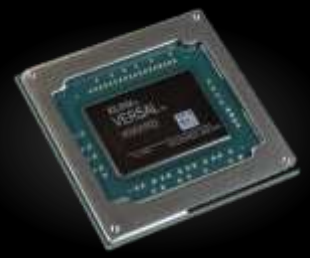
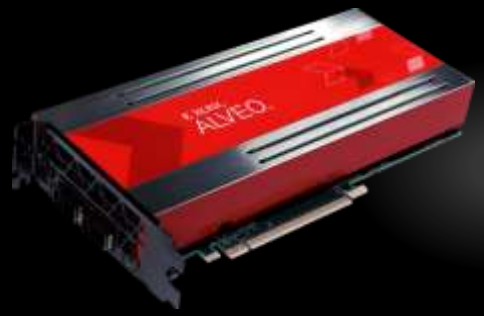
Expanding KRIA SOM family…

AMD Kria™ K24 SOM and KD240 Drives Starter Kit Product Overview

AMD
together we advance_

Expanding Our Portfolio with System-on-Modules

Devices	Accelerator Cards	System-On-Modules
		
FPGAs, Adaptive SoCs	x86 Applications	Embedded Applications

A Wide Range of Deployment Methods

ANIMATED

Developing and Deploying with a SOM

What is a SOM

Small form factor embedded PCB at the heart of the system (processor, DDR, peripherals)

Abstracts the Hardware

Design at the board-level instead of the chip-level

Production-Ready

Plugs directly into end product for production deployment

Typical SOM Users

Why SW and HW Users Choose SOMs?

SOFTWARE DEVELOPER

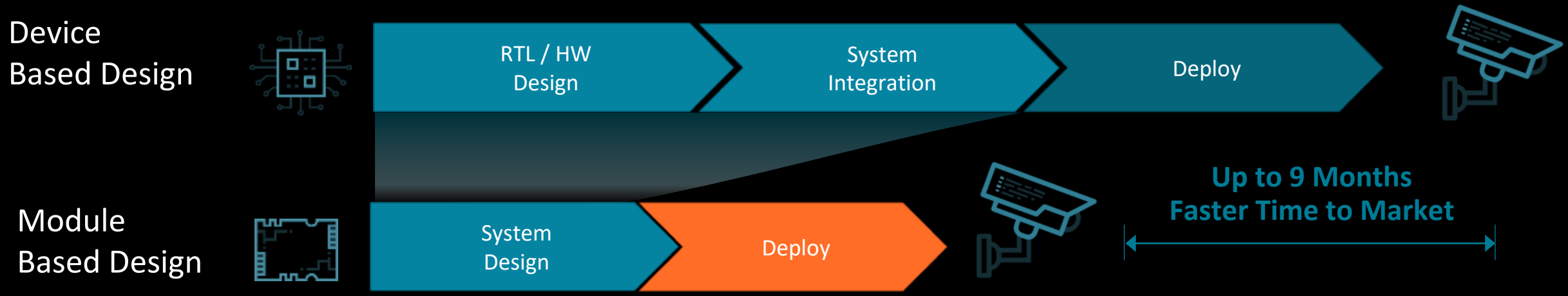
- **Edge-based Production Hardware**
  GPUs & PCs not suited for edge
- **Enable Immediate Development**
  AI & application SW development can be decoupled from in-house hardware availability

HARDWARE DEVELOPER

- **Faster Time to Market**
  Up to 9 months savings vs. pure chip-down
- **Focus Resources on Value Add**
  HW Developer resources are a precious commodity

Accelerating & Simplifying Design Cycle & *Productization*

SOM Advantages over Chip-Down Design



- Reduce development time by designing at higher abstraction
- Lower BOM cost
- Simplified inventory management
- Turnkey longevity and product life cycle management

Faster Productization for High Volume Deployment

Introducing the AMD Kria™ K26 SOM

Pre-Built HW Acceleration

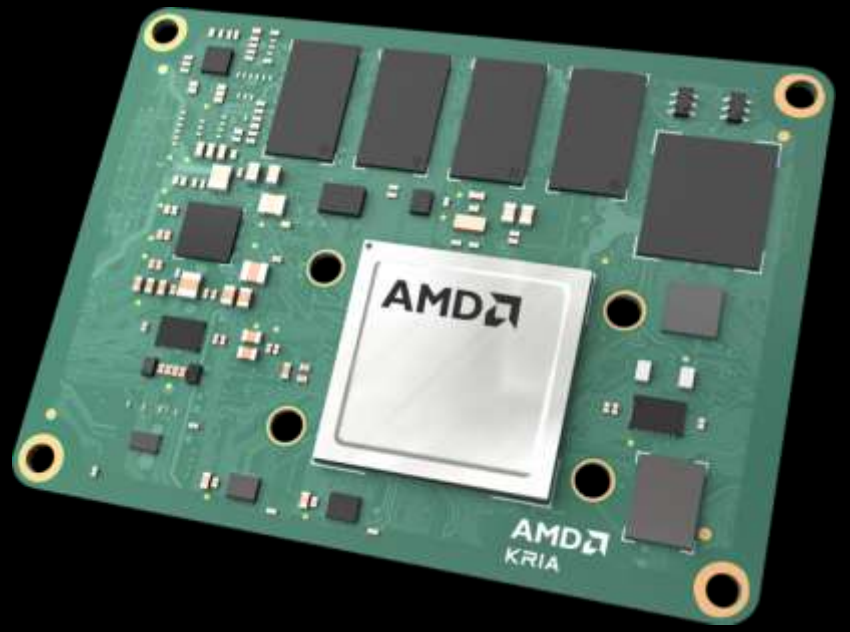
- Application designs included for common AI functions
- ‘Out-of-the-box’ ready for SW developers

