



**Worldsemi**

**WORLDSEMI CO., LIMITED**

## **WS2812B Specifications**

**Intelligent control LED integrated light source**

**Mar-2017**

## Features and Benefits

- The control circuit and the LED share the only power source.
- Control circuit and RGB chip are integrated in a package of 5050 components, form a complete control of pixel point.
- Built-in signal reshaping circuit, after wave reshaping to the next driver, ensure wave-form distortion not accumulate.
- Built-in electric reset circuit and power lost reset circuit.
- Each pixel of the three primary color can achieve 256 brightness display, completed 16777216 color full color display, and scan frequency not less than 2KHz.
- Cascading port transmission signal by single line.
- Any two point the distance not more than 3m transmission signal without any increase circuit.
- When the refresh rate is 30fps, cascade number are not less than 1024 points.
- Send data at speeds of 800Kbps.
- The color of the light were highly consistent, cost-effective..

## Applications

- Full-color module, Full color soft lights a lamp strip.
- LED decorative lighting, Indoor/outdoor LED video irregular screen.

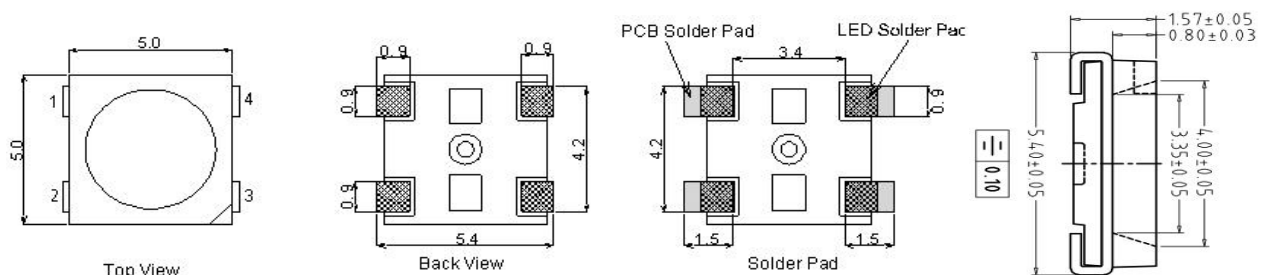
## General description

WS2812B is a intelligent control LED light source that the control circuit and RGB chip are integrated in a package of 5050 components. It internal include intelligent digital port data latch and signal reshaping amplification drive circuit. Also include a precision internal oscillator and a 12V voltage programmable constant current control part, effectively ensuring the pixel point light color height consistent.

The data transfer protocol use single NZR communication mode. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit sent to the next cascade pixel through the DO port. After transmission for each pixel, the signal to reduce 24bit. pixel adopt auto reshaping transmit technology, making the pixel cascade number is not limited the signal transmission, only depend on the speed of signal transmission.

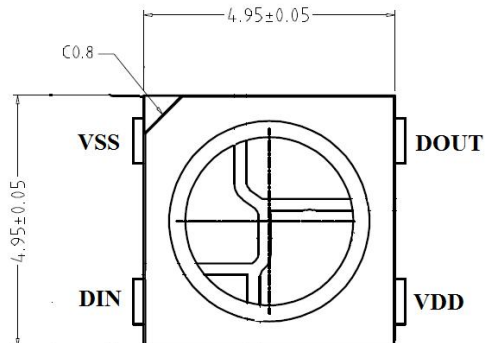
LED with low driving voltage, environmental protection and energy saving, high brightness, scattering angle is large, good consistency, low power, long life and other advantages. The control chip integrated in LED above becoming more simple circuit, small volume, convenient installation.

## Mechanical Dimensions



**Remarks:** Dimension of 5.0\*5.4\*1.57mm, default Tolerance of 0.05mm.

## PIN Configuration



## PIN Function

NO.	Symbol	Function description
1	VDD	Power supply LED
2	DOUT	Control data signal output
3	VSS	Ground
4	DIN	Control data signal input

## Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Power supply voltage	$V_{DD}$	+3.5~+5.3	V
Input voltage	$V_I$	-0.5~ $V_{DD}+0.5$	V
Operation junction temperature	$T_{opt}$	-25~+80	°C
Storage temperature range	$T_{stg}$	-40~+105	°C

