

W91570DN SERIES



23-MEMORY TONE/PULSE DIALER WITH AUTOREDIAL RTC AND LCD DISPLAY FUNCTIONS

GENERAL DESCRIPTION

The W91570DN series ICs are Si-gate CMOS ICs that provide the signals needed for either pulse or tone dialing. They feature 23 number memories and a 16-digit LCD driver for displaying telephone numbers and calling time. A real time clock is included to display the time of day. The W91570DN series is fabricated using CMOS technology providing good performance in low voltage, low power applications.

FEATURES

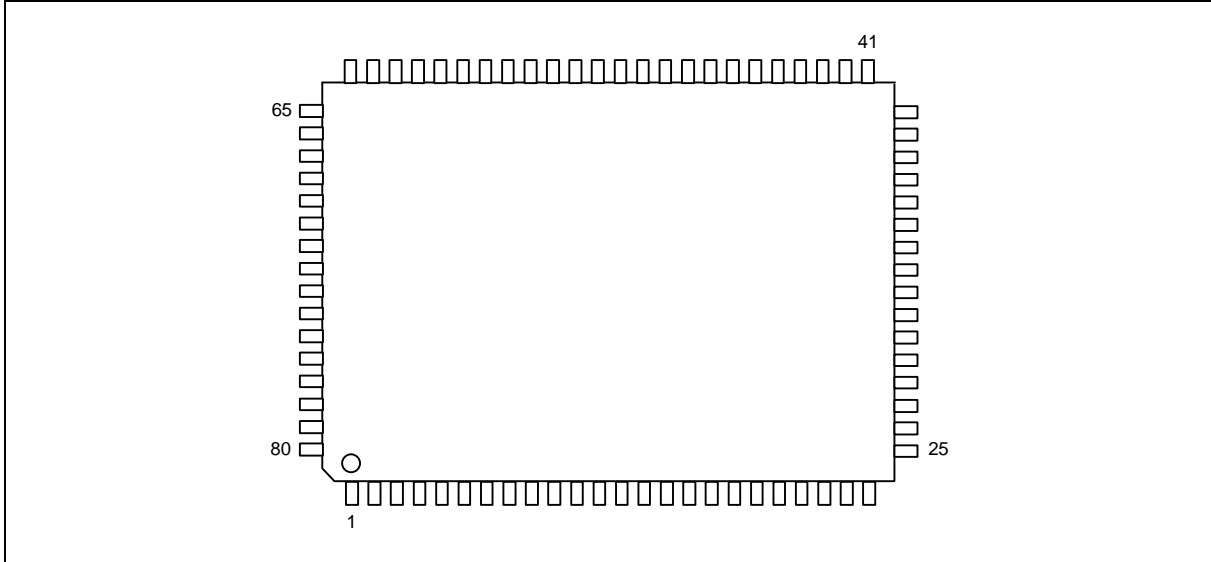
- Three by 32 digits for redial, save and mercury memory
- Twenty by 16 digits for one-touch direct or two-touch indirect repertory memory
- Uses 6 × 10 keyboard
- Pause, Pulse-to-tone (*T) and flash can be stored as a digit in memory
- Minimum tone output duration: 87 mS
- Minimum intertone pause: 87 mS
- Tone/Pulse mode pin selectable
- Make/Break ratio pin selectable
- Dialing rate (10 or 20 ppS) pin selectable
- Pause time (2.0 or 3.6 Sec) selectable by keypad
- Flash break time (100, 300, or 600 mS) selectable by keypad
- Built-in 12 or 16-digit LCD driver (1/4 duty, 1/3 bias) selectable by mask option
- Built-in calling timer from [00:00] to [59:59]
- Uses 3.579545 MHz TV quartz crystal or ceramic resonator
- Uses 32768 Hz crystal as RTC frequency base
- Packaged in 80-pin plastic QFP with RTC
- Provides one-key-redial and auto-redial functions
- Switchable 24-hour clock or 12-hour clock with p.m. mode
- 0 or 9 dialing inhibition pin for PABX systems or long distance dialing lock out
- On-hook debounce: 150 msec in normal mode and 20 msec in lock mode
- Off-hook delay 300 mS in lock mode (i.e. \overline{DP} will keep low for 300 mS while off hook)
- First key-in delay: 300 msec in lock mode
- MUTE key for speech mute
- Cascade and mixed dialing allowed
- The functions of the different dialers in the W91570DN series are shown in the following table:

| PRODUCT NO. | LCD DIGITS | LOCK | RTC BATTERY |
|-------------|------------|------|-------------|
| W91572DNF | 16 | √ | 1.5V |
| W91574DNF | 16 | √ | 3V |
| W91576DNF | 12 | √ | 1.5V |
| W91578DNF | 12 | √ | 3V |

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PIN CONFIGURATION



| PIN NAME | QFP-80 | PIN NAME | QFP-80 | PIN NAME | QFP-80 | PIN NAME | QFP-80 |
|--|--------|---------------------------|--------|---------------------------|--------|----------|--------|
| SEG29 | 1 | COL2 | 21 | $\overline{\text{TESTL}}$ | 41 | SEG9 | 61 |
| SEG30 | 2 | COL3 | 22 | APSET | 42 | SEG10 | 62 |
| SEG31 | 3 | COL4 | 23 | XT2 | 43 | SEG11 | 63 |
| SEG32 | 4 | COL5 | 24 | $\overline{\text{XT2}}$ | 44 | SEG12 | 64 |
| TEST | 5 | COL6 | 25 | VLCD | 45 | SEG13 | 65 |
| $\overline{\text{KMUTE}}$ | 6 | COL7 | 26 | VRTC2 | 46 | SEG14 | 66 |
| KT | 7 | COL8 | 27 | CN | 47 | SEG15 | 67 |
| $\overline{\text{TEST1}}$ | 8 | COL9 | 28 | CP | 48 | SEG16 | 68 |
| VDD | 9 | ROW1 | 29 | COM1 | 49 | SEG17 | 69 |
| NC/LOCK | 10 | ROW2 | 30 | COM2 | 50 | SEG18 | 70 |
| B/M | 11 | ROW3 | 31 | COM3 | 51 | SEG19 | 71 |
| DTMF | 12 | ROW4 | 32 | COM4 | 52 | SEG20 | 72 |
| $\overline{\text{SET}}_{\text{RTC}}$ | 13 | ROW5 | 33 | SEG1 | 53 | SEG21 | 73 |
| VSS | 14 | XT1 | 34 | SEG2 | 54 | SEG22 | 74 |
| H/P MUTE | 15 | $\overline{\text{XT1}}$ | 35 | SEG3 | 55 | SEG23 | 75 |
| T/P $\overline{\text{MUTE}}$ | 16 | $\overline{\text{HKS}}$ | 36 | SEG4 | 56 | SEG24 | 76 |
| HFO | 17 | $\overline{\text{HFI}}$ | 37 | SEG5 | 57 | SEG25 | 77 |
| $\overline{\text{DP}}/\overline{\text{C10}}$ | 18 | VRTC1 | 38 | SEG6 | 58 | SEG26 | 78 |
| MODE | 19 | $\overline{\text{TEST2}}$ | 39 | SEG7 | 59 | SEG27 | 79 |
| COL1 | 20 | ARD | 40 | SEG8 | 60 | SEG28 | 80 |

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PIN DESCRIPTION

| SYMBOL | PIN NO. | I/O | FUNCTION |
|-----------------------|-----------------|------|---|
| Row, Column Inputs | 29–33 and 20–28 | I | The keyboard inputs may be used with either the standard 6×10 keyboard, an inexpensive single contact (form A) keyboard or electronic input. A valid key entry is defined by a single row being connected to a single column. |
| XT1, \overline{XT} | 34, 35 | I, O | A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator. The oscillator ceases when a keypad input is not sensed after chip enable and dialing is finished. The crystal frequency deviation is $\pm 0.02\%$. |
| T/P \overline{MUTE} | 16 | O | The T/P \overline{MUTE} is a conventional CMOS N-channel open drain output. The output transistor is switched on low level during the dialing sequence (both pulse and tone mode), one-key redial break, auto redial break and flash break. Otherwise, it is switched off. |
| H/P MUTE | 15 | O | The H/P MUTE is a conventional CMOS inverter output. During pulse dialing, one-key redial break, auto redial break, flash break, hold, and mercury functions, this pin will output an active high. It remains in a low state at all other times. |
| \overline{KMUTE} | 6 | O | The \overline{KMUTE} is a CMOS N-channel open drain output. The output transistor is switched on only during mute function. Otherwise, it is switched off. |
| \overline{HKS} | 36 | I | Hook switch input. $\overline{HKS} = V_{DD}$ or floating: On-hook state. Chip in sleeping mode, no operation. $\overline{HKS} = V_{SS}$: Off-hook state. Chip enable for normal operation. \overline{HKS} pin is pulled to V_{DD} by internal resistor. |

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Pin Description, continued

| SYMBOL | PIN NO. | I/O | FUNCTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-----------|-------------------------|--|------------------|--|------------|--|--|-----------|--------|---------|-----|---------|-----|-------|-------------------------|------|-----|---------|------|-------------------------|-----|-------|----------|------|-------------------------|-------|-----|---------|------|----------|-----|------|----------|-------|---------|------|------|----------|------|---------|------|-----|
| $\overline{\text{HFI}}$, HFO | 37, 17 | I, O | <p>Handfree control pins. A low pulse on the $\overline{\text{HFI}}$ input pin toggles the handfree control state.</p> <p>Status of the handfree control 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>$\overline{\text{HFI}}$ </td> <td>High</td> <td>Yes</td> </tr> <tr> <td>On Hook</td> <td>High</td> <td>$\overline{\text{HFI}}$ </td> <td>Low</td> <td>No</td> </tr> <tr> <td>Off Hook</td> <td>High</td> <td>$\overline{\text{HFI}}$ </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> </tbody> </table> <p>The $\overline{\text{HFI}}$ pin is pulled to VDD by internal resistor.</p> <p>Detailed timing diagrams are shown in Figure 4(a), 4(b).</p> | CURRENT STATE | | NEXT STATE | | | Hook SW. | HFO | Input | HFO | Dialing | – | Low | $\overline{\text{HFI}}$ | High | Yes | On Hook | High | $\overline{\text{HFI}}$ | Low | No | Off Hook | High | $\overline{\text{HFI}}$ | 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 | $\overline{\text{HFI}}$ | High | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On Hook | High | $\overline{\text{HFI}}$ | Low | No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Off Hook | High | $\overline{\text{HFI}}$ | Low | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On Hook | – | Off Hook | Low | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Off Hook | Low | On Hook | Low | No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Off Hook | High | On Hook | High | Yes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\overline{\text{DP}}/\overline{\text{C10}}$ | 18 | O | <p>This pin is a CMOS N-channel open drain output. The flash key will cause $\overline{\text{DP}}/\overline{\text{C10}}$ to go active in either pulse mode or tone mode. In lock mode, the $\overline{\text{DP}}/\overline{\text{C10}}$ keeps low for 300 mS during off-hook delay time (If first off-hook occurred after power-on reset, the $\overline{\text{DP}}/\overline{\text{C10}}$ will keep high for 100ms then go low 200 mS. It will be recovered when first key-in was accepted). The timing diagram is shown as Figure 1(a), 1(b), 1(c), 1(d).</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DTMF | 12 | O | <p>In pulse mode, this pin remains in low state at all times.</p> <p>In tone mode, it will output a dual or single tone. Detailed timing diagram for tone mode is shown in Figure 2(a), 2(b), 2(c), 2(d).</p> <table border="1"> <thead> <tr> <th colspan="4">OUTPUT FREQUENCY</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 | | | | | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MODE | 19 | I | <p>Pulling the mode pin to VSS places the dialer in tone mode.</p> <p>Pulling the mode pin to VDD places the dialer in pulse mode and the dialing rate is 10 ppS.</p> <p>Floating the mode pin places the dialer in pulse mode and the dialing rate is 20 ppS.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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Pin Description, continued

| SYMBOL | PIN NO. | I/O | FUNCTION | | | | | | | | |
|--------------------------------------|------------------------------|---------|---|------------------------------|----------|----------|----------------|-----|----------------------------|-----|-----------------------|
| B/M | 11 | I | Make:Break ratio select pin. If B/M = VDD, the M/B ratio is 40:60. If B/M = Vss, the M/B ratio is 33.3:66.7. The B/M pin is pulled to VDD by internal resistor. | | | | | | | | |
| $\overline{\text{LOCK}}$ | 10 (for all lock version) | I | The $\overline{\text{LOCK}}$ pin is used to prevent "0" or "9" dialing under PABX system long distance call control. When the first key input after reset is "0" or "9", all the key inputs, including "0" or "9" key, become invalid, and the chip generates no output. The telephone is reinitialized by a reset. The following table describes the functions of the $\overline{\text{LOCK}}$ pin: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>$\overline{\text{LOCK}}$ PIN</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr> <td>Floating</td> <td>Normal dialing</td> </tr> <tr> <td>VDD</td> <td>"0", "9" dialing inhibited</td> </tr> <tr> <td>Vss</td> <td>"0" dialing inhibited</td> </tr> </tbody> </table> | $\overline{\text{LOCK}}$ PIN | FUNCTION | Floating | Normal dialing | VDD | "0", "9" dialing inhibited | Vss | "0" dialing inhibited |
| $\overline{\text{LOCK}}$ PIN | FUNCTION | | | | | | | | | | |
| Floating | Normal dialing | | | | | | | | | | |
| VDD | "0", "9" dialing inhibited | | | | | | | | | | |
| Vss | "0" dialing inhibited | | | | | | | | | | |
| COM1 to COM4 | 49 to 52 | O | COM1 to COM4 are the common signal output terminal for the 1/4 duty LCD. | | | | | | | | |
| SEG1 to SEG32 | 53 to 80, 1 to 4 | O | SEG1 to SEG32 are the 16-digit segment signal outputs. | | | | | | | | |
| VLCD | 45 | O | Power supply pin for LCD driver. A 0.1 μF capacitor is connected between VLCD and Vss. | | | | | | | | |
| CP, CN | 48, 47 | I | CP is the voltage control capacitor positive pin. CN is the voltage control capacitor negative pin. A 0.1 μF capacitor is connected between these two pins. | | | | | | | | |
| VDD, Vss | 9, 14 | I | Power input pins. | | | | | | | | |
| XT2, $\overline{\text{XT2}}$ | 43, 44 | I, O | A quartz crystal oscillator provides an RTC frequency time base of 32.768 KHz. | | | | | | | | |
| VRTC1, VRTC2 | 38, 46 | I | Either VRTC1 should be connected to a 1.5V battery (W91572DN/576DN) or VRTC2 should be connected to a 3.0V battery (W91574DN/578DN), which supplies the power source for the RTC. | | | | | | | | |
| $\overline{\text{SET}}_{\text{RTC}}$ | 13 | I | In the chip enable state, pulling $\overline{\text{SET}}_{\text{RTC}}$ to Vss toggles the RTC set function on/off, when the set function is toggled on, the RTC can be set using the "HOUR" and "MIN" keypads. | | | | | | | | |

