

2A, 18V, 450 kHz Synchronous Rectified Step-Down

Features

2A Output Current

Wide 4.75V to 18V Operating Input Range

Integrated $130m\Omega$ Power MOSFET Switches

Output Adjustable from 0.923V to 15V

Up to 95% Efficiency

Programmable Soft-Start

Stable with Low ESR Ceramic Output Capacitors

Fixed 450KHz Frequency

Cycle-by-Cycle Over Current Protection

Input Under Voltage Lockout

Applications

TFT LCD Monitors

Portable DVDs, Headphones, MP3 Players, etc.

Car-Powered or Battery-Powered Equipment

Set-Top Boxes

Telecom Power Supplies

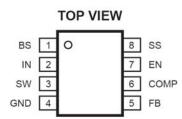
DSL and Cable Modems and Routers

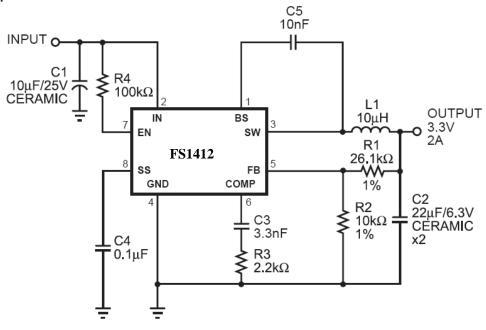
Typical Application

General Description

The FS1412 is a monolithic synchronous buck regulator. The device integrates $100m\Omega$ MOSFETS that provide 2A continuous load cur-rent over a wide operating input voltage of 4.75V to 18V. Current mode control provides fast transient response and cycle-by-cycle cur-rent limit. An adjustable soft-start prevents inrush current at turn-on. In shutdown mode, the supply cur-rent drops below 1 μ A. This device, available in an 8-pin SOIC pack-age, provides a very compact system solution with minimal reliance on external components.

Package Information





PIN DESCRIPTIONS

Pin	Name	Description
4	BS	High-Side Gate Drive Boost Input. BS supplies the drive for the high-side N-Channel MOSFET switch. Connect a
1	85	0.01µF or greater capacitor from SW to BS to power the high side switch.
	IN	Power Input. IN supplies the power to the IC, as well as the step-down converter switches. Drive IN with a 4.75V to
2		18V power source. Bypass IN to GND with a suitably large capacitor to eliminate noise on the input to the IC. See
		Input Capacitor.
	SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter
3		from SW to the output load. Note that a capacitor is required from SW to BS to power the high-side switch.
4	GND	Ground.
	FB	Feedback Input. FB senses the output voltage to regulate that voltage. Drive FB with a resistive voltage divider from
5		the output voltage. The feedback threshold is 0.923V. See Setting the Output Voltage.
		Compensation Node. COMP is used to compensate the regulation control loop. Connect a series RC network from
6	COMP	COMP to GND to compensate the regulation control loop. In some cases, an additional capacitor from COMP to
		GND is required. See Compensation Components.
7	EN	Enable Input. EN is a digital input that turns the regulator on or off. Drive EN high to turn on the regulator, drive it low
,		to turn it off. Pull up with $100k\Omega$ resistor for automatic startup.
	SS	Soft-Start Control Input. SS controls the soft start period. Connect a capacitor from SS to GND to set the soft-start
8		period. A 0.1µF capacitor sets the soft-start period to 15ms. To disable the soft-start feature, leave SS
		unconnected.

Functional Block Diagram

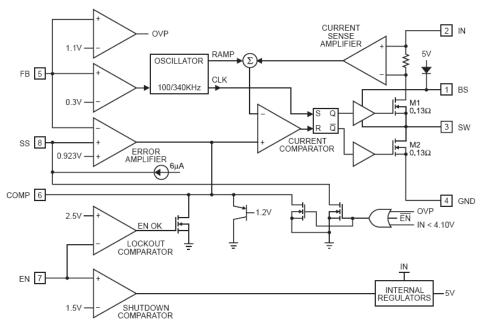


Figure 1—Functional Block Diagram

● Absolute Maximum Ratings @T_A=25°C unless otherwise noted

PARAMETER	SYMBOL	TYP			
Supply Voltage	VIN	-0.3V to +20V			
Switch Node Voltage	vsw	21V			
Boost Voltage	VBS	VSW – 0.3V to VSW + 6V			
All Other Pins		-0.3V to +6V			
Junction Temperature.		150°C			
Lead Temperature		260°C			
Storage Temperature		-65°C to +150°C			
Recommended Operating Conditions					
Input Voltage	VIN	4.75V to 18V			
Output Voltage	VOUT	0.923V to 15V			
Ambient Operating Temperature		-40°C to +85°C			
Thermal Resistance (3)	өја өјс	90 45 ° C/W			

VIN = 12V, TA = +25°C, unless otherwise noted.

