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AVNET®

/ FIVE CONSIDERATIONS FOR CHOOSING AN FPGA FOR YOUR NEXT CONSUMER DESIGN

Conventional wisdom holds that FPGA devices aren't suitable for use in consumer electronics.

While that may be the case for some FPGA manufacturers, FPGAs from AMD Xilinx — especially those in the **Cost-Optimized Portfolio** (COP) — can empower developers to bring new consumer devices to market more quickly and cost-effectively than ever.

AMD Xilinx has a heritage of innovative, field-proven consumer applications across several verticals. From real-time gaming to 5G network gateways, devices based on AMD Xilinx FPGAs provide developers with unmatched, high-level capabilities that can enable market entry earlier at a lower price point vs. an ASIC-based design.

These five considerations can help you decide whether an FPGA or ASIC is right for your next consumer design:

1. SYSTEM INTEGRATION

FPGAs provide designers with system performance benefits and functional capabilities to leverage when developing new products. One of these benefits is integrating several diverse functionalities within a single device. An example is an application requiring a discrete processor connected to a DSP that uses a small programmable logic device for glue logic integration. By using a device from the AMD Xilinx COP, developers can integrate the processor, DSP and glue logic all within the same package. This reduces the Bill of Materials (BoM) cost as well as the size and weight of the solution.

2. TIME TO MARKET

The consumer market moves fast. Time to develop and implement a bespoke application using an ASIC can potentially delay market introduction and significantly reduce revenue goals. Developers can accelerate design time by leveraging an AMD Xilinx FPGA to deploy first-to-market products. Prototyping and developing an ASIC-based solution can come later.

3. IN-FIELD UPGRADABILITY

Product road maps and industry standards are evolving. Devices that can be re-programmed in the field to add new capabilities or implement updates deliver significant advantages because they adapt to evolving standards. This enables gradual implementation of new features from the product road map. In-field upgrades can also eliminate the need for recalls should engineers detect issues as adoption commences.

4. ARCHITECTURAL FLEXIBILITY

FPGAs and embedded processors are being asked to perform more complex tasks than ever to feed the demand of compute-hungry devices. AMD Xilinx devices offer significant architectural flexibility when utilizing an FPGA or SoC. When utilizing a SoC, developers can offload high computationally intensive programming to the parallel programmable logic structure, enabling increased performance and throughput. Similarly, the flexibility of an FPGA/SoC I/O structure enables any-to-any interfacing, freeing developers from the constrained interface of ASIC or off-the-shelf microcontrollers. Flexibility at the solution, algorithm and interfacing levels enables developers to create solutions which are deterministic, responsive and highly power efficient.

5. LOW-RISK SOLUTION

Not only does the system integration enable an integrated single-chip solution with lower BOM cost, it reduces the overall technical risk and cost of development (non-recurring cost). A single device simplifies the design of the circuit board as complex signal integrity layout rules demanded to achieve high-speed interconnection between devices are no longer required. Further, an integrated single-chip solution also results in a simpler power architecture, along with reduced electromagnetic interference and compatibility issues.

Another significant risk-reduction factor in the use of AMD Xilinx FPGAs occurs when new standards, applications or algorithms are deployed. They can include inadvertent errors (84% of FPGAs make it to the field with at least one nontrivial bug). The re-programmability of AMD Xilinx devices in development, manufacture and in the field enables these issues to be quickly and easily addressed, again lowering technical risk.

This integration of several discrete components into a single chip solution along with the associated risk reduction in layout and board complexity and size enables the developer to achieve both a reduced cost and reduced technical risk solution.

INCREASED PROCESSING POWER IN A SMALL, COST-OPTIMIZED PACKAGE

Let's dive a little deeper into AMD Xilinx technology and their development tools to understand why these five key points hold true.

AMD Xilinx offers a broad portfolio of adaptable solutions for cost-sensitive applications. From the 28nm Spartan®-7 FPGA, the smallest devices in the portfolio, to the ultra-compact Artix® and Zynq® devices, to the Zynq UltraScale™+ MPSoCs, the COP is tailor made for the consumer market.

