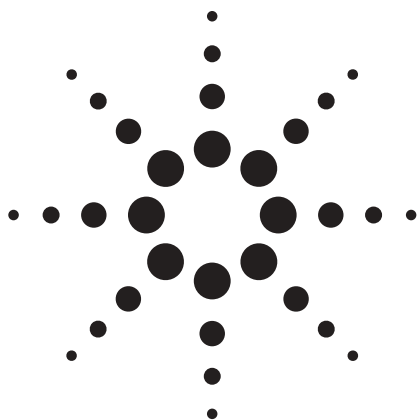




# Agilent HLMP-Cxxx T-1<sup>3</sup>/<sub>4</sub> (5 mm) Super Bright Precision Optical Performance InGaN LED Lamps Data Sheet

**HLMP-CB18, HLMP-CB19, HLMP-CM18, HLMP-CM19, HLMP-CE18,  
HLMP-CE19, HLMP-CB28, HLMP-CB29, HLMP-CM28, HLMP-CM29,  
HLMP-CE28, HLMP-CE29, HLMP-CB38, HLMP-CB39, HLMP-CM38,  
HLMP-CM39, HLMP-CE38, HLMP-CE39**

## Description

These Super Bright Precision Optical Performance LED lamps are based on flip chip InGaN material, which is the brightest and most efficient technology for LEDs in the blue, green, and cyan region of the spectrum. The 470 nm typical dominant wavelength for blue and 530 nm typical wavelength for green is well suited to color mixing in full color signs. The 500 nm typical dominant wavelength for cyan is suitable for traffic signal application.

These LED lamps are untinted, non-diffused, T-1<sup>3</sup>/<sub>4</sub> packages incorporating second

generation optics which produce well-defined spatial radiation patterns at specific viewing cone angles.

These lamps are made with advanced optical grade epoxy, offering superior temperature and moisture resistance in outdoor signal and sign applications. The high maximum LED junction temperature limit of +130°C enables high temperature operation in bright sunlight conditions. The package epoxy contains both UV-a and UV-b inhibitors to reduce the effects of long-term exposure to direct sunlight.

## Features

- Well defined spatial radiation pattern
- High luminous output
- Available in blue, green and cyan color
- Viewing angle: 15°, 23° and 30°
- Standoff or non-standoff leads
- Superior resistance to moisture
- New InGaN flip chip die technology with protective diode
- ESD class 3

## Applications

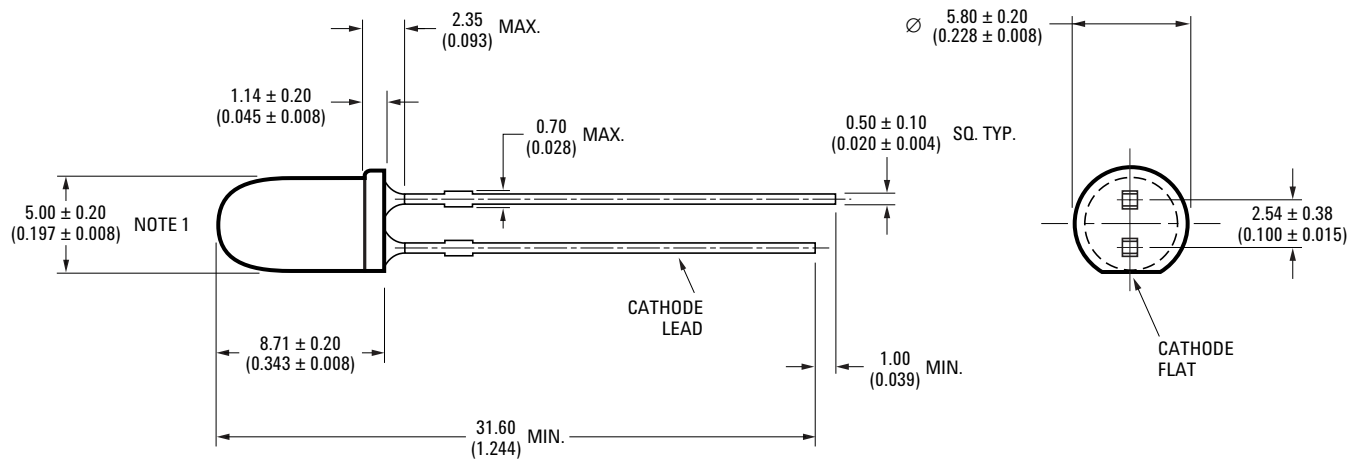
- Traffic signals
- Commercial outdoor advertising
- Front panel backlighting
- Front panel indicators



