

Preliminary W91F820N SERIES



13-FLASH MEMORY TON/PULSE DIALER WITH HANDFREE, LOCK AND HOLD FUNCTIONS

GENERAL DESCRIPTION

The W91F820N is a series of tone/pulse switchable telephone dialers with 13-flash memory, keytone, hold, lock, and handfree dialing control features. These chips are fabricated using Winbond's high-performance CMOS technology and thus offer good performance in low-voltage, low-power operations.

FEATURES

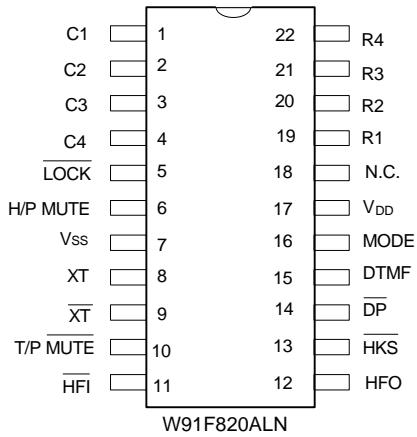
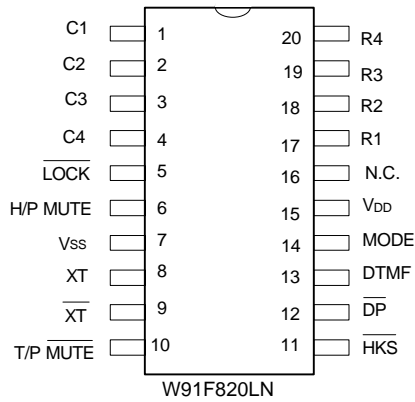
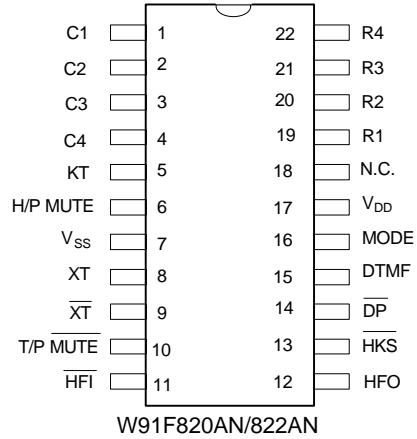
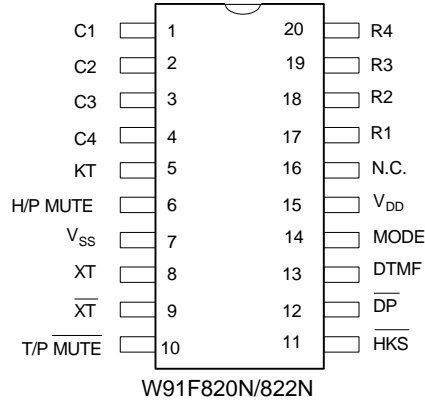
- Tone/pulse switchable dialer
- Two by 32 digits redial and save memory
- Three by 32 digits one-touch direct repertory flash memory
- Ten by 32 digits one-touch direct or two-touch indirect repertory flash memory
- The read-write times: 10^4
- Pulse-to-tone (*T) keypad for long distance call operation
- Chain dialing
- Uses 5×5 keyboard
- Easy operation with redial, flash, pause, and *T keypads
- Pause, P→T (pulse-to-tone) can be stored as a digit in memory
- Dialing rate: 10 pps or 20 pps by mask option
- Minimum tone output duration: 93 mS
- Minimum intertone pause: 93 mS
- Pause time: 3.6 sec.
- Flash break time (73 mS, 100 mS, 300 mS, or 600 mS) selectable by keypad; pause time is 1.0 S
- Make/break ratio (2:3 or 1:2) selectable by MODE pin
- Mute key for speech network mute
- No key will be accepted except the "HOLD" key when in the Hold mode
- Key tone output for valid keypad entry recognition
- On-chip power-on reset
- Uses 3.579545 MHz crystal or ceramic resonator
- 20-pin 300 mil, or 22-pin 400 mil dual-in-line plastic package
- The different dialers in the W91F820N series are shown in the following table:

| TYPE NO. | PULSE (PPS) | LOCK | KEY TONE | HANDFREE DIALING | PACKAGE (PINS) |
|------------|-------------|------|----------|------------------|----------------|
| W91F820N | 10 | - | √ | - | 20 |
| W91F820AN | 10 | - | √ | √ | 22 |
| W91F820LN | 10 | √ | - | - | 20 |
| W91F820ALN | 10 | √ | - | √ | 22 |
| W91F822N | 20 | - | √ | - | 20 |
| W91F822AN | 20 | - | √ | √ | 22 |

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PIN CONFIGURATIONS



Preliminary W91F820N SERIES



PIN DESCRIPTION

| SYMBOL | 20-PIN | 22-PIN | I/O | FUNCTION | | | | | | | | |
|---|----------------------------|-------------|-----|---|----------|----------|-----------------|----------------------------|----------|---------------------|-----------------|-----------------------|
| Column-Row Inputs | 1-4 & 17-20 | 1-4 & 19-22 | I | The keyboard input is compatible with a standard 5 × 5 keyboard, an inexpensive single contact (Form A) keyboard, and electronic input. In normal operation, any single button can be pushed to produce dual tone, pulses, or functions. Activation of two or more buttons will result in no response except for a single tone. | | | | | | | | |
| XT | 8 | 8 | I | A built-in inverter together with an inexpensive 3.579545 MHz crystal supplies the oscillator. The oscillator stops when there is no keypad input. The crystal frequency deviation is 0.02%. | | | | | | | | |
| $\overline{\text{XT}}$ | 9 | 9 | O | Crystal oscillator output pin. | | | | | | | | |
| T/P MUTE | 10 | 10 | O | The T/P $\overline{\text{MUTE}}$ is a conventional CMOS N-channel open drain output. The output transistor turns on with a low level during a dialing sequence (both pulse and tone mode). Otherwise, it is off. | | | | | | | | |
| N.C. | 16 | 18 | - | No connect | | | | | | | | |
| MODE | 14 | 16 | I | Connecting the mode pin to V _{SS} places the dialer in tone mode. Connecting the mode pin to V _{DD} places the dialer in pulse mode with an M/B ratio of 40:60. Leaving the mode pin floating places the dialer in pulse mode with an M/B ratio of 33.3:66.7. | | | | | | | | |
| $\overline{\text{HKS}}$ | 11 | 13 | I | The $\overline{\text{HKS}}$ (hook switch) input is used to sense whether the handset is on-hook or off-hook. In on-hook state, $\overline{\text{HKS}} = 1$: chip is in sleeping mode, no operation. In off-hook state, $\overline{\text{HKS}} = 0$: chip is enabled for normal operation. $\overline{\text{HKS}}$ pin is pulled to V _{DD} by internal resistor. | | | | | | | | |
| KT (W91F820N/ F820AN/ F822N) | 5 | 5 | O | The key tone output is a conventional CMOS inverter. The key tone is generated when any valid key is pressed; the KT pin generates a 1.2 KHz square wave at 35 mS. When no key is pressed, the KT pin remains in low state. | | | | | | | | |
| $\overline{\text{LOCK}}$ (W91F820LN/ 820ALN only) | 5 | 5 | I | The function of this terminal is to prevent "0" dialing and "9" dialing under PABX system long distance call control. When the first key input after reset is 0 or 9, all key inputs, including the 0 or 9 key, become invalid and the chip generates no output. The telephone is reinitialized by a reset. The function of the $\overline{\text{LOCK}}$ pin is shown below: | | | | | | | | |
| | | | | <table border="1"> <thead> <tr> <th>LOCK PIN</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr> <td>V_{DD}</td> <td>"0", "9" dialing inhibited</td> </tr> <tr> <td>Floating</td> <td>Normal dialing Mode</td> </tr> <tr> <td>V_{SS}</td> <td>"0" dialing inhibited</td> </tr> </tbody> </table> | LOCK PIN | FUNCTION | V _{DD} | "0", "9" dialing inhibited | Floating | Normal dialing Mode | V _{SS} | "0" dialing inhibited |
| LOCK PIN | FUNCTION | | | | | | | | | | | |
| V _{DD} | "0", "9" dialing inhibited | | | | | | | | | | | |
| Floating | Normal dialing Mode | | | | | | | | | | | |
| V _{SS} | "0" dialing inhibited | | | | | | | | | | | |

