



BRIGHTTEK
BRIGHTTEK (EUROPE) LIMITED

Brighten up The World With LED!



ISO/TS 16949:2009



BS EN ISO 14001:2004



QC 080000 IECQ HSPM

PRODUCT DATASHEET



- ▶ PLCC6 SMD with IC
- ▶ 3535IC 1.47t Series
- ▶ Red/Green/Blue

NOM67S13IC



Sleep Mode



Release Date: 11 August 2024 | Version: A1.1



3535 IC-Integrated



FEATURES:

- **Package:** PLCC6 STD Package with Integrated IC
- **Forward Current:** 20mA
- **Forward Voltage (typ.):** +4.5~+5.5V
- **Luminous Intensity (typ.):** 460/1900/330mcd*
- **Colour:** Red/Green/Blue
- **Dominant Wavelength (typ.):** 633/527/457nm
- **Viewing Angle:** 120°
- **Materials:**
 - Resin: Silicone (White Diffused)
- **Operating Temperature:** -40~+105°C
- **Storage Temperature:** -40~+105°C
- **IC Feature:** Serial data transmission signal by dual-wire DATA & CLK lines. One pixel contains R, G, and B colour that each can achieve 256 level brightness grayscales, which forms 16,777,216 combination colours. Support sleep/wake-up mode. In sleep mode, the LED current is lower than 5µA.
- **Soldering methods:** IR reflow soldering
- **MSL Level:** acc. to JEDEC J-STD-020E Level 3
- **Packing:** 12mm tape with max.1300pcs/reel, ø180mm (7")

* in order of Red/Green/Blue

APPLICATIONS:

- Automotive Interior Light
- Telecommunication
- Home Appliance
- Decoration Lighting
- Full Colour LED Strip
- Gaming Device



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

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	I _{OMAX}	20/channel	mA
Power Dissipation	P _D	Max. 400	mW
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
Thermal Resistance Junction/Solder Point	R _{THJ-S}	65/110/100*	°C/W
Junction Temperature	T _j	125	°C
Soldering Temperature (10s)	T _{SD}	245	°C

* in order of Red/Green/Blue

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

Parameter		Symbol	Values			Unit	Test Condition
			Min.	Typ.	Max.		
Forward Voltage		V _F	4.5	---	5.5	V	---
Luminous Intensity	R	I _v	450	1800	3200	mcd	V _{DD} =5V
	G		1000	290	500		
	B		160	2800	4000		
Mix White	W		2000	2800	4000		
Dominant Wavelength	R	λ _d	615	---	630	nm	V _{DD} =5V
	G		520	---	535		
	B		450	---	460		
Colour Coordinate	X	---	---	0.2355	---	---	V _{DD} =5V
	Y		---	0.1850	---		
Viewing Angle		2θ _{1/2}	---	120	---	deg	V _{DD} =5V

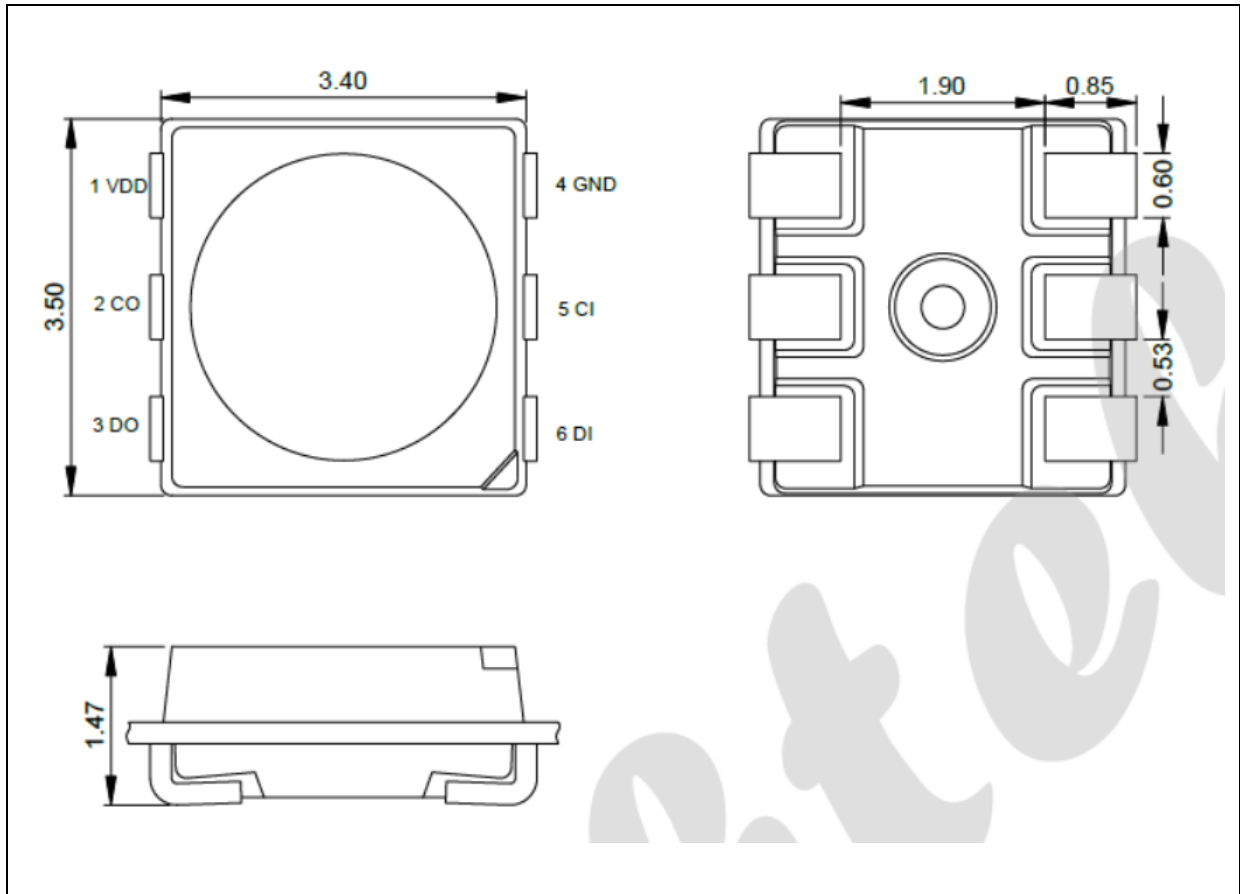
1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.
2. 2θ_{1/2} is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
3. The dominant wavelength, λ_d is derived from CIE chromaticity diagram and represents the single wavelength which defines the colour of the device. Peak Emission Wavelength Tolerance is ±1nm.

