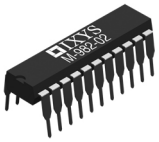
IXYS
INTEGRATED CIRCUITS DIVISION



M-982-02
Precise Call Progress Tone Detector

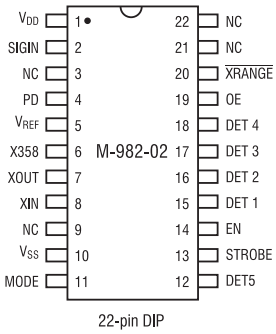
Features

- Precise Detection of Call Progress Tones
- Linear (Analog) Input
- Digital (CMOS Compatible), Tri-State Outputs
- Single Supply, 3V to 5V (Low Power CMOS)
- Inexpensive 3.58MHz Time Base
- Wide Dynamic Range (30dB)
- Lower Power Consumption (Power-Down Mode)
- 425Hz Detection
- 22-Pin DIP and 20-Pin SOIC Packages

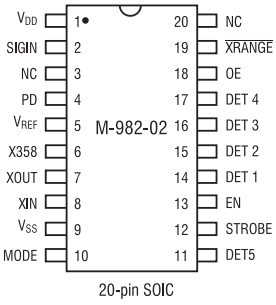
Applications

- Automatic Dialers
- Dialing Modems
- Traffic Measurement Equipment
- Test Equipment
- Service Evaluation
- Billing Systems

Pin Configuration



22-pin DIP



20-pin SOIC

Description

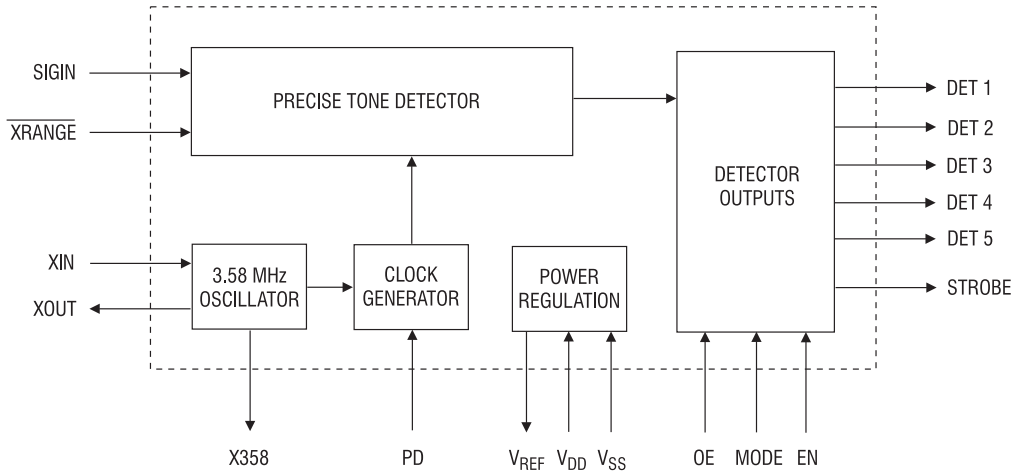
The M-982-02 is an integrated circuit, precise tone detector for special-purpose use in automatic following of switched telephone calls. The circuit uses low power CMOS techniques to provide the complete filtering and control required for this function. The basic timing of the M-982-02 is designed to permit operation with almost any progress tone system.The use of integrated circuit techniques allows the M-982-02 to pack the five filters for call progress following into a single 22-pin DIP or 20-pin SOIC. A 3.58 MHz crystal-controlled time base guarantees accuracy and repeatability.

The M-982-02 is an enhanced drop-in replacement for the M-982-01. It has a wider operating voltage range (down to 3V). It has lower power consumption under normal operating conditions. In addition, a power down (PD) feature is provided to further reduce power consumption when inactive. It includes a 425Hz detector to support common international call progress requirements.

Ordering Information

Part	Description
M-982-02P	22-Pin plastic DIP
M-982-02S	20-Pin Plastic SOIC
M-982-02T	20-Pin Plastic SOIC, Tape and Reel

Block Diagram



1 Specifications

1.1 Absolute Maximum Ratings

Symbol	Ratings	Units
V_{DD}	7	V
Input Voltage on SIGIN	V_{SS} - 6.5 to V_{DD} + 0.3	V
Input Voltages (Except SIGIN)	V_{SS} - 0.3 to V_{DD} + 0.3V	V
Operating Temperature	- 40 to +85	°C
Storage Temperature Range	- 40 to +150	°C

Absolute maximum ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.

