# 10-MEMORY TONE/PULSE DIALER WITH HANDFREE AND HOLD FUNCTION

## GENERAL DESCRIPTION

The W91340 series are Si-gate CMOS IC that provide necessary signal for either Pulse or Tone dialing. It features Handfree dialing, Hold, and 10 by 16 digits automatic dialing memory.

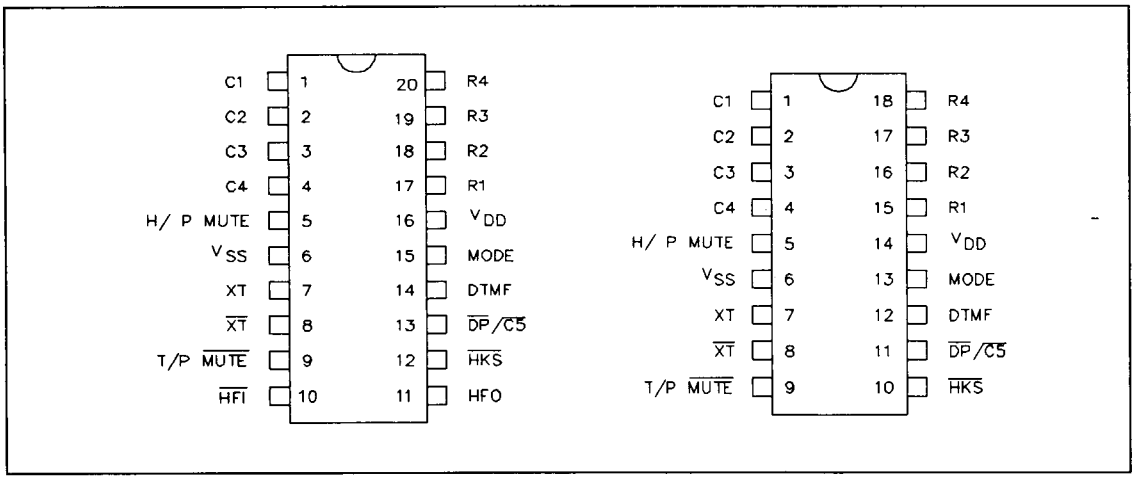
## FEATURES

- DTMF/PULSE switchable dialer.
- 32 digits for Redial memory
- Ten by 16 digits for two touch indirect repertory.
- Mix dialing is allowable,and the dialing length is unlimited.
- Pulse to Tone (*/T) keypad for Long Distance Call operation.
- Easy operation with Redial, Flash, Pause and */T keypads.
- Pause, P-->T (Pulse to Tone) can be stored as a digit in memory.
- Minimum tone output duration : 100 msec.
- Minimum inter tone pause : 100 msec.
- Flash time 98mS or 600mS is selectable by mask option.
- DIP 18, 20 pins two type package for different need of Handfree control function (HFI/O).
- 4 × 5 keyboard can be used.
- Power on reset on chip.
- Use 3.579545 MHz crystal or ceramic resonator.

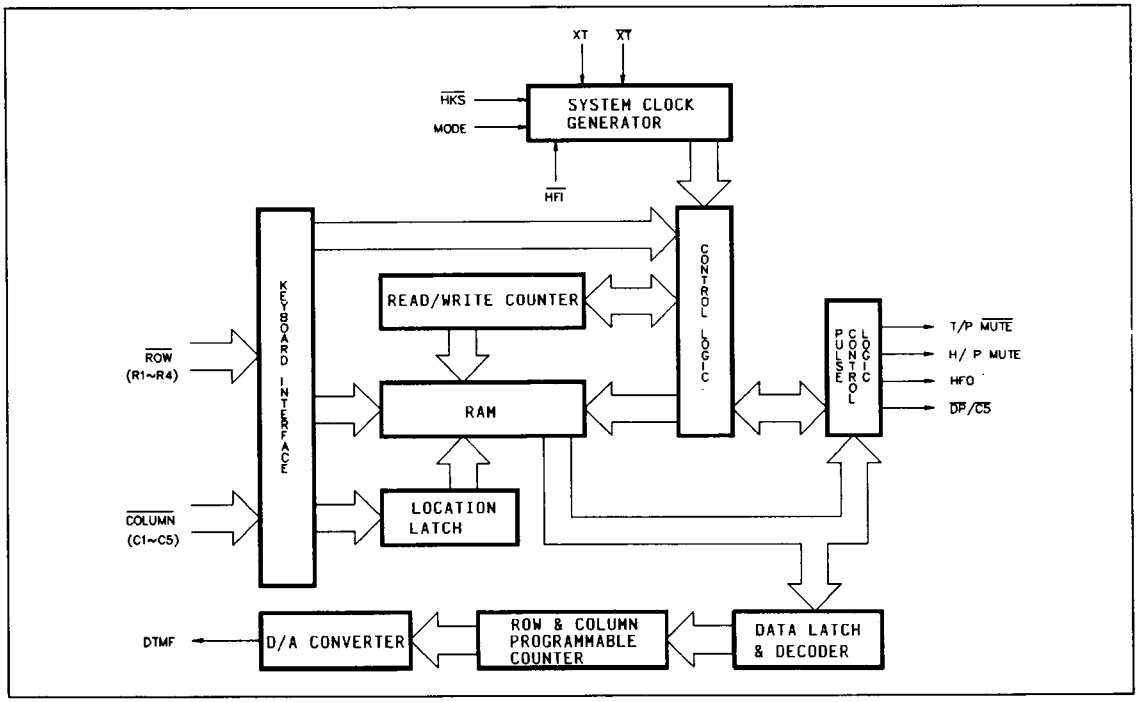
TABLE 1:

| TYPE NO. | PULSE (pps) | FLASH (ms) | M/B | H/ P MUTE | HANDFREE | PACKAGE |
|---|---|---|---|---|---|---|
| W91340 | 10 | 600 | Pin | Yes | - | 18 |
| W91340A | 10 | 600 | Pin | Yes | Yes | 20 |
| W91341 | 10 | 98 | Pin | Yes | - | 18 |
| W91341A | 10 | 98 | Pin | Yes | Yes | 20 |
| W91342 | 10/20 | 600 | 2:1 | Yes | - | 18 |
| W91342A | 10/20 | 600 | 2:1 | Yes | Yes | 20 |

## PIN CONFIGURATION




## BLOCK DIAGRAM



## PIN DESCRIPTION

| SYMBOL | 18 PIN | 20 PIN | I/O | FUNCTION |
|---|---|---|---|---|
| Column-Row Inputs | 1-4 & 15-18 | 1-4 & 17-20 | I | The Keyboard input may be used with either the standard 4X5 keyboard or the inexpensive single contact (Form A) keyboard, the electronic input with $\mu$C, that also can be connected to be used. A valid key entry is defined by a single row being connected to a single column. |
| XT | 7 | 7 | I | A built in inverter provides oscillation with an inexpensive 3.579545MHz crystal or ceramic resonator. |
| $\overline{XT}$ | 8 | 8 | O | The oscillator output pin. |
| T/P $\overline{MUTE}$ | 9 | 9 | O | The T/P $\overline{MUTE}$ is a conventional CMOS N-channel open drain output. The output transistor is switched on during Pulse and Tone mode dialing sequence and Flash break. Otherwise, it is switched off. |
| MODE | 13 | 15 | I | Pull mode pin to $V_{SS}$; the dialer is in Tone mode.<br>Pull mode pin to $V_{DD}$; the dialer is in Pulse mode-10pps, M/B=2:3.<br>Pull mode pin to floating;the dialer is in Pulse mode-10pps,M/B=1:2. |
| $\overline{HKS}$ | 10 | 12 | I | This pin is the hook switch input.<br>HKS=1, ON HOOK state, chip in sleeping mode, no operation.<br>HKS=0, OFF HOOK state, enable chip on normal operation.<br>This pin must combine to HFI, HFO to perform the above function. Please refer to HFI, HFO pin.<br>HKS pin is pulled to $V_{DD}$ by internal resistor. |
| $\overline{DP}/\overline{C5}$ | 11 | 13 | O | Open drain dialing pulse output (Fig. 1).<br>Flash key will cause DP active either in Tone mode or Pulse mode. |
| DTMF | 12 | 14 | O | In pulse dialing, it always keeps at low state.<br>In tone mode, it will output a dual or single tone.<br>The detailed timing diagram of tone mode is shown in Fig.2(a,b). |

| OUTPUT FREQUENCY (Hz) | | | |
|---|---|---|---|
| | Specified | Actural | Error % |
| R1 | 697 | 699 | + 0.28 |
| R2 | 770 | 766 | - 0.52 |
| R3 | 852 | 848 | - 0.47 |
| R4 | 941 | 948 | + 0.74 |
| C1 | 1209 | 1216 | + 0.57 |
| C2 | 1336 | 1332 | - 0.30 |
| C3 | 1477 | 1472 | - 0.34 |

