1.5MHz Synchronous Step-down DC-DC Converter AP3410B

General Description

The AP3410B is a high efficiency step-down DC-DC voltage converter. The chip operation is optimized by peak-current mode architecture with built-in synchronous power MOSFET switchers. The oscillator and timing capacitors are all built-in providing an internal switching frequency of 1.5MHz that allows the use of small surface mount inductors and capacitors for portable product implementations.

Integrated Soft Start (SS), Under Voltage Lock Out (UVLO), Thermal Shutdown Detection (TSD) and Short Circuit Protection are designed to provide reliable product applications.

The device is available in adjustable output voltage version ranging from 0.6V to $0.9\times V_{IN}$ when input voltage range is from 2.5V to 5.5V, and is able to deliver up to 1.2A.

The AP3410B is available in SOT-23-5 package.

Features

- High Efficiency Buck Power Converter
- Wide Input Voltage Range: 2.5V to 5.5V
- Adjustable Output Voltage: 0.6V to $0.9\times V_{IN}$
- Low $R_{DS(ON)}$ Internal Switches:200mΩ (V_{IN}=5V)
- Built-in Power Switches for Synchronous Rectification with High Efficiency
- Output Current: 1.2A
- Feedback Voltage: 600mV
- 1.5MHz Constant Frequency Operation
- Thermal Shutdown Protection
- Low Dropout Operation at 100% Duty Cycle
- No Schottky Diode Required
- Input Over Voltage Protection
- Output Over Voltage Protection
- Over Current Protection

Applications

- Post DC-DC Voltage Regulation
- PDA and Notebook Computer



SOT-23-5

Figure 1. Package Type of AP3410B

Pin Configuration

K Package
(SOT-23-5)

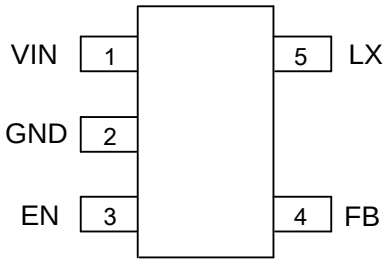


Figure 2. Pin Configuration of AP3410B (Top View)

Pin Description

Pin Number	Pin Name	Function
1	VIN	Power supply
2	GND	Ground pin
3	EN	Chip enable pin. Active high
4	FB	Feedback voltage of output
5	LX	Switch output pin

