

# LR48252

## Pulse/Tone Dialer LSI

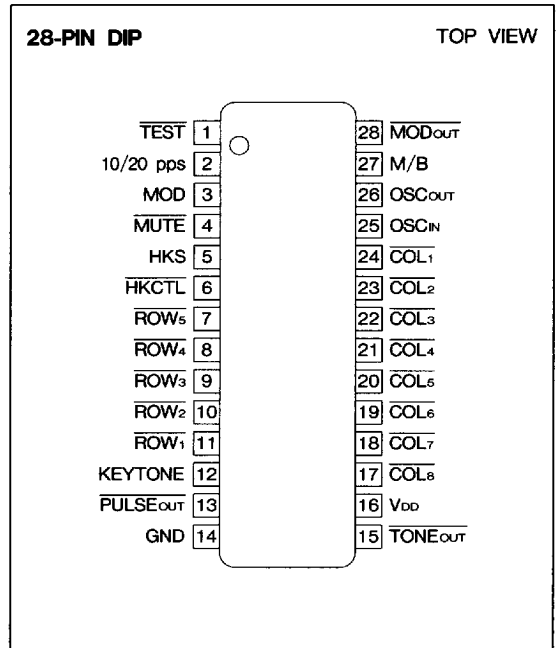
### DESCRIPTION

The LR48252 is a single-chip telephone system incorporating 20 one-touch or three-touch repertory memories of 16-digit each.

### FEATURES

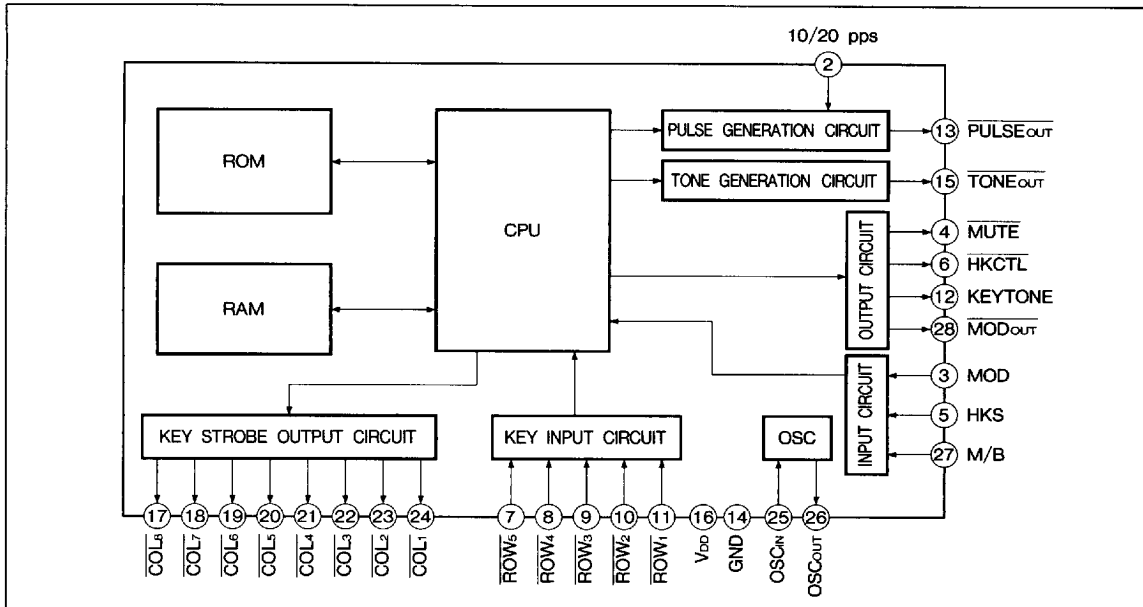
- 32-digit redial memory, and 20 one-touch or three-touch repertory memories of 16-digit each.
- Make ratio : 33/39% pin-selectable
- Pulse rate : 10/20 pps pin-selectable
- Key tone output (1 kHz)
- Allows switching from pulse mode to tone mode for mixed-mode dialing by the key entry
- Pulse/Tone dialer operation can be selected by the pin
- Flash function (FLASH key can be stored in memory)
- Pause capability for PABX
- Internal crystal oscillator using external a 3.579 545 MHz crystal resonator for color burst
- CMOS process
- Package : 28-pin DIP (DIP028-P-0600)

