TX9417

SOT-23-6L DC-DC 同步降压 IC

Features

- Wide 4.5V to 18V Operating input Range
- 2A Continuous Output Current
- No Schottky Diode Required
- 500KHz Frequency Operation
- Built-in Over Current Limit
- Built-in Over Voltage Protection
- PFM Mode for High Efficiency in Light Load
- Internal Soft start
- 110mΩ/70mΩ Low RDS(ON) Internal Power MOSFETs
- Output Adjustable from 0.6V
- Integrated internal compensation
- No Schottky Diode Required
- Thermal Shutdown
- Available in SOT23-6 ,Package
- -40℃ to +85℃ Temperature Range

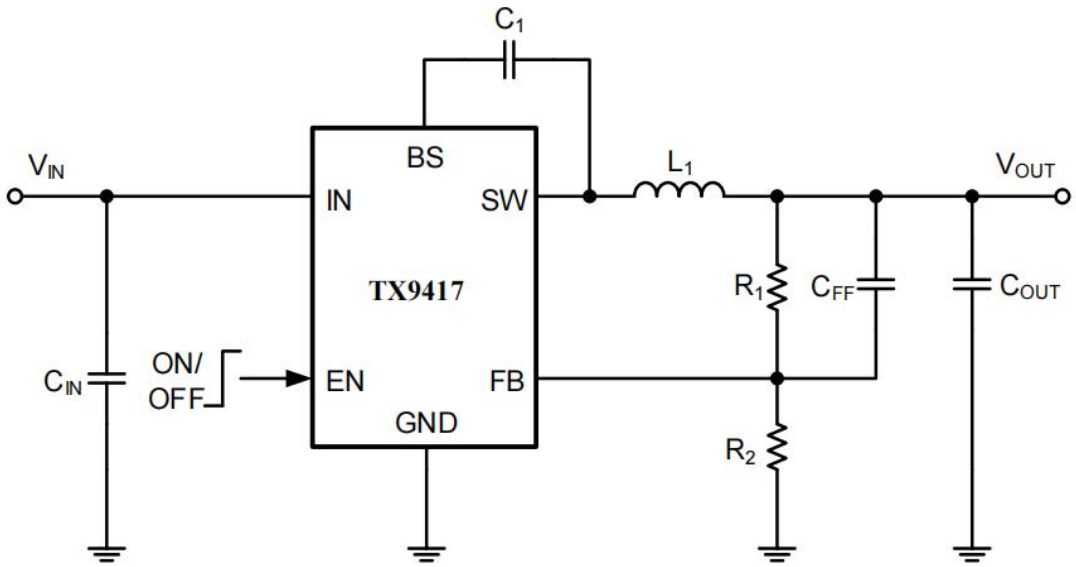
Applications

- Digital Set-top Box (STB)
- Tablet Personal Computer (Pad)
- Flat-Panel Television and Monitor
- Wi-Fi Router / AP
- Digital Video Recorder (DVR)
- Portable Media Player (PMP)
- Cable Modem / XDSL
- General Purposes

