

Pulse (Repertory) Dialer CMOS LSI

LR4174

T-75-07-07

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■ Description

The LR4174 is a CMOS LSI for a repertory dialer with ten 16-digit number memory storage. It generates the same pulse and mute signals as in a pulse dialer.

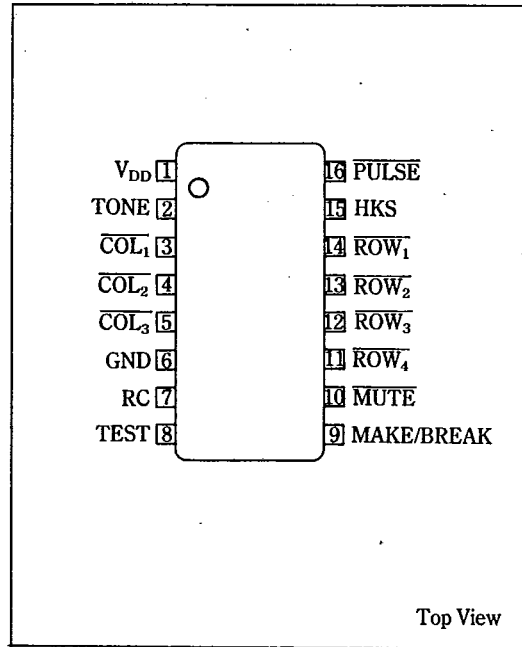
The LR4174 incorporates a 64×10 bit RAM which is used to store the ten telephone numbers. The oscillator frequency is obtained from RC composed of an external resistor and capacitor.

When used in a Public Branch Exchange (PBX) System, a pause function is provided. This function suspends dial pulse output upon pause detection (Via # key input), and resumes the output after one of the numeric keys is pressed.

■ Features

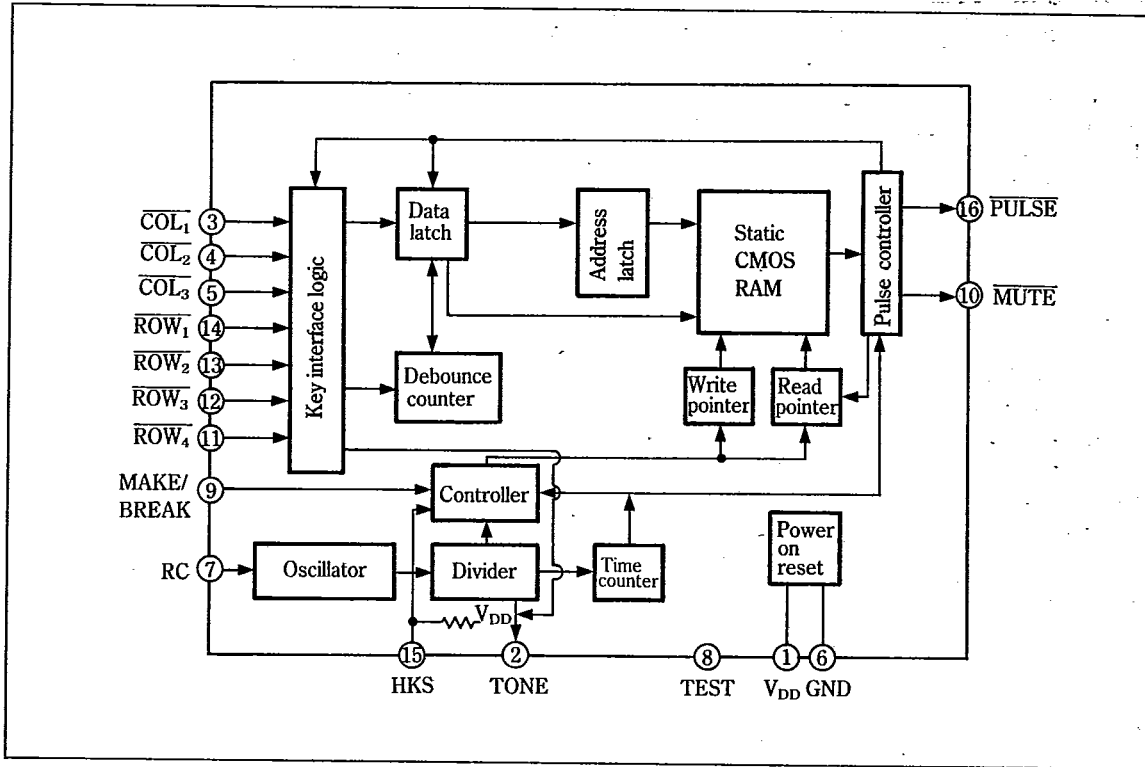
1. Make ratio: 32/40% pin-selectable
2. Pulse output: "0" true
3. Mute output: "0" true
4. Stores ten 16-digit telephone numbers
5. One temporary memory and permanent memory storage of telephone numbers are possible
6. Key tone output
7. Uses a CR oscillator as a frequency reference
8. Line operation Off-Hook, battery operation On-Hook
9. Uses either a standard 2-of-7 matrix keyboard or a single contact keyboard
10. PBX pause storage
11. 16-pin dual-in-line-package

