

AD1385

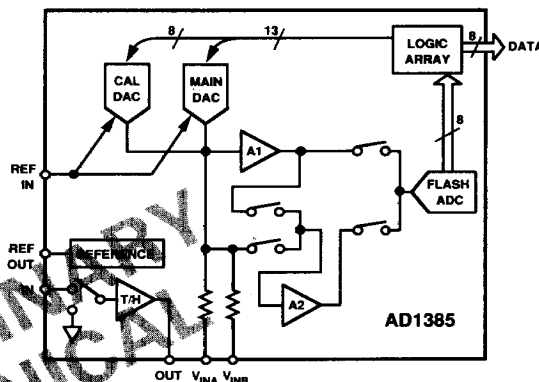
PRODUCT FEATURES

16-Bit Resolution
500 kHz Sampling Rate
Differential Linearity Autocalibration
Specified over -55°C to $+125^{\circ}\text{C}$ Range
SNR 90 dB @ 100 kHz (min)
THD -88 dB @ 100 kHz (min)
0.0006% FSR DNL (typ)
0.0015% FSR INL (typ)
 ± 5 , ± 10 V Bipolar Input Ranges
Zero Offset Autocalibration

APPLICATIONS

Medical Imaging
CAT
Magnetic Resonance
Radar
Vibration Analysis
Parametric Measurement Unit (ATE)
Digital Storage Oscilloscopes
Waveform Recorders
Analytical Instruments

FUNCTIONAL BLOCK DIAGRAM



PRODUCT DESCRIPTION

The AD1385 is a complete 500 kHz, 16-bit, sampling analog-to-digital converter contained in a single package. Its differential linearity autocalibration feature allows this high resolution, high speed converter to offer outstanding noise and distortion performance, as well as excellent INL and DNL specifications, over the full military temperature range. Autocalibration effectively eliminates DNL drift over temperature.

The AD1385 architecture includes a low noise, low distortion track/hold, a three pass digitally corrected subranging ADC, and linearity calibration circuitry. A complete linearity calibration requires only 15 ms. Precision thin-film resistors and a proprietary DAC contribute to the part's outstanding dynamic and static performance.

The AD1385 uses four power supplies, ± 5 V and ± 15 V, and an external 10 MHz clock. Power dissipation is nominally 2.76 W. Two user selectable bipolar input ranges, ± 5 V and ± 10 V, are provided. Careful attention to grounding and a single package make it easy to design PCBs to achieve specified performance.

The AD1385's pinout is nearly identical to that of the AD1382. Just two additional connections, to enable and monitor autocalibration, are required. This commonality provides an easy upgrade path to extend system performance and operating temperature range.

This information applies to a product under development. Its characteristics and specifications are subject to change without notice. Analog Devices assumes no obligation regarding future manufacture unless otherwise agreed to in writing.

AD1385—SPECIFICATIONS ($T_A = +25^{\circ}\text{C}$, $V_S = \pm 15\text{ V}$, $V_{DD} = +5\text{ V}$, $V_{SS} = -5\text{ V}$, 10 MHz External Clock, unless otherwise noted)

