



# FRONTGRADE

## PRODUCT BRIEF

### RPS

Reconfigurable Processing System

8/23/2024  
Version 1.0.3

## Introduction

The Frontgrade™ Reconfigurable Processing System™ (RPS) includes the Reconfigurable Processing Module (RPM) with an AMD/Xilinx® XQR-Grade VC1902 System-on-Chip (SoC) with dual A72 ARM cores (up to 1.7 GHz) and dual Cortex-R5 cores. Programmable logic may be implemented by the end user to allow high-throughput SpaceWire and Ethernet data switching. Compact 3U design with a customizable XMC+ mezzanine allows for tailoring I/O to meet program requirements. Development dongle is available to access the I/O on the SBC using JTAG, UART, or Ethernet for software development.

## Reconfigurable Processing Module: RPM

### Features

#### Processing / Data Rates / Connectivity

- Processor: Versal® VC1902 System-on-Chip (SoC) with dual A72 ARM™ cores (up to 1.7 GHz) and dual Cortex-R5® cores (up to 750 MHz)
- Volatile Memory: 16 GB DDR4 memory
- Non-Volatile Boot Memory: 8 Gbits QSPI memory
- Non-Volatile Storage: 1Tb maximum of raw data storage in SLC mode

#### When configured with the RPS™ mezzanine card:

- One 100Base-TX and four 1000Base-T ports
- Four SpaceWire ports of up to 200 Mbps per port
- Redundant RS422 1PPS inputs
- One RS422 UART
- Discrete IOs: 3 LVDS inputs, 1 LVDS pulse output, 1 LVTTTL/LVCMOS input, and 4 LVTTTL/LVCMOS outputs

