NTE1731
Integrated Circuit
CMOS 10 Number Pulse Dialer

Description:

The NTE1731 is a CMOS LSI repertory dialer with ten 16–digit number memory storage in a 16–Lead DIP type package. The pulse and mute signal outputs resulting from keyboard input are like those of a pulse dialer. The NTE1731 incorporates a 64 x 10 bit RAM which is used to store the ten telephone numbers.

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:

- Make Ratio: 30/40% Pin Selectable
- Pulse Output: "0" True
- Mute Output: "0" True
- Stores Ten 16–digit Telephone Numbers
- One Temporary Memory and Permanent Memory Storage of Telephone Numbers are Possible
- Uses a CR Oscillator as a Frequency Reference
- Line Operation Off–Hook, Battery Operation On–Hook
- Uses Either a Standard 2–of–7 Matrix Keyboard or a Single Contact Keyboard
- PBX Pause Storage

Absolute Maximum Ratings:

Supply Voltage (Note 1), V_{DD} 6.2V
Power Dissipation (Note 2), P_D 500mW
Maximum Pin Voltage 1 (Note 3), V_{in1} . . . . –0.3V
Maximum Pin Voltage 2 (Note 4), V_{in2} . . . . +0.3V
Operating Temperature Range, T_{opr} . . . . –30° to +50°C
Storage Temperature Range, T_{stg} . . . . –55° to +150°C

Note 1. Referenced to GND
Note 2. T_A = +25°C
Note 3. The Maximum applicable voltage on any pin with respect to GND
Note 4. The maximum applicable voltage on any pin with respect to V_{DD}

Recommended Operating Conditions:

Supply Voltage, V_{DD} . . . . 2.6V to 6.0V

DC Characteristics: (–30°C ◻ T_A ◻ =60°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Standby Current	I_{SB}	V_{DD} = 2.5V, Note 5	–	1.0	5.0	μA
Operating Current	I_{OP}	V_{DD} = 2.5V, Note 6	–	100	200	μA
$\overline{MUTE}$ Sink Current	I_{ML}	V_{DD} = 2.5V, V_O = 0.5V	0.5	2.0	–	mA
Pulse Sink Current	I_{PL}	V_{DD} = 2.5V, V_O = 0.5V	1.0	4.0	–	mA
$\overline{MUTE}$ Pulse Leakage Current	I_{LKG}	V_{DD} = 6V, V_O = 6V	–	0.001	1.0	μA
Key Contact Resistance	RK_1		–	–	1.0	kΩ
Keyboard Capacitance	CK_1		–	–	3.0	pF
"0" Logic Level	V_{IL}		GND	–	$0.2V_{DD}$	V
"1" Logic Level	V_{IN}		$0.8V_{DD}$	–	V_{DD}	V
Key Pull–Up Resistance	K_{RU}	V_{DD} = 4V, Note 7	–	100	–	kΩ
Key Pull–Down Resistance	K_{RD}	V_{DD} = 4V, Note 7	–	5.0	–	kΩ

Note 5. All output pins in no–load condition when clock is stopped in Off–Hook mode.
Note 6. All output pins in no–load condition during key input, in either On–Hook or Off–Hook Mode.
Note 7. Resistance when $\overline{ROW}$ and $\overline{COL}$ pins are scanned at 125Hz and at high or low level.

AC Characteristics:

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Oscillator Frequency	f_{OSC}	Note 8	–	480	–	kHz
Key Debounce Time	t_{DB}	Note 9, Note 10	–	32	–	ms
Oscillator Start–Up Time	t_{OS}		–	–	8.0	ms
Pulse Rate	P_R	Note 10	–	10	–	pps
Break Time	t_B	Pin9 = V_{DD}, Note 10	–	60	–	ms
		Pin9 = GND, Note 10	–	68	–	ms
Inter–Digital Pause Time	t_{IDP}	Note 10	–	840	–	ms
Mute Overlap Time	t_{MOL}	Note 10	–	2	–	ms

Note 8. Use elements with the following characteristics as the ceramic oscillator:
     $R < 20\Omega$, $R_A \geq 70K\Omega$, $C_O \leq 500pF$.
Note 9. Key input is accepted if it is valid 32msec after the start of oscillation.
Note 10. Changes in proportion to the frequency of the oscillator.

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 NTE1731 may be entered into the LND buffer while either On–Hook or Off–Hook.

Dialed Number Memory (Cont'd)
However, the NTE1731 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 ✱ ✱ N

(N = 1 to 9), followed by the address (1 to 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 �□*□ □N□ (N = 1 to 9), followed by the address (1 to 9) of the desired telephone number. Dialing will begin with the valid entry of the address dey, and can be interrupted by initiating a new radial command. The LND buffer will contain the information last entered. A key sequence of �□*□ □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 NTE1731 permits pauses to be programmed within the 1 to 15 digits of the telephone number. This pause is input and stored in memory with the # key. If a pause code is detected during automatic dialing, the dialing operation is suspended. Any key except the ∗ key is used to dial in data after the pause, once the inter digital–pause time passes (CONTINUE command).

Normal dialing

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

Sample Operation:

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)   "1–234–621–1221" is dialed.
   while waiting for a dial tone.

Pin Description

V_{DD} (Pin1)

Pin1 is the positive power supply pin with respect to the GND pin. Maximum input voltage is 6.0 Volts

Test Input (Pin2)

Pin2 is for testing the device. It should be connected to GND.

Keyboard Inputs (Pin3, Pin4, Pin5, Pin11, Pin12, Pin13, and Pin14)

The key entry is defined by either a single $\overline{ROW}$ being connected to a single $\overline{COLUMN}$, or GND level being simultaneously applied to both a $\overline{ROW}$ and a $\overline{COLUMN}$. Consequently,either a single contact or a standard 2–of–7 keyboard with GND common can be used.

Keyboard Inputs (Pin3, Pin4, Pin5, Pin11, Pin12, Pin13, and Pin14) (Cont'd)

The NTE1731 keyboard input pins are totally static until a valid key input is sensed. The oscillator is then enabled and the rows and columns 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 (Pin6)

Negative power supply pin.

Oscillator (Pins7 and Pin8)

The oscillator is formed by using a 480kHz ceramic resonator and two capacitors.

Make/Break Select (Pin9)

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

Table 1

Level of Pin9	Make	Break
V_{DD} (Pin1)	40%	60%
GND (Pin6)	32%	68%

$\overline{\text{Mute}}$ Output (Pin10)

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 pulled.

Hook Switch Input (Pin15)

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 inputs puts it into OFF–Hook or dialing mode.

$\overline{\text{Pulse}}$ Output (Pin16)

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

Pin Connection Diagram

V_{DD}	1	16 Pulse Output
Test	2	15 Hook Switch
Column Input	3	14 Row Input
Column Input	4	13 Row Input
Column Input	5	12 Row Input
GND	6	11 Row Input
OSC Input	7	10 Mute Output
OSC Output	8	9 Make/Break Select

16　　　　　　　　　　　　　　　　9

1　　　　　　　　　　　　　　　　8

.260
(6.6)
Max

.785 (19.9) Max

.200
5.08)
Max

.300 (7.62)

.245
(6.22)
Min

.100 (2.54)

.700 (17.7)