3X Performance[1]

- AI at half the power with low latency
- Accelerates the whole application from AI to control

Future Proof

- Adaptable to changing AI and sensor requirements
- Ruggedized for industrial life cycles
- Path from concept to production to design revisions



Embedded Design Simplicity with System Flexibility

1: AMD Benchmarks vs. Jetson Nano published data (https://www.nvidia.com/en-us/autonomous-machines/embedded-systems/jetson-nano/)

K26 Adaptive SoM for Deployment in the Factory

Based on the Zynq™ UltraScale+™ MPSoC Architecture

77 x 60 x 11mm

ADAPTIVE SoC

Arm®
A53 Quad-Core
R5F Dual-Core

Native ROS 2
Humble Hawksbill
Ubuntu 22.04

256K
System Logic Cells for
Custom Acceleration

4K60p
H.264/265
Video Codec

INTERFACES

245 I/O
Flexible for
Multiple

15 Cameras
Mix of SLVS-EC,
MIPI, sub-LVDS

TSN-Enabled
4x 10G Ethernet, Support
for Converged Traffic

4x USB
Mix of USB
3.0 and 2.0

4GB
64-bit DDR4
Memory

Enhanced Security
HW Root of Trust
along with TPM 2.0[1]

1: HW-based security for remote attestation, measured boot, cryptographic functions

Introducing the AMD Kria™ System-on-Module Portfolio

KV260

Vision AI Starter Kit

K26

Production SOM Module

DEVELOP ⟶ DEPLOY

Accessible Vision Applications for SW & AI Developers

Security Cameras

Smart City

Retail Analytics

Machine Vision

Vision-Guided Robotics

Introducing the Kria KR260 Robotics Starter Kit

Native ROS[1] 2 Support

- Up to 5X productivity[2] with Kria™ Robotics Stack
- C/C++ and RTL flexibility for HW/SW architects

Low Latency and Determinism

- Real-time response for high-performance machines
- Safety & Security for industrial-grade solutions

Complete Industrial Solution

- Pre-built interfaces for robotics and industrial solutions
- Simplified integration, faster time from out-of-box to deployment

Out-of-the-Box Ready for Software and Hardware Developers

1: Robotics Operating System

2: Testing conducted as of December 1, 2021, on test systems comprising Nvidia Jetson AGX Xavier Developer Kit and Jetson Nano Developer Kit using Isaac ROS SDK 4.6.1; Kria KV260 Starter Kit based on Kria K26 SOM, using Vitis Unified SW Platform 2021.2 and Kria Robotics Stack. Development time accounts for tool chain setup with ROS 2, cross-compilation of host code, and creation and build of accelerator implementing two functions: doublevadd_publisher and accelerated_doublevadd_publisher available at https://github.com/ros-acceleration/acceleration_examples.

Accelerating Path to Production by Up to 9 Months

SOM Advantages over Chip-Down Design

KR260 Kit for Development

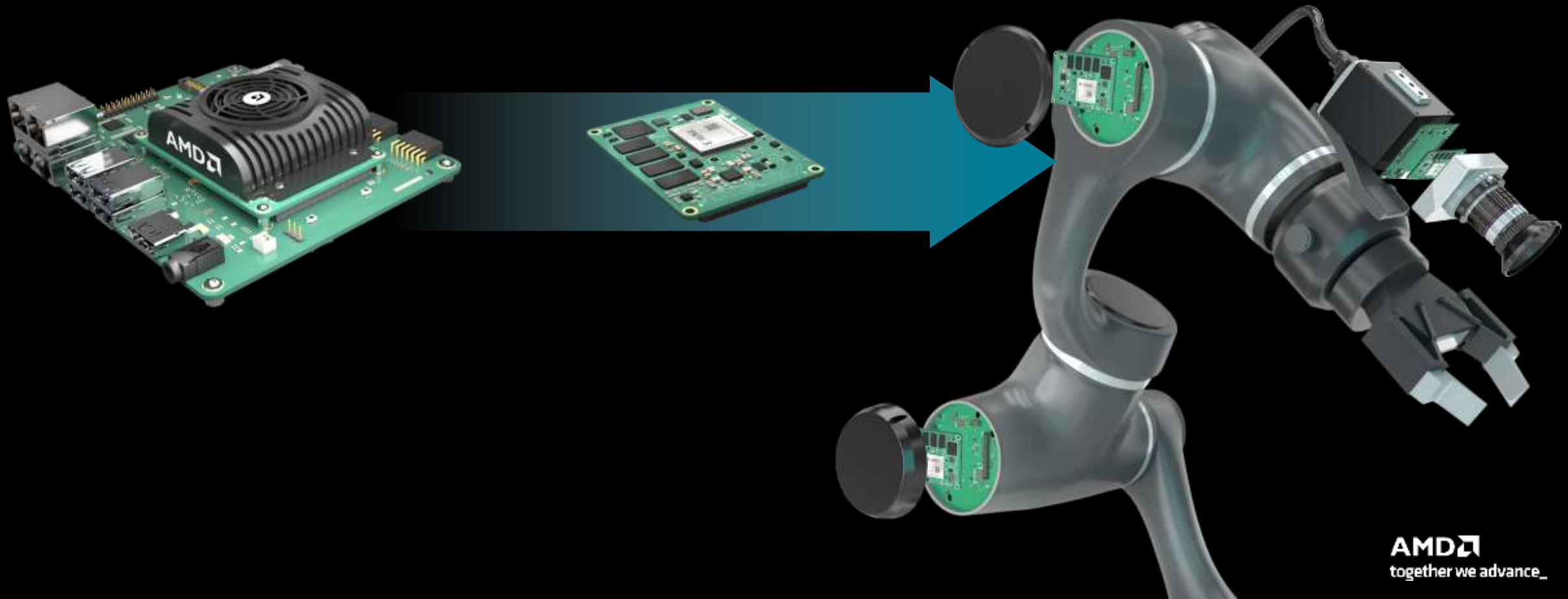
Develop application with kit and Kria™ Robotics Stack (KRS)

