

ILC6376

ADVANCED INFORMATION

Step-down PWM DC-DC Converter with Shutdown

General Description

A high efficiency, compact step-down DC-DC converter delivering up to 600mA output current using PWM technique. The ILC6376 uses a unique p-channel architecture with built-in charge pump to maintain low on-resistance even at low input voltages. Start-up is controlled via an external soft-start capacitor, and the part will automatically re-enter start-up mode when the output current overload condition is sensed, providing automatic short-circuit protection.

Undervoltage lockout prevents faulty operation below the minimum operating voltage level, and in standby the part consumes less than 25µA of current.

The ILC6376 can be configured as a step-up/down, or Buck-Boost, converter using only 1 inductor by adding 2 external N-channel FETs.

The part comes in a SOP 8-pin package and can be externally adjustable for different voltage options.

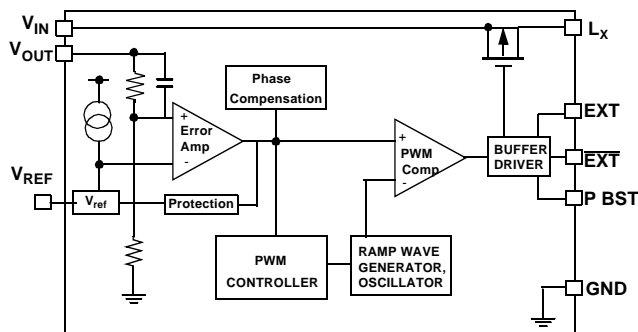
Features

- u ±2.5% accurate output voltages
- u Up to 600mA output currents
- u 90% efficient conversion
- u Unique PSWITCH™ architecture maintains high efficiency and current capability at low input voltage
- u Built in short circuit and undervoltage lockout
- u Shutdown to 25µA
- u Selectable soft-start condition
- u External transistor drive available
- u 100 or 180kHz operation
- u Only four external components needed

Applications

- u Cellular Phones, Pagers
- u Consumer goods
- u Palmtops and PDAs
- u Portable instrumentation

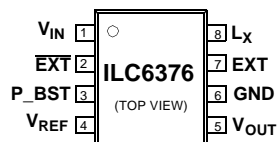
Block Diagram



Ordering Information*

ILC6376AS-18	180kHz 1.8V DC-DC converter
ILC6376AS-27	180kHz 2.7V DC-DC converter
ILC6376AS-30	180kHz 3.0V DC-DC converter
ILC6376AS-50	180kHz 5.0V DC-DC converter
ILC6376CS-18	100kHz 1.8V DC-DC converter
ILC6376CS-27	100kHz 2.7V DC-DC converter
ILC6376CS-30	100kHz 3.0V DC-DC converter
ILC6376CS-50	100kHz 5.0V DC-DC converter

Pin-Package Configurations



8-pin SOP package

ILC6376 Step-down PWM DC-DC Converter with Shutdown
Absolute Maximum Ratings (T_A=25°C)

Parameter	Symbol	Ratings	Units
V _{in} Input Voltage	V _{IN}	12	V
V _{out} Voltage (FB input voltage)	V _{OUT}	V _{IN} + 0.3V	V
Voltage on pin L _x	V _{Lx}	12	V
Current on pin L _x	I _{Lx}	700	mA
Voltage on pin P BST	V _{PBST}	12	V
Current on pin EXT, EXT	I _{EXT}	±50	mA
Voltage on all other pins	V	V _{IN} + 0.3	V
Continuous Total Power Dissipation (SOT-89-5)	P _d	500	mW
Operating Ambient Temperature	T _{opr}	-30~+80	°C
Storage Temperature	T _{stg}	-40~+125	°C

Electrical Characteristics ILC6376AS-30

V_{OUT}=3.0V, F_{OSC}=180kHz, T_A=25°C. Unless otherwise specified, V_{in}=3.6V, I_{out}=120mA, circuit configuration of Figure 1.

