EG&G RETICON

RF5609A/RF5613A
RF5609A Elliptic Low-pass Filter
RF5613A Linear Phase Low-pass Filter

Description

The Reticon RF5609, and RF5613 are monolithic, switched-capacitor low-pass filters fabricated in a double-poly NMOS process.

The RF5609 is a seven-pole, six-zero elliptic low-pass filter with over 75 dB out-of-band rejection and less than ±0.5 dB of passband ripple. The Reticon RF5613 is a linear-phase low-pass filter with over 60 dB out-of-band rejection.

Key Features

- Easy to use
- No external components required
- Small size: 8 pin mini-DIP
- Wide power supply range: ±5V to ±10V
- Dynamic Range: up to 75 dB
- Corner Frequency Range: 10 Hz to 25 KHz
- Insertion loss typically: 0 dB

Typical Applications

- Antialias filters
- Reconstruction filters
- Tracking filters
- Audio analysis
- Telecommunications
- Portable instrumentation
- Biomedical/Geophysical instrumentation
- Speech processing

Device Operation

The RF5609 and RF5613 are self-contained and require only an external clock trigger, either TTL or CMOS, and power supply. The device characteristic and operating parameters were obtained using the test configuration shown in Figure 2.

In applications where DC information must be passed through the filter, the output offset may be nulled out by varying the reference voltage, which will change the input trigger level and may require adjustment of clock voltage values. The reference input requires less than 100 μA of current and must always be well-filtered. A circuit that may be used to adjust out the output offset is shown as optional resistors in Figure 2.

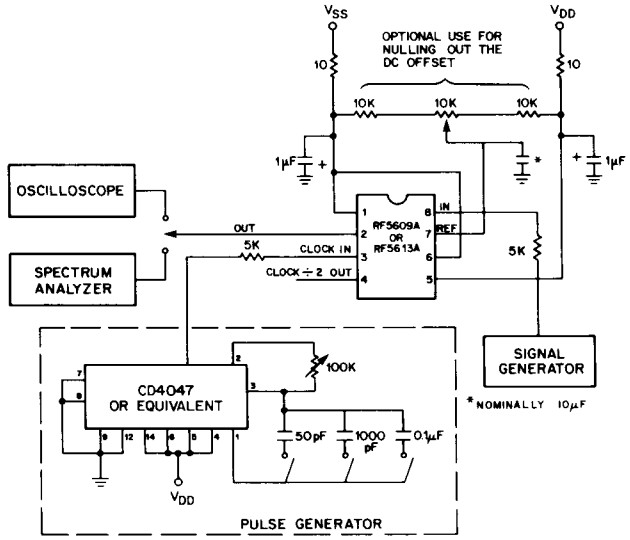

Figure 2. Test Circuit

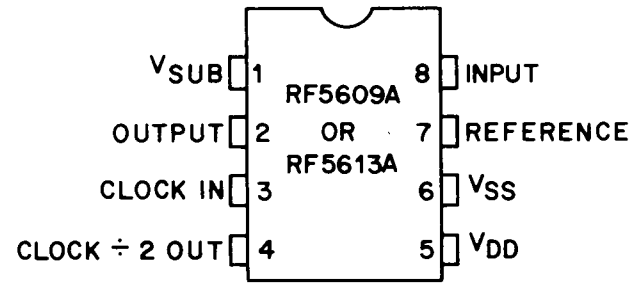

Figure 1. Pinout.

A divide-by-two clock output is also available. This output contains a square wave at the sample rate and may be used for triggering, summing out the sample rate residue, or driving additional filters especially when filtering requirements are spaced by an octave. Gain and phase tracking from device to device and over the temperature range is typically better than 0.5%. This measurement excludes the fixed offset and fc/fo tolerance at room temperature.

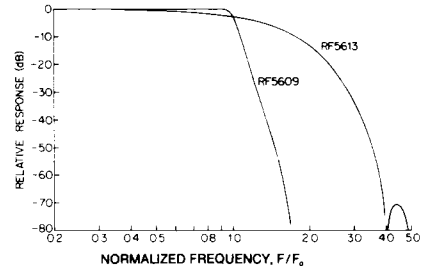

Figure 3. Magnitude response

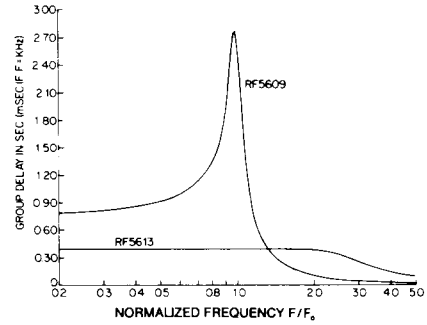

Figure 4. Group delay

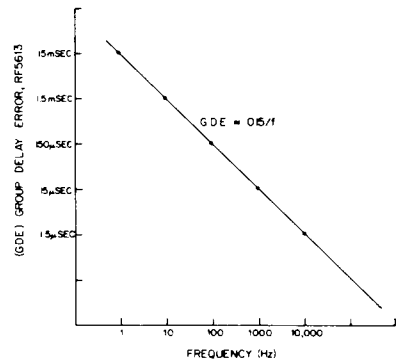

Figure 5. Group delay error
(Second order effects of switched capacitor filter)

TABLE I ABSOLUTE MINIMUM/MAXIMUM RATINGS

	Min	Max	Units
Input voltage — any terminal with respect to substrate, pin 1 (V_{SS})	-0.4	21	V
Output Short-circuit duration — any terminal	Indefinite		
Operating Temperature	0	70	°C
Storage Temperature	-55	125	°C
Lead Temperature (soldering, 10 sec.)		300	°C

CAUTION: Observe MOS Handing and Operating Procedures

NOTE: This table shows stress ratings *exclusively*: functional operation of this product under any conditions beyond those listed under standard operating conditions is not suggested by the table. Permanent damage may result if the device is subject to stresses beyond these absolute min/max values. Moreover, reliability may be diminished if the device is run for protracted periods at absolute maximum values.

Although devices are internally gate-protected to minimize the possibility of static damage, MOS handling precautions should be observed. Do not apply instantaneous supply voltages to the device or insert or remove device from socket while under power. Use decoupling networks to suppress power supply turn-off/on switching transients and ripple. Applying AC signals or clock to device with power off may exceed negative limit.

Pre/Post Filtering Considerations

The typical sampling rate on the RF5609 is 50 times the corner frequency; for the RF5613 it is 64 times the corner frequency. (Note: Sampling rate = ½ input clock trigger rate.) Because these sample rates will be far from the frequencies of interest in most cases, antialiasing filtering will usually not be required. However, as with all sampling systems, frequencies or noise above half the sample rate will be aliased and may appear in the band of interest. If this is the case, an external antialiasing filter will be required on the input. A one or two pole Butterworth low-pass filter will usually suffice. An unstable clock frequency can also produce the effect of an aliased signal. In applications where sampling residue may affect system performance, a single pole RC filter may be added to the output.

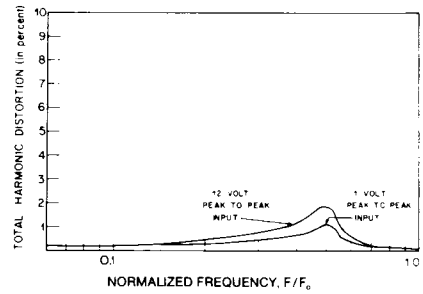

Figure 6. Typical total harmonic distortion

TABLE II: DEVICE CHARACTERISTICS AND OPERATING RANGE LIMITS(1) — RF5609, RF5613

PARAMETER	CONDITIONS & COMMENTS		SYM	MIN	TYP	MAX	UNITS
Supply Voltages			V_{DD}	+5		+10	V
			V_{SS}	-5		-10	V
Quiescent Current(3)	No load		IQ		16	21	mA
Clock Frequency	fc = 2 x fs		fc	1		2500	KHz
Clock Pulse Width			Tc	200		10^9/fc-200	nsec
Input Clock Threshold Level			Vth	0.8	2.2	3.0	V
Maximum Output Signal(2)	Vin = 4 Vrms		Vo	3.8			V rms
	No Load		Io		4		mA
Clock to Corner Freq. Ratio		RF5609	fc/fo	97	100	105	
		RF5613	fc/fo	122	128	134	
Corner Frequency(2)		RF5609	fo	0.01		25	KHz
		RF5613	fo	0.01		19.5	KHz
Input Impedance(s)			Ri		≥10		MΩ
			Ci			≤15	pF
Load Impedance(s)			RL	≥10			KΩ
			CL			≤50	pF
Dynamic Output Impedance	Small Signal		Ro		10	250	Ω

TABLE III: PERFORMANCE STANDARDS(1) — RF5609, RF5613

PARAMETER	CONDITIONS COMMENTS	SYM	MIN	TYP	MAX	UNITS
Output Noise		e_n			2.5	mV rms
Dynamic Range(2)	RF5609	D.R.	70	75		dB
	RF5613	D.R.	60	65		dB
Total Harmonic Distortion		THD			3	%
Insertion Loss(2)			-0.4		0.4	dB
Clock Feedthrough	RF5609			30	60	mV rms
Ripple	RF5609		-0.2		0.2	dB
DC Offset Voltage(2)	RF5609		-0.8	0.1	0.8	VDC
	RF5613		-1.0		1.0	VDC

(1) V_{DD} = +10V, V_{SS} = -10V, fc = 500 KHz, T = 25°C, V_{IN} = 4 V rms at 1 KHz
(2) Performance degrades at temperatures above 25°C
(3) Increases 15% for operation at 0°C

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055-0032
May 1987

JUN 29 1993