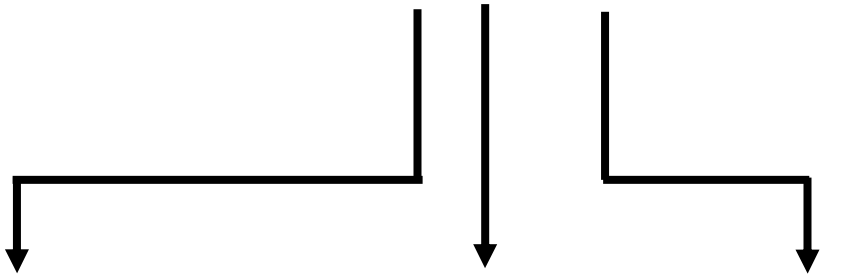
# SPECIFICATION

## HPL- H44XX1BA



1W

**Lens & Assembly Type:**

R：Lens 60°
T：Lens 60° & Star
L：Lens 120°
F：Lens 120° & Star

**Color:**

W: Cool White
N: Neutral white
S: Warm White
R: Red
G: Green
B: Blue
A: Amber
O: Orange

## Caution:

Depends on different chips structures, the thermal pad could has a polarity as Anode. To avoid the risk of circuit-fail, **It is strongly recommended to suppose the condition (Anode – thermal pad)** while designing a circuit.

## Part Number Matrix

| Color \ Type | 60˚Lens | 60˚Lens & Star | 120˚Lens | 120˚Lens & Star |
|---|---|---|---|---|
| Cool White | HPL-H44RW1BA | HPL-H44TW1BA | HPL-H44LW1BA | HPL-H44FW1BA |
| Neutral White | HPL-H44RN1BA | HPL-H44TN1BA | HPL-H44LN1BA | HPL-H44FN1BA |
| Warm White | HPL-H44RS1BA | HPL-H44TS1BA | HPL-H44LS1BA | HPL-H44FS1BA |
| Red | HPL-H44RR1BA | HPL-H44TR1BA | HPL-H44LR1BA | HPL-H44FR1BA |
| Green | HPL-H44RG1BA | HPL-H44TG1BA | HPL-H44LG1BA | HPL-H44FG1BA |
| Blue | HPL-H44RB1BA | HPL-H44TB1BA | HPL-H44LB1BA | HPL-H44FB1BA |
| Amber | HPL-H44RA1BA | HPL-H44TA1BA | HPL-H44LA1BA | HPL-H44FA1BA |
| Orange | HPL-H44RO1BA | HPL-H44TO1BA | HPL-H44LO1BA | HPL-H44FO1BA |

## 1. Features

- Dimension : 4.4mm(L)×4.4mm(W)
- 1W High Flux type
- All Metal Design Cu PCB/Al reflector
- Low thermal resistance
- The InGaN or AlInGaP Chip inside
- Superior ESD protection

## 2. Application

- Traffic signaling
- Backlighting
- Interior & exterior automotive lighting
- Decorative and landscape lighting
- Signage and channel letter
- Portable light source
- Decorating and entertainment lighting
- Architectural lighting
- Street lighting

## 3. Absolute Maximum Ratings

(Tj=25℃)

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Power Dissipation | Cool White | P | 1.5 | W |
| | Neutral White | | 1.5 | |
| | Warm White | | 1.5 | |
| | Red | | 1.05 | |
| | Green | | 1.5 | |
| | Blue | | 1.5 | |
| | Amber | | 1.05 | |
| | Orange | | 1.05 | |
| Forward Current | | IF | 350 | mA |
| Forward Pulse Current (1/10 Duty Cycle, 400msec Pulse Width) | | IFP | 500 | mA |
| Thermal Resistance, Junction-Case | | Rth, J-C1 | 10 | °C/W |
| Reverse Voltage | | VR | 5 | V |
| LED Junction Temperature | | Tj | 125 | °C |
| Operating Temperature Range | | Topr | -40°C to + 80°C | |
| Storage Temperature Range | | Tstg | -40°C to + 120°C | |
| Soldering Condition | | Tsol | 260°C For 5 Seconds | |

Note: 1. The thermal resistance value is measured with MCPCB (Star).

# 4. Initial Electrical/Optical Characteristics

## • Forward Voltage

(Tj=25℃)

| Color | Forward Voltage | | | | | |
|---|---|---|---|---|---|---|
| | Symbol | MIN. | TYP. | MAX. | Test Condition | Unit |
| Cool White→W | $V_F$ | 3.03 | 3.80 | 4.23 | $I_F$= 350mA | V |
| Neutral White→N | $V_F$ | 3.03 | 3.80 | 4.23 | $I_F$= 350mA | V |
| Warm White→S | $V_F$ | 3.03 | 3.80 | 4.23 | $I_F$= 350mA | V |
| Red→R | $V_F$ | 1.83 | 2.50 | 3.03 | $I_F$= 350mA | V |
| Green→G | $V_F$ | 3.03 | 3.80 | 4.23 | $I_F$= 350mA | V |
| Blue→B | $V_F$ | 3.03 | 3.80 | 4.23 | $I_F$= 350mA | V |
| Amber→A | $V_F$ | 1.83 | 2.50 | 3.03 | $I_F$= 350mA | V |
| Orange→O | $V_F$ | 1.83 | 2.50 | 3.03 | $I_F$= 350mA | V |

## • Reverse Current

(Tj=25℃)

| Color | Reverse Current | | | | | |
|---|---|---|---|---|---|---|
| | Symbol | MIN. | TYP. | MAX. | Test Condition | Unit |
| Cool White→W | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Neutral White→N | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Warm White→S | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Red→R | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Green→G | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Blue→B | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Amber→A | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |
| Orange→O | $I_R$ | - | - | 100 | $V_R$ = 5V | μA |

## • Luminous Flux

(Tj=25℃)

| Color | Luminous Flux | | | | | |
|---|---|---|---|---|---|---|
| | Symbol | MIN. | TYP. | MAX. | Test Condition | Unit |
| Cool White→W | $\Phi_V$ | - | 70 | - | $I_F$ = 350mA | lm |
| Neutral White→N | $\Phi_V$ | - | 55 | - | $I_F$ = 350mA | lm |
| Warm White→S | $\Phi_V$ | - | 45 | - | $I_F$ = 350mA | lm |
| Red→R | $\Phi_V$ | - | 40 | - | $I_F$ = 350mA | lm |
| Green→G | $\Phi_V$ | - | 55 | - | $I_F$ = 350mA | lm |
| Blue→B | $\Phi_V$ | - | 10 | - | $I_F$ = 350mA | lm |
| Amber→A | $\Phi_V$ | - | 34 | - | $I_F$ = 350mA | lm |
| Orange→O | $\Phi_V$ | - | 38 | - | $I_F$ = 350mA | lm |

## • Radiometric Power

(Tj=25℃)

| Color | Luminous Flux | | | | | |
|---|---|---|---|---|---|---|
| | Symbol | MIN. | TYP. | MAX. | Test Condition | Unit |
| Blue[1] | $\Phi_V$ | - | 200/180 | - | $I_F$ = 350mA | mW |

## • Color Temperature or Dominate wavelength

(Tj=25℃)

| Color | Color Temperature or Dominate Wavelength | | | | | |
|---|---|---|---|---|---|---|
| | Symbol | MIN. | TYP. | MAX. | Test Condition | Unit |
| Cool White→W | CCT | 4500 | 5650 | 10000 | IF = 350mA | °K |
| Neutral White→N | CCT | 3500 | 4000 | 4500 | IF = 350mA | °K |
| Warm White→S | CCT | 2670 | 2850 | 3500 | IF = 350mA | °K |
| Red→R | λd | 620 | | 630 | IF = 350mA | nm |
| Green→G | λd | 520 | | 530 | IF = 350mA | nm |
| Blue[1]→B | λd | 460 | | 475 | IF = 350mA | nm |
| Amber→A | λd | 584.5 | | 594.5 | IF = 350mA | nm |
| Orange→O | λd | 610 | | 620 | IF = 350mA | nm |

Note: 1. Royal Blue Products: Wavelength defined is Peak Wavelength ($\lambda_p = 445 \sim 455$nm).

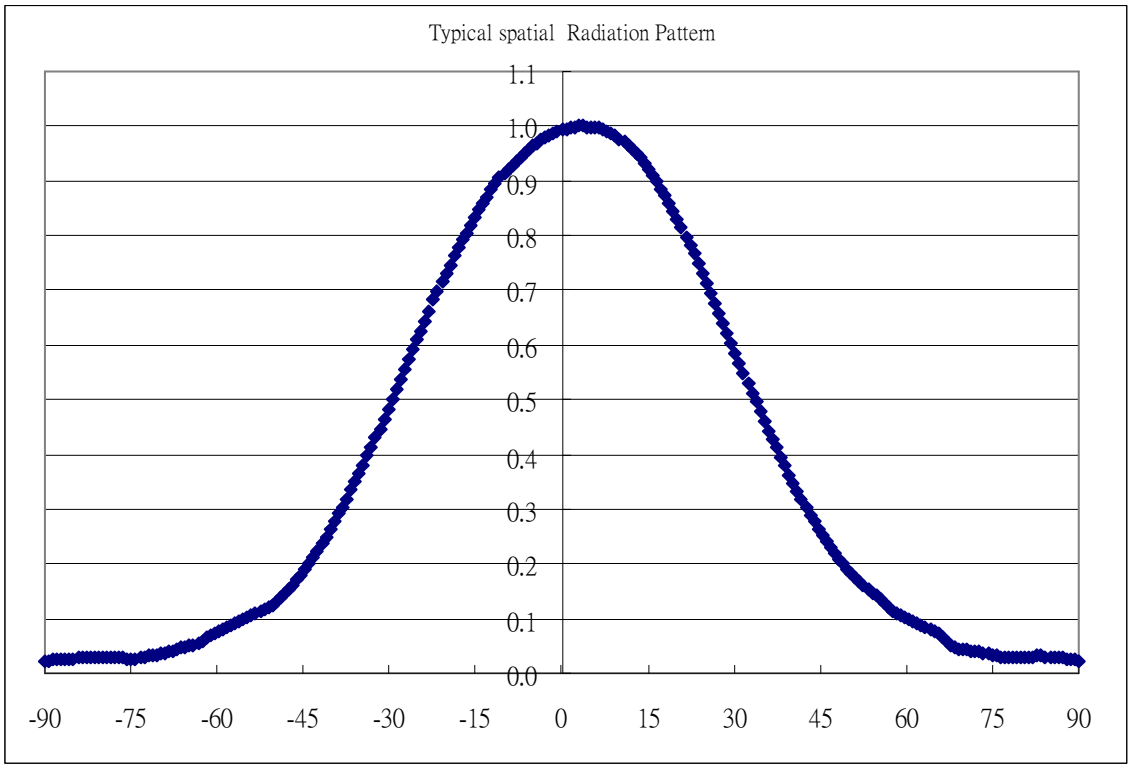
## • Color rendering Index (CRI, Ra value)

(Tj=25℃)