Functional Block Diagram

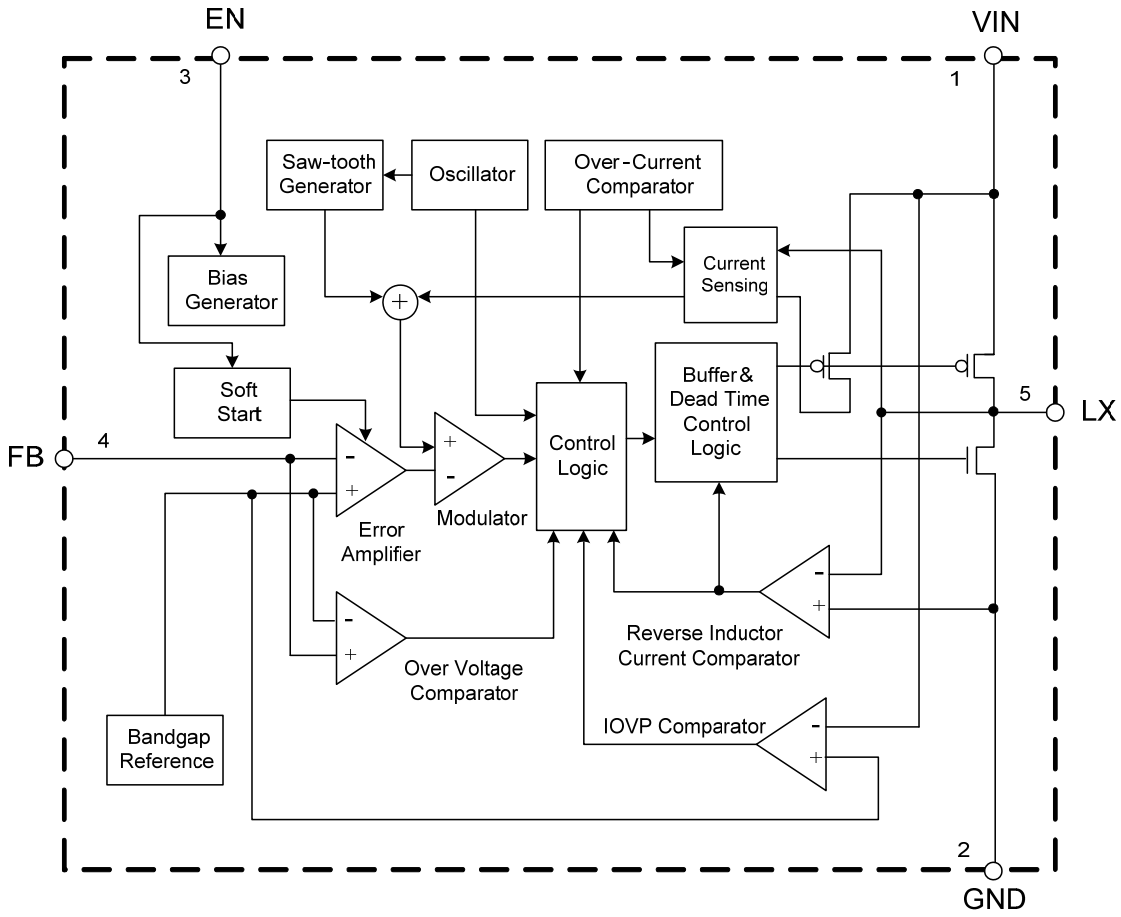
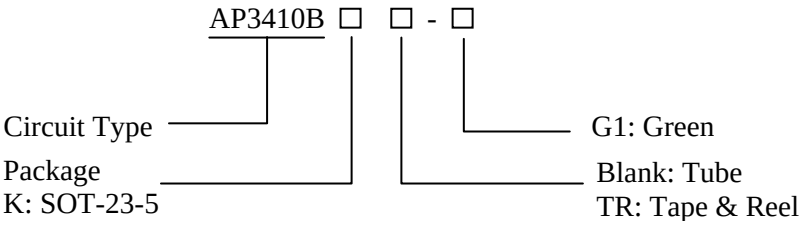


Figure 3. Functional Block Diagram of AP3410B

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOT-23-5	-40 to 85ºC	AP3410BK-G1	G3U	Tube
		AP3410BKTR-G1	G3U	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" in the part number, are RoHS compliant and green.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Input Voltage for the MOSFET Switch	V_{IN}	0 to 6.0	V
Enable Input Voltage	V_{EN}	-0.3 to V_{IN}+0.3	V
LX Pin Switch Current	I_{LX}	1.8	A
Power Dissipation (On PCB, T_A=25°C)	P_D	0.4	W
Thermal Resistance (Junction to Ambient, Simulation)	θ_{JA}	250	°C/W
Thermal Resistance (Junction to Case, Simulation)	θ_{JC}	130	°C/W
Operating Junction Temperature	T_J	155	°C
Storage Temperature	T_{STG}	-55 to 150	°C
Operating Temperature	T_{OP}	-40 to 85	°C
ESD (Machine Model)	V_{MM}	200	V
ESD (Human Body Model)	V_{HBM}	2000	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Input Voltage	V_{IN}	2.5	5.5	V
Operating Ambient Temperature	T_A	-40	85	°C
Operating Junction Temperature	T_J	-40	125	°C

Electrical Characteristics

V_{IN}=V_{EN}=5V, V_{OUT}=1.2V, V_{FB}=0.6V, L=2.2μH, C_{IN}=4.7μF, C_{OUT}=10μF, T_A=25°C, unless otherwise specified.

