W91580 SERIES

Winbond
Electronics Corp.

24-MEMORY TONE/PULSE SWITCHABLE DIALER WITH HANDFREE AND HOLD FUNCTIONS
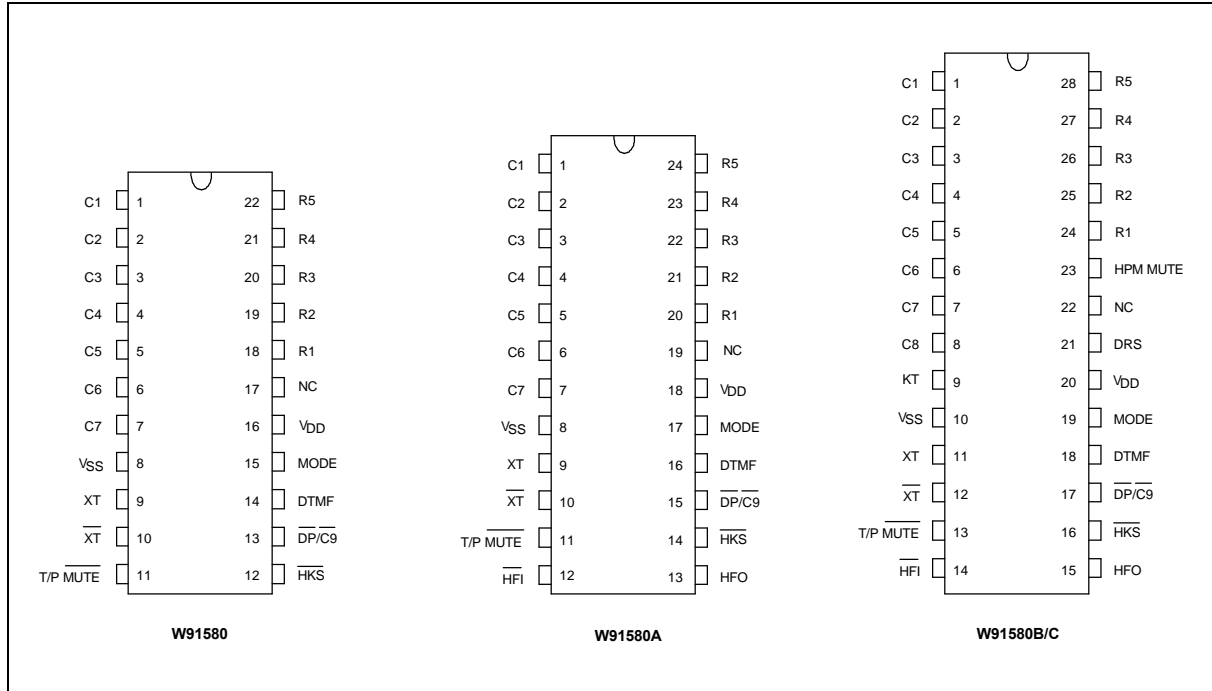
GENERAL DESCRIPTION

The W91580 series dialers are Si-gate CMOS IC tone/pulse switchable dialers containing a 24-channel automatic dialing memory, including a 16-digit $\times$ 3 emergency dialing memory, a 16-digit $\times$ 20 channel repertory memory that provides one-touch and three-touch dialing, and a 32-digit mercury memory. These dialers also provide flash, clear, hold, and one-key redial functions.

FEATURES

- DTMF/Pulse switchable dialer
- 31/32-digit LNB (last number buffer) memory (tone/pulse mode)
- 31/32-digit mercury memory (tone/pulse mode)
- 15/16-digit $\times$ 3 one-touch direct repertory memory (tone/pulse mode)
- 15/16-digit $\times$ 20 direct or indirect repertory memory (tone/pulse mode)
- Uses 9 $\times$ 5 keyboard
- Flash time: 98 mS, 305 mS, or 600 mS (selectable by keypad option)
- Pause time: 3.6 sec.
- Pause and P$\rightarrow$T (pulse-to-tone) can be stored as a digit in memory
- Minimum tone output duration: 100 mS
- Minimum intertone pause: 100 mS
- On-chip power-on reset
- Uses 3.579545 MHz crystal or ceramic resonator
- Packaged in 22, 24, or 28-pin plastic DIP
- The different dialers in the W91580 series are shown in the following table:

TYPE NO.	PULSE (ppS)	MEMORY	MERCURY MEMORY	HOLD	HANDFREE	PACKAGE
W91580	10	20	-	-	-	22
W91580A	10	20	-	-	Yes	24
W91580B	10/20	24	Yes	Yes	Yes	28
W91580C	10/20	24	Save	Yes	Yes	28

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PIN CONFIGURATIONS

W91580

C1	1		22	R5
C2	2		21	R4
C3	3		20	R3
C4	4		19	R2
C5	5		18	R1
C6	6		17	NC
C7	7		16	V_{DD}
V_{SS}	8		15	MODE
XT	9		14	DTMF
$\overline{XT}$	10		13	$\overline{DP/C9}$
T/P $\overline{MUTE}$	11		12	$\overline{HKS}$

W91580A

C1	1		24	R5
C2	2		23	R4
C3	3		22	R3
C4	4		21	R2
C5	5		20	R1
C6	6		19	NC
C7	7		18	V_{DD}
V_{SS}	8		17	MODE
XT	9		16	DTMF
$\overline{XT}$	10		15	$\overline{DP/C9}$
T/P $\overline{MUTE}$	11		14	$\overline{HKS}$
$\overline{HFI}$	12		13	HFO

W91580B/C

C1	1		28	R5
C2	2		27	R4
C3	3		26	R3
C4	4		25	R2
C5	5		24	R1
C6	6		23	HPM MUTE
C7	7		22	NC
C8	8		21	DRS
KT	9		20	V_{DD}
V_{SS}	10		19	MODE
XT	11		18	DTMF
$\overline{XT}$	12		17	$\overline{DP/C9}$
T/P $\overline{MUTE}$	13		16	$\overline{HKS}$
$\overline{HFI}$	14		15	HFO

PIN DESCRIPTION

SYMBOL	22-PIN	24-PIN	28-PIN	I/O	FUNCTION
Column-Row Inputs	1–7 & 18–22	1–7 & 20–24	1–8 & 24–28	I	The keyboard input may be used with either the standard 9×5 keyboard or an inexpensive single contact (form A) keyboard. Electronic input from a μC can also be used. A valid key entry is defined by a single row being connected to a single column.
XT, $\overline{XT}$	9, 10	9, 10	11, 12	I, O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.
T/P $\overline{MUTE}$	11	11	13	O	The T/P $\overline{MUTE}$ 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.
HPM MUTE	-	-	23	O	The HPM MUTE is a conventional inverter output. During pulse dialing, flash, hold, and mercury mute functions, this pin will output an active high. It remains in a low state at all other times.