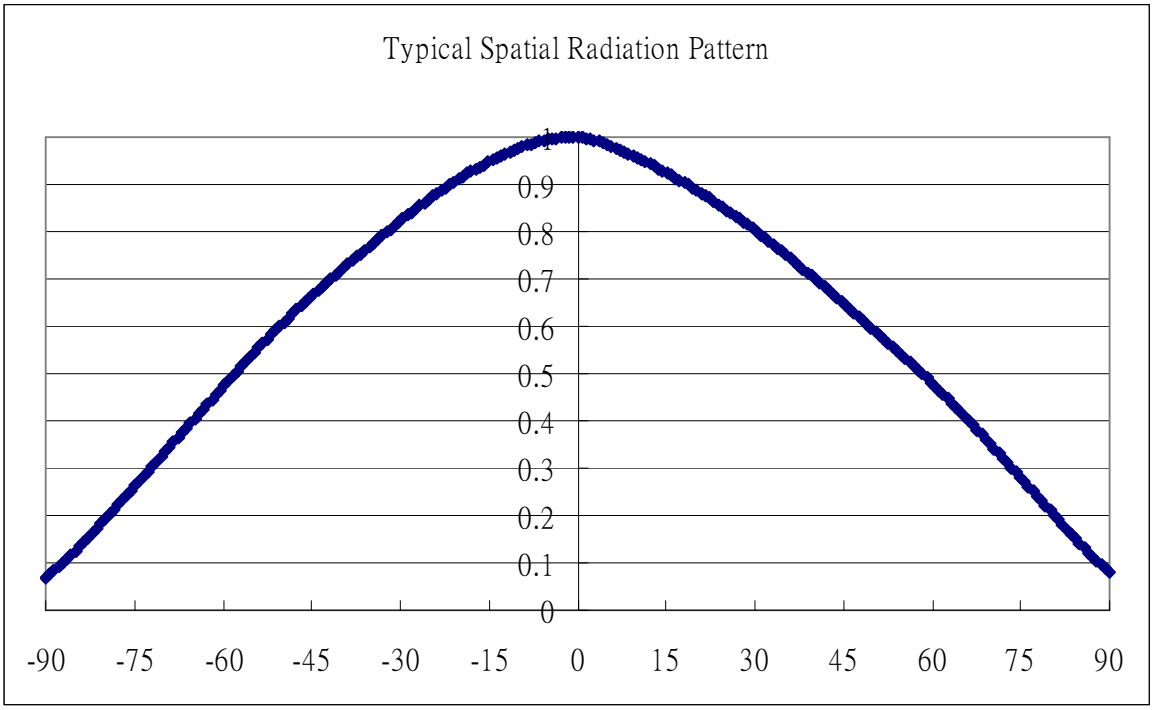
| Color | Color Temperature or Dominate Wavelength | | | | | |
|---|---|---|---|---|---|---|
| | Symbol | MIN. | TYP. | MAX. | Test Condition | Unit |
| Cool White→W | Ra | 65 | 70 | - | IF = 350mA | - |
| Neutral White→N | | 70 | 75 | - | IF = 350mA | - |
| Warm White→S | | 75 | 80 | - | IF = 350mA | - |

.

## • Typical Radiation Pattern




**60˚ lens**


Typical Spatial Radiation Pattern
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-90
-75
-60
-45
-30
-15
0
15
30
45
60
75
90

**120° lens**

## • Bin Code List for Reference

(Tj=25℃)

| Item | Bin Code | Symbol | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage[1] | C | $V_F$ | $I_F$ = 350 [mA] | 1.83 | 2.07 | V |
| | D | | | 2.07 | 2.31 | |
| | E | | | 2.31 | 2.55 | |
| | F | | | 2.55 | 2.79 | |
| | G | | | 2.79 | 3.03 | |
| | H | | | 3.03 | 3.27 | |
| | J | | | 3.27 | 3.51 | |
| | K | | | 3.51 | 3.75 | |
| | L | | | 3.75 | 3.99 | |
| | M | | | 3.99 | 4.23 | |
| Luminous Flux[2] | A | $\Phi_V$ | $I_F$ = 350 [mA] | 8.2 | 10.7 | lm |
| | B | | | 10.7 | 13.9 | |
| | C | | | 13.9 | 18.1 | |
| | D | | | 18.1 | 23.5 | |
| | E | | | 23.5 | 30 | |
| | F | | | 30 | 40 | |
| | G | | | 40 | 50 | |
| | H | | | 50 | 60 | |
| | J | | | 60 | 70 | |
| | K | | | 70 | 80 | |
| | L | | | 80 | 90 | |
| | M | | | 90 | 100 | |
| | N | | | 100 | 120 | |
| | P | | | 120 | 140 | |
| | Q | | | 140 | 160 | |

Note: 1. Forward voltage measurement allowance is ± 0.1V.

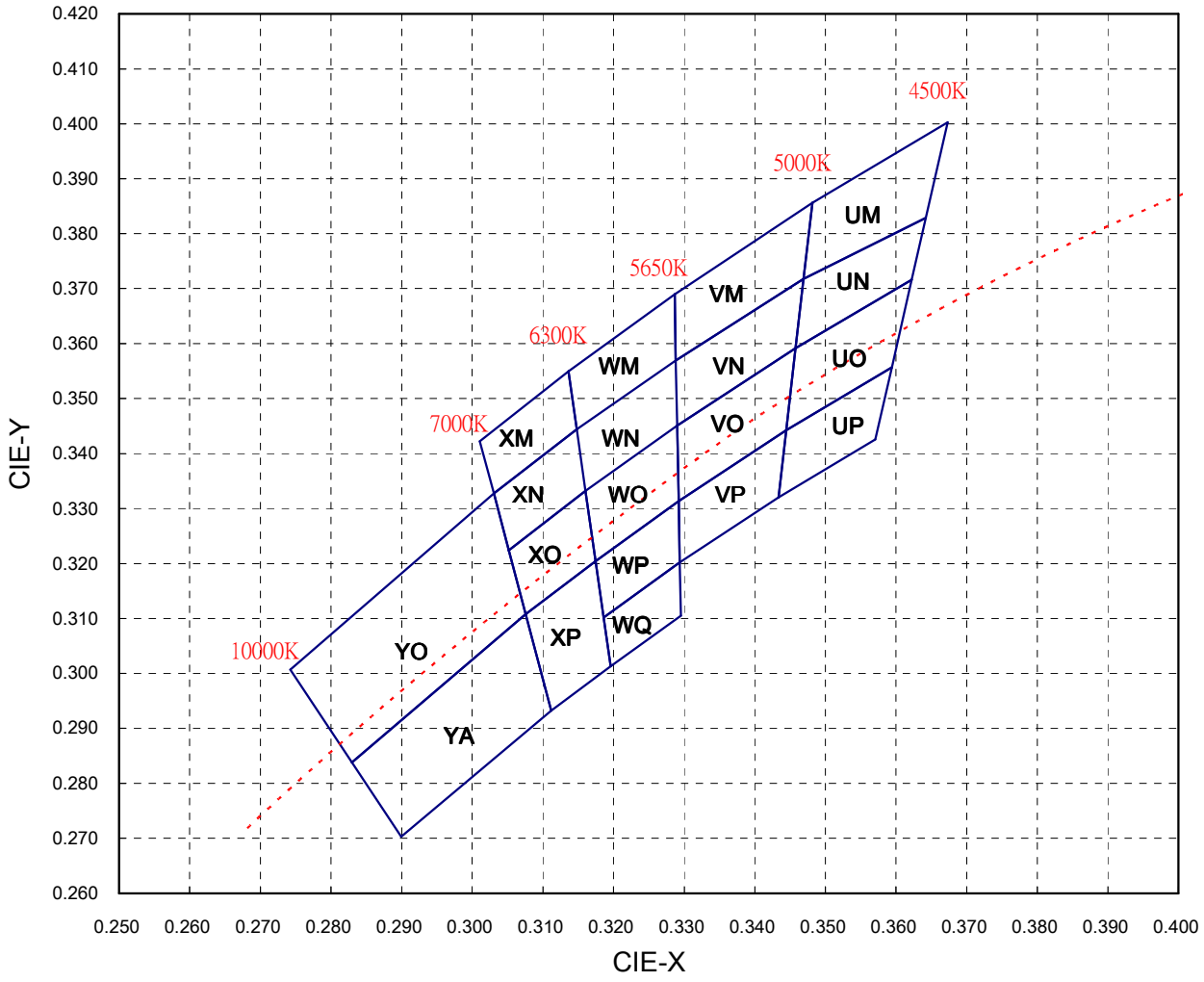
2. Luminous flux measurement allowance is ± 10%.

- **Hue Bin Code List for Reference**

**Cool White→W color**

| Bin Code | CIE 1931 x, y Range | | | | | °k |
|---|---|---|---|---|---|---|
| UP | x | 0.3444 | 0.3594 | 0.3571 | 0.3434 | 4750 |
| | y | 0.3442 | 0.3557 | 0.3426 | 0.3320 | |
| UO | x | 0.3458 | 0.3622 | 0.3594 | 0.3444 | |
| | y | 0.3592 | 0.3716 | 0.3557 | 0.3442 | |
| UN | x | 0.3469 | 0.3642 | 0.3622 | 0.3458 | |
| | y | 0.3717 | 0.3829 | 0.3716 | 0.3592 | |
| UM | x | 0.3481 | 0.3673 | 0.3642 | 0.3469 | |
| | y | 0.3856 | 0.4003 | 0.3829 | 0.3717 | |
| VP | x | 0.3292 | 0.3444 | 0.3434 | 0.3294 | 5300 |
| | y | 0.3313 | 0.3442 | 0.3320 | 0.3202 | |
| VO | x | 0.3290 | 0.3458 | 0.3444 | 0.3292 | |
| | y | 0.3451 | 0.3592 | 0.3442 | 0.3313 | |
| VN | x | 0.3288 | 0.3469 | 0.3458 | 0.3290 | |
| | y | 0.3569 | 0.3717 | 0.3592 | 0.3451 | |
| VM | x | 0.3286 | 0.3481 | 0.3469 | 0.3288 | |
| | y | 0.3690 | 0.3856 | 0.3717 | 0.3569 | |
| WQ | x | 0.3186 | 0.3294 | 0.3295 | 0.3196 | 6000 |
| | y | 0.3102 | 0.3202 | 0.3105 | 0.3013 | |
| WP | x | 0.3175 | 0.3292 | 0.3294 | 0.3186 | |
| | y | 0.3204 | 0.3313 | 0.3202 | 0.3102 | |
| WO | x | 0.3160 | 0.3290 | 0.3292 | 0.3175 | |
| | y | 0.3332 | 0.3451 | 0.3313 | 0.3204 | |
| WN | x | 0.3148 | 0.3288 | 0.3290 | 0.3160 | |
| | y | 0.3444 | 0.3569 | 0.3451 | 0.3332 | |
| WM | x | 0.3136 | 0.3286 | 0.3288 | 0.3148 | |
| | y | 0.3550 | 0.3690 | 0.3569 | 0.3444 | |
| XP | x | 0.3076 | 0.3175 | 0.3196 | 0.3112 | 6700 |
| | y | 0.3108 | 0.3204 | 0.3013 | 0.2932 | |
| XO | x | 0.3052 | 0.3160 | 0.3175 | 0.3076 | |
| | y | 0.3224 | 0.3332 | 0.3204 | 0.3108 | |
| XN | x | 0.3031 | 0.3148 | 0.3160 | 0.3052 | |
| | y | 0.3327 | 0.3444 | 0.3332 | 0.3224 | |
| XM | x | 0.3011 | 0.3136 | 0.3148 | 0.3031 | |
| | y | 0.3422 | 0.3550 | 0.3444 | 0.3327 | |
| YA | x | 0.2830 | 0.3076 | 0.3112 | 0.2899 | 8000 |
| | y | 0.2838 | 0.3108 | 0.2932 | 0.2703 | |
| YO | x | 0.2742 | 0.3031 | 0.3076 | 0.2830 | |
| | y | 0.3007 | 0.3327 | 0.3108 | 0.2838 | |

