BRIGHTEK

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Brighten Up The World With LED !

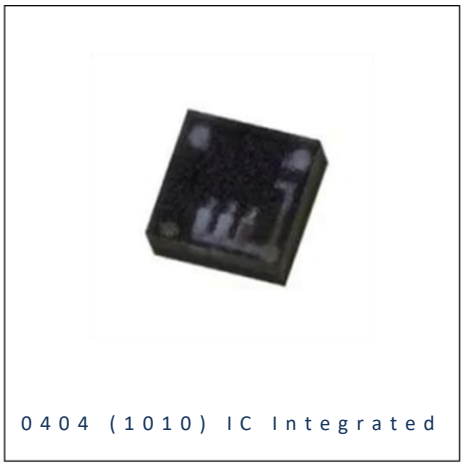
ISO/TS 16949:2009 BS EN ISO 14001:2004 QC 080000 IECQ HSPM

# PRODUCT DATASHEET


- ▶ CHIP PCB LED w/ IC
- ▶ 0404 (1010) IC 0.50t (5 pins)
- ▶ Red/Green/Blue

Release Date: 15 May 2025 Version: A1.1

# N0M68S99IC



0 4 0 4 ( 1 0 1 0 ) I C I n t e g r a t e d

## 0404 (1010) IC-Integrated

RoHS Compliant

## FEATURES:

- **Package:** PCB Top View Package with Integrated IC
- **R/G/B Output Current (typ.):** 5mA
- **Supply Voltage:** +3.3~+5.5V
- **Luminous Intensity (typ.):** 65/85/20mcd*
- **Colour:** Red/Green/Blue
- **Lens Colour:** Water Clear
- **IC Feature:** Programmable IC and RGB LED chip integrated 0404 (1010) package. Data Transmission by 2 Data Inputs. 24-bit data transfer rate. The data transmission frequency can reach 800Kbps. Support Sleep (Power Saving) Mode, the quiescent current is less than 5μA (typ.). Support 16-level current gain control (dimming control).
- **Soldering Methods:** Reflow soldering
- **ESD Level:** 2kV
- **MSL Level:** acc. to JEDEC Level 4
- **Packing:** 8mm tape with max.4000pcs/reel, ø178mm (7'')

* in order of Red/Green/Blue

## APPLICATIONS:

- Telecommunication
- Indicator
- Home Appliance
- Decoration Lighting
- Full Colour LED Strip
- Gaming Device
- Guardrail Tube
- LED Screen

Support sleep/wake up mode. In sleep mode the LED's current was lower than 5μA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## CHARACTERISTICS:

### Absolute Maximum Characteristics ($T_a$=25°C)

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | 6.5 | V |
| Power Dissipation | $P_D$ | 400 | mW |
| Maximum Output Current | $I_{LED}$ | 5 | mA |
| Operation Temperature | $T_{OPT}$ | -40~+85 | °C |
| Storage Temperature | $T_{STG}$ | -65~+120 | °C |
| Soldering Temperature | $T_{sol}$ | Reflow: 210 for 5 sec. | °C |