Pin Description, continued

SYMBOL	22-PIN	24-PIN	28-PIN	I/O	FUNCTION
MODE	15	17	19	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, M/B = 2:3). Leaving mode pin floating places the dialer in pulse mode (10 ppS, M/B = 1:2).
$\overline{\text{HKS}}$	12	14	16	I	Hook switch input. $\overline{\text{HKS}}$ = 1: On-hook state. Chip in sleep mode, no operation. $\overline{\text{HKS}}$ = 0: Off-hook state. Chip enabled for normal operation. $\overline{\text{HKS}}$ pin is pulled to VDD by internal resistor.
$\overline{\text{DP}}/\overline{\text{C9}}$	13	15	17	O	N-channel open drain dialing pulse output (see Figure 1). Flash key causes $\overline{\text{DP}}$ to go active when in pulse mode and tone mode.
NC	17	19	22	-	No connection.
DTMF	14	16	18	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.
VDD, VSS	16, 8	18, 8	20, 10	I	Power input pins.

Within the DTMF row:

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	22-PIN	24-PIN	28-PIN	I/O	FUNCTION
$\overline{\text{HFI}}$, HFO	-	12, 13	14, 15	I, O	Handfree control pins. A low pulse on the $\overline{\text{HFI}}$ input pin toggles the handfree control state. The status of the handfree control state is described by 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 internal resistor.

SYMBOL	22-PIN	24-PIN	28-PIN	I/O	FUNCTION
KT	-	-	9	O	Keytone signal output. A keytone will be generated whenever a valid key is pressed. Frequency is 600 Hz and duration is 35 mS.
DRS	-	-	21	I	Dial rate selection. This pin is pulled to V_{DD} by an internal resistor.

DRS	MODE PIN	TONE/PULSE	DIAL RATE	M/B
1	V_{DD}	Pulse	10 ppS	2:3
	Floating	Pulse	10 ppS	1:2
	V_{SS}	Tone	—	—
0	V_{DD}	Pulse	10 ppS	1:2
	Floating	Pulse	20 ppS	1:2
	V_{SS}	Tone	—	—

W91580 SERIES

BLOCK DIAGRAM
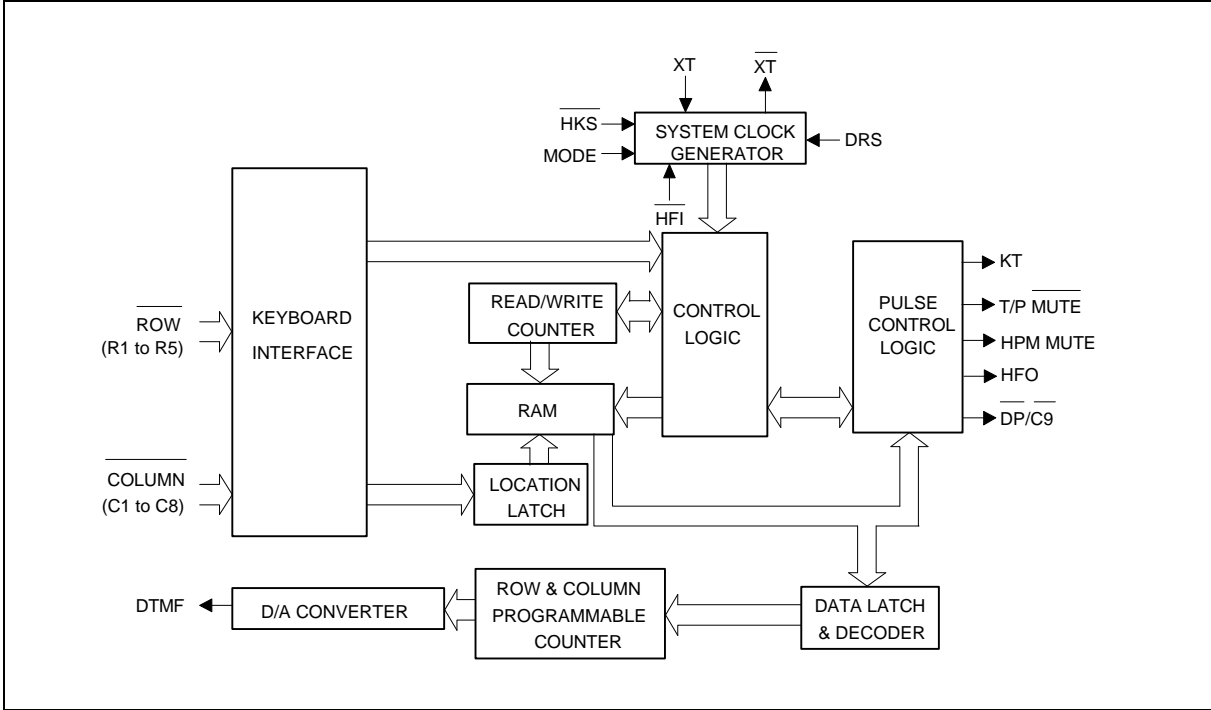
FUNCTIONAL DESCRIPTION

Keyboard Operation

C1	C2	C3	C4	C5	C6	C7	$\overline{DP}/\overline{C9}$	C8	
1	2	3	S	M00	M05	M10	M15	EM1	R1
4	5	6	MEMO	M01	M06	M11	M16	EM2	R2
7	8	9	CLR	M02	M07	M12	M17	EM3	R3
*/T	0	#	R/P	M03	M08	M13	M18	H	R4
F1	F2	F3	R	M04	M09	M14	M19	*MER	R5

* ‎ MER ‎ is for W91580B only; Fin W91580C this key performs ‎ Save ‎ function.

