



WS2913F

Single wire, 65536 grayscale, 3 Channels Constant Current LED Drive IC

Main Features

- The **OUTR, G, B** ports withstand a voltage of **40V**, while the **DIN, DOUT** port withstands **24V**.
- The chip includes a built-in voltage regulator; for power supplies below **36V**, simply connect a resistor in series to the **VDD** pin—no external regulator is required.
- The chip is equipped with an internal resistor. The **DIN** and **DOUT** ports have over-voltage protection, so a momentary short-circuit of **24V** will not cause burnout.
- Grayscale adjustment circuit (65,536 levels of grayscale adjustable).
- The device features a built-in signal shaping circuit that processes signals into optimized waveforms before output, preventing cumulative waveform distortion along the transmission path.
- Built-in power-on reset and power-off reset circuits.
- The PWM control unit supports 65536-level adjustment with a scanning frequency of **2KHz**.
- A serial interface cascaded interface that enables data reception and decoding via a single signal line.
- The transmission distance between any two points does not exceed 4 meters without requiring additional circuits.
- When the refresh rate is 30 frames per second, the number of cascades can be at least 400 points.
- Data transmission speed can reach up to 800 Kbps.

Main Applications

- LED full-color decorative lighting, such as LED strings, LED strips, LED modules, etc.
- Indoor/outdoor LED video or irregular screens.
- LED consumer electronic products.
- Various LED lighting products.

Product Overview

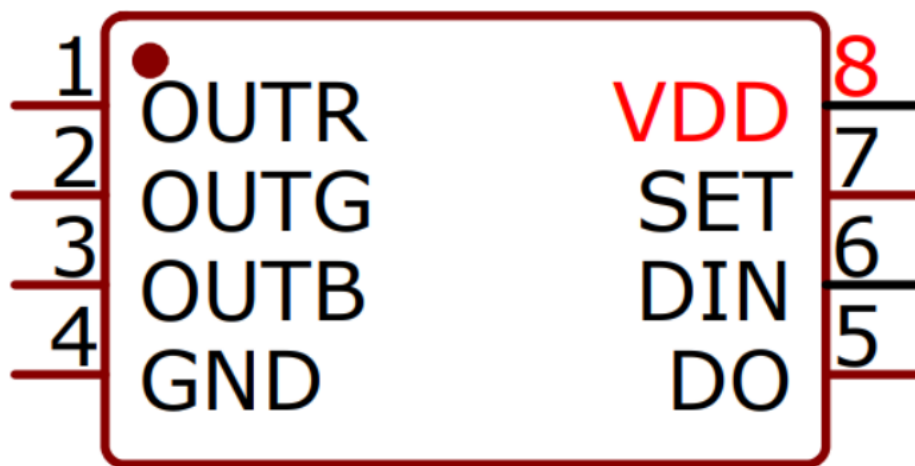
The **WS2913F** is 3 output channels special for LED driver circuit. Its internal includes intelligent digital port data latch and signal reshaping amplification drive circuit. Also include a precision internal oscillator and a **40V** voltage programmable constant current output drive. At the same time, to reduce the power supply ripple, the **OUTR, G, and B** channels have a delayed conduction function. During frame refreshing, this can lower the circuit ripple.

IC use single single wire RZ protocol. After the chip power-on reset, the **DIN** port receive data from controller, the first IC 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 IC through the **DO** port. After transmission for each chip, the signal will reduce **48bit**. IC adopt auto reshaping transmit technology, making the chip cascade number is not limited the signal transmission, only depend on the speed of signal transmission.

The data latch inside the chip generates different duty cycle control signals at the **OUTR, OUTG, and OUTB** control terminals based on the received **48-bit** data. When a **RESET** signal is input at the **DIN** terminal, all chips synchronously send the received data to each segment. After the signal ends, the chips will receive the data again. After receiving the

initial **48-bit** data, the data port is forwarded through the DO port. Before the chip receives the RESET code, the original output of the OUTR, OUTG, and OUTB pins remains unchanged. When a low-level RESET code above **280 μ s** is received, The chip outputs the **48-bit** PWM data pulse width just received to the OUTR, OUTG, and OUTB pins.

