Ensemble® 6000 Series
OpenVPX SFM6102 Module

MERCURY SYSTEMS™

10 Gigabit Ethernet Switching, System Management and Front-Panel I/O in a Single Slot
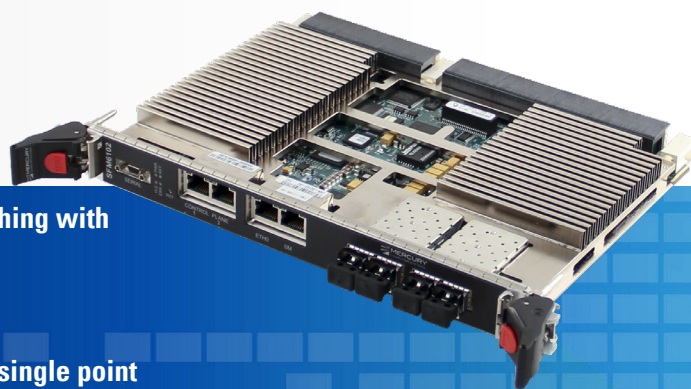
- **High-bandwidth standard 10 Gigabit Ethernet data plane switching with front-panel access**
- **Gigabit Ethernet control plane switching and front-panel**
- **Gigabit Ethernet ports**
- **Intelligent OpenVPX™ system management capabilities from a single point**
- **Built-in accordance with OpenVPX design principles**
- **Air-cooled, Air Flow-By® and conduction-cooled variants available**
- **Identical software infrastructure across Mercury products**

The Ensemble® 6000 Series OpenVPX™ SFM6102 Switch Fabric Module from Mercury Systems is a VITA 46/48 switch board that provides full inter-board 10 Gigabit Ethernet data plane and Gigabit Ethernet control plane connections in an OpenVPX system.

Built to comply with the VITA 65 OpenVPX specification, the Ensemble SFM6102 offers 3 functions in a single OpenVPX slot: data plane switching, control plane switching and chassis management in a single OpenVPX slot. By providing Ethernet switching for the data plane and control plane, the Ensemble SFM6102 delivers a standard open architecture suitable for net-centric processing and control applications within the embedded marketplace.

The Ensemble SFM6102 implements data plane switching via the Broadcom BCM56820 10 Gigabit Ethernet switch, supporting up to twenty 10 Gigabit Ethernet ports to the backplane for customer use. An additional four 10 Gigabit Ethernet ports are provided to the front-panel in air-cooled configurations, allowing external traffic to flow directly on to the OpenVPX data plane. The Ensemble SFM6102 module provides Gigabit Ethernet switching for up to 18 VPX payload slots via the on-board Broadcom BCM56312 Layer-2 managed switch. Up to two front-panel Gigabit Ethernet ports are available, allowing

external Ethernet traffic access to the backplane Ethernet links. The Ensemble SFM6102 module also implements OpenVPX chassis management capabilities, allowing the switch module to intelligently manage the entire system from a single point.

Full-Featured Switching Technology

The Ensemble SFM6102 module utilizes the Broadcom® BCM56820 as the heart of its data plane switching architecture. With 24 ports available, the BCM56820 provides up to 20 data plane interfaces to the backplane and four interfaces to the front-panel (air-cooled configurations only). Supported by Broadcom's FastPath® software suite, the Ensemble SFM6102 is fully managed, supporting the full spectrum of Layer-2 switching protocols and functions.

A single Ensemble SFM6102 module provides full connectivity for up to 18 payload modules in an OpenVPX chassis, with two interfaces provided for inter-switch connectivity. A second Ensemble SFM6102 module can be configured as an additional full-duplex connection for payload modules, supporting applications with increased bandwidth requirements. Smaller configurations can create high-bandwidth interfaces by routing all four standard OpenVPX data plane ports from a payload slot to a single Ensemble SFM6102 switch module.

