HT9290A/B
One-Key Dialer

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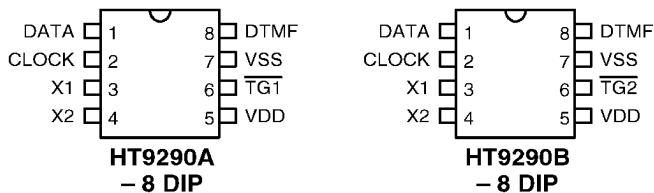
Patent Number: 113235(R.O.C.), 5424740(U.S.A.)

* Operating voltage: 2.0V~5.5V
* Low standby current
* 22-digit memory at max.
* Pause time selectable by programming (0.3/0.9 sec)

* Phone number programmable/readable
* Pause time for HT9290A can be accumulated
* 3.58MHz crystal or ceramic resonator
* Two kinds of nonretriggerable trigger functions (local/long distance call)
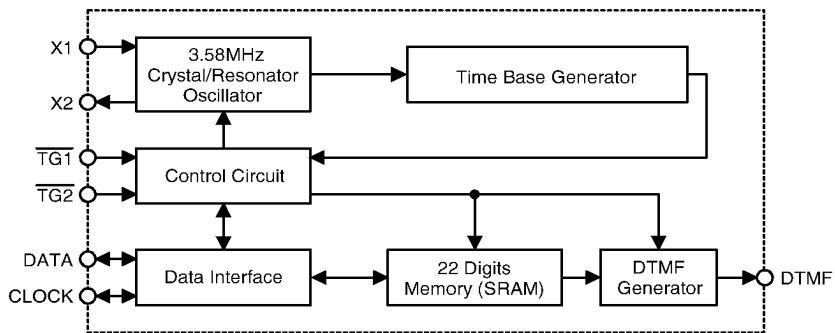
General Description

The HT9290A/B are programmable one-key tone dialer. It provides a station number with two trigger pins for long distance (HT9290A) and local (HT9290B) call dialing. The DTMF pin will output the tone signal if any of the two trigger pins is actuated. A phone number of 22-digit memory at maximum can be programmed through the DATA and CLOCK pins.
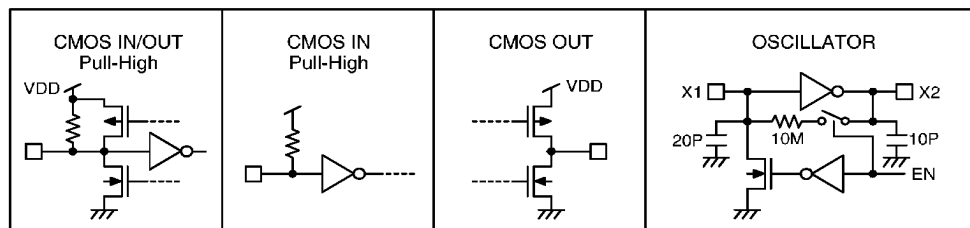
Pin Assignment

HT9290A
– 8 DIP

HT9290B
– 8 DIP

Block Diagram

Pad Description

Pad No.	Pad Name	I/O	Internal Connection	Description
1	DATA	I/O	CMOS IN/OUT Pull-High	Data input or output (interface to μC)
2	CLOCK	I/O	CMOS IN/OUT Pull-High	Clock input or output (interface to μC)
3	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 the X1 and X2 terminals can implement the oscillator function. The oscillator is turned off in the standby mode, and will be actuated whenever the $\overline{TG1}/\overline{TG2}$ entry is detected.
4	X2	O		
5	VDD	I	—	Positive power supply, 2V~5.5V for normal operation
6	$\overline{TG2}$	I	CMOS IN Pull-High	Trigger for local call, active low
7	$\overline{TG1}$	I	CMOS IN Pull-High	Trigger for long distance call, active low
8	VSS	I	—	Negative power supply
9	DTMF	O	CMOS OUT	Output terminal of tone signal

