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## 1MHz 2.5A Current-Mode Step-Up DC/DC Converter

### Description

The FP67380 is a current-mode, pulse-width modulation, step-up DC/DC converter. The built-in high voltage N-channel MOSFET allows FP67380 for step-up applications with up to 24V output voltage, as well as for Single Ended Primary Inductance Converter (SEPIC).

The high switching frequency (1MHz) 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 FP67380 is available in space-saving TDFN-6 (2mmx2mm) packages.

### Features

- Fixed Frequency 1MHz Current-Mode PWM Operation
- Adjustable Output Voltage up to 24V
- Automatically Switch to PSM Mode for Improving Efficiency at Light Load
- 3V to 24V Input Range
- Maximum 1µA Shutdown Current
- Programmable Soft-start / Internal Soft-start
- Meet SMD Ceramic Inductor application
- Space-Saving TDFN-6 (2mmx2mm) Packages
- RoHS Compliant

### Applications

- LCD Displays
- Portable Applications
- Handheld Devices

### Pin Assignments

WD Package TDFN-6 (2mmx2mm)

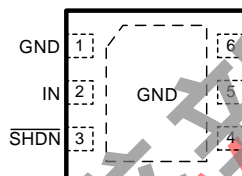
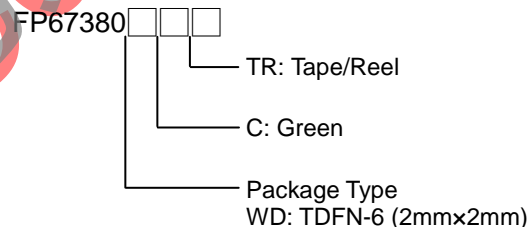


Figure 1. Pin Assignment of FP67380

### Ordering Information



### TDFN-6 (2mmx2mm) Marking

Part Number	Product Code
FP67380WDCTR	FM3

## Typical Application Circuit

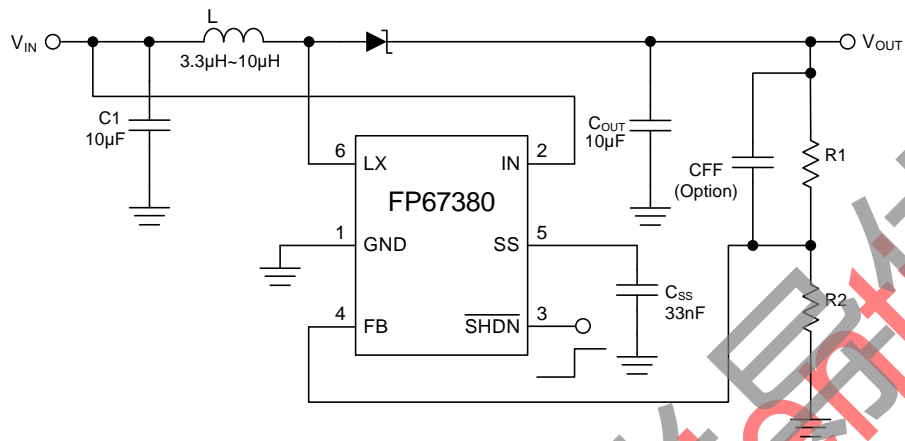


Figure 2. Typical Application Circuit (TDFN-6 Package)

## Functional Pin Description

Pin Name	Pin No. (TDFN-6)	Pin Function
<b>LX</b>	6	Switch Node Pin. Connect LX to the inductor and output rectifier. Connect components as close to LX as possible.
<b>GND</b>	1	Ground.
<b>FB</b>	4	Feedback Pin. Connect a resistive voltage-divider from the output to FB to set the output voltage.
<b>SHDN</b>	3	Shutdown Input. Drive SHDN low to turn off the converter. To automatically start the converter, connect SHDN to IN. Do not leave SHDN unconnected.
<b>IN</b>	2	Internal Bias Voltage Input. Connect IN to the input voltage source. Bypass IN to GND with a 10µF or greater capacitor as close to IN as possible.
<b>SS</b>	5	Soft-start Input. Connect a soft-start capacitor from SS to GND to soft-start the converter. Leave SS open to inform internal soft-start function.

