



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

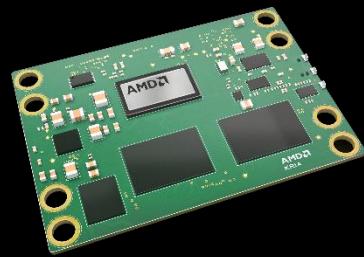
Expanding Our Portfolio of Adaptive System-on-Modules



AVAILABLE NOW

Kria™ K26 SOM

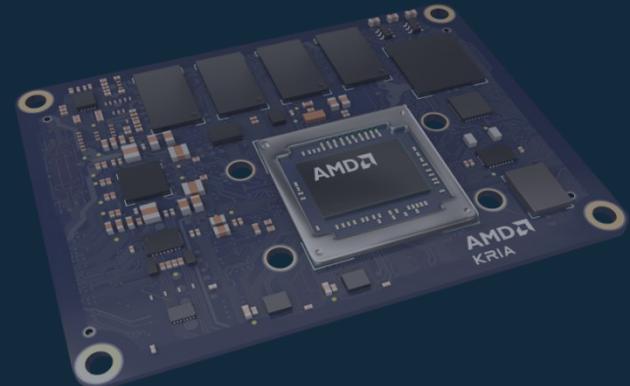
For vision AI and robotics in smart cities and smart factories



NEW: AVAILABLE NOW

Kria K24 SOM

For electric drives and other digital signal processing-intensive applications



ROADMAP

High AI Compute

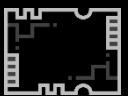
High real-time compute/watt for edge AI applications

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



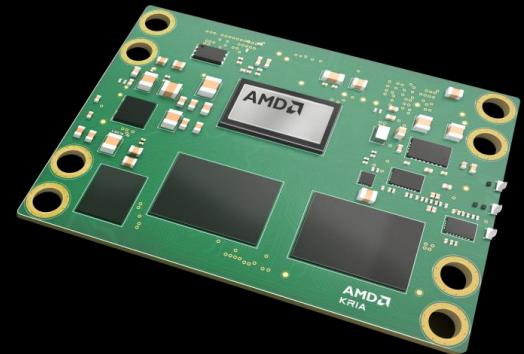
DEPLOY SCALABLE & ADAPTABLE SYSTEMS

- 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

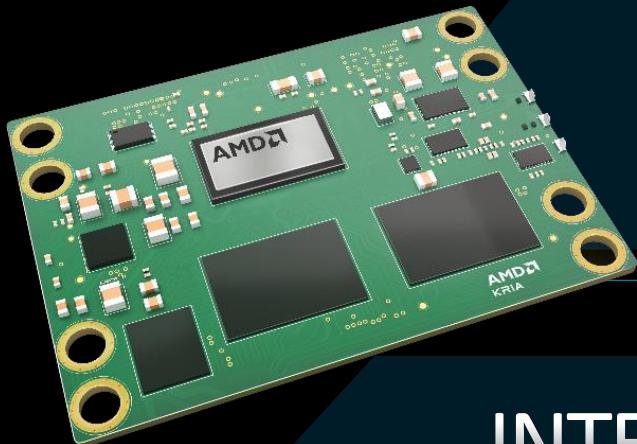


Simplify DSP Development with a Scalable, Power-Efficient SOM

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 traffic¹

4x USB

Mix of USB 3.0 and 2.0

2 GB

32-bit LPDDR4 memory (w/ ECC config²)

Security Features

HW Root of Trust along with TPM 2.0³

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

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

Developing and Deploying with a SOM: Now Becoming Mainstream

SOM Selection

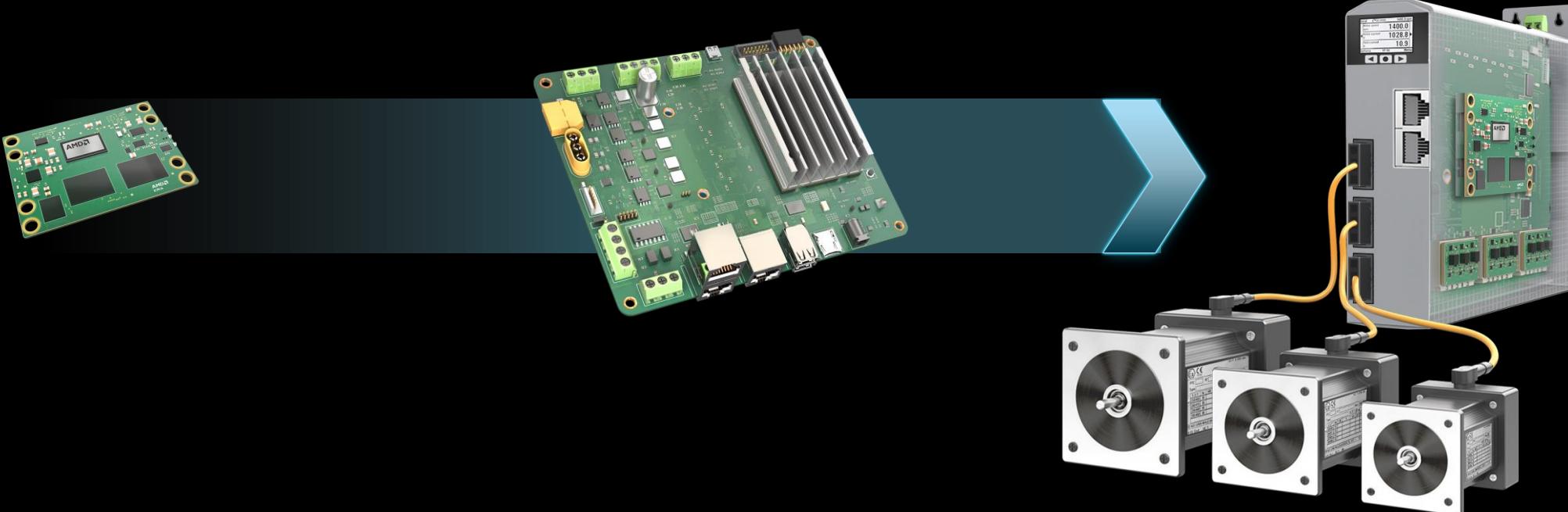
- Examine specifications
- Determine if it fits your requirements
- Design at the system level

