



10-MEMORY TONE/PULSE SWITCHABLE DIALER WITH SAVE FUNCTION

GENERAL DESCRIPTION

The W91440A/B series are monolithic integrated circuit. It contains 12 number memories which can perform Tone/Pulse switchable dialing functions.

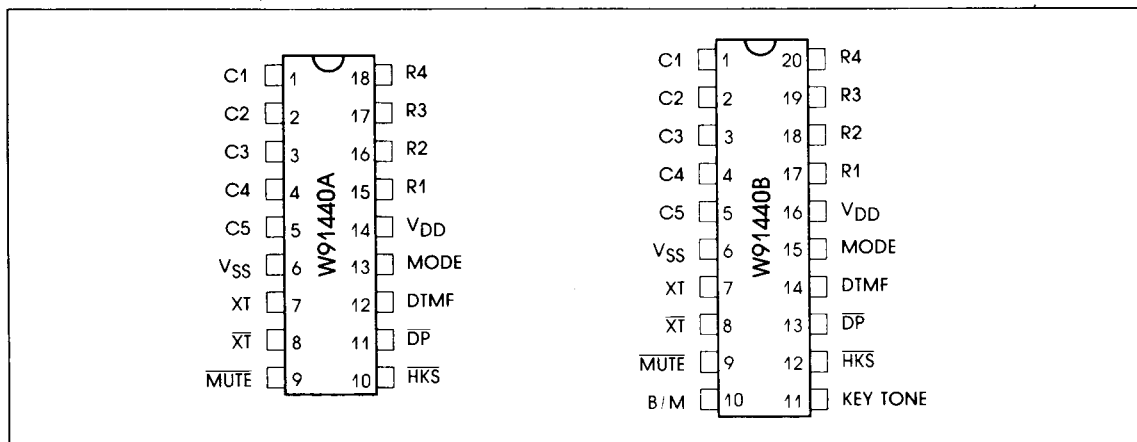
It is fabricated in CMOS technology thus has good performance in low voltage, low power operations.

Ten 16-digits indirect dialing memories and two 32-digits Redial & Save memories are design for convenient operations.

FEATURES

- DTMF/PULSE switchable dialer.
- 2 number by 32 digits for Redial and Save memory.
- 10 number by 16 digits for two touch indirect repertory memory.
- P – T key for Long Distance Call operation.
- Break/Make ratio is selectable by pin or bonding option.
- Fully key-in & key-released debounced 4x5 keyboard.
- Key tone output for valid keyin, include Pulse mode, Store mode and Function key only.
- Easy operation with Redial, Flash, Pause and P – T keypads.
- Flash, Pause, P – T can be stored as a digit in memory.
- Flash time 100mS, 350mS, 600mS is selectable by mask option.
- Call Disconnect (CD key) use for line break operation.
- Mute key use for speech mute.
- Minimum tone output duration: 100mS; Minimum inter tone pause: 100mS.
- Dial rate 10 or 20 pps is selectable by pin option.
- SWEDISH (N+1) & NEW ZEALAND (10-N) dialing mode is selectable by mask option.
- Tone or Pulse mode is selectable by pin option.
- Internal power on reset.
- Long mute for Redial & Repertory dialing.
- Uses 3.579545 MHz TV quartz crystal or ceramic resonator.
- 18 / 20 pins.

PIN CONFIGURATION



TYPE NO.	PINS & FUNCTIONS					
	DP	KEY TONE	B/M	FLASH	PAUSE	PINS
W91444A	10/20	No	3 : 2	100 mS	3.6 S	18
W91445A	10/20	No	2 : 1	100 mS	3.6 S	18
W91445B	10/20	Yes	PIN	100 mS	3.6 S	20
W91446A	10/20	No	3 : 2	600 mS	3.6 S	18
W91447A	10/20	No	2 : 1	600 mS	3.6 S	18
W91447B	10/20	Yes	PIN	600 mS	3.6 S	20
**W91448A	N+1	No	3 : 2	100 mS	3.6 S	18
**W91448B	N+1	Yes	PIN	100 mS	3.6 S	20
**W91449A	10-N	No	2 : 1	350 mS	3.6 S	18
**W91449B	10-N	Yes	PIN	350 mS	3.6 S	20

(Normal)

0--10 Pulse
 1--1 Pulse
 2--2 Pulse
 3--3 Pulse
 4--4 Pulse
 5--5 Pulse
 6--6 Pulse
 7--7 Pulse
 8--8 Pulse
 9--9 Pulse

*-- Ignored

#-- Ignored

(N+1)

0--1 Pulse
 1--2 Pulse
 2--3 Pulse
 3--4 Pulse
 4--5 Pulse
 5--6 Pulse
 6--7 Pulse
 7--8 Pulse
 8--9 Pulse
 9--10 Pulse

*-- Ignored

#-- Ignored

(10-N)

