Winbond Electronics Corp.

TONE/PULSE DIALER WITH HANDFREE LOCK AND HOLD FUNCTIONS

GENERAL DESCRIPTION

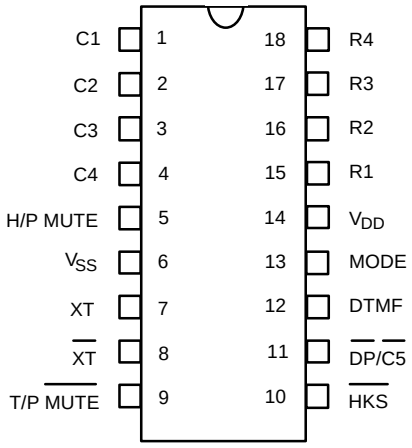
The W91320N series are Si-gate CMOS ICs that provide the necessary signals for tone or pulse dialing. The W91320N series provide one-key redial, handfree dialing, hold, redial, and lock functions.

FEATURES

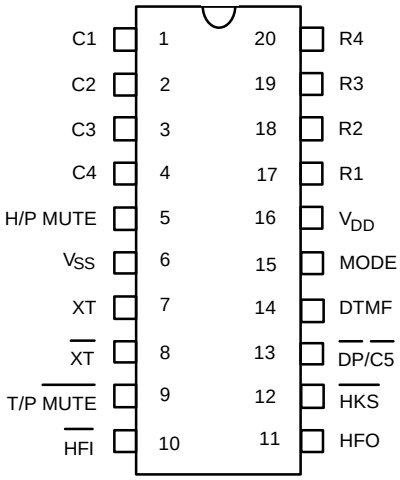
- DTMF/pulse switchable dialer
- 32-digit redial memory
- Pulse-to-tone (*/T) keypad for long distance call operation
- Uses 5×5 keyboard
- Easy operation with redial, flash, pause, and */T keypads
- Pause, pulse-to-tone (*/T) can be stored as a digit in memory
- 0 or 9 dialing inhibition pin for PABX system or long distance dialing lock out
- Off-hook delay 300 mS in lock mode ($\overline{DP}$ will keep low for 300 mS while off hook)
- First key-in delay 300 mS output in lock mode
- Dialing rate (10, 20 ppS) selected by bonding option
- Minimum tone output duration: 93 msec.
- Minimum intertone pause: 93 msec.
- Flash break time (73, 100, 300, 600 msec.) selectable by keypad, and the pause time is 1.0 sec.
- On-chip power-on reset
- Uses 3.579545 MHz crystal or ceramic resonator
- Packaged in 18, 20, or 22-pin plastic DIP
- The different dialers in the W91320N series are shown in the following table:

TYPE NO.	REPLACEMENT TYPE NO.	PULSE (ppS)	FLASH (mS)	M/B	HANDFREE DIALING	LOCK	PACKAGE (PINS)
W91320N	W91320	10	600/100/300/73	Pin	-	-	18
W91321N	W91321	20	600/100/300/73	Pin	-	-	18
W91320AN	W91320A	10	600/100/300/73	Pin	Yes	-	20
W91321AN	W91321A	20	600/100/300/73	Pin	Yes	-	20
W91320LN	W91322L	10	600/100/300/73	Pin	-	Yes	20
W91320ALN	W91322AL	10	600/100/300/73	Pin	Yes	Yes	22

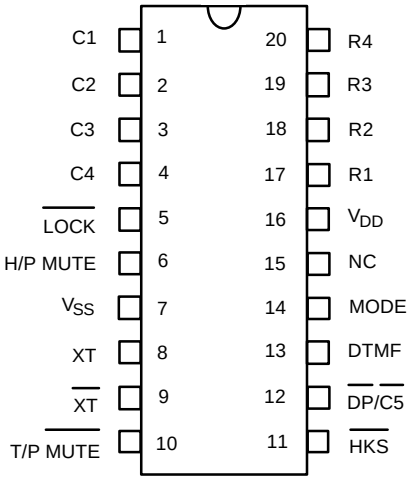
PIN CONFIGURATIONS



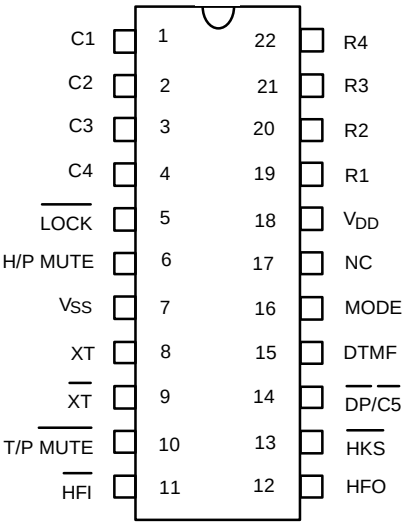
W91320N/W91321N



W91320AN/W91321AN



W91320LN



W91320ALN

PIN DESCRIPTION

SYMBOL	18-PIN	20-PIN	22-PIN	I/O	FUNCTION
Column-Row Inputs	1–4 & 15–18	1–4 & 17–20	1–4 & 19–22	I	The keyboard inputs may be used with either the standard 5 × 5 keyboard or the inexpensive single contact (Form A) keyboard. Electronic input from a µC can also be used. A valid key-in is defined as a single row being connected to a single column
XT, $\overline{XT}$	7, 8	7, 8 (8, 9, W91320LN only)	8, 9	I, O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.
T/P $\overline{MUTE}$	9	9 (10, W91320LN only)	10	O	The T/P $\overline{MUTE}$ is a conventional CMOS N-channel open drain output. The output transistor is switched on during dialing sequence, one-key redial break and flash break time. Otherwise, it is switched off.
MODE	13	15 (14, W91320LN only)	16	I	Pulling mode pin to V_{SS} places the dialer in tone mode. Pulling mode pin to V_{DD} places the dialer in pulse mode. (10 ppS; 20 ppS for W91321N/321AN M/B = 40:60) Floating mode pin places the dialer in pulse mode. (10 ppS; 20 ppS for W91321N/321AN M/B = 33.3:66.7)
$\overline{HKS}$	10	12 (11, W91320LN only)	13	I	Hook switch input. $\overline{HKS}$ = V_{DD}: On-hook state. Chip in sleeping mode, no operation. $\overline{HKS}$ = V_{SS}: Off-hook state. Chip is enable for normal operation. $\overline{HKS}$ pin is pulled to V_{DD} by internal resistor.

