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92D 00352 D T-75-07-07



# UM91603C

## 3 Memory Pulse Dialer

### Features

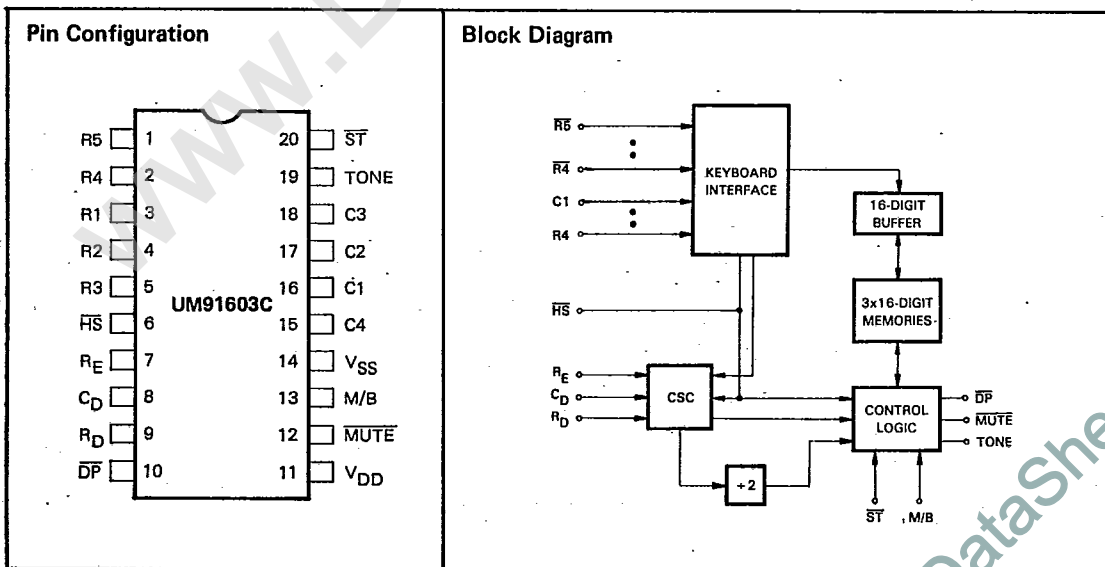
- Three 16-digit memories (direct dialing) plus a 16-digit last number redial memory
- Low voltage CMOS process for direct operation from telephone line
- Inexpensive RC oscillator design with accuracy better than  $\pm 5\%$  over temperature and unit-unit variations
- Independent select for make/break ratio ( $33\frac{1}{3}/66\frac{2}{3}$  or 40-60)
- Interfaces with inexpensive XY matrix keyboard
- Output pulse dial rate 10 pps with interdigit pause 800 ms
- Independent select input for storage mode
- 3.2-second access pause feature
- Pacifier tone output for valid key input
- \* and # keys available in high speed master mode

### General Description

The UM91603C pulse dialer is a monolithic CMOS integrated circuit which converts pushbutton inputs into a series of pulses suitable for telephone dialing. The UM91603C has three 16-digit memories which provide one-touch dialing operation, a great convenience for telephone dialing. Also, the UM91603C protects the memories from improper keyboard operation with a

storage switch (ST).

CMOS technology is used to produce this device, resulting in very low power consumption, high noise immunity, and easy interface to a variety of telephones and requires few external components.



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**Absolute Maximum Ratings\***

|   |       |   |
|---|-------|---|
| Supply Voltage                          | ..... | -0.3V to +4.0V                                |
| Operating Temperature Range Under Bias  |       |   |
| (T <sub>OP</sub> )                      | ..... | -10°C to +60°C                                |
| Storage Temperature (T <sub>STG</sub> ) | ..... | -55°C to +125°C                               |
| Applied Voltage on Any Pin              |       |   |
| (V <sub>IN</sub> )                      | ..... | V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3V |

**\*Comments**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

**Electrical Characteristics**

(Specifications apply over the operating temperature range, and V<sub>SS</sub> = 0V and 2.0V ≤ V<sub>DD</sub> ≤ 3.5V, unless otherwise specified.)

