FEATURES

- High Efficiency: Up to 96%
- 1.4MHz Constant Frequency Operation
- 1500mA Output Current
- No Schottky Diode Required
- 2.3V to 5.5V Input Voltage Range
- Output Voltage as Low as 0.6V
- 100% Duty Cycle in Dropout
- Low Quiescent Current: 35μA
- Slope Compensated Current Mode Control for Excellent Line and Load Transient Response
- Short Circuit Protection
- Thermal Fault Protection
- Inrush Current Limit and Soft Start
- <1μA Shutdown Current
- Tiny SOT23-5 Package

APPLICATIONS

- Cellular and Smart Phones
- Wireless and DSL Modems
- PDAs
- Digital Still and Video Cameras
- MP3 Players

GENERAL DESCRIPTION

The SD6410 are high-efficiency, high frequency synchronous step-down DC-DC regulator ICs capable of delivering up to 1.5A output currents. The SD6410 can operate over a wide input voltage range from 2.3V to 5.5V and integrate main switch and synchronous switch with very low RDS(ON) to minimize the conduction loss.

It is ideal for powering portable equipment that runs from a single cell Lithium-Ion (Li+) battery. The output voltage can be regulated as low as 0.6V. The SD6410 can also run at 100% duty cycle for low dropout operation, extending battery life in portable system. This device offers two operation modes, PWM control and PFM Mode switching control, which allows a high efficiency over the wider range of the load.

The SD6410 is offered in a low profile (1mm) 5-pin, thin SOT package, and is available in an adjustable version.

Typical Application

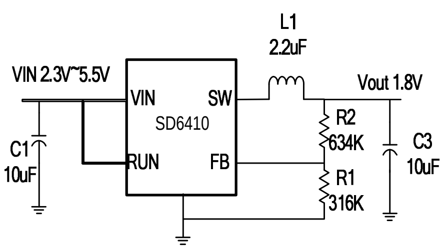
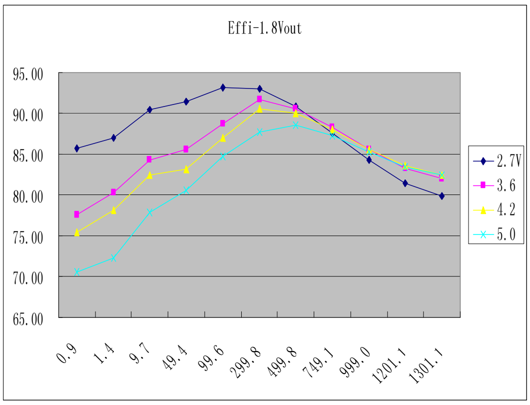


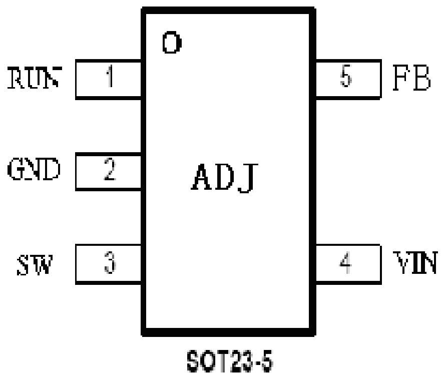
Figure 1. Basic Application Circuit



Absolute Maximum Ratings (Note 1)

Input Supply Voltage ……… -0.3V to 6V
RUN,VOUT Voltages……... -0.3V to 6V
SW Voltage ……………-0.3V to (Vin+0.3V)
Peak SW Sink and Source Current 2.5A
Operating Temperature Range … -40℃ to +85℃
Junction Temperature(Note2) ……………..125℃
Storage Temperature Range …..-65℃ to 150℃
Lead Temperature(Soldering,10s) ……..+300℃

Package/Order Information



Part Number	SWICHING FREQUENCY	Temp Range	OUTPUT VOLTAGE (V)	OUTPUT CURRENT (A)
SD6410	1.4MHz	-40℃ to +85℃	ADJ	1.5

Pin Description

PIN	NAME	FUNCTION
1	RUN	Chip Enable Pin. Drive RUN above 1.5V to turn on the part. Drive RUN below 0.3V to turn it off. Do not leave RUN floating.
2	GND	Ground Pin
3	SW	Power Switch Output. It is the switch node connection to Inductor. This pin connects to the drains of the internal P-ch and N-ch MOSFET switches.
4	VIN	Power Supply Input. Must be closely decoupled to GND with a 10μF or greater ceramic capacitor.
5	VOUT	Output Voltage Feedback Pin. An internal resistive divider divides the output voltage down for comparison to the internal reference voltage.

