# WS2814C

## Main Features

- Output voltage of port R, G, B, W is above 20V, and output voltage of port DIN / DOUT is above 9V.

- With a zener diode built in the chip, 24V, power supplies less than 24V only need to connect resistance to IC VDD feet and don't need an additional zener diode.

- With the signal shaping circuit built in, every pixel will output the signal after the shaping of waveform, which ensures that the distortion of the circuit wave will not accumulate.

- Built-in electrical reset and drop reset circuit.

- The PWM control end can achieve 256 level adjustment with a scanning frequency of 4KHz.

- The serial cascade interface can receive and decode the data through one signal line.

- No circuit is required between any two pixels whose transmission distance is less than 2 meters.

- The color of the light is highly consistent and cost-effective.

- When the refresh rate is 30 frames/s, the number of cascades is more than 1024 points.

- Data transmission speed is up to 800 Kbps.

- With the SOP 8, FSOP 8 package.

## Main Application

- Full Color LED string, Full Color LED strip, LED Guardrail Tube.
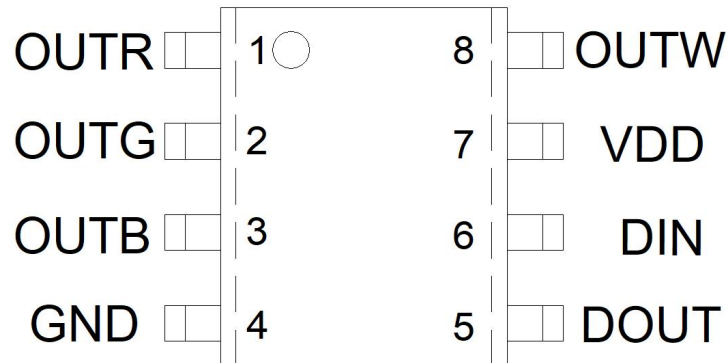- LED Point Light Source, LED pixel screen, Special-shaped LED screen.

## Product Overview

WS2814C is a four-channel circuit specially driven by LED. The chip contains intelligent digital interface data latch signal shaping amplifier drive circuit, high precision internal oscillator and 20V high voltage programmable current output driver and high precision constant current control module, ensuring that the pixel light on the drive circuit is highly consistent.

Data protocol uses Return Zero code. After the chip power reset, the DIN port receives data transmitted from the controller. The first 32bit data is extracted by the first chip and sent to the internal chip latch. The rest of the data will be transmitted to the pixel of next cascade through the DO port after being shaped and amplified by the internal signal shaping circuit. And the signal is reduced by 32bit each time it passes through a pixel. The chip adopts automatic shaping and transmission technology, so that the cascade number of the pixels is not limited by the signal transmission but only limited by the signal transmission speed.

The data latch inside the chip, based on the received 32bit data, creates different duty cycle at the OUTR, OUTG, OUTB, OUTW control ends to control the signals. While waiting for the DIN port inputing RESET signal, all chips send the received data to each segment simultaneously. The chip will receive new data again after the signal ends. After receiving the initial 32-bit data, the chip transmits the data port through the DO port. And the original output of OUTR, OUTG, OUTB and OUTW Chip remains the same before the chip receives the RESET code. Only after receiving the Vil RESET code above 280μs can the chip output the received 32bitPWM data pulse-width to the OUTR, OUTG, OUTB, OUTW pins.

# WS2814C

Single Line/256 Grayscale/Four Channel /Constant Current/LED Driving IC

## Lead End Layout

```
OUTR   1 ○      8   OUTW
OUTG   2        7   VDD
OUTB   3        6   DIN
GND    4        5   DOUT
```

## Function of Lead End

| Pin Number | Symbol | Name of Pin | Function Description |
|---|---|---|---|
| 1 | OUTR | LED-Driven Output | RED PWM controlling output |
| 2 | OUTG | LED-Driven Output | GREEN PWM controlling output |
| 3 | OUTB | LED-Driven Output | BLUE PWM controlling output |
| 4 | GND | Ground | Earthing of signal and power supply |
| 5 | DOUT | Data Output | Indication of data cascade output |
| 6 | DIN | Data Input | Indication of data input |
| 7 | VDD |  | Powered by IC |
| 8 | OUTW | LED-Driven Output | WHITE PWM controlling output |

