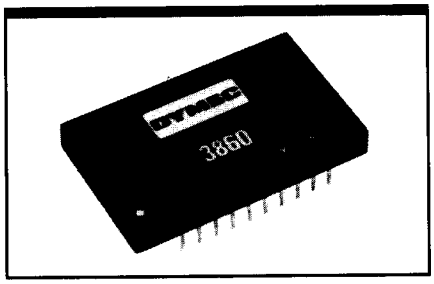
DYMEC

A Subsidiary of
SILICON TRANSISTOR CORP.

MODEL:

3860

Signal Conditioning 10MHz V/F Converter



Description

The **3860** is a high performance, precision 10MHz full scale voltage-to-frequency converter with integral low noise, user-configurable high input impedance buffer and gain stage amplifiers. Each functional block may be used independently or in combination to obtain a signal conditioning and V/F converter subsystem. By integrating a high performance amplifier and V/F in the same package, users can quickly implement a front-end/converter design with guaranteed end-to-end specifications, tailored to their application requirements, and save design time and pc board space, reduce potential ground loops and improve overall performance.

The input buffer stage provides an input impedance of 10^{12} ohms. The separate inverting gain stage offers user programmable gains by adding a pair of precision resistors. When used in combination, the input buffer/gain stage offer an extremely stable amplifier chain.

The V/F converter intself accepts a -100µV to -10V full scale analog signal which is converted to an output frequency proportional to the input signal and 10MHz, within ±0.05% linearity. Buffered complementary TTL-compatible frequency outputs are provided that will drive

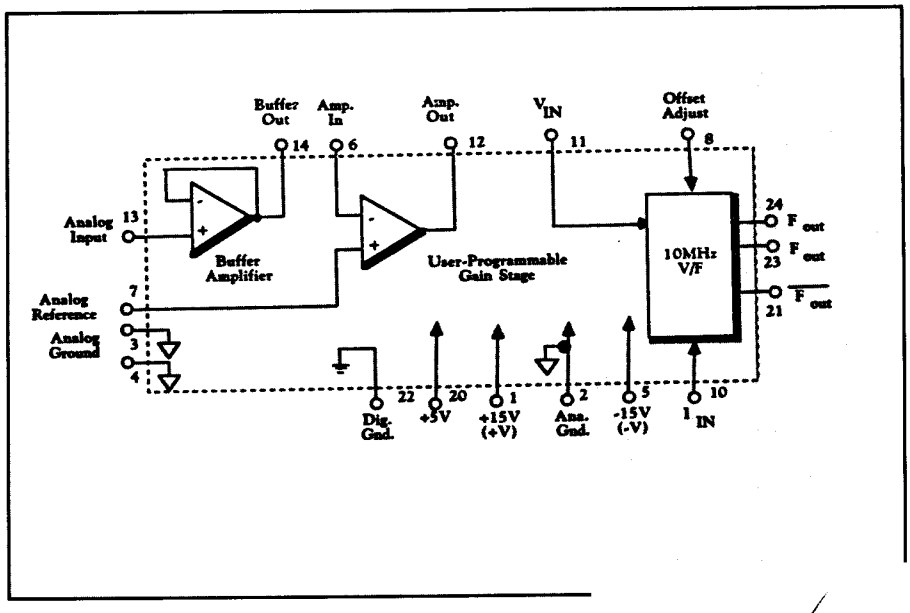


Figure 1. 3860 Block Diagram

FEATURES

- ☐ **Integral High Input Impedance Buffer**
  10^{12} ohms
- ☐ **Integral User-Programmable Inverting Gain Stage**
  Two-resistor Programming
- ☐ **Wide Dymanic Range**
  10,000,000:1
  >142dB
- ☐ **Precision V/F Converter**
  ±0.05% Linearity
- ☐ **Excellent Stability**
  10µV/°C offset
  60ppm/°C gain
- ☐ **Complementary Frequency Outputs**
  TTL/CMOS Compatible
- ☐ **Small Size**
  24-pin Double-width DIL Package
- ☐ **Low Power**
  <1.25W