### PIN CONNECTIONS



8180798 0014285 594

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT	NOTE
Supply voltage	V <sub>DD</sub>	6.5	V	1
Operating temperature	T <sub>opr</sub>	-30 to +60	°C	
Storage temperature	T <sub>stg</sub>	-55 to +150	°C	
Power dissipation	P <sub>d</sub>	500	mW	2
Pin voltage	V <sub>IN1</sub>	-0.3	V	3
	V <sub>IN2</sub>	+0.3	V	4

NOTES :

1. Referenced to GND.
2. T<sub>a</sub>=25°C
3. The maximum applicable voltage on any pin with respect to the GND.
4. The maximum applicable voltage on any pin with respect to V<sub>DD</sub>.

TELECOMMUNICATIONS



## DC CHARACTERISTICS

(Ta=25°C, GND=0 V)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Supply voltage	V <sub>DD</sub>	Pulse mode	2.0		5.5	V	
		Tone mode	2.0		5.5		
Standby current	I <sub>ST</sub>	V <sub>DD</sub> =3.5 V			0.3	μA	1
Operating current	I <sub>OPP</sub>	V <sub>DD</sub> =3.5 V : Pulse mode		0.5	2.0	mA	2
	I <sub>OPT</sub>	V <sub>DD</sub> =3.5 V : Tone mode		1.0	3.0		
Input voltage	V <sub>IL</sub>		GND		0.2V <sub>DD</sub>	V	3
	V <sub>IH</sub>		0.8V <sub>DD</sub>		V <sub>DD</sub>		
Sink current	I <sub>CL</sub>	V <sub>DD</sub> =2.0 V, V <sub>OL</sub> =0.5 V	1.0	2.0		mA	4
KEYSTONE output current	I <sub>TL</sub>	V <sub>DD</sub> =2.0 V, V <sub>OL</sub> =0.5 V	1.0	2.0		mA	
	I <sub>TH</sub>	V <sub>DD</sub> =2.0 V, V <sub>OL</sub> =1.5 V	1.0	2.0			
Output leakage current	I <sub>LKG</sub>	V <sub>DD</sub> =5.5 V, V <sub>OH</sub> =5.5 V			1.0	μA	5
COLUMN output current	I <sub>CL</sub>	V <sub>DD</sub> =3.5 V, V <sub>OL</sub> =0.5 V		100		μA	
	I <sub>CH</sub>	V <sub>DD</sub> =3.5 V, V <sub>OH</sub> =3.0 V		5			
ROW input current	I <sub>P</sub>	V <sub>DD</sub> =3.5 V, V <sub>IL</sub> =0 V		35		μA	
HKS input current	I <sub>HP</sub>	V <sub>DD</sub> =3.5 V, V <sub>IL</sub> =0 V		5		μA	
TEST input current	I <sub>TP</sub>	V <sub>DD</sub> =3.5 V, V <sub>IL</sub> =0 V		5		μA	
Memory retention voltage	V <sub>R</sub>		1.0			V	

## NOTES :

1. Current required to back up memories, with all outputs unloaded in on-hook mode.
2. Operating current with all outputs unloaded.
3. Applicable to all input pins.
4. Applicable to the MUTE, MOD<sub>OUT</sub>, and HKCTL pins.
5. Applicable to the MUTE, MOD<sub>OUT</sub>, HKCTL, and PULSE<sub>OUT</sub> pins.

