

1.4MHz SOT23 Current-Mode Step-Up DC/DC Converter

Description

The FP6736 is a current-mode, pulse-width modulation and 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 and TSOT-23-5 packages.

Features

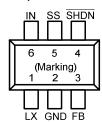
- Fixed Frequency 1.4MHz Current-Mode PWM Operation
- Adjustable Output Voltage up to 30V
- Guaranteed 13V/200mA Output with 5V Input
- 2.5V to 5.5V Input Range
- Maximum 0.1µA Shutdown Current
- Programmable Soft-Start
- Need Only Tiny Inductor and Capacitor
- SOT-23-6 and TSOT-23-5 Packages
- RoHS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

Applications

- Notebook Computer
- LCD Display
- Portable Application
- PCMCIA Card
- Handheld Device

Pin Assignments

S6 Package (SOT-23-6)



S8 Package (TSOT-23-5)

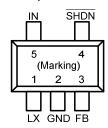
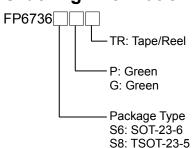


Figure 1. Pin Assignment of FP6736

Ordering Information



SOT-23-6 Marking

Part Number	Product Code				
FP6736S6P	C3				
FP6736S6G	C3=				

TSOT-23-5 Marking

1301-23-3 Warking			
Part Number	Product Code		
FP6736S8G	Fi1		



Typical Application Circuit

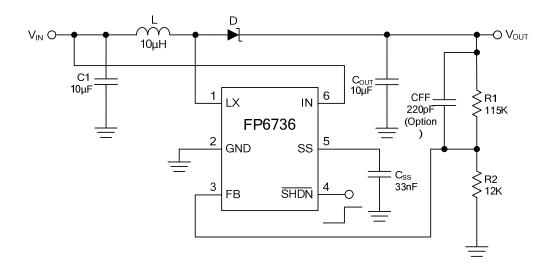


Figure 2. Typical Application Circuit of FP6736

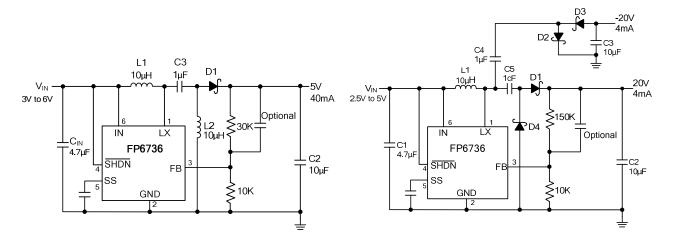


Figure 3. 4-Cell to 5V SEPIC Converter

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

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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.
SHDN	Shutdown Input. Drive SHDN low to turn off the converter. To automatically start the converter, connect SHDN to VIN. Do not leave 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 VIN to the input voltage source. Bypass VIN to GND with a 1µF or greater capacitor as close to VIN as possible.

Block Diagram

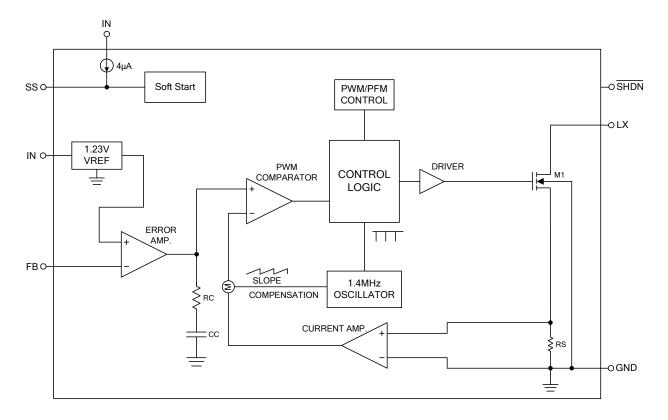


Figure 5. Block Diagram of FP6736



Absolute Maximum Ratings (Note 1)

•	
• LX to GND	0.3V to +33V
• IN, SHDN, FB to GND	0.3V to +6V
• SS to GND	0.3V to V _{IN} +0.3V
• Power Dissipation @T _A =+25°C, (P _D)	- 0.4W
Package Thermal Resistance, (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 1: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent dam	age to the device.
Recommended Operating Conditions	
• Input Voltage (V _{IN})	+2.5V to +5.5V
Operating Temperature Range (T _{OPR})	40°C to +85°C