- S: Store function key
- F1, F2, F3: Flash keys
- R: One-key redial
- H: Hold function key
- $\overline{DP}/\overline{C9}$: This key is connected to pin $\overline{DP}/\overline{C9}$ via a bipolar switching transistor and a diode.
- M0j: Direct or indirect (MEMO + M0j = M1j) repertory memory
- M1j: Direct repertory dialing
- EMi: One-touch memory for emergency call
- */T: * & P→T
- CLR: Clear key
- R/P: Redial and pause function key
- MER: One-touch memory for mercury code dialing
- MEMO: Indirect repertory dialing function key

Note: Dn = 0 to 9, *, #, Mij = M00 to M19 (i = 0, 1; j = 0 to 9).

Normal Dialing

| OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$⤓ |), | D1 | , | D2 | , …, | Dn |

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

Redialing

1. | OFF HOOK | , | D1 | , | D2 | , …, | Dn | BUSY, Come | ON HOOK | , | OFF HOOK |

   (or | ON HOOK | & | $\overline{HFI}$⤓ |), | R/P |

   or | ON HOOK | & | $\overline{HFI}$⤓ | , | D1 | , | D2 | , …, | Dn | , BUSY, | $\overline{HFI}$⤓ | Come

   | $\overline{HFI}$⤓ | , | R/P |

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

2. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$⤓ |), | D1 | , | D2 | , …, | Dn | , | R |

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

   b. If dialing | D1 | to | Dn | is completed, pressing the | R | key will cause the pulse output of
       pin to go low for 2.2 seconds. Break time and a 600 mS pause will automatically be added.

   c. If the | R | key is pressed before the pulses for the number dialed out are completed, it will be
       ignored.

Number Store

1. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | S | , | D1 | , | D2 | , …, | Dn |

| S | , | Mij | , | EMi | or | MER |

D1, D2, ..., Dn will be stored in memory location but will not be dialed out.
| R/P | and | */T | keys can be stored as a digit in memory. In store mode | R/P | is the pause function key.

The store mode is released after the store function is executed or when the state of the hook switch is changed.

2. | S | , | D1 | , | D2 | , …, | Dn | , | S | , | i | , | j |

   D1, D2, ..., Dn will be stored in memory location Mij and will not be dialed out.

3. | S | , | D1 | , | D2 | , …, | Dn | , | S | , | MEMO | , | M0j |

   a. D1, D2, ..., Dn will be stored in memory location M10 to M19 and will not be dialed out.
   b. MEMO + M0j = M1j.

4. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | D1 | , | D2 | , …, | Dn | , | S | , | S | , | Mn |

   (or | Ln |), | ON HOOK |

   a. D1, D2, ..., Dn will be stored in memory location and will be dialed out.
   b. The | S | key must be pressed after completion of the dialing sequence.

5. | D1 | , | D2 | , …, | Dn | , | S | , | S | , | i | , | j |
   D1, D2, ..., Dn will be stored in memory location Mij and will be dialed out.

6. | D1 | , | D2 | , …, | Dn | , | S | , | S | , | MEMO | , | M0j |
   a. D1, D2, ..., Dn will be stored in memory location M10 to M19 and will be dialed out.
   b. MEMO + M0j = M1j.

Repertory Dialing

1. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | Mij | or | EMi | or | MER |

2. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | MEMO | , | i | , | j |

3. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | MEMO | , | M0j |

Access Pause

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| OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | D1 | , | D2 | , | R/P | , | D3 | , …, | Dn |

1. The pause function can be stored in memory.

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

3. The pause function timing diagram is shown in Figure 5.

Pulse-to-Tone (*/ T)

| OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | 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 (3.6s) , 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) (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 P→T function timing diagram is shown in Figure 6.

5. */ T key can be stored as a digit in memory

Flash (F = F1, F2, F3)

| OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↧ |), | F |

1. Flash key cannot be stored as a digit in memory, and it has first priority among keyboard functions.

2. The system will return to the initial state after the break time is finished.

3. The flash function timing diagram is shown in Figure 7.

Clear key

1. | CLR | , | R/P | (or | R |)

Redial and one-key redial buffer will be cleared.

2. | CLR | , | Mij |

Location Mij buffer content will be cleared.

3. | CLR | , | i | , | j |

Location Mij buffer content will be cleared.

4. | CLR | , | MEMO | , | M0j |

Location M1j buffer content will be cleared.

Save

1. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↳ |), D1, D2, …, Dn | S | , | S | , | SAVE |

D1, D2, …, Dn will be stored in save memory and dialed out.

2. | OFF HOOK | (or | ON HOOK | & | $\overline{HFI}$↳ |), | S | , D1, D2, …, Dn | S | , | SAVE |

D1, D2, …, Dn will be stored in save memory but will not be dialed out.

CHAIN DIALING

Relationship between the memory and the chain dialing buffer:

Memory		Chain Dialing Buffer
Digit	Location	
16	M00	Section 1
16	M01	
. . .	. . .	Section 2
. .	M18	
. .	M19	Section 3
. .	M20	
. .	EM1	Section 4
. .	EM2	
16	EM3	
32	Normal Dialing	
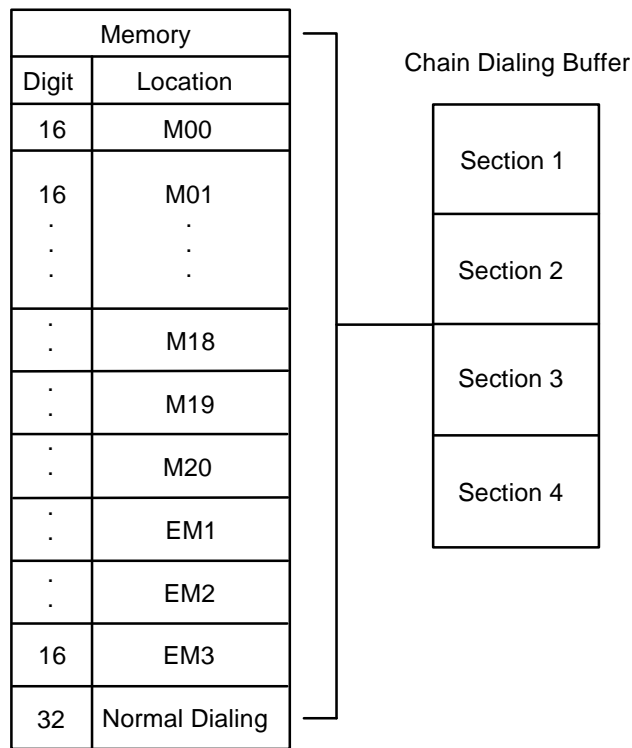
The chain dialing buffer may be divided into four sections, allowing up to four numbers to be dialed out in sequence. For example, if the user enters M01, M03, EM1, and normal dialing (manual dialing), the content of sections 1 to 4 will be M01, M03, EM1, and normal dialing (manual dialing). When numbers are entered into the chain dialing buffer, there is no need to wait until the previous dialing sequence has been completed. Numbers may be entered directly, one after the other, even while previous numbers are being dialed out.

