WS2812B-2020-V6

Intelligent control LED
integrated light source

Main Features

- The control integrated circuit and the LED share the only power source.
- Control circuit and RGB chip are integrated in a package of 2020 components, to form a complete addressable pixel
- 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.
- OUT R/G/B output gray level: 256 gray scale,complete 16777216 full color display effect.
- Port Refresh frequency is of **2KHz**.
- Serial cascade interface, data receiving and decoding depend on just one signal line.
- When the refresh rate is 30fps, cascade number are not less than 1024 pixels.
- Send data at speeds of 800Kbps.
- The color of the light is highly consistent, 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 μA; 3.3 V power supply is supported.**

Main Applications

- Consumer electronics.
- LED decorative lighting, LED Screen.
- Computer and related equipment, game equipment, various electrical equipment field.

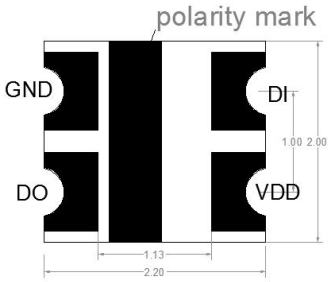
General description

WS2812B-2020-V6 is an intelligent control LED light source, its exterior adopts the latest Molding packaging technology, the control circuit and RGB chips are integrated in a package of 2020 component.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.

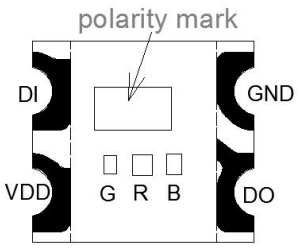
The data transfer protocol use single NZR communication mode. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit 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>**280μs** , 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.

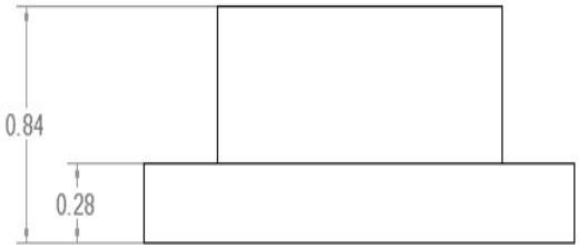
Mechanical Dimensions（unit:mm）



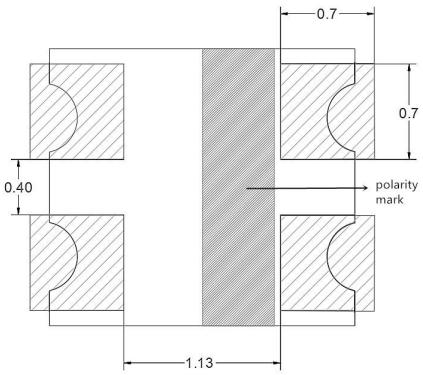
Back View



Top View

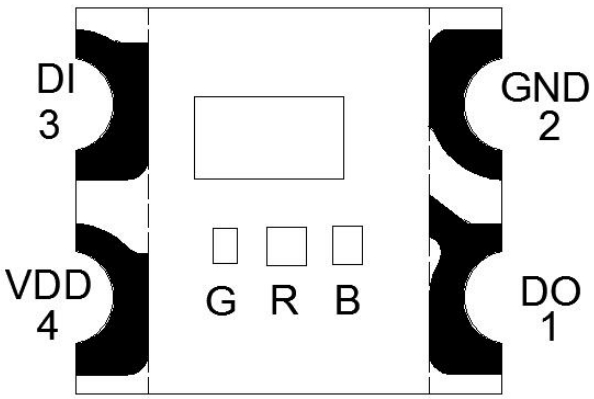


Side View



PCB Solder Pad

PIN Configuration



PIN Function

NO.	Symbol	PIN	Function description
1	DO	DO	Control data signal output
2	GND	GND	Data & Power Grounding
3	DI	DI	Control data signal input
4	VDD	VDD	LED POWER SUPPLY, connect to "+5V"

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

Parameter	Symbol	Ratings	Unit
Power supply voltage	VDD	+3.3~+5.3	V
Logical Input Voltage	V_I	**-0.3V ~ VDD+0.7**	V
Operating Temperature	Topt	-40 ~ +85	℃
Storage Temperature (Bulk material)	Tstg	-40 ~ +105	℃
Storage Temperature (Whole reel)	Tstg	-40 ~ +70	

Electrical Characteristics (T_A=25℃, V_{DD}=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 voltage	V_{IH}	**0.55VDD**	——	**VDD+0.7V**	V	D_{IN}, SET
Low-level input voltage	V_{IL}	**-0.3V**	——	**0.7V**	V	D_{IN}, SET