### Electrical & Optical Characteristics ($T_a$=25°C)

| Parameter | Symbol | Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Supply Voltage | $V_{DD}$ | 3.3 | 5.0 | 5.5 | V | --- |
| Operation Current (with IC) | $I_{DD1}$ | --- | 1 | --- | mA | R/G/B without load @$V_{DD}$=5V |
| Operation Current (with IC) | $I_{DD2}$ | --- | 0.6 | --- | mA | R/G/B without load @$V_{DD}$=3.3V |
| Sleep Mode Current | $I_{sleep}$ | --- | 5 | --- | μA | --- |
| Input High “H” of DI, BI | $V_{IH}$ | 0.7*$V_{DD}$ | --- | $V_{DD}$+0.4 | V | --- |
| Input Low “L” of DI, BI | $V_{IL}$ | -0.4 | --- | 0.2*$V_{DD}$ | V | --- |
| Output High “H” of DO | $V_{OH}$ | 4.5 | --- | --- | V | $I_{OH}$=3mA |
| Output Low “L” of DO | $V_{OL}$ | --- | --- | 0.4 | V | $I_{OL}$=3mA |
| R/G/B Sink Current | $I_{sink}$ | 2.9 | 3.0 | 3.1 | mA | Max.3mA option |
| | | 4.8 | 5.0 | 5.2 | mA | Max.5mA option |
| R/G/B Current Gain | $G_{level}$ | --- | 3/17 | --- | mA/level | Max.3mA option |
| | | --- | 5/17 | --- | mA/level | Max.5mA option |
| DI / BI Input Leakage | $I_{leak}$ | --- | --- | 1 | μA | $V_{DI}$=$V_{BI}$=$V_{DD}$=5V |
| R/G/B Off Leakage Current | $I_{off}$ | --- | --- | 1 | μA | $V_{R/G/B}$=5V PWM off |


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## CHARACTERISTICS:

Electrical & Optical Characteristics ($T_a$=25°C)

| Parameter | | Symbol | Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Propagation Delay Time | | $t_{PLZ}$ | --- | --- | 80 | ns | DI → DO Load=30pF |
| | | $t_{PZL}$ | --- | --- | 80 | ns | |
| Rising Time | | $t_{THL}$ | --- | 15 | --- | ns | DI → DO Load=30pF |
| Falling Time | | $t_{TLH}$ | --- | 15 | --- | ns | |
| Rising Time | | $t_R$ | --- | 50 | --- | ns | $I_{SK(R/G/B)}$=3/5mA Load=30pF |
| Falling Time | | $t_F$ | --- | 50 | --- | ns | |
| Data Rate | | $F_{data}$ | --- | 800 | --- | KHz | --- |
| Dominant Wavelength | Red | $\lambda_d$ | --- | 624 | --- | nm | $I_F$=5mA |
| | Green | | --- | 523 | --- | | |
| | Blue | | --- | 470 | --- | | |
| Spectrum Radiation Bandwidth | Red | Δλ | --- | 18 | --- | nm | $I_F$=5mA |
| | Green | | --- | 35 | --- | | |
| | Blue | | --- | 25 | --- | | |
| Luminous Intensity | Red | $I_v$ | --- | 65 | --- | mcd | $I_F$=5mA |
| | Green | | --- | 85 | --- | | |
| | Blue | | --- | 20 | --- | | |


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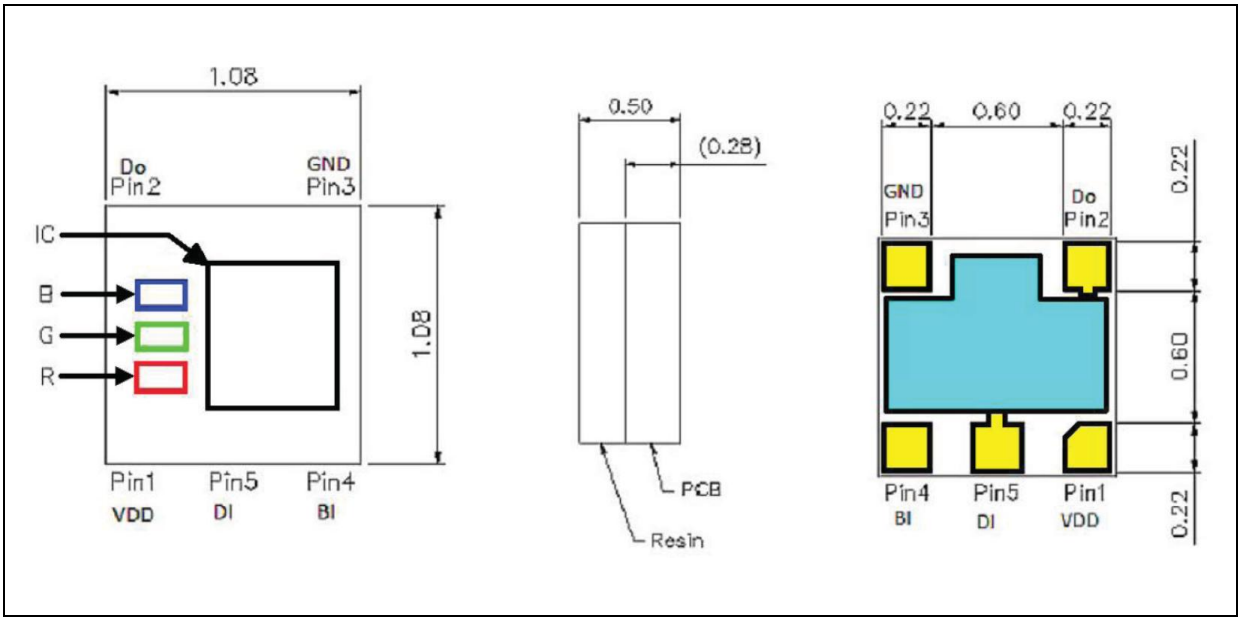
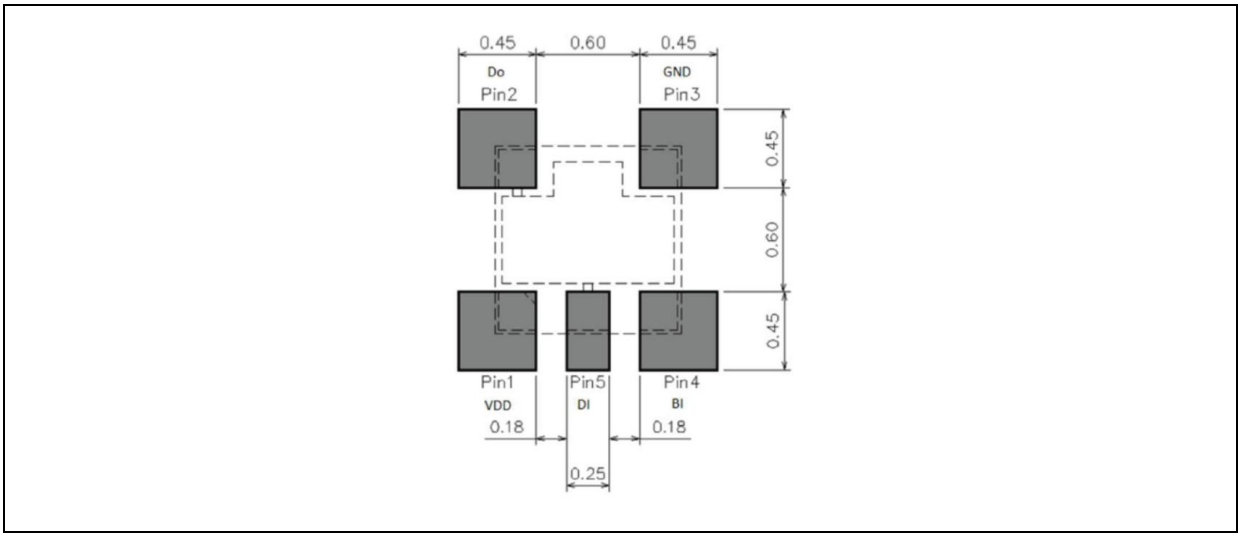
## OUTLINE DIMENSION:

Package Dimension:




1. All dimensions are in millimetre (mm).
2. Tolerance ±0.1mm, unless otherwise noted.

Recommended Soldering Pad Dimension:




1. Dimensions are in millimetre (mm).
2. Tolerance ±0.1mm with angle tolerance ±0.5°.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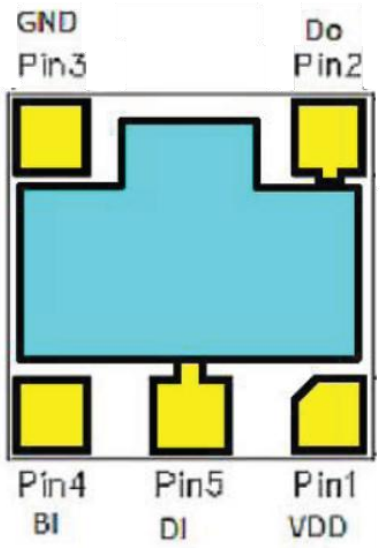
## PIN CONFIGURATION:




| No. | Symbol | Function Description |
|---|---|---|
| 1 | VDD | Power Supply |
| 2 | DO | Control Data Signal Output |
| 3 | GND | Ground |
| 4 | BI | Backup Data Signal Input.*<br>(Single Signal Wiring Diagram: BI is connected to GND) |
| 5 | DI | Control Data Signal Input |

* Support BI backup input data line to prevent data input failure from malfunction DL.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## FUNCTION DESCRIPTION:

1. Pre-design Stage:

   Emitted colour sequence: Red, Gren, Blue

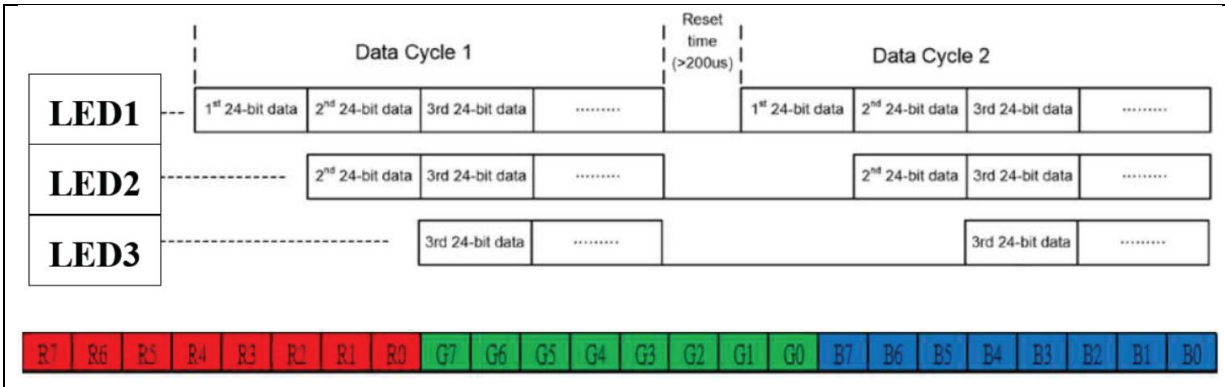
   In practical circuit applications, it is crucial to connect the signal input and output pins of the integrated circuit (IC) to their respective terminals. Additionally, for enhanced stability of the IC chip, it is necessary to include capacitance between displays.

   For short display transmission distances, it is recommended to connect series protection resistor (approximately 470 ohms) at both the input and output ends of the clock line signal.

   In cases where the display transmission distance is longer, especially for modules or specialized products, variations in wire type and transmission distance may occur. As a result, slight differences in grounding protection resistance at both ends of the clock line signal should be anticipated and addressed to ensure consistent performance in practical usage.

2. Input/Output Signals Relations:


3. Data Transfer Protocol:




The single wire data transfer protocol supports 24-bit data for each LED RGB display data refresh. The IC receives 24-bit data ad passes the remaining data to the next LED. The 24-bit data consist of red, green, and blue data, each with 8-bit width, and are transferred with MSB first.

The transferred data are recognized based on the pulse widths received by the IC. A low but 0 is represented by a 0.3μs high pulse followed by a 0.9μs low pulse. A high bit 1 is represented by a 0.9 high pulse followed by a 0.3μs low pulse. A low pulse ≥ 200μs is used to issue a reset command to the IC to start a new cycle of serial commands.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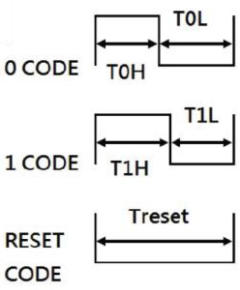
4. Sequence Chart:




(T0H: 0.3us+0.15us, T0L: 0.9us+0.15us)
(T1H: 0.9us+0.15us, T1L: 0.3us+0.15us)

5. Sleep and Power Saving Mode:

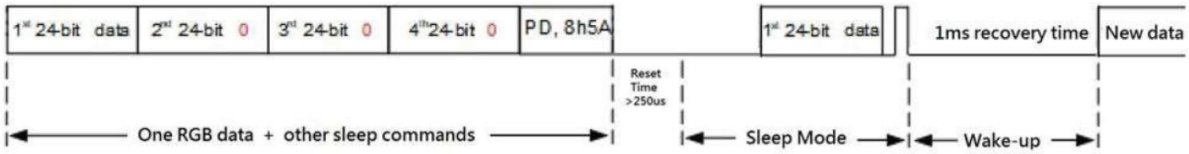
N0M68S99IC supports sleep/wake-up modes for power-saving purpose. When receiving 24-bit 0's RGB data, 8-bit 0x5A special data, and a reset command, N0M68S99IC will enter sleep mode. In sleep mode, the built-in oscillator and associated circuitry is disabled. The quiescent current of N0M68S99IC is less than 2μA (typ.) in sleep mode.

A sleeping N0M68S99IC wakes up from sleep mode when detecting an input rising edge on DI or BI pin. Normally a positive pulse on DI or BI pin can be used as a wake-up trigger. After waking up, all sleeping circuits in N0M68S99IC return to normal working mode within 1ms. To wake-up the next cascaded N0M68S99IC, the received positive pulse on DI pin is passed to DO pin, which connected to DI pin of the next N0M68S99IC, and in turn wakes up the next N0M68S99IC. Hence, all cascaded sleeping N0M68S99ICs can wake up successively.

Since it takes 1ms for a sleeping N0M68S99IC returning to normal functioning mode, it is recommended for MCU to wait for 1ms to send display data and commands after issuing a wake-up pulse. In case a mal-functioned N0M68S99IC exists in an LED strip, the one next to the mal-functioned N0M68S99IC determines the sleep/wake-up mode through BI pin, instead of DI pin.

In an LED strip, it is possible to set certain N0M68S99ICs active, while the others in sleep mode. As an example, the following commands are for two leading active N0M68S99ICs and other sleeping N0M68S99ICs.


As an example of sleep/wake-up commands shown below, the first N0M68S99IC is kept active and the remaining N0M68S99ICs enter sleep mode by 24-bit 0's and an ending 0x5A byte. Later on, a positive pulse wakes up all sleeping N0M68S99ICs.





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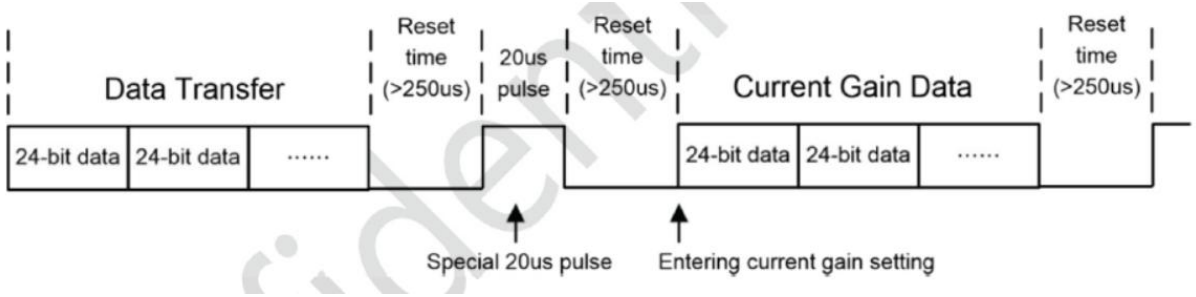
6. Dimming Control:

N0M68S99IC supports an 16-level current gain control to adjust sink current of R/G/B channels. This feature enables dimming control of LED lighting. Each of the red, green, and blue channels can be controlled individually, which in turn not only save power consumption, but also fine-tune the color temperature of R/G/B LEDs.