1. | Manual Dialing | + | Repertory Dialing |

Redial buffer content = Manual dialing + Repertory dialing.

2. | Repertory Dialing | + | Manual Dialing |

Redial buffer content = Repertory dialing + Manual dialing.

3. | Repertory Dialing | + | Repertory Dialing |

Redial buffer content = Repertory dialing + Repertory dialing.

4. | Redialing | + | Manual Dialing |

Redial buffer content = Redialing + Manual dialing.

The primary redial content may not be manual dialing. Otherwise, the last redial content will be overwritten.

5. | Redialing | + | Repertory Dialing |

Redial buffer content = Redialing + Repertory dialing.

Redialing is valid only as the first key-in after off-hook or after the handfree dialing function is toggled on.

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

6. | Manual Dialing | + | One Key Redialing |

Redial buffer content = Manual dialing.

The one-key redial may only be used after dialing out of a manual dialing sequence is completed.

7. | Repertory Dialing 1 (M1) | + | One Key Redialing | +

| Repertory Dialing 2 (M2) | + | One Key Redialing |

   or

| Repertory Dialing 1 (M1) | + | One Key Redialing | +

| Repertory Dialing 2 (M2) | , | ON HOOK | , | OFF HOOK | , | Redialing |

M1 and M2 represent any of the repertory dialing memories.

The first redialing will dial out M1; the second will dial out M1, M2.

If dialing out of the repertory dialing memories has not been completed, the one-key redial key will be ignored.

Dialing of the second repertory dialing memory (M2) should not be performed until the one-key redialing operation is completed.

Notes:

1. Chain dialing (cascaded dialing) allows for memory or manual dialing while a previous dialing sequence is still being dialed out.

2. More than one sequence of manual dialing is not permitted.
   Entering more than one manual dialing sequence will inhibit redialing.
   Chain dialing of more than four sections is not permitted.

   | Manual Dialing | + | M1 | + | Manual Dialing | (two sections of manual dialing)

3. If more than four sections are entered, all sections after the fourth section will be ignored and redialing will be inhibited.
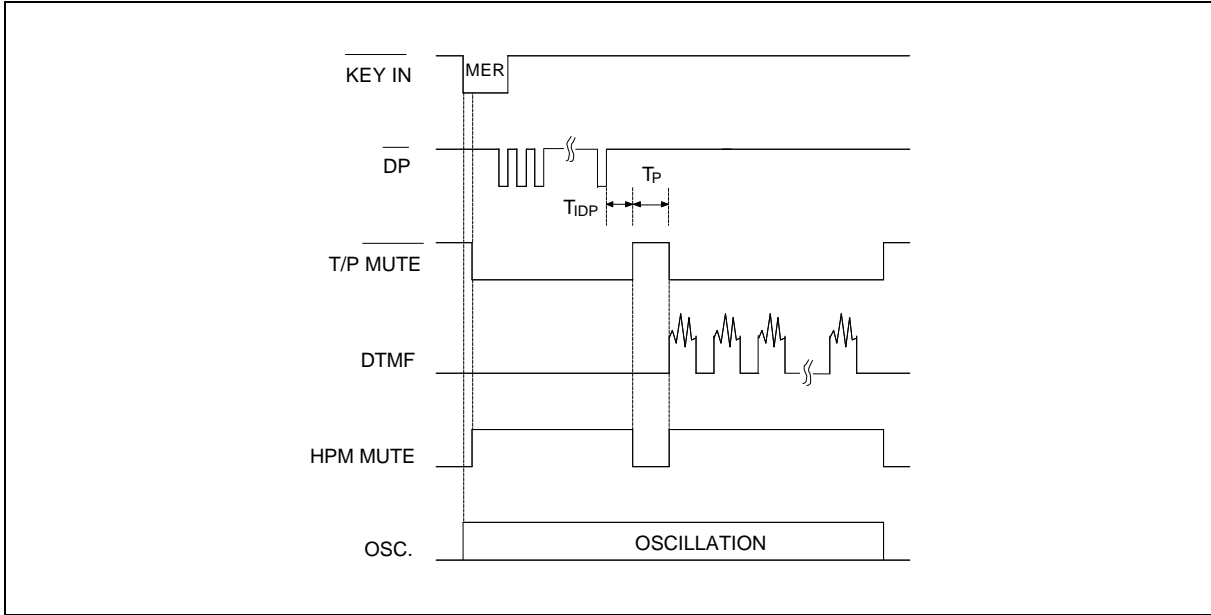
   | Manual Dialing | + | M1 | + | M2 | + | M3 | + | M4 | (over 4 sections, ignore | M4 | and inhibit redial)

4. There is a 2.0 sec. inter-chain dialing pause for cascaded dialing.

MERCURY DIALING

1. Up to 32 digits may be stored.

2. Mercury dialing is activate only as the first key-in after off-hook or when handfree dialing is activated.

3. The timing diagram for the mercury memory function is shown below.

Mercury Function Timing Diagram

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 Temprature	T_{STG}	-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

(V_{DD}–V_{SS} = 2.5V, $F_{OSC.}$ = 3.58 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	-	0.3	0.5	mA
		Pulse	-	0.15	0.3	
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
DTMF Output Voltage	V_{TO}	Row group, R_L = 5K	130	150	170	Vrms
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
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
HPM MUTE Output Sink Current	I_{HPML}	V_{TO} = 0.5V	0.5	-	-	mA
HPM MUTE Output Drive Current	I_{HPMH}	V_{TH} = 2.0V	0.5	-	-	mA
$\overline{HKS}$ I/P Pull High Resistor	R_{KH}		-	300	-	KΩ
Key Tone Output Current	I_{KTH}	V_{KTH} = 2.0V	0.5	-	-	mA
	I_{KTL}	V_{KTH} = 0.5V	0.5	-	-	
HFO Drive/Sink Current	I_{HFH}	V_{HFH} = 2.0V	0.5	-	-	mA
	I_{HFL}	V_{HFL} = 0.5V	0.5	-	-	
Keypad Input Drive Current	I_{KD}	V_I = 0V	30	-	-	µA
Keypad Input Sink Current	I_{KS}	V_I = 2.5V	200	400	-	µA
Keypad Resistance			-	-	5.0	KΩ

