HT9245-1AL/BL/CL/DL
15-Memory Tone/Pulse Dialer

Features

- Universal specification
- Operating voltage: 2.0V~5.5V
- Low stand-by 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
- Memory number: 15 memories
- Keytone function
- Lock function
- CD key

General Description

The HT9245-1 series tone/pulse dialers are CMOS LSIs for the telecommunication system.

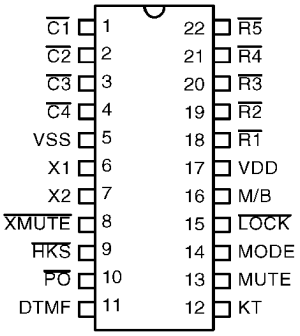
The HT9245-1 series tone/pulse dialers are offered in various packages from 22 DIP to 28 DIP. The 22 DIP version is suitable for low cost applications, while the 28 DIP version supplies versatile functions such as: Hold-line, Hand-free, IDD lock and LCD dialing number display interface, all of which are suitable for feature phone applications.

The HT9245-1 provides SA, Redial, 3 one-touch (EM1~ EM3) and 10 two-touch (M0~M9) memory dials for speed dialing in either pulse or tone mode.

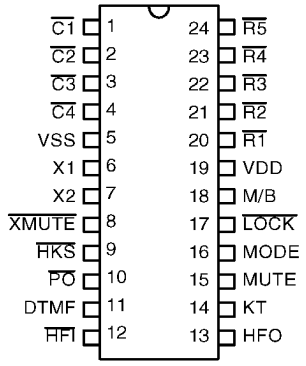
Selection Table

Function / Item	Memory No.	Memory Dialing	Hold-Line	Hand-Free	LCD Interface	Flash Function	Flash Time (ms)	Pulse No.	Tone Duration (ms)	Inter-Tone-Pause (ms)	Lock Function
HT9245-1AL – 22 DIP	15	SA,R EM1~EM3 M0~M9	—	—	—	Control	98/300/600	N	91	91	√
HT9245-1BL – 24 DIP	15	SA,R EM1~EM3 M0~M9	—	√	—	Control	98/300/600	N	91	91	√
HT9245-1CL – 24 DIP	15	SA,R EM1~EM3 M0~M9	—	—	√	Control	98/300/600	N	91	91	√
HT9245-1DL – 28 DIP	15	SA,R EM1~EM3 M0~M9	√	√	√	Control	98/300/600	N	91	91	√