The breadth of devices within the COP portfolio enables developers to select the most appropriate device for the application at hand:

- **Spartan-7 FPGAs:** Built on 28nm technology, the Spartan-7 family offers programmable logic with associated block memories and DSP elements coupled with a high number of I/O counts. With best-in-class performance per watt, the device is ideal for any-to-any connectivity, sensor fusion or embedded vision applications where a small footprint is required.

- **Artix-7 FPGAs:** The industry's only cost-optimized 16nm FPGAs, Artix-7 devices match I/O bandwidth to compute to maximize system performance for cost-sensitive and low power applications. The devices provide the best value for applications such as machine vision, secure networking, 4K broadcast, and a range of industrial IoT and edge markets.

- **Zynq-7000 SoCs:** This family of SoCs integrates the software programmability of a single- or dual-core Arm®-based processor with the hardware programmability of an FPGA, enabling key analytics and hardware acceleration while

integrating CPU, DSP, ASSP and mixed-signal functionality on a single device. Fully scalable for unique application requirements, the family is ideal for consumer applications such as after-market multi-camera driver assistance systems and 4K Ultra-HDTV.

- **Zynq UltraScale+ MPSoCs (ZU1-ZU3):** Based on the AMD Xilinx next-generation UltraScale+ architecture, devices provides Arm 64-bit processor scalability while combining real-time control with soft and hard engines for graphics, video, waveform and packet processing. These ultra-compact devices provide unmatched compute density for an unlimited number of applications across 5G wireless, next-generation ADAS and Industrial Internet-of-Things devices.

The processing systems for both the Zynq-7000 SoC and the Zynq UltraScale+ MPSoC provide the user with a range of standard interfaces to enable communication with a variety of peripherals. These include simple interfaces such as I^2C/UART/SPI to gigabit Ethernet, USB 3.0, SATA and DisplayPort™. Other interfaces such as HDMI® or SDI can be implemented in the programmable logic.

If sequential processing is required but a heterogeneous SoC is not suitable for the desired application, AMD Xilinx provides developers with a MicroBlaze softcore processor. The processor can be implemented directly in any AMD Xilinx device and deployed with an embedded Linux solution (if required), significantly easing the software development. Alternatively, Arm M1 and M3 soft processors can be implemented at no cost or royalty fee.

SIMPLIFYING DEVELOPMENT TIME WITH SOFTWARE TOOLS & LIBRARIES

Physical devices aren't all that enable such innovation. So do the powerful software tools, libraries and methodologies necessary to develop and deploy solutions on AMD Xilinx FPGAs. These environments reduce development time while allowing developers to create custom hardware accelerators easily and on demand.

The AMD Xilinx field-proven Vivado® platform enables developers to define the contents of programmable logic, the configuration of the processing elements and the resources available for acceleration using the Vitis™ Unified Software Development Platform. Vitis enables developers to create embedded software solutions that run on bare metal or Linux, along with leveraging high-level synthesis (HLS) and a large range of libraires to enable acceleration from the software to implementation in programmable logic.