## Cool White Bin Structure



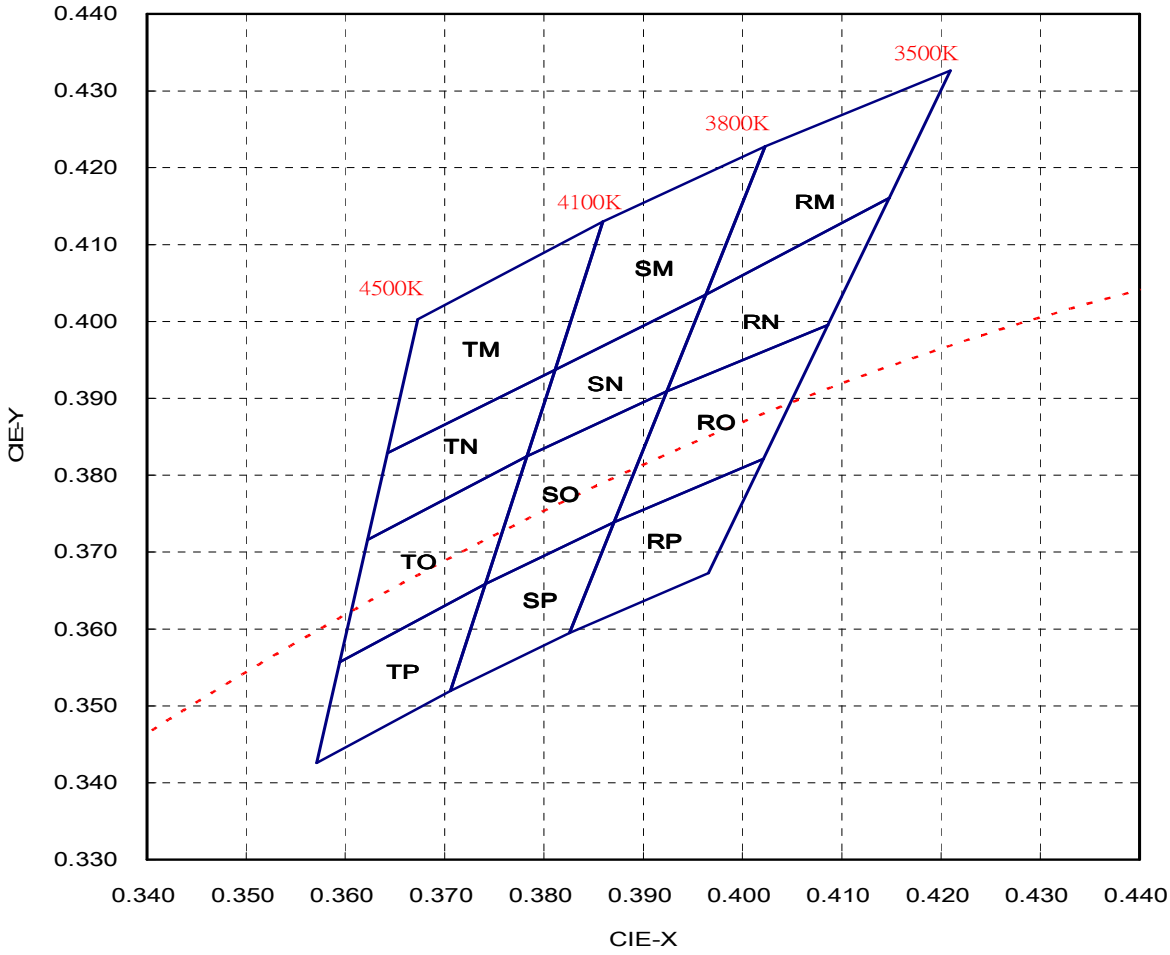



**HPL-H44XX1BA**
**Color: WNSRGBAO**
**11/16/2007**

## Neutral White→N color

| Bin Code | CIE 1931 x, y Range | | | | | ˚K |
|---|---|---|---|---|---|---|
| RP | x | 0.3871 | 0.4021 | 0.3966 | 0.3826 | 3650 |
| | y | 0.3739 | 0.3822 | 0.3673 | 0.3595 | |
| RO | x | 0.3924 | 0.4086 | 0.4021 | 0.3871 | |
| | y | 0.3909 | 0.3995 | 0.3822 | 0.3739 | |
| RN | x | 0.3963 | 0.4148 | 0.4086 | 0.3924 | |
| | y | 0.4035 | 0.4161 | 0.3995 | 0.3909 | |
| RM | x | 0.4023 | 0.4209 | 0.4148 | 0.3963 | |
| | y | 0.4228 | 0.4326 | 0.4161 | 0.4035 | |
| SP | x | 0.3741 | 0.3871 | 0.3826 | 0.3706 | 3950 |
| | y | 0.3658 | 0.3739 | 0.3595 | 0.3520 | |
| SO | x | 0.3783 | 0.3924 | 0.3871 | 0.3741 | |
| | y | 0.3825 | 0.3909 | 0.3739 | 0.3658 | |
| SN | x | 0.3811 | 0.3963 | 0.3924 | 0.3783 | |
| | y | 0.3937 | 0.4035 | 0.3909 | 0.3825 | |
| SM | x | 0.3860 | 0.4023 | 0.3963 | 0.3811 | |
| | y | 0.4130 | 0.4228 | 0.4035 | 0.3937 | |
| TP | x | 0.3594 | 0.3741 | 0.3706 | 0.3571 | 4300 |
| | y | 0.3557 | 0.3658 | 0.3520 | 0.3426 | |
| TO | x | 0.3622 | 0.3783 | 0.3741 | 0.3594 | |
| | y | 0.3716 | 0.3825 | 0.3658 | 0.3557 | |
| TN | x | 0.3642 | 0.3811 | 0.3783 | 0.3622 | |
| | y | 0.3829 | 0.3937 | 0.3825 | 0.3716 | |
| TM | x | 0.3673 | 0.3860 | 0.3811 | 0.3642 | |
| | y | 0.4003 | 0.4130 | 0.3937 | 0.3829 | |

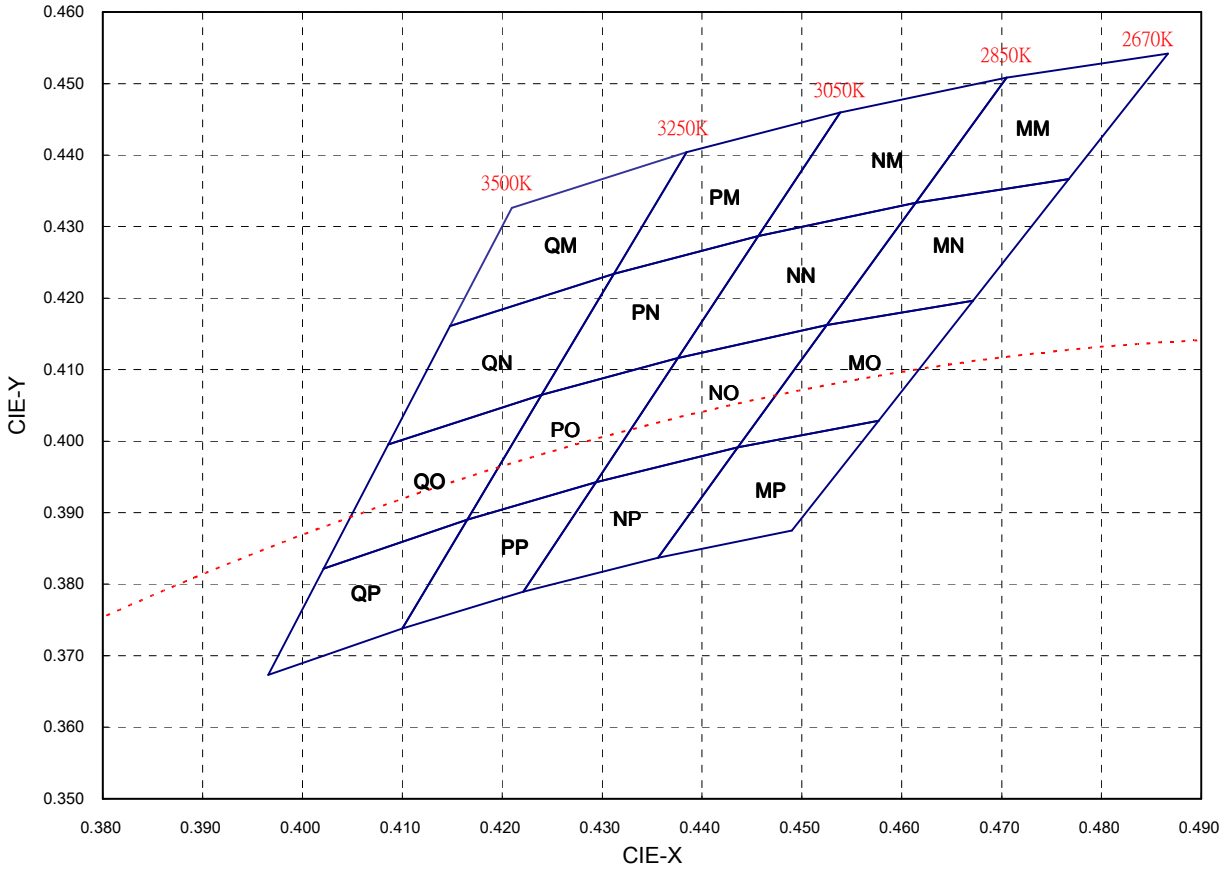
## Neutral White Bin Structure



## Warm white→S color

| Bin Code | CIE 1931 x, y Range | | | | | ˚K |
|---|---|---|---|---|---|---|
| MP | x | 0.4436 | 0.4577 | 0.4490 | 0.4356 | 2760 |
| | y | 0.3991 | 0.4029 | 0.3875 | 0.3837 | |
| MO | x | 0.4525 | 0.4671 | 0.4577 | 0.4436 | |
| | y | 0.4162 | 0.4196 | 0.4029 | 0.3991 | |
| MN | x | 0.4614 | 0.4767 | 0.4671 | 0.4525 | |
| | y | 0.4333 | 0.4366 | 0.4196 | 0.4162 | |
| MM | x | 0.4705 | 0.4866 | 0.4767 | 0.4614 | |
| | y | 0.4508 | 0.4542 | 0.4366 | 0.4333 | |
| NP | x | 0.4294 | 0.4436 | 0.4356 | 0.4221 | 2950 |
| | y | 0.3943 | 0.3991 | 0.3837 | 0.3790 | |
| NO | x | 0.4376 | 0.4525 | 0.4436 | 0.4294 | |
| | y | 0.4116 | 0.4162 | 0.3991 | 0.3943 | |
| NN | x | 0.4456 | 0.4614 | 0.4525 | 0.4376 | |
| | y | 0.4287 | 0.4333 | 0.4162 | 0.4116 | |
| NM | x | 0.4538 | 0.4705 | 0.4614 | 0.4456 | |
| | y | 0.4460 | 0.4508 | 0.4333 | 0.4287 | |
| PP | x | 0.4165 | 0.4294 | 0.4221 | 0.4100 | 3150 |
| | y | 0.3890 | 0.3943 | 0.3790 | 0.3738 | |
| PO | x | 0.4240 | 0.4376 | 0.4294 | 0.4165 | |
| | y | 0.4065 | 0.4116 | 0.3943 | 0.3890 | |
| PN | x | 0.4312 | 0.4456 | 0.4376 | 0.4240 | |
| | y | 0.4234 | 0.4287 | 0.4116 | 0.4065 | |
| PM | x | 0.4385 | 0.4538 | 0.4456 | 0.4312 | |
| | y | 0.4404 | 0.4460 | 0.4287 | 0.4234 | |
| QP | x | 0.4021 | 0.4165 | 0.4100 | 0.3966 | 3375 |
| | y | 0.3822 | 0.3890 | 0.3738 | 0.3673 | |
| QO | x | 0.4086 | 0.4240 | 0.4165 | 0.4021 | |
| | y | 0.3995 | 0.4065 | 0.3890 | 0.3822 | |
| QN | x | 0.4148 | 0.4312 | 0.4240 | 0.4086 | |
| | y | 0.4161 | 0.4234 | 0.4065 | 0.3995 | |
| QM | x | 0.4209 | 0.4385 | 0.4312 | 0.4148 | |
| | y | 0.4326 | 0.4404 | 0.4234 | 0.4161 | |

## Warm White Bin Structure




Note: The CIE1931 x, y color coordinates measurement allowance is ± 0.01.

