

Features and Benefits

- The control circuit and RGB chip are integrated in a **2121** components, to form an external control pixel.
- **12V** power supply voltage can effectively reduce the working current of the whole pixel, reduce the voltage drop of the circuit board, and maximize the consistency of the mixed light when the pixel is transmitted over a long distance.
- 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
- The refresh frequency reaches to **4KHz**.
- 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 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.
- No need any electronic components including capacitors on the periphery.

Applications

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

General description

WS2815C-2121 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 a 12V 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.

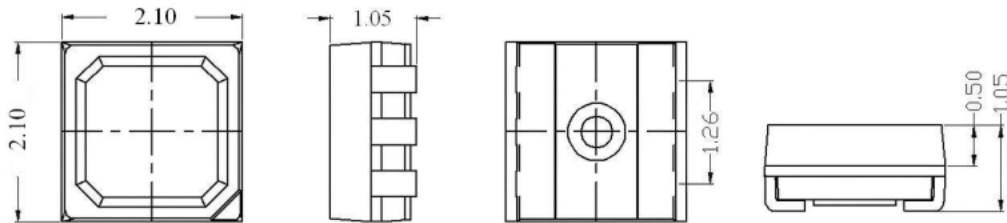
The data transfer protocol use Single-wire RZ protocol. After the pixel power-on reset, the DIN port receive data from controller, the first pixel collect initial 24bit data then sent to the internal data latch, the other data which reshaping by the internal signal reshaping amplification circuit sent 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 **4KHz**, Low Frame Frequency and no Flicker appear in HD Video Camera.

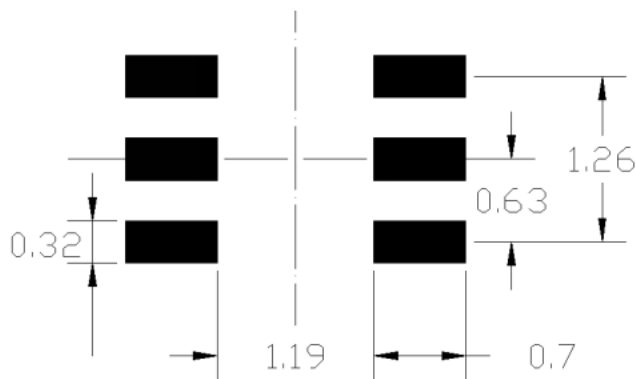
RESET time>**280μs**, it won't cause wrong reset while interruption, it supports the lower frequency and inexpensive MCU.

Mechanical Dimensions(Unit:mm)

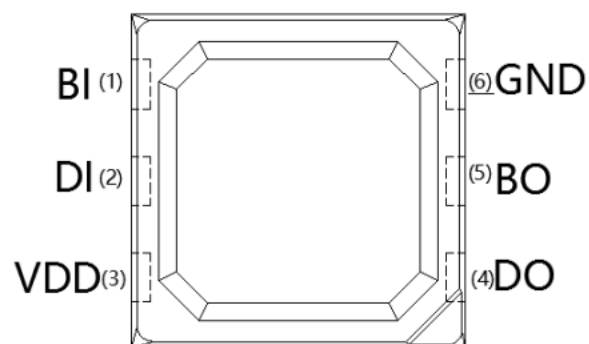
Tolerance: $\pm 0.15\text{mm}$



Recommended pad size(Unit:mm)



PIN Configuration



PIN Function

NO.	Symbol	PIN	Function description
1	BI	Bypass signal input	Bypass signal input
2	DI	Main signal input	Main signal input
3	VDD	Power supply	LED POWER SUPPLY, connect to “+12V”
4	DO	Data signal input	Control data signal output
5	BO	Backup signal output	Backup signal output
6	GND	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	V_{DD}	+9.5~+13.5	V
Logical Input Voltage	V_I	-0.3~5.7	V
Working Temperature	T_{opt}	-40~+85	$^{\circ}\text{C}$
Storage temperature(bulk material)	T_{stg}	-40~+105	$^{\circ}\text{C}$
Storage temperature(Whole reel)	T_{stg}	-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	—	2	—	mA	DC=12V
Input Current	I_I	—	—	± 1	μA	$V_I=V_{DD}/V_{SS}$
High-level Input	V_{IH}	3.0	—	5.7	V	D_{IN} , SET
Low-level Input	V_{IL}	-0.3	—	1.5	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
Transmission Delay Time	T_{PLZ}	—	—	300	ns	$CL=15\text{pF}$, $D_{IN} \rightarrow D_{OUT}$, $R_L=10\text{K}\Omega$
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	—

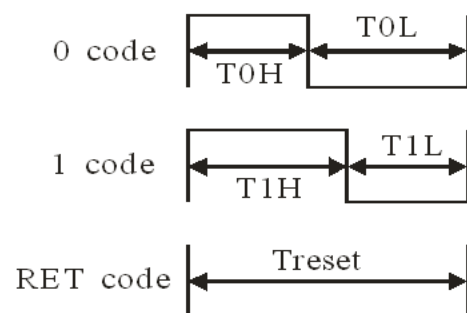
LED Characteristics

Parameter	Symbol	Color	Min.	Typ.	Max.	Unit	Condition (DC=12V)
Brightness	IV	Red	45	55	65	mcd	2.5mA
		Green	170	220	260		
		Blue	36	45	55		
Wavelength	λ_d	Red	620	622	625	nm	2.5mA
		Green	515	517	518		
		Blue	467	469	471		

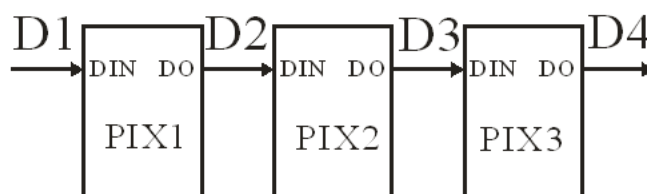
Data Transfer Time

T0H	0-code, High-level time	220ns~380ns
T1H	1-code, High-level time	580ns~840ns
T0L	0-code, Low-level time	900ns~5000ns
T1L	1-code, Low-level time	600ns~5000ns
RES	Frame unit, Low-level time	> 280 μ s
T_{DATA}	T0H+T0L、T1H+T1L	$\geq$ 1.25 μ s

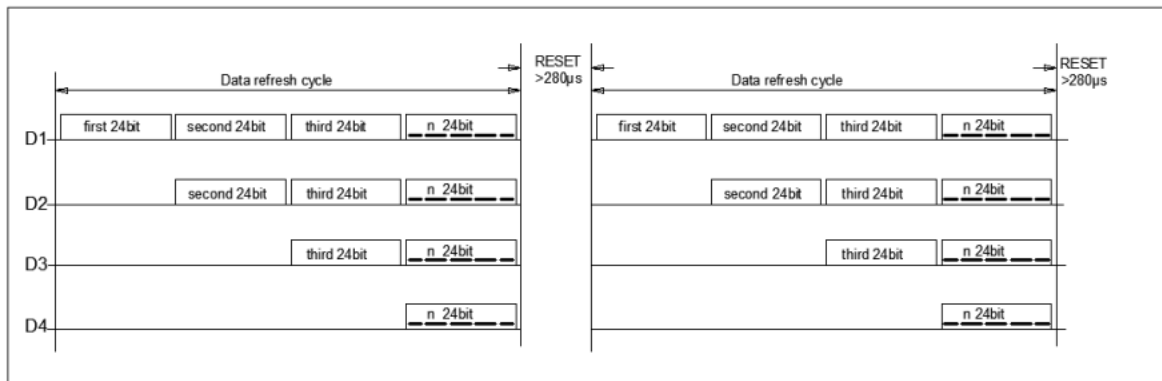
Sequence chart



Cascade method



Data Transmission Method



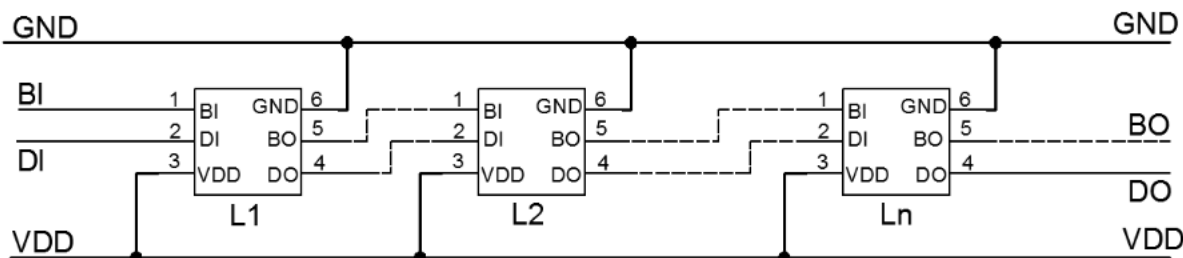
Note: D1 is the data from MCU, and D2, D3, D4 are from Cascade Circuits.

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



Depending on the power quality, a filter capacitor can be appropriately added between GND and VDD (it is recommended to take a value of 100nf).

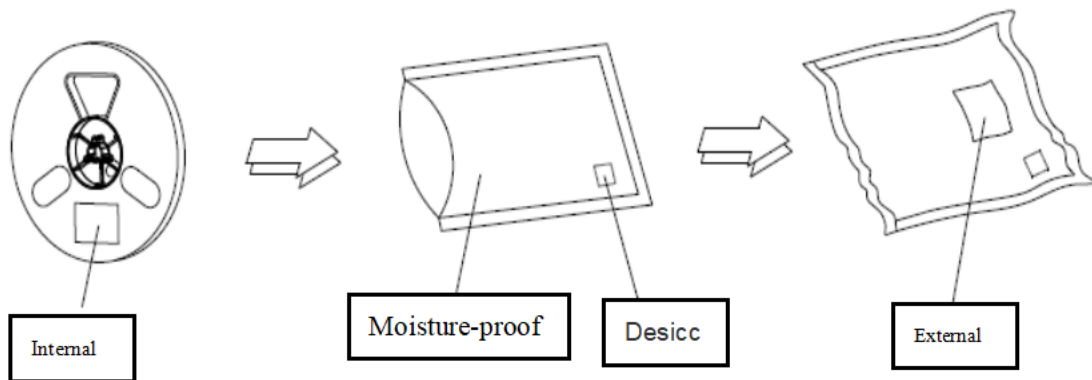
Remark:

1. DIN is the main input signal, and BIN is the bypass input signal. Under normal circumstances, the LED extracts signals from DIN. When one of the leds is damaged, the latter LED extracts the signal from BIN without affecting the signal transmission of the subsequent leds.
2. For finished led products application, the BIN pin of the first LED should not be left floating. It is recommended to connect it to GND.

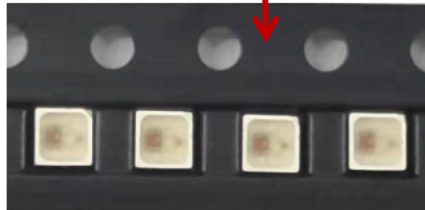
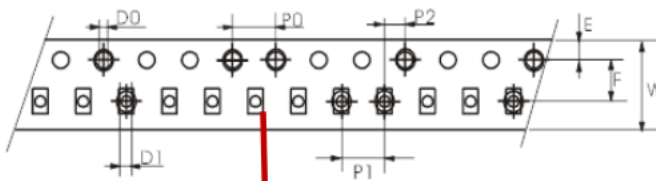
Packing Standard

Packing Standard

Packaging quantity: 4000PCS /Bag



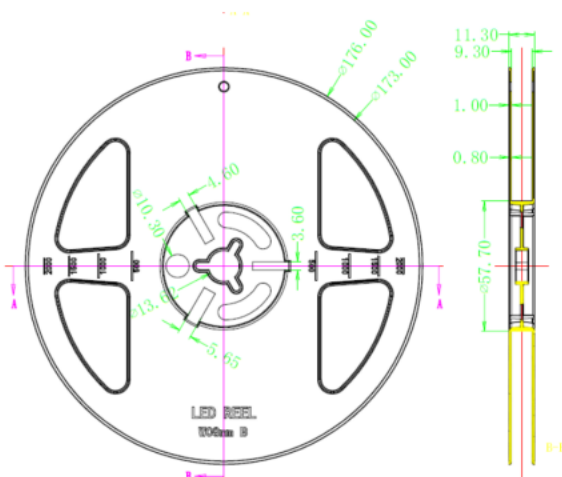
Tape Size (Unit: mm)



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 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
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 $70 \sim 75^{\circ}\text{C} \cong 24\text{H}$);

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;

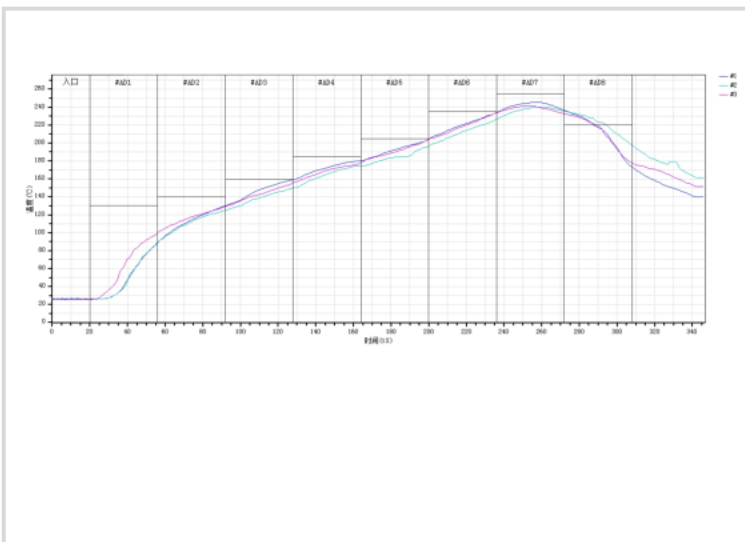
2.3.4 Bulk material LED, such as production surplus, machine material, maintenance material, can not be used directly if exposed to the air for a long time. It is recommended to be dehumidified and dried before being used.

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

3. SMT Reflow

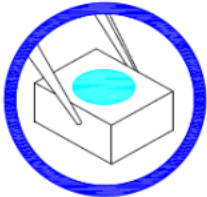
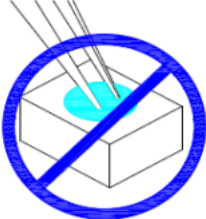
Refer to the parameters listed below, the experimental results prove that the TOP SMD LED meets the JEDEC J-STD-020C standards. As a general guideline, it is recommended to follow the SMT reflow temperature curve recommended by the solder paste manufacturer.

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



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	20221128	Hu Jin	Yin HuaPing
V1.1	M	Modification of optical parameters	20231124	Hu Jin	Yin HuaPing
V1.2	M	Modify High-level input, Operating and storage temperature, Static current description, Application circuit description	20250818	Chen YongZhao	Yin HuaPing
V1.3	M	Format adjustment	20260803	Chen YongZhao	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