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Electronics Corp.

13-MEMORY TONE/PULSE DIALER WITH SAVE, KEYTONE, LOCK, AND HANDFREE FUNCTIONS

GENERAL DESCRIPTION

The W91530N series are tone/pulse switchable telephone dialers with 13 memories, keytone or lock, and handfree dialing control. These chips are fabricated using Winbond's high-performance CMOS technology and thus offer good performance in low-voltage, low-power operations.
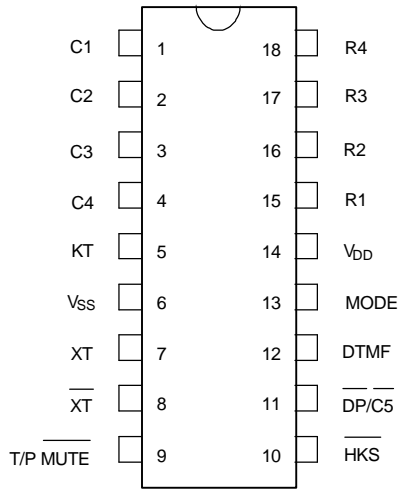
FEATURES

- DTMF/pulse switchable dialer
- Two by 32 digits redial and save memory
- Three by 16 digits one-touch direct repertory memory
- Ten by 16 digits two-touch indirect repertory memory
- Pulse-to-tone (*/T) keypad for long distance call operation
- Cascaded 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
- 0 or 9 dialing inhibition pin for PABX system or long distance dialing lock out
- Dialing rate (10 ppS or 20 ppS) selectable by bonding option
- Minimum tone output duration: 93 mS (W91534AN: 87 mS)
- Minimum intertone pause: 93 mS (W91534AN: 87 mS)
- Pause time: 3.6 sec.
- 300 mS off-hook delay in lock mode ($\overline{DP}$ remains low for 300 mS while off hook)
- Flash break time (73 mS, 100 mS, 300 mS, or 600 mS) selectable by keypad; pause time is 1.0 mS
- Make/break ratio (2:3 or 1:2) selectable by MODE pin
- Key tone output for valid keypad entry recognition
- On-chip power-on reset
- Uses 3.579545 MHz crystal or ceramic resonator
- 18 or 20-pin dual-in-line plastic package
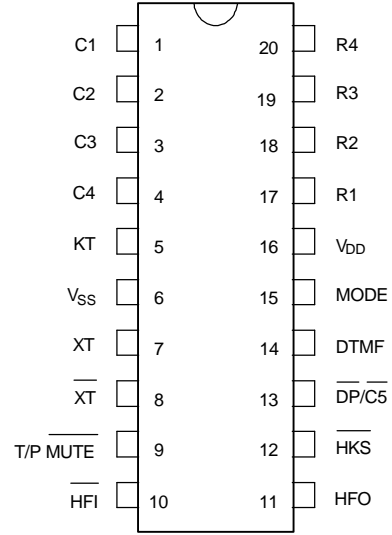- The different dialers in the W91530N series are shown in the following table:

TYPE NO.	REPLACEMENT TYPE NO.	PULSE (ppS)	FLASH (mS)	M/B	KEY TONE	HANDFREE DIALING	LOCK	PACKAGE (PINS)
W91530N	W91530	10	600/300/73/100	Pin	Yes	-	-	18
	W91531							
W91530AN	W91530A	10	600/300/73/100	Pin	Yes	Yes	-	20
	W91531A							
W91531LN	W91531L	10	600/300/73/100	Pin	-	-	Yes	18
W91531ALN	W91531AL	10	600/300/73/100	Pin	-	Yes	Yes	20
W91532N	W91532	20	600/300/73/100	Pin	Yes	-	-	18
W91532AN	W91532A	20	600/300/73/100	Pin	Yes	Yes	-	20
W91534AN	New type	10	600/300/73/100	Pin	Yes	Yes	-	20

Note: The W91534AN is for use in France only. In this version, the pause time is not be added in pulse-to-tone function mode.
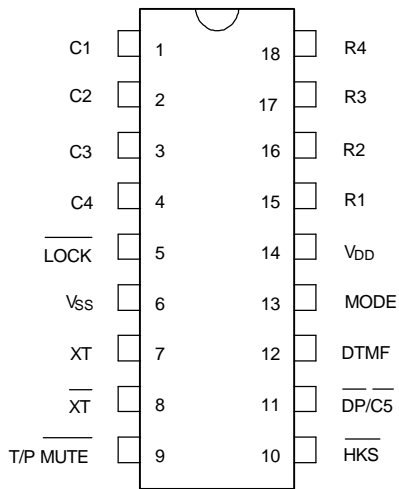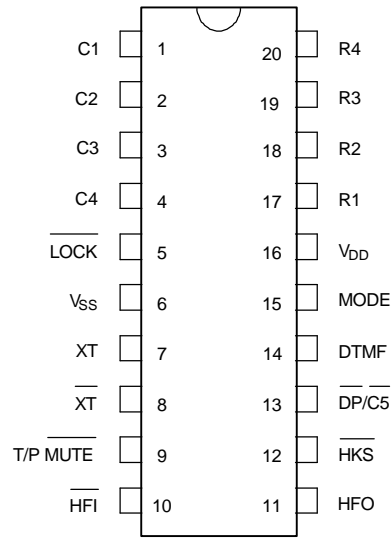
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PIN CONFIGURATIONS

	W91530N		
C1	1	18	R4
C2	2	17	R3
C3	3	16	R2
C4	4	15	R1
KT	5	14	V_{DD}
V_{SS}	6	13	MODE
XT	7	12	DTMF
$\overline{XT}$	8	11	$\overline{DP}/C5$
$\overline{T/P\ MUTE}$	9	10	$\overline{HKS}$

W91530N

	W91530AN/532AN/534AN		
C1	1	20	R4
C2	2	19	R3
C3	3	18	R2
C4	4	17	R1
KT	5	16	V_{DD}
V_{SS}	6	15	MODE
XT	7	14	DTMF
$\overline{XT}$	8	13	$\overline{DP}/C5$
$\overline{T/P\ MUTE}$	9	12	$\overline{HKS}$
HFI	10	11	HFO