SOM Development

- Evaluate capability with off-the-shelf kit
- Design for end application

SOM Deployment

- Build carrier card for custom form factor
- Customize for requirements
- Plug directly into an end system for production deployment



Enabling Developers in Their Familiar Environment



Control System Developer

- Implement enhanced motor control functionality
- Leverage industry-standard tools like MATLAB® Simulink® environment



Embedded Developer

- Application SW and firmware dev
- Design at C, C++ level



Python Developer

- Develop with Python and its vast libraries
- Hardware and firmware abstracted away



HW Developer / System Architect

- Design in RTL, Verilog, VHDL
- Prefer traditional FPGA flexibility

Building Power-Efficient DSP Solutions

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



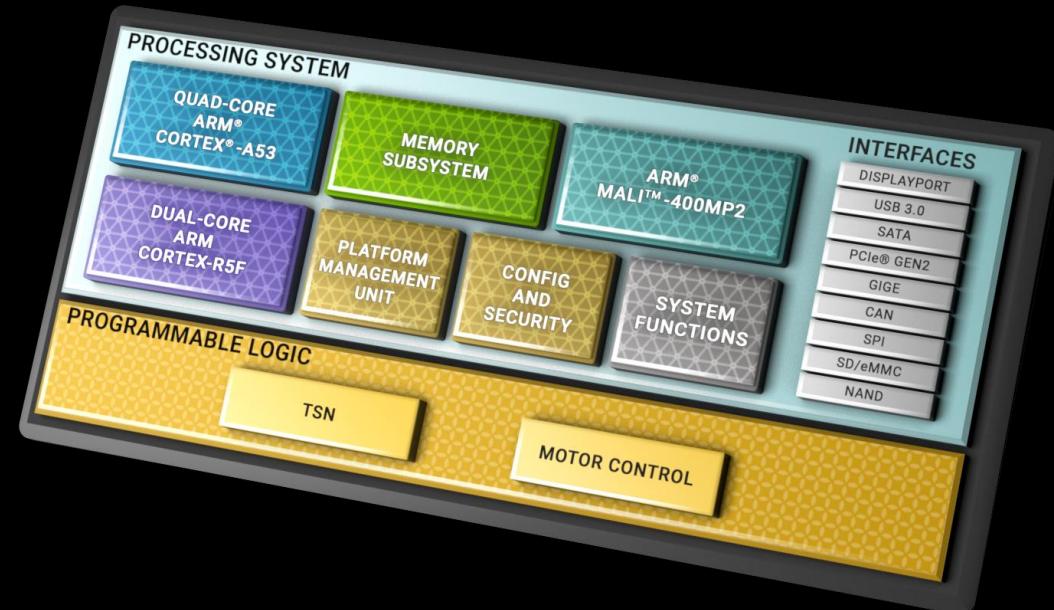
Real-Time Deterministic Networking

Industrial Ethernet capabilities unlocked from EtherCAT to TSN



Arm® Processing System

Applications and system decision making augmenting programmable logic

