

13-station repertory pulse / tone dialer for telephone set

BU8329 / BU8329F

The BU8329 and BU8329F are large scale integrated circuits designed for use with telephones, with all of the pulse / tone dialer functions necessary for basic telephone operation. These ICs are equipped with an internal repertory memory containing 13 stations and 16 digits.

● Applications

Telephones

● Features

- 1) The chip includes both a pulse and tone dialer, making it possible to dial in either pulse or tone mode.
- 2) Wide operating voltage range of 2.0V to 5.5V.
- 3) Internal on-hook dial control function and hold control function.
- 4) A built-in memory enables redialing of up to 32 digits.
- 5) Repertory dial function
 - : 3 stations and 16 digits for 1-touch,
 - : 10 stations and 16 digits for 2-touch.
- 6) Ceramic resonator of 3.579545MHz used.
- 7) Internal digital pause timer.
- 8) Internal flash function.
- 9) Compact SOP 24 pin and DIP 22 pin packages used.

● Selection guide

| Model | Operating voltage | Pulse speed (PPS) | Pulse break ratio% | Redial memory | Repertory memory (stations × digits) OT: 1-touch, TT: 2-touch | DTMF | Access pause | Key-tone | Hooking | Hands-free capability | Package |
|---------|-------------------|-------------------|--------------------|---------------|--|------|--------------|----------|---------|-----------------------|---------|
| BU8329 | 2.0~5.5 | 10 / 20 | 67 | 32 | OT : 3×16, TT : 10×16 | ○ | ○ | ○ | ○ | ○ | DIP22 |
| BU8329F | | | | | | | | | | | SOP24 |

● Absolute maximum ratings (Ta=25°C)

| Parameter | Symbol | Limits | Unit |
|-----------------------|----------------------|---|------|
| Power supply voltage | V _{DD} | 7.0 | V |
| Input voltage | *1 V _{IN} | V _{SS} ~0.3~V _{DD} +0.3 | V |
| Output voltage 1 | *2 V _{OUT1} | V _{SS} ~0.3~V _{DD} +0.3 | V |
| Output voltage 2 | *3 V _{OUT2} | V _{SS} ~0.3~7.0 | V |
| Power dissipation | *4 P _d | 600 (DIP22) | mW |
| | *5 | 450 (SOP24) | |
| Storage temperature | T _{STG} | -55~+125 | °C |
| Operating temperature | T _{OPR} | -10~+60 | °C |

*1 Applied to the following pins: R1 to R4, C1 to C5, HF1, MODE, OSC1, HKS.

*2 Applied to the OSCO, KEYTONE, DTMF, PO, and HFO pins.

*3 Applied to the MUTE pin.

*4 Reduced by 6 mW for each increase in Ta of 1°C over 25°C (22-pin DIP).

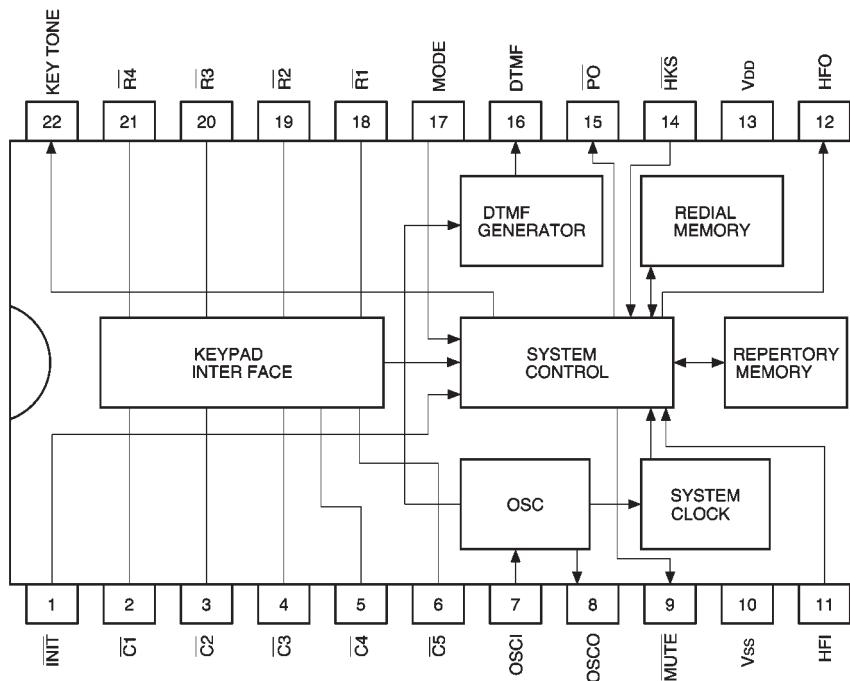
*5 Reduced by 4.5 mW for each increase in Ta of 1°C over 25°C (24-pin SOP).

