FREQUENCY DEVICES™, INC.

D78 & DP78 Series

1.0 Hz to 100 kHz Fixed Frequency

32 Pin DIP 8-Pole Filters

Description

The D78 and DP78 Series of low-power, fixed-frequency, linear active filters are high performance, 8-pole filters in a compact package. These Butterworth and Bessel low-pass and Butterworth high-pass filters (D78 only) combine linear active filter design with the space savings of a 32-pin dual in-line package (DIP). Each model comes factory tuned to a user-specified corner frequency between 1 Hz and 100 kHz (DP78, 1 Hz to 5kHz). These fully self-contained units require no external components or adjustments and operate with dynamic input voltage range from non-critical ±5V to ±18V power supplies.

Features/Benefits:

- Low cost solution for low frequency signal conditioning
- Compact DIP design minimizes board space requirements
- Plug-in ready-to-use, reducing engineering design and manufacturing time
- Factory tuned, no external clocks or adjustments needed saving time and labor of other discrete assembly solutions
- Low harmonic distortion and wide signal-to-noise ratio to 12 bit resolution

Applications

- Anti-alias filtering
- Vibration & shock analysis
- Automatic test equipment
- Aerospace, navigation and sonar
- Communication systems
- Medical electronics
- Sound and vibration testing
- Noise elimination
- Process control

Available Low-Pass Models:

Available High-Pass Models:

General Specifications:

1784 Chessie Lane, Ottawa, IL 61350 • Tel: 800/252-7074, 815/434-7800 • FAX: 815/434-8176
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Fixed Frequency 8-Pole Low-Pass and High-Pass Filters

Model	D78L8B & DP78L8B	D78L8L & DP78L8L	Model	D78H8B
Product Specifications	**Low-Pass**	**Low-Pass**		**High-Pass**
Transfer Function	8-Pole, Butterworth	8-Pole, Bessel	**Transfer Function**	8-Pole, Butterworth,
Size			**Size**	
D78 1.00 Hz to 1.00 kHz	1.8" x 0.8" x 0.5"	1.8" x 0.8" x 0.5"	**D78** 1.00 Hz to 1.00 kHz	1.8" x 0.8" x 0.5"
D78 1.01 kHz to 100 kHz	1.8" x 0.8" x 0.3"	1.8" x 0.8" x 0.3"	**D78** 1.01 kHz to 100 kHz	1.8" x 0.8" x 0.3"
DP78 1.00 Hz to 5.00 kHz	1.8" x 0.8" x 0.5"	1.8" x 0.8" x 0.5"		
Range f_c			**Range f_c**	
D78	1 Hz to 100 kHz	1 Hz to 100 kHz	**D78**	1 Hz to 100 kHz
DP78	1 Hz to 5 kHz	1 Hz to 5 kHz		
Theoretical Transfer Characteristics	Appendix A Page 9	Appendix A Page 4	**Theoretical Transfer Characteristics**	Appendix A Page 29
Passband Ripple (theoretical)	0.0 dB	0.0 dB	**Passband Ripple** (theoretical)	0.0 dB
DC Voltage Gain (non-inverting)	0 ± 0.1 dB typ.	0 ± 0.1 dB typ.	**Voltage Gain** (non-inverting)	0 ± 0.1 dB to 100 kHz
Stopband Attenuation Rate	48 dB/octave	48 dB/octave	**Stopband Attenuation Rate**	48 dB/octave
			Power Bandwidth	120 kHz
			Small Signal Bandwidth	(-6 dB) 1 MHz
Cutoff Frequency	f_c ± 2% max.	f_c ± 2% max.	**Cutoff Frequency**	f_c ± 2% max.
Stability	± 0.03% /°C	± 0.03% /°C	**Stability**	± 0.03% /°C
Amplitude	-3 dB	-3 dB	**Amplitude**	-3 dB
Phase	-360°	-182°	**Phase**	-360°
Filter Attenuation (theoretical)	0.12 dB 0.80 f_c 3.01 dB 1.00 f_c 60.0 dB 2.37 f_c 80.0 dB 3.16 f_c	1.91 dB 0.80 f_c 3.01 dB 1.00 f_c 60.0 dB 4.52 f_c 80.0 dB 6.07 f_c	**Filter Attenuation** (theoretical)	80 dB .31 f_c 60 dB .42 f_c 3.01 dB 1.00 f_c 0.00 dB 2.0 f_c
Total Harmonic Distortion @ 1 kHz			**Total Harmonic Distortion @ 1 kHz**	
D78	<-70 dB	<-70 dB	**D78**	<-70 dB
DP78	<-70 dB	<-70 dB		
Wide Band Noise (5 Hz - 2 MHz)	200 µVrms typ.	200 µVrms typ.	**Wide Band Noise** (5 Hz - 2 MHz)	400 µVrms typ.
Narrow Band Noise (20 Hz - 100 kHz)	50 µVrms typ.	50 µVrms typ.	**Narrow Band Noise** (20 Hz - 100 kHz)	100 µVrms typ.
Filter Mounting Assembly	FMA-01A	FMA-01A	**Filter Mounting Assembly**	FMA-01A

