ACP2808

1.2A Synchronous Buck Converter

■ GENERAL DESCRIPTION

The ACP2808 is a high efficiency synchronous, PWM step-down DC/DC converter capable of delivering up to 1.2A of output current. The device operates from an input voltage range of 2.6V to 7V and provides an output voltage from 0.6V to VIN, making the ACP2808 ideal for low voltage power conversions. Running at a fixed frequency of 1.5MHz allows the use of small external components, such as ceramic input and output caps, as well as small inductors, while still providing low output ripples. This low noise output along with its excellent efficiency achieved by the internal synchronous rectifier, making ACP2808 an ideal green replacement for large power consuming linear regulators. Internal soft-start control circuitry reduces inrush current. Short-circuit and thermal-overload protection improves design reliability.

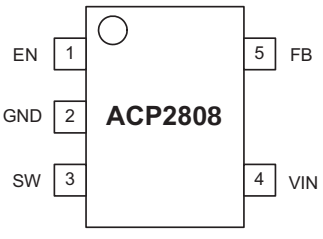
■ FEATURES

- Input Operating Range : 2.6V to 7V
- High Efficiency: Up to 97%
- 1.5MHz Switching Frequency
- 1.2A Guarantee Load Current
- Low dropout 100% Duty operation
- Internal Compensation and Soft-Start
- 0.6V Reference for Low Output voltages
- <1uA Iq Logic Control Shutdown
- Thermal shutdown, UVLO
- Available in SOT23-5

■ APPLICATION CIRCUIT

- Wireless and DSL Modems
- USB supplied Devices
- Portable Devices
- Cellular phones
- Core Board Power Supply
- Set Top Box

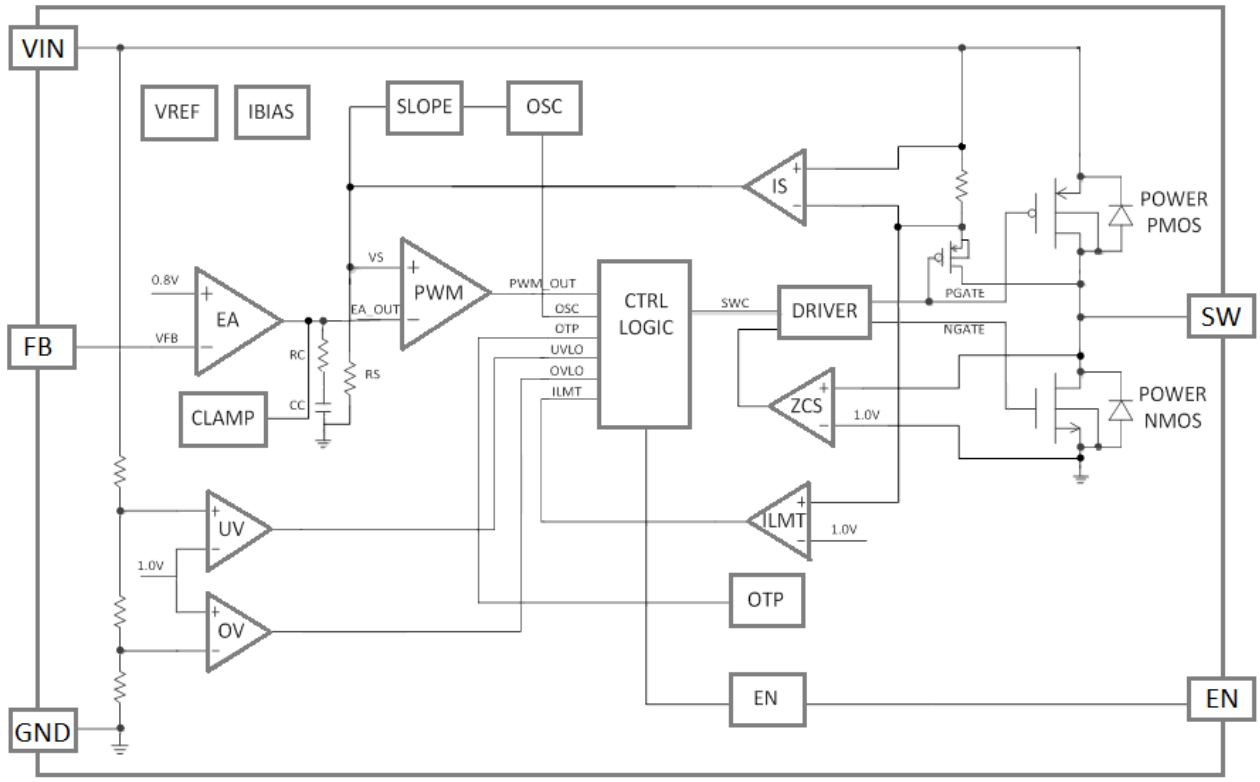
■ PIN DESCRIPTION

Pin Configuration	Pin Description		
	Pin#	Symbol	Function
	1	EN	Enable pin. A high input at EN enables the device and a low input disables the devices.
	2	GND	Ground
	3	SW	Inductor connection. Connect an inductor between SW and the regulator output.
	4	IN	Input Supply Pin.
	5	FB	Connect an external resistor divider from the output to FB and GND to set the output to a voltage between 0.6V and Vin

