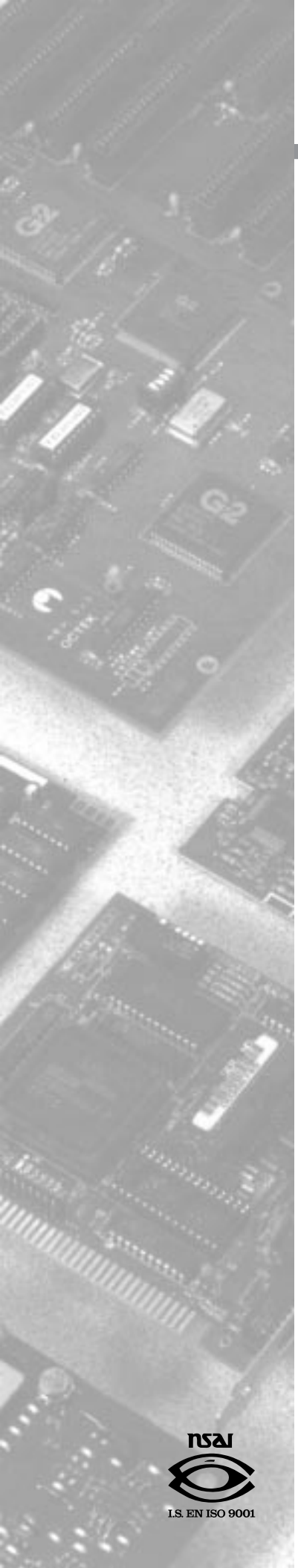

MD3902/3905/3910

2/5/10MHz V/F Converters

Models MD3902/3905/3910 are high-performance, precision 2/5/10MHz full-scale voltage-to-frequency converters, intended for those applications that require maximum performance at the most economical cost. These converters feature >126/134/142-dB dynamic range, ±0.01/0.02/0.05% linearity, and ±5% overrange capability. The MD3902/3905/3910 devices feature overall performance and stability virtually identical to that of similar units costing 40% or more.

All models accept a -100μV to -10V full-scale single-ended analog input signal that is converted to an output signal whose frequency is proportional to the full-scale frequency, within 0.01/0.02/0.05% linearity, using the long-proven charge-balance technique. The devices offer 5% overrange capability, and buffered complimentary TTL-compatible frequency outputs that will drive capacitive loads as high as 50 pF.

Stability of the MD3902/3905/3910 Series is excellent for V/F converters in the respective price ranges, with 10μV/°C typical, 30μV/°C maximum offset and 60 ppm/°C typical, 100 ppm/°C maximum gain temperature coefficients. Warm-up time to specified accuracy is less than two minutes.

In applications where overall system throughput must be maintained at a specific rate, or where fixed offset or different scale voltages would be more convenient, custom frequencies and/or custom trimming can be easily accommodated. By increasing the full-scale output frequency by 10 to 20%, for example, additional time would be available for the system microprocessor to access the results of each conversion. Please contact the factory to discuss your specific timing requirements.

All models are packaged in a 1.31" x 0.69" x 0.22" 24-pin ceramic DIL package. Power dissipation is lower than 0.65/0.80/0.85 watts, and operation to specified accuracy is guaranteed over the 0°C to +70°C temperature range.

For additional information regarding Custom Microelectronic Products and Services, please contact Micro Networks at:

Features:

- **Outstanding Price/ Performance Ratio**
- **Guaranteed Minimum/ Maximum Specifications**
- **Wide Dynamic Range >2,000,000/5,000,000/ 10,000,000:1 >126/134/142 dB**
- **Excellent Linearity ±0.01/0.02/0.05% FSR ±0.01/0.02/0.05% of Input**
- **Excellent Stability 10 μV/°C Offset 60 ppm/°C Gain**
- **Voltage or Current Inputs**
- **Offset and Gain Error Trimmable to Zero**
- **Complementary Frequency Outputs-TTL/CMOS Compatible**
- **Small 24-Pin DIP**
- **Low Power <0.65/0.80/0.85W**

Applications:

- **Precision Integration**
- **Digital Data Transmission**
- **Frequency Synthesis**
- **Analytical Instrumentation**
- **Medical Instrumentation**
- **Telemetry**
- **Data Recording**
- **Weighing Systems**
- **Tachometers**
- **Accelerometers**
- **Flow Meters**
- **Robotics**