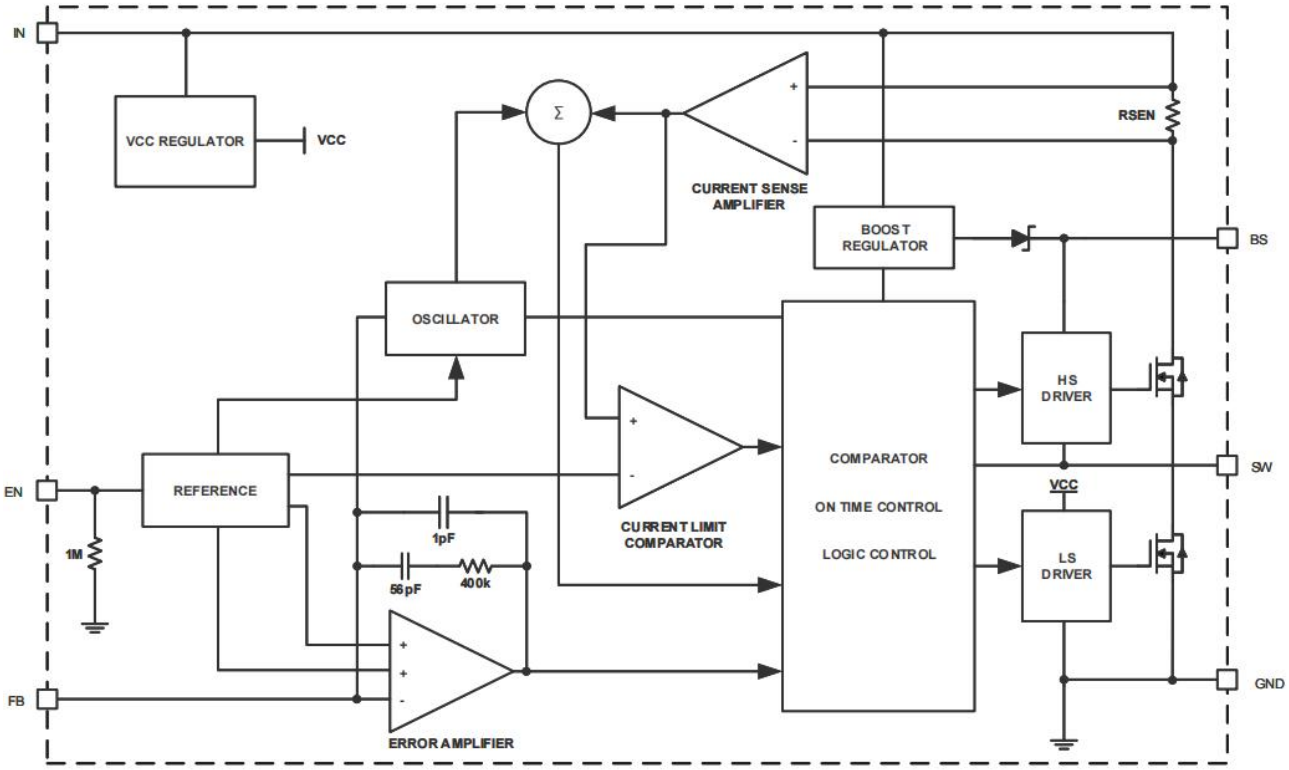
General Description

The TX9417 is a high frequency, synchronous, rectified, step-down, switch-mode converter with internal power MOSFETs. It offers a very compact solution to achieve a 2A continuous output current over a wide input supply range, with excellent load and line regulation.The TX9417 requires a minimal number of readily available, external components and is available in a space saving SOT23-6 package.

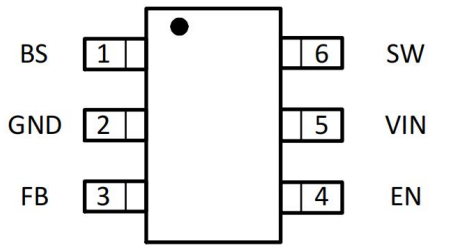
Typical Application



System Block Diagram



Pin Configuration



PIN	NAME	FUNCTION
1	BS	Bootstrap
2	GND	Groung
3	FB	Feedback input
4	EN	Enable
5	VIN	Power Supply
6	SW	Switching

Absolute Maximum Ratings

Vin,EN,Voltage .....-0.3V to 20V

Operating Temperature Range .....-40℃to +85℃

FB Voltages.....-0.3 to 6V

Lead Temperature(Soldering,10s) .....+260℃

SW Voltage .....-0.3V to (VIN+0.5V)

Storage Temperature Range.....-55℃to 150℃

BS Voltage.....(Vsw-0.3) to (Vsw+5V)

ESD(Machine Made)MM.....200V

ESD(Human Body Made)HMB.....2KV

Thermal Resistance (θJA) .....105 ℃/W

Thermal Resistance(θJC).....55 ℃/W

Electrical Characteristics

V_{IN}=12V, T_A=25℃, unless otherwise specified.

Parameter	Test Conditions	Min	Typ.	Max	Unit
Input Voltage Range		4.5		18	V
Supply Current (Quiescent)	V_{EN} =3.0V		0.6	0.8	mA
Supply Current (Shutdown)	V_{EN} =0V or EN = GND			4	uA
Feedback Voltage		0.585	0.600	0.615	V
High-Side Switch On-Resistance	I_{SW}=100mA		110	120	mΩ
Low-Side Switch On-Resistance	I_{SW}=-100mA		70	80	mΩ
Upper Switch Current Limit		2.5	3	3.5	A
Over Voltage Protection Threshold			18.6	19.5	V
Switching Frequency		400	500	600	KHz
Maximum Duty Cycle	V_{FB}=90%		97		%
Minimum On-Time		65	72	110	nS
EN Rising Threshold		1.4			V
EN Falling Threshold				0.8	V
Under-Voltage Lockout Threshold	Wake up VIN Voltage		3.5	3.8	V
	Shutdown VIN Voltage	2.9	3.2		V
	Hysteresis VIN voltage		300		mV
Soft Start			1.5		mS
Thermal Shutdown		150	160		℃
Thermal Hysteresis			30		℃

