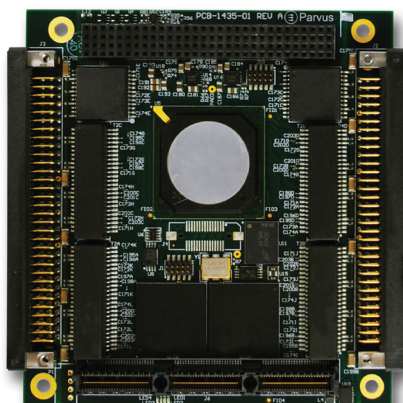# Parvus SWI-22-10

Rugged 20-port / 8-port Gigabit Ethernet Switch
PCI/104-Express Card, Fully Managed

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Key Features

- Rugged embedded Gigabit Ethernet switch
- Small form factor: up to 20 ports on single 3.6" x 3.8" card
- Layer 2 fully managed network switch with Layer 3 static routing capability
- Low-power, Energy Efficient Ethernet (802.az) compliant
- IEEE-1588v2 Precision Timing Protocol (PTP) support
- Qual tested to MIL-STD-810 for wide temperature operation (-40 to +85°C) and high shock/vibration

Application

- Embedded Gigabit Ethernet managed edge network applications
- Tactical in-vehicle/airborne LAN switching
- Fixed wing / rotary (unmanned) air systems
- Network-centric operations / situational awareness upgrades
- Defense, homeland security, energy, industrial, oil & gas

Overview

The Parvus® SWI-22-10 is a rugged Commercial Off the Shelf (COTS) Gigabit Ethernet switch card optimized for size, weight and power (SWaP) sensitive embedded military and civilian computer network systems applications. Featuring advanced Layer 2 networking features with up to 20 ports of 10/100/1000 Mbps connectivity, an integrated management processor, low power consumption, and robust carrier Ethernet software features, the SWI-22-10 enables reliable local area network (LAN) switching across extended operating temperature ranges (-40 to +85°C) and extreme shock/vibration for technology refresh and platforms including mobile, tactical, aerospace, and ground vehicle applications. With a compact PCI/104-Express™ form factor (approx. 3.6" x 3.8") featuring either eight (8) or twenty (20) ports of 1000Base-T Ethernet, the SWI-22-10 is one of the smallest rugged Gigabit Ethernet switches available and an ideal solution for connecting a large number of IP-enabled embedded devices, including computers, cameras, sensors, and command-and-control equipment deployed in manned and unmanned system platforms at the network edge. To enhance reliably, the product features industrial temperature grade components, BGA underfilling, component potting, no moving parts, and optional conformal coating.

