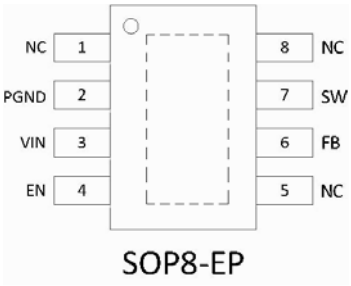
High Efficiency 1.2MHz Peak 5.5A Step Up Regulator

- **Features**
  - · Wide Input Range: 2.5V to 6V
  - . Maximum Output: 12V
  - · Up to 2.5A output Current with 3.0V to 4.5V Input
  - · 1.2MHz switching Frequency
  - · Low RDS (ON): 70mΩ
  - · Up to 93% Efficiency
  - · Under-Voltage Lockout Protection
  - · Over-Temperature Protection
  - · Internal Soft Start
  - · Less Than1uA Shutdown Current
  - · Accurate Reference: 0.6V Voltage Reference

- **Applications**
  - · Battery-Powered Equipment
  - · Set-Top Boxed & White LED Driver
  - · DSL and Cable Modems and Routers
  - · cards powered from PCI or PCI express slots

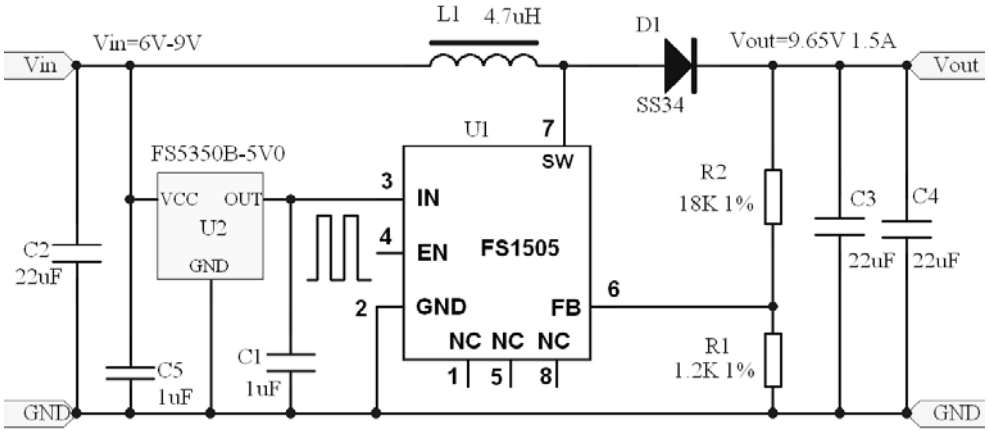
- **Pin Configurations (E-SOP8)**



- **General Description**

FS1505 is a high efficiency current-mode boost converter with a fixed operation frequency. The FS1505 integrates a very low Rds-on NMOSFTET to reduce power loss and achieve high efficiency. The maximum efficiency is up to 93%. The peak current of power MOSFET is limited to 5.5A. 1.2MHz operation frequency minimizes L and C value, and internal compensation network reduces external component counts. SOP8-EP package provides the best solution for PCB heat dissipation.

- **TYPICAL APPLICATION**



For Vin=6V～9V Vout=9.65V 1.5A efficiency≥90%

Choose R1 and R2 to program the proper output voltage

VOUT=5V		VOUT=6V		VOUT=9V		VOUT=12V	
R1	R2	R1	R2	R1	R2	R1	R2
1.5K	11K	1K	9K	1.5K	21K	6.3K	120K

- **PIN DESCRIPTION**

Pin Name		Pin Function
1	NC	No Internal Connection
2	PGND	Power Ground
3	VIN	Input Supply. Must be locally bypassed.
4	EN	Enable. A high input at EN enables the device anda low input disables the devices. When not used,connect EN to the input source for automaticstartup.
5	NC	No Internal Connection
6	FB	Feedback
7	SW	Power Switch Output. Connect the inductor and theblocking Schottky diode to SW.
8	NC	No Internal Connection

