

Low Cost, 8 Bit Monolithic A/D and D/A Converters Models ADC-MC8BC, ADC-MC8BM

FEATURES

- Low Cost
- 8 Bit Resolution
- Internal Reference
- Single Supply Operation
- Multifunction-A/D-D/A
- Full Mil Temp. Range Available

GENERAL DESCRIPTION

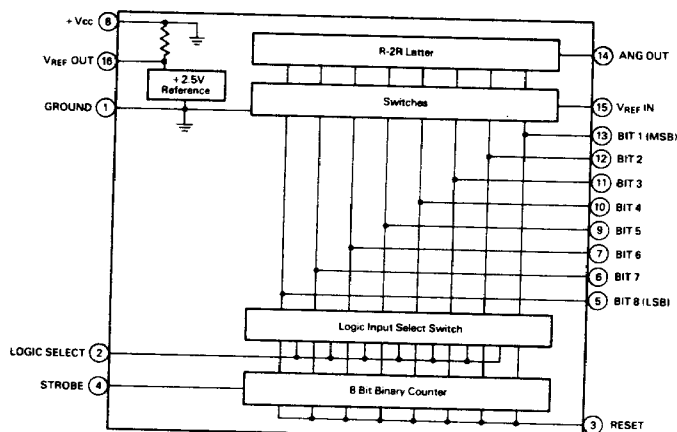
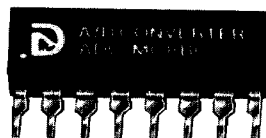
The ADC-MC8B is an 8-bit monolithic multifunction A/D-D/A converter with single +5 Volts supply operation. This device is a complete D/A converter which can be configured as an A/D converter by using the internal binary counter and two external IC's (311 comparator and a 74132 quad 2-input Schmitt trigger NAND gate).

The ADC-MC8B consists of eight current switches, a specially designed ladder network using diffused resistors, a precision +2.5V reference, an eight bit binary counter and a logic input select switch. This feature allows a single control signal to determine whether the switches accept the output from the binary counter (A/D MODE) or external digital inputs (D/A MODE).

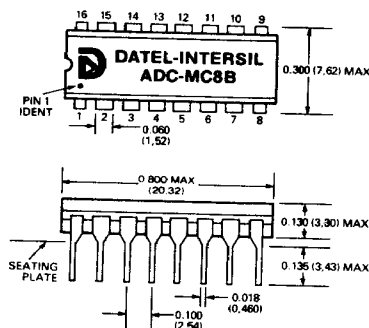
The converter can be used with the internal reference to give an output voltage range of 0 to +2.5V or connected to an external reference for a 0 to +3.0V range. Full scale settling time is 2.0 μ s MAX for the voltage output mode. Using the device as a counter-comparator A/D, a full scale conversion time of 500 μ s can be achieved.

The ADC-MC8B is ideal for such applications as complete low cost D/A's, multiplying D/A's, low cost A/D's and precision ramp generators.

This converter is available in two operating temperature ranges. The ADC-MC8BC (0°C to 70°C) is packaged in a plastic 16 pin DIP and the ADC-MC8BM (-55°C to +125°C) is packaged in a ceramic DIP.



MECHANICAL DIMENSIONS INCHES (MM)



INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	GROUND	9	BIT 5
2	LOGIC SELECT	10	BIT 4
3	RESET	11	BIT 3
4	STROBE	12	BIT 2
5	BIT 8 (LSB)	13	BIT 1 (MSB)
6	BIT 7	14	ANG OUT
7	BIT 6	15	VREF IN
8	+ Vcc	16	VREF OUT

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Data Acquisition

DATTEL-INTERFIL, INC., 11 CABOT BOULEVARD, MANSFIELD, MA 02048/TEL. (617) 339-9341/TWX 710-346-1953/TLX 951340

SPECIFICATIONS. MODEL ADC-MC8B (Typical at 25°C. +5V supply unless otherwise noted)

MAXIMUM RATINGS		ADC-MC8BC ADC-MC8BM		A/D PERFORMANCE		ADC-MC8BC ADC-MC8BM	
Supply Voltage, V _{CC}		+7.0V		Analog Input Range		Dependent on values of R ₁ & R ₂ (See Range Select Chart)	
Digital Input Voltage		+5.5V		Resolution		8 Bits (1 part in 256)	
Reference Input Voltage		+5.5V		Nonlinearity		±1/2 LSB	
				Differential Nonlinearity		±1/2 LSB	
				Conversion Time		500µS max. ⁵	
INPUT/OUTPUTS				POWER REQUIREMENT			
Coding, unipolar		Straight Binary		Supply Voltage		+5.0V ±10%	
Coding, bipolar		Offset Binary		Supply Current		30 mA typ., 40 mA max.	
V _{REF} IN		0 to +3V					
V _{REF} OUT		+2.55V _i					
Input Logic Level, Bit ON ("1")		+2.0V min.					
Input Logic Level, Bit OFF ("0")		+0.7V max.					
Output Logic Level, "1"		+2.4V min.					
Output Logic Level, "0"		+0.4V max.					
Logic Loading		1 TTL load					
Parallel Output Data		12 Parallel lines of data held until next convert command.					
REFERENCE				PHYSICAL-ENVIRONMENTAL			
V _{REF} OUT		+2.55V		Operating Temperature Range		0°C to 70°C -55°C to +125°C	
V _{REF} Tempco		±40 ppm/°C		Storage Temperature Range		-55°C to +125°C	
				Package Type		16 Pin Plastic 16 Pin Ceramic	
D/A PERFORMANCE				NOTES:		1. Internal Reference requires .22 µf stabilization capacitor between Pin 1 and 16.	
Resolution		8 Bits (1 part in 256)				2. 0 to +2.55V when using internal reference	
Output Voltage Range		0 to +3.0V ²				3. ±1/2 LSB max. nonlinearity from 0°C to +70°C	
Output Resistance		10K Ohms				4. ±1/2 LSB max. differential nonlinearity from 0°C to +70°C	
Nonlinearity		±1/2 LSB max.	±1 LSB max. ³			5. See Graph CONV. TIME vs VIN	
Differential Linearity Error		±1/2 LSB max.	±1/2 LSB ⁴				
Zero Error		3 mV	8 mV				
Gain Error		0.1%					
Zero Tempco		5µV/°C					
Gain Tempco		3 ppm/°C					
Nonlinearity Tempco		7.5 ppm/°C					
Monotonicity		Guaranteed 0°C to +70°C					
Settling Time, full scale change to 1/2 LSB		2µS					
Settling Time, 1 LSB change to 1/2 LSB		1µS					
				ORDERING INFORMATION			
				MODEL	OPERATING TEMP. RANGE	CASE	
				ADC-MC8BC	0 to 70°C	Plastic	
				ADC-MC8BM	-55°C to +125°C	Ceramic	
				Trimming Potentiometers: TP2K and TP10K are available from Datel-Intersil			
				THE ADC-MC8BC and ADC-MC8BM ARE COVERED BY GSA CONTRACT			

THEORY OF OPERATION

A negative going pulse on the START line will reset counter to all zeros and enable the clock. If the DAC's output is less than ANG IN, the counter is incremented and DAC's output increases by one LSB. These comparisons continue until DAC's output is equal to the analog signal, at which time the EOC goes low (Logic "0") indicating that the digital output data is valid. Maximum clock frequency is 512 kHz. This may be varied by using different values for R and C.

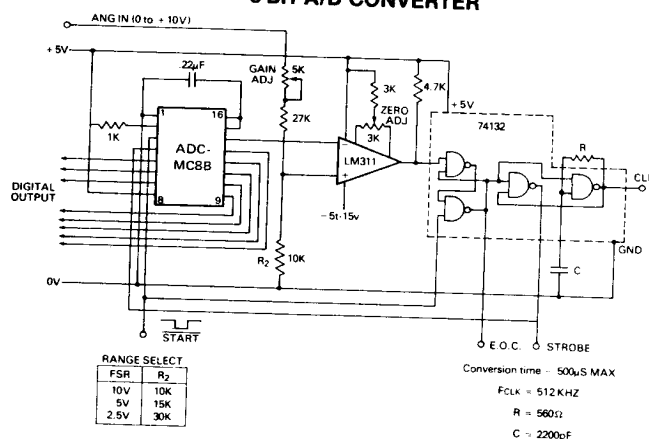
Full Scale voltage may also be changed by setting R_1 and R_2 to desired gain function.

1% Metal Film resistors and 100 ppm/°C trim pots are recommended for best performance over temperature.

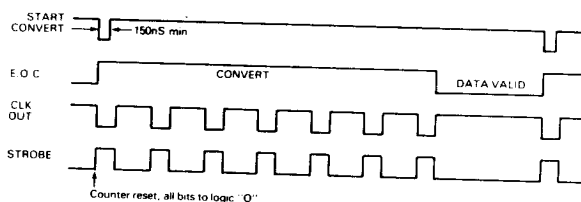
CALIBRATION PROCEDURES

1. Connect converter as shown in connection diagram. Apply continuous start commands to the START input.
2. ZERO ADJUSTMENT—Ground analog input. Vary ZERO ADJ. potentiometer until LSB flickers between logic "1" and "0" with all other bits at logic "0".
3. GAIN ADJUSTMENT—Apply FS-1/2 LSB to ANG IN. Vary GAIN ADJ. potentiometer until LSB flickers between logic "1" and "0" with all other bits at logic "1".

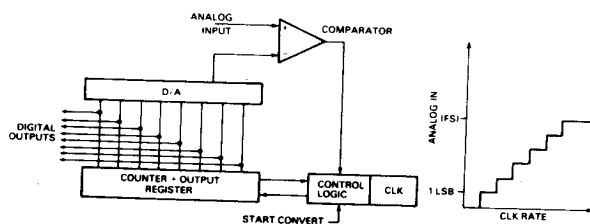
8 BIT A/D CONVERTER



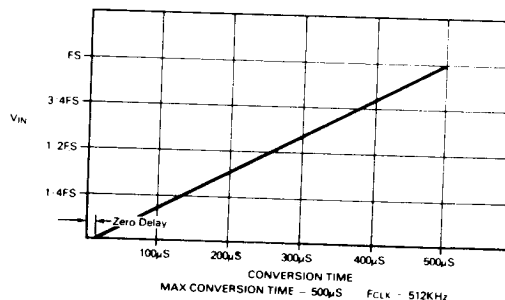
A/D TIMING DIAGRAM



COUNTER-COMPARATOR A/D



CONVERSION TIME VS. VIN



THEORY OF OPERATION

Vout is directly proportional to digital input. R_z should be kept $\geq 650K$ Ohms to assure good T.C. To remove offset voltage and calibration of converter, a buffer amplifier is necessary. The source impedance of the inverting input should be approximately 6K Ohms to minimize temperature drift.

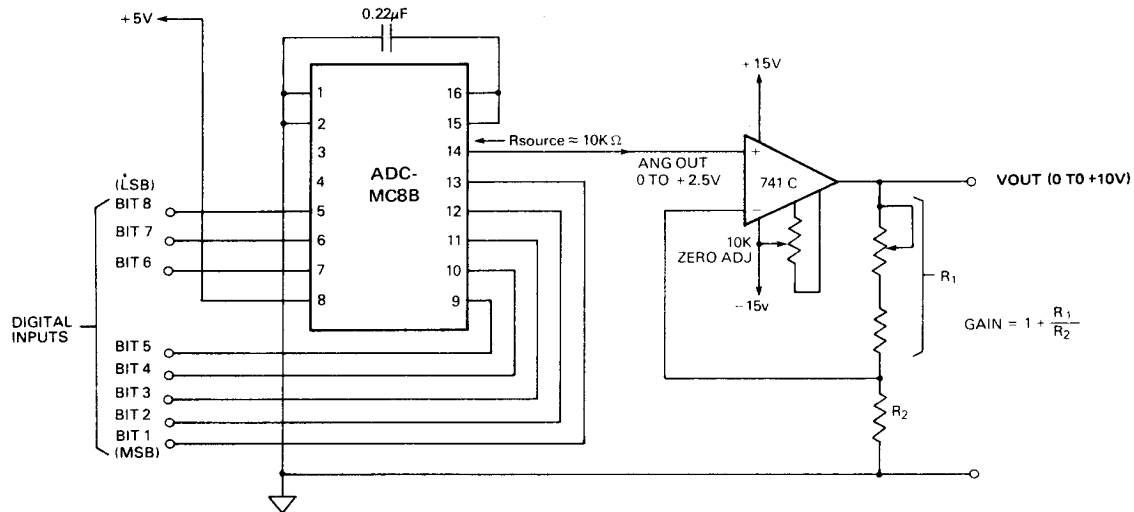
1% Metal Film resistors and 100 ppm/°C trim pots are recommended for best performance over temperature. For best settling time, a fast buffer amplifier is required (DATEL -INTERASIL'S AM-452).

CALIBRATION PROCEDURE

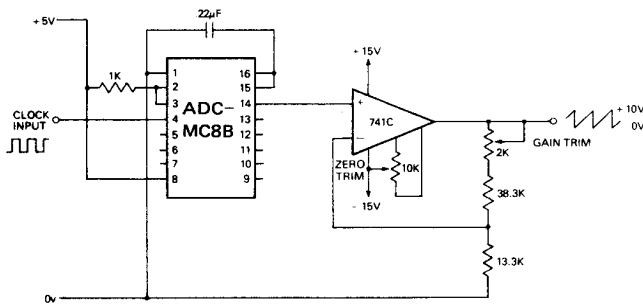
1. Connect converter as shown in connections diagram. Apply continuous start commands to the START input.
2. Set all bits to logic "0" and vary ZERO ADJ. potentiometer until Vout is equal to zero volts.
3. Set all bits to logic "1" and vary GAIN ADJ. potentiometer until Vout = Nominal F.S. - 1 LSB

$$LSB = \frac{FSR}{256}$$

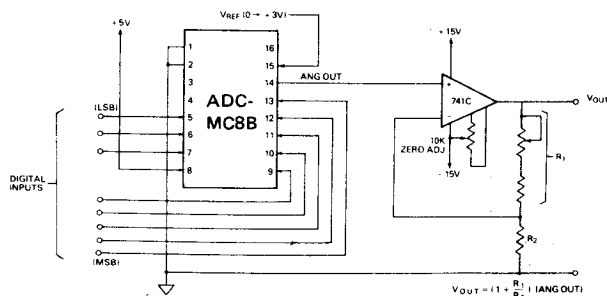
BASIC D/A WITH OUTPUT BUFFER



PRECISION RAMP GENERATOR



MULTIPLYING D/A



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