# High Voltage, High Bandwidth, Current Sense Amplifier

Preliminary Technical Data

# AD8410

## FEATURES

- High common-mode input voltage range
  - −2V to +70 V continuous
  - −20V to +75 V survival
- Typical 1.0 µV/°C offset drift
- 2.0 MHz Bandwidth
- Maximum ±400 µV voltage offset over full temperature range
- Initial gain = 20 V/V
- Wide operating temperature range
  - AD8410WB: −40°C to +125°C
  - AD8410WH: −40°C to +150°C
- Bidirectional operation
- 3.0 V to 5.5 V power supply operating range
- Available in 8-lead MSOP and 8-lead SOIC
- Common-mode rejection ratio (CMRR): 86 dB, dc to 10 kHz
- Qualified for automotive applications

## APPLICATIONS

- High-side current sensing in
  - 48V/ 12V DC to DC Converters
  - Motor controls
  - Solenoid controls
  - Power management
- Low-side current sensing
- Diagnostic protection

## GENERAL DESCRIPTION

The AD8410 is a high voltage, high resolution, and high bandwidth current shunt amplifier. It features an initial gain of 20 V/V, with a 2.0 MHz bandwidth with a maximum ±0.3% gain error over the entire temperature range. The buffered output voltage directly interfaces with any typical converter. The AD8410 offers excellent input common-mode rejection from −2 V to +70 V. The AD8410 performs bidirectional current measurements across a shunt resistor in a variety of automotive and industrial applications, including motor control, power management, and solenoid control.

The AD8410 offers breakthrough performance throughout the −40°C to +150°C temperature range. It features a in package trim core, which leads to a typical offset drift of 1.0 µV/°C throughout the operating temperature range and the common-mode voltage range. The AD8410 is qualified for automotive applications. The device includes patented circuitry to enable output accuracy with pulse-width modulation (PWM) type input common-mode voltages. The typical input offset voltage is ±200 µV. The AD8410 is offered in 8-lead MSOP or SOIC packages.

**Table 1. Related Devices**

| Part No. | Description |
|---|---|
| AD8205 | Current sense amplifier, gain = 50 |
| AD8206 | Current sense amplifier, gain = 20 |
| AD8207 | High accuracy current sense amplifier, gain = 20 |
| AD8210 | High speed current sense amplifier, gain = 20 |
| AD8418A | High accuracy current sense amplifier, gain = 20 |

## FUNCTIONAL BLOCK DIAGRAM

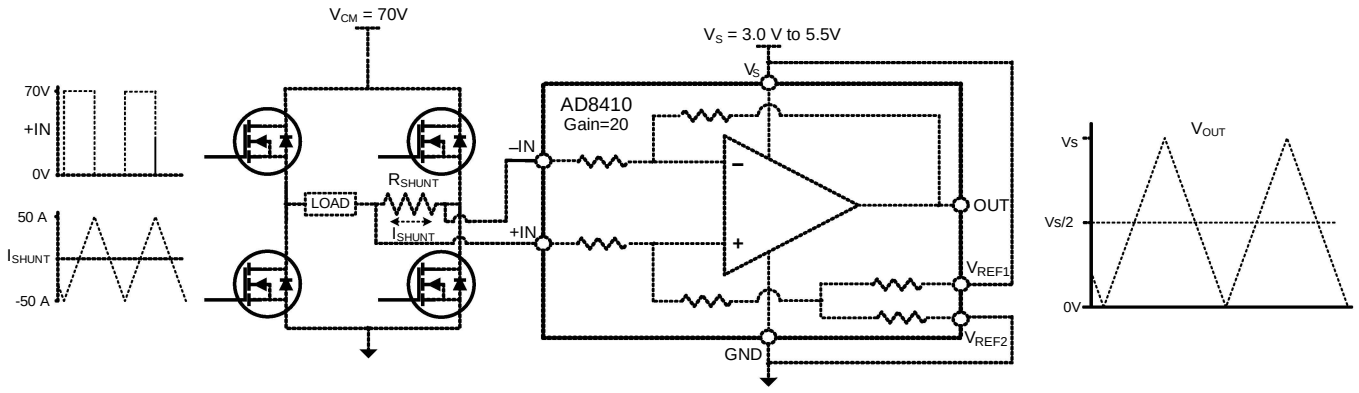


*Figure 1.*


**Rev. PrE** Document Feedback





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Technical Support www.analog.com

# AD8410* Product Page Quick Links

Last Content Update: 11/01/2016

## Comparable Parts

View a parametric search of comparable parts

## Documentation

**Data Sheet**

- AD8410: High Voltage, High Bandwidth, Current Sense Amplifier Preliminary Data Sheet

## Design Resources

- AD8410 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## Discussions

View all AD8410 EngineerZone Discussions

## Sample and Buy

Visit the product page to see pricing options

## Technical Support

Submit a technical question or find your regional support number

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# SPECIFICATIONS

$T_A$ = −40°C to +125°C (operating temperature range) for the AD8410WB, $T_A$ = −40°C to +150°C for the AD8410WH, $V_S$ = 5 V, unless otherwise noted.

