

Shelf + 30 / 60 MHz Filter



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Introduction

This document covers the Turn Island Systems Shelf + 30 MHz + 60 MHz filter (F3060).

The F3060 is designed to provide optional frequency-compensated attenuation below 30 or 60 MHz and an aggressive low-pass response above those frequencies, providing good anti-aliasing performance for modern SDR receivers. The 60 MHz filter stopband response has been carefully tailored to give maximum attenuation of the 88-108 MHz FM broadcast band, providing in excess of 80 dB relative attenuation.

This filter is designed for a 50 Ohm input and output impedance.

Circuit Description

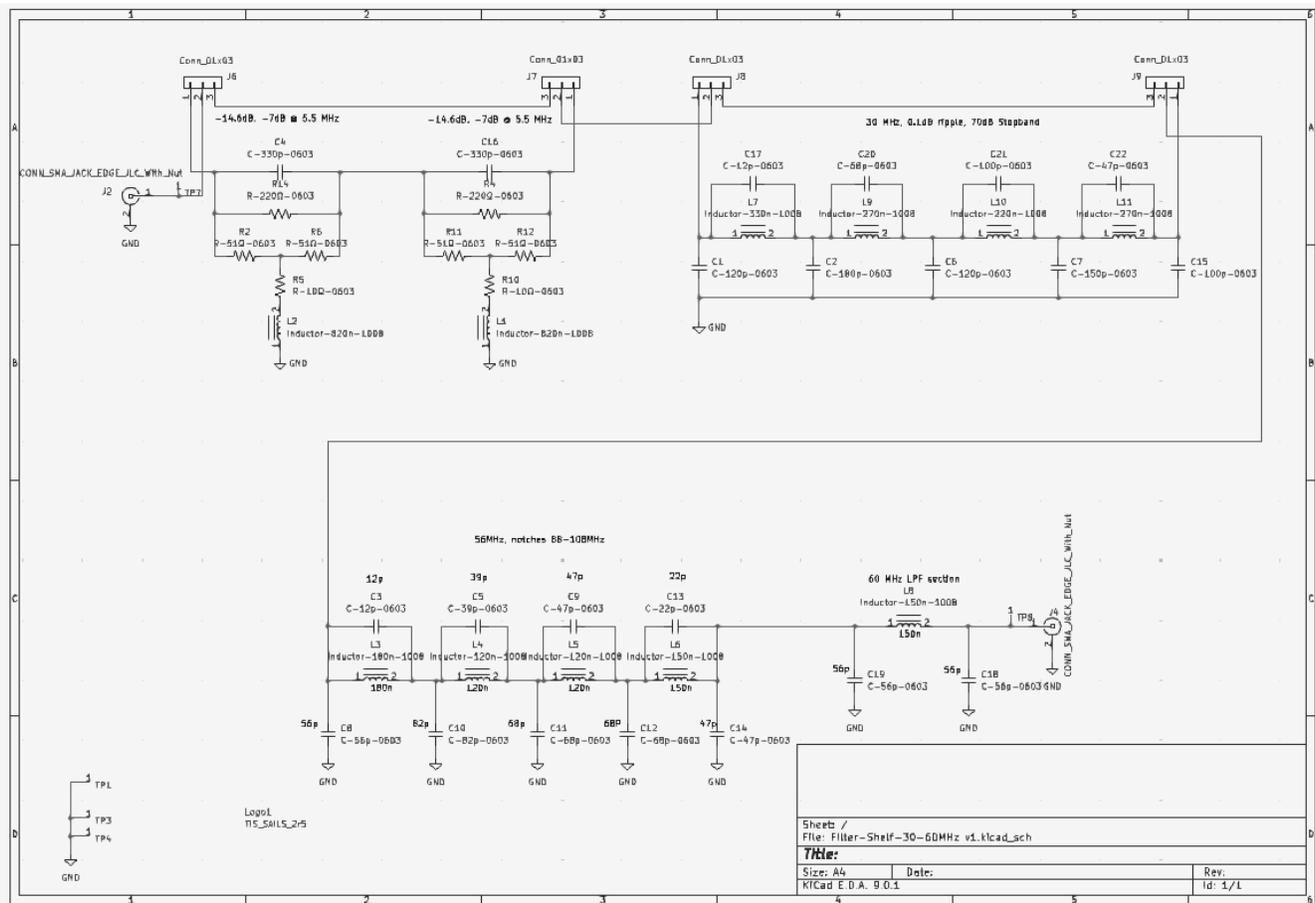


Illustration 1: Schematic

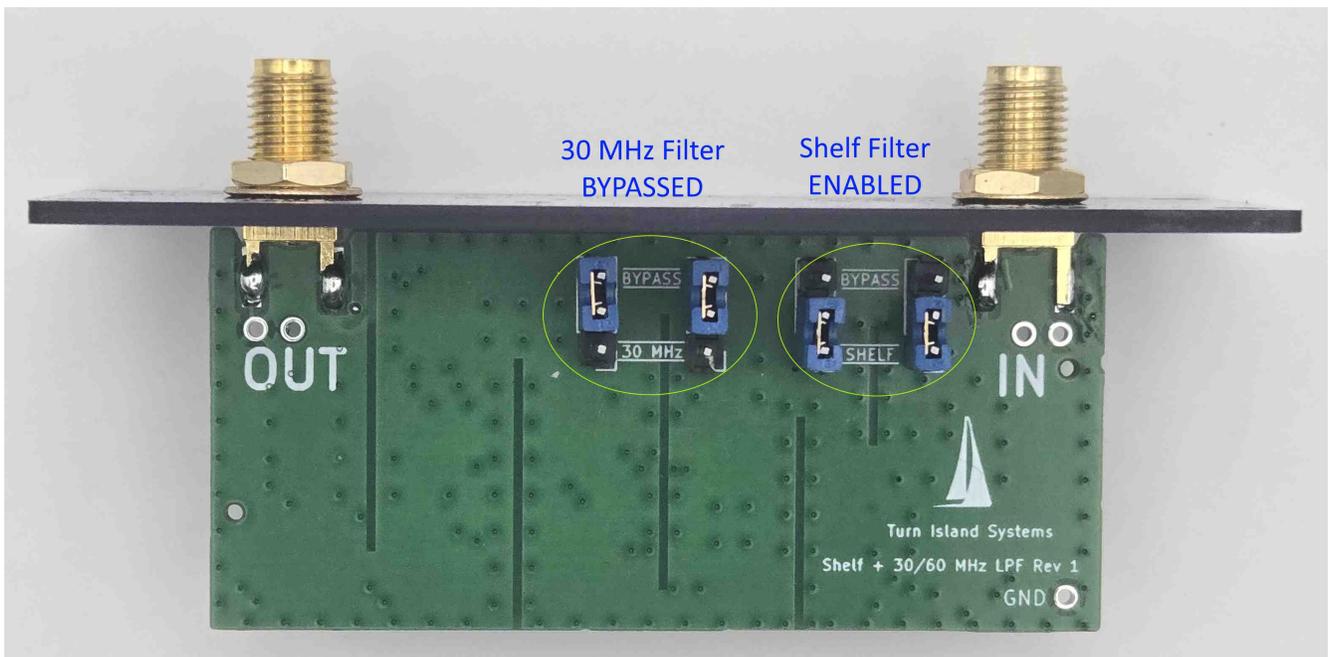
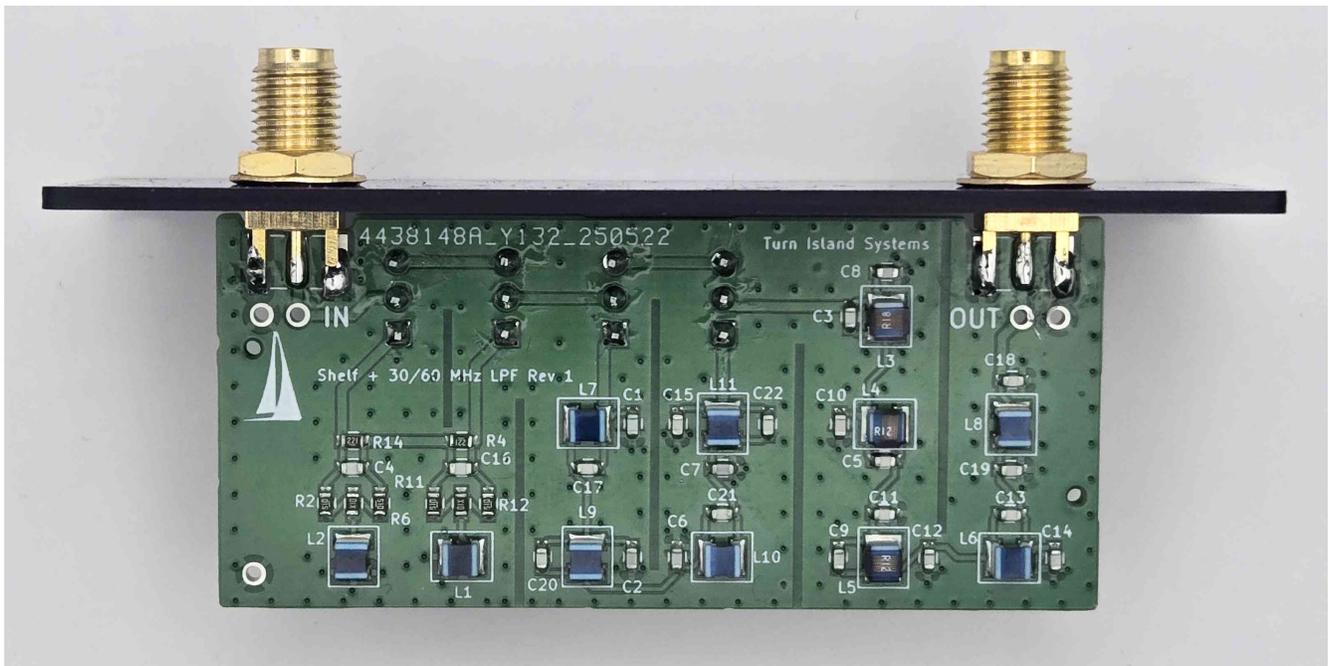
There are three stages to the F3060:

- The dual-stage shelf filter, with header pin / jumpers used to enable or bypass this stage
- The 30 MHz low-pass filter, with header pin / jumpers used to enable or bypass this stage
- The 60 MHz low-pass filter (elliptic + pi), This stage is always enabled.

All capacitors used in the F3060 are multilayer ceramic surface-mount with NP0/C0G temperature coefficients.

All inductors are surface-mount wire-wound ceramic core types.

Configuration



The 30 MHz and Shelf filters can be individually bypassed using jumper-pairs. The configuration in the image above shows the 30 MHz filter bypassed, and the shelf filter enabled, resulting in a 60 MHz filter with shelf filter.

Performance

The following plots show the F3060 frequency response.

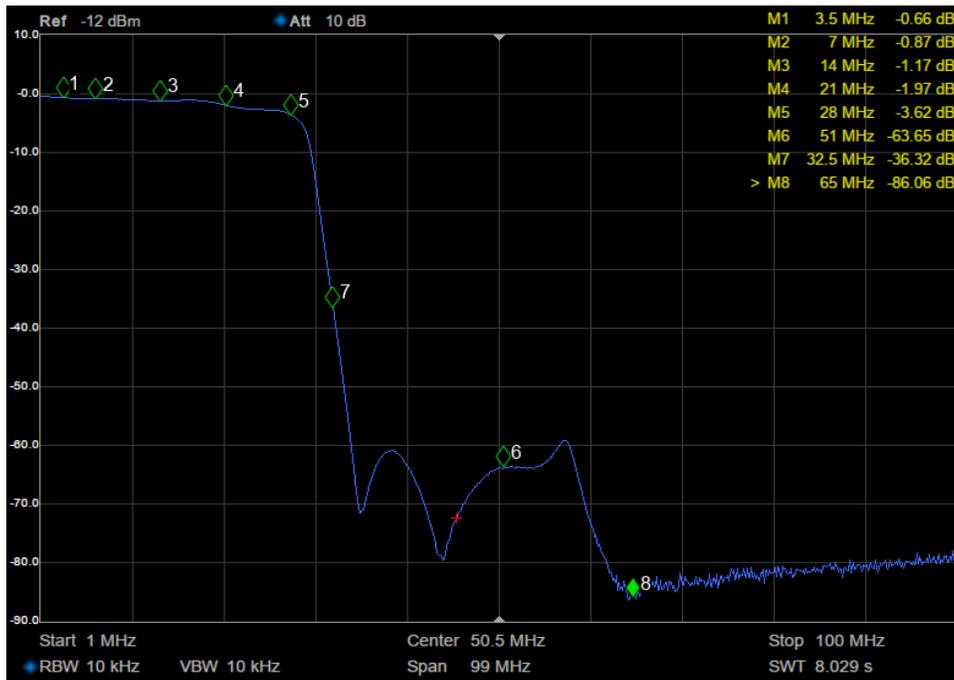


Illustration 2: 30 MHz Filter

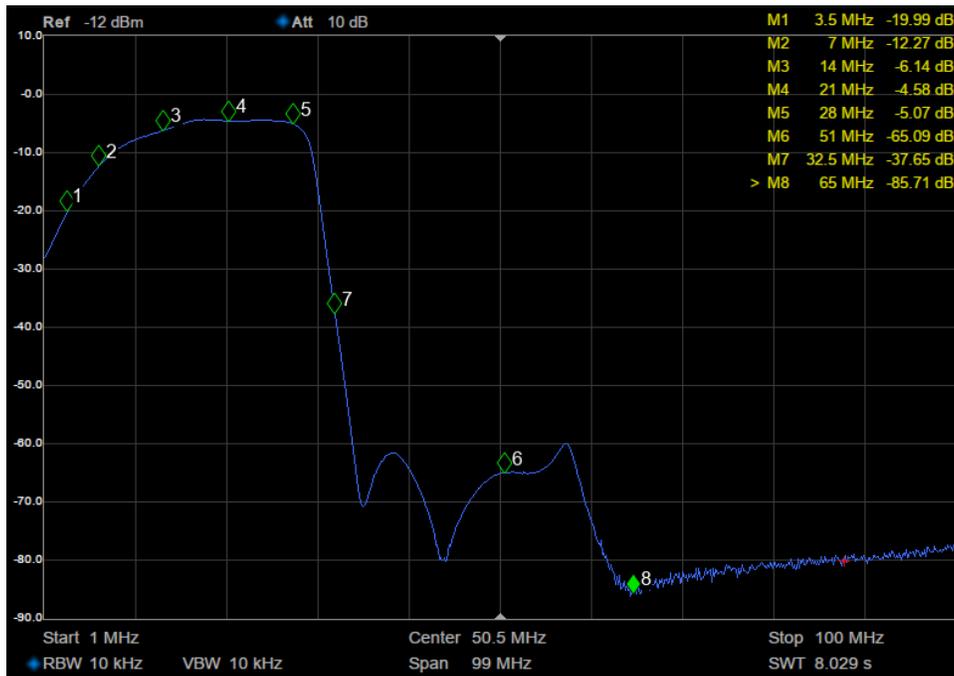


