HT9205A/B/C/D/K

5-Memory/6-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
- 4×5 keyboard matrix
- 3.58MHz crystal or ceramic resonator
- Hand-free control
- Hold-line control
- Pause, P→T can be saved for redialing
- Resistor options:
  - M/B ratio
  - Flash function and flash time
  - Pause and P→T duration
  - Pulse number
  - Keyboard form
- Memory number:
  - HT9205A/B/C/D: 5 memories
  - HT9205K: 6 memories

General Description

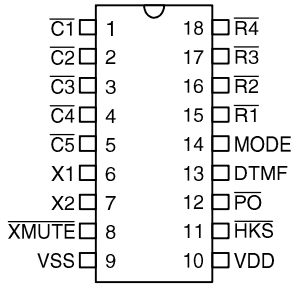
The HT9205 series tone/pulse dialers are CMOS LSIs for the telecommunication system. They are designed to meet various dialing specifications through resistor options matrix.

The HT9205 series tone/pulse dialers are offered in various packages from 18 DIP to 24 SDIP. The 18 DIP version is suitable for low cost applications, while the 24 SDIP version supplies versatile functions such as: Hold-line, Hand-free and LCD dialing number display interface, all of which are suitable for feature phone applications.

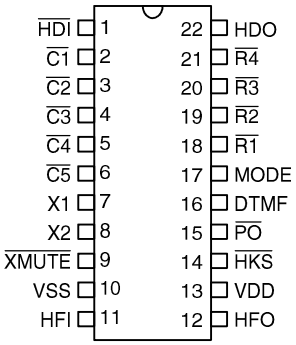
Selection Table

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)
HT9205A – 18 DIP	5	SA,R EM1~EM3	—	—	—	Control	600	N,N+1 10–N	82.5	85.5
						Digit	600/300/98			
HT9205B – 22 SDIP	5	SA,R EM1~EM3	√	√	—	Control	600	N,N+1 10–N	82.5	85.5
						Digit	600/300/98			
HT9205C – 20 DIP	5	SA,R EM1~EM3	—	—	√	Control	600	N,N+1 10–N	82.5	85.5
						Digit	600/300/98			
HT9205D – 24 SDIP	5	SA,R EM1~EM3	√	√	√	Control	600	N,N+1 10–N	82.5	85.5
						Digit	600/300/98			
HT9205K – 22 DIP/SDIP	6	R/P EM1~EM5	√	√	—	Control	600/300	N,N+1 10–N	100	106