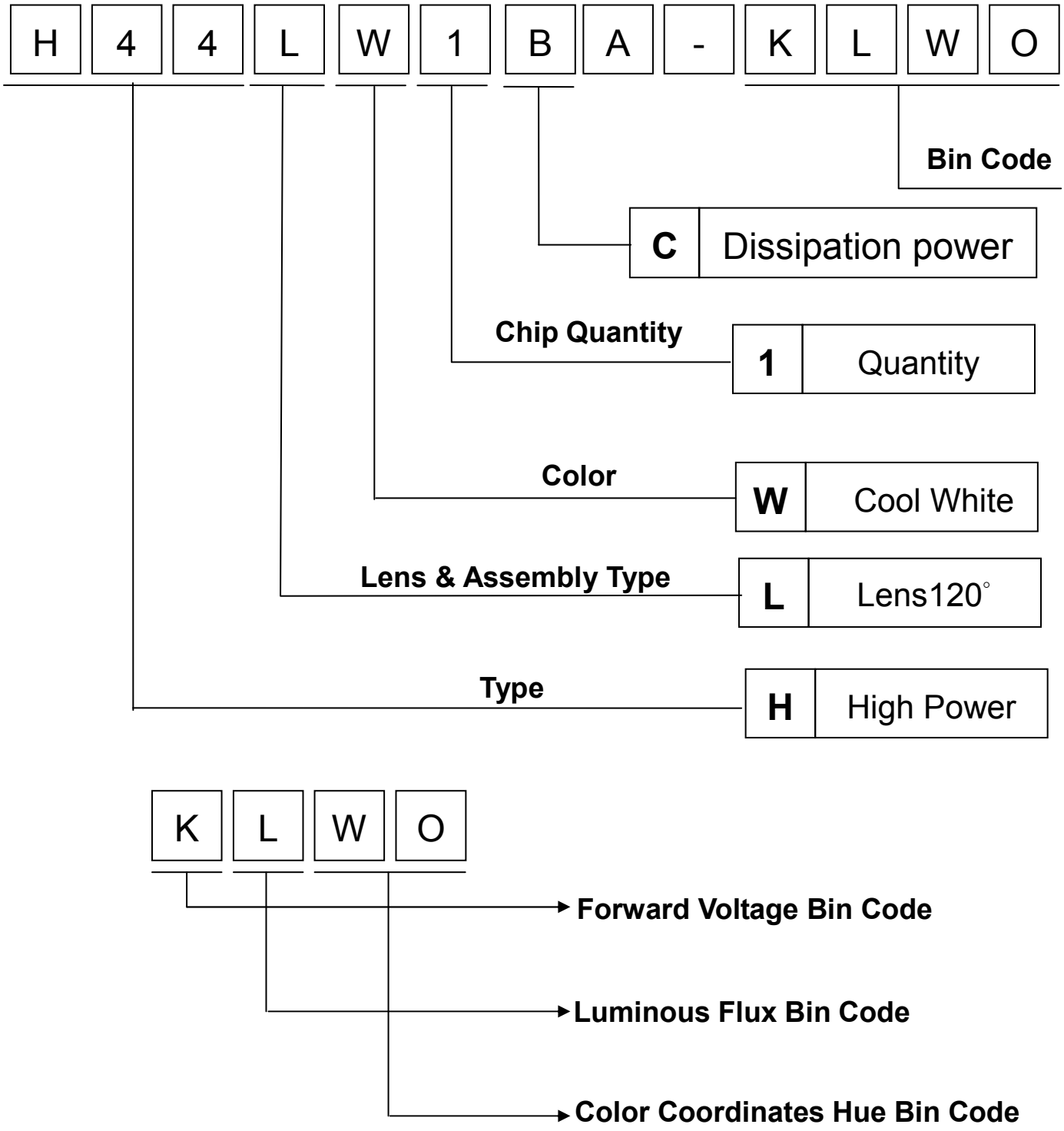
# Hue Bin Specification for Red, Green, Blue, Amber, Orange

| Name | Code | λp Max (nm) | λp Min (nm) |
|---|---|---|---|
| Royal Blue | D0 | 440 | 445 |
| | D1 | 445 | 450 |
| | D2 | 450 | 455 |
| | D3 | 455 | 460 |
| Name | Code | λd Max(nm) | λd Min(nm) |
| Blue | B1 | 460 | 465 |
| | B2 | 465 | 470 |
| | B3 | 470 | 475 |
| | B4 | 475 | 480 |
| | B5 | 480 | 485 |
| | B6 | 485 | 490 |
| Cyan | C1 | 490 | 495 |
| | C2 | 495 | 500 |
| | C3 | 500 | 505 |
| | C4 | 505 | 510 |
| | C5 | 510 | 515 |

| Name | Code | λd Max(nm) | λd Min(nm) |
|---|---|---|---|
| Green | G1 | 515 | 520 |
| | G2 | 520 | 525 |
| | G3 | 525 | 530 |
| | G4 | 530 | 535 |
| | G5 | 535 | 540 |
| | G6 | 540 | 545 |
| | G7 | 545 | 550 |
| Amber | A1 | 584.5 | 587 |
| | A2 | 587 | 589.5 |
| | A4 | 589.5 | 592 |
| | A6 | 592 | 594.5 |
| | A7 | 594.5 | 597 |
| Red & Orange | R1 | 605 | 610 |
| | R2 | 610 | 615 |
| | R3 | 615 | 620 |
| | R4 | 620 | 625 |
| | R5 | 625 | 630 |
| | R6 | 630 | 635 |
| | R7 | 635 | 640 |

