



# Selectable Very High Frequency LP/BP Filter Data Sheet

MSVHFS1-6

## Description

The MSVHFS1-6 is a selectable very high frequency lowpass/bandpass filter CMOS IC. The lowpass response can be a 6 pole Butterworth, Elliptic or Bessel filter. The band pass response can be a six pole full, third or sixth octave bandpass filter. The device uses switched-capacitor filters (SCF) and no external components (except for decoupling capacitors) are required, Two external clocks are needed for the mixer and filter functions. Lower current, and lower frequencies are pin selected.

An externally selectable gain setting pin, along with a power down and clock to corner ratio select pin are included in the 16 pin version.

## Absolute Maximum Ratings

Power Supply Voltage	+3.5V
Storage Temperature Range	-60° to +150° C
Operating Temperature Range	-40° to +85° C

## Features

- Low Voltage: 3.0 VDC
- Six Filter Types In One Package
- No External Components
- Switched-Capacitor Filters
- Very High Frequency Filter Operation
- Selectable Gain 0, 10 or 20 dB
- Small Package Size
- On Chip Power Save Pin
- ANSI Compatible Bandpass

## Applications

- Spectrum Analyzers
- General Purpose Systems
- Portable Systems
- Anti-Alias Filters
- Telecommunications
- Tracking Filters
- Harmonic Analysis
- Noise Analysis
- Data Communication
- Wireless Applications

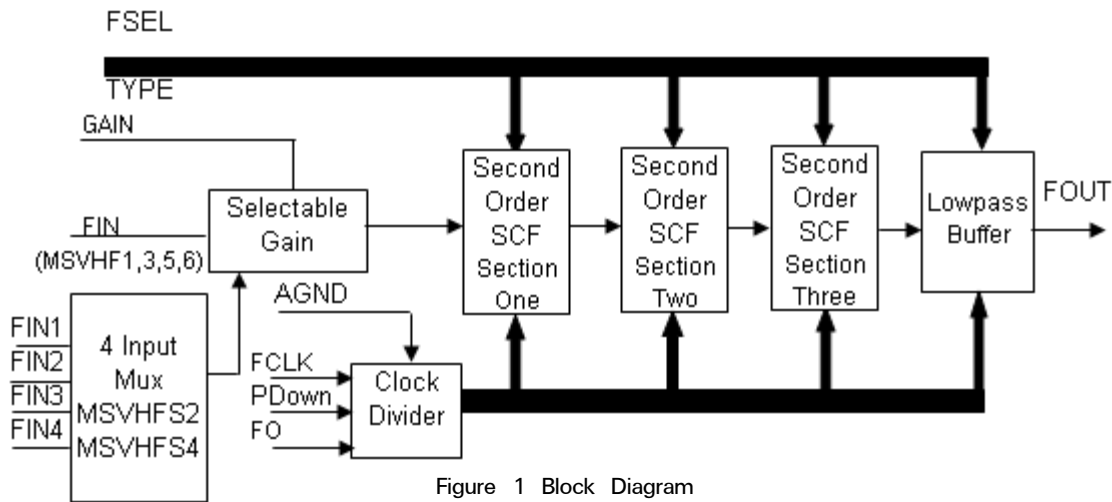


Figure 1 Block Diagram





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## Electrical Characteristics

(VDD = +3.0V, T = 25 C) Sample rate is 2X clock to corner ratio

MSVHFS1-6

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DC Specifications</b>						
Operating Voltage	VDD			3.0	3.3	V
Supply Current	IDD	MSVHFS3,4,6		1.0		mA
Supply Current	IDD	MSVHFS1,2,5		5.0		mA
Supply Current in Power Down Mode	IDD <sub>PD</sub>	PDown=High		200		μA
<b>Filter AC Specifications</b>						
Gain	A <sub>V</sub>	G=VSS	-0.5	0	0.5	dB
Gain with 10 dB Selected	A <sub>V10dB</sub>	G=1/2 VDD		10		dB
Gain with 20 dB Selected	A <sub>V20dB</sub>	G= VDD		20		dB
Noise	e <sub>n</sub>	To 1/2 Sample		200		μVrms
Distortion	THD	5MHz Butterworth with 1 MHz Input		-72		dB
Signal Swing	V <sub>O</sub>			2.8		V <sub>PP</sub>
Input Imedance	Z <sub>IN</sub>			1.0		MΩ
Output Drive	I <sub>O</sub>			300		μA
Output Impedance	Z <sub>O</sub>			500		Ω
Output Capacitive Load	C <sub>OMAX</sub>				20	pF
Clock to Corner		FO=2		12.5		
Clock to Corner		FO=0		6,25		
Center Frequency Range	F <sub>O</sub>	FO=0 PWR=High	0.00001	5		MHz
Center Frequency Range	F <sub>O</sub>	FO=2 PWR=Low	0.00001	1		MHz
<b>Ripple</b>						
Elliptic Lowpass, Bandpass				0.2		dB
<b>Stop Band Rejection</b>						
Elliptic Lowpass				70		dB
Bessel Lowpass				60		dB
<b>40 dB Bandwidth</b>						
Full Octave		Normalized F <sub>C</sub>	0.3		3	
1/3 Octave		Normalized F <sub>C</sub>	0.6		1.67	
1/6 Octave		Normalized F <sub>C</sub>	0.76		1.32	