Parameters	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		2.5		5.5	V
Shutdown Current	I_{OFF}	V_{EN}=0			0.1	μA
Active Current	I_{ON}	V_{FB}=0.55V		220		μA
Regulated Feedback Voltage	V_{FB}		0.588	0.6	0.612	V
Regulated Output Voltage Accuracy	$\Delta V_{OUT}/V_{OUT}$	V_{IN}=2.5V to 5.5V, I_{OUT}=0 to 1.2A	-3		3	%
Peak Inductor Current	I_{PK}		1.5	1.9		A
Oscillator Frequency	f_{OSC}	V_{IN}=2.5V to 5.5V	1.2	1.5	1.8	MHz
PMOSFET $R_{DS(ON)}$	$R_{DS(ON)P}$	V_{IN}=5V		200		mΩ
NMOSFET $R_{DS(ON)}$	$R_{DS(ON)N}$	V_{IN}=5V		200		mΩ
EN High Level Input Voltage	V_{EN_H}		1.5			V
EN Low Level Input Voltage	V_{EN_L}				0.4	V
EN Input Current	I_{EN}				0.1	μA
Soft Start Time	t_{SS}			400		μs
Maximum Duty Cycle	D_{MAX}		100			%
Under Voltage Lock Out Threshold	V_{UVLO}	Rising		2.3		V
		Falling		2.1		
		Hysteresis		0.2		
Thermal Shutdown	T_{SD}	Hysteresis=30°C		155	160	°C

Typical Performance Characteristics

V_{IN}=5V, T_A=25°C, unless otherwise noted.

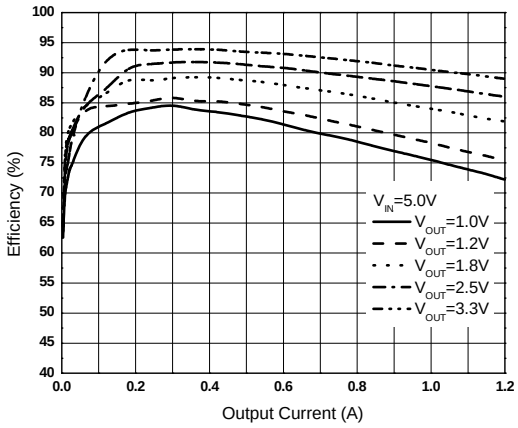


Figure 4. Efficiency vs. Output Current

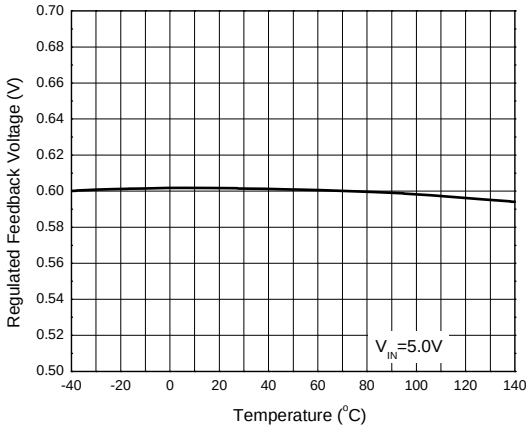
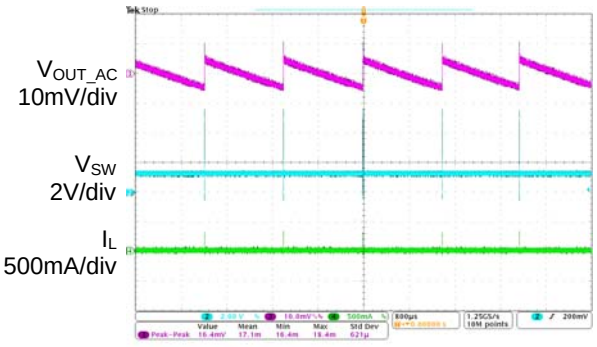
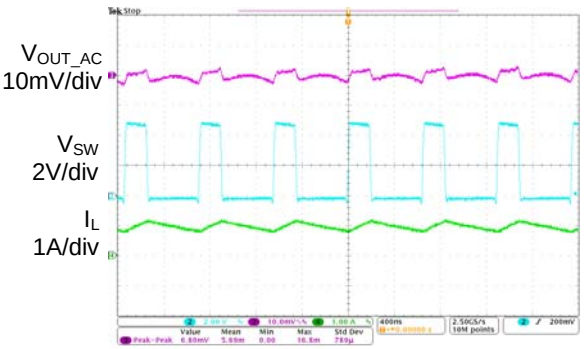


