DESCRIPTION

The A7406A is a high frequency (1.8MHz) step-down switching regulator with integrated internal high-side high voltage power MOSFET. It provides single 0.6A(or less) highly efficient output with current mode control for fast loop response.

The wide input range(4.2V to 40V) accommodates a variety of step-down applications. Low shutdown mode quiescent current allows use in battery-powered applications.

High efficiency at light load condition is achieved by scaling down the switching frequency to reduce the switching and gate driving losses.

The A7406A is available in SOT-26 package.

ORDERING INFORMATION

| Package Type	Part Number	
SOT-26 SPQ: 3,000pcs/Reel	E6	A7406AE6R
		A7406AE6VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

FEATURES

- 4.2 V to 40 V operating input range
- 230uA operating quiescent current.
- Low shutdown supply current
- 500mΩ internal power MOSFET
- 1.8 MHz fixed switching frequency
- >90% efficiency
- Internally compensated
- Stable with ceramic output capacitors
- Internal soft-start
- Thermal shutdown function
- Precision current limit without current sensing resistor
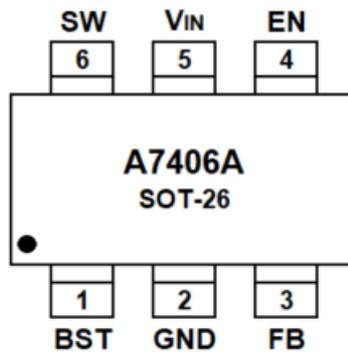- Available in SOT-26 Package

APPLICATION

- High voltage power conversion
- Industrial power systems
- Power meter
- Battery powered systems

TYPICAL APPLICATION

PIN DESCRIPTION

Top View
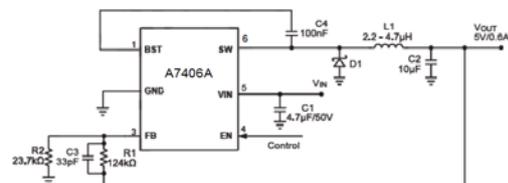
Pin #	Symbol	Function
1	BST	Bootstrap. This is the positive power supply for the internal floating high side MOSFET driver. Connect a bypass capacitor between this pin and SW pin.
2	GND	Ground. It should be connected as close as possible to the output capacitor.
3	FB	Feedback. This is the input to the error amplifier. An external resistive divider connected between the output and GND is compared to the internal +0.8V reference to set the regulation voltage.
4	EN	Enable input. Pull this pin below the specified threshold to disable. Pull it above the specified threshold to enable. Float this pin to disable.
5	V_{IN}	Input Supply. A decoupling capacitor to ground is required close to this pin to reduce switching spikes.
6	SW	Switch node. This is the output from the high-side switch. A low V_F

ABSOLUTE MAXIMUM RATINGS

V_{IN}, Supply Voltage	-0.3V ~ 43V
V_{SW}, Switch Voltage	-0.3V ~ $V_{IN (MAX)}$+0.3V
BST to SW	-0.3V ~ 6.0V
All Other Pins	-0.3V ~ 5.0V
Continuous Power Dissipation(T_A=+25℃)	0.57W
Junction Temperature	150℃
Lead Temperature	260℃
Storage Temperature	-65°C ~ 150°C

Stress beyond above listed "Absolute Maximum Ratings" may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Supply Voltage	V_{IN}	4.2 ~ 40	V
Output Voltage	V_{OUT}	Up to 40	V
Operating Junction Temp	T_J	-40 ~ +125	℃

THERMAL RESISTANCE

| Package	θ$_{JA}$	θ$_{JC}$
SOT-26	220℃/W	110℃/W

ELECTRICAL CHARACTERISTICS

V_{IN}=12V, V_{EN}=2V, T_A=25ºC, unless otherwise stated.

| Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Feedback Voltage	V_{FB}		-	0.794	-	V
Upper Switch ON Resistance	R_{SW}	Vbst-V_{SW}=5V	-	500	-	mΩ
Upper Switch Leakage	I_{SWLEAK}	V_{EN}=0V, V_{SW}=0V	-	0.1	1	µA
Current Limit	I_{LIM}		-	1	-	A
Transconductance	Gcs	COMP to SENSE	-	3	-	A/V
Minimum Operating Voltage	$V_{IN\ MIN}$		4.2	-	-	V
UVLO Up Threshold	$V_{IN(UVLO)}$		3.3	-	4.2	V
UVLO Hysteresis	$V_{IN(UVLO)\ HYS}$		-	0.8	-	V
Soft-Start Time	t_{SS}	FB from 0 to 1.8V	-	0.5	-	ms
Oscillator Frequency	f_{OSC}		-	1.8	-	MHz
Minimum Switch ON Time	$t_{ON\ MIN}$		-	100	-	ns
Shutdown Current	I_{SD}	V_{EN}<0.3V	-	3	15	µA
Quiescent Current	I_Q	V_{FB}=0.9V , No load	-	200	-	µA
Thermal Shutdown	T_{SD}		-	150	-	°C
Enable up threshold	V_{ENH}		1.6	-	2.0	V
Enable Threshold Hysteresis	V_{ENHYS}		-	0.6	-	V

TYPICAL APPLICATION CIRCUITS
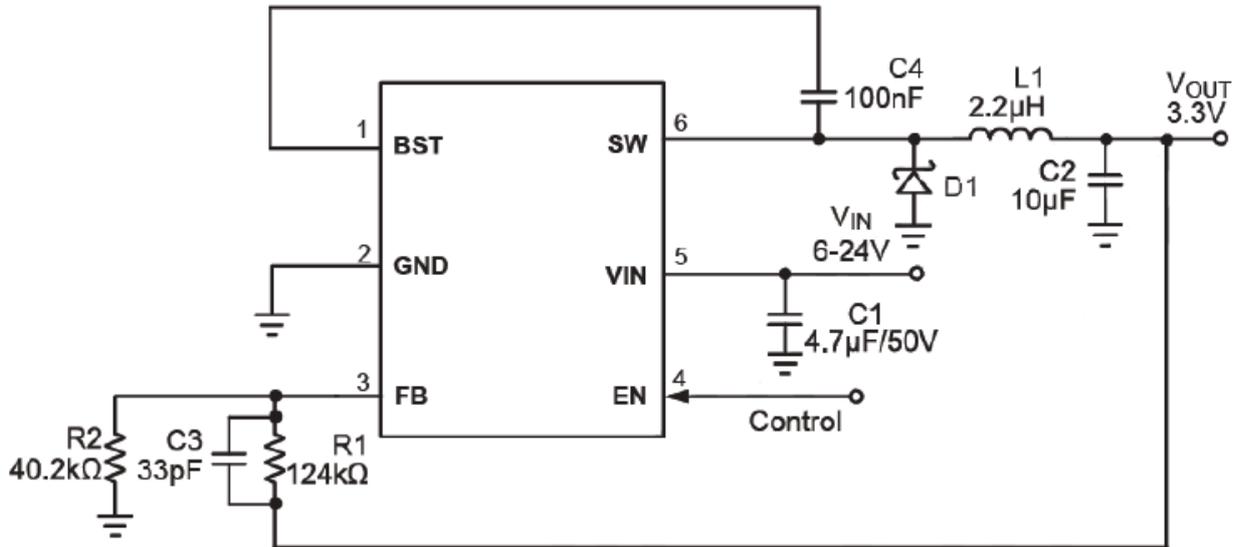
3.3V output typical application circuit
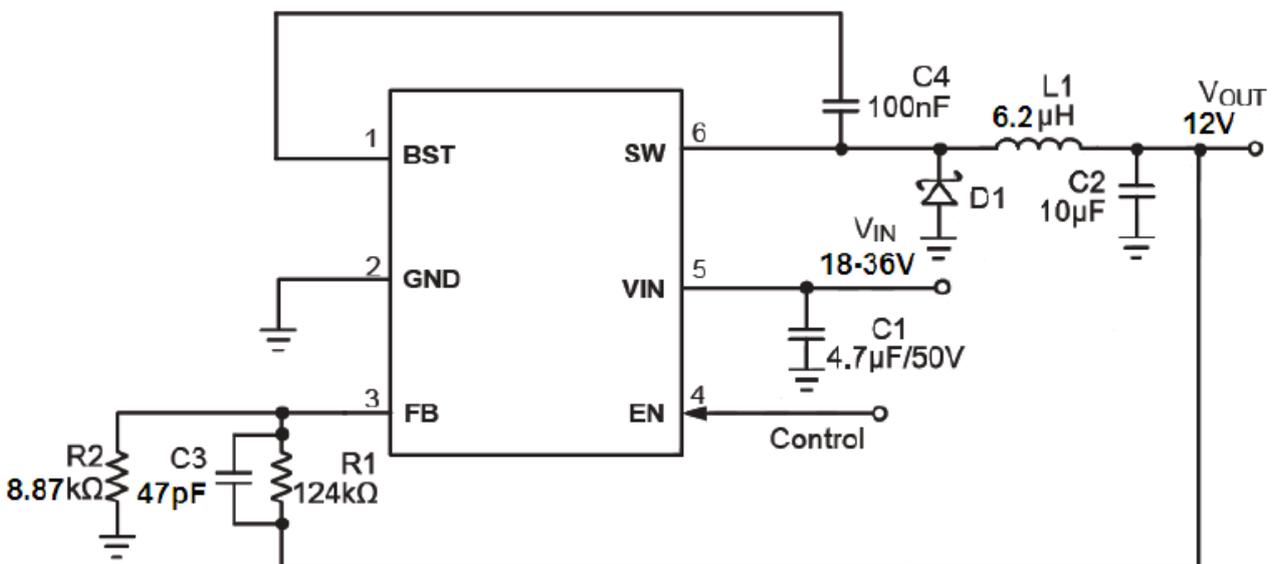
12V output typical application circuit