## TONE OUTPUT CHARACTERISTICS

(Ta=25°C, GND=0 V)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Tone output voltage	ROW	R <sub>L</sub> =10 kΩ, V <sub>DD</sub> =4.0 V	130	175	220	mV <sub>rms</sub>	
	COLUMN	R <sub>L</sub> =10 kΩ, V <sub>DD</sub> =4.0 V	160	210	270		
Output distortion	Dis	R <sub>L</sub> =10 kΩ, V <sub>DD</sub> ≥2.0 V			-23	dB	1
Pre-emphasis	P <sub>EMB</sub>	R <sub>L</sub> =10 kΩ, V <sub>DD</sub> ≥2.0 V	1.0	2.0	3.0	dB	
Inter-digit pause	t <sub>IDP</sub>		100			ms	2
Tone duration	t <sub>OD</sub>		100			ms	2
Tone output rate	t <sub>OR</sub>		200			ms	2

## NOTES :

1. Distorting frequency components in the range of 20 Hz to 80 kHz are contained in the fundamental ROW and COLUMN tone signals.
2. For redialing and repertory memory dialing.

AC CHARACTERISTICS

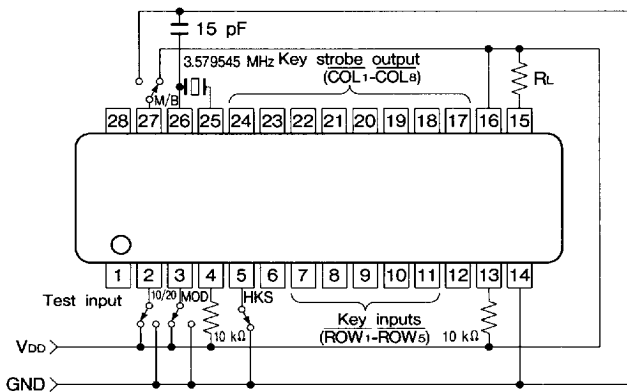
(Ta=25°C, GND=0 V)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT	NOTE
Oscillation start-up time	$t_{OS}$				8.0	ms	1
Pulse output rate	$P_R$	Pin 2 = GND		10		pps	
		Pin 2 = V <sub>DD</sub>		20			
Break time	$t_B$	Pin 27 = GND		67		ms	2
		Pin 27 = V <sub>DD</sub>		61			
Inter-digit pause	$t_{IDP}$	Pin 2 = GND		850		ms	
		Pin 2 = V <sub>DD</sub>		500			
Pre-digit pause	$t_{PDP}$	Pin 27 = GND		33		ms	2
		Pin 27 = V <sub>DD</sub>		39			

NOTES :

- Crystal resonator parameters :  $R_s=100 \Omega$ ,  $L_M=96 \text{ mH}$ ,  $C_M=0.02 \text{ pF}$ ,  $C_H=5 \text{ pF}$ ,  $f=3.579545 \text{ MHz}$ .
- Value at 10 pps (value 1/2 at 20 pps).

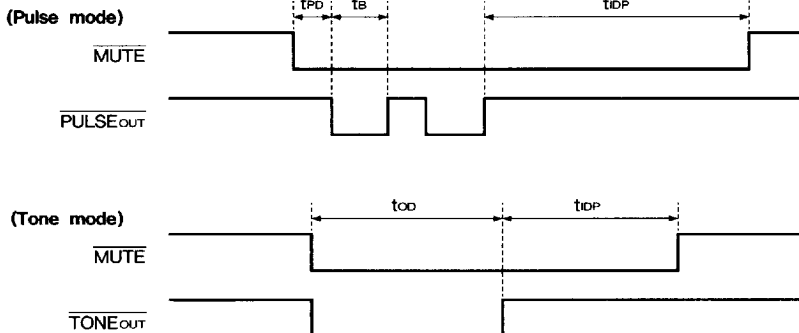
TEST CIRCUIT



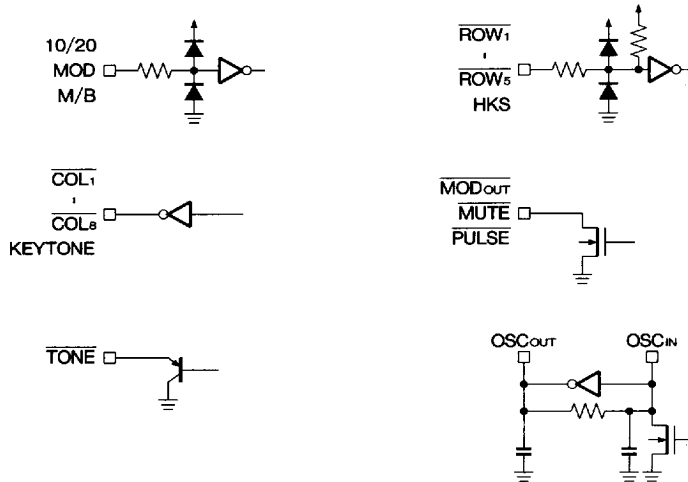
NOTES :

- Use a 68  $\mu\text{F}$  capacitor across V<sub>DD</sub> and GND for supply voltage smoothing and latch-up prevention. And connect the TEST pin to V<sub>DD</sub>.

TIMING DIAGRAMS



INPUT/OUTPUT CIRCUITS



PIN FUNCTION

SYMBOL	I/O	FUNCTION
COL <sub>1</sub> - COL <sub>8</sub>	O	Key strobe outputs
OSC <sub>in</sub>	I	Crystal resonator pin
OSC <sub>out</sub>	O	Crystal resonator pin
M/B	I	Make/break ratio selection pin
MOD <sub>out</sub>	O	Pulse/Tone mode output pin
TEST	I	Test input pin
10/20 pps	I	Pulse rate selection pin (10/20 pps)
MOD	I	Pulse/Tone mode selection input pin
MUTE	O	Mute signal output pin
HKS	I	Hook switch input pin
HKCTL	O	Hook control signal output pin
ROW <sub>1</sub> - ROW <sub>5</sub>	I	Key input pins
KEYSTONE	O	Key-tone output pin
PULSE <sub>out</sub>	O	Pulse output pin
TONE <sub>out</sub>	O	Tone output pin
V <sub>DD</sub>	I	Power supply pin
GND	I	Ground pin

PIN DESCRIPTIONS

10/20 ms (Pin 2)

This pin selects the pulse rate in the Pulse mode.

10/20 PIN	PULSE RATE
GND	10 pps
V <sub>DD</sub>	20 pps

M/B (Pin 27)

This pin selects make/break ratio in the Pulse mode.

M/B PIN	MAKE/BREAK RATIO
GND	33/67
V <sub>DD</sub>	39/61

MOD (Pulse/Tone mode selection; Pin 3)

Switching from the Pulse to the Tone mode is done as follows :

**i) MOD pin**

If the mode is switched to the Tone mode during dialing in Pulse mode, the device yields tone signals for the subsequent dial key operations. In On-Hook mode, the MOD pin also specifies the initial mode in Off-Hook mode :

MOD PIN	INITIAL MODE
GND	Tone mode
V <sub>DD</sub>	Pulse mode

**ii) MOD key**

If the MOD or \* key is pressed during dialing in Pulse mode, the device outputs tone signals for subsequent dial key operations.

In either case, mode switching information is stored to the buffer memory like other data. If the mode switching key is pressed during dialing, a pause of 4 seconds is automatically inserted before the Tone mode is selected.

STATUS	MODE	MOD <sub>OUT</sub> output
Off-hook	Pulse mode	HZ
	Tone mode	LOW
On-hook	—	HZ

HZ : High impedance

**MUTE (Pin 4)**

The MUTE pin is an N-channel open drain output. It is set to a Low level when a pulse or tone dial signal is being output. It is set to high impedance during a pause.

**HKS (Pin 5)**

This is the hook switch input, and has a pull-up resistor to V<sub>DD</sub>.

HKS PIN	MODE
GND	Off-Hook
V <sub>DD</sub>	On-Hook

**KEYTONE (Pin 12)**

The KEYTONE is a CMOS output. It yields a 1 kHz square-wave signal while a key is pressed, after the key data becomes valid.

**PULSE<sub>OUT</sub> (Pin 13)**

The PULSE<sub>OUT</sub> is an N-channel open-drain output. During dialing in Pulse mode, it outputs a pulse signal. This pin also yields the flash signal.