| Parameter   | Symbol                          | Min.                | Typ. | Max.                  | Units | Conditions   |
|---|---------------------------------|---------------------|------|-----------------------|-------|--|
| <b>OPERATING VOLTAGE</b>  |                                 |                     |      |                       |       |  |
| Data Retention  | V <sub>DD</sub>                 | 1.0                 |      |                       | V     | On Hook (HS = V <sub>DD</sub> )  |
| Nondialing  | V <sub>DD</sub>                 | 1.5                 |      | 3.5                   | V     | Off Hook, Oscillator not running   |
| Dialing   | V <sub>DD</sub>                 | 2.0                 |      | 3.5                   | V     | Off Hook, Oscillator running   |
| <b>OPERATING CURRENT</b>  |                                 |                     |      |                       |       |  |
| Data Retention  | I <sub>DD</sub>                 |                     |      | 200                   | nA    | On Hook V <sub>DD</sub> = 1.0V @ 25°C                                      |
|   | I <sub>DD</sub>                 |                     |      | 750                   | nA    | On Hook V <sub>DD</sub> = 1.0V @ 40°C                                      |
| Nondialing  | I <sub>DD</sub>                 |                     |      | 10                    | μA    | Off Hook V <sub>DD</sub> = 1.5V Oscillator not running, outputs not loaded |
| Dialing   | I <sub>DD</sub>                 |                     |      | 500                   | μA    | Off Hook V <sub>DD</sub> = 3.5V Oscillator running, outputs not loaded     |
| <b>OUTPUT CURRENT</b>   |                                 |                     |      |                       |       |  |
| DP Sink Current   | I <sub>OLDP</sub>               | 125                 |      |                       | μA    | V <sub>DD</sub> = 3.5V, V <sub>OUT</sub> = 0.5V                            |
| DP Source Current   | I <sub>OHDP</sub>               | 20                  |      |                       | μA    | V <sub>DD</sub> = 1.5V, V <sub>OUT</sub> = 1.0V                            |
|   | I <sub>OHDP</sub>               | 125                 |      |                       | μA    | V <sub>DD</sub> = 3.5V, V <sub>OUT</sub> = 2.5V                            |
| MUTE Sink Current   | I <sub>OLM</sub>                | 125                 |      |                       | μA    | V <sub>DD</sub> = 3.5V, V <sub>OUT</sub> = 0.5V                            |
| MUTE Source Current   | I <sub>OHM</sub>                | 20                  |      |                       | μA    | V <sub>DD</sub> = 1.5V, V <sub>OUT</sub> = 1.0V                            |
|   | I <sub>OHM</sub>                | 125                 |      |                       | μA    | V <sub>DD</sub> = 3.5V, V <sub>OUT</sub> = 2.5V                            |
| TONE Drive Current  | T <sub>OHT</sub>                | 250                 |      |                       | μA    | V <sub>DD</sub> = 2.0V, V <sub>OUT</sub> = 1.5V                            |
| Input High Voltage  | V <sub>IH</sub>                 | 80% V <sub>DD</sub> |      | V <sub>DD</sub> + 0.3 | V     |  |
| Input Low Voltage   | V <sub>IL</sub>                 | -0.3                |      | 20% V <sub>DD</sub>   | V     |  |
| Oscillator Frequency (F <sub>0</sub> ) Stability vs. Supply Voltage | Δf <sub>0</sub> /f <sub>0</sub> | -4                  |      | +4                    | %     | V <sub>DD</sub> = 2.0V to V <sub>DD</sub> = 2.75V                          |
|   | Δf <sub>0</sub> /f <sub>0</sub> | -4                  |      | +4                    | %     | V <sub>DD</sub> = 2.75V to V <sub>DD</sub> = 3.5V                          |

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**UM91603C**

**Pin Description**

**Keyboard (R1, R2, R3, R4, R5, C1, C2, C3, C4)**

These pins can be interfaced to an XY matrix keyboard. Each row input has a pull-up resistor. When any key is depressed, scanning signals will be presented at the 4 column outputs. Debouncing is provided to avoid false entry (typ.: 16.7ms).

**Make/Break (M/B)**

This input provides the selection of the Make/Break ratio (33.3:66.7/40:60) when M/B connects to  $V_{SS}/V_{DD}$ . In addition to the normal M/B ratio control function, this pin provides a high speed master mode function which enables fast dial pulse output to drive a UM9160 Slave Pulse/Tone Dialer (see next page).