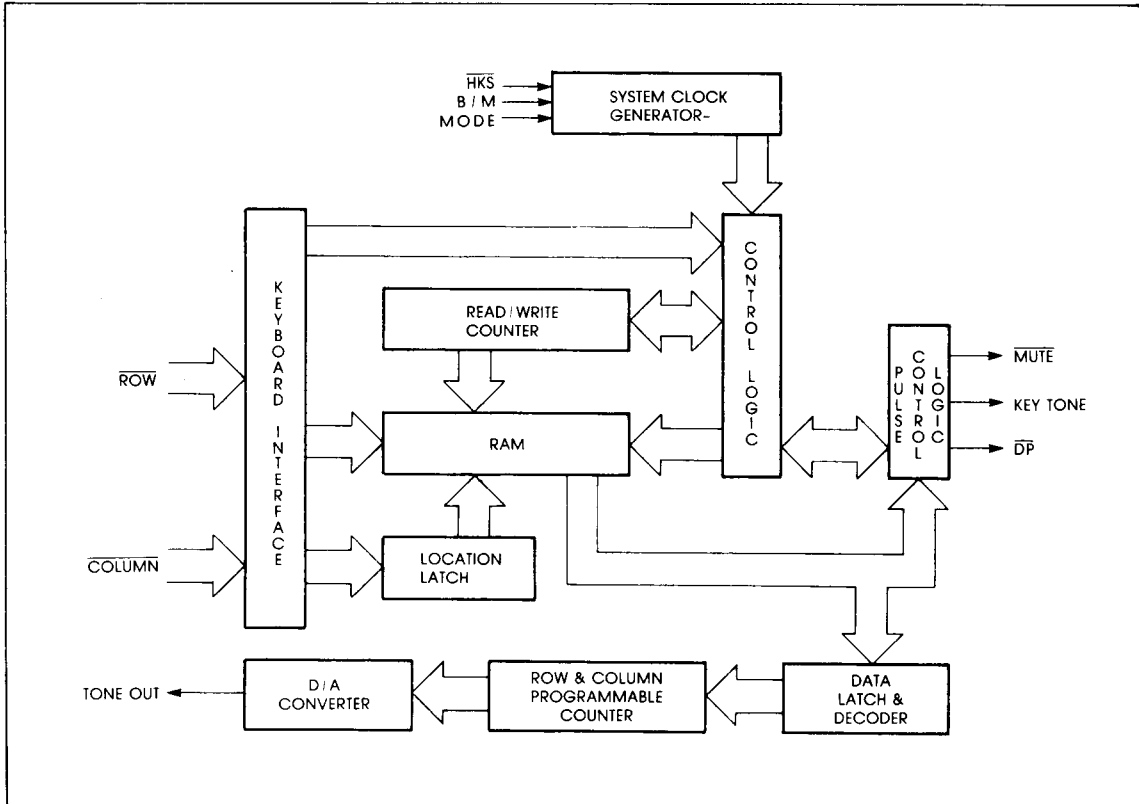
0--10 Pulse
 1--9 Pulse
 2--8 Pulse
 3--7 Pulse
 4--6 Pulse
 5--5 Pulse
 6--4 Pulse
 7--3 Pulse
 8--2 Pulse
 9--1 Pulse

*-- Ignored

#-- Ignored

** STOP PRODUCTION

BLOCK DIAGRAM



PIN / FUNCTIONAL DESCRIPTION

A. ROW - COLUMN INPUTS

The keyboards input is compatible with the standard 2-of-9 keyboard, the inexpensive single contact (Form A) keyboard, and electronic input.

In normal operation, any single button is pushed to produce dual tone, pulses or functions. Activation of two or more buttons will result in no response, except for single tone.

B. XT, $\overline{\text{XT}}$

An built in inverter provides oscillation with

an inexpensive 3.579545MHz TV color burst crystal. The oscillator ceases when a keypad input is not sensed. Most crystals do not vary more than $\pm 0.02\%$.

C. MUTE

The $\overline{\text{MUTE}}$ is a conventional CMOS N-Channel open drain output.

The output transistor is switched on during dialing sequence (both Pulse and Tone mode), or MUTE key is keyed. Otherwise, it is switched off.

TONE/PULSE
DIALER

D. $\overline{\text{HKS}}$

The $\overline{\text{HKS}}$ (HOOK SWITCH) input is used to sense the state of handset in ON HOOK or OFF HOOK. In ON HOOK state, $\overline{\text{HKS}}=1$, or open the keyboard input is disabled, there is not any operation for any keyboard entry, to avoid the energy lose stored in capacitor.

In OFF HOOK state, $\overline{\text{HKS}}=0$, all of the function work.

$\overline{\text{HKS}}$ pin is pulled to V_{DD} by internal resistor.

E. $\overline{\text{DP}}$

This pin is an N-channel open drain output. The output is low (switched on) in the dial pulse "Break" operation during Off Hook Pulse or during CD key is keyed. Otherwise, this output is "open" (switched off).

In DTMF mode, the pulse out keeps open (switched off) regardless of keyboard entry

except CD key.

In Pulse mode, the output sends a chain of pulses to correspond the address keypad input, but keep open level for * & # entry and can be stored in memory for * & # entry.

Fig.-1(a,b) shows the timing diagram in pulse mode. The pulse rate and inter digit pause are fixed, to be 10 pps (800 mS) and 20 pps (500 mS) respectively.

F. DTMF

This pin is used to output DTMF address signals.

During pulse dialing, it always keep at low state regardless of keypad input.

In tone mode, it will output dual or single tone.

The detail timing diagram of tone mode is shown in Fig.-2(a,b).

OUTPUT FREQUENCY (HZ)			% ERROR
SPECIFIED		ACTUAL	
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

G. MODE

Pulls MODE pin to V_{DD} or floating, the dialer is in pulse mode, the pulse rate is 10 pps or 20 pps respectively.

Pulls MODE pin to V_{SS} , it is in DTMF mode.

H. B/M

For W91440B, the Break/Make ratio is option by B/M pin. In pulse mode, if B/M = 1

the break/make ratio is 60:40, else, it is 66:33.

In tone mode, this pin influence nothing.

I. KEY TONE

This pin is a conventional inverter output -- 600Hz, 35mS. The key tone will be generated for each valid key-in. A detailed description for key tone, please refer to Table - 1.

Table 1

MODE \ KEY	0-9 * #	SAVE R, A-LN	P, F S, P-T	MUTE CD
Pulse	YES	YES	YES	YES
Tone	NO	NO	YES	YES
Store	YES	YES	YES	YES

J. VDD, VSS (pin 14,6)

These are the power input pins for the Tone/Pulse dialer.

OPERATION DESCRIPTION

KEYBOARD FUNCTION

C1	C2	C3	C4	C5	
1	2	3	S	MUTE	R1
4	5	6	F	CD	R2
7	8	9	A	P-T	R3
*	0	#	R / P	SAVE	R4

KEYBOARD OPERATION

Notes: 1. All the keyboard operation should be under OFF HOOK condition.

