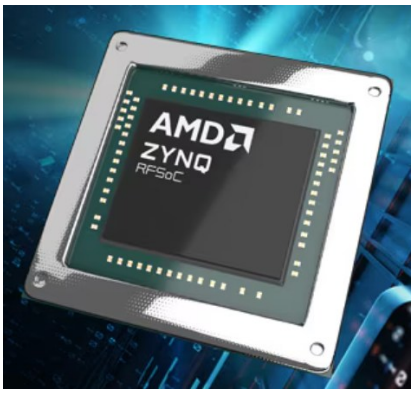
VPX3-RFSOC-B

3U VPX Module AMD Zynq UltraScale+ RFSoC Gen3



Overview

PanaTeQ's VPX3-RFSOC-B is a 3U VPX module based on the Zynq UltraScale+ RFSoC Gen3 device from AMD.

The board is build around a **ZU47DR, ZU48DR RFSoC** with Front and Rear Analog I/O (8x ADC, 8x DAC, 2x REFCLKIN, 2x TRIGGER) that enables true wideband direct RF sampling from 10 MHz to 6 GHz without intermediate frequency stages.

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-R5F 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 8 channels** of RF-ADCs and RF-DACs. The RF-ADCs can sample input frequencies from **10MHz to 6GHz at 5GSPS** with excellent noise spectral density. The RF-DACs generate output carrier frequencies from **10MHz to 6GHz** using the 2nd Nyquist zone with excellent noise spectral density at an update rate of **10.554GSPS**.

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 4/8GB 64-bit of DDR4-2400 is also available as the Programmable Logic Memory, allowing data streaming signal processing applications. 256GB of soldered eMMC managed NAND Flash is available for local data storage.

Frond-end and Rear Analog I/O interfaces are available using on-board **Front SMPM** or **VITA 67.3 NanoRF backplane** connectors depending of the models.

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

PanaTeQ offers the **VPX3-RFSOC-B-PSDK-A** System Development Kit. Please contact us for more details.

Key Features

- 3U VITA 46.0 46.4 46.6 46.11 48.1 48.2 65.0 Compliant
- SOSA aligned, VITA 67.3D, VITA 66.4

AMD Zynq UltraScale+ RFSoC Gen3

- ZU47DR/ZU48DR FFVG1517 Package
- Quad-Core Cortex-A53 up to 1.3GHz
- Dual-Core Cortex-R5F up to 533MHz
- 4/8GB DDR4-2400 64-bit PS memory with 8-bit ECC
- 4/8GB DDR4-2400 64-bit PL memory
- eMMC 256GB, MRAM 512KB

