

# Sample AppKit:

## Using the CM8880 DTMF Transceiver

This document is the first few pages of our CM8880 AppKit. The complete AppKit includes programming information for using the CM8880 chip with the BASIC Stamp I, BASIC Stamp II and PIC microcontrollers. The "missing" portions of this document contain the programs and full manufacturer's spec sheet on the chip. The full AppKit consists of 31 pages of printed docs, a CM8880 chip, and the BS1, BS2, and PIC programs on disk. (The PIC programs are in the Parallax dialect of PIC assembly language.)

The AppKit is \$25. To order, contact:

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# AppKit:

## Using the CM8880 DTMF Transceiver

This AppKit shows how to use the California Microdevices CM8880 DTMF transceiver chip with PIC microcontrollers and Parallax BASIC Stamp® single-board computers.

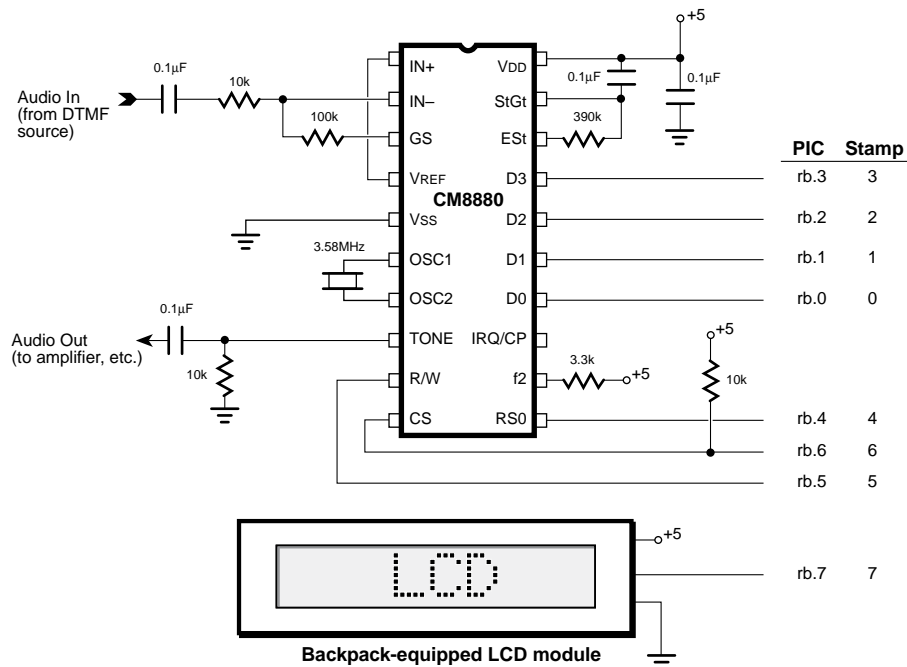
### Description

The CM8880 is a dual-tone, multifrequency (DTMF) transceiver on a chip. It can be configured to send or receive “touch” tones used in many phone and radio communication systems.

### Hardware interface

Communication with the CM8880 takes place over a 4-bit bus, consisting of D0 through D3, with three additional bits selecting modes of operation. Those bits are chip select (CS), read/write (RW) and register select (RS0).

The figure shows how to connect the CM8880 to the PIC or Stamp for the demo programs. Do not omit the bypass capacitor—not even if you feel that your power supply is solid and well-filtered. Noise from the digital parts of your circuit, particularly strobing of the CS line, can fall into the audio range and interfere with the CM8880’s ability to hear and distinguish DTMF tones.



## Software interface

The software needed to interface with the CM8880 is relatively simple, thanks to a four-bit data bus. A write cycle consists of the following steps (starting with the CM8880's CS pin high to deselect it):

- (1) Put the data pins into output mode
- (2) Write the data to the bus
- (3) Set up RS0: 0 = write data; 1 = write instructions
- (4) Clear the RW bit to request a write
- (5) Clear CS to activate the CM8880
- (6) Set CS to terminate the write operation and deactivate the CM8880

Reading the CM8880 is similar. Starting with CS high, the steps are:

- (1) Put the data pins into input mode
- (2) Set the RW bit to request a read
- (3) Set up RS0: 0 = read data; 1 = read instructions
- (4) Clear CS to activate the CM8880
- (5) Read the data from the bus
- (6) Set CS to terminate the read operation and deactivate the CM8880

The table below summarizes the interaction of the CM8880's control pins. To sum up the table, the 8880 is active only when CS is 0. The RW bit determines the data direction; 1 = read (data from 8880 to Stamp) and 0 = write (data from Stamp to 8880). The RS bit determines whether the transaction involves data (DTMF tones) or internal CM8880 functions (instructions or status); 1 = instructions/status and 0 = data.

<b>CS</b>	<b>RW</b>	<b>RS0</b>	<b>Description</b>
0	0	0	Active: write data (i.e., send DTMF)
0	0	1	Active: write instructions to 8880
0	1	0	Active: read data (i.e., receive DTMF)
0	1	1	Active: read status from 8880
1	0	0	Inactive
1	0	1	Inactive
1	1	0	Inactive
1	1	1	Inactive

The CM8880 has quite a few operational modes and options, and not enough control pins to select them. Instead, a program must store these settings in a pair of internal registers known as control register A and control register B (CRA and CRB). The tables that follow summarize the operation of these registers. Note that some of the control settings interact, or have different meanings depending on other settings.

### Functions of Control Register A

Bit	Name	Function
0	Tone Out	0 = tone generator disabled 1 = tone generator enabled
1	Mode Control	0 = Send and receive DTMF 1 = Send DTMF, receive call-progress tones (DTMF bursts lengthened to 104 ms)
2	Interrupt Enable	0 = Make controller check for DTMF rec'd 1 = Interrupt controller via pin 13 when DTMF rec'd
3	Register Select	0 = Next instruction write goes to CRA. 1 = Next instruction write goes to CRB.

### Functions of Control Register B

Bit	Name	Function
0	Burst	0 = Output DTMF bursts of 52 or 104 ms 1 = Output DTMF as long as enabled
1	Test	0 = Normal operating mode 1 = Present test timing bit on pin 13
2	Single/Dual	0 = Output dual (real DTMF) tones. 1 = Output separate row or column tones
3	Column/Row	0 = If above = 1, select row tone. 1 = If above = 1, select column tone.

#### Tips for using the CM8880

- A phone can serve as a suitable source of DTMF tones. Connect a 9V battery across the wires that normally connect to the phone line and press the keys. You will hear DTMF tones in the handset. To connect this setup to the circuit shown in the schematic, ground the battery's negative terminal and connect the positive terminal to the point marked "Audio In."
- To hear DTMF tones generated by the circuit, connect an audio amplifier to the point marked "Audio Out." Radio Shack's 277-1008C is suitable. Keep the volume low! You may dial a phone by holding the amplified speaker close to the telephone mouthpiece.
- Connecting hardware directly to the phone lines requires FCC approval. A shortcut is to use interface hardware that is already approved by the FCC. One source for this hardware, known as a Data Access Arrangement (DAA) is Cermetek, Sunnyvale, CA, 408-752-5000.