## Electrical Characteristics ( $T_A=-20\sim+70^\circ\text{C}$ , $V_{DD}=4.5\sim 5.5\text{V}$ , $V_{SS}=0\text{V}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min	Tpy	Max	Unit
Input current	$I_I$	$V_I=V_{DD}/V_{SS}$	—	—	±1	μA
Input voltage level	$V_{IH}$	$D_{IN}, SET$	$0.7V_{DD}$	—	—	V
	$V_{IL}$	$D_{IN}, SET$	—	—	$0.3 V_{DD}$	V
Hysteresis voltage	$V_H$	$D_{IN}, SET$	—	0.35	—	V

**Switching Characteristics** ( $T_A=-20\sim+70^{\circ}\text{C}$ ,  $V_{DD}=4.5\sim5.5\text{V}$ ,  $V_{SS}=0\text{V}$ , unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Transmission delay time	$t_{PLZ}$	$CL=15\text{pF}$ , $DIN\rightarrow DO$ , $RL=10\text{K}\Omega$	—	—	300	ns
Fall time	$t_{THZ}$	$CL=300\text{pF}$ , $OUTR/OUTG/OUTB$	—	—	120	$\mu\text{s}$
Input capacity	$C_I$	—	—	—	15	pF

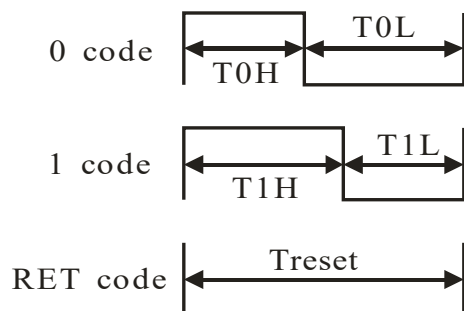
**LED Characteristics**

Color	Wavelength(nm)	Intensity(mcd)	Operating Current(mA)	Operating Voltage(V)
<b>RED</b>	620-630	550-700	16	1.8-2.2
<b>GREEN</b>	515-530	1100-1400	16	2.8-3.1
<b>BLUE</b>	465-475	200-400	16	2.9-3.2

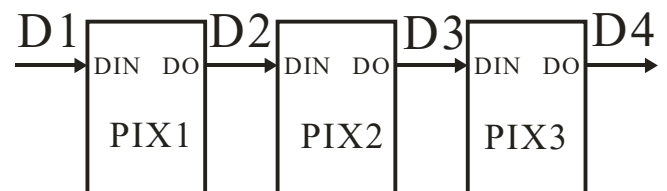
**Data Transfer Time** ( $T_H+T_L=1.25\mu\text{s}\pm 600\text{ns}$ )

T0H	0 code, high voltage time	220ns~380ns
T1H	1 code, high voltage time	750ns~1.6 $\mu\text{s}$
T0L	0 code, low voltage time	750ns~1.6 $\mu\text{s}$
T1L	1 code, low voltage time	220ns~420ns
RES	low voltage time	>300 $\mu\text{s}$