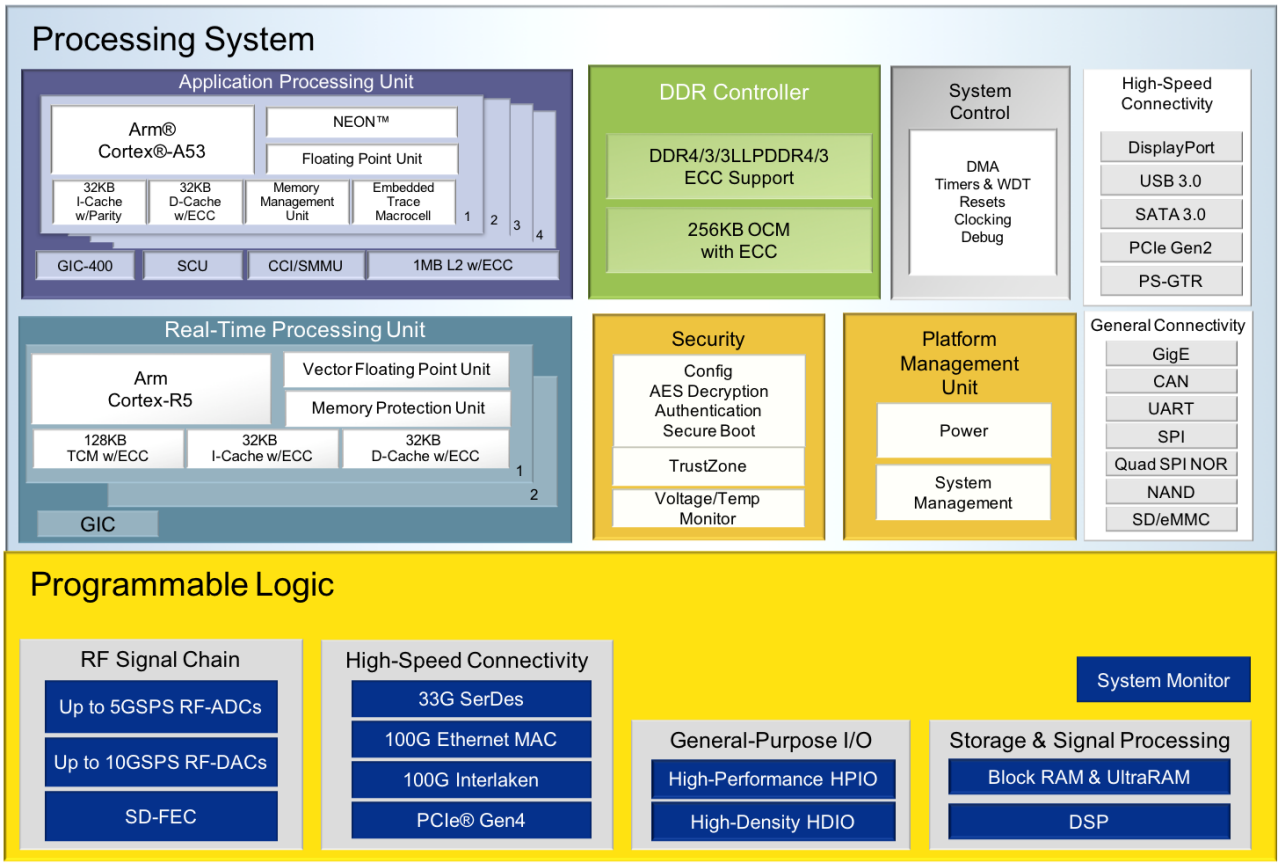
Integrated RF Data Converter Subsystem

- 8x 14-bit 5GS/s ADCs, 8x 14-bit 10 GS/s DACs
- Analog bandwidth: 10MHz to 6GHz
- RF interface: 50 Ω single-ended
- Optional Front RF SMPM Connectors
- Optional RF VITA 67.3D NanoRF Connectors
- Optional Rear Optical VITA 66.4 Connectors
- 2x GTYx4 (**FPA & FPB**) on VPX
- 2x ETH 1000Base-BX on VPX Control Plane
- 1x ETH 1000Base-T on VPX
- 1x USB 2.0, 2x RS.232/485,
- 10x LVCMOS or 10x LVDS GPIO on VPX
- Board Management Controller ARM Cortex-M3 based
- Smart Power Management technology
- Board Management Controller SmartFusion based
- IPMI Controller ELMA based.
- VPX System Controller
- Air Cooled and Conduction Cooled
- Optional KVPX Connectors and Coating

Typical Applications

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

AMD 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

RF Data Converter SubSystem:

- 14-bit RF-ADCs support sample rates up to 5GSPS
- 14-bit RF-DACs support sample reates up to 10GSPS

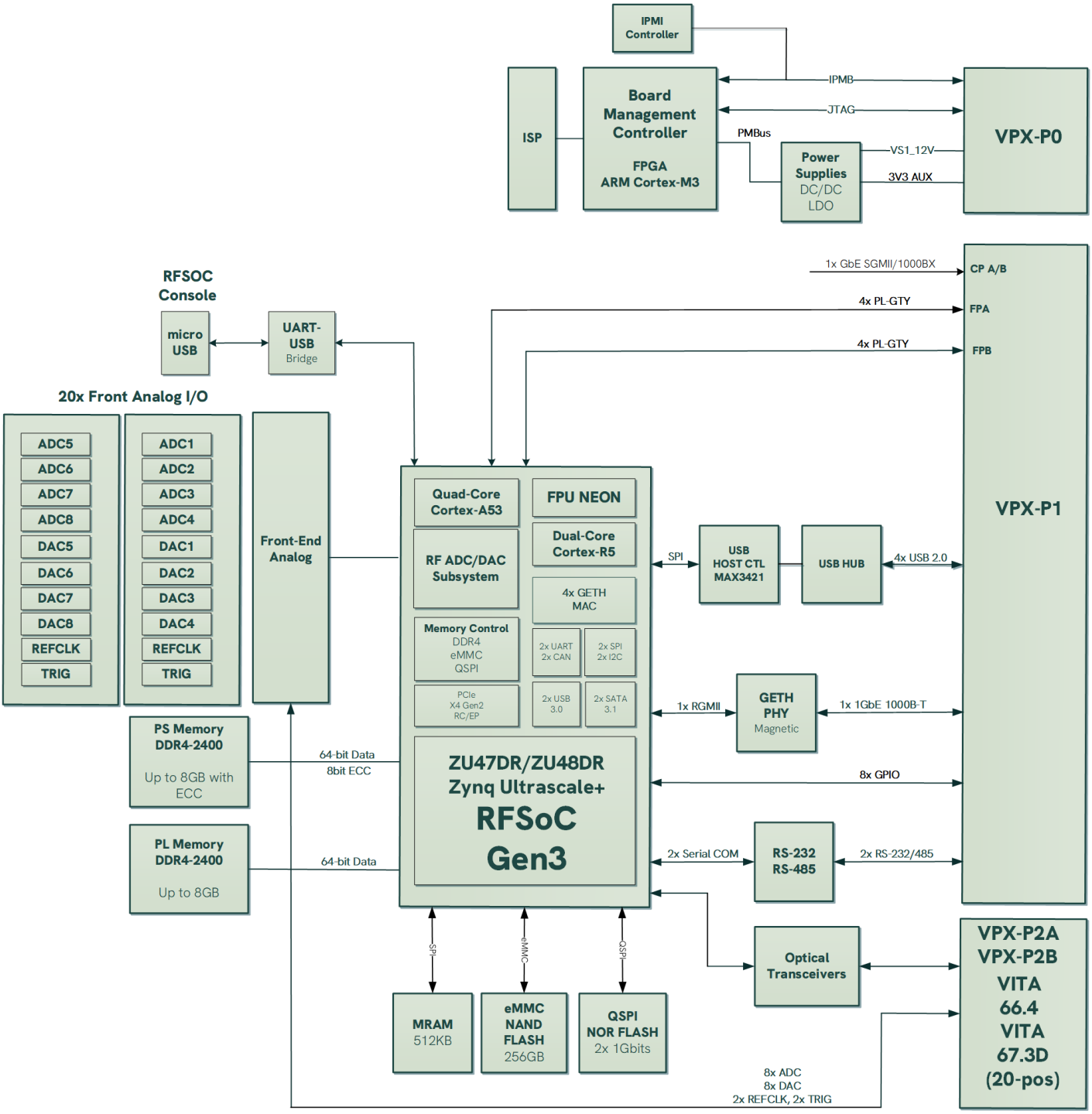
Integrated high-speed peripherals:

- 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

Block Diagram



Board Specifications

3U VPX Interfaces

- VITA 46.0, 46.4, 46.11, 65.0, 67.3 VPX/OpenVPX Specifications compliant
- 8x MGT GTY connected to/from Zynq Ultrascale+ RFSOC Programming Logic to/from VPX-P1 FP0
- 2x 1GbE 1000BASE-T, 4x RS-232/485, 2x USB 3.0, 20x GPIO
- Board Management Controller (BMC) Interface. VITA 46.11 Ready
- System Controller capability
- JTAG
- Optional Front RF Connectors
- Optional Rear Optical VITA 66.4 Connectors
- Optional RF VITA 67.3D NanoRF Connectors

SOSA Profiles

- Please contact us for the SOSA Profiles support

AMD Zynq Ultrascale+ RFSoC

- Supported Devices: **ZU47DR ZU48DR** (Speed Grade –1/2) FFVG1517 package
- Processing System : Quad-Core ARM A53, Dual-Core ARM R5F, 2x SATA, 2x USB, 4x GETH MACs
- Programmable Logic: 930K Logic Cells
- On-Chip Memories: 60.5Mb
- DSP Slices: 4272
- High Speed Serial Links: 16 full duplex, high performance, GTY Multi-Gigabit Tranceivers (MGT) @ up to 28.0 Gb/s
- Supported by AMD standard development tools

Integrated RF Subsystem

- 8x 14-bit 5GS/s ADCs, 8x 14-bit 10 GS/s DACs
- Analog bandwidth: 10 MHz to 6 GHz
- 50 Ω single-ended RF interface. Internal fully differential signal path to RF data converters.
- Broadband RF front-end optimized for direct RF sampling
- High-linearity, phase-balanced differential signal path using wideband balun-based architecture

External Memories

- 4GB or 8GB of DDR4-2400 Processor System (PS) memory, 64-bit data, 8-bit ECC
- 4GB or 8GB of DDR4-2400 Programmable Logic (PL) memory, 64-bit data, no ECC
- 256GB eMMC of managed NAND Flash memory. HS200 support @ up to 100MB/s
- 512KB of SPI MRAM (NVRAM)
- 2x 1Gb of QSPI NOR Flash memory for booting Zynq Utrascale+ RFSOC Programmable Logic and Firmware

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. Buit-In Test (**BIT**)
- Watchdogs (Avionics type)
- Large private 32MB Event Log Flash Memory.
- UART communication with host using RTM-ZU1-A1 Rear-Transition Module
- Smart Power Management technology using LTM467x wiith PMBus
- Hardware Ready for full Vita 46.11 compliance

Environnemental Specifications

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

Product Codification

The VPX3-RFSOC-B 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-B-a b c– rl-d - e - k

a	Device	RF-ADC 14-bit 5GSPS	RF-DAC 14-bit 10GSPS	System Logic Cells	SD-FEC	DSP Slices	Memory
A	ZU47DR	8	8	930K	0	4272	60.5 Mb
B	ZU48DR	8	8	930K	8	4272	60.5 Mb

b	Device Speed Grade
1	Slowest
2	Faster

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

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

d	RF I/O	Optical
A	Front SMPM	None
B	Backplane VITA 67.D	Rear 66.4
C	Rear 67.3C	N/A
D	Rear 67.D	Rear 66.4

e	PS / PL Memory Size
E	Conformal Coating

k	PS / PL Memory Size
K	KVPX Connectors

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
VPX3-RFSOC-B-A1N-AS-A	ZU47DR	-1	4GB/4GB	Standard Air Cooled

Reference	Description
RTM-RFSOC-B	Rear Transition Module for VPX3-RFSOC-B
VPX3-RFSOC-B-PSDK	VPX3-RFSOC-B System Development Kit

PanaTeQ Advanced Engineering

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Available from: