

LR48211

Pulse/Tone Dialer LSI

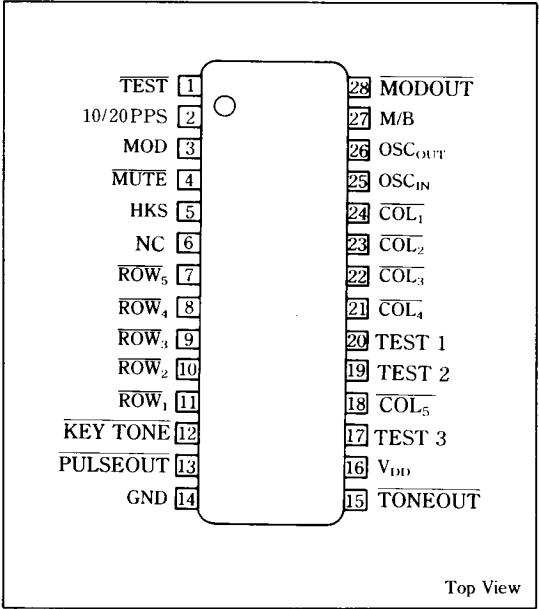
■ Description

The LR48211 is a CMOS pulse/tone dialer LSI providing auto-dialing and redialing. It features a built-in 16-digit×15-channel automatic dialing memory including a 16-digit×5 one-touch memory, a 16-digit×10 two-touch memory and a 32-digit redial memory.

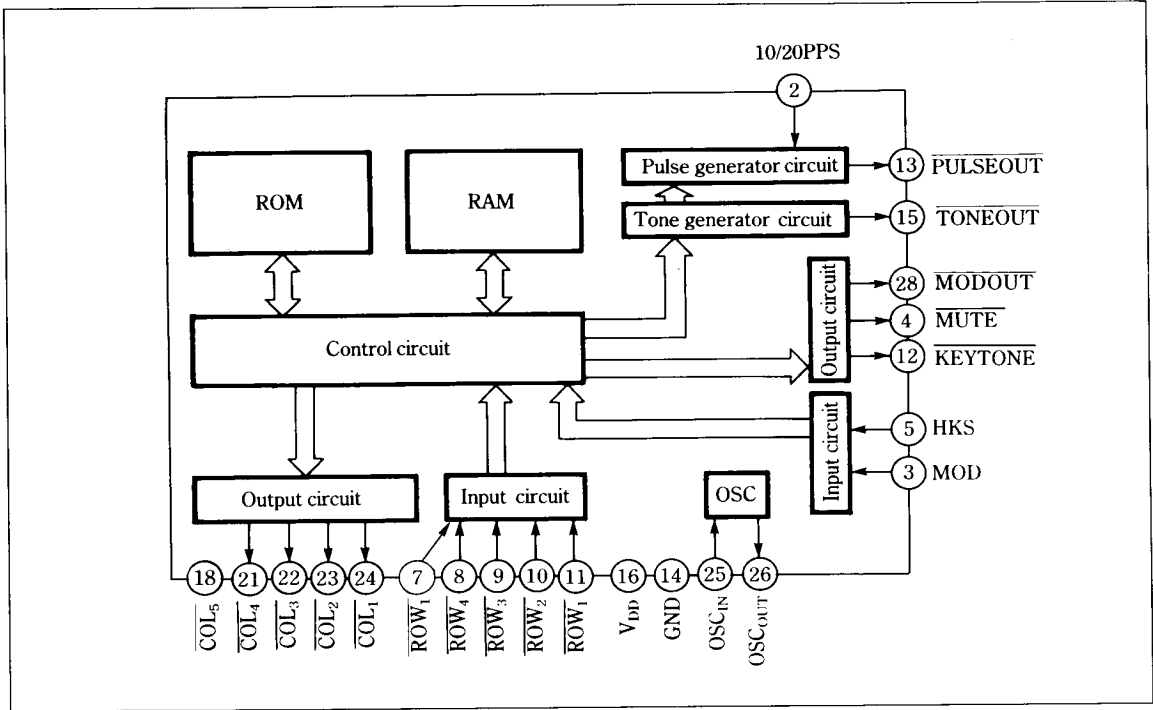
■ Features

- 1. 32-digit redial memory
- 2. Auto memory dialing :
16D×5M one-touch dialing
16D×10M two-touch dialing
- 3. Make ratio : 33/37% pin-selectable
- 4. Pulse rate : 10/20pps pin-selectable
- 5. Key tone output
- 6. Normal/memory combination redialing memory
- 7. Key input allows switching from pulse to tone mode to provide mixed-dialing capability
- 8. Pulse/tone dialer operation can be selected by the pin
- 9. Uses a 3.579545MHz color-burst crystal/ceramic oscillator as a frequency reference
- 10. Flash signal output
- 11. PBX pause storage
- 12. 28-pin dual-in-line package

■ Pin Connections



■ Block Diagram



■ Pin Functions

Name	I/O	Function
COL ₁ -COL ₄	O	Key strobe output
OSC _{IN}	I	Crystal oscillation circuit pin
OSC _{OUT}	O	Crystal oscillation circuit pin
M/B	I	Make/break ratio select pin
MODOUT	O	Pulse/tone mode output pin
TEST ₁ -TEST ₃	I	Factory test pins
10/20pps	I	10/20pps select pin
MOD	I	Pulse/tone mode select pin
MUTE	O	Mute signal output pin
HKS	I	Hook switch input pin
ROW ₁ -ROW ₅	I	Key input pin
KEY TONE	O	Beep tone output pin
PULSE OUT	O	Pulse output pin
TONE OUT	O	Tone output pin
V _{DD}	I	Power supply pin
GND	I	Power supply pin

10/20pps pin	Pulse rate
GND	10pps
V _{DD}	20pps

M/B pin	Make/break ratio
GND	33/67
V _{DD}	37/63

Pulse/Tone Mode Selection (Pin 3)

The mode immediately after going Off-Hook is selected by the MOD pin. If the MOD key is depressed in pulse mode, the rest of the dialing will be performed in tone mode. Data input through the MOD key will be stored in memory as well as other data. The dialing after the MOD pin is switched from pulse to tone mode when dialing, is mode in tone mode. Then, same code as MOD key is stored into memory. The key input mode will be output at the MODOUT pin. (Pin 28, N-channel, open-drain)

MOD pin	Initial mode
GND	Tone mode
V _{DD}	Pulse mode

■ Pin Descriptions

10/20pps (Pin 2), M/B (Pin 27) pin

In pulse mode, the following modes can be selected.

Condition	Mode	MODOUT output
Off-Hook	Pulse mode	High impedance
	Tone mode	"Low" level
On-Hook	Pulse/tone	High impedance

Mute Signal Output (Pin 4)

The MUTE output consists of an N-channel open-drain transistor. It is used to mute the receiver while the telephone line is being pulsed.

Hook Switch Input (Pin 5)

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

The HKS pin must be On-Hook (i.e., not grounded) when power is turned on.

HKS pin	Mode
GND	Off-Hook
Open or V_{DD}	On-Hook

Key Tone Output (Pin 12)

The KEYTONE pin is a CMOS complementary output. It outputs a 1kHz tone signal while a key is held down.

PULSEOUT (Pin 13)

The PULSEOUT pin consists of an N-channel open-drain transistor that outputs a pulse signal in pulse mode. It also outputs a flash signal.

Tone Output (Pin 15)

The TONEOUT pin outputs a DTMF signal in tone mode. Fig. 1 shows the output circuit diagram.

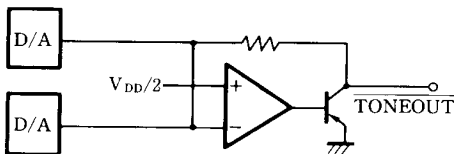


Fig. 1 Tone output circuit diagram

Test (Pin 1)

The TEST pin is used for resetting and testing, and is pulled-up to V_{DD} .

TEST pin	ROW ₅	Mode
GND	GND	Single tone
GND	Open or V_{DD}	Reset
V_{DD}	—	Normal dialing

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

COL ₁	COL ₁	COL ₂	COL ₃	COL ₄
1	2	3	FLASH	M1
4	5	6	STORE	M2
7	8	9	CLR	M3
*	0	#	PAUSE	M4
MOD	RED/P		RECALL	M5

Key matrix

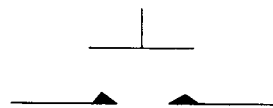


Fig. 2 Single contact key

Key Functions

Key	Function
0-9	Number Key
*	Pulse mode : pause key
	Tone mode : data key
#	Pulse mode : redial key
	Tone mode : data key
RED/P	Redial/Pause key (Note)
PAUSE	Pause key
STORE	Memory store key
M1-M5	Memory recall key
MOD	Pulse→tone switch key
FLASH	Flash function key
CLR	Memory clear 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)	LR48211 (Hz)	Deviation (%)
Low group frequency	ROW ₁	697	701.3	+0.62
	ROW ₂	770	771.4	+0.19
	ROW ₃	852	857.2	+0.61
	ROW ₄	941	935.1	-0.63
High group frequency	COL ₁	1209	1215.9	+0.57
	COL ₂	1336	1331.7	-0.32
	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.

Key Input Specifications

Parameter	Specification
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	Max. 130msec (from data key)

Test Mode Output Frequencies

Key input	Higher band frequency (Hz)	Lower band frequency (Hz)
7	1215.9	—
2	1331.7	—
6	1471.9	—
3	—	701.3
4	—	771.3
8	—	857.2
0	—	935.1

Functional Description

Normal Dialing

Following a transition to Off-Hook, normal dialing is accomplished by data key input (pulse mode : 0-9, tone mode : 0-9, * and #). 32 digits of input data can be stored in buffer memory. Any further input after the 32nd digit will be accepted after the initial 32 digits in buffer memory have been dialed. When the 33rd digit is received, the buffer memory is cleared.

Input	Dial output	Memory contents
Pulse Mode Off-Hook 07436 5 1321	0743651321	last number dialed 0743651321
Tone Mode Off-Hook 07436 5 1321 # *	[0743651321 # *]	last number dialed 0743651321 # *
Pulse Mode Off-Hook 07436 5 1321	0743651321	last number dialed 0743651321 # *
Pulse Mode Off-Hook 123456...012 (32 digits) 3456789	123456...012 (32digits) 3456789	last number dialed 1234567...012 3456789

Note : Digits inside the [] represent the DTMF output.

Redial Function

Following a transition to Off-Hook, redial key input causes the contents of buffer memory to be dialed. In pulse mode, the # key will also act as a redial key.

Input	Dial output	Memory contents
Pulse mode REDIAL or #	0743651321	0743651321

Mixed Dialing

The MOD key is used to switch from pulse mode to tone mode.

Input	Dial output	Memory contents
MOD pin = V _{DD} Off-Hook 07436MOD51321	07436(Pause)51321	(R)=07436MOD51321
On-Hook Off-Hook 07436 MOD pin = V _{DD} →GND 51321	07436 (Pause) 51321	(R)=07436 (R)=07436MOD51321

MOD key input will be stored in memory as a single digit data value as if it were data key input.

It should be noted that switching from pulse to tone mode causes a pause to be automatically in-

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serted. (Refer to the Pause function.)

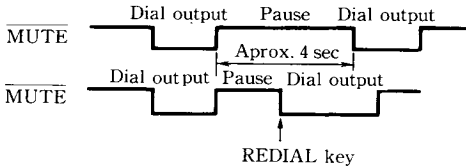
Pause Function

The pause key is used to suspend dial output for intervals of about 4 seconds. Pause key input is stored in memory in the same way as data key input.

Input	Dial output	Memory contents
Off-Hook		
07436PAUSE51321	07436(Pause)51321	07436PAUSE 51321

Note : The * key also acts as a pause key in the pulse mode.

The pause will be reset by redial key input in pause mode or by # key input in pulse mode.



Redialing+Normal Dialing

Normal dialing is permitted after redialing in Off-Hook mode. After redialing, up to 32 digits of normally dialed data may be stored in buffer memory. If more than 32 digits are input, the digits stored in the buffer must be dialed first before additional key input can be stored. Then, after the buffer contents have been dialed, the buffer is cleared and data from the 33rd digit on can be newly stored.

Input	Dial output	Memory contents
Pulse Mode		(R)=last number dialed,
Off-Hook		
RED/P	07436 5 1321	(R)=07436 5 1321
1234...456	1234...456	(R)=1234...456

Flash Function

When FLASH key input is made in Off-Hook mode, the signal outputs shown in Fig. 4 will be generated from the PULSEOUT and MUTE pins

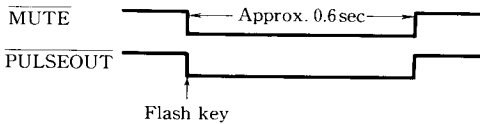


Fig. 4 Flash function

Memory Dialing

Up to ten one-touch 16-digit memory dialing slots may be selected. The contents of two memory slots can be dialed in succession. The 3rd memory slot is effective upon completion of the 1st and 2nd memory dialing.

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

Memory Operations

Input	Memory contents
Off-Hook	
STORE 07436 [M1]	(M1)=(R)=07436
STORE 41321 [STORE] [2]	(M02)=(R)=51321

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

Erase data from the buffer memory, as follows :

Input	Memory contents
Off-Hook	(R)=last number dialed, (M1)=07436 (M0)=51321
CLR	(R)=__, (M1)=07436, (M02)=51321
STORE [M1]	(R)=__, (M1)=__, (M02)=51321
STORE [STORE] [2]	(R)=__, (M1)=__, (M02)=

Memory Dialing plus Normal Dialing

Normal dialing input is accepted after memory dialing or indirect memory dialing by memory key, Off-Hook. Both memory-dialed data and a maximum of 16 digits of data input through normal dialing can be stored in the buffer. Further input on the keys is accepted when the dialing of data stored in the buffer memory is finished. In this case, the buffer memory clears old data to store new ones from the 17th digit on.

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

■ Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Note
Power Supply	V _{DD}	6.5	V	1
Operating temperature	T _{opr}	−30 to +60	°C	
Storage temperature	T _{stg}	−55 to +150	°C	
Power dissipation	P _D	500	mW	2
Pin voltage (1)	V _{IN1}	−0.3	V	3
Pin voltage (2)	V _{IN2}	+0.3	V	4

Note 1 : Referenced to GND.
Note 2 : Ta=25°C
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°C, 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		0.1	0.3	μA	1
Operating current	I _{OPP}	V _{DD} =3.5V, Pulse mode		0.5	2.0	mA	2
	I _{OPT}	V _{DD} =3.5V, Tone mode		1.0	3.0	mA	
Input voltage	V _{IL}		GND		0.2V _{DD}	V	3
	V _{IH}		0.8V _{DD}		V _{DD}	V	
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 _{OL} =0.5V	1.0			mA	
KEYTONE output current	I _{TL}	V _{DD} =2.0V, V _{OL} =0.5V	1.0	2.0		mA	
	I _{TH}	V _{DD} =2.0V, V _{OH} =1.5V	1.0	2.0		mA	
Output leakage current	I _{LKG}	V _{DD} =3.5V, V _{OH} =0.5V			1.0	μA	5
COLUMN output current	I _{CL}	V _{DD} =3.5V, V _{OH} =0.5V	50	100	500	μA	
	I _{CH}	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 required for circuit operation, Off-Hook or On-Hook mode. All outputs unloaded.
Note 3 : Applied to all input pins.
Note 4 : Applied to MUTE, MODOUT pins.
Note 5 : Applied to MUTE, MODOUT, PULSEOUT pins.

■ Tone Output Characteristics

(Ta=25°C, GND=0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Tone output voltage	ROW V _{OR}	R _L =10kΩ, V _{DD} =4.0V	160	210	270	mV _{rms}
	COLUMN V _{OC}	R _L =10kΩ, V _{DD} =4.0V	210	260	340	mV _{rms}
Output distortion	DIS	R _L =10kΩ, V _{DD} ≥2.5V			−20	dB
Pre-emphasis	P _{EHB}	R _L =10kΩ, V _{DD} ≥2.5V	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

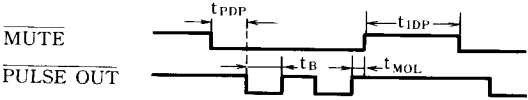
Note : Output Distortion measured in terms of total out-of-band power (the frequency is 20Hz to 80kHz) relative to fundamental signals of ROW and COLUMN.

