FREQUENCY DEVICES™, INC.

100 Hz to 100 kHz Band Pass Filter

Fixed Frequency 4-Pole Pair Band Pass Filters

Description:
The D68HPLP Series of small 4-pole-pair fixed frequency, precision band-pass active filters provide high performance in a compact 32-pin DIP package, with a broad range of fixed center frequencies (fo) from 1 Hz to 100 kHz. Each filter type features a near theoretical amplitude/phase response along with low output voltage noise enabling these filters to achieve a 10,000:1 or better dynamic signal range.

These filters consist of a four pole Butterworth high pass filter followed by a four pole Bessel or Butterworth low pass filter in one package. The user can select the low pass and high pass filter cutoff frequencies as long as they are not too close to each other. The Q of this filter must remain below 1. For Qs of higher than 1 see our D68BP series of filters. See note 1 below to determine how to calculate the filter Q.

Both frequencies are factory pre-tuned to within ±2% of the fixed, user specified high pass and low pass frequencies. Band pass D68HPLP filters pass all frequencies lying between the upper and lower -3dB points of the amplitude response curve.

Features/Benefits:

- Small 32-pin DIP (1.8"L x 0.8"W) footprint minimizes board space requirements.
- Plug-in ready-to-use, reducing engineering design and manufacturing cycle time.
- Factory tuned, no external clocks or adjustments needed
- Broad range of corner frequencies to meet a wide range of applications.

Applications

- Transducer output filtering:
- Production test instrumentation
- Medical electronics equipment and research
- Noise and harmonic analysis
- Frequency spectrum analysis

1784 Chessie Lane, Ottawa, Illinois 61350 • Tel:800/252-7074, 815/434-7800 • FAX:815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com

100 Hz to 100 kHz
Band Pass Filter

Fixed Frequency
4-Pole Pair Band Pass Filters

	D68HPLP
Product Specifications	
	Band-Pass
Size	1.8" x 0.8" x 0.3"
Range f_o	1 Hz to 100 kHz
RAvailable "Q's"[1]	<1
High Pass Theoretical Transfer Characteristics	Appendix A Page 31
Low Pass Theoretical Transfer Characteristics Butterworth	Appendix A Page 11
Low Pass Theoretical Transfer Characteristics Bessel	Appendix A Page 5
Pass-Band Gain (non-inverting)	0 ± 0.2 dB typ. 0 ± 0.4 dB max.
Attenuation Rate	24 dB/octave
Both Center Frequency	f_o ± 2% max.
Stability	± 0.01%/°C
Filter Mounting Assembly[2]	FMA-01S

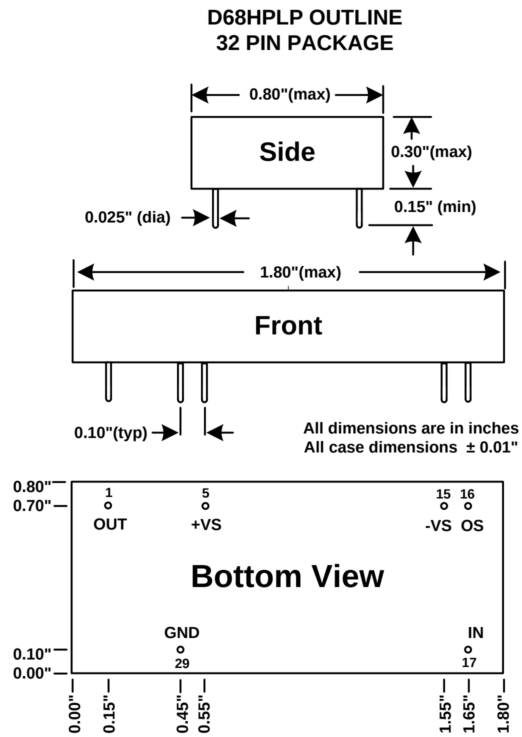
1. Quality factor for this filter is: $Q = \frac{fo}{fh - fl}$ The center frequency of this filter is: $fo = \sqrt{fh \times fl}$ All Q's must be less than 1. For Q's of more than one see our D64BP and D68BP series of filters.