#### Mass / Volume / Thermal

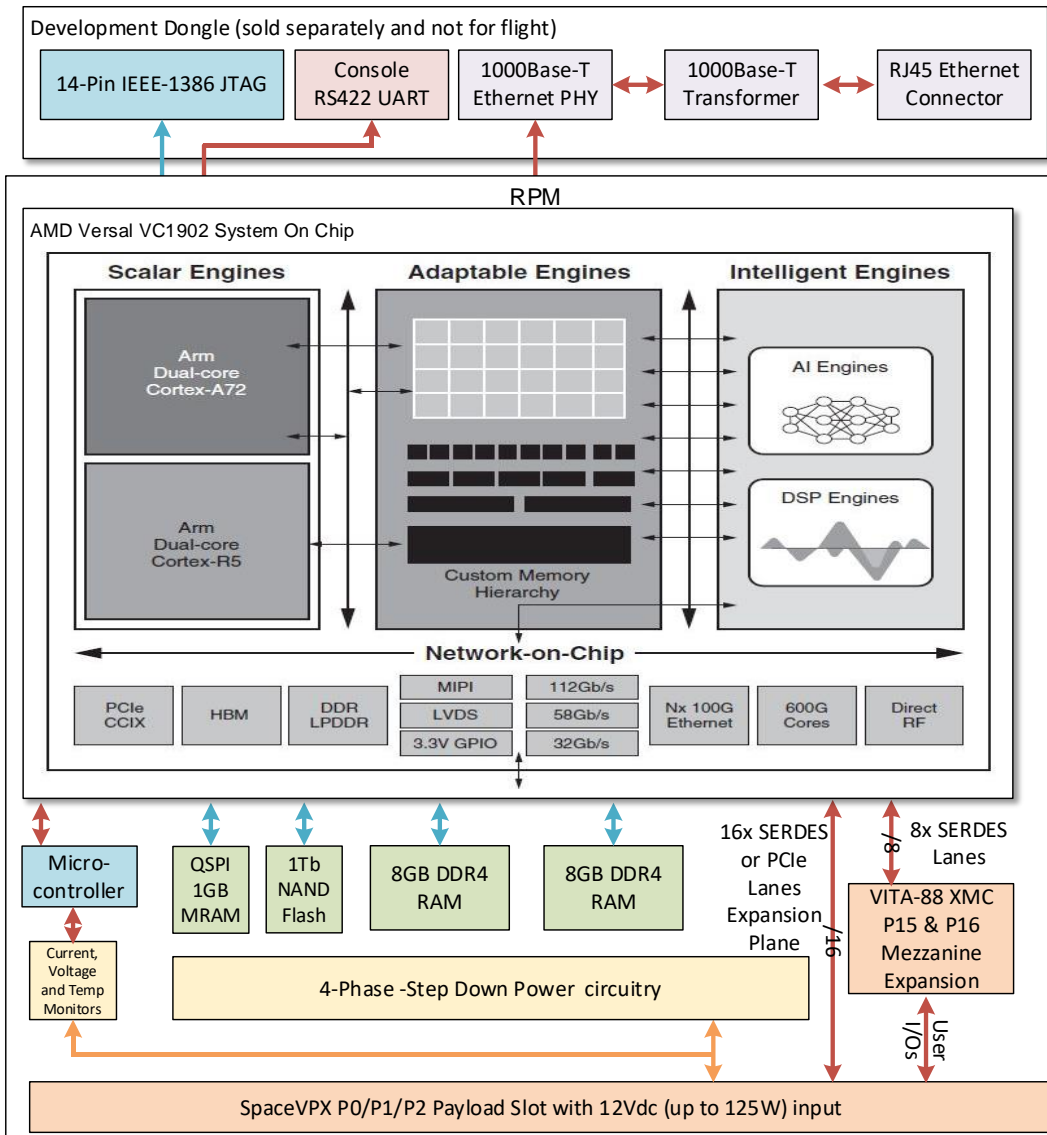
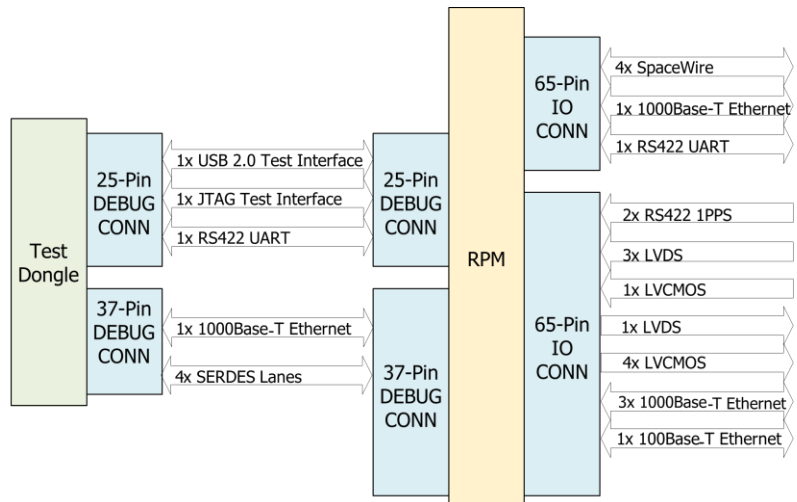
- Mass: less than 2 kg (estimated)
- Dimensions: 195 mm (L) x 120 mm (W) x 90 mm (H); ICD including mounting hole pattern with six blind inserts
- Maximum operating temperature mounted on a regulated thermal interface: 52°C
- Maximum power consumption: 125W (80W maximum for Versal SoC 0.8 Vdc core voltage)

#### OPERATIONAL LIFE / RELIABILITY AND PERFORMANCE

- System reliability over 0.9
- System SEU rate: No more than one per year for typical LEO Missions
- TID of 25 krad (Si) or 100 krad (Si) optional assuming 100 mils of shielding with 6061-T6 Aluminum
- Level-2 parts pedigree per EEE-INST-002 and PEM-INST-001 is available

