M-984-02
Special Information Tone Detector

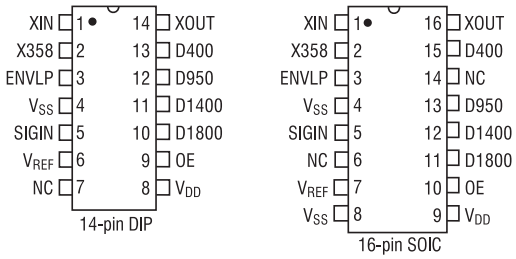
Features

- Detects single-frequency tones used for error indication and call progress in telephone systems
- Provides detection windows for:
  400/425 Hz (Call Progress)
  950 Hz (Special and error indication)
  1400 Hz (Special and error indication)
  1800 Hz (Special and error indication)
- Separate tri-state outputs for each tone window
- Inexpensive 3.58 MHz crystal time base
- Auxiliary 3.58 MHz clock output
- 14-pin DIP package and 16-pin SOIC package
- Single supply 3 to 5 volt (low power CMOS)
- Wide dynamic range (30 dBm)

Applications

- Automatic dialers
- Modems
- Telecom test equipment
- Telephone traffic measurement,
- Service evaluation
- Billing equipment

Pin Diagram



Description

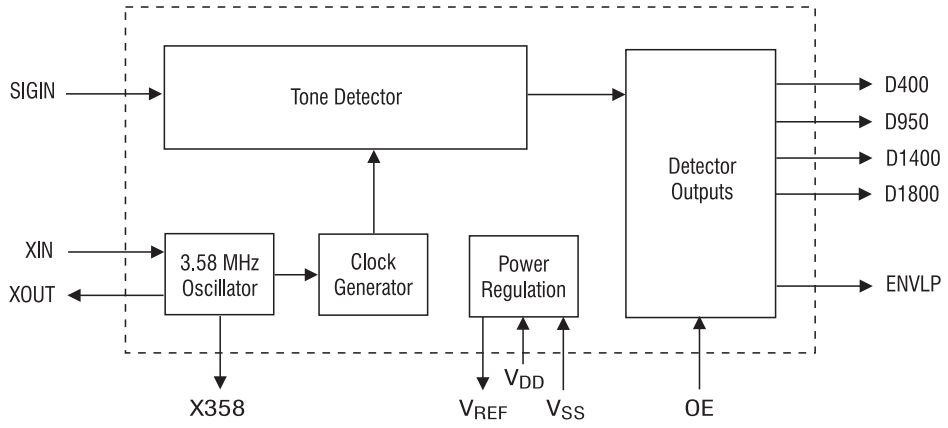
The M-984-02 Special Information Tone Detector is a monolithic integrated circuit designed to provide reliable detection of many common telephone network status signals. In particular, it detects the signals known as Special Information Tones (SITs) or error tones as defined by the CCITT, and single tones often used as dial tone, audible ringing, and other general progress indications. The M-984-02 uses CMOS switched capacitor filters and a crystal time base to achieve the high stability and accuracy specified. Each tone detection window has an associated output pin, which can be placed in a high impedance state for use with time-share microcomputer bus applications.

In comparison with the earlier M-984, the M-984-02 has wider acceptance bands for SIT tones to facilitate reception of tape-loop tones, lower power consumption at 5V operation, 3V operation, superior temperature performance, lower cost, and is available in DIP, SOIC, and SOIC tape and reel versions.

Ordering Information

Part #	Description
M-984-02P	14-pin plastic DIP
M-984-02S	16-pin plastic, SOIC
M-984-02T	16-pin SOIC, Tape and Reel

Block Diagram



Absolute Maximum Ratings

DC Supply Voltage	7V
Input Voltage on SIGIN	V_{SS} - 6.5V to V_{DD} +0.3V
Input Voltage on Any Pin (except SIGIN)	V_{SS} - 0.3 to V_{DD} + 0.3V
Storage Temperature Range	-40°C to +150°C
Operating Temperature Range	-40°C to +85°C
Lead Soldering Temperature	260°C for 5 seconds

Note:
Exceeding these ratings may permanently damage the device.

