CURTISS-WRIGHT

VPX3-6826 Ethernet Switch

100G Data Plane & Control Plane Ethernet Switch with TSN Developed in Alignment with the SOSA™ Technical Standard

The versatile, high-performance VPX3-6826 Ethernet switch provides rugged Ethernet switching for the next generation of 3U systems. It is developed in alignment with the Sensor Open Systems Architecture™ (SOSA) Technical Standard to assure interoperability with today's latest VPX systems.

Offering performance without compromises, the VPX3-6826 provides non-blocking line-rate Ethernet switching with independent Data Plane and Control Plane switches for traffic isolation in dual-domain environments.

Backplane copper connectivity provides up to 24 ports of Data Plane and 7 or 8 ports of Control Plane Ethernet. Optional front-panel network ports add Control and Data Plane optical interfaces for simplified external connectivity. The VPX3-6826 high-performance architecture is suitable for low-latency, time-critical, and high-throughput data-centric applications.

The VPX3-6826 supports a complete suite of Time-Sensitive Networking (TSN) features on its Control Plane, ideal for time-sensitive and deterministic traffic.

A fully managed multi-layer Ethernet switch and router, the VPX3-6826 supports an extensive range of network services including efficient multicast, flexible quality of service (QoS) and a range of security features. On-board management software provides a powerful command line interface (CLI), SNMP, and web-based options for configuration and monitoring.

Validated for deployment in the harshest environments, the VPX3-6826 is available in conduction-cooled L300 ruggedization with 2LM covers and is suitable for high-reliability embedded ground, naval, airborne, and commercial/industrial applications.

Key Features

- **Developed in alignment with the SOSA Technical Standard** as a 3U Data/Control Plane (6F) Ethernet Switch
- **Fabric100™ Ecosystem** Support for 100G Ethernet in a SOSA-aligned form factor
- **Independent Data Plane and Control Plane switches** for dual-domain security separation
  - **Data Plane** support for 10G, 25G, 40G, 50G, and 100G Ethernet
  - **Control Plane** support for 1G and 10G Ethernet ports
- **Optional front-panel optical ports** for both Data and Control Planes
- **Multi-layer** L2 switching and L3 routing
- **TSN support** on Control Plane

Applications

- **High-density MOSA/SOSA standards-based Ethernet** connectivity for HPEC and sensor processing systems
- **Deterministic and time-sensitive** 10 GbE Control Plane switch with TSN switching support
- **High-throughput** 100 Gbps Data Plane fabric