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

Parameter	Symbol	Values			Unit	Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V _{DD}	4.5	5.0	5.5	V	---
Input Voltage Level	V _{IH}	2.7	---	V _{DD} +0.4	V	---
	V _{IL}	-0.4	---	1.0	V	
Clock High Level Width	T _{CLKH}	30	---	---	ns	---
Clock Low Level Width	T _{CLKL}	30	---	---	ns	---
Data Set-Up Time	T _{SETUP}	10	---	---	ns	---
Data Hold Time	T _{HOLD}	5	---	---	ns	---
Working Current (IC)	I _{DD}	---	---	2	mA	I _{out} =OFF
Static Current	I _{sleep}	---	---	5	μA	Sleep Mode

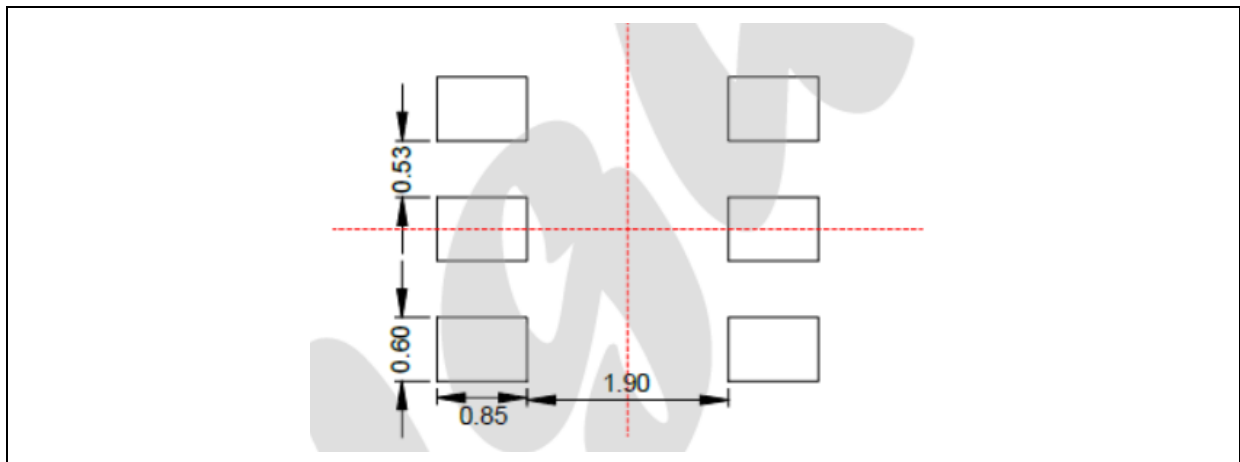
OUTLINE DIMENSION:

Package Dimension:



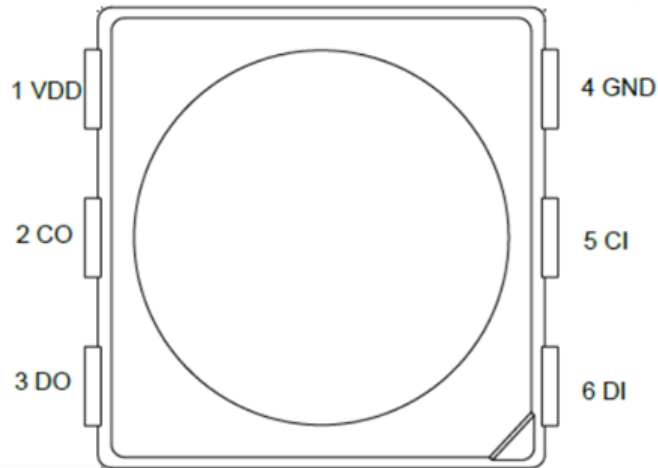
1. All dimensions are in millimetre (mm).
2. Tolerance $\pm 0.2\text{mm}$, unless otherwise noted.

Recommended Soldering Pad Dimension:



1. Dimensions are in millimetre (mm).
2. Tolerance $\pm 0.1\text{mm}$ with angle tolerance $\pm 0.5^\circ$.

PIN CONFIGURATION:



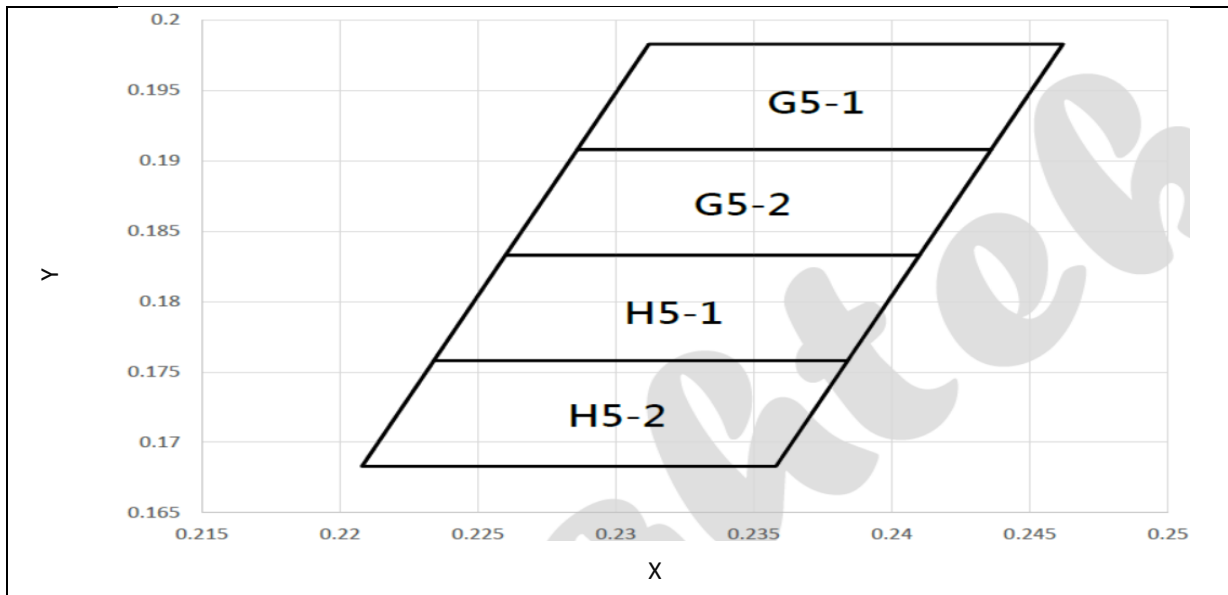
No.	Symbol	Function Description
1	VDD	Supply Voltage
2	CO	Clock Output
3	DO	Data Output
4	GND	Ground
5	CI	Clock Input
6	DI	Data Input

BINNING GROUPS:

Luminous Intensity Classifications ($V_{DD}=5V$; $I_F=20mA*3$):

Code		Min.	Max.	Unit
Mix White	25	2000	2500	mcd
	26	2500	3200	
	27	3200	4000	

Chromaticity Coordinate Classifications ($V_{DD}=5V$; $I_F=20mA$):