Electrical Characteristics (Note 3)

(V_{IN}=V_{RUN}=3.6V, V_{OUT}=1.8V, T_A = 25℃, unless otherwise noted.)

Parameter	Conditions	MIN	TYP	MAX	unit
Input Voltage Range		2.3		5.5	V
UVLO Threshold		1.7	1.9	2.1	V
Input DC Supply Current	(Note 4)				µA
PWM Mode	Vout = 90%, Iload=0mA		140	300	µA
PFM Mode	Vout = 105%, Iload=0mA		35	70	µA
Shutdown Mode	V_{RUN} = 0V, V_{IN}=4.2V		0.1	1.0	µA
Regulated Feedback Voltage	T_A = 25℃	0.588	0.600	0.612	V
	T_A = 0℃ ≤ T_A ≤ 85℃	0.586	0.600	0.613	V
	T_A = -40℃ ≤ T_A ≤ 85℃	0.585	0.600	0.615	V
Reference Voltage Line Regulation	Vin=2.5V to 5.5V		0.04	0.40	%/V
Output Voltage Line Regulation	V_{IN} = 2.5V to 5.5V		0.04	0.4	%
Output Voltage Load Regulation			0.5		%
Oscillation Frequency	Vout=100%		1.5		MHz
	Vout=0V		300		KHz
On Resistance of PMOS	I_{SW}=100mA		0.13	0.2	Ω
ON Resistance of NMOS	I_{SW}=-100mA		0.1	0.2	Ω
Peak Current Limit	V_{IN}= 3V, Vout=90%		2.5		A
RUN Threshold		0.30	1.0	1.50	V
RUN Leakage Current			±0.01	±1.0	µA
SW Leakage Current	V_{RUN}=0V,V_{IN}=Vsw=5V		±0.01	±1.0	µA

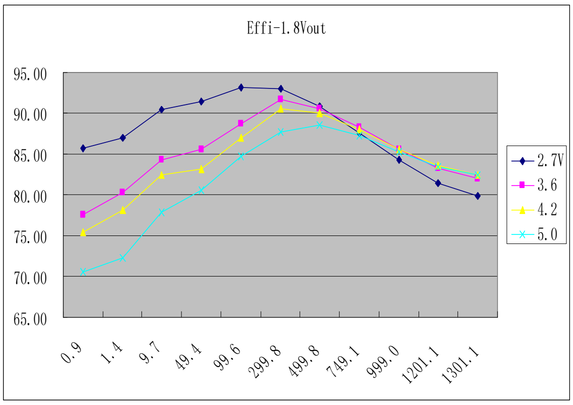
Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

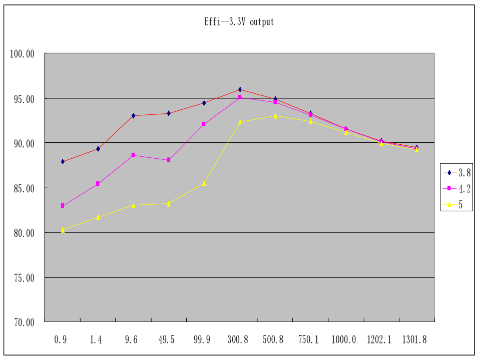
Note 2: T_J is calculated from the ambient temperature T_A and power dissipation P_D according to the following formula: $T_J = T_A + (P_D) \times (250℃/W)$.

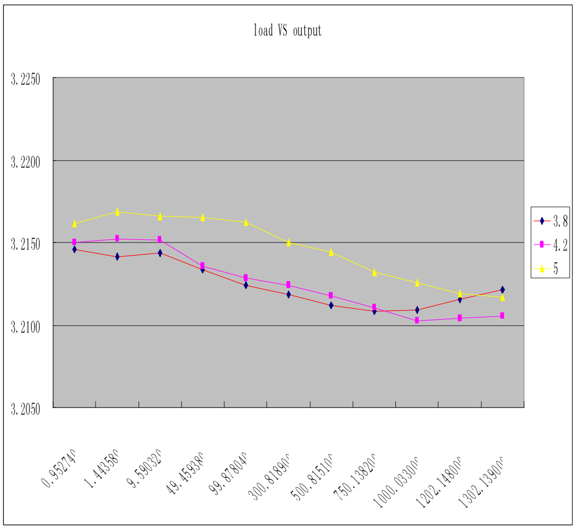
Note3: 100% production test at +25℃. Specifications over the temperature range are guaranteed by design and characterization.