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 these or any other conditions beyond those indicated in the operational sections of this data sheet is not implied. Exposure of the device to the absolute maximum ratings for an extended period may degrade the device and effect its reliability.

Specifications

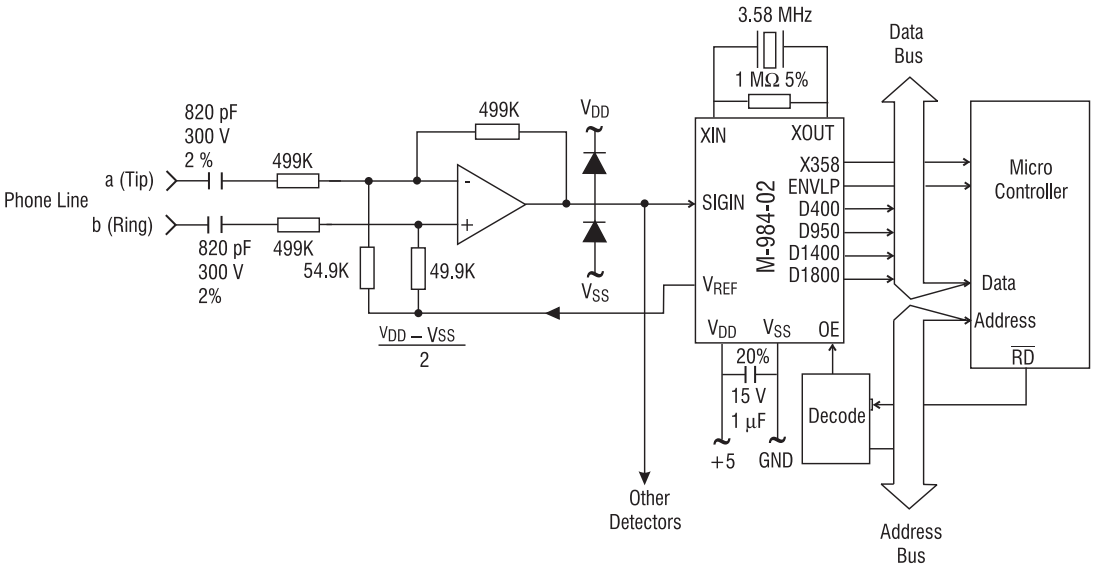
	Parameter		Conditions	Min	Max	Units
Operating Conditions	V_{DD}		-	2.7	5.5	V
	Power supply noise		0.1 - 5 kHz	-	20	mV p-p
Power	Current drain (I_{DD})		V_{REF} open	-	15	mA
V_{REF}	V_{REF}		-	48% of V_{DD}	52% of V_{DD}	V
	Impedance		-	3.25	8.25	kΩ
Signal Detection	Frequency Range		-	Note 1	Note 1	-
	Level: V_{DD} = 5.0V		-	-30 (24.5 mV)	0 (775 mV)	dBm
	Level: V_{DD} = 3.0V		-	-33 (17.4 mV)	-3 (173.5 mV)	dBm
	Duration		f_c = 400 Hz	85	-	ms
			f_c = 950, 1400, 1800 Hz	50	-	ms
	Bridge Time		-	-	15	ms
	Signal to Noise Ratio		-	16	-	dB
Signal Rejection	Frequency Range		-	Note 1	Note 1	-
	Level: V_{DD} = 5.0V		-	-	-40 (7.8 mV)	dBm
	Level: V_{DD} = 3.0V		-	-	-43 (5.5 mV)	dBm
	Duration		-	-	50	ms
Outputs	Except X358	V_{OL}	I_{SINK} = -1.0 mA	-	0.5	V
		V_{OH}	I_{SOURCE} = 1.0 mA	V_{DD}-0.5	-	V
	Dn pins only	I_{OZ}	V_O = V_{DD}, V_{SS}	-	1	µA
Inputs	EN pin	V_{IL}	-	-	0.5	V
		V_{IH}	V_{DD} = 5V	V_{DD} -2.0	-	V
			V_{DD} = 2.7V	V_{DD} - 0.5	-	V
	Pull-up and Pull-down currents	MODE = V_{SS}	V_{DD} = 5V	12.5	50	µA
			V_{DD} = 2.7V	4	20	µA
		/XRANGE +V_{SS}	-	2	6	µA
		MODE2 = V_{DD}	V_{DD} = 5V	12.5	100	µA
			V_{DD} = 2.7V	12.5	25	µA
		PD = V_{DD}	-	4	10	µA
	SIGIN pin	Voltage range	-	-6.5	V_{DD}	V
		Input impedance	f = 500 Hz	80	-	kΩ
		Input Spectrum	-	-	28	kHz
Clock	External clock connected to XIN pin	V_{IL}	XOUT open	-	0.2	V
		V_{IH}	XOUT open	V_{DD} - 0.2	-	V
		Duty cycle	XOUT open	40	60	%
	XIN, XOUT with crystal ocs. active	Capacitance	-	-	10	pF
		Internal res.	-	20	-	MΩ
	X358 pin	V_{OL}	C_L = 20 pF, I_{SINK} = -1.0 mA	-	0.5	V
		V_{OH}	C_L = 20 pF, I_{SOURCE} = 1.0 mA	V_{DD} - 0.5	-	V
		Duty cycle	C_L = 20 pF	40	60	%
Tri-state Operation	t_{EN} (High Z to Low Z)		C_L = 50 pF	-	250	ns
	t_{DE} (Low Z to High Z)		RL = 100 KΩ	-	250	ns