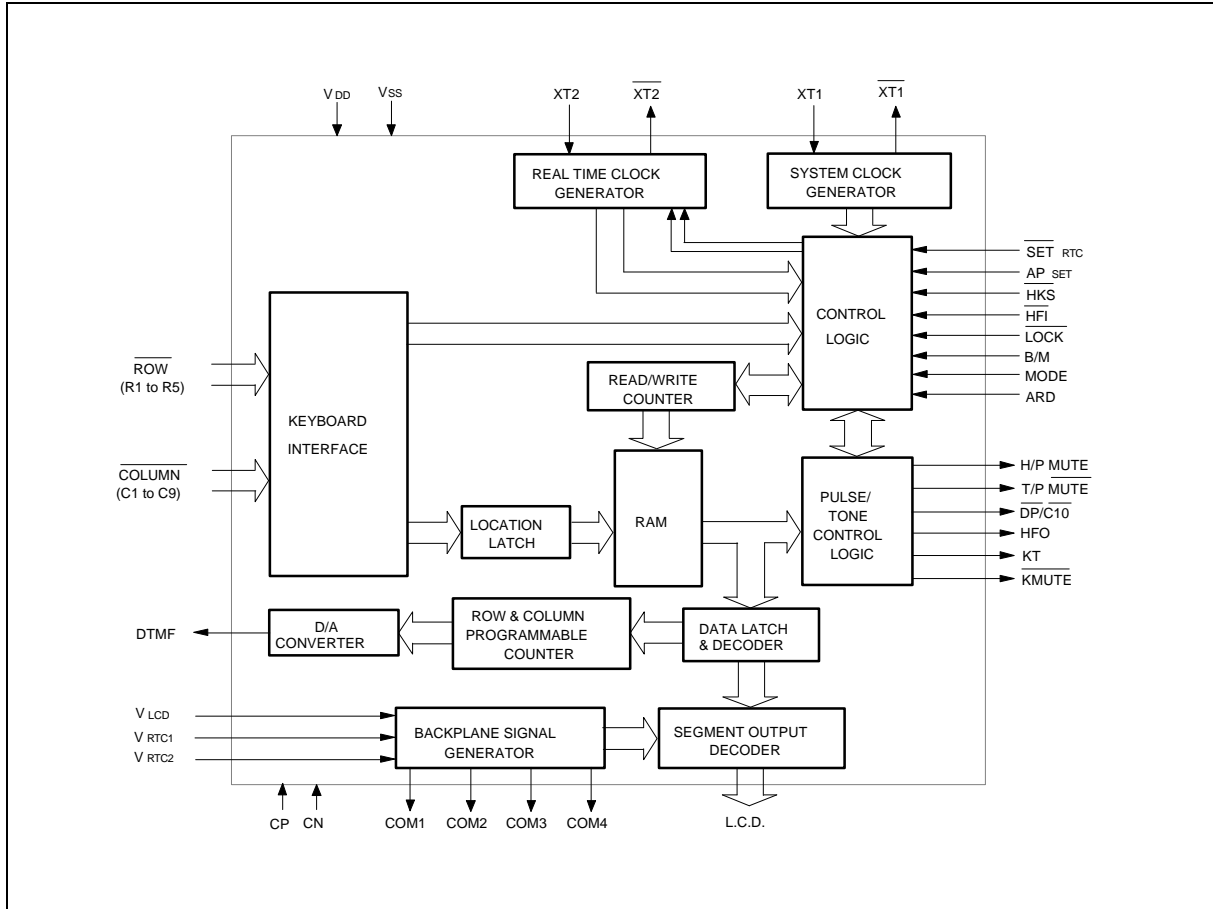
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Pin Description, continued

| SYMBOL | PIN NO. | I/O | FUNCTION | | | | | | | | | | | | | | | | | | | | |
|--|--|-------|---|--------------|-------|-------|---------------|--------------|-----------------|--------|-------|---------|----|-----------------|---------|-------|---------|----|----------|--------|-------|---|---|
| APSET | 42 | I | If APSET = VDD or floating, 24-hour clock mode. If APSET = VSS, 12-hour clock with p.m. mode. | | | | | | | | | | | | | | | | | | | | |
| ARD | 40 | I | Auto redial function selection. <table border="1" data-bbox="646 558 1260 722"> <thead> <tr> <th>ARD</th> <th>BREAK</th> <th>PAUSE</th> <th>WAIT INTERVAL</th> <th>REPEAT TIMES</th> </tr> </thead> <tbody> <tr> <td>V_{DD}</td> <td>4 secs</td> <td>1 sec</td> <td>25 secs</td> <td>10</td> </tr> <tr> <td>V_{SS}</td> <td>30 secs</td> <td>1 sec</td> <td>30 secs</td> <td>10</td> </tr> <tr> <td>Floating</td> <td>4 secs</td> <td>1 sec</td> <td>-</td> <td>1</td> </tr> </tbody> </table> <p>When ARD is left floating, the one-key redial function is enabled.</p> | ARD | BREAK | PAUSE | WAIT INTERVAL | REPEAT TIMES | V _{DD} | 4 secs | 1 sec | 25 secs | 10 | V _{SS} | 30 secs | 1 sec | 30 secs | 10 | Floating | 4 secs | 1 sec | - | 1 |
| ARD | BREAK | PAUSE | WAIT INTERVAL | REPEAT TIMES | | | | | | | | | | | | | | | | | | | |
| V _{DD} | 4 secs | 1 sec | 25 secs | 10 | | | | | | | | | | | | | | | | | | | |
| V _{SS} | 30 secs | 1 sec | 30 secs | 10 | | | | | | | | | | | | | | | | | | | |
| Floating | 4 secs | 1 sec | - | 1 | | | | | | | | | | | | | | | | | | | |
| KT | 7 | O | The key tone output is a conventional CMOS inverter. The key tone is generated as any valid key pressed, as the KT pin generates a 1.2 KHz square wave which keeps on 35 mS; otherwise, it remain in low state. | | | | | | | | | | | | | | | | | | | | |
| TEST, <u>TEST1</u> , <u>TEST2</u> , TESTL | 5, 8, 39, 41 | I | For testing only. | | | | | | | | | | | | | | | | | | | | |
| NC | 10 (for W91572/574/ W91576/578) | - | No connection. | | | | | | | | | | | | | | | | | | | | |

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Keyboard Operation

| C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | DP/C10 | |
|-------|----|--------|--------|--------|--------|--------|-----|-----|--------|-------------------------------------|
| 1 | 2 | 3 | E | HOUR | M0 | M5 | M10 | M15 | HOLD1 | R1 |
| 4 | 5 | 6 | MUTE | MIN | M1 | M6 | M11 | M16 | HOLD2 | R2 |
| 7 | 8 | 9 | A2 | SAVE | M2 | M7 | M12 | M17 | MER | R3 |
| * / T | 0 | # | R/P1 | OKR | M3 | M8 | M13 | M18 | A1 | R4 |
| F1 | F2 | F3 | CHK | TIM | M4 | M9 | M14 | M19 | RTC | R5 |
| R/P2 | - | ICON12 | ICON13 | ICON14 | ICON15 | ICON16 | | | | V _{DD} /V _x /R6 |



- E: Store digit
- MUTE: Mute key
- F1, F2, F3: Flash keys
- SAVE: Save memory key
- MER: Mercury memory key
- OKR: One-key redial function
- RTC: Real time clock toggle key
- HOLD1, HOLD2: Hold function keys
- R/P1, R/P2: Redial and pause function keys, P1 is 3.6 sec. and P2 is 2.0 sec.
- TIM: a. Display last calling time
b. Start and/or stop counting up calling time
- HOUR and MIN: Active when setting mode is operated after off-hook
- A1, A2: Indirect repertory memory dialing function keys, A1 for page 1 and A2 for page 2
If $L_p = 0$ to 9, $M_p = M_0$ to M_9 , and $M_q = M_{10}$ to M_{19} , then
 - a. $A_1 + L_p$ (or M_p) the memory location M_0 to M_9 will be selected
 - b. $A_2 + L_p$ (or M_p) the memory location M_{10} to M_{19} will be selected
 - c. A_1 (or A_2) + M_q the memory location M_{10} to M_{19} will be selected
- */T: * in tone mode and $P \rightarrow T$ in pulse mode
- CHK: a. Check dialing number
b. Check last dialing time
c. Memory check (except mercury)
- ICON12, ..., ICON16: Keys reserved for user, can be toggled on any time when the chip is enabled

Notes: D1, ..., Dn, D1', ..., Dn': 0, ..., 9, */T, #

R/P: R/P1 or R/P2

An: A1, A2

Ln: 0, ..., 9, map to indirect memory location 0, ..., 9

Mn: Direct memory location M_0 , ..., M_{19}

Normal Dialing

OFF HOOK (or ON HOOK & $\overline{HF1}$ $\overline{i\hat{0}}$), D1 , D2 , ..., Dn

1. D1, D2, ..., Dn will be dialed out.
2. Dialing length is unlimited, but redial is inhibited if the length oversteps 32 digits in normal dialing.

Redialing

If ARD pin = floating, the one-key redial function is selected:

1. OFF HOOK (or ON HOOK & $\overline{HF1}$ $\overline{i\hat{0}}$), D1 , D2 , Check Memory (or Number Store), D3 , ..., Dn , Busy, ON HOOK , OFF (or

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Come HOOK
 ON HOOK & $\overline{\text{HF1}} \overline{\text{i}\dot{\text{O}}}$), R/P

a. R/P key can execute the redial function only as the first dialing after off-hook; otherwise, The it

will invoke the pause function.

b. The redial memory contents will be D3, ..., Dn.

c. Redial memory can be checked in memory check mode.

d. If redialing length oversteps 32 digits, the redialing function will be inhibited.

2. OFF HOOK (or ON HOOK & $\overline{\text{HF1}} \overline{\text{i}\dot{\text{O}}}$), D1 , D2 , ..., Dn , Busy, OKR

a. If the dialing D1 to Dn is finished, pressing the OKR key will cause the pulse output of

pin $\overline{\text{DP}}/\overline{\text{C10}}$ to go low for 2.2 seconds break time and 0.6 seconds pause time will be added automatically.

b. If the pulses of the dialed digits D1 to Dn have not finished, OKR will be ignored.

c. The one-key redialing function timing diagram is shown in Figure 3.

Number Entry

1. OFF HOOK (or ON HOOK & $\overline{\text{HF1}} \overline{\text{i}\dot{\text{O}}}$), D1 , D2 , ..., Dn , E (many times

same as one time), Mn (or An , Ln) , ON HOOK

D1, D2, ..., Dn will be stored in memory location Mn (or Ln) and will be dialed out.

2. OFF HOOK (or ON HOOK & $\overline{\text{HF1}} \overline{\text{i}\dot{\text{O}}}$), E , D1 , D2 , ..., Dn , E

(could be skipped), Mn (or An , Ln) , ON HOOK

3. OFF HOOK (or ON HOOK & $\overline{\text{HF1}} \overline{\text{i}\dot{\text{O}}}$), E , D1 , D2 , ..., Dn , Mn

(or An , Ln) , ON HOOK

a. D1, D2, ..., Dn will be stored in memory location Mn (or Ln) but will not be dialed out.

b. R/P and */T keys can be stored as a digit in memory, in store R/P mode,

is the pause function key.

c. The store mode is released after the store function is executed or when the state of the hook



switch changes is executed.

4. , , (or ,)

The redial content excluding memory dialing will be copied to memory location Mn (or Ln).

5. The first 16 digits will be stored into memory, if the key-in number over 16 digits.

Save

1. (or &), , , ..., CONVERSATION, , , , ..., ,

D1', D2', ..., Dn' will be stored in save memory but will not be dialed out.

2. (or &), , , ..., ,

a. If the dialing sequence D1, D2, ..., Dn has not finished, SAVE will be ignored.

b. If the sequence off hook, D1, D2, ..., Dn (dialing finish), SAVE, SAVE is keyed in, D1, D2, ..., Dn

will be copied to save memory and D1, D2, ..., Dn will be dialed out again.

c. If the sequence off hook, D1, D2 (dialing finish), SAVE, D3, D4 (dialing finish), SAVE is keyed in,

D1, D2 will be copied to save memory and D3, D4 will not be copied to save memory.

d. All above sequences will be displayed on LCD.

Mercury

1. (or &), , , ..., CONVERSATION, , , , ..., ,

D1', D2', ..., Dn' will be stored in mercury memory and display on the LCD, but will not be dialed out.

2. MERCURY memory content = D1', D2', ..., Dn'

- (or &), , , ..., , ,
 , (or &),

a. The dialing sequence will be D1, D2, ... Dn, on hook, off hook, D1', D2', ..., Dn'.

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- b. The MER key can be used to execute the mercury function only when it is the first key-in in dialing mode after off-hook or first priority flash operation.
- c. The contents of mercury memory will not be displayed on the LCD except for mercury mark.
- d. If the sequence D1, D2, ..., Dn, MER, on-hook, off-hook, MER is keyed in, D1, D2, ..., Dn will not be copied to mercury memory, D1', D2', ..., Dn' will be dialed out, and the mercury mark (icon 10) will be blinking after off-hook. Detailed timing diagram is shown in Figure 5.
- e. Mercury memory cannot be checked in memory check mode.



Repertory Dialing

1. One-touch direct repertory dialing.

- a. OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), Mn (or R/P)
- b. OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), SAVE (or MER)
- c. OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), Mn (or R/P), SAVE

2. Two-touch indirect repertory dialing.

OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), An , Ln (or Mn)

Access Pause

OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), D1 , D2 , R/P , D3 , ..., Dn
 , Busy, Come, ON HOOK , OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), R/P

1. The first R/P functions as a pause key and the second as a first key-in redial key.
2. The pause function can be stored in memory, and only one R/P key can be released to the user.
3. The pause function is executed in normal dialing, redialing, or memory dialing.
4. The pause duration of 2.0 or 3.6 seconds per pause is selected through the keypad.
5. The default pause duration is 3.6 seconds after power on.
6. The pause function timing diagram is shown in Figure 6.

Pulse- to-tone (*/T)

OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\dot{\text{O}}}$), D1 , D2 , ..., Dn , */T , D1' ,
 D2' , ..., Dn'

1. If the mode switch is set to pulse mode, then the output signal will be:

D1, D2, ... Dn, Pause (2.0 sec/3.6 sec), D1', D2', ..., Dn'
 (Pulse) (Tone)

2. If the mode switch is set to tone mode, then the output signal will be:

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

3. The dialer remains in tone mode after the digits have been dialed out and can be reset to pulse mode only by going on-hook.
4. The pause time of pulse-to-tone is default to 3.6 seconds.
5. The pulse-to-tone function timing diagram is shown in Figure 7.



Flash (F = F1, F2, F3)

(or &),

1. The dialer will execute a flash break time of 600 mS (F1), 300 mS (F2), or 100 mS (F3) and pause time of 1S before the next digit (except flash key) is dialed out.
2. Flash keeps first priority in normal dialing but insert flash can be stored into memory when flash is the first digit in memory. In this condition, only one flash key can be released to the user.
 - a. E, F1, D1, D2, D3, E, Mn then the digit stored in Mn will be F1, D1, D2, D3.
 - b. E, D1, F1, D2, D3, E, Mn then the digit stored in Mn will be D1, D2, D3.
 - c. F1, D1, D2, D3, E, Mn then the digit stored in Mn will be D1, D2, D3.
3. The system will return to the initial state after the flash pause time is finished.
4. Keyboard functions are inhibited when flash break is being executed.
5. The flash timing diagram is shown in Figure 8.

Mute

(or &),

1. The MUTE is switched on and off by a toggle switch.
2. The function timing diagram is shown in Figure 9.

Hold Key

(or &), (or)

1. The hold function is toggled on and off by Hold1 or Hold2 key. When the hold function is toggled on, the hold mark (icon 4) will be lit and all key-ins (except hold keys and icon keys) will be ignored.

2. The following are examples of hold function toggled on and off:

- a. , (or) , (or)
- b. , (or) ,
- c. , (or) , ,
- d. & , (or) ,

3. Hold1 and Hold2 have the same function in off-hook state. The difference between Hold1 and Hold2 are shown as follows:

- a. If , (or) , , is entered, then the dialer will be off-line.



If **OFF HOOK** , **HOLD1** (or **HOLD2**) , **ON HOOK** , **HOLD2** is entered, then the dialer stay at hold function.

b. If **ON HOOK** & **HFI i0** , **HOLD1** (or **HOLD2**) , **HOLD1** is entered, then the dialer will be off-line.

If **ON HOOK** & **HFI i0** , **HOLD1** , (or **HOLD2**) , **HOLD2** is entered, then the dialer stay at hold function.

4. The function timing diagram is shown in Figure 10(a), 10(b), 10(c).

Adjusting Time Setting

OFF HOOK (or **ON HOOK** & **HFI i0**) , **SET RTC i0** , **HOUR** , **MIN** ,
SET RTC i0 (or **ON HOOK**)

1. Only HOUR and MIN keys are valid in set RTC mode.
2. Hours and minutes count forward as long as the HOUR or MIN key is pressed.
3. The on/off function of **SET RTC** is toggled, and the dialer will go back to a previous state after the toggle off **SET RTC** function.
4. If the dialing sequence D1, D2, ..., Dn (including flash and pause) has not finished, **SET RTC** (or 'RTC' key pressed) will be ignored.

RTC Display Mode

OFF HOOK (or **ON HOOK** & **HFI i0**) , **RTC**

1. The real time clock display mode can be toggled on and off by RTC key.
2. The icon display will not be changed when enter RTC display mode and set RTC mode.

Check Key

OFF HOOK (or **ON HOOK** & **HFI i0**) , **CHK** , **R/P** (or **OKR** , **SAVE** , **Mn** , ..., etc.)

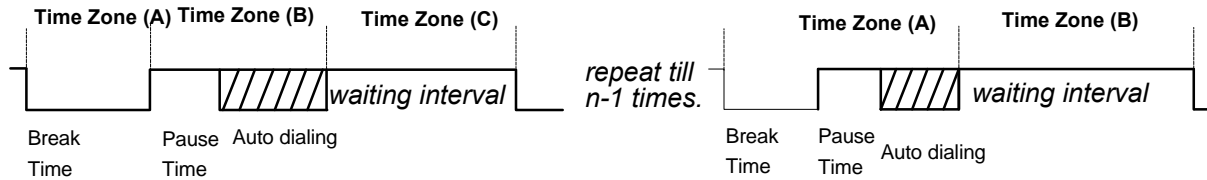
The redial (or memory) content will be displayed on the LCD when either **R/P** or **OKR** is keyed in.



