# TELTONE®

# M-980 General Purpose Call Progress Tone Detector

The Teltone® M-980 is an integrated circuit tone detector for general 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-980 is designed to permit operation with almost any progress tone system.

The use of integrated circuit techniques allows the M-980 to pack the complete frequency and amplitude portion of call progress following into a single 8-pin DIP. A 3.58 MHz crystal-controlled time base guarantees accuracy and repeatability.

## Features

- Covers the 315 to 640 Hz range (common call progress)
- Sensitivity to -38 dBm
- Dynamic range over 36 dB
- 40 ms minimum detect (50 ms to output)
- 8-pin DIP or 16-pin SOIC
- Single supply CMOS (low power)
- Supply range 4.5 to 5.5 VDC
- Inexpensive 3.58-MHz time base

## Applications

- Automatic dialers
- Dialing modems
- Traffic measurement equipment
- Test equipment
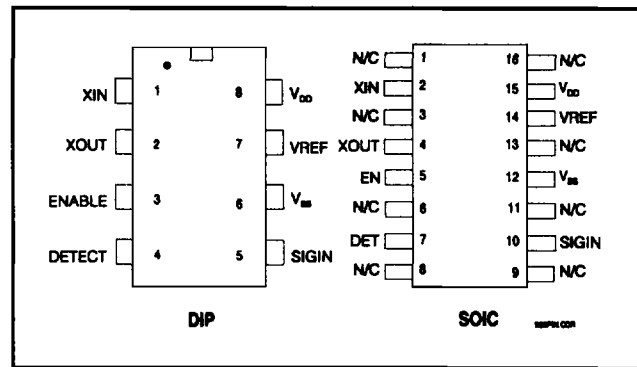- Service evaluation
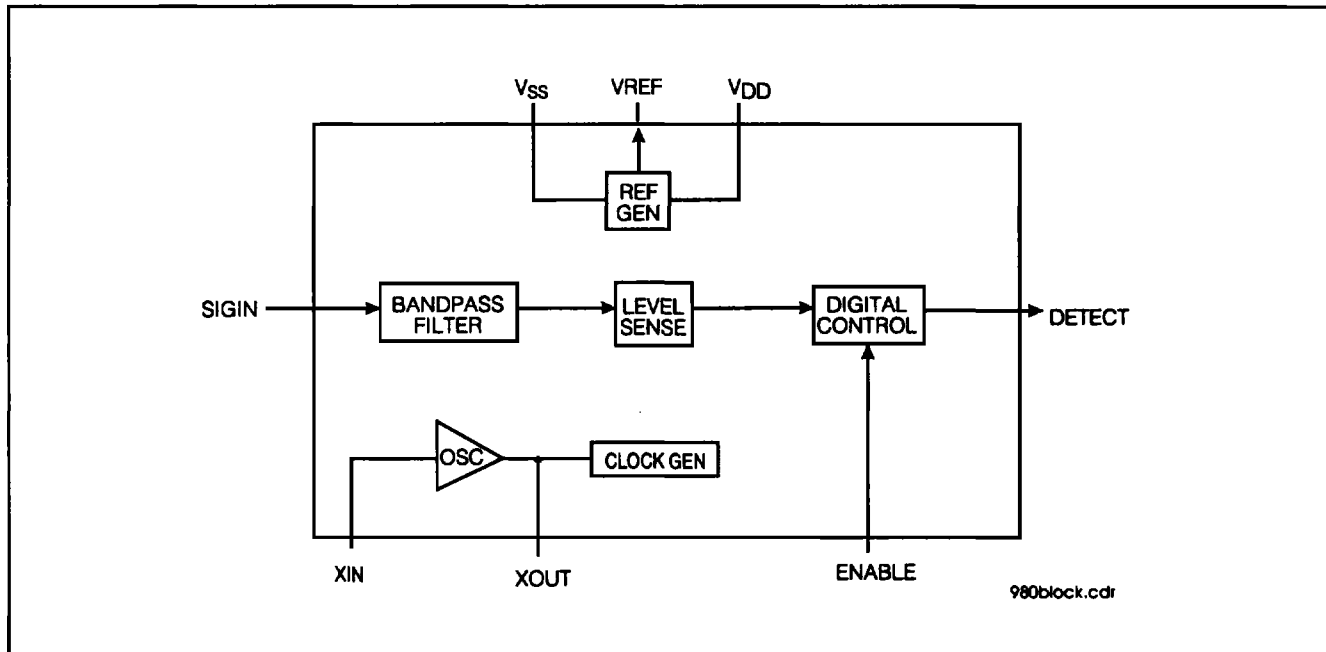- Billing systems