**TONE<sub>OUT</sub> (Pin 15)**

In the Tone mode, this pin yields the DTMF signal. Fig. 3 shows the output circuit.

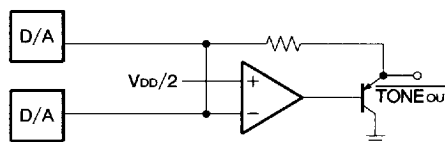


Fig. 3 Tone Output Circuit

**HKCTL (Pin 6)**

The HKCTL is an N-channel open-drain output. It is controlled by the ON/OFF key to be used for hook control.

PRESENT STATE		INPUT	HKCTL output
Hook switch	HKCTL		
—	HZ	ON/OFF key	LOW
—	LOW	ON/OFF key	HZ
On-hook	—	To Off-Hook	HZ
Off-hook	HZ	To On-Hook	HZ
Off-hook	LOW	To On-Hook	LOW

HZ : High impedance

**TEST (Pin 1)**

This is the reset and test input pin. It is pulled up to V<sub>DD</sub>.

TEST PIN	ROW <sub>s</sub>	MODE
GND	GND	Single tone
	Open or V <sub>DD</sub>	Reset
V <sub>DD</sub>	—	Normal

A Low input to this pin resets the entire system, upon which all memory contents are cleared. Use a reset switch to prepare for uncertain memory contents resulting from supply voltage drop.

**Key Function**

KEY	FUNCTION
0 - 9	Numeric keys
*	Pulse mode : Switches from Pulse into Tone mode.
	Tone mode : Data key
#	Pulse mode : Redial key
	Tone mode : Data key
M1 - M20	One-touch memory keys
FLASH	Flash key
ON/OFF	Hook control ON/OFF key
STORE	Store to memory key
RED/P	Redial/Pause key
PAUSE	Pause key
MOD	Pulse/Tone mode switching key
RECALL	Repertory memory recall key
CLR	Memory clear key

	COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8
ROW1	1	2	3	FLASH	M1	M6	M11	M16
ROW2	4	5	6	STORE	M2	M7	M12	M17
ROW3	7	8	9	CLR	M3	M8	M13	M18
ROW4	*	0	#	PAUSE	M4	M9	M14	M19
ROW5	MOD	RED/P	ON/OFF	RECALL	M5	M10	M15	M20

Fig. 4 Key Matrix



Fig. 5 Single-Contact Key

**Key Signal Specifications**

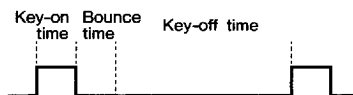
While a key tone is being output, no other key entry is accepted. Also during flash output, no key entry is accepted.

Table 1 Key Signal Specifications

PARAMETER	SPECIFICATION
Double key operation	Only one key code is accepted according to the specified priority order. (NOTE 1)
Bounce time	24 ms
Key on time	30 ms (MIN.) required (NOTE 2)
Key off time	100 ms (MIN.) required (NOTE 2)

**NOTES :**

- Priority order among keys : Keys in the COL1 column have the highest priority, while those in the COL8 have the lowest. Keys in the ROW5 row have the highest priority, while those in the ROW1 row have the lowest. Columns have higher priority than rows.
- If the key-on or key-off time is less than these, the key entry may not be accepted.



**FUNCTIONAL DESCRIPTION**

**Output Frequencies in Tone Mode**

Table 2 lists the DTMF frequencies. The device yields the DTMF signal while a data key in COL1-COL3 and ROW1-ROW4 is pressed.

Table 3 lists the output frequencies in the Single Tone Test mode.

Table 2 DTMF Output Frequencies

		STANDARD DTMF (Hz)	LR48252 (Hz)	DEVIATION (%)
Lower-group frequencies	ROW1	697	692.6	-0.63
	ROW2	770	774.1	+0.54
	ROW3	852	849.0	-0.35
	ROW4	941	940.0	-0.11
Higher-group frequencies	COL1	1209	1214.2	+0.43
	COL2	1336	1335.7	-0.03
	COL3	1477	1484.1	-0.48

**NOTE :**

The frequencies given in the LR48252 column are when the internal oscillator is oscillating at 3.579545 MHz. Deviation in the oscillation frequency affects tone output frequency.

Table 3 Output Frequencies in Test Mode


KEY	HIGH FREQUENCY (Hz)	LOW FREQUENCY (Hz)
7	1214.2	—
2	1335.7	—
6	1484.1	—
3	—	692.6
4	—	774.1
8	—	849.0
0	—	940.0

**Normal Dialing**

If data keys (0-9 in Pulse mode; 0-9, \*, and # in Tone mode) are used for Off-Hook dialing, the device performs normal dialing operation. In the Tone mode, the device outputs the DTMF signal while a key is pressed and held. (In this case, no key tone is output.) Up to 32 digits of input data are stored in a buffer memory. Key entries in excess of 32 digits are accepted when all of the 32-digit data stored in the buffer memory are dialed. Once the 33rd digit is accepted, the entire buffer memory is cleared, and an additional 32 digits beginning with the 33rd digit can be stored in the buffer.

INPUT	DIAL OUTPUT	BUFFER MEMORY CONTENTS
↓ <P> ↑ 07436 5 1321	0743651321	(R)=last number dialed (R)=0743651321
↓ <T> ↑ 07436 5 1321 #*	0743651321*	(R)=last number dialed (R)=0743651321#*
↓ <P> ↑ 12345 ... 012	12345 ... 012	(R)=last number dialed (R)=12345 ... 012 32 digits
32 digits 3456789	3456789	(R)=3456789
↓ ↑		(R)=3456789

**NOTE :**

↓ : On-hook, ↑ : Off-hook, < > : MOD pin status,  
 : DTMF output, (R) : Buffer memory

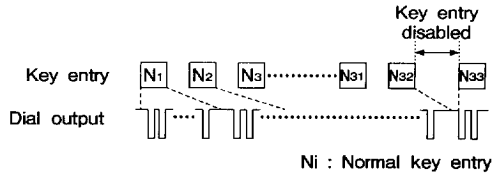


Fig. 6 Normal Mode Dialing Sequence

**Redialing Feature**

If the RED/P key is pressed following Off-Hook, the contents of the buffer memory are dialed (in Pulse mode, the # key also acts as the REDIAL key). Redialing corresponds to 32 digits of normal dialing.

ENTRY	DIAL OUTPUT	MEMORY CONTENTS
↓ <P> ↑ 1234567890	1234567890	(R)=last number dialed (R)=1234567890
↓ ↑ RED/P or #	1234567890	(R)=1234567890

**Repertory Dialing**

Twenty memories of 16 digits each can be assigned to one-touch or three-touch repertory dial keys.

Two repertory dial keys may be operated consecutively in Off-Hook mode. The dialed data are stored in the buffer memory. A third repertory dial key is accepted after all the numbers assigned to the first and second keys have been dialed. When the third key is pressed, the buffer memory is cleared and only the number for the third key is stored in the buffer. Each memory has a length of 16 digits.

ENTRY	DIAL OUTPUT	MEMORY CONTENTS
↓ <P>		(M1)=07436, (M2)=51321, (M3)=12345
↑		(R)=last number dialed
M1	07436	(R)=07436
M2	51321	(R)=0743651321
↓ ↑		
REC		
02	12345	(R)=12345



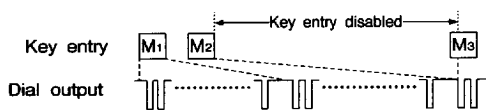


Fig. 7 Repertory Dialing Sequences

**Storing Numbers to Memories**

Memory contents can be set only in On-Hook mode.

KEY ENTRY	MEMORY CONTENTS
↓	(R)=last number dialed
STORE M <sub>1</sub>	(M <sub>1</sub> )=(R)=last number dialed
STORE 07436 M <sub>2</sub>	(M <sub>2</sub> )=(R)=07436
STORE 51321 STORE 02	(M <sub>3</sub> )=(R)=51321

**NOTE :**

Up to 16 digits can be stored to each memory. For a number exceeding 16 digits, only the first 16 digits are stored and the remaining digits are ignored.