Parameter	Symbol	Condition	Min	Тур	Max	Units
Shutdown Supply Current		VEN = 0V		1	3.0	μA
Supply Current		VEN = 2.0V; VFB = 1.0V		1.3	1.5	mA
Feedback Voltage	VFB	4.75V ≤ VIN ≤ 18V	0.900	0.923	0.946	V
Feedback Overvoltage Threshold				1.1		V
Error Amplifier Voltage Gain (4)	AEA			400		V/V
Error Amplifier Transconductance	GEA	Δ IC = ±10μA		800		μA/V
High-Side Switch On Resistance (4)	RDS(ON)1			130		mΩ
Low-Side Switch On Resistance (4)	RDS(ON)2			130		mΩ
High-Side Switch Leakage Current		VEN = 0V, VSW = 0V			10	μA
Upper Switch Current Limit		Minimum Duty Cycle	2.4	3.4		Α
Lower Switch Current Limit		From Drain to Source		1.1		Α
COMP to Current Sense	GCS			3.5		A/V
Transconductance	GCS			3.5		AVV
Oscillation Frequency	Fosc1			450		KHz
Short Circuit Oscillation Frequency	Fosc2	VFB = 0V		100		KHz
Maximum Duty Cycle	DMAX	VFB = 1.0V		90		%
Minimum On Time (4)				220		ns
EN Shutdown Threshold Voltage		VEN Rising	1.1	1.5	2.0	V
EN Shutdown Threshold Voltage				210		mV
Hysteresis				210		IIIV
EN Lockout Threshold Voltage			2.2	2.5	2.7	V
EN Lockout Hysterisis				210		mV

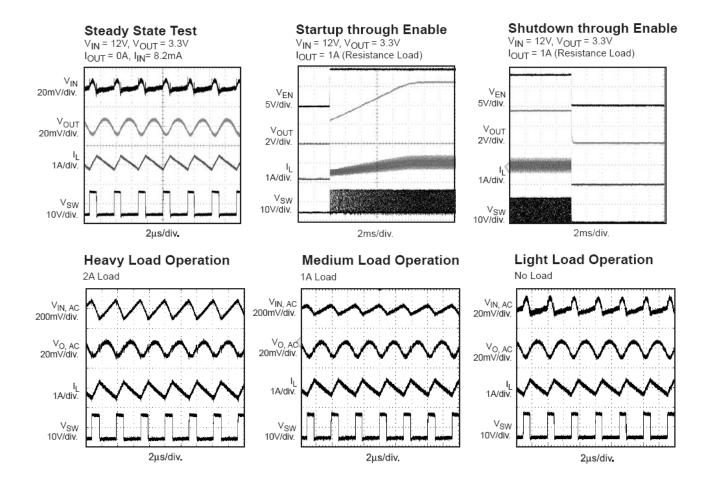
FS1412

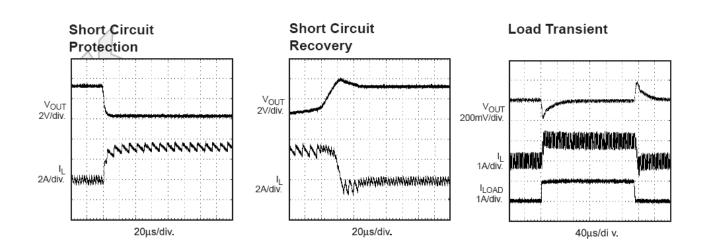
Input Under Voltage Lockout Threshold	VIN Rising	3.80	4.10	4.40	V
Hysteresis			210		mV
Soft-Start Current	VSS = 0V		6		μA
Soft-Start Period	CSS = 0.1	μF	15		ms
Thermal Shutdown (4)			160		°C

Note: 4) Guaranteed by design, not tested.

Typical Performance Characteristics

(VIN = 12V, VO = 3.3V, L = $10\mu H$, C1 = $10\mu F$, C2 = $22\mu F$, TA = $+25^{\circ} C$, unless otherwise noted.)





OPERATION

FUNCTIONAL DESCRIPTION

The FS1412 is a synchronous rectified, current-mode, step-down regulator. It regulates input voltages from 4.75V to 18V down to an output voltage as low as 0.923V, and supplies up to 2A of load current.

The FS1412 uses current-mode control to regulate the output voltage. The output voltage is measured at FB through a resistive voltage divider and amplified through the internal transconductance error amplifier. The voltage at the COMP pin is compared to the switch current measured internally to control the output voltage.

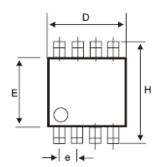
The converter uses internal N-Channel MOSFET switches to step-down the input voltage to the regulated output voltage. Since the high side MOSFET requires a gate voltage greater than the input voltage, a boost capacitor connected between SW and BS is needed to drive the high side gate. The boost capacitor is charged from the internal 5V rail when SW is low.

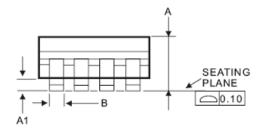
When the FS1412 FB pin exceeds 20% of the nominal regulation voltage of 0.923V, the over voltage comparator is tripped and the COMP pin and the SS pin are discharged to GND, forcing the high-side switch off.

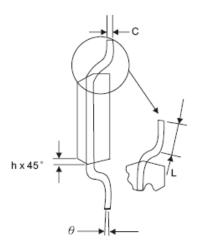
Package Information

Physical Dimensions inches(millimeters) unless otherwise noted

SOP8







DIM	MILLIMETERS		
DIW	MIN	MAX	
Α	1.35	1.75	
Al	0.10	0.25	
В	0.35	0.49	
С	0.18	0.25	
D	4.80	5.00	
E	3.80	4.00	
е	1.27 BSC		
н	5.80	6.20	
h	0.25	0.50	
L	0.40	1.25	
θ	0°	7 °	