

Main Features

- OUTR、G、B、W1 ports compression 35V. DOUT、DIN port withstand voltage 24V
- Built-in voltage-regulator tube, only a resistor needed in series to VDD, no need external regulator.
- Built-in resistors, DIN&DOUT have over voltage protection. Instantaneous short-circuiting to 24V won't cause damage.
- Gray-scale adjustment circuit (65,536 levels gray-scale adjustable). The refresh frequencies of the R, G, B, W1, W2 output ports are up to 2 KHz.
- Built-in signal shaping circuit. After receiving signal, any IC will shape the waveform before outputting it, ensuring that waveform distortion does not accumulate along the circuit.
- Built-in power-on reset and power-off reset circuits.
- The PWM control terminal can achieve 65,536 levels adjustment.
- Serial interface and cascading interface, capable of receiving and decoding data through a single signal line.
- Any two pixel's distance less than 4 Meters' transmission signal without any increase circuit.
- When the refresh rate is 30fps, the cascading number is no less than 400 pixels.
- The data transmission speed can reach 800Kbps.
- W1 and W2 connected in parallel can achieve a current of 120mA.

Main Applications

- Full-color LED 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.

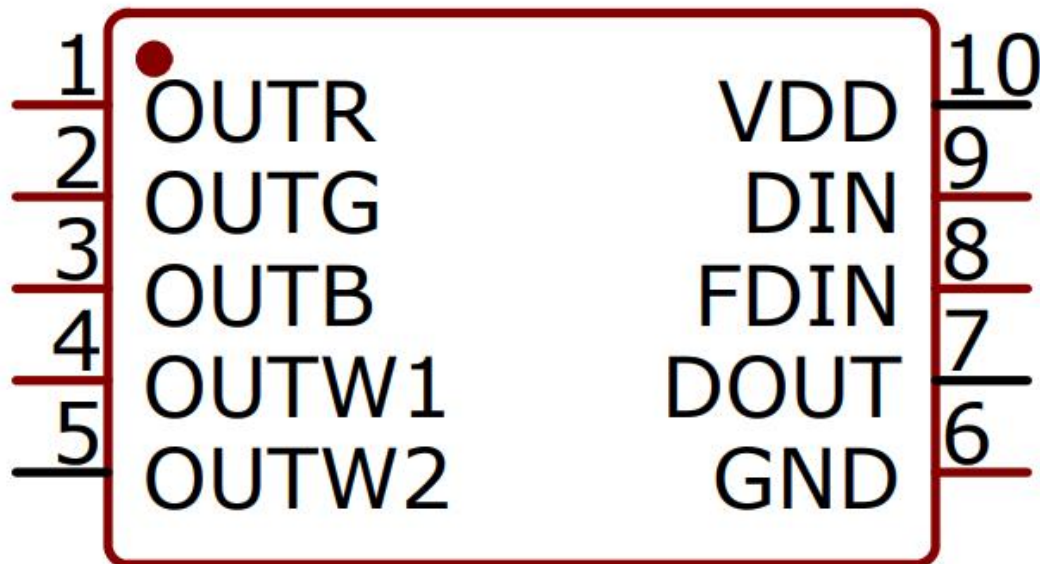
General description

WS2914 is a dedicated circuit for four-channel LED drive control. The chip contains intelligent digital interface, data latch, signal shaping, and amplification, as well as an internal oscillator and a 20V high-voltage programmable constant current output driver. To reduce power supply ripple, OUTR, G, B, W1 channels have a delayed turn-on function. During frame refreshing, it can reduce circuit ripple.

IC use single NZR communication mode. After the chip power-on reset, the DIN port receives data from controller, the first IC collects initial 64 bits 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. With each chip transmission, the signal reduces by 64bits. IC adopts auto reshaping transmit technology, making the chip cascade number not limited by the signal transmission, only depend on the speed of signal transmission.

