M-991 CALL PROGRESS TONE GENERATOR

The Teltone® M-991 is an integrated circuit call progress tone generator for use in telephone systems. The circuit uses low-power CMOS techniques to generate tones which are digitally controlled and highly linear. The M-991 is designed to permit operation with almost any system.

The use of integrated circuit techniques allows the M-991 to incorporate the control, tone generating, and power output buffer into a single 14-pin DIP. A 3.58-MHz (color burst) crystal-controlled time base guarantees accuracy and repeatability.

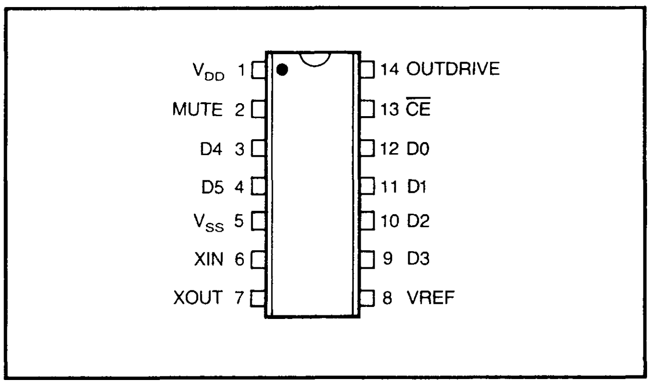

Figure 1 Pin Diagram

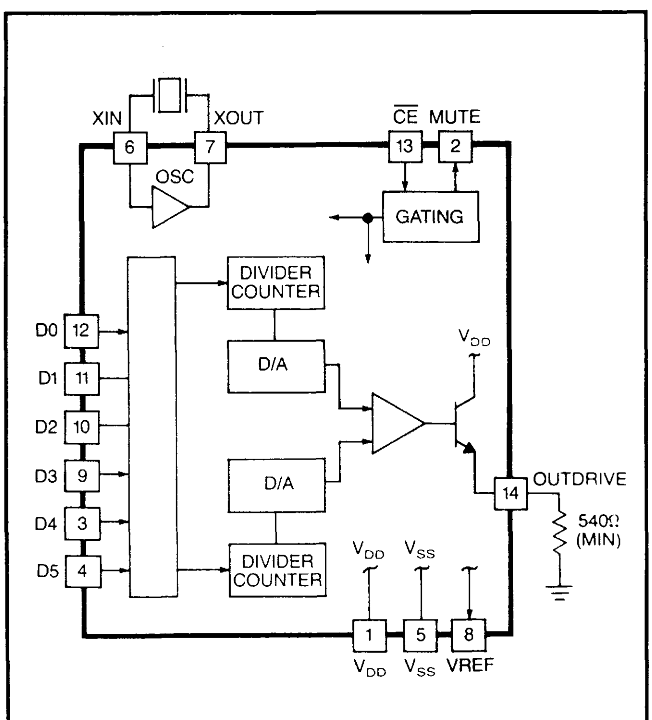

Figure 2 Block Diagram

Features

- Generates standard call progress tones
- Digital input control
- Linear (analog) output
- Power output capable of driving standard line
- 14-pin DIP
- Single supply 4B CMOS (low power)
- Inexpensive 3.58-MHz time base

Applications

- Telephone systems
- Test equipment
- Callback security systems
- Billing systems
- Audible alert systems

