

VPX3-652

Low-Power 3U VPX Managed Ethernet Switch

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Key Features

- 3U VPX™ Form Factor
- Full support for IPv4 and IPv6 networks
- 16 or 20 Gigabit Ethernet ports to the VPX backplane
- High-performance Layer 2+ network features
- Fast boot architecture with extensive Built-in Test (BIT)
- IPMI to support system-wide health management
- Extremely low-power operation (11W typical)
- Air-cooled and conduction-cooled variants
- Industry-leading technical and lifecycle management support

Applications

- Connectivity for low-power 3U VPX embedded computing systems
- Gigabit Ethernet vehicle networks

Overview

The VPX3-652 is a fully-featured, Layer-2 managed Ethernet switch designed to provide gigabit connectivity within size, weight and power (SWaP)-constrained embedded systems. Supporting an extremely low-power and fast boot architecture, the VPX3-652 provides up to 20 Gigabit Ethernet ports and can be used to connect modules within a VPX system, or externally to other systems or sensors.

The VPX3-652 follows in the footsteps of other popular Curtiss-Wright Ethernet switches, with an extensive set of networking features. The VPX3-652 supports a familiar industry standard Command Line Interface (CLI) for setup and configuration, as well as SNMP and web management interfaces- accelerating development time to market and simplifying maintenance and support.

Available in a full range of air- and conduction-cooled configurations, the rugged VPX3-652 combines the latest networking hardware and software technology into a cost-effective building block for deployed systems. Built to Curtiss-Wright's rigorous environmental standards, the VPX3-652 is durable in the harshest environments.

Architecture

The VPX3-652 features a highly integrated Ethernet switching core. Twelve BASE-T ports are directly supported from the switch device, and select models include an additional PHY to provide up to 16 BASE-T ports

An integrated MIPS management processor provides switch configuration and management, and features a serial RS-232 out-of-band management port on the front panel (air-cooled modules) and on the backplane (all modules).

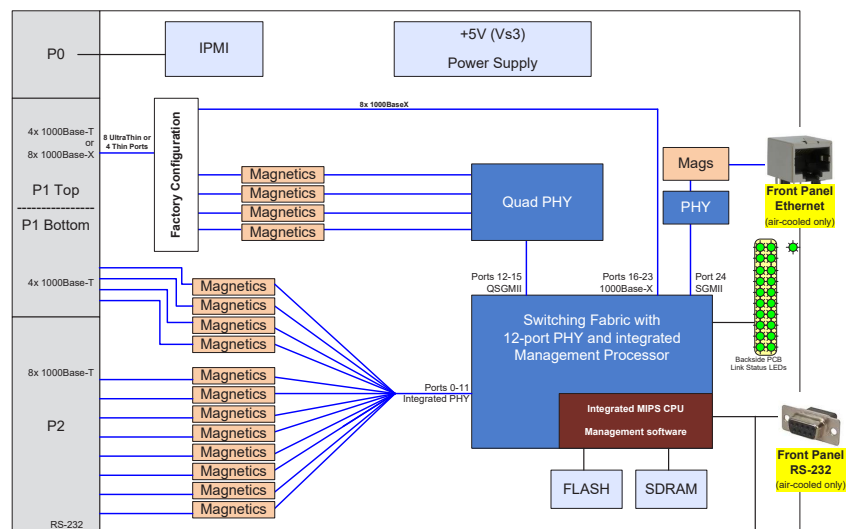


Figure 1: VPX3-652 block diagram

Hardware Specifications

Switching fabric

Carrier grade L2 Gigabit Ethernet switch

- Fully non-blocking, wire-speed performance with all ports and all frame sizes
- 4 Mb integrated shared packet memory

Management/Control processor

Integrated MIPS management processor

- 128 MB DDR2 RAM, 32 MB Flash

Ethernet fabric ports

- 12 or 16 ports 1000BASE-T supporting 10BASE-T, 100BASE-TX, and 1000BASE-T
- 8 or 0 ports 1000BASE-X (SerDes)

Ethernet port specifications

- 10BASE-T interfaces per IEEE 802.3
- 100BASE-TX interfaces per IEEE 802.3u
- 1000BASE-T interfaces per IEEE 802.3ab
 - + Auto MDI/MDIX crossover
 - + Max 100 m segment length
- 1000BASE-X interface per IEEE 802.3ap
- Energy Efficient Ethernet per IEEE 802.3az

Out-of-band management port

- RS-232 serial port

Reset

- Reset switch on RTM or via backplane

LEDs

- Front panel LEDs for Power, Status, Fail
- Rear PCB mounted LEDs for link status of each port