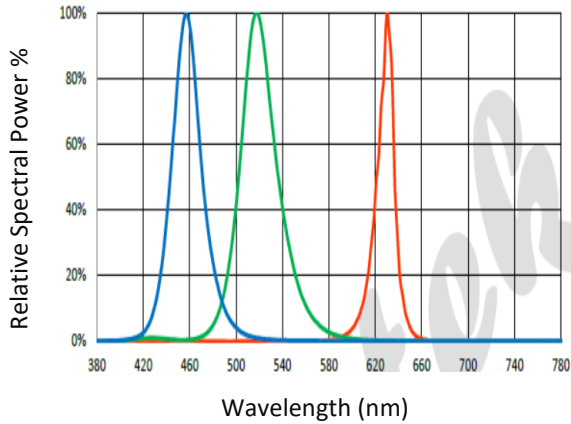


	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
G5-1	0.2312	0.1983	0.2286	0.1908	0.2436	0.1908	0.2462	0.1983
G5-2	0.2286	0.1908	0.2260	0.1833	0.2410	0.1833	0.2436	0.1908
H5-1	0.2260	0.1833	0.2234	0.1758	0.2384	0.1758	0.2410	0.1833
H5-2	0.2234	0.1758	0.2208	0.1683	0.2358	0.1683	0.2384	0.1758

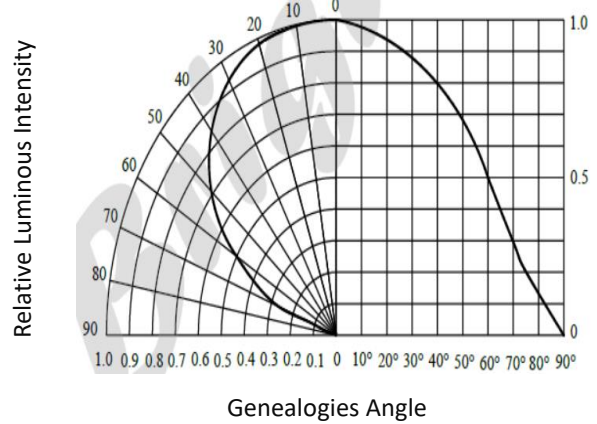
1. Tolerance of X/Y ± 0.005 .

ELECTRO-OPTICAL CHARACTERISTICS (Full PWM):

