FrontPanel Overview

Build high-performance software-connected FPGA applications for prototypes, proof-of-concept, and production

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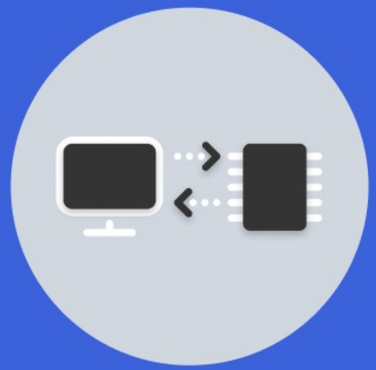
System Components



Software API and a robust driver to communicate with your device over USB, PCI Express, or the internet

Proprietary device firmware to manage FPGA configuration and communication as well as other device management and monitoring

Lightweight FPGA IP blocks that integrate with your HDL to make host communication simple and easy

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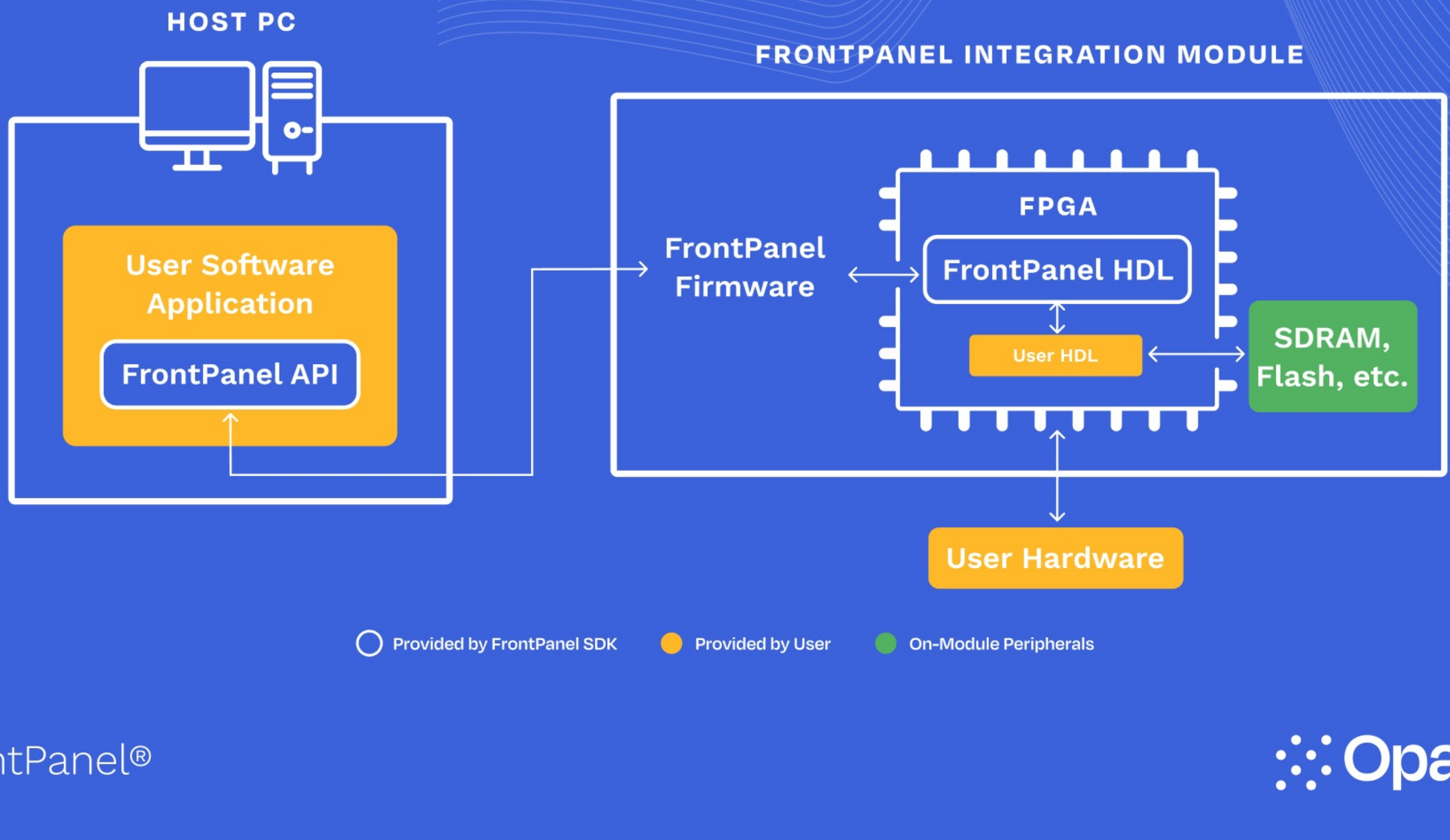
System Architecture



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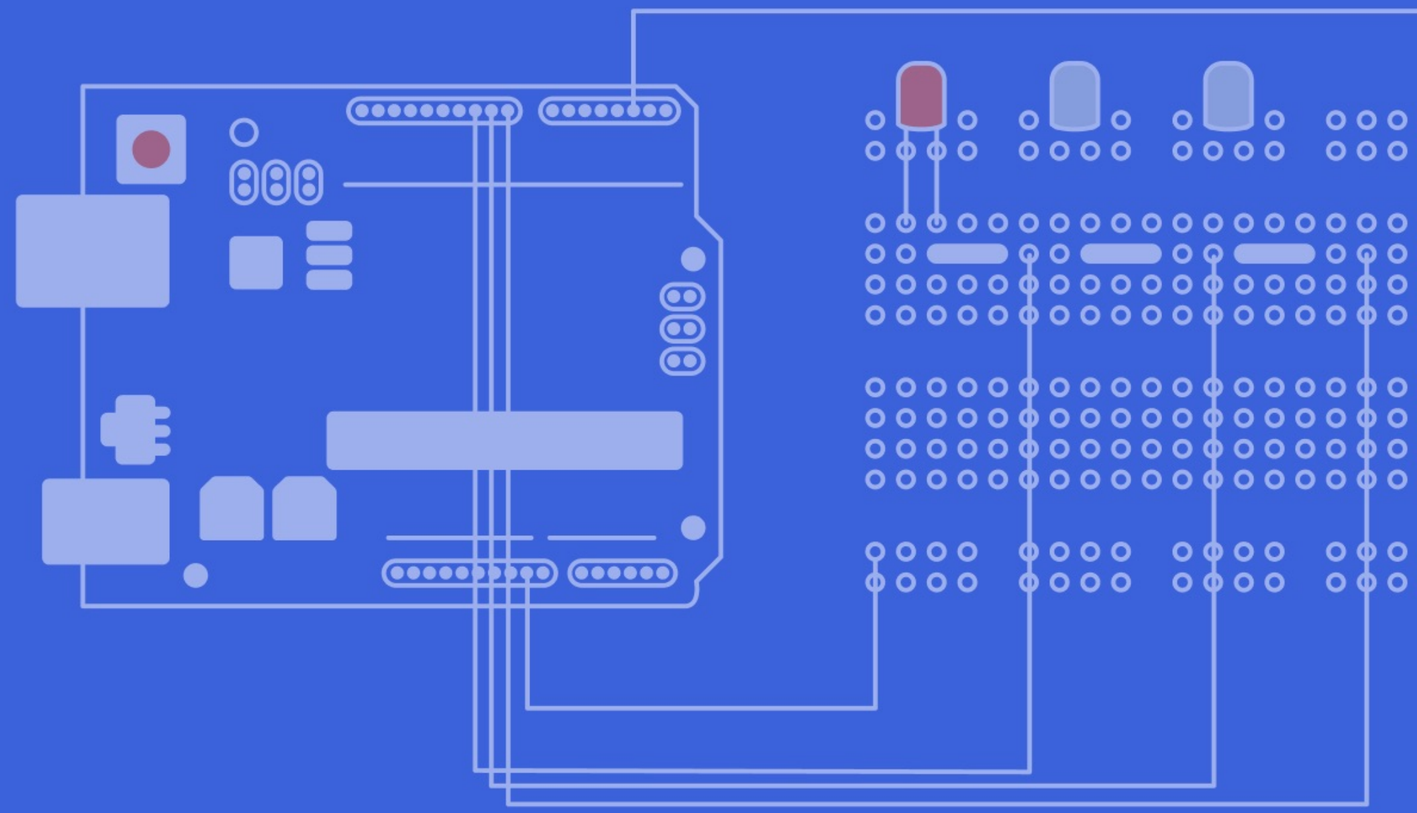
Wires