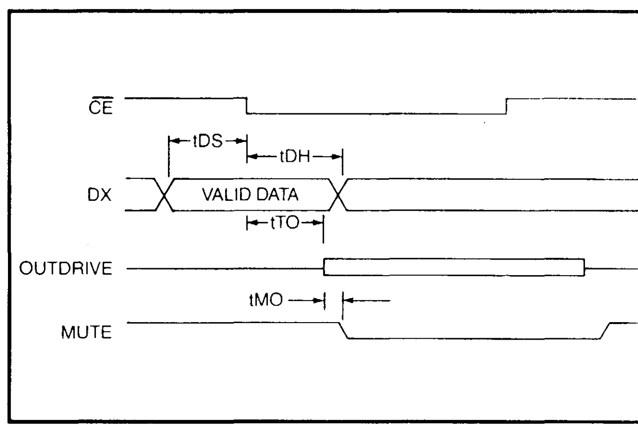

Figure 3 Timing Diagram

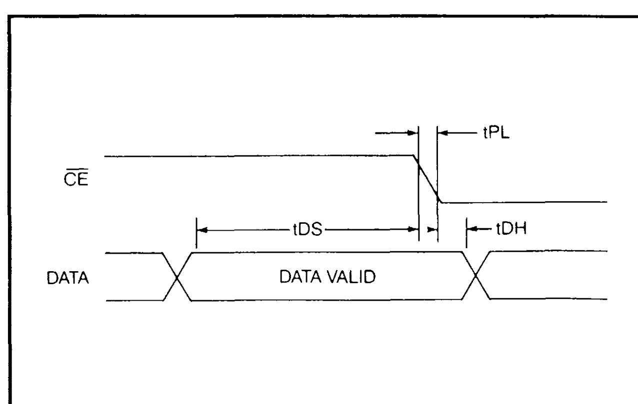

Figure 4 Expanded Wire Data Timing Diagram

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Teltone Limited / 3375-14th Avenue, Markham, Ontario, Canada L3R 2L6 Phone: 416-475-0837 Fax: 416-474-9151 Envoy User Name: TTL.HQ

Call Progress Tone Generation

Call progress tones are audible tones sent from switching systems to calling parties (or equipment) to show the status of calls. Calling parties can identify the success of a placed call by what is heard after dialing.

The M-991 is a highly linear tone generator that produces the unique frequencies (singly or in pairs) that are common to call progress signals. Duration and frequency selection are digitally controlled (see Table 2 for data settings for a particular tone output). A typical control sequence for the M-991 is: (1) set data lines to desired frequency selection, (2) wait for data lines to settle, (3) drive the chip enable ($\overline{CE}$) low, (4) maintain $\overline{CE}$ low for desired tone duration (Note: data lines may be changed after data hold time), and (4) return $\overline{CE}$ to a logic high.

The commonly used call progress tones are shown in Table 3.

Table 1 Pin Functions

PIN	FUNCTION
$\overline{CE}$	Latches data and enables output (active low input).
D0 - D5	Data input pins. (See Table 2).
MUTE	Output indicates that a signal is being generated at OUTDRIVE.
OUT-DRIVE	Linear buffered tone output.
V_{DD}	Most positive power supply input pin.
VREF	Internally generated mid-power supply voltage (output).
V_{SS}	Most negative power supply input pin.
XIN	Crystal oscillator or digital clock input.
XOUT	Crystal oscillator output.

Table 2 Data/Tone Selection

D3	D2	D1	D0	FREQUENCY (Hz) 1	FREQUENCY (Hz) 2	USE
0	0	0	0	350	440	Dial tone
0	0	0	1	400	Off	Special
0	0	1	0	440	Off	Alert Tone
0	0	1	1	440	480	Audible Ring
0	1	0	0	440	620	Pre-empt
0	1	0	1	480	Off	Bell high tone
0	1	1	0	480	620	Reorder (Bell low)
0	1	1	1	350	Off	Special
1	0	0	0	620	Off	Special
1	0	0	1	941	1209	DTMF "*"

Note: D4, D5 reserved for future use and default to inactive when left open.

