

Features

Patent Number: 86474, 113235(R.O.C.), 5424740(U.S.A.)

- Universal specification
- Operating voltage: 2.0V~5.5V
- Low standby current
- Low memory retention current: 0.1μA (Typ.)
- Tone/pulse switchable
- Interface with LCD driver
- 32 digits for redialing
- 32 digits for the SA memory dialing
- One-key redialing
- Pause and P→T key for PBX
- 5×5 keyboard matrix
- Make/Break ratio control
- 3.58MHz crystal or ceramic resonator
- Hand-free control
- Hold-line control
- Pause, P→T can be saved for redialing
- Keytone function
- Lock function
- CD key
- Memory number: 12 memories

General Description

The HT9242 series tone/pulse dialers are CMOS LSIs for telecommunication systems.

The HT9242 series are offered in various packages from 22-pin DIP to 28-pin DIP. The 22-pin DIP version is suitable for low cost applications, while the 28-pin DIP version has versatile functions such as: Hold-line, Hand-free, IDD lock

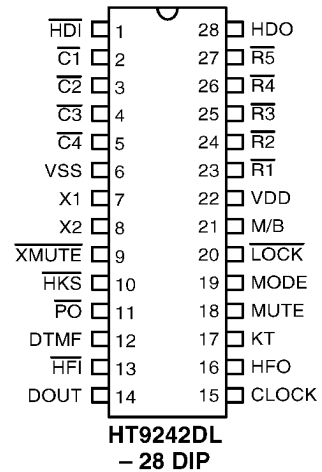
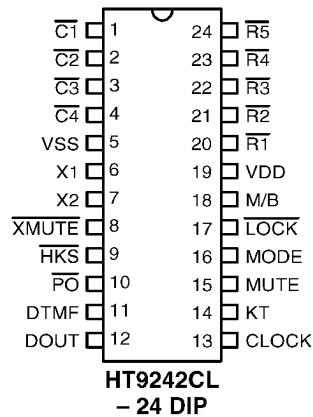
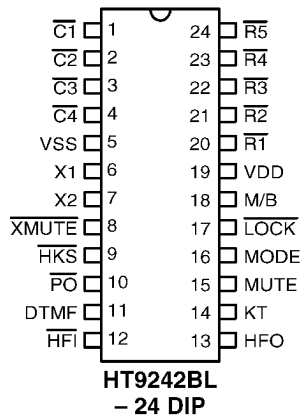
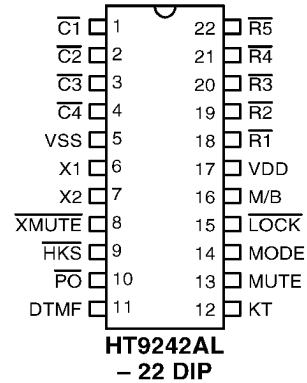
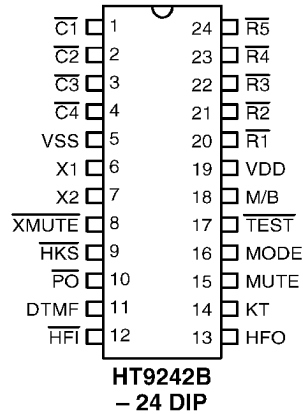
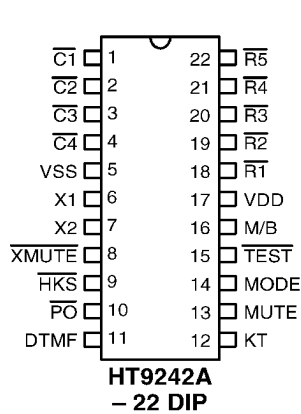
and LCD dialing number display interface, all of which are suitable for feature phone applications.

The HT9242 provides SA, Redial and 10 two-touch memory dials for speed dialing in either pulse or tone mode.

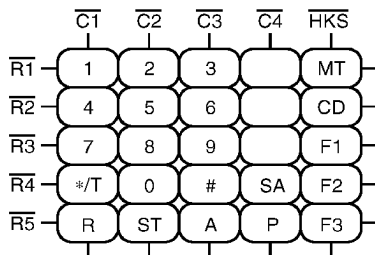
Selection Table

| Function Item | Memory Diding | Hold-Line | Hand-Free | LCD Interface | Flash Function | Flash Time (ms) | Pulse No. | Tone Duration (ms) | Inter-Tone-Pause (ms) | Lock Function | Package |
|---------------|---------------|-----------|-----------|---------------|----------------|-----------------|-----------|--------------------|-----------------------|---------------|---------|
| HT9242A | SAR MD~MP | — | — | — | Control | 98,800,600 | N | 91 | 91 | — | 22 DIP |
| HT9242B | SAR MD~MP | — | √ | — | Control | 98,800,600 | N | 91 | 91 | — | 24 DIP |
| HT9242AL | SAR MD~MP | — | — | — | Control | 98,800,600 | N | 91 | 91 | √ | 22 DIP |
| HT9242BL | SAR MD~MP | — | √ | — | Control | 98,800,600 | N | 91 | 91 | √ | 24 DIP |
| HT9242CL | SAR MD~MP | — | — | √ | Control | 98,800,600 | N | 91 | 91 | √ | 24 DIP |
| HT9242DL | SAR MD~MP | √ | √ | √ | Control | 98,800,600 | N | 91 | 91 | √ | 28 DIP |

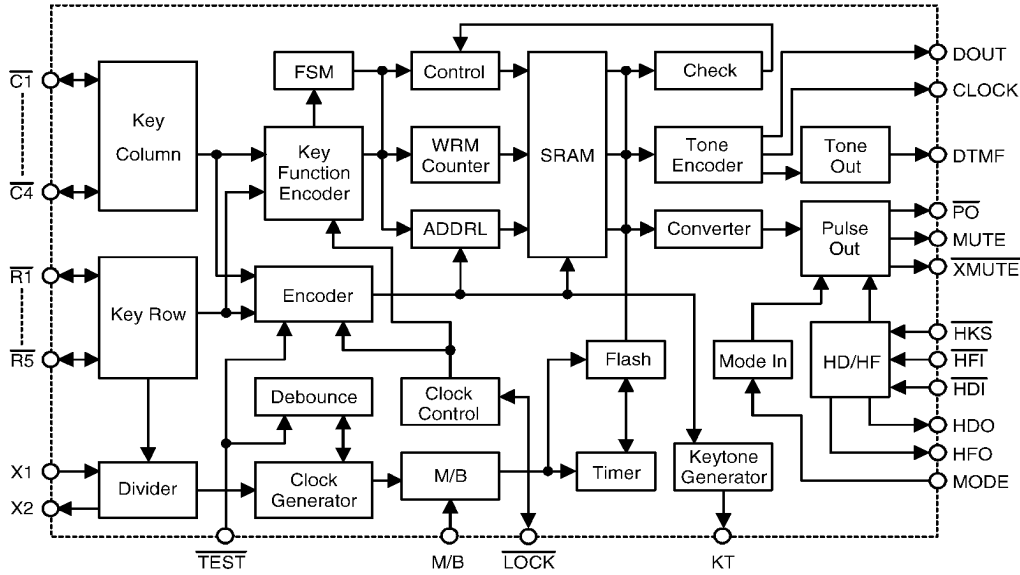
Pin Assignment



Keyboard Information



Block Diagram



Pin Description

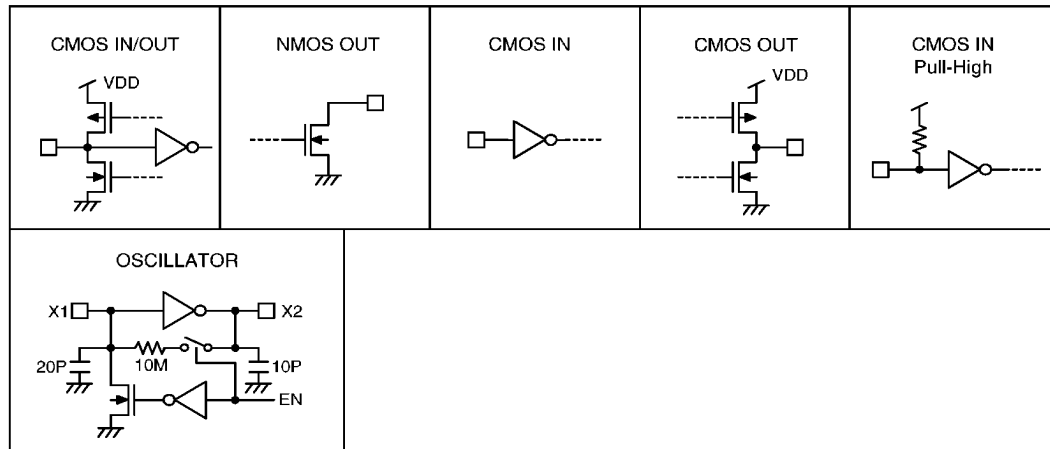
| Pin Name | I/O | Internal Connection | Description |
|---|-----|---------------------|---|
| $\overline{C1}\sim\overline{C4}$ $R1\sim R5$ | I/O | CMOS IN/OUT | <p>These pins form a 5x5 keyboard matrix which can perform keyboard input detection. When on-hook (\overline{HKS}= high) all the pins are set high. While off-hook the column group ($\overline{C1}\sim\overline{C4}$) remains low and the row group ($R1\sim R5$) is set high for key input detection.</p> <p>An inexpensive single contact 5x5 keyboard can be used as an input device. Pressing a key connects a single column to a single row, and actuates the system oscillator that results in a dialing signal output. If more than two keys are pressed at the same time, no response occurs. The key-in debounce time is 20ms. Refer to the keyboard information for keyboard arrangement and to the functional description for dialing specification selection.</p> |
| X1 | I | OSCILLATOR | <p>The system oscillator consists of an inverter, a bias resistor and the necessary load capacitor on chip. Connecting a standard 3.579545MHz crystal or ceramic resonator to the X1 and X2 terminals can implement the oscillator function. The oscillator is turned off in the standby mode, and is actuated whenever a keyboard entry is detected.</p> |
| X2 | O | | |