# Selectable Very High Frequency LP/BP Filter Data Sheet

## Electrical Characteristics Continued

(VDD = +3.0V, T = 25 C) Sample rate is 2X clock to corner ratio

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Bandpass Q</b>						
Full Octave	Q			1.5		
1/3 Octave	Q			4.5		
1/6 Octave	Q			9		

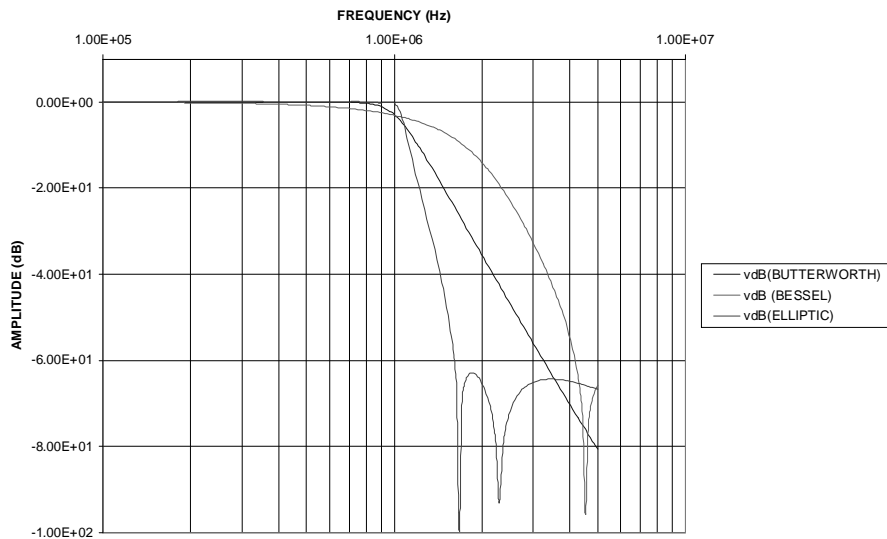


Figure 2 Lowpass Filter Responses

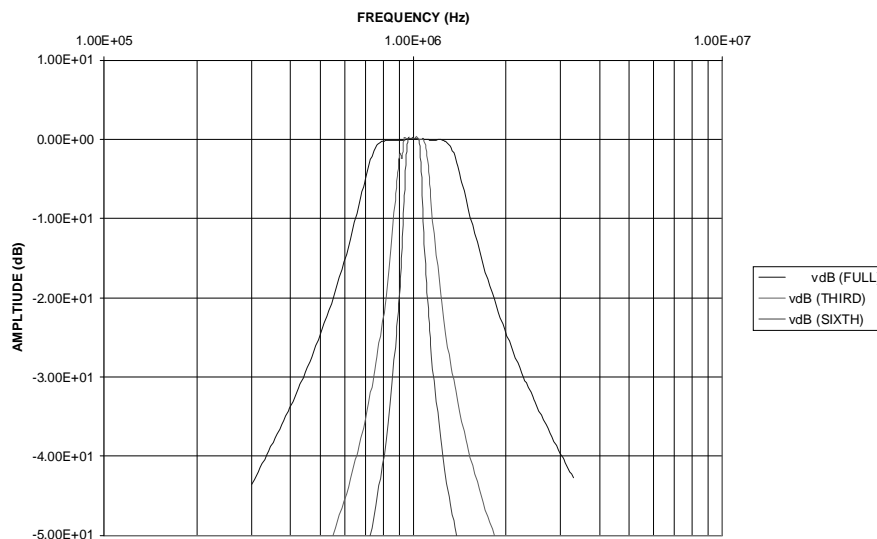


Figure 3 Bandpass Filter Responses

MSVHFS1-6





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## Filter Selection

The filter type is selected using the two filter select pins, TYPE and FSEL, FSEL is a CMOS level pin that selects lowpass or bandpass response (lowpass = 0, bandpass = 2). TYPE is a tertiary control pin that selects the filter response. State 0 is VSS, state 1 is GND and state 2 is VDD.

