

# W91820N SERIES



## 13-MEMORY TONE/PULSE DIALER WITH HANDFREE, LOCK AND HOLD FUNCTIONS

### GENERAL DESCRIPTION

The W91820N is a series of tone/pulse switchable telephone dialers with 13 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

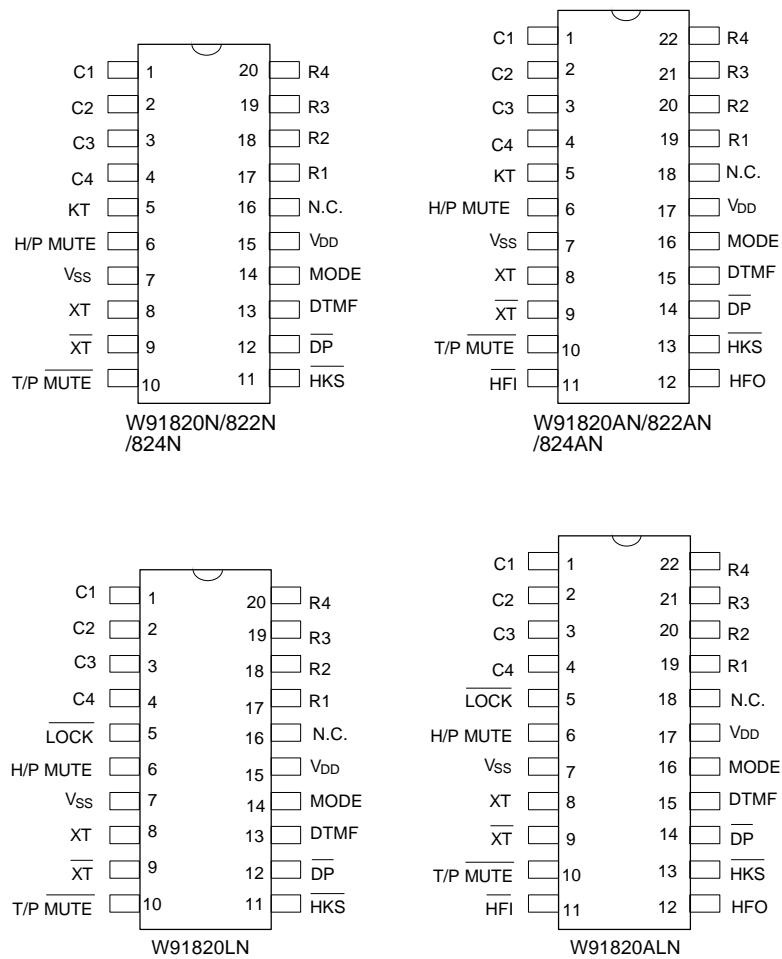
- Tone/pulse switchable dialer
- Two by 32 digits redial and save memory
- Three by 32 digits one-touch direct repertory memory
- Ten by 32 digits two-touch indirect repertory memory
- Pulse-to-tone (\*T) keypad for long distance call operation
- Chain dialing
- Uses 5 × 5 keyboard
- Easy operation with 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 (unless W91824N/AN is 87 mS)
- Minimum intertone pause: 93 mS (unless W91824N/AN is 87mS)
- Pause time: 3.6 sec. (unless W91824N/AN is 2.0 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, or 22-pin dual-in-line plastic package
- The different dialers in the W91820N series are shown in the following table:

TYPE NO.	PULSE (ppS)	LOCK	KEY TONE	HANDFREE DIALING	PACKAGE (PINS)
W91820N/824N	10	-	√	-	20
W91820AN/824AN	10	-	√	√	22
W91820LN	10	√	-	-	20
W91820ALN	10	√	-	√	22
W91822N	20	-	√	-	20
W91822AN	20	-	√	√	22

Note: W91824N/824AN for French only.

Publication Release Date: May 1999

## PIN CONFIGURATIONS



# W91820N 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 $\overline{\text{MUTE}}$	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 Vss places the dialer in tone mode.  Connecting the mode pin to VDD 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 VDD by internal resistor.
KT (W91820N/8 20AN/822N/ 824N/822AN /824AN only)	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.

# W91820N SERIES



Pin Description, continued

SYMBOL	20-PIN	22-PIN	I/O	FUNCTION																																				
$\overline{\text{LOCK}}$ (W91820LN/ 820ALN only)	5	5	I	<p>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.</p> <p>The function of the <math>\overline{\text{LOCK}}</math> pin is shown below:</p> <table border="1"> <thead> <tr> <th><math>\overline{\text{LOCK}}</math> PIN</th> <th>FUNCTION</th> </tr> </thead> <tbody> <tr> <td>V<sub>DD</sub></td> <td>"0", "9" dialing inhibited</td> </tr> <tr> <td>Floating</td> <td>Normal dialing Mode</td> </tr> <tr> <td>V<sub>SS</sub></td> <td>"0" dialing inhibited</td> </tr> </tbody> </table>	$\overline{\text{LOCK}}$ PIN	FUNCTION	V <sub>DD</sub>	"0", "9" dialing inhibited	Floating	Normal dialing Mode	V <sub>SS</sub>	"0" dialing inhibited																												
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H/P MUTE	6	6	I	<p>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.</p>																																				
$\overline{\text{DP}}$	12	14	O	<p>N-channel open drain dialing pulse output. Flash key will cause <math>\overline{\text{DP}}</math> to be active in either tone mode or pulse mode.</p> <p>In lock mode, the <math>\overline{\text{DP}}</math> remains low for 300 mS during off-hook delay time.</p> <p>The timing diagram for pulse mode is shown in Figure 1(a, b).</p>																																				
DTMF	13	15	O	<p>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.</p> <p>A detailed timing diagram for tone mode is shown in Figure 2(a, b).</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
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V <sub>DD</sub> , V <sub>SS</sub>	15, 7	17, 7	I	<p>Power input pins for the dialer chip. V<sub>DD</sub> is the power and V<sub>SS</sub> is the ground.</p>																																				