● Recommended operating conditions (Ta=25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|--------------------------|------------------|---------------------|----------|---------------------|------|--|
| Power supply voltage | V _{DD} | 2.0 | — | 5.5 | V | |
| Power supply voltage | V _{DD} | 1.0 | — | 5.5 | V | When memory retention |
| Oscillation frequency | f _{osc} | — | 3.579545 | — | MHz | * |
| Input high level voltage | V _{IH} | 0.8 V _{DD} | — | V _{DD} | V | |
| Input low level voltage | V _{IL} | 0 | — | 0.2 V _{DD} | V | |
| DTMF pin load resistance | R _{MF} | 10 | — | — | kΩ | Load resistance connected between DTMF and V _{SS} |
| Key contact resistance | R _{KC} | — | — | 10 | kΩ | Keypad contact resistance |
| Key contact capacitance | C _{KC} | — | — | 470 | pF | Capacitance connected between Rx, C _X and V _{SS} |
| MODE IN pin resistance | R _{MI} | 10 | — | — | kΩ | |

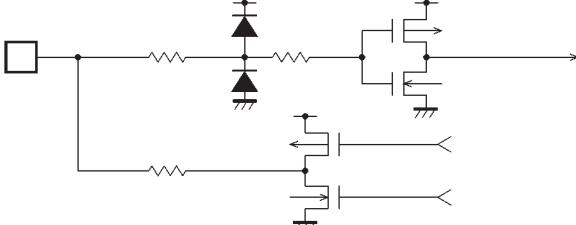
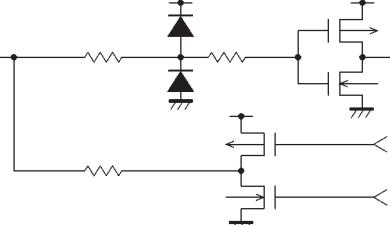
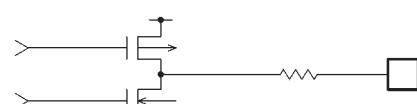
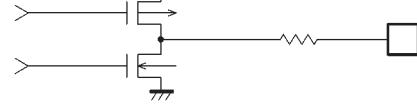
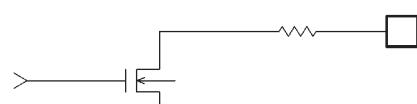
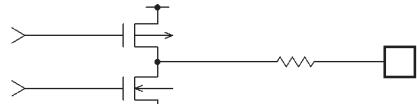
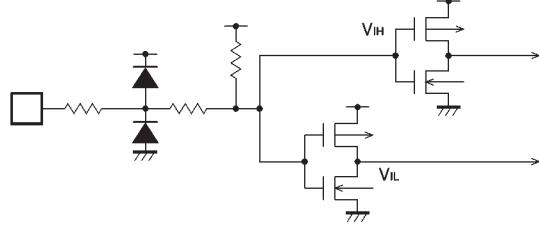
* Recommended product: CST3.58MGW300GAB by Murata

