
WS2811C

Single-line 256-level grayscale three-channel constant current LED driver IC

Main feature

- The R, G, and B output ports can withstand 24V, and the DIN port can withstand 9.5V.
- The chip has a built-in voltage regulator. For power supplies below 24V, only a resistor needs to be connected to the IC VDD pin, without an external voltage regulator.
- Grayscale adjustment circuit (256 grayscale levels are adjustable).
- Built-in signal shaping circuit. After any IC receives a signal, it undergoes waveform shaping before outputting it, ensuring that line waveform distortion will not accumulate.
- Built-in power-on reset and power-off reset circuits.
- The PWM control end can achieve 256-level adjustment, with a scanning frequency of 2KHz.
- The serial interface cascade interface can complete data reception and decoding through a signal line.
- The transmission distance between any two points does not exceed 5 meters without adding any circuit.
- When the refresh rate is 30 frames/second, the number of cascades is not less than 1024 points.
- The data transmission speed can reach 800Kbps.

Main application areas

- LED full-color luminous character light string, LED full-color module.
- LED full-color soft light bar, hard light bar, LED guardrail tube.
- LED point light source, LED pixel screen, LED special-shaped screen.
- Various electronic products, electrical equipment marquee.
- Other various LED lighting products.

Product Overview

WS2811C is a three-channel LED drive control dedicated circuit. The chip contains an intelligent digital interface data latch signal shaping and amplification drive circuit, a high-precision internal oscillator and a 20V high-voltage programmable constant current output driver. At the same time, in order to reduce power supply ripple, the three channels have a certain delay conduction function, so that the circuit ripple can be reduced when the frame is refreshed.

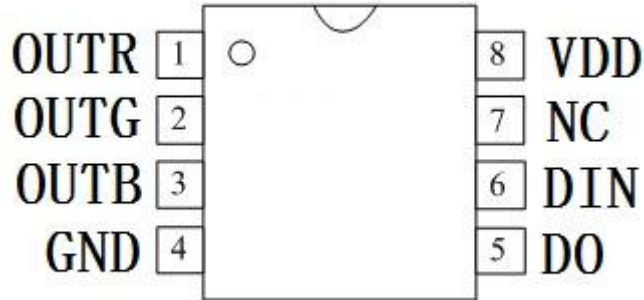
The chip adopts a single-line return-to-zero code communication method. After the chip is powered on and reset, the DIN end receives the data transmitted from the controller. The first 24-bit data sent is extracted by the first chip and sent to the data latch inside the chip. The remaining data is shaped and amplified by the internal shaping processing circuit and then forwarded to the next cascade chip through the DO port. After each chip is transmitted, the signal is reduced by 24 bits. The chip adopts automatic shaping and forwarding technology, so that the number of cascades of the chip is not limited by signal transmission, but only by the signal transmission speed requirements.

The data latch inside the chip generates different duty cycle control signals at the OTR, OUTG, and OUTB control terminals according to the received 24-bit data. When waiting for the RESET signal to be input at the DIN terminal, all chips will synchronously send the received data to each segment. The chip will re-receive the data after the signal ends. After receiving the initial 24-bit data, it will forward the data port through the DO port. Before the chip receives the RESET code, the original output of the OTR, OUTG, and OUTB pins remains unchanged. After receiving a low-level RESET code of more than 280 μ s, the chip will output the 24-bit PWM data pulse width just received to the OTR, OUTG, and OUTB pins.

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Pin Configuration



Pin function

Pin number	Pin Symbols	Pin name	Function description
1	OUTR	LED driver output	RED (red) PWM control output
2	OUTG	LED driver output	GREEN PWM control output
3	OUTB	LED driver output	BLUE (blue) PWM control output
4	GND	Ground	Signal ground and power ground
5	DO	Data output	Display data cascade output
6	DIN	Data input	Display data input
7	NC	Null pin	Null pin
8	VDD	Logic Power Supply	IC power supply

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

Parameter	Symbol	Range	Unit
Logic supply voltage	V_{DD}	+3.5~+5.5	V
R, G, B output port withstand voltage	V_{OUT}	20	V
Logic input voltage	V_I	$V_{DD}-0.7\sim V_{DD}+0.7\text{V}$	V
Operating temperature	T_{opt}	-40~+80	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-40~+85	$^{\circ}\text{C}$