BLOCK DIAGRAM
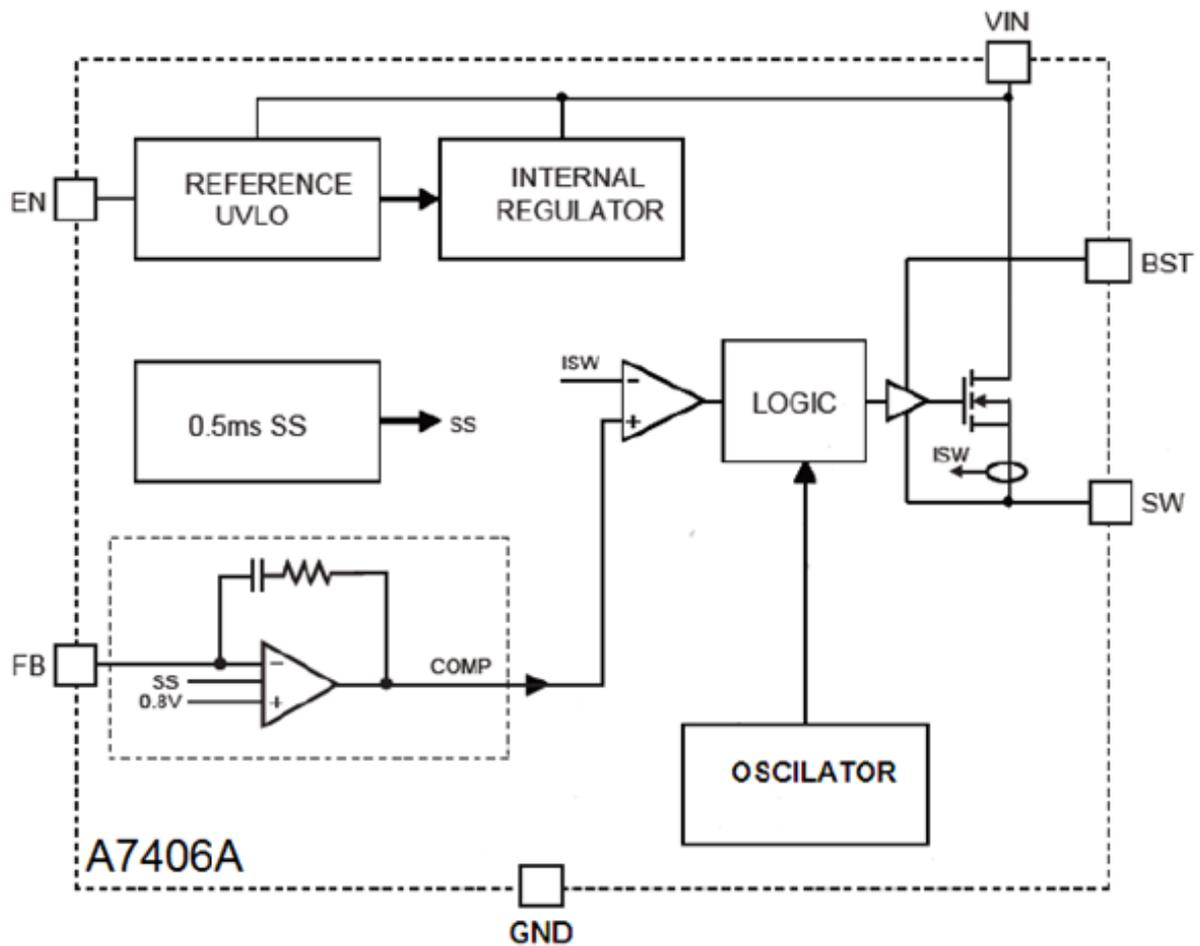
DETAILED INFORMATION

The A7406A is a 1.8MHz, non-synchronous, step-down switching regulator with integrated internal high side MOSFET. It provides internally compensated single 0.6A high efficient output. It features wide input voltage range, internal soft-start control, and precision current limit. Low operational quiescent current feature is suit for battery powered applications.

PWM Control

At heavy load or moderate load condition, the A7406A operates in a fixed frequency, peak current control mode to regulate the output voltage. A PWM cycle is initiated by the internal clock. The power MOSFET is turned on and remains on until its current reaches the value set by COMP voltage. When the power switch is off, it remains off for at least 100ns before the next cycle starts. If, in one PWM period, the current in the power MOSFET does not reach COMP set current value, the power MOSFET remains on, saving a turn-off operation. At light load condition, the A7406A operates in pulse skipping mode to improve light load efficiency.

Internal Regulator

Most of the internal circuitry is powered on by the 2.6V internal regulator.

When V_{IN} is higher than 4.0V, the output of the regulator is in full regulation.

When V_{IN} is lower, the output degrades.

Under Voltage Lockout (UVLO)

V_{IN} Under voltage lockout (UVLO) is implemented to protect the chip from operating at insufficient supply voltage.

Thermal Shutdown

Thermal shutdown is implemented to prevent the chip from thermally running away. When the temperature is higher than its upper threshold, the A7406A will shut down. When the temperature is lower than its lower threshold, the chip is enabled again.

APPLICATION INFORMATION

Setting the Output Voltage

The output voltage is set using a resistive voltage divider from the output voltage to FB pin.

$$V_{FB}=V_{OUT}*R2/(R1+R2)$$

The feedback resistor R1 also sets the feedback loop bandwidth with the internal compensation capacitor. Choose R1 around 124kΩ for optimal transient response.

Inductor

The inductor is required to supply constant current to the output load. A larger value inductor will result in lower output ripple voltage. Generally, a good rule for determining the inductance to use is to allow the peak-to-peak ripple current in the inductor to be approximately 30% of the maximum load current.

Also, make sure that the peak inductor current is below the maximum switch current limit.

Input Capacitor

The input capacitor (C1) can be electrolytic, tantalum or ceramic. When using electrolytic or tantalum capacitors, a small, high quality ceramic capacitor, i.e.

