The AD9432 is an 12-bit monolithic sampling analog–to–digital converter with an on–chip track–and–hold circuit and is optimized for high speed conversion 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 5.0V power supply and a 100MHz 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 3.3V logic.

The encoder input supports either differential or single-ended and is TTL/CMOS compatible. The 12-bit digital outputs can be operated from +3.0V (2.5V to 3.6V) supplies.
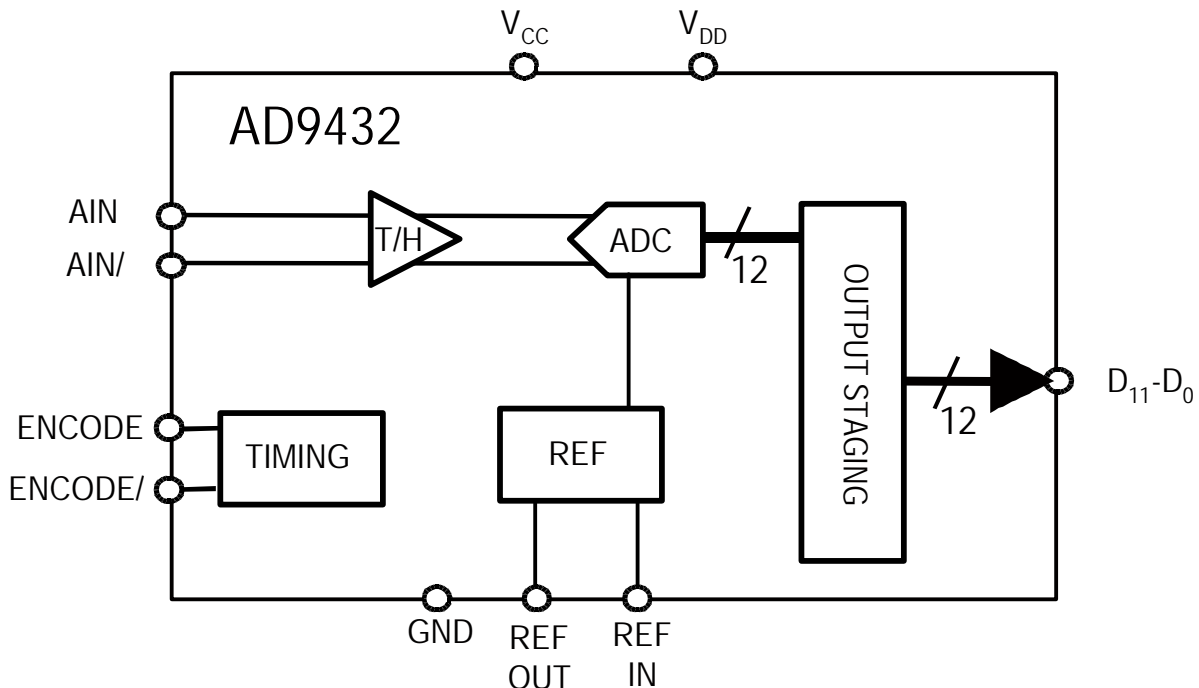
Fabricated on an advanced BiCMOS process, the AD9432 is available in a 52 pin plastic quad flat package (52 LQFP) specified over the industrial temperature range (–40°C to +85°C).

**FEATURES**
**12–Bit, 100Msps ADC**
**On-chip Linear Self-Calibration Loop**
**Two's Complement output format**
**On–Chip Reference and Track/Hold**
**Target Low Power: 850 mW Typical at 100 Msps**
**Target: 500 MHz Analog Bandwidth**
**Target: SNR = 67dB @ 47MHz**
**Target: SFDR = 80dB @ 30MHz $A_{IN}$**
**2.0 Vp–p Differential Analog Input Range**
**Single +5.0V Supply Operation**
**+3.3V CMOS/TTL outputs**

**APPLICATIONS**
**Communications**
**Basestations and 'Zero-IF' subsystems**
**Wireless Local Loop (WLL)**
**Local Multipoint Distribution Service (LMDS)**

**One Technology Way, P.O Box 9106, Norwood, MA 02062–9106, USA**
**Tel: 617/329–4700**
**Fax: 617–326–8703**

# AD9432—TARGET SPECIFICATIONS

## ELECTRICAL CHARACTERISTICS[1] ($V_{DD}$ = 3.0V, $V_{CC}$ = 5.0V; external reference; ENCODE = 100 Msps, unless otherwise noted)

