VPX3-655

Versatile 1G / 10G / 40G Ethernet Switch

Key Features

- Fully managed multi-layer Ethernet switching in a standards-compliant module
- 20 high-speed Ethernet ports offering 8x 10GBASE-KR and 12x 10GBASE-T interfaces
  + 10GBASE-KR ports also support 1000BASE-KX and 40GBASE-KR4 configurations
  + 10GBASE-T ports support 1000BASE-T and 100BASE-TX
- Includes IEEE-1588v2 features for PTP and accurate time synchronization
- Available in standard air-cooled and conduction-cooled rugged form factors

Benefits

- Maximum flexibility to connect internal backplane and external twisted pair Ethernet systems and sensors
- Increased connectivity speeds between processing modules and between external systems
- Pin compatible performance upgrade for 1 Gigabit systems

Applications

- Mission computing for manned and unmanned vehicles that fuse and process high-speed sensor data

Overview

The Curtiss-Wright VPX3-655 is a fully-featured 1/10/40 Gigabit Ethernet switch that provides versatile and high-performance connectivity for today's modular embedded computing applications.

3U VPX systems increasingly combine multiple processing modules to enable higher levels of performance or to converge multiple single-function appliances into a multi-function system. The VPX3-655 provides these converged processing systems with high-speed communication links between processors and flexible connectivity to sensors, datalinks, and other systems.

The VPX3-655 supports OpenVPX module profiles 8U12T and 2F12T, which provide a flexible mix of pin-efficient BASE-KR/-KX backplane SerDes Ethernet for connections between modules, and BASE-T Ethernet for robust network links over standard twisted pair cables. Its eight SerDes links provide high performance and low latency connections between processors supporting 1G, 10G, and 40G (4-lane) port configurations. Twelve BASE-T interfaces feature tri-speed support for 10G, 1G, and 100Mbps connections to external systems and sensors.

The VPX3-655 features a highly integrated switch device ideal for modern embedded networking. It delivers low-latency, line-rate switching on all ports across all packet sizes. Integrated multi-layer switching software provides an extensive set of features for monitoring and enforcing traffic policies and creating advanced network architectures. Management interfaces include a powerful command line interface, SNMP, and web-based options. In-band management and networking features provide support for both IPv4 and IPv6.

To support critical real-time traffic management, the VPX3-655 switch incorporates software features for traffic scheduling and prioritization. It includes hardware support for IEEE-1588v2 Precision Time Protocol (PTPv2) as a transparent clock.

As more devices and critical systems connect to the network, robust security has become essential. To address this need, the VPX3-655 addresses essential managed switch security requirements, with the ability to disable non-essential services and secure management access. Regular maintenance updates to the VPX3-655 networking software serve to address emerging threats.

Designed from the ground up for superior durability and reliability, the VPX3-655 incorporates Curtiss-Wright's industry-leading hardware design and validation practices to meet the stringent requirements of the most demanding front-line environments.

To support life-cycle extensions and upgrades, the VPX3-655 is a pin-compatible replacement for earlier 1 Gigabit 8U12T switches including the VPX3-652 and VPX3-685.

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Figure 1: VPX3-655 block diagram

Specifications

Form Factor

- 3U VPX – VITA 65 OpenVPX, supporting module profiles:
  + MOD3-SWH-8U12T-16.4.11
  + MOD3-SWH-2F12T-16.4.9

Ethernet Interfaces

- 8 x SerDes backplane Ethernet supporting 10GBASE-KR with link training and auto-negotiation, compatible with 1000BASE-KX
  + 4 lanes can be combined for 40GBASE-KR4 operation, for 2 x 40G ports, or 1 x 40G plus 4 x 10G ports
- 12 x 10GBASE-T with support for 1000BASE-T and 100BASE-TX

Forwarding Performance

- Non-blocking line rate forwarding on all switch interfaces at all packet sizes
- Jumbo frames (up to 12K bytes)
- 8K MAC addresses
- 4K VLANs
- 4MB packet buffer

Multi-Layer Switching

- IEEE 802.1d bridging with support for STP, RSTP, MSTP
- VLANs and IEEE 802.1q tagging
- Link aggregation per 802.3ad and LACP
- IP multicast via IGMP and MLD snooping
- QoS via L2-L4 headers
- Refer to software release notes for full list of supported features.