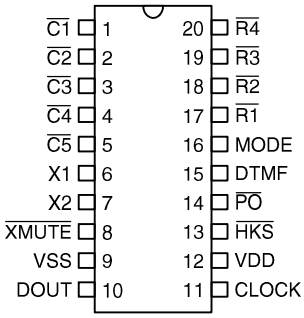
Package Information



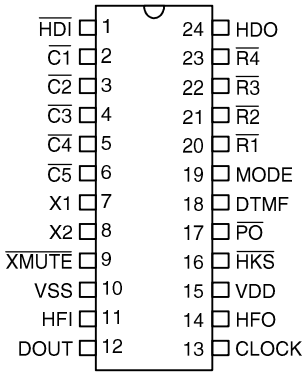
HT9205A
– 18 DIP



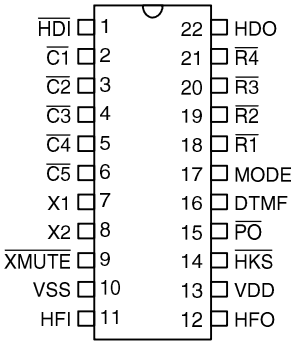
HT9205B
– 22 SDIP



HT9205C
– 20 DIP



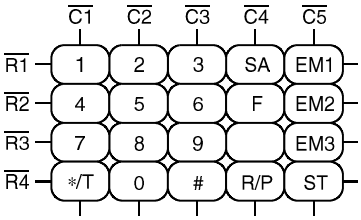
HT9205D
– 24 SDIP



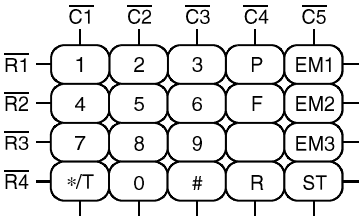
HT9205K
– 22 DIP/SDIP

Keyboard Information

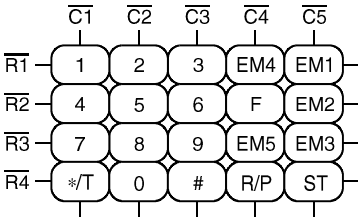
Form A for the HT9205A/B/C/D



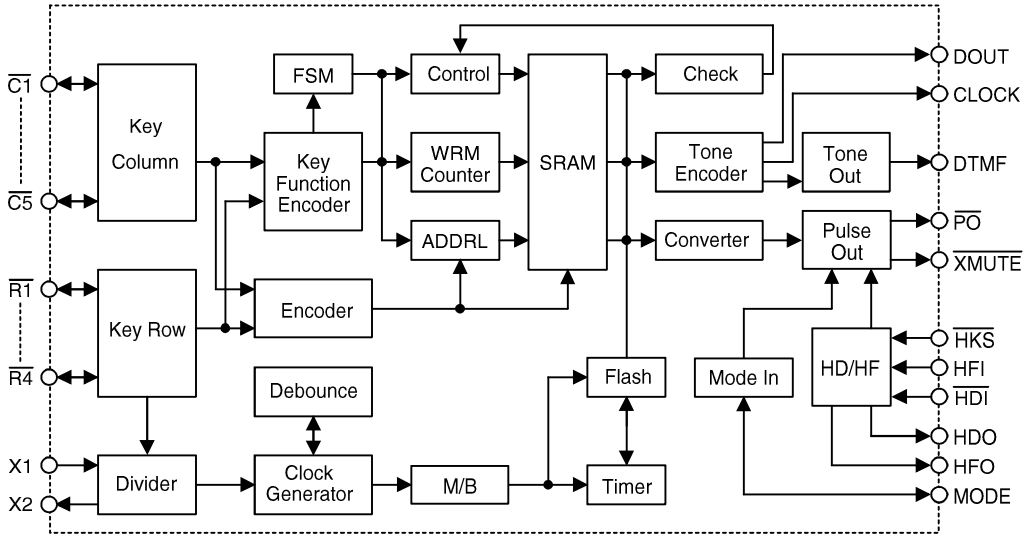
Form B for the HT9205A/B/C/D



HT9205K



Block Diagram



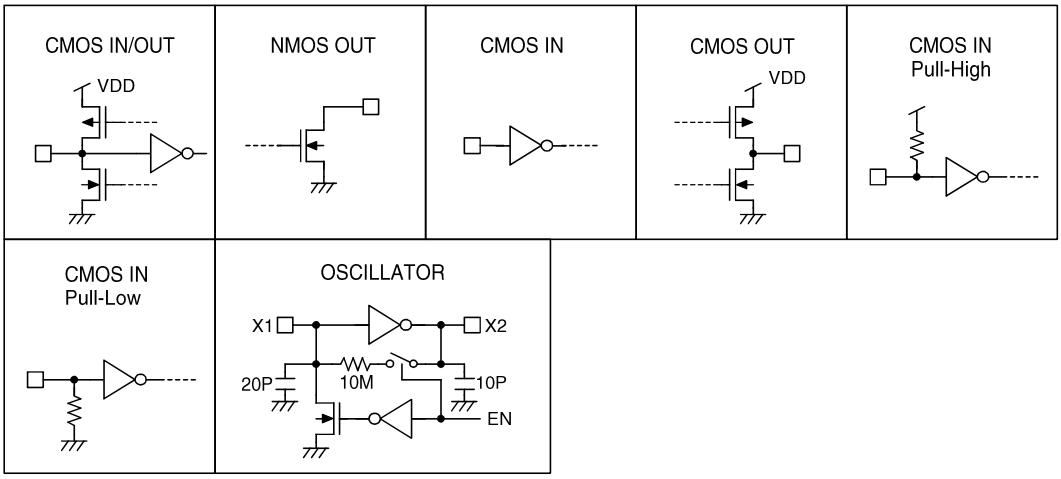
Pin Description

Pin Name	I/O	Internal Connection	Description
$\overline{C1}$~$\overline{C5}$ $\overline{R1}$~$\overline{R4}$	I/O	CMOS IN/OUT	These pins construct a 4×5 keyboard matrix to perform the keyboard input detecting and dialing specification setting functions. When on-hook ($\overline{HKS}$=high) all the pins are set to high. While off-hook the column group ($\overline{C1}$~$\overline{C5}$) stays low and the row group ($\overline{R1}$~$\overline{R4}$) is set to high for key input detecting. An inexpensive single contact 4×5 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		
$\overline{XMUTE}$	O	NMOS OUT	The $\overline{XMUTE}$ is an NMOS open drain structure pulled to VSS during dialing signal transmitting. Otherwise, it is an open circuit. The $\overline{XMUTE}$ is used to mute the speech circuit when transmitting the dial signal.
$\overline{HKS}$	I	CMOS IN (HT9205A/B/C/D)	This pin is used to monitor the status of the hook-switch and its combination with HFI can control the $\overline{PO}$ pin output to make or break the line. $\overline{HKS}$=VDD: On-hook state ($\overline{PO}$=low). Except HFI/$\overline{HDI}$ (hand-free/hold-line control input), other functions are all disabled. $\overline{HKS}$=VSS: Off-hook state ($\overline{PO}$=high). The chip is in the stand-by mode and ready to receive the key input. The pull-high resistance of the HT9205K is 200KΩ typically.
		CMOS IN Pull-High (HT9205K)	
$\overline{PO}$	O	CMOS OUT	This pin is a CMOS output structure which receives $\overline{HKS}$ and HFO signals to control the dialer so as to connect or disconnect the telephone line. $\overline{PO}$ outputs low to break line when $\overline{HKS}$ is high (on-hook) and HFO is low (hand-free inactive). $\overline{PO}$ outputs high to make line when $\overline{HKS}$ 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.

Pin Name	I/O	Internal Connection	Description
MODE	I/O	CMOS IN/OUT	This is a three-state input/output pin, provided to the user for selecting a dialing mode among Tone/20pps/10pps. MODE=VDD: Pulse mode, 10pps. MODE=OPEN: Pulse mode, 20pps. 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 tone to the pulse mode will be recognized.
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.
$\overline{\text{HDI}}$	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 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 $\overline{\text{HDI}}$. When HDO is toggled to 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 generator to produce hold-line back ground melody. Refer to the functional description for the hold-line function.
HFI	I	CMOS IN Pull-Low	This pin is a schmitt trigger input structure. Active high. Applying a positive going pulse to HFI can toggle the HFO once and hence control the hand-free function. The pull-low resistance of 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 positive transition on the HFI pin. When HFO is high, the hand-free function is enabled and $\overline{\text{PO}}$ outputs high to connect the line. The hand-free function can be released by an on-off-hook operation or by another 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.

Pin Name	I/O	Internal Connection	Description
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 clock.
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_{XMO}	$\overline{\text{XMUTE}}$ Leakage Current	—	$V_{\overline{XMUTE}}$=12V No entry		—	—	1	μA
I_{OLXM}	$\overline{\text{XMUTE}}$ Sink Current	2.5V	$V_{\overline{XMUTE}}$=0.5V		1	—	—	mA
$I_{\overline{HKS}}$	$\overline{\text{HKS}}$ Pin Input Current	2.5V	$V_{\overline{HKS}}$=2.5V		—	—	0.1	μA
R_{HFI}	HFI Pull-Low Resistance	2.5V	V_{HFI}=2.5V		—	200	—	KΩ
$R_{\overline{HDI}}$	$\overline{\text{HDI}}$ Pull-High Resistance	2.5V	$V_{\overline{HDI}}$=0V		—	200	—	KΩ
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
			Digit key		—	1	—	
T_{RP}	One-key Redialing Pause Time	—	One-key redialing		—	1	—	s
T_{DB}	Key-in Debounce Time	—	—		—	20	—	ms
T_{BRK}	Break Time for One-key Redialing	—	One-key redialing		—	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
			MODE pin is opened.	—	20	—	
M/B	Make/Break Ratio	—	A resistor is linked between $\overline{R2}$ and $\overline{C1}$.	—	33:66	—	%
			No resistor is linked between $\overline{R2}$ and $\overline{C1}$.	—	40:60	—	
T_{PDP}	Pre-digit-pause Time	—	M/B ratio=40:60	—	40 (10pps) 20 (20pps)	—	ms
			M/B ratio=33:66	—	33 (10pps) 17 (20pps)	—	
T_{IDP}	Inter-digit-pause Time	—	Pulse rate=10pps	—	800	—	ms
			Pulse rate=20pps	—	500	—	
T_M	Pulse Make Duration	—	A resistor is linked between $\overline{R2}$ and $\overline{C1}$.	—	33 (10pps) 17 (20pps)	—	ms
			No resistor is linked between $\overline{R2}$ and $\overline{C1}$.	—	40 (10pps) 20 (20pps)	—	
T_B	Pulse Break Duration	—	A resistor is linked between $\overline{R2}$ and $\overline{C1}$.	—	66 (10pps) 33 (20pps)	—	ms
			No resistor is linked between $\overline{R2}$ and $\overline{C1}$.	—	60 (10pps) 30 (20pps)	—	

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	HT9205A/B/C/D	—	82.5	—	ms
				HT9205K	—	100	—	ms
T_{ITPM}	Minimum Inter-tone Pause	—	Auto-redial	HT9205A/B/C/D	—	85.5	—	ms
				HT9205K	—	106	—	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 matrix

The $\overline{C1}$~$\overline{C5}$ and $\overline{R1}$~$\overline{R4}$ make up of a keyboard matrix. Together with a standard 4×5 keyboard, the keyboard matrix is used for dialing entrance. In addition, the keyboard matrix provides resistor options for different dialing specification selections. The keyboard arrangement for each of the HT9205 series are listed in **Keyboard Information**.

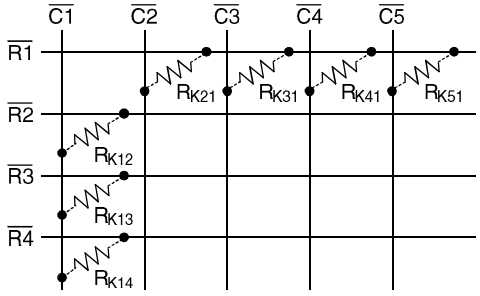
Tone frequency

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.

Dialing specification selection

By means of adding resistors across keyboard matrix pins, various dialing specifications can be selected. The allowable option resistor connections are shown below.



All the resistors are 330KΩ. The resistor option functions and the default specifications (without option resistors) are listed below.