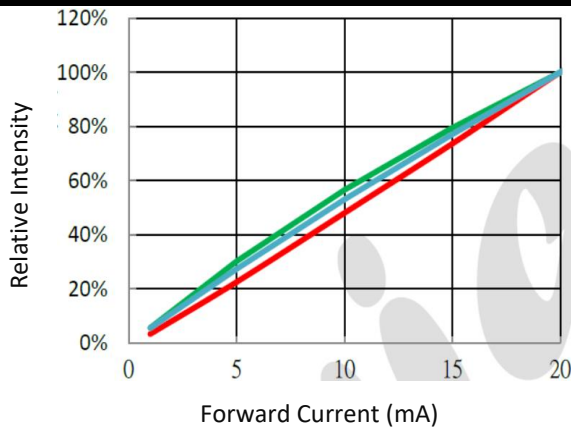
Relative Spectral Power v.s. Wavelength



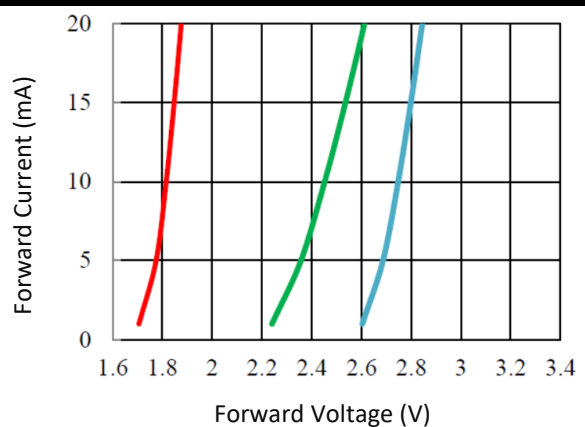
Directive Radiation



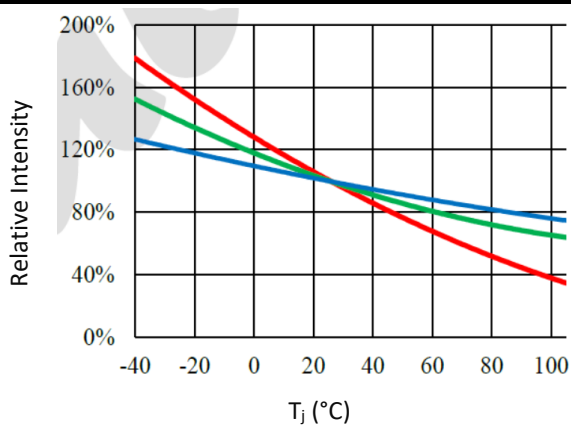
Relative Intensity v.s. Forward Current



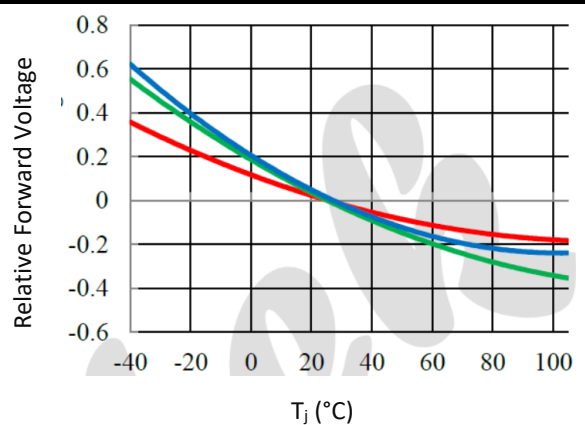
Forward Current v.s. Forward Voltage



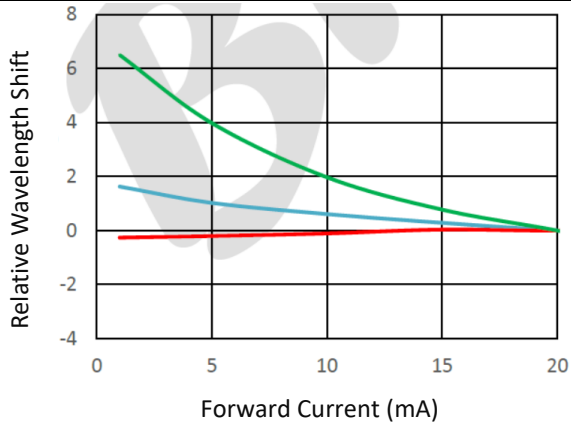
Relative Intensity v.s. Temperature



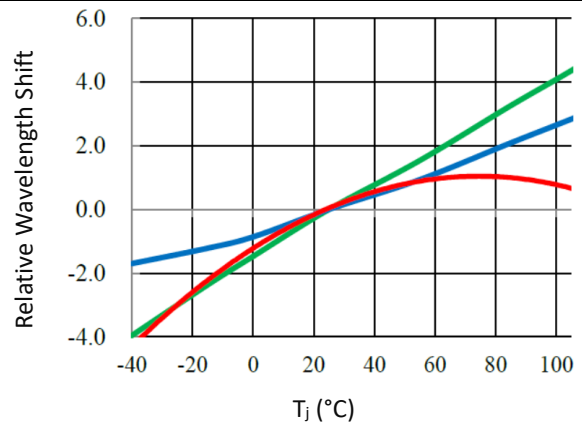
Relative Forward Voltage v.s. Temperature



Wavelength Shift v.s. Forward Current

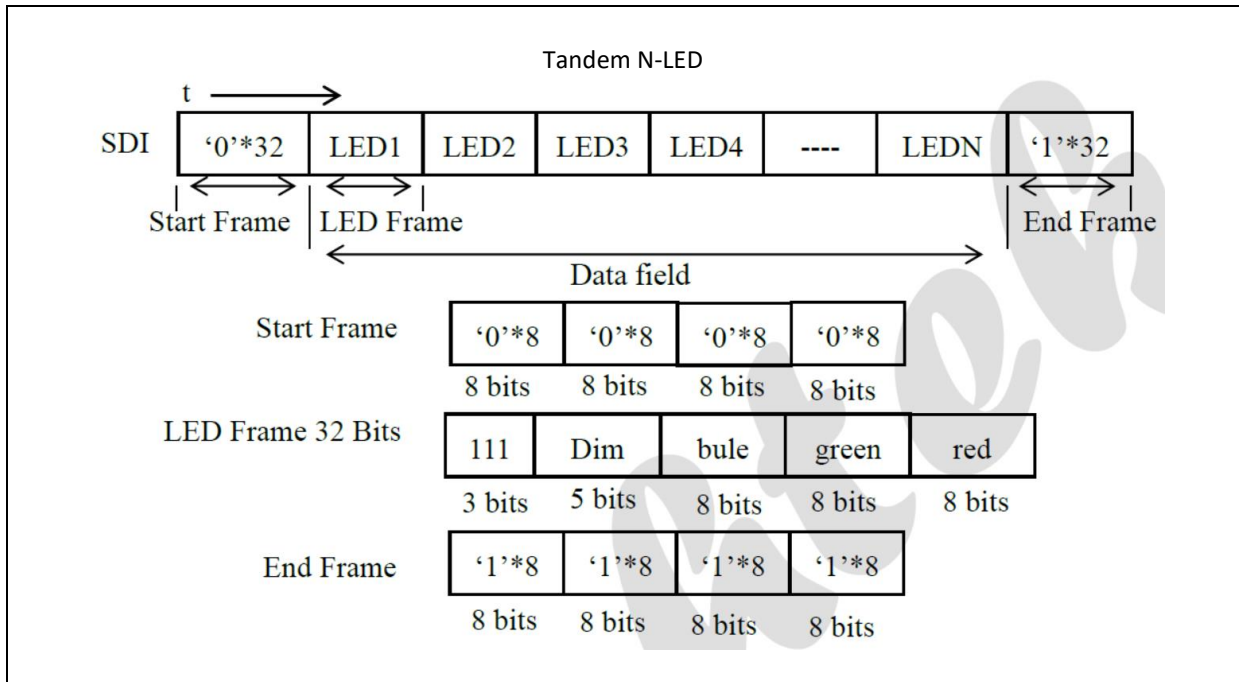


Wavelength Shift v.s. Temperature



Function Description:

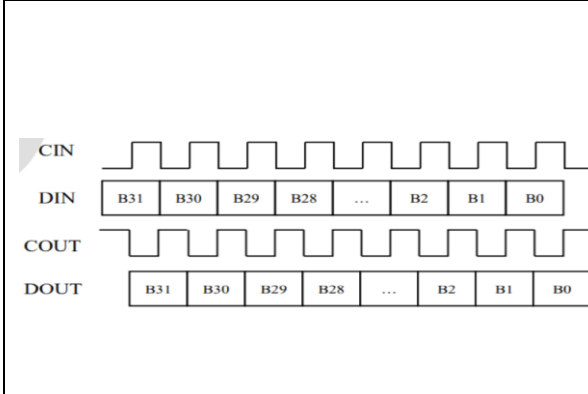
1. Series data structure:



2. Dim 5-Bit (level 32) brightness adjustment (simultaneous control of OUTR/OUTG/OUTB three port current):

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 signal relations:

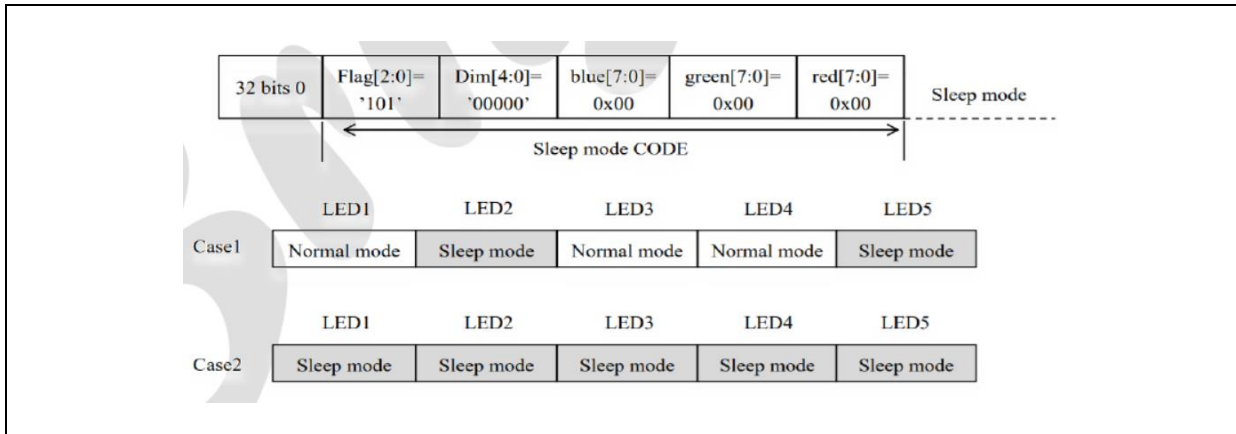


Data MSB--	Duty Cycle
00000000	0/255(min)
00000001	1/255
00000010	2/255
.....	
11111101	253/255
11111110	254/255
11111111	255/255(max)

4. Sleep and power saving mode:

LED supports sleep/wake-up modes for power saving purposes. After the IC receives 24-bits 0's BGR data (that is B[7:0]=8h00, G[7:0]=8h00, R[7:0]=8h00), in the meantime, both of the data in 3-bits FLAG and 5-bits DIMMING is 8h'A0' (that is FLAG[2:0]=3b101 and DIMMING[4:0]=5b00000), the IC will enter sleep mode, its current is about 1μA.

