

FEATURES

- High common-mode voltage range
- 6 V to +30 V at a 5 V supply voltage
- Operating temperature range: -40°C to +125°C
- Supply voltage range: 3.5 V to 12 V
- Low-pass filter (1-pole or 2-pole)
- Excellent ac and dc performance
 - ±1 mV voltage offset (8-lead SOIC)
 - ±1 ppm/°C typical gain drift
 - 80 dB CMRR minimum dc to 10 kHz

APPLICATIONS

- Transmission control
- Diesel injection control
- Engine management
- Adaptive suspension control
- Vehicle dynamics control

GENERAL DESCRIPTION

The AD8203 is a single-supply difference amplifier for amplifying and low-pass filtering small differential voltages in the presence of a large common-mode voltage (CMV). The input CMV range extends from -6 V to +30 V at a typical supply voltage of 5 V.

The AD8203 is available in die and packaged form. The MSOP and SOIC packages are specified over a wide temperature range, from -40°C to +125°C, while the die is specified over a wider temperature range, from -40°C to +150°C, making the AD8203 well-suited for use in many automotive platforms.

Automotive platforms demand precision components for better system control. The AD8203 provides excellent ac and dc performance keeping errors to a minimum in the user's system. Typical offset and gain drift in the SOIC package are 0.3 $\mu\text{V}/^\circ\text{C}$ and 1 ppm/°C, respectively. Typical offset and gain drift in the MSOP package are 2 $\mu\text{V}/^\circ\text{C}$ and 1 ppm/°C, respectively. The device also delivers a minimum CMRR of 80 dB from dc to 10 kHz.

The AD8203 features an externally accessible 100 k Ω resistor at the output of the Preamp A1, which can be used for low-pass filter applications and for establishing gains other than 14.

FUNCTIONAL BLOCK DIAGRAMS

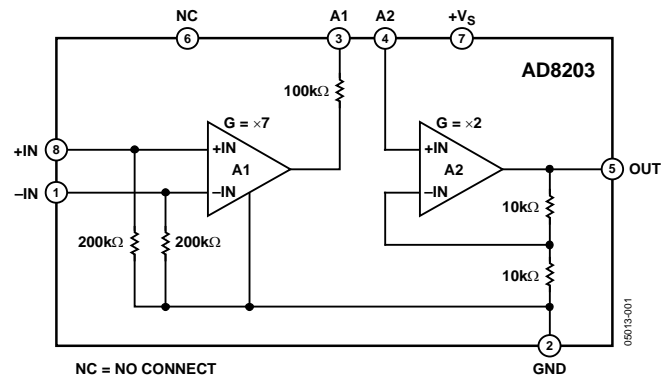


Figure 1. Functional Block Diagram

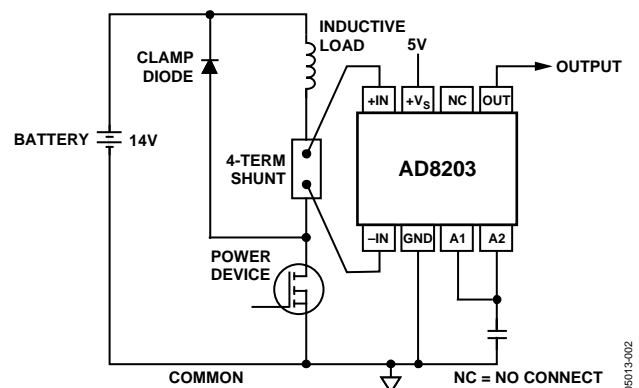


Figure 2. High Line Current Sensor

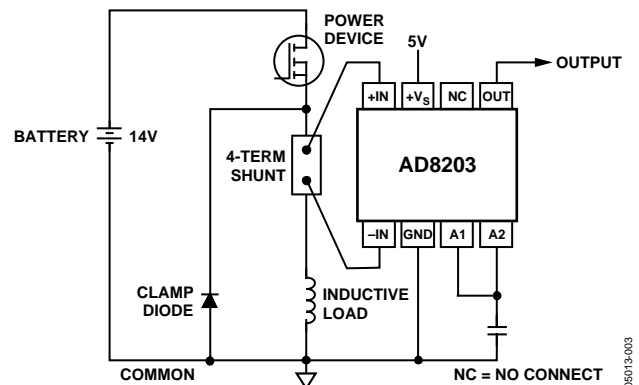


Figure 3. Low Line Current Sensor

Rev. B

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SPECIFICATIONS

SINGLE SUPPLY

T_A = operating temperature range, $V_S = 5$ V, unless otherwise noted.