Option Resistor	Option Function	Default (No Resistor)
R_{K12}	Make/Break Ratio Selection	40:60
R_{K13}	Flash Function and Flash Time Selection	Flash= control function Flash time= 600ms
R_{K14}		
R_{K21}	Pause & P→T Duration Selection	T_P= 3.6s $T_{P\rightarrow T}$= 3.6s
R_{K31}	Pulse Number Selection	N
R_{K41}		
R_{K51} (HT9205 A/B/C/D)	Keypad Form	Form A

M/B ratio selection table

R_{K12}	M/B Ratio (%)
No	40:60
Yes	33.3:66.6

Flash function/time (duration) selection table

- HT9205A/B/C/D

R_{K13}	R_{K14}	Flash Function	Flash Time (T_F)
No	No	Control	600ms
No	Yes	Digit	600ms
Yes	No	Digit	98ms
Yes	Yes	Digit	300ms

- HT9205K

R_{K14}	Flash Function	Flash Time (T_F)
No	Control	300ms
Yes	Control	600ms

Pause and P→T duration selection table

R_{K21}	T_P (sec)	$T_{P\rightarrow T}$ (sec)
No	3.6	3.6
Yes	2	1

Pulse number selection table

R_{K31}	R_{K41}	Pulse Number
No	No	N
No	Yes	N+1
Yes	No	10-N
Yes	Yes	—

The keyboard arrangement selection table

- HT9205A/B/C/D

R_{K51}	Keypad Form
No	Form A (see keyboard information)
Yes	Form B (see keyboard information)

Pulse number table

Keypad	Output Pulse Number		
Digit Key	Normal N	New Zealand (10–N)	Sweden/ Denmark (N+1)
1	1	9	2
2	2	8	3
3	3	7	4
4	4	6	5
5	5	5	6
6	6	4	7
7	7	3	8
8	8	2	9
9	9	1	10
0	10	10	1
*/T	P→T	P→T	P→T
#	Ignored	Ignored	Ignored

Tone duration and pause in redial function

- HT9205A/B/C/D

Parameter	Symbol	Typ.	Unit
Minimum Tone Duration	T_{TMIN}	82.5	ms
Minimum Inter-tone Pause	T_{ITPM}	85.5	ms
Cycle Time	T_C	168	ms

- HT9205K

Parameter	Symbol	Typ.	Unit
Minimum Tone Duration	T_{TMIN}	100	ms
Minimum Inter-tone Pause	T_{ITPM}	106	ms
Cycle Time	T_C	206	ms

Hand-free function operation

- Hand-free function execution

  When HFO is low, a rising edge triggers the 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 rising edge to HFI
  - Changing the HDO pin from low to high

- Hand-free function table

Current State			Input			Next State	
$\overline{HKS}$	HFO	HDO	$\overline{HDI}$	HFI	$\overline{HKS}$	HFO	HDO
H	L	X	H	L	An	L	An
H	L	X	H	↑	An	H	L
H	H	X	H	↑	An	L	An
H	X	L	H	L	L	L	L
L	L	X	H	L	An	L	An
L	L	X	H	↑	An	H	L
L	H	L	H	↑	An	L	An
L	X	X	H	L	H	An	An
X	X	L	↓	L	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 the $\overline{HDI}$, 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	HFI	$\overline{HDI}$	$\overline{HKS}$	HDO	HFO
H	L	X	L	H	An	L	An
H	L	X	L	↓	An	H	L
H	H	L	L	↓	An	L	An
H	X	X	L	H	L	L	L
L	L	X	L	H	An	L	An
L	L	X	L	↓	An	H	L
L	H	L	L	↓	An	L	An
L	X	X	L	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 (HT9205A/B/C/D)

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.

• F

The flash key can be selected as a digit or a control key by the option resistors R_{K13} & R_{K14}. Pressing the flash key will force the $\overline{PO}$ pin to be "low" for the T_F duration and is then followed by T_{FP} (sec). T_F can also be selected by R_{K13}, R_{K14}.

• P

Pause key. The execution of the pause key pauses the output for the T_P duration. T_P can be selected by R_{K21}.

• R

Redial key. It executes the redialing as well as one-key redial function.

• R/P

Redial and pause function key. If it is pressed as the first key after off-hook, this key executes the redial function. Otherwise, it works as the pause key.

• 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~EM5

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

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 $T_{P\rightarrow T}$ 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]

  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] (or [R/P])

  Dialing output: D1 D2 ... Dn

  RM: Unchanged

  SAM: Unchanged

  (b) with ∗/T

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

  Keyboard input: [R] (or [R/P])

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

  RM: Unchanged

  SAM: Unchanged

  – Tone mode

  (a) without ∗/T

  RM content: D1 D2 ... Dn

  Keyboard input: [R] (or [R/P])

  Dialing output: D1 D2 ... Dn

  RM: Unchanged

  SAM: Unchanged

  (b) with ∗/T

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

  Keyboard input: [R] (or [R/P])

  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: D1 D2 ... Dn; Tone: Dn+1 ... Dm)
  T_{BRK} T_{RP} D1 D2 ... Dn $T_{P\rightarrow T}$
  (Pulse: D1 D2 ... Dn)
  Dn+1 ... Dm
  (Tone: Dn+1 ... Dm)

  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] [SA]

  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: D1 D2 ... Dn; Tone: Dn+1 ... Dm)

  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] [SA]

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

- Flash
  - Flash as a digital key
    (a) The intervenient key
    Keyboard input: [D1] [D2] ... [Dn] [F] [Dn+1] ... [Dm]
    Dialing output: D1 D2 ... Dn T_F T_{FP} Dn+1 ... Dm
    RM: D1 D2 ... Dn
    SAM: Unchanged
    (b) The first key
    Keyboard input: [F] [D1] [D2] ... [Dn]
    Dialing output: T_F T_{FP} D1 D2 ... Dn
    RM: Unchanged
    SAM: Unchanged
  - Flash as a control key
    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

- Pause
  Keyboard input: [D1] [D2] ... [Dn] [P] (or [R/P]) [Dn+1] ... [Dm]
  Dialing output: D1 D2 ... Dn T_P Dn+1 ... Dm
  RM: D1 D2 ... Dn P Dn+1 ... Dm
  SAM: Unchanged

- Memory store

  – Memory store without dialing output

  Keyboard input: [ST] [D1] [D2] ... [Dn] [ST] [EMa]
  Dialing output:
  EMa: D1 D2 ... Dn
  RM: D1 D2 ... Dn
  SAM: Unchanged

  – Memory store 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

  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~EM5.

- Memory dialing

  EMa content: D1 D2 ... Dn
  Keyboard input: [EMa]
  Dialing output: D1 D2 ... Dn
  EMa: Unchanged
  RM: D1 D2 ... Dn
  SAM: Unchanged

  Note: EMa=EM1~EM5.

- Chain dialing

  EM1 content: D1 D2 ... Dn
  EM2 content: Dn+1 ... Dm
  Keyboard input: [D1] [D2] [D3] [EM1] [EM2]
  Dialing output: D1 D2 D3 D1 D2 ... Dn Dn+1 ... Dm
  EM1: Unchanged
  EM2: Unchanged
  RM: D1 D2 D3 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.