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MD3902/3905/3910

2/5/10MHz V/F Converters

Absolute Maximum Ratings

Operating Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C
+15V Supply (Pin 1)	+15.45 Volts
-15V Supply (Pin 5)	-15.45 Volts
+5V Supply (Pin 20)	+5.25 Volts
Analog Input (Pin 11)	-15 Volts to +15 Volts

Ordering Information

Part Number — **MD3902** — **MD3905** — **MD3910**

- MD3902 — 2MHz Full-scale
- MD3905 — 5MHz Full-scale
- MD3910 — 10MHz Full-scale

Specifications

Specifications @ T_A = +25°C, Supplies = ±15V and +5V, unless otherwise indicated

		Min.	Typ.	Max.	Units
ANALOG INPUTS					
Input Voltage Range			0 to -10		Volts
Nonsaturating Overrange		5			%
Configuration			Single-Ended		
Input Impedance	MD3902		15		kΩ
	MD3905		6		kΩ
	MD3910		6		kΩ
Offset Voltage (trimmable to zero)			±7	±10	mV
TRANSFER CHARACTERISTICS					
Full-Scale Output	MD3902	2			MHz
	MD3905	5			MHz
	MD3910	10			MHz
Transfer Function	MD3902		2MHz•(V_{IN} / 10V)		
	MD3905		5MHz•(V_{IN} / 10V)		
	MD3910		10MHz•(V_{IN} / 10V)		
Gain Error (trimmable to zero)				±1	%
Nonlinearity (max.)	MD3902		±0.01%FS±0.01%V_{IN}		
(not specified under	MD3905		±0.02%FS±0.02%V_{IN}		
overrange conditions)	MD3910		±0.05%FS±0.05%V_{IN}		
Full-Scale Step Response	MD3902		2 cycles of new f_{OUT} + 20µsec		
(maximum; to 0.01%)	MD3905		2 cycles of new f_{OUT} + 10µsec		
	MD3910		2 cycles of new f_{OUT} + 5µsec		
Overload Recovery	MD3902		8 cycles of new f_{OUT}		
	MD3905		10 cycles of new f_{OUT}		
	MD3910		12 cycles of new f_{OUT}		
STABILITY					
Gain Temperature Coefficient			60	100	ppm of FSR/°C
Offset Temperature Coefficient			10	30	ppm of FSR/°C
Power Supply Rejection	Gain			200	ppm of FSR/%Vs
	Offset			10	µV/%Vs
Warm-up Time (to specified accuracy)				2	Minutes
OUTPUT					
Pulse Width	MD3902	200	250	300	nsec
	MD3905	80	100	120	nsec
	MD3910	35	50	65	nsec
Logic Levels: Logic "1"		+3.5	+4.0	+4.5	Volts
Logic "0" (3 mA sink)				0.4	Volts
POWER SUPPLY REQUIREMENTS					
±15V Supplies		±14.55		±15.45	Volts
+5V Supply		+4.75		±5.25	Volts
+15V Current Drain	MD3902			20	mA
	MD3905			30	mA
	MD3910			30	mA
-15V Current Drain				10	mA
+5V Current Drain	MD3902			40	mA
	MD3905			40	mA
	MD3910			50	mA
Power Dissipation	MD3902			650	mW
	MD3905			800	mW
	MD3910			850	mW

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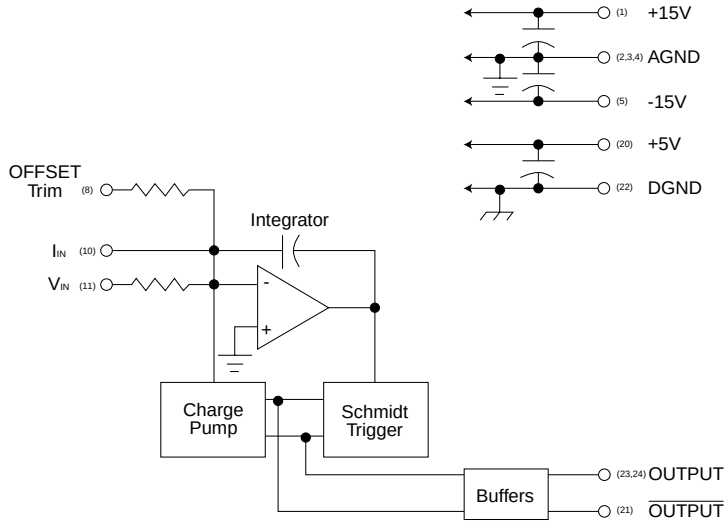
Block Diagram



USING THE MD39XX

GENERAL CONSIDERATIONS – Figure 2 depicts a typical circuit configuration for the MD39XX. The layout should be clean, with output pulses routed as far away from the input analog signals as possible. To obtain maximum performance, bypass capacitors, as shown in Figure 2, should be mounted right at the appropriate pins of the MD39XX.

