05/2004

Resistor Programmable Active High Frequency Filter
Preliminary Data Sheet

MSRAHF

Description

The resistor programmable continuous active high frequency filter IC Is a CMOS chip that can be configured for either a lowpass, bandpass, highpass, allpass or notch filter. Butterworth, Bessel, elliptic and Chebyshev filters can be implemented. The frequency range extends to 1 MHz. The low power mode has a frequency range to 100 kHz. A power down pin reduces current consumption when the filter is not in use.The 20 pin part offers dual 2nd order filter stages. Between 2 and 5 external resistors set the filter characteristics depending on the desired response. Q can be set from between 0.25 and 50. No clock signal is required.

Absolute Maximum Ratings

Power Supply Voltage	+6V
Storage Temperature	-60 to +150 C
Operating Temperature	0 to 70 C

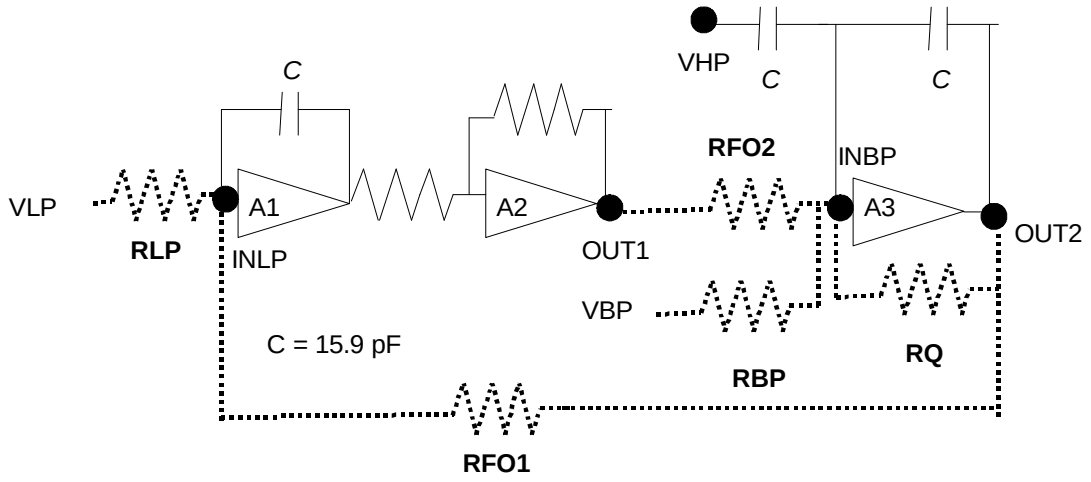
Features

Independent Q, frequency and gain adjustments
Low sensitivity to external resistor variation
Operates up to 1 MHz
Q range from 0.25 to 50
Low Power Operation
Power Down Mode
Cascadable for Higher Order Filtering

Applications

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

Block Diagram



MSRAHF

Electrical Characteristics

(VDD = +5.0V, T = 25° C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC Specifications						
Operating Voltage	VDD		4.5	5	5.5	V
Supply Current	IDD	PWR = HI		10		mA
Supply Current	IDD	PWR = LO		2		mA
Power Down Current		PD = HI		100		uA
AC Specifications						
Gain	Av		-0.5	0	0.5	dB
Signal to Noise Ratio				95		dB
Distortion	THD			0.1		%
Signal Swing		1 kHz	3.5	4		V p-p
Input Impedance	ZIN			1		Mohm
Output Drive	Io			1		mA
Output Impedance	Zo			500		ohm
Output Capacitive Load				12		pF
Center Frequency Range	Fo	PWR = HI	1		1,000	kHz
Center Frequency Range	Fo	PWR = LOW	1		100	kHz
fo Accuracy		exact external resistor		+/- 3		%
Q Range	Q		0.25		50	

