FREQUENCY DEVICES

# FIXED FREQUENCY BAND-REJECT/BANDPASS ACTIVE FILTERS



FREQUENCY DEVICES INC

T-64-05

## FEATURES

- Ready-to-Use Fully Finished Components
- Center Frequencies 0.2Hz to 20kHz
- Transfer Characteristics Stable and Precise
- Passband Gain 0dB for All Models
- Low Profile Package for Card Files
- Economy Priced.....Now Available

## APPLICATIONS

- Transducer Output Filtering
- Power Line Interference Rejection
- Production Test Instrumentation
- Medical Instrumentation
- Comb Filtering

## GENERAL

Frequency Devices' 700 Series of fixed frequency, bandpass and band-reject active filters are value-engineered components for system filtering functions. Incorporating various design techniques - some patented by F.D.I. - each filter type features a near-theoretical amplitude/phase response. Along with this, low output voltage noise enables these filters to resolve microvolt-level signals for a 1000:1 or better dynamic signal range.

The bandpass filters pass all frequencies lying between the upper and lower -3dB points of the amplitude response curve, while the band reject filter sharply attenuates those frequencies. A more detailed discussion of essential filter characteristics is presented further on.

## FDI OFFERS MANY APPLICATION-SPECIFIC BANDPASS AND BAND REJECT FILTERS

**These include active filters from other product families. Examples are ANSI Full-Octave, Half-Octave and Third-Octave CCITT 60, 75, 110, 150, 300 and 600 Baud AT&T Ref. 41009 C-Message and C-Notch filters, as well as EEG, EKG, AND EMG filters for bio-medical instrumentation.**

**Call our application engineer about these and many more solutions to your filtering problems.**



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## SPECIFICATIONS - (Typical at 25°C and $\pm V_s = \pm 15Vdc$ )

| Line Number | Model Number | No of Pole Pairs | CENTER FREQ. $f_o$ Range Hz | CENTER FREQ. $f_o$ Stability %/°C | Passband Gain [1] | Notch Att'n dB (min) | Q | Input Impedance Ohms (min) [2] | Input Bias Current |
|---|---|---|---|---|---|---|---|---|---|
| **BAND REJECT RESPONSES** | | | | | | | | | |
| 1 | 783R3Q3 | 3 | 50-5K | Note 5 | 0 ± 0.3dB | 50 | 3 | 20K | 40nA |
| 2 | 783R3Q10 | | | | | | 10 | | |
| 3 | 781R1Q2 | 1 | 0.2-20K | ± 0.01 | 0 ± 0.1dB | 50 | 2[6] | 20K | 40nA |
| 4 | 719R1Q2 | 1 | 1-10 | ± 0.05 | 0 ± 0.02dB | 40 | 2 ± 10% | 1000M | 10nA |
| 5 | 720R1Q2 | | 10-20K | | | | | | |
| **BANDPASS RESPONSES** | | | | | | | | | |
| 6 | 725P1Q10 | 1 | 1-10 | ± 0.05 | 0 ± 0.2dB[7] | NA | 10 ± 10% | 100K | NA[8] |
| 7 | 727P1Q10 | | 10-20K | | | | | | |
| 8 | 726P2Q5 | 2 | 1-10 | ± 0.05 | 0 ± 0.3dB[7] | NA | 5 ± 10% | 30K | NA[8] |
| 9 | 728P2Q5 | | 10-20K | | | | | | |
| 10 | 781R1Q2 | 1 | 0.2-20K | ± 0.01 | 0 ± 0.1dB | NA | 2[6] | 20K | 40nA |

**NA = Not Applicable**

## SPECIFICATIONS COMMON TO ALL MODELS

| | |
|---|---|
| **CENTER FREQUENCY** | |
| Initial Tolerance | ± 2% |
| **INPUT** | |
| Linear Input Voltage Range | ± 10V |
| Maximum Safe Input Range | ± $V_S$ |
| **OUTPUT** | |
| Noise (DC to 50kHz; Input Grounded) | 50μV RMS |
| Resistance | 1Ω |
| **POWER SUPPLY** | |
| Rated Voltage | ± 15Vdc |
| Operating Range | ± 5Vdc to ± 18Vdc |
| **TEMPERATURE** | |
| Operating Range | 0°C to +70°C |
| Storage Range (Non-Operating) | -25°C to +85°C |



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## SPECIFICATIONS — Continued...

| OUTPUT CHARACTERISTICS | | | | | SUPPLY (± Vs) | MECHANICAL | |
|---|---|---|---|---|---|---|---|
| Line Number | Full Power Response | Linear[3] Output Range | Initial[4] Offset Voltage | Offset Drift ± μV/°C | Quiescent Current | Case Size Inches | Case Style |
| **BAND REJECT RESPONSES - Continued . . .** | | | | | | | |
| 1 | 10kHz | ± 10V@5mA | ± 25mV | 50 | 25mA | 2x2x0.4 | H-1 |
| 2 | | | | | | | |
| 3 | 10kHz | ± 10V@5mA | ——— | ——— | 25mA | 1.5x2x0.4 | G-1 |
| 4 | 50kHz | ± 10V@2mA | ± 2mV | 40 | 8mA | 1.2x2x0.6 | L-2 |
| 5 | | | | 30 | | | |
| **BANDPASS RESPONSES - Continued . . .** | | | | | | | |
| 6 | $f_O$ | ± 10V@2mA | ± 2mV | 20 | 6mA | 1.2x2x0.6 | L-2 |
| 7 | | | | | | | |
| 8 | $f_O$ | ± 10V@2mA | ± 2mV | 30 | 6mA | 1.4x2.9x1 | R-3 |
| 9 | | | | | | 1.2x2x0.6 | L-2 |
| 10 | $f_O$ | ± 10V@5mA | ——— | ——— | 8mA | 1.5x2x0.4 | G-1 |

**NA = Not Applicable**

**NOTES:**

1) Passband gain of band reject filters is specified at DC and frequencies above 7 $f_O$. Passband gain of bandpass filters is specified at $f_O$.
2) To maintain specified accuracy of gain and $f_O$, the external source impedance should not exceed 600 ohms.
3) The output is short circuit protected to ground.
4) The initial offset voltage of all models is externally adjustable to zero.
5) The 783 Series transfer characteristics remain within specified limits over the full 0°C to +70°C operating temperature range.
6) All 781R1Q2 Models are factory set for a Q of 2 and are externally adjustable for Q values ranging between 0.5 and 100.
7) The passband gain of all 725, 726, 727 and 728 Models can be user adjusted for any value between 0 and +1.2. Note that the gain is expressed as a ratio - not a dB value.
8) The input is capacitively coupled.



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## FUNCTIONAL DESCRIPTION

A BAND REJECT FILTER attenuates signal frequencies within the center or notch region, and passes frequencies above and below the notch. The filter's upper and lower -3dB frequencies $-f_H$ and $f_L$, respectively - both bound and define the width of the notch.

The filter sensitivity is defined as $Q = f_O/(f_H - f_L)$ where $f_O$ is the filter center frequency. The models presented here are fixed frequency devices, some of which include provisions for narrow band trimming.

Another key parameter is notch attenuation, or "notch depth". This is defined as the gain reduction in dB relative to the passband gain of the band-reject filter well above and below the frequencies bounding the notch.

The following active filters having **band-reject** capabilities will be described fully in order of appearance:

- **The 783 Series Interference Elimination Filters**
- **The 781 Series Band-Reject/Bandpass Filters**
- **The Models 719R1Q2 and 720R1Q2 Band Reject Filters**

A BANDPASS FILTER passes signal frequencies in the passband region and attenuates frequencies above and below this region. The passband is defined and bounded by the filter's upper and lower -3dB break frequencies $-f_H$ and $f_L$, respectively; the break frequencies occur at the points where the filter amplitude response passes through the designed -3dB gain-reduction with respect to the passband gain.

Several key parameters define a bandpass filter. First one must specify the center frequency, $f_O$. This must be specified for these fixed frequency filters and can be expressed as the geometric mean of the -3dB frequencies: $f_O = \sqrt{f_H f_L}$.

