



Winbond

PRELIMINARY W91320 SERIES

TONE/PULSE DIALER WITH HANDFREE AND HOLD FUNCTION

GENERAL DESCRIPTION

The W91320 series are Si-gate CMOS IC that provide necessary signal for either Pulse or Tone dialing. It features Handfree dialing, one key redial, Hold and Redial.

FEATURES

- DTMF/PULSE switchable dialer.
- 32 digits for Redial memory.
- Pulse to Tone (* / T) keypad for Long Distance Call operation.
- 4 X 5 keyboard can be used.
- 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.
- Power on reset on chip.
- 3.579545 MHz crystal or ceramic resonator is used.
- 18, or 20 pin DIP plastic package.
- The different types of W91320 series are shown as the following Table 1.

TABLE 1:

| TYPE NO. | PULSE (pps) | FLASH (ms) | M/B | H/ P MUTE | HANDFREE | PACKAGE |
|----------|-------------|------------|-----|-----------|----------|---------|
| W91320 | 10 | 600/ 98 | Pin | Yes | - | 18 |
| W91320A | 10 | 600/ 98 | Pin | Yes | Yes | 20 |
| W91321 | 10/20 | 600/305 | 1:2 | Yes | - | 18 |
| W91321A | 10/20 | 600/305 | 1:2 | Yes | Yes | 20 |

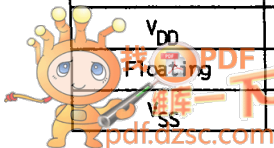
W91320/A

| MODE PIN | TONE/PULSE | DIAL RATE | M/B RATIO | FLASH TIME |
|-----------------|------------|-----------|-----------|---------------------------|
| V _{DD} | Pulse | 10 pps | 2 : 3 | F1 = 600 mS F2 = 98 mS |
| Floating | Pulse | 10 pps | 1 : 2 | |
| V _{SS} | Tone | - | - | |

W91321/A

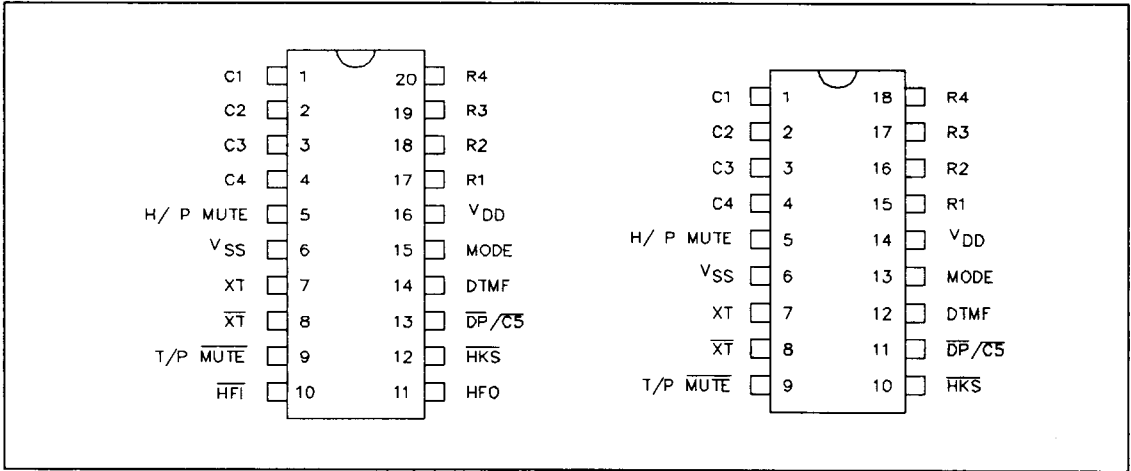
| MODE PIN | TONE/PULSE | DIAL RATE | M/B RATIO | FLASH TIME |
|-----------------|------------|-----------|-----------|----------------------------|
| V _{DD} | Pulse | 10 pps | 1 : 2 | F1 = 600 mS F2 = 305 mS |
| Floating | Pulse | 20 pps | 1 : 2 | |
| V _{SS} | Tone | - | - | |

