ADVANCED ANALOG

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A-8400

Voltage-to-Frequency-to-Voltage Converter

DESCRIPTION

The A-8400 is a low cost monolithic voltage-to-frequency converter that provides linear conversion of 0 to +10V analog signals to a digital pulse train whose repetition rate is proportional to the analog voltage. This converter is designed to provide accurate and reliable performance, with versatile adjustment free operation at low cost. A wide variety of input voltage scaling and output interfacing can be accomplished to satisfy many data acquisition and signal conditioning applications.

An improved form of the charge balancing technique of conversion is used in the A-8400 to convert analog input voltages of 0 to +10V to an extremely stable, linear output pulse rate of 0 to 100 kHz. When linked to a frequency-to-voltage converter such as the A-8400, connected for F/V operation, an accurate two-wire data link may be formed with the V/F as the transmitter and the F/V as the receiver. The A-8400 may also be linked to a binary counter which can perform approximately 390 8-bit digital conversions per second.

Versatility and convenience of operation are key features of the A-8400. By just adding a minimum of external components, other full scale inputs and outputs may be obtained. These devices are especially suited for applications in data transmission, magnetic tape recording, servo loops and isolating analog from digital.

A maximum nonlinearity of ±0.05% for the A-8400 with a 100 kHz full scale output and ±0.025% with the 10 kHz full scale output, and the versatility offered by the A-8400 makes this low cost V/F/V converter an ideal choice for very accurate data encoding and decoding.

FEATURES

- 0 to +10V conversion to:
  100 kHz, ±0.05% accuracy, max.
  10 kHz, ±0.025% accuracy, max.
- Excellent linearity over many decades
- Excellent temperature stability, <±50 ppm/ °C
- DTL/TTL/CMOS compatible output
- Small size - monolithic
- Low cost

APPLICATIONS

- Remote control or monitoring
- 2 - Wire digital transmission
- Telemetry
- Isolation
- Servo loops
- Synchronous speed control
- Magnetic tape recording

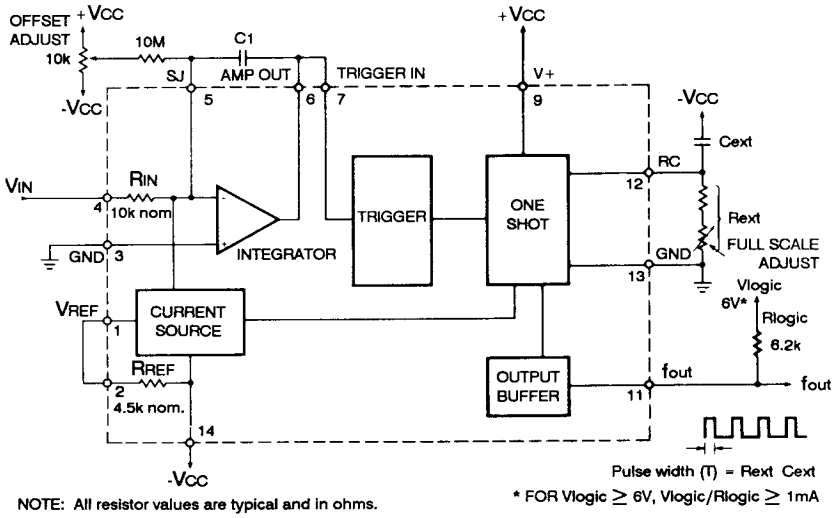
SPECIFICATIONS

Typical @ +25°C and ±15V supplies unless otherwise noted.

