## Features

- 1010 with integrated high quality external control single line serial cascade constant current LED driver IC.
- Single line data transmission, unlimited cascade.
- Specific Shaping Transmit Technology - number of LED stacked is not restricted.
- Output gray level: 65536.
- The transmission distance between two points is more than 10m.
- MSL 4.

## Description

The IN-PH10TAT6R6G6B is 1.1*1.1*0.33mm RGB 65336 high gray LED with integrated IC. It is a SMD type LED which can be used in various applications.

## Applications

- LED color module
- LED guardrail tube
- LED scene lighting
- LED point light
- LED pixel screen
- LED shaped screen
- General use.

## Package Outline Dimensions & Pin Configuration

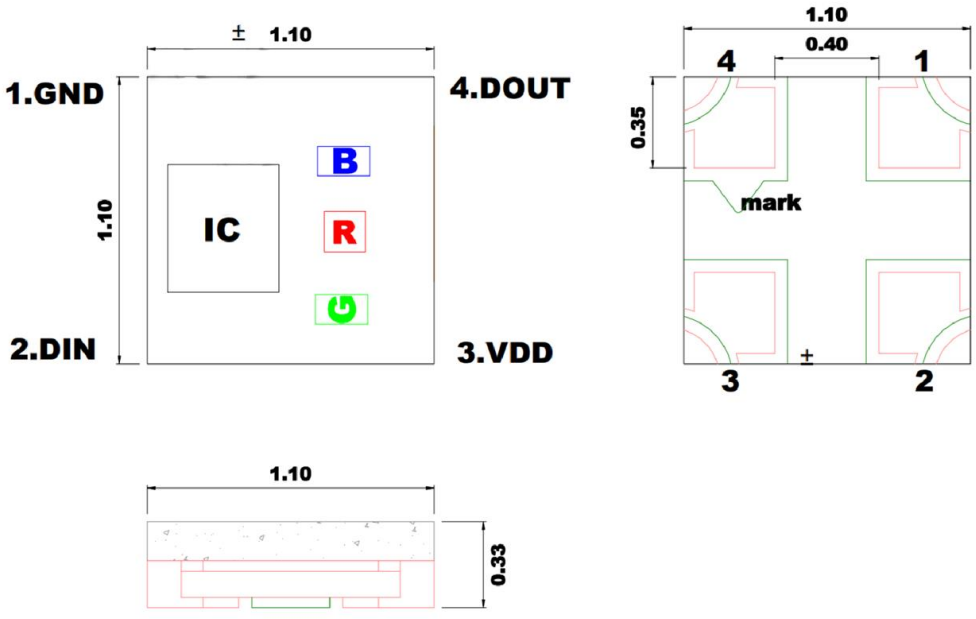



**Figure 1. IN-PH10TAT6R6G6B Package Outline Dimensions**

**Note:**

**All dimensions are in millimeters.**

**Tolerance is ± 0.10mm unless otherwise note.**

## Pin Configuration

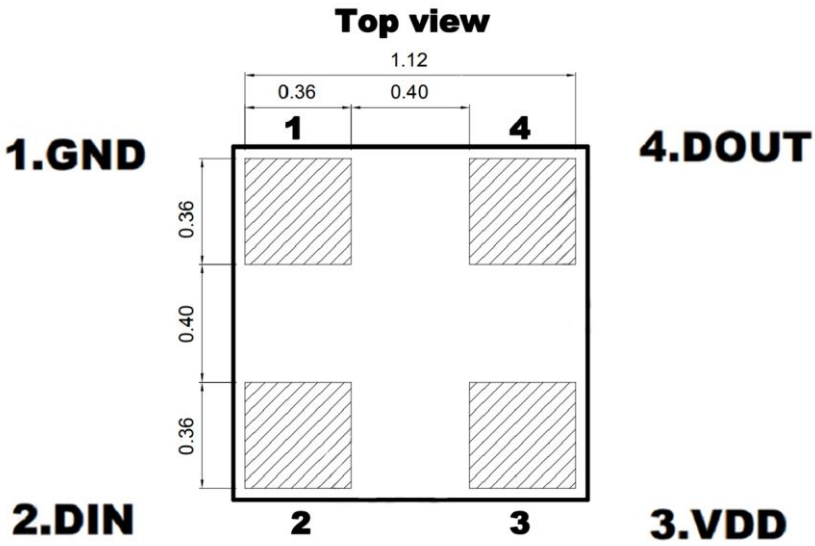



**Figure 2. IN-PH10TAT6R6G6B Pin Configuration**

Notes:
1. Dimension in millimeter, tolerance is ±0.1mm unless otherwise noted.

