BRIGHTEK

BRIGHTEK (EUROPE) LIMITED

Brighten Up The World With LED!

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

PRODUCT DATASHEET

- PLCC6 LED with IC
- 1212 IC 0.42t
- Red/Green/Blue

Release Date: 31 December 2024 Version: A1.2

N0M66S09IC

1212 IC Integrated

1212 IC-Integrated

RoHS Compliant

FEATURES:

- **Package:** PLCC 6-Pins EIA STD Package with Integrated IC
- **Forward Current:** 3.63/3.63/3.63mA*
- **Luminous Intensity (typ.):** 460mcd mixed white
- **Colour:** Red/Green/Blue
- **IC Feature:**
  - ✓ Single data line employing a communication protocol that utilizes zero-return codes.
  - ✓ Built-in high-precision and high-stability oscillator. The serial data frequency is adjustable up to 1300kHz.
  - ✓ Data output re-shaping for accurate and long-distance transmission.
  - ✓ Built-in overvoltage protection.
  - ✓ 2 data input ports to allow breakpoint jumping.
- **Pixel:** Supports 65536 levels (16 bits) grayscale adjustment of each R/G/B single channel. Maximum 12mA of constant current output for each R/G/B channel with 5 bits dimming level.
- **Soldering methods:** IR Reflow soldering
- **MSL Level:** acc. to JEDEC Level 3
- **Packing:** 8mm tape with max.4000pcs/reel, ø178mm (7'')

APPLICATIONS:

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

* in order of Red/Green/Blue

CHARACTERISTICS:

Absolute Maximum Characteristics (T_a=25°C)

Parameter	Symbol	Ratings	Unit
Forward Current	I_F	12	mA
IC Power Supply Voltage	V_{DD}	4.0~7.5	V
R/G/B Output Port Withstand Voltage	V_{ds}	max. 9	V
IC Input Voltage	V_I	-0.5~+5.5	V
Operating Temperature	T_{OPR}	-40~+85	°C
Storage Temperature	T_{STG}	-40~+85	°C
Junction Temperature	Tj	125	°C
Soldering Temperature	T_{SD}	220	°C
ESD Withstand Voltage acc. ANSI/ESDA/JEDEC JS-001	ESD	4	kV

Electrical & Optical Characteristics (T_a=25°C)

Parameter	Symbol	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Input Voltage	V_{DD}	4.5	5.0	5.5	V	---
R/G/B Output Drive Current	I_O	0.71	3.63	12	mA	V_{ds}=1V
Input Voltage Level	V_{IH}	0.7V_{DD}	---	---	V	---
	V_{IL}	---	---	0.3V_{DD}	V	---
Current Deviation	dI_O	---	±3	±5	%	V_{ds}=1V; I_O=12mA
Dynamic IC Consumption	$I_{dd.dyn}$	---	---	1	mA	Data input, light off
Quiescent Current	I_{DD}	---	---	5	uA	No data in, light off

Electrical & Optical Characteristics (T_a=25°C, V_{DD}=5V)

Parameter		Symbol	Values			Unit	Test Condition
			Min.	Typ.	Max.		
Luminous Intensity	R	I_V	---	70	---	mcd	I_F=3.63mA
	G		---	310	---		I_F=3.63mA
	B		---	65	---		I_F=3.63mA
	W		250	460	630		I_F=10.89mA
Dominant Wavelength	R	λ_D	---	624	---	nm	I_F=3.63mA
	G		---	528	---		I_F=3.63mA
	B		---	469	---		I_F=3.63mA
Colour Coordinate	X	---	---	0.2200	---	---	I_F=10.89mA
	Y		---	0.2783	---	---	
Viewing Angle		$2\theta_{1/2}$	---	120	---	deg	I_F=10.89mA

