



## U9131X

Preliminary

CMOS IC

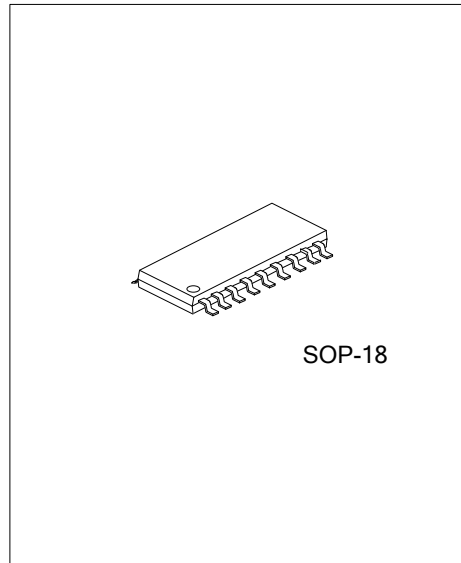
### TONE/PULSE DIALER WITH REDIAL FUNCTION

#### DESCRIPTION

The UTC **U9131X** series are monolithic ICs that offer the dialing signals in either pulse or tone mode. The UTC **U9131X** series feature a redial memory.

#### FEATURES

- \* Uses 4×4 keyboard
- \* Pulse-to-tone (P→T) keypad for long distance call operation
- \* Easy operation with redial, flash, pause, and P→T keypads
- \* 32 digits for redial memory
- \* Flash, Pause, P→T (pulse-to-tone) can be stored as a digit in memory
- \* Switchable dialing mode: DTMF/Pulse
- \* Switchable beak/make ratio
- \* Minimum tone output duration: 100mS
- \* Minimum intertone pause: 100mS
- \* On-chip power-on reset
- \* Uses 3.579545MHz crystal or ceramic resonator



#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
U9131XL-S18-T	U9131XG-S18-T	SOP-18	Tube
U9131XL-S18-R	U9131XG-S18-R	SOP-18	Tape Reel
U9131XAL-S18-T	U9131XAG-S18-T	SOP-18	Tube
U9131XAL-S18-R	U9131XAG-S18-R	SOP-18	Tape Reel

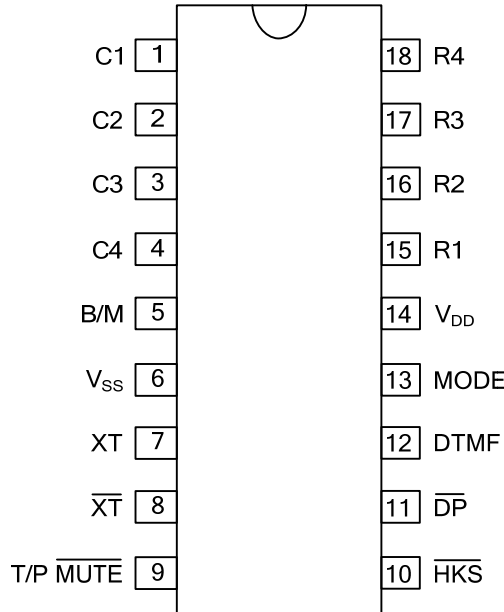
<p>U9131XAL-S18-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Free (4)Dialer Type</p>	<p>(1) T: Tube, R: Tape Reel (2) S18: SOP-18 (3) L: Lead Free, G: Halogen Free (4) refer to DIALER TYPE</p>
--	---

#### DIALER TYPE

The different dialers in the UTC **U9131X** series are shown in the following table:

TYPE NO.	PULSE (ppS)	FLASH (mS)	FLASH PAUSE (mS)	PAUSE (S)
U91312	10/20	600	600	2.0
U91314	10/20	73	140	3.6
U91316	10/20	600	600	3.6
U91312A	10/20	300	300	2.0
U91314A	10/20	100	100	3.6

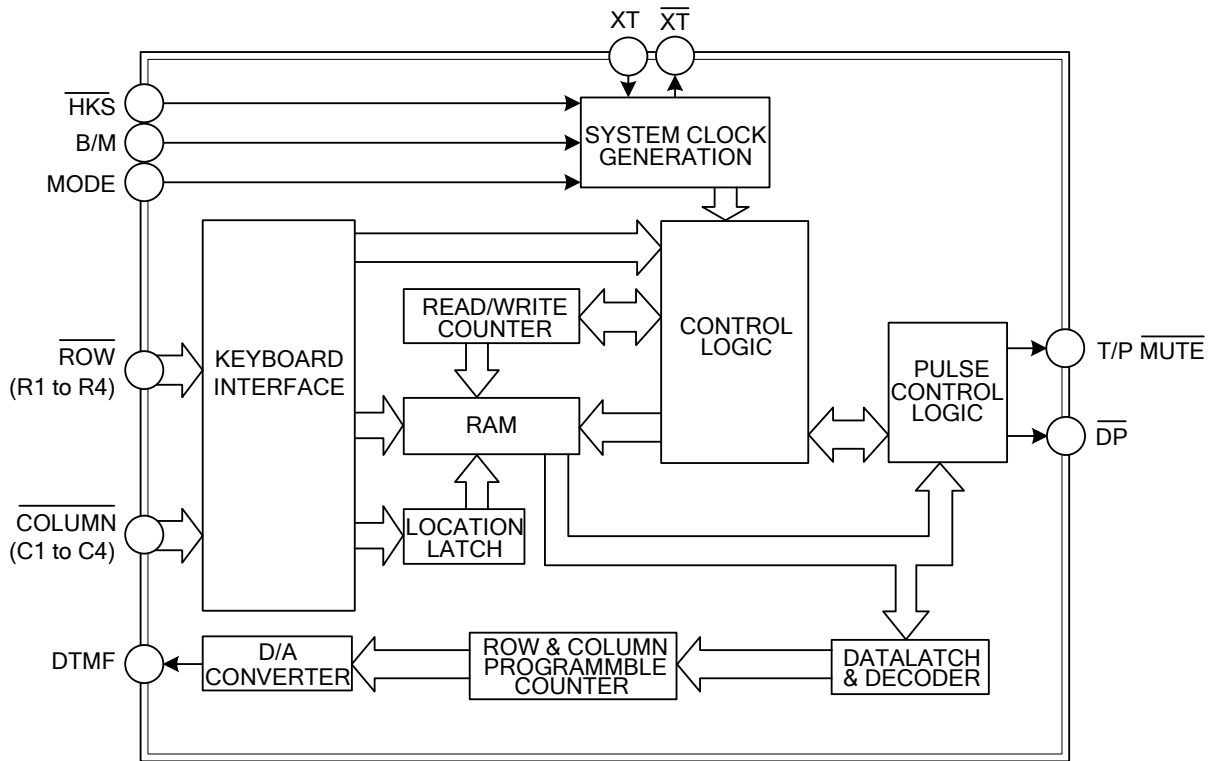
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION																																				
1-4 & 15-18	Column-Row Inputs	The keyboard input may be from either the standard 4×4 keyboard or an inexpensive single contact (from A) keyboard. Electronic input from a μC can also be used. A valid key entry is defined as a single row being connected to a single column.																																				
5	B/M	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.																																				
7, 8	XT, XT̄	A built-in inverter provides oscillation with an inexpensive 3.579545MHz crystal or ceramic resonator.																																				
9	T/P MUTĒ	The T/P MUTĒ 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.																																				
13	MODE	Pulling mode pin to V <sub>SS</sub> places the dialer in tone mode. Pulling mode pin to V <sub>DD</sub> places the dialer in pulse mode (10ppS). Leaving mode pin floating places the dialer in pulse mode (20ppS).																																				
10	HKS̄	Hook switch input. HKS̄=1: On-book state. Chip in sleeping mode, no operation. HKS̄=0: Off-book state. Chip enabled for normal operation. The HKS pin is pulled to V <sub>DD</sub> by an internal resistor.																																				
11	DP̄	N-channel open drain dialing pulse output (Figure 1). Flash key will cause DP̄ to go active in both pulse mode and tone mode.																																				
12	DTMF	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-left: 20px;"> <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
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																																			
14, 6	V <sub>DD</sub> , V <sub>SS</sub>	Power input pins.																																				

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
DC Supply Voltage	$V_{DD}-V_{SS}$	-0.3~+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~+70	°C
Storage Temperature	$T_{STG}$	-55~+125	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ DC CHARACTERISTICS ( $V_{DD}-V_{SS}=2.5V$ ,  $F_{OSC}=3.58MHz$ ,  $T_A=25^\circ C$ , all outputs unloaded)

