# WS2811

## Single wire, 256 grayscale, 3 Channels Constant Current LED Drive IC

## Main Features

- The **OUTR, G, B, and DOUT** ports withstand a voltage of 20V, while the **DIN** port withstands 9.5 V.
- The chip includes a built-in voltage regulator; for power supplies below 24V, simply connect a resistor in series to the VDD pin—no external regulator is required.
- Gray scale adjustment circuit (with 256 adjustable gray levels).
- 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.
- It features built-in power-on reset and power-off reset circuits.
- The PWM control unit supports 256-level adjustment with a scanning frequency of 4 kHz.
- 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 exceed5 meters without requiring additional circuits.
- When the refresh rate is 30 frames per second, the number of cascades can be at least 1024 points.
- Data transmission speed can reach up to 800 Kbps.

## Main Applications

- LED full-color pixel string and LED full-color modules.
- LED full-color flexible LED strips, Rigid LED strips, and LED guardrail tubes.
- LED point light sources, LED pixel displays, and LED custom-shaped displays.
- Various electronic products, electrical equipment, running lights.
- Other various LED lighting products.

## Product Overview

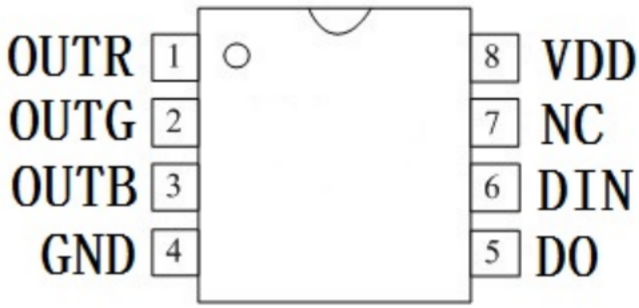
The **WS2811** is **3** output channels special for LED driver circuit. Its internal includes intelligent digital port data latch and signal reshaping amplification drive circuit. Also include a precision internal oscillator and a **20V** voltage programmable constant current output drive. In the purpose of reduce power supply ripple, the 3 output channels designed to delay turn-on function.

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 **24bit** 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 to reduce **24bit.** 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 of IC depend on the received **24bit** data produce different duty ratio signal at OUTR, OUTG, OUTB port. All chip synchronous send the received data to each segment when the DIN port input a reset signal. It will receive new data again After the reset signal finished. Before a new reset signal received, the control signal of OUTR ,OUTG, OUTB port unchanged. IC sent PWM data that received justly to OUTR, OUTG, OUTB port, after receive a low voltage reset signal the time retain over **280μs**.

We offer SOP8、MSOP8 package.

## 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 | GND | Ground | Data & Power Grounding |
| 5 | DO | Data Output | Data Output |
| 6 | DIN | Data Input | Control data input |
| 7 | NC | Non connection | Empty Pin |
| 8 | VDD | Power Voltage | IC power supply |

## Absolute Maximum Ratings(TA = 25°C, VSS = 0 V)

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Logical Power Supply Voltage | $V_{DD}$ | +3.5~+5.5 | V |
| R/G/B Channel Output Port Withstand Voltage | $V_{OUT}$ | 20 | V |
| Logical Input Voltage | $V_I$ | VDD-0.7 ~ VDD+0.7V | V |
| Operation Temperature | Topt | -25 ~ +85 | ℃ |
| Storage Temperature Range | Tstg | -40~+150 | ℃ |

## Electrical parameters (TA = 25°C, VDD = 4.5–5.5 V, VSS = 0 V)

| Parameter | Symbol | Min | Tpy | Max | Unit | Conditions |
|---|---|---|---|---|---|---|
| Quiescent current | Io | —— | 0.6 | —— | mA | DC=5V |
| R、G、B Low-level output current | $I_{OL}$ | 15.5 | 16.5 | 17.5 | mA | DC=5V, DIN （FFH) |
| Low-level output current | $I_{dout}$ | 10 | —— | —— | mA | Vo=0.4V， DOUT |
| Input Current | $I_I$ | —— | —— | ±1 | μA | VI=VDD/VSS |
| High-level input | $V_{IH}$ | $0.7V_{DD}$ | —— | —— | V | DIN |
| Low-level input | $V_{IL}$ | —— | —— | $0.3\ V_{DD}$ | V | DIN |
| Lagging voltage | $V_H$ | —— | 0.35 | —— | V | DIN |

