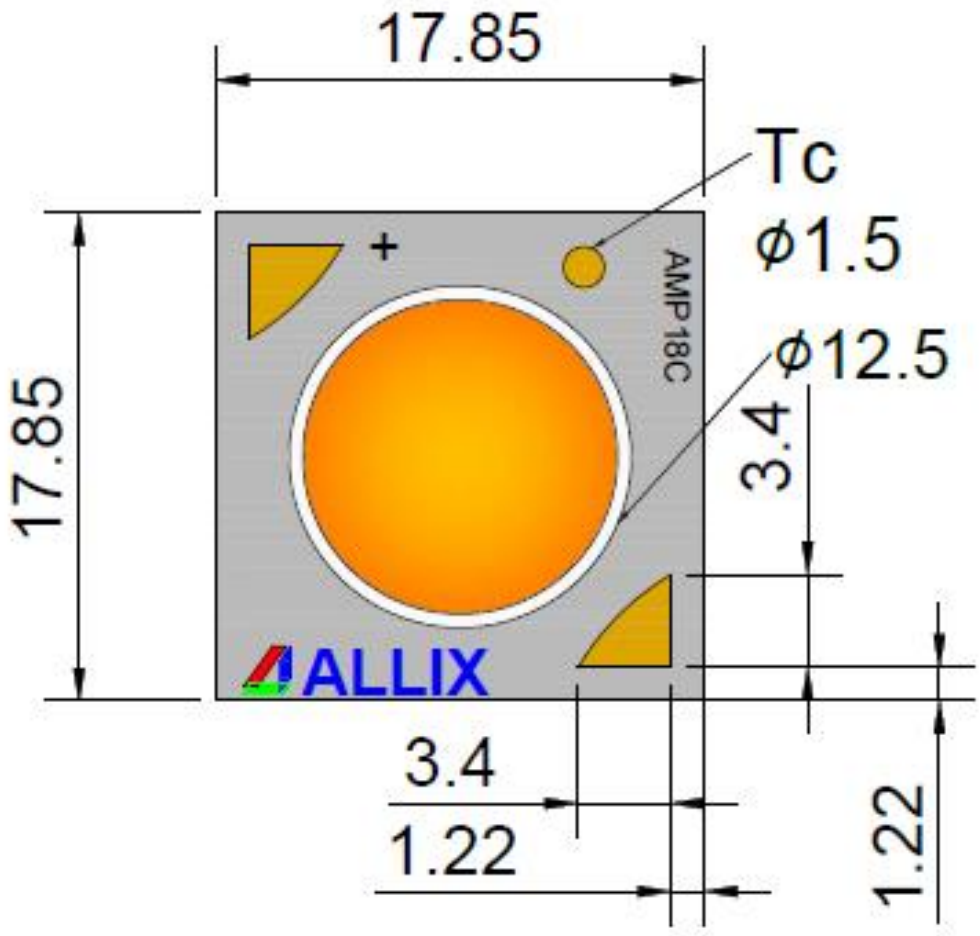
## 1. Part Number Description

**AM18CW – P20 – A□ □ □ □ - (XL)**

| | |
|---|---|
| **A** | ALLIX |
| **M** | Multi-Chip Power |
| **18C** | **PCB Size**<br>18C->17.85*17.85 |
| **w** | **Color**<br>ex) W -> White, P -> Pink, B -> Blue, R : Red<br>G -> Green |
| **P 00** | **Power Dissipation**<br>ex) P5.5 → 5.5W, P11 → 11W, P 13 → 13 watt |
| **A** | **Color Rendering Index**<br>A : High (Ra≥90), B : Medium (Ra=80~89),<br>C : Low (Ra≤79) |
| □ | **Color Rank(CCT) ANSI**<br>C : 6,500K, D : 5,700K, E : 5,000K, F : 4,500K,<br>G : 4,000K, H : 3,500K, I : 3,000K, J : 2,700K,<br>K : 2,500K, L : 2,200K, M : 2,000K |
| **L 0** | Luminous Intensity (Φv lm) |
| **XL** | XENOLED™400 |

## 2. Outer Dimension

* Unit : mm
* Tolerance is not directed: ± 0.1



## 3. Specifications

■ Absolute Maximum Ratings

($T_a$=25℃)

| Parameter | Symbol | Absolute Maximum Rating | Unit | Remark |
|---|---|---|---|---|
| Power Dissipation | $P_D$ | 40 | W | |
| Forward Current | $I_F$ | 1,200 | mA | |
| Reverse Current | $I_R$ | 1 | mA | |
| Operating Temperature | $T_{opr}$ | -30 to +85 | ℃ | |
| Storage Temperature | $T_{stg}$ | -40 to +100 | ℃ | |
| Junction Temperature | $T_j$ | 125 | ℃ | |

Note
* D.C Normally: $T_j = T_c + R_{j-c} * P_d$

■ Initial Electrical/Optical Characteristics

($T_a$=25℃)

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage | $V_F$ | $I_F$ =580㎃ | 35 | - | 37 | V |
| Luminous Flux | $\Phi_v$ | $I_F$ =580㎃ | - | 2,100 | - | lm |
| Optical Efficiency | $\eta_{elc}$ | $I_F$ =580㎃ | - | 104 | - | lm/W |
| Color Temperature | CCT | $I_F$ =580㎃ | - | 3,000 | - | K |
| Color Rendering Index(CRI) | $R_a$ | $I_F$ =580㎃ | - | 96 | - | |
| Thermal Resistance | $R_{j-c}$ | ★ | - | 1.51 | - | ℃/W |

Note ★ Junction-Case
* Forward Voltage Measurement allowance ± 3%
* Luminous Intensity or Luminous Flux Measurement allowance is ± 10%

## 4. Rank

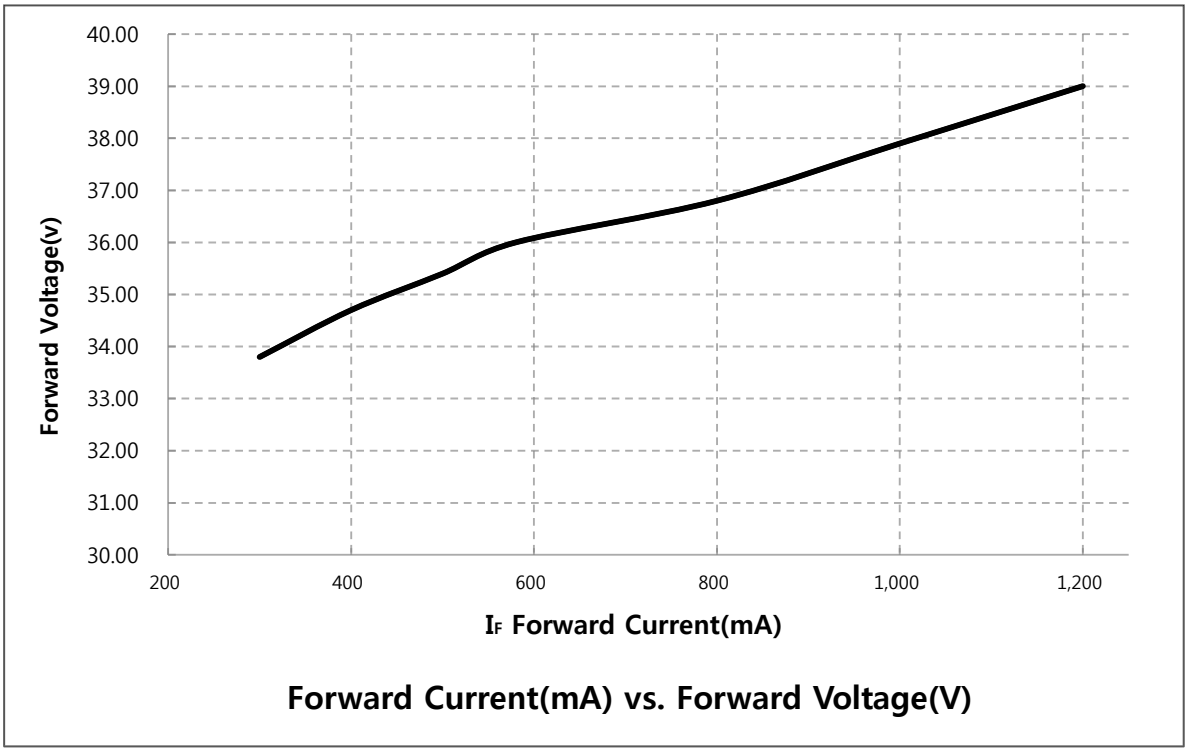
| CCT Range (K) | CRI | | Base Order Codes Min. Luminous Flux @580mA | | ANSI Rank | Mac-Adam 3step Rank | Device |
|---|---|---|---|---|---|---|---|
| | Min | Typ | Group | Flux(lm) @25℃ | Chromaticity Region | Chromaticity Region | |
| 6,500K | 93 | 95 | L29 | 2000-2200 | C | C1 | AM18CW-P20-AC1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AC1L28 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AC1L31 |
| | | | L32 | 2600-2800 | | | AM18CW-P20-AC1L32 |
| | | | L33 | 2800-3000 | | | AM18CW-P20-AC1L33 |
| 5,700K | 93 | 95 | L29 | 2000-2200 | D | D1 | AM18CW-P20-AD1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AD1L28 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AD1L31 |
| | | | L32 | 2600-2800 | | | AM18CW-P20-AD1L32 |
| | | | L33 | 2800-3000 | | | AM18CW-P20-AD1L33 |
| 5,000K | 94 | 96 | L29 | 2000-2200 | E | E1 | AM18CW-P20-AE1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AE1L28 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AE1L31 |
| | | | L32 | 2600-2800 | | | AM18CW-P20-AE1L32 |
| | | | L33 | 2800-3000 | | | AM18CW-P20-AE1L33 |
| 4,500K | 95 | 96 | L29 | 2000-2200 | F | F1 | AM18CW-P20-AF1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AF1L28 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AF1L31 |
| | | | L32 | 2600-2800 | | | AM18CW-P20-AF1L32 |
| | | | L33 | 2800-3000 | | | AM18CW-P20-AF1L33 |

| CCT Range (K) | CRI | | Base Order Codes Min. Luminous Flux @580mA | | ANSI Rank | Mac-Adam 3step Rank | Device |
|---|---|---|---|---|---|---|---|
| | Min | Typ | Group | Flux(lm) @25℃ | Chromaticity Region | Chromaticity Region | |
| 4,000K | 95 | 97 | L29 | 2000-2200 | G | G1 | AM18CW-P20-AG1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AG1L28 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AG1L31 |
| | | | L32 | 2600-2800 | | | AM18CW-P20-AG1L32 |
| | | | L33 | 2800-3000 | | | AM18CW-P20-AG1L33 |
| 3,500K | 95 | 97 | L27 | 1800-1900 | H | H1 | AM18CW-P20-AH1L27 |
| | | | L28 | 1900-2000 | | | AM18CW-P20-AH1L28 |
| | | | L29 | 2000-2200 | | | AM18CW-P20-AH1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AH1L30 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AH1L31 |
| 3,000K | 95 | 97 | L27 | 1800-1900 | I | I1 | AM18CW-P20-AI1L27 |
| | | | L28 | 1900-2000 | | | AM18CW-P20-AI1L28 |
| | | | L29 | 2000-2200 | | | AM18CW-P20-AI1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AI1L30 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AI1L31 |
| 2,700K | 95 | 97 | L27 | 1800-1900 | J | J1 | AM18CW-P20-AJ1L27 |
| | | | L28 | 1900-2000 | | | AM18CW-P20-AJ1L28 |
| | | | L29 | 2000-2200 | | | AM18CW-P20-AJ1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AJ1L30 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AJ1L31 |

| CCT Range (K) | CRI | | Base Order Codes Min. Luminous Flux @580mA | | ANSI Rank | Mac-Adam 3step Rank | Device |
|---|---|---|---|---|---|---|---|
| | Min | Typ | Group | Flux(lm) @25℃ | Chromaticity Region | Chromaticity Region | |
| 2,500K | 95 | 97 | L27 | 1800-1900 | K | K1 | AM18CW-P20-AK1L27 |
| | | | L28 | 1900-2000 | | | AM18CW-P20-AK1L28 |
| | | | L29 | 2000-2200 | | | AM18CW-P20-AK1L29 |
| | | | L30 | 2200-2400 | | | AM18CW-P20-AK1L30 |
| | | | L31 | 2400-2600 | | | AM18CW-P20-AK1L31 |
| 2,200K | 95 | 97 | L25 | 1600-1700 | L | L1 | AM18CW-P20-AL1L25 |
| | | | L26 | 1700-1800 | | | AM18CW-P20-AL1L26 |
| | | | L27 | 1800-1900 | | | AM18CW-P20-AL1L27 |
| | | | L28 | 1900-2000 | | | AM18CW-P20-AL1L28 |
| | | | L29 | 2000-2200 | | | AM18CW-P20-AL1L29 |
| 2,000K | 95 | 97 | L25 | 1600-1700 | M | M1 | AM18CW-P20-AM1L25 |
| | | | L26 | 1700-1800 | | | AM18CW-P20-AM1L26 |
| | | | L27 | 1800-1900 | | | AM18CW-P20-AM1L27 |
| | | | L28 | 1900-2000 | | | AM18CW-P20-AM1L28 |
| | | | L29 | 2000-2200 | | | AM18CW-P20-AM1L29 |