Unless otherwise noted, specifications hold over V_{DD} - V_{SS} = 2.8V to 5.5V power supply, and T_{OL} -40°C to +85°C.
Notes:
1. See the Detector Frequency Windows table on page 4 for detection/ rejection frequencies.

Pin Functions

PIN	FUNCTION
XIN XOUT	Crystal Connection — 3.58 MHz crystal across these pins will produce the timebase needed for proper operation of the M-984-02. An external clock signal may be fed to XIN providing the clock signal has a duty cycle of 50 ±10% and comes within 0.2 volts of the supply rails. XOUT remains unconnected when an external clock is used.
X358	A buffered output pin. A 3.58 MHz clock signal is available for use in other circuits as a timebase. Leave open when unused.
ENVLP	The ENVLP pin is a common detection indicator for the four detect pins. Simply put, the ENVLP is a logical "OR" of the active detect circuits for each of the four windows, though there is a delay provided to permit ENVLP to latch the first active detect pin. ENVLP is not tri-state controlled.
V_{SS} V_{DD}	The power supply pins, V_{DD} being the most positive. Commonly, V_{DD} is at 3-5 volts, white V_{SS} is at ground.
SIGIN	Analog signal input. (Internally capacitively coupled.)
V_{REF}	V_{REF} is a bias voltage generated in the chip for use in external analog circuits, such as active filters and AC-coupled buffers. Leave open when unused.
OE	The tri-state control pin. OE places the DET pins in the active mode when at logic "1". When at logic "0," OE causes the DET outputs to appear as high impedance. Should be tied to logic "1" when the M-984-02 is not used in a time-shared bus application.
D1800 D1400 D950 D400	The detect outputs associated with each window. Tri-state control is available through use of the OE pin. Timing is shown in the Timing Diagram on page 4.