TONE/PULSE DIALER

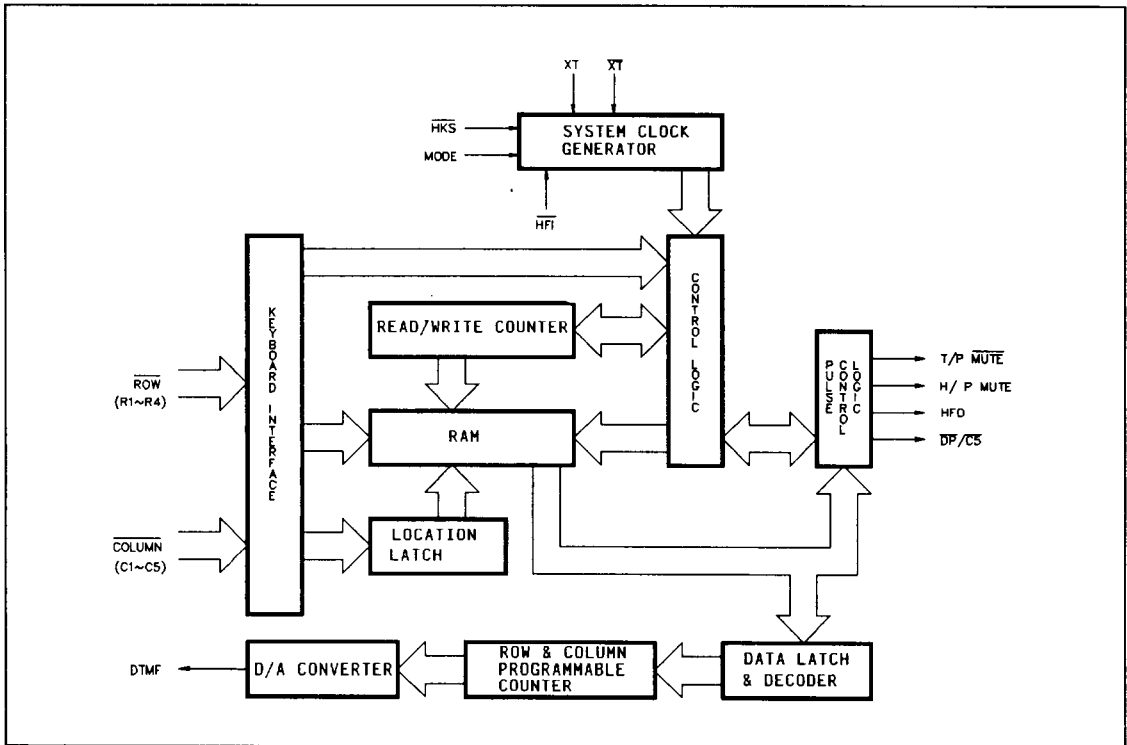




PIN CONFIGURATION



BLOCK DIAGRAM



W91320 SERIES

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 μC , 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. Pull mode pin to V_{DD} ; the dialer is in Pulse mode-10pps, M/B=2:3. 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. $\overline{HKS}=1$, ON HOOK state, chip in sleeping mode, no operation. $\overline{HKS}=0$, OFF HOOK state, enable chip on normal operation. This pin must combine to HFI, HFO to perform the above function. Please refer to HFI, HFO pins. \overline{HKS} pin is pulled to V_{DD} by internal resistor. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\overline{DP}/\overline{CS}$ | 11 | 13 | O | Open drain dialing pulse output (Fig. 1). Flash key and one key redial will cause DP active either in Tone mode or Pulse mode. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DTMF | 12 | 14 | O | In pulse mode, it always keeps at low state. In tone mode, it will output a dual or single tone. The detailed timing diagram of tone mode is shown in Fig.2(a,b). <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4">OUTPUT FREQUENCY (Hz)</th> </tr> <tr> <th></th> <th>Specified</th> <th>Actual</th> <th>Error %</th> </tr> </thead> <tbody> <tr> <td>R1</td> <td>697</td> <td>699</td> <td>+ 0.28</td> </tr> <tr> <td>R2</td> <td>770</td> <td>766</td> <td>- 0.52</td> </tr> <tr> <td>R3</td> <td>852</td> <td>848</td> <td>- 0.47</td> </tr> <tr> <td>R4</td> <td>941</td> <td>948</td> <td>+ 0.74</td> </tr> <tr> <td>C1</td> <td>1209</td> <td>1216</td> <td>+ 0.57</td> </tr> <tr> <td>C2</td> <td>1336</td> <td>1332</td> <td>- 0.30</td> </tr> <tr> <td>C3</td> <td>1477</td> <td>1472</td> <td>- 0.34</td> </tr> </tbody> </table> | OUTPUT FREQUENCY (Hz) | | | | | Specified | Actual | 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 |
| OUTPUT FREQUENCY (Hz) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| SYMBOL | 18 PIN | 20 PIN | I/O | FUNCTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------|--------|-----------------------------|------|--|---------------|--|------------|--|--|----------|-----|-------|-----|----------|---|-----|-----------------------------|------|-----|---------|------|-----------------------------|-----|----|----------|------|-----------------------------|-----|-----|---------|---|----------|-----|-----|----------|-----|---------|-----|----|----------|------|---------|------|-----|
| V_{DD}, V_{SS} | 14, 6 | 16, 6 | I | Power input pins. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| \overline{HFI}, HFO | - | 10, 11 | I, 0 | <p>Handfree control pins. When \overline{HFI} input pin has a low pulse, the handfree control state is toggled on. Status of the handfree control state is listed in the following table :</p> <table border="1"> <thead> <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> </thead> <tbody> <tr> <td>-</td> <td>Low</td> <td>$\overline{HFI} \downarrow$</td> <td>High</td> <td>Yes</td> </tr> <tr> <td>On Hook</td> <td>High</td> <td>$\overline{HFI} \downarrow$</td> <td>Low</td> <td>No</td> </tr> <tr> <td>Off Hook</td> <td>High</td> <td>$\overline{HFI} \downarrow$</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> </tbody> </table> <p>\overline{HFI} pin is pulled to V_{DD} by internal resistor. The control function and Hold function relationship is shown in Fig.3.