



Processor

Motorola StarCore™ MSC8101 DSP.

Background

SIGNALS+SOFTWARE are developing a complete suite of communication software for the Motorola MSC8100 family of DSPs. The initial development platform, the MSC8101, utilizes the StarCore™ 140 four ALU (Algorithmic Logic Unit) DSP core. This device also has 512kb memory and a Communications Processor Module (CPM) making it a versatile device for communication applications.

The algorithm implemented is the Dual Tone Multi-Frequency (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 encode 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. The Mitel and Belcore talkoff test tapes exist to verify the performance of DTMF receivers.

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

- The transmitter software produces the required tones with a frequency tolerance of $\pm 0.1\%$
- The receiver software has been extensively tested with all Mitel and Belcore tests

Dynamic range	In excess of 40dB from full scale (0dB)
Guard time	The receiver detects digits of 35ms duration and greater
Signal-to-noise Ratio	The receiver identifies all digits correctly at an SNR of 10dB
Mitel talk-off test (CM7291)	1 false digit detected during this test. The pass level is 30.
Frequency offset	The receiver passes all frequency offset tests
Twist	The receiver passes all 8 twist tests, with average attenuation at cut-off of 9.8dB for normal twist, and 4.2dB for reverse twist

Table 1 : DTMF Performance

DTMF	Program Memory (Kbytes)	Tables (Kbytes)	Stack (Kbytes)	Data Memory (Kbytes)	Processing Load (MHz)
Transmitter	0.76	0.13	0.16	n * 0.03	n * 0.09
Receiver	2.19	0.07	0.27	n * 0.06	n * 0.58

Table 2 : DSP Requirements for DTMF

Note: Processing loads quote worst-case scenarios and n represents the number of channels. Program memory table values are initialisation values. Kbytes equals 1024 bytes.

Technical Notes

The receiver code is highly configurable for a particular application. Output decisions are to be held in buffers of user-selectable size, allowing infrequent polling for results by the host.

The code consists of an initialisation routine, which is normally called upon DSP reset, and by a single subroutine, which is called once for each channel. The audio input/output format is 8kHz linear samples. Additional code may then be required to interface to the host platform, for example to extract data from a serial link.

Interface Details

For convenience the individual software functions are supplied as a single library module. The library contains all the object code that is required to link in to a user's top-level application code. The audio functions are either callable as C functions or as assembly functions.

Availability

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

Also available for StarCore™ are a full range of vocoders, echo cancellers and other communication algorithms.

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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