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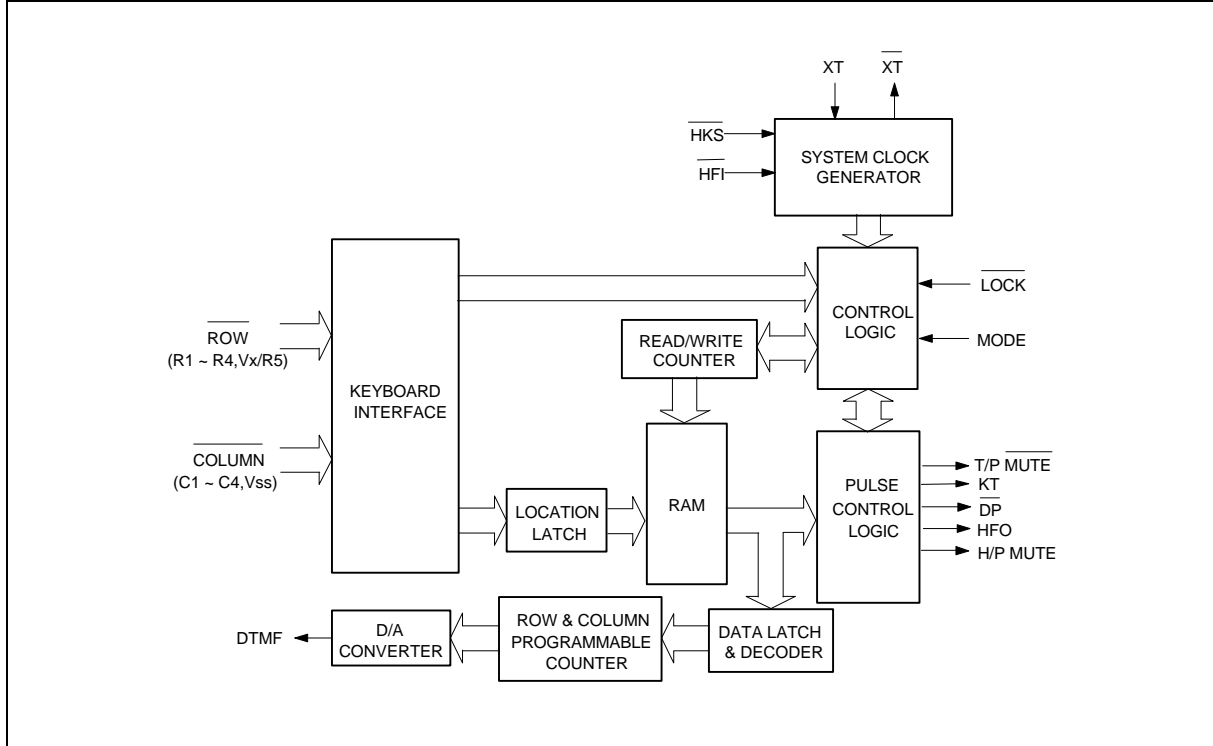
Pin Description, continued

| SYM. | 20-PIN | 22-PIN | I/O | FUNCTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------|-----------|-----------------------------|---------|---|------------------|--|------------|--|--|-----------|--------|---------|-----|---------|-----|-------|-----------------------------|------|-----|---------|------|-----------------------------|-----|-------|----------|------|-----------------------------|-------|-----|---------|------|----------|-----|------|----------|-------|---------|------|------|----------|------|---------|------|-----|
| H/P MUTE | 6 | 6 | I | The H/P MUTE is a conventional inverter output. During pulse dialing, flash break or hold period, this output is active high; otherwise, it remains in low state. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| \overline{DP} | 12 | 14 | O | N-channel open drain dialing pulse output. Flash key will cause \overline{DP} to be active in either tone mode or pulse mode. The timing diagram for pulse mode is shown in Figure 1(a, b). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DTMF | 14 | 15 | O | During pulse dialing, this pin remains in a low state regardless of the keypad input. In tone mode, it will output a dual or single tone. A detailed timing diagram for tone mode is shown in Figure 2(a, b). <table border="1" style="margin: 10px auto;"> <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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VDD, VSS | 15, 7 | 17, 7 | I | Power input pins for the dialer chip. VDD is the power and VSS is the ground. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| \overline{HFI} , HFO | - | 11, 12 | I, O | Handfree control pins. A low pulse on the \overline{HFI} input pin toggles the handfree control state. The status of the handfree control state is listed in the following table: <table border="1" style="margin: 10px auto;"> <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>The \overline{HFI} pin is pulled to VDD by an internal resistor. A detailed timing diagram is shown in Figure 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Keyboard Operation

| C1 | C2 | C3 | C4 | Vss | |
|-----|----|----|-----|------|-------|
| 1 | 2 | 3 | S | EM1 | R1 |
| 4 | 5 | 6 | F4 | EM2 | R2 |
| 7 | 8 | 9 | A | EM3 | R3 |
| */T | 0 | # | R/P | SAVE | R4 |
| F1 | F2 | F3 | H | | Vx/R5 |

- S: Store function key
- A: Indirect repertory memory dialing function key
- H: Hold function key
- R/P: Redial and pause function key
- */T: * in tone mode and P→T key in pulse mode
- SAVE: Save function key for one-touch 32-digit memory
- M0–M9: One touch memory. The dialing number can be stored in M0–M9 locations by the S key. Note that the two touch memory (A+ 0–A+9) share the same memory buffer with M0–M9, respectively

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- EM1, ..., EM3: Emergency one-touch memory key
- F1, ..., F4: Flash function keys: F1 = 600 mS, F2 = 300 mS, F3 = 73 mS, F4 = 100 mS; all flash pause time is 1.0 mS

Note: D1, ..., Dn, D1', ..., Dn', */T, #, Mn: EM1, ..., EM3, Ln: 0-9

Normal Dialing

(or &), , , ...,

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

Redialing Dialing

(or & , , , ..., , BUSY

Come , (or & ,

The key can execute redial function only as first key-in after off-hook. Otherwise, it will invoke the pause function.

Number Store

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

- a. The dialing out of to must first be finished before the key is pressed.
- b. D1, D2, ..., Dn will be stored in memory location Mn or saved and then dialed out.

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

- a. D1, D2, ..., Dn will be stored in memory location, Mn (or saved), but will not be dialed out.
- b. and keys can be stored as a digit in memory, but the key cannot be the first digit. In store 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 or the flash function is executed.

Save

(or & , , , ..., ,

- a. D1, D2, ..., Dn will be dialed out.
- b. If the dialing of to is finished, pressing will duplicate D1 to Dn to the save memory.

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(or &),
come on (or &),
c. D1 to Dn will be dialed out after the key is pressed.

Repertory Dialing Procedure

One-touch direct repertory dialing:

(or &), (or)

Two-touch direct repertory dialing:

(or &), , (or)

Access Pause

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

1. The pause function can be stored in memory.
2. The pause function is executed with normal dialing, redialing or memory dialing.
3. The pause function timing diagram is shown in Figure 6.

Pulse to Tone (*T)

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

1. If the mode switch is set in pulse mode, then it will perform
D1, D2, ---, Dn, Pause (3.6 sec), D1', D2', ---, Dn'
(Pulse) (Tone)
2. If the mode switch is set in tone mode, then the output signal will be:
D1, D2, ---, Dn, * , D1', D2', ---, Dn'
(Tone)
3. It can be reset to pulse mode only if ON HOOK is active. This is because it remains in tone mode when the digits have been dialed out.
4. The function timing diagram is shown in Figure 7.

Flash

(or &),

1. Fn = F1–F4. If is pressed, the dialer will execute a flash break time of 600 mS (F1), 300 mS

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(F2), 73 mS (F3) or 100 mS (F4) and a pause time of 1.0 second, after which the next digit is dialed out.

2. The flash key has the first priority of the keyboard function only one flash key will be released to the user.
3. When the flash key is key in, the system will return to the initial state after the flash pause time is finished.
4. The flash function timing diagram is shown in Figure 8.

Cascaded Dialing

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

1. Normal Dialing + Repertory Dialing + Normal Dialing
 (1st sequence) (2nd sequence)
2. Repertory Dialing + Normal Dialing + Repertory Dialing
 (1st sequence) (2nd sequence)
3. Redialing + Normal Dialing + Repertory Dialing
 (1st sequence) (2nd sequence)

Redialing is valid only for the first key-in.