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Electrical Characteristics

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

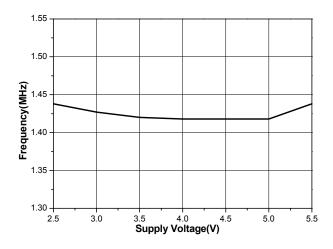
Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Input Supply Range	V _{IN}		2.5		5.5	V
Output Voltage Adjustable Range	V _{OUT}				30	V
Outro and Oursell		V _{FB} =1.3V, not switching		75	200	μΑ
Quiescent Current	I _{IN}	V _{FB} =1.0V, switching		1	2.5	mA
Shutdown Supply Current	I _{SD}	V _{SHDN} =0V		0.1	10	μΑ
Under Voltage Lockout	V _{UVLO}		2	2.2	2.4	V
Error Amplifier			1			•
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 <v<sub>IN<5.5V</v<sub>		0.05	0.2	%/V
Oscillator			_			•
Frequency	f _{OSC}		1000	1400	1800	kHz
Maximum Duty Cycle	DC		86	93		%
Power Switch			_			•
On Resistance (Note2)	R _{DS(ON)}			1		Ω
Switch Current Limit (Note2)	I _{LIM}			600		mA
Lookogo Current	I _{LX(OFF)}	V _{LX} =12V, T _A =+25°C		0.1	1	μΑ
Leakage Current		V _{LX} =12V			10	μΑ
Soft-start						
Reset Switch Resistance (Note2)					2	kΩ
Charge Current		V _{SS} =1.2V	1.5	4	7	μΑ
Control Input	•	•	•	•	•	•
Input Low Voltage	V _{IL}	V _{SHDN} , V _{IN} =2.5V to 5.5V			0.3	V
Input High Voltage	V _{IH}	V _{SHDN} , V _{IN} =2.5V to 5.5V	1.0			V
	I _{SHDN}	V _{SHDN} =1.8V		25	50	μΑ
SHDN Input Current	I _{SHDN}	V _{SHDN} =0V		0.01	0.1	μΑ

Note 2: The specification is guaranteed by design, not production tested.

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Typical Performance Curves



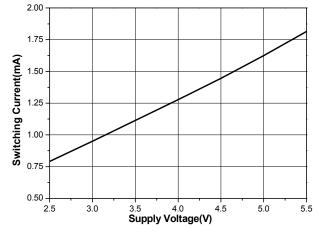


Figure 6. Frequency vs. Supply Voltage

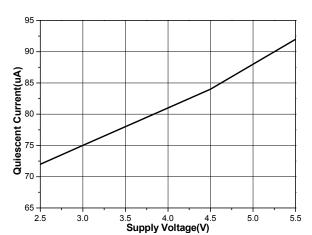


Figure 7. Switching Current vs. Supply voltage

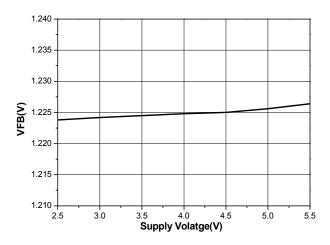


Figure 8. Non-Switching Current vs. Supply Voltage

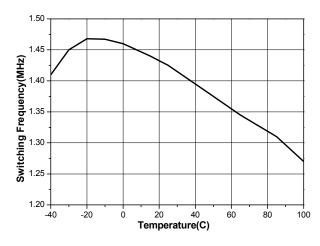


Figure 9. Feedback Voltage vs. Supply Voltage

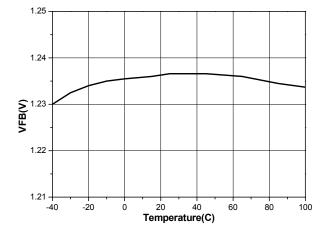


Figure 10. Switching Frequency vs. Temperature

Figure 11. Feedback Voltage vs. Temperature



Typical Performance Curves (Continued)

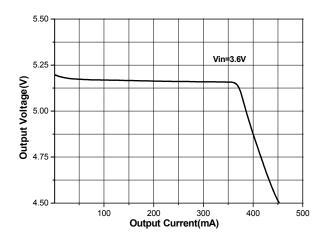


Figure 12.Load Regulation (Vo=5V)