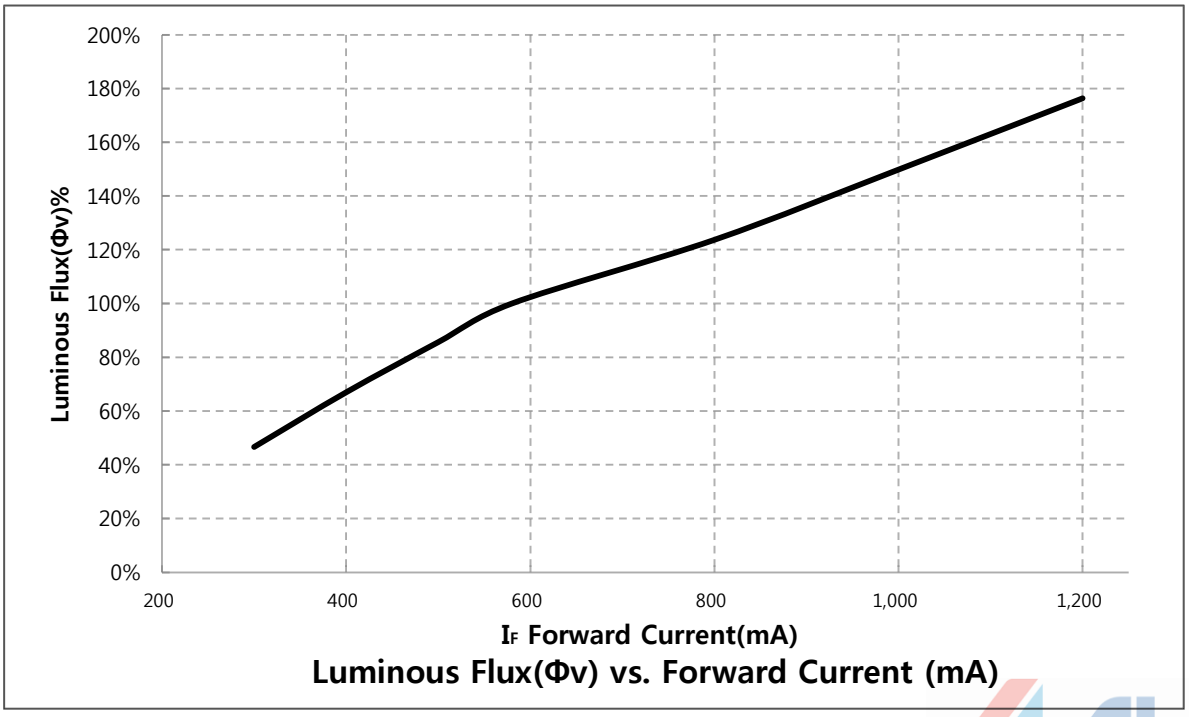
## 5. Characteristics Diagrams

($T_a$=25℃)



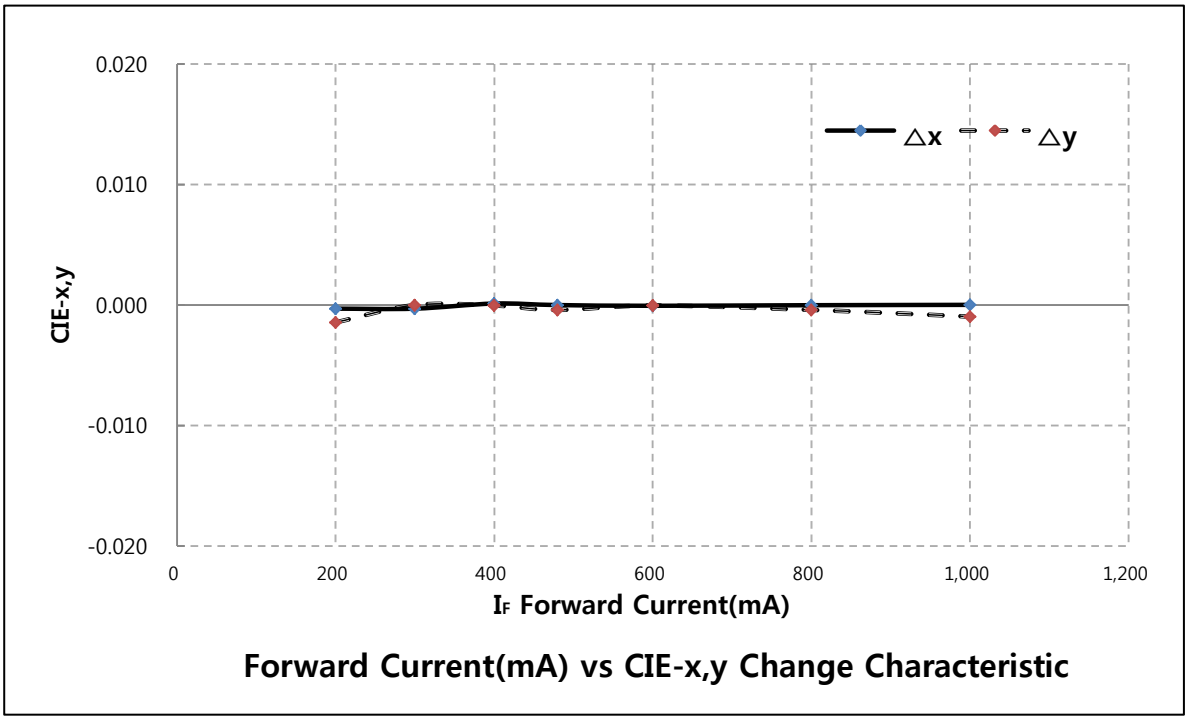

**Forward Current(mA) vs. Forward Voltage(V)**

($T_a$=25℃)



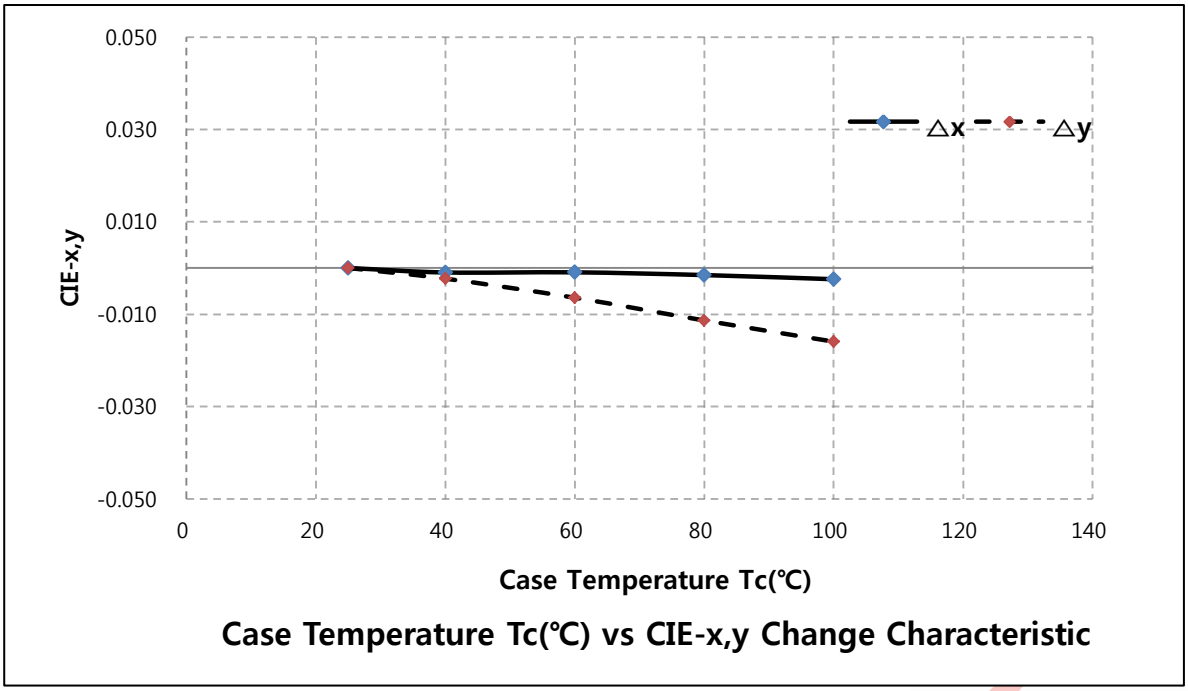

**Luminous Flux(Φv) vs. Forward Current (mA)**

($T_a$=25℃)



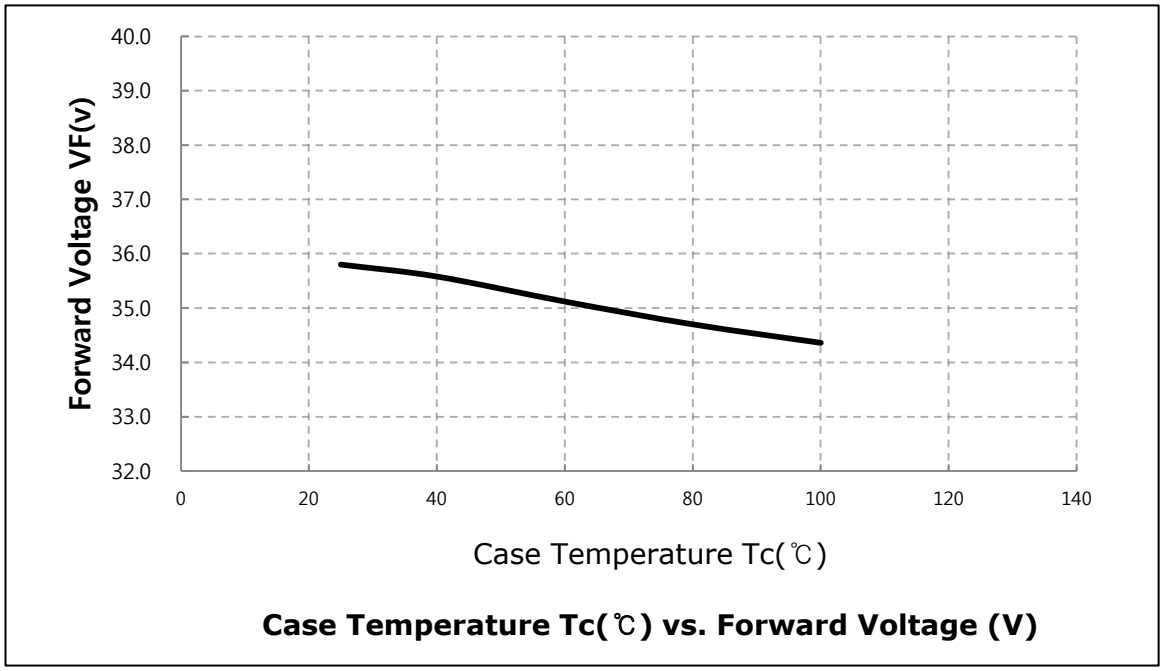

**Forward Current(mA) vs CIE-x,y Change Characteristic**

($I_F$=580mA)