1784 Chessie Lane, Ottawa, Illinois 61350 • Tel:800/252-7074, 815/434-7800 • FAX:815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com

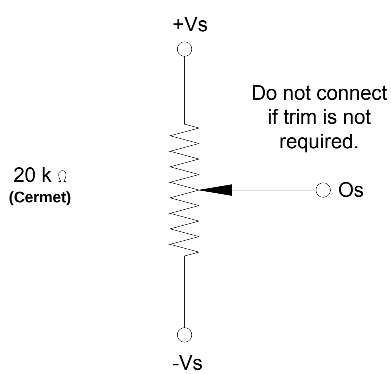
Specifications
(25ºC and Vs ± 15 Vdc)

Pin-Out and Package Data
Ordering Information

Analog Input Characteristics[1]	
Impedance	10.0 kΩ min.
Voltage Range	±10 V_{peak}
Max. Safe Voltage	± Vs
Analog Output Characteristics	
Impedance	1 Ω typ., 10 Ω max..
Linear Operating Range	± 10V
Current[2] @ (Vs @ ±15V)	2 mA max.
Offset Voltage[3]	2 mV typ. 20 mV max.
Offset Temp. Coefficient	50 µV/ºC.
Power Supply (±V_S)	
Rated Voltage	±15V
Operating Range	±5V min. ±18V max.
Quiescent Current	25 mA typ. 40 mA max.
Temperature Range	
Operating	0ºC to +70ºC
Storage	-25ºC to +85ºC



DC Offset Adjustment



Notes:
1. Input and output signal voltage referenced to supply common.
2. Output is short circuit protected to common. DO NOT CONNECT TO ±Vs.
3. Adjustable to zero.
4. Units operate with or without offset pin connected.
5. How to specify Corner Frequency. Corner frequency is specified by attaching two three-digit frequency designators to the basic model number. The first number is the high pass corner frequency and the second number is the low pass corner frequency.

ORDERING INFORMATION

D68HPLP-10.0 Hz-10.0 kHz

High Pass Corner Freq[5]
e.g., 849 Hz
2.50 kHz
33.3 kHz

Low Pass Corner Freq[5]
e.g., 849 Hz
2.50 kHz
33.3 kHz

Note: To order the Bessel Low-Pass filter use part number D68HPLPL

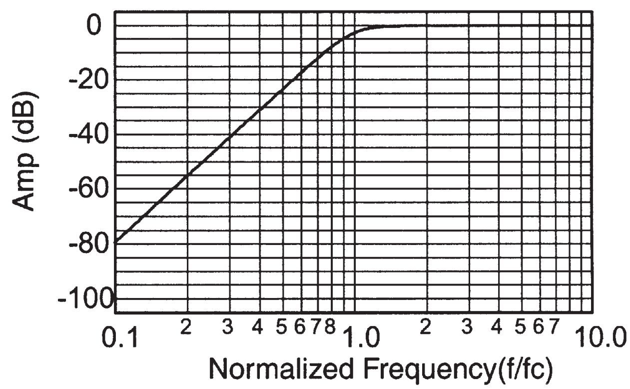
1784 Chessie Lane, Ottawa, Illinois 61350 • Tel:800/252-7074, 815/434-7800 • FAX:815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com

High-Pass 4-Pole Butterworth

Theoretical Transfer Characteristics

f/fc (Hz)	Amp (dB)	Phase (deg)	Delay[1] (sec)
0.10	-80.0	345	.418
0.20	-55.9	330	.423
0.30	-41.8	314	.433
0.40	-31.8	299	.449
0.50	-24.1	282	.474
0.60	-17.8	264	.511
0.70	-12.6	245	.558
0.80	-8.43	224	.604
0.85	-6.69	213	.619
0.90	-5.22	202	.622
0.95	-3.99	191	.612
1.00	-3.01	180	.588
1.20	-0.908	143	.427
1.40	-0.285	118	.289
1.60	-0.100	100	.204
1.80	-0.039	87.6	.152
2.00	-0.017	78.0	.119
2.50	-0.003	61.4	.072
3.00	-0.001	50.7	.049
4.00	0.00	37.8	.027
5.00	0.00	30.1	.017
6.00	0.00	25.1	.012
7.00	0.00	21.4	.009
8.00	0.00	18.8	.007
9.00	0.00	16.7	.005
10.0	0.00	15.0	.004

Frequency Response



1. **Normalized Group Delay:**
The above delay data is normalized to a corner frequency of 1.0Hz.The actual delay is the normalized delay divided by the actual corner frequency (fc).

$$\text{Actual Delay} = \frac{\text{Normalized Delay}}{\text{Actual Corner Frequency (fc) in Hz}}$$

1784 Chessie Lane, Ottawa, IL 61350 • Tel: 800/252-7074, 815/434-7800 • FAX: 815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com

Low-Pass 4-Pole Butterworth

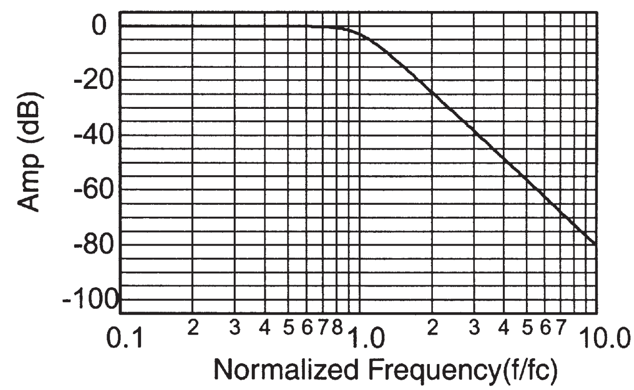
Theoretical Transfer Characteristics

f/fc (Hz)	Amp (dB)	Phase (deg)	Delay[1] (sec)
0.00	0.00	0.00	.416
0.10	0.00	-15.0	.418
0.20	0.00	-30.1	.423
0.30	-0.00	-45.5	.433
0.40	-0.003	-61.4	.449
0.50	-0.017	-78.0	.474
0.60	-0.072	-95.7	.511
0.70	-0.243	-115	.558
0.80	-0.674	-136	.604
0.85	-1.047	-147	.619
0.90	-1.555	-158	.622
0.95	-2.21	-169	.612
1.00	-3.01	-180	.588
1.10	-4.97	-200	.513
1.20	-7.24	-217	.427
1.30	-9.62	-231	.350
1.40	-12.0	-242	.289
1.50	-14.3	-252	.241
1.60	-16.4	-260	.204
1.70	-18.5	-266	.175
1.80	-20.5	-272	.152
1.90	-22.3	-277	.134
2.00	-24.1	-282	.119
2.25	-28.2	-291	.091
2.50	-31.8	-299	.072
2.75	-35.1	-304	.059
3.00	-38.2	-309	.049
3.25	-41.0	-313	.041
3.50	-43.5	-317	.035
4.00	-48.2	-322	.027
5.00	-55.9	-330	.017
6.00	-62.3	-335	.012
7.00	-67.6	-339	.009
8.00	-72.2	-341	.007
9.00	-76.3	-343	.005
10.0	-80.0	-345	.004

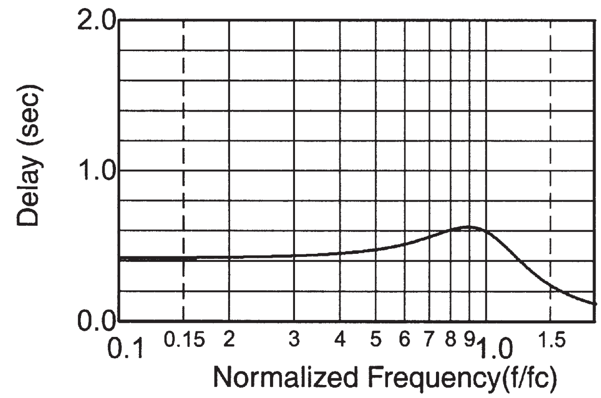
1.**Normalized Group Delay:**
The above delay data is normalized to a corner frequency of 1.0Hz.The actual delay is the normalized delay divided by the actual corner frequency (fc).

$$\text{Actual Delay} = \frac{\text{Normalized Delay}}{\text{Actual Corner Frequency (fc) in Hz}}$$

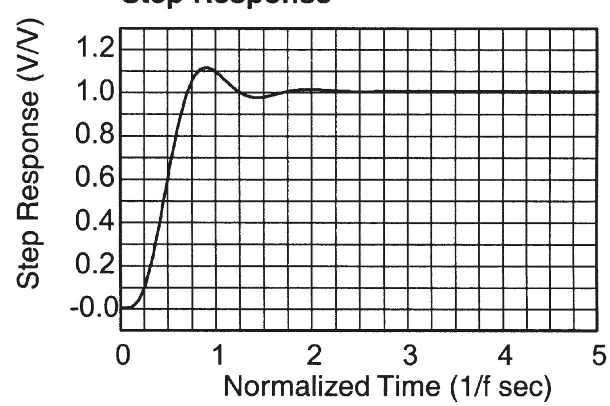
Frequency Response



Delay (Normalized)



Step Response



1784 Chessie Lane, Ottawa, IL 61350 • Tel: 800/252-7074, 815/434-7800 • FAX: 815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com