Next, the selectivity - known as the Q of the filter - must be determined. This characteristic establishes the filter's sharpness of frequency discrimination and is expressed as $Q = f_O/(f_H - f_L)$.

BOTH BAND-REJECT AND BANDPASS FILTERS exhibit greater selectivity (Q) as the difference between the upper and lower -3dB frequencies grows smaller. In the limit - but not in practice - the Q of both types of filter will approach infinity as $(f_H - f_L)$ approaches zero or as $f_H$ and $f_L$ approach $f_O$. However, practical limitations often constrain filters to operate with more finite values of Q such as 2, 5, 10 or 100; limited resolution of the calibration instruments and incompatible system bandwidth requirements are two such restraints.

The preceding two pages tabulated the key dynamic and static specifications of the filters described by this document. The following pages will present one self-contained section for each product family, beginning with band-reject filters and concluding with bandpass filters. Each section will contain calibration procedures and application techniques, along with graphs and/or tables of the amplitude and/or phase response versus frequency for each of the product families. The Models 781R1Q2, 725P1Q10, 727P1Q10, 726P2Q5 and 728P2Q5 compose this category.



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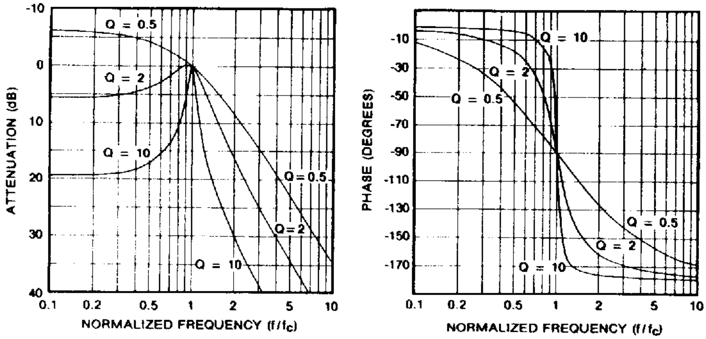
## THEORETICAL LOWPASS FREQUENCY RESPONSE




## THEORETICAL LOWPASS RESPONSE TABLE

### Attenuation and Phase vs. Normalized Frequency, Q from 1 to 50.

| $f/f_o$ | Q = 1 | | Q = 2 | | Q = 5 | | Q = 10 | | Q = 20 | | Q = 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A[dB] | ψ[°] | A[dB] | ψ[°] | A[dB] | ψ[°] | A[dB] | ψ[°] | A[dB] | ψ[°] | A[dB] | ψ[°] |
| 0.1000 | 0.0 | -5.8 | 5.9 | -2.9 | 13.9 | -1.2 | 19.9 | -0.6 | 25.9 | -0.3 | 33.9 | -0.1 |
| 0.2000 | -0.2 | -11.8 | 5.7 | -5.9 | 13.6 | -2.4 | 19.7 | -1.2 | 25.7 | -0.6 | 33.6 | -0.2 |
| 0.3000 | -0.4 | -18.2 | 5.3 | -9.4 | 13.2 | -3.8 | 19.2 | -1.9 | 25.2 | -0.9 | 33.2 | -0.4 |
| 0.5000 | -0.9 | -33.7 | 4.0 | -18.4 | 11.6 | -7.6 | 17.5 | -3.8 | 23.5 | -1.9 | 31.5 | -0.8 |
| 0.7000 | -1.3 | -53.9 | 1.9 | -34.5 | 8.5 | -15.4 | 14.2 | -7.8 | 20.2 | -3.9 | 28.1 | -1.6 |
| 0.8000 | -1.1 | -65.8 | 0.6 | -48.0 | 5.9 | -24.0 | 11.3 | -12.5 | 17.2 | -6.3 | 25.1 | -2.5 |
| 0.9000 | -0.7 | -78.1 | -0.2 | -67.1 | 2.3 | -43.5 | 6.5 | -25.3 | 11.8 | -13.3 | 19.6 | -5.4 |
| 0.9200 | | | | | | | | | 10.1 | -16.7 | 17.8 | -6.8 |
| 0.9300 | | | | | 1.2 | -54.0 | 4.3 | -34.5 | | | | |
| 0.9400 | | | | | | | | | 8.0 | -22.0 | 15.4 | -9.2 |
| 0.9500 | | | | | 0.6 | -62.8 | 2.7 | -44.3 | | | | |
| 0.9600 | -0.3 | -85.3 | | | | | | | | | | |
| 0.9700 | | | -0.1 | -83.1 | 0.1 | -73.1 | 1.1 | -58.6 | 3.7 | -39.4 | 9.9 | -18.2 |
| 0.9850 | | | | | | | | | 1.2 | -58.8 | 5.0 | -33.5 |
| 0.9900 | -0.1 | -88.8 | | | 0.0 | -84.3 | | | | | | |
| 0.9950 | | | 0.0 | -88.9 | | | 0.0 | -84.3 | 0.1 | -78.7 | 0.9 | -63.4 |
| 0.9980 | | | | | 0.0 | -88.9 | | | 0.0 | -85.4 | | |
| 0.9990 | | | | | | | 0.0 | -88.9 | | | 0.0 | -84.3 |
| 0.9996 | | | | | | | | | 0.0 | -89.1 | | |
| 0.9998 | | | | | | | | | | | 0.0 | -88.9 |
| 1.0000 | 0.0 | -90.0 | 0.0 | -90.0 | 0.0 | -90.0 | 0.0 | -90.0 | 0.0 | -90.0 | 0.0 | -90.0 |
| 1.0002 | | | | | | | | | | | 0.0 | -91.1 |
| 1.0004 | | | | | | | | | 0.0 | -90.0 | | |
| 1.0010 | | | | | | | 0.0 | -91.1 | | | 0.1 | -95.7 |
| 1.0020 | | | | | 0.0 | -91.1 | | | 0.1 | -94.6 | | |
| 1.0050 | | | 0.1 | -91.1 | | | 0.1 | -95.7 | 0.2 | -101.3 | 1.0 | -116.5 |
| 1.0100 | 0.1 | -91.1 | | | 0.1 | -95.7 | | | | | | |
| 1.0150 | | | | | | | | | 1.5 | -120.8 | 5.2 | -146.1 |
| 1.0300 | | | 0.3 | -96.7 | 0.6 | -106.5 | 1.6 | -120.6 | 4.1 | -139.8 | 10.1 | -161.3 |
| 1.0400 | 0.4 | -94.5 | | | | | | | | | | |
| 1.0500 | | | | | 1.4 | -116.0 | 3.3 | -134.3 | | | | |
| 1.0600 | | | | | | | | | 8.6 | -156.8 | 16.0 | -170.3 |
| 1.0700 | | | | | 2.2 | -124.1 | 5.1 | -143.6 | | | | |
| 1.0800 | | | | | | | | | 10.9 | -162.0 | 18.5 | -172.6 |
| 1.1000 | 1.0 | -100.8 | 1.4 | -110.9 | 3.6 | -133.7 | 7.5 | -152.4 | 12.8 | -165.3 | 20.5 | -174.0 |
| 1.2000 | 2.1 | -110.1 | 3.5 | -126.3 | 8.0 | -151.4 | 13.2 | -164.7 | 19.0 | -172.2 | 26.9 | -176.9 |
| 1.4000 | 4.6 | -124.4 | 7.5 | -143.9 | 14.0 | -163.7 | 19.7 | -171.7 | 25.7 | -175.8 | 33.6 | -178.3 |
| 1.7000 | 8.1 | -138.0 | 12.4 | -155.8 | | | | | 31.6 | -177.4 | 39.5 | -179.0 |
| 2.0000 | 11.1 | -146.3 | 16.0 | -161.6 | 23.6 | -172.4 | 29.6 | -176.2 | 35.6 | -178.1 | 43.5 | -179.2 |
| 3.0000 | 18.6 | -159.4 | 24.2 | -169.4 | 32.1 | -175.7 | 38.1 | -177.9 | 44.0 | -178.9 | 52.0 | -179.6 |
| 5.0000 | 27.8 | -168.2 | 33.7 | -174.1 | 41.6 | -177.6 | 47.6 | -178.8 | 53.6 | -179.4 | 61.6 | -179.8 |
| 10.0000 | 40.0 | -174.2 | 45.9 | -177.1 | 53.9 | -178.8 | 59.9 | -179.4 | 65.9 | -179.7 | 73.9 | -179.9 |