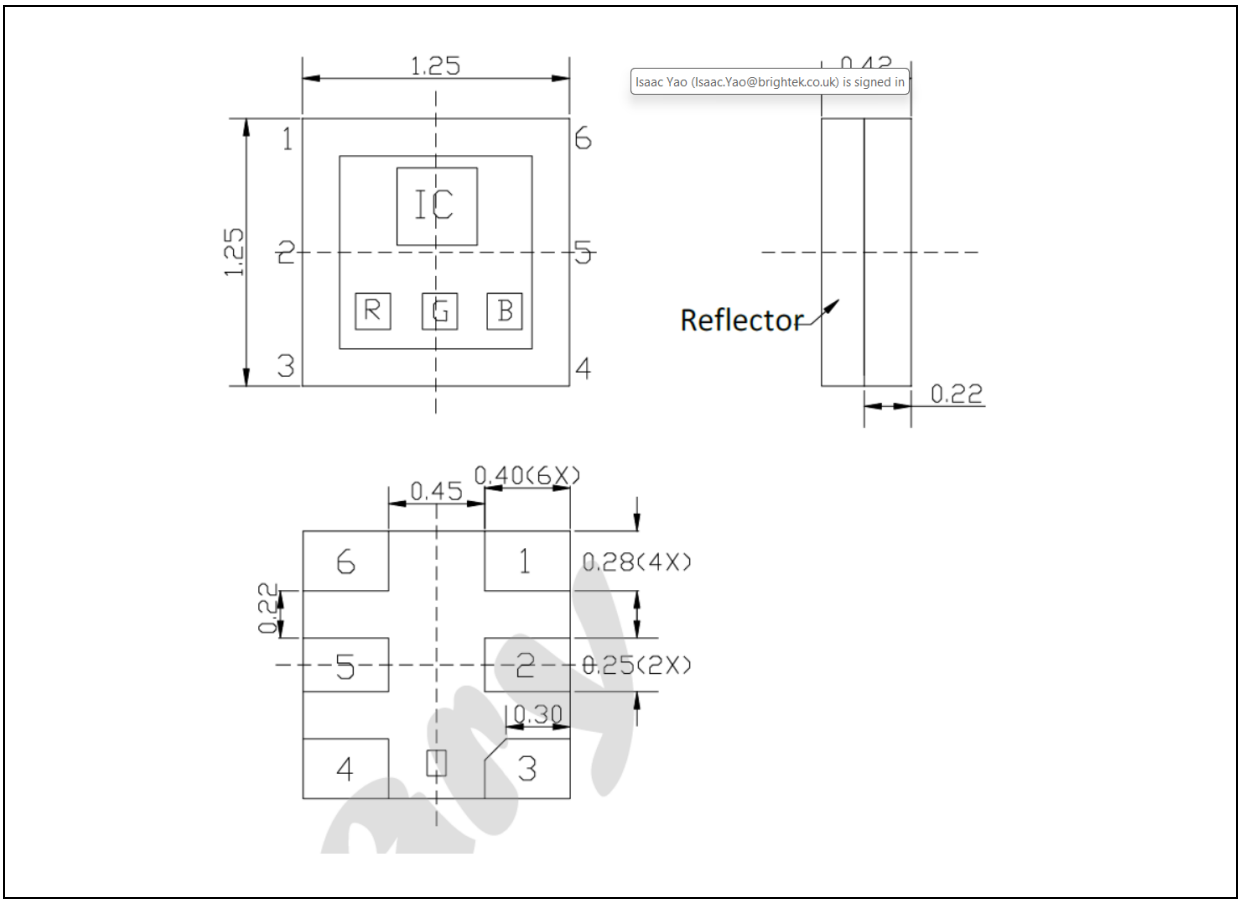
1. Luminous Intensity: ±10%mcd, Dominant Wavelength: ±1.0nm, Color Coordinate: ±0.005

Switching Characteristics (T_a=25°C)

Parameter	Symbol	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Rate of Data Signal	F_{DIN}	---	1	1.3	MHz	V_{DD}=5V
Oscillation Frequency	F_{OSC}	---	8	---	MHz	V_{DD}=5V
PWM Frequency	F_{PWM}	---	4	---	KHZ	---
Output Current Conversion Time	T_r	---	---	60	ns	V_{ds}=1.5V; I_O=12mA
	T_f	---	---	60	ns	
Transmission Delay Time	T_{pzl}	---	---	200	ns	D_{IN} → D_{OUT}

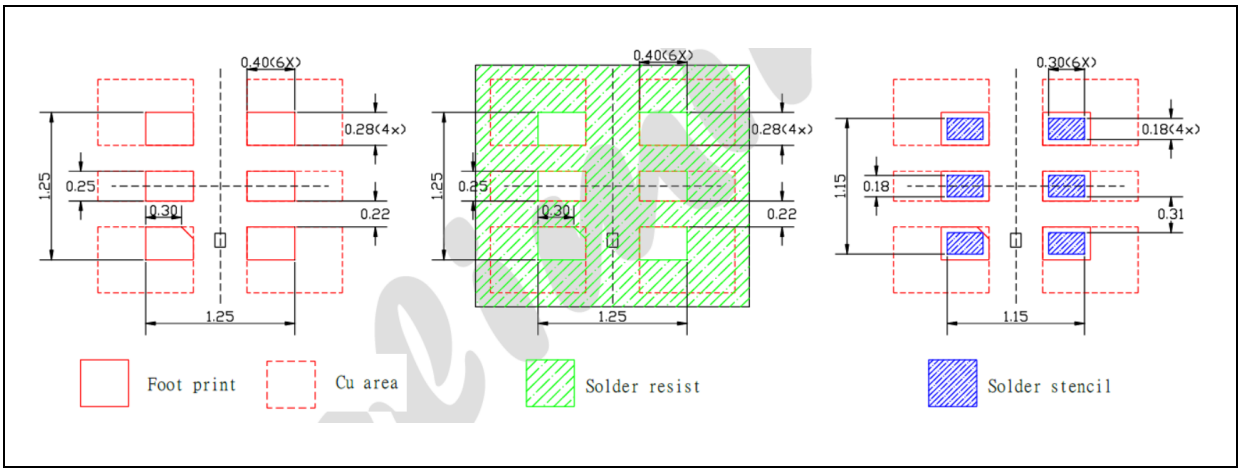
OUTLINE DIMENSION:

Package Dimension:



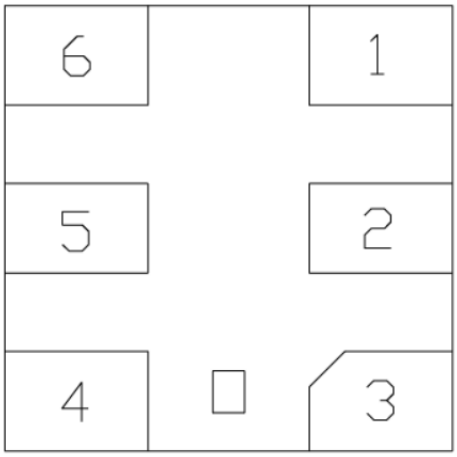
1. All dimensions are in millimetre (mm).
2. Tolerance ±0.1mm, unless otherwise noted.

Recommended Soldering Pad Dimension:



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

PIN CONFIGURATION:



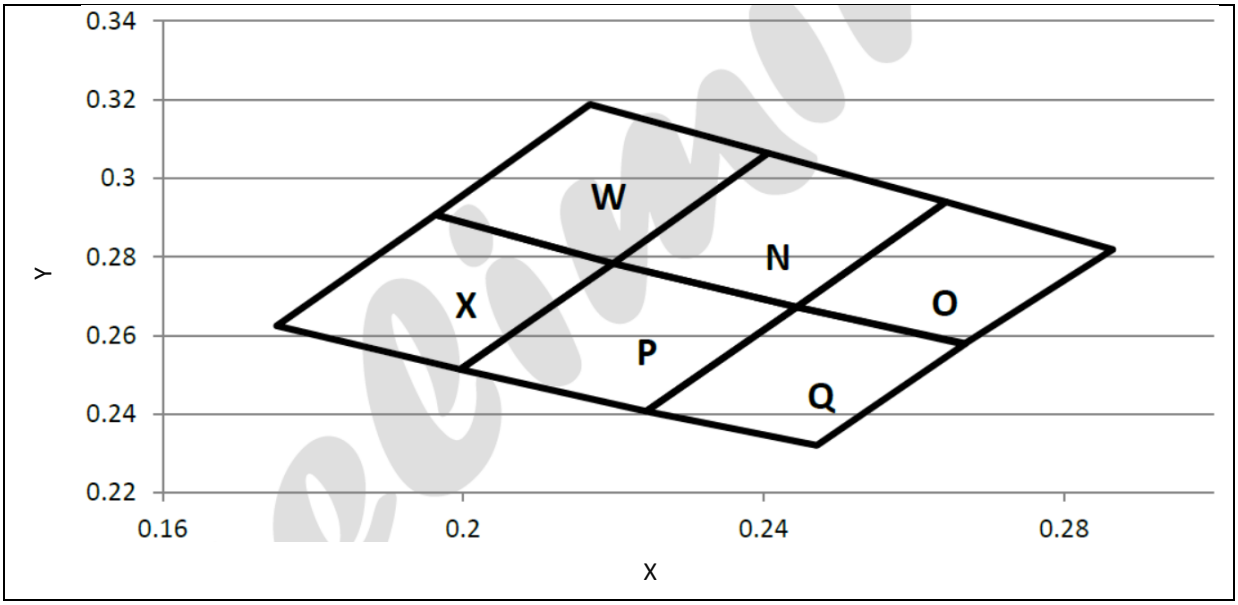
No.	Symbol	Function Description
1	DIN2	Control Data Signal Input 2
2	DIN1	Control Data Signal Input 1
3	VDD	Power Supply Voltage
4	DOUT1	Control Data Signal Output1
5	NC	Not Connected
6	GND	Ground