W91530AN/532AN/534AN

	W91531LN		
C1	1	18	R4
C2	2	17	R3
C3	3	16	R2
C4	4	15	R1
$\overline{LOCK}$	5	14	V_{DD}
V_{SS}	6	13	MODE
XT	7	12	DTMF
$\overline{XT}$	8	11	$\overline{DP}/C5$
$\overline{T/P\ MUTE}$	9	10	$\overline{HKS}$

W91531LN

	W91531ALN		
C1	1	20	R4
C2	2	19	R3
C3	3	18	R2
C4	4	17	R1
$\overline{LOCK}$	5	16	V_{DD}
V_{SS}	6	15	MODE
XT	7	14	DTMF
$\overline{XT}$	8	13	$\overline{DP}/C5$
$\overline{T/P\ MUTE}$	9	12	$\overline{HKS}$
HFI	10	11	HFO

W91531ALN

PIN DESCRIPTION

SYMBOL	18-PIN	20-PIN	I/O	FUNCTION
Column-Row Inputs	1–4 & 15–18	1–4 & 17–20	I	The keyboard input is compatible with a standard 5 x 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 single tone.
XT	7	7	I	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal. The oscillator ceases when a keypad input is not sensed. The crystal frequency deviation is 0.02%.
$\overline{XT}$	8	8	O	Crystal oscillator output pin.
T/P $\overline{MUTE}$	9	9	O	The T/P $\overline{MUTE}$ is a conventional CMOS N-channel open drain output. The output transistor is switched on low level during dialing sequence (both pulse and tone mode). Otherwise, it is switched off.
MODE	13	15	I	Pulling mode pin to V_{SS} places dialer in tone mode. Pulling mode pin to V_{DD} places dialer in pulse mode (10 ppS) with M/B ratio of 40:60 (W91532/532AN is 20 ppS). Leaving mode pin floating places dialer in pulse mode (10 ppS) with M/B ratio of 33.3:66.7 (W91532/532AN is 20 ppS).
$\overline{HKS}$	10	12	I	The $\overline{HKS}$ (hook switch) input is used to sense whether the handset is on-hook or off-hook. In on-hook state, $\overline{HKS}$ = 1: chip is in sleeping mode, no operation. In off-hook state, $\overline{HKS}$ = 0: chip is enabled for normal operation. $\overline{HKS}$ pin is pulled to V_{DD} by internal resistor.
KT	5 (except W91531LN)	5 (except W91531ALN)	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.

Pin Description, continued

SYMBOL	18-PIN	20-PIN	I/O	FUNCTION
$\overline{\text{LOCK}}$	5 (only for W91531LN)	5 (only for W91531ALN)	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:
$\overline{\text{DP}}/\overline{\text{C5}}$	11	13	O	N-channel open drain dialing pulse output. Flash key will cause $\overline{\text{DP}}$ to be active in either tone mode or pulse mode. In lock mode, the $\overline{\text{DP}}$ remains low for 300 mS during off-hook delay time. The timing diagram for pulse mode is shown in Figure 1(a, b, c, d).
DTMF	12	14	O	During pulse dialing, this pin remains in low state regardless of 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, c, d).
V_{DD}, V_{SS}	14, 6	16, 6	I	Power input pins for the dialer chip. V_{DD} is the main power and V_{SS} is the ground.

$\overline{\text{LOCK}}$ PIN	FUNCTION
V_{DD}	"0", "9" dialing inhibited
Floating	Normal dialing mode
V_{SS}	"0" dialing inhibited

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

SYMBOL	18-PIN	20-PIN	I/O	FUNCTION
$\overline{\text{HFI}}$, HFO	-	10, 11	I, O	Handfree control pins. A low pulse on the $\overline{\text{HFI}}$ input pin toggles the handfree control state. Status of the handfree control state is listed in the following table:

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

$\overline{\text{HFI}}$ pin is pulled to V_{DD} by an internal resistor.

Detailed timing diagram is shown in Figure 3.

BLOCK DIAGRAM

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FUNCTIONAL DESCRIPTION

Keyboard Operation

C1	C2	C3	C4	$\overline{DP}/\overline{C5}$	
1	2	3	S	M1	R1
4	5	6	F4	M2	R2
7	8	9	A	M3	R3
*/T	0	#	R/P	SAVE	R4
F1	F2	F3			Vx

- S: Store function key

- A: Indirect repertory memory dialing 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

- M1, ..., M3: One-touch memory

- F1, ..., F4: Flash function keys: F1 = 600 mS, F2 = 300 mS, F3 = 73 mS, F4 = 100 mS, and all flash   pause time is 1.0 mS

Note: Mn = M1, ..., M3; Ln = 0, ..., 9, */T, #, Pause.

Normal Dialing

OFF HOOK (or ON HOOK & HFI ïõ), 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

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

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

or ON HOOK & HFI ïõ , D1 , D2 , ..., Dn , BUSY, HFI ïõ , Come

1. The redial memory content will be D1, D2, ..., Dn.

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

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Number Store

| OFF HOOK | (or | ON HOOK | & | $\overline{\text{HFI}}$ ¡õ̲ |), | D1 | , | D2 | , ..., | Dn | , | S | , | S |

, | Mn | (or | Ln |)

1. If the sequence of the dialed digits D1, D2, ..., Dn has not | S | will be ignored.
finished,

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

| OFF HOOK | (or | ON HOOK | & | $\overline{\text{HFI}}$ ¡õ̲ |), | S | , | D1 | , | D2 | , ..., | Dn | , | S |

, | Mn | (or | Ln |)

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

4. | R/P | and | */T | keys can be stored as a digit in memory, but | R/P | key cannot be the first

   digit. In store | R/P | is the pause function key.
   mode,

5. 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 | & | $\overline{\text{HFI}}$ ¡õ̲ |), | D1 | , | D2 | , ..., | Dn | , | SAVE |

1. D1, D2, ..., Dn will be dialed out.

2. If the dialing | D1 | to | Dn | is finished, pressing | SAVE | will cause D1 to Dn to be
of

   duplicated to save memory.

| ON HOOK | , | OFF HOOK | (or | $\overline{\text{HFI}}$ ¡õ̲ |), | SAVE |

3. D1 to Dn will be dialed out | SAVE | key is pressed.
   after

Repertory Dialing Procedure

| OFF HOOK | (or | ON HOOK | & | $\overline{\text{HFI}}$ ¡õ̲ |), | Mn | (or | SAVE |)

1. The content of memory location Mn (or save) will be dialed out.

| OFF HOOK | (or | ON HOOK | & | $\overline{\text{HFI}}$ ¡õ̲ |), | A | , | Ln |

2. The content of memory location Ln will be dialed out.

Access Pause

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

1. The pause function can be stored as a digit in memory.

2. The pause function is executed in normal dialing or redialing or memory dialing.

3. The pause function timing diagram is shown in Figure 4.

Pulse-to-tone (*/T)

| OFF HOOK | (or | ON HOOK | & | HFI ǐõ |), | 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, D1', D2', ..., Dn'
    (Pulse)   (Tone)

  In the case of the W91534AN, the output signal will be:

    D1, D2, ..., Dn, *, 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 function timing diagram is shown in Figure 5.

