TONE/PULSE DIALER WITH REDIAL FUNCTION

GENERAL DESCRIPTION

The W91210 series are Si-gate CMOS ICs that provide the necessary signals for either pulse or tone dialing. The W91210 series features a redial function.

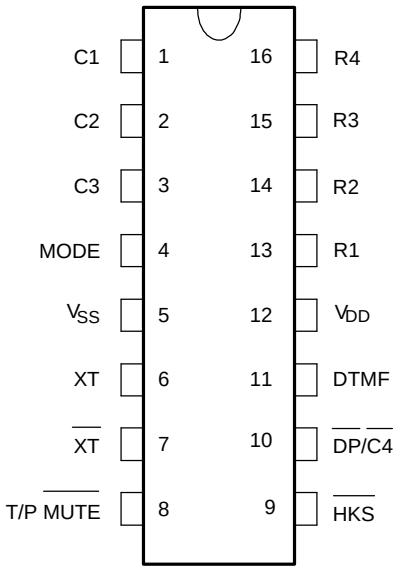
FEATURES

- DTMF/Pulse switchable dialer
- One by 32 digits for redial memory
- Pulse-to-tone (*/T) keypad for long distance call operation
- Uses 4 × 4 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: 87 mS
- Minimum intertone pause: 87 mS
- Flash time (100 mS, 300 mS or 600 mS) selectable by keypad
- Pause time 3.6 sec or 2.0 sec
- On-chip power-on reset
- Uses 3.579545 MHz crystal or ceramic resonator
- Packaged in 16-pin plastic DIP
- The different dialers in the W91210 series are described in the following table:

TYPE NO.	PULSE (ppS)	FLASH (mS)	PAUSE TIME (S)	M/B	PULSE-TO-TONE PAUSE TIME
W91212	10	100/300/600	3.6	Pin	Yes
W91214/A	10	100/300/600	3.6/2.0	Pin	No
W91216	10	100/300/600	3.6	Pin	Yes

Note: W91214 designed for use in France, W91216 for Germany.

PIN CONFIGURATION



W91212/W91214/W91214A/W91216

PIN DESCRIPTION

SYMBOL	16-PIN	I/O	FUNCTION
Column-Row Inputs	1–3 & 13–16	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 μC can also be used. A valid key entry is defined by a single row being connected to a single column.
XT, $\overline{XT}$	6, 7	I, O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.
T/P $\overline{MUTE}$	8	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	4	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).