PARAMETER	SYMBOL	TEST 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	mA
Standby Current	$I_{SB}$	HKS=0, No load, & No key entry			15	$\mu A$
Memory Retention Current	$I_{MR}$	HKS=1, $V_{DD}=1.0V$			0.2	$\mu A$
DTMF Output Voltage	$V_{TO}$	Row group, $R_L=5K\Omega$	130	150	170	mVrms
Pre-emphasis		Col/Row, $V_{DD}=2.0\sim 5.5V$	1	2	3	dB
DTMF Distortion	$T_{HD}$	$R_L=5K\Omega$ , $V_{DD}=2.0\sim 5.5V$		-30	-23	dB
DTMF Output DC Level	$V_{TDC}$	$R_L=5K\Omega$ , $V_{DD}=2.0\sim 5.5V$	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 MUTE Output Sink Current	$I_{ML}$	$V_{MO}=0.5V$	0.5			mA
HKS I/P Pull-high Resistor	$R_{KH}$			300		K $\Omega$
Keypad Input Drive Current	$I_{KD}$	$V_I=0V$	30			$\mu A$
Keypad Input Sink Current	$I_{KS}$	$V_I=2.5V$	200	400		$\mu A$
Keypad Resistance					5.0	K $\Omega$

■ AC CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Keypad Active in Debounce	$T_{KID}$			20		mS
Key Release Debounce	$T_{KRD}$			20		mS
Pre-digit Pause (Note 1)	$T_{PDP1}$	B/M=1		40		mS
		10ppS B/M=0		33.3		
Pre-digit Pause (Note 2)	$T_{PDP2}$	B/M=1		20		mS
		20ppS B/M=0		16.7		
Interdigit Pause (Auto dialing)	$T_{IDP}$	10ppS		800		mS
		20ppS		500		
Make/Break Ratio	M/B	B/M=1		40:60		%
		B/M=0		33:67		
DTMF Output Duration	$T_{TD}$	Auto Dialing		100		mS
Intertone Pause	$T_{ITP}$	Auto Dialing		100		mS
Flash Break Time	$T_{FB}$	U91314		73		mS
		U91314A		100		
		U91312A		300		
		U91312/U91316		600		
Flash Pause Time	$T_{FP}$	U91314A		100		mS
		U91314		140		
		U91312A		300		
		U91312/U91316		600		
Pause Time	$T_P$	U91312		2.0		S
		U91314/A/U91316		3.6		

Notes: 1. Crystal parameters suggested for proper operation are  $R_s < 100\Omega$ ,  $L_m = 96mH$ ,  $C_m = 0.02pF$ ,  $C_n = 5pF$ ,  $C_i = 18pF$ ,  $F_{OSC} = 3.579545MHz \pm 0.02\%$ .

2. Crystal oscillator accuracy directly affects these times.

## FUNCTIONAL DESCRIPTION

### Keyboard Operation

	C1	C2	C3	C4
R1	1	2	3	
R2	4	5	6	F
R3	7	8	9	P→T
R4	*	0	#	R/P

\* R/P: Redial and pause function key

\* F: Flash key

\* P→T: Pulse mode to tone mode

### Normal Dialin

[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 [RP] Key can execute redial function only as the first key-in after off-hook; otherwise, it will execute 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 or memory dialing.
3. The pause function timing diagram is shown in Figure 3.

### Pulse-To-Tone (P→T)

[OFF HOOK], [D1], [D2], ..., [Dn], [R→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, [P→T] D1', D2', ..., Dn'  
(Pulse) (Pause) (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

[OFF HOOK], [F]

