WS2814B

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

Main feature

- The **R, G, B, W** output ports have a withstand voltage of 20V, and the DIN port has a withstand voltage of 9V.
- The chip has a built-in voltage regulator. For power supplies of 24V and below, only a resistor needs to be connected to the ICVDD pin, and no external voltage regulator is required.
- Built-in signal shaping circuit. After any pixel 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 levels of adjustment and a scanning frequency of 2KHz.
- The serial cascade interface can complete data reception and decoding through a signal line.
- No circuit needs to be added when the transmission distance between any two points does not exceed 2 meters.
- The color of the light is highly consistent and cost-effective.
- 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.
- It has the function of breakpoint resumption.

Main application areas

- LED full-color luminous character light string, LED full-color soft light bar and hard light bar, LED guardrail tube.
- LED point light source, LED pixel screen, LED special-shaped screen.

Product Overview

WS2814B is a four-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 and a high-precision constant current control module, which effectively ensures that the color of the pixel light on the drive circuit is highly consistent.

The data protocol uses a single-line return-to-zero code communication method. After the chip is powered on and reset, the DIN terminal receives the data transmitted from the controller. The first 32-bit data 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 cascaded pixel through the DO port. After each pixel is transmitted, the signal is reduced by 32 bits. The chip uses automatic shaping and forwarding technology, so that the number of cascaded pixels is not limited by signal transmission, but only by the signal transmission speed requirement.

The data latch inside the chip generates different duty cycle control signals at the OUTR, OUTG, OUTB, and OUTW control terminals according to the received 32-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 receive new data again after the signal ends. After receiving the initial 32-bit data, the data port is forwarded through the DO port. Before the chip receives the RESET code, the original outputs of the OUTR, OUTG, OUTB, and OUTW pins remain unchanged. After receiving a low-level RESET code of more than 280μs, the chip will output the 32-bit PWM data pulse width just received to the OUTR, OUTG, OUTB, and OUTW pins.

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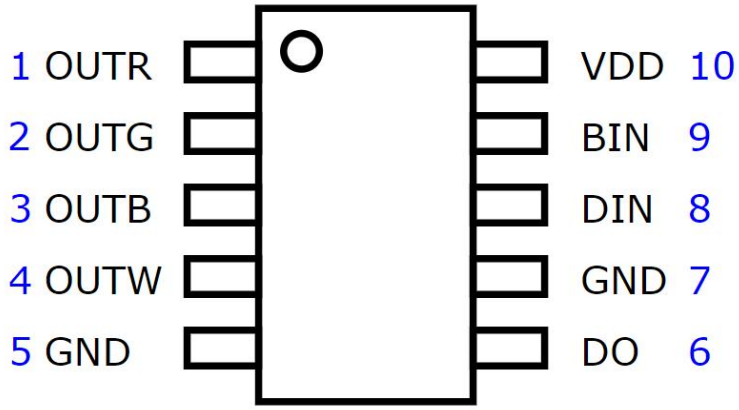
Pin Configuration



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	OUTW	LED driver output	WHITE (white) PWM control output
5	GND	Ground	Signal ground and power ground
6	DO	Data output	Display data output
7	GND	Ground	Signal ground and power ground
8	DIN	Main data input	Main data input
9	BIN	Auxiliary data input	Auxiliary data input
10	VDD	Logic Power Supply	IC Power Supply

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Maximum Ratings（T_A=25℃，V_{SS}=0V）

Parameter	Symbol	Range	Unit
Logic supply voltage	V_{DD}	+3.7~+5.3	V
Logic input voltage	V_I	VDD-0.7～VDD+0.7	V
R, G, B, W output port withstand voltage	Vout	20	V
Operating temperature	Topt	-40～+85	℃
Storage temperature	Tstg	-40~+150	℃
Electrostatic immunity	ESD	≧4	KV

