



# WS2812B-MINI-V6

Intelligent external control LED  
Integrated light source

## Features and Benefits

- The IC's control circuit and the LED share the same power supply.
- Control circuit and RGB chip are integrated in a package of 3535 component, to form a complete external control pixel.
- Built-in signal reshaping circuit, any pixel receives the signal, and then re-export after waveform reshaping to ensure that the waveform distortion of the circuit will not accumulate.
- Built-in Power-on reset and Power-off reset circuits.
- The three primary color of each pixel can achieve 256 level Gray scale, and to fulfill 16777216 colors full-color display, its scan frequency is higher than 2KHz.
- The reception and decoding of cascading data can be completed by a Serial Interface.
- Any two transmission distance not more than 3 Meters, without adding any circuit.
- When the refresh rate is of 30fps, the cascade numbers are not less than 1024 pixels.
- Data transfer speeds up to 800Kbps.
- Highly brightness consistency, and cost-effective.
- **Reverse power connection will not cause damage.**
- **No external electronic components (including capacitors) are required.**
- **Supports bidirectional signal input; DI and DO can be interchanged at will.**
- **Static power consumption is below 1  $\mu$  A; 3.3 V power supply is supported.**

## Applications

- Full-color module, Full-color flexible strip.
- LED decorative lighting, Indoor/outdoor LED video irregular screen.

## General description

WS2812B-MINI-V6 is an intelligent control LED light source that the control circuit and RGB chip are integrated in a package of 3535 component. It internal include intelligent digital port data latch and signal reshaping amplification drive circuit. It also includes a high-precision internal oscillator and a programmable constant current control part to ensure high color consistency.

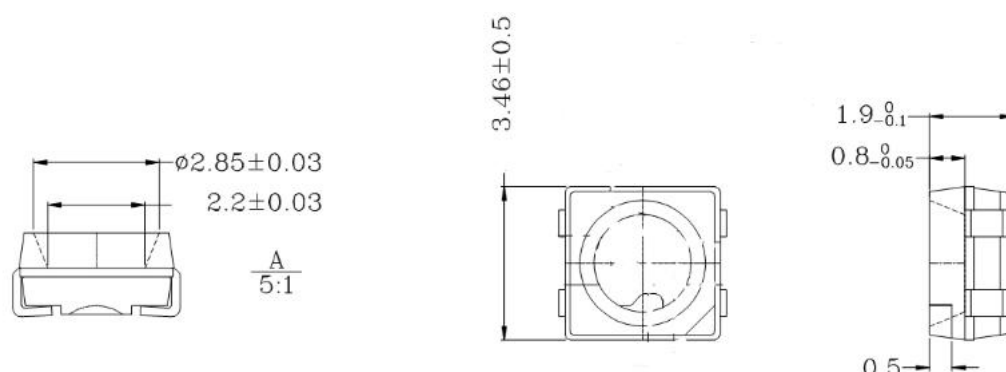
The data transfer protocol use single NZR communication mode. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit 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.

RESET time>280 $\mu$ s , it won't cause wrong reset while interruption, it supports the lower frequency and inexpensive MCU.

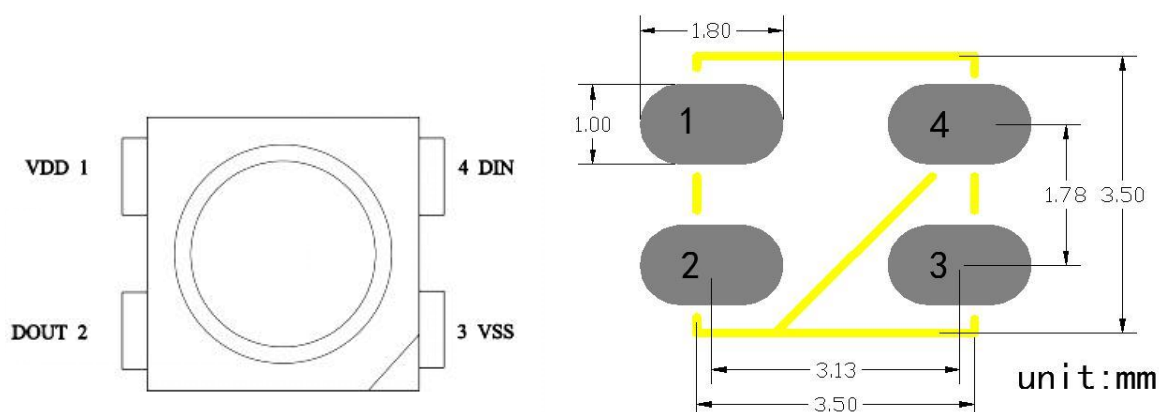
Refresh Frequency updates to 2KHz, Low Frame Frequency and No Flicker appear in HD Video Camera, it improve excellent display effect.