The data latch inside IC generates different duty cycle control signals at the OUTR, G, B, W1 control terminals based on the received 64-bit data. When the DIN terminal receives the RESET signal, all chips synchronously send the received data to each segment. IC will receive the data after the signal ends and forward the data through the DO port. Before receiving the RESET code, the OUTR, OUTG, OUTB, OUTW1 pins of the chip maintain the original output. When receiving a RESET code more than 280μs, the chip will output the 64-bit PWM data pulse width to the OUTR, OUTG, OUTB, OUTW1 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	OUTW1	LED Driver Output	Output of WHITE W1 PWM control
5	OUTW2	LED Driver Output	Output of WHITE W2 PWM control
6	GND	Ground	Data & Power Grounding
7	DOUT	DO	Data Output
8	FDIN	Data2 Input	Control data2 input
9	DIN	Data1 Input	Control data1 input
10	VDD	Power Voltage	IC power supply

Single line 65536 Gray level 4 channel Constant current LED driver IC

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

Parameter	Symbol	Ratings	Unit
Power Supply Voltage	V_{DD}	+3.5~+5.7	V
R、G、B、W1 Channel Output Port Withstand Voltage	V_{OUT}	$V_{SS}-0.7\sim 35$	V
DIN Logical Input Voltage	V_I	$V_{SS}-0.7\sim 24$	V
DOUT Logical Input Voltage	V_O	$V_{SS}-0.7\sim 24$	V
Working Temperature	T_{opt}	-40~+85	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	-40~+85	$^{\circ}\text{C}$

Electrical 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	Conditions
Static current	I_O	—	0.3	—	mA	DC=5V
R、G、B Low voltage output current	I_{OL}	28	30	35	mA	DC=5V, DIN(FFH)
W1 Low voltage output current	I_{OL}	58	60	70	mA	DC=5V, DIN(FFH)
W1 W2 Parallel connection low voltage output current	I_{OL}	—	120	150	mA	DC=5V, DIN(FFH)
Low voltage 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 voltage input	V_{IH}	$0.60V_{DD}$	—	—	V	D_{IN}
Low voltage input	V_{IL}	—	—	$0.3 V_{DD}$	V	D_{IN}
Hysteresis voltage	V_H	—	0.35	—	V	D_{IN}

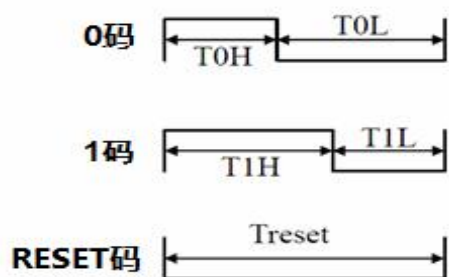
Switching characteristics ($T_A=25^{\circ}\text{C}$, $V_{DD}=4.5\sim 5.5\text{V}$, $V_{SS}=0\text{V}$)

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	Pulse width ratio: 50%
Input capacity	C_I	—	—	15	pF	—

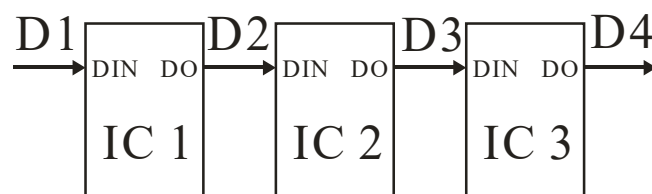
Data Transfer Time

T0H	0 code, high voltage time	220ns~380ns
T1H	1 code, high voltage time	580ns~1us
T0L	0 code, low voltage time	580ns~1us
T1L	1 code, low voltage time	580ns~1us
RES	Frame unit, low voltage time	>280μs
T0H+T0L, T1H+T1L ≥ 1.25μs		