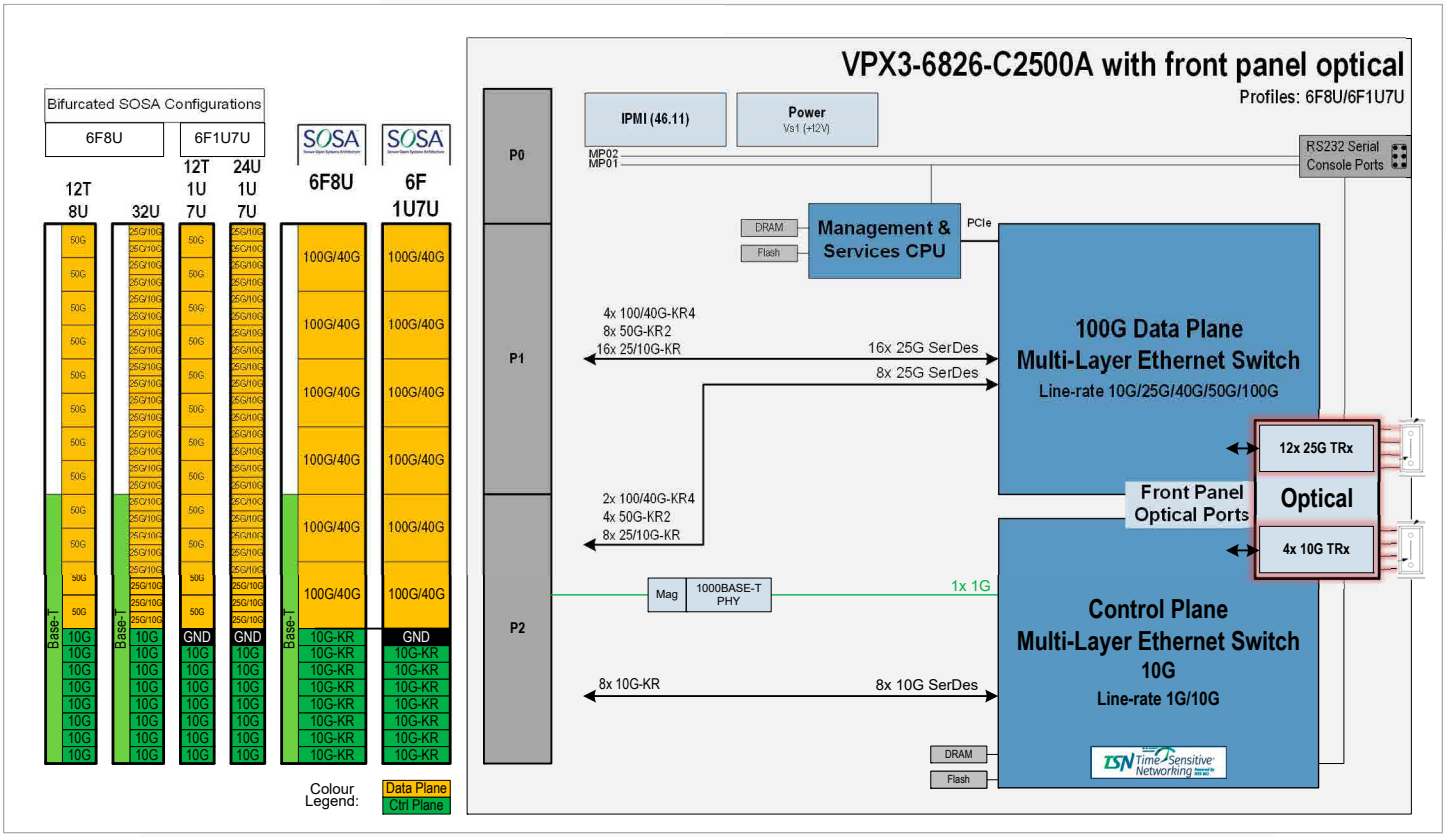

Figure 1: VPX3-6826 SOSA 100GbE Switch with optional Front Panel Optical Ports, block diagram

Fabric100 Ecosystem

This product is a member of Curtiss-Wright's Fabric100 Ecosystem

- Offering end-to-end support for 100G Ethernet fabrics, with proven performance for OpenVPX Gen5 (25Gbaud) signalling and reduced signal integrity risks
- Enhancing interoperability and ensuring optimal configuration of all aspects of the data fabric technology

VPX3-6826 Key Features

100G Ethernet for Modern Embedded Systems

Developed to connect modules within 3U VPX systems and with optional external optical interfaces, the VPX3-6826 delivers high-performance switching and routing with the latest managed networking features combined with the security and reliability required for today's rugged embedded applications.

Designed to meet MOSA and SOSA profiles, the VPX3-6826 supports a dual-switch architecture providing separate Data Plane and Control Plane switches. Backplane connectivity offers copper connectivity with flexible port speeds and configurations, and optional front-panel optical ports offer simplified systems integration for external connectivity.

IEEE 802.3 Backplane Ethernet

To connect between VPX modules within a chassis, the VPX3-6826 features standards-based IEEE 802.3 backplane Ethernet.

The Data Plane offers up to 24 ports supporting single-lane 10GBASE-KR and 25GBASE-KR ports, dual-lane 50GBASE-KR2 ports, and four-lane 40GBASE-KR4 and 100GBASE-KR4 ports.

The Control Plane offers 7 or 8 ports supporting single-lane 1000BASE-KX and 10GBASE-KR ports, and one port of 1000Base-T for some profiles.

Optical Ethernet Ports

The VPX3-6826 can be ordered with front-panel optical ports, ideal for direct sensor ingest and network distribution or for connecting high-speed Ethernet between systems.

Supporting MT optical interconnects specifically designed for deployed rugged environments, the VPX3-6826 provides 12 duplex fiber ports of Data Plane and 4 duplex fiber ports of Control Plane Ethernet on two independent MPO interfaces using Glenair 183-003 Series 79 rugged MT connectors.

Figure 2: Front Panel Optical Interfaces

The Data Plane optics can be configured as single-lane 10GBASE-SR or 25GBASE-SR ports, dual-lane 50GBASE-SR2 ports, or four-lane 40GBASE-SR4 or 100GBASE-SR4 ports. Up to 12 single-lane, 6 dual-lane, or 3 four-lane ports are supported.

The Control Plane optics supports four 10GBASE-SR ports.