Design for K26 SOM

Small form factor embedded PCB based on Hardware adaptive SoC

Go to Production

Plug SOM directly into end-product for deployment



Target Applications for KR260 Robotics Kit

Robotics

Multi-Axis Control • Embedded Controller
Multi-Camera Vision AI

- Collaborative Robots
- Surgical Robots
- AGVs, AMRs, and Aerial Robots

Industrial Communication & Control

Real-Time Control • Predictive Maintenance
Mixed Criticality • TSN

- Programmable Logic Controllers (PLC)
- Programmable Automation Controllers (PAC)
- Industrial Gateway and CNC Routers

Machine Vision

Low Latency • Fast High-Resolution Image Sensor
Minimum CPU load, Maximum Bandwidth

- SLVS-EC Sensor-Based Camera
- USB-Stereo Camera
- 1GigE/10GigE Vision / CXP Over Fiber

Expanding Our Portfolio of Adaptive System-on-Modules

AVAILABLE NOW

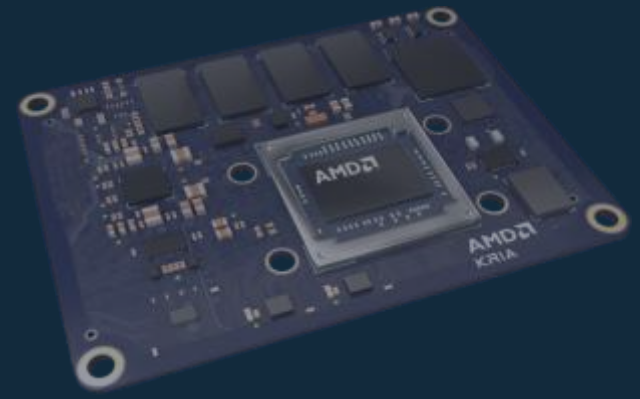
Kria™ K26 SOM

For vision AI and robotics in smart cities and smart factories

NEW: AVAILABLE NOW

Kria K24 SOM

For electric drives and other digital signal processing-intensive applications



ROADMAP

High AI Compute

High real-time compute/watt for edge AI applications

Introducing the Kria™ K24 SOM

BUILD POWER-EFFICIENT DSP SOLUTIONS

- High level of determinism, reliability, and security features via Zynq™ UltraScale+™ MPSoC
- Multiple motor connections and drives stage technologies for power-efficient compute
- About half the size of a credit card for low power consumption

DEPLOY SCALABLE & ADAPTABLE SYSTEMS

- Connector compatibility with Kria K26 SOM for scalability
- A plethora of sensors and peripherals support
- Over-the-air software updates and adaptable hardware for evolving standards

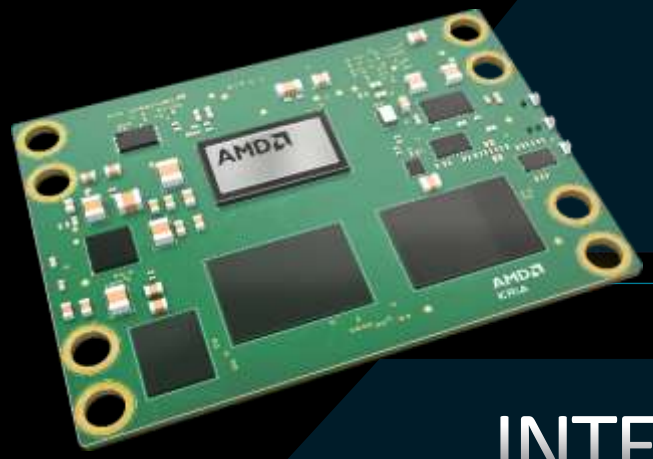
ENABLE EASY SIGNAL PROCESSING FOR FAST DEVELOPMENT

- Ready-to-use KD240 Drivers Starter Kit
- New Vitis™ accelerated libraries for motor control application development
- Expanding development flows to Python and the MATLAB® Simulink® environment

Simplify DSP Development with a Scalable, Power-Efficient SOM

Kria K24 SOM Overview

Based on Zynq™ UltraScale+™ MPSoC Technology



ADAPTIVE SOC (Custom Device for Kria™ K24 SOM)