- **Typical Block Diagram**

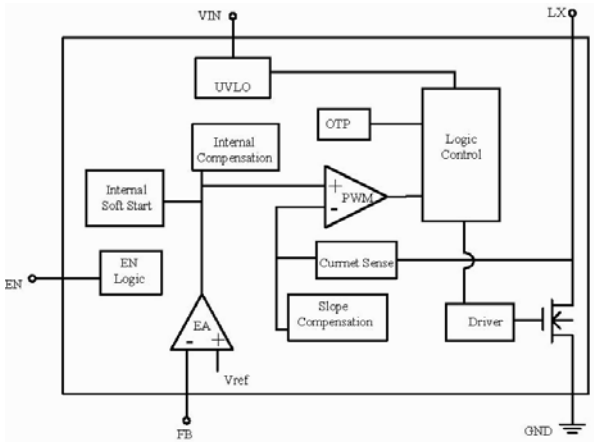


Figure1： Functional Block Diagram

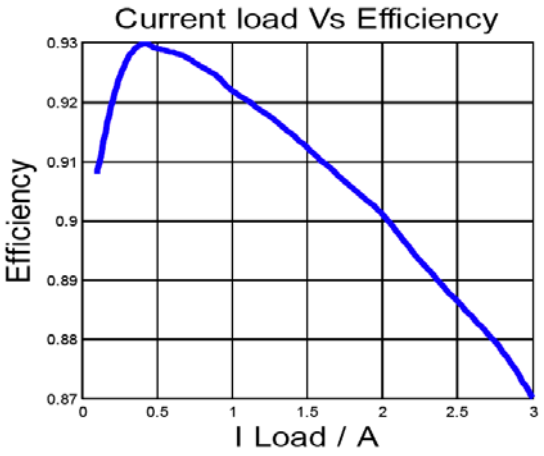


Figure 2：Efficiency Curve for Vout=5V

- **ABSOLUTE MAXIMUM RATINGS**

SYMBOL	NAME	VALUE	UNIT
VIN	Input Voltage	-0.3～6.5	V
VSW	Voltage at SW Pin	-0.5～14	V
VIO	All Other I/O Pins	GND-0.3 to V_{IN}+0.3	V
P_{TR1}	Thermal Resistance(ESOP8) Θ_{JA}	50	℃/W
Tstg	Storage Temperature	-55 to 150	℃
Tsolder	Package Lead Soldering Temperature	260℃, 10s	
ESD Susceptibility	HBM(Human Body Mode)	2	kV

- **ELECTRICAL CHARACTERISTICS**

  (VIN = 3.3V, VOUT=5V, IOUT=100mA, TA = 25°C unless otherwise specified)

SYMBOL	ITEMS	CONDITIONS	Min.	Typ.	Max.	UNIT
VIN	Input Voltage		2.5		6	V
Feedback						
VFB	Feedback Voltage		588	600	612	mV
Ibias	FB Pin Input Bias Current			0.05	1	μA
UVLO						
UVLO	Under Voltage Lockout			2.1		V
Operating Current						
I_{off}	Operating Current（Shutdown）			0.1	1	μA
Isby	No Switching	Vin=3V VFB=0.7V		100		μA
Fsw	Switching Frequency			1.2		MHz
Dmax	Maximum Duty Cycle	VFB=0V		90		%
Chip Enable						
VEN_H	EN Minimum High Level		1.5			V
VEN_L	EN Maximum Low Level				0.4	V
VHYS	EN Hysteresis			90		mV
IEN	EN Input Bias Current				1	μA
OTP						
OTP	Thermal Shutdown Temperature			130		℃
OTP Hystersis				20		℃
Output Switch						
RON	SW On Resistance (Note 3)			70		mΩ
ILIMIT	SW Current Limit			5.5		A
ILEAK	SW Leakage Current	Vsw＝5V		0.01	1	μA
Open Circuit Protection						
VOVP	Over Voltage Protection	VOVP Rising		12		V
Soft Start						
tss	Soft Start Time (Note 3)	VIN Power On		400		μS

Note: Guaranteed by design, not tested.