■ Pin Connections



Block Diagram

T-75-07-07



4

Pin Functions

Pin name	I/O	Function
V _{DD}	I	Power supply
GND	I	Power supply
TONE	O	Tone signal output
COL ₁ -COL ₃	I	Key input
ROW ₁ -ROW ₄	I	Key input
RC	I	Oscillator circuit
MAKE/BREAK	I	Make/Break select
MUTE	O	Mute output
HKS	I	Hook switch input
PULSE	O	Pulse output
TEST	I	Test input

T-75-07-07

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit	Note
Supply voltage	V_{DD}	6.2	V	1
Maximum pin voltage (1)	V_{IN1}	-0.3	V	2
Maximum pin voltage (2)	V_{IN2}	+0.3	V	3
Maximum power dissipation	P_D	500	mW	4
Operating temperature	T_{opr}	-30 to +60	°C	
Storage temperature	t_{stg}	-55 to +150	°C	

Note 1 : Referenced to GND.

Note 2 : The maximum applicable voltage on any pin with respect to GND.

Note 3 : The maximum applicable voltage on any pin with respect to V_{DD} .Note 4 : $T_a=25^{\circ}\text{C}$.

DC Characteristics

(-30°C ≤ T_a ≤ 60°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Supply voltage	V_{DD}		2.5		6.0	V	
Standby current	I_{SB}	$V_{DD}=2.5\text{V}$		1.0	5.0	μA	1
Operating current	I_{OP}	$V_{DD}=2.5\text{V}$		100	200	μA	2
MUTE sink current	I_{ML}	$V_{DD}=2.0\text{V}, V_O=0.5\text{V}$	0.5	2.0		mA	
PULSE sink current	I_{PL}	$V_{DD}=2.0\text{V}, V_O=0.5\text{V}$	1.0	4.0		mA	
MUTE, PULSE leakage current	I_{LKG}	$V_{DD}=6.0\text{V}, V_O=6.0\text{V}$		0.001	0.1	μA	
Key contact resistance	RK_i				1.0	kΩ	
Keyboard capacitance	CK_i				30	pF	
"0" logic level	V_{IL}		GND		0.2 V_{DD}	V	
"1" logic level	V_{IH}		0.8 V_{DD}		V_{DD}	V	
Key pull-up resistance	R_{KU}	$V_{DD}=4.0\text{V}$		200		kΩ	3
Key pull-down resistance	R_{KD}	$V_{DD}=4.0\text{V}$		10		kΩ	3
HKS pull-up resistance	R_{HU}	$V_{DD}=4.0\text{V}$		60		kΩ	
Tone output source current	I_{TH}	$V_{DD}=2.0\text{V}, V_O=1.5\text{V}$		2		mA	
Tone output sink current	I_{TL}	$V_{DD}=2.0\text{V}, V_O=0.5\text{V}$		2		mA	
Memory retention voltage	V_{DD}		2.0		6.0	V	

Note 1 : All output pins in no-load condition when clock is stopped and when on hook.

