White LED Step-Up Converter in Tiny Package

General Description

The RT9271 is a step-up DC/DC converter specifically designed to drive white LEDs with a constant current. The device can drive one to four LEDs in series from a Li-Ion cell. Series connection of the LEDs provides identical LED currents resulting in uniform brightness and eliminating the need for ballast resistors. The RT9271 switches at 1.1 MHz, allowing the use of tiny external components. The input and output capacitor can be as small as 1uF, saving space and cost versus alternative solutions. A low 0.25V feedback voltage minimizes power loss in the current setting resistor for better efficiency.

The RT9271 is available in low profile SOT26 package.

Ordering Information

RT9271 □ □

- Package Type
  E : SOT-26
- Operating Temperature Range
  C : Commercial Standard

Marking Information

For marking information, contact our sales representative directly or through a RichTek distributor located in your area, otherwise visit our website for detail.

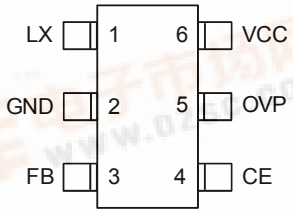
Features

- **Inherently Matched LED Current**
- **High Efficiency: 85% Typical**
- **Drives Up to Four LEDs from 2.8V Supply**
- **20V Internal Switch**
- **Fast 1.1 MHz Switching Frequency**
- **Uses Tiny 1 mm Tall Inductors**
- **Requires Only 1uF Output Capacitor**
- **Low Profile SOT-26 Package**
- **Optional 15V Over Voltage Protection**

Applications

- Mobile Phone
- Digital Still Camera
- PDAs, Handheld Computers
- MP3 Players
- GPS Receivers

Pin Configurations

Part Number	Pin Configuration
RT9271CE (Plastic SOT-26)	

Pin Assignment

Pin	Name	Function
1	LX	Switch Pin. Connect inductor/diode here. Minimize trace area at this pin to reduce EMI
2	GND	Ground Pin. Connect directly to local ground plane.
3	FB	Feedback Pin. Reference voltage is 0.25V. Connect cathode of lowest LED and resistor here. Calculate resistor value according to the formula: $R_{FB} = 0.25/I_{LED}$
4	CE	Chip Enable Pin. Connect to 1.4V or higher to enable device, 0.4V or less to disable device.
5	OVP	Over Voltage Protection Pin. Voltage sensing input to trigger the function of over voltage protection, the trip point is 15.5V. Leave it unconnected to disable this function.
6	VCC	Input Voltage Pin. Must be locally bypass with 1uF capacitor to GND.