| Symbol | Function Description |
|---|---|
| GND | Ground |
| DIN | Control data signal input |
| VDD | Power supply |
| DOUT | Control data signal output |

## Absolute Maximum Rating *(Ta = 25 ℃)*

| Parameter | Symbol | Range | Unit |
|---|---|---|---|
| Power supply voltage | $V_{DD}$ | +3.5～+5.5 | V |
| Logical input voltage | $V_{IN}$ | -0.5 ~ VDD+0.5 | V |
| Operating temperature | $T_{OPT}$ | −40 ~ +85 | °C |
| Storage temperature | $T_{STG}$ | −40 ~ +85 | °C |
| ESD pressure (DM) | $V_{ESD}$ | *200* | V |
| ESD pressure (HBM) | $V_{ESD}$ | *>2K* | V |
| Soldering Condition | Tsol | Reflow soldering: 260°C, 10s | |
| | | Hand soldering: 300°C, 3s | |

## LED Characteristics *($T_a$ = 25℃, @12mA)*

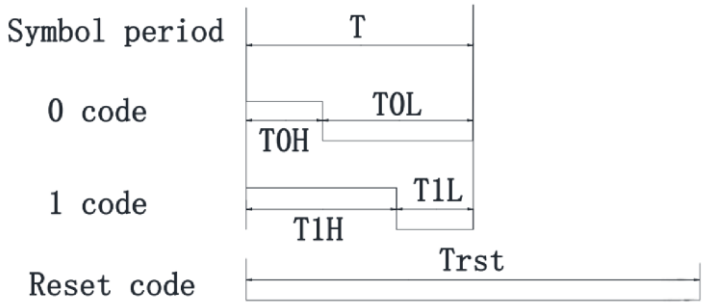
| Color | IN-PH10TAT6R6G6B (6.5 mA) | |
|---|---|---|
| | Dominate Wavelength (nm) | Brightness (MCD) |
| Red | 615-625 | 80-160 |
| Green | 525-535 | 120-240 |
| Blue | 465-475 | 25-50 |

## Recommended Operating Ranges *(unless otherwise specified, Ta= 25 ℃)*

| Parameter | Symbol | Min. | Typ. | Max | Unit | Test conditions |
|---|---|---|---|---|---|---|
| Input voltage | $V_{DD}$ | 3.5 | - | 5.5 | V | - |
| High level input voltage | $V_{IH}$ | 0.5*VDD | - | | V | DIN High level |
| Low level input voltage | $V_{IL}$ | - | - | 0.3*VDD | V | DIN Low level |
| G/R/B output drive current | $I_{DOUT}$ | - | 6.5 | - | mA | $V_{DS}$=1V |
| PWM frequency | $F_{PWM}$ | - | 4.5 | - | KHz | - |
| Static power consumption | $I_{DD}$ | - | 0.25 | - | mA | - |
| Transfer rate | $F_{DIN}$ | - | 800 | | Kbps | - |