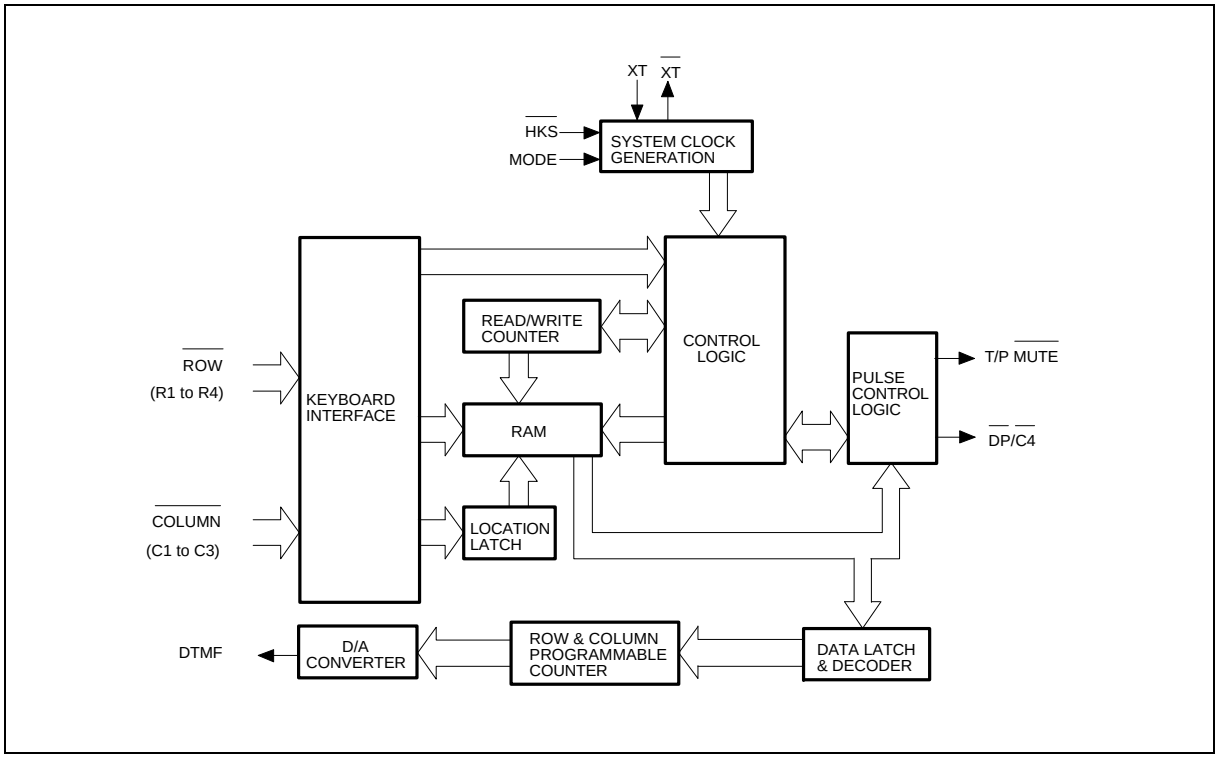
Pin Description, continued

SYMBOL	16-PIN	I/O	FUNCTION
$\overline{HKS}$	9	I	Hook switch input. $\overline{HKS}$ = 1: On-hook state. Chip in sleep mode, no operation. $\overline{HKS}$ = 0: Off-hook state. Chip enabled for normal operation. $\overline{HKS}$ pin is pulled to V_{DD} by internal resistor.
$\overline{DP}/\overline{C4}$	10	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	11	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}	12, 5	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

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Keyboard Operation

C1	C2	C3	$\overline{DP}/\overline{C4}$	
1	2	3	F1	R1
4	5	6	F2	R2
7	8	9	F3	R3
*/T	0	#	R/P	R4

- */T: * and P→T key
- R/P: Redial and pause function key
- F1, F2, F3: Flash keys

Normal Dialing

OFF HOOK , 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 , 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.

Access Pause

OFF HOOK , 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 , 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)

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(a, b).

Flash

OFF HOOK , F

1. The flash key cannot be stored as a digit in memory. The flash key has first priority among the keyboard functions.
2. The system will return to the initial state after the flash pause time is finished.
3. The flash function timing diagram is shown in Figure 5.

   OFF HOOK , F , D1 , D2 , D3 , ..., Dn

   LNB = D1, D2, D3, ..., Dn

   OFF HOOK , D1 , D2 , F , D3 , ..., Dn

   LNB = D3, ..., Dn

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, Fosc. = 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	-	0.30	1.0	mA
		Pulse	-	0.15	0.5	mA
Standby Current	I_{SB}	$\overline{HKS}$ = 0, No load & No key enry	-	-	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	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_{ML}	V_{MO} = 0.5V	0.5	-	-	mA
$\overline{HKS}$ I/P Pull-High Resistor	R_{KH}		-	300	500	KΩ
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 = V_{DD}	-	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 = V_{DD}	-	40:60	-	%
		Mode Pin = Floating	-	33:67	-	%
DTMF Output Duration	T_{TD}	Auto Dialing	85	87	-	mS
Intertone Pause	T_{ITP}	Auto Dialing	85	87	-	mS
Flash Break Time	T_{FB}	F1	-	100	-	mS
		F2	-	300	-	
		F3	-	600	-	
Flash Pause Time	T_{FP}	F1	-	1.0	-	S
		F2	-	1.0	-	
		F3	-	1.0	-	
Pause Time	T_P	W91212/214/216	-	3.6	-	S
		W91214A	-	2.0	-	