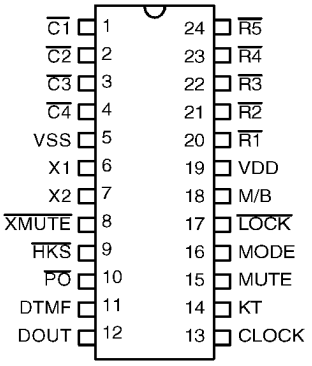
Package Information



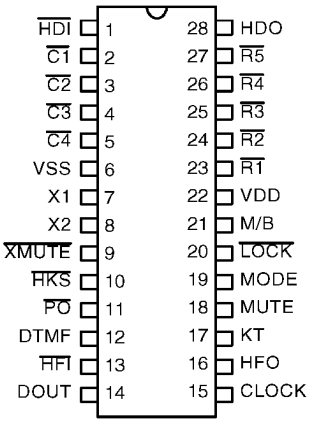
HT9245-1AL
– 22 DIP



HT9245-1BL
– 24 DIP

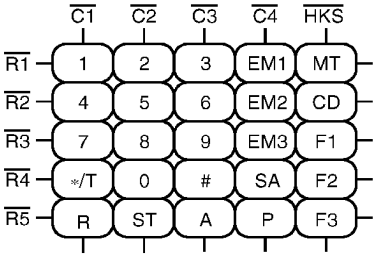


HT9245-1CL
– 24 DIP

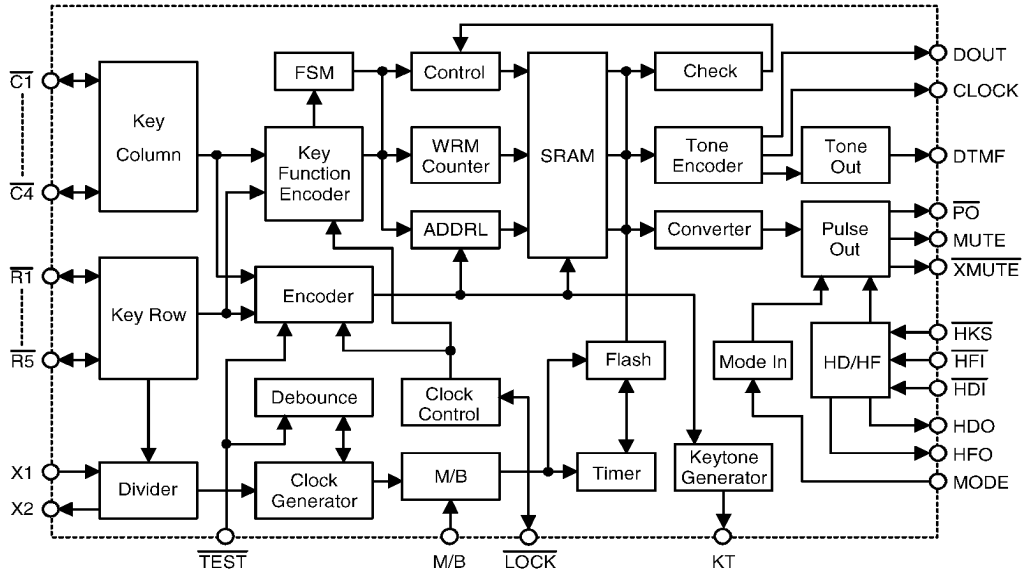


HT9245-1DL
– 28 DIP

Keyboard Information



Block Diagram



Pin Description

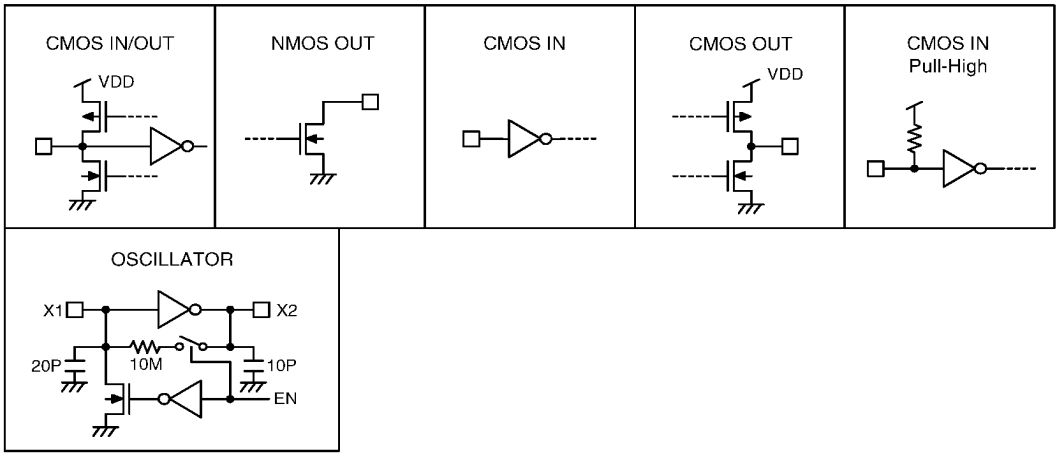
Pin Name	I/O	Internal Connection	Description
$\overline{C1}$~$\overline{C4}$ $\overline{R1}$~$\overline{R5}$	I/O	CMOS IN/OUT	These pins construct a 5×5 keyboard matrix to perform the keyboard input detecting functions. When on-hook ($\overline{HKS}$= high) all the pins are set to high. While off-hook the column group ($\overline{C1}$~$\overline{C4}$) stays low and the row group ($\overline{R1}$~$\overline{R5}$) is set to high for key input detecting. An inexpensive single contact 5×5 keyboard can be used as an input device. Pressing a key connects a single column to a single row, and actuates the system oscillator to result in a dialing signal output. If more than two keys are pressed at the same time, no response can be brought about. The key-in debounce time is 20ms. Refer to the keyboard table for keyboard arrangement and to the functional description for dialing specification selection.
X1	I	OSCILLATOR	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 X1 and X2 terminals can implement the oscillator function. The oscillator is turned off in the stand-by mode, and is actuated whenever a keyboard entry is detected.
X2	O		

Pin Name	I/O	Internal Connection	Description
$\overline{\text{XMUTE}}$	O	CMOS OUT	The $\overline{\text{XMUTE}}$ is an CMOS structure pulled to VSS during dialing signal transmitting. Otherwise, it stays at "high". The $\overline{\text{XMUTE}}$ 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. $\overline{\text{HKS}}$=VDD: On-hook state ($\overline{\text{PO}}$=low). Except $\overline{\text{HFI}}$/$\overline{\text{HDI}}$ (hand-free/hold-line control input), other functions are all disabled. $\overline{\text{HKS}}$=VSS: Off-hook state ($\overline{\text{PO}}$=high). The chip is in the stand-by mode and ready to receive the key input.
$\overline{\text{PO}}$	O	CMOS OUT	This pin is a CMOS output structure which receives the $\overline{\text{HKS}}$ and HFO signals to control the dialer so as to connect or disconnect the telephone line. $\overline{\text{PO}}$ outputs low to break line when $\overline{\text{HKS}}$ is high (on-hook) and HFO is low (hand-free inactive). $\overline{\text{PO}}$ outputs high to make line when $\overline{\text{HKS}}$ is low (off-hook) or HFO is high or HDO is high. During the off-hook state, the 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 a input pin, provided to the user for selecting a dialing mode among Tone/10pps. MODE=VDD: Pulse mode, 10pps. MODE=VSS: Tone mode. During the pulse mode dialing, switching this pin to the tone mode changes the following entrance of digits to the tone mode. When the chips are working in the tone mode, the switching from the tone to the pulse mode will be recognized.
MUTE	O	CMOS OUT	The MUTE is an CMOS structure that is pulled to VDD during Tone (DTMF) output transmitting. Otherwise, it remains "low" at all time.
M/B	I	CMOS IN	This is a Make/Break ratio select pin in the pulse mode. Otherwise, it has no functions. M/B=VDD: Make/Break ratio is 40/60. M/B=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 low. The pin outputs tone signals to drive the external transmitter amplifier circuit. The load resistor should not be less than 5KΩ.

Pin Name	I/O	Internal Connection	Description
$\overline{HDI}$	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 recommanded to use for the input debouncing. The pull-high resistance is 200KΩ typically.
HDO	O	CMOS OUT	The HDO is a CMOS output structure. Its output is toggle-controlled by a negative transition on $\overline{HDI}$. When HDO is toggled to high, $\overline{PO}$ 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 $\overline{HDI}$ input. The HDO pin can directly drive the HT3810 series melody generators to produce hold-line back ground melody. Refer to the functional description for the hold-line function.
$\overline{HFI}$	I	CMOS IN Pull-High	This pin is a schmitt trigger input structure. Active low. Applying a negative going pulse to $\overline{HFI}$ can toggle HFO once and hence control the hand-free function. The pull-high resistance of $\overline{HFI}$ is 200KΩ typically. An external RC network is recommanded to use for the input debouncing.
HFO	O	CMOS OUT	The HFO is a CMOS output structure. Its output is toggle-controlled by a negative transition on the $\overline{HFI}$ pin. When HFO is high, the hand-free function is enabled and $\overline{PO}$ outputs high to connect the line. The hand-free function can be released by an on-off-hook operation or by another $\overline{HFI}$ input or by setting HDO high. Refer to the functional description for the hand-free functional operation.
DOUT	O	NMOS OUT	This is an 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 the DOUT data synchronization. The DOUT data is valid at the falling edge of the clock.
KT	O	CMOS OUT	Key-tone output pin. It outputs 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.
$\overline{TEST}$	I	CMOS IN	For IC test only. $\overline{TEST}$=VDD for normal operation.

Pin Name	I/O	Internal Connection	Description
$\overline{\text{LOCK}}$	I/O	CMOS IN/OUT	This is three-state input-output pin, provided to the user for controlling long distance call function with a lock-switch. LOCK=OPEN: Normal dialing LOCK=VDD: "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
Input Voltage ..... V_{SS}–0.3 to V_{DD}+0.3V
Storage Temperature ..... –50°C to 125°C
Operating Temperature ..... –20°C to 75°C

Electrical Characteristics

(F_{OSC}=3.5795MHz, Ta=25°C)