## Timing Waveforms

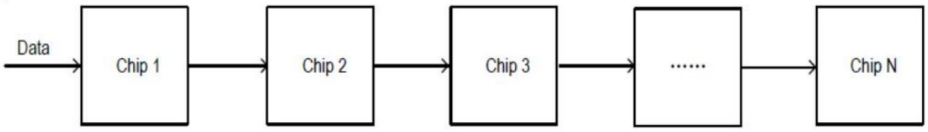
1. Input Code



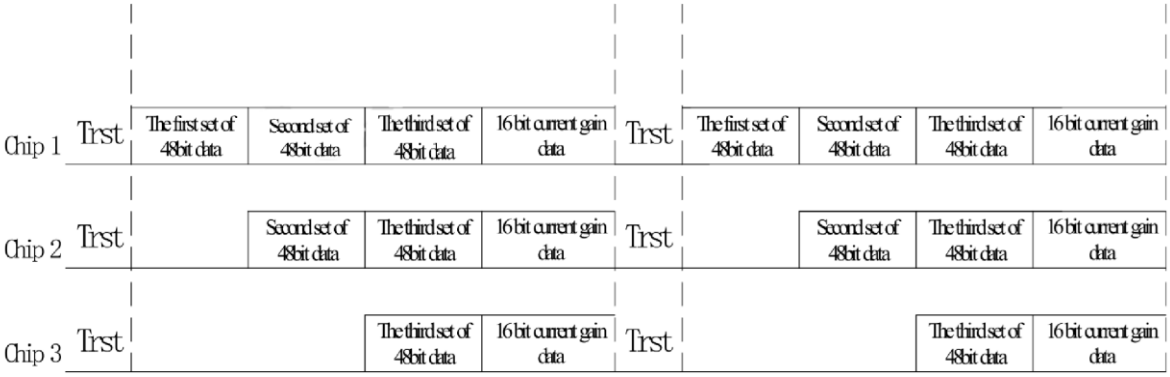

2. The data transmission time (*Ta=25 ℃*):

| Name | Description | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| T | code period | - | 1.2 | - | μs |
| T0H | 0 code, high level time | 0.2 | 0.3 | 0.4 | μs |
| T0L | 0 code, low level time | 0.8 | - | - | μs |
| T1H | 1 code, high level time | 0.8 | 0.9 | 1 | μs |
| T1L | 1 code, low level time | 0.2 | - | - | μs |
| Trst | Reset code, low level time | >200 | - | - | μs |

3. Connection Scheme




4. Data Transfer Format




Note: the D1 sends data for MCU, D2, D3, D4 for data forwarding automatic shaping cascade circuit.

5. The data structure of 48bit（Ta=25℃）:

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R15 | R14 | R13 | R12 | R11 | R10 | R9 | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 |
| G15 | G14 | G13 | G12 | G11 | G10 | G9 | G8 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 |
| B15 | B14 | B13 | B12 | B11 | B10 | B9 | B8 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |

Note: High bit first sends, send data in RGB order (R15 → R14 →.... B0)

Trst+48bit data from the first chip+48bit data from the second chip+...+48bit data from the Nth chip+16bit current gain data+Trst.

48Bits grayscale data structure: high first, sent in RGB order.

| R15 | R14 | R13 | R12 | R11 | R10 | R9 | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G15.....G0 | B15...B0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit48.....bit0 | | | | | | | | | | | | | | | | | |

Current gain adjustment parameter:

The current gain data is 16bits in total, this product supports software to set the current of OUT output. It contains 5bits of current gain, gain data and 1bit reserved bit data for each OUT G/R/B port. The current gain data is 16bits in total. High up in the front, send in the order of the RGBs, the structure is as follows:

| Current gain parameter transmission format | | | |
|---|---|---|---|
| Red light（R) | Green light（G) | Blue light（B) | S0 (reserved data) |
| GR4 , GR3 , GR2,GR1 , GR0 | GG4 , GG3 , GG2,GG1 , GG0 | GB4 , GB3 , GB2, GB1 , GB0 | 0 |

(1) GR4-GR0 is the OUTR port current gain data, GG4-GG0 is the OUTR port current gain data, GB4-GB0 is the OUTB port current gain data, and S0 is the reserved bit data.

(2) When sending current gain data, the reserved bit data S0 must be 0.

The maximum output of OUT G/R/B is 6.5mA, and users can set other current values by changing the current gain value. Please refer to the following table for reference current values:

| Current gain | IOUT(mA) | Current gain | IOUT(mA) |
|---|---|---|---|
| 0 | 0.2 | 16 | 3.4 |
| 1 | 0.4 | 17 | 3.6 |
| 2 | 0.6 | 18 | 3.8 |
| 3 | 0.8 | 19 | 4.0 |
| 4 | 1.0 | 20 | 4.2 |
| 5 | 1.2 | 21 | 4.4 |
| 6 | 1.4 | 22 | 4.6 |
| 7 | 1.6 | 23 | 4.8 |
| 8 | 1.8 | 24 | 5.0 |
| 9 | 2.0 | 25 | 5.2 |
| 10 | 2.2 | 26 | 5.4 |
| 11 | 2.4 | 27 | 5.6 |
| 12 | 2.6 | 28 | 5.8 |
| 13 | 2.8 | 29 | 6.0 |
| 14 | 3.0 | 30 | 6.2 |
| 15 | 3.2 | 31 | 6.4 |