Auto Redial

If ARD pin = VDD or VSS, the auto redial function is selected:

OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\hat{0}}$), OKR



1. During time zone (B) the keypads are inhibited, and in time zone (A), (C) the auto redial can be interrupted by pressing any keypad or by going off-hook.
2. The visible dialing number will be blinking during the waiting time interval.
3. If OKR is the first key-in after off-hook or handfree then the first break and pause time will be ignored.
4. The following show examples to interrupt auto redial function:

OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\hat{0}}$), OKR , Any Keypad (at break time and waiting interval)

5. If ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\hat{0}}$, OKR , OFF HOOK

a. When in time zone (A) or (C), the auto-redial function will be interrupted and changed to hook mode after OFF HOOK

b. When in time zone (B), the auto-redial function will continue and changed to hook mode after OFF HOOK

6. If ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\hat{0}}$, OKR , $\overline{\text{HFI}} \overline{\text{i}\hat{0}}$ (any time) is entered, the dialer will be off-line.

7. The auto redial function timing diagram is shown in Figure 11(a), 11(b).

8. The calling time will auto-count when the auto-redial function is interrupted in break time zone (A) and (C).

TIM

OFF HOOK (or ON HOOK & $\overline{\text{HFI}} \overline{\text{i}\hat{0}}$), D1 , D2 , ..., Dn (or Redialing or Repertory dialing 1), CONVERSATION

1. If no key is pressed after dialing is finished, the LCD will display counting time after 6 seconds.
2. If the dialing sequence D1, D2, ..., Dn has not finished, TIM will be ignored.
3. The timer will be initialized by flash and auto redial.



Cascaded and Mixed Dialing

Cascaded Dialing

1. Definition of cascaded dialing:

In cascaded dialing, a new sequence may be pressed before the previous sequence has been sent out completely. The following are examples of cascaded dialing:

Example 1: + + +...

Example 2: + + +...

Example 3: + + +...

2. Normal dialing, redialing, or repertory dialing as represented by each rectangle above is treated as one sequence.
3. At most 64 digits are allowed in cascaded dialing, but there is no limitation on the number of sequences.
4. The content of cascaded dialing may a combination of normal dialing, redialing, and repertory dialing. Redialing is valid only as the first key-in, however.
5. If , , is entered, then the cascaded dialing sequence described in the above examples will be dialed out only if there are not more than 32 digits. If the sequence exceeds 32 digits then the redialing is inhibited.

Mixed Dialing

1. Definition of mixed dialing:

The examples of cascaded dialing given above are also examples of mixed dialing except that in mixed dialing a new sequence may be accepted only when the previous sequence has been dialed out completely.

2. There is no limitation on the number of digits and sequences in the mixed dialing.
3. The content of mixed dialing may be a combination of normal dialing, memory dialing, or one-key redialing.
4. If , , is entered, then the mixed dialing sequence described in the above examples will be dialed out only if the total number of digits does not exceed 32. If the total exceeds 32 digits, then redialing is inhibited.

Combining of Cascaded and Mixed Dialing

1. Cascaded dialing and mixed dialing may be combined, and each follows the rules described above.
2. To apply redialing to combinations of cascaded and mixed dialing:

, , then redialing will be executed only if the total number of digits does not exceed 32. Otherwise, the redialing is inhibited.

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3. If there had been n cascaded sequences with a total of 60 digits dialed, then for the (n+1)th cascaded sequence, one 4-digit normal dialing sequence or one complete repertory dialing sequence (length up to 32 digits) can be dialed. The (n+2)th sequence will not be accepted for cascaded dialing.
4. After a total of 64 digits of cascaded dialing have been completed, mixed dialing can be added.

ABSOLUTION MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATING | UNIT |
|-----------------------|---------|--------------|------|
| DC Supply Voltage | VDD-VSS | -0.3 to +7.0 | V |
| Input/Output Voltage | VIL | VSS - 0.3 | V |
| | VIH | VDD + 0.3 | |
| | VOL | VSS - 0.3 | |
| | VOH | VDD + 0.3 | |
| Power Dissipation | PD | 120 | mW |
| Operating Temperature | TOPR | -0.5 to +70 | °C |
| Storage Temperature | TSTG | -55 to +125 | °C |

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

(VDD-VSS = 2.5V. Fosc = 3.58 MHz, TA = 25° C, all outputs unloaded.)

| PARAMETER | SYM. | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------------------------|------|---|------|------|------|-------|
| Operating Voltage | VDD | - | 2.0 | - | 5.5 | V |
| Operating Current | IOP | Tone, Unloaded | - | 0.5 | 0.7 | mA |
| | | Pulse, Unloaded | - | 0.4 | 0.5 | |
| Standby Current | ISB | $\overline{\text{HKS}} = 0$, Unloaded and no key entry | - | - | 15 | μA |
| Memory Retention Current | IMR | $\overline{\text{HKS}} = 1$ VDD = 1.0V | - | - | 0.5 | μA |
| Tone Output Voltage | VTO | Row group RL = 10 KΩ | 130 | 150 | 170 | mVrms |
| Pre-emphasis | | Col/Row VDD = 2.0 to 5.5V | - | 2 | 3 | dB |

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DC Characteristics, continued

| PARAMETER | SYM. | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|------------|---|--------------|------|--------------|------------------|
| DTMF Distortion | THD | $R_L = 10\text{ K}\Omega$ $V_{DD} = 2.0\text{ to }5.5\text{V}$ | - | -30 | -23 | dB |
| DTMF Output DC Level | V_{TDC} | $V_{DD} = 2.0\text{ to }5.5\text{V}$ | 1.0 | - | 3.0 | 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 |
| Common Output Voltage | V_{CH} | - | 4.2 | 4.5 | 4.8 | V |
| | V_{CL} | - | - | 0 | 0.3 | |
| Common Output Current | I_{CH} | - | -20 | - | - | μA |
| | I_{CL} | - | 20 | - | - | |
| Segment Output Voltage | V_{SH} | - | 4.2 | 4.5 | 4.8 | V |
| | V_{SL} | - | - | 0 | 0.3 | |
| Segment Output Current | I_{SH} | - | -5 | - | - | μA |
| | I_{SL} | - | 5 | - | - | |
| RMS Voltage Across a Segment | V_{ON} | - | 2.34 | 2.6 | - | V_{rms} |
| | V_{OFF} | - | - | 1.5 | 1.65 | |
| Average DC Offset Voltage | V_{DC} | - | - | - | 100 | mV |
| \overline{HFI} High Voltage | V_{HFIH} | - | $0.8 V_{DD}$ | - | V_{DD} | V |
| \overline{HFI} Low Voltage | V_{HFIL} | - | - | - | $0.2 V_{DD}$ | V |
| T/P \overline{MUTE} Output Sink Current | I_{TML} | $V_{TMO} = 0.5\text{V}$ | 0.5 | - | - | mA |
| H/P \overline{MUTE} Output Drive Current | I_{HMH} | $V_{HMO} = 2.5\text{V}$ | 0.5 | - | - | mA |
| H/P \overline{MUTE} Output Sink Current | I_{HML} | $V_{HMO} = 0.5\text{V}$ | 0.5 | - | - | mA |
| \overline{K} \overline{MUTE} Output Sink Current | I_{KML} | $V_{TMO} = 0.5\text{V}$ | 0.5 | - | - | mA |
| Keypad Input Drive Current | I_{KD} | $V_I = 0\text{V}$ | 4 | - | 80 | μA |
| Keypad Input Sink Current | I_{KS} | $V_I = 2.5\text{V}$ | 200 | - | 400 | μA |
| Keypad Resistance | R_K | - | - | - | 5 | $\text{K}\Omega$ |
| Control Input Pull Up/Down Resistor | R_{CIP} | B/M, \overline{HFI} | 100 | - | - | $\text{K}\Omega$ |
| \overline{HKS} Input Pull High Resistor | R_{HK} | - | - | 500 | 2000 | $\text{K}\Omega$ |

AC CHARACTERISTICS

(V_{DD}-V_{SS} = 2.5V, Fosc. = 3.58 MHz, T_A = 25° C, all outputs unloaded.)

| PARAMETER | SYM. | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|-------|-----------------------|------|-------|------|------|
| Key-in Debounce | TKID | - | - | 20 | - | mS |
| Key Release Debounce | TKRD | - | - | 20 | - | mS |
| Off Hook Delay Time | TOFD | - | - | 300 | - | mS |
| First Key-in Delay Time | TFKD | - | - | 300 | - | mS |
| On Hook Debounce Time | TOHD | Unlock | - | 150 | - | mS |
| | | Lock | - | 20 | - | |
| Key Tone Frequency | FKT | - | - | 1.2 | - | KHz |
| Key Tone Duration | TKTD | - | - | 35 | - | mS |
| Key Tone Delay | TKD | - | - | 20 | - | mS |
| Pulse Mute Delay | TMD | B/M = V _{DD} | - | 40 | - | mS |
| | | B/M = V _{SS} | - | 33.3 | - | |
| Pre-digit-pause ⁽¹⁾ 10 ppS | TPDP1 | B/M = V _{DD} | - | 40 | - | mS |
| | | B/M = V _{SS} | - | 33.3 | - | |
| Pre-digit-pause ⁽²⁾ 20 ppS | TPDP2 | B/M = V _{DD} | - | 20 | - | mS |
| | | B/M = V _{SS} | - | 16.7 | - | |
| Inter-digit Pause (Auto Dialing) | TIDP1 | 10 ppS | - | 800 | - | mS |
| | TIDP2 | 20 ppS | - | 500 | - | |
| Make/Break Ratio | M:B | B/M = V _{DD} | - | 40:60 | - | % |
| | | B/M = V _{SS} | - | 33:67 | - | |
| Tone Output Duration | TTD | - | - | 87 | - | mS |
| Inter-tone Pause | TITP | - | - | 87 | - | mS |
| Flash Break Time | TFB | F1 | - | 600 | - | mS |
| | | F2 | - | 300 | - | |
| | | F3 | - | 100 | - | |
| Flash Pause Time | TFP | F1, F2, F3 | - | 1 | - | S |
| Pause Time | TP | R/P1 | - | 3.6 | - | S |
| | | R/P2 | - | 2.0 | - | |
| One Key Redialing Break Time | TRB | - | - | 4 | - | S |
| One Key Redialing Pause Time | TRP | - | - | 1 | - | S |

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AC Characteristics, continued

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---------------------------------|--------|------------|------|------|------|------|
| Auto Redialing Break Time | TARB | ARD = VDD | - | 4 | - | S |
| | | ARD = VSS | - | 30 | - | |
| Auto Redialing Pause Time | TAPR | ARD = VDD | - | 1 | - | S |
| | | ARD = VSS | - | 1 | - | |
| Auto Redialing Waiting Interval | TWI | ARD = VDD | - | 25 | - | S |
| | | ARD = VSS | - | 30 | - | |
| LCD Frame Frequency | FLCD | - | - | 32 | - | Hz |

RTC DC CHARACTERISTICS

(V_{RTC} = 1.5V, V_{SS} = 0V, F_{osc.} = 32,768 Hz, T_A = 25° C, all outputs unloaded.)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|-------------------|--|----------------------|------|----------------------|------|
| Supply Voltage | V _{RTC} | - | 1.2 | 1.5 | 1.8 | V |
| Supply Current | I _{RTC} | No Load | - | 2.0 | 4.0 | μA |
| OSC. Starting Time | T _{OSC} | - | - | - | 3 | S |
| OSC. Output Built-in Cap. | C _o | Cl = 12.5 pF | - | 25 | - | pF |
| OSC. in Trimmer Cap. | C _{TRIM} | - | 5 | - | 35 | pF |
| Frequency Stability | Δf/f | V _{DD} -V _{SS} = 1.3 to 1.6V | - | - | 1 | ppM |
| $\overline{\text{SET}}_{\text{RTC}}$ Input High Voltage | V _{SETH} | - | V _{DD} -0.3 | - | V _{DD} | V |
| $\overline{\text{SET}}_{\text{RTC}}$ Input Low Voltage | V _{SETL} | - | V _{SS} | - | V _{SS} +0.3 | V |

Notes :

- Crystal parameters suggested for proper operation are R_s < 100Ω, L_m = 96 mH, C_m = 0.02 pF, C_n = 5 pF, C_l = 18 pF, and F_{osc.} = 3.579545 MHz ±0.02%
- Crystal oscillator accuracy directly affects these times.

TIMING WAVEFORMS

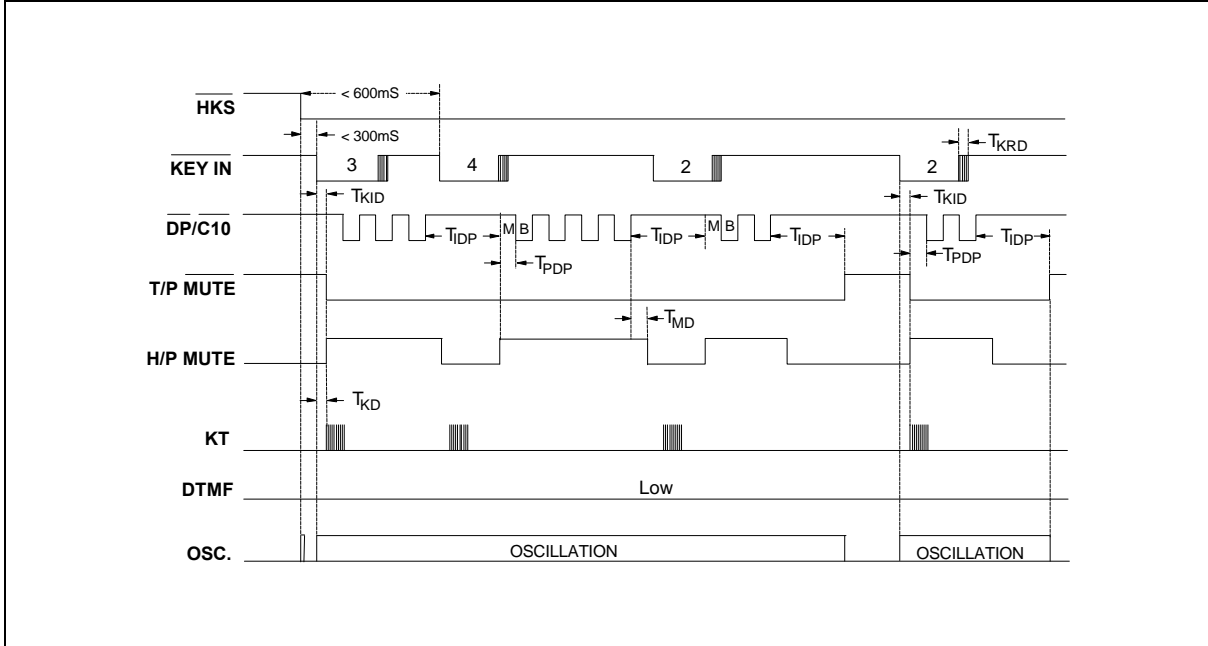


Figure 1(a). Normal Dialing Timing Diagram (Pulse Mode without Lock Function)

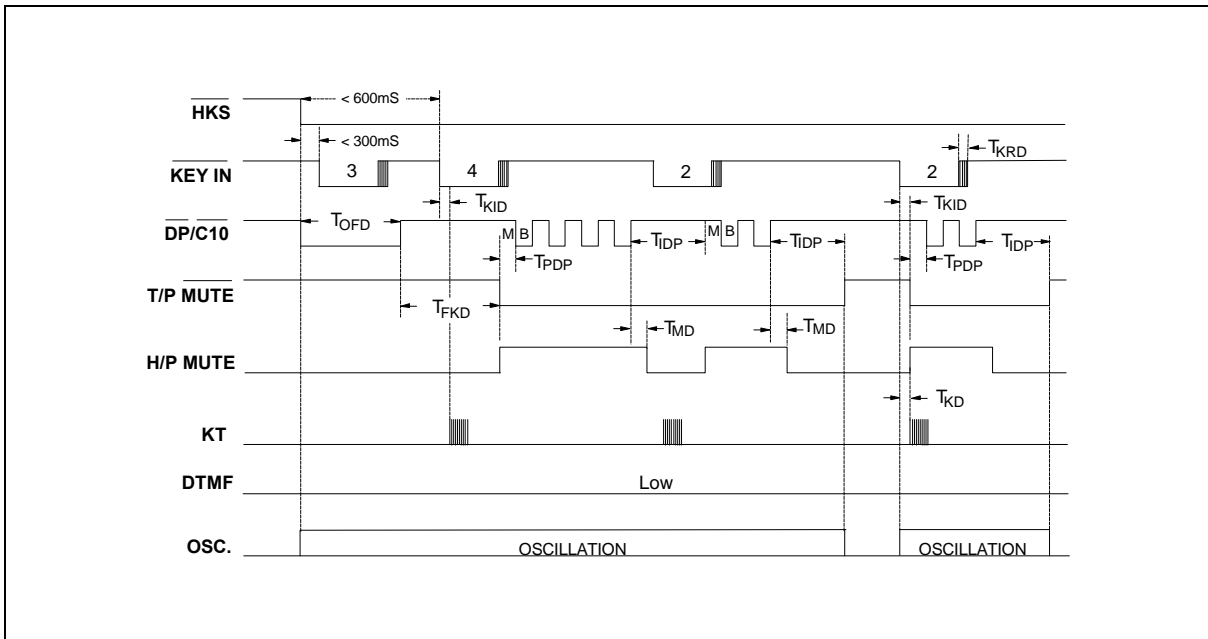


Figure 1(b). Normal Dialing Timing Diagram (Pulse Mode with Lock Function)