| Pin Name | I/O | Internal Connection | Description |
|---------------------------|-----|----------------------|--|
| $\overline{\text{XMUTE}}$ | O | CMOS OUT | $\overline{\text{XMUTE}}$ is a CMOS output structure pulled to VSS during dialing signal transmission. Otherwise, it remains "high". $\overline{\text{XMUTE}}$ is used to mute the speech circuit when transmitting the dial signal. |
| $\overline{\text{HKS}}$ | I | CMOS IN Pull-High | This pin is used to monitor the status of the hook-switch and its combination with $\overline{\text{HFI}}$ can control the $\overline{\text{PO}}$ pin output to make or break the line. $\overline{\text{HKS}}=\text{VDD}$: On-hook state ($\overline{\text{PO}}=\text{low}$). Except $\overline{\text{HFI}}/\overline{\text{HDI}}$ (hand-free/hold-line control input), other functions are all disabled. $\overline{\text{HKS}}=\text{VSS}$: Off-hook state ($\overline{\text{PO}}=\text{high}$). The chip is in the standby mode and ready to receive the key input. |
| $\overline{\text{PO}}$ | O | CMOS OUT | This pin is a CMOS output structure which by receiving the $\overline{\text{HKS}}$ and HFO signals, control the dialer to connect or disconnect the telephone line. $\overline{\text{PO}}$ outputs a low to break the line when $\overline{\text{HKS}}$ is high (on-hook) and HFO is low (hand-free inactive). $\overline{\text{PO}}$ outputs a high to make the line when $\overline{\text{HKS}}$ is low (off-hook) or HFO is high or HDO is high. During the off-hook state, this pin also outputs the dialing pulse train in pulse mode dialing. While in the tone mode, this pin is always high. |
| MODE | I | CMOS IN | This is an input pin used for dialing mode selection, either Tone mode or Pulse mode, 10pps $\text{MODE}=\text{VDD}$: Pulse mode, 10pps $\text{MODE}=\text{VSS}$: Tone mode During pulse mode dialing, switching this pin to the tone mode changes the subsequent digit entry to tone mode. When the chips are in tone mode, switching to pulse mode will also be recognized. |
| MUTE | O | CMOS OUT | MUTE is a CMOS output structure pulled to VDD during Tone (DTMF) output transmission. Otherwise, it continuously remains "low". |
| M/B | I | CMOS IN | This is a Make/Break ratio selection pin in pulse mode. Otherwise, it has no function. $\text{M/B}=\text{VDD}$: Make/Break ratio is 40/60 $\text{M/B}=\text{VSS}$: Make/Break ratio is 33/66 |
| DTMF | O | CMOS OUT | This pin is active only when the chip transmits tone dialing signals. Otherwise, it always outputs a low. The pin outputs tone signals to drive the external transmitter amplifier circuit. The load resistor should not be less than 5k Ω . |

| Pin Name | I/O | Internal Connection | Description |
|--------------------------|-----|----------------------|--|
| $\overline{\text{HDI}}$ | I | CMOS IN Pull-High | This pin is a schmitt trigger input structure. Active low. Applying a negative going pulse to this pin can toggle the HDO output once. An external RC network is recommended for input debouncing. The pull-high resistance is 200k Ω typ. |
| HDO | O | CMOS OUT | The HDO is a CMOS output structure. Its output is toggle-controlled by a negative transition on $\overline{\text{HDI}}$. When HDO is toggled high, $\overline{\text{PO}}$ keeps high to hold the line. The hold function can be released by setting HFO high or by an on-off-hook operation or by another $\overline{\text{HDI}}$ input. The HDO pin can directly drive the HT3810 series melody generators to produce a hold-line background melody. Refer to the functional description for the hold-line function. |
| $\overline{\text{HFI}}$ | I | CMOS IN Pull-High | This pin is a schmitt trigger input structure. Active low. Applying a negative going pulse to $\overline{\text{HFI}}$ can toggle HFO once and hence control the hand-free function. The pull-high resistance of $\overline{\text{HFI}}$ is 200k Ω typ. An external RC network is recommended for input debouncing. |
| HFO | O | CMOS OUT | The HFO is a CMOS output structure. Its output is toggle-controlled by a negative transition on the $\overline{\text{HFI}}$ pin. When HFO is high, the hand-free function is enabled and $\overline{\text{PO}}$ outputs a high to connect the line. The hand-free function can be released by an on-off-hook operation or by another $\overline{\text{HFI}}$ input or by setting HDO high. Refer to the functional description for the hand-free functional operation. |
| DOUT | O | NMOS OUT | NMOS open drain output pin. It outputs the BCD code of the dialing digits to the LCD driver chip (HT16XX series) or μC for dialing number display. Refer to the functional description for the detailed timing. |
| CLOCK | O | NMOS OUT | NMOS open drain output. When dialing, it outputs a series of pulse trains for DOUT data synchronization. DOUT data is valid at the falling edge of the clock. |
| KT | O | CMOS OUT | Keytone output pin. Outputs a 1.2kHz tone carrier when any key is pressed in the pulse mode or when the function keys are pressed in the Tone (DTMF) mode. |
| $\overline{\text{TEST}}$ | I | CMOS IN | For IC test only. $\overline{\text{TEST}}=\text{VDD}$ for normal operation |

| Pin Name | I/O | Internal Connection | Description |
|--------------------------|-----|---------------------|--|
| $\overline{\text{LOCK}}$ | I/O | CMOS IN/OUT | This is a three-state input-output pin, used for controlling long distance call function with a lock-switch. LOCK=VDD: Normal dialing LOCK=OPEN: "0, 9" is inhibited for use as the first key input LOCK=VSS: "0" is inhibited for use as the first key input |
| VDD | I | — | Positive power supply, 2.0V~5.5V for normal operation |
| VSS | I | — | Negative power supply |

Approximate internal connection circuits



Absolute Maximum Ratings*

| | | | |
|----------------------|---|-----------------------------|----------------|
| Supply Voltage | -0.3V to 6V | Storage Temperature | -50°C to 125°C |
| Input Voltage | V _{SS} -0.3 to V _{DD} +0.3V | Operating Temperature | -20°C to 75°C |

*Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics

 (F_{OSC}=3.5795MHz, T_a=25°C)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit | |
|--------------------|--|-----------------|------------------------------|-------------------------------------|------|--------------------|------|----|
| | | V _{DD} | Conditions | | | | | |
| V _{DD} | Operating Voltage | — | — | 2 | — | 5.5 | V | |
| I _{DD} | Operating Current | 2.5V | Pulse | Off-hook Keypad entry No load | — | 0.2 | 1 | mA |
| | | | Tone | | — | 0.6 | 2 | mA |
| I _{STB} | Standby Current | 1V | On-hook, no load No entry | — | — | 1 | μA | |
| V _R | Memory Retention Voltage | — | — | 1 | — | 5.5 | V | |
| I _R | Memory Retention Current | 1V | On-hook | — | 0.1 | 0.2 | μA | |
| V _{IL} | Input Low Voltage | — | — | V _{SS} | — | 0.2V _{DD} | V | |
| V _{IH} | Input High Voltage | — | — | 0.8V _{DD} | — | V _{DD} | V | |
| I _{OHXM} | Mute Pin Source Current ($\overline{\text{XMUTE}}$, MUTE) | 2.5V | V _{OH} =2V | -1 | — | — | mA | |
| I _{IOLXM} | Mute Pin Sink Current ($\overline{\text{XMUTE}}$, MUTE) | 2.5V | V _{OL} =0.5V | 1 | — | — | mA | |
| I _{HKS} | $\overline{\text{HKS}}$ Pin Input Current | 2.5V | V _{HKS} =2.5V | — | — | 0.1 | μA | |
| R _{HFI} | $\overline{\text{HFI}}$ Pull-High Resistance | 2.5V | V _{HFI} =0V | — | 200 | — | kΩ | |
| R _{HDI} | $\overline{\text{HDI}}$ Pull-High Resistance | 2.5V | V _{HDI} =0V | — | 200 | — | kΩ | |
| R _{HKS} | $\overline{\text{HKS}}$ Pull-High Resistance | 2.5V | V _{HKS} =0V | — | 1 | — | MΩ | |
| T _{F1} | Flash Time for F1 Key | — | — | — | 98 | — | ms | |
| T _{F2} | Flash Time for F2 Key | — | — | — | 300 | — | ms | |
| T _{F3} | Flash Time for F3 Key | — | — | — | 600 | — | ms | |
| I _{OH1} | Keypad Pin Source Current | 2.5V | V _{OH} =0V | -4 | — | -40 | μA | |
| I _{IOL1} | Keypad Pin Sink Current | 2.5V | V _{OL} =2.5V | 200 | 400 | — | μA | |
| I _{OH2} | HFO Pin Source Current | 2.5V | V _{OH} =2V | -1 | — | — | mA | |
| I _{IOL2} | HFO Pin Sink Current | 2.5V | V _{OL} =0.5V | 1 | — | — | mA | |
| I _{OH3} | HDO Pin Source Current | 2.5V | V _{OH} =2V | -1 | — | — | mA | |
| I _{IOL3} | HDO Pin Sink Current | 2.5V | V _{OL} =0.5V | 1 | — | — | mA | |
| T _{FP} | Pause Time After Flash | — | Control key | — | 0.2 | — | s | |
| T _{RP} | Pause Time for One-key Redialing | — | One-key redialing | — | 0.6 | — | s | |
| T _{DB} | Key-in Debounce Time | — | — | — | 20 | — | ms | |

