

Features and Benefits

- The IC control circuit and the LED point light source share one power supply.
- The control circuit and RGB chip are integrated in a **2121** components, to form an external control pixel.
- 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
- Integrated with power-on reset and power-off reset circuits.
- The refresh frequency reaches to 2KHz.
- Serial cascade interface, data receiving and decoding depend on just one signal line.
- Single-wire Self-By pass function. One additional signal line is added to realize double signal transmission. Any single pixel failure won't affect the overall display effect.
- Any two point the distance more than 2Meters 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.
- **Static power consumption is below 1μA; 3.3 V power supply is supported.**
- **LED's rated operating voltage is 5V (Max. operating driving voltage mustn't exceed 7V), LED won't be damaged when the power supply is reversed.**

Applications

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

General description

WS2813B-2121-V6 is an intelligent control LED light source that the control circuit and RGB chip are integrated in a package of **2121** 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.

Single-wire Self-By pass function. Any pixel's failure won't affect signal transfer and overall emitting color effect.

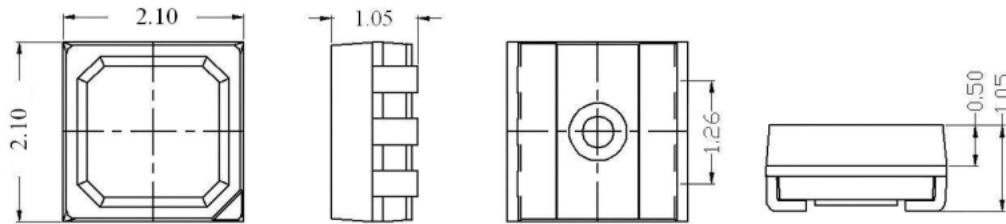
The data transfer protocol use Single-wire RZ protocol. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit sent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

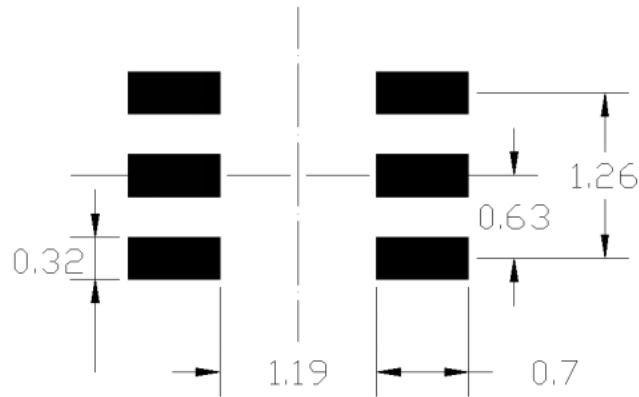
RESET time > **280μs**, it won't cause wrong reset while interruption, supports the lower frequency and inexpensive MCU.

Mechanical Dimensions(Unit:mm)

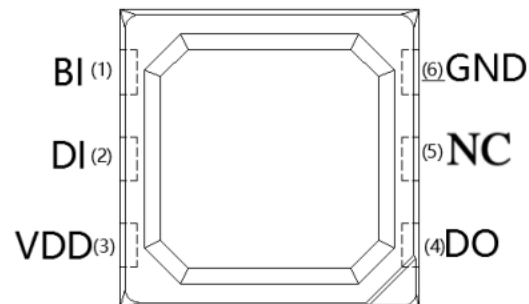
Tolerance: $\pm 0.15\text{mm}$



Recommended pad size(Unit:mm)



PIN Configuration



PIN Function

NO.	Symbol	PIN	Function description
1	BI	Bypass signal input	Backup data signal input PIN
2	DI	Data input	Control data signal input PIN
3	VDD	POWER SUPPLY	Power supply PIN
4	DO	Data output	Control data signal output
5	NC	Non connected	No connection
6	GND	GROUND	Ground, data & power grounding

Absolute Maximum Ratings($T_A=25^{\circ}\text{C}$, $V_{SS}=0\text{V}$)

Parameter	Symbol	Ratings	Unit
Power supply voltage	VCC	+3.3~+5.3	V
Logical Input Voltage	V_I	-0.3V~VDD+0.7	V
Working temperature	T_{opt}	-40~+85	$^{\circ}\text{C}$
Storage temperature(bulk material)	Tstg	-40~+105	$^{\circ}\text{C}$
Storage temperature(Whole reel)	Tstg	-40~+70	$^{\circ}\text{C}$

Electrical Characteristics ($T_A=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$, $V_{SS}=0\text{V}$)

