LR48064 Pulse/Tone Dialer LSI

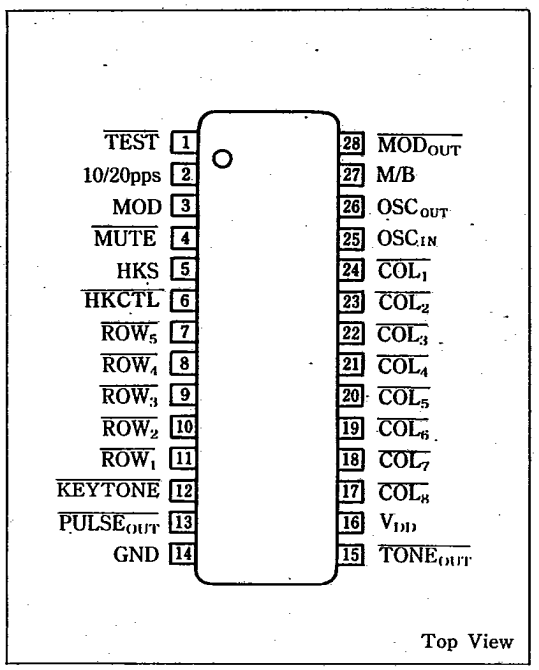
Description

The LR48064 is a CMOS pulse/tone dialer LSI providing auto-dialing and redialing. It features a built-in 16-digit×20-channel automatic dialing memory including a 16-digit×(10 to 20) one-touch memory, a 16-digit×(0 to 10) two-touch memory and a 32-digit redial memory

Features

1. 32-digit redial memory
2. Auto memory dialing : 16D×(10M to 20M) one-touch dialing and 16D×(0 to 10M) two touch dialing
3. Make ratio : 33/37% pin-selectable
4. Pulse rate : 10/20pps pin-selectable
5. Key tone output (1kHz)
6. Normal/memory combination dialing
7. Key or switch input allows switching from pulse to tone mode to provide mixed-dialing capability
8. Pulse/tone dialer operation pin-selectable
9. Flash signal output
10. PBX pause storage
11. Key input allows control of ON/OFF-hook
12. 28-pin shrink dual-in-line package

Pin Connections



Top View

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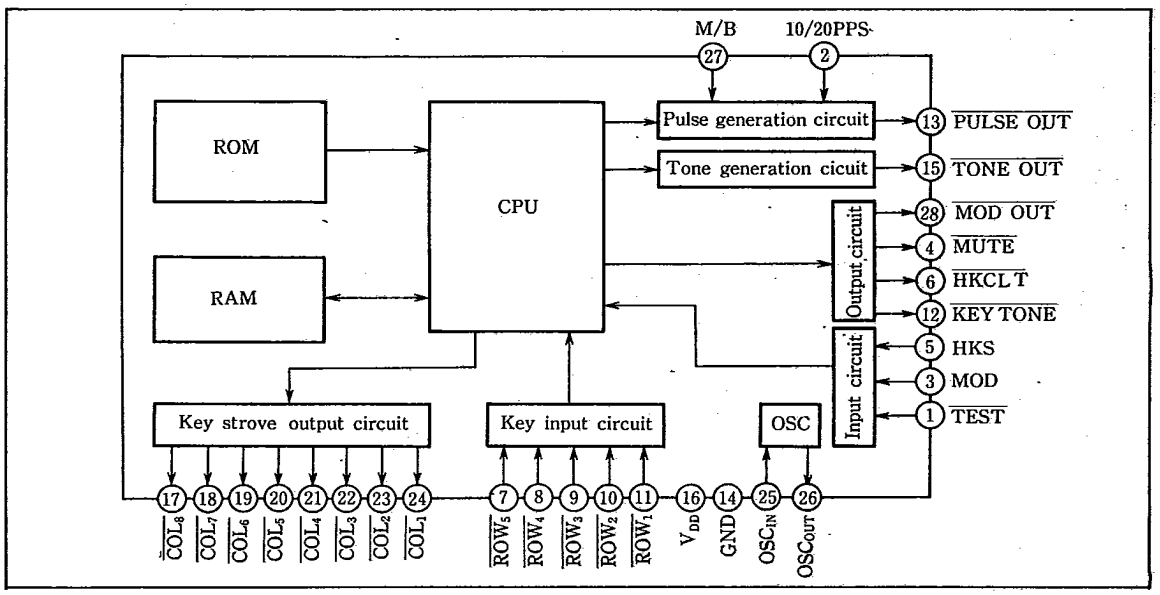
Block Diagram



Pin Functions

Name	I/O	Function	Name	I/O	Function
$\overline{COL_1}$-$\overline{COL_8}$	O	Key strobe outputs	HKS	I	Hook switch input pin
OSC_{IN}	I	Crystal oscillation circuit pin	HKCTL	O	Hook control signal output pin
OCS_{OUT}	O	Crystal oscillation circuit pin	$\overline{ROW_1}$-$\overline{ROW_5}$	I	Key inputs
M/B	I	Make/Break ratio select pin	KEY TONE	O	Beep tone output pin
MODOUT	O	Make/Break ratio select pin	PULSE OUT	O	Pulse output pin
TEST	I	Test pin	TONE OUT	O	Tone output pin
10/20pps	I	10/20pps select pin	V_{DD}	I	Power supply pin
MOD	I	Pulse/tone mode select pin	GND	I	Power supply pin
MUTE	O	Mute signal output pin			

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Note
Supply voltage	V_{DD}	6.5	V	1
Operating temperature	T_{opr}	−30 to+60	℃	
Storage temperature	T_{stg}	−55 to+150	℃	
Power dissipation	P_D	500	mW	2
Pin voltage	V_{IN1}	−0.3	V	3
Pin voltage	V_{IN2}	+0.3	V	4

Note 1 : Referenced to GND.
Note 2 : Ta=25℃.
Note 3 : The maximum applicable voltage on any pin with respect to GND.
Note 4 : The maximum applicable voltage on any pin with respect to V_{DD}.

DC Characteristics

(Ta=25℃, GND=0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Supply voltage	V_{DD}		2.0		6.0	V	
Standby current	I_{SP}	V_{DD}=3.5V		0.5	1.0	μA	1
Operating current	I_{OPP}	V_{DD}=3.5V Pulse Mode		0.5	2.0	mA	
	I_{OPT}	V_{DD}=3.5V Tone Mode		1.0	3.0	mA	2
Input voltage	V_{IL}		GND		$0.2V_{DD}$	V	
	V_{IH}		$0.8V_{DD}$		V_{DD}	V	3
Sink current	I_{OL}	V_{DD}=2.0V, V_{OL}=0.5V	1.0	2.0		mA	4
Pulse sink current	I_{PL}	V_{DD}=2.0V, V_{DL}=0.5V	1.0			mA	
KEYTONE output current	I_{TL}	V_{DD}=2.0V, V_{OL}=0.5V	1.0	2.0		mA	
	I_{IH}	V_{DD}=2.0, V_{OB}=1.5V	1.0	2.0		mA	
Output leakage current	I_{LKG}	V_{DD}=6.0V, V_{OH}=6.0V			1.0	μA	5
COLUMN output current	I_{CL}	V_{DD}=3.5V, V_{OL}=0.5V	50	100	500	μA	
	I_{CA}	V_{DD}=3.5V, V_{OH}=3.0V	1	5	15	μA	
ROW input current	I_{RP}	V_{DD}=3.5V, V_{IL}=0V	5	35	150	μA	
HKS input current	I_{HP}	V_{DD}=3.5V, V_{IL}=0V	5	58	150	μA	
TEST input current	I_{TP}	V_{DD}=3.5V, V_{IL}=0V	5	58	270	μA	

Note 1 : Current necessary for memory retention ; all outputs unloaded ; On-Hook mode.
Note 2 : Current during operation , Off-Hook or On-Hook mode.
Note 3 : Applied to all pins.
Note 4 : Applied to $\overline{MUTE}$, $\overline{MODOUT}$ pins.
Note 5 : Applied to $\overline{MUTE}$, $\overline{MODOUT}$, $\overline{PULSEOUT}$ pins.

■ Tone output Characteristics

(Ta=25℃, GND=0V)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Tone output voltage	ROW	V_{OR}	R_L=10kΩ, V_{DD}=4.0V	160	210	270	mVrms	
	COLUMN	V_{OC}	R_L=10kΩ, V_{DD}=4.0V	210	260	340	mVrms	
Output distortion		DIS	R_L=10kΩ, V_{DD}≧2.5V			−20	dB	1
Pre-emphasis		PE_{HB}	R_L=10kΩ, V_{DD}≧4.0V	1.0	2.0	3.0	dB	
Inter-digital pause		t_{IDP}			100		ms	
Tone output time		t_{OD}			100		ms	
Tone output rate		t_{OR}			200		ms	

Note 1 : Output distortion measured in terms of total out-of-band power (20Hz to 80kHz frequency range) relative to fundamental power of the Row and Column Signals.

■ AC Characteristics

(Ta=25℃, GND=0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Oscillation start time	t_{OS}				8.0	ms	1
Pulse rate	Pr	P_{IN2}=GND		10		pps	
		P_{IN2}=V_{DD}		20		pps	
Break time	t_B	P_{IN27}=GND		67		ms	2
		P_{IN27}=V_{DD}		63		ms	
Inter-digital pause time	t_{IDP}	10pps mode		850		ms	
		20pps mode		500		ms	
Mute overlap time	t_{MOLT}			2		ms	2
Pre-digital pause time	t_{PDP}	P_{IN27}=GND		33		ms	2
		P_{IN27}=GND		37		ms	

Note 1 : When crystal oscillation parameters Rs=100Ω, L_M=96mH, C_M=0.02pF, Ch=5pF, f=3.579545MHz are used.
Note 2 : 10pps pulse mode value. Values for 20pps are half of these.

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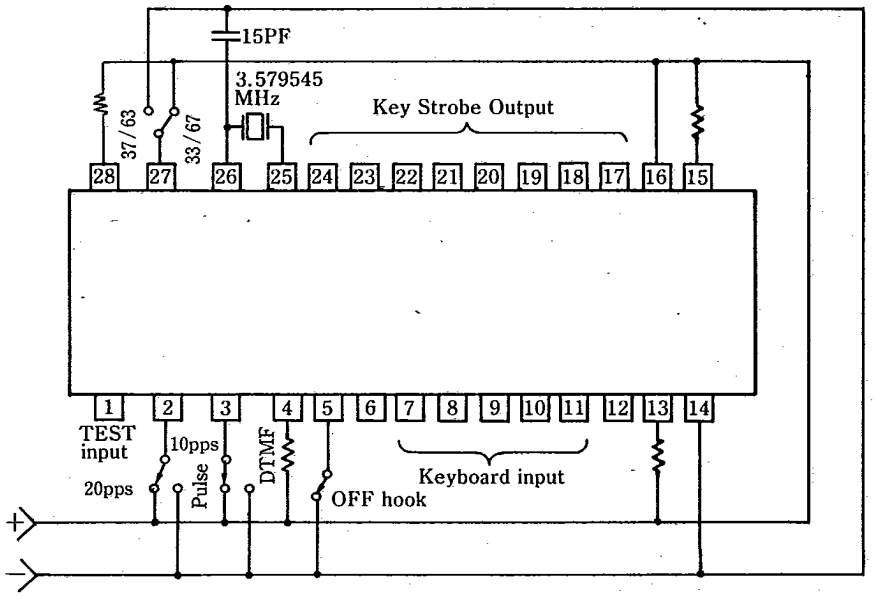
■ Test Circuit



Pin Descriptions

10/20pps (Pin 2), Make/Break (Pin 27)

In pulse mode, the pulse rate and Make/Break ratio can be selected by connecting pins 2 and 20, respectively, as follows.

10/20pps pin	Pulse rate
GND	10pps
V_{DD}	20pps

M/B pin	Make/Breake ratio
GND	33/67
V_{DD}	37/63

Pulse/Tone Mode Selection (Pin 3)

The mode immediately after going On-Hook or Off-Hook is selected by the MOD pin (Pin 3). If the MOD key is depressed in pulse mode, the rest of the dialing will be performed in tone mode. Mode key input data is stored in memory along with other data.

The key input mode will be output at the $\overline{\text{MOD-OUT}}$ pin (N-channe open-drain).

MOD pin	Ininial Mode
GND	Tone mode
V_{DD}	Pulse mode

$\overline{\text{Mute}}$ Output (Pin 4)

The $\overline{\text{MUTE}}$ pin consists of an N-channel open-drain transistor. The signal it outputs is used to mute the receiver while a pulse signal is being output on the telephone line.

Hook Switch Input (Pin 5)

A pull-up resistor is built in between V_{DD} and the HKS pin.

$\overline{\text{HKCTL}}$ (Pin 6)

This N-channel open-drain pin is controlled by the ON/OFF key ind is used for hook-control.

Current state		Input	HKCTL output
Hook switch	$\overline{\text{HKCTL}}$		
—	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 imepedance

KEYTONE Output (Pin 12)

This CMOS complementary output produce a 1kHz tone signal (a rectangular wave) while the key is held depressed.

$\overline{\text{PULSEOUT}}$ (Pin 13)

The Pulse Output is an N-channel open-drain pin that produces a pulse signal in pulse mode. It also outputs a flash signal.

$\overline{\text{TONEOUT}}$ (Pin 15)

The tone output produce a DTMF signal in tone mode. Fig. 1 shows the output circuit diagram.

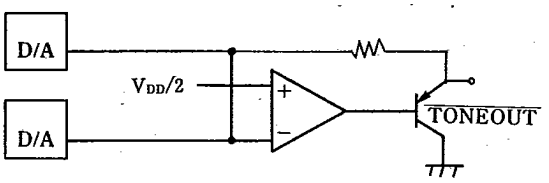


Fig. 1 Tone output circuit diagram

$\overline{\text{TEST}}$ (Pin 1)

The $\overline{\text{Test}}$ pin is used to reset and test the circuit. It is pulled-up to V_{DD}. For normal dialing, it should be connected to V_{DD}.

$\overline{\text{TEST}}$ pin	$\overline{\text{ROW}_5}$	Mode
GND	GND	Single tone
GND	Open or V_{DD}	Reset
V_{DD}		Normal dialing

The reset function intializes the system and clears memory of all its contents. Please provide a reset switch to guard against memory corruption caused by abrupt changes in supply voltage.

$\overline{\text{COL}_1}$	$\overline{\text{COL}_2}$	$\overline{\text{COL}_3}$	$\overline{\text{COL}_4}$	$\overline{\text{COL}_5}$	$\overline{\text{COL}_6}$	$\overline{\text{COL}_7}$	$\overline{\text{COL}_8}$	
1	2	3	FLASH	M1	M6	M11	M16	$\overline{\text{ROW}_1}$
4	5	6	STORE	M2	M7	M12	M17	$\overline{\text{ROW}_2}$
7	8	9	CLR	M3	M8	M13	M18	$\overline{\text{ROW}_3}$
*	0	#	PAUSE	M4	M9	M14	M19	$\overline{\text{ROW}_4}$
MOD	RED/P	ON/OFF	RECALL	M5	M10	M15	M20	$\overline{\text{ROW}_5}$

Fig. 2 Key matrix

Fig. 3 Single contact key

Key Functions

Key	Function
0-9	Number key
*	Tone mode : data key
#	Tone mode : data key
RED/P	Redial/Pause key (Note)
PAUSE	Pause key
ON/OFF	Hook Control ON/OFF KEY
STORE	Memory store key
M1-M20	Memory recall key
MOD	Pulse→tone switch key
FLASH	Flash function key
CLR	Memory clear key
RECALL	Rcall Memory key

Note : A RED/P key is valid for a redial when depressed immediately after going Off-Hook, and for a pause when depressed otherwise.

DTMF Output Frequencies

		Standard DTMF [Hz]	LR48064 [Hz]	Deviation [%]
Low group frequency	$\overline{ROW_1}$	697	701.3	+0.62
	$\overline{ROW_2}$	770	771.4	+0.19
	$\overline{ROW_3}$	852	857.2	+0.61
	$\overline{ROW_4}$	941	935.1	−0.63
High group frequency	$\overline{COL_1}$	1209	1215.9	+0.57
	$\overline{COL_2}$	1336	1331.7	−0.32
	$\overline{COL_3}$	1477	1471.9	−0.35

Note : These values were obtained with an oscillator frequency of 3.579545MHz. Any deviations of the oscillation frequency will affect the tone output frequency.
When a data key connected to $\overline{COL_1}$-$\overline{COL_3}$, $\overline{ROW_1}$-$\overline{ROW_4}$ is depressed in tone mode, one of the DTMF signals shown above will be output. In normal mode, a signal will be output while a key is held down.
However, if the key is depressed for less than 100msec, the signal will only be output for 100msec.

Test Mode Output Frequencies

Key	High level frequency(Hz)	Low level frequency(Hz)
7	1215.9	—
2	1331.7	—
6	1471.9	—
3		701.3
4		771.4
8		857.2
0		935.1

Key Input Specification

Parameter	Specifications
Double keys depressed	Only one of the two will be recognized as valid input according to a given priority.
Bounce count	22msec
Key-on time	30msec (minimum) required
Key cycle time	130msec (maximum) for data keys

Functional Description

Normal Dialing

Input data through data keys (pulse mode : 0 to 9, tone mode : 0 to 9 "*", and "#"), while Off-Hook, for an ordinary dial operation. Up to 32 digits of input data is stored in a buffer memory. Data exceeding 32 digits is accepted after the dial operation for the intial 32 digits has completed.

Input	Dial output	Memory contents
Pulse Mode		
Off-Hook		(R)=last number dialed
07436 5 1321	0743651321	(R)=0743651321
Tone Mode		
Off-Hook		(R)=last number dialed
07436 5 1321 # *	[0743651321 # *]	(R)=0743651321 # *
Tone Mode		
Off-Hook		(R)=last number dialed
07436 5 1321	[0743651321]	(R)=0743651321

Note 1 (R) : Buffer memory , [ ] : DTMF output

In pulse mode, the # and * keys are not available for dialing and storing data to buffer memory.

Redialing Function

Depress the RED/P key immediately after going Off-Hook to redial data in the buffer memory.

The next key input cannot be accepted until the redialing operation is completed and the buffer memory is cleared. Then, the operation is the same as in normal dialing and memory dialing.

Memory Dialing

An optional number of memories for one-touch dialing (10 to 20) and for two-touch dialing (0 to 10) can be selected, within a range of 20 memories in total (up to 16 digits for each memory).

Two memories can be dialed in succession during memory dialing. The 3rd memory can be dialed when the 1st and 2nd memory dialings are complete.

Input	Dial output	Memory contents
Tone-Mode		
Off-Hook		(M1)=07436, (M2)=51321
M1	07436	(M3)=2116
M2	51321	(R)=07436
M3	2116	(R)=0743651321
Off-Hook		(R)=2116
RECALL		
1	07436	(M01)=07436, (R)=07436

(M_1-M_{20})-(M_{20}) : One-touch Memory
(M_{00}-M_{09})-(M_{09}) : Two-touch Memory

Memory Operations

Set the buffer memory On-Hook.

Input	Memory contents
On-Hook STORE 07436 M1	(M1)=(R)=07436
STORE 51321 STORE2	(M02)=(R)=51321

Note : When the input in the buffer memory exceeds 16 digits, digit beyond the 17th are ignored.

Eras data from the buffer memory, as follows :

Input	Memory contents
Off-Hook	(R)=last number dialed, (M1)=07436 (M02)=(R)=51321
CLR	(R)=___, (M1)=07436, (M02)=51321
STORE M1	(R)=___, (M1)=___, (M02)=51321
STORE STORE 2	(R)=___, (M1)=___, (M02)=___

Mixed Dialing

Permits switching from pulse to tone mode bey the MOD key.

Input	Dial output	Memory contents
MOD pin=V_{DD} Off-Hook 07436 MOD 51321 On-Hook	07436 (pause) [51321]	(R)=07436MOD51321
Off-Hook 07436		(R)=07436
MOD pin =V_{DD}→GND 51321	07436 (pause) [51321]	(R)=07436MOD51321

MOD key input will be stored in memory as one digit data in the same way as data key input. It should be noted that switching from pulse mode to tone mode causes a pause to be inserted automatically. (Refer to the Pause function.)

Redialing plus Normal Dialing

Normal dialing can be done when redialing is completed.

Input	Dial output	Memory contents
Pulse Mode Off-Hook		(R)=0743651321
RED/P 1234...456	0743651321 1234...456	(R)=1234...456

Memory Dialing plus Normal Dialing

Normal dialing is possible, in Off-Hook mode, following memory dialing or indirect memory dialing by memory key.

Both memory-dialied data and a maximum of 16 columns of data input through normal dialing can be stored in buffer memory. Additional key input is accepted when the dialing of data stored in the buffer memory is over. In this case, old data in buffer memory is cleared to store new digits from the 17 column on.

Input	Dial output	Memory contents
Pules Mode Off-Hook		(R)=last number dialed, (M1)=07436
M1	07436	(R)=07436
1234.....456	074361234.....456	(R)=074361234.....456
16 columns 7890	7890	(R)=7890
Pulse mode Off-Hook		(R)=last number dialed, (M1)=123MOD456
M1	123 (Pause) [456]	(R)=123MOD456
0246	[0246]	(R)=123MOD4560246

Pause Function

The PAUSE key or RED/P key allows insertion of a pause about 4 seconds long during which no dial output is generated. PAUSE key input will be stored in memory in the same way as data key input.

Input	Dial output	Memory contents
Off-Hook 07436PAUSE51321	07436 (PAUSE) 51321	(R)=07436PASUE51321

A RED/P key input releases a PAUSE during the paused state.

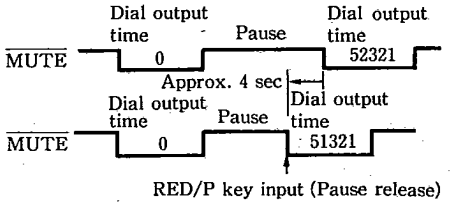


Fig. 4 Pause operation

Flash Function

A flash key input in Off-Hook mode causes the PULSEOUT and MUTE pins to produce signal outputs as shown in Figure 5.

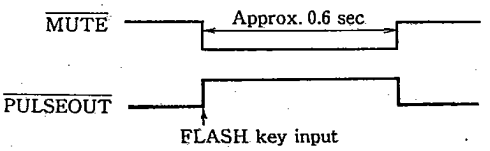
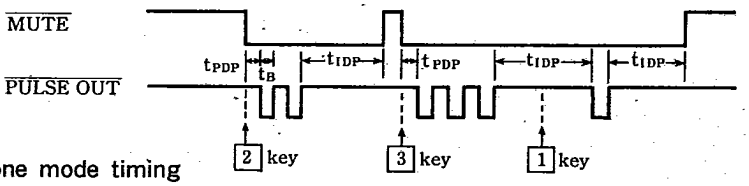


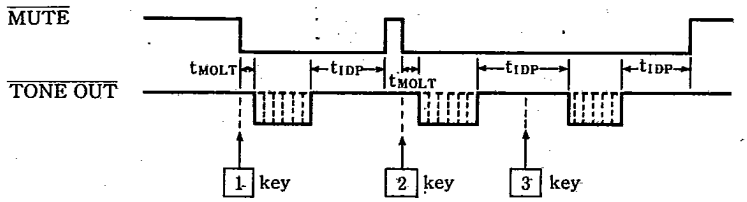
Fig. 5 Flash function

■ Timing Diagram

Pulse mode timing



Tone mode timing



■ System Configuration Example