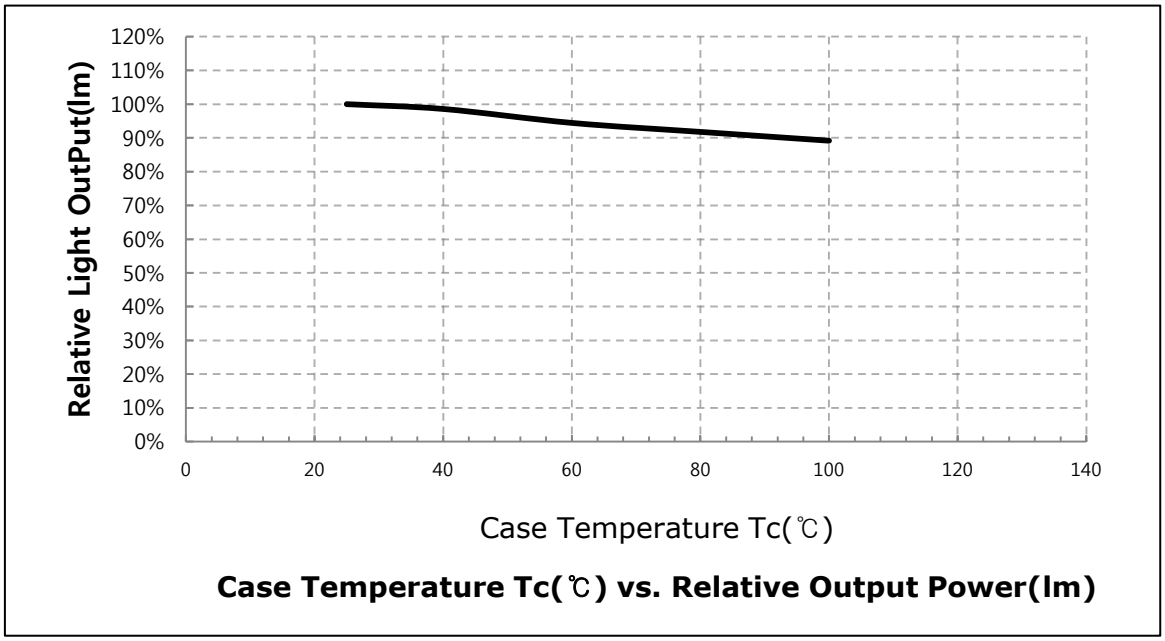

**Case Temperature Tc(℃) vs CIE-x,y Change Characteristic**

($I_F$=580mA)



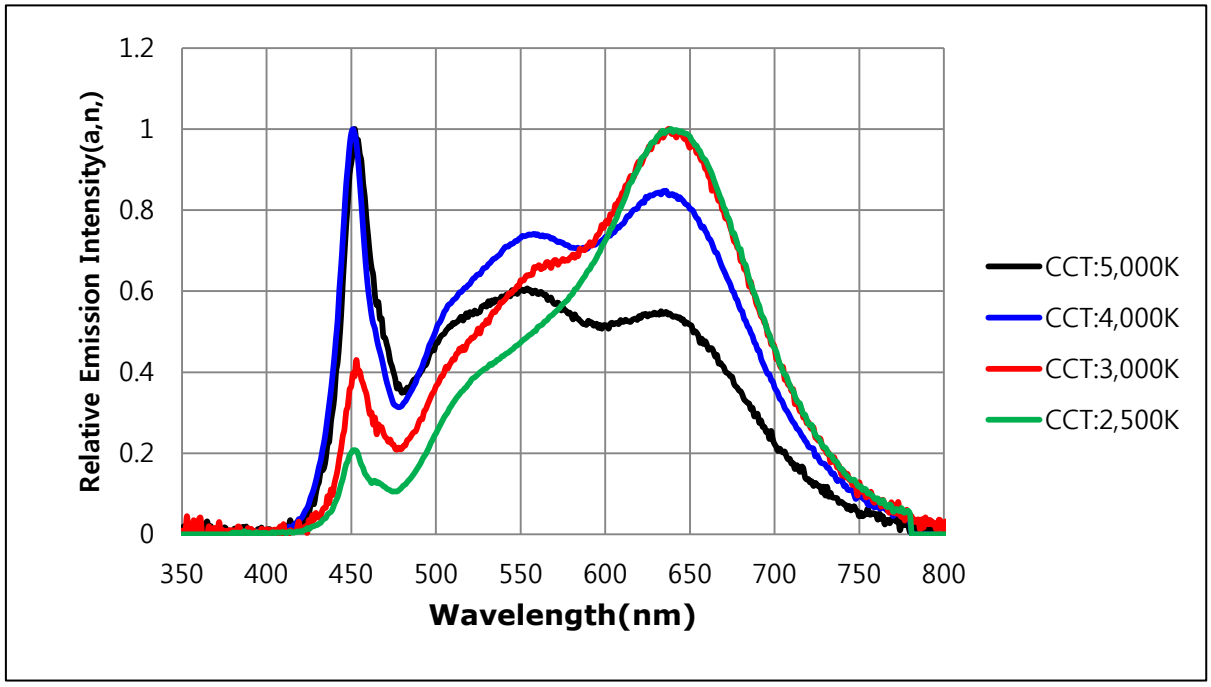

**Case Temperature Tc(℃) vs. Forward Voltage (V)**

($I_F$=580mA)

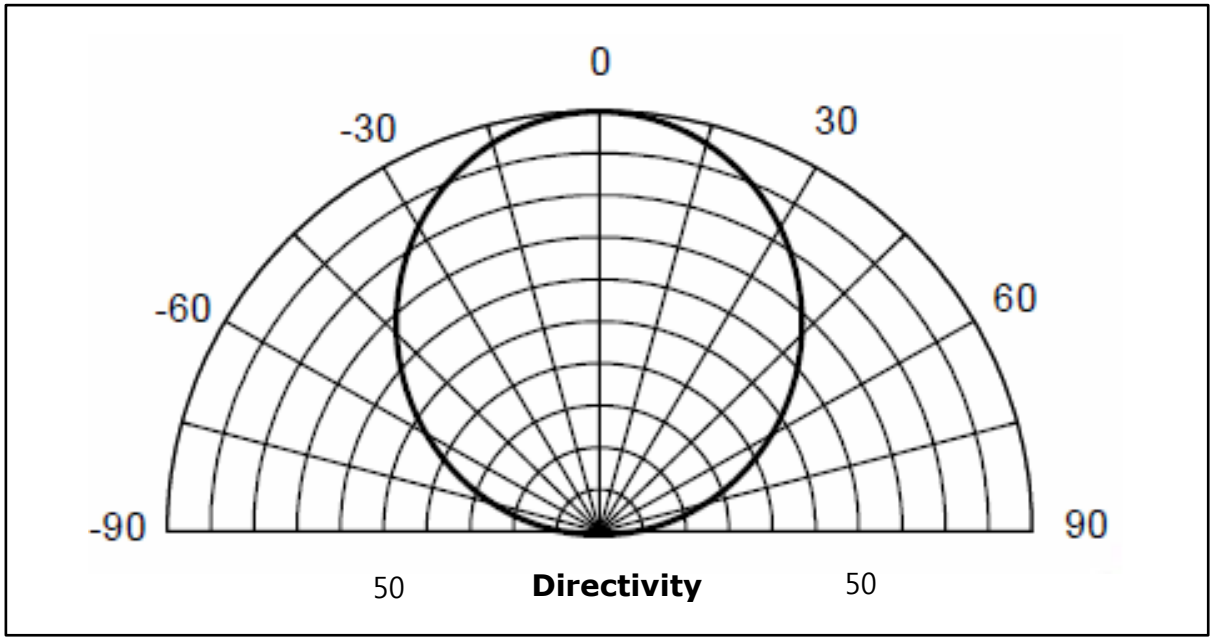


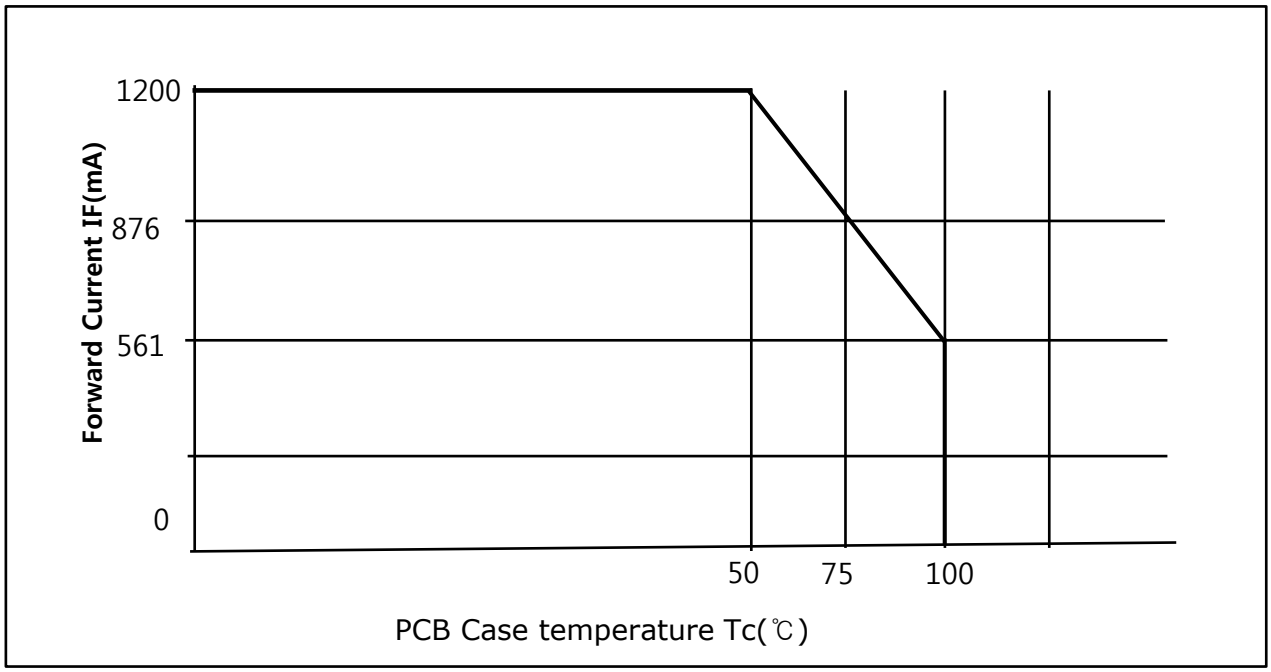

**Case Temperature Tc(℃) vs. Relative Output Power(lm)**

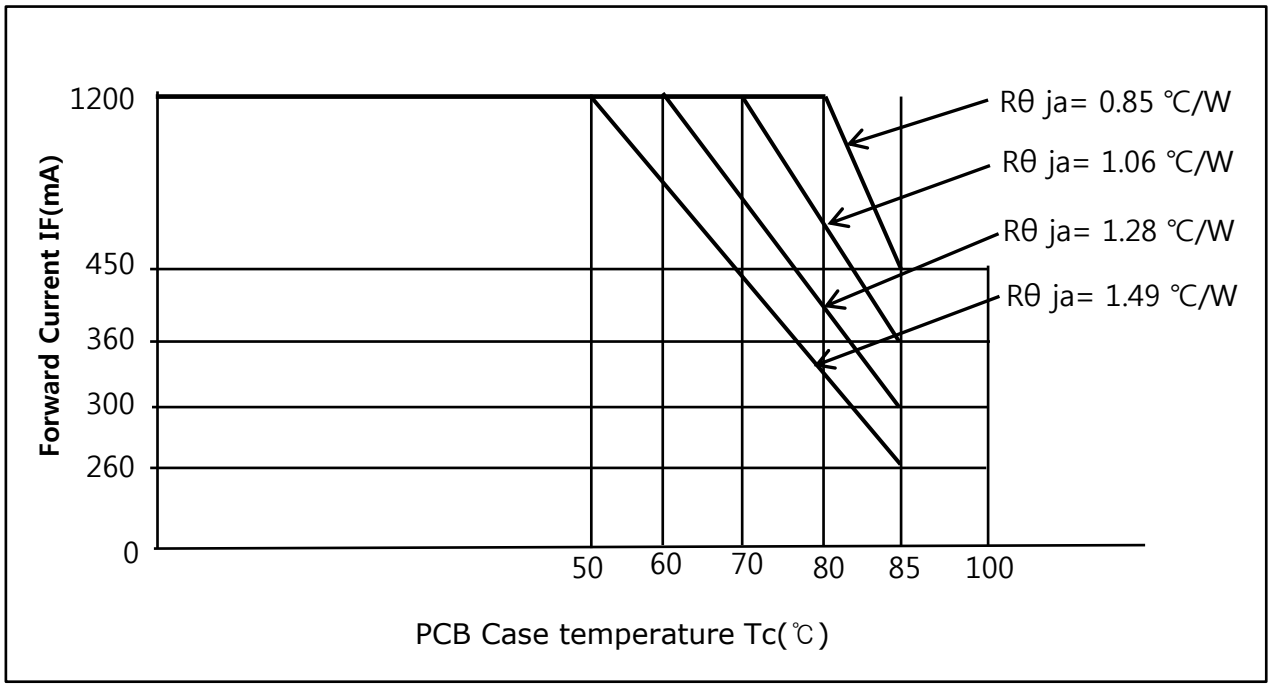
($I_F$=580mA)