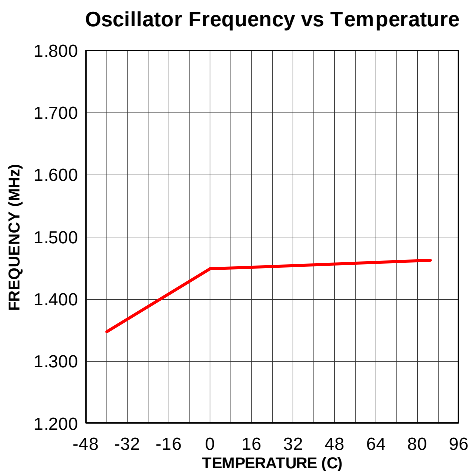
Note 4: Dynamic supply current is higher due to the gate charge being delivered at the switching frequency

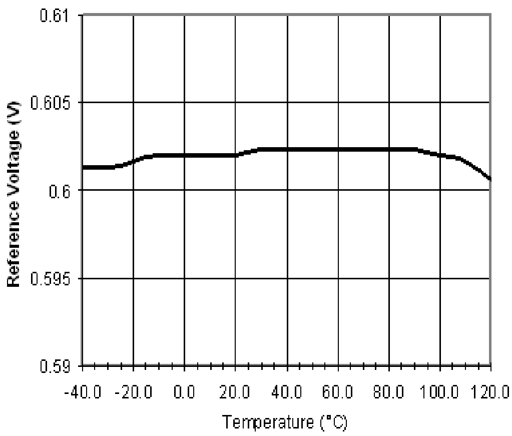
Typical Performance Characteristics

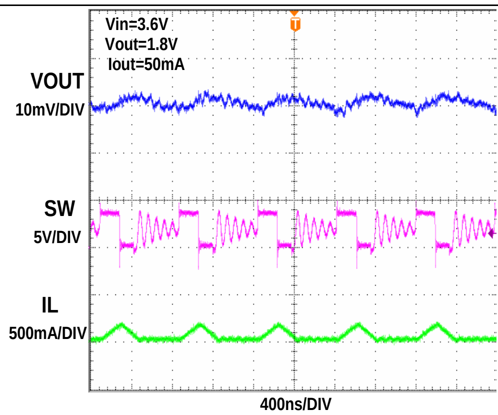












PFM MODE

Functional Block Diagram

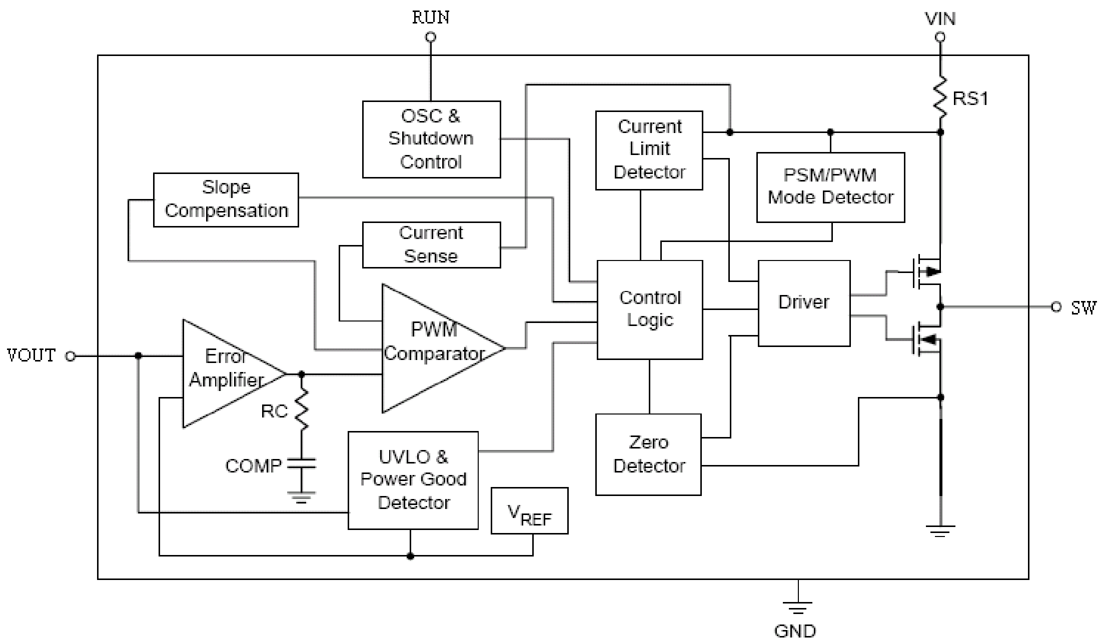


Figure 2. SD6410 Block Diagram

Functional Description

SD6410 is a synchronous buck regulator IC that integrates the PWM/PFM control, top and bottom switches on the same die to minimize the switching transition loss and conduction loss. With ultra low RDS(ON) power switches and proprietary PWM control, this regulator IC can achieve the highest efficiency and the highest switch frequency simultaneously to minimize the external inductor and capacitor size, and thus achieving the minimum solution footprint.

The SD6410 requires only three external power components (Cin, Cout and L). The adjustable version can be programmed with external feedback to any voltage, ranging from 0.6V to the input voltage.

At dropout, the converter duty cycle increases to 100% and the output voltage tracks the input voltage minus the Rdson drop of the high-side MOSFET.

The internal error amplifier and compensation provides excellent transient response, load, and line regulation. Soft start function prevents input inrush current and output overshoot during start up.

APPLICATIONS INFORMATION

Inductor Selection

For most designs, the SD6410 operates with inductors of 1µH to 4.7µH. Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following equation:

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f_{OSC}}$$

