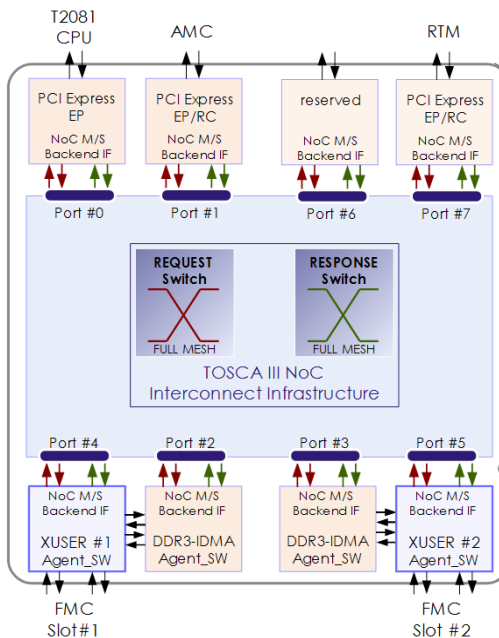


## IFC\_1420 QorIQ T2081 & Kintex UltraScale AMC Building the Next Generation of Control Systems

Data Sheet



### Key Features

- MTCA.4 mid-size double-width AMC form factor
- NXP QorIQ T2081 CPU @ 1.8 GHz
  - ✓ Four dual-threaded e6500 computing cores
  - ✓ On-board 2 GB DDR3L-1866 SDRAM
  - ✓ High-speed peripheral interfaces supporting PCI Express Gen3 and 10 Gbps Ethernet
  - ✓ AltiVec technology-based SIMD engine
  - ✓ Non-volatile boot media: NOR and SPI
  - ✓ Non-volatile storage memory: 4 Gbit NAND flash
- Xilinx Kintex UltraScale Central FPGA:
  - ✓ High end Xilinx Kintex UltraScale KU040 (default) or KU060 FPGA
  - ✓ 1024 MB dual channel DDR3L-1066 SDRAM
  - ✓ Local (SPI flash) and remote (Ethernet) configuration support
  - ✓ Up to three embedded PCI Express blocks configurable as End Point or Root Complex
  - ✓ Powered by TOSCA III FPGA Design Kit for straight-forward FMC integration and customization
- Customizable onboard DAQ function:
  - ✓ 10 channels ADC 16-bit @ 250 Msps
  - ✓ 4 channels DAC 16-bit @ 2.5 Gsps
- Single HPC VITA 57.1 compliant FMC slot
- MTCA.4.1 A1.1CO-compliant RTM interface
- Total integration within EPICS ecosystem

### Overview

IOxOS Technologies introduces the IFC\_1420, a high-performance digitizer in AMC form factor that enhances its comprehensive MTCA.4 ecosystem based on:

- MTCA.4 line of AMCs and  $\mu$ RTM modules, including CPUs, FMC carriers, Fast Digitizers and communication extenders
- High-end set of ADC and DAC modules in FMC form factor
- FPGA Design Kits for faster integration and customization
- EPICS support

The IFC\_1420 data acquisition function is fully implemented in a mezzanine (DAQ\_1430) that is directly interfaced to rear-transition analog signalling conditioning boards compliant with MTCA.4.1 class A1.1CO standard. This modular approach allows to develop a comprehensive family of MTCA.4 digitizers just by redesigning the mezzanine, that is seen by the on-board Central FPGA as a standard FMC module.

The on-board Xilinx Kintex UltraScale FPGA is powered by IOxOS Technologies' FPGA Design Kit (TOSCA series), that enables the straight-forward integration of the FMC modules and the implementation of custom data acquisition applications within a high-performance Network on Chip (NoC) based architecture.

An extensive EPICS ecosystem of open source tools, libraries and applications is growing around these MTCA.4 and FMC COTS, with the invaluable collaboration of the Paul Scherrer Institut (PSI) in Switzerland, aiming to support the physics community in the development of efficient distributed real-time platforms for precision instrumentation and state of the art accelerator control systems.



## Product Overview

The IFC\_1420 high-performance digitizer is a mid-size (4HP) double-width MTCA.4-compliant AMC unit featuring a mezzanine implementing a data acquisition function and a single HPC VITA57.1-compliant FMC slot. Both the mezzanine and the FMC slot are controlled by a Xilinx Kintex UltraScale device, connected to a NXP QorIQ T-series T2081 processor with a PCIe x4 Gen 3 link.

This versatile AMC unit can also be used as a standalone CPU module.

## On-board DAQ Function

The on-board data acquisition function implemented by the DAQ\_1430 mezzanine is handled by the Central FPGA as a standard FMC slot and provides the following resources:

- 10 channel ADC, AC or DC coupled (static selection), 16-bit @ 250 Msps based on Texas Instruments ADS42LB69
- 4 channel DAC, current mode, 16-bit @ 2.5 Gsps implemented with Texas Instruments DAC38J84 device
- Ultra-low noise clocking architecture with on-board dual-PLL VCXO and external clock input

## Kintex UltraScale Central FPGA

The IFC\_1420 Central FPGA is intended for user defined applications, providing FMC VITA57.1 interfacing resources. This FPGA is a major upgrade from the previous family based on Virtex-6T devices.