Symbol	Parameter	Test Condition			Min.	Typ.	Max.	Unit
		V_{DD}	Condition					
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}	Stand-by 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 ($\overline{XMUTE}$, MUTE)	2.5V	V_{OH}=2V		–1	—	—	mA
I_{OLXM}	Mute Pin Sink Current ($\overline{XMUTE}$, MUTE)	2.5V	V_{OL}=0.5V		1	—	—	mA
$I_{\overline{HKS}}$	$\overline{HKS}$ Pin Input Current	2.5V	$V_{\overline{HKS}}$=2.5V		—	—	0.1	μA
$R_{\overline{HFI}}$	$\overline{HFI}$ Pull-High Resistance	2.5V	$V_{\overline{HFI}}$=0V		—	200	—	KΩ
$R_{\overline{HDI}}$	$\overline{HDI}$ Pull-High Resistance	2.5V	$V_{\overline{HDI}}$=0V		—	200	—	KΩ
$R_{\overline{HKS}}$	$\overline{HKS}$ Pull-High Resistance	2.5V	$V_{\overline{HKS}}$=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_{OL1}	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_{OL2}	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_{OL3}	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 Condition		Min.	Typ.	Max.	Unit
		V_{DD}	Condition				
T_{KTD}	Key-tone Delay	—	—	—	20	—	ms
T_{KTR}	Key-tone 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, Ta=25°C)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
		V_{DD}	Condition				
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 V_{DD}.	—	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 Condition		Min.	Typ.	Max.	Unit
		V_{DD}	Condition				
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	Vr.m.s
R_L	DTMF Output Load	2.5V	THD≤–23dB	5	—	—	KΩ
A_{CR}	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
T_{MUTE}	$\overline{XMUTE}$ Hold Time	—	—	—	3	—	ms

THD (Distortion) (dB) = 20 log ($\sqrt{V1^2 + V2^2 + \ldots + Vn^2} / \sqrt{Vi^2 + Vh^2}$)

Vi, Vh: Row group and column group signals

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

Functional Description

Keyboard matrixs

The $\overline{C1}$~$\overline{C4}$ and $\overline{R1}$~$\overline{R5}$ make up of a keyboard matrix. Together with a standard 5×5 keyboard, the keyboard matrix is used for dialing entrance. The keyboard form arrangement for the HT9245 series is listed 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%

% 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)	$T_{P\rightarrow T}$ (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 $\overline{HFI}$, asserting 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 $\overline{HFI}$
  - Changing the HDO pin from low to high
- Hand-free function table

Current State			Input			Next State	
$\overline{HKS}$	HFO	HDO	$\overline{HDI}$	$\overline{HFI}$	$\overline{HKS}$	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 $\overline{HDI}$, asserting the Hold-line function (HDO becomes high). The $\overline{XMUTE}$ 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 $\overline{HDI}$
  - Changing the HFO pin from low to high

- Hold-line function table

Current State			Input			Next State	
$\overline{HKS}$	HDO	HFO	$\overline{HFI}$	$\overline{HDI}$	$\overline{HKS}$	HDO	HFO
H	L	X	H	H	An	L	An
H	L	X	H	↓	An	H	L
H	H	L	H	↓	An	L	An
H	X	X	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

DOUT BCD code

When dialing, the corresponding 4-bit BCD codes are serially presented on DOUT from MSB to LSB. The data of the 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 the pause 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. It executes the 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 the key actuates the store memory function with (or without) dialing output. During the dialing signal transmission, the ST key is inhibited.

- EM1~EM3

  One-touch memory dialing key. For speed-calling convenience, they provide memory dialing for speed-dialing in either pulse or tone mode.

- A

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

- CD

  Call disconnect key. When it is pressed the chip will be reset to its initial state.

Keyboard operation

The following operations are all described under an on-off-hook or on-hook 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 (Pulse) $T_{P\rightarrow T}$ Dn+1 ... Dm (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 over 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 (Pulse) $T_{P\rightarrow T}$ Dn+1 ... Dm (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 redial

  – Pulse mode

  (a) without */T

  Keyboard input: [D1] [D2] ... [Dn] [R]

  Dialing output: D1 D2 ... Dn T_{BRK} T_{RP} D1 D2 ... Dn

  RM: D1 D2 ... Dn

  SAM: Unchanged

  (b) with */T

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

  Dialing output: D1 D2 ... Dn ($T_{P\rightarrow T}$) Dn+1 ... Dm (Pulse, Tone) T_{BRK} T_{RP} D1 D2 ... Dn ($T_{P\rightarrow T}$) 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] [R]

  Dialing output: D1 D2 ... Dn T_{BRK} T_{RP} D1 D2 ... Dn

  RM: D1 D2 ... Dn

  SAM: Unchanged

  (b) with */T

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

  Dialing output: D1 D2 ... Dn * Dn+1 ... Dm T_{BRK} T_{RP} D1 D2 ... Dn * Dn+1 ... Dm

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

  SAM: Unchanged

  Note: If the dialing number is over 32 digits, the redialing is inhibited and $\overline{PO}$=VDD.

- SA copy

  – Pulse mode

  (a) without */T

  Keyboard input: [D1] [D2] ... [Dn] [R]

  Dialing output: D1 D2 ... Dn

  RM: D1 D2 ... Dn

  SAM: D1 D2 ... Dn

  (b) with */T

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

  Dialing output: D1 D2 ... Dn ($T_{P\rightarrow T}$) Dn+1 ... Dm (Pulse, Tone)

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

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

  – Tone mode

  (a) without */T

  Keyboard input: [D1] [D2] ... [Dn] [R]

  Dialing output: D1 D2 ... Dn

  RM: D1 D2 ... Dn

  SAM: D1 D2 ... Dn

  (b) with */T

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

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

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

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

  Note: The maximum capacity of the RM memory is 32 digits. When over 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.

- SA dialing

  – 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: D1 D2 ... Dn (Pulse) $T_{P\rightarrow T}$ Dn+1 ... Dm (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

  – One-touch memory store

  (a) without dialing output

  Keyboard input: [ST][D1][D2] ... [Dn][ST][EMa]

  Dialing output:

  EMa: D1 D2 ... Dn

  RM: D1 D2 ... Dn

  SAM: Unchanged

  (b) with dialing output

  Keyboard input: [D1][D2] ... [Dn][ST][ST][EMa]

  Dialing output: D1 D2 ... Dn

  EMa: D1 D2 ... Dn

  RM: D1 D2 ... Dn

  SAM: Unchanged

  – Two-touch 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 is over 32 digits, the memory store is inhibited.
  However, if the dialing number is not over 32 digits the memory will store 16 digits at maximum.
  EMa=EM1~EM3, Ma=M0~M9, a=0~9 .

- Memory dialing

  – One-touch memory dialing (EM1~EM3)

  EMa content: D1 D2 ... Dn

  Keyboard input: [EMa]

  Dialing output: D1 D2 ... Dn

  EMa: Unchanged

  RM: D1 D2 ... Dn

  SAM: Unchanged

  – Two-touch memory dialing (M0~M9)

  Ma content: D1 D2 ... Dn

  Keyboard input: [A][a]

  Dialing output: D1 D2 ... Dn

  Ma: Unchanged

  RM: D1 D2 ... Dn

  SAM: Unchanged

  Note: EMa=EM1~EM3, Ma=M0~M9, a=0~9.

