



## DTMF Transmitter/Receiver

### SIGNALS+SOFTWARE

#### Processor

Texas Instruments TMS320C5000 DSP range.



#### Background

The algorithm implemented is the DTMF signalling system. DTMF is the most common signalling method used within the telephone network, and has now largely replaced loop disconnect (“pulse”) dialling. DTMF works by employing pairs of tones to code the digits 0-9, #, \* and A to D. DTMF receivers need to correctly detect the presence of these tones, while eliminating background noise and allowing for distortions introduced by the network.

DTMF applications include reception for public or private telephone exchanges; telephony and line test equipment; remote control of computer and telephone equipment.

#### Features and Performance

- TI eXpressDSP™ Compliant software available as part of the SIGNALS+SOFTWARE RENAISSANCE range
- The transmitter software produces the required tones with a frequency tolerance of 0.1%
- The receiver software is extensively tested and passes Mitel and Belcore tests

<b>Dynamic range</b>	The receiver detects digits with 40dB dynamic range
<b>Guard time</b>	The receiver detects digits of 35ms duration and greater
<b>Signal-to-noise Ratio</b>	The receiver identifies all digits correctly at an SNR of 11dB and better
<b>Mitel talk-off test (CM7291)</b>	1 false digit detected during this test. The pass level is 30
<b>Bellcore talk-off test</b>	A maximum of 30 false digits detected during this test. The pass level is 333
<b>Frequency offset</b>	The receiver detects digits with ± 1.5% offset
<b>Twist</b>	The receiver detects digits with 8dB normal twist, and 4dB reverse twist

Table 1 : DTMF Performance

DTMF	Program Memory		Data Memory			Interrupt Latency (Cycles)	Typical call Period (ms)	Processing Load (MHz)
	Code (Kbytes)	Tables (Kbytes)	Static Memory		Stack Memory (Kbytes)			
			Heap (Kbytes)	Tables (Kbytes)				
TX	0.86	0.03	n * 0.04	0.12	0.05	50	20	n * 0.26
RX	1.33	0.03	n * 0.07	0.12	0.08	16	20	n * 0.70

Table 2 : DSP Requirements for DTMF

**Note:** All performance tests completed for 16\*100 digits.  
Processing loads quote worst-case scenarios and n represents the number of channels.

#### Interface Details

The DTMF eXpressDSP™ software uses an interface defined by SIGNALS+SOFTWARE that is similar to the other interfaces specified by Texas Instruments in the eXpressDSP™ developers’ kit.

The software is also available in a non-eXpressDSP version with a basic multi-channel interface. The specified DSP requirements for this version is similar to those given in Table 2.

### Availability

The code is available now for a one-off payment and/or royalties depending on the commercial application.

Software for the TMS320C5000 is available for a full range of vocoders, echo-cancellers and for other communication algorithms. DTMF is available for the TMS320C6000. **SIGNALS+SOFTWARE** also has experience of MF signalling systems.

### SIGNALS+SOFTWARE

**SIGNALS+SOFTWARE** was founded in 1992 as a developer of high quality Digital Signal Processing application software for the communications industry. Supplying to a whole range of customers, including large blue chip corporations, **SIGNALS+SOFTWARE** has quickly established itself as the world leader in DSP software design and production.

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