- Asynchronous - e.g. switches, pushbuttons
- 32 wires available, each is 32-bit wide
- Use synchronizers to interface to synchronous circuits reliably
- Best for asynchronous resets, data input, output monitoring

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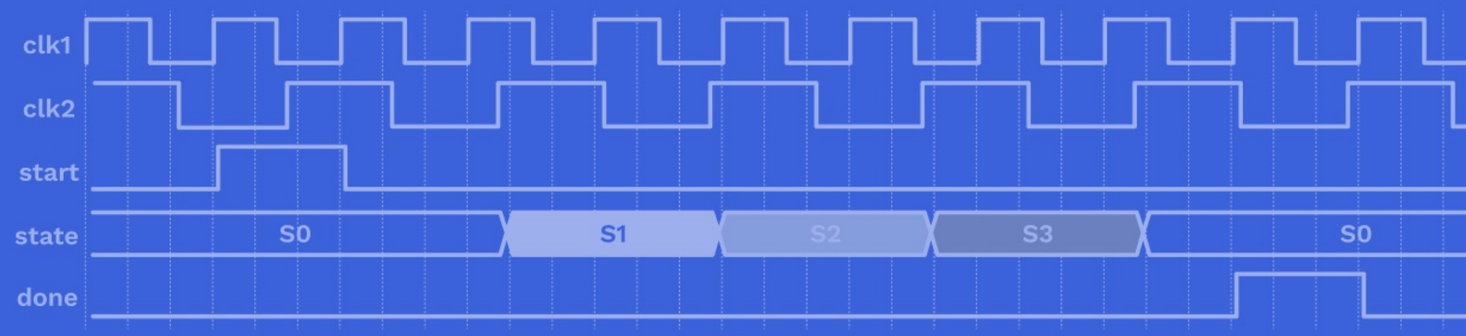
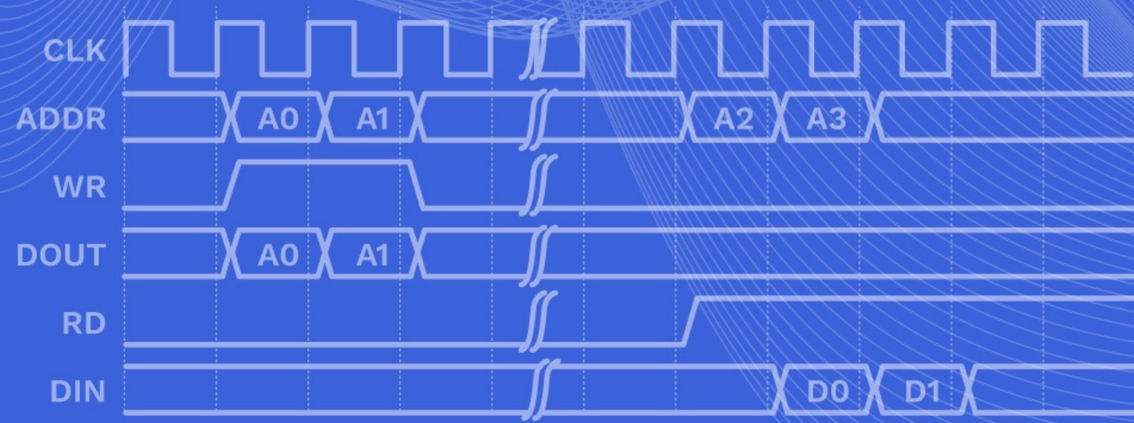
Triggers