Figure 5. Regulated Feedback Voltage vs. Temperature



Time 800μs/div

Figure 6. Output Ripple (I_{OUT}=0A)

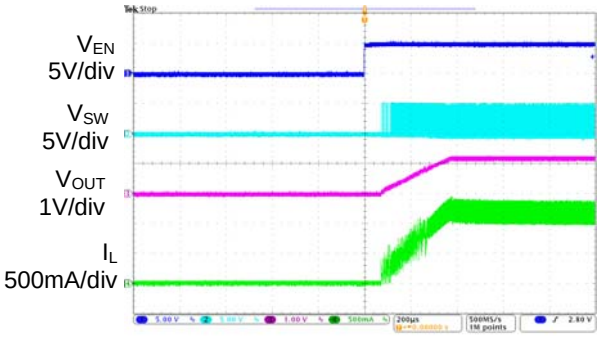


Time 400ns/div

Figure 7. Output Ripple (I_{OUT}=1.2A)

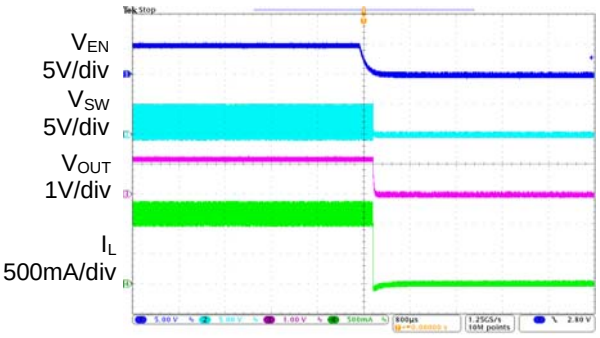
Typical Performance Characteristics (Continued)

V_{IN}=5V, T_A=25°C, unless otherwise noted.



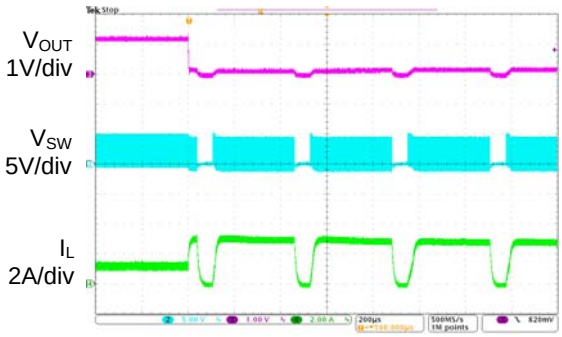
Time 200μs/div

Figure 8. Enable Turn On (I_{OUT}=1.2A)



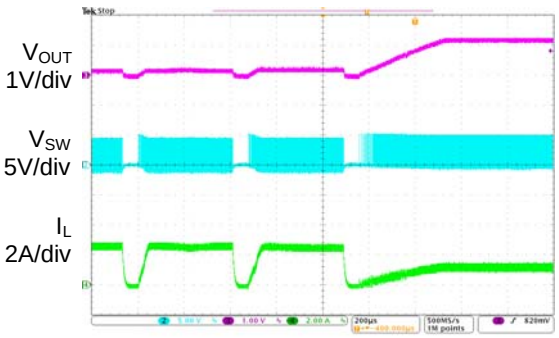
Time 800μs /div

Figure 9. Enable Turn Off (I_{OUT}=1.2A)



Time 200μs/div

Figure 10. Short Circuit Protection (I_{OUT}=1.2A)



Time 200μs /div

Figure 11. Short Circuit Protection Recovery (I_{OUT}=1.2A)