Typical Application Circuit

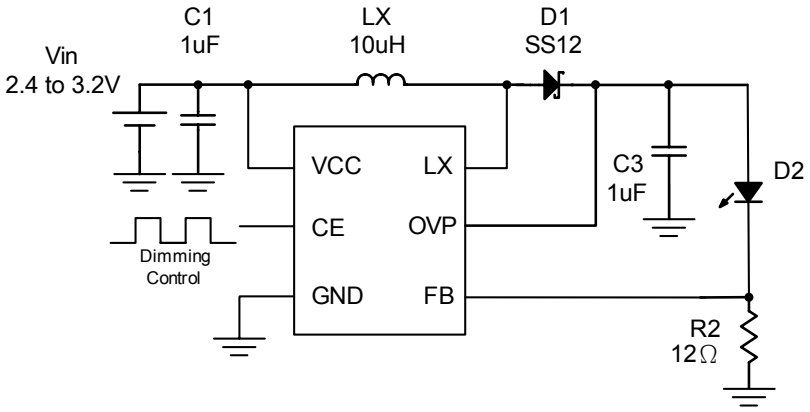


Fig. 1 RT9271 Drivers 1 WLED Application Circuit

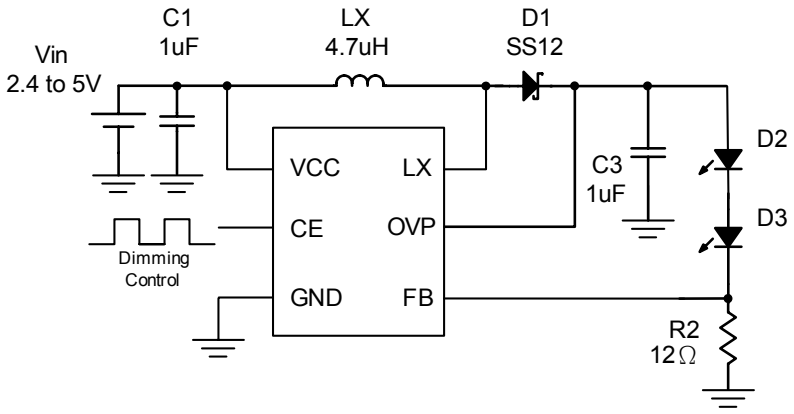


Fig. 2 RT9271 Drivers 2 Series WLEDs Application Circuit

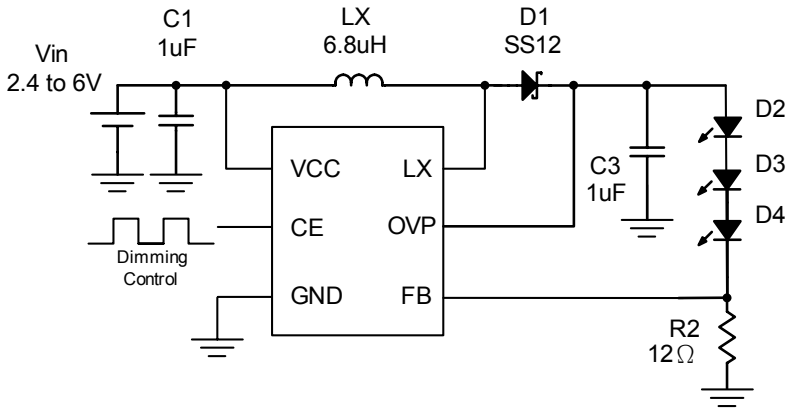


Fig. 3 RT9271 Drivers 3 Series WLEDs Application Circuit

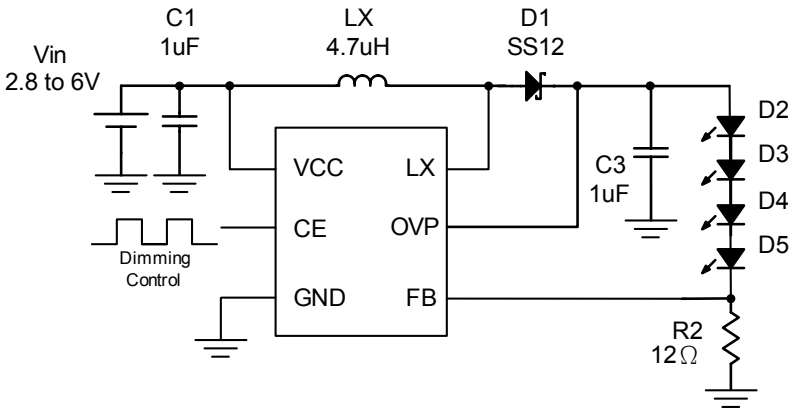


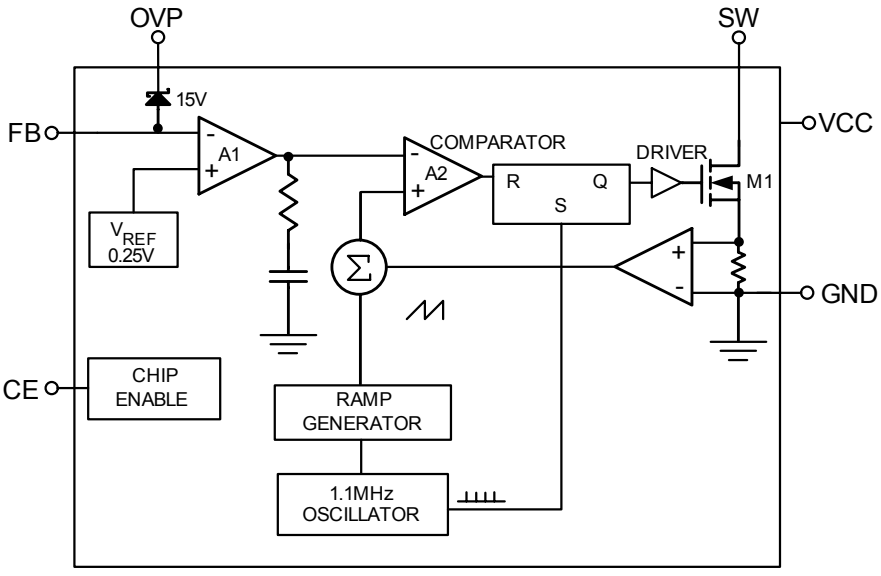
Fig. 4 RT9271 Drivers 4 Series WLEDs Application Circuit

Note : 1. D1 is Schottky diode (SS12).

2. D2 ~ D5 are the WLED (HT-S91CW-DT) of HARVATEK.

3. LX is the SH4018 series of ABC TAIWAN ELECTRONICS CORP.

Function Block Diagram



Absolute Maximum Ratings

- Input Supply Voltage ---------- –0.3V to 7V
- SW ---------- –0.3V to 21V
- The Other Pins ---------- –0.3V to 21V
- Operating Temperature Range ---------- 0°C to 70°C
- Junction Temperature Range ---------- 0°C to 125°C
- Storage Temperature Range ---------- –65°C to 150°C