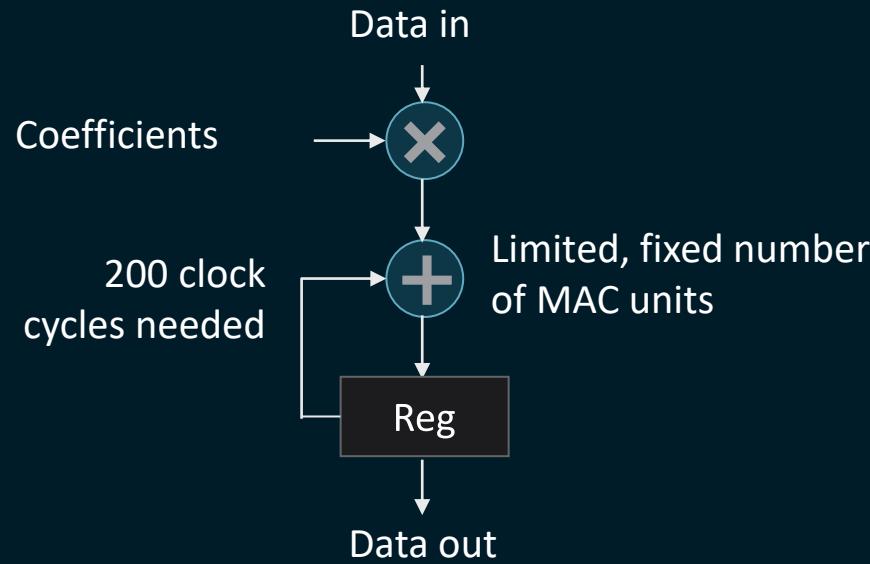


InFO enabled: Smallest Package MPSoC Device for a More Compact Kria™ SOM



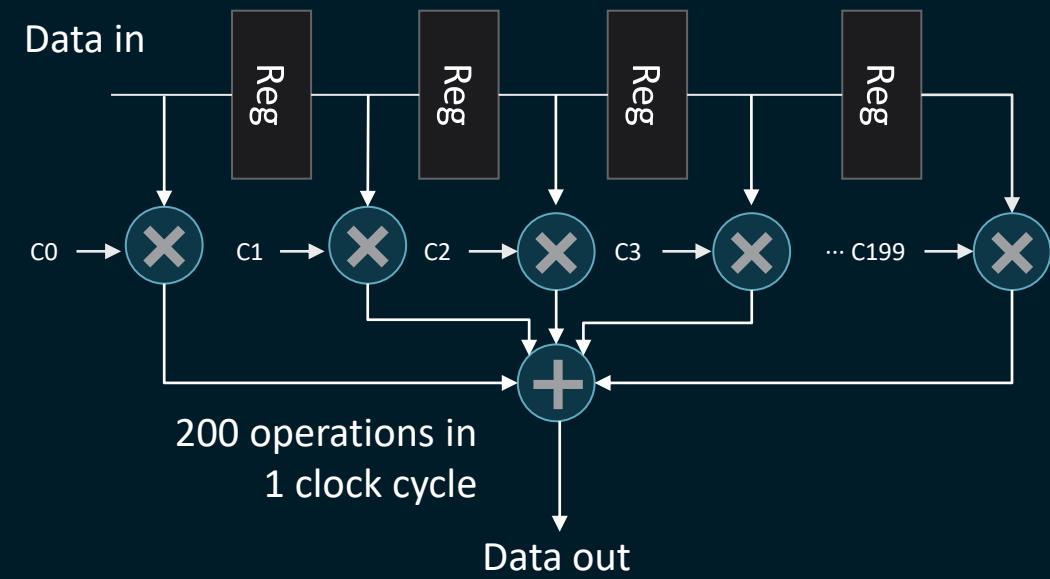
Adaptive Computing Offers Higher Throughput due to Parallelism

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

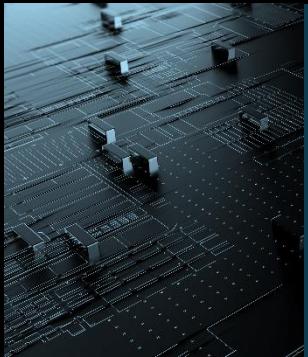
Clock frequency and number of MAC units can be adjusted to trade off power and performance

Delivering Real-Time Processing with K24 SOM



Resource Contention

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

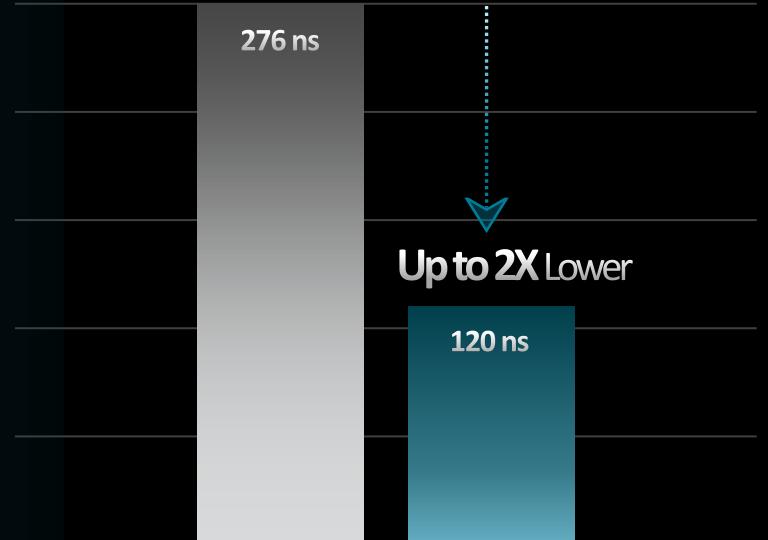


Interference

Interference mitigation at processor cache level with cache coloring

Deterministic Low-Latency Processing

Latency Advantage
Single Axis Drives Application



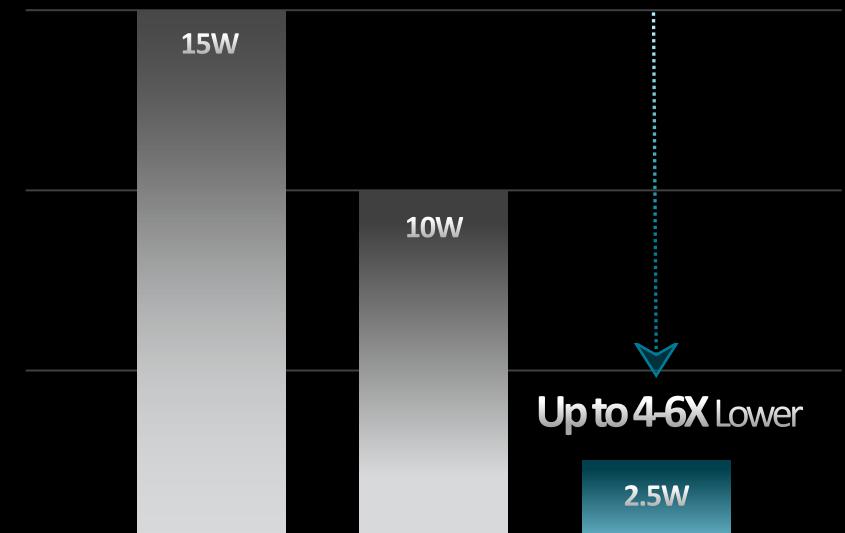
Texas Instruments
AM64XX

AMD Kria™
K24 SOM

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

Power Advantage over GPU-based Solutions



Nvidia
Jetson TX2

Nvidia
Jetson Nano

AMD
Kria K24 SOM

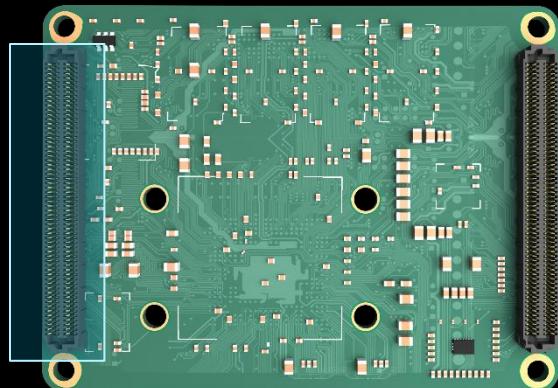
Deploying Scalable and Adaptable Systems