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

Mute

OFF HOOK , MUTE

MUTE has an on/off toggle function. The functional timing diagram is shown in Figure 8 .

ABSOLUTE MAXIMUM RATING

| 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 | V |
| | VOL | VSS -0.3 | V |
| | VOH | VDD +0.3 | V |
| Power Dissipation | PD | 120 | mW |
| Operation Temperature | TOPR | -20 to +70 | °C |
| Storage Temperature | TSTG | -55 to +150 | °C |

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

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DC 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 |
|--|------------------|--|------|------|------|-------|
| Operating Voltage | V _{DD} | - | 2.4 | - | 5.5 | V |
| Operating Current | I _{OP} | Tone | - | 0.4 | 0.6 | mA |
| | | Pulse | - | 0.2 | 0.4 | mA |
| Standby Current | I _{SB} | $\overline{\text{HKS}} = 0$, No load & No key entry | - | - | 15 | μA |
| Memory Retention Current | I _{MR} | $\overline{\text{HKS}} = 1$, V _{DD} = 1.0V | - | - | 1 | μA |
| Tone Output Voltage | V _{TO} | Row group, R _L = 5 KΩ | 130 | 150 | 170 | mVrms |
| Pre-emphasis | | Col/Row, V _{DD} = 2.0-5.5V | 1 | 2 | 3 | dB |
| DTMF Distortion | THD | R _L = 5 KΩ, V _{DD} = 2.0-5.5V | - | -30 | -23 | dB |
| DTMF Output DC Level | V _{TDC} | R _L = 5 KΩ, V _{DD} = 2.0-5.5V | 1.0 | - | 3.0 | V |
| DTMF Output Sink Current | I _{TL} | V _{TO} = 0.5V | 0.2 | - | - | mA |
| $\overline{\text{DP}}$ Output Sink Current | I _{PL} | V _{PO} = 0.5V | 0.5 | - | - | mA |
| T/P $\overline{\text{MUTE}}$ Output Sink Current | I _{ML} | V _{MO} = 0.5V | 0.5 | - | - | mA |
| KT Drive/Sink Current | I _{KTH} | V _{KTH} = 2.0V | 0.5 | - | - | mA |
| | I _{KTL} | V _{KTL} = 0.5V | 0.5 | - | - | mA |
| HFO Drive/Sink Current | I _{HFH} | V _{HFH} = 2.0V | 0.5 | - | - | mA |
| | I _{HFL} | V _{HFL} = 0.5V | 0.5 | - | - | mA |
| H/P MUTE | I _{HPH} | V _{HPH} = 2.0V | 0.5 | - | - | mA |
| Drive/Sink Current | I _{HPL} | V _{HPL} = 0.5V | 0.5 | - | - | mA |
| Keypad Input Drive Current | I _{KD} | V _I = 0V | 4 | - | - | μA |
| $\overline{\text{HKS}}$ Pull High Resister | R _{HKS} | | 300 | 500 | - | KΩ |
| Keypad Input Sink Current | I _{KS} | V _I = 2.5V | 200 | 400 | - | μA |
| Keypad Resistance | | | - | - | 5.0 | KΩ |

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AC CHARACTERISTICS

| PARAMETER | SYM. | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-------------------------------------|-------|---|---------------------|-----------|------|------|
| Key-in Debounce | TKID | - | - | 20 | - | mS |
| Key Release Debounce | TKRD | - | - | 20 | - | mS |
| On-hook Debounce | TOHD | Lock Mode | - | 20 | - | mS |
| | | Unlock Mode | - | 150 | - | mS |
| Pre-digit Pause ¹ | TPDP1 | Mode Pin = VDD | - | 40 | - | mS |
| | | 10 ppS | Mode Pin = Floating | - | 33.3 | - |
| Pre-digit Pause ² | TPDP2 | Mode Pin = VDD | - | 20 | - | mS |
| | | 20 ppS | Mode Pin = Floating | - | 16.7 | - |
| Inter Digit Pause (Auto Dialing) | TIDP | 10 ppS (W91F820N/W91F820AN/ F820LN/F820ALN) | - | 800 | - | mS |
| | | 20 ppS (W91F822N/F822AN only) | - | 500 | - | mS |
| Interdigit Pause (Auto dialing) | TIDP | 10 ppS | - | 800 | - | mS |
| | | 20 ppS | - | 500 | - | mS |
| Make/Break Ratio | M:B | Mode Pin = VDD | - | 40:60 | - | % |
| | | Mode Pin = Floating | - | 33.3:66.7 | - | % |
| Tone Output Duration | TTD | - | - | 93 | - | mS |
| Intertone Pause | TITP | - | - | 93 | - | mS |
| Flash Break Time | TFB | F1 | - | 600 | - | mS |
| | | F2 | - | 300 | - | |
| | | F3 | - | 73 | - | |
| | | F4 | - | 100 | - | |
| Flash Pause Time | TFP | - | - | 1.0 | - | S |
| Pause Time | TP | - | - | 3.6 | - | S |
| Key Tone Frequency | FKT | - | - | 1.2 | - | KHz |
| Key Tone Duration | TKTD | - | - | 35 | - | mS |
| One-key Redialing Pause Time | TRP | - | - | 600 | - | mS |
| One-key Redialing Break Time | TRB | - | - | 2.2 | - | S |
| First Key-in Delay | TFKD | Lock only | - | 300 | - | mS |

Notes:

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

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TIMING WAVEFORMS

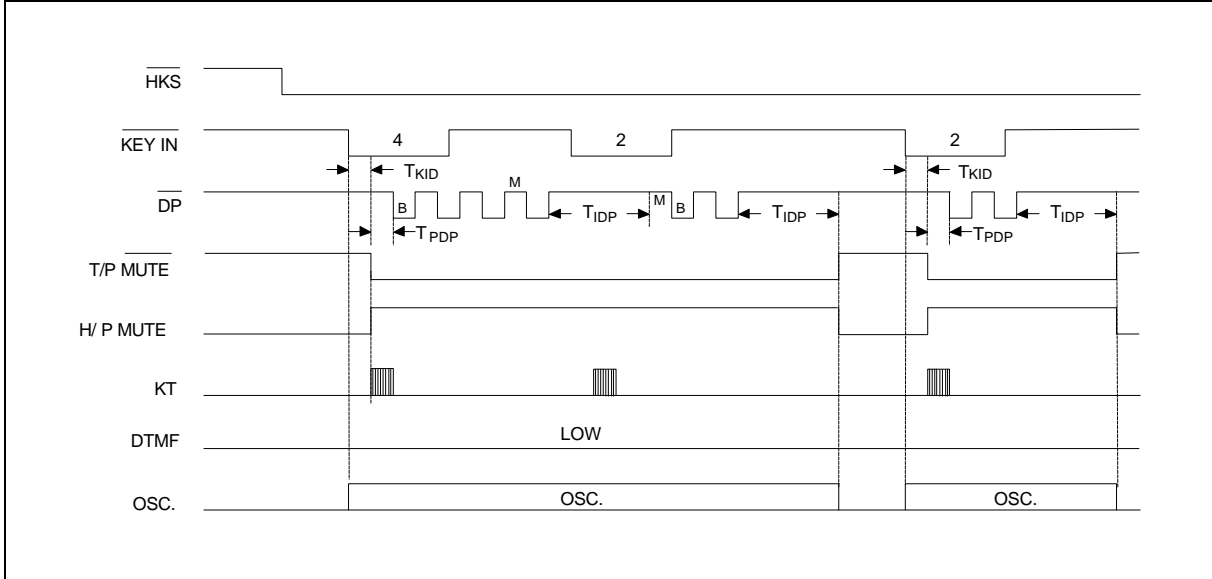


Figure 1(a) Pulse Mode Timing Diagram (Normal dialing without lock function)