**Block Diagram**

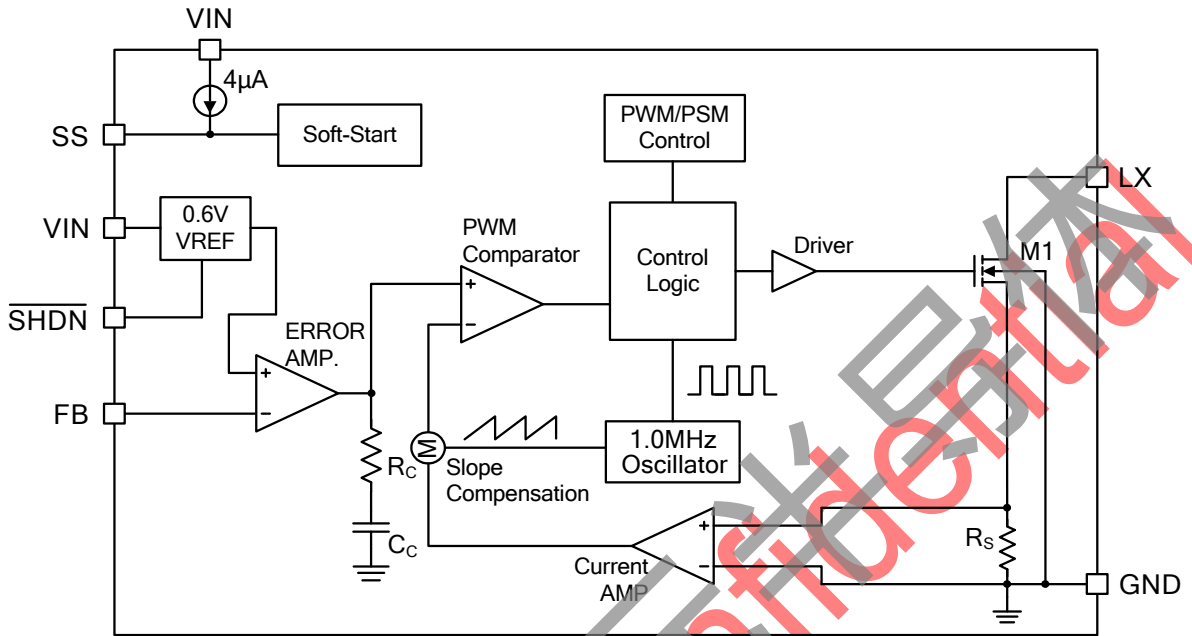


Figure 3. Block Diagram.

### Absolute Maximum Ratings

- LX , Vin to GND ----- +26V
- All Other Pins to GND ----- +6V
- LX Voltage  $V_{LX}$  (15ns) ----- -6V to  $V_{IN}+6V$
- Power Dissipation @ $T_A=25^{\circ}C$ , ( $P_D$ )
  - TDFN-6 (2mmx2mm)----- 1.25W
- Package Thermal Resistance, ( $\theta_{JA}$ )
  - TDFN-6 (2mmx2mm)----- 80°C/W
- Package Thermal Resistance, ( $\theta_{JC}$ )
  - TDFN-6 (2mmx2mm)----- 56°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

Note1 : Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

### Recommended Operating Conditions

- Input Voltage ( $V_{IN}$ ) ----- +3V to +24V
- Operating Junction Temperature Range ( $T_{OP}$ ) ----- -40°C to +85°C

## Electrical Characteristics

( $V_{IN}=5V$ ,  $T_A=25\text{ }^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input Supply Range	$V_{IN}$		3		24	V
Output Voltage Adjustable Range	$V_{OUT}$				24	V
Quiescent Current	$I_{IN}$	$V_{FB}=0.7V$ , not switching		120	200	$\mu\text{A}$
		$V_{FB}=0.6V$ , switching		1		$\text{mA}$
Shutdown Supply Current	$I_{SD}$	$V_{\overline{\text{SHDN}}}=0V$		0.1	1	$\mu\text{A}$
Under Voltage Lockout	$V_{UVLO}$				2.8	V
Under Voltage Lockout Hysteresis	$\Delta V_{UVLO}$			0.2		V
Thermal Shutdown (Note 2)	$T_{SD}$			150		$^\circ\text{C}$
Thermal Shutdown Hysteresis				30		$^\circ\text{C}$
<b>Error Amplifier</b>						
Feedback Regulation Set Point	$V_{FB}$		0.588	0.6	0.612	V
FB Input Bias Current	$I_{FB}$	$V_{FB}=0.6V$		21	80	$\text{nA}$
Line Regulation		$3V < V_{IN} < 24V$		0.05	1	$\%/V$
<b>Oscillator</b>						
Frequency	$f_{OSC}$		800	1000	1200	KHz
Maximum Duty Cycle	DC	$FB=GND$	90	95		%
<b>Power Switch</b>						
On Resistance	$R_{DS(ON)}$	Guaranteed By Design		0.2		$\Omega$
Switch Current Limit	$I_{LIM}$			2.5		A
Leakage Current	$I_{LX(OFF)}$	$V_{LX}=25V$ , $T_A=+25^\circ\text{C}$		0.1	1	$\mu\text{A}$
<b>Soft-start</b>						
Charge Current	$I_{SS}$		2	4	7	$\mu\text{A}$
Soft-start time	$t_{SS}$	SS Pin Voltage=1V, $C_{SS}=10\text{nF}$		2		ms
Internal Soft-start time	$t_{SS}$	$C_{SS}=NC$		1		ms
<b>Control Input</b>						
Input Low Voltage	$V_{IL}$	$V_{\overline{\text{SHDN}}}$ , $V_{IN}=2.5V$ to $6V$			0.3	V
Input High Voltage	$V_{IH}$	$V_{\overline{\text{SHDN}}}$ , $V_{IN}=2.5V$ to $6V$	1.0			V
$\overline{\text{SHDN}}$ Input Current	$I_{\overline{\text{SHDN}}}$	$V_{\overline{\text{SHDN}}}=-5V$		0.1	1	$\mu\text{A}$

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

## Application Information

### Inductor Selection

The inductor recommended from 3.3 $\mu$ F to 10 $\mu$ F for most FP67380 applications. Although small size and high efficiency are major concerns, the inductor should have low core losses at 1MHz and low DCR (copper wire resistance).