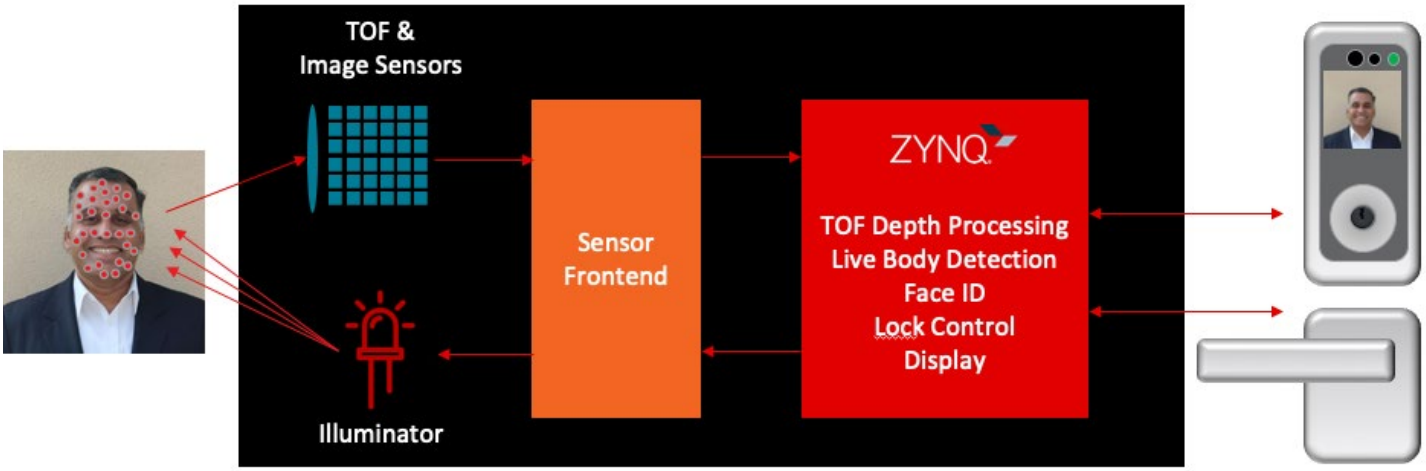
The Vitis tool chain also extends to the implementation of advanced processing and machine learning (ML) inference solutions. Vitis AI enables developers to utilize commonly used AI frameworks such as PyTorch, Caffe and TensorFlow to take floating point networks and deploy them on fixed-point quantized accelerators, which provide the same accuracy with significantly increased performance.

COST-OPTIMIZED CONSUMER PRODUCTS

Application examples of the advantages of using AMD Xilinx technology:

Home security

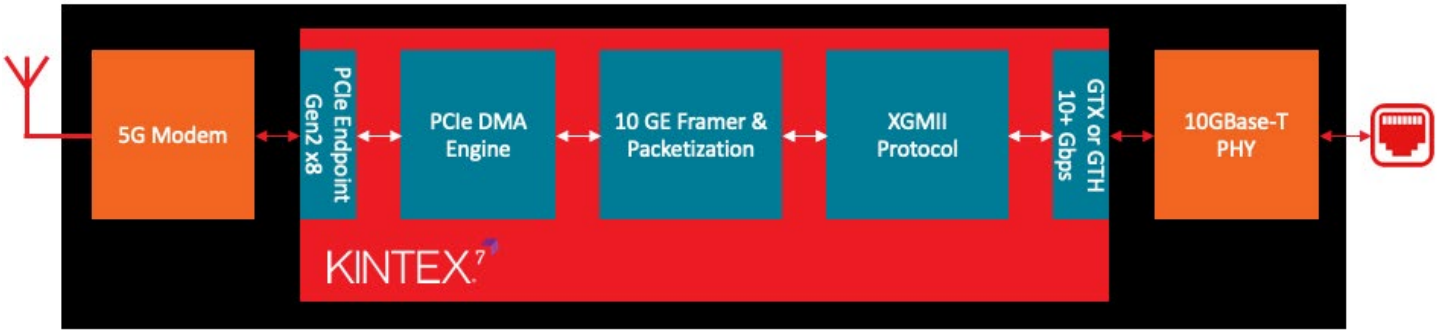
Smart locks are increasingly used to secure the home. Traditionally, smart locks rely on 2D facial recognition or fingerprints. However, these are not as secure as other approaches. One high-security approach is to use a "live body" check, which uses a time-of-flight (ToF) sensor. A ToF sensor is depth aware, which prevents a simple 2D photograph from being presented to the system to gain admission. A ToF sensor combined with structured light illumination enables a 3D image to be created. An AMD Xilinx device such as a Zynq-7000 SoC can perform the interfacing and configuration of the sensor, while at the same time able to calculate the depth and "live body" detection and the necessary edge machine learning models to identify the face. The flexibility of the I/O also enables interfacing with the lock control and timing generation required. Flexibility in the field also enables updates to be implemented remotely as security standards are updated. When running an AMD Xilinx device, unlocking can be achieved in about 300 mS from power on to unlock and requires only 20 mWh per operation as the lock can be used for millions of operations off a single battery.



