WS2813B-RGBW

Intelligent control LED integrated light source

Features and Benefits

- The control circuit and the lighting diodes are integrated in a 5050 components, to form an external control pixel.
- Intelligent reverse-connection protection, no damage to LEDs when 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.
- 256 Gray-scale adjustable.
- The refresh frequency reaches to 2KHz.
- Serial cascade interface, data receiving and decoding depend on just one signal line.
- Dual-signal wires version, one additional signal line is added to realize double signal transmission signal break-point continuous transmission. Any single pixel failure won't affect the overall display effect.
- 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

- Consumer Electronics.
- Landscape lighting fields.
- Computer peripheral products, games devices and machinery equipment etc.

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 voltage programmable constant current control part, which achieves highly consistent color effect.

Double channel Dual-signal wires version, signal break-point continuous transmission. Any pixel's failure won't affect signal transfer and overall emitting color effect.

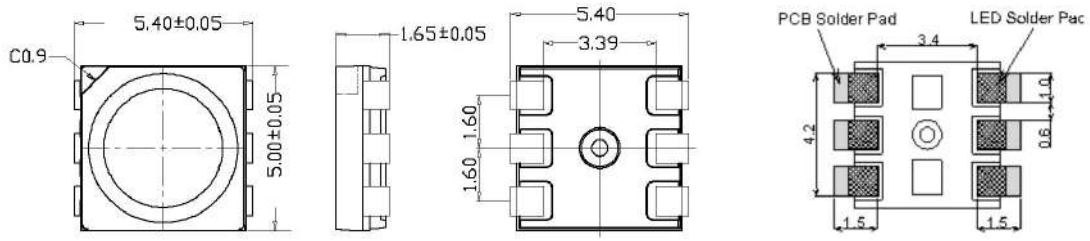
The data transfer protocol use single NZR communication mode. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit sent to the next cascade pixel through the DO port. After transmission for each pixel, the signal to reduce 24bit. 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**, No flicker occurs even when captured by hd camera, which is very suitable for the use of 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 while NO extra components needed.

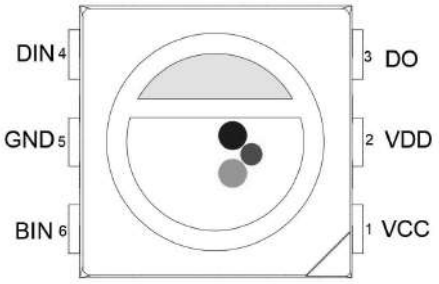
Mechanical Dimensions



◆ **Remarks**

1. Dimension: 5.0*5.4*1.65mm
2. Default tolerance: ± 0.05mm

PIN Configuration



PIN Function

NO.	Symbol	PIN	Function description
1	VCC	VCC	PCB LAYOUT is connected with VDD directly or with series resistors
2	VDD	VDD	LED POWER SUPPLY, connect to “+5V”
3	DO	DO	Control data signal output
4	DIN1	DIN1	Control data-1 signal input
5	GND	GND	Data & Power Grounding
6	DIN2	DIN2	Control data-2 signal input

Absolute Maximum Ratings(T_A=25℃,V_{SS}=0V)

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
Working Temperature	Topt	-25 ~ +85	℃
Storage Temperature	Tstg	-40~+105	℃

Electrical Characteristics (T_A=25℃, Vcc=5V, V_{SS}=0V)

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

Switching Characteristics (T_A=25℃, Vcc=5V, V_{SS}=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	——

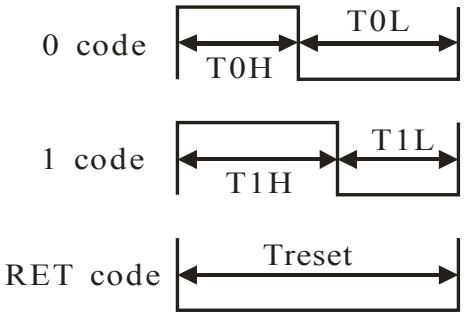
LED Characteristics

Parameter	**Symbol**	**Color**	Quiescent Current: **<0.6mA**				**Condition** (Working current)
			Min	**Tpy**	**Max**	**Unit**	
Brightness	IV	**RED**	300	/	500	mcd	15mA
		GREEN	800	/	1500		
		BLUE	200	/	400		
		W	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		
	Warm White		3000	-	3500		