Arm® Core
A53 Quad core
R5F Dual core

Ubuntu OS
Supports latest 22.04 version

154K
System logic cells for custom acceleration

INT8
B2304 DPU support

INTERFACES

132 I/Os
Flexible for connecting multiple motors, sensors, and connectors

Industrial Ethernet
4x 1G Ethernet, support for converged traffic[1]

4x USB
Mix of USB 3.0 and 2.0

2 GB
32-bit LPDDR4 memory (w/ ECC config[2])

Security Features
HW Root of Trust along with TPM 2.0[3]

1: TSN is enabled only through programmable logic (PL)-based Ethernet interfaces
2: ECC support only available on industrial grade SKU of K24 SOM, 32-bit LPDDR4 @ 1066 Mbps
3: HW-based security for remote attestation, measured boot, cryptographic functions

At the Heart of the K24 SOM: Zynq™ UltraScale+™ MPSoC

Single-Chip Whole Application Acceleration for High Compute Density

Custom MPSoC Optimized for K24 SOM

System-level capability for mixed-criticality, functional safety, cybersecurity, and HMI

Scalable Sensor Fusion

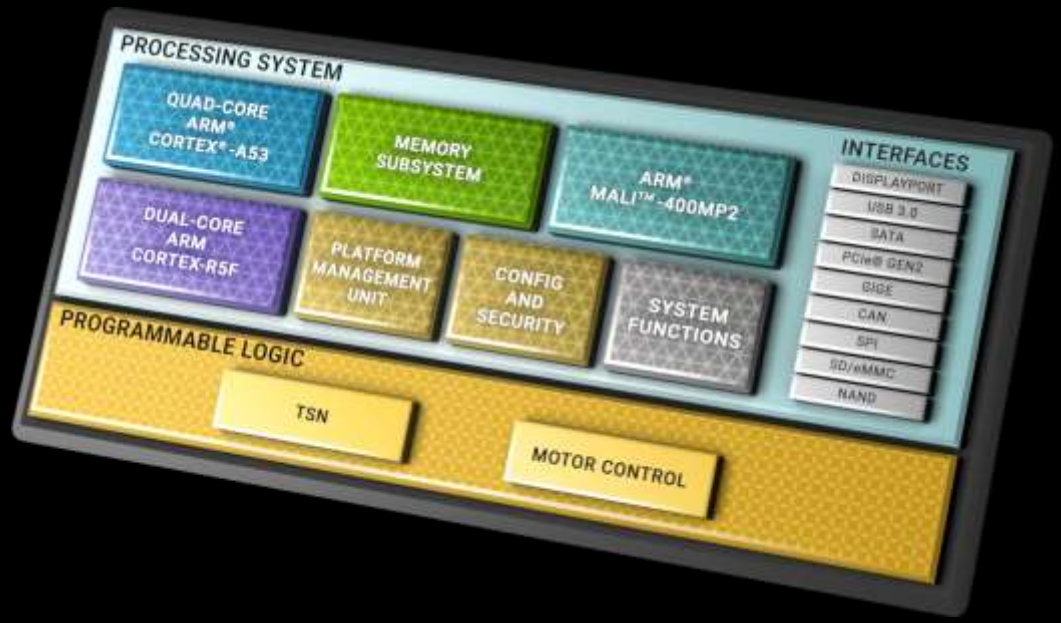
Compatible with wide assortment of environmental, orientation, and vision sensors

Real-Time Deterministic Networking

Industrial Ethernet capabilities unlocked from EtherCAT to TSN

Arm® Processing System

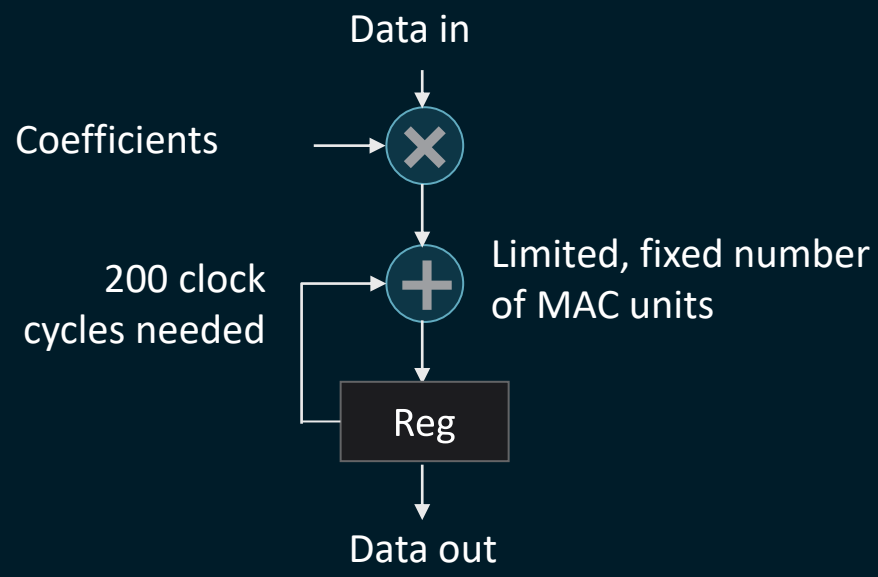
Applications and system decision making augmenting programmable logic