To set the current gain of N0M68S99IC's R/G/B channels, a special pulse must be issued by MCU before setting the current gain levels, as shown below.




After a reset pulse following normal data transfer, if a 20us positive pulse is issued with another reset pulse, N0M68S99IC is forced into a special mode to interpret following 24-bit data as current gain setting data. Each of the 24-bit data comprises 4-bit gain values of R/G/B channels, as shown below.

| S23 | S22 | S21 | S20 | S19 | S18 | S17 | S16 | S15 | S14 | S13 | S12 | S11 | S10 | S9 | S8 | S7 | S6 | S5 | S4 | S3 | S2 | S1 | S0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | R[3] | R[2] | R[1] | R[0] | 0 | 0 | 0 | 0 | G[3] | G[2] | G[1] | G[0] | 0 | 0 | 0 | 0 | B[3] | B[2] | B[1] | B[0] |

The maximum output current of each R/G/B channels is then determined as below (ISK=3mA or 5mA).

Rsink = ISK * (R[3]*10/17 + R[2]*4/17 + R[1]*2/17 + R[0]*1/17)
Gsink = ISK * (G[3]*10/17 + G[2]*4/17 + G[1]*2/17 + G[0]*1/17)
Bsink = ISK * (B[3]*10/17 + B[2]*4/17 + B[1]*2/17 + B[0]*1/17)
By default, R[3:0] = G[3:0] = B[3:0] = 0x0F.

Recommended programming flow:

After system power-on, MCU should send data 0 first (dark mode) for all LEDs in the strip, then MCU can deliver normal display data or execute current gain (dimming) command to LEDs.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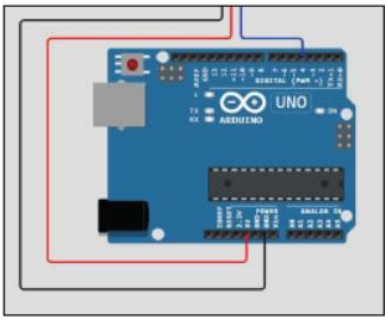
7. Sample Code:

```
// Please write using Arduino IDE.
// Make sure that the Adafruit_NeoPixel library has been installed.
#include <Adafruit_NeoPixel.h>
#define LED_PIN     4   // Signal pin for the LED Display.
#define LED_COUNT  10   // Number of LEDs in the LED Display.
Adafruit_NeoPixel strip(LED_COUNT, LED_PIN, NEO_RGB + NEO_KHZ800);
//  Function used to create colorful effects
void setup() {
  strip.begin();
  strip.show();
  strip.setBrightness(127); //Set brightness to approximately 1/2 (maximum value = 255)
}
void loop() {
  strip.setPixelColor(0, 255, 0, 0); // Turn on D1-Red
  strip.setPixelColor(1, 255, 0, 0); // Turn on D3-Red
  strip.setPixelColor(8,   0, 0, 0); // Turn off
  strip.setPixelColor(9,   0, 0, 0); // Turn off
  strip.show();  // Update to display
  delay(500); // delay 0.5 seconds.
  strip.setPixelColor(0, 0, 0, 0); // Turn off
  strip.setPixelColor(1, 0, 0, 0); // Turn off
  strip.setPixelColor(8, 0, 255, 0); // Turn on D9-Green
  strip.setPixelColor(9, 0, 255, 0); // Turn on D10-Green
  strip.show();  // Update to display
  delay(500); // delay 0.5 seconds.
}
```