BINNING GROUPS:

Luminous Intensity Classifications (I_F=10.89mA, V_{DD}=5V, T_a=25°C):

Code	Min.	Max.	Unit
16	250	320	mcd
17	320	400	
18	400	500	
19	500	630	

CIE CHROMATICITY DIAGRAM:



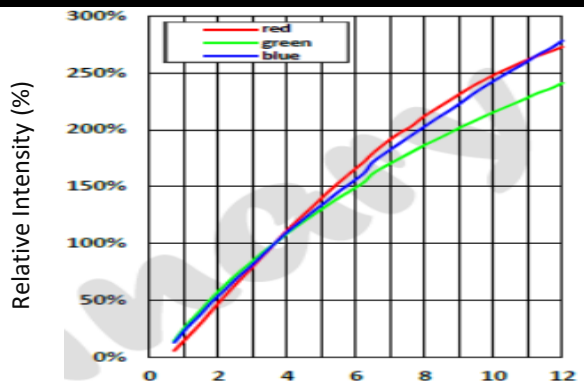
Chromaticity Coordinates Classifications:

	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
W	0.1963	0.2907	0.2169	0.3188	0.2406	0.3064	0.2200	0.2783
N	0.2200	0.2783	0.2406	0.3064	0.2643	0.2940	0.2444	0.2672
X	0.1963	0.2907	0.1752	0.2624	0.1996	0.2513	0.2200	0.2783
P	0.2200	0.2783	0.1996	0.2513	0.2244	0.2407	0.2444	0.2672
O	0.2444	0.2672	0.2643	0.2940	0.2865	0.2819	0.2667	0.2578
Q	0.2444	0.2672	0.2244	0.2407	0.2471	0.2320	0.2669	0.2579

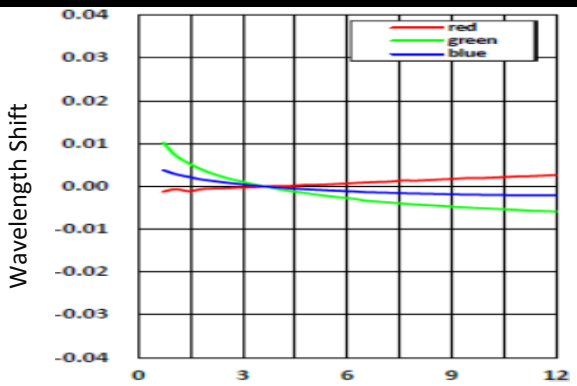
1. Tolerance Luminous Intensity: ±10%mcd, Color Coordinate: ±0.005

ELECTRO-OPTICAL CHARACTERISTICS:

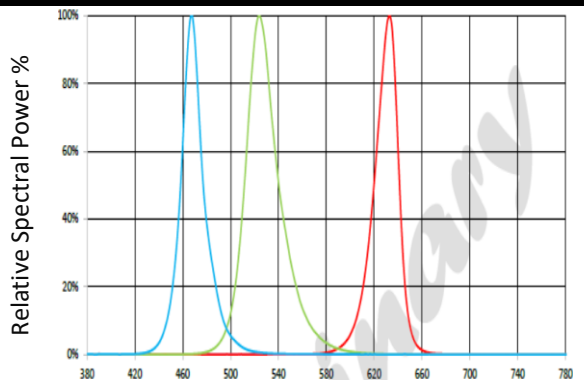
Relative Luminous Intensity v.s. Forward Current



