

### FEATURES

#### High common-mode input voltage range

- 2V to +70 V continuous
- 20V to +75 V survival

#### Typical 1.0 $\mu\text{V}/^\circ\text{C}$ offset drift

#### 2.0 MHz Bandwidth

#### Maximum $\pm 400 \mu\text{V}$ voltage offset over full temperature range

#### Initial gain = 20 V/V

#### Wide operating temperature range

- AD8410WB:  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$
- AD8410WH:  $-40^\circ\text{C}$  to  $+150^\circ\text{C}$

#### 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  $\pm 0.3\%$  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  $-2 \text{ V}$  to  $+70 \text{ V}$ . 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  $-40^\circ\text{C}$  to  $+150^\circ\text{C}$  temperature range. It features a in package trim core, which leads to a typical offset drift of  $1.0 \mu\text{V}/^\circ\text{C}$  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  $\pm 200 \mu\text{V}$ . 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

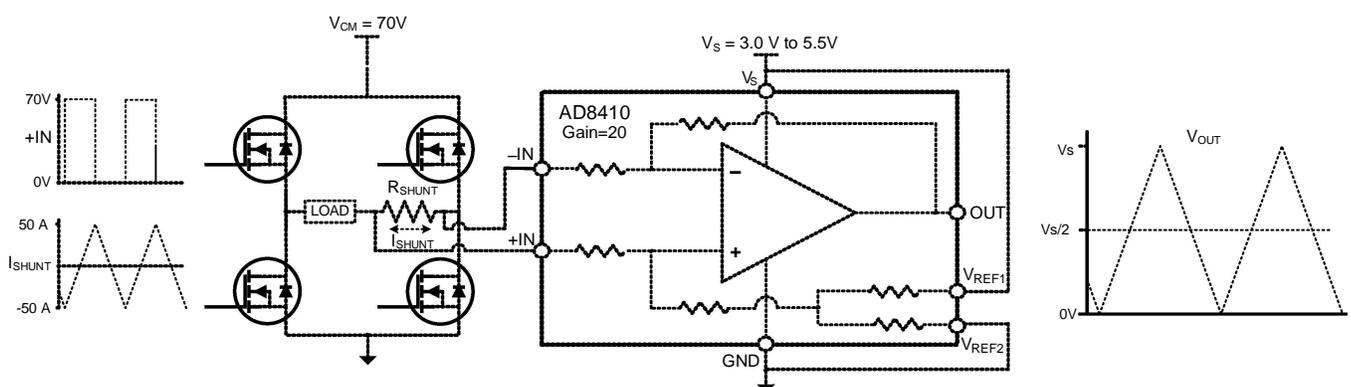


Figure 1.

Rev. PrE

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## SPECIFICATIONS

$T_A = -40^\circ\text{C}$  to  $+125^\circ\text{C}$  (operating temperature range) for the AD8410WB,  $T_A = -40^\circ\text{C}$  to  $+150^\circ\text{C}$  for the AD8410WH,  $V_S = 5\text{ V}$ , unless otherwise noted.

Table 2.

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

<sup>1</sup> The offset adjustment is ratiometric to the power supply when  $V_{\text{REF}1}$  and  $V_{\text{REF}2}$  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

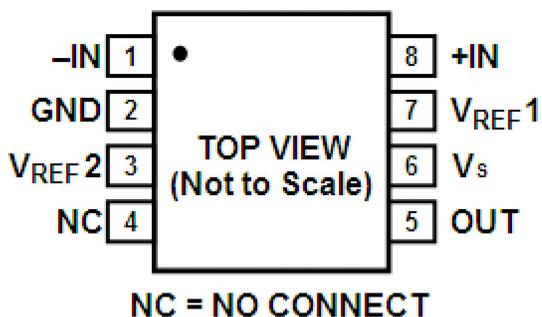


Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	-IN	Negative Input
2	GND	Ground
3	V <sub>REF2</sub>	Reference Input
4	NC	No Connect
5	OUT	Output
6	V <sub>s</sub>	Supply
7	V <sub>REF1</sub>	Reference Input
8	+IN	Positive Input