

FEATURES

- 12-bit resolution
- 1MHz sampling rate
- Extended temperature -55°C to +200°C
- No missing codes
- Functionally complete
- 28-pin side braze DDIP or SMT package
- Low power, 480mW
- Operates from $\pm 5V$ supplies
- Edge-triggered; no pipeline delays
- 0 to 5V and $\pm 2.5V$ input range
- Qualified and characterized for more than 1,000-hour operating life

PRODUCT OVERVIEW

The ADS-1201HT series of Harsh Environment Analog to Digital converters are developed and manufactured using processes that originate with DATEL's MIL-PRF-38534 standards and controls. These standards have been extended and increased to meet the demanding -55 to +200°C operating temperature range.

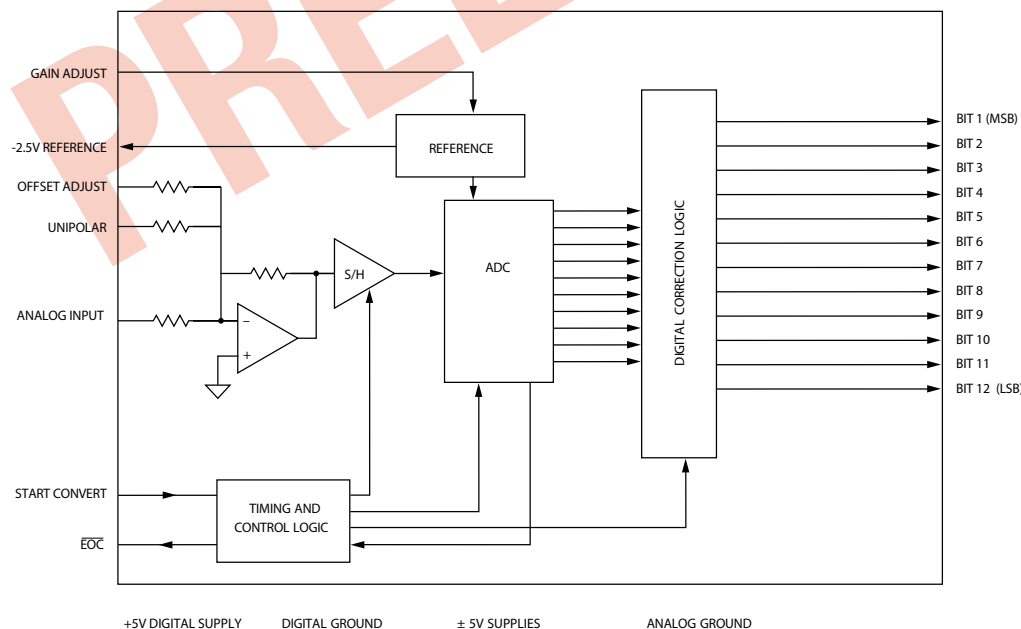
Housed in a small 28-pin DDIP or SMT hermetically sealed ceramic package, the ADS-1201HT is fabricated on a thick film ceramic (96% alumina), with low temperature drift thin film resistors on 96% alumina and 250°C rated capacitors. All of the ultrasonic and thermo-sonically wire bonded high-temperature ICs are qualified and characterized from -55 to +200°C.

This family of extended temperature converters are designed and qualified to provide more than 1,000 hours of high level of confidence operation.

The ADS-1201HT contains a fully functional 1 MHz A/D converter with a fast settling sample-and-hold, a precise reference, and offset and gain adjustment capabilities. Requiring only $\pm 5V$ supplies, this model is offered with both a 0 to 5V and $\pm 2.5V$ input range (contact the factory for variations on input range or input circuitry).

Applications Include: down-hole and geothermal exploration, hot engine control, undersea cabling, harsh environment data acquisition systems, aerospace.