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|------------------|----------------------------------|-----------------|-------------------|--------|--------|--------|------|
| | | V _{DD} | Conditions | | | | |
| T _{KTD} | Keytone Delay | — | — | — | 20 | — | ms |
| T _{KTR} | Keytone Release | — | — | — | 20 | — | ms |
| T _{BRK} | Break Time for One-key Redialing | — | One-key redialing | — | 2.2 | — | s |
| F _{OSC} | System Frequency | — | Crystal=3.5795MHz | 3.5759 | 3.5795 | 3.5831 | MHz |

Pulse Mode Electrical Characteristics

 (F_{OSC}=3.5795MHz, T_a=25°C)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|------------------|---------------------------------------|-----------------|------------------------------|------|-------|------|------|
| | | V _{DD} | Conditions | | | | |
| I _{POH} | \overline{PO} Output Source Current | 2.5V | V _{OH} =2V | -0.2 | — | — | mA |
| I _{POL} | \overline{PO} Output Sink Current | 2.5V | V _{OL} =0.5V | 0.2 | 0.6 | — | mA |
| PR | Pulse Rate | — | MODE pin is connected to VDD | — | 10 | — | pps |
| M/B | Make/Break Ratio | — | M/B=VSS | — | 33:66 | — | % |
| | | | M/B=VDD | — | 40:60 | — | |
| T _{PDP} | Pre-digit-pause Time | — | M/B ratio=40:60 | — | 40 | — | ms |
| | | | M/B ratio=33:66 | — | 33 | — | |
| T _{IDP} | Inter-digit-pause Time | — | Pulse rate=10pps | — | 800 | — | ms |
| T _M | Pulse Make Duration | — | M/B ratio=33:66 | — | 33 | — | ms |
| | | | M/B ratio=40:60 | — | 40 | — | |
| T _B | Pulse Break Duration | — | M/B ratio=33:66 | — | 66 | — | ms |
| | | | M/B ratio=40:60 | — | 60 | — | |

Tone Mode Electrical Characteristics

 (F_{OSC}=3.5795MHz, Ta=25°C)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|-------------------|--------------------------|-----------------|--------------------------------|---------------------|-------|--------------------|------------------|
| | | V _{DD} | Conditions | | | | |
| V _{TDC} | DTMF Output DC Level | — | — | 0.45V _{DD} | — | 0.7V _{DD} | V |
| I _{TOL} | DTMF Sink Current | 2.5V | V _{DTMF} =0.5V | 0.1 | — | — | mA |
| V _{TAC} | DTMF Output AC Level | — | Row group, R _L =5kΩ | 0.12 | 0.155 | 0.18 | V _{rms} |
| R _L | DTMF Output Load | 2.5V | THD≤-23dB | 5 | — | — | kΩ |
| ACR | Column Pre-emphasis | 2.5V | Row group=0dB | 1 | 2 | 3 | dB |
| THD | Tone Signal Distortion | 2.5V | R _L =5kΩ | — | -30 | -23 | dB |
| T _{TMIN} | Minimum Tone Duration | — | Auto-redial | — | 91 | — | ms |
| T _{ITPM} | Minimum Inter-tone Pause | — | Auto-redial | — | 91 | — | ms |

$$\text{THD (Distortion) (dB)} = 20 \log \left(\frac{\sqrt{V_1^2 + V_2^2 + \dots + V_n^2}}{\sqrt{V_i^2 + V_h^2}} \right)$$

 V_i, V_h: Row group and column group signals

 V₁, V₂, ... V_n: Harmonic signals (BW=300Hz~3500Hz)

Functional Description
Keyboard matrix

$\overline{C1} \sim \overline{C4}$ and $\overline{R1} \sim \overline{R5}$ form a keyboard matrix. Together with a standard 5×5 keyboard, the keyboard matrix is used for dialing entries. The keyboard arrangement for the HT9242 series is shown in the **Keyboard Information**.

Tone frequency

| Tone Name | Output Frequency (Hz) | | % Error |
|-----------------|-----------------------|--------|---------|
| | Specified | Actual | |
| $\overline{R1}$ | 697 | 699 | +0.29% |
| $\overline{R2}$ | 770 | 766 | -0.52% |
| $\overline{R3}$ | 852 | 847 | -0.59% |
| $\overline{R4}$ | 941 | 948 | +0.74% |
| $\overline{C1}$ | 1209 | 1215 | +0.50% |
| $\overline{C2}$ | 1336 | 1332 | -0.30% |
| $\overline{C3}$ | 1477 | 1472 | -0.34% |

Note: % Error does not contain the crystal frequency drift

M/B ratio selection table

| M/B Pin | M/B Ratio (%) |
|---------|---------------|
| VDD | 40:60 |
| VSS | 33.3:66.6 |

Flash function/time (duration) selection table

| Key-In | Flash Function | Flash Time (T _F) |
|--------|----------------|------------------------------|
| F1 | Control | 98ms |
| F2 | Control | 300ms |
| F3 | Control | 600ms |

Pause and P→T duration table

| T _P (sec) | T _{P→T} (sec) |
|----------------------|------------------------|
| 3.1 | 3.1 |

Pulse number table

| Keypad | Output Pulse Number |
|-----------|---------------------|
| Digit Key | Normal N |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |
| 9 | 9 |
| 0 | 10 |
| */T | P→T |
| # | Ignored |

Tone duration and pause in redial function

| Parameter | Symbol | Typ. | Unit |
|--------------------------|-------------------|------|------|
| Minimum Tone Duration | T _{TMIN} | 91 | ms |
| Minimum Inter-tone Pause | T _{ITPM} | 91 | ms |
| Cycle Time | T _C | 182 | ms |

Hand-free function operation

- Hand-free function execution
When HFO is low, a falling edge triggers the HFI, enabling the Hand-free function (HFO becomes high).
- Reset Hand-free function
When HFO is high, the Hand-free function is enabled and can be reset by:
 - Off-hook
 - Applying a falling edge to $\overline{\text{HFI}}$
 - Changing the HDO pin from low to high

Hand-free function table

| Current State | | | Input | | | Next State | |
|---------------|-----|-----|-------|-----|-----|------------|-----|
| HKS | HFO | HDO | HDI | HFI | HKS | HFO | HDO |
| H | L | X | H | H | An | L | An |
| H | L | X | H | ↓ | An | H | L |
| H | H | X | H | ↓ | An | L | An |
| H | X | L | H | H | L | L | L |
| L | L | X | H | H | An | L | An |
| L | L | X | H | ↓ | An | H | L |
| L | H | L | H | ↓ | An | L | An |
| L | X | X | H | H | H | An | An |
| X | X | L | ↓ | H | An | L | H |

H: Logic HIGH X: Don't care ↑: Rising edge
L: Logic LOW An: Unchanged ↓: Falling edge

Hold-line function operation

• **Hold-line function execution**

When HDO is low, a falling edge triggers $\overline{\text{HDI}}$, enabling the Hold-line function (HDO becomes high). The $\overline{\text{XMUTE}}$ remains low when HDO is high.

• **Reset Hold-line function**

When HDO is high, the Hold-line function is enabled and can be reset by:

- ♦ Off-hook
- ♦ Applying a falling edge to $\overline{\text{HDI}}$
- ♦ Changing the HFO pin from low to high

• **Hold-line function table**

| Current State | | | Input | | | Next State | |
|-------------------------|-----|-----|-------------------------|-------------------------|-------------------------|------------|-----|
| $\overline{\text{HKS}}$ | HDO | HFO | $\overline{\text{HF1}}$ | $\overline{\text{HDI}}$ | $\overline{\text{HKS}}$ | HDO | HFO |
| H | L | X | H | H | An | L | An |
| H | L | X | H | \downarrow | An | H | L |
| H | H | L | H | \downarrow | An | L | An |
| H | X | X | H | H | L | L | L |
| L | L | X | H | H | An | L | An |
| L | L | X | H | \downarrow | An | H | L |
| L | H | L | H | \downarrow | An | L | An |
| L | X | X | H | H | H | An | An |
| X | X | L | \downarrow | H | An | L | H |

H: Logic HIGH X: Don't care \uparrow : Rising edge
 L: Logic LOW An: Unchanged \downarrow : Falling edge

DOUT BCD code

When dialing, the corresponding 4-bit BCD codes are serially presented on DOUT from MSB to LSB. The data of DOUT is valid at the falling edge of the CLOCK pin.

The following table lists the BCD codes corresponding to the keyboard input.

| Key-In | BCD Code | Key-In | BCD Code |
|--------|----------|--------|----------|
| 1 | 0001 | 8 | 1000 |
| 2 | 0010 | 9 | 1001 |
| 3 | 0011 | 0 | 1010 |
| 4 | 0100 | */T | 1101 |
| 5 | 0101 | # | 1100 |
| 6 | 0110 | F | 1011 |
| 7 | 0111 | P | 1110 |

Key definition

• 0,1,2,3,4,5,6,7,8,9 keys

These are dialing number input keys for both the pulse mode and the tone mode operations.

• */T

This key executes the P→T function and waits a $T_{P \rightarrow T}$ duration in the pulse mode. On the other hand, the */T key executes the * function in the tone mode.

• #

This is a dialing signal key for the tone mode only, no response in the pulse mode.

• SA

Pressing this key can save the preceding dialing telephone numbers. The saved number is redialed if it is pressed again. SA will also redial the saved number if it is the first key depressed at the off-hook state. During the dialing signal transmission, the SA key is inhibited.

• P

Pause key. The execution of this key pauses the output for the T_P duration. T_P is 3.1 secs.