Pin Description, continued

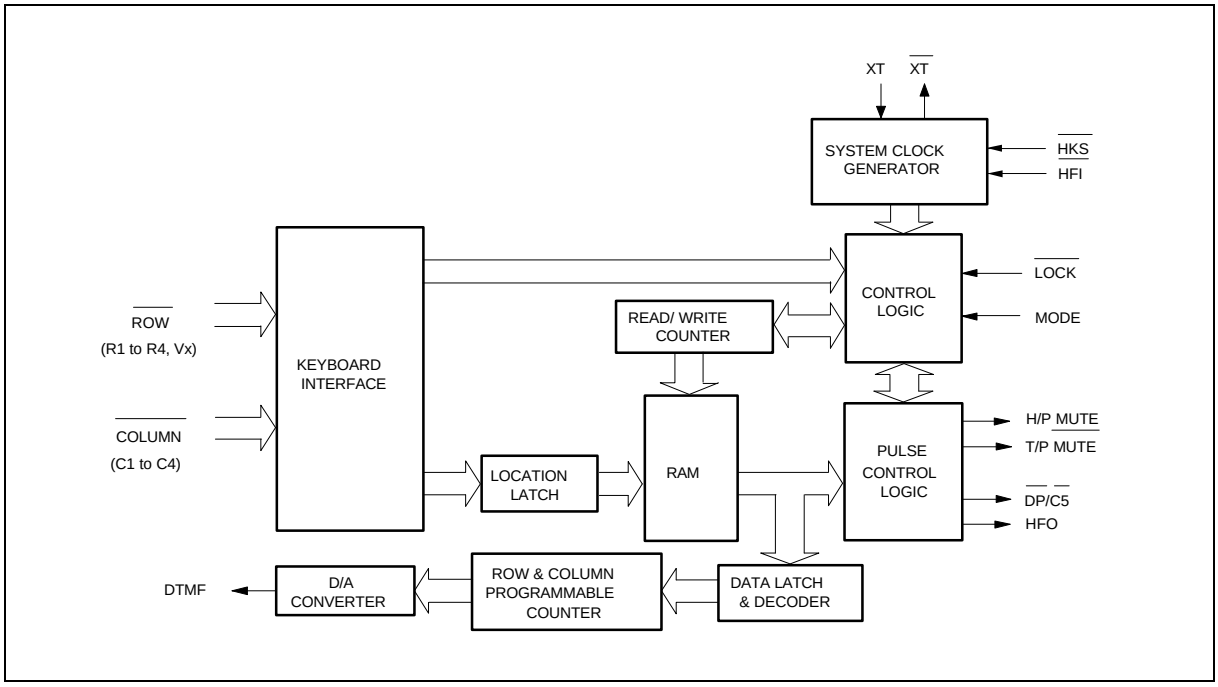
SYMBOL	18-PIN	20-PIN	22-PIN	I/O	FUNCTION
$\overline{DP}$ / $\overline{C5}$	11	13 (12, W91320LN only)	14	O	N-channel open drain dialing pulse output. Flash key will cause $\overline{DP}$ to be active in either tone mode or pulse mode. The timing diagram for pulse mode is shown in Figure 1(a, b, c, d).
V_{DD}, V_{SS}	14, 6	16, 6 (16, 7 W91320LN only)	18, 7	I	Power input pins.
H/P MUTE	5	5 (6, W91320LN only)	6	O	The H/P MUTE is a conventional inverter output. During pulse dialing, flash break, one-key redial break, and hold period, this output is active high; otherwise, it remains in low state.
NC	-	15 (W91320LN only)	17	-	No connection.
DTMF	12	14 (13, W91320LN only)	15	O	In pulse mode, this pin remains in low state at all time. In the tone mode, it will output a dual or single tone. Detailed timing diagram for tone mode is shown in Figure 2(a, b, c, d).

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

Pin Description, continued

<table>
<tr><th>SYMBOL</th><th>18-PIN</th><th>20-PIN</th><th>22-PIN</th><th>I/O</th><th>FUNCTION</th></tr>
<tr><td>$\overline{HFI}$, HFO</td><td>-</td><td>10, 11
(W91320AN/ 321AN)</td><td>11, 12</td><td>I, O</td><td>Handfree control pins. The handfree control state is toggled on by a low pulse on the $\overline{HFI}$ input pin. The status of the handfree control state is described in the following table:
<table>
<tr><th colspan="2">CURRENT STATE</th><th colspan="3">NEXT STATE</th></tr>
<tr><th>Hook SW.</th><th>HFO</th><th>Input</th><th>HFO</th><th>Dialing</th></tr>
<tr><td>–</td><td>Low</td><td>$\overline{HFI}$ ↓</td><td>High</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>High</td><td>$\overline{HFI}$ ↓</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>$\overline{HFI}$ ↓</td><td>Low</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>–</td><td>Off Hook</td><td>Low</td><td>Yes</td></tr>
<tr><td>Off Hook</td><td>Low</td><td>On Hook</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>On Hook</td><td>High</td><td>Yes</td></tr>
</table>
$\overline{HFI}$ pin is pulled to V_{DD} by internal resistor.
Detailed timing diagrams are shown in Figure 3(a, b, c).</td></tr>
<tr><td>$\overline{LOCK}$</td><td>-</td><td>5
(6, W91320LN only)</td><td>5</td><td>I</td><td>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.
<table>
<tr><th>$\overline{LOCK}$ PIN</th><th>FUNCTION</th></tr>
<tr><td>Floating</td><td>Normal dialing mode</td></tr>
<tr><td>V_{DD}</td><td>"0," "9" dialing inhibited</td></tr>
<tr><td>V_{SS}</td><td>"0" dialing inhibited</td></tr>
</table></td></tr>
</table>

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Keyboard Operation

C1	C2	C3	C4	$\overline{DP}$ / $\overline{C5}$	
1	2	3			R1
4	5	6	F1		R2
7	8	9	F2	H	R3
∗/T	0	#	R/P1	R	R4
R/P2	R	F3	F4		VX

- R/P1, R/P2: Redial and pause function key, P1 is 3.6 sec. and P2 is 2.0 sec.
- ∗/T: ∗ in tone mode and P→T in pulse mode
- F1, …, F4: Flash keys, the flash break time of F1 = 600 mS, F2 = 100 mS, F3 = 300 mS, F4 = 73 mS
- H: Hold function key
- R: One-key redial function

Notes: D1, ..., Dn, D1', ..., Dn': 0, ..., 9, */T, #
R/P: R/P1 or R/P2.
Fn: F1, ..., F4

Normal Dialing

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

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

Redialing

1. OFF HOOK (or ON HOOK & HFI), D1 , D2 , ..., Dn , Busy,

   Come ON HOOK , OFF HOOK (or ON HOOK & HFI), R/P

   a. The redial memory content will be dialed out.

   b. The R/P key can execute the redial function only as the first key-in after off-hook; otherwise, it executes pause function.

