1.4MHz SOT23 CURRENT-MODE STEP-UP DC/DC CONVERTER

Description

The FP6736 is a current-mode, pulse-width modulation, step-up DC/DC converter. The built-in high voltage N-channel MOSFET allows FP6736 for step-up applications with up to 30V output voltage, as well as for Single Ended Primary Inductance Converter (SEPIC) and other low-side switching DC/DC converter.

The high switching frequency (1.4MHz) allows the use of small external components. The Soft-Start function is programmable with an external capacitor, which sets the input current ramp rate.

The FP6736 is available in space-saving SOT-23-6, TSOT-23-6 and SOT-23-5 packages.

Features

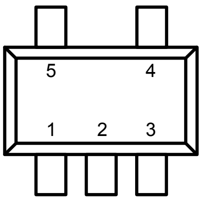
- Fixed Frequency 1.4MHz Current-Mode PWM Operation.
- Adjustable Output Voltage up to 30V.
- Guaranteed 13V/200mA Output with 5V Input.
- 2.5V to 5.5V Input Range
- Maximum 0.1uA Shutdown Current.
- Programmable Soft-Start
- Needs Only Tiny Inductor and Capacitor
- Space-Saving SOT-23-6 ,TSOT-23-6 and SOT-23-5 Packages
- RoHS Compliant

Applications

- Notebook Computers
- LCD Displays
- Portable Applications
- PCMCIA Cards
- Handheld Devices

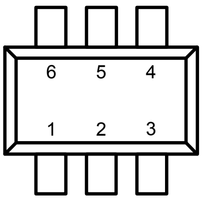
Pin Assignments

S5 Package (SOT-23-5)



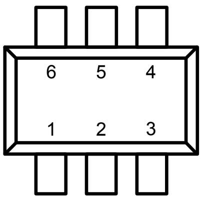
TOP VIEW
1. LX
2. GND
3. FB
4. $\overline{SHDN}$
5. IN

S6 Package (SOT-23-6)



TOP VIEW
1. LX
2. GND
3. FB
4. $\overline{SHDN}$
5. SS
6. IN

S9 Package (TSOT-23-6)



TOP VIEW
1. LX
2. GND
3. FB
4. $\overline{SHDN}$
5. SS
6. IN

Figure 1. Pin Assignment of FP6736

Ordering Information

FP6736□□□

- TR: Tape / Real
  Blank: Tube
- P: Pb Free with Commercial Standard (RoHS Compliant)
  G: Green
- Package Type
  S5: SOT-23-5
  S6: SOT-23-6
  S9: TSOT-23-6

