SE3507

1MHz, 2.5A Step-Up Current Mode PWM Converter(Preliminary)

General Description

The SE3507 is a current mode boost DC-DC converter. Its PWM circuitry with built-in 0.16Ω power MOSFET make this regulator highly power efficient. The internal compensation network also minimizes as much as 6 external component counts. The non-inverting input of error amplifier connects to a 1.275V precision reference voltage and internal soft-start function can reduce the inrush current.

The SE3507 is available in the SOT23-6 package and provides space-saving PCB for the application fields.

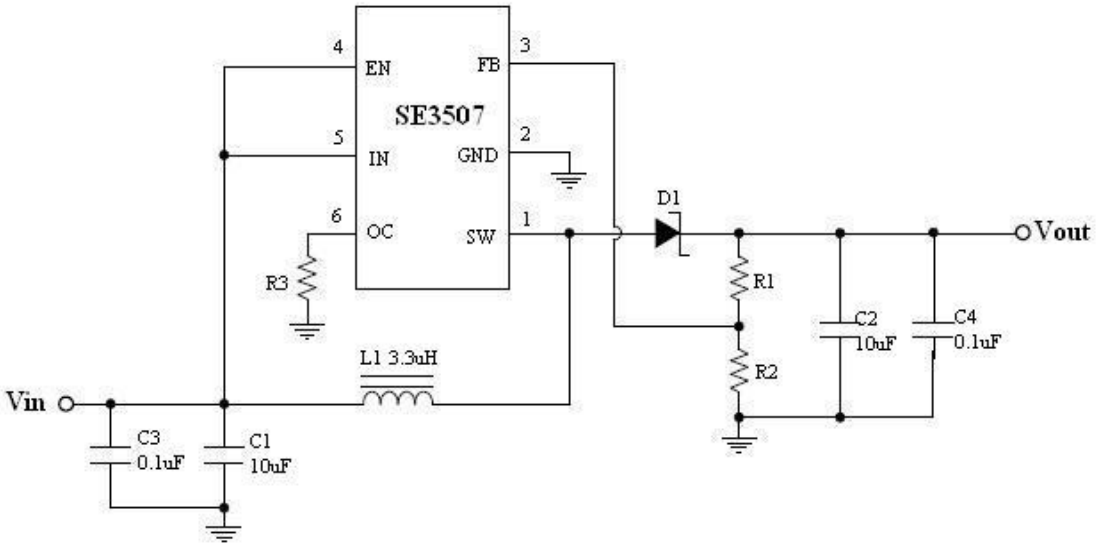
Features

- Adjustable Output up to 6V
- Internal Fixed PWM frequency: 1.0MHz
- Precision Feedback Reference Voltage: 1.275V (±2%)
- Internal 0.16Ω, 2A, 6V Power MOSFET
- Shutdown Current: 0.1μA
- Over Temperature Protection
- Adjustable Over Current Protection: 0.5A ~ 2.5A
- Package: SOT23-6

Application

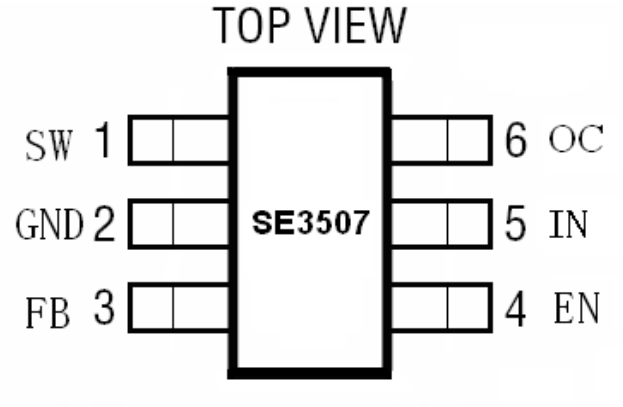
- Chargers
- LCD Displays
- Digital Cameras
- Handheld Devices
- Portable Products