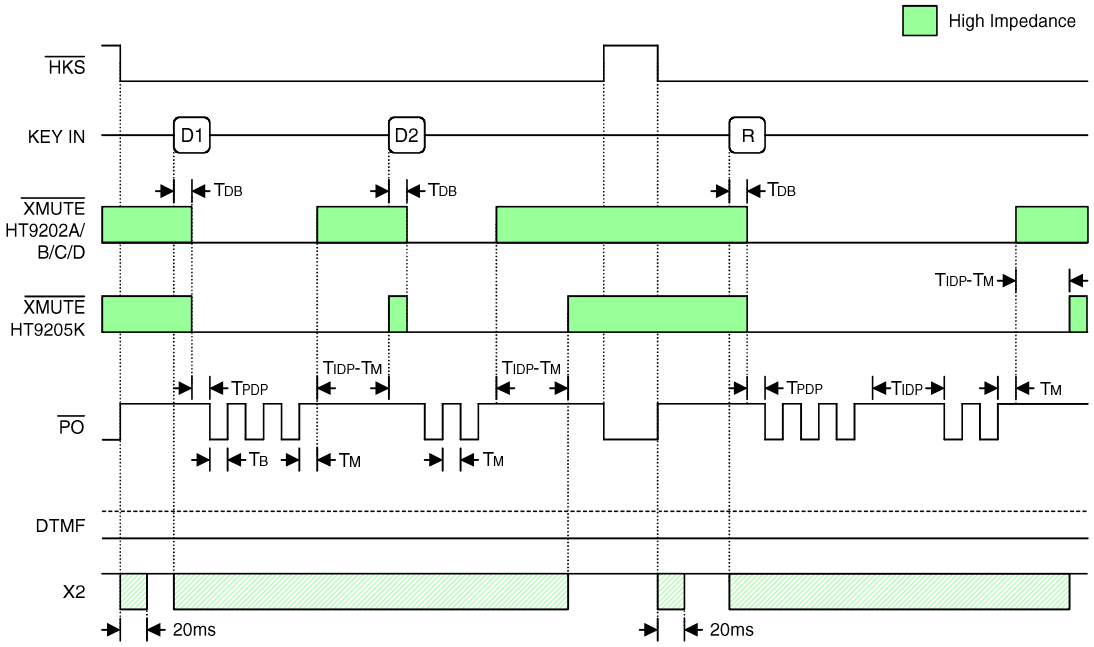
- Note

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

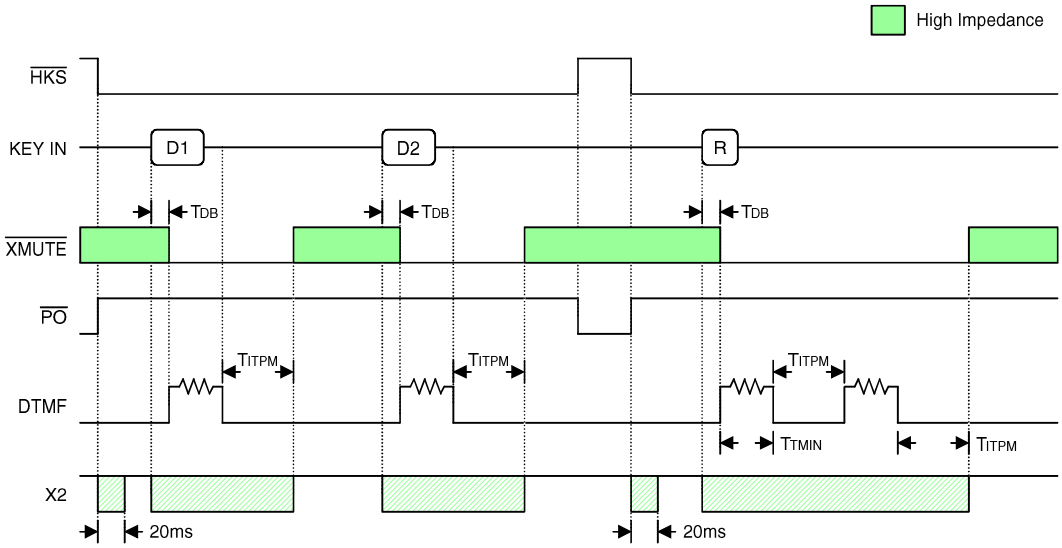
Operation Timing

Normal dialing

• Pulse mode

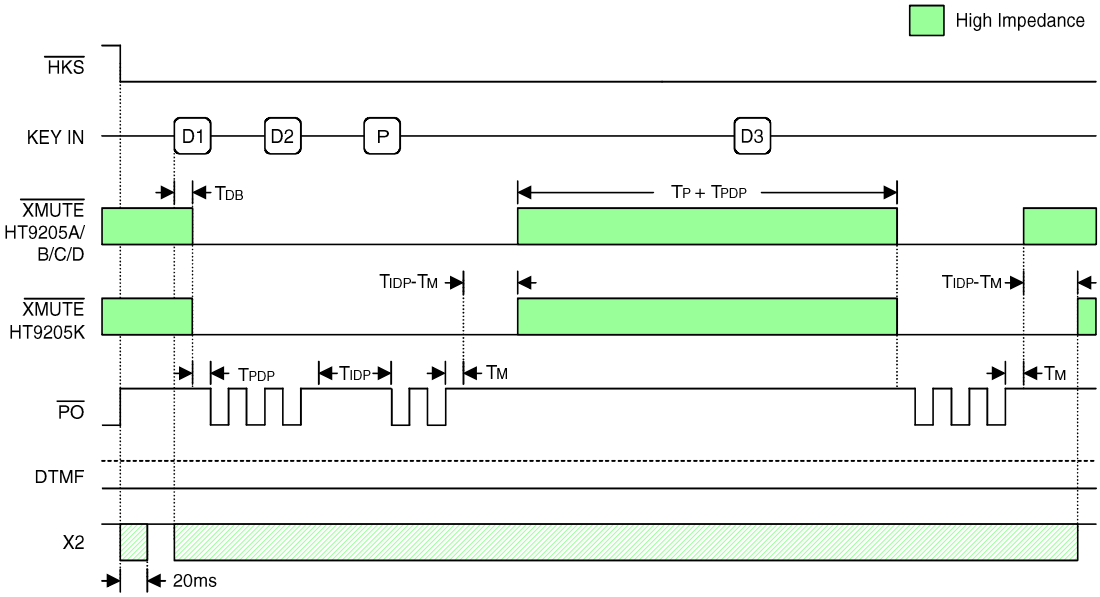


• Tone mode

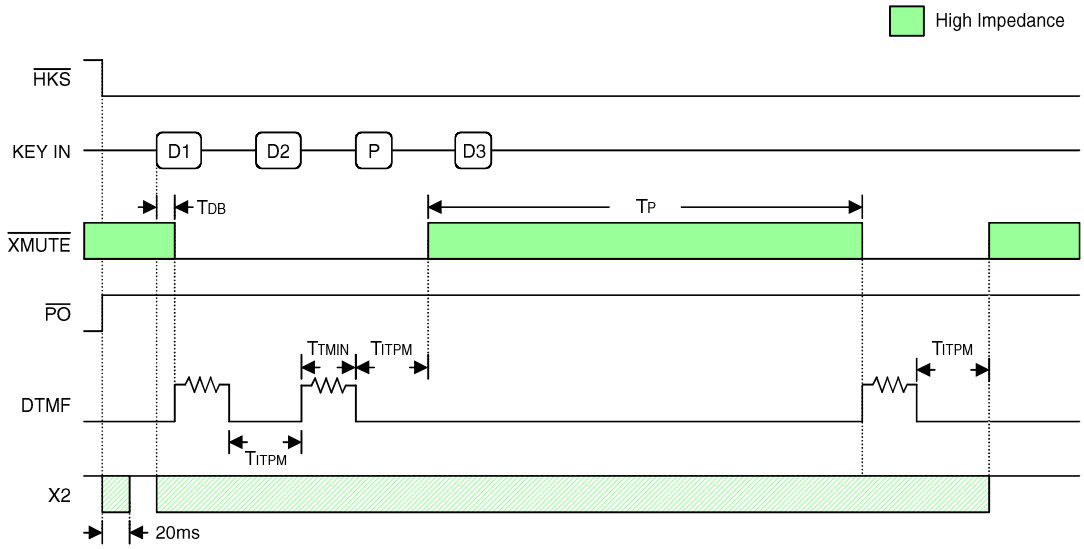


Dialing with pause key