Switching Characteristics (T_A=25℃, V_{SS}=0V)

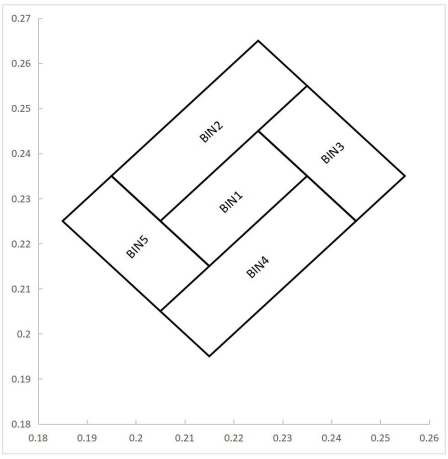
Parameter	Symbol	Min.	Tpy.	Max.	Unit	Condition
Transmission Delay Time	t_{PLZ}	——	——	300	ns	CL=15pF, DIN→DOUT, RL=10KΩ
Fall time	t_{THZ}	——	——	120	μs	CL=300pF, OUTR/OUTG/OUTB
Input-capacitance	C_I	——	——	15	pF	——

LED Characteristics

Parameter	Symbol	Color	Quiescent Current≤1μA				Test Condition DC=5V (Working Current)
			Min.	Typ.	Max.	Unit	
Brightness	IV	Red	140	200	270	mcd	12mA
		Green	450	520	650		
		Blue	120	160	190		
Wavelength	λd	Red	620		625	nm	12mA
		Green	515		520		
		Blue	465		470		
Color-mixing	XY	White	——	x: 0.21 y: 0.23	——	——	36mA
	CCT	White	25000	——	——	K	

BIN Selecting

BIN1	X	0.215	0.205	0.225	0.235
	Y	0.215	0.225	0.245	0.235
BIN2	X	0.205	0.195	0.225	0.235
	Y	0.225	0.235	0.265	0.255
BIN3	X	0.245	0.225	0.235	0.255
	Y	0.225	0.245	0.255	0.235
BIN4	X	0.215	0.205	0.235	0.245
	Y	0.195	0.205	0.235	0.225
BIN5	X	0.205	0.185	0.195	0.215
	Y	0.205	0.225	0.235	0.215

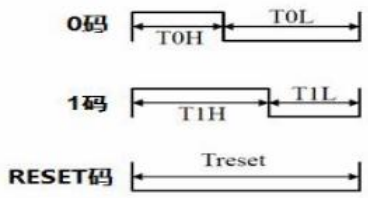


Data Transfer Time

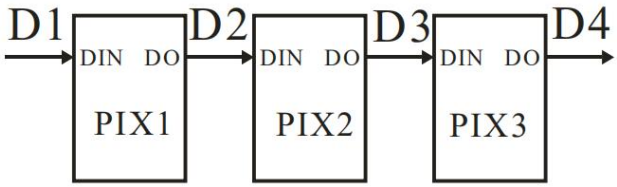
T0H	0 code, high voltage time	220ns~380ns
T1H	1 code, high voltage time	580ns~1μs
T0L	0 code, low voltage time	580ns~1μs
T1L	1 code, low voltage time	580ns~1μs
RES	Frame unit, low voltage time	>280μs
T0H+T0L、T1H+T1L≥1.25μs		

Timing simulation waveform

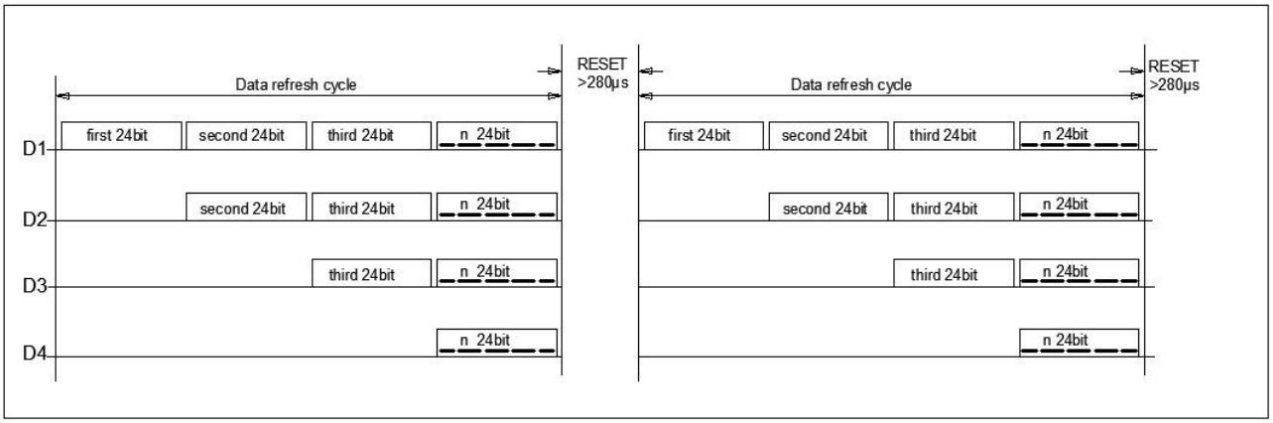
Sequence Chart:



Cascade method:



Data Transmission Method



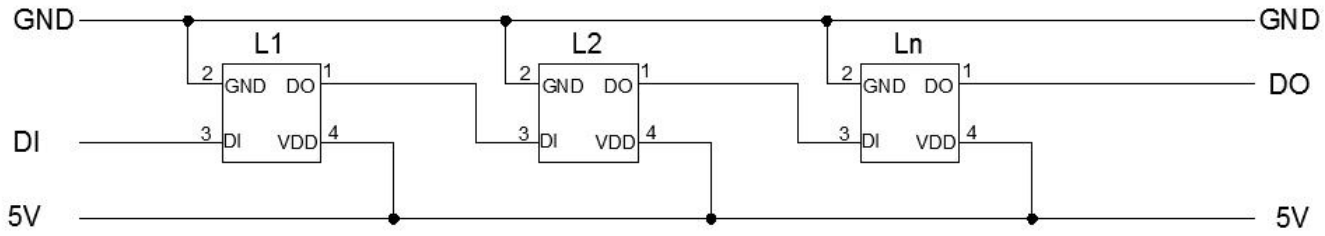
Note: The data of D1 is sent by MCU, D2, D3, D4 through pixel internal reshaping amplification to transmit.

● Composition of 24bit data

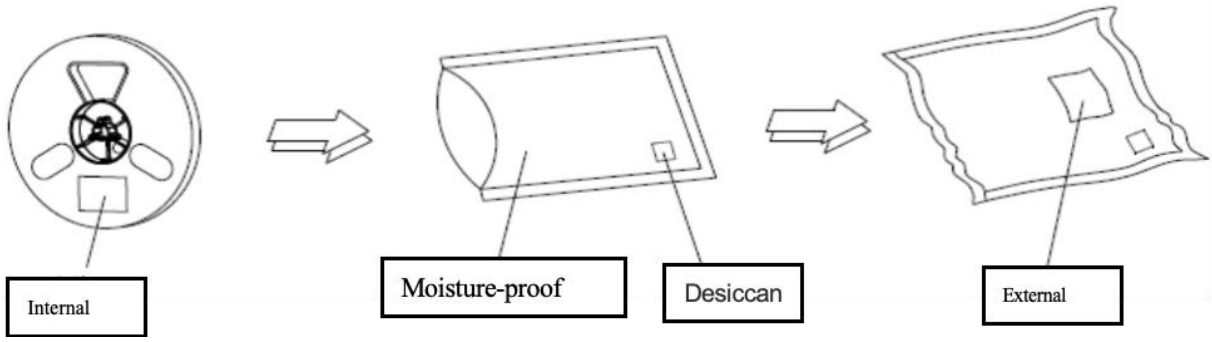
G7	G6	G5	G4	G3	G1	G0	R7	R6	R5	R4	R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0

Note: Data transmit in order of GRB, high bit data at first.

● Typical application circuit

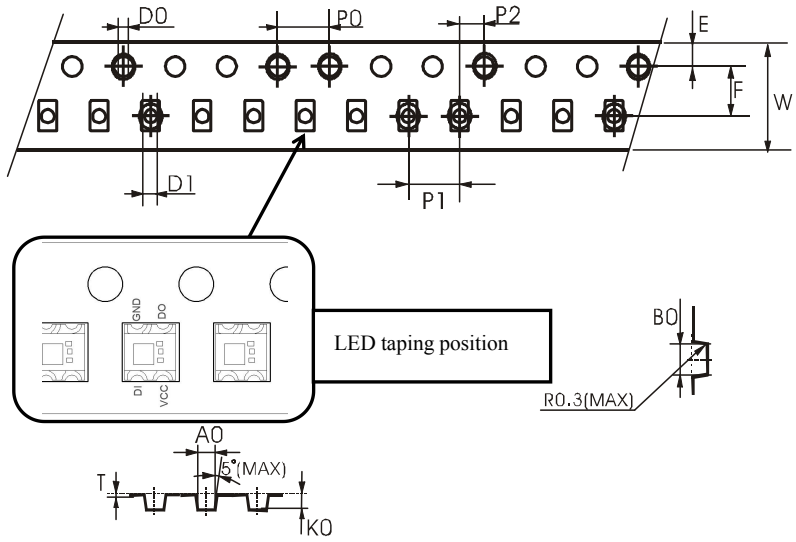


● **Packaging method and quantity: 4500PCS /Bag**



Tape Size (Unit: mm)