**Table 2.**

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| GAIN | | | | | |
| Initial | | | 20 | | V/V |
| Error Over Temperature | Specified temperature range | | | ±0.3 | % |
| Gain vs. Temperature | | −10 | | +10 | ppm/°C |
| VOLTAGE OFFSET | | | | | |
| Offset Voltage, Referred to the Input (RTI) | 25°C | | ±200 | | µV |
| Over Temperature (RTI) | Specified temperature range | | | ±400 | µV |
| Offset Drift | | −1.0 | +0.1 | +1.0 | µV/°C |
| INPUT | | | | | |
| Input Bias Current | | | 130 | | µA |
| Input Offset Current | | | 10 | | µA |
| Input Voltage Range | Common mode, continuous | −2 | | +70 | V |
| Common-Mode Rejection Ratio (CMRR) | Specified temperature range, f = dc | 90 | 100 | | dB |
| | f = dc to 10 kHz | | 86 | | dB |
| OUTPUT | | | | | |
| Output Voltage Range | $R_L$ = 10 kΩ | 0.020 | | $V_S$ − 0.020 | V |
| Output Resistance | | | 2 | | Ω |
| DYNAMIC RESPONSE | | | | | |
| Small Signal −3 dB Bandwidth | | | 2000 | | kHz |
| Slew Rate | | | 9 | | V/µs |
| NOISE | | | | | |
| 0.1 Hz to 10 Hz (RTI) | | | 32 | | µV p-p |
| Spectral Density, 1 kHz (RTI) | | | 38 | | nV/√Hz |
| OFFSET ADJUSTMENT | | | | | |
| Ratiometric Accuracy[1] | Divider to supplies | 0.499 | | 0.501 | V/V |
| Accuracy, Referred to the Output (RTO) | Voltage applied to $V_{REF}1$ and $V_{REF}2$ in parallel | | | ±1 | mV/V |
| Output Offset Adjustment Range | $V_S$ = 5 V | 0.045 | | $V_S$ − 0.035 | V |
| POWER SUPPLY | | | | | |
| Operating Range | | 2.9 | | 5.5 | V |
| Quiescent Current Over Temperature | $V_{OUT}$ = 0.1 V dc | | | | |
| | AD8410WB | | | 9 | mA |
| | AD8410WH | | | 9 | mA |
| Power Supply Rejection Ratio | | 80 | | | dB |
| Temperature Range | | | | | |
| For Specified Performance | Operating temperature range | | | | |
| | AD8410WB | −40 | | +125 | °C |
| | AD8410WH | −40 | | +150 | °C |

[1] The offset adjustment is ratiometric to the power supply when $V_{REF}1$ and $V_{REF}2$ are used as a divider between the supplies.

# ABSOLUTE MAXIMUM RATINGS

**Table 3.**

| Parameter | Rating |
|---|---|
| Supply Voltage | 6 V |
| Input Voltage Range | |
| Continuous | −2 V to +70 V |
| Survival | −20 V to +75 V |
| Differential Input Survival | ±20 V |
| Reverse Supply Voltage | 0.3 V |
| ESD Human Body Model (HBM) | ±2000 V |
| Operating Temperature Range | |
| AD8410WB | −40°C to +125°C |
| AD8410WH | −40°C to +150°C |
| Storage Temperature Range | −65°C to +150°C |
| Output Short-Circuit Duration | Indefinite |

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

## ESD CAUTION

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

# PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

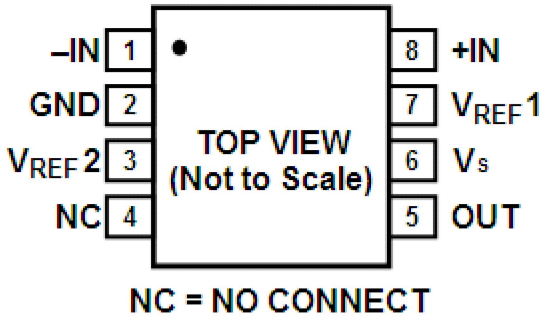


*Figure 2. Pin Configuration*

**Table 4. Pin Function Descriptions**

| Pin No. | Mnemonic | Description |
|---|---|---|
| 1 | –IN | Negative Input |
| 2 | GND | Ground |
| 3 | $V_{REF}2$ | Reference Input |
| 4 | NC | No Connect |
| 5 | OUT | Output |
| 6 | $V_S$ | Supply |
| 7 | $V_{REF}1$ | Reference Input |
| 8 | +IN | Positive Input |


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