A High Performance DTMF Decoder Simplifies Control of Remote Base Stations

By Eric J. Grabowski, WA8HEB
17020 Snyder Rd., Chagrin Falls, OH 44022

Introduction

The need for a compact, low power, and maintenance free DTMF decoder resulted in the design described here. It replaced an existing circuit which used several NE-567 decoders and required regular tweaking for satisfactory operation. The primary application was to control various functions of a VHF base station by using DTMF signals received on either the telephone line or an auxiliary receiver.

To keep the circuit as small as possible, printed circuit board construction was used.[1] The board measures 2.0 x 3.6 inches; that is less than 20% of the size previously required by the NE-567 board.

Circuit Description

Refer to the schematic diagram in Fig 1. The design centers around two LSI CMOS integrated circuits, the American Microsystems S3525A band-split filter and the Mostek MK5102 DTMF decoder. Together, these devices contain an incredible amount of circuitry which permit building a high-performance DTMF decoder with a minimum of parts. A color burst TV crystal controls all of the digital timing functions; therefore, no critical, interactive adjustments are required.

An audio input signal between 50 mV and 1.0-V P-P is needed to drive the circuitry. Input Z is about 1 Megohm. When a valid digit is received for 30 ms, the data is latched onto the output lines driving the appropriate lines active high. Then the output strobe goes active high for 35 ms. Data remains latched until the next digit is received.

A jumper wire, four-station DIP switch, or digital logic signal can be used to select the format of the output signal. The choices are: ground to inhibit output; 5 V to produce 4-bit binary output; and leave floating to product dual, 2-bit, row/column output.

The circuit requires a power source capable of supplying 12.5-V dc at 40 mA. Voltage regulation is provided by a 12-V Zener diode shunt regulator and a three terminal 5-V regulator.

Adjustment

Tune up consists of a single gain adjustment. Connect the input of an oscilloscope to TP6. Apply a DTMF signal to the input and adjust trimmer R2 until a 200 mV P-P signal is achieved. Excessive gain causes a notch to appear in the decoder input channels. This can be seen by observing the signal at points A and B.

References

[1] The following are available from Proham Electronics, Inc., 7181 Industrial Park Blvd., Mentor, OH 44060-5327:
Bare board (P/N 2009) and manual $9.95;
Chip set (S3525A and MK5102) $35.00.

	4-Bit Binary				Row		Column	
Digit	D1	D2	D3	D4	D1	D2	D3	D4
1	0	0	0	1	0	1	0	1
2	0	0	1	0	0	1	1	0
3	0	0	1	1	0	1	1	1
4	0	1	0	0	1	0	0	1
5	0	1	0	1	1	0	1	0
6	0	1	1	0	1	0	1	1
7	0	1	1	1	1	1	0	1
8	1	0	0	0	1	1	1	0
9	1	0	0	1	1	1	1	1
0	1	0	1	0	0	0	1	0
*	1	0	1	1	0	0	0	1
#	1	1	0	0	0	0	1	1
A	1	1	0	1	0	1	0	0
B	1	1	1	0	1	0	0	0
C	1	1	1	1	1	1	0	0
D	0	0	0	0	0	0	0	0

