TONE/PULSE DIALER WITH HANDFREE AND KEYTONE FUNCTIONS AND ONE MEMORY

GENERAL DESCRIPTION

The W91080 series dialers are Si-gate CMOS ICs that provide the necessary signals for either pulse or tone dialing. The W91080 series feature handfree dialing and redial functions and one number memory.

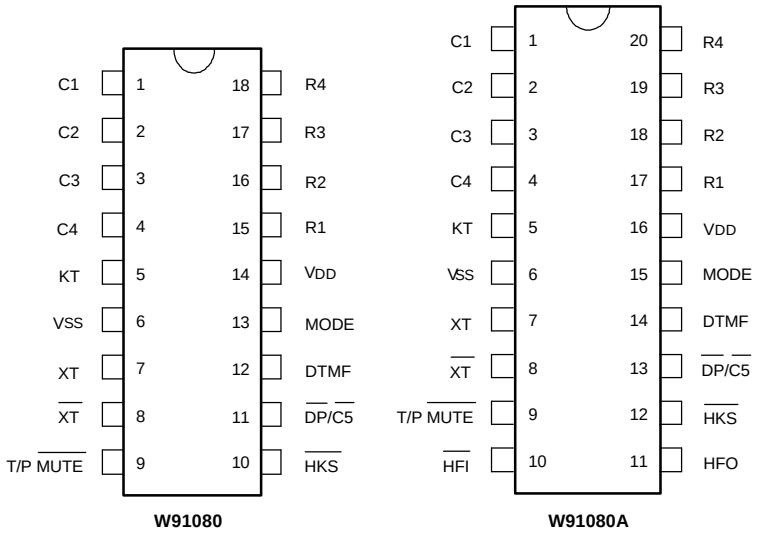
FEATURES

- DTMF/Pulse switchable dialer
- Two by 32 digits for redial memory and one number memory
- Pulse-to-tone (*/T) keypad for long distance call operation
- Uses 4 × 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
- Minimum tone output duration: 100 msec
- Minimum intertone pause: 100 msec
- On-chip power-on reset
- Uses 3.579545 MHz crystal or ceramic resonator
- Packaged in 18 or 20-pin plastic DIP
- The different dialers in the W91080 series are described in the following table:

TYPE NO.	PULSE (ppS)	FLASH (mS)	M/B	HANDFREE DIALING	PACKAGE (PINS)
W91080	10	600/98	Pin	-	18
W91080A	10	600/98	Pin	Yes	20

Publication Release Date: June 1994
Revision A3

PIN CONFIGURATIONS



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 may be from either the standard 4 × 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, $\overline{XT}$	7, 8	7, 8	I, O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.
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 during pulse and tone mode dialing sequences and flash break. Otherwise, it is switched off.
MODE	13	15	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). If the mode pin is left floating, the dialer is in pulse mode (10 ppS, M/B = 1:2).

Pin Description, continued

SYMBOL	18-PIN	20-PIN	I/O	FUNCTION
$\overline{HKS}$	10	12	I	Hook switch input. $\overline{HKS}$ = 1: On-hook state. Chip in sleeping mode, no operation. $\overline{HKS}$ = 0: Off-hook state. Chip enabled for normal operation. This pin must be set in conjunction with $\overline{HFI}$, HFO. Refer to description of $\overline{HFI}$, HFO pins. $\overline{HKS}$ pin is pulled to V_{DD} by internal resistor.
$\overline{DP}/\overline{C5}$	11	13	O	N-channel open drain dialing pulse output (Figure 1). Flash key will cause $\overline{DP}$ to be active in either tone mode or pulse mode.
DTMF	12	14	O	In pulse mode, remains in low state. In tone mode, outputs a dual or single tone. Detailed timing diagram for tone mode is shown in Figure 2 (a, b).
V_{DD}, V_{SS}	14, 6	16, 6	I	Power input pins.