Functional Description

Internal Regulator

The TX9417 is a current mode step down DC/DC converter that provides excellent transient response with no extra external compensation components. This device contains an internal, low resistance, high voltage power MOSFET, and operates at a high 500K operating frequency to ensure a compact, high efficiency design with excellent AC and DC performance.

Error Amplifier

The error amplifier compares the FB pin voltage with the internal FB reference (VFB) and outputs a current proportional to the difference between the two. This output current is then used to charge or discharge the internal compensation network to form the COMP voltage,which is used to control the power MOSFET current. The optimized internal compensation network minimizes the external component counts and simplifies the control loop design.

Under-Voltage Lockout (UVLO)

Under-voltage lockout (UVLO) protects the chip from operating at an insufficient supply voltage. UVLO protection monitors the internal regulator voltage. When the voltage is lower than UVLO threshold voltage, the device is shut off. When the voltage is higher than UVLO threshold voltage, the device is enabled again.

Thermal Shutdown

Thermal shutdown prevents the chip from operating at exceedingly high temperatures. When the silicon die temperature exceeds 160℃, it shuts down the whole chip. When the temperature falls below its lower threshold (Typ. 130℃) the chip is enabled again.

Internal Soft-Start

The soft-start is implemented to prevent the converter output voltage from overshooting during startup. When the chip starts, the internal circuitry generates a soft-start voltage (SS) ramping up from 0V to 0.6V. When it is lower than the internal reference (REF), SS overrides REF so the error amplifier uses SS as the reference. When SS is higher than REF, REF regains control. The SS time is internally max to 1.5ms.

Over Current Protection & Hiccup

The TX9417 has cycle-by-cycle over current limit when the inductor current peak value exceeds the set current limit threshold. Meanwhile, output voltage starts to drop until FB is below the Under-Voltage (UV) threshold, typically 25% below the reference. Once a UV is triggered, the TX9417 enters hiccup mode to periodically restart the part. This protection mode is especially useful when the output is dead-short to ground. The average short circuit current is greatly reduced to alleviate the thermal issue and to protect the regulator. The TX9417 exits the hiccup mode once the over current condition is removed.

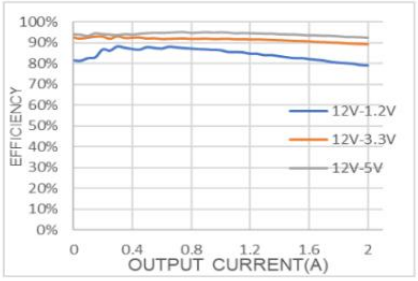
Startup and Shutdown

If both VIN and EN are higher than their appropriate thresholds, the chip starts. The reference block starts first, generating stable reference voltage and currents, and then the internal regulator is enabled. The regulator provides stable supply for the remaining circuitries. Three events can shut down the chip: EN low, VIN low and thermal shutdown. In the shutdown procedure, the signaling path is first blocked to avoid any fault triggering. The COMP voltage and the internal supply rail are then pulled down. The floating driver is not subject to this shutdown command.