SOT-23-5 Marking

Part Number	Product Code
FP6736S5P	CY

SOT-23-6 Marking

Part Number	Product Code
FP6736S6P	C3
FP6736S6G	C3=

TSOT-23-6 Marking

Part Number	Product Code
FP6736S9P	CX
FP6736S9G	CX=

Typical Application Circuit

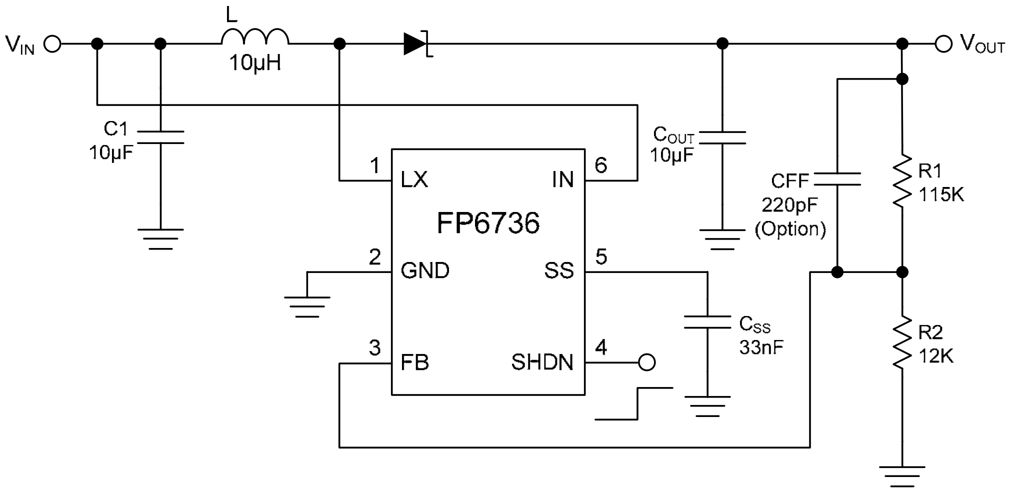


Figure 2. Typical Application Circuit of FP6736

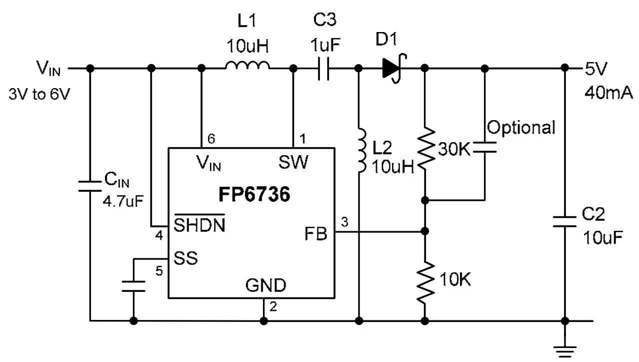


Figure 3. 4-Cell to 5V SEPIC Converter

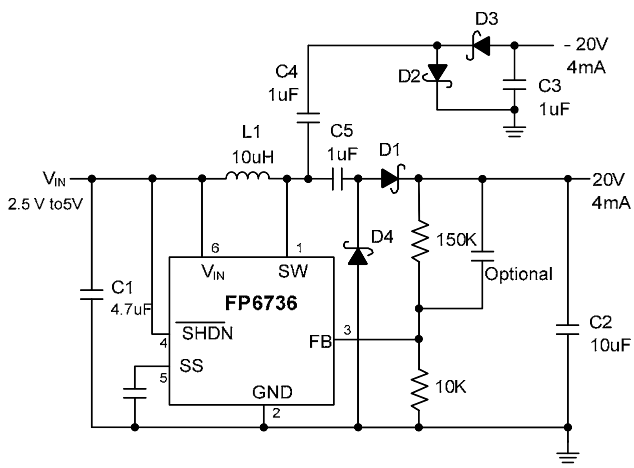


Figure 4. +20V Dual Output Converter with Output Disconnect

Functional Pin Description

Pin Name	Pin Function
LX	Power Switching Connection. Connect LX to the inductor and output rectifier. Connect components as close to LX as possible.
GND	Ground.
FB	Feedback Pin. Connect a resistive voltage-divider from the output to FB to set the output voltage.
$\overline{\text{SHDN}}$	Shutdown Input. Drive $\overline{\text{SHDN}}$ low to turn off the converter. To automatically start the converter, connect SHDN to IN. Do not leave $\overline{\text{SHDN}}$ unconnected
SS	Soft-Start Input. Connect a soft-start capacitor from SS to GND to soft-start the converter. Leave SS open to disable the soft-start function.
IN	Internal Bias Voltage Input. Connect IN to the input voltage source. Bypass IN to GND with a 1uF or greater capacitor as close to IN as possible.

Block Diagram

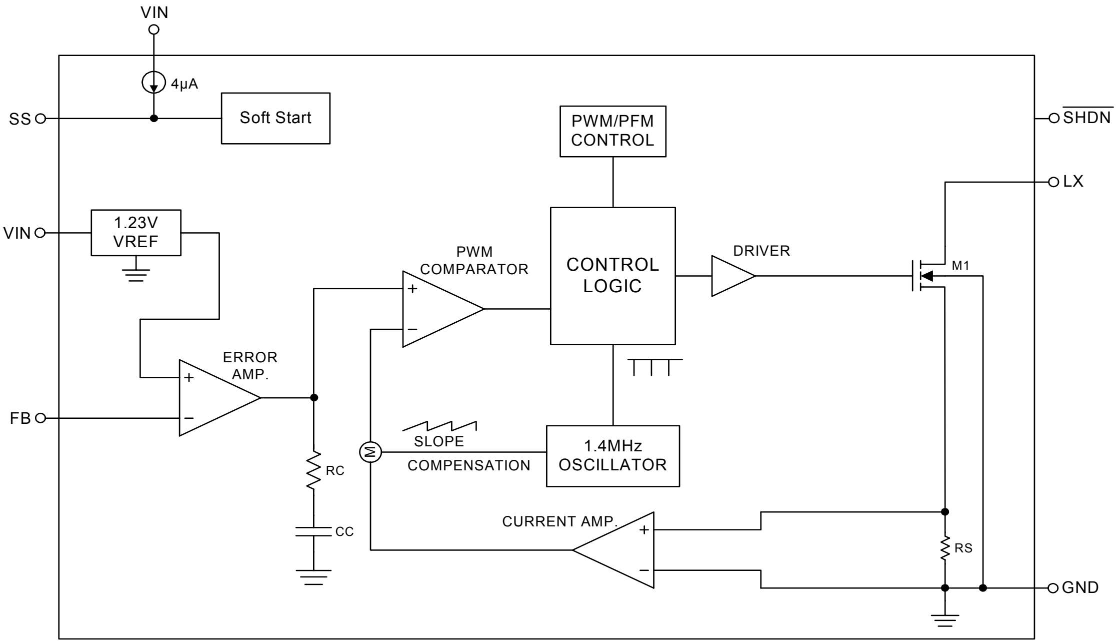


Figure 5. Block Diagram of FP6736

Absolute Maximum Ratings

- LX to GND-- + 33V
- IN, $\overline{\text{SHDN}}$, FB to GND--- + 6V
- SS to GND-- V_{IN}+0.3V
- Power Dissipation (T_A=+70°C), SOT-23-6,TSOT-23-6,SOT-23-5 (P_D)------------------------- 0.22W
- Package Thermal Resistance, SOT-23-6 ,TSOT-23-6,SOT-23-5 (θ_{JA})------------------------- 250°C/W
- Junction Temperature (T_J)--- + 150°C
- Storage Temperature Range (T_S)-- - 65°C to + 150°C
- Lead Temperature (Soldering, 10 sec.) (T_{LEAD})-- + 260°C