- F1~F3

The flash keys are control keys. Pressing the F1~F3 keys will force the \overline{PO} pin to be “low” for the T_F duration and is then followed by T_{FP} (sec).

| Key-In | Flash Time |
|--------|------------|
| F1 | 98ms |
| F2 | 300ms |
| F3 | 600ms |

- R

Redial key. Executes redialing as well as one-key redial function.

- MT

The MUTE and \overline{XMUTE} pin output will be toggled when the MT key is pressed.

- ST

Store key. The execution of this key actuates the store memory function with (or without) dialing output. During the dialing signal transmission, the ST key is inhibited.

- A

Auto key. When this key is pressed before pressing any of the digital keys (0~9) it executes the two-touch memory dialing function.

- CD

Call disconnect key. When pressed, the chip will reset to its initial state.

Keyboard operation

The following operations are described under an on-off-hook or on-hook condition with the hand-free active condition.

• Normal dialing

– Pulse mode

(a) without */T

Keyboard input: D1 D2 ... Dn

Dialing output: D1 D2 ... Dn

RM: D1 D2 ... Dn

SAM: Unchanged

(b) with */T

Keyboard input: D1 D2 ... Dn */T Dn+1 ...
Dm

Dialing output: D1 D2 ... Dn TP→T Dn+1 ... Dm
Pulse Tone

RM: D1 D2 ... Dn */T Dn+1 ... Dm

SAM: Unchanged

– Tone mode

(a) without */T

Keyboard input: D1 D2 ... Dn

Dialing output: D1 D2 ... Dn

RM: D1 D2 ... Dn

SAM: Unchanged

(b) with */T

Keyboard input: D1 D2 ... Dn */T Dn+1 ...
Dm

Dialing output: D1 D2 ... Dn * Dn+1 ... Dm

RM: D1 D2 ... Dn * Dn+1 ... Dm

SAM: Unchanged

Note: The maximum capacity of the RM memory is 32 digits. When more than 32 digits are entered, the signal is transmitted but the redial function is inhibited.

• Redial

– Pulse mode

(a) without */T

RM content: D1 D2 ... Dn

Keyboard input: R

Dialing output: D1 D2 ... Dn

RM: Unchanged

SAM: Unchanged

(b) with */T

RM content: D1 D2 ... Dn */T Dn+1 ... Dm

Keyboard input: R

Dialing output: D1 D2 ... Dn TP→T Dn+1 ... Dm
Pulse Tone

RM: Unchanged

SAM: Unchanged

– Tone mode

(a) without */T

RM content: D1 D2 ... Dn

Keyboard input: R

Dialing output: D1 D2 ... Dn

RM: Unchanged

SAM: Unchanged

(b) with */T

RM content: D1 D2 ... Dn */T Dn+1 ... Dm

Keyboard input: R

Dialing output: D1 D2 ... Dn * Dn+1 ... Dm

RM: Unchanged

SAM: Unchanged

• One-key recall

- Pulse mode

(a) without */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{R}$
 Diding output: $D1 \ D2 \dots Dn \ TBRK \ TRP$
 $D1 \ D2 \dots Dn$
 RM: $D1 \ D2 \dots Dn$
 SAM: Unchanged

(b) with */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{*/T} \boxed{Dn+1} \dots$
 $\boxed{Dm} \boxed{R}$
 Diding output: $D1 \ \underbrace{D2 \dots Dn}_{\text{Pulse}} \ TP \rightarrow T \ \underbrace{Dn+1 \dots Dm}_{\text{Tone}}$
 $TBRK \ TRP \ \underbrace{D1 \ D2 \dots Dn}_{\text{Pulse}} \ TP \rightarrow T$
 $Dn+1 \dots Dm$
 Tone
 RM: $D1 \ D2 \dots Dn \ */T \ Dn+1 \dots Dm$
 SAM: Unchanged

- Tone mode

(a) without */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{R}$
 Diding output: $D1 \ D2 \dots Dn \ TBRK \ TRP \ D1 \ D2$
 $\dots Dn$
 RM: $D1 \ D2 \dots Dn$
 SAM: Unchanged

(b) with */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{*/T} \boxed{Dn+1} \dots$
 $\boxed{Dm} \boxed{R}$
 Diding output: $D1 \ D2 \dots Dn \ * \ Dn+1 \dots Dm$
 $TBRK \ TRP \ D1 \ D2 \dots Dn \ * \ Dn+1$
 $\dots Dm$
 RM: $D1 \ D2 \dots Dn \ * \ Dn+1 \dots Dm$
 SAM: Unchanged

Note: If the dding number exceeds 32 digits, redling is inhibited and $\overline{PO} = VDD$

• SA copy

- Pulse mode

(a) without */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{R}$
 Diding output: $D1 \ D2 \dots Dn$
 RM: $D1 \ D2 \dots Dn$
 SAM: $D1 \ D2 \dots Dn$

(b) with */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{*/T} \boxed{Dn+1} \dots$
 $\boxed{Dm} \boxed{SA}$
 Diding output: $D1 \ \underbrace{D2 \dots Dn}_{\text{Pulse}} \ TP \rightarrow T \ \underbrace{Dn+1 \dots Dm}_{\text{Tone}}$
 RM: $D1 \ D2 \dots Dn \ */T \ Dn+1 \dots Dm$
 SAM: $D1 \ D2 \dots Dn \ */T \ Dn+1 \dots Dm$

- Tone mode

(a) without */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{R}$
 Diding output: $D1 \ D2 \dots Dn$
 RM: $D1 \ D2 \dots Dn$
 SAM: $D1 \ D2 \dots Dn$

(b) with */T

Keyboard input: $\boxed{D1} \boxed{D2} \dots \boxed{Dn} \boxed{*/T} \boxed{Dn+1} \dots$
 $\boxed{Dm} \boxed{SA}$
 Diding output: $D1 \ D2 \dots Dn \ * \ Dn+1 \dots Dm$
 RM: $D1 \ D2 \dots Dn \ * \ Dn+1 \dots Dm$
 SAM: $D1 \ D2 \dots Dn \ * \ Dn+1 \dots Dm$

Note: The maximum capacity of the RM memory is 32 digits. When more than 32 digits plus the "SA" key are entered, the SAVE function will not be executed, and all the existing data in the save memory will not be changed.

• SAadding

- Pulse mode

(a) without */T

SAM content: D1 D2 ... Dn

Keyboard input: SA

Dialing output: D1 D2 ... Dn

RM: Unchanged

SAM: Unchanged

(b) with */T

SAM content: D1 D2 ... Dn */T Dn+1 ... Dm

Keyboard input: SA

Dialing output: $\underbrace{D1 D2 \dots Dn}_{\text{Pulse}} \xrightarrow{*/T} \underbrace{Dn+1 \dots Dm}_{\text{Tone}}$

RM: Unchanged

SAM: Unchanged

- Tone mode

(a) without */T

SAM content: D1 D2 ... Dn

Keyboard input: SA

Dialing output: D1 D2 ... Dn

RM: Unchanged

SAM: Unchanged

(b) with */T

SAM content: D1 D2 ... Dn * Dn+1 ... Dm

Keyboard input: SA

Dialing output: D1 D2 ... Dn * Dn+1 ... Dm

RM: Unchanged

SAM: Unchanged

• Memory store

(a) without dialing output

Keyboard input: ST D1 D2 ... Dn ST a

Dialing output:

Ma: D1 D2 ... Dn

RM: D1 D2 ... Dn

SAM: Unchanged

(b) with dialing output

Keyboard input: D1 D2 ... Dn ST ST a

Dialing output: D1 D2 ... Dn

Ma: D1 D2 ... Dn

RM: D1 D2 ... Dn

SAM: Unchanged

Note: If the dialing number exceeds 32 dgts, the memory store is inhibited

However, if the dialing number is not more than 32 dgts the memory will store a max. of 16 dgts

Ma=MD~MP, a=0~9

• Memory dialing

Ma content: D1 D2 ... Dn

Keyboard input: A a

Dialing output: D1 D2 ... Dn

Ma: Unchanged

RM: D1 D2 ... Dn

SAM: Unchanged

Note: Ma=MD~MP, a=0~9

• Chain dding

M1 content: Dm+1 ... D1
 M2 content: D1+1 ... Dk
 Keyboard input:
 Diding output: D1 D2 D3 Dm+1 ... D1 D1+1 ... Dk
 M1/M2: Unchanged
 RM: D1 D2 D3 Dm+1 ... D1 D1+1 ... Dk
 SAM: Unchanged

Note: The maximum capacity of the RM memory is 32 dgits. When the dding number exceeds 32 dgits, redding is inhibited and $\overline{PC}=VDD$

• Flash

Keyboard input:
 Diding output: D1 D2 ... Dn TF TFP Dn+1 ... Dm
 RM: Dn+1 ... Dm
 SAM: Unchanged

Note: TF: breck a flash time
 F: any one of the F1-F3

• Pause

Keyboard input:
 Diding output: D1 D2 ... Dn TP Dn+1 ... Dm
 RM: D1 D2 ... Dn P Dn+1 ... Dm
 SAM: Unchanged