<table>
<tr><th>SYMBOL</th><th>18 PIN</th><th>20 PIN</th><th>I/O</th><th>FUNCTION</th></tr>
<tr><td>$V_{DD}$,$V_{SS}$</td><td>14, 6</td><td>16, 6</td><td>I</td><td>Power input pins.</td></tr>
<tr><td>$\overline{HFI}$,HFO</td><td>-</td><td>10,11</td><td>I,O</td><td>Handfree control pins.<br>When $\overline{HFI}$ input pin has a low pulse, the handfree control state is toggled on.<br>Status of the handfree control state is listed in the following table :
<table>
<tr><th colspan="2">CURRENT STATE</th><th colspan="3">NEXT STATE</th></tr>
<tr><th>Hook SW.</th><th>HFO</th><th>Input</th><th>HFO</th><th>Dialing?</th></tr>
<tr><td>-</td><td>Low</td><td>$\overline{HFI}$ ↓</td><td>High</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>High</td><td>$\overline{HFI}$ ↓</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>$\overline{HFI}$ ↓</td><td>Low</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>-</td><td>Off Hook</td><td>Low</td><td>Yes</td></tr>
<tr><td>Off Hook</td><td>Low</td><td>On Hook</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>On Hook</td><td>High</td><td>Yes</td></tr>
</table>
$\overline{HFI}$ pin is pulled to $V_{DD}$ by internal resistor.<br>The control function and Hold function relationship is shown in Fig.3.</td></tr>
<tr><td>H/ P MUTE</td><td>5</td><td>5</td><td>O</td><td>The H/ P MUTE is a conventional inverter output.<br>In pulse dialing, flash and hold period, the output will be at active high, otherwise it will keep at low state.</td></tr>
</table>

## FUNCTIONAL DESCRIPTION

### A.Keyboard Operation

| | C1 | C2 | C3 | C4 | $\overline{C5}$ |
|---|---|---|---|---|---|
| R1 | 1 | 2 | 3 | ST | |
| R2 | 4 | 5 | 6 | F | |
| R3 | 7 | 8 | 9 | A | |
| R4 | */ T | 0 | # | R/P | H |

- ST -- Store function key.
- H -- Hold function key.
- F -- Flash key.
  Flash key can not be stored in memory.
- */ T -- In the Pulse mode this key works as Pulse-->Tone key, and it works as * key in the tone mode.
  */T key can be stored as a digit in Pulse or Tone mode.
- R/P -- Redial and Pause function key.
  The Redial function can be executed only in first key-in after OFF HOOK, otherwise will be operated as Pause function.
- A -- Indirect repertory dialing function key.

**B.Normal Dialing**

OFF HOOK (or ON HOOK & HFI ↓), D1, D2, - - - - , Dn

1.D1, D2, - - -, Dn will be dialed out.

2.Dialing length is unlimited, but the Redial is inhibited if it oversteps 32 digits.

**C.Redialing**

OFF HOOK, D1, D2, - - - , Dn, BUSY, Come ON HOOK, OFF HOOK ( or ON HOOK & HFI ↓ ), R/P

or ON HOOK & HFI ↓, D1, D2, - - - , Dn, BUSY, HFI ↓, Come HFI ↓, R/P

- The R/P key can execute Redial function only in first key-in after OFF HOOK, otherwise it will be Pause function.

**D.Number store**

1. OFF HOOK (or ON HOOK & HFI ↓), D1, D2, - - - , Dn, ST, ST, Ln ON HOOK (or ON HOOK & HFI ↓)

a.The dialing of D1, D2, - - -, Dn must have finished, then ST key may be pressed.

b. D1 , D2 , - - - , Dn will be stored in Ln memory location and they will be dialed out.

c. Ln = 0 ~ 9; Dn = 0 ~ 9, *, #, Pause.

2. OFF HOOK (or ON HOOK & HFI ↓), ST, D1 , D2 , - - - , Dn , ST, Ln ON HOOK (or ON HOOK & HFI ↓)

a. D1 , D2 , - - - , Dn will be stored in Ln memory location but they will not be dialed out.

b. R/P and */T keys can be sotred as a digit in memory. In store mode, R/P in the pause function key.

c.The store mode can be release after the store function is executed or the present state of hook switch is changed.

