Product Brief

FPGAs and SoCs

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An Intel Company

Agilex™ FPGAs and SoCs: A Comprehensive Programmable Logic Portfolio for the Connected World

Intel Agilex FPGA Portfolio Leadership and Innovation	
Power Efficiency	~2X performance per watt vs. competitive 7 nm FPGAs[1]
Performance	50% higher performance compared to competing 7 nm FPGAs[2]
IO / Interfaces	Highest transceiver data rates (116 Gbps) First PCI Express (PCIe) 5.0 and Compute Express Link (CXL) support
Memory	Highest memory bandwidth FPGAs (> 1 TBps)[3] First LPDDR5 Support
DSP	First Enhanced DSP with AI Tensor Block First support for half-precision floating point and BFLOAT16 precisions
Processor	First asymmetric applications processor system
Analog	Highest sample rate data converters (up to 64 Gsps)

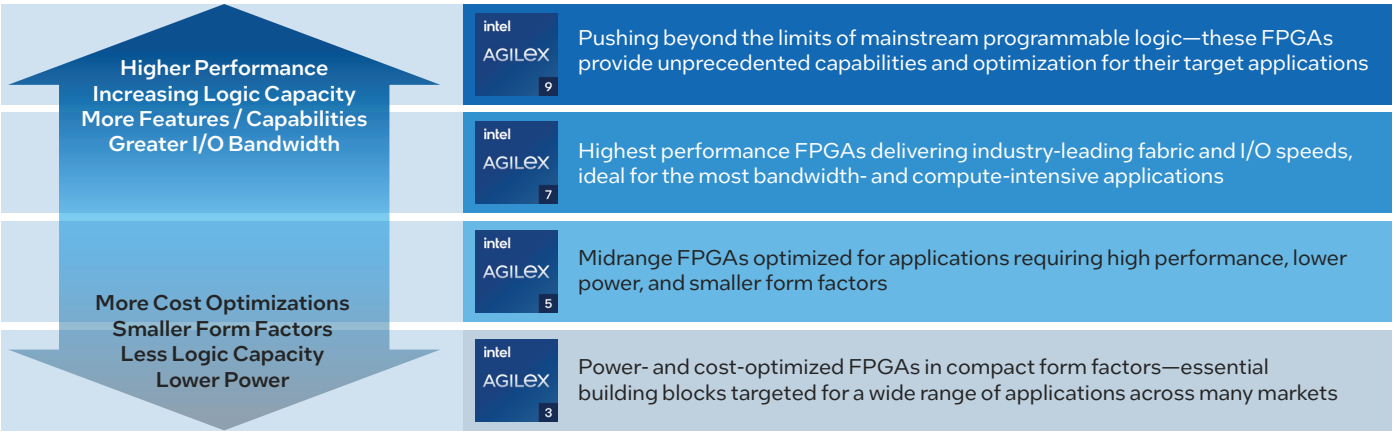
The Intel Agilex FPGA portfolio presents a broad range of product offerings that address the full breadth of programmable logic needs across every technology sector from edge to embedded systems, to communications and data centers. In all these sectors, a data explosion is driving demand for new products to move, process, and store the data, as well as derive actionable insights from it. The developers of these products need hardware flexibility to address the challenges of changing market requirements, integrating multiple functions, adopting evolving standards, and supporting diverse workloads. Intel Agilex FPGAs provide the flexibility needed to tackle these challenges, as well as advanced application-optimized features and capabilities that help developers deliver innovation with agility.

Leading Edge Manufacturing Capabilities

Intel leverages the full force of its innovation and manufacturing capabilities to deliver Intel Agilex FPGA products. Built using advanced Intel 10 nm SuperFin and Intel 7 technologies sourced from geographically diverse fabs and using proprietary packaging techniques as well as chiplet-based design, Intel maintains control over all aspects of the manufacturing of Intel Agilex FPGAs to ensure maximum supply chain resilience, resulting in reliable delivery and best-in-class lead times.

