D61 Series

0.02 Hz to 1.00 Hz
Fixed Frequency

32-Pin DIP
4 - Pole Filters

Description

The D61 Series of small 4-pole fixed-frequency, precision active filters provide high performance linear active filtering in a compact 32-pin DIP package, with a broad range of corner frequencies and a choice of transfer functions. Individual D61 filters can serve in low-pass or high-pass applications or be combined to create custom band-pass or band reject filters. These fully self-contained units require no external components or adjustments. Each model comes factory tuned to a user-specified corner frequency between 0.02 Hz and 1.00 Hz and operate with low total harmonic distortion over a wide dynamic input voltage range from non-critical +/-5V to +/-18V power supplies.

Features/Benefits:

- Low harmonic distortion and wide signal-to-noise ratio
- Compact 1.8"L x 0.8"W x 0.5"H 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 transfer characteristics and corner frequencies to meet a wide range of applications.

Applications

- Anti-alias filtering
- Data acquisition systems
- Communication systems and electronics
- Medical electronics equipment and research
- Aerospace, navigation and sonar applications
- Sound and vibration testing
- Acoustic and vibration analysis and control
- Noise elimination
- Signal reconstruction

Available Low-Pass Models: **Page**

D61L4B 4-pole Butterworth 2
D61L4L 4-pole Bessel .2

Available High-Pass Models:

D61H4B 4-pole Butterworth 2

General Specifications:

Pin-out/package data & ordering information 3

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FREQUENCY DEVICES™, INC.

D61 Series

Fixed Frequency 4-Pole Low-Pass Filters

Model	D61L4B	D61L4L	Model	D61H4B
Product Specifications	**Low-Pass**	**Low-Pass**		**High-Pass**
Transfer Function	4-Pole, Butterworth	4-Pole, Bessel	**Transfer Function**	4-Pole, Butterworth
Size	1.8″ x 0.8″ x 0.5″	1.8″ x 0.8″ x 0.5″	**Size**	1.8″ x 0.8″ x 0.5″
Range fc **D61**	0.02 Hz to 1.00 Hz	0.02 Hz to 1.00 Hz	**Range fc** **D61**	0.02 Hz to 1.00 Hz
Theoretical Transfer Characteristics	Appendix A Page 7	Appendix A Page 2	**Theoretical Transfer Characteristics**	Appendix A Page 27
Passband Ripple (theoretical)	0.0 dB	0.0 dB	**Passband Ripple** (theoretical)	0.0 dB
DC Voltage Gain (non-inverting)	0 ± 0.1 dB max. 0 ± 0.05 dB typ.	0 ± 0.1 dB max. 0 ± 0.05 dB typ.	**Voltage Gain** (non-inverting)	0 ± 0.2 dB to 100 kHz 0 ± 0.5 dB to 120 kHz
			Power Bandwidth	120 kHz
			Small Signal Bandwidth	(-6dB) 1 MHz
Stopband Attenuation Rate	24 dB/octave	24 dB/octave	**Stopband Attenuation Rate**	24 dB/octave
Cutoff Frequency **Stability** **Amplitude** **Phase**	fc ± 2% max. ± 0.01% /°C -3dB -180°	fc ± 2% max. ± 0.01% /°C -3dB -121°	**Cutoff Frequency** **Stability** **Amplitude** **Phase**	fc ± 2% max. ± 0.01% /°C -3dB -180°
Filter Attenuation (theoretical)	0.67 dB 0.80 fc 3.01 dB 1.00 fc 30.0 dB 2.37 fc 40.0 dB 3.16 fc	1.86 dB 0.80 fc 3.01 dB 1.00 fc 30.0 dB 3.50 fc 40.0 dB 4.72 fc	**Filter Attenuation** (theoretical)	40 dB 0.31 fc 30 dB 0.42 fc 3.01 dB 1.00 fc 0.02 dB 2.00 fc
Phase Match[1]	0 - 0.8 fc ± 2° max. ± 1° typ. 0.8 fc - 1.0 fc ± 3° max. ± 1.5° typ.	0 - fc ± 2° max. ± 1° typ.	**Phase Match**[1]	0 - 100 kHz ± 3° max. ± 1.5° typ.
Amplitude Accuracy (theoretical)	0 - 0.8 fc ± 0.2 dB max. ± 0.1 dB typ. 0.8 fc - 1.0 fc ± 0.3 dB max. ± 0.15 dB typ.	0 - fc ± 0.2 dB max. ± 0.1 dB typ.	**Amplitude Accuracy** (theoretical)	1.0 - 1.25 fc ± 0.30 dB max. ± 0.15 dB typ. 1.25 fc -100 kHz ± 0.20 dB max. ± 0.10 dB typ.
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

1. Unit to unit match for the same transfer function, set to the same frequency and operating configuration, and from the same manufacturing lot.