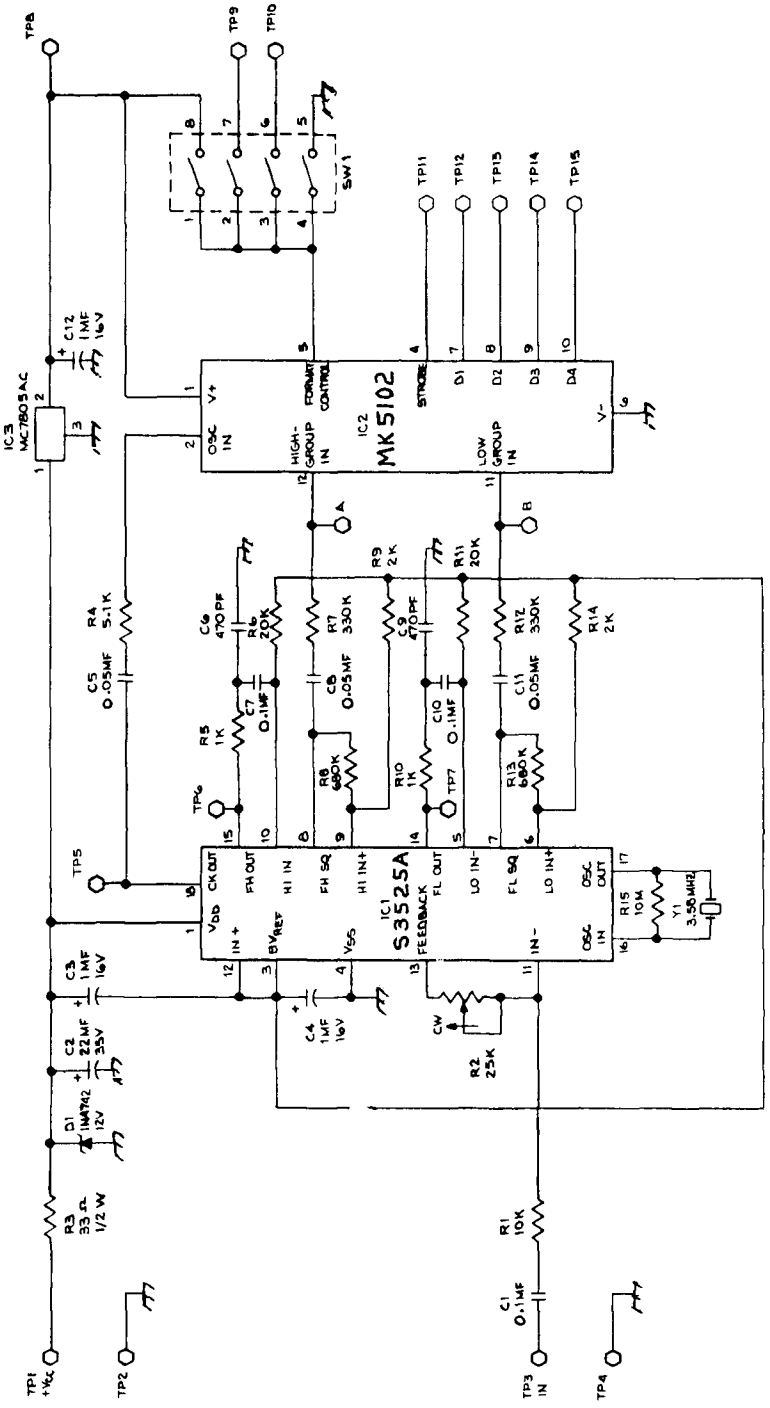

Figure 1 DTMF decoder schematic.

(continued from page 2)

in the 250-420 MHz region. We have been steadily reducing the amount of 5%, 1/4-watt, carbon composition resistors we use for several reasons:

[1] The cost of a composition resistor compared to an inexpensive carbon film unit is as much as five times greater, and climbing every day.

[2] Our purchasing people in Hong Kong tell us that the number of companies manufacturing composition units is down to a small handful (they only know of two in the Orient).

[3] We have noticed that the tolerance of 5% marked composition resistors can be as great as ±22 percent! This has caused us a small number of production problems where these resistors were used in our superregenerative receivers' bias section, resulting in widely out-of-spec quench frequencies.

[4] I have found very little difference in circuit behavior using carbon film resistors over composition units. The most marked difference is at higher (>22k) resistances. The carbon film units are repeatable and (mostly) predictable. There appears to be greater parallel capacitance in the composition units, probably relating to the packing of the carbon granules, and greater variation in behavior at high frequencies.

I would be interested in seeing someone do a more comprehensive study of the effects of composition versus film (not expensive metal film) resistors in VHF and higher frequencies. This affects most of us when we attempt to duplicate a construction article from **The ARRL 1985 Handbook** or other sources of homemade equipment. Most of Doug DeMaw's, W1FB, articles I have seen in **QST** over the years call out carbon composition resistors. Maybe the time has come to stop that once routine practice.

I am a great respector of the effects of lead inductances on the repeatability of circuits. Even though I have access to chip or leadless resistors, I sometimes hesitate to use them in duplicating a circuit that appears to depend on lead inductance or other parasitic elements for proper operation of the circuit. The answer would appear to be more widespread use of carbon film units in homemade articles because of the availability of them at Radio Shack and other over-the-counter shops. What do you think? — Dave Andrus, WB6VYN, 1186 Drifting Circle Dr., Vista, CA 92083.