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

2. OFF HOOK (or ON HOOK & HFI), D1 , D2 , ..., Dn , Busy, R

   a. The one-key redialing function timing diagram is shown in Figure 4.

   b. If the dialing of D1 to Dn is finished, pressing the R key will cause the pulse output pin to go low for 2.2 seconds break time and 0.6 seconds pause time will automatically be added.

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

   d. The redial function by R key has no break time (2.2 sec.) if it is the first key in after off-hook.

   e. The R key uses the same redial buffer as the redial function by R/P1 or R/P2 key, and it is actived during normal dialing or repertory dialing.

Access Pause

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

1. The pause function is executed in normal dialing, redial dialing, or memory dialing.
2. The pause duration of 2.0 or 3.6 seconds per pause is selected by keypad, but only one pause time can be stored in memory.
3. The detailed timing diagram for the pause function is shown in Figure 5.

Pulse-to-tone (*/T)

OFF HOOK (or ON HOOK & HFI), 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. or 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 when the digits have been dialed out and can be reset to pulse mode only by going on-hook.
4. The pulse-to-tone function timing diagram is shown in Figure 6.

Flash

OFF HOOK (or ON HOOK & HFI), Fn

1. Fn = F1, ..., F4
2. The dialer will execute flash break time of 600 mS (F1), 100 mS (F2), 300 mS (F3), or 73 mS (F4) and all the pause time is 1.0 sec. before the next digit is dialed out.
3. Flash key can not be stored as a digit in memory. The flash key has the first priority among the keyboard functions.
4. The system will return to the initial state after the flash pause time is finished.
5. The flash function timing diagram is shown in Figure 7.

HOLD

OFF HOOK (or ON HOOK & HFI), H

The hold function is switched on and off by a toggle switch. The keypad will be disabled when in hold mode. The function timing diagram is shown in Figure 3(a, b, c).

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}–V_{SS}	-0.3 to +7.0	V
Input/Output Voltage	V_{IL}	V_{SS} –0.3	V
	V_{IH}	V_{DD} +0.3	V
	V_{OL}	V_{SS} –0.3	V
	V_{OH}	V_{DD} + 0.3	V
Power Dissipation	P_D	120	mW
Operation Temperature	T_{OPR}	-20 to +70	°C
Storage Temperature	T_{STG}	-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.

DC CHARACTERISTICS

(V_{DD}-V_{SS} = 2.5V, $F_{OSC.}$ = 3.579545 MHz, T_A = 25° C, All outputs unloaded)

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V_{DD}	-	2.0	-	5.5	V
Operating Current	I_{OP}	Tone, Unloaded	-	0.4	0.6	mA
		Pulse, Unloaded	-	0.2	0.4	
Standby Current	I_{SB}	$\overline{HKS}$ = V_{SS}, No load & No key entry	-	-	15	µA
Memory Retention Current	I_{MR}	$\overline{HKS}$ = V_{DD}, V_{DD} = 1.0V	-	-	0.2	µA
DTMF Output Voltage	V_{TO}	Row group, R_L = 5 KΩ	130	150	170	mVrms
Pre-emphasis		Col/Row, V_{DD} = 2.0 to 5.5V	1	2	3	dB
DTMF Distortion	THD	R_L = 5 KΩ, V_{DD} = 2.0 to 5.5V	-	-30	-23	dB
DTMF Output DC Level	V_{TDC}	R_L = 5 KΩ, V_{DD} = 2.0 to 5.5V	1.0	-	3.0	V
DTMF Output Sink Current	I_{TL}	V_{TO} = 0.5V	0.2	-	-	mA
$\overline{DP}$ Output Sink Current	I_{PL}	V_{PO} = 0.5V	0.5	-	-	mA
T/P $\overline{MUTE}$ Output Sink Current	I_{TML}	V_{TMO} = 0.5V	0.5	-	-	mA
H/P MUTE Output Drive/Sink Current	I_{HPH}	V_{HPL} = 2.0V	0.5	-	-	mA
	I_{HPL}	V_{HPL} = 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
Keypad Input Drive Current	I_{KD}	V_I = 0.0V	30	-	-	µA
Keypad Input Sink Current	I_{KS}	V_I = 2.5V	200	400	-	µA
$\overline{HKS}$ I/P Pull-High Resistor	R_{HK}	-	-	300	-	KΩ
Keypad Resistance	R_K	-	-	-	5	KΩ

AC CHARACTERISTICS

(V_{DD}–V_{SS} = 2.5V, $F_{OSC.}$ = 3.579545 MHz, T_A = 25° C, All outputs unloaded)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Key-in Debounce	T_{KID}	-	-	20	-	mS
Key Release Debounce	T_{KRD}	-	-	20	-	mS
Off-hook Delay	T_{OFD}	Lock only	-	300	-	mS
First Key-in Delay	T_{FKD}	Lock only	-	300	-	mS
Pre-digit-pause1	T_{PDP1}	Mode = V_{DD}	-	40	-	mS
	10 ppS	Mode = Floating	-	33.3	-	
Pre-digit-pause2	T_{PDP2}	Mode = V_{DD}	-	20	-	mS
	20 ppS	Mode = Floating	-	16.7	-	
Interdigit Pause	T_{IDP}	10 ppS	-	800	-	mS
(Auto Dialing)		20 ppS	-	500	-	
Make/Break Ratio	M:B	Mode = V_{DD}	-	40:60	-	%
		Mode = Floating	-	33.3:66.7	-	
Tone Output Duration	T_{TD}	Auto dialing	-	93	-	mS
Intertone Pause	T_{ITP}	Auto dialing	-	93	-	mS
Flash Break Time	T_{FB}	F1	-	600	-	mS
		F2	-	100	-	
		F3		300		
		F4	-	73	-	
Flash Pause Time	T_{FP}	F1, F2, F3, F4	-	1.0	-	S
Pause Time	T_P	R/P1	-	3.6	-	S
		R/P2	-	2.0	-	
One-key Redial Break Time	T_{RB}	-	-	2.2	-	S
One-key Redial Pause Time	T_{RP}	-	-	600	-	mS

Notes:

1. Crystal parameters suggested for proper operation are Rs < 100 Ω, Lm = 96 mH, Cm = 0.02 pF, Cn = 5 pF, Cl = 18 pF, $F_{OSC.}$ = 3.579545 MHz ±0.02%.
2. Crystal oscillator accuracy directly affects these times.