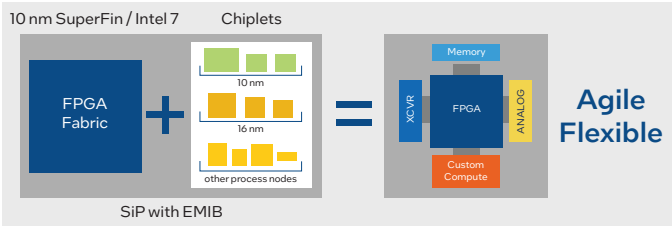
The Intel Agilex FPGA product portfolio is composed of four tiers, with each tier offering specific optimizations that are designed to meet and exceed the needs of their target applications.

The Intel Agilex FPGA Product Portfolio



Delivering Advanced Capabilities in Intel Agilex® 9 and Intel Agilex® 7 FPGA Products with Chiplet-Based Design

With chiplet-based design, Intel can rapidly combine production-proven FPGA fabric die with new purpose-built chiplets, such as advanced transceivers, processor interfaces, optimized I/O, custom computing, and many other functions to create solutions that are uniquely optimized for each application. The result is a range of pioneering FPGA products that have delivered industry-first capabilities and leadership features.



Intel Agilex 9 Devices

Intel Agilex 9 devices are a unique class of products that push beyond the limits of mainstream programmable logic by providing unprecedented capabilities and optimization for their target applications. Comprised of the Intel Agilex® Direct RF-Series FPGAs and SoCs integrating industry-leading wideband data converters with sample rates up to 64 Gsps, these devices can deliver an order of magnitude improvement in size, weight, power, and cost for analog or RF systems.

Intel Agilex 7 Devices

The Intel Agilex 7 devices include the industry's highest performance FPGAs providing a range of premium features for the most demanding applications, including the F-Series, I-Series, and M-Series. This tier offers the industry's highest data rate transceivers—up to 116 Gbps—the first PCIe 5.0 and CXL support, and options to integrate in-package HBM2e memory delivering the industry's highest memory bandwidth (over 1 TBps). These capabilities enable customized connectivity and acceleration for the most compute, bandwidth, and memory-intensive use cases in communications, data center, defense, high-performance computing, video, high-end test/measurement/medical, and more.

Intel Agilex 5 Devices

Intel Agilex 5 devices serve a broad range of applications that require high performance, lower power, and smaller form factors. This tier consists of the performance-optimized D-Series FPGAs and the power-optimized E-Series FPGAs. Intel Agilex 5 devices also feature the industry's first Enhanced DSP with AI Tensor Block, which deliver high-efficiency AI and digital signal processing (DSP) functionality, and the FPGA industry's first asymmetric applications processor system consisting of dual Arm Cortex-A76 cores and dual Cortex-A55 cores, which enable you to optimize the performance and power efficiency of their workloads. These characteristics make them ideal for midrange FPGA applications across the edge and core including wireless and wireline communications, video and broadcast equipment, industrial applications, test and measurement products, medical electronics, and defense applications.

Intel Agilex 3 Devices

Intel Agilex 3 devices are designed to perform a wide range of essential functions that are key to nearly every electronic system. Optimized for low power and cost, as well as ease of use, they will be offered in very compact form factors making them widely useful for every sector that benefits from programmable logic. More information on these products is forthcoming.

Intel Agilex® FPGA Portfolio Application

- Networking
- 5G and Wireless Infrastructure
- Application and Infrastructure Acceleration
- AI and Data Analytics
- High-Performance Computing
- Aerospace / Defense
- Embedded Vision, Video and Broadcast
- Test & Measurement
- Medical
- Industrial and Smart City
- Consumer and Automotive
- Prototyping

A Complete Portfolio United by a Single, Powerful Development Flow

All Intel Agilex devices are served by a single, unified development flow based on Intel® Quartus® Prime Software tools. With the goal of providing the best FPGA developer experience, the Intel Quartus Prime Software tools maximize user productivity and provide access to all device features and capabilities, enabling you to derive the greatest value from Intel FPGAs. With Intel's complete programmable logic solution, you need only invest in a single development tool to access a complete portfolio of FPGA product options to satisfy all programmable logic needs.

