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

- ▶ CHIP SMD with IC
- ▶ 0808 (2020) IC 0.75t
- ▶ Red/Green/Blue

Release Date: 11 August 2024 Version: A1.1

N0M67S15IC

Sleep Mode

0808 IC Integrated

APPLICATIONS:

- Automotive Interior Light
- Telecommunication
- Status Indicator
- Home Appliance
- Decoration Lighting
- Full Colour LED Strip

Support sleep/wake up mode. In sleep mode the LED's current was lower than 1μA

0808 IC-Integrated

RoHS Compliant

AUTOMOTIVE AEC-Q100 AUTOMOTIVE AEC-Q102

FEATURES:

- **Package:** CHIP EIA STD Package 6 Pins with Integrated IC
- **Output Current (typ.):** 1.875~5.000mA
- **LED Voltage:** 4.5~5.5V
- **Luminous Intensity (typ.):** 23/147/16mcd*
- **Mixed White Intensity (typ.):** 184mcd
- **Colour:** Red/Green/Blue
- **Dominant Wavelength (typ.):** 630/535/457nm
- **Viewing Angle:** 120°
- **Materials:**
  - Resin: Epoxy (Water Clear)
- **Operating Temperature:** -40~+105°C
- **Storage Temperature:** -40~+105°C
- **IC Feature:** Serial data transmission signal by dual-wire DATA & CLK lines. Supports sleep/wake-up mode. In sleep mode, the LED's current was lower than 1μA.
- **Pixel:** One pixel contains R, G, and B colour that each can achieve 256 level brightness grayscales, which forms 16,777,216 combination colours.
- **Soldering methods:** IR reflow soldering
- **MSL Level:** acc. to JEDEC Level 3
- **Packing:** 8mm tape with max.4000pcs/reel, ø180mm (7'')

* in order of Red/Green/Blue

CHARACTERISTICS:

Absolute Maximum Characteristics (Ta=25°C)

Parameter	Symbol	Ratings	Unit
IC Power Supply Voltage	V_{DD}	Max. 6.5	V
Rate of Data Signal	F_{CLK}	15	MHz
Max. LED Output Current (DIM 8)*	I_{OMAX}	5.419	mA
Power Dissipation	PD	97.5	mW
Junction Temperature	T_j	125	°C
Operating Temperature	T_{OPR}	-40~+105	°C
Storage Temperature	T_{STG}	-40~+105	°C
Electrostatic Discharge (HBM) acc. To ANSI/ESDA/JEDEC JS-001	ESD	2000	V
Soldering Temperature	T_{SD}	245 for 10s max.	°C

* The actual current of DIM level, please refer to DIM Current Range table.

Electrical & Optical Characteristics (Ta=25°C, V_{DD}=5V, I_F=1.875mA (DIM 3))

Parameter		Symbol	Values			Unit	Test Condition
			Min.	Typ.	Max.		
LED Voltage		V_{LED}	4.5	---	5.5	V	---
Luminous Intensity	R	I_V	13	23	40	mcd	V_{DD}=5V I_F=1.875mA (DIM 3)
	G		125	147	170		
	B		9	16	30		
Mixed White	W		125	184	250		
Luminous Flux	R	Φ_v	---	86	---	mlm	V_{DD}=5V I_F=1.875mA (DIM 3)
	G		---	473	---		
	B		---	44	---		
Mixed White	W		---	177	---		
Dominant Wavelength	R	λ_d	628	---	633	nm	V_{DD}=5V I_F=1.875mA (DIM 3)
	G		532	---	537		
	B		455	---	460		
Colour Coordinate	X	---	---	0.2264	---	---	V_{DD}=5V I_F=1.875mA (DIM 3)
	Y		---	0.2378	---	---	
Viewing Angle		$2\theta_{1/2}$	---	120	---	deg	---

1. Tolerance of Measure: Luminous Intensity: ±10%mcd, Dominant Wavelength: ±1.0nm, Color Coordinate: ±0.005.
2. Luminous Flux is for reference only.

Electrical Characteristics (Ta=25°C)