- Chain dialing

  EM1 content: D1 D2 ... Dn
  EM2 content: Dn+1 ... Dm
  M1 content: Dm+1 ... Dl
  M2 content: Dl+1 ... Dk
  Keyboard input: [D1][D2][D3][A][1][A][2][EM1][EM2]
  Dialing output: D1 D2 D3 Dm+1 ... Dl Dl+1 ... Dk D1 D2 ... Dn Dn+1 ... Dm
  EM1/EM2/M1/M2: Unchanged
  RM: D1 D2 D3 Dm+1 ... Dl Dl+1 ... Dk D1 D2 ... Dn Dn+1 ... Dm
  SAM: Unchanged

  Note: The maximum capacity of the RM memory is 32 digits. When the dialing number is over 32 digits, the redialing is inhibited and $\overline{PO}$=VDD.

- Flash

  Keyboard input: [D1][D2] ... [Dn][F][Dn+1] ... [Dm]
  Dialing output: D1 D2 ... Dn T_F T_{FP} Dn+1 ... Dm
  RM: Dn+1 ... Dm
  SAM: Unchanged

  Note: T_F: break a flash time
  F: any one of the F1~F3

- Pause

  Keyboard input: [D1][D2] ... [Dn][P][Dn+1] ... [Dm]
  Dialing output: D1 D2 ... Dn T_P Dn+1 ... Dm
  RM: D1 D2 ... Dn P Dn+1 ... Dm
  SAM: Unchanged

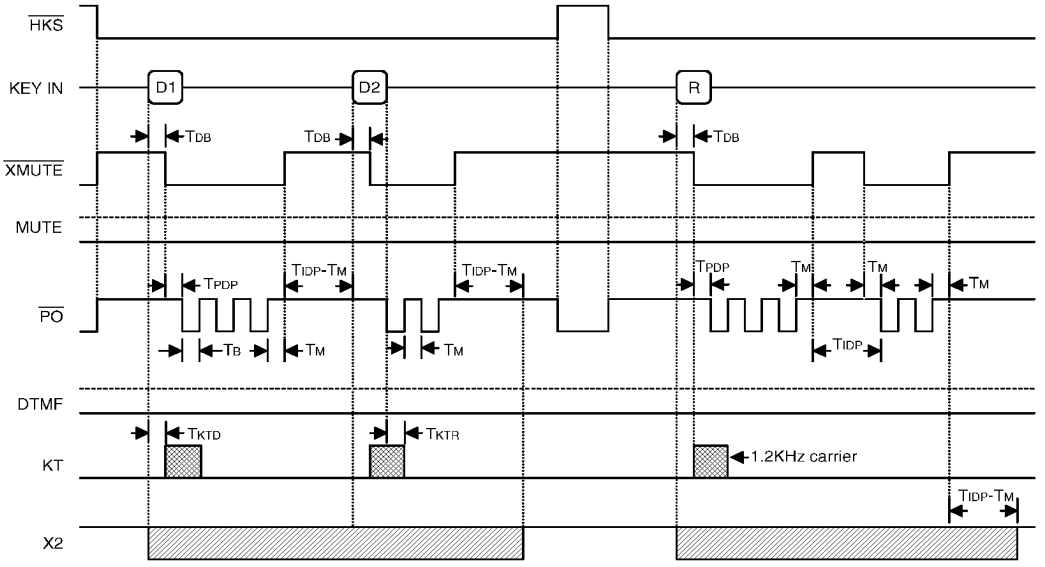
- Note

  RM: Redial memory
  SAM: Save dialing memory
  D1 D2 ... Dn: 0~9
  Dn+1 ... Dm: 0~9, *, #
  Dm+1 ... Dl: 0~9, *, #
  Dl+1 ... Dk: 0~9, *, #