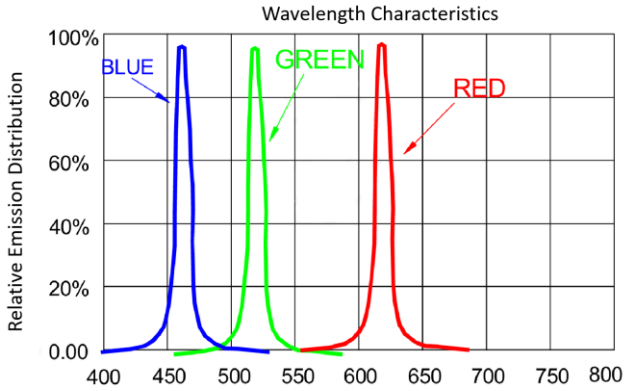
Note :

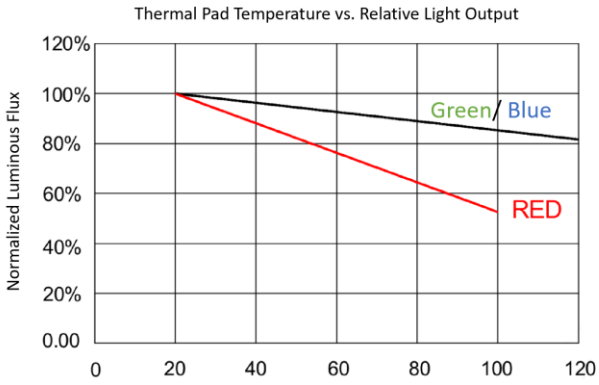
1). The above current values are only theoretical data, and there may be deviations in actual current. It is recommended that customers adjust the current values based on actual measurements.

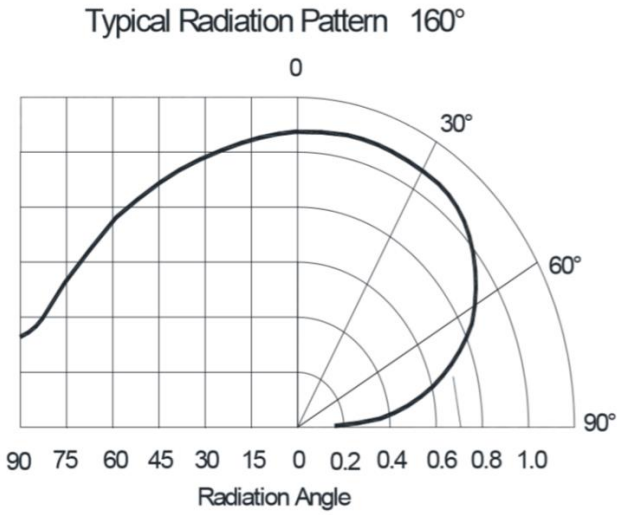
2). Suggested use of current: 0 ~ 24 current regulation grades.

3). Based on product heat dissipation, it is recommended to use a maximum current of 5mA (level 24) for this product, and current regulation levels of 25-31 are not recommended.

## LED Performance Graph



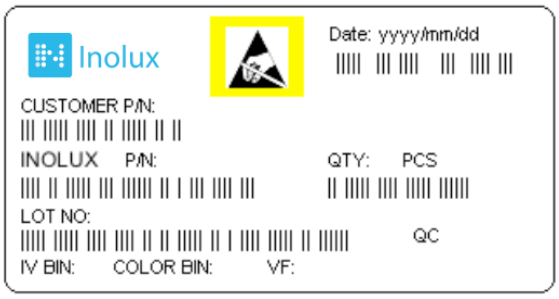



## Ordering Information

| Product | Emission Color | IV(mcd) | Orderable Part Number |
|---|---|---|---|
| IN-PH10TAT6R6G6B | Red | 80-160 | IN-PH10TAT6R6G6B |
| | Green | 120-240 | |
| | Blue | 20-40 | |