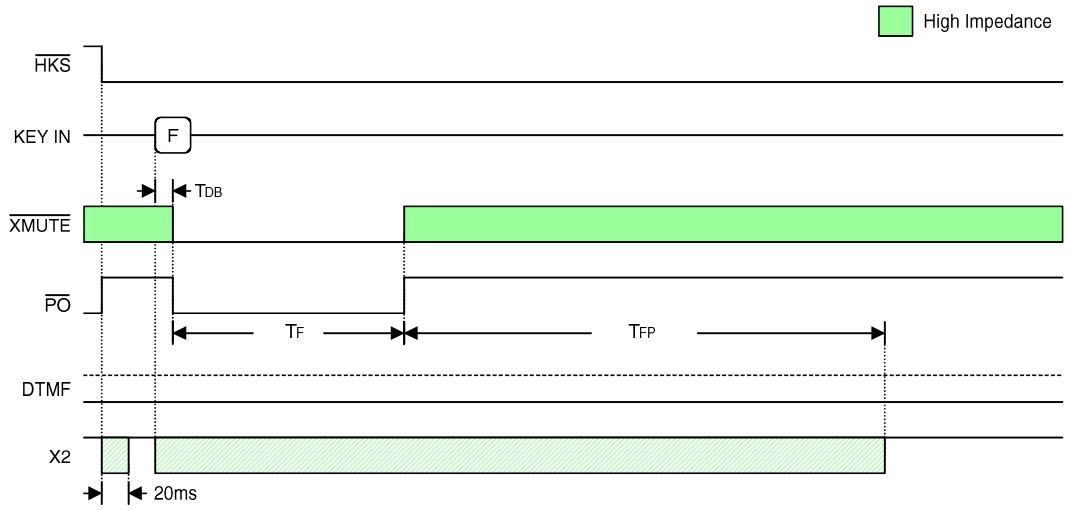
- Pulse mode



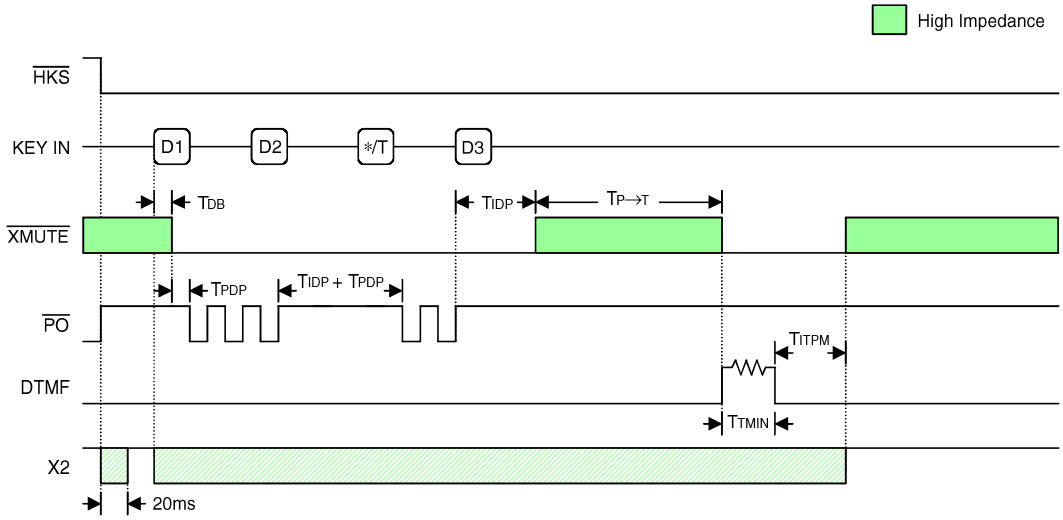
- Tone mode



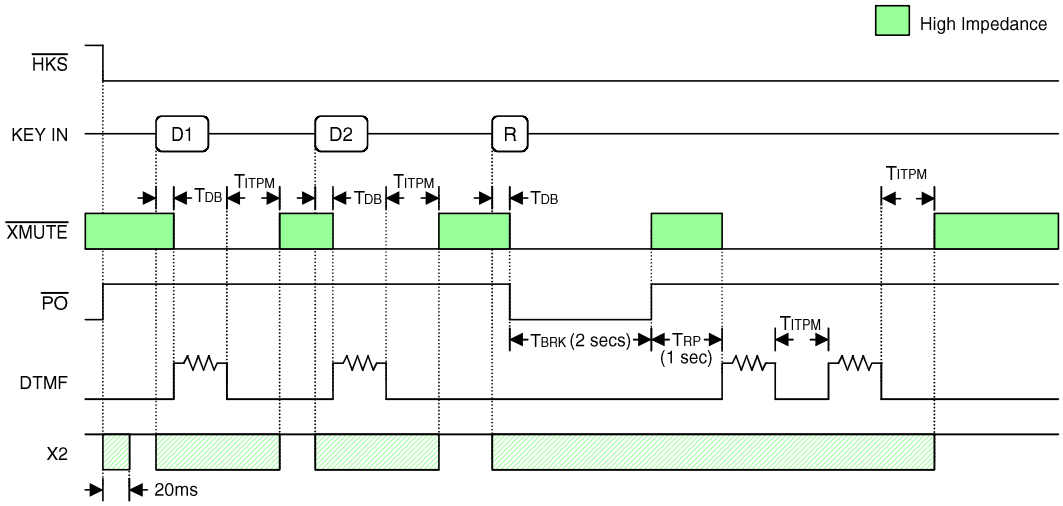
Flash key operation



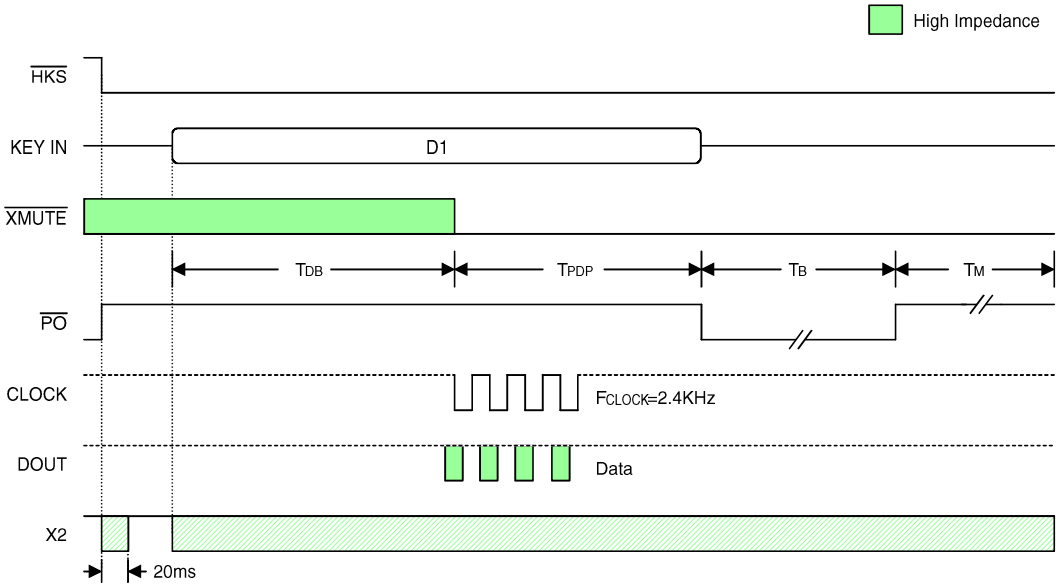
Pulse→Tone operation



One key redial operation



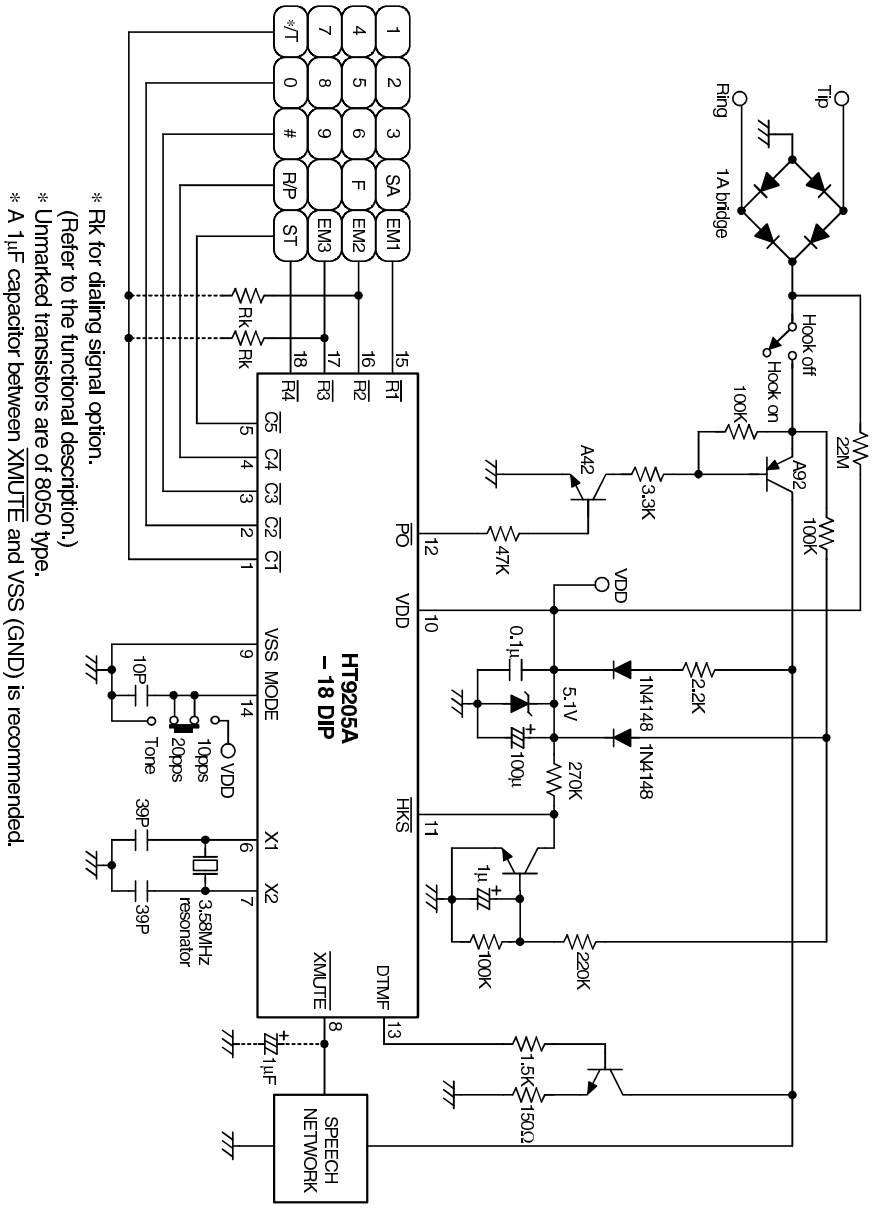