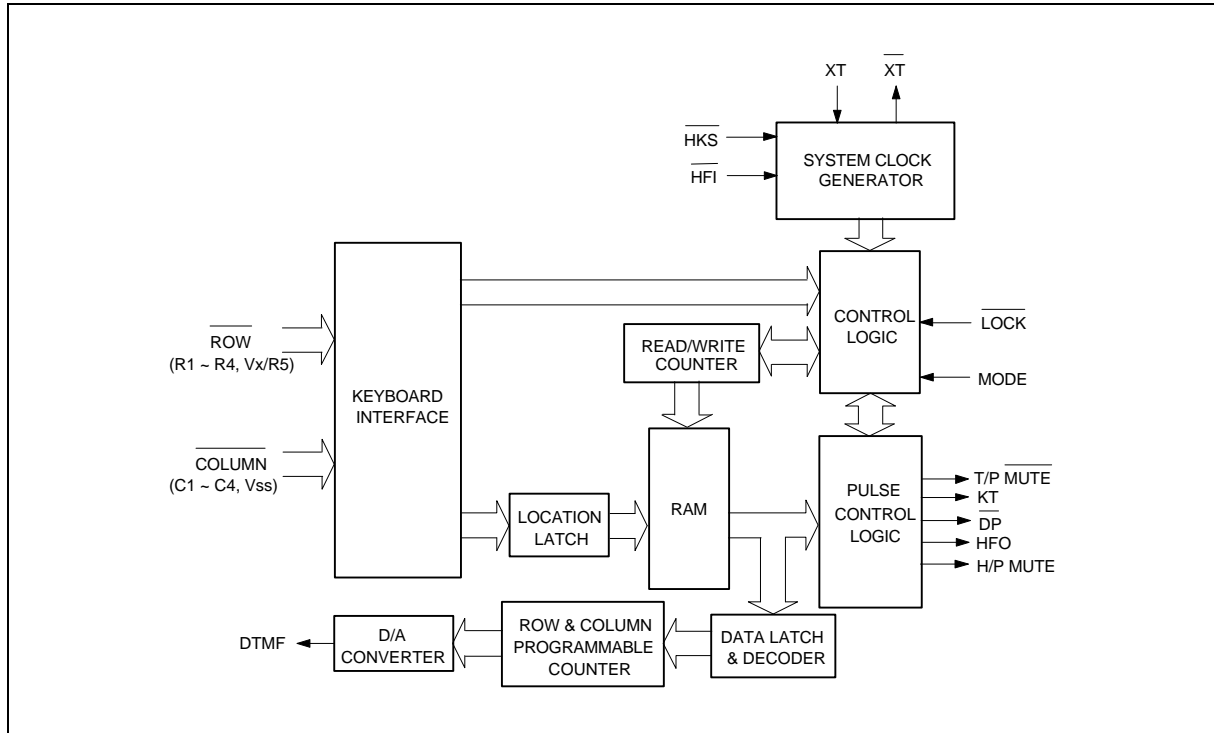
# W91820N SERIES



Pin Description, continued

SYMBOL	20-PIN	22-PIN	I/O	FUNCTION																																								
$\overline{\text{HFI}}$ , HFO	-	11, 12	I, O	<p>Handfree control pins.</p> <p>A low pulse on the <math>\overline{\text{HFI}}</math> input pin toggles the handfree control state. The 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><math>\overline{\text{HFI}} \downarrow</math></td> <td>High</td> <td>Yes</td> </tr> <tr> <td>On Hook</td> <td>High</td> <td><math>\overline{\text{HFI}} \downarrow</math></td> <td>Low</td> <td>No</td> </tr> <tr> <td>Off Hook</td> <td>High</td> <td><math>\overline{\text{HFI}} \downarrow</math></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 <math>\overline{\text{HFI}}</math> pin is pulled to VDD by an internal resistor.</p> <p>A detailed timing diagram is shown in Figure 3.</p>	CURRENT STATE		NEXT STATE			HOOK SW.	HFO	INPUT	HFO	DIALING	-	Low	$\overline{\text{HFI}} \downarrow$	High	Yes	On Hook	High	$\overline{\text{HFI}} \downarrow$	Low	No	Off Hook	High	$\overline{\text{HFI}} \downarrow$	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
- 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

OFF HOOK (or ON HOOK &  $\overline{\text{HFI}} \downarrow$ ), D1, D2, ..., Dn

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

OFF HOOK (or ON HOOK &  $\overline{\text{HFI}} \downarrow$ ), D1, D2, ..., Dn, BUSY

Come ON HOOK, OFF HOOK (or ON HOOK &  $\overline{\text{HFI}} \downarrow$ ), R/P

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

- The below cases are selected by mask option for W91824N/AN (French version) only.

In tone mode:

D1, D2, D3, \*(or #), D4, D5, D6

The chip will only output D1, D2, D3 and ignore \*(or #), D4, D5, D6.

In pulse mode:

D1, D2, D3, \*/T, D4, D5, D6



The chip will only output D1,D2,D3 and do not transfer to tone mode. In pulse mode, the # sign does not effect.

## Number Store

1. **OFF HOOK** (or **ON HOOK** & **HFI** ↓ ), **D1** , **D2** , ..., **Dn** , **S** , **S** , **EMn** (or **A** , **Ln** or **SAVE** )

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

2. **OFF HOOK** (or **ON HOOK** & **HFI** ↓ ), **S** , **D1** , **D2** , ..., **Dn** , **S** , **EMn** (or **A** , **Ln** or **SAVE** )

- a. D1, D2, ..., Dn will be stored in memory location, Mn (or saved), but will not be dialed out.
- b. **R/P** and **\*/T** keys can be stored as a digit in memory, but the **R/P** key cannot be the first digit. In store mode, **R/P** 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

**OFF HOOK** (or **ON HOOK** & **HFI** ↓ ), **D1** , **D2** , ..., **Dn** , **Save**

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

**OFF HOOK** (or **ON HOOK** & **HFI** ↓ ),

come on **OFF HOOK** (or **ON HOOK** & **HFI** ↓ ), **SAVE**

- c. D1 to Dn will be dialed out after the **SAVE** key is pressed.

## Repertory Dialing Procedure

One-touch direct repertory dialing:

**OFF HOOK** (or **ON HOOK** & **HFI** ↓ ), **Mn** (or **SAVE** )



Two-touch direct repertory dialing:

(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  
case a: D1, D2, ---, Dn, Pause (3.6 sec), D1', D2', ---, Dn'  
(Pulse) (Tone)  
case b: (only for French version)  
D1, D2, ---, Dn, \* , 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 (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.

## ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATING	UNIT
DC Supply Voltage	V <sub>DD</sub> -V <sub>SS</sub>	-0.3 to +7.0	V
Input/Output Voltage	V <sub>IL</sub>	V <sub>SS</sub> -0.3	V
	V <sub>IH</sub>	V <sub>DD</sub> +0.3	V
	V <sub>OL</sub>	V <sub>SS</sub> -0.3	V
	V <sub>OH</sub>	V <sub>DD</sub> +0.3	V
Power Dissipation	P <sub>D</sub>	120	mW
Operation Temperature	T <sub>OPR</sub>	-20 to +70	°C
Storage Temperature	T <sub>STG</sub>	-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.

# W91820N SERIES



## DC CHARACTERISTICS

( $V_{DD}-V_{SS} = 2.5V$ ,  $F_{osc} = 3.58\text{ MHz}$ ,  $T_A = 25^\circ\text{ C}$ , all outputs unloaded)

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage	$V_{DD}$	-	2.0	-	5.5	V
Operating Current	IOP	Tone	-	0.4	0.6	mA
		Pulse	-	0.2	0.4	mA
Standby Current	ISB	$\overline{HKS} = 0$ , No load & No key entry	-	-	15	$\mu\text{A}$
Memory Retention Current	IMR	$\overline{HKS} = 1$ , $V_{DD} = 1.0V$	-	-	1	$\mu\text{A}$
Tone Output Voltage	VTO	Row group, $R_L = 5\text{ K}\Omega$	130	150	170	mVrms
Pre-emphasis		Col/Row, $V_{DD} = 2.0-5.5V$	1	2	3	dB
DTMF Distortion	THD	$R_L = 5\text{ K}\Omega$ , $V_{DD} = 2.0-5.5V$	-	-30	-23	dB
DTMF Output DC Level	VTDC	$R_L = 5\text{ K}\Omega$ , $V_{DD} = 2.0-5.5V$	1.0	-	3.0	V
DTMF Output Sink Current	ITL	$V_{TO} = 0.5V$	0.2	-	-	mA
$\overline{DP}$ Output Sink Current	IPL	$V_{PO} = 0.5V$	0.5	-	-	mA
T/P $\overline{MUTE}$ Output Sink Current	IML	$V_{MO} = 0.5V$	0.5	-	-	mA
KT Drive/Sink Current	IKTH	$V_{KTH} = 2.0V$	0.5	-	-	mA
	IKTL	$V_{KTL} = 0.5V$	0.5	-	-	mA
HFO Drive/Sink Current	IHFH	$V_{HFH} = 2.0V$	0.5	-	-	mA
	IHFH	$V_{HFH} = 0.5V$	0.5	-	-	mA
H/P MUTE	IHPH	$V_{HPH} = 2.0V$	0.5	-	-	mA
Drive/Sink Current	IHPL	$V_{HPL} = 0.5V$	0.5	-	-	mA
Keypad Input Drive Current	IKD	$V_I = 0V$	4	-	-	$\mu\text{A}$
$\overline{HKS}$ Pull High Resister	RHKS		300	500	-	$\text{K}\Omega$
Keypad Input Sink Current	Iks	$V_I = 2.5V$	200	400	-	$\mu\text{A}$
Keypad Resistance			-	-	5.0	$\text{K}\Omega$

## 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 Pause1	TPDP1	Mode Pin = VDD	-	40	-	mS
		10 ppS Mode Pin = Floating	-	33.3	-	mS
Pre-digit Pause2	TPDP2	Mode Pin = VDD	-	20	-	mS
		20 ppS Mode Pin = Floating	-	16.7	-	mS
Inter Digit Pause (Auto Dialing)	TIDP	10 ppS (W91820N/W91820AN/820LN /820ALN/824N/824AN only)	-	800	-	mS
		20 ppS (W91822N/822AN 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
		(W91824N/AN only)	-	2.0	-	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.