Appendix A

Low-Pass 4-Pole Bessel

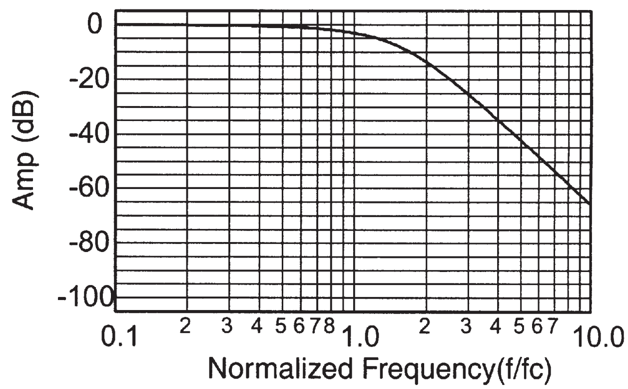
Theoretical Transfer Characteristics

f/fc (Hz)	Amp (dB)	Phase (deg)	Delay[1] (sec)
0.00	0.00	0.00	.336
0.10	-0.028	-12.1	.336
0.20	-0.111	-24.2	.336
0.30	-0.251	-36.3	.336
0.40	-0.448	-48.4	.336
0.50	-0.705	-60.6	.336
0.60	-1.02	-72.7	.336
0.70	-1.41	-84.8	.336
0.80	-1.86	-96.8	.335
0.85	-2.11	-103	.334
0.90	-2.40	-109	.333
0.95	-2.69	-115	.332
1.00	-3.01	-121	.330
1.10	-3.71	-133	.325
1.20	-4.51	-144	.318
1.30	-5.39	-156	.308
1.40	-6.37	-166	.295
1.50	-7.42	-177	.280
1.60	-8.54	-187	.263
1.70	-9.71	-195	.246
1.80	-10.9	-204	.228
1.90	-12.2	-212	.211
2.00	-13.4	-219	.194
2.25	-16.5	-235	.158
2.50	-19.5	-248	.129
2.75	-22.4	-259	.107
3.00	-25.1	-267	.089
3.25	-27.6	-275	.076
3.50	-30.0	-281	.065
4.00	-34.4	-291	.049
5.00	-41.9	-305	.031
6.00	-48.1	-315	.021
7.00	-53.4	-321	.016
8.00	-58.0	-326	.012
9.00	-62.0	-330	.009
10.0	-65.7	-333	.008

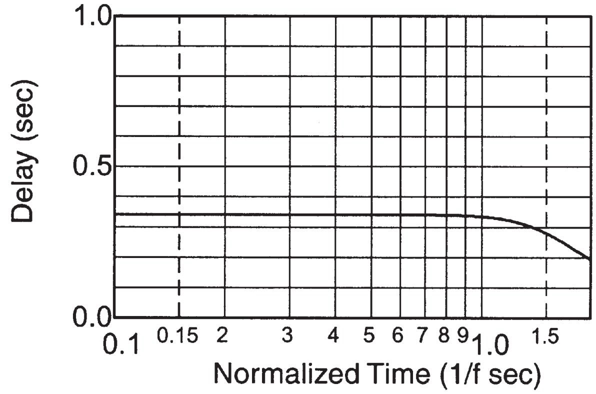
1. **Normalized Group Delay:**
The above delay data is normalized to a corner frequency of 1.0Hz.The actual delay is the normalized delay divided by the actual corner frequency (fc).

$$\text{Actual Delay} = \frac{\text{Normalized Delay}}{\text{Actual Corner Frequency (fc) in Hz}}$$

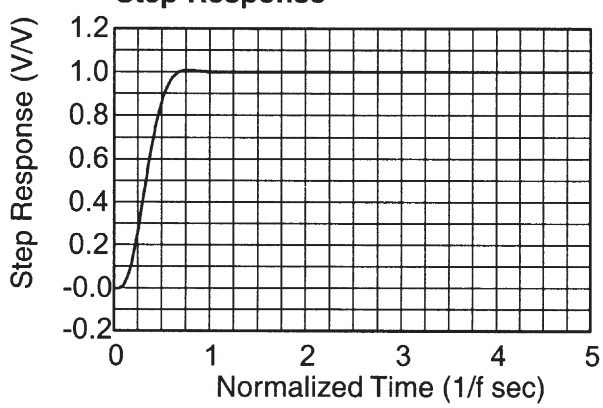
Frequency Response



Delay (Normalized)



Step Response



1784 Chessie Lane, Ottawa, Illinois 61350 • Tel:800/252-7074, 815/434-7800 • FAX:815/434-8176
e-mail: sales@freqdev.com • Web Address: http://www.freqdev.com