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Pin Description

20 Pin Package

1. VDDA	Positive Power Supply, Typically 2.5 Volts for Split Supply, 5.0 Volts for Single Supply
2. OUTA 2	Output 2 for Channel A
3. OUTA 1	Output 1 for Channel A
4. INBPA	Bandpass Input for Channel A
5. ER	Erase DO NOT CONNECT Test Only
6. DCK	Data Clock DO NOT CONNECT Test Only
7. INHPA	Highpass Input for Channel A
8. INLPA	Lowpass Input for Channel A
9. VSS	Negative Power Supply, Typically -2.5 Volts for Split Supply. 0 Volts for Single Supply
10.PD	Power Down Pin, CMOS level, Hi = Power Down
11.WRITE	Write DO NOT CONNECT Test Only
12.GND	GND Pin, OV for Split Supplies 2.5 Volts Typical for Single Supply
13. BIAS	Bias Pin, In some high frequency applications (above 1 Mhz), a 10K-100K resistor from this pin to VDD will improve A and B filter performance. IDD will increase as this resistor is made smaller.
14. INLPB	Low Pass Input for Channel B
15. INHPB	High Pass Input for Channel B
16. INBPB	Band Pass Input for Channel B
17. OUTB 1	Output 1 for Channel B
18. OUTB 2	Output 2 for Channel B
19. PWR	Digital Bias Current Control for Filter Stages, LO=Low power, HI=normal power
2C. V20	Test Pin, Tie to VDDA

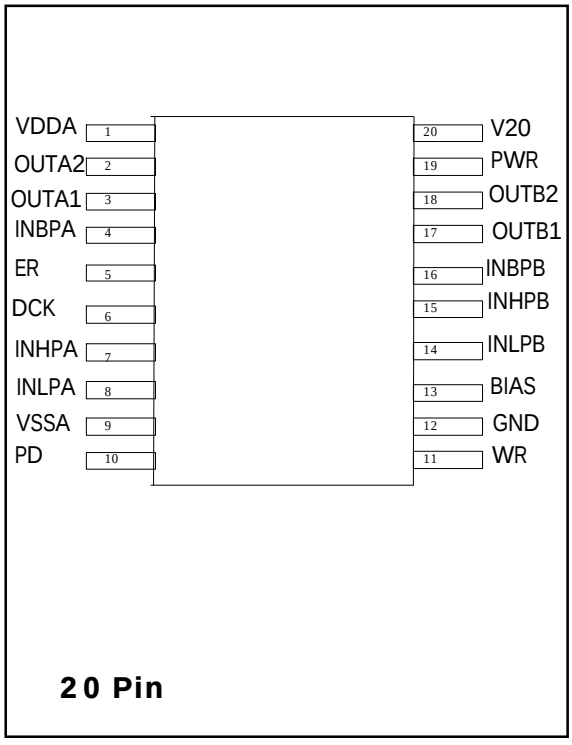
Digital Levels

In both single and dual supply applications, the digital levels should be CMOS levels from VSS to VDD.

Ordering Information

Part Number	Package
MSRAHF	20 Pin SOIC

Pin Configuration



20 Pin

$(RFO1 * RFO2)^{1/2} = 1E10/Fo$

$RQ = Q * RFO2 ((RFO1/RFO2)^{1/2})$

SIMPLIFIED

If RFO1 = RFO2; RFO1=RFO2=1E10/Fo

RQ = Q * RFO2

LOWPASS KLP = Lowpass Gain

RLP = RFO1/KLP ; RBP = ? ; INHP to GND

BANDPASS KBP = Bandpass Gain

RBP = RQ/KBP; RLP = ? ; INHP to GND

HIGHPASS Gain = 1

RLP = ? ; RBP = ?

NOTCH

RLP = RFO1 ; RBP = ?

ALLPASS

An External Op Amp Inverter is required

RLP = RFO1 ; RBP = RQ ; R1 = R2

LOWPASS ELLIPTIC

An External Resistor Divider is required on INHP

RLP = RFO1 ; RBP = ?