BLOCK DIAGRAM



INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	-2.5V Reference	28	Offset Adjustment
2	Unipolar	27	Gain Adjustment
3	Analog Input	26	+5V Digital Supply
4	Analog GND	25	Digital GND
5	+5V Supply	24	Digital GND
6	Analog GND	23	NC
7	-5V Supply	22	B12 (LSB)
8	Digital GND	21	B11
9	EOC	20	B10
10	Start Convert	19	B9
11	B1 (MSB)	18	B8
12	B2	17	B7
13	B3	16	B6
14	B4	15	B5

Figure 1. ADS-1201HT Functional Block Diagram

ABSOLUTE MAXIMUM RATINGS

Parameters	Min.	Typ.	Max.	Units
-5V Supply (Pin 7)	-6	—	+0.3	Volts
+5V Supply (Pin 5)	-0.3	—	+6	Volts
+5VD Supply (Pin 726)	-0.3	—	+6	Volts
Digital Input (Pin 10)	-0.3	—	Vdd+0.3V	Volts
Analog Input (Pin 3)	-6	—	+6	Volts
Lead Temperature	—	—	300	°C

FUNCTIONAL SPECIFICATIONS

The following specifications apply over the operating temperature range, under the following conditions: +5VA = +5V, 5VD = +5V, -5VA = -5V, sample rate = 1.0MHz.

Analog Input	Min.	Typ.	Max.	Units
Input Voltage Range				
Unipolar	0	—	5.0	Volts
Bipolar	-2.5	—	2.5	Volts
Input Resistance	—	1000	—	Ohms
Input Capacitance	—	4	—	pF
Digital Inputs				
Logic Levels				
Logic 1 (Start Convert)	+2.4	—	—	Volts
Logic 0 (Start Convert)	—	—	+0.8	Volts
Logic Loading				
Logic 1	—	—	+10	μA
Logic 0	—	—	-10	μA
Digital Outputs				
Logic Levels				
Logic 1 (0.5mA)	4.5	5.0	—	Volts
Logic 0 (0.5mA)	—	—	+0.4	Volts
Logic Loading				
Logic 1	—	10	—	mA
Logic 0	—	-10	—	mA
Capacitive Loading			20	pF
Static Performance				
Differential Nonlinearity				
+25°C	±0.2	±0.12	±0.2	LSB
-55 to +200°C	±0.8	±0.4	±0.8	LSB
Integral Nonlinearity				
+25°C	—	±0.2	—	LSB
-55 to +200°C	—	±0.4	±0.8	LSB
Guaranteed No Missing Codes				
-55 to +200°C	12	—	—	LSB
Unipolar Offset				
+25°C			0.02	%FSR
-55 to +200°C			0.3	%FSR
Bipolar Zero				
+25°C			0.02	%FSR
-55 to +200°C			0.15	%FSR
Gain Error				
+25°C		0.02		%FSR
-55 to +200°C		1.5		%FSR
Unipolar Full Scale Absolute Accuracy				
+25°C		0.04		%FSR
-55 to +200°C		1.6		%FSR

Static Performance, continued	Min.	Typ.	Max.	Units
Bipolar Full Scale Absolute Accuracy				
+25°C		0.04		%FSR
-55 to +200°C		1.8		%FSR
Reference				
+25°C	-2.45	-2.5	-2.55	Volts
-55 to +200°C			1.5	%FSR
Dynamic Performance				
SNR with Distortion				
+25°C		72		dB
-55°C		66		dB
+200°C		60		dB
SNR without Distortion				
+25°C		73		dB
-55°C		68		dB
+200°C		62		dB
THD				
+25°C		-78		dB
-55°C		-76		dB
+200°C		-65		dB
SFDR				
+25°C		-78		dB
-55°C		-76		dB
+200°C		-70		dB
Input Bandwidth (-3dB)				
Small Signal		7.5		MHz
Large Signal		7.2		MHz
Slew Rate		113		V/us
Noise		427		uVrms
Power Requirements				
Power Supply Ranges				
+5VD Supply	+ 4.75	+ 5.0	+5.25	Volts
+5V Supply	+4.75	+ 5.0	+5.25	Volts
-5V Supply	- 4.75	- 5.0	- 5.25	Volts
Power Supply Currents				
+5V Supply		29	33	mA
-5V Supply		59	66	mA
+5VD Supply		8.5	10	mA
Power Dissipation		480	520	mW
Power Supply Rejection		0.015	0.025	% / %

TECHNICAL NOTES

- Obtaining fully specified performance from the ADS-1201HT requires careful attention to pc-card layout and power supply decoupling. The device's analog and digital ground systems are connected to each other internally. For optimal performance, tie all ground pins (4,6,8,24,25) directly to a large analog ground plane beneath the package.