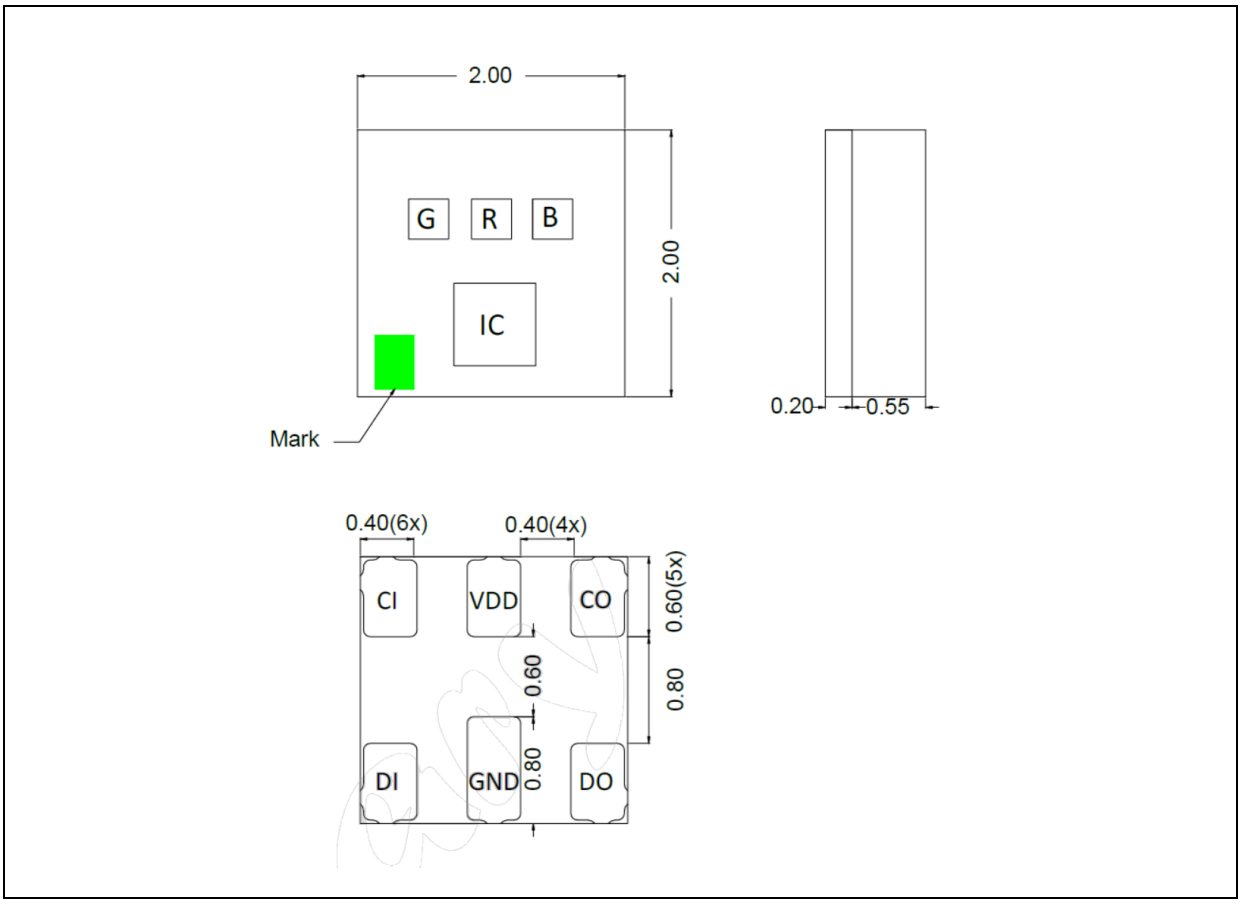
Parameter	Symbol	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	4.5	5.0	5.5	V	---
Input High Voltage	V_{IH}	2.7	---	V_{DD}+0.4	V	---
Input Low Voltage	V_{IL}	-0.4	---	1.0	V	---
Clock High Level Width	T_{CLKH}	30	---	---	ns	---
Clock Low Level Width	T_{CLKL}	30	---	---	ns	---
Data Setup Time	T_{SETUP}	10	---	---	ns	---
Data Hold Time	T_{HOLD}	5	---	---	ns	---
Working Current (IC)	I_{DD}	---	---	1.5	mA	I_{out}="OFF"
Static Current	I_{Sleep}	---	---	1	μA	Sleep Mode

DIM Current Range

Parameter	Setting	Symbol	Values			Unit
			Min.	Typ.	Max.	
DC Forward Current	DIM 3	I_F	1.839	1.875	2.032	mA
	DIM 4		2.452	2.500	2.709	
	DIM 5		3.065	3.125	3.387	
	DIM 6		3.677	3.750	4.065	
	DIM 7		4.290	4.375	4.742	
	DIM 8		4.903	5.000	5.419	

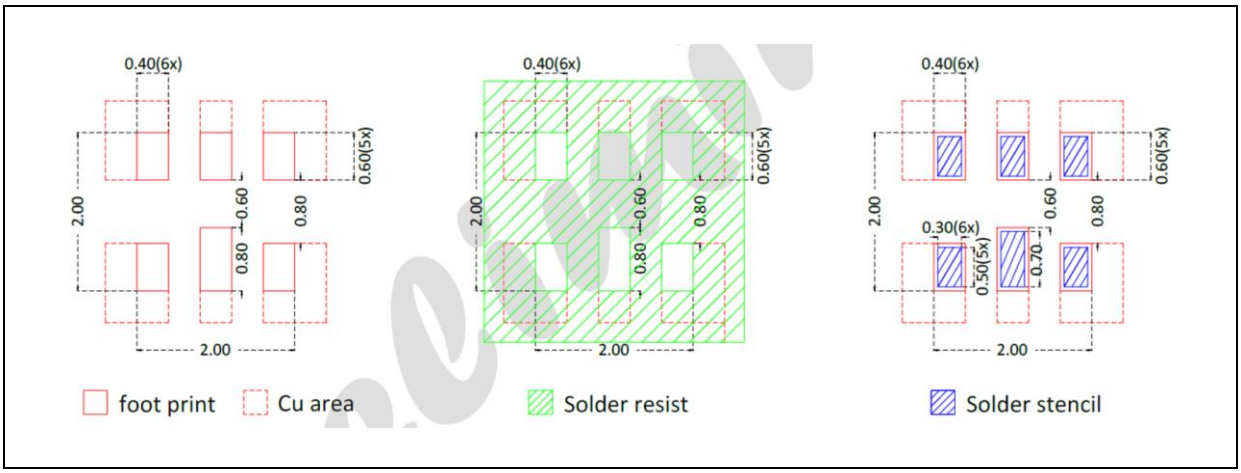
OUTLINE DIMENSION:

Package Dimension:



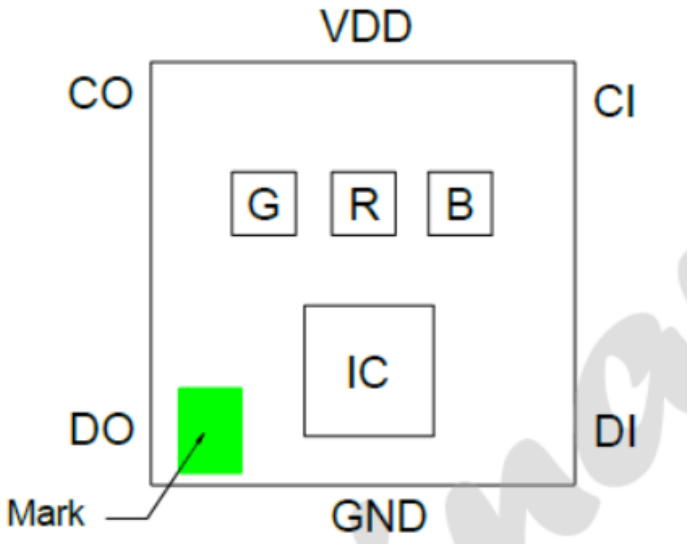
1. All dimensions are in millimetre (mm).
2. Tolerance ±0.1mm, unless otherwise noted.

Recommended Soldering Pad Dimension:



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

PIN CONFIGURATION:



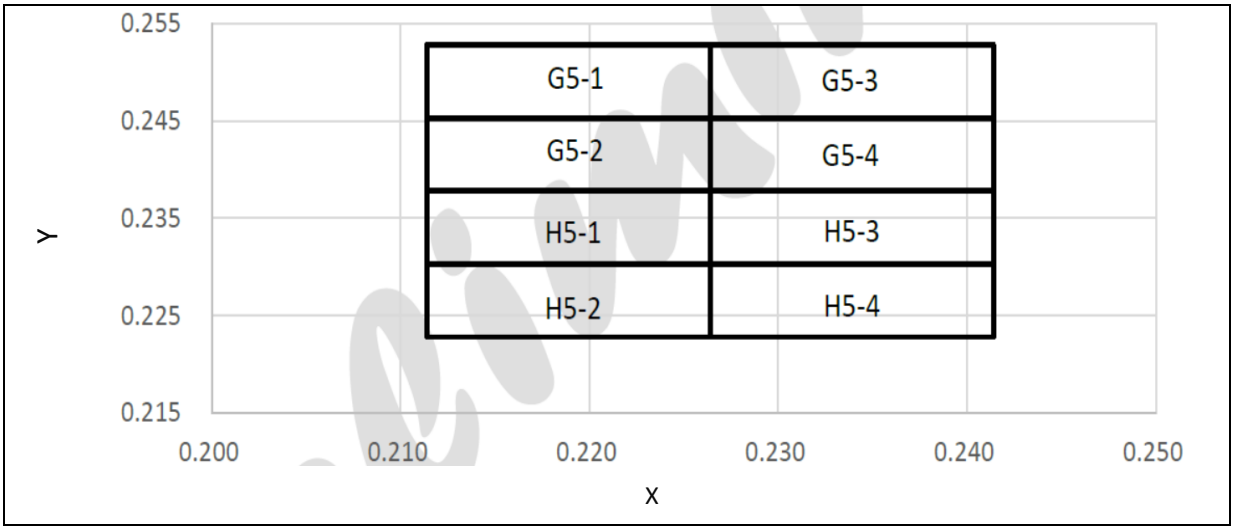
No.	Symbol	Function Description
1	CO	Clock Output
2	VDD	Supply Voltage
3	CI	Clock Input
4	DO	Data Output
5	GND	Ground
6	DI	Data Input

BINNING GROUPS:

Luminous Intensity Classifications (T_a=25°C, V_{DD}=5V, I_F=1.875mA (DIM 3)):

Code		Min.	Max.	Unit
Mix White	13	125	160	mcd
	14	160	200	
	15	200	250	

Chromaticity Coordinate Classifications (T_a=25°C, V_{DD}=5V, I_F=1.875mA (DIM 3)):