PIN configuration



PIN function

NO.	Symbol	PIN	Function description
1	OUTR	LED Driver Output	Output of RED PWM control
2	OUTG	LED Driver Output	Output of GREEN PWM control
3	OUTB	LED Driver Output	Output of BLUE PWM control
4	DO	DO	Data Output
5	DIN1	Data1 Input	Control data1 input
6	GND	Ground	Data & Power Grounding
7	DIN2	Data1 Input	Control data2 input
8	VDD	Power Voltage	IC power supply

Note: When the SET pin is left floating, it is 8-bit and fully compatible with WS2811. When connected to VDD, it is 16-bit.

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

Parameter	Symbol	Ratings	Unit
Logical Power Supply Voltage	V_{DD}	+3.5~+5.8	V
R/G/B Channel Output Port Withstand Voltage	V_{OUT}	$V_{SS}-0.7\sim 40$	V
DIN withstand voltage	V_I	$V_{SS}-0.7\sim 24$	V
DOUT withstand voltage	V_O	$V_{SS}-0.7\sim 24$	V
Working Temperature	T_{opt}	-40~+85	$^{\circ}\text{C}$
Storage Temperature Range(Only for the IC itself, excluding packaging materials)	T_{stg}	-40~+85	$^{\circ}\text{C}$

Electrical parameters ($T_A=25^{\circ}\text{C}$, $V_{DD}=4.5\sim 5.5\text{V}$, $V_{SS}=0\text{V}$)

Parameter	Symbol	Min	Tpy	Max	Unit	Conditions
Quiescent current	I_O	—	0.6	—	mA	DC=5V
R、G、B Low-level output current	I_{OL}	15.0	17.0	19.0	mA	DC=5V, DIN (FFH)
Current difference/ single RGB chip	Dif	—	—	1.5	mA	DC=5V, DIN
Low-level output current	I_{dout}	10	—	—	mA	$V_O=0.4\text{V}$, D_{OUT}
Input Current	I_I	—	—	± 1	μA	$V_I=V_{DD}/V_{SS}$
High-level input	V_{IH}	$0.55V_{DD}$	—	—	V	D_{IN}
Low-level input	V_{IL}	—	—	$0.3 V_{DD}$	V	D_{IN}
Lagging voltage	V_H	—	0.35	—	V	D_{IN}

Switching characteristics ($T_A=25^{\circ}\text{C}$, $V_{DD}=4.5\sim 5.5\text{V}$, $V_{SS}=0\text{V}$)

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	占空比50%
Input capacity	C_1	—	—	15	pF	—

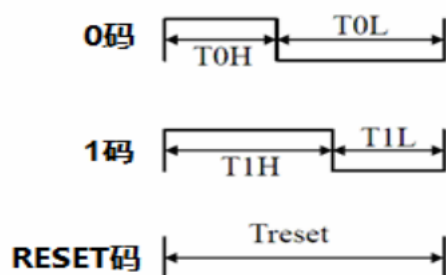
Data Transmission Time

T0H	0 code, high level duration	220ns~380ns
T1H	1 code, high level duration	580ns~1us
T0L	0 code, low-level duration	580ns~1us
T1L	1 code, low-level duration	580ns~1us
RES	Frame unit, low-level duration	>280 μs

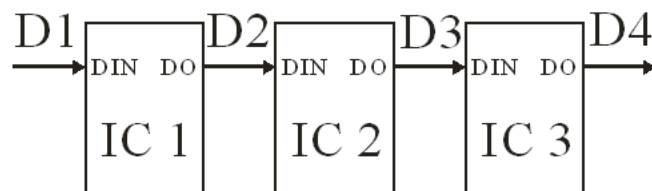
$T0H+T0L$, $T1H+T1L \geq 1.25\mu\text{s}$