| Parameter | Temp | Test Level | AD9432BST-100 Min | AD9432BST-100 Typical | AD9432BST-100 Max | Units |
|---|---|---|---|---|---|---|
| RESOLUTION | | | | 10 | | bits |
| **DC ACCURACY** | | | | | | |
| Differential Nonlinearity | +25°C | I | | ±0.5 | | LSB |
| | Full | VI | | | | LSB |
| Integral Nonlinearity | +25°C | I | | ±0.75 | | LSB |
| | Full | VI | | | | LSB |
| No Missing Codes | Full | VI | | Guaranteed | | |
| Gain Error | +25°C | I | | ±1 | | % FS |
| | Full | VI | | | | % FS |
| Gain Tempco | Full | V | | 150 | | ppm/°C |
| **ANALOG INPUT** | | | | | | |
| Input Voltage Range (with respect to AIN\) | Full | V | | ±1.0 | | V p–p |
| Common Mode Voltage | Full | V | | 3.0 | | V |
| Input Offset Voltage | +25°C | I | | ±3 | | mV |
| | Full | I | | | | mV |
| Reference Voltage | +25°C | I | | 2.5 | | V |
| Input Resistance | +25°C | I | | 3 | | kΩ |
| | Full | I | | | | kΩ |
| Input Capacitance | +25°C | V | | 4 | | pF |
| Input Bias Current | +25°C | I | | 15 | | µA |
| | Full | I | | | | µA |
| Analog Bandwidth, Full Power | +25°C | V | | 500 | | MHz |
| **SWITCHING PERFORMANCE** | | | | | | |
| Maximum Conversion Rate | Full | VI | 100 | | | Msps |
| Minimum Conversion Rate | Full | IV | | | 2 | Msps |
| Encode Pulse Width High ($t_{EH}$) | +25°C | IV | | 5.0 | | ns |
| Encode Pulse Width Low ($t_{EL}$) | +25°C | IV | | 5.0 | | ns |
| Aperture Delay ($t_A$) | +25°C | V | | 2.0 | | ns |
| Aperture Uncertainty (Jitter) | +25°C | V | | 0.2 | | ps rms |
| Output Valid Time ($t_V$) | Full | VI | 4.0 | 6.0 | | ns |
| Output Propagation Delay ($t_{PD}$) | Full | VI | | 8.0 | 11.0 | ns |
| Output Rise Time ($t_R$) | Full | VI | | 1.4 | | ns |
| Output Fall Time ($t_F$) | Full | VI | | 1.0 | | ns |
| **DIGITAL INPUTS** | | | | | | |
| Differential Input (Enc,Enc\) | Full | IV | 0.4 | | 3.5 | V |
| Logic "1" Voltage | Full | IV | 2.0 | | | V |
| Logic "0" Voltage | Full | IV | | | 0.8 | V |
| Logic "1" Current | Full | VI | | | ±1 | µA |
| Logic "0" Current | Full | VI | | | ±1 | µA |
| Input Capacitance | +25°C | V | | 4.5 | | PF |
| **DIGITAL OUTPUTS** | | | | | | |
| Logic "1" Voltage ($V_{DD}$ = +3.3V) | Full | VI | $V_{DD}$-0.05 | | | V |
| Logic "0" Voltage ($V_{DD}$ = +3.3V) | Full | VI | | | 0.05 | V |
| Output Coding | | | | Two's complement | | |
| **POWER SUPPLY** | | | | | | |
| Power Dissipation | Full | VI | | 750 | | mW |
| Power Supply Rejection Ratio (PSRR) | +25°C | I | | ±1 | | mV/V |

| Parameter | Temp | Test Level | AD9432BR | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typical | Max | |
| DYNAMIC PERFORMANCE | | | | | | |
|   Signal–to–Noise Ratio (SNR) | | | | | | |
|   (Without Harmonics) | | | | | | |
|    $f_{IN}$ = 10 MHz | +25°C | I | | 68 | | dB |
| | Full | V | | | | dB |
|    $f_{IN}$ = 20 MHz | +25°C | I | | 68 | | dB |
| | Full | V | | | | dB |
|    $f_{IN}$ = 47 MHz | +25°C | I | | 67 | | dB |
| | Full | V | | | | dB |
|   Signal–to–Noise Ratio (SINAD) | | | | | | |
|   (With Harmonics) | | | | | | |
|    $f_{IN}$ = 10 MHz | +25°C | I | | 67 | | dB |
| | Full | V | | | | dB |
|    $f_{IN}$ = 20 MHz | +25°C | I | | 66.5 | | dB |
| | Full | V | | | | dB |
|    $f_{IN}$ = 47 MHz | +25°C | I | | 65 | | dB |
| | Full | V | | | | dB |
|   Effective Number of Bits | | | | | | |
|    $f_{IN}$ = 10 MHz | +25°C | I | | 11.0 | | bits |
|    $f_{IN}$ = 20 MHz | +25°C | I | | 10.9 | | bits |
|    $f_{IN}$ = 47 MHz | +25°C | I | | 10.5 | | bits |
|   2nd Harmonic Distortion | | | | | | |
|    $f_{IN}$ = 10 MHz | +25°C | I | | 78 | | dBc |
|    $f_{IN}$ = 20 MHz | +25°C | I | | 78 | | dBc |
|    $f_{IN}$ = 47 MHz | +25°C | I | | 71 | | dBc |
|   3rd Harmonic Distortion | | | | | | |
|    $f_{IN}$ = 10 MHz | +25°C | I | | 78 | | dBc |
|    $f_{IN}$ = 20 MHz | +25°C | I | | 78 | | dBc |
|    $f_{IN}$ = 47 MHz | +25°C | I | | 71 | | dBc |
|   Two–Tone Intermod Distortion (IMD) | | | | | | |
|    $f_{IN}$ = 10 MHz | +25°C | V | | 78 | | dBc |
|    $f_{IN}$ = 20 MHz | +25°C | V | | 78 | | dBc |
|    $f_{IN}$ = 47 MHz | +25°C | V | | 71 | | dBc |

NOTES
1. Target Specifications only for product development purposes.