1.2 Electrical Characteristics

Parameter			Conditions	Min	Max	Units	Notes
Operating Conditions	V_{DD}		-	2.7	5.5	V	-
	Power Supply Noise		0.1 to 5kHz	-	20	mV_{P-P}	
Power	Current Drain (I_{DD})		V_{REF} Open	-	15	mA	-
V_{REF}	V_{REF}		-	48% of VDD	52% of VDD	V	-
	Impedance		-	3.25	8.25	kΩ	
Signal Detection	Frequency Range		In-Band Signal	-1	+1	% of f_o	1
	Level: V_{DD}=5V		XRANGE = Open	-30 (24.5mV)	0 (775mV)	dBm	
			XRANGE = V_{SS}	-40 (7.8mV)	-10 (245mV)		
	Level: V_{DD}=3V		XRANGE = Open	-33 (17.4mV)	-3 (549mV)	dBm	
			XRANGE = V_{SS}	-43 (5.5mV)	-13 (173.5mV)		
	Duration (t_{DD})		-	200	-	ms	
	Bridge Time (t_{BB})		-	-	20	ms	
	Level Skew Between Adjacent In-Band signals		For Detection of Both	-	6	dB	
	High-Level to Low-Level Signal for Detection of Both (t_{IL})		High = 0dBm (775mV) Low = -30dBm (24.5mV)	1	-	s	-
	Time to Output (t_{DO})		SIGIN about -24dBm	-	200	ms	-
			SIGIN < -24dBm	-	240		
	Time from DET n to STROBE (t_{DS})		-	-	10	ms	-
Signal Rejection	Frequency Range		-	-6	-6	% of f_o	1
	Level: V_{DD}=5V		XRANGE = Open	-	-50 (2.5mV)	dBm	
			XRANGE = V_{SS}	-	-60 (0.8mV)		
	Level: V_{DD}=3V		XRANGE = Open	-	-53 (1.7mV)	dBm	
			XRANGE = V_{SS}	-	-63 (0.6mV)		
	Interval Duration (t_{ID})		-	160	-	ms	
	Time to Output (t_{IO})		-	-	200	ms	
Outputs	DET n, STROBE Pins	V_{OL}	I_{SINK} = -1mA	-	0.5	V	-
		V_{OH}	I_{SOURCE} = 1mA	V_{DD} - 0.5	-		
	DET n Pins	I_{OZ}	V_O = V_{DD} , V_{SS}	-	1	µA	

Parameter			Conditions	Min	Max	Units	Notes
Inputs	EN, OE, XRANGE, MODE, PD Pins	V_{IL}	-	-	0.5	V	-
		V_{IH}	V_{DD} = 5V	V_{DD} - 2	-	V	
			V_{DD} = 2.7V	V_{DD} - 0.5	-		
	Pull-Up and Pull-Down Currents	MODE = V_{SS}	V_{DD} = 5V	12.5	50	µA	
			V_{DD} = 2.7V	4	20		
		/XRANGE = V_{SS}	-	2	6		
		PD = V_{DD}	-	4	10		
	SIGIN Pin	Voltage Range	-	-6.5	V_{DD}	V	
		Input Impedance	f = 500Hz	80	-	kΩ	
		Input Spectrum	-	-	28	kHz	
Clock	External Clock Connected to XIN Pin	V_{IL}	XOUT Open	-	0.2	V	-
		V_{IH}		V_{DD} - 0.2	-		
		Duty Cycle		40	60	%	
	XIN, XOUT with Oscillator Active	Capacitance	-	-	10	pF	
		Internal Resistance	-	20	-	MΩ	
		Power-Up (TPU)	PD Hi to Lo	-	30	ms	
	X358 Pin	V_{OL}	C_L = 20pF, I_{SINK} = -1mA	-	0.2	V	
		V_{OH}	C_L = 20pF, I_{SOURCE} = 1mA	V_{DD} - 0.2	-		
		Duty Cycle	C_L = 20pF	40	60	%	
Tri-State Operation	t_{EN} (High Z to LOW Z)	C_L = 50pF	-	-	250	ns	-
	t_{DE} (Low Z to High Z)	R_L = 100kΩ	-	-	250		

Unless otherwise noted, V_{DD}-V_{SS} = 5V, T_A = 25°C, PD at logical low state, and XRANGE at logical high state.
Power levels are in dBm referenced to 600Ω.
DC voltages are referenced to V_{SS} .
1. Per tone.