Note: Wavelength measurement allowance is ± 2nm

## 5. Part Number Formation



## 6. Characteristic Diagram

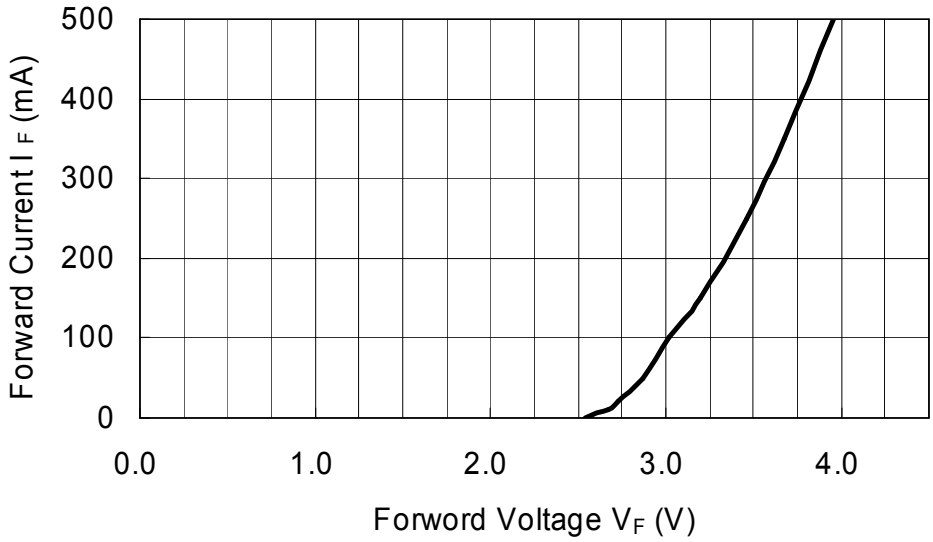



**Fig. 1-A Forward Current vs. Forward Voltage: Cool White/ Neutral White/ Warm White/ Blue/ Green color**

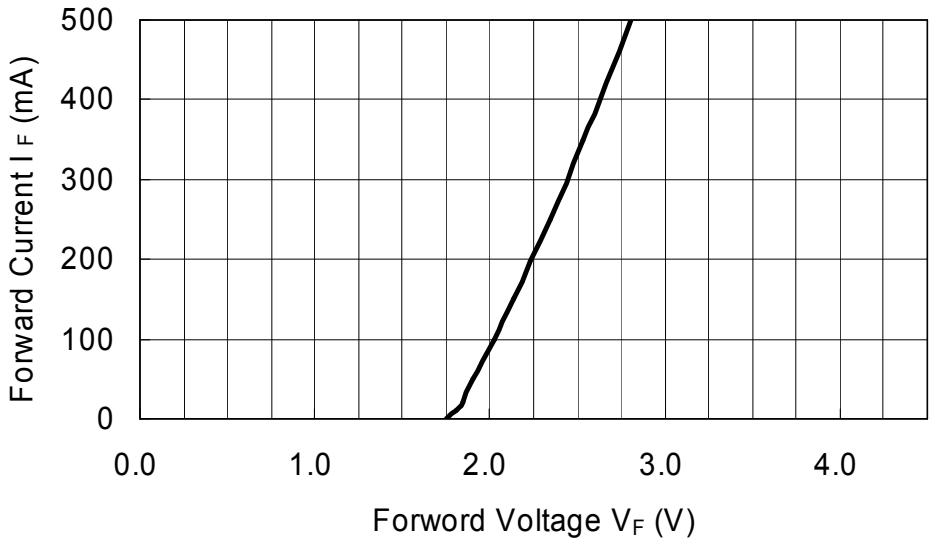



**Fig. 1-B Forward Current vs. Forward Voltage: Red/Amber/Orange color**

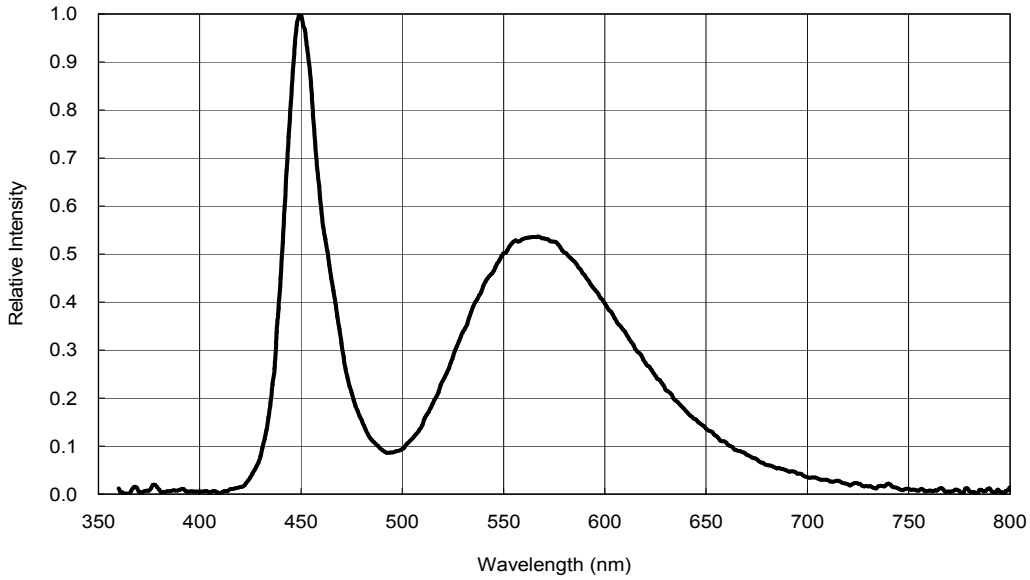



**Fig. 2-A Relative Intensity vs. Wavelength: Cool White**

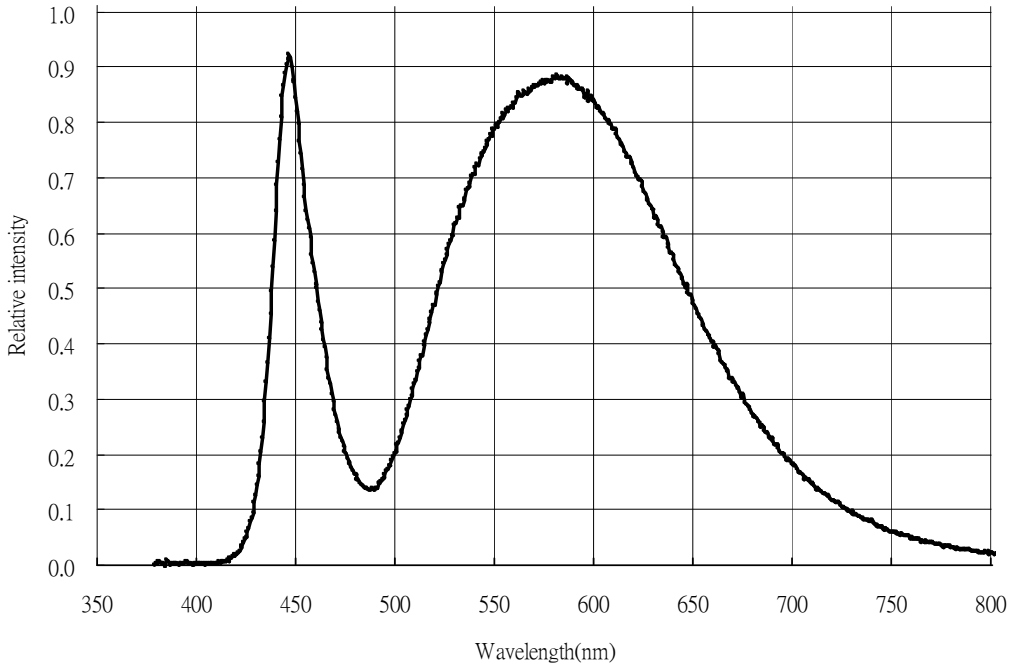



**Fig. 2-B Relative Intensity vs. Wavelength: Nature White**

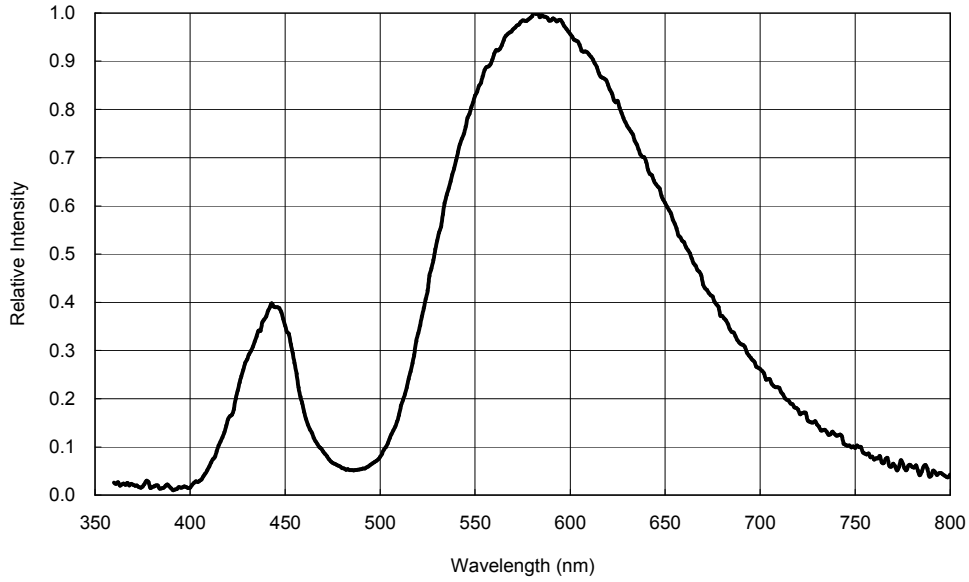



**Fig. 2-C Relative Intensity vs. Wavelength: Warm White**

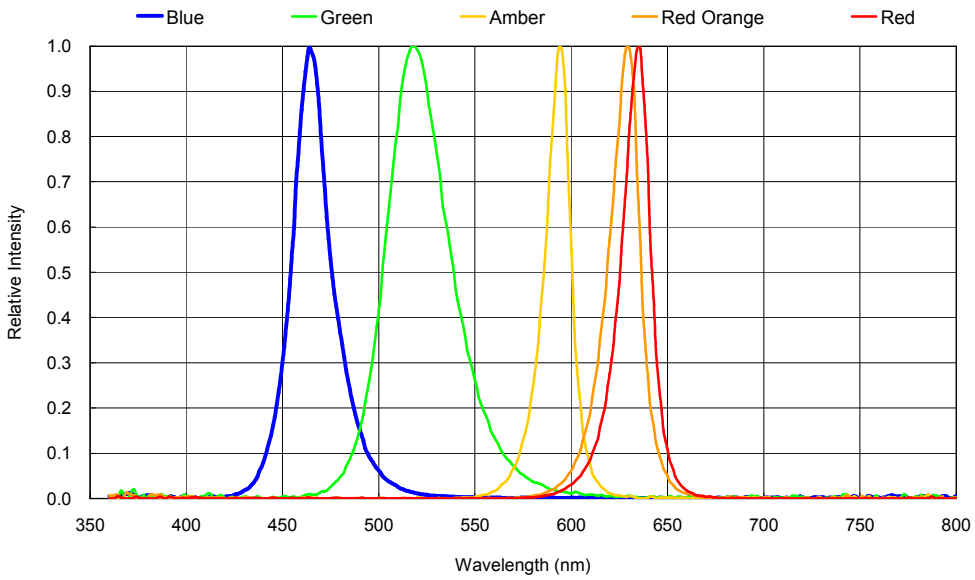



**Fig. 2-D Relative Intensity vs. Wavelength: Single Color**

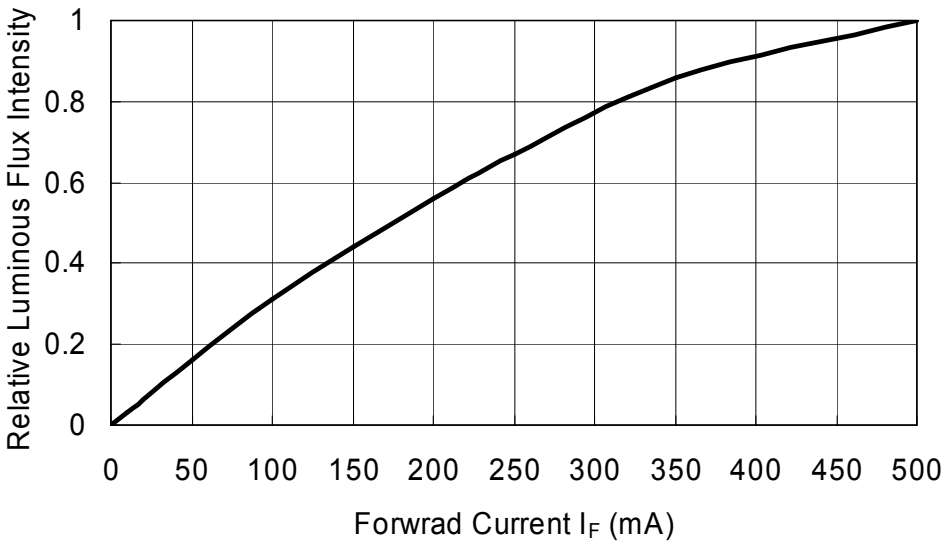



**Fig. 3 Relative Intensity vs. Forward Current**

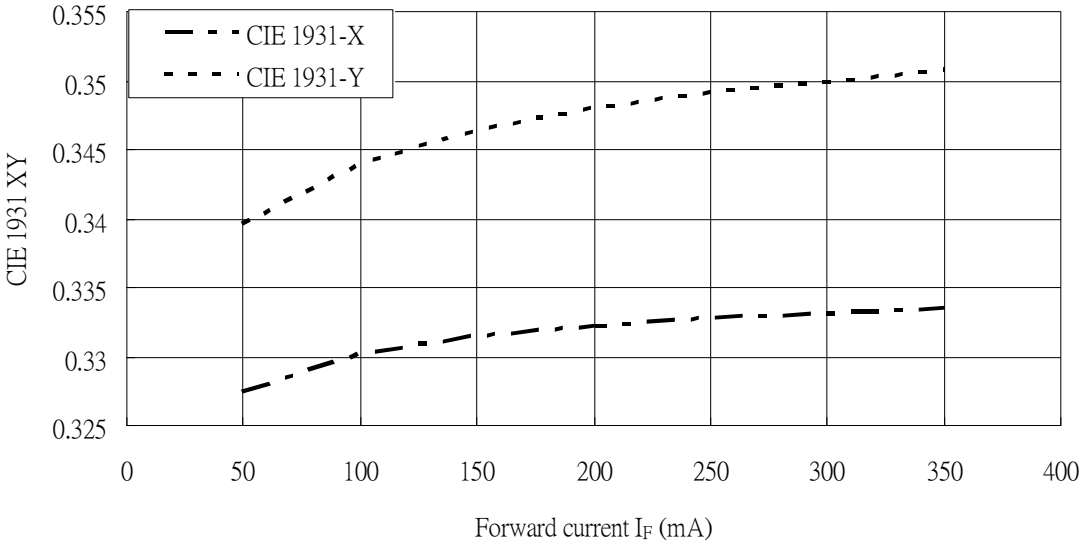
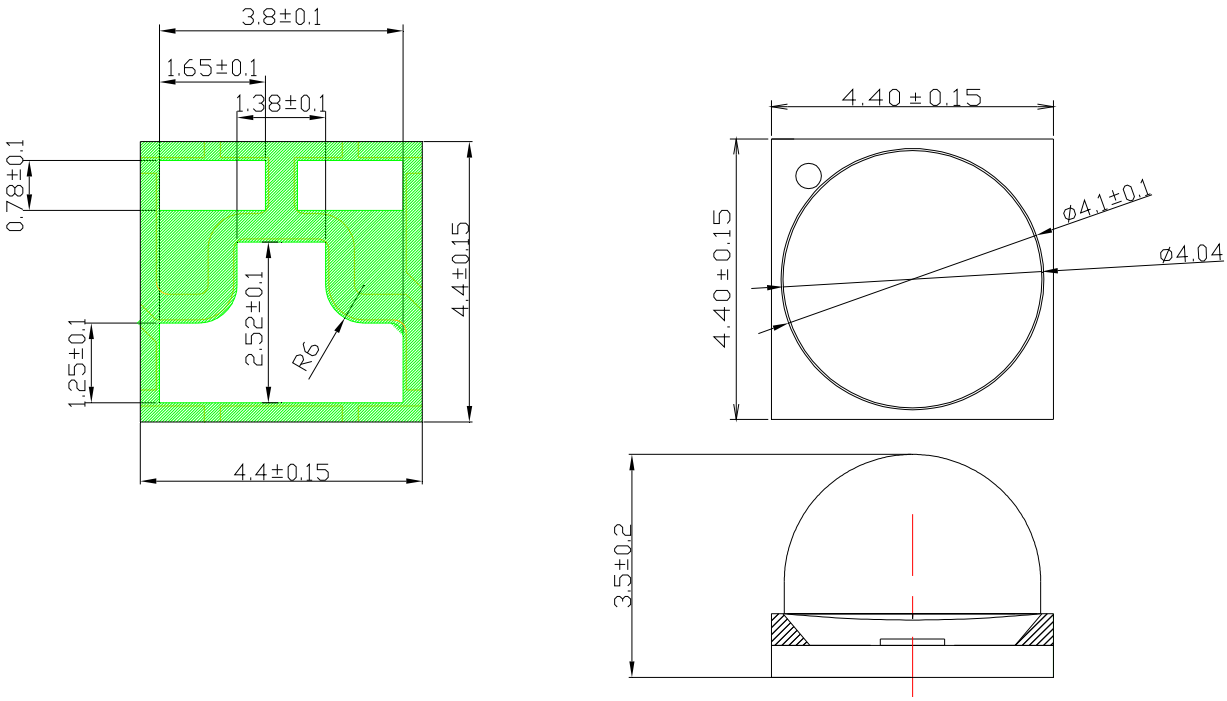



