Single Chip Pulse/Tone Dialer

GENERAL DESCRIPTION

The XR-T5990 Single Chip Pulse/Tone Dialer is a silicon gate CMOS technology circuit which performs both pulse and tone functions.

It is designed to operate directly from the telephone line or on a separate small power supply. A 17 digit buffer is provided for redial feature.

FEATURES

Pin Selectable Pulse/Tone Dialing
Low Standby Current
17 Digit Redial Buffer
Uses TV Crystal Standard 3.58 MHz or Ceramic Resonator to Provide High Accuracy and Stability
3.5 Second Pause Timer
Regulated Tone Amplitude
Pin Selectable Dialing Rate (10 pps/20 pps)
Pin Selectable Break Ratio (63%/66%)
Interface Directly to a Standard Telephone Push Button or Calculator Type X-Y Keyboard
Generates 12 Standard Tone Pairs
Single Tone and Dual Tone Capability

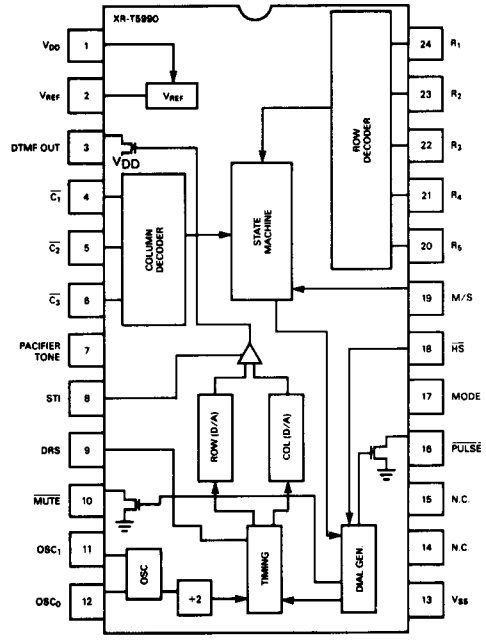
APPLICATIONS

Electronic Telephones
Smart Auto Dialers (modems)
Electronic Banking
Security Controller
Radio Communications

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage V_{DD}	6 V
Operating Temperature	0°C to 70°C
Input Voltage	$-.3 \leq V_{IN} \leq V_{DD} +.3$
Maximum Power Dissipation	500 mW

FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-T5990CP	Plastic	0°C to 70°C
XR-T5990CN	Ceramic	0°C to 70°C

SYSTEM DESCRIPTION

The XR-T5990 Pulse/Tone Dialer is a CMOS integrated circuit that can provide recall of previously entered numbers as well as perform the normal dialing function. Dialing is interchangeable from pulse to tone or vice versa, capable of inserting 3.5 second pause between digits for PABX dialing.

The XR-T5990 dialer is capable of dialing * and # functions in tone mode and ignore in pulse mode. Selectable dialing rate is provided for rapid dialing.

ELECTRICAL CHARACTERISTICS

Test Conditions:

SYMBOL	PARAMETERS	MIN	TYP	MAX	UNIT	CONDITIONS
DC CHARACTERISTICS $0\,^{\circ}C \leq T \leq 70\,^{\circ}C$, V_{DD} = 3.5 V						
V_{DD}	DC Operating Voltage	2.5		6	V	
V_{REF}	Magnitude of (V_{DD}-V_{REF})	1.5	2.5	3.5	V	
V_M	Memory Retention Voltage	1.5			V	
I_{OP}	DC Operating Current			4.2	mA	V_{DD} = 3.5 V, Outputs Unloaded
I_S	DC Standby Current			1.5 500	µA nA	V_{DD} = 3.5 V, Outputs Unloaded V_{DD} = 2.5 V, Outputs Unloaded
I_{ML}	Mute Sink Current			10	mA	V_{DD} = 3.5 V, V_{OUT} = .5 V
I_P	Pulse Sink Current			20	mA	V_{DD} = 3.5 V, V_{OUT} = .5 V
K_L	Keyboard "0" Logic Level	V_{SS}		20% of V_{DD}	V	
K_H	Keyboard "1" Logic Level	80% of V_{DD}		V_{DD}	V	
K_{PU}	Keyboard Pull-up Resistance		100		KΩ	
K_{PD}	Keyboard Pull-down Resistance		4		KΩ	
H_{SRU}	Hookswitch Pull-up Resistance		100		KΩ	
Cf_{osc}	Oscillator Stability			.05	%	V_{DD} 2.5 to 3.5 V
S_F	Keyboard Scanning Frequency		932		Hz	
dB_{CR}	Ration of Column to Row Tone		2	3	dB	
%DIS	Distortion		6	7	%	
V_{OR}	Single Tone Row Frequency Amplitude		212		mVRms	R_L = 330Ω
V_{OC}	Single Tone Column Frequency Amplitude		311		mVRms	R_L = 330Ω
T_{DB}	Keyboard Debound Time	11.8			ms	
K_T	Keydown	40			ms	
R_T	Tone Load Resistor	120		400	Ω	