## Maximum Rated Value（$T_A$=25℃，$V_{SS}$=0V）

| Parameter | Symbol | Scope | Unit |
|---|---|---|---|
| Logical voltage of power supply | $V_{DD}$ | +3.7~+5.3 | V |
| Logical input voltage | $V_I$ | VDD-0.7～VDD+0.7 | V |
| Input voltage of R、G、B、W port | Vout | 20 | V |
| Working Temperature | Topt | -40～+85 | ℃ |
| Stock Temperature | Tstg | -40~+150 | ℃ |
| Anti-static electricity | ESD | ≧4 | KV |

## Electric Parameter （$T_A$=25℃，$V_{DD}$=4.5～5.5V，$V_{SS}$=0V）

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Test Condition |
|---|---|---|---|---|---|---|
| R、G、B、W low level input current | $I_{OL}$ | 15.5 | 16.5 | 17.5 | mA | |
| Low level input 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 | $V_{IH}$ | 0.7$V_{DD}$ | —— | —— | V | $D_{IN}$ |
| Low level input | $V_{IL}$ | —— | —— | 0.3 $V_{DD}$ | V | $D_{IN}$ |
| Voltage delay | $V_H$ | —— | 0.35 | —— | V | $D_{IN}$ |

## Characteristics of Switch （$T_A$=25℃，$V_{DD}$=4.5～5.5V，$V_{SS}$=0V）

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Transmission delay | $t_{PLZ}$ | —— | —— | 300 | ns | CL=15pF, DIN→DOUT, RL=10KΩ |
| Decline time | $t_{THZ}$ | —— | —— | 120 | μs | CL=300pF, OUTR/OUTG/OUTB/OUTW |
| Transmission rate | $F_{MAX}$ | 600 | —— | —— | Kbps | Duty ratio is 50% |
| Input capacitance | $C_I$ | —— | —— | 15 | pF | —— |

## Time of Data Transmission

| | | | |
|---|---|---|---|
| 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 | unit of frame, low level time | | 280μs以上 |
| $T_{DATA}$ | Data cycle | | ≥1.25us |

## Waveform of Sequence Signal

**Input Code:**



**Connection:**



Chip 1        Chip 2        Chip 3
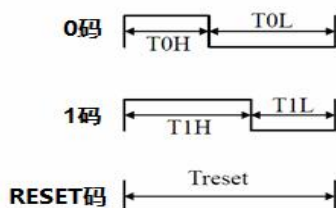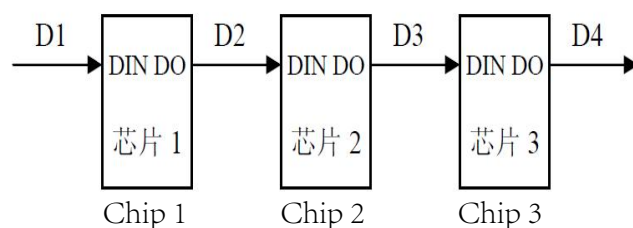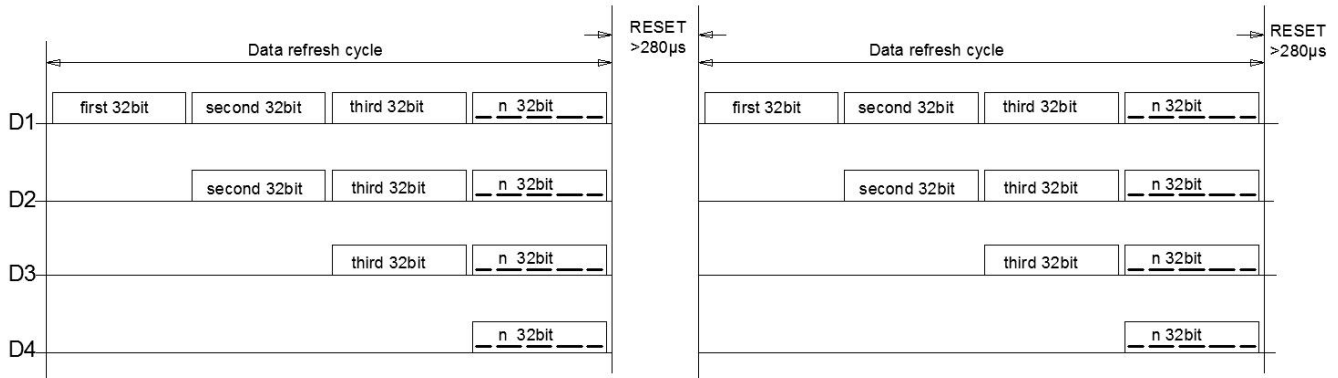
## Method of Data Transmission:



PS. D1 is the data sent by MCU port，D2、D3、D4 are data shaped and transmitted by cascade circuit.