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

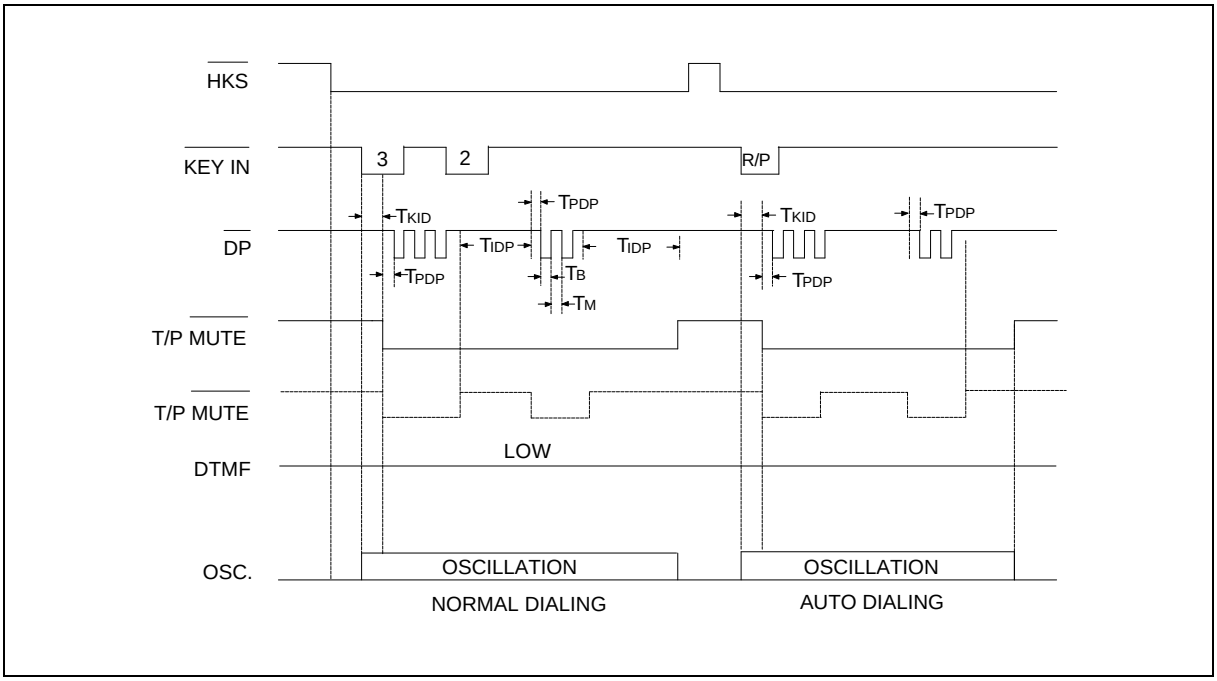


Figure 1. Pulse Mode Timing Diagram

Note: The dashed line is for W91216 only in pulse mode.