D61 Series

Specification
(25°C and Vs ± 15 Vdc)

Pin-Out and Package Data Ordering Information

Analog Input Characteristics[1]

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

Analog Output Characteristics

Impedance(Closed Loop)	1 Ω typ.
	10 Ω max.
Linear Operating Range	± 10 V
Maximum Current[2]	± 2 mA
Offset Voltage[3]	2 mV typ.
	10 mV max.
Offset Temp. Coeff.	50 µV / °C

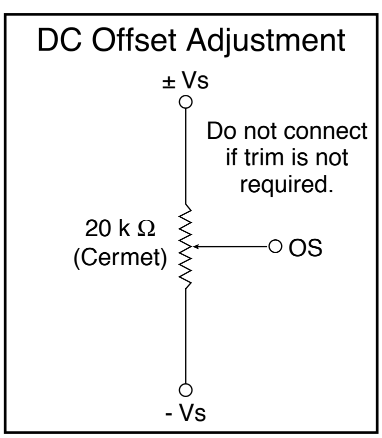
Power Supply (±V)

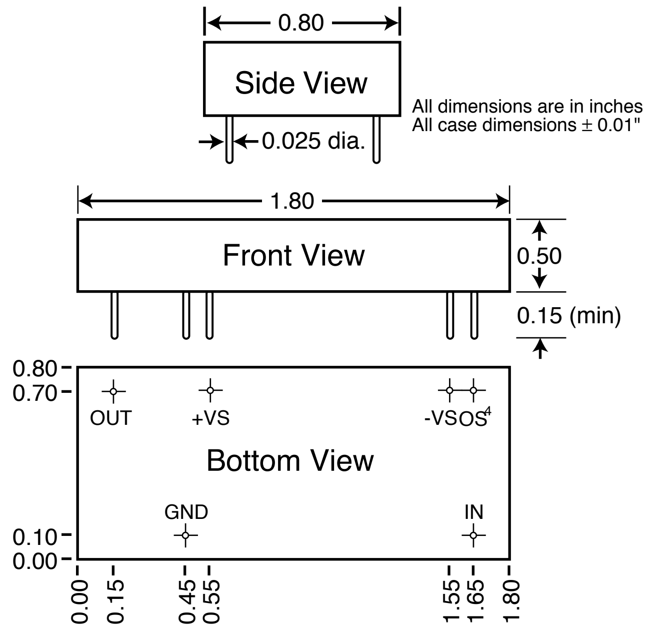
Rated Voltage	± 15 Vdc
Operating Range	± 5 to ± 18 Vdc
Maximum Safe Voltage	± 18 Vdc
Quiescent Current D61	± 12.5 mA typ.
	± 20 mA max.

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.
3. Adjustable to zero.





Filter Mounting Assembly-See FMA-01A

Ordering Information

Filter Type
L - Low Pass
H - High Pass

Transfer Function
B - Butterworth
L - Bessel

D61L4B-0.05 Hz

- 3 dB Corner Frequency[5]
e.g., 0.05 Hz
0.85 Hz
1.00 Hz

4. Units operate with or without offset pin connected.

5. 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 0.02 Hz to 1.00 Hz.

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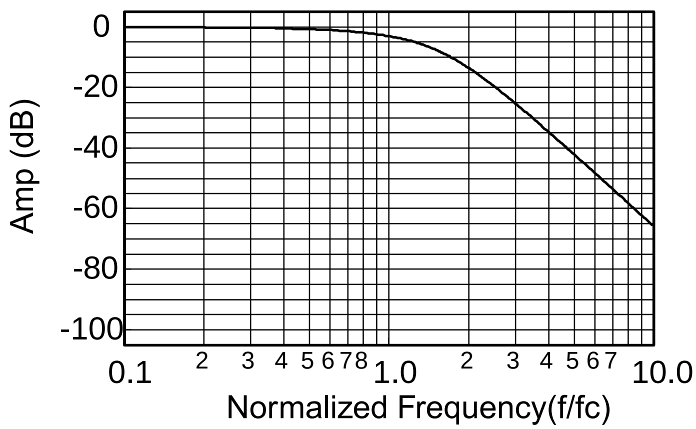
Theoretical Transfer Characteristics

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

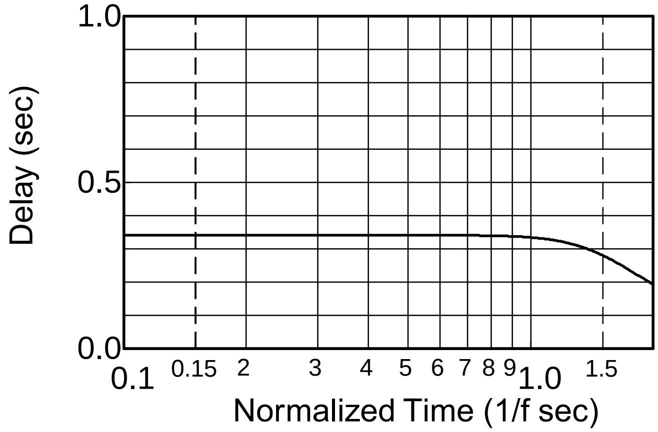
1. **Normalized Group Delay:**
The above delay data is normalized to a corner frequency of 1.0Hz. The actual delay is the normalized delay divided by the actual corner frequency (fc).

