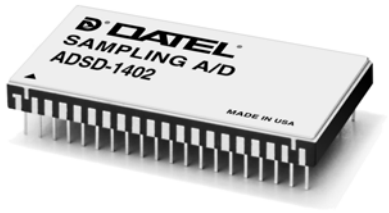
ADSD-1402
Dual, 14-Bit, 2MSPS Sampling A/D Converter

FEATURES
- **14-bit resolution; 2MSPS sampling rate**
- **Functionally complete; ±5V input range**
- **No missing codes over full temperature range**
- **Edge-triggered; No pipeline delays**
- **±5V supplies, 0.725 Watts**
- **Small, 40-pin, side-brazed, ceramic TDIP**
- **79dB SNR, –80dB THD**
- **Ideal for both time and frequency domain applications**
- **Out-of-range indicator**



GENERAL DESCRIPTION

DATEL's ADSD-1402 is a functionally complete, dual 14-bit, 2MSPS, sampling A/D converter. Its standard, 40-pin, triple-wide ceramic DIP contains two fast-settling sample/hold amplifiers, two 14-bit A/D converters, multiplexed output buffers, a precision reference, and all the timing and control logic necessary to operate from either two or a single start convert pulse.

The ADSD-1402 is optimized for wideband frequency-domain applications and is fully FFT tested. The ADSD-1402 requires only ±5V supplies and typically consumes 0.725 Watts. Models are available in either commercial 0 to +70°C or military -55 to +125°C operating temperature ranges.

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	INPUT A	40	INPUT B
2	+5VA	39	+5VA
3	ANALOG GROUND	38	ANALOG GROUND
4	GAIN A	37	GAIN B
5	OFFSET A	36	OFFSET B
6	RANGE	35	N/C
7	2.5V REF	34	N/C
8	ANALOG GROUND	33	ANALOG GROUND
9	–5V	32	–5V
10	$\overline{\text{ENABLE A}}$	31	$\overline{\text{ENABLE B}}$
11	START A	30	START B
12	+5VD	29	$\overline{\text{EOC}}$
13	BIT 14 (LSB)	28	BIT 1 (MSB)
14	BIT 13	27	BIT 2
15	BIT 12	26	BIT 3
16	BIT 11	25	BIT 4
17	BIT 10	24	BIT 5
18	BIT 9	23	BIT 6
19	BIT 8	22	BIT 7
20	DGND	21	DGND

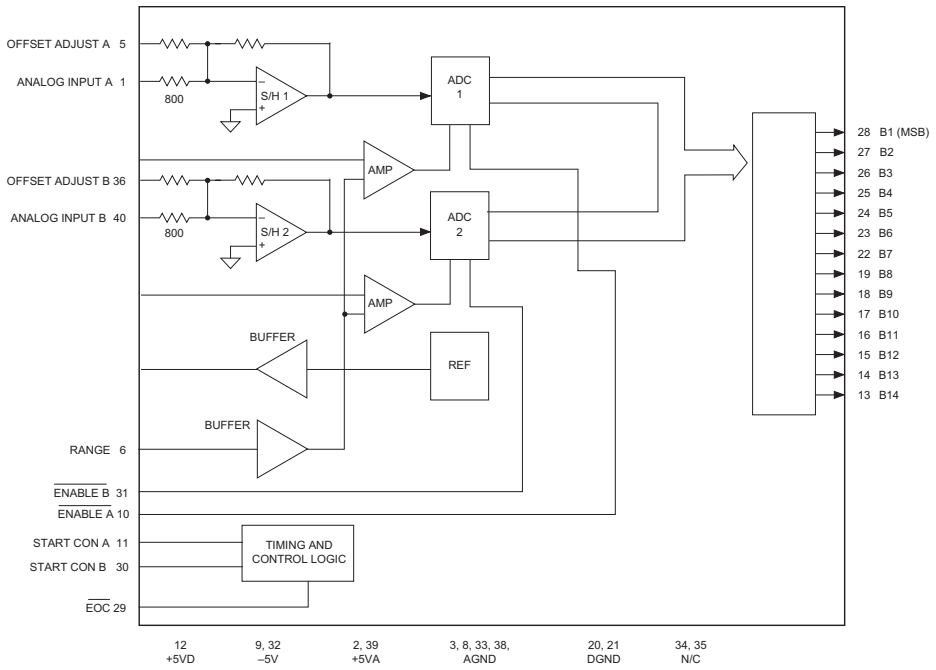


Figure 1. ADSD-1402 Functional Block Diagram

ABSOLUTE MAXIMUM RATINGS

PARAMETERS	LIMITS	UNITS
+5V Supply (Pins 2, 12, 39)	0 to +6	Volts
–5V Supply (Pins 9, 32)	0 to –6	Volts
Digital Inputs (Pins 3, 10, 11, 31)	–0.3 to +V_{DD} +0.3	Volts
Analog Input (Pins 1, 40)	±7	Volts
Lead Temp. (10 seconds)	+300	°C