</p> | CURRENT STATE | | NEXT STATE | | | Hook SW. | HFO | Input | HFO | Dialing? | - | Low | $\overline{HFI} \downarrow$ | High | Yes | On Hook | High | $\overline{HFI} \downarrow$ | Low | No | Off Hook | High | $\overline{HFI} \downarrow$ | Low | Yes | On Hook | - | Off Hook | Low | Yes | Off Hook | Low | On Hook | Low | No | Off Hook | High | On Hook | High | Yes |
| CURRENT STATE | | NEXT STATE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hook SW. | HFO | Input | HFO | Dialing? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| - | Low | $\overline{HFI} \downarrow$ | High | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On Hook | High | $\overline{HFI} \downarrow$ | Low | No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Off Hook | High | $\overline{HFI} \downarrow$ | Low | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On Hook | - | Off Hook | Low | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Off Hook | Low | On Hook | Low | No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Off Hook | High | On Hook | High | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H/ P MUTE | 5 | 5 | 0 | The H/ P MUTE is a conventional inverter output. In pulse dialing, flash and hold period, the output will be at active high, otherwise it will keep at low state. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

FUNCTIONAL DESCRIPTION

A. Keyboard Operation

| | C1 | C2 | C3 | C4 | $\overline{C5}$ |
|----|-------|----|----|-------|-----------------|
| R1 | 1 | 2 | 3 | | |
| R2 | 4 | 5 | 6 | F1 | |
| R3 | 7 | 8 | 9 | F2 | H |
| R4 | * / T | 0 | # | R / P | R |

- F1, F2 -- Flash keys.
Flash keys 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 it will be operated as Pause function.
The Redial function has not break function.
- R -- One key Redial key.
The one key redial function has no break function in the first key-in after OFF HOOK.
The one key redial function uses the redial buffer same as the redial function (R/P), and it is active during normal dialing or repertory dialing.
- H -- Hold 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

1. 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

- a. The R/P key can execute Redial function only in first key-in after OFF HOOK, otherwise it will be Pause function.
2. OFF HOOK (or ON HOOK & HFI ↓), D1, D2, - - - -, Dn, BUSY R
- a. The one key Redialing function timing diagram is shown in Fig.4.
 - b. If the dialing of D1 to Dn is finished, pressing R key will cause the Pulse output pin to go low for 2.2 seconds break time and 600 ms pause will automatically be added.
 - c. If the pulses of the dialed number with D1 to Dn have not finished, pressing the R key will be ignored.
3. OFF HOOK, D1, D2, - - -, Dn, BUSY ON HOOK come OFF HOOK R
- a. If R is the first key after OFF HOOK, it only can execute Redialing function and it will not cause the Pulse output pin to go low for the break time of 2.2 seconds.