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

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
R, G, B low level output current	IOL	30	34	38	mA	
Low level output current	Idout	10	—	—	mA	$V_o=0.4\text{V}$, DOUT
Signal input current	II	—	—	± 1	μA	$V_I=V_{DD}/V_{SS}$
High level input	V _{IH}	0.7V _{DD}	—	—	V	DIN
Low level input	V _{IL}	—	—	0.3 V _{DD}	V	DIN
Hysteresis voltage	V _H	—	0.35	—	V	DIN

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

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
Oscillation frequency	<i>Fosc</i>	—	800	—	KHz	—
Transmission delay time	t _{PLZ}	—	—	300	ns	$C_L=15\text{pF}$, DIN→DOUT, $R_L=10\text{K}\Omega$
Fall time	t _{THZ}	—	—	120	μs	$C_L=300\text{pF}$, OUTR/OUTG/OUTB
Fall time Data transfer rate	<i>FMAX</i>	600	—	—	Kbps	Duty cycle 50%
Input capacitance	C _I	—	—	15	pF	—

Data transmission time

T _{0H}	0 code, High level time	220ns~380ns
T _{1H}	1 code, High level time	580ns~1us
T _{0L}	0 code, Low level time	580ns~1us
T _{1L}	1 code, Low level time	580ns~1us
RES	Frame unit, low level time	280 μs or more

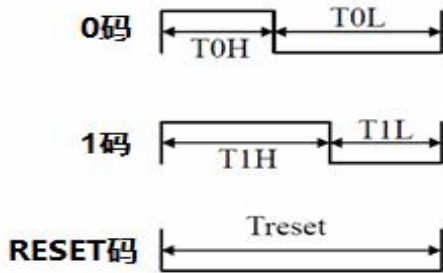
Data cycle: $T_{1H}+T_{1L}$ 、 $T_{0H}+T_{0L} \geq 1.25\mu\text{s}$

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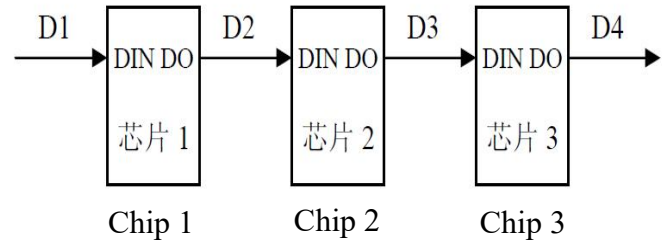
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Timing waveform

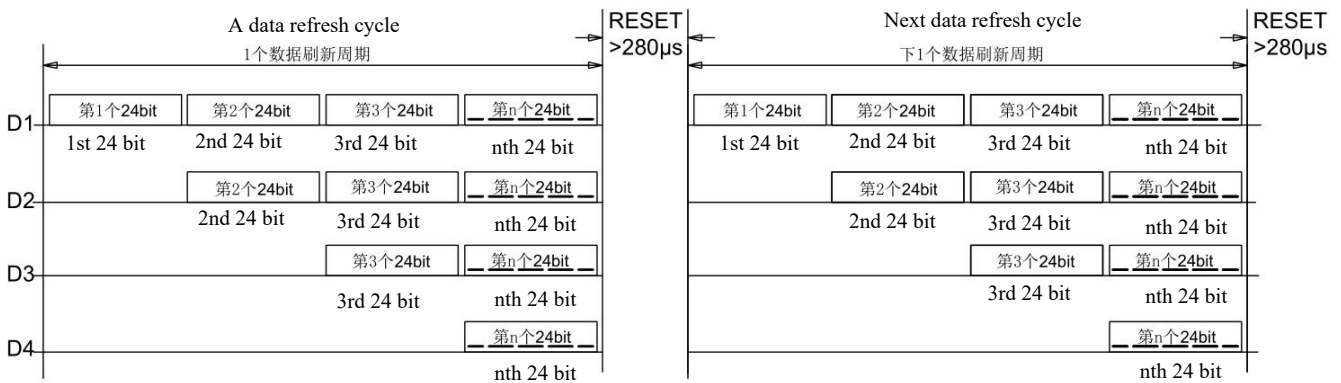
Input code type:



Connection method:



Data transmission method



Note: D1 is the data sent by the MCU, and D2, D3, and D4 are the data automatically shaped and forwarded by the cascade circuit.