TYPE	Lowpass	Bandpass
0	Butterworth	Full Octave
1	Bessel	Third Octave
2	Elliptic	Sixth Octave

## Gain and Frequency Selection

The Gain select pin G is a tertiary control pin where state 0 is VSS, state 1 is GND level and state 2 is VDD.

G	Gain
0	0dB
1	10dB
2	20dB

The clock to corner select pin FO is a CMOS level pin where HIGH is clock to corner of 12.5 to 1 (25 to 1 for Bessel) and LOW is clock to corner of 6.25 to 1 (12.5 to 1 for Bessel). The sample rate ratio is twice the clock to corner ratio (double sampling).

MSVHFS1-6



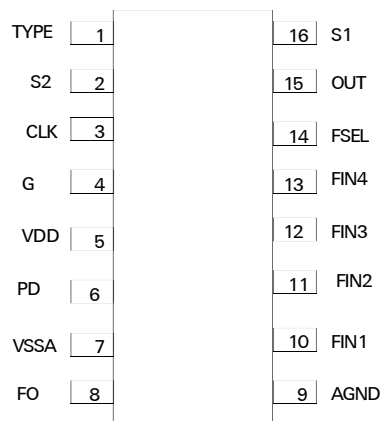


# Selectable Very High Frequency LP/BP Filter Data Sheet

## Pin Description MSVHFS2/4 \_\_\_\_\_

- 1. TYPE Filter Response Select Pin.
- 2. S2 Input Multiplexor Select Pin
- 3. CLK Square Wave Clock Input
- 4. G Gain Select Pin
- 5. VDD Positive Power Supply,Typically +1.5 Volts for Split Supply, +3.0 Volts for Single Supply
- 6. PD Power Down Pin, CMOS level, Hi = Power Down
- 7. VSS Negative Power Supply,Typically -1.5 Volts for Split Supply, 0 Volts for Single Supply
- 8. FO Clock to Corner Select Pin
- 9. GND GND Pin, OV for Split Supplies +1.5 Volts Typical for Single Supply
- 10. FIN1 Filter Input 1
- 11. FIN2 Filter Input 2
- 12. FIN3 Filter Input 3
- 13. FIN4 Filter Input 4
- 14. FSEL Filter Select  
2 = Bandpass; 0= Lowpass
- 15. OUT Filter Output
- 16. S1 Input Multiplexor Select Pin

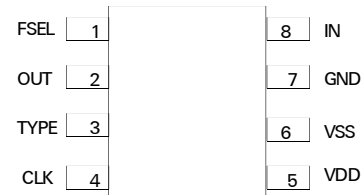
## Pin Configuration MSVHFS2/4 \_\_\_\_\_



## Pin Description MSVHFS1/3/5/6 \_\_\_\_\_

- 1.. FSEL Filter Select
- 2. OUT Filter Output
- 3 TYPE Filter Response Select Pin.
- 4. CLK Square Wave Clock Input
- 5. VDD Positive Power Supply,Typically +1.5 Volts for Split Supply, +3.0 Volts for Single Supply
- 6. VSS Negative Power Supply,Typically -1.5 Volts for Split Supply, 0 Volts for Single Supply
- 7. AGND GND Pin, OV for Split Supplies +1.5 Volts Typical for Single Supply
- 8. FIN Filter Input

## Pin Configuration MSVHFS1/3/5/6 \_\_\_\_\_



MSVHFS1-6

## Ordering Information \_\_\_\_\_

Part Number	Package	Operating Temperature
MSVHFS1N	SOIC-8	-40 <sup>o</sup> to +85 <sup>o</sup> C
MSVHFS2N	SOIC-16	-40 <sup>o</sup> to +85 <sup>o</sup> C
MSVHFS3N	SOIC-8	-40 <sup>o</sup> to +85 <sup>o</sup> C
MSVHFS4N	SOIC-16	-40 <sup>o</sup> to +85 <sup>o</sup> C
MSVHFS5N	SOIC-8	-40 <sup>o</sup> to +85 <sup>o</sup> C
MSVHFS6N	SOIC-8	-40 <sup>o</sup> to +85 <sup>o</sup> C