This fully managed Layer 2+ switch card supports IPv4 and IPv6 multicast traffic, Virtual Local Area Networks (VLANs), port control (speed / mode / statistics, flow control), Quality of Service (QoS) traffic prioritization, Link Aggregation (802.3ad), SNMPv1/v2/v3 management, secure authentication (802.1X, ACLs, Web/CLI), redundancy (RSTP/MSTP), precision timing (IEEE-1588v2), port monitoring, IGMP Snooping, and data zeroization. The unit also supports Layer 3 IPv4 / IPv6 unicast static routing for IP routing to attached WAN / radio ports.The SWI-22-10 is designed to integrate with open-architecture PCI-104, PCIe/104™, PC/104-Plus, PCI/104-Express, EPIC, or EBX systems, as well as non-PC/104 embedded systems, while flexibly supporting either CAT5e cabling or cableless (board-to-board) termination of the Ethernet signals. The SWI-22-10 is available as a standalone card or pre-integrated into the DuraNET 20-10 switch subsystem. The board is also available pre-integrated in a combined switch/router system (see DuraMAR® 5915 "3X" model) and can also be integrated by the factory with other PC104-based DuraCOR® or DuraWORX® mission computer subsystems.
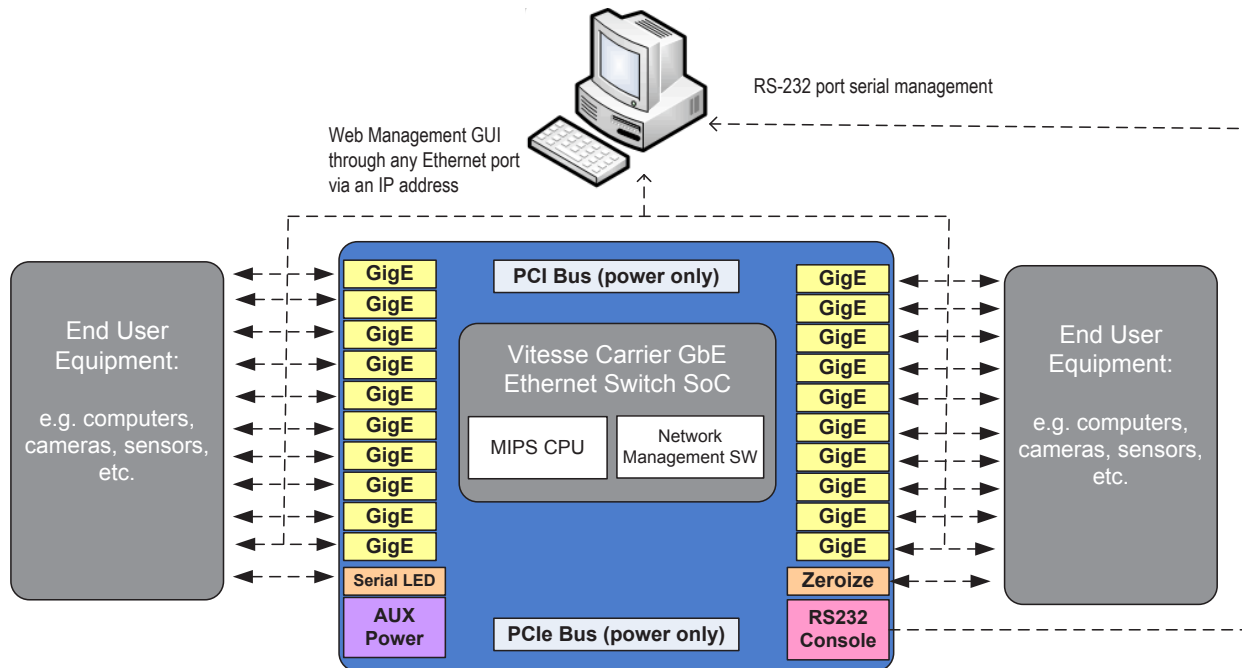
Figure 1: SWI-22-10 block diagram

Features

High port density

- Up to twenty (20) ports of Gigabit Ethernet switching in single-slot PCI/104-Express form factor (3.6" x 3.8") card; 8-port option also available

Rugged design

- Extended temperature (-40/+85°C), high shock/vibration tolerant connectors for board to wire or board to board connectors
- Underfilled BGA device and potted components for shock/vibe reliance; optional conformal coating for corrosion resistance

Carrier grade

- Carrier Ethernet (CE) switch engine with embedded 32-bit management processor (no separate CPU required for management)
  + Comprehensive Layer 2 managed switch features, Layer 3 packet processing, service classification and traffic policing
  + IEEE-15888 PTP and hardware accurate time-stamping

Layer 2 Switching

- Gigabit Ethernet connectivity (10/100/1000 Mbps) with support for Link Aggregation (802.3ad), Spanning Tree (RSTP, MSTP), IPv4 / IPv6 multicast traffic, VLANs, QoS / CoS traffic prioritization

Layer 3 Routing

- Layer 3 IPv4 / IPv6 unicast static routing support for attached WAN / radio ports

Management

- SNMPv3, HTTP server, web GUI, RS-232 console CLI, port monitoring, RMON, Syslog, Network Access Server (NAS), 802.1X authentication, IGMP Snooping, Access Control Lists (ACLs), zeroization, Built in Test (BIT) diagnostics