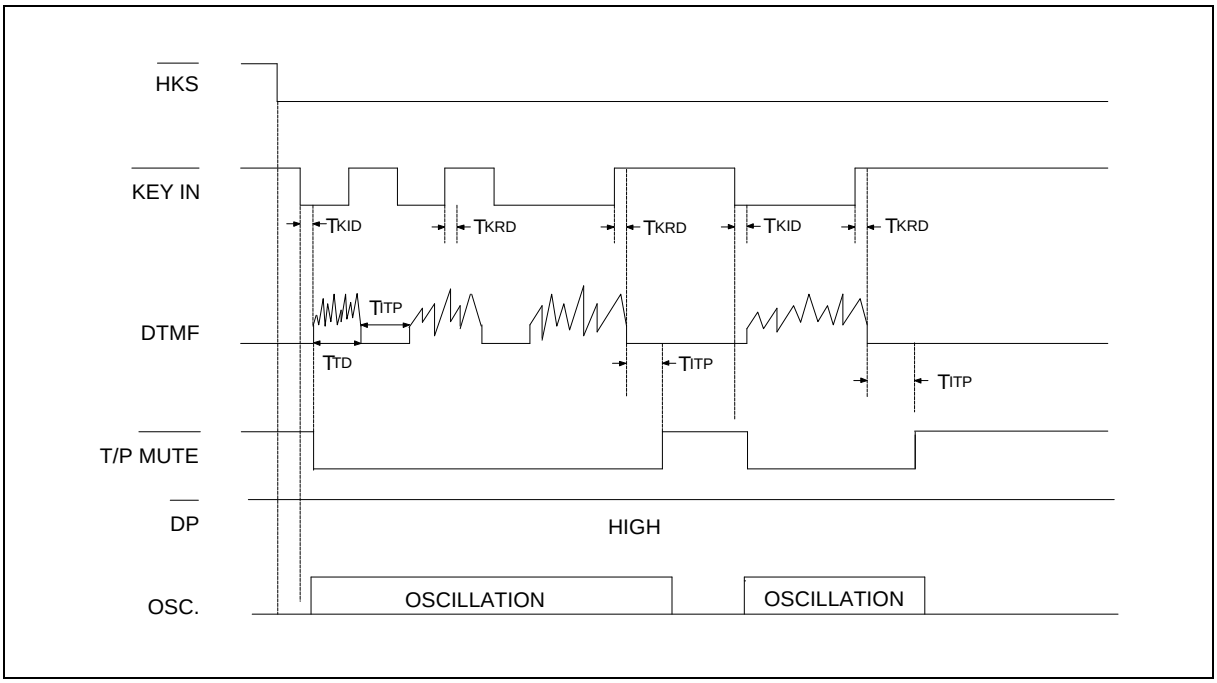


Figure 2(a). Tone Mode Normal Dialing Timing Diagram

Timing Waveforms, continued

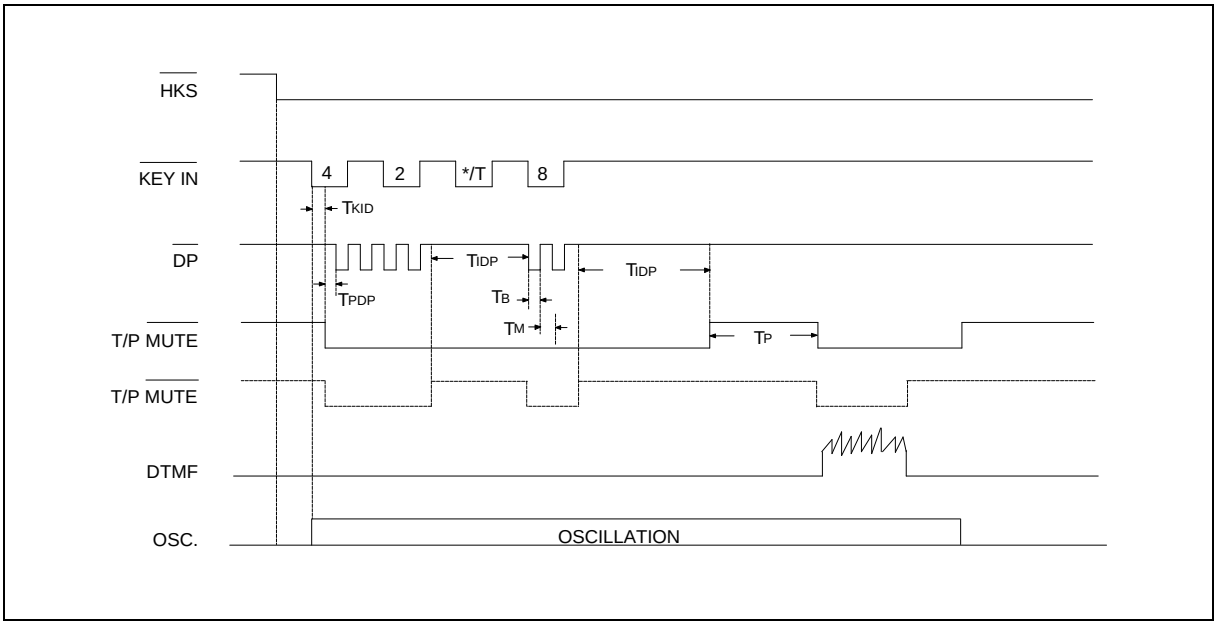


Figure 4(a). P→T Operation Timing Diagram in Normal Dialing (W91212, W91216)

Note: The dashed line is for W91216 only.