TIMING WAVEFORMS

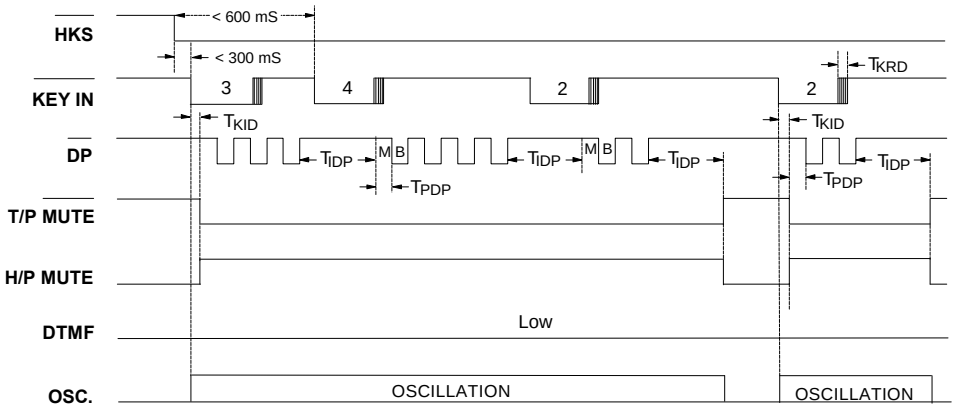


Figure 1a. Normal Dialing Timing Diagram (Pulse Mode Without Lock Function)

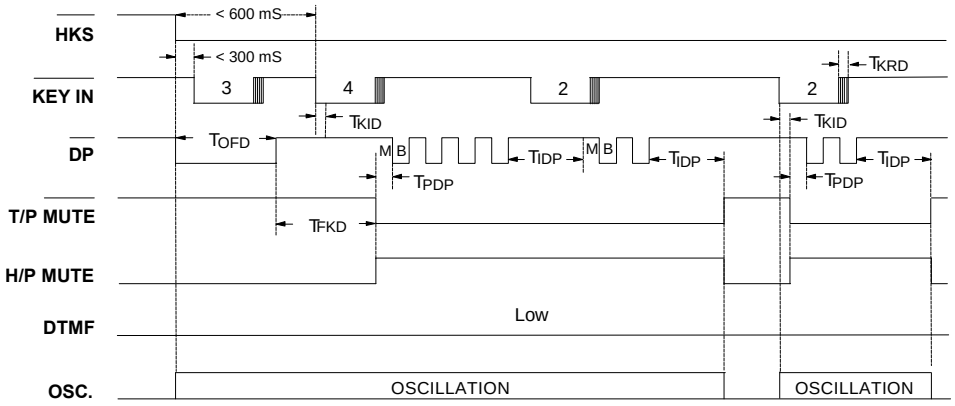


Figure 1b. Normal Dialing Timing Diagram (Pulse Mode with Lock Function)

Timing Waveforms, continued

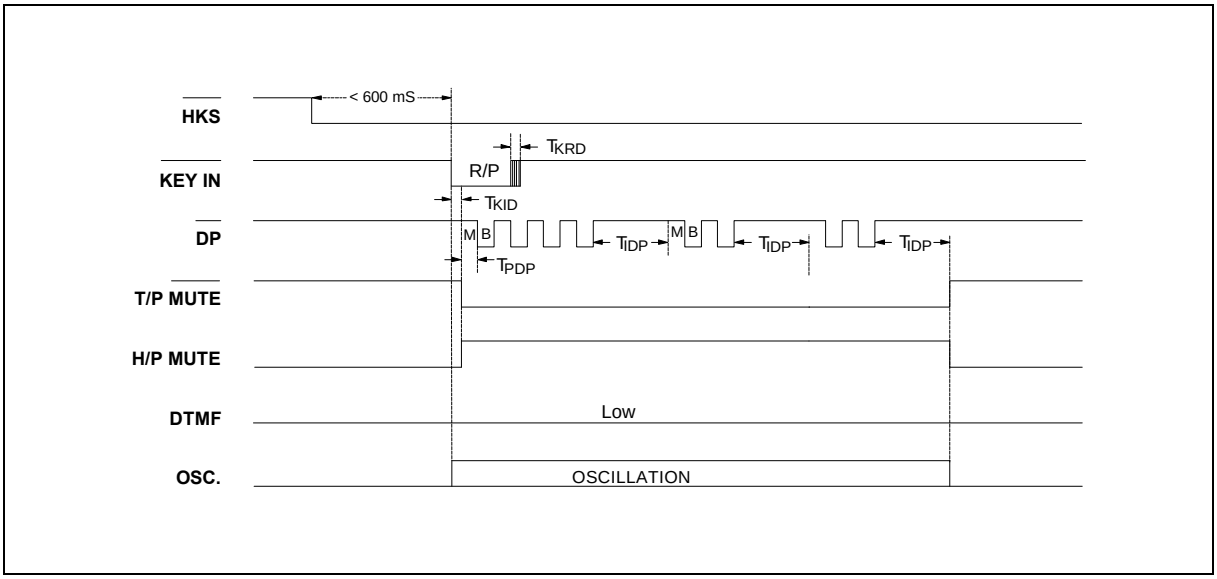


Figure 1c. Auto Dialing Timing Diagram (Pulse Mode Without Lock Function)