## Label Specifications



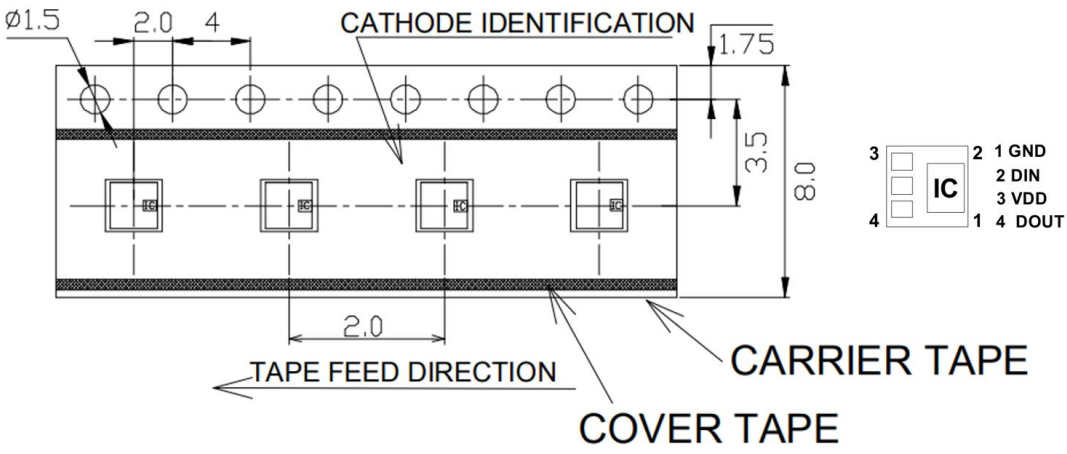

## Inolux P/N:

| I | N | - | PH | 10 | TA | T | 6 | R | 6 | G | 6 | B | | X | X | X | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inolux | | - | Product | Package | Variation | Orientation | Current | Color | Current | Color | Current | | | Customized Stamp-off | | | |
| | | - | PH- High Gray Digital LED | 10TA = 1.1 x 1.1 x 0.33 mm (4 pins) | | T = Top Mount | 6= 6.5mA | R = 620 nm | 6= 6.5mA | G = 520 nm | 6= 6.5mA | B = 460 nm | | | | | |

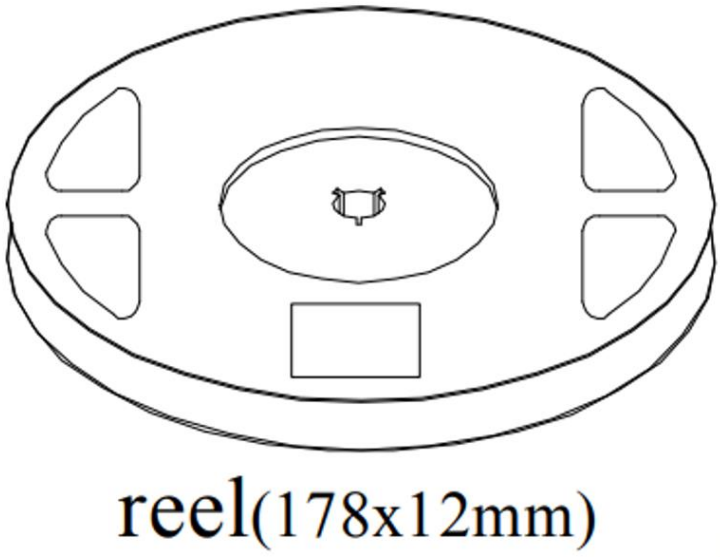
## Lot No.:

| Z | 2 | 0 | 1 | 7 | 01 | 24 | 001 |
|---|---|---|---|---|---|---|---|
| Internal Tracker | Year (2017, 2018, .....) | | | | Month | Date | Serial |

## Packaging




1. All dimensions are in millimeters.
2. Tolerance is ±0.1 mm unless otherwise noted.



## Precautions

Please read the following notes before using the product:

1. Storage

1.1 Do not open moisture proof bag before the products are ready to use.

1.2 Before opening the package, the LEDs should be kept at 30℃ or less and 80%RH or less.

1.3 The LEDs should be used within a year.

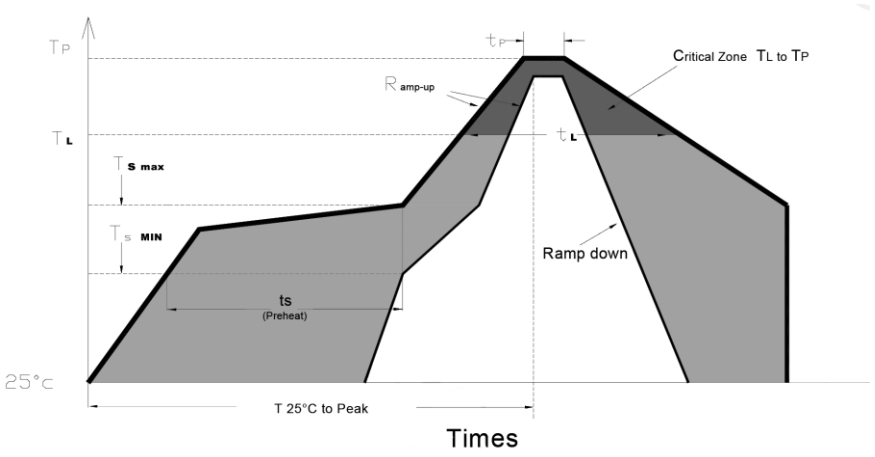
1.4 After opening the package, the LEDs should be kept at 30℃ or less and 60%RH or less.

1.5 The LEDs should be used within 24 hours (1 days) after opening the package.

1.6 If the moisture adsorbent material has fabled away or the LEDs have exceeded the storage time, baking treatment should be performed using the following conditions. Baking treatment: 60±5℃ for 24 hours.

2. Soldering Condition

Recommended soldering conditions:




| Profile Feature | Lead-Free Solder |
|---|---|
| Average Ramp-Up Rate ($Ts_{max}$ to Tp ) | 3℃/second max. |
| Preheat: Temperature Min ($Ts_{min}$) | 150℃ |
| Preheat: Temperature Min ($Ts_{max}$) | 200℃ |
| Preheat: Time ( $ts_{min}$ to $ts_{max}$ ) | 60-180 seconds |
| Time Maintained Above: Temperature ($T_L$) | 217 ℃ |
| Time Maintained Above: Time ($t_L$) | 60-150 seconds |
| Peak/Classification Temperature ($T_P$) | 240 ℃ |
| Time Within 5℃ of Actual Peak Temperature ( tp) | <10 seconds |
| Ramp-Down Rate | 6℃/second max. |
| Time 25 ℃ to Peak Temperature | <6 minutes max. |

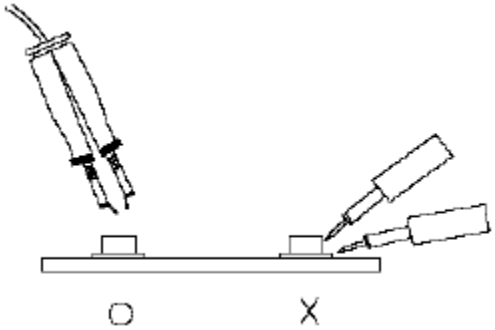
Note: Excessive soldering temperature and / or time might result in deformation of the LED lens or catastrophic failure of the LED.

## 3. Soldering Iron

Each terminal is to go to the tip of soldering iron temperature less than 260℃ for 5 seconds within once in less than the soldering iron capacity 25W. Leave two seconds and more intervals, and do soldering of each terminal. Be careful because the damage of the product is often started at the time of the hand solder.

## 4. Repairing

Repair should not be done after the LEDs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used (as below figure). It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.




## 5. Caution in ESD

Static Electricity and surge damages the LED. It is recommended to use a wristband or anti-electrostatic glove when handling the LED. All devices, equipment and machinery must be properly grounded.

## Revision History

| Changes since last revision | Page | Version No. | Revision Date |
|---|---|---|---|
| Initial Release | | 1.0 | 07-01-2024 |
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