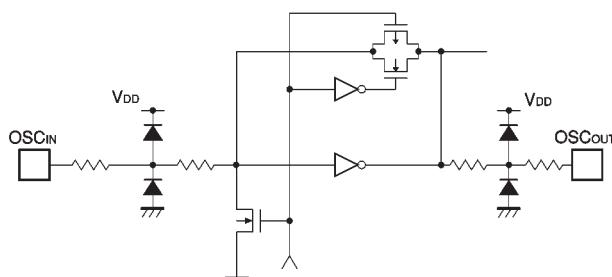
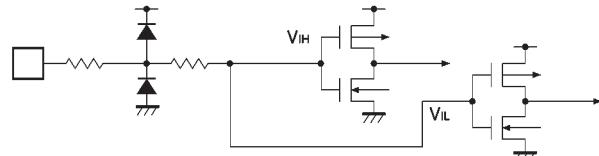
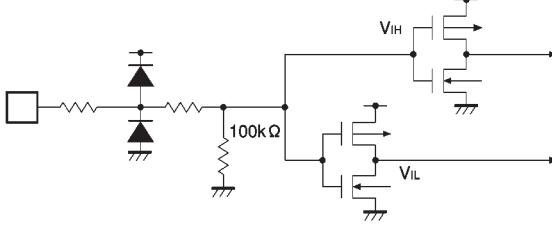
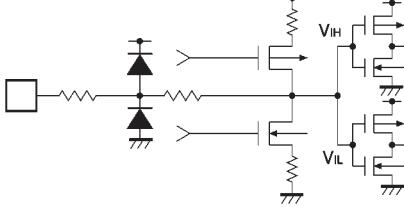
● Block diagram



● Pin descriptions

| Pin No. | | Pin name | Function |
|--------------|----------------------|--|--|
| DIP package | SOP package | | |
| 18~21 2~6 | 1, 2 4, 5 8~12 | $\overline{R1} \sim \overline{R4}$ $\overline{C1} \sim \overline{C5}$ | Keypad input pins. 5 × 4 keypad can be connected. In order to enable keypad input, single - Rx and single - Cx must be short-circuited, or set at "L" level simultaneously. Keypad input will be disabled when two keys or more are pressed simultaneously. When HKS is H, both Rx and Cx will output "L" level. When HKS is stopped at "L," Rx will output "L" level and Cx output "H" level. |
| 7, 8 | 13, 15 | OCSI OSCO | Input and output pins of the built-in oscillator. Connect a ceramic oscillator of 3.579545 MHz between OSC1 and OSC0. When using ceramics other than capacity built-in types, connect the oscillator of 30 pF to each Vss. |
| 9 | 16 | MUTE | Mute output pin. Nch open drain. When dial pulses or DTMF signals are output, "L" level is attained, otherwise remains at "Z" level. |
| 14 | 21 | HKS | Hook switch input terminal. On hook state at "H" level, hook off state at "L" level. |
| 15 | 22 | \overline{PO} | Pulse output pin. CMOS output. Outputs dial pulse in response to key input done in pulse mode. Goes to "L" level when brake, brush, or standby mode. Otherwise goes to "H" level. |
| 16 | 23 | DTMF | DTMF signal output pin. Outputs DTMF signal in response to key input done in tone mode. With memory dial, redial, and fast key input, correction is carried out between 100 ms output time and 106 ms interdigital pause. Real time transfer continues while key is pressed down. Goes to "L" level except during DTMF signal output. |
| 17 | 24 | MODE | Mode switch input terminal. Goes to tone mode at "L" level, to pulse mode at "H" level (10 pps), and pulse mode at "Z" level. Goes to tone mode even at "H" or "Z" level when */T is input. |
| 22 | 6 | KEY TONE | Key tone output pin. Outputs 1.16 KHz (duty 50%), 30 ms key tone in response to effective key input. Does not produce output in tone mode. |
| 11 | 18 | HFI | Hands-free input terminal. Toggle between HFI ON and HFI OFF by rise edge input. Employs Schmidt trigger, so external resistance pull-down resistor (100 kΩ) is built in. |
| 12 | 19 | HFO | Hands-free output terminal. Goes to "L" level with HFO off, and to "H" level with HFO on. For further information, see "On-Hook Dial Control Function, Hold Control Function". |
| 1 | 7 | INIT | Reset input pin. Should generally be used open. Is reset when "L" level is input. Built-in pull-up resistor (80 kΩ) |
| 13 | 20 | V _{DD} | V _{DD} input terminal. |
| 10 | 17 | V _{SS} | V _{SS} input terminal. |
| — | 3, 14 | N.C. | Not connected internally. |