InFO enabled: Smallest Package MPSoC Device for a More Compact Kria™ SOM

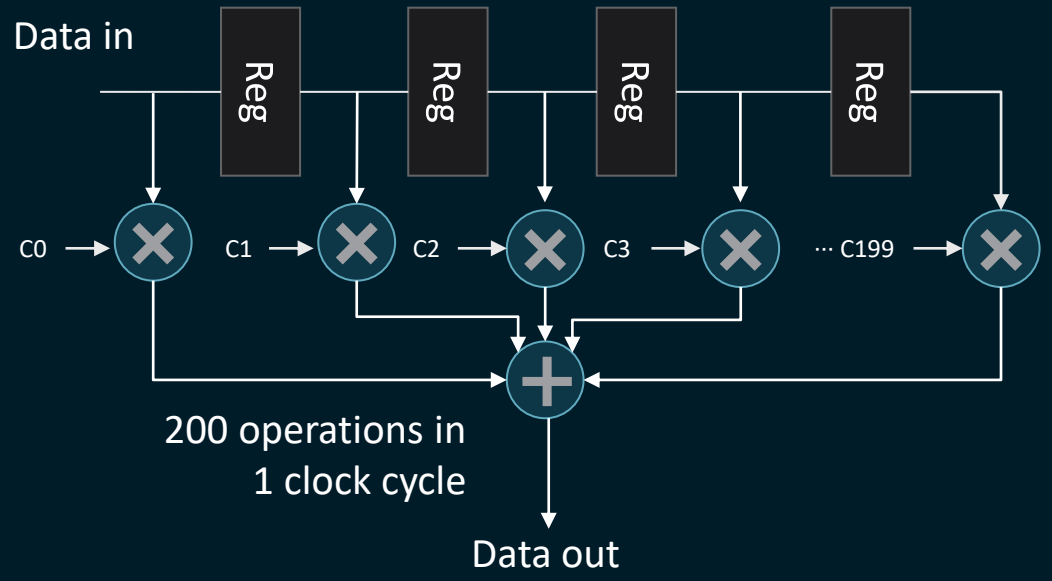
Adaptive Computing Offers Higher Throughput due to Parallelism

Standard DSP Processor - Sequential



48 MSPS total at 1.2 GHz w/ 8 MAC units

Adaptive SoC – Fully Parallel



200 MSPS total at 200 MHz w/ 200 MAC units

Clock frequency and number of MAC units can be adjusted to trade off power and performance

Delivering Real-Time Processing with K24 SOM

Resource Contention

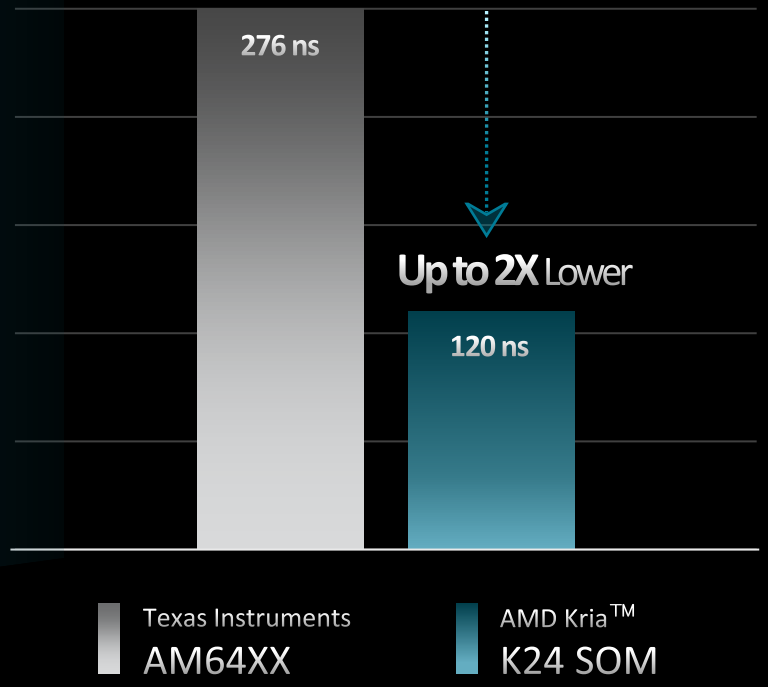
Ready-to-use solutions for resource contention with offloading in programmable logic (PL)