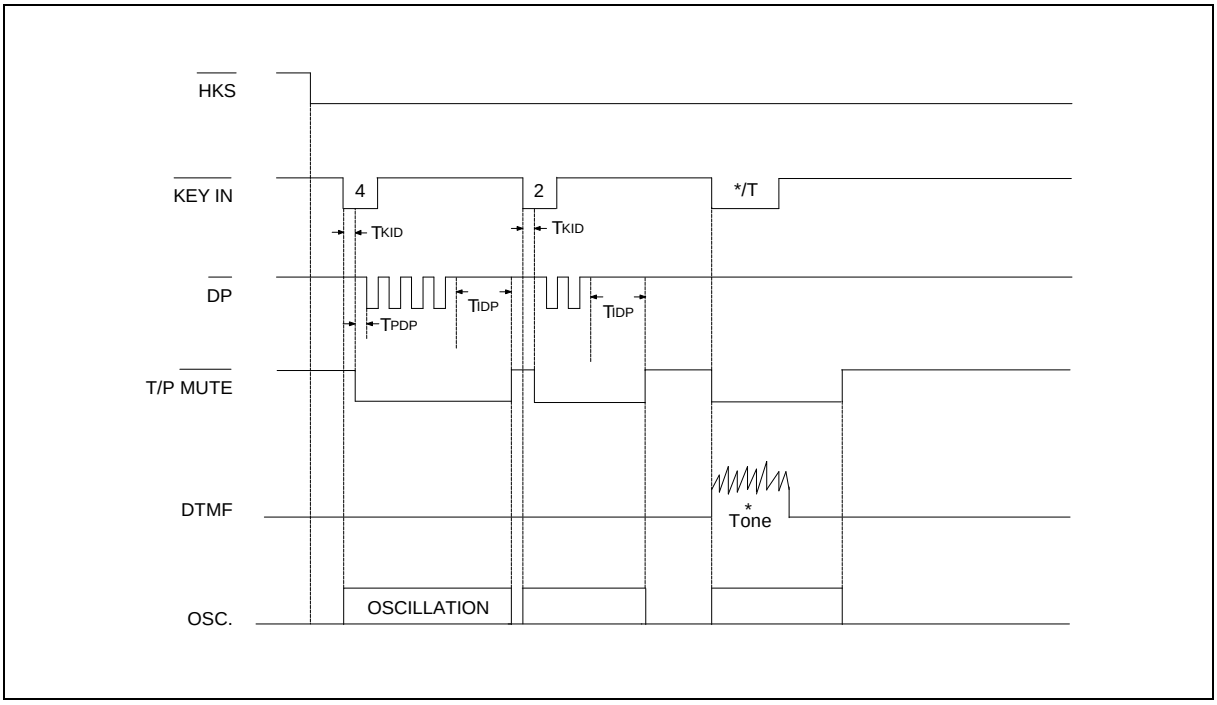


Figure 4(b). P→T Operation Timing Diagram in Normal Dialing (for W91214/W91214A)

Timing Waveforms, continued

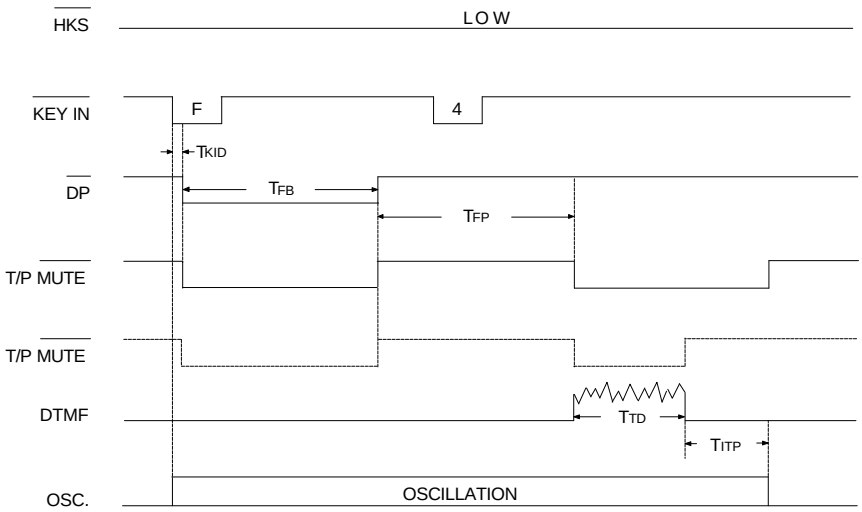


Figure 5. Flash Operation Timing Diagram

Note: The dashed line is for W91216 only.

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