1. Flash key can be stored as a digit in memory.
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.

■ TIMING WAVEFORMS

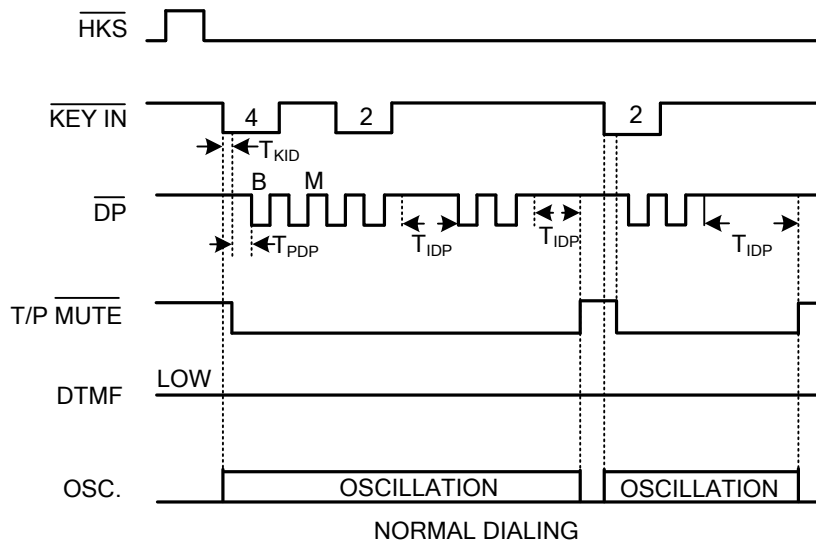


Fig 1 (a). Pulse Mode Timing Diagram

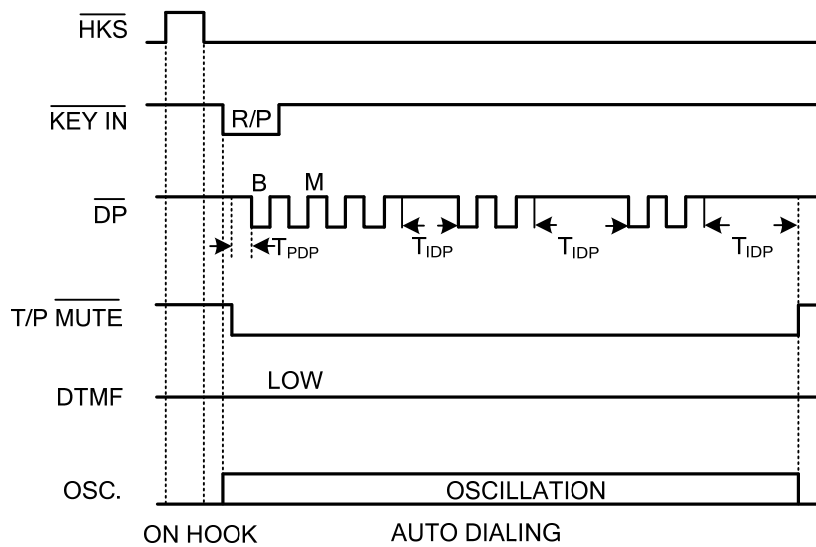


Fig. 1 (b). Pulse Mode Timing Diagram

■ TIMING WAVEFORMS(Cont.)