Interference

Interference mitigation at processor cache level with cache coloring

Deterministic Low-Latency Processing

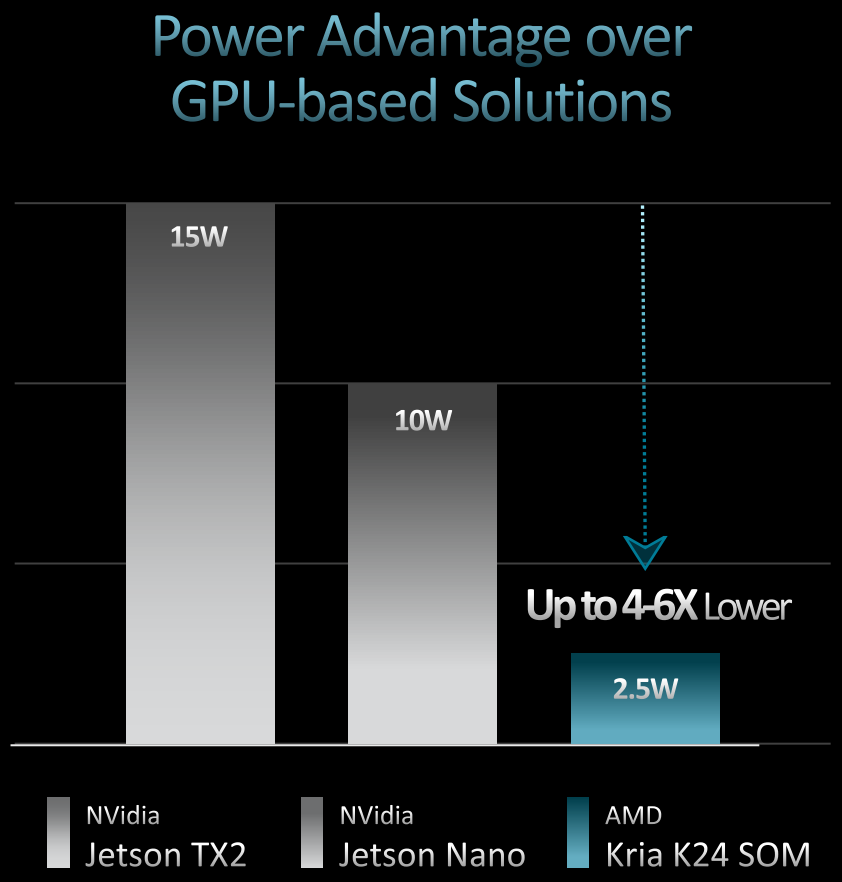
Latency Advantage
Single Axis Drives Application



See Endnote SOM-003

Enabling Power-Efficient Motor Controls

- Electric drives typically require passive cooling
- Adaptive computing with Kria™ K24 SOM can achieve the desired performance at a lower clock speed due to parallelism
- Results in lower total power consumption



See Endnote SOM-004

Benefit from the Scalable Portfolio of Kria SOMs

Choose the Starter Kit → Select the right Production SOM → Develop your Custom Carrier Card

KD240 DRIVES
For Drives and Motor Control Systems

KV260 VISION AI
For Vision AI Cameras and Systems

KR260 ROBOTICS
For Robotics and Machine Vision Systems

KRIA™ K24 SOM
- Half the size of a credit card
- Power efficient
- ECC support

KRIA K26 SOM
- VCU and larger DPU
- 55% more I/Os
- Transceivers

Target Applications for Embedded Developers

Robotics

- Joint Control
- Actuation
- Motion

Power Generation

- Pitch/Yaw Control
- Multi-level Inverter
- Communications

EV Charging

- Inverter Control
- V2G Communication

Medical Control

- Gantry and Bed
- Surgical Actuation
- Surgical Generator

Patient Care

- Sensor Fusion
- 3D Graphic Display
- Precision Calculations

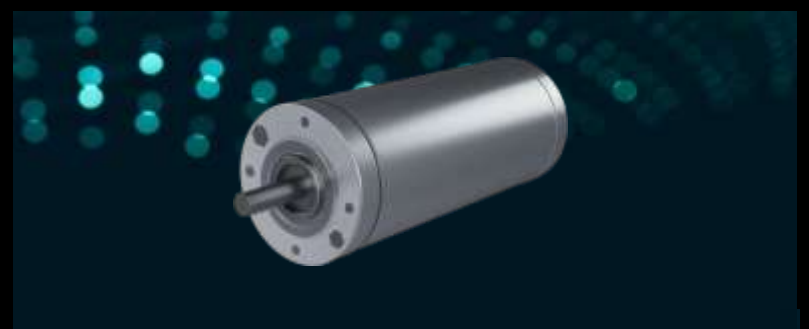
Public Transportation

- Train Control / Mgmt.
- Comfort / Information
- Comms / Recorder

Kria™ K24 SOM: Adaptable for a Variety of Motors & Drive Stages

Induction Motors

- Wound Rotor
  - Single Phase
  - Poly Phase
- Squirrel Cage
  - Single Phase
  - Poly Phase



Permanent Magnet Motors

- Brushless
  - BLDC, PMSM
  - Stepper
- Brushed
  - Series Wound
  - Shunt Wound
  - Compound Wound

Reluctance Motors

Servo Motors

In-house libraries and ecosystem solutions support all motors

Introducing the Kria KD240 Drives Starter Kit

End-to-End Solution for Embedded SW Developers

- A variety of motor control interfaces to build target DSP applications
- Implementing customizable designs without access to HW expertise
- Supported by SW tool flows and the latest Ubuntu OS

Cost-Effective, Faster Time to Deployment

- Affordable motor control solution for small to mid-sized providers
- Easy to use all-in-one platform; no power stage or extension boards needed
- Fast initial HW bring-up and prototyping using Kria™ Motor Accessory Packs

Accessible to Design Communities

- Supported by open standards, app store, and free resources[1]
- Active forum support to get your questions answered by the community

Kria KD240 Drives Starter Kit

1: Free resources include documentation, carrier card design resources, wiki pages