($I_F$=580mA)



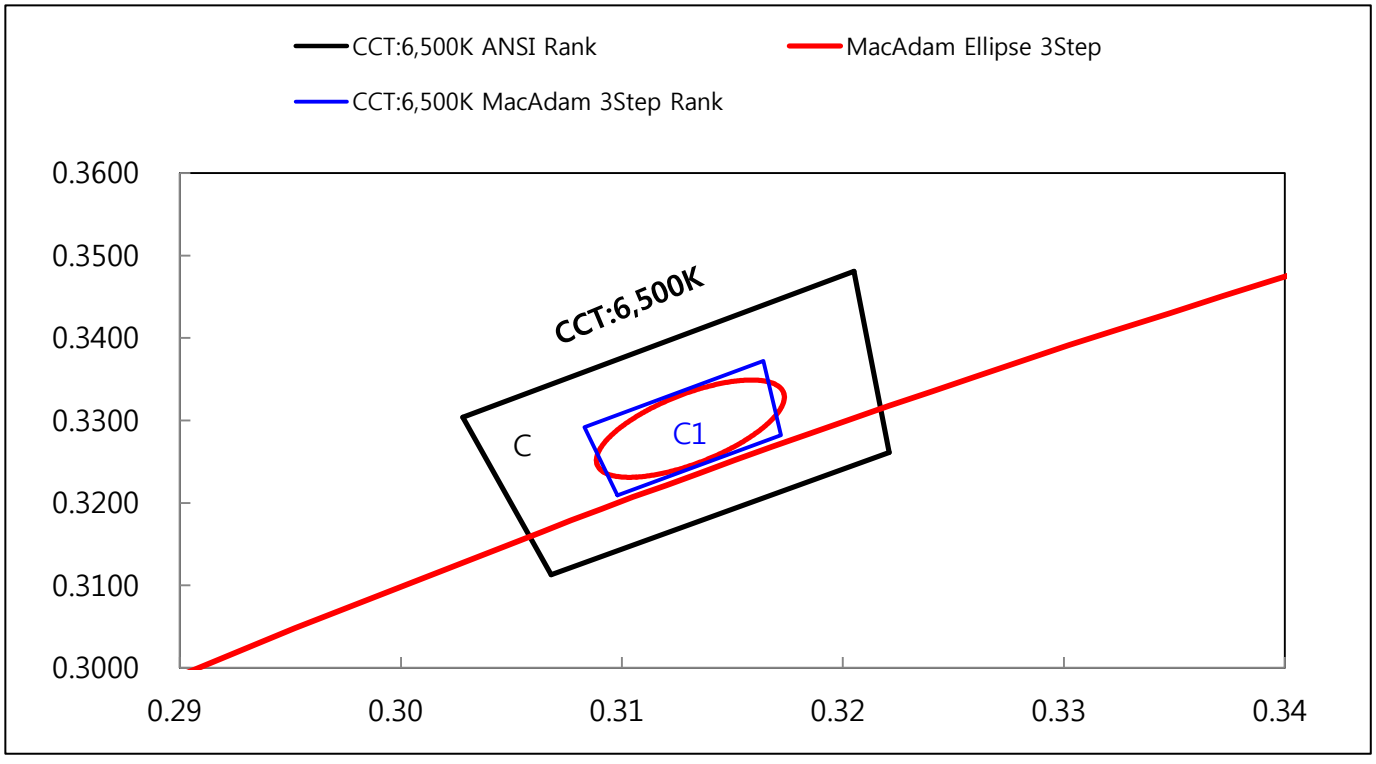


## 6. Color Rank

| CCT(K) | CIE-x,y Avg | | CCT : 6,500K | | CCT : 6,500K | |
|---|---|---|---|---|---|---|
| 6,500K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.3131 | 0.3290 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.3028 | 0.3304 | 0.3098 | 0.3209 |
| | Major Axis Distance a | 0.00223 | 0.3068 | 0.3113 | 0.3083 | 0.3292 |
| | Minor Axis Distance b | 0.00095 | 0.3221 | 0.3261 | 0.3164 | 0.3372 |
| | Angle θº | 58.57 | 0.3205 | 0.3481 | 0.3172 | 0.3282 |

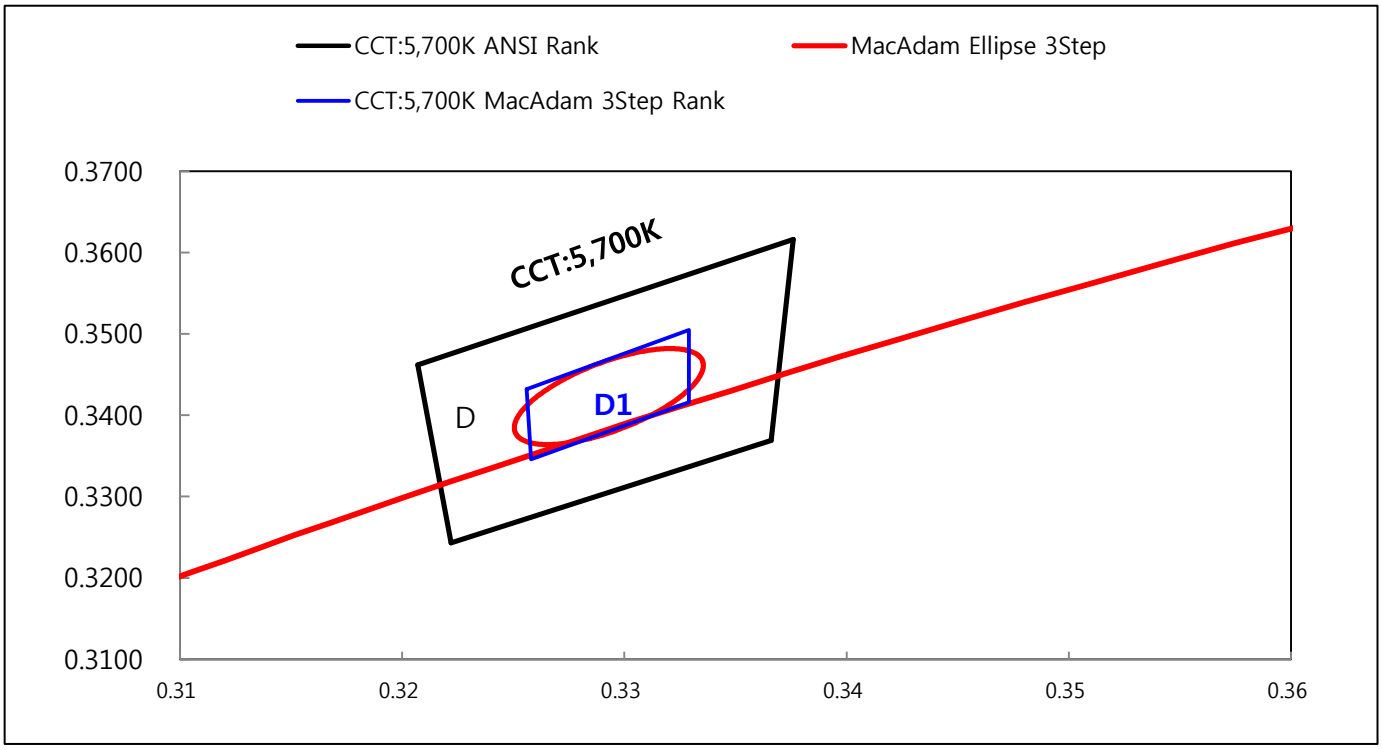
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 5,700K | | CCT : 5,700K | |
|---|---|---|---|---|---|---|
| 5,700K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.3293 | 0.3423 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.3207 | 0.3462 | 0.3256 | 0.3432 |
| | Major Axis Distance a | 0.00223 | 0.3222 | 0.3243 | 0.3258 | 0.3346 |
| | Minor Axis Distance b | 0.00095 | 0.3366 | 0.3369 | 0.3329 | 0.3416 |
| | Angle θº | 58.57 | 0.3376 | 0.3616 | 0.3329 | 0.3505 |

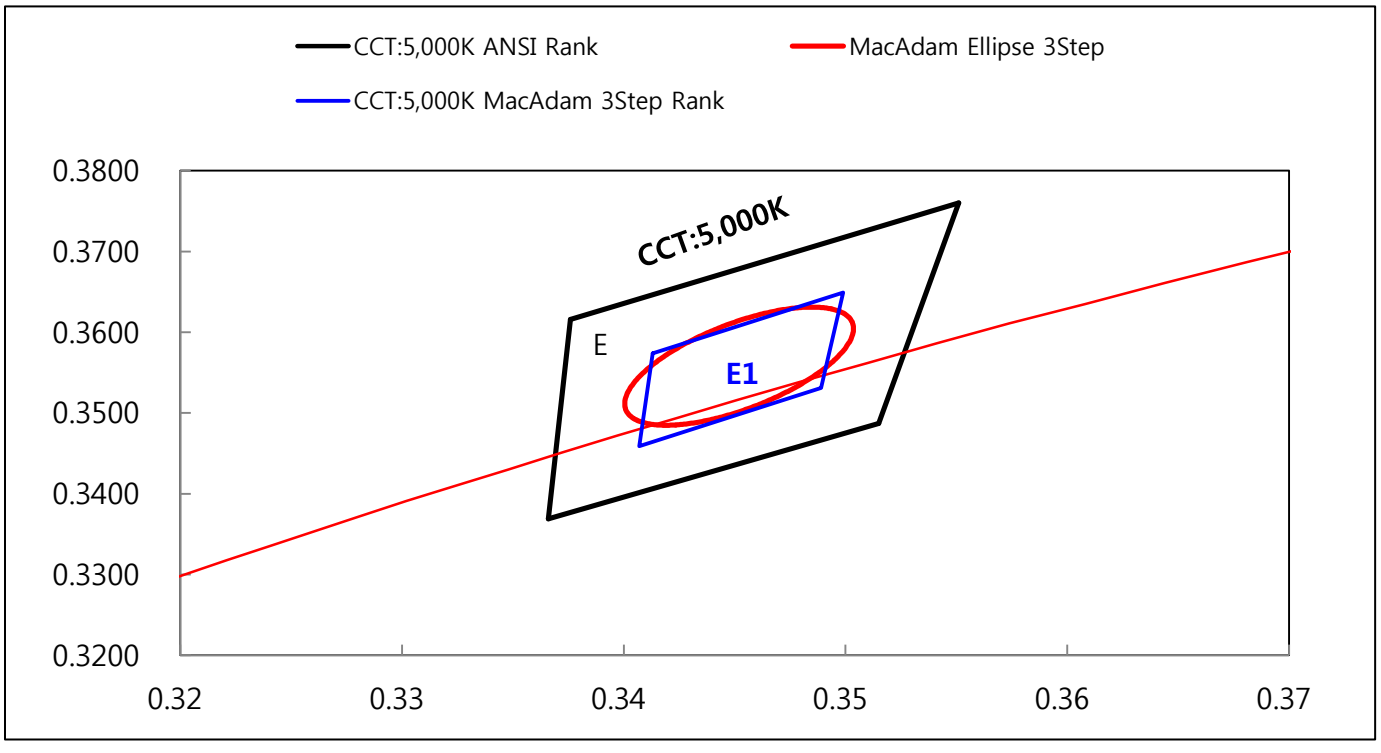
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 5,000K | | CCT : 5,000K | |
|---|---|---|---|---|---|---|
| 5,000K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.3452 | 0.3558 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.3376 | 0.3616 | 0.3413 | 0.3574 |
| | Major Axis Distance a | 0.00274 | 0.3366 | 0.3369 | 0.3407 | 0.3459 |
| | Minor Axis Distance b | 0.00118 | 0.3515 | 0.3487 | 0.3489 | 0.3531 |
| | Angle θº | 59.62 | 0.3551 | 0.3760 | 0.3499 | 0.3649 |

