ADVANCED MEDICAL IMAGING WITH 2ND GENERATION AMD VERSAL™ ADAPTIVE SOCS

A step function increase in processing performance for demanding diagnostic medical applications. Next-generation AI Engines accelerate beamforming, image processing, and AI.

together we advance_

OVERVIEW

Diagnostic medical imaging equipment must be able to produce high-quality images, achieve the required scan depth, and display real-time results. The optimal System-on-Chip (SoC) used in this equipment must deliver the desired application performance, target frame rates, and display results in real-time. This SoC must also have the right combination of the type, speed, and number of high-speed interfaces. Going forward, much of this equipment will also need to support execution and acceleration of AI functions like Region-of-Interest (ROI) selection, image classification, and other AI tasks.

The second-generation of Versal[™] adaptive SoCs comes with a processing system that offers up to 10X more scalar compute performance than the previous generation¹ and supports DDR5 memory. The new AI Engines in the Versal AI Edge Series Gen 2 offer up to 3X TOPS/watt over the previous generation.² They are ideal for the execution of advanced beamforming algorithms, image reconstruction, and other high-performance functions. Next-generation connectivity like PCIe[®] Gen5, 32G high-speed transceivers, 10 GbE, and USB 3.2 allow high-speed data movement both for signal acquisition and for efficient data movement.

HIGHLIGHTS

UP TO 10X SCALAR COMPUTE WITH NEXT-GENERATION PROCESSOR SYSTEM¹

- 8-core Arm[®] Cortex[®]-A78AE up to 200k DMIPs
- 10-core Arm Cortex-R52 up to 23k DMIPs
- DDR5 memory support up to 5600-DDR5, 8533-LPDDR5X with ECC

NEXT-GENERATION HIGH-PERFORMANCE AI ENGINES

- Up to to 3X TOPS/watt vs. previous generation²
- Adds support for MX6, MX9, FP8, and FP16 datatypes
- Leverages increased DDR bandwidth for higher performance on neural network inference and signal processing workloads

INTEGRATED VIDEO PROCESSING

- Image signal processors (ISP)
- Video codec unit (VCU) for 4k60 HEVC/AVC³
- Graphics processing unit (GPU) with up to 256 GFLOPs

HIGH-SPEED CONNECTIVITY

- 32G high-speed transceivers
- Dedicated high-speed interfaces for USB 3.2, 10 GbE, PCIe Gen5, NVMe, UFS, and HSM (no FPGA soft IP needed)

KEY BENEFITS

- Single-chip integration of heterogeneous processing enables reduction of system-level power
- Leverage AI Engines to accelerate complex neural networks, like regionof-interest selection for detecting critical ailments
- Combine DSP blocks and Al Engines to solve major digital signal processing challenges like 2D-FFT in MR, back projection in CT, and advanced beamforming for ultrasound
- Leverage AMD Vitis[™] unified software platform to quickly develop custom algorithms using C, C++, or Python[™]
- Deploy MATLAB[®] algorithms by using Vitis Model Composer and Simulink[®]

TARGET APPLICATIONS

MEDICAL ULTRASOUND

Diagnostic medical cart ultrasound systems are widely used for general imaging and OBGYN, and they are quickly expanding to cardiac and radiology functions. The challenging requirements for 3D-4D visualization, beamforming images with high-quality image output, real-time signal processing, ROI, and IR using AI are taxing the compute in commercial scanners.

The Versal AI Edge Series Gen 2 with its heterogeneous architecture of Arm[®] multiprocessors, SIMD-VLIW-based AI Engines, programmable logic, and high-speed interfaces is ideal for medical ultrasound. The device meets the requirements for image quality, frame-rates, multi-dimensional visualization, and AI processing in advanced premium radiology and cardiac imaging ultrasound systems.

CT SCANNERS AND MRI

CT scanners and MRI are large, highly synchronous medical diagnostic machines used to see details of human tissues, organs, and skeletal structures. They also identify abnormal tissues. They have fundamental differences (CT uses X-rays and MRI uses radio waves), but both technologies require significant computation capabilities and need to move enormous amount of data across their various subsystems.

The heterogeneous compute capabilities available on the 2nd generation Versal adaptive SoCs can accelerate image reconstruction algorithms, 2D-FFT functions on MRIs, and back-projection for CTs. Additionally, smaller 2nd generation Versal devices can perform functions like data acquisition and gantry control, inverter control in gradient amplifiers, signal processing in RF receive, and transmit using the PL.

ENDOSCOPY SYSTEMS

The video processing pipeline requirements in the camera control unit of a diagnostic GI endoscopy and some surgical endoscopy systems are rapidly increasing. In premium and high-end systems, the camera sensor resolution quickly grew from $2K \rightarrow 4K$ and now rapid adoption is happening for 4K 3D and even 8K. Integration of AI-ML inference for diagnostic assistance is making the system requirements far more complex. Low-latency or even real-time preprocessing of such a complex video pipeline requires the type of heterogeneous architecture offered in the 2nd generation Versal portfolio.

NEXT STEPS

- To learn more about AMD Versal AI Edge Series Gen 2, visit www.amd.com/versal-ai-edge-gen2
- To learn more about AMD Versal Prime Series Gen 2, visit www.amd.com/versal-prime-gen2
- Visit the AMD Healthcare page at www.amd.com/healthcare

FOOTNOTES

- Based on AMD internal pre-silicon performance estimates for combined total DMIPs of the Versal AI Edge Series Gen 2 and Versal Prime Series Gen 2 processing system when configured with 8 Arm Cortex-A78AE applications cores: @2.2 GHz and 10 Arm Cortex-R52 real-time cores @1.05 GHz, compared to the published combined total DMIPs of the processing system in the first-generation Versal AI Edge Series and Versal Prime Series. Versal AI Edge Series Gen 2 and Prime Series Gen 2 operating conditions: Highest available speed grade, 0.88V PS operating voltage, split-mode operation, maximum supported operating frequency. Actual DMIPs performance will vary when final products are released in market. (VER-027)
- Based on AMD internal performance and power projections for the AIE-ML v2 compute tile architecture in the Versal AI Edge Series Gen 2 using the MX6 data type, compared to performance specifications and AMD Power Design Manager power results for the AIE-ML compute tile architecture featured in the first-generation Versal AI Edge Series using INT8 data type. Assumptions: 2 row, 8 column sub-arrays. Operating conditions: 1 GHz F_{MAX}, 0.7V AIE operating voltage, 100°C junction temperature, typical process, 60% vector load, % activations = 0 < 10%. Actual performance will vary when final products are released in market. Performance projections as of March 2024. (VER-023)
- Video codec acceleration (including at least the HEVC (H.265), H.264, VP9, and AV1 codecs) is subject to and not operable without inclusion/installation of compatible media players. (GD-176)

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