1.3 Pin Functions

Pin	Description
DET 1	Active high tri-state output, detect for 350Hz.
DET 2	Active high tri-state output, detect for 400Hz/620Hz. (See Note.)
DET 3	Active high tri-state output, detect for 440Hz.
DET 4	Active high tri-state output, detect for 480Hz.
DET 5	Active high tri-state output, detect for 425Hz.
EN	Active high enabled, when low drives STROBE low.
OE	Active high input. When low tri-state DET n pins.
SIGIN	Analog signal input (internally capacitive coupled).
STROBE	Active high output, indicates valid DET n.
V_{DD}	Most positive power supply input pin.
V_{REF}	Internally generated mid-power supply voltage (output).
V_{SS}	Most negative power supply input pin.
X358	Buffered oscillator output (3.58 MHz).
XIN	Crystal oscillator or digital clock input.
XOUT	Crystal oscillator output. Used only with a crystal. Use X358 when clock output signal is required.
$\overline{\text{XRANGE}}$	Active low input. Adds 10dB of gain to input stage.
MODE	Compatibility selection. Connection to V_{SS} selects 400Hz detection. (M-981-02 emulation.) Connection to V_{DD} or no connection selects 620Hz detection.
PD	Power-down operation, logic high inhibits internal clock. Internal pull-down resistor.

Note: This output indicates 400Hz detect when MODE is connected to V_{SS} and 620Hz detect when open or connected to V_{DD} .

Call Progress Tones

Frequency 1 (Hz)	Frequency 2 (Hz)	Use
350	440	Dial Tone
400	Off	Special
440	Off	Alert Tone
440	480	Audible Ring
440	620	Pre-empt
480	Off	Bell High Tone
480	620	Reorder (Bell Low)
350	Off	Special
620	Off	Special
941	1209	DTMF * (asterisk)
425	Off	European

2 Call Progress Tone Detection

Call progress tones are audible tones sent from switching systems to calling parties to show the status of calls. Calling parties can identify the success of a call placed by what is heard after dialing. The type of tone used and its timing vary from system to system, and, though intended for human ears these signals can provide valuable information for automated calling systems.

The M-982-02 contains five signal detectors sensitive to the frequencies often used for these progress tones. Electronic equipment monitoring the DET n outputs of the M-982-02 can determine the nature of signals present by measuring their duty cycle. See "Typical Application" on page 6 for a diagram of a circuit that could be used to permit a microcomputer to directly monitor tones on the telephone line. Much of the character of the progress tones is in their duty cycle or cadence (sometimes referred to as interruption rate). This information, coupled with level and frequency indication from the M-982-02, can be used to decide what progress tones have been encountered. For example, dial tones as shown in "Call Progress Tones" on page 4 are usually "on" continuously, and last until the first dial digit is received by the switching system. Line Busy, on the other hand, is turned off and on at a rate of 1 Hz with a 50% duty cycle, or an interruption rate of 60 times per minute (60 IPM). The tones can be distinguished in this way. It should be noted that while such techniques will usually be effective, there are some circumstances in which the M-982-02 cannot be accurately used. Examples include situations where ringback tone may be short or not even encountered. Ringback may be provided at ringing voltage frequency (20 or 30 Hz) with some harmonics and may not fall in the detect range, and speech or other strong noise may obscure tones making cadence measurement difficult.

