



# 8-Bit, 50 MSPS/80 MSPS/100 MSPS 3 V A/D Converter

## AD9283

### FEATURES

8-Bit, 50, 80, and 100 MSPS ADC

Low Power: 90 mW at 100 MSPS

On-Chip Reference and Track/Hold

475 MHz Analog Bandwidth

SNR = 46.5 dB @ 41 MHz at 100 MSPS

1 V p-p Analog Input Range

Single 3.0 V Supply Operation (2.7 V–3.6 V)

Power-Down Mode: 4.2 mW

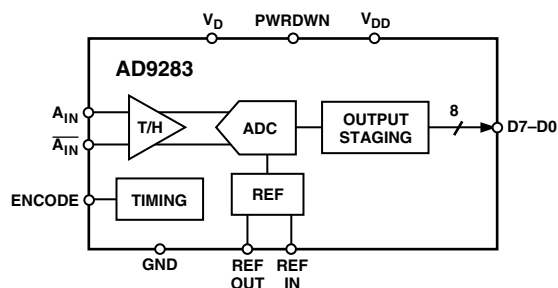
### APPLICATIONS

Battery Powered Instruments

Hand-Held Scopemeters

Low Cost Digital Oscilloscopes

### FUNCTIONAL BLOCK DIAGRAM



### GENERAL DESCRIPTION

The AD9283 is an 8-bit monolithic sampling analog-to-digital converter with an on-chip track-and-hold circuit and is optimized for low cost, low power, small size and ease of use. The product operates at a 100 MSPS conversion rate, with outstanding dynamic performance over its full operating range.

The ADC requires only a single 3.0 V (2.7 V to 3.6 V) power supply and an encode clock for full performance operation. No external reference or driver components are required for many applications. The digital outputs are TTL/CMOS compatible and a separate output power supply pin supports interfacing with 3.3 V or 2.5 V logic.

The encoder input is TTL/CMOS compatible. A power-down function may be exercised to bring total consumption to 4.2 mW. In power-down mode, the digital outputs are driven to a high impedance state.

Fabricated on an advanced CMOS process, the AD9283 is available in a 20-lead surface mount plastic package (SSOP) specified over the industrial temperature range (–40°C to +85°C).

### REV. C

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# AD9283—SPECIFICATIONS (V<sub>DD</sub> = 3.0 V, V<sub>D</sub> = 3.0 V; single-ended input; external reference, unless otherwise noted)