D. 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.5.

E. 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.6.

F. Flash (F1 or F2)

OFF HOOK (or ON HOOK & HFI ↓), FL

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.7.

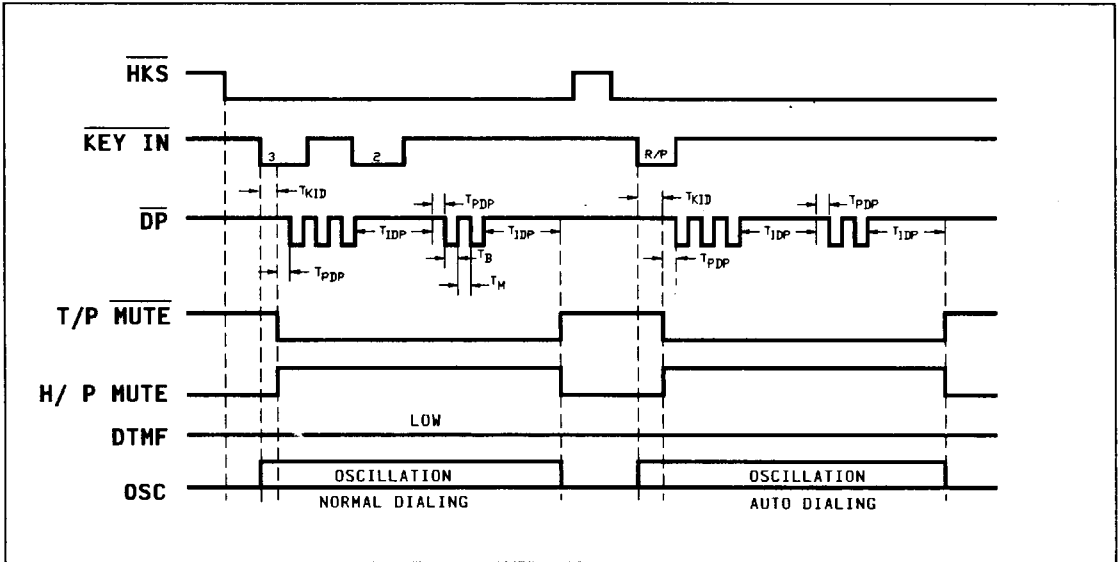


Figure 1. Pulse Mode Timing Diagram

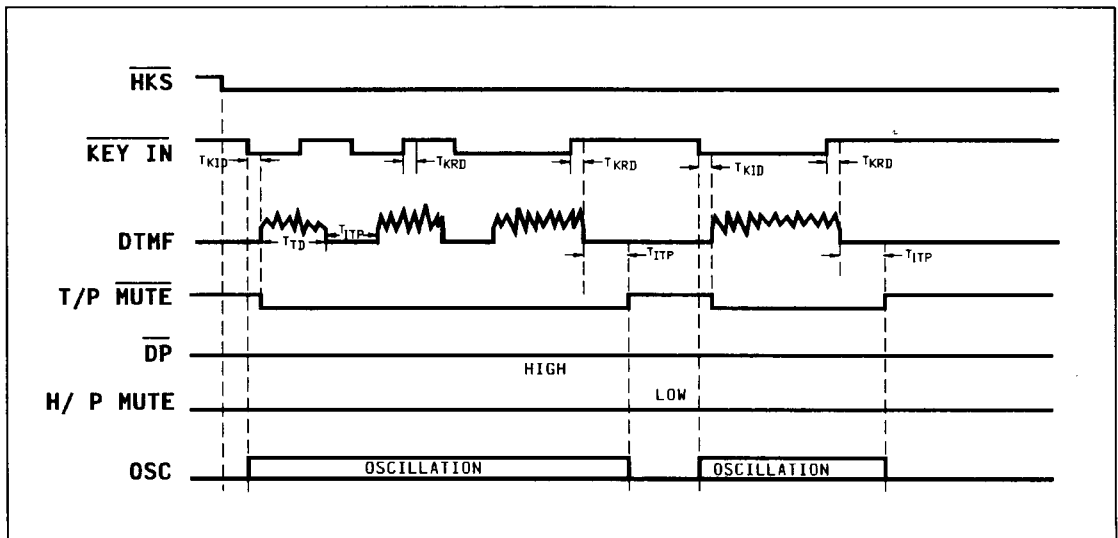


Figure 2(a). Tone Mode Normal Dialing Timing Diagram

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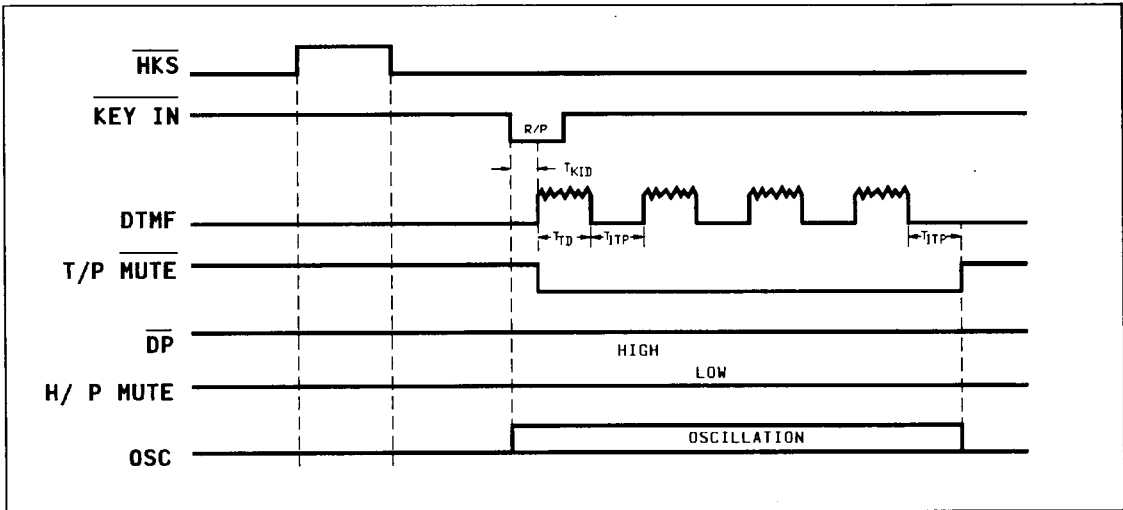