- D1 - Dn : 0 - 9, *, #.
- Ln : Memory location 0 - 9
- The number D1, D2, ---, Dn will be dialed out in Pulse or Tone mode as mode selected.

A. Normal Dialing

OFF HOOK [D1], [D2], ---, [Dn]

- D1, D2, ---, Dn will be dialed out.
- Dialing length is unlimited, if dialing length over 32 digits the Redial is inhibited.

B. Redialing

OFF HOOK [D1], [D2], ---, [Dn],
BUSY ON HOOK

Come OFF HOOK [R / P]

- The [R / P] key can execute Redial function only in first key in after OFF HOOK, otherwise will be Pause function.

C. Number store

OFF HOOK [D1], [D2], ---, [Dn], [S],
[S] [Ln]

- D1, D2, ---, Dn will be stored in Ln memory location and they will be dialed out.

OFF HOOK [S], [D1], [D2], [Dn], [S], [Ln]
ON HOOK

- D1, D2, ---, Dn will be stored in Ln memory location but they will not be dialed out.
- [F], [R/P] and [P-T] keys can be stored

as a digit in memory, but **[R/P]** key can not be occupied in first digit.

- The store mode can be released after the store function is executed or the present state of hook switch is changed or CD key is keyin.

D. Memory Dialing

[OFF HOOK] [AUTO] [Ln]

E. Access Pause

[OFF HOOK] [D1], [D2], [R/P], [D3], - - [Dn], BUSY [ON HOOK]

Come **[OFF HOOK] [R/P]**

- The Pause function is executed in Redialing or Memory dialing.
- The Pause function timing diagram is shown in Fig.-3.

F. Pulse to Tone (P→T key)

[OFF HOOK] [D1], [D2], - - -, [Dn], [P→T], [D1'], [D2'], [Dn']

- If the mode switch is set in Pulse mode, then the output signal will be:
D1, D2, - - -, Dn, Pause (3.6s),
(Pulse)

D1', D', - - -, Dn'
(Tone)

- If the mode switch is set in Tone mode, then the output signal will be:
D1, D2, - - -, Dn, Pause (3.6s),
(Tone)
- D1', D2', - - -, Dn'
(Tone)

- It can be reset to Pulse mode in operation of ON HOOK or CD key is keyin, because it's still in Tone mode when the digits have been dialed out.
- The P→T function timing diagram is shown in Fig.-4.

G. Flash

[OFF HOOK] [F]

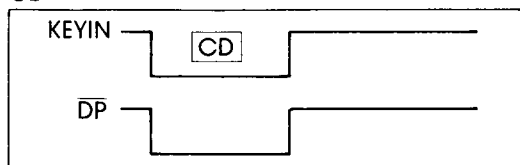
- It will execute ON HOOK 100/350/600 mS and flash pause for 100/350/600 mS before the next digit is dialed out.
- Flash key can be stored as a digit in memory.
- The Flash function timing diagram is shown in Fig.-5.

H. Call Disconnect

[OFF HOOK] [CD]

- The pulse output will switch on (line break) as long as CD key keyin and the system will be reset to initial state.

CD



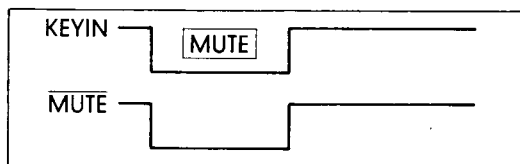
TIMING SAME AS KEYIN

I. MUTE key

[OFF HOOK] [MUTE]

- The mute output will switch on as long as MUTE key keyin.

MUTE:



TIMING SAME AS KEYIN

J. SAVE Key

a. **[OFF HOOK] [D1], [D2], - - -, [Dn], [SAVE] [ON HOOK]**

Come **[OFF HOOK] [SAVE]**

- D1, D2, - - -, Dn will be dialed out after SAVE key is keyed.
- If $n > 32$, D1, D2, - - -, Dn can not copy to SAVE memory and the SAVE memory is unchanged.

b. OFF HOOK [D1], [D2], [D2], ---, [Dn]

CONVERSATION

[S], [D1'], [D2'], ---, [Dn'], [SAVE]

- D1', D2', ---, Dn' will be stored in SAVE memory, but they will not be dialed out.

K. Mix Dialing

a. Normal dialing + Memory dialing +

Normal dialing

b. Memory dialing + Normal dialing + Memory dialing

c. Redialing + Normal dialing + Memory dialing

- Redialing and Save dialing valid just for first key-in.