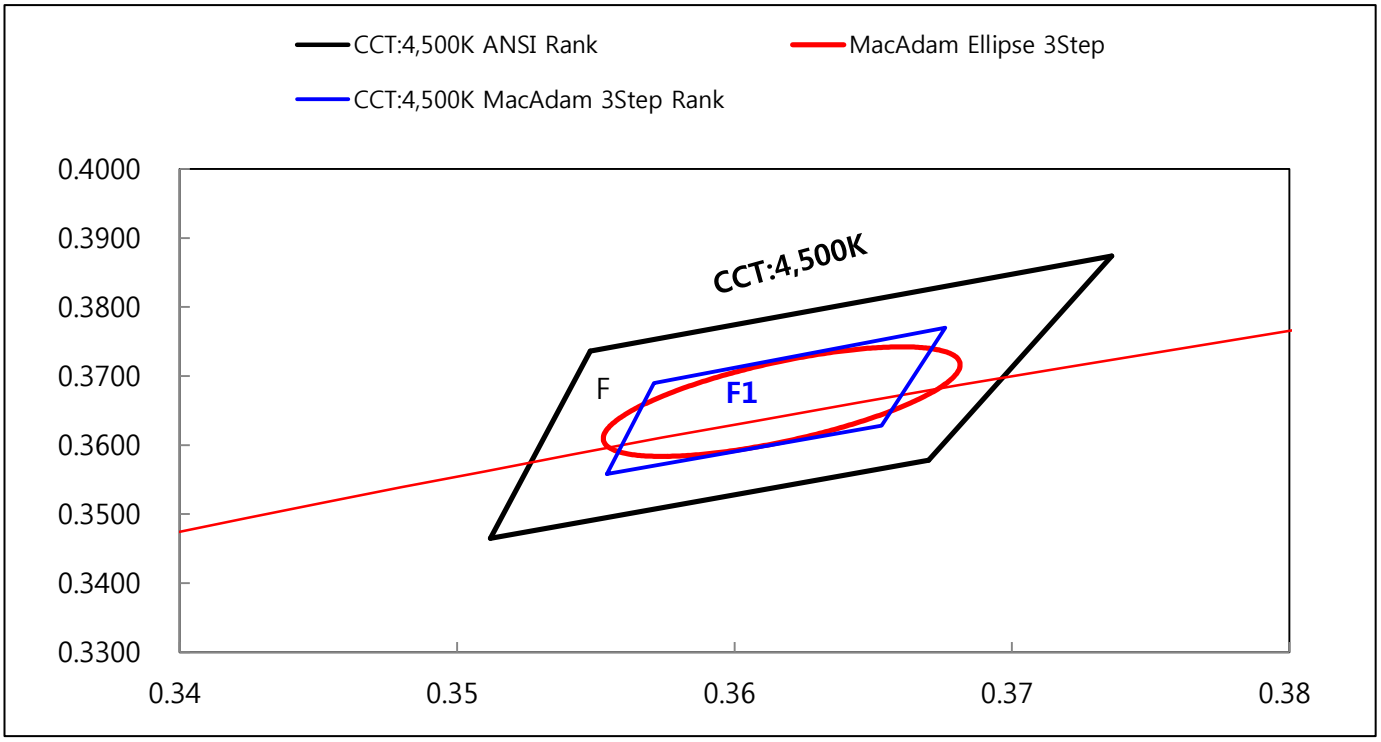
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 4,500K | | CCT : 4,500K | |
|---|---|---|---|---|---|---|
| 4,500K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.3617 | 0.3668 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.3548 | 0.3736 | 0.3554 | 0.3558 |
| | Major Axis Distance a | 0.00313 | 0.3512 | 0.3465 | 0.3571 | 0.3690 |
| | Minor Axis Distance b | 0.00134 | 0.3670 | 0.3578 | 0.3676 | 0.3770 |
| | Angle θº | 53.72 | 0.3736 | 0.3874 | 0.3653 | 0.3628 |

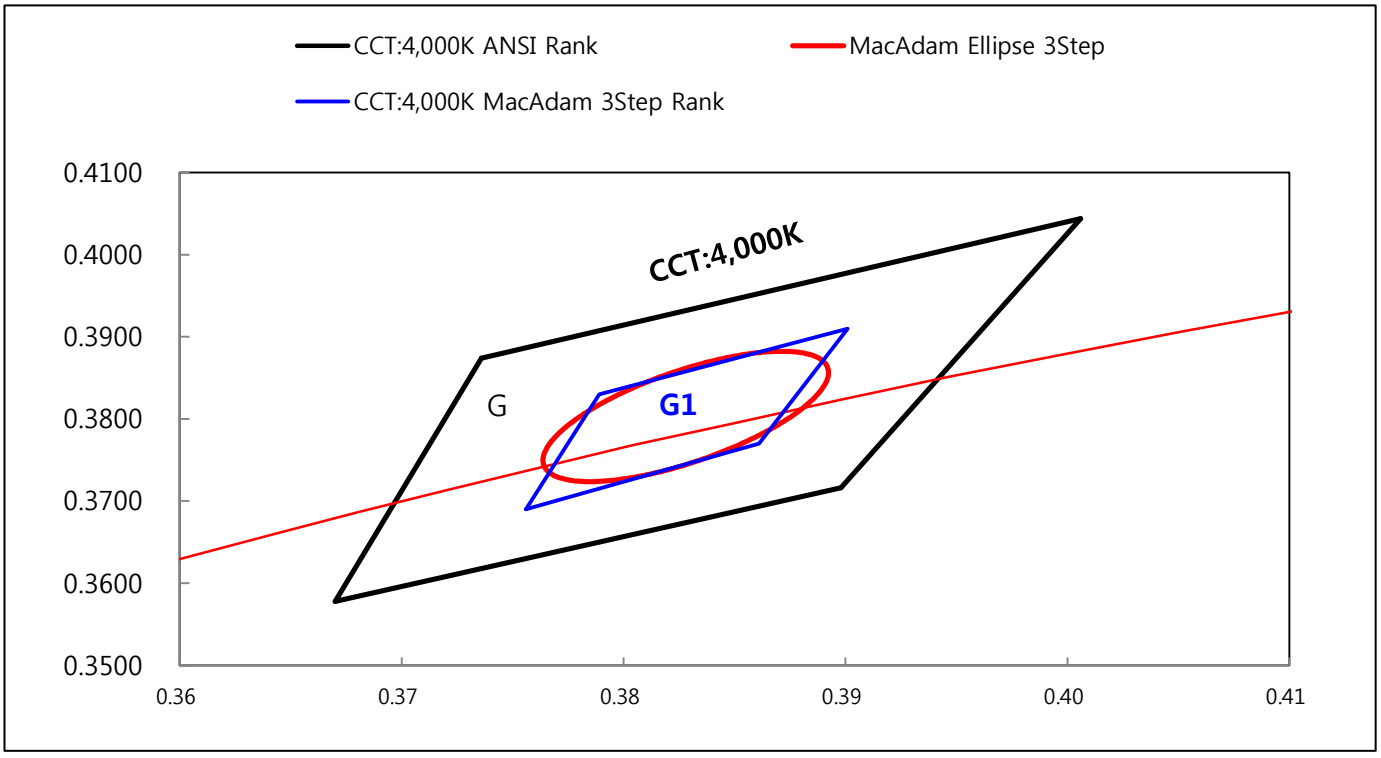
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 4,000K | | CCT : 4,000K | |
|---|---|---|---|---|---|---|
| 4,000K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.3828 | 0.3803 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.3736 | 0.3874 | 0.3756 | 0.3690 |
| | Major Axis Distance a | 0.00313 | 0.3670 | 0.3578 | 0.3789 | 0.3830 |
| | Minor Axis Distance b | 0.00134 | 0.3898 | 0.3716 | 0.3901 | 0.3910 |
| | Angle θº | 53.72 | 0.4006 | 0.4044 | 0.3861 | 0.3770 |

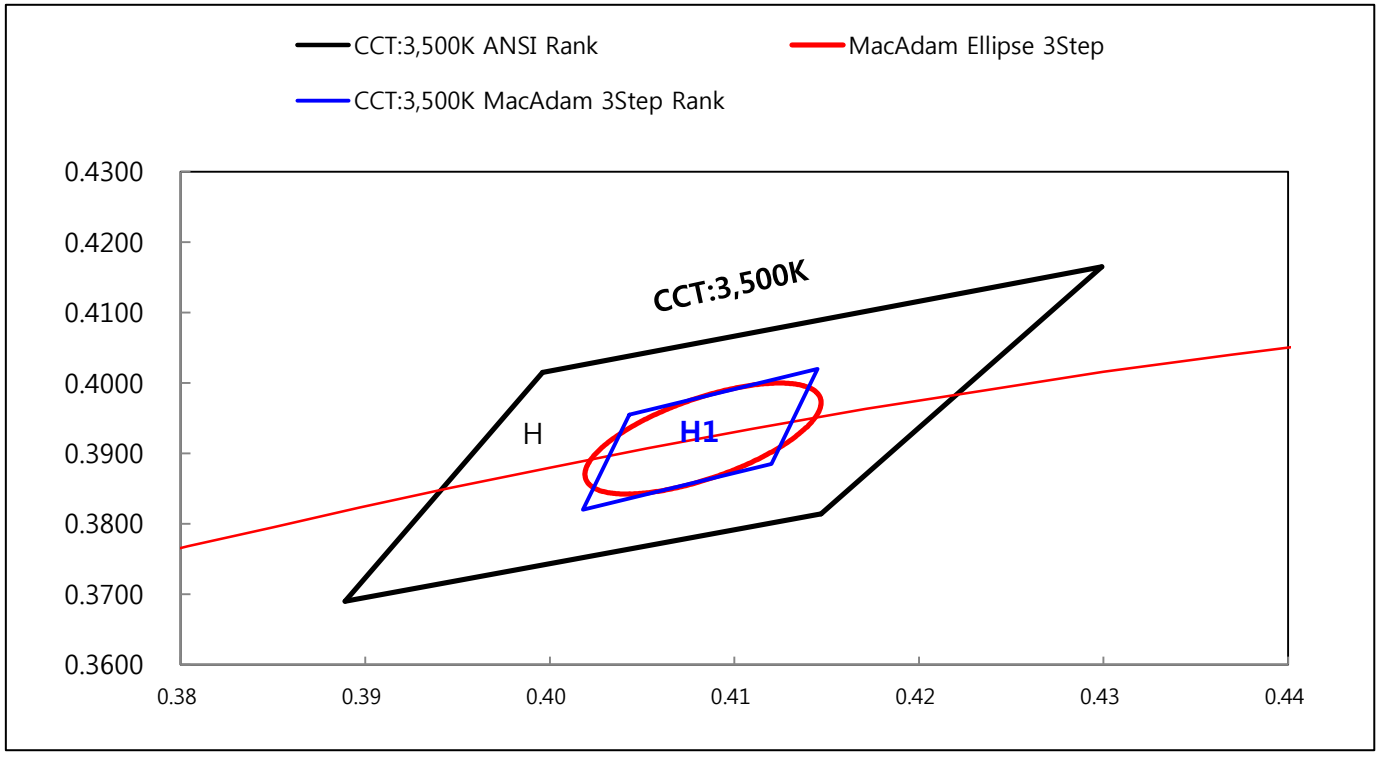
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 3,500K | | CCT : 3,500K | |
|---|---|---|---|---|---|---|
| 3,500K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.4083 | 0.3921 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.3996 | 0.4015 | 0.4043 | 0.3955 |
| | Major Axis Distance a | 0.00309 | 0.3889 | 0.3690 | 0.4018 | 0.3820 |
| | Minor Axis Distance b | 0.00138 | 0.4147 | 0.3814 | 0.4120 | 0.3885 |
| | Angle θº | 54 | 0.4299 | 0.4165 | 0.4145 | 0.4020 |