Note：Stresses beyond those listed under “Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Input Voltage (V_{IN})--- + 2.5V to + 5.5V
- Operating Junction Temperature Range (T_{OP})--- - 40°C to + 85°C

Electrical Characteristics

(V_{IN}= $V_{\overline{SHDN}}$=3V, FB=GND, SS=Open, T_A=25 °C, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Supply Range	V_{IN}		2.5		5.5	V
Output Voltage Adjustable Range	V_{OUT}				30	V
Quiescent Current	I_{IN}	V_{FB}=1.3V, not switching		75	200	μA
		V_{FB}=1.0V, switching		1	2.5	mA
Shutdown Supply Current	I_{SD}	$V_{\overline{SHDN}}$=0V		0.1	10	μA
Under Voltage Lockout	V_{UVLO}		2	2.2	2.4	V
ERROR AMPLIFIER						
Feedback Regulation Set Point	V_{FB}		1.205	1.23	1.255	V
FB Input Bias Current	I_{FB}	V_{FB}=1.24V		21	80	nA
Line Regulation		2.5V<VIN<5.5V		0.05	0.2	%/V
OSCILLATOR						
Frequency	f_{OSC}		1000	1400	1800	KHz
Maximum Duty Cycle	DC		86	93		%
POWER SWITCH						
On Resistance	$R_{DS(ON)}$	Guaranteed By Design		1		Ω
Switch Current Limit	I_{LIM}			600		mA
Leakage Current	$I_{LX(OFF)}$	V_{LX}=12V, T_A=+25°C		0.1	1	μA
		V_{LX}=12V			10	μA
SOFT-START						
Reset Switch Resistance		Guaranteed By Design			2	KΩ
Charge Current		V_{SS}=1.2V	1.5	4	7	μA
CONTROL INPUT						
Input Low Voltage	V_{IL}	$V_{\overline{SHDN}}$, V_{IN}=2.5V to5.5V			0.3	V
Input High Voltage	V_{IH}	$V_{\overline{SHDN}}$, V_{IN}=2.5V to5.5V	1.0			V
SHDN Input Current	$I_{\overline{SHDN}}$	$V_{\overline{SHDN}}$=1.8V		25	50	μA
	$I_{\overline{SHDN}}$	$V_{\overline{SHDN}}$=0V		0.01	0.1	μA