Electrical parameters（T_A=25℃，V_{DD}=4.5～5.5V，V_{SS}=0V）

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
R, G, B，W low level output current	I_{OL}	15.5	16.5	17.5	mA	
Low level output current	I_{dout}	10	——	——	mA	Vo=0.4V，D_{OUT}
Input Current	I_I	——	——	±1	μA	V_I=V_{DD}/V_{SS}
High level input	V_{IH}	0.7V_{DD}	——	——	V	D_{IN}
Low level input	V_{IL}	——	——	0.3 V_{DD}	V	D_{IN}
Hysteresis voltage	V_H	——	0.35	——	V	D_{IN}

Switching characteristics（T_A=25℃，V_{DD}=4.5～5.5V，V_{SS}=0V）

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
Transmission delay time	t_{PLZ}	——	——	300	ns	CL=15pF, DIN→DOUT, RL=10KΩ
Fall time	t_{THZ}	——	——	120	μs	CL=300pF, OUTR/OUTG/OUTB/OUTW
Data transfer rate	F_{MAX}	600	——	——	Kbps	Duty cycle 50%
Input Capacitance	C_I	——	——	15	pF	——

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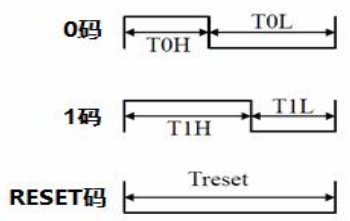
Data transmission time

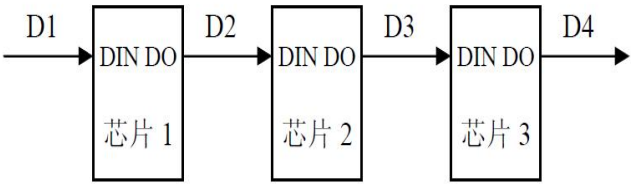
T0H	0 code，High level time	220ns~380ns
T1H	1 code，High level time	580ns~1μs
T0L	0 code，Low level time	580ns~1μs
T1L	1 code，Low level time	580ns~1μs
RES	Frame unit, low level time	280μs以上
T_{DATA}	Data cycle	⩾1.25us

Timing waveform

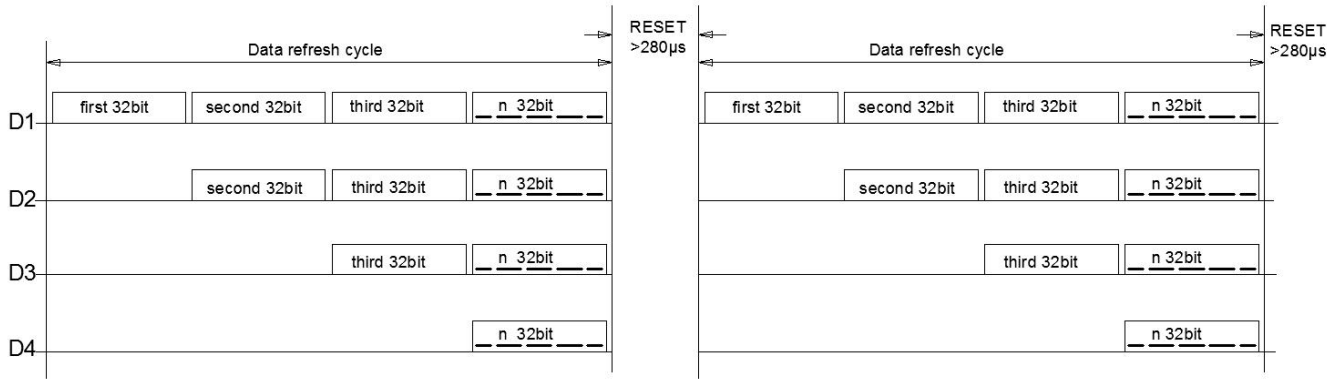
Input code type:



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.

32-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	W7	W6	W5	W4	W3	W2	W1	W0

Note: The high bit is sent first, and the data is sent in the order of RGBW.

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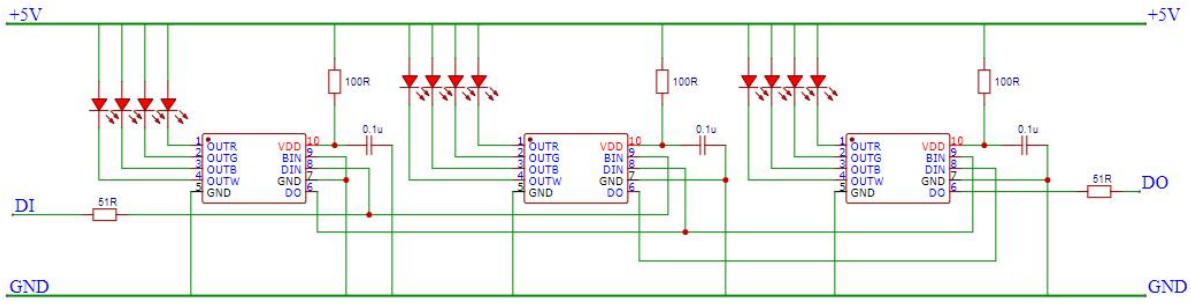
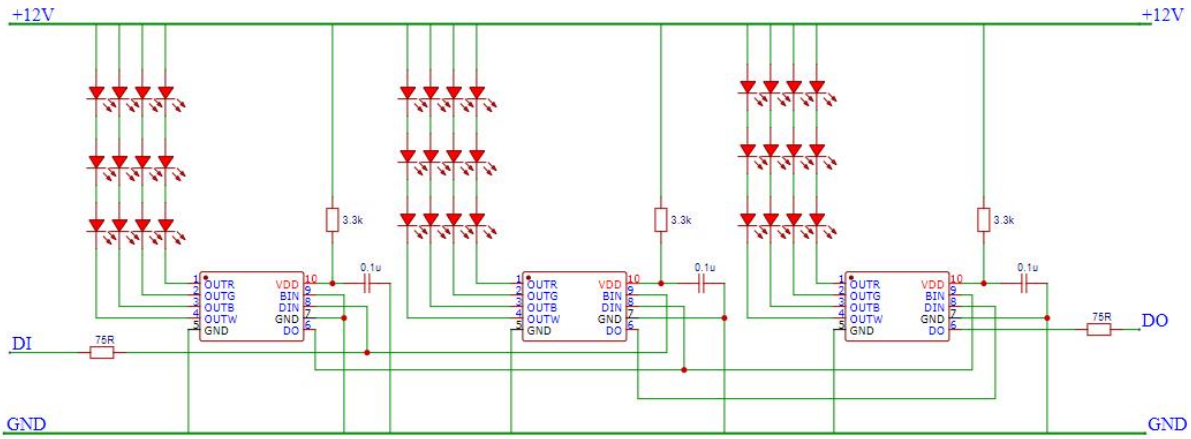
Typical application circuit

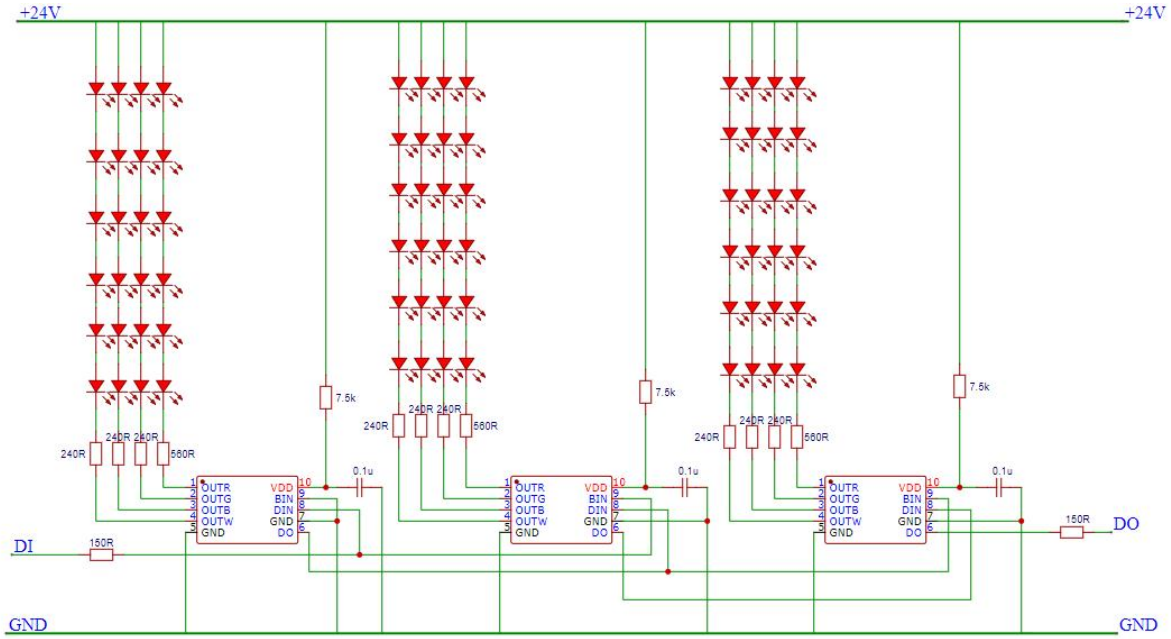
1. 5V power supply application reference circuit (each channel has 1 LED):



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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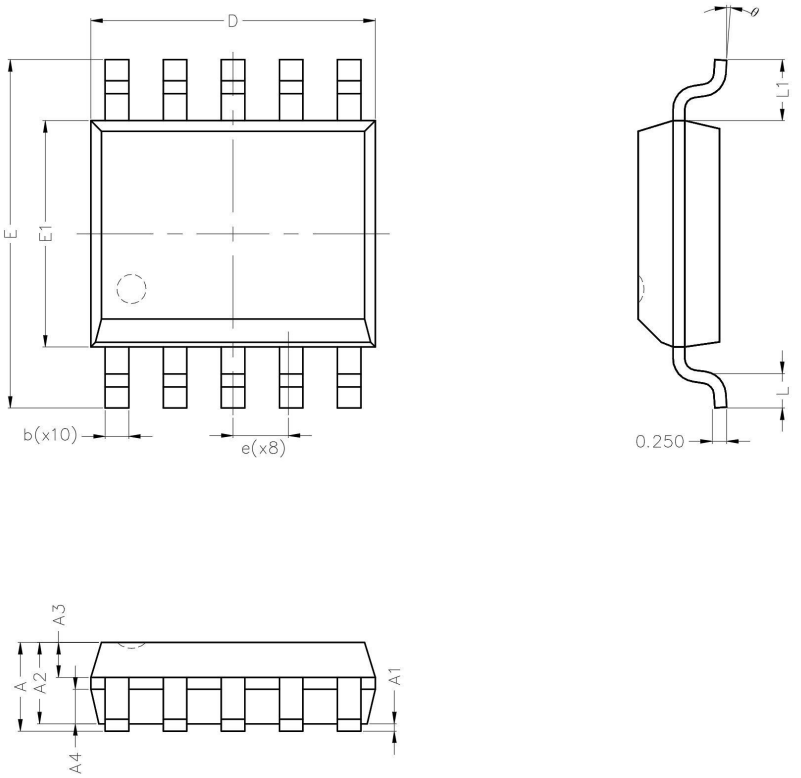
Package diagram and parameters

- SOP10 Package



	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	–	–	1.75
STAND OFF	A1	0.05	0.125	0.20
MOLD TOTAL THICKNESS	A2	1.30	1.40	1.60
TOP MOLD THICKNESS	A3	0.55	0.60	0.65
BOTTOM MOLD THICKNESS	A4	0.547	0.597	0.647
LEAD WIDTH	b	0.31	–	0.53
MOLD LENGTH	D	4.80	4.90	5.00
MOLD WIDTH	E1	3.80	3.90	4.00
LEAD SPAN	E	5.80	6.00	6.20
LEAD PITCH	e	1.00 BSC		
LEAD LENGTH	L1	0.95	1.05	1.15
LEAD SOLE LENGTH	L	0.40	0.60	0.80
LEAD FORM ANGLE	θ	0°	–	8°

File Change Log

Version number	Status	Summary of the revised content	Revision date	Revised by	Approver
V1.0	N	New	20230718	HuJing	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.