| Pin name | I/O | I/O circuit | Notes |
|------------------------------------|--------------|---|---|
| $\overline{R1} \sim \overline{R4}$ | Input/output |  | |
| $\overline{C1} \sim \overline{C5}$ | Input/output |  | |
| HFO | Output |  | |
| \overline{PO} | Output |  | |
| KEYTONE | Output | | |
| MUTE | Output |  | |
| DTMF | Output |  | |
| \overline{INIT} | Input |  | Hysteresis input; internal pull-up resistance of 80k Ω |

| Pin name | I/O | I/O circuit | Notes |
|----------|--------|---|--|
| OSCI | Input |  | |
| OSCO | Output | | |
| HKS | Input |  | Hysteresis input |
| HFI | Input |  | Hysteresis input; internal pull-down resistance of 100kΩ |
| MODE | Input |  | Tertiary input |

● Electrical characteristics (unless otherwise noted, $T_a=25^\circ\text{C}$, $V_{DD}=2.5\text{V}$)

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|-----------------------------|--------------------------|--------------|------|---------|------|--------------------------|----------------------------|
| Operating current 1 | | I_{DD1} | — | 0.2 | 0.5 | mA | Pulse mode, no output load |
| Operating current 2 | | I_{DD2} | — | 0.7 | 2.0 | mA | Tone mode, no output load |
| Operating current 3 | | I_{DD3} | — | — | 2.0 | μA | Memory retention time |
| HKS | Input high level current | I_{IH} | — | — | 1.0 | μA | |
| | Input low level current | I_{IL} | — | — | -1.0 | μA | |
| Keypad input | Sink current | I_{SIK} | 0.2 | 0.4 | — | mA | $V_i=V_{DD}$ |
| | Source current | I_{SOK} | — | -10 | -30 | μA | $V_i=V_{SS}$ |
| PO | Sink current | I_{SIP} | 0.2 | — | — | mA | $V_o=0.5\text{V}$ |
| | Source current | I_{SOP} | -0.2 | — | — | mA | $V_o=2.0\text{V}$ |
| HFO | Sink current | I_{SIH} | 1.0 | — | — | mA | $V_o=0.5\text{V}$ |
| | Source current | I_{SOH} | -1.0 | — | — | mA | $V_o=2.0\text{V}$ |
| MUTE | Sink current | I_{SIM} | 1.0 | — | — | mA | $V_o=0.5\text{V}$ |
| | Source current | I_{LKM} | — | — | 1.0 | μA | $V_o=7.0\text{V}$ |
| KEY TONE | Sink current | I_{SIT} | 0.2 | — | — | mA | $V_o=0.5\text{V}$ |
| | Source current | I_{SOT} | -0.2 | — | — | mA | $V_o=2.0\text{V}$ |
| HFI pull-down resistance | | R_{HFI} | — | 100 | — | $\text{k}\Omega$ | |
| Key debounce time | | t_{DB} | — | 20 | — | ms | |
| Pulse rate | PR1 | — | 10 | — | pps | MODE=H | |
| | PR2 | — | 20 | — | pps | MODE=Z | |
| Make break ratio | | MB | — | 33 : 66 | — | % | MODE=H |
| Pre-digital pause | | t_{PDP} | — | 40 | — | ms | MODE=H |
| Inter-digital pause | | t_{IDP} | — | 800 | — | ms | MODE=H |
| Tone output time | | t_T | — | 100 | — | ms | MODE=L |
| Tone inter-digital pause | | t_{ITP} | — | 106 | — | ms | MODE=L |
| Pause time | | t_P | — | 3.6 | — | sec | |
| P→T wait time | | t_{PT} | — | 3.6 | — | sec | |
| Flash time | | t_F | — | 600 | — | ms | |
| Flash pause time | | t_{FP} | — | 0.2 | — | sec | |
| Tone output cycle variation | | $ \Delta f $ | — | — | 0.15 | % | MODE=L |
| Tone output voltage, ROW | | V_{OR} | 130 | 155 | 180 | mV_{rms} | MODE=L |
| Tone output voltage, COL | | V_{OC} | 163 | 195 | 227 | mV_{rms} | MODE=L |
| High-band pre-emphasis | | P_{EHB} | 1.0 | 2.0 | 3.0 | dB | MODE=L |
| Tone output distortion | | DIS | — | 5.0 | 10.0 | % | MODE=L |
| Pre-tone pause | | t_{PTP} | — | 20 | — | ms | MODE=L |

