MSM6352-20RS

TONE/PULSE SWITCHABLE REPERTORY DIALER

GENERAL DESCRIPTION

The MSM6352-20RS is repertory tone/pulse switchable dialer which is fabricated by OKI's low power consumption CMOS silicon gate technology. This LSI can generate either DTMF (Dual Tone Multi Frequency) signal or DP (Dial Pulse) signal.

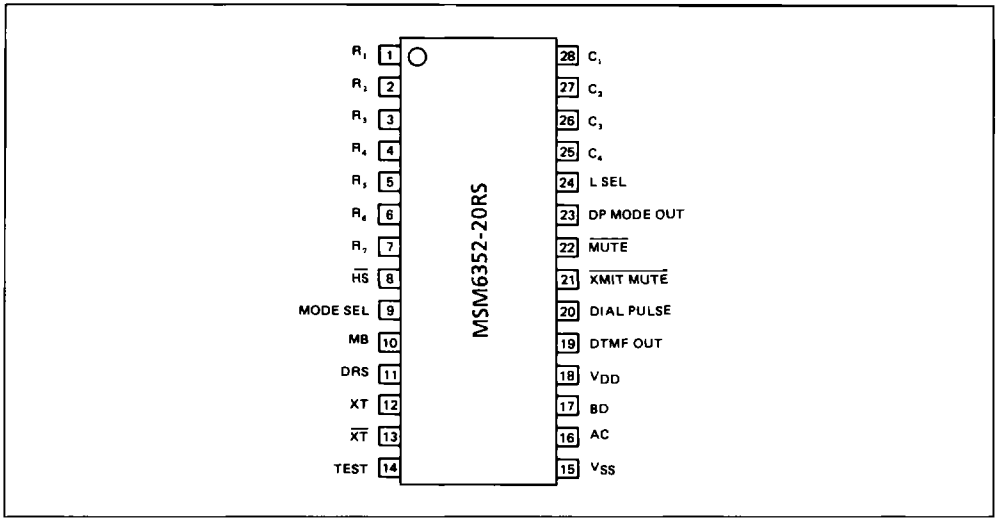
The repertory memory has a capacity of 500 digits. A maximum of 54 telephone numbers of 32 digits maximum/number can be stored as long as the total number of stored digitis does not exceed 500.

This part operates on 2.0 V ~ 5.5 V single supply. Standby current is 0.2 μA maximum and memory retention voltage is 1.2 V.

