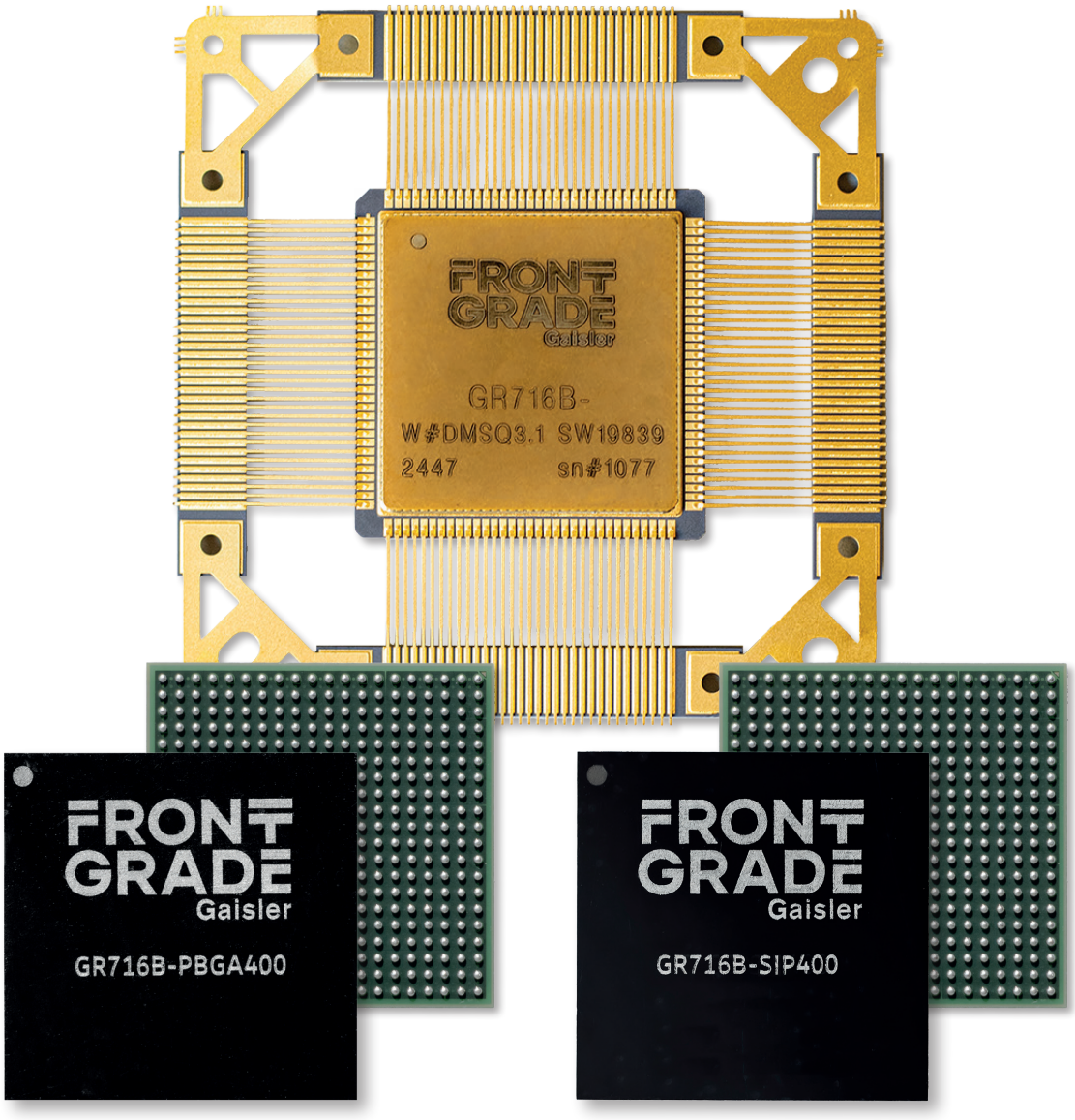
LEON3FT MIXED-SIGNAL MICROCONTROLLER

GR716B



The GR716B is a radiation-hardened, fault-tolerant mixed-signal microcontroller specifically designed for high-reliability space applications, with a focus on satellite super-vision and monitoring. The microcontroller is well suited for tasks such as controlling DC/DC converters, motors and magnetorquer drivers. Additionally, it incorporates hardware features for the supervision and control of SRAM FPGAs in space environments.

A comprehensive development environment is provided, complete with development boards, a debugger (GRMON4), and a simulator (TSIM3). The software ecosystem includes toolchains and board support packages, including both bare-metal and real-time operating system (RTOS) options.

PRODUCT BRIEF

RELEASED OCTOBER 2025

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GR716B

Specification

- System frequency up-to 100 MHz
- SpaceWire links up-to 100 Mbps
- Support for single 3.3V supply
- Proven Single Event Upset (SEU) tolerance

Integrated Analog functions

- 4x ADC: 11-14bit resolution, 4 diff or 8 single channels
- 4xDAC: 12bit, 3 Msps, digital ramp generation up to 25MS/s
- 8x DAC: 24bit ΔΣ, up to 25MHz
- 20x Fast Analogue Comparator
- Rad Hard PLL
- Crystal oscillator, with external XTAL
- Precision Reference 1.9 V Output
- LDO for Core and PLL supply
- Power-on-Reset and Brown-out-detection
- 1.8V and 3.3V voltage monitors
- Temperature sensor

Software

The software ecosystem comprises tool-chains and board support packages, offering both bare metal and Zephyr RTOS options. Peripheral drivers are integrated with the toolchains.

Simulator

TSIM3-GR716 serves as a cycle-accurate simulator for the GR716B. The simulation environment encompasses the LEON3FT, the RTAs, and also on-chip peripherals.

Features

- LEON3FT - Fault-tolerant SPARC V8 32-bit processor
  - 16-bit instruction set extension: LEON-REX for improved code density
  - Double precision IEEE-754 pipelined floating point unit
  - Memory protection units
  - Determinism: Multi-bus, fixed interrupt latency, cache-less architecture
- 2x Real Time Accelerator (RTA)
  - Offload main LEON3 of demanding real-time tasks
- 192 KiB EDAC protected on-chip RAM
- Memory scrubber to prevent error accumulation
- External EDAC protected 8-bit PROM/SRAM memory
- (PBGA400 package only) additional 8/16-bit PROM/SRAM (EDAC available in 8-bit mode)
- SPI memory protected by EDAC and dual memory redundancy
- On-chip Boot ROM for low-level initialization and optional self-testing, standby and application loading
  - Enables also remote boot through SpaceWire RMAP, CANOpen, SPI slave or UART
- FPGA Supervisor designed for FPGA programming and scrubbing, compatible with Xilinx Virtex-5 and Kintex UltraScale
- Programmable PWM interface with Analog/Digital Voltage control and motor control loop support
- DMA controllers with support for conditional operations
- Timer units with seven 32-bit timers including watchdog
- 8x digital FIR filters

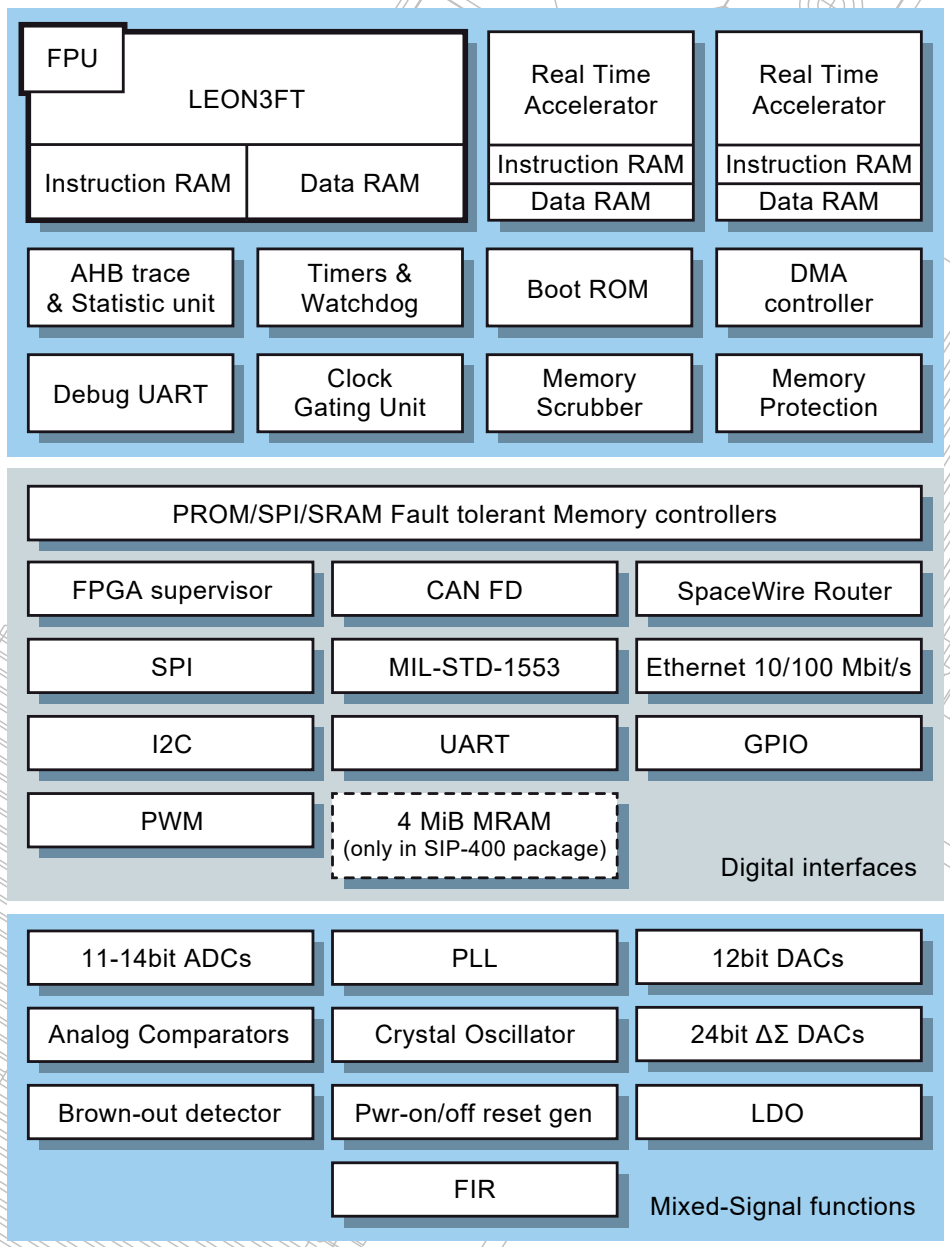
Interfaces

- 2-Port SpaceWire Router with time distribution support
  - LVDS with extended common-mode, Cold-Spare and Fail-Safe support
- 10/100 Mbit/s Ethernet
- MIL-STD-1553B interface
- CAN-FD controller interface with CANopen support for remote boot
- SPI with SPI-for-Space protocols
- UARTs, I2C, GPIO
- Configurable I/O selection matrix with support for mixed signals, internal pull-up/pull-down resistors, schmitt-trigger input.

Packages

The GR716B is available in three different packages: CQFP-132, PBGA-400, and SIP-400.
The SIP-400 package includes 4 MiB of embedded MRAM.
The GR716B PBGA and SIP devices with 400-pin package has fewer pin-sharing constraints compared to GR716B devices with a 132-pin package.

More information:
gaisler.com/GR716B

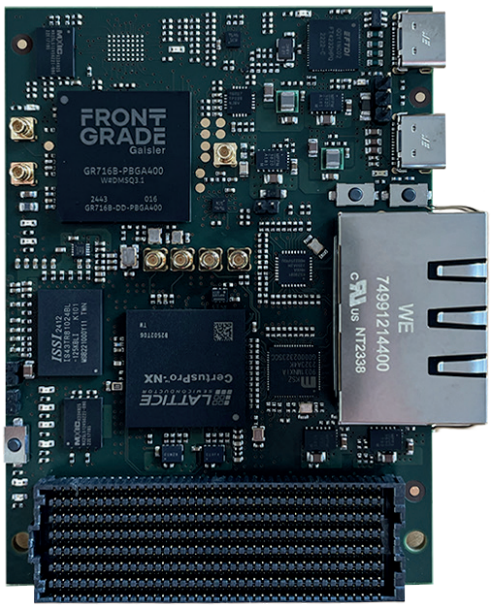


PART NO.	PACKAGE	RADIATION TOLERANCE	TEMPERATURE	QUALIFICATION
GR716B-MS-CQ132	132-pin Ceramic Quad Flat Pack	(TID) up to 100 krad(Si) SEL immunity: 118 MeV*cm²/mg	-55°C to +125°C (case)	Qualification tests as per ESCC9000
GR716B-AS-PBGA400	400-pin Plastic Ball Grid Array 21x21mm	(TID) up to 100 krad(Si) SEL immunity: 118 MeV*cm²/mg	-40°C to +105°C (case)	Targeting lot acceptance tests as per ECSS-Q-ST-60-13C class 2
GR716B-AS-SIP400	400-pin Plastic Ball Grid Array 21x21mm	(TID) up to 100 krad(Si) (TBC) SEL immunity: 70 (TBC) MeV*cm²/mg	-40°C to +105°C (case)	Targeting qualification tests as per ESCC9030

EVALUATION BOARDS

GR716B-MIDI

- Evaluation board for the GR716B Microcontroller and the CertusPro FPGA
- Small form factor (7x9.5 cm)
- GR716B Microcontroller
  - Ethernet
  - Spacewire to FMC+ connector & FPGA
  - 64Mb parallel MRAM, 512Mb SPI flash
  - Analog interfaces to MMCX connectors
  - Thermistor
- CertusPro-NX FPGA
  - COTS variant of the radiation-tolerant CertusPro-NX-RT FPGA
  - Ethernet
  - SerDes and LVDS to FMC+
  - 1GB DDR3, 512Mb SPI flash
  - Analog interfaces to MMCX connectors



The board can be borrowed for free and used with the evaluation version of the GRMON Debugger.

GR716-MINI Evaluation

- Software Evaluation board
- 50mm x 35mm (37.5% of a credit card)
- SPI Flash PROM (32 MiB)
- SRAM (2 MiB)

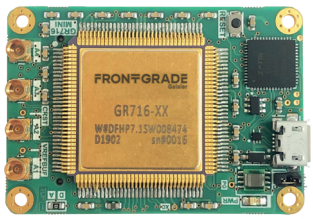
The board can be borrowed for free and used with the evaluation version of the GRMON Debugger.

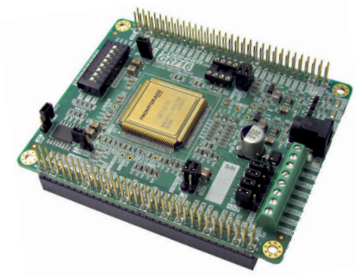
GR716-BOARD-Daughter, Development Board

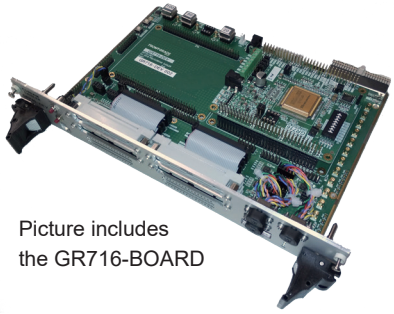
- Hardware Engineering board
- 80mm x 100mm format
- SPI Flash PROM (64 MiB)
- PCI104 style stackable headers (2 x 64 pin) for interfaces access, connection to user-defined modules and to GR-CPCI-GR716-DEV

GR-CPCI-GR716-DEV-Mother Interface Board

- 233mm x 160mm, 6U cPCI format, 2 slot wide front panel
- Access to all the GR716 through front panel and expansion connectors
- Accessory boards shipped with GR-CPCI-GR716-DEV
- Requires the GR716-Board to be useful







Picture includes the GR716-BOARD

More information:
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