## 32bit Data Structure
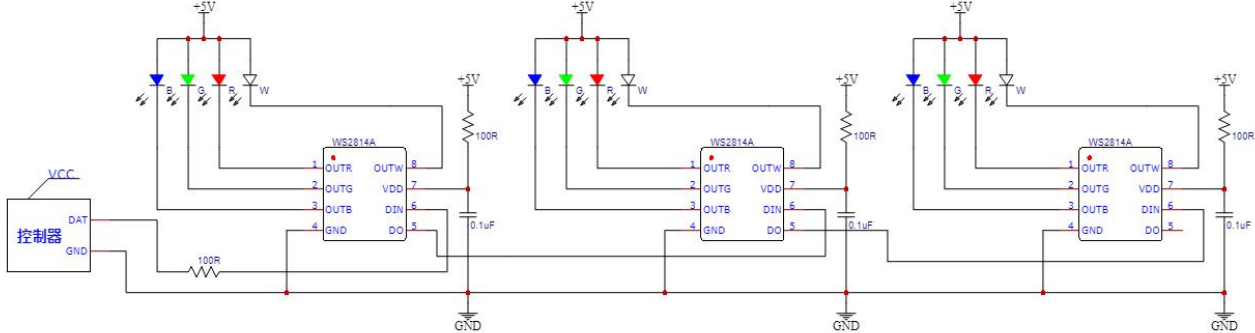
| W7 | W6 | W5 | W4 | W3 | W2 | W1 | W0 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

PS. Transmission begins from the top and follows the order of W, R, G, B.
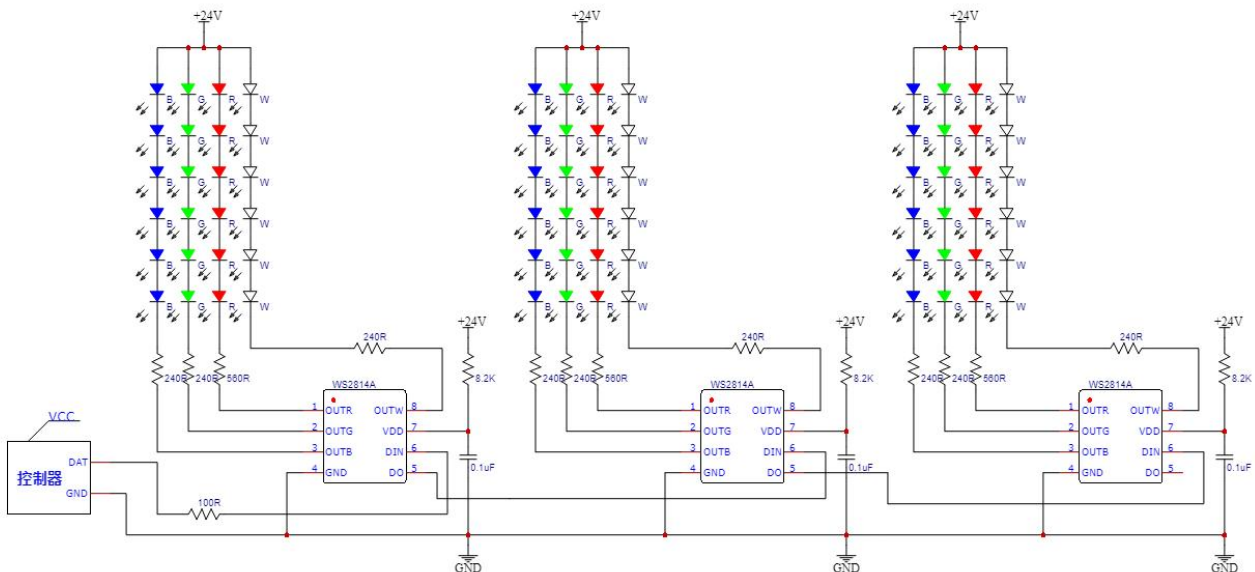
## Typically Applied Circuit

1.5V供电应用参考电路（每通道带1颗LED）：5V power supply application reference circuit (each channel with 1 LED):