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Specification

(25°C and Vs ± 15 Vdc)

Analog Input Characteristics[1]

Impedance	10 kΩ min.
Voltage Range	± 10 Vpeak
Max. Safe Voltage	± Vs

Analog Output Characteristics

Impedance	1 Ω
Linear Operating Range	± 10 V
Maximum Current[2]	
D78	± 10 mA
DP78	± 5 mA
Offset Voltage	20 mV max. 3 mV typ.
Offset Temp. Coeff.	20 µV / °C typ.

Power Supply (±V)

Rated Voltage	± 15 Vdc
Operating Range	± 5 to ± 18 Vdc
Maximum Safe Voltage	± 18 Vdc
Quiescent Current **D78**	12 mA max. 8 mA typ.
Quiescent Current **DP78**	3.0 mA max. 1.5 mA typ.

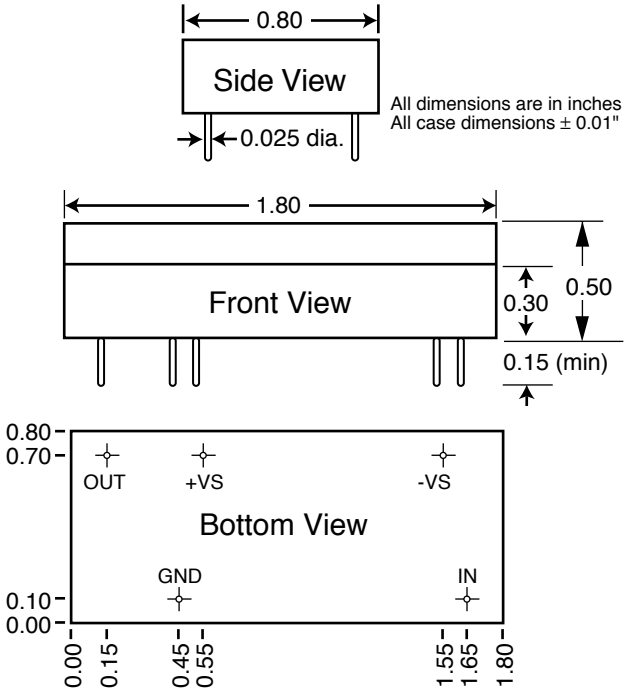
Temperature

Operating	0 to + 70 °C
Storage	- 25 to + 85 °C

Notes:

1. Input and output signal voltage referenced to supply common.
2. Output is short circuit protected to common. DO NOT CONNECT TO ±Vs.

Pin-Out and Package Data
Ordering Information



Filter Mounting Assembly-See FMA-01A

Ordering Information

Filter Type

L - Low Pass
H - High Pass

Transfer Function

B - Butterworth
L - Bessel

D78L8B-849 Hz

Power Level

D – Standard Power

DP – Low Power

- 3 dB Corner Frequency[3]

e.g., 849 Hz
2.50 kHz
33.3 kHz

3. How to Specify Corner Frequency:
Corner frequencies are specified by attaching a three digit frequency designator to the basic model number. Corner frequencies can range from 1 Hz to 100 kHz.