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

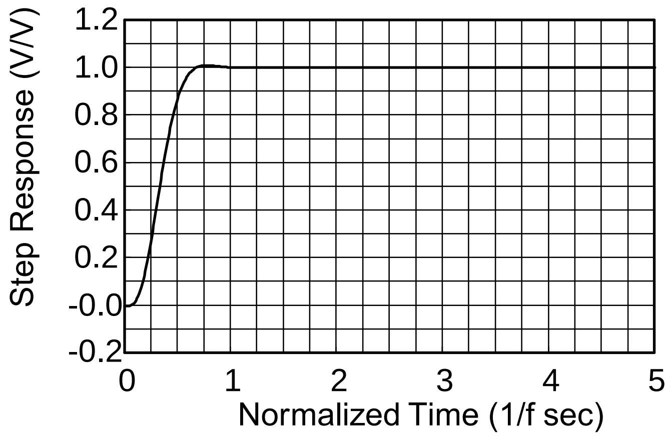
Frequency Response



Delay (Normalized)



Step Response



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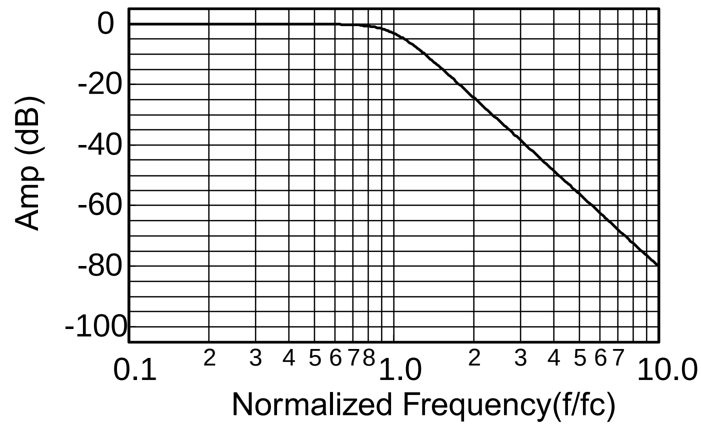
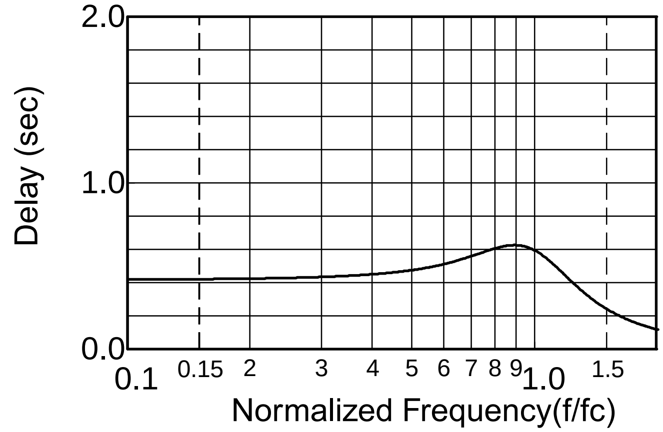
Theoretical Transfer Characteristics

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

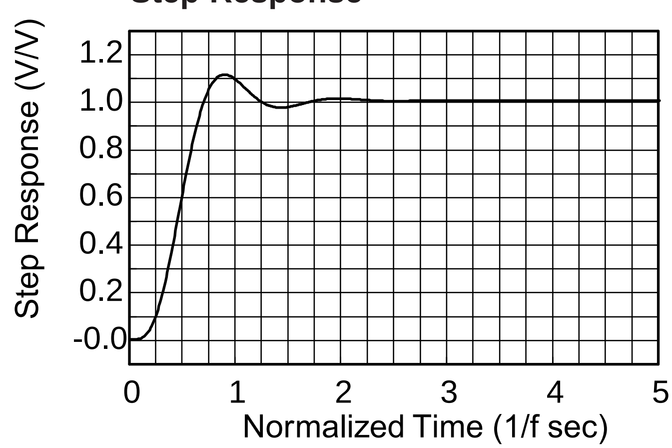
Frequency Response



Delay (Normalized)



Step 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).

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

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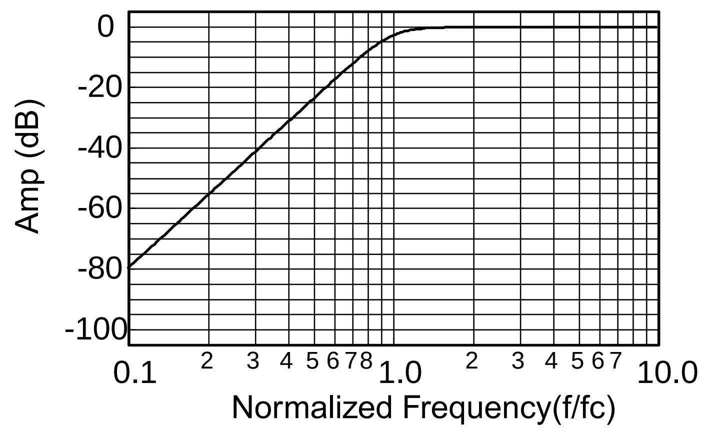
Theoretical Transfer Characteristics

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



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