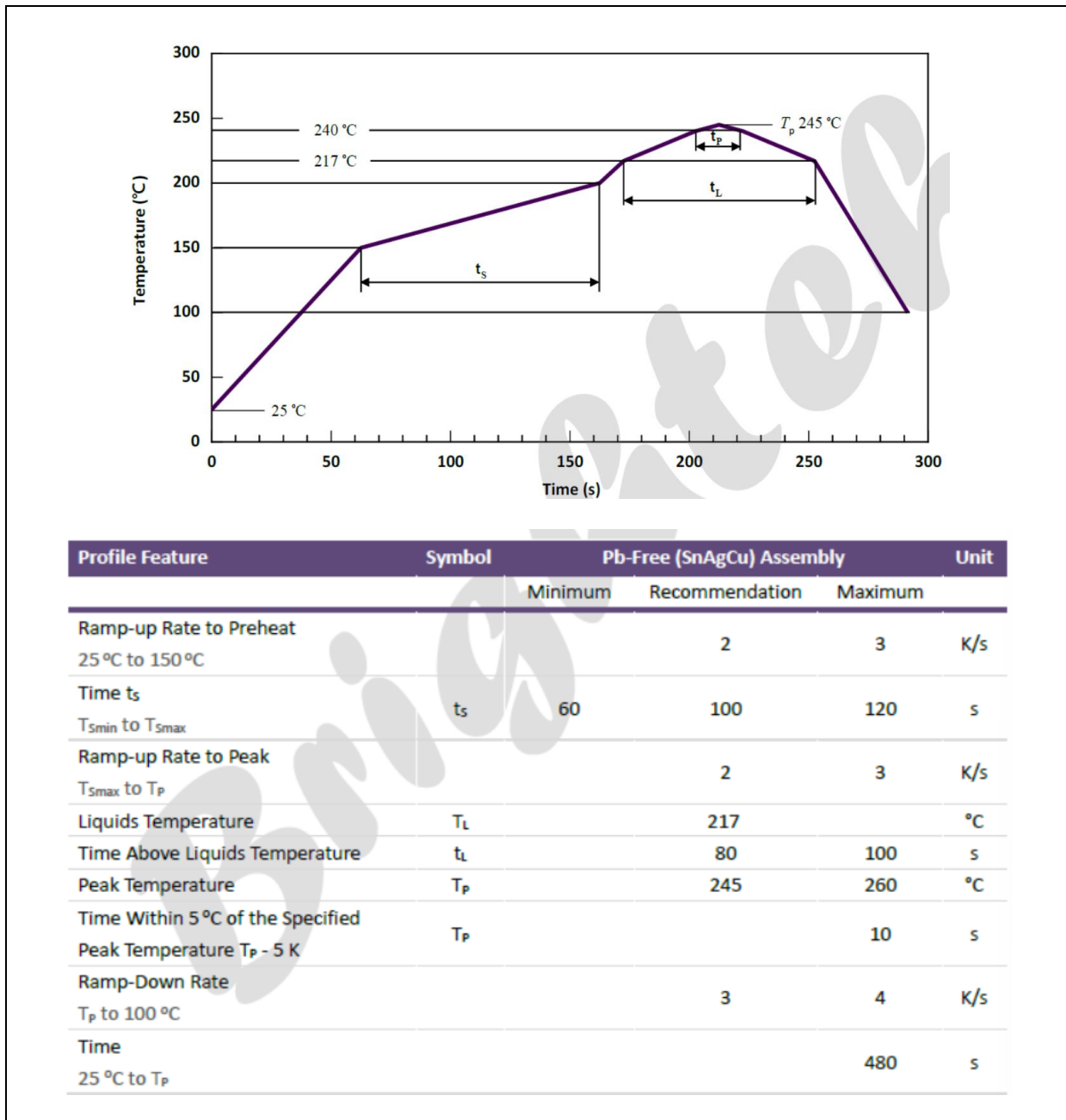
The IC will wake-up from sleep mode once receiving the new data with the data of FLAG[2:0], DIMMING[4:0] is not 8h'A0'; after wake-up, all sleeping circuits in IC return to normal working mode within 1ms. Since it takes 1ms for a sleeping IC to return to normal function mode, it is recommended for a host to wait for 1ms to send display data and command after issuing a wake-up command.



In case 1, while lamp 2 is under sleep mode, in the following data transfer process, the state of lamp 2 will be not changed as long as the 32-bits data for lamp 2 is received with data of FLAG[2:0] and DIMMING[4:0] being 8h'A0'. It means lamp 2 will keep in sleep mode as well. In this situation, lamp 2 can pass through the remaining data to lamp 3 (32-bits) to change the display data of lamp 3. In other words, the sleeping chip is able to pass the data to the next chips.

RECOMMENDED SOLDERING PROFILE:

Lead-free Solder IR Reflow:

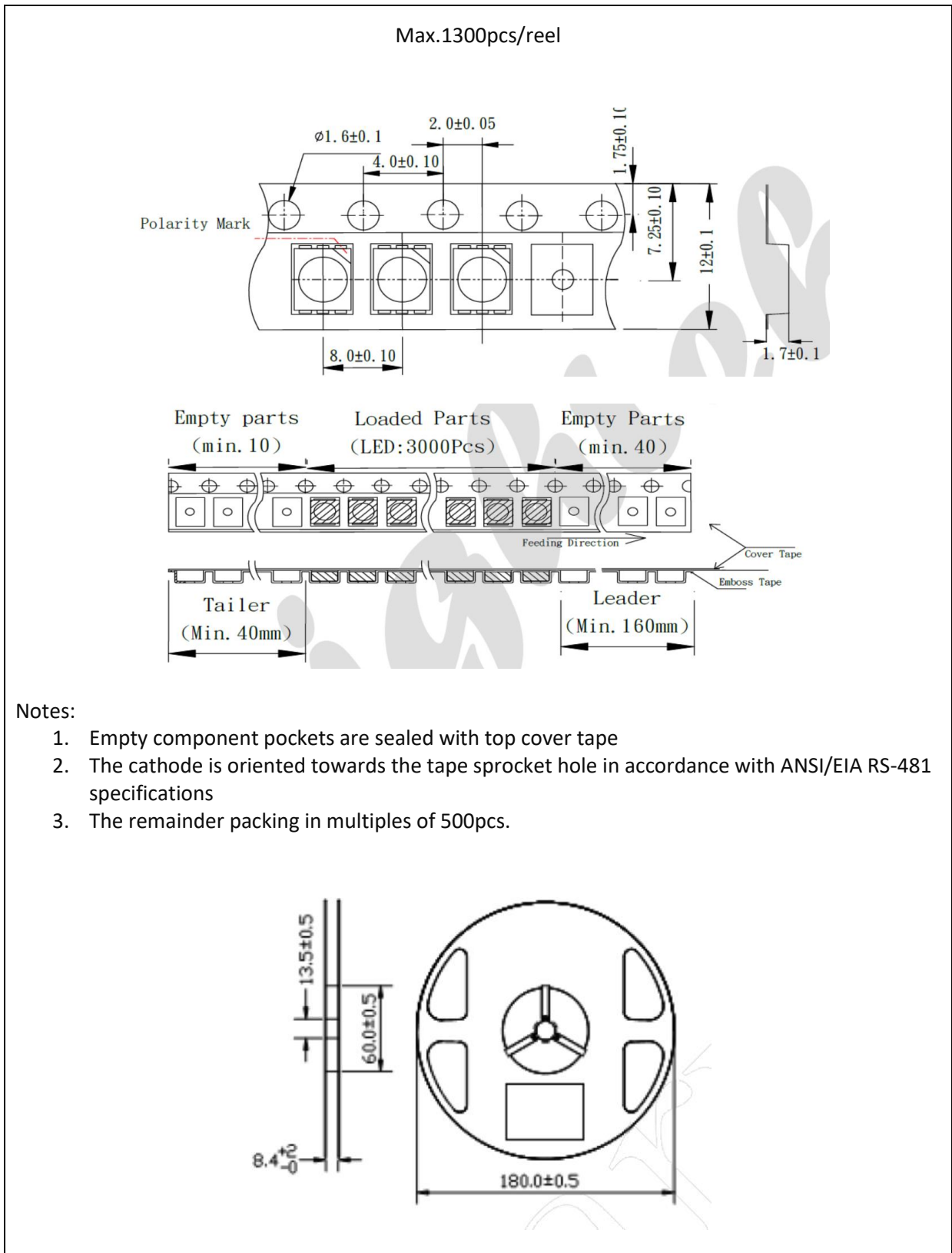


Note:

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

PACKING SPECIFICATION:

Reel Dimension:



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 desiccating 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.

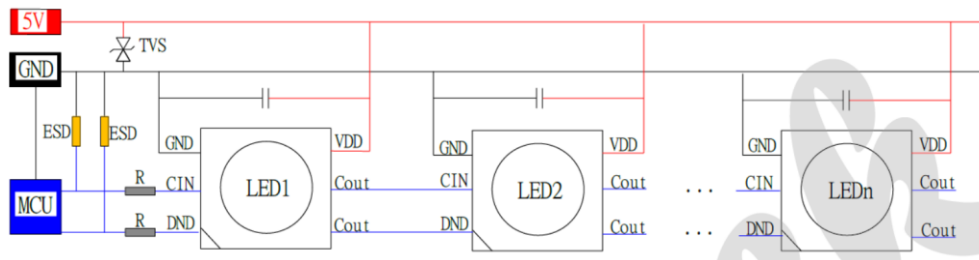
Baking:

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:



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. A 100Ω~300Ω resistance is connected between the first lamp bead and MCU signal line to reduce the impact of MCU output signal surge voltage. It can also be replaced with a magnetic bead to enhance the interference ability.
3. TVS tube shall be added at the power inlet position of the LED module, and the TVS protection voltage shall be within the normal working voltage range of the LED as far as possible, so as to reduce the damage of the high voltage surge at the power end to the lamp bead.
4. DIN and CIN of each ICLED connect an ESD tube to GND to reduce EMC interference, and the clamping voltage of ESD tube is controlled at about 5.5V.

ESD (Electrostatic Discharge):

Static Electricity or power surge will damage the LED. Use of a conductive wrist band or anti-electrostatic glove is recommended when handling 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	14/03/2024	Datasheet set-up.
A1.1	11/08/2024	Update automotive certificate.