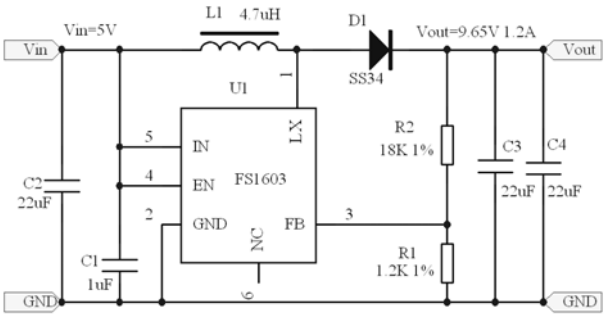
1.2MHz, 2A Output Current, Boost Converter

Features

·Wide Input Range: 2.5-6V Input,·
·FS1603 Up To 2A Output Current
· 1.2MHz Switching Frequency
· Low RDS(ON): 70mΩ
· Up to 93% Efficiency
. Over Voltage Protection
· Under-Voltage Lockout Protection
· Over-Temperature Protection
· Internal Soft Start
· 1uA Shutdown Current
· Accurate Reference: 0.6V VREF
· Compact package: SOT23-6

Applications

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

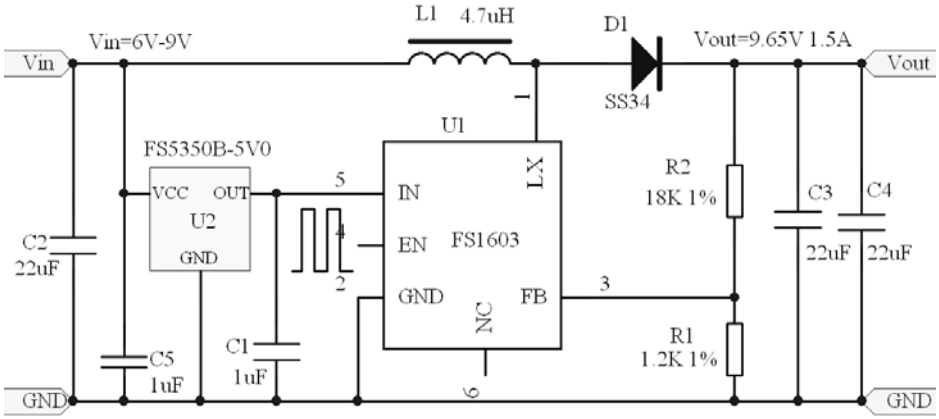


General Description

The FS1603 is a high efficiency current-mode boost converter with a fixed operation frequency. The FS1603 has been integrated a very low Rds-on NMOSFTET to reduce power loss and achieve high efficiency. The maximum efficiency is up to 93%. FS1603 can output 2A current when VIN is higher than 3.3V and output is 5V. 1.2MHz operation frequency minimizes L and C value, and internal compensation network reduces external component counts. SOT23-6 package provides the best solution for PCB layout area.