## Switching characteristics (TA = 25°C, VDD = 4.5–5.5 V, VSS = 0 V)

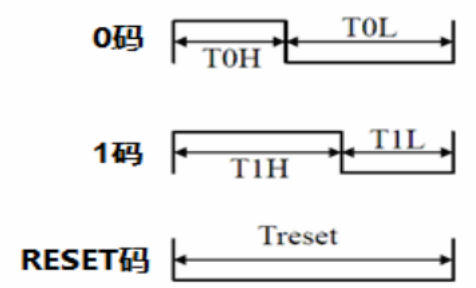
| Parameter | Symbol | Min | Tpy | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Oscillation frequency | *Fosc* | —— | 800 | —— | KHz | —— |
| Transmission delay time | tPLZ | —— | —— | 300 | ns | CL=15pF, DIN→DOUT, RL=10KΩ |
| Fall time | tTHZ | —— | —— | 120 | μs | CL=300pF, OUTR/OUTG/OUTB |
| Data transmission rate | *FMAX* | 600 | —— | —— | Kbps | Occupancy Ratio 50% |
| Input capacity | CI | —— | —— | 15 | pF | —— |

## Data Transmission Time

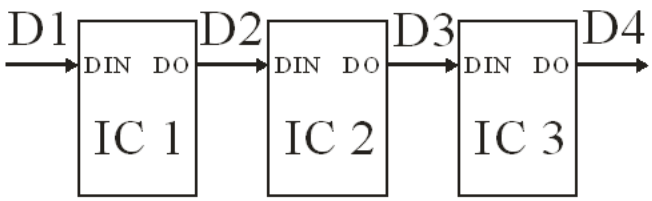
| | | |
|---|---|---|
| T0H | 0 code, high level duration | 220ns~380ns |
| T1H | 1 code, high level duration | 540ns~1μs |
| T0L | 0 code, low-level duration | 580ns~1μs |
| T1L | 1 code, low-level duration | 580ns~1μs |
| RES | Frame unit, low-level duration | >280 μs |
| $T_{DATA}$ | Data Cycle | ⩾1.25us |