- **TYPICAL OPERATING CHARACTERISTICS**

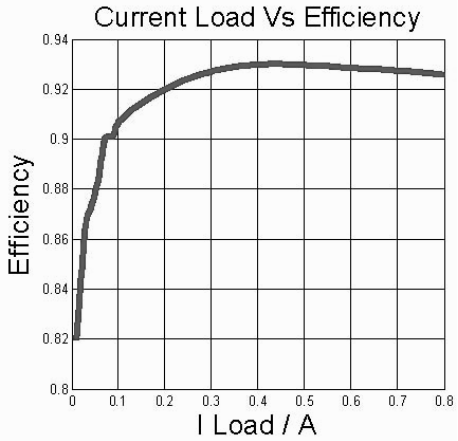


Fig 3 Efficiency Vs Light Load

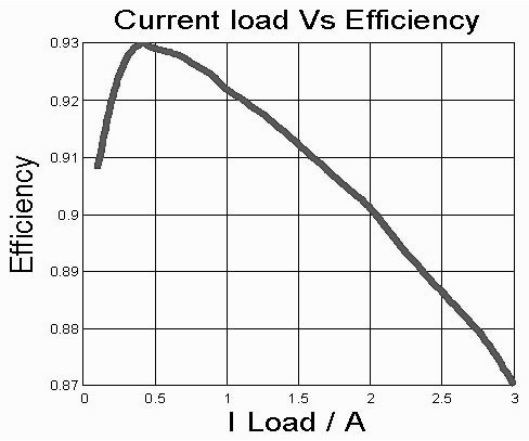


Fig 4 Efficiency Vs Heavy Load

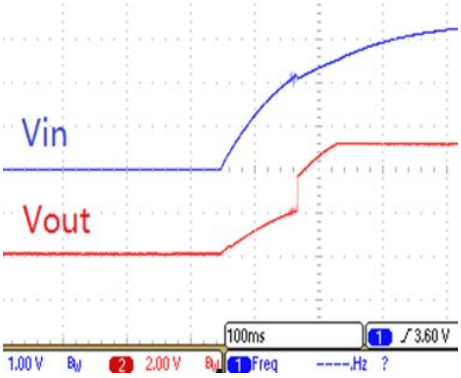


Fig 5 Startup with V_{IN}

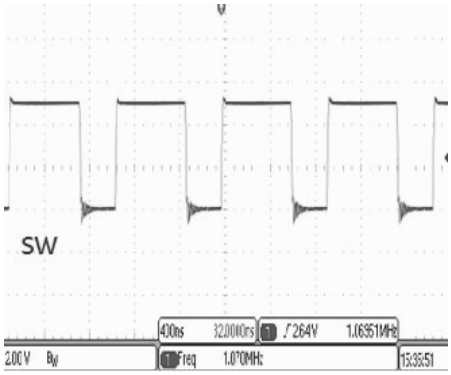


Fig 6 SW Waveform

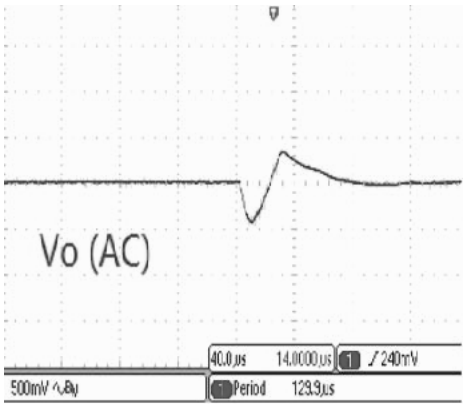


Fig 7 Transient Response

(V_{IN}=3.6V, Vout=5V, I_{load}=0.15A to 0.9A)

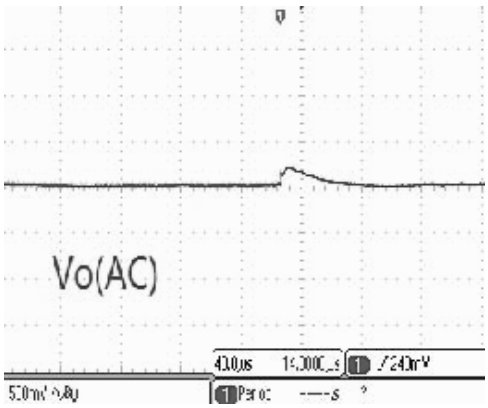


Fig 8 Transient Response

(V_{IN}=3.6V, Vout=5V, I_{load}=0.9A to 0.15A)

- **Operation Description**

The FS1505 adopts fixed frequency, peak current mode boost regulator architecture to regulate output voltage. The operating principle of the FS1505 can be easily understood by referring to the functional block diagram. At the beginning of each oscillator cycle the MOSFET is turned on by the control circuit. To prevent sub-harmonic oscillations at duty cycle larger than 50 percent, a stabilizing ramp is added to

the output of the current sense amplifier and the result is fed into the negative input of the PWM comparator. When this voltage equals the output voltage of the error amplifier, the power MOSFET is turned off. The voltage at the output of the error amplifier is an amplified result of the difference between the 0.6V reference voltage and the feedback voltage. In this way the peak current level keeps the output voltage in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases, resulting in more current to flow through the power MOSFET, thus increasing the power delivered to the output. The FS1505 has internal soft start to avoid rush input current during the startup and also to avoid overshoot on the output.