- Synchronous event / clock domain crossing
- 32 trigger bundles available, each with 32 triggers to a single clock
- Synchronizer is built-in
- Best for synchronous resets, event monitoring

Register Bridge



- Synchronous and addressable
- One register block: 32-bit data value, 32-bit address
- Good for memory interfaces, large register files, coefficient memory

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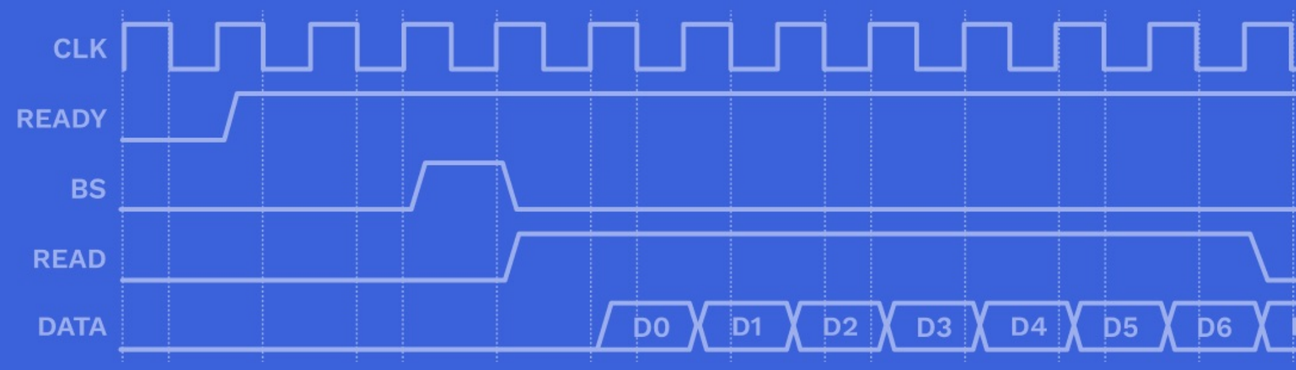
Pipes



- Synchronous raw data payload transfer
- High performance data transfer to / from a single “endpoint”
- 32 pipe endpoints available, each with a 32-bit wide data bus
- Best for data acquisition, large memory transfers
- Combine with wires or triggers for advanced protocol implementations (e.g. handshaking)

Pipe Performance

- Super Speed USB: **350 MBps** sustained uni-directional transfers
- High Speed USB: **38 MBps** sustained uni-directional transfer

Performance figures represent optimal transfer conditions and may vary by host OS, host system architecture, and other factors.

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Additional Features

- Product-specific **Device Settings** for volatile & non-volatile registers
- Product-specific **Device Sensors**: voltage, current, temperature monitoring
- **Reset Profiles** to initialize new-configuration FrontPanel context
- Software-programmable VIO for select modules
- SYZYGY support for selected development boards and breakout boards (including SmartVIO)

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Camera Example Design

- Wires implement register settings such as frame size and capture mode
- Triggers implement capture and readout event
- Pipes implement image buffer transfer
- Internal FIFOs implement a DDR image buffer controller
- N-Deep capture controller for large capture memory

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Desktop App

- Rapid user interface prototyping with virtual UI elements
- Text-based XML UI description file
- Supports wire, trigger, and pipe endpoints
- Business logic implemented in Lua scripts