Timing Waveforms, continued

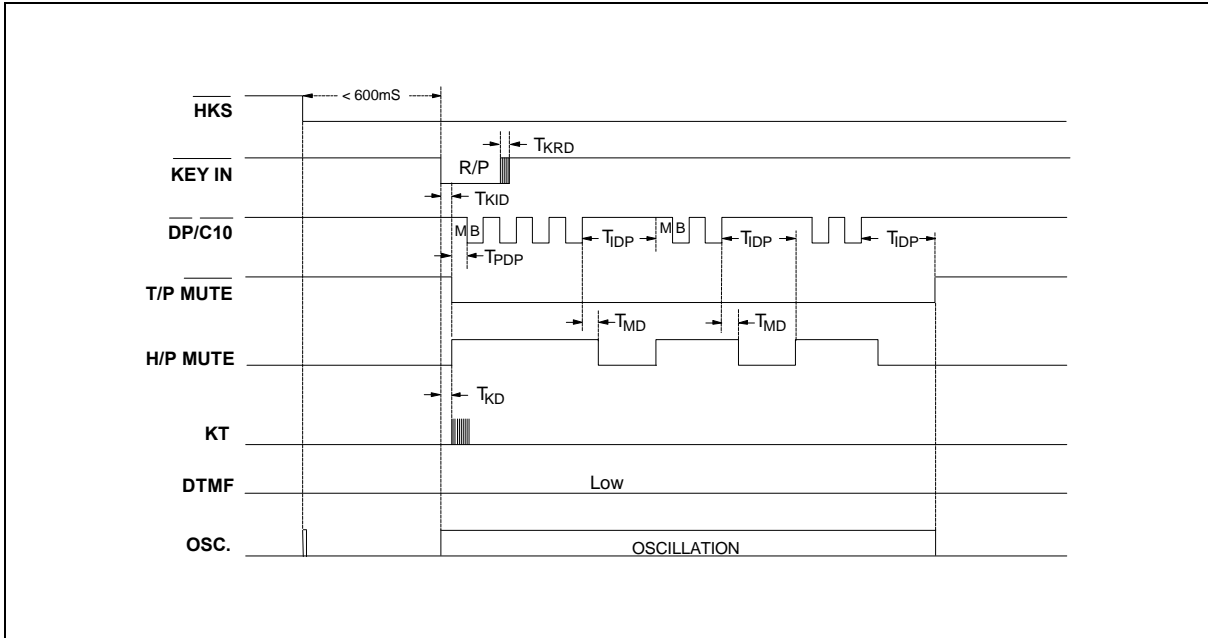


Figure 1(c). Auto Dialing Timing Diagram (Pulse Mode without Lock Function)

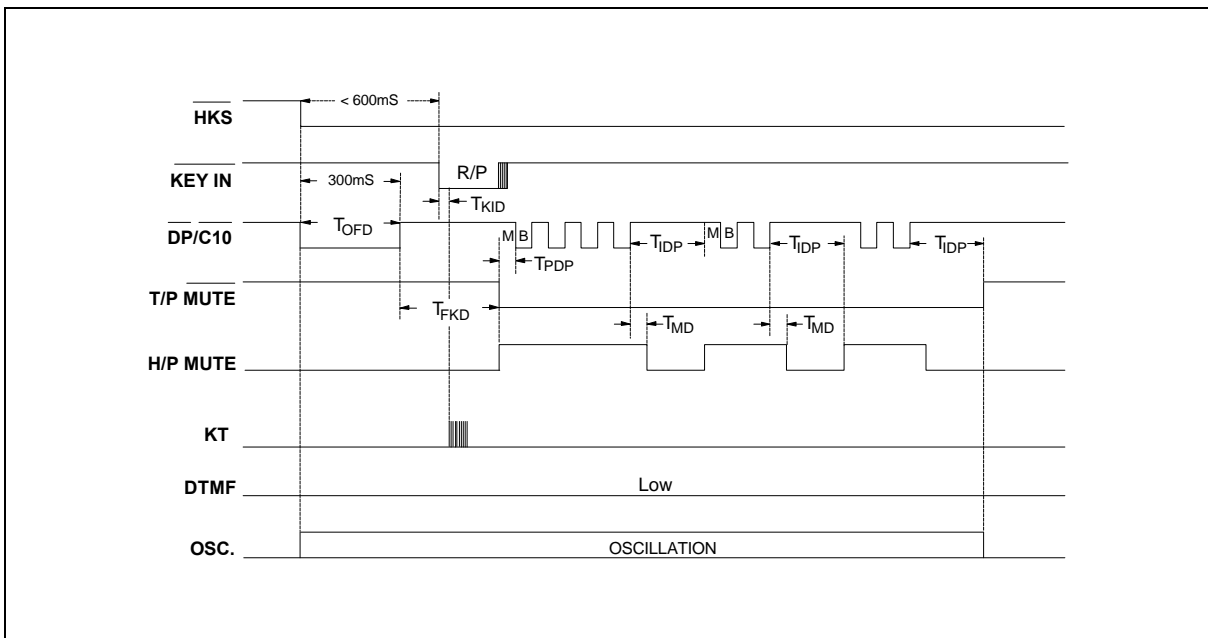


Figure 1(d). Auto Dialing Timing Diagram (Pulse Mode with Lock Function)

Timing Waveforms, continued

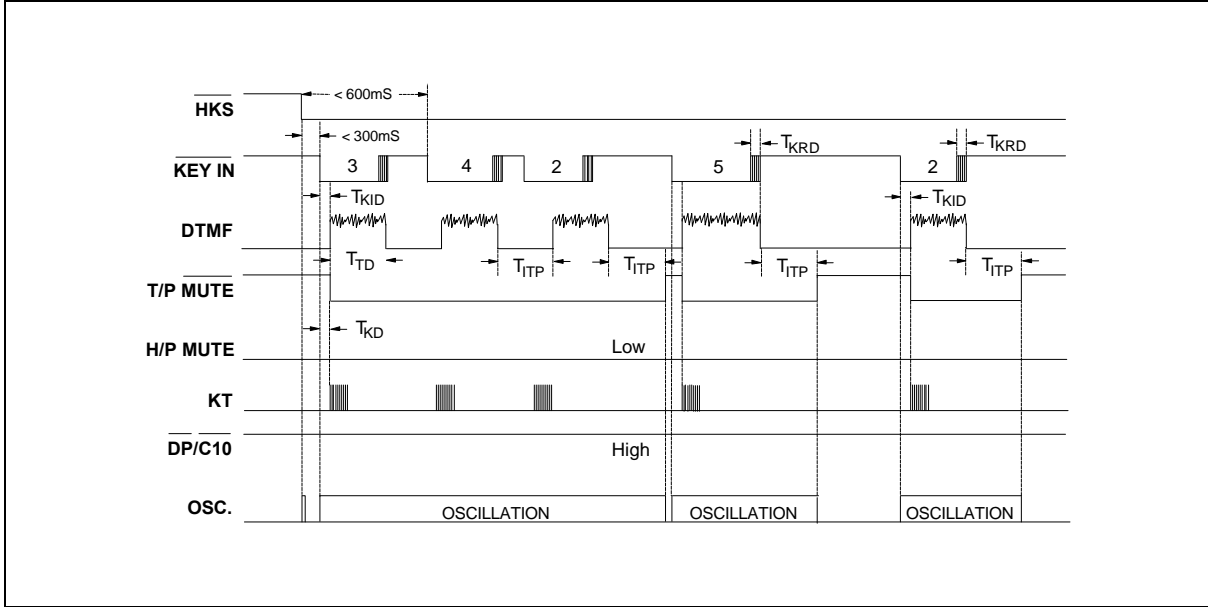


Figure 2(a). Normal Dialing Timing Diagram (Tone Mode without Lock Function)

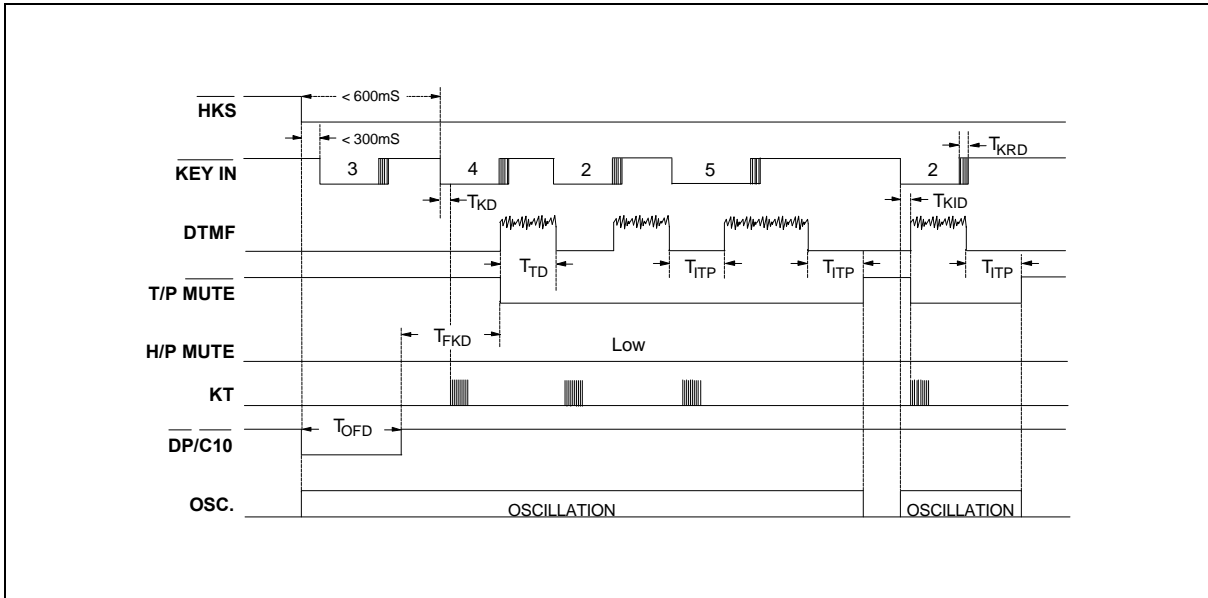


Figure 2(b). Normal Dialing Timing Diagram (Tone Mode with Lock Function)

Timing Waveforms, continued

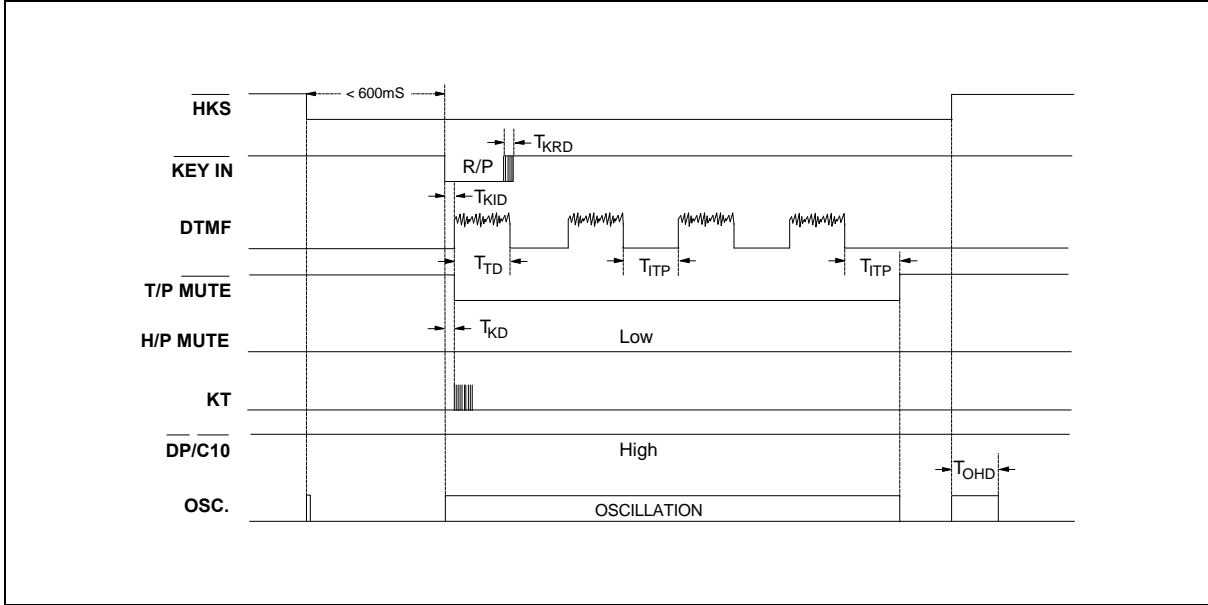


Figure 2(c). Auto Dialing Timing Diagram (Tone Mode without Lock Function)

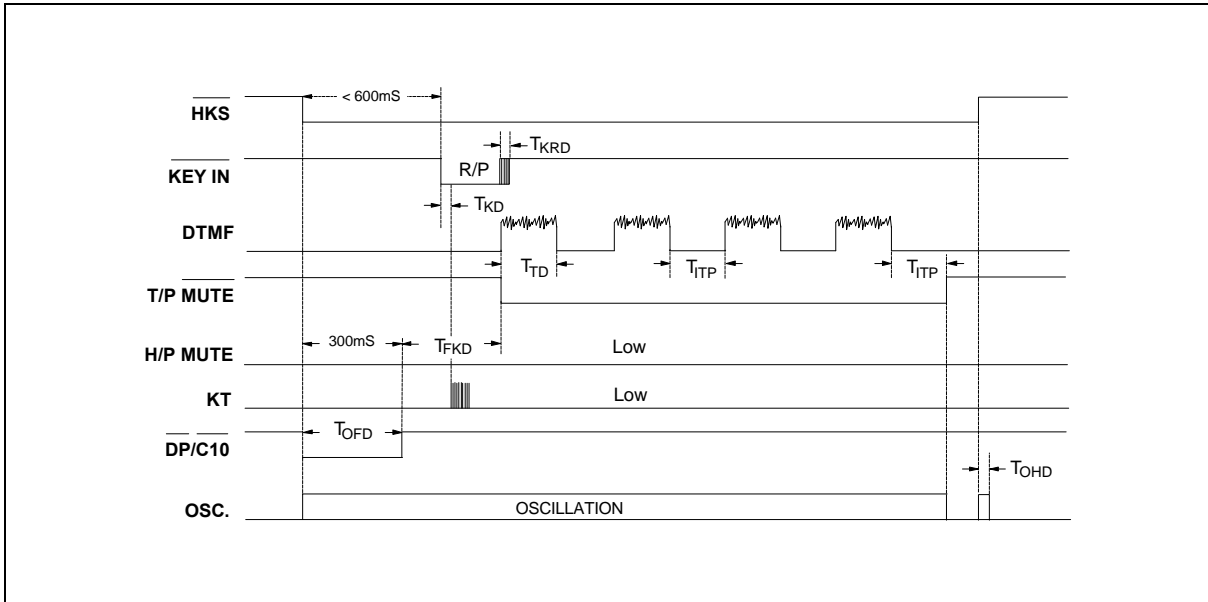


Figure 2(d). Auto Dialing Timing Diagram (Tone Mode with Lock Function)