Flash

| OFF HOOK | (or | ON HOOK | & | HFI ǐõ |), | Fn |

1. Fn = F1, ..., F4.

2. If | Fn | is pressed, the dialer will execute a flash break time of 600 mS (F1), 300 mS (F2),

  73 mS (F3), or 100 mS (F4). The pause time is 1.0 second.

3. Flash key cannot be stored as a digit in memory. The flash key has first priority among 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 6.

Cascaded Dialing

| OFF HOOK | (or | ON HOOK | & | HFI ǐõ |),

1. | Normal dialing | + | Repertory dialing | + | Normal dialing |
    (1st sequence)   (2nd sequence)

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2. | Repertory dialing | + | Normal dialing | + | Repertory dialing |
    (1st sequence)   (2nd sequence)

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

- Redialing and save dialing is valid only for the first key-in.

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
Operating 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, Fosc. = 3.58 MHz, T_A = 25° C, all outputs unloaded)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V_{DD}	-	2.0	-	5.5	V
Operating Current	I_{OP}	Tone	-	0.4	0.6	mA
		Pulse	-	0.2	0.4	mA
Standby Current	I_{SB}	$\overline{HKS}$ = 0, No load & No key entry	-	-	15	μA
Memory Retention Current	I_{MR}	$\overline{HKS}$ = 1, V_{DD} = 1.0V	-	-	0.2	μA
Tone 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	T_{HD}	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

DC Characteristics, continued

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
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_{ML}	$V_{MO} = 0.5V$	0.5	-	-	mA
KT Drive/Sink	I_{KTH}	$V_{KTH} = 2.0V$	0.5	-	-	mA
Current	I_{KTL}	$V_{KTL} = 0.5V$	0.5	-	-	mA
HFO Drive/Sink	I_{HFH}	$V_{HFH} = 2.0V$	0.5	-	-	mA
Current	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
Keypad Input Sink Current	I_{KS}	$V_I = 2.5V$	200	400	-	µA
Keypad Resistance		-	-	-	5.0	KΩ

AC CHARACTERISTICS

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Key-in Debounce	T_{KID}	-	-	20	-	mS
Key Release Debounce	T_{KRD}	-	-	20	-	mS
On-hook Debounce	T_{OHD}	Lock Mode	-	20	-	mS
		Unlock Mode	-	150	-	mS
Pre-digit Pause[1]	T_{PDP1}	Mode Pin = V_{DD}	-	40	-	mS
	10 ppS	Mode Pin = Floating	-	33.3	-	mS
Pre-digit Pause[2]	T_{PDP2}	Mode Pin = V_{DD}	-	20	-	mS
	20 ppS	Mode Pin = Floating	-	16.7	-	mS
Interdigit Pause	T_{IDP}	10 ppS	-	800	-	mS
(Auto dialing)		20 ppS	-	500	-	mS
Make/Break Ratio	M:B	Mode Pin = V_{DD}	-	40:60	-	%
		Mode Pin = Floating	-	33.3:66.7	-	%

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AC Characteristics, continued

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Tone Output Duration	T$_{TD}$	Except for W91534AN	-	93	-	mS
Intertone Pause	T$_{ITP}$	Except for W91534AN	-	93	-	mS
Tone Output Duration	T$_{TD}$	W91534AN Only	-	87	-	mS
Intertone Pause	T$_{ITP}$	W91534AN Only	-	87	-	mS
Flash Break Time	T$_{FB}$	F1	-	600	-	mS
		F2	-	300	-	
		F3	-	73	-	
		F4	-	100	-	
Flash Pause Time	T$_{FP}$		-	1.0	-	S
Pause Time	T$_P$		-	3.6	-	S
Key Tone Frequency	F$_{KT}$		-	1.2	-	KHz
Key Tone Duration	T$_{KTD}$		-	35	-	mS
One-key Redialing Pause Time	T$_{RP}$		-	600	-	mS
One-key Redialing Break Time	T$_{RB}$		-	2.2	-	S
Off-hook Delay	T$_{OFD}$	Lock Only	-	300	-	mS
First Key-in Delay	T$_{FKP}$	Lock Only	-	300	-	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, Fosc. = 3.579545 MHz ±0.02%.

2. Crystal oscillator accuracy directly affects these times.

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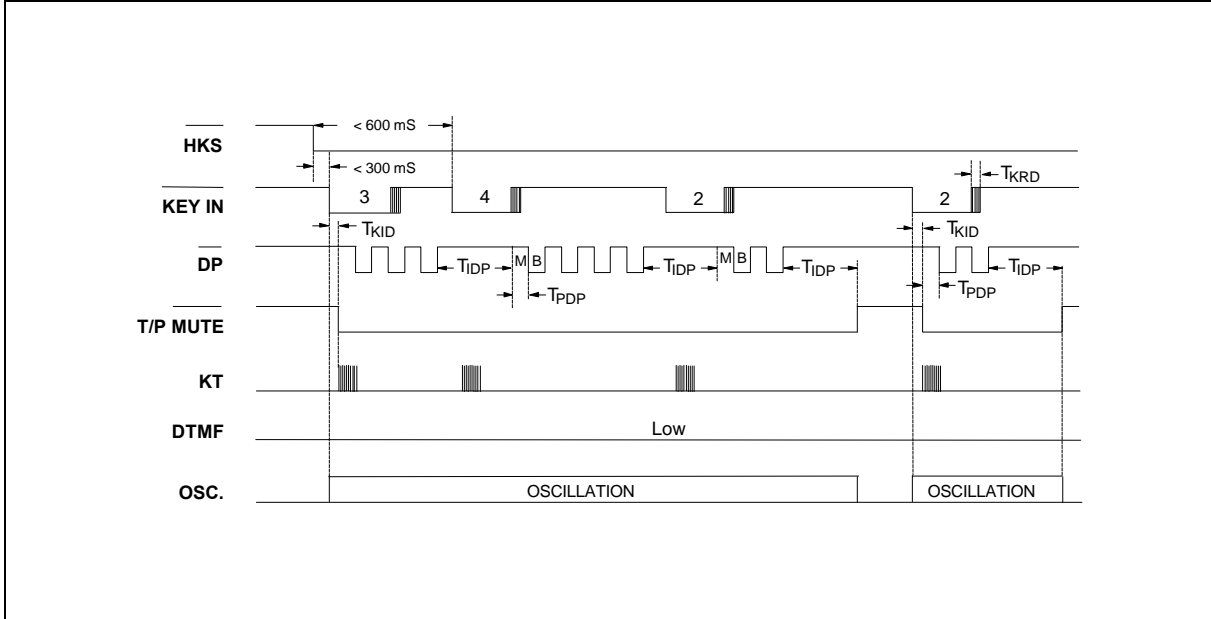
TIMING WAVEFORMS