Typical Application



$$Vout = 1.275V \times \left(1 + \frac{R1}{R2}\right)$$

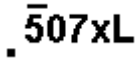
Pin Configuration



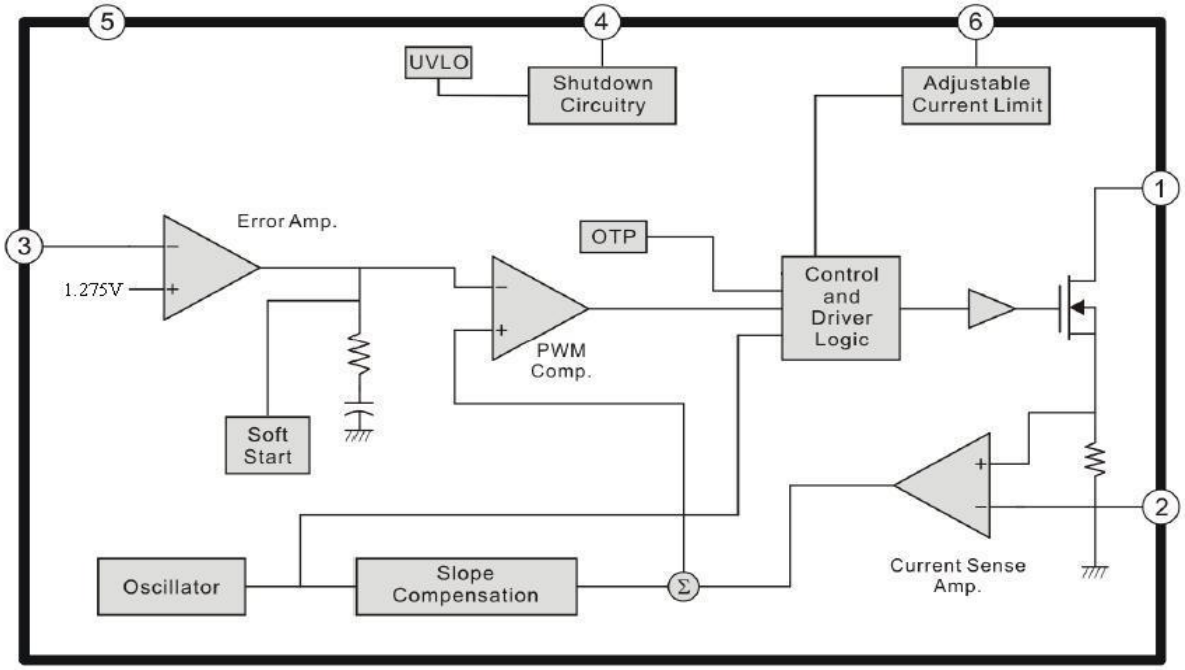
Pin Description

Number	Pin	Pin Function Description
1	SW	Switch pin
2	GND	Power ground
3	FB	Feedback pin
4	EN	Shutdown control input, Connect this pin to logic high level to enable the device
5	IN	Input power supply pin
6	OC	Adjustable Current Limit

Ordering Information

Part Number	Marking Information	Package	Remarks
SE3507-LF		SOT23-6	Starting with 5, a bar on top of 5 is for production year 2011, and underlined 5 is for year 2012. The next character is marked on top for 2013, and underlined for 2014. The naming pattern continues with consecutive characters for later years. The character "x" is the week code. (A-Z: 1-26, a-z: 27-52) The last character "L" is for lead-free process. A dot on bottom left corner is Pin 1.

Functional Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Maximum	Units
Supply Voltage V_{IN}	V_{CC}	6	V
SW Voltage	V_{SW}	6	V
FB, EN Voltage		6	V
Power Dissipation	P_D	455	mW
Thermal Resistance	θ_{JA}	+220	°C/W
Junction Temperature	T_J	+150	°C
Operating Temperature	T_{OP}	-40 to +85	°C
Storage Temperature	T_{ST}	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)		+260	°C

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{IN}	2.6		5.5	V
Operating Temperature Range	T_A	-40		+85	℃

Electrical Characteristics

V_{IN} = 3.3V, T_A= 25℃; unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
System Supply Input						
V_{CC}	Input Supply Range		2.6		5.5	V
V_{UVLO}	Under Voltage Lockout			2.6		V
	UVLO Hysteresis			0.1		V
I_{CC}	Quiescent Current	V_{FB}=1.3V, No switching		0.3		mA
I_{CC}	Average Supply Current	V_{FB}=1.2V, Switching		2		mA
I_{CC}	Shutdown Supply Current	V_{EN}=GND		0.1		μA
Oscillator						
F_{OSC}	Operation Frequency	V_{FB}=1.0V	0.8	1.0	1.2	MHz
△f / △V	Frequency Change with Voltage	V_{CC}=2.6V to 5.5V		5		%
T_{DUTY}	Maximum Duty Cycle			90		%
Reference Voltage						
V_{REF}	Reference Voltage		1.25	1.275	1.3	V
	Line Regulation	V_{CC}=2.6V_5.5V		0.05		%/V
Enable Control						
V_{EN}	Enable Voltage		0.9			V
V_{EN}	Shutdown Voltage				0.7	V
MOSFET						
$R_{DS\ (ON)}$	On Resistance of Driver	I_{SW}=2A		0.16		Ω
Protection						
I_{OCP}	OCP Current	With External Resistor：20k		2		A
I_{OCP}	Adjustable OCP Current	With External Resistor：16k~80k	0.5		2.5	A
T_{OTP}	OTP Temperature			+150		℃