Timing Waveforms, continued

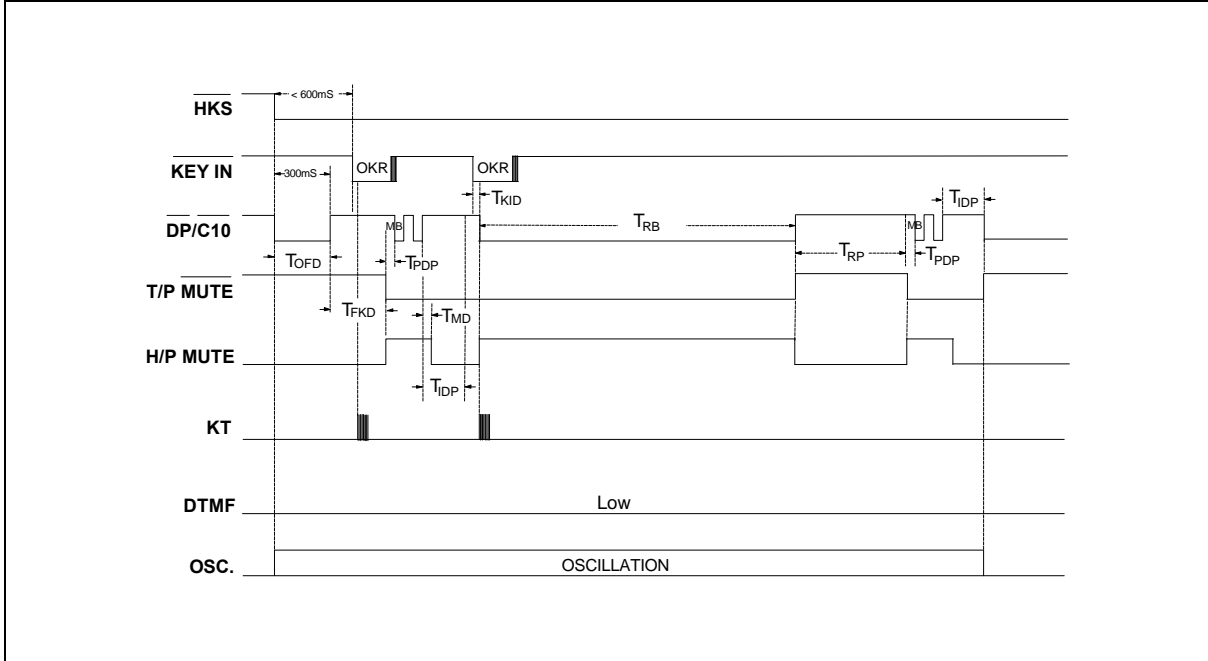


Figure 3. One-key Redial Timing Diagram

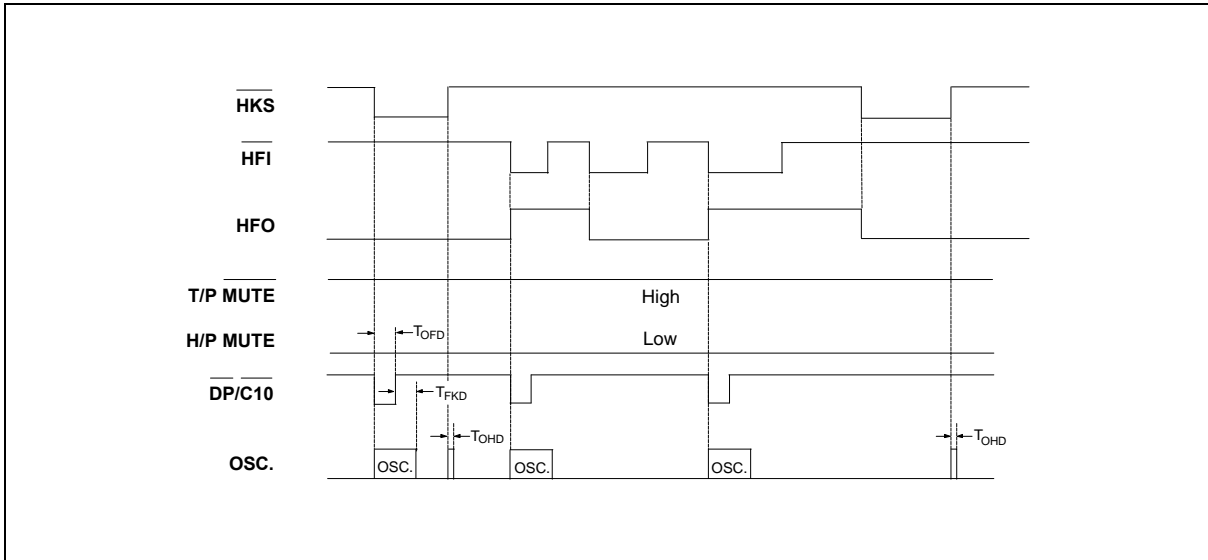


Figure 4(a). Handfree Timing Diagram (with Lock Function)

Timing Waveforms, continued

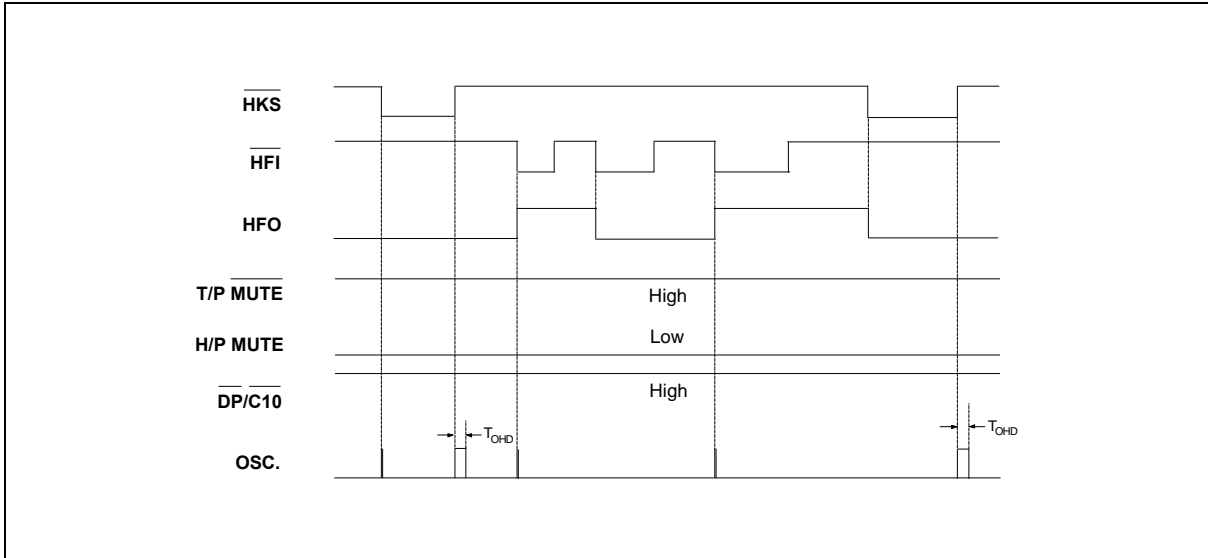


Figure 4(b). Handfree Timing Diagram (without Lock Function)

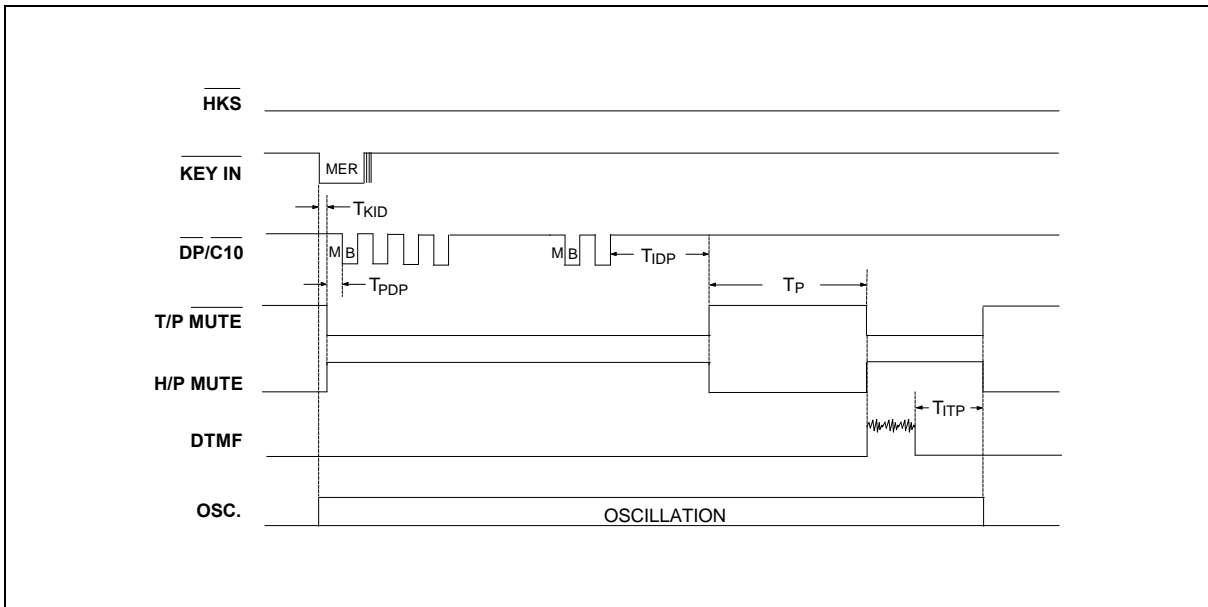


Figure 5. Mercury Function Timing Diagram

Timing Waveforms, continued

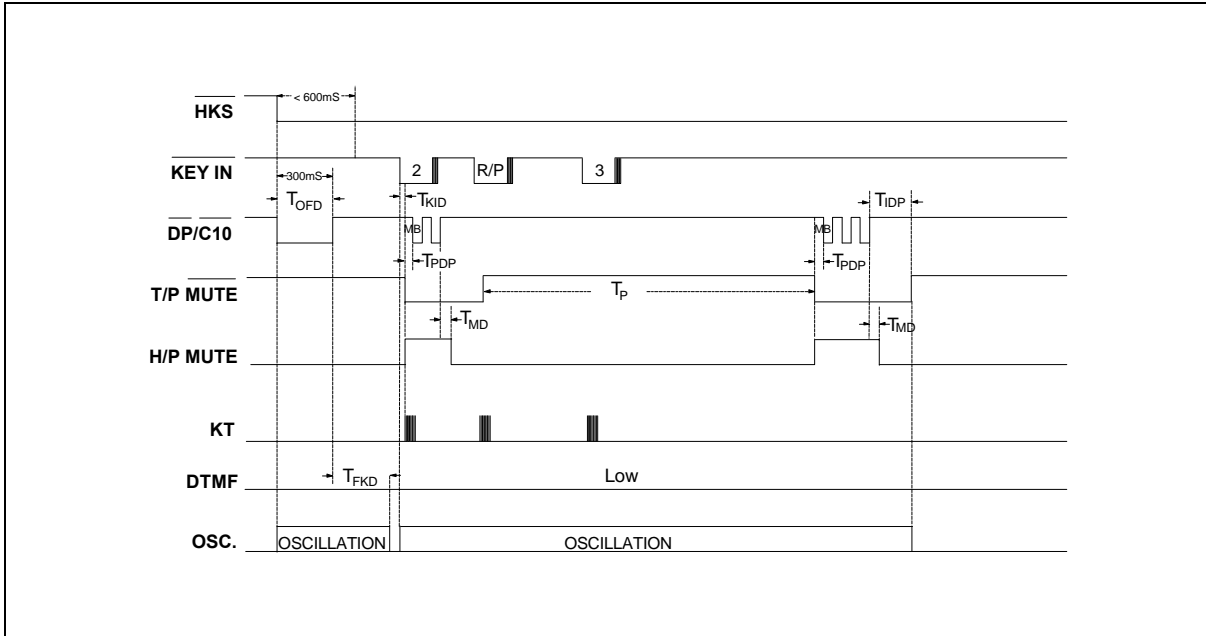


Figure 6. Pause Function Timing Diagram (Pulse Mode)