FUNCTIONAL SPECIFICATIONS

(T_A = +25°C, +V_{DD} = +5V, Vee = –5V, 2MSPS sampling rate,Vin = ±5V and a minimum 7 minute warmup unless otherwise specified.)

ANALOG INPUTS	MIN.	TYP.	MAX.	UNITS
Input Voltage Range	—	±5V	—	Volts
Input Impedence	—	800	—	Ω
Input Capacitance	—	7	15	pF
DIGITAL INPUTS				
Logic Levels				
Logic "1"	+2.0	—	—	Volts
Logic "0"	—	—	+0.8	Volts
Logic Loading "1"	—	—	+5	µA
Logic Loading "0"	—	—	–600	µA
PERFORMANCE				
Integral Non-Linearity				
+25°C(fin=10kHz)	—	±1	—	LSB
0 to +70°C	—	±1	—	LSB
–55 to +125°C	—	±2	—	LSB
Differential Non-Linearity				
(f_{in} = 10kHz)				
+25°C	–0.99	±0.5	+1.75	LSB
0 to +70°C	–0.99	±0.5	+1.75	LSB
–55 to +125°C	–0.99	±0.75	+1.75	LSB
Offset Error				
+25°C (see Figure 3)	—	±0.25	±0.5	%FSR
0 to +70°C	—	±0.25	±0.5	%FSR
–55 to +125°C	—	±0.5	±0.8	%FSR
Gain Error				
+25°C (see Figure 3)	—	±0.3	±0.6	%FSR
0 to +70°C	—	±0.3	±0.6	%FSR
–55 to +125°C	—	±0.6	±0.8	%FSR
No Missing Codes (f_{in} = 975kHz)	–55 to +125°C			
14 Bits				
Resolution	14 Bits			
OUTPUTS				
Output Coding	Offset Bin.			
Logic Level				
Logic "1"	+2.4	—	—	Volts
Logic "0"	—	—	+0.4	Volts
Logic Loading "1"	—	—	–160	µA
Logic Loading "0"	—	—	+6.4	mA
Internal Reference				
Voltage, +25°C	+2.45	+2.5	+2.55	Volts
0 to +70°C	+2.45	+2.5	+2.55	Volts
External Current	—	—	5	mA

DYNAMIC PERFORMANCE	MIN.	TYP.	MAX.	UNITS
Total Harm. Distort. (–0.5dB)				
dc to 500kHz	—	–79	–72	dB
500kHz to 1MHz	—	–73	–70	dB
Signal-to-Noise Ratio				
(w/o distortion, –0.5dB				
dc to 500kHz	75	79	—	dB
500kHz to 1MHz	75	78	—	dB
Signal-to-Noise Ratio				
(and distortion, –0.5dB)				
dc to 500kHz	71	76	—	dB
500kHz to 1MHz	69	73	—	dB
Spurious Free Dyn. Range ①				
dc to 500kHz	—	–85	–70	dB
500kHz to 1MHz	—	–74	–70	dB
Two-tone IMD				
Distortion (f_{in} = 975kHz,				
fs = 2.0Mhz, –0.5dB)	–76	—	—	dB
Input Bandwidth (–3dB)				
Small Signal (–20dB input)	—	16	—	MHz
Large Signal (–0.5dB input)	—	12	—	MHz
Slew Rate	—	±250	—	V/µs
Aperture Delay Time	—	—	±10	ns
Aperature Uncertainty	—	—	5	ps
S/H Acq. Time, (to ±0.003%FSR)				
Step input	—	100	150	ns
Conversion Rate	2	—	—	MHz
Feedthrough Rejection				
(f_{in} = 1MHz)	—	85	—	dB
Noise	—	250	—	µVrms
POWER REQUIREMENTS				
Power Supply Ranges				
–5V Supply	–5.25	–5	–4.75	Volts
+5V Supply	+4.75	+5.0	+5.25	Volts
Power Supply Currents				
–5V Supply	–80	–70	—	mA
+5V Supply	—	+50	+70	mA
Power Dissipation	—	0.6	0.725	Watts
Power Supply Rejection	—	—	±0.01	%FSR%V
PHYSICAL/ENVIRONMENTAL				
Oper. Temp. Range, Ambient				
ADSD-1402MC	0	—	+70	°C
ADSD-1402MM	–55	—	+125	°C
Storage Temperature Range	–65	—	+150	°C
Package Type	40-pin, metal-sealed, ceramic TDIP			

Footnote:

① Same specification as In-Band Harmonics and Peak Harmonics.