Typical Performance Curves

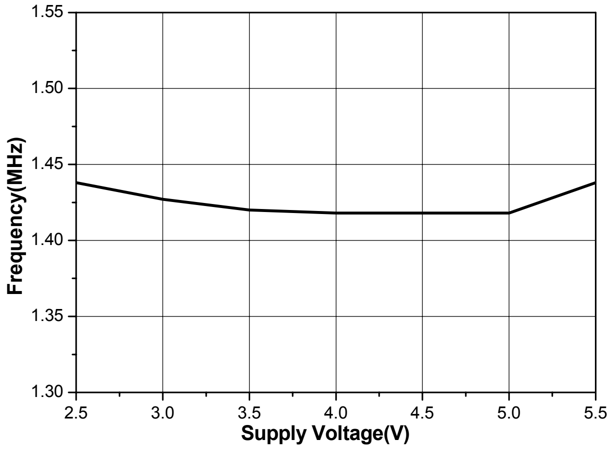


Figure 6. Frequency vs. Supply Voltage

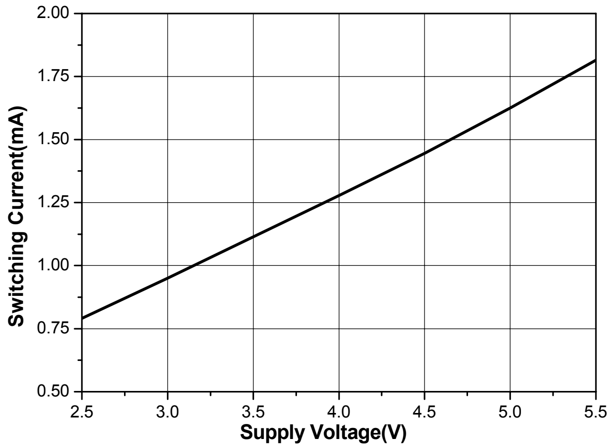


Figure 7. Switching Current vs. Supply voltage

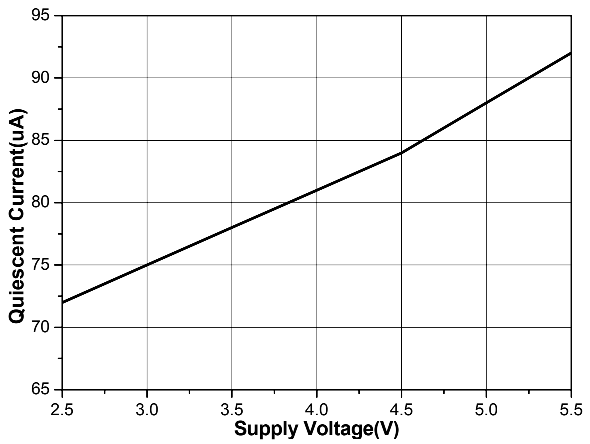


Figure 8. Non-Switching Current vs. Supply Voltage

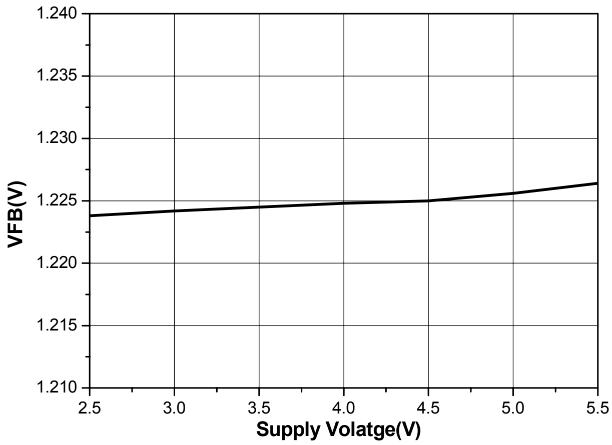


Figure 9. Feedback Voltage vs. Supply Voltage

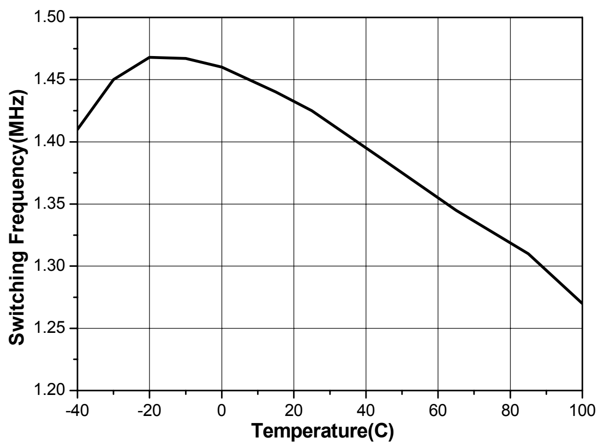


Figure 10. Switching Frequency vs. Temperature

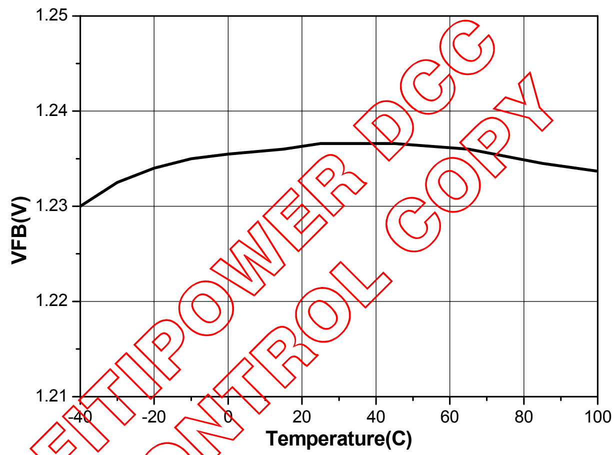


Figure 11. Feedback Voltage vs. Temperature

Typical Performance Curves (Continued)

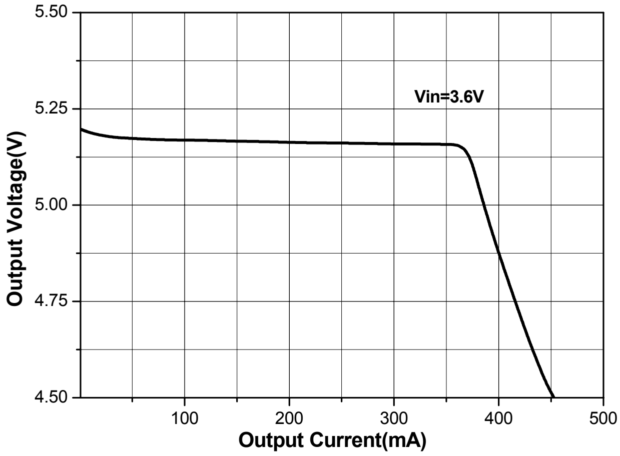


Figure 12.Load Regulation (Vo=5V)

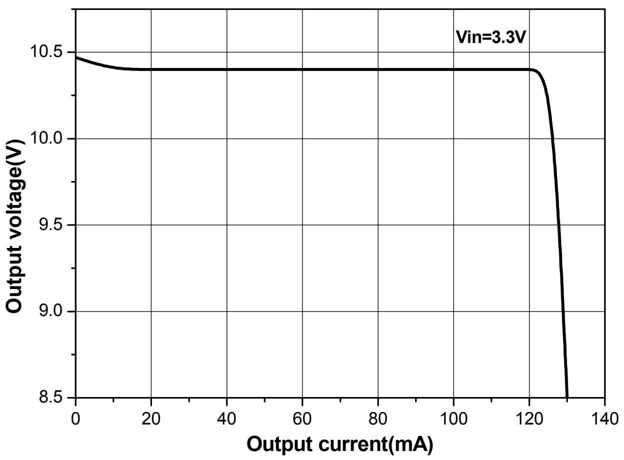


Figure 13. Load Regulation (Vo=10V)