PIN AND FUNCTION DESCRIPTIONS

Pin	Number
Supplies V_{DD}, V_{SS}	1,13

Power Supply Inputs – The device is designated to operate from 2.5 to 6 volts.

V_{REF}	2

The V_{REF} output provides a negative reference voltage relative to V_{DD}, which defines minimum operating voltage. In a typical application, this pin is simply tied to V_{SS}.

Keyboard Inputs

C_1, C_2, C_3	4,5,6
R_1, R_2, R_3, R_4, R_5	24,23,22,21,20

These inputs are open when the keyboard is inactive. When a key is pushed, an appropriate row to column input must go to V_{SS} or connect with each other.

Oscillator

OSC_{IN}, OSC_{OUT}	11,12

These pins are provided to connect external crystal or ceramic resonator. The device contains the necessary parasitic capacitances and feedback resistor on chip so that is is only necessary to connect a standard 3.58 MHz TV crystal.

Dialing Rate	9

DRS

Dialing Rate is programmable by connecting this pin to V_{DD} or V_{SS}. The rate is 20 pps when connected to V_{DD} and 10 pps when connected to V_{SS}.

Mark/Space	19

M/S

Mark/Space ratio may be selected by connecting the pin to V_{DD} or V_{SS}.

M/S Pin (19)	MARK	SPACE
V_{SS}	37%	63%
V_{DD}	34%	66%

$\overline{\text{Mute}}$	10

This N-channel open drain output is designed to drive external bipolar transistor to mute the receiver during dialing.

$\overline{\text{Dial Pulse Out}}$	16

An output drive is provided to turn on a transistor at the dial pulse rate. The normal output will be "low" during "space", and "high" otherwise.

Mode Select	17

State of this pin selects the proper dialing mode. Tone dialing is selected by connecting this pin to V_{SS}.

Hookswitch	18

$\overline{\text{HS}}$

This input detects the state of the hookswitch contact. The XR-T5990 will accept key inputs when this pin is at low state (off hook).

Single Tone Inhibit	8

$\overline{\text{STI}}$

Single tone output can be inhibited when this pin is connected to V_{SS}.

Tone Out	3

This N-channel open drain output is designed to drive external transistor.

Pacifier Tone Output	7

PT

The XR-T5990 provides a pacifier tone output to provide audio feedback to the user that a key has been depressed. The output is a 1800 Hz tone that can be capacitvely coupled into the telephone receiver.

This option is provided in dial pulse mode only.

FUNCTIONAL DESCRIPTION

Keyboard

The XR-T5990 employs a scanning technique to determine a key closure. This permits interface to DPCT keyboard with common connected to V_{SS} or SPST switch matrix connecting row to column.

A logic interface is also possible as shown in Figure 1.

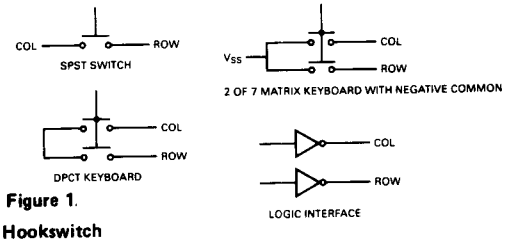


Figure 1.