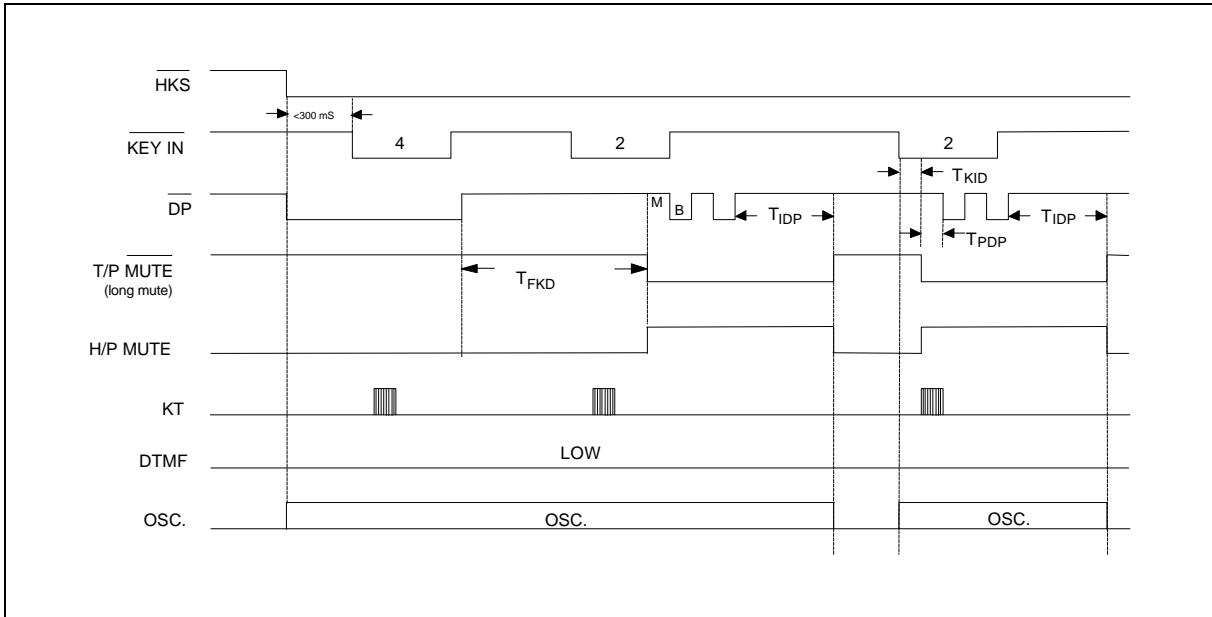


Figure 1(b) Pulse Mode Timing Diagram (Normal dialing with lock function)

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Timing Waveforms, continued

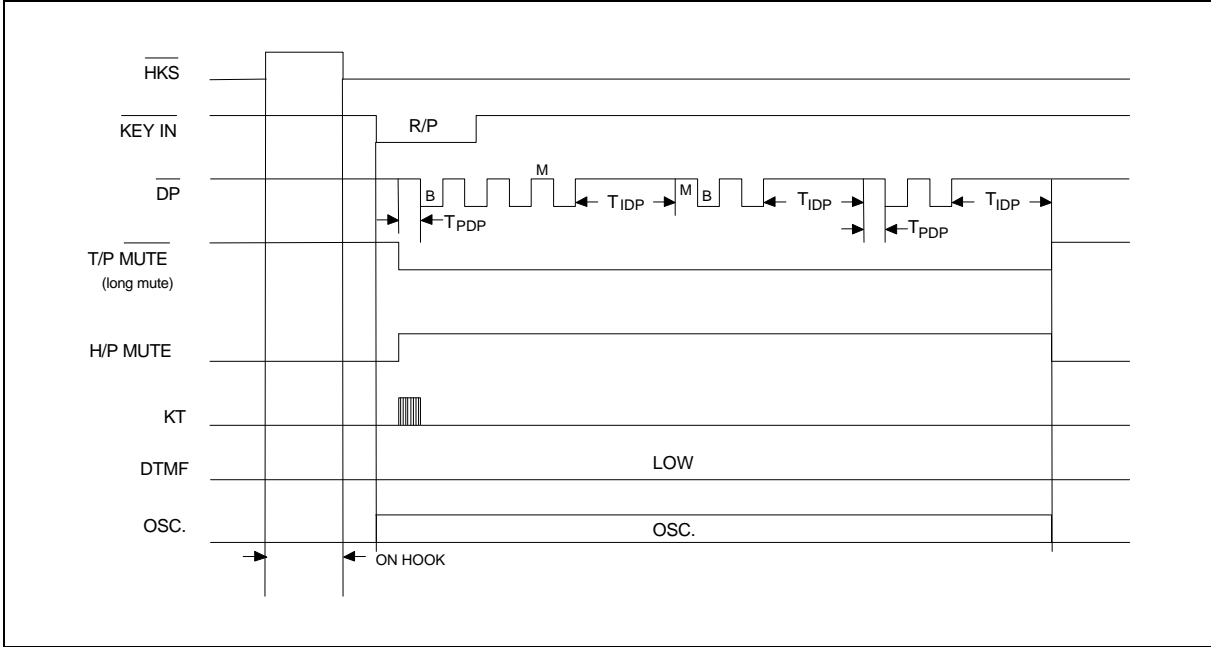


Figure 1(c) Pulse Mode Timing Diagram (Auto dialing without lock)

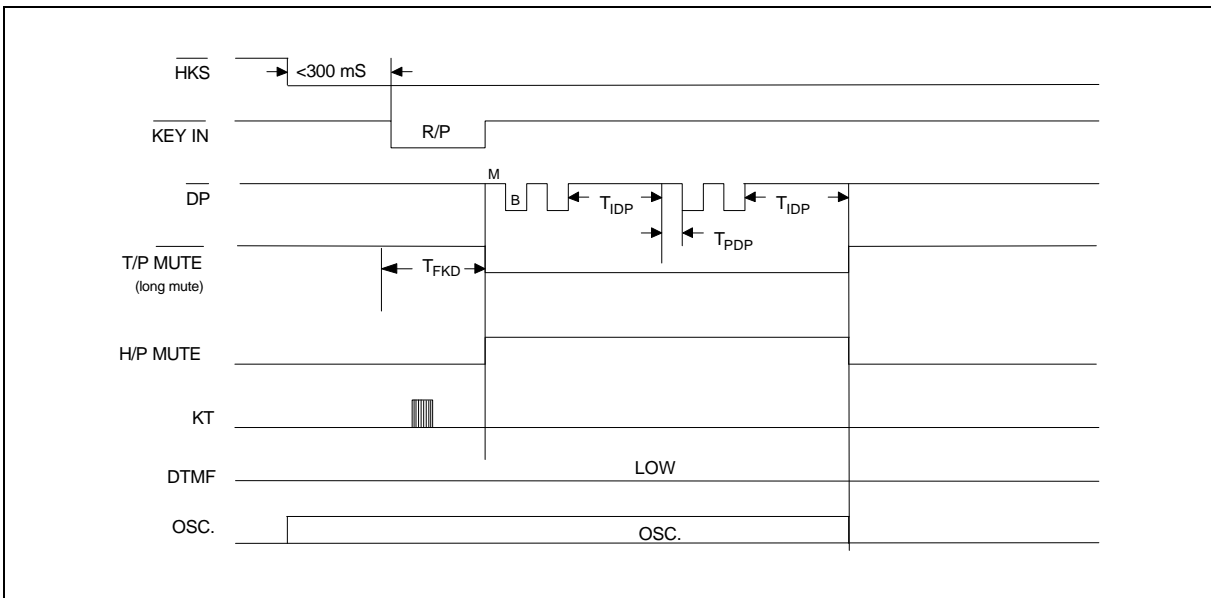


Figure 1(d) Pulse Mode Timing Diagram (Auto dialing with lock function)