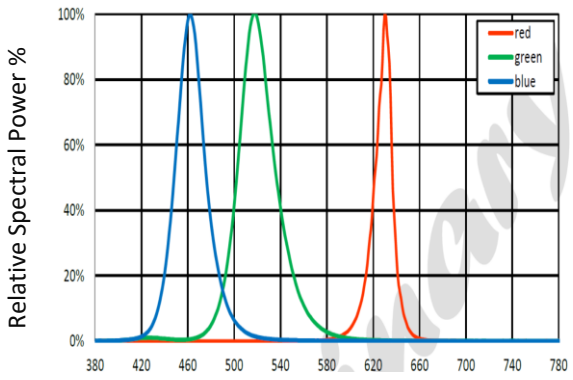


	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
G5-1	0.2114	0.2528	0.2114	0.2453	0.2264	0.2453	0.226	0.2528
G5-2	0.2114	0.2453	0.2114	0.2378	0.2264	0.2378	0.2264	0.2453
G5-3	0.2264	0.2528	0.2264	0.2453	0.2414	0.2453	0.2414	0.2528
G5-4	0.2264	0.2453	0.2264	0.2378	0.2414	0.2378	0.2414	0.2453
H5-1	0.2114	0.2378	0.2114	0.2303	0.2264	0.2303	0.2264	0.2378
H5-2	0.2114	0.2303	0.2114	0.2228	0.2264	0.2228	0.2264	0.2303
H5-3	0.2264	0.2378	0.2264	0.2303	0.2414	0.2303	0.2414	0.2378
H5-4	0.2264	0.2303	0.2264	0.2228	0.2414	0.2228	0.2414	0.2303

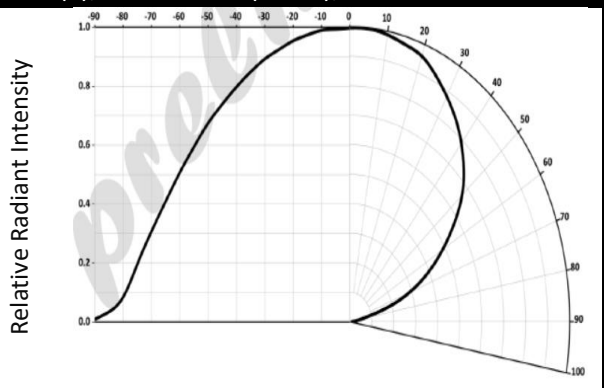
1. Tolerance of X/Y ±0.005.

ELECTRO-OPTICAL CHARACTERISTICS (Full PWM):

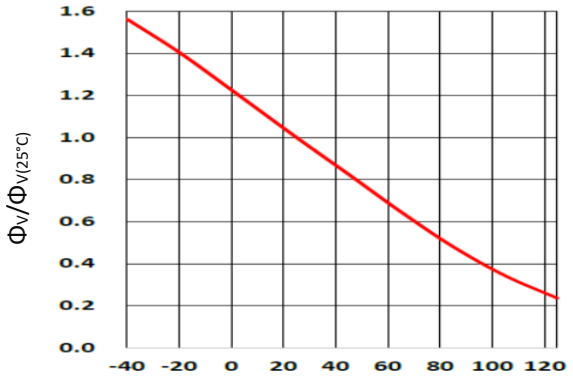
Relative Spectral Power v.s. Wavelength
$\Phi_{rel}=f(\lambda)$; I_F=1.875mA (DIM3); T_S=25°C



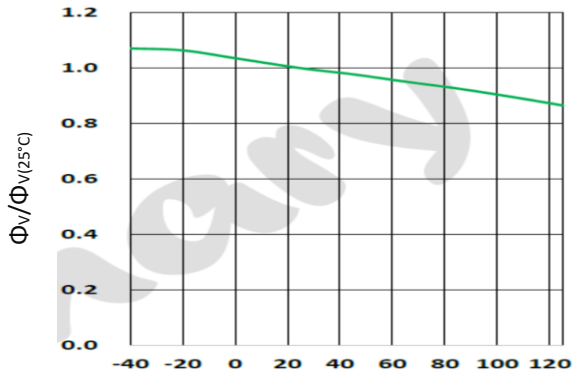
Directive Radiation
$\Phi_{rel}=f(\lambda)$; I_F=1.875mA (DIM3); T_S=25°C



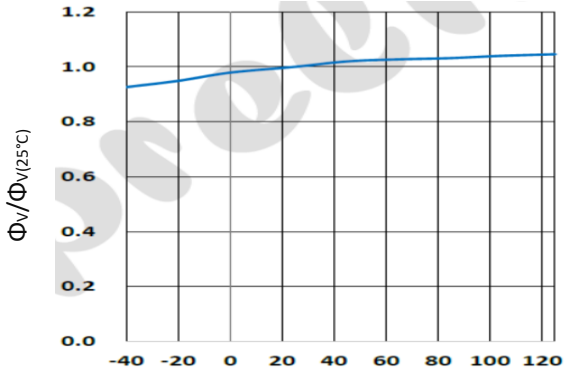
Relative Intensity v.s. Temperature (RED ●)
$\Phi_V/\Phi_{V(25°C)}=f(T_j)$; T_S=25°C