AC Characteristics

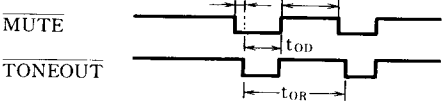
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Oscillation start-up time	t_{OS}				8.0	ms	1
Pulse rate	Pr	Pin 2 = GND		10		pps	
		Pin 2 = V_{DD}		20		pps	
Break time	t_B	Pin 27 = GND		67		ms	2
		Pin 27 = V_{DD}		63		ms	
Inter-digital pause	t_{IDP}	10pps mode		850		ms	
		20pps mode		500		ms	
Mute overlap time	t_{MOLP}			2		ms	2
	t_{MOLT}			2		ms	
Pre-digital pause	t_{PDP}	Pin 27 = GND		33		ms	2
		Pin 27 = V_{DD}		37		ms	

Note 1 : Crystal parameters $R_S=100\Omega$, $L_M=96mH$, $C_M=0.02pF$, $C_0=5pF$, $f=3.579545MHz$.
 Note 2 : The 10pps pulse mode value. The values for the 20pps are half of these values.

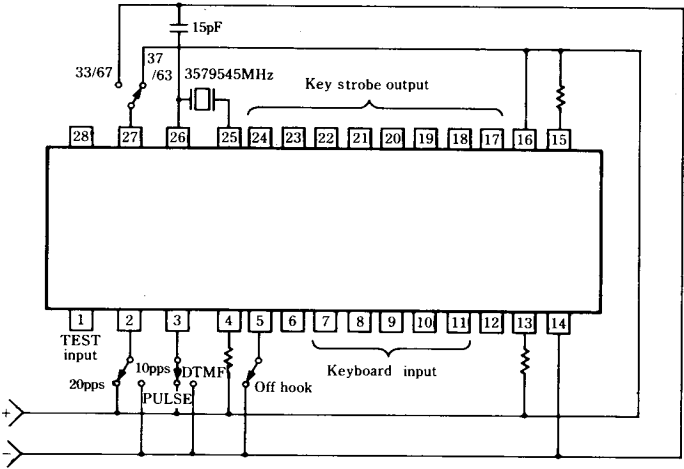
Pulse mode timing



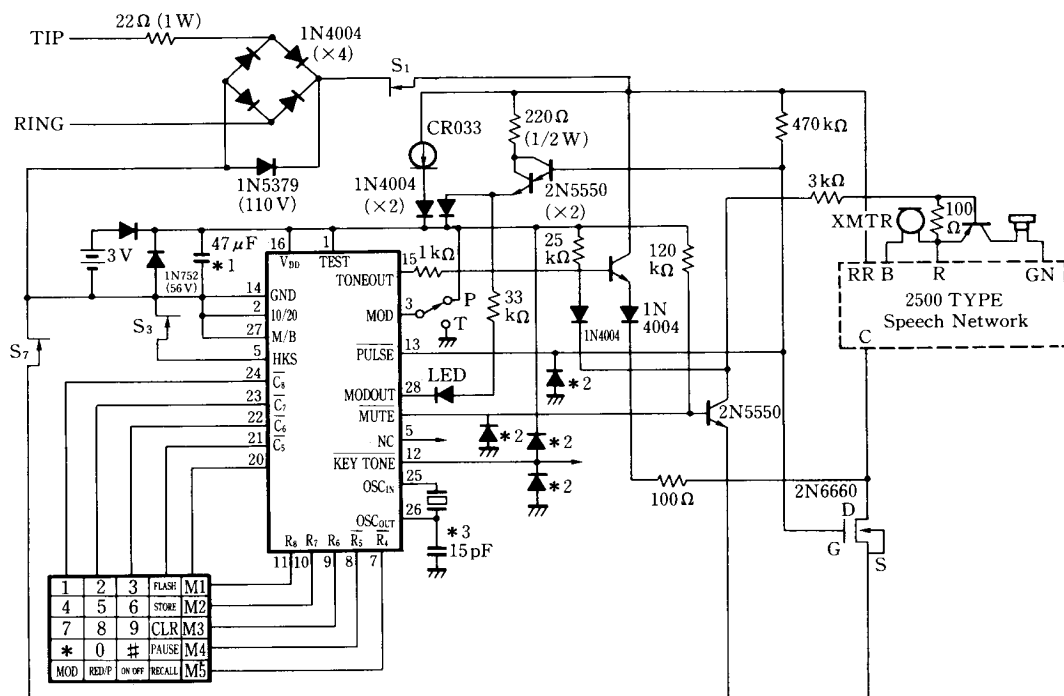
Tone mode timing



Test Circuit



System Configuration Example



- *1 Insert a capacitor to smooth the power supply and prevent latch-up.
- *2 Insert protective diodes not to apply voltages higher than the absolute maximum ratings.
- *3 Insert a capacitor to keep a stable oscillation.