Parameter	AD1385KD			AD1385TD			Units
	Min	Typ	Max	Min	Typ	Max	
RESOLUTION	16			16			Bits
ANALOG INPUT							
Input Ranges		± 5 , ± 10			± 5 , ± 10		V
Input Impedance	2.45	2.5	2.55	2.45	2.5	2.55	k Ω
TRANSFER CHARACTERISTICS (Combined ADC/Track/Hold)							
Integral Nonlinearity ^{1, 2} , T_{MIN} to T_{MAX}		± 0.0015			± 0.0015		% FSR ³
Differential Nonlinearity ¹		± 0.0006	± 0.0015		± 0.0006	± 0.0015	% FSR
Drift, T_{MIN} to T_{MAX}		0.3			0.3		ppm/ $^{\circ}\text{C}$
Missing Codes, T_{MIN} to T_{MAX}			None			None	
Gain Error ⁴		± 0.05	± 0.15		± 0.05	± 0.15	% FSR
Drift, T_{MIN} to T_{MAX}		8	15		8	15	ppm/ $^{\circ}\text{C}$
Bipolar Zero ⁴		± 0.05	± 0.10		± 0.05	± 0.10	% FSR
Drift, T_{MIN} to T_{MAX}		5	15		5	15	ppm/ $^{\circ}\text{C}$
PSRR		± 0.006	± 0.10		± 0.006	± 0.10	% FSR/V
Noise		70			70		$\mu\text{V RMS}$
DYNAMIC CHARACTERISTICS ² $\pm 5\text{ V FSR}$, $V_{\text{IN}} = -0.4\text{ dB}$, T_{MIN} to T_{MAX}							
Sample Rate		500			500		kHz
Signal-to-Noise Ratio ⁵							
f = 5 kHz	90	93		90	93		dB
f = 100 kHz	90	92		90	92		dB
f = 200 kHz	88	91		88	91		dB
Peak Distortion							
f = 5 kHz	-90	-107		-90	-107		dB
f = 100 kHz	-88	-95		-88	-95		dB
f = 200 kHz	-82	-88		-82	-88		dB
Total Harmonic Distortion ⁶							
f = 5 kHz	-90	-105		-90	-105		dB
f = 100 kHz	-88	-95		-88	-95		dB
f = 200 kHz	-82	-88		-82	-88		dB
DYNAMIC CHARACTERISTICS ² $\pm 10\text{ V FSR}$, $V_{\text{IN}} = -0.4\text{ dB}$, T_{MIN} to T_{MAX}							
Sample Rate		500			500		kHz
Signal-to-Noise Ratio ⁵							
f = 5 kHz	90	95		90	95		dB
f = 100 kHz	90	94		90	94		dB
f = 200 kHz	88	93		88	93		dB
Peak Distortion							
f = 5 kHz	-90	-108		-90	-108		dB
f = 100 kHz	-80	-87		-80	-87		dB
f = 200 kHz	-74	-82		-74	-82		dB
Total Harmonic Distortion ⁶							
f = 5 kHz	-90	-105		-90	-105		dB
f = 100 kHz	-80	-87		-80	-87		dB
f = 200 kHz	-74	-82		-74	-82		dB
DIGITAL INPUTS ⁷							
Input Voltage			0.8			0.8	V
V_{IL}	2.25			2.25			V
V_{IH}			± 200			± 200	μA
Input Current							
Input Capacitance		2			2		pF
Start Command							
Setup Time, t_{SCS}	10			10			ns
Hold Time, t_{SCH}	10			10			ns
Autozero							
Setup Time, t_{AZS}	10			10			ns
Hold Time, t_{AZH}	20			20			ns
Calibrate Pulsewidth	20			20			ns
Clock							
Frequency	2.5		10	2.5		10	MHz
Duty Cycle	40		60	40		60	%
Aperture Delay ⁸		7			7		ns

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Parameter	AD1385KD			AD1385TD			Units
	Min	Typ	Max	Min	Typ	Max	
DIGITAL OUTPUTS ⁷							
Output Voltage							V
$V_{OL} @ I_{OL} = 3.2 \text{ mA}$		0.2	0.4		0.2	0.4	V
$V_{OH} @ I_{OH} = -3.2 \text{ mA}$	2.4	3.5		2.4	3.5		V
Output Capacitance		10			10		pF
Leakage, Outputs Disabled			±200			±200	μA
Data Valid							
Setup Time, t_{DVS}	75	125		75	125		ns
Hold Time, t_{DVH}	25	50		25	50		ns
Hold Command Time, t_H		1300			1300		ns
Hold Command Delay, t_{HD}		6			6		ns
Data Strobe Pulse Width, t_{DS}		200			200		ns
Data Strobe Delay, t_{DSD}		1650			1650		ns
Calibration Status Duration		15			15		ms
OUTPUT CODING	Complementary Offset Binary or Complementary Twos Complement						
INTERNAL REFERENCE							
Voltage	9.990		10.010	9.990		10.010	V
Current	2	5		2	5		mA
Drift		5			5	15	ppm/°C
TEMPERATURE RANGE, CASE							
Specified	0		+70	-55		+125	°C
Storage	-65		+150	-65		+150	°C
POWER REQUIREMENTS							
Specified Operating Range							
±V _S	4.25		15.75	14.25		15.75	V
+V _{DD}	4.75		5.25	4.75		5.25	V
-V _{SS}	-4.25		-4.75	-5.25		-4.75	V
Current Drains							
+V _S	52	80		52	80		mA
-V _S	48	75		48	75		mA
+V _{DD}	104	160		104	160		mA
-V _{SS}	148	200		148	200		mA
Power Dissipation	2.76	4.125		2.76	4.125		Watts

