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DC voltage-controlled switches

ROBERT F. SCOTT, SEMICONDUCTOR EDITOR

THIS MONTH WE'LL TAKE A LOOK AT A DC-controlled switch that can replace the usual rotary or pushbutton used to connect various signal sources to the input of an audio amplifier. In this case, the selector switch feeds the input to the graphic equalizer circuit that we discussed in the June 1982 issue.

National Semiconductor has just announced the LM1037 and LM1038 DC Controlled Audio Switches. Both are designed to allow any one of four stereo-input sources to be connected to the stereo-output lines. Channels are selected by applying a DC voltage level to the channel-select control pins. Features of the LM1037/38 switches are:

- Wide supply-voltage range (5 to 30 volts)
- Click-free operation
- Low distortion, 0.04% typical
- High signal-to-noise ratio
- High audio-input impedance
- Low audio-output impedance
- Wide control-voltage range (2 to 50 volts)
- High input-impedance on select pin

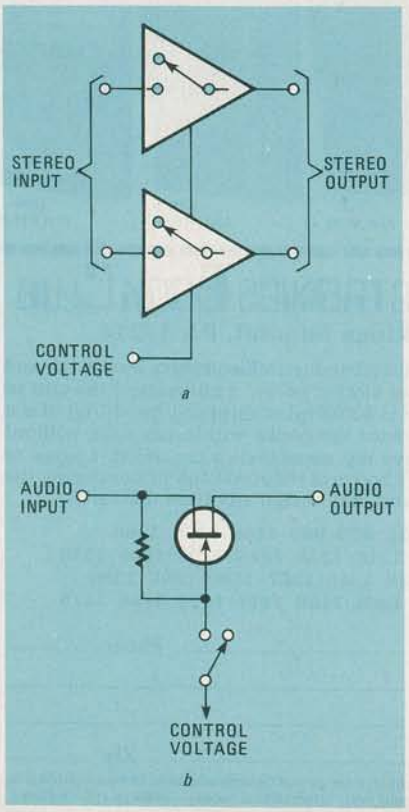

FIG. 1

TABLE 1

Parameter	Min	Typ	Max	Units	Conditions
Supply voltage	5	12	30	volts	
Supply current (LM1037)		7		mA	V_{supply} = 12
Supply current (LM1037)		10		mA	V_{supply} = 30
Supply current (LM1038)		14		mA	V_{supply} = 12
Supply current (LM1038)		20		mA	V_{supply} = 30
Voltage gain	−0.2	0		dB	
Signal handling			3.2	$volts_{rms}$	V_{supply} = 12
Distortion (THD)		0.04	0.1	percent	$1V_{rms}$ input @ 1 kHz
S/N Ratio (CCIR)		−100		dB	$1V_{rms}$ input @ 1 kHz
Crosstalk between stereo channels	−80	−100		dB	$1V_{rms}$ @ 1 kHz
Crosstalk between connected and unconnected channels	−80	−100		dB	$1V_{rms}$ @ 1 kHz
Relative output in muted state	−80	−90		dB	$1V_{rms}$ @ 1 kHz

The LM1037 has four control or channel-select pins; one for each stereo-input source. If no channel is selected, the outputs are muted and clamped to the DC output level.

The LM1038 is designed so that channels can be selected by BCD input pulses. Two input pins feed clock-enabled latches so that the BCD pulses can be strobed from a bus. Or, the clock-input pin can be permanently enabled and the channels selected by DC voltage levels. A separate pin allows the output to be muted, via either a pulse or a DC level.

To date, only preliminary specifications (Table 1) on the LM1037/38 have been released, so we don't have complete details on the structure of the semiconductor device used as the switch elements; but I'll bet that the switch is some form of FET. In similar analog switches from other manufacturers, JFET's, MOSFET's and CMOS (N-channel and P-channel FET's in parallel) have been used as gates or switches. Figure 1-a is a functional diagram of a stereo-audio switch. When the control voltage is applied, the switches close so that the input signals pass through to the output terminals. Figure 1-b is the circuit of a basic analog switch using a JFET as the switch element.

Figure 2 is the functional block diagram of the LM1037. The channel-selection details are outlined in Table 2 (See page 86).

Emitter and detector product guide

The *Infrared/Photodetector Product Guide* lists a line of GaAs IR emitting diodes and photodiodes, phototransistors, and photovoltaic cells. The IR emitters develop a wavelength of either 820 or 950 nM (nanometers) depending on the device. Detectors can be selected with maximum sensitivity specified at wavelengths ranging from 555 to 950 nM. The guide includes dimensioned outline drawings.—**Litronix,** 19000 Homestead Road, Cupertino, CA 59014.

Unique monolithic active filter

National Semiconductor's MF10 is the first monolithic active filter that does not

TABLE 2

Inputs switched to output pins

Input channel		1A	2A	1B	2B	1C	2C	1D	2D	
Pin no.		2	4	6	8	11	13	17	15	12
DC control conditions (pins)	1	VL	VL	VL	VL	VH	VH	VL	VL	VL
	3	VL	VL	VL	VL	VL	VL	VH	VH	VL
	16	VH	VH	VL	VL	VL	VL	VL	VL	VL
	18	VL	VL	VH	VH	VL	VL	VL	VL	VL
Output pin		10	9	10	9	10	9	10	9	9 & 10 (MUTE)
Output channel		1	2	1	2	1	2	1	2	