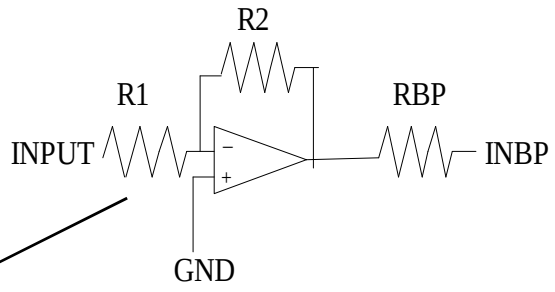
$FZ = Fo * (((R2 + R1)/R2)^{1/2})$

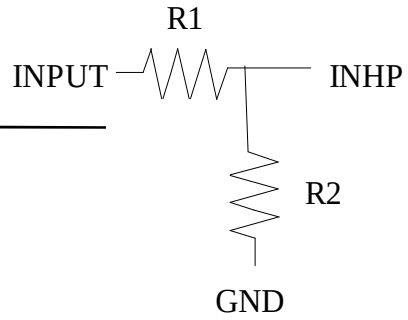
HIGHPASS ELLIPTIC

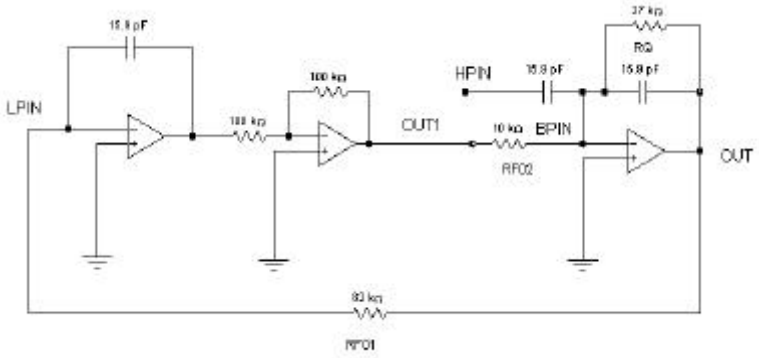
$RLP = (Fo/Fz)^2 * RFO1$; RBP = ?

Choosing RFO

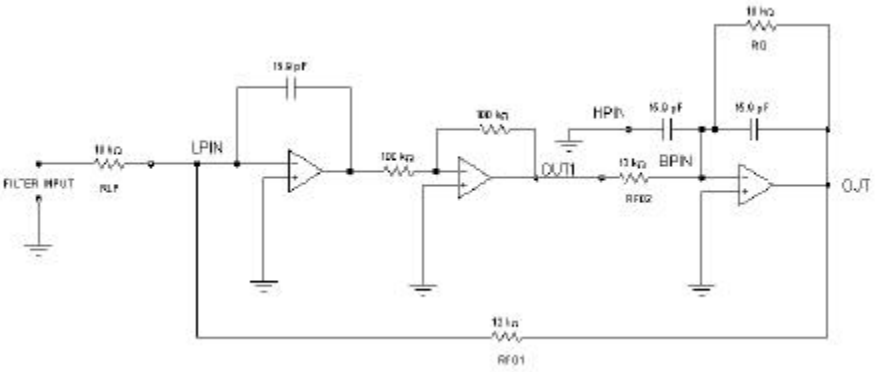
For applications where Q is › = 1, making RFO1 = RFO2 will usually be a good simplification. For applications where Q is significantly less than one, the maximum signal can be reduced. For example, if Q = 0.5, RFO2 = 100K and RQ = 50K, the signal at OUT1 will be twice OUT2 and will clip for large signals. By using the general equations, it can be seen that one solution to this problem would be to make RFO2 = RQ = 50K and RFO1 = 200K.