Design Path for Any Developer to Evaluate K24 Capabilities

Python Developer	Design Effortlessly	• Platform runtime orchestration with Python • Fully paved road with prebuilt hardware libraries
AI Developer	Customize AI Model	• Build custom AI inference application • Configure AI processor to requirements
Control System Developer	Simulate Motor Control	• Leverage Vitis™ Model Composer • Implement enhanced motor control functionality
Roboticist	Develop Robot Behavior via KRS	• Based on workspaces (vs. applications) • Computational graph centric
Software Developer	Customize Adaptive Drives	• Accelerate entire pipeline from SW • Customized HW acceleration using HLS
Hardware Developer	Develop Using Full Custom RTL	• Ultimate flexibility through RTL • Customize connectivity with catalog IP

Accelerated Applications

Adaptable FOC

Customizable field-oriented control

MAKARENA

Sensor-based Control

Field-oriented control with position sensor

Sensorless Control

Sensorless field-oriented control

Motion Coordination

ROS 2 control-based command and orchestration

Available at launch
OOB-ready with Motor Accessory Pack

Available post-launch
Developed by AMD using Vitis™ Motor Control Libraries

Pre-Built Solutions without “K24 Place and Route”

Kria App Store for Edge Applications

A Wide Selection of Accelerated Applications for Evaluation and Deployment

Kria™ KV260 Vision AI Starter Kit

- Smart Camera
- AI Box with ReID
- Defect Detection
- Natural Language Processing Smart Vision
- Multi-Stream Facial Recognition
- HDR ISP (image processing)
- Touch Screen HMI
- DFX Accelerators
- Smart Model Select

Kria KR260 Robotics Starter Kit

- ROS 2 Multi-Node Communication TSN
- ROS 2 Perception Node
- 10GigE Vision Camera
- Precision Time[1]
- DFX Accelerators
- ROS 2 Multi-Node Control[1]
- Memory monitor & optimizer[1]

Kria KD240 Drives Starter Kit

- Adaptable FOC[1]
- Sensor-Based FOC[1]
- Sensorless FOC[1]
- DPU-PYNQ
- ROS 2 Motion Coordination
- Vision AI Sensorless FOC[1]

3 accelerated apps
(Vision)
At launch in April 2021

16 accelerated + demo apps
(Vision, Robotics)

25+ accelerated + demo apps
(Vision, Robotics, Motor Control, and Healthcare)

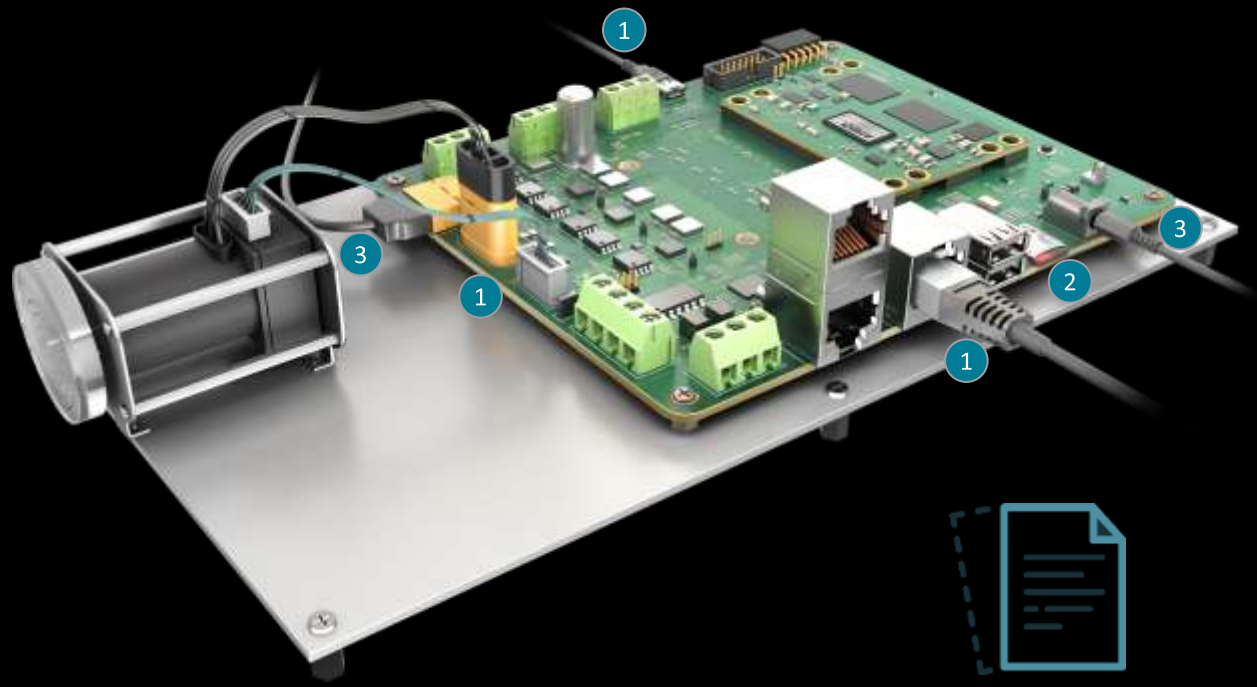
1: Coming soon

KD240 Out-of-the Box Experience

Get Started with the KD240 Drives Starter Kit

In 5 simple steps

1. Connect micro-USB, Ethernet, and Motor Accessory Pack items*
2. Insert microSD card programmed with Ubuntu image
3. Power on the starter kit & motor
4. Download and install the "*Sensor-based Control*" accelerated application
5. Launch from Ubuntu command line and customize using Jupyter Notebook