■ ORDERING INFORMATION

Standard Part NO.	VFB	Package	Packing	Min. Quantity	RoHS
ACP2808-60BTRAL	1.23V	SOT23-5L	Tape&Reel	3000PCS	Green

■ FUNCTION BLOCK



■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Max Input Voltage	V_{IN}	8	V
Operating Junction Temperature	T_J	-40 to 125	℃
Ambient Temperature	T_A	-40 to 85	℃
Storage Temperature Range	T_{STG}	-40 to 150	℃
Lead Temperature(Soldering,10 sec.)	Ts	260	℃
Maximum Power Dissipation/SOT23-5L	P_D	400	mW
ESD	V_{HMB}	>2000	V

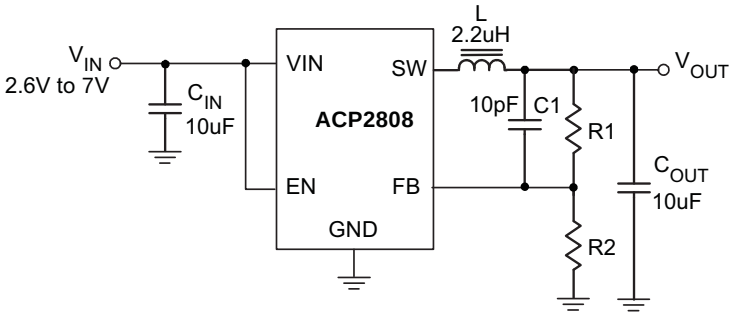
■ ELECTRICAL CHARACTERISTICS

(V_{IN}=5V, T_A=25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_{IN}	Input Voltage Range		2.6		7	V
I_Q	Quiescent Current	Active, V_{FB}=0.65V, No Switching		50		uA
		Shutdown			1	uA
V_{FB}	FB Regulation Voltage	V_{IN}=5V	0.588	0.6	0.612	V
I_{FBB}	FB Leakage Current			0.1	1	uA
I_{NOLOAD}*	V_{IN} Leakage Current	V_{IN}=5V,V_{OUT}=3.3V,I_{OUT}=0		75		uA
%V_{FB}/ △V_{IN}	Line Regulation	2.7V ≤ V_{IN} ≤ 5.5V		0.1	0.2	%/V
%V_{FB}/ △I_{LOAD}	Load Regulation	I_{OUT}=0.01 to 1A		0.1	0.2	%/A
Fs	Switching Frequency			1500		kHz
I_{LIMIT}	Switch Current Limit		1.2	1.5	2	A
I_{EN}	Shutdown Current Limit	V_{EN}=1.2V			1	uA
V_{EN}	Enable Voltage Threshold	Active High	1			V
V_{EN}	Enable Voltage Threshold	Active Low			0.5	V
R_{DSONP}	PMOS R_{DSON}			250	350	mOhm
R_{DSONN}	NMOS R_{DSON}			150	250	mOhm

Note: When duty cycle>85%,I_{NOLOAD} will increase. E.g V_{IN}=3.6V/V_{OUT}=3.3V,I_{NOLOAD}=1mA*