TIMING WAVEFORM

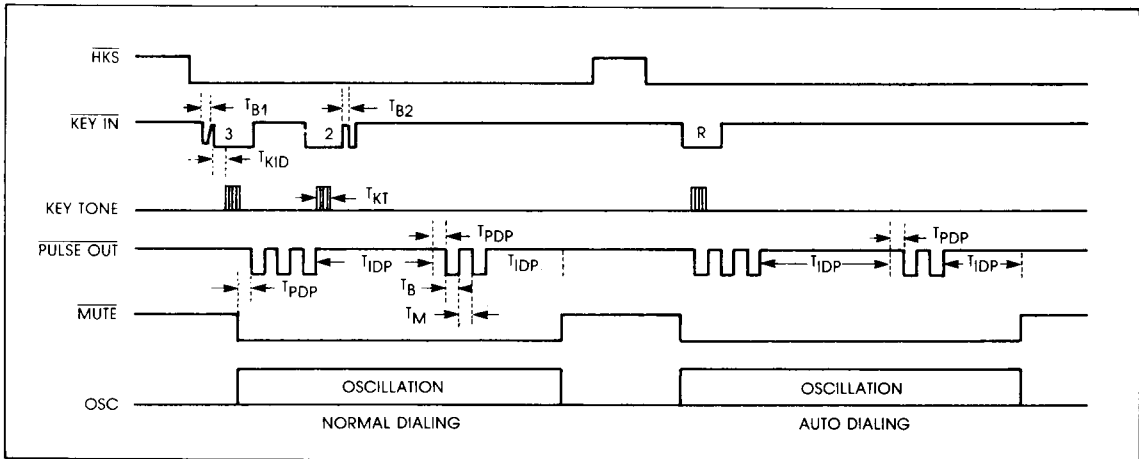


Figure 1. PULSE MODE

Note: MODE=1 B/M=1 or 0 $T_{B1} < T_{KID}$ $T_{B2} < T_{KRD}$

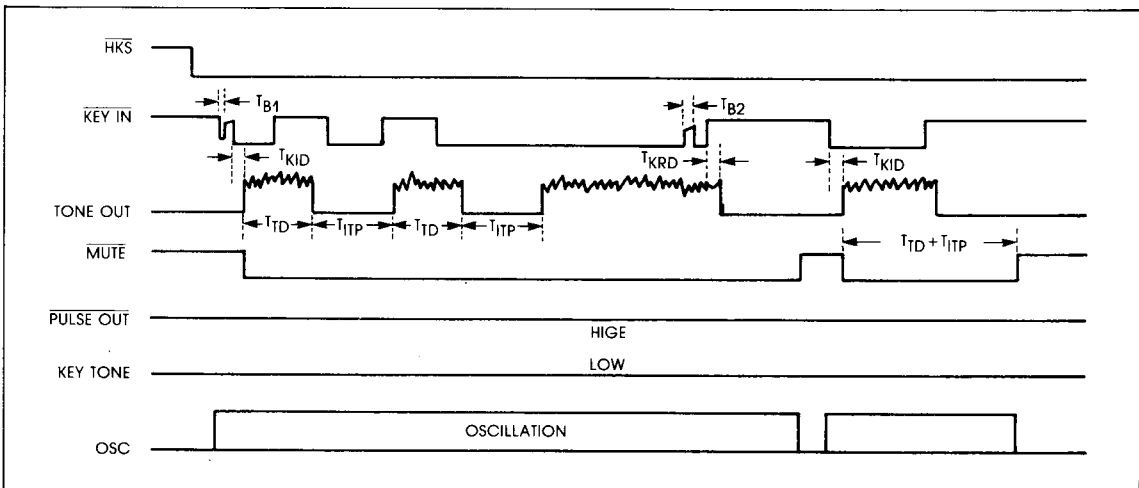


Figure 2(a) TONE MODE NORMAL DIALING

Note:

MODE=0

B/M=1 or 0

$T_{B1} < T_{KID}$

$T_{B2} < T_{KRD}$

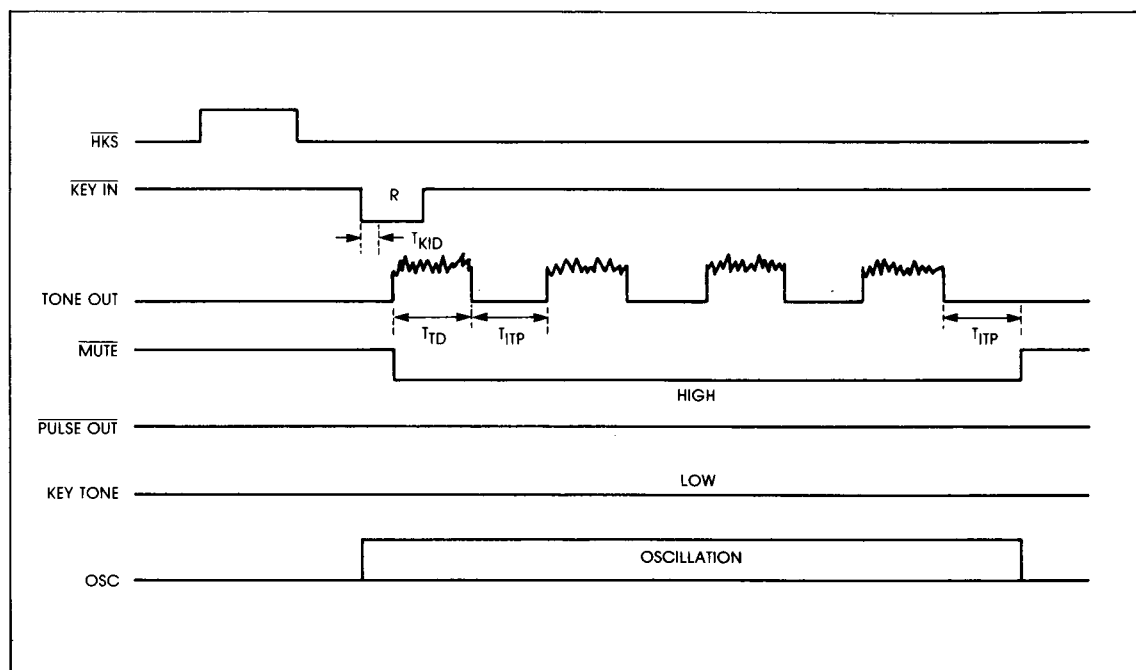
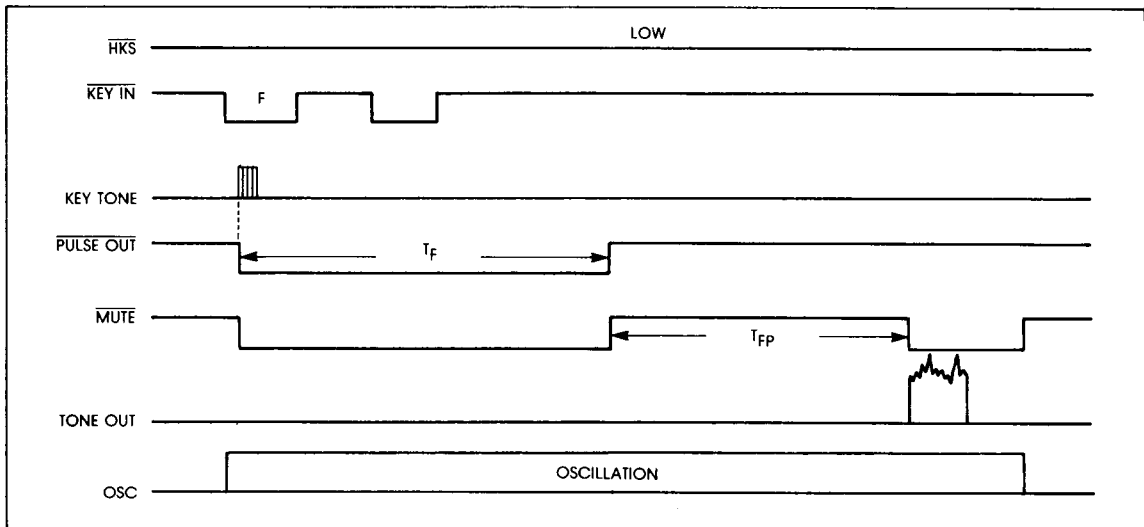
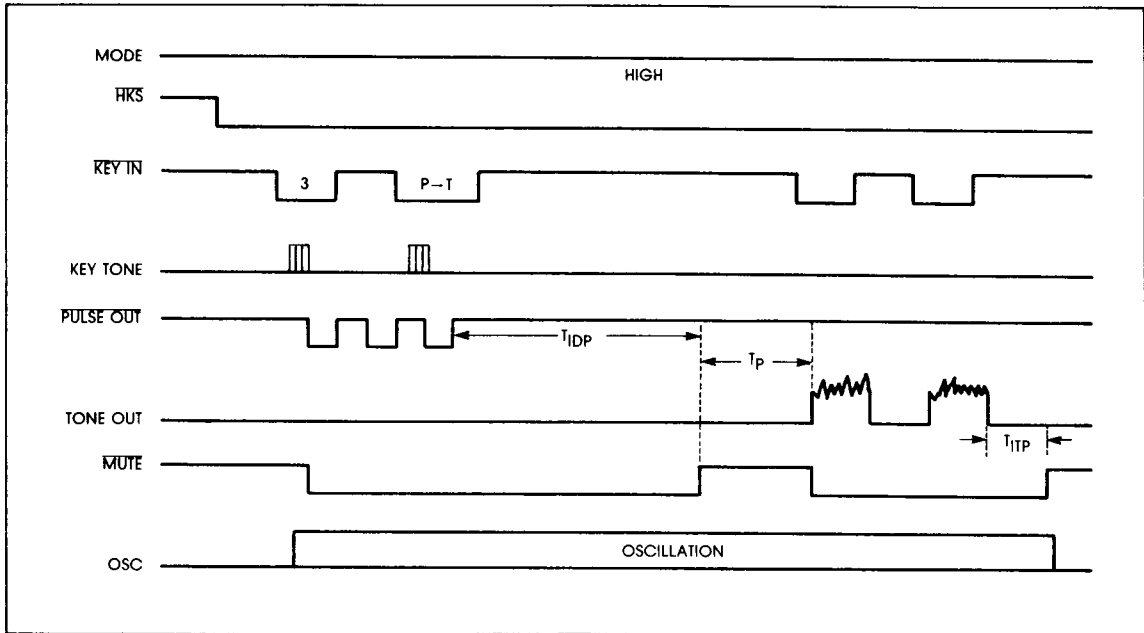


Figure 2(b) TONE MODE AUTO DIALING

Note:

MODE=0

B/M=1 or 0



Note:

B/M = 1 or 0

MODE = 1 ; if not, KEY TONE output keeps low.

TONE/PULSE
DIALER

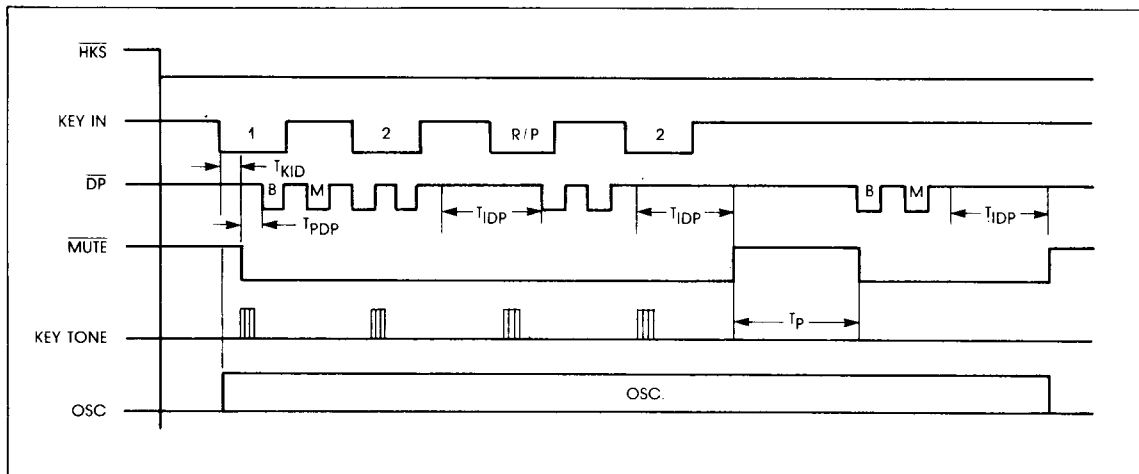


Figure 3 PAUSE FUNCTION

ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT
DC Supply Voltage	7.0	V
Input Voltage Range	$-0.3 \sim V_{DD} + 0.3$	V
Power Dissipation per Package	120	mW
Operation Temperature	$-20 \sim +70$	°C
Storage Temperature	$-55 \sim +125$	°C

D.C. CHARACTERISTICS

($V_{DD} - V_{SS} = 2.5$ V, $f_{osc} = 3.58$ MHz, $T_a = 25$ °C All output unloaded)

PARAMETER	SYM.	TEST	CONDITIONS	MIN.	TYP.	MAX.	UNIT
OP. Voltage	V_{DD}		—	2.0	—	5.5	V
OP. Current	I_{OP}	A	Tone	—	—	1.0	mA
			Pulse	—	—	0.5	
Standby Current	I_{SB}	A	$\overline{HKS}=0$, No Load & No key entry	—	10	15	μA
Memory Retention Current	I_{MR}	B	$\overline{HKS}=1$, $V_{DD}=1.0V$	—	—	0.2	μA
Tone Output Voltage	V_{TO}	C	Row group, $R_L = 10\Omega$	130	150	170	mVrms

PARAMETER	SYM.	TEST	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Pre-emphasis		D	Col / Row 2.0 - 5.5V	1	2	3	dB
DTMF Distortion	T _{HD}	D	R _L = 10 Ω 2.0 - 5.5V	—	-30	-23	dB
Tone Output DC Level	V _{TDC}	D		1.1	—	2.8	V
Tone Output Sink Current	I _{TL}	F	V _{TO} = 0.5V	0.2	—	—	mA
Pulse Output Sink Current	I _{PL}	E	V _{PO} = 0.5V	0.5	—	—	mA
Mute Output Sink Current	I _{ML}	E	V _{MO} = 0.5V	0.5	—	—	mA
Key Tone Drive	K _{TD}	E	—	0.5	—	—	mA
Key Tone Sink	K _{TS}	E	—	0.5	—	—	
HKS Pull High Resister	R _{KH}			300	—	—	K Ω
Keypad Input Drive Current	I _{KD}	F	V _I = 0V	4	10		μ A
Keypad Input Sink Current	I _{KS}	F	V _I = 2.5V	200	400	—	
Keypad Resistance				—	—	5.0	K Ω

A.C. CHARACTERISTICS

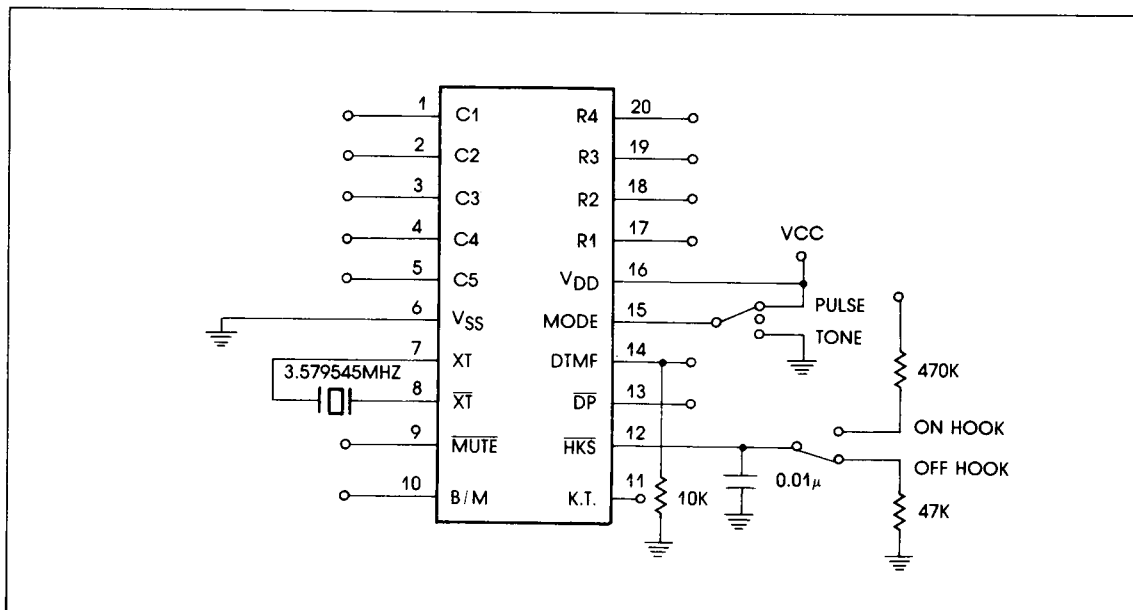
(V_{DD}-V_{SS} = 2.5 V, Fosc. = 3.58 MHz, Ta = 25°C All output unloaded)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Key in Debounce	T _{KID}		—	20	—	mS
Key Release Debounce	T _{KRD}		—	20	—	mS
Pre-Digit-Pause (1)	T _{PDP1} 10 pps	B/M = 3:2	—	40	—	mS
		B/M = 2:1	—	33.3	—	
Pre-Digit-Pause (2)	T _{PDP2} 20 pps	B/M = 3:2	—	20	—	mS
		B/M = 2:1	—	16.7	—	
Pulse Rate (1)	FPR1	Pin option	—	10	—	pps
Pulse Rate (2)	FPR2		—	20	—	

