

Preliminary W91310N SERIES



-tone/pulse dialer with FLASH TIME STOREABLE AND SAVE FUNCTIONS

GENERAL DESCRIPTION

The W91310N series are monolithic ICs that provide the necessary signals for either pulse or tone dialing. The W91310N series feature a redial memory, Handsfree, auto redial function, and flash time storeable.

FEATURES

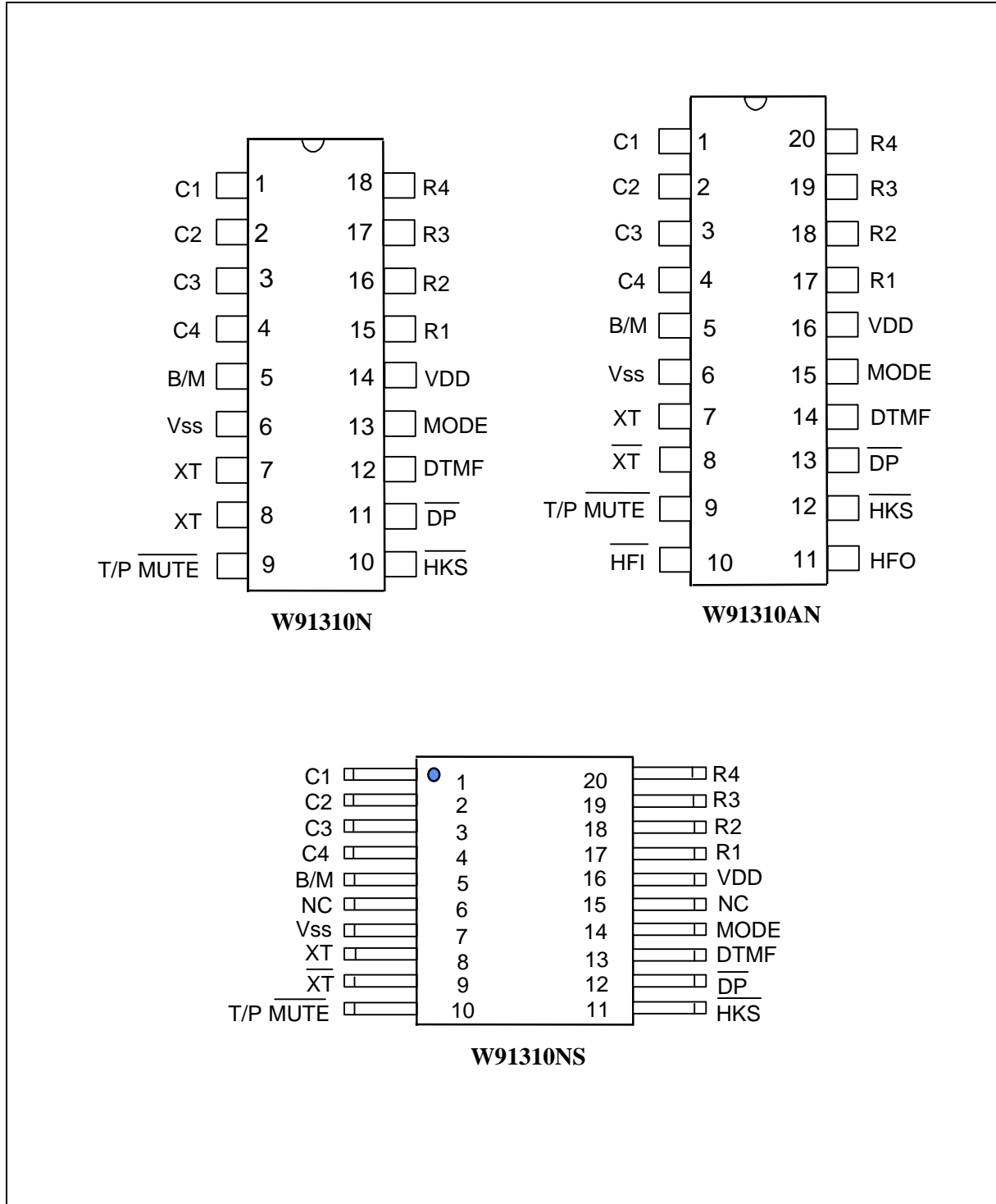
- DTMF/Pulse switchable dialer
- 32 digits for redial memory
- Pulse-to-tone (P→T) keypad for long distance call operation
- Break/Make ratio is selectable by pin option
- Uses 5 × 5 keyboard
- Easy operation with redial, flash, pause, and P→T keypads
- Flash, pause, P→T (pulse-to-tone) can be stored as a digit in memory
- Minimum tone output duration: 93 mS
- Minimum intertone pause: 93 mS
- On-chip power-on reset
- One flash time storeable
- Uses 3.579545 MHz crystal or ceramic resonator
- Packaged in 18-pin plastic DIP, and 300 mil 20-pin SOP.
- The dialer in the W91310N series are shown in the following table:

TYPE NO.	PULSE (ppS)	FLASH (Ms)	FLASH PAUSE (S)	PAUSE (S)
W91310N	10/20	600/300/100/73	1.0	2.0/3.6
W91310AN	10/20	600/300/100/73	1.0	2.0/3.6