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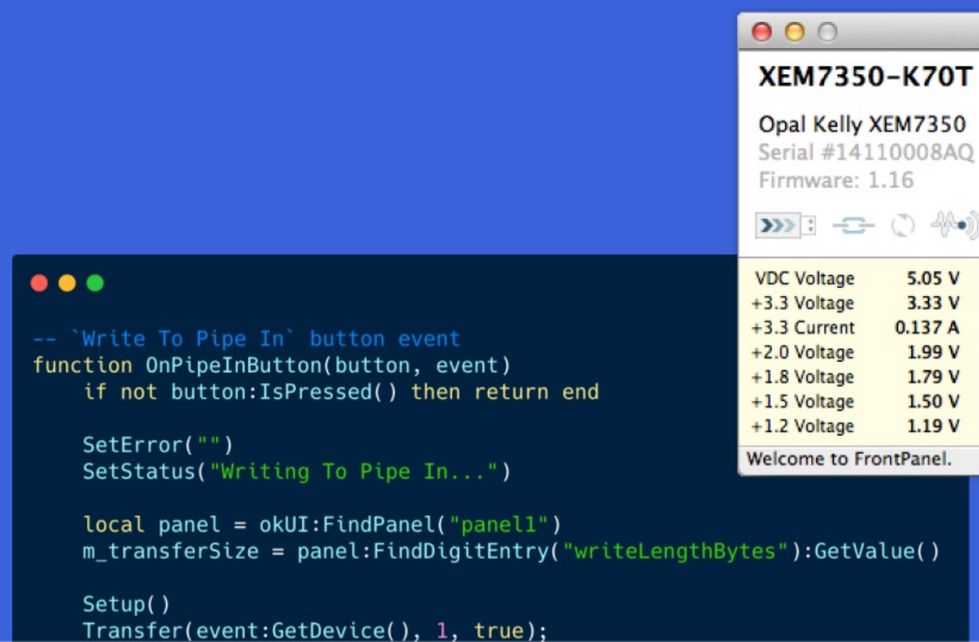
- LEDs
- Hexadecimal displays
- Sliders
- Pushbuttons
- Checkboxes
- Toggle buttons
- Numerical entry

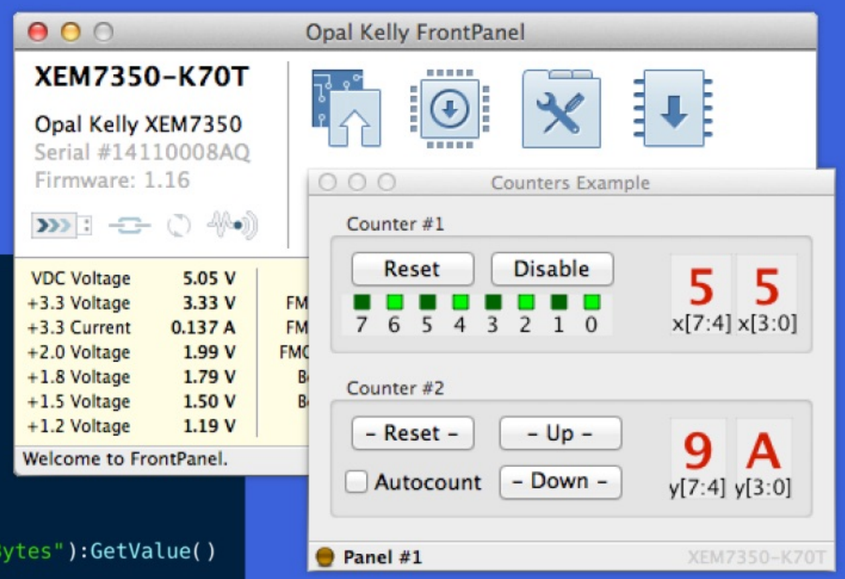


```
-- `Write To Pipe In` button event
function OnPipeInButton(button, event)
    if not button:IsPressed() then return end

    SetError("")
    SetStatus("Writing To Pipe In...")

    local panel = okUI:FindPanel("panel1")
    m_transferSize = panel:FindDigitEntry("writeLengthBytes"):GetValue()

    Setup()
    Transfer(event:GetDevice(), 1, true);
```



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Platform Support

2.0
3.0

FPOIP

C++ C# Python Java Javascript

3rd-party Library (e.g. MATLAB, LabView)

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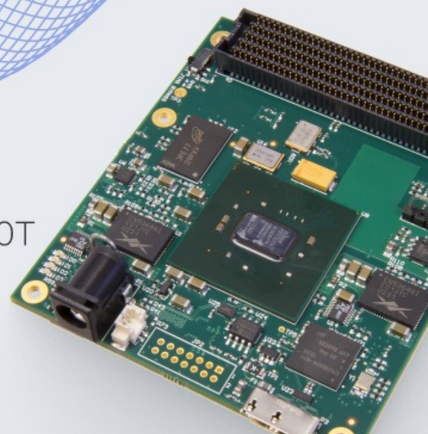
FPGA Modules + FrontPanel® SDK

XEM8350

Xilinx Kintex UltraScale XCKU060
4 GiB DDR4 memory with ECC
Dual SuperSpeed USB 3.0 interface
330+ I/O
28 Gigabit Transceivers



XEM7350

Xilinx Kintex-7 XC7K160T / K410T
512 MiB DDR3 memory
SuperSpeed USB 3.0 interface
170 I/O and 8 Gigabit Transceivers
FMC-HPC expansion connector

XEM7310MT

Xilinx Artix-7 XC7A75T / A200T
1 GiB DDR3 memory
SuperSpeed USB 3.0 interface
136 I/O and 4 Gigabit Transceivers
Samtec 0.5mm board-to-board connectors

ZEM5305

Intel Cyclone V (A2)
512 MiB DDR3 memory
SuperSpeed USB 3.0 interface
94 I/O and 2 GCLK
Samtec 0.8mm Connectors

ZEM5310

Intel Cyclone V E 5CEFA4F23C7N
512 MiB DDR3 memory
SuperSpeed USB 3.0 interface
106 I/O
Samtec 0.8mm board-to-board connectors

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Applications

Machine Learing / AI
Software-Defined Radio
Networking
Machine Vision
Test Equipment
University Labs
Scientific Instrumentation
Data Acquisition
RADAR, LIDAR
Satellite Imagery
Advanced / Remote Sensing
Semiconductor Simulation, Test, and Debug

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FrontPanel Deployments

- Over 2,200 named customers
  (+ “No Company” purchases)
- Over 200 Universities worldwide
- Research Organizations
- National Laboratories
- Military / Aerospace
- Scientific Instrumentation
- Commercial

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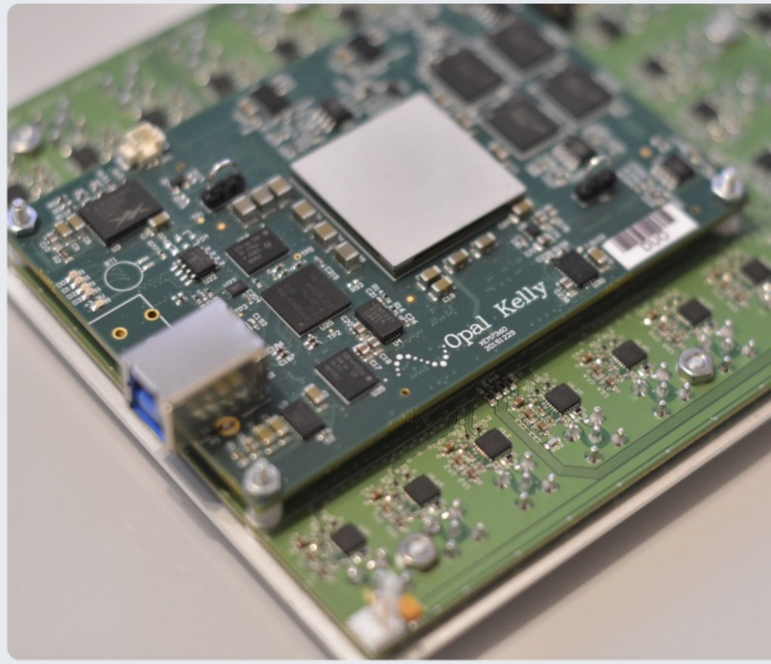
Production-Ready Customer Story:

Swabian Instruments



- Located in Stuttgart, Germany
- Ultra high-end time tagging for photonics, quantum
- Time Tagger 20 - Based on Opal Kelly XEM3005
- Time Tagger Ultra - Based on Opal Kelly XEM7360

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Key Benefits

Reduce time to market.

Build a team that strengthens your core.

Simplify your supply chain.