We hope the information given here will be helpful. The information is based on data and our best knowledge, and we consider the information to be true and accurate. Please read all statements, recommendations or suggestions herein in conjunction with our conditions of sale which apply to all goods supplied by us. We assume no responsibility for the use of these statements, recommendations or suggestions, nor do we intend them as a recommendation for any use which would infringe any patent or copyright.

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FREQUENCY DEVICES™, INC.

8-Pole

Bessel

Low-Pass

Appendix A

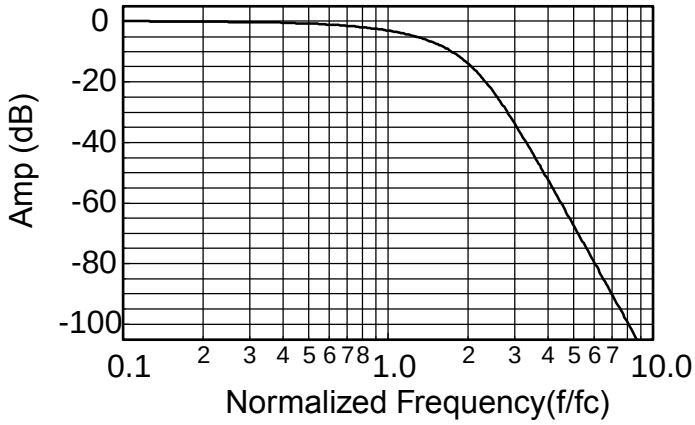
Theoretical Transfer Characteristics

f/fc (Hz)	Amp (dB)	Phase (deg)	Delay[1] (sec)
0.00	0.00	0.00	.506
0.10	-0.029	-18.2	.506
0.20	-0.117	-36.4	.506
0.30	-0.264	-54.7	.506
0.40	-0.470	-72.9	.506
0.50	-0.737	-91.1	.506
0.60	-1.06	-109	.506
0.70	-1.45	-128	.506
0.80	-1.91	-146	.506
0.85	-2.16	-155	.506
0.90	-2.42	-164	.506
0.95	-2.71	-173	.506
1.00	-3.01	-182	.506
1.10	-3.67	-200	.506
1.20	-4.40	-219	.506
1.30	-5.20	-237	.506
1.40	-6.10	-255	.505
1.50	-7.08	-273	.504
1.60	-8.16	-291	.502
1.70	-9.36	-309	.498
1.80	-10.7	-327	.492
1.90	-12.1	-345	.482
2.00	-13.7	-362	.468
2.25	-18.1	-402	.417
2.50	-23.1	-436	.352
2.75	-28.3	-465	.291
3.00	-33.4	-489	.241
3.25	-38.3	-509	.201
3.50	-43.1	-526	.170
4.00	-51.8	-552	.126
5.00	-66.8	-587	.077
6.00	-79.2	-610	.052
7.00	-89.8	-626	.038
8.00	-99.0	-638	.029
9.00	-107	-647	.023
10.0	-114	-655	.018

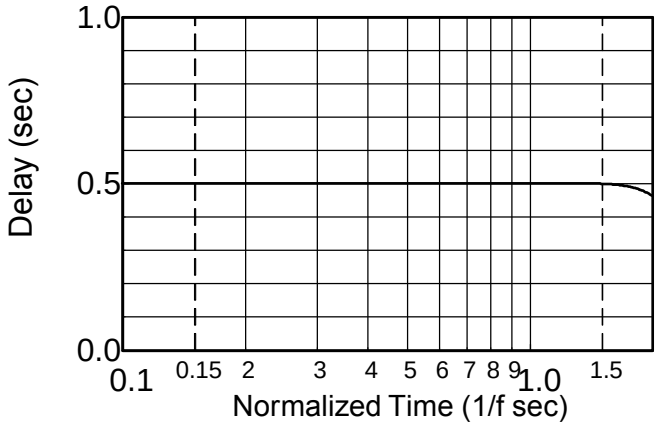
1. **Normalized Group Delay:**
The above delay data is normalized to a corner frequency of 1.0Hz.The actual delay is the normalized delay divided by the actual corner frequency (fc).

