Analysis of Microchip's PIC32 library

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In April Microchip Technology announced a "high-performance" software library of common DSP functions for its 32-bit microcontroller family, the PIC32. This library replaces Microchip's earlier DSP library for the PIC32, which was quietly released last October. The library includes 16- and 32-bit vector math routines, 16-bit filters, and 16- and 32-bit FFTs. Library components are implemented as C-callable assembly and are free of charge; support for the new functions has been added to the MPLAB C compiler for the chip.

The main difference between the older and newer libraries is the FFT. According to Microchip, an 80 MHz PIC32 chip can execute a 256-point, 16-bit radix-2 FFT in 283 microseconds, which Microchip says is approximately 22% faster than the version in its previous PIC32 DSP Library. The improvement is due to additional assembly-level optimizations.

As BDTI discussed in an earlier article, the PIC32 family is based on the MIPS 4K core; it is the first Microchip MCU to use this core (earlier Microchip MCUs are based on Microchip-proprietary cores). PIC32 chips execute at up to 80 MHz and cost about $3.00-5.00 in 10K quantities. (BDTI has also published a white paper on the DSP capabilities of the MIPS 4K core and how it compares to the ARM Cortex-M3.)

The announcement follows close on the heels of ST Microelectronics' announcement late last year of a DSP library for its STM32 microcontroller, which is based on the Cortex-M3 core. The STM32 operates at a similar top clock speed of up to 72 MHz.

As shown in the Table below, however, the two libraries encompass different functions. For example, Microchip offers a range of 32-bit algorithms, such as a 32-bit FFT—ST doesn't. And ST offers a PID controller, which is a somewhat higher-level component than the building-block functions that comprise the bulk of both libraries. ST includes a Speex speech codec in its library; Microchip also offers Speex for the PIC32, but it's part of a separate audio library that includes ADPCM and WAV software components.
Microchip is well-known for its popular 8-bit MCUs but is relatively new to the growing 32-bit microcontroller space. Having chosen to go with the MIPS core, the company is now competing with ARM-based chips and the juggernaut of the ARM ecosystem. Offering optimized DSP libraries for the PIC32 is a good strategy since even relatively low-cost, low-performance CPUs are often called upon to perform signal processing functions. And as DSP has become ubiquitous in embedded applications, off-the-shelf DSP software components are becoming de rigeur for even low-end embedded processors.

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