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Timing Waveforms, continued

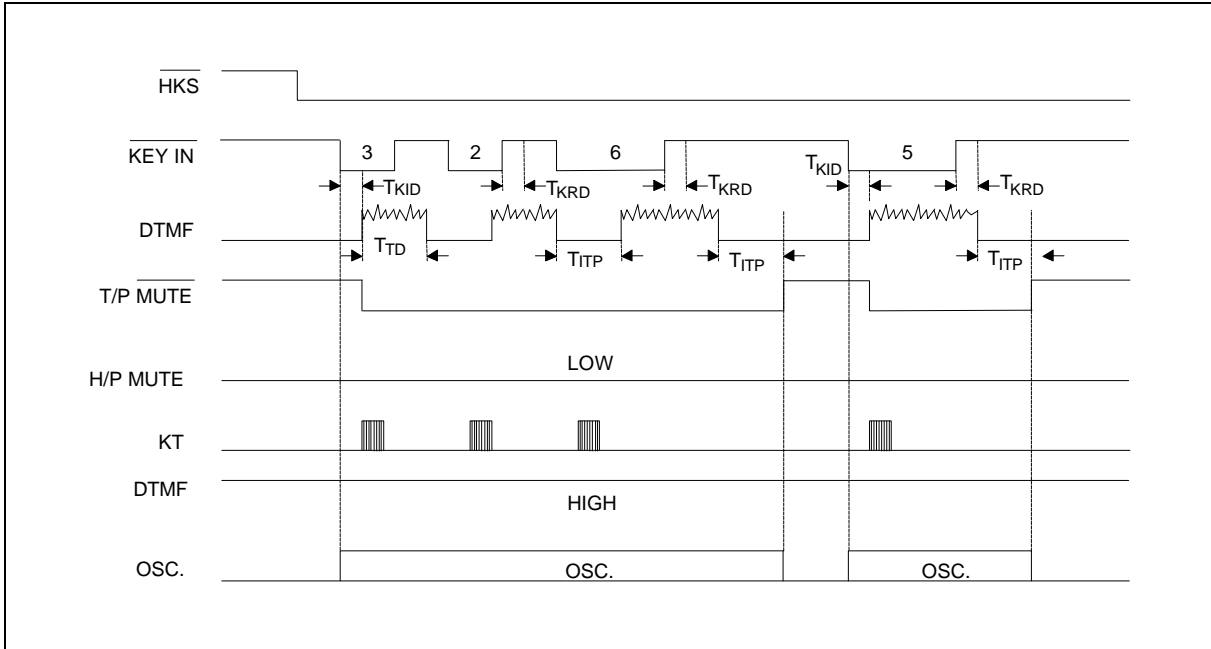


Figure 2(a) Tone Mode Timing Diagram (Normal dialing without lock)

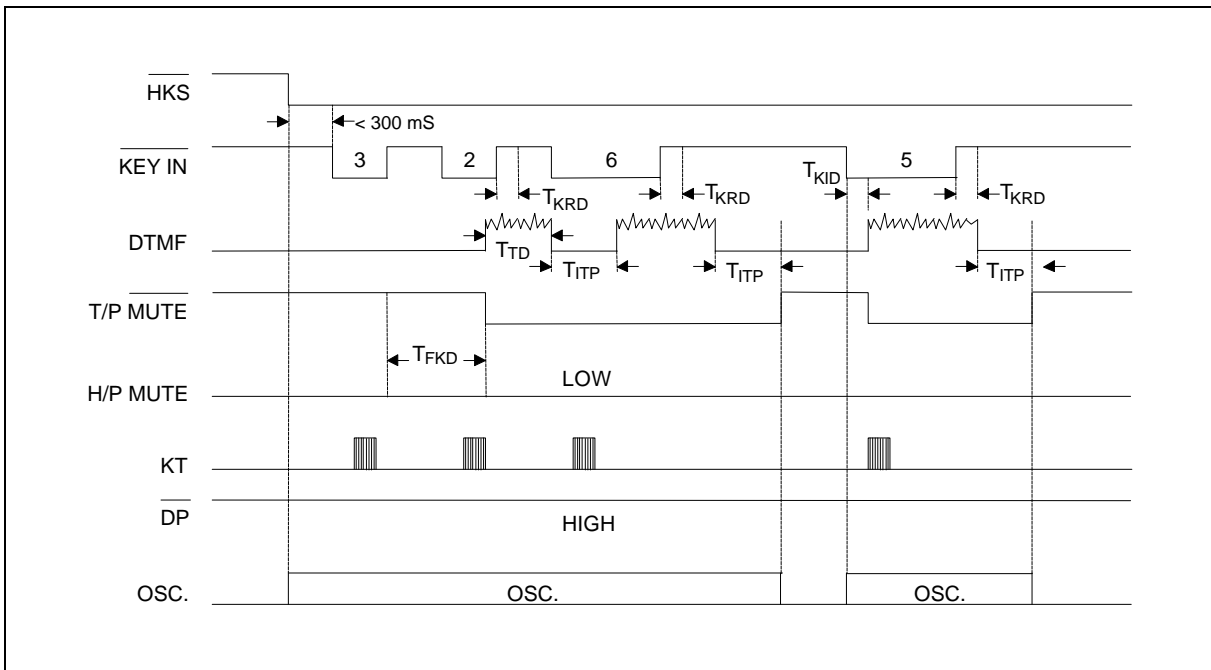


Figure 2(b) Tone Mode Timing Diagram (Normal dialing with lock function)

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Timing Waveforms, continued

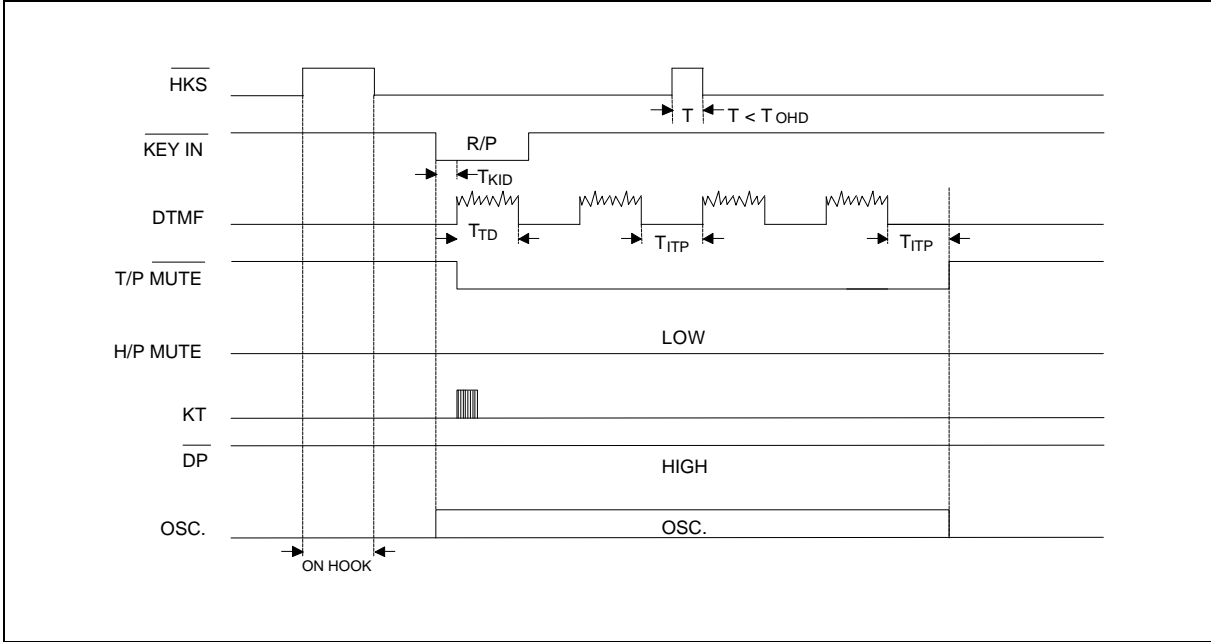


Figure 2(c) Tone Mode Timing Diagram (Auto dialing without lock)

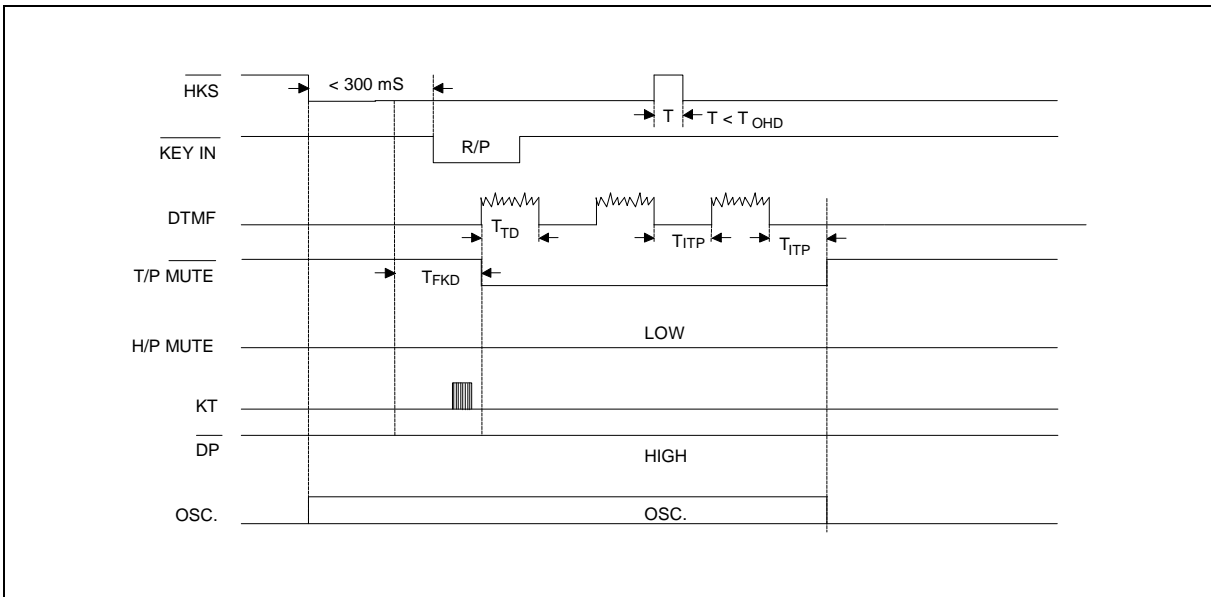


Figure 2(d) Tone Mode Timing Diagram (Auto dialing with lock function)