CLOCK & DOUT operation



Note: D1=D3=3
D2=2

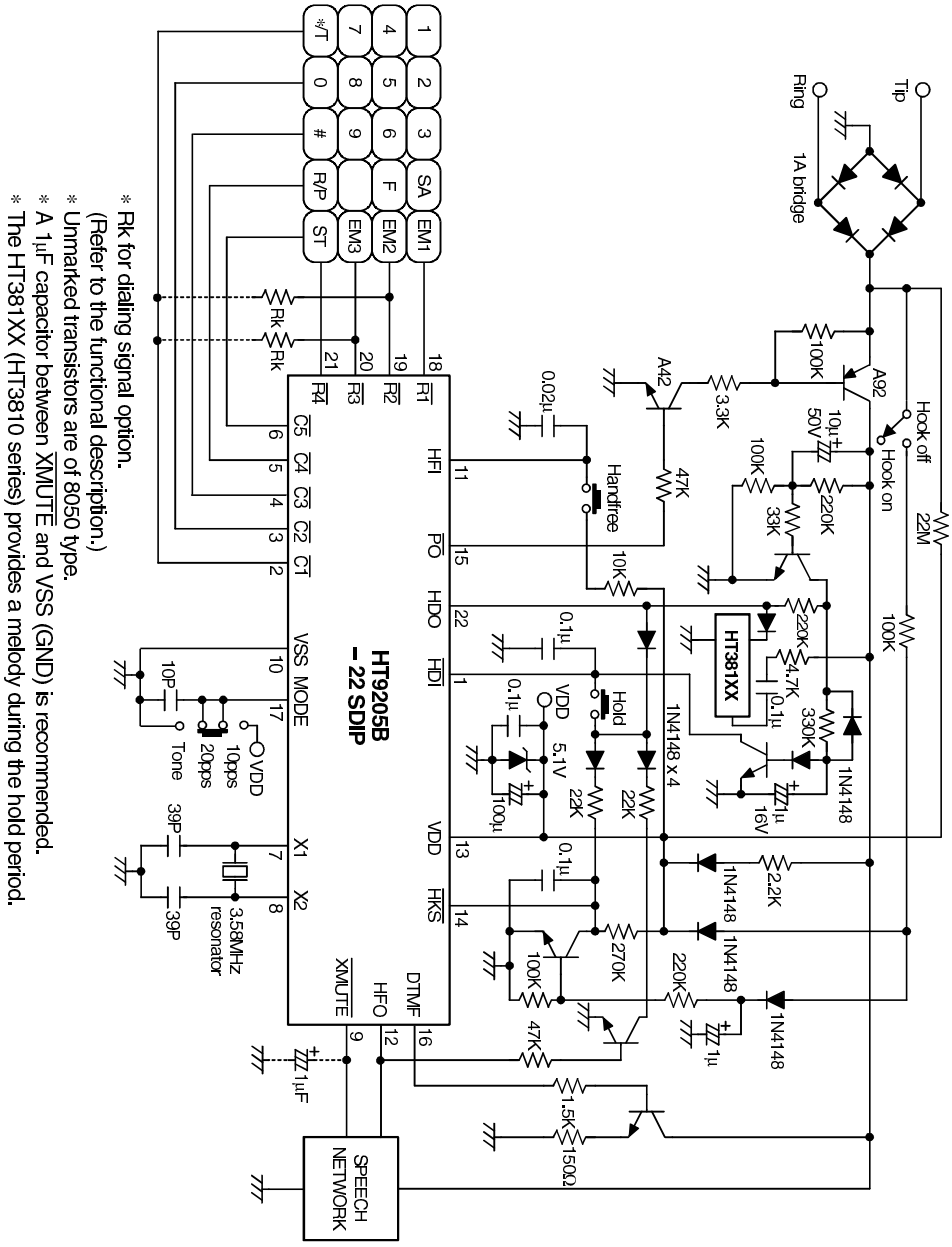
Application Circuits

Application circuit 1



* Rk for dialing signal option.
(Refer to the functional description.)
* Unmarked transistors are of 8050 type.
* A 1µF capacitor between $\overline{\text{XMUTE}}$ and VSS (GND) is recommended.