Connector Compatibility for Seamless Migration Between Kria™ SOMs

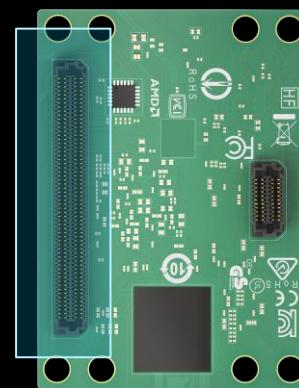
Same Zynq™
UltraScale+™ MPSoc
Architecture

Common Mapping of I/Os,
Transceivers, and Memory Banks

Same SOM-to-Carrier Card
Connectors



K26 SOM



K24 SOM

Build a Common Carrier Card for both SOMs using Carrier Card Design Guide

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

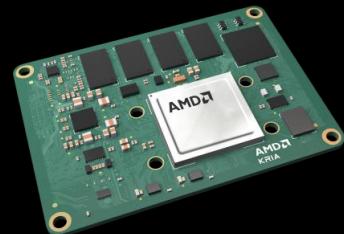


Select the right Production SOM



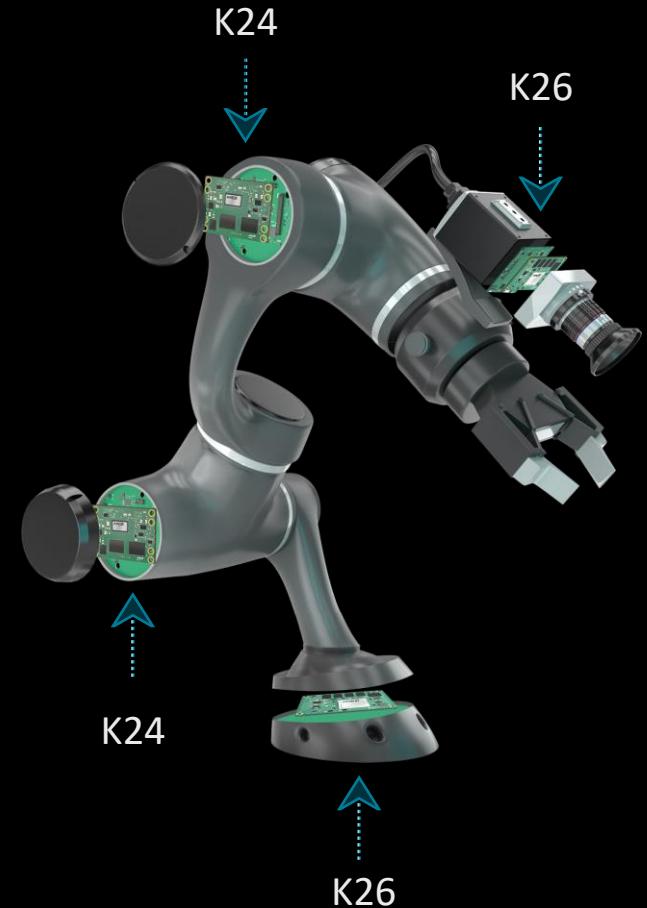
KRIA™ K24 SOM

- Half the size of a credit card
- Power efficient
- ECC support



KRIA K26 SOM

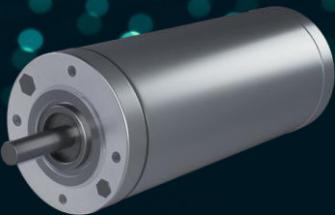
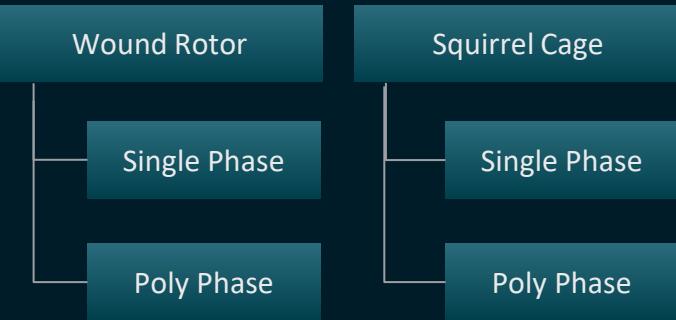
- VCU and larger DPU
- 55% more I/Os
- Transceivers



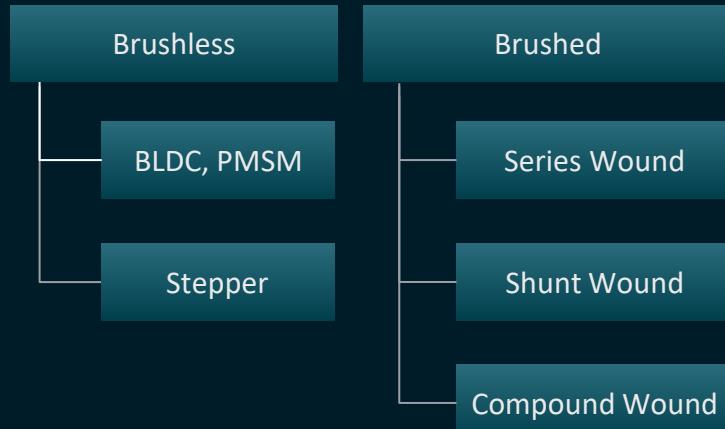
Kria™ K24 SOM: Adaptable for a Variety of Motors & Drive Stages



Induction Motors



Permanent Magnet Motors



Reluctance Motors



Servo Motors

In-house libraries and ecosystem solutions support all motors

Ruggedization for Extreme Operating Conditions Including Industrial Applications

- Built for indoor/outdoor and low/high temperature ranges
- Meets country-specific compliance and certification requirements
- Ruggedized connectors for shock resistance



Meeting Reliability Requirements

Kria™ K24 SOM		
	C-Grade	I-Grade ¹
Shock	40G, 11ms	40G, 11ms
Vibration	1.9g RMS	5g RMS
Temp Range at Module TTP	0°C to 85°C	-40°C to 100°C
Humidity	85°C / 80% RH	85°C / 80% RH
Operating Life ²	5 years	10 years
Availability ³	10 years	10 years
Warranty (Production SOM) ⁴	2 years	3 years

Certifications

Country	Certification
US ; Canada	FCC, UL ; IC
EU	CE, ROHS 10
China	CC, ROHS 10
Vietnam	ICT
Japan ; Korea	VCCI ; KCC
Malaysia	ST CoA, SIRIM
Singapore	SPRING Safety
South Africa	SABS EMC, NRSC

1: I-grade specs are tentative and subject to change

2: Operating Life – Suitable for deployment in a production environment

3: Availability – Time period SOM product will be available for purchase

4: Kria KD240 Drives Starter Kits are not intended for production use and come with a 90-day warranty

Enabling Easy Signal Processing for Fast Development

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 resources¹
- Active forum support to get your questions answered by the community

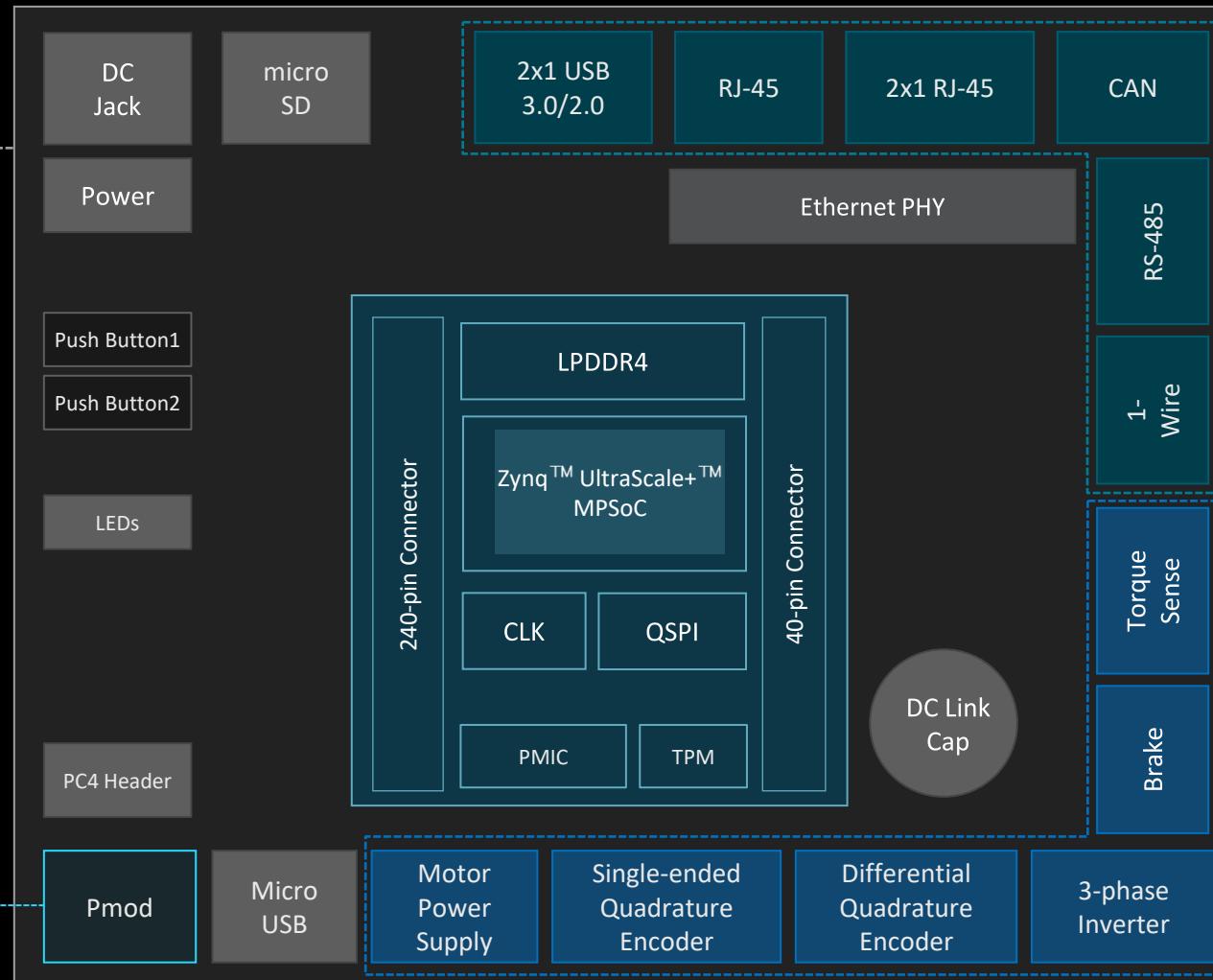


Kria KD240 Drives Starter Kit

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

Drives Starter Kit Carrier Card Features & Capabilities

**Carrier Card Optimized for
Kria™ K24 SOM**



Network and General Connectivity

Drives Application Ready

**Pmod Expansion for
Sensors or Interfaces**

*Production SOM includes eMMC

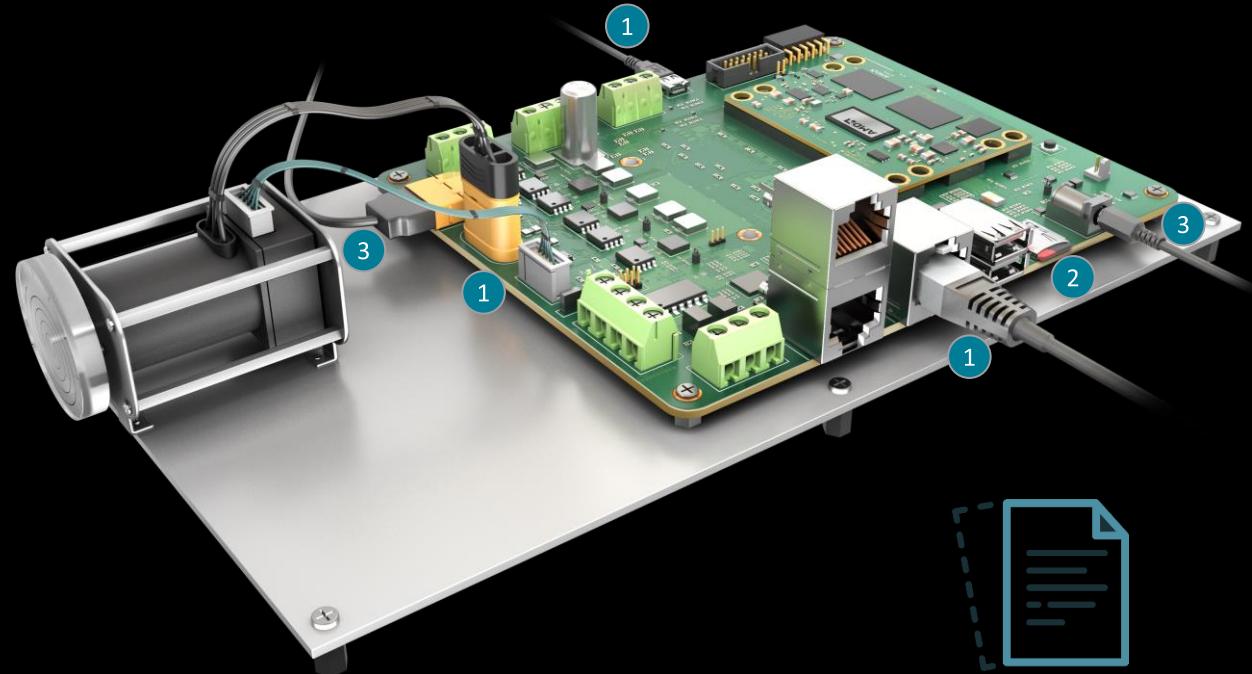
140 x 119 x 32 mm
(SOM + Carrier Card + Heatsink)

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