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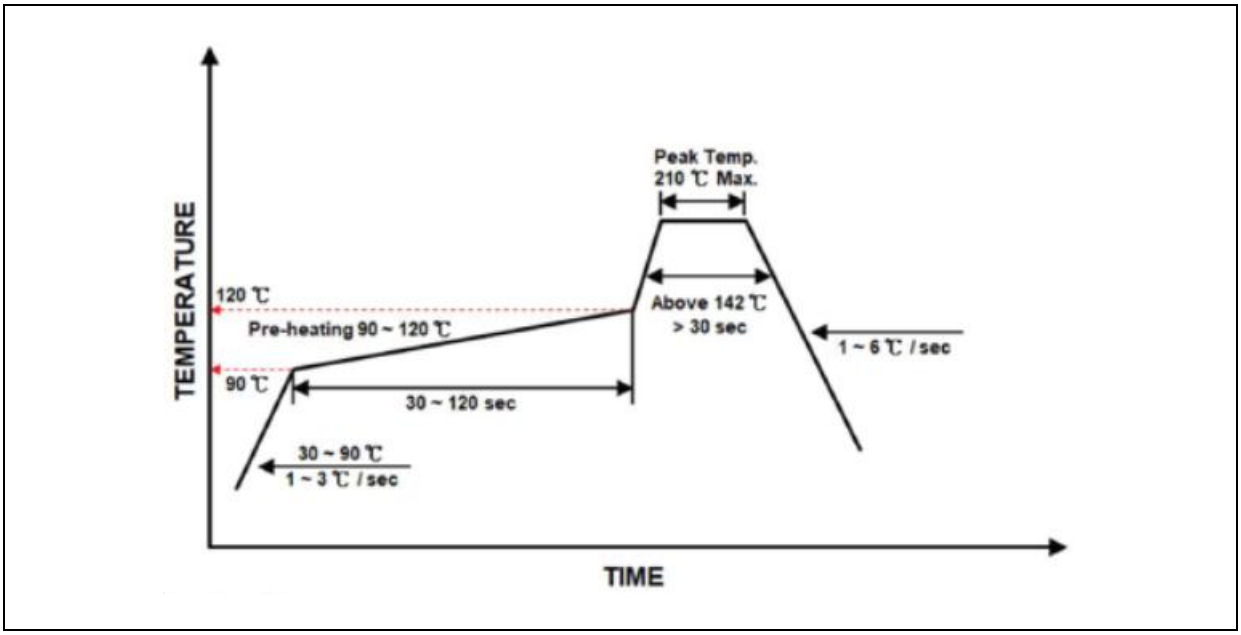
## RECOMMENDED SOLDERING PROFILE:

Lead-free Solder IR Reflow:




Note:

1. The maximum soldering temperature should be limited to 210°C, 5 sec. max.
2. Never take the next process until the component is cooled down to room temperature after reflow.
3. Maxima reflow soldering: 2 times.
4. Before, during, and after soldering, should not apply stress on the components and PCB board.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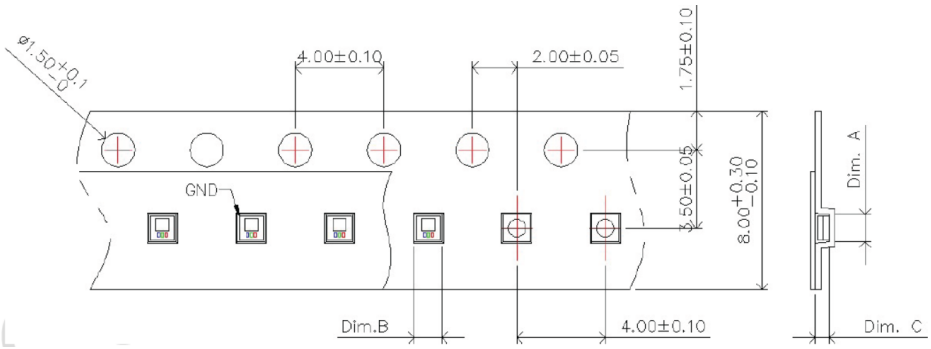
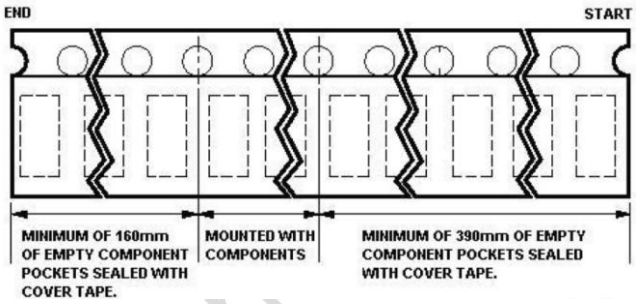
## PACKING SPECIFICATION:

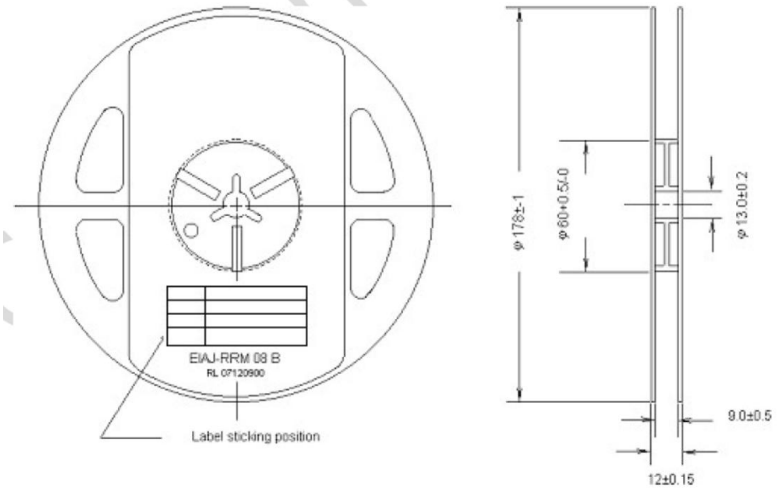
Reel Dimension:

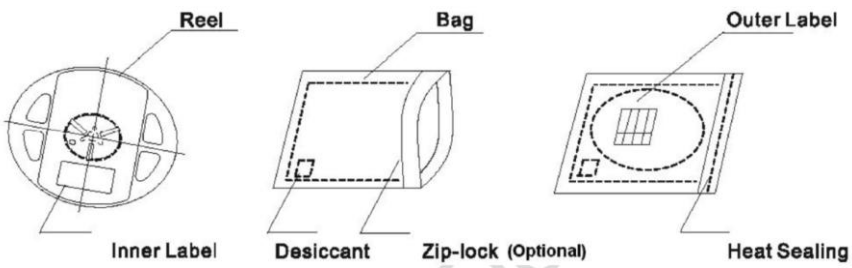
Max.4000pcs/reel




| Dim. A | Dim. B | Dim. C | Q'ty/Reel |
|---|---|---|---|
| 1.24±0.05 | 1.28±0.05 | 0.80±0.05 | 4K |





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## PRECAUTIONS OF USE:

### Storage:

It is recommended to store the products in the following conditions:

- Humidity: 60% R.H. Max.
- Temperature: 5°C~30°C (41°F ~86°F).

Shelf life in sealed bag: 12 months at 5°C~30°C and <60% R.H.

Once the package is opened, the products should be used within 72 hours. Otherwise, they should be kept in a damp-proof box with descanting agent stored at R.H.<10% and apply baking before use.

### Over-Current Proof:

Must apply resistors for protection otherwise slight voltage shift will cause big current change and burn-out will happen.

### Baking:

It is recommended to bake the LED before soldering if the pack has been unsealed for longer than 24hrs. The suggested baking conditions are as followings:

- 60±5°C x 12hrs and <5%RH, taped / reel package.

It's normal to see slight color fading of carrier (light yellow) after baking in process.

### Cleaning:

Use alcohol-based cleaning solvents such as isopropyl alcohol to clean the LED carrier / package. Avoid putting any stress force directly on to the LED lens.

### ESD (Electrostatic Discharge):

Static Electricity or power surge will damage the LED. Use of a conductive wrist band or anti-electrosatic glove is recommended when handing the LED all time. All devices, equipment, machinery, work tables, and storage racks must be properly grounded.


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## REVISION RECORD:

| Version | Date | Summary of Revision |
|---|---|---|
| A1.0 | 17/02/2025 | Datasheet set-up. |
| A1.1 | 15/05/2025 | Revise MSL level. |


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