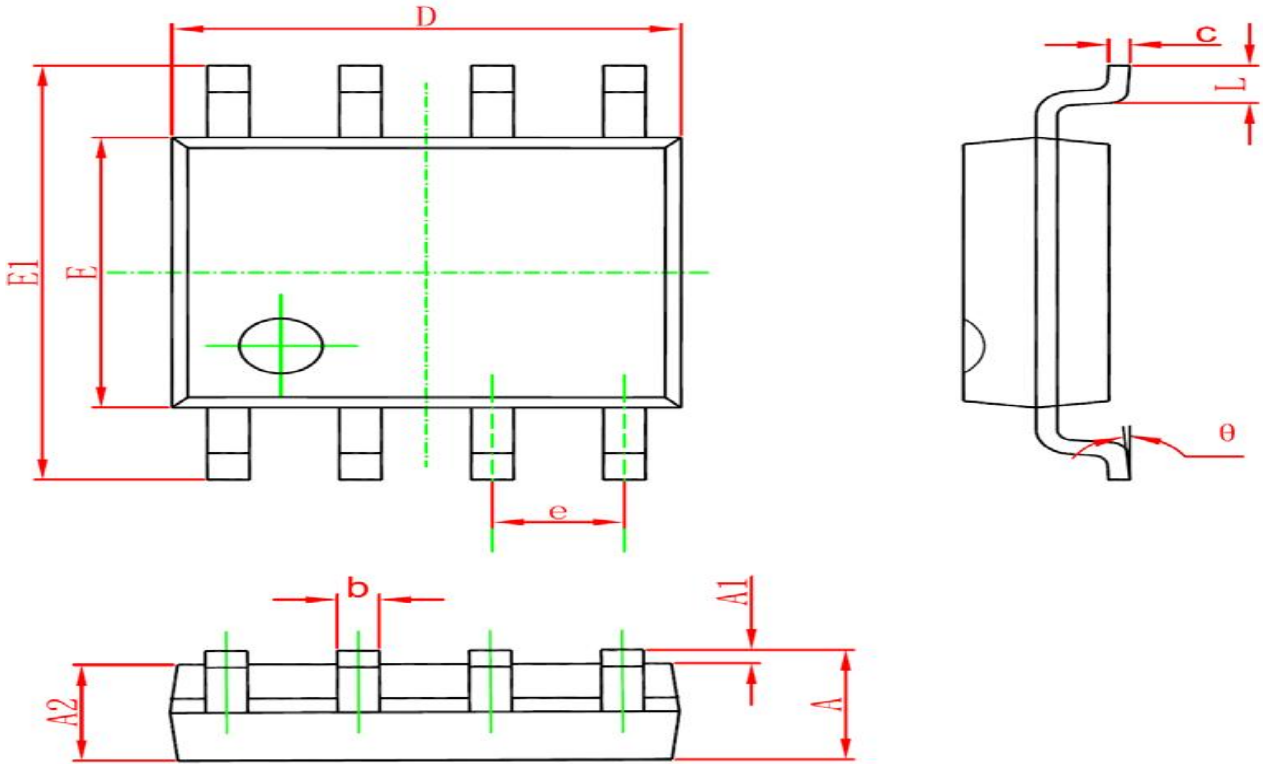2.12V供电应用参考电路（每通道带3颗LED）：12V power supply application reference circuit (each channel with 3 LED):
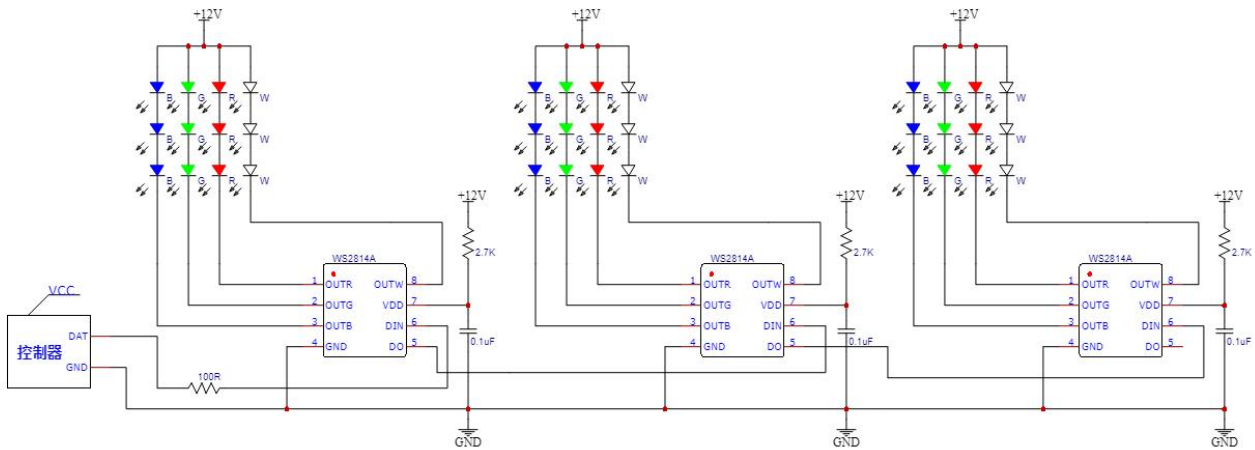