Application circuit 2



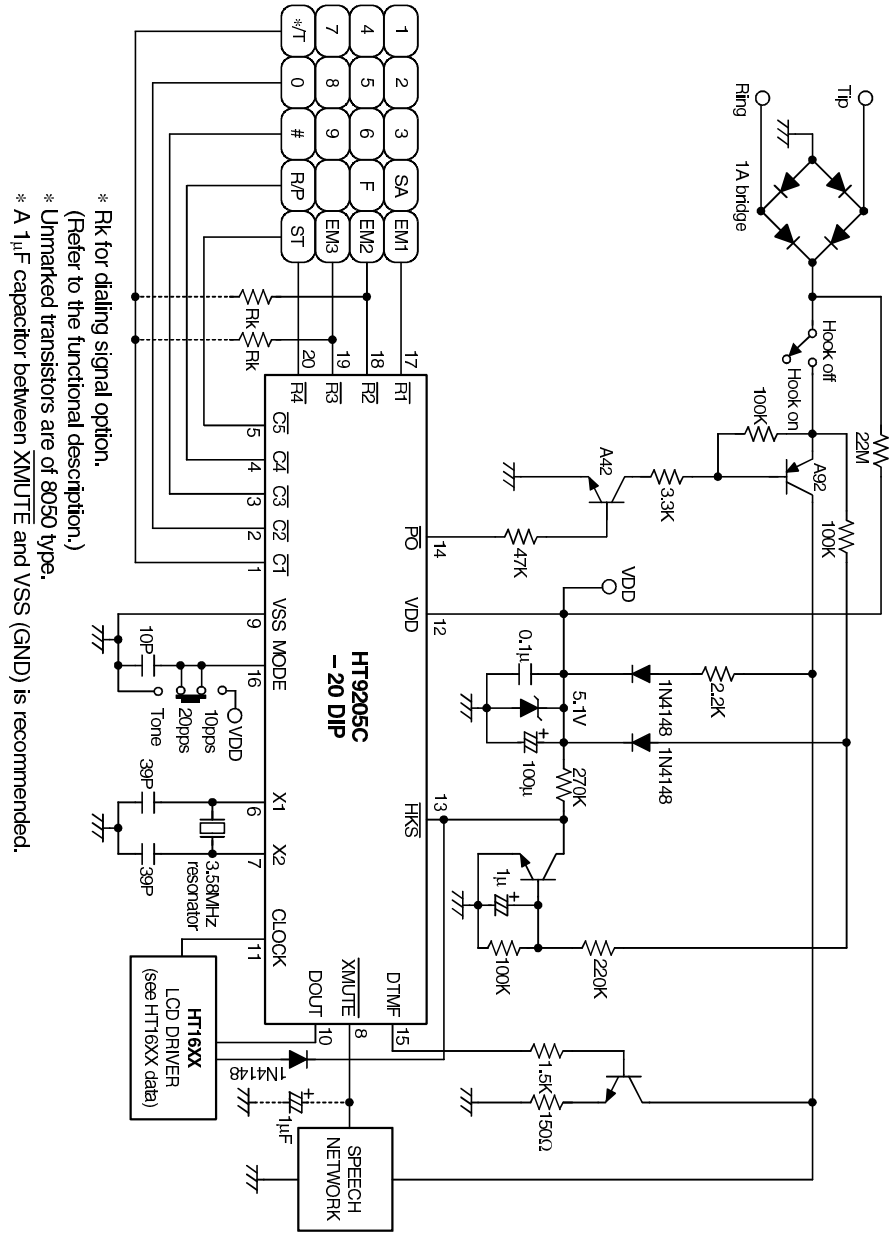
* Rk for dialing signal option.
(Refer to the functional description.)

* Unmarked transistors are of 8050 type.

* A 1μF capacitor between XMUTE and VSS (GND) is recommended.

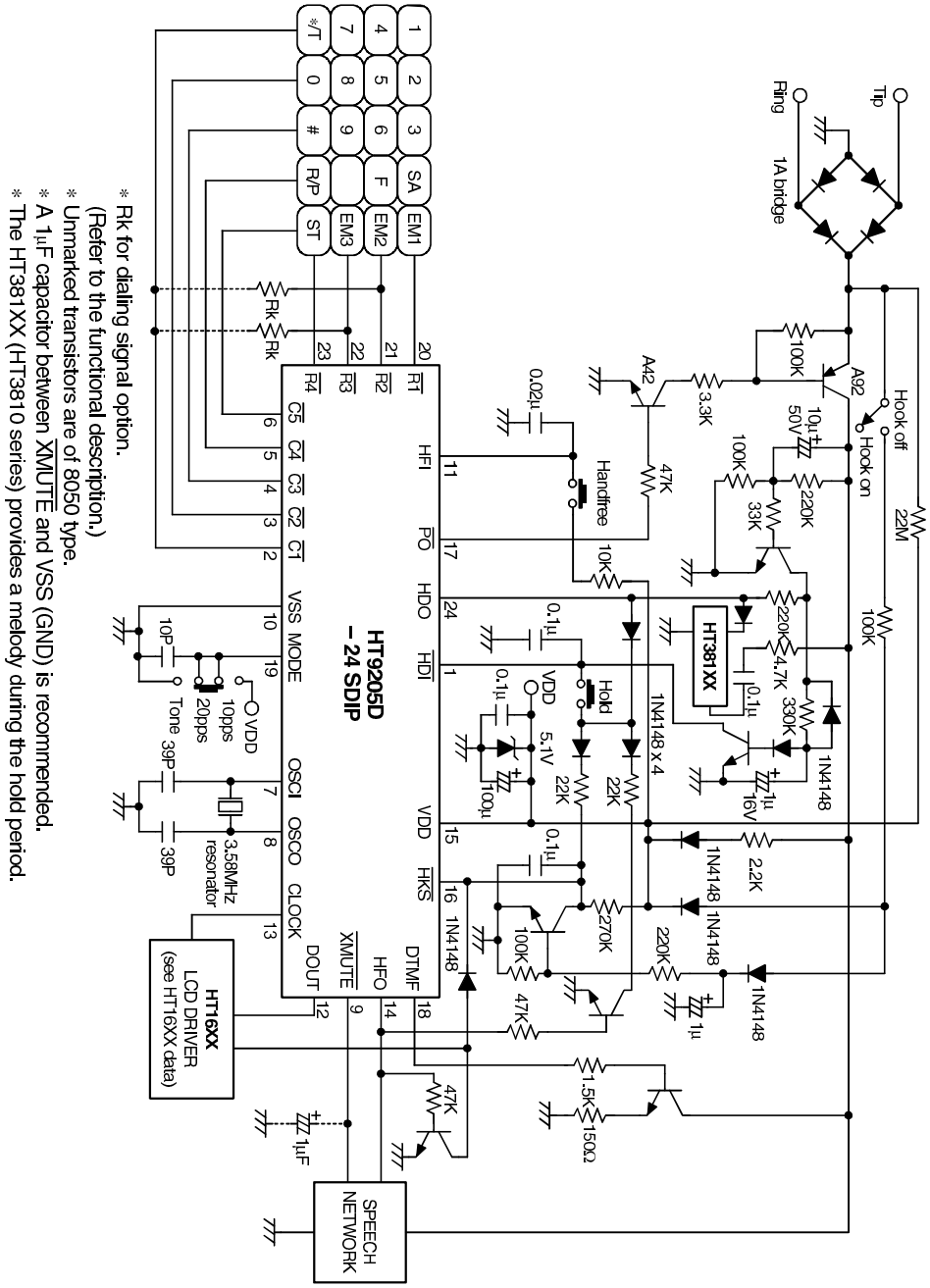
* The HT381XX (HT3810 series) provides a melody during the hold period.