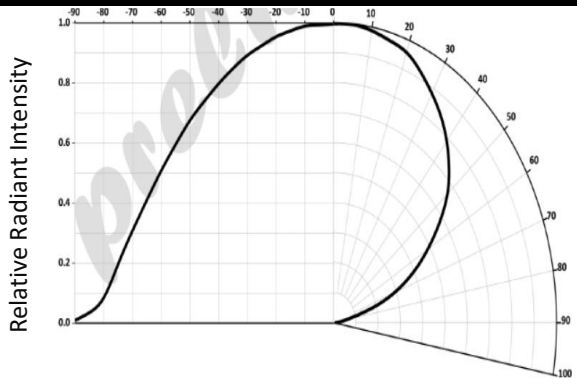
Wavelength Shift v.s. Forward Current



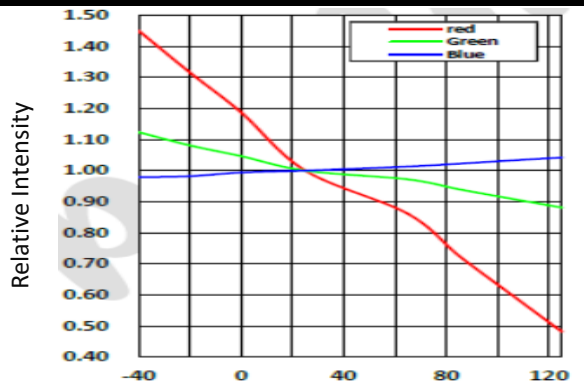
Relative Spectral Power v.s. Wavelength



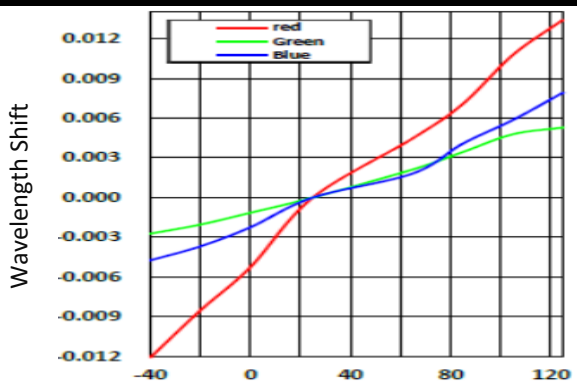
Directive Radiation



Relative Intensity v.s. Temperature



Dominant Wavelength v.s. Temperature

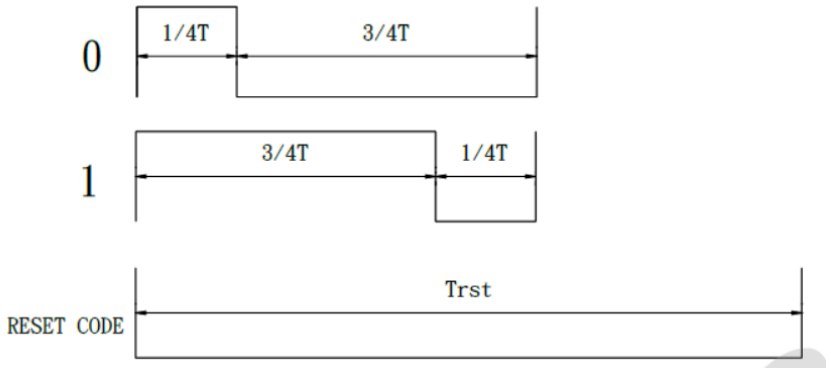


Function Description:

1. Current Gain (Dimming Level) Regulation

RGB Gain Setting	RGB Output（mA）		
0	0.71	10	6.47
1	1.07	11	6.83
2	1.46	12	7.22
3	1.81	13	7.60
4	2.18	14	7.96
5	2.55	15	8.34
6	2.94	16	8.73
7	3.30	17	9.08
8	3.63	18	9.40
9	3.98	19	9.77
A	4.36	1A	10.15
B	4.74	1B	10.54
C	5.11	1C	10.90
D	5.48	1D	11.27
E	5.87	1E	11.67
F	6.24	1F	12.00

2. Timing Wave Form:



3. Data Transfer Time:

Item	Description	Typical	Tolerance
TOH	0 code, high voltage time	0.24μs	±10%
TOL	0 code, low voltage time	0.48μs	±10%
T1H	1 code, high voltage time	0.48μs	±10%
T1L	1 code, low voltage time	0.24μs	±10%
Trst	reset time, low voltage time	≥80μs	-