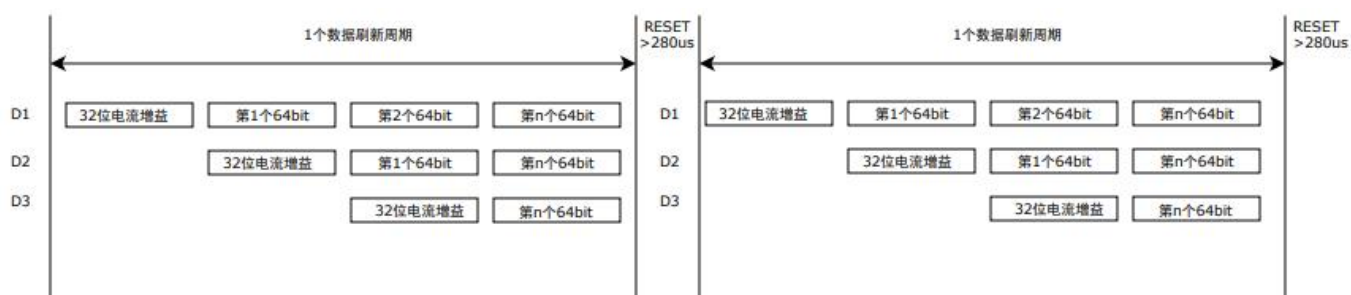
Sequence Chart



Cascade Method



Data Transmission Method



Note: D1 represents the data sent by the MCU end, while D2, D3, D4 are the data automatically processed and forwarded by the cascaded circuit.

4-channel data structure

RI4	RI3	RI2	RI1	RI0	GI4	GI3	GI2	GI1	GI0	BI4	BI3	BI2	BI1	BI0	W1I 4
W1I 3	W1I 2	W1I 1	W1I 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0	Check digit 0
R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R2	R0
G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
W1_ 15	W1_ 14	W1_ 13	W1_ 12	W1_ 11	W1_ 10	W1_ 9	W1_ 8	W1_ 7	W1_ 6	W1_ 5	W1_ 4	W1_ 3	W1_ 2	W1_ 1	W1_ 0

Note: Note:Data transmit in order of RGBW1, high bit data at first

Typical Application Circuit

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

The recommended values for RV and CV are 150R and 0.1uF respectively.

WS2914 is compatible with the earlier 5V WS2814 application circuit and can operate normally at 100R.
(RR, RG, RB, RW1, RD do not require series resistors)

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

The recommended values for RV and CV are 4.7k and 0.1uF respectively.

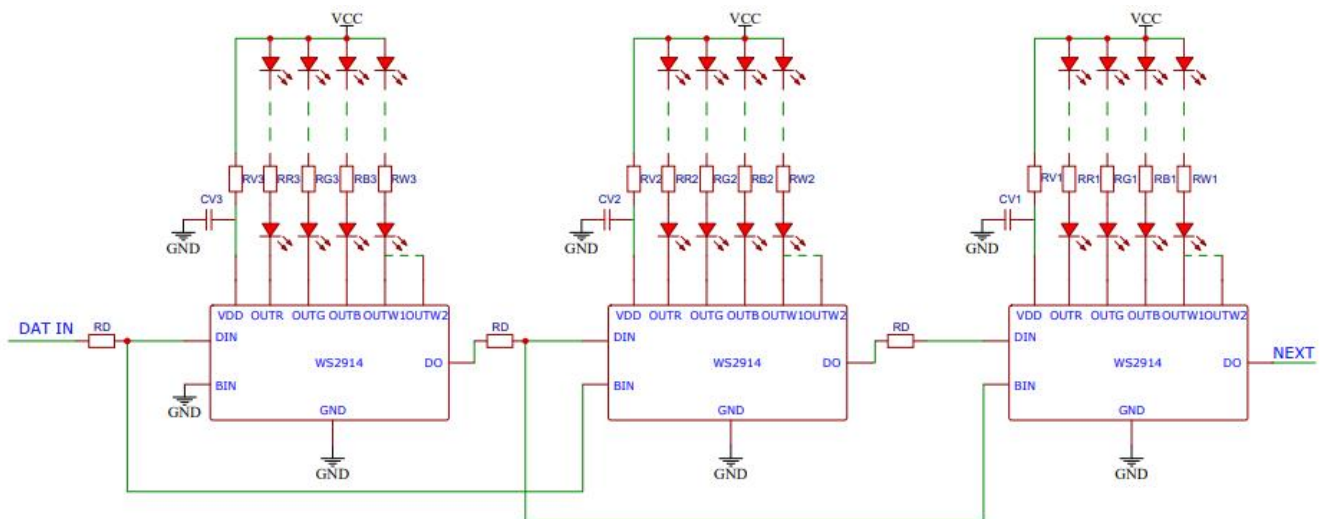
WS2914 is compatible with the earlier 12V WS2814 application circuit and can operate normally at 2.7k.
(RR, RG, RB, RW1 do not require series resistors, RD signal resistor recommended as 75R)

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

The recommended values for RV and CV are 10k and 0.1uF respectively.

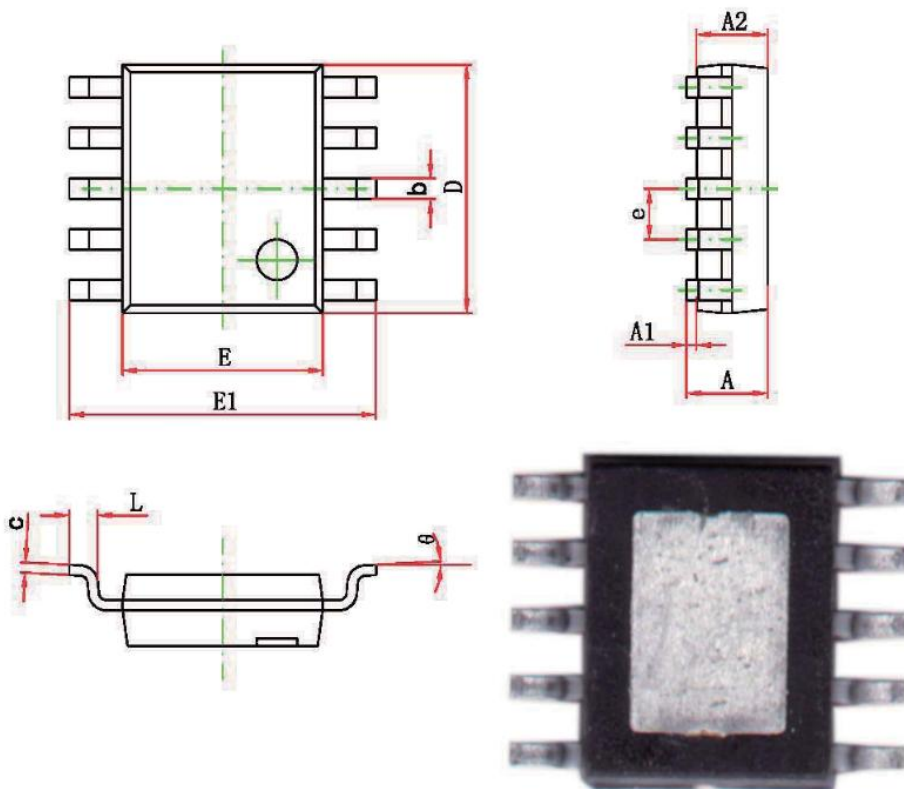
WS2914 is compatible with the earlier 24V WS2814 application circuit and can operate normally at 7.5k.
(RR recommended resistance as 300R, RG, RB recommended resistances as 100R, RW1 recommended resistance as 51R, RD signal resistor recommended as 150R)

WS2914 Application Circuit



Package information

- ESOP10 Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0	0.100	0	0.004
A2	1.350	1.550	0.053	0.061
b	0.300	0.450	0.012	0.018
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.000 (BSC)		0.039 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	1°	8°

Modify Records

Version №	Status Bar	Modify Content Summary	Date	Reviser	Approved
V1.0	N	New	20240801	He WenBin	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.