Functional Description

Operation

The SE3507 is a current mode boost converter. The constant switching frequency is 1MHz and operates with pulse width modulation (PWM). Build-in 6V / 2A MOSFET provides a high output voltage. The control loop architecture is peak current mode control; therefore slope compensation circuit is added to the current signal to allow stable operation for duty cycles larger than 50%.

Soft Start Function

Soft start circuitry is integrated into SE3507 to avoid inrush current during power on. After the IC is enabled, the output of error amplifier is clamped by the internal soft-start function, which causes PWM pulse width increasing slowly and thus reducing input surge current.

Current Limit Program

A resistor between OC and GND pin programs peak switch current. The resistor value should be between 16k and 80k. The current limit will be set from 2.5A to 0.5A. Keep traces at this pin as short as possible.

Do not put capacitance at this pin. To set the over current trip point according to the following equation:

$$I_{OCP} = \frac{40000}{R3}$$

Over Temperature Protection (OTP)

SE3507 will turn off the power MOSFET automatically when the internal junction temperature is over 150℃. The power MOSFET wake up when the junction temperature drops 30℃ under the OTP threshold temperature.

Application Information

Inductor Selection

Inductance value is decided based on different condition. 3.3uH to 4.7μH inductor value is recommended for general application circuit. There are three important inductor specifications, DC resistance, saturation current and core loss. Low DC resistance has better power efficiency. Also, it avoids inductor saturation which will cause circuit system unstable and lower core loss at 1 MHz.

Capacitor Selection

The output capacitor is required to maintain the DC voltage. Low ESR capacitors are preferred to reduce the output voltage ripple. Ceramic capacitor of X5R and X7R are recommended, which have low equivalent series resistance (ESR) and wider operation temperature range.

Diode Selection

Schottky diodes with fast recovery times and low forward voltages are recommended. Ensure the diode average and peak current ratings exceed the average output current and peak inductor current. In addition, the diode's reverse breakdown voltage must exceed the output voltage.

Output Voltage Programming

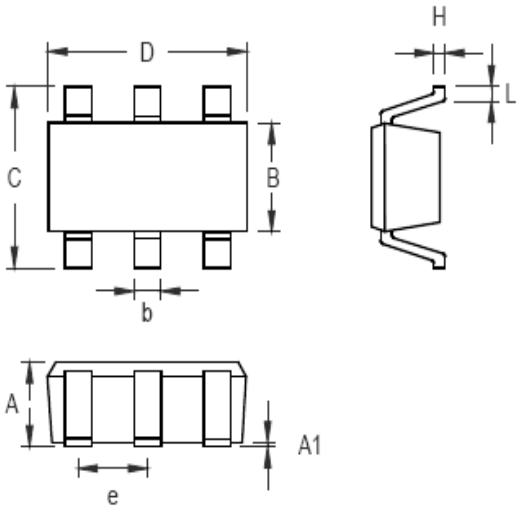
The output voltage is set by a resistive voltage divider from the output voltage to FB. The output voltage is:

$$V_{OUT} = 1.275V \times \left(1 + \frac{R1}{R2}\right)$$

Layout Considerations

1. The power traces, consisting of the GND trace, the SW trace and the V_{IN} trace should be kept short, direct and wide.
2. SW、L and D switching node, wide and short trace to reduce EMI.
3. Place C_{IN} near V_{IN} pin as closely as possible to maintain input voltage steady and filter out the pulsing input current.
4. The resistive divider R1and R2 must be connected to FB pin directly as closely as possible.
5. FB is a sensitive node. Please keep it away from switching node, SW.
6. The GND of the IC, C_{IN} and C_{OUT} should be connected close together directly to a ground plane.

Outline Drawing For SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	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	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

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