TECHNICAL NOTES

1. Rated performance requires using good high-frequency circuit board layout techniques. Connect the digital and analog grounds to one point, the analog ground plane beneath the converter. Due to the inductance and resistance of the power supply return paths, return the analog and digital ground separately to the power supplies.

CALIBRATION PROCEDURE

1. Connect the converter per Figure 3. Apply a pulse of 100 nanoseconds minimum to START CONVERT (pin 11) at a rate of 200kHz. This rate is chosen to reduce flicker if LED's are used on the outputs for calibration purposes.

2. **Zero (Offset) Adjustments**

   Apply a precision voltage reference source between ANALOG INPUT A (pin 1) and SIGNAL GROUND (pin 3), then adjust the reference source output per Table 2. Adjust trimpot R2 until the code flickers equally between 10 0000 0000 0000 and 10 0000 0000 0001.

3. **Full-Scale (Gain) Adjustments**

   Set the output of the voltage reference used in step 2 to the value shown in Table 2.

Table 2. Offset and Gain Adjustments

Input Range	Offset Adjust +1/2 LSB	Gain Adjust FS – 1½ LSB
±5V	+0.000305V	+4.999085V

   Adjust the gain trimpot R1 until the output code flickers equally between 11 1111 1111 1110 and 11 1111 1111 1111

4. Repeat above steps for Analog Input B (Pin 40). Use trimpot R3 for the zero (Offset) adjustment and trimpot R4 for the Full-Scale (Gain) adjustment.

5. To confirm proper operation of the device, vary the precision reference voltage source to obtain the output coding listed in Table 3.

