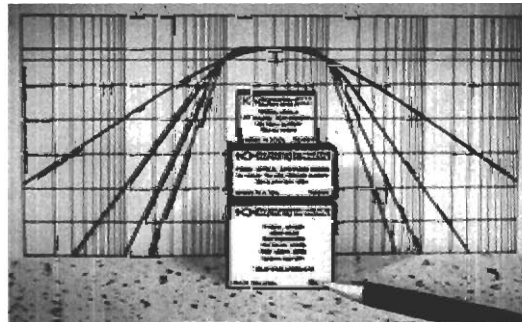


KH KROHN-HITE CORPORATION

15 Jonathan Drive, Unit 4, Brockton, MA 02301-5566; Tel (508) 580-1660

Filter Module Information Sheet



Part Number: 3BS8TB-1k/50k

The enclosed filter module is 8-pole, 1kHz to 50kHz band-pass with a Butterworth response with unity gain.

The following chart shows the pin connections of the module as shown on the data sheet enclosed.

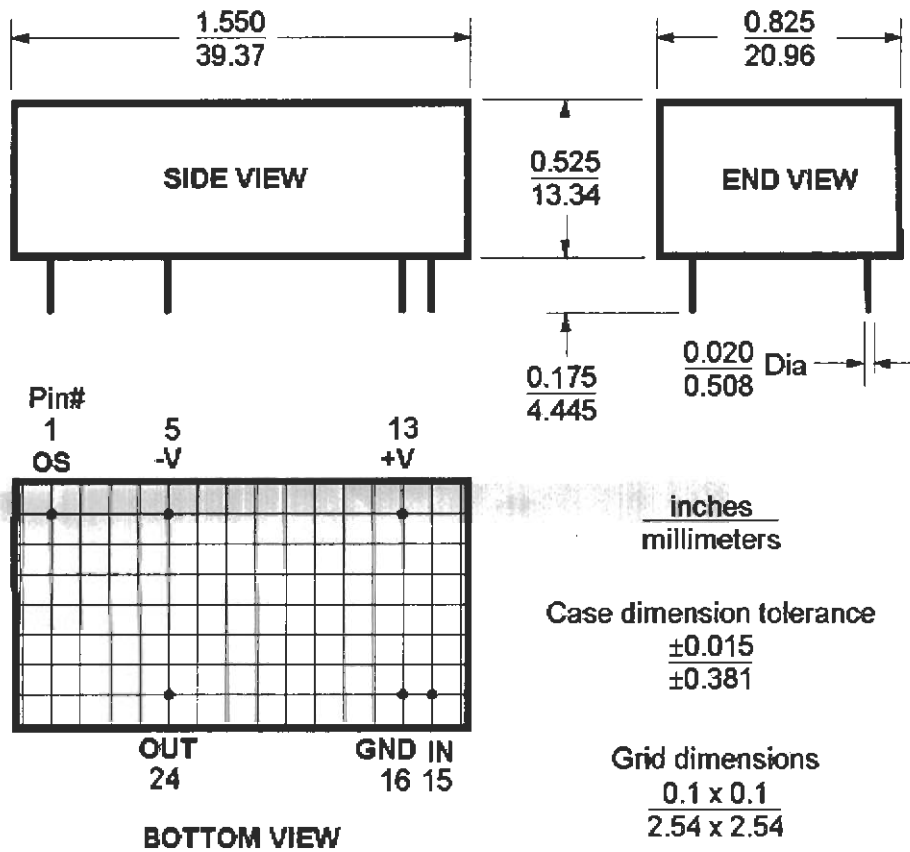
PIN #	CONNECTIONS
1	dc offset connection
5	- V (supply)
13	+ V (supply)
35	Input
38	Ground
40	Output

1. To verify cutoff accuracy for filters without input gain, you must drive the input from a 10 ohm or less source impedance.
2. The filter has two internal 0.1 μ F ceramic capacitors, bypassing the supply inputs to ground. If the supply is unusually dirty with noise or signal, a larger external capacitor is recommended. If necessary, de-coupling resistors of 10 ohms will also help.