TIMING WAVEFORMS

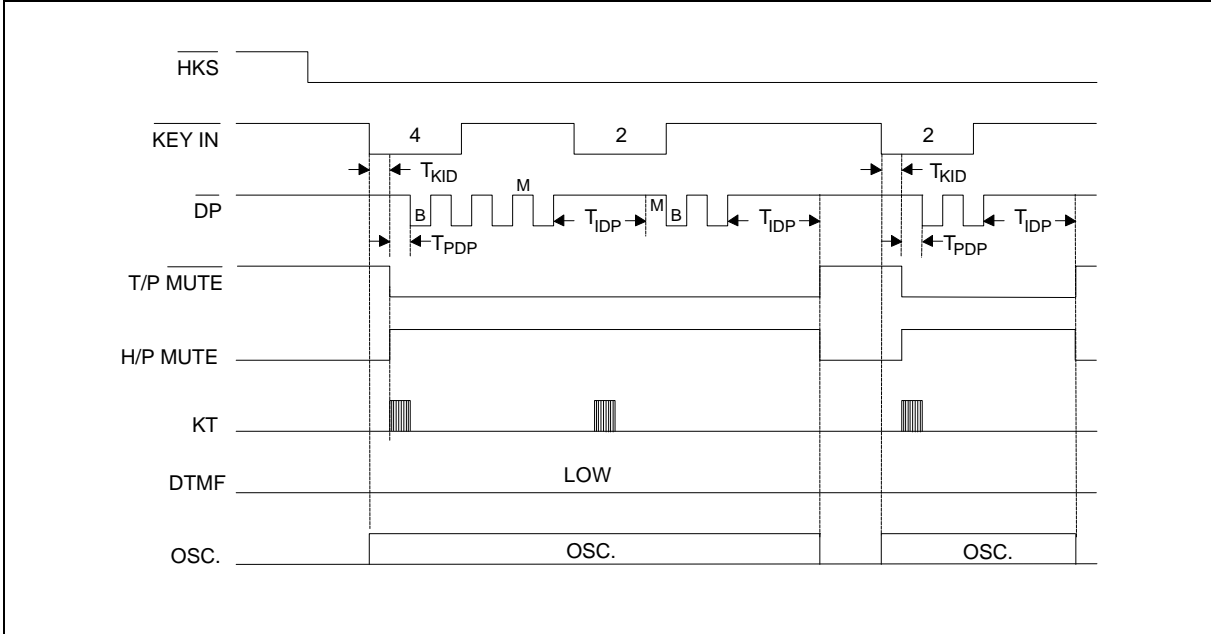


Figure 1(a). Pulse Mode Tming Diagram (Normal dialing without lock function)

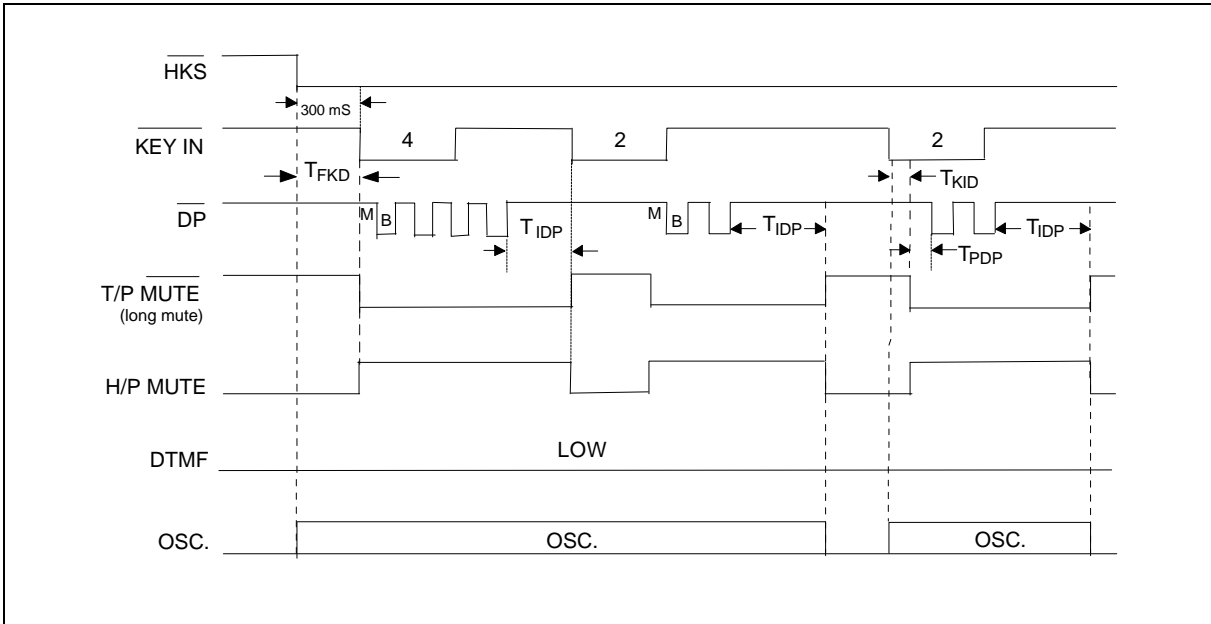


Figure 1(b). Pulse Mode Timing Diagram (Normal dialing with lock function)



Timing Waveforms, continued

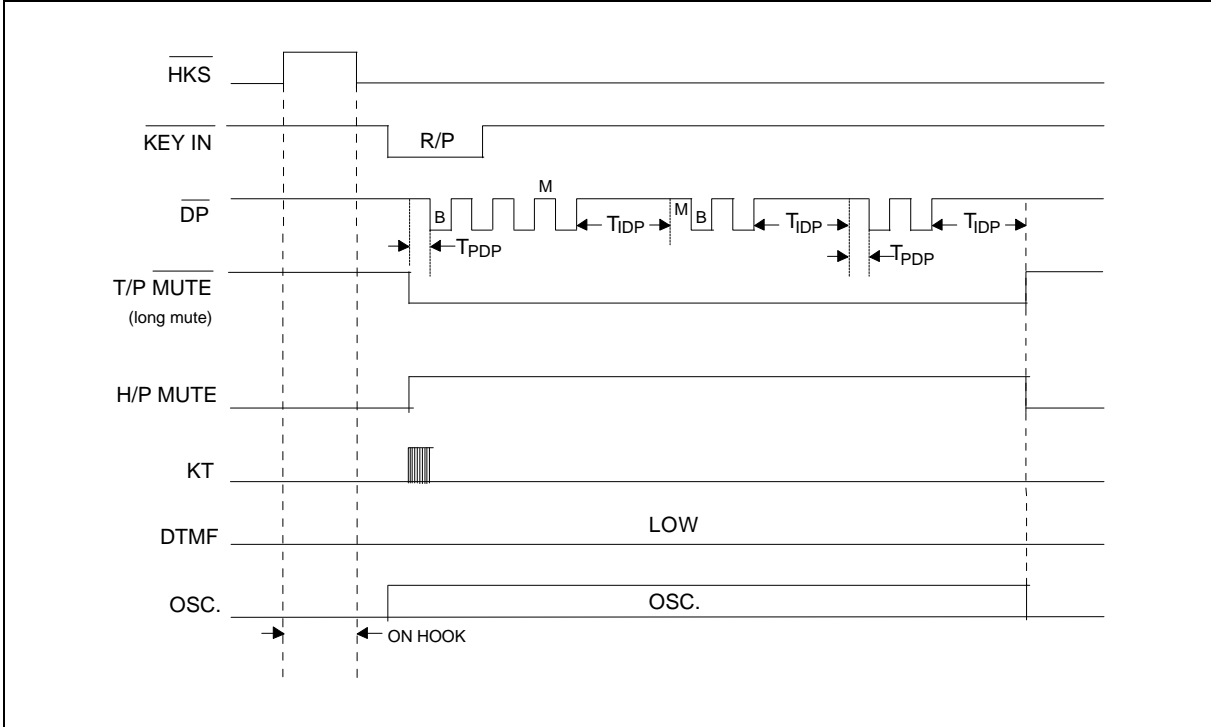


Figure 1(c). Pulse Mode Timing Diagram (Auto dialing without lock)

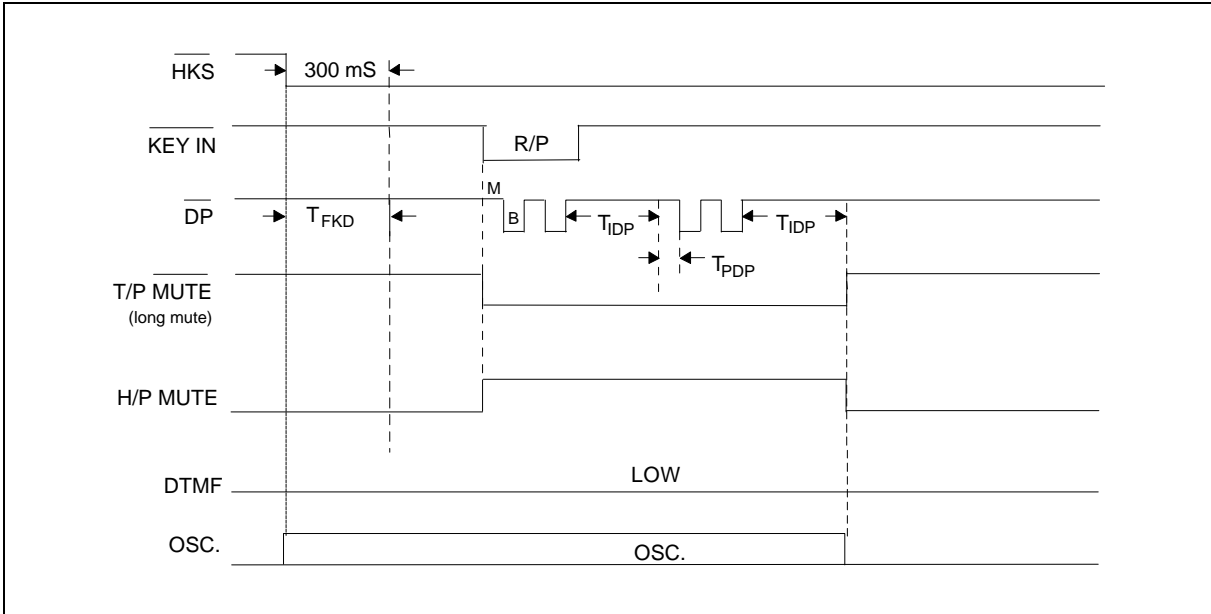


Figure 1(d). Pulse Mode Timing Diagram (Auto dialing with lock function)