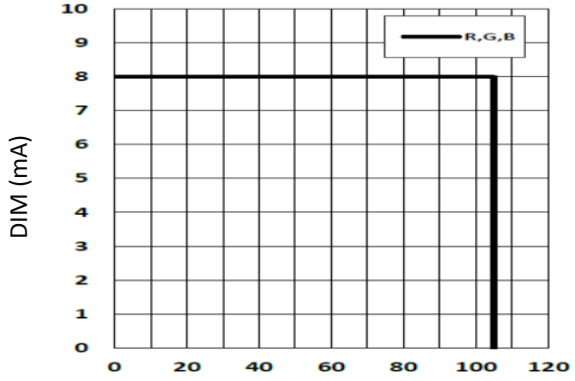
Relative Intensity v.s. Temperature (GREEN ●)
$\Phi_V/\Phi_{V(25°C)}=f(T_j)$; T_S=25°C



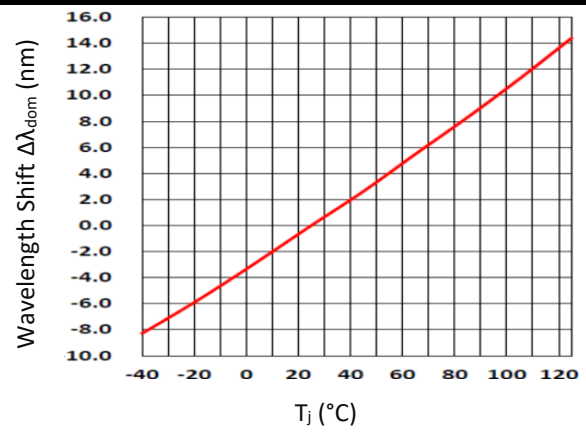
Relative Intensity v.s. Temperature (BLUE ●)
$\Phi_V/\Phi_{V(25°C)}=f(T_j)$; T_S=25°C



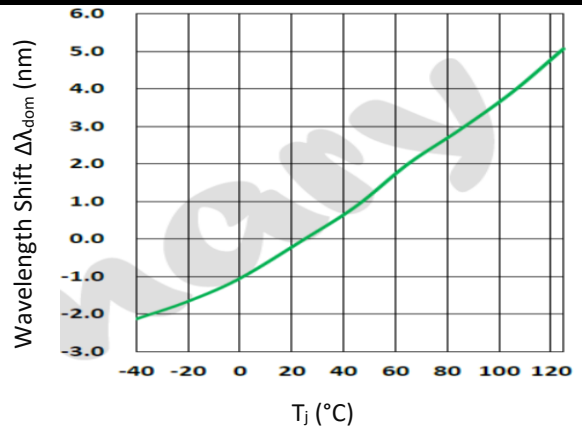
Max. Permissible Forward Current
$I_F=f(T_s)$



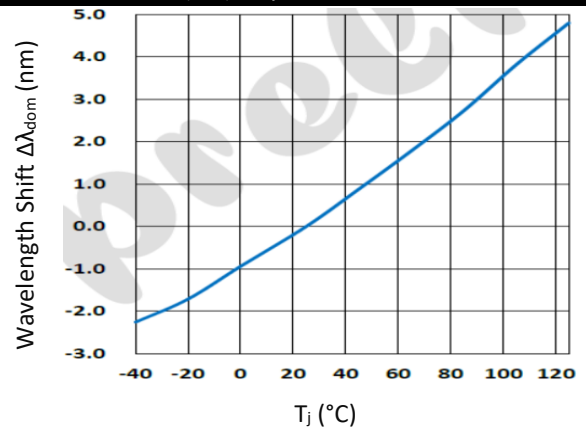
Dominant Wavelength Shift v.s. Temperature $\Delta\lambda_{dom}=\lambda_{dom}-\lambda_{dom(25°C)}=f(T_j)$ (RED ●)



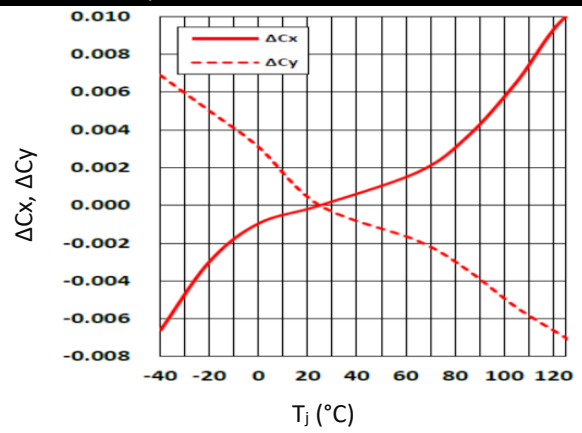
Dominant Wavelength Shift v.s. Temperature $\Delta\lambda_{dom}=\lambda_{dom}-\lambda_{dom(25°C)}=f(T_j)$ (GREEN ●)



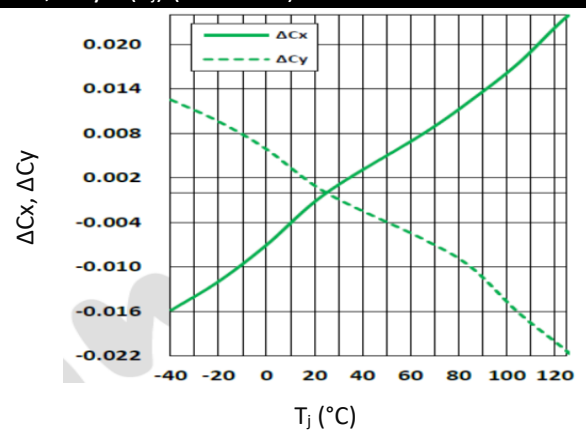
Dominant Wavelength Shift v.s. Temperature $\Delta\lambda_{dom}=\lambda_{dom}-\lambda_{dom(25°C)}=f(T_j)$ (BLUE ●)