| Parameter                                                | Temp | Test Level | AD9283BRS-100      |       |       | AD9283BRS-80       |       |       | AD9283BRS-50       |       |       | Unit   |
|----------------------------------------------------------|------|------------|--------------------|-------|-------|--------------------|-------|-------|--------------------|-------|-------|--------|
|                                                          |      |            | Min                | Typ   | Max   | Min                | Typ   | Max   | Min                | Typ   | Max   |        |
| RESOLUTION                                               |      |            | 8                  |       |       | 8                  |       |       | 8                  |       |       | Bits   |
| DC ACCURACY                                              |      |            |                    |       |       |                    |       |       |                    |       |       |        |
| Differential Nonlinearity                                | 25°C | I          |                    | ±0.5  | +1.25 |                    | ±0.5  | +1.25 |                    | ±0.5  | +1.25 | LSB    |
|                                                          | Full | VI         |                    |       | +1.50 |                    |       | +1.50 |                    |       | +1.50 | LSB    |
| Integral Nonlinearity                                    | 25°C | I          | −1.25              | ±0.75 | +1.25 | −1.25              | ±0.75 | +1.25 | −1.25              | ±0.75 | +1.25 | LSB    |
|                                                          | Full | VI         |                    |       | +2.25 |                    |       | +1.50 |                    |       | +1.50 | LSB    |
| No Missing Codes                                         | Full | VI         | Guaranteed         |       |       | Guaranteed         |       |       | Guaranteed         |       |       |        |
| Gain Error <sup>1</sup>                                  | 25°C | I          | −6                 | ±2.5  | +6    | −6                 | ±2.5  | +6    | −6                 | ±2.5  | +6    | % FS   |
|                                                          | Full | VI         | −8                 |       | +8    | −8                 |       | +8    | −8                 |       | +8    | % FS   |
| Gain Tempco <sup>1</sup>                                 | Full | VI         | 80                 |       |       | 80                 |       |       | 80                 |       |       | ppm/°C |
| ANALOG INPUT                                             |      |            |                    |       |       |                    |       |       |                    |       |       |        |
| Input Voltage Range                                      | Full | V          |                    | ±512  |       |                    | ±512  |       |                    | ±512  |       | mV p-p |
| (With Respect to A <sub>IN</sub> )                       | Full | V          |                    | ±200  |       |                    | ±200  |       |                    | ±200  |       | mV     |
| Common-Mode Voltage                                      | 25°C | I          | −35                | ±10   | +35   | −35                | ±10   | +35   | −35                | ±10   | +35   | mV     |
| Input Offset Voltage                                     | Full | VI         |                    | ±40   |       |                    | ±40   |       |                    | ±40   |       | mV     |
| Reference Voltage                                        | Full | VI         | 1.2                | 1.25  | 1.3   | 1.2                | 1.25  | 1.3   | 1.2                | 1.25  | 1.3   | V      |
| Reference Tempco                                         | Full | VI         |                    | ±130  |       |                    | ±130  |       |                    | ±130  |       | ppm/°C |
| Input Resistance                                         | 25°C | I          | 7                  | 10    | 13    | 7                  | 10    | 13    | 7                  | 10    | 13    | kΩ     |
|                                                          | Full | VI         | 5                  |       | 16    | 5                  |       | 16    | 5                  |       | 16    | kΩ     |
| Input Capacitance                                        | 25°C | V          |                    | 2     |       |                    | 2     |       |                    | 2     |       | pF     |
|                                                          | Full | VI         |                    |       |       |                    |       |       |                    |       |       | μA     |
| Analog Bandwidth, Full Power                             | 25°C | V          |                    | 475   |       |                    | 475   |       |                    | 475   |       | MHz    |
| SWITCHING PERFORMANCE                                    |      |            |                    |       |       |                    |       |       |                    |       |       |        |
| Maximum Conversion Rate                                  | Full | VI         | 100                |       |       | 80                 |       |       | 50                 |       |       | MSPS   |
| Minimum Conversion Rate                                  | 25°C | IV         |                    |       | 1     |                    |       | 1     |                    |       | 1     | MSPS   |
| Encode Pulsewidth High (t <sub>EH</sub> )                | 25°C | IV         | 4.3                |       | 1000  | 5.0                |       | 1000  | 8.0                |       | 1000  | ns     |
| Encode Pulsewidth Low (t <sub>EL</sub> )                 | 25°C | IV         | 4.3                |       | 1000  | 5.0                |       | 1000  | 8.0                |       | 1000  | ns     |
| Aperture Delay (t <sub>A</sub> )                         | 25°C | V          |                    | 0     |       |                    | 0     |       |                    | 0     |       | ns     |
| Aperture Uncertainty (Jitter)                            | 25°C | V          |                    | 5     |       |                    | 5     |       |                    | 5     |       | ps rms |
| Output Valid Time (t <sub>V</sub> ) <sup>2</sup>         | Full | VI         | 2.0                | 3.0   |       | 2.0                | 3.0   |       | 2.0                | 3.0   |       | ns     |
| Output Propagation Delay (t <sub>PD</sub> ) <sup>2</sup> | Full | VI         |                    | 4.5   | 7.0   |                    | 4.5   | 7.0   |                    | 4.5   | 7.0   | ns     |
| DIGITAL INPUTS                                           |      |            |                    |       |       |                    |       |       |                    |       |       |        |
| Logic “1” Voltage                                        | Full | VI         | 2.0                |       |       | 2.0                |       |       | 2.0                |       |       | V      |
| Logic “0” Voltage                                        | Full | VI         |                    |       | 0.8   |                    |       | 0.8   |                    | 0.8   |       | V      |
| Logic “1” Current                                        | Full | VI         |                    |       | ±1    |                    |       | ±1    |                    |       | ±1    | μA     |
| Logic “0” Current                                        | Full | VI         |                    |       | ±1    |                    |       | ±1    |                    |       | ±1    | μA     |
| Input Capacitance                                        | 25°C | V          |                    | 2.0   |       |                    | 2.0   |       |                    | 2.0   |       | pF     |
| DIGITAL OUTPUTS                                          |      |            |                    |       |       |                    |       |       |                    |       |       |        |
| Logic “1” Voltage                                        | Full | VI         | 2.95               |       |       | 2.95               |       |       | 2.95               |       |       | V      |
| Logic “0” Voltage                                        | Full | VI         |                    |       | 0.05  |                    |       | 0.05  |                    |       | 0.05  | V      |
| Output Coding                                            |      |            | Offset Binary Code |       |       | Offset Binary Code |       |       | Offset Binary Code |       |       |        |
| POWER SUPPLY                                             |      |            |                    |       |       |                    |       |       |                    |       |       |        |
| Power Dissipation <sup>3, 4</sup>                        | Full | VI         |                    | 90    | 120   |                    | 90    | 115   |                    | 80    | 100   | mW     |
| Power-Down Dissipation                                   | Full | VI         |                    | 4.2   | 7     |                    | 4.2   | 7     |                    | 4.2   | 7     | mW     |
| Power Supply Rejection Ratio (PSRR)                      | 25°C | I          |                    |       | 18    |                    |       | 18    |                    |       | 18    | mV/V   |

