SHM-6
0.02%, 2.0 Microseconds Microelectronic Sample-Hold

PRODUCT DATA SHEET

FEATURES

- **0.02% Accuracy**
- **2.0 Microseconds acquisition time**
- **2 Nanoseconds aperture uncertainty**
- **5 MHz Bandwidth**
- **25 mA Output current**
- **Gain-programmable from ±1 to ±10**

GENERAL DESCRIPTION

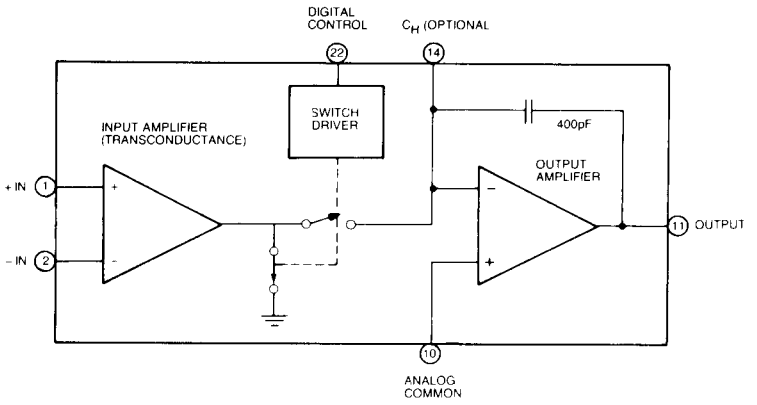
The SHM-6 is a high speed, high accuracy sample-hold circuit manufactured with thin film hybrid technology. This design offers the speed and performance of modular sample-holds with the compactness and integrity of advanced hybrid techniques. The unit's excellent high-speed characteristics include a guaranteed acquisition time of 700 nanoseconds to 0.1% accuracy and 2.0 microseconds to 0.02% for a 10 volt change.

The SHM-6 is a complete sample-hold containing a precision MOS holding capacitor. The input amplifier is an open loop transductance amplifier which can be externally connected for closed loop gains from ±1 to ±10. In addition to its speed, accuracy and selectable gain, the SHM-6 has an output capability of 25 mA. These features allow this unit to offer an unusual degree of adaptability.

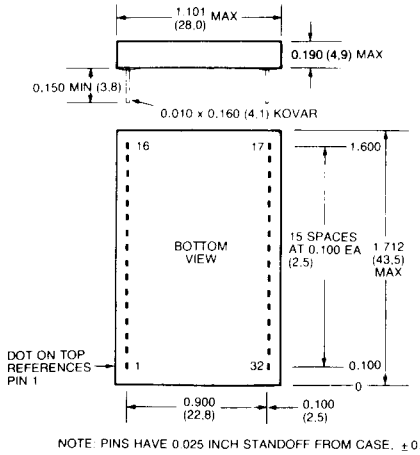
The most frequently utilized configuration of the SHM-6 is a unity gain, noninverting sample-hold. In this mode, the device has a ±10V input and output range with $10^8\ \Omega$ input resistance. Full power bandwidth is 500 KHz, and small signal tracking capability is 5 MHz. The input offset voltage and sample to hold error can be adjusted to zero with the use of two external trim pots.

The SHM-6 is a key component in fast data acquisition systems. A 100 KHz throughput rate can be accomplished using the SHM-6 in conjunction with DATEL's ADC-HZ 12-bit A/D converter (which offers 8 microseconds maximum conversion time).

The sample-hold is cased in a 32-pin ceramic package. Models are available in two operating temperature ranges: 0 to +70°C and −55 to +100°C.



MECHANICAL DIMENSIONS INCHES (MM)



NOTE: PINS HAVE 0.025 INCH STANDOFF FROM CASE. ±0.01"

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	+IN	17	S/H STEP ADJUST
2	−IN	18	S/H STEP ADJUST
3	NC	19	NC
4	OFFSET ADJUST	20	NC
5	NC	21	NC
6	OFFSET ADJ (Wiper)	22	DIGITAL CONTROL
7	NC	23	NC
8	OFFSET ADJUST	24	+V dc
9	NC	25	NC
10	ANALOG COMMON	26	POWER GROUND
11	OUTPU	27	NC
12	NC	28	+15V dc
13	NC	29	NC
14	C.H (OPTIONAL)	30	NC
15	NC	31	−15V dc
16	S/H ADJ (Wiper)	32	NC

ABSOLUTE MAXIMUM RATINGS	
Positive Supply	+18V
Negative Supply	−18V
Logic Supply	+7.0V
Digital Input Voltage	+5.5V
Analog Input Voltage	±Vs
Differential Input Voltage	±30V

FUNCTIONAL SPECIFICATIONS

Typical at 25°C, ±15V and +5V supplies unless otherwise noted.

INPUT AMPLIFIER SPECIFICATIONS	
Offset Voltage	±2 mV
Offset Voltage Tempco	±100 μV/°C
Offset Current	1 nA maximum
Offset Current vs. Temp.	Doubles every 10°C
Bias Current	10 nA maximum
Input Resistance	10^8 Ω
Common Mode Voltage Range	±10V minimum
Common Mode Rejection Ratio	74 dB minimum
Open Loop Gain	10^6V/V
Gain Bandwidth Product	5 MHz
Power Supply Rejection Ratio	0.004%/% Supply

DIGITAL INPUT CHARACTERISTICS	
Digital Control Logic	DTL, TTL
Input Logic Level, Sample Mode	0V to +0.8V at −3.2 mA
Input Logic Level, Hold Mode	+2.0V to +5.0V at +80μA

ANALOG OUTPUT CHARACTERISTICS	
Output Voltage Range	±10V minimum
Output Current	±25 mA maximum
Output Resistance	0.1 Ω maximum

SAMPLE/HOLD CHARACTERISTICS (Noninverting unity gain)	
Acquisition Time, 10V Step to 0.1%	700 nsec. maximum
Acquisition Time, 10V Step to 0.02%	1.5 μsec. typical 2 μsec. maximum
Aperture Delay Time	20 nsec.
Aperture Uncertainty Time	2 nsec.
Sample to Hold Error	Adjustable to Zero
Hold Mode Voltage Droop	10 μV/μsec. maximum
Hold Mode Feedthrough	0.02% maximum
Offset	Adjustable to Zero
Gain	±1 to ±10
Gain Error	0.01% maximum
Nonlinearity, V_{OUT} = ±10V	0.02% maximum
Full Power Bandwidth, V_{OUT} = ±10V	500 KHz
Slew Rate	40 V/μsec.

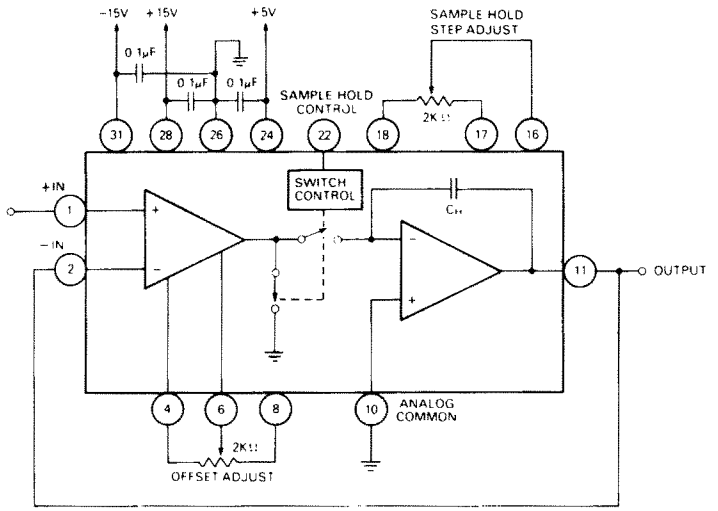
POWER REQUIREMENTS	
Positive Supply	+15V dc ±0.5V at 55 mA
Negative Supply	−15V dc ±0.5V at 60 mA
Logic Supply	+5V dc ±0.5V at 30 mA

PHYSICAL/ENVIRONMENTAL	
Operating Temperature Ranges	
SHM-6MC	0°C to +70°C
SHM-6MM	−55°C to +100°C
Storage Temperature Range	−65°C to +150°C
Package Type	32 Pin Ceramic
Pins	Kovar (0.010 x 0.018)
Weight	0.5 Ounce (14 grams)

TECHNICAL NOTES

1. It is essential that the +15V, −15V and +5V supplies, pins 28, 31, and 24 respectively, each be bypassed to ground with a 0.1 μF ceramic capacitor connected as close to the pins as possible.
2. Digital Common, pin 26, and Analog Common, pin 10, are not connected together internally, therefore they must be connected externally as directly as possible. It is strongly recommended that a ground plane be run underneath the case between the two commons. Analog ground and ±15V power ground should be run to pin 10, digital ground and +5V power ground should be run to pin 26.
3. An external holding capacitor can be added to decrease hold mode voltage droop but with consequently longer acquisition time. For temperatures up to +85°C, polystyrene capacitors are recommended; for higher temperatures, polypropylene or teflon capacitors should be used.
4. In the inverting unity gain operating mode, the feedback and input resistors should be carefully matched or trimmed to yield the desired gain of one. In general, the operating parameters are the same as the noninverting unity gain configuration, except that the sampling bandwidth is reduced by a factor of two. For applications of the SHM-6 with gain greater than one, sampling bandwidth is inversely proportional to gain.
5. Capacitive loads on the output should be limited to 100 pF to maximize acquisition time. The SHM-6 has a ±25 mA current drive capability.
6. This device dissipates approximately 2 watts of power due to the transconductance amplifier. The case to ambient thermal resistance is approximately 25°C per watt. For ambient temperatures above +50°C, care should be taken to maintain air circulation in the vicinity of the case.
7. The adjustment procedures for the SHM-6 are as follows. Ground the input pin and connect the output to a D.V.M.; operate the offset adjustment potentiometer to yield an output of zero as read on the D.V.M. The sample-hold step adjustment is performed with the input pin grounded and the output connected to an oscilloscope set to 1 mV/cm sensitivity. The digital input pin is driven with a compatible square wave at approximately 250 KHz and the sample-hold step adjustment potentiometer is operated to produce a flat-line output on the oscilloscope.

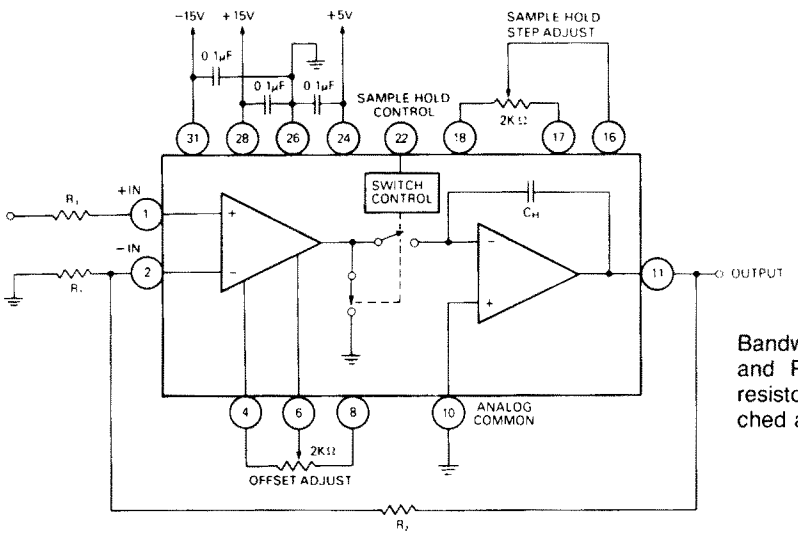
OPERATING MODES



NONINVERTING SAMPLE-HOLD

GAIN = +1

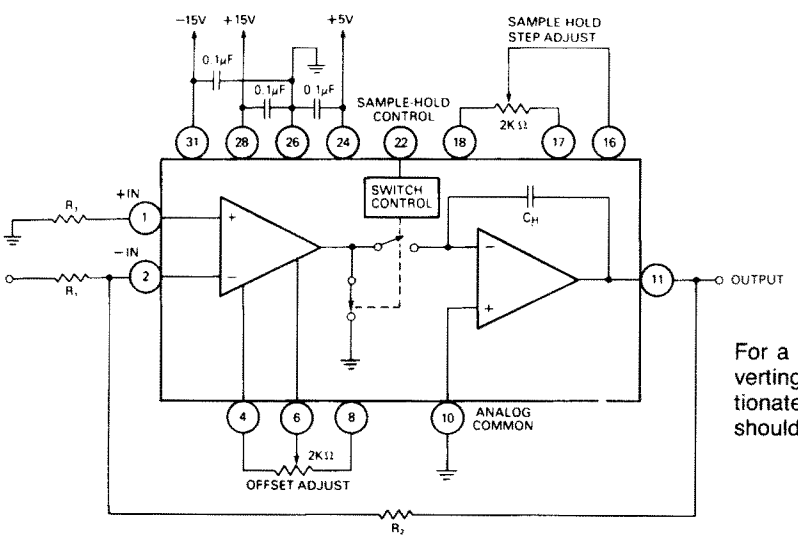
The 2KΩ offset trimming potentiometers should be of the 100PPM/°C cermet type. These are available from DATEL's as model TP2K.



NONINVERTING SAMPLE-HOLD

$$\text{GAIN} = 1 + \frac{R_2}{R_1}$$

Bandwidth decreases proportionately with gain. Resistors R_1 and R_2 should be 100PPM/°C or better, metal film type resistors. The indicated ratio between R_1 and R_2 should be matched as closely as possible and trimmed if necessary.



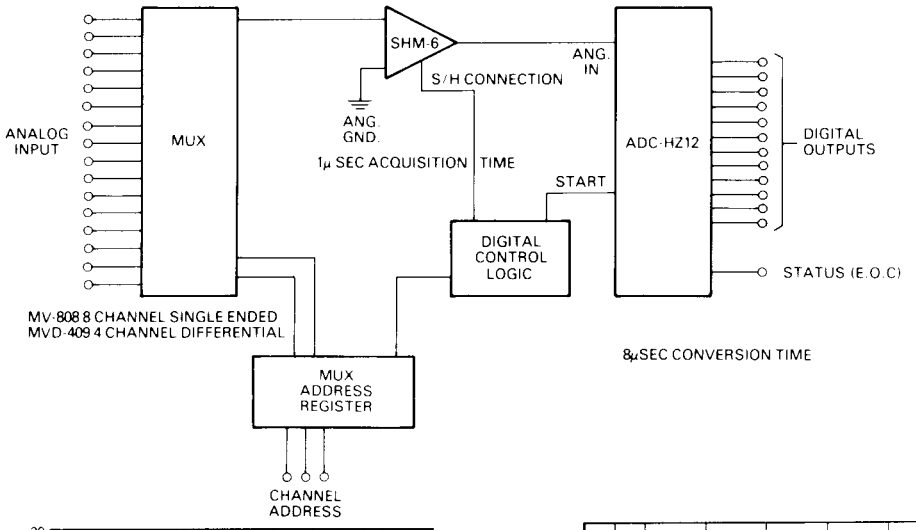
INVERTING SAMPLE-HOLD

$$\text{GAIN} = -\frac{R_2}{R_1}$$

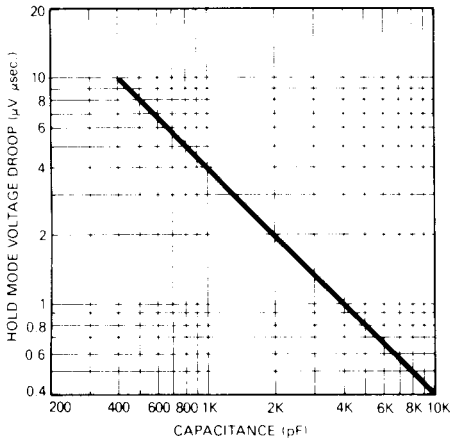
For a gain of −1 the bandwidth is one half that of the noninverting mode, for higher gains the sampling bandwidth is proportionately reduced. The above-mentioned matching procedures should be followed.

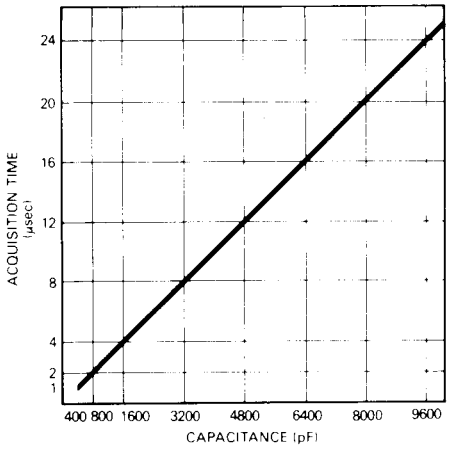
TYPICAL PERFORMANCE

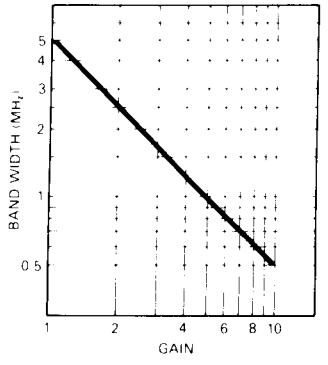
(Noninverting unity gain at 25°C, ±15V and +5V supplies unless otherwise noted)

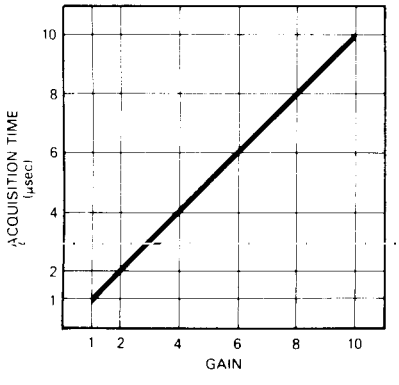


A high speed data acquisition system employing the SHM-6. This system is capable of a 110 kHz throughput rate with 12 bit resolution. In this system the SHM-6 is used with DATEL's ADC-HZ12, a high-speed hybrid 12 bit A/D converter, and DATEL's MV-808, a low cost monolithic analog multiplexer. Use of a low on-resistance MUX is recommended, so that the time constant formed by MUX on-resistance and bus capacitance does not limit the acquisition performance of the SHM-6.









ORDERING INFORMATION

MODEL	OPERATING TEMP. RANGE	SEAL
SHM-6MC	0°C to +70°C	Hermetic
SHM-6MM	−55°C to +100°C	Hermetic

ACCESSORIES

Part Number	Description
DILS-2	Mating Socket (2 required per SHM-6)
TP2K	Trimming Potentiometers (2 required per Sample-Hold)

For high reliability devices, contact DATEL.

DS-0140

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