AC CHARACTERISTICS

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Keypad Active in Debounce	T_{KID}	-	-	20	-	mS
Key Release Debounce	T_{KRD}	-	-	20	-	mS
Pre-digit Pause[1]	T_{PDP1}	MODE Pin = V_{DD}	-	40	-	mS
	10 ppS	MODE Pin = Floating	-	33.3	-	
Pre-digit Pause[2]	T_{PDP2}	MODE Pin = V_{DD}	-	20	-	mS
	20 ppS	MODE Pin = Floating	-	16.7	-	
Interdigit Pause (Auto dialing)	T_{IDP}	10 ppS	-	800	-	mS
		20 ppS	-	500	-	
Make/Break Ratio	M/B	MODE Pin = V_{DD}	-	40:60	-	%
		MODE Pin = Floating	-	33:67	-	
Tone Output Duration	T_{TD}	Auto Dialing	-	100	-	mS
Intertone Pause	T_{ITP}	Auto Dialing	-	100	-	mS
Flash Break Time	T_{FB}	-	-	98	-	mS
			-	305	-	
			-	600	-	
Pause Time	T_P	-	-	3.6	-	S
Key Tone Frequency	F_{KT}	-	-	600	-	Hz
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

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.

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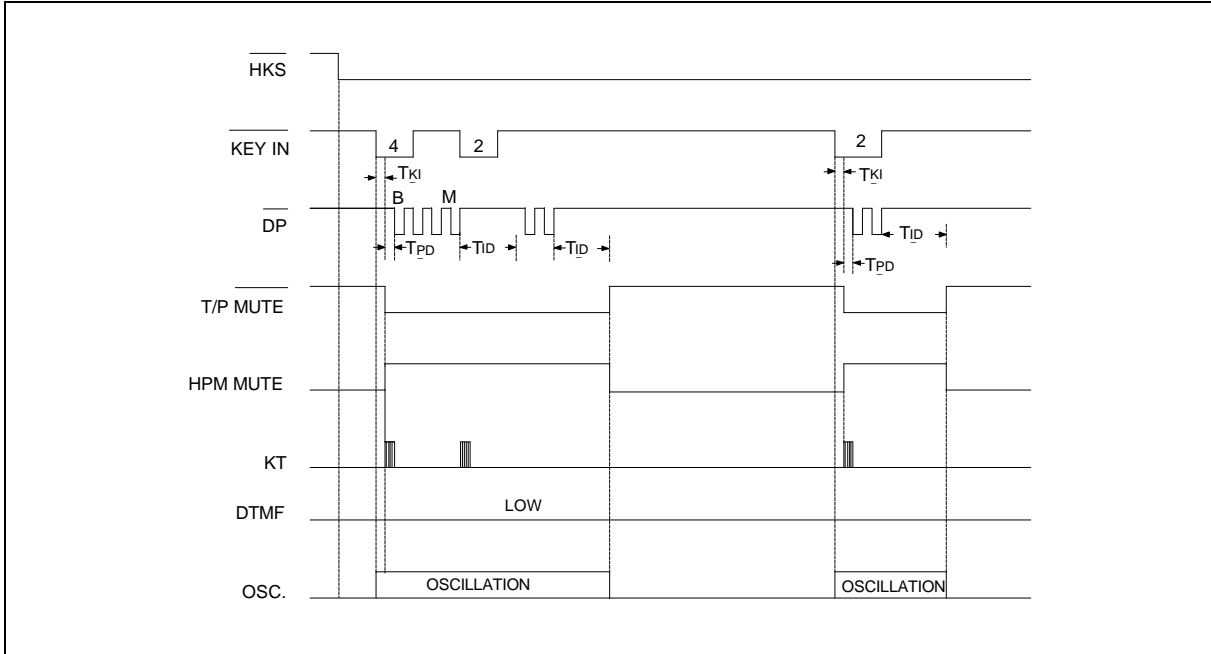
TIMING WAVEFORMS

Figure 1. Pulse Mode Diagram (Normal Dialing)
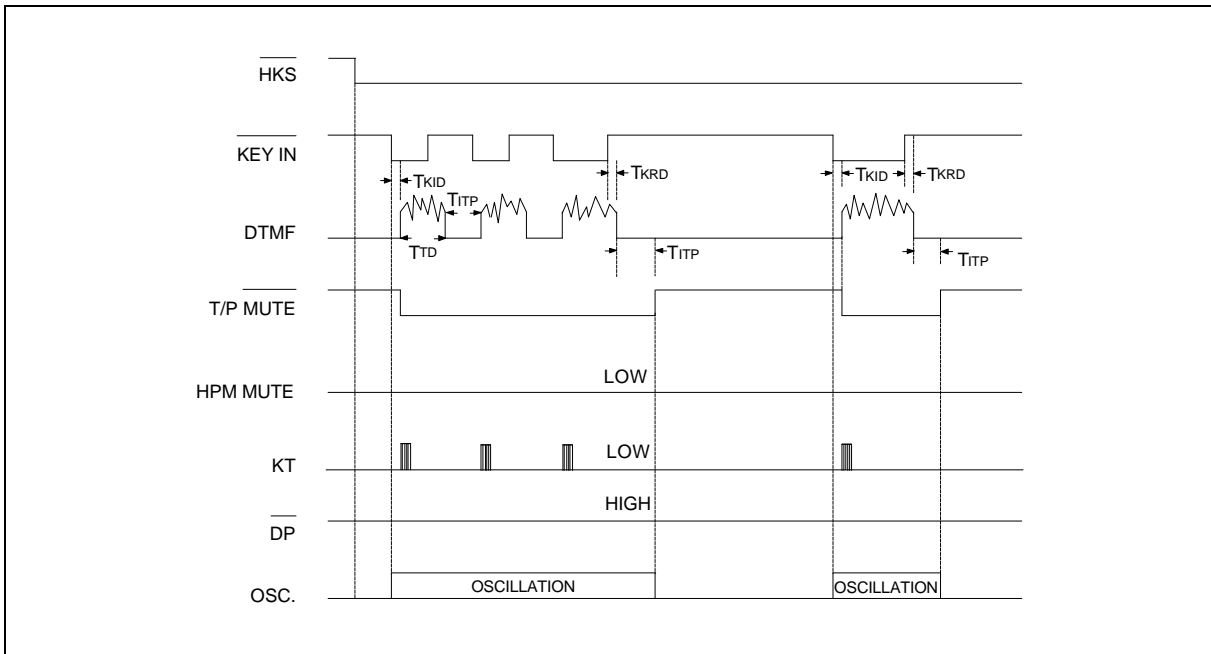
Figure 2. Tone Mode Diagram (Normal Dialing)

