



ANALOG-TO-DIGITAL CONVERTERS VOL. I, 10-201

SPECIFICATIONS (typical @ +25°C with nominal voltages unless otherwise noted)

MODEL	UNITS	HAS-0802	HAS-1002	HAS-1202
RESOLUTION				
LSB Weight	BITS	8	10	12
	% Full Scale	0.4	0.1	0.025
	mV	40	10	2.5
RELATIVE ACCURACY (INCLUDING LINEARITY)	% Full Scale	0.05	0.025	0.012
Quantization Error	LSB	±1/2	*	*
LINEARITY VS. TEMPERATURE	ppm/°C	3	*	*
(No Missing Codes over Temperature Range)				
INPUT OFFSET VOLTAGE				
Initial (Trimable to Zero)	mV	10	*	*
Zero Offset vs. Temperature	μV/°C	15	*	*
Bipolar Offset vs. Temperature	μV/°C	100	*	*
GAIN ERROR				
Initial (Trimable to Zero)	% Full Scale	0.1	*	*
Gain vs. Temperature	ppm/°C	30	*	*
INPUT				
Ranges (Full Scale)				
"Built-In" Standard Unipolar	V ±0.1%	+10.24	*	*
Bipolar	V ±0.05%	±5.12	*	*
Resistor Programmable (See Figure 3)	V, 0 to:	+5, +7.5, +15, +20, ±2.5, ±3.75, ±7.5, ±10	*	*
Impedance	Ω min	1000	*	*
Overvoltage	V	Two Times Full Scale + or -		
CONVERSION TIME (COMPLETE CYCLE TIME)	μs max (typ)	1.5 (1.2)	1.7 (1.4)	2.8 (2.2)
CONVERSION RATE	kHz max	667	588	357
ENCODE COMMAND – TTL LOGIC INPUT				
Logic Levels (Positive Logic)	V	"0" = 0 to +0.4, "1" = +2 to +5		
Function ¹		Logic "1" Resets Converter		
Loading		Logic "0" Starts Conversion		
		1 Standard TTL Load:		
		"0" = -1.6mA, max		
		"1" = 40μA, max		
Pulse Width	ns min	100	*	*
Repetition Rate		0 to Maximum Conversion Rate		
LOGIC OUTPUTS				
Data Ready (DR)				
Function		Signals conversion is complete when low. After DR goes low, data is valid. A new conversion may be initiated at this time. DR may be used to strobe data into external register if adequate register setup time is allowed. See Figure 1		
Timing		5 Standard TTL Loads, max		
Loading		8-, 10-, or 12-bits parallel data. Valid from time DR output goes low until 20ns after receipt of next encode command.		
Parallel Data		TTL Compatible:		
Format		"0" = 0V to +0.4V		
		"1" = +2.4V to +5V		
Logic Levels		Will drive up to 5 Standard TTL Loads or 2 TTL		
Loading		"S" or "H" Loads.		
Coding ²		Offset Binary (BIN) for Unipolar Inputs:		
		+10.24V = 1 1 1 1 1		
		0V = 0 0 0 0 0		
		Offset Binary (OBN) for Bipolar Inputs:		
		+5.12V = 1 1 1 1 1		
		0V = 0 1 1 1 1		
		-5.12V = 0 0 0 0 0		
POWER REQUIREMENTS				
+14.5V to +15.5V (+18V Absolute Max)	mA	40	*	*
-14.5V to -15.5V (-18V Absolute Max)	mA	15	*	*
+4.75V to +5.25V (+7V Absolute Max)	mA	200	*	*
TEMPERATURE RANGE				
Operating (Case)	°C	0 to +70	*	*
Storage	°C	-55 to +125	*	*
PACKAGE OPTION³				
		HY32A (ceramic package)	HY32C (metal package)	

NOTES

¹After converter is reset, all other logic signals, including clock, are internally generated.

²When HAS series A/D's are used with HTC-0300 track/hold, output coding is complementary binary (CBN) for unipolar inputs and complementary offset binary (COB) for bipolar inputs (see Table I).

³See Section 19 for package outline information.

*Specifications same as model HAS-0802.

Specifications subject to change without notice.

Table 1. Output Coding*

SCALE	INPUT OF HTC-0300	INPUT OF HAS-1202	DIGITAL OUTPUT
UNIPOLAR OPERATION			
FS-1LSB	-10.2375V	+10.2375V	111111111111
3/4 FS	- 7.6800V	+ 7.6800V	110000000000
1/2 FS	- 5.1200V	+ 5.1200V	100000000000
1/4 FS	- 2.5600V	+ 2.5600V	010000000000
+1LSB	- 0.0025V	+ 0.0025V	000000000001
0	0.0000V	0.0000V	000000000000
BIPOLAR OPERATION			
+FS-1LSB	- 5.1175V	+ 5.1175V	111111111111
0	0.0000V	0.0000V	100000000000
-FS+1LSB	+ 5.1175V	- 5.1175V	000000000001
-FS	+ 5.1200V	- 5.1200V	000000000000

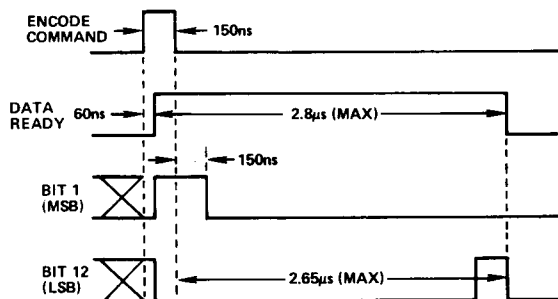
*Coding and input levels shown are for HAS-1202. For 8- and 10-bit A/D's the input levels are less by the values of the LSB weight for each type, and the digital output will show only 8 or 10 bits, respectively.