Mercury Systems is a best-of-breed provider of commercially developed, open sensor and Big Data processing systems, software and services for critical commercial, defense and intelligence applications.
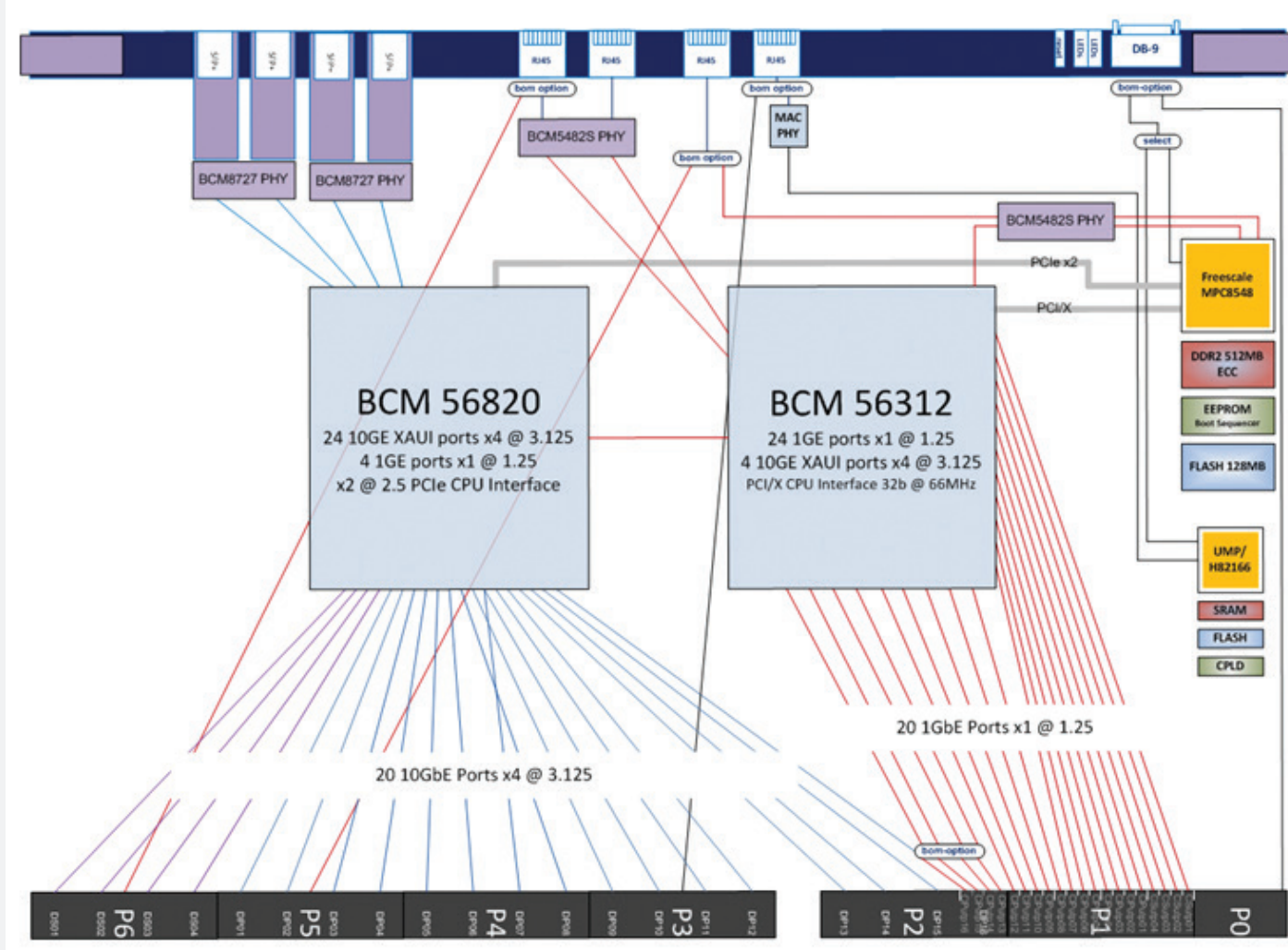
ACQUIRE   DIGITIZE   PROCESS   STORAGE   EXPLOIT   DISSEMINATE

Figure 1. *Ensemble 6000 Series OpenVPX SFM6102 module functional block diagram*

The Ensemble SFM6102 is field configurable to support nineteen 10 Gigabit Ethernet interfaces to the backplane to allow support for up to 20 control plane interfaces. This setting is managed via an on-board soft jumper.

Systemwide Gigabit Ethernet Switching

The Ensemble SFM6102 module provides control plane Gigabit Ethernet switching in addition to data plane switching. The Ensemble SFM6102 module implements the Broadcom BCM56312 switch to provide Gigabit Ethernet connectivity over the backplane to each payload module. System designers can avoid the need for an external control plane switch and cabling in their configurations. The Ensemble SFM6102 module embeds this functionality within the OpenVPX system. This design leverages the design of the Ensemble SFM6100 module, Mercury's Gen1 Serial RapidIO® switch module.

Front-Panel Ethernet Interfaces

The Ensemble SFM6102 module provides two Gigabit Ethernet ports to the front-panel (air-cooled variants only; conduction-cooled and

Air Flow-By configurations provide a single interface). These ports are routed to the Ethernet switch. This allows users to direct TCP/IP traffic directly into the on-board Gigabit Ethernet switch for dispersal among the payload modules. It also enables easy integration of the OpenVPX system into the network backbone of the deployed platform. A third port provides an interface to the on-board support processor for software and firmware updates, and for access to switch management software.

Additionally, four 10 Gigabit Ethernet interfaces to the data plane Ethernet switch are provided in air-cooled configurations. These high-bandwidth interfaces support use cases such as direct data flow on to the 10 Gigabit Ethernet data plane, inter-chassis communication or failover capabilities.

Highly Capable Switching Software

With the assistance of the Ensemble SFM6102 module's on-board service processor, both the BCM56820 and the BCM56312 Ethernet switches can be configured as Layer-2 managed switches. Both the

data plane switch and control plane switch support features such as link aggregation (including LACP), VLAN capabilities, spanning tree protocols (including MSTP, RSTP and STP), IGMP snooping, port mirroring, multicast functionality and jumbo packets. The switch can be configured to act as an in-system DHCP server, if required. Switch management support is available via SNMP, HTTP or SSH.

System Management Capabilities

An on-board system management block allows the Ensemble SFM6102 module to manage the entire OpenVPX system. The on-board shelf manager can query sensor values across the system, reset and power up/down modules, set sensor thresholds, and manage firmware updates. Remote network access to the management subsystem is provided via a front-panel (air-cooled only) or backplane 10/100BASE-T port.

Flexible, Modular System Configurations

OpenVPX systems from Mercury are designed to the system level, with a rich set of fully integrated modules that can be flexibly scaled and combined in a variety of configurations to meet a broad range of embedded application requirements. Many board types are available for end-to-end solutions, including a variety of digital receiver solutions, single-board computers and signal processing modules. In particular, Protocol Offload Engine Technology (POET™)-enabled Intel modules from Mercury (such as the Ensemble LDS6520, HDS6600 and LDS6521) can support 10 Gigabit Ethernet data planes and the Ensemble SFM6102 by simply upgrading their POET interface with the appropriate image.

A fully loaded VPX system that balances processing power with flexible