



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 10 V**
- Small Inductor and MLC Capacitors**
- Low Quiescent Current while Pulse Skipping**
- Thermal Shutdown**
- Fully Integrated Soft Start**
- Cycle-by-cycle Current Limit**

APPLICATIONS

- PDA's and Palmtop Computers**
- Notebook Computers**
- PCMCIA Cards**
- Bus Products**
- Portable Instruments**
- Industrial Systems**

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 11 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.

REV. PrE

8/26/02

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FUNCTIONAL BLOCK DIAGRAM

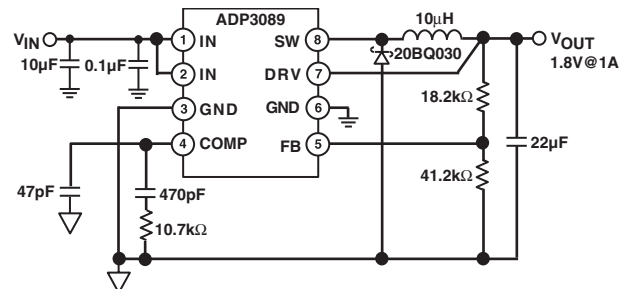
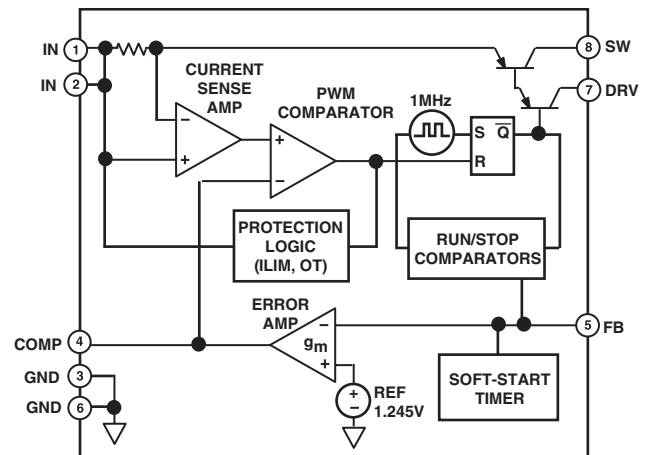


Figure 1. Typical Application

PRELIMINARY TECHNICAL DATA

ADP3089—SPECIFICATIONS¹ ($V_{IN} = +3.3\text{ V}$, $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$, unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|-----------------------------|----------------|--|-------|-------|-------|------------------|
| SUPPLY | | | | | | |
| Input Voltage Range | V_{IN} | DRV to GND | 2.5 | | 11 | V |
| Quiescent Current | I_Q | $V_{IN} = 10\text{ V}$, $I_L = 1\text{ A}$, DRV = GND | | 12 | | mA |
| Operating | | No load | | 180 | 280 | μA |
| Shutdown | I_{SD} | $V_{COMP} = 0\text{ V}$ | | 15 | 40 | μA |
| Ground Current | I_{GND}^2 | $V_{IN} = 10\text{ V}$, $I_L = 1\text{ A}$, DRV = 2 V | | 3 | 3.6 | mA |
| Normal Operation | | | | | | |
| Thermal Shutdown Threshold | T_{SD} | | | 160 | | $^\circ\text{C}$ |
| OSCILLATOR | | | | | | |
| Oscillator Frequency | f_{SW} | | 0.75 | 1 | 1.25 | MHz |
| Minimum Sleep Duty Cycle | D_{PSM} | | | 14 | | % |
| 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 | $I_L = 1\text{ A}$, FB and DRV tied to GND | | .7 | 1.0 | V |
| Current Limit Threshold | I_{LIM} | $V_{IN} = 12\text{ V}$ | 1.5 | 1.7 | 2 | A |
| Leakage Current | | | | 0.5 | | μA |
| ERROR AMPLIFIER | | | | | | |
| Reference Voltage Accuracy | V_{REF} | FB tied to COMP | 1.222 | 1.245 | 1.265 | V |
| Reference Voltage Line | | FB tied to COMP, | | .02 | | %/V |
| Regulation | | $V_{IN} = 3\text{ V}$ to 12 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 | $I_{COMP, SD}$ | $V_{COMP} = 0\text{ V}$, activating shutdown | | 20 | 40 | μA |
| Transconductance | g_m, EA | V_{FB} to I_{COMP} | | 480 | | $\mu\text{A/V}$ |
| 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} | | 0.5 | | 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 $I_L < 250\text{ mA}$, and $V_{IN} > 3\text{ V}$.

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 V |
| Voltage on any pin with respect to GND | -0.3 V to +12 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} (4-layer board) | 47°C/W |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature Range (Soldering, 10 sec) | +240°C |
| Vapor Phase (60 sec) | +240°C |
| Infrared (20 sec) | +240°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.

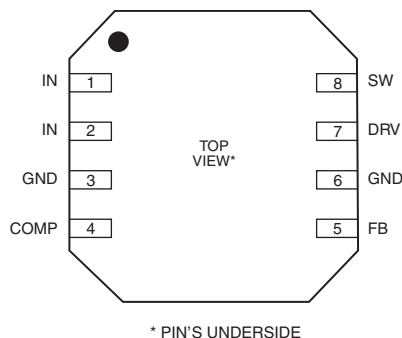
PIN FUNCTION DESCRIPTIONS

| 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 3x3 | 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.