**Figure 1 Pin Diagram**



**Figure 2 Typical Application: Dialed Digit Monitor**

## Table 1  Pin Descriptions

| PIN | DESCRIPTION |
|---|---|
| SIGIN | Signal input, AC or DC coupled (see level limitations elsewhere). |
| DETECT | Active output indicating signal detection. Activated by ENABLE. |
| ENABLE | Enables DETECT output. Used to mask signal activity. |
| $V_{DD}$ | Most positive power supply pin. |
| $V_{REF}$ | Internally generated reference voltage. ($V_{SS}$ + $V_{DD}$) /2 volts. |
| $V_{SS}$ | Most negative power supply pin. |
| XIN, XOUT | Crystal attachment pins. XIN may be used as the input for an external 3.58 MHz clock. |
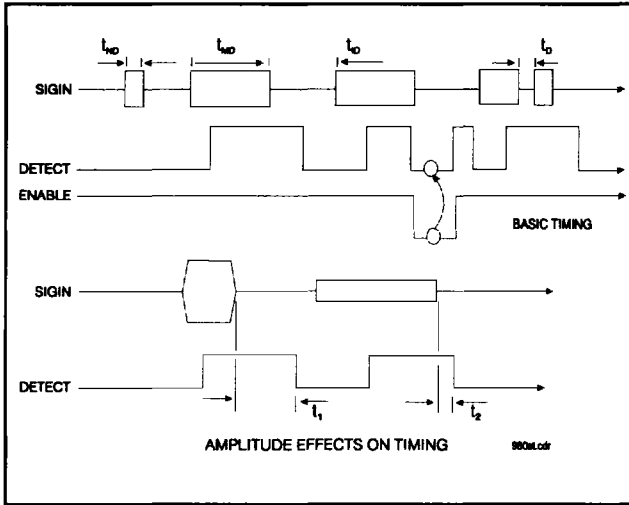


**Figure 3  Signal Timing (See Table 2)**
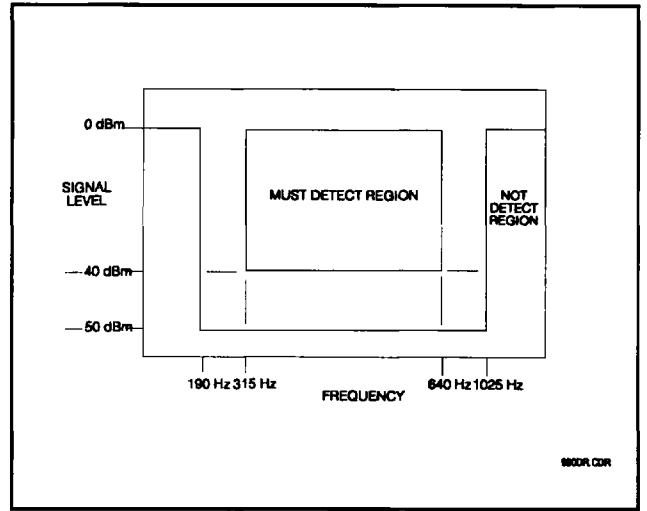


**Figure 4  Detect Range**

## Table 2  Device Timing

| TIME | VALUE | SIGNIFICANCE |
|---|---|---|
| tND | not specified | Length of an otherwise valid tone which will be ignored. |
| tMD | 40 ms maximum | A valid tone will always be detected if it is at least 40 ms long. |
| tID | 40 ms maximum | Inter-tone gaps must be at least 40 ms to be detected. See t1 and t2 below. |
| tB | 20 ms maximum | Drop-outs of valid tone of up to 20 ms will be ignored. |
| t1 | 90 ms maximum | Detection of gaps may require as long as 90 ms following a large tone burst (0 dBm). |
| t2 | 40 ms maximum | Valid low level tones (< - 10 dBm) will require only 40 ms for detection. |

## Table 3 Absolute Maximum Ratings*

DC Supply Voltage (VDD - VSS) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 16.0V

Voltage on SIGNAL IN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . (VDD + 0.5) to (VSS-22V)

Voltage on Any Pin Except SIGNAL IN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . (VDD + 0.5V) to VSS - 0.5V

Storage Temperature Range . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -65° to 150°C

Operating Temperature Range . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -30° to 70°C

Lead Soldering Temperature . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 260°C for 5 seconds

* **Note:** Exceeding these ratings may permanently damage the M-980.