Access Control & Port Security

- Port-based authentication via IEEE 802.1x
- MAC-based access control lists
- DHCP snooping
- Static MAC filtering
- ACLs based on L2-L4

Timing Services

- IEEE 1588-2008 Precision Time Protocol (PTPv2) transparent clock

Management Interfaces

- Command-line interface (CLI) for configuration and monitoring via RS-232 serial console
- In-band management over Ethernet interfaces
  + SSH, SNMP, or Web interface
  + HTTP and HTTPs for configuration and SW update
- 10/100 Mbps management Ethernet port for software upgrades

Health Management

- IPMC per VITA 46.11 for all Tier 1 and Tier 2 requirements

Serviceability & Monitoring

- Power-up BIT (PBIT)
- User Initiated BIT (IBIT)
- Continuous BIT (CBIT)

Power

- Primary Power: factory orderable for VPX Vs1 (+12V) or Vs3 (+5V)
- Typical power consumption = 32 watts
- Maximum power consumption = 51 watts

Environmental

- Air-cooled: available in Level 0 and Level 100
- Conduction-cooled: available in Level 200 and Level 300
- VITA 48.8 Air Flow-Through also available

Weight

- Air-cooled Level 0: 460g
- Air-cooled Level 100: 460g
- Conduction-cooled Level 200: 465g
- Conduction-cooled Level 300: 525g

VPX3-655 Features

10G Ethernet for Modern Embedded Systems

Developed to connect a new generation of 3U VPX systems, the VPX3-655 delivers high-performance switching and the latest managed networking features with the security and reliability required for today's rugged embedded applications.

The Broadcom® StrataConnect® BCM53570 switch device combines high-switching performance with a range of new features ideal for embedded applications. In the VPX3-655, the switch is configured to provide up to 20 ports of mixed 1G/10G/40G Ethernet to the backplane to enable mid-sized processing systems with multiple high-speed external interfaces.

IEEE 802.3 Backplane Ethernet

To connect between VPX modules and external systems, the VPX3-655 features up to 20 ports of standards-based Gigabit Ethernet.

Twelve ports of 10GBASE-T connect to the VPX backplane, providing robust, high-performance connectivity between processing modules or to external systems via twisted-pair cabling. Compliance to the 802.3 standard helps to ensure compatibility with legacy endpoints, and provides auto-negotiation to 1000 and 100 Mbps link partners.

Eight lanes of SerDes Ethernet are also supported, with flexible configurations to fit into any system. When configured as 10GBASE-KR, the ports provide link training and auto-negotiation, and are compatible with 1000BASE-KX link partners. Groups of four lanes can be combined into a single 40GBase-KR4 interface, offering one or two high-speed 40G Ethernet interfaces for fast network traffic. These 40G ports can also be used as uplink or backbone/trunk ports for switch-to-switch connectivity.

