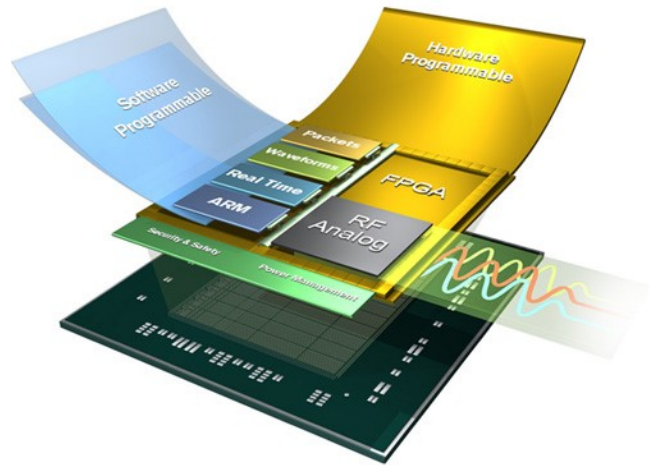
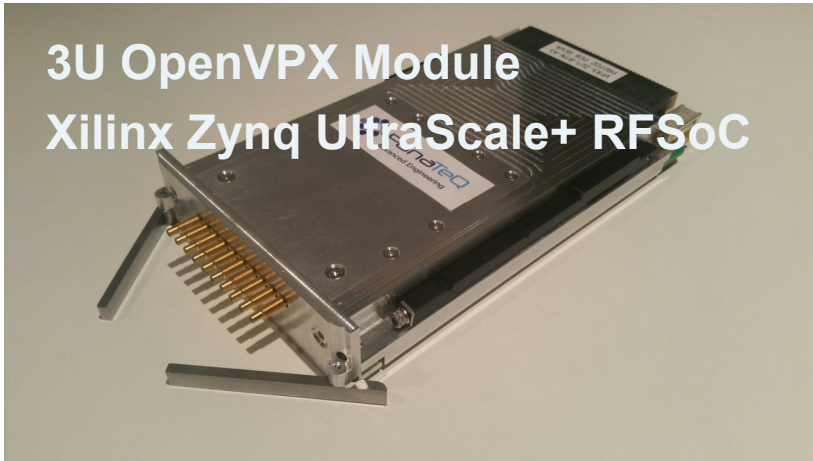


## 3U OpenVPX Module Xilinx Zynq UltraScale+ RFSoc



## Overview

PanaTeQ's **VPX3-RFSOC** is a 3U OpenVPX module based on the Zynq UltraScale+ RFSoc device from Xilinx.

The Zynq® UltraScale+™ RFSoc family integrates key subsystems for multiband, multi-mode cellular radios and cable infrastructure (DOCSIS) into an SoC platform that contains a feature-rich 64-bit quad-core ARM® Cortex™-A53 and dual-core ARM Cortex-R5 based processing system.

Combining the processing system with UltraScale™ architecture programmable logic and RF-ADCs, RF-DACs, and soft-decision FECs, the Zynq UltraScale+ RFSoc family is capable of implementing a complete software-defined radio including direct RF sampling data converters, enabling CPRI™ and gigabit Ethernet-to-RF on a single, highly programmable SoC.

Zynq UltraScale+ RFSocs integrate up to 16 channels of RF-ADCs and RF-DACs. The RF-ADCs can sample input frequencies up to 4GHz at 4GSPS with excellent noise spectral density. The RF-DACs generate output carrier frequencies up to 4GHz using the 2nd Nyquist zone with excellent noise spectral density at an update rate of 6.554GSPS.

The RF data converters also include power efficient digital down converters (DDCs) and digital up converters (DUCs) that include programmable interpolation and decimation, NCO, and complex mixer. The DDCs and DUCs can also support dual-band operation. The soft-decision FEC (SD-FEC) is a highly flexible forward error correction engine capable of operating in Turbo decoding mode for wireless applications such as LTE and LDPC encode/decode mode used in 5G wireless, backhaul, and DOCSIS 3.1 cable modems.