Low power

- Energy Efficient Ethernet (IEEE-802.3az) support with low-power PHYs and smart cable reach technology for extremely low power consumption

Bus or external powering

- Can be powered via PCI-104 (PCI) bus, PCIe/104 (PCI Express) bus or auxiliary power connector for standalone operation

Integration flexibility

- Two connector options (Harwin for 20-port, Molex for 8-port) to support either hand crimping CAT5e cabling or board-to-board (cableless) interface for Ethernet ports

Applications

- Small form factor embedded platforms, including standalone systems or integrated with stacking board architectures (i.e. PC/104-Plus, PCI-104, PCIe/104, PCI/104-Express, EBX, EPIC)

- High-speed Gigabit Ethernet LAN switching for IP-enabled equipment, such as on-board computers, cameras, sensors, monitoring devices, and command-and-control gear in harsh temperature and high shock / vibration environments

- SWaP sensitive mobile, tactical, airborne, and vehicle applications for situational awareness and network centric operations

Architecture

- Packet processor: highly integrated Vitesse carrier-grade network switching engine

- Switching: non-blocking Layer 2, IPv4 / IPv6 multicast, low- latency, auto-MDI/MDIX, auto-negotiation, auto-detect; speed auto-sensing, auto-crossover, full/half duplex modes

- Management processor: embedded 32-bit MIPS CPU @ 416 MHz with DDR-2 memory

- Networking software: Vitesse CE Services Carrier Ethernet application

Port Configurations

- 20-port: 20 x copper Gigabit Ethernet 1000Base-T, Harwin connectors

- 8-port: 8 x copper Gigabit Ethernet 1000Base-T, Molex connectors

Layer 2 Switching

- Port control: port-speed, duplex mode, flow control, port frame size (jumbo frames), port state, port status (link monitoring), port statistics (MIB counters)

- Quality of Service (QoS) traffic prioritization and queuing: 8 priorities, 8 CoS queues per port, strict or deficit-weighted RR scheduling, shaping/policing per queue and per port, storm control

- VLAN: 8K MAC addresses, 4K VLANs, 802.1Q static VLAN, protocol-based VLAN, MRP, MVRP, MVR, IEEE-80210ad provider bridge, link aggregation (IEEE-802.3ad)

- IEEE-802.1 D/w/s (Spanning Tree, Rapid Spanning Tree, Multiple Spanning Tree Protocol)

- PTP (IEEE-1588v2) time stamping as (a) peer to peer transparent clock, (b) end to end transparent clock, (c) boundary clock, or (d) slave only clock
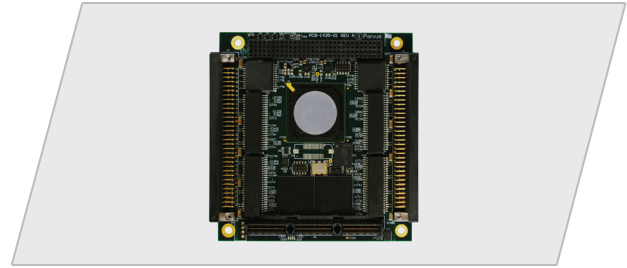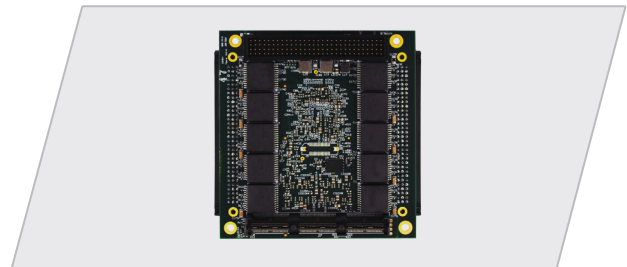

Figure 2: Top view (20-port)

Figure 3: Bottom view (20-port)

Figure 4: Side view with thermal plate installed (20-port)

Figure 5: Top view with thermal plate installed (20-port)

