



WS2811F

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

Main Features

- The **OUTR, G, B** ports withstand a voltage of **40V**, while the **DIN, DOUT** port withstands **24V**.
- The chip includes a built-in voltage regulator; for power supplies below **36V**, 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 exceed 2 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.

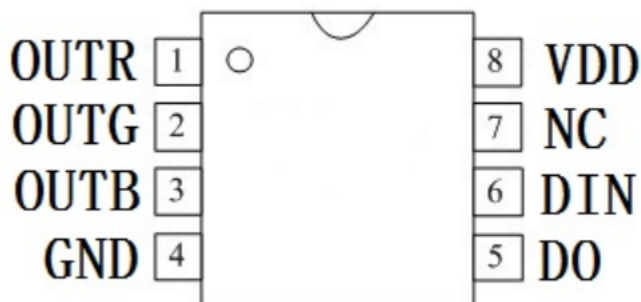
Product Overview

The **WS2811F** 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 **40V** voltage programmable constant current output drive. To reduce power supply ripple, the **OUTR, G, and B** channels have interleaved conduction functions. During frame refreshing, this can lower the circuit ripple.

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 will 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 inside the chip generates different duty cycle control signals at the **OUTR, OUTG, and OUTB** control terminals based on the received **24-bit** data. When a **RESET** signal is input at the **DIN** terminal, all chips synchronously send the received data to each segment. After the signal ends, the chips will receive the data again. After receiving the initial **24-bit** data, the data port is forwarded through the **DO** port. Before the chip receives the **RESET** code, the original output of the **OUTR, OUTG, and OUTB** pins remains unchanged. When a low-level **RESET** code above **350μs** is received, The chip outputs the 24-bit PWM data pulse width just received to the **OUTR, OUTG, and OUTB** 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	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	Logic 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~+5.8	V
R/G/B Channel Output Port Withstand Voltage	V _{OUT}	40	V
Logical Input Voltage	V _I	V _{DD} -0.7~V _{DD} +0.7V	V
Operation Temperature	T _{opt}	-40~+85	°C
Storage Temperature Range	T _{stg}	-40~+105	°C
Electrostatic Resistance	ESD	≥2.5	KV

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

Parameter	Symbol	Min	Tpy	Max	Unit	Conditions
Quiescent current	I_o	—	0.4	—	mA	DC=5V
R、G、B Low-level output current	I_{OL}	13.5	—	18.5	mA	DC=5V, DIN (FFH)
Single RGB Current Difference	Dif	0	—	0.8	mA	DC=5V, DIN
Low-level 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-level input	V_{IH}	$0.7V_{DD}$	—	—	V	D_{IN}
Low-level input	V_{IL}	—	—	$0.30V_{DD}$	V	D_{IN}
Lagging voltage	V_H	—	0.35	—	V	D_{IN}

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

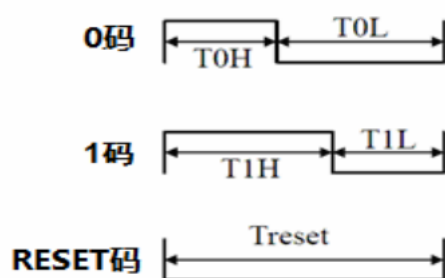
Parameter	Symbol	Min	Tpy	Max	Unit	Condition
Oscillation frequency	F_{osc}	—	800	—	KHz	—
Transmission delay time	t_{PLZ}	—	—	300	ns	$CL=15\text{pF}$, $DIN \rightarrow DOUT$, $RL=10\text{K}\Omega$
Fall time	t_{THZ}	—	—	120	μs	$CL=300\text{pF}$, $OUTR/OUTG/OUTB$
Data transmission rate	F_{MAX}	600	—	—	Kbps	Occupancy Ratio 50%
Input capacity	C_I	—	—	15	pF	—

Data Transmission Time

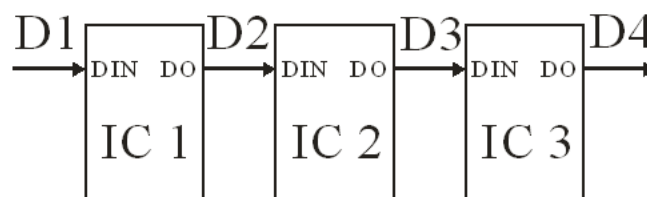
T0H	0 code, high level duration	220ns~380ns
T1H	1 code, high level duration	580ns~1us
T0L	0 code, low-level duration	580ns~1us
T1L	1 code, low-level duration	580ns~1us
RES	Frame unit, low-level duration	>350 μ s
T _{DATA}	Data Cycle	$\geq 1.25\mu$ s

Timing Waveform Chart

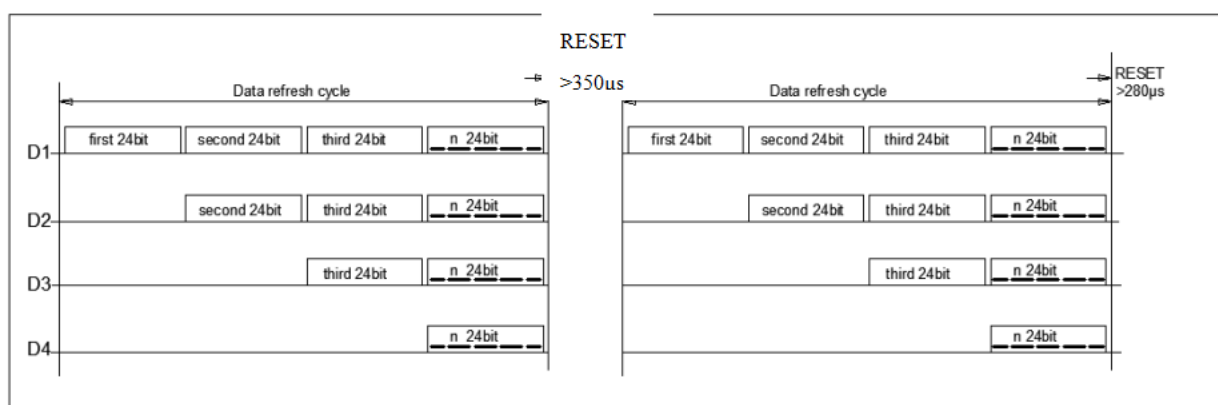
Sequence Chart



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



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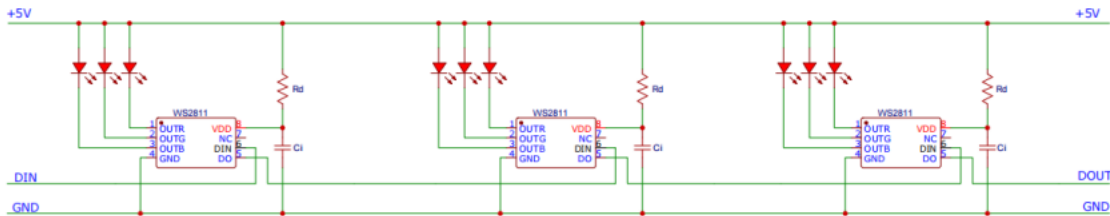
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Typical Application Circuit

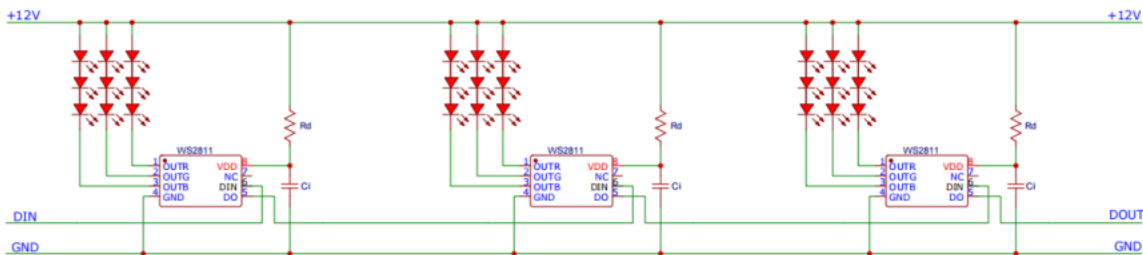
1. Supply voltage=5V, 1 LED for each channel

The recommended value for R_d is 150 Ω , and the recommended value for C_i is 1 μF .



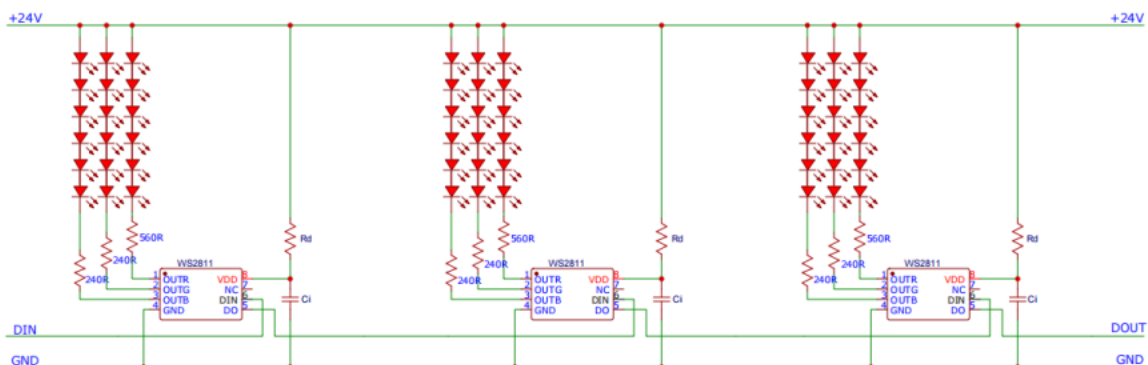
2. Supply voltage=12V, 3 LED for each channel

The recommended values are 3.3 k for R_d and 1 μF for C_i .



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

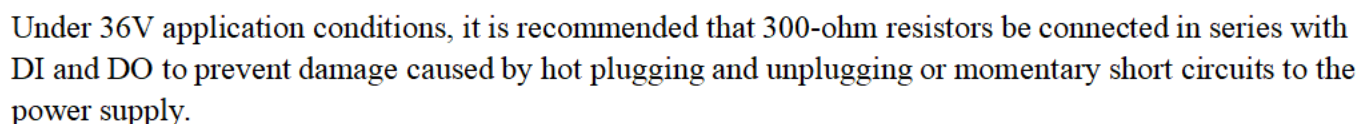
The recommended value for R_d is 7.5 k, and the recommended value for C_i is 1 μF .





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The recommended value for R_d is 7.5 k, and the recommended value for C_i is 1 μF .



- **SOT23-8 Package**



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
V1.6	M	12V full-voltage test for RGB ports; DIF test added	2021-12-31	Yu Xinghui	Yin Huaping
V2.0	M	LED Driver IC upgrade	2022-10-10	Yu Xinghui	Yin Huaping
V2.1	M	Add FSOP8 packaging	2022-11-11	Yu Xinghui	Yin Huaping
V2.2	M	Modify the range of output current parameters	20240806	Chen Yongzhao	Yin Huaping
V2.3	M	High-level input Add a 36V application circuit	20250806	Chen Yongzhao	Yin Huaping
V2.4	M	Modify the high-level input and RES reset time	20260115	Chen Yongzhao	Yin Huaping
V2.5	M	Update logo; Format adjustment	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.