

Efficient audio processing coming to low cost Microcontrollers!

Audio is increasingly becoming a mandatory feature in every range of consumer appliances seen off late. Audio centric features like voice instructions, compressed music playback provide for an enhanced user interaction. Such features are now expected in every application segment, even in the low cost applications based on microcontrollers without DSPs. The solution for **low cost**, efficient **audio processing** lies in the upcoming **microcontrollers** based on ARM Cortex-M4.

With the arrival of digital audio and the success of compressed music with innovative ways of enabling these functionalities, speech and audio processing has dramatically changed in the last decade. However, in the embedded world, most of such intensive audio processing is typically done on DSP kind of devices, as they can provide both the capability and the level of power required. Those days are now gone, with future microcontrollers being as capable of processing audio as their DSP counterparts.

“With the launch of ARM Cortex-M4 processor, intensive audio processing can be efficiently implemented on the microcontrollers without DSPs. This enables power efficient audio centric features even on low cost microcontroller based applications.”

Processing of audio on DSPs inherently limits the least achievable power and price. Several companies have been working to get the similar kind of performance and listening experience as achieved in DSPs from more general purpose kind of chips, ARM being a strong candidate in that space. With the launch of the Cortex-M4 core, intensive audio processing is really made possible on microcontrollers alone. Have a look at the interesting numbers evaluated on audio solution from Ittiam Systems.

ITTIAM Audio Solution		ARM Cortex-M4	
		Percentage Load	Memory (kB)
Audio Decoders	MP3 Decode	6%	36
	WMA Decode		67
Post Processing	Equalizer	4%	18
	Stereo Widening		24

Resource utilization of audio components on Cortex-M4 processor

The percentage loading on Cortex-M4, assuming it is clocked at 150 MHz, and the combined program and data memory requirements are presented. Thanks to its architecture including the single cycle 32-bit MAC unit, DSP instructions with Single Instruction Multiple Data (SIMD), saturation arithmetic, Thumb-2 enabling 32-bit performance at 16-bit code density, an optional floating point unit (FPU) amongst other features, the **Cortex-M4** has all the **essential DSP features** to enable **efficient audio processing**.

With all these attributes, Cortex-M4 presents an ideal solution in many ways, by enabling *easier development*, a *simpler hardware design* as well as a *lower bill of material cost* when compared over DSPs. To add to this, such implementation intrinsically *consumes less power* than many other DSP-based audio solutions.

Cortex-M4 powered devices are coming soon and promise exciting new innovations in the microcontroller segment by enabling **low cost, energy efficient audio processing** while providing an **enhanced user experience**.

Guest Partner Blog:



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Pradeep is a Senior Engineer in the Media Processing group at Ittiam Systems, headquartered at Bangalore. He works on the implementation of audio compression standards on various ARM processors, including Cortex-M3 & the latest Cortex-M4 cores, apart from design of audio post processing algorithms. He holds a bachelor degree from National Institute of Technology, Trichy, India. He is a member of IEEE.

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