**Dial Pulse Out (DP)**

Output drive is provided to turn on a transistor at the dial pulse rate. The normal putput will be "low" during "break" and "high" during "make."

**Mute Out (MUTE)**

A negative going low pulse is available to turn off an external transistor to mute the receiver during dial pulsing.

**Dial Rate Oscillator ( $R_E, C_D, R_D$ )**

These pins are provided to connect external resistors  $R_E$  and  $R_D$  and Capacitor  $C_D$  to form an RC oscillator that generates the time base for this chip. (The recommended value of RC components are  $R_E = 1.5 M\Omega$ ,  $R_D = 470 K\Omega$ ,  $C_D = 330 pF$ ,  $F_0 = 2.4 KHz$ )

**Store Switch (ST)**

This input consists of a pull-up resistor. When this input is switched to the  $V_{SS}$ , the chip will go into storage mode. When this input is floating or connected to  $V_{DD}$ , the 91603C will stay in dialing mode unless the ST key is depressed.

**Pacifier Tone (TONE)**

This pin provides a direct piezo drive capability to produce a  $1/2 f_0$  frequency tone output when a valid key/press is detected.

**Hook Switch (HK)**

This input detects the state of the hook switch contact. "Off Hook" corresponds to the  $V_{SS}$  condition.

**Power ( $V_{DD}, V_{SS}$ )**

These are the power supply inputs. This device is designed to operate at 2.0 to 3.5 volts.

**Keyboard Definition**

**NORMAL MODE**

|                |   |   |   |                |
|----------------|---|---|---|----------------|
| R <sub>1</sub> | 1 | 2 | 3 | E <sub>1</sub> |
| R <sub>2</sub> | 4 | 5 | 6 | E <sub>2</sub> |
| R <sub>3</sub> | 7 | 8 | 9 | E <sub>3</sub> |
| R <sub>4</sub> | P | 0 | R | ST             |

C<sub>1</sub> C<sub>2</sub> C<sub>3</sub> C<sub>4</sub>

**HIGH-SPEED MASTER MODE**

|                |   |   |   |                |
|----------------|---|---|---|----------------|
| R <sub>1</sub> | 1 | 2 | 3 | E <sub>1</sub> |
| R <sub>2</sub> | 4 | 5 | 6 | E <sub>2</sub> |
| R <sub>3</sub> | 7 | 8 | 9 | E <sub>3</sub> |
| R <sub>4</sub> | * | 0 | # | ST             |
| R <sub>5</sub> | P | 0 | R | ST             |

C<sub>1</sub> C<sub>2</sub> C<sub>3</sub> C<sub>4</sub>

R: Redial  
ST: Store  
P: Automatic access pause

E<sub>1</sub>/E<sub>2</sub>/E<sub>3</sub>: Repertory direct access dialing key

**HIGH-SPEED MASTER MODE**

The UM91603C provides a High-speed Master Mode (PDR = 300 pps, IDP = 6.7 ms) which signals a UM9160 Slave Pulse/Tone Dialer. In this mode of operation, \* and # signals are available.

The M/B pin is used for triggering the UM91603C into the High-speed master Mode by applying a high to low transition when HS is low. The UM91603C will stay in the High-speed Master Mode until "On Hook."

The operation is the same as in normal mode except that the speed is faster (PDR = 300 pps, IDP = 6.7 ms). Another difference is that the Pause key signals a 13 pulse train to provide an acceptable input code for the UM9160 Slave Pulse/Tone Dialer.

Slave Pulse Dialer



**Operating Characteristics**

**Normal Dialing**

OFF Hook,  $[D1] \dots [Dn]$ ;  $n \leq 16$  (See Note) Dial pulsing starts as soon as first digit is entered (debounced and detected on chip). Pause may be entered in the dialing sequence by pressing the "P" key and can be recognized as one digit in redial memory. Pause access time is 3.2 seconds. The digit that is entered after the "P" key will be sent out after a 3.2-second delay.

Note: Digits which are entered after the 16th digit are ignored unless the first 16-digit dialing sequence is complete. The buffer memories are cleared when the 17th digit is entered and restored beginning with the 17th digit.

**Redialing**

OFF HOOK, [R]  
Last number dialed (in normal dialing) can be redialed by pressing the "R" key.