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Timing Waveforms, continued
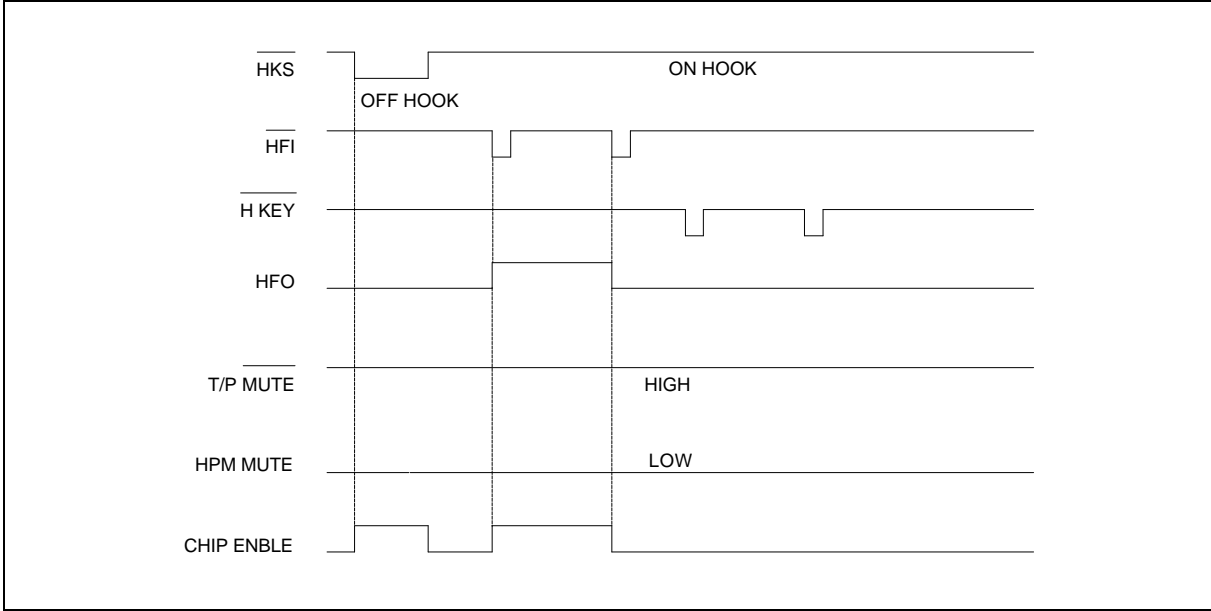
Figure 3(a).

Note: H KEY cannot be enabled when chip is disabled.
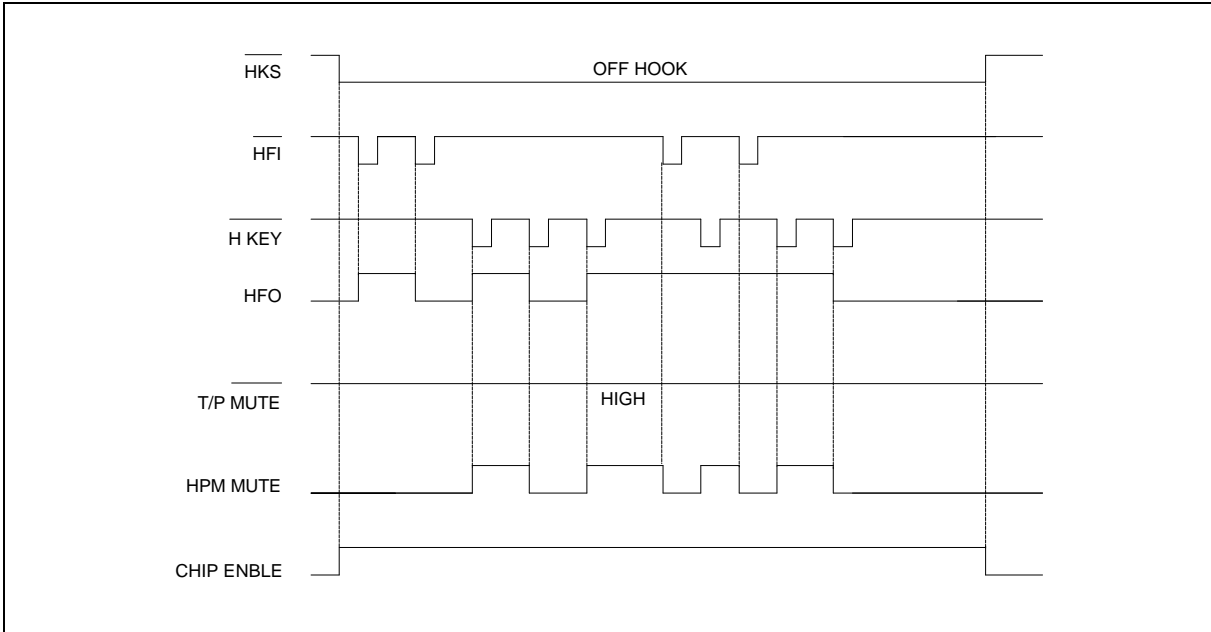
Figure 3(b).

 Note: The HFI and H KEY inputs will toggle the HFO signal; as soon as either HFI or H KEY is activated, the HFO signal will go high and previous inputs will be ignored.

Timing Waveforms, continued
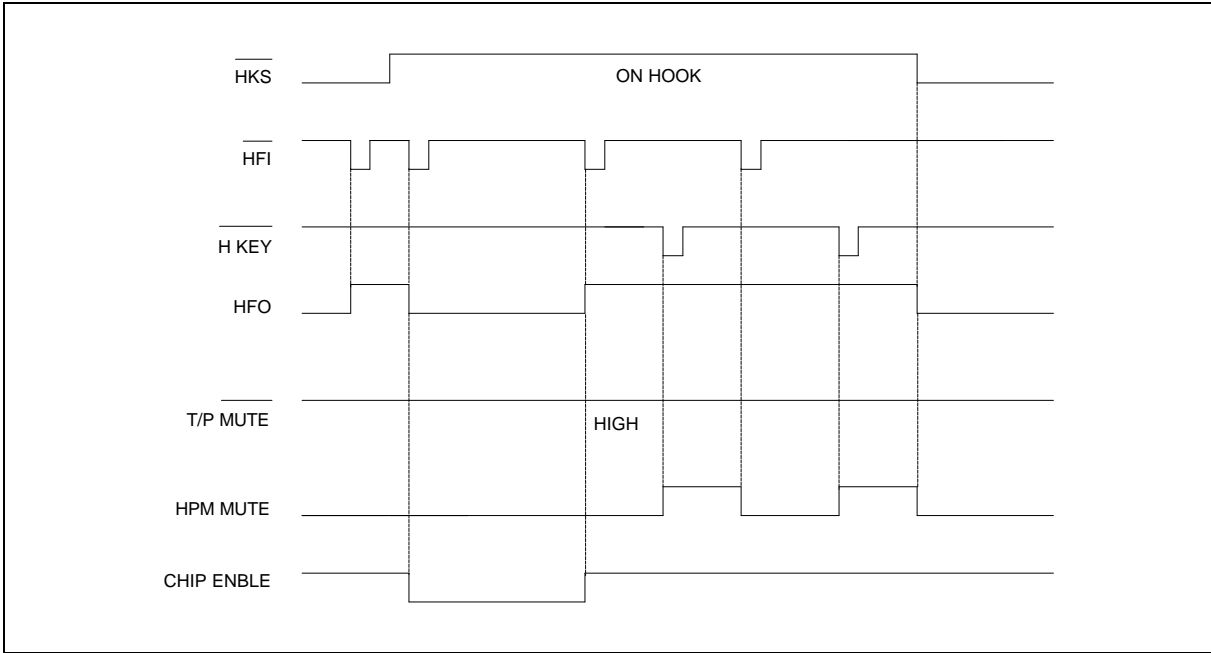
Figure 3(c).

Note: Changing the state of the $\overline{\text{HKS}}$ signal from high to low will initialize the HFO and HPM MUTE signals.
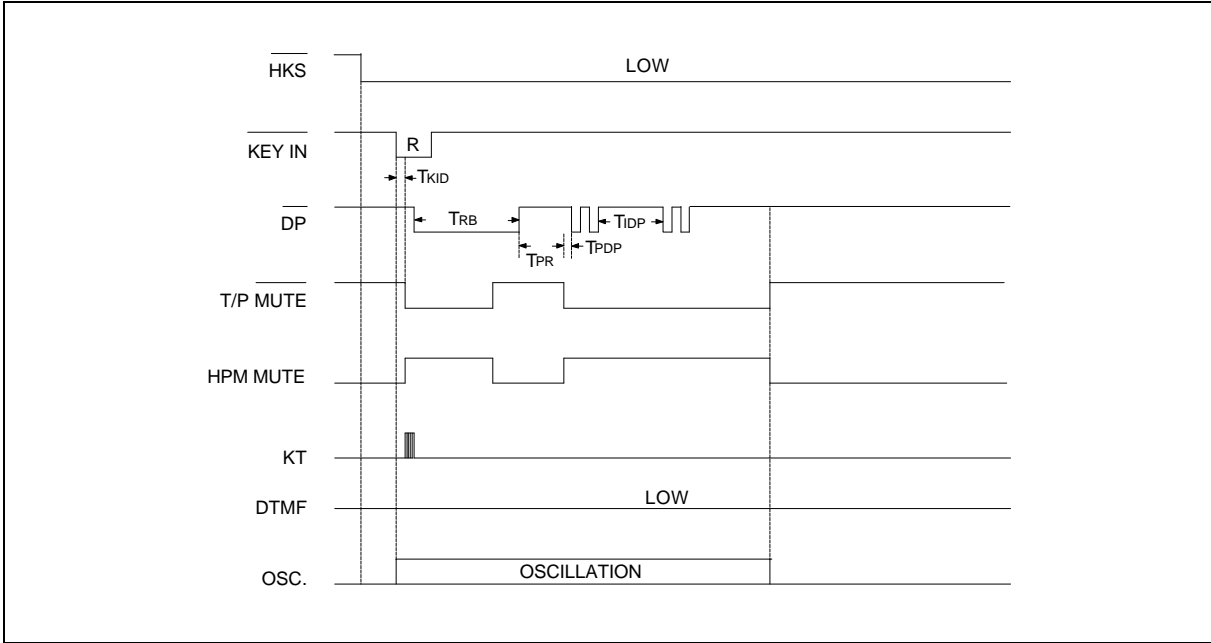
Figure 4. Pulse Mode One-key Redialing Timing Diagram (when not first key)

