

# XQR Versal™ for Space 2.0 Applications

## SPACE-GRADE VERSAL ACAP

The Space-Grade (XQR) Versal device is a continuation of AMD's full radiation tolerant, ultra-high throughput, machine learning capable and bandwidth performance offering of reconfigurable devices for satellite and space applications. Built on the Versal platform, this family includes the industry's first Adaptable Compute Acceleration Platform (ACAP) devices with flexible and dynamically reconfigurable high-performance AI/ML compute engines, DSP engines, programmable logic, 26 Gb/s transceivers, dual-core Arm® Cortex-A72 and dual-core Arm Cortex-R5 embedded processors.

The XQR Versal is targeted for on board processing payload applications with a dramatic increase in compute density for vector-based algorithms, system logic cells, on-board SRAM and multi-gigabit transceivers as compared to previous space devices. The devices offer a processing sub-system, hard-wired peripherals and a platform controller facilitating true unlimited on-orbit reconfiguration and SEU mitigation.

Building on AMD's space heritage and highly successful 20nm and 65nm space-grade devices, the launch of the next generation of space devices advances the space industry by multiple process node generations setting a new benchmark for reconfigurable solutions in space.

## 7nm Adaptable SoC for Space Applications

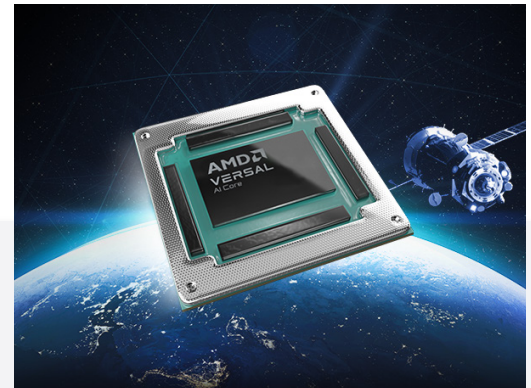
- > Versal AI Core and AI Edge family members with Scalar, Intelligent and Adaptable Engines (ARM CPUs, AI Engines & Programmable Logic)
- > Innovative silicon design for SEU mitigation
- > SEL and TID characteristics suitable for many space environments
- > True on-orbit reconfiguration with unlimited programming cycles

## Ruggedized Organic Packaging

- > Lidless, ruggedized package with stiffener ring for added thermal mitigation capabilities
- > Footprint compatible with commercial packages
- > AI Core 45mm x 45mm, AI Edge 23mm x 23mm

## Production Space Test Flow

- > Class B screening flow for organic substrates derived from Mil Prf 38535
- > Designed for Space 2.0 Applications - up to 7 Year Mission Duration



## AMD IN SPACE 2.0 APPLICATIONS

- > ML/AI
- > Cloud & Object Detection
- > Broadband Internet
- > High-Speed Networks
- > Hyperspectral Imaging
- > Synthetic Aperture Radar
- > GPS / GNSS
- > Instrumentation

## KEY TAKEAWAYS

- > Industry's first 7nm Radiation Tolerant Adaptive SoC targeted for Broadband and Constellation Satellite Applications
- > True unlimited on-orbit reconfiguration to enable "Upgrade-on-the-Fly" capability
- > No external scrubber required. XiSEM meets LEO SEU mitigation requirements
- > Complete solution to "process and analyze" for real-time on-board processing needs including machine learning and artificial intelligence

## SCALAR ENGINES

The Scalar Engines are built from the dual-core Arm® Cortex-A72, providing a 2X increase in per-core single-threaded performance compared to AMD's previous-generation Arm Cortex-A53 core. A combination of advanced architecture and power improvements from the 7nm FinFET process yield a 2X improvement in DMIPs/watt over the earlier 16nm implementation. The ASIL-C certified(1) UltraScale+™ Cortex-R5F Scalar Engines migrate forward to 7nm with additional system-level safety features based on learning from Xilinx's current automotive volume deployments.

## ADAPTABLE ENGINES

The Adaptable Engines are made up of programmable logic and memory cells connected with the next generation of the industry's fastest programmable logic. In addition to supporting legacy designs, these structures can be reprogrammed to form memory hierarchies customized to a particular compute task. This allows AMD's Intelligent Engines to achieve a much higher cycle efficiency and a much higher memory bandwidth per unit compute than the latest GPUs and CPUs. This is key to optimizing for latency and power at the edge and for optimizing for absolute performance in the core.

## ADAPTIVE INTELLIGENT ENGINES

The Adaptive Intelligent Engines are an array of innovative very long instruction word (VLIW) and single instruction, multiple data (SIMD) processing engines and memories, all interconnected with 100s of terabits per second of interconnect and memory bandwidth. These permit 5X–10X performance improvement for machine learning and digital signal processing (DSP) applications.

The XQR Versal AI Core device includes the first generation AI Engines, optimized for complex matrix multiplications, as required in signal processing applications such as beamforming. The XQR Versal AI Edge device offers the second generation AI Engine ML tiles, providing enhanced support for data types commonly used in neural network applications, along with increased local memory resources

		XQRVC1902-1MSBVSRA2197 (AI CORE)	XQRVE2302-1MSBSSRA784 (AI EDGE)
Intelligent Engines	AI Engine Tiles	400 (AIE)	34 (AIE-ML)
	AI Engine Data Memory (Mb)	100	17
	AIE-ML Shared Memory (Mb)	-	68
	DSP Engines	1,968	464
Adaptable Engines	System Logic Cells (K)	1,968	329
	LUTs	899,840	150,272
	NoC Master/NoC Slave Ports	28	5
	Distributed RAM (Mb)	27	4.6
Memory	Total Block RAM (Mb)	34	5.4
	UltraRAM (Mb)	130	43.6
	Accelerator RAM (Mb)	-	32
	Total PL Memory (Mb)	191	86
	DDR Memory Controllers	4	1
	DDR Bus Width	256	64
Scalar Engines	Application Processing Unit	Dual-core Arm® Cortex®-A72, 48KB/32KB L1 Cache w/ECC 1 MB L2 Cache w/ECC	
	Real-time Processing Unit	Dual-core Arm Cortex-R5F, 32KB/32KB L1 Cache, and 256KB TCM w/ECC	
	Memory	256KB On-Chip Memory w/ECC	
	Gigabit Transceivers	Ethernet (x2); UART (x2); CAN-FD (x2) USB 2.0 (x1); SPI (x2); I2C (x2)	
Serial Transceivers	Gigabit Transceivers	44 GTY (26.5625 Gb/s)	8 GTYP (26.5625 Gb/s)
Integrated Protocol IP	CCIX & PCIe® w/DMA (CPM)	1 x Gen4x8, CCIX	-
	PCI Express	4 x Gen4x8	1 x Gen4x8
	Multirate Ethernet MAC	4	1
Platform Management Controller	Platform Management Controller	Boot, Security, Safety, Monitoring, High-Speed Debug, SEU Mitigation (XIISEM)	
Ruggedized Package	Organic BGA, Sn-Pb Solder Balls	VSRA2197, 45mm x 45mm, 0.92mm pitch	SSRA784, 23mm x 23mm, 0.8mm pitch
I/O	I/O	648 XPIO, 44 HDIO, 78 MIO, 44 GTY	216 XPIO, 22 HDIO, 78 MIO, 8 GTYP

## TAKE THE NEXT STEPS

Check out all Space-grade offerings from AMD on the web  
[www.xilinx.com/applications/aerospace-and-defense/space](http://www.xilinx.com/applications/aerospace-and-defense/space)

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