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

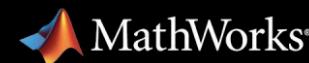
- Build custom AI inference application
- Configure AI processor to requirements



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

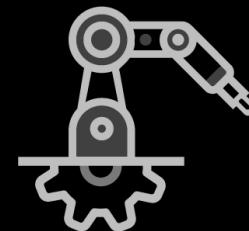
- Ultimate flexibility through RTL
- Customize connectivity with catalog IP



Python (PYNQ) based Flow for Entry-level Developers

- PYNQ™ is an open-source Python framework from AMD
- Extensive ecosystem includes libraries for adaptive computing platforms like Kria™ SOMs
- PYNQ is built for developers who want to maximize the capabilities of Kria SOMs but have limited K24 expertise
- Using the Python language and libraries, designers can leverage the programmable logic (PL) to build more capable and innovative target applications

For new K24 SOM developers:



A very powerful combination to build applications using AMD adaptive compute platforms

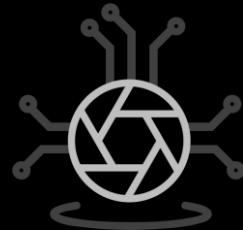
KD240 is out-of-the box ready with PYNQ support—including two overlays



Accelerated Applications

Adaptable FOC

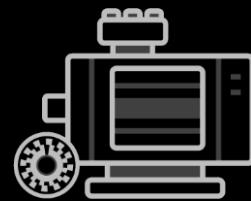
Customizable field-oriented control



Available at launch
OOB-ready with Motor Accessory Pack

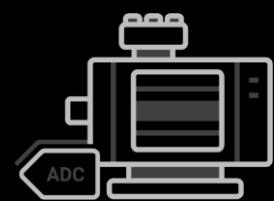
Sensor-based Control

Field-oriented control with position sensor



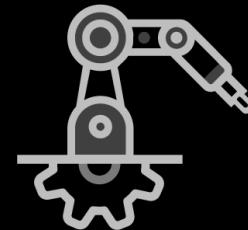
Sensorless Control

Sensorless field-oriented control



Motion Coordination

ROS 2 control-based command and orchestration

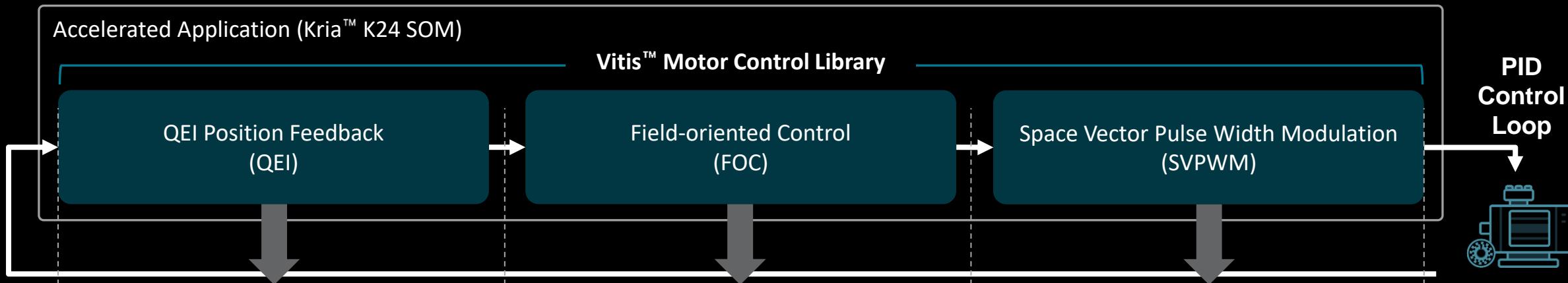
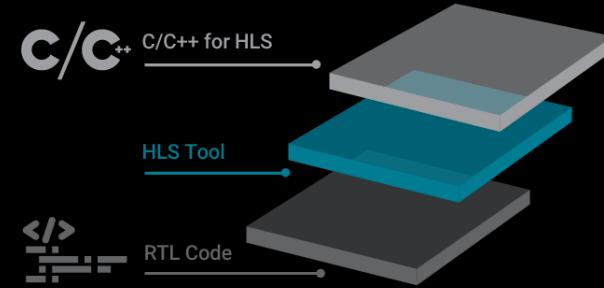


