Bringing the benefits of Cortex-M processors to FPGA

Presented By

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Agenda

- Market trends
- Introducing Arm DesignStart FPGA
- DesignStart FPGA in the Xilinx Ecosystem
- Summary
Powering diverse embedded devices with Arm Cortex-M CPUs

Cortex-M based devices are growing exponentially

35bn+
Cortex-M based SoCs shipped to date

Billions of Cortex-M based chips shipped
A large growth in application-optimized designs

- Over 1 billion cost-optimized Xilinx devices sold to date
- Xilinx continues investment in their cost-optimized portfolio with new devices, tool, and IP improvements
- Multiple generations of Arm-based embedded processing solutions:
  - ARTIX™ SPARTAN™
  - ZYNQ™ Z-7000
  - ZYNQ™ UltraSCALE+

Cortex-A9 shipments on Zynq-7000

3X growth in the past 2 years for Arm Cortex-A9 on Zynq-7000
Introducing DesignStart FPGA
Consistent architecture across the hardware spectrum

Fast time to market

Operating systems

Development tools

Software libraries

Training, resources and support

Application optimized

Single-board computer

System components

Off-the-shelf SoCs

FPGAs

Custom silicon
DesignStart: addressing the needs of FPGA users

DesignStart for SoC

- Quick and easy access to
  - Cortex-M0 and subsystem
  - Cortex-M3 and subsystem
- DesignStart Eval for design, simulation and prototyping on FPGA
- DesignStart Pro for full products with manufacturing rights for SoC

DesignStart FPGA

- Easy to access and free to use
  - Cortex-M1
  - Cortex-M3
- For use in FPGA fabric, including full commercial use
- Integrated in Xilinx Vivado Design Suite for ease of use
Fast and simple access to the world’s leading IP

Quick and easy access
  • Instant download of Cortex-M1 and Cortex-M3 processors
  • Simple click-through agreement

Free to use on FPGA
  • Free use on FPGA for Cortex-M1 and Cortex-M3
  • For prototyping, research and commercial use

Integrated with Xilinx Vivado Design Suite
  • Drag and drop the Vivado compatible Cortex-M component
  • Available for on any Vivado supported Xilinx FPGA device

Available at designstart.arm.com/fpga
Proven Cortex-M technology optimized for FPGA integration

**Cortex-M1**
- FPGA-optimized version of Cortex-M0
- 32-bit processing in the smallest area
- For constrained devices

**Cortex-M3**
- General purpose 32-bit processor
- Balanced performance and area
- For diverse embedded and IoT applications

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Exceptional code density

Simplified software development and vendor-independent CMSIS abstraction layer

Supported by the broadest technology ecosystem of software, tools and services
Best-in-class code density with Thumb instructions

- Cortex-M are 32-bit processors with 32-bit and 16-bit Thumb instructions
- Thumb technology brings to reduced code size than 8/16-bit processors

Together resulting in reduction of memory flash size
Cortex Microcontroller Software Interface Standard (CMSIS)

Vendor-independent standard for hardware manufacturers and tool vendors

Available open source at https://github.com/ARM-software/CMSIS_5
Access the world’s #1 embedded ecosystem on Xilinx

Largest choice of proven OS and tools

- 40+ RTOS
- 20+ IDE compiler
- 21+ Debug & trace

Thriving developer base

- 350k+ Mbed OS registered developers
- 2+ million Eclipse/GCC (Arm) downloads in 1 year
- 8.5+ million CMSIS pack downloads in 1 year

Largest open-access development resources

- 1000s of how-to guides, articles, and online development resources
Rapid time to market with simplified development flow

Design hardware
Simple drag-and-drop integration of CPU

Develop software
Benefit from broadest embedded ecosystem
Reuse existing code
Access widest range of third-party software

Deploy on FPGA
Deploy to any development board
Pre-integrated on Arty A7 & S7
DAPLink adaptor board available for a simpler, out-of-box experience
DesignStart FPGA in the Xilinx Ecosystem
Arm DesignStart FPGA is integrated with Vivado

1. DesignStart FPGA imports as a Vivado repository
2. Cortex-M1/Cortex-M3 then part of the Vivado IP catalog
3. Configure M cores as needed:
   • Configuration
   • Debug
   • Instruction Memory
   • Data Memory
4. Add and configure peripherals
5. Hardware/Software Manager recognizes the Arm CPUs
6. Export to your IDE for software implementation
Innovative Arm / Programmable Logic Architecture

Complete Arm-based Processing Systems
- Single/Dual Cortex-A9 (Zynq-7000)
- Dual/Quad Cortex-A53 (ZU+)
- Dual Cortex-R5 (ZU+)
- Soft Cortex-M processing options

Tightly Integrated Programmable Logic
- Extension of the processing system
- Scalable density and performance

Ultimate Flexibility
- Create custom, flexible SoC to meet exact project needs in a single device
- HW / SW partitioning optimized to specific application requirements

Flexible Array of External Interfaces
- Wide range of external multi-standard I/O
- High performance integrated serial transceivers
- Analog-to-digital converter inputs

Remove the Multi-chip Bottleneck
- Data transfers Up to ~100Gbps BW

Vast Internal IP Catalogs
- Common functions and peripherals
Cortex-M ideal for optimizing Zynq hardware performance

ARM Cortex-A9 for Application Processing

Cortex-M for Real-Time Co-Processing

Hardware for Parallelism and Determinism

Programmable Logic

Non-Critical Compute-Intensive Tasks

Critical Tasks

RTOS

Cortex-M

Non-Critical Compute-Intensive Tasks

ARM Cortex-A9 Processor

Linux
DesignStart FPGA is ready to use today

<table>
<thead>
<tr>
<th>Part Number</th>
<th>XC7S6</th>
<th>XC7S15</th>
<th>XC7S25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic Cells</td>
<td>6,000</td>
<td>12,800</td>
<td>23,360</td>
</tr>
</tbody>
</table>

> Spartan XC7S25 on the Arty-S7 features over 23K logic cells!
> A single Cortex-M consumes less than $\frac{1}{10}$th of the programmable logic
> Block RAM can be configured as on-chip memory

Cortex M1/M3 reference designs available on the Arty-S7 and A7

Optional DAPLink adaptor with Arm mbed support
- Serial wired debug over USB
- Dedicated QSPI flash
- DAPLink USB composite device
Cost-optimized development kits available

- **ARTY S7**  
  Spartan-7 25  
  $89

- **ARTY A7**  
  Artix-7 35T  
  $119

- **ARTY Z7**  
  Zynq-7000 Z7-10  
  $149

- **MiniZed**  
  Zynq-7000 7S  
  $89

- **Ultra96**  
  Zynq UltraScale+ ZU3EG  
  $249

✓ Cortex-M1 and Cortex-M3 reference designs available
Summary
Easier, faster development of FPGA-based products

$0 and instant access to Arm Cortex-M1 and Cortex-M3

Faster hardware development with integration in Xilinx FPGA tools

Faster software development with the extensive Arm ecosystem

Choice, flexibility and innovation

Using the CPUs of choice

Download today at designstart.arm.com/fpga