## **HLMP-Cxxx**

T-13/4 (5 mm) Extra Bright Precision Optical Performance InGaN LED Lamps



# **Data Sheet**

HLMP-CB11, HLMP-CB12, HLMP-CM11, HLMP-CM12, HLMP-CE11, HLMP-CE12, HLMP-CB26, HLMP-CB27, HLMP-CM26, HLMP-CM27, HLMP-CE26, HLMP-CE27, HLMP-CB36, HLMP-CB37, HLMP-CM36, HLMP-CM37, HLMP-CE36, HLMP-CE37

## Description

These high intensity blue, green, and cyan LEDs are based on the most efficient and cost effective InGaN material technology. The 470 nm typical dominant wavelength for blue and 525 nm typical wavelength for green is well suited to color mixing in full color signs. The 505 nm typical dominant wavelength for cyan is suitable for traffic signal application.

These LED lamps are untinted, non-diffused, T-13/4 packages incorporating second generation optics which produce well-defined spatial radiation patterns at specific viewing cone angles.

These lamps are made with an advanced optical grade epoxy, offering superior temperature and moisture resistance in outdoor signal and sign applications. The high maximum LED junction temperature limit of +110°C enables high temperature operation in bright sunlight conditions.

#### **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

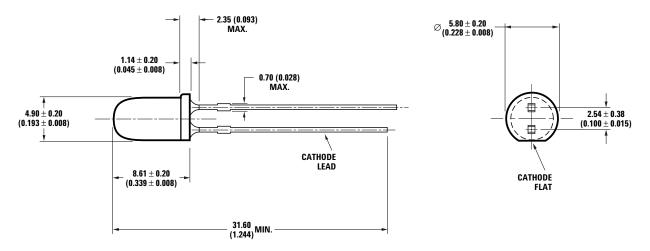
### **Applications**

- Traffic signals
- Commercial outdoor advertising
- Front panel backlighting
- · Front panel indicator

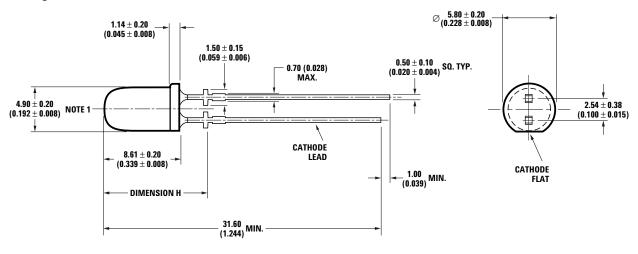
**CAUTION:** Devices are Class 1C ESD sensitive. Please observe appropriate precautions during handling and processing. Refer to Application Note AN-1142 for additional details.

## **Package Dimensions**

# Package A



# Package B



| DIMENSION H:  |
|---|
| $15^\circ = 10.80 \pm 0.25$ mm (0.425 $\pm$ 0.01 INCH) $23^\circ = 10.00 \pm 0.25$ mm (0.394 $\pm$ 0.01 INCH) |
| $23^{\circ} = 10.00 \pm 0.25 \text{ mm} (0.394 \pm 0.01 \text{ INCH})$  |
| $30^{\circ} = 11.27 \pm 0.25 \; \text{mm} \; (0.444 \pm 0.01 \; \text{INCH})$                                 |

### NOTES:

- 1. MEASURED JUST ABOVE FLANGE.
- 2. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES).
- 3. EPOXY MENISCUS MAY EXTEND ABOUT 1 mm (0.040") DOWN THE LEADS.
- 4. IF HEAT SINKING APPLICATION IS REQUIRED, THE TERMINAL FOR HEAT SINK IS ANODE.

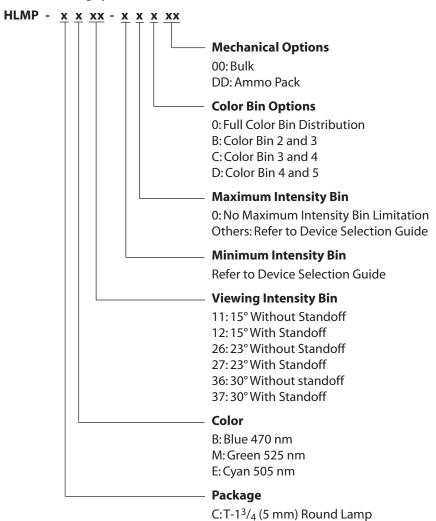
# **Device Selection Guide**

|                 |       | Typical<br>Viewing Angle,   | Intensity | (cd) at 20 mA |          | Package              |       |
|-----------------|-------|-----------------------------|-----------|---------------|----------|----------------------|-------|
| Part Number     | Color | $2\theta^{1}/_{2}$ (Degree) | Min.      | Max.          | Standoff | Packaye<br>Dimension | Lens  |
| HLMP-CB11-TW0xx | Blue  | 15                          | 2.5       | 7.2           | No       | А                    | Clear |
| HLMP-CB11-UVBxx | Blue  | 15                          | 3.2       | 5.5           | No       | A                    | Clear |
| HLMP-CB12-TW0xx | Blue  | 15                          | 2.5       | 7.2           | Yes      | В                    | Clear |
| HLMP-CM11-Y20xx | Green | 15                          | 9.3       | 27.0          | No       | Α                    | Clear |
| HLMP-CM11-Z1Cxx | Green | 15                          | 12.0      | 21.0          | No       | Α                    | Clear |
| HLMP-CM12-Y20xx | Green | 15                          | 9.3       | 27.0          | Yes      | В                    | Clear |
| HLMP-CE11-X10xx | Cyan  | 15                          | 7.2       | 21.0          | No       | Α                    | Clear |
| HLMP-CE12-X10xx | Cyan  | 15                          | 7.2       | 21.0          | Yes      | В                    | Clear |
| HLMP-CB26-SV0xx | Blue  | 23                          | 1.9       | 5.5           | No       | Α                    | Clear |
| HLMP-CB26-TUDxx | Blue  | 23                          | 2.5       | 4.2           | No       | Α                    | Clear |
| HLMP-CB27-SV0xx | Blue  | 23                          | 1.9       | 5.5           | Yes      | В                    | Clear |
| HLMP-CM26-X10xx | Green | 23                          | 7.2       | 21.0          | No       | Α                    | Clear |
| HLMP-CM26-YZCxx | Green | 23                          | 9.3       | 16.0          | No       | Α                    | Clear |
| HLMP-CM27-X10xx | Green | 23                          | 7.2       | 21.0          | Yes      | В                    | Clear |
| HLMP-CE26-WZ0xx | Cyan  | 23                          | 5.5       | 16.0          | No       | Α                    | Clear |
| HLMP-CE27-WZ0xx | Cyan  | 23                          | 5.5       | 16.0          | Yes      | В                    | Clear |
| HLMP-CB36-QT0xx | Blue  | 30                          | 1.15      | 3.2           | No       | Α                    | Clear |
| HLMP-CB36-RSBxx | Blue  | 30                          | 1.5       | 2.5           | No       | Α                    | Clear |
| HLMP-CB37-RU0xx | Blue  | 30                          | 1.5       | 4.2           | Yes      | В                    | Clear |
| HLMP-CB37-RSDxx | Blue  | 30                          | 1.5       | 2.5           | Yes      | В                    | Clear |
| HLMP-CM36-X10xx | Green | 30                          | 7.2       | 21.0          | No       | Α                    | Clear |
| HLMP-CM36-XYCxx | Green | 30                          | 7.2       | 12.0          | No       | Α                    | Clear |
| HLMP-CM37-X10xx | Green | 30                          | 7.2       | 21.0          | Yes      | В                    | Clear |
| HLMP-CM37-XYCxx | Green | 30                          | 7.2       | 12.0          | Yes      | В                    | Clear |
| HLMP-CM37-XYDxx | Green | 30                          | 7.2       | 12.0          | Yes      | В                    | Clear |
| HLMP-CE36-WZ0xx | Cyan  | 30                          | 5.5       | 16.0          | No       | Α                    | Clear |
| HLMP-CE37-WZ0xx | Cyan  | 30                          | 5.5       | 16.0          | Yes      | В                    | Clear |

### Notes:

- 1. Tolerance for luminous intensity measurement is ±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.
- 5.  $2\theta_{1/2}$  is the off-axis angle where the luminous intensity is 1/2 the on-axis intensity.

## **Part Numbering System**



# Absolute Maximum Rating at $T_A = 25^{\circ}C$

| Parameters                                 | Value       | Unit |
|--|-------------|------|
| DC Forward Current <sup>[1]</sup>          | 30          | mA   |
| Peak Pulsed Forward Current <sup>[2]</sup> | 100         | mA   |
| Power Dissipation                          | 116         | 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 2.
- 2. Duty factor 10%, frequency 1 KHz.

## **Electrical/Optical Characteristics**

 $T_A = 25^{\circ}C$ 

|                                  |                        |      | Blue | )    |      | Gree | en   |      | Cyar | 1    |       |                               |
|----------------------------------|------------------------|------|------|------|------|------|------|------|------|------|-------|-------------------------------|
| Parameters                       | Symbol                 | Min. | Тур. | Max. | Min. | Тур. | Max. | Min. | Тур. | Max. | Units | <b>Test Condition</b>         |
| Forward Voltage                  | $V_{F}$                |      | 3.2  | 3.85 |      | 3.3  | 3.85 |      | 3.2  | 3.85 | V     | $I_F = 20 \text{ mA}$         |
| Reverse Voltage <sup>[1]</sup>   | $V_R$                  | 5.0  |      |      | 5.0  |      |      | 5.0  |      |      | V     | $I_R = 10 \mu A$              |
| Thermal Resistance               | $R\theta_{J-PIN}$      |      | 240  |      |      | 240  |      |      | 240  |      | °C/W  | LED Junction to               |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | Anode Lead                    |
| Dominant                         | $\lambda_{\sf d}$      | 460  | 470  | 480  | 520  | 525  | 540  | 490  | 505  | 508  | nm    | $I_F = 20 \text{ mA}$         |
| Wavelength <sup>[2]</sup>        |                        |      |      |      |      |      |      |      |      |      |       |                               |
| Peak Wavelength                  | $\lambda_{PEAK}$       |      | 464  |      |      | 516  |      |      | 501  |      | nm    | Peak of Wavelength            |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | of Spectral Distribu-         |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | tion at $I_F = 20 \text{ mA}$ |
| Spectral Half Width              | $\Delta \lambda_{1/2}$ |      | 23   |      |      | 32   |      |      | 30   |      | nm    | Wavelength Width              |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | at Spectral Distribu-         |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | tion Power Point              |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | at $I_F = 20 \text{ mA}$      |
| Luminous Efficacy <sup>[3]</sup> | $\eta_{V}$             |      | 74   |      |      | 484  |      |      | 319  |      | Im/W  | <b>Emitted Luminous</b>       |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | Power/Emitted                 |
|                                  |                        |      |      |      |      |      |      |      |      |      |       | Radiant Power                 |

#### Notes

- 1. The reverse voltage of the product is equivalent to the forward voltage of the protective chip at  $I_B = 10 \mu A$ .
- 2. The dominant wavelength,  $\lambda_d$ , is derived from the Chromaticity Diagram and represents the color of the lamp.
- 3. The radiant intensity, le in watts/steradian, may be found from the equation le =  $lv/\eta_v$ , where lv is the luminous intensity in candelas and  $\eta_v$  is the luminous efficacy in lumens/watt.

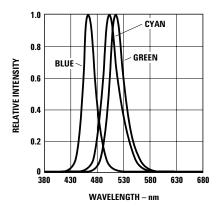


Figure 1. Relative intensity vs. wavelength

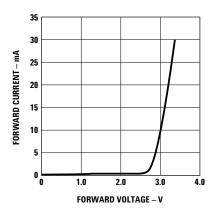


Figure 3. Forward current vs. forward voltage

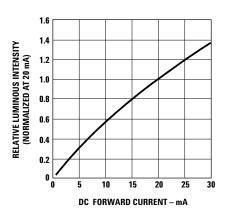


Figure 5. Relative intensity vs. DC forward current

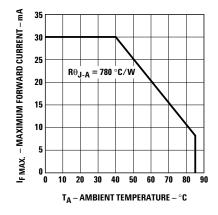


Figure 2. Forward current vs. ambient temperature

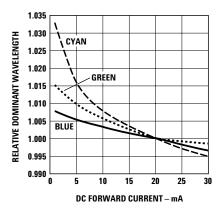


Figure 4. Relative dominant wavelength vs. DC forward current

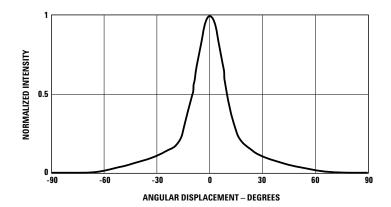


Figure 6. Spatial radiation pattern for Cx11 and Cx12

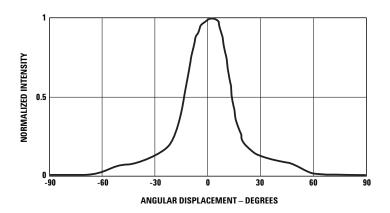


Figure 7. Spatial radiation pattern for Cx26 and Cx27

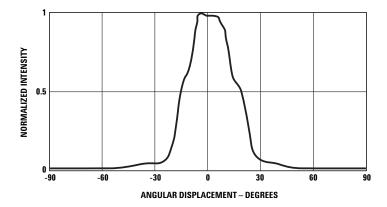


Figure 8. Spatial radiation pattern for Cx36 and Cx37

# **Intensity Bin Limit Table**

|     | Intensity | (mcd) at 20 mA | 1 |
|-----|-----------|----------------|---|
| Bin | Min       | Max            |   |
| N   | 680       | 880            |   |
| P   | 880       | 1150           |   |
| 0   | 1150      | 1500           |   |
| R   | 1500      | 1900           |   |
| S   | 1900      | 2500           |   |
| T   | 2500      | 3200           |   |
| U   | 3200      | 4200           |   |
| V   | 4200      | 5500           |   |
| W   | 5500      | 7200           |   |
| Χ   | 7200      | 9300           |   |
| Υ   | 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  $\pm 0.5 \text{ nm}$ .

# **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 | 0.306  | 0.0235 | 0.4127 |
| 2   | 495.0   | 500.0   | 0.0345 | 0.4127 | 0.1057 | 0.4769 |
|     |         |         | 0.1164 | 0.3889 | 0.0082 | 0.5384 |
| 3   | 500.0   | 505.0   | 0.0082 | 0.5384 | 0.1027 | 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.

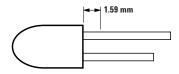
### **Precautions**

## **Lead Forming**

- The leads of an LED lamp may be preformed or cut to length prior to insertion and soldering on PC board.
- If lead forming is required before soldering, care must be taken to avoid any excessive mechanical stress induced into the LED package. Otherwise, cut the leads to applicable length after soldering process at room temperature. The solder joint formed will absorb the mechanical stress, due to lead cutting, from traveling to the LED chip die attach and wirebond.
- For better control, it is recommended to use proper tool to precisely form and cut the leads to applicable length rather than doing it manually.

### **Soldering Conditions**

- Care must be taken during PCB assembly and soldering process to prevent damage to LED component.
- The closest manual soldering distance of the soldering heat source (soldering iron's tip) to the body is 1.59 mm. Soldering the LED closer than 1.59 mm might damage the LED.



· Recommended soldering conditions:

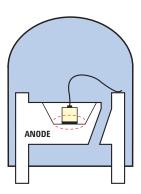
|                      | Wave Soldering | Manual Solder<br>Dipping |
|----------------------|----------------|--------------------------|
| Pre-heat Temperature | 105 °C Max.    | _                        |
| Pre-heat Time        | 30 sec Max.    | _                        |
| Peak Temperature     | 250 °C Max.    | 260 °C Max.              |
| Dwell Time           | 3 sec Max.     | 5 sec Max.               |

 Wave soldering parameter must be set and maintained according to recommended temperature and dwell time in the solder wave. Customer is advised to daily check on the soldering profile to ensure the soldering profile is always conforming to recommended soldering condition.

#### Notes

- 1. PCB with different size and design (component density) will have different heat mass (heat capacity). This might cause a change in temperature experienced by the board if samewave soldering setting is used. So, it is recommended to recalibrate the soldering profile again before loading a new type of PCB.
- 2. Avago Technologies' high brightness LEDs use a high efficiency LED die with single wire bond, as shown below. Customer is advised to take extra precaution during wave soldering to ensure that the maximum wave temperature does not exceed 250°C. Over-stressing the LED during soldering process might cause premature failure to the LED due to delamination.

### **Avago Technologies LED Configuration**



**InGaN Device** 

Note: Electrical connection between bottom surface of LED die and the lead frame material through conductive paste of solder.

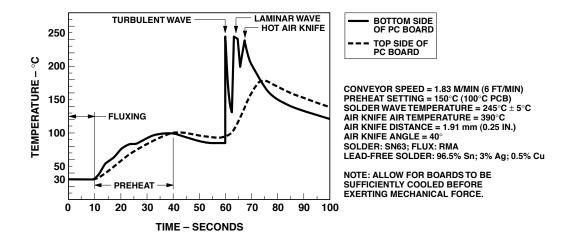
- If necessary, use fixture to hold the LED component in proper orientation with respect to the PCB during soldering process.
- At elevated temperature, the LED is more susceptible to mechanical stress. Therefore, PCB must be allowed to cool down to room temperature prior to handling, which includes removal of jigs, fixtures or pallet.
- 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 hole sizes for LED component leads:

| LED Component                       |              | Plated Through        |
|-------------------------------------|--------------|-----------------------|
| Lead Size                           | Diagonal     | <b>Hole Diameter</b>  |
| 0.457 x 0.457 mm                    | 0.646 mm     | 0.976 to 1.078 mm     |
| (0.018 x 0.018 inch)                | (0.025 inch) | (0.038 to 0.042 inch) |
| 0.508 x 0.508 mm                    | 0.718 mm     | 1.049 to 1.150 mm     |
| $(0.020 \times 0.020 \text{ inch})$ | (0.028 inch) | (0.041 to 0.045 inch) |

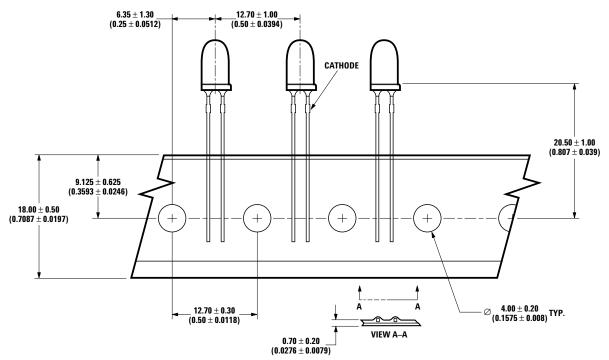
 Over sizing of plated through hole can lead to twisting or improper LED placement during auto insertion. Under sizing plated through hole can lead to mechanical stress on the epoxy lens during clinching.

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

## **Recommended Wave Soldering Profile**



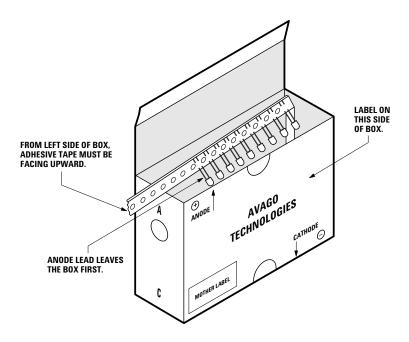
## **Ammo Packs Drawing**



ALL DIMENSIONS IN MILLIMETERS (INCHES).

 $NOTE: THE\ AMMO-PACKS\ DRAWING\ IS\ APPLICABLE\ FOR\ PACKAGING\ OPTION\ -DD\ \&\ -ZZ\ AND\ REGARDLESS\ OF\ STANDOFF\ OR\ NON-STANDOFF.$ 

## **Packaging Box for Ammo Packs**



NOTE: FOR InGaN DEVICE, THE AMMO PACK PACKAGING BOX CONTAINS ESD LOGO.

### **DISCLAIMER**

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