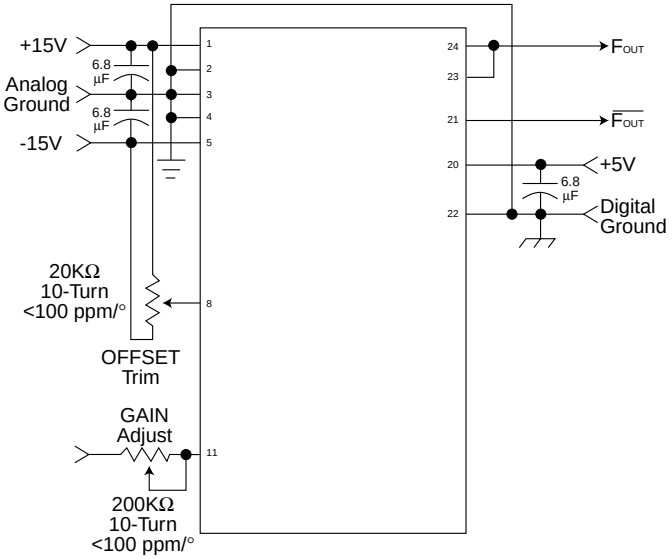


Figure 2. Typical Circuit Configuration.

OFFSET AND GAIN TRIMMING – The Offset adjustment potentiometer should be a 20kΩ, 10-turn unit. To ensure that the temperature coefficient of the potentiometer does not become significant relative to the overall offset tempco specification, a 100ppm or better potentiometer is recommended. With this pot in the circuit, initial offsets of up to ±10mV may be trimmed to zero.

The Gain adjustment potentiometer should be a 200Ω, 10-turn unit with a recommended temperature coefficient of 100ppm or better. With this pot in the circuit, initial gain errors of up to ±2% may be trimmed to zero.

GROUNDING – The Analog and Digital grounds are internally separated in the MD39XX. The use of ground plane is not necessary for proper operation of the MD39XX. However, a ground plane is recommended with any analog signal conditioning circuitry that may be used in front of the V/F, especially if this circuitry involves high gains. Any amplifiers used ahead of the MD39XX should be decoupled to eliminate potential problems with the high-frequency output of the V/F.

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OFFSET AND GAIN CALIBRATION

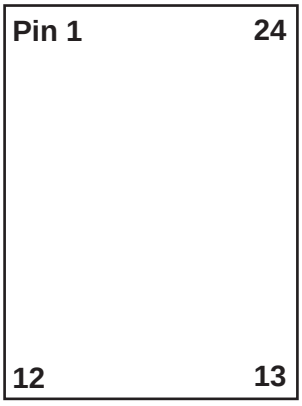
OFFSET CALIBRATION – Offset calibration should be performed prior to gain calibration. With a -10mV analog input signal at pin 11 of the MD39XX, adjust the Offset potentiometer until a frequency of 2.000/5.000/10.000kHz is observed on output pins 21, 23 or 24.

GAIN CALIBRATION – With a full scale analog input voltage of -10.00V on pin 11, adjust the Gain potentiometer until a full-scale frequency of 2.000/5.000/10.000MHz is observed on output pin 21, 23 or 24.

N/C PINS – Pins marked as No Connect have no electrical connection to the internal circuitry of the MD39XX.

OUTPUT PINS – Pins 23 and 24 are tied together internally. Either or both may be used as the source of the frequency output of the MD39XX, as long as the load specifications are not exceeded. Pin 21 provides a complementary signal relative to pins 23 and 24 with similar loading limits.

Pin Designations



1 +15V Supply	24 Output
2 Analog Ground	23 Output
3 Analog Ground	22 Digital Ground
4 Analog Ground	21 $\overline{\text{Output}}$
5 -15V Supply	20 +5V Supply
6 No Connect	19 No Connect
7 No Connect	18 No Connect
8 Offset Trim	17 No Connect
9 No Connect	16 No Connect
10 I_{IN}	15 No Connect
11 V_{IN}	14 No Connect
12 No Connect	13 No Connect

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