NOTE: When using long supply leads to the module (when testing out of circuit), you may have to use 1 μ F by-pass capacitors at the module to prevent oscillation.



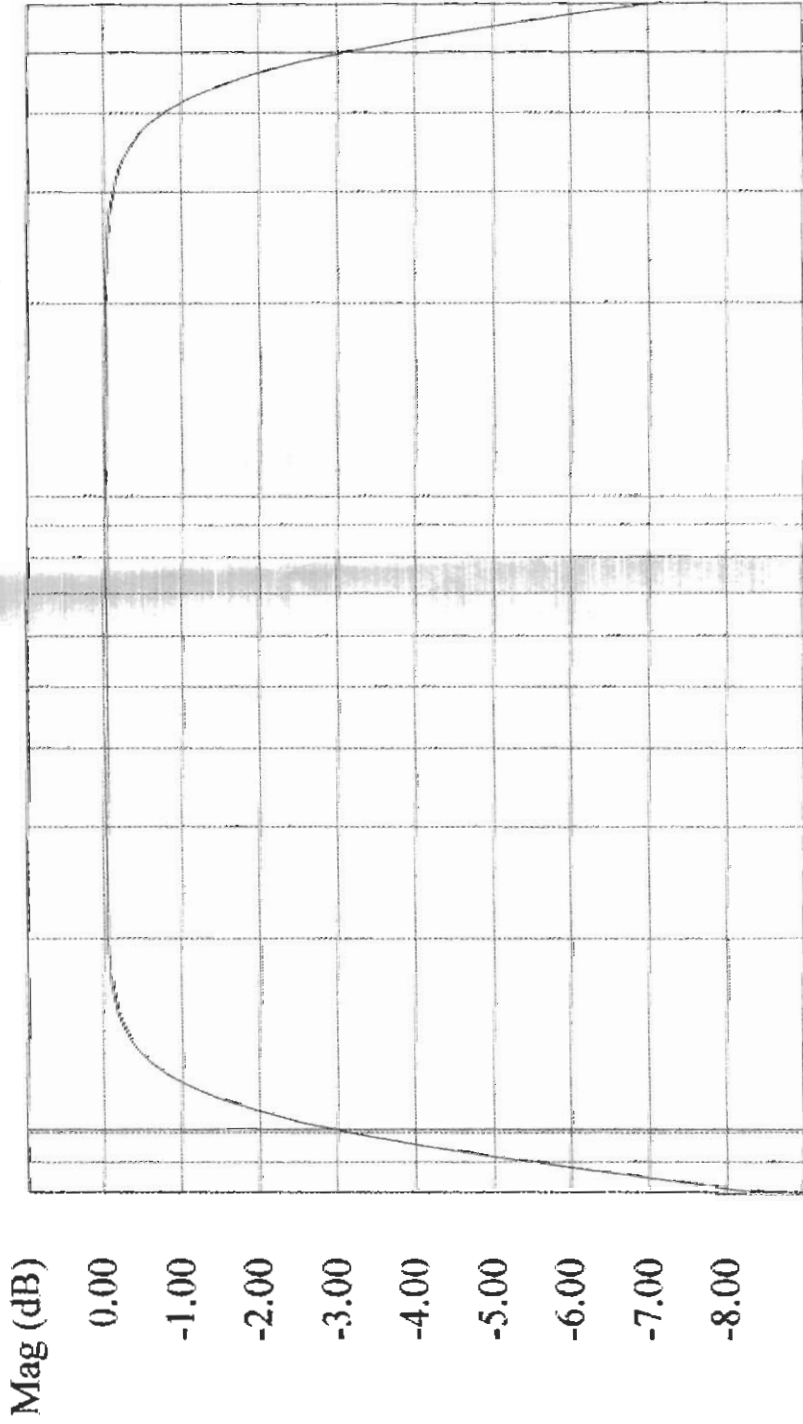
FILTER MODULE INFORMATION SHEET