Parameter	Symbol	Min.	Tpy.	Max.	Unit	Conditions
Quiescent current	I_o	—	—	1	μA	No signal transmission, RGB Channel is turned off
Port output current	I_{out}	—	16	—	mA	DC=5V, OUTR/G/B
Input Current	I_I	—	—	± 1	μA	$V_I=V_{DD}/V_{SS}$
High-level Input	V_{IH}	0.55VDD	—	VDD+0.7V	V	D_{IN} , SET
Low-level Input	V_{IL}	-0.3V	—	0.7V	V	D_{IN} , SET

Switching Characteristics ($T_A=25^{\circ}\text{C}$, $V_{CC}=5\text{V}$, $V_{SS}=0\text{V}$)

Parameter	Symbol	Min	Tpy	Max	Unit	Condition
Oscillation frequency	F_{osc}	—	800	—	KHz	—
Transmission Delay Time	T_{PLZ}	—	—	300	ns	$CL=15\text{pF}$, $DIN \rightarrow DOUT$, $RL=10\text{K}\Omega$
Fall time	T_{THZ}	—	—	120	μs	$CL=300\text{pF}$, $OUTR/OUTG/OUTB$
Data transmission rate	F_{MAX}	600	—	—	Kbps	Duty cycle 50%
Input-capacitance	C_I	—	—	15	pF	—

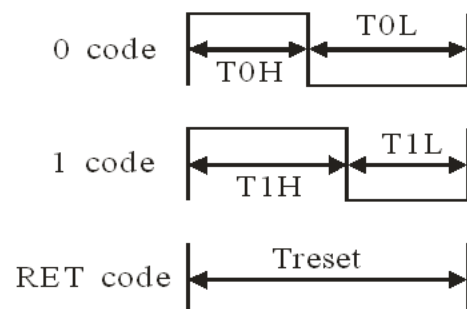
LED Characteristics

Parameter	Symbol	Color	Min.	Typ.	Max.	Unit	Condition ($DC=5\text{V}$)
Brightness	IV	Red	380	440	500	mcd	16mA
		Green	900	1000	1100		
		Blue	180	220	260		
Wavelength	λ_d	Red	620	622	625	nm	16mA
		Green	520	522	525		
		Blue	465	468	470		

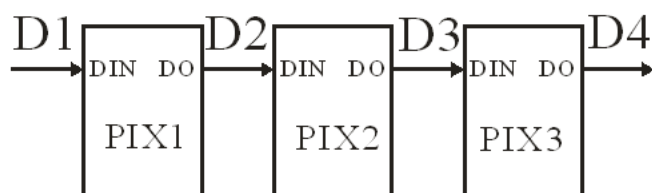
Data Transfer Time

T0H	0-code, High-level time	220ns~380ns
T1H	1-code, High-level time	580ns~1 μs
T0L	0-code, Low-level time	580ns~1 μs
T1L	1-code, Low-level time	580ns~1 μs
RES	Frame unit, Low-level time	> 280 μs
T_{DATA}	T0H+T0L、T1H+T1L	$\geq 1.25\mu\text{s}$

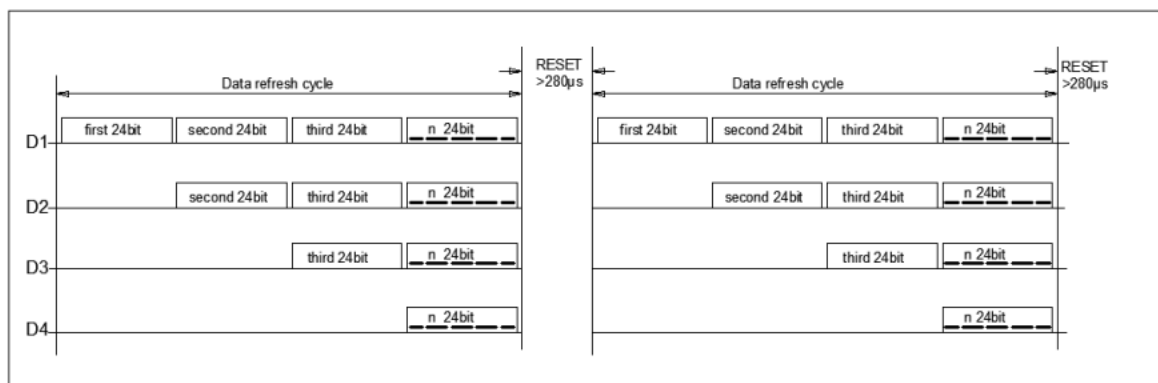
Sequence chart



Cascade method



Data Transmission Method



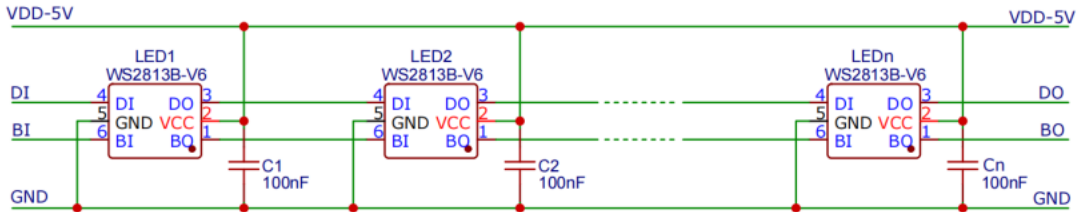
Note: D1 is the data from MCU, and D2, D3, D4 are from Cascade Circuits.

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 is first.

Typical application circuit

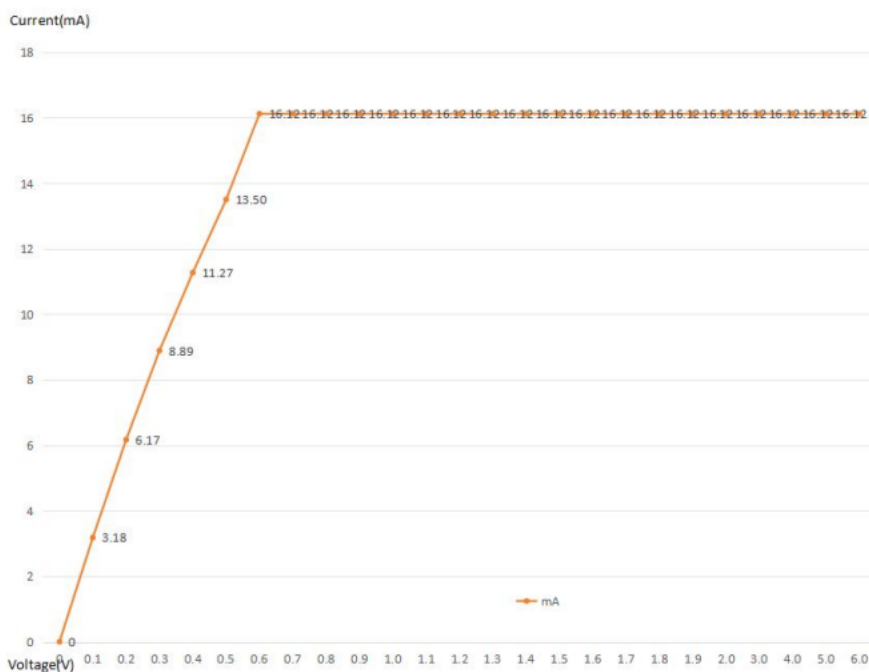


C_n is the filter capacitor of the LED's VDD pin, $C_n = 100\text{nf}$.

Remark:

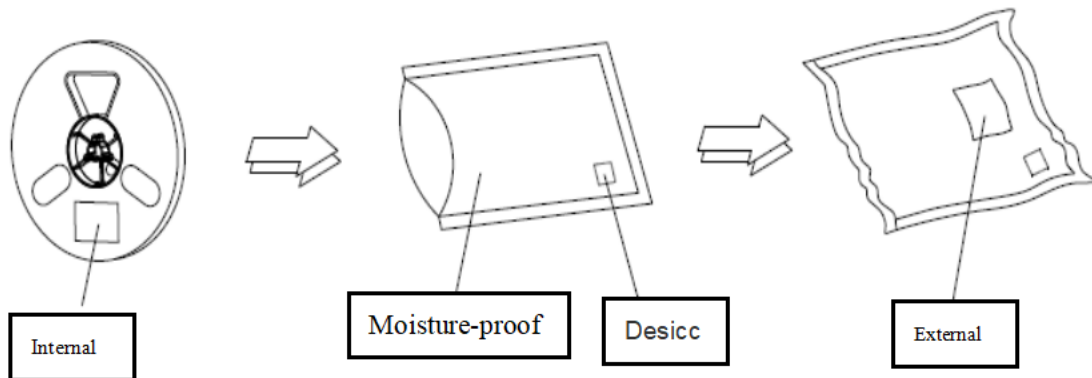
1. DIN is the main input signal and BIN is the bypass input signal. Under normal circumstances, the IC extracts signals from the DIN. When one IC among them is damaged, the latter IC extracts the signal from the BIN without affecting the signal transmission of the subsequent ics.
2. For the finished product application, the BIN pin of the first IC can't be left floating. It is recommended to connect it to GND.

VF Constant current curve

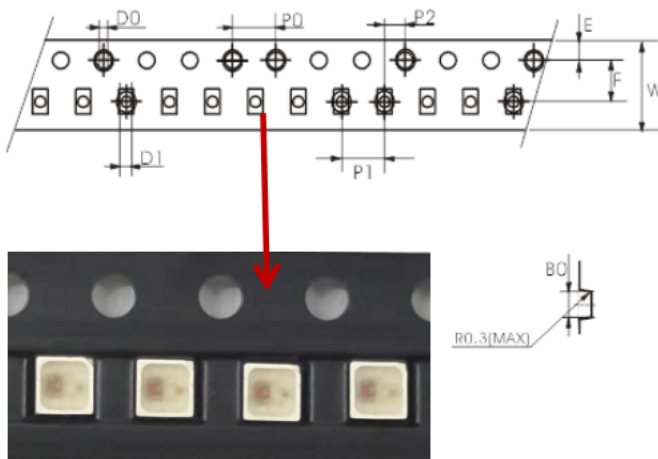


Packing Standard

Packaging quantity: 4000PCS /Bag



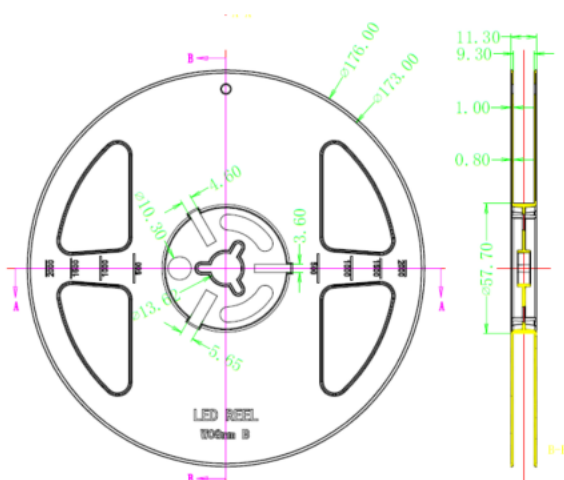
Tape Size (Unit: mm)



UNIT:MM

SYMBOL	SPEC
A0	2.35±0.1
B0	2.35±0.1
K0	1.25±0.1
P0	4.00±0.1
P1	4.00±0.1
P2	2.00±0.1
T	0.18±0.1
E	1.75±0.1
F	3.50±0.1
D0	1.50+0.1
D1	1.00+0.1
W	8.00±0.1
10P0	40.00±0.2

Reel Packing Specifications (Unit: mm)



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 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°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
LEVEL5a	24 Hours	≤30°C/60%RH
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 ~ 75°C ≧ 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°C, 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**;

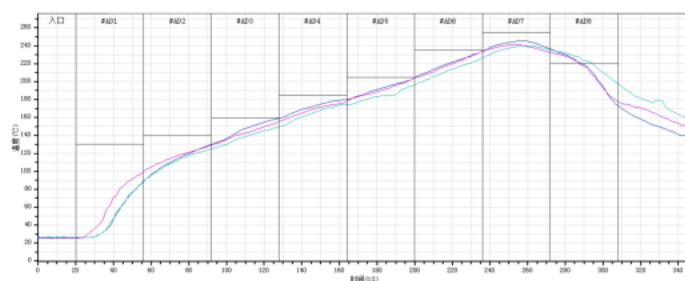
2.3.4 Bulk material LED, such as production surplus, machine material, maintenance material, can not be used directly if exposed to the air for a long time. It is recommended to be dehumidified and dried before being used.

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

3. SMT Reflow Soldering

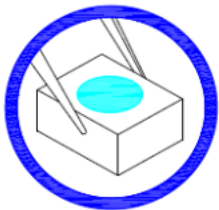
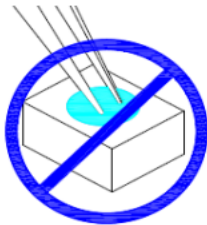
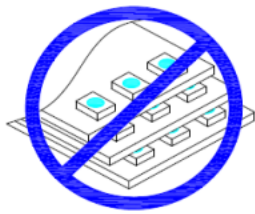
Refer to the parameters listed below, the experimental results prove that the TOP SMD LED meets the JEDEC J-STD-020C standards. As a general guideline, it is recommended to follow the SMT reflow temperature curve recommended by the solder paste manufacturer.

Curve Description	Lead-free
30°C ~ 150°C preheating slope	1~4 °C/s
30°C ~ 150°C preheating time	60~120 s
150°C to 200°C constant temperature slope	0~3 °C/s
150°C ~ 200°C constant temperature time	60~120 s
LIQUID REGION temperature (TL)	217°C
Peak Temperature (Tp)	245°C
Reflow slopeTime (tp)	0~3 °C/s
Reflow soldering time	45~90 s
Cooling Rate	-4~0 °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(Upgrade from WS2813B-2121)	20260527	He WenBin	Yin HuaPing
V1.1	M	Logo update; Application circuit update; Add port output current description; Add the Data transmission rate; Add working&storage temperature; Add Dimensional tolerance;	20260730	Chen YongZhao	Yin HuaPing

Remarks:

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