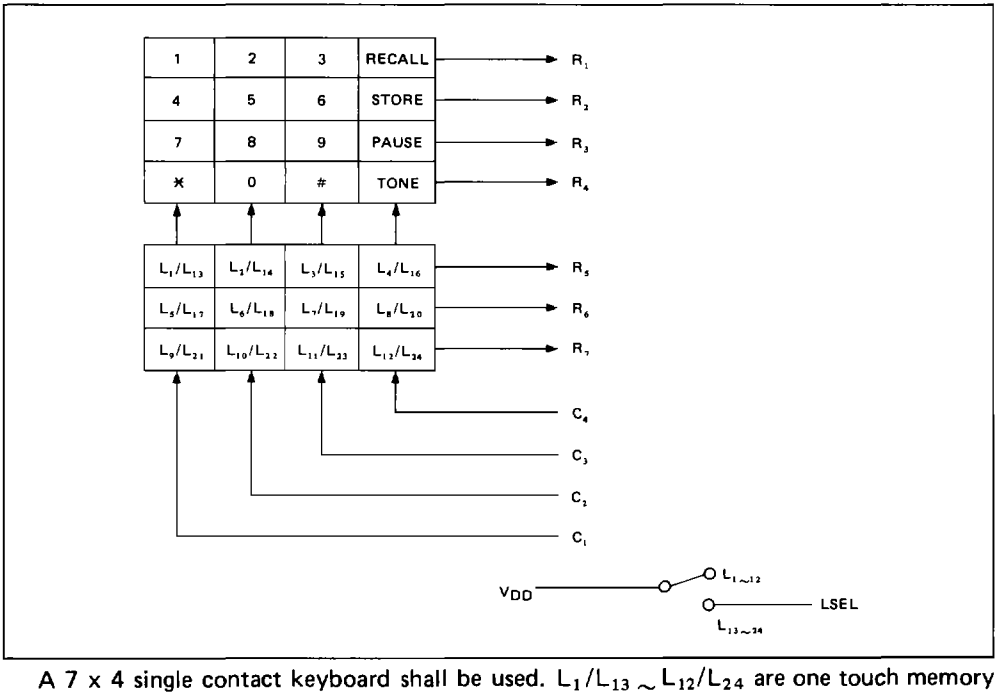
FEATURES

- Either DTMF signal or DP signal generation.
- DP/TONE output starts 100 msec after keying in normal dialing .
- 500 digits repertory memory. (54 numbers maximum, 32 digits maximum/number).
- 24 numbers repertory dialing by single key dialing plus maximum 30 numbers repertory dialing by 2-digit abbreviated code dialing.
- Last number redial (32 digits maximum).
- Mixed dialing/storing.
- Auto insersion of 4 seconds access pause.
- Pulse rate 10/20 pps pin selectable.
- Make/Break ratio 34/66 or 40/60 pin selectable.
- Tone output for valid key input (2 kHz, 32 msec).
- Alarm tone for wrong operations.
- Single contact matrix keyboard to be used.
- 3.58 MHz oscillation circuit on chip for ceramic resonator.
- Supply voltage range 2.0 V ~ 5.5 V.
- Low standby current 0.2 μA maximum.
- 28 pin plastic DIP (DIP28-P-600)

PIN CONFIGURATION



KEYBOARD INTERFACE



A 7 x 4 single contact keyboard shall be used. $L_1/L_{13} \sim L_{12}/L_{24}$ are one touch memory recall keys. By connecting or disconnecting LSEL to/from V_{DD}, two telephone numbers can be assigned for each key. So, the 24 numbers in total can be recalled by single key operation.

In addition, a maximum 30 numbers can be abbreviated into 2-digit address code (00 ~ 29).

PIN DESCRIPTION

Pin Name	Pin No.	Function
$R_1 \sim R_7$ $C_1 \sim C_4$	1 ~ 7 25 ~ 28	Key input pins. $C_1 \sim C_4$ are set to low level in on-hook mode, while they are set to high level in off-hook standby mode. When the key input is off, key scanning and oscillation stop. Single contact keyboard shall be connected.
$\overline{HS}$	8	Hook switch input pin. $\overline{HS}$ = High: On-hook $\overline{HS}$ = Low: Off-hook
LSEL	24	Selection pin for $L_1 \sim L_{12}$ or $L_{13} \sim L_{24}$ for single-key dialing LSEL = Low: $L_1 \sim L_{12}$ LSEL = High: $L_{13} \sim L_{24}$
MB	10	Make/Break ratio selection pin. MB = Low: 40/60 MB = High: 34/66 This input is sensed during the transition stage from On-hook to Off-hook.
DRS	11	Dial rate selection pin. DRS = Low: 10 pps DRS = High: 20 pps This input is sensed during the transition stage from On-hook to Off-hook.
MODE SEL	9	DP/DTMF mode selection pin. MODE SEL = Low: DP mode MODE SEL = High: DTMF mode The status at off-hook is maintained. If TONE key is pressed when this pin is being set to low level, the DTMF mode is established.
XT, $\overline{XT}$	12, 13	Ceramic resonator connection pins. Since this LSI is provided with oscillation inverter and feed-back resistor, 3.58 MHz ceramic resonator and capacitors are connected to XT and $\overline{XT}$ pin.
V_{DD}, V_{SS}	18, 15	V_{DD}: Positive power supply pin. 2.0 V ~ 5.5 V. V_{SS}: Negative power supply pin (Ground).
AC	16	IC initial pin. When IC is powered on, "H" level reset signal has to be applied to this pin.
TEST	14	Test pin.

Pin Name	Pin No.	Function
BD	17	Buzzer output pin. It outputs key tone for valid key input. It also outputs various alarm/confirming tone. Refer to "Sound output waveforms" for details.
DTMF OUT	19	DTMF output pin. In case of double keying or pressing some key without releasing a previous key, DTMF output is disabled.
DIAL PULSE	20	Dial pulse output pin. Make: High Break: Low $\overline{HS}$ = High (On hook): Low
$\overline{XMIT\ MUTE}$	21	Transmit mute output pin. When $\overline{HS}$ = High (On-hook): Low When $\overline{HS}$ = Low (Off-hook) ① While DP signal or DTMF signal is being sent out: Low ② All other times: High
$\overline{MUTE}$	22	Mute output pin. When $\overline{HS}$ = High (On-hook): Low When $\overline{HS}$ = Low (Off-hook) ① While DP is being sent out: Low ② All other times: High
DP MODE OUT	23	Dial Pulse Mode output pin. MODE SEL = High: Low MODE SEL = Low: High When mode is changed to DTMF mode by TONE key input: Low

FUNCTIONAL DESCRIPTION

Dialing Function

(1) Normal Dialing

Off-Hook [D_1] ..... [D_N]

Maximum 32 digits can be sent out at a time. Further key inputs are effective only after the first 32 digits have been sent out to the line. If more than 32 digits are dialed, redialing of that number is disabled. Pressing [PAUSE] key causes 4 seconds access pause. The access pause is released automatically 4 seconds later or manually by pressing [PAUSE], [RECALL], [STORE] or [TONE] key again.

Switching from DP dialing to DTMF dialing can be done during the course of dialing. By pressing [TONE] key during DP mode, the mode is changed to DTMF mode. When [TONE] key is pressed, if DP signal is being sent out, the mode will be changed after sending out all DP signal and an access pause of 4 seconds is automatically inserted. An access pause can be released earlier by pressing [PAUSE], [RECALL], [STORE] or [TONE] key, if so desired.

(2) Redialing

Off-Hook [R] [R]

The last dialed number can be redialed by pressing [RECALL] key twice. The functions of [TONE] and [PAUSE] signals included in the redialed number are same as in the repertory dialing. When the redialing is being prohibited, an alarm sound is generated at the second [RECALL] key input. The normal dialing can follow after that leaving the telephone off hook.

(3) Repertory Dialing

Off-Hook [R] [A_1] [A_2]

Off-Hook [L_n]

The telephone numbers abbreviated to [L_n] code can be dialed by single key operation ([L_1] ~ [L_{24}]), while those abbreviated to 2-digit can be dialed by pressing [RECALL] key followed by 2-digit code.

If a wrong address code is input, an alarm sound is generated.

If a stored number has an access pause, dialing halts for 4 seconds or until [PAUSE], [RECALL], [STORE] or [TONE] key is pressed. If a stored number has a [TONE] signal, the dialing mode is changed from DP mode to DTMF mode, and dialing halts for 4 seconds or until [PAUSE], [RECALL], [STORE] or [TONE] key is pressed.

(4) Mixed Dialing

Off-Hook [R] [R] [D1] ..... [Dn] [R] [A1] [A2] [Ln]

- [R] [R]: Redial
- [D1] ..... [Dn]: Normal dialing
- [R] [A1] [A2]: 2-digits abbreviated code dialing
- [Ln]: Single key dialing

Mixed dialing of normal dialing, redialing and repertory dialing can be done. In that case, however, redialing must come to the first part. If the digits of the mixed dialed number is up to 32, that number can be redialed.

Memory Storing/Clearing Function

(1) Storing of telephone number

Off-Hook [S] [D1] ..... [Dn] [S] [A1] [A2] (Store into 2-digits abbreviated code address)

[S] [D1] ..... [Dn] [S] [L] (Store into single key address)

Storing operation can be continued leaving the telephone off hook. When the storing of a telephone number has been completed, a sound is generated to indicate that the next number's storing is allowed. The first [STORE] key input can be omitted from the second number.

If the empty space of the repertory memory is less than 16 digits, an alarm sound is generated at the first [STORE] key input. In other words, if an alarm is not generated at the first [STORE] key input, minimum 16 digits can be newly stored.

An alarm sound is generated at the 500th digit input showing the memory has no more capacity. That 500th input digit can be stored in the memory, however, if the 501st digit is input, an alarm sound is generated again. That input digit is neglected and the entire key operation is disabled until the telephone is hooked on.

Maximum digits of a telephone number to be stored is 32. [TONE] signal and [PAUSE] signal are counted as one digit respectively.

If the 33rd digit is input, an alarm sound is generated and the entire key operation is disabled until the telephone is hooked on.

24 telephone numbers can be abbreviated to single key address codes, which are [L1] ~ [L24] . Other than those single key address codes, maximum 30 telephone numbers can be abbreviated to 2-digit address codes, which are 00 ~ 29, so far as total stored digits in the repertory memory do not exceed 500.

[0] ~ [2] can be used for the first digit [A1] , and [0] ~ [9] can be used for the second digit [A2] . If a wrong number is used, an alarm sound is generated and that input is neglected.

(2) Mixed Storing

Off-Hook [S] [D_1] ..... [D_n] [R] [A_1] [A_2] [S] [A'_1] [A'_2]

..... Store into 2-digit abbreviated code address

Off-Hook [S] [L_m] [D_1] ..... [D_n] [L_n] [S] [L'_n]

..... Store into single key address

The telephone number once stored in the repertory memory can be used as a part of the newly stored telephone number in the form of abbreviated code ([L_n] or [R] [A_1] [A_2]). Maximum 32 digits can be mixed-stored. Either [L_n] or [R] [A_1] [A_2] is counted as 3 digits.

Therefore, if [L_n] key or [R] key is pressed at 31st or 32nd digit, an alarm sound is generated and storing is disabled.

Abbreviated code used for the newly stored number must not include abbreviated code of the other telephone number.

(3) Clearing of Telephone Number

Off-Hook [S] [S] [A_1] [A_2]

[S] [S] [L_n]

Clearing operation can be continued leaving the telephone off hook. Pressing [STORE] key twice followed by [L_n] key or 2-digit code clears the stored number in that address. Clearing operation and storing operation can be done alternately leaving the telephone off-hook.

If a wrong address code is input after pressing [STORE] key twice, an alarm sound is generated and that key input is neglected.

Redial Inhibition

Off-Hook [R] [A_1] [A_2] (After signals sent out) [S] [S]

Off-Hook [D_1] ..... [D_n] (After signals sent out) [S] [S]

Pressing [STORE] key twice after all signals have been sent out to the line disables the redialing of that telephone number. It is applicable to any of normal dialing, repertory dialing and mixed dialing. Redialing is also disabled when more than 32 digits are dialed or after telephone number's clearing/storing operation.

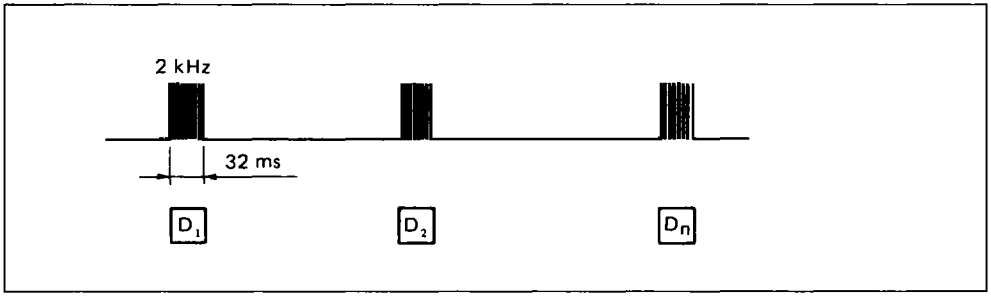
Others

When there is no data in the specified memory address, an alarm sound is generated and that key input is neglected.

SOUND OUTPUT WAVEFORM

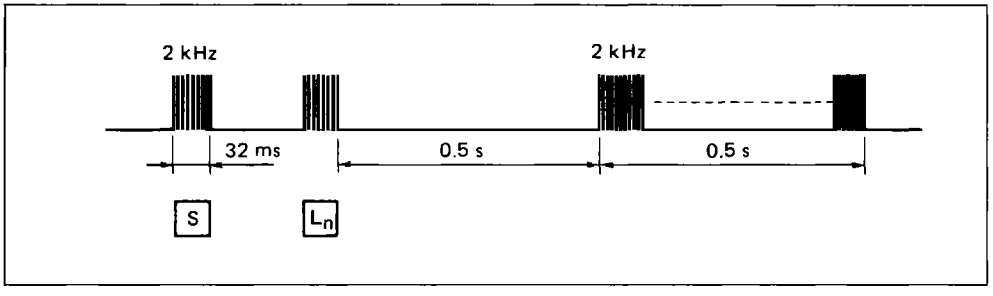
Operation Confirmation Sound

It is output for valid key input.