**Mixed-Mode Dialing**

During dialing in Pulse mode, the user can switch to Tone mode with the MOD or \* key. If the mode switching key is pressed during dialing or mode switching data is encountered in memory, a pause of 4 seconds is automatically inserted before the Tone mode is selected. Like other data, the mode switching information is stored in the buffer memory (one-touch or three-touch memory) occupying a single digit.

KEY ENTRY	DIAL OUTPUT	MEMORY CONTENTS
↓ <P>		(M <sub>1</sub> )=123MOD456
↑		
07436	07436	(R)=07436
MOD 51321	51321	(R)=07436MOD51321
↓ <P>		
↑		
07436 MOD 51321	07436 (PAUSE) 51321	(R)=07436MOD51321
Pressed while dialing 07436		
↓ <P>		
↑		
M <sub>1</sub>	123 (PAUSE) 456	(R)=123MOD456

**NOTE :**

DTMF output

**Pause Feature**

The PAUSE or RED/P\* key allows the user to insert a pause of about 4 seconds into a stored dialing sequence. During pause, the MUTE output is set to high impedance. Like other data keys, the PAUSE key data can also be stored in memory. The pause can be cleared by pressing the PAUSE or RED/P key during pause.

KEY ENTRY	DIALING SEQUENCE	MEMORY CONTENTS
↑		
012 PAUSE 3456	012 (PAUSE) 3456	(R)=012PAUSE3456

**NOTE :**

\* Immediately after the off-hook, this key acts as the REDIAL key.

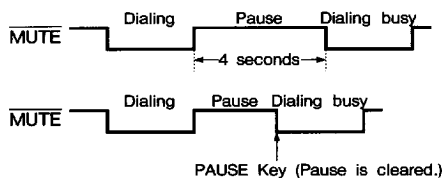


Fig. 8 Pause Feature

**Repertory Dialing Plus Normal Dialing**

In Off-Hook mode, normal dialing can follow repertory dialing. A number of up to 16 digits can be stored in buffer memory following the repertory number. When the number stored in the buffer has been dialed, the device is ready to accept subsequent key entry. In this case, all previous contents of the buffer are cleared before the 17th digit is stored.

KEY ENTRY	DIAL OUTPUT	MEMORY CONTENTS
↑		(M <sub>1</sub> )=07436
M <sub>1</sub>	07436	(R)=07436
1234 ... 456	1234 ... 456	(R)=074361234 ... 456
16 digits	16 digits	16 digits
7890	7890	(R)=7890
↓ ↑		(M <sub>2</sub> )=09876
REC 01	09876	(R)=09876
1234 ... 456	1234 ... 456	(R)=098761234 ... 456
16 digits	16 digits	16 digits
7890	7890	(R)=7890

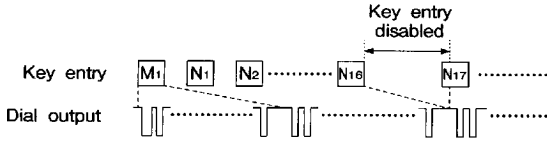


Fig. 9 Repertory Dialing Plus Normal Dialing

**Normal Dialing Plus Repertory Dialing**

In Off-Hook mode, repertory dialing can follow normal dialing.

After normal dialing up to 16 digits, a repertory dial key can be entered. All numbers dialed with data and repertory keys are stored in a buffer. After all numbers in the buffer have been dialed, the device is ready to accept subsequent data key entry.

When a new data key entry is accepted, the previous contents of the buffer are cleared.

If a number 17 to 32 digits length is dialed with data keys in Off-Hook mode, a repertory dial key can be entered after the entire number is dialed normally. The previous contents of the buffer are cleared when the repertory dial key is entered.