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



## PIN Configurations



## PIN Functions

| NO. | Symbol | Function description       |
|-----|--------|----------------------------|
| 1   | VDD    | LED Power supply           |
| 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 <sub>DD</sub>  | +3.3~+5.3        | V    |
| Logical Input Voltage               | V <sub>I</sub>   | -0.3V ~ VDD+0.7V | V    |
| Working Temperature                 | T <sub>opt</sub> | -40~+85          | °C   |
| Storage Temperature (Bulk material) | T <sub>stg</sub> | -40 ~ +105       | °C   |
| Storage Temperature (Whole reel)    | T <sub>stg</sub> | -40 ~ +70        | °C   |
| Working Temperature                 | T <sub>opt</sub> | -40~+85          | °C   |

**Electrical Characteristics** ( $T_A=25^{\circ}\text{C}$ ,  $V_{SS}=0\text{V}$ , unless otherwise specified)

| Parameter          | Symbol   | Min            | Tpy | Max                  | Unit          | Conditions          |
|--------------------|----------|----------------|-----|----------------------|---------------|---------------------|
| Input current      | $I_I$    | —              | —   | $\pm 1$              | $\mu\text{A}$ | $V_I=V_{DD}/V_{SS}$ |
| High Voltage Input | $V_{IH}$ | $0.55V_{DD}$   | —   | $V_{DD}+0.7\text{V}$ | V             | $D_{IN}$ , SET      |
| Low Voltage Input  | $V_{IL}$ | $-0.3\text{V}$ | —   | $0.7\text{V}$        | V             | $D_{IN}$ , SET      |

**Switching Characteristics** ( $T_A=-25^{\circ}\text{C}$ ,  $V_{SS}=0\text{V}$ , unless otherwise specified)

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

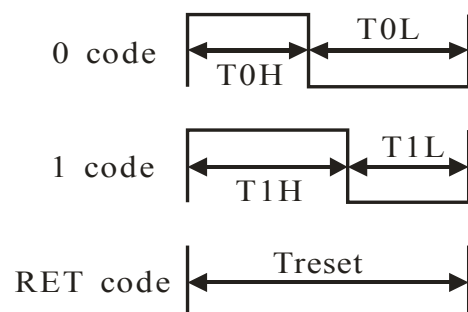
**LED Characteristics**

| Parameter          | Symbol      | Color | Quiescent Current $<0.6\text{mA}$ |     |      |      | Condition<br>(Working current) |
|--------------------|-------------|-------|-----------------------------------|-----|------|------|--------------------------------|
|                    |             |       | Min                               | Tpy | Max  | Unit |                                |
| Luminous intensity | IV          | RED   | 300                               | 310 | 500  | mcd  | 12mA                           |
|                    |             | GREEN | 600                               | 780 | 1000 |      |                                |
|                    |             | BLUE  | 200                               | 215 | 300  |      |                                |
| Wavelength         | $\lambda_d$ | RED   | 620                               | 622 | 630  | nm   | 12mA                           |
|                    |             | GREEN | 515                               | 518 | 525  |      |                                |
|                    |             | BLUE  | 465                               | 472 | 475  |      |                                |

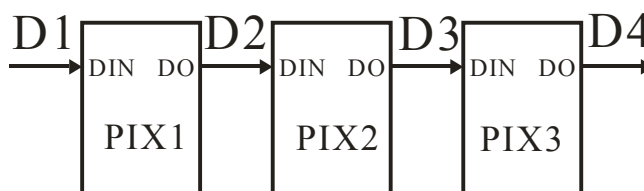
**Data Transfer Time**

|                   |                           |                                        |
|-------------------|---------------------------|----------------------------------------|
| T0H               | 0 code, high voltage time | 220ns~380ns                            |
| T1H               | 1 code, high voltage time | 580ns~1 $\mu\text{s}$                  |
| T0L               | 0 code, low voltage time  | 580ns~1 $\mu\text{s}$                  |
| T1L               | 1 code, low voltage time  | <b>580ns~1<math>\mu\text{s}</math></b> |
| RES               | low voltage time          | $> 280\mu\text{s}$                     |
| T <sub>DATA</sub> | Data cycle                | $\geq 1.25\mu\text{s}$                 |

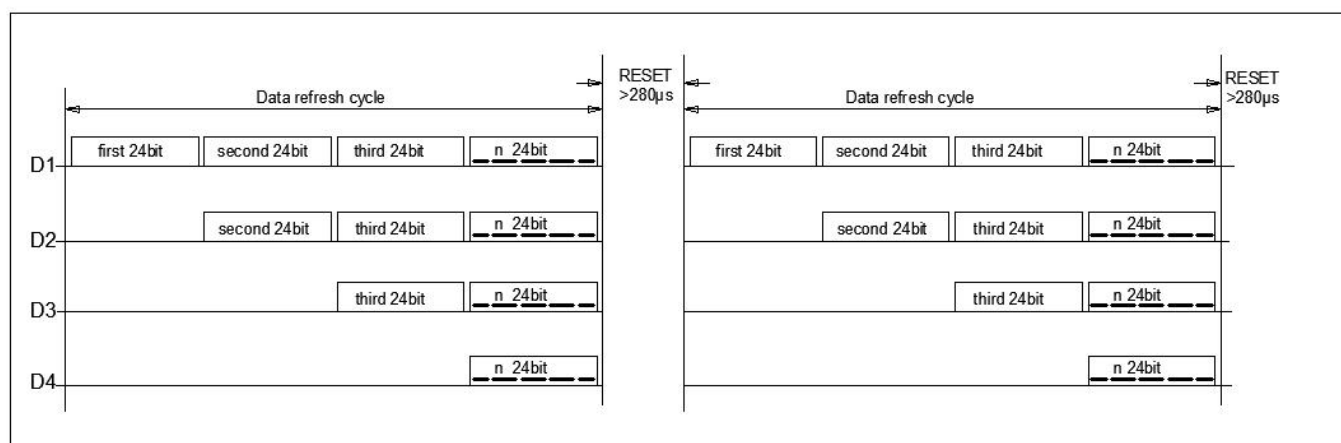
## Sequence chart



## Cascade Method



## Data Transmission Method



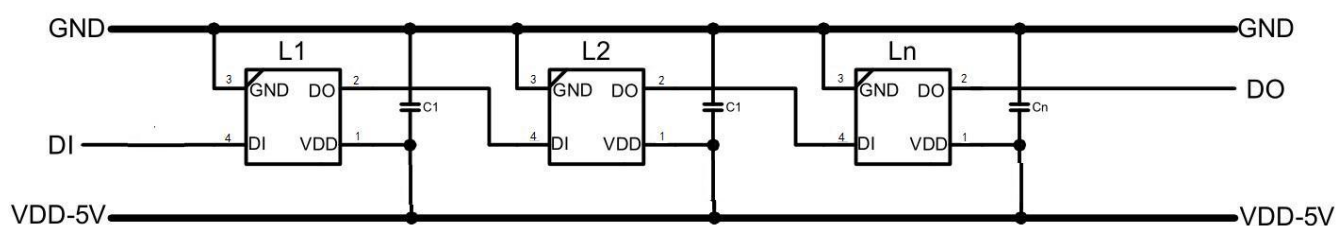
Note: The data of D1 is sent by MCU, and D2, D3, D4 through pixel internal reshaping amplification to transmit.

