Pulse Dialer

GENERAL DESCRIPTION

The XR-T5992 pulse dialer is a silicon gate CMOS integrated circuit which converts push-button inputs into pulses to simulate a rotary telephone dial.

It is designed to operate directly from the telephone line and to meet telephone specifications. A 17 digit buffer is provided for redialing feature. The XR-T5992 is available in a 18 pin package.

FEATURES

Direct Telephone Line Operation
Redial with Either a * or # Input
Pin Selectable Mark/Space and Dialing Rate
Inexpensive RC Oscillator
Interface Directly to a Standard Telephone
Push-button or Calculator Type X-Y Keyboard
Mute Driver on Chip
Pin-to-pin Compatible with MK50992

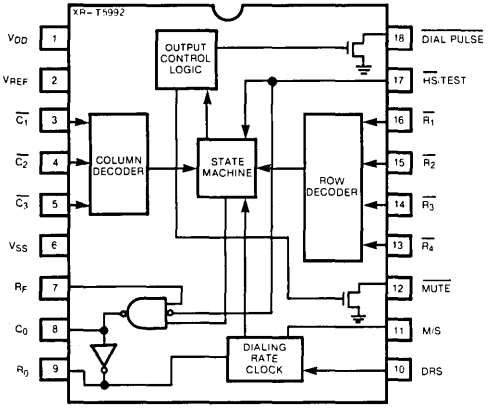
APPLICATIONS

Electronic Telephones
Smart Modems (Auto Dialer)
Security Controller

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage V^+	6.2 Volts
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-T5992CP	Plastic	0°C to 70°C
XR-T5992CN	Ceramic	0°C to 70°C

SYSTEM DESCRIPTION

The XR-T5992 Pulse Dialer is a CMOS integrated circuit that can provide recall of previously entered numbers as well as perform the normal dialing function. It is capable of receiving keys faster than dialing rate. XR-T5992 is intended as a replacement for the mechanical telephone dial and can operate directly from the telephone line. Selectable dialing rate is provided for rapid dialing.

ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNIT	CONDITIONS
DC CHARACTERISTICS: $0°C \leq T \leq 70°C$						
V_{DD}	DC Operating Voltage	2.5		6.0	V	
V_{REF}	Magnitude of ($V_{DD}-V_{REF}$)	1.5	2.5	3.5	V	I Supply = 150 μA
I_{OP}	DC Operating Current		100	150	μA	
I_{MR}	Memory Retention Current		.7	2.5	μA	
I_{ML}	Mute Sink Current	.5	2.0		mA	V_{DD} = 2.5 V, V_O = .5 V
I_{MH}	Mute Source Current	.5	2.0		mA	V_{DD} = 2.5 V, V_O = 2.0 V
I_P	Pulse Sink Current	1.0	4.0		mA	V_{DD} = 2.5 V, V_O = .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_{RU}	Keyboard Pull-up Resistance		100		KΩ	
K_{RD}	Keyboard Pull-down Resistance		4.0		KΩ	
HS_{RU}	Hookswitch Pull-up Resistance		100		KΩ	
f_{OSC}	Oscillator Frequency		4.0		KHz	
Δf_{OSC}	Oscillator Stability		±4		%	V_{DD} = 2.5 to 3.5 V
T_{DB}	Keyboard Debounce Time		10		ms	
T_{MO}	Mute Overlap Pulse		5		ms	
S_F	Keyboard Scanning Frequency		500		Hz	

PIN AND FUNCTION DESCRIPTIONS

Pin	Number
Supplies V_{DD}, V_{SS}	1, 6

Power Supply Inputs — The device is designed 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	3, 4, 5
R_1, R_2, R_3, R_4	16, 15, 14, 13

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

A logic interface is also possible as shown in Figure 2.

Oscillator and keyboard scanning starts when a key is pressed.

Oscillator	
R_f, C_O, R_O	7, 8, 9

These pins are provided to connect external resistors and capacitor to form an R-C oscillator.

Dialing Rate Select	
DRS	10

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 Select	
M/S	11

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

M/S Pin (11)	Mark	Space
V_{DD}	34%	66%
V_{SS}	40%	60%

Mute	12

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

Dial Pulse Out	18

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.

Hookswitch/Test	17

This input detects the state of the hookswitch contact. The XR-T5992 will accept key inputs when this pin is at low state (off hook).

FUNCTIONAL DESCRIPTION

V_{REF}

The V_{REF} output provides a reference voltage that tracks internal parameters of the XR-T5992. V_{REF} provides a negative voltage reference to the V_{DD} supply. Its magnitude will be approximately 0.6 volt greater than the minimum operating voltage of each particular XR-T5992. For normal use this pin is connected to V_{SS}.