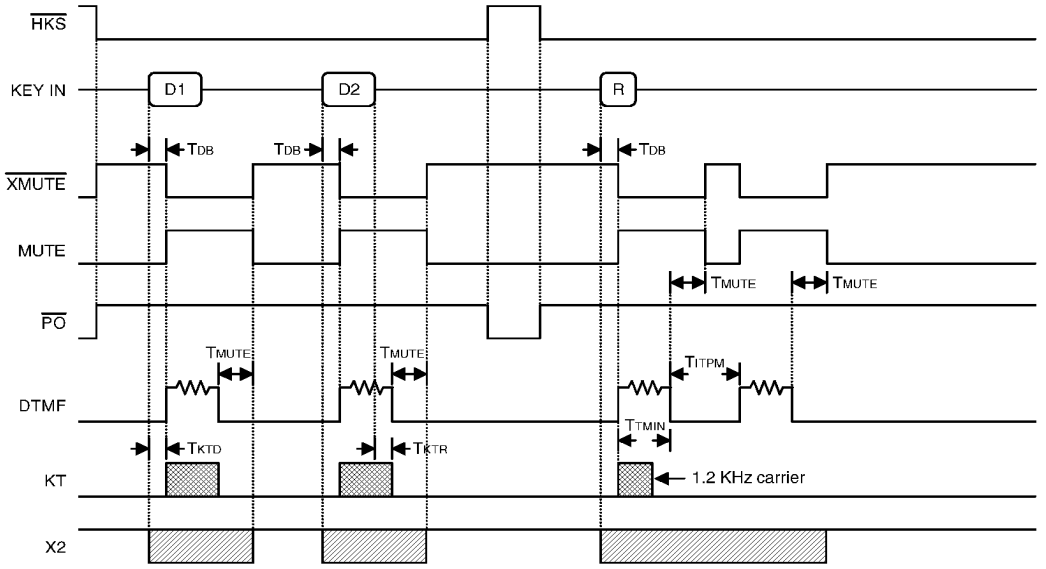
Operation Timing

Normal dialing

• Pulse mode

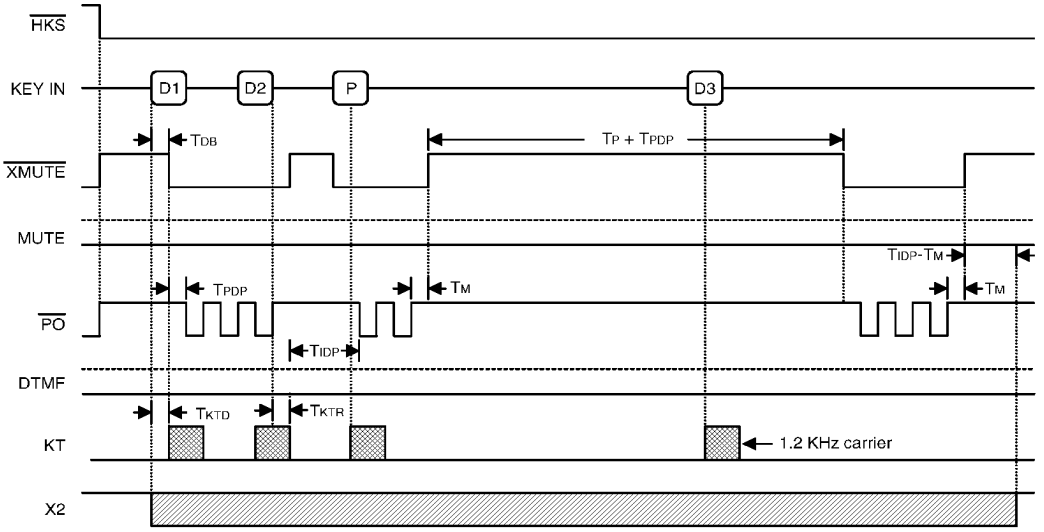


• Tone mode

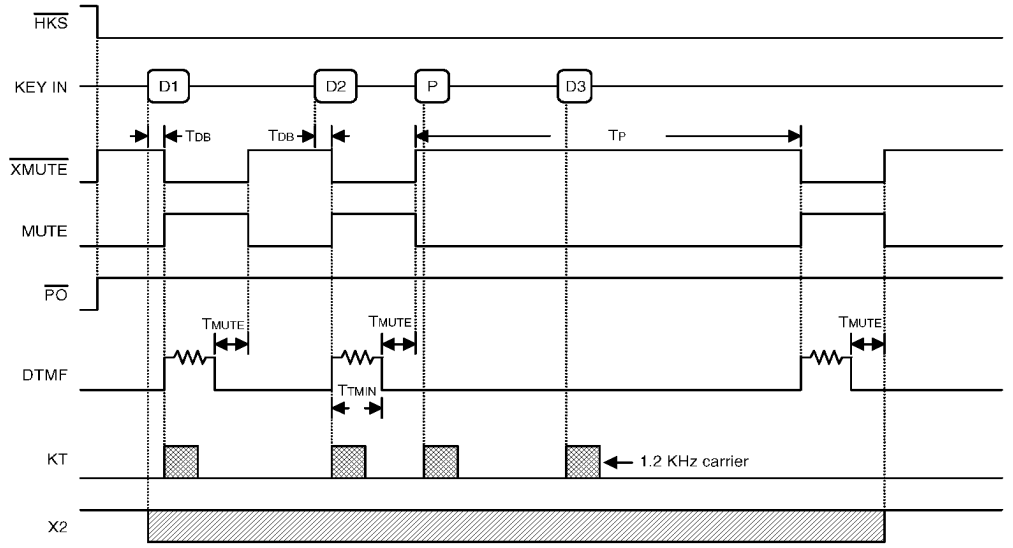


Dialing with pause key

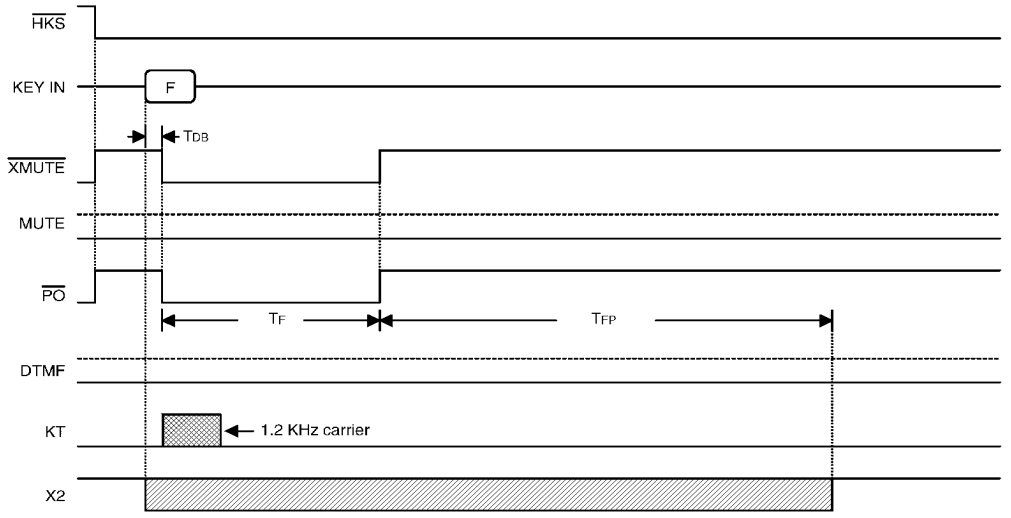
