ANALOG DEVICES

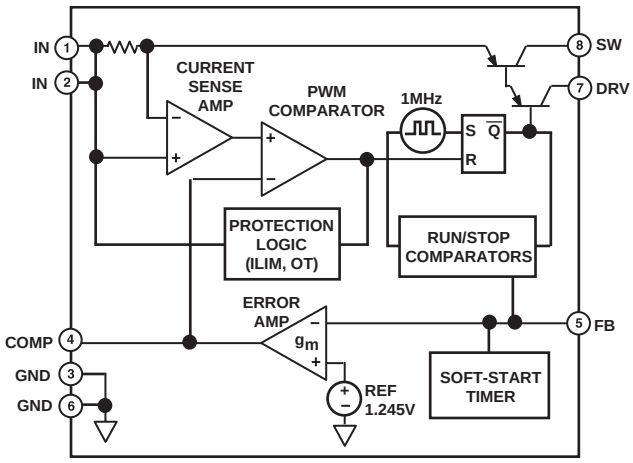
1 MHz, 1 A Buck Regulator

Preliminary Technical Data ADP3089

FEATURES
1 MHz PWM Frequency
Ultrasmall 8-lead 3×3 Sq. mm Chip Scale Package
Automatic PWM to Power Saving Mode at Light Load
Fully Integrated 1.5 A Power Switch
3% Output Regulation Accuracy over Temperature, Line, and Load
100% Duty Cycle Operation
Simple Compensation
Output Voltage: 1.25 V to 11.5 V
Input Voltage: up to 12 V
Small Inductor and MLC Capacitors
Low Quiescent Current while Pulse Skipping
Thermal Shutdown
Fully Integrated Soft Start
Cycle-by-cycle Current Limit

APPLICATONS
PDAs and Palmtop Computers
Notebook Computers
PCMCIA Cards
Bus Products
Portable Instruments
Industrial Systems

FUNCTIONAL BLOCK DIAGRAM



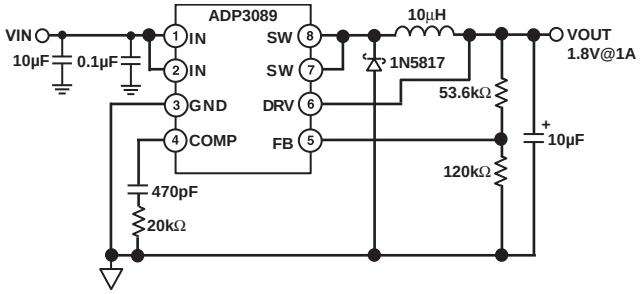


Figure 1. Typical Application

GENERAL DESCRIPTION

The ADP3089 is a high frequency, non-synchronous PWM step-down DC-DC regulator with an integrated 1.5 A power switch in a space-saving chip scale package. It provides high efficiency, excellent dynamic response, and is very simple to use.

The ADP3089's 1 MHz switching frequency allows for small, inexpensive external components, and the current mode control loop is simple to compensate and eases noise filtering. It operates in PWM current mode under heavy loads and saves energy at lighter loads by switching automatically into Power Saving mode. Soft start is integrated completely on chip, as is the cycle-by-cycle current limit.

Capable of operating from 2.5 V to 12 V input with a typical output current of 1 A, it is ideal for portable, battery powered, industrial, PC and instrumentation applications. Supporting output voltages down to 1.25 V, the ADP3089 is ideal to generate low voltage rails, providing the optimal solution in its class for delivering power efficiently, responsively, and simply with minimal printed circuit board area.

The device is specified over the industrial temperature range of -40°C to +85°C, and is offered in an ultrasmall 8-lead 3×3 square mm chip scale package.

