



# Digital Filter Box

## Description

With Moku:Lab's Digital Filter Box, you can interactively design and generate different types of infinite impulse response filters with output sampling rates of 122 kHz and 15.625 MHz. Select between lowpass, highpass, bandpass and bandstop filter shapes with up to seven fully configurable types including Butterworth, Chebyshev and Elliptical.



## Features

- Design IIR filters using an interactive Bode plot
- Observe signals at different stages in the digital signal processing chain using probe points
- View the frequency response of your filter in both magnitude and phase
- Filter up to two channels of data simultaneously with the ability to blend input signals using a control matrix
- Implement custom filters by uploading your own coefficients



# Specifications

## Inputs

### Input characteristics

Channels	2
Input control matrix coefficients	-20 to +20
Input impedance	50 $\Omega$ / 1 M $\Omega$
Input coupling	AC / DC
Input attenuation	0 dB / 20 dB
Input voltage range	$\pm$ 0.5 V into 50 $\Omega$ with 0 dB attenuation

## Filter characteristics

### Pre-filter

Input offset range	$\pm$ 500 mV
Input offset resolution	100 $\mu$ V
Input gain range	-40 dB to +40 dB
Input gain resolution	0.1 dB

### Post-filter

Output offset range	$\pm$ 500 mV
Output offset resolution	100 $\mu$ V
Output gain range	-40 dB to +40 dB
Output gain resolution	0.1 dB

### General filter characteristics

Filter shapes	Lowpass, Highpass, Bandpass, Bandstop, Custom
Sampling rates	122 kHz, 15.625 MHz
Filter types	Butterworth, Chebyshev I, Chebyshev II, Elliptic, Bessel, Gaussian, Legendre
Passband ripple	0.1 dB to 10 dB
Stopband attenuation	10 dB to 100 dB
Zoom view	Allows the user to zoom in on the filter's frequency response



### Low-pass filter

---

Filter order	2, 4, 6, 8
Low-pass corner frequency	1.221 Hz to 48.83 kHz at 122 kHz sampling rate 156.3 Hz to 6.250 MHz at 15.625 MHz sampling rate

---

### High-pass filter

---

Filter order	2, 4, 6, 8
High-pass corner frequency	1.221 Hz to 48.83 kHz at 122 kHz sampling rate 156.3 Hz to 6.250 MHz at 15.625 MHz sampling rate

---

### Band-pass / band-stop filter

---

Filter order	2, 4
Low corner frequency	1.221 Hz to 48.83 kHz at 122 kHz sampling rate 156.3 Hz to 6.250 MHz at 15.625 MHz sampling rate
High corner frequency	2.002 Hz to 48.83 kHz at 122 kHz sampling rate 256.3 Hz to 6.250 MHz at 15.625 MHz sampling rate
Minimum bandwidth	770 mHz at 122 kHz sampling rate 100 Hz at 15.625 MHz sampling rate

---

## Selecting the right IIR filter

### Filter type

---

Butterworth	Butterworth filters have a maximally flat passband and a monotonic frequency response, making them a good all-round filter type suitable for most applications.
Chebyshev I	Chebyshev I filters have ripple in the passband but a sharper transition than Butterworth filters, making them useful for applications requiring aggressive stopband attenuation but can tolerate passband ripple between 0.1 dB and 10 dB.
Chebyshev II	Chebyshev II filters have ripple in the stopband but a sharper transition than Butterworth filters, making them useful in applications requiring flat passbands and aggressive stopband attenuation.
Elliptical	Elliptical (Cauer) filters have ripple in both passband and stopband, but also have the sharpest possible transition. Elliptical filters are useful in applications requiring extremely aggressive stopband attenuation.
Bessel	Bessel filters have maximally flat group and phase delay in the passband, thus preserving the wave shape of passband signals.
Gaussian	Gaussian filters have the minimum possible group delay, and a step response with no overshoot and minimum rise and fall time.
Legendre	Legendre (Optimum L) filters have the sharpest possible transition while maintaining a monotonic frequency response.

---