● Measurement circuit

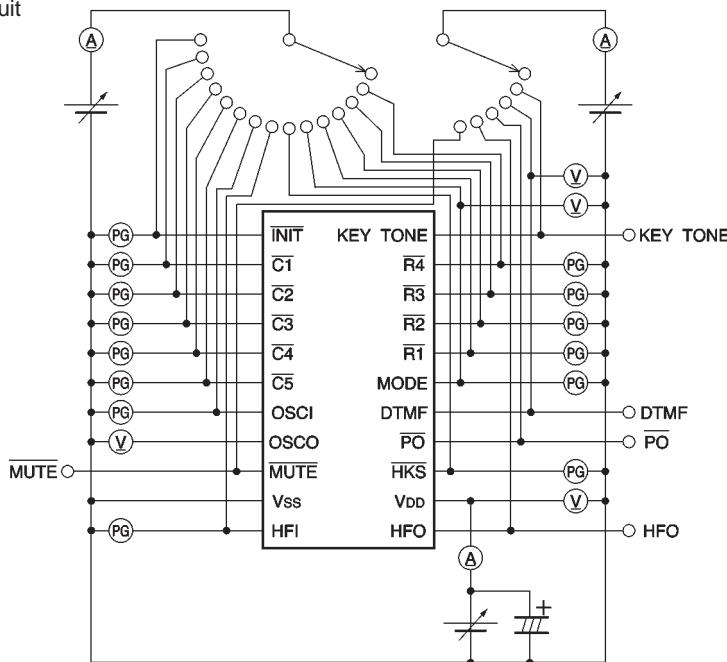


Fig. 1

● Circuit operation
Keypad matrix

| | | | | | |
|----|-------|----|----|--------|-----|
| R1 | 1 | 2 | 3 | | EM1 |
| R2 | 4 | 5 | 6 | F | EM2 |
| R3 | 7 | 8 | 9 | AUTO | EM3 |
| R4 | * / T | 0 | # | RD / P | ST |
| | C1 | C2 | C3 | C4 | C5 |

Keypad funtions

[0] to [9] These are numeric keys, and dial signals are sent when one of these keys is pressed.

When these are used in combination with the **[ST]** and **[AUTO]** keys, they can be used to specify a location in the 2-touch memory.

[#] In tone mode, when this key is pressed, the corresponding DTMF signal is sent.

[RD / P] This is the redial pause key. If it is the first key pressed after redialing, the last number dialed is redialed, and when it is the second or subsequent key pressed after re-

[* / T]

[ST]

dialing, it serves as a pause key. This is used to switch from pulse mode to tone mode. In tone mode, pressing the * key causes the corresponding DTMF signal to be transmitted.