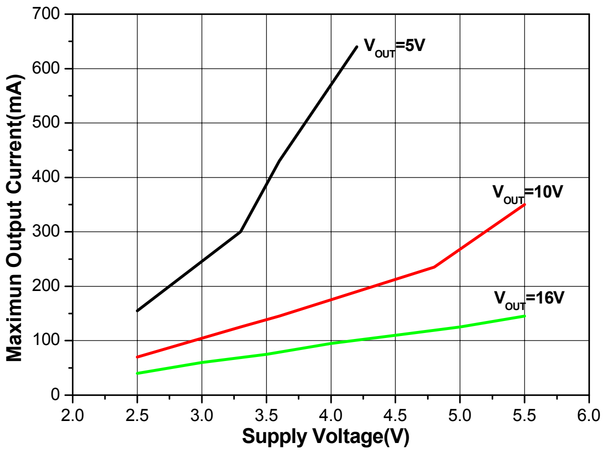


Figure 14. Maximum Output Current vs. Supply Voltage

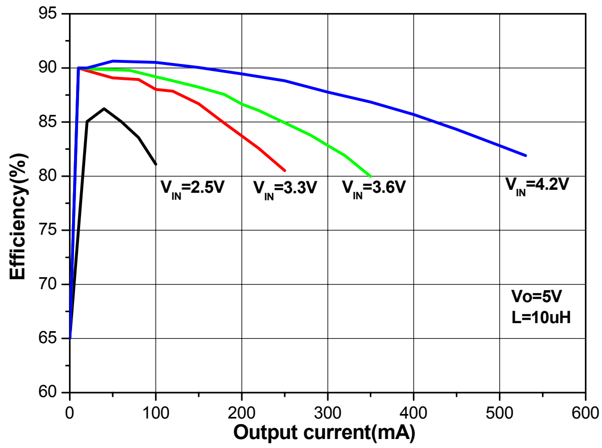


Figure 15.Efficiency vs. Output Current (Vo=5V)

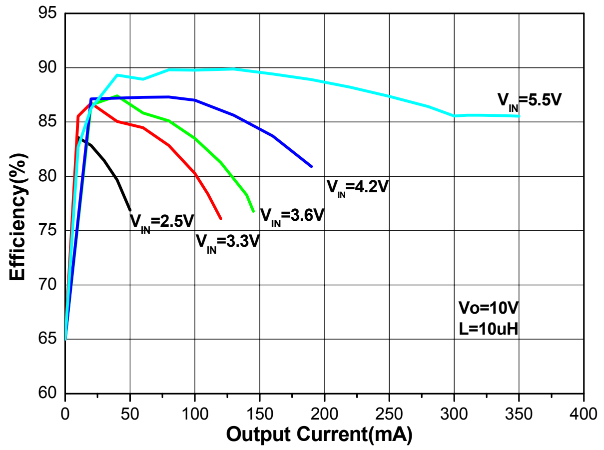


Figure 16. Efficiency vs. Output Current (Vo=10V)

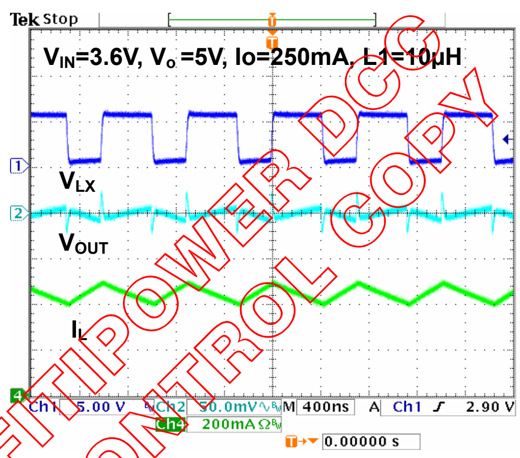


Figure 17. Operation Waveform

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Typical Performance Curves (Continued)