Bypass ±5V and +5VD supplies to ground with 1uF and 0.1uF capacitors. Locate the bypass capacitors as close to the unit as possible.
- The ADS-1201HT achieves its specified accuracies without the need for external calibration. If required, the device's small initial offset and gain errors can be reduced to zero using a low cost bipolar DAC. When using offset and gain-calibration hardware, make adjustments after device has reached thermal equilibrium. To avoid interaction, always adjust offset before gain.

FULL-SCALE AND OFFSET ADJUSTMENTS

Figure 2 shows a calibration circuit to null offset errors in the ADS-1201HT. The offset adjustment range is approximately +7.2 codes per volt applied to the Offset Adjust pin. The gain adjustment range is approximately +26 codes per volt applied to the Gain Adjust pin. An external resistor can be added in series with the output of the calibration DACs and the adjustment pins to reduce the codes per volt sensitivity adjustment range. For example, an external 50k resistor in series with the offset adjust will result in a +3.6 codes per volt offset adjustment range, and an external 200k resistor in series with the gain adjustment will result in a +13 code per volt gain adjustment range.

Offset and gain adjustments should be made after the ADS-1201HT has reached thermal equilibrium.

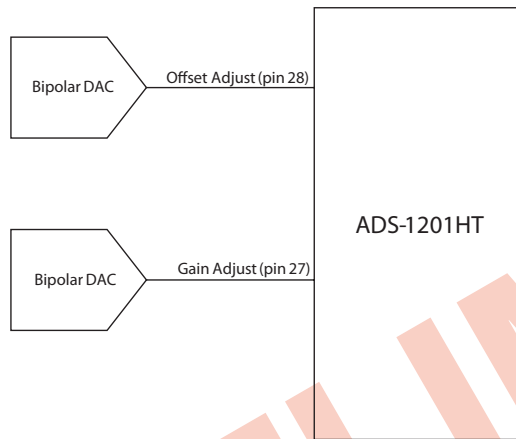


Figure 2. ADS-1201HT Calibration Circuit

ZERO/OFFSET ADJUST

Offset adjustments must be made prior to gain adjustment.

Apply +0.610mV to the Analog Input and adjust the offset DAC until the output flickers between 0000 0000 0000 and 0000 0000 0001 for unipolar and between 1000 0000 0000 and 1000 0000 0001 for bipolar.

GAIN ADJUST

For unipolar applications: apply +4.99817 to the Analog Input and adjust the gain DAC until the output flickers between 0111 1111 1111 and 0111 1111 1110.

For bipolar applications: apply +2.49817 to the Analog Input and adjust the gain DAC until the output flickers between 0111 1111 1111 and 0111 1111 1110.

Table 1. Bipolar Two's Complement Coding: 1LSB = 1.22mV

OUTPUT CODING		INPUT RANGE ±2.5V	BIPOLAR SCALE
MSB	LSB		
0111	1111 1111	+2.49878	+FS – 1 LSB
0110	0000 0000	+1.87500	+3/4 FS
0100	0000 0000	+1.25000	+1/2 FS
0000	0000 0000	0.000000	0
1100	0000 0000	-1.25000	-1/2 FS
1010	0000 0000	-1.87500	-3/4 FS
1000	0000 0001	-2.49878	-FS +1 LSB
1000	0000 0000	-2.50000	-FS