• Pulse mode



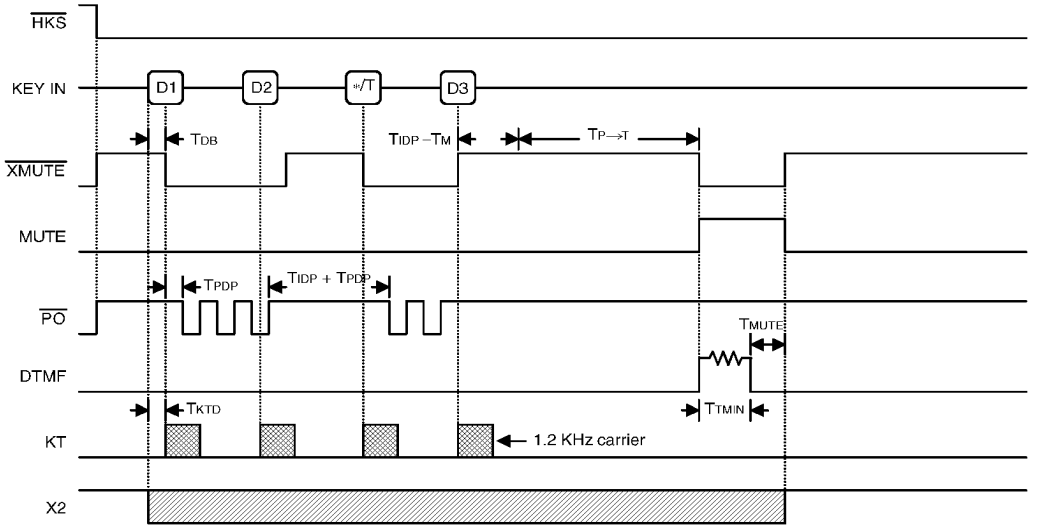
• Tone mode



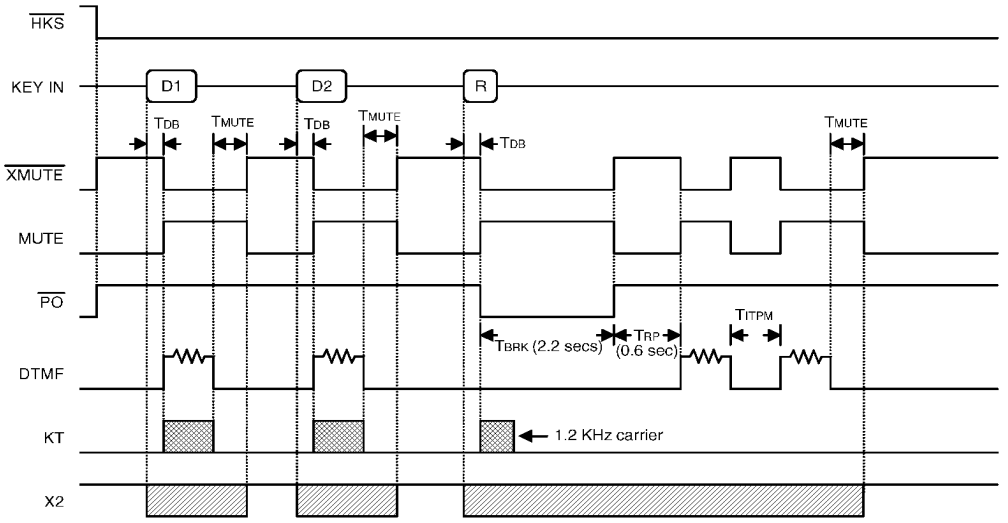
Flash key operation



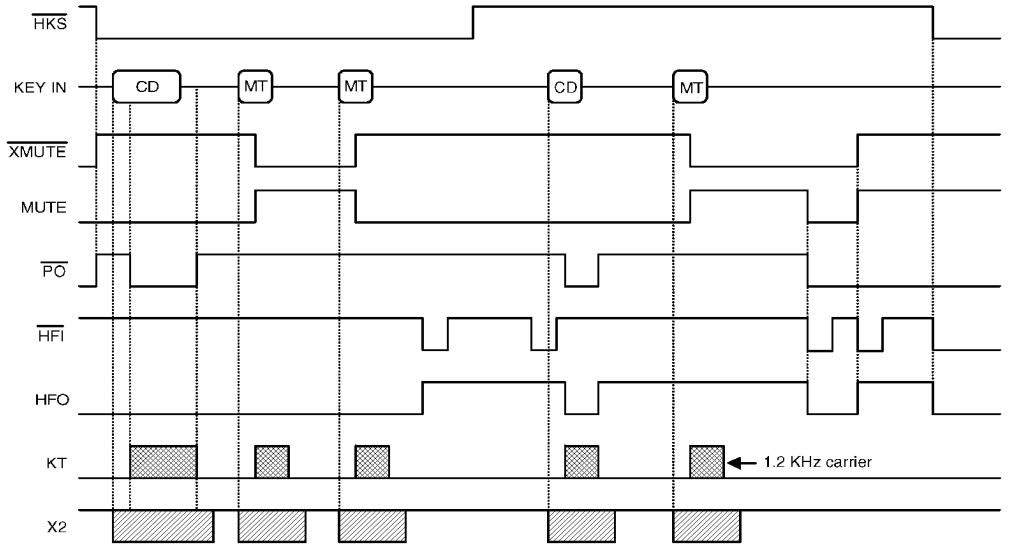
Pulse→Tone operation



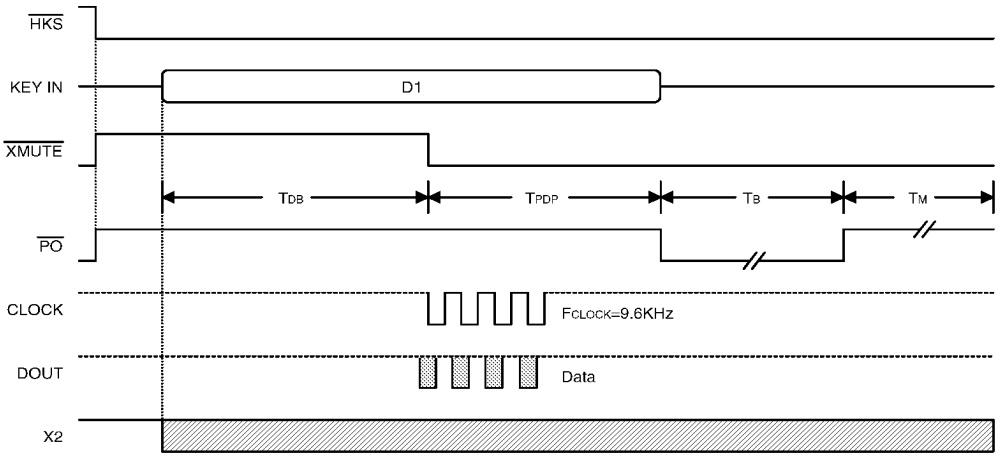
One key redial operation



Call disconnect (CD) & MUTE (MT) operation



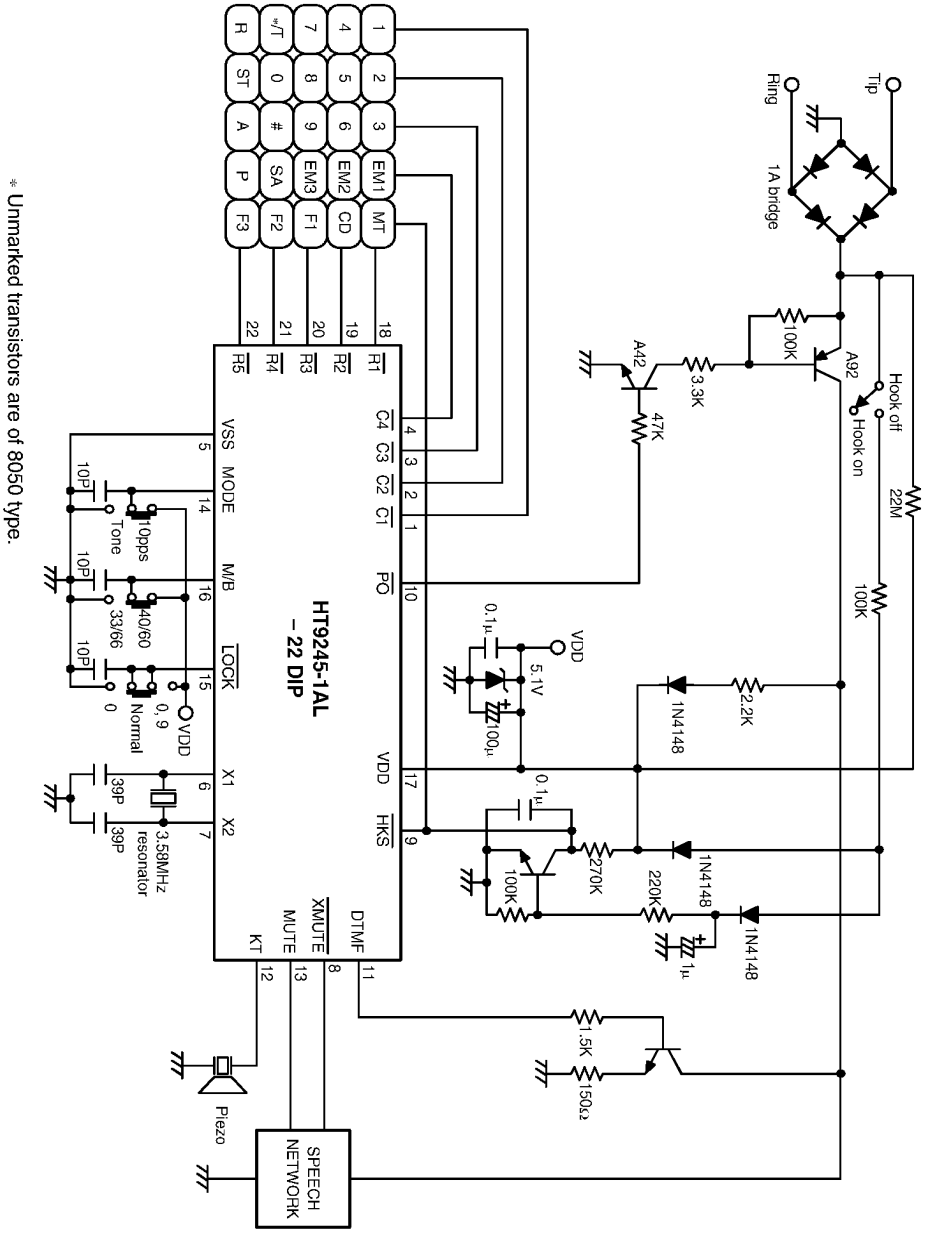
CLOCK & DOUT operation



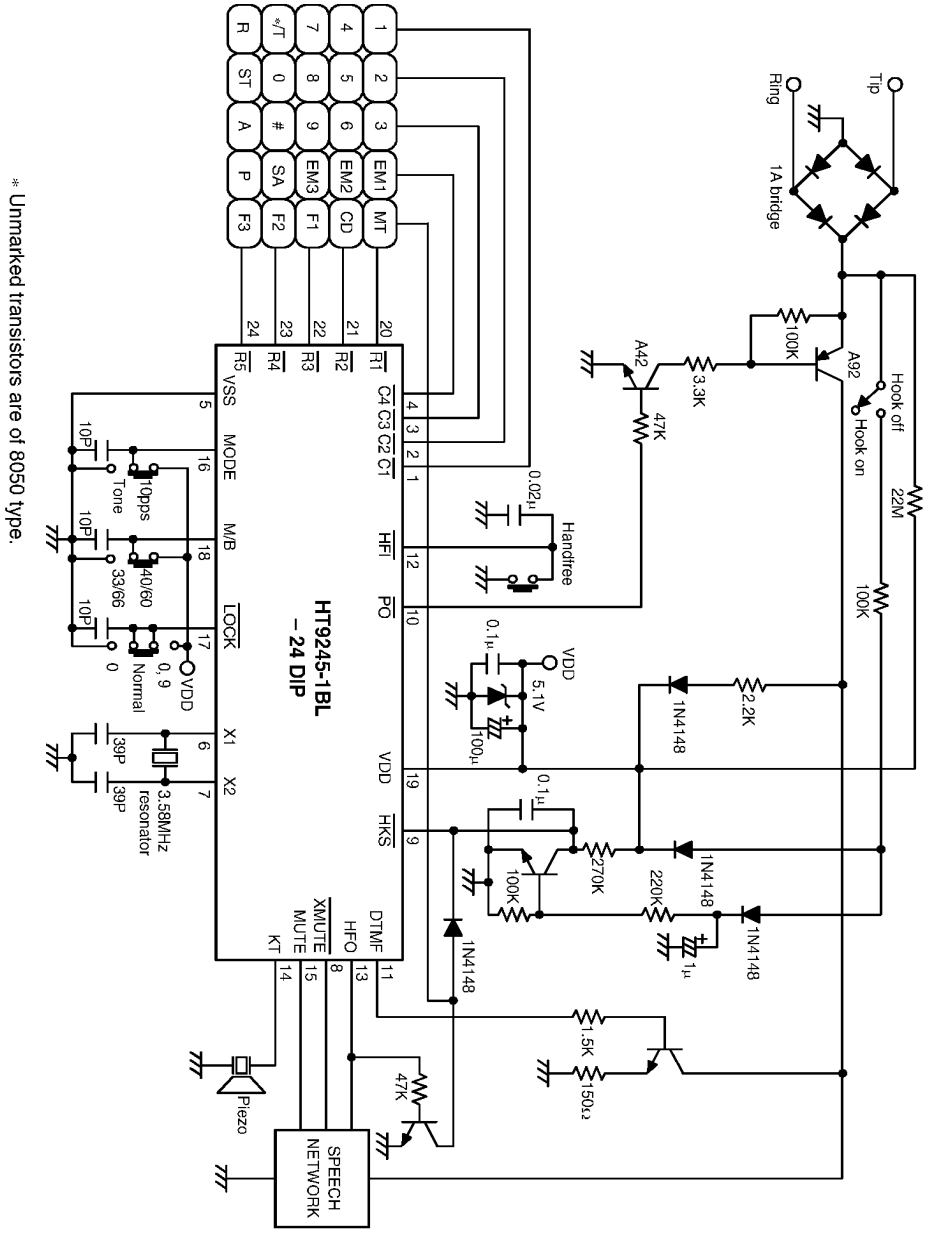
Note: D1=D3=3
D2=2

Application Circuits

Application circuit 1

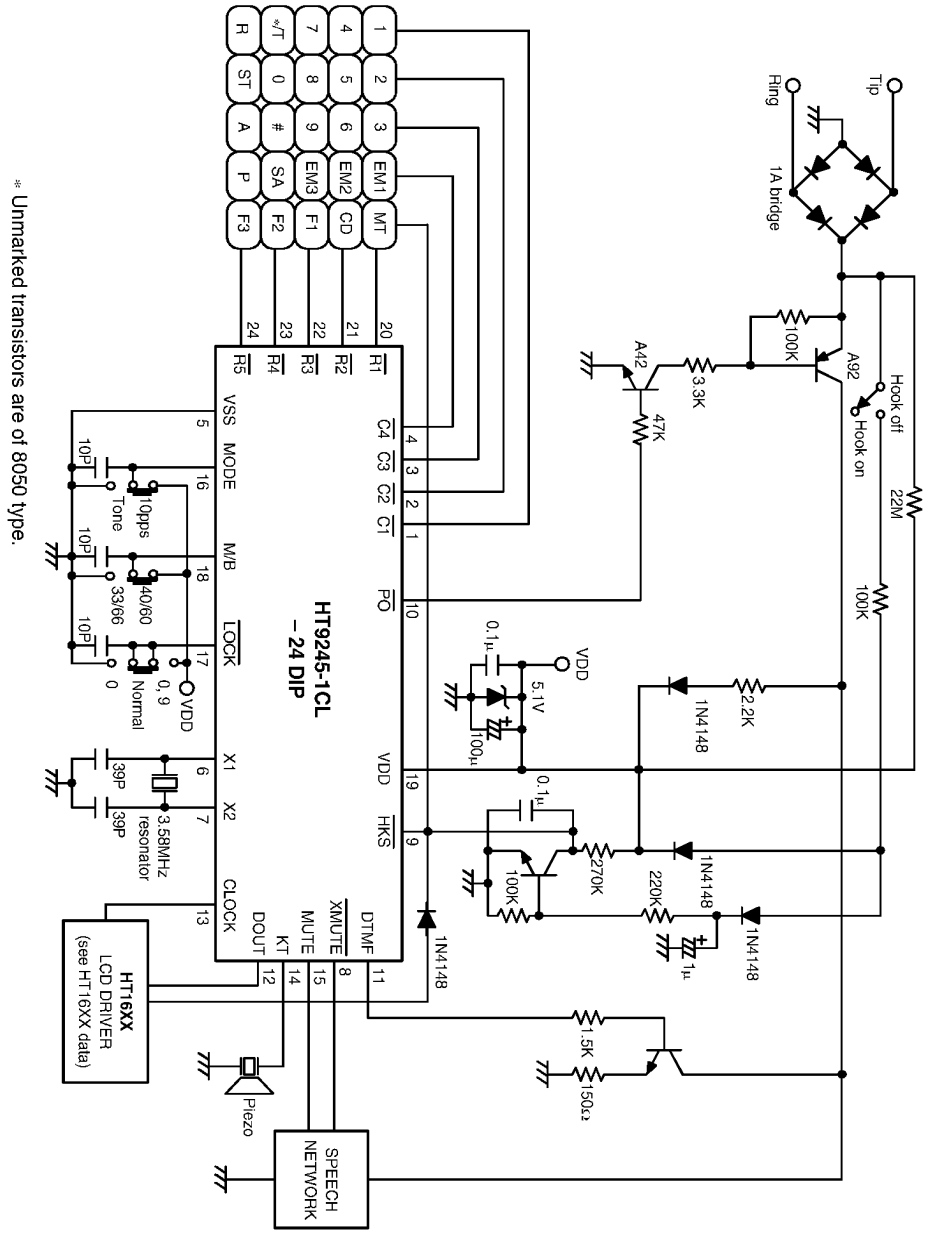