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Layer 3 Routing

- Layer 3 IPv4 / IPv6 unicast static routing support

Management

- In-band Ethernet management using web GUI or Simple Network Management Protocol (SNMP), or Command Line Interface (CLI) over RS-232 console for Telnet / SSH / Terminal
- HTTP/HTTPS web server, SNMP v1 / v2 / v3 client, DHCP client, IEEE 802.1X authentication, system Syslog, SSHv2, IPv6 management, IGMP/MLD/DHCP snooping, Access Control Lists (ACLs), port mirroring, BPDU Guard, RMON, Cisco Discovery Filtering, IEEE-802.10AB LLDP, BIT

Security

- NAS IEEE-802.1X, RADIUS accounting, MAC address limit, TACACS, web and CLI authentication, ACLs, IP source guard
- Declassification: data zeroization / sanitization support to erase non-volatile Flash memory and restore board to factory default configuration (initiated by offboard signal trigger)

Power

- Power input: 5V only (via PCI bus / PCI Express bus / auxiliary power header)
- Power consumption
  + 20-port: < 14 watts max
  + 8-port: < 10 watts max
- Support for Energy Efficient Ethernet (IEEE 802.3az), ActiPHY, and Vitesse PerfectReach technologies to reduce active Ethernet power for unused / idle links and/or shorter cable lengths

Status Indication

- Activity, link, and speed indication support (signals on connectors, no on-board LEDs)

Physical

- Dimensions: PCI/104-Express form factor, without thermal plate
  + L x W: 3.6" x 3.8" (90 x 96 mm)
- Weight
  + 20-port
    › 0.24 lbs (0.11 kgs) for board
    › 0.47 lbs (0.21 kgs) with thermal plate
  + 8-port
    › 0.18 lbs (0.08 kgs) for board
    › 0.41 lbs (0.19 kgs) with thermal plate
- Passive thermal management: optional integrated thermal plate on top of card for conductive cooling to optimize/ease integration with system thermal interface
- Connectors
  + 20-port config: Harwin Datamate 2mm connectors, support for hand-crimping of CAT5e wiring and board-to-board (cableless) interfacing, includes positive latching mechanisms for vibration mitigation
  + 8-port config: Molex Milli-Grid 2mm right angle connectors, support for hand-crimped wire only

Environmental

Qualified to meet MIL-STD-810G

- Operating / storage temp: -40 to +85°C / -40° to +185°F (MIL-810G, Methods 501,502) with proper thermal management
- Operating shock: 40g, 11ms, 3 pos/neg per axis (MIL-STD-810G, Meth 516)
- Random vibration: combined jet-helo-tracked vehicle profile, 3 axes (MIL-810G, method 514)
- Humidity: up to 95% RH @ 40°C, non-condensing (special order: conformal coating)

Other Specifications

Reliability

- Workmanship: assembled to IPC-A-610 Class III workmanship

- No moving parts, no active cooling required, staked components and underfilled BGA

- Designed & manufactured using AS9100 aerospace-grade / ISO 9001:2000 certified quality program

Mean Time Between Failure (MTBF)

Calculated per MIL-HDBK-217F

- Ground Benign, +25°C: 979,192 hours (111.8 years)

- Ground Mobile, +25°C: 60,204 hours (6.88 years)

- Airborne Inhabit, +25°C: 48,152 hours (5.5 years)

- Airborne Rotary, +25°C: 25,826 hours (2.94 years)

Note: MTBF analysis based on 20-port product configuration

Ordering Information

Ordering codes

20-port configuration

- SWI-22-10-10: PCI/104-Express GigE Switch, 20 x 1000Base-T, Harwin Conn

- SWI-22-10-10T: PCI/104-Express GigE Switch, 20 x 1000Base-T, Harwin Conn, w/Thermal Plate

- CBL-SWI-22-10-10: Breakout starter cable set for SWI-22-10 with Harwin Connectors to RJ-45, DB-9