## A Set of ADC/DAC and GPIO FMC Modules

The IFC\_1420 FMC Carrier takes full advantage of IOxOS Technologies comprehensive line of ADC/DAC and GPIO modules in FMC form factor to increase its capabilities for data acquisition and control applications.

These FMCs include the following products:

- **ADC\_3110/3111 Fast ADC:** 8 channels ADC 16-bit @ 250 Msps (AC / DC coupling)
- **ADC\_3112 Ultra-Fast ADC:** 4 channels ADC 12-bit @ 1 Gsps or 2 channels ADC 12-bit @ 2 Gsps (DC coupling)
- **DAC\_3113 Fast DAC:** Dual channel ADC 16-bit @ 250 Msps & Dual channel DAC 16-bit @ 250 Msps (DC coupling)
- **ADC\_3117 High-Density ADC:** 20 channels ADC 16-bit @ 5 Msps & 2 channel DAC 16-bit @ 1 Msps (SE or Differential inputs)
- **DIO\_3118 High-Density Digital I/O:** 16 TTL/LVDS programmable inputs and 16 TTL/LVDS programmable outputs

## Analog RTM Interface

The IFC\_1420 complies with MTCA.4.1 class A1.1CO RTM standard, providing 10 AC-coupled ADC inputs, 10 DC-coupled ADC inputs, 4 DC-coupled DAC outputs and 6 clock inputs.

## TOSCA III FPGA Design Kit

Conventional FPGA design environments offer a set of IP Cores along with implementation examples. IOxOS Technologies goes one step further releasing the **TOSCA III FPGA Design Kit**, a comprehensive system design environment optimized for Kintex UltraScale devices that covers all the path, from the SW application to the FPGA user code.

The TOSCA III FPGA Design Kit is delivered with full VHDL source code together with a set of test-benches and Bus Functional Models (BFM) to set up a complete VHDL simulation environment for functional verification purposes.

The TOSCA III architecture is based on a PCI Express switch centric structure implementing a memory mapped model with segregated I/O Space (CONTROL Plane) and Memory Space (DATA Plane).

The TOSCA III FPGA Design Kit enhances the versatility of the IFC\_1420 AMC board, providing the user with a powerful tool for the direct integration of FMC modules and for the implementation of custom data acquisition applications within the IFC\_1420 on-board Kintex UltraScale FPGA. This solution also makes possible a significant reduction of the FPGA development time, by allowing users to focus on their specific application and providing:

- access to IOxOS Technologies IP library
- a user area (XUSER) with a dedicated simulation environment
- reference designs

To match PCIe Gen3 performance requirements, the embedded NoC switch is enhanced to support 128-bit data paths.

TOSCA III FDK is fully integrated within Xilinx CAE Tools (Vivado 2015.2 and later).

## XUSER Specific Applications

The TOSCA III infrastructure is backward compatible with TOSCA II FDK used with the IFC\_1210/1211. This means that all XUSER specific applications designed for the IFC\_1210/1211 VME64x Single Board Computers can be used within the new IFC\_1420 TOSCA III environment.

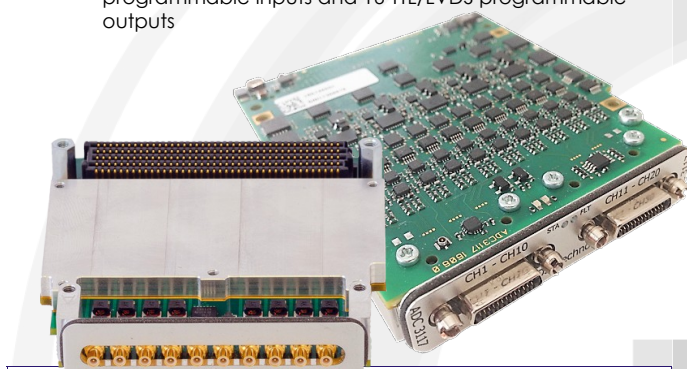
## EPICS Support

The whole MTCA.4 ecosystem (AMCs and  $\mu$ RTM modules, ADC/DAC FMCs and TOSCA III FPGA Design Kit) is fully integrated within the EPICS environment by means of open source tools, libraries and applications developed by the Paul Scherrer Institut (PSI) in Switzerland.

## Ordering Information

Article Reference	Product Description
IFC_1420-A0	MTCA.4 NXP T2081 High-Performance Digitizer AMC with Xilinx Kintex UltraScale XCKU040
TOSCAIII_FDK-SP	TOSCA III FPGA Design Kit – Starter Package (10 licenses + 3-days hands on workshop)
TOSCAIII_FDK-DP	TOSCA III FPGA Design Kit – Development Package (10 additional licenses)

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