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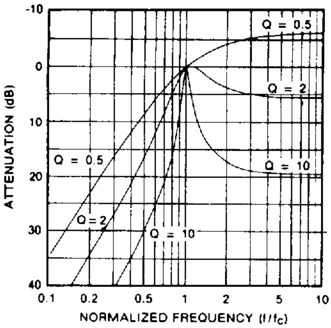
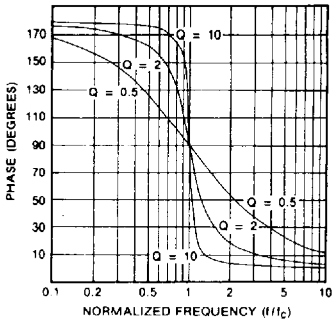
## THEORETICAL HIGHPASS FREQUENCY RESPONSE




## THEORETICAL HIGHPASS RESPONSE TABLE

Attenuation and Phase vs. Normalized Frequency, Q from 1 to 50.

| $f/f_c$ | Q = 1 | | Q = 2 | | Q = 5 | | Q = 10 | | Q = 20 | | Q = 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] |
| 0.1000 | 40.0 | 174.2 | 45.9 | 177.1 | 53.9 | 178.8 | 59.9 | 179.4 | 65.9 | 179.7 | 73.9 | 179.9 |
| 0.2000 | 27.8 | 168.2 | 33.7 | 174.1 | 41.6 | 177.6 | 47.6 | 178.8 | 53.6 | 179.4 | 61.6 | 179.8 |
| 0.3000 | 20.5 | 161.8 | 26.2 | 170.6 | 34.1 | 176.2 | 40.1 | 178.1 | 46.1 | 179.1 | 54.1 | 179.6 |
| 0.5000 | 11.1 | 148.3 | 16.0 | 161.6 | 23.6 | 172.4 | 29.6 | 176.2 | 35.6 | 178.1 | 43.5 | 179.2 |
| 0.7000 | 5.0 | 126.1 | 8.0 | 145.5 | 14.6 | 164.6 | 20.4 | 172.2 | 26.4 | 176.1 | 34.3 | 178.4 |
| 0.8000 | 2.7 | 114.2 | 4.5 | 132.0 | 9.8 | 156.0 | 15.2 | 167.5 | 21.1 | 173.7 | 29.0 | 177.5 |
| 0.9000 | 1.1 | 101.9 | 1.6 | 112.9 | 4.2 | 136.5 | 8.3 | 154.7 | 13.7 | 166.7 | 21.4 | 174.6 |
| 0.9200 | | | | | | | | | 11.6 | 163.3 | 19.2 | 173.2 |
| 0.9300 | | | | | 2.5 | 126.0 | 5.6 | 145.5 | | | | |
| 0.9400 | | | | | | | | | 9.0 | 158.0 | 16.5 | 170.8 |
| 0.9500 | | | | | 1.5 | 117.2 | 3.6 | 135.7 | | | | |
| 0.9600 | 0.4 | 94.7 | | | | | | | | | | |
| 0.9700 | | | 0.3 | 96.9 | 0.7 | 106.9 | 1.6 | 121.4 | 4.2 | 140.6 | 10.4 | 161.8 |
| 0.9850 | | | | | | | | | 1.5 | 121.2 | 5.3 | 146.5 |
| 0.9900 | 0.1 | 91.2 | | | 0.1 | 95.7 | | | | | | |
| 0.9950 | | | 0.1 | 91.1 | | | 0.1 | 95.7 | 0.2 | 101.3 | 1.0 | 116.6 |
| 0.9980 | | | | | 0.0 | 91.1 | | | 0.1 | 94.6 | | |
| 0.9990 | | | | | | | 0.0 | 91.1 | | | 0.1 | 95.7 |
| 0.9996 | | | | | | | | | 0.0 | 90.9 | | |
| 0.9998 | | | | | | | | | | | 0.0 | 91.1 |
| 1.0000 | 0.0 | 90.0 | 0.0 | 90.0 | 0.0 | 90.0 | 0.0 | 90.0 | 0.0 | 90.0 | 0.0 | 90.0 |
| 1.0002 | | | | | | | | | | | 0.0 | 88.9 |
| 1.0004 | | | | | | | | | 0.0 | 89.1 | | |
| 1.0010 | | | | | | | 0.0 | 88.9 | | | 0.0 | 84.3 |
| 1.0020 | | | | | 0.0 | 88.9 | | | 0.0 | 85.4 | | |
| 1.0050 | | | 0.0 | 88.9 | | | 0.0 | 84.3 | 0.1 | 78.7 | 0.9 | 63.5 |
| 1.0100 | -0.1 | 88.9 | | | 0.0 | 84.3 | | | | | | |
| 1.0150 | | | | | | | | | 1.2 | 59.2 | 5.0 | 33.9 |
| 1.0300 | | | -0.2 | 83.3 | 0.1 | 73.5 | 1.0 | 59.4 | 3.5 | 40.2 | 9.6 | 18.7 |
| 1.0400 | -0.3 | 85.5 | | | | | | | | | | |
| 1.0500 | | | | | 0.5 | 64.0 | 2.5 | 45.7 | | | | |
| 1.0600 | | | | | | | | | 7.6 | 23.2 | 14.9 | 9.7 |
| 1.0700 | | | | | 1.0 | 55.9 | 3.9 | 36.4 | | | | |
| 1.0800 | | | | | | | | | 9.5 | 18.0 | 17.1 | 7.4 |
| 1.1000 | -0.7 | 79.2 | -0.2 | 69.1 | 2.0 | 46.3 | 5.8 | 27.6 | 11.1 | 14.7 | 18.8 | 6.0 |
| 1.2000 | -1.0 | 69.9 | 0.3 | 53.7 | 4.8 | 28.6 | 10.0 | 15.3 | 15.8 | 7.8 | 23.7 | 3.1 |
| 1.4000 | -1.3 | 55.6 | 1.7 | 36.1 | 8.1 | 16.3 | 13.9 | 8.3 | 19.8 | 4.2 | 27.8 | 1.7 |
| 1.7000 | -1.1 | 42.0 | 3.1 | 24.2 | | | | | 22.3 | 2.6 | 30.3 | 1.0 |
| 2.0000 | -0.9 | 33.7 | 4.0 | 18.4 | 11.6 | 7.6 | 17.5 | 3.8 | 23.5 | 1.9 | 31.5 | 0.8 |
| 3.0000 | -0.5 | 20.6 | 5.2 | 10.6 | 13.0 | 4.3 | 19.0 | 2.1 | 25.0 | 1.1 | 53.0 | 0.4 |
| 5.0000 | -0.2 | 11.8 | 5.7 | 5.9 | 13.6 | 2.4 | 19.7 | 1.2 | 25.7 | 0.6 | 33.6 | 0.2 |
| 10.0000 | 0.0 | 5.8 | 5.9 | 2.9 | 13.9 | 1.2 | 19.9 | 0.6 | 25.9 | 0.3 | 33.9 | 0.1 |



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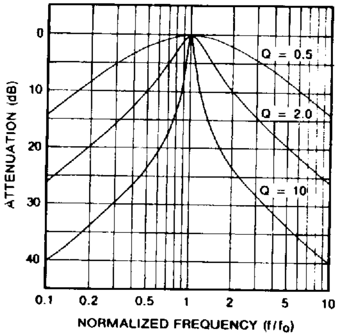
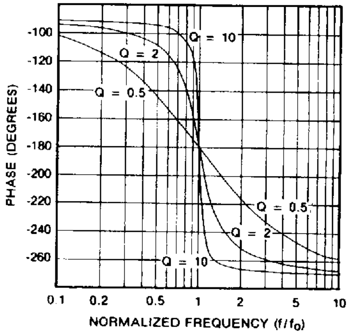
# THEORETICAL BANDPASS RESPONSE



FREQUENCY DEVICES INC

## THEORETICAL BANDPASS FREQUENCY RESPONSE




## THEORETICAL BANDPASS RESPONSE TABLE

Attenuation and Phase vs. Normalized frequency, Q from 1 to 50.

| $f/f_c$ | Q = 1 | | Q = 2 | | Q = 5 | | Q = 10 | | Q = 20 | | Q = 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] |
| 0.1000 | 20.0 | -95.8 | 25.9 | -92.9 | 33.9 | -91.2 | 39.9 | -90.6 | 45.9 | -90.3 | 53.9 | -90.1 |
| 0.2000 | 13.8 | -101.8 | 19.7 | -95.9 | 27.6 | -92.4 | 33.6 | -91.2 | 39.7 | -90.6 | 47.6 | -90.2 |
| 0.3000 | 10.1 | -108.2 | 15.8 | -99.4 | 23.6 | -93.8 | 29.6 | -91.9 | 35.7 | -90.9 | 43.6 | -90.4 |
| 0.5000 | 5.1 | -123.7 | 10.0 | -108.4 | 17.6 | -97.6 | 23.5 | -93.8 | 29.6 | -91.9 | 37.5 | -90.8 |
| 0.7000 | 1.9 | -143.9 | 5.0 | -124.5 | 11.5 | -105.4 | 17.3 | -97.8 | 23.3 | -93.9 | 31.2 | -91.6 |
| 0.8000 | 0.8 | -155.8 | 2.6 | -138.0 | 7.8 | -114.0 | 13.3 | -102.5 | 19.1 | -96.3 | 27.1 | -92.5 |
| 0.9000 | 0.2 | -168.1 | 0.7 | -157.1 | 3.3 | -133.5 | 7.4 | -115.3 | 12.8 | -103.3 | 20.5 | -95.4 |
| 0.9200 | | | | | | | | | 10.9 | -106.7 | 18.5 | -96.8 |
| 0.9300 | | | | | 1.8 | -144.0 | 4.9 | -124.5 | | | | |
| 0.9400 | | | | | | | | | 8.5 | -112.0 | 16.0 | -99.2 |
| 0.9500 | | | | | 1.0 | -152.8 | 3.1 | -134.3 | | | | |
| 0.9600 | 0.0 | -175.3 | | | | | | | | | | |
| 0.9700 | | | 0.0 | -173.1 | 0.4 | -163.1 | 1.4 | -148.6 | 4.0 | -129.4 | 10.1 | -108.2 |
| 0.9850 | | | | | | | | | 1.4 | -148.8 | 5.2 | -123.5 |
| 0.9900 | 0.0 | -178.8 | | | 0.0 | -174.3 | | | | | | |
| 0.9950 | | | 0.0 | -178.9 | | | 0.0 | -174.3 | 0.1 | -168.7 | 1.0 | -153.4 |
| 0.9980 | | | | | 0.0 | -178.9 | | | 0.0 | -175.4 | | |
| 0.9990 | | | | | | | 0.0 | -178.9 | | | 0.0 | -174.3 |
| 0.9996 | | | | | | | | | 0.0 | -179.1 | | |
| 0.9998 | | | | | | | | | | | 0.0 | -178.9 |
| 1.0000 | 0.0 | -180.0 | 0.0 | -180.0 | 0.0 | -180.0 | 0.0 | -180.0 | 0.0 | -180.0 | 0.0 | -180.0 |
| 1.0002 | | | | | | | | | | | 0.0 | -181.1 |
| 1.0004 | | | | | | | | | 0.0 | -180.9 | | |
| 1.0010 | | | | | | | 0.0 | -181.1 | | | 0.0 | -185.7 |
| 1.0020 | | | | | 0.0 | -181.1 | | | 0.0 | -184.6 | | |
| 1.0050 | | | 0.0 | -181.1 | | | 0.0 | -185.7 | 0.1 | -191.3 | 1.0 | -206.5 |
| 1.0100 | 0.0 | -181.1 | | | 0.0 | -185.7 | | | | | | |
| 1.0150 | | | | | | | | | 1.3 | -210.8 | 5.1 | -236.1 |
| 1.0300 | | | 0.0 | -186.7 | 0.4 | -196.5 | 1.3 | -210.6 | 3.8 | -229.8 | 9.9 | -251.3 |
| 1.0400 | 0.0 | -184.5 | | | | | | | | | | |
| 1.0500 | | | | | 0.9 | -206.0 | 2.9 | -224.3 | | | | |
| 1.0600 | | | | | | | | | 8.1 | -246.8 | 15.4 | -260.3 |
| 1.0700 | | | | | 1.6 | -214.1 | 4.5 | -233.6 | | | | |
| 1.0800 | | | | | | | | | 10.2 | -252.0 | 17.8 | -262.6 |
| 1.1000 | 0.2 | -190.8 | 0.6 | -200.9 | 2.8 | -223.7 | 6.7 | -242.4 | 11.9 | -255.3 | 19.6 | -264.0 |
| 1.2000 | 0.6 | -200.1 | 1.9 | -216.3 | 6.4 | -241.4 | 11.6 | -254.7 | 17.4 | -262.2 | 25.3 | -266.9 |
| 1.4000 | 1.7 | -214.4 | 4.6 | -253.9 | 11.1 | -253.7 | 16.8 | -261.7 | 22.8 | -265.8 | 30.7 | -268.3 |
| 1.7000 | 3.5 | -228.0 | 7.7 | -245.8 | | | | | 27.0 | -267.4 | 34.9 | -269.0 |
| 2.0000 | 5.1 | -236.3 | 10.0 | -251.6 | 17.6 | -262.4 | 23.5 | -266.2 | 30.0 | -268.1 | 37.5 | -269.2 |
| 3.0000 | 9.1 | -249.4 | 14.7 | -259.4 | 22.5 | -265.7 | 28.5 | -267.9 | 34.6 | -268.9 | 42.5 | -269.6 |
| 5.0000 | 13.8 | -258.2 | 19.7 | -264.1 | 27.6 | -267.6 | 33.6 | -268.8 | 39.7 | -269.4 | 47.6 | -269.8 |
| 10.0000 | 20.0 | -264.2 | 25.9 | -267.1 | 33.9 | -268.8 | 39.9 | -269.4 | 45.9 | -269.7 | 53.9 | -269.9 |



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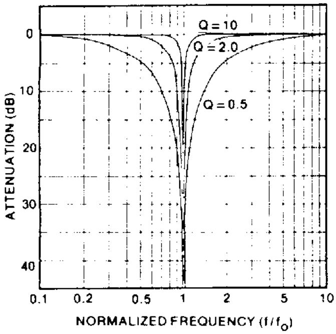
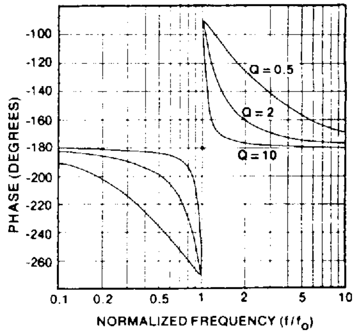
# THEORETICAL BAND-REJECT RESPONSE



## THEORETICAL BAND-REJECT FREQUENCY RESPONSE




## THEORETICAL BAND-REJECT RESPONSE TABLE

Attenuation and Phase vs. Normalized frequency, Q from 1 to 50.

| $f/f_c$ | Q = 1 | | Q = 2 | | Q = 5 | | Q = 10 | | Q = 20 | | Q = 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] | A[dB] | Ψ[°] |
| 0.1000 | 0.0 | -185.8 | 0.0 | -182.9 | 0.0 | -181.2 | 0.0 | -180.6 | 0.0 | -180.3 | 0.0 | -180.1 |
| 0.2000 | 0.2 | -191.8 | 0.1 | -185.9 | 0.0 | -182.4 | 0.0 | -181.2 | 0.0 | -180.6 | 0.0 | -180.2 |
| 0.3000 | 0.5 | -198.2 | 0.1 | -189.4 | 0.0 | -183.8 | 0.0 | -181.9 | 0.0 | -180.9 | 0.0 | -180.4 |
| 0.5000 | 1.6 | -213.7 | 0.5 | -198.4 | 0.1 | -187.6 | 0.0 | -183.9 | 0.0 | -181.9 | 0.0 | -180.8 |
| 0.7000 | 4.6 | -233.9 | 1.7 | -214.5 | 0.3 | -195.4 | 0.1 | -187.8 | 0.0 | -183.9 | 0.0 | -181.6 |
| 0.8000 | 7.7 | -245.8 | 3.5 | -228.0 | 0.8 | -204.0 | 0.2 | -192.5 | 0.1 | -186.3 | 0.0 | -182.5 |
| 0.9000 | 13.7 | -258.1 | 8.2 | -247.1 | 2.8 | -223.5 | 0.9 | -205.3 | 0.2 | -193.3 | 0.0 | -185.4 |
| 0.9200 | | | | | | | | | 0.4 | -196.7 | 0.1 | -186.8 |
| 0.9300 | | | | | 4.6 | -234.0 | 1.7 | -214.5 | | | | |
| 0.9400 | | | | | | | | | 0.7 | -202.0 | 0.1 | -189.2 |
| 0.9500 | | | | | 6.8 | -242.8 | 2.9 | -224.3 | | | | |
| 0.9600 | 21.8 | -265.3 | | | | | | | | | | |
| 0.9700 | | | 18.3 | -263.1 | 10.7 | -253.1 | 5.7 | -238.6 | 2.2 | -219.4 | 0.4 | -198.2 |
| 0.9850 | | | | | | | | | 5.7 | -238.8 | 1.6 | -213.5 |
| 0.9900 | 33.9 | -268.8 | | | 20.0 | -264.3 | | | | | | |
| 0.9950 | | | 34.0 | -268.9 | | | 20.0 | -264.3 | 14.1 | -258.7 | 7.0 | -243.4 |
| 0.9980 | | | | | 34.0 | -268.9 | | | 22.0 | -265.4 | | |
| 0.9990 | | | | | | | 34.0 | 268.9 | | | 20.0 | -264.3 |
| 0.9996 | | | | | | | | | 35.9 | -269.1 | | |
| 0.9998 | | | | | | | | | | | 34.0 | -268.9 |
| 1.0000 | ∞ | -180.0 | ∞ | -180.0 | ∞ | -180.0 | ∞ | -180.0 | ∞ | -180.0 | ∞ | -180.0 |
| 1.0002 | | | | | | | | | | | 34.0 | -91.1 |
| 1.0004 | | | | | | | | | 35.9 | -90.9 | | |
| 1.0010 | | | | | | | 34.0 | -91.1 | | | 20.1 | -95.7 |
| 1.0020 | | | | | 34.0 | -91.1 | | | 22.0 | -94.6 | | |
| 1.0050 | | | 34.0 | -91.1 | | | 20.1 | -95.7 | 14.2 | -101.3 | 7.0 | -116.5 |
| 1.0100 | 34.0 | -91.1 | | | 20.1 | -95.7 | | | | | | |
| 1.0150 | | | | | | | | | 5.8 | -120.8 | 1.6 | -146.1 |
| 1.0300 | | | 18.6 | -96.7 | 11.0 | -106.5 | 5.9 | -120.6 | 2.3 | -139.8 | 0.5 | -161.3 |
| 1.0400 | 22.1 | -94.5 | | | | | | | | | | |
| 1.0500 | | | | | 7.2 | -116.0 | 3.1 | -134.3 | | | | |
| 1.0600 | | | | | | | | | 0.7 | -156.8 | 0.1 | -170.3 |
| 1.0700 | | | | | 5.0 | -124.1 | 1.9 | -143.6 | | | | |
| 1.0800 | | | | | | | | | 0.4 | -162.0 | 0.1 | -172.6 |
| 1.1000 | 14.5 | -100.8 | 9.0 | -110.9 | 3.2 | -133.7 | 1.0 | -152.4 | 0.3 | -165.3 | 0.1 | -174.0 |
| 1.2000 | 9.3 | -110.1 | 4.6 | -126.3 | 1.1 | -151.4 | 0.3 | -164.7 | 0.1 | -172.2 | 0.0 | -176.9 |
| 1.4000 | 5.0 | -124.4 | 1.9 | -143.9 | 0.4 | -163.7 | 0.1 | -171.7 | 0.0 | -175.8 | 0.0 | -178.3 |
| 1.7000 | 2.6 | -138.0 | 0.8 | -155.8 | | | | | 0.0 | -177.4 | 0.0 | -179.0 |
| 2.0000 | 1.6 | -146.3 | 0.5 | -161.6 | 0.1 | -172.4 | 0.0 | -176.2 | 0.0 | -178.1 | 0.0 | -179.2 |
| 3.0000 | 0.6 | -159.4 | 0.2 | -169.4 | 0.0 | -175.7 | 0.0 | -177.9 | 0.0 | -178.9 | 0.0 | -179.6 |
| 5.0000 | 0.2 | -168.2 | 0.1 | -174.1 | 0.0 | -177.6 | 0.0 | -178.6 | 0.0 | -179.4 | 0.0 | -179.8 |
| 10.0000 | 0.0 | -174.2 | 0.0 | -177.1 | 0.0 | -178.8 | 0.0 | -179.4 | 0.0 | -179.7 | 0.0 | -179.9 |



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## 783 SERIES INTERFERENCE ELIMINATION FILTERS

### DESCRIPTION

Frequency Devices' 783 Interference Elimination Filters feature temperature stable, notch-like rejection characteristics that are symmetric about any single user-specified center frequency $f_O$ between 50Hz and 5kHz. Packaged in a low profile, 0.4 inch high case style, these filters are available in two versions: the 783R3Q10-$f_O$ with a Q of 10 and the 783R3Q3-$f_O$ with a Q of 3 -with $f_O$ specified by the user at time of order.

The frequencies at which no less than 50dB of attenuation exists are $f_O \pm 0.835\%$ for the Q10 versions and $f_O \pm 1.5\%$ for the Q3 versions. The frequencies at which no greater than 3dB of attenuation exists are $\pm$ 5% $f_O$ for the Q10 versions and $\pm$0.83% for the Q3 versions. These frequencies are accurate to within $\pm$0.05% and remain so over the 0°C to +70°C operating temperature range.

All 783 Series filters pass signal frequencies outside the notch band with an inverting gain of 0$\pm$0.3dB. The units include provisions for an optional DC offset potentiometer with which the user can externally zero the output.

The extremely steep-skirted rejection characteristics of the 783 Series filters make them ideal for a large variety of interference elimination applications.

Examples include the elimination of 50 or 60Hz power line interference from the low level signals common to EEG, EMG and EKG bio-medical measurements. In aircraft applications, 400 to 1200Hz interference generated by the on-board mobile power source must often be eliminated.

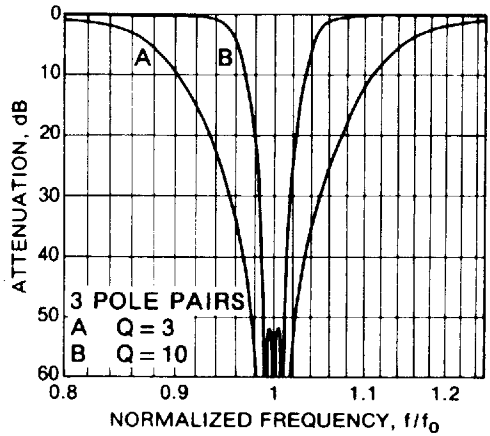


**Figure 5.1:** Frequency Response



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# 783 SERIES
# OFFSET ADJUSTMENTS, SOCKET DATA



## OPTIONAL OFFSET ADJUSTMENT

All 783 Series Band Elimination Filters are factory trimmed for an initial output offset not in excess of ±5 millivolts at 25°C. For applications requiring a lower, or zero output offset voltage, a user-supplied external potentiometer is employed as shown in Figure 6.1.

A cermet potentiometer will provide adequate resolution and temperature stability.

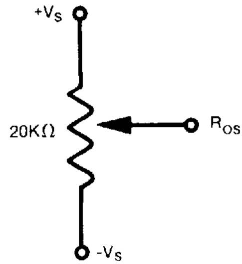
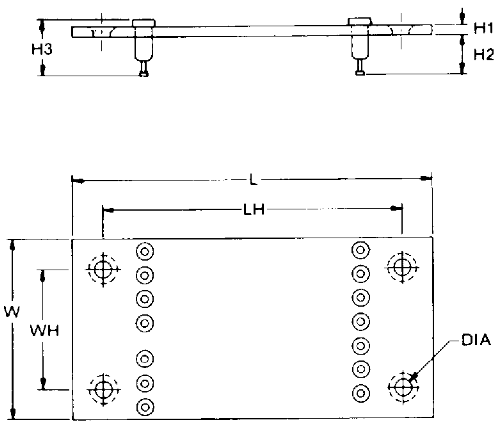



**Figure 6.1: External Offset Adjustment**

To the zero output simply disconnect the external signal source and connect mode pin Vin to ground. Then, simply zero the output with the external offset potentiometer.

## SOCKET FOR 783 SERIES




| DIMENSION | MILLIMETERS | INCHES |
|---|---|---|
| L | 76 | 3.0 |
| LH | 64 | 2.5 |
| W | 38 | 1.5 |
| WH | 25 | 1.0 |
| H1 | 2.3 | 0.09 |
| H2 | 7.9 | 0.31 |
| H3 | 12 | 0.47 |
| DIA | 3.5 | 0.14 |

**BOTTOM AND EDGE VIEWS**



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# 783 SERIES DIMENSION AND ORDERING INFORMATION



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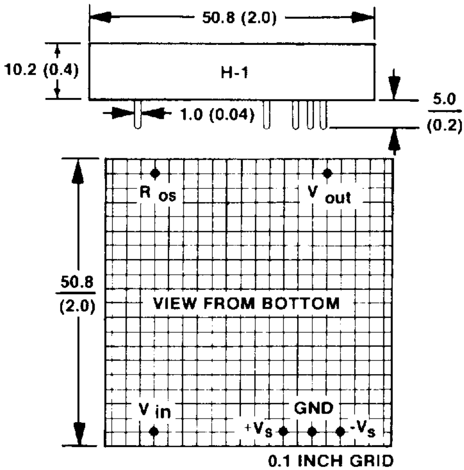
**DIMENSIONS IN MM (INCHES)**




| TERMINAL KEY | |
|---|---|
| $R_{OS}$ | Rotor of Offset Potentiometer |
| $V_{out}$ | Band-Reject Output |
| $V_{in}$ | Signal Input |
| $+V_s$ | Supply Voltage, Positive |
| GND | Ground, Common |
| $-V_s$ | Supply Voltage, Negative |

## HOW TO ORDER

To order a 783 Series, first select the desired Q: A 783R3Q10-$f_O$ is furnished with a Q of 10, while 783R3Q3-$f_O$ is furnished with a Q of 3.

Next, complete the part number specifying the required center frequency, $f_O$, by applying the following code:

Specify the frequency in Hertz, using the letter A in place of a decimal point or K in place of a thousand's comma.

Thus an $f_O$ of 1,250Hz is coded as 1K25. The complete part number is given as either 783R3Q10-1K25 or 783R3Q3-1K25, depending on the Q desired. Some frequencies, like 750Hz, are correctly coded by either a K (K750) or an A (750A).



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# 781 SERIES DESCRIPTION AND INSTALLATION NOTES

FREQUENCY DEVICES INC

## 781 SERIES BAND REJECT/BANDPASS FILTERS

### DESCRIPTION

Frequency Devices' 781 Series fixed frequency active filters deliver simultaneous band reject, bandpass, lowpass and highpass outputs via four individual output terminals. This filter family benefits from a unique, patented design concept which renders both the band reject notch depth and the bandpass gain fully independent of external tuning component match.

All 781 Series models are ready-to-use active filters. Each is factory pretuned to within ±2% of the fixed, user-specified center/corner frequency between 0.2Hz and 20kHz. These units allow optional fine tuning (Figure 9.1) and precision tuning (Figure 9.2) of the center/corner frequency by simple, external means.

For versatility, both the Q and the notch depth of the 781 Series can be externally adjusted if required. Factory-set at a value of 2, the filter Q can be adjusted for values ranging from 0.5 to 100 by a single external resistor. Similarly, an external potentiometer can increase the notch depth of the band reject response from the factory set range of 50-60dB to a maximized range of 60-80dB.

### INSTALLATION NOTES

As is true for most electronic components, the performance of 781 Series filters may be adversely influenced by external stray capacitive coupling, wiring inductance and capacitance as well as capacitive loading of the outputs. To minimize these effects, the following precautions should be heeded:

1. Use the shortest possible lead length when connecting to terminal $\Delta Q$. Any component connected to this terminal should be non-inductive, should exhibit low distributed capacitance and should be located as close to the filter as possible.

Avoid connecting shielded cable to terminal $\Delta Q$. If system requirements make this impossible, connect the cable shield directly to the filter GND terminal, module tie-point for the power supply common.

2. An excessive capacitive load connected to any of the outputs — terminals $V_R$, $V_B$, $V_H$ and $V_L$ — will cause the filter to oscillate. To avoid this, connect a series resistor of at least 470Ω between any output terminal and its load capacitance of 100pF or more. The optional resistor value must be determined experimentally, and is usually that value which eliminates oscillation while providing acceptably fast transient response. Large capacitive loads such as long shielded lines may require the insertion of a buffer amplifier between the filter output and the load; this may also be required when the isolation resistor of the previous method forms a breakpoint with the load capacitance that is too close to the filter center/corner frequency.



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**OPTIONAL ADJUSTMENTS**

All 781 Series models are fully finished, ready-to-use filters. Factory calibration of each unit sets the center/corner frequency to within ± 2% of nominal; the notch depth is factory-set to a minimum 50dB for filter selectivity (Q) of 2.

When required by the application, the frequency and notch depth can be externally adjusted by connecting several readily available passive components to 781 Series provided for this purpose.

**781 SERIES FREQUENCY CALIBRATION (OPTIONAL)**

Connect a non-inductive FINE TUNE potentiometer as shown in Figure 9.1A below. This will provide a ± 5% range of center/corner frequency adjustment.

For high Q applications, temporarily connect the 781 Series filter as an oscillator, in accordance with Figure 9.1B. Set the FINE TUNE potentiometer of Figure 9.1A for an oscillation frequency exactly equal to the desired center/corner frequency. Remove the external components of Figure 9.1B.

**781 SERIES NOTCH DEPTH TRIM (OPTIONAL)**

Connect a non-inductive NOTCH TRIM potentiometer as in Figure 9.1C below. Input the 781 Series filter with a sinusoidal test signal of notch frequency $f_0$, and monitor the band reject output between filter terminal $V_R$ and GND. When tuned, the filter will reject the fundamental frequency, $f_0$, but will pass harmonics caused by distortion present in the sinusoidal input test signal. While a low distortion input source and/or a narrow band tuned voltmeter (spectrum analyzer) would be ideal, neither is really necessary.

