Overview

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

The board is offered in two models with different possible options:

**VPX3-RFSOC-A**: Cost Effective model with 10x SSMC Front Analog I/O (4x ADC, 4x DAC, 1x REFCLKIN, 1x TRIGGER)

**VPX3-RFSOC-B**: High-End model with 20x SSMC Front Analog I/O (8x ADC, 8x DAC, 2x REFCLKIN, 2x TRIGGER), VITA 66.4 or 66.5 Optical links (Optional)

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 4GS/s 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 6.554GS/s.

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 to 4/8GB 64-bit DDR4-2400 Processing Memory with 8-bit ECC.

2/4GB 32/64-bit of DDR4 64-bit 4GS/s ADCs and 8x 14-bit 6.4 GS/s DACs

The board Management Controller ARM Cortex-M3 based

Board Management Controller SmartFusion based

VPX System Controller

Air Cooled and Conduction Cooled

Typical Applications

- Electronic Warfare, Signal Intelligence
- MILCOM, Software Defined Radio, Massive MIMO
- LIDAR/RADAR/SONAR Systems
- Rugged Signal Processing
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 VPX3-RFSOC-A

3U VPX Interfaces
- VITA 46.0/46.4/46.11/65.0 VPX/OpenVPX Specifications compliant
- 8x MGT GTY connected to/from Zynq Ultrascale+ RFSOC Programming Logic to/from VPX-P1 DP0 DP1
- 4x MGT GTR connected to/from Zynq Ultrascale+ RFSOC Programming Logic to/from VPX-P1 EP
- 2x1000BASE-X links on VPX Control Plane
- 1x 1GbE 1000BASE-T, 4x RS-232/422/485, 4x USB 3.0, 2x SATA 3.1, 16x GPIO
- Board Management Controller (BMC) Interface. VITA 46.11 Ready
- System Controller capability
- JTAG

OpenVPX VITA 65.0 Profiles
- MOD3-PAY-2F4F2U-16.2.10-3, MOD3-PAY-2F4F2U-16.2.10-4
- Please contact us for other VITA 65.0 Profiles support

Xilinx Zynq Ultrascale+ RFSoc
- Supported Devices: ZU25DR / ZU27DR / ZU28DR (Speed Grade –1/2/3) FFVE1156 package
- Processing System: Quad-Core ARM A53, Dual-Core ARM R5, 2x SATA, 2x USB, 4x GETH MACs
- Programmable Logic: 67K 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) / 3528 (ZU28DR)
- High Speed Serial Links: 8 full duplex, high performance, GTY Multi-Gigabit Transceivers (MGT) @ up to 28.0 Gb/s
- 2x 10-bit, 1MSPS ADCs for System Monitoring
- Supported by Xilinx standard development tools

Integrated RF Subsystem
- Four 12-bit ADCs 4GSPS
- Four 14-bit DACs 6.4GSPS
- 10x SSMC 12GHz Front Analog I/O connectors

External Memories
- 4GB or 8GB of DDR4-2400 Processor System (PS) memory, 64-bit data, 8-bit ECC
- 2GB or 4GB of DDR4-2400 Programmable Logic (PL) memory, 32-bit data, no ECC
- 64GB eMMC of managed NAND Flash memory. HS200 support @ up to 100MB/s
- 512KB of SPI MRAM (NVRAM)
- 2x 2Gb of QSPI NOR Flash memory for booting Zynq Ultrascale+ 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. Built-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 with PMBus
- Hardware Ready for full VITA 46.11 compliance

