



aptek microsystems

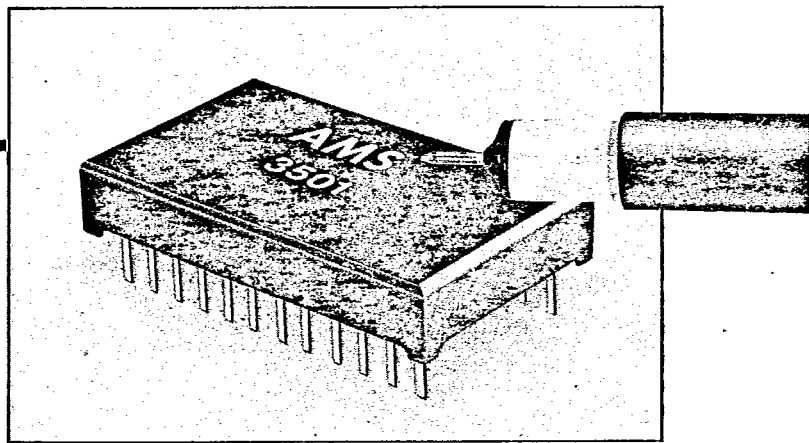
Hybrid MF Generator with Digital Frequency Synthesizer

DESCRIPTION

This hybrid microcircuit comprises a proprietary CMOS digital frequency synthesizer and hybrid digital to analog conversion and filtering. An inexpensive crystal reference generates the 18 frequencies required for MF inter-office signalling. In each signalling format, six frequencies are combined in pairs to provide the 15 tone combinations.

Designed for ease of interfacing, with four-bit code selection of tone pairs in a signalling format, and two-bit code which provides format selection and on/off control. Starting sine waves at 0° phase assures control of harmonic content.

Selection of the appropriate tone pair code and signalling format generates divider ratios to obtain the two audio tones from the 2.976MHz reference oscillator. D/A conversion is achieved by a staircase waveform with levels accurate to within 1% of ideal. The operational amplifier combines the outputs of the two tones generated. The resultant tone is exceptionally free of harmonics, and those



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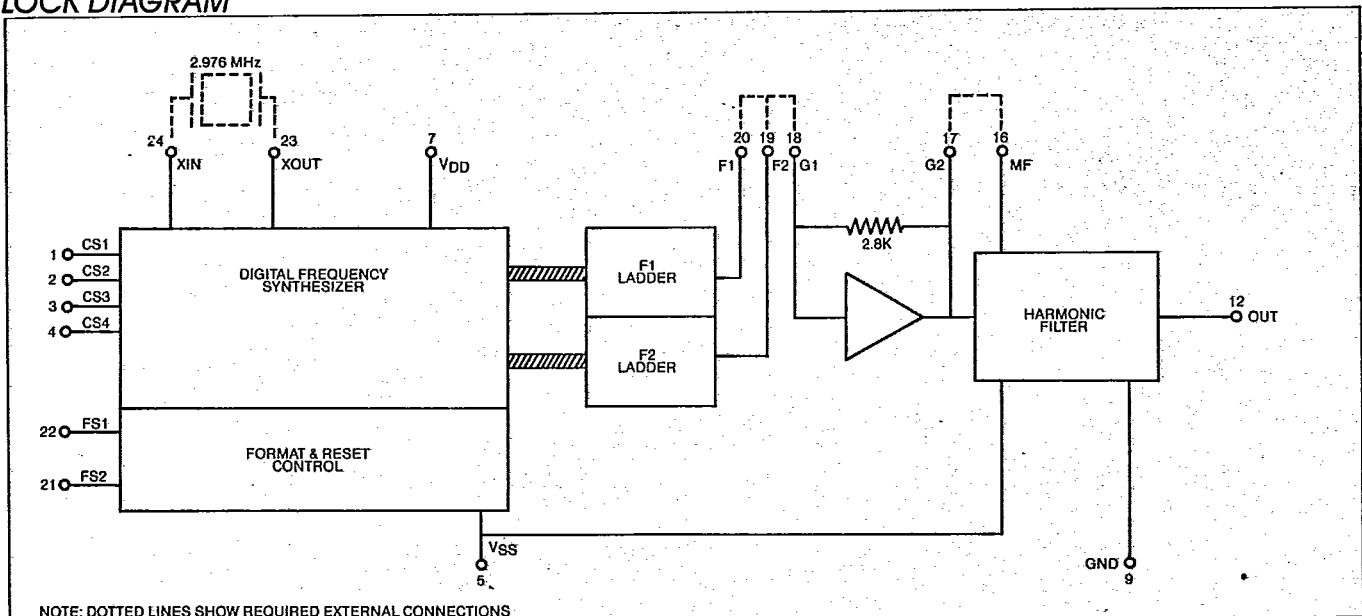
present are attenuated by a lowpass filter.

The frequency stability of this type generator is such that no adjustments are needed to meet the accuracy requirements of MF signalling.