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PIN CONFIGURATIONS



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PIN DESCRIPTION

SYMBOL	PIN	PIN	I/O	FUNCTION																																				
	DIP	SSOP																																						
Column-Row Inputs	1-4 & 15-18 (17-20)/ (AN)	1-4 & 17-20	I	The keyboard input may be from either the standard 4 × 4 keyboard or an inexpensive single contact (form A) keyboard. Electronic input from a μ C can also be used. A valid key entry is defined as a single row being connected to a single column.																																				
XT, $\overline{\text{XT}}$	7, 8	8, 9	I, O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.																																				
T/P $\overline{\text{MUTE}}$	9	10	O	The T/P $\overline{\text{MUTE}}$ is a conventional CMOS N-channel open drain output. The output transistor is switched on during pulse and tone mode dialing sequence and flash break. Otherwise, it is switched off.																																				
MODE	13 15(AN)	14	I	Pulling mode pin to VSS places the dialer in tone mode. Pulling mode pin to VDD places the dialer in pulse mode (10 ppS). Leaving mode pin floating places the dialer in pulse mode (20 ppS).																																				
$\overline{\text{HKS}}$	10 12(AN)	11	I	Hook switch input. $\overline{\text{HKS}} = 1$: On-hook state. Chip in sleeping mode, no operation. $\overline{\text{HKS}} = 0$: Off-hook state. Chip enabled for normal operation. The $\overline{\text{HKS}}$ pin is pulled to VDD by an internal resistor.																																				
$\overline{\text{DP}}$	11 13(AN)	12	O	N-channel open drain dialing pulse output (Figure 1). Flash key will cause $\overline{\text{DP}}$ to go active in both pulse mode and tone mode.																																				
DTMF	12 14(AN)	13	O	In pulse mode, remains in low state at all times. In tone mode, outputs a dual or single tone. 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
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VDD, VSS	14, 6 16, 6 (AN)	16, -7	I	Power input pins.																																				
B/M	5	5	I	The break make ratio is 60:40 if B/M = 1 and is 66.6:33.3 if B/M = 0. This pin has no function in DTMF mode.																																				

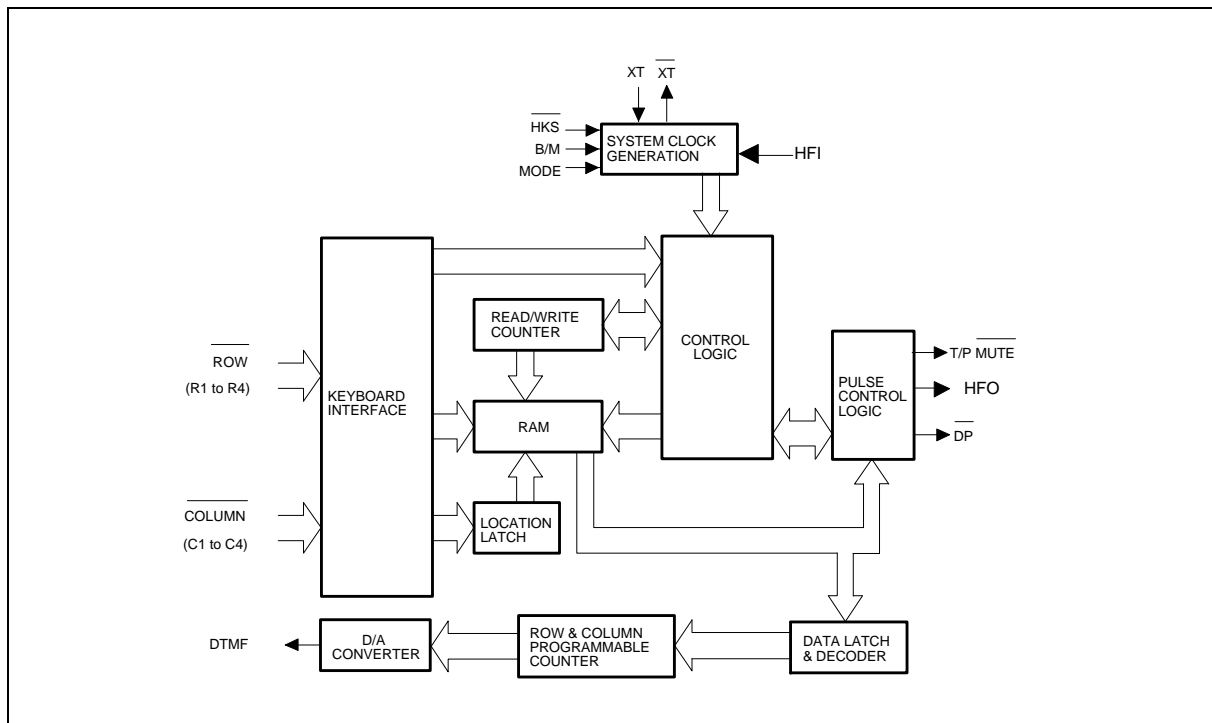
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Pin Description, continued

SYMBOL	PIN	PIN	I/O	FUNCTION																																								
	DIP	SSOP																																										
$\overline{\text{HFI}}$, HFO	11, 12 (AN Only)	-	I, O	<p>Handfree control pins.</p> <p>A low pulse on the $\overline{\text{HFI}}$ 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>$\overline{\text{HFI}} \downarrow$</td> <td>High</td> <td>Yes</td> </tr> <tr> <td>On Hook</td> <td>High</td> <td>$\overline{\text{HFI}} \downarrow$</td> <td>Low</td> <td>No</td> </tr> <tr> <td>Off Hook</td> <td>High</td> <td>$\overline{\text{HFI}} \downarrow$</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 $\overline{\text{HFI}}$ 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



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FUNCTIONAL DESCRIPTION

Keyboard Operation

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

- R/P: Redial and pause function key
- *T: * in tone mode and P→T: Pulse mode to tone mode
- S: Store function
- MEM: With the same memory location as SAVE memory
- SAVE: Save function memory
- R/P1, R/P2: Redial and pause function key, P1 is 3.6 sec, and P2 is 2.0 sec.
- F1, ..,F4: Flash key
- RD: One key redial.

Normal Dialing

OFF HOOK , (or ON HOOK & $\overline{HF1} \overline{I} \overline{C}$), 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.

Redialing

1. OFF HOOK , (or ON HOOK & $\overline{HF1} \overline{I} \overline{C}$), D1 , D2 , ..., Dn

Busy, come ON HOOK , OFF HOOK (or ON HOOK & $\overline{HF1} \overline{I} \overline{C}$), R/P

1. The redial memory content will be D1, D2, ..,Dn.
- b. The R/P key can execute the redial function only as the first key-in after off-hook; otherwise, it will invoke the pause function.
- c. If redialing length oversteps 32 digits, the redialing function will be inhibits.

Save

OFF HOOK or ON HOOK , $\overline{HF1} \overline{I} \overline{C}$, D1 , D2 , ..., Dn , SAVE .

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

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- If the sequence of the dialed digits D1, D2, ..., Dn has not finished, **SAVE** will be ignored; otherwise, D1, D2, ..., Dn will be duplicated to SAVE memory.

Repertory Dialing

One-touch direct repertory dialing:

- OFF HOOK** (or **ON HOOK** , $\overline{\text{HF1}} \overline{\text{i}} \overline{\text{c}}$, **MEN** .
- OFF HOOK** (or **ON HOOK** , $\overline{\text{HF1}} \overline{\text{i}} \overline{\text{c}}$, **SAVE** .

Press **MEM** will dial out the same as pressing **SAVE** .

Access Pause

OFF HOOK , (or **ON HOOK** , $\overline{\text{HF1}} \overline{\text{i}} \overline{\text{c}}$) **D1** , **D2** , **R/P** , **D3** , ..., **Dn**

- The pause function can be stored in memory.
- The pause function is executed in normal dialing or memory dialing.
- The pause function timing diagram is shown in Figure 5.

Pulse-to-tone (P[®]T)

OFF HOOK (or **ON HOOK** , $\overline{\text{HF1}} \overline{\text{i}} \overline{\text{c}}$) **D1** , **D2** , ..., **Dn** , **P→T** , **D1'** , **D2'** , ..., **Dn'**

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

D1, D2, ..., Dn, Pause, D1', D2', ..., Dn'
(Pulse) (Tone)

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

D1, D2, ..., Dn, **P→T** D1, D2, ..., Dn,
(Tone) (Pause) (Tone)

- 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.
- The P→T function timing diagram is shown in Figure 6.

Flash

OFF HOOK , (or **ON HOOK** , $\overline{\text{HF1}} \overline{\text{i}} \overline{\text{c}}$), **Fn**

- Flash key can be stored as a digit in memory.
- Only one flash key can be released to end user.
- The system will return to the initial state after the break time is finished.

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4. If the mode switch is set in pulse mode, after the dialing sequence D1, D2, *T, D3, Fn, D4, the dialer will keep in tone mode.
5. The flash function timing diagram is shown in Figure 7.

Mixed Dialing

1. Definition of mixed dialing:

In mixed dialing, a new sequence may be accepted only when the previous sequence has been dialed out completely. The following are examples of mixed dialing:

Example 1:

Normal dialing

 +

Repertory dialing 1

 +

Repertory dialing 2

 +

(1st sequence) (2nd sequence) (3rd sequence)

Example 2:

Repertory dialing 1

 +

Normal dialing

 +

Repertory dialing 2

 +

(1st sequence) (2nd sequence) (3rd sequence)

Example 3:

Redialing

 +

Normal dialing

 +

Repertory dialing 1

 +

(1st sequence) (2nd sequence) (3rd sequence)

2. There is no limitation on the number of digits and sequences in the mixed dialing.
3. The content of mixed dialing may be a combination of normal dialing, memory dialing, or one-key redialing.
4. If

ON HOOK

 ,

OFF HOOK

 (or

ON HOOK

 &

$\overline{\text{HF1}} \overline{\text{I}} \overline{\text{C}}$

),

RD

 is entered, then the mixed dialing sequence described in the above examples will be dialed out only if the total number of digits does not exceed 32.
If the total exceeds 32 digits, then redialing is inhibited.

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ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
DC Supply Voltage	VDD-VSS	-0.3 to +7.0	V
Input/Output Voltage	VIL	VSS -0.3	V
	VIH	VDD +0.3	V
	VOL	VSS -0.3	V
	VOH	VDD +0.3	V
Power Dissipation	PD	120	mW
Operating Temperature	TOPR	-20 to +70	°C
Storage Temperature	TSTG	-55 to +125	°C

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

DC CHARACTERISTICS

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

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage	VDD		2.0	-	5.5	V
Operating Current	IOP	Tone, Unloaded	-	0.4	0.6	mA
		Pulse, Unloaded	-	0.2	0.4	mA
Standby Current	ISB	$\overline{\text{HKS}} = 0$, No load, & No key entry	-	-	15	μA
Memory Retention Current	IMR	$\overline{\text{HKS}} = 1$, VDD = 1.0V	-	-	0.2	μA
DTMF Output Voltage	VTO	Row group, RL = 5 KΩ	130	150	170	mVrms
Pre-emphasis		Col/Row, VDD = 2.0 to 5.5V	1	2	3	dB
DTMF Distortion	THD	RL = 5 KΩ, VDD = 2.0 to 5.5V	-	-30	-23	dB
DTMF Output DC Level	VTDC	RL = 5 KΩ, VDD = 2.0 to 5.5V	1.0	-	3.0	V
DTMF Output Sink Current	ITL	VTO = 0.5V	0.2	-	-	mA
$\overline{\text{DP}}$ Output Sink Current	IPL	VPO = 0.5V	0.5	-	-	mA
T/P $\overline{\text{MUTE}}$ Output Sink Current	IML	VMO = 0.5V	0.5	-	-	mA
$\overline{\text{HKS}}$ I/P Pull-high Resistor	RKH		-	300	-	KΩ
HFO Drive/Sink Current	IHFH	VHFH = 2.0 V	0.5	-	-	mA
	IHFL	VHFL = 0.5 V	0.5	-	-	mA

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DC Characteristics, continued

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Keypad Input Drive Current	IKD	$V_i = 0V$	30	-	-	μA
Keypad Input Sink Current	IKS	$V_i = 2.5V$	200	400	-	μA
Keypad Resistance			-	-	5.0	$K\Omega$

AC CHARACTERISTICS

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Keypad Active in Debounce	TKID		-	20	-	mS
Key Release Debounce	TKRD		-	20	-	mS
Pre-digit Pause ¹	TPDP1 10 ppS	B/M = 1	-	40	-	mS
		B/M = 0	-	33.3	-	
Pre-digit Pause ²	TPDP2 20 ppS	B/M = 1	-	20	-	mS
		B/M = 0	-	16.7	-	
Interdigit Pause (Auto dialing)	TIDP	10 ppS	-	800	-	mS
		20 ppS	-	500	-	
Make/Break Ratio	M/B	B/M = 1	-	40:60	-	%
		B/M = 0	-	33:67	-	
DTMF Output Duration	T _{TD}	Auto Dialing	-	93	-	mS
Intertone Pause	T _{ITP}	Auto Dialing	-	93	-	mS
Flash Break Time	TFB	F1	-	600	-	mS
		F2	-	100	-	
		F3	-	300	-	
		F4	-	73	-	
Flash Pause Time	T _{FP}	F1, F2, F3, F4	-	1.0	-	S
One Key Redial Break Time	TRB	-	-	2.2	-	S
One Key Redial Pause Time	TRP	-	-	0.6	-	S
Pause Time	TP	R/P1	-	3.6	-	S
		R/P2	-	2.0	-	

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.
 - Pause Time selectable.
 - Flash time only can be use any one in any same time.

Publication Release Date: January 2001
Revision A1

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TIMING WAVEFORMS

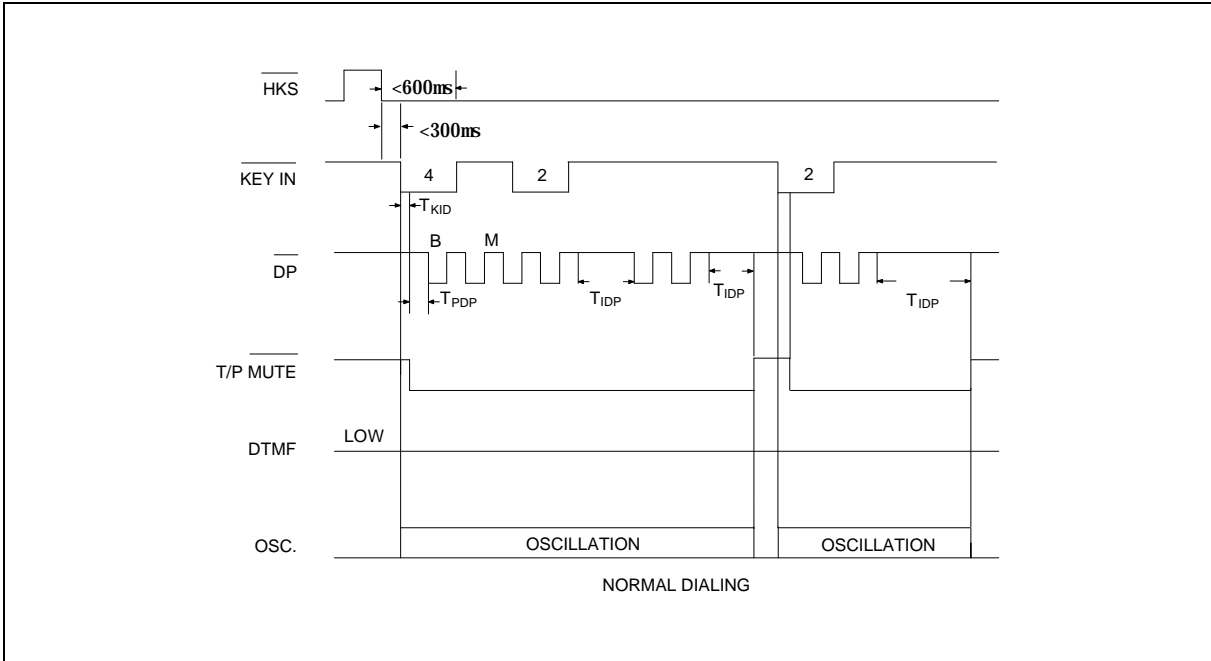


Figure 1(a). Normal Dialing Timing Diagram (Pulse Mode Timing Diagram)

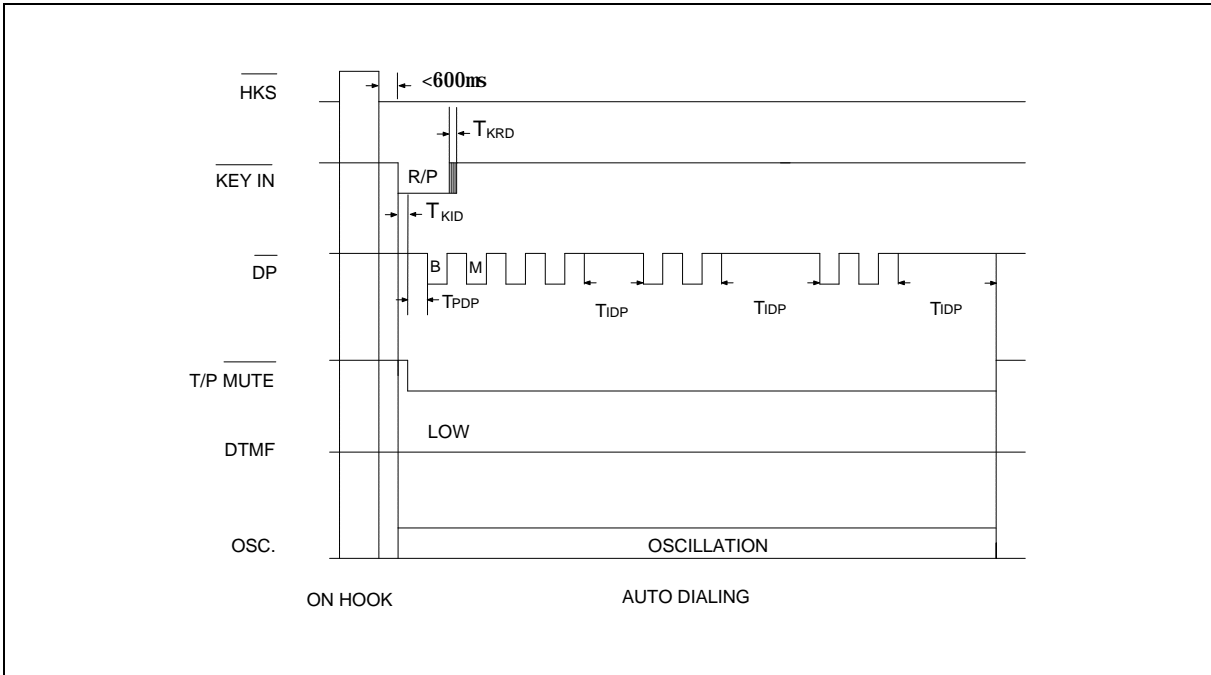


Figure 1(b). Auto Dialing Timing Diagram (Pulse Mode Timing Diagram)

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Timing Waveforms, continued

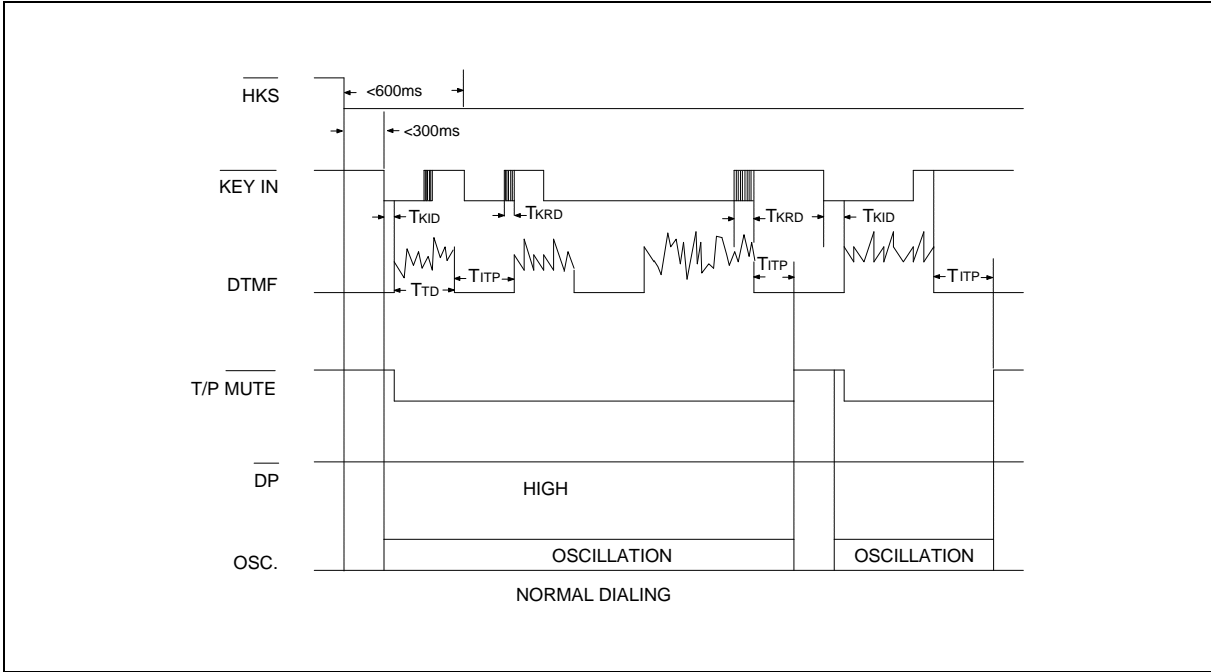


Figure 2(a). Normal Dialing Timing Diagram (Tone Mode Timing Diagram)

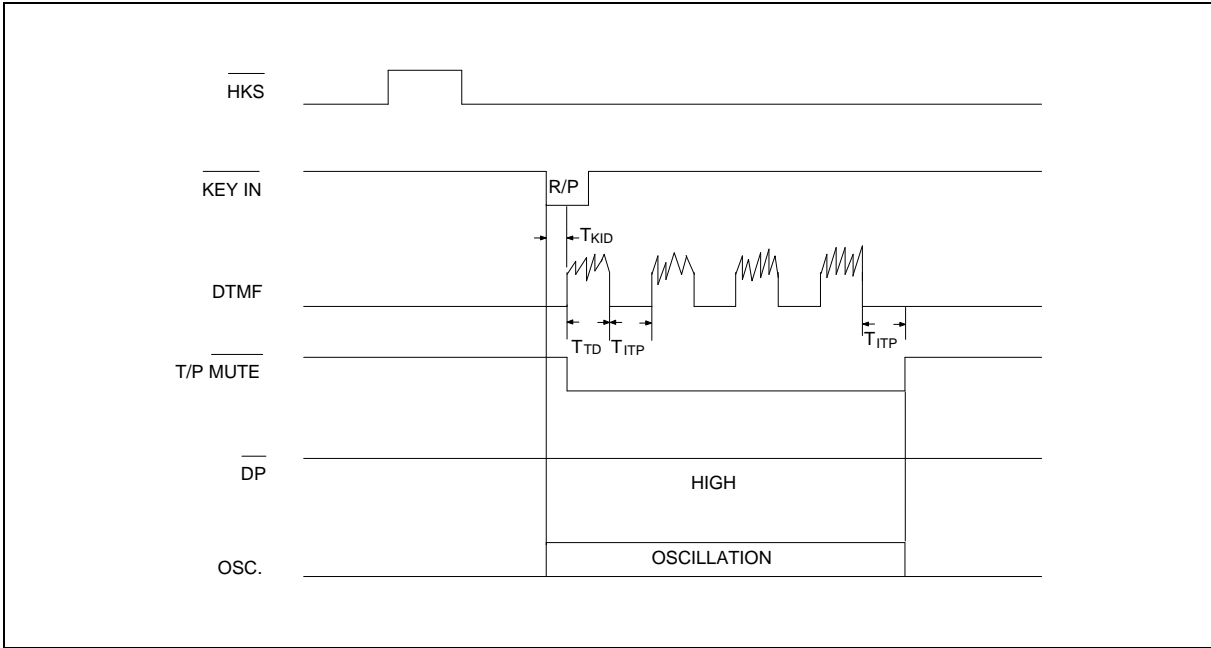


Figure 2(b). Auto Dialing Timing Diagram (Tone Mode Auto Dialing Timing Diagram)

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Timing Waveforms, continued

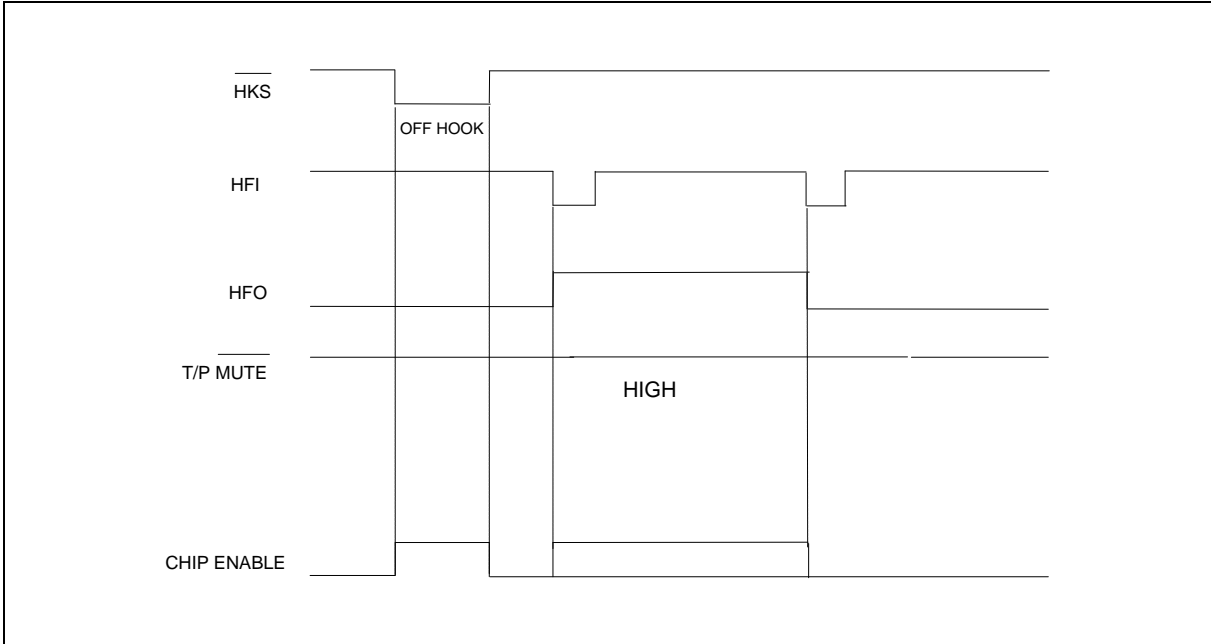


Figure 3. Handfree Timing Diagram

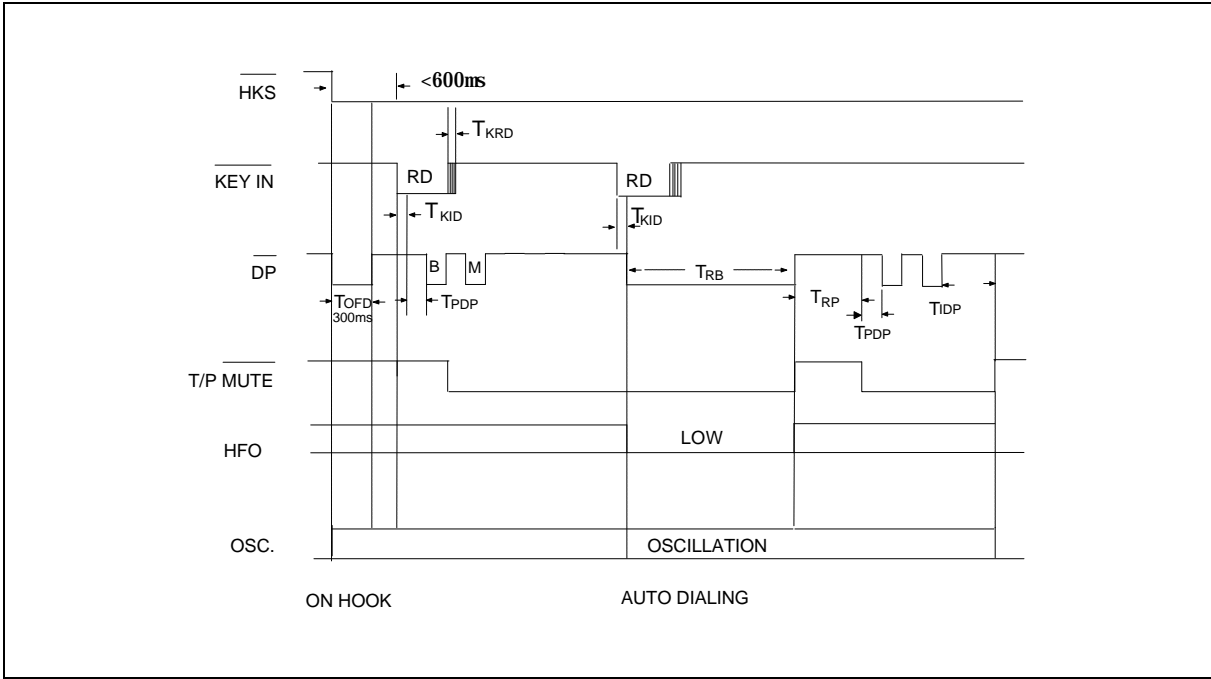


Figure 4 One-key redial Timing Diagram (Pulse mode)

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Timing Waveforms, continued

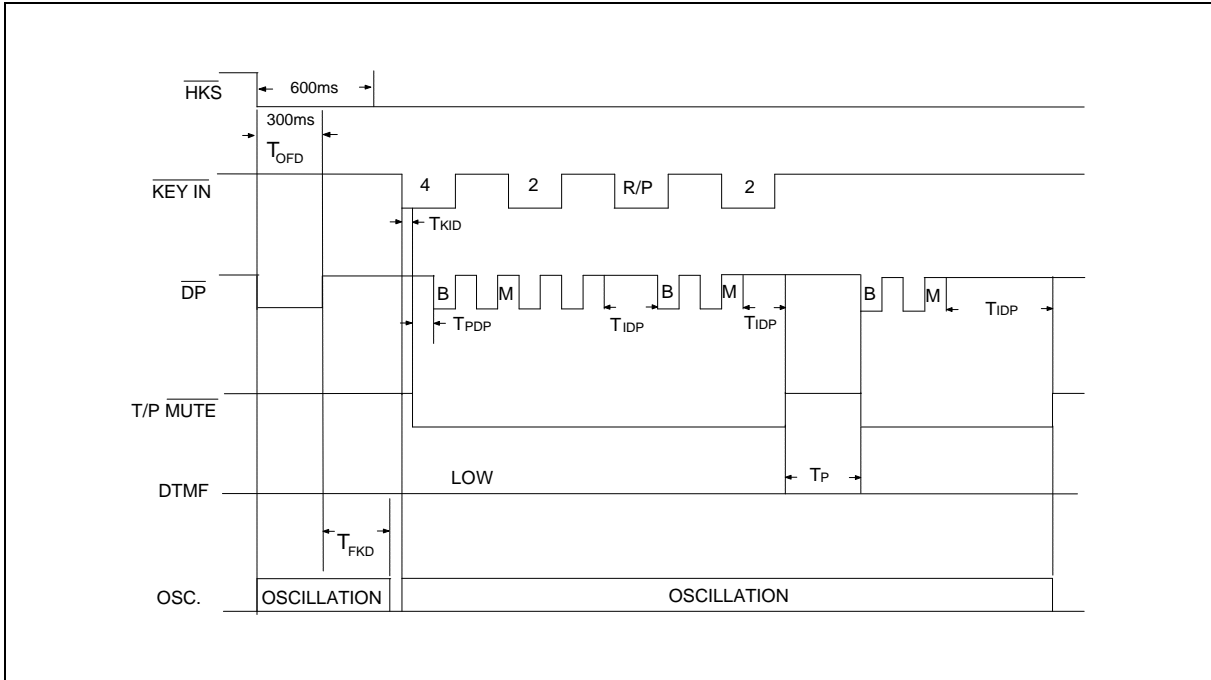


Figure 5. Pause Function Timing Diagram

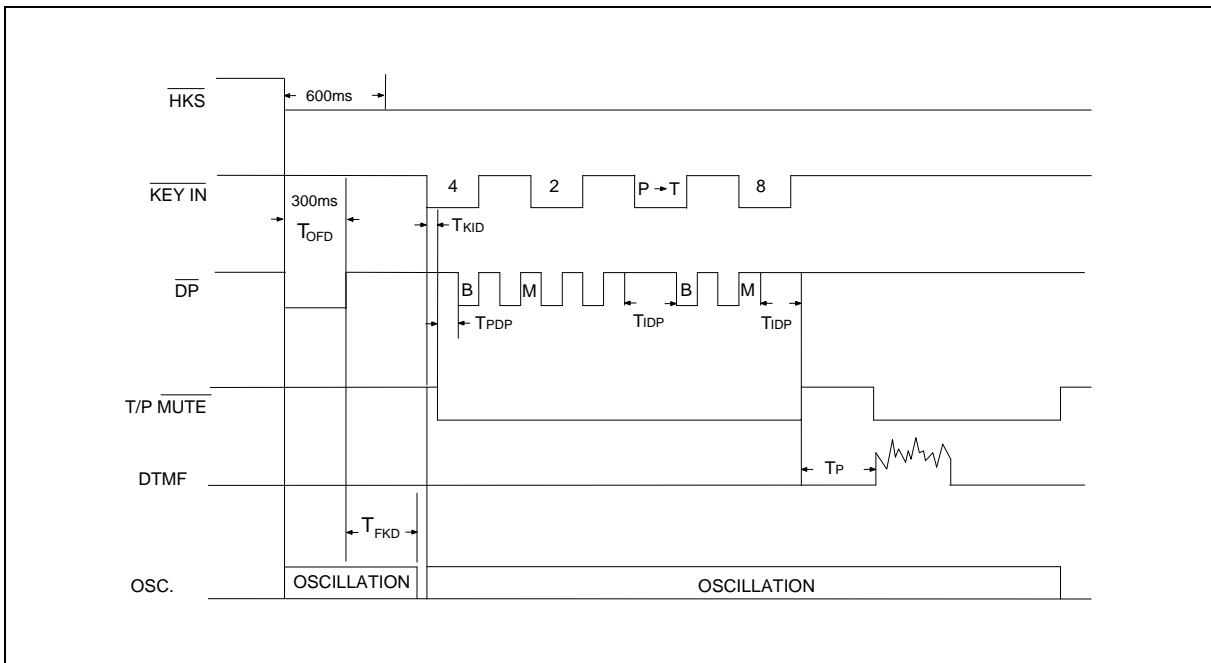


Figure 6. Pulse-to-tone Function Timing Diagram

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Timing Waveforms, continued

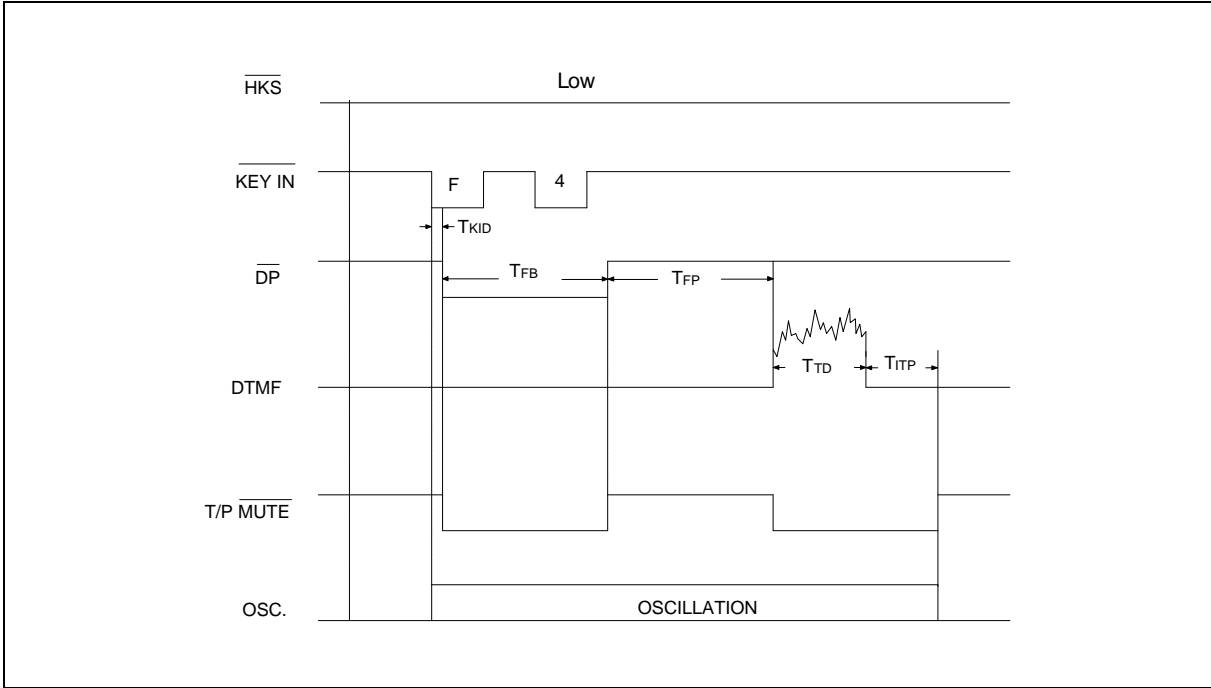
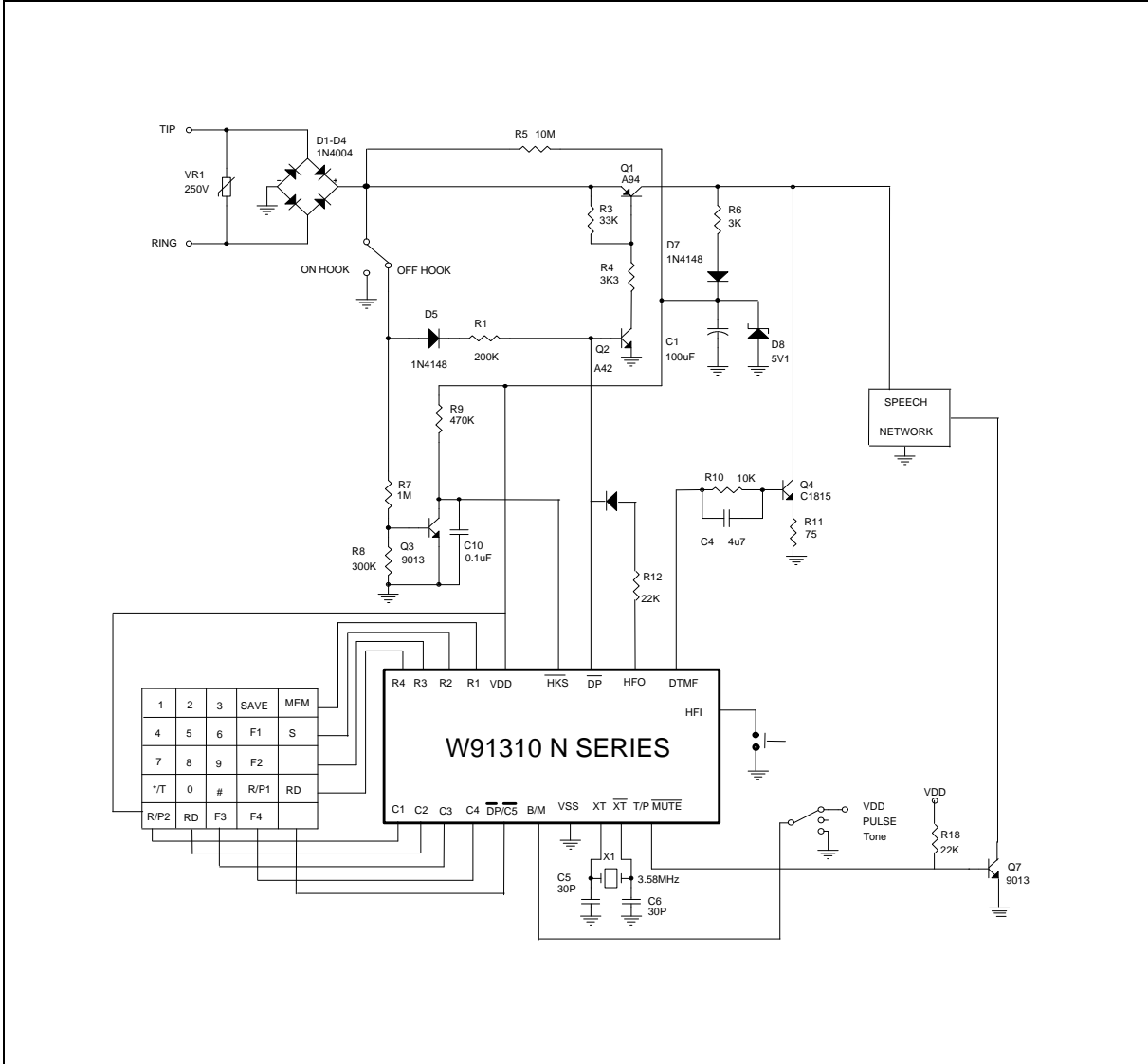


Figure 7. Flash Function Timing Diagram

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APPLICATION CIRCUIT



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