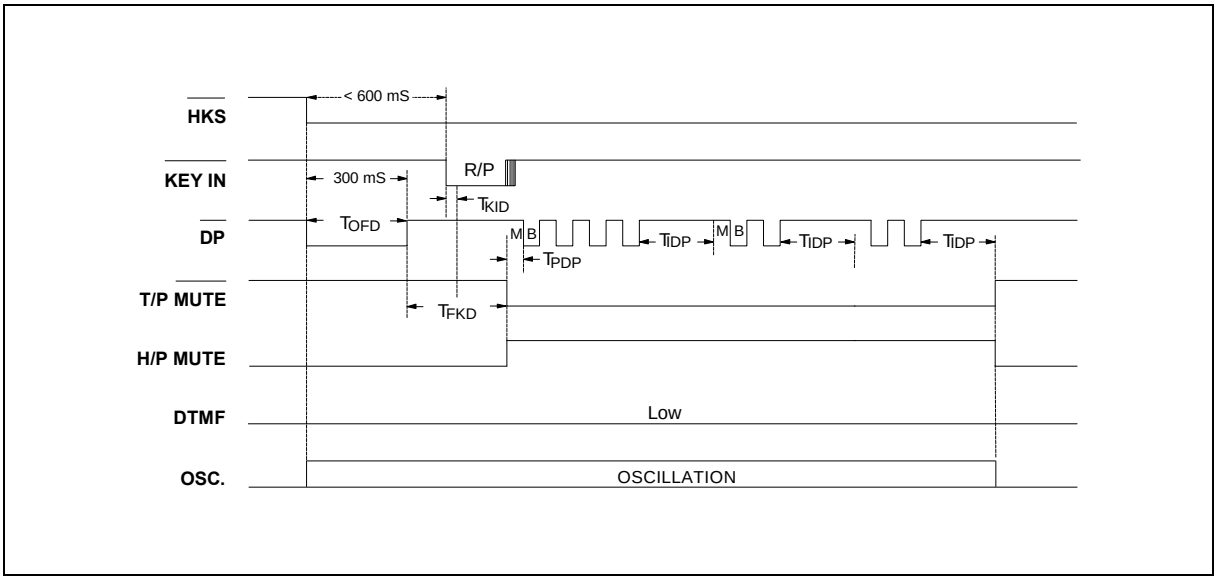


Figure 1d. Auto Dialing Timing Diagram (Pulse Mode with Lock Function)

Timing Waveforms, continued

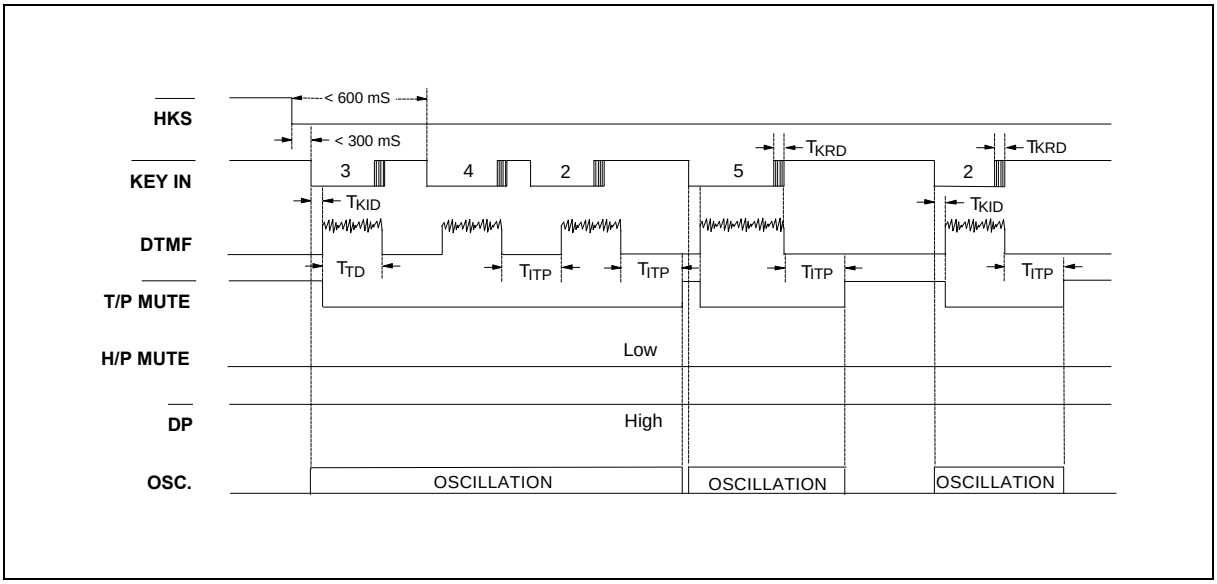


Figure 2a. Normal Dialing Timing Diagram (Tone Mode Without Lock Function)

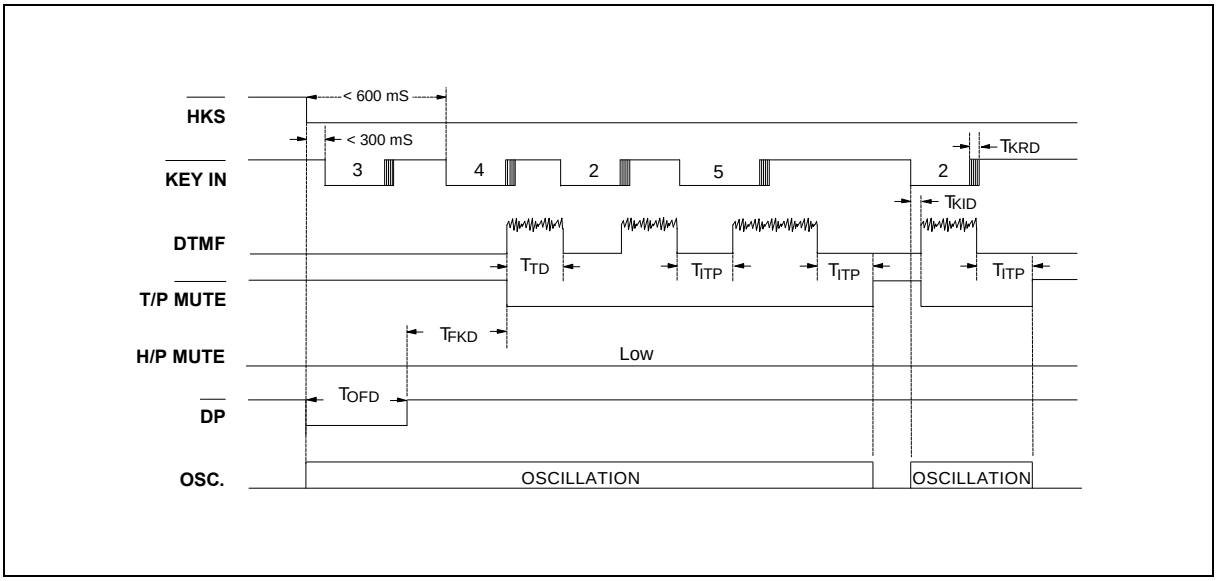


Figure 2b. Normal Dialing Timing Diagram (Tone Mode with Lock Function)