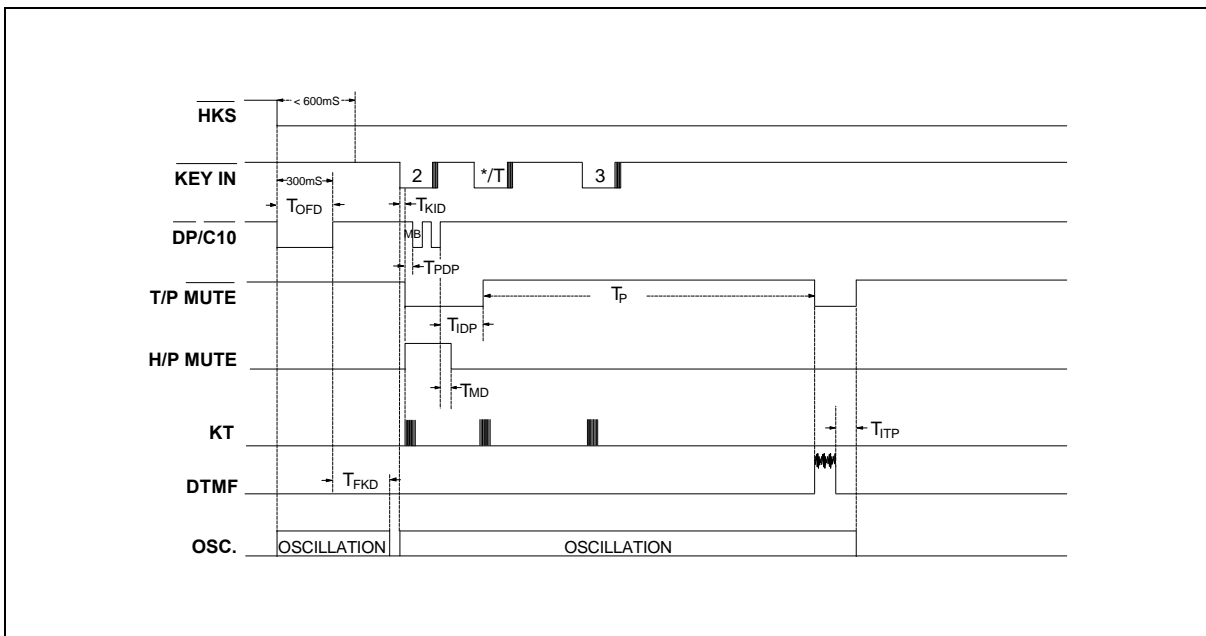


Figure 7. Pulse to Tone Timing Diagram

Timing Waveforms, continued

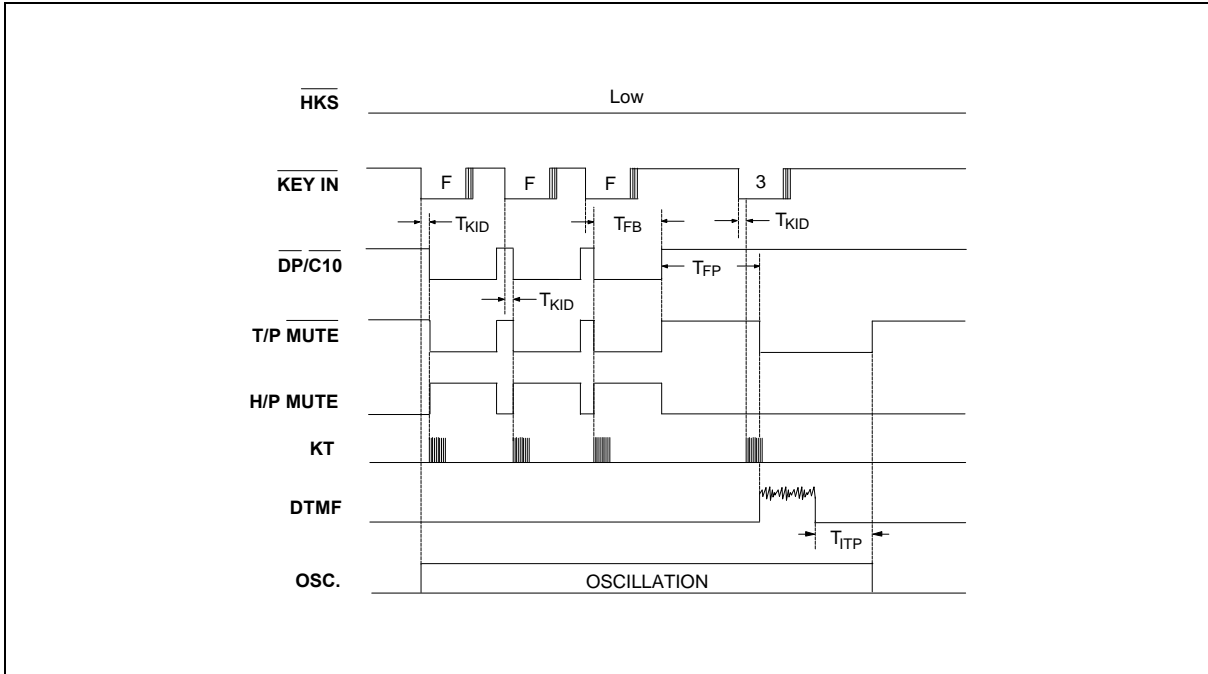


Figure 8. First Priority Flash Timing Diagram

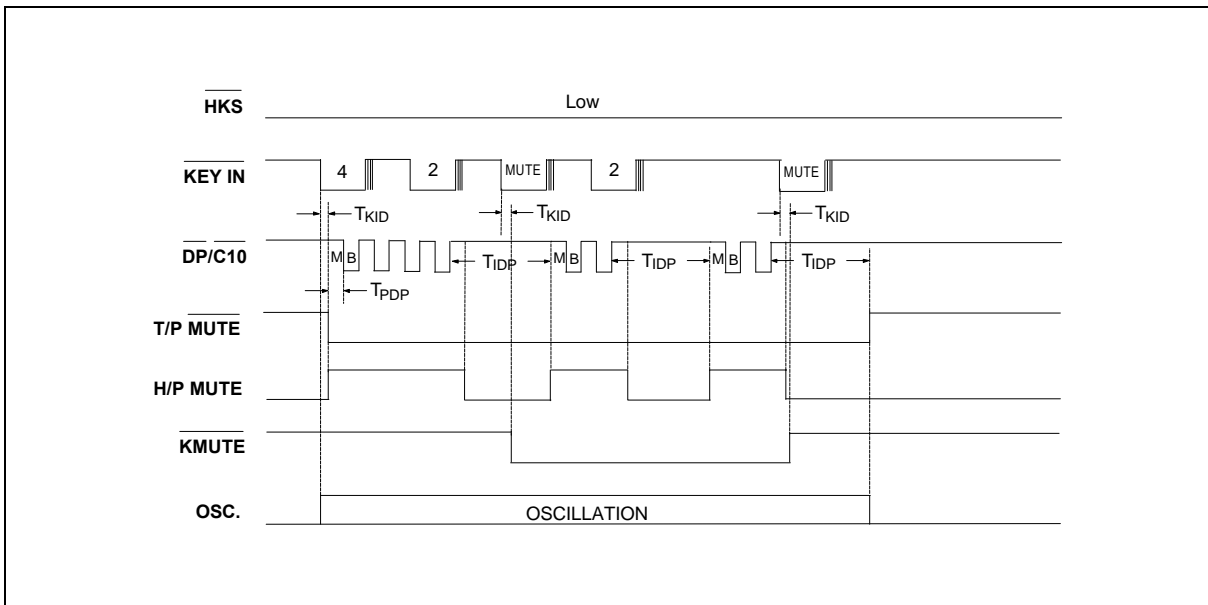


Figure 9. Mute Timing Diagram

Timing Waveforms, continued

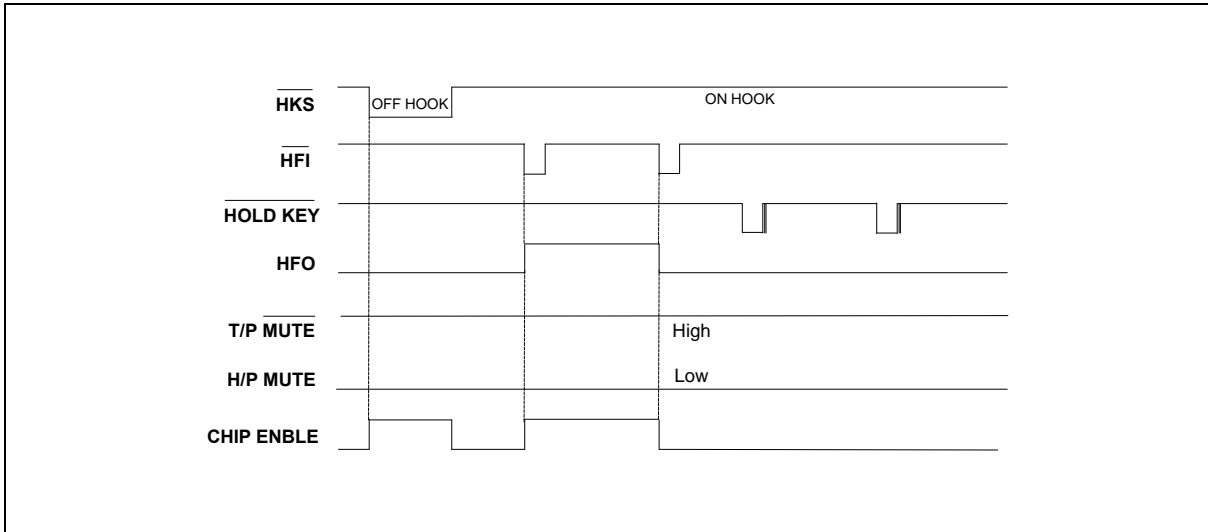


Figure 10(a). Hold and Handfree Timing Diagram

Note: The $\overline{\text{HOLD KEY}}$ cannot be enabled when the chip is disabled.

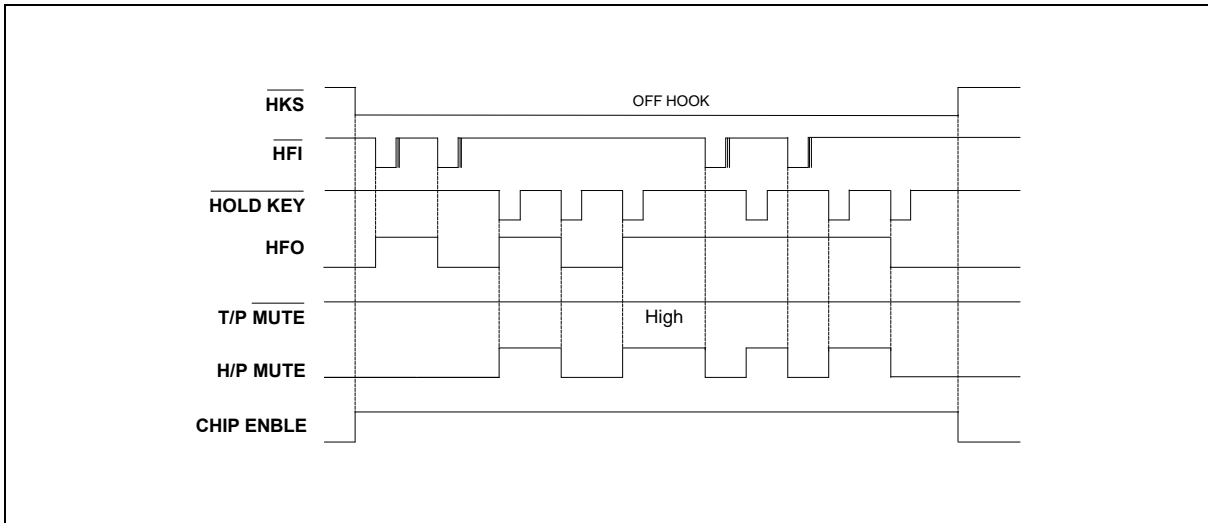


Figure 10(b). Hold and Handfree Timing Diagram

Note: The $\overline{\text{HFI}}$ and $\overline{\text{HOLD KEY}}$ inputs will toggle the HFO signal; as soon as either $\overline{\text{HFI}}$ or $\overline{\text{HOLD KEY}}$ is activated, the HFO signal will go high and previous activate inputs will be ignored.

Timing Waveforms, continued

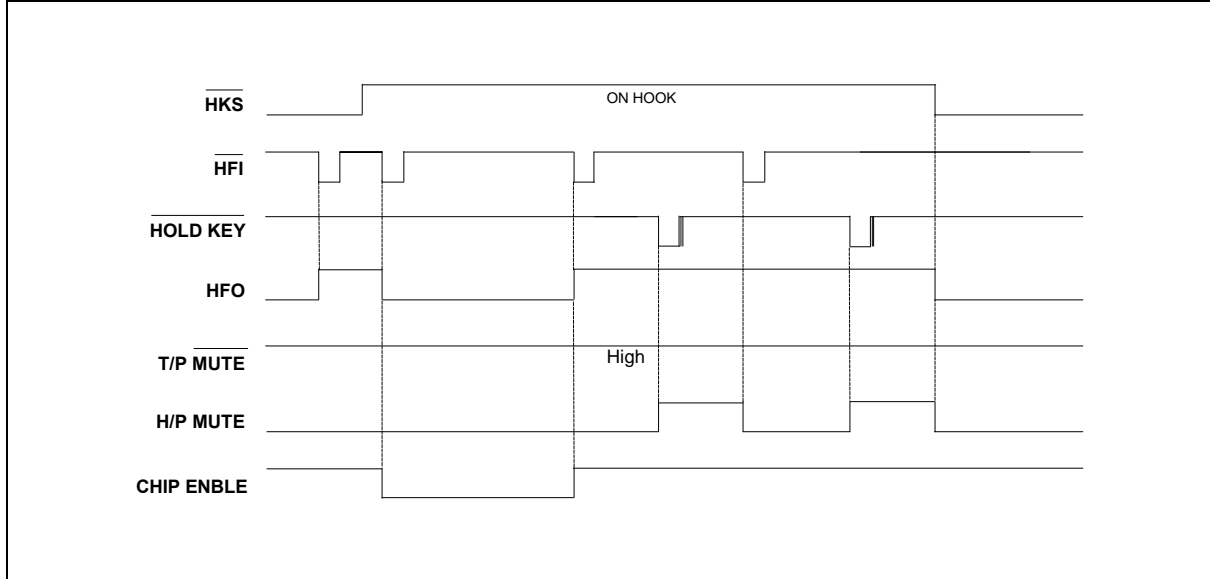


Figure 10(c). Hold and Handfree Timing Diagram

Note: Changing the state of the HKS signal from high to low will initialize the HFO and HPM MUTE signals.

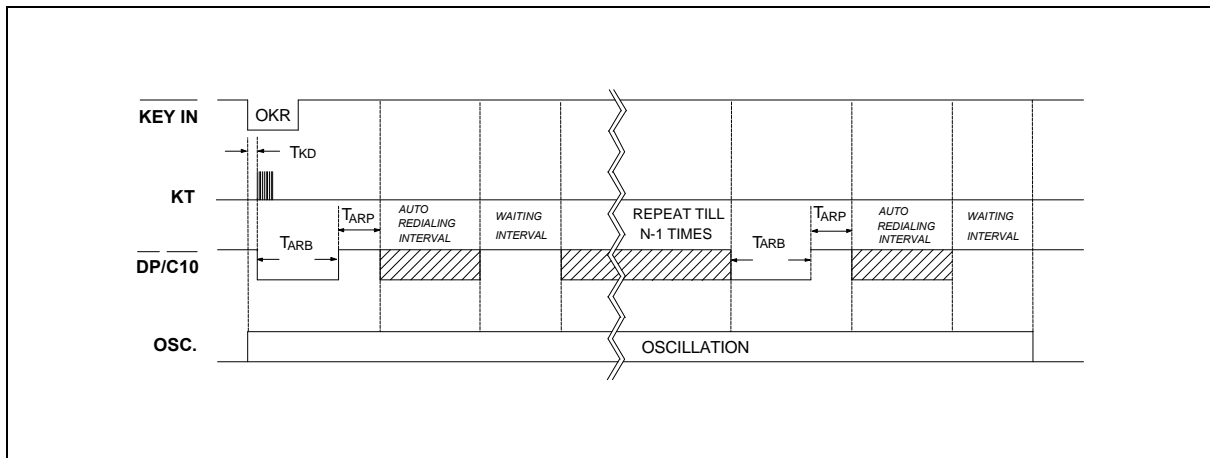


Figure 11(a). Auto Redialing Timing Diagram

Notes:

1. The auto redial function is enabled in off-hook or handfree state.
2. If OKR is the first key-in after off-hook or handfree then the first TARB and TARP will be ignored.

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Timing Waveforms, continued

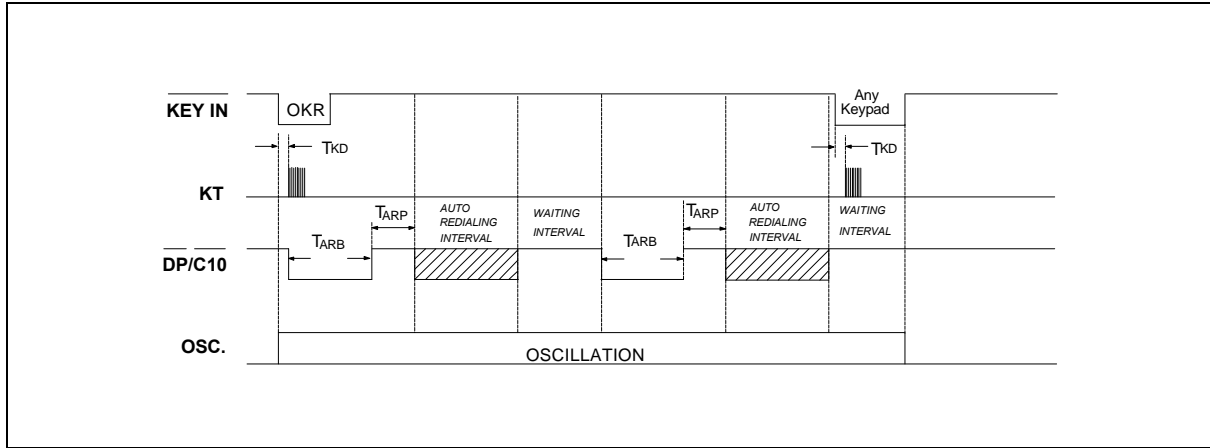
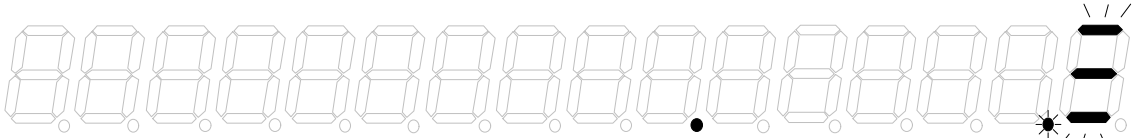


Figure 11(b). Auto Redialing Timing Diagram



LCD DISPLAY FORMAT

A. Normal Dialing



Off hook or press the "HFI" switch
(Here tone mode was selected).

Blinking

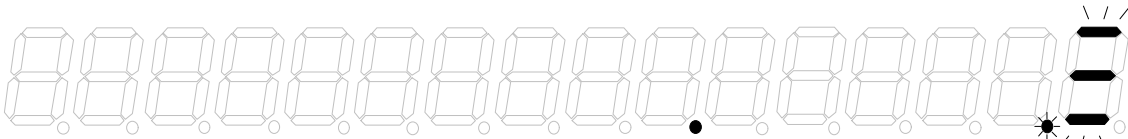


Dial "0123456789123456"



and "78"

B. Redialing, Save Dialing, One Touch Dialing



Off hook or press the "HFI" switch
(Here tone mode was selected).

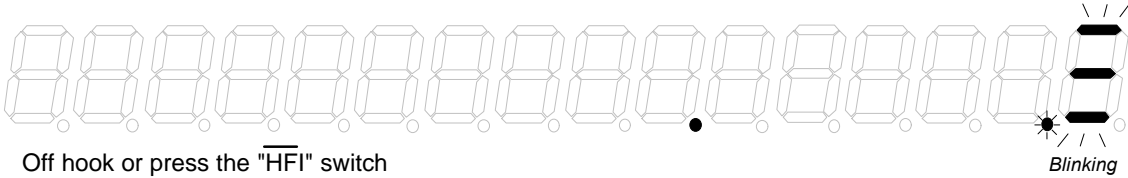
Blinking



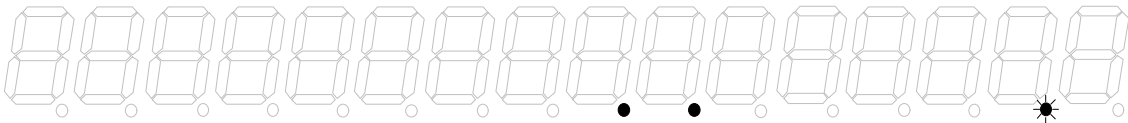
Press the "R/P", "OKR", "SAVE" or "Mn" key
(Redial or SAVE or Mn = "8123456789")



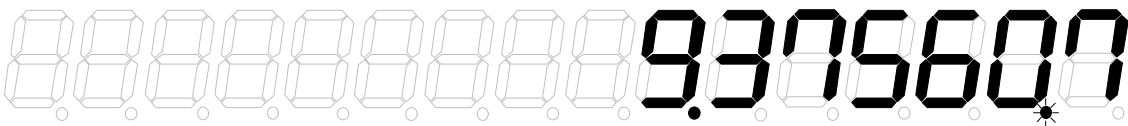
C. Abbreviated Auto Dialing



Off hook or press the "HFI" switch
(Here tone mode was selected).