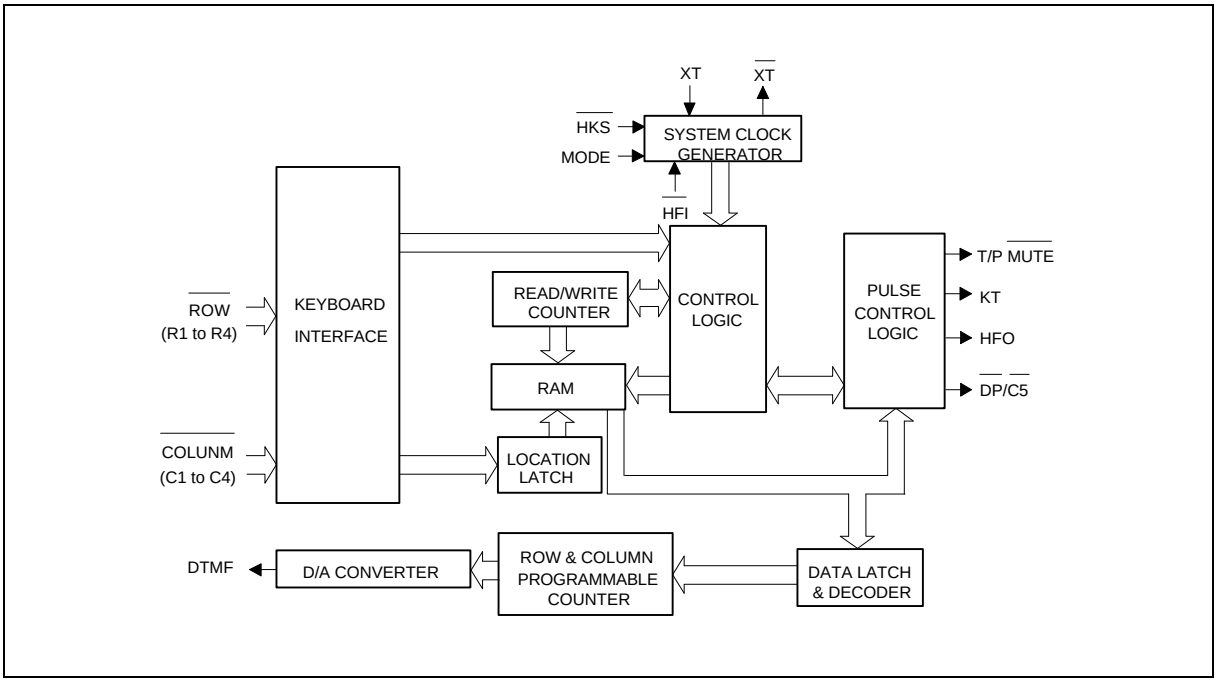
OUTPUT FREQUENCY

	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
$\overline{HFI}$, HFO	-	10, 11	I, O	Handfree control pins. Handfree control state is toggled by a low pulse on the $\overline{HFI}$ input pin. Status of the handfree control state is described in the following table: **CURRENT STATE** / **NEXT STATE** Hook SW. / HFO / Input / HFO / Dialing - / Low / $\overline{HFI}$↓ / High / Yes On Hook / High / $\overline{HFI}$↓ / Low / No Off Hook / High / $\overline{HFI}$↓ / Low / Yes On Hook / - / Off Hook / - / Yes Off Hook / Low / On Hook / Low / No Off Hook / High / On Hook / High / Yes $\overline{HFI}$ is pulled to V_{DD} by an internal resistor.
KT	5	5	O	Key-tone signal output. The key tone will be generated in pulse mode and when operation and function keys (R/P, S, F1, F2, */T) are pressed in tone mode. Frequency is 600 Hz and duration is 35 mS.

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Keyboard Operation

C1	C2	C3	C4	$\overline{DP}/\overline{C5}$	
1	2	3		MEM	R1
4	5	6	F1	S	R2
7	8	9	F2		R3
*/T	0	#	R/P		R4

- S: Store function key
- */T: * & P→T key
- R/P: Redial and pause function key
- F1, F2: Flash keys
- MEM: Memory function key

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 oversteps 32 digits.

Redialing

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 executes the pause function.

Number Store

OFF HOOK , D1 , D2 , ..., Dn , S , S , MEM

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

   OFF HOOK , S , D1 , D2 , ..., Dn , S , MEM

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

3. [R/P] and [P→T] keys can be stored as a digit in memory, but [R/P] key cannot be the first digit.

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

Repertory Dialing

[OFF HOOK] (or [ON HOOK] & [HFI ¡õ_]), [MEM]

The contents of MEM will be dialed out.