Storing Confirmation Sound

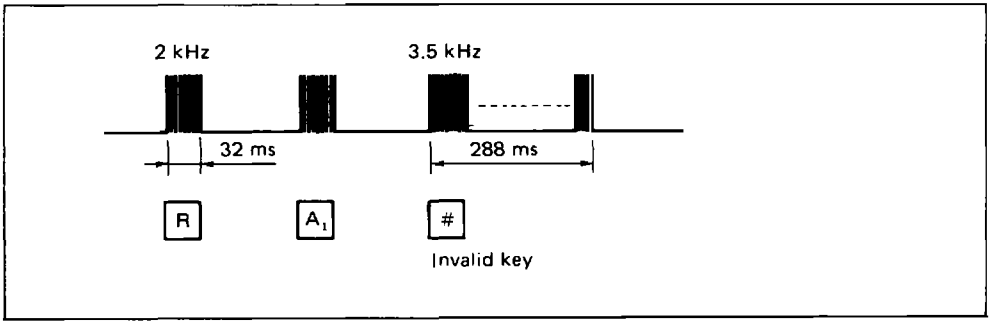
It is output when storing or clearing of telephone number has been completed.



Alarm Sound (a)

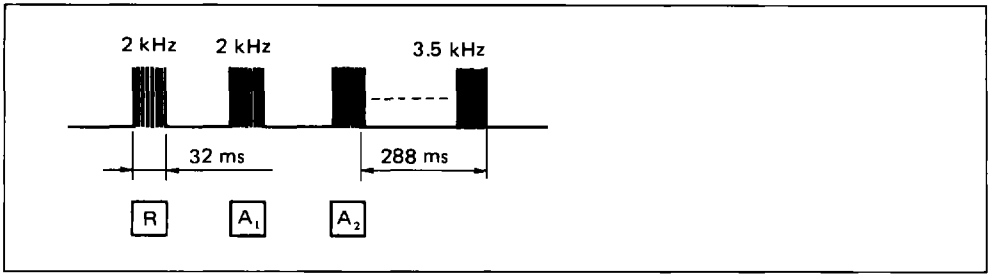
It is output for the followings.

- Wrong key input.
- 33rd digit input for storing.
- STORE key input when the empty capacity of repertory memory is less than 16 digits.



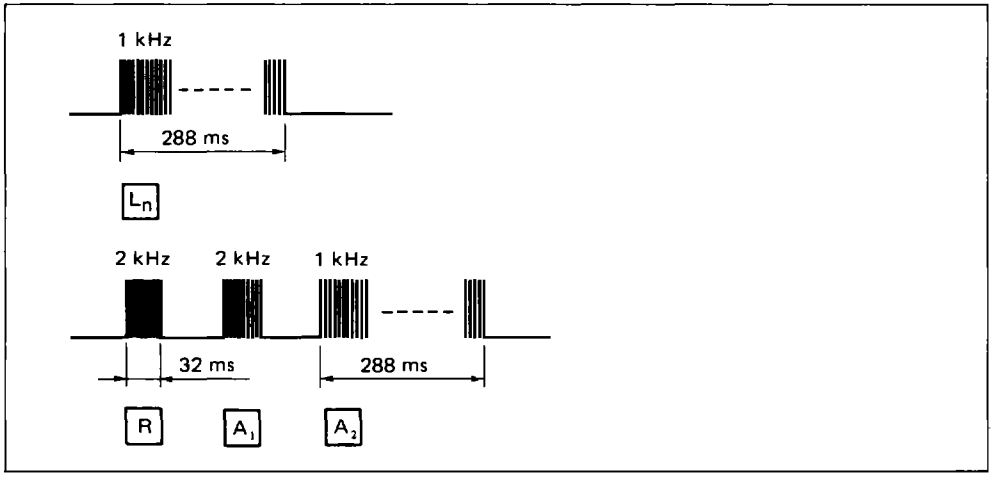
Alarm Sound (b)

It is used when the repertory number using other telephone number's abbreviated code as a part of it is used as a part of newly stored number.



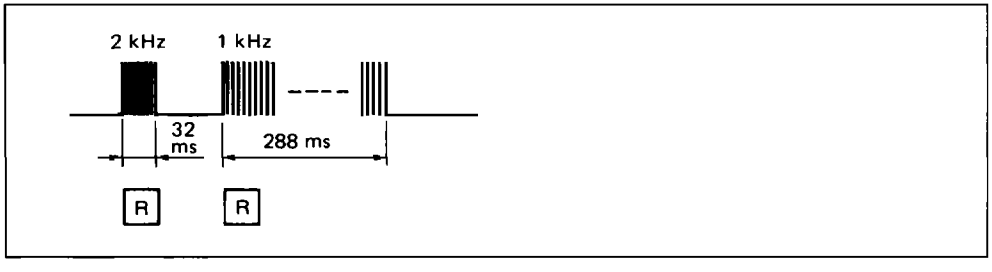
Alarm Sound (c)

It is output when there is no data in the accessed memory address.



Alarm Sound (d)

It is output when redial is prohibited.



ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	V_{DD}	Ta = 25°C	− 0.3~7	V
Input voltage	V_I	Ta = 25°C	− 0.3~V_{DD} + 0.3	V
Output voltage	V_O	Ta = 25°C	− 0.3~V_{DD} + 0.3	V
Power dissipation	P_D	Ta = 25°C	200max.	mW
Storage temperature	Tstg	–	− 55~ + 125	°C

Operational Ranges

Parameter	Symbol	Condition	Rating	Unit
Operating voltage	V_{DD}	f_{osc} = 3.58 MHz	2.0~5.5	V
Memory retention voltage	V_{DDM}	–	1.2~5.5	V
Operating temperature	T_{OP}	–	− 20~ + 75	°C

*NOTE: In the tone mode, minimum operating voltage is 2.2V.

DC Characteristics

(Ta = − 20~ + 75°C)

Parameter	Symbol	Conditions		Supply voltage	Min	Typ	Max	Unit
"H" output current (1)	I_{OH1}	$\overline{MUTE}$ / $\overline{XMIT\ MUTE}$ / DIAL PULSE	V_{OH} = 2.6V	3.0V	− 0.2	–	–	mA
"L" output current (1)	I_{OL1}		V_{OL} = 0.4V	3.0V	0.5	–	–	mA
"H" output current (2)	I_{OH2}	C_1~C_4	V_{OH} = 2.6V	3.0V	− 1.0	–	–	mA
"L" output current (2)	I_{OL2}		V_{OL} = 0.4V	3.0V	10	–	–	µA
"H" output current (3)	I_{OH3}	DP MODE OUT / BD	V_{OH} = 2.6V	3.0V	− 20	–	–	µA
"L" output current (3)	I_{OL3}		V_{OL} = 0.4V	3.0V	10	–	–	µA
"H" input voltage	V_{IH}	–		3.0V	2.2	–	–	V
				5.5V	4.0	–	–	
"L" input voltage	V_{IL}	–		3.0V	–	–	0.8	V
				5.5V	–	–	1.4	

Parameter	Symbol	Conditions		Supply voltage	Min	Typ	Max	Unit
"H" input current (1)	I_{IH1}	$\overline{HS}$	V_{IH} = 5.5V	5.5V	–	–	2	μA
"L" input current (1)	I_{IL1}		V_{IL} = 0V	3.0V	– 20	–	– 180	μA
				5.5V	– 40		– 360	
"H" input current (2)	I_{IH2}	R_1~R_7	V_{IH} = 5.5V	5.5V	20	–	180	μA
			V_{IH} = 3.0V	3.0V	10		90	
"L" input current (2)	I_{IL2}		V_{IL} = 0V	5.5V	–	–	– 2	μA
"H" input current (3)	I_{IH3}	LSEL,MB DRS MODE SEL AC, TEST	V_{IH} = 5.5V	5.5V	60	–	600	μA
			V_{IH} = 3.0V	3.0V	30		300	
"L" input current (3)	I_{IL3}		V_{IL} = 0V	5.5V	–	–	– 2	μA
Power supply current (1)	I_{DDP}	DTMF circuit off, No load		2.5V	–	0.25	0.6	mA
				5.0V	–	1.5	2.4	
Power supply current (2)	I_{DDT}	DTMF circuit on, No load		2.5V	–	1.3	2.4	mA
				5.0V	–	4.2	6.8	
Power supply current (3)	I_{DDM}	On-hook mode, Ta = 25°C, No load		2.5V	–	–	0.2	μA

AC Characteristics

f_{OSC} = 3.579545 MHz, T_a = -20 ~ +75°C

Parameter	Symbol	Condition		Min	Typ	Max	Unit
Key Input Time	T_{KIN}			16	—	—	ms
Tone Output	V_{OUT}	ROW side only R_L = 1 KΩ	V_{DD} = 2.2 V	—	180	—	mV rms
			V_{DD} = 4.0 V	—	260	—	
High/Low Level Ratio	dB_{CR}			1.0	2.0	3.0	dB
Distortion	$\%_{Dis}$	R_L = 1KΩ		—	5	10	%

Tone Output Frequency

f_{OSC} = 3.579545 MHz

Key Input	Nominal Frequency (Hz)	Output Frequency (Hz)	Distortion (%)
R_1	697	699.1	+0.30
R_2	770	766.2	-0.49
R_3	852	847.4	-0.54
R_4	941	948.0	+0.74
C_1	1209	1215.9	+0.57
C_2	1336	1331.7	-0.32
C_3	1477	1471.9	-0.35

Signal Output Timing

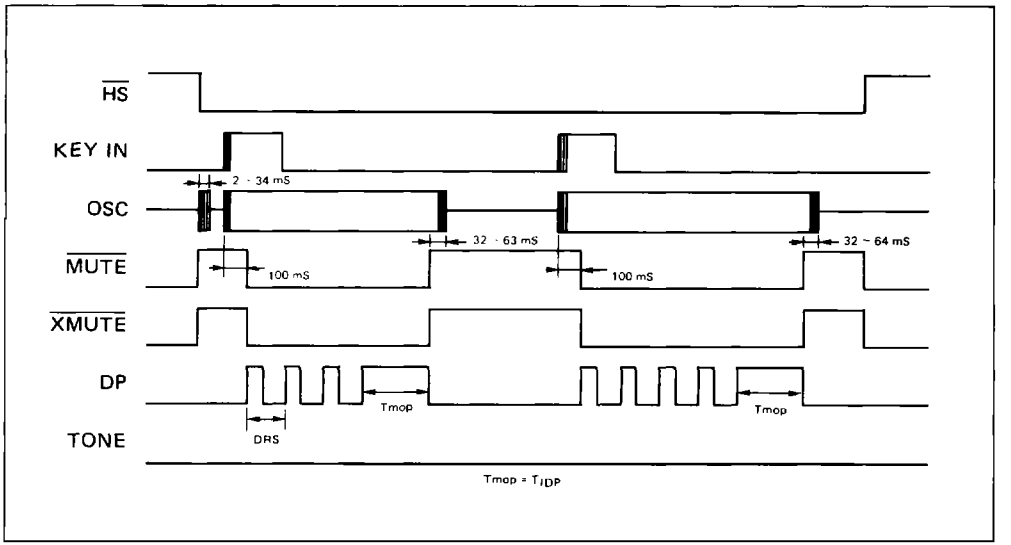
f_{OSC} = 3.579545 MHz

Parameter	Symbol	Condition	Typ	Unit
Tone Output Time	T_{tone}	Tone auto dial	100	ms
Inter Digit Pause	T_{IDP_1}	Tone auto dial	100	ms
	T_{IDP_2}	Pulse auto dial (10 pps)	800	ms
	T_{IDP3}	Pulse auto dial (20 pps)	500	ms