The board can be ordered with different versions of the Zynq UltraScale+ RFSoc family of devices, coupled up to 8GB 64-bit DDR4-2400 Processing Memory with 8-bit ECC.

Up to 8GB 64-bit of DDR4-2400 is also available as the Programmable Logic Memory, allowing data streaming signal processing applications. 64GB of soldered eMMC managed NAND Flash is available for local data storage.

Front-end Analog I/O interfaces are available using on-board **SSMC connectors**.

The board can act as a **Single Board Computer** in the VPX system thanks to its on-board PCIe Gen3 Switch.

When the VPX3-RFSoc is System Controller, it can manage up to eight 3U OpenVPX slots with a PCIe x1 Gen3 link per slot. There is no need to add any SBC in the VPX System, improving **Size, Weight, Power and Cost (SWaP-C)**.

A large number of the Zynq Ultrascale+ PS peripherals are available on the VPX backplane: ETH 1000Base-T, USB 3.0/2.0, SATA 3.1, RS-232/422/485, DisplayPort 1.2, GPIOs.

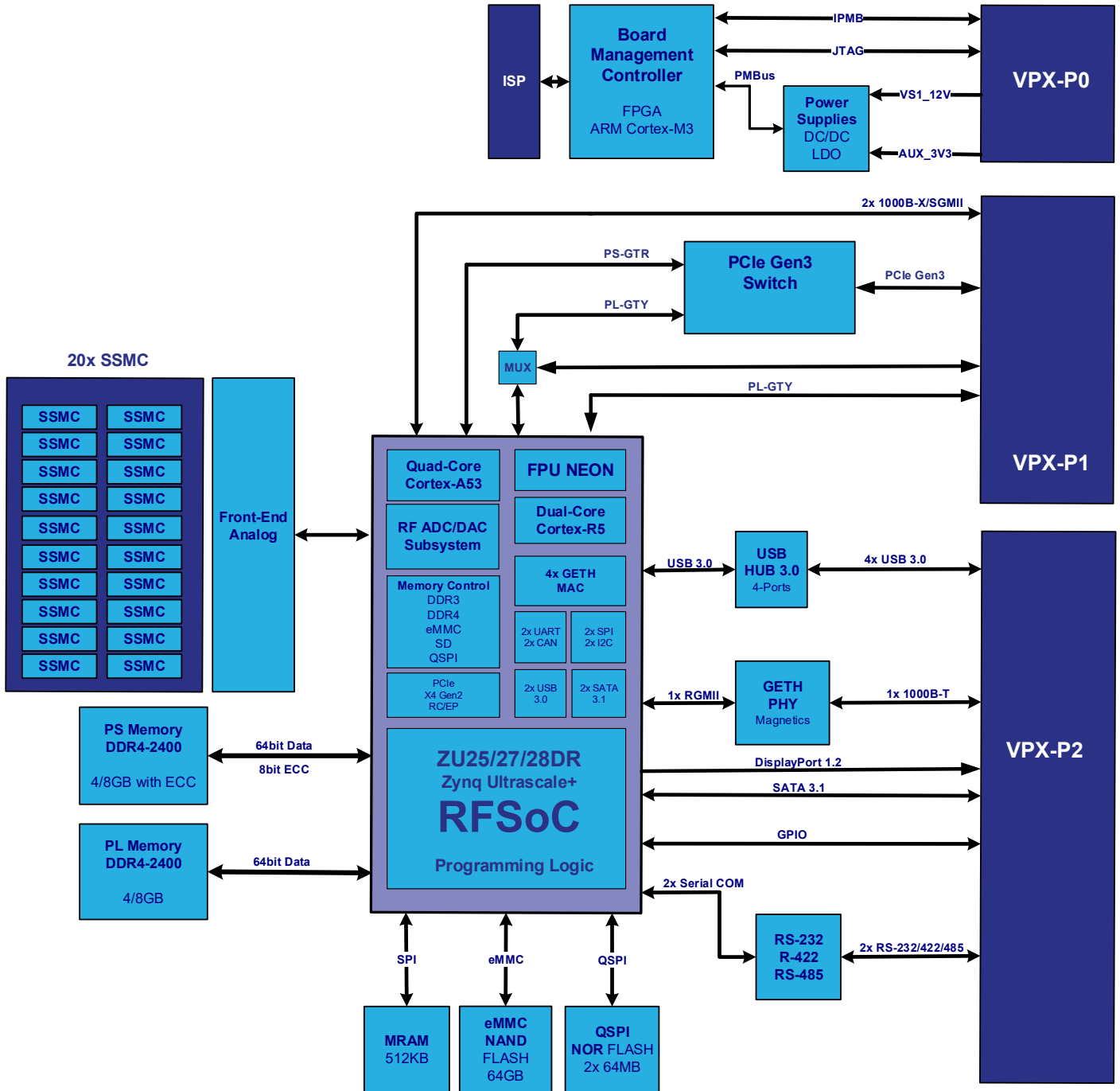
## Key Features

- 3U VITA 46.0 46.4 46.11 48.1 48.2 65.0 Compliant
- Xilinx Zynq UltraScale+ RFSoc
- XCZU25DR-1FFVE1156 Package
- Quad-Core Cortex-A53 up to 1.5GHz
- Integrated RF Data Converter Subsystem
- 8x 12-bit 4GS/s ADCs and 8x 14-bit 6.4 GS/s DACs
- RF Front End using 20x SSMC 12GHz Front Connectors
- Up to 8GB DDR4-2400 64-bit PS memory with 8-bit ECC
- Up to 8GB DDR4-2400 64-bit PL memory
- eMMC 64GB (V4.51), MRAM 512KB
- On-board PCIe Gen3 Switch 16-Lanes 16-Ports with NT support
- 4x MGT on VPX-P1 Expansion Plane
- 2x ETH 1000Base-X on VPX-P1 Control Plane
- 1x ETH 1000Base-T on VPX-P2
- 4x USB 3.0, 1x SATA 3.1 on VPX-P2
- LVCMOS or 10x LVDS GPIO on VPX-P2
- 2x RS.232/422/485, 2x CAN 2.0B on VPX-P2
- Board Management Controller ARM Cortex-M3 based
- Smart Power Management technology
- VPX System Controller
- Air Cooled and Conduction Cooled