	Min	Typ	Max	Units
TRANSFER CHARACTERISTIC		fout = $\frac{VIN}{10}$ 100 kHz		
ACCURACY[6]				
Resolution		5		decades
Linearity, FS				
10kHz bandwidth			±0.025	%
100kHz bandwidth			±0.05	%
Monotonic		inherent		
Scale Factor[1]	-0, +20			%
Offset[1]			±10	mV
STABILITY[6]				
Scale Factor vs. Temperature @10kHz		±50	±100	ppm/°C
vs. Power Supply		±300		ppm/%
vs. Time/Day		±100		ppm
vs. Time/Month		±200		ppm
Offset vs. Temperature		±3	10	ppm/°C
vs. Power Supply		±100		µV/%
vs. Time/Day		±15		ppm
vs. Time/Month		±30		ppm
RESPONSE - V/F Mode				
Settling Time, to 0.01%, FS step			2	cycles[5]
Overload Recovery		10		ms
RESPONSE - F/V Mode		Depends on CINT/RIN time constant		
ANALOG INPUT (V/F)/OUTPUT (F/V)				
Voltage Range[2]		0 to +10		V
Current Range		0 to +1		mA
Overrange		Depends on external RC time constant		
Configuration		Single-ended, referred to analog ground		
Impedance (voltage input)		10		kΩ nom.
Overvoltage Protection (VIN)		±VS		
OUTPUT (V/F)/INPUT (F/V)				
Frequency Range[2]		0 to 100		kHz
Overrange		Depends on external RC time constant		
Waveform[3]		Compatible with DTL/TTL/CMOS[7]		
Fan Out[4] (V/F Mode)		1		TTL Load
Short Circuit Protection		Indefinite to GND		
TEMPERATURE				
Rated - Commercial	0		+70	°C
Extended - ET1	-55		+85	°C
Operating - Commercial	-25		+85	°C
Extended - ET1	-55		+85	°C
Storage	-55		+125	°C
POWER SUPPLY				
Voltage - Rated		±15		V
- Operate	±12		±18	V
Current		±15@±15		mA@V

Notes:
1. Adjustable to zero error.
2. Adjustable to other full scale input/output levls.
3. Output level determined by external pullup resistor.
4. One TTL load unit is = -1.6mA at LO (+0.4V) and +40µA at HI (+2.4V.)
5. Of final frequency.
6. Applies to V/F & F/V modes.
7. Maximum output (V/F) = 6V.

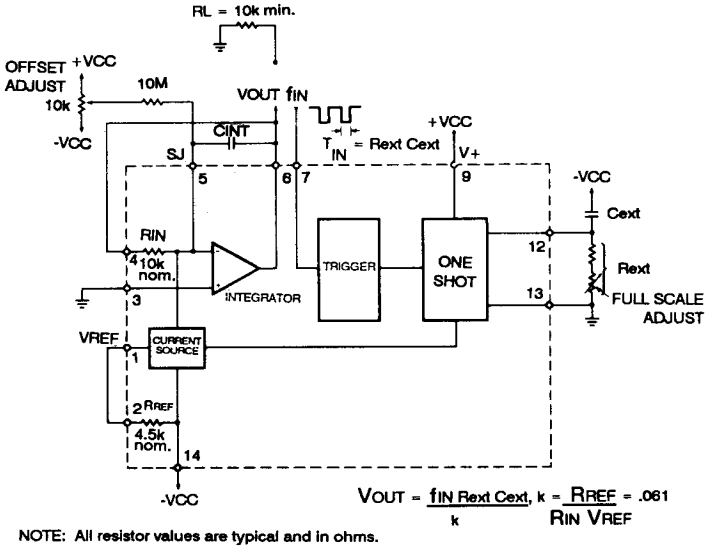
BLOCK DIAGRAM



NOTE: All resistor values are typical and in ohms.

FULL SCALE	C1	Cext	Rext
10kHz	0.02	2700pF	22.7k
100kHz	0.002	220pF	27.8k

V/F Mode



NOTE: All resistor values are typical and in ohms.

* @ RIPPLE = 200mV p-p

FULL SCALE	CINT	Cext	Rext
10kHz	0.5μF*	2700pF	22.7k
100kHz	0.05μF*	220pF	27.8k

F/V Mode

OPERATION

V/F Mode

The analog input forces a current to flow through RIN into C1 causing the output of the integrator to move in a negative direction - refer to Block Diagram - V/F Mode. At a given voltage level, the comparator circuit triggers the timing reference network to turn the controlled current source on so that it discharges C1. As the capacitor discharges, the output of the integrator moves in a positive direction. When the timing reference has finished discharging the capacitor, the output of the integrator is positive and ready to start the process again for the next cycle. For current inputs into the summing junction (pin 5,) it is recommended for good temperature stability that an external RREF be used between pin 1 and -VCC.