Table 1.

Parameter	Conditions	AD8203 SOIC			AD8203 MSOP			AD8203 Die			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
SYSTEM GAIN											
Initial			14			14			14		V/V
Error vs. Temperature	$0.02 \leq V_{OUT} \leq 4.8$ V dc @ 25°C	-0.3		+0.3	-0.3		+0.3	-0.3		+0.3	% ppm/°C
VOLTAGE OFFSET											
Input Offset (RTI) vs. Temperature	$V_{CM} = 0.15$ V; 25°C -40°C to +125°C -40°C to +150°C	-1		+1	-2		+2	-1		+1	mV μV/°C μV/°C
INPUT											
Input Impedance											
Differential		260	320	380	260	320	380	260	320	380	kΩ
Common Mode		130	160	190	130	160	190	130	160	190	kΩ
CMV	Continuous	-6		+30	-6		+30	-6		+30	V
CMRR ¹	$V_{CM} = -6$ V to +30 V f = dc f = 1 kHz f = 10 kHz ²	82			82			82			dB dB dB
PREAMPLIFIER											
Gain			7			7			7		V/V
Gain Error		-0.3		+0.3	-0.3		+0.3	-0.3		+0.3	%
Output Voltage Range		0.02		4.8	0.02		4.8	0.02		4.8	V
Output Resistance		97	100	103	97	100	103	97	100	103	kΩ
OUTPUT BUFFER											
Gain	$0.02 \leq V_{OUT} \leq 4.8$ V dc		2			2			2		V/V
Gain Error		-0.3		+0.3	-0.3		+0.3	-0.3		+0.3	%
Output Voltage Range		0.02		4.8	0.02		4.8	0.02		4.8	V
Input Bias Current			40			40			40		nA
Output Resistance			2			2			2		Ω
DYNAMIC RESPONSE											
System Bandwidth	$V_{IN} = 0.01$ V p-p, $V_{OUT} = 0.14$ V p-p	40	60		40	60		40	60		kHz
Slew Rate	$V_{IN} = 0.28$ V, $V_{OUT} = 4$ V step		0.33			0.33			0.33		V/μs
NOISE											
0.1 Hz to 10 Hz Spectral Density, 1 kHz (RTI)			10			10			10		μV p-p nV/√Hz
POWER SUPPLY											
Operating Range		3.5		12	3.5		12	3.5		12	V
Quiescent Current vs. Temperature	$V_O = 0.1$ V dc		0.25	1.0		0.25	1.0		0.25	1.0	mA
PSRR	$V_S = 3.5$ V to 12 V	75	83		75	83		75	83		dB
TEMPERATURE RANGE											
For Specified Performance		-40		+125	-40		+125	-40		+150	°C

¹ Source imbalance <2 Ω.

² The AD8203 preamplifier exceeds 80 dB CMRR at 10 kHz. However, since the signal is available only by way of a 100 kΩ resistor, even the small amount of pin-to-pin capacitance between Pin 1, Pin 8 and Pin 3, Pin 4 may couple an input common-mode signal larger than the greatly attenuated preamplifier output. The effect of pin-to-pin coupling may be neglected in all applications by using filter capacitors at Node 3.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage	12.5 V
Transient Input Voltage (400 ms)	44 V
Continuous Input Voltage (Common Mode)	35 V
Reversed Supply Voltage Protection	0.3 V
Operating Temperature Range	
Die	-40°C to +150°C
SOIC	-40°C to +125°C
MSOP	-40°C to +125°C
Storage Temperature	-65°C to +150°C
Output Short-Circuit Duration	Indefinite
Lead Temperature Range (Soldering 10 sec)	300°C

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

ESD 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 this product 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.



PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

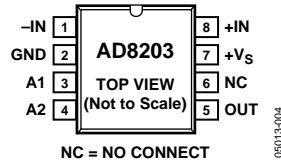


Figure 4. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	X	Y
1	-IN	-409.0	-205.2
2	GND	-244.6	-413.0
3	A1	+229.4	-413.0
4	A2	+410.0	-308.6
5	OUT	+410.0	+272.4
6	NC	NA	NA
7	+Vs	+121.0	+417.0
8	+IN	-409.0	+205.2

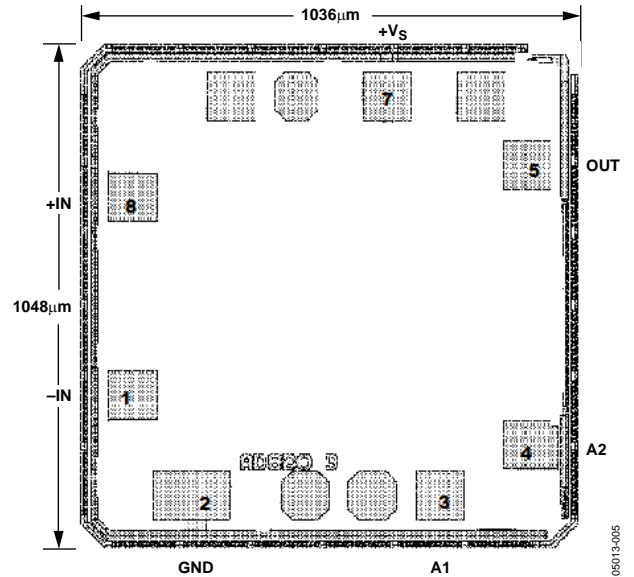
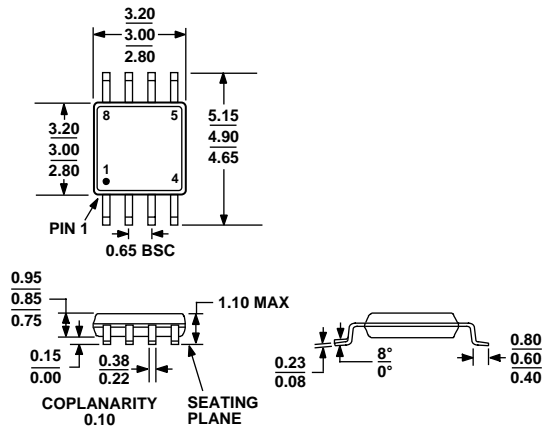


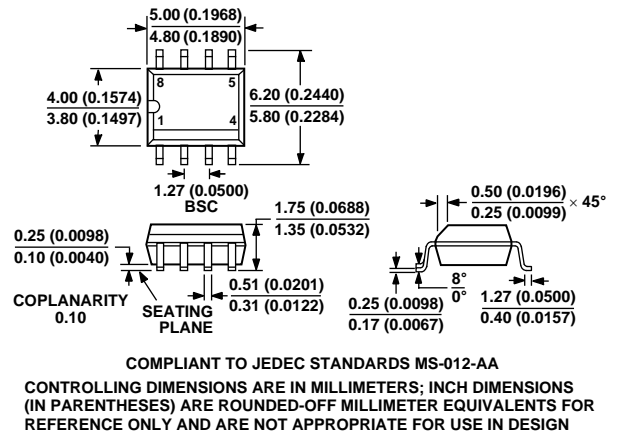
Figure 5. Metallization Photograph

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-187-AA

Figure 52. 8-Lead Mini Small Outline Package [MSOP] (RM-8)
Dimensions shown in millimeters



COMPLIANT TO JEDEC STANDARDS MS-012-AA
CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

Figure 53. 8-Lead Standard Small Outline Package [SOIC_N] Narrow Body (R-8)
Dimensions shown in millimeters and (inches)

ORDERING GUIDE

Model	Temperature Package	Package Description	Package Outline	Branding
AD8203YRMZ ¹	-40°C to +125°C	8-Lead Mini Small Outline Package [MSOP]	RM-8	JXA
AD8203YRMZ-RL ¹	-40°C to +125°C	8-Lead Mini Small Outline Package [MSOP]	RM-8	JXA
AD8203YRMZ-R7 ¹	-40°C to +125°C	8-Lead Mini Small Outline Package [MSOP]	RM-8	JXA
AD8203YRZ ¹	-40°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8	
AD8203YRZ-RL ¹	-40°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8	
AD8203YRZ-R7 ¹	-40°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8	
AD8203YCSURF		Die		

¹ Z = Pb-free part.