PIN DESIGNATIONS

HAS-1202*

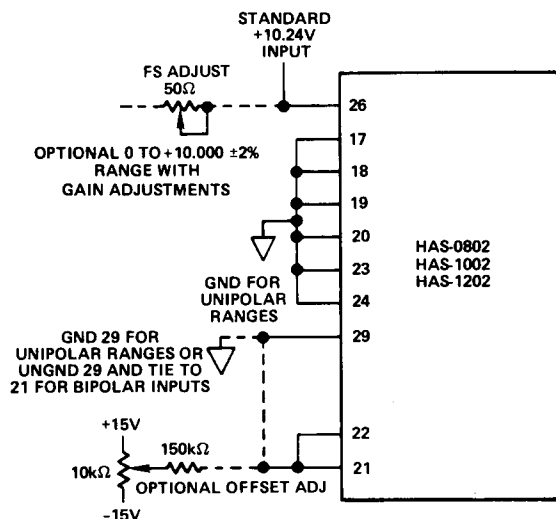
PIN	FUNCTION
1, 30	DIGITAL GROUND
2, 27, 31	+5V
3	DATA READY
4	+15V
5	BIT 1 OUTPUT (MSB)
6	BIT 2 OUTPUT
7	BIT 3 OUTPUT
8	BIT 4 OUTPUT
9	BIT 5 OUTPUT
10	BIT 6 OUTPUT
11	BIT 7 OUTPUT
12	BIT 8 OUTPUT
13	BIT 9 OUTPUT
14	BIT 10 OUTPUT
15	BIT 11 OUTPUT
16	BIT 12 OUTPUT (LSB)
17, 18, 19	ANALOG GROUND
20, 23, 24	ANALOG GROUND
21	D/A OUT
22	D/A IN
25	COMP INPUT
26	ANALOG INPUT
28	-15V
29	BIPOLAR OFFSET
32	ENCODE COMMAND

*HAS-1002, PINS 15 AND 16 ARE NOT CONNECTED INTERNALLY.
HAS-0802, PINS 13, 14, 15 AND 16 ARE NOT CONNECTED INTERNALLY.



TIMING SHOWN FOR HAS-1202. TIMING IS SIMILAR FOR HAS-0802 AND HAS-1002 EXCEPT LSB IS BIT 10 AND 8, RESPECTIVELY, AND TOTAL TYPICAL CONVERSION TIME IS 1.4µs AND 1.2µs, RESPECTIVELY.

Figure 1. Timing Diagram (Typical)



NOTES:

1. THIS CIRCUIT SHOWN FOR UNIPOLAR (0 TO +10.24V) INPUT. 0V INPUT = 000000000000; +10.24 INPUT = 111111111111.
2. FOR BIPOLAR (±5.12V) INPUT, UNGROUND PIN 29 AND CONNECT PIN 29 TO PIN 21.
3. FOR EXTRA-PRECISE GAIN (FULL-SCALE) ADJUSTMENT, CONNECT A 50Ω VARIABLE RESISTANCE IN SERIES WITH PIN 26 OF HAS-1202. THIS WILL RESULT IN 0 TO +10.000V INPUT WITH ADJUSTMENT RANGE OF ±2% OF FULL SCALE.
4. FOR EXTRA-PRECISE ZERO OFFSET ADJUSTMENT, CONNECT 150kΩ RESISTOR FROM PIN 21 TO THE TAP OF A 10kΩ POTENTIOMETER. END TERMINATIONS OF POTENTIOMETER CONNECT TO +15V AND -15V. THIS ZERO OFFSET ADJUSTMENT WILL HAVE A RANGE OF APPROXIMATELY ±100mV.

Figure 2. Input Connections For Standard Input Ranges

INPUT RANGE	R1	R2	Z _{IN}	ABSOLUTE MAXIMUM SIGNAL
0 to +5V, ±2.5V	SHORT	800	500	±10V
0 to +7.5V, ±3.75V	SHORT	2500	750	±15V
0 to +15V, ±7.5V	500	OPEN	1500	±30V
0 to +20V, ±10V	1000	OPEN	2000	±40V

Input Connections For Optional Input Ranges

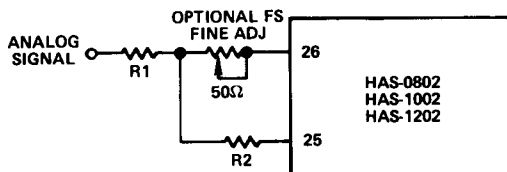


Figure 3. Full Scale Trim

APPLICATION CIRCUIT

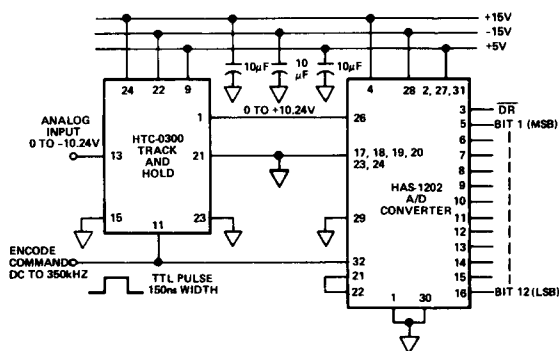


Figure 4. DC to 350kHz, 12-Bit, A/D Conversion System

ORDERING INFORMATION

Order model number HAS-0802, HAS-1002, or HAS-1202 for 8-, 10-, or 12-bit operation, respectively. Mating connector for the HAS series A/D's is model number HSA-2. Metal cased versions of this A/D with extended operating temperature range are also available. Consult the factory or nearest Analog Devices' sales office for further information.