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

*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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operation Voltage	—	—	2	—	5.5	V
I_{DD}	Operation Current	2.5V	—	—	0.6	2	mA
V_{IL}	"Low" Input Voltage	2.5V	—	V_{SS}	—	$0.2V_{DD}$	V
V_{IH}	"High" Input Voltage	2.5V	—	$0.8V_{DD}$	—	V_{DD}	V
I_{STB}	Standby Current	2.5V	Oscillator stop	—	—	1	μA
R_{TG}	Pull-High Resistance ($\overline{TG1}$, $\overline{TG2}$)	2.5V	V ($\overline{TG1}$, $\overline{TG2}$)=0V	—	300	—	kΩ
R_{DAT}	Pull-High Resistance (DATA)	2.5V	V_{DATA}=0V	—	60	—	kΩ
R_{CK}	Pull-High Resistance (CLOCK)	2.5V	V_{CLOCK}=0V	—	60	—	kΩ
V_{MR}	Memory Retention Voltage	—	—	1	—	5.5	V
I_{MR}	Memory Retention Current	2V	—	—	0.2	0.5	μA
V_{TDC}	DTMF Output DC Level	2V~ 5.5V	DTMF output	$0.45V_{DD}$	—	$0.75V_{DD}$	V
I_{TOL}	DTMF Sink Current	2.5V	V_{DTMF}=0.5V	0.1	—	—	mA
V_{TAC}	DTMF Output AC Level	2.5V	Row group, R_L=5kΩ	0.12	0.15	0.18	Vrms
R_L	DTMF Output Load	2.5V	THD ≤ −23 dB	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
F_{OSC}	System Frequency	—	Crystal=3.5795MHz	3.5759	3.5795	3.5831	MHz

A.C. Electrical Characteristic

(F_{OSC}=3.5795MHz, Ta=25°C)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
T_{TD}	Tone Duration	2V~5.5V	DTMF output	—	100	—	ms
T_{ITP}	Inter-tone Pause	2V~5.5V	DTMF output	—	106	—	ms
T_{P1}	Tone Pause Time For P1	2V~5.5V	—	—	0.3	—	s
T_{P2}	Tone Pause Time For P2	2V~5.5V	—	—	0.9	—	s
t_{CK}	Clock Period	5V	—	0.2	—	2	ms
t_{SACC}	Store Accept Time	5V	—	0.6	—	2	ms
t_{IDP}	Inter-digit-pause Time	5V	—	0.6	—	2	ms
t_{RACC}	Read Accept Time	5V	—	—	—	15	ms
t_{CKR}	Clock Rising Time	5V	—	—	—	100	ns
t_{CKF}	Clock Falling Time	5V	—	—	—	100	ns
t_{CKL}	Clock Low Time	5V	—	0.1	—	—	ms
t_{CKH}	Clock High Time	5V	—	0.1	—	—	ms

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

Vi,Vh: Row group and Column group signals

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

Functional Description

The HT9290A/B is a one-key tone dialer. A station number with 22 digits at maximum can be programmed. The HT9290A is used for long distance calls while the HT9290B is used for local calls.

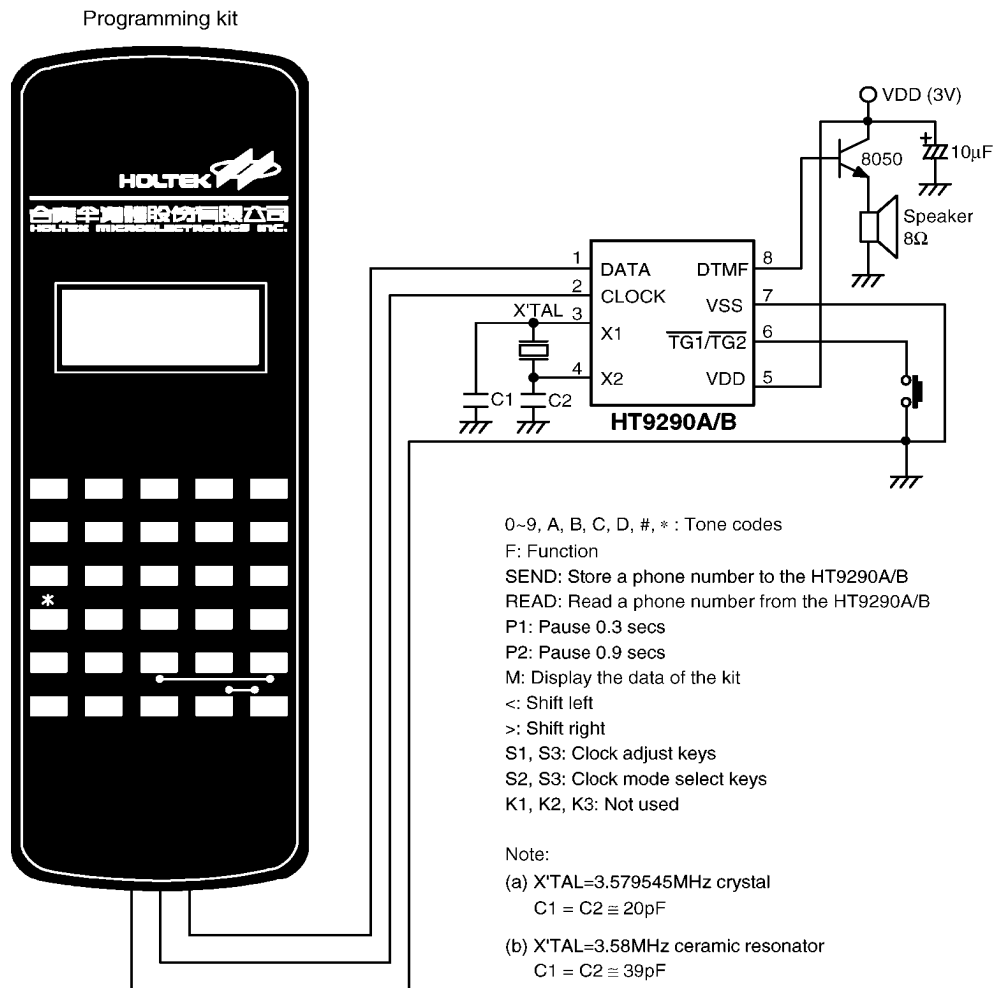The phone number can be easily programmed through HOLTEK's programming kit (refer to Figure 1).