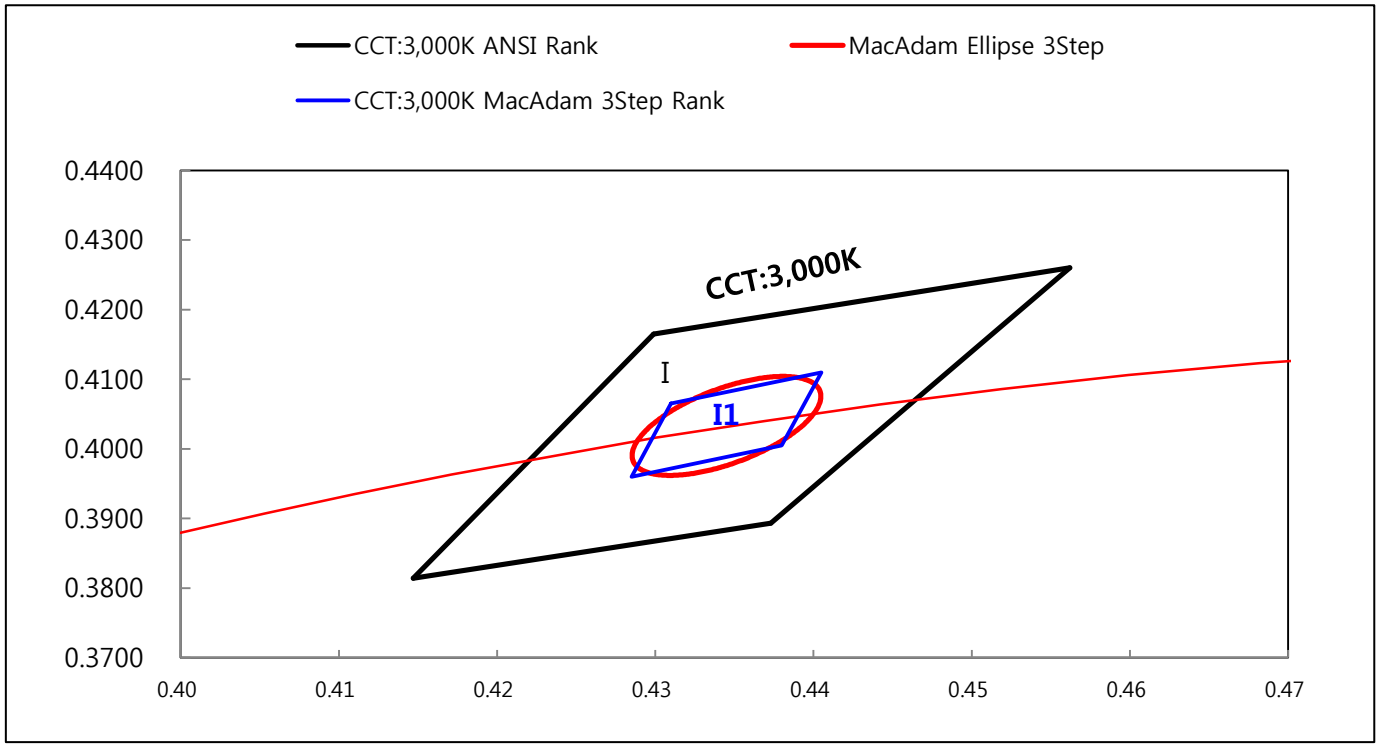
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 3,000K | | CCT : 3,000K | |
|---|---|---|---|---|---|---|
| 3,000K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.4345 | 0.4033 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.4299 | 0.4165 | 0.4310 | 0.4065 |
| | Major Axis Distance a | 0.00278 | 0.4147 | 0.3814 | 0.4285 | 0.3960 |
| | Minor Axis Distance b | 0.00136 | 0.4373 | 0.3893 | 0.4380 | 0.4005 |
| | Angle θº | 53.22 | 0.4562 | 0.4260 | 0.4405 | 0.4110 |

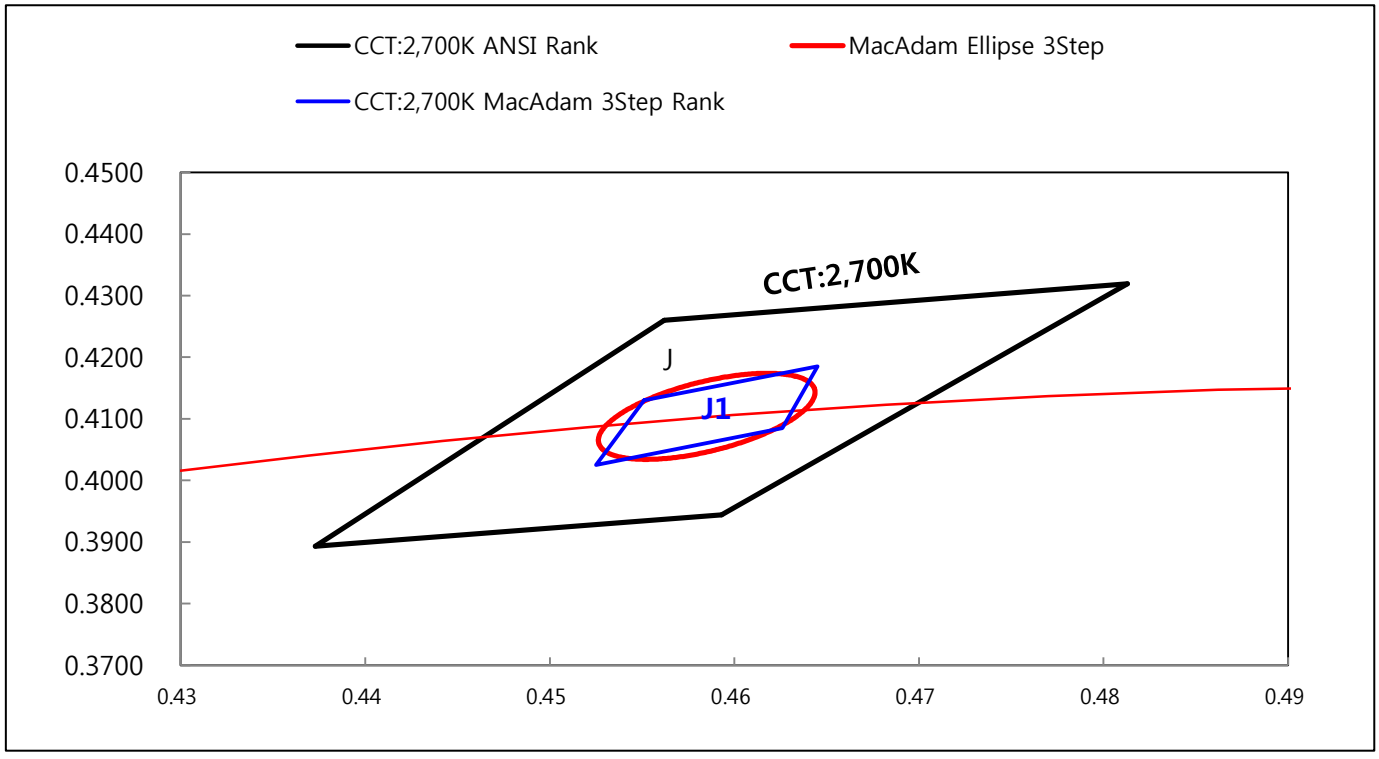
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 2,700K | | CCT : 2,700K | |
|---|---|---|---|---|---|---|
| 2,700K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.4585 | 0.4104 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.4562 | 0.4260 | 0.4551 | 0.4130 |
| | Major Axis Distance a | 0.0027 | 0.4373 | 0.3893 | 0.4525 | 0.4025 |
| | Minor Axis Distance b | 0.0014 | 0.4593 | 0.3944 | 0.4626 | 0.4085 |
| | Angle θº | 53.7 | 0.4813 | 0.4319 | 0.4645 | 0.4185 |

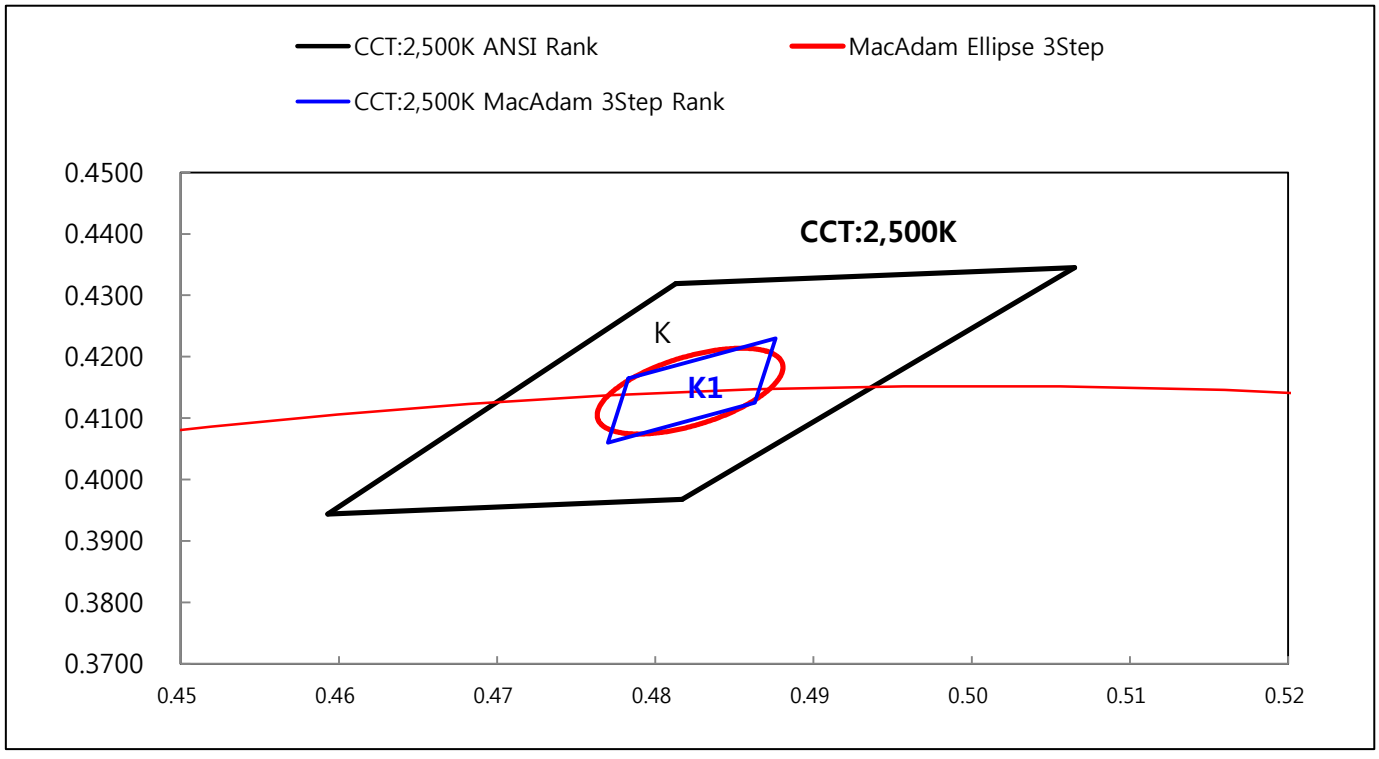
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 2,500K | | CCT : 2,500K | |
|---|---|---|---|---|---|---|
| 2,500K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.4822 | 0.4144 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.4593 | 0.3944 | 0.4783 | 0.4165 |
| | Major Axis Distance a | 0.0027 | 0.4813 | 0.4319 | 0.4770 | 0.4060 |
| | Minor Axis Distance b | 0.0014 | 0.5065 | 0.4345 | 0.4863 | 0.4125 |
| | Angle θº | 53.7 | 0.4817 | 0.3968 | 0.4876 | 0.4230 |