Hookswitch

The XR-T5990 will enter in off hook mode when hookswitch is pulled low. This state enables the device to accept a valid key and enable the oscillator.

Mute Output

The mute output turns on (pulls to the V_{SS} supply) at the beginning of the mark, and turns off (goes to an open circuit) following the last interdigit pause. A small delay is provided to overlap mute output from the end of the last interdigit pause.

Redial

The last number dialed is retained in the memory, and therefore can be redialed out by going off hook and pressing the redial key.

Dialing will start when the key is depressed and finish after the entire number is dialed out unless an access pause is detected. If this is the case, the dialing will stop, and resume again after 3.5 seconds. During redial mode, tone will be on for 70 ms and off for 70 ms.

Normal Dialing

Normal dialing can start after going off hook, since the device is designed in a FIFO arrangement, digitas can be entered at a rate considerably faster than the output rate. Digits can be entered approximately once every 65 ms. Pauses may be entered when required in the dial sequences by pressing pause key which provides access pause for future redial.

During normal tone dialing, tone will go out at 70 ms burst. Continuance single tone can be generated by depressing two digit keys in the appropriate row or appropriate column.

CIRCUIT DESCRIPTION

The XR-T5990 is capable of generating 12 standard tones in the tone mode. Low group frequencies consist of 697, 770, 852, 941 Hz and the high group consists of three frequencies 1209, 1336, and 1477 Hz

A keyboard arranged in a row, column format is used for number entry. When a push button corresponding to a digit is pushed, one appropriate row frequency, and one appropriate column frequency are selected. The appropriate row and column frequencies in the keyboard arrangement are shown below.

Active Input	Specified Frequency
R_1	697
R_2	770
R_3	852
R_4	941
C_1	1209
C_2	1336
C_3	1477

Table 1.

C_1	C_2	C_3	
1	2	3	R_1
4	5	6	R_2
7	8	9	R_3
*	0	#	R_4

Table 2.

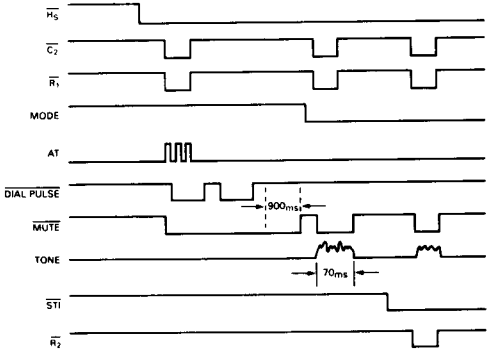


Figure 2. XR-T5990 Timing Diagram

OPERATING DESCRIPTION

Normal Dialing	Tone or Dial Pulse Output
Off Hook, D1 , D2 , ... DN	D1 D2 D3 . . . . . DN
Normal Dialing using Pause Function	
Off Hook, D1 PA D2 . . . . . DN	D1 D2 D3 . . . . . DN
Redial	
On Hook, Off Hook, RD	D1 D2 D3 . . . . . DN
Dialing will halt for 3.5 seconds when a pause is detected.	D1 3.5 sec D2 . . . . . DN
Redial and Normal Dialing Combination	
On Hook, Off Hook, RD , D18 , D19 , D20 . DN	D1 . . . D17 D18 . . . . . DN

