Tiny Package, High Performance, Constant Current Switching Regulator for White LED

General Description

The RT9284A/B/C is a compact, high efficient and high integration LED driver. Internal 20V MOSFET can support 2 to 4 White LEDs for backlighting and camera flashing.

Highly integration and internal compensation network minimizes as 5 external component counts. Tiny package type of TSOT-23 package provide the best solution for PCB space saving and total BOM cost.

Internal 0.1V low current feedback voltage, which minimize the power loss due to the current sense resistor. Optimized operation frequency can meet the requirement of small LC filters value and low operation current with high efficiency, as one of the LED is open. Floating or pull EN pin low can easily disable this function. For reducing the inrush current, internal soft start function can protect inrush current.

Features

- **V_{IN} Operating Range: 3.0V to 5.5V**
- **Maximum Output Voltage up to 20V**
- **Dimming with Zero-inrush and Wide Frequency Range of 100 to 100kHz**
- **Over Voltage Protection**
- **Output Current up to 100mA at V_{OUT} = 12V.**
- **Zero Shutdown Supply Current**
- **Minimize the Output Component**
- **Small LC Filter**
- **Internal Soft Start**

Applications

- Camera Flash white Led
- Mobile Phone, Smart Phone Led Backlight
- PDA Led Backlight
- Digital Still Camera
- Camcorder

Ordering Information

RT9284□(-□□)□□

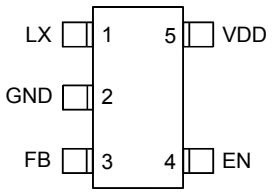
- Package Type
  - J5 : TSOT23-5
  - J6 : TSOT23-6
- Operating Temperature Range
  - C : Commercial Standard
  - P : Pb Free with Commercial Standard
- OVP Voltage
  - Default : No OVP Voltage
  - 15 : 15V
  - 18 : 18V
- FB Voltage
  - A : 0.1V
  - B : 0.25V
  - C : 1.235

Marking Information

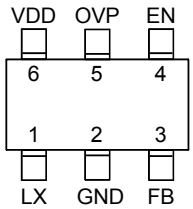
For marking information, contact our sales representative directly or through a RichTek distributor located in your area, otherwise visit our website for detail.

Pin Configurations

TOP VIEW



TSOT-23-5



TSOT-23-6

Note : There is no pin1 indicator on top mark for TSOT-23-6 type, and pin 1 will be lower left pin when reading top mark from left to right.