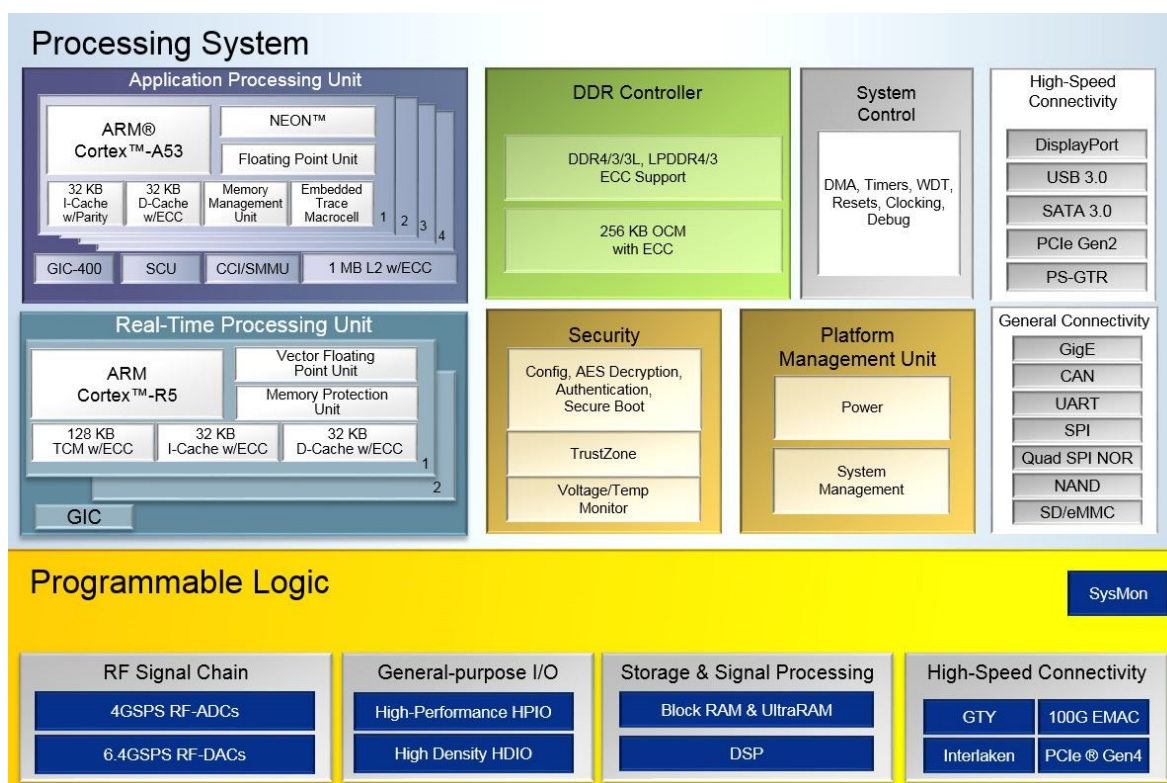
## Typical Applications

- MILCOM, Software Defined Radio, MIMO
- Electronic Warfare, Signal Intelligence
- LIDAR/RADAR/SONAR Systems
- Signal Processing

## Block Diagram



## Xilinx Zynq Ultrascale+ RFSoc Processing System Highlights



### Applications processing unit (APU) with quad-core ARM® Cortex™-A53 processors up to 1.5GHz:

- Next-generation ARMv8 architecture supporting 32- or 64-bit data widths
- Ideal for Linux and bare-metal SMP/AMP application systems

### Real-time processing unit (RPU) with dual-core ARM Cortex-R5 processors up to 600MHz:

- Low-latency, highly deterministic performance APU offloading

### New RF Data Converter SubSystem:

- 12-bit RF-ADCs support sample rates up to 4GSPS
- 14-bit RF-DACs support sample rates up to 6.4GSPS

### New integrated high-speed peripherals:

- PCIe® Gen1 or Gen2 root complex and integrated Endpoint block in x1, x2, and x4 lanes
- USB 3.0/2.0 with host, device, and OTG modes
- Gigabit Ethernet with jumbo frames and precision time protocol
- SATA 3.1 host
- Dedicated quad transceivers up to 6Gb/s

### General and boot peripherals:

- CAN, I2C, QSPI, SD, eMMC, and NAND flash interfaces
- GPIO, UART, and trace ports
- 6-port DDR controller with ECC, supporting x32 and x64 DDR3, DDR3L, LPDDR3, LPDDR4, DDR4
- Integrated platform management unit (PMU) supporting multiple power domains
- Integrated configuration security unit (CSU)
- TrustZone support
- Peripheral and memory protection

## Board Specifications

### 3U VPX Interfaces

- VITA 46.0/46.4/46.11/65.0 VPX/OpenVPX Specifications compliant
- On-board PCIe Gen3 NT Switch 2x PCIe x4 or 8x PCIe x1 Gen2 links connected to Zynq Ultrascale+ Processing System
- 4x MGT GTH @ up to 16.3 Gb/s connected to/from Zynq Ultrascale+ Programming Logic
- 2x1000BASE-X links on VPX Control Plane
- 1x1000BASE-T, 2x RS-232/422/485, 4x USB 3.0, 1x SATA 3.1, DisplayPort 1.2, GPIO
- Board Management Controller (BMC) Interface. VITA 46.11 Ready
- System Controller capability
- JTAG

### OpenVPX VITA 65.0 Profiles

- MOD3-PAY-2F2U-16.2.3-2, MOD3-PAY-2F2U-16.2.3-3
- MOD3-PAY-8U-16.2.9-1, MOD3-PAY-8U-16.2.9-2
- MOD3-PAY-2F4F2U-16.2.10-3, MOD3-PAY-2F4F2U-16.2.10-4