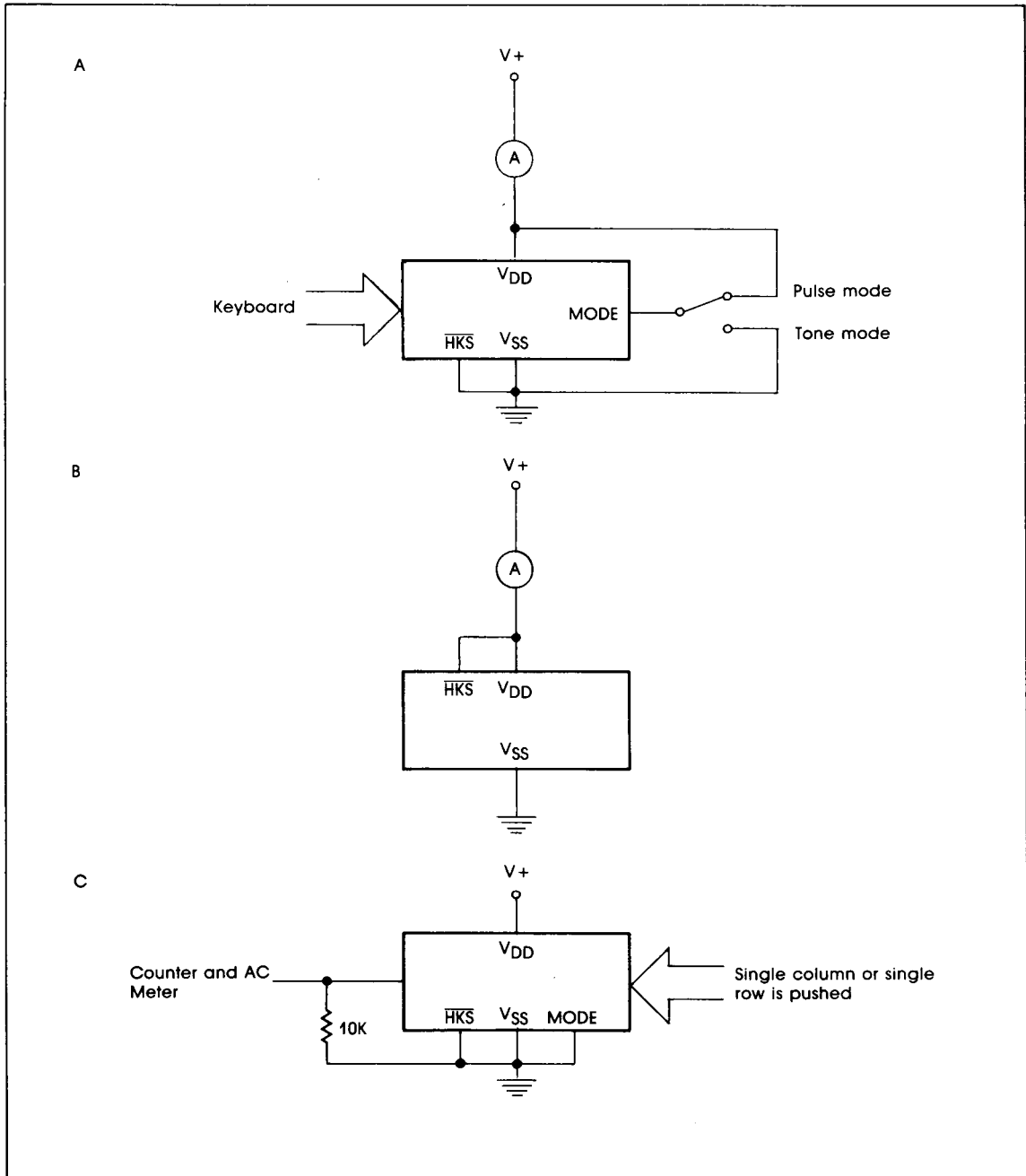
TONE/PULSE
DIALER

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Inter Digit Paues	T _{IDP1}	10 pps	—	800	—	mS
	T _{IDP2}	20 pps	—	500	—	
Break / Make Ratio	B:M	B/M=3:2	—	60:40	—	%
		B/M=2:1	—	67:33	—	
Tone Output Duration	T _{TD}		—	100	—	mS
Inter Tone Pause	T _{ITP}		—	100	—	mS
Key Tone Frequency	T _{KF}		—	600	—	Hz
Key Tone Duration	T _{KD}		—	35	—	mS
Flash Time	T _F	Type option	—	100	—	mS
			—	350	—	
			—	600	—	
Flash Pause	T _{FP}	Type option	—	100	—	mS
			—	350	—	
			—	600	—	
Pausse Time	T _p	Type option	—	3.6	—	S