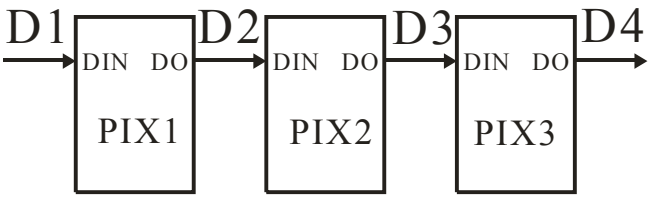
Data Transfer Time

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

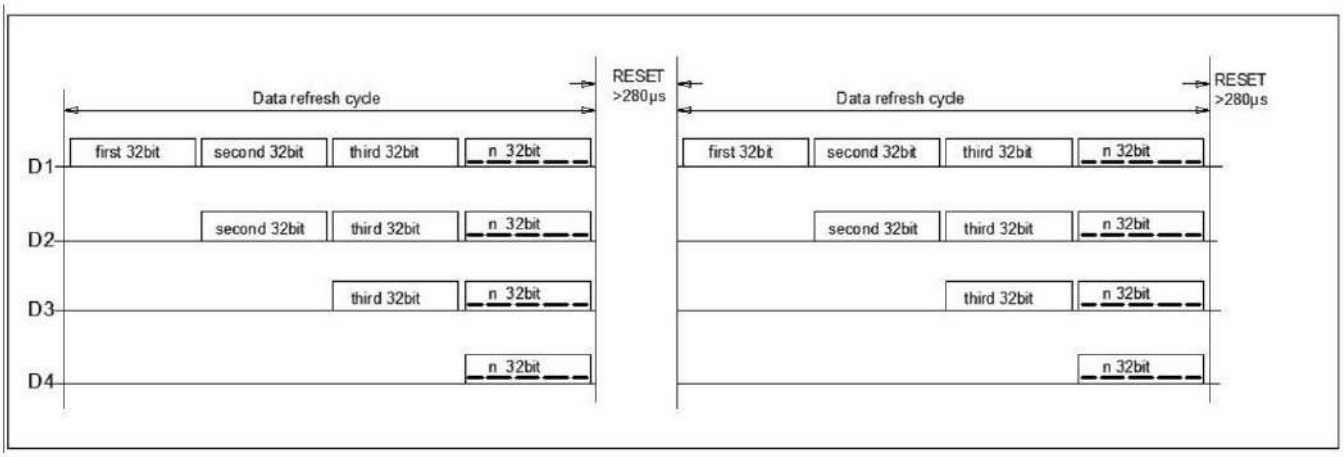
Sequence chart



Cascade method



Data Transmission Method



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

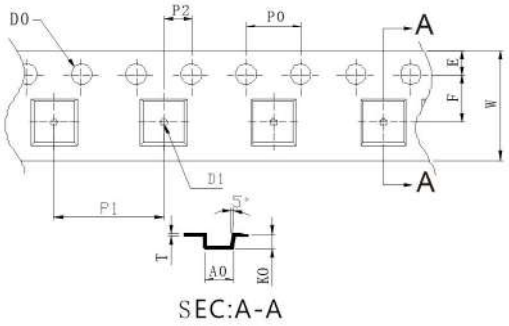
Composition of 32bit data

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0	W7	W6	W5	W4	W3	W2	W1	W0

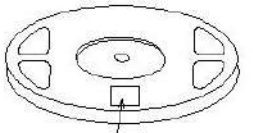
Note: Data transmit in order of GRBW, high bit data is first.

Packing Standard

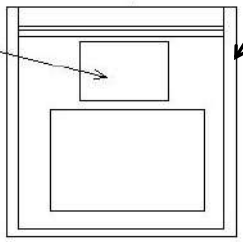
Packing: 1K/Reel: 167*12mm
4.5K/Reel: 327*12mm

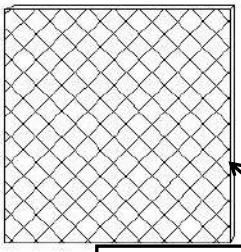


Carrier tape	
SYMBOL	SPEC
W	12.00±0.20
T	0.25±0.02
A0	5.35±0.10
B0	5.75±0.10
K0	1.85±0.10
E	1.75±0.10
F	5.50±0.10
D0	1.60±0.10
D1	1.60±0.10
P1	8.00±0.10
P2	2.00±0.05
10*P0	40.00±0.20