## Table 4  Specifications

| PARAMETER | | MIN | TYP | MAX | UNITS | NOTES |
|---|---|---|---|---|---|---|
| Unless otherwise noted, $V_{DD} - V_{SS} = 4.5$ to $5.5$ V and Ta = 25 °C | | | | | | |
| Supply Current | | | 4 | 10 | mA | |
| Signal Detection | Level | -38 | | 0 | dBm | 1,2,9 |
| | Duration | 40 | | | ms | |
| Signal Rejection | Level | | | -50 | dBm | 1,2 |
| | | | | 0 | dBm | 1,3 |
| | Duration | | | 20 | ms | 2 |
| Quiet Interval Detect | Duration | 40 | | | ms | 4 |
| | | 90 | | | ms | 5 |
| "Detect" Output Pin | Logic 0 | | | 0.5 | V | 6 |
| | Logic 1 | 4.5 | | | V | 6 |
| "Enable", "XIN" Input Pin | Logic 0 | $V_{SS}$ | | $V_{SS}$ +0.2 | V | 7 |
| | Logic 1 | $V_{DD}$ - 0.2 | | $V_{DD}$ | V | 7 |
| "XIN" Duty Cycle | | | 40 | 60 | % | |
| "XIN", "XOUT" Loading | | | | 10 | pF | |
| "VREF" Output Pin | Deviation | -2 | | +2 | % | 8 |
| | Resistance | 3.25 | | 6.75 | Kohms | |
| "SIGIN" Input Pin | Max Voltage | $V_{DD}$ - 18 | | $V_{DD}$ | V | |
| | Impedance (500 Hz) | 80 | | | Kohms | |

Notes:
1. 0 dBm = 0.775 Vrms.
2. f = 340 to 640 Hz.
3. f > 1025 Hz, < 190 Hz.
4. Signal dropping from -40 to -50 dBm.
5. Signal dropping from 0 to -50 dBm.
6. Output current = 1 mA, $V_{SS}$ - $V_{DD}$ = 5.0V.
7. Input current = 10 μA max.
8. Nominal = ($V_{DD}$ + $V_{SS}$)/2.
9. -37 dBm (Ta = 50 °C), -36 dBm (Ta = 60 °C), -35 dBm (Ta = 70 °C)

## 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 Teltone M-980 is a signal detector sensitive to the frequencies most often used for these progress tones. Electronic equipment monitoring the DETECT output of the M-980 can determine the nature of signals present by measuring their duty cycle. See Figure 5 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-980, can be used to decide what progress tones have been encountered.

For example, dial tones as shown in the table 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. Table 5 shows some call progress tones with on/off times —0.25/0.25 being 250 ms on, 250 ms off on a repeating basis. It should be noted that while such techniques will usually be effective, there are some circumstances in which the M-980 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. Detection of "answer" is most difficult for many reasons. One way to determine if a called party has answered is by looking for a short burst of DETECT indications without a cadence match (produced by a click and "hello" at the far end). Some applications will require special methods like speech detection, but most can be reliably handled with the M-980 and simple cadence measurement.

As can be seen, the tones used for the same purposes in different systems may not be the same. Standards do exist and
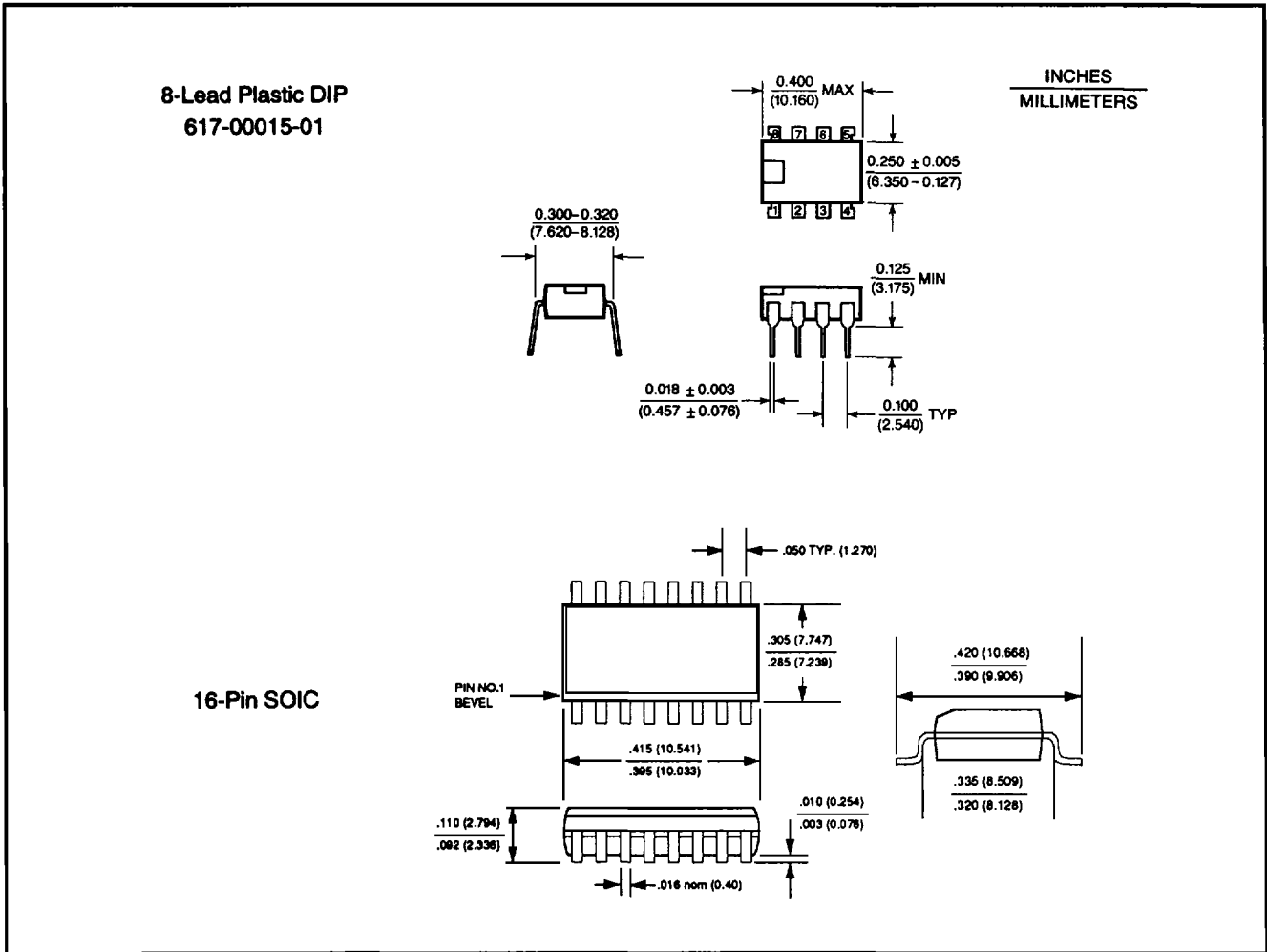
Teltone Corporation, 22121-20th Avenue SE, Bothell, Washington 98021-4408 U.S.A.        Phone: 1-800-426-3926 or 206-487-1515    Fax: 206-487-2288
40-406-00006, Rev. A

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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.

### Table 5  Call Progress Tones

| FREQUENCY 1 | FREQUENCY 2 | ON/OFF | USE |
|---|---|---|---|
| 350 | +440 | Continuous | Dial tones |
| 425 | — | | |
| 600 | X 120 | | |
| 400 | — | | |
| 480 | +620 | 0.5/0.5s | Line Busy Tones |
| 600 | X 120 | | |
| 480 | +620 | 0.25/0.25s | Reorder Tones |
| 600 | X 120 | | |
| 440 | + 480 | 2.0/4.0s | Audible Ringing |
| 500 | X 40 | | |
| 440 | | 0.5s burst | Various |



**Figure 5  A Telephone Line Circuit Application**

**Figure 6 Package Dimensions**

## Ordering Information

| | |
|---|---|
| M-980-01 | 8-pin plastic DIP |
| M-980-01SM | 16-pin SOIC |
| M-980-01SMTR | 16-pin SOIC, Tape and Reel |