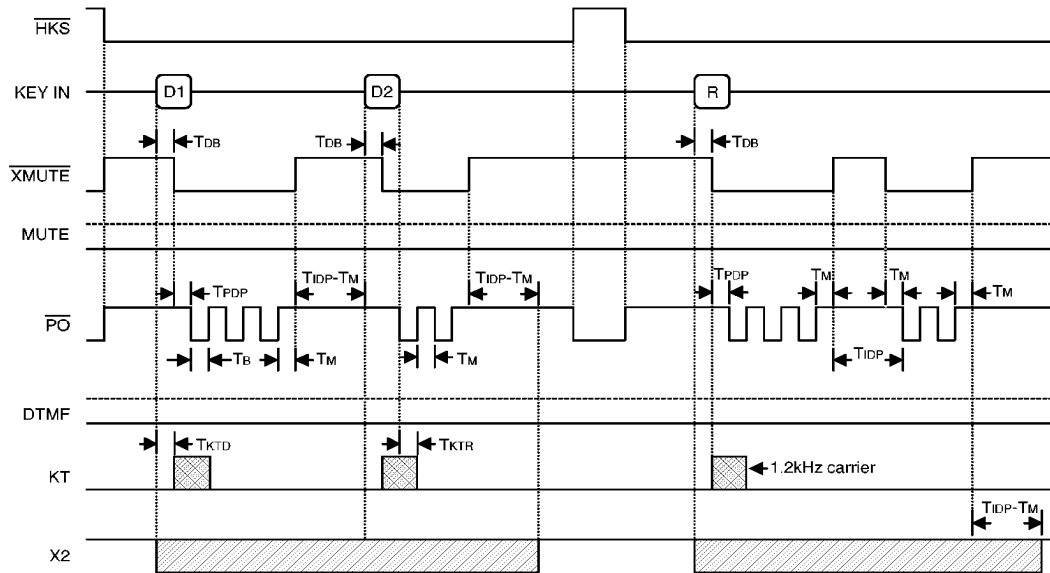
• Note:

RM: Redd memory
 SAM: Save dding memory
 D1 D2 ... Dn: 0~9
 Dn+1 ... Dm: 0~9, *, #
 Dm+1 ... D1: 0~9, *, #
 D1+1 ... Dk: 0~9, *, #