**E.Repertory dialing**

OFF HOOK (or ON HOOK & HFI ↓) A , Ln

**F.Access Pause**

OFF HOOK (or ON HOOK & HFI ↓), D1, D2, R/P, D3, - - -, Dn

1.The Pause function can be stored in memory.

2.The Pause function is executed in normal dialing or Redialing or memory dialing.

3.The pause function timing diagram is shown in Fig.4.

**G.Pulse to Tone ( */T )**

OFF HOOK (or ON HOOK & HFI ↓), D1, D2, - - -, Dn, */T, D1', D2', - - -, Dn'

1.If the mode switch is set in Pulse mode, then the output signal will be:

D1 , D2 , - - , Dn ,Pause (3.6s)
( Pulse )

D1' , D2' , - - -, Dn'
( Tone )

2.If the mode switch is set in Tone mode , then the output signal will be:

D1 , D2 , - - - , Dn
( Tone )

, * , D1' , D2' , - - -, Dn'
( Tone ) ( Tone )

3.It can be reset to Pulse mode only in operation of ON HOOK, because it's still in Tone mode when the digits have been dialed out.

4.The P --> T function timing diagram is shown in Fig.5.

## H.Flash

OFF HOOK (or ON HOOK & $\overline{\text{HFI}}$ ↓ ) F

1. Flash key can not be stored as a digit in memory and it has the first priority of the keyboard function.
2. The system will return to the initial state after the break time is finished.
3. The Flash function timing diagram is shown in Fig.6.

## I.Mix Dialing

OFF HOOK (or ON HOOK & $\overline{\text{HFI}}$ ↓ )

1. Normal dialing + Repertory dialing + Normal dialing
2. Repertory dialing + Normal dialing + Repertory dialing
3. Redialing + Normal dialing + Repertory dialing

a. Redialing and Save dialing are valid just for first key in.

b. The second sequence should not be operated until the first sequence is dialed out completely.