All packages are 150 mil wide (Narrow SOIC)





6/2014

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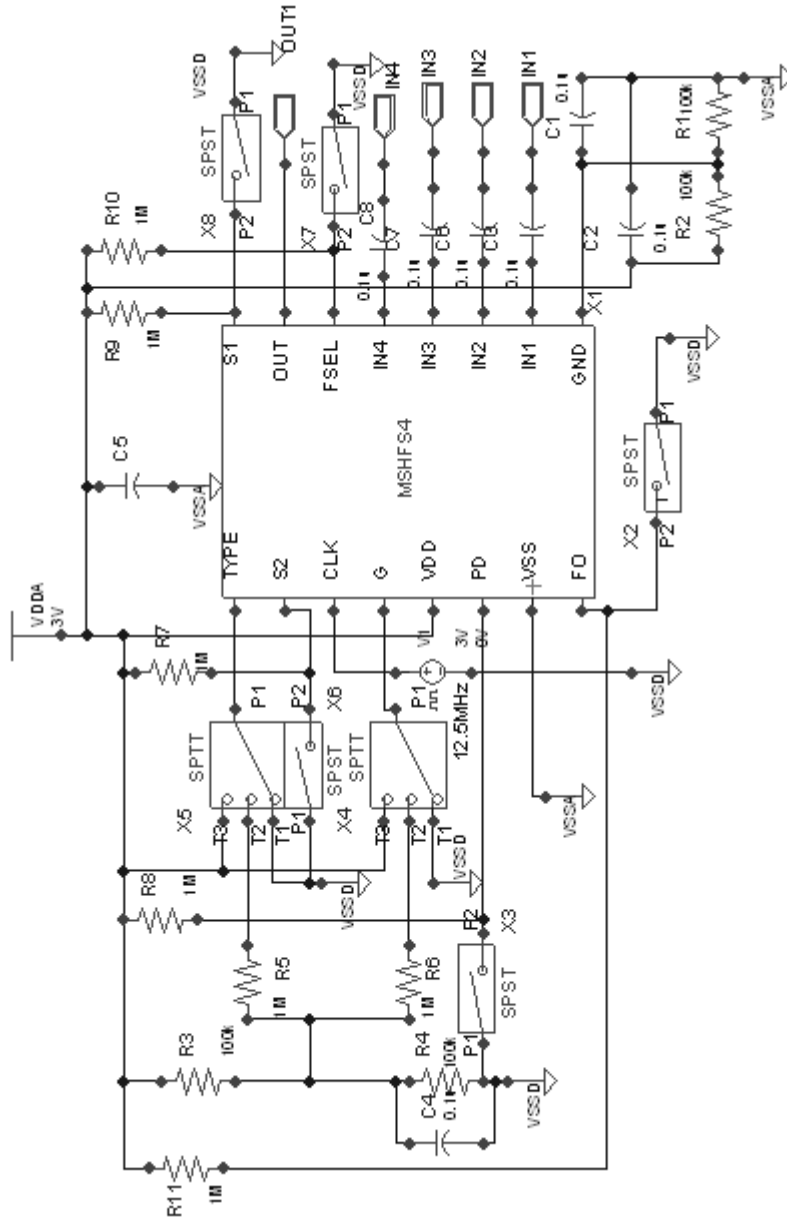