Electrical Characteristics

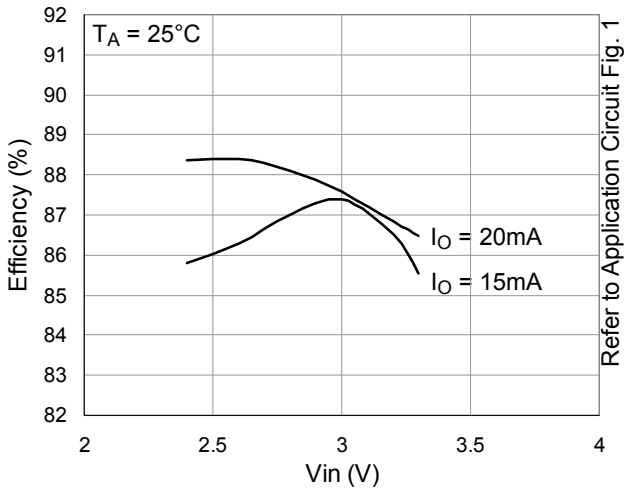
(V_{CC} = 3.6V, T_A = 25°C, Unless Otherwise specification)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
System Supply Input						
Operation Voltage Range	V_{CC}		2.4		6	V
Under Voltage Lock Out	UVLO			2.2		V
Maximum Output Voltage					20	V
Supply Current	I_{CC1}	V_{CC}=6V, Continuously Switching			2	mA
Quiescent Current	I_{CC2}	V_{CC}=6V, FB=1.3V, No Switching		90		μA
Shut Down Current	I_{CC3}	V_{CC}=6V, V_{CE}<0.4V			1	μA
Oscillator						
Operation Frequency	F_{OSC}		0.9	1.1	1.3	MHz
Maximum Duty Cycle	Dmax		85	90		%
Reference Voltage						
Feedback Voltage	VFB		0.237	0.25	0.263	V
MOSFET						
On Resistance of MOSFET	Rds(on)			0.75		Ω
Current Limitation	I_{max1}	Normal Operation		800		mA
Current Limit	I_{max2}	Start up Condition		500		mA
Control and Protection						
Shut Down Voltage	V_{CE1}		0.4	0.8		V
Enable Voltage	V_{CE2}			0.8	1.4	V
CE Pin Pull Low Current	I_{CE}			4		μA
OVP Threshold	OVP		14.5	15.5	20.0	V

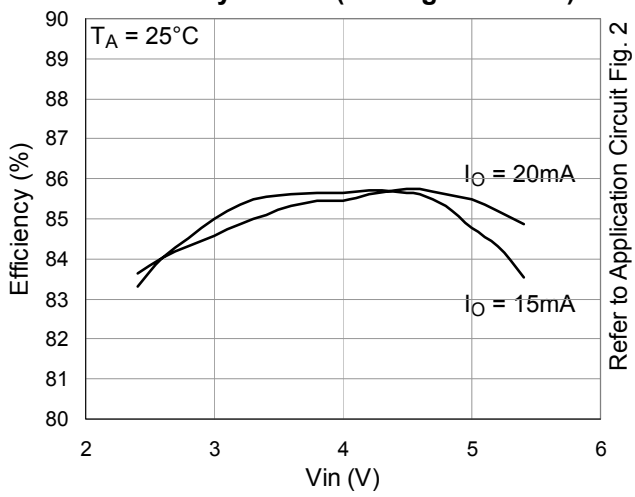
Note: Floating the OVP pin to disable OVP function

Typical Operating Characteristics

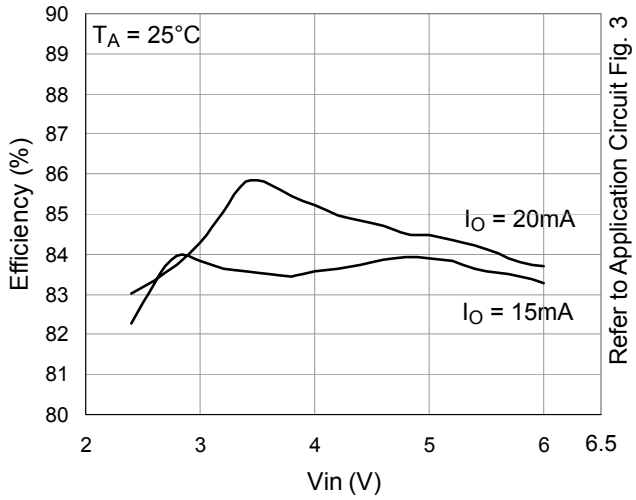
Efficiency vs. Vin (Driving 1 WLED)



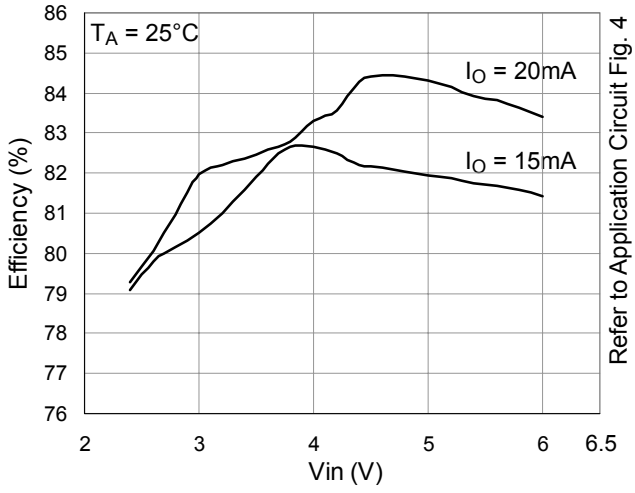
Efficiency vs. Vin (Driving 2 WLEDs)



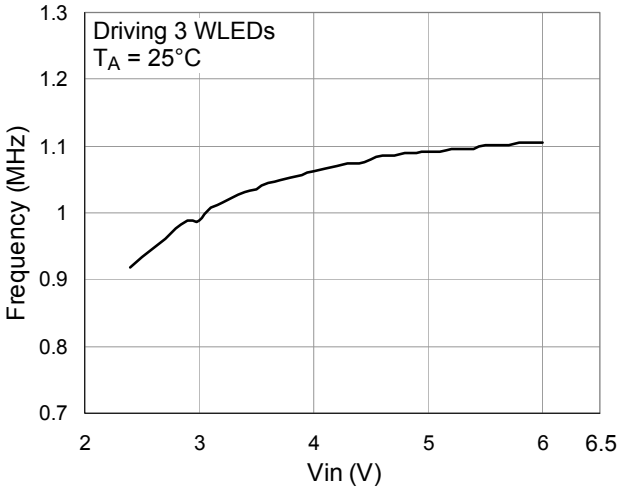
Efficiency vs. Vin (Driving 3 WLEDs)



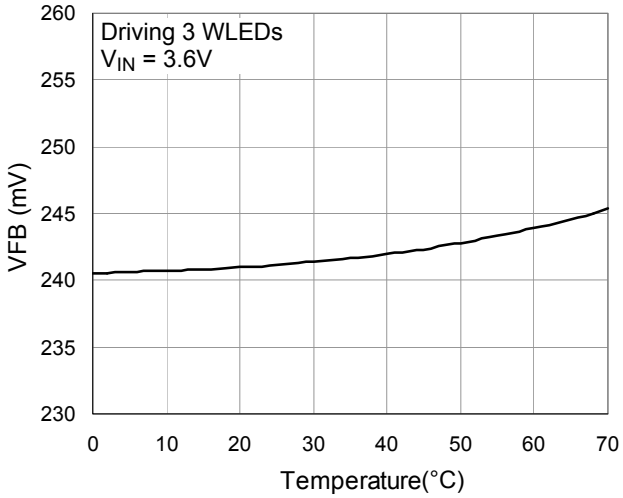
Efficiency vs. Vin (Driving 4 WLEDs)



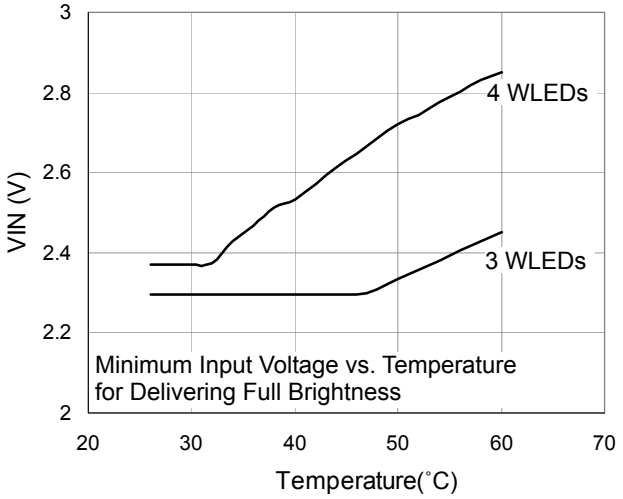
Frequency vs. Vin



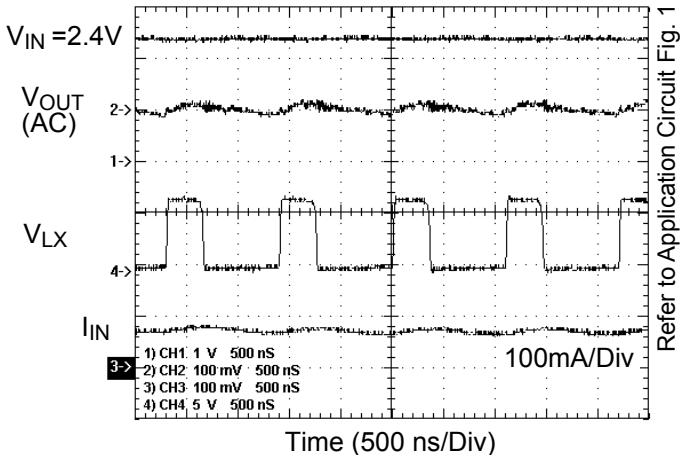
VFB vs. Temperature



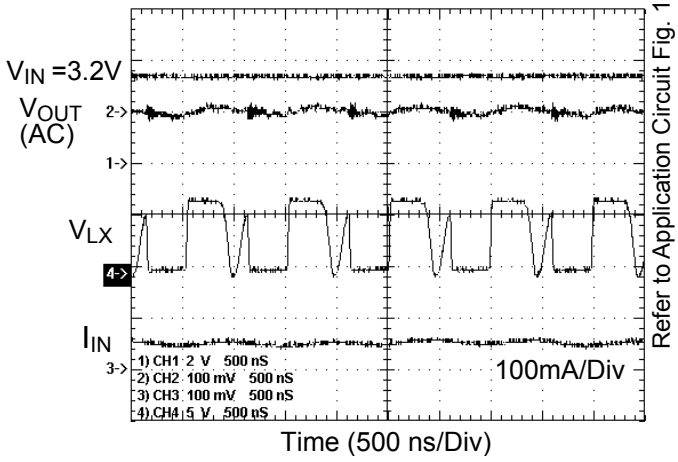
VIN vs. Temperature



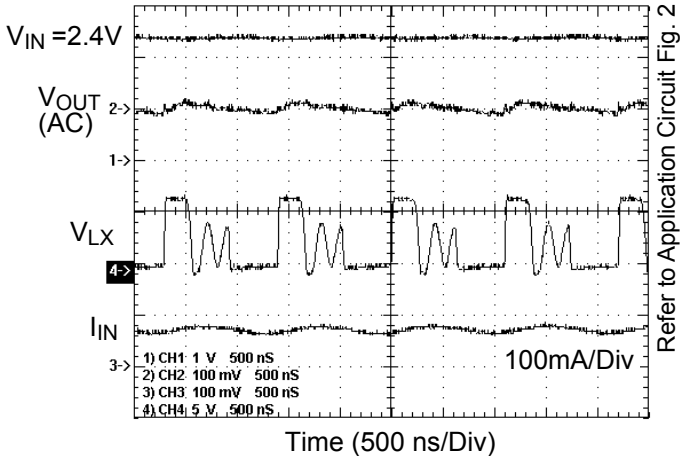
Stability for Driving 1 WLED



Stability for Driving 1 WLED



Stability for Driving 2 WLEDs



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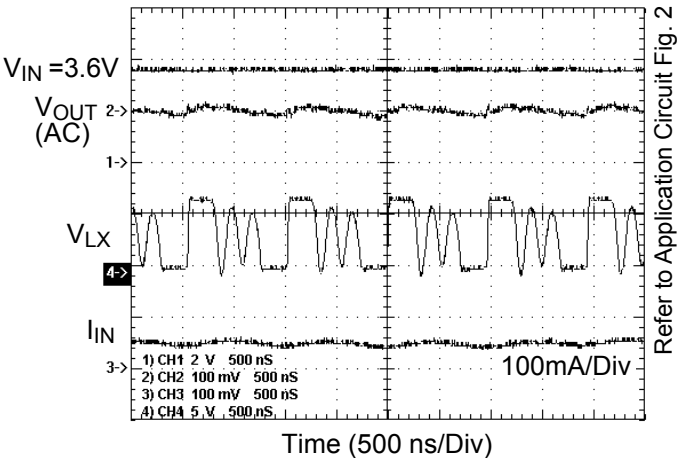
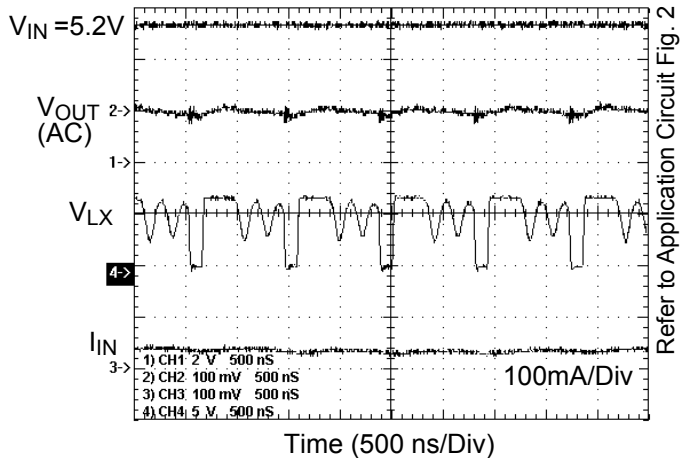
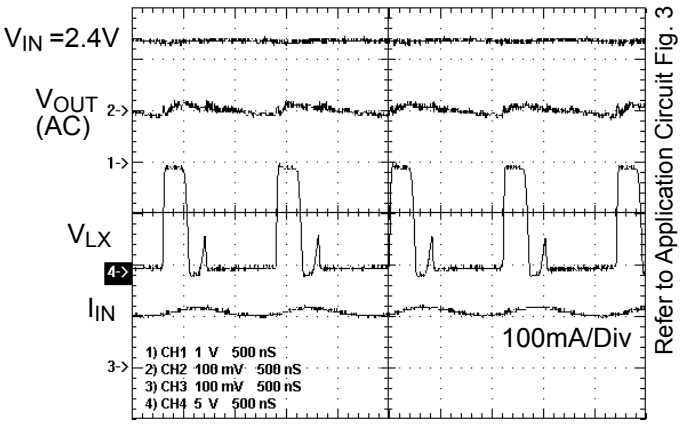


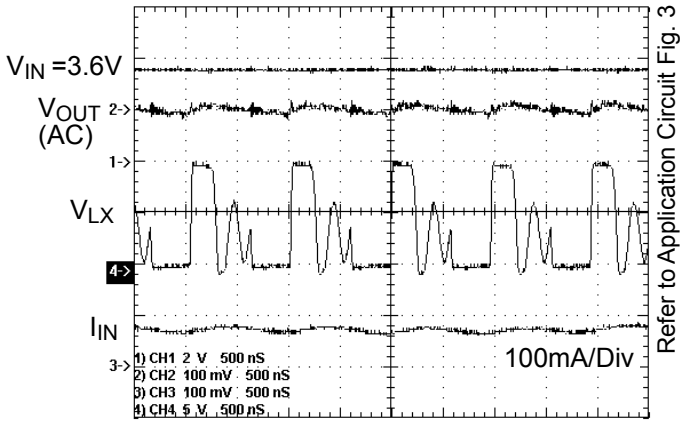
Stability for Driving 2 WLEDs



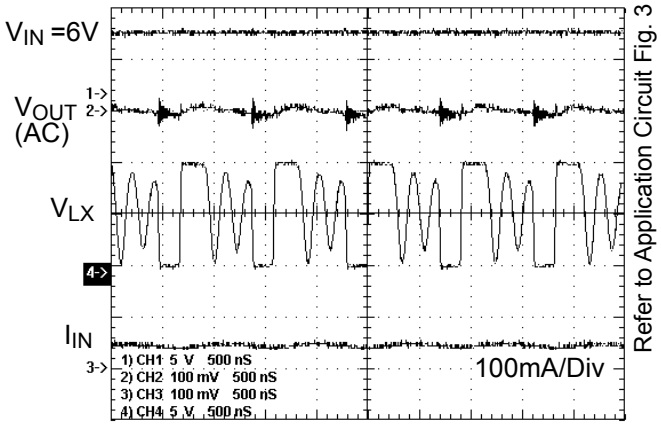
Stability for Driving 3 WLEDs



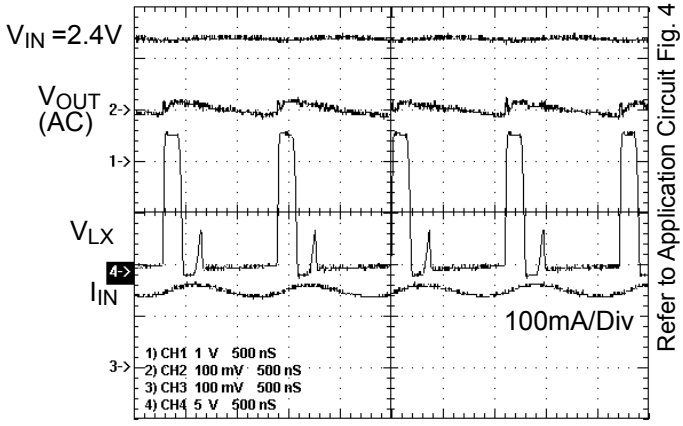
Stability for Driving 3 WLEDs



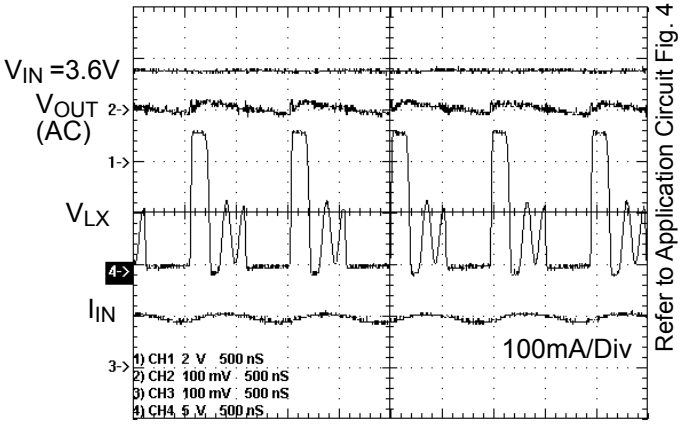
Stability for Driving 3 WLEDs



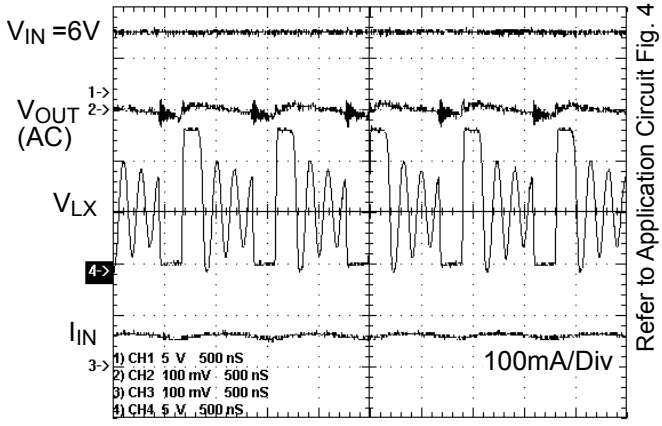
Stability for Driving 4 WLEDs



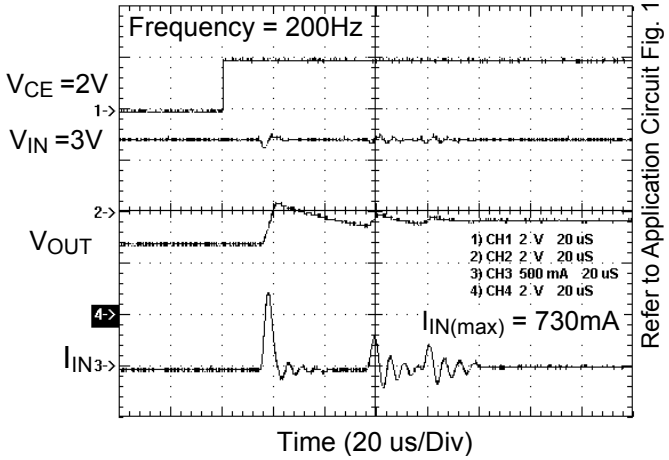
Stability for Driving 4 WLEDs



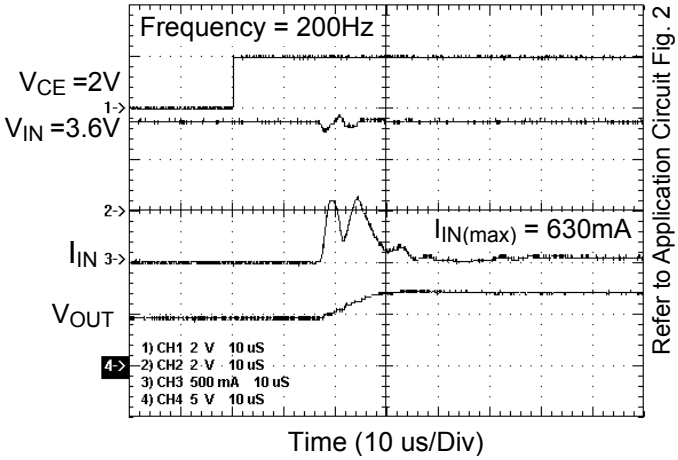
Stability for Driving 4 WLEDs



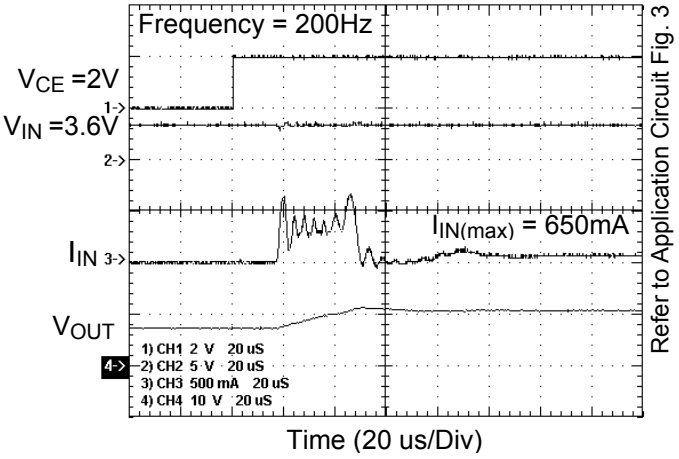
Inrush Current for Driving 1 WLED



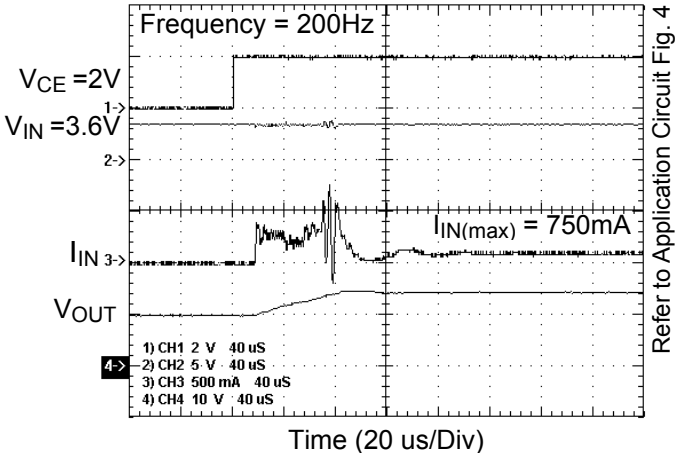
Inrush Current for Driving 2 WLEDs



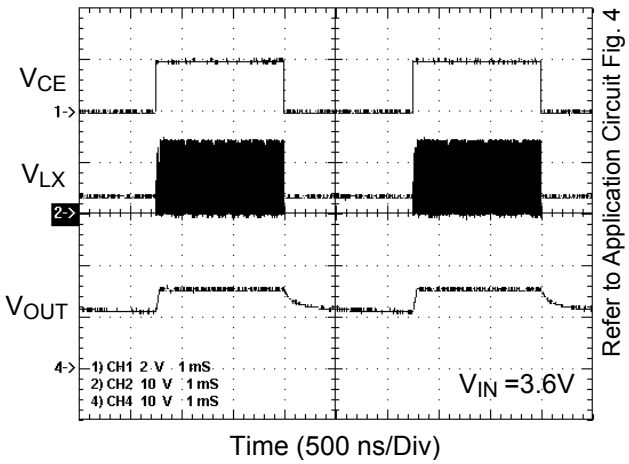
Inrush Current for Driving 3 WLEDs



Inrush Current for Driving 4 WLEDs



Dimming Control for Driving 4 WLEDs



Application Note

LED Current Control

The LED current is controlled by the feedback resistor (R2 in Application Circuit). The feedback reference is 0.25V. The LED current is 0.25V/R2. In order to have accurate LED current, precision resistors are preferred (1% is recommended). The formula and table for R2 selection are shown below.

$$R2 = 0.25V/I_{LED}$$

R2 Resistor Value Selection

ILED (mA)	R2 (Ω)
5	49.9
10	24.9
12	21
15	16.5
20	12.4

Recommended Inductance (for Li-Ion cell)

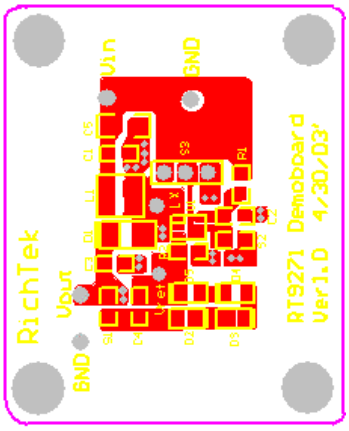
Condition	Inductance (μH)
1 WLED	10
2 WLEDs	4.7
3 WLEDs	6.8
4 WLEDs	4.7

Layout Guide

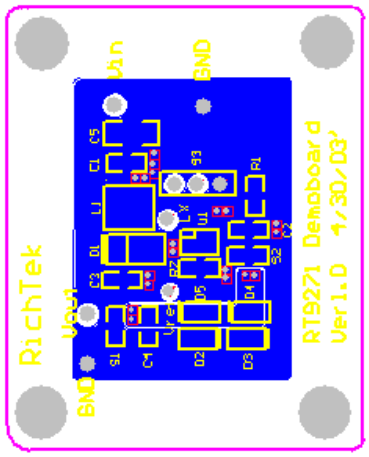
- A full GND plane without gap break.
- V_{CC} to GND noise bypass – Short and wide connection for the 1μF MLCC capacitor between Pin6 and Pin2.
- Minimized LX node copper area to reduce EMI.
- Minimized FB node copper area and keep far away from noise sources.

Board Layout Example (2-Layer EVB Board)

(Refer to EVB Circuit)



- Top Layer –



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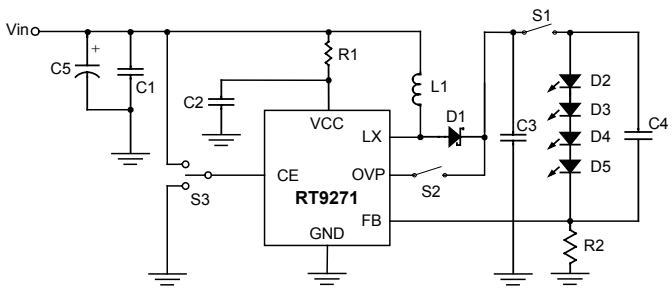
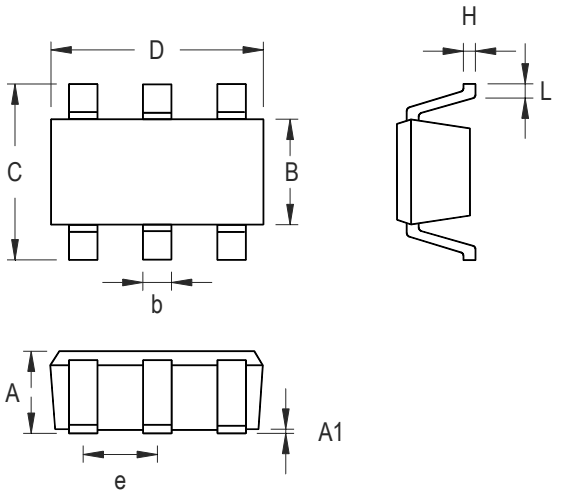


EVB Circuit

Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	--	0.152	--	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.102	0.254	0.004	0.010
L	0.356	0.610	0.014	0.024

SOT- 26 Surface Mount Package

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