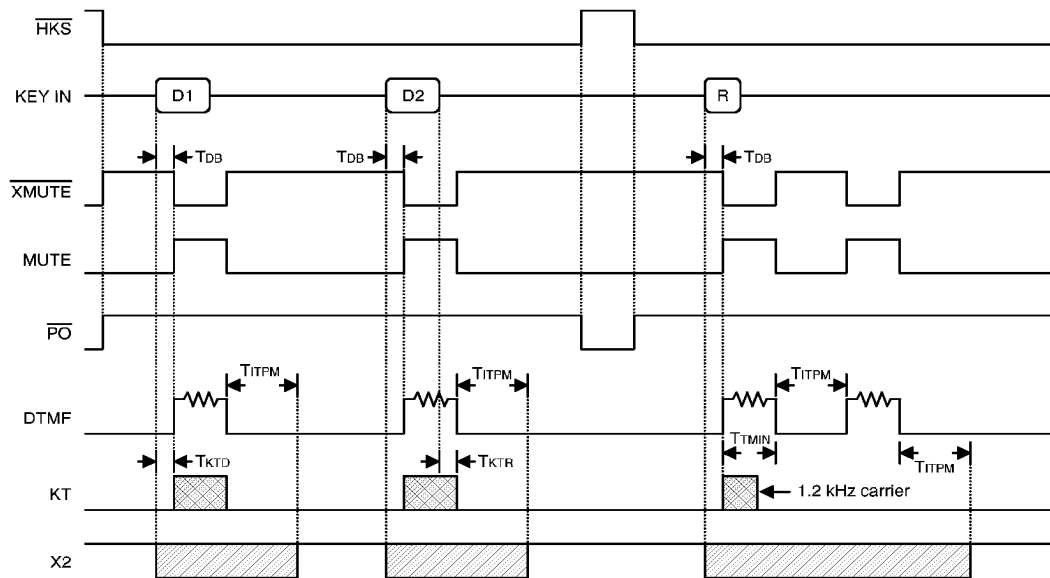
Timing Diagrams

Normal dialing

• Pulse mode

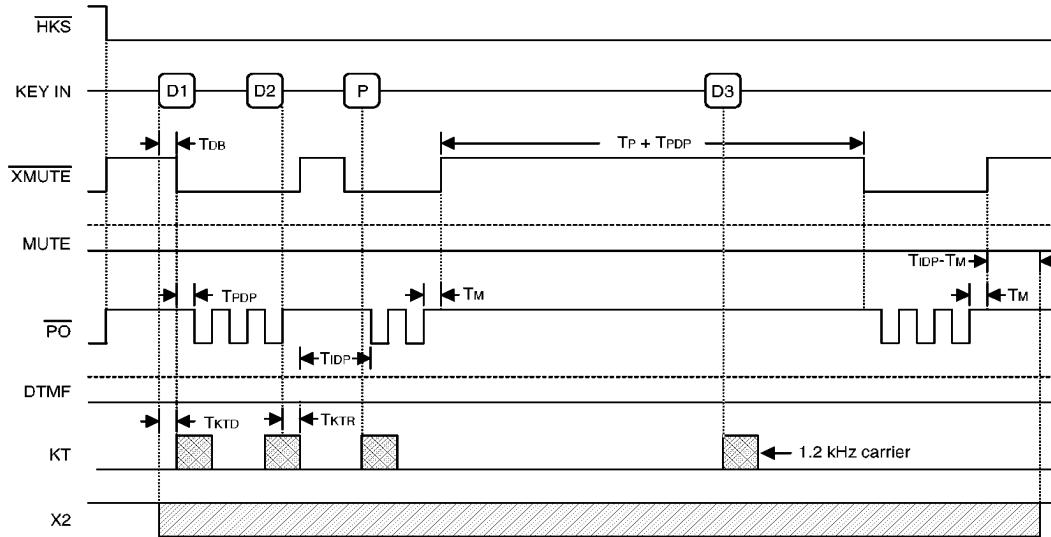


• Tone mode

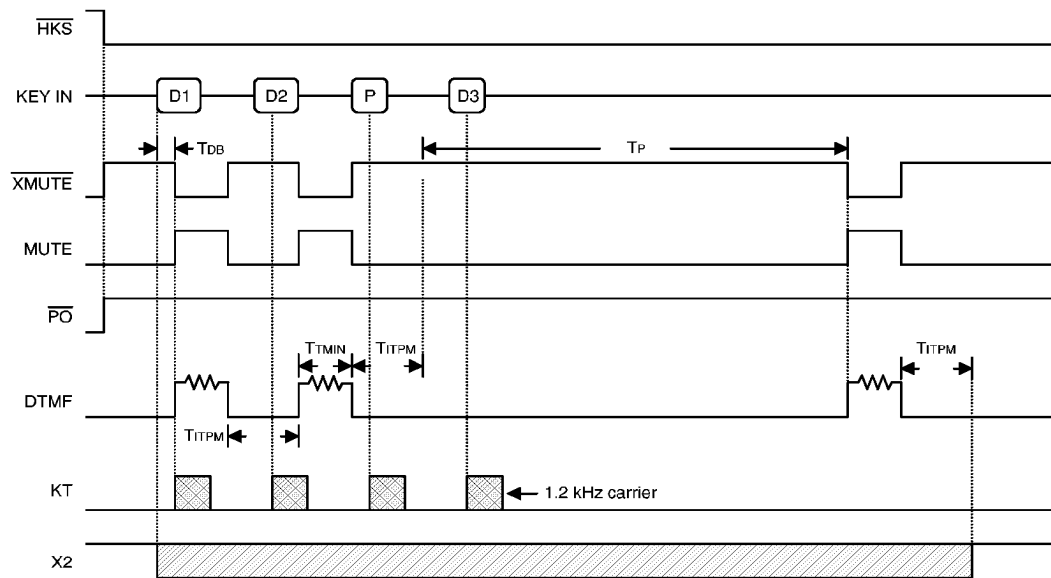


Dialing with pause key

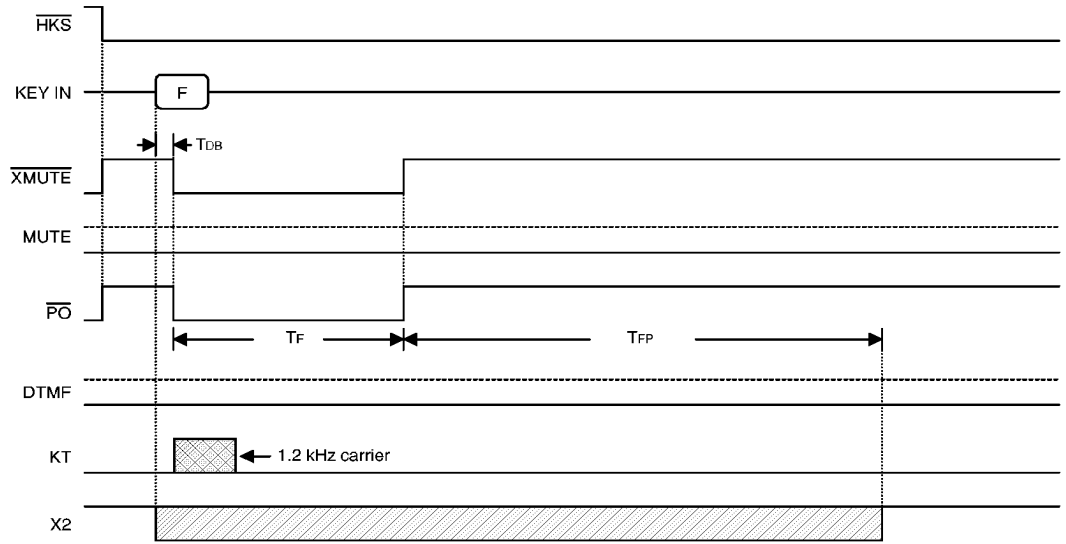
• Pulse mode



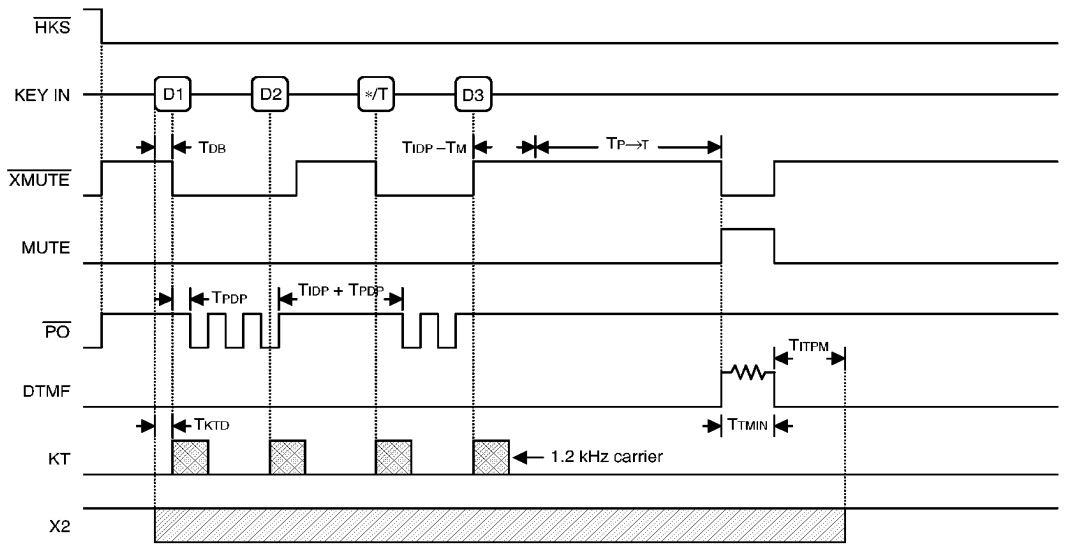
• Tone mode



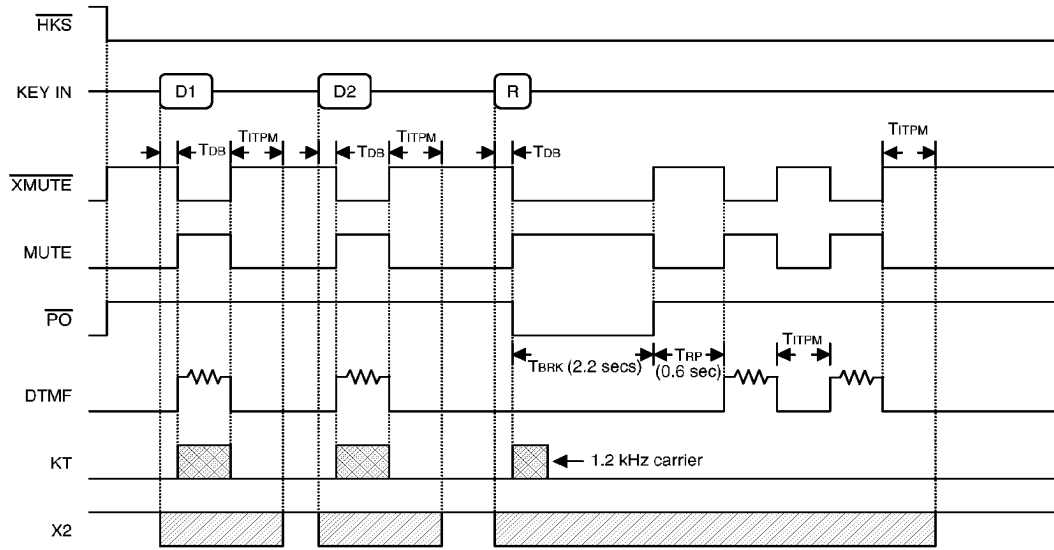
Flash key operation



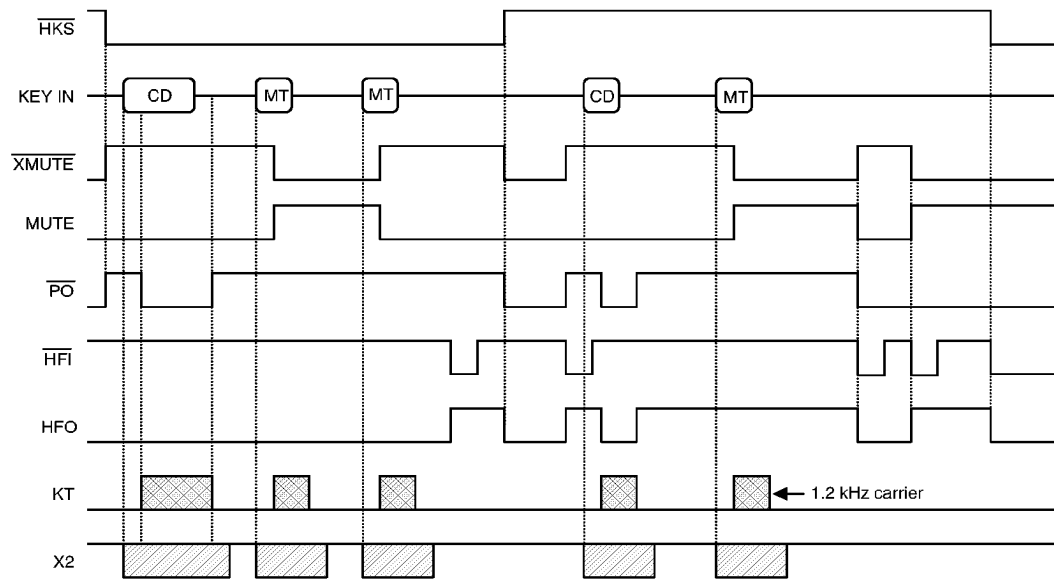