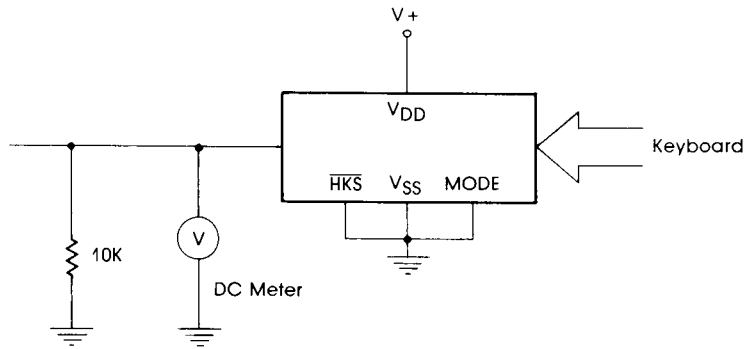
GENERAL TEST CIRCUIT



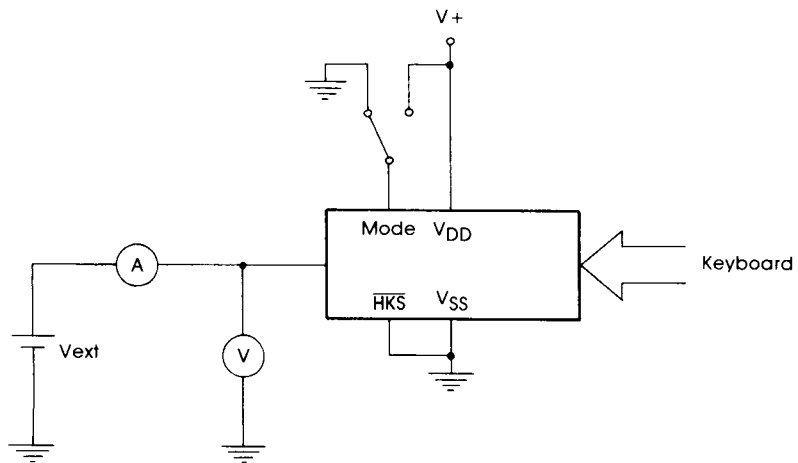
TEST CIRCUIT



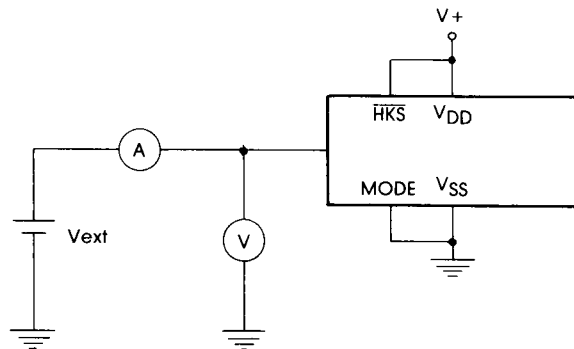
D



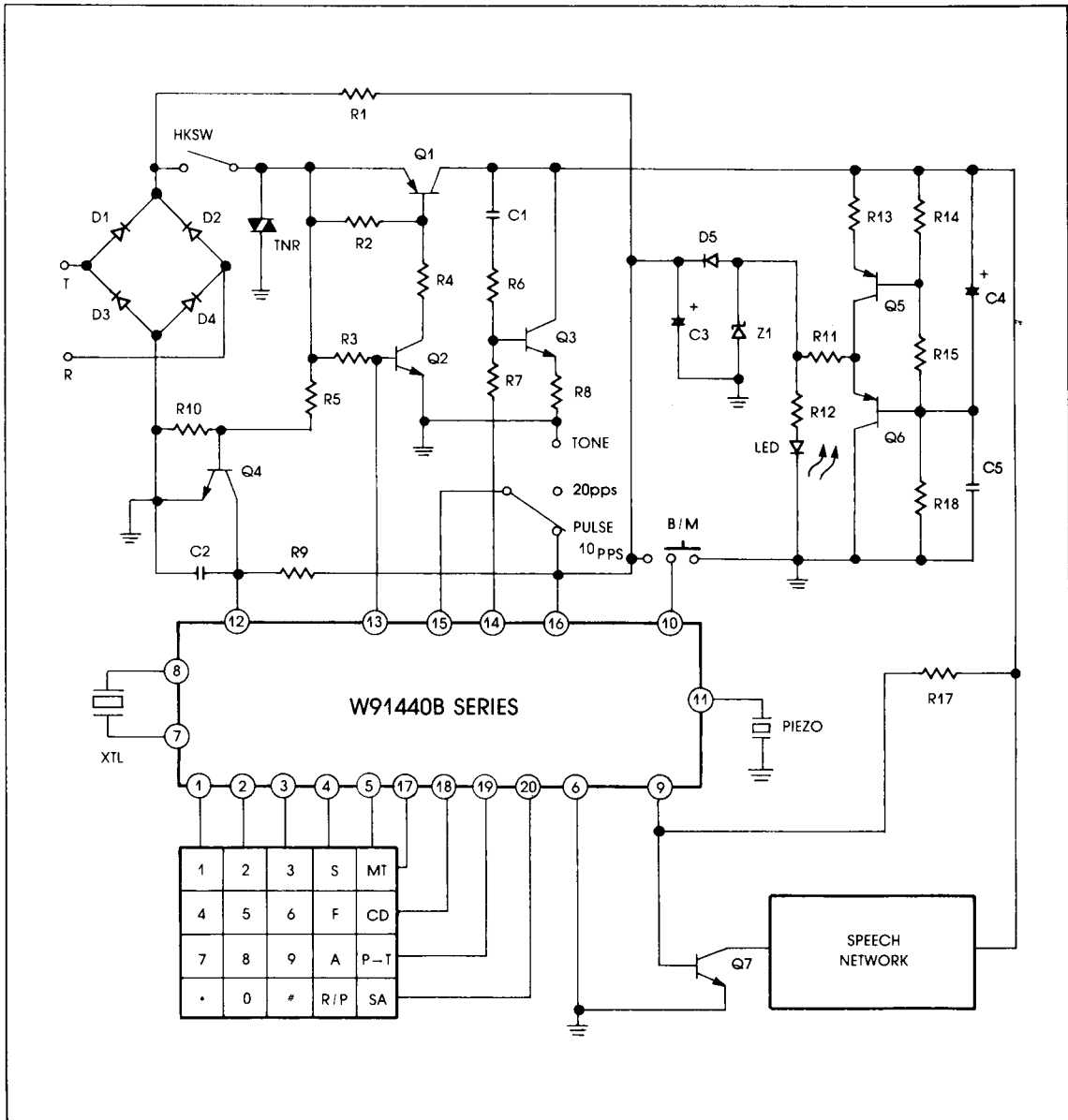
E



F



APPLICATION CIRCUIT DIAGRAM



TONE/PULSE
DIALER

COMPONENT SELECTION TABLE

R1	20M Ω	R14	1.5K Ω	D5	1N4148
R2	33K Ω	R15	1.2K Ω	TNR	TNR680K
R3	220K Ω	R16	4.7K Ω	Z1	1N4731
R4	3.9K Ω	R17	220K Ω	Q1	MPSA92
R5	1M Ω	C1	0.01 μ F	Q2	2N5551
R6	100K Ω	C2	0.1 μ F	Q3	2N5551
R7	10K Ω	C3	100 μ F / 10V	Q4	2N9014
R8	68 Ω	C4	2.2 μ F / 10V	Q5	2N4403
R9	470K Ω	C5	0.01 μ F	Q6	2N4403
R10	100K Ω	D1	1N4002	Q7	MPSA13
R11	100K Ω	D2	1N4002	XTL	3.579545MHz
R12	100K Ω	D3	1N4002		
R13	10 Ω	D4	1N4002		