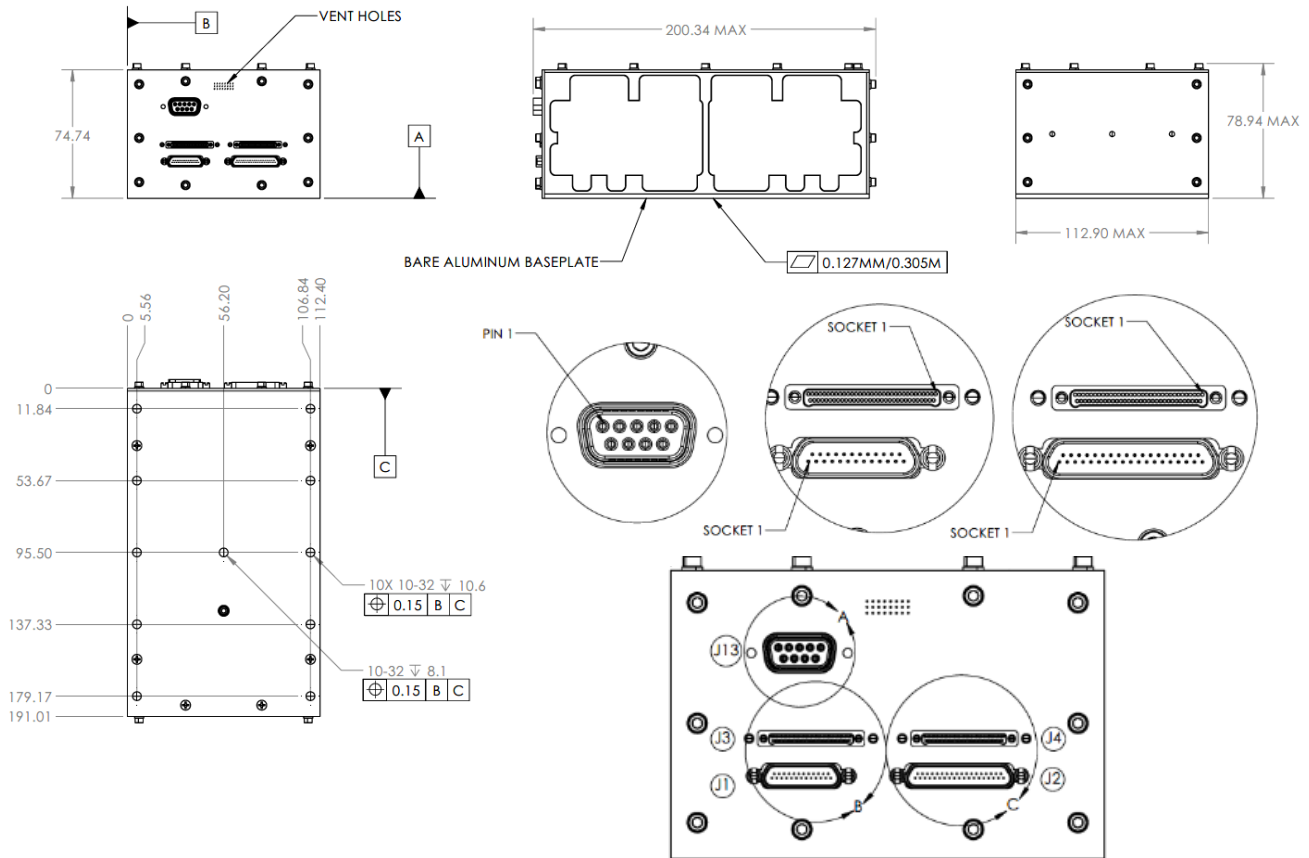
#### DEVELOPMENT ENVIRONMENT

- Separate development dongle for interface with
- SmartLynq+ System Debugger
- Vivado® 2023.2 development environment
- PetaLinux Linux Support Package (LSP)



Frontgrade RPS System with Block Diagram (Top) and RPM Block Diagram (Bottom)