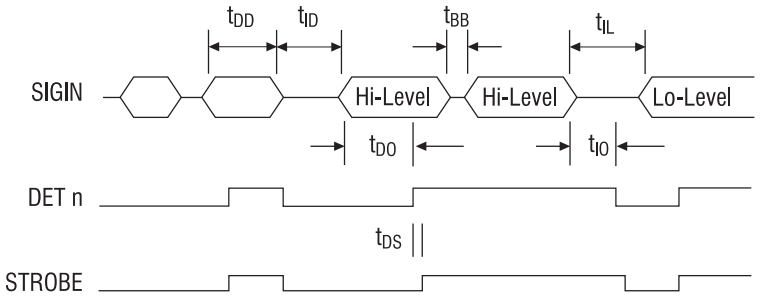
Standards do exist and should be consulted for your particular application. In North America, AT&T's "Notes on the Network" or EIA's RS-464 PBX standard should be reviewed. In Europe, tone plans may vary with locale, in which case the CEPT administration in each country must be consulted. Outside these areas, national PTT organizations can provide information on the systems within their borders.

Truth Table

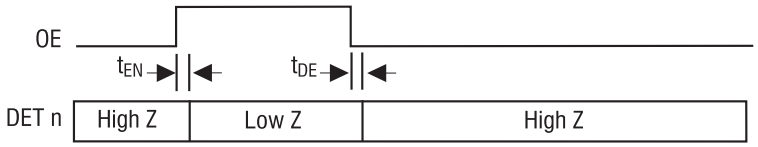
Signal Present (f_o)	MODE	Det 1	Det 2	Det 3	Det 4	Det 5	Strobe	PD	OE	EN
350Hz	X	1	X	X	X	X	1	0	1	1
400Hz (Note)	0	X	1	X	X	X	1	0	1	1
620Hz (Note)	1 / Open	X	1	X	X	X	1	0	1	1
440Hz	X	X	X	1	X	X	1	0	1	1
480Hz	X	X	X	X	1	X	1	0	1	1
425Hz	X	X	X	X	X	1	1	0	1	1
Other (no detect)	X	0	0	0	0	0	0	0	1	1
Any	X	0	0	0	0	0	0	1	1	X
Any	X	0	0	0	0	0	0	0	1	0
Any	X	High Impedance					X	0	0	1
Any	X	High Impedance					0	0	0	0
Any	X	High Impedance					X	1	0	X

Note: Connect MODE pin to V_{SS} to select 400Hz detect on DET 2; connect to V_{DD} or leave open to select 620Hz detect on DET 2.

Signal Timing

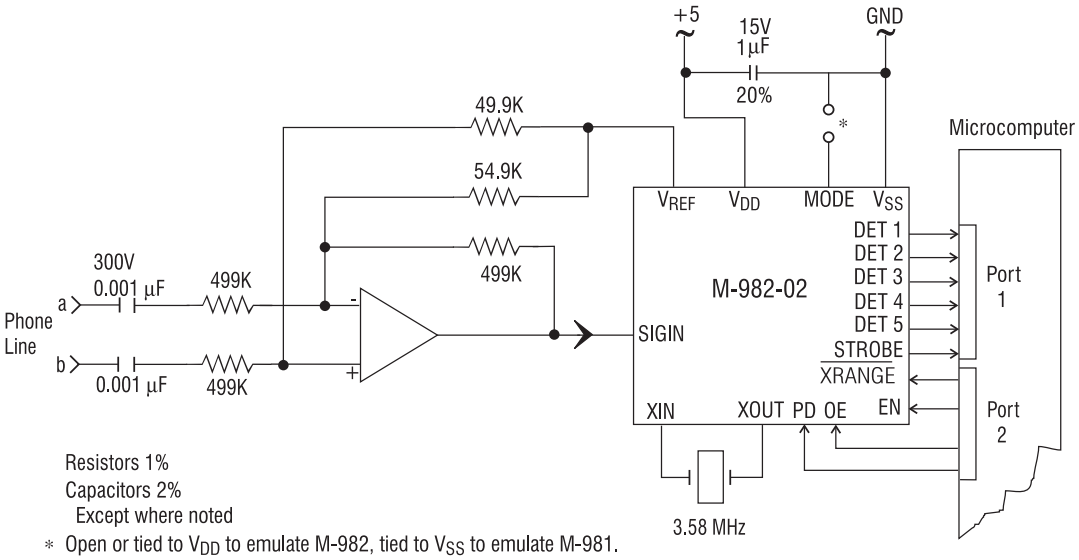


Tri-State Timing



Power-Down Timing

Typical Application



Resistors 1%
Capacitors 2%
Except where noted

* Open or tied to V_{DD} to emulate M-982, tied to V_{SS} to emulate M-981.