4. Composition of 48bit Data:

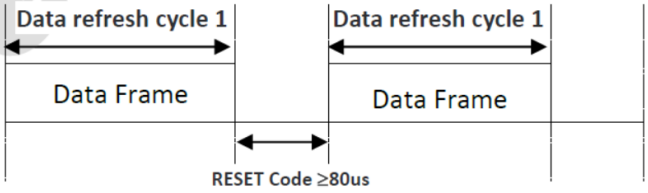
R15	R14	...	R1	R0	G15	G14	...	G1	G0	B15	B14	...	B1	B0

LED brightness 48bits data structure, high bit is sent first, and data is sent in the order of RGB

GR4	GR3	GR2	GR1	GR0	GG4	GG3	GG2	GG1	GG0	GB4	GB3	GB2	GB1	GB0

RGB gain 15bits data structure, high bit is sent first, and data is sent in the order of RGB

5. Data transmission method:

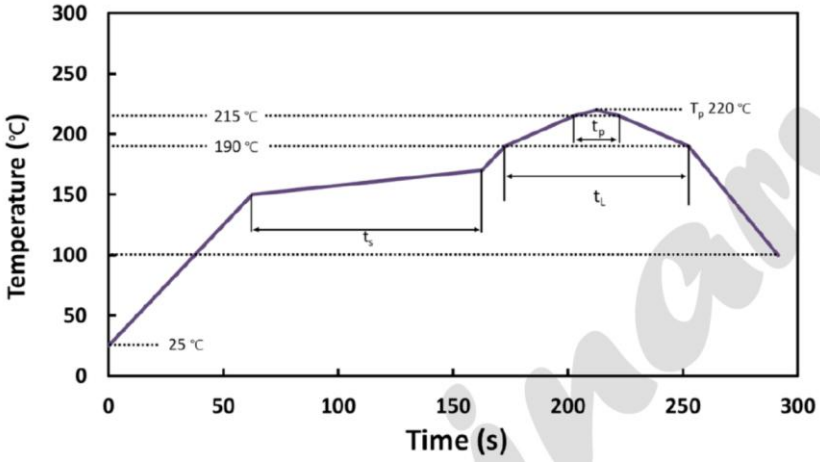


LED1 DIN	LED1 (48bits)	LED2 (48bits)	.....	LEDN (48bits)	RGB (15bits)
LED2 DIN		LED2 (48bits)	.....	LEDN (48bits)	RGB (15bits)
LEDN DIN				LEDN (48bits)	RGB (15bits)

Note: The data frame D(1) is the data sent by the MCU, and D(2) and D(N) are the data that the cascade circuit automatically reshapes and forwards.

RECOMMENDED SOLDERING PROFILE:

Lead-free Solder IR Reflow:



Profile Feature	Symbol	Pb-Free (SnAgCu) Assembly			Unit
		Minimum	Recommendation	Maximum	
Ramp-up Rate to Preheat 25 °C to 150 °C			2	3	K/s
Time t_S T_{Smin} to T_{Smax}	t_S	60	100	120	s
Ramp-up Rate to Peak T_{Smax} to T_P			2	3	K/s
Liquids Temperature	T_L		190		°C
Time Above Liquids Temperature	t_L		80	100	s
Peak Temperature	T_P		220	230	°C
Time Within 5 °C of the Specified Peak Temperature T_P - 5 K	T_P			10	s
Ramp-Down Rate T_P to 100 °C			3	6	K/s
Time 25 °C to T_P				480	s

1. Do not stress the silicone resin while it is exposed to high temperature.
2. The reflow process should not exceed 2 times.

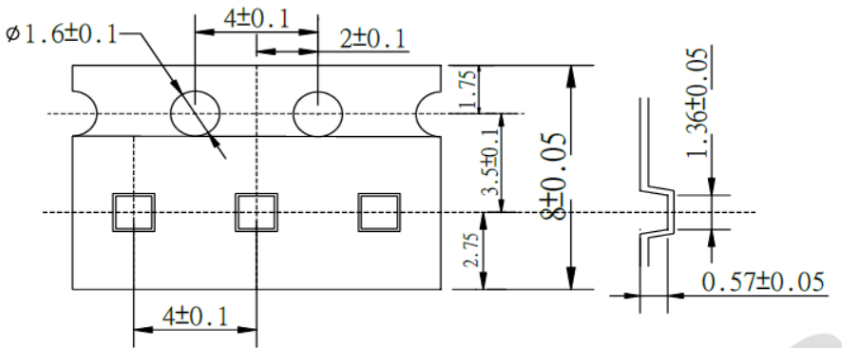
Note:

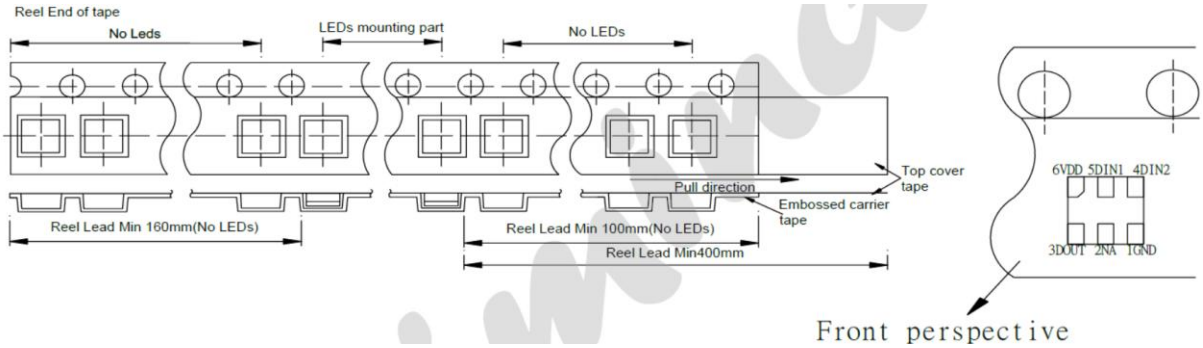
1. We recommend the reflow temperature 240°C (±5°C). The maximum soldering temperature should be limited to 260°C.
2. Maxima reflow soldering: 2 times.
3. Before, during, and after soldering, should not apply stress on the components and PCB board.

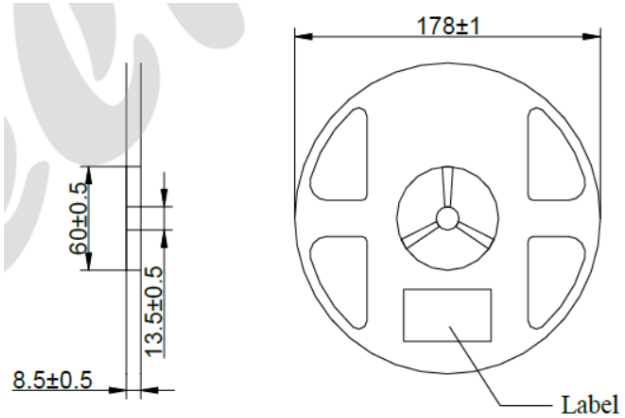
PACKING SPECIFICATION:

Reel Dimension:

Max.4000pcs/reel







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 a week. 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.

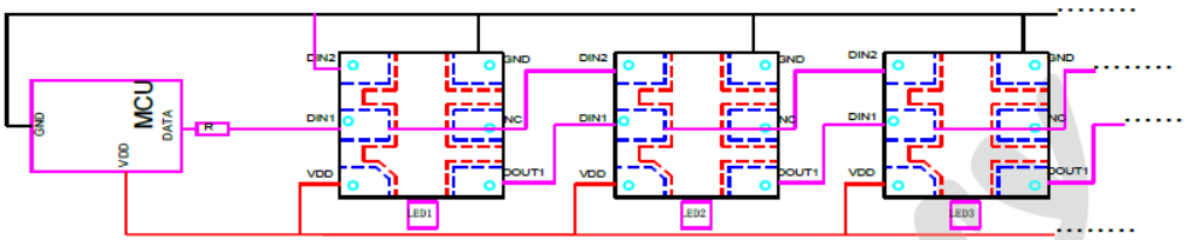
Baking:

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±3°C x 6hrs and <5%RH, taped / reel package.

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

Typical Application Circuit:



When connecting the first LED to the MCU, a resistor R needs to be connected in series between its signal input line and the MCU. The value of R depends on the number of cascaded LEDs. The more LEDs cascaded, the lower the resistance R used. Generally, the recommended setting ranges between 100 and 1K. The suggested value typically falls around 300 ohms. To ensure more stable LED operation, it is necessary to include a parallel capacitor between the VDD and GND of the first LED.

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.

REVISION RECORD:

Version	Date	Summary of Revision
A1.0	05/03/2024	Datasheet set-up.
A1.1	27/03/2024	Update title text.
A1.2	31/12/2024	Revise soldering temperature and ESD level.