F/V Mode

As a frequency-to-voltage converter, the A-8400 accepts negative going TTL pulses into the trigger circuit which starts the one shot cycle (period = T = Rext Cext. Refer to Block Diagram - F/V Mode.

The current source forces current out of the summing junction for the one shot period. The amplifier acts as a current-to-voltage integrator providing a voltage output proportional to the average current (also proportional to the input frequency.) F/V linearity will be the same as in the V/F mode. Output ripple is controlled by the integrating capacitor (Cint - refer to Block Diagram - F/V Mode.)

PIN DESIGNATIONS

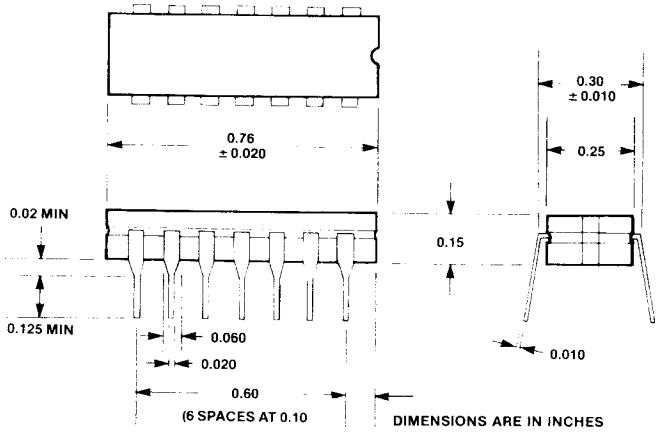
Pin 1	VREF	Pin 14	-VCC
Pin 2	R1	Pin 13	GND
Pin 3	ANA GND	Pin 12	RC
Pin 4	VIN	Pin 11	fOUT
Pin 5	SJ	Pin 10	N/C
Pin 6	AMP OUT	Pin 9	+VCC
Pin 7	TRIGGER IN	Pin 8	N/C

V/F Mode

Pin 1	VREF	Pin 14	-VCC
Pin 2	R1	Pin 13	GND
Pin 3	ANA GND	Pin 12	RC
Pin 4	VIN	Pin 11	N/C
Pin 5	SJ	Pin 10	N/C
Pin 6	AMP OUT	Pin 9	+VCC
Pin 7	TRIGGER IN	Pin 8	N/C

F/V Mode

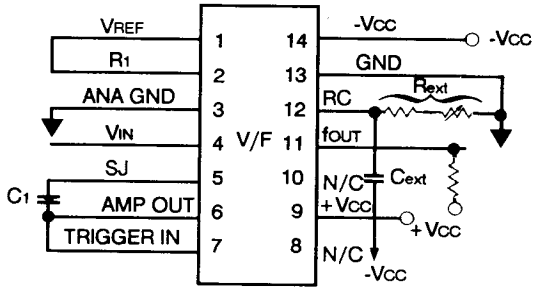
MECHANICAL OUTLINE

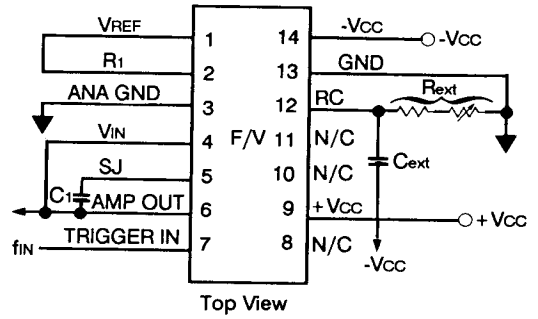


14 pin DIP

A plastic or a ceramic package will be used to fulfill an order depending on availability.

PIN CONNECTION





Top View

The information in this data sheet has been carefully checked and is believed to be accurate, however, no responsibility is assumed for possible errors. The specifications are subject to change without notice.

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