3 Manufacturing Information

3.1 ESD Sensitivity

This product is **ESD Sensitive**, and should be handled according to the industry standard **JESD-625**.

3.2 Reflow Profile

This product has a maximum body temperature and time rating as shown below. All other guidelines of **J-STD-020** must be observed.

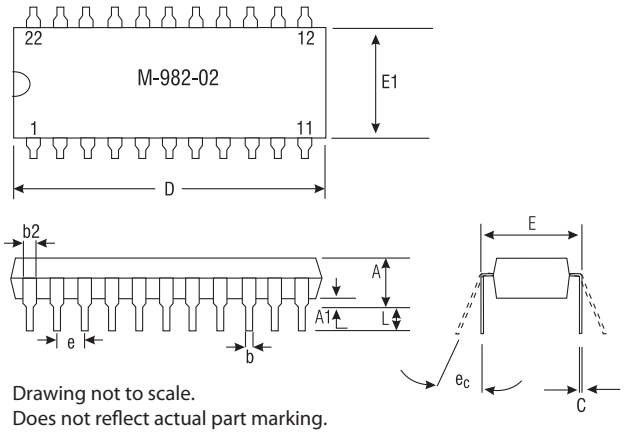
Device	Maximum Temperature x Time
M-982-02P	245°C for 30 seconds
M-982-02S	250°C for 30 seconds

3.3 Board Wash

IXYS Integrated Circuits Division recommends the use of no-clean flux formulations. However, board washing to remove flux residue is acceptable, and the use of a short drying bake may be necessary. Chlorine-based or Fluorine-based solvents or fluxes should not be used. Cleaning methods that employ ultrasonic energy should not be used.

3.4 Mechanical Dimensions

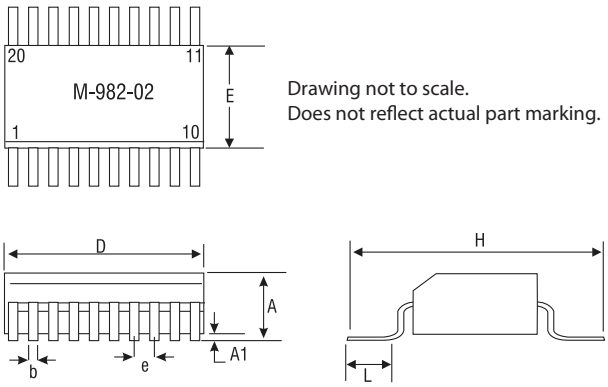
3.4.1 M-982-02P 22-Pin DIP Package



Drawing not to scale.
Does not reflect actual part marking.

	Tolerances (Inches)			Metric Approximation (mm)		
	Min	Nom	Max	Min	Nom	Max
A	-	-	0.210	-	-	5.33
A1	0.015	-	-	0.38	-	-
b	0.014	-	0.022	0.36	-	0.56
b2	0.045	0.060	0.065	1.1	1.5	1.7
C	0.009	-	0.015	0.23	-	0.38
D	1.065	1.085	1.120	27.1	27.6	28.4
E	0.390	0.415	0.425	9.9	10.5	10.8
E1	0.330	0.360	0.390	8.4	9.1	9.9
e	0.100 BSC			2.54 BSC		
ec	0°	15°	15°	0°		15°
L	0.115	0.130	0.160	2.9	3.3	4.1

3.4.2 M-982-02S 20-Pin SOIC Package



Drawing not to scale.
Does not reflect actual part marking.

	Tolerances (mm)		SAE Approximation (Inches)	
	Min	Max	Min	Max
A	2.35	2.65	0.0926	0.1043
A1	0.10	0.30	0.0040	0.0118
b	0.33	0.51	0.013	0.020
D	12.60	13.00	0.4961	0.5118
E	7.4	7.6	0.2914	0.2992
e	1.27 BSC		0.050 BSC	
H	10.00	10.65	0.394	0.419
L	0.40	1.27	0.016	0.050

For additional information please visit our website at: www.ixysic.com

Specification: DS-M-982-02-R05

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