

General description

Worldsemi New generation digital led is specially designed for high resolution display application,each channel with 16bit gray scale,4bit gamma correction inside ,can achieve 20bit display effect.With 10KHZ Port refresh frequency.

High-tech integrated digital led,no need any external components including capacitor;

Dual input and output signals, automatic switching to ensure reliability;

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 48bit 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 48bit. 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.

Features and Benefits

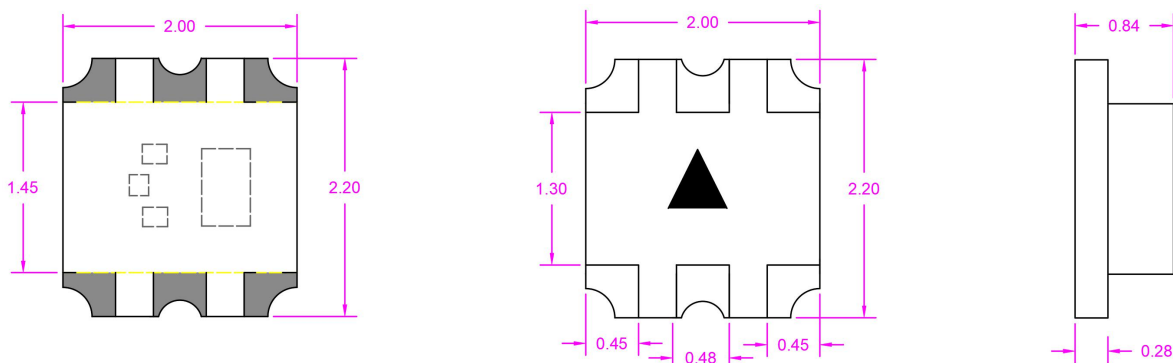
- The control integrated circuit and the LED share the only power source.
- Control circuit and RGB chip are integrated in a package of **2020** components, to form a complete addressable pixel.
- Built-in signal reshaping circuit, after wave reshaping to the next driver, ensure wave-form distortion not accumulate.
- Built-in electric reset circuit and power lost reset circuit.
- OUT R / G / B output gray level: R,G,B 65536 gray scale(Built-in 4Bit GAMMA correction).
- Port with 10KHz refresh frequency.
- Cascading port transmission signal by single line.
- 2.2mm*2.0mm*0.84mm,Super tiny size

Applications

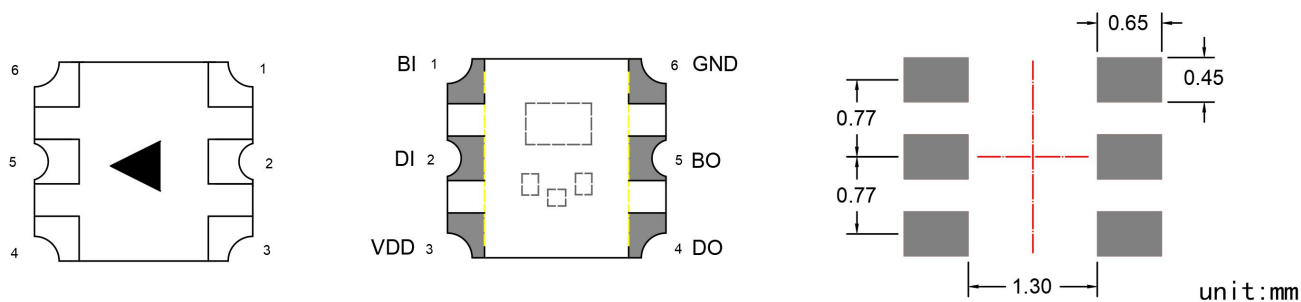
- LED transparent screen, LED pixel screen, LED special-shaped screen, various electronic products.

16Bit 3 Channel Constant current digital LED breakpoint continuous transmission LED light source

Mechanical Dimensions (Unit:mm)



PIN Configuration



Recommended pad size(Unit: mm)

PIN Function

NO.	Symbol	PIN	Function description
1	BI	Secondary DATA IN	Secondary data in PIN
2	DI	DATA IN	Control data signal input
3	VDD	POWER SUPPLY	Power supply
4	DO	DATA OUT	Control data signal output
5	BO	Secondary DATA OUT	Secondary data out PIN
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	V_{DD}	+3.7~+5.5	V
Logical Input Voltage	V_I	-0.3V~ $V_{DD}+0.7$	V
Quiescent Current	I_{DD}	<0.8	mA
Operation junction temperature	T_{opt}	-25~+85	$^{\circ}\text{C}$
Storage temperature range	T_{stg}	-40~+105	$^{\circ}\text{C}$

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

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Port output current	I_{out}	—	20	—	mA	OUTR+OUTG+OUTB
Input Current	I_I	—	—	± 1	μA	$V_I=V_{DD}/V_{SS}$
High-level input voltage	V_{IH}	$0.7V_{DD}$	—	—	V	
Low-level input voltage	V_{IL}	—	—	$0.3 V_{DD}$	V	
Hysteresis voltage	V_H	—	0.35	—	V	
Dynamic current consumption	IDD_{dyn}	—	0.7	1	mA	OUTR,OUTG,OUTB =OFF DO=open circuit
Power consumption	PD	—	—	250	mW	$T_a=25^{\circ}\text{C}$
Signal output sink current	I_{odo}	—	—	45	mA	

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition (Working current)
Transmission delay time	t_{PLZ}	—	—	300	ns	$CL=15\text{pF}$, DIN→DO, $RL=10\text{K}\Omega$
Fall time	t_{THZ}	—	—	120	μs	$CL=300\text{pF}$, OUTR/OUTG/OUTB
Input capacity	C_I	—	—	15	pF	—

LED Characteristics

Parameter	Symbol	Color	Test Condition: $V_{DD}=5\text{V}$			
			Min.	Typ.	Max.	Unit
Luminous intensity	IV	Red	210	285	360	mcd
		Green	400	520	650	
		Blue	70	90	120	
		Red	620	623	625	

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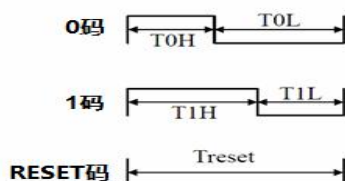
Wavelength	λ_d	Green	522	525	527	nm
		Blue	467	469	472	
Color Coordinate	CIE		-	0.30	-	/
			-	0.33	-	/
Luminous Angle	$\Theta_{1/2}$		-	120	-	Deg

Data Transfer Time

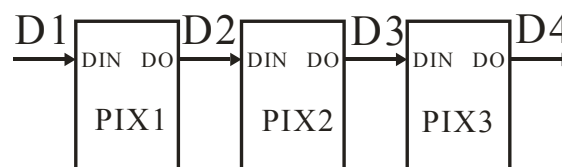
T0H	0 code, high voltage time	200ns~320ns
T1H	1 code, high voltage time	520ns~800ns
T0L	0 code, low voltage time	800ns~1.2 μ s
T1L	1 code, low voltage time	480ns-1 μ s
RES	Frame unit, low voltage time	> 280 μ s
Data Cycle: T0H+TOL \geq 1.25 μ s ; T1H+T1L \geq 1.25 μ s		

Timing waveform diagram

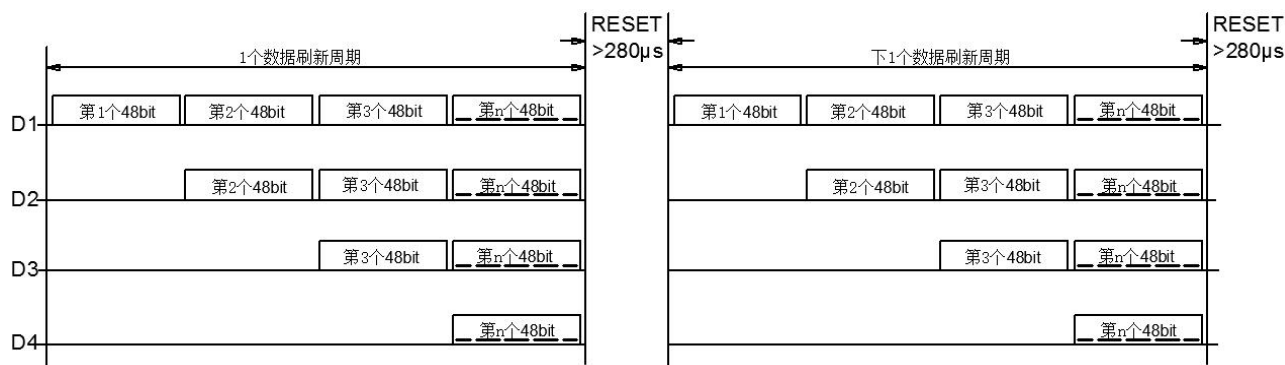
Sequence Chart



Cascade Method:



Data Transmission Method



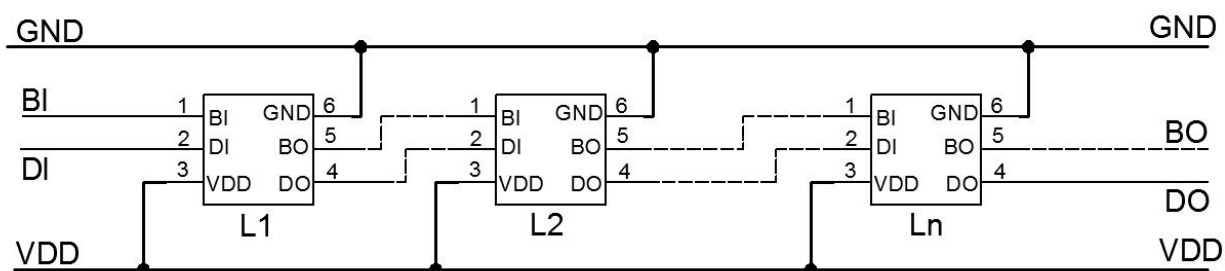
Note: The data of D1 is send by MCU, and D2, D3, D4 through pixel internal reshaping amplification to transmit.

Composition of 48bit Data

G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	…接下…	
…接上…	R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	…接下…
…接上…	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0	

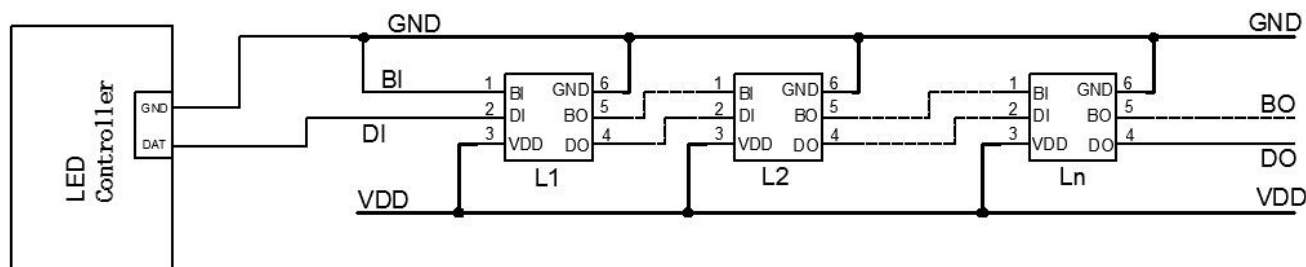
Note: Data transmit in order of GRB, high bit data at first.

Typical Application Circuit

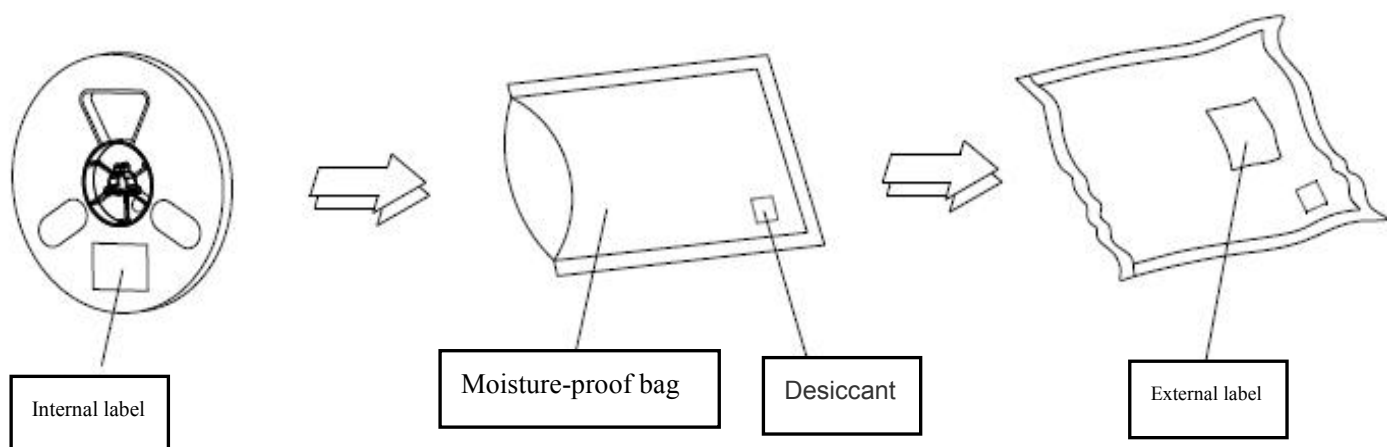


The peripheral circuit don't need to add filter capacitor.

Signal wiring diagram: The first LED BI is connected to GND

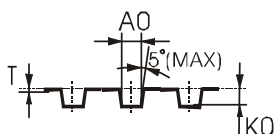
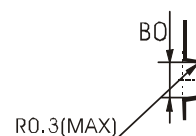
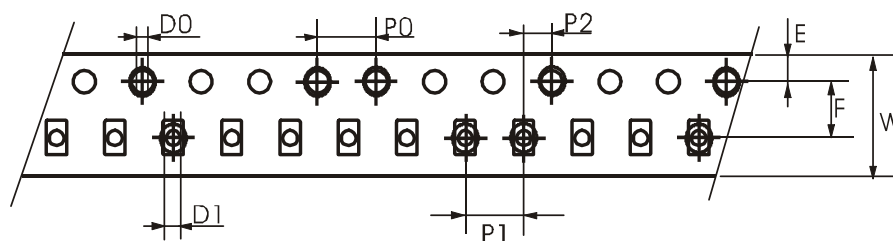


Packaging method



Carrier specification (Unit: mm)

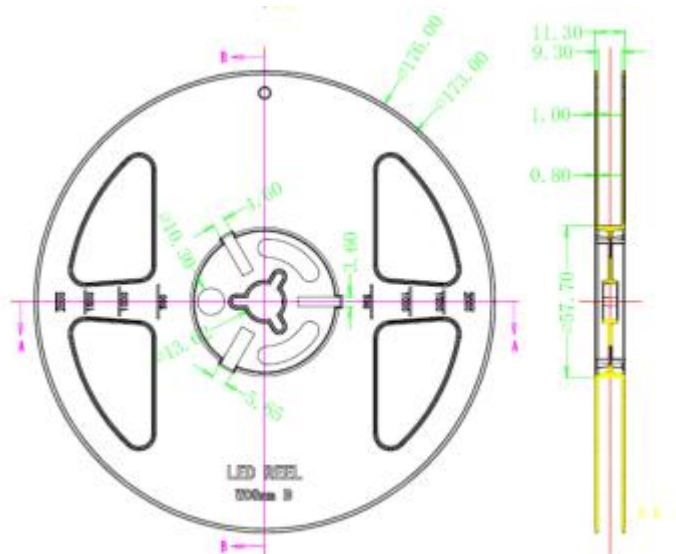
Inspector:



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 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.

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

MSL Level	Workshop Life	
	Time	Conditions
LEVEL1	Unlimited	$\leq 30^{\circ}\text{C}/85\%\text{RH}$
LEVEL2	1 Year	$\leq 30^{\circ}\text{C}/60\%\text{RH}$

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LEVEL2a	4 Weeks	$\leq 30^{\circ}\text{C}/60\%\text{RH}$
LEVEL3	168 Hours	$\leq 30^{\circ}\text{C}/60\%\text{RH}$
LEVEL4	72 Hours	$\leq 30^{\circ}\text{C}/60\%\text{RH}$
LEVEL5	48 Hours	$\leq 30^{\circ}\text{C}/60\%\text{RH}$
LEVEL5a	24 Hours	$\leq 30^{\circ}\text{C}/60\%\text{RH}$
LEVEL6	Take-out and Use immediately	$\leq 30^{\circ}\text{C}/60\%\text{RH}$

2.3 SMT requirements

2.3.1 It is recommended to unpack the LED before SMT and put the whole roll in the oven for dehumidification and drying ($70\sim 75^{\circ}\text{C}$ baking $\cong 24\text{H}$);

2.3.2 The product is taken out from the oven to the completion of high-temperature soldering (including multiple reflow soldering, immersion tin, wave soldering, heating maintenance and other high-temperature operations/operations), the time period is controlled within 24 (under $T < 30^{\circ}\text{C}$, $\text{RH} < 60\%$ conditions) ;

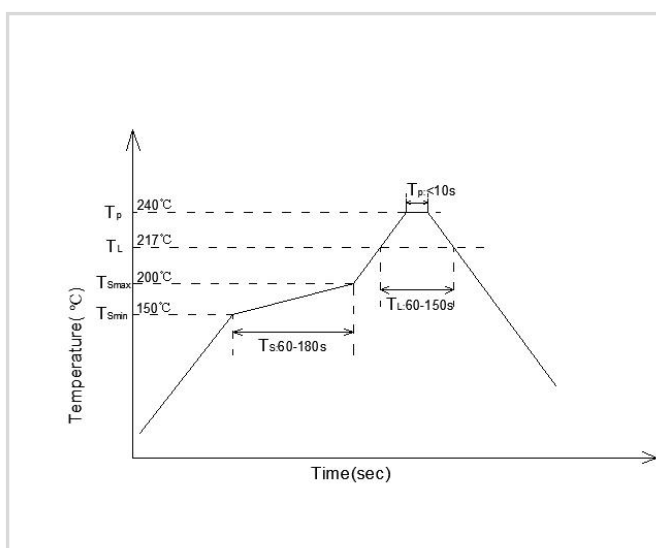
2.3.3 After the LED is attached to the PCBA after printing the solder paste, the SMT should be completed as soon as possible, and it is recommended not to exceed 1H;

2.3.4 Bulk LEDs such as production surplus, machine throwing materials, maintenance materials, etc., should not be used directly if they are exposed to the air for a long time. It is recommended to use them after dehumidification and drying. Whole roll baking: $70\sim 75^{\circ}\text{C}^* \cong 24\text{H}$ or bulk 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
The lowest preheat temperature (T_{Smin})	150°C
The highest preheat temperature (T_{Smax})	200°C
Preheating time (T_{Smin} to T_{Smax}) (t_{s})	60-180 S
Average rate of temperature rise (T_{Smax} to T_{p})	$< 3^{\circ}\text{C}/\text{S}$
LIQUID REGION temperature (T_{L})	217°C
LIQUID REGION Holding Time (t_{L})	60-150 S
Peak Temperature (T_{p})	240°C
High Temperature Region($T_{\text{p}}-5^{\circ}\text{C}$) Holding	$< 10\text{ S}$
Cooling Rate	$< 6^{\circ}\text{C}/\text{S}$
Room Temperature to Peak Holding Time	$< 6\text{ min}$

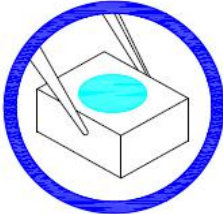
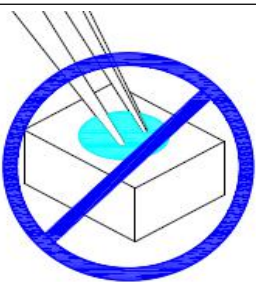
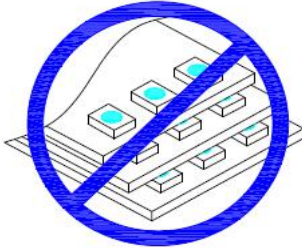



Remarks: 1. These general guidelines may not apply to all PCB designs and reflow soldering configurations.

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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-Official release	20201206	Shen JinGuo	Yin HuaPing