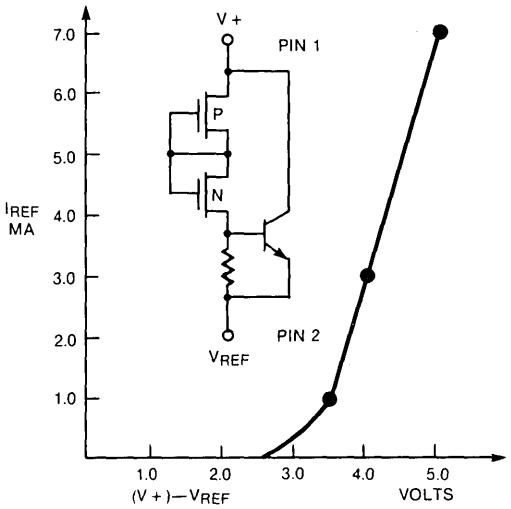


Figure 1. V_{REF} Typical I-V Characteristics

Keyboard

The XR-T5992 employs a scanning technique to determine a key closure. This permits interface to a DPCT keyboard with common connected to V_{SS} or SPST switch matrix connecting rows to columns.

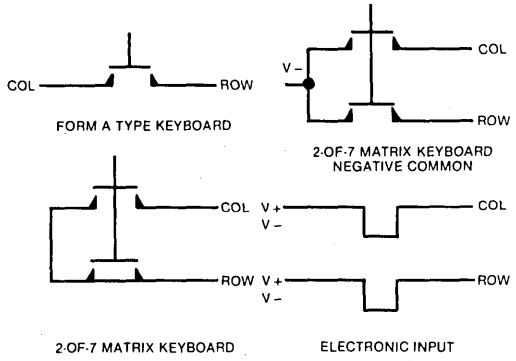


Figure 2. Keyboard Configurations

Oscillator

The device contains an oscillator circuit that requires three external components: two resistors and one capacitor. All internal timing is derived from this master timebase. For a dialing rate of 10 pps, the oscillator should be adjusted to 4000 Hz. Typical values of external components are R_f = 2MΩ, R_O = 220 KΩ, C_O = 390 pF.

The oscillator frequency can be determined by the following equation:

$$T=RC\ [\ 1.386\ +(3.5KC_S)/C\ -2(2K/(K+1))LN\ (K/1.5K+.5))]$$

where C_S is the pad capacitance on pin 7 optimum stability occurs with the ration $K = R_F/R_O$ equals 10.

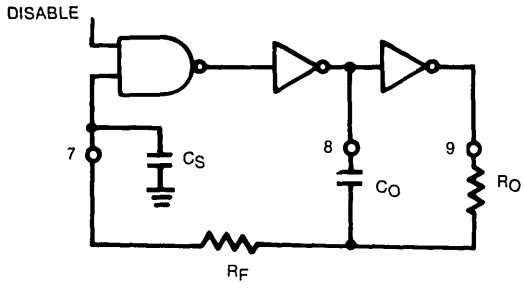


Figure 3. Oscillator Circuit

On Hook/Test

The hookswitch input of XR-T5992 has a 100 KΩ pull-up to the positive supply. A positive input or allowing the pin to float sets the circuit in its on hook, or test mode. Switching the XR-T5992 to on hook while it is outpulsing causes the remaining digits to be outpulsed at 100x the normal rate. This feature provides a means of rapidly testing the device.

$\overline{\text{Off}}$ Hook

The XR-T5992 will enter in off hook mode when hookswitch is pulled low. This state enables the device to accept a valid key and to turn the oscillator on.

$\overline{\text{Mute}}$ Output

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

$\overline{\text{Pulse}}$ Output

The pulse output is an open drain N-channel transistor designed to drive an external bipolar transistor. These transistors would normally be used to pulse the telephone line by disconnecting and connecting the network.

The XR-T5992 pulse out is an open circuit during mark and pulls to the V_{SS} during break.

Redial

The last number dialed is retained in the memory and therefore can be redialed by going off hook and pressing the * or # key. Dial pulsing will start when the key is depressed and finish after the entire number is dialed.