24-bit data structure

R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
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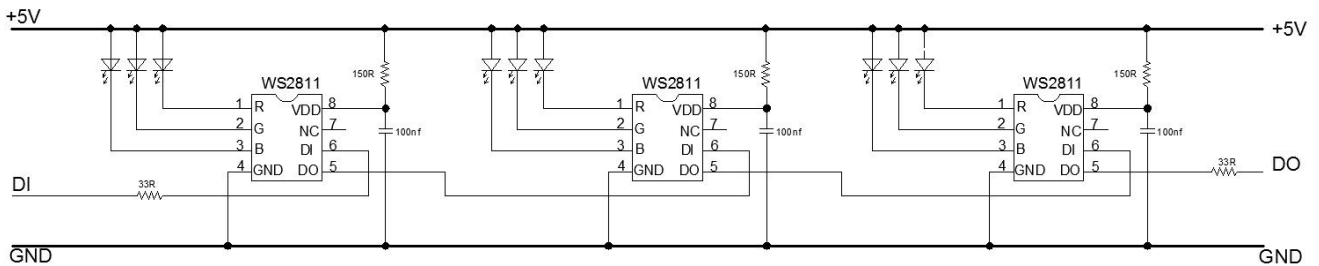
Note: The high bit is sent first, and the data is sent in the order of RGB.

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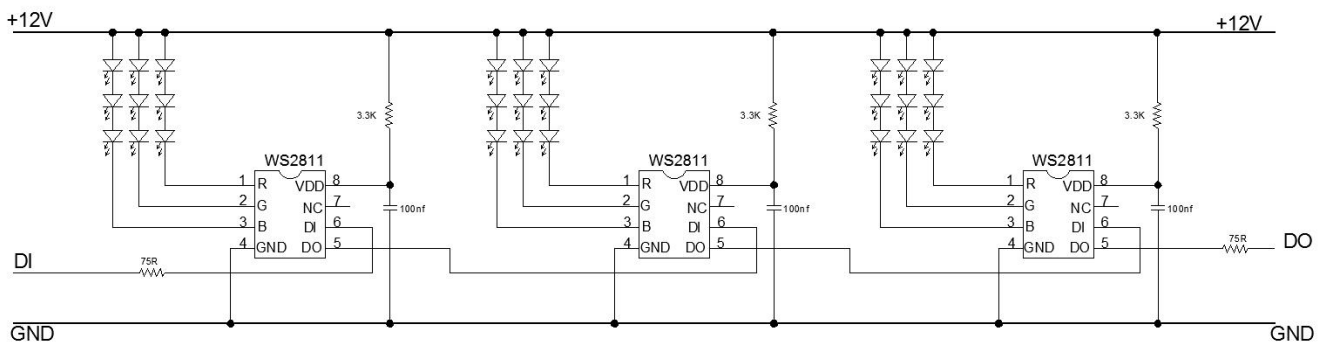
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Typical application circuit

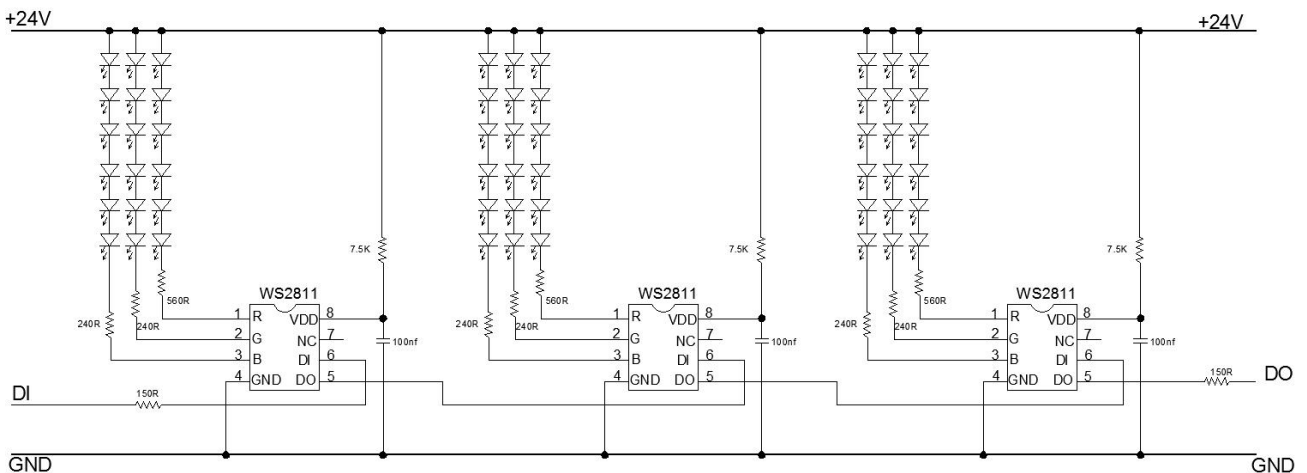
1. 5V power supply application reference circuit (each channel has 1 LED):



2. 12V power supply application reference circuit (each channel with 3 LEDs):



3. 24V power supply application reference circuit (each channel with 6 LEDs):

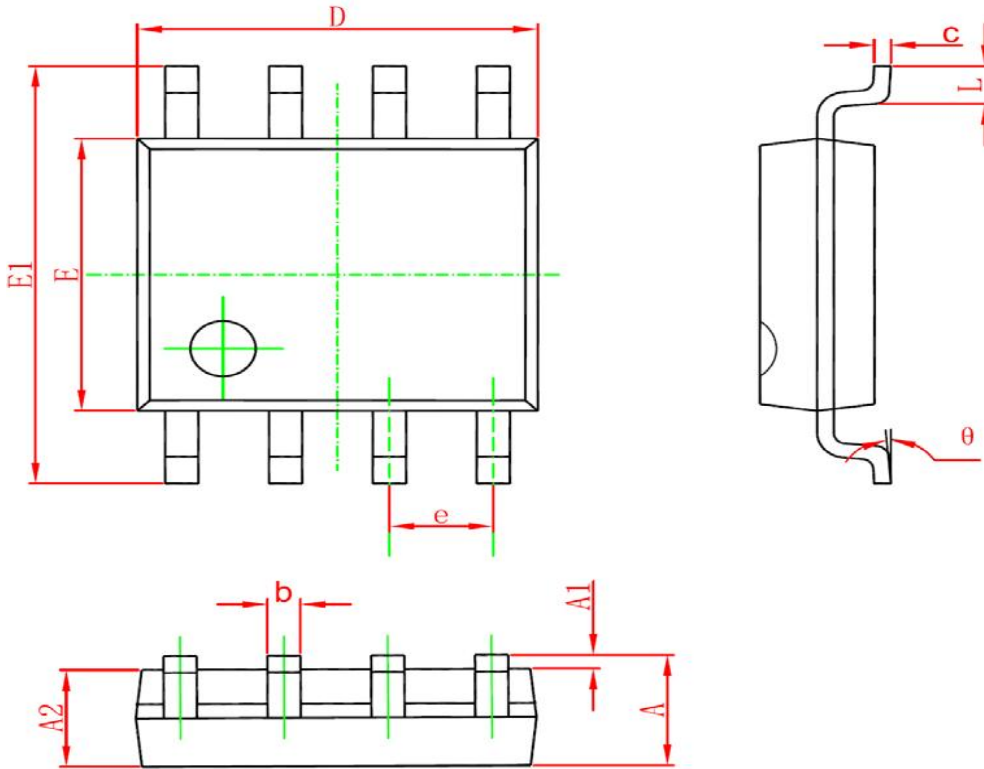


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Package diagram and parameters

- SOP8 package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270		0.050	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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File Change Log

Version number	Status	Summary of changes	Revision date	Revised by	Approver
V1.0	N	New	20170524	Shen Jinguo	Yin Huaping
V1.1	M	Detail parameter correction	20190524	Shen Jinguo	Yin Huaping

Note: The initial version number is V1.0; after each revision is approved, the version number is incremented by "0.1";
Status includes: N--New, A--Add, M--Modify, D--Delete.