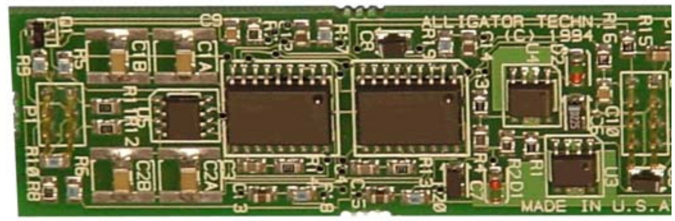
# AAF-3F

## Programmable, 2-Channel Low-Pass Filter Module

**Compatible with the AAF-3, AAF-3PCI, and OEM Data Acquisition Systems**

## Features

- Filter types, 8 pole
  - Elliptic (Cauer)
  - Linear phase
- ±5V Input and Output
- Continuously tunable bandwidths from 1Hz to 100kHz
- Active DC compensation
- DC Offset 0.5mV typical



## Description

The AAF-3F is designed for use with the AAF-3M and AAF-3MPCI filter boards. The AAF-3F can be used effectively in time domain as well as frequency domain processing. The filter characteristics can be switched from elliptic to linear phase in software making it ideally suited for multiple applications without changing the hardware or the cabling. The AAF-3F is single-ended in and out but when combined with an AAF-3G instrumentation amplifier in an AAF-3 system, differential or single-ended inputs can be accommodated. The AAF-3F supports a wide range of corner frequencies and the standard model can be tuned to any frequency from 10Hz to 50kHz in Linear Phase mode or 10Hz to 100kHz in Elliptic mode. A factory implemented optional modification can broaden the bandwidth down to corner frequencies as low as 1Hz. In the time domain where a small DC offset is critical, the AAF-3F filters include Automatic DC offset correction.

Bandpass filters can be created on an AAF-3 system by combining an AAF-3F low pass filter and the AAF-HP high pass filter.

## Filter Types

The AAF-3F can switch between elliptic and a linear phase response on the fly. The bandwidth of the elliptic mode is up to 100kHz while the bandwidth of the linear phase mode is up to 50kHz. The AAF-2F module when combined with the AAF-3 or AAF-3PCI is suitable for a large range of applications where data is processed in the time domain, frequency domain, or both.

***Elliptic (Cauer):*** The Elliptic filter has ripple in both the pass band and stop band, but provides the fastest transition of any filter type. It has the largest phase non-linearity, especially near the corner frequency. The step response has the largest overshoot and ringing.

***Linear Phase:*** The Linear Phase filter approximates a maximally flat frequency response. The Linear Phase filter's transition band is faster than the Bessel. At $2f_c$ the Bessel filter has 12dB of attenuation, while the Linear Phase has 34dB, and at $3f_c$, the Bessel has 30dB, and the Linear Phase 68dB. The Linear Phase filter is optimized for constant group delay out to about $2f_c$. The time domain response has approximately 5% overshoot with no ringing. The Linear Phase filter is a good choice for a compromise filter that works well in both the time domain and frequency domain. One drawback to the Linear Phase filter is at higher cutoff frequencies the filter amplitude response has up to 1dB of gain. To maintain a given distortion level, the input signal level must be reduced at high cutoff frequencies.

### Filter Specifications

| | Cutoff Frequency | Passband Performance | **Stopband** Rejection | **Total** Wideband Noise | **Phase Matching** |
|---|---|---|---|---|---|
| **Elliptic** | 10 Hz - 100 kHz standard<br>1 Hz - 100 kHz optional | +0.4dB -0.2dB max, to 0.85 Fc | 90 dB Typ. | 110µVRMS Typ. | **±0.75°max up to 0.75Fc** |
| **Linear Phase** | 10 Hz - 50 kHz standard<br>1 Hz - 50 kHz optional | Group delay ±0.5% max and -1dB droop max at 0.75 Fc, low-freq gain +0.4dB -0.2dB max | 90 dB Typ. | 90µVRMS Typ. | **±0.6°max up to 0.75Fc** |

## Input Amplifier

DC offset ..............................±0.4mV typ, ±1.9mV max
DC offset vs. temperature .....<±4 μV/°C typ
Common-mode rejection.......80 dB min, 96 dB typ
Input voltage ........................±5 V max
Input protection .....................±14 V max
Input impedance ...................$10^{12}\Omega$ analog ground
Input bias current ..................±7pA type, ±75 pA max
Input offset current................±4 pA type, ±50 pA max
Amplifier bandwidth...............5MHz typ
Amplifier slew rate.................14 V/μsec typ, $V_o$=±5 V

## Filter Specifications

DC offset, Automatic ............<±.0.5 mV typ. 3.0mV max
Elliptic Mode Gain .................+0.4dB–0.2dBmax, +0.25dB–0.05dBtyp
Linear Phase Mode Gain ......+0.4dB–0.2dBmax, +0.25dB–0.05dBtyp
Output voltage ......................±5 V max
Load resistance.....................1KΩ min
Output impedance.................27±3 Ω

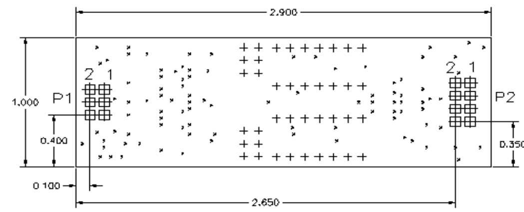
## Miscellaneous

Power consumption ..............60mA at ±12V
Operating temperature..........0°C to 70°C

## Options

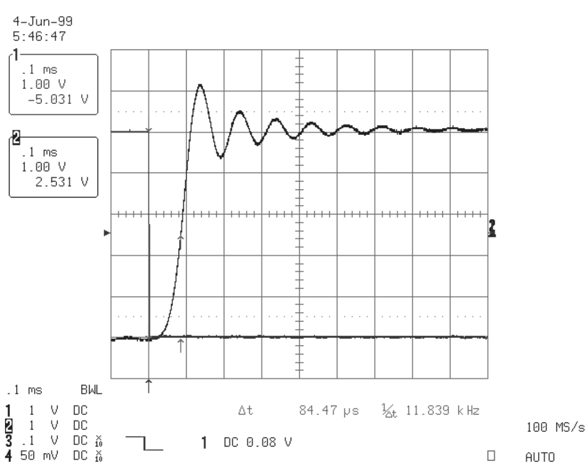
-100 for use with Fc = 1Hz to 10Hz

## Physical Dimensions

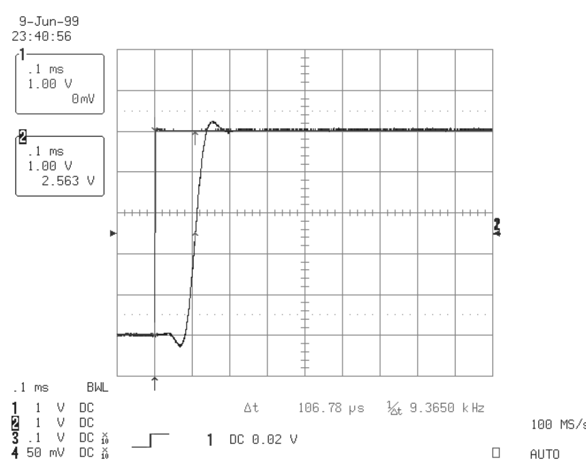



## Pin Description

| Pin # | Input Connector 0.1" pin | Output Connector |
|---|---|---|
| | In_A_Hi | Agnd |
| 2 | In_A_Lo | Out_A_Hi |
| 3 | Agnd | Agnd |
| 4 | Mode Selection | Out_B_Hi |
| 5 | In_B_Hi | +12V |
| 6 | In_B_Lo | -12V |
| 7 | | Filter Clock |
| 8 | | DGnd |




**Step Response Elliptic Fc = 10kHz**




**Step Response Linear Phase Fc = 10kHz**

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