Power

Maximum power required from +5V (VS3)

- Supply: < 11W typical, 15W max

Form factor

3U VPX

- Air-cooled, 0.8" pitch with 1.0" front panel
- Conduction-cooled 0.8" pitch or 0.85" pitch with 2LM covers

Environmental

- Convection (air-cooled): Available in Levels 0 (AC L0) and 100 (AC L100)
 - + Required airflow is 15 CFM at sea level
- Conduction-cooled: Available at level 200 (CC L200) and 300 (CC L300)

Unless otherwise noted environmental tolerance is as defined in Curtiss-Wright's Ruggedization Guidelines factsheet.

Weight

- Air-cooled: 295 g
- Conduction-cooled: 406 g

Software/Functional Specifications

Ethernet

- Energy Efficient Ethernet (EEE) with ActiPHY

Capacity

- 4 Mb integrated shared packet memory
- Support for Jumbo Packets to 9,600 bytes
- Up to 8K Layer 2 MAC addresses
- Up to 4K VLANs
- Up to 8K Layer-2 Multicast Groups

Layer 2 switching features

- Support for IPv4 and IPv6 switching
- Automatic switch learning and aging with up to 8,192 MAC addresses
- Support for jumbo frames up to 9,600 bytes
- QoS Support with eight traffic classes
- VLANs
 - + 4,096 VLANs per 802.1Q
 - + VLAN broadcast, 802.1Q VLAN tagging & double-tagging
- Multicast
 - + 8K L2 multicast groups, 8K IPv4/v6 multicast groups
 - + IGMPv2/v3, MLDv1/v2 snooping for forwarding of multicast traffic
 - + GMRP for multicast registration propagation
- Link Aggregation (802.3ad, 802.1ax) for increased bandwidth and load sharing
- Port mirroring

- Rapid and Multiple Spanning Tree protocol (802.1w, 802.1s)
- IEEE 802.3x flow control and back-pressure support
- Packet or byte-based rate limiting on a per-port basis

Layer 3 routing

- IPv4 Unicast Static Routing

Other features

- IEEE-1588v2 Precision Time Protocol (PTP) with support for 1-step and 2-step clock sync
- DHCP client
- SNMP Network Time client
- Multiple configurations selectable via Geographical Addressing

Management

- Port-based security per 802.1X
- RADIUS accounting, TACACS+ authentication
- Management via CLI in-band via Telnet, out-of-band via serial RS-232
- Management via Web/HTTP or HTTPS with SSHv2 security
- SNMP v1/v2/v3, Syslog, RMON
- All management interfaces feature user-level password security

Built-in Test

- PBIT for power up self-test
- IBIT for user initiated self-test
- CBIT for continuous self-test

Ethernet Port Options

The VPX3-652 supports a 16-port configuration and a 20-port configuration.

In the 16-port configuration, the VPX3-652 provides all 16 ports as tri-speed 10/100/1000BASE-T interfaces. Each port supports legacy 10 Mbps and 100 Mbps connections, as well as today's gigabit speed 1000 Mbps connections. Auto-negotiation ensures that any connected Ethernet device can connect seamlessly to the VPX3-652. All BASE-T ports support auto-MDI/MDIX which provides trouble-free connections using both straight-thru as well as cross-over connections.

In the 20-port configuration, the VPX3-652 provides 12 ports of tri-speed 10/100/1000BASE-T interfaces and adds an additional eight ports of 1000BASE-X (SerDes) interfaces. These BASE-X interfaces are typically used

within a chassis to connect board-to-board, and connect using four wires instead of the BASE-T interface's eight wires. BASE-X interfaces can also be connected directly to optical transceivers to support optical fiber cabling within a platform.

Air-cooled models include an additional 10/100/1000BASE-T port available on the front panel RJ45 connector. Conduction-cooled modules include an additional 10/100BASE-TX port available on the rear VPX connector.

Ethernet Features

Built around a non-blocking fabric, the VPX3-652 supports a wide range of network features, including:

- Full support for IPv4 and IPv6 networks
- Tri-speed operation (10BASE-T, 100BASE-TX, and 1000BASE-T) with auto-negotiation and auto-MDIX for trouble-free interconnects
- Diagnostic/status LEDs to display link status
- Energy Efficient Ethernet per 802.3az
- Port, MAC, and protocol-based VLANs per 802.1Q with MVRP
- Spanning Tree support (RSTP, MSTP)
- Multicast support, including IGMP and MLD snooping
- Multiple traffic classes via QoS with flexible scheduling algorithms and traffic shaping
- Support for jumbo frames up to 9,600 bytes
- Link aggregation, port mirroring
- IPv4 static routing for connecting to WAN/radio ports

The network switch also includes full support for hardware-based Precision Time Protocol (IEEE-1588-2008), enabling network nodes to synchronize time with nanoseconds accuracy. Both Boundary Clock and Transparent Clock modes are supported.