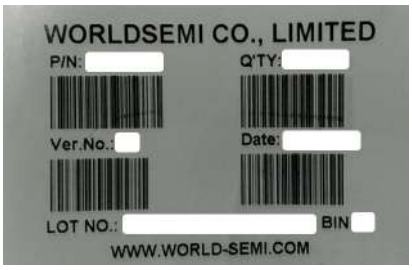
Anti-static bag

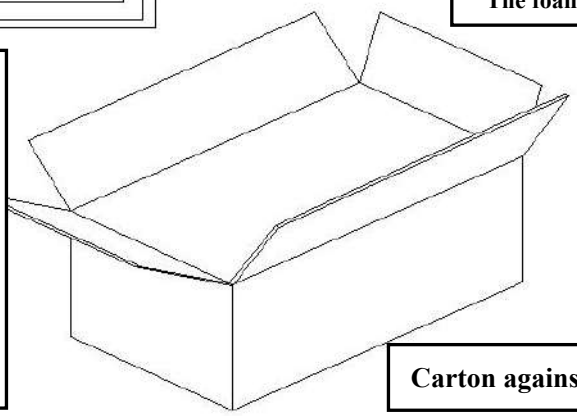




Product Label

The foam protective layer





Carton against damp/ Keep dry

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 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 ~ 75℃ ≧24H);

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℃, 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;

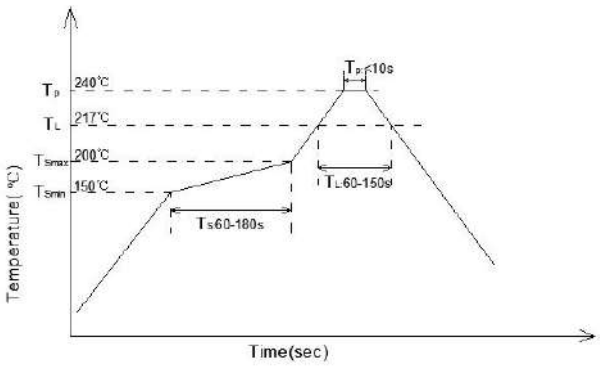
2.3.4 Bulk material LED, such as production surplus, machine material, maintenance material, can not be used directly if exposed to the air for a long time. It is recommended to be dehumidified and dried before being used.

Whole reel baking: 70 ~ 75℃* ≧24H or bulk led 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.

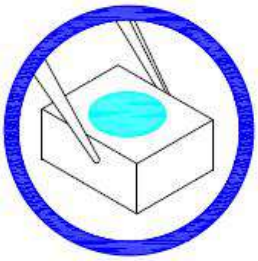
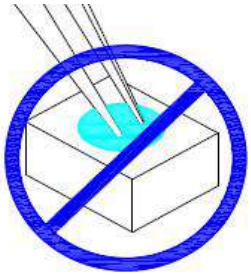
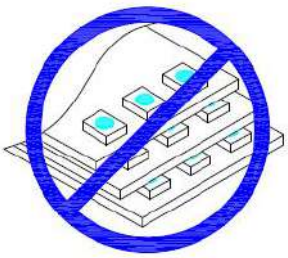
Curve Description	Lead-free
The lowest preheat temperature (Tsmin)	150℃
The highest preheat temperature (Tsmax)	200℃
Preheating time (Tsmin to Tsmax) (ts)	60-180 S
Average rate of temperature rise (Tsmax to Tp)	<3℃/S
LIQUID REGION temperature (TL)	217℃
LIQUID REGION Holding Time (tL)	60-150 S
Peak Temperature (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	A	Add color temperature range and modify patch instruction	20191009	Shen JinGuo	Yin HuaPing
V1.2	M	Modify product description	20200522	Shen JinGuo	Yin HuaPing
V1.3	M	Modify product description	20210401	Dong Le	Yin HuaPing
V1.4	M	Content revision and updating	20211105	Yu XingHui	Yin HuaPing

Remarks:

1. Initial version: V1.0; Parameter added or modified, version number plus "0.1", for example: V1.0→ V1.1
2. Major version design or more parameters modified, version number plus “1.0”, for example: V1.0→V2.0
3. With no version number attached to part number
4. Status bar: N--New, A--Add, M--Modify, D--Delete