Available post-launch
Developed by AMD using Vitis™ Motor Control Libraries

Pre-Built Solutions without “K24 Place and Route”

Sensor-based Control App Customization

- Fully customizable Motor Control Library C/C++ source code under Apache 2.0 licensing
- Programmable logic (PL) hardware blocks and RTL generated from Motor Control Library using AMD Vitis™ HLS tool



Config Type	QEI	FOC	SVPWM
Run Time	<ul style="list-style-type: none"> • Sensor Counts Per Revolution (CPR)* • Sensor Encoding Type* 	<ul style="list-style-type: none"> • Control Mode → Stop, Speed, Torque, and Field Weakening • Set Points • Proportional & Integral Gains • Open-Loop Motor Period* 	<ul style="list-style-type: none"> • Phase-to-Phase Shift (0° or 120° Offsets) • DC Link Voltage Source (Static or Live Feedback) • PWM Frequency • Dead-Time Period
Build Time	<ul style="list-style-type: none"> • PL Clock Frequency* 	<ul style="list-style-type: none"> • Motor Model Parameters* 	<ul style="list-style-type: none"> • PL Clock Frequency*

*Customization parameters should be considered only when targeting different encoder/motor outside of KD240 Motor Accessory Kit

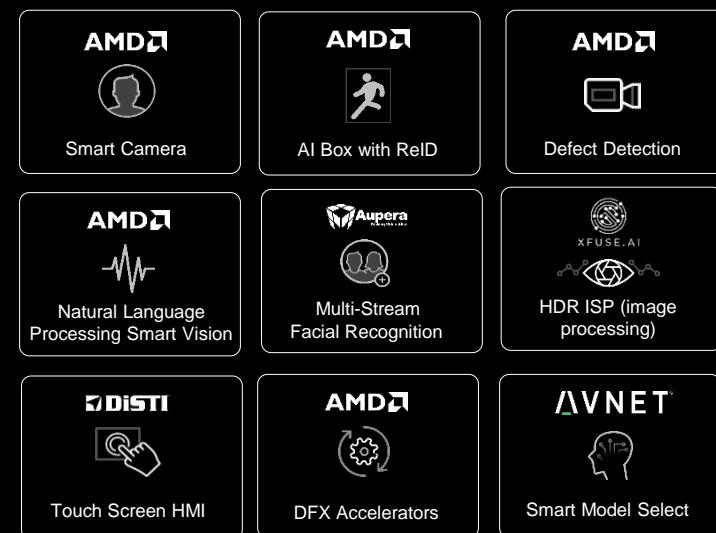
Kria App Store for Edge Applications

A Wide Selection of Accelerated Applications for Evaluation and Deployment

Kria™ KV260
Vision AI Starter Kit

Kria KR260
Robotics Starter Kit

Kria KD240
Drives Starter Kit



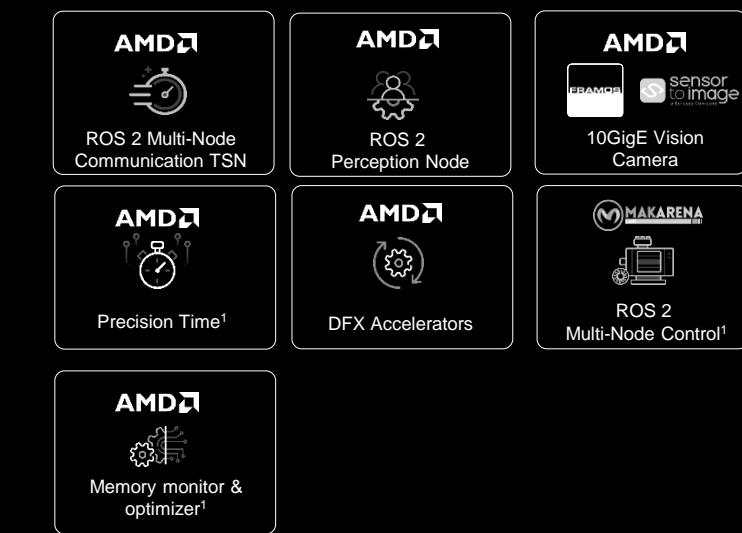
3 accelerated apps

(Vision)

At launch in April 2021

16 accelerated + demo apps

(Vision, Robotics)



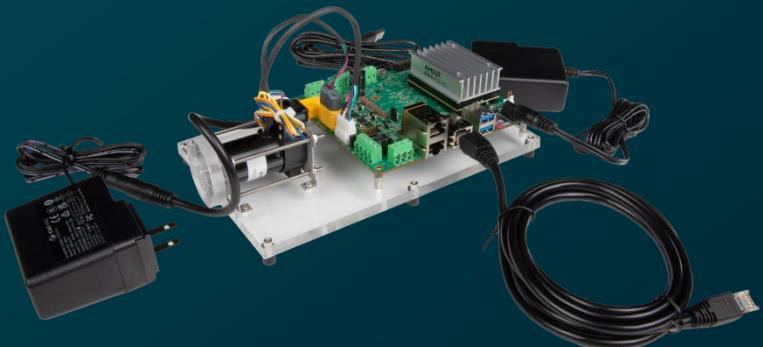
25+ accelerated + demo apps

(Vision, Robotics, Motor Control, and Healthcare)

1: Coming soon

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)

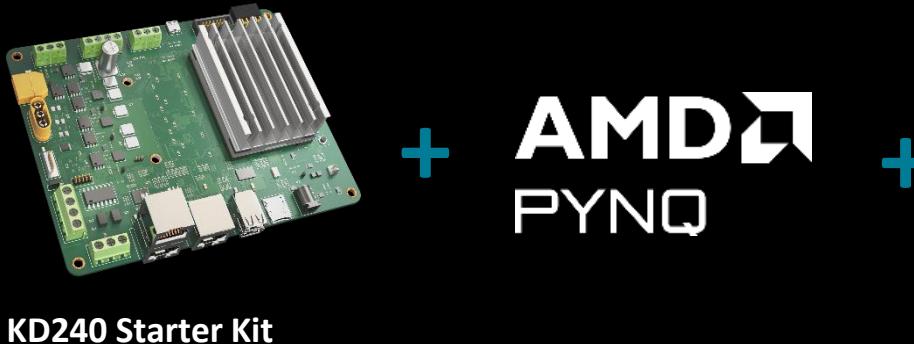


- Rev Robotics BLDC motor – 11,000 RPM/12V/1.4A
- Ball shooter with optional vison AI
- Simple robotic arm
- Sensorless field-oriented control accelerated app

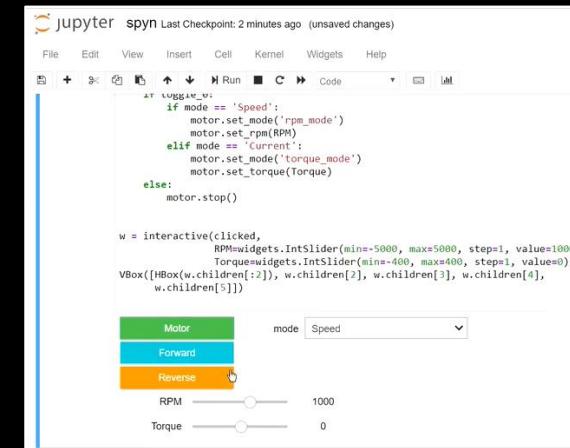
Competitive Advantage with AI/ML for Electric Drives

SPYN: Python-powered Control, Edge Analytics & Machine Learning for Electric Drives

- Electric drives have evolved in the era of Industrial IoT/Industry 4.0
- Expected to do much more than just control a motor
- AMD is leveraging Python to make drives intelligent & adaptive so that you can use it for your target application!
- The SPYN use case shows motor control + DPU (AI) + PYNQ™ framework for predictive maintenance of electric drive



KD240 Starter Kit



- ✓ Import custom libraries as needed
- ✓ Easily store motor data into frames
- ✓ Utilize readily available & labeled motor data as training dataset
- ✓ Train your predictive maintenance model on any model in the library

- Using IIoT-SPYN, users can control, monitor, capture data, visualize, and analyze Industrial-grade motors
- Competitive processor-based products don't offer AI/ML capabilities and can hinder further innovation

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



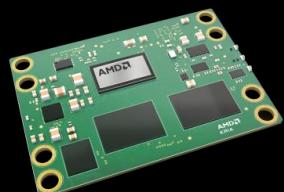
SK-KD240-G

For deterministic motor control and DSP applications

Production Modules

FULLY QUALIFIED & CERTIFIED

Kria K24 SOM



Kria K26 SOM



SM-K24-XCL2GC/I

Lower power, smaller industrial 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
- PYNN™ 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

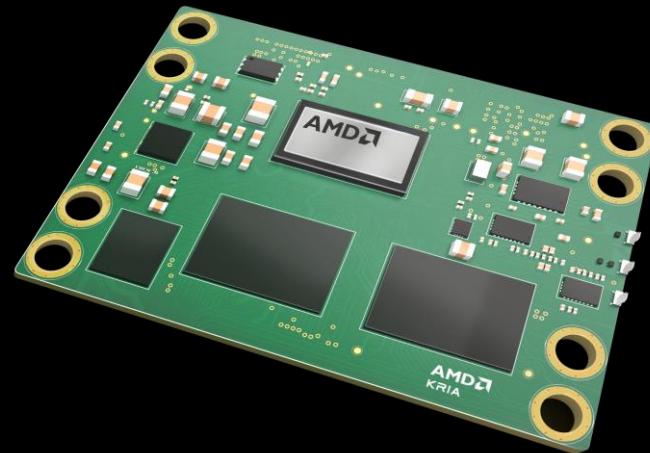
Key Takeaways



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

AMD

Comparing Kria™ K24 vs. K26 SOM



(C-grade | I-grade)

CONNECTOR
COMPATIBLE

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
POWER²	2.5W	► 51% LESS	5.1W
STARTER KITS	KD240 DRIVES	► DEV KITS	KV260 VISION AI, KR260 ROBOTICS

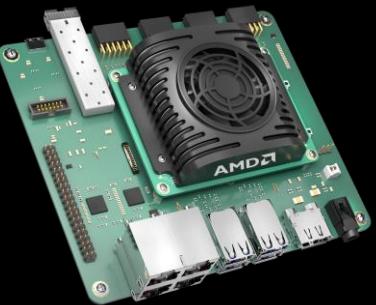
¹ ECC support available on K24 SOM I-grade

² Measured power while loading application specific bitstream on the SOM-based starter kit

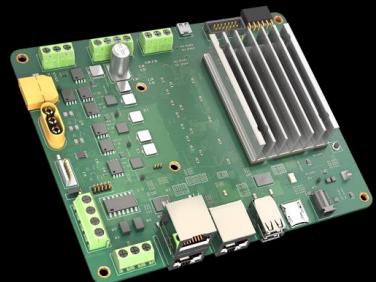
Comparing Kria™ Starter Kits



For mainstream vision AI camera & smart city applications



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



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