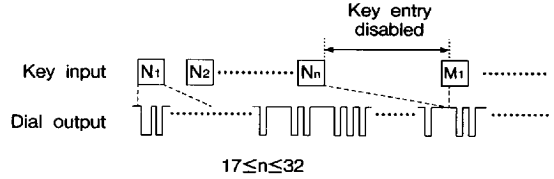
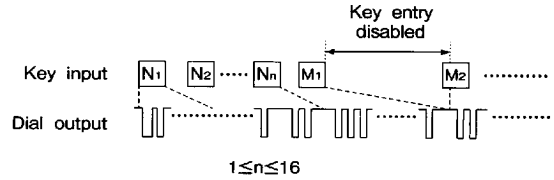


Fig. 10 Normal Dialing Plus Repertory Dialing

**Flash Feature**

i) If FLASH key is pressed in Off-Hook mode, the device outputs the flash signal pulses shown in Fig. 11 from its  $\overline{\text{PULSEout}}$  and  $\overline{\text{MUTE}}$  pins. The flash signal is output at the exact timing of FLASH key operation even if dialing is busy. Once the flash signal is output, the device is placed in the same state as that in the temporary On-Hook mode. In this case, the flash signal is not stored in buffer.

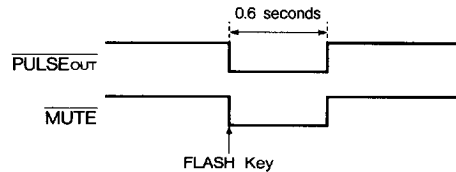


Fig. 11 Flash Signal Pulses

ii) The flash signal can be stored in the one-touch or three-touch repertory dial memories. In this case, flash pulses as shown in Fig. 12 are output.

When a repertory memory containing the FLASH key is recalled, the stored number including the FLASH key is transferred to the buffer.

A subsequent REDIAL key operation causes any of the following dialing sequences, depending on the position where the FLASH key is inserted :

KEY ENTRY	DIAL OUTPUT	MEMORY CONTENTS
↑		(M1) = 51321
07436	07436	(R) = 07436
M1	51321	(R) = 0743651321
2416	2416	(R) = 2416
↑		(M1) = 51321
1234 ... 4567	1234 ... 4567	(R) = 1234 ... 4567
17 digits	17 digits	17 digits
REC 00	51321	(R) = 51321
2416	2416	(R) = 513212416

- i) When a flash is placed at the last digit of the data in the buffer:  
The first digit through the digit just before the flash in the buffer are redialed.
- ii) When a flash is placed in the middle of data in the buffer:  
The digit following the flash through the last digit are redialed.
- iii) When a flash is placed at the first digit of the buffer:  
The second digit through the last digit are redialed.

In any of the three cases above, the flash signal itself is not redialed.

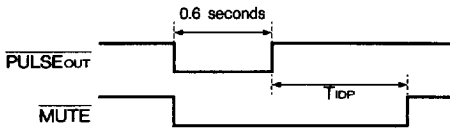


Fig. 12 Flash Signal

Table 4 Flash Function

KEY ENTRY	DIAL OUTPUT	MEMORY CONTENTS
<P>		(R) = last number dialed
↑		(R) = last number dialed
123	123	(R) = 123
FLASH	FLASH	(R) = 123
456	456	(R) = 456
↓ ↑		
RED/P	456	(R) = 456
<P>		(R) = last number dialed
↑		(R) = last number dialed
123	123	(R) = 123
FLASH	FLASH	(R) = 123
↓ ↑		
RED/P	123	(R) = 123
(M <sub>1</sub> ) = 123FLASH456 (M <sub>2</sub> ) = 123FLASH (M <sub>3</sub> ) = FLASH789		
↑		(R) = last number dialed
M <sub>1</sub>	123FLASH456	(R) = 123FLASH456
↓ ↑		
RED/P	456	(R) = 123FLASH456
↑		(R) = last number dialed
M <sub>2</sub>	123FLASH	(R) = 123FLASH
↓ ↑		
RED/P	123	(R) = 123FLASH
↑		(R) = last number dialed
M <sub>3</sub>	FLASH789	(R) = FLASH789
↓ ↑		
RED/P	789	(R) = FLASH789