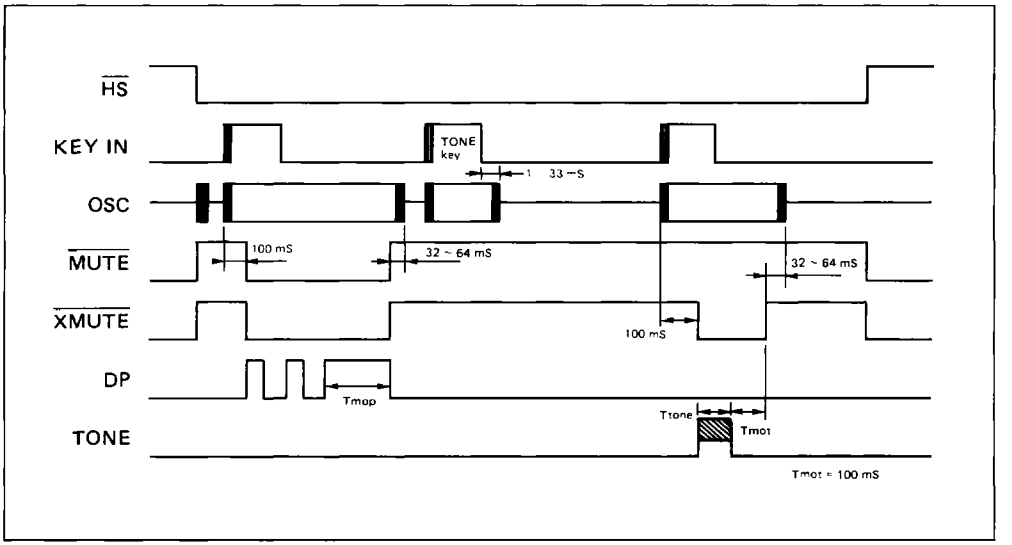
TIMING CHART

DP MODE TIMING CHART

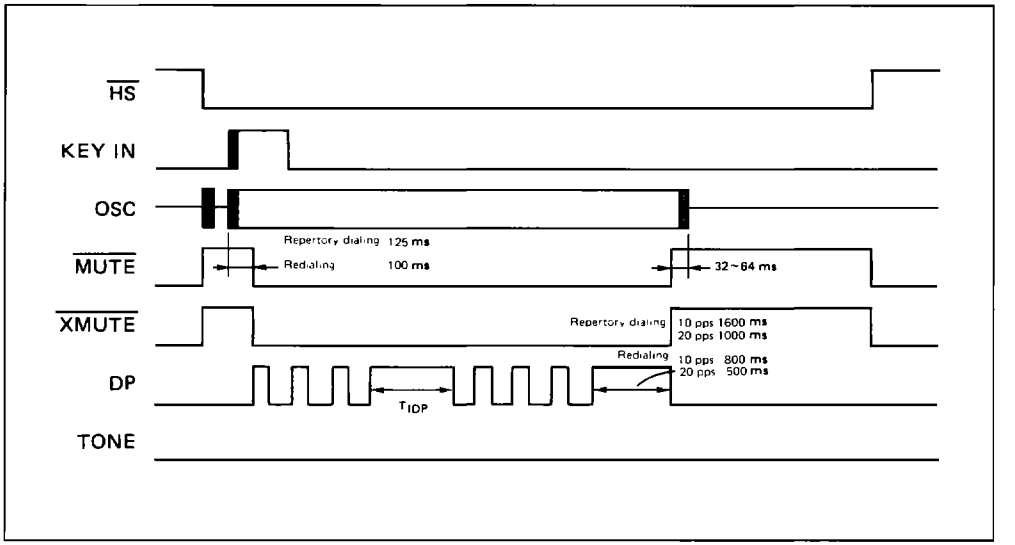
1) Normal dialing



2) Mode change-over by Tone key

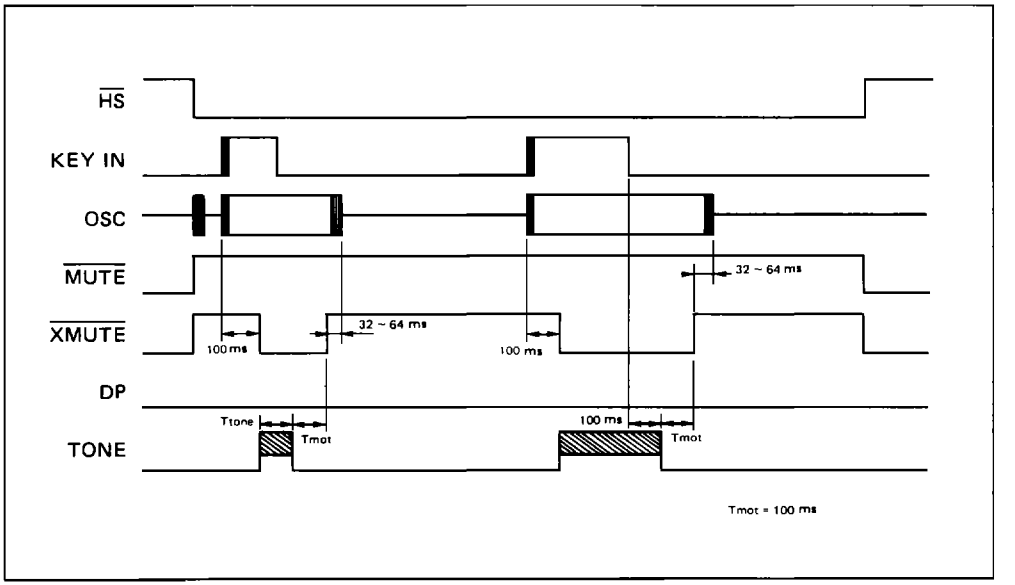


3) Repertory dialing



DTMF MODE TIMING CHART

1) Normal dialing



2) Repertory dialing, Last number re-dial