Pulse→Tone operation



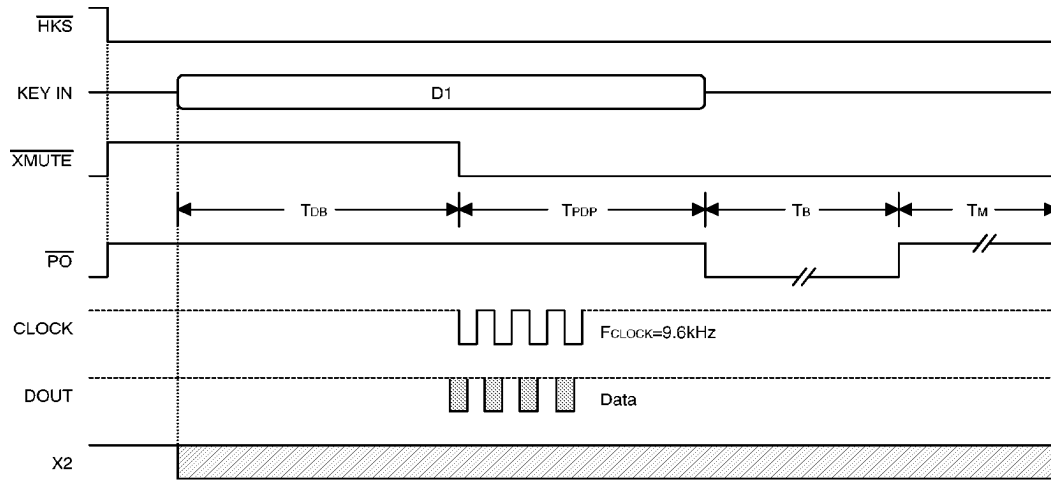
One-key redial operation



Call disconnect (CD) & MUTE (MT) operation



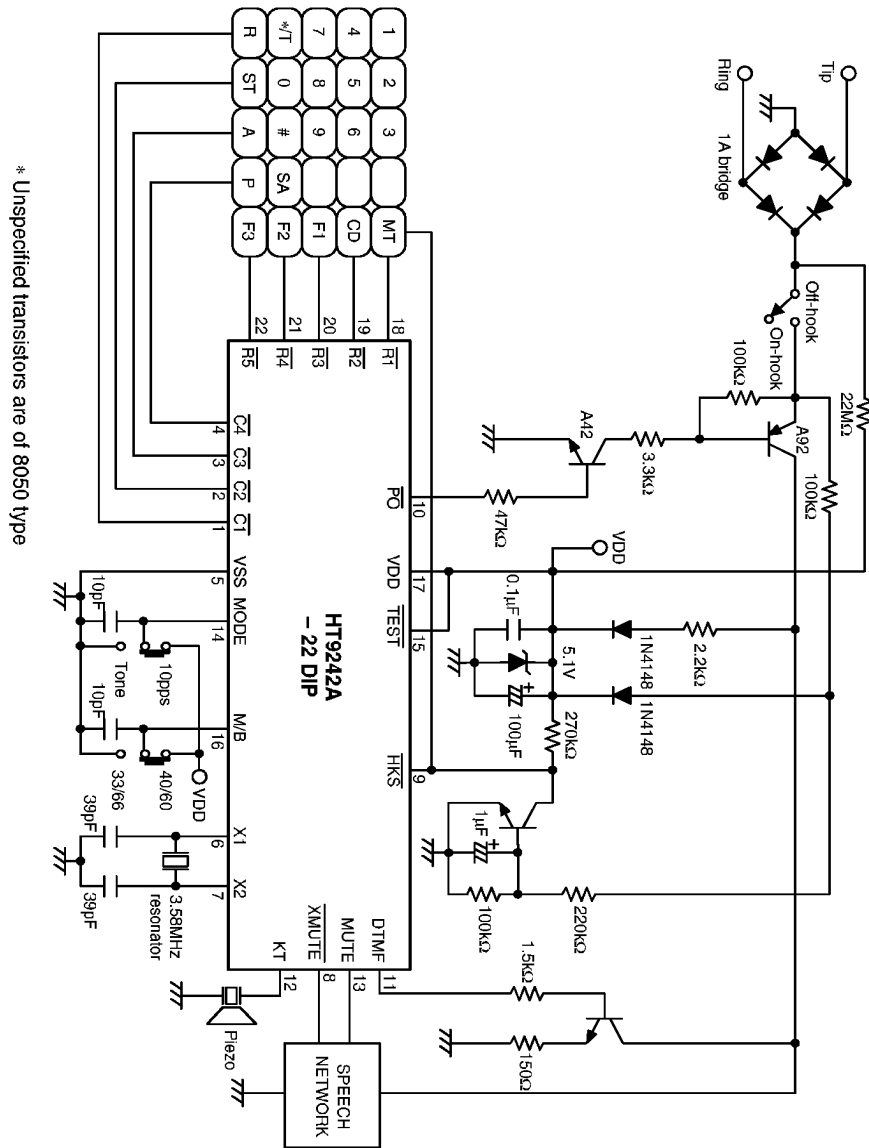
CLOCK & DOUT operation



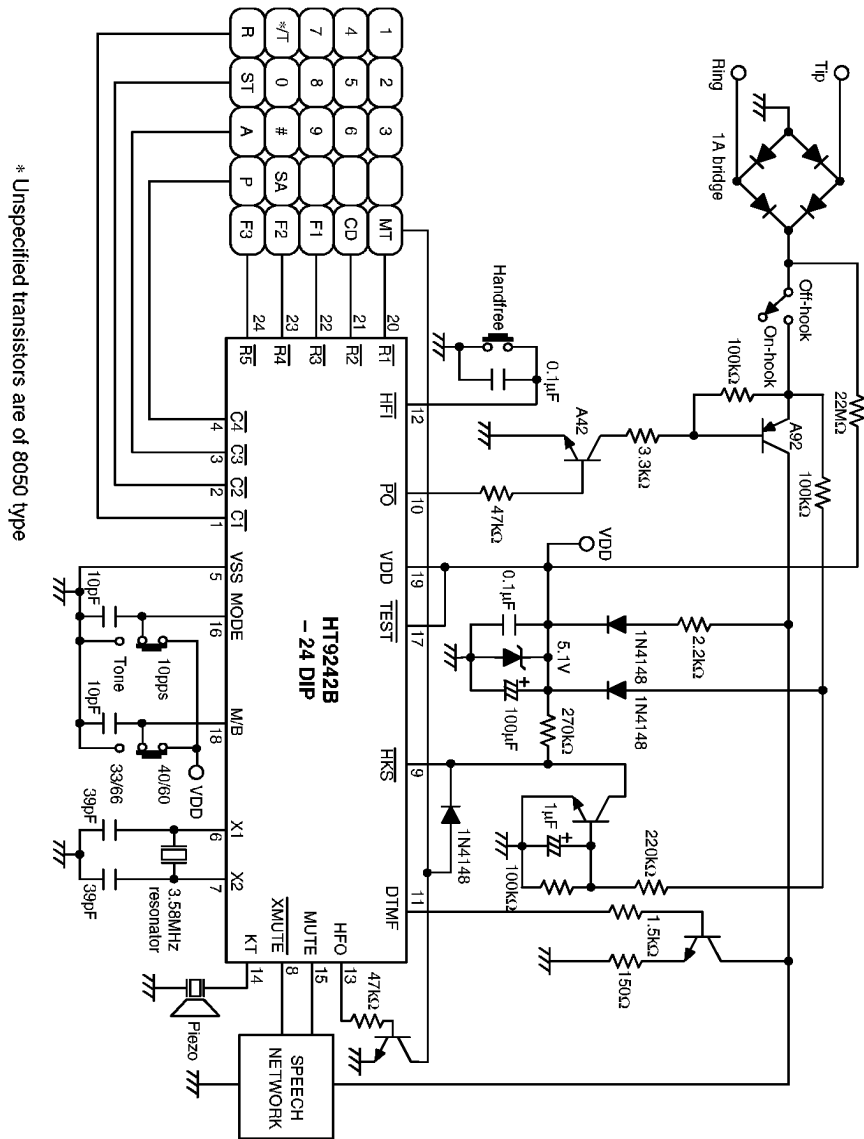
Note: D1=D3=3
D2=2

Application Circuits

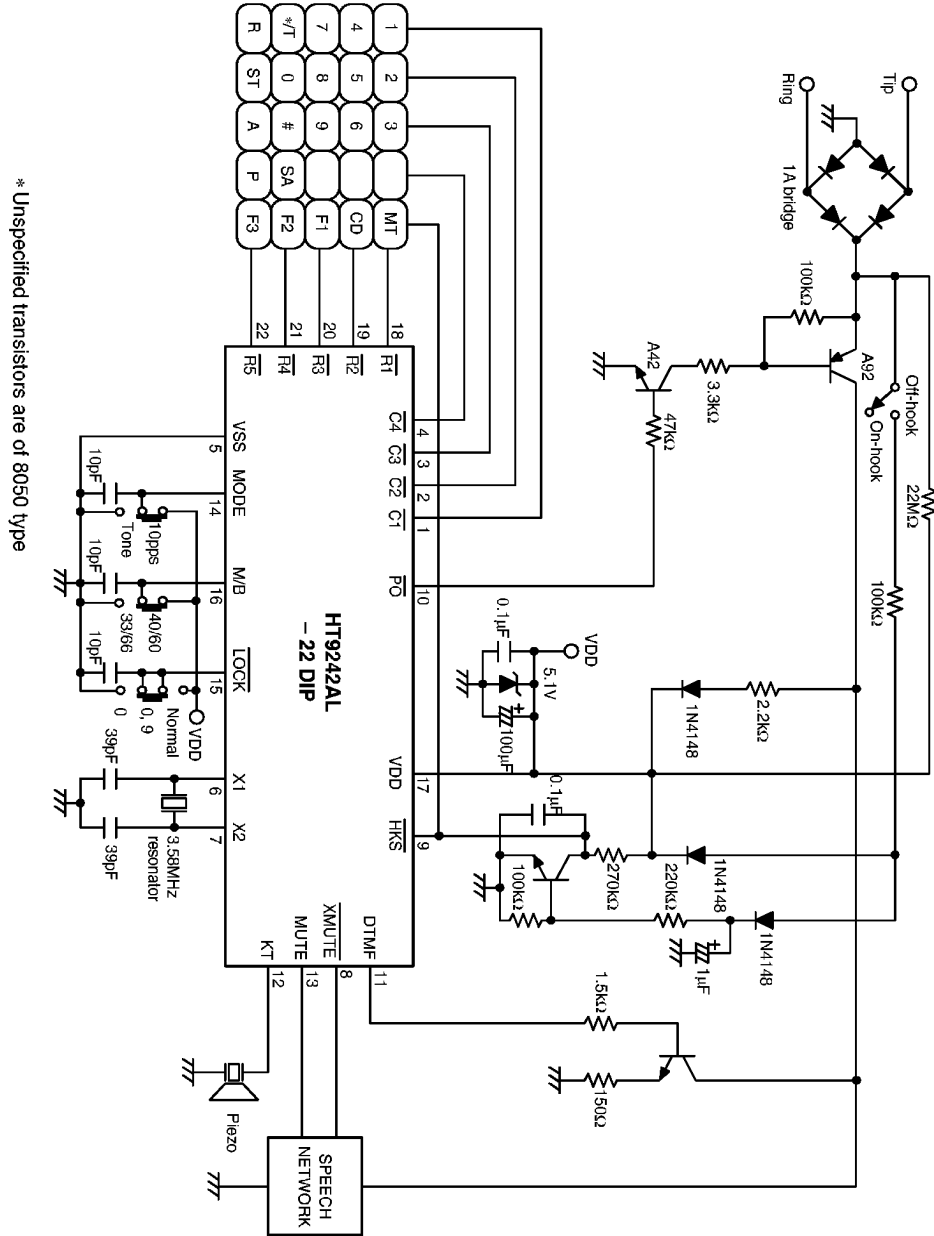
Application circuit 1



Application circuit 2

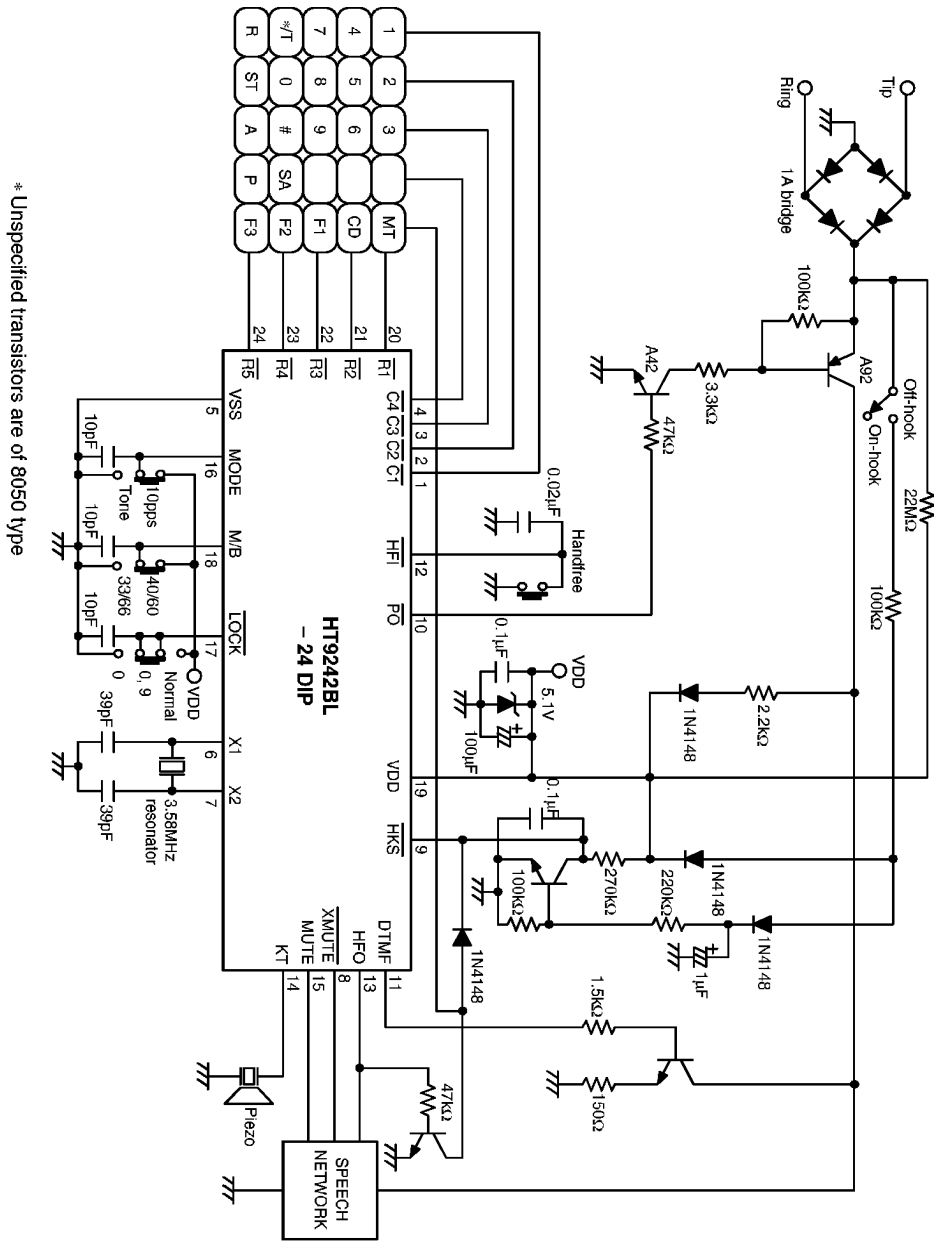