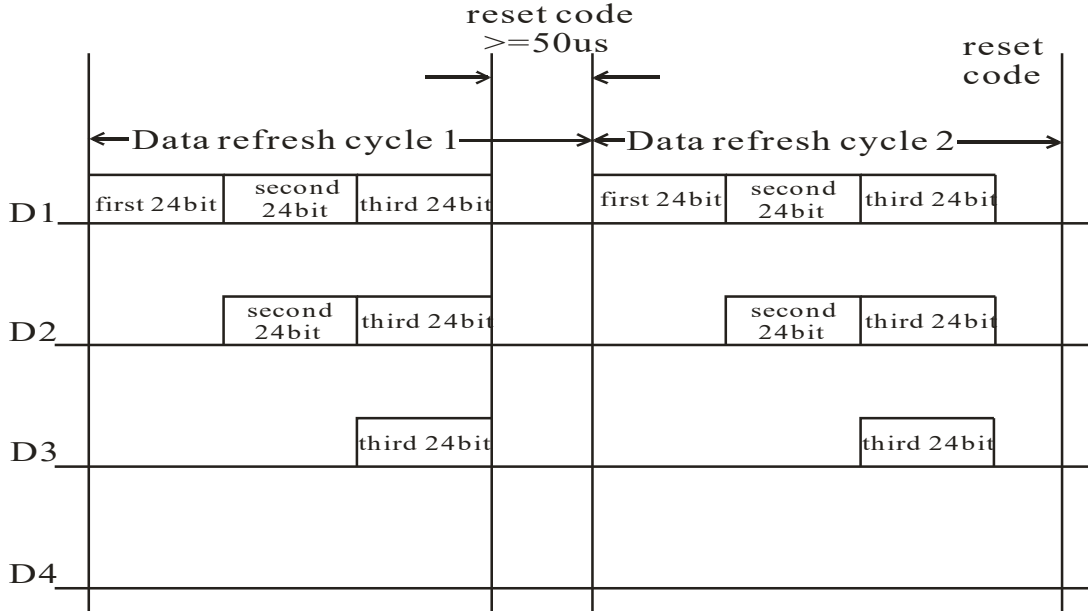
**Sequence chart:**



**Cascade method:**



**Data transmission method:**



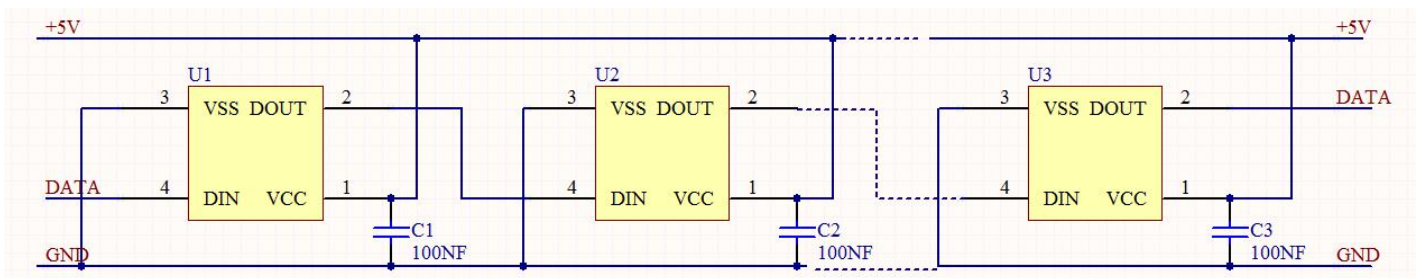
Note: The data of D1 is send by MCU, and D2, D3, D4 through pixel internal reshaping amplification to transmit.

**Composition of 24bit data:**

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0
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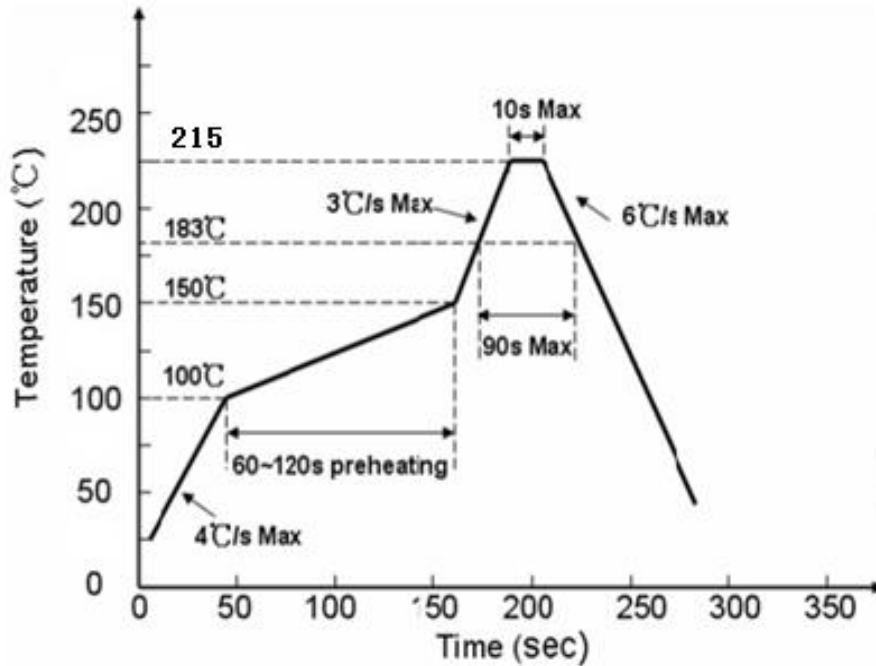
Note: Data transmit in order of GRB, high bit data at first.