TYPICAL APPLICATION

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



- **Pin Configurations (SOT23-6L)**

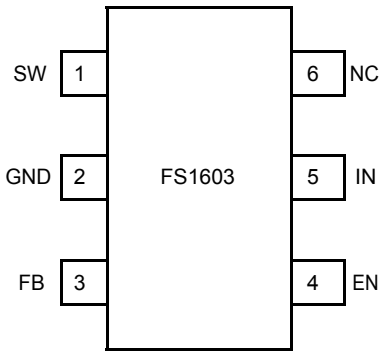


Figure 1：Pin Configuration

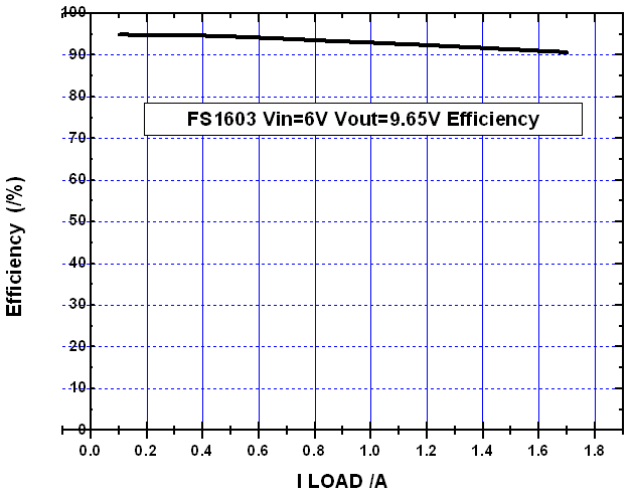


Figure 2：efficiency

- **PIN DESCRIPTION**

Pin Name		Pin Function
1	SW	Power Switch Output. Connect the inductor andthe blocking Schottky diode to SW.
2	GND	GND
3	FB	Feedback
4	EN	Enable pin. A high input at EN enables the deviceand a low input disables the devices. When notused, connect EN to the input source forautomatic startup.
5	V_{IN}	Input Supply Pin. Must be locally bypassed.
6	NC	No Internal Connection

- **ABSOLUTE MAXIMUM RATINGS**

SYMBOL	NAME	VALUE	UNIT
V_{IN}	Input Voltage	-0.3～6.5	V
V_{SW}	Voltage at SW Pin	-0.5～12	V
V_{IO}	All Other I/O Pins	GND-0.3 to VDD+0.3	V
P_{TR1}	Thermal Resistance(SOT23-6) Θ_{JA}	220	℃/W
T_{stg}	Storage Temperature	-55 to 150	℃
T_{solder}	Package Lead Soldering Temperature	260℃, 10s	
ESD Susceptibility	HBM(Human Body Mode)	2	kV

- **ELECTRICAL CHARACTERISTICS**

(V_{IN} = 3.3V, V_{OUT}=5V, I_{OUT}=100mA, T_A = 25°C unless otherwise specified)

SYMBOL	ITEMS	CONDITIONS	Min.	Typ.	Max.	UNIT
V_{IN}	Input Voltage		2.5		6	V
Feedback						
V_{FB}	Feedback Voltage		588	600	612	mV
I_{bias}	FBPin Input Bias Current			0.05	1	μA
UVLO						
UVLO	Under Voltage Lock Out			2.1		V
Operating Current						
I_{off}	Operating Current（Shutdown）			0.1	1	μA
I_{sby}	No Switching	Vin=3V VFB=0.7V		100		μA
F_{sw}	Switching Frequency			1.2		MHz
D_{max}	Maximum Duty Cycle	VFB=0V		90		%
Chip Enable						
V_{EN_H}	EN Minimum High Level		1.5			V
V_{EN_L}	EN Maximum Low Level				0.4	V
V_{HYS}	EN Hysteresis			90		mV
I_{EN}	EN Input Bias Current				1	μA
OTP						
OTP				130		℃
OTP Hystersis				20		℃
Output Switch						
R_{ON}	SW On Resistance (Note 3)			70		mΩ
I_{LIMIT}	SW Current Limit			5		A
I_{LEAK}	SW Leakage Current	Vsw＝5V		0.01	1	μA
Open Circuit Protection						
V_{OV}	FS1603	V_{OV} Rising		10		V
Soft Start						
tss	Soft Start Time (Note 3)	V_{IN} Power On		400		μS

Note:

1) Guaranteed by design, not tested.