Where ΔI_L is inductor Ripple Current. Large value inductors result in lower ripple current and small value inductors result in high ripple current. For optimum voltage-positioning load transients, choose an inductor with DC series resistance in the 50mΩ to 150mΩ range.

Input Capacitor Selection

With the maximum load current at 1.5A, the maximum ripple current through input capacitor is about 0.6Arms. A typical X7R or better grade ceramic capacitor with 6V rating and greater than 10uF capacitance can handle this ripple current well. To minimize the potential noise problem, place this 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.

Output Capacitor Selection

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current ratings. The output ripple V_{OUT} is determined by:

$$\Delta V_{OUT} \le \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times f_{OSC} \times L} \times \left(ESR + \frac{1}{8 \times f_{osc} \times C3} \right)$$

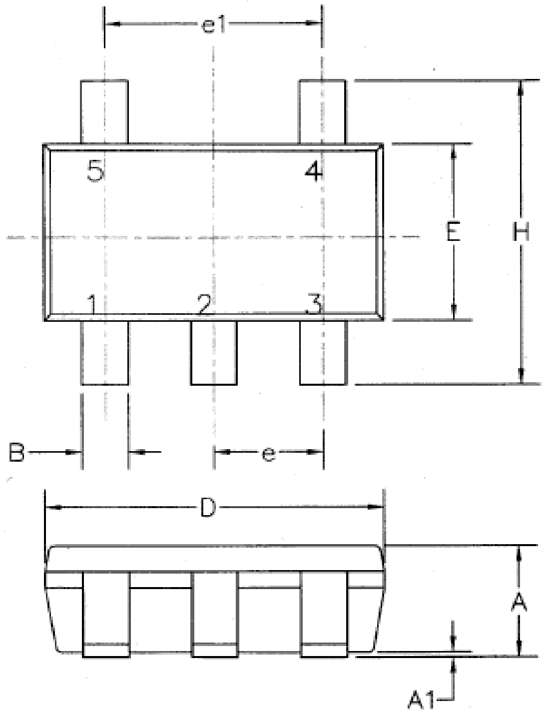
A 10µF ceramic can satisfy most applications.

PC Board Layout Checklist

When laying out the printed circuit board, the following checking should be used to ensure proper operation of the SD6410. Check the following in your layout:

1. The power traces, consisting of the GND trace, the SW trace and the VIN trace should be kept short, direct and wide.
2. Does the (+) plates of Cin connect to Vin as closely as possible? This capacitor provides the AC current to the internal power MOSFETs.
3. Keep the switching node, SW, away from the sensitive VOUT node.
4. Keep the (-) plates of Cin and Cout as close as possible

Package Description



5LD SOT-23 PACKAGE OUTLINE DIMENSIONS
ALL DIMENSIONS IN MM.

Dimension	Min.	Max.
A	0.9	1.10
A1	0.01	0.13
B	0.3	0.5
C	0.09	0.2
D	2.8	3.0
H	2.5	3.1
E	1.5	1.7
e	0.95 REF.	
e1	1.90 REF.	
L1	0.2	0.55
L	0.35	0.8
Q	0°	10°