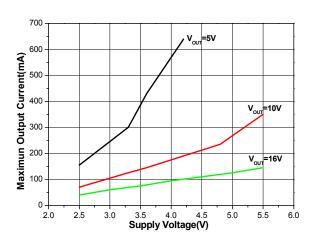


Figure 14. Maximum Output Current vs. Supply Voltage

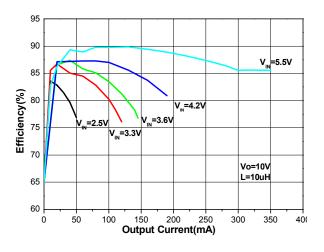


Figure 16. Efficiency vs. Output Current (Vo=10V)

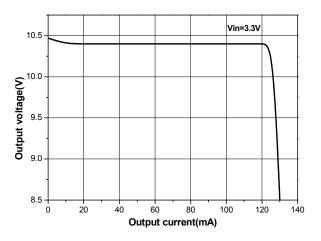


Figure 13. Load Regulation (Vo=10V)

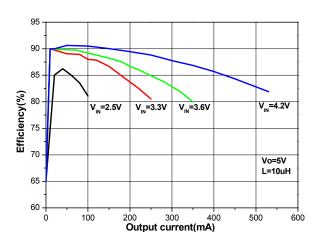
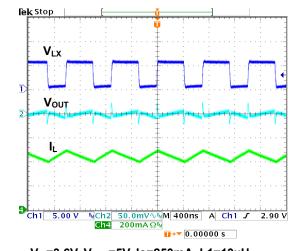


Figure 15. Efficiency vs. Output Current (Vo=5V)

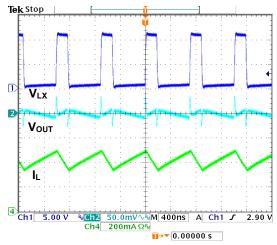


 $V_{\text{IN}}\text{=}3.6\text{V},\,V_{\text{OUT}}\text{=}5\text{V},\,\text{Io=}250\text{mA},\,\text{L1=}10\mu\text{H}$

Figure 17. Operation Waveform

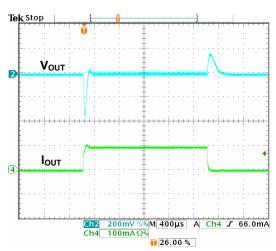


Typical Performance Curves (Continued)



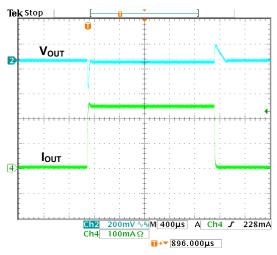
 V_{IN} =3.3V, V_{OUT} =10V, Io=100mA, L1=10 μ H

Figure 18. Operation Waveform



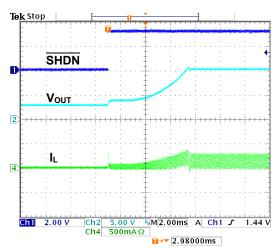
V_{IN}=3.3V, V_{OUT}=10V, Io=5 to 250mA, CFF=220pF

Figure 20. Load Step Response



 V_{IN} =3.6V, V_{OUT} =5V,Io=5 to 250mA, CFF=220pF

Figure 19. Load Step Response



V_{IN}=3.3V, V_{OUT}=10V, Io=50mA, CSS=33nF

Figure 21. Start-Up from Shutdown



Application Information

Inductor Selection

A $10\mu H$ 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).

Capacitor Selection

Small size ceramic capacitors are ideal for FP6736 applications. 5R and X7R types are recommended because they retain their capacitance over wider voltage and temperature ranges better than other types such as Y5V or Z5U. A $4.7\mu F$ input capacitor and a $4.7\mu F$ output capacitor are sufficient for most FP6736 applications.

Diode Selection

Schottky diodes, with 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.

Open-Circuit Protection

In the cases of output open circuit, when R1 is 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 LX pin voltage to exceed its maximum 33V rating. A Zener diode can be used at the output to limit the voltage on the LX pin (Figure 22). 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.