| Parameter                                          | Temp | Test Level | AD9283BRS-100 |      |     | AD9283BRS-80 |      |     | AD9283BRS-50 |      |     | Unit |
|----------------------------------------------------|------|------------|---------------|------|-----|--------------|------|-----|--------------|------|-----|------|
|                                                    |      |            | Min           | Typ  | Max | Min          | Typ  | Max | Min          | Typ  | Max |      |
| DYNAMIC PERFORMANCE <sup>5</sup>                   |      |            |               |      |     |              |      |     |              |      |     |      |
| Transient Response                                 | 25°C | V          | 2             |      |     | 2            |      |     | 2            |      |     | ns   |
| Overvoltage Recovery Time                          | 25°C | V          | 2             |      |     | 2            |      |     | 2            |      |     | ns   |
| Signal-to-Noise Ratio (SNR)<br>(Without Harmonics) |      |            |               |      |     |              |      |     |              |      |     |      |
| f <sub>IN</sub> = 10.3 MHz                         | 25°C | I          |               | 46.5 |     |              | 47   |     | 44           | 47   |     | dB   |
| f <sub>IN</sub> = 27 MHz                           | 25°C | I          |               | 46.5 |     | 44           | 47   |     |              | 47   |     | dB   |
| f <sub>IN</sub> = 41 MHz                           | 25°C | I          | 43.5          | 46.5 |     |              | 47   |     |              |      |     | dB   |
| f <sub>IN</sub> = 76 MHz                           | 25°C | V          |               | 46.0 |     |              |      |     |              |      |     | dB   |
| Signal-to-Noise Ratio (SINAD)<br>(With Harmonics)  |      |            |               |      |     |              |      |     |              |      |     |      |
| f <sub>IN</sub> = 10.3 MHz                         | 25°C | I          |               | 45   |     |              | 47   |     | 43.5         | 46.5 |     | dB   |
| f <sub>IN</sub> = 27 MHz                           | 25°C | I          |               | 45.5 |     | 43.5         | 46.5 |     |              | 46   |     | dB   |
| f <sub>IN</sub> = 41 MHz                           | 25°C | I          | 42.5          | 45   |     |              | 42   |     |              |      |     | dB   |
| f <sub>IN</sub> = 76 MHz                           | 25°C | V          |               | 42.5 |     |              |      |     |              |      |     | dB   |
| Effective Number of Bits                           |      |            |               |      |     |              |      |     |              |      |     |      |
| f <sub>IN</sub> = 10.3 MHz                         | 25°C | I          |               | 7.3  |     |              | 7.5  |     |              | 7.6  |     | Bits |
| f <sub>IN</sub> = 27 MHz                           | 25°C | I          |               | 7.4  |     |              | 7.5  |     |              | 7.5  |     | Bits |
| f <sub>IN</sub> = 41 MHz                           | 25°C | I          |               | 7.3  |     |              | 7.5  |     |              |      |     | Bits |
| f <sub>IN</sub> = 76 MHz                           | 25°C | V          |               | 6.9  |     |              |      |     |              |      |     | Bits |
| 2nd Harmonic Distortion                            |      |            |               |      |     |              |      |     |              |      |     |      |
| f <sub>IN</sub> = 10.3 MHz                         | 25°C | I          |               | 57   |     |              | 60   |     | 55           | 60   |     | dBc  |
| f <sub>IN</sub> = 27 MHz                           | 25°C | I          |               | 60   |     | 55           | 60   |     |              | 56   |     | dBc  |
| f <sub>IN</sub> = 41 MHz                           | 25°C | I          | 50            | 58   |     |              | 55   |     |              |      |     | dBc  |
| f <sub>IN</sub> = 76 MHz                           | 25°C | V          |               | 46   |     |              |      |     |              |      |     | dBc  |
| 3rd Harmonic Distortion                            |      |            |               |      |     |              |      |     |              |      |     |      |
| f <sub>IN</sub> = 10.3 MHz                         | 25°C | I          |               | 54.5 |     |              | 70   |     | 55           | 70   |     | dBc  |
| f <sub>IN</sub> = 27 MHz                           | 25°C | I          |               | 55   |     | 55           | 62.5 |     |              | 60   |     | dBc  |
| f <sub>IN</sub> = 41 MHz                           | 25°C | I          | 47            | 52.5 |     |              | 60   |     |              |      |     | dBc  |
| f <sub>IN</sub> = 76 MHz                           | 25°C | V          |               | 53   |     |              |      |     |              |      |     | dBc  |
| Two-Tone Intermod Distortion<br>(IMD)              |      |            |               |      |     |              |      |     |              |      |     |      |
| f <sub>IN</sub> = 10.3 MHz                         | 25°C | V          |               | 52   |     |              | 52   |     |              | 52   |     | dBc  |