- **Typical Block Diagram**

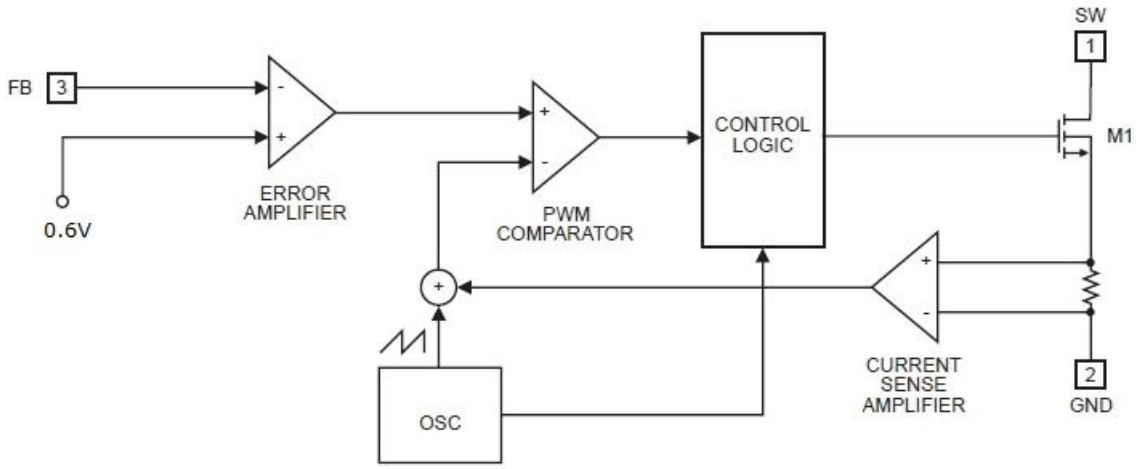