Timing Waveforms, continued

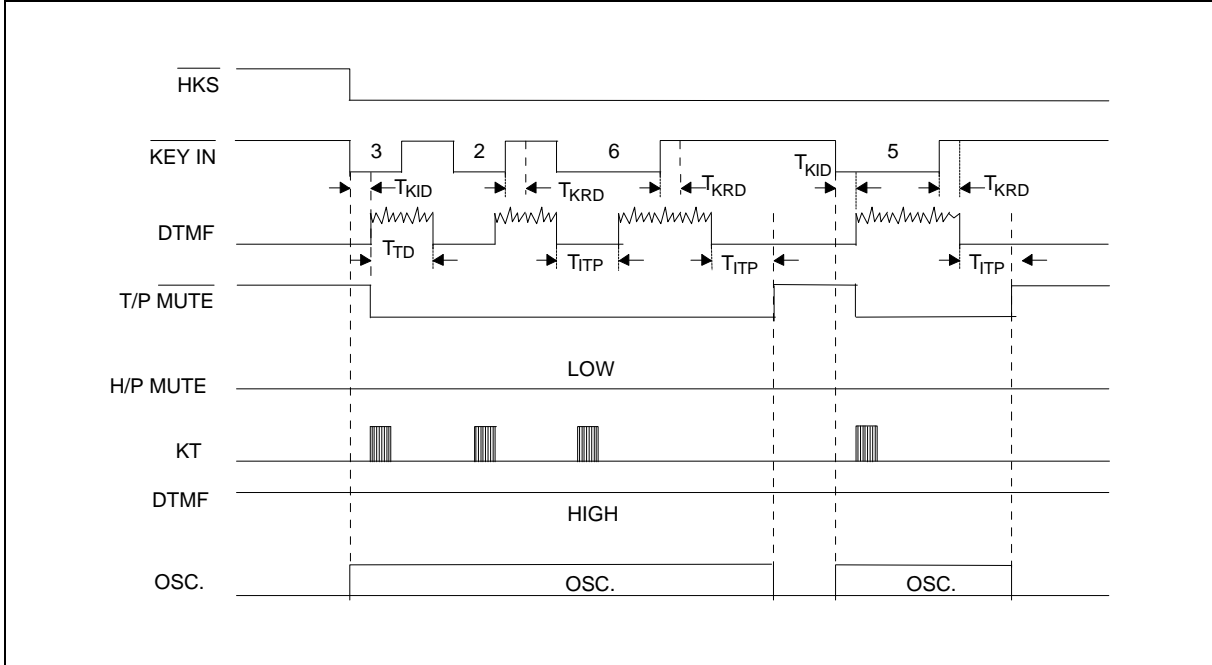


Figure 2(a). Tone Mode Timing Diagram

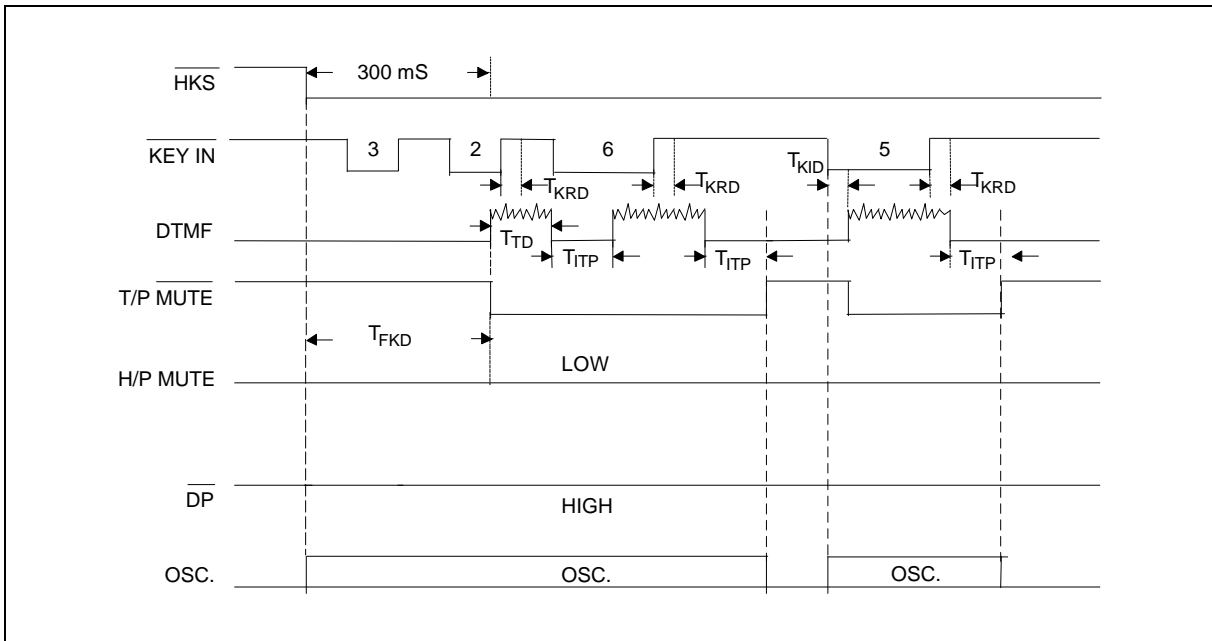


Figure 2(b). Tone Mode Timing Diagram (Normal dialing with lock function)

Timing Waveforms, continued

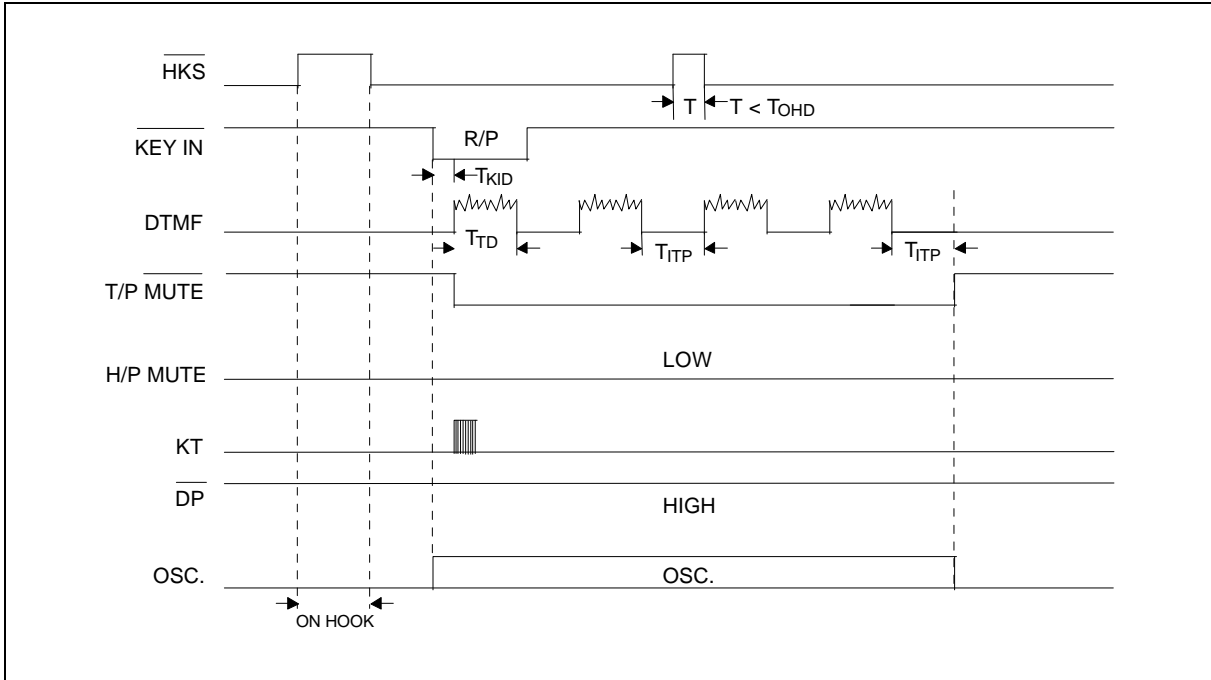


Figure 2(c). Tone Mode Timing Diagram (Auto dialing without lock function)

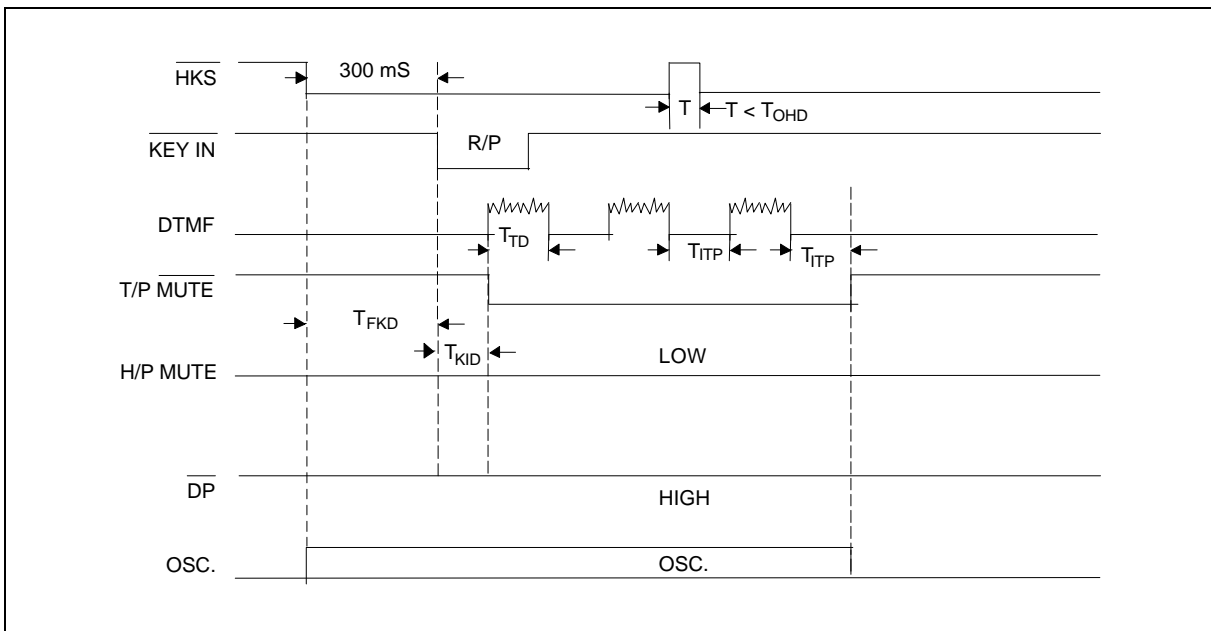


Figure 2(d). Tone Mode Timing Diagram (Auto dialing with lock function)

Timing Waveforms, continued

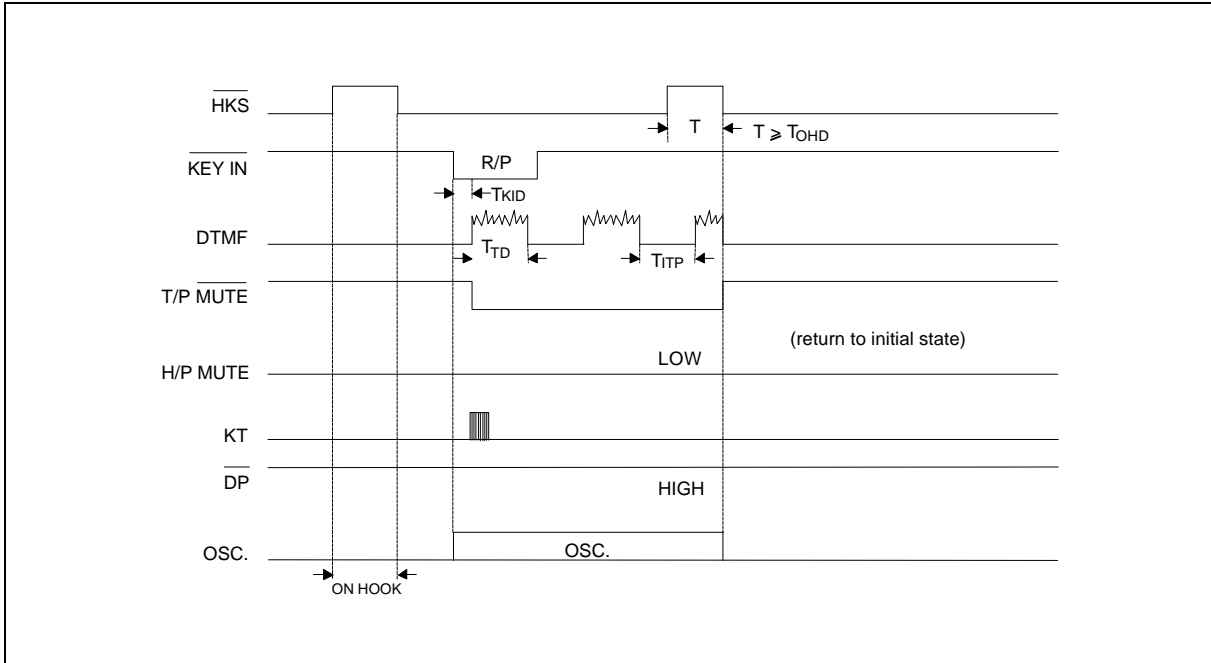


Figure 2(c). Tone Mode Timing Diagram with On-hook Debounce (Auto dialing)

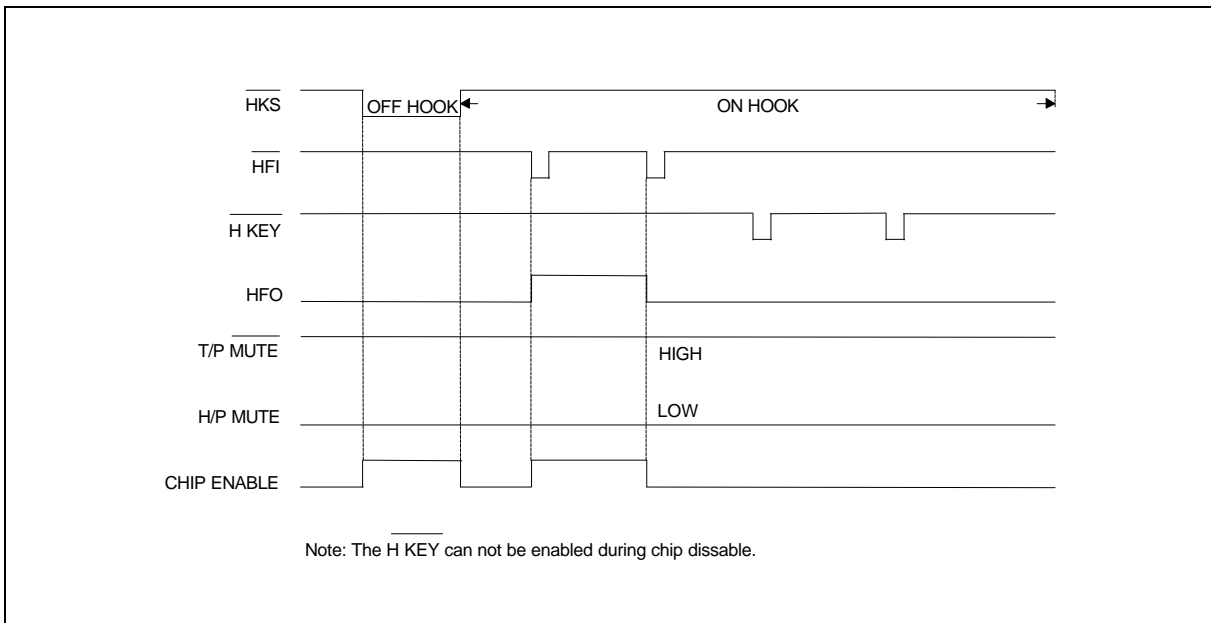


Figure 3(a)



Timing Waveforms, continued

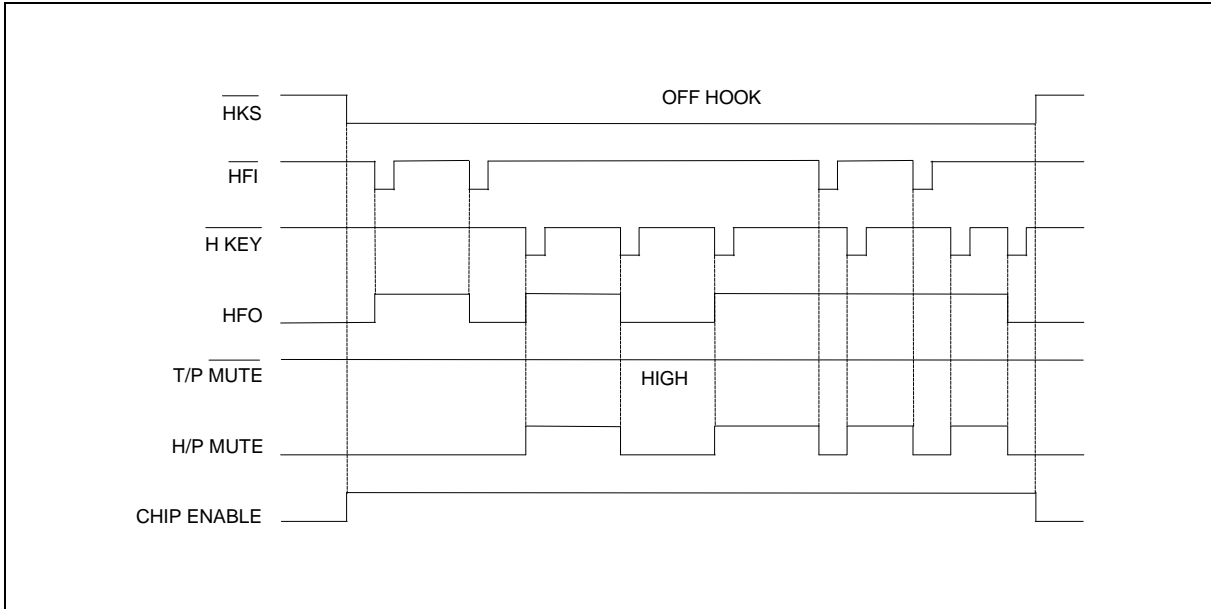


Figure 3(b)

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.

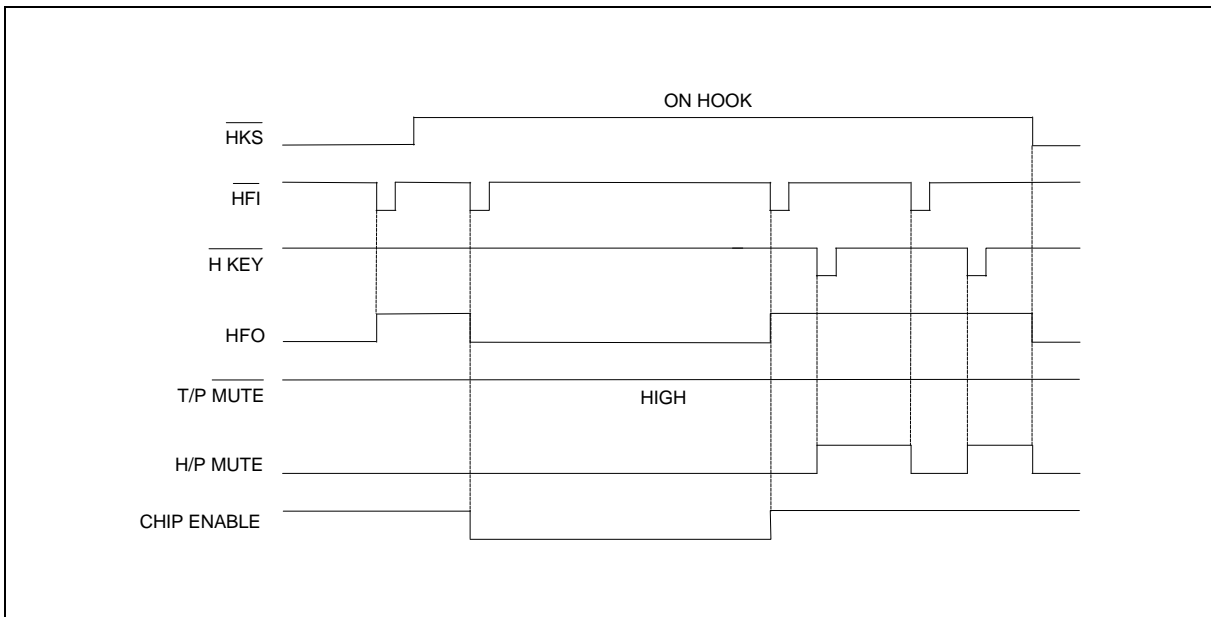


Figure 3(c)

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

Timing Waveforms, continued

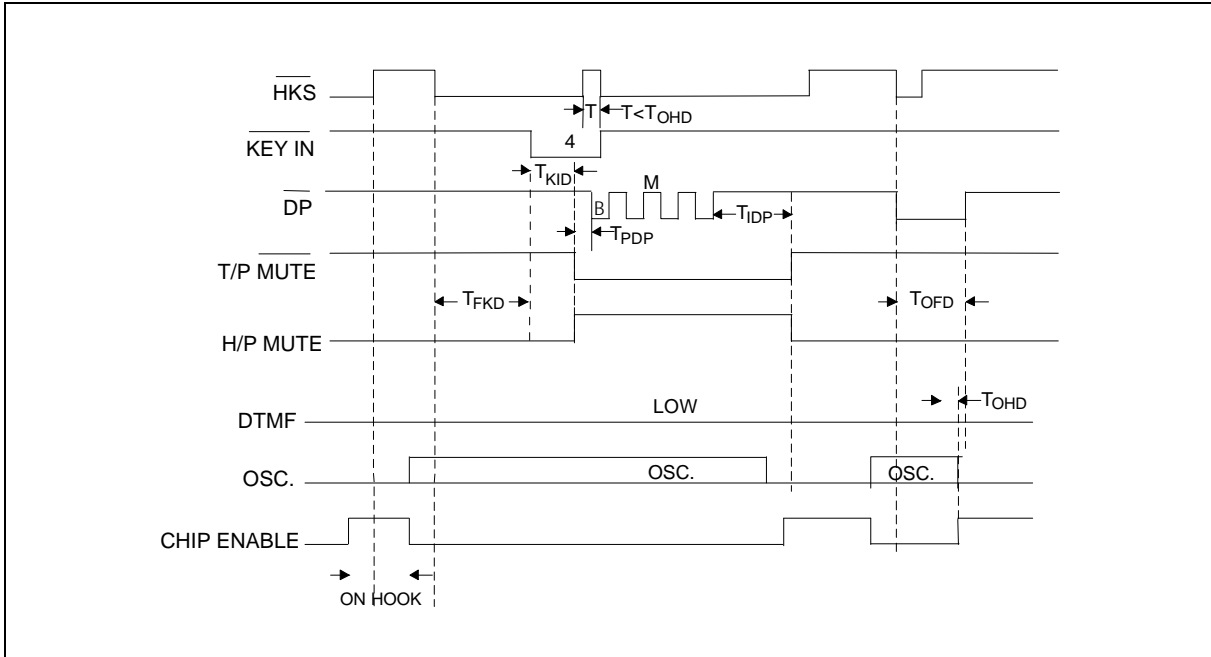


Figure 4. Lock Function Timing Diagram

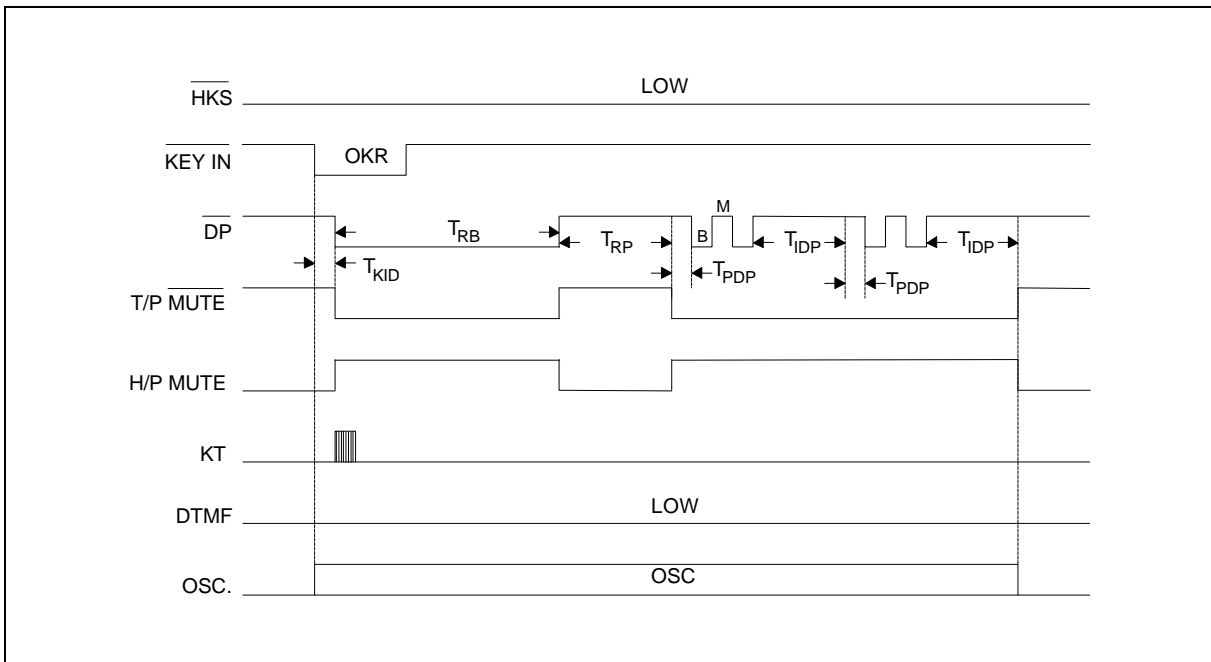


Figure 5. Pulse Mode One-key Redialing Timing Diagram

Timing Waveforms, continued

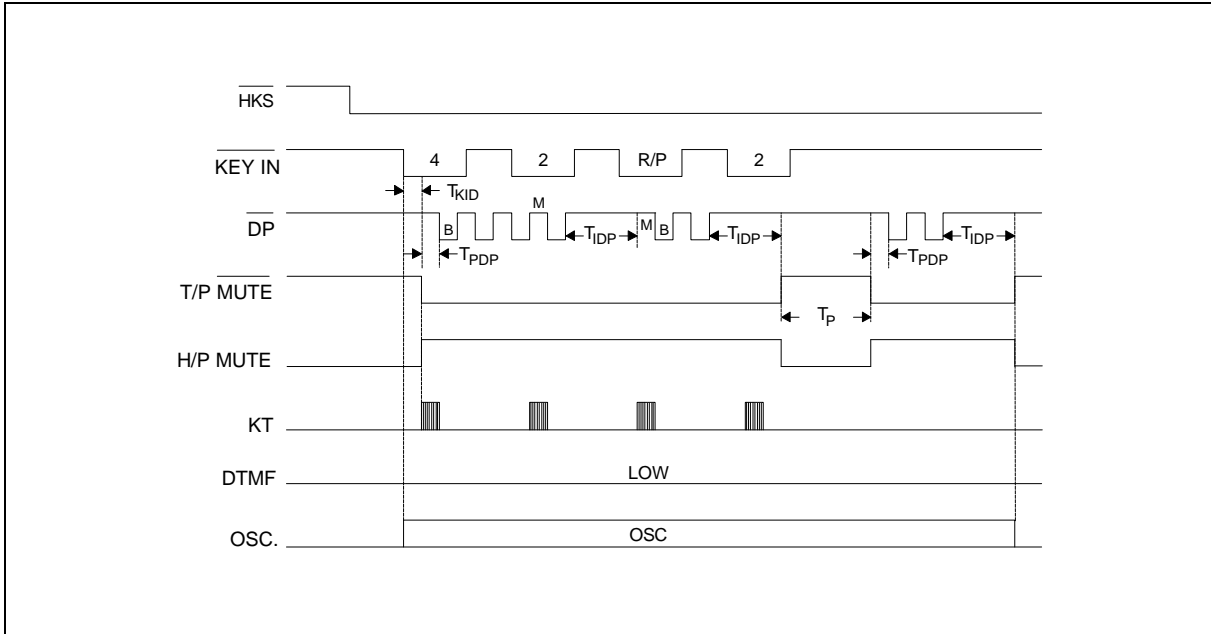


Figure 6. Pause Function Timing Diagram

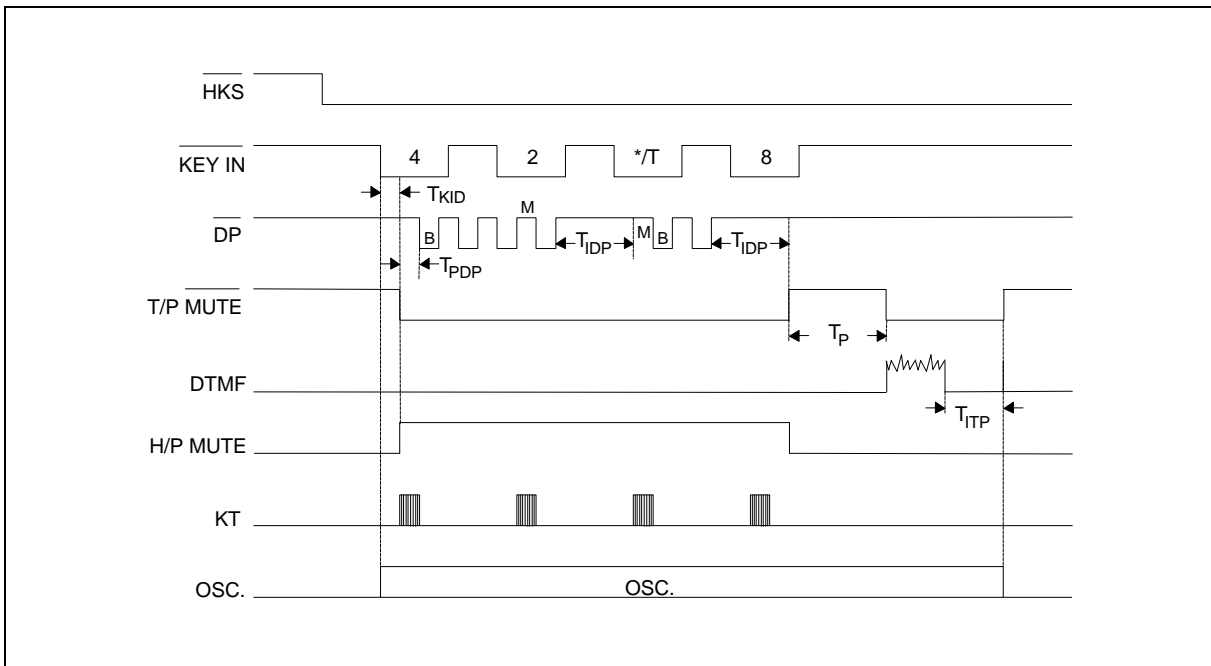


Figure 7(a). Pulse to Tone Function Timing Diagram

Timing Waveforms, continued

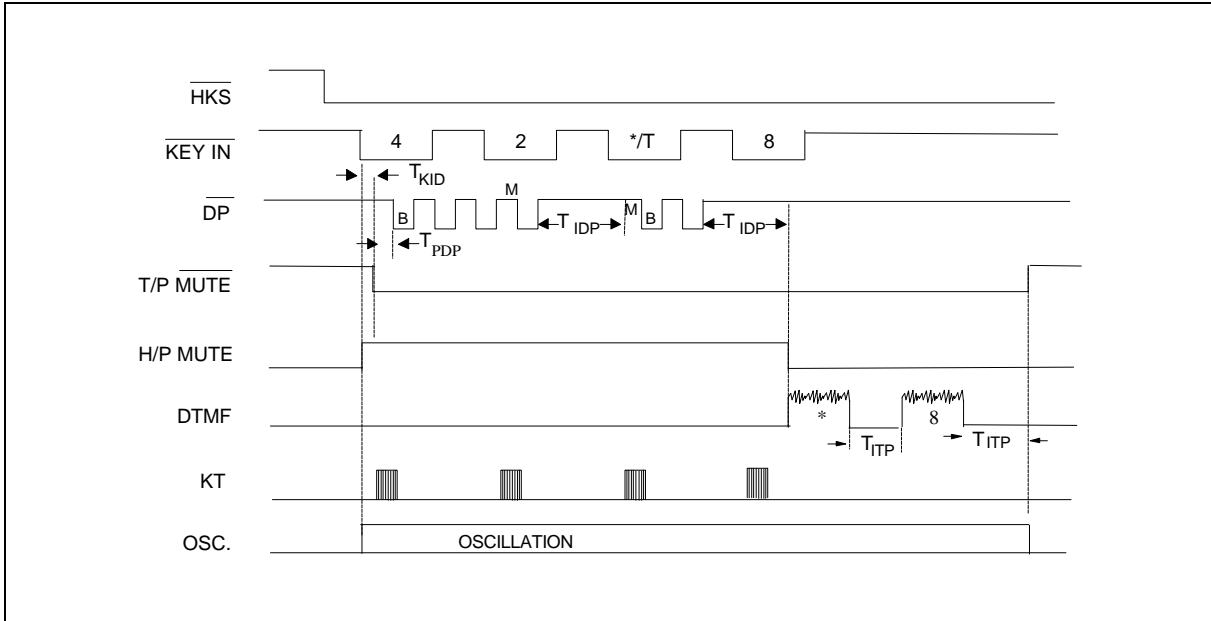


Figure 7(b). Pulse to tone function timing diagram (only for French version)

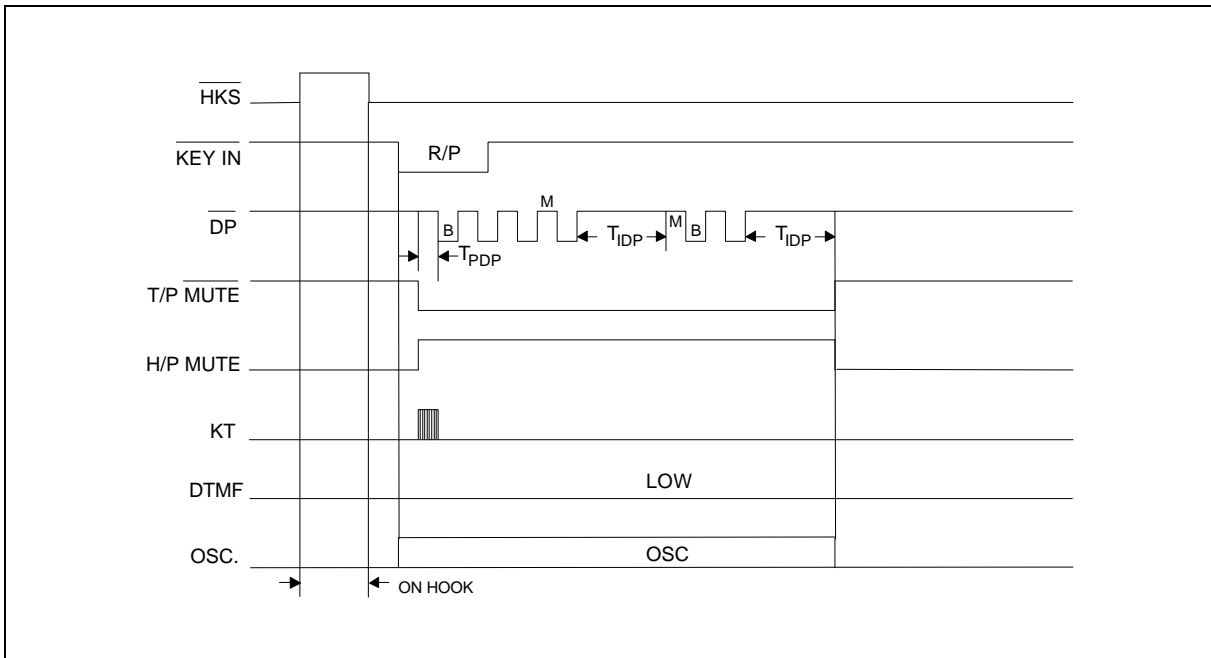


Figure 7(c). Pulse mode auto-redialing timing diagram continue Figure 6(b). (only for French version)

Timing Waveforms, continued

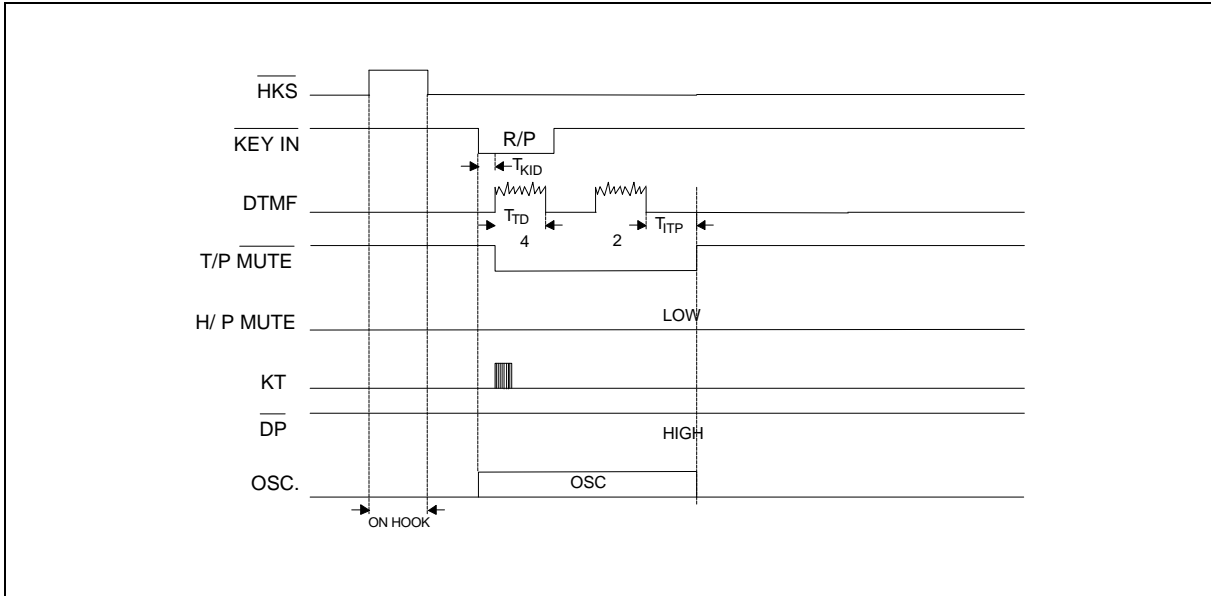


Figure 7(d). Tone mode auto-redialing timing diagram continue Figure 6(b). (only for French version)

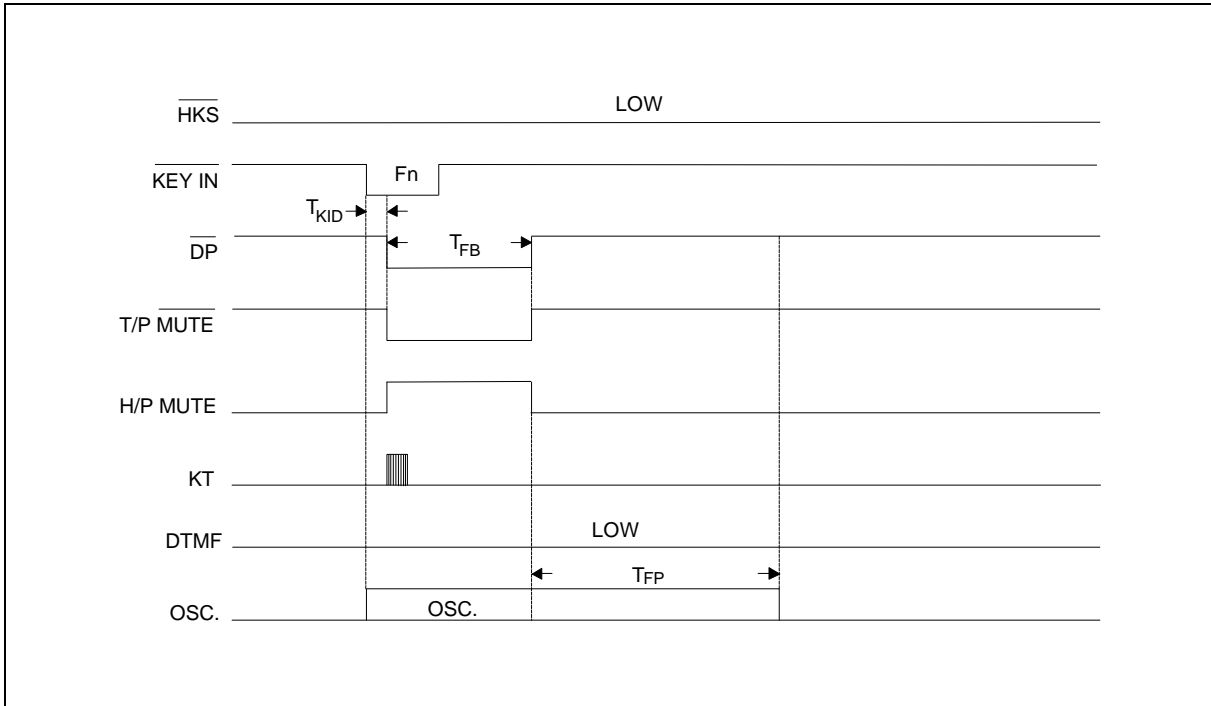


Figure 8. Flash Operation Timing Diagram

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