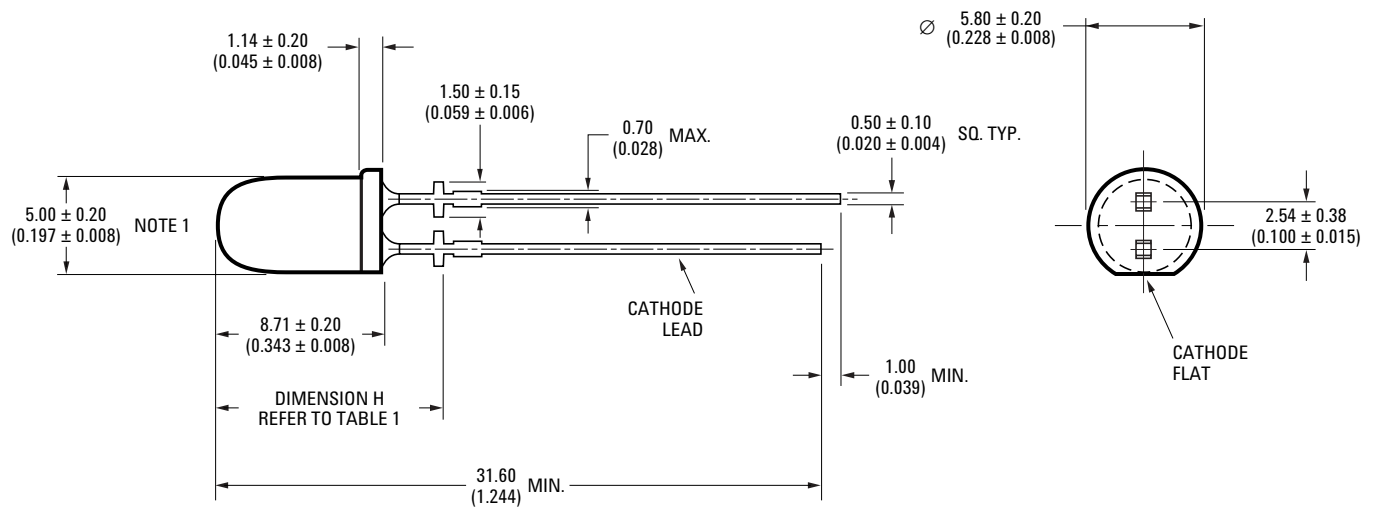
**Agilent Technologies**

## Package Dimensions

PACKAGE DIMENSION A



PACKAGE DIMENSION B



### NOTES:

1. MEASURED JUST ABOVE FLANGE.
2. DIMENSIONS IN MILLIMETERS (INCHES).

### DIMENSION H:

23 & 30 DEGREE =  $12.67 \pm 0.25$  mm (0.499  $\pm$  0.01 INCH)  
 15 DEGREE =  $12.93 \pm 0.25$  mm (0.509  $\pm$  0.01 INCH)