Figure 4 MSVHFS2/4 Typical Application

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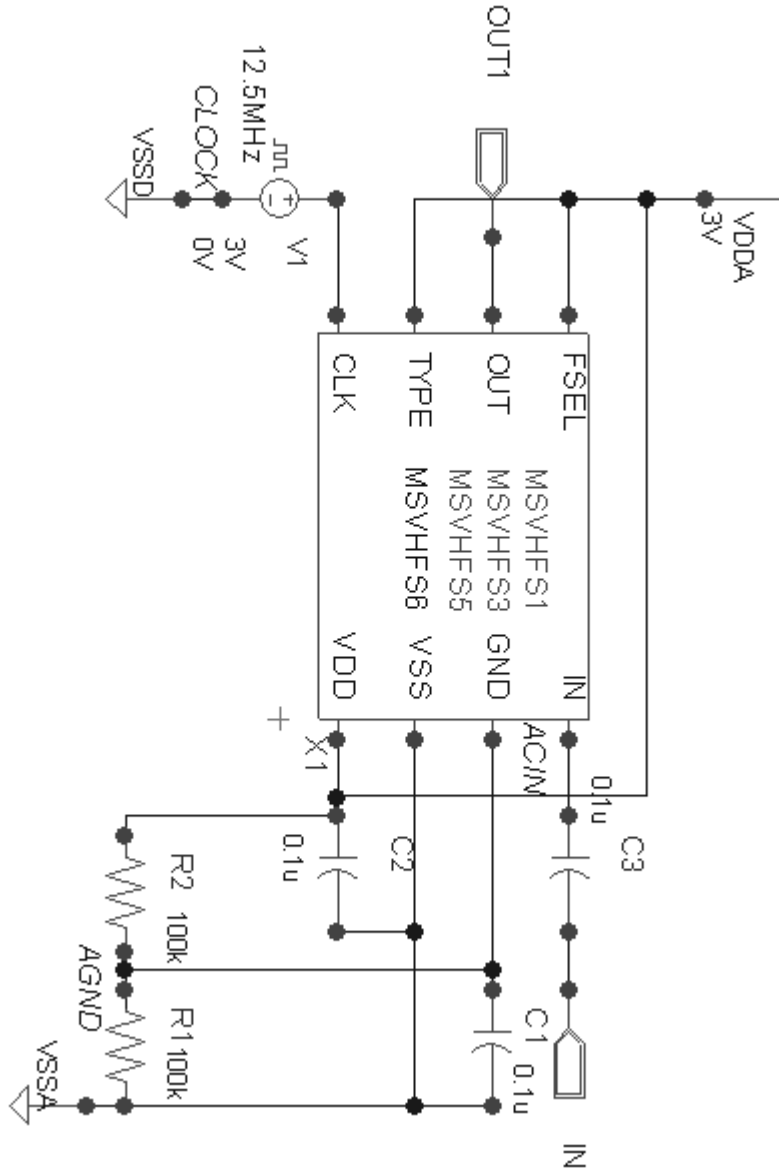


Figure 5 MSVHFS1/3/5/6 Typical Application

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 STANDARD PRODUCTS

MSGEQ5A	Five Band Graphic Equalizer Display Filter
MSGEQ7	Seven Band Graphic Equalizer Display Filter
MSHFS1-6	Selectable High Frequency LP/BP Filter
MSFS1-6	Selectable Lowpass/Bandpass Filter
MSCAHF	Selectable High Frequency Active Lowpass/Bandpass Filter
MSU1F1-4, MSU2F1	Resistor Programmable Universal Active Filter
MSU1HF1-4, MSU2HF1	High Frequency Resistor Programmable Universal Active Filter
MSELP	Switched Capacitor Elliptic Lowpass Filter with Op Amps
MSNBLP	Switched Capacitor Butterworth Lowpass Filter
MSLE/B/C5L/M	Switched Capacitor General Purpose Lowpass Filter
MS2LFS	Dual Selectable Low Voltage Lowpass/Bandpass Filter
MSLFS	Selectable Low Voltage Lowpass/Bandpass Filter
MSHN1-6	Selectable High Pass/Notch Filter
MSRAAF	Resistor Programmable Active Audio Filter
MSRAHF	Resistor Programmable Active High Frequency Filter
MSDET	Tone Detector
MSEPAF	Electrically Programmable Active Filter
MSCBT	Communications Baseband Transceiver
MSVL14	14 MHz Video Lowpass Filter
MSSPSI	Smart Programmable Sensor Interface
MSCPSI	Computer Programmable Sensor Interface
MSLOSC	15 Hz to 64 kHz All Silicon Sine Source
MSTHDA	Total Harmonic Distortion Analyzer
MSSCSA	Single Chip Spectrum Analyzer
MSFIPS	FIP-140 Level 4+ Security Supervisor
MSLSA	Low Power Single Chip Spectrum Analyzer
MSRFIF	Radio Frequency Interface Front-End
MSVHFS1-6	Selectable Very High Frequency LP/BP Filter
MSMXVHF	High Frequency Mixer and Selectable VHF LP/BP Filter



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