Table 2. Unipolar Two's Complement Coding: 1LSB = 1.22mV

OUTPUT CODING		INPUT RANGE 0 to +5V	UNIPOLAR SCALE
MSB	LSB		
0111	1111 1111	+4.99878	+FS – 1 LSB
0110	0000 0000	+4.37500	+3/4 FS
0100	0000 0000	+3.75000	+1/2 FS
0000	0000 0000	+2.50000	+1/2 FS
1100	0000 0000	+1.25000	-1/2 FS
1010	0000 0000	+0.62500	-3/4 FS
1000	0000 0001	+0.00122	-FS +1 LSB
1000	0000 0000	0	-FS

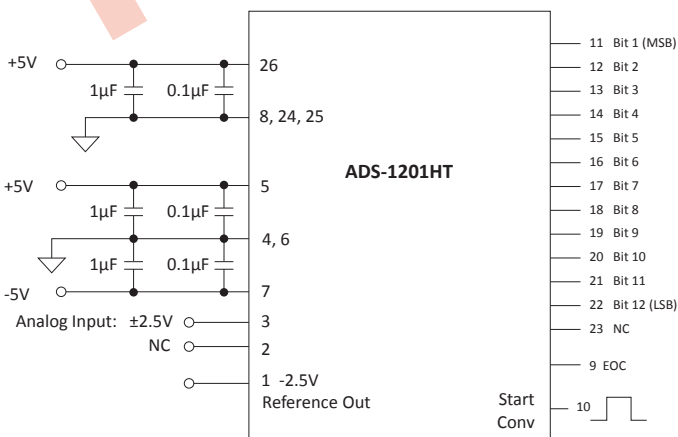


Figure 3. Bipolar Typical Wiring Diagram

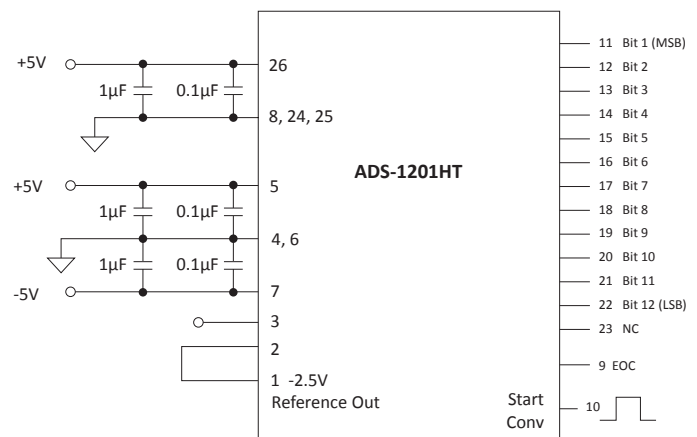


Figure 4. Unipolar Typical Wiring Diagram

TIMING

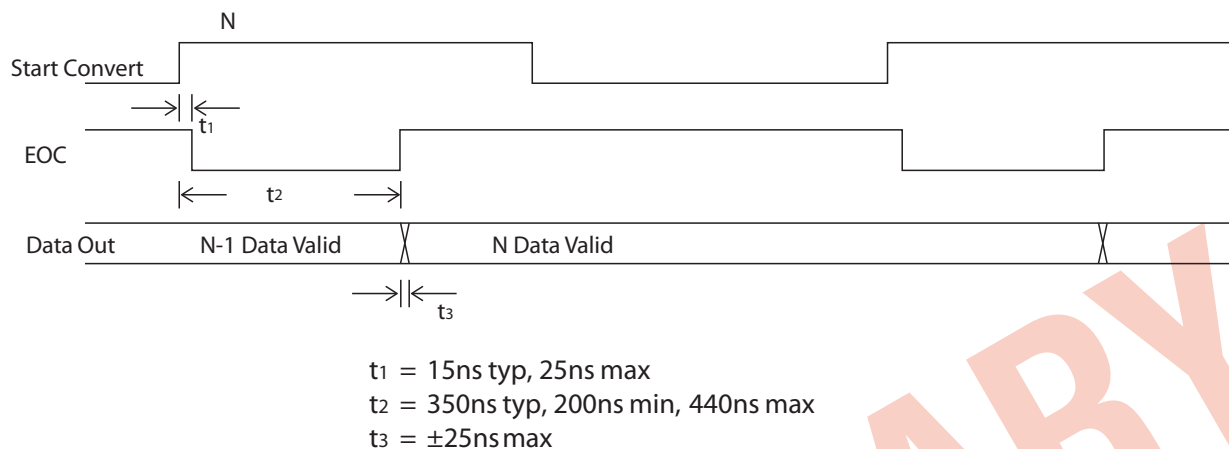
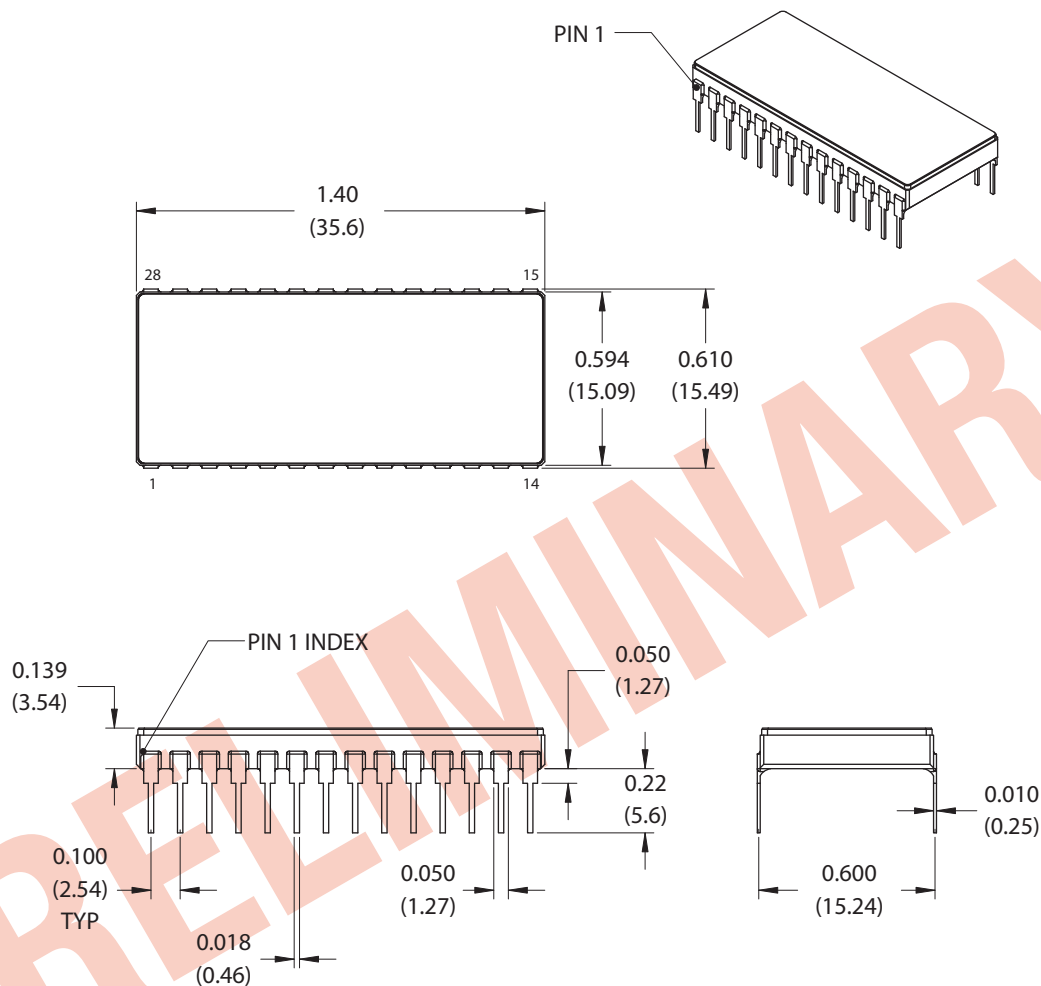