Typical Application Circuit

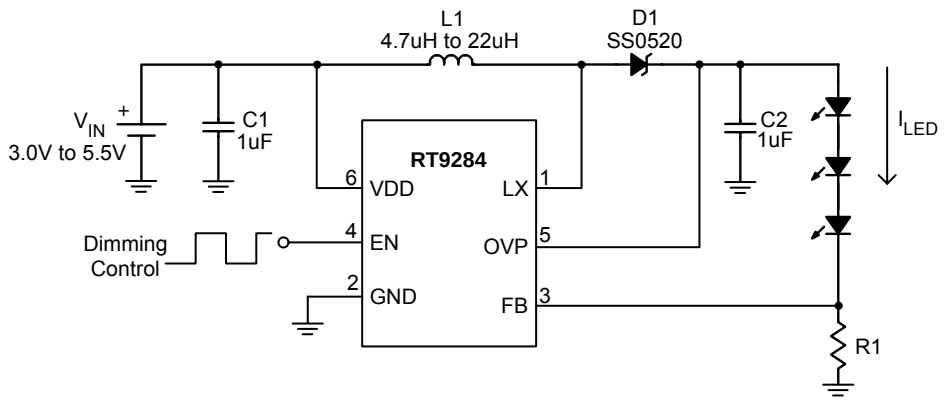


Figure 1. Application for Driving 3 Series WLEDs

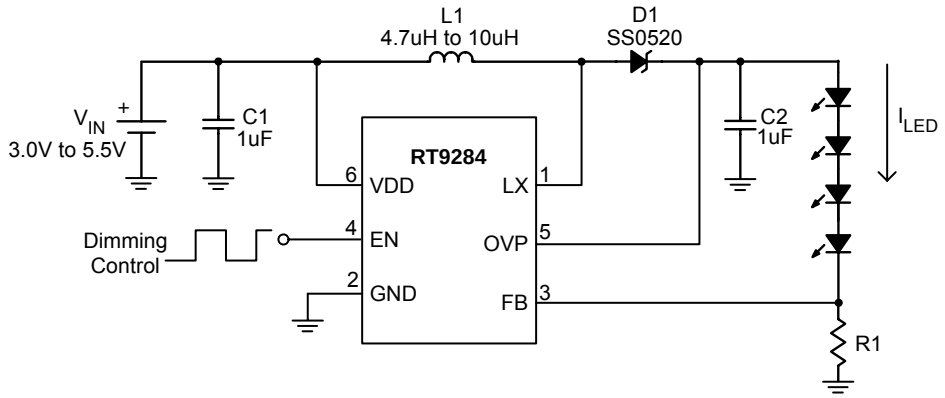


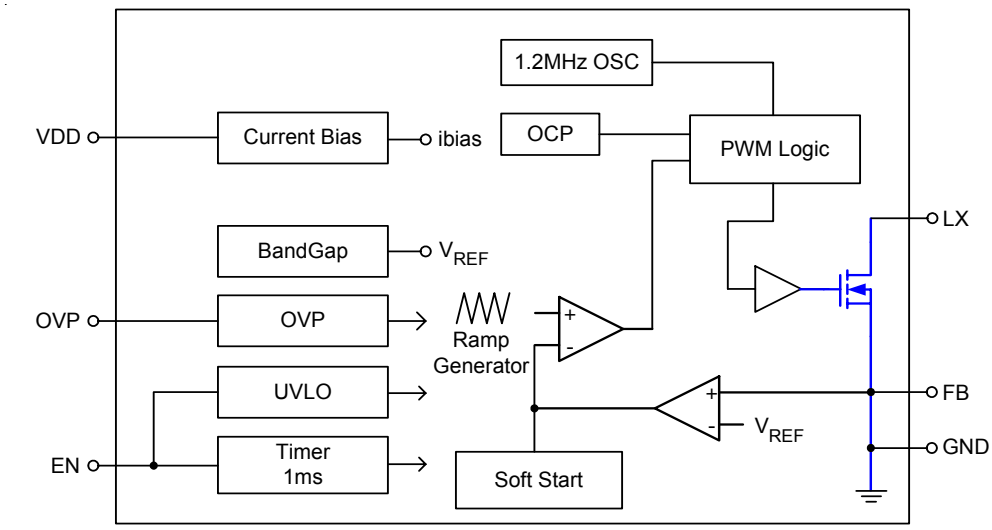
Figure 2. Application for Driving 4 Series WLEDs

Version	Feedback Reference Voltage V_{FB} (V)	LED Current Setting I_{LED} (A)
RT9284A	0.1	I_{LED} =0.1/R1
RT9284B	0.25	I_{LED} = 0.25/R1
RT9284C	1.235	I_{LED} = 1.235/R1

Pin Description

TSOT-23-5	TSOT-23-6	Pin Name	Pin Function
1	1	LX	Switch Pin. Connect this Pin to inductor and catch diode. Minimize the track area to reduce EMI.
2	2	GND	Ground Pin
3	3	FB	Feedback Reference Voltage Pin. Series connect a resistor between WLED and ground as a current sense. Sense the current feedback voltage to set the current rating.
4	4	EN	Chip Enable Pin. Voltage sensing input to trigger the function of over voltage protection. Leave it unconnected to disable this function.
--	5	OVP	Over Voltage Protection Pin. Voltage sensing input to trigger the function of over voltage protection. Leave it unconnected to disable this function.
5	6	VDD	Supply Input Voltage Pin. Bypass 1uF capacitor to GND to reduce the input noise.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