For example, Figure 2 shows two VPX3-655 modules combined to create a 24-port 10GBASE-T switch with an 80Gbps inter-switch trunk.
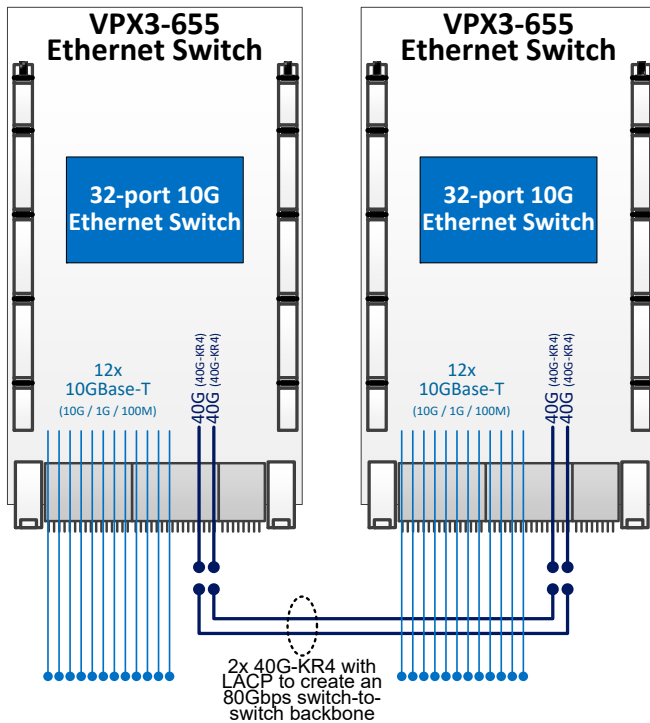
Figure 2: Dual Module 24-port configuration with 80Gbps inter-switch trunk

Secure Management Interfaces

As embedded computers transition from stand-alone appliances to connected systems, the importance of network security continues to grow. The VPX3-655 is designed with cyber-security in mind and uses a number of approaches to limit and mitigate potential vulnerabilities.

To support both system development and stable deployment, VPX3-655 offers multiple management interfaces for configuring and monitoring its networking features. These administrative interfaces can be individually disabled to limit access, protected with passwords, or secured with standards-based encryption. Hardware write protection features can be used to prevent unauthorized or unintentional modification of the switch configuration. Logging of configuration changes and administrative actions facilitates security audits. Other network services exposed on the switch interfaces can be disabled to further limit potential network threats.

Software Maintenance

To keep pace with emerging requirements and security threats, Curtiss-Wright continues to maintain switch networking software over the full life-cycle of a product. Customers with an active maintenance contract receive access to periodic updates that address potential vulnerabilities and maintain compliance with specification updates.

Time and Synchronization

Maintaining accurate time is essential for many applications, including those that combine data from multiple sensors or connected systems. To enable high-precision synchronization of real-time clocks over the Ethernet network, the VPX3-655 supports the IEEE 1588-2008 Precision Time Protocol. Acting as a transparent clock, the switch uses hardware timestamps in the switch and its PHY devices to account for the transit time through the network, allowing connected endpoints to synchronize time and clocks with sub-microsecond precision.

High-performance switching

The VPX3-655 features a 640 Gbps switching core that provides line-rate, non-blocking forwarding for all packet sizes in all configurations. It performs extensive packet processing in hardware to provide an array of features at full rate without performance degradation.

Powerful networking features

In today's embedded systems, a switch must provide more than connectivity – it must ensure secure and reliable forwarding for a variety of applications on a converged network.

Managed networking software integrated on the VPX3-655 provides a rich set of enterprise-class multi-layer switching features. Policy features such as VLANs and Access Control Lists (ACLs) allow traffic to be filtered and segregated. Support for IGMP snooping allows multicast traffic to be efficiently forwarded. Flexible quality of service (QoS) mechanisms can classify traffic to provide priority forwarding to delay-sensitive, real-time applications. Port security and 802.1x authentication restrict access to the network to trusted devices.

QoS and Real-Time Networking

Capable of forwarding at line-rate on all interfaces, the VPX3-655 delivers high performance and low latency for applications with high data rates. For applications where multiple applications share the network, a variety of quality of service (QoS) mechanisms are available to manage congestion and prioritize time-sensitive flows. Hardware parsing allows classification of packets based on L2-L4 headers. Multiple output queues per port and configurable queue service schemes enable low-latency treatment for high-priority traffic. Rate limiting can be used to police best-effort traffic to enforce partitioning of overall network bandwidth.

