

### Description and Operation

The RM5604A contains three 1/3 octave ANSI Class III filters (6-pole Chebyshev). It is a monolithic, switched-capacitor bandpass filter in a 16-pin DIP requiring only an external clock trigger with plus and minus power supplies to operate. The pinout configuration for the device is shown in Figure 1, a test configuration is shown in Figure 2, and the package dimensions are shown in Figure 5.

The center frequency is tunable by the clock frequency. Dynamic range is better than 73 dB and distortion is less than 0.3%. The filter will handle input signals of greater than  $10 V_{P-P}$ , and have a typical insertion loss of 0 dB.

### Key Features

- Easy to use
- No external components required
- 3 matched, clock-tunable filters in a single package
- Wide power supply range:  $\pm 5V$  to  $\pm 10V$
- Dynamic range: up to 80 dB
- Wide center frequency range

### Typical Applications

- Spectrum analysis
- Harmonic analysis
- Equalization

### Antialiasing Considerations

The sampling rate on the RM5604A filter is approximately 54 times the 2nd filter center frequency. As in all sampled data systems, signals above half the sampling frequency ( $f_s$ ) will be aliased and may appear in the band of interest. If signals greater than  $27 f_0$  are applied to the filter, an external antialiasing filter may be required. A typical 2-pole antialiasing filter with design equations is shown in Figure 3. In applications where the clock feedthrough or sampling residue may affect system performance, a single-pole filter should be added to the filter output.

Note that the input trigger-clock frequency,  $f_c$ , is twice the sample rate, or approximately 108 times the center frequency. The input clock rate is divided by two in generating the on-chip clock waveforms which control the sample rate,  $f_s$ .

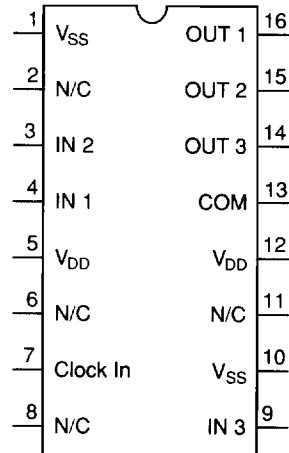


Figure 1. Pinout Configuration

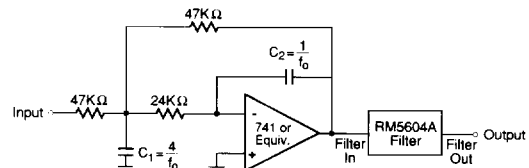


Figure 2. Test Circuit

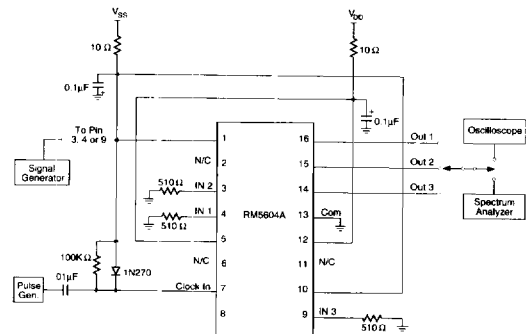


Figure 3. Antialiasing Filter for Use with the RM5604A

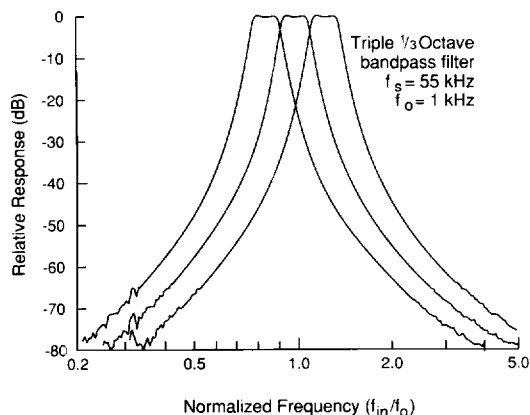


Figure 4. Frequency Response

Table 1. Absolute Minimum/Maximum Ratings

	Min	Max	Units
Input voltage - any terminal with respect to substrate	-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

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 the device from a socket while under power. Use decoupling networks to suppress power supply turn-off/on switching transients and ripple. Applying AC signals or clock to the device with power off may exceed the negative limit.

Caution: Observe MOS handling and operating procedures.