- Supply Input Voltage ---------- –0.3V to 7V
- EN Input Voltage ---------- –0.3V to 20V
- OVP Voltage ---------- –0.3V to 20V
- The Other Pins ---------- –0.3V to 20V
- Power Dissipation, P_D @ T_A = 25°C
  - TSOT-23-5 ---------- 0.4W
  - TSOT-23-6 ---------- 0.4W
- Package Thermal Resistance (Note 4)
  - TSOT-23-5, θ_{JA} ---------- 250°C/W
  - TSOT-23-6, θ_{JA} ---------- 250°C/W
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- Operation Temperature Range ---------- –40°C to 80°C
- Junction Temperature Range ---------- 0°C to 125°C
- Storage Temperature Range ---------- –65°C to 150°C
- Operation Junction Temperature Range ---------- 0°C to 125°C
- ESD Susceptibility (Note 2)
  - HBM ---------- 2kV
  - MM ---------- 200V

Recommended Operating Conditions (Note 3)

- Supply Input Voltage ---------- 3.0V to 5.5V
- Junction Temperature Range ---------- –40°C to 125°C

Electrical Characteristics

(V_{IN} = 3.7V, T_A = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
System Supply Input						
Operation voltage Range	V_{DD}		3.0	--	5.5	V
Under Voltage Lock Out	V_{DD}		--	2.2	--	V
Quiescent Current	I_{DD}	FB=1.5V, No switch	--	700	--	uA
Supply Current	I_{DD}	FB=0V, Switch	--	2	--	mA
Shut Down Current	I_{DD}	V_{EN} < 0.4V	--	--	1	uA
Line Regulation		V_{IN} : 3.0~4.3V	--	3	--	%
Oscillator						
Operation Frequency	F_{OSC}		--	1.2	--	MHz
Maximum Duty Cycle			85	--	--	%
Dimming Frequency			100	--	100k	Hz

To be continued

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Reference Voltage						
Feedback Voltage (Note 5)	RT9284A	Default	0.095	0.1	0.105	V
	RT9284B	Option 1	0.237	0.25	0.263	V
	RT9284C		1.173	1.235	1.296	V
MOSFET						
On Resistance of MOSFET	$R_{DS(ON)}$		--	0.75	--	Ω
Protection						
OVP Threshold	V_{OVP}	for 2,3 WLEDs application	--	15	--	V
		for 4 WLEDs application	--	18	-	V
OCP			--	1000	--	mA
Shut Down Voltage	V_{EN}		--	--	0.4	V
Enable Voltage	V_{EN}		1.6	--	--	V

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. Devices are ESD sensitive. Handling precaution recommended.

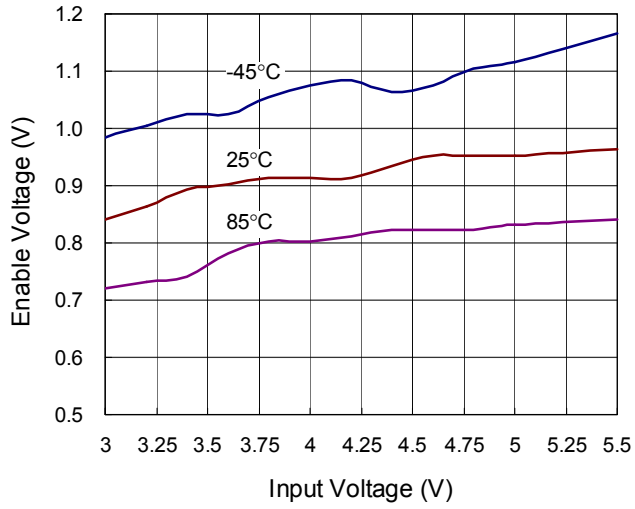
Note 3. The device is not guaranteed to function outside its operating conditions.

Note 4. θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

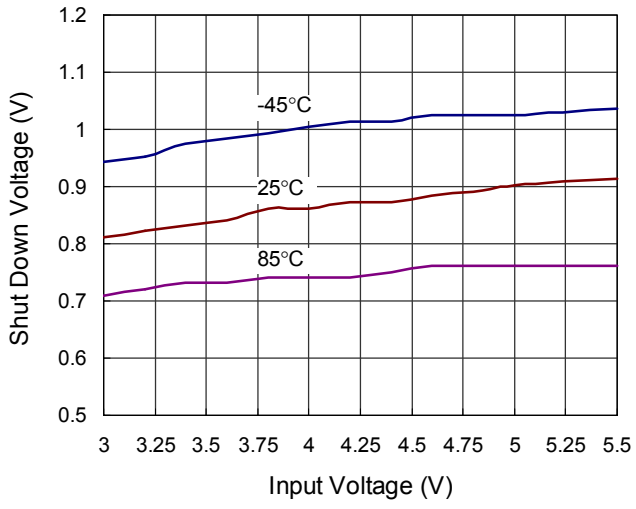
Note 5. Floating the OVP pin to disable OVP function.