Figure 1(a). Normal Dialing Timing Diagram (Pulse Mode Without Lock Function)
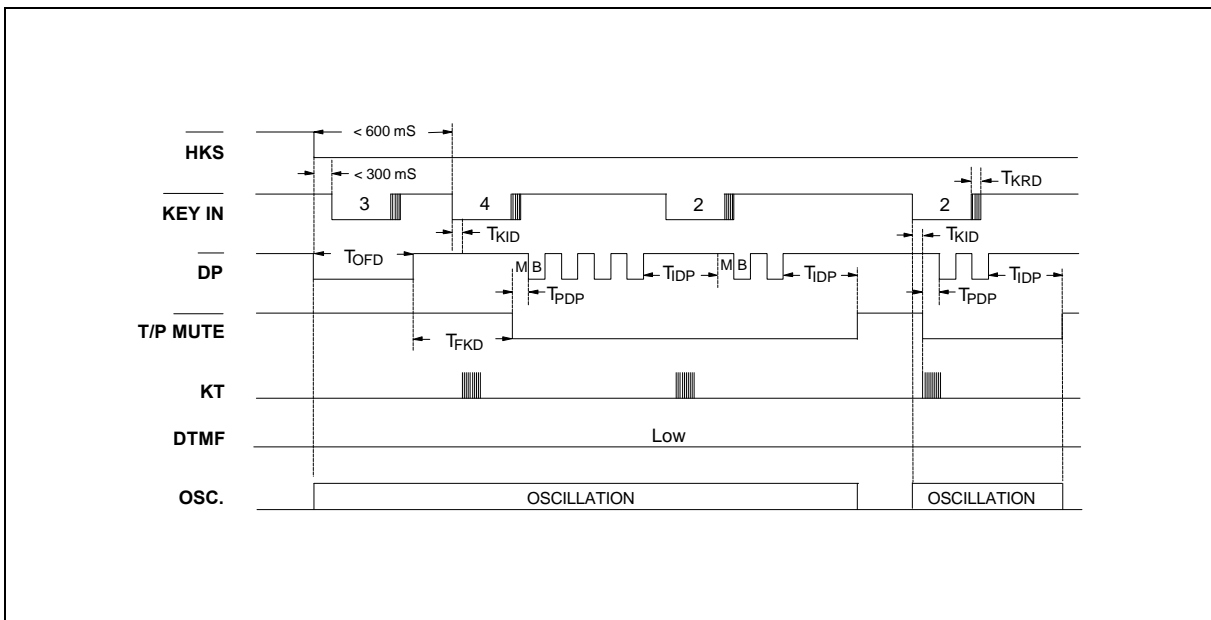
Figure 1(b). Normal Dialing Timing Diagram (Pulse Mode with Lock Function)
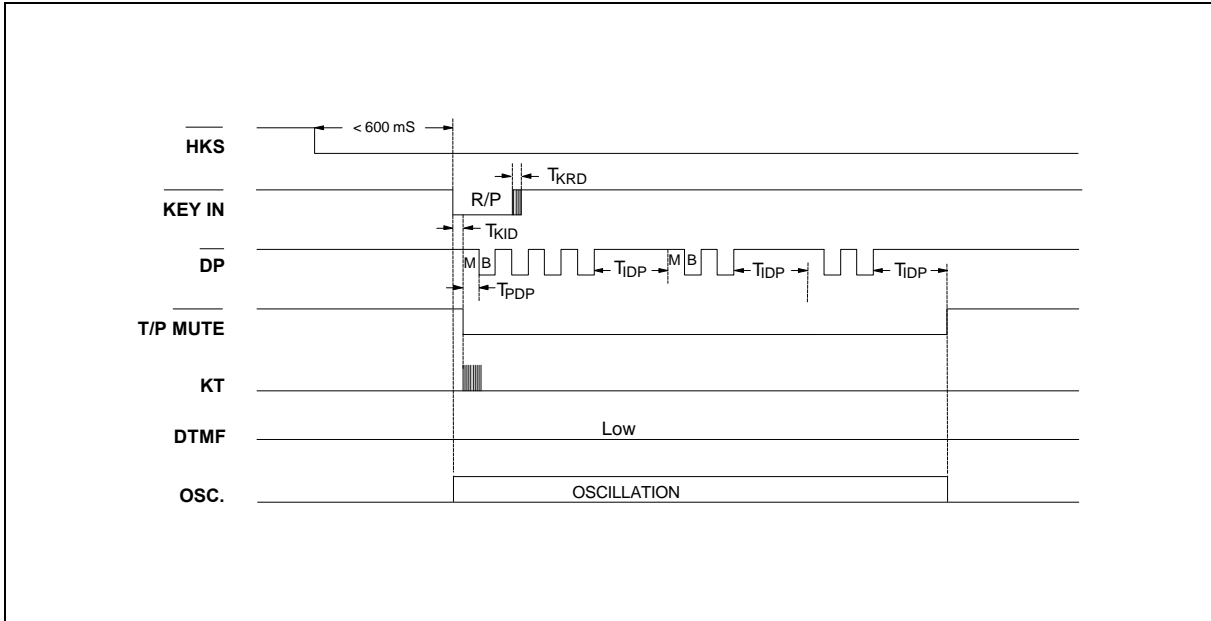
Timing Waveforms, continued

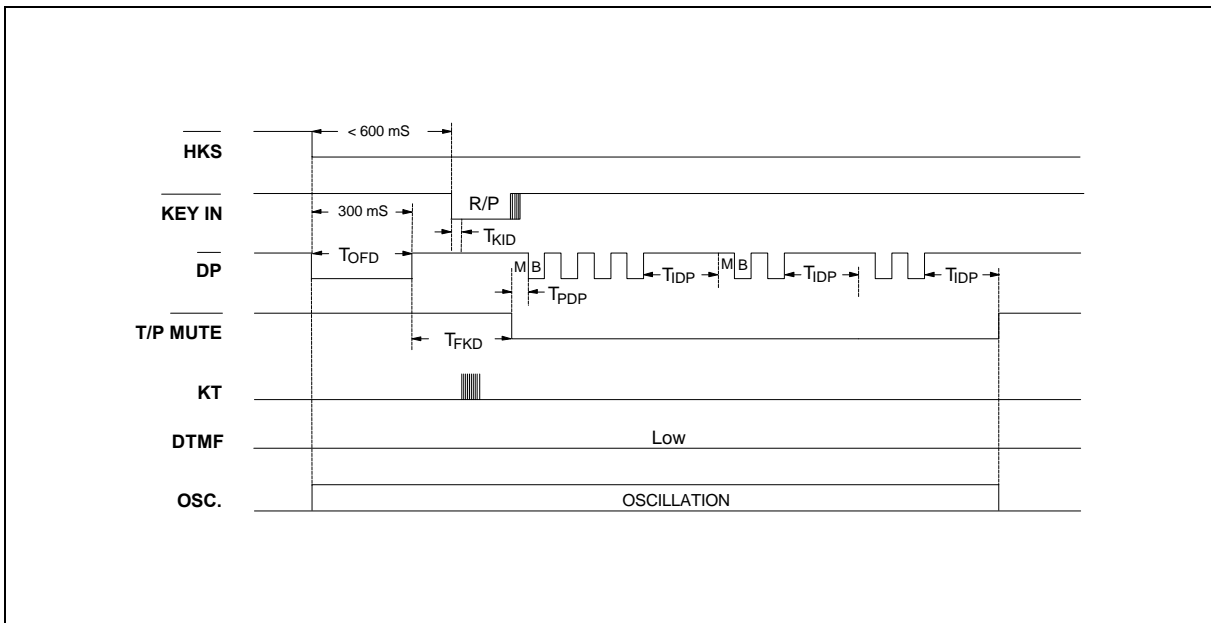Figure 1(c). Auto Dialing Timing Diagram (Pulse Mode Without Lock Function)

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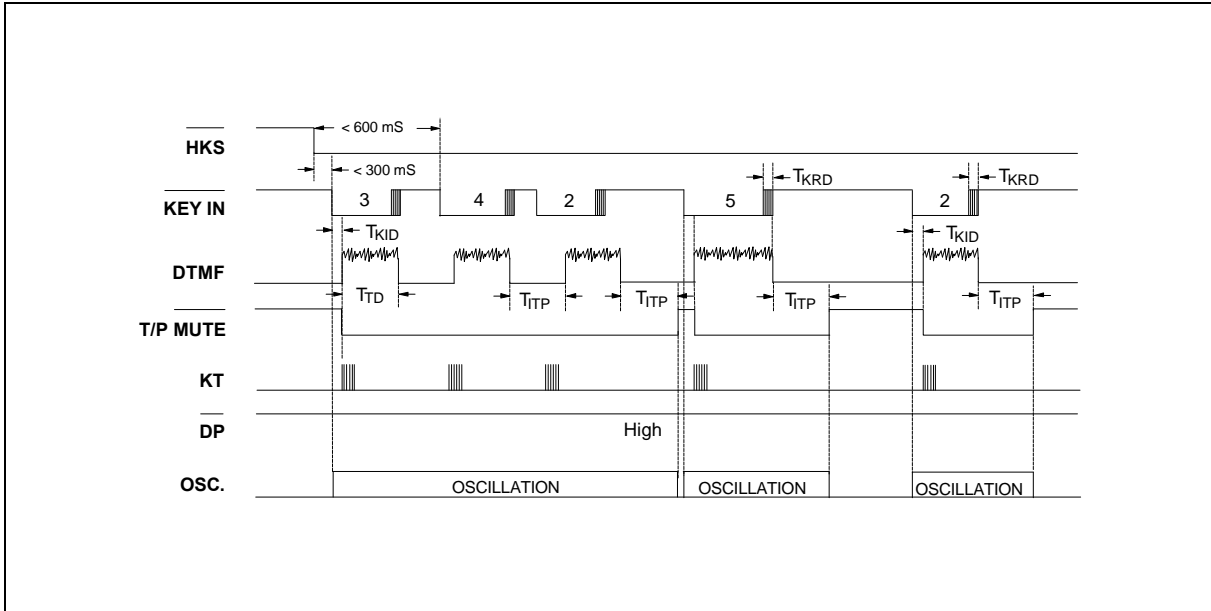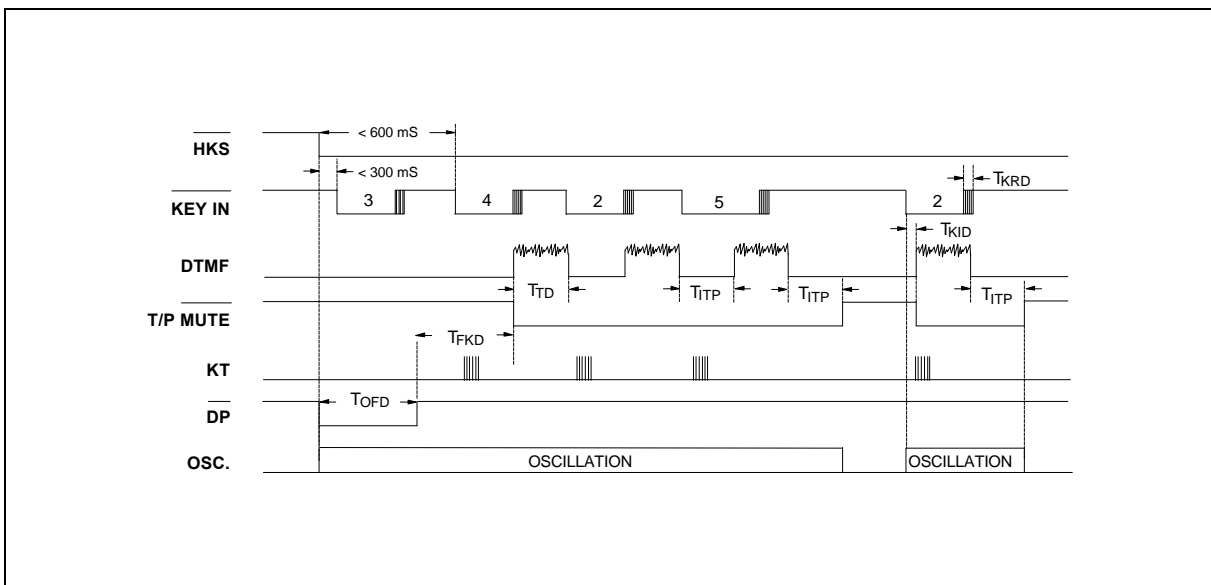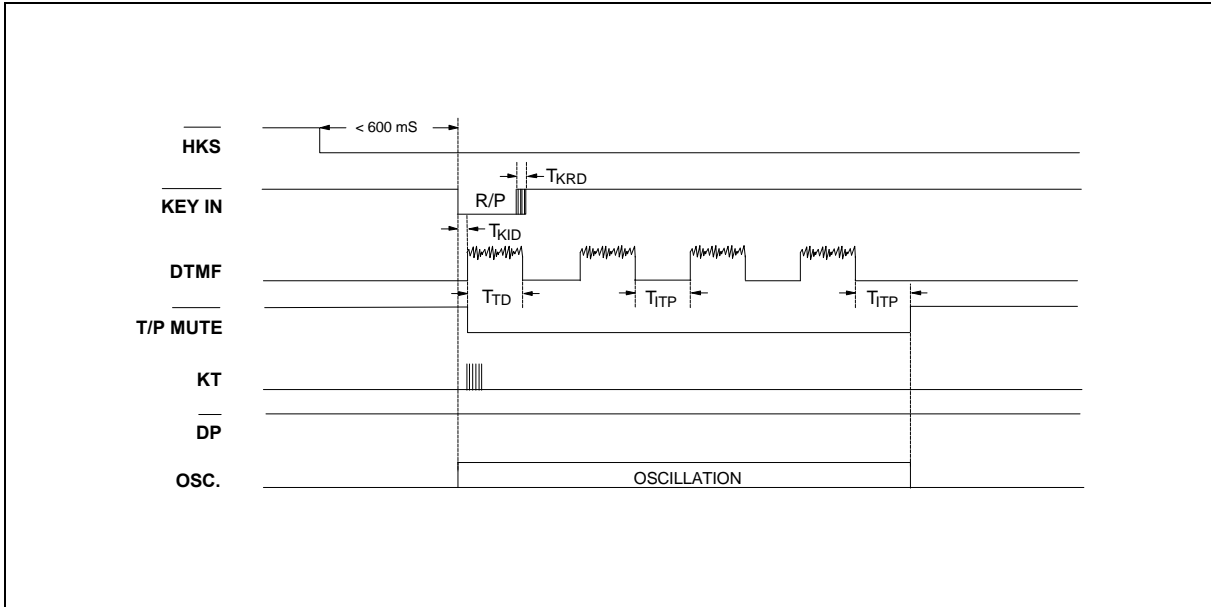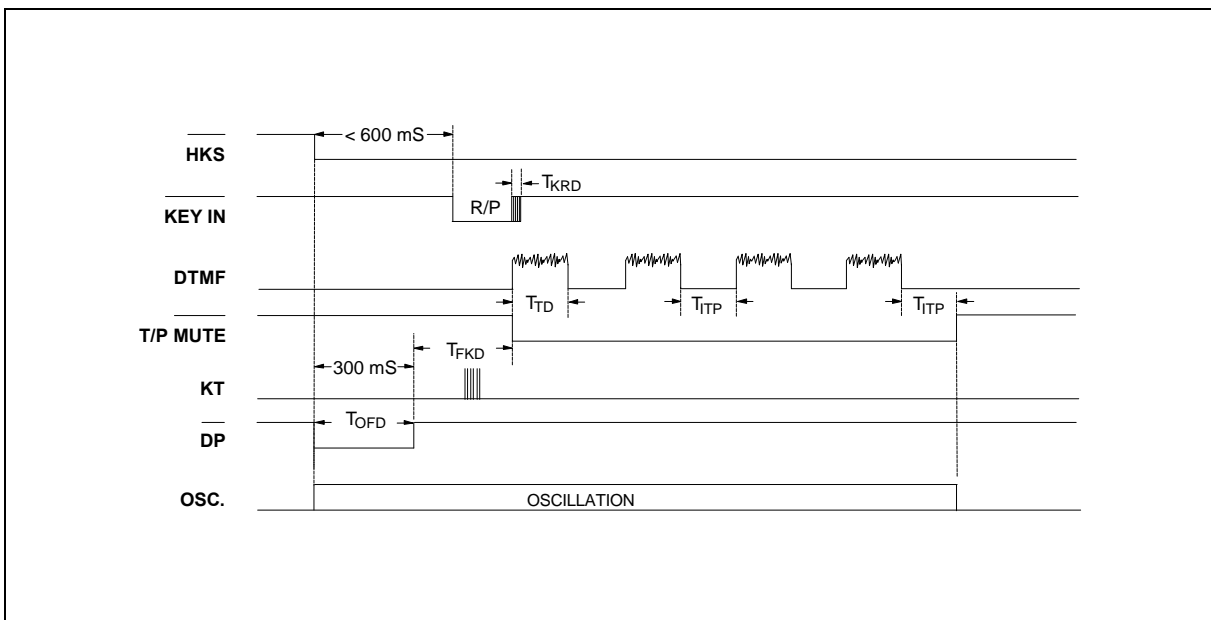
Timing Waveforms, continued

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

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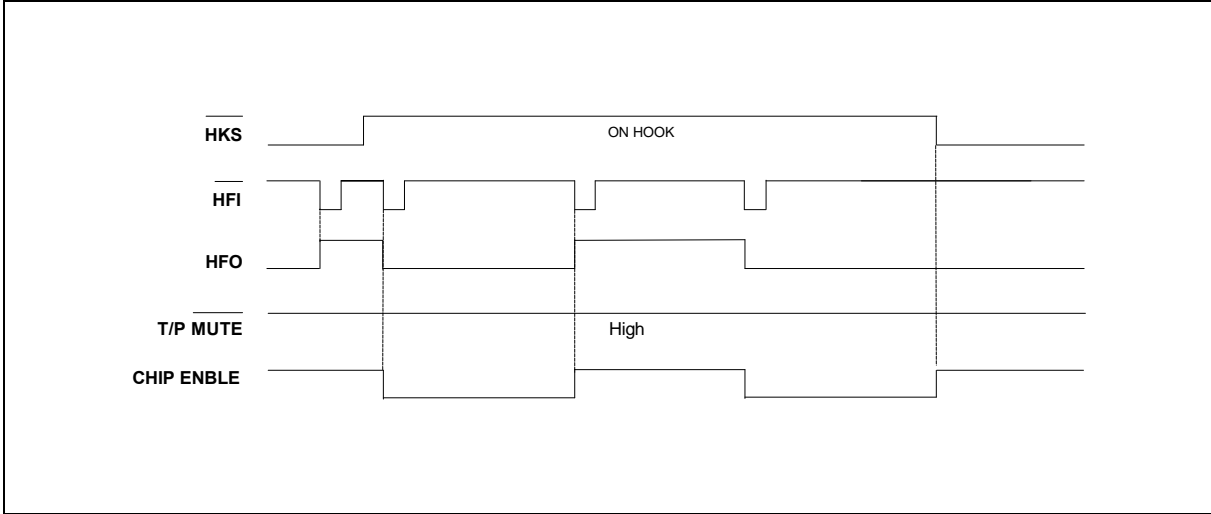
Timing Waveforms, continued