**Fig. 4 Forward Current vs. CIE1931 X,Y**

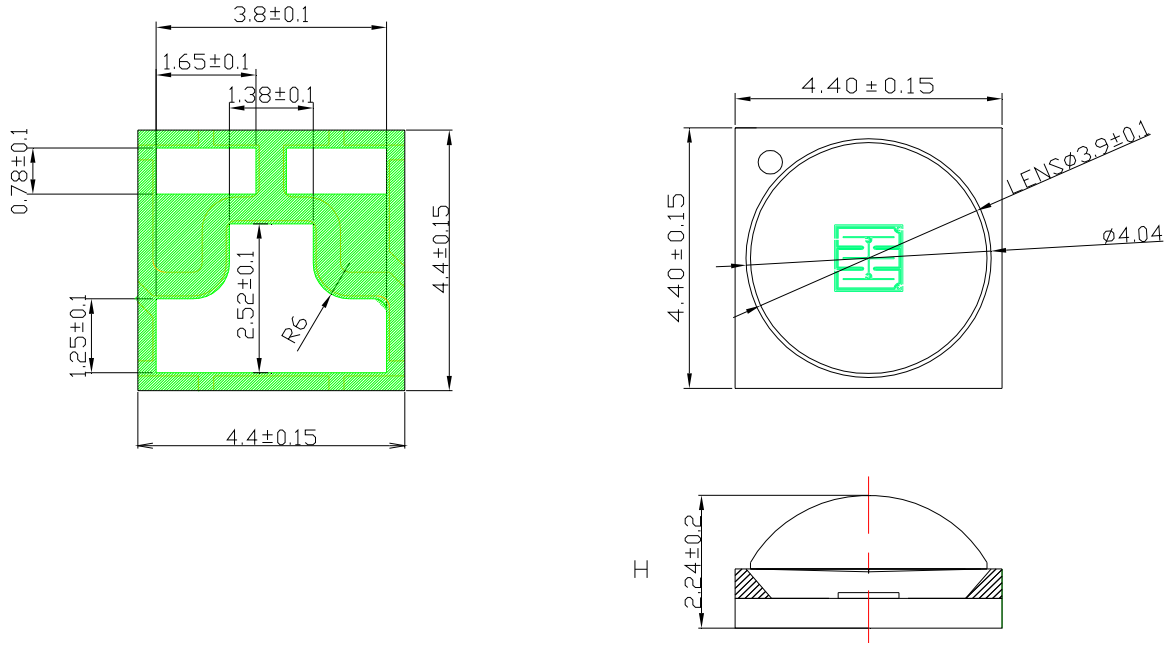
# 7. Outline Dimension

**Unit : mm**

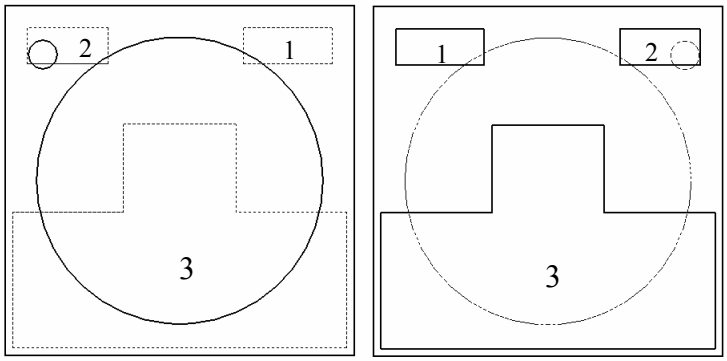
## HPL-H44RX1BA




## HPL-H44LX1BA



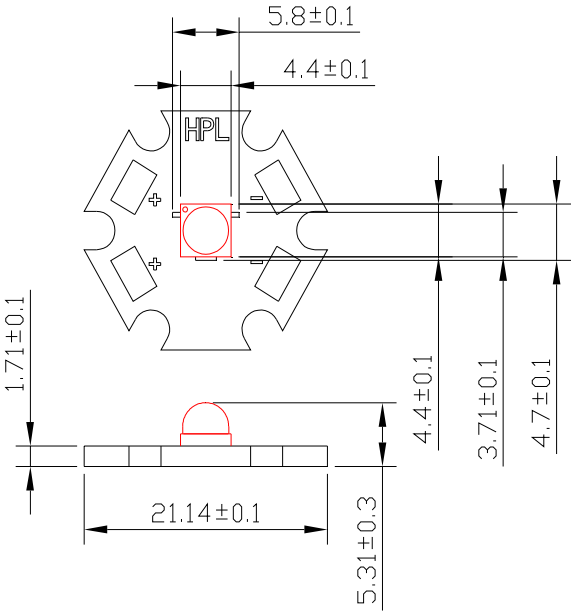
## Pad configuration



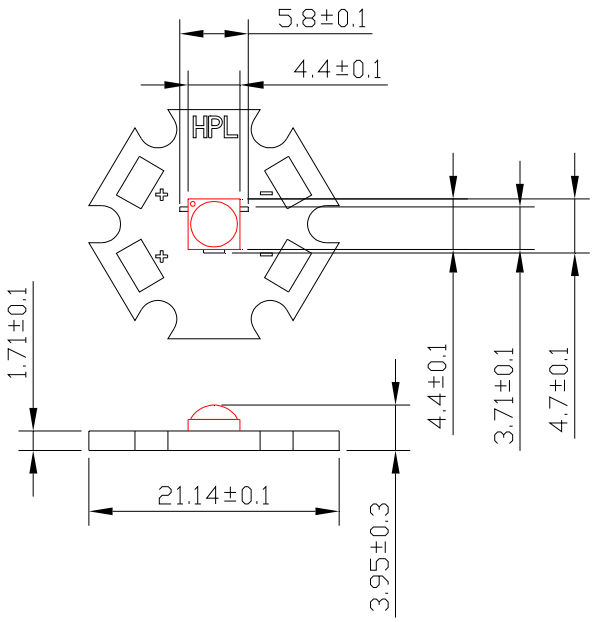

TOP BOTTOM

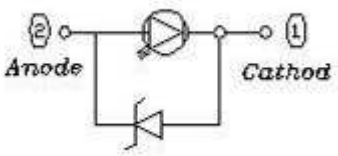
| PAD | Function |
|---|---|
| 1 | cathode |
| 2 | anode |
| 3 | thermal |

