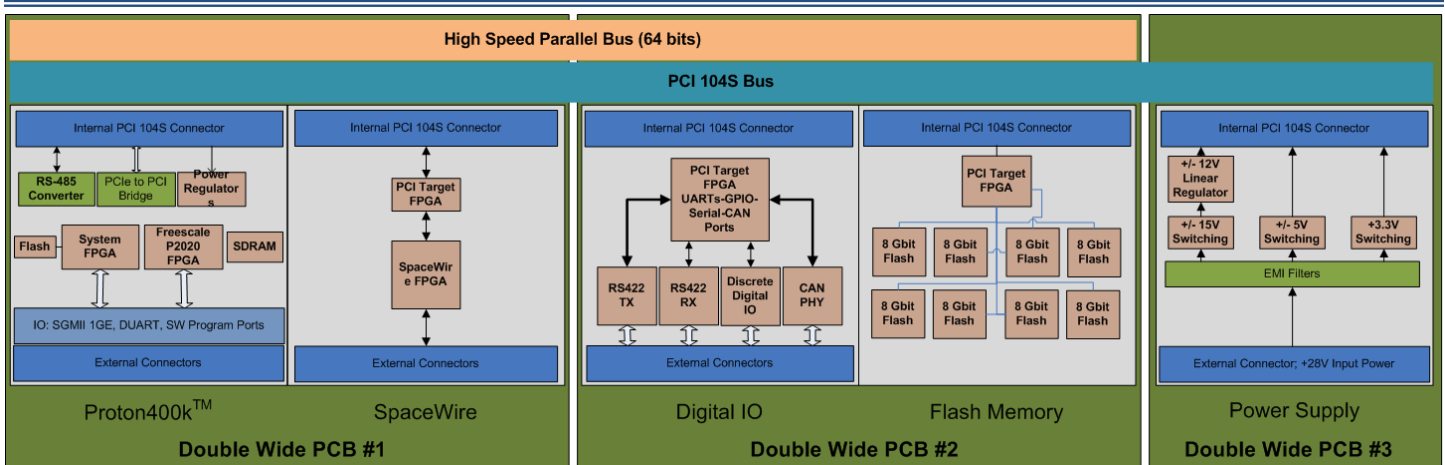




## FEATURES

- Modular, Customizable Design
- Lightweight Interchangeable Slices
  - High Performance Computing with Proton-400k SBC
  - Solid State Buffer Storage
  - Analog IO, Digital IO
- Interface Options
  - RS-422 Buffered Serial and Parallel Ports
  - RS-485
  - SpaceWire
- PCI-104S Backplane Connector
- Applications: Command and Data Handling, Payload Control Electronics, Sensor/Data Processing
- Size: 8.0" x 6.6" (204x155mm) cross section, length depends on slices
- Custom Parts Program: Space Micro Commercial Space, EEE-INST-001 Level 1 or 2
- Radiation Hardened Electronics (TID, SEU, SEL)
- Internal Connectors: Two (2) 120-pin, board to board
- End Slice Connectivity: Between slices and inter-vehicle
- Frame and End Caps: Aluminum 6061-T651, configurable, conductive cooling, high strength, radiation shielding

## SAMPLE PROTON2X-BOX



Three (3) Slice Standard Configuration of Proton2X-Box™ Chassis  
 The size is 22.48 x 17.15 x 5.72 cm (8.85 x 6.75 x 2.25 inches), yielding a volume of 2205 cc.

## SLICE

Proton200k

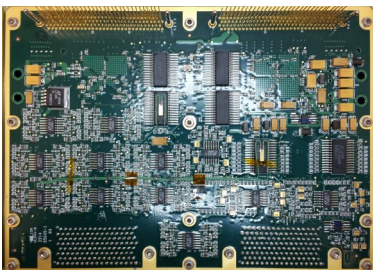


Proton400k

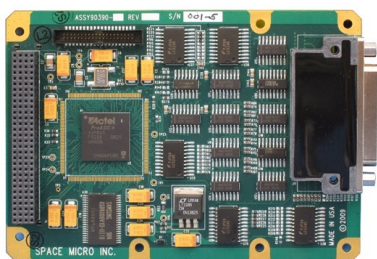


Proton400K with Ethernet

Analog I/O



Digital I/O



Digital I/O (1X Form Factor)

## KEY PARAMETERS

- Advanced Very Long Instruction Word (VLIW) DSP core – TI 320C6 Series
  - 4,000 MIPS@1GHz (Fixed Point Version)
  - 900 MFLOPS@300MHz (Floating Point Version)
  - Memory
    - 128 MB to 512 MB SDRAM with EDAC
    - 1 MB RH EEPROM or 8 Gb RH Flash
  - Interfaces:
    - cPCI - 32 bit, 33 MHz I/O bus at 3.3 V
    - UART
    - Programmable GPIO
  - OS – TI Code Composer Studio
- 
- Dual Core 45 nm Freescale 2020 PowerPC Processor
  - 5,760 MIPS @ 1.2GHz (2,880 MIPS w/TTMR)
  - Memory
    - 512 MB to 1 GB SDRAM with EDAC
    - 8 Gb RH flash storage memory
    - 512 kB L2 cache
    - 32 kB Instruction/32 kB Data Caches
  - Interfaces:
    - cPCI - 32 bit, 33 MHz I/O bus at 3.3 V
    - UART
    - 16 Programmable GPIO
  - OS Options:
    - Linux
    - VxWorks
- 
- General purpose data acquisition card with 48 single ended channels
  - Monitor a variety of sensor types:
    - Attitude sensors such as gyroscope, magnetometer, and sun trackers
    - Environmental sensors such as mixed thermal sensors
    - Any instrument requiring simultaneous measurements
  - 14 bit ADC and 8 bit DAC
  - Configurable with 12-bit /8-bit input/output channels
  - 48 single ended input multiplexed channels of resistance or voltage output measurements
  - 16 single output channels, single ended or differential
- 
- 16 Differential RS-422 Receivers, FPGA configured as Single RX or part of a Multi Drop
  - 16 Differential RS-422 Drivers, FPGA configured as Single TX or Multi Drop
  - 36 Bit, discrete signal, Bi Directional Bus, in 8255 format, programmable as:
    - Bi Directional CMOS (+5V)
    - Bi Directional CMOS (+3.3V)
    - 16 Bits LVDS (at +2.5V) drive capability from the FPGA. (Note: this can be programmed as serial ports or discrete signals)
  - Logic Voltage: 0 to 3.3V and 5.0V (CMOS)
  - Logic Low < 0.66V
  - Logic High > 2.65V

## SLICE

Solid State Buffer



## KEY PARAMETERS

- Variety of sizes and formats
  - SDRAM or DDR3 memory (8GB to 512 GB)
  - Flash memory (32 GB to 1 TB)
- No SEL >70 MeV/mg/cm<sup>2</sup>
- Auto-corrected SEFI's
- SEU rate of 1E-4 unrecoverable errors per day
- Reed-Solomon EDAC
- Heritage on ORS-1 and Classified programs
- Up to 256 GB flash in Proton2X-Box
- Read speed 24 MB/sec
- Write speed 9 MB/sec
- Faster Speeds Coming

## SWAP, INDIVIDUAL SINGLE WIDE SLICE FORM FACTOR (NOMINAL)

Function	Footprint	Weight	Power Consumption	Comments
Processor P200K	8.0" x 6.1" (204x155 mm)*	150g (0.33 lb)	4.24W	
Processor P400K	8.0" x 6.1" (204x155 mm)*	150g (0.33 lb)	12.7W (max)	Freescale P2020 dual core PowerPC processor, VxWorks™ BSP or Linux BSP available Standard cryptographic acceleration available
FPGA P300K	8.0" x 6.1" (204x155 mm)*	~250g (0.55 lb)	~8.0W (depending on gate use & speed)	Reconfigurable FPGA utilizing Virtex 7
Analog I/O AIO	8.0" x 6.1" (204x155 mm)*	150g (0.33 lb)	2.12W	General purpose data acquisition card with 42 single ended channels
Digital I/O DIO	8.0" x 6.1" (204x155 mm)*	150g (0.33 lb)	1.12W	General Purpose Digital I/O card with up to 32 differential and 36 discrete signals available
Space Wire	8.0" x 6.1" (204x155 mm)*	150g (0.33 lb)	2.12W	Supports GSFC design Full-duplex LVDS Transceiver circuits Raw Data rate of 200 Mbit/sec 3 user ports for communication
1553 Slice 1553	8.0" x 6.1" (204x155 mm)*	180g (0.4 lb)	1.90W	MIL-STD-1553 dual redundant Bus 16-bit read/write time-tag Simultaneous RT/MT operation
Flash Module	8.0" x 6.1" (204x155 mm)*	150g (0.33 lb)	3.5W	Available Memory up to 256 Gb
Battery Mgmt.	8.0" x 6.1" (204x155 mm)*	200g (0.44 lb)	0.45W	Measures current and voltage for up to 4 solar panels Provides 4 sensed and switched +/- 5V to lines
Power Switch	8.0" x 6.1" (204x155 mm)*	180g (0.4 lb)	1.90W	4 H-bridges that can be configured to 8 half-bridges 8 high-side switches Switches external 28V spacecraft power Switches redundant slices
Power Supply	4.0" x 6.1" (102x155 mm)*	200g (0.44 lb)	(74% efficiency)	3 isolated DC-DC converters produces 3.3V, 5V, and ±12V Input Voltage is 15 to 50V Turn On Time is < 1 s EMI filtering meets MIL-STD-461C and MIL-STD-461D EMC Requirements.
End Cap	4.0" x 6.1" (102x155 mm)*	150g (0.33 lb)	N/A	