- **Application Information**

Because of the high integration in the FS1505, the application circuit based on this regulator IC is rather simple. Only input capacitor CIN, output capacitor COUT, inductor L, schottky diode and feedback resistors (R1 and R2) need to be selected for the targeted applications.

Feedback Resistor Divider R1 and R2:

Choose R1 and R2 to program the proper output voltage. To minimize the power consumption under light loads, it is desirable to choose large resistance values for both R1 and R2. A value of between 10KΩ and 1MΩ is recommended for both resistors. If R2=220 KΩ is chosen, then R1 can be calculated to be 30KΩ based on the following equation:

R1 = (R2×0.6V)/(VOUT - 0.6V)

Input Capacitor CIN:

To minimize the potential noise problem, place a typical X5R or better grade ceramic capacitor really close to the IN and GND pins. Care should be taken to minimize the loop area formed by CIN, and IN/GND pins. In this case a 10uF low ESR ceramic is recommended.

Output Capacitor COUT:

The output capacitor is selected to meet the output ripple noise requirements. Both steady state ripple and transient requirements must be taken into consideration when selecting this capacitor. For the best performance, it is recommended to use X5R or better grade ceramic capacitor with 10V rating and more than two pieces of 22uF Capacitor. The ESR of the capacitor COUT is critical for low ripple and noise in the output voltage.

Boost Inductor L:

The recommended values of inductor is 2.2uH to 10 u H. Small size and better efficiency are the major concerns for portable devices. The inductor should have low core loss at 1.2MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Diode Selection:

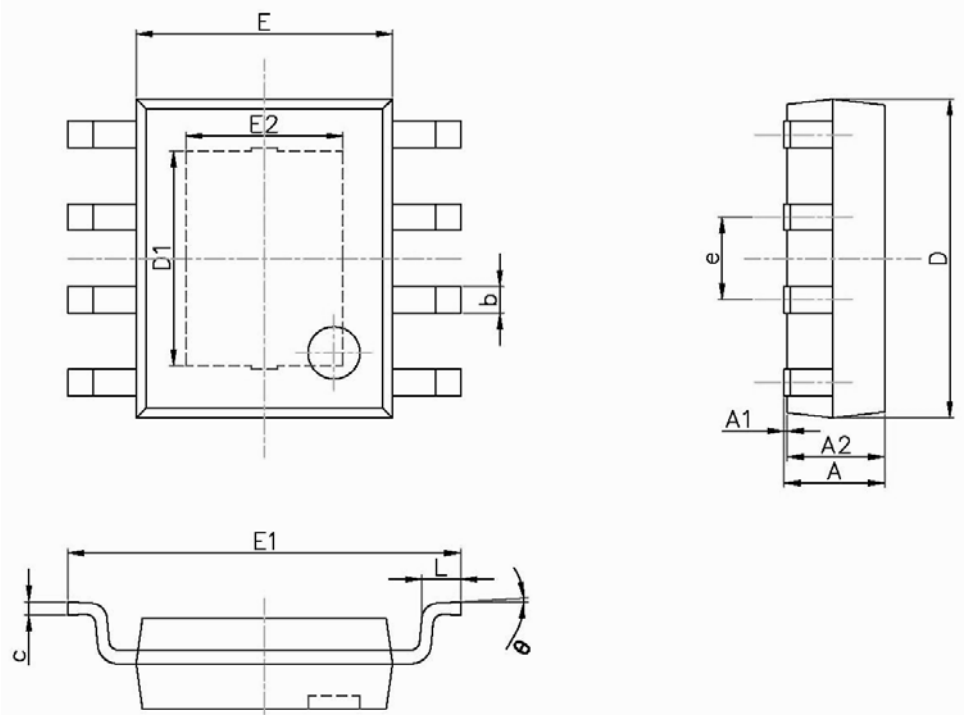
Schottky diode is a good choice for FS1505 because of its low forward voltage drop and fast reverses recovery in order to get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. The diode reverse breakdown voltage should be larger than the output voltage.

Start-up and Inrush Current:

The FS1505 has internal soft start to limit the value of current through VIN during the startup and also to avoid overshoot on the output. The soft start is realized by gradually increasing the output of error amplify during start-up.

- **Package Information**

  E-SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.300	1.700	0.051	0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum
SOP8-EP	8.0±0.1 mm	4.0±0.1 mm	180±1 mm	2500pcs