Low switching-level: VL < 0.8 volts
High switching-level: VH > 2.0 volts

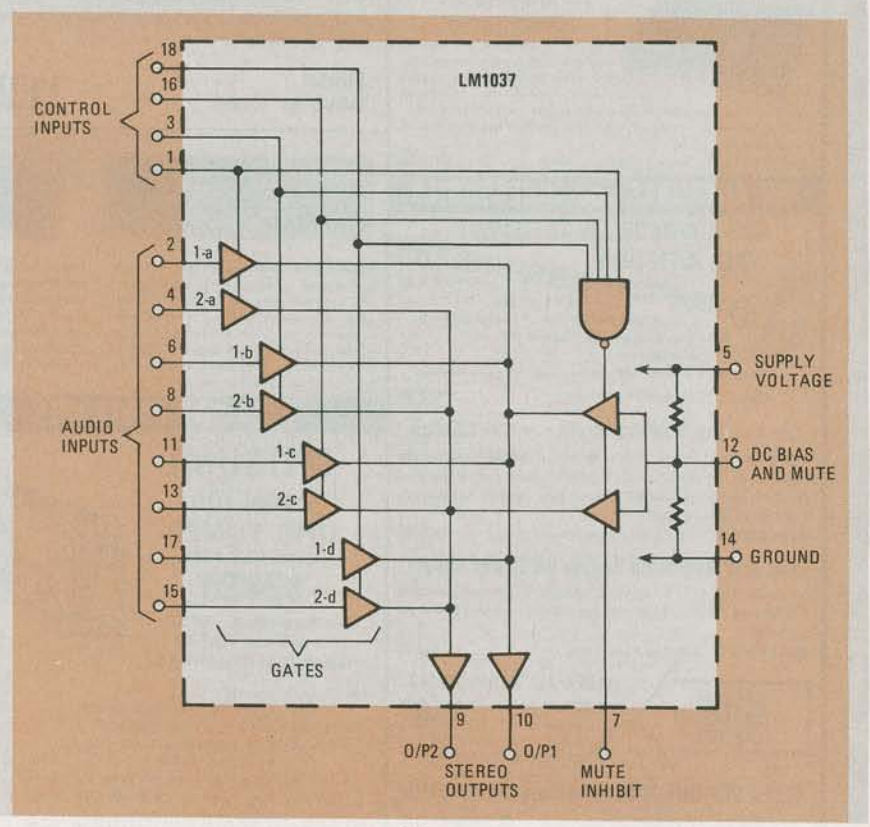

FIG. 2

require external capacitors to operate, and is capable of performing a variety of functions. It is ideal for signal processing, telecommunications, modems, instrumentation, and audio equipment. The center frequencies of all previously available active filters are adjusted with external resistors and/or capacitors. The MF10 filter is unique in that the center frequencies of its various second-order functions are directly proportional to an external clock frequency and fixed at an accuracy of 0.6%, or directly proportional to both the clock frequency and external resistor ratios. Gain and selectivity (Q) are adjusted using external resistors.

The clock and three or four resistors are the only external components necessary to operate the MF10 so the device is less sensitive to external component variations. Frequency stability is directly dependent on the quality of the clock. A single clock can be used to drive an almost infinite number of MF10 filters.

Unlike other available monolithic filters which have been designed for a specific function, the general-purpose MF10 can perform a wide variety of functions including allpass, highpass, bandpass, and notch. Up to fourth-order functions, and any configurations such as Butterworth, Bessel, Cauer, and Chebyshev

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can be had by cascading the two second-order building blocks. The center frequency can be as high as 20 kHz with a Q of 500. Typically, the lowpass and bandpass outputs can sink 0.75 mA and source 3 mA while the notch, allpass, and highpass outputs sink 1.5 mA and source 3 mA. The devices come in 20-pin DIP packages and cost $3.50 in lots of 100.—**National Semiconductor,** 2900 Semiconductor Drive, Santa Clara, CA 95051.

Optocouplers feature back-to-back LED's

Motorola has introduced two new dual-LED Optocouplers designed specifically for AC input applications. The devices—the HIAA1 and HIAA2—consist of two gallium-arsenide (GaAs) infrared-emitting diodes connected in inverse parallel, and optically coupled to a single silicon phototransitor (detector) in the standard 6-pin DIP package.

The Optocouplers can be used to detect the presence, absence, or interruption of AC power and trigger a desired action. A major application is the detection of a ring signal on telephone lines while providing isolation from the ring lines. The HIAA1 and HIAA2 are directly interchangeable with GE devices bearing the same type numbers, while providing for up to 7500 volts. The HIAA1 has a current transfer ratio of 20% and costs $1.98 in lots of 1 to 99. The HIAA2 has a 10% current transfer ratio and costs $1.70 in lots of 1 to 99.—**Motorola Semiconductor Products,** P.O. Box 20912, Phoenix, AZ 85036.

Tunable low-pass sampled-data filters

The MC145414 dual-tunable low-pass filter from the Motorola MOS Integrated Circuits Group is the latest addition to the growing family of CMOS switched-capacitor filters.

The MC145414 has a typical power dissipation of 30 mW when active and 1 mW in the power-down condition. Operating voltage can be obtained either from a single or split power-supply with a voltage range of 10 to 16 volts. It can interface to either TTL or CMOS devices. The device is useful in LPC (*L*inear *P*redictive *C*oding) or CVSD (*C*ontinuously *V*ariable *S*lope *D*etection) speech applications, modems, or other applications where a precision low-pass filter is needed. Specifications include a dynamic range better than 80 dB, passband ripple less than 0.3 dB, and idle noise typically 100 dBrnC0 (Decible RMS noise C-message weighted referenced to zero). The device is offered in a 16-pin DIP plastic or ceramic package and is available for $4.50 each in lots of 1000.—**Motorola Inc.,** 3501 Ed Bleustein Blvd., Austin, TX 78721. **R-E**