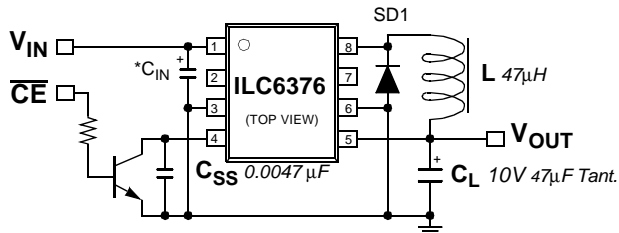
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Output Voltage	V _{OUT}		2.925	3.000	3.075	V
Max Input Voltage	V _{IN(max)}		9.0			V
Max Output Current	I _{OUT(max)}		600			mA
Input Current	I _{IN}	V _{in} = V _{out} x 1.05 (3.15V), no load		433	706	μA
Idle Current	I _{DD 1}	V _{out} = V _{lx} = V _{in} (oscillation suspended)		20.5	28.4	μA
Standby Current	I _{DD 2}	V _{out} = V _{lx} = V _{in} , V _{ref} = 0		1.5	2.5	μA
L _x Switch-On Resistance	R _{SWON}	V _{lx} = V _{in} - 0.4V, V _{ref in} = 1.05V, V _{out} = V _{in} X 0.9 (2.7V)		0.69	0.94	Ω
L _x Leakage Current	I _{LXL}	V _{out} = V _{in} , V _{lx} = V _{ref} = 0V			2.0	μA
Oscillating Frequency	F _{OSC}	I _{out} = 1.5mA	153	180	207	kHz
Max Duty Cycle	MAXDTY		100			%
Efficiency	EFFI			90		%
Undervoltage Lockout	V _{UVLO}	Minimum V _{in} when V _{ref} does not start up	1.2		2.0	V
Soft-start Time	T _{SS}	V _{ref} rises to 0.9V from 0V	6.0	10.0	16.0	msec
Internal Protection Time	T _{pro}	Time from V _{out} =0V to V _{ref} =LOW	3.0	5.0	8.0	msec
Internal Reference Voltage	V _{REF}	V _{out} = V _{in} = V _{lx}	0.985	1.000	1.015	V
V _{ref} Sink Current	I _{REF}	V _{out} = V _{in} = V _{lx} , V _{ref in} = 1.05V	5.0			mA

Electrical Characteristics ILC6376AS-30

$V_{OUT}=3.0V$, $F_{OSC}=180kHz$, $T_A=25^{\circ}C$. Unless otherwise specified, $V_{in}=3.6V$, $I_{out}=120mA$, circuit configuration of Figure 1.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
CE HI Voltage	V_{ceH}	$V_{ref_{in}} = 1.05V$, $V_{out} = V_{in} = V_{lx}$, measure EXT going HIGH	0.9			V
CE LOW Voltage	V_{ceL}	$V_{ref_{in}} = 1.05V$, $V_{out} = V_{in} = V_{lx}$, measure EXT going LOW			0.4	V
EXT HI On-Resistance	$R_{ext_{HI}}$	$V_{ref_{in}} = 1.05V$, $V_{out} = V_{in}$, $V_{ext} = V_{in}-0.4V$, LX floating		38.0	51.4	Ω
EXT LOW On-Resistance	$R_{ext_{LOW}}$	$V_{ref_{in}} = 1.05V$, $V_{out} = V_{in}$, $V_{ext} = 0.4V$, LX floating		30.8	40.4	Ω
\overline{EXT} HI On-Resistance	$\overline{R_{ext_{HI}}}$	$V_{ref_{in}} = 1.05V$, $V_{out} = V_{in}$, $\overline{V_{ext}} = V_{in}-0.4V$, LX floating		38.0	51.4	Ω
\overline{EXT} LOW On-Resistance	$\overline{R_{ext_{LOW}}}$	$V_{ref_{in}} = 1.05V$, $V_{out} = V_{in}$, $\overline{V_{ext}} = 0.4V$, LX floating		30.8	40.4	Ω

Application Circuits



* C_{IN} is not required but helps ensure stable operation

Figure 1. Step-down Mode

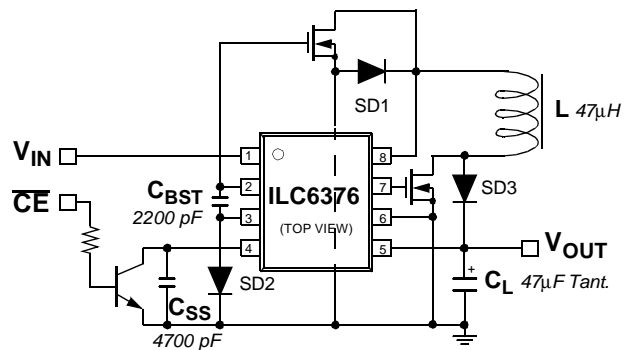
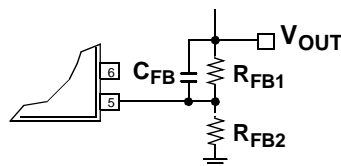


Figure 2. Buck-Boost Mode



$$R_{FB1} + R_{FB2} \leq 2M\Omega$$

$$C_{FB} \text{ chosen so that } 1kHz < \frac{1}{2 \times \pi \times C_{FB} \times R_{FB1}} < 20kHz$$

Figure 3. External Setting of Vout

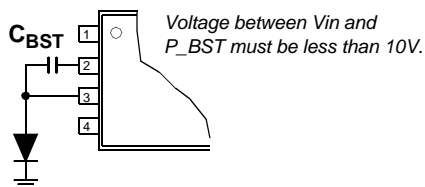


Figure 4. PSWITCH™ Setup

Pin	Symbol	Function
1	Vin	Input voltage & power supply to part
2	EXT	External drive pin (LOW when P-channel is ON)
3	P_BST	P-channel gate boost
4	Vref	Reference voltage pin, also Chip Enable, Soft-Start input
5	Vout	Output voltage sense, also feedback pin for external set
6	GND	Ground connection
7	EXT	External drive pin (HI when P-channel is ON)
8	Lx	P-channel FET switch