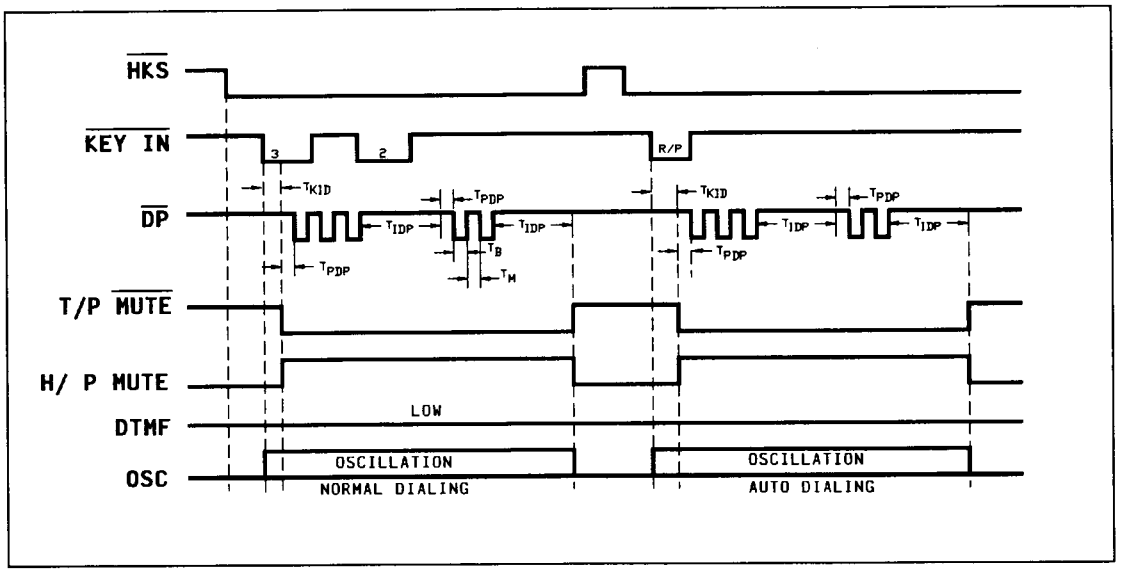



Figure 1. Pulse Mode Timing Diagram

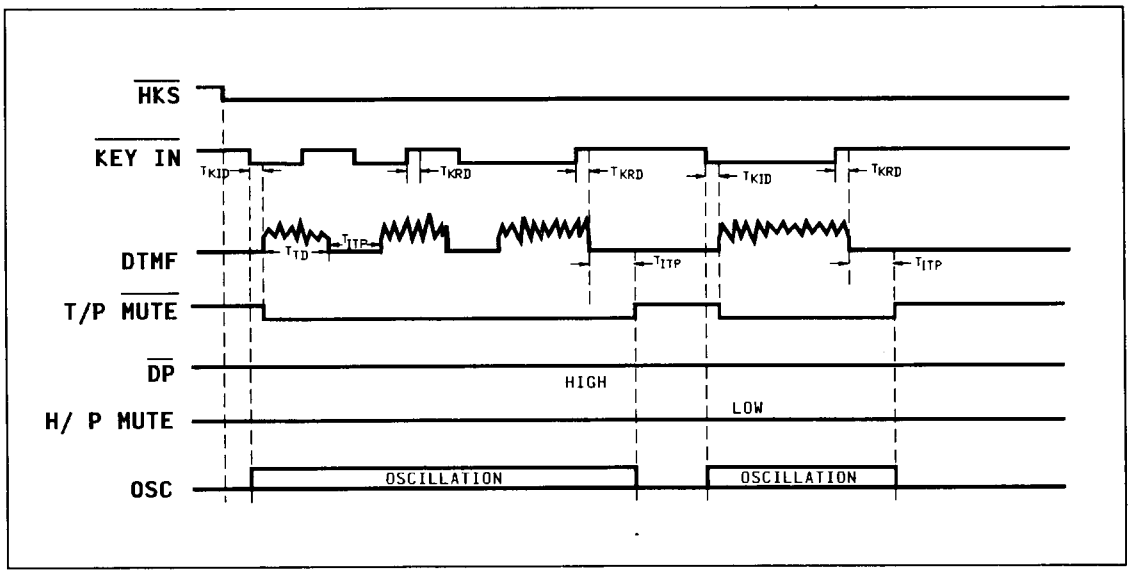



Figure 2(a). Tone Mode Normal Dialing Timing Diagram