Timing Waveform Chart

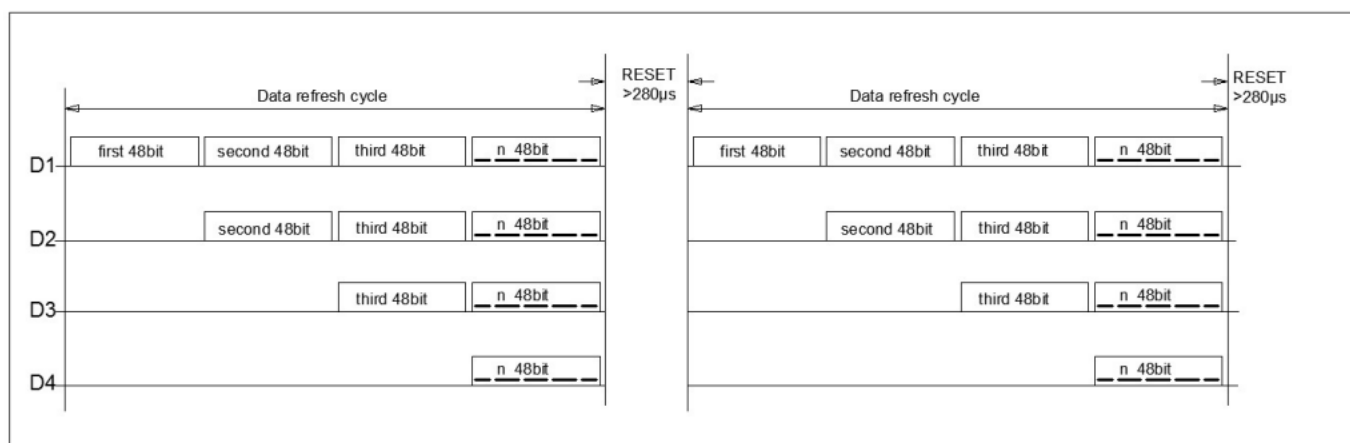
Sequence Chart



Cascade Method



Data Transmission Method



Note: D1 represents data transmitted by the MCU, while D2, D3, and D4 denote data automatically shaped and forwarded by the cascaded circuit.

16bit current gain data structure

Data transmit in order of RGB, high bit data at first.

IR4	IR3	IR2	IR1	IR0	IG4	IG3	IG2	IG1	IG0	IB4	IB3	IB2	IB1	IB0	校验码
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Note: To verify the number, please send "1".

Composition of 48bit Data

R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	...Continued...
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...Continued...	G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	...Continued...
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...Continued...	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
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Note: Data transmit in order of RGB, high bit data at first.

Current gain

Current gain setting	RGB current (mA)
0	0.00
1	0.57
2	1.18
3	1.77
4	2.40
5	2.96
6	3.56
7	4.14
8	4.68
9	5.25
A	5.84
B	6.40
C	6.99
D	7.55
E	8.13
F	8.67
10	9.21
11	9.77
12	10.36
13	10.90
14	11.49
15	12.02
16	12.60
17	13.12
18	13.61
19	14.14
1A	14.71
1B	15.23
1C	15.79
1D	16.30
1E	16.86
1F	17.36

Typical Application Circuit

1. Power supply voltage $VCC=5V$ (each channel with 1 LED) :

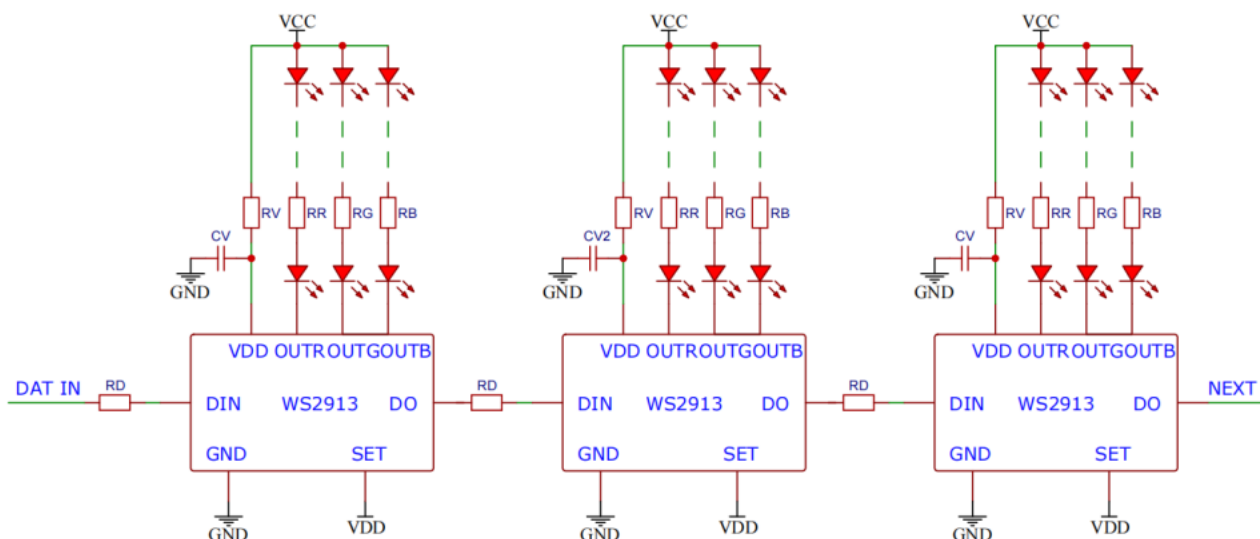
The recommended values for RV and CV are 150R and 1uF respectively. The WS2913 is compatible with the earlier 5V WS2811 application circuit and can operate normally at a CV of 100R.