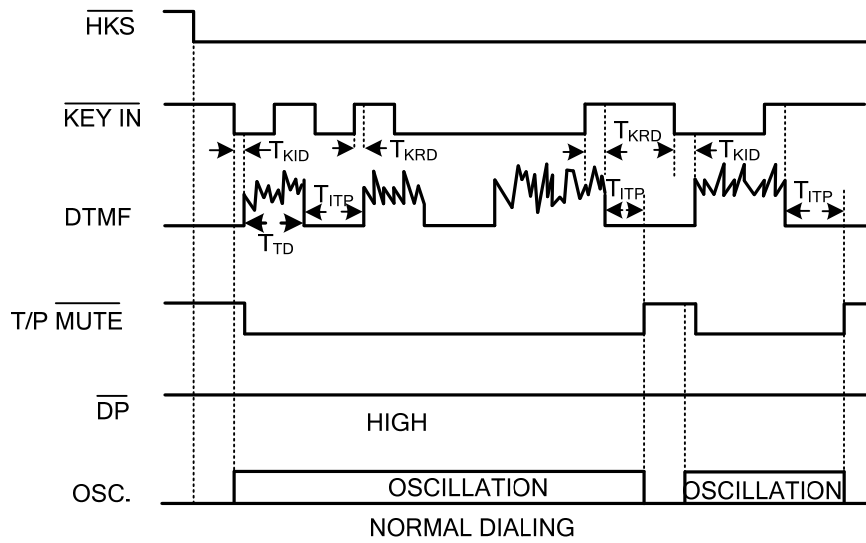


Fig. 2 (a). Tone Mode Timing Diagram

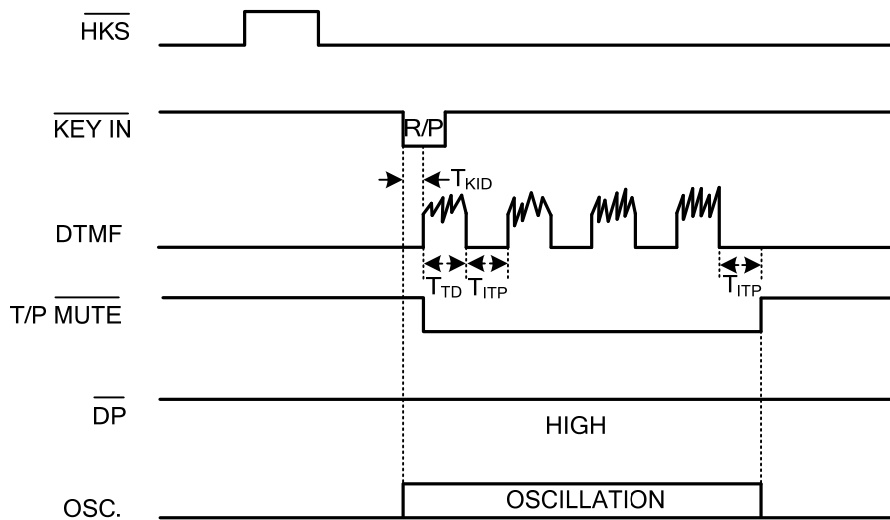


Fig. 2 (b). Tone Mode Auto Dialing Timing Diagram



■ TIMING WAVEFORMS(Cont.)

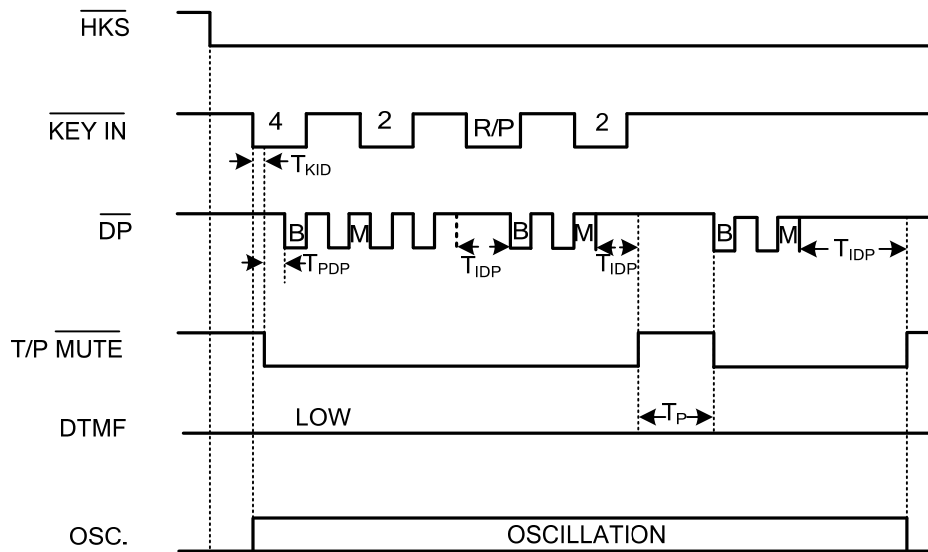


Fig. 3 Pulse Function Timing Diagram

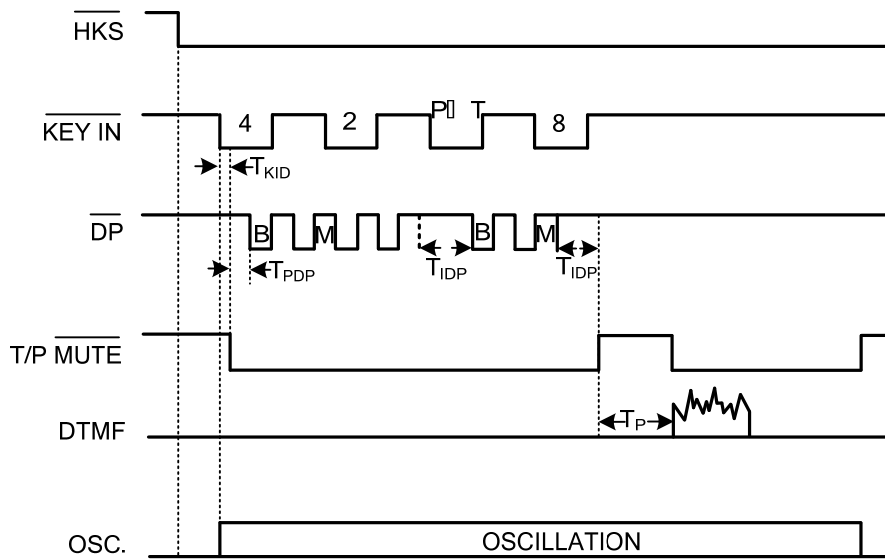


Fig. 4 Pulse-to-tone Function Timing Diagram

■ TIMING WAVEFORMS(Cont.)