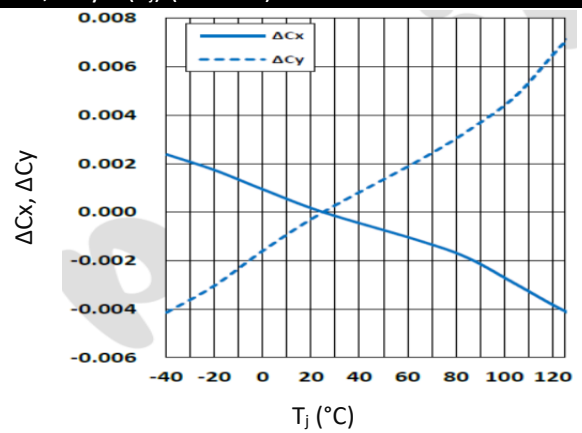
Chromaticity Coordinate Shift v.s. Temperature $\Delta Cx, \Delta Cy=f(T_j)$ (RED ●)



Chromaticity Coordinate Shift v.s. Temperature $\Delta Cx, \Delta Cy=f(T_j)$ (GREEN ●)

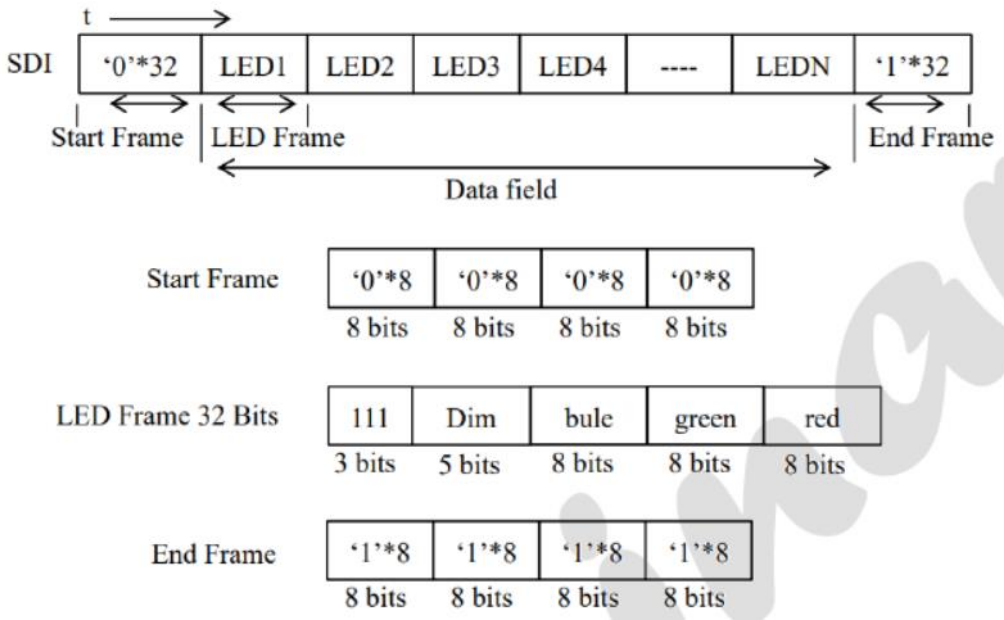


Chromaticity Coordinate Shift v.s. Temperature $\Delta Cx, \Delta Cy=f(T_j)$ (BLUE ●)



Function Description:

1. Series data structure – Tandem N-LED:

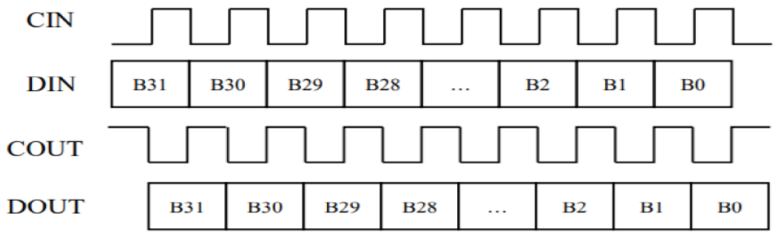


2. 5-Bit brightness adjustment and specification limits:

DIM 5-Bit (level 32) brightness adjustment involves simultaneous control of OUTR\OUTG\OUTB three port currents. DIM=8 serves as the recommended upper limit for this specification, while DIM=3 represents the testing condition for photoelectric parameters within this specification.