Getting Started Guide

Get started quickly, no FPGA experience needed

*KD240 Motor Accessory Pack sold separately

Out-of-the Box Ready with Kits and Apps

AMD Kria™ KD240 Motor Accessory Pack (Available Now)

- Anaheim automation BLDC motor with quadrature encoder – 10,000 RPM/24V/0.63A
- Adaptable sensor/sensorless field-oriented control app
- Sensor-based field-oriented control accelerated app

REV Robotics 2-in-1 Motor Kit Accessory (Coming Soon)

- Rev Robotics BLDC motor – 11,000 RPM/12V/1.4A
- Ball shooter with optional vison AI
- Simple robotic arm
- Sensorless field-oriented control accelerated app

Summary and Next Steps

Kria SOM Portfolio: Available NOW

SOM-based Development Kits

Kria™ KV260
Vision AI Starter Kit

SK-KV260-G

For vision and smart city applications with latest AI models

Kria KR260
Robotics Starter Kit

SK-KR260-G

For industrial systems including ROS2-based robotics applications

Kria KD240
Drives Starter Kit

SK-KD240-G

For deterministic motor control and DSP applications

Production Modules

FULLY QUALIFIED & CERTIFIED

Kria K24 SOM

SM-K24-XCL2GC/I

Lower power, smaller industrial applications

Kria K26 SOM

SM-K26-XCL2GC/I

Vision AI and robotics applications

- Connector compatible between SOMs
- Offered in C-Grade and **I-Grade**

Resources Available

Collateral, Tutorials & Guides

- Overview White Paper
- E-book
- SOM & Starter Kit Product Briefs
- Unboxing Video
- Getting Started Web Page
- User Guides, Data Sheets, PSG
- Thermal & Power Design Guide
- Carrier Card Design Guide
- Carrier Card Schematics, 3D CAD and PCB Layout Files*

Accelerated Applications

- Adaptable FOC
- Sensor-based Control
- Sensorless Control
- Motion Coordination
- PYNQ™ DPU Overlays
- Partner Apps

AMD Wiki

- Pre-Built Images (Ubuntu)
- Firmware Updates
- PetaLinux Board Support Packages (BSPs)
- Vitis™ Platform & Associated XDCs
- GitHub Repositories for Source Code

On-Demand Training Courses

- Getting Started with the Starter Kit**
- Deep Dive of Accelerated Applications**

Complete online experience from Education, to Purchase, to Design

* Carrier card refers to the Drives Starter Kit carrier card
** Available after launch

Key Takeaways

- Expanding our Kria™ SOM Portfolio with New Power-Efficient K24 SOM
- Pre-built Motor Control and DSP Applications for Developers without FPGA Expertise
- Get Orders in Now for the Kria KD240 Drives Starter Kit to Get Started and K24 SOM for Production

Docs, Tools, and Starter Kits
Available to Order from AMD.com

Simplify DSP Development with a Scalable, Power-Efficient SOM

DISCLAIMER AND ATTRIBUTIONS

DISCLAIMER

Timelines, roadmaps, and/or product release dates shown in these slides are plans only and subject to change.

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AMD

Backup

Comparing Kria™ K24 vs. K26 SOM

$250 | $350
(C-grade | I-grade)

CONNECTOR COMPATIBLE

$325 | $450
(C-grade | I-grade)

Cost-optimized SOM for lower power, smaller form-factor & cost sensitive industrial applications

Mid-range SOM for Vision AI and Robotics applications requiring higher performance per watt

	K24 SOM		K26 SOM
SILICON (SYS LOGIC CELLS)	XCK24 InFO (154K)	SILICON	XCK26 (256K)
SOM I/O ACCESS	1x 240-Pin Connector, 1x 40-Pin Connector	SOM I/O	2x 240-Pin Connectors
FORM FACTOR	60 x 42mm	46% SMALL	60 x 77mm
MEMORY	2GB LPDDR4[1], 32 GB	DDR, eMMC	4GB DDR4, 16 GB
POWER[2]	2.5W	51% LESS	5.1W
STARTER KITS	KD240 DRIVES	DEV KITS	KV260 VISION AI, KR260 ROBOTICS

[1] ECC support available on K24 SOM I-grade
[2] Measured power while loading application specific bitstream on the SOM-based starter kit

Comparing Kria™ Starter Kits

$249

For mainstream vision AI camera & smart city applications

$349

For high-performance industrial systems including ROS 2-based robotics applications

$399

For deterministic motor control and DSP applications

	KV260 VISION AI	KR260 ROBOTICS	KD240 DRIVES
NON-PROD SOM	K26	K26	K24
SOM I/O ACCESS	1x 240-Pin Connector	2x 240-Pin Connectors	1x 240-Pin, 1x 40-Pin Connector
NETWORK	1x Ethernet	4x Ethernet, SFP+	3x Ethernet
KEY INTERFACES	MIPI Vision Sensors	SLVS-EC Vision Sensors	3-phase inverter & quadrature encoder
EXPANSION	1x Pmod	4x Pmod	1x Pmod
ACCESSORIES	Basic Accessory Pack	Sony IMX547 Camera Kits	Motor Accessory Pack