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Timing Waveforms, continued

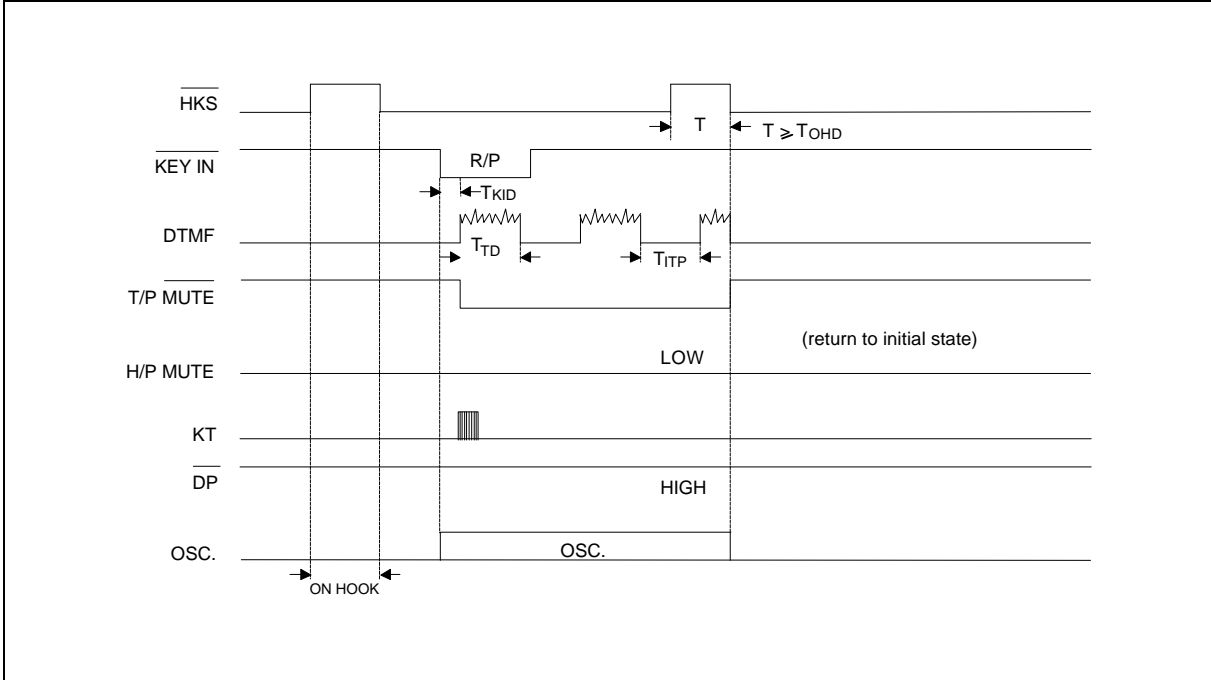


Figure 2(e) Tone Mode Timing Diagram with On-hook Debounce (Auto dialing without lock)

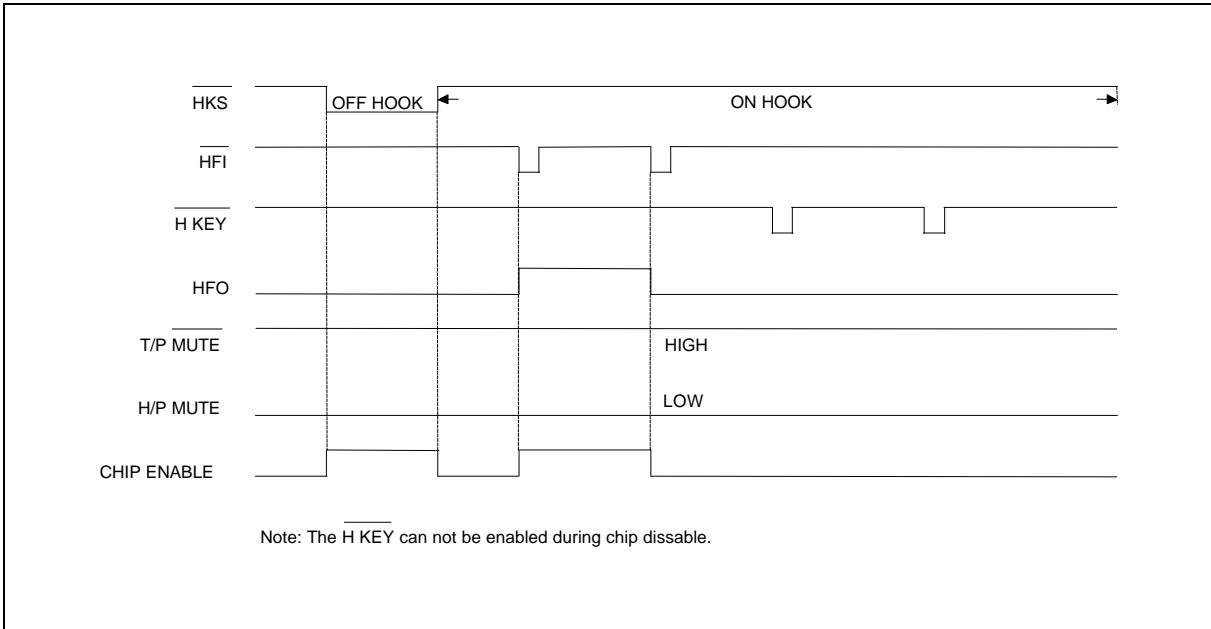


Figure 3(a)

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Timing Waveforms, continued

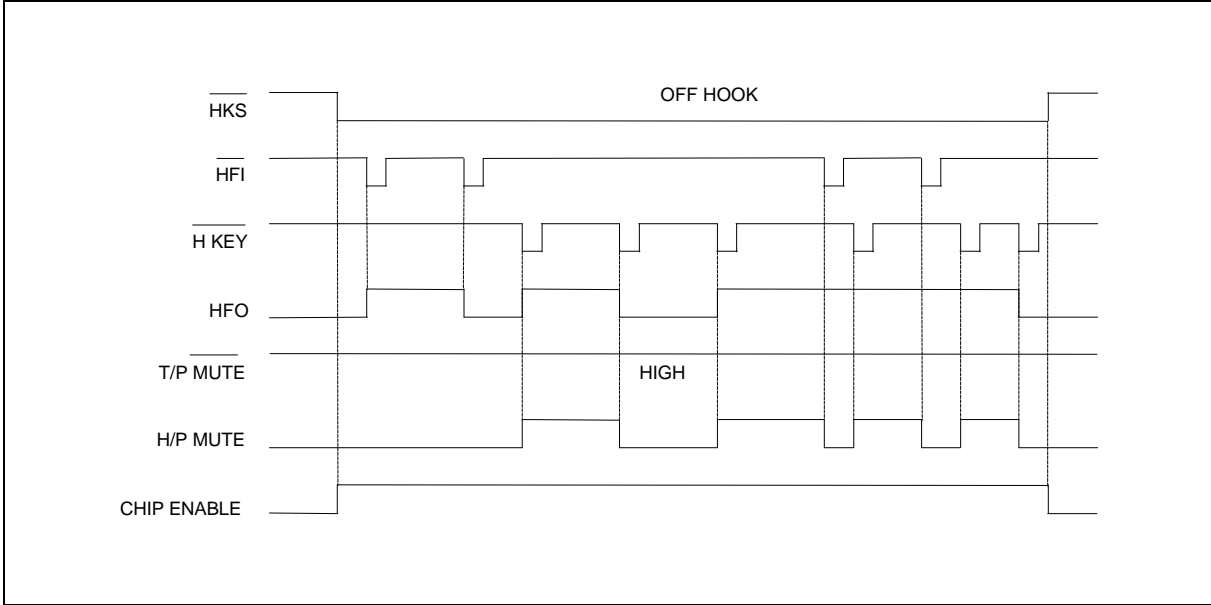


Figure 3(b)

Note: The H KEY and HFI inputs will toggle the HFO signal. The first time HFI or H KEY are activated, the HFO signal will go high and the previous active input will be neglected.