Residential gateways

A 5G residential gateway is a more complex implementation. 5G mobile networks can deliver significant bandwidth improvements for remote and rural locations. Many 5G chipsets are not designed to provide an Ethernet output, which is needed for residential gateways. There is limited choice for Ethernet speeds beyond 1 Gigabit⁄sec which does not maximize 5G's bandwidth. AMD Xilinx devices like the Artix-7 FPGA can be used to implement a bridge between a 5G radio and 2.5/5G Ethernet, or a Kintex-7 FPGA can bridge to 10GBase-T. This can be implemented by leveraging AMD Xilinx soft IP MAC, which provides capabilities for 1/2.5/5/10Gbps Ethernet.

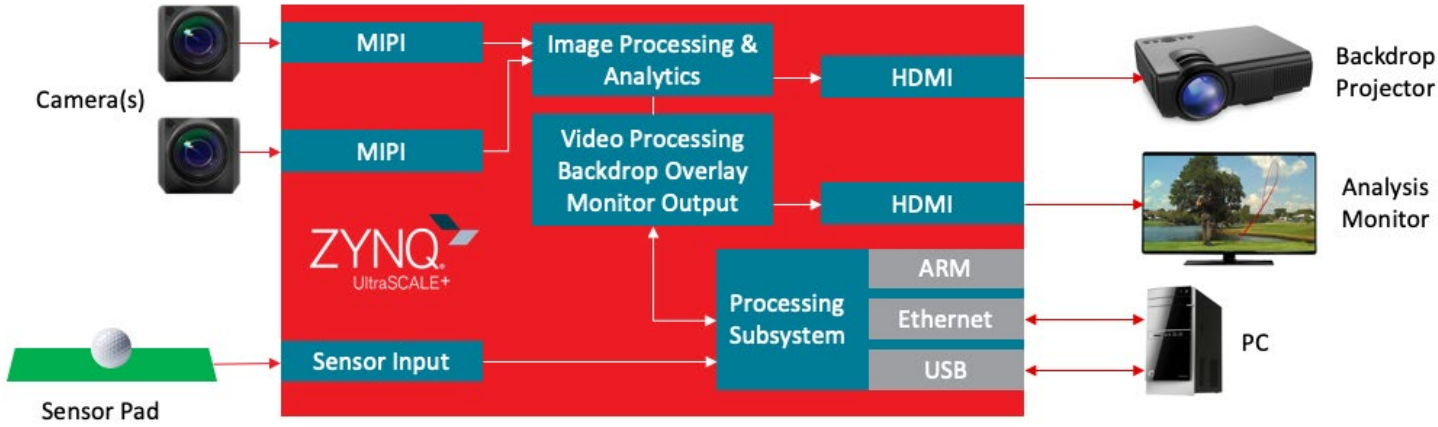
Alternatively, should a WiFi solution be required, an AMD Xilinx Artix-7 FPGA can be used to implement digital up and down conversions between 5G and WiFi.



Golf swing analyzer

A golf swing analyzer or launch monitor is one example of real-time sensor fusion. Such a solution must perform sensor fusion from several different sensors including cameras and pads. It must perform complex DSP algorithms and provide the results in near real time to the user for analysis and performance improvement. In this application, the sensor inputs can be provided into either the PS or PL, depending upon the bandwidth required. Camera processing can be achieved in real time using the parallel nature of the programmable logic.

Development of the image processing chain can also be very fast by leveraging AMD Xilinx IP and Vitis Vision libraires (based on OpenCV). The combination of processing in the PS and PL concurrently will provide real-time analysis of the golf swing. The results can then be overlaid on the backdrop projection, and/or shown on a nearby monitor for viewing and analysis.