OpenVPX Standards Compliant

The VPX3-652 is designed to be fully VITA 46/VITA 48/VITA 65/OpenVPX compliant.

Module pinouts

The 16-port variant complies with the OpenVPX module profile: MOD3-SWH-16T-16.4.7-1.

The 20-port variant complies with the OpenVPX module profile: MOD3-SWH-8U12T-16.4.11-1.

IPMI

The VPX3-652 includes an Intelligent Platform Management Interface (IPMI), enabling system monitoring and management. Backplane supply voltages, along with board temperature measurements, can be queried by an IPMI system controller.

Additionally, the IPMI system controller can perform a system reset to the VPX3-652 module.

Power-Saving Features

The VPX3-652 supports several unique power saving mechanisms. Each of these features can be turned on or off for each port independently, permitting fine-tuning of power saving features when tailoring the VPX3-652 for your system.

Energy Efficient Ethernet (EEE)

EEE is an industry standard (IEEE 802.3az) that reduces active Ethernet power during periods of low data activity. During idle periods, a periodic low-power-idle (LPI) signal is sent across the Ethernet connection, ensuring the links remain active, but consuming less power than the full power active mode.



Vitesse ActiPHY™

ActiPHY is a method of reducing power for unused links. When enabled, Ethernet ports that are not connected to a link partner will periodically go into a low-power mode, ensuring that transmitters are not continuously driving signals where there is no receiver connected. Transmitters are periodically turned on to check for a link partner, ensuring fast connections when a partner is connected. In addition to ActiPHY, unused ports can be permanently disabled through configuration, further reducing power.

Vitesse PerfectReach™

PerfectReach smart cable algorithm reduces active power for cable lengths shorter than the IEEE defined maximum of 100 meters. Most Ethernet connections on deployed platforms are shorter than the maximum 100 meters allowed, and PerfectReach determines the optimal power levels to drive Ethernet signals based on automatic cable length detection, while not sacrificing signal integrity and link reliability.

Depending on connection and traffic patterns, the use of these three power saving features combined can provide an estimated link power savings of 45-80%.

Cable Diagnostics

The VPX3-652 includes comprehensive cable diagnostics that can test the integrity of connected Ethernet wiring. This feature will report the approximate cable length of Ethernet connections, and identifies common wiring faults such as opens, shorts, improper termination, and excessive crosstalk.

Complete Integrated Software Solution

The VPX3-652 is a complete networking solution, with pre-integrated and optimized software that runs on its on-board processor. All software is included for the full suite of Layer-2 switching functionality and protocols, along with a comprehensive set of management interfaces to configure and monitor the switch.

Management

Management interfaces include a Command Line Interface (CLI), accessible through a dedicated serial RS-232 port, and also available in-band through any Ethernet port. The use of a CLI allows system integrators to “script” operational and test configurations.

An HTTP/Web interface is also supported through in-band Ethernet ports, and offers an intuitive way to configure the switch.

For centralized configuration and management, the VPX3-652 fully supports SNMP network management protocols. In-band management security is assured using SSL/SSH secure login protocols. All management interfaces incorporate user-level password security to guard against unwanted access.

Built-in Test (BIT)

The VPX3-652 supports Power-On BIT (PBIT), Continuous BIT (CBIT), and Initiated BIT (IBIT) designed to detect system faults. BIT results are available on all management interfaces.

Declassification

Curtiss-Wright switch products provide a declassification utility that erases all non-essential content in the board’s non-volatile flash memory. This feature provides an extra layer of security, often required when removing a module from service, and can also be used to recover to a default configuration in the event of misconfiguration or corruption.

Accessories

Rear Transition Module

For building networks in the lab environment, Curtiss-Wright provides a Rear Transition Module (RTM) that plugs into the back side of the VPX backplane and provides access to the following connections:

- 12-ports of 10/100/1000BASE-T via RJ45 connectors
- 4-ports of 10/100/1000BASE-T or 8 ports 1000BASE-X via CX4 connectors
- One 10/100BASE-TX debug port via RJ45
- Two RS-232 serial interfaces via RJ45
- A reset switch and headers for other utility signals

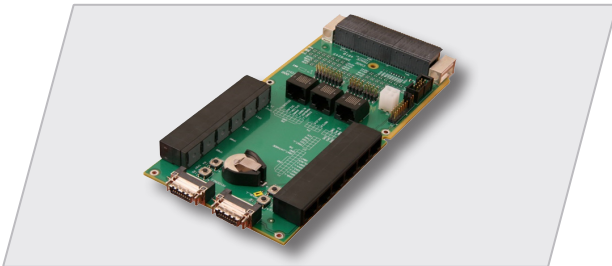


Figure 2: RTM3-652 Rear Transition Module

Two Level Maintenance (2LM) covers

For conduction-cooled units, a rear cover can be added to protect electronic components when used in a 2LM environment.

Ordering Information

The VPX3-652 is ordered with the following part numbers. Not all possible configurations are offered. Please consult Curtiss-Wright for available configurations.

TABLE 1 VPX3-652 ordering information		
PART NUMBER	RUGGEDIZATION	AVAILABLE OPTIONS AND DESCRIPTION
VPX3-652-A04120 VPX3-652-A14120	AC L0 AC L100	<p>3U VPX Ethernet Switch</p> <ul style="list-style-type: none"> › 21-port Ethernet switch with 12 ports 10/100/1000BASE-T and eight ports 1000BASE-X (SerDes) to backplane, one port 10/100/1000BASE-T to front panel › L2 features include VLANs, QoS, Multicast, RSTP/MSTP, LA, port mirroring, IPv4 static routing › Management via CLI, HTTP/Web and SNMP, IEEE-1588/PTP support › OpenVPX profile MOD3-SWH-8U12T › Air-cooled L0/L100 Ruggedization, 0.8" pitch with 1.0" front panel
VPX3-652-C21020 VPX3-652-C23020	CC L200 CC L300 (2LM covers)	<p>3U VPX Ethernet Switch</p> <ul style="list-style-type: none"> › 21-port Ethernet switch with 12 ports 10/100/1000BASE-T, eight ports 1000BASE-X (SerDes) and one port 10/100BASE-TX to backplane › L2 features include VLANs, QoS, Multicast, RSTP/MSTP, LA, port mirroring, IPv4 static routing › Management via CLI, HTTP/Web and SNMP, IEEE-1588/PTP support › OpenVPX profile MOD3-SWH-8U12T › Conduction-cooled L200 Ruggedization, 0.8" pitch › Conduction-cooled L300 Ruggedization, 0.85" pitch with 2LM covers
VPX3-652-A04116 VPX3-652-A14116	AC L0 AC L100	<p>3U VPX Ethernet Switch</p> <ul style="list-style-type: none"> › 17-port Ethernet switch with 16 ports 10/100/1000BASE-T to backplane, one port 10/100/1000BASE-T to front panel › L2 features include VLANs, QoS, Multicast, RSTP/MSTP, LA, port mirroring, IPv4 static routing › Management via CLI, HTTP/Web and SNMP, IEEE-1588/PTP support › OpenVPX profile MOD3-SWH-16T › Air-cooled L0/L100 Ruggedization, 0.8" pitch with 1.0" front panel
VPX3-652-C21016 VPX3-652-C23016	CC L200 CC L300 (2LM covers)	<p>3U VPX Ethernet Switch</p> <ul style="list-style-type: none"> › 17-port Ethernet switch with 16 ports 10/100/1000BASE-T and one port 10/100BASE-TX to backplane › L2 features include VLANs, QoS, Multicast, RSTP/MSTP, LA, port mirroring, IPv4 static routing › Management via CLI, HTTP/Web and SNMP, IEEE-1588/PTP support › OpenVPX profile MOD3-SWH-16T › Conduction-cooled L200 Ruggedization, 0.8" pitch › Conduction-cooled L300 Ruggedization, 0.85" pitch with 2LM covers
RTM3-652-0020	AC Lab Use	<p>3U Rear Transition Module (RTM) for the VPX3-652 Ethernet Switch</p> <ul style="list-style-type: none"> › Ideally suited for the development phase. Breaks out the following I/O for the VPX3-652: <ul style="list-style-type: none"> › 12 ports 10/100/1000BASE-T to RJ45 connectors › Four ports 10/100/1000BASE-T or 8-ports 1000BASE-X on CX4 connectors › One port 10/100BASE-TX on RJ45 › RS-232 out-of-band maintenance port on RJ45. › Air-cooled L0 for lab use. Includes one RJ45 to DB9 serial cable adapter (1m length)