Typical Operating Characteristics

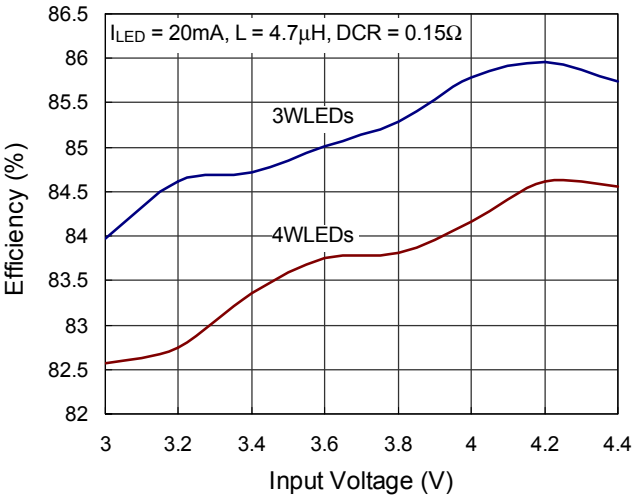
Enable Voltage vs. Input Voltage



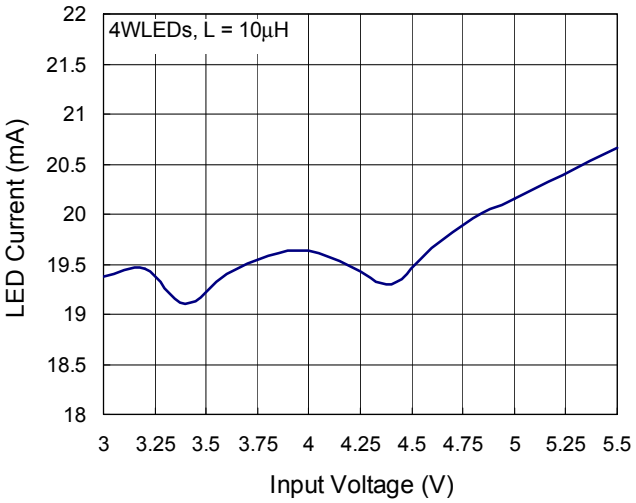
Shut Down Voltage vs. Input Voltage



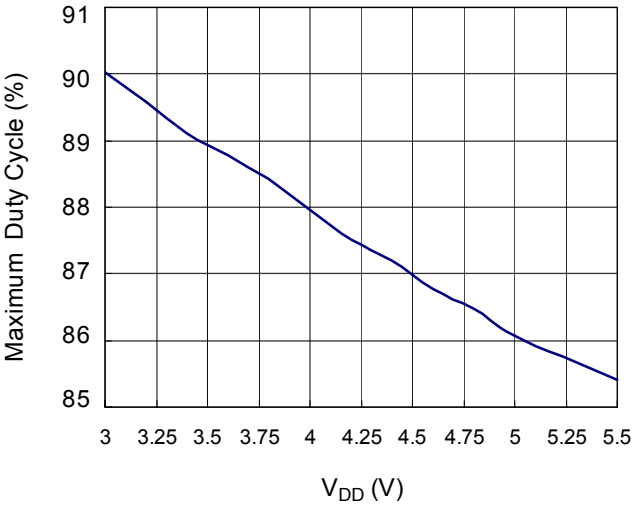
Efficiency vs. Input Voltage



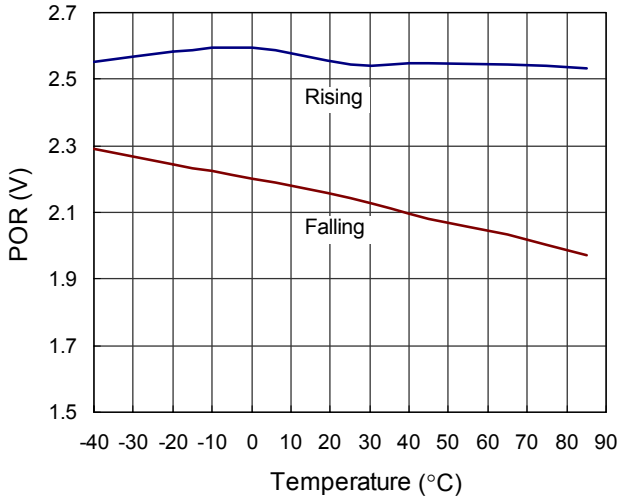
LED Current vs. Input Voltage



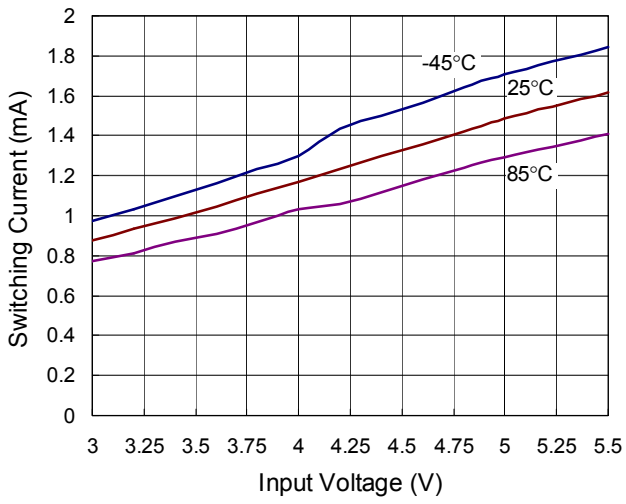
Maximum Duty Cycle vs. V_{DD}



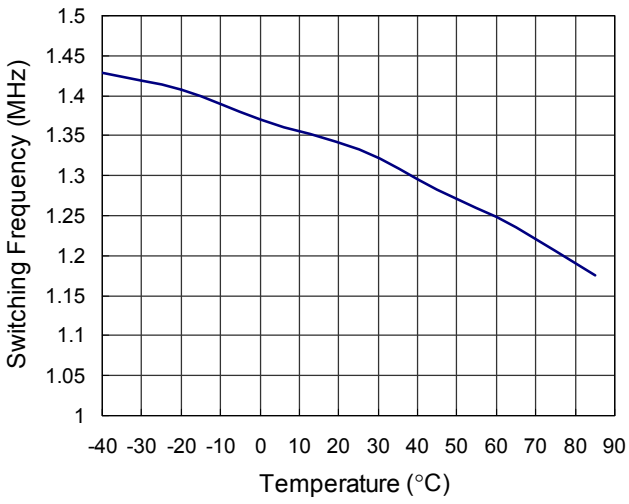
POR (Rising/Falling) vs. Temperature



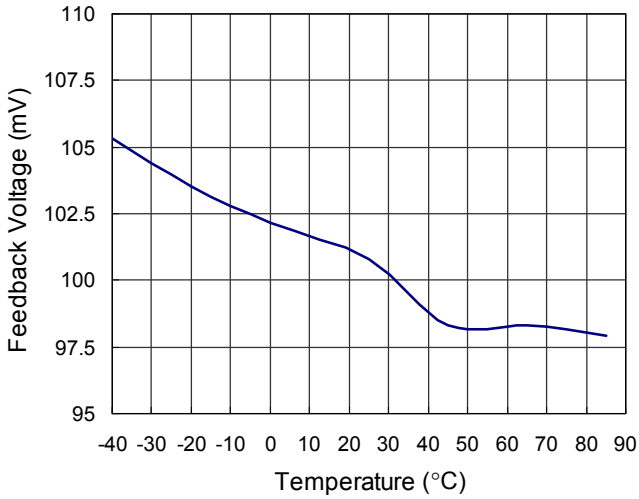
Switching Current vs. Input Voltage



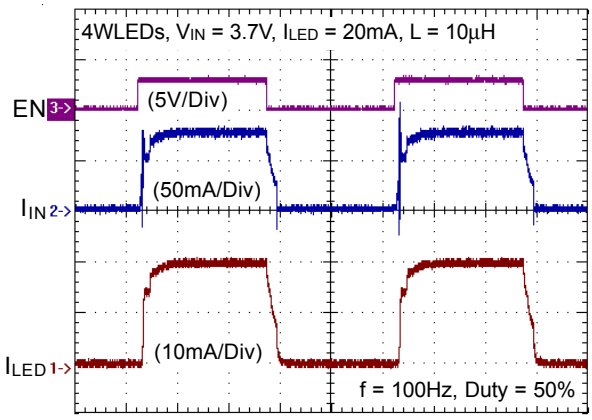
Switching Frequency vs. Temperature



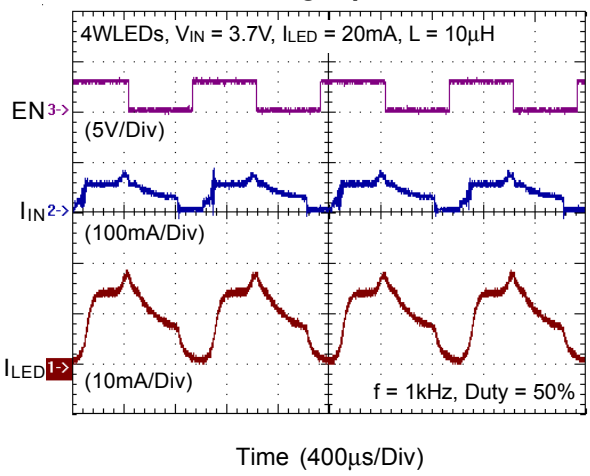
Feedback Voltage vs. Temperature



Dimming Operation



Dimming Operation



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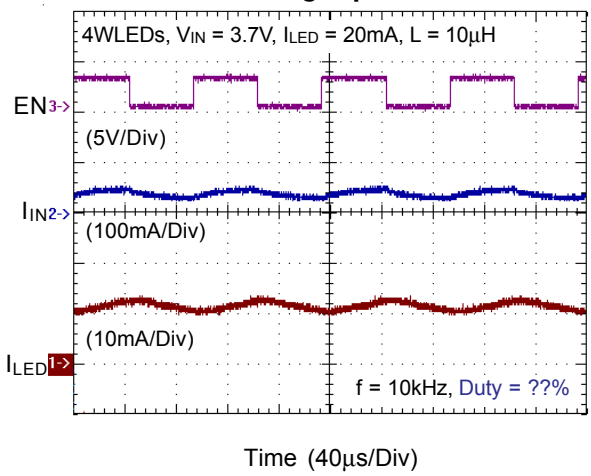
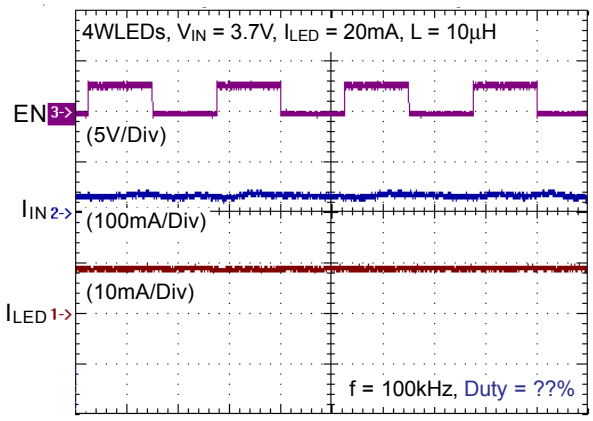
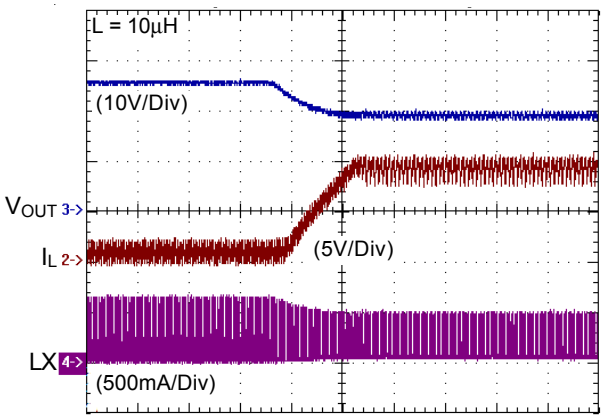


Dimming Operation



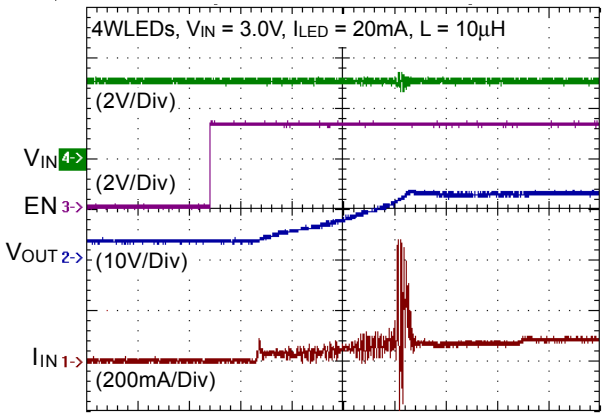
Time (4µs/Div)

OCP



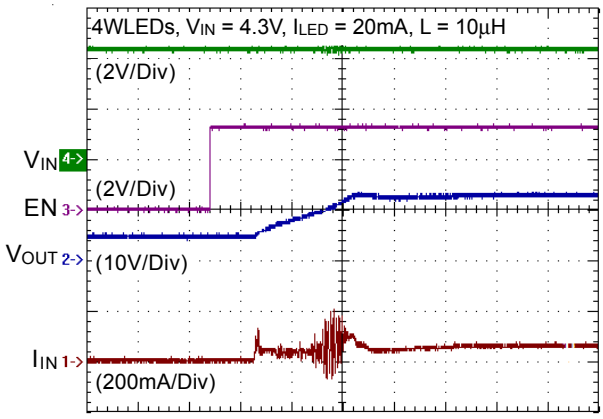
Time (20µs/Div)

Inrush Current



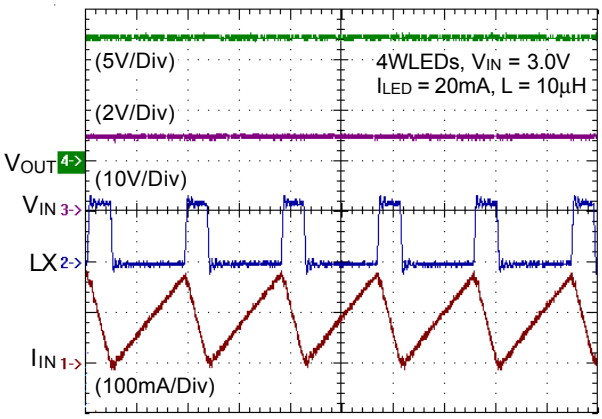
Time (100µs/Div)

Inrush Current



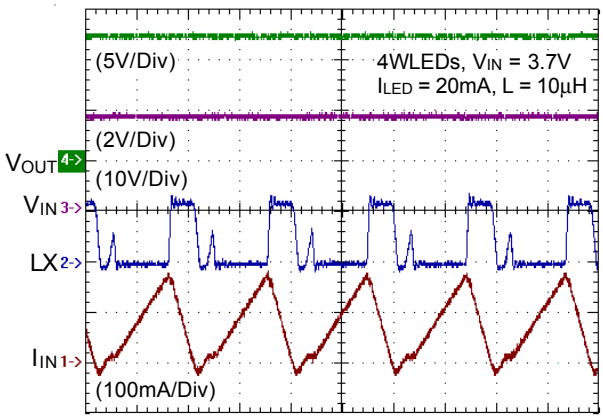
Time (100µs/Div)

Normal Operation



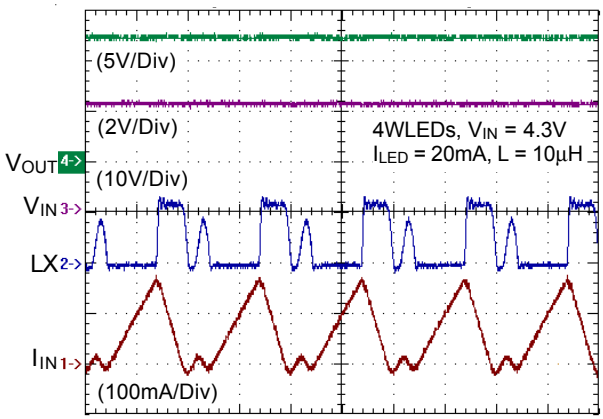
Time (400ns/Div)

Normal Operation



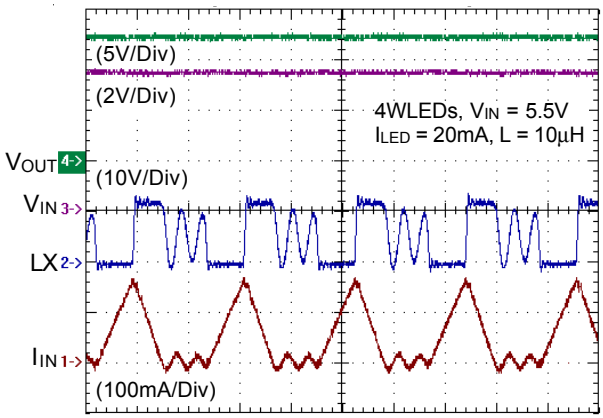
Time (400ns/Div)

Normal Operation



Time (400ns/Div)

Normal Operation

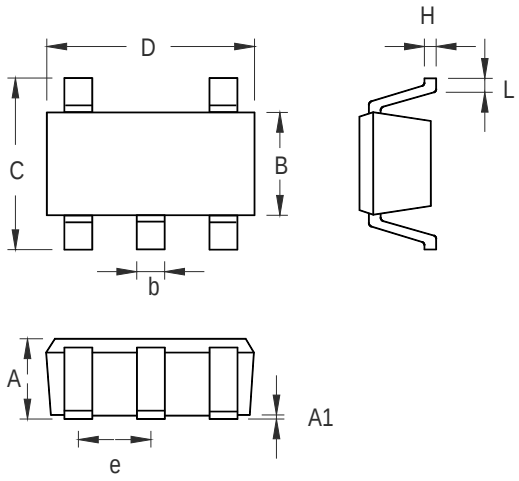


Time (400ns/Div)

Datasheet Revision History

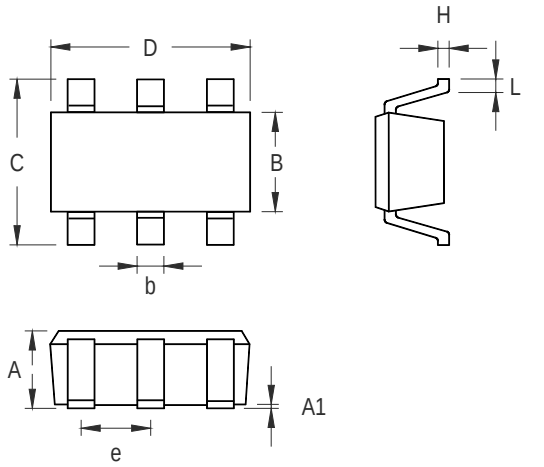
Version	Data	Page No.	Item	Description
00C	2005/3/1			New

Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	1.000	0.028	0.039
A1	0.000	0.100	0.000	0.004
B	1.397	1.803	0.055	0.071
b	0.350	0.559	0.014	0.022
C	2.591	3.000	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.100	0.254	0.004	0.010
L	0.356	0.610	0.014	0.024

TSOT- 23-5 Surface Mount Package



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TSOT- 23-6 Surface Mount Package

RICHTEK TECHNOLOGY CORP.

Headquarter
5F, No. 20, Taiyuen Street, Chupei City
Hsinchu, Taiwan, R.O.C.
Tel: (8863)5526789 Fax: (8863)5526611

RICHTEK TECHNOLOGY CORP.

Taipei Office (Marketing)
8F-1, No. 137, Lane 235, Paochiao Road, Hsintien City
Taipei County, Taiwan, R.O.C.
Tel: (8862)89191466 Fax: (8862)89191465
Email: marketing@richtek.com