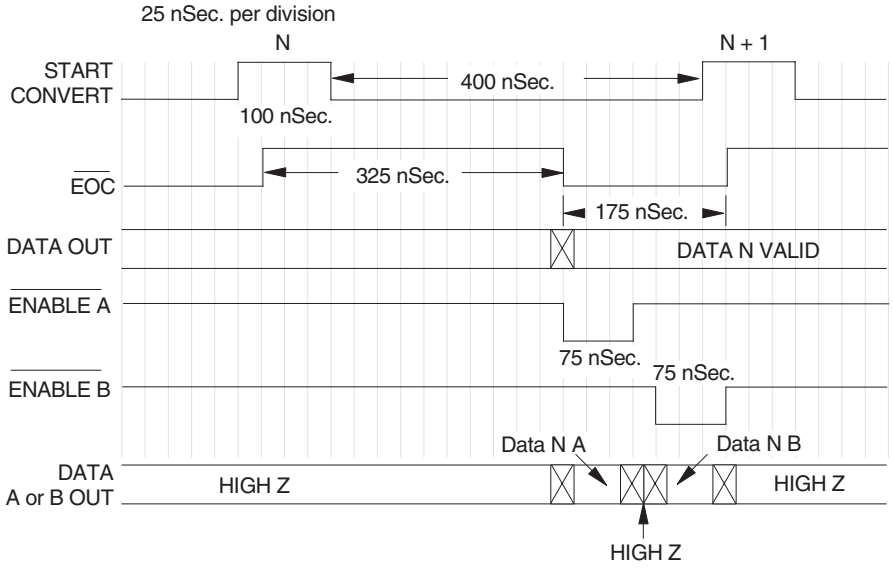
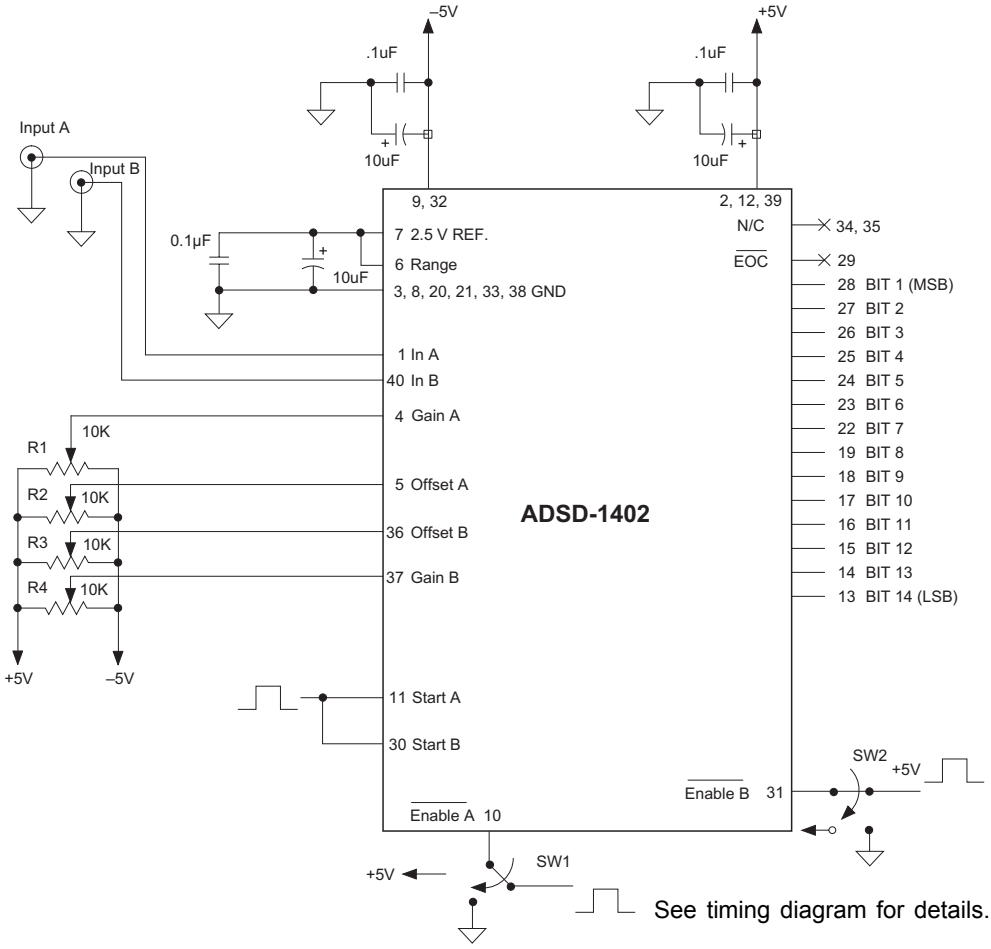


Figure 2. ADSD-1402 Timing Diagram

Table 3. Output Coding

OUTPUT CODING MSB LSB	INPUT RANGE ±5V	BIPOLAR SCALE
11 1111 1111 1111	+4.999390	+FS – 1LSB
11 1000 0000 0000	+4.250000	+3/4FS
11 0000 0000 0000	+2.500000	+1/2FS
10 0000 0000 0000	±0.000000	0
01 0000 0000 0000	–2.500000	–1/2FS
00 1000 0000 0000	–4.250000	–3/4FS
00 0000 0000 0001	–4.999390	–FS+1LSB
00 0000 0000 0000	–5.000000	–FS



Notes:

① Recommended to use same supply source for +5 Analog and +5 Digital. Try using as clean of a supply as possible (Bypass caps., 10uF and .1uF).

② Outputs are enabled by either turning $\overline{\text{ENABLE}}$ A (Pin 10) or $\overline{\text{ENABLE}}$ B (Pin 31) low for prespective analog inputs A or B. A high on ENABLE A or ENABLE B results in disabling the output bus (High Z).