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

www.panateq.com
### Board Specifications VPX3-RFSOC-B

**3U VPX Interfaces**
- VITA 46.0/46.4/46.11/65.0 VPX/OpenVPX Specifications compliant
- 8x MGT GTY connected to/from Zynq Ultrascale+ RFSoC Programming Logic to/from VPX-P1 DP0 DP1
- 4x MGT GTR connected to/from Zynq Ultrascale+ RFSoC Programming Logic to/from VPX-P1 EP
- 2x1000BASE-X links on VPX Control Plane
- 1x 1GbE 1000BASE-T, 2x RS-232/422/485, 1x USB 3.0, 1x USB 2.0, 16x 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: ZU25DR / ZU27DR / ZU28DR (Speed Grade –1/2/3) FFVG 1517 package
- Processing System: Quad-Core ARM A53, Dual-Core ARM R5, 2x SATA, 2x USB, 4x GETH MACs
- Programmable Logic: 67K Logic Cells (ZU25DR) / 93K Logic Cells (ZU27DR) / 93K Logic Cells (ZU28DR)
- On-Chip Memories: 41.3Mb (ZU25DR) / 60.5Mb (ZU27DR) / 60.5Mb (ZU28DR)
- DSP Slices: 3145 (ZU25DR) / 4272 (ZU27DR) / 3528 (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**
- 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
- 64GB eMMC of managed NAND Flash memory. HS200 support @ up to 100MB/s
- 512KB of SPI MRAM (NVRAM)
- 2x 2Gb of QSPI NOR Flash memory for booting Zynq Ultrascale+ 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. Built-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 with PMBus
- Hardware Ready for full Vita 46.11 compliance

**Environnamental Specifications**
- Compliant with VITA 47 specification. Please contact PanaTeQ for more information
**Product Codification**

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

### VPX3-RFSOC-A–B1N–AS

<table>
<thead>
<tr>
<th>Reference</th>
<th>Device</th>
<th>Speed Grade</th>
<th>Memory PS/PL</th>
<th>Ruggedization Level</th>
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</thead>
<tbody>
<tr>
<td>VPX3-RFSOC-A1N-AS</td>
<td>ZU25DR</td>
<td>-1</td>
<td>4GB/2GB</td>
<td>Standard Air Cooled</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTM-RFSOC-A</td>
<td>Rear Transition Module for VPX3-RFSOC-A</td>
</tr>
<tr>
<td>VPX3-RFSOC-PSDK-A</td>
<td>VPX3-RFSOC System Development Kit</td>
</tr>
</tbody>
</table>
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 and ruggedization level are also available options. The following table shows the product coding for all these options.

### VPX3-RFSOC-B– B 1 N – AS

<table>
<thead>
<tr>
<th>Device</th>
<th>RF-ADC 12-bit 4GSPS</th>
<th>RF-DAC 14-bit 6.4GSPS</th>
<th>System Logic Cells</th>
<th>DSP Slices</th>
<th>Memory</th>
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</thead>
<tbody>
<tr>
<td>A XCUZU25DR</td>
<td>8</td>
<td>8</td>
<td>678K</td>
<td>3145</td>
<td>41.3 Mb</td>
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<tr>
<td>B XCUZU27DR</td>
<td>8</td>
<td>8</td>
<td>930K</td>
<td>4272</td>
<td>60.5 Mb</td>
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<tr>
<td>C XCUZU28DR</td>
<td>8</td>
<td>8</td>
<td>930K</td>
<td>4272</td>
<td>60.5 Mb</td>
</tr>
</tbody>
</table>

**Device Speed Grade**
- 1: Slowest
- 2: Mid
- 3: Fastest

**PS / PL Memory Size**
- N: 4GB/4GB
- M: 8GB/8GB

**Ruggedization Level**
- AS: Air Standard
- AR: Air Rugged
- CC: Conduction Cooled
- CR: Conduction Rugged
- EAC4
- ECC3
- 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.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Device</th>
<th>Speed Grade</th>
<th>Memory PS/PL</th>
<th>Ruggedization Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>VPX3-RFSOC-B-A1N-AS</td>
<td>ZU25DR</td>
<td>-1</td>
<td>4GB/4GB</td>
<td>Standard Air Cooled</td>
</tr>
</tbody>
</table>

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

Available from:

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