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

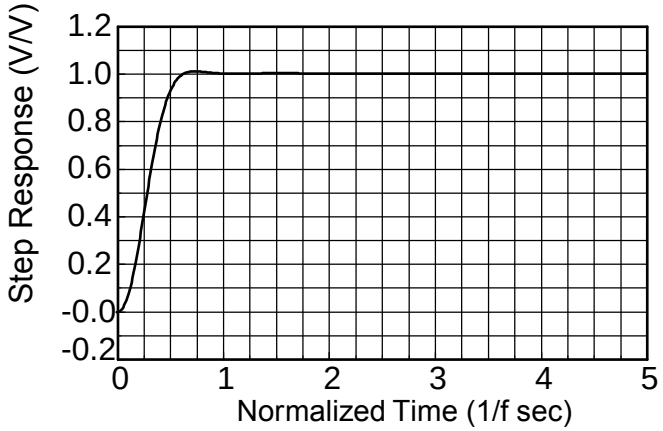
Frequency Response



Delay (Normalized)



Step Response



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FREQUENCY DEVICES™, INC.

Low-Pass

8-Pole

Butterworth

Appendix A

Theoretical Transfer Characteristics

f/fc (Hz)	Amp (dB)	Phase (deg)	Delay[1] (sec)
0.00	0.00	0.00	.816
0.10	0.00	-29.4	.819
0.20	0.00	-59.0	.828
0.30	0.00	-89.1	.843
0.40	0.00	-120	.867
0.50	0.00	-152	.903
0.60	-0.001	-185	.956
0.70	-0.014	-221	1.04
0.80	-0.121	-261	1.19
0.85	-0.311	-283	1.29
0.90	-0.738	-307	1.40
0.95	-1.58	-333	1.48
1.00	-3.01	-360	1.46
1.10	-7.48	-408	1.17
1.20	-12.9	-445	.873
1.30	-18.2	-472	.672
1.40	-23.4	-494	.540
1.50	-28.2	-511	.448
1.60	-32.7	-526	.380
1.70	-36.9	-539	.328
1.80	-40.8	-550	.287
1.90	-44.6	-560	.253
2.00	-48.2	-568	.226
2.25	-56.3	-586	.174
2.50	-63.7	-600	.139
2.75	-70.3	-611	.113
3.00	-76.3	-621	.094
3.25	-81.9	-629	.080
3.50	-87.1	-635	.069
4.00	-96.3	-646	.052
5.00	-112	-661	.033
6.00	-125	-671	.023
7.00	-135	-678	.017
8.00	-144	-683	.013
9.00	-153	-687	.010
10.0	-160	-691	.008