## Device Selection Guide

| Part Number     | Color | Typical Viewing Angle (Degree) | Intensity (cd) at 20 mA |          |         | Standoff | Package Dimension |
|-----------------|-------|--------------------------------|-------------------------|----------|---------|----------|-------------------|
|                 |       |                                | Minimum                 | Typ.ical | Maximum |          |                   |
| HLMP-CB18-TW0xx | Blue  | 15                             | 2.50                    | 3.50     | 7.20    | No       | A                 |
| HLMP-CB19-TW0xx | Blue  | 15                             | 2.50                    | 3.50     | 7.20    | Yes      | B                 |
| HLMP-CM18-X10xx | Green | 15                             | 7.20                    | 12.0     | 21.0    | No       | A                 |
| HLMP-CM19-X10xx | Green | 15                             | 7.20                    | 12.0     | 21.0    | Yes      | B                 |
| HLMP-CE18-WZ0xx | Cyan  | 15                             | 5.50                    | 11.8     | 16.0    | No       | A                 |
| HLMP-CE19-WZ0xx | Cyan  | 15                             | 5.50                    | 11.8     | 16.0    | Yes      | B                 |
| HLMP-CB28-RU0xx | Blue  | 23                             | 1.50                    | 2.40     | 4.20    | No       | A                 |
| HLMP-CB29-RU0xx | Blue  | 23                             | 1.50                    | 2.40     | 4.20    | Yes      | B                 |
| HLMP-CM28-WZ0xx | Green | 23                             | 5.50                    | 9.30     | 16.0    | No       | A                 |
| HLMP-CM29-WZ0xx | Green | 23                             | 5.50                    | 9.30     | 16.0    | Yes      | B                 |
| HLMP-CE28-VY0xx | Cyan  | 23                             | 4.20                    | 7.40     | 12.0    | No       | A                 |
| HLMP-CE29-VY0xx | Cyan  | 23                             | 4.20                    | 7.40     | 12.0    | Yes      | B                 |
| HLMP-CB38-QT0xx | Blue  | 30                             | 1.15                    | 1.50     | 3.20    | No       | A                 |
| HLMP-CB39-QT0xx | Blue  | 30                             | 1.15                    | 1.50     | 3.20    | Yes      | B                 |
| HLMP-CM38-UX0xx | Green | 30                             | 3.20                    | 5.00     | 9.30    | No       | A                 |
| HLMP-CM39-UX0xx | Green | 30                             | 3.20                    | 5.00     | 9.30    | Yes      | B                 |
| HLMP-CE38-TW0xx | Cyan  | 30                             | 2.50                    | 3.90     | 7.20    | No       | A                 |
| HLMP-CE39-TW0xx | Cyan  | 30                             | 2.50                    | 3.90     | 7.20    | Yes      | B                 |
| HLMP-CB18-UVAxx | Blue  | 15                             | 3.20                    | -        | 5.50    | No       | A                 |
| HLMP-CB28-STDxx | Blue  | 23                             | 1.90                    | -        | 3.20    | No       | A                 |
| HLMP-CB38-QRAxx | Blue  | 30                             | 1.15                    | -        | 1.90    | No       | A                 |
| HLMP-CB39-RSDxx | Blue  | 30                             | 1.50                    | -        | 2.50    | Yes      | B                 |
| HLMP-CM18-YZCxx | Green | 15                             | 9.30                    | -        | 16.0    | No       | A                 |
| HLMP-CM28-WXCxx | Green | 23                             | 5.50                    | -        | 9.30    | No       | A                 |
| HLMP-CM38-UVCxx | Green | 30                             | 3.20                    | -        | 5.50    | No       | A                 |
| HLMP-CM39-UVCxx | Green | 30                             | 3.20                    | -        | 5.50    | Yes      | B                 |
| HLMP-CM39-WXDxx | Green | 30                             | 5.50                    | -        | 9.30    | Yes      | B                 |

### Notes:

1. Tolerance for luminous intensity measurement is  $\pm 15\%$ .
2. The luminous intensity is measured on the mechanical axis of the lamp package.
3. The optical axis is closely aligned with the package mechanical axis.
4. LED light output is bright enough to cause injuries to the eyes. Precautions must be taken to prevent looking directly at the LED without proper safety equipment.