2. Power supply voltage $VCC=12V$ (each channel with 3 leds) :

The recommended values for RV and CV are 4.7k and 1uF respectively. The WS2913 is compatible with the earlier 12V WS2811 application circuit and will operate normally under the CV of 2.7k RV.

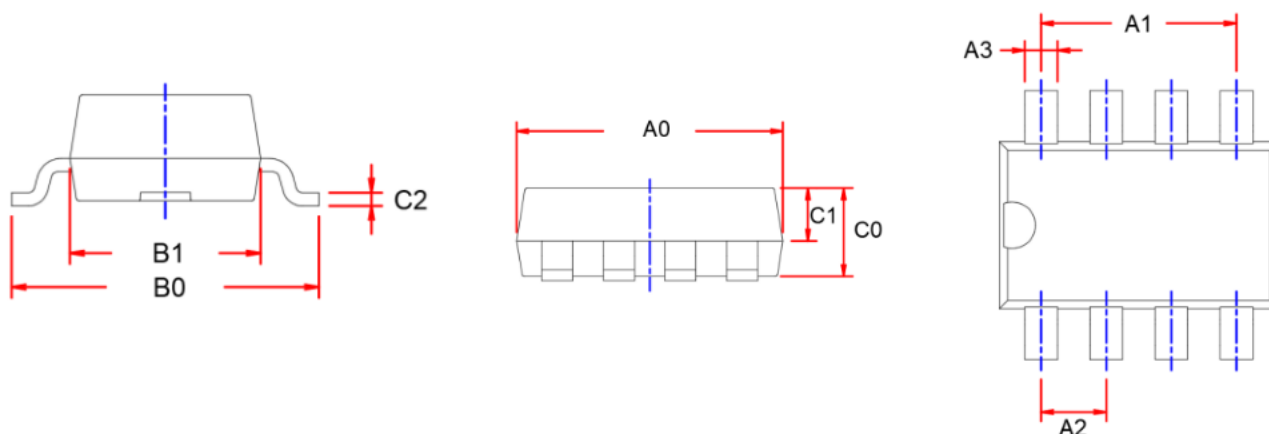
3. Power supply voltage $VCC=24V$ (each channel with 6 leds) :

The recommended values for RV and CV are 10k and 1uF respectively. The WS2913 is compatible with the earlier 24V WS2811 application circuit and can operate normally at a CV of 7.5k RV.



Package information

● SOT23-8 Package



Dimension Position	Position Name	Typical size(mm)
A0	Total length	3.25
A1	Total PIN distance	2.40
A2	Single PIN distance	0.80
A3	PIN Width	0.35
B0	Total Width	2.85
B1	Colloid width	1.65
C0	Colloid height	1.00
C1	Bonding wire height	0.55
C2	PIN thickness	0.15



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Modify Records

Version №	Status Bar	Modify Content Summary	Date	Reviser	Approved
V1.0	N	New(Separated from WS2913)	20260714	Chen YongZhao	Yin Huaping
V1.1	N	Update Logo,Format adjustment	20260731	Chen YongZhao	Yin Huaping

Remarks: Initial version: V1.0; Version number plus "0.1" after each revision;

Status bar: N--New, A--Add, M--Modify, D--Delete.