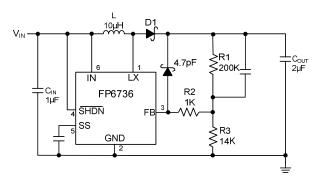


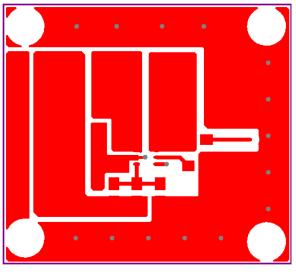
Figure 22. With Open-Circuit Protection



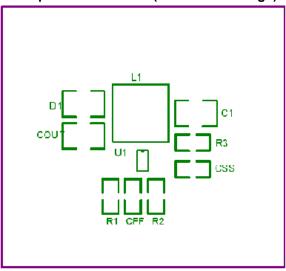
Demo Board Circuit & Layout

SOT-23-6 Package VQUT VIN D1 10uH C3 10uF C1 10uF FP6736 R1 110K = LX VIN GND SS C2 FB SHDN 33nF R2 12K

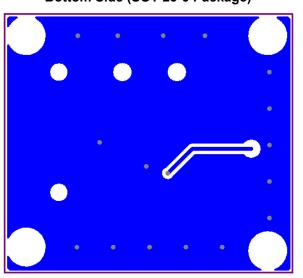
Top Side (SOT-23-6 Package)



Component Placement(SOT-23-6 Package)

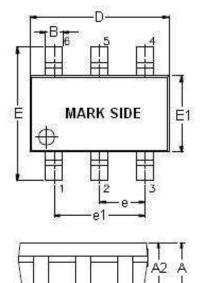


Bottom Side (SOT-23-6 Package)

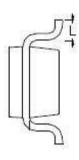




Outline Information



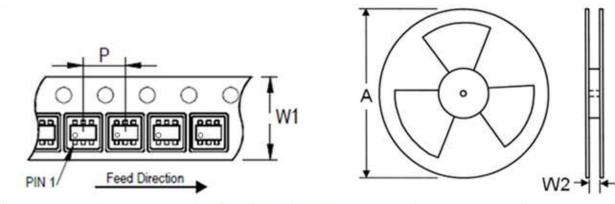
SOT-23-6 Package (Unit: mm)



SYMBOLS	DIMENSION IN MILLIMETE				
UNIT	MIN	MAX			
Α	0.90	1.45			
A1	0.00	0.15			
A2	0.90	1.30			
В	0.30	0.50			
D	2.80	3.00			
E	2.60	3.00			
E1	1.50	1.70			
е	0.90	1.00			
e1	1.80	2.00			
L	0.30	0.60			

Note: Followed From JEDEC MO-178-C.

Carrier Dimensions

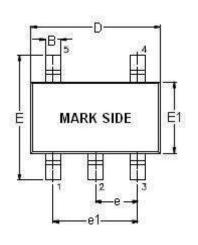


Tape Size	Pocket Pitch	Reel Size (A)		Reel Width	Empty Cavity	Units per Reel
(W1) mm	(P) mm	in	mm	(W2) mm	Length mm	
8	4	7	180	8.4	300~1000	3,000



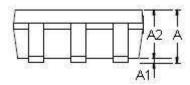
Outline Information (Continued)

TSOT-23-5 Package (Unit: mm)

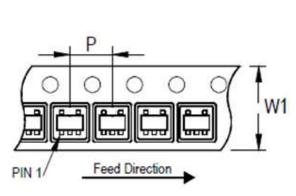


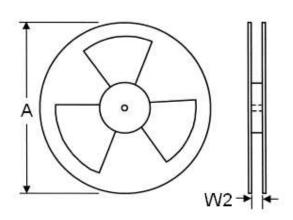


SYMBOLS	MILLIMETER		
UNIT	MIN	MAX	
Α	0.70	0.90	
A1	0.00	0.10	
A2	0.70	1.00	
В	0.30	0.50	
D	2.80	3.00	
E	2.60	3.00	
E1	1.50	1.70	
е	0.90	1.00	
e1	1.80	2.00	
L	0.30	0.60	



Carrier Dimensions





Tape Size	Pocket Pitch	Reel	Size (A)	Reel Width	Empty Cavity	Units per Reel
(W1) mm	(P) mm	in	mm	(W2) mm	Length mm	
8	4	7	180	8.4	300~1000	3,000

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