**Continued next page**

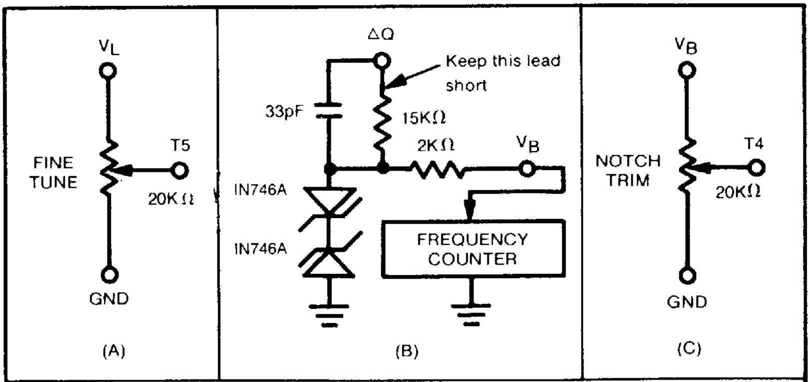


**FIGURE 9.1: 781 Series Fine Tuning of Frequency (A), Precision Calibration Circuit (B) and Notch Trim Circuit (C).**



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## OPTIONAL NOTCH TRIM, Continued

Instead, temporarily increase the filter Q, then trim the notch depth by the method of the following example:

An application requires a filter having 20dB notch depth at a center frequency, $f_O$, and a Q of 2. The distortion of the input test signals is 0.5% (-46dB). First increase the filter Q to 50 by connecting a 309Ω resistor between ΔQ and GND terminals of the filter. Next, set the NOTCH TRIM potentiometer of Figure 9.1C for a filter notch depth of 42dB, then remove the 309Ω resistor.

The increment by which the notch depth at a Q of 2 ($Q_B$) will exceed the notch depth at a Q of 50 ($Q_A$) is 20 log $Q_A/Q_B$, or 28dB. The total notch depth, with a Q of 2, will be 42dB + 28dB or 70dB.

## 781 SERIES Q ADJUSTMENT

All 781 Series filters are resistively tuneable for any Q value between 0.5 and 100 by connecting either an external 20KΩ potentiometer OR a SINGLE external fixed resistor (either R4 OR R5) as in Figure 10.1. For a given Q, R4 or R5 will take the standard 1% resistor value closest that computed by Eq 10.1 or 10.2, respectively. Some standard 1% Q resistor values appear in Table 10.1.

$R4(k\Omega) = 15[(2Q-1)/(2-Q)]$ $\quad 0.5 \leq Q < 2$ $\quad$ EQ. 10.1

$R5(k\Omega) = 15/(Q-2)$ $\quad 2 < Q \leq 100$ $\quad$ EQ. 10.2

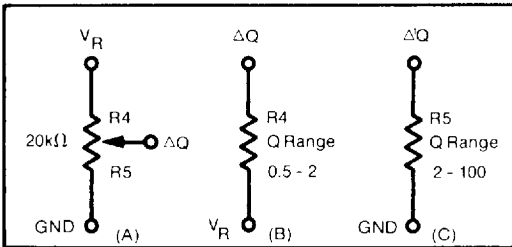


**Figure 10.1:** Q Adjustment by potentiometer (A) and Fixed Resistance (B) & (C).

**TABLE 10.1** Q RESISTOR VALUES

| Q | R4(Ω) | R5 (Ω) |
|---|---|---|
| 0.5 | 0 | ∞ |
| 1 | 15k | ∞ |
| 2 | ∞ | ∞ |
| 5 | ∞ | 4.99k |
| 10 | ∞ | 1.87k |
| 20 | ∞ | 825 |
| 50 | ∞ | 309 |
| 100 | ∞ | 154 |

## DC OFFSET ADJUSTMENT

The DC offset of either the bandpass or the band reject output of any 781 Series filter is trimmable to zero. Use the external OFFSET TRIM potentiometer connected as in Figure 10.2. NOTE: The zeroing of one output does not guarantee that the other will be zeroed.

**OFFSET TRIM**

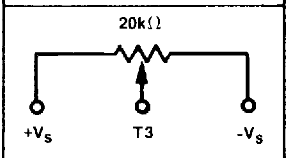


**FIGURE 10.2**



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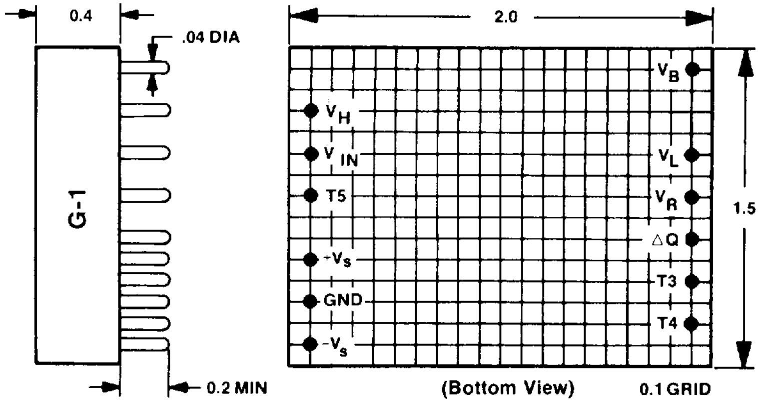
## CASE DIMENSIONS IN INCHES




## TERMINAL KEY

| | | | |
|---|---|---|---|
| $V_H$ | Highpass Output | $V_B$ | Bandpass Output |
| $V_{in}$ | Signal Input | $V_L$ | Lowpass Output |
| T5 | Frequency Fine Tune | $V_R$ | Band Reject Output |
| $+V_s$ | Supply Voltage, Positive | ΔQ | Q Adjustment |
| GND | Ground, Common | T3 | Band Reject Notch Trim |
| $-V_s$ | Supply Voltage, Negative | T4 | Band Reject Notch Trim |

## SOCKET DIMENSIONS

All 781 Series models mate with the S1006 socket described earlier in 783 Series section of this specification. Please refer to page 6.

## HOW TO ORDER

To order a 781 Series filter, complete the basic model number — 781R1Q2-f — by replacing the suffixed -f with a simple coded form of a desired center/corner frequency. The frequency code expresses frequency in Hertz, and replaces the decimal point with the letter A, the thousands comma with the letter K.

Thus, for example, to specify a center/corner frequency of 1,250Hz, simply write 1K25 and express the complete model number as 781R1Q2-1K25.

It is equally correct to express some frequencies by means of the A **or** the K notation. For example, both K750 and 750A specify a center/corner frequency of 750Hz.



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## 719/720 SERIES BAND REJECT FILTERS

### DESCRIPTION

The 719 and 720 Series are fully-finished band reject filters which exhibit the notch like frequency response of Figure 16.1. The user may specify any fixed center frequency between 1 and 10Hz for the 719 Series and 10Hz to 20kHz for the 720 Series. All models provide a factory calibrated notch depth of 40dB min and a Q of 2, which can be adjusted by a user, if desired.

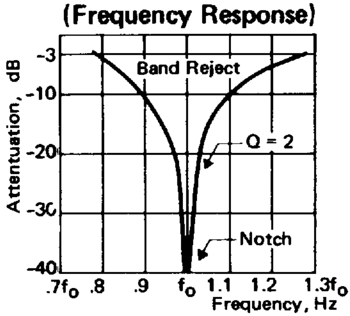


Figure 16.1

Other specifications common to both families include a non-inverting passband gain of 0dB, an input impedance of 1000 Megohms and an output resistance of less than 1 ohm. This combination of performance features make the 719/720 Series approach the ideal for a large variety of practical filtering applications.

### 719/720 SERIES OPTIONAL ADJUSTMENTS

**Q TRIM:** The circuit of Figure 16.2A Q adjustment of the 719 and 720 Series filters. With no external resistors (RA=RB=∞), the Q will be the factory set value of 2±10%. Connecting RA as shown, while RB remains infinite, increases Q to as high as 10; however, this may reduce notch depth. Connecting RB as shown, with no RA connected (RA=∞), can reduce Q to as low as 1. Resistors RA and RB are best determined empirically by a resistor decade box having short leads.

**OFFSET ADJUST:** The circuit of Figure 16.2B allows DC offset adjustment. Simply ground the input terminal and null the output with the OFFSET ADJ potentiometer.

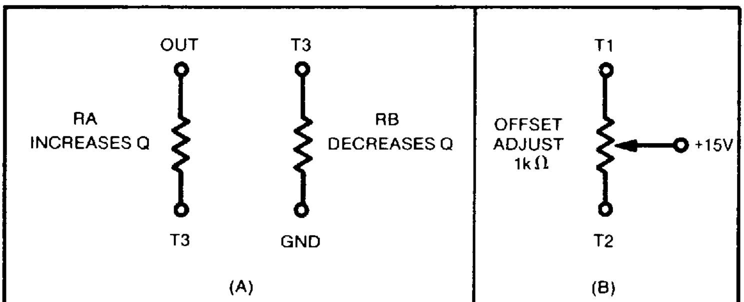


**Figure 16.2:** 719 and 720 Series Q Trim (A) and Offset Adjust (B)



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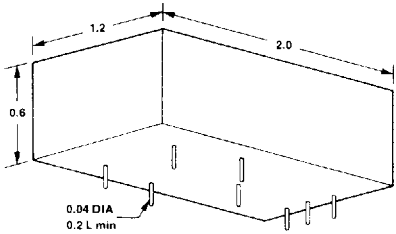
**FREQUENCY DEVICES**

# 719 / 720 SERIES CASE, SOCKET AND ORDERING INFORMATION

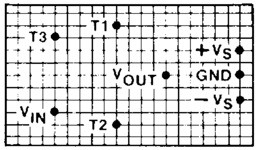


FREQUENCY DEVICES INC

## PACKAGE AND PIN-OUT DATA
**(Dimensions in Inches)**




L-02 Base

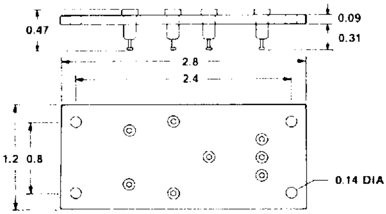



**BOTTOM VIEW**
0.1 INCH GRID

## TERMINAL KEY

| | | | |
|---|---|---|---|
| **T3** | Band Reject Notch Trim | $V_{out}$ | Signal Output |
| $V_{in}$ | Signal Input | $+V_s$ | Supply Voltage, Positive |
| **T1** | Offset Adjust Trim | $-V_s$ | Supply Voltage, Negative |
| **T2** | Offset Adjust Trim | **GND** | Ground, Common |

## S1001 MATING SOCKET
**(Dimensions in Inches)**




BOTTOM VIEW

## HOW TO ORDER

To specify a 719 or 720 Series filter, add the appropriate frequency designation code to the model numbers 719R1Q2- and 720R1Q2-, respectively. The frequency code uses the letter A in place of the decimal point and the letter K in place of the thousand's comma.

For example, the model number 720R1Q2-1K23 specifies a 720 Series 2-pole band reject filter with a corner frequency of 1230Hz.

Since only a ±2% frequency tolerance is available for standard models, three consecutive digits are allowable in specifying a frequency between 0.001Hz and 20kHz. The 4 digit frequency 1.023Hz, for example, implies a 0.1% accuracy, and will result in a phone call from us inquiring whether a special is desired.

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FREQUENCY DEVICES

# 725 / 726 / 727 / 728 SERIES DESCRIPTION AND OPTIONAL ADJUSTMENTS

FREQUENCY DEVICES INC

## 725/726/727/728 SERIES BANDPASS FILTERS

### DESCRIPTION

The 725/726/727/728 Series active bandpass filters exhibit a gain of +1.0 at the center frequency $f_O$, and sharp, near-symmetric attenuation to frequencies above and below $f_O$.

The 725 and 727 Series models operate with a Q of 10 and are available with a user-specified, factory-set $f_O$ in the range of 1-10Hz and 10Hz-20kHz, respectively.

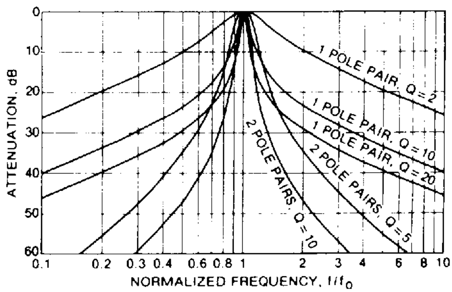


**Figure 18.1:** Frequency Response of 725/726/727/728 Series

Similarly, the 726 and 728 Series are available with the same choice of user-specified, fixed center frequencies: 1-10Hz for the 726 Series and 10Hz-20kHz for the 728 Series. However, these units operate with a Q of 5. The SPECIFICATION section at the beginning of this document specifies other significant operating parameters.

## 725/726/727/728 SERIES OPTIONAL ADJUSTMENTS

The circuits of Figure 18.2 provide external means for adjusting the gain (A) and the offset (B) of all 725/726/727/728 Series models.

**GAIN ADJUST:** The circuit of Figure 18.2A adjusts the passband gain at $f_O$ to any numerical — not decibel — value between 0 and +1.2. The values of RA and RB must be determined empirically using a resistor decade box with short interconnecting leads.

**OFFSET ADJUST:** The circuit of Figure 18.2B adjusts the output offset voltage. Simply ground the filter input terminal and null the output with the OFFSET ADJUST potentiometer shown.

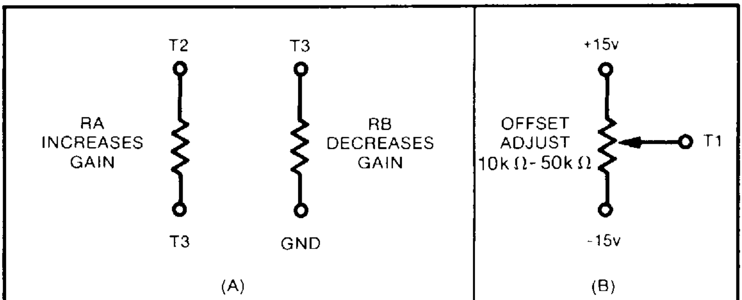


**Figure 18.2:** 725/726/727/728 Series Gain Trim (A) and Offset Adjust (B).



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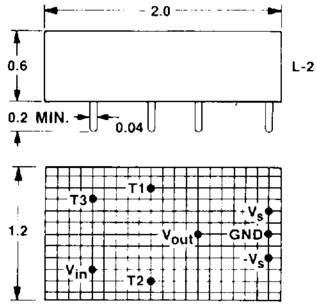
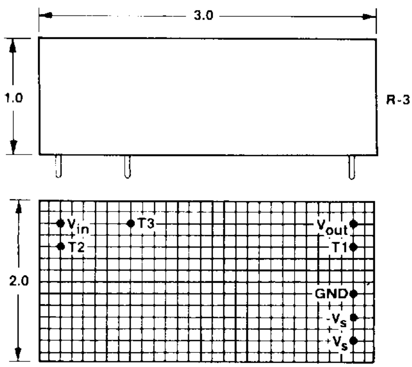
FREQUENCY DEVICES INC

**PACKAGE AND PIN-OUT DATA**
**( Dimensions in Inches) (Bottom Views) (0.1 Inch Grid)**

**725, 727, 728 Series**




**726 Series**




**TERMINAL KEY**

| | | | |
|---|---|---|---|
| $V_{in}$ | Signal Input | **T1** | Offset Adjust Trim |
| **T2** | Gain Trim | **GND** | Ground. Supply Common |
| **T3** | Gain Trim | $-V_s$ | Supply Voltage. Negative |
| $V_{out}$ | Signal Output | $+V_s$ | Supply Voltage. Positive |

**HOW TO ORDER**

Each 725. 726. 727 and 728 Series model is defined by a fixed series designator prefix followed by the identical frequency designator coding applied to the previously discussed 719/720 Series. The prefix 725P1Q10- defines a 725 Series model; 726P2Q5- a 726 Series model: 727P1Q10- a 727 Series model and the prefix 728P2Q5- denotes a 728 Series model.

Thus. for example. the model number 728P2Q5-123A defines a 728 Series bandpass filter with a center frequency of 123Hz. As with the 719 and 720 Series the 2% frequency tolerance for standard models restricts the frequency designator to three significant digits between 0.001Hz and 20kHz.



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