SOLUTION BRIEF

DIFFERENTIATE MACHINE VISION CAMERAS WITH AMD FPGA ADVANTAGES

AMD
together we advance_

OVERVIEW

In today's industrial landscape, the push for greater productivity and automation has driven a rising demand for advanced machine vision systems.

These cameras require low cost, lower power, and a compact form factor, while at the same time need to support the latest sensor and output interfaces to keep up with the rapid pace of production lines. To address the diverse requirements of machine vision applications, designers must balance performance, power consumption, and form factor while offering solutions ranging from cost-effective to high-end.

This competitive solution brief highlights the features of the scalable AMD product portfolio and its advantages against competitive offerings in enabling the development of optimized machine vision systems across varying performance tiers.

ADVANTAGES FOR MACHINE VISION CAMERA APPLICATIONS

1 - Lower Total Power[1]

Do More with Less

The AMD LUT6 architecture uses up to 40% fewer resources[2] while achieving a 2-speed grade advantage over the competition.[3] This allows customers to design with a smaller density device, reducing both static and dynamic power.

2 - Simplify Thermal Design

Reduce Design Complexity

AMD offers up to 34% lower junction-to-ambient thermal dissipation,[4] thereby reducing junction temperature. This results in a simpler design with the potential to eliminate the need for a thermal solution.

3 - Shorten Design Cycles

Achieve Faster Time to Market

AMD Vivado™ Design Suite streamlines the development process with near-100% out-of-the-box timing closure,[5] enabling fewer design iterations compared to competitors, who offer a fragmented design environment.

4 - Connect to Range of Sensors

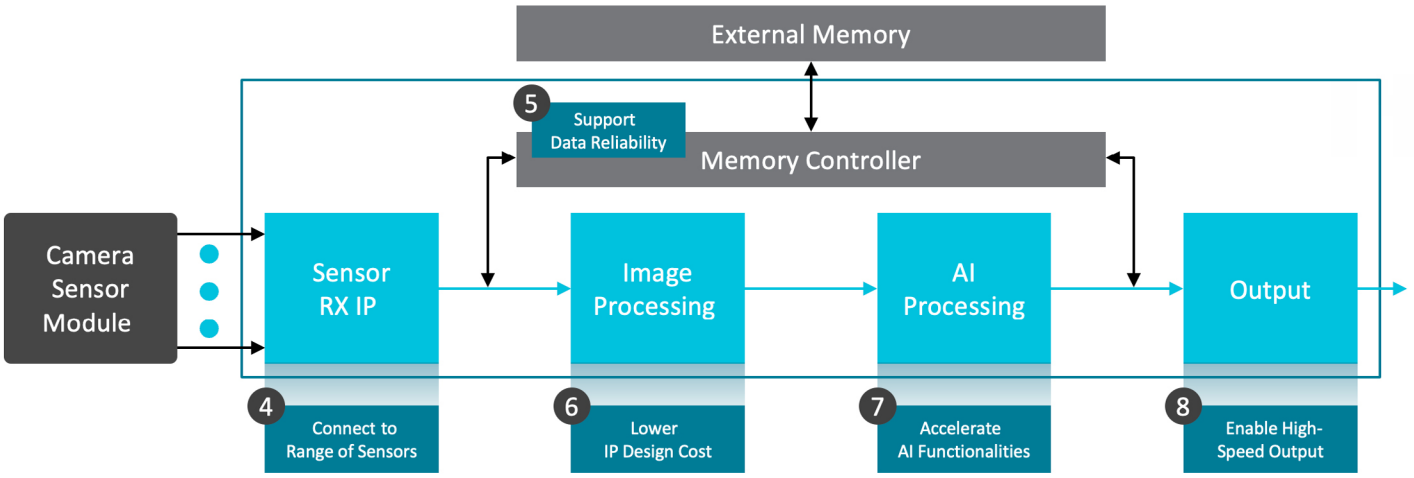
5 - Support Data Reliability

6 - Lower IP Design Cost

7 - Accelerate AI Functionalities

8 - Enable High-Speed Output

Learn more about benefits 4 to 8 on the next page.



4 - I/O FLEXIBILITY FOR SEAMLESS INTEGRATION WITH VARIOUS SENSOR MODULES

AMD provides highly adaptable I/O capabilities to support a broad range of sensor modules, including LVDS, MIPI, and SLVS-EC. These interfaces are compatible with MIPI D-PHY speeds of 2.5 Gb/s/lane and up to 3.2 Gb/s/lane. AMD also supports SLVS-EC standards 1.0, 2.0, and 3.1 with transceiver speeds up to 12.5 Gb/s/lane, meeting the needs of diverse sensor technologies.

5 - HIGH-SPEED MEMORY ACCESS

The vast AMD product portfolio provides customers options for a soft or hard memory controller IP. Our newest devices, such as Spartan™ UltraScale+™ FPGAs, support integrated memory controllers for high-speed memory access via LPDDR4X/LPDDR5 up to 4266 Mb/s, providing high bandwidth, low latency, and lower power.[1]

6 - SIMPLIFIED DESIGN WITH OPTIMIZED IMAGE PROCESSING TOOLS

AMD offers open-source, performance-optimized libraries designed to accelerate image processing pipelines right out of the box. These libraries provide varying levels of abstraction, enabling developers to select tools that align with their specific needs and streamline development efforts. Supported IP include Tri Ethernet MAC, 10G/25G Ethernet, MIPI, GigE Vision, TSN, and more.

