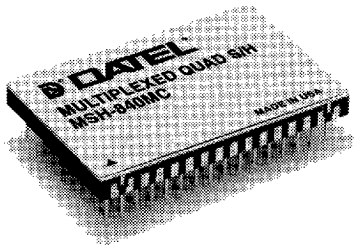
MSH-840
Quad, Simultaneous Sample-Hold with Multiplexer

FEATURES

- **4 Simultaneous sample-hold amplifiers**
- **Internal 4-channel multiplexer**
- **775ns acquisition time**
  10V step to ±0.01% (including multiplexer)
- **2 Channels with optional X10 gain**
- **Control logic for interfacing to A/D's**
- **100MΩ minimum input impedance**
- **Low power, 2.25 Watts**
- **Small, 32-pin, ceramic TDIP**
- **–55°C to +125°C versions**



GENERAL DESCRIPTION

The MSH-840 is a quad, simultaneous sample-hold featuring an acquisition time (including the internal multiplexer!) of 775 ns for a 10V step to ±0.01% accuracy. Control logic is provided for strobing the channels simultaneously and for interfacing to A/D's. A four-channel multiplexer allows individual S/H outputs to be selected.

The MSH-840 requires ±15V and +5V power supplies and dissipates just 2.25 Watts. Packaged in a small, 32-pin, ceramic TDIP, both commercial 0 to +70°C and military –55 to +125°C operating temperature range models are offered.

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	DIGITAL GROUND	32	$\overline{\text{RESET}}$
2	+5V SUPPLY	31	$\overline{\text{EOC}}$ IN
3	SSH1 IN	30	$\overline{\text{S/H}}$ IN
4	OFFSET ADJUST 1	29	CONVERT IN
5	SSH1 OUT	28	START CONVERT OUT
6	SSH2 IN	27	CA0
7	OFFSET ADJUST 2	26	CA1
8	SSH2 OUT	25	ANALOG GROUND
9	SSH3 IN	24	MUX IN1
10	OFFSET ADJUST 3	23	MUX IN2
11	GX10 CH3	22	MUX IN3
12	SSH3 OUT	21	MUX IN4
13	SSH4 IN	20	MUX OUTPUT
14	OFFSET ADJUST 4	19	–15V SUPPLY
15	GX10 CH4	18	POWER GROUND
16	SSH4 OUT	17	+15V SUPPLY

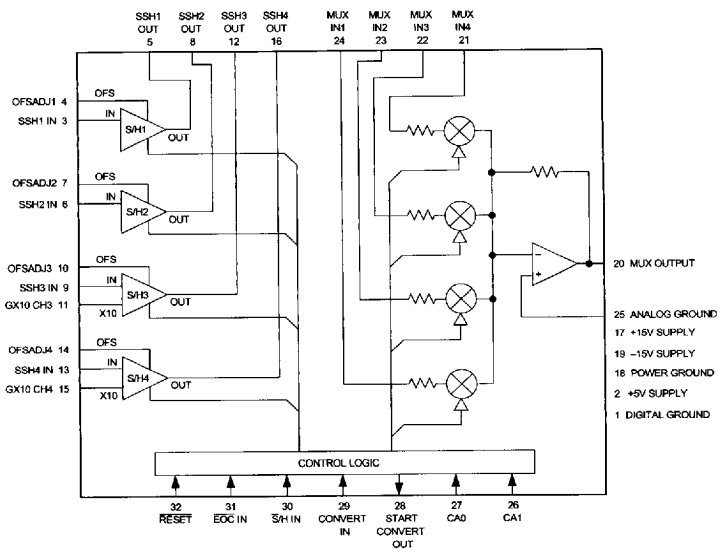


Figure 1. Functional Block Diagram

ABSOLUTE MAXIMUM RATINGS

PARAMETER	LIMITS	UNITS
+15V Supply, Pin 17	0 to +18	Volts
–15V Supply, Pin 19	0 to -18	Volts
+5V Supply, Pin 2	–0.5 to +7.0	Volts
Digital Inputs, Pins 26-27, 29-32	–0.3 to +5.5	Volts
Analog Inputs, Pins 3, 4, 6, 7, 9, 10, 13, 14	–Vcc to +Vcc	Volts
Lead Temperature (10 seconds)	300	°C
Output Short Circuit To Ground	50	mA

FUNCTIONAL SPECIFICATIONS

(Apply over the operating temperature range and at ±15V and +5V unless specified.)