1.5MHz Synchronous Step-down DC-DC Converter AP3410B

Typical Application

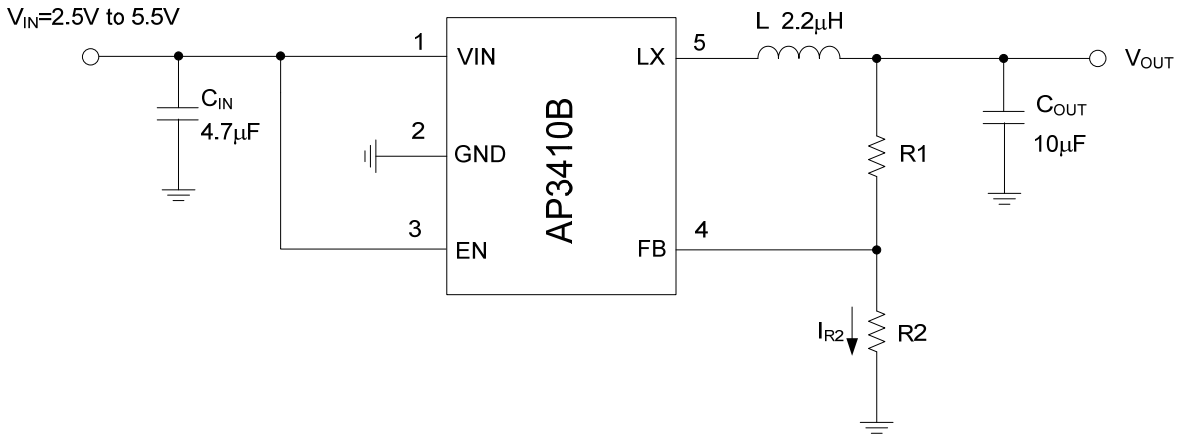


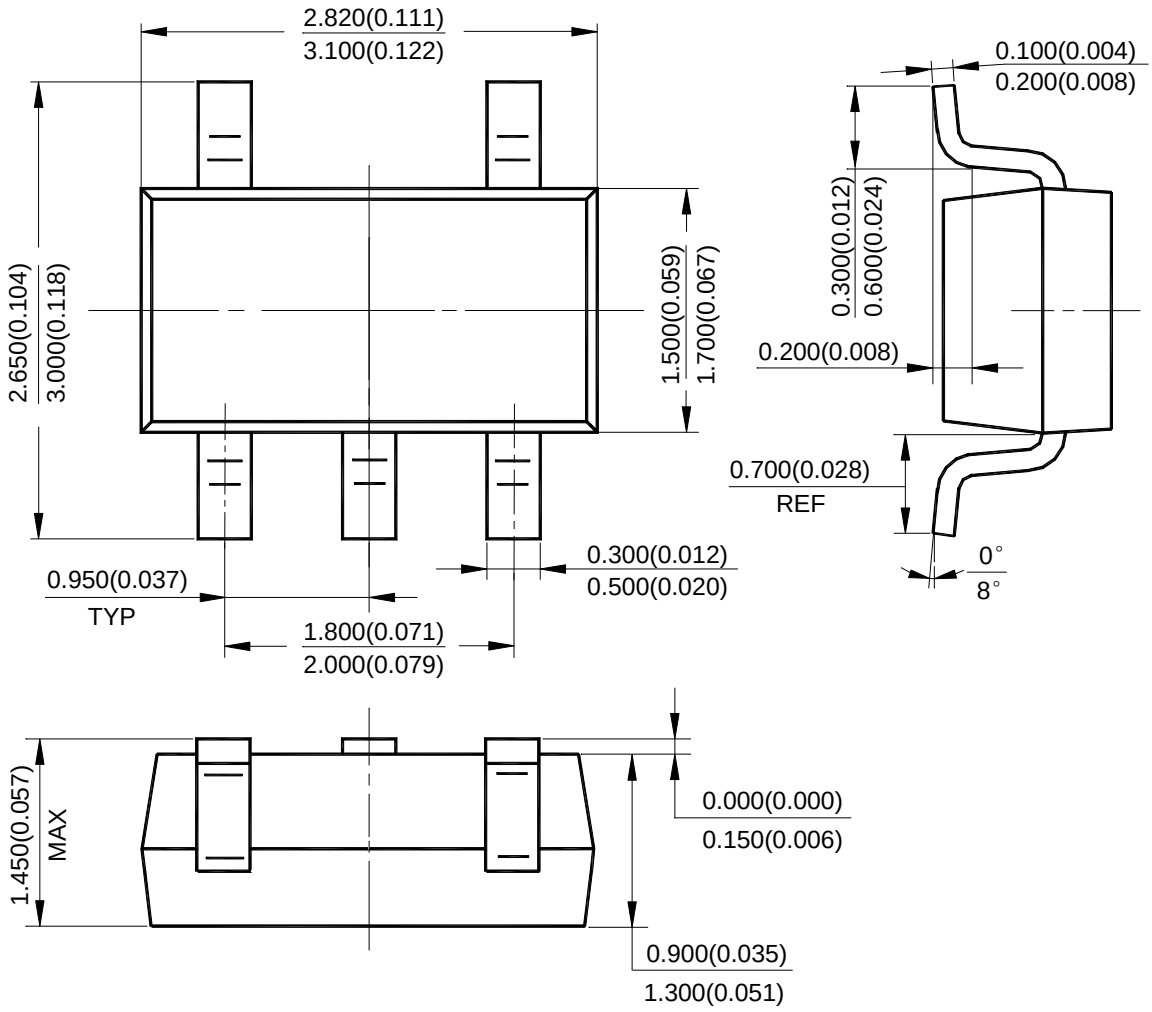
Figure 12. Typical Application of AP3410B