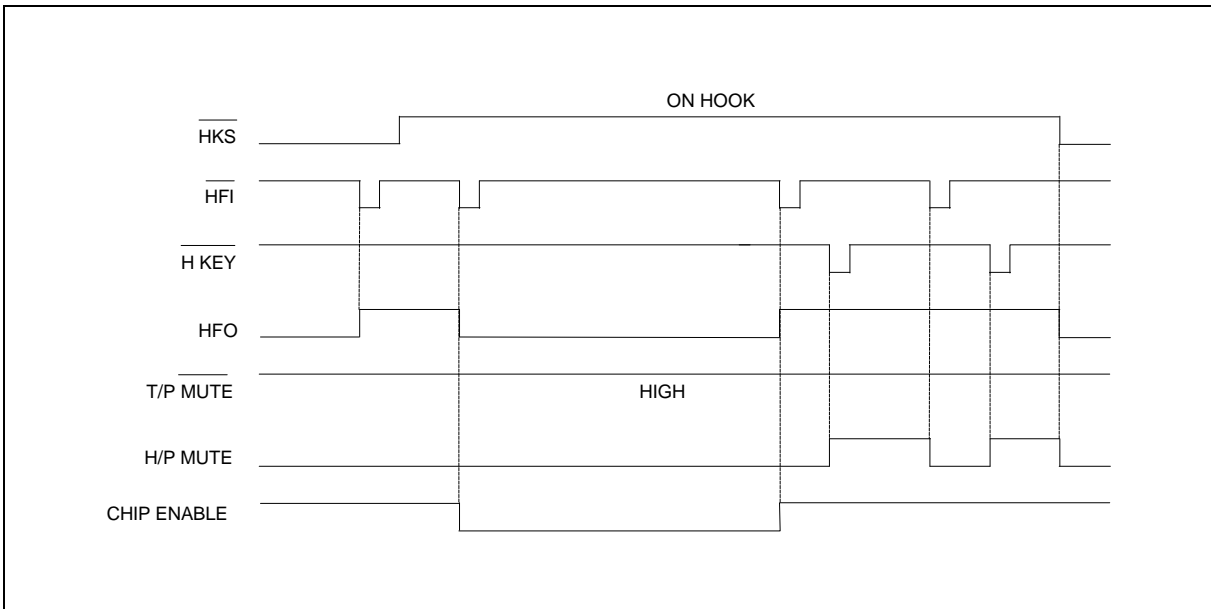


Figure 3(c)

Note: The HKS signal change of state from high to low will initialize both the HFO and H/P MUTE signals.

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Timing Waveforms, continued

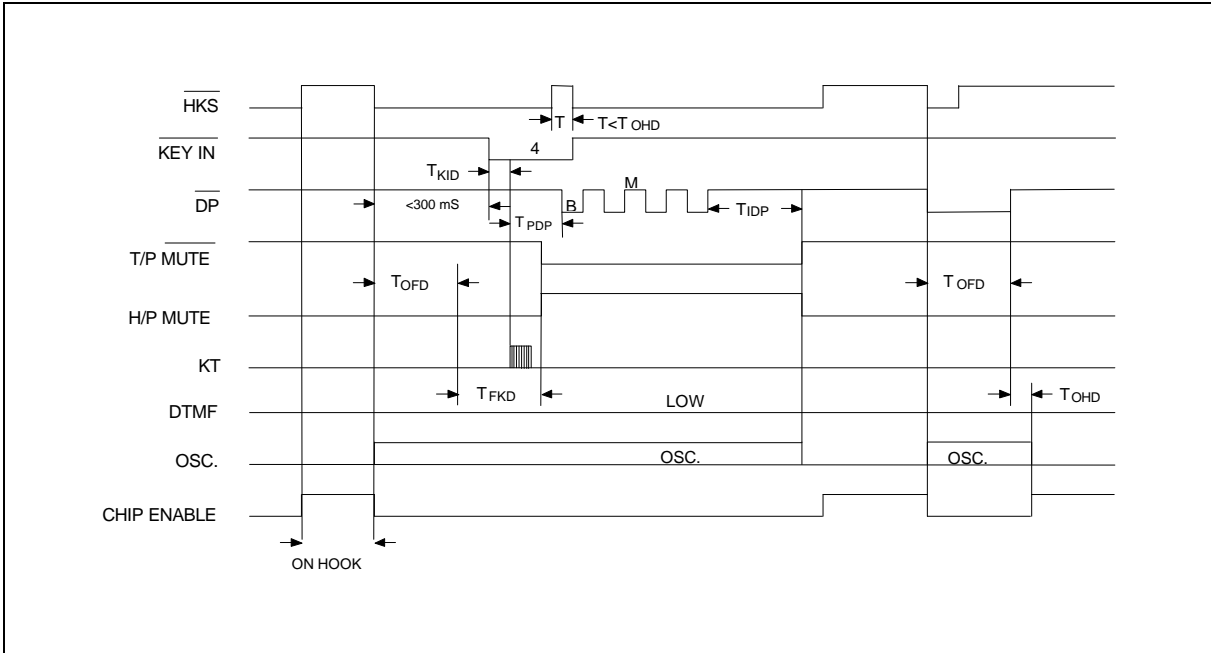


Figure 4 Lock Function Timing Diagram

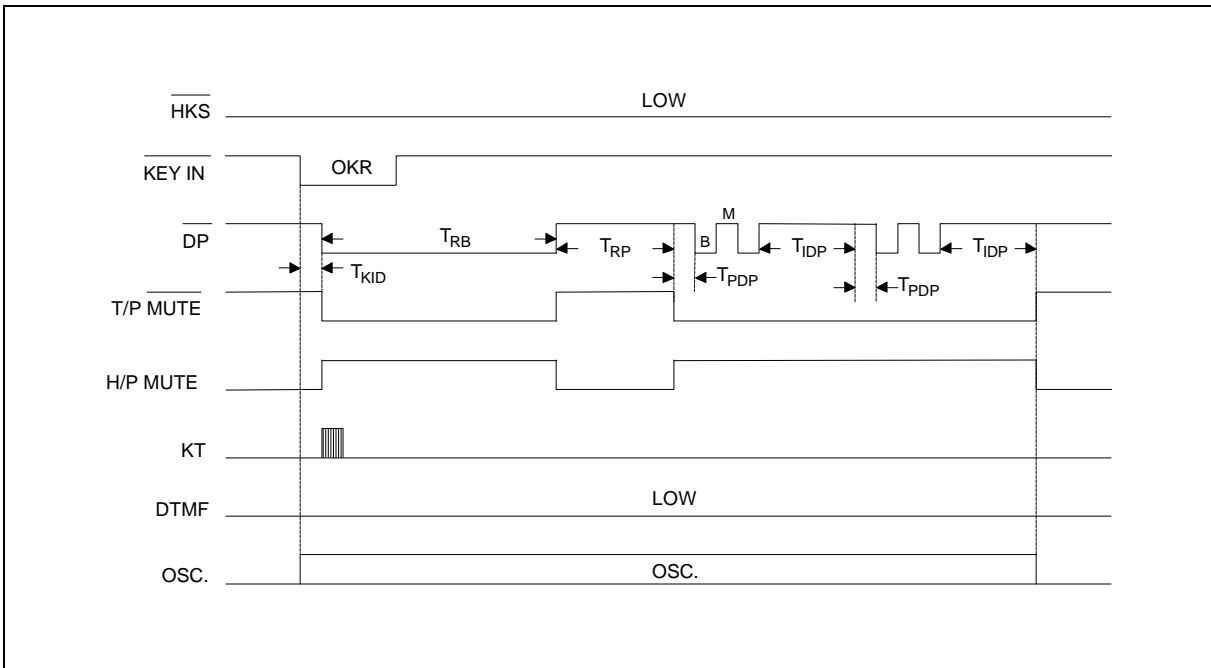


Figure 5 Pulse Mode One-key Dedialing Timing Diagram (without lock)