Illustration 3: 30 MHz Filter with Shelf

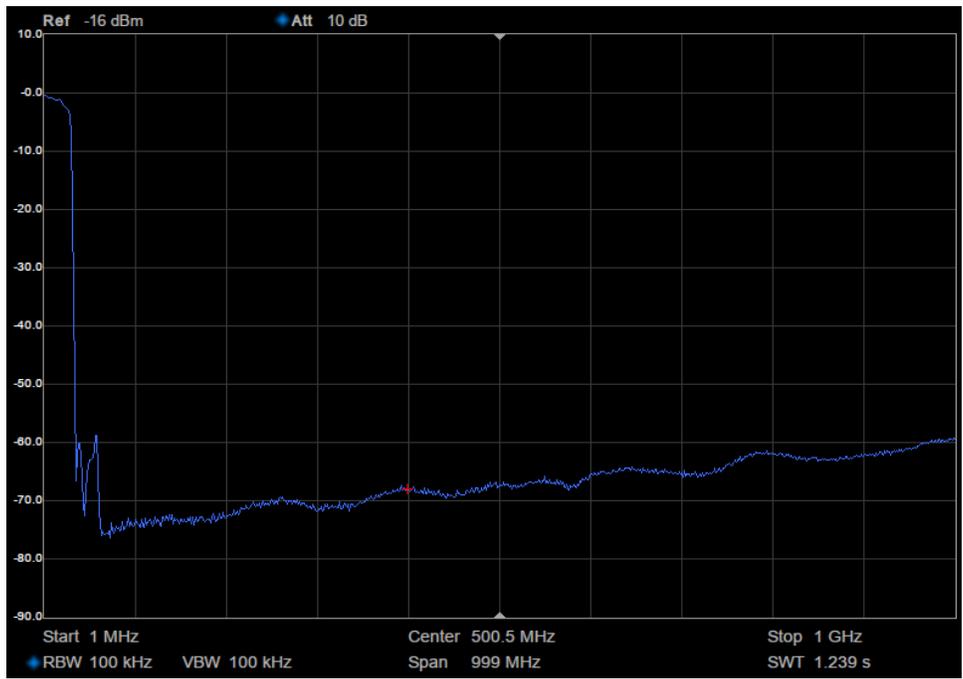


Illustration 4: 30 MHz Filter, 1 - 1000 MHz

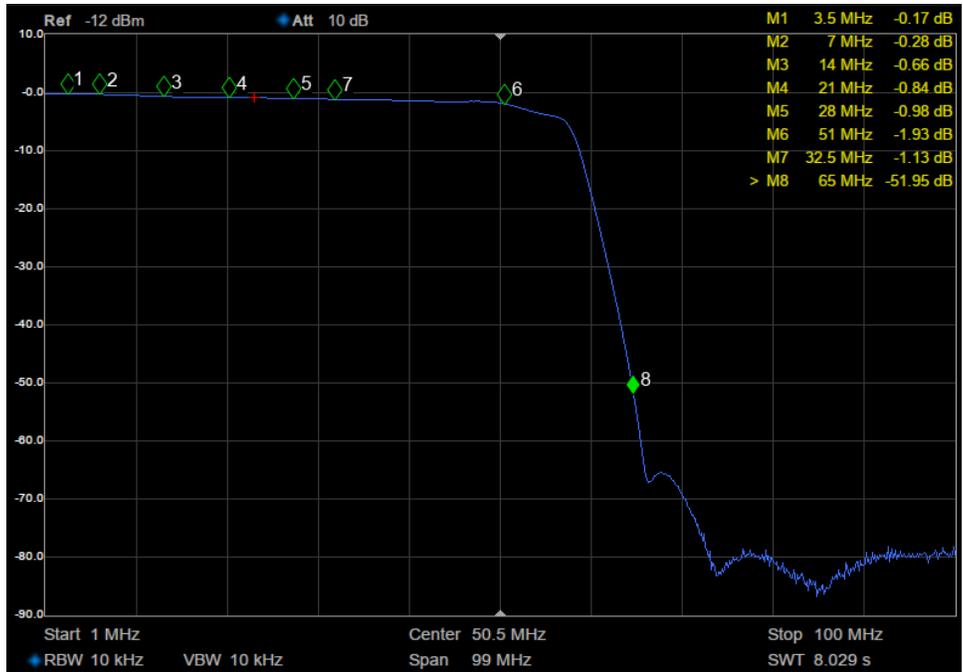


Illustration 5: 60 MHz Filter

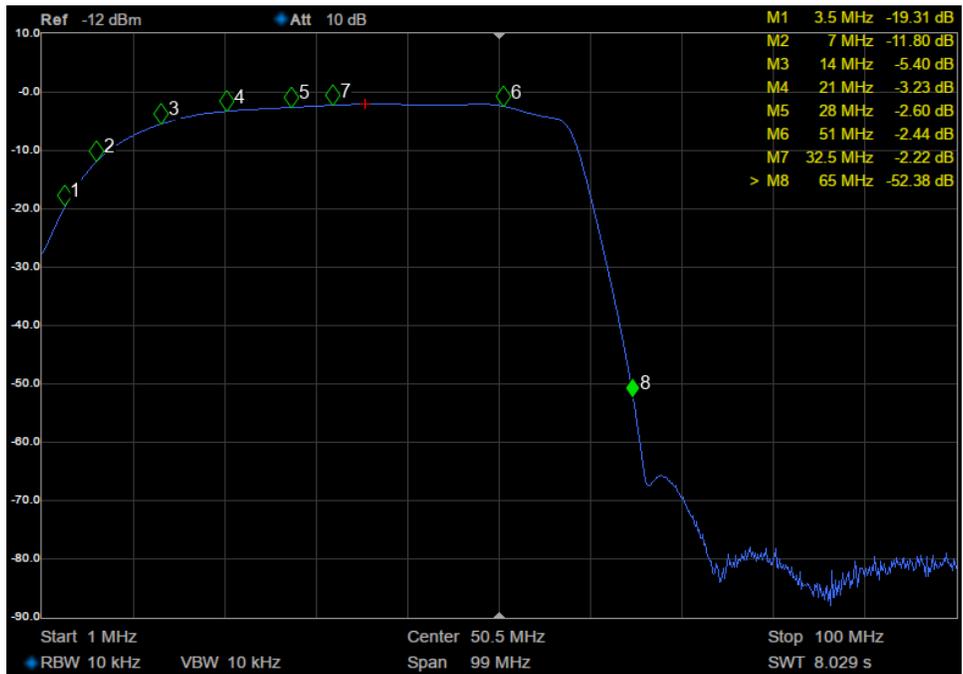


Illustration 6: 60 MHz Filter with Shelf

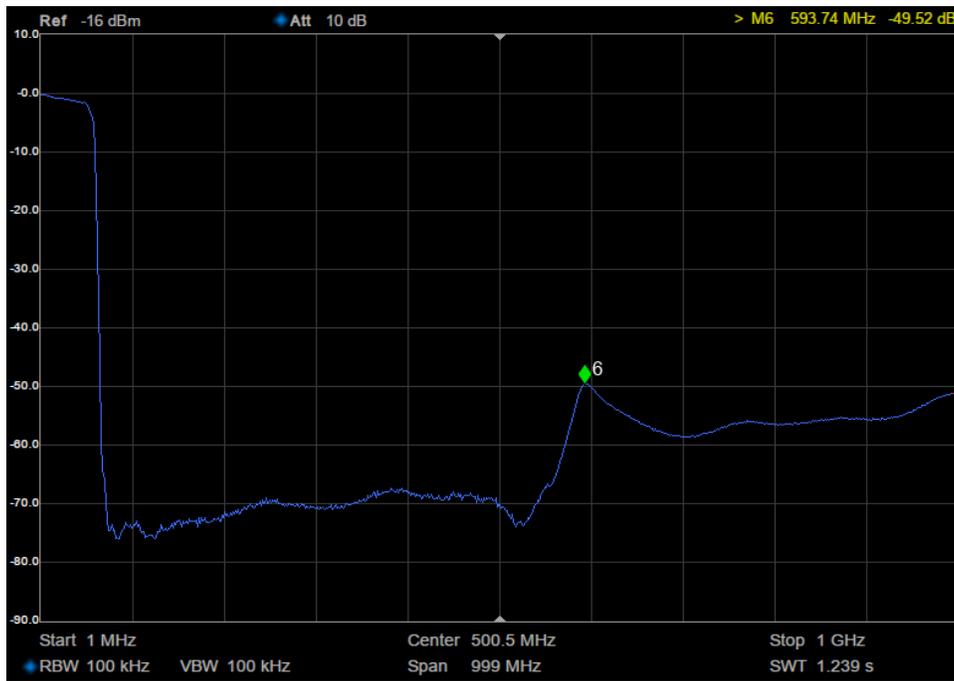


Illustration 7: 60 MHz Filter, 1 - 1000 MHz

Below is a log-frequency plot of the dual shelf filter (simulation, no other filters), which gives a better idea of the this filter shape. As you can see, the attenuation is roughly 30 dB below 1 MHz, with the output climbing from 1 to 30 MHz where it flattens out close to zero attenuation. This behavior compensates for the characteristics of the typical RF background noise floor and does provide useful attenuation of strong AM broadcast band signals.