## Ordering Information

| HLMP | - | x | x | xx | - | x | x | xx |                                          |
|------|---|---|---|----|---|---|---|----|------------------------------------------|
|      |   |   |   |    |   |   |   |    | <b>Mechanical Option</b>                 |
|      |   |   |   |    |   |   |   |    | 00: Bulk                                 |
|      |   |   |   |    |   |   |   |    | DD: Ammo pack                            |
|      |   |   |   |    |   |   |   |    | <b>Color Bin Option</b>                  |
|      |   |   |   |    |   |   |   |    | 0: Full color bin distribution           |
|      |   |   |   |    |   |   |   |    | A: Color bin 1 & 2 only                  |
|      |   |   |   |    |   |   |   |    | C: Color bin 3 & 4 only                  |
|      |   |   |   |    |   |   |   |    | D: Color bin 4 & 5 only                  |
|      |   |   |   |    |   |   |   |    | <b>Maximum Intensity Bin</b>             |
|      |   |   |   |    |   |   |   |    | Refer to Device Selection Guide          |
|      |   |   |   |    |   |   |   |    | <b>Minimum Intensity Bin</b>             |
|      |   |   |   |    |   |   |   |    | Refer to Device Selection Guide          |
|      |   |   |   |    |   |   |   |    | <b>Viewing Angle and Standoff Option</b> |
|      |   |   |   |    |   |   |   |    | 18: 15° without standoff                 |
|      |   |   |   |    |   |   |   |    | 19: 15° with standoff                    |
|      |   |   |   |    |   |   |   |    | 28: 23° without standoff                 |
|      |   |   |   |    |   |   |   |    | 29: 23° with standoff                    |
|      |   |   |   |    |   |   |   |    | 38: 30° without standoff                 |
|      |   |   |   |    |   |   |   |    | 39: 30° with standoff                    |
|      |   |   |   |    |   |   |   |    | <b>Color</b>                             |
|      |   |   |   |    |   |   |   |    | B: Blue 470 nm                           |
|      |   |   |   |    |   |   |   |    | M: Green 530 nm                          |
|      |   |   |   |    |   |   |   |    | E: Cyan 500 nm                           |
|      |   |   |   |    |   |   |   |    | <b>Package</b>                           |
|      |   |   |   |    |   |   |   |    | C: T-1 $\frac{3}{4}$ (5 mm) Round Lamp   |

## Absolute Maximum Ratings at T<sub>A</sub> = 25°C

| Parameter                                  | Value       | Unit |
|--------------------------------------------|-------------|------|
| DC Forward Current <sup>[1]</sup>          | 30          | mA   |
| Peak Pulsed Forward Current <sup>[2]</sup> | 100         | mA   |
| Average Forward Current                    | 30          | mA   |
| Power Dissipation                          | 120         | mW   |
| LED Junction Temperature                   | 130         | °C   |
| Operating Temperature Range                | -40 to +85  | °C   |
| Storage Temperature Range                  | -40 to +100 | °C   |

### Notes:

1. Derate linearly as shown in Figure 3.
2. Duty factor 30%, 1KHz.

## Electrical Characteristics at $T_A = 25^\circ\text{C}$

| Parameters                         | Symbol                | Blue |      |      | Green |      |      | Cyan |      |      | Units              | Test Condition                                                                |
|------------------------------------|-----------------------|------|------|------|-------|------|------|------|------|------|--------------------|-------------------------------------------------------------------------------|
|                                    |                       | Min. | Typ. | Max. | Min.  | Typ. | Max. | Min. | Typ. | Max. |                    |                                                                               |
| Forward Voltage                    | $V_F$                 |      | 3.4  | 4.0  |       | 3.2  | 4.0  |      | 3.3  | 4.0  | V                  | $I_F = 20\text{ mA}$                                                          |
| Capacitance                        | C                     |      | 53   |      |       | 53   |      |      | 53   |      | pF                 | $V_F = 0, f = 1\text{ MHz}$                                                   |
| Reverse Voltage <sup>[2]</sup>     | $V_R$                 |      | 0.6  |      |       | 0.6  |      |      | 0.6  |      | V                  | $I_R = 10\text{ }\mu\text{A}$                                                 |
| Thermal Resistance                 | $R\theta_{J-PIN}$     |      | 240  |      |       | 240  |      |      | 240  |      | $^\circ\text{C/W}$ | LED Junction to cathode lead                                                  |
| Dominant Wavelength <sup>[3]</sup> | $\lambda_d$           | 460  | 470  | 480  | 520   | 530  | 540  | 490  | 500  | 510  | nm                 | $I_F = 20\text{ mA}$                                                          |
| Peak Wavelength                    | $\lambda_{PEAK}$      |      | 466  |      |       | 523  |      |      | 495  |      | nm                 | Peak of wavelength of spectral distribution at $I_F = 20\text{ mA}$           |
| Spectral Half Width                | $\Delta\lambda_{1/2}$ |      | 21   |      |       | 30   |      |      | 26   |      |                    | Wavelength width at spectral distribution power point at $I_F = 20\text{ mA}$ |
| Luminous Efficacy <sup>[4]</sup>   | $\eta_v$              |      | 62   |      |       | 588  |      |      | 220  |      | lm/W               | Emitted luminous power/Emitted radiant power                                  |