For deployed systems, rugged optical mating connectors and cabling is available from Glenair. One option would be to use an MT24 breakout into dual MT12, as shown in Figure 2. Other cable options are available from Glenair, such as cabling directly from MT-24 into a MIL-38999 connector.

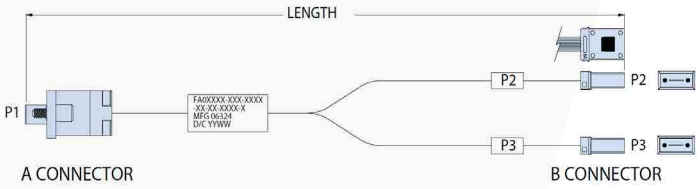

Figure 3: Example front breakout cable: MT24 into dual MT12

The VPX3-6826 keys the front optical connectors with an A keyed connector for Data Plane interface and a B keyed connector for Control Plane interface, as shown in Figure 3. This ensures deployed systems can be implemented with uniquely polarized cables for the DP and CP ports respectively.

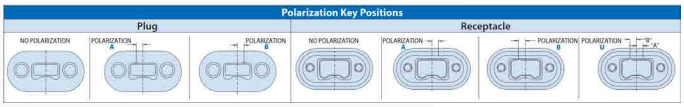

Figure 4: Optical connector keying options

Breakout cables for development are available from Curtiss-Wright. Cable CBL-OPT-12724A breaks out the Data Plane 24 fiber MT interface into separate LC duplex connectors, suitable for standard lab interfacing with single-lane duplex fiber interfaces. To interface with QSFP/QSFP28+ optical equipment, a QSFP+ MTP/MPO transceiver with LC breakouts can be used with the CBL-6800-1001 using passive LC to LC receptacles.

Cable CBL-OPT-12712B breaks out the Control Plane 12 fiber MT interface into LC duplex paired connectors.

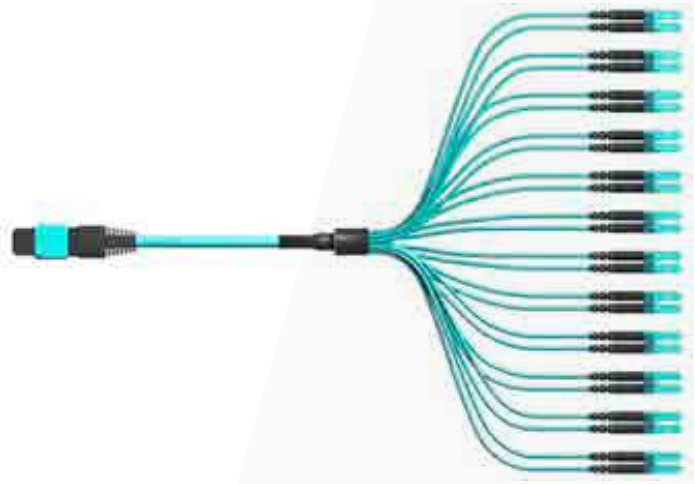

Figure 5: CBL-6800-1001 breaks out MT24 into 12x LC pairs

Flexible Management Interfaces

The VPX3-6826 is a complete networking solution with integrated software that provides a range of multi-layer services. Separate management processors operate the Data Plane and Control Plane independently.

Management interfaces for switch configuration and monitoring include a flexible command-line interface (CLI), SNMP, and a web-based interface.

The VPX3-6826's command line interface is available on dedicated serial console ports, independently supporting the management of the Data Plane and Control Plane switches (MP01 and MP02). Management and is also available in-band via SSH on any of the switches' Ethernet interfaces. The management interfaces support a range of usability features, including command completion, enables configuration auditing, and facilitates the deployment of standard configurations.

For switch management and operations using SNMP, the VPX3-6826 implements a wide range of standards-based MIBs.

For enhanced security, in-band ports can be restricted from management capabilities, allowing only specific ports, or no in-band ports at all, to access management functions.

Management interfaces are also accessible from the front of the module, as shown in Figure 2. This can be used for lab development, or also for updating or configuring fielded units if in-band management interfaces are disabled or unavailable. Cable CBL-6800-0001 breaks out this front panel interface to access the serial management ports as EIA-232, and also supports out-of-band Ethernet maintenance ports for software updates or reloading.

High-performance Packet Switching

The VPX3-6826 features a 1.9 Tbps bandwidth Data Plane and a 200Gbps bandwidth Control Plane 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 line rates without performance degradation.