Access Pause

[OFF HOOK] (or [ON HOOK] & [HFI ¡õ_]), [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 3.

Pulse to Tone (*/ T)

[OFF HOOK] (or [ON HOOK] & [HFI ¡õ_]), [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 4.

Flash (F = F1 or F2)

[OFF HOOK] (or [ON HOOK] & [HFI ¡õ_]), [F]

1. The flash key cannot be stored as a digit in memory. The flash key 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 5.

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 +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	-	0.4	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
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	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

DC Characteristics, continued

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
T/P $\overline{\text{MUTE}}$ Output Sink Current	I_{ML}	V_{MO} = 0.5V	0.5	-	-	mA
$\overline{\text{HKS}}$ I/P Pull-High Resistor	R_{KH}		-	300	-	KΩ
KT Drive/Sink Current	I_{KTH}	V_{KTH} = 2.0V	-0.5	-	-	mA
	I_{KTL}	V_{KTL} = 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 = 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	T_{PDP}	Mode Pin = 1	-	40	-	mS
	10 ppS	Mode Pin = Floating	-	33.3	-	mS
Interdigit Pause (Auto dialing)	T_{IDP}	10 ppS	-	800	-	mS
Make/Break Ratio	M/B	Mode Pin = 1	-	40:60	-	%
		Mode Pin = Floating	-	33:67	-	%
DTMF Output Duration	T_{TD}	Auto Dialing	-	100	-	mS
Intertone Pause	T_{ITP}	Auto Dialing	-	100	-	mS
Flash Break Time	T_{FB}	F2	-	98	-	mS
		F1	-	600	-	mS
KT Duration Time	T_{KT}		-	35	-	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