APPLICATIONS

- ☐ **Precision Integration**
- ☐ **Analytical Instrumentation**
- ☐ **Medical Instrumentation**
- ☐ **Weighing Systems**
- ☐ **Data Recording**
- ☐ **Data Transmission**

007018 ✓

Specifications

All Specifications Guaranteed at 25°C Unless Otherwise Noted

V/F CONVERTER

ANALOG INPUT

Input Range
-100μV to -10V
Overrange
5% minimum
Configuration
Single-ended
Impedance
6KΩ nominal
Offset Voltage
±7mV typical, ±10mV maximum; adjustable to zero
Overvoltage Protection
$\pm V_S$ without damage

TRANSFER CHARACTERISTICS

Full Scale Frequency Output (Fout)
10.000MHz; ±5% overrange minimum
V/F Transfer Characteristic
10MHz(Vin/10V)
Gain Error
±1%, trimmable to zero
Non-Linearity
±0.05% FS, ±0.05% of input, maximum
Full Scale Step Response
2 cycles of new frequency, plus 5μs; to ±0.01%
Overload Recovery
12 cycles of new frequency

STABILITY

(Exclusive of external components)
Gain - Tempco
±60ppm/°C typical, ±100ppm /°C maximum
Gain - Power Supply Sensitivity
200ppm per 1% change in power supply voltage
Offset - Tempco
±10μV/°C typical, ±30μV/°C maximum
Offset - Power Supply Sensitivity
±10μV per 1% change in power supply voltage
Warmup Time
< 2 minutes to specified accuracy

OUTPUT

Pulse Polarity
Positive and Negative
Pulse Width
50ns±15ns
Logic Levels (V_{CC}=+5V)
Logic "1" (High) = +4.0V±0.5V
Logic "0" (Low) = <0.4V @ 3mA sink
Load
≤50pF for rated performance; 10 LSTTL loads

INPUT BUFFER

Input Offset Voltage
5mV typical, 10mV maximum
Input Offset Current
25pF typical, 100pA maximum; doubles every 10°C
Input Impedance
$10^{12}\Omega$
Common Mode Voltage Range
11V minimum
Gain
+1
Supply Voltage Rejection
70dB minimum, 100dB typical
Slew Rate
13V/μs typical
Bandwidth
4MHz typical
Equivalent Input Voltage Noise
25nV/√Hz typical; R_S=100Ω, f=1kHz
Equivalent Input Current Noise
0.01pA/√Hz typical; f=1kHz

GAIN STAGE

Input Offset Voltage
5mV typical, 10mV maximum
Input Offset Current
25pA typical, 100pA maximum; doubles every 10°C
Input Impedance
$10^{12}\Omega$
Common Mode Voltage Range
11V minimum
Common Mode Rejection Ratio
100dB typical, 70dB minimum
Large Signal Voltage Gain
25V/mV minimum, 100V/mV typical; V_O=10V, R_L=2.0kΩ
Supply Voltage Rejection
70dB minimum, 100dB typical
Slew Rate
13V/μs typical; gain= -1
Gain-Bandwidth Product
4MHz typical
Equivalent Input Voltage Noise
25nV/√Hz typical; R_S=100Ω, f=1kHz
Equivalent Input Current Noise
0.01pA/√Hz typical; f=1kHz

TOTAL POWER REQUIREMENTS

($+V_S$) +15V, ±3%
40mA maximum
($-V_S$) -15V, ±3%
20mA maximum

Specifications (continued)

($+V_{CC}$) +5V, ±5% 50mA maximum **Power Dissipation** 1.25W maximum **ENVIRONMENTAL AND MECHANICAL** **Operating Temperature** 0°C to +70°C	**Storage Temperature** -55°C to +125° **Dimensions** 1.6"x0.69"x0.22" (40.6x17.5x5.5mm)

Description (continued)

up to 50pF capacitive loads. Stability of the V/F over temperature is excellent, with offset and gain temperature coefficients of 10µV/°C and 60ppm/°C typical respectively.

The **3860** is packaged in a 1.6"x0.69"x0.22" 24-pin DIL plastic package. Pin spacing is 0.1"x0.6". Power dissipation is less than 1.25W. Operation to specified performance is over the 0°C to +70°C temperature range.