Powerful Packet Switching Services

In today's embedded systems, a switch must provide more than connectivity – it must also participate in converged network architectures that utilize the power of network services and secure and reliable packet forwarding.

Managed networking software integrated on the VPX3-6826 provides a rich set of enterprise-class multi-layer switching features. Policy features such as virtual LANs (VLAN) and Access Control Lists (ACLs) allow traffic to be filtered, segregated and/or restricted. Support for IGMP snooping allows multicast traffic to be efficiently forwarded to multiple destinations at hardware speeds. 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.

Ethernet switching on the VPX3-6826 is based on the IEEE 802.1d standards for bridging. Support for the Spanning Tree Protocols (STP) provides automated topology discovery for loop-free forwarding at a line rate between any devices on the LAN. It includes support for RSTP and MSTP to provide faster recovery when links fail or topology changes.

QoS and Real-Time Networking

For applications where many devices share the network, a variety of QoS mechanisms are available to manage congestion and prioritize time-sensitive flows. Hardware parsing allows the classification of packets based on L2-L4 headers filtering and differential service policies. 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.

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 VPX3-6826 supports the IEEE 1588v2 Precision Time Protocol (PTP). Acting as a transparent clock, the switch supports 1-step or 2-step timestamping in the switch to account for the transit time through the network, allowing connected endpoints to synchronize with sub-microsecond precision.

Time Sensitive Networking (TSN) on Control Plane

The VPX3-6826, acting as an IEEE 802.1AS time-aware bridge (relay instance), provides a range of Time Sensitive Networking (TSN) features on the Control Plane, which adds real-time deterministic messaging capabilities to standard Ethernet networks. To make use of TSN features, TSN capable endpoints are required, such as the Curtiss-Wright VPX3-1262 Processing module.

Layer 3 Routing

In addition to all the Layer-2+ switching features, the VPX3-6826 supports Layer 3 IP routing features. Supporting both static and dynamic IPv4 and IPv6 routing protocols, the VPX3-6826 can participate in larger platform-wide or off-platform routed networks, efficiently routing traffic between network segments.

Secure Management Interfaces

As embedded computers transition from stand-alone appliances to connected systems, the importance of network security grows. The VPX3-6826 is designed with cybersecurity in mind and uses several approaches to limit and mitigate potential vulnerabilities.

To support both system development and stable deployment, VPX3-6826 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 limit potential network threats further.

Built-in Test (BIT) for Reliability and Serviceability

The VPX3-6826 features a comprehensive power-on built-in test (PBIT) suite to detect hardware faults that may affect module performance. To support diagnostics and monitoring at the system level, interface status and statistics are available via the management CLI as Continuous BIT (CBIT).

- PBIT for power-up self-test
- CBIT for continuous status and monitoring

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 VPX3-6826 is available in the Curtiss-Wright standard conduction-cooled L200/L300 ruggedization level.

Conduction-cooled modules include VITA 48 two-level maintenance covers to create a truly field-serviceable Line Replaceable Module (LRM).

Full details of Curtiss-Wright's standard Ruggedization Guidelines can be found on the Curtiss-Wright website.

Software Maintenance

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

VPX Slot Profile

The VPX3-6826 is available in two SOSA-aligned profiles:

- SLT3-SWH-6F1U7U-14.4.14 switch slot profile, shown in Figure 6
- SLT3-SWH-6F8U-14.4.15 switch slot profile, shown in Figure 7

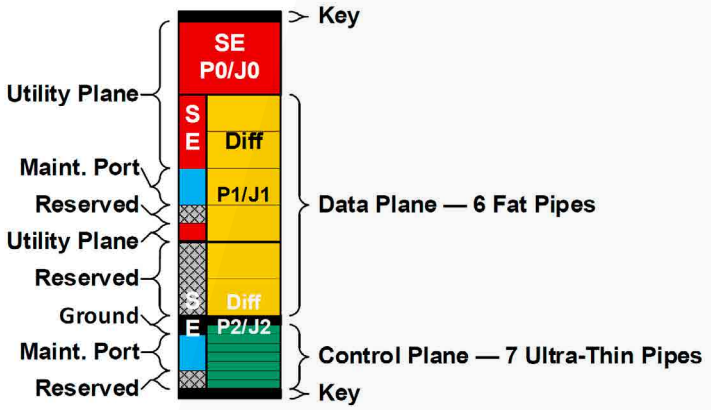

Figure 6: SOSA and OpenVPX Profile SLT3-SWH-6F1U7U-14.4.14

The 6F1U7U profile offers 6x Data Plane fat-pipe (FP) Ethernet ports and 7x Control Plane ultra-thin pipe (UTP) Ethernet ports.

Two out-of-band UART Maintenance Ports (MP01, MP02) are available using LVCMOS signaling levels. A factory build option can provide these interfaces to EIA-232 signal levels for non-SOSA systems.

The UART ports are also available with EIA-232 signal levels from the front panel of the module. Additionally, out-of-band maintenance Ethernet ports are available on the front panel for software/firmware updates when in-band ports have been disabled.

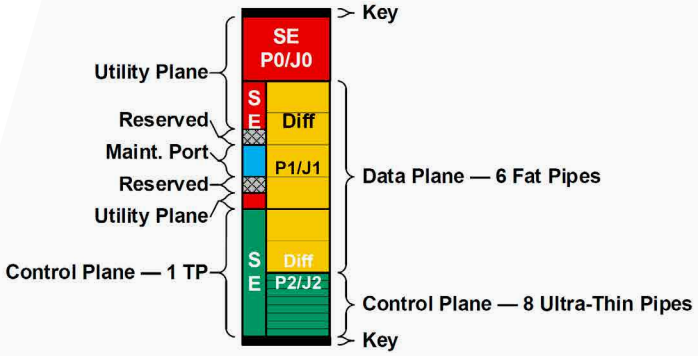

Figure 7: SOSA and OpenVPX Profile SLT3-SWH-6F8U-14.4.15

The SLT3-SWH-6F8U profile eliminates the P2 grounding wafer and adds one additional Control Plane ultra-thin pipe (UTP) Ethernet port for a total of eight, and adds one 1000BASE-T port on P2. This profile only provides one Maintenance Port (MP01) on the backplane.

The board draws primary power from the VPX Vs1 (12V) power rail only. A factory build option is available to support Vs3 (5V) primary power – please contact Curtiss-Wright.

Specifications and Standards

Form factor

- 3U OpenVPX, developed in alignment with the SOSA Technical Standard
- Supports the following profiles:
  - SLT3-SWH-6F1U7U-14.4.14 (SOSA Aligned)
  - SLT3-SWH-6F8U-14.4.15 (SOSA Aligned)
  - SLT3-SWH-2F24U-14.4.3

Ethernet Interfaces

- Dual switch architecture provides traffic and management isolation between Data Plane and Control Plane
- Data Plane switch supports up to 25 Gbaud per lane, and 1-lane UTP, 2-lane TP, or 4-lane FP ports
- Control Plane switch supports up to 10 Gbaud per lane with 1-lane UTP ports
- Backplane FP (4-lane) Ethernet Interface Standards
  - 100GBASE-KR4 @ 25.78125 Gbaud per lane
  - 40GBASE-KR4 @ 10.3125 Gbaud per lane
  - 4 x 25GBASE-KR @ 25.78125 Gbaud per lane
  - 4 x 10GBASE-KR @ 10.3125 Gbaud per lane
- Backplane TP (2-lane) Ethernet Interface Standards
  - 50GBASE-KR2 @ 25.78125 Gbaud per lane
- Backplane UTP (1-lane) Ethernet Interface Standards
  - 25GBASE-KR @ 25.78125 Gbaud per lane
  - 10GBASE-KR @ 10.3125 Gbaud per lane
  - 1000BASE-KX @ 1.25 Gbaud per lane (CP only)
- 1 x 1000BASE-T interface for profile 6F8U-14.4.15

Optional Front Panel Optical Ethernet Interfaces

- Data Plane
  - 12 x 25 Gbaud optical interfaces supporting a mix of 10G, 25G, 40G, 50G and 100G Ethernet ports
  - Glenair 183-003 Series 79, MT24 optical connector, A keyed
- Control Plane
  - 4 x 10 Gbaud optical interfaces supporting 1G and 10G Ethernet ports
  - Glenair 183-003 Series 79, MT12 optical connector, B keyed

Additional I/O

- 2 x UART maintenance ports, LVCMOS
  - Contact Curtiss-Wright for variants with RS-232 levels

Health management

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

Switching Features

The switching and routing software suite includes the following capabilities:

- Switching (Layer 2) features
  - STP, RSTP, MSTP Spanning Tree Support
  - VLANs including trunking, IEEE 802.1ad and QinQ
  - Multicast
  - LACP Link Aggregation
  - LLDP
  - Rate limiting
  - Port mirroring
  - QoS Quality of Service based on 802.1P, IPv4 and IPv6 headers with configurable queue parameters
  - Jumbo frame support up to 9K bytes
- Routing (Layer 3) features for IPv4 and IPv6
  - OSFPv2/v3, BGP4/4+ routing protocols
  - Static routing between VLANS (IPv4 and IPv6)
  - ICMPv6, NDP
  - UDP port number filtering
  - DHCP client, server, and relay
- Multi-layer services
  - IGMP and MLD snooping
  - Multicast IPv4, IGMP v1/v2/v3 router, PIM SSM
  - Multicast IPv6, MLD router
  - Access Control List (ACL) filtering based on
    - Source or destination MAC address
    - IP protocol, IP address
    - Source or destination TCP/UDP port
  - IEEE 802.1x port-based authentication
- Management (CLI, Web UI, and SNMP) supporting IPV4 and IPV6
  - Secure Management
  - Radius/TACACS+ authentication
  - SNMPv3, RMON
- IEEE 1588v2 / PTP transparent clock with hardware time stamp

Time Sensitive Networking (TSN) Features

The Control Plane switch offers the following TSN features:

- Time Synchronization
  - 802.1AS-2020 Time synchronization for TSN
- Low Latency
  - 802.1Qav Forwarding and queuing enhancements (credit-based shaping), partial support
  - 802.1Qbv Time-aware shaping
  - 802.1Qbu, 802.3br Frame pre-emption

- 802.1Qch Cyclic queuing and forwarding, partial support
- High Availability
  - 802.1CB Frame replication
  - 802.1Qci Per-stream filtering and policing

Switch Boot Time

- Fast-boot (no BIT) = <TBD> seconds to data forwarding
- Minimal BIT = <TBD> seconds to data forwarding
- Full BIT = <TBD> seconds to data forwarding

Built-in Test

- Power-up BIT (PBIT)
- Continuous BIT (CBIT)

Security

- Port security and 802.1x authentication
- Administrative interfaces can be individually disabled
- Declassification

Power

- Primary Power: Vs1 (+12V), 3.3V_AUX
  - Optional Vs3 (+5V) main power - contact Curtiss-Wright
- RTC Power from VBAT (optional)

Power Consumption

Power consumption will vary based on number of connected Ethernet devices and traffic patterns.

- Minimum power consumption = <TBD> watts
- Typical power consumption = <TBD> watts
- Maximum power consumption = <TBD> watts

Environmental

- Conduction-cooled: available in Level 200 and Level 300 with 2LM covers
  - Designed to meet VITA 47.3 ECC3SL1
- For additional cooling methods, such as Air-Cooled, Air Flow-Through, LFT/FFT, etc, please contact Curtiss-Wright

Weight

- Conduction-cooled Level 300: TBD

VPX3-6826 Ordering Information

VPX3-6826 modules described in this product sheet are orderable per below.

- All VPX3-6826 modules listed are conduction-cooled, L300 with 2LM covers
- Cables are for lab development only and not intended for deployment

Table 1 VPX3-6826 Ordering Information

Part Number	Description
VPX3-6826-C25000	Fabric100 Dual Domain Ethernet Switch, Copper Only • CC-L300 ruggedization, Vs1 (+12V) power, 6F1U7U Profile copper backplane VPX ports • No front panel optical ports
VPX3-6826-C2500A	Fabric100 Dual Domain Ethernet Switch, Front Optical Ports • CC-L300 ruggedization, Vs1 (+12V) power, 6F1U7U Profile copper backplane VPX ports • 12x 25G Data Plane optical ports, 4x 10G Control Plane optical ports
CBL-6800-0001	Front Panel Utility breakout cable for lab use • Breaks out front panel utility signals into standard lab connectors: DB9 for RS232, RJ45 for Ethernet
CBL-OPT-12724A	Glenair 183-014 003 Series 79 MT24 Optical Data Plane breakout cable for lab use, A-keyed • Breaks out MT24 front panel optical interface into 12x duplex LC connectors
CBL-OPT-12712B	Glenair 183-014 003 Series 79 MT12 Optical Control Plane breakout cable for lab use, B-keyed • Breaks out MT12 front panel optical interface into 6x duplex LC connectors

Table 2 Software and Maintenance

Part Number	Description
MNT-6826-0030	Annual maintenance and Software Upgrade Program (SUP) for VPX3-6826