Timing Waveforms, continued

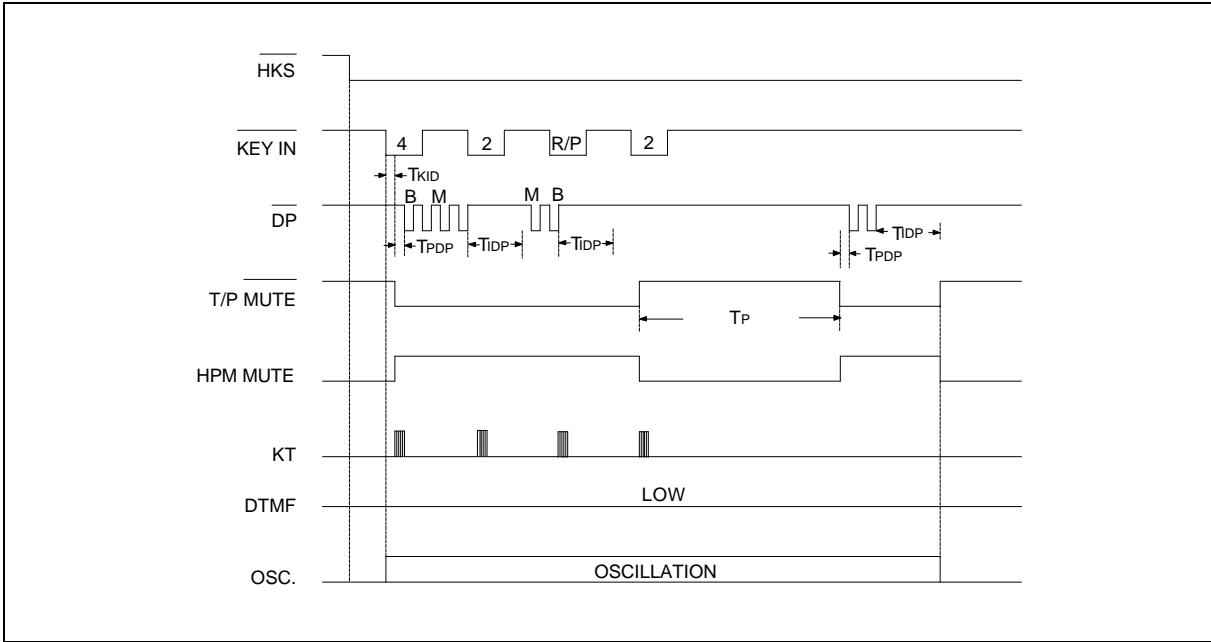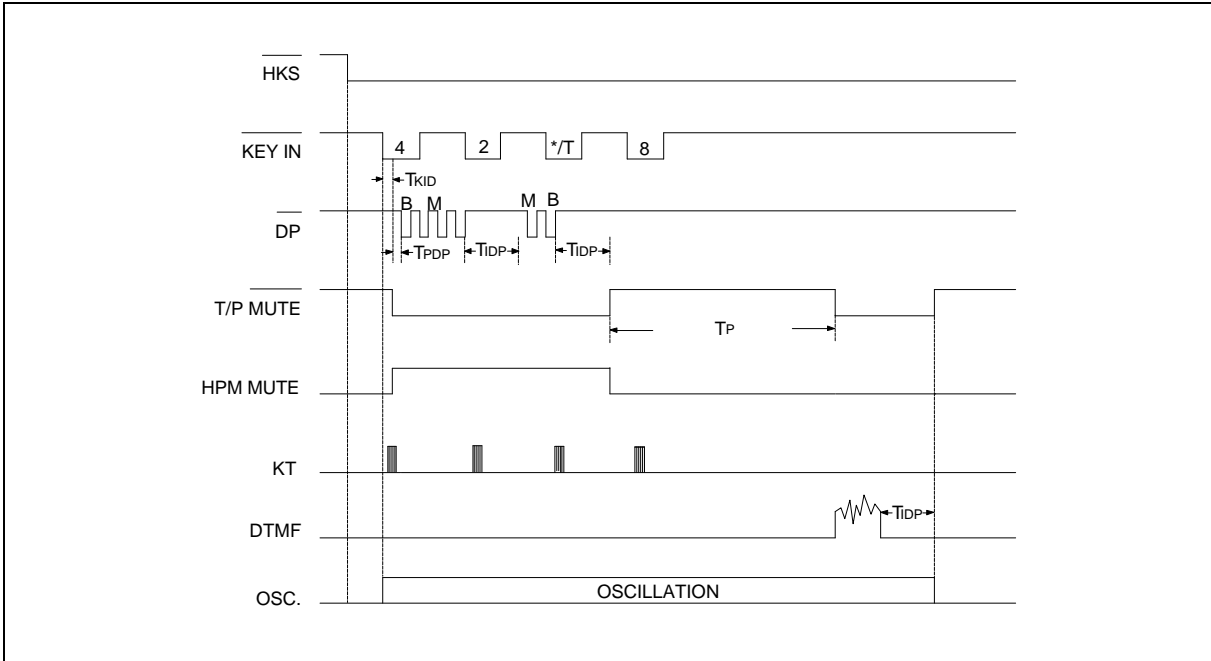Figure 5. Pause Function Timing Diagram

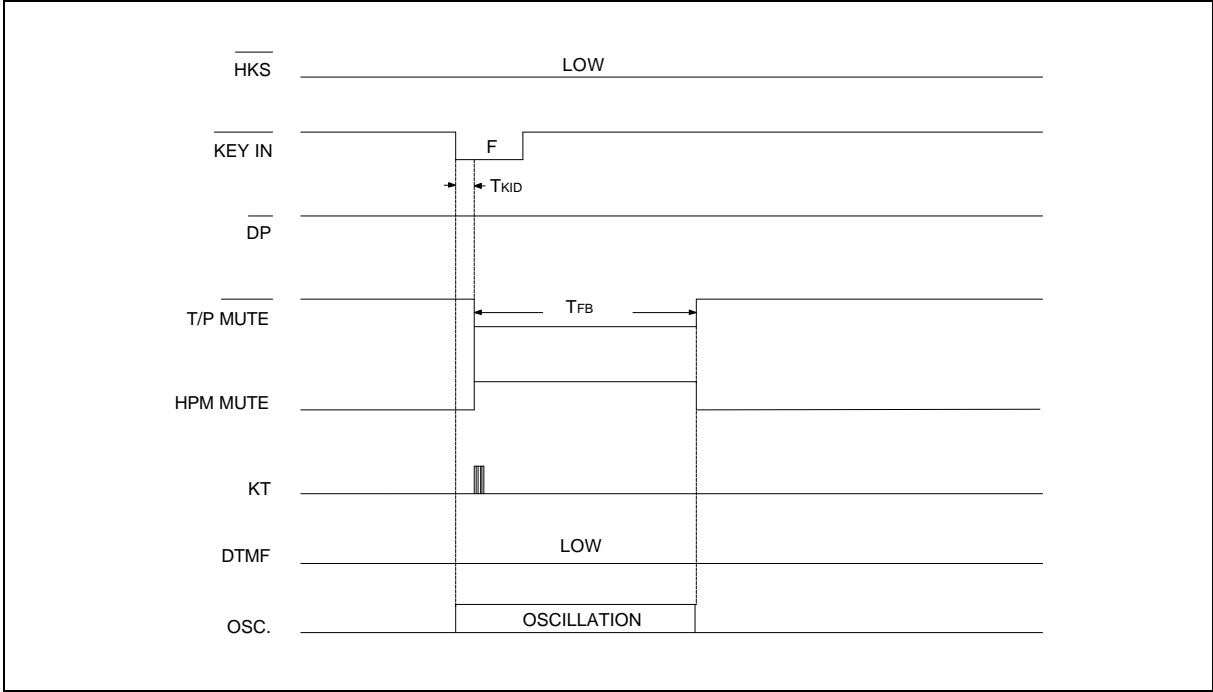
Figure 6. Pulse-to-Tone Function Timing Diagram

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Timing Waveforms, continued

Figure 7. Flash Operation Timing Diagram

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