


# TTESwitch Space 3U cPCI

TTEthernet® switch with 12 ports for use in space



### Key Benefits

- ✓ 6x 1000BASE-T + 6x 100BASE-TX Ethernet ports, 16 Gb/s total switching performance
- ✓ Safe partitioning between IEEE 802.3, rate-constrained and time-triggered Ethernet traffic (SAE AS6802)
- ✓ Up to 4096 virtual links, up to 8 traffic priorities
- ✓ Fault-tolerant communication with high bandwidth utilization

The TTESwitch Space 3U cPCI is a high-performance TTEthernet® switch specifically designed to meet the challenges of harsh space environments. TTEthernet® simplifies the design of complex distributed systems and applications and allows safe processing of critical and non-critical Ethernet traffic on a single network.

## TTESwitch Space 3U cPCI

The TTESwitch Space 3U cPCI forms the core of a TTEthernet® network. The card is built in a compact cPCI 3U form factor as an off-the-shelf product. TTEthernet® permits the use of synchronized and non-synchronized functions of distributed systems in the same Ethernet network. System-critical hard real-time functions enjoy reserved bandwidth, full determinism and a jitter below 1 μs. Thanks to a combination of SAE AS6802 time-triggered Ethernet, ARINC 664 part 7 compatible rate-constrained Ethernet and IEEE 802.3 Ethernet, high transfer rates for non-critical data can be achieved at the same time, without impacting critical traffic. The switch has an internal frame memory of 512 kB, supporting the storage of lower priority traffic while higher priority traffic is processed.

## Innovation meets Heritage

Based on TTTech's core technology, this product is manufactured and qualified by

Beyond Gravity, leveraging on an extensive heritage of successful space products.

## Built for modular cPCI architectures

The TTESwitch Space 3U cPCI was designed for maximum ease of use and reduced development cost. In the development phase, it can be placed in a standard cPCI rack, enabling access to all interfaces via a rear-I/O break-out board. The power supply is set up according to PICMG 2.0 R3, while all Ethernet signals are provided at the cPCI J2 Connector and can be routed through a customized backplane for each specific use case.

## COM/MON safety mechanism

The TTESwitch Space 3U cPCI offers a duplicated switch IP core (COM/MON architecture on a single ASIC) that allows a bitwise comparison (dual-core lockstep) of data frames. This feature enables comparison of two outgoing data frames, to ensure fail-silent behaviour of the Ethernet switching engine. This safety feature facilitates fault-tolerant data handling architectures with two channels and implicit



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## Application fields

- Human Spaceflight
- Reconnaissance
- Space Transportation
- Space Robotics

voting architectures with three flight computers, independent of the used processing hardware.

### Quality of service and partitioning

The TTESwitch Space 3U cPCI allows the configuration of up to 4096 virtual links, which can be fully separated via the 8 memory partitions. Virtual links can be configured with a bandwidth allocation gap (BAG) of 0.5 ms to 1600 ms. The configuration of the network is stored in the built-in non-volatile memory. As an option, IEEE 802.1Q VLANs can be configured. Redundancy management, traffic shaping, and traffic policing are implemented in hardware.

### Device and network management

The TTESwitch Space 3U cPCI features an integrated management CPU to perform loading and diagnostic services to continuously assess the system health state over the network via SNMP v1. Monitored parameters include synchronization state, supply voltage, board temperatures, dropped/rejected frames and built-in self-test results. Both firmware and network traffic schedule can be updated safely via the TFTP network protocol.

### Product variants

**EDU:** Functionally-representative with commercial parts for laboratory use only.

**PROTO:** Built for unit-level qualification (lower parts grade).

**FLIGHT:** Qualified according to ECSS and acceptance-tested. Flight-grade model for safety-critical space applications. Built with level-1 grade ceramic parts.

### Applicable documents

**PICMG 2.0 R3** - compact PCI® specification

**S-311-P-822** - NASA specification, connectors, PWB, 2 mm cPCI™ Style

**ECSS-Q-ST-60C Rev.2** - ECSS, Electrical, electronic and electromechanical (EEE) components

**ECSS-Q-ST-70** - ECSS, Qualification of PCBs

**ECSS-E-ST-40C** - ECSS, Software

**ECSS-E-ST-10-03C** - ECSS, Testing

**ECSS-Q-ST-30C Rev.1**- ECSS, Dependability

### Related products

- TTERearIO 3U cPCI (EDU)
- TTEEnd System Space 3U cPCI
- TTETools

13267/14517 - TTESwitch Space 3U cPCI (FLIGHT)	Connectors	cPCI Connector J1	cPCI Connector J2
		<ul style="list-style-type: none"> <li>Supply voltage (+3.3 V)</li> </ul>	<ul style="list-style-type: none"> <li>6x 1000 BASE-T + 6x 100 BASE-TX Ethernet (magnetics not on FLIGHT/PROTO; EDU magnetics are placed on RearIO)</li> <li>UART/DSU I/F for laboratory use</li> </ul>
	Lifetime	15 years	
	Environmental	<p><b>Vibration (random, all axes, acceptance test levels):</b> 20 - 60 Hz: +3 db/oct, 60-1000 Hz: 0.273 g<sup>2</sup>/Hz, 1000-2000 Hz: -6db/oct</p> <p><b>Shock, all axes (acceptance test levels):</b> 20 Hz: 20 g, 1000 Hz: 2000 g, 2000 Hz: 3000 g, 10000 Hz: 3000 g</p> <p><b>Qualification Temperature range:</b> Operational range: -35 °C to +75 °C</p> <p><b>Radiation:</b> TID for 15 years cis-lunar environment, all components SEL free up to 60 MeV/cm<sup>2</sup>/mg &amp; SEE tested up to 60 MeV/cm<sup>2</sup>/mg</p> <p><b>EMC</b> Acc. to PICMG 2.0 R3</p>	
	Power	Supply voltage: 3.3 V (according to PICMG 2.0 R3), power consumption: < 14 W	
	Dimensions	3U cPCI form factor (PICMG 2.0 R3), conduction-cooled (ANSI/VITA 30.1-2008)	
	Mass	600 g	

### Ordering Codes

14034 & 14365 (w. wedgelocks)	TTESwitch Space 3U cPCI (EDU)	Comm. cPCI conn. for 3U cPCI chassis
13587	TTESwitch Space 3U cPCI (EDU - H)	Flight-compatible cPCI conn. (Hypertac)
14514	TTESwitch Space 3U cPCI (PROTO)	
13267	TTESwitch Space 3U cPCI (FLIGHT)	