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ADP3089–SPECIFICATIONS[1] (V_{IN} = +3.3 V, T_A = -40°C to +85°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
SUPPLY						
Input Voltage Range	V_{IN}	DRV to GND	2.5		12	V
Quiescent Current						
Operating	I_Q	VIN = 10 V, I_L = 1 A, DRV = GND		12		mA
Shutdown	I_{SD}	V_{COMP} = 0 V		15	40	µA
Ground Current	I_{GND}[2]					
Normal Operation		V_{IN} = 10 V, I_L = 1 A, DRV = 2 V		3	3.6	mA
Thermal Shutdown Threshold	T_{SD}			160		°C
OSCILLATOR						
Oscillator Frequency	f_{SW}		0.75	1	1.25	MHz
Minimum Sleep Duty Cycle	D_{PSM}	I_L = 500 mA		14	TBD	%
Maximum Duty Cycle	D_{MAX}		100			%
Wake up Hysteresis	V_{HYST}	FB voltage drops below V_{REF}	20	30	40	mV
OUTPUT SWITCH						
Switch On Voltage	V_{IO}[3]	I_L = 500 mA, FB and DRV tied to GND		0.35	0.45	V
Current Limit Threshold	I_{LIM}		1.4	1.7	2	A
Leakage Current		V_{IN} = 12 V		0.5		µA
ERROR AMPLIFIER						
Reference Voltage Accuracy	V_{REF}	FB tied to COMP	1.222	1.245	1.265	V
Reference Voltage Line Regulation		FB tied to COMP, V_{IN}= 3 V to 12 V		.02		%/V
Feedback Input Bias Current	I_{FB}	soft start expired	-50	1	50	nA
Maximum Output Current	$I_{COMP, SC}$		35	60	85	µA
Short Circuit Current	$I_{COMP, SD}$	V_{COMP} = 0 V, activating shutdown		20	40	µA
Transconductance	$g_{m, EA}$	V_{FB} to I_{COMP}		480		µA/V
MODULATOR						
Transconductance	$g_{m, MOD}$	V_{COMP} to I_L		1		A/V
Control Offset Voltage	$V_{PWM, OS}$			0.90		V
Soft Start Time	t_{SS}			250	600	µs
Shutdown Threshold Voltage	$V_{COMP, SD}$		340		750	mV
Slope Compensation	m_{SC}	Effectively summed to I_{SW}		0.7		A/µs

NOTES

1 All limits at temperature extremes are guaranteed via correlation using standard Statistical Quality Control (SQC).

2 For higher efficiency operation, tie the DRV pin to the output for I_L < 250 mA, and VIN > 3 V.

3 V(IN) - V(SW), includes voltage drop across internal current sensor.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS*

Input Supply Voltage ..... –0.3 V to +12.6 V
Voltage on any pin with respect to GND –0.3 V to +12.6 V
(voltage on any pin may not exceed V_{IN})
Operating Ambient Temperature Range .. –40°C to +85°C
Operating Junction Temperature ..... +125°C
θ_{JA}[1] (4-layer board) ..... TBD
θ_{JA}[1] (2-layer board) ..... TBD
Storage Temperature Range ..... –65°C to +150°C
Lead Temperature Range (Soldering, 10 sec.) ..... +300°C
Vapor Phase (60 sec) ..... +215°C
Infrared (15 sec) ..... +220°C

*This is a stress rating only; operation beyond these limits can cause the device to be permanently damaged. Unless otherwise specified, all voltages are referenced to GND.

[1] θ_{JA} is specified for the worst case conditions, θ_{JA} is specified for a device soldered in a circuit board for SOT-23 packages. Following good PCB board layout guidelines can significantly reduce θ_{JA}.

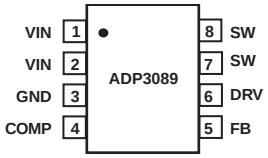
PIN FUNCTION DESCRIPTIONS

Pin	Mnemonic	Function
1, 2	IN	Power Supply Input. Both pins must be connected.
3, 6	GND	Ground. Both pins must be connected.
4	COMP	Feedback Loop Compensation and Shutdown Input. An open drain or collector used to pull the pin to ground will shutdown the device.
5	FB	Feedback Voltage Sense Input. This pin senses the voltage via an external resistor divider.
7	DRV	This pin provides a separate path for drive current to be connected to ground.
8	SW	Switching Output.

ORDERING GUIDE

Model	Temperature Range	Package Option	Branding Information
ADP3089ACP	-40°C to +85°C	CSP-8 3×3	P7A

PIN CONFIGURATION



CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the device features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.