Pin No.s correspond to a 28 Pin DIP

09/22/04 08:48 AM

1kHz to 50kHz 8-Pole Band-Pass Filter Response



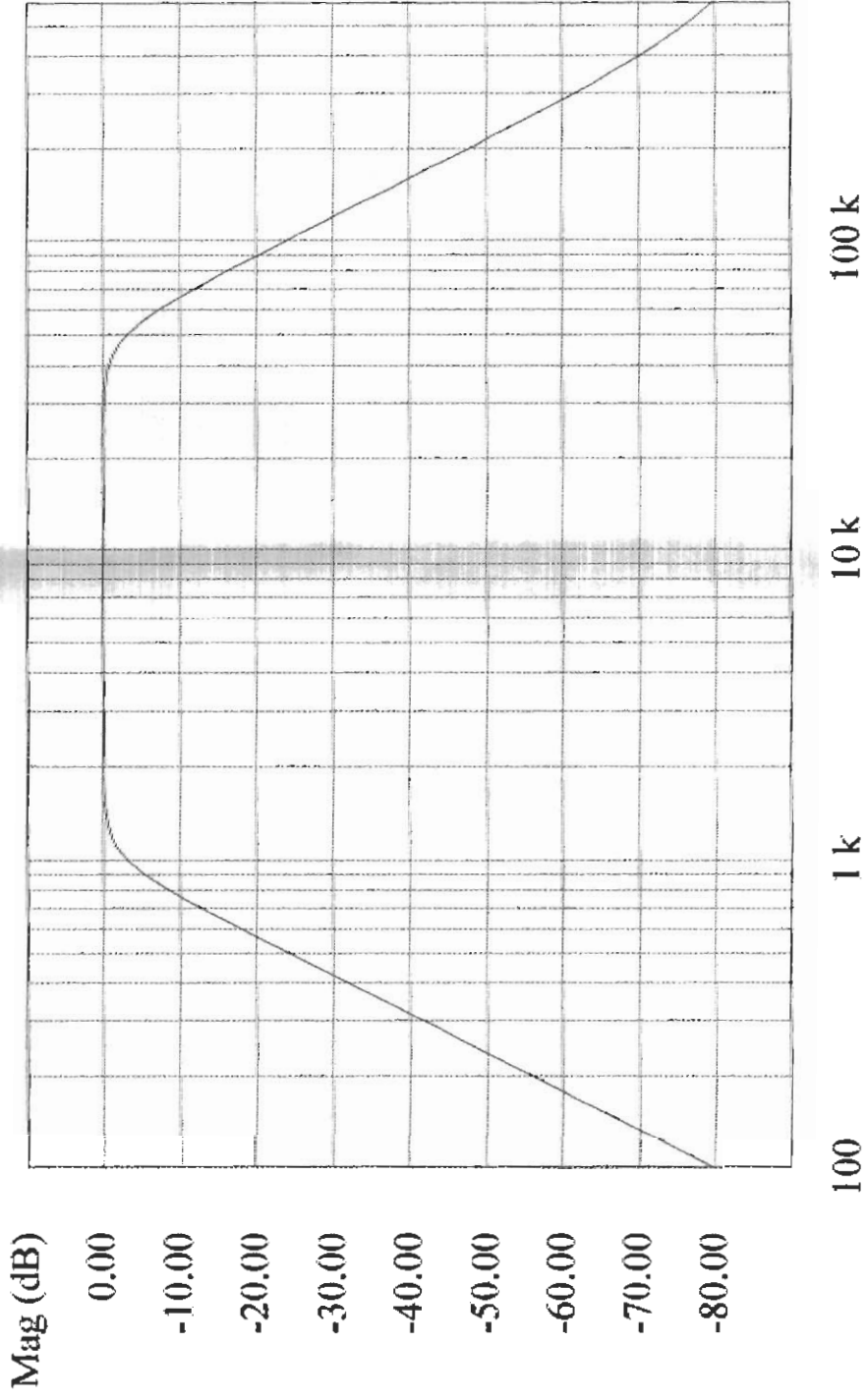
1 k

10 k

Mag	M1	M2	M2 - M1
Freq	1.01 kHz	50.05 kHz	49.03 kHz
Left	-2.98 dB	-3.08 dB	-0.10 dB
Right			

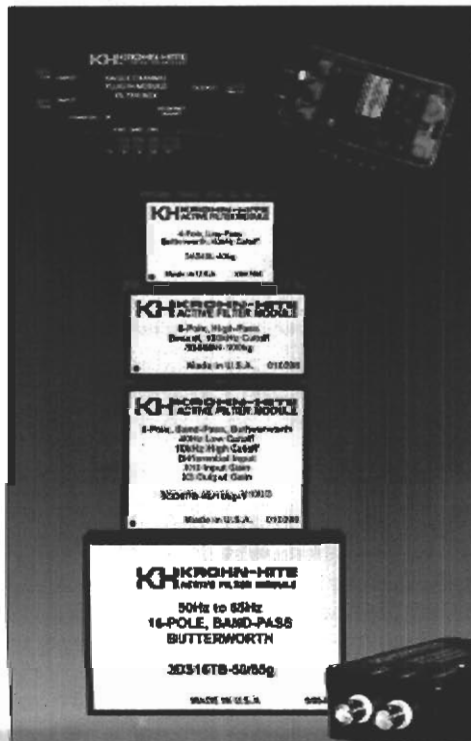
09/22/04 08:50 AM

1kHz to 50kHz 8-Pole Band-Pass Filter



KROHN-HITE CORPORATION

Model 3A, 3B, 3C, 3D FMB300 and FMB302



DESCRIPTION

The NEW 3A, 3B, 3C and 3D Series of continuous-time fixed-frequency precision active filter modules from Krohn-Hite provide filtering in a 1 to 16-pole compact package, with the choice of cutoff frequencies selectable within the frequency range from 1Hz to 1MHz for low-pass and band-pass, 1Hz to 600kHz high-pass.

Choose between Butterworth or Bessel responses, user-defined input and output gain from 1 to 100 in 1% increments (0dB to 40dB). Functions of low-pass, high-pass and band-pass. Each one factory tuned to a user-specified cutoff frequency, number of poles, response, function, single-ended or differential input gains and output gains.

APPLICATIONS

Applications include: anti-alias filtering, data acquisition systems, aerospace (sonar and navigation), sound and vibration testing, medical electronics, communication systems, real and compressed time data analysis, noise elimination and signal reconstruction.

SPECIFICATIONS

AVAILABLE FILTER MODULES

3A Package: 1 to 4-pole.

3B Package: 1 to 4-pole with input gain and output gain; 5 to 8-pole, with no gain.

Continuous Time Fixed Frequency Active Filter Modules

1 and 2 Channel Filter Module Boxes

- **Cutoff Frequencies:** 1Hz to 1MHz LP/BP
1Hz to 600kHz HP
- **Attenuation Slope:** 6dB to 48dB/Octave
- **Responses:** Butterworth or Bessel
- **Functions:** Low-Pass, High-Pass and Band-Pass
- **Input:** Differential and Single-Ended
- **Input Gain:** 1 to 100 (0dB to 40dB)
- **Output Gain:** 1 to 100 (0dB to 40dB)
- **Continuous Time, No Sampling Noise**
- **Wide Signal-to-Noise Ratio and Low Distortion**
- **Factory Tuned, No External Adjustments Needed**
- **Broad Range of Modules to Choose From**
- **FMB300:** Will accept 3A, 3B and 3C Modules
- **FMB302:** Will accept 2 3A, 3B, 3C and 1 3D Module

3G Package: 1 to 8-pole, single-ended or differential with input gain and/or output gain.

3D Package: 8 to 16-pole.

See packaging dimensions.

USER-DEFINED CHARACTERISTICS

Number of poles, function, response type, cutoff frequency, cutoff frequency accuracy, differential or single-ended input gain, output gain.

FILTER CHARACTERISTICS

Functions: High-Pass, Low-Pass or Band-Pass.

Number of Poles: 1 to 16.

Response Types: Butterworth or Bessel.

Cutoff Frequency: Any fixed value in the range from 1Hz to 1MHz, low-pass and band-pass; 1Hz to 600kHz, high-pass.

Relative Gain at f_c : -3.01dB for both Butterworth and Bessel.

Cutoff Frequency Accuracy: 2% standard, 1% optional (driven from 10Ω or less).

Temperature Coefficient: 0.05%/°C.

Passband Response Deviation from Theoretical (non-inverting):

Low-Pass: 1Hz to 50kHz, ± 0.1 dB; to 200kHz, ± 0.2 dB; 0.5dB to 1MHz.

High-Pass (small signal, 0.4Vp-p): Cutoffs below 100Hz and input frequencies to 600kHz, ± 0.1 dB, -3dB point approximately 2.5MHz; cutoffs above 100Hz, ± 0.1 dB for input frequencies to

SPECIFICATIONS

2MHz, ± 0.2 dB for input frequencies to 5MHz, +2dB to -3dB for input frequencies to 25MHz.

Stopband Attenuation (Signal Rejection):

Low-Pass: >100dB to 100kHz, >80dB to 1MHz, >60dB to 5MHz, >50dB to 10MHz.

High-Pass: >100dB.

Signal rejection is printed circuit layout dependent. Use good grounding and shielding practices.

Harmonic Distortion:

LOW-PASS			
Cutoff Frequency	Input Frequencies	Distortion	
		10Vp-p	20Vp-p
<100Hz	All	0.005% (-86dB)	0.01% (-80dB)
100Hz to 10kHz	All	0.003% (-90dB)	0.006% (-84dB)
10kHz to 200kHz	<10kHz	0.005% (-86dB)	0.01% (-80dB)
10kHz to 200kHz	>10kHz	0.015% (-78dB)	0.03% (-70dB)
Distortion will rise by 6dB (factor of 2) at 1/2 the cutoff frequency for 8-pole Butterworth filter types.			
HIGH-PASS			
Cutoff Frequency	Input Frequencies	Distortion	
		10Vp-p	20Vp-p
<100Hz	<2kHz	0.003% (-90dB)	0.006% (-84dB)
	2kHz to 20kHz	0.015% (-76dB)	0.03% (-70dB)
	20kHz to 200kHz	0.15% (-56dB)	0.3% (-50dB)
>100Hz	<10kHz	0.003% (-90dB)	0.006% (-84dB)
	10kHz to 100kHz	0.015% (-76dB)	0.03% (-70dB)
	100kHz to 500kHz	typically 0.2% (-54dB)	
	500kHz to 2MHz	typically 1% (-40dB)	

INPUT CHARACTERISTICS (with no input gain)

Impedance: 10k Ω or greater. Impedance will vary depending upon cutoff frequency selected.

Voltage Range: ± 10 V peak (typically ± 12 V peak for ± 15 V supplies). Reduced in proportion to supply voltages.

Maximum Safe Voltage: Equal to supply voltages.

INPUT GAIN CHARACTERISTICS

Gain: 1 to 100 in 1% increments (0dB to 40dB in 0.1dB increments).

Input Impedance: 1M Ω or greater.

Maximum Voltage Without Damage: Equal to supply voltages.

Input Type: Bipolar (FET input available).

Bias Current: Single-ended input, typically 200nA, 600nA max.; differential input, typically 4 μ A, 12 μ A max., (1 μ A max. offset current).

Single-Ended Gain:

3B Package: 1 to 4-poles.

3C Package: 5 to 8-poles.

Gain Bandwidth (GB) Factor for Determining Useful High-Pass Bandwidth:

3B Package: For high-pass cutoffs <100Hz, 2MHz GB.

All Other Packages: 20MHz GB.

Differential Gain: Available in the 3C Module.

Common Mode Maximum Signal Amplitude (For linear operation with ± 15 V supplies): (differential signal) X (input gain) + (common mode signal) must be $< \pm 10$ V peak reduced in proportion to power supply voltages.

CMMR: >80dB to 1kHz.

Maximum Common Mode or Differential Mode Without Damage: Equal to supply voltages.

Gain Bandwidth: Typically 5MHz with unity input gain; 700kHz, X100 input gain; full power bandwidth, typically 240kHz.

OUTPUT CHARACTERISTICS

Impedance: <0.1 Ω to 200kHz.

Linear Operating Range: ± 10 V peak for ± 15 V supplies, (typically ± 12 V peak). Reduced in proportion to supply voltages.

Low-Pass Maximum Voltage: 20Vp-p (24p-p typical), 1Hz to 1MHz.

High-Pass Maximum Voltage:

Cutoff Frequency	Input Frequencies	Output Voltage
1Hz to 99Hz	1Hz to 200kHz	20Vp-p
	200kHz to 500kHz	10Vp-p
	500kHz to 1MHz	4Vp-p
100Hz to 200kHz	100Hz to 2MHz	20Vp-p
	2MHz to 3MHz	10Vp-p
	3MHz to 5MHz	5Vp-p
	5MHz to 10MHz	1Vp-p

The above specifications are without input and output gain performance limits and apply to modules with ± 15 V supplies. Reduce output performance in proportion to the reduced supply voltage, and input and output gain bandwidth limits.

Maximum Current (2k load): ± 5 mA peak with 10V output.

Offset Voltage: <10mV settable to zero with offset control.

Offset Temperature Coefficient: <0.2mV/ $^{\circ}$ C.

Noise (with input shorted to ground and detector bandwidth of 5Hz to 300kHz): typically 25 μ V, 50 μ V rms max. referred to input.

Noise Spectral Density: <100nV/ \sqrt Hz, 100Hz to 300kHz, typically 40nV/ \sqrt Hz. For 8-pole Butterworth modules specification may be 3 times higher near the cutoff region.

Signal-to-Noise Ratio (at 7V rms): >100dB.

OUTPUT GAIN CHARACTERISTICS

Output gain is available in 1 to 4-pole modules in the 3B package and 5 to 8 poles modules in the 3C package.

Gain: 1 to 100 in 1% increments (0dB to 40dB in 0.1dB increments).

Gain Bandwidth: 100MHz for output gains of 5 or greater. For gains less than 5, max. useful bandwidth is a fixed 20MHz.

POWER SUPPLY (\pm Vs)

Specifications Apply at ± 15 Vdc to ± 15 Vdc or single supply from 10Vdc to 30Vdc.

Operating Range: ± 5 Vdc to ± 18 Vdc.

Maximum Safe Voltage: ± 18 Vdc.

Current: 3A and 3B Package, <15mA; 3C Package with gain, <30mA. Consult factory for ultra-low power version.

GENERAL

Output Short Circuit Protection: Limited to short duration.

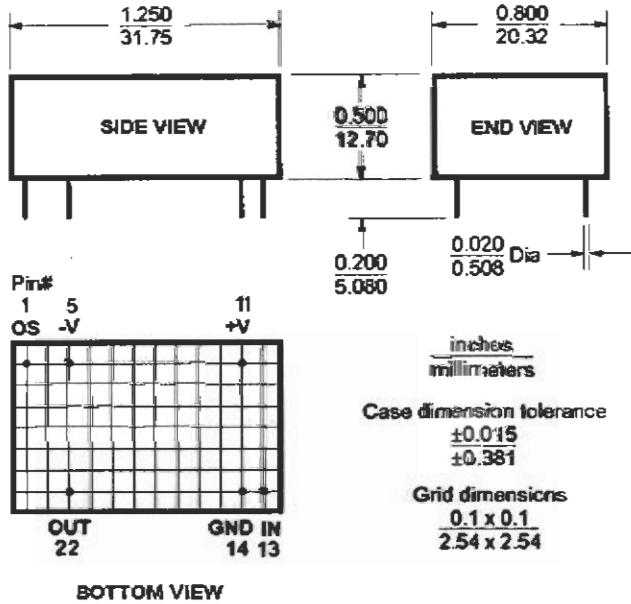
Operating Temperature Range: 0 $^{\circ}$ C to -70 $^{\circ}$ C.

Storage Temperature Range: -25 $^{\circ}$ C to +85 $^{\circ}$ C.

Specifications apply at 25 $^{\circ}$ C $\pm 5^{\circ}$ C.

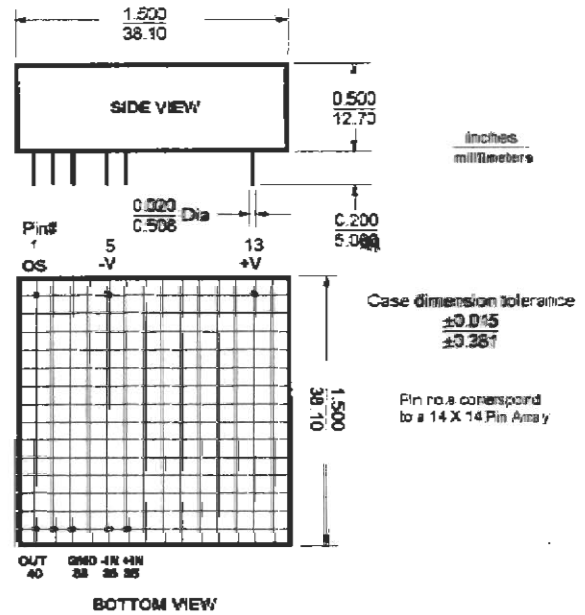
Specifications subject to change without notice.

SPECIFICATIONS



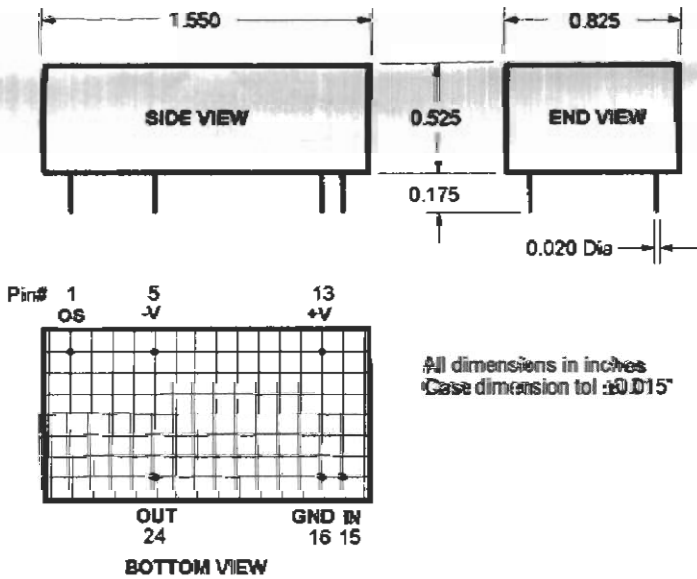
Pin No.s correspond to a 24 Pin DIP

3A Module Dimension Information



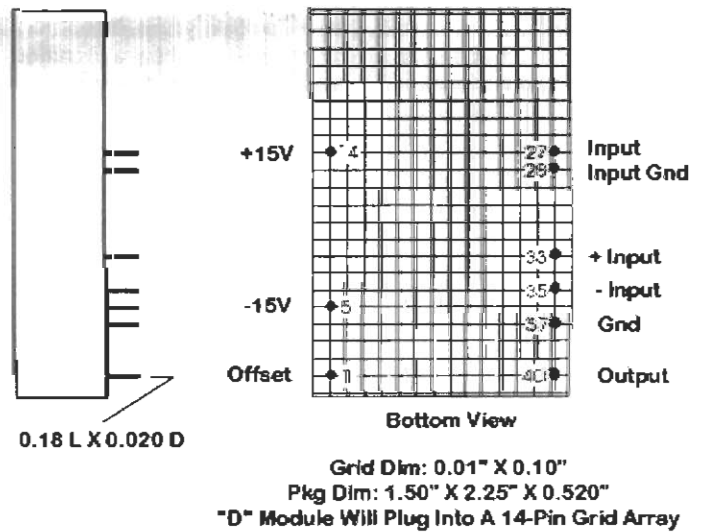
Pin no.s correspond to a 14 X 14 Pin Array

3C Module Dimension Information



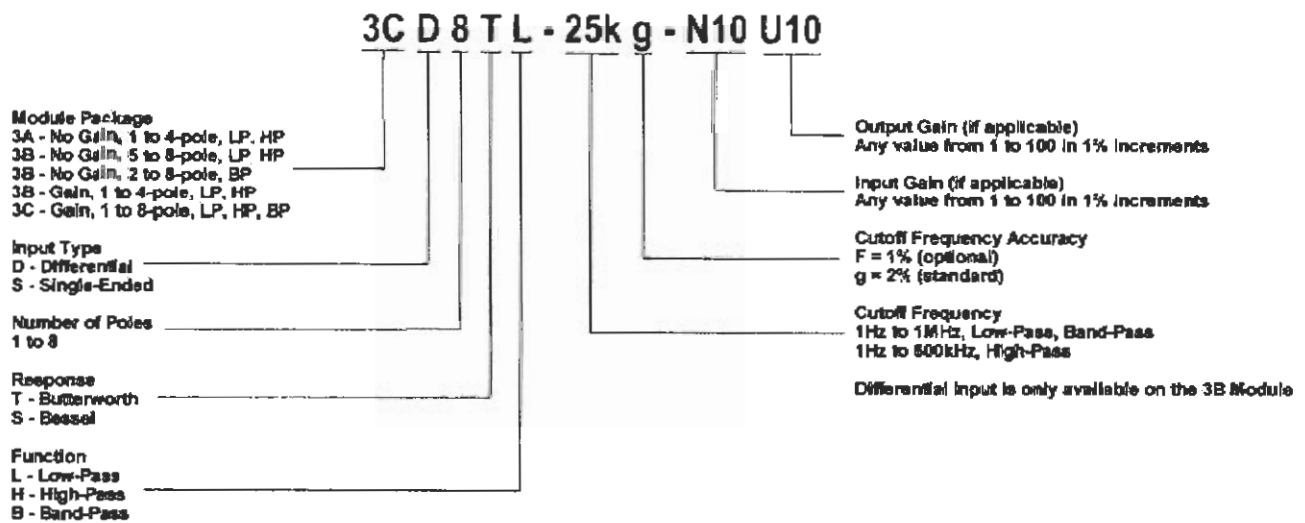
Grid Dimensions 0.1" x 0.1"
Pin No.s correspond to a 28 Pin DIP

3B Module Dimension Information



3D Module Dimension Information

ORDERING INFO



Application Note

1. To verify cutoff accuracy for filters without input gain, you must drive the input from a 10 ohm or less source. Most signal generators have a 50 ohm output impedance, arrangement in Figure 1 can be used to accomplish a 10 ohm source impedance.

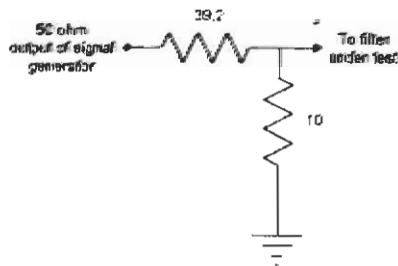


Figure 1

3. For single-ended input gain in the 3C package, connect the offset (OS) pin as shown in Figure 2:

$$R_{OS} = 51.1k \text{ for } \pm 15V \text{ supplies}$$

$$R_{OS} = 36k \text{ for } \pm 10V \text{ supplies}$$

$$R_{OS} = 0 \text{ for } \pm 5V \text{ supplies}$$

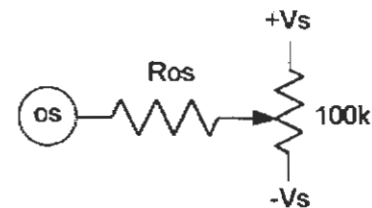


Figure 2

2. For proper operation, low-pass filters require a dc return path to ground for input bias current of typically 150nA (500nA max.). For filters with FET input bias or below 100-Hz cutoff frequency, the bias current is less than 1nA.

The filter has two internal 0.1 μ F ceramic capacitors, bypassing the supply inputs to ground. If the supply is unusually dirty with noise or signal, a larger external capacitor is recommended. If necessary, decoupling resistors of 10 ohms will also help.

For all filters in the 3A and 3B package, connect the offset pin as shown in Figure 2:

$$R_{OS} = 51.1k \text{ for } \pm 5V \text{ supplies}$$

$$R_{OS} = 32.4k \text{ for } \pm 10V \text{ supplies}$$

$$R_{OS} = 12.4k \text{ for } \pm 5V \text{ supplies}$$