### Notes:

1.  $2\theta_{1/2}$  is the off-axis angle where the luminous intensity is  $\frac{1}{2}$  the on axis intensity.
2. The reverse voltage of the product is equivalent to the forward voltage of the protective chip at  $I_R = 10\text{ }\mu\text{A}$ .
3. The dominant wavelength,  $\lambda_d$ , is derived from the Chromaticity Diagram and represents the color of the lamp.
4. The radiant intensity,  $I_e$  in watts/steradian, may be found from the equation  $I_e = I_v/\eta_v$ , where  $I_v$  is the luminous intensity in candelas and  $\eta_v$  is the luminous efficacy in lumens/watt.

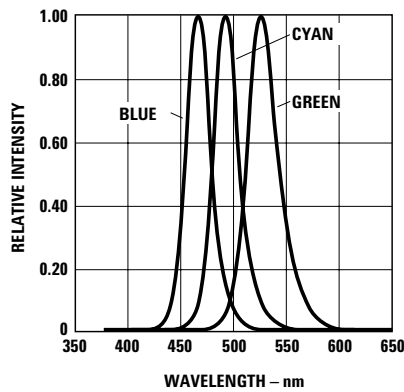


Figure 1. Relative intensity vs. wavelength.

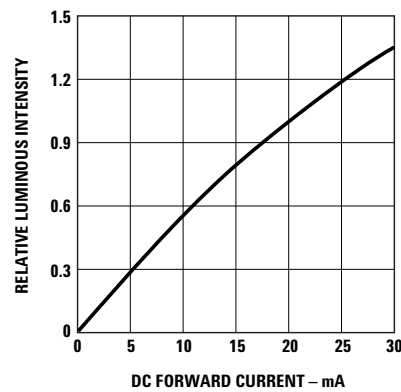


Figure 2. Relative luminous intensity vs. forward current.

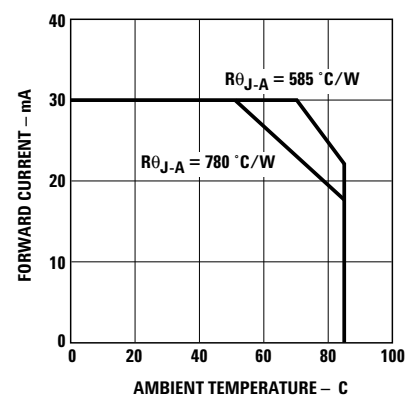


Figure 3. Forward current vs. ambient temperature.

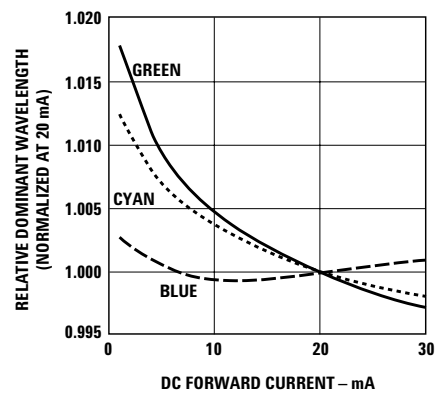
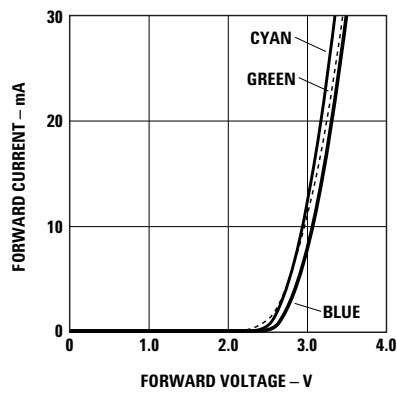


Figure 4. Forward current vs. forward voltage.

Figure 5. Relative dominant wavelength vs DC forward current.