Application circuit 2



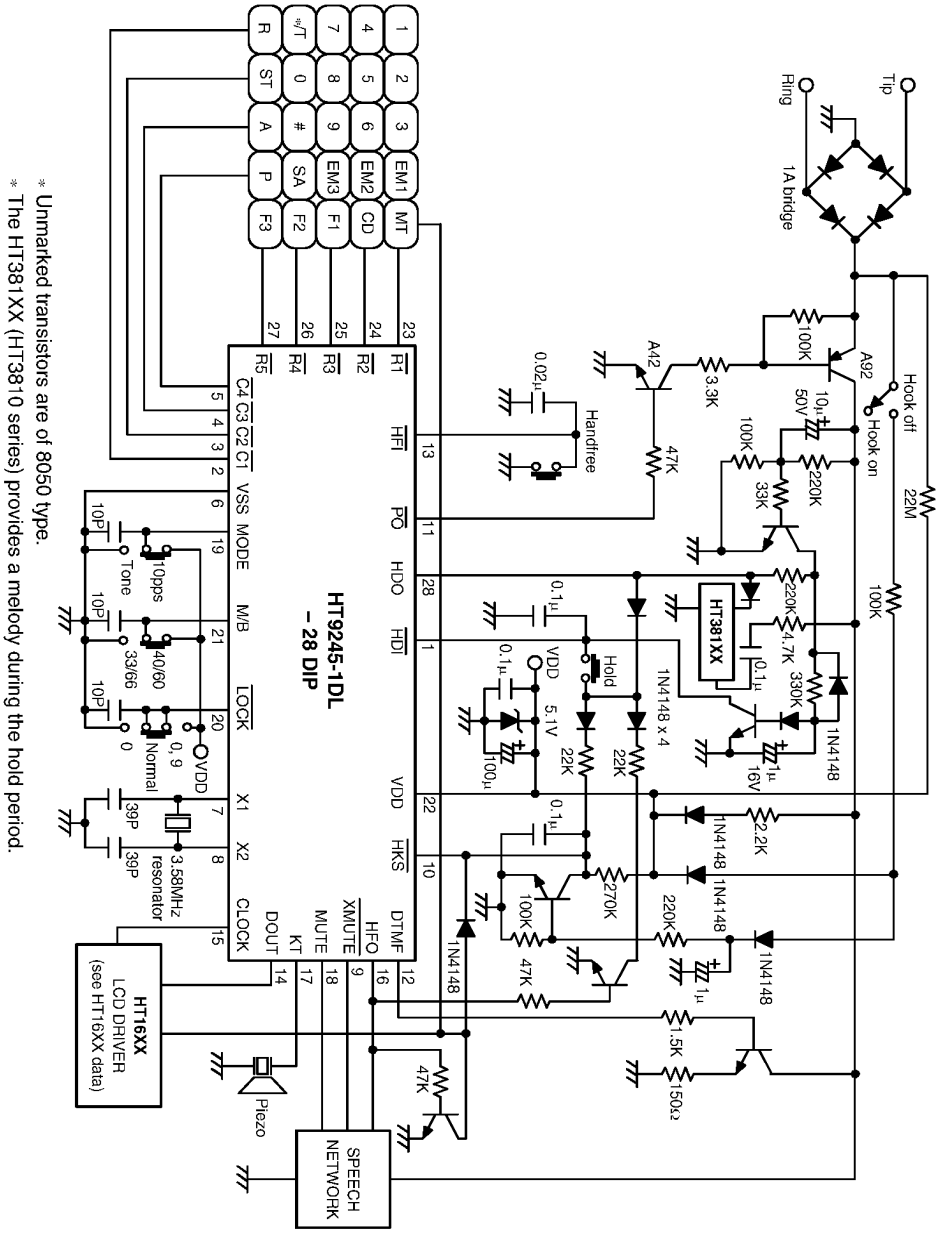
* Unmarked transistors are of 8050 type.

Application circuit 3



* Unmarked transistors are of 8050 type.

Application circuit 4



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