## NOTES

<sup>1</sup>Gain error and gain temperature coefficient are based on the ADC only (with a fixed 1.25 V external reference).

<sup>2</sup> $t_V$  and  $t_{PD}$  are measured from the 1.5 V level of the ENCODE input to the 50%/50% levels of the digital outputs swing. The digital output load during test is not to exceed an ac load of 10 pF or a dc current of  $\pm 40 \mu\text{A}$ .

<sup>3</sup>Power dissipation measured with encode at rated speed and a dc analog input.

<sup>4</sup>Typical thermal impedance for the RS style (SSOP) 20-lead package:  $\theta_{JC} = 46^\circ\text{C/W}$ ,  $\theta_{CA} = 80^\circ\text{C/W}$ ,  $\theta_{JA} = 126^\circ\text{C/W}$ .

<sup>5</sup>SNR/harmonics based on an analog input voltage of  $-0.7 \text{ dBFS}$  referenced to a 1.024 V full-scale input range.

Specifications subject to change without notice.

## ABSOLUTE MAXIMUM RATINGS\*

|                                    |                                              |
|------------------------------------|----------------------------------------------|
| $V_D, V_{DD}$ .....                | 4 V                                          |
| Analog Inputs .....                | $-0.5 \text{ V}$ to $V_D + 0.5 \text{ V}$    |
| Digital Inputs .....               | $-0.5 \text{ V}$ to $V_{DD} + 0.5 \text{ V}$ |
| $V_{REF IN}$ .....                 | $-0.5 \text{ V}$ to $V_D + 0.5 \text{ V}$    |
| Digital Output Current .....       | 20 mA                                        |
| Operating Temperature .....        | $-55^\circ\text{C}$ to $+125^\circ\text{C}$  |
| Storage Temperature .....          | $-65^\circ\text{C}$ to $+150^\circ\text{C}$  |
| Maximum Junction Temperature ..... | $150^\circ\text{C}$                          |
| Maximum Case Temperature .....     | $150^\circ\text{C}$                          |

\*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 outside of those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

## ORDERING GUIDE

| Model          | Temperature Ranges                         | Package Descriptions | Package Options |
|----------------|--------------------------------------------|----------------------|-----------------|
| AD9283BRS      |                                            |                      |                 |
| -50, -80, -100 | $-40^\circ\text{C}$ to $+85^\circ\text{C}$ | 20-Lead SSOP         | RS-20           |
| AD9283/PCB     | $25^\circ\text{C}$                         | Evaluation Board     |                 |

## 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 AD9283 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.