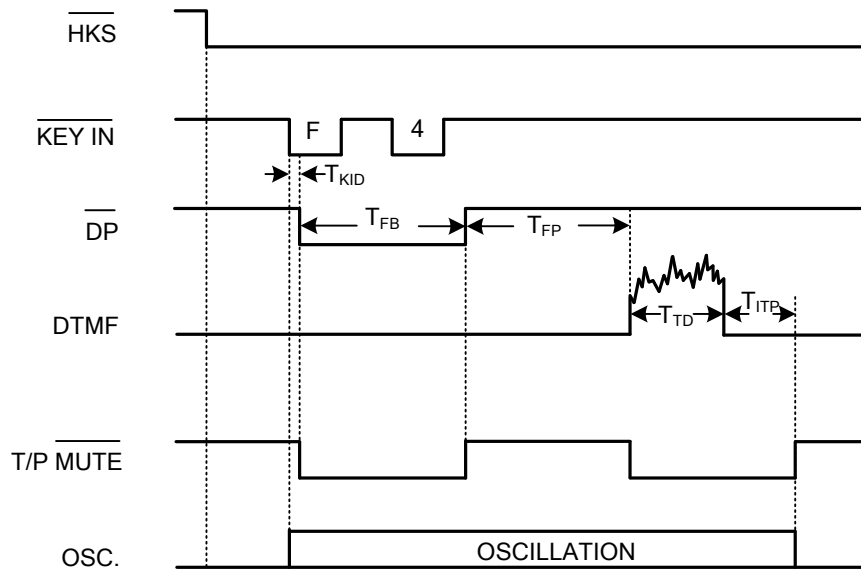
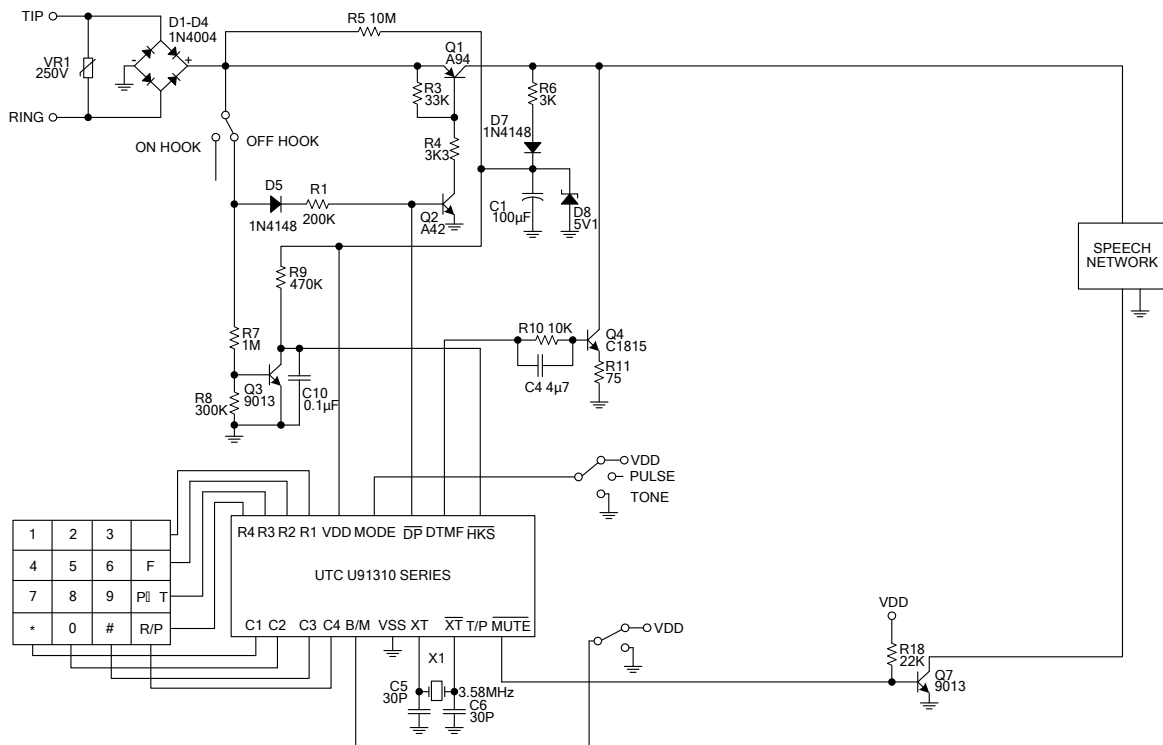


Fig. 5 Flash Function Timing Diagram

■ TYPICAL APPLICATION CIRCUIT



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.