Typical Performance Characteristics

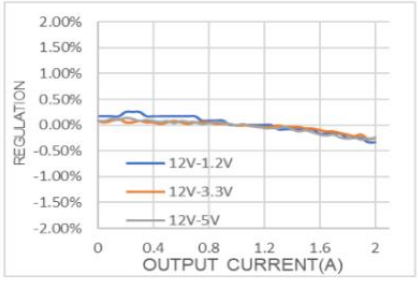
Efficiency vs Load Current

V_{OUT}=5V, 3.3V, 1.2V



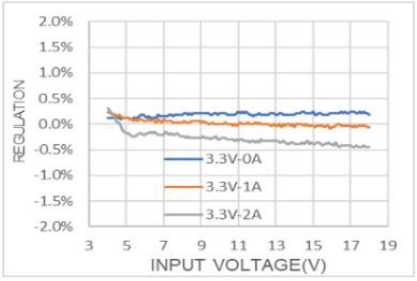
Load Regulation

V_{OUT}=5V, 3.3V, 1.2



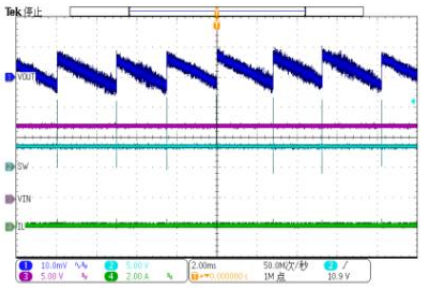
Line Regulation

V_{OUT}=3.3V



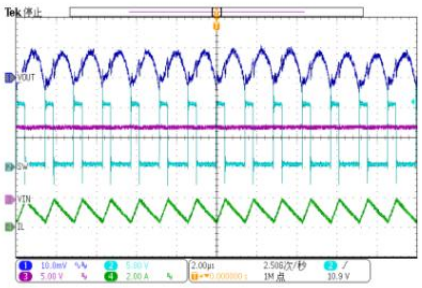
Output Ripple Voltage

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0A



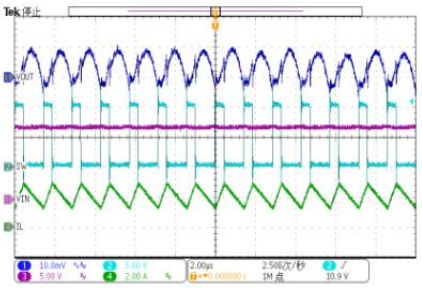
Output Ripple Voltage

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=1A



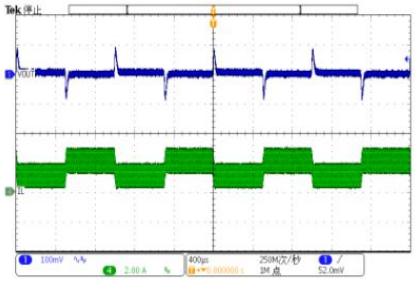
Output Ripple Voltage

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=2A



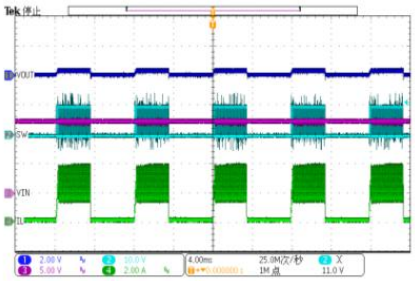
Loop Response

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=1A-2A



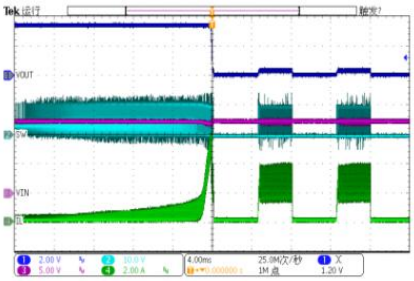
Output Short

V_{IN}=12V, V_{OUT}=3.3V



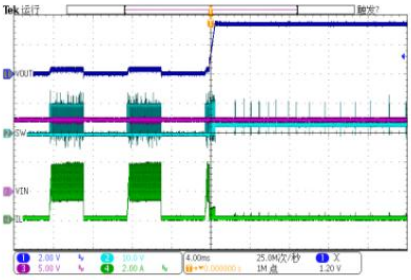
Short Circuit Entry

V_{IN}=12V, V_{OUT}=3.3V



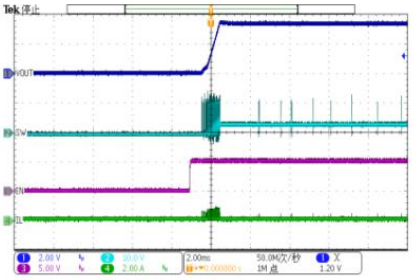
Short Circuit Recovery

V_{IN}=12V, V_{OUT}=3.3V



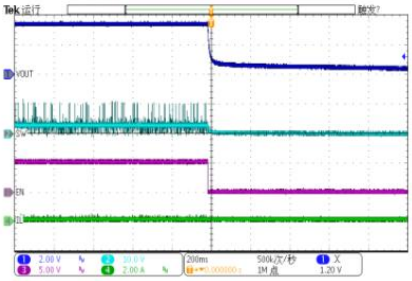
Enable Startup at No Load

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0A



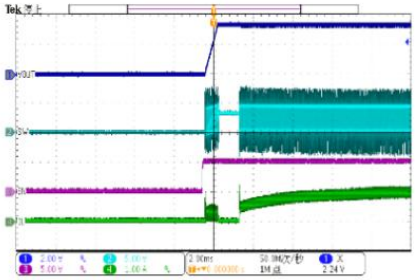
Enable Shutdown at No Load

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0A



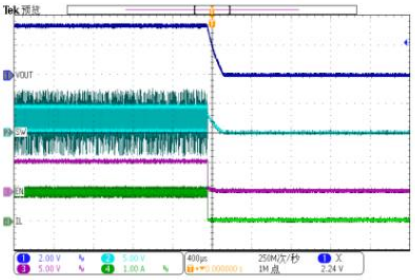
Enable Startup at Full Load

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=2A



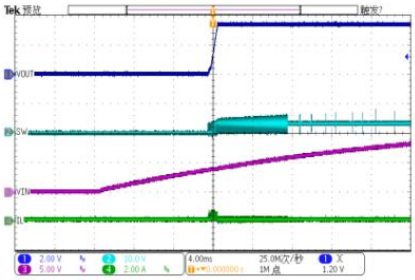
Enable Shutdown at Full Load

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=2A



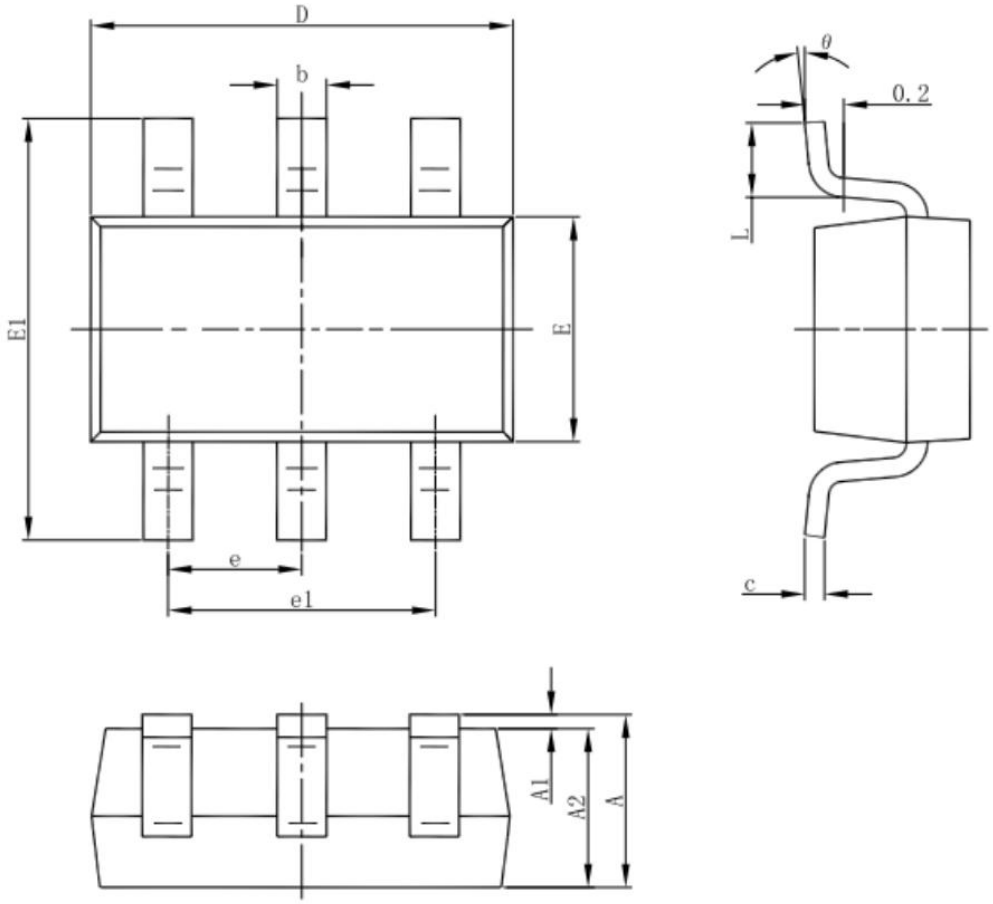
Power Up at No Load

V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0A



Package Description

6-pin SOT23-6 Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°