FEATURES

- Generates MFR1, R2 forward & R2 backward tone combinations
- Auxiliary tones: 425Hz, 500Hz, 350/440Hz
- Digital frequency synthesizer for stability and accuracy
- Low harmonic content
- Low twist
- Exceeds CCITT Specifications
- One external component: 2.976 MHz crystal
- Low power (less than 60mW)
- Single supply: +5 to +12Vdc

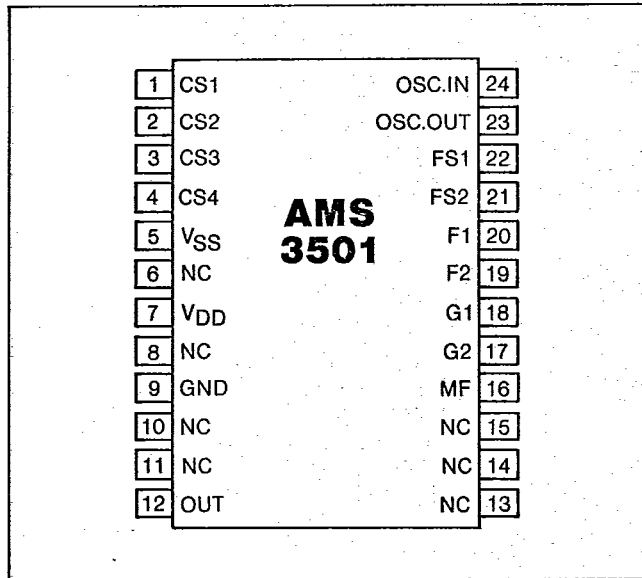
BLOCK DIAGRAM



AMS 3501

Pin Description

PIN-OUT DRAWING



TONE PAIRS

				FORMAT CONTROL (FS1 FS2)			
CS4	CS3	CS2	CS1	00	01	10	11
0	0	0	0	DC	500/DC	350/440	425/DC
0	0	0	1	DC	700/900	1380/1500	540/660
0	0	1	0	DC	700/1100	1380/1620	540/780
0	0	1	1	DC	900/1100	1500/1620	660/780
0	1	0	0	DC	1500/1700	1860/1980	1020/1140
0	1	0	1	DC	1100/1300	1620/1740	780/900
0	1	1	0	DC	700/1300	1380/1740	540/900
0	1	1	1	DC	900/1300	1500/1740	660/900
1	0	0	0	DC	1300/1700	1740/1980	900/1140
1	0	0	1	DC	1100/1700	1620/1980	780/1140
1	0	1	0	DC	700/1700	1380/1980	540/1140
1	0	1	1	DC	900/1700	1500/1980	660/1140
1	1	0	0	DC	1300/1500	1740/1860	900/1020
1	1	0	1	DC	1100/1500	1620/1860	780/1020
1	1	1	0	DC	700/1500	1380/1860	540/1020
1	1	1	1	DC	900/1500	1500/1860	660/1020

P/N	NAME	DESCRIPTION
7	VDD	The positive supply pin.
5	VSS	The negative supply pin.
12	TONEOUT	Analog output of final filter providing selected tone combination.
24 23	OSCIN OSCOU	Connections for external 2.976 MHz crystal. External oscillator may be connected to OSCIN. Frequency accuracy of external crystal or oscillator is reflected in accuracy of generated tones.
1 2 3 4	CS1 CS2 CS3 CS4	Code Select Pins. The four bit code present at these pins determines the tone pair present at TONEOUT. The table above lists corresponding tone pairs and four bit codes.
22 21	FS1 FS2	Format Select Pins. The state of these two pins determines which signaling format will be generated. When both FS1 and FS2 are low, no tone is generated, thus providing the on/off control for the tone generator. See Table above.
6, 8, 10, 11, 13, 14, 15	NC	These pins are to be left unconnected.
9	GND	Connect to analog ground reference.
16, 17	MF, G2	These pins must be connected together.
18, 19, 20	G1, F2, F1	These pins must be connected together.

AMS 3501 MF TONE GENERATOR

NOTE: Please refer to this Insert for the correct information regarding "Tone Pairs" on the second page of this data sheet.

TONE PAIRS

					FORMAT CONTROL (FS1 FS2)		
CS4	CS3	CS2	CS1	00	10	01	11
0	0	0	0	DC	500/DC	350/440	425/DC
0	0	0	1	DC	700/900	1380/1500	540/660
0	0	1	0	DC	700/1100	1380/1620	540/780
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0	1	0	0	DC	1500/1700	1860/1980	1020/1140
0	1	0	1	DC	1100/1300	1620/1740	780/900
0	1	1	0	DC	700/1300	1380/1740	540/900
0	1	1	1	DC	900/1300	1500/1740	660/900
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1	1	1	0	DC	700/1500	1380/1860	540/1020
1	1	1	1	DC	900/1500	1500/1860	660/1020



aptek microsystems

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Electrical Characteristics

ABSOLUTE MAXIMUM RATINGS

(all voltages referred to V_{SS}) Operation above absolute maximum ratings may permanently damage device.

