

LR48063

Pulse/Tone Dialer LSI

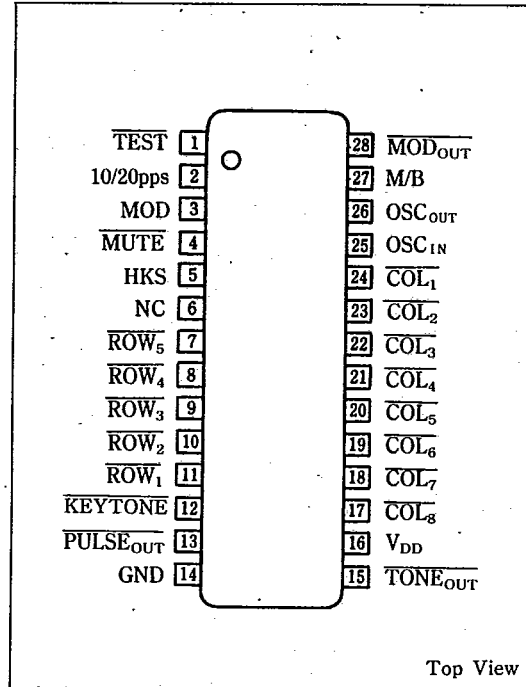
Description

The LR48063 is a CMOS pulse/tone dialer LSI providing auto-dialing and redialing. It features a built-in 16-digit \times 20-channel automatic dialing memory including a 16-digit \times (10 to 20) one-touch memory, a 16-digit \times (0 to 10) two-touch memory and a 32-digit redial memory

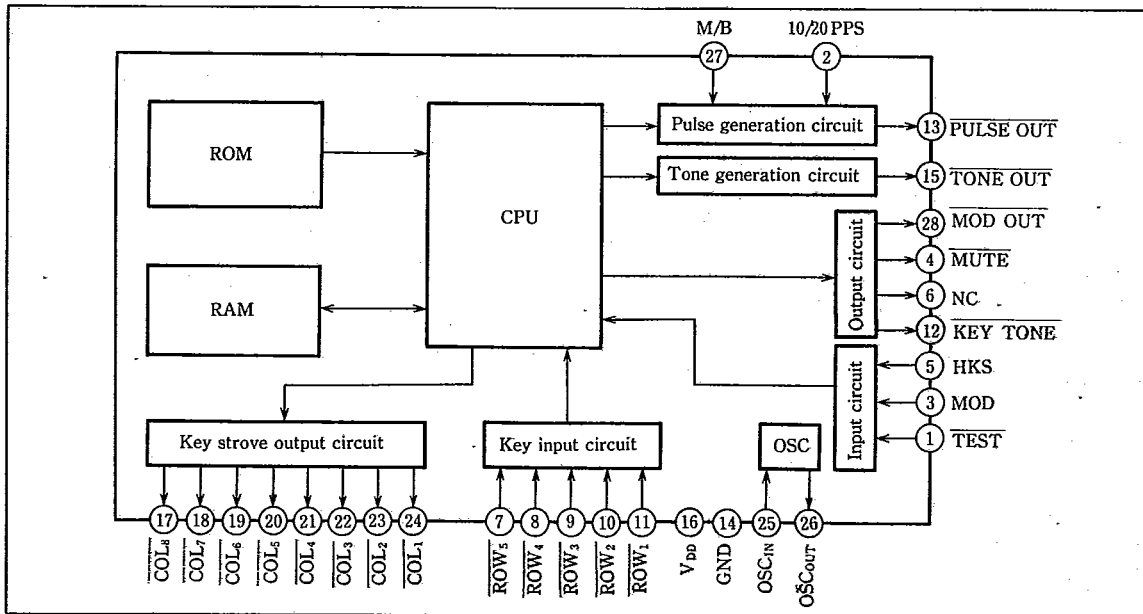
Features

- 32-digit redial memory
- Auto memory dialing : 16D \times (10M to 20M) one-touch dialing and 16D \times (0 to 10M) two touch dialing
- Make ratio : 33/37% pin-selectable
- Pulse rate : 10/20pps pin-selectable
- Key tone output (1kHz)
- Normal/memory combination dialing
- Key or switch input allows switching from pulse to tone mode to provide mixed-dialing capability
- Pulse/tone dialer operation pin-selectable
- Flash signal output
- PBX pause storage
- 28-pin dual-in-line package

Pin Connections



Block Diagram



SHARP

Absolute Maximum Ratings

| Parameter | Symbol | Ratings | Unit | Note |
|-----------------------|-----------|-------------|------|------|
| Supply voltage | 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 | V_{IN1} | -0.3 | V | 3 |
| Pin voltage | V_{IN2} | +0.3 | V | 4 |

Note 1 : Referenced to GND.

Note 2 : $T_a=25^\circ\text{C}$.

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

($T_a=25^\circ\text{C}$, GND=0V)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit | Note |
|------------------------|-----------|---|-------------|------|-------------|---------------|------|
| Supply voltage | V_{DD} | | 2.0 | | 6.0 | V | |
| Standby current | I_{SP} | $V_{DD}=3.5\text{V}$ | | 0.1 | 0.3 | μA | 1 |
| Operating current | I_{OPP} | $V_{DD}=3.5\text{V}$ Pulse Mode | | 0.5 | 2.0 | mA | |
| | I_{OPT} | $V_{DD}=3.5\text{V}$ 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} | $V_{DD}=2.0\text{V}$, $V_{OL}=0.5\text{V}$ | 1.0 | 2.0 | | mA | 4 |
| Pulse sink current | I_{PL} | $V_{DD}=2.0\text{V}$, $V_{DL}=0.5\text{V}$ | 1.0 | | | mA | |
| KEYTONE output current | I_{TL} | $V_{DD}=2.0\text{V}$, $V_{OL}=0.5\text{V}$ | 1.0 | 2.0 | | mA | |
| | I_{IH} | $V_{DD}=2.0\text{V}$, $V_{OB}=1.5\text{V}$ | 1.0 | 2.0 | | mA | |
| Output leakage current | I_{LKG} | $V_{DD}=6.0\text{V}$, $V_{OH}=6.0\text{V}$ | | | 1.0 | μA | 5 |
| COLUMN output current | I_{CL} | $V_{DD}=3.5\text{V}$, $V_{OL}=0.5\text{V}$ | 50 | 100 | 500 | μA | |
| | I_{CA} | $V_{DD}=3.5\text{V}$, $V_{OH}=3.0\text{V}$ | 1 | 5 | 15 | μA | |
| ROW input current | I_{RP} | $V_{DD}=3.5\text{V}$, $V_{IL}=0\text{V}$ | 5 | 35 | 150 | μA | |
| HKS input current | I_{HP} | $V_{DD}=3.5\text{V}$, $V_{IL}=0\text{V}$ | 5 | 58 | 150 | μA | |
| TEST input current | I_{TP} | $V_{DD}=3.5\text{V}$, $V_{IL}=0\text{V}$ | 5 | 58 | 270 | μA | |

Note 1 : Current necessary for memory retention ; all outputs unloaded ; On-Hook mode

Note 2 : Current during operation ; Off-Hook mode. All outputs are unload.

Note 3 : Applied to all pins.

Note 4 : Applied to MUTE, MODOUT pins

Note 5 : Applied to MUTE, MODOUT, PULSEOUT pins.



Tone output Characteristics

($T_a=25^\circ\text{C}$, GND=0V)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit | Note |
|---------------------|------------------|---|------|------|------|-------|------|
| Tone output voltage | ROW | $R_L=10\text{k}\Omega$, $V_{DD}=4.0\text{V}$ | 160 | 210 | 270 | mVrms | |
| | COLUMN | $R_L=10\text{k}\Omega$, $V_{DD}=4.0\text{V}$ | 210 | 260 | 340 | mVrms | |
| Output distortion | DIS | $R_L=10\text{k}\Omega$, $V_{DD}\geq 2.5\text{V}$ | | | -20 | dB | 1 |
| Pre-emphasis | PE _{HB} | $R_L=10\text{k}\Omega$, $V_{DD}\geq 4.0\text{V}$ | 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 Row and Column signals.

AC Characteristics

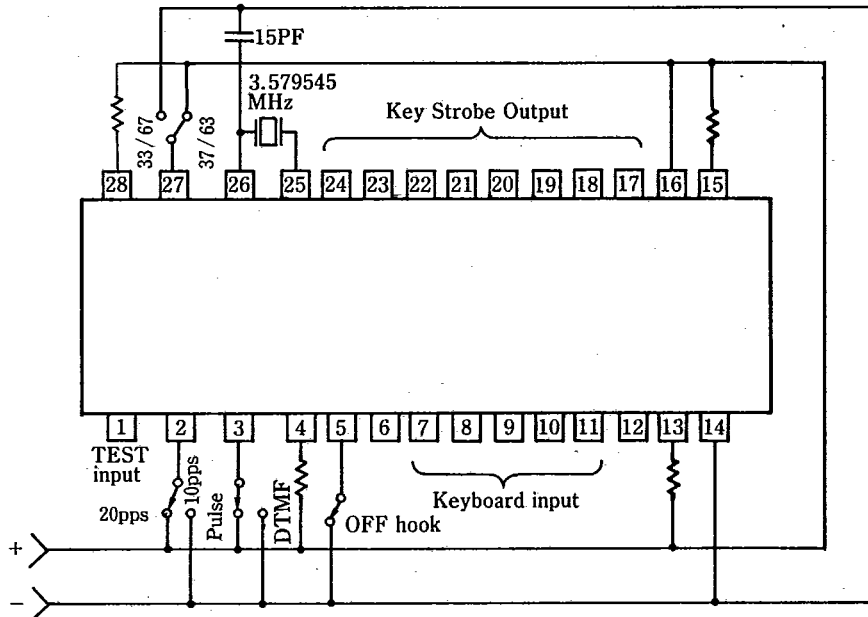
(Ta=25°C, GND=0V)

| 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 |
| | | $P_{IN27}=V_{DD}$ | | 37 | | ms | |

Note 1 : When crystal oscillation parameters $R_s=100\Omega$, $L_M=96mH$, $C_M=0.02pF$, $C_h=5pF$, $f=3.579545MHz$ are used.

Note 2 : 10pps pulse mode value. Values for 20pps are half of these.

Test Circuit



Pin Functions

| Name | I/O | Function | Name | I/O | Function |
|---------------|-----|---------------------------------|---------------|-----|------------------------|
| COL_1-COL_3 | O | Key strobe outputs | MUTE | O | Mute signal output pin |
| OSC_{IN} | I | Crystal oscillation circuit pin | HKS | I | Hook switch input pin |
| OCS_{OUT} | O | Crystal oscillation circuit pin | ROW_1-ROW_5 | I | Key inputs |
| M/B | I | Make/Break ratio select pin | KEY TONE | O | Beep tone output pin |
| MOD_{OUT} | O | Pulse/Tone mode output 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 |

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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/Break 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 MOD-OUT pin (Pin 28).

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

Mute Output (Pin 4)

The MUTE pin output 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.

Key Output (Pin 12)

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

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.

TONEOUT (Pin 15)

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

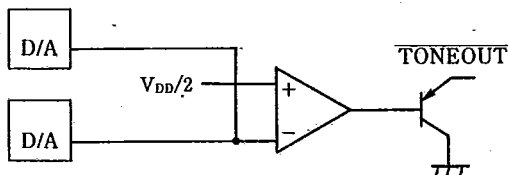


Fig. 1 Tone output circuit diagram

TEST (Pin 1)

The 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}.

| 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 of all its contents. Please provide a reset switch to guard against memory corruption caused by abrupt changes in supply voltage.

| COL ₁ | COL ₂ | COL ₃ | COL ₄ | COL ₅ | COL ₆ | COL ₇ | COL ₈ | ROW ₁ |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| 1 | 2 | 3 | FLASH | M1 | M6 | M11 | M16 | ROW ₁ |
| 4 | 5 | 6 | STORE | M2 | M7 | M12 | M17 | ROW ₂ |
| 7 | 8 | 9 | CLR | M3 | M8 | M13 | M18 | ROW ₃ |
| * | 0 | # | PAUSE | M4 | M9 | M14 | M19 | ROW ₄ |
| MOD | RED/P | | RECALL | M5 | M10 | M15 | M20 | 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 |
| STORE | Memory store key |
| M1-M20 | Memory recall key |
| MOD | Pulse→tone switch key |
| FLASH | Flash function key |
| ON/OFF | Hook control ON/OFF 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] | LR48063 [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.

When a data key connected to COL₁-COL₃, ROW₁-ROW₄ 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 input | 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 |

In test mode, the single tones shown above are output when individual keys are depressed.

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 initial 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 2) |

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 RECALL | | (R)=2116 |
| 1 | 07436 | (M01)=07436, (R)=07436 |

(M₁-M₂₀)-(M₂₀) : One-touch Memory

(M₀₀-M₀₉)-(M₀₉) : Two-touch Memory

Memory Operations

Set the buffer memory Off-Hook.

| Input | Memory contents |
|--------------------|-----------------|
| Off-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.

Erase 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 by the MOD key.

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

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 | 0743651321 | |
| 1234...456 | 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-dialled 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 | 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 |

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 | | |
| 07436PAUSE | 07436 (PAUSE) | (R)=07436PASUE51321 |
| 51321 | 51321 | |

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

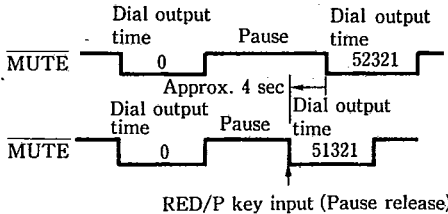


Fig. 4 Pause operation

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.

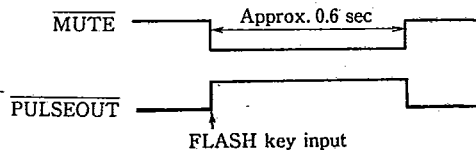
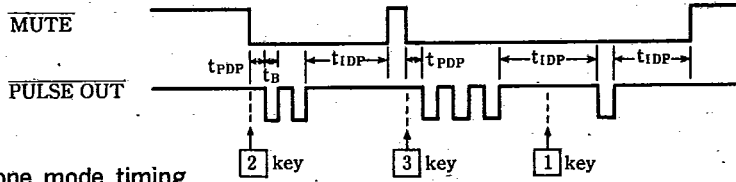


Fig. 5 Flash function

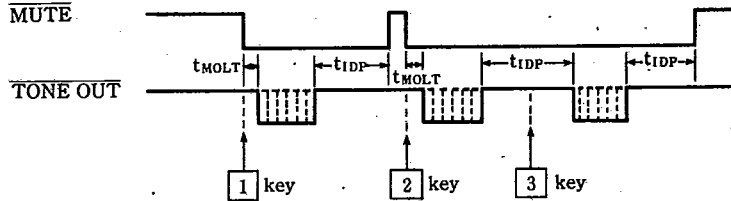


■ Timing Diagram

Pulse mode timing



Tone mode timing



■ System Configuration Example