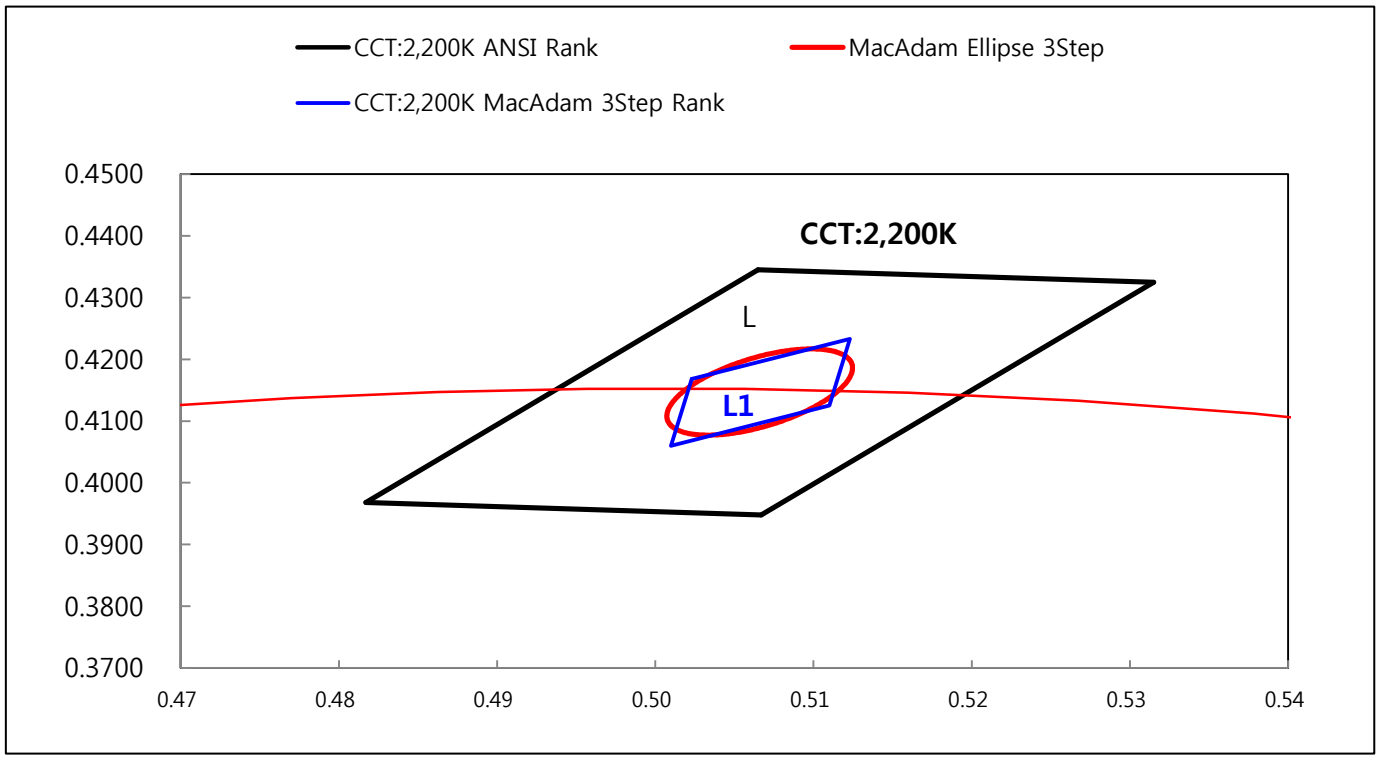
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 2,200K | | CCT : 2,200K | |
|---|---|---|---|---|---|---|
| 2,200K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.5066 | 0.4147 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.4817 | 0.3968 | 0.5023 | 0.4168 |
| | Major Axis Distance a | 0.0027 | 0.5065 | 0.4345 | 0.5010 | 0.4060 |
| | Minor Axis Distance b | 0.0014 | 0.5315 | 0.4325 | 0.5110 | 0.4125 |
| | Angle θº | 53.7 | 0.5067 | 0.3948 | 0.5123 | 0.4233 |

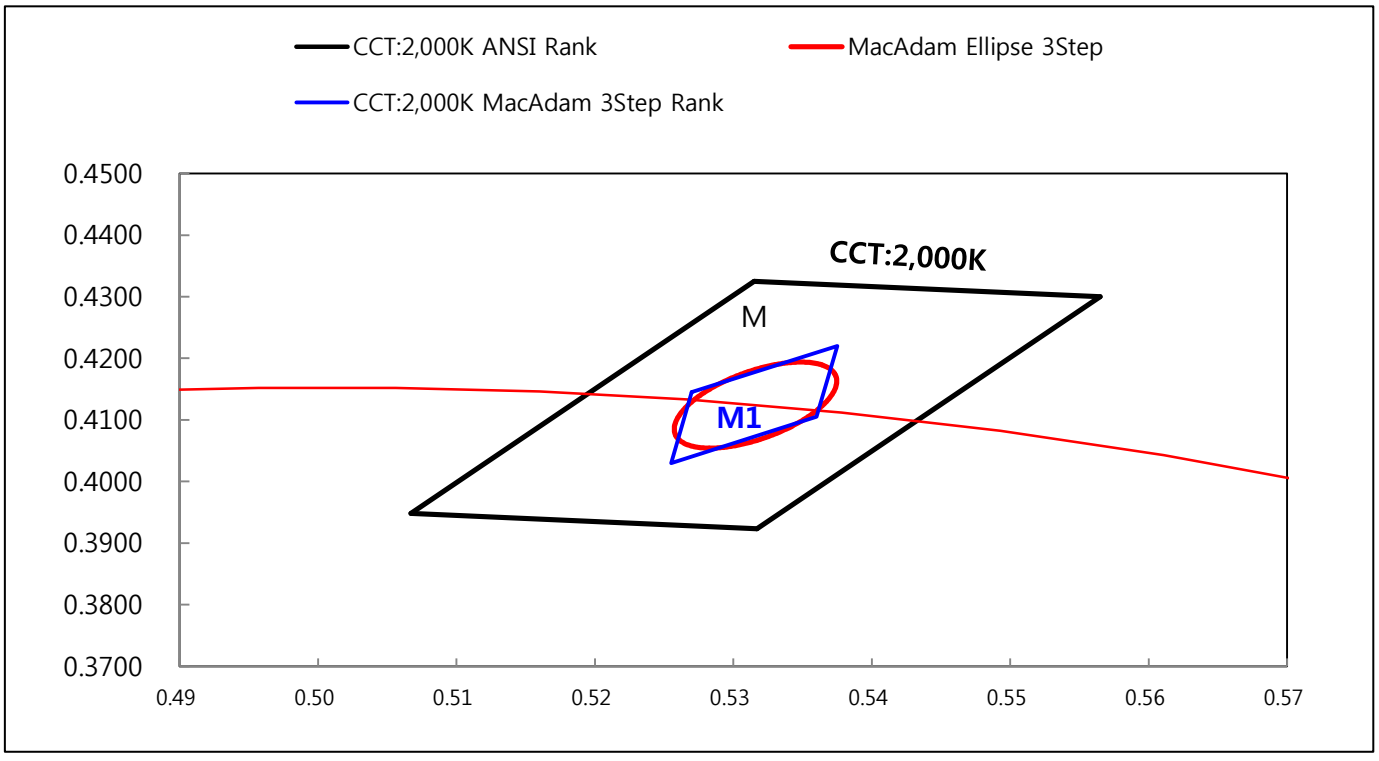
Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

| CCT(K) | CIE-x,y Avg | | CCT : 2,000K | | CCT : 2,000K | |
|---|---|---|---|---|---|---|
| 2,000K | CIE-x | CIE-y | ANSI Rank | | Mac-Adam 3-step Rank | |
| | 0.5316 | 0.4124 | CIE-x | CIE-y | CIE-x | CIE-y |
| | Ellipse Parameter | | 0.4817 | 0.3968 | 0.5023 | 0.4168 |
| | Major Axis Distance a | 0.0027 | 0.5065 | 0.4345 | 0.5010 | 0.4060 |
| | Minor Axis Distance b | 0.0014 | 0.5315 | 0.4325 | 0.5110 | 0.4125 |
| | Angle θº | 53.7 | 0.5067 | 0.3948 | 0.5123 | 0.4233 |

Note
* MacAdam 3-step range from the center of chromaticity




Note
* Chromaticity coordinates measurement allowance is ±0.01

# 7. Results of Reliability Test

## (1) Test Items and Results

| Test Item | Test Condition | Notes |
|---|---|---|
| Temperature Cycle | -40℃~25℃~100℃~25℃ (30min~5min~30min) | 100 cycle |
| Steady State Operating Life | $T_a$=25℃, $I_F$=580mA | 1,000 hrs |
| Steady State Operating Life of High Temperature | $T_a$=85℃, $I_F$=350mA | 1,000 hrs |
| High Temperature & Humidity Storage | $T_a$=85℃, RH=85% | 500 hrs |
| High Temperature Storage | $T_a$=100℃ | 1,000 hrs |
| Low Temperature Storage | $T_a$=-40℃ | 1,000 hrs |

## (2) Failure Criteria

($T_a$=25℃)

| Item | Symbol | Condition | Failure Criteria |
|---|---|---|---|
| Forward Voltage | $V_F$ | $I_F$= 580mA | > U * 1.1 |
| Total Luminous Flux | $\Phi_v$ | $I_F$= 580mA | < S * 0.75 |

* U : Specification Phase Limit
* S : Initial

Note
* Measurement shall be taken within 2 hours, and the test pieces should be returned to the normal ambient conditions after the completion of each test.

# 8. Packing standard

## (1) Test Items and Results

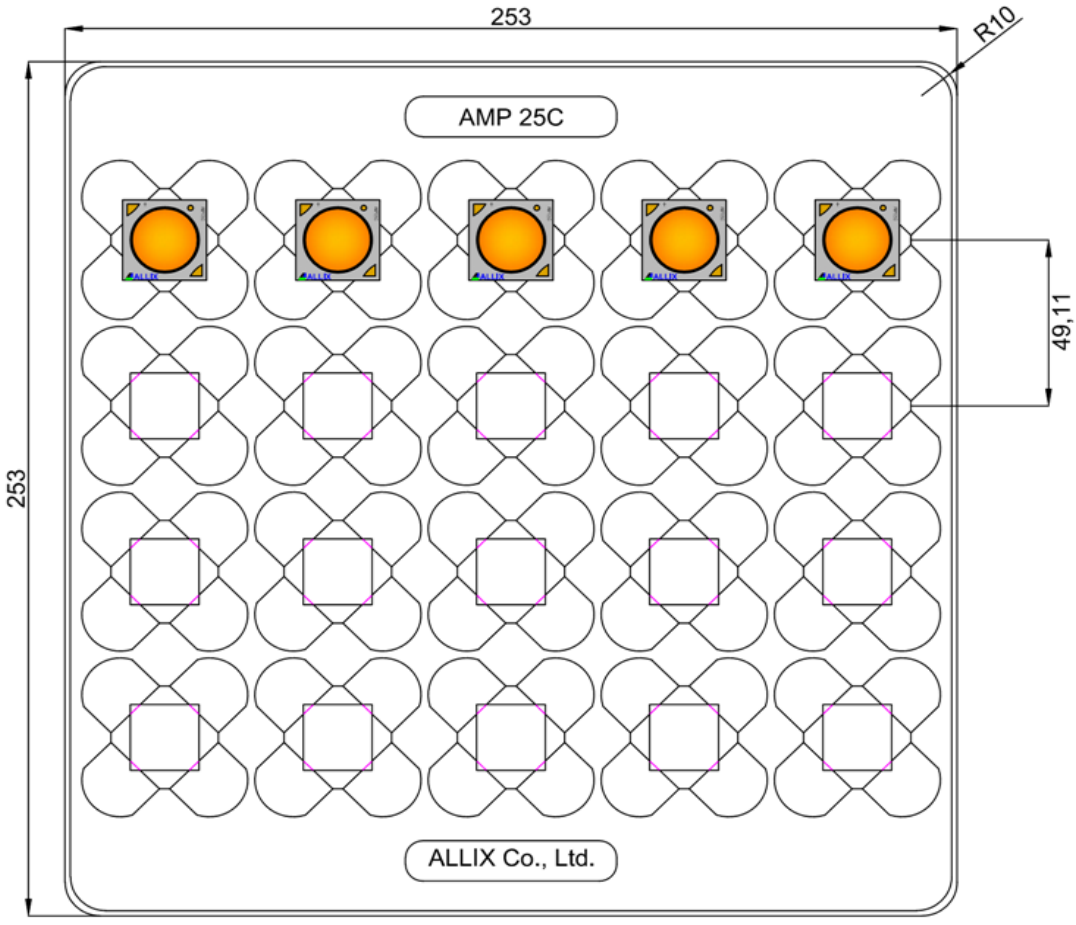
* 1 LED Packaging : 20 pcs/ 1 tray × 20 trays