This is used to write data to the 1-touch and 2-touch memories.

[AUTO] This is used to read data from the 2-touch memory.

[F] This is the flash key.

[EM1] to **[EM3]** These are used to write data to and read data from the 1-touch memory.

●Key operation : example

| Item | Key sequence | Dial output | Memory contents |
|--------------------|--|--|--|
| Normal dialing | | | |
| Pulse mode | MODE=H ↑ D1 … Dn ↓ | D1 … Dn | Redial=D1 … Dn |
| Tone mode | MODE=L ↑ D1 … Dn ↓ | D1 … Dn | Redial=T D1 … Dn |
| Mixed dialing | MODE=H | | |
| MODE pin | ↑ D1 … Di (MODE ↓) Di+1…Dn ↓ | D1 … Di (t _{PT}) Di+1…Dn | Redial=D1 … Di T Di+1 … Dn |
| T/* key | MODE=H ↑ D1 … Di T / * Di+1 … Dn ↓ | D1 … Di (t _{PT}) Di+1…Dn | Redial=D1 … Di T Di+1 … Dn |
| Redial | ↑ D1 … Di T / * Di+1 … Dn ↓ ↑ RD / P | D1 … Di (t _{PT}) Di+1…Dn D1 … Di (t _{PT}) Di+1…Dn | Redial=D1 … Di T Di+1 … Dn Redial=D1 … Di T Di+1 … Dn |
| Memory writing | | | |
| 1-touch memory | ↑ ST D1 … Dn (ST) EMi ↓ | — | EMi=D1 … Dn |
| 2-touch memory | ↑ ST D1'… Dn' ST Ln ↓ | — | Ln=D1'… Dn' |
| Memory reading | (Memory contents for memory writing) | | |
| 1-touch memory | ↑ EMi ↓ | D1 … Dn | Redia=D1 … Dn |
| 2-touch memory | ↑ AUTO Ln ↓ | D1'… Dn' | Redial=D1'… Dn' |
| Continuous reading | ↑ EMi AUTO Ln ↓ | D1 … Dn + D1'… Dn' | Redial=D1 … Dn / D1'… Dn' |
| Flash | ↑ D1 … Dn F D1'… Dn' ↓ | D1 … Dn (t _F , t _{FP}) D1'… Dn' | Redial=D1'… Dn' |
| Pause | | | |
| Normal dialing | ↑ D1 … Di RD / P Di+1 … Dn ↓ | D1 … Dn (t _{PA}) Di+1…Dn | Redial=D1 … Di + P Di+1 … Dn |
| Writing | ↑ ST D1 … Di RD / P Di+1 … Dn ST Ln ↓ | — | Ln=D1 … Di P Di+1 … Dn |

| | | | | | | |
|----------|------------------|----------------|-----------------|--------------------------------|-----------------|--------------------|
| Legend | ↑ | : Off-hook | ~~~~ | : DTMF output | t _{PA} | : Pause time |
| | ↓ | : On-hook | EMi | : 1-touch memory (i = 1, 2, 3) | t _F | : Flash time |
| (MODE ↓) | : MODE pin H → L | | Ln | : 2-touch memory (n = 0 to 9) | t _{FP} | : Flash pause time |
| | | : Pulse output | t _{PT} | : P → T wait time | | |