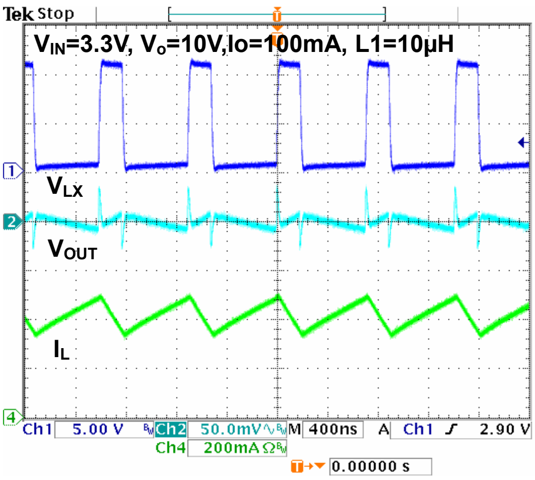


Figure 18. Operation Waveform

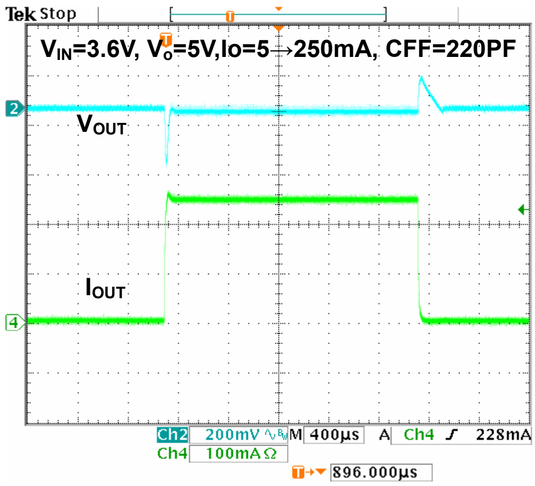


Figure 19. Load Step Response

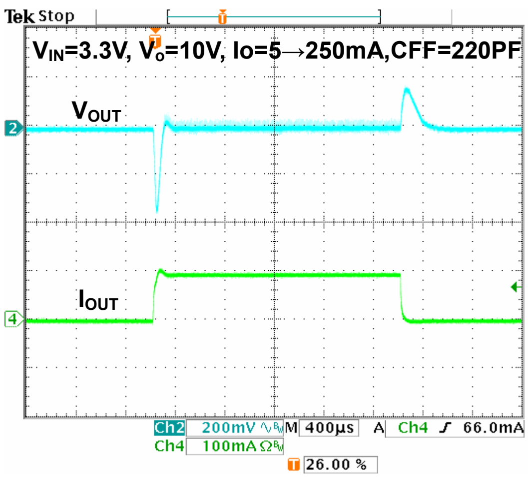


Figure 20. Load Step Response

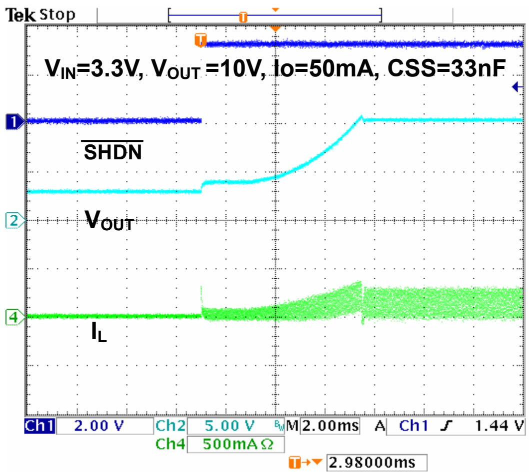


Figure 21. Start-Up from Shutdown

Application Information

1. Inductor Selection

A 10μH inductor is recommended for most FP6736 applications. Although small size and high efficiency are major concerns, the inductor should have low core losses at 1.4MHz and low DCR (copper wire resistance).

2. Capacitor Selection

The small size of ceramic capacitors makes them ideal for FP6736 applications. X5R and X7R types are recommended because they retain their capacitance over wider voltage and temperature ranges than other types such as Y5V or Z5U. A 4.7μF input capacitor and a 4.7μF output capacitor are sufficient for most FP6736 applications.

3. Diode Selection

Schottky diodes, with their low forward voltage drop and fast reverse recovery, are the ideal choices for FP6736 applications. The forward voltage drop of a Schottky diode represents the conduction losses in the diode, while the diode capacitance (C_T or C_D) represents the switching losses. For diode selection, both forward voltage drop and diode capacitance need to be considered. Schottky diodes with higher current ratings usually have lower forward voltage drop and larger diode capacitance, which can cause significant switching losses at the 1MHz switching frequency of the FP6736. A Schottky diode rated at 100mA to 400mA is sufficient for most FP6736 applications.

4. Open-Circuit Protection

In the cases of output open circuit, when the R1 are disconnected from the circuit, the feedback voltage will be zero. The FP6736 will then switch at a high duty cycle resulting in a high output voltage, which may cause the SW pin voltage to exceed its maximum 33V rating. A zener diode can be used at the output to limit the voltage on the SW pin (**Figure 4**). The zener voltage should be larger than the maximum voltage of the V_{OUT}. The current rating of the zener should be larger than 0.1mA.

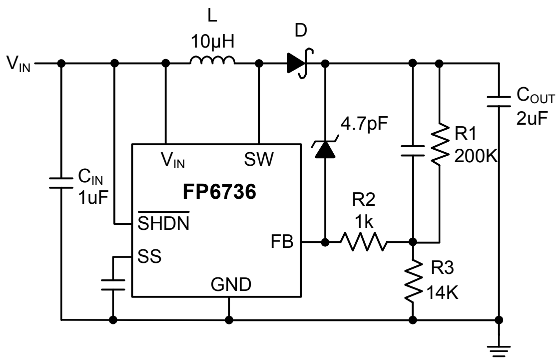
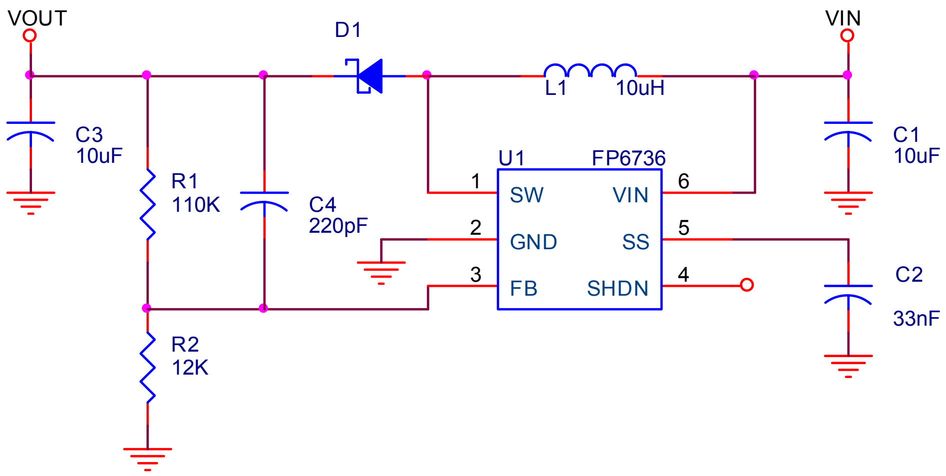