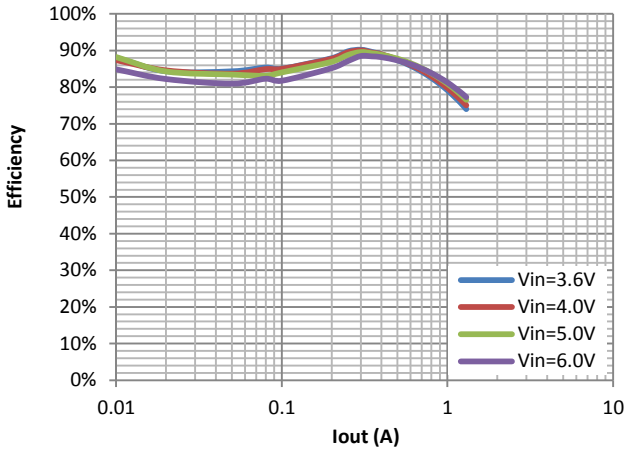
■ APPLICATION CIRCUITS



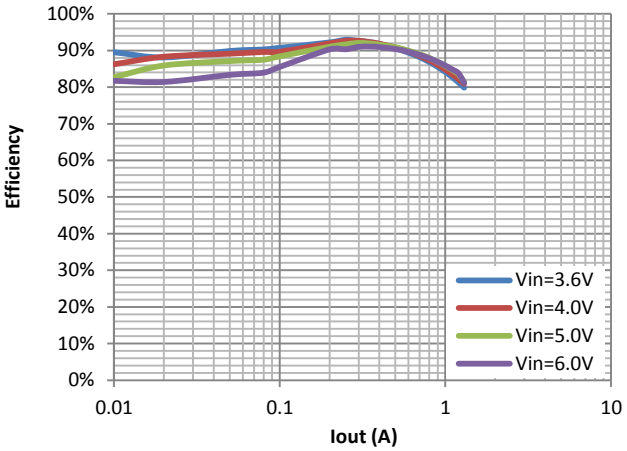
■ PERFORMANCE CHARACTERISTICS

Tested under T_A=25℃, unless otherwise specified

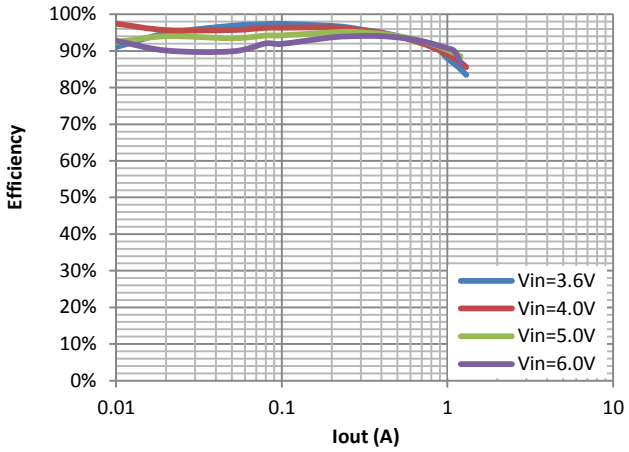
Efficiency vs. Output Current
(Vout=1.2V)



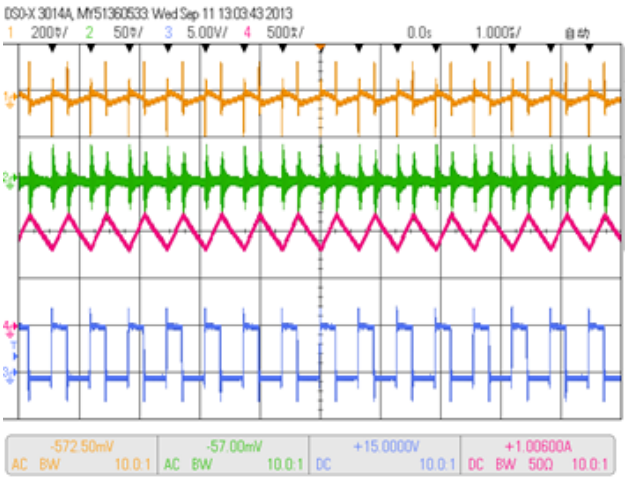
Efficiency vs. Output Current
(Vout=1.8V)



Efficiency vs. Output Current
(Vout=3.3V)



Output Ripple and SW at 1A load
Vin=5V / Vout=1.8V
Ch1—Vin, Ch2—Vout, Ch3—Vsw



■ APPLICATION NOTES

●Loop Operation

ACP2808 uses a PWM current-mode control scheme. An open-loop comparator compares the integrated voltage-feedback signal against the sum of the amplified current-sense signal and the slope compensation ramp. At each rising edge of the internal clock, the internal high-side MOSFET turns on until the PWM comparator terminates the on cycle. During this on-time, current ramps up through the inductor, sourcing current to the output and storing energy in the inductor. The current mode feedback system regulates the peak inductor current as a function of the output voltage error signal. During the off cycle, the internal high-side P-channel MOSFET turns off, and the internal low-side N-channel MOSFET turns on. The inductor releases the stored energy as its current ramps down while still providing current to the output

●Current Sense

An internal current-sense amplifier senses the current through the high-side MOSFET during on time and produces a proportional current signal, which is used to sum with the slope compensation signal. The summed signal then is compared with the error amplifier output by the PWM comparator to terminate the on cycle.

●Current Limit

There is a cycle-by-cycle current limit on the high-side MOSFET of 1.5A(typ). When the current flowing out of SW exceeds this limit, the high-side MOSFET turns off and the synchronous rectifier turns on. ACP2808 utilizes a frequency fold-back mode to prevent overheating during short-circuit output conditions. The device enters frequency fold-back mode when the FB voltage drops below 200mV, limiting the current to 1.5A (typ) and reducing power dissipation. Normal operation resumes upon removal of the short-circuit condition.

●Soft-start

ACP2808 has a internal soft-start circuitry to reduce supply inrush current during startup conditions. When the device exits under-voltage lockout (UVLO), shutdown mode, or restarts following a thermal-overload event, the l soft-start circuitry slowly ramps up current available at SW.

●UVLO and Thermal Shutdown

If VIN drops below 2.5V, the UVLO circuit inhibits switching. Once VIN rises above 2.6V, the UVLO clears, and the soft-start sequence activates. Thermal-overload protection limits total power dissipation in the device. When the junction temperature exceeds TJ= +160°C, a thermal sensor forces the device into shutdown, allowing the die to cool. The thermal sensor turns the device on again after the junction temperature cools by 15°C, resulting in a pulsed output during continuous overload conditions. Following a thermal-shutdown condition, the soft-start sequence begins.

●Setting Output Voltages

Output voltages are set by external resistors. The FB_ threshold is 0.6V.

$$R_{TOP} = R_{BOTTOM}[(V_{OUT} / 0.6) - 1]$$

■ APPLICATION NOTES(Continued)

●Input Capacitor Selection

The input capacitor in a DC-to-DC converter reduces current peaks drawn from the battery or other input power source and reduces switching noise in the controller. The impedance of the input capacitor at the switching frequency should be less than that of the input source so high-frequency switching currents do not pass through the input source. The output capacitor keeps output ripple small and ensures control-loop stability. The output capacitor must also have low impedance at the switching frequency. Ceramic, polymer, and tantalum capacitors are suitable, with ceramic exhibiting the lowest ESR and high-frequency impedance. Output ripple with a ceramic output capacitor is approximately as follows:

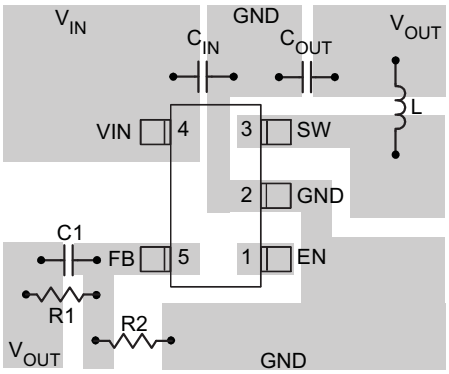
$$V_{RIPPLE} = I_{L(PEAK)}[1 / (2\pi \times f_{OSC} \times C_{OUT})]$$

If the capacitor has significant ESR, the output ripple component due to capacitor ESR is as follows:

$$V_{RIPPLE(ESR)} = I_{L(PEAK)} \times ESR$$

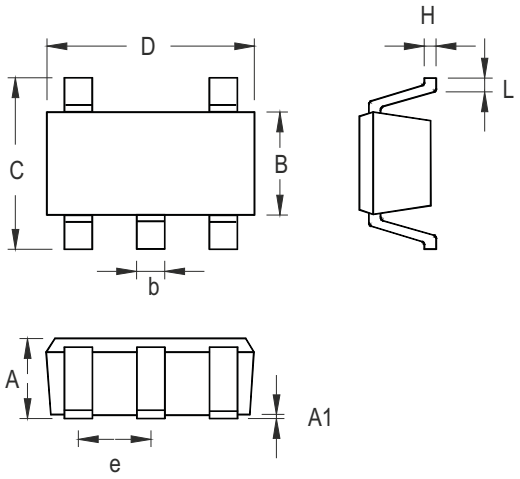
●Board Layout Consideration

As with all switching regulators, careful attention must be paid to the PCB board layout and component placement. To maximize efficiency, switch rise and fall times are made as short as possible. To prevent electromagnetic interference (EMI) problems, proper layout of the high frequency switching path is essential. The voltage signal of the SW pin has sharp rise and fall edges. Minimize the length and area of all traces connected to the SW pin and always use a ground plane under the switching regulator to minimize interplane coupling. In addition, the ground connection for the feedback resistor R2 should be tied directly to the GND pin and not shared with any other component, ensuring a clean, noise-free connection. Please refer to next figure:



■ PACKAGE INFORMATION

◆ **SO23-5L**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT23-5L Surface Mount Package