**Repertory Dialing**

OFF HOOK,  $[E1], [EJ], [EK]$ ;  $J, K \in \{1, 2, 3\}$   
The telephone numbers that are stored in the repertory dialing memories can be directly dialed out by pressing the  $[E1], [E2]$  or  $[E3]$  keys. Any second key/press will be ignored unless the first dialing sequence is complete.

**Normal Dialing + Repertory Dialing**

OFF HOOK,  $[D1] \dots [Dn], [E1] \dots$   
Wait for normal dialing to complete before pressing the "[E1]" key.

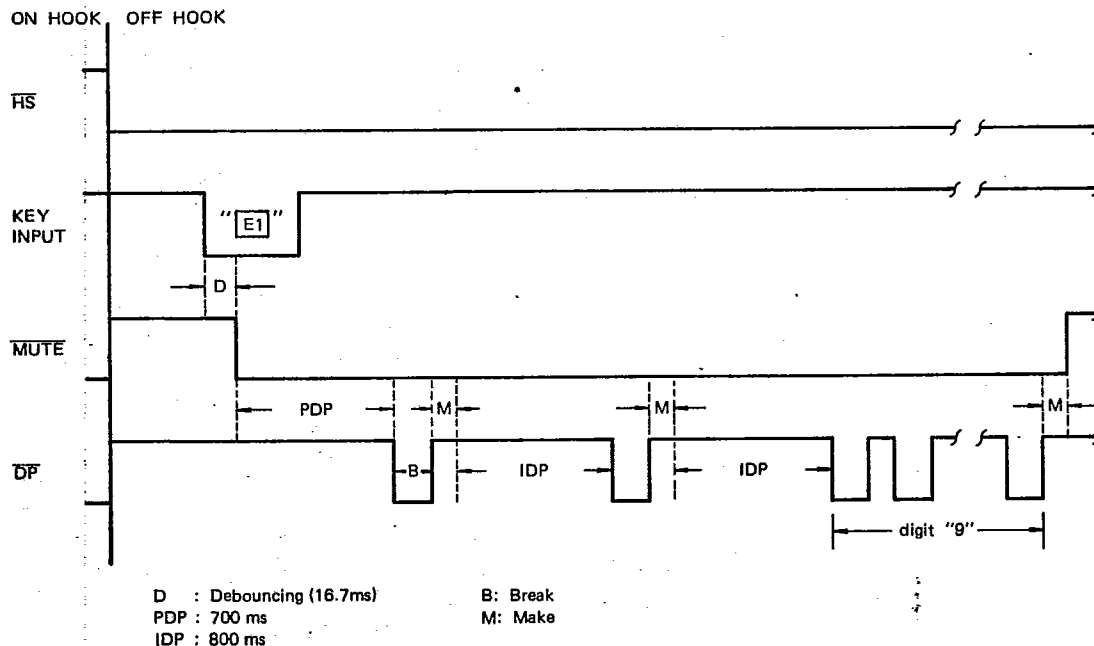
**Storing a Telephone Number**

- a) OFF HOOK,  $[ST], [D1] \dots [Dn], [E1]$ ;  $n \leq 16, l = 1, 2$  or  $3$ .
- b) OFF HOOK,  $[D1] \dots [Dn], [E1]$ ;  $n \leq 16, l = 1, 2, 3$ ; ST pin connected to  $V_{SS}$ .

Pause may be entered in the storing sequence by pressing "P" key and is recognized as one digit in repertory memories.

**Timing Diagram**

NORMAL MODE REPERTORY DIALING  
(ASSUMING THE NUMBER STORED IN  $[E1]$  IS 119)