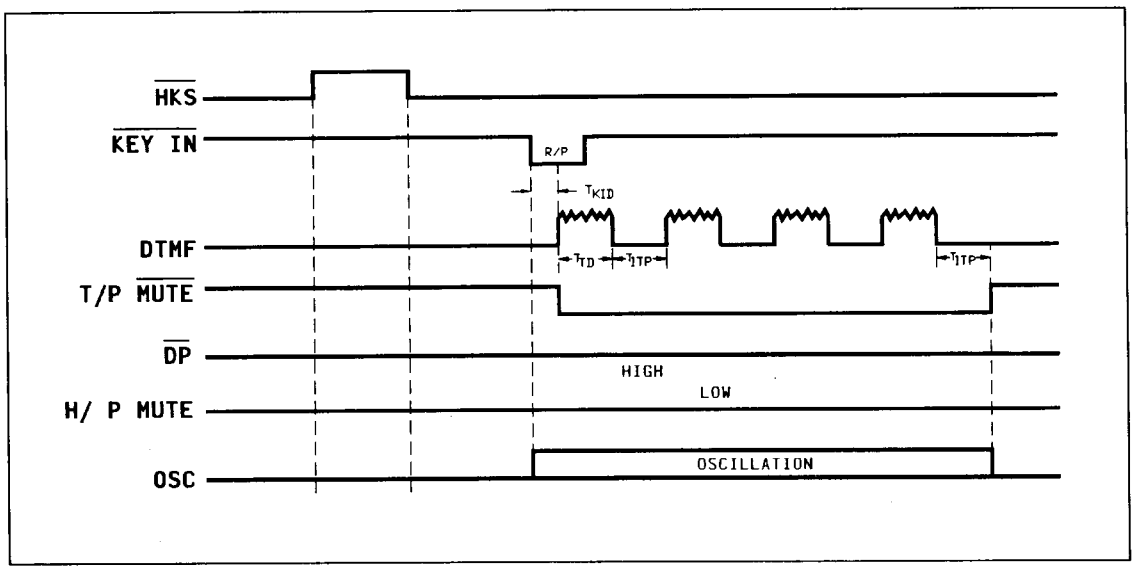



Figure 2(b). Tone Mode Auto Dialing Timing Diagram

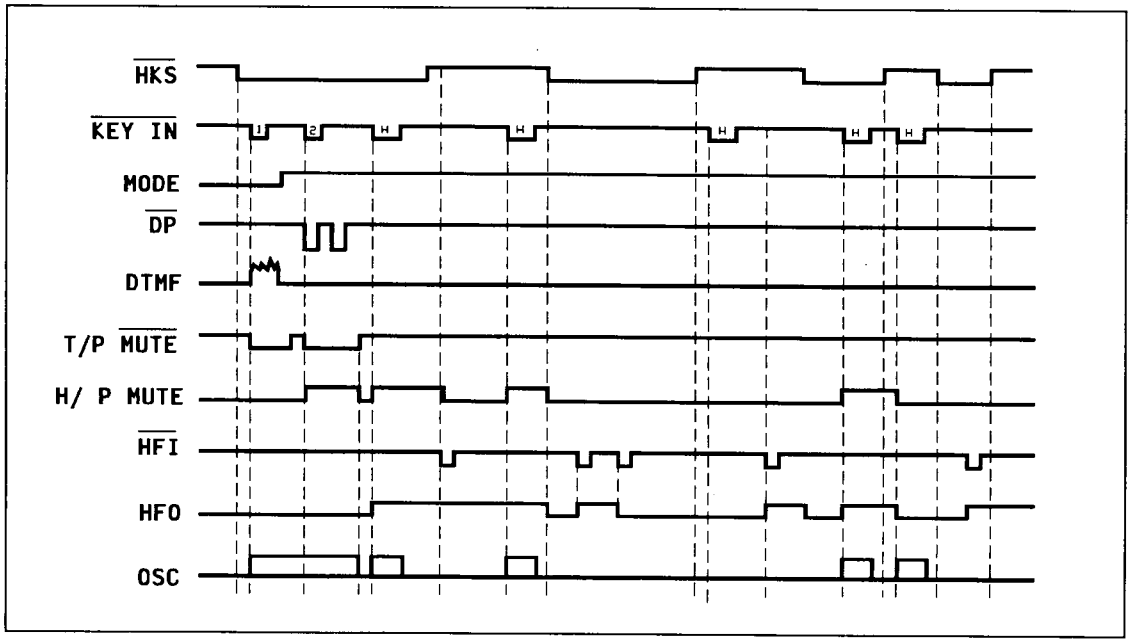



Figure 3.