Inspector:

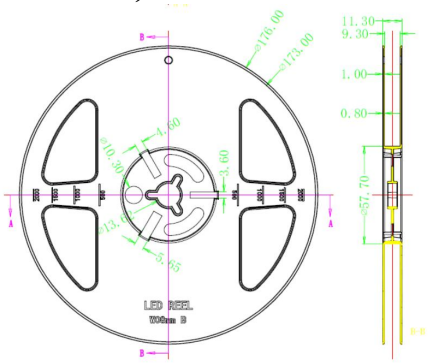


UNIT:mm

CARRIER TAPES TEST REPORTS

SYMBOL	A0	B0	K0	P0	P1	P2	T	E	F	D0	D1	W
SPEC	2.20	2.40	1.01	4.00	4.00	2.00	0.18	1.75	3.50	1.50	1.00	8.00

Reel Packing Specifications (Unit: mm)



TOP SMD LED Using Instructions

1. Summary

To make the best use of D, please refer to the below precautions, they are of same usage method as other e .

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 designed to prevent moisture in the bag, but the protection time can only last for 1 to 2 months.The moisture resistance level of the LED is:5a. For SMT, please refer to the MATERIAL Moisture Resistance Grade (MSL) defined by IPC/JEDECJ-STD-020 for MSL control.

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

MSL Level	Workshop Life after unpacking	
	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;

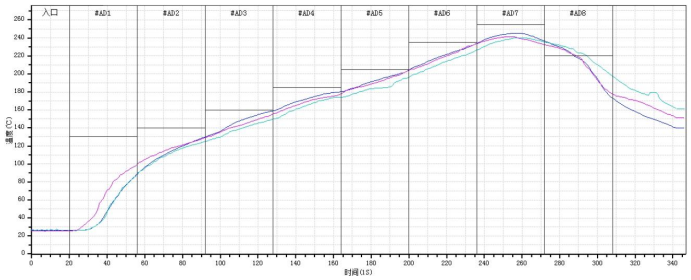
2.3.4 Bulk material LED, such as production surplus, machine material, maintenance material, can not be used directly if exposed to the air for a long time. It is recommended to be dehumidified and dried before being used.

Whole reel baking: 70 ~ 75℃* ≧24H or bulk led baking: 120℃*4H.

3. SMT Reflow Soldering

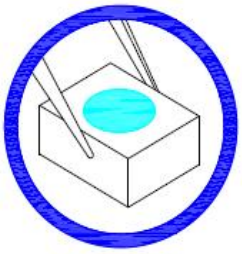
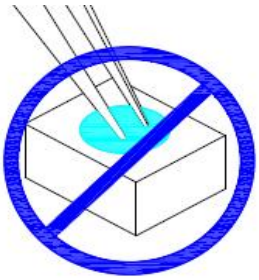
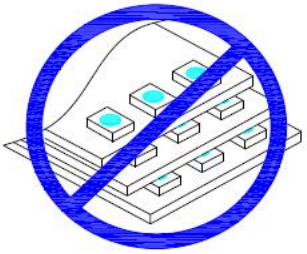
Refer to the parameters listed below, the experimental results prove that the TOP SMD LED meets the JEDEC J-STD-020C standards. As a general guideline, it is recommended to follow the SMT reflow temperature curve recommended by the solder paste manufacturer.

Curve Description	Lead-free
30℃ ~ 150℃ preheating slope	1 ~ 4 ℃/s
30℃ ~ 150℃ preheating time	60 ~ 120 s
150℃ to 200℃ constant temperature slope	0 ~ 3 ℃/s
150℃ ~ 200℃ constant temperature time	60 ~ 120 s
LIQUID REGION temperature (TL)	217℃
Peak Temperature (Tp)	245℃
Reflow slopeTime (tp)	0 ~ 3 ℃/s
Reflow soldering time	45~90 s
Cooling Rate	-4 ~ 0 ℃/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 Records

Version №	Status Bar	Modify Content Summary	Date	Reviser	Approved
V1.0	N	New	20251021	Chen Yongzhao	Yin HuaPing

Remarks:

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

Initial version: V1.0, Status bar: N--New, A--Add, M--Modify, D--Delete.