DEVELOPMENT BOARDS TO HELP YOU GET STARTED

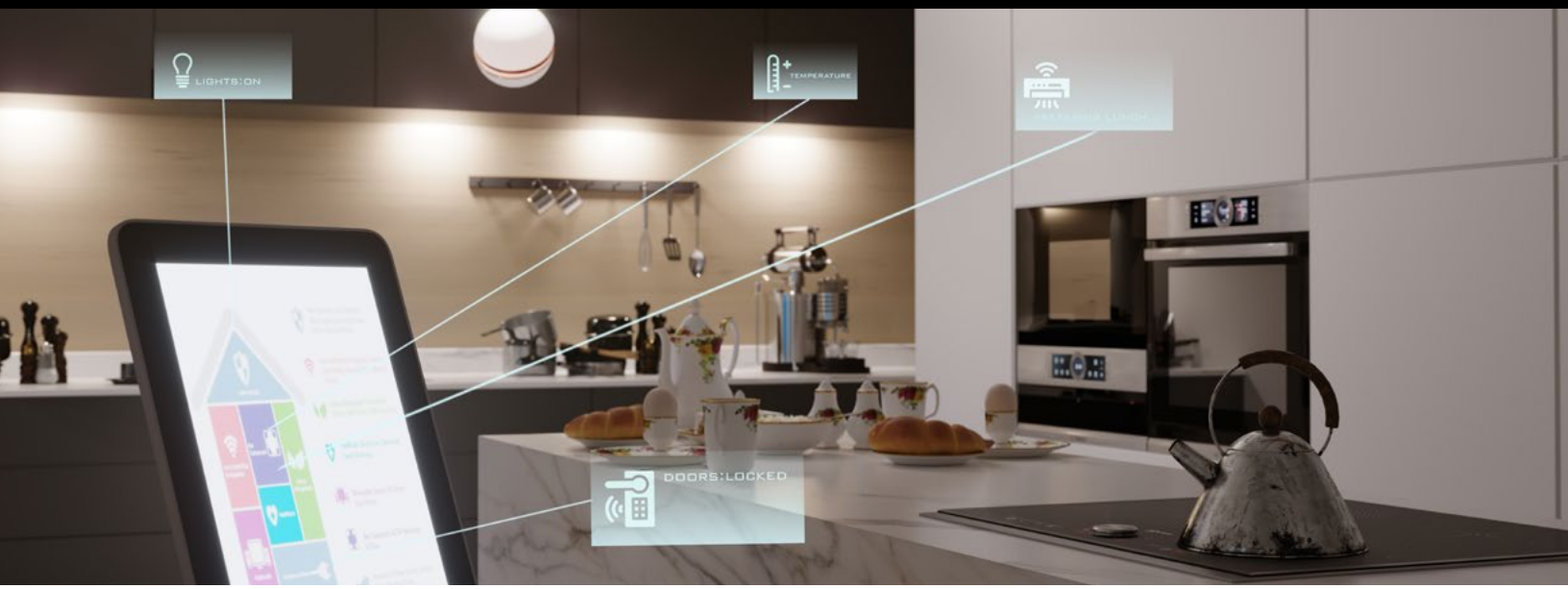
AMD Xilinx offers a range of development boards that enable developers to quickly create consumer-based designs. These include:

- **Zynq UltraScale+ ZU1 MPSoC development board** for accelerated sensor fusion and machine learning acceleration at the edge
- **Spartan-7 SP701 development board** for consumer networking and imaging applications with dual Ethernet ports and MIPI CSI / DSI connections
- **Artix-7 AC701 development board** with gigabit serial links for high-speed interfacing with PCIe and QSFP+ provision
- **Zynq-7000 ZC706 development board** for embedded applications at the edge

These boards provide the developer with a range of interfaces and breakouts to enable the additions of external development cards and circuits to prototype the end solution, reduce time to market, and de-risk the project. Interface solutions include FMC (LPC and HPC), SYZYGY, Micro Click, Pmod, QSFP+ cages, USB 3.0, Gigabit Ethernet. Of course, UART and JTAG enable configuration and communications.

AMD Xilinx devices have an excellent heritage in consumer electronics. The company provides developers with multiple benefits including system integration, architectural flexibility, in-field upgrades, low cost of total ownership and reduced time to market. Starting with development kits available at the beginning of the journey, AMD Xilinx devices and tools deliver a significant benefit to developers of consumer applications who wish to innovate and deliver advanced consumer solutions.

Learn more about cost-optimized solutions from AMD Xilinx **here**



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