Figure 5. ADS-1201HT Timing Diagram

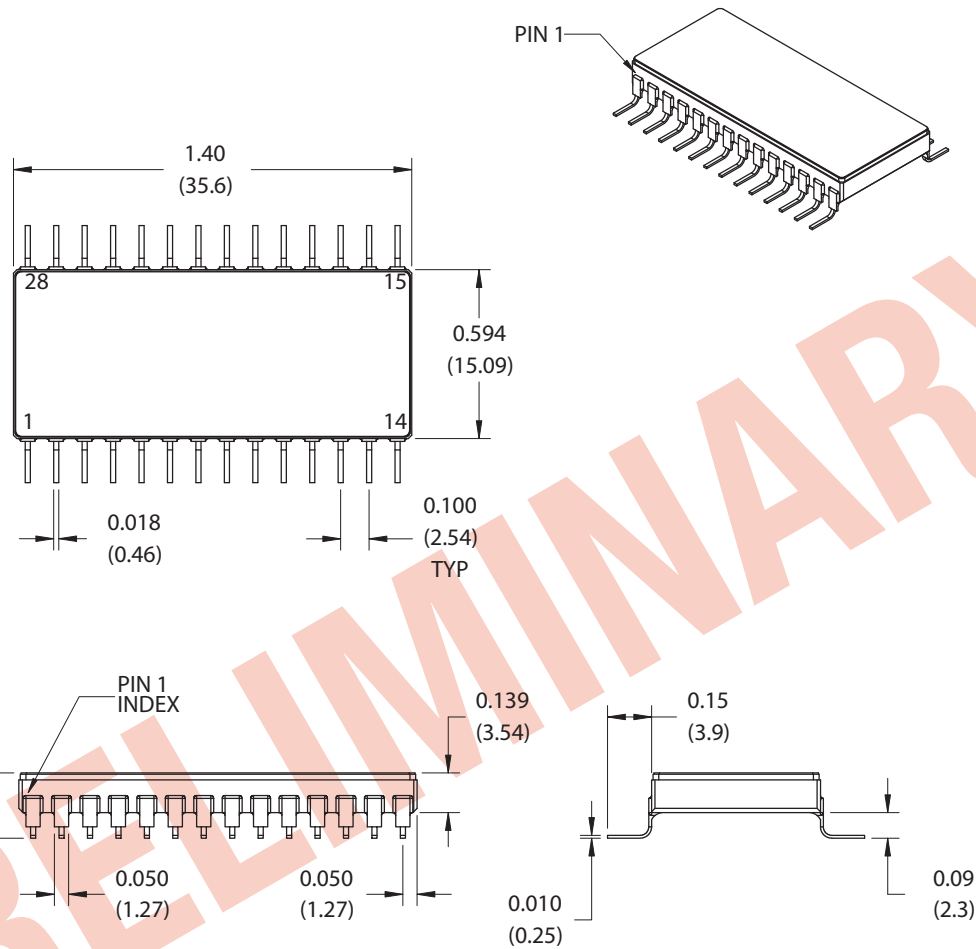
Timing Notes:

1. Start Convert frequency = 1MHz
2. The ADS-1201HT is an edge-triggered device. All internal operations are triggered by the rising edge of the start convert pulse, which may be as narrow as 20ns. All production testing is performed with a 1MHz 50% duty-cycle clock.

MECHANICAL DIMENSIONS, 28-PIN CERAMIC DIP PACKAGE – inches (mm)



MECHANICAL DIMENSIONS, 28-PIN SURFACE MOUNT PACKAGE – inches (mm)



ORDERING INFORMATION			
MODEL NUMBER	OPERATING TEMP. RANGE	ANALOG INPUT	PACKAGE
ADS-1201MHT	-55 to +200°C	Bipolar ($\pm 2.5V$)	DIP
		Unipolar (0 to +5V)	
ADS-1201GHT	-55 to +200°C	Bipolar ($\pm 2.5V$)	SMT
		Unipolar (0 to +5V)	

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