INPUTS	MIN.	TYP.	MAX.	UNITS
Input Type		Single-Ended		
Input Voltage Ranges	—	±10V	—	Volts
Input Impedance	100	—	—	MΩ
Digital Inputs				
Logic Levels				
Logic 1	+2.0	—	—	Volts
Logic 0	—	—	+0.8	Volts
Logic Loading				
Logic 1	—	—	+1.0	µA
Logic 0	—	—	–1.0	µA
CONVERT IN Minimum Pulse Width				
+25°C	20	—	—	ns
0 to +70°C	25	—	—	ns
–55 to +125°C	40	—	—	ns
OUTPUTS				
Output Range	±10	—	—	Volts
Output Current	—	—	±20	mA
Stable Capacitive Load	100	—	—	pF
Output Impedance	—	0.003	—	Ω
START CONVERT OUT Pulse Width	40	50	60	ns
CONVERT IN to START CONVERT OUT delay				
+25°C	—	—	60	ns
0 to +70°C	—	—	75	ns
–55 to +125°C	—	—	90	ns
PERFORMANCE				
Nonlinearity ⑤	—	±0.005	±0.01	%FS
Nonlinearity TC	—	—	±1	④
Sample Mode Offset Error (Gain =1)	—	±2	±15	mV
Sample Mode Offset Error (Gain =10)	—	±20	±150	mV
Sample Mode Offset Tempco	—	±2	±4	④
Offset Adjustment Range	±0.5			%FS
S/H Offset (Pedestal) Error (Over Full Input)	—	—	±10	mV
Gain	—	+1	—	V/V
Gain Tempco (+ tempco of gain pot. or resistor)	—	±2	±5	ppm/°C
Gain Adjustment Range	±1	—	—	%
Gain Error (Externally Adjustable to Zero)				
25Ω gain resistor	—	—	±0.3	%
50Ω gain resistor	—	—	±0.3	%
No gain resistor (shorted)	—	—	±0.3	%
Harmonic Distortion (dc to 500kHz, 20Vp-p)	–69	–70	—	dB

PERFORMANCE (Cont.)	MIN.	TYP.	MAX.	UNITS
Acquisition Time ①				
±0.1%FS, 20V Step	—	800	850	ns
±0.01%FS, 10V Step ②	—	775	900	ns
±0.01%FS, 20V Step	—	1.2	1.4	µs
±0.003%FS, 20V Step	—	1.5	2.0	µs
Aperture Delay	—	15	60	ns
Aperture Uncertainty	—	15	50	psec
Slew Rate	±45	—	—	V/µs
Full Power BW	300	500	—	kHz
Small Signal BW (–3dB)	8	13	—	MHz
Hold Mode Settling Time				
To ±10mV	—	—	100	ns
To ±1mV	—	—	200	ns
To ±0.3mV	—	—	300	ns
Feedthrough Rejection (20V Step)	—	–74	–70	dB
Hold Mode Crosstalk ③	—	–74	–70	dB
Droop Rate				
+25°C	—	—	±1.5	µV/µs
0 to +70°C	—	—	±25	µV/µs
–55 to +125°C	—	—	±3	mV/µs
Output Noise, Hold Mode	—	—	600	µVrms
POWER REQUIREMENTS				
Ranges				
+15V Supply	+14.25	+15	+15.75	Volts
–15V Supply	–14.25	–15	–15.75	Volts
+5V Supply	+4.5	+5	+5.25	Volts
Currents				
+15.75V Supply	—	+75	+90	mA
–15.75V Supply	—	–75	–90	mA
+5V Supply	—	—	+1.0	mA
Power Dissipation	—	2.25	2.75	Watts
Power Supply Rejection	—	—	±0.006	%FSR/%V
PHYSICAL/ENVIRONMENTAL				
Operating Temp. Range, Case				
MSH-840MC	0	—	+70	°C
MSH-840MM	–55	—	+125	°C
Storage Temp. Range	–65	—	+150	°C
Package Type	32-pin, metal-sealed, ceramic DIP			
Weight	0.5 ounces (14.2 grams)			

Footnotes:

① Includes multiplexer.
② +25°C
③ 500kHz
④ Units are ppm of FS/°C.
⑤ FS = full scale = 10V.

TECHNICAL NOTES

1. Avoid ground related problems by connecting the analog, power and digital grounds to one point, the ground plane beneath the MSH-840. The analog, power and digital grounds are not connected to each other internally.
2. Bypass the analog and digital supplies to ground with a 2.2µF, 25V tantalum electrolytic capacitor in parallel with a 0.1µF ceramic capacitor.
3. Offset adjustments are provided by connecting the offset adjust pins (OFSADJ1-4) to the wipers of 20kΩ trimpots connected between the ±15 Volt power supplies. For operation without offset adjustments, connect these pins to ground.

4. Gain adjustments are made by connecting 50Ω trimpots between each SSH OUT pin and its respective MUX IN pin. See the typical connection diagram in Figure 4. For the most accurate operation without adjustment, use a 25Ω fixed resistor instead of a trimpot. A short between the respective SSH OUT and MUX IN pins can also be used for operation without adjustment, but with increased gain error.
5. A gain of 10 is possible on channels 3 and 4 by grounding pins GX10 CH3 (pin 11) or GX10 CH4 (pin 15) respectively. Do not connect GX10 CH3/CH4 for gain = 1 operation.

Scan Mode (Simultaneous Sample-Hold)

The MSH-840's scan mode allows sampling up to four channels at the same time. There are two ways to put the MSH-840 into a sampling mode:

1. Toggling the $\overline{\text{RESET}}$ line (pin 32) low and then high again, upon power-up for instance, puts the four sample-holds into the sampling mode.

2. The four sample-holds can also be put into the sampling mode by using the $\overline{\text{S}}$/H IN control line (pin 30). Using pin 30 is preferred over toggling the $\overline{\text{RESET}}$ line because pin 30 can also put the MSH-840 into the hold mode.

After waiting for the appropriate acquisition time, all four sample-holds can be simultaneously put into the hold mode by bringing the $\overline{\text{S}}$/H IN pin to a high state.

External A/D conversions can begin after waiting for the appropriate hold mode settling time. The rising edge of a signal on CONVERT IN (pin 29) generates a 50ns start convert pulse on the START CONVERT OUT line (pin 28). An external A/D converter requiring 50ns start convert pulses could use these pulses to begin conversions.

Refer to Table 1 to see how channel address selectors CA0 and CA1 (pins 27, 26) select the particular channel to be digitized by the A/D converter. $\overline{\text{EOC}}$ IN serves no function in this simultaneous scan mode and should be tied to ground.

$\overline{\text{RESET}}$ = Resets all sample-holds to the sample mode ($\overline{\text{S}}$/H must be low during the negative transition of $\overline{\text{RESET}}$)

$\overline{\text{S}}$/H IN = Sets all sample-holds to hold mode

= Sets all sample-holds to sample mode

CONVERT IN = Internally generates a start convert pulse for use with an external A/D converter

$\overline{\text{EOC}}$ IN = No function during scan (while $\overline{\text{S}}$/H is high)

START CONVERT OUT = A 50 nanosecond positive pulse generated by CONVERT IN

CA0 and CA1 = A two-bit binary word to select one of the four multiplexer channels

Table 1. Output Channel Selection

	CA1	CA0
Channel 1	0	0
Channel 2	0	1
Channel 3	1	0
Channel 4	1	1

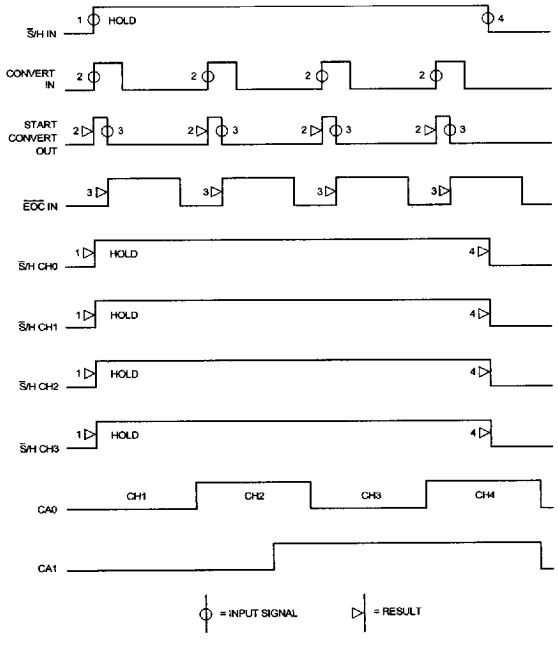


Figure 2. MSH-840 Scan Mode Timing

Random Single Channel Mode

The MSH-840's single channel mode can randomly select a particular channel(s) for digitization by an external A/D converter. Once again, the $\overline{\text{RESET}}$ function can set all sample-holds to the sample mode on initial power-up. Channels are selected using the CA0 and CA1 channel address pins. The S/H IN pin serves no function in this mode and should be tied to ground.

A high-to-low falling edge on $\overline{\text{EOC}}$ IN (pin 31) puts the particular channel chosen into the sample mode. After the initial falling edge on $\overline{\text{EOC}}$ IN, this signal could be derived from the A/D converter's EOC or status pin, which would indicate completion of the previous conversion. The sample-hold could then be put back into the sample mode.

A low-to-high rising edge on the CONVERT IN pin puts the selected channel into the hold mode. After putting the sample-hold into hold, this same edge generates a 50 ns wide start convert signal on START CONVERT OUT (pin 28). An external A/D converter requiring 50ns start convert pulses could use these pulses to begin conversions.

$\overline{\text{RESET}}$ = Resets all sample-holds to the sample mode ($\overline{\text{S/H}}$ must be low during the negative transition of RESET)

$\overline{\text{S/H}}$ IN = Tie to ground

CONVERT IN = Sets the channel selected by CA0 and CA1 to hold and internally generates a start convert pulse for use with an external A/D converter

$\overline{\text{EOC}}$ IN = Sets the selected sample-hold to the sample mode

START CONVERT OUT = A 50 nanosecond positive pulse generated by CONVERT IN

CA0 and CA1 = A two-bit binary word to select one of the four multiplexer channels

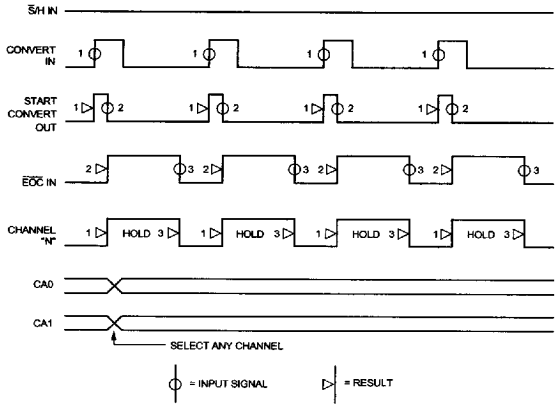


Figure 3. MSH-840 Single-Channel Mode Timing

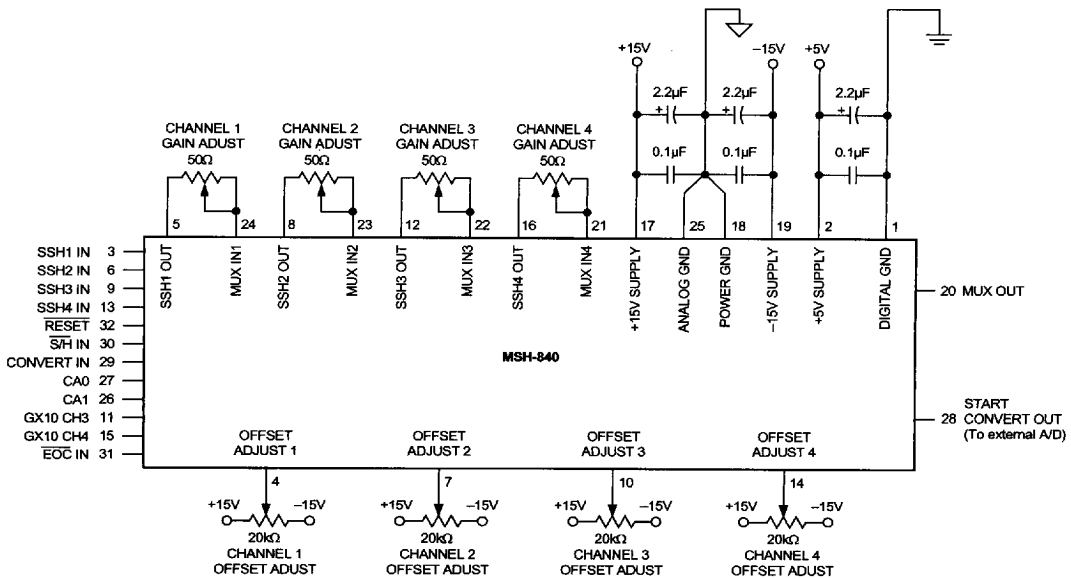
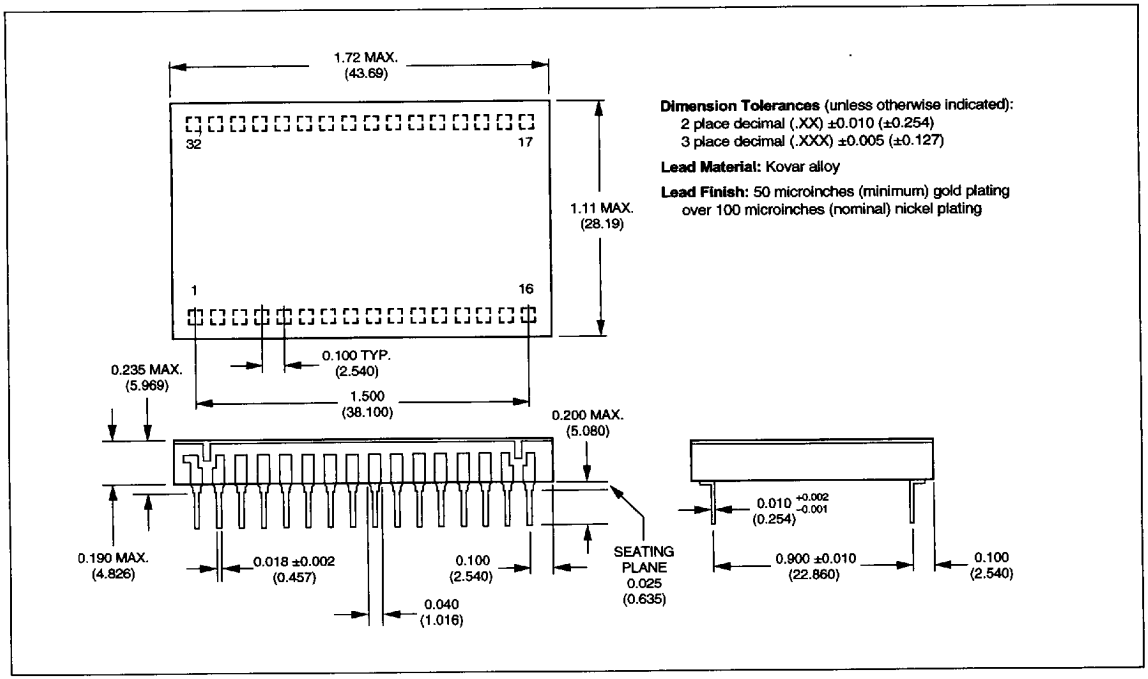


Figure 4. Typical Connection Diagram

MECHANICAL DIMENSIONS
INCHES (mm)



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ORDERING INFORMATION

MODEL	TEMPERATURE RANGE
MSH-840MC	0 to +70°C
MSH-840MM	–55 to +125°C

ACCESSORIES
Receptacle for PC board mounting is available from AMP, Inc. Part Number 3-331272-8 (Component Lead Socket), 32 required.

For availability of a MIL-STD-883 version, contact DATEL.