

Realtek Semiconductor Cuts Development Time by 50% and Takes the Lead in New-Generation HDA Codecs

To claim a top market position in the competitive semiconductor industry, companies continually seek to shrink their research and development time to launch new chips that meet emerging standards.

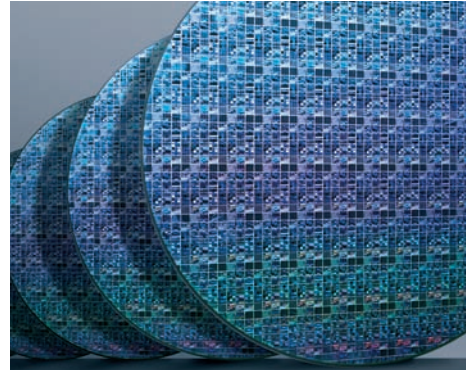
Realtek Semiconductor Corporation of Taiwan has improved their analog and digital signal processing (DSP) design flow by incorporating MathWorks tools for Model-Based Design into their design environment. This approach enabled the company to reduce development time in designing their ALC880 High-Definition Audio (HDA) codec, which complies fully with Intel audio codec standards.

The early release and high quality of the ALC880 helped Realtek, already the leading provider of Ethernet integrated circuits, to capture a 60% share of the global PC audio codec (compression/decompression) market.

THE CHALLENGE

Designers of audio codec algorithms must perform complex, large-scale computations. They must also satisfy the global demand for lighter, smaller, and more portable designs in consumer electronic products such as PDAs, laptops, and mobile phones. This means creating designs that maximize system performance while minimizing chip size.

In the past, Realtek engineers had used C code or SPICE for product development, but they found these approaches to be time-consuming, incapable of guaranteeing the quality of their design, and problematic for system testing and verification. Realtek engineers needed design tools with powerful mathematical computation and analysis capabilities. They also needed a development environment that would enable their R&D teams to work together and share their designs.



THE SOLUTION

Realtek used MATLAB®, Simulink®, and companion toolboxes and blocksets throughout the design process for the ALC880, which involved system analysis and numerical computation, Verilog simulation and cosimulation, and hardware implementation. “The powerful computing engine and the user-friendly interface provided by MATLAB and Simulink simplified the design process,” says Chang Jong-Ming, analog IC design engineer at Realtek. “MATLAB helped me design and implement my work easily, and significantly reduced our design cycle time.”

The analog engineers used MATLAB functions with Signal Processing Toolbox and Optimization Toolbox to transfer the product concept into a workable model.

The DSP engineers relied on MATLAB and Simulink to accelerate the design process. “With traditional C code or other hand-coding design methods, we would have dedicated a lot of time and effort to dealing with coding problems,” says Chang Yi-Shu, digital IC design manager. “The MATLAB language and built-in functions met all our needs, enabling us to concentrate on product development rather than on hand coding. Simulink enabled us to see simulation results

THE CHALLENGE

To reduce research and development time in delivering chips to market quickly

THE SOLUTION

Standardize on MathWorks tools to streamline the design process and enable analog and DSP designers to work together

THE RESULTS

- 60% global market share and high ROI
- Smaller chip size
- Improved collaboration and reduced design time



MATLAB and Simulink helped us break through every critical issue and complete the tasks before the projected deadlines. Our new streamlined design process ensures our leadership position in a highly competitive market.



Ku Shih-Yu,

Realtek Semiconductor Corporation

within a short period of time, allowing us to make fast and low-cost design changes.”

Before hardware implementation, Realtek’s engineers needed to convert the model into Verilog. Using Signal Processing Blockset and Simulink Fixed Point, they fine-tuned the Verilog model by cross-referencing the original MATLAB M-file and algorithm. They could then detect errors more efficiently.

Simulink helped them generate a Verilog model that was virtually identical to the original product concept. In the cosimulation stage, Realtek used Simulink to dynamically simulate the model. They then used Signal Processing Blockset and Simulink Fixed Point to accelerate the processing of complex analog/digital signals.

Optimization Toolbox helped them to further enhance the effectiveness of the product, which led to increased performance in a smaller chip, and greatly reduced production costs.

After iterative analysis, simulation, and verification, the system code was ready for hardware implementation. In early 2004, the team designed and launched the ALC880, the first HD audio codec in the world, in fewer than 18 months—well ahead of the planned launch timeframe. In 2006, with Model-Based Design engrained in their culture, Realtek launched a full range of third-generation audio chips, including the ALC885, which rivals home cinema chips, with a signal-to-noise ratio reaching 106dB; the award-winning ALC888T, which embraces high-level audio, VoIP, and traditional telephone networks; and the ALC262, which provides notebook computers with the best audio quality.

THE RESULTS

■ 60% market share and high ROI.

As a result of getting to market first with a quality product, Realtek acquired more than a 60% share in the global audio codec market. By replacing their design tools with MATLAB and Simulink, Realtek used their R&D resources more efficiently and reaped economic and business benefits sooner and at a lower cost.

■ Smaller chip size.

“Optimization Toolbox is extremely complete and enables us to establish numerous constraints and to effectively reduce chip size,” says Chang Yi-Shu, digital IC design manager.

■ Improved collaboration and reduced design time.

The development projects involved strong teamwork between two major R&D departments. “The intuitive graphical user interface and integrated design environment provided by MATLAB and Simulink played vital roles throughout the project,” says Wang Wen-Chi, Analog IC Design Department assistant manager. “With a shared design environment, engineers could easily understand each other’s work and quickly integrate design diagrams.”

To learn more about Realtek, visit

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APPLICATION AREAS

- Communications
- Electronics
- Semiconductor
- Signal processing

PRODUCTS USED

- MATLAB
- Simulink
- Optimization Toolbox
- Signal Processing Blockset
- Signal Processing Toolbox
- Simulink Fixed-Point

www.mathworks.com