Table 3 Standard Call Progress Tones

TONE NAME	FREQUENCY (Hz) 1	FREQUENCY (Hz) 2	INTERRUPTION RATE
Dial	350	440	Steady
Reorder	480	620	Repeat, tones on and off 250 ms ±25 ms each
Busy	480	620	Repeat, tones on and off 500 ms ±50 ms each
Audible Ring	440	480	Repeat, tones on 1 ±0.2 s; tones off 3 ± 0.3 s
Recall Dial	350	440	Three bursts tones on and off 100 ms ±20 ms each followed by dial tone
Special AR	440	480	Tones on 1 ±0.2 s, followed by single 440 Hz on for 0.2 s on, and silence for 3 ± 0.3 s, repeat
Intercept	440	620	Repeat alternating tones, each on for 230 ms ±70 ms with total cycle of 500 ±50 ms
Call Waiting	440	Off	One burst 200 ± 100 ms
Busy Verification	440	Off	One burst of tone on 1.75 ±0.25 s before attendant intrudes, followed by burst of tone 0.65 ±0.15 s on, 8 to 20 s apart for as long as the call lasts
Executive Override	440	Off	One burst of tone for 3 ± 1 s before overriding station intrudes
Confirmation	350	440	Three bursts on and off 100 ±20 ms each

Abbreviations: Hz.= hertz, ms = milliseconds, s = seconds

Table 4 Specifications

Unless otherwise noted, $V_{DD} - V_{SS} = 5VDC$, Ta = 25°C

	PARAMETER	MIN	TYP	MAX	UNITS	NOTES
Power Supply and Reference	V_{DD}	4.75	—	5.25	V	1
	Current Drain, IDD	—	—	30	mA	8
	VREF Pin:					
	Deviation from $(V_{DD} + V_{SS})/2$	−2	—	+2	%	
	Internal Resistance from VREF to V_{DD}, V_{SS}	3.25	—	6.75	Kohms	
Oscillator	Frequency Deviation	−0.01	—	+0.01	%	7
	External Clock: (XOUT open)					
	VIL	0	—	0.2	V	
	VIH	V_{DD} −0.2	—	V_{DD}	V	
	Duty Cycle	40	—	60	%	
	XIN, XOUT Loading:					
	Capacitance	—	—	10	pF	10
	Resistance	20	—	—	Mohms	
Tone Output	Frequency Deviation	−0.5	—	+0.5	%	
	Level	110	—	180	mV	2
	Distorting Components	−35	—	—	dB	3
	Idle	—	—	−60	dBm	4
	OUTDRIVE Envelope Rise Time	—	—	4	ms	5
Control	DX, $\overline{CE}$ Pins:					
	VIL	—	—	0.5	V	6
	VIH	2.5	—	—	V	
	Mute Pins:					
	VOL (ISINK = −100 μA)	—	—	1.5	V	
	VOH (ISOURCE = 100 μA)	V_{DD} − 1.5	—	—	V	
Timing	Data Setup (tDS)	200	—	—	ns	
	Data Hold (tDH)	10	—	—	ns	
	Chip Enable Fall (tPL)	—	—	90	ns	11
	Tone On Delay (tTO)	—	—	5	ms	
	Tone Off Delay (tTD)	—	—	5	ms	
	Mute Delay from Outdrive (tMO)	—	—	200	ns	

Notes: (unless otherwise specified)

1. All DC voltages are referenced to V_{SS}.
2. Vrms per tone, 540 ohm load.
3. Any one frequency relative to the lowest level output tone (f < 4000 Hz).
4. 0 dBm = 0.775 Vrms.
5. To 90% maximum amplitude.
6. For all supply voltages in the operating range.
7. At XOUT pin as compared to 3.579545 MHz.
8. OUTDRIVE inactive.
9. Resistance at VREF to V_{DD} or V_{SS} >1 Mohm.
10. Crystal oscillator active.
11. Measured 90% to 10%.