**Typical application circuit:**

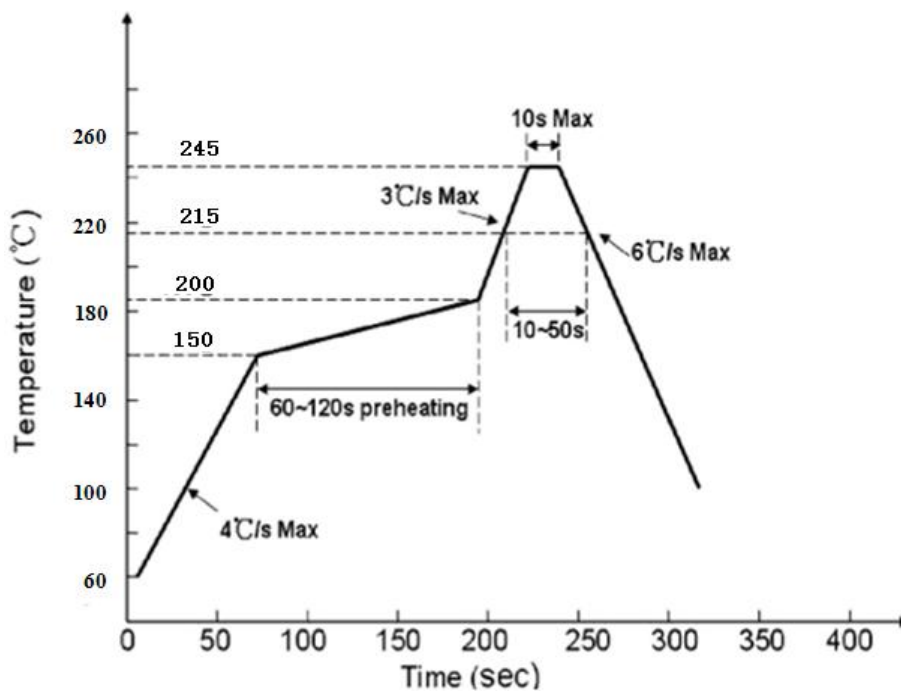


## Reflow Instructions

### 1) Leaded Reflow:



### 2) Leade-free Reflow:



Curve Description	Lead Reflow Solder	Lead-free Reflow Solder/SMT
The lowest preheat temperature (T <sub>min</sub> )	100°C	150°C
The highest preheat temperature (T <sub>max</sub> )	150°C	200°C
Preheating time (T <sub>min</sub> to T <sub>max</sub> ) (ts)	60-120 S	60-180 S
Average rate of temperature rise (T <sub>max</sub> to T <sub>p</sub> )	<3°C/S	<3°C/S
LIQUID REGION temperature (TL)	183°C	217°C
LIQUID REGION Holding Time (tL)	60-150 S	60-150 S
Peak Temperature (T <sub>p</sub> )	215 °C	245 °C
High Temperature Region(T <sub>p</sub> =-5°C) Holding Time (tp)	<10 S	<10 S
Cooling Rate	<6°C/S	<6°C/S
Room Temperature to Peak Holding Time	<6 min	<6 min

### ◆ Remarks

1. This has to be baked for 48 hours at the baking temperature of 70-75°C before being used.
2. Use up with 2 hours after taking out from oven.
3. Please replace the unused LEDs into oven.

### ◆ Reflow instruction

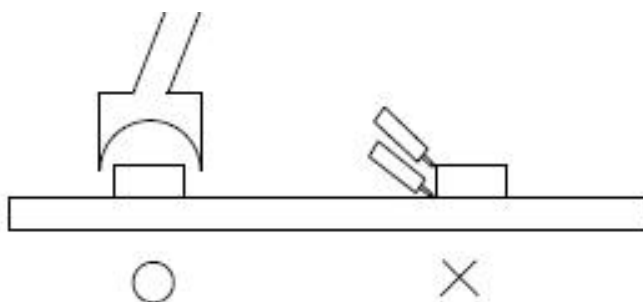
1. No more than two times of reflow.
2. Do not beat the colloid surface when the material is heated.

### ◆ Manual Soldering instruction

1. Soldering iron's temperature must be under 300°C, and operating time must be less than 3 seconds.
2. It should be done only once for the manual soldering.