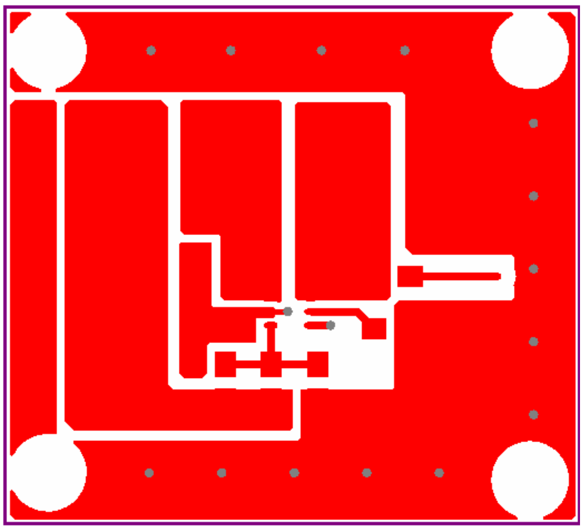
Figure 22. With Open-Circuit Protection

Demo Board Circuit & Layout

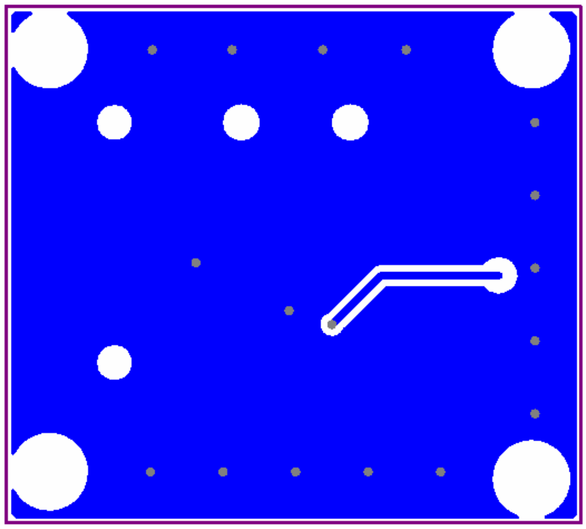
SOT-23-6 Package



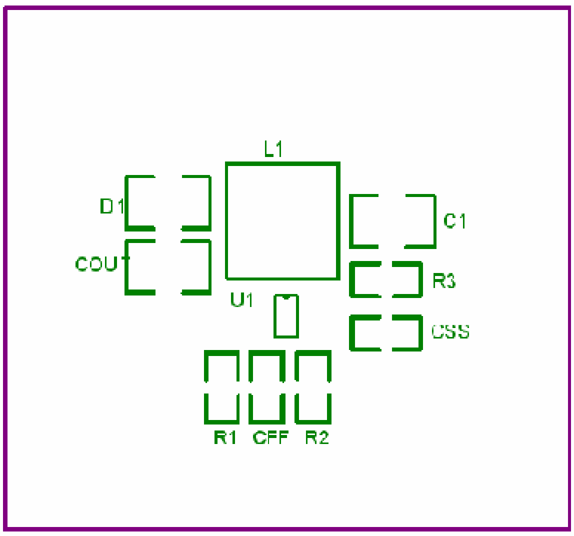
Top Side (SOT-23-6 Package)



Bottom Side (SOT-23-6 Package)

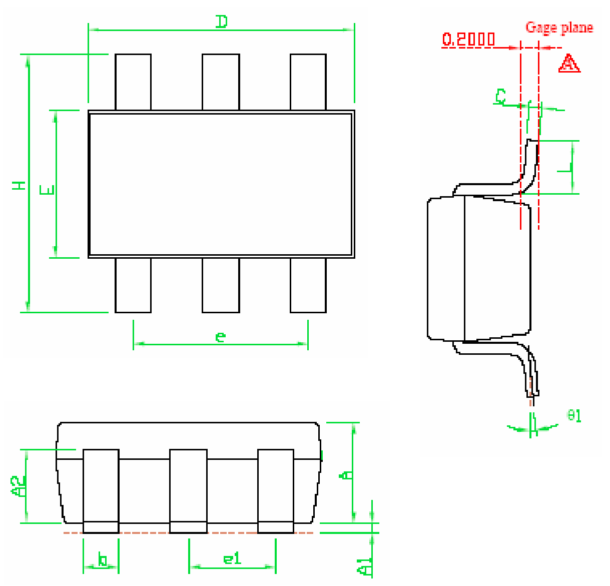


Component Placement(SOT-23-6 Package)



Outline Information

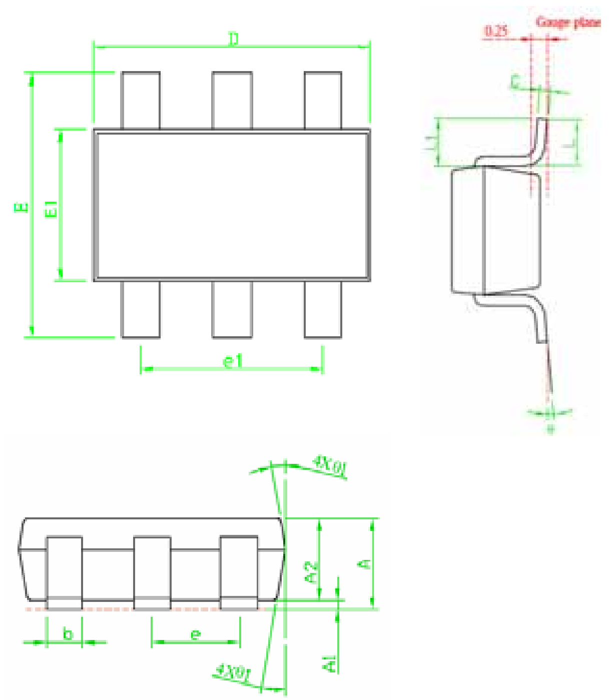
SOT-23-6 Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER		
	MIN	NOM	MAX
A	1.00	1.10	1.30
A1	0.00	---	0.10
A2	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E	1.40	1.60	1.80
e	---	1.90(TYP)	---
H	2.60	2.80	3.00
L	0.37	---	---
θ1	1º	5º	9º
e1	---	0.95(TYP)	---

Note 1：Package Body Sizes Exclude Mold Flash Protrusions or Gate Burrs.
Note 2：Tolerance ± 0.1000 mm(4mil) Unless Otherwise Specified.
Note 3：Coplanarity：0.1000 mm
Note 4：Dimension L Is Measured in Gage plane.

TSOT-23-6 Package (Unit: mm)

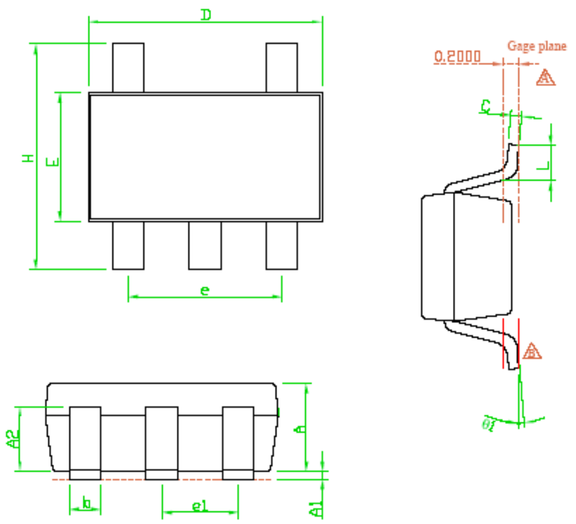


SYMBOLS UNIT	DIMENSION IN MILLIMETER		
	MIN	NOM	MAX
A	---	---	1.00
A1	0.00	0.05	0.10
A2	0.84	0.87	0.90
b	0.35	0.40	0.50
C	0.10	0.125	0.15
D	2.70	2.90	3.10
E1	1.40	1.60	1.80
e1	---	1.90(TYP)	---
E	2.60	2.80	3.00
L	0.30	0.40	0.60
θ	0°	4°	8°
θ1	4°	10°	12°
e	---	0.95(TYP)	---
L1	0.5	0.6	0.7

Note 1：Package Body Sizes Exclude Mold Flash Protrusions or Gate Burrs.
Note 2：Tolerance ± 0.1000 mm(4mil) Unless Otherwise Specified.
Note 3：Coplanarity：0.1000 mm
Note 4：Dimension Measuring Is Based on The Gage Plane.

Outline Information(Continued)

SOT-23-5 Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER		
	MIN	NOM	MAX
A	1.00	1.10	1.30
A1	0.00	---	0.10
A2	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E	1.50	1.60	1.80
e	---	1.90(TYP)	---
H	2.60	2.80	3.00
L	0.37	---	---
θ1	1º	5º	9º
e1	---	0.95(TYP)	---

Note 1：Package Body Sizes Exclude Mold Flash Protrusions or Gate Burrs.
Note 2：Tolerance ± 0.1000 mm(4mil) Unless Otherwise Specified.
Note 3：Coplanarity：0.1000 mm
Note 4：Dimension L Is Measured in Gage plane.

Life Support Policy
Fitipower's products are not authorized for use as critical components in life support devices or other medical systems.