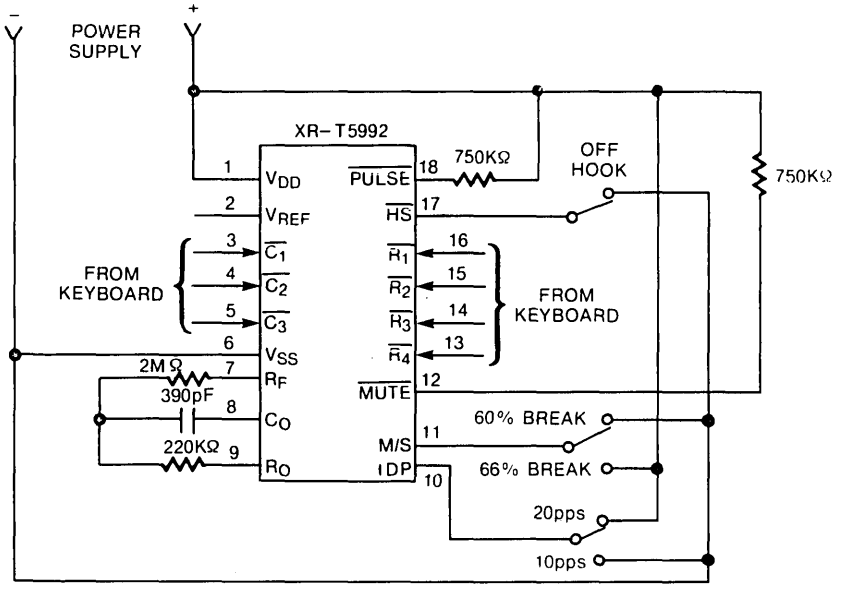


Figure 4. Test Configuration

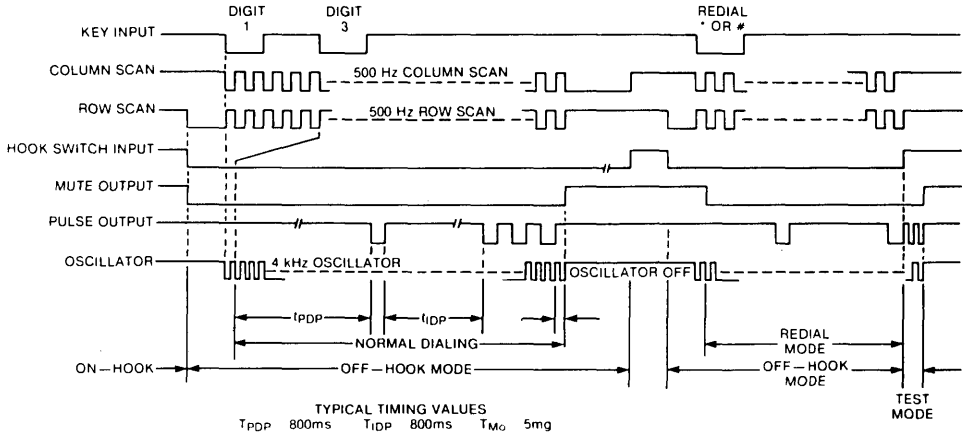
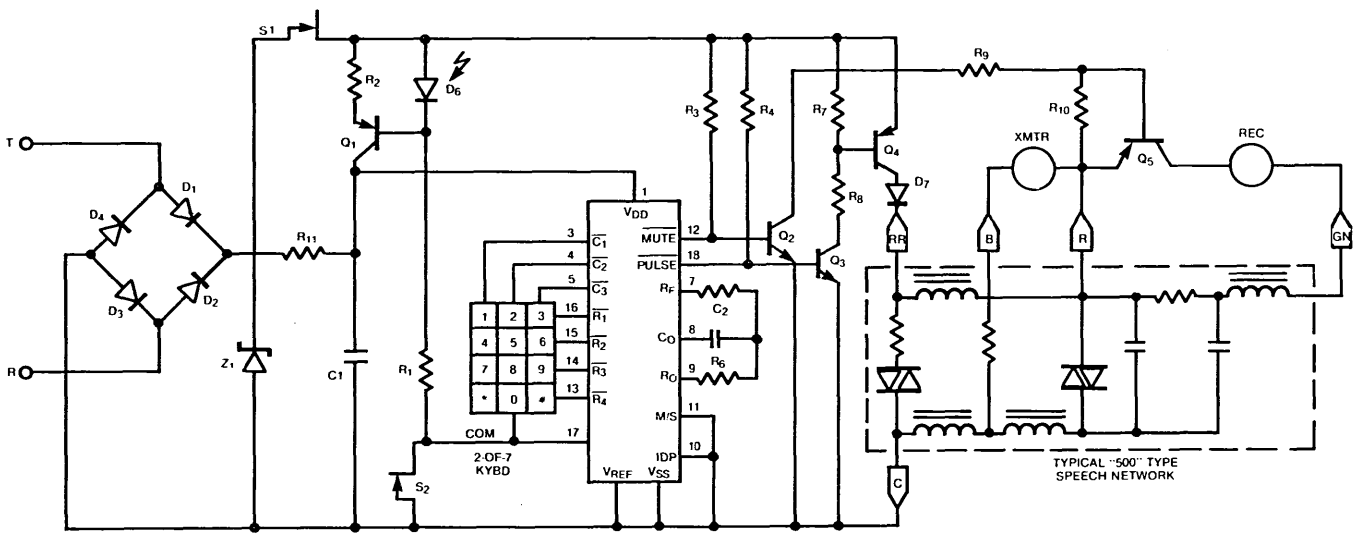


Figure 5. Timing Characteristics



R1 = 560kΩ
R2 = 1.4kΩ
R3 = 470kΩ
R4 = 330kΩ
R5 = 2MΩ
R6 = 220kΩ
R7 = 100kΩ
R8 = 3kΩ
R9 = 3kΩ
R10 = 100kΩ
R11 = 20MΩ
Q1 = 2N5401
Q2 = 2N5550
Q3 = 2N5550
Q4 = 2N5401
Q5 = 2N5401
D1 = 1N4004
D2 = 1N4004
D3 = 1N4004
D4 = 1N4004
D6 = LED
D7 = 1N4004
C1 = 68μ (Low Leakage)
C2 = 390pF
S1 = HOOK SWITCH
S2 = HOOK SWITCH
Z1 = 120-volt, 1-watt zener

Figure 6. Typical Application Schematic