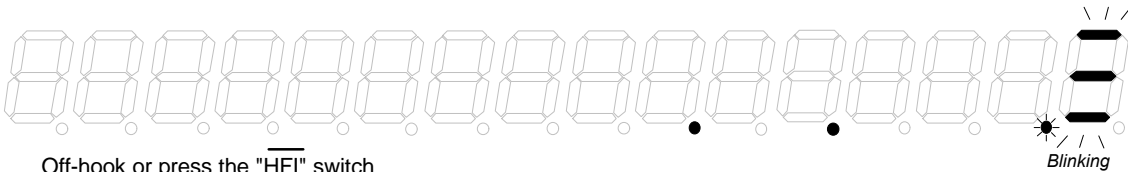
Press the "A1" key in chip enable condition
(L5 = "9375607", here L5 is the fifth memory)



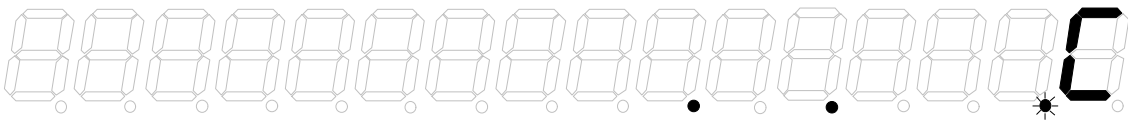
Press the "5" key

D. Memory Check

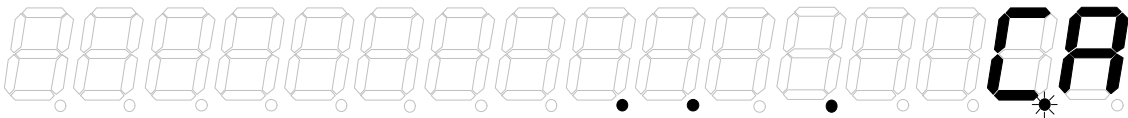
a.



Off-hook or press the "HFI" switch
(L6 = "314P4430256", and here handfree and tone mode were selected)



Press the "CHK" key



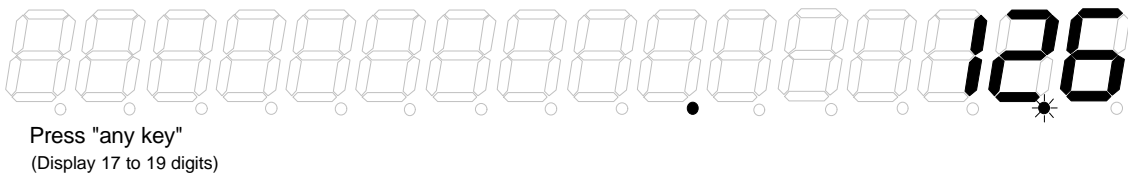
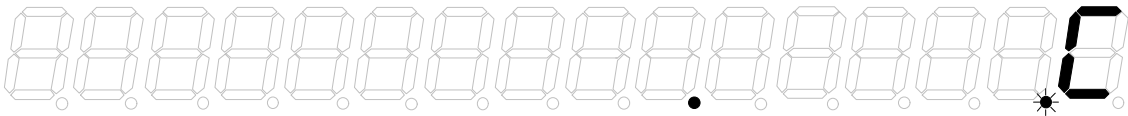
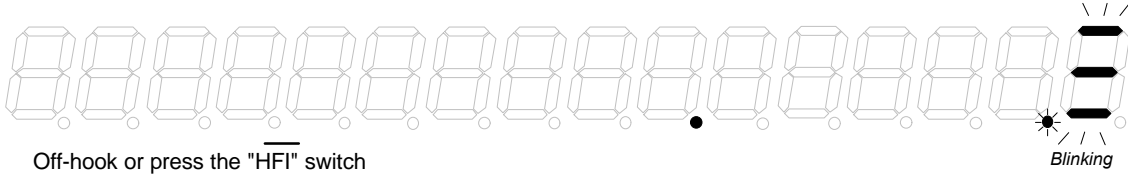
Press the "A1" key
(The auto(A) is shown on check and store mode)



Press the "6" key

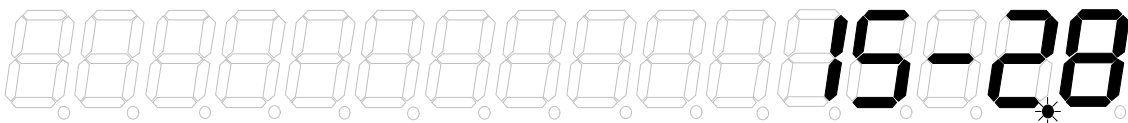
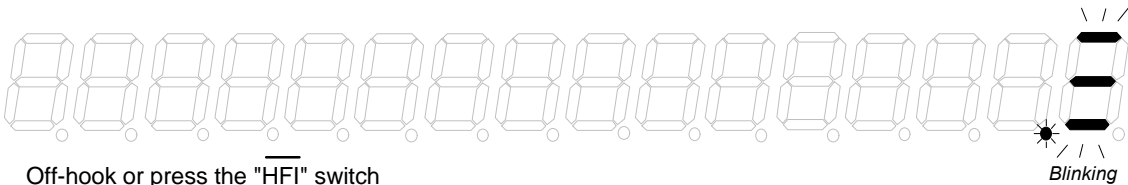


b.

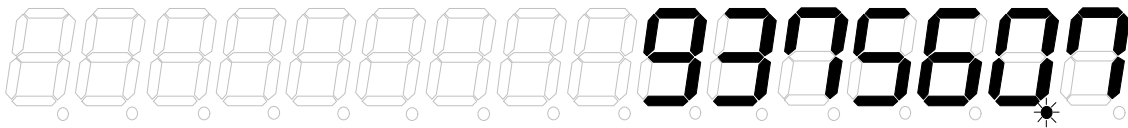


E. Timer Function

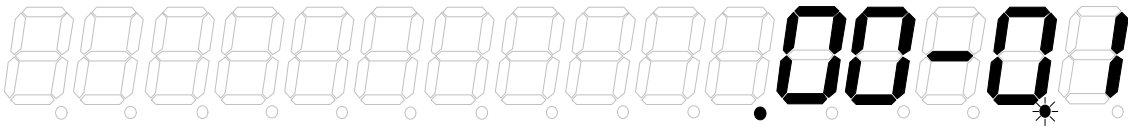
a.



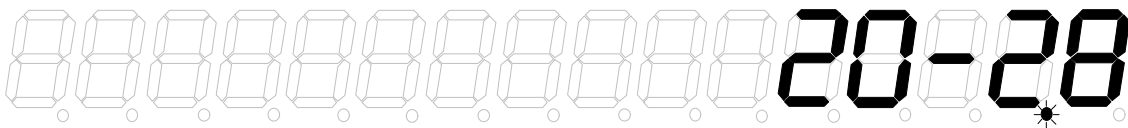
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Dial "9375607"

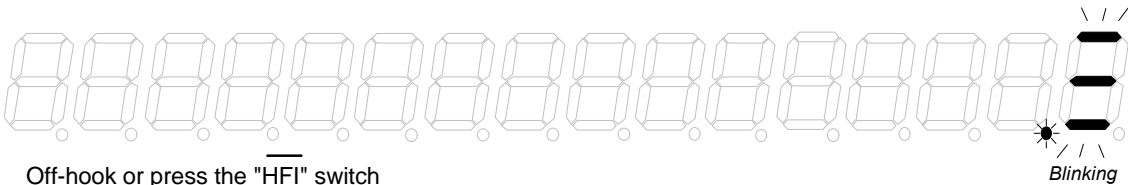


If "9375607" is dialed completed, the system will start timer after 6 seconds
(Timer will start counting up)

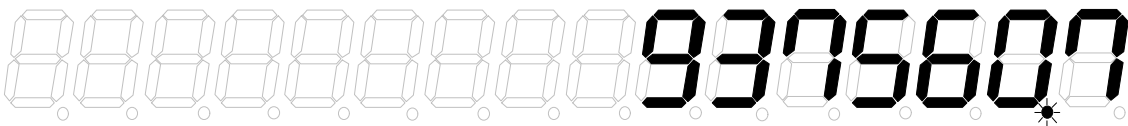


Press the "TIM"
(Timer will stop)

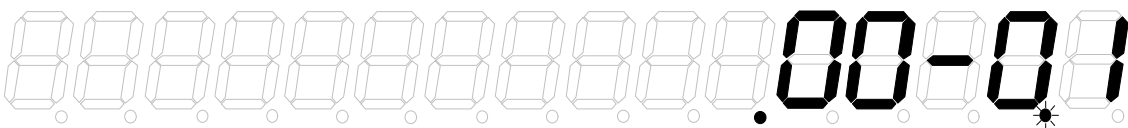
b.



Off-hook or press the "HFI" switch
(here pulse mode was selected)

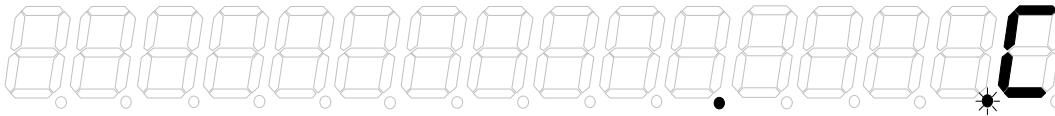


Dial "9375607"

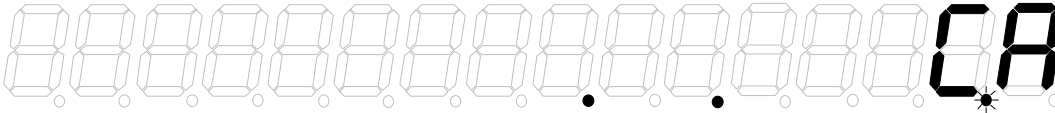


If "9375607" is dialed completed
press the "TIM" key
(Timer will start counting up)

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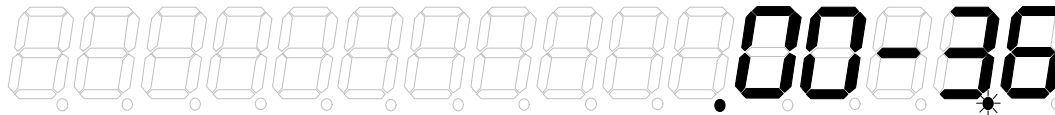
Press the "CHK" key
(L6 = "314P4430256")



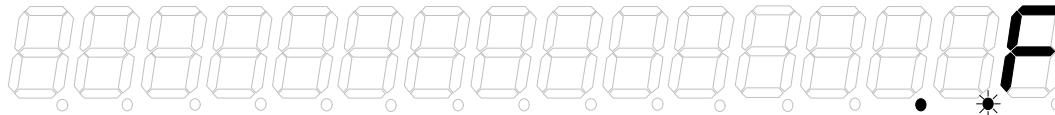
Press the "A1" key



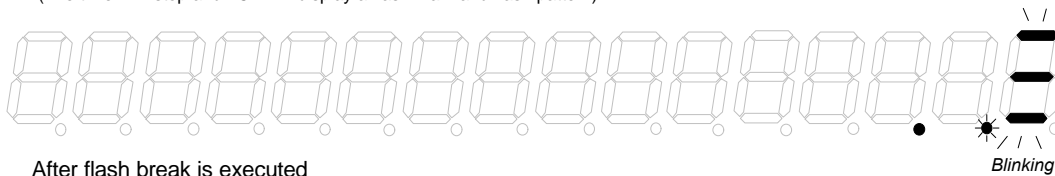
Press the "6" key



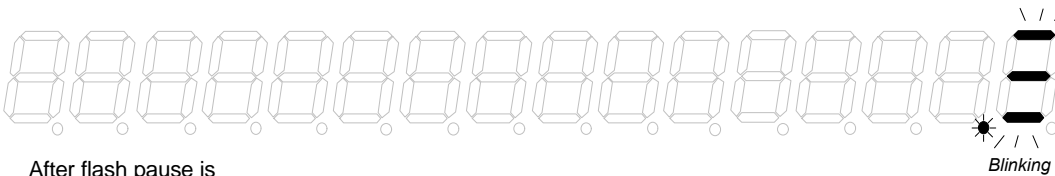
The system will go back to timer mode after 6 seconds
(Timer count up continuously)



Press the "F1", "F2" or "F3" key
(The timer will stop and LCD will display a flash mark and flash pattern)



After flash break is executed



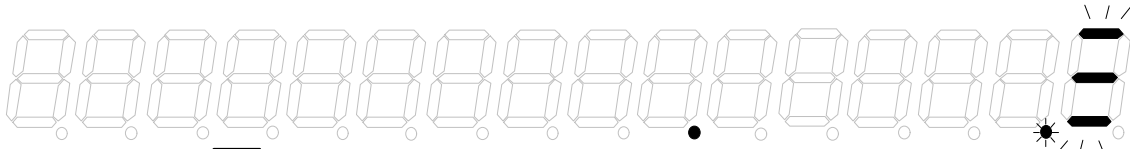
After flash pause is



F. RTC Setting Function



On-hook
(Display real time)



Off-hook, before $\overline{\text{SET}}_{\text{RTC}}$ pin was switched ON
(Here tone mode was selected)

Blinking

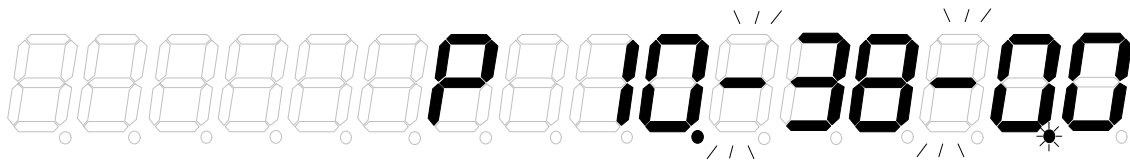


Entering "Setting Mode"

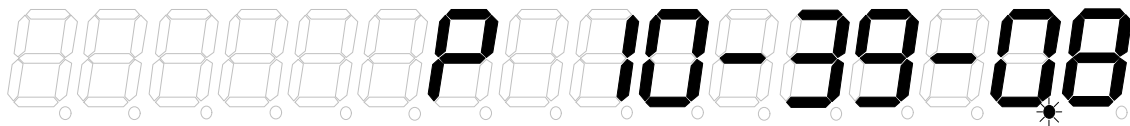


Adjusting "Hour"
(Hour counts forward as long as pressing)

Blinking



Adjusting "Minute"
(Minute counts forward as long as pressing)



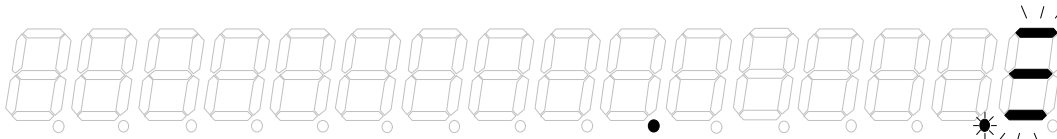
On-hook or switching $\overline{\text{SET}}_{\text{RTC}}$ pin OFF
(Here on-hook was selected)



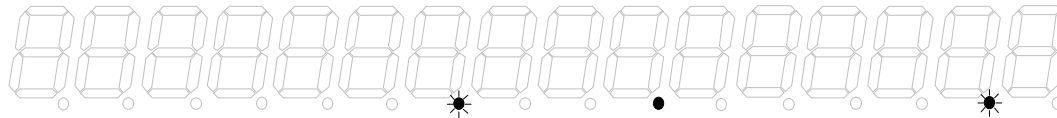
G. RTC Display Function



On-hook
(Display real time)



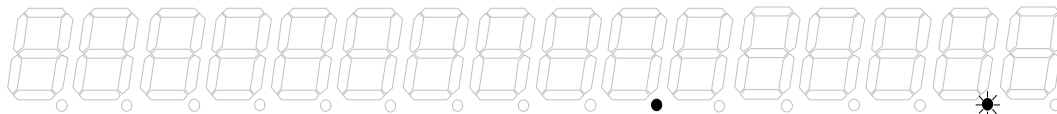
Off-hook or press the "HFI" switch
(Here off-hook and tone mode was selected)



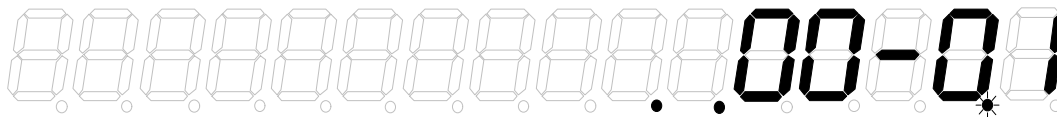
Press the "MER" key
(MER = "035PP770066")



Press the "RTC" key when "MER" dialing
is completed within 6 seconds.