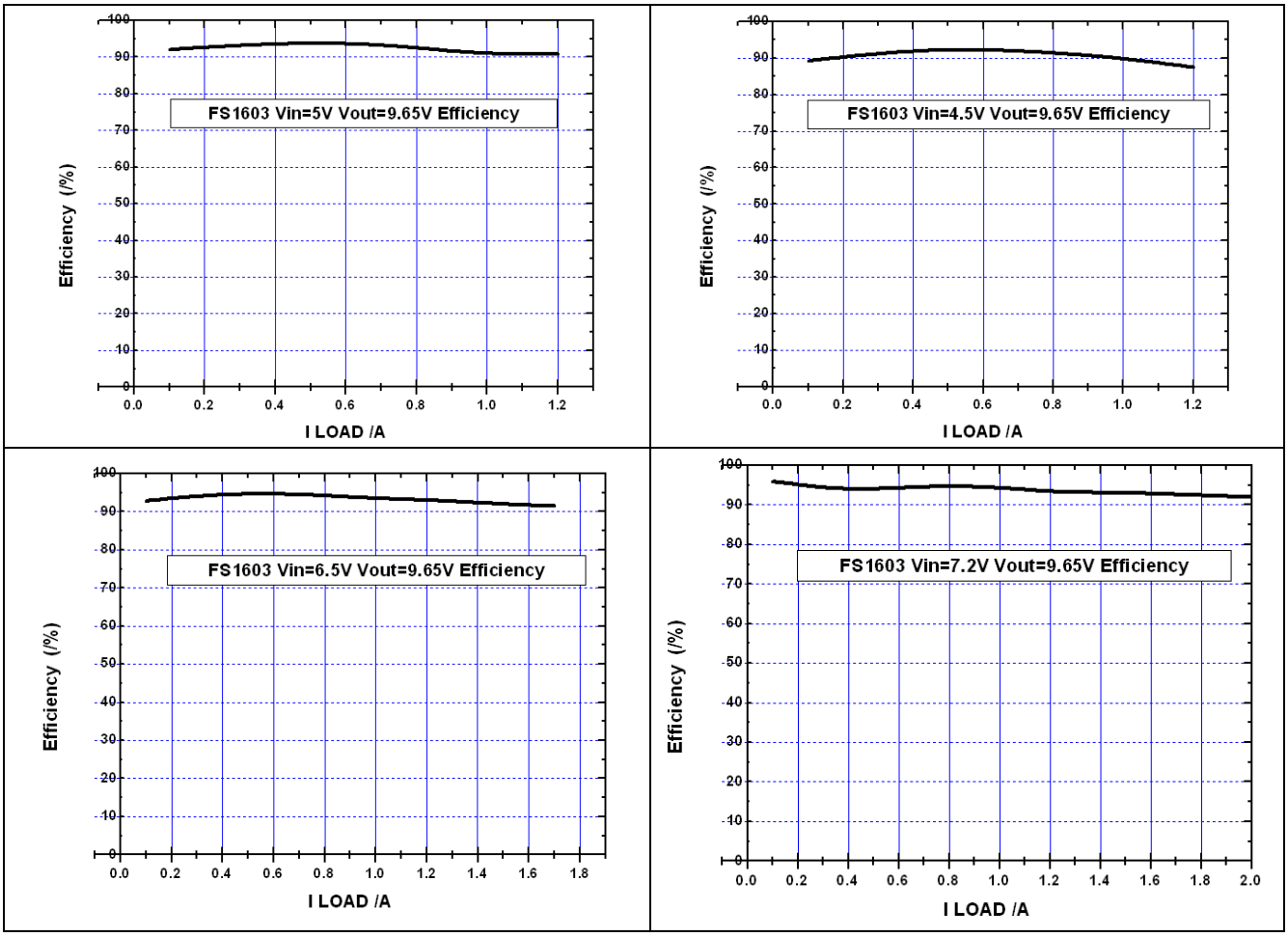
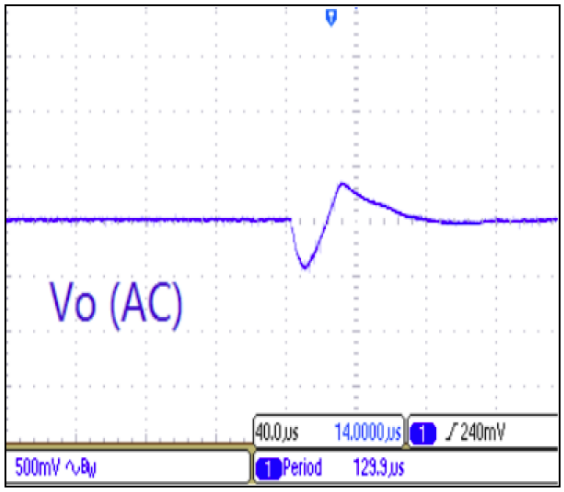