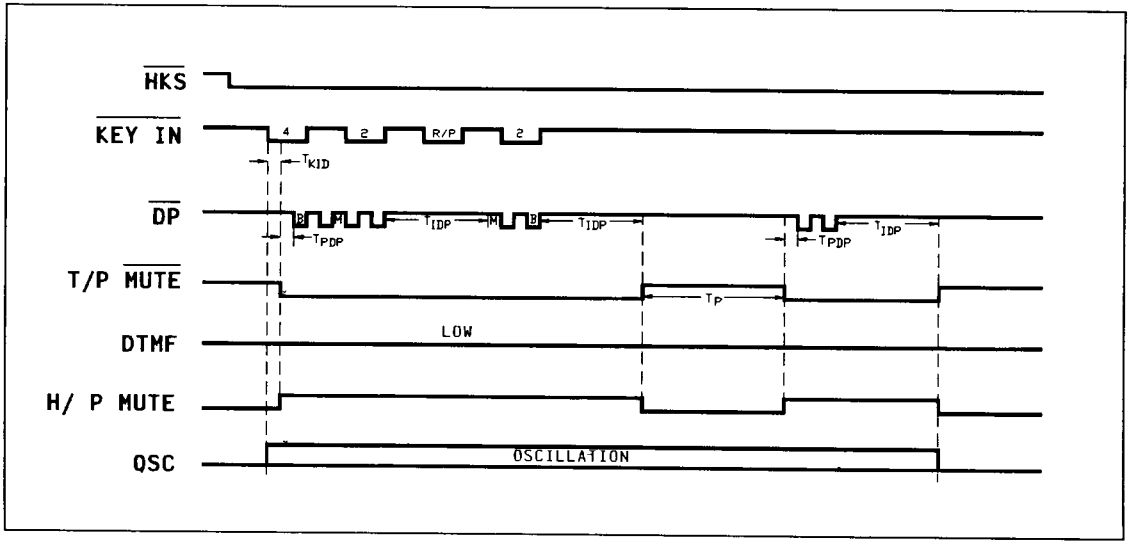



Figure 4. Pause Function Timing Diagram

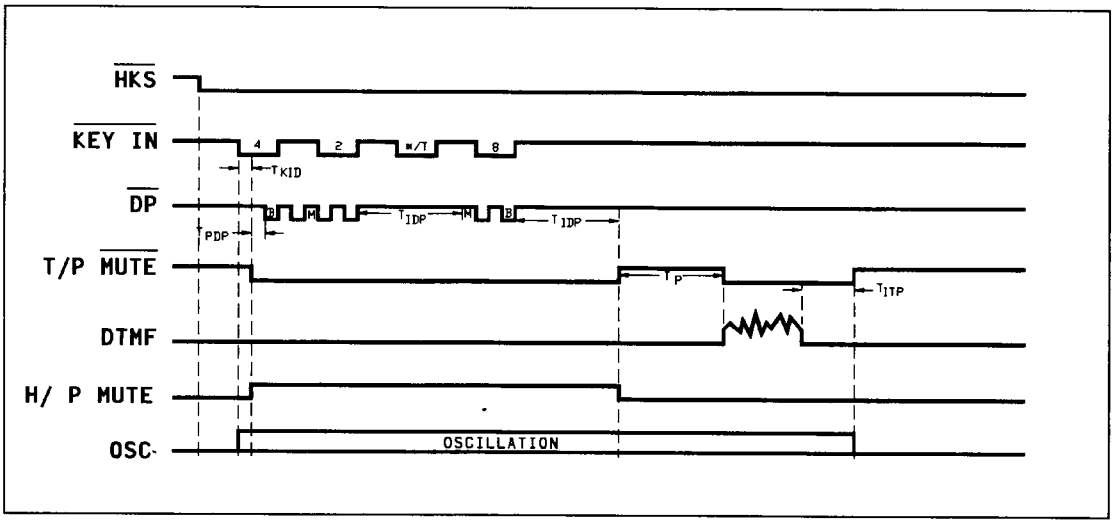



Figure 5. P-->T Operation Timing Diagram in Normal Dialing

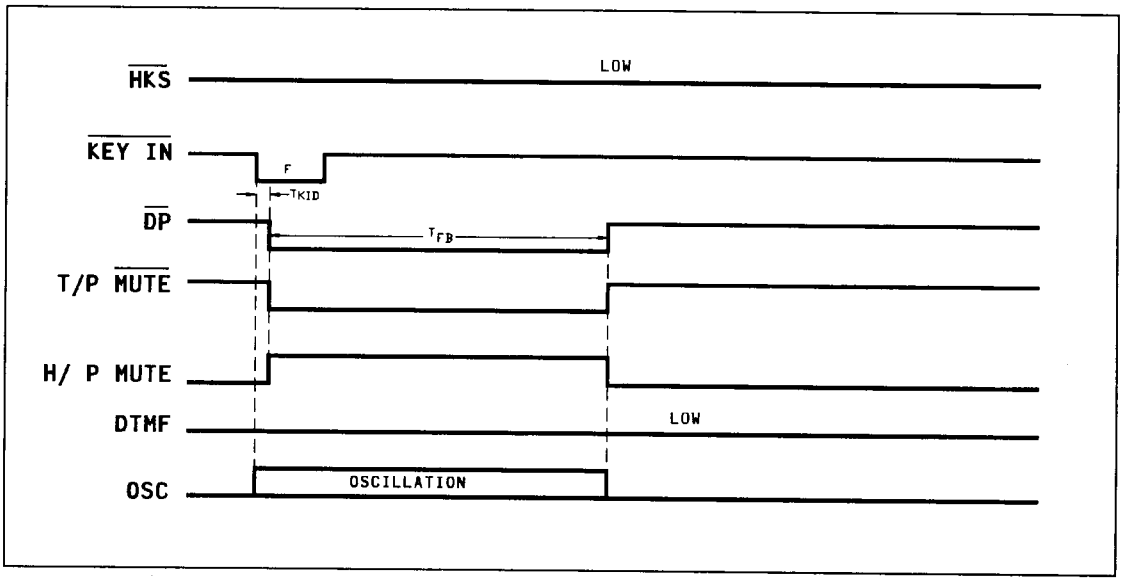



Figure 6. Flash Operating Timing Diagram

## ABSOLUTE MAXIMUM RATING

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| DC Supply Voltage | $V_{DD}$ - $V_{SS}$ | -0.3 ~ +7.0 | V |
| Input/Output Voltage | $V_{IL}$ | $V_{SS}$ - 0.3 | V |
| | $V_{IH}$ | $V_{DD}$ + 0.3 | V |
| | $V_{OL}$ | $V_{SS}$ - 0.3 | V |
| | $V_{OH}$ | $V_{DD}$ + 0.3 | V |
| Power Dissipation | $P_D$ | 120 | mW |
| Operating Temperature | $T_{OPR}$ | -20 ~ 70 | ℃ |
| Storage Temperature | $T_{STG}$ | -55 ~ +150 | ℃ |

## DC CHARACTERISTICS

($V_{DD}$ - $V_{SS}$ = 2.5 V , Fosc. = 3.58 MHz , Ta = 25 ℃, All output unloaded)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | - | 2.0 | - | 5.5 | V |
| Operating Current | $I_{OP}$ | Tone | - | 0.30 | 0.50 | mA |
| | | Pulse | - | 0.15 | 0.30 | |
| Standby Current | $I_{SB}$ | $\overline{HKS}$ = 0, No load & No key entry | - | - | 15 | μA |
| Memory Retention Current | $I_{MR}$ | $\overline{HKS}$ = 1, $V_{DD}$ = 1.0V | - | - | 0.2 | μA |
| DTMF Output Voltage | $V_{TO}$ | Row group, $R_L$ = 5KΩ | 130 | 150 | 170 | mVrms |
| Pre-emphasis | | Col/Row, $V_{DD}$=2.0~5.5V | 1 | 2 | 3 | dB |
| DTMF Distortion | $T_{HD}$ | $R_L$=5KΩ, $V_{DD}$=2.0~5.5V | - | -30 | -23 | dB |
| DTMF Output DC Level | $V_{TDC}$ | $R_L$=5KΩ, $V_{DD}$=2.0~5.5V | 1.1 | - | 2.8 | V |
| DTMF Output Sink Current | $I_{TL}$ | $V_{TO}$ = 0.5V | 0.2 | - | - | mA |
| $\overline{DP}$ Output Sink Current | $I_{PL}$ | $V_{PO}$ = 0.5V | 0.5 | - | - | mA |
| T/P $\overline{MUTE}$ Output Sink Current | $I_{ML}$ | $V_{MO}$ = 0.5V | 0.5 | - | - | mA |
| $\overline{HKS}$ I/P Pull High Resister | $R_{KH}$ | | - | 300 | - | KΩ |
| HFO Drive/Sink Current | $I_{HFH}$ | $V_{HFH}$ = 2.0V | 0.5 | - | - | mA |
| | $I_{HFL}$ | $V_{HFL}$ = 0.5V | 0.5 | - | - | |
| Keypad Input Drive current | $I_{Kd}$ | $V_I$ = 0V | 4 | - | 30 | μA |
| Keypad Input Sink Current | $I_{KS}$ | $V_I$ = 2.5V | 200 | 400 | - | μA |
| keypad Resistance | | | - | - | 5.0 | KΩ |

## AC CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Keypad Active in Debounce | $T_{KID}$ | | - | 20 | - | mS |
| Key Release Debounce | $T_{KRD}$ | | - | 20 | - | mS |
| Pre-digit-pause | $T_{PDP1}$ | M/B = 2:3 | - | 40 | - | mS |
| | 10 pps | M/B = 1:2 | - | 33.3 | - | |
| Inter Digit Pause (Auto Dialing) | $T_{IDP}$ | 10 pps | - | 800 | - | mS |
| Make / Break Ratio | M/B | M/B = 2/3 | - | 40:60 | - | % |
| | | M/B = 1/2 | - | 33:67 | - | |
| DTMF Output Duration | $T_{TD}$ | Auto Dialing | - | 100 | - | mS |
| Inter Tone Pause | $T_{ITP}$ | | - | 100 | - | mS |
| Flash Break Time | $T_{FB}$ | | - | 98 | - | mS |
| | | | - | 600 | - | |
| Pause Time | $T_P$ | | - | 3.6 | - | S |

## APPLICATION CIRCUIT