WS2813B-RGBW

Intelligent control LED integrated light source

Features and Benefits

- The control circuit and RGB chip are integrated in a 5050 components, to form an external control pixel.
- Intelligent Reverse-connection protection.The components will not be damaged when the 5V power supply is reversed.
- Using the built-in signal reshaping circuit to achieve the signal waveform shaping, and no distortion of waveform of signal takes place.
- The gray levels of each pixel are of 256 levels, which achieves “256*256*256=16777216” full-color display, and the refresh frequency reaches to 2KHz.
- Serial cascade interface, data receiving and decoding depend on just one signal line.
- Dual-signal wires version, signal break-point continuous transmission.
- Any two point the distance more than 5M transmission signal without any increase circuit.
- When the refresh rate is 30fps, cascade numbers is at least 1024 pixels.
- Data transmitting at speeds of up to 800Kbps.
- Good color consistency reliability, high cost-effective.

Applications

- Guardrail tube series, point light display series, flexible/rigid strips series, module series applications.
- Lighting stage costumes, innovative gadgets or any other electronic products.

General description

WS2813B-RGBW is an intelligent control LED light source that the control circuit and RGB chip are integrated in a package of 5050 components. Its 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, which achieves highly consistent color effect.

Dual-signal wires version, signal break-point continuous transmission. Any pixel’s failure won't affect signal transfer and total emitting effect.

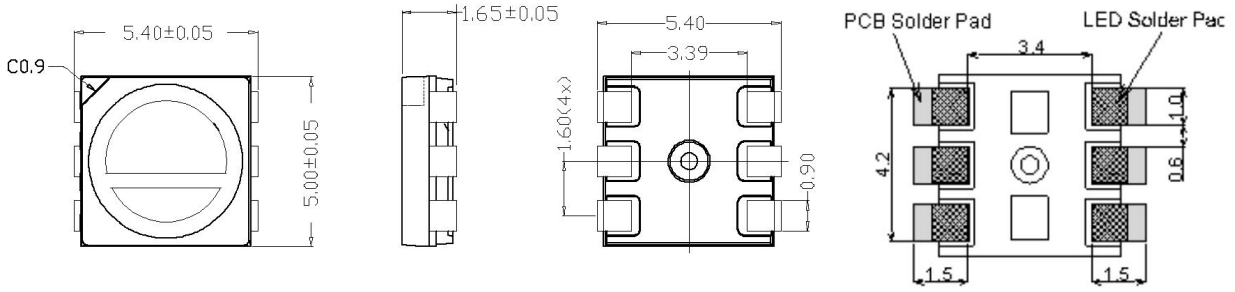
The data transfer protocol use single NZR communication mode. After the pixel power-on reset, the DIN1 port receive data from controller, the first pixel collect initial 32bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit sent to the next cascade pixel through the DO port. After transmission for each pixel, the signal to reduce 32bit. Every pixel adopts auto-reshaping transmit technology, making the pixel cascade numbers are not limited to the signal transmission, only relate to the speed of signal transmission.

Refresh Frequency updates to **2KHz**, Low Frame Frequency and no Flicker appear in HD Video Camera.

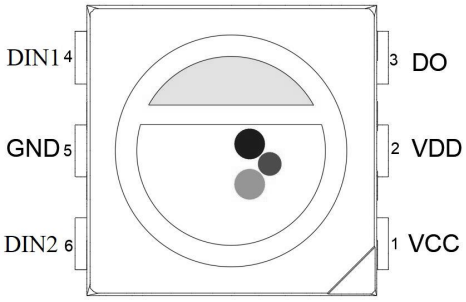
RESET time>**280μs**, it won’t cause wrong reset while interruption, it supports the lower frequency and inexpensive MCU.

Integrated circuit chips enable the circuit control simpler, neater and more reliable.

Mechanical Dimensions



PIN Configuration



PIN Function

NO.	Symbol	PIN	Function description
1	VCC	VCC	Connect to VDD in PCB layout or shunted by a series resistor
2	VDD	VDD	LED POWER SUPPLY, connect to “+5V”
3	DO	DO	Control data signal output
4	DIN1	DIN1	Control data signal1 input
5	GND	GND	Data & Power Grounding
6	DIN2	DIN2	Control data signal2 input

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Power supply voltage	V_{DD}	+3.7~+5.3	V
Logical Input Voltage	V_I	-0.7～VDD+0.7	V
Operating Temperature	Topt	-25～+85	℃
Storage Temperature	Tstg	-40~+105	℃

Electrical Characteristics (TA=25℃, VDD=5V, VSS=0V)

Parameter	Symbol	Min.	Tpy.	Max.	Unit	Conditions
Input Current	I_I	——	——	±1	μA	V_I=VDD/VSS
High-level Input	V_{IH}	0.7VDD	——	VDD+0.7	V	D_{IN}
Low-level Input	V_{IL}	-0.7V	——	0.3 VDD	V	D_{IN}
Hysteresis voltage	V_H	——	0.35	——	V	D_{IN}

Switching Characteristics (TA=25℃, VDD=5V, VSS=0V)

Parameter	Symbol	Min	Tpy	Max	Unit	Condition
Transmission Delay Time	T_{PLZ}	——	——	300	ns	CL=15pF, DIN→DOUT, RL=10KΩ
Fall time	T_{THZ}	——	——	120	μs	CL=300pF, OUTR/OUTG/OUTB
Input-capacitance	C_I	——	——	15	pF	——

LED Characteristics

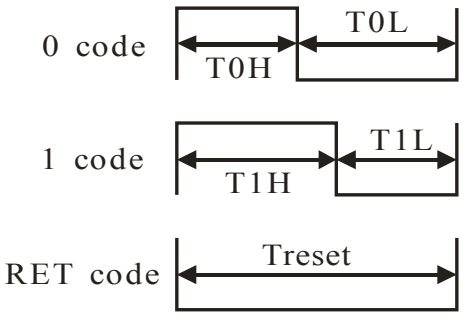
Parameter	Symbol	Color	Quiescent Current(Central value): 0.6mA				Test condition (Operating current)
			Min.	Typ.	Max.	Unit	
Luminous intensity	IV	RED	300	/	500	mcd	15mA
		GREEN	800	/	1500		
		BLUE	200	/	400		
		WHITE	1500	/	2500		
Wavelength	λd	RED	620	/	630	nm	15mA
		GREEN	515	/	525		
		BLUE	465	/	475		
Color Temperature		Pure white	6000	-	8000	K	15mA
		Natural White	4000	-	5000	K	
		Warm white	3000	-	3500	K	

Data Transfer Time

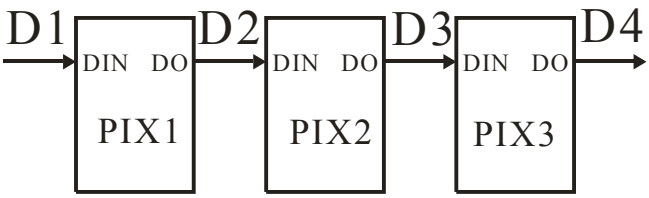
T0H	0-code, High-level time	220ns~380ns
T1H	1-code, High-level time	580ns~1μs

T0L	0-code, Low-level time	580ns~1μs
T1L	1-code, Low-level time	580ns~1μs
RES	Frame unit, Low-level time	> 280μs

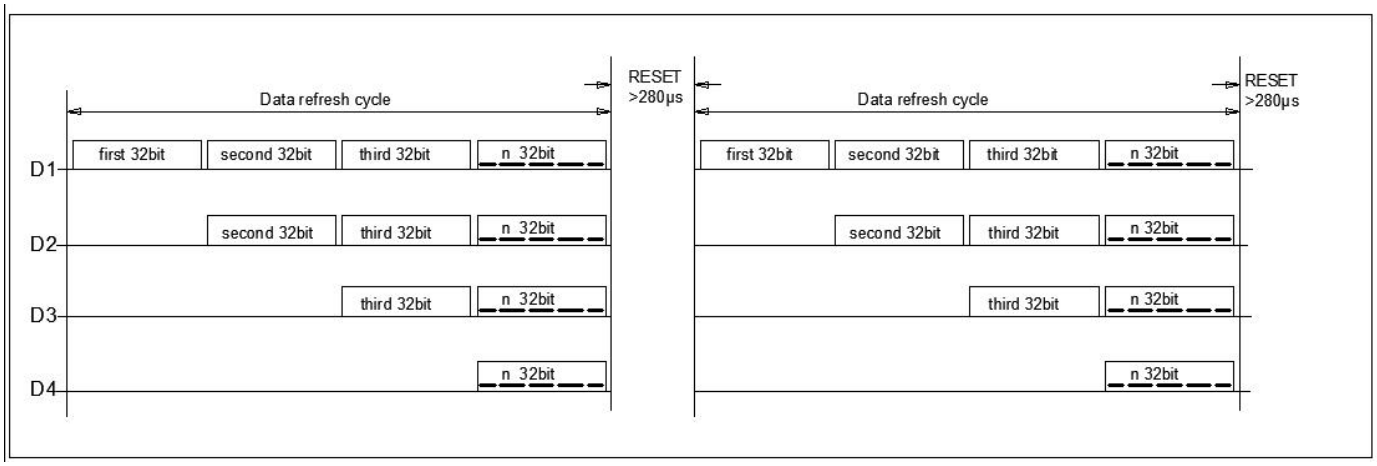
Sequence chart



Cascade method



Data Transmission Method



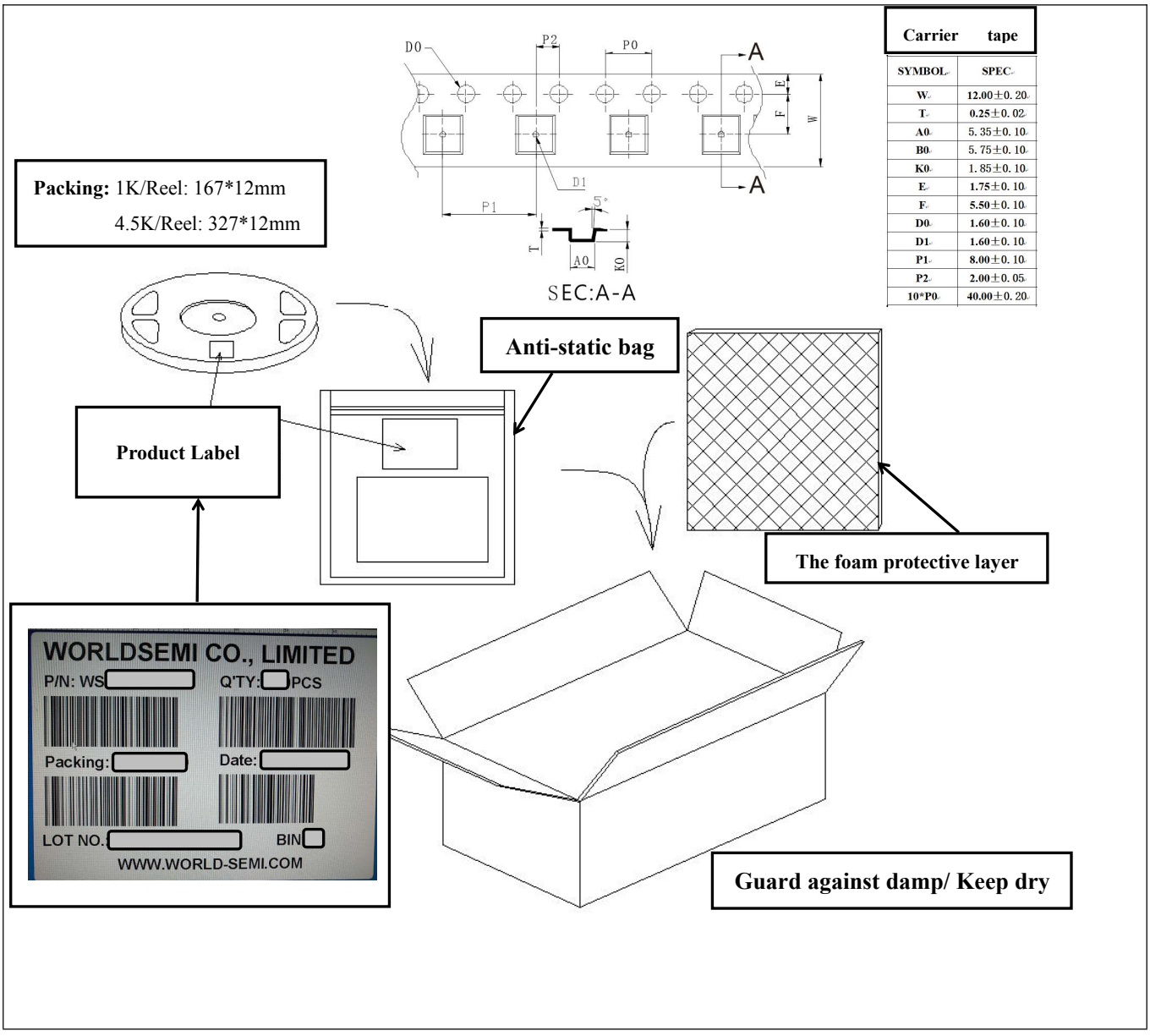
Note: D1 is the data from MCU, and D2, D3, D4 are from Cascade Circuits.

Composition of 32bit 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	W1	W2	W3	W4	W5	W6	W7	W8

Note: Data transmit in order of GRBW, high bit data is first.

Packing Standard



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 from absorbing moisture during transport and storage. A 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. 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℃/85%RH
LEVEL2	1 Year	≤30℃/60%RH
LEVEL2a	4 Weeks	≤30℃/60%RH
LEVEL3	168 Hours	≤30℃/60%RH
LEVEL4	72 Hours	≤30℃160%RH
LEVEL5	48 Hours	≤30℃/60%RH
LEVEL5a	24 Hours	≤30℃/60%RH
LEVEL6	Take-out and Use immediately	≤30℃/60%RH

2.3. SMT Requirement:

2.3.1 It is recommended to unpack the LED before SMT and put the whole roll into the oven for dehumidification and drying (baking at 70 ~ 75 ℃ for ≥ 24h);

2.3.2 The product is taken out of the oven to the completion of high-temperature soldering (including multiple high-temperature operations/operations such as reflow soldering, tin immersion, wave soldering, and heating maintenance), and the time period is controlled within 24 hours (under the conditions of T<30℃, RH<60%) ;

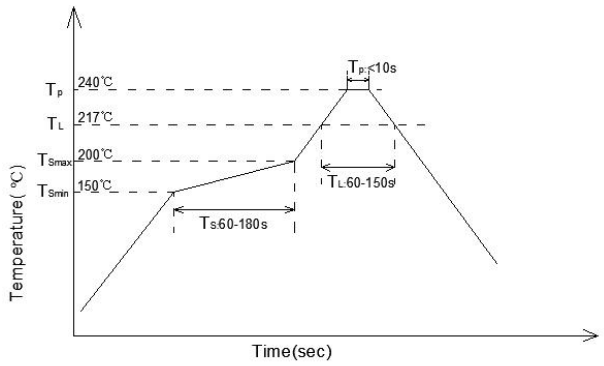
2.3.3SMT shall be completed as soon as possible for LED pastes on PCBA after printing solder paste, and it is recommended not to exceed 1H;

2.3.4 Bulk LEDs such as production surplus, machine throwing materials, and maintenance materials cannot be used directly if they are exposed to the air for a long time. It is recommended to dehumidify and dry before use. Whole roll baking: 70～75℃*≧24H or bulk material baking: 120℃*4H.

3. SMT Reflow

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.

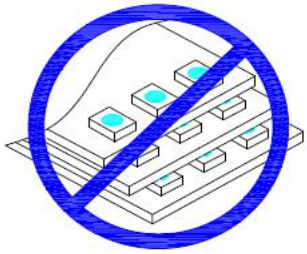
Curve Description	Lead-free
The lowest preheat temperature (Tsmin)	150℃
The highest preheat temperature (Tsmax)	200℃
Preheating time (Tsmin to Tsmax) (ts)	60-180 S
Average rate of temperature rise (Tsmax to Tp)	<3℃/S
LIQUID REGION temperature (TL)	217℃
LIQUID REGION Holding Time (tL)	60-150 S
Peak Temperature (Tp)	240℃
High Temperature Region(Tp=-5℃) Holding	<10 S
Cooling Rate	<6℃/S
Room Temperature to Peak Holding Time	<6 min



Remarks: 1. These general guidelines may not apply to all PCB designs and reflow soldering configurations.

2. All temperatures referred are 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	20181016	Shen JinGuo	Yin HuaPing
V1.1	M	Increase the color temperature range and modify the SMT description	20191009	Shen JinGuo	Yin HuaPing
V1.2	M	Modify product description	20200522	Shen JinGuo	Yin HuaPing
V1.3	M	Modify product description	20210401	Shen JinGuo	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.