### HPL-H44TX1BA

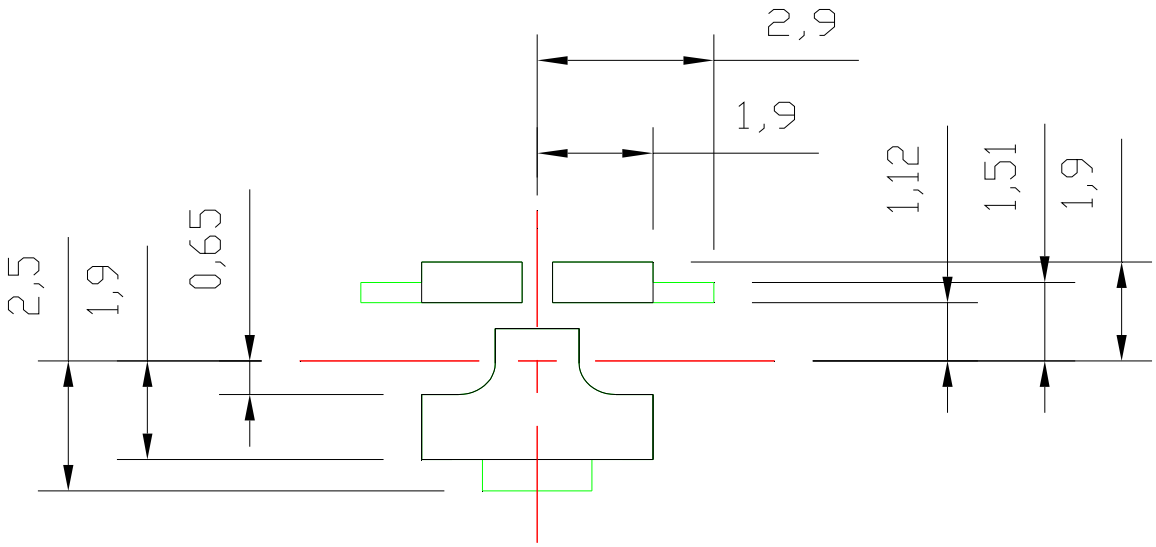


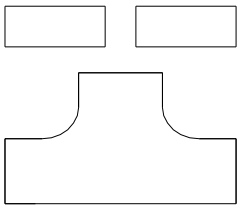

### HPL-H44FX1BA



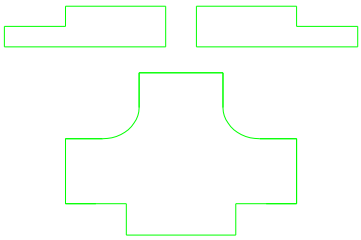



## 8. Recommended Solder Pattern



SOLDER
MASK



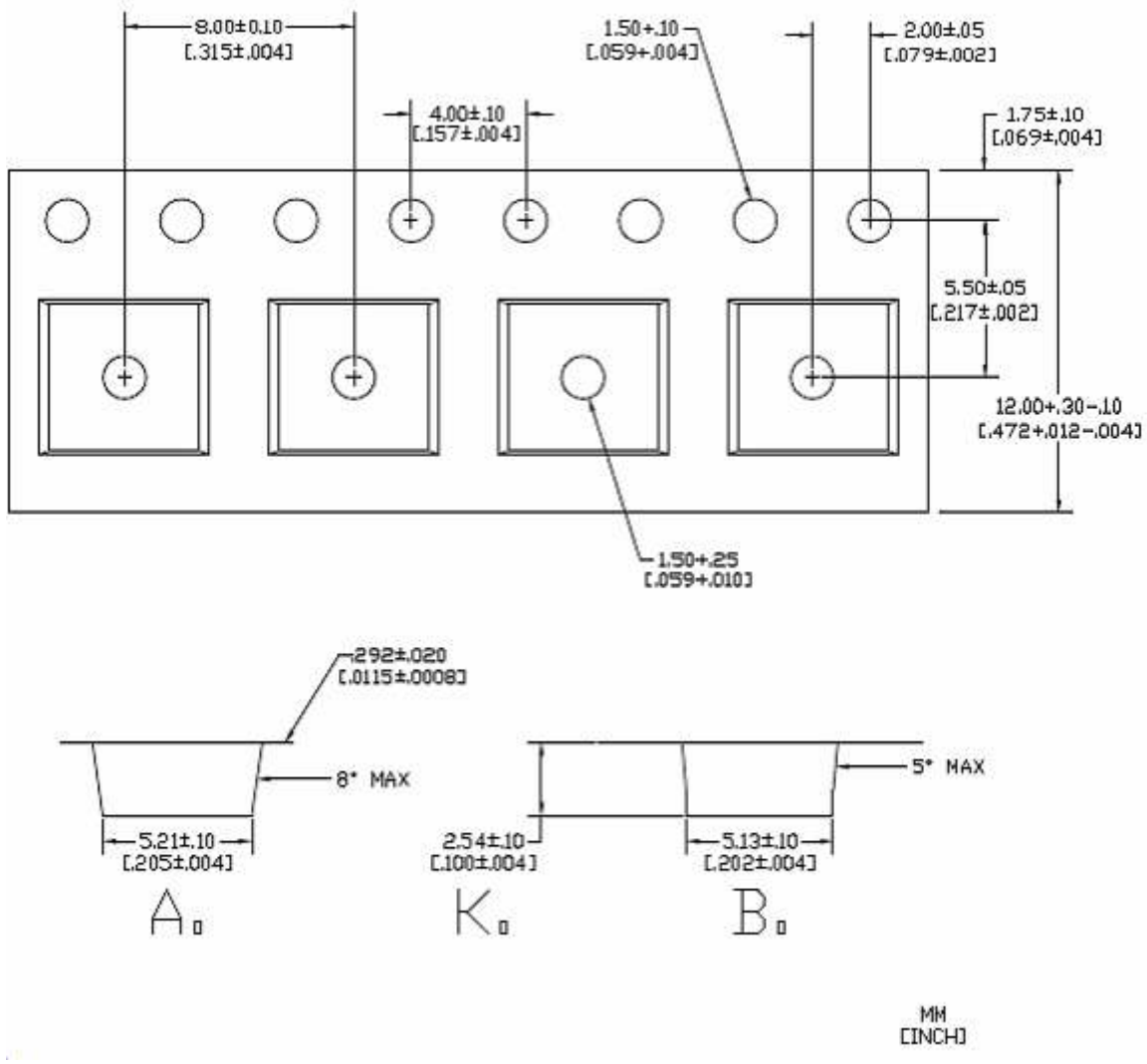
COOPER
LAYER

# 9. Shipping Package Style

## (1)Tapping Dimension Packaging Specification

- **120 degree Lens Type :**
  - Moisture proof bag.
  - 1 Reel/bag.
  - Q'ty: 800(MAX)/Reel.

**Unit : mm**



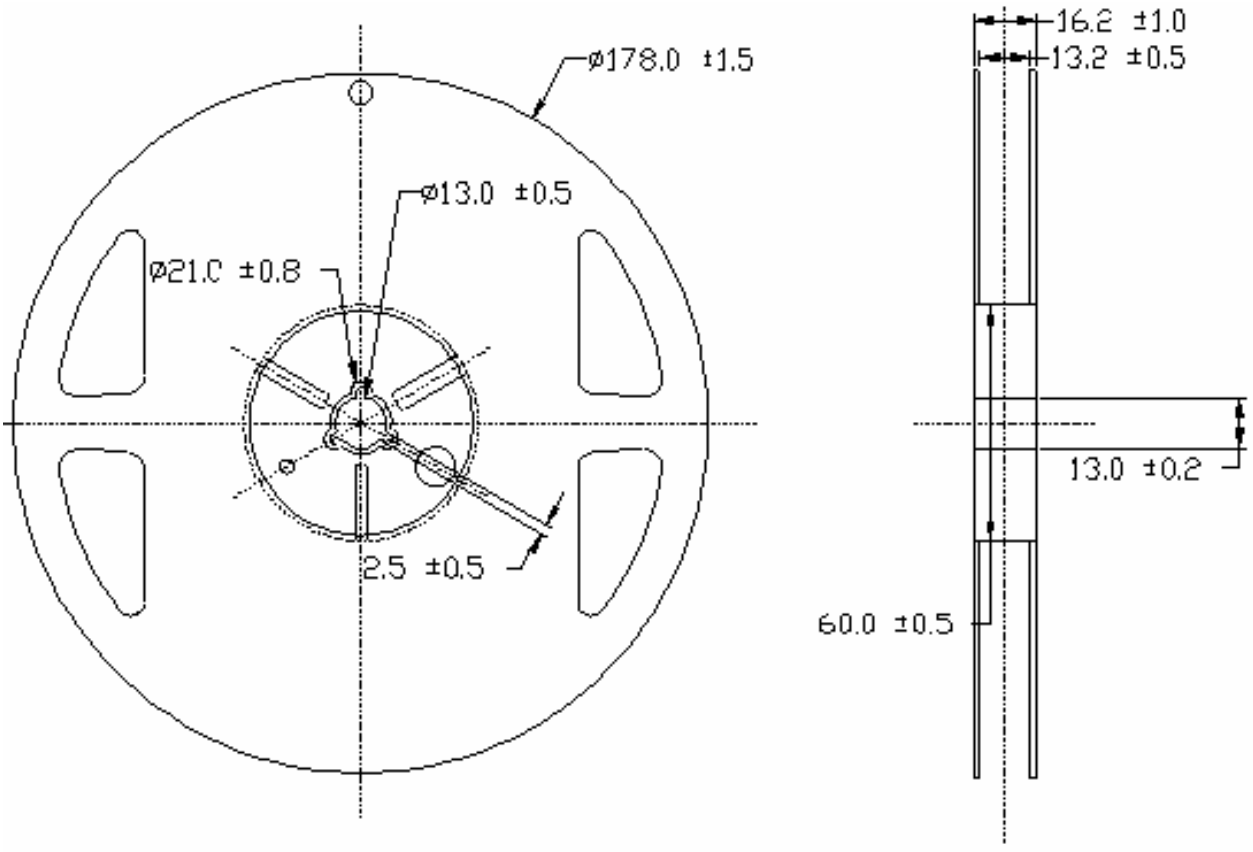
## (2) Package

| Box Type | Dimension (mm) | Reel/Box | 120˚Lens Type (Pcs) |
|---|---|---|---|
| **Small Box(S)** | 230x85x265 | 5 Reel/Box | 4000 |
| **Middle Box(M)** | 470x265x270 | 30 Reel/Box | 24000 |
| **Large Box(L)** | 470x435x270 | 50 Reel/Box | 40000 |