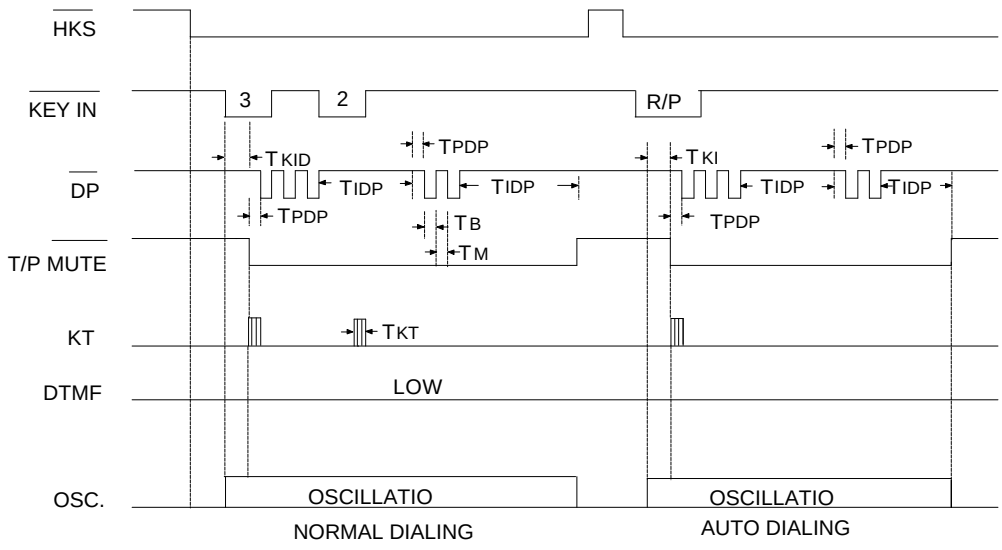


Figure 1. Pulse Mode Timing Diagram

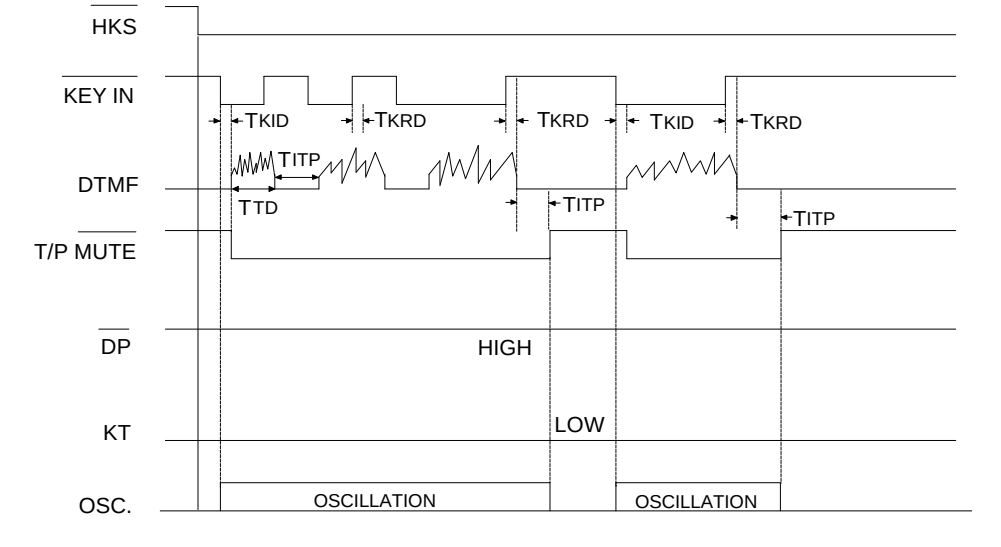


Figure 2(a). Tone Mode Normal Dialing Timing Diagram

Timing Waveforms, continued