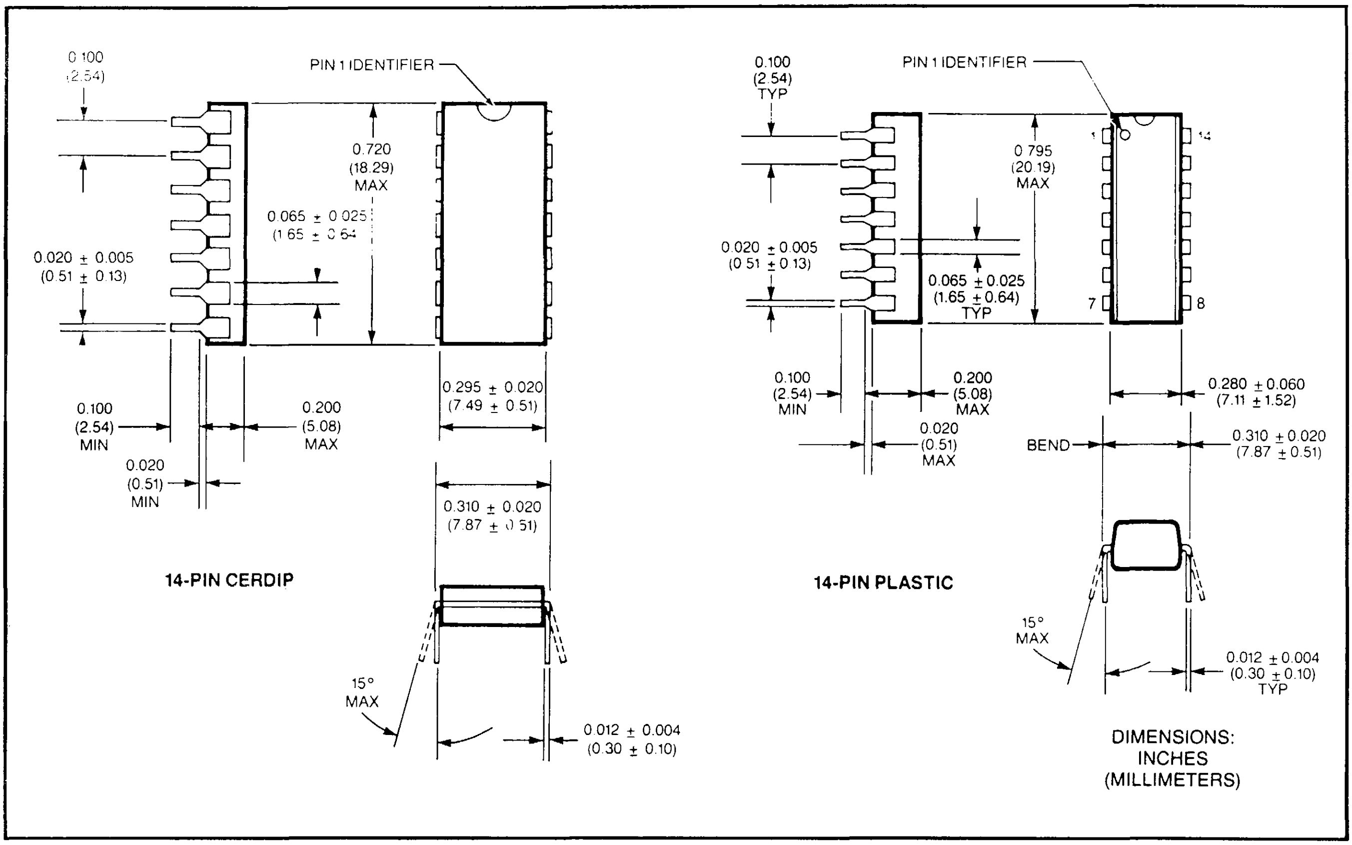

Figure 5 Package Dimensions

Table 5 Absolute Maximum Ratings (Note 1)

Storage Temperature	−55 to 125 °C
Operating Ambient Temperature	−25 to 70 °C
V_{DD}	7.0V
Any Input Voltage	V_{SS} −0.6 to V_{DD} +0.6V

Note:

1. Exceeding these ratings may permanently damage the M-991.