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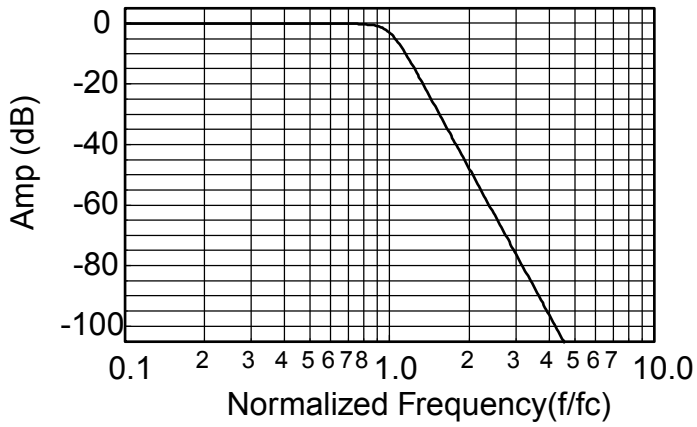
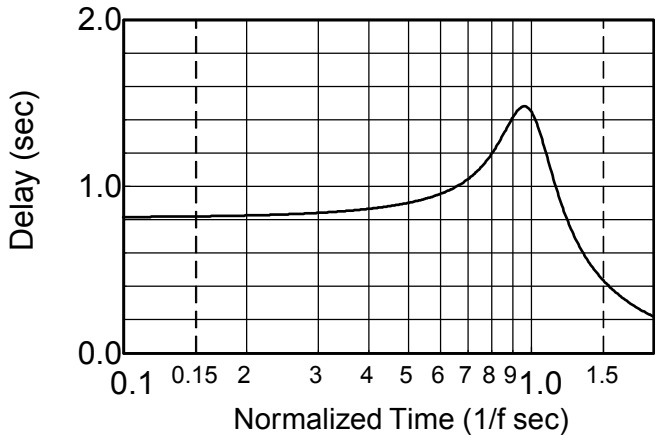
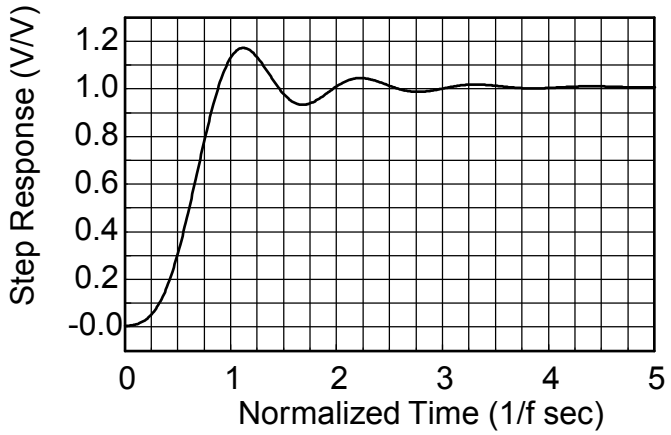
Frequency Response



Delay (Normalized)



Step Response



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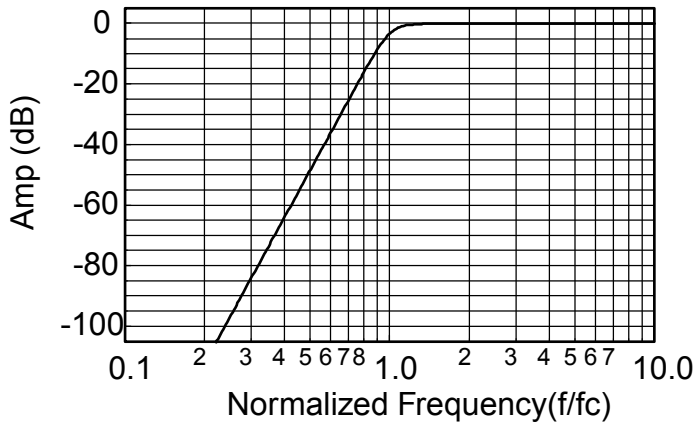
Theoretical Transfer Characteristics

f/fc (Hz)	Amp (dB)	Phase (deg)	Delay[1] (sec)
0.10	-160	691	0.819
0.20	-112	661	0.828
0.30	-83.7	631	0.843
0.40	-63.7	600	0.867
0.50	-48.2	568	0.903
0.60	-35.5	535	.956
0.70	-24.8	499	1.04
0.80	-15.6	459	1.19
0.85	-11.6	437	1.29
0.90	-8.06	413	1.40
0.95	-5.15	386	1.48
1.00	-3.01	360	1.46
1.20	-0.229	275	0.873
1.40	-0.020	226	0.540
1.60	-0.002	194	0.380
1.80	0.00	170	0.287
2.00	0.00	152	0.226
2.50	0.00	120	0.139
3.00	0.00	99.2	0.094
4.00	0.00	74.0	0.052
5.00	0.00	59.0	0.033
6.00	0.00	49.0	0.023
7.00	0.00	42.1	0.017
8.00	0.00	36.8	0.013
9.00	0.00	32.7	0.010
10.0	0.00	29.4	0.008

Frequency Response



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