Figure 2(b). Tone Mode Auto Dialing Timing Diagram

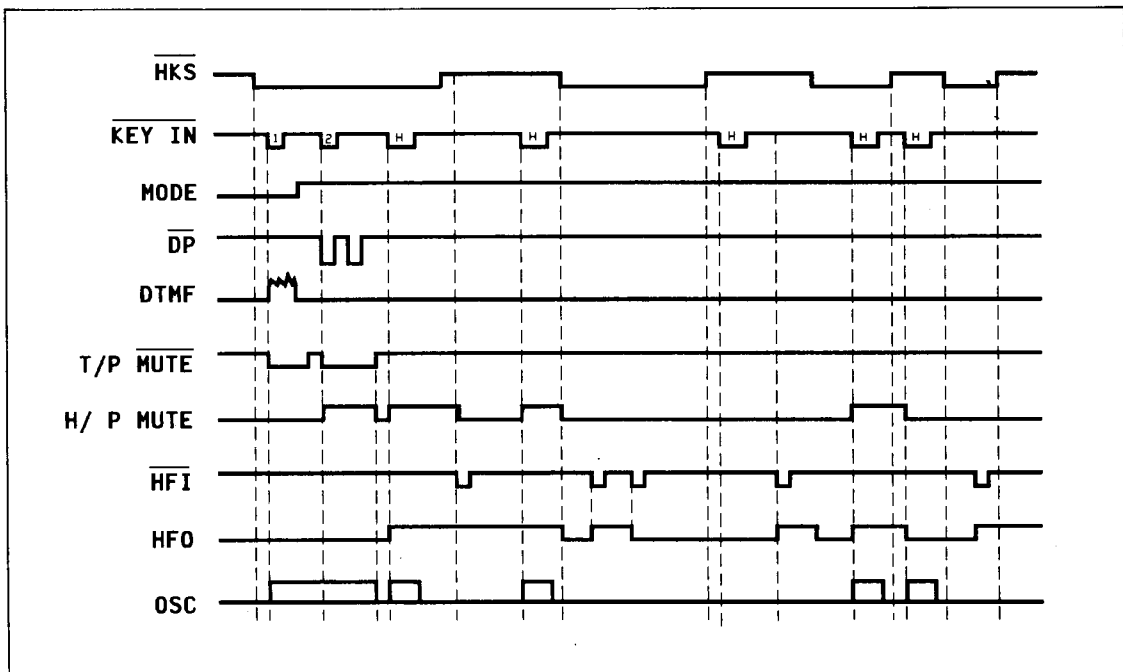


Figure 3.