NOTES¹Integral linearity is inferred from FFTs. Differential linearity is derived from histograms.²Performance over temperature is specified within $\pm 15^\circ\text{C}$ of the temperature at which the last calibration was performed.³FSR = Full-Scale Range.⁴Adjustable to zero.⁵SNR excludes harmonics 2-9 of the fundamental.⁶THD includes harmonics 2-9 of the fundamental.⁷Refer to Figures 17, 18 and 24. Guaranteed over operating temperature range, not 100% production tested.⁸Aperture delay is the time from the rising edge on the Hold Command Input to the opening of the switch in the Track/Hold.

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ABSOLUTE MAXIMUM RATINGS*

+V _S to AGND	18 V
-V _S to AGND	-18 V
V _{DD} to PGND	7 V
V _{SS} to PGND	-7 V
AGND to PGND	±0.3 V
Analog Inputs	±V _S
Reference Input	0 V to +11 V
Digital Inputs	-0.3 V to V _{DD} + 0.3 V
Output Short Circuit Duration	
Reference Output	Indefinite
Track/Hold Output	1 sec
Digital Outputs	1 sec for Any One Output
Case Temperature (Operating)	-55°C to +125°C
Storage Temperature	-65°C to +150°C

*Stresses greater than 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 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.

ORDERING GUIDE

Model	Temperature Range (Case)	Package Option
AD1385KD	0°C to +70°C	DH-48A
AD1385TD	-55°C to +125°C	DH-48A
AD1385TD/883B	-55°C to +125°C	DR-48A

*DH-48A = Bottom Brazed Ceramic DIP. For outline information see Package Information section.

AD1385 PIN CONNECTIONS

The AD1385 is housed in a 48-pin bottom-brazed ceramic bath-tub package. The pinout is as follows:

Pin	Function	Pin	Function
1	CLOCK IN	48	V _{DD2} (+5 V POWER)
2	POWER GROUND	47	POWER GROUND
3	B1/B9 (MSB)	46	V _{SS2} (-5 V POWER)
4	B2/B10	45	AUTOZERO
5	B3/B11	44	B1 SELECT
6	B4/B12	43	POWER GROUND
7	B5/B13	42	POWER GROUND
8	B6/B14	41	CAL
9	B7/B15	40	GAIN ADJUST
10	B8/B16 (LSB)	39	+10 V REFERENCE OUT
11	V _{DD1} (+5 V SIGNAL)	38	-V _{S1} (-15 V)
12	POWER GROUND	37	SIGNAL GROUND
13	V _{SS1} (-5 V SIGNAL)	36	+V _{S1} (+15 V)
14	SIGNAL GROUND	35	SIGNAL GROUND
15	DATA STROBE	34	DNC
16	HI/LO BYTE SELECT	33	DNC
17	OE DATA ENABLE	32	+10 V REFERENCE IN
18	START CONVERT	31	V _{IN B}
19	HOLD COMMAND OUT	30	V _{IN A}
20	SIGNAL GROUND	29	OFFSET ADJUST
21	+V _{S2} (+15 V)	28	CAL STATUS
22	HOLD COMMAND IN	27	TRACK/HOLD OUTPUT
23	-V _{S2} (-15 V)	26	SIGNAL GROUND
24	POWER GROUND	25	TRACK/HOLD INPUT

DNC = DO NOT CONNECT

CAUTION

ESD (electrostatic discharge) sensitive device. The digital control inputs are diode protected; however, permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. The protective foam should be discharged to the destination socket before devices are removed.



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