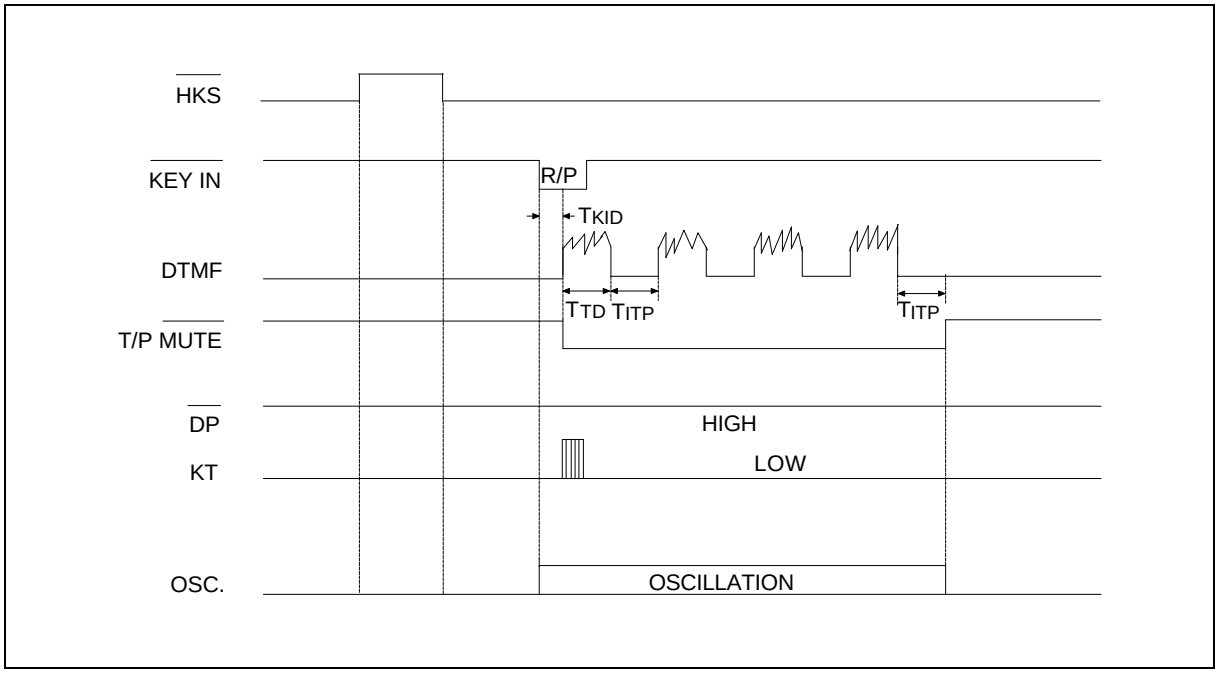


Figure 2(b). Tone Mode Auto Dialing Timing Diagram

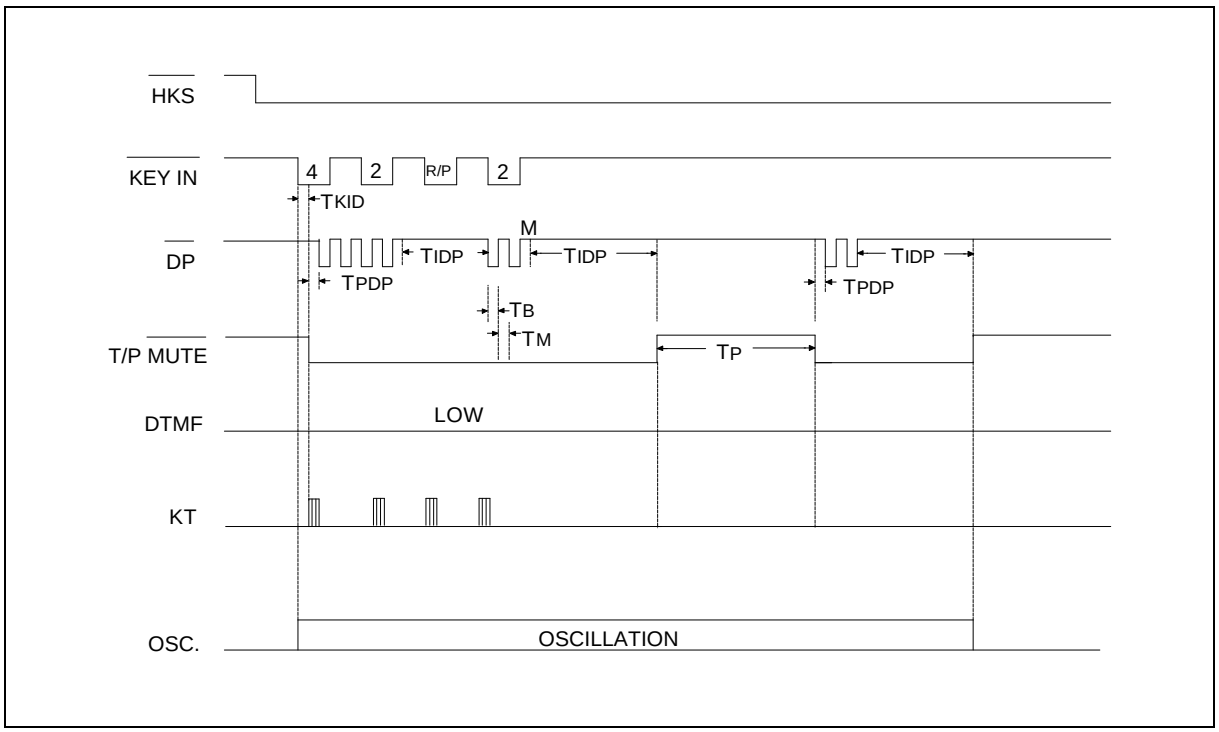


Figure 3. Pause Function Timing Diagram

Timing Waveforms, continued