## Time Series Waveform Chart

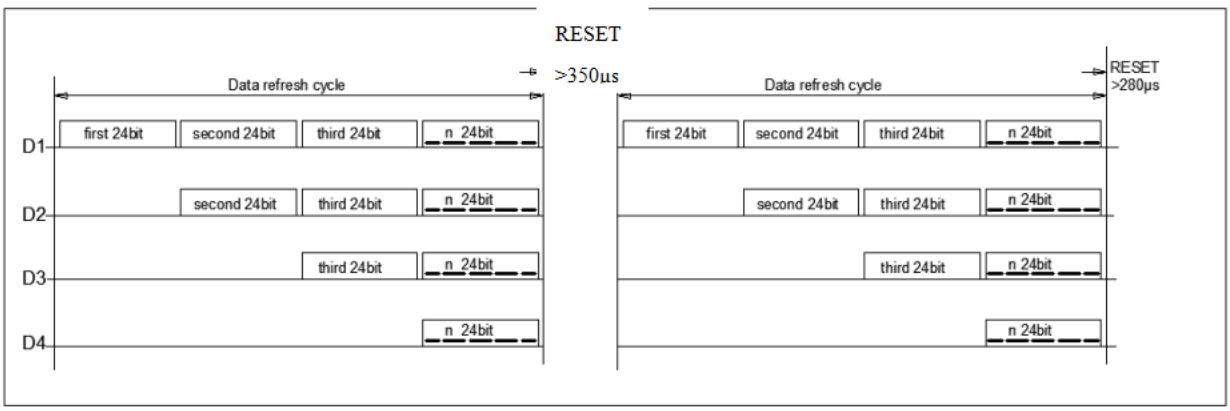
### Sequence Chart




### 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.

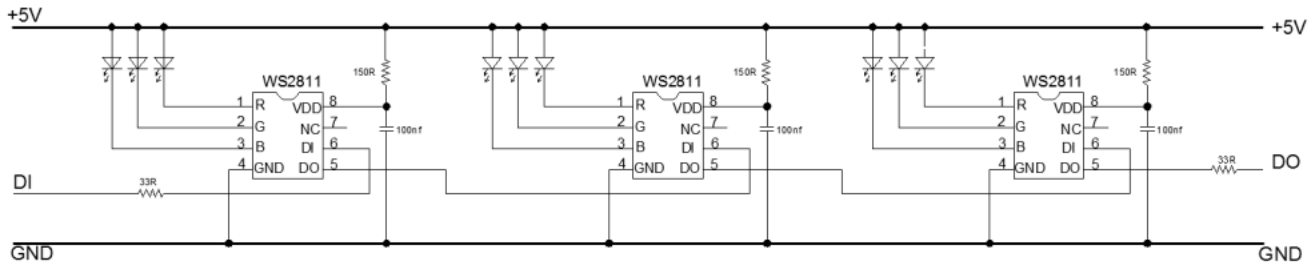
## 24-bit Data Structure

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |

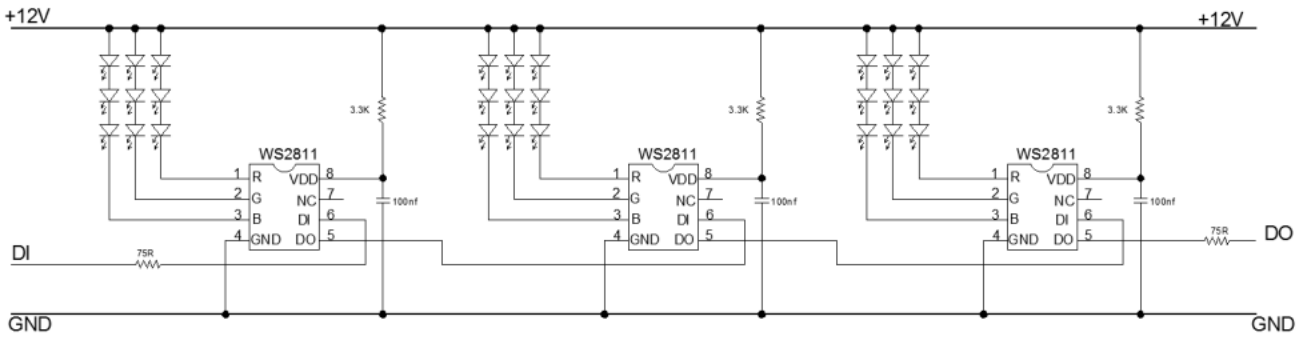
Note: Data transmit in order of RGB, high bit data at first.

## Typical Application Circuit

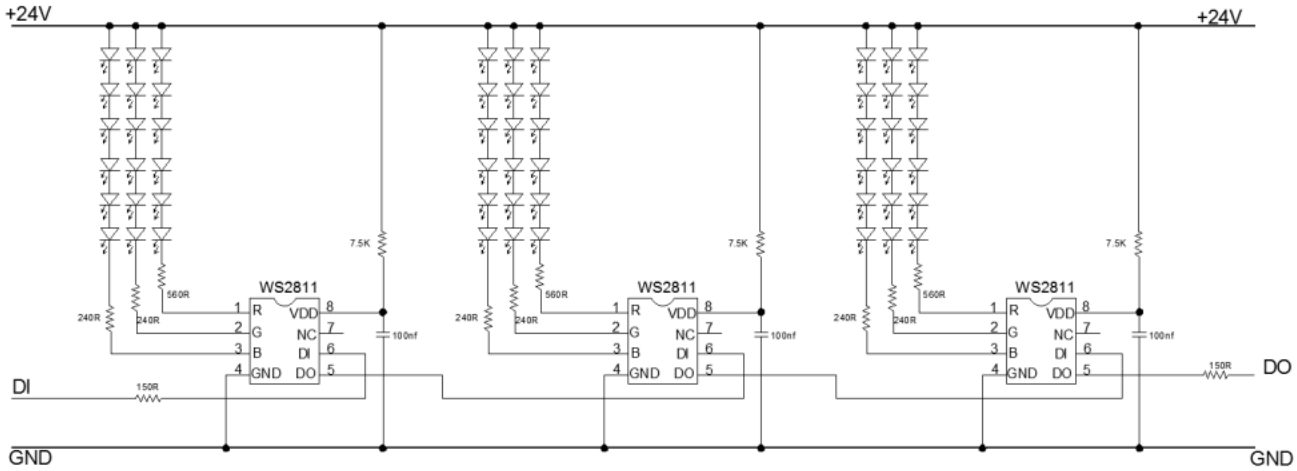
### 1. Supply voltage=5V, 1 LED for each channel




### 2. Supply voltage=12V, 3 LED for each channel

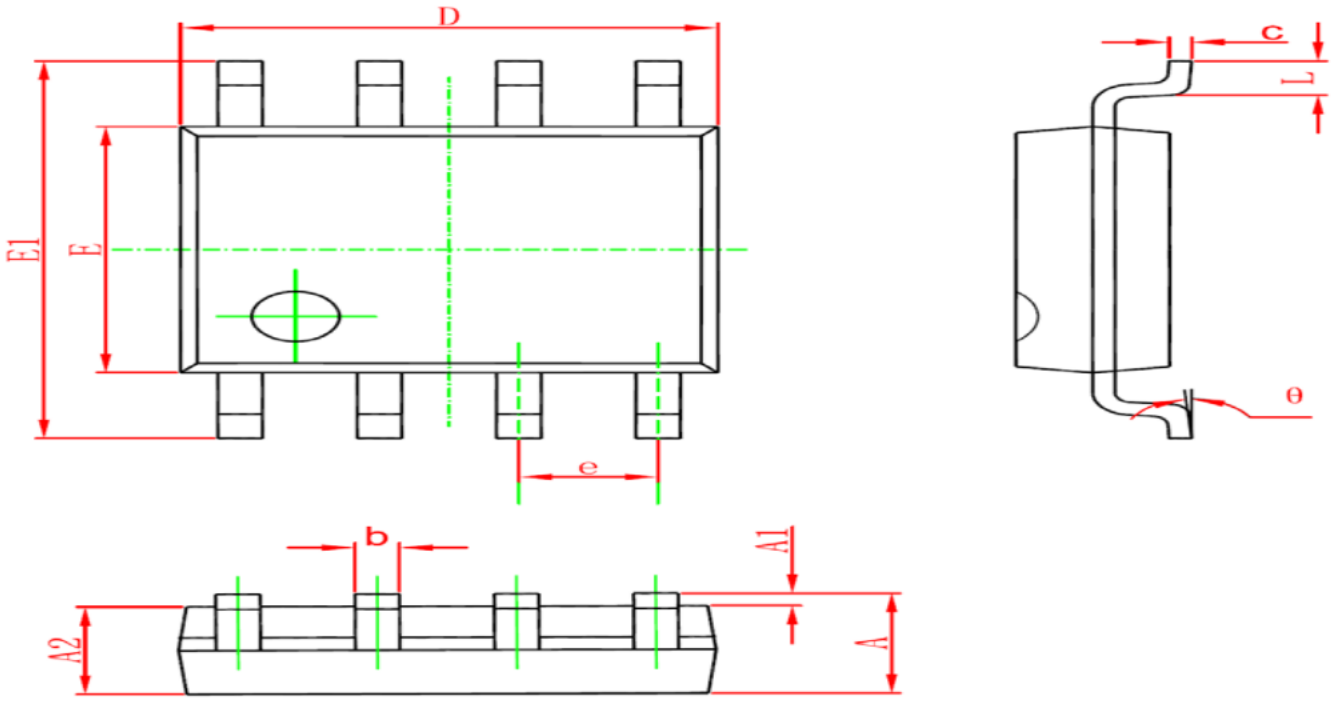


**3. Supply voltage=24V, 6 LED for each channel**



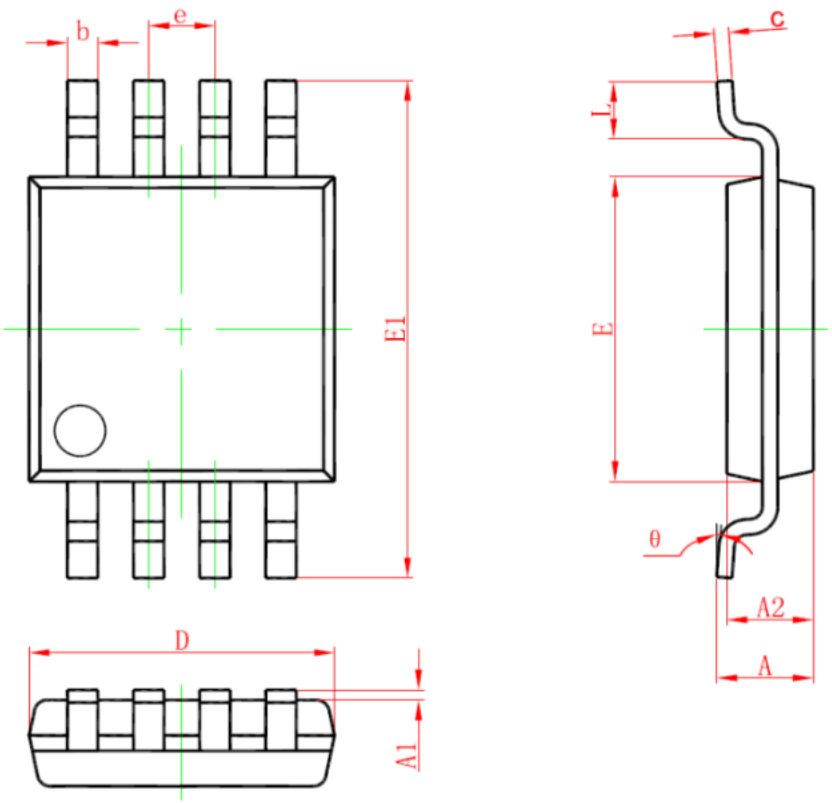
## Package information

- **SOP8 Packaging**




| 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° |

- **MSOP8 Packaging**




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.820 | 1.100 | 0.032 | 0.043 |
| A1 | 0.020 | 0.150 | 0.001 | 0.006 |
| A2 | 0.750 | 0.950 | 0.030 | 0.037 |
| b | 0.250 | 0.380 | 0.010 | 0.015 |
| c | 0.090 | 0.230 | 0.004 | 0.009 |
| D | 2.900 | 3.100 | 0.114 | 0.122 |
| e | 0.650(BSC) | | 0.026(BSC) | |
| E | 2.900 | 3.100 | 0.114 | 0.122 |
| E1 | 4.750 | 5.050 | 0.187 | 0.199 |
| L | 0.400 | 0.800 | 0.016 | 0.031 |
| θ | 0° | 6° | 0° | 6° |

## Modify Records

| Version № | Status Bar | Modify Content Summary | Date | Reviser | Approved |
|---|---|---|---|---|---|
| V1.0 | N | New-built | 20170524 | Shen Jingguo | Yin Huaping |
| V1.1 | M | Maximum rating | 20171014 | Shen Jingguo | Yin Huaping |
| V1.2 | M | Switching characteristic | 20171108 | Shen Jingguo | Yin Huaping |
| V1.3 | M | Maximum ratings, Data transfer time, Main feature, General description | 2018-2-7 | Shen Jingguo | Yin Huaping |
| V1.4 | M | Logical Input Voltage, T1L timing | 2018-9-10 | Shen Jingguo | Yin Huaping |
| V1.5 | M | Modify the typical application circuit diagram (add a 24V application circuit) | 2018-9-20 | Shen Jingguo | Yin Huaping |
| V1.51 | M | T1H timing modification | 2025-11-01 | OuYang Yu | Yin Huaping |
| V1.52 | M | Logo Update | 20260728 | 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.