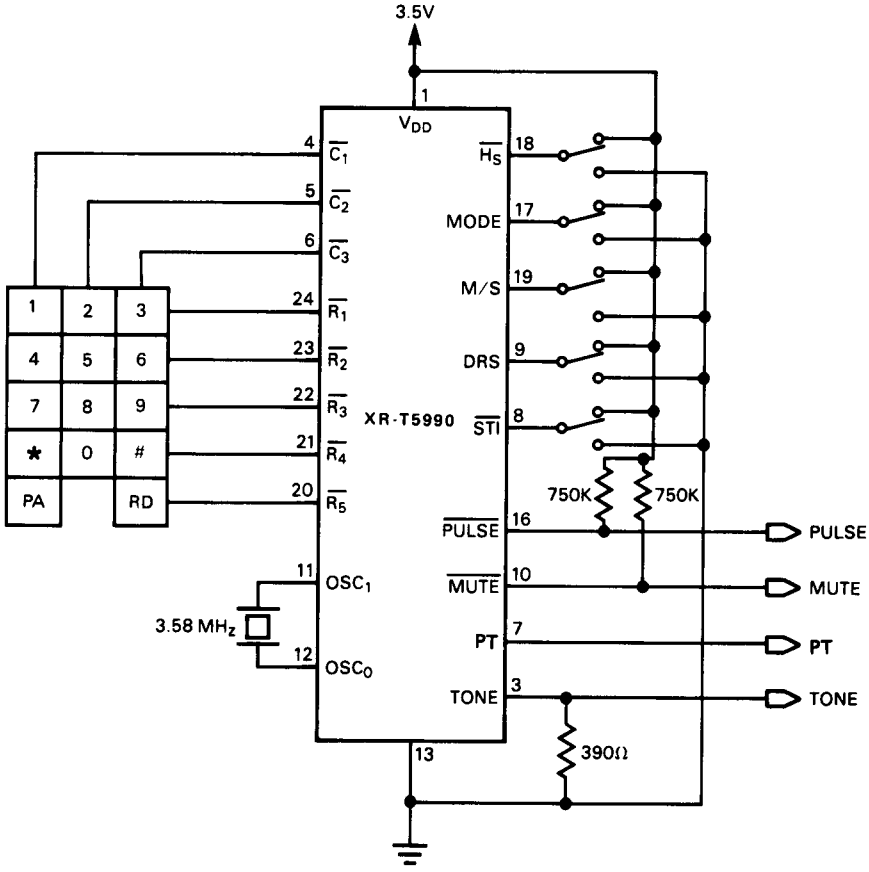


Figure 3. XR-T5990 Test Circuit

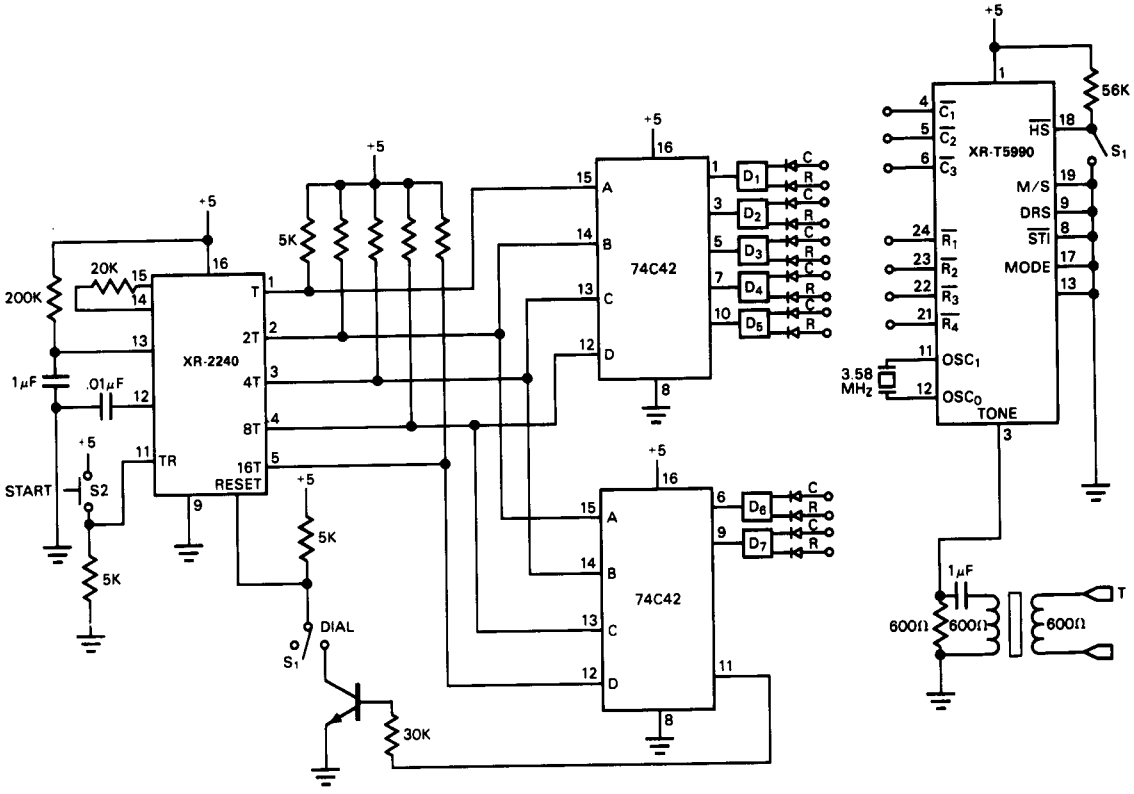
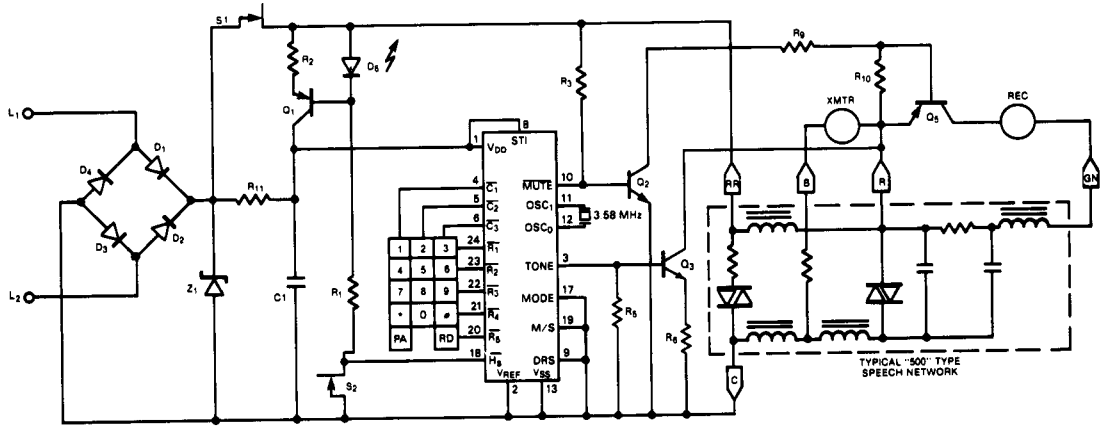
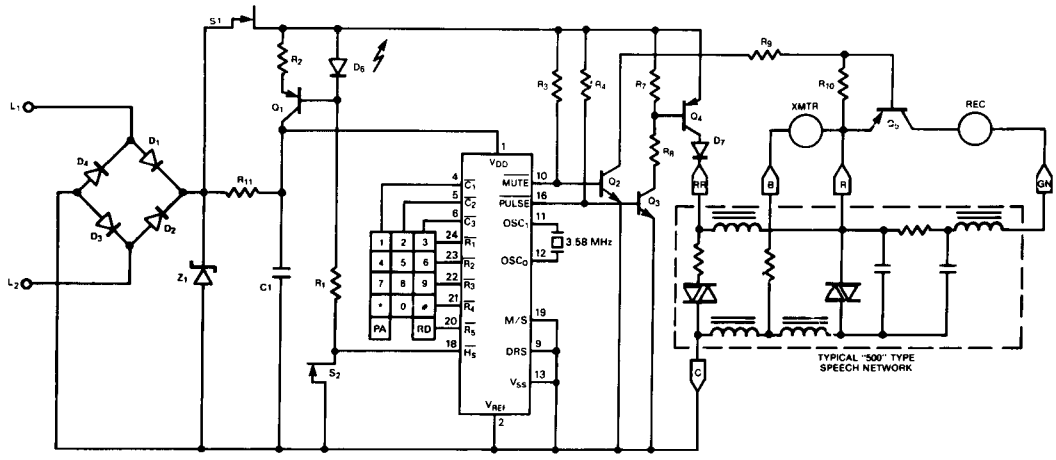