8-port configuration

- SWI-22-10-01: SWI-22-10, PCI/104-Express GigE Switch, 8 x 1000Base-T, Molex Conn

- SWI-22-10-01T SWI-22-10, PCI/104-Express GigE Switch, 8 x 1000Base-T, Molex Conn, Thermal Plate

- CBL-SWI-22-10-01: Breakout Starter Cable Set for SWI-22-10 with Molex Connectors to RJ-45, DB-9

Breakout cable set

- Optional starter breakout cable set to mate with on-board Harwin/Molex connectors and transition to traditional RJ-45s (for lab / testing purposes)

Special order options

- Conformal coating; integration with Parvus DuraCOR or DuraWORX systems

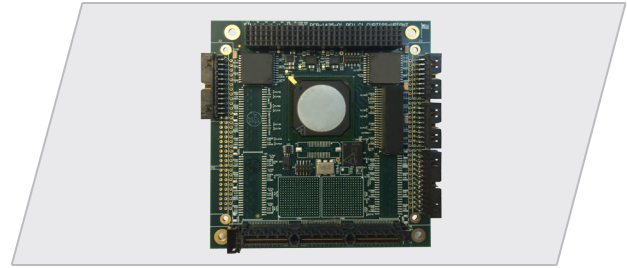- Board (de)population options (minimum order applies): no PCI/104-Express buses
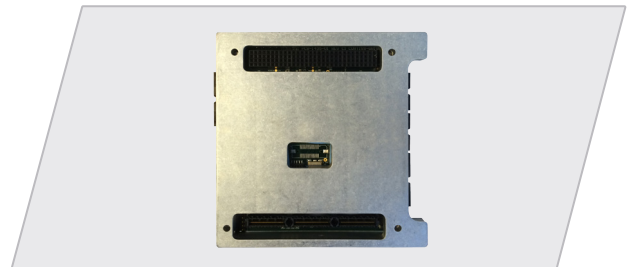