Note 2 : All output pins in no-load condition during key input, in either On-Hook or Off-Hook mode.

Note 3 : Resistance when ROW pin or COL pin is 125Hz and is scanned at high or low level.

AC Characteristics

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Note
Oscillator frequency	f_{OSC}		8.0		kHz	1
Keyboard debounce time	t_{DB}		32		ms	2, 3
Oscillator start-up time	t_{OS}			8.0	ms	
Pulse rate	P_R		10.0		pps	3
Break Time	Pin 9 tied to V_{DD}	t_B	60		ms	3
	Pin 9 tied to GND	t_B	68		ms	3
Inter-digital pause time	t_{IDP}		800		ms	3
Mute overlap time	t_{MOL}		2		ms	3
Tone frequency	f_{TN}		1.0		kHz	3

Note 1 : Ceramic oscillator should have the following equivalent values:

 $R=270\text{k}\Omega, C=390\text{pF}$.

Note 2 : A key entry must be present after 32ms to be valid (oscillator on).

Note 3 : Varies according to the oscillator frequency.

SHARP

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T-75-07-07

Pin Description

V_{DD} (Pin 1)

Pin 1 is the positive power supply pin with respect to the GND pin. Maximum input voltage is 6.0 volts.

Tone Signal Output (Pin 2)

The tone signal output pin is a CMOS complementary output and drive an external bipolar transistor. This pin generates a tone signal when a key is depressed as its recognition. Tone signal frequency is 1kHz (TYP.).

Keyboard Inputs (Pins 3, 4, 5, 11, 12, 13, 14)

The key entry is defined by either a single ROW being connected to a single COLUMN, or GND level being simultaneously applied to both a ROW and a COLUMN. Consequently, either a single contact or a standard 2-of-7 keyboard with GND common can be used. Fig. 1 shows the possible keyboard configurations.

The LR4174 keyboard input pins are totally static until a valid key input is sensed. The oscillator is then enabled and the ROW and COLUMN are alternately scanned (pulled high, then low) to verify that the input is valid. Keyboard bounce is ignored for 32ms after the initial key down is detected. A key input is accepted if it is valid after this initial debounce time. This scheme allows any valid key input to be recognized within 40ms of the initial key closure.

GND (Pin 6)

Negative power supply pin.

Oscillator (Pin 7)

An RC oscillator circuit is formed by connecting

a resistor between pin 7 and V_{DD} (pin 1), and a capacitor between pin 7 and GND (pin 6).

Make/Break Select (Pin 9)

The Make/Break ratio may be selected by connecting this pin to either the V_{DD} or GND. Table 1 indicates the two popular ratios from which the user can choose.

Table 1

Level of Pin 9	MAKE	BREAK
V_{DD} (Pin 1)	40%	60%
GND (Pin 6)	32%	68%

Mute Output (Pin 10)

Pin 10 is the output of an open-drain N-channel transistor. It provides the logic necessary to mute the network while the telephone line is being pulsed.

Hook Switch Input (Pin 15)

The Hook Switch input pin requires an external pull-up resistor to the positive supply. A V_{DD} input puts the circuit into On-Hook mode, while a GND input puts it into Off-Hook or dialing mode.

Pulse Output (Pin 16)

The Pulse Output pin is an N-channel open-drain output for driving an external transistor. This external transistor is used to switch the loop current in a telephone line.

Test (Pin 8)

By connecting Test pin to GND, a high speed pulse signal is generated. However, the test pin should be kept open for normal use.

