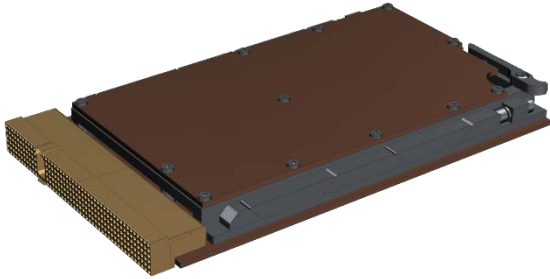




TTE Switch Space cPCI

Space qualified 12-port TTEthernet switch



Key Benefits

- ✓ 6x 1000 Base-T + 6x 100 Base-TX Ethernet ports, 16 Gbps total switching performance
- ✓ Safe partitioning between IEEE 802.3, rate-constrained and time-triggered Ethernet traffic (SAE AS6802)
- ✓ Switch IP for up to 4096 virtual links, up to 8 priorities
- ✓ Fault-tolerant high-speed communication with > 80 % effective bandwidth

The TTE Switch Space 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.

TTE Switch Space cPCI

The TTE Switch Space cPCI forms the core of a TTEthernet network. The card is provided in a compact cPCI 3U form factor, allowing the reuse in a standard 3U cPCI chassis. 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 delivery jitter below 1 μ s. Thanks to a combination of SAE AS6802 time-triggered, rate-constrained 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 512kB to enable the storage of lower priority traffic while higher priority traffic is processed.

Built for modular cPCI Architectures

The TTE Switch Space 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 TTE Switch offers a duplicated switch IP core (COM/MON architecture on a single ASIC) that allows a bitwise comparison (dual-core lockstep) of two sent/received data frames. This feature can be used in two ways:

- Comparison of two incoming data frames to ensure fail-silent behavior in case of a data mismatch

Application Fields

- Human Space Flight
- Telecommunication
- Earth observation
- Reconnaissance



- Comparison of two outgoing data frames, to ensure fail-silent behavior of the switching engine

This safety feature enables the creation of single fault tolerant architectures with two channels and implicit voting architectures with three flight computers, independent of the used processing hardware.

Quality of Service and Partitioning

The TTESwitch Space 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 switch's non-volatile memory. As an option, IEEE 802.1Q VLANs can be configured. Profiled IP/UDP, redundancy management and traffic shaping are implemented in the hardware.

Device and Network Management

The TTESwitch Space cPCI provides an integrated LEON2 management CPU to perform loading and diagnostic services. These internal monitoring functions allow the user to continuously assess the system health and the status of the network. Monitored parameters include synchronization state, supply voltage, board temperatures, dropped/rejected frames and built-in self-test results.

With the TTESwitch Space cPCI, firmware and network traffic schedule can be updated safely via the TFTP network protocol without interruption of the network service. The internal monitoring data and health state can also be retrieved via SNMP v1 requests.

Product Variants

- **Engineering Model (Available Q1/2020):** Functionally representative model for laboratory use.
- **Flight Model (Available Q2/2021):** Design qualified according to ECSS and acceptance-tested. Flight-grade model for safety-critical space applications.

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

- TTEEnd System Space cPCI
- TTETools

| | | |
|---------------|---|--|
| Connectors | cPCI Connector J1 | cPCI Connector J2 |
| | <ul style="list-style-type: none"> • Power supply (+3.3V) | <ul style="list-style-type: none"> • 6x 1000 Base-T + 6x 100 Base-TX Ethernet (magnetics not included) • UART/DSU I/F for laboratory use |
| Lifetime | 15 years | |
| Environmental | <p>Vibration (random, all axes, acceptance test levels): 20 – 60 Hz: +3db/oct, 60-1000 Hz: 0.273 g²/Hz, 1000-2000 Hz: -6db/oct</p> <p>Shock, all axes (acceptance test levels): 100 Hz: 15g, 1000 Hz: 1000g, 2000 Hz: 3000g, 10000 Hz: 3000g</p> <p>Temperatures (acceptance test levels): Operational range: -35 °C to +85 °C, Storage range: -40 °C to +85 °C</p> <p>Radiation: TID for 15 years GEO Missions, all components SEL free up to 60MeV/cm²/mg & SEE tested up to 60 MeV/cm²/mg</p> <p>EMC Compliant to PICMG 2.0 R3</p> | |
| Power supply | Supply voltage: 3.3V (according to PICMG 2.0 R3) Power consumption: < 14W | |
| Dimensions | 3U cPCI form factor (PICMG 2.0 R3), conduction-cooled (ANSI/VITA 30.1-2008) | |
| Mass | 600 g | |