Figure 6: Top view of 8-port config

Figure 7: Top view of 8-port config with thermal plate

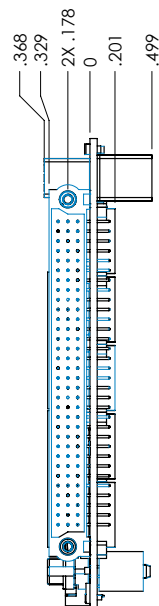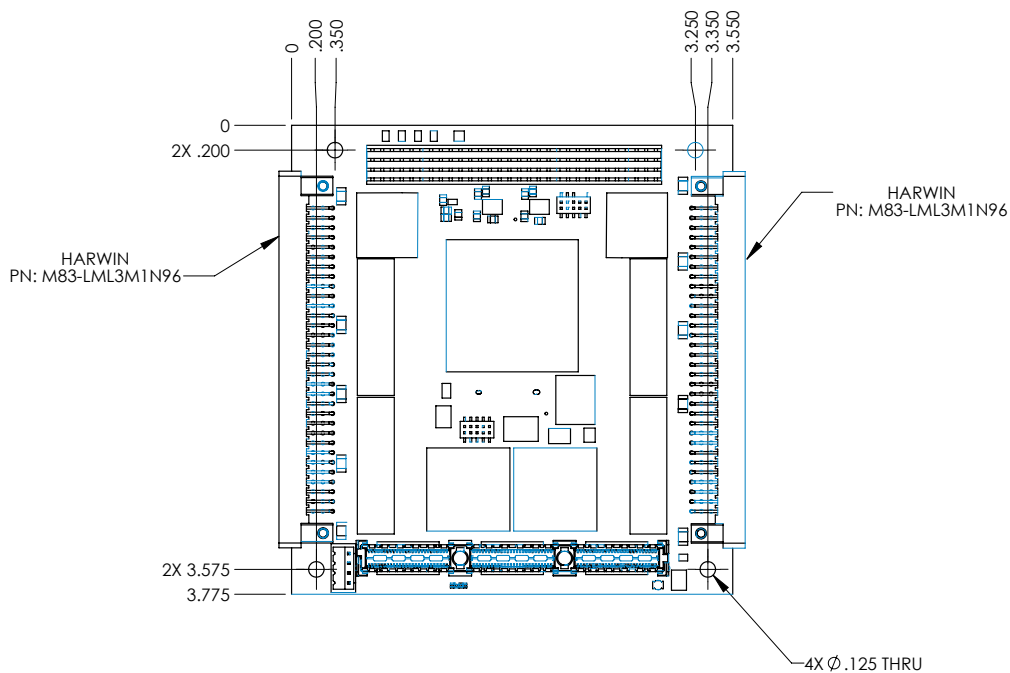Figure 8: Starter breakout cable set (20-port Harwin configuration)
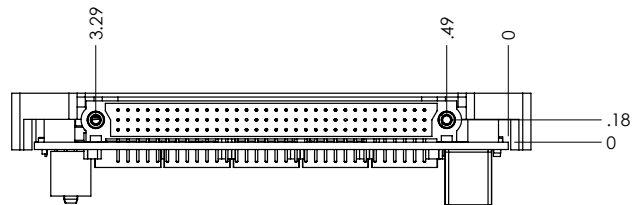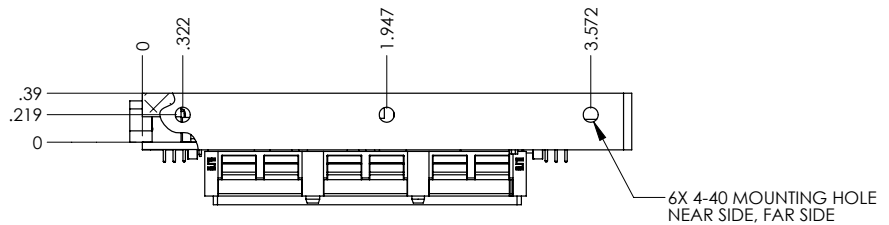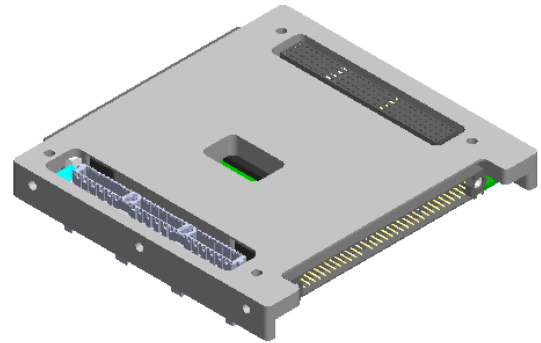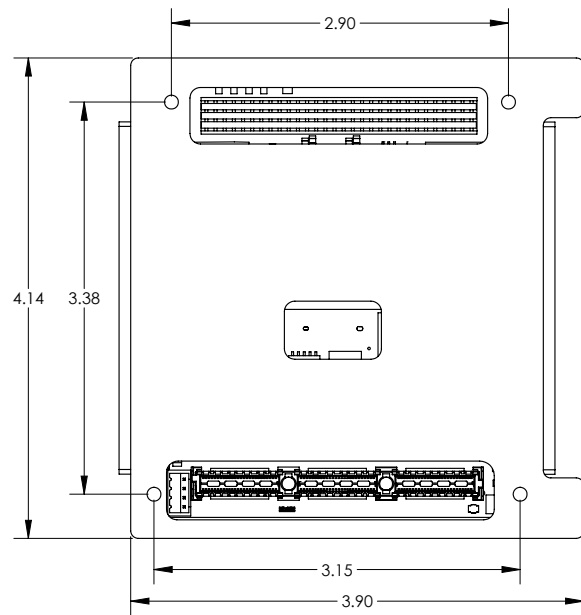

Figure 9: Starter breakout cable set (8-port Molex configuration)

Dimensional Drawings

20-port Configuration

Dimensional Drawings

8-port Configuration