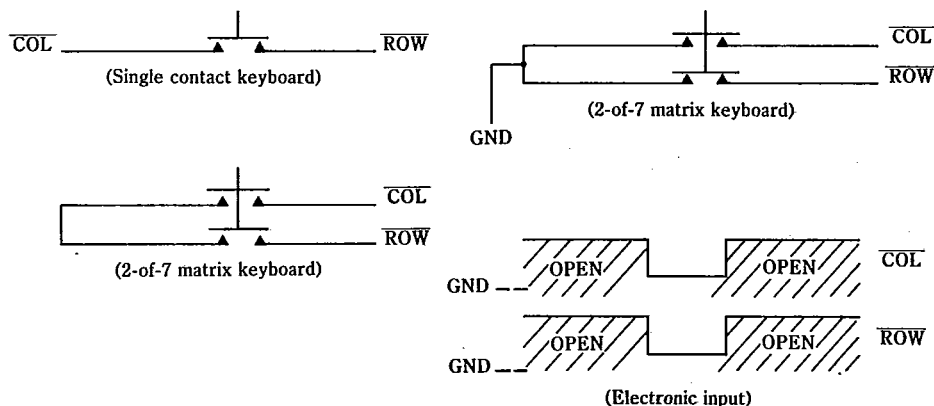


Fig. 1 Keyboard configurations

■ Functional Description

Dialed Number Memory

During normal dialing, each digit is stored in the LND (Last Number Dialed) Buffer, location 0. The telephone number dialed can be left in this temporary LND buffer for later use or it can be copied into any of the other nine permanent memory locations.

Telephone numbers to be automatically dialed by the LR4174 may be entered into the LND buffer while either On-Hook or Off-Hook.

However, the LR4174 must be in On-Hook mode for a number to be copied into a permanent memory location. A number may be copied and stored by entering the key sequence $\boxed{*} \boxed{*} \boxed{N}$ (N=1-9), followed by the address (1-9) of the memory location into which the number is to be stored. This operation requires 300ms before going Off-Hook or reinitiating the store function. Information present in the LND buffer is replaced when new data is entered and cannot be recalled.

Automatic Dialing

The automatic dialing function is implemented by going Off-Hook and entering a $\boxed{*} \boxed{N}$ (N=1-9), followed by the address (1-9) of the desired telephone number. Dialing will begin with the valid entry of the address key and can be interrupted by initiating a new redial command. The LND buffer will contain the information last entered. A key sequence of $\boxed{*} \boxed{0}$ will cause the last number entered to be redialed.

Normal dialing is performed when telephone numbers are input in the Off-Hook mode.

Pause/Continue Command

The LR4174 has a feature which allows an indefinite pause to be programmed into the first 15 digits of a number sequence by entering a # key at the point in the sequence where a pause is desired.

When the number is automatically dialed, the circuit will stop dialing when the pause is encountered. Any key entry after the inter-digital pause (except * key) will cause the LR4174 to continue dialing the remainder of the number. If more than one pause was originally programmed into the number sequence, a corresponding number of continue commands must be made in order for the number to be completely dialed.

Normal dialing

When dialing normally, the key entry rate may exceed the dialing rate. The memory has a FIFO (first-in-first-out) architecture and any length number sequence up to 16 digits may be dialed.

■ Sample Operations

(Example 1)