## ORDERING GUIDE

| Model | Temperature Range | Package Option |
|---|---|---|
| AD9432BST-100 | –40°C to +85°C | |
| AD9432/PCB | +25°C | Evaluation Board |

*

## EXPLANATION OF TEST LEVELS

**Test Level**

I    100% production tested.

II   100% production tested at +25°C and sample tested at specified temperatures.

III  Sample tested only.

IV  Parameter is guaranteed by design and characterization testing.

V   Parameter is a typical value only.

VI  100% production tested at +25°C; guaranteed by design and characterization testing for industrial temperature range.

## ABSOLUTE MAXIMUM RATINGS*

$V_{DD}$ ............................................................................... +4 V
$V_{CC}$ ................................................................................ +6V
Analog Inputs ............................................ -0.5V to $V_{CC}$ + 0.5 V
Digital Inputs ............................................ -0.5V to $V_{DD}$ + 0.5 V
VREF IN ................................................... -0.5V to $V_{CC}$ + 0.5 V
Digital Output Current ......................................................... 20 mA
Operating Temperature ...................................... –55°C to +125°C
Storage Temperature ......................................... –65°C to +150°C
Maximum Junction Temperature ........................................ +175°C
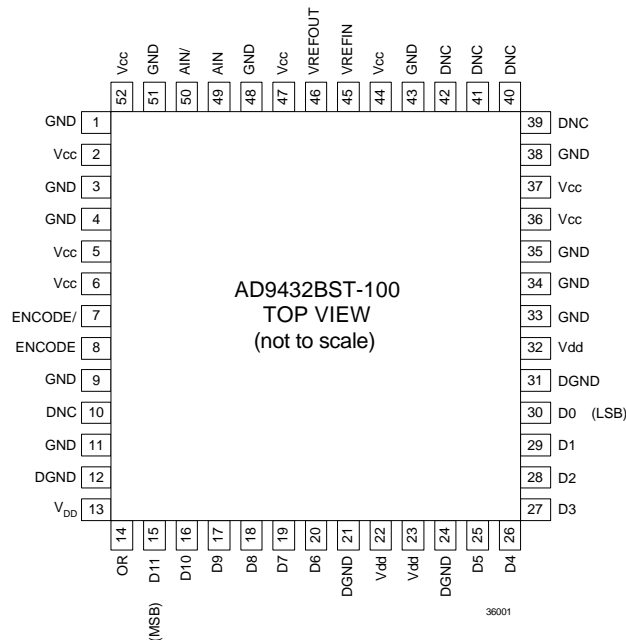Maximum Case Temperature ............................................. +150°C

* Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and 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.

# AD9432

## PIN DESCRIPTIONS

| Pin Number AD9432BST | Datasheet Name | Function |
|---|---|---|
| 1,3,4,9,11,33,34,35,38,43, 48,51 | GND | Analog Ground |
| 2,5,6,36,37,44,47,52 | Vcc | Analog Supply (+5V) |
| 7 | ENCODE/ | Encode Clock for ADC – Complementary |
| 8 | ENCODE | Encode Clock for ADC – True - (ADC samples on rising edge of ENCODE) |
| 10,39,40,41,42 | DNC | Do Not Connect |
| 14 | OR | Out of Range Output. |
| 15-20, 25-30 | D11-0 | Digital Output |
| 12,21,24,31 | DGND | Digital Output Ground |
| 13,22,23,32 | Vdd | Digital Output Power Supply (+3V) |
| 45 | VREFIN | Reference input for ADC (2.5V typical) |
| 46 | VREFOUT | Internal reference output (2.5V typical); bypass with 0.1uF to Vcc |
| 49 | AIN | Analog input – True |
| 50 | AIN/ | Analog input – Complementary |

## PIN CONFIGURATION

AD9432BST-100
TOP VIEW
(not to scale)

Top pins (52-40): Vcc 52, GND 51, AIN/ 50, AIN 49, GND 48, Vcc 47, VREFOUT 46, VREFIN 45, Vcc 44, GND 43, DNC 42, DNC 41, DNC 40

Left pins (1-13): GND 1, Vcc 2, GND 3, GND 4, Vcc 5, Vcc 6, ENCODE/ 7, ENCODE 8, GND 9, DNC 10, GND 11, DGND 12, V_DD 13

Right pins (39-27): DNC 39, GND 38, Vcc 37, Vcc 36, GND 35, GND 34, GND 33, Vdd 32, DGND 31, D0 (LSB) 30, D1 29, D2 28, D3 27

Bottom pins (14-26): OR 14 (MSB), D11 15, D10 16, D9 17, D8 18, D7 19, D6 20, DGND 21, Vdd 22, Vdd 23, DGND 24, D5 25, D4 26

36001

(To be finalized)