Supply Voltage	+13 Volts
Operating Temperature	0°C to 70°C ambient
Storage Temperature	65°C to 150°C
Power Dissipation at $T_A = 25^\circ\text{C}$ derate above $T_A = 25^\circ\text{C}$ at	750 mW 10 mW/°C
Digital Input Voltage	$V_{SS} - .5\text{V}$ to $V_{DD} + .5\text{V}$
DC Current into any Digital Input	1.0 ma
Lead Temperature (soldering, 10 sec.)	300°C

AC CHARACTERISTICS $0^\circ \leq T_A \leq 70^\circ\text{C}; V_{DD} = +12\text{V}; V_{SS} = 0\text{V}$

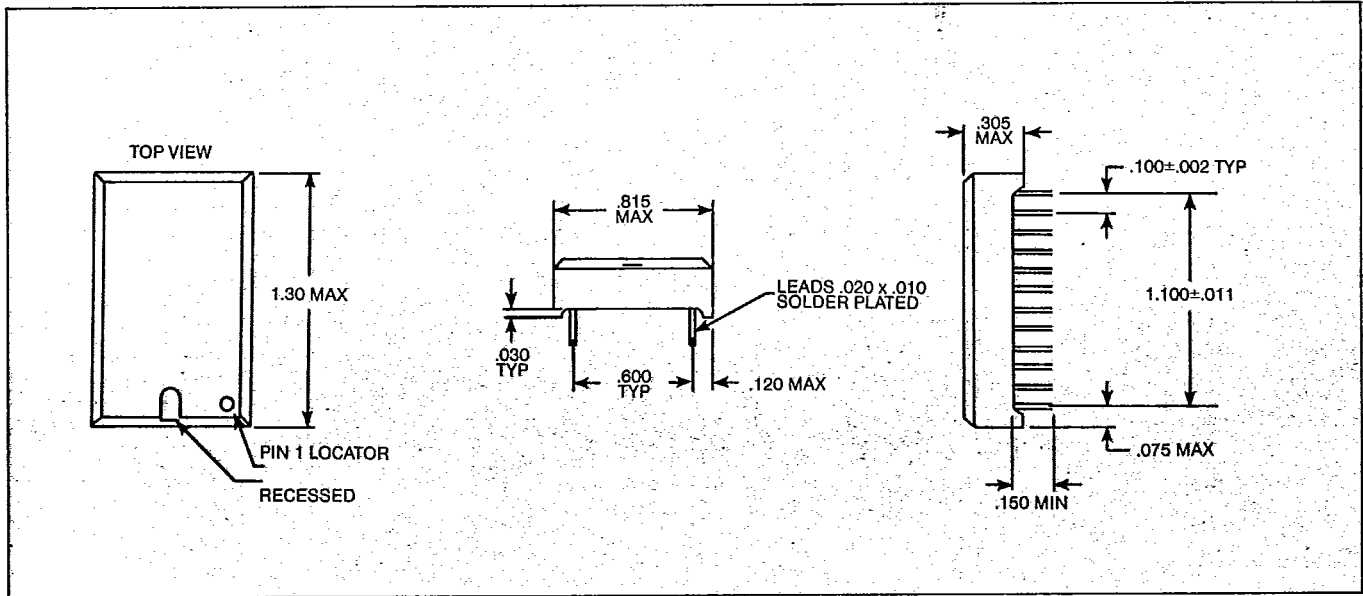
SYM	PARAMETER		MIN.	MAX.	UNITS
I_{DD}	Supply Current			10.0	mA
ΔF	Frequency Deviation	R1	-4	+4	% of F_0
		R2	-2.7	+2.7	Hz
V_H/V_L	Twist	R1		± 5	dB
		R2		± 1	dB
	Harmonic Distortion	Wide Band		-34	dB
		below 3400 Hz		-37	dB
V_{OUT}	Output per Tone	$V_{DD} = 12\text{V}$	-0.5	+0.5	dBm
		$V_{DD} = 6\text{V}$	-6.25	-5.75	dBm
$T_{on/off}$	Turn on or Turn off delay			1.0	ms
V_{OUT}	Tone off			-80	dBm

DC CHARACTERISTICS $0^\circ \leq T_A \leq 70^\circ\text{C};$ Voltages referred to V_{SS}

SYM	PARAMETER	MIN.	MAX.	UNITS
V_{DD}	Supply Voltage	4.75	12.6	Volts
V_{IL}	Digital Input Low Level		$.2V_{DD}$	Volts
V_{IH}	Digital Input High Level	$.8V_{DD}$		Volts
R_{OUT}	Output Resistance Tone Out		10	Ohms

AMS 3501

PACKAGE DESCRIPTION



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