● On-hook dial control function and hold control function

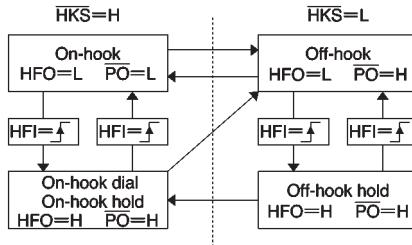


Fig. 2 Change in states

● Timing charts

(1) Pulse mode timing chart

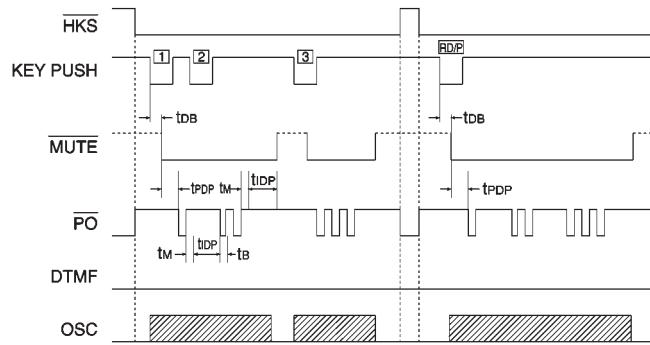


Fig. 3

(2) Tone mode timing chart

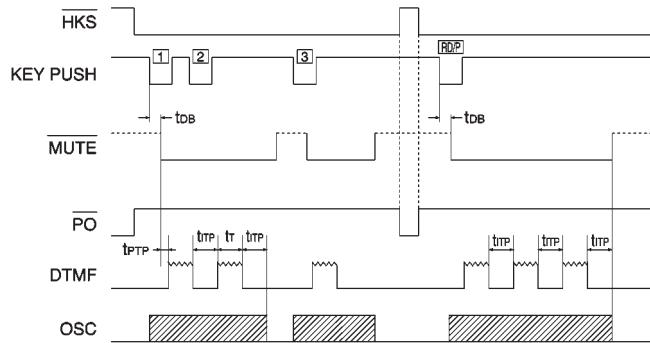


Fig. 4

(3) Timing when mode is switched

1) Using $*/\bar{T}$

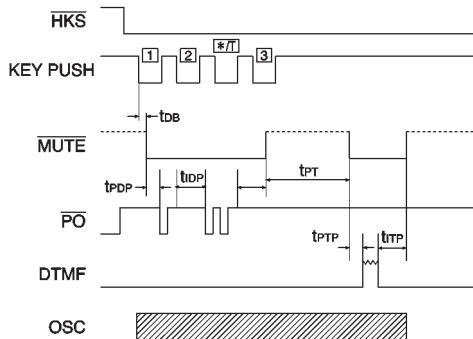


Fig. 5

2) Using MODE pin

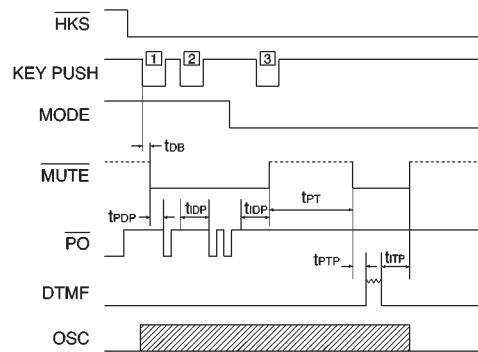


Fig. 6

(4) Pause function timing chart

1) Pulse mode

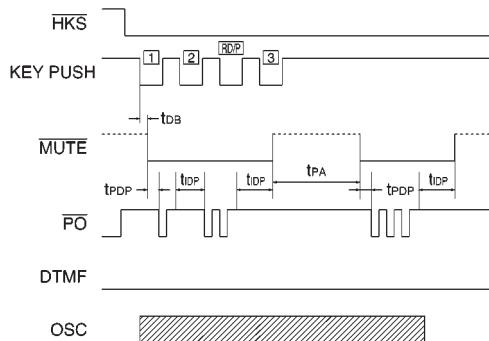


Fig. 7

2) Tone mode

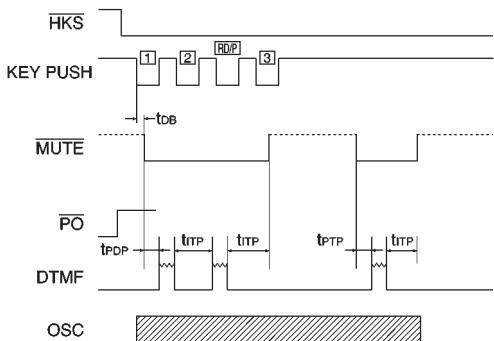


Fig. 8

(5) Flash function timing chart

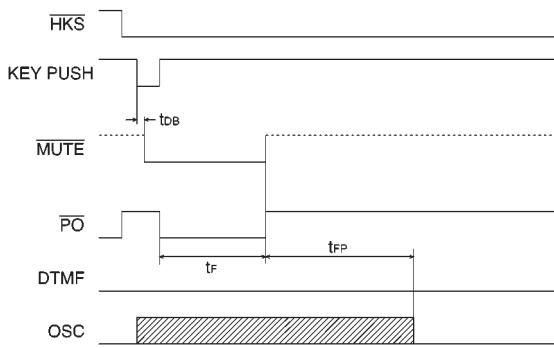


Fig. 9

● Electrical characteristic curves

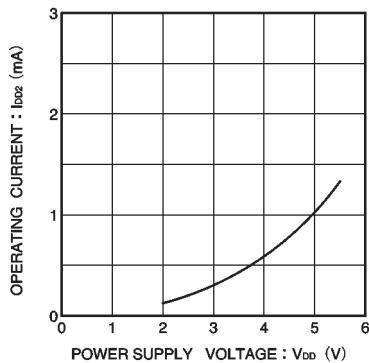


Fig. 10 Tone mode, operating current vs. power supply voltage

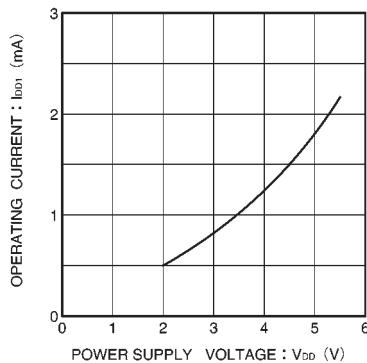


Fig. 11 Pulse mode, operating current vs. power supply voltage

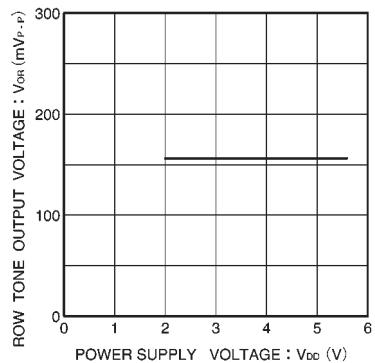


Fig. 12 Row tone output voltage vs. power supply voltage

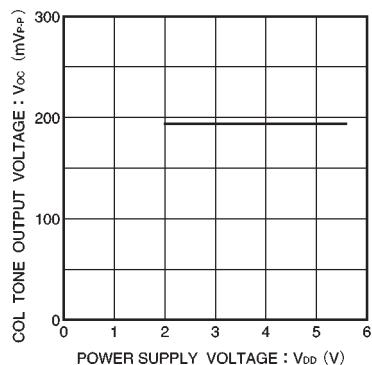
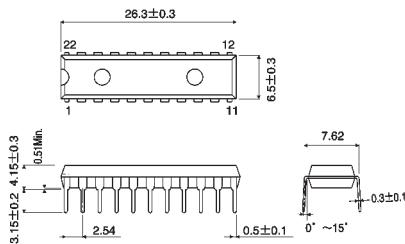
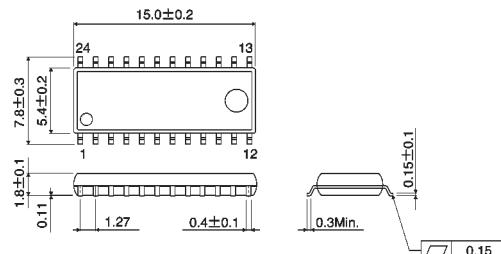


Fig. 13 COL tone output voltage vs. power supply voltage

● External dimensions (Units: mm)



DIP22



SOP24