### Xilinx Zynq Ultrascale+ RFSoc

- Supported Devices: **XCZU25DR**-FFVE1156 / **XCZU27DR**-FFVE1156 / **XCZU28DR**-FFVE1156 (Speed Grade –1/2/3)
- Processing System : Quad-Core ARM A53, Dual-Core ARM R5, 2x SATA, 2x USB, 4x GETH MACs
- Programmable Logic: 678K Logic Cells (ZU25DR) / 930K Logic Cells (ZU27DR) / 930K Logic Cells (ZU28DR)
- On-Chip Memories: 41.3Mb (ZU25DR) / 60.5Mb (ZU27DR) / 60.5Mb (ZU28DR)
- DSP Slices: 3145 (ZU25DR) / 4272 (ZU27DR) / 4272 ZU28DR)
- High Speed Serial Links: 16 full duplex, high performance, GTH Multi-Gigabit Transceivers (MGT) @ up to 16.3 Gb/s
- 2x 10-bit, 1MSPS ADCs for System Monitoring
- Supported by Xilinx standard development tools

### Integrated RF Subsystem

- Eight 12-bit ADCs 4GSPS
- Eight 14-bit DACs 6.4GSPS
- 20x SSMC 12GHz Front Analog I/O connectors

### External Memories

- Up to 8GB of DDR4-2400 Processor System (PS) memory, 64-bit data, 8-bit ECC
- Up to 8GB of DDR4-2400 Programmable Logic (PL) memory, 64-bit data, no ECC
- 64GB eMMC v4.51 of managed NAND Flash memory. HS200 support @ up to 100MB/s
- 512KB of SPI MRAM (NVRAM)
- 2x 512Mb of QSPI NOR Flash memory for booting Zynq Ultrascale+ Programmable Logic and Firmware Processing System

### Board Management Controller (BMC)

- Based on Microsemi SmartFusion Customizable System-on-Chip (**cSoC**) with on-chip ARM Cortex-M3 at up to 100MHz
- Real-Time Monitoring+Alarms: Voltages, Currents, Temperatures, 6-Axis Accelerometer, Magnetometer and Humidity
- Reset Management, Power-Up and Power-Down Sequencing. Built-In Test (**BIT**)
- Watchdogs (Avionics type)
- Large private 32MB Event Log Flash Memory.
- UART communication with host using RTM-RFSOC Rear-Transition Module
- Smart Power Management technology using LTM467x with PMBus
- Hardware Ready for full Vita 46.11 compliance

### Environmental Specifications

- Compliant with VITA 47 specification. Please contact PanaTeQ for more information

## Product Codification

The VPX3-RFSOC can be assembled with different versions of the Zynq Ultrascale+ RFSoc devices and various amounts of memory storage. The cooling technique et ruggedization level are also available options. The following table shows the product coding for all these options.

# VPX3-RFSOC-B1N-AS

	Device	RF-ADC 12-bit 4GSPS	RF-DAC 14-bit 6.4GSPS	System Logic Cells	DSP Slices	Memory
A	XCZU25DR	8	8	678K	3145	41.3 Mb
B	XCZU27DR	8	8	930K	4272	60.5 Mb
C	XCZU28DR	8	8	930K	4272	60.5 Mb

	Device Speed Grade
1	Slowest
2	Mid
3	Fastest

	PS / PL Memory Size
N	4GB/4GB
M	8GB/8GB

	Ruggedization Level	VITA 47
AS	Air Standard	EAC4
AR	Air Rugged	EAC6
CC	Conduction Cooled	ECC3
CR	Conduction Rugged	ECC4

## Ordering Information

The following product references are offered by Panateq as standard products. Other combinations of devices, speed grade, memory and cooling can be specially ordered. Please contact us for details

Reference	Device	Speed Grade	Memory PS/PL	Ruggedization Level
<b>VPX3-RFSOC-A1N-AS</b>	ZU25DR	-1	4GB/4GB	Standard Air Cooled

Reference	Description
<b>RTM-RFSOC</b>	Rear Transition Module for VPX3-RFSOC
<b>VPX3-RFSOC-PSDK</b>	VPX3-RFSOC System Development Kit