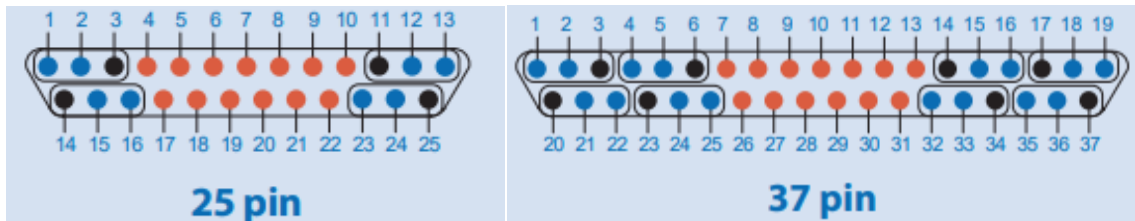
### RPS Physical Dimensions and External Connector Summary



### J1 RPM Front-Panel Development Connector

J1 Socket	25-Pin Connector for USB, JTAG, RS422 Signal Assignment Flight Connector Part Number: GHSM2R-25SHBRR3-.140-186
1	DBG_SERDES_0_TX0_P
2	DBG_SERDES_0_TX0_N
3	GND
4	VERSAL_JTAG_CLK
5	VERSAL_JTAG_TMS
6	VERSAL_JTAG_TDO
7	VERSAL_JTAG_TDI
8	GND
9	JTAGOVERRIDE
10	N/C
11	GND
12	DBG_SERDES_0_TX1_N

J1 Socket	25-Pin Connector for USB, JTAG, RS422 Signal Assignment Flight Connector Part Number: GHSM2R-25SHBRR3-.140-186
13	DBG_SERDES_0_TX1_P
14	GND
15	DBG_SERDES_0_RX0_N
16	DBG_SERDES_0_RX0_P
17	N/C
18	GND
19	VERSAL_UART0_TX_P
20	VERSAL_UART0_TX_N
21	VERSAL_UART0_RX_P
22	VERSAL_UART0_RX_N
23	DBG_SERDES_0_RX1_P
24	DBG_SERDES_0_RX1_N
25	GND



J1 and J2 Connector Pin Orientation for the 25-Pin and 37-Pin RPS Front Panel Connectors (View from the Front of the Card)

**J2 RPM Front-Panel Development Connector**

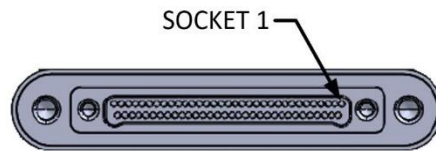
J2 Socket	37-Pin Connector for SERDES and 1000BASE-T Flight Connector Part Number: GHSM2R-37SHBRR3-.140-186
1	FRONT_SERDES_TX0_P
2	FRONT_SERDES_TX0_N
3	GND
4	FRONT_SERDES_TX2_P
5	FRONT_SERDES_TX2_N
6	GND
7	RGMII_PS0_TX0
8	RGMII_PS0_TX1
9	RGMII_PS0_TX2
10	RGMII_PS0_TX3
11	RGMII_PS0_TX_CLK
12	RGMII_PS0_TX_CTL
13	RGMII_PS0_RX0
14	GND
15	FRONT_SERDES_RX0_N

J2 Socket	37-Pin Connector for SERDES and 1000BASE-T Flight Connector Part Number: GHSM2R-37SHBRR3-.140-186
16	FRONT_SERDES_RX0_P
17	GND
18	FRONT_SERDES_RX2_N
19	FRONT_SERDES_RX2_P
20	GND
21	FRONT_SERDES_TX1_N
22	FRONT_SERDES_TX1_P
23	GND
24	FRONT_SERDES_TX3_N
25	FRONT_SERDES_TX3_P
26	RGMII_PS0_RX1
27	RGMII_PS0_RX2
28	RGMII_PS0_RX3
29	RGMII_PS0_RX_CLK
30	RGMII_PS0_RX_CTL
31	GND
32	FRONT_SERDES_RX1_N
33	FRONT_SERDES_RX1_P
34	GND
35	FRONT_SERDES_RX3_N
36	FRONT_SERDES_RX3_P
37	GND

### J3 Mezzanine Front Panel Connector

J3 Mezzanine Socket	65 PinRS422, LVDS, LVCMOS, 100BASE-T Signal Assignments Flight Connector Part Number: 891-028-65SS-BRT3T-02-186		
1	GND	34	GND
2	Ethernet Port 2	35	GND
3	Ethernet Port 2	36	Ethernet Port 1
4	Ethernet Port 2	37	Ethernet Port 1
5	Ethernet Port 2	38	GND
6	GND	39	Ethernet Port 1
7	GND	40	Ethernet Port 1
8	Ethernet Port 2	41	GND
9	Ethernet Port 2	42	LVDS 1
10	Ethernet Port 2	43	LVDS 1
11	Ethernet Port 2	44	LVDS 2
12	GND	45	LVDS 2
13	GND	46	LVDS 3
14	Ethernet Port 3	47	LVDS 3

J3 Mezzanine Socket		65 Pin RS422, LVDS, LVCMOS, 100BASE-T Signal Assignments Flight Connector Part Number: 891-028-65SS-BRT3T-02-186	
15	Ethernet Port 3	48	LVDS 4
16	Ethernet Port 3	49	LVDS 4
17	Ethernet Port 3	50	GND
18	GND	51	GND
19	Ethernet Port 3	52	LVCMOS 1
20	Ethernet Port 3	53	LVCMOS 4
21	Ethernet Port 3	54	LVCMOS 2
22	Ethernet Port 3	55	GND
23	GND	56	LVCMOS 3
24	Ethernet Port 4	57	LVCMOS 5
25	Ethernet Port 4	58	Primary 1PPS
26	GND	59	Ethernet Port 4
27	Ethernet Port 4	60	Primary 1PPS
28	GND	61	GND
29	GND	62	Secondary 1PPS
30	Ethernet Port 4	63	GND
31	Ethernet Port 4	64	Secondary 1PPS
32	Ethernet Port 4	65	GND
33	Ethernet Port 4		



J3 and J4 Connector Pin Orientation for the 65-Pin Front Panel Mezzanine Connectors (View from the Front of the Card)

### J4 Mezzanine Front Panel Connector

J4 Mezzanine Socket		65 Pin SpaceWire, RS422, UART, 1000BASE-T Signal Assignment Flight Connector Part Number: 891-028-65SS-BRT3T-02-186	
1	GND	34	GND
2	GND	35	SpaceWire 1
3	Ethernet Port 5	36	SpaceWire 1
4	Ethernet Port 5	37	SpaceWire 1
5	Ethernet Port 5	38	SpaceWire 1
6	Ethernet Port 5	39	GND
7	GND	40	GND
8	GND	41	SpaceWire 1
9	Ethernet Port 5	42	SpaceWire 1

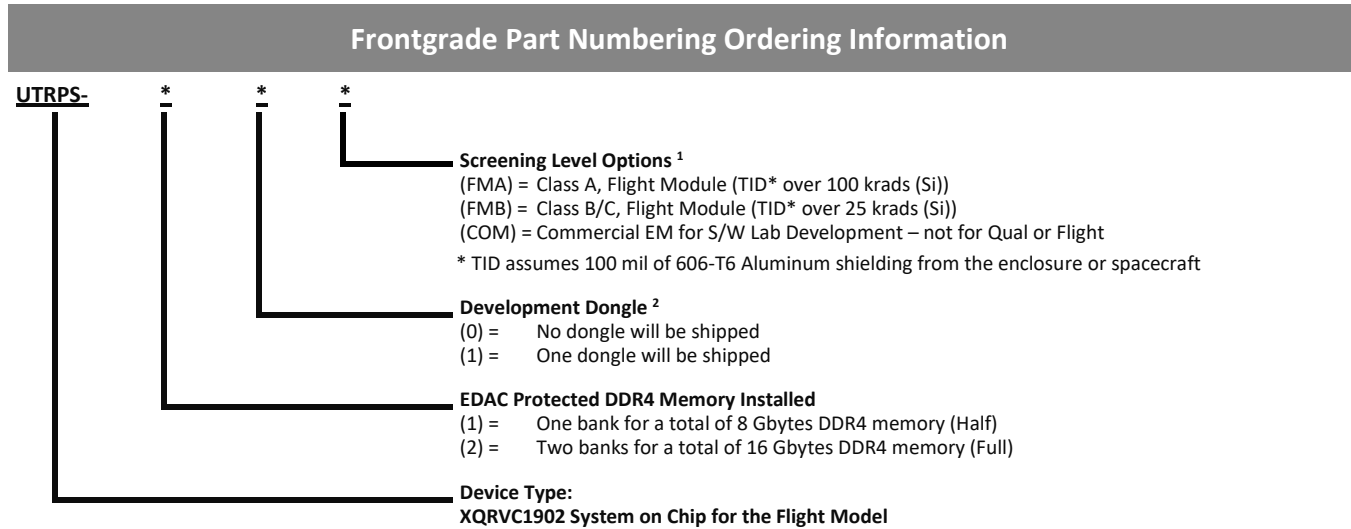
J4 Mezzanine Socket		65 Pin SpaceWire, RS422, UART, 1000BASE-T Signal Assignment Flight Connector Part Number: 891-028-65SS-BRT3T-02-186	
10	Ethernet Port 5	43	SpaceWire 1
11	Ethernet Port 5	44	SpaceWire 1
12	Ethernet Port 5	45	GND
13	GND	46	SpaceWire 2
14	SpaceWire 3	47	SpaceWire 2
15	SpaceWire 3	48	SpaceWire 2
16	GND	49	SpaceWire 2
17	SpaceWire 3	50	GND
18	SpaceWire 3	51	GND
19	GND	52	SpaceWire 2
20	SpaceWire 3	53	SpaceWire 2
21	SpaceWire 3	54	GND
22	SpaceWire 3	55	SpaceWire 2
23	SpaceWire 3	56	SpaceWire 2
24	GND	57	GND
25	SpaceWire 4	58	UART 1
26	SpaceWire 4	59	GND
27	SpaceWire 4	60	UART 1
28	SpaceWire 4	61	GND
29	GND	62	UART 1
30	SpaceWire 4	63	GND
31	SpaceWire 4	64	UART 1
32	SpaceWire 4	65	GND
33	SpaceWire 4		

**J13 Power Connector**

J13 Power Socket		9-Pin Connector for Power Input and Return Flight Connector Part Number: 280-028P1S9MEGPA-186	
1	100V_IN		
2	100V_IN		
3	FENCE		
4	FENCE		
5	100V_RTN		
6	100V_IN		
7	FENCE		
8	100V_RTN		
9	100V_RTN		



## Ordering Information



**Notes:**

- 1. Screening Level Options (FMA, FMB, or COM) must be specified.
- 2. Linux Support Package will be offered separately with the Frontgrade Software License Agreement.

## Revision History

Date	Revision #	Author	Change Description	Page #
2/22/24	1.0.1	Anthony L	First release in Frontgrade Template and descriptions updated	All
2/28/24	1.0.2	Anthony L	Updated with higher resolution connector diagrams	5
8/23/24	1.0.3	TLM	Removed Export Controlled statement pursuant to Global Trade Compliance content review and approval and replaced with unlimited distribution statement.	10

## Datasheet Definitions

	Definition
Advanced Datasheet	Frontgrade reserves the right to make changes to any products and services described herein at any time without notice. The product is still in the development stage and the <b>datasheet is subject to change</b> . Specifications can be <b>TBD</b> and the part package and pinout are <b>not final</b> .
Preliminary Datasheet	Frontgrade reserves the right to make changes to any products and services described herein at any time without notice. The product is in the characterization stage and prototypes are available.
Datasheet	Product is in production and any changes to the product and services described herein will follow a formal customer notification process for form, fit or function changes.

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