Figure 4. Typical Application Circuit for Auto Dialer Modem



R1 = 560KΩ
R2 = 14KΩ
R3 = 470KΩ
R5 = 330Ω
R6 = 120KΩ
R9 = 3KΩ
R10 = 100KΩ
R11 = 20KΩ
Q1 = 2N5401
Q2 = 2N5550
Q3 = 2N5550
Q5 = 2N5401
D1 1N4004
D2 1N4004
D3 1N4004
D4 1N4004
D5 LED
C1 68μF
S1 HOOK SWITCH
S2 HOOK SWITCH
Z1 120V 1 WATT ZENER

Figure 5. Typical Tone Dialing Application Circuit



R_1 = 560KΩ R_2 = 14KΩ R_3 = 470KΩ R_4 = 330Ω R_7 = 100KΩ R_8 = 3KΩ R_9 = 3KΩ R_{10} = 100KΩ R_{11} = 20KΩ Q_1 = 2N5401 Q_2 = 2N5550 Q_3 = 2N5550 Q_4 = 2N5401 Q_5 = 2N5401 D_1 = 1N4004 D_2 = 1N4004 D_3 = 1N4004 D_4 = 1N4004 D_6 = LED D_7 = 1N4004 C_1 = 68μF S_1 = HOOK SWITCH S_2 = HOOK SWITCH Z_1 = 120V 1 WATT ZENER

Figure 6. Typical Pulse Dialing Application Circuit

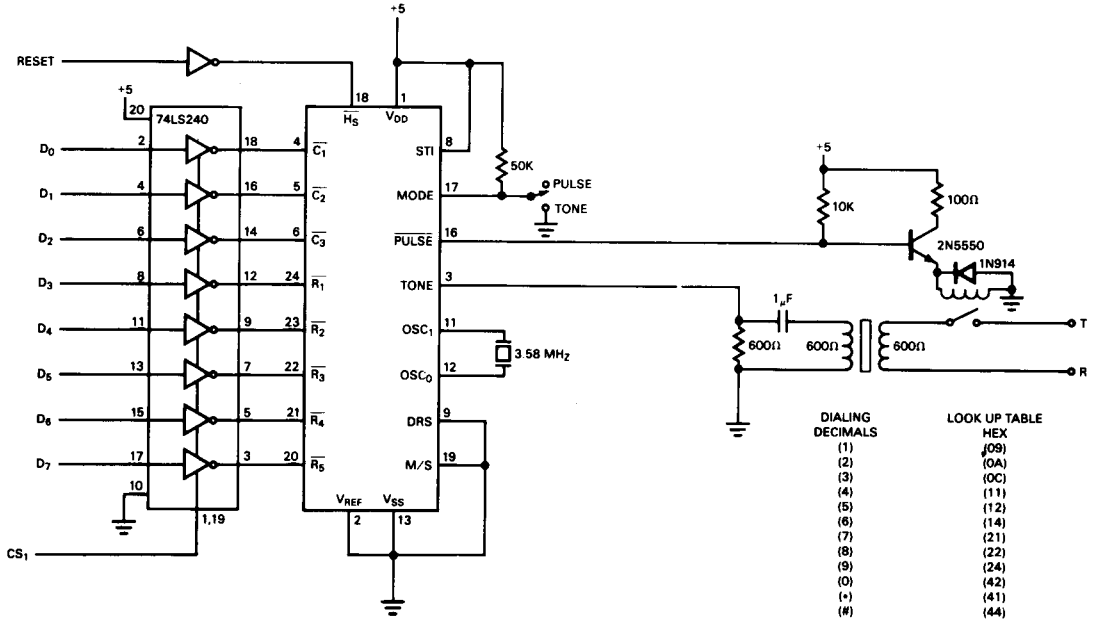


Figure 7. Typical Microprocessor Interface Circuit