# How to Use the HT9170 DTMF Receiver

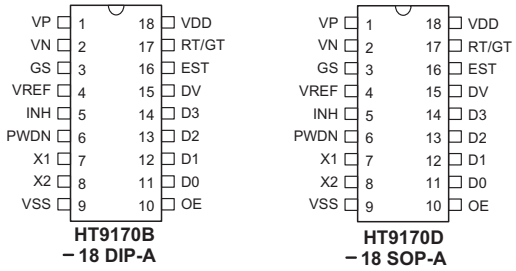
**D/N：HA0038E**

## Introduction

The HT9170 is a Dual Tone Multi Frequency (DTMF) receiver integrating a digital decoder and bandsplit filter functions. The HT9170B and HT9170D devices can enter the power down mode. The HT9170 series all use the digital counting techniques to detect and decode the 16 kinds of DTMF input into a 4-bit code output. Highly accurate filter circuits are implemented to divide tone signals into high frequency and low frequency signal.

The HT9170B package type is 18-pin DIP

The HT9170D package type is 18-pin SOP

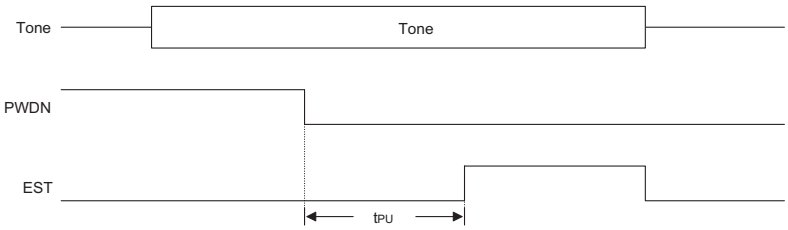



## Functional Description

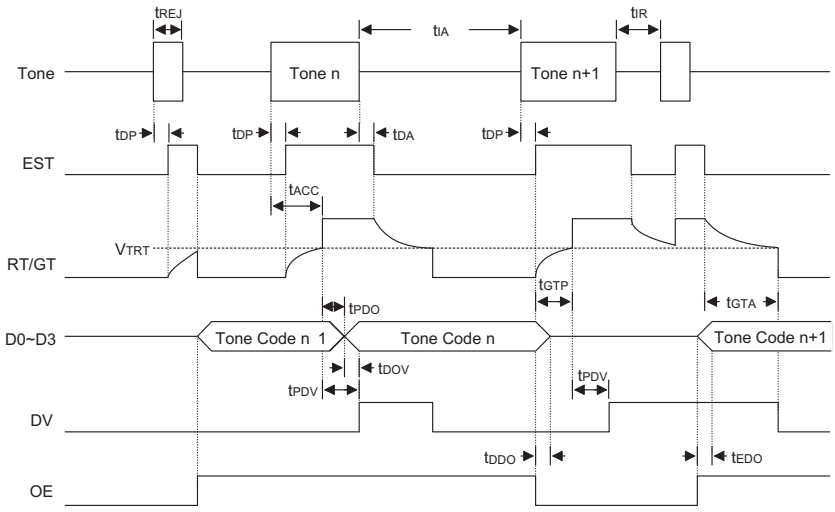
The HT9170 series consist of three bandpass filters and two digital decoder circuits to convert a tone DTMF signal into some signal output. It has a built-in amplifier circuit to adjust the input signal. The pre-filter circuit may filter out the dialing tone of 350Hz to 400Hz signal, and then use the high-pass and low-pass filters to split into high and low frequency signals.

When the HT9170 receives an effective tone (DTMF) signal, the DV pin goes high and the tone code (DTMF) signal is transferred to its internal circuitry for decoding. After setting, the OE pin goes high, the DTMF decoder will appear on pins D0~D3.

## Timing Diagram




**Power up Timing**



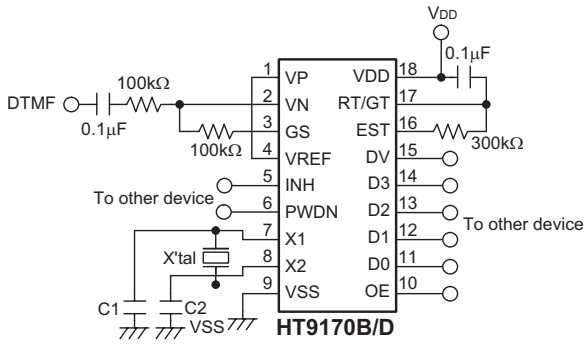

**Steering Timing**

## DTMF Input and Decoder Output Table

| Low-Freq. (Hz) | High-Freq. (Hz) | Code | OE | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|
| 697 | 1209 | 1 | H | L | L | L | H |
| 697 | 1336 | 2 | H | L | L | H | L |
| 697 | 1477 | 3 | H | L | L | H | H |
| 770 | 1209 | 4 | H | L | H | L | L |
| 770 | 1336 | 5 | H | L | H | L | H |
| 770 | 1447 | 6 | H | L | H | H | L |
| 852 | 1209 | 7 | H | L | H | H | H |
| 852 | 1336 | 8 | H | H | L | L | L |
| 852 | 1447 | 9 | H | H | L | L | H |
| 941 | 1336 | 0 | H | H | L | H | L |
| 941 | 1209 | * | H | H | L | H | H |
| 941 | 1447 | # | H | H | H | L | L |
| 697 | 1633 | A | H | H | H | L | H |
| 770 | 1633 | B | H | H | H | H | L |
| 852 | 1633 | C | H | H | H | H | H |
| 941 | 1633 | D | H | L | L | L | L |
| — | — | ANY | L | Z | Z | Z | Z |

Note: "Z" stands for high-impedance

## Application Circuit



## Program List

```
include ht48r10a-1.inc
;-----------------------------------------------------------------
;Defined pin
D0   EQU  PA.0
D1   EQU  PA.1
D2   EQU  PA.2
D3   EQU  PA.3
OE   EQU  PB.0
DV   EQU  PB.1
INH  EQU  PB.2
PWDNEQU  PB.3
;-----------------------------------------------------------------
data .section 'data'
out_code db ?                          ; decoder data output register
;-----------------------------------------------------------------
code .section at 0 'code'
         org     00h
         jmp     start
         org     04h
         reti
         org     08h
         reti
;-----------------------------------------------------------------
start:
         clr     intc
         set     pac                   ;set PA as input port
         clr     pbc                   ;set PB as output port
         set     pbc.1                 ;set PB.1 as input
         mov     a,offset out_code
         mov     mp0,a
         mov     a,18h
         mov     count,a
         clr     PWDN                  ;start the HT9170 crystal
         clr     OE
         CLR     INH
scan:  snz       DV                    ; received a DTMF signal
         jmp     scan
         set     OE                    ;set OE to output code
         set     pa
         mov     a,pa                  ;read code to MCU
         and     a, 0fh
         mov     [00h],a
scan1:
         sz      DV
         jmp     scan1
         clr     OE
         inc     mp0
```

```
            sdz     count
            jmp     scan                ;check the next DTMF signal
            jmp     start
        end
```