Table 1. Component Guide

V_{OUT} (V)	R1 (kΩ)	R2 (kΩ)	L (μH)
3.3	450	100	2.2
2.5	320	100	2.2
1.8	200	100	2.2
1.2	100	100	2.2
1.0	66	100	2.2

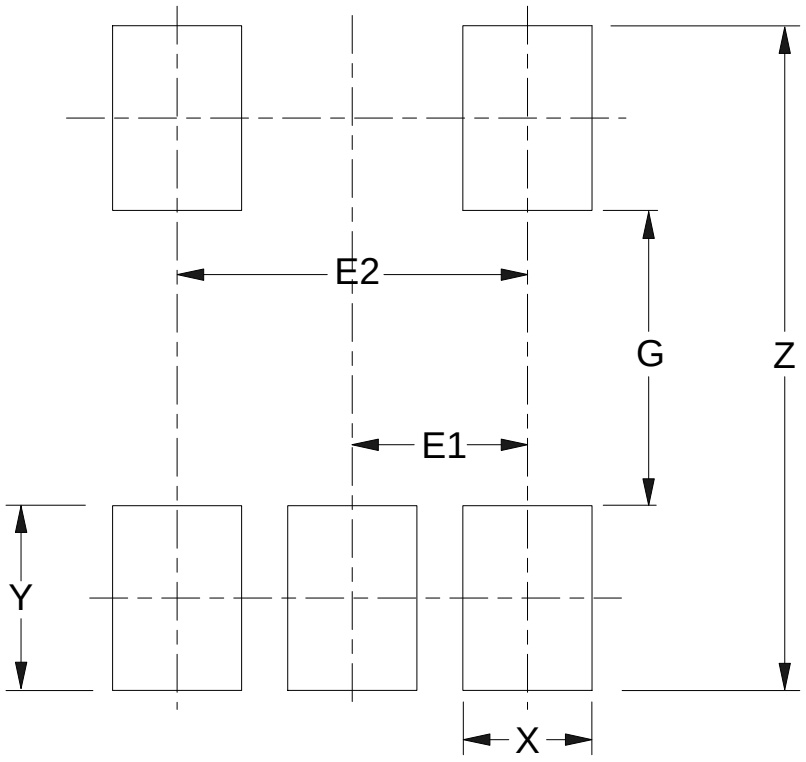
Mechanical Dimensions

SOT-23-5 **Unit: mm(inch)**



Mounting Pad Layout

SOT-23-5



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075



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