Programming kit

0~9, A, B, C, D, #, * : Tone codes
F: Function
SEND: Store a phone number to the HT9290A/B
READ: Read a phone number from the HT9290A/B
P1: Pause 0.3 secs
P2: Pause 0.9 secs
M: Display the data of the kit
<: Shift left
>: Shift right
S1, S3: Clock adjust keys
S2, S3: Clock mode select keys
K1, K2, K3: Not used

Note:
(a) X'TAL=3.579545MHz crystal
    $C1 = C2 \cong 20pF$

(b) X'TAL=3.58MHz ceramic resonator
    $C1 = C2 \cong 39pF$

Figure 1. Programming kit wiring diagram

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Every digit of the phone number consists of a 5-bit data. It receives data at the rising edge of the CLOCK (refer to Figure 2). The relation of the digital codes and tone output frequency are shown in Table 1.
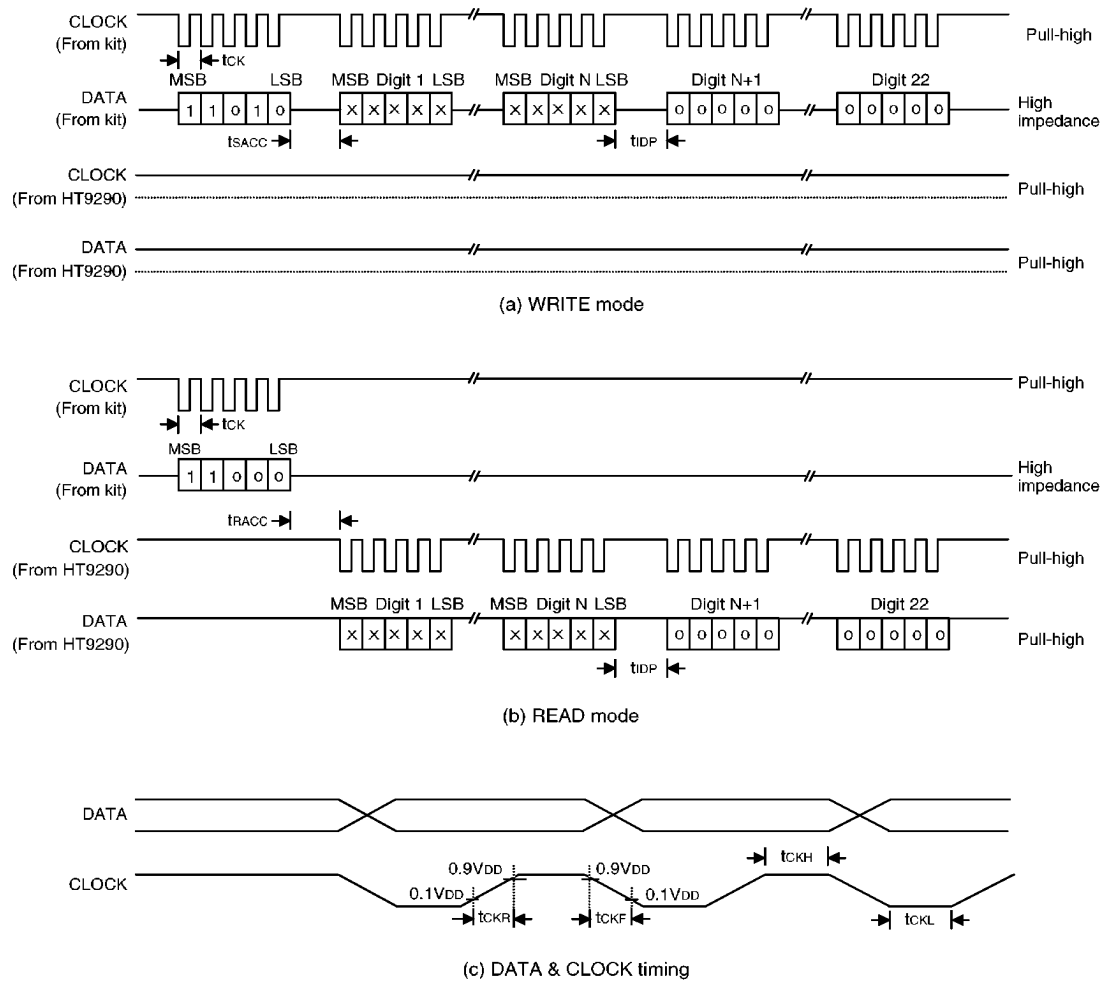
Programming timing diagram