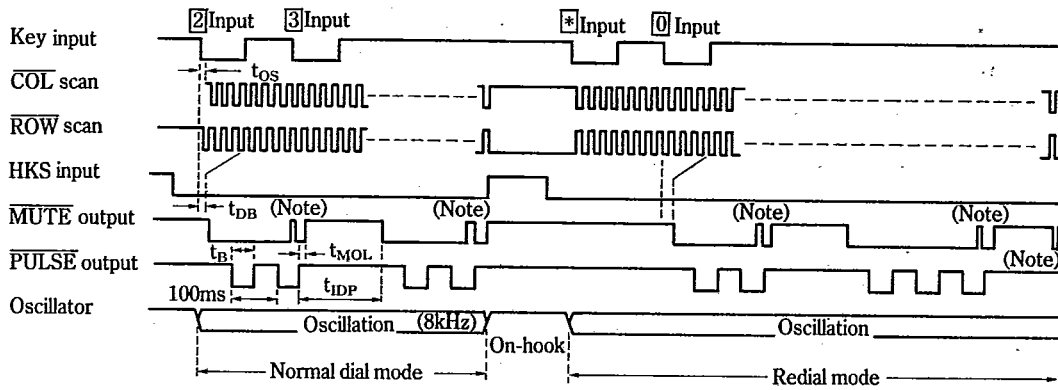
1. On-Hook
2. Input "621-1221" "621-1221" is written into the memory buffer
3. Input "* *5" "621-1221" is stored in location 5.
4. Off-Hook
5. Input "* *5" "621-1221 is automatically dialed.

(Example 2)

1. Off-Hook
2. Input PBX access code "42" "42" is written into memory and dialed.
3. While waiting for dial tone, enter "#" "#" is written into memory.
4. Dial "1-234-621-1221" The number is written into memory and dialed.
5. On-Hook.
6. Input "* *3" "42 #1-234-621-1221" is transmitted to location 3.
7. Off-Hook
8. Input "* *3" "42" is dialed, then a pause occurs.
9. Enter "3" (Continue Command) while waiting for a dial tone. "1-234-621-1221" is dialed.

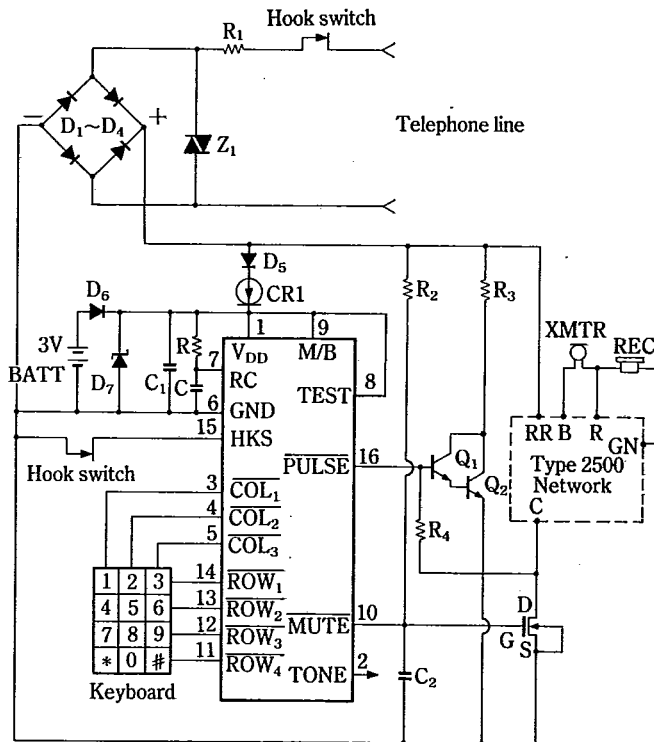
Timing Diagram

T-75-07-07



Note 1: MUTE output is delimited with a 250 μ sec end pulse.
PULSE output is delimited with a 2msec end pulse.

System Configuration Example



- Z₁=10DK820 (Panasonic)
- R₁=22 Ω , 1W
- R₂=1M Ω
- R₃=150 Ω
- R₄=270k Ω
- R=270k Ω
- C=390pF
- C₁=10 μ F
- C₂=0.01 μ F
- D₁-D₄=IN4004
- D₅=IN270
- D₆=IN270
- D₇=IN752 (5.6V)
- CR₁=J500 (Siliconix)
- Q₁=2N5550
- Q₂=2N5550