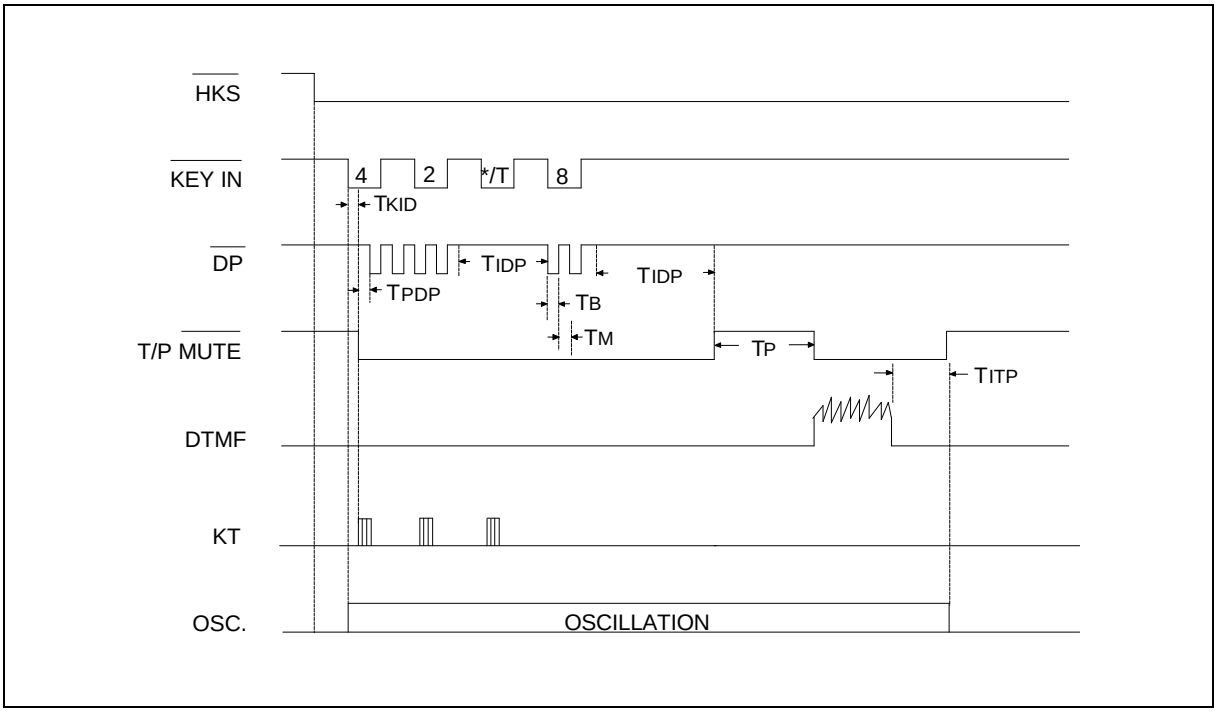


Figure 4. P→T Operation Timing Diagram in Normal Dialing

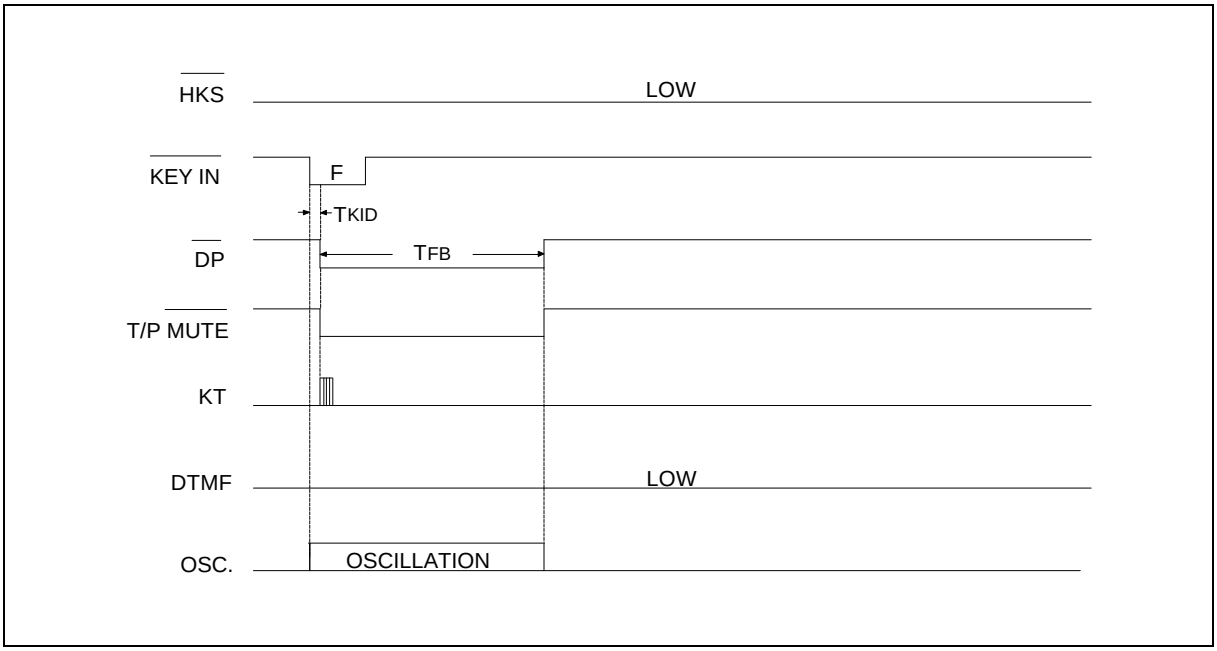


Figure 5. Flash Operation Timing Diagram

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