In addition, AMD offers over 250 free AMD Vivado IP, over 700 AMD Vitis™ library functions, and free AMD MicroBlaze™ and MicroBlaze V soft-core processors. Visit our **IP Page** for a full list of Machine Vision IP offered through AMD and partners.

7 - STREAMLINED AI APPLICATIONS WITH COMPREHENSIVE AI SOFTWARE TOOLS

AMD provides the open-source FINN software stack, enabling customers to optimize and streamline their end-to-end AI pipeline for the most customized and efficient AI processing in resource-constrained devices. For customers that prefer a more generic AI complier, Vitis AI can be used to seamlessly integrate their AI models onto the platform. AMD has a proven track record of delivering embedded AI for our embedded customers.

8 - VERSATILE BOARD PORTFOLIO FOR VARIOUS CAMERA SPEEDS

From cutting-edge factory automation cameras featuring ultra-high resolution and frame rates to cost-efficient mass-market cameras, AMD delivers a comprehensive portfolio to meet diverse needs. With transceiver speeds ranging from 500 Mb/s to 32.75 Gb/s, the range of the AMD portfolio provides scalable and flexible solutions.

CONCLUSION

Designing a machine vision camera requires a high signal-to-noise ratio, superior thermal performance, support for a wide range of sensors and output standards, and a focus on maximizing data reliability while accelerating time to market.

Choose AMD FPGA solutions with a high-performance LUT6 architecture, to enable superior resource utilization, higher F_{MAX}, and efficient thermal management. With a comprehensive product portfolio and robust software support, customers can select the optimal product mix for their cameras while leveraging vision libraries and IP support to further reduce development time.

REFERENCES

SOLUTION HIGHLIGHTS	
AMD FPGA ADVANTAGES OVER COMPETING LEGACY LUT4 ARCHITECTURES	• Architecture competitive analysis white paper against Lattice offerings • **AMD FPGA Advantages over Competing Legacy LUT4 Architectures**
MAXIMIZING DESIGN SUCCESS WITH AMD VIVADO DESIGN SUITE	• Design tools competitive analysis white paper against Lattice offerings • **Maximizing Design Success with AMD Vivado Design Suite**
AMD SPARTAN ULTRASCALE+ FPGA	• For up to 3.2 Gb/s MIPI D-PHY and mid-end SLVS-EC sensor modules • High I/O-to-logic ratio • Hard IP memory controllers and multi-tiered security features • **Machine Vision Solution Brief**
AMD ARTIX™ ULTRASCALE+ FPGA	• For up to 2.5 Gb/s MIPI D-PHY and mid-end SLVS-EC sensor modules • Ultra-Compact form factor • **Artix UltraScale+ FPGA Product Brief**
AMD KINTEX™ ULTRASCALE+ FPGA	• For high-end SLVS-EC connected sensor modules • High resolution and frame rates required • **Kintex UltraScale+ FPGA Product Brief**

NEXT STEPS

- Visit the **AMD Cost-Optimized Portfolio webpage** to learn more about AMD offerings
- Learn more about **AMD competitive advantages** over other offerings in the market
- Speak to your local support team on your next machine vision camera design

FOOTNOTES

1. Based on AMD testing in July 2024, performed in AMD Power Estimation Tools (XPE_2019_1_2 for 28 nm and PDM_2024.1 for 16 nm), and Lattice Radiant Power Estimation Tool 2024.1, to measure the power consumption of the Spartan UltraScale+ 35P, 50P, and 100P FPGAs versus Lattice MachXO5-NX 25, CertusPro-NX50, and MachXO5-NX 100T FPGAs at HP speed grade. Total Power results include fabric power and HDIO only. Stated results assume a normalized max ambient temperature of 100°C and a 40% utilization advantage for LUT6, when selecting competitive devices for comparison. Results are subject to change when products are released in market and will vary based on architecture, package size, speed grade, device, design, configuration, and other factors. (SUS-014)
2. Based on AMD testing in July 2024, measuring the utilization scores of the LUT6 architecture-based AMD Artix 7 A100T (28 nm) and Artix UltraScale+ AU7P (16 nm) versus the LUT4 architecture-based Lattice Nexus MachXO5 25 (28 nm) and Lattice Avant E70 (16 nm) devices, measured on AMD Vivado™ 2024.1 and Lattice Radiant 2024.1, respectively, at various speed grades, averaged over 30 open-core designs. Results will vary based on architecture, device, speed grade, package size, design, configuration, and other factors. (COP-001)
3. Based on AMD analysis in July 2024, calculating the F_{MAX} yields for all available speed grades for the (16 nm) AMD Artix UltraScale+ FPGA and the (16 nm) Lattice Avant platform. Results will vary based on device, customer design specifications, system configuration, and other factors. (AUS-009)
4. Based on July 2024 AMD analysis of public data sheets, comparing Spartan UltraScale+ and Artix UltraScale+ FPGA device packages versus comparable Lattice Certus Pro & MachXO5-NX packages and Lattice Avant versus Kintex UltraScale+ FPGA device packages. Stated results assume still air conditions. (COP-003)
5. Based on AMD place-and-route testing in September 2024, using 30 open-core designs compiled with AMD Vivado 2024.1 and Lattice Radiant Software 2024.1 in default mode, with the AMD Artix UltraScale+ AU10P device versus Lattice Mach LFMXO5 device @ 150 MHz F_{MAX} target; and AMD Kintex UltraScale+ KU5P device versus Lattice Avant E70 device @ 200 MHz F_{MAX} target. P&R performance will vary based on device, design, configuration, and other factors. (VIV-011)

DISCLAIMERS

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