## Reel Packaging :

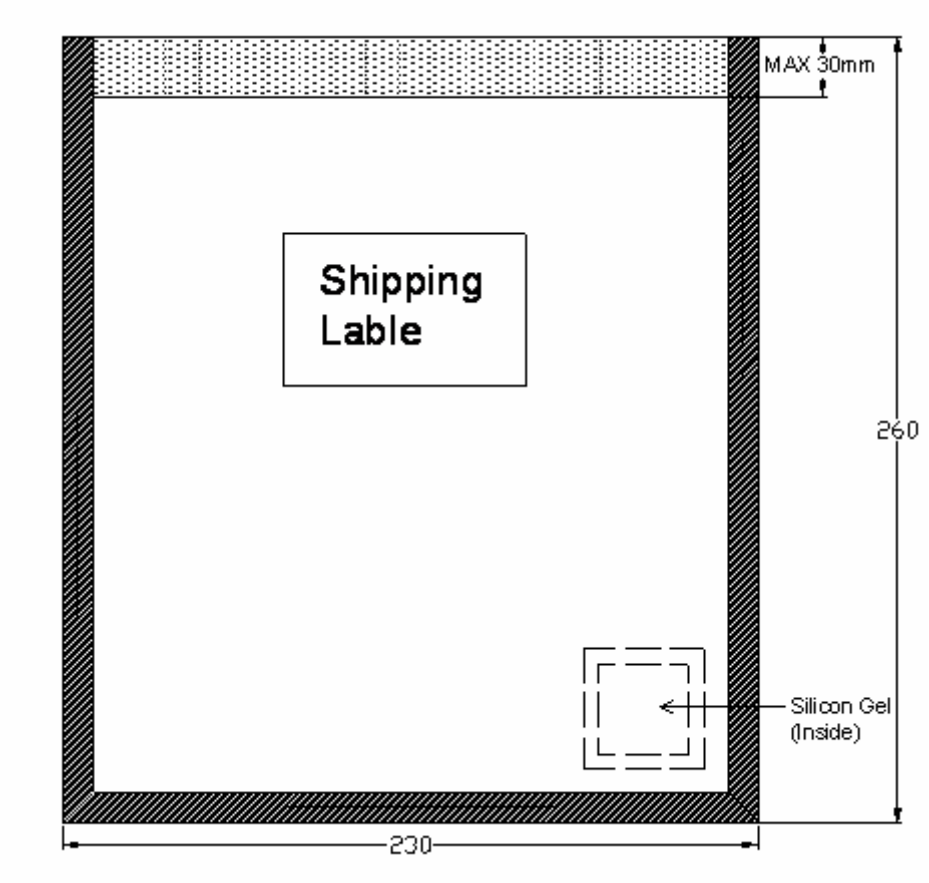
**Reel Part :**

**Unit : mm**



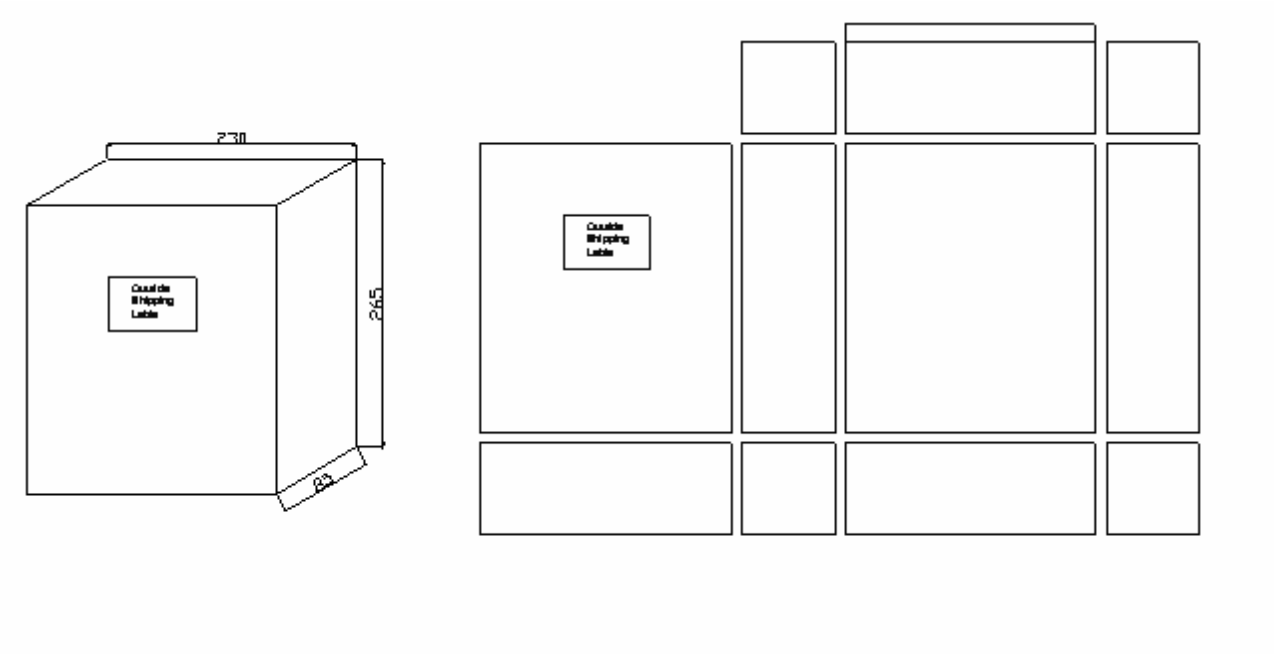
**Anti Statistic Bag :**

**Unit : mm**



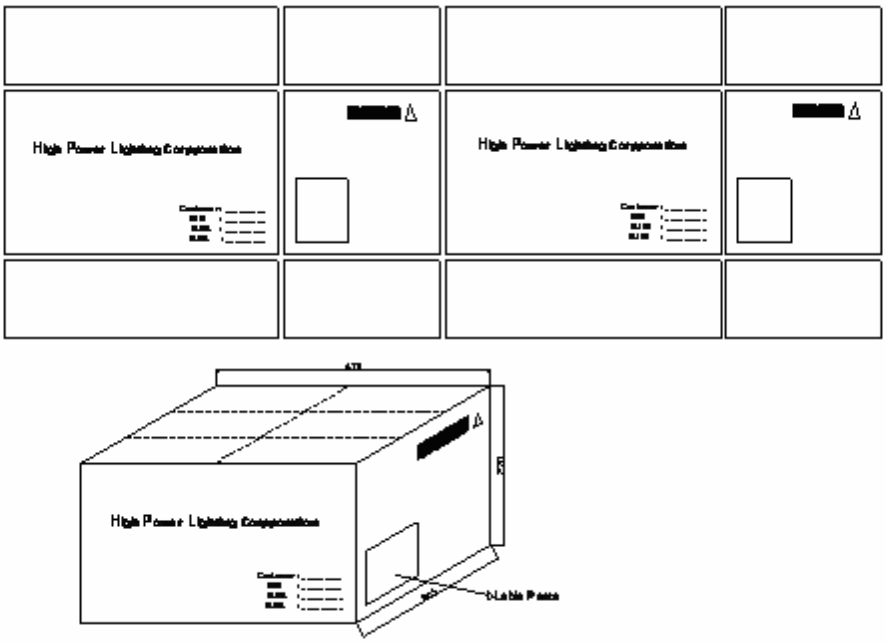
## Small Box

Unit : mm




## Middle Box

Unit : mm

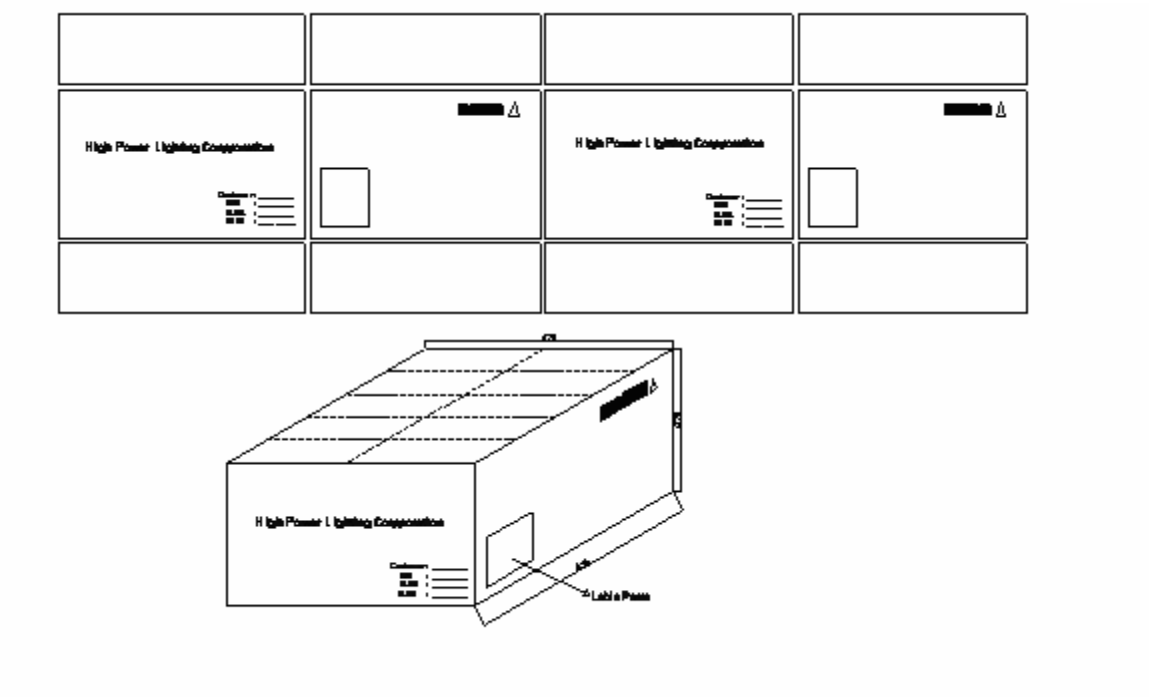




**HPL-H44XX1BA**
**Color: WNSRGBAO**
**11/16/2007**

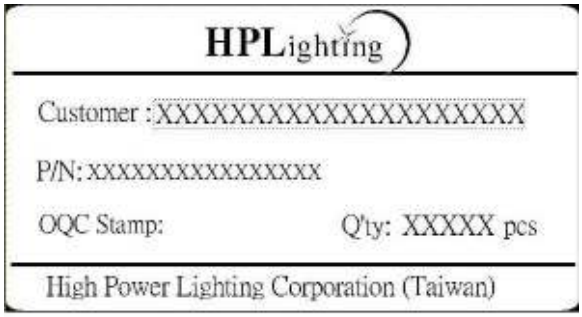
## Large Box

Unit : mm



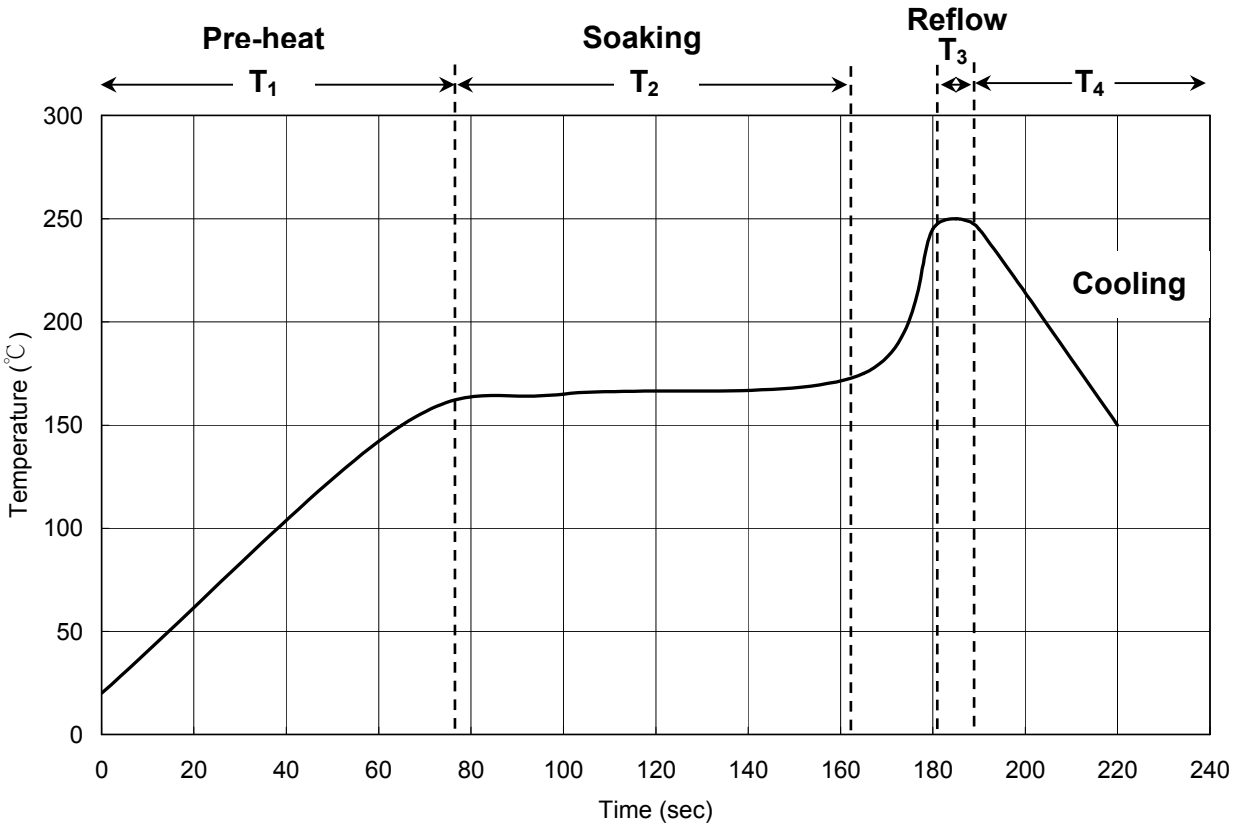
## (3) Label Formation

Unit : mm

# 10. Recommended Solder profile

**Soldering** Recommended soldering conditions:




| | | |
|---|---|---|
| $T_1$ | Ramp up rate | 1.0 ~ 3.0 ℃/sec |
| | Pre-heat time | 50 ~ 80 sec |
| $T_2$ | Soaking temperature | 155 ~ 185 ℃ |
| | Dwell time during soaking | 60 ~ 120 sec |
| $T_3$ | Reflow temperature | 240 ~ 250 ℃ |
| | Reflow time | Max 10 sec |
| | Ramp up rate during reflow | 1.2 ~ 2.3 ℃/sec |
| $T_4$ | Cooling | 1.0 ~ 6.0 ℃/sec |

Note: Suggest using Sn96Ag3Cu0.5 lead free solder.

**Cleaning**

Use alcohol-based cleaning solvents such as isopropyl alcohol to clean the LED if necessary.