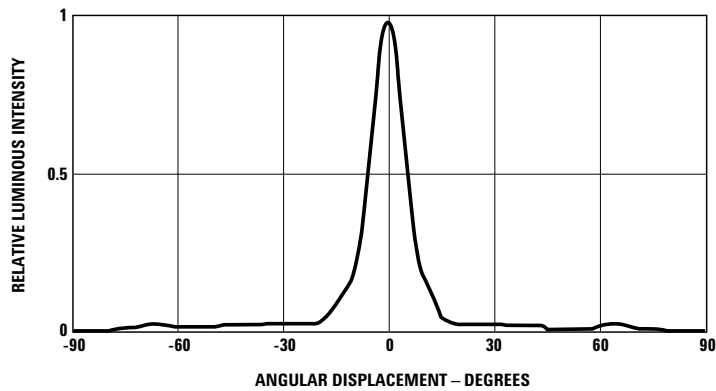


Figure 6. Spatial radiation pattern – 15 degree lamps.

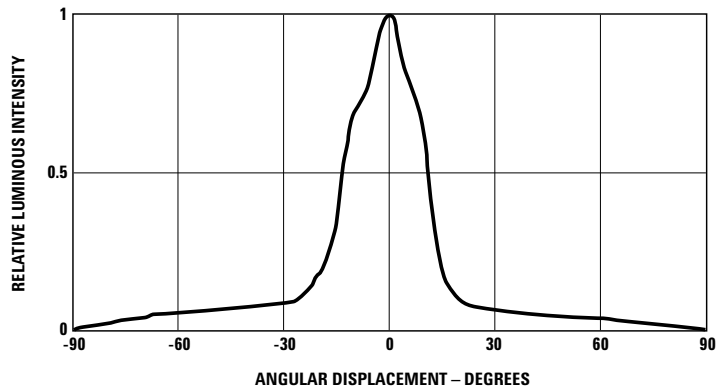


Figure 7. Spatial radiation pattern – 23 degree lamps.

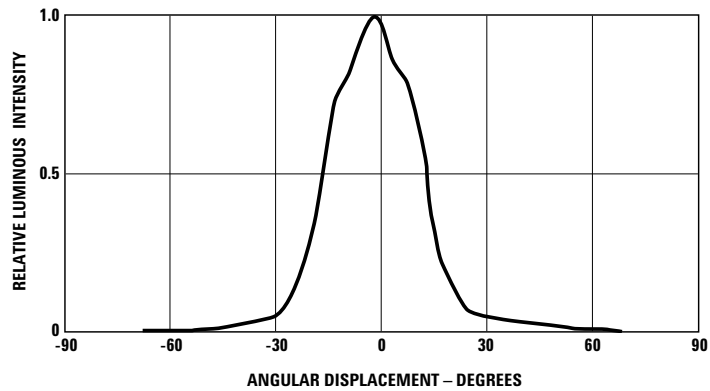


Figure 8. Spatial radiation pattern – 30 degree lamps.

**Intensity Bin Limit Table**

| Bin | Intensity (mcd) at 20 mA |       |
|-----|--------------------------|-------|
|     | Min                      | Max   |
| N   | 680                      | 880   |
| P   | 880                      | 1150  |
| Q   | 1150                     | 1500  |
| R   | 1500                     | 1900  |
| S   | 1900                     | 2500  |
| T   | 2500                     | 3200  |
| U   | 3200                     | 4200  |
| V   | 4200                     | 5500  |
| W   | 5500                     | 7200  |
| X   | 7200                     | 9300  |
| Y   | 9300                     | 12000 |
| Z   | 12000                    | 16000 |
| 1   | 16000                    | 21000 |

Tolerance for each bin limit is  $\pm 15\%$ .

**Blue Color Bin Table**

| Bin | Min. Dom | Max. Dom | Xmin.  | Ymin.  | Xmax.  | Ymax.  |
|-----|----------|----------|--------|--------|--------|--------|
| 1   | 460.0    | 464.0    | 0.1440 | 0.0297 | 0.1766 | 0.0966 |
|     |          |          | 0.1818 | 0.0904 | 0.1374 | 0.0374 |
| 2   | 464.0    | 468.0    | 0.1374 | 0.0374 | 0.1699 | 0.1062 |
|     |          |          | 0.1766 | 0.0966 | 0.1291 | 0.0495 |
| 3   | 468.0    | 472.0    | 0.1291 | 0.0495 | 0.1616 | 0.1209 |
|     |          |          | 0.1699 | 0.1062 | 0.1187 | 0.0671 |
| 4   | 472.0    | 476.0    | 0.1187 | 0.0671 | 0.1517 | 0.1423 |
|     |          |          | 0.1616 | 0.1209 | 0.1063 | 0.0945 |
| 5   | 476.0    | 480.0    | 0.1063 | 0.0945 | 0.1397 | 0.1728 |
|     |          |          | 0.1517 | 0.1423 | 0.0913 | 0.1327 |

Tolerance for each bin limit is  $\pm 0.5$  nm.

**Green Color Bin Table**

| Bin | Min. Dom | Max. Dom | Xmin.  | Ymin.  | Xmax.  | Ymax.  |
|-----|----------|----------|--------|--------|--------|--------|
| 1   | 520.0    | 524.0    | 0.0743 | 0.8338 | 0.1856 | 0.6556 |
|     |          |          | 0.1650 | 0.6586 | 0.1060 | 0.8292 |
| 2   | 524.0    | 528.0    | 0.1060 | 0.8292 | 0.2068 | 0.6463 |
|     |          |          | 0.1856 | 0.6556 | 0.1387 | 0.8148 |
| 3   | 528.0    | 532.0    | 0.1387 | 0.8148 | 0.2273 | 0.6344 |
|     |          |          | 0.2068 | 0.6463 | 0.1702 | 0.7965 |
| 4   | 532.0    | 536.0    | 0.1702 | 0.7965 | 0.2469 | 0.6213 |
|     |          |          | 0.2273 | 0.6344 | 0.2003 | 0.7764 |
| 5   | 536.0    | 540.0    | 0.2003 | 0.7764 | 0.2659 | 0.6070 |
|     |          |          | 0.2469 | 0.6213 | 0.2296 | 0.7543 |

Tolerance for each bin limit is  $\pm 0.5$  nm.

**Cyan Color Bin Table**

| Bin | Min Dom | Max Dom | Xmin.  | Ymin.  | Xmax.  | Ymax.  |
|-----|---------|---------|--------|--------|--------|--------|
| 1   | 490.0   | 495.0   | 0.0454 | 0.2945 | 0.1164 | 0.3889 |
|     |         |         | 0.1318 | 0.3060 | 0.0235 | 0.4127 |
| 2   | 495.0   | 500.0   | 0.0345 | 0.4127 | 0.1057 | 0.4769 |
|     |         |         | 0.1164 | 0.3899 | 0.0082 | 0.5384 |
| 3   | 500.0   | 505.0   | 0.0082 | 0.5384 | 0.1207 | 0.5584 |
|     |         |         | 0.1057 | 0.4769 | 0.0039 | 0.6548 |
| 4   | 505.0   | 510.0   | 0.0039 | 0.6548 | 0.1097 | 0.6251 |
|     |         |         | 0.1027 | 0.5584 | 0.0139 | 0.7502 |
| 7   | 498.0   | 503.0   | 0.0132 | 0.4882 | 0.1028 | 0.5273 |
|     |         |         | 0.1092 | 0.4417 | 0.0040 | 0.6104 |
| 8   | 503.0   | 508.0   | 0.0040 | 0.6104 | 0.1056 | 0.6007 |
|     |         |         | 0.1028 | 0.5273 | 0.0080 | 0.7153 |

Tolerance for each bin limit is  $\pm 0.5$  nm.

#### Precautions:

#### Lead Forming:

- The leads of an LED lamp may be preformed or cut to length prior to insertion and soldering into PC board.
- If lead forming is required before soldering, care must be taken to avoid any excessive mechanical stress induced to LED package. Otherwise, cut the leads of LED to length after soldering process at room temperature. The solder joint formed will absorb the mechanical stress of the lead cutting from traveling to the LED chip die attach and wirebond.
- It is recommended that tooling made to precisely form and cut the leads to length rather than rely upon hand operation.

#### Soldering Condition:

- Care must be taken during PCB assembly and soldering process to prevent damage to LED component.
- The closest LED is allowed to solder on board is 1.59mm below the body (encapsulant epoxy) for those parts without standoff.
- Recommended soldering condition:

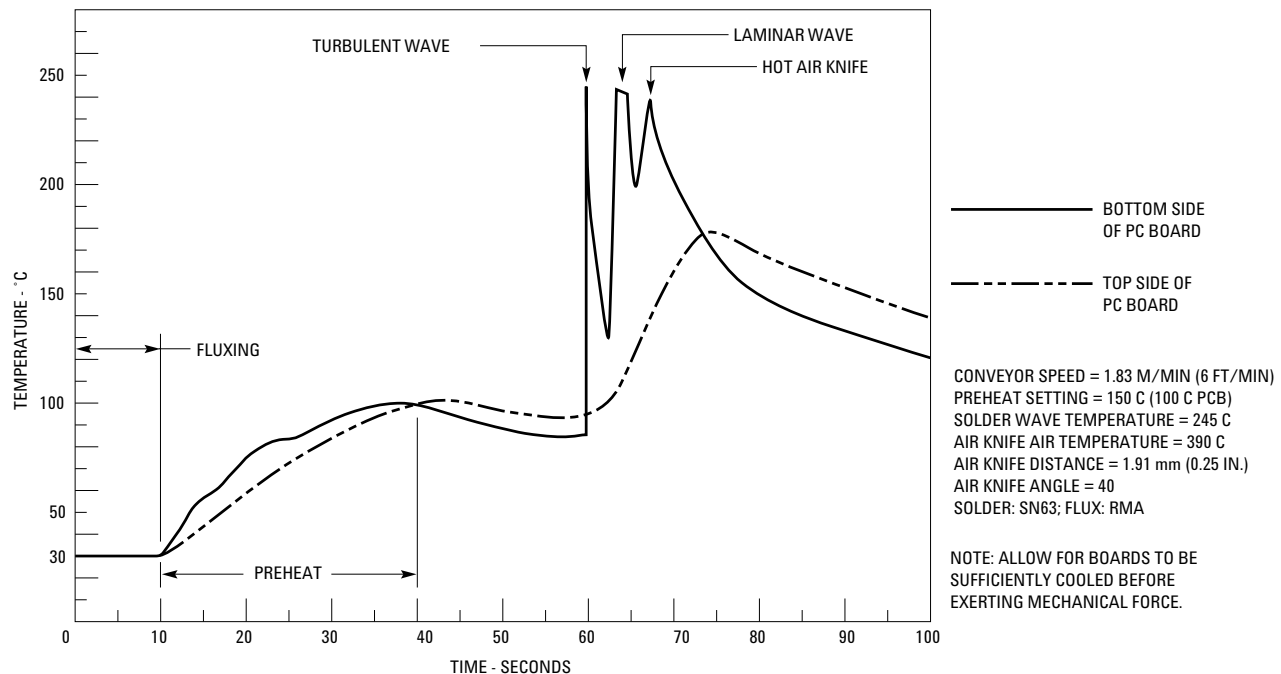
|                      | Wave Soldering | Manual Solder Dipping |
|----------------------|----------------|-----------------------|
| Pre-heat temperature | 105 °C Max.    | —                     |
| Preheat time         | 30 sec Max     | —                     |
| Peak temperature     | 250 °C Max.    | 260 °C Max.           |
| Dwell time           | 3 sec Max.     | 5 sec Max             |

- Wave soldering parameter must be set and maintain according to recommended temperature and dwell time in the solder wave. Customer is advised to periodically check on the soldering profile to ensure the soldering profile used is always conforming to recommended soldering condition.
- If necessary, use fixture to hold the LED component in proper orientation with respect to the PCB during soldering process.
- Proper handling is imperative to avoid excessive thermal stresses to LED components when heated. Therefore, the soldered PCB must be allowed to cool to room temperature, 25°C before handling.
- Special attention must be given to board fabrication, solder masking, surface plating and lead holes size and component orientation to assure solderability.
- Recommended PC board plated through holes size for LED component leads.

| LED component lead size                | Diagonal                 | Plated through hole diameter               |
|----------------------------------------|--------------------------|--------------------------------------------|
| 0.457 x 0.457mm<br>(0.018 x 0.018inch) | 0.646 mm<br>(0.025 inch) | 0.976 to 1.078 mm<br>(0.038 to 0.042 inch) |
| 0.508 x 0.508mm<br>(0.020 x 0.020inch) | 0.718 mm<br>(0.028 inch) | 1.049 to 1.150mm<br>(0.041 to 0.045 inch)  |

**Note:** Refer to application note AN1027 for more information on soldering LED components.

#### Recommended Wave Soldering Profile





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