TONE/PULSE
DIALER

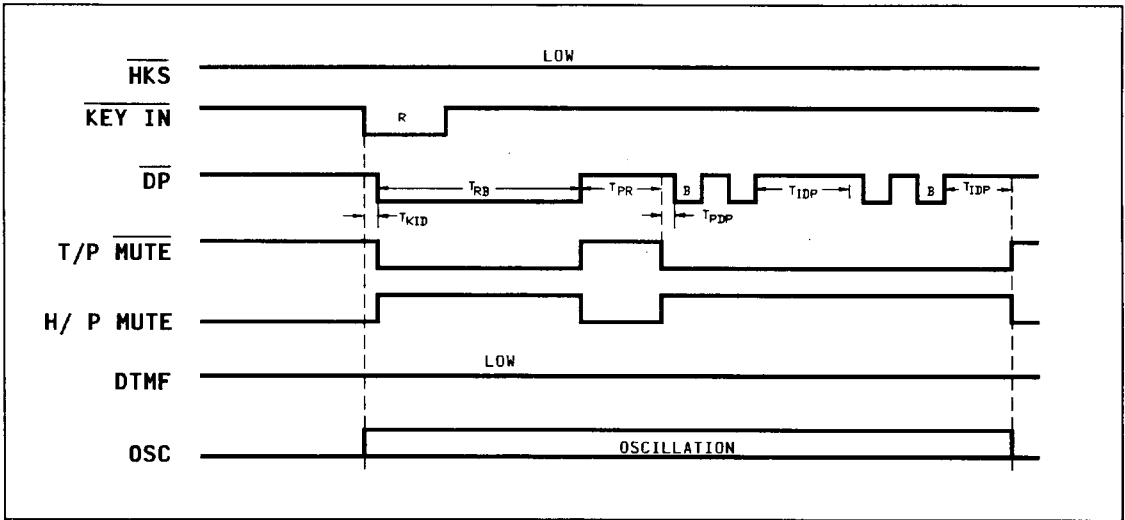


Figure 4. Pulse Mode Timing Diagram

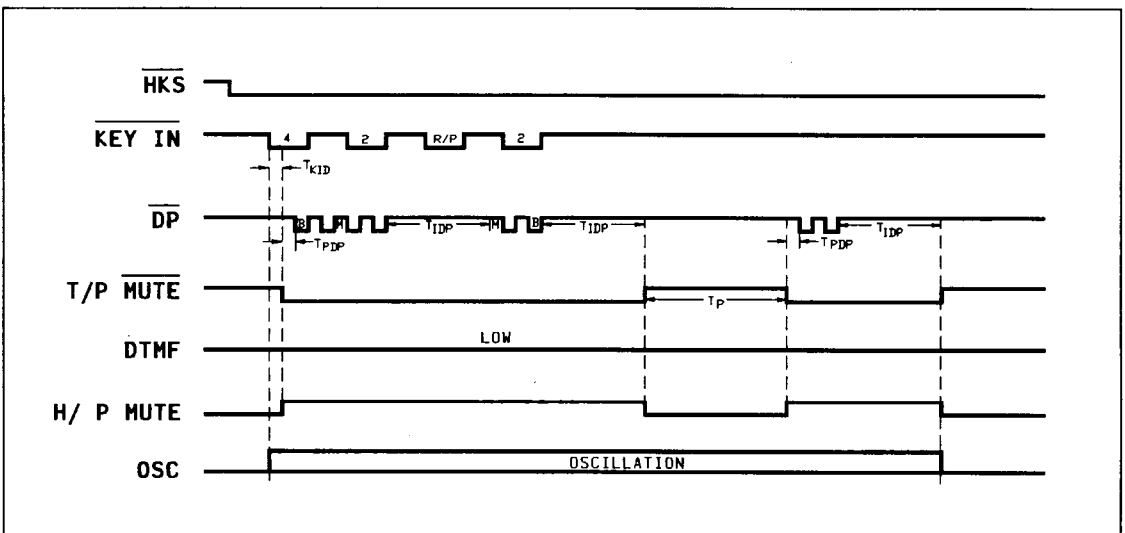


Figure 5. Pause Function Timing Diagram

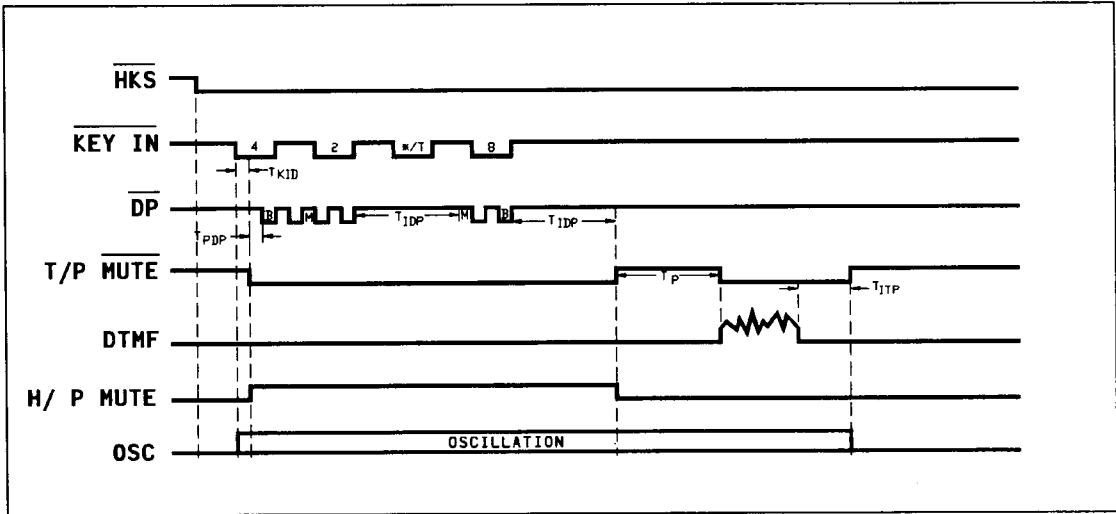


Figure 6. P-->T Operation Timing Diagram in Normal Dialing

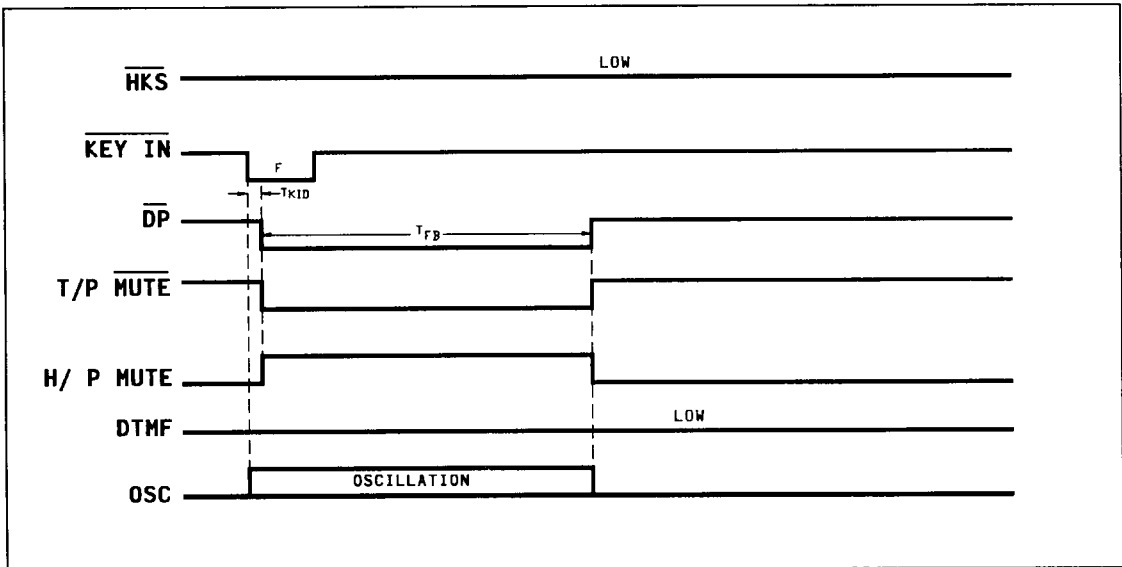


Figure 7. Flash Operating Timing Diagram



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 | °C |
| Storage Temperature | T_{STG} | -55 ~ +150 | °C |

DC CHARACTERISTICS

($V_{DD} - V_{SS} = 2.5\text{ V}$, $F_{osc} = 3.58\text{ MHz}$, $T_a = 25\text{ °C}$, 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} | $\overline{HKS} = 1$, $V_{DD} = 1.0\text{V}$ | - | - | 0.2 | μA |
| DTMF Output Voltage | V_{TO} | Row group, $R_L = 5\text{K}\Omega$ | 130 | 150 | 170 | mVrms |
| Pre-emphasis | | Col/Row, $V_{DD} = 2.0\text{--}5.5\text{V}$ | 1 | 2 | 3 | dB |
| DTMF Distortion | T_{HD} | $R_L = 5\text{K}\Omega$, $V_{DD} = 2.0\text{--}5.5\text{V}$ | - | -30 | -23 | dB |
| DTMF Output DC Level | V_{TDC} | $R_L = 5\text{K}\Omega$, $V_{DD} = 2.0\text{--}5.5\text{V}$ | 1.1 | - | 2.8 | V |
| DTMF Output Sink Current | I_{TL} | $V_{TO} = 0.5\text{V}$ | 0.2 | - | - | mA |
| \overline{DP} Output Sink Current | I_{PL} | $V_{PO} = 0.5\text{V}$ | 0.5 | - | - | mA |
| T/P \overline{MUTE} Output Sink Current | I_{ML} | $V_{MO} = 0.5\text{V}$ | 0.5 | - | - | mA |
| \overline{HKS} I/P Pull High Resister | R_{KH} | | - | 300 | - | $\text{K}\Omega$ |
| HFO Drive/Sink Current | I_{HFH} | $V_{HFH} = 2.0\text{V}$ | 0.5 | - | - | mA |
| | I_{HFL} | $V_{HFL} = 0.5\text{V}$ | 0.5 | - | - | |
| Keypad Input Drive current | I_{Kd} | $V_I = 0\text{V}$ | 4 | - | 30 | μA |
| Keypad Input Sink Current | I_{KS} | $V_I = 2.5\text{V}$ | 200 | 400 | - | μA |
| Keypad Resistance | | | - | - | 5.0 | $\text{K}\Omega$ |

W91320 SERIES

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 (1) | T_{PDP1} 10 pps | M/B = 2:3 | - | 40 | - | mS |
| | | M/B = 1:2 | - | 33.3 | - | |
| Pre-digit-pause (2) | T_{PDP2} 20 pps | M/B = 2:3 | - | 20 | - | mS |
| | | M/B = 1:2 | - | 16.7 | - | |
| Inter Digit Pause (Auto Dialing) | T_{IDP} | 10 pps | - | 800 | - | mS |
| | | 20 pps | - | 500 | - | |
| 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 |
| | | | - | 305 | - | |
| | | | - | 600 | - | |
| Pause Time | T_P | | - | 3.6 | - | S |
| One Key Redialing Pause Time | T_{PR} | | - | 600 | - | mS |
| One Key Redialing Break Time | T_{RB} | | - | 2.2 | - | S |