## 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 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

Note: Follow the order of GRB to send data and the high bit sent at first.

## Typical Application Circuit



Note: C1 is the filter capacitor for VDD, its value of 100nF.

## WorldSemi Top SMD LED Using Instructions

### 1. Summary

To make the best use of WORLDSEMI's LED, please refer to the below precautions, they are of same usage method as other electronic components.

### 2. Cautions

#### 2.1. Dust & Cleaning

The surface of the LED is encapsulated with modified epoxy resin because it plays a very good role in protecting the optical performance and aging resistance. The modified epoxy resin is easy to stick with dust and must be kept clean. When there's a certain amount of dust on the surface of the LED, it won't affect brightness, but dust proof should be taken care of. Promoting the use of unsealed package in preference to others and the assembled LEDs should be placed in a clean container. Avoid using the organic solvents to clean the dust on the LED surface and it's necessary to confirm whether the cleaning fluid will dissolve the LED. Do not clean the LEDs by the ultrasonic. Some parameters affecting the LED performance must be evaluated if have no alternative but to the ultrasonic cleaning method, such as ultrasonic power, baking time and assembly conditions, etc.

#### 2.2. Moisture-proof packaging

TOP SMD LEDs are moisture sensitive components. LEDs are packaged in aluminum foil bag to prevent the LED from absorbing moisture during transport and storage. desiccant is placed in the bags to absorb moisture. If the LED absorbs moisture, then it evaporates and expands when in reflow process, which may break the colloid from the bracket and damage the optical performance of LED. For this reason, moisture-proof packaging is to prevent the from absorbing moisture during transport and storage. But usually the protection time can only maintain 1 ~ 2 months. During SMT, please refer to the definition of material moisture-proof Grade (MSL) stipulated by IPC/JEDECJ-STD-020 for MSL control. The moisture resistance rating of WORLDSEMI's LED is: **LEVEL 5a**.

**Tabel I - IPC/JEDEC J-STD-020 Moisture/Reflow Sensitivity Classification**

| MSL Level      | Workshop Life                |                    |
|----------------|------------------------------|--------------------|
|                | Time                         | Conditions         |
| LEVEL1         | Unlimited                    | ≤30°C/85%RH        |
| LEVEL2         | 1 Year                       | ≤30°C/60%RH        |
| LEVEL2a        | 4 Weeks                      | ≤30°C/60%RH        |
| LEVEL3         | 168 Hours                    | ≤30°C/60%RH        |
| LEVEL4         | 72 Hours                     | ≤30°C/60%RH        |
| LEVEL5         | 48 Hours                     | ≤30°C/60%RH        |
| <b>LEVEL5a</b> | <b>24 Hours</b>              | <b>≤30°C/60%RH</b> |
| LEVEL6         | Take-out and Use immediately | ≤30°C/60%RH        |

### 2.3 SMT Instruction:

2.3.1 It is recommended that opening the Vacuum plastic bag before SMT, and put the whole reel into the oven for dehumidification and drying (Bake at  $70 \sim 75^{\circ}\text{C} \geq 24\text{H}$ );

2.3.2 From the led taken out of the oven to the completion of high temperature welding (including multiple reflow welding, tin immersion, wave soldering, heating maintenance and other high temperature operations/operations), the time period shall be controlled within 24Hours (Under condition of  $T < 30^{\circ}\text{C}$ ,  $\text{RH} < 60\%$ );

2.3.3 After the LED paste is printed on the PCBA, SMT process should be completed as soon as possible, it is recommended not to exceed 1H;

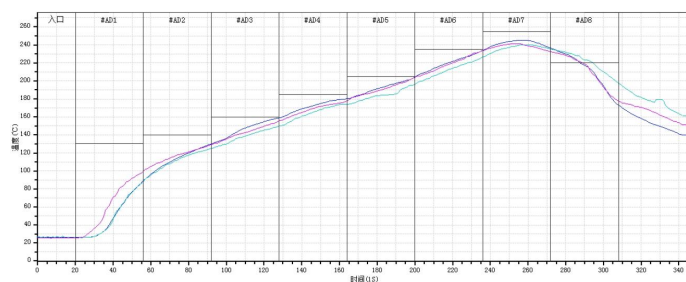
2.3.4 Bulk material LED, such as production surplus, machine material, maintenance material, can not be used directly if exposed to the air for a long time. It is recommended to be dehumidified and dried before being used.

Whole reel baking:  $70 \sim 75^{\circ}\text{C} * \geq 24\text{H}$  or bulk led baking:  $120^{\circ}\text{C} * 4\text{H}$ .

### 3. SMT Reflow Soldering

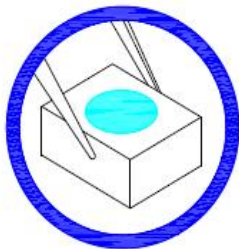
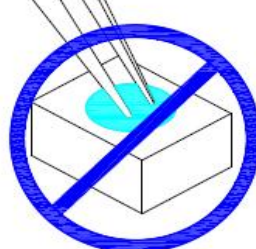
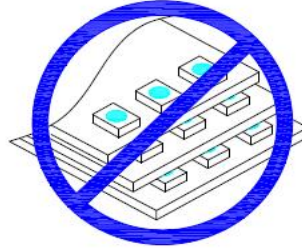
Refer to the parameters listed below, the experimental results prove that the TOP SMD LED meets the JEDEC J-STD-020C standards. As a general guideline, it is recommended to follow the SMT reflow temperature curve recommended by the solder paste manufacturer.

| Curve Description                                                         | Lead-free                     |
|---------------------------------------------------------------------------|-------------------------------|
| $30^{\circ}\text{C} \sim 150^{\circ}\text{C}$ preheating slope            | $1 \sim 4^{\circ}\text{C/s}$  |
| $30^{\circ}\text{C} \sim 150^{\circ}\text{C}$ preheating time             | 60 ~ 120 s                    |
| $150^{\circ}\text{C}$ to $200^{\circ}\text{C}$ constant temperature slope | $0 \sim 3^{\circ}\text{C/s}$  |
| $150^{\circ}\text{C} \sim 200^{\circ}\text{C}$ constant temperature time  | 60 ~ 120 s                    |
| LIQUID REGION temperature (TL)                                            | $217^{\circ}\text{C}$         |
| Peak Temperature (Tp)                                                     | $245^{\circ}\text{C}$         |
| Reflow slopeTime (tp)                                                     | $0 \sim 3^{\circ}\text{C/s}$  |
| Reflow soldering time                                                     | 45-90 s                       |
| Cooling Rate                                                              | $-4 \sim 0^{\circ}\text{C/s}$ |
| Room Temperature to Peak Holding Time                                     | <6 min                        |



Remarks: 1. All the above temperatures refer to the temperatures measured on the surface of the package body

## 4. Assembly Precautions

|                                                                                   |                                                                                                                  |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 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.                     |
|  |                                 |  |  |

## Modify Record

| Version № | Status Bar | Modify Content Summary         | Date      | Reviser       | Approved    |
|-----------|------------|--------------------------------|-----------|---------------|-------------|
| V1.0      | N          | New                            | 20251021  | Chen Yongzhao | Yin Huaping |
| V1.1      | A          | Parameters modified            | 202510201 | Ouyang Yu     | Yin Huaping |
| V1.2      | M          | Add brightness variation curve | 20260318  | Chen Yongzhao | Yin Huaping |
|           |            |                                |           |               |             |

**Remarks:** Initial version: V1.0; Version number plus "0.1" after each revision;

Status bar: N--New, A--Add, M--Modify, D--Delete.

1. Version number plus "0.1" if for add & modify parameters, eg. V1.0→ V1.1
2. Major revision or many parameters modified, version number plus "1.0", eg. V1.0→ V2.0
3. No version number is attached to Part Number