### Capacitor Selection

The small size of ceramic capacitors makes them ideal for FP67380 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 10 $\mu$ F input capacitor and a 10 $\mu$ F output capacitor are sufficient for most FP67380 applications.

### Diode Selection

Schottky diodes, with their low forward voltage drop and fast reverse recovery, are the ideal choices for FP67380 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 FP67380. A Schottky diode rated at 3A is sufficient for most FP67380 applications.

### 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 FP67380 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 24V rating. A zener diode can be used at the output to limit the voltage on the LX pin (Figure 5). 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.

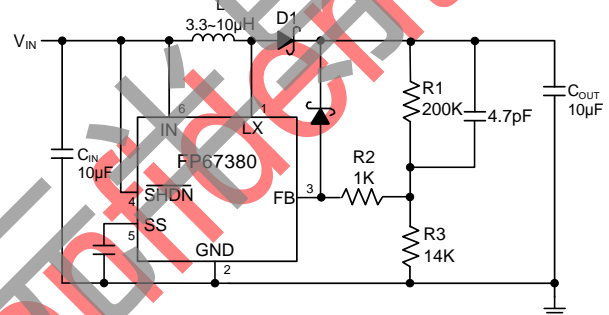
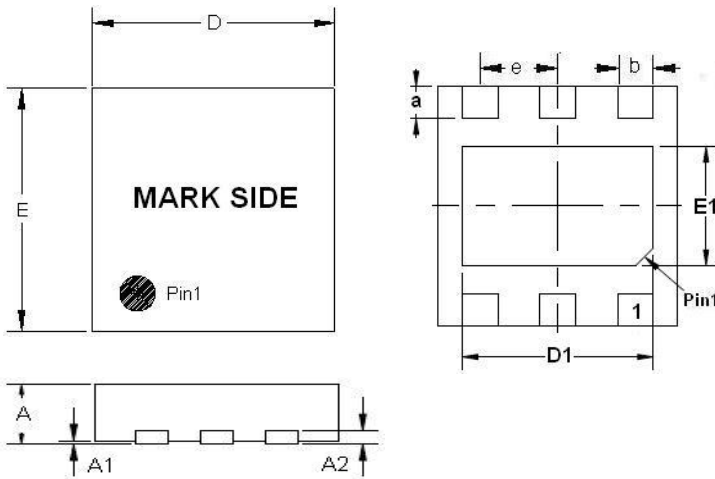


Figure 6. With Open-Circuit Protection

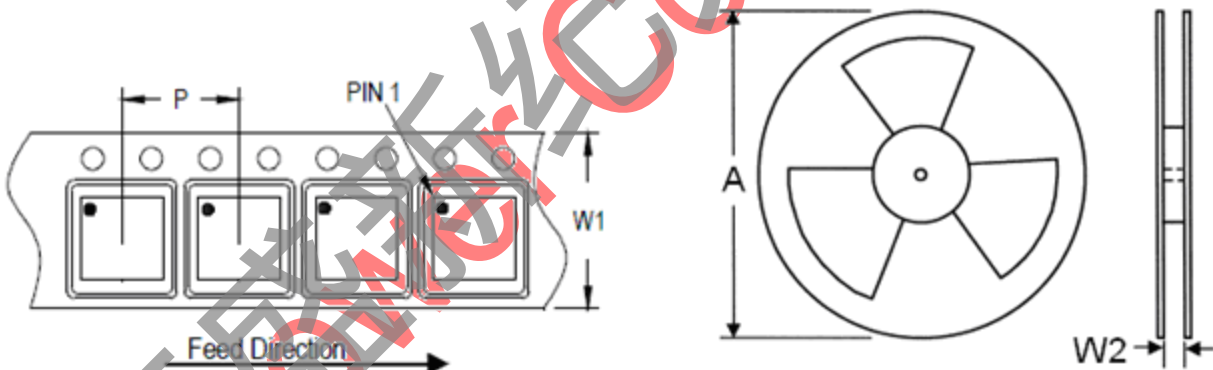
**Outline Information**

TDFN-6 2mm×2mm (pitch 0.65 mm)Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.70	0.80
A1	0.00	0.05
A2	0.19	0.22
D	1.95	2.05
E	1.95	2.05
a	0.20	0.40
b	0.25	0.35
e	0.60	0.70
D1	1.15	1.65
E1	0.55	1.05

**Carrier Dimensions**



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
8	4	7	180	8.4	400~1000	3,000

**Life Support Policy**

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