Figure 3： Functional Block Diagram

- **TYPICAL OPERATING CHARACTERISTICS**

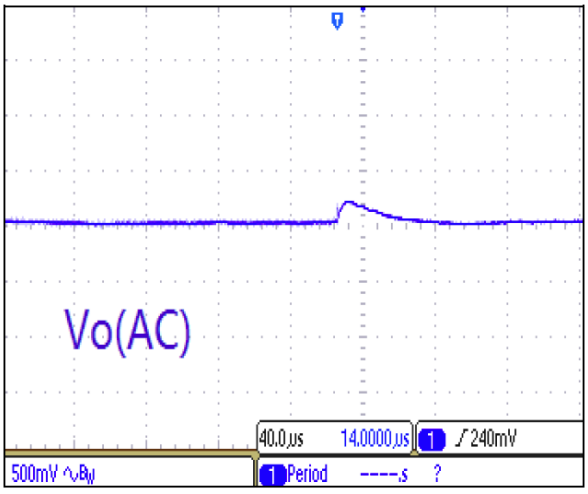


TYPICAL OPERATING CHARACTERISTICS



Transient Response

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



Transient Response

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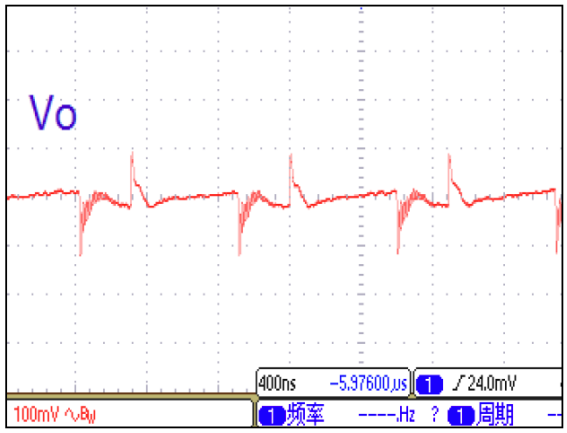
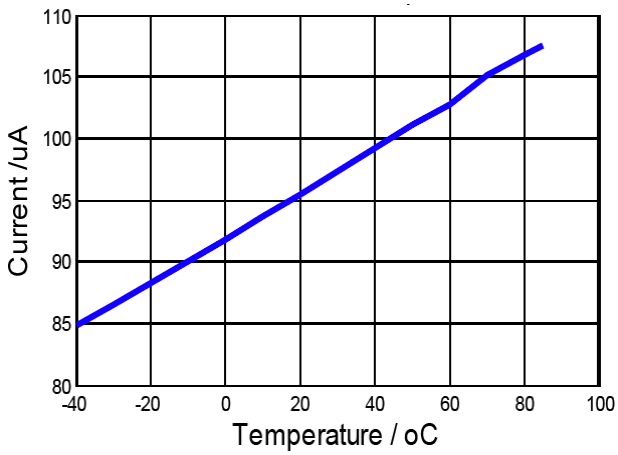


Vout Ripple



Quiescent Current Vs Temperature

- **OPERATION**

The FS1603 adopts fixed frequency, peak current mode boost regulator architecture to regulate output voltage. The operating principle of the FS1603 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 FS1603 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 FS1603, the application circuit based on this regulator IC is rather simple. Only input capacitor C_{IN}, output capacitor C_{OUT}, inductor L, schottky diode and feedback resistors (R_1 and R_2) need to be selected for the targeted applications.

Feedback Resistor Divider R_1 and R_2:

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 R1=220 KΩ is chosen, then R2 can be calculated to be 30KΩ based on the following equation:

R2 = (R1×0.6V)/(VOUT - 0.6V)

Input Capacitor C_{IN}:

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 C_{OUT}:

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:

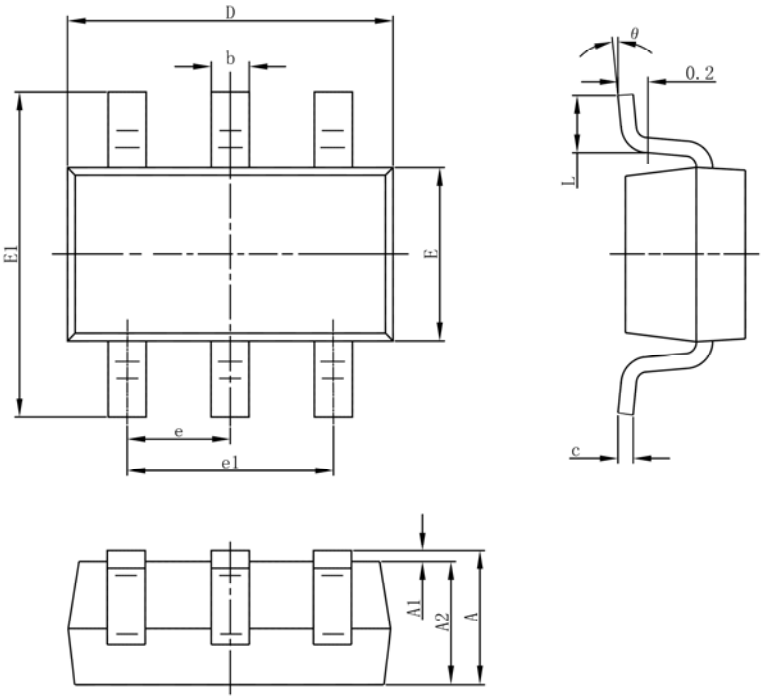
Schottky diode is a good choice for FS1603 because of its low forward voltage drop and fast reverses recovery in order to get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. The diode reverse breakdown voltage should be larger than the output voltage.

Start-up and Inrush Current:

The FS1603 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**

SOT-23-6L PACKAGE 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°