Application circuit 3



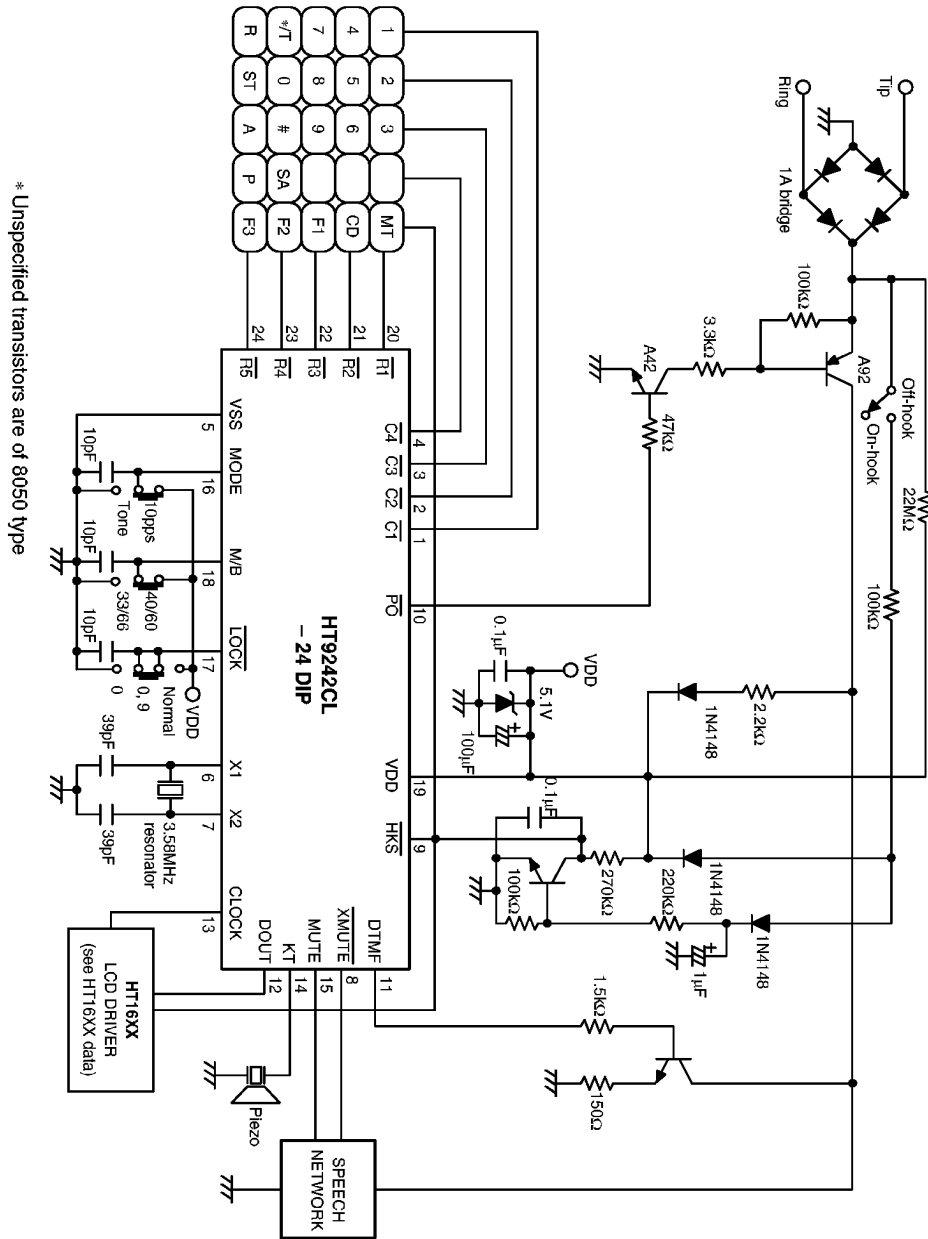
* Unspecified transistors are of 8050 type

Application circuit 4



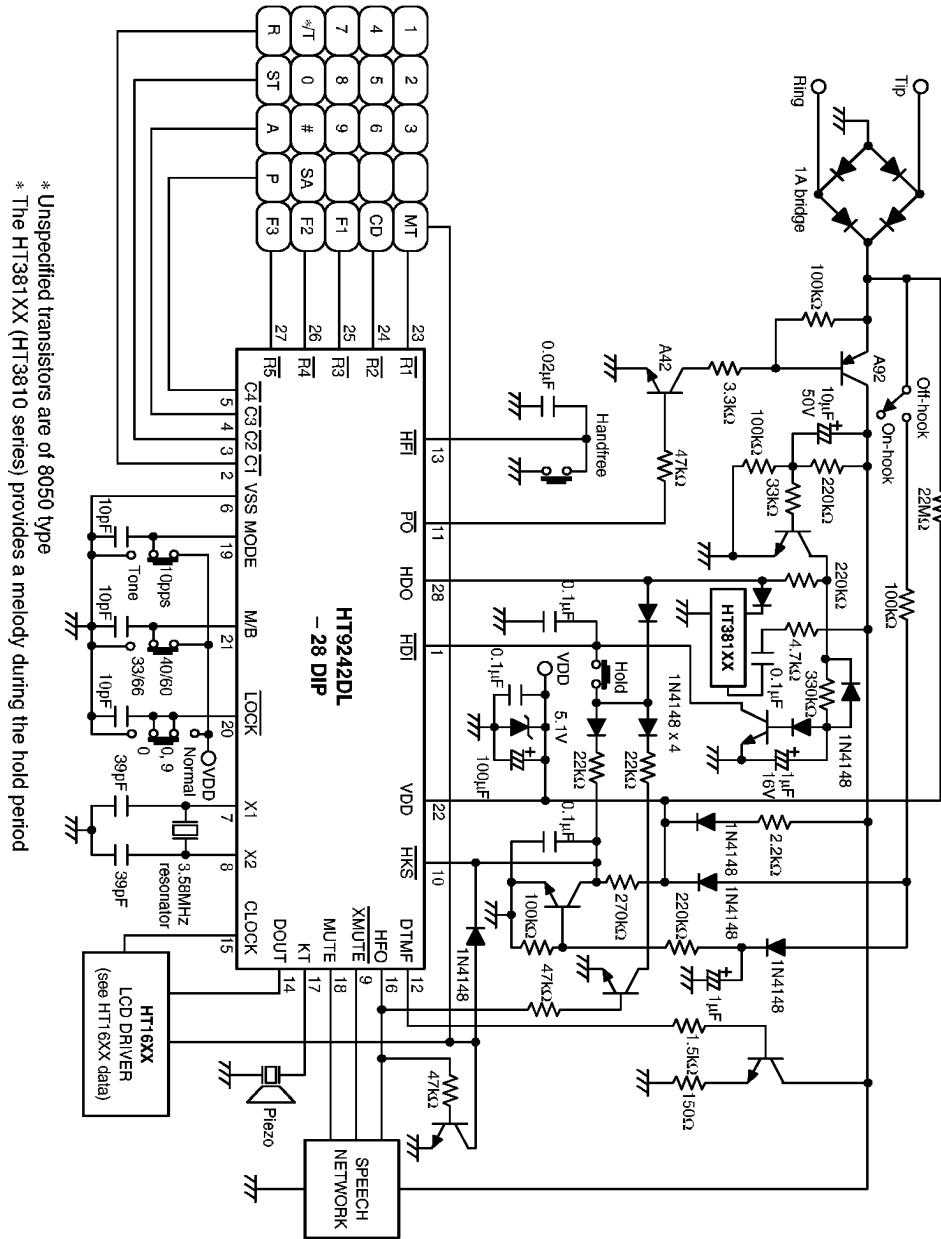
* Unspecified transistors are of 8050 type

Application circuit 5



* Unspecified transistors are of 8050 type

Application circuit 6



* Unspecified transistors are of 8050 type
 * The HT381XX (HT3810 series) provides a melody during the hold period