Table 2. Device Characteristics and Operating Range Limits <sup>1</sup>

Parameter	Conditions & Comments	Sym	Min	Typ	Max	Units
Supply voltages		V <sub>DD</sub>	+5		+10	V
		V <sub>SS</sub>	-5		-10	V
Supply current <sup>2</sup>		I <sub>D</sub>		16	25	mA
Input clock levels		V <sub>IL</sub>	V <sub>SS</sub>		V <sub>SS</sub> +0.8	V
		V <sub>IH</sub>	V <sub>SS</sub> +2.0		V <sub>DD</sub>	V
Clock pulse width	T <sub>C</sub> =clock period in nsec	T <sub>cp</sub>	200		T <sub>C</sub> -200	nsec
Center frequency	2nd filter	f <sub>0</sub>	5		10,000	Hz
Clock to center freq. ratio	1st filter	f <sub>c</sub> /f <sub>0</sub>	130	136.3	143.5	
	2nd filter		104	109	115	
	3rd filter		83.9	87.2	92	
Q range		Q	4.3	4.7	4.9	
Input resistance		R <sub>i</sub>	3			MΩ
Input capacitance		C <sub>i</sub>			20	pF

Notes:

<sup>1</sup> V<sub>DD</sub> = +10V, V<sub>SS</sub> = -10V, f<sub>0</sub> = 1 kHz, T = 25°C, V<sub>IN</sub> = 4 V<sub>rms</sub> at 1 kHz

<sup>2</sup> Increases 15% for operation at 0°C

**Table 3. Performance Standards <sup>1</sup>**

Parameter	Conditions & Comments	Sym	Min	Typ	Max	Units	
Output noise	1 kHz	$e_n$		0.75		mV <sub>rms</sub>	
Dynamic range		DR	73	76		dB	
Total harmonic distortion		THD			0.1	0.3	%
Crosstalk				-66	-70		dB
Passband ripple					0.2	0.5	dB
Insertion loss			-0.5		0.5	dB	
Output amplitude <sup>2</sup>		$V_o$	9.5	10		V <sub>p-p</sub>	

**Notes:**

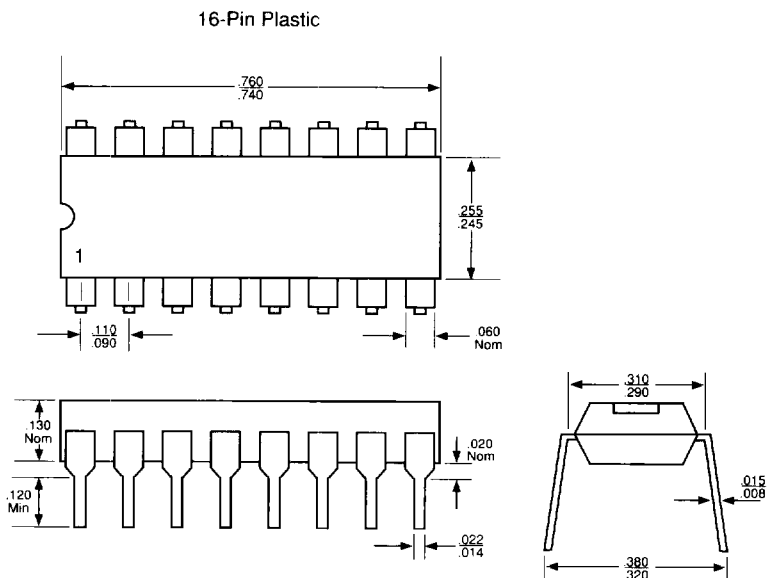
- <sup>1</sup>  $V_{DD} = +10V$ ,  $V_{SS} = -10V$ ,  $f_o = 1$  kHz,  $T = 25^\circ C$ ,  $V_{IN} = 4$  V<sub>rms</sub> at 1 kHz
- <sup>2</sup> Performance degrades at temperatures above 25°C

**Table 4. ANSI S1.11 Specifications for Typical -3 dB and -40 dB Cutoff Frequencies <sup>1</sup>**

	$F_o$	-3 dB Cutoffs		-40 dB Cutoffs	
		Low	High	Low	High
Filter 1	0.8	0.720	0.889	0.442	1.45
Filter 2	1	0.900	1.11	0.552	1.81
Filter 3	1.25	1.13	1.39	0.690	2.26

**Note:**

- <sup>1</sup> All frequencies are normalized to the center frequency of filter 2.



**Figure 5. Package Dimensions**

**Ordering Information**

<b>Part Number</b>	<b>Description</b>
RM5604ANP-011	Triple 1/3-octave bandpass filter, 16-pin plastic package