(a) WRITE mode

(b) READ mode

(c) DATA & CLOCK timing

Figure 2. Programming timing

Table 1: Digits vs. input data vs. tone output frequency

Digit	D4	D3	D2	D1	D0	Tone Output Frequency (Hz)
1	0	0	0	0	1	697+1209
2	0	0	0	1	0	697+1336
3	0	0	0	1	1	697+1477
4	0	0	1	0	0	770+1209
5	0	0	1	0	1	770+1336
6	0	0	1	1	0	770+1477
7	0	0	1	1	1	852+1209
8	0	1	0	0	0	852+1336
9	0	1	0	0	1	852+1477
0	0	1	0	1	0	941+1336
*	0	1	1	0	1	941+1209
#	0	1	1	0	0	941+1477
A	1	0	0	0	0	697+1633
B	1	0	0	0	1	770+1633
C	1	0	0	1	0	852+1633
D	1	0	0	1	1	941+1633
P1	0	1	0	1	1	—
P2	0	1	1	1	0	—
WRITE	1	1	0	1	0	—
READ	1	1	0	0	0	—
SEND	0	0	0	0	0	—

When the HT9290A/B receives the WRITE code (11010), the phone number is stored from MSB to LSB, and the SEND (00000) code is added at the end of the phone number until 22 digits are reached.

When the HT9290A/B receives the serial data (11000) from the programming kit, the code of the phone number is sent back to the kit from MSB to LSB for verification.

Using the programming kit (Figure 1.)

• WRITE

Store 035-784888 into the HT9292A/B.
Press these keys into the programming kit:
F 035 P (P1 or P2) 784888 SEND

• READ

Press these keys into the programming kit: F READ

• Dialing

Memory content: 035 P1 (or P2) 784888
$\overline{TG1}$ trigger: 035 T_{P1} (or T_{P2}) 784888
TG2 trigger: 784888

The $\overline{TG1}$ and $\overline{TG2}$ are trigger pins. If $\overline{TG1}$ is "H" to "L", it sends a long distance call. If $\overline{TG2}$ is "H" to "L", it sends a local call. The telephone number is dialed out from the DTMF pin.
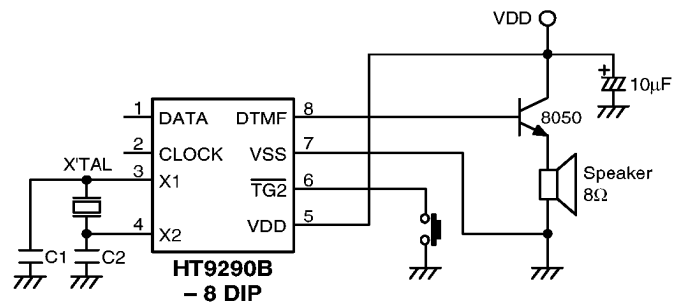
Note: The stored number will be lost if the power supply is removed

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Application Circuits

Long distance call
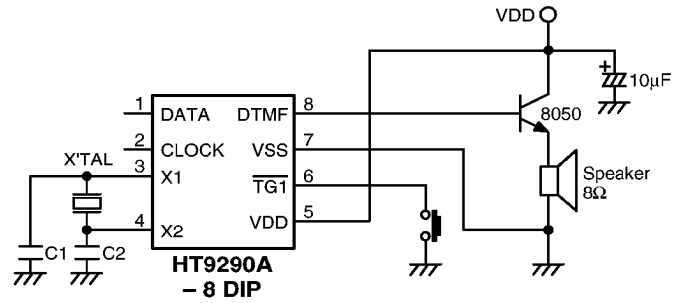
Local call

Note: (a) X'TAL = 3.579545MHz crystal
C1 = C2 ≅ 20pF

(b) X'TAL = 3.58MHz ceramic resonator
C1 = C2 ≅ 39pF