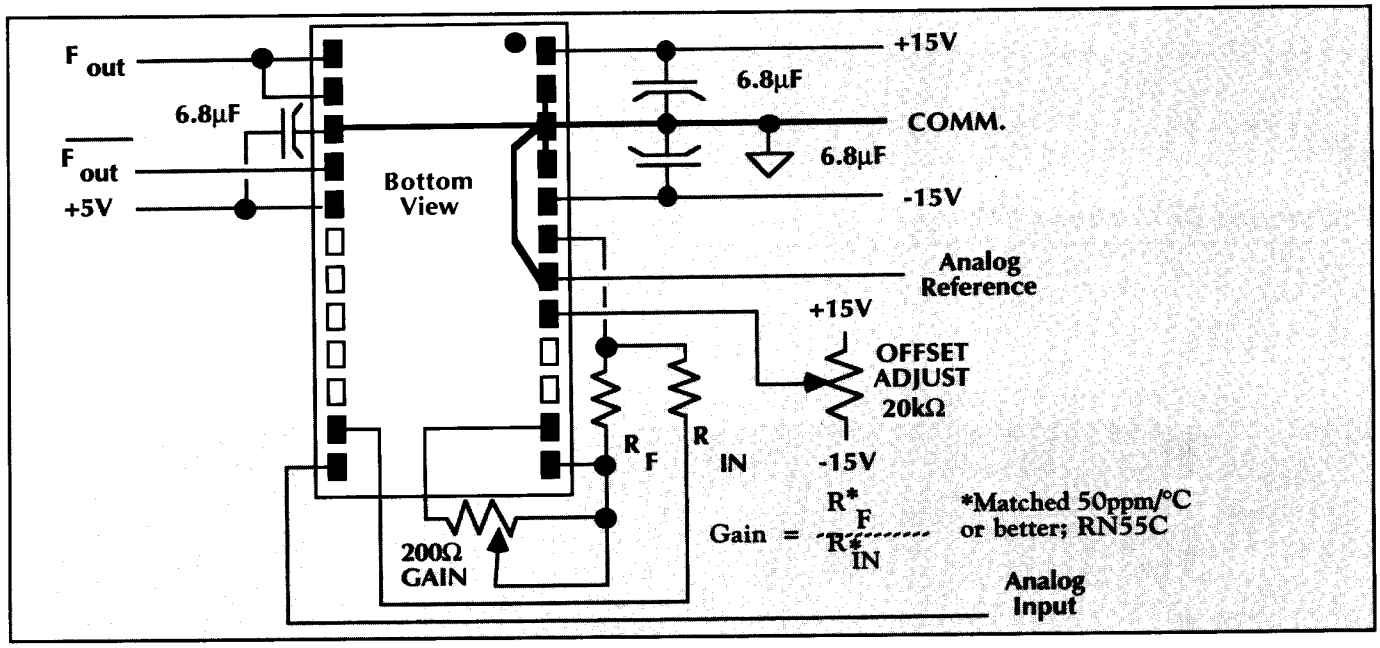


Figure 2. Recommended Interconnection and Signal Routing

Using the 3860

General Considerations

As with any high precision, signal conditioning and data acquisition and conversion circuitry, the use of a ground plane is strongly recommended. The layout should be clean, with output pulses routed as far away as possible from the input analog signals. As shown in Figure 2, bypass capacitors should be mounted as close as possible to the power supply pins of the **3860**.

Gain Stage

As shown in Figure 2, the gain stage is configured such that the gain can be set using a matched set of user-supplied, 50ppm or better, RN55C metal film resistors.

Improving the Offset TC Performance

Due to the offset voltage tracking and compensation scheme employed in the **3860** design, an approximate 2:1 improvement in the offset TC is possible for the combination buffer/gain stage, over the gain stage alone. In circuit configurations that do not require the high impedance buffer, consideration should be given to using the buffer stage to improve the overall offset TC performance of the complete front-end.

Using the 3860 (continued)

Offset and Gain Calibration

The V/F OFFSET adjustment potentiometer should be a 20KΩ, 10-turn unit. With this pot in the circuit, initial offsets from the V/F, buffer and gain stage combination of up to ±50mV may be trimmed to zero.

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

To calibrate the **3860**, the offset is adjusted prior to adjusting the gain. With a voltage at the analog input of the buffer/gain stage/V-to-F configuration that will yield a -10mV signal at pin 11 (V_{IN}) of the V/F, adjust the OFFSET pot until an output frequency of 10.000kHz is obtained at pins 21, 23 or 24. With a full scale voltage at the input of the circuit such that -10.000V is present at pin 11 (V_{IN}) of the V/F, adjust the gain pot for an output frequency of 10.000MHz. Calibration is now completed.

Grounding

The Analog and Digital grounds are internally separated within the **3860** circuitry. The use of a ground plane is recommended with the **3860** to avoid ground loops and common mode problems. If a ground plane is not feasible, then a single-point ground ("star" ground) must be used. Significant performance degradation will result if these grounding schemes are not utilized.

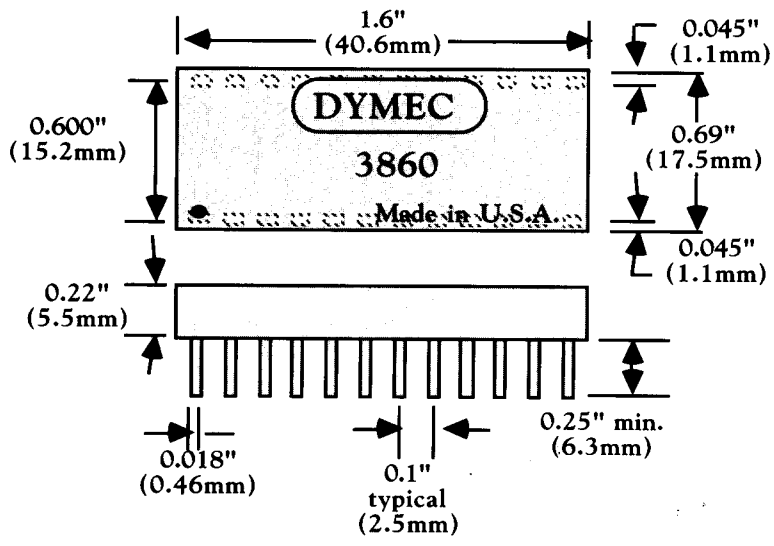
N/C Pins

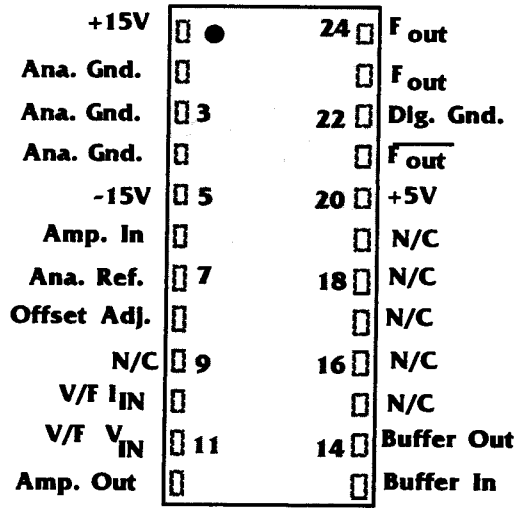
Pins marked as N/C (no connection) have no electrical connection to the circuitry of the **3860**.

Frequency Outputs

Pins 23 and 24 are tied together internally to the **3860**. Either or both may be used as the source of the frequency output of the **3860** as long as the 10 LSTTL and 50pF load limits are not exceeded. Pin 21 provides an inverted signal relative to pins 23 and 24 with the same load limits.

Mechanical Dimensions & Pinout





DYMEC
A Subsidiary of
SILICON TRANSISTOR CORP.

Printed in U.S.A.

8 Lowell Avenue ☐ Winchester, MA 01890 ☐ 800-225-1151
(617) 729-7870 ☐ TWX: (710) 348-6596

Bulletin No. 87043860 Rev.0