Intel Agilex FPGA Product Overview Table

	Intel Agilex® 9 FPGA	Intel Agilex® 7 FPGA	Intel Agilex® 5 FPGA	Intel Agilex® 3 FPGA
Logic Capacity Range (logic elements)	1.4M – 2.7M	573k – 4M	50k – 650k	Coming Soon
Embedded Memory (Max)	287 Mb	485 Mb (32 GB HBM2e option)	69 Mb	
DSP Type	Variable-Precision DSP Blocks		Enhanced DSP with AI Tensor Blocks	
18x19 Multipliers (Max)	17,056	25,584	3,680	
Hard Processor Options	Quad-Core Arm Cortex-A53		Dual-Core Arm Cortex-A76 Dual-Core Arm Cortex-A55	
Transceiver Data Rate (Max)	58 Gbps	116 Gbps	28 Gbps	
Processor Interfaces	PCIe 4.0	PCIe 4.0/5.0, CXL	PCIe 4.0	
Ethernet Interfaces	Up to 400 GbE	Up to 400 GbE (high-performance crypto block option)	Up to 25 GbE	
Memory Interfaces	DDR4, QDR IV	DDR4/5, LPDDR5, QDR IV	DDR4/5, LPDDR4/5	
I/O Count (Max)	660	768	444	
Transceiver count (Max)	32	120	32	
Package Size (Min)	45x32 mm	37.5x34 mm	15x15 mm	

For More Information

Intel Agilex FPGA portfolio page: www.intel.com/agilex

Intel Agilex 9 FPGA product page: www.intel.com/agilex9

Intel Agilex 7 FPGA product page: www.intel.com/agilex7

Intel Agilex 5 FPGA product page: www.intel.com/agilex5

Intel Agilex FPGA Architecture White Paper: www.intel.com/agilex-wp

Compute Express Link: www.computeexpresslink.org

Intel Quartus Prime Software: www.intel.com/quartus

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*Configurations and Details

Note (1): ~2X better Fabric Performance per Watt Compared to competing 7nm FPGA

The Intel Agilex and Versal devices (part number/speed grade) used in the perf/watt comparison are as follows: Agilex: AGF014-2, Versal: Equivalent density to AGF014-2 in 2M speed grade. Design profile used for the comparison: Base Stratix 10 frequency: 450MHz, Agilex Fmax = 450 * 1.59 = 716Mhz, Versal Fmax = 450 * 1.19 = 536Mhz. Resource usage: 60% of AGF014 resource (logic, M20K memory, DSP), power at the respective Fmax Version of all the tools used for this data: Agilex: Quartus 20.4/PTC 21.1 b149, Versal: Vivado 2020.2/XPE: 2020.2.

Note (2): 50% Higher Performance Compared to competing 7nm FPGA

Derived from a set of five video IP designs comparing Fmax of each design achieved in Xilinx Versal ACAP devices with the Fmax achieved in Intel Agilex devices, using Intel® Quartus® Prime Software (version 20.4) and Xilinx Vivado Software (version 2020.2). On geomean, designs running in the mid speed grade of Intel Agilex FPGAs achieve a 50% higher in Fmax compared to the same designs running in the mid speed grade of Xilinx Versal devices (-2M speed grade), and 42% higher in Fmax compared to the same designs running in the fast speed grade of Xilinx Versal devices (-2H speed grade) and 24% higher in Fmax compared to the same designs running in the mid speed grade of Xilinx 16nm VUP devices (-2 speed grade).

Note (3): Highest Memory Bandwidth FPGAs

Intel Agilex M-Series theoretical maximum bandwidth of 1.099 Tbps with 2 banks of HBM2e using ECC as data and 8 DDR5 DIMMs as compared to Xilinx Versal HBM memory bandwidth of 1.056 TBps from https://www.xilinx.com/products/silicon-devices/acap/versal-hbm.html#productAdvantages and from https://www.xilinx.com/content/dam/xilinx/support/documentation/selection-guides/versal-hbm-product-selection-guide.pdf as of October 14, 2021 and to Achronix Speedster 7t memory bandwidth of 0.5 Tbps from https://www.achronix.com/sites/default/files/docs/Speedster7t_Product_Brief_PB033.pdf as of October 14th 2021.

Intel technologies may require enabled hardware, software, or service activation. For more information on workloads and configurations, see www.intel.com/performanceindex.

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