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

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

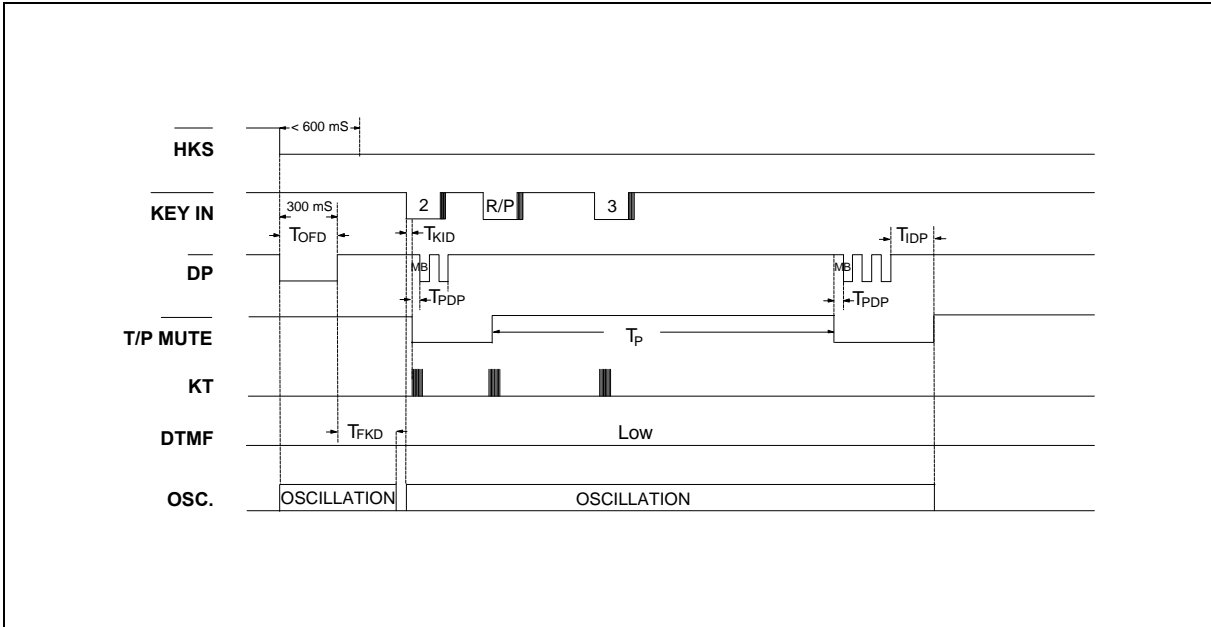Timing Waveforms, continued

Figure 3. Handfree Timing Diagram

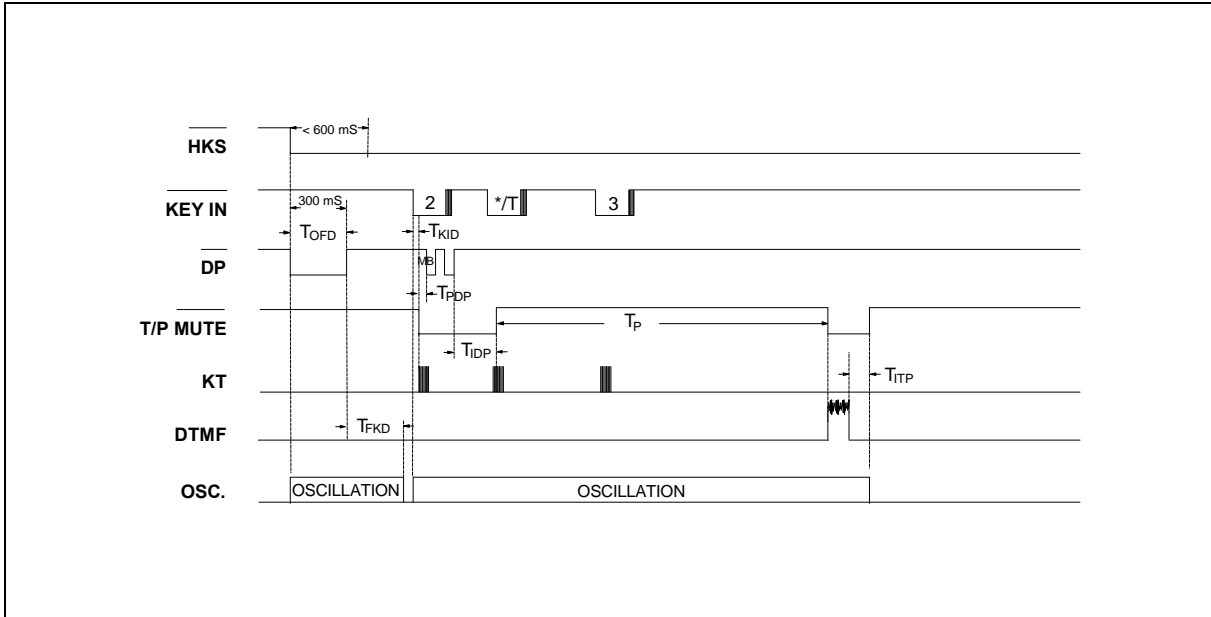Figure 4. Pause Function Timing Diagram

Timing Waveforms, continued

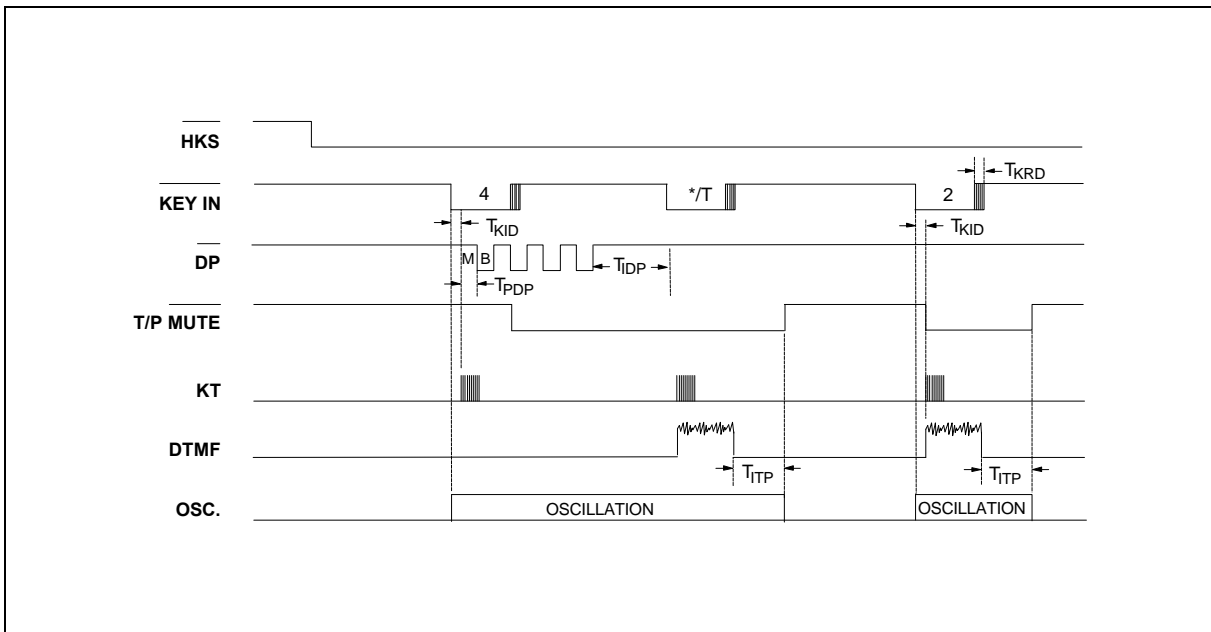Figure 5(a). Pulse-to-tone Timing Diagram (except W91534AN)

Figure 5(b). Pulse-to-tone Timing Diagram (W91534AN only)

W91530N SERIES

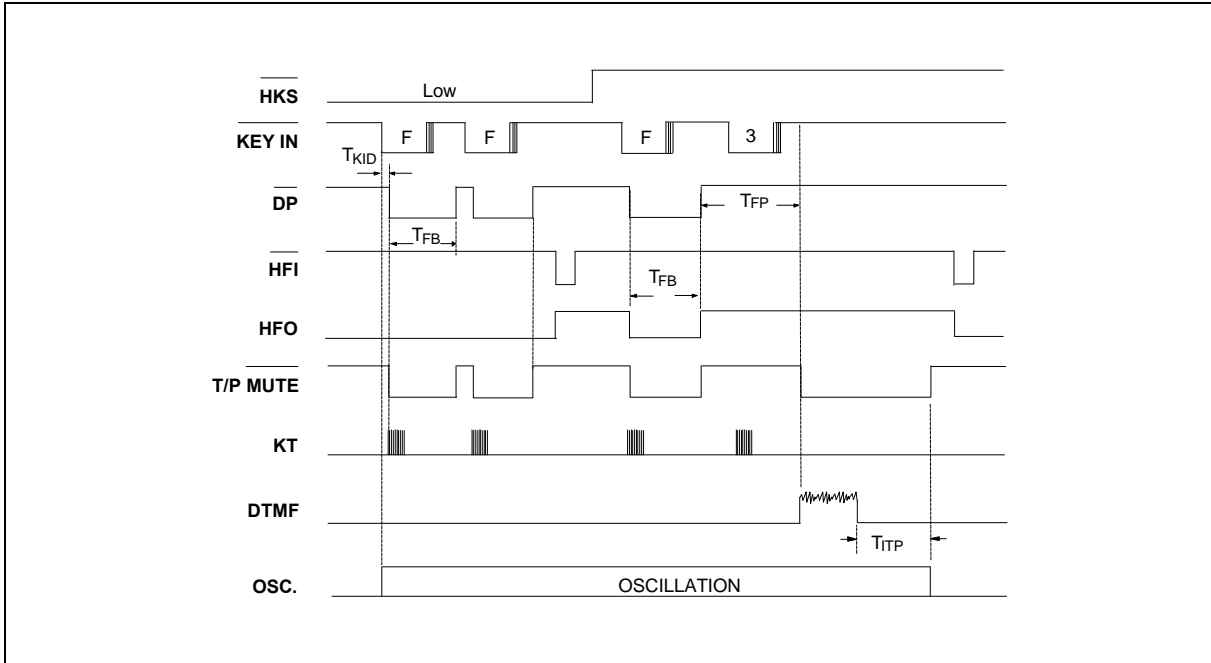Timing Waveforms, continued

Figure 6. 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

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