Application circuit 3



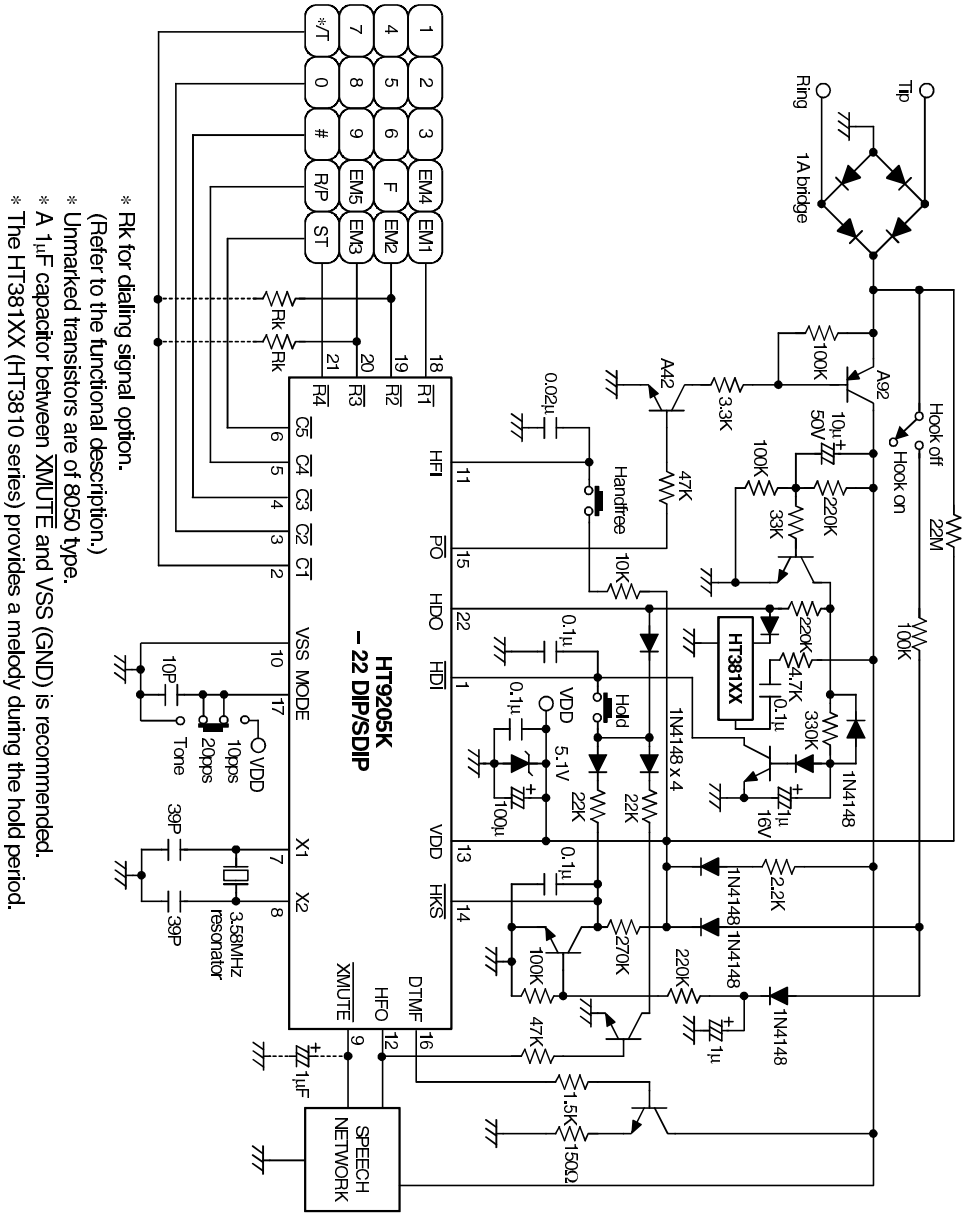
* Rk for dialing signal option.
(Refer to the functional description.)
* Unmarked transistors are of 8050 type.
* A 1µF capacitor between XMUTE and VSS (GND) is recommended.

Application circuit 4



* Rk for dialing signal option.
(Refer to the functional description.)
* Unmarked transistors are of 8050 type.
* A 1μF capacitor between $\overline{XMUTE}$ and VSS (GND) is recommended.
* The HT381XX (HT3810 series) provides a melody during the hold period.

Application circuit 5



* Rk for dialing signal option.
(Refer to the functional description.)
* Unmarked transistors are of 8050 type.
* A 1µF capacitor between XMUTE and VSS (GND) is recommended.
* The HT3815XX (HT3810 series) provides a melody during the hold period.

User Notes

The HT9205 Version 1 (9XXXX–1) series are originally designed for the U.S.A. specification. In order to meet the Universal specification also, Version 2 (9XXXX–2) is derived. Version 1 and Version 2 are different in the following ways:

How to select the HT9205 by the version

Version (Date Code)	Version 1 (9XXXX–1)	Version 2 (9XXXX–2)
Hand-free/Hold Function	HDO can be reset by HFO (active high), but HFO cannot be reset by HDO (active high).	HFO can be reset by HDO (active high) and HDO can be reset by HFO (active high) as well.
Flash Time (A Resistor is Linked Between $\overline{R3}$ and $\overline{C1}$.)	86ms	98ms
Tone (DTMF) Inter-tone-duration/Inter-tone-pause Time for Redialing (Except the HT9205K)	100/106ms	82.5/85.5ms
$\overline{XMUTE}$ Behavior After Pulse Dialing (Except the HT9205K)	Keeps low for a T_{IDP} (long mute) time	Keeps low for a T_M (short mute) time

On the basis of the above table, the major differences between the Version 1 (9XXXX–1) and Version 2 (9XXXX–2) can be summarized as follows:

- With respect to the switch between Hand-free and Hold modes
  Version 1 (9XXXX–1): HDO can be reset by HFO whereas HFO cannot be reset by HDO.
  Version 2 (9XXXX–2): HFO can be reset by HDO, and HDO can also be reset by HFO.
- The flash time (A resistor is linked between $\overline{R3}$ and $\overline{C1}$.)
  Version 1 (9XXXX–1) is 86ms.
  Version 2 (9XXXX–2) is 98ms.
- Tone (DTMF) Inter-tone-duration/Inter-tone-pause time (Except the HT9205K)
  Version 1 (9XXXX–1) is 100/106ms.
  Version 2 (9XXXX–2) is 82.5/85.5ms.
- $\overline{XMUTE}$ behavior after pulse dialing (Except the HT9205K)
  Version1 (9XXXX–1) is kept low for a T_{IDP} time.
  Version 2 (9XXXX–2) is kept low for a T_M time.