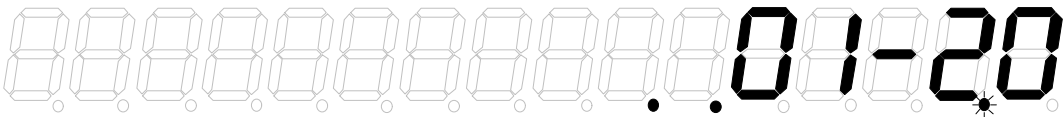
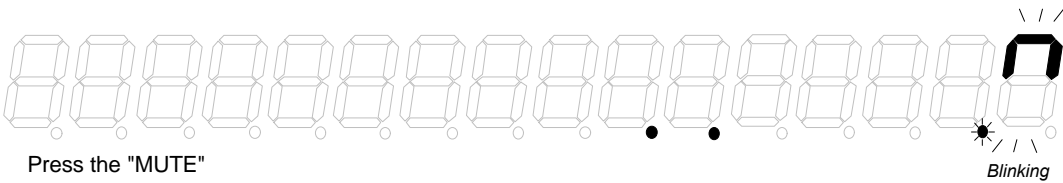
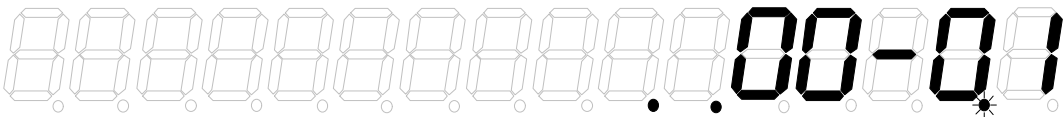
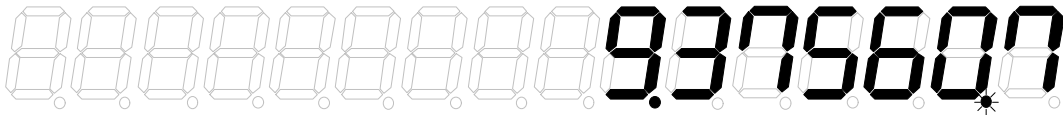
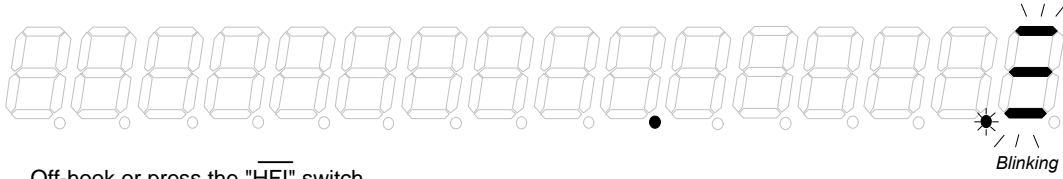
Press the "RTC" key again



If the "MER" is dialed completed for 6 seconds

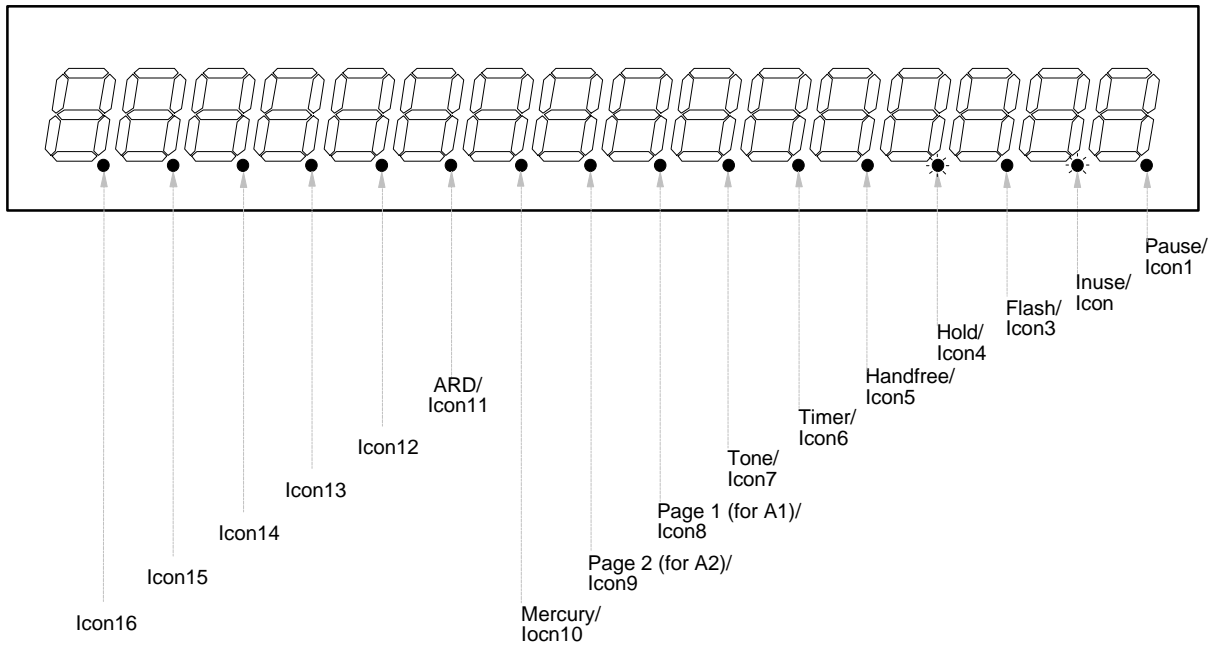
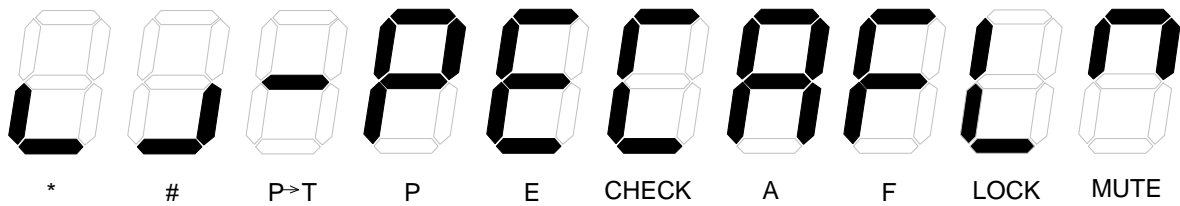
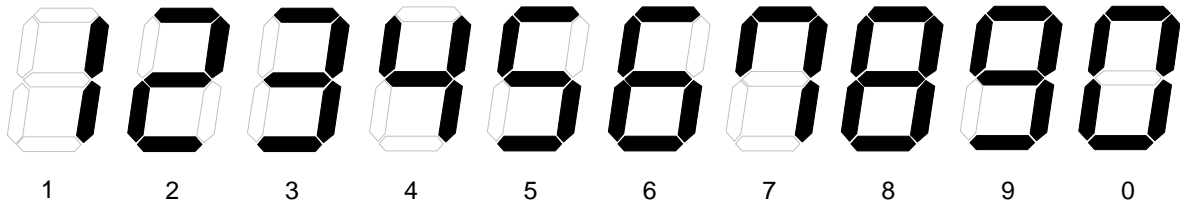


H. Mute Function





LCD PATTERN FOR DATA



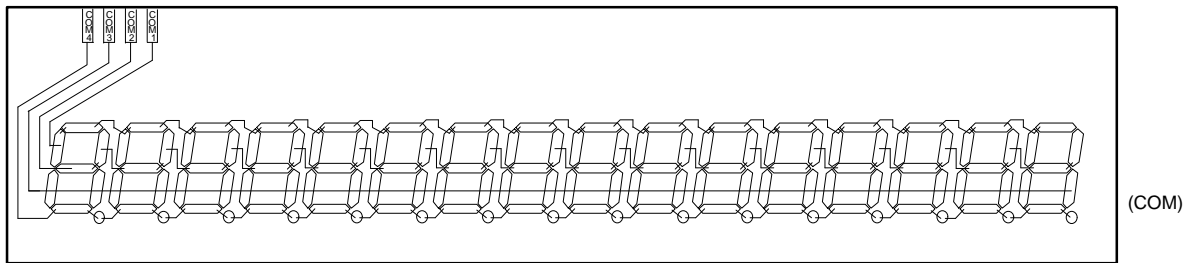
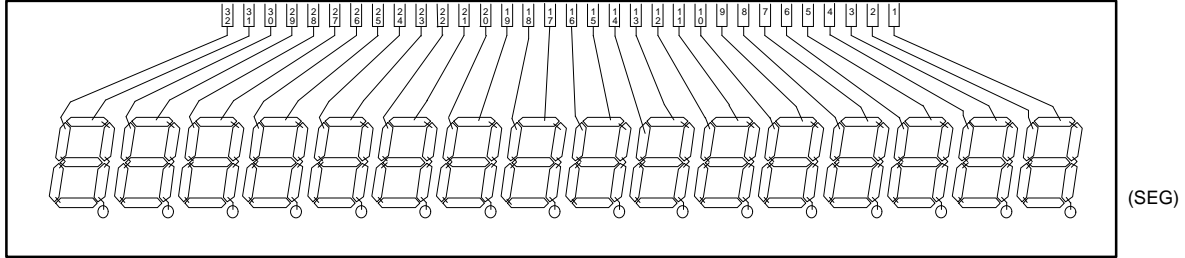
Notes:

1. The icon1 to icon 10 are controlled by function operation.
2. The icon 12 to icon16 can be toggled on/off individually, irrespective of keypad function.
3. The off-hook (or hand free) state of icon12 is on, the other icons are off.
4. The icon2 always blinked after power on.

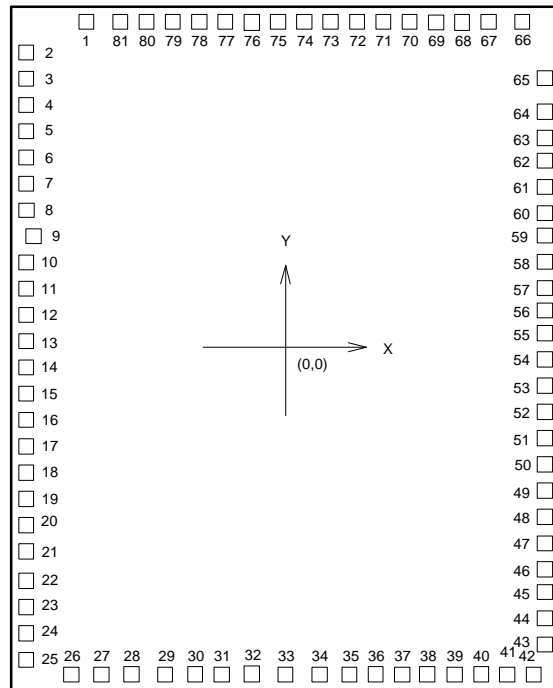
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LCD PANEL PATTERN



BONDING PAD DIAGRAM



Notes:

1. The substrate must be connected to Vss

Publication Release Date: May 1997
Revision A2



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2. The chip size is $3450 \times 4280 \mu\text{m}^2$

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Bonding Pad List

| PAD NO. | PAD NAME | PIN NAME | X | Y | PAD NO. | PAD NAME | PIN NAME | X | Y |
|---------|-----------|----------|----------|----------|---------|-----------|----------|---------|----------|
| 1 | SEG29<15> | 1 | -1205.80 | 1988.70 | 42 | TESTL | 41 | 1514.90 | -2009.80 |
| 2 | SEG30<15> | 2 | -1581.90 | 1871.70 | 43 | APSET | 42 | 1589.40 | -1805.40 |
| 3 | SEG31<16> | 3 | -1581.90 | 1716.70 | 44 | XT2 | 43 | 1589.40 | -1638.20 |
| 4 | SEG32<16> | 4 | -1581.90 | 1561.70 | 45 | XT2 | 44 | 1589.40 | -1488.20 |
| 5 | TEST | 5 | -1581.90 | 1389.40 | 46 | VLCD | 45 | 1589.40 | -1333.60 |
| 6 | K MUTE | 6 | -1581.90 | 1231.40 | 47 | VRTC2 | 46 | 1589.40 | -1179.00 |
| 7 | KT | 7 | -1581.90 | 1073.20 | 48 | CN | 47 | 1589.40 | -996.00 |
| 8 | TEST1 | 8 | -1581.90 | 915.20 | 49 | CP | 48 | 1589.40 | -844.00 |
| 9 | VDD | 9 | -1546.90 | 749.00 | 50 | COM<1> | 49 | 1589.40 | -668.90 |
| 10 | NC/LOCK | 10 | -1581.90 | 579.10 | 51 | COM<2> | 50 | 1589.40 | -513.90 |
| 11 | B/M | 11 | -1581.90 | 421.10 | 52 | COM<3> | 51 | 1589.40 | -358.90 |
| 12 | DTMF | 12 | -1581.90 | 248.00 | 53 | COM<4> | 52 | 1589.40 | -203.90 |
| 13 | SET RTC | 13 | -1581.90 | 67.00 | 54 | SEG1<1> | 53 | 1589.40 | -48.90 |
| 15 | VSS | 14 | -1581.90 | -241.00 | 55 | SEG2<1> | 54 | 1589.40 | 106.10 |
| 16 | H/P MUTE | 15 | -1581.90 | -391.00 | 56 | SEG3<2> | 55 | 1589.40 | 261.10 |
| 17 | T/P MUTE | 16 | -1581.90 | -549.20 | 57 | SEG4<2> | 56 | 1589.40 | 416.10 |
| 18 | HFO | 17 | -1581.90 | -707.20 | 58 | SEG5<3> | 57 | 1589.40 | 571.10 |
| 19 | DP/C10 | 18 | -1581.90 | -865.40 | 59 | SEG6<3> | 58 | 1589.40 | 726.10 |
| 20 | MODE | 19 | -1581.90 | -1023.40 | 60 | SEG7<4> | 59 | 1589.40 | 881.10 |
| 21 | COL1 | 20 | -1581.90 | -1194.10 | 61 | SEG8<4> | 60 | 1589.40 | 1036.10 |
| 22 | COL2 | 21 | -1581.90 | -1377.10 | 62 | SEG9<5> | 61 | 1589.40 | 1191.20 |
| 23 | COL3 | 22 | -1581.90 | -1560.30 | 63 | SEG10<5> | 62 | 1589.40 | 1346.20 |
| 24 | COL4 | 23 | -1581.90 | -1743.30 | 64 | SEG11<6> | 63 | 1589.40 | 1501.20 |
| 25 | COL5 | 24 | -1581.90 | -1926.50 | 65 | SEG12<6> | 64 | 1589.40 | 1720.60 |
| 26 | COL6 | 25 | -1196.70 | -2009.80 | 66 | SEG13<7> | 65 | 1407.40 | 1987.70 |
| 27 | COL7 | 26 | -1013.70 | -2009.80 | 67 | SEG14<7> | 66 | 1158.00 | 1987.70 |
| 28 | COL8 | 27 | -830.50 | -2009.80 | 68 | SEG15<8> | 67 | 1003.00 | 1987.70 |
| 29 | COL9 | 28 | -647.50 | -2009.80 | 69 | SEG16<8> | 68 | 848.00 | 1987.70 |
| 30 | ROW1 | 29 | -464.30 | -2009.80 | 70 | SEG17<9> | 69 | 693.00 | 1987.70 |
| 31 | ROW2 | 30 | -281.30 | -2009.80 | 71 | SEG18<9> | 70 | 538.00 | 1987.70 |
| 32 | ROW3 | 31 | -98.10 | -2009.80 | 72 | SEG19<10> | 71 | 383.00 | 1987.70 |
| 33 | ROW4 | 32 | 84.90 | -2009.80 | 73 | SEG20<10> | 72 | 228.00 | 1987.70 |
| 34 | ROW5 | 33 | 268.10 | -2009.80 | 74 | SEG21<11> | 73 | 72.90 | 1987.70 |
| 35 | XT1 | 34 | 435.60 | -2009.80 | 75 | SEG22<11> | 74 | -82.10 | 1987.70 |
| 36 | XT1 | 35 | 585.60 | -2009.80 | 76 | SEG23<12> | 75 | -237.10 | 1987.70 |
| 37 | HKS | 36 | 735.60 | -2009.80 | 77 | SEG24<12> | 76 | -392.10 | 1987.70 |

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Bonding Pad List, continued

| PAD NO. | PAD NAME | PIN NAME | X | Y | PAD NO. | PAD NAME | PIN NAME | X | Y |
|---------|----------|----------|----------|----------|---------|-----------|----------|----------|---------|
| 38 | HFI | 37 | 885.60 | -2009.80 | 78 | SEG25<13> | 77 | -547.10 | 1987.70 |
| 39 | VRTC1 | 38 | 1040.70 | -2009.80 | 79 | SEG26<13> | 78 | -702.10 | 1987.70 |
| 40 | TEST2 | 39 | 1198.80 | -2009.80 | 80 | SEG27<14> | 79 | -857.10 | 1987.70 |
| 41 | ARD | 40 | 1356.80 | -2009.80 | 81 | SEG28<14> | 80 | -1012.10 | 1987.70 |
| 14 | DISP | | -1581.90 | -91.00 | | | | | |

Note: Pad 14 is for 12-digit LCD display bonding only.



W91570DN SERIES



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Note: All data and specifications are subject to change without notice.