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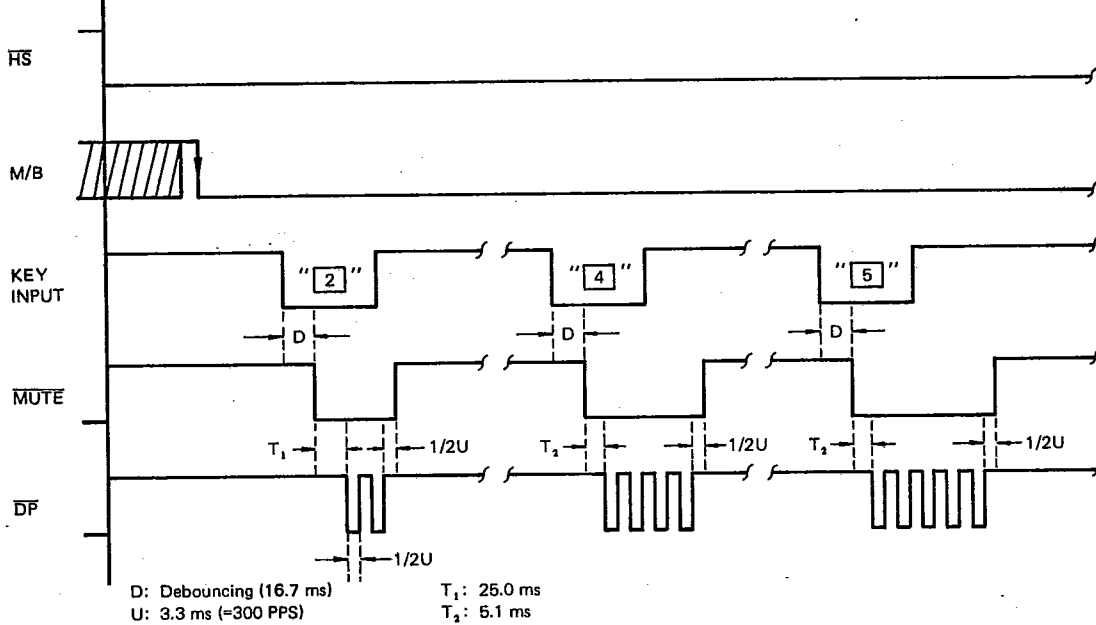
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HIGH-SPEED MASTER MODE NORMAL DIALING

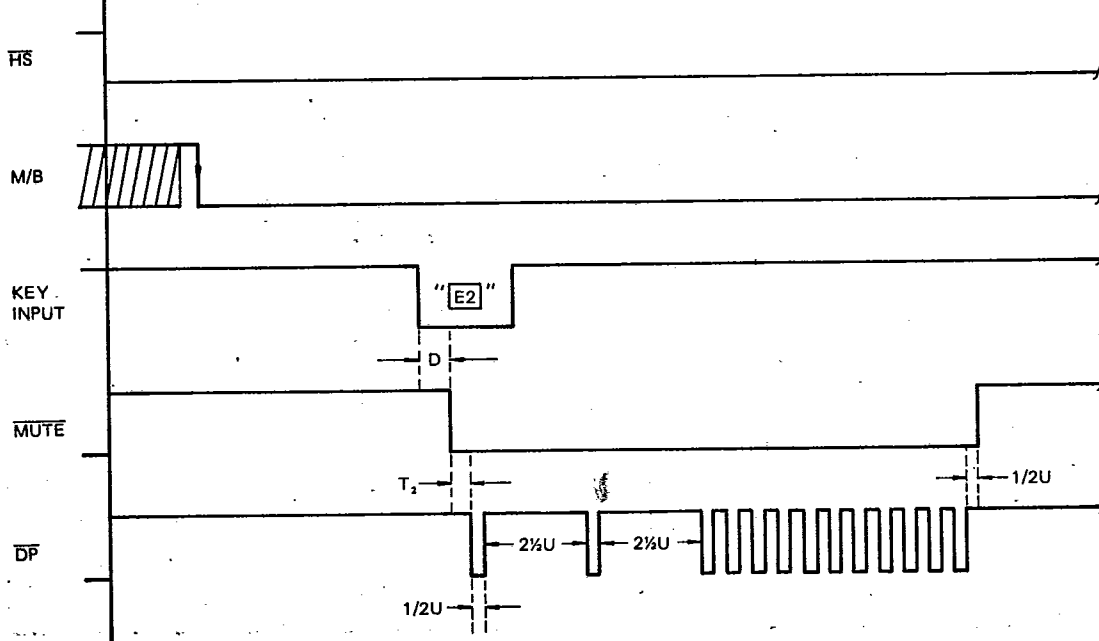
ON HOOK, OFF HOOK



Pulse Dialing

HIGH-SPEED MASTER MODE REPERTORY DIALING  
(ASSUMING THE NUMBER STORED IN [E2] IS 110)

ON HOOK, OFF HOOK





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Typical Applications (WITH TONE RINGER)