Figure 3. ADSD-1402 Connection Diagram

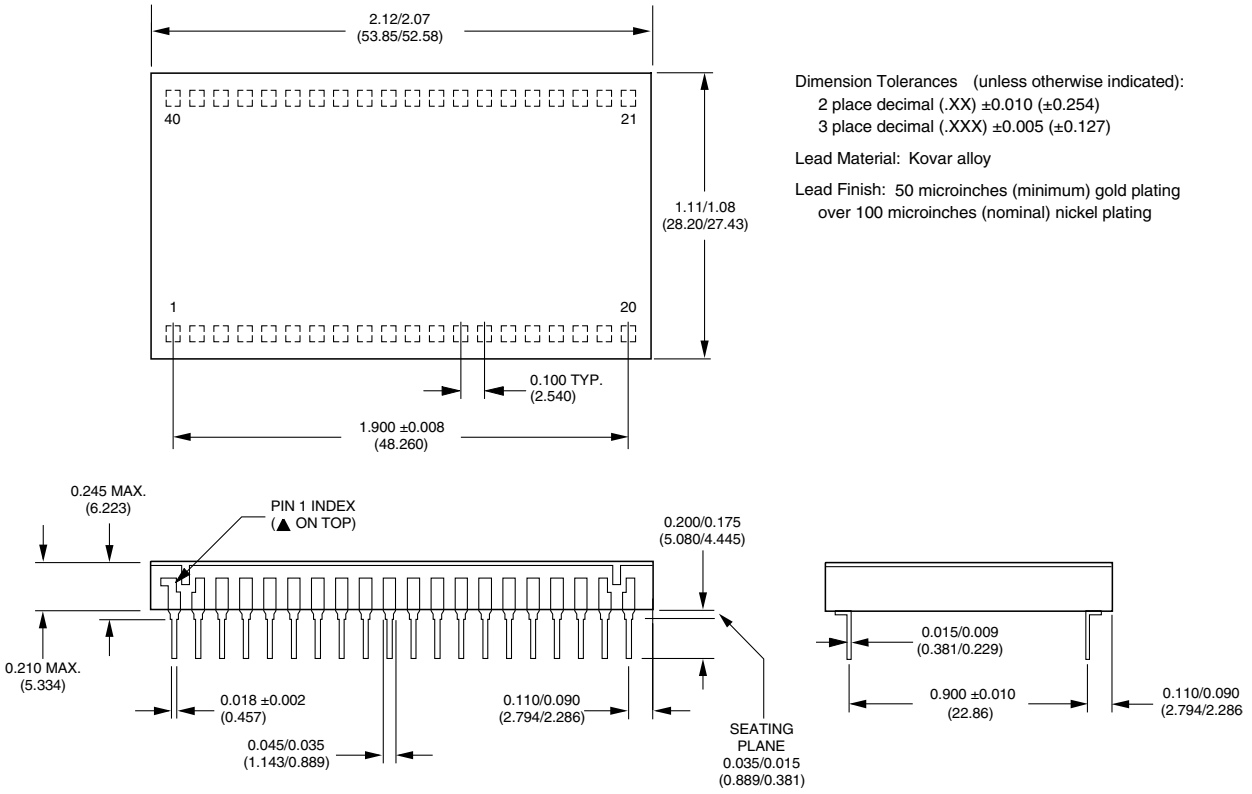
THERMAL REQUIREMENTS

The ADSD-1402 sampling A/D converter is fully characterized and specified over the commercial operating temperature (ambient) range of 0 to +70°C (MC suffix) and military temperature range of –55 to +125°C (MM suffix). All room-temperature (T_A = +25°C) production testing is performed without the use of heat sinks or forced-air cooling. Thermal impedance figures for each device are listed in their respective specification tables.

These devices do not normally require heat sinks, however, standard precautionary design and layout procedures should be used to ensure devices do not overheat. The ground and power planes beneath the package, as well as all pcb signal runs to and from the device, should be as heavy as possible to help conduct heat away from the package. Electrically-insulating, thermally-conductive "pads" may be installed underneath the package. Devices should be soldered to boards rather than "socketed", and of course, minimal air flow over the surface can greatly help reduce the package temperature.

In more severe ambient conditions, the package/junction temperature of a given device can be reduced dramatically (typically 35%) by using one of DATEL's HS Series heat sinks. See Ordering Information for the assigned part number. Request DATEL Application Note AN-8, "Heat Sinks for DIP Data Converters", or contact DATEL directly, for additional information.

MECHANICAL DIMENSIONS INCHES (mm)



Dimension Tolerances (unless otherwise indicated):
2 place decimal (.XX) ±0.010 (±0.254)
3 place decimal (.XXX) ±0.005 (±0.127)

Lead Material: Kovar alloy

Lead Finish: 50 microinches (minimum) gold plating over 100 microinches (nominal) nickel plating

ORDERING INFORMATION

MODEL NUMBER	OPERATING TEMP. RANGE
ADSD-1402MC	0 to +70°C
ADSD-1402MM	–55 to +125°C

ACCESSORIES

HS-40 Heat Sink for all ADSD-1402 models

Contact DATEL for high-reliability versions

INNOVATION and EXCELLENCE

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