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Timing Waveforms, continued

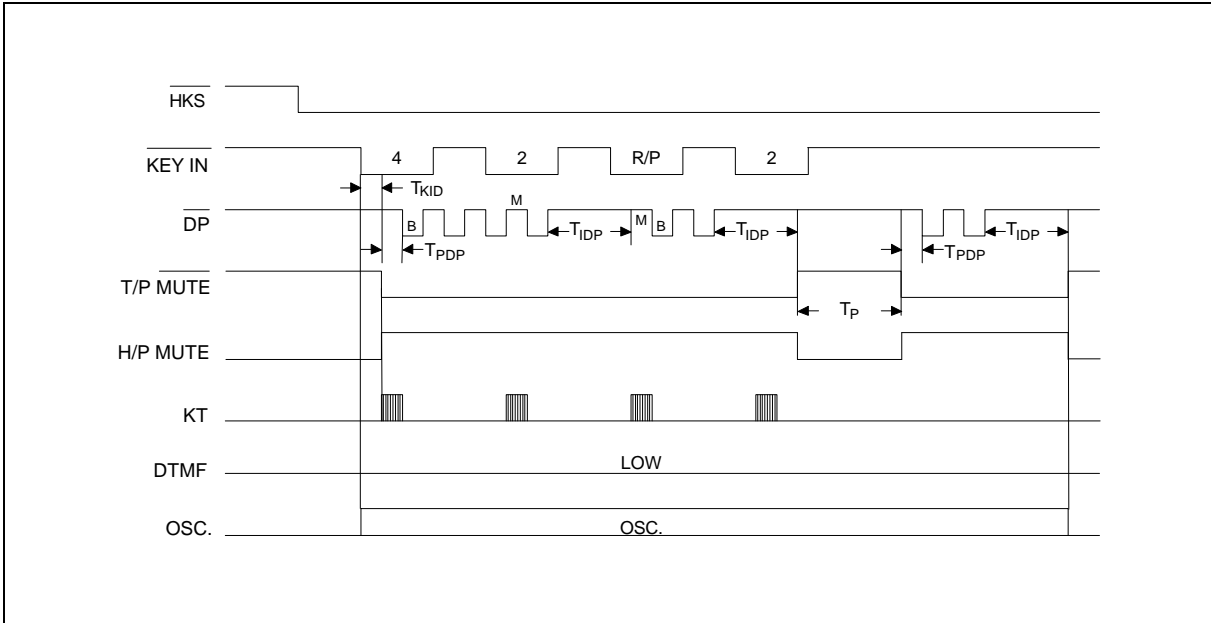


Figure 6 Pause Function Timing Diagram (without lock)

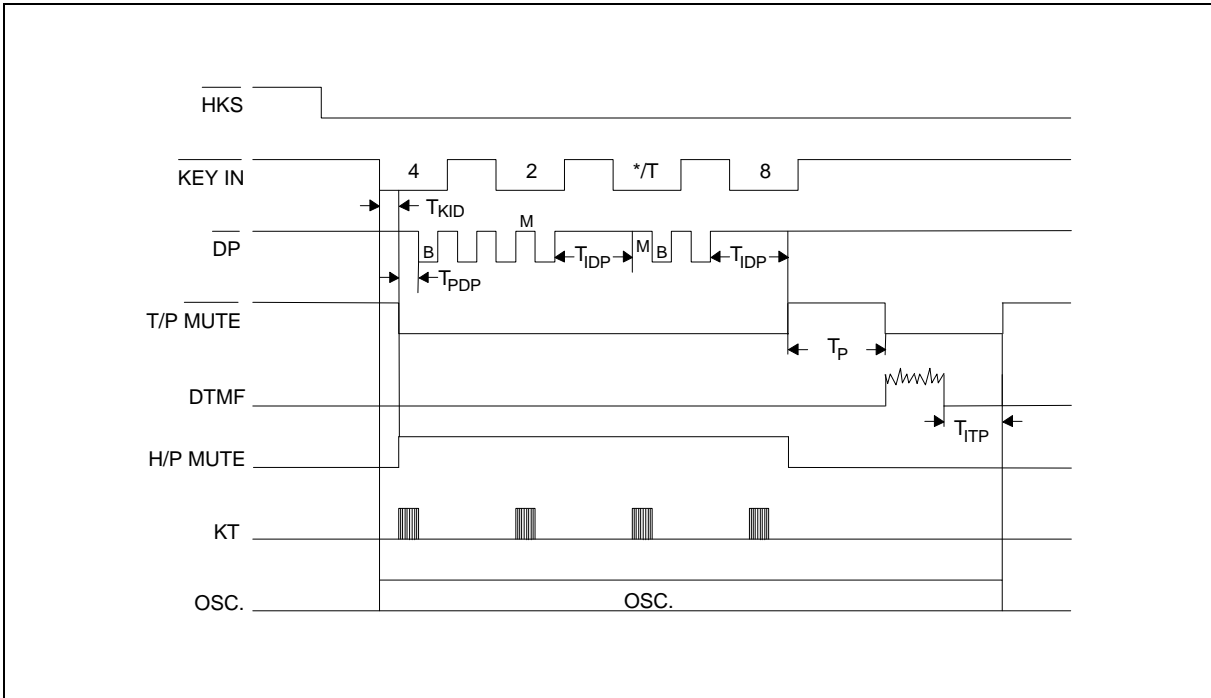


Figure 7. Pulse to Tone Function Timing Diagram (without lock)

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Timing Waveforms, continued

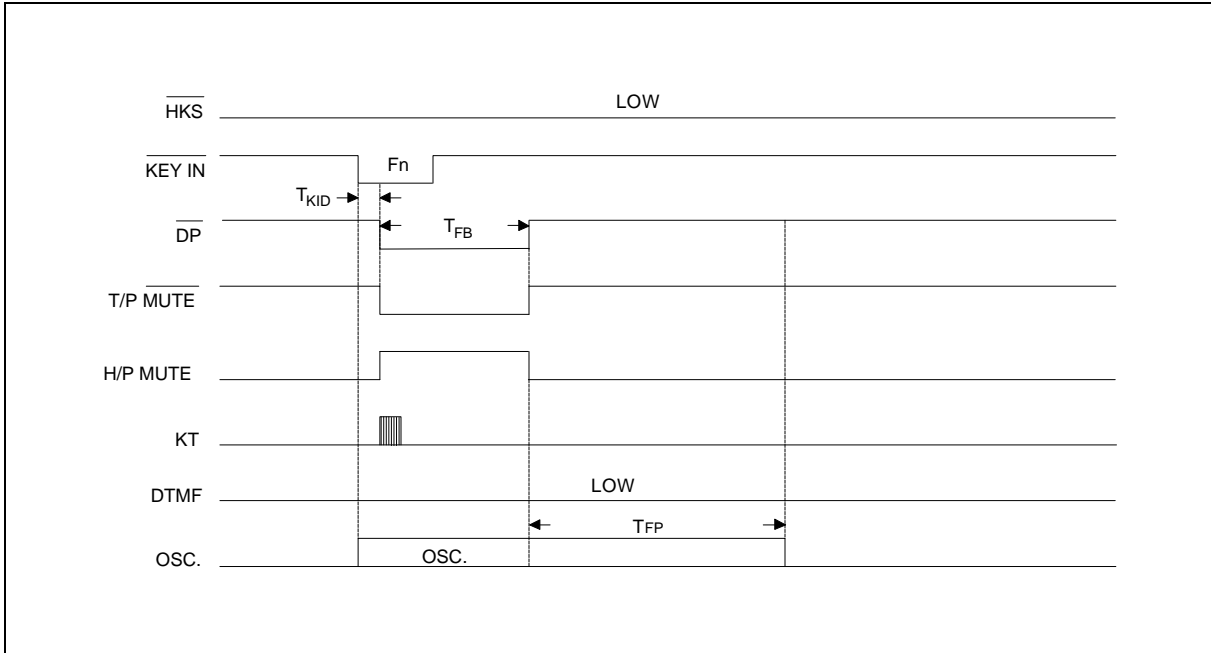


Figure 8 Flash Operation Timing Diagram

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