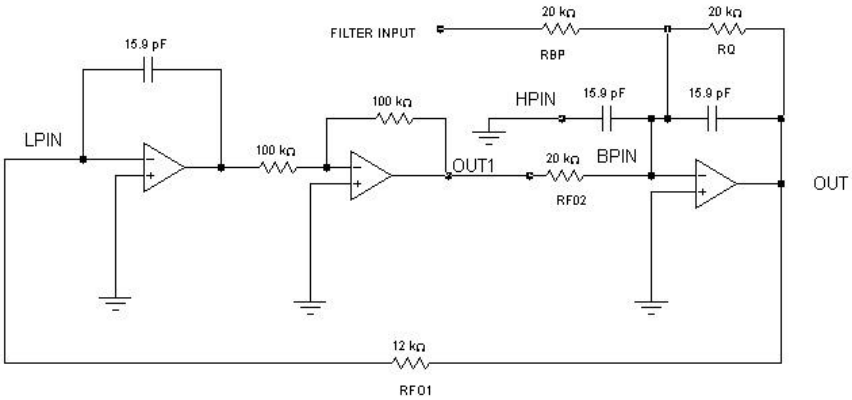




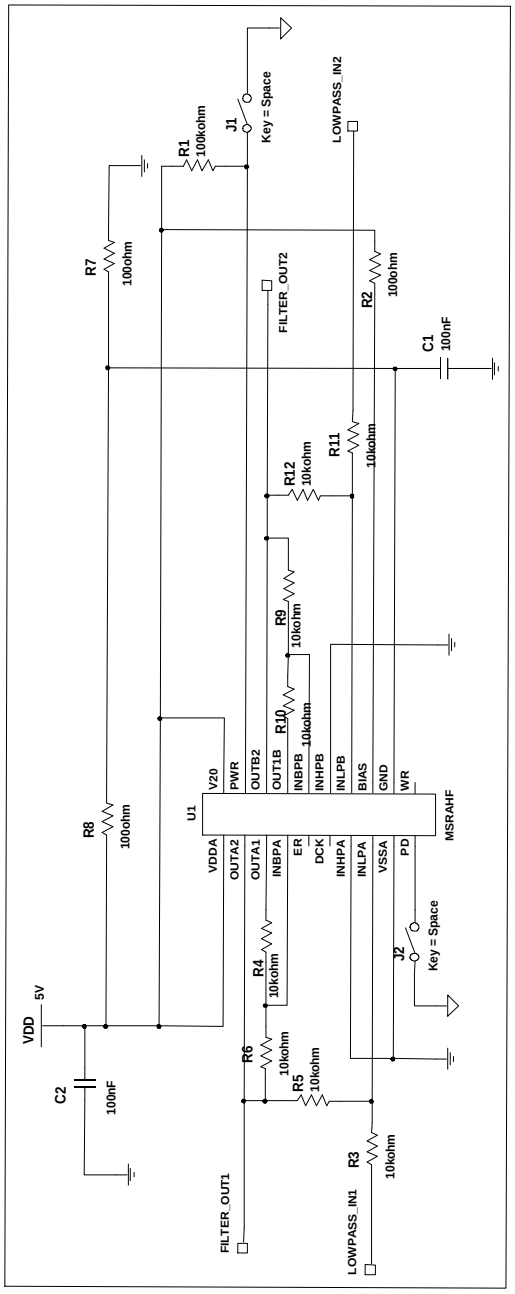
High Pass Application



Low Pass Application



Bandpass Application



Low Pass Application

STANDARD PRODUCTS

MSGEQ5A	Five Band Graphic Equalizer
MSGEQ7	Seven Band Graphic Equalizer
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
MSLV14	14 MHz Video Lowpass Filter

Mixed Signal Integration
2157F O'Toole Avenue
San Jose, California 95131-1332
Phone: (408)-434-6305
Fax: (408)-434-6417

In Mississippi, Alabama, Georgia
South Carolina, North Carolina, and Tennessee
contact:

AdeptRep, Inc.
280 Metaire Lane
Madison, Alabama 35758
Telephone: 256-772-1922
Facsimile: 256-325-2841

In Arizona, Utah, Colorado, Montana, Wyoming, Idaho, New Mexico and southern Nevada
contact:

Nelco Electronix
6970 S. Holly Circle, #205
Centennial, CO 80112
Telephone: 720-493-9630
Facsimile: 720-493-9631

In Indiana, Kentucky, Ohio, Michigan, and western Pennsylvania contact:

CCR Electronics, Inc.
8425 Woodfield Crossing Blvd
Suite 100
Indianapolis, Indiana 46240-2495
Telephone: 317-469-4855

In Taiwan contact:

Maxtek Technology Co., Ltd.
5F, No. 13-20, Sec. 6, Min Chian E Road, Nei Hu
Taipei, 114 R.O.C.
Telephone: 886-2-2794-6060
Facsimile: 886-2-2879-8922

In Hong Kong and the People's Republic of China contact:

Alphatron
2L, Cooke Street/F
G/F, Hung Hom
Kowloon Bay, Hong Kong
Telephone: 852-2303-1290
Facsimile: 852-2900-3616

In Korea contact:

H. B. Corp.
#1409, Seocho World Officetel,
1355-3, Seocho-Dong, Seocho-Ku,
Seoul, Korea 137-070
Telephone: (02)3472-3450
Facsimile: (02)3472-3458

In Singapore, Indonesia and Malaysia contact:

EXER Technologies (S) PTE LTD
45 Kaki Bukit Industrial Terrace
Singapore 416125
Telephone: (65)-6-747-9669
Facsimile: (65)-6-749-9669

In Israel contact:

Phoenix Technologies Ltd.
3 Gavish St.
Kfar-Saba, 44424
Israel
Telephone: 09-764-4800
Facsimile: 09-764-4801

In the United Kingdom contact:

Electronics 2000 Ltd.
Grafton House
Grafton Street
High Wycombe
Bucks HP12 3AJ
Telephone:00-44-1494-444044
Facsimile: 00-44-1494-470499