Data MSB←→LSB	Driving Current
00000	0/31
00001	1/31
00010	2/31
.....	
11110	30/31
11111	31/31(max)

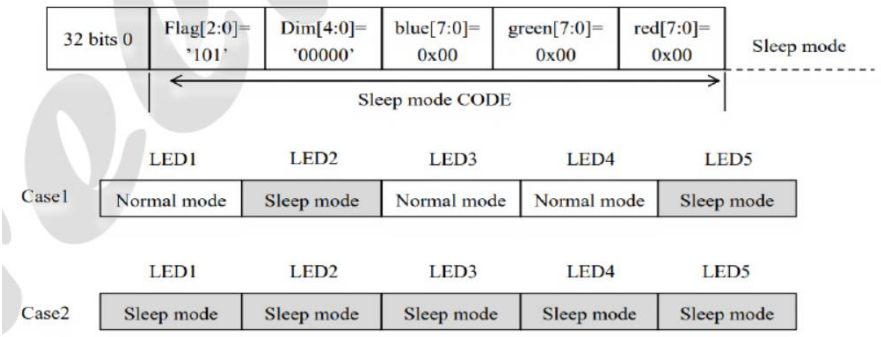
3. PWM input/output signals relations:



4. Sleep and power saving mode:

Data MSB--	Duty Cycle
00000000	0/255(min)
00000001	1/255
00000010	2/255
.....	
11111101	253/255
11111110	254/255
11111111	255/255(max)

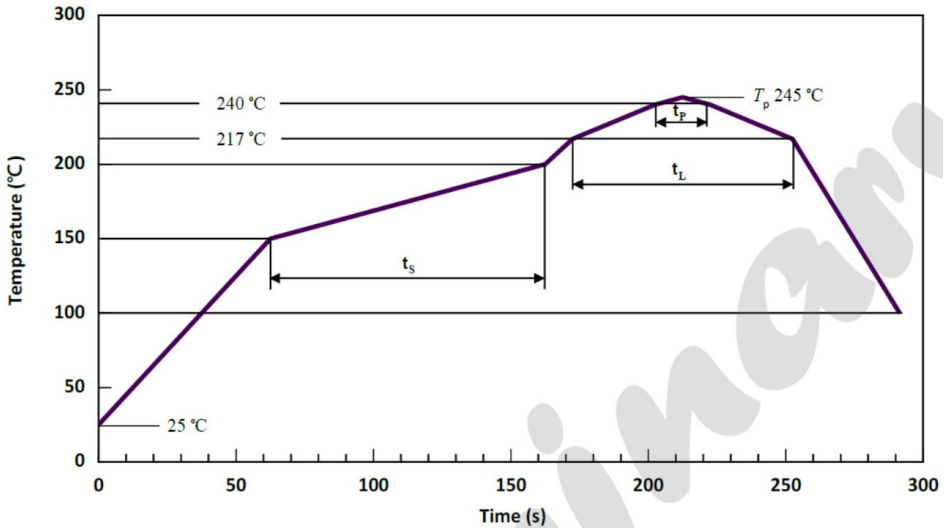
The LED supports sleep/wake-up modes for power-saving purposes. Upon receiving 24 bits of '0's in BGR data (where B[7:0]=8h00, G[7:0]=8h00, R[7:0]=8h00), concurrently, both the 3-bit FLAG and the 5-bit DIMMING are set to 8h"A0" (indicating FLAG[2:0]=3b101 and DIMMING[4:0]=5b00000), the IC will enter sleep mode with a current of approximately 1uA. The IC will awaken from sleep mode upon receiving new data where FLAG[2:0] and DIMMING[4:0] are not 8h"A0". Following the wake-up, all sleeping circuits within the IC return to normal operating mode within 1ms. Considering the 1ms required for the IC to transition from sleep to normal function, it is recommended for the host to wait 1ms after issuing a wake-up command before sending display data and commands.



In Case 1, if LED 2 is in sleep mode, during the subsequent data transfer process, the state of LED 2 will remain unchanged as long as 32 bits of data for LED 2 is received with FLAG[2:0], DIMMING[4:0] set as 8h"A0". This indicates that LED 2 will remain in sleep mode. In this scenario, LED 2 can relay the remaining 32 bits of data to LED 3 to modify the display data of LED 3. In essence, the inactive chip (LED 2 in sleep mode) has the capability to relay data to the subsequent chips.

ECOMMENDED 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		217		°C
Time Above Liquids Temperature	t_L		80	100	s
Peak Temperature	T_P		245	260	°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	4	K/s
Time 25 °C to T_P				480	s

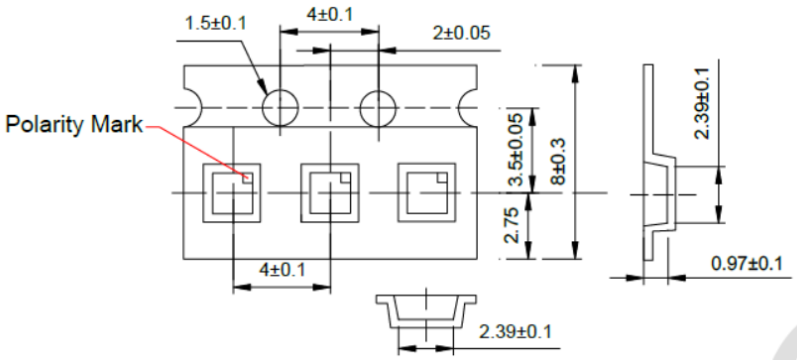
Note:

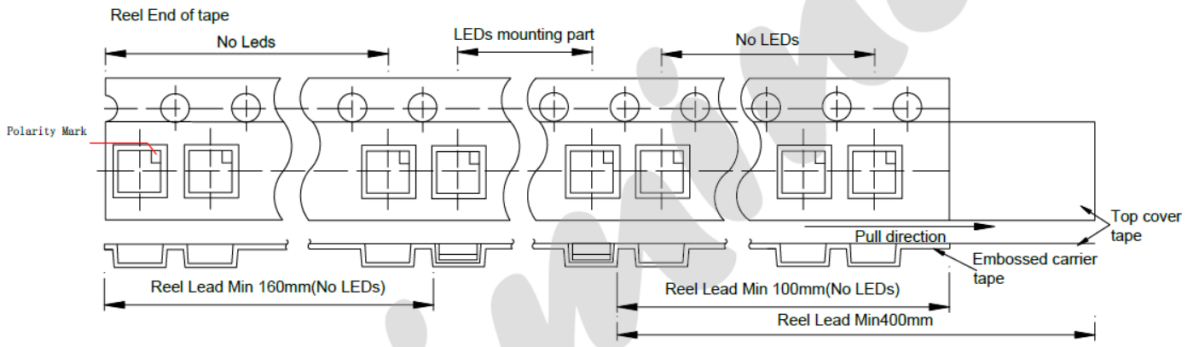
1. We recommend the reflow temperature 240°C (±5°C). The maximum soldering temperature should be limited to 245°C.
2. Maxima reflow soldering: 2 times.
3. Before, during, and after soldering, should not apply stress on the components and PCB board.

PACKING SPECIFICATION:

Reel Dimension:

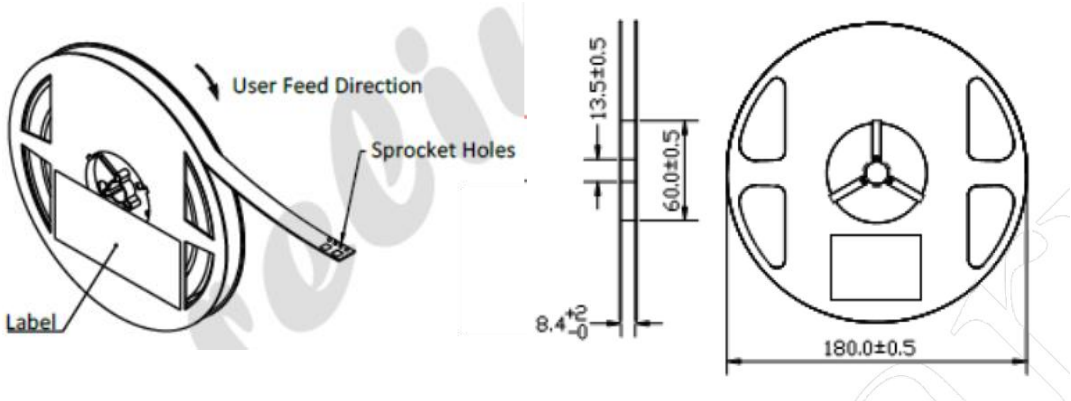
Max.4000pcs/reel





Notes:

1. Empty component pockets are sealed with top cover tape.
2. The max loss number of SMD is 2pcs.
3. The cathode is oriented towards the tape sprocket hole in accordance with ANSI/EIA RS-481 specifications.
4. The remainder packing in multiples of 500pcs.



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 1 week. Otherwise, they should be kept in a damp-proof box with descanting agent stored at R.H.<20% 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.

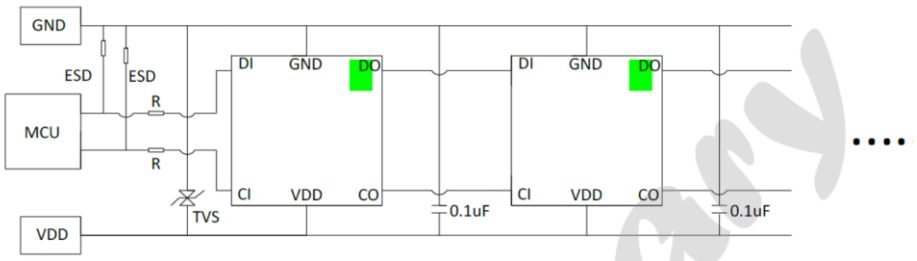
Baking:

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:



Circuit description:

1. A bypass capacitor should be connected in parallel between VDD and GND of each bead. It is recommended to use the 104 capacitor.
2. Connected between the first LED bead and the MCU signal line is a 100Ω to 300Ω resistor, reducing surge voltage impact from the MCU output signal. Alternatively, it can be replaced with a magnetic bead to improve interference resistance.
3. Add a TVS diode at the power input position of the LED module. Its breakdown voltage should be between 5.5-7.0V, with a clamping voltage below 6.5V, to avoid damage from high voltage surges to the LEDs.
4. Each iCLed's DIN and CIN connect to an ESD diode, grounding it to reduce EMC interference. The clamping voltage of the ESD diode is controlled to about 5.5V.

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	24/11/2023	Datasheet set-up.
A1.1	11/08/2024	Update automotive qualification.