3.24V供电应用参考电路（每通道带6颗LED）：24V power supply application reference circuit (each channel with 6 LED):
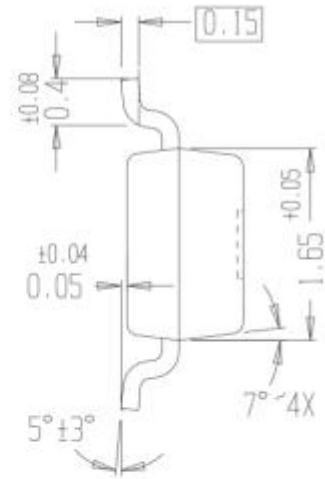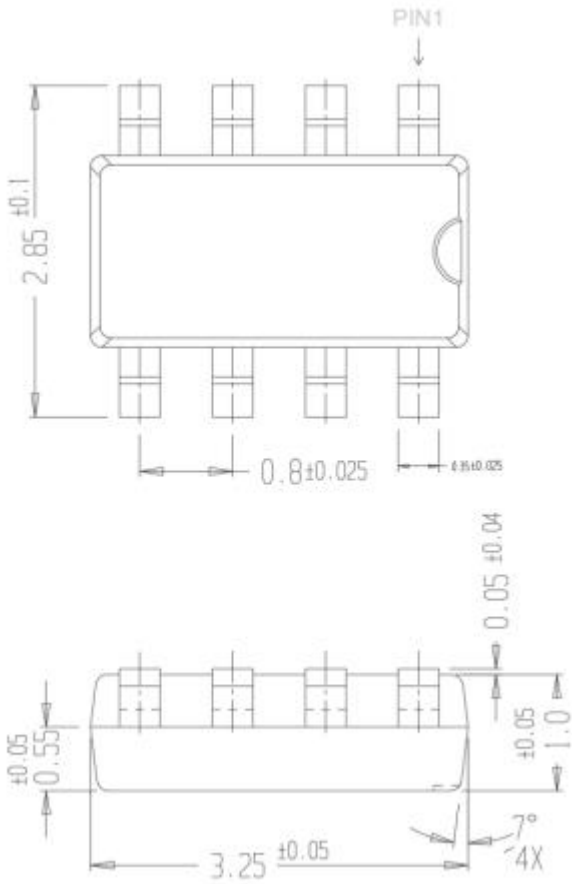
## Package and Parameter

- **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 | 0º | 8º | 0º | 8º |

● **FSOP8** Package

## Record of File Alteration

| Version | Condition | Outline of Alteration | Date | Modifier | Approver |
|---|---|---|---|---|---|
| V1.0 | N | Establishment | 20190410 | Dong Le | Shen Jinguo |
| V1.1 | M | Revision of detailed parameters | 20210118 | Dong Le | Shen Jinguo |
| V1.2 | M | Revision of typically applied circuit | 20211125 | Xie Yanfan | Yu Xinghui |
| V1.3 | M | Addition of item ESD | 20220712 | Hu Jin | Yu Xinghui |
| V1.4 | A | Addition of FSOP8 package | 2023/3/28 | Hu Jin | Yu Xinghui |
| V1.5 | M | To avoid misleading, make FSOP8 package an independent part | 20230422 | Hu Jin | Yu Xinghui |
| V2.0 | M | ● The conduction time between RGBW ports is staggered by 30us, and the port refresh frequency is increased to 4kHz, which can effectively reduce power ripple. <br> ● The IC printing is changed from WS2814A to WS2814C. | 20231107 | Hu Jin | Yin Huaping |
| | | | | | |

PS. The initial version is V1.0; the number of version plus 0.1 after every modification；Conditions including：N--newly built，A--addition，M--modification，D--delete。