### ◆ Repairing instruction

Normally, it can't be repaired after reflow. You need to use double-ended solder iron and make sure that whether it will do damage to the LEDs' characteristics when repairing is inevitable.



◆ **Storing and Transporting**

1. Scope of application

Front side up, moisture-proof and waterproof, no extrusion, no collision and no vibration.

2. Storage and its period

- ① Room temperature sealed storage: 20°C ~ 30°C, 40% ~ 60%RH, product is valid for ONE month.
- ② Moisture-proof sealed storage: 20°C ~ 30°C, 25% ~ 60%RH, product is valid for THREE month.
- ③ Use up with 2 hours after removing from packages. (Environmental conditions for temperature < 30°C, relative humidity < 60%)

◆ **Dehumidification**

We would recommend to do dehumidification if they exceed the valid storage period of products or dampened due to other reasons.

Dehumidification Method: 70°C - 75°C / 22 ± 2 Hours

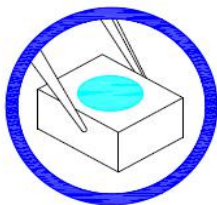
◆ **Electrostatic Protection**

LED is an electrostatic sensitive component, although the LED products are with excellent anti-static ability, they will cause a certain damage by any electrostatic discharge. By taking some electrostatic measures to avoid the damages when using the LEDs, such as wearing anti-static gloves and anti-static bracelet, etc..

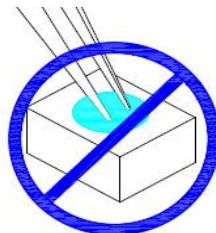
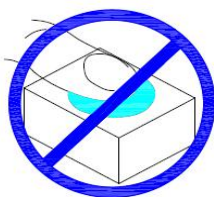
◆ **Precautions**

Pressing the colloid surface will affect the reliability of LED because the LED is advanced silicone-gel. And therefore precautions should be taken to avoid the strong pressure on the component. It's proper to make the LED be used in safe condition when using a suction nozzle. Silicon packing with soft and elastic, it greatly reduces thermal stresses and unable to bear external mechanical forces. Therefore, preventive measures should be taken in process of manually handling.

- ① Clip the LED from its side.

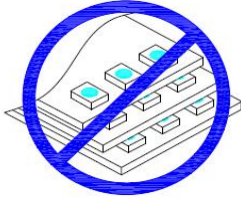


- ② Neither directly touch the gel surface with the hand or sharp instrument, it may damage its internal circuit.





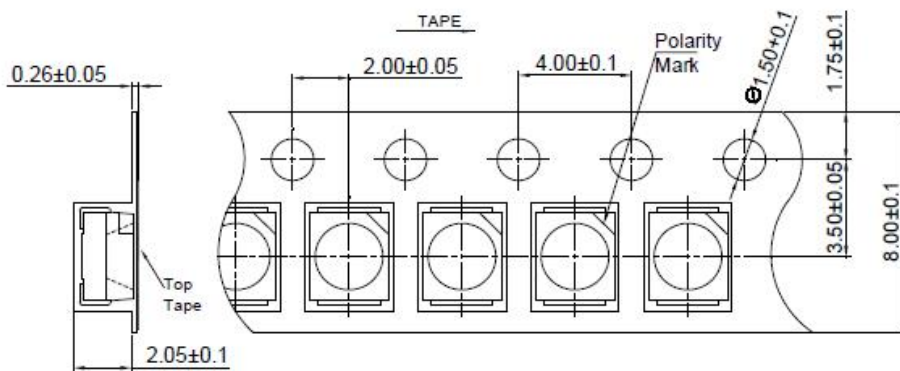
- ③ Not to be double stacked. it may damage its internal circuit.



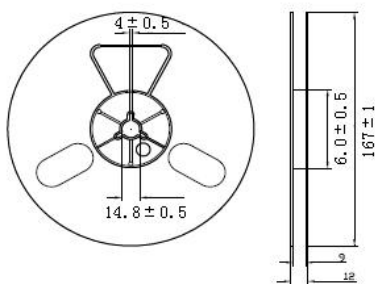
- ④ Can not be stored in or applied in the acidic sites of PH<7.



### Carrier tape (Unit: mm)



### Reel size (Unit: mm)



### Moisture-proof bag