Timing Waveforms, continued

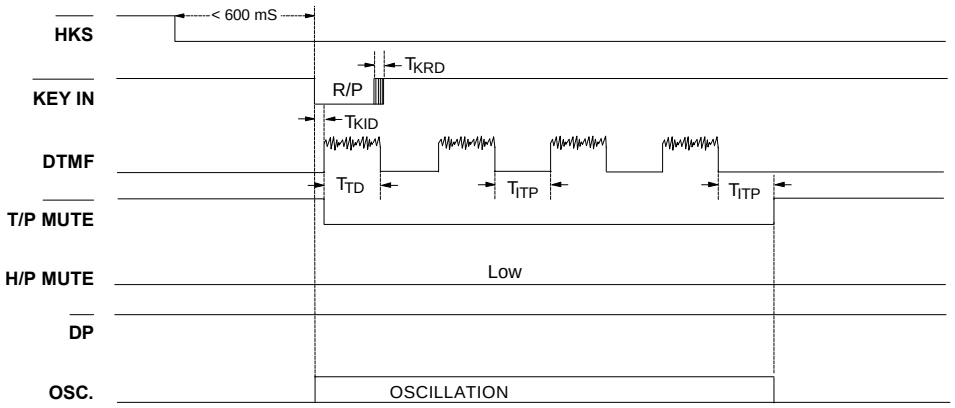


Figure 2c. Auto Dialing Timing Diagram (Tone Mode Without Lock Function)

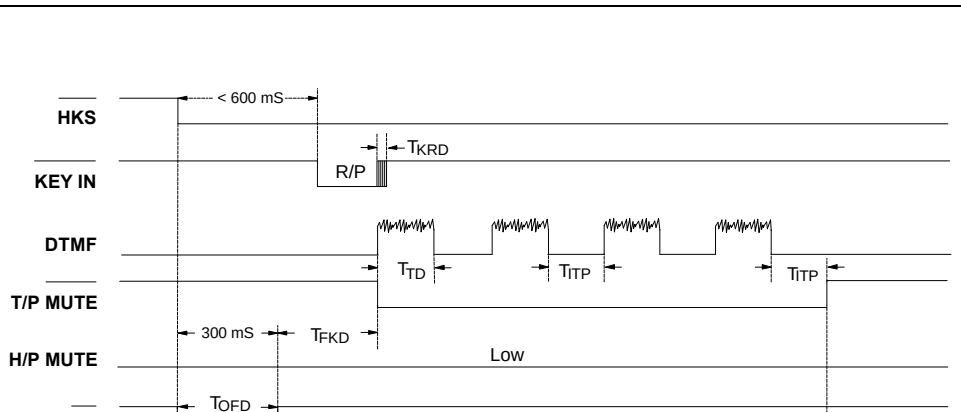


Figure 2d. Auto Dialing Timing Diagram (Tone Mode with Lock Function)

Timing Waveforms, continued

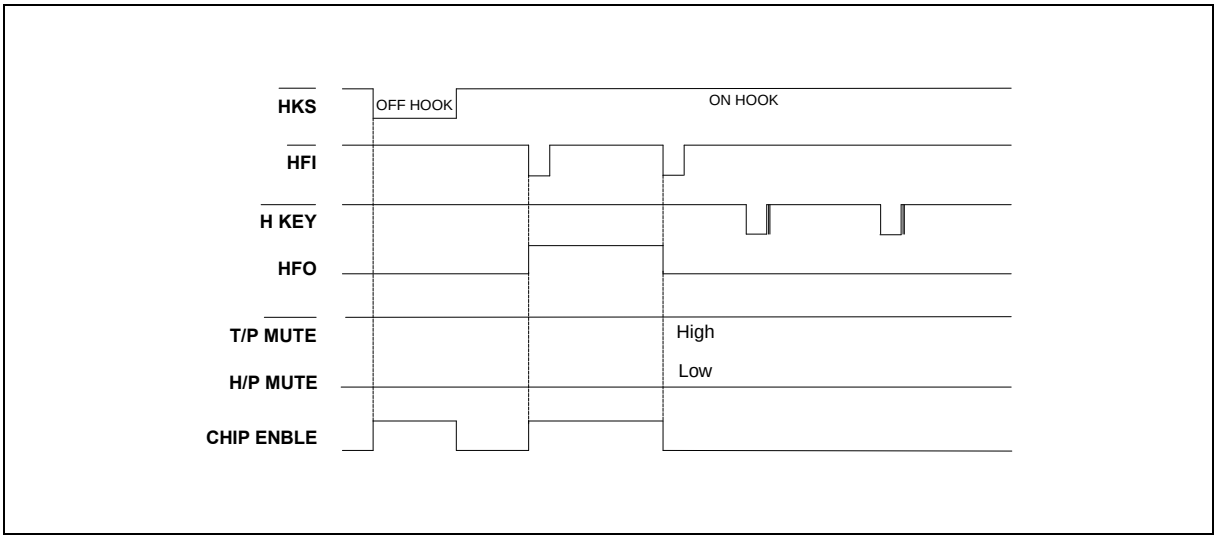


Figure 3a. Handfree and Hold Timing Diagram

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

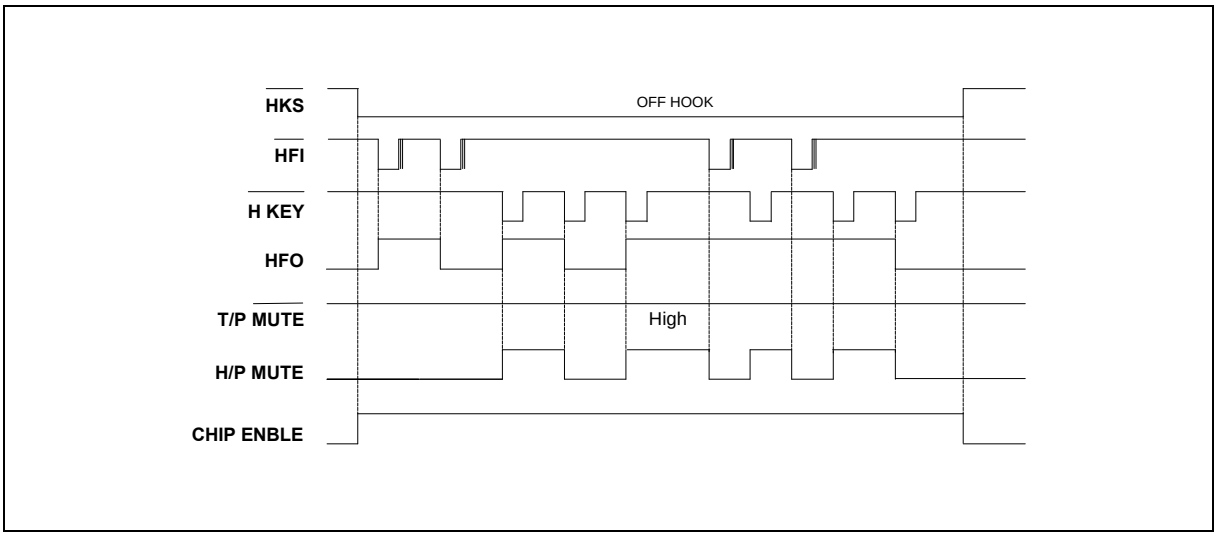


Figure 3b. Handfree and Hold Timing Diagram

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

Timing Waveforms, continued

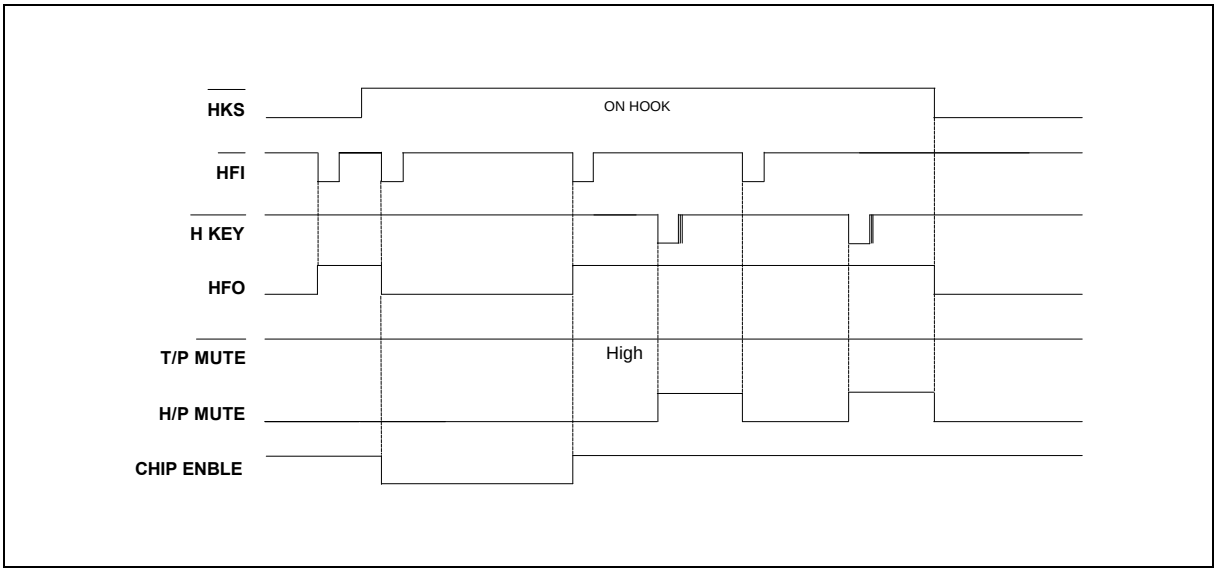


Figure 3c. Handfree and Hold Timing Diagram

Note: Changing the state of the $\overline{\text{HKS}}$ signal from high to low will initialize the HFO and H/P MUTE signals.

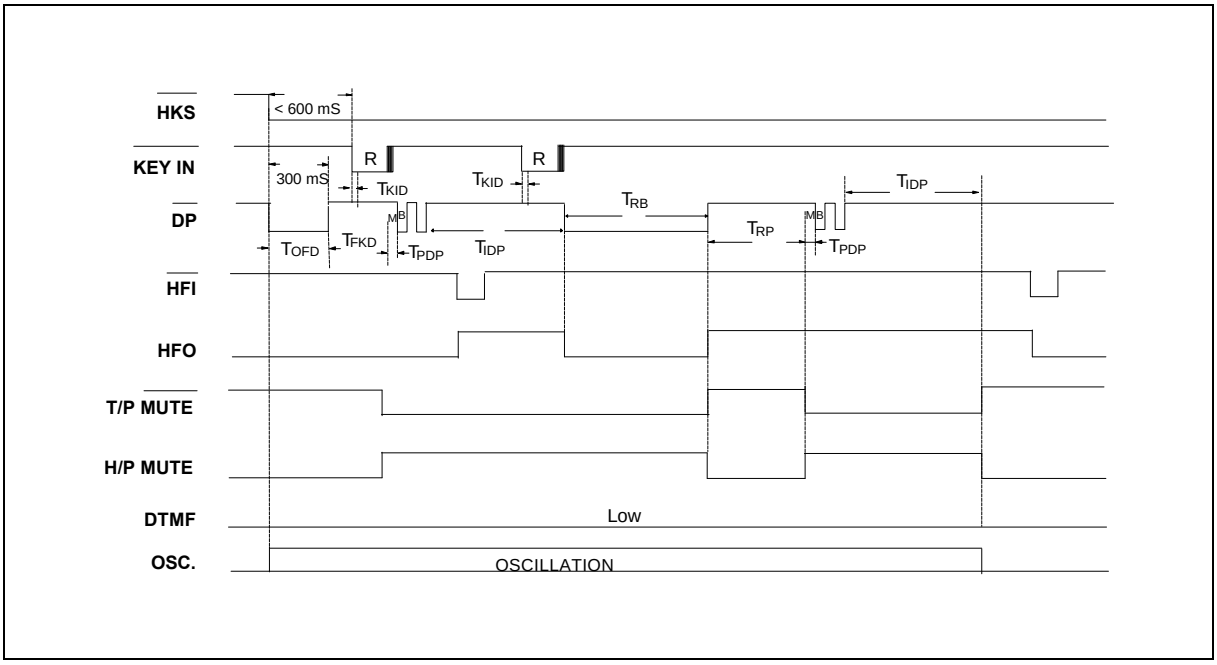


Figure 4. One-key Redial Timing Diagram (Pulse Mode)

Timing Waveforms, continued

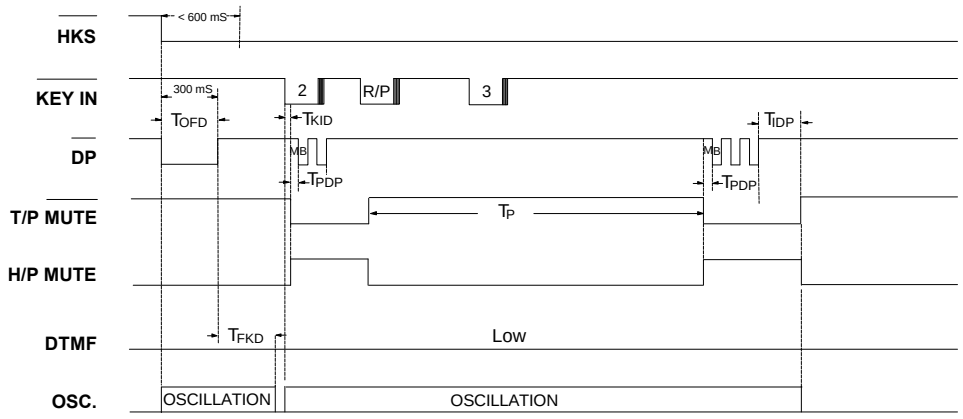


Figure 5. Pause Function Timing Diagram

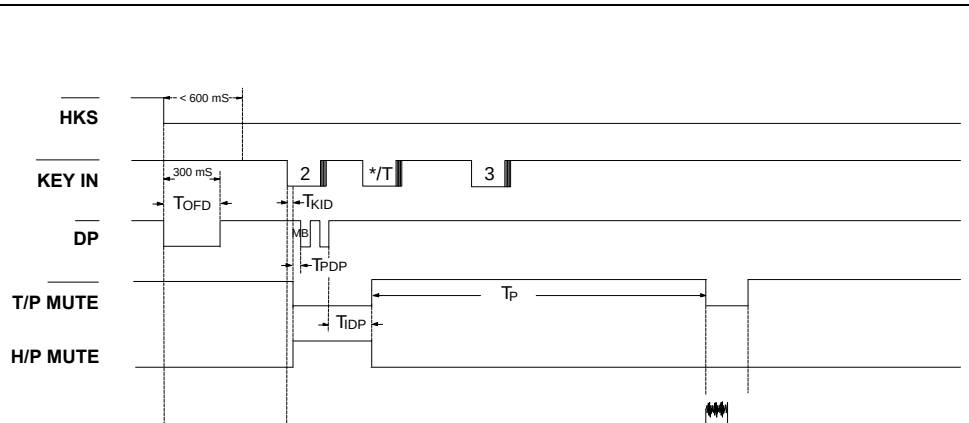


Figure 6. Pulse-to-tone Timing Diagram

Timing Waveforms, continued

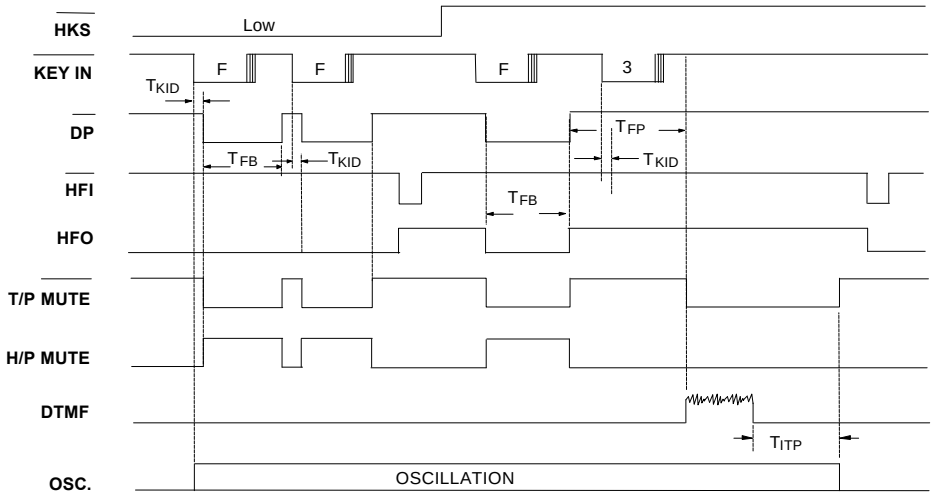


Figure 7. Flash Timing Diagram

Winbond Electronics Corp.

Headquarters
No. 4, Creation Rd. III,
Science-Based Industrial Park,
Hsinchu, Taiwan
TEL: 886-3-5770066
FAX: 886-3-5792697
http://www.winbond.com.tw/
Voice & Fax-on-demand: 886-2-7197006

Taipei Office
11F, No. 115, Sec. 3, Min-Sheng East Rd.,
Taipei, Taiwan
TEL: 886-2-7190505
FAX: 886-2-7197502

Winbond Electronics (H.K.) Ltd.
Rm. 803, World Trade Square, Tower II,
123 Hoi Bun Rd., Kwun Tong,
Kowloon, Hong Kong
TEL: 852-27516023
FAX: 852-27552064

Winbond Electronics North America Corp.
Winbond Memory Lab.
Winbond Microelectronics Corp.
Winbond Systems Lab.
2730 Orchard Parkway, San Jose,
CA 95134, U.S.A.
TEL: 1-408-9436666
FAX: 1-408-9436668