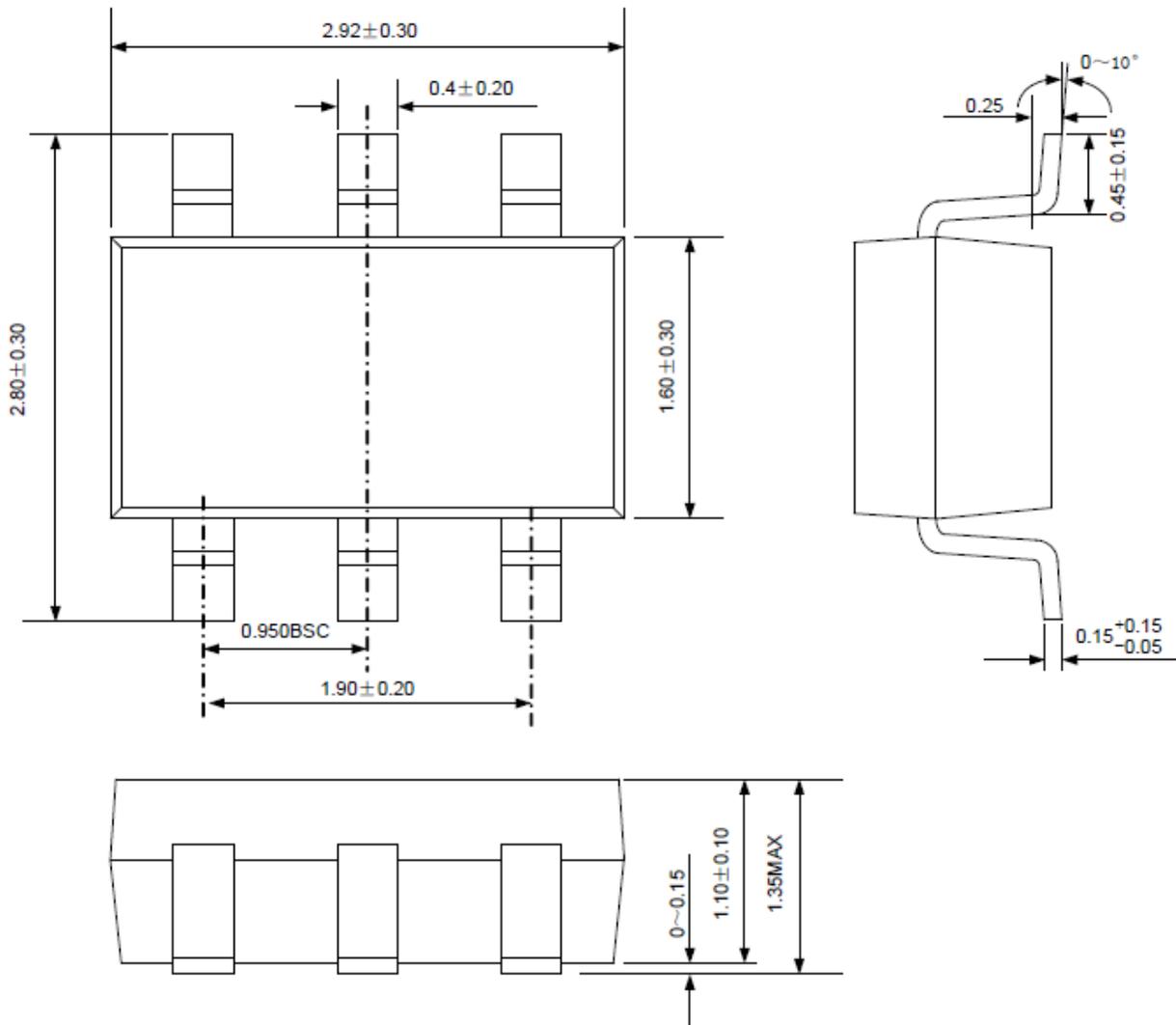0.1μF, should be placed as close to the IC as possible.

Output Capacitor

The output capacitor (C2) is used to maintain the DC output voltage. Ceramic, tantalum, or low ESR electrolytic capacitors are recommended. Low ESR capacitors are preferred to keep the output voltage ripple low.

PACKAGE INFORMATION

Dimension in SOT-26 Package (Unit: mm)

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