Reliability and Serviceability

The VPX3-655 features a comprehensive power-on built-in test (PBIT) suite to detect hardware faults that affect module performance. Additional tests can be initiated (IBIT) while the card is operational.

To support diagnostics and monitoring at the system level, interface status and statistics are available via the management Command Line Interface (CLI). These vital signs can also be monitored using an array of SNMP MIBs.

Designed for Harsh Environments

Curtiss-Wright modules are designed and manufactured to meet the challenging requirements of military, aerospace, and industrial environments and benefit from decades of experience and investment focused on achieving the highest levels of quality and durability.

The VPX3-655 is available in the Curtiss-Wright standard L0, L100 and L200 ruggedization levels.

Accessories for Development

To facilitate system development, the VPX3-655 rear transition module (RTM3-655) provides access to all switch Ethernet interfaces, as well as the serial management console and maintenance interfaces on convenient lab-friendly connectors such as RJ45 and mDB9. SFP+ and QSFP+ cages facilitate connection to SerDes Ethernet signals using passive copper cables (optical modules not supported).
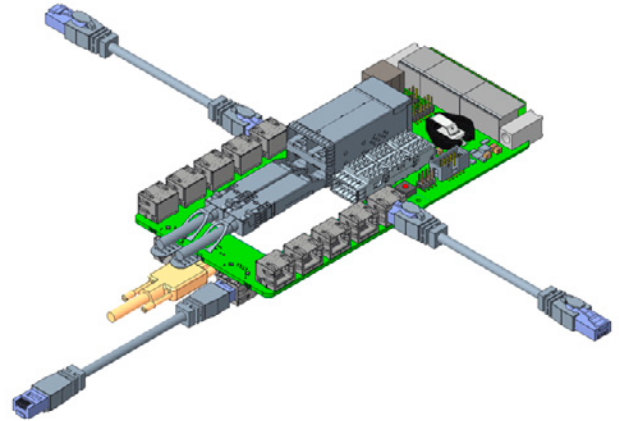

Figure 3: RTM-655 Rear Transition Module

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Ordering Information

The following VPX3-655 module combinations are available.

TABLE 1	VPX3-655 ordering information
PART NUMBER	**DESCRIPTION**
VPX3-655-A041200	3U VPX Versatile 1G/10G/40G Ethernet Switch › Managed L2 switching & routing feature set › Air-cooled L0, 1.0" pitch, microDB9 on front panel for RS-232 console › Vs1 (+12V) main power
VPX3-655-A045200	As above with Vs3 (+5V) main power
VPX3-655-A141200	3U VPX Versatile 1G/10G/40G Ethernet Switch › Managed L2 switching & routing feature set › Air-cooled L100, 1.0" pitch, microDB9 on front panel for RS-232 console › Vs1 (+12V) main power
VPX3-655-A145200	As above with Vs3 (+5V) main power
VPX3-655-C211200	3U VPX Versatile 1G/10G/40G Ethernet Switch › Managed L2 switching & routing feature set › Conduction-cooled L200, 0.8" pitch › Vs1 (+12V) main power
VPX3-655-C215200	As above with Vs3 (+5V) main power
RTM3-655-0020	Rear Transition Module for VPX3-655 modules › 12x BASE-T ports on RJ45 connectors › 4x SFP+ and 1x QSFP+ cages for SerDes ports › Management console via RS-232 serial port on mDB9 › For lab use only. › Works with Vs1 (+12V) or Vs3 (+5V) main power › NOTE: this RTM extends beyond the chassis
MNT-655-0020	VPX3-655 annual switch software maintenance › Provides access to regular software updates, including fixes and feature enhancements

Note: Ruggedization levels L0, L100, L200 and more are explained on Curtiss-Wright's web site. There, you will find a table defining the environmental parameters applicable to each level, and information about how Curtiss-Wright assures reliable performance even under challenging physical conditions.