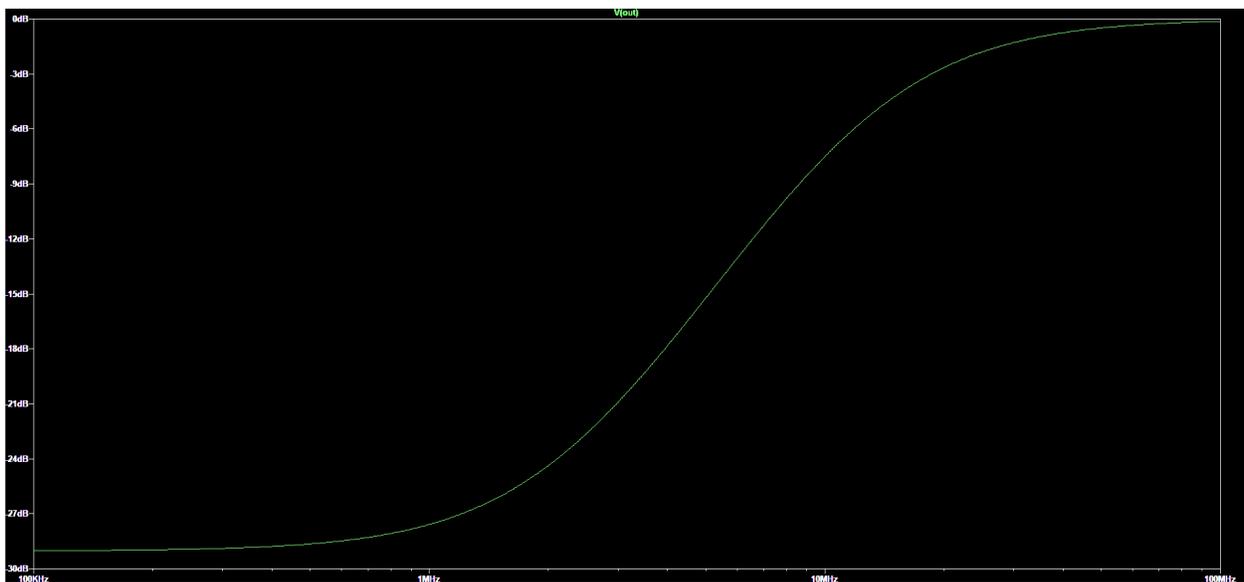


Illustration 8: Dual Shelf Filter Frequency Response

Specifications

Attenuation / Frequency, 30 MHz Filter:

Frequency (MHz)	Atten.(dB) with Shelf	Atten.(dB) without Shelf
0.1	-29.9	-0.5
1	-28.5	-0.5
3.5	-20.0	-0.7
7	-12.3	-0.9
14	-6.1	-1.2
21	-4.6	-2.0
28	-5.1	-3.7
32.5	-37.7	-36.3
51	-65.1	-63.7
65	-85.7	-86.1
100	-78.0	-79.0
>100	< -60	< -60

Attenuation / Frequency, 60 MHz Filter:

Frequency (MHz)	Atten.(dB) with Shelf	Atten.(dB) without Shelf
0.1	-29.6	-0.2
1	-28.2	-0.2
3.5	-19.3	-0.2
7	-11.8	-0.3
14	-5.4	-0.7
21	-3.2	-0.8
28	-2.6	-1.0
32.5	-2.2	-1.1
51	-2.4	-1.9
65	-52.4	-52.0
100	-81.0	-79.5
>100	< -50	< -50

Dimensions:

83mm wide x 32mm high x 40mm deep (including SMA jacks)

Weight: 2.5 oz