Designers of medical imaging systems play an invaluable role in improving healthcare, leveraging every available technology advantage to ensure that medical practitioners can assess patients’ medical imagery with the highest possible resolution and accuracy. From diagnostic imaging to imaging-assisted medical procedures, the ability to maximize visual clarity and fidelity is vitally important.

Simultaneously, designers are under increasing pressure to expand advanced visualization features to lower-end products while reducing overall system costs throughout their portfolios. Design agility is another key consideration, particularly for designers migrating to software-defined architectures that support sophisticated, next-generation product features.

**AMD Products for Medical Imaging Solutions**

- **AMD Embedded SoCs**
  - AMD Embedded G-Series SoCs optimized for low power and portable devices
  - AMD Ryzen™ Embedded R-Series and AMD Embedded R-Series SoCs optimized for performance and power efficiency
  - AMD Ryzen™ Embedded V-Series SoCs optimized for ultra-high performance

- **AMD EPYC™ Processors**
  - AMD EPYC™ 7000 Series processors for breakthrough CPU performance

- **AMD Discrete Graphics**
  - AMD Embedded Radeon™ graphics
  - AMD Radeon™ Pro graphics for enhanced graphics and compute

**Key Medical Imaging Applications:**

- Ultrasound systems
- Endoscopes
- X-ray and CT equipment
- MRI machines

**Additional Medical Imaging Applications:**

- Medical Monitors
- Patient Monitoring systems
- Anesthesia systems
- Bedside terminals

**Application Brief: Medical Imaging**

High-Performance Solutions Deliver Superior Performance, Visualization, and Design Versatility for Medical Imaging Applications

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Simultaneously, designers are under increasing pressure to expand advanced visualization features to lower-end products while reducing overall system costs throughout their portfolios. Design agility is another key consideration, particularly for designers migrating to software-defined architectures that support sophisticated, next-generation product features.
The AMD Embedded G-Series and AMD Embedded R-Series are ideal for small form factor applications with exacting power efficiency requirements, enabling portable yet advanced medical imaging capabilities for clinicians and medical emergency response teams. The exceptional compute performance of AMD Ryzen™ Embedded R-Series and AMD Ryzen™ Embedded V-Series SoCs can deliver high image transformation speeds, and helps reconstruct images from sparse data. This can make low-dose X-ray imaging feasible, an attractive option for those medical practitioners and patients concerned with the possibility of increased cancer risk associated with exposure to certain types of radiation. AMD Ryzen™ Embedded V-Series SoCs and AMD Embedded Radeon™ GPUs can enable high resolution, multi-display visualization, thereby helping increase efficiency and reduce the fatigue of surgical staff using imaging-assisted systems.

The Benefits of GPU Acceleration:

All of the medical imaging application modalities highlighted above involve image reconstruction from sound, radio, or X-ray waves. Figure 1 on the following page shows a typical ultrasound imaging pipeline, and the large amount of signal and image processing that’s required. Much of this processing is parallelizable and therefore well suited for GPU acceleration. The combination of GPU and CPU can be an ideal fit to process such a pipeline. Even though this pipeline is representative of an ultrasound device, the underlying principles are applicable to other modalities as well. Endoscope, CT, MRI, and X-ray imaging all contain similar levels of signal and image processing, thus making GPU compute an ideal fit for medical imaging applications.

Cost Effective and High Performance

GPU compute – which can address both the need for increased processing power and the need for system cost reduction – can enable dramatic evolutions in algorithm complexity and image quality. GPU processing, using either the GPU onboard an AMD Embedded SOC or a discrete AMD Embedded Radeon™ GPU paired with an AMD EPYC™ 7000 processor, can significantly impact performance of image processing algorithms relative to CPU-only processing. This increased performance can translate to improved image fidelity, enhanced accuracy, and ultimately more accurate diagnoses for patients. GPU compute can help medical equipment manufacturers deliver superior performance at cost-effective price points and achieve solid return on investment.
**Design Agility for Software-Defined Solutions**

Medical equipment designers are increasingly interested in migrating to a software-defined architecture. Figure 2 and Figure 3 below show how customers can implement software beamforming using Direct GPU Memory Access (dGMA) technology from AMD combined with GPU compute. dGMA technology can enable external acquisition devices to transfer data to GPU memory at more than 10 GB/s, and the GPU can process this data without intervention from the CPU. This capability allows a system to collect data from ultrasound transducers in parallel, transfer this data to GPU memory, and use GPU compute to coherently combine the data to generate an image. GPU compute can enable plane wave imaging and the combining of data in the frequency domain, typically yielding better image quality. Technology advancements such as software beamforming are poised to trigger the next level of innovation in the medical equipment industry, and AMD Embedded processing solutions can accelerate customers’ transition through this inflection point.

AMD provides software development kits and tools to help OEMs make the transition to software-defined architecture and free them from a single vendor solution. OpenCL™ – the royalty-free open standard for parallel processing software development – can help to reduce system costs through compatibility with CPUs, GPUs, and some DSPs and FPGAs from a variety of vendors. OpenCL compatibility across AMD Embedded G-Series, AMD Embedded R-Series, and Ryzen™ Embedded V-Series SoC and AMD Embedded Radeon™ discrete graphics platforms enables software-defined solutions that can leverage a single code base to scale across a portfolio of products, which can help reduce software development costs.
For more information about the specific features and specifications supported by select products in AMD’s solution portfolio, or to learn more about AMD’s medical imaging solutions, visit [www.amd.com/medicalimaging](http://www.amd.com/medicalimaging)