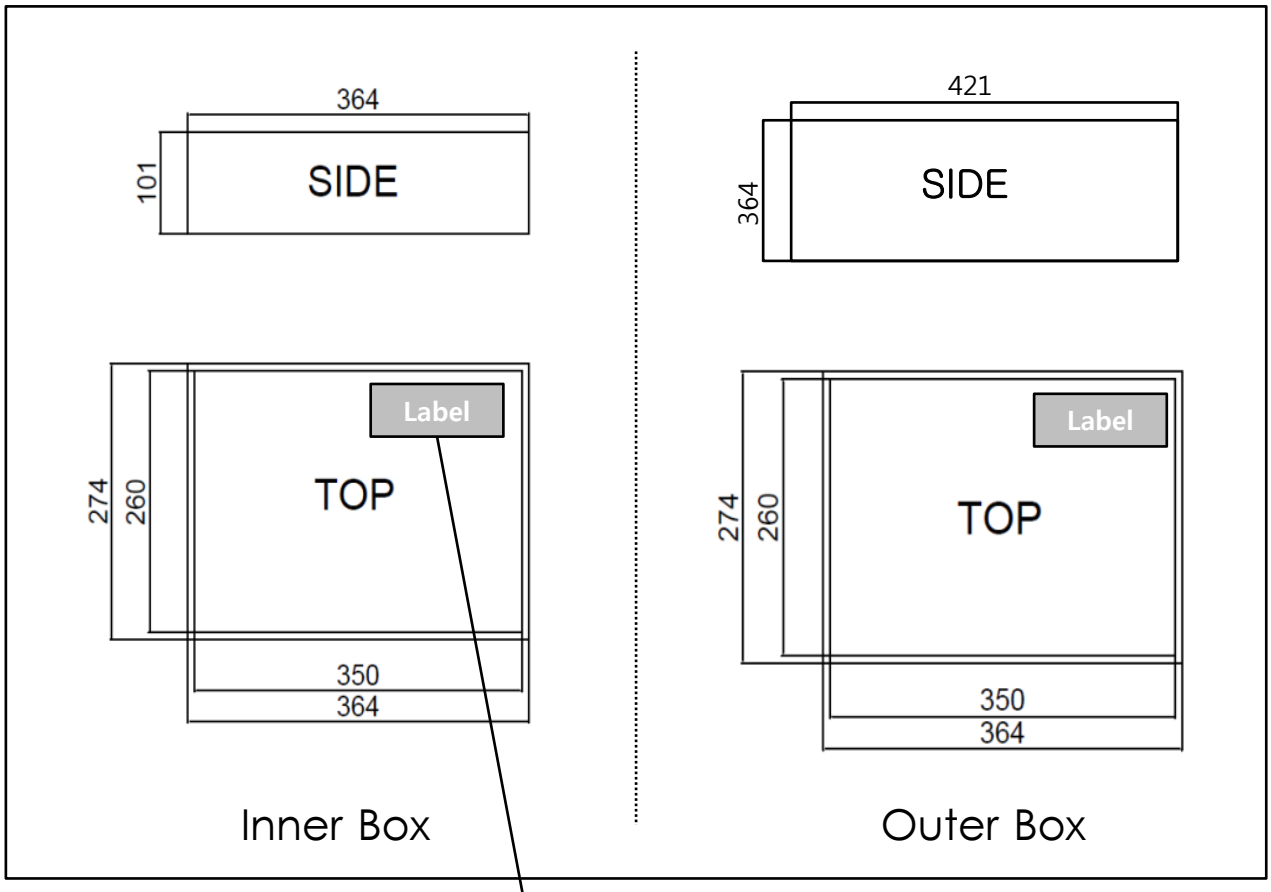
* 1 OUT BOX Packaging Unit : Min. 400 pcs

* Device, quantity, lot no. shipping label will be displayed on the box.

* Tray Dimension : 253 × 253 × 10mm

* Material : Conductive PS






Customer

Device: AM18CW-P20-A00L00

LOT No: AL150213

Q'ty: 400 pcs

ALLIX Co., Ltd.

*LOT NO.
(AL)(15)(02)(13) → (ALLIX)(Year)(Month)(Day)

# 9. Precautions

## (1) Storage Conditions

1. Before the package is opened: The LEDs should be stored at 25°C or less and 40%RH or less after being shipped from ALLIX and the storage life limit is 6 months. If the LEDs are stored for 6 months or more, they should be stored in a sealed container with a nitrogen atmosphere and moisture absorbent material.

2. After opening the package: The LED should be stored under 40°C or less and 30%RH or less. The LEDs should be used within 168hrs(7days) after opening the package. If unused LEDs remain, it should be stored in moisture-proof packages.

3. Do not stack assemblies.

## (2) Recommended Soldering Condition (This product is not adaptable to reflow process.)

- For manual soldering :

1. Please use lead-free soldering.

2. Soldering shall be implemented using a soldering bit at a temperature lower than 320~330°C, and shall be finished within 2 seconds for one land.

3. No external force shall be applied to resin part while soldering is implemented.

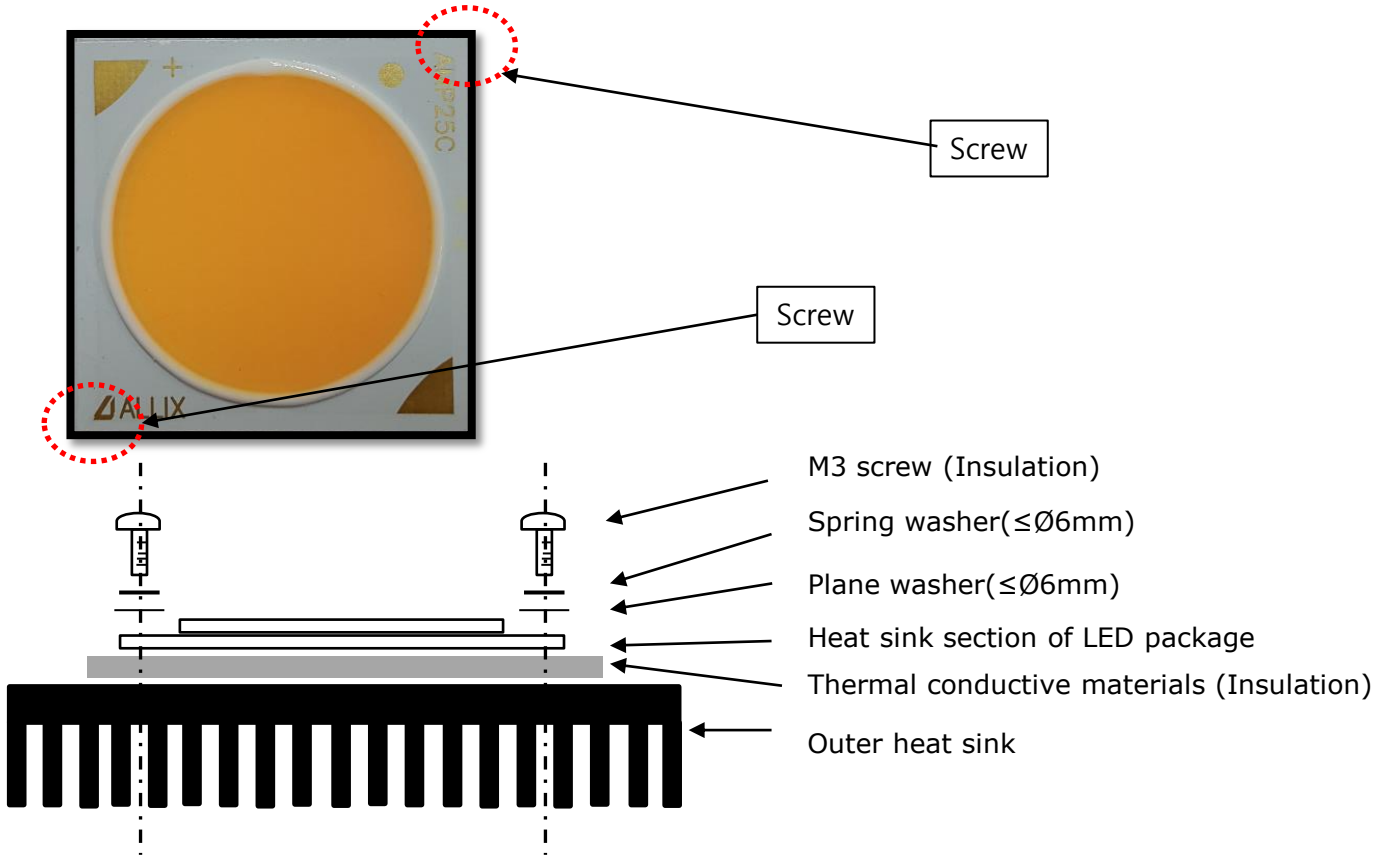
4. Next process of soldering should be carried out after the product is returned to ambient temperature.

5. Contacts number of soldering bit should be within twice for each terminal.

* ALLIX cannot guarantee if usage exceeds these recommended conditions. Please use it after sufficient verification is carried out on your own risk if necessary.

### (3) Caution of Product Assembly

1. This product should be secured firmly by fastening an M3 screw on both sides of the product. Please be careful not to apply any stress on the product during the clamping operation. As the connection status could vary depending on materials of outer heat sink, please check thoroughly.




### (4) Handling

1. Do not put mechanical stress on the LED.

2. Do not touch the resin with tweezers to avoid scratching or other damage.

3. In low-humidity work environment, please keep handling the LEDs with appropriate ESD grounding.

4. It is recommended to handle the LED with powder-less latex gloves.

## (5) Countermeasure against static electricity

1. Handling of this product needs countermeasures against static electricity because this is a semiconductor product.

2. Please take adequate measures to prevent any static electricity from being produced such as the wearing of a wristband or anti-static gloves when handling this product.

3. Every manufacturing facility in regard to the product (plant, equipment, machine, carrier machine and conveyance unit) should be connected to ground and please avoid the product to be electric-charged.

4. After assembling the LEDs into your final product(s), it is recommended to check whether the assembled LEDs are damaged by static electricity (electrical leak phenomenon) or not.

5. It is easy to find static damaged LED dies by a light-on test with the minimum current value.

## (6) Thermal Design

1. The thermal design to draw heat away from the LED junction is the most critical parameter for an LED illumination system.

2. High operating temperatures at the LED junction adversely affect the performance of LED's light output and lifetime. Therefore the LED junction temperature should not exceed the absolute maximum rating in LED illumination system.

3. The LED junction temperature while operation of LED illumination system depends upon thermal resistance of internal LED package (Rj-c), outer thermal resistances of LED package, power loss and ambient temperature. Please take both of the thermal design specifications and ambient temperature conditions into consideration for the setting of driving conditions.

## (7) Driving Current

1. A constant current is recommended as an applying driving current to this product. In the case of constant voltage driving, please connect current-limiting resistor to each products in series and control the driving current to keep under the absolute maximum rating forward current value.

2. Electrical transient might apply excess voltage, excess current and reverse voltage to the product(s). They also affect negative impact on the product(s) therefore please make sure that no excess voltage, excess current and reverse voltage is applied to the product(s) when the LED driver is turn-on and/or turn-off.

## (8) Lighting at a minimum current value

1. In a case where the minimum current is applied to the product, some of LED dice in the product might look different in their brightness due to the individual difference of the LED dice, and they are not failed.

## (9) This product is not designed for usage under the following conditions.

1. If the product might be used under the following conditions, you shall evaluate its effect and appropriate them.

2. In places where the product might:
 - directly and indirectly get wet due to rain and/or at place with the fear.
 - be damage by seawater and/or at place with the fear
 - be exposed to corrosive gas (such as Cl2, H2S, NH3, SOx, Nox etc.) and/or at place with the fear.
 - be exposed to dust, fluid or oil and/or at place with the fear.

*All information included in this document such as product data, charts, diagrams, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice.