

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, RGB color balance 3:6:1, pretty suitable for large display screen image.

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

With high stability dual-signal function, more simple and convenient to design, performance more stable.

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.

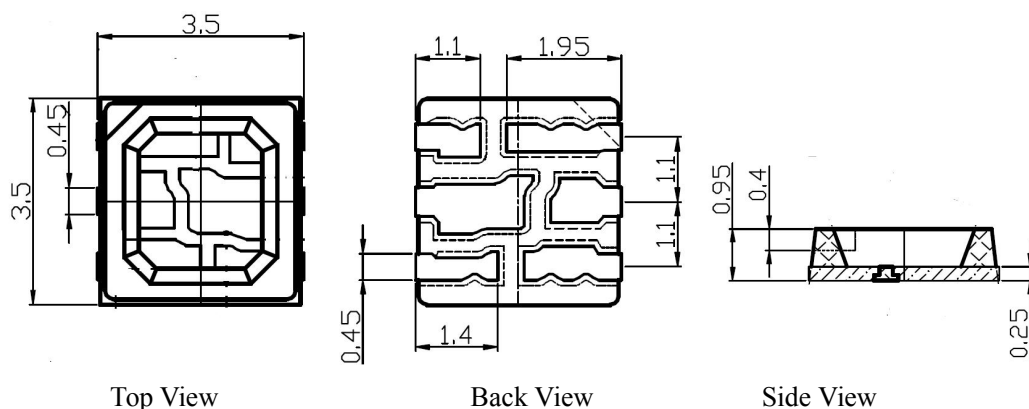
Features and Benefits

- The control integrated circuit and the LED share the only power source.
- Control circuit and RGB chip are integrated in a package of **3535** 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)
- RGB Port with 10KHz refresh frequency
- Cascading port transmission signal by single line.
- 3.5mm*3.5mm*1mm(L*W*H), Super tiny size
- Use standard display 3:6:1 brightness ratio color match.
- White light color temperature: 6000K±500

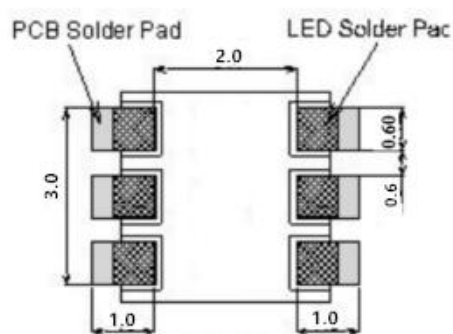
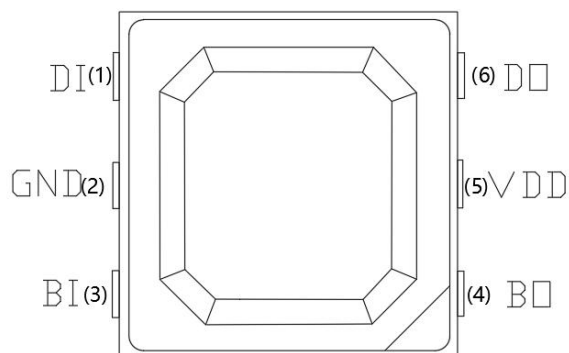
Applications

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

Mechanical Dimensions (Unit:mm)



PIN Configuration



Recommended pad size(Unit: mm)

PIN Function

NO.	Symbol	PIN	Function description
1	DI	DATA IN	Control data signal input PIN
2	GND	GROUND	Ground, data & power grounding
3	BIN	BIN	Backup data signal input
4	BO	BO	Backup data signal output
5	VDD	VDD	LED POWER SUPPLY, connect to “+5V”
6	DO	DO	Control data signal output

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}	0.7 V_{DD}	—	—	V	
Low-level input voltage	V_{IL}	—	—	0.3 V_{DD}	V	
Hysteresis voltage	V_H	—	0.35	—	V	
Dynamic current consumption	I_{DDdyn}	—	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	$CL=15\text{pF}$, $DIN \rightarrow DOUT$, $RL=10\text{K}\Omega$
Fall time	t_{THZ}	—	—	120	μs	$CL=300\text{pF}$, OUTR/OUTG/OUTB
Input capacity	C_I	—	—	15	pF	—

LED Characteristics

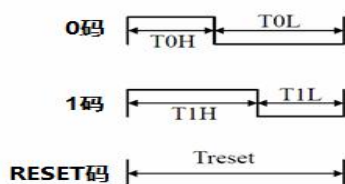
Parameter	Symbol	Color	Test Condition: VDD=5V			
			Min.	Typ.	Max.	Unit
Luminous intensity	IV	RED	220	320	420	mcd
		GREEN	620	720	820	
		BLUE	80	120	150	
Wavelength	λ_d	RED	620		625	nm
		GREEN	522		527	
		BLUE	470		475	
Color Coordinate	X	CCT: 6000K \pm 500		0.32		
	Y			0.33		
Luminous Angle			-	120	-	Deg

Data Transfer Time

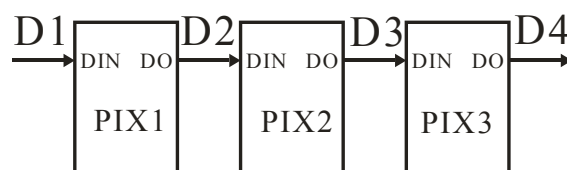
T0H	0 code, high voltage time	200ns~320ns
T1H	1 code, high voltage time	520ns~800ns
T0L	0 code, low voltage time	800ns~1.2 μ s
T1L	1 code, low voltage time	480ns~1 μ s
RES	Frame unit, low voltage time	>280 μ s
Data Cycle: T0H+T0L \geq 1.25 μ s; T1H+T1L \geq 1.25 μ s		

Timing waveform diagram

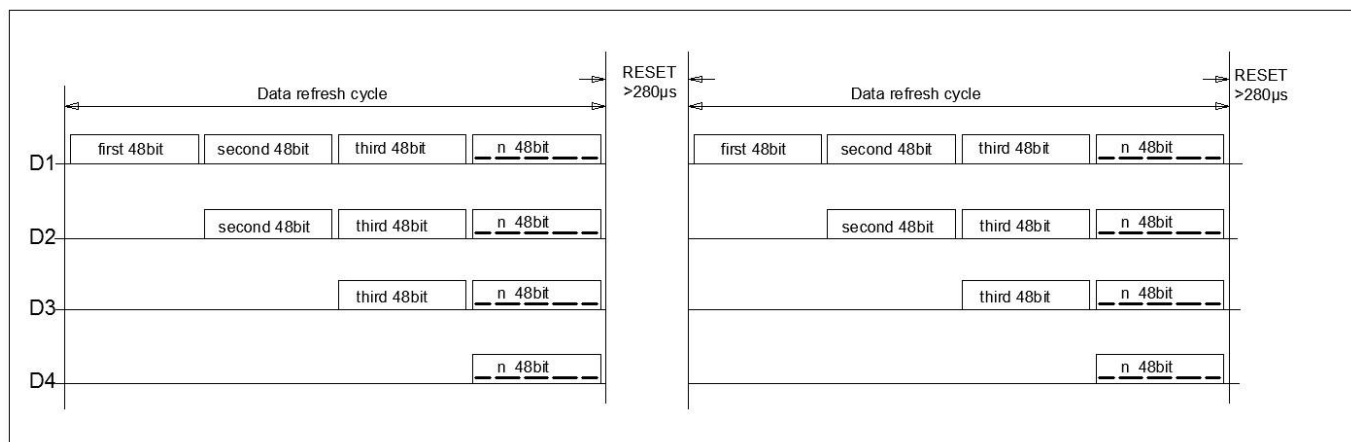
Sequence Chart



Cascade Method:



Data Transmission Method



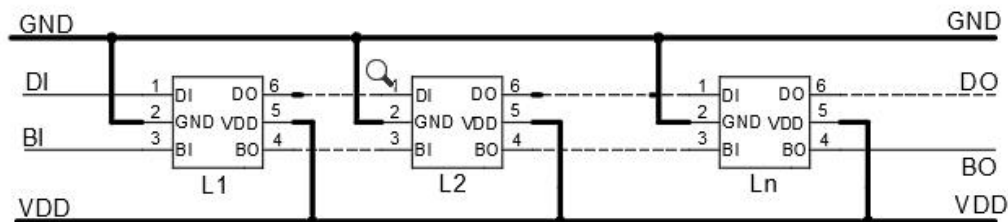
Note: The data of D1 is send by MCU, and D2, D3, D4 through pixel internal reshaping amplification to transmit.

Composition of 48bit Data

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4
D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23
G3	G2	G1	G0	R15	R14	R13	R12	R11	R10	R9	R8
D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35
R7	R6	R5	R4	R3	R2	R1	R0	B15	B14	B13	B12
D36	D37	D38	D39	D40	D41	D42	D43	D44	D45	D46	D47
B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0

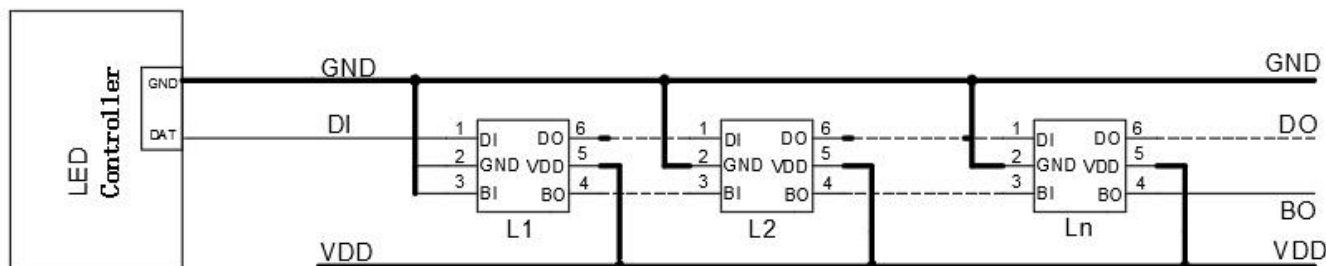
Note: Data transmit in order of GRB, high bit data at first.

Typical Application Circuit:



No need any external components;

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



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	$\leq 30^{\circ}\text{C}/85\%\text{RH}$
LEVEL2	1 Year	$\leq 30^{\circ}\text{C}/60\%\text{RH}$
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 patch description

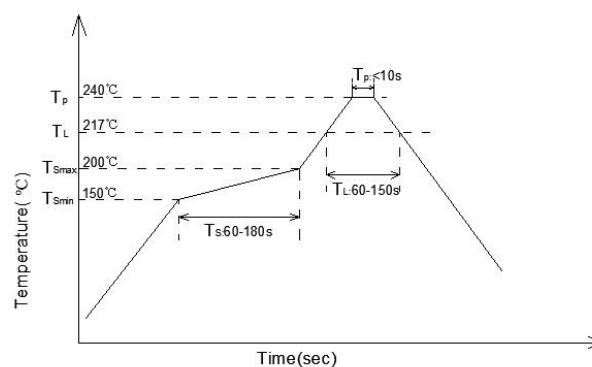
1. Please use it under the condition of $T < 30^{\circ}\text{C}$ and $\text{RH} < 60\%$;
2. The product opening period to the reflow soldering completion time period is controlled within 24H;
3. If time-out occurs, it is necessary to dehumidify and bake the LED.

2.4 Demand for dehumidification: $75^{\circ}\text{C}/>24\text{H}$

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.

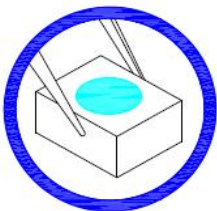
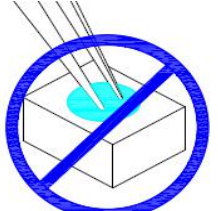
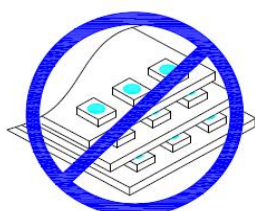

Curve Description	Lead-free
The lowest preheat temperature (T _{smin})	150°C
The highest preheat temperature (T _{smax})	200°C
Preheating time (T _{smin} to T _{smax}) (ts)	60-180 S
Average rate of temperature rise (T _{smax} to T _p)	<3°C/S
LIQUID REGION temperature (T _L)	217°C
LIQUID REGION Holding Time (t _L)	60-150 S
Peak Temperature (T _p)	240°C
High Temperature Region(T _p -5°C) Holding	<10 S
Cooling Rate	<6°C/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.

3. 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	20200503	Shen JinGuo	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.