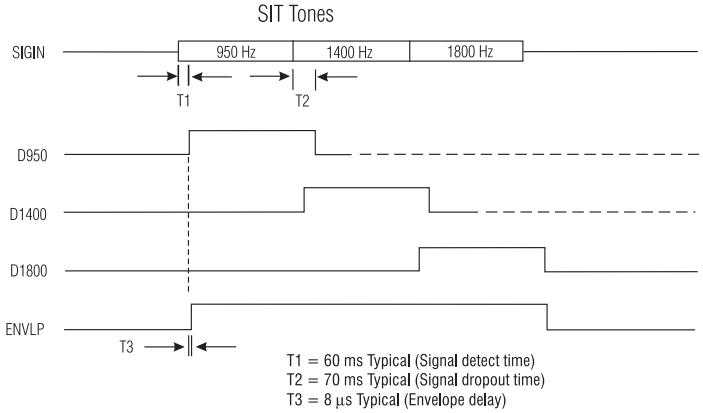
Typical Application



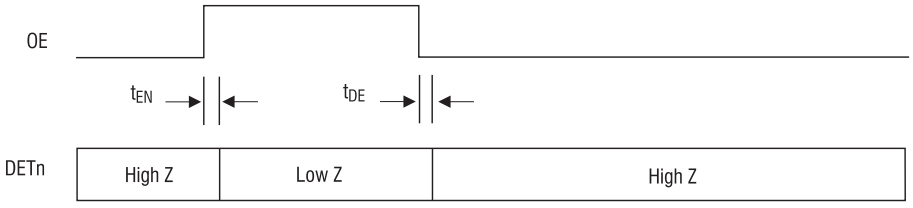
Detector Frequency Windows

Detector	Low Reject	Low Accept	High Accept	High Reject
D400	363	392	459	493
D950	835	885	1016	1070
D1400	1275	1328	1472	1527
D1800	1656	1722	1854	1924

Timing Diagram

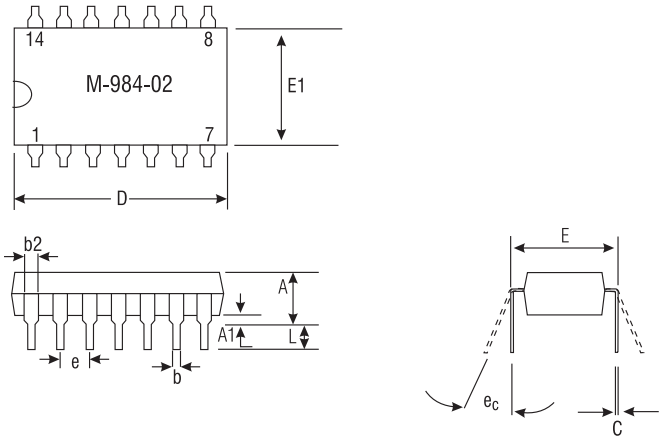


Tri-State Timing



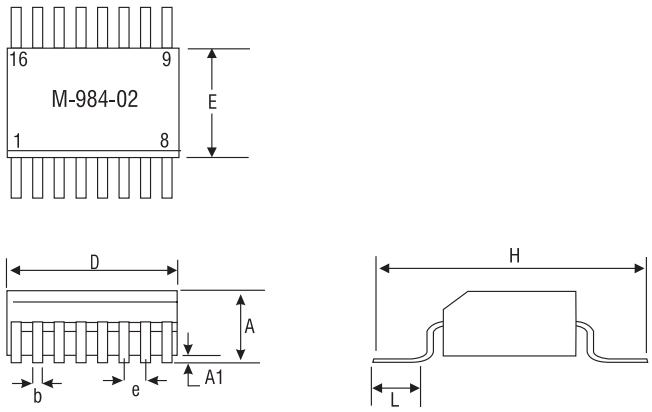
Mechanical Dimensions

14-Pin DIP



	Tolerances			
	Inches		Metric (mm)	
	Min	Max	Min	Max
A	-	.210	-	5.33
A1	.015	-	.38	-
b	.014	.022	.36	.56
b2	.045	.070	1.1	1.8
C	.008	.014	.20	.36
D	.735	.775	18.7	19.7
E	.300	.325	7.6	8.3
E1	.240	.280	6.1	7.1
e	.100 BSC		2.54 BSC	
ec	0°	15°	0°	15°
L	.115	.150	2.9	4.1

16-Pin SOIC



	Tolerances			
	Inches		Metric (mm)	
	Min	Max	Min	Max
A	.093	.104	2.35	2.65
A1	.004	.012	.10	.30
b	.013	.020	.33	.51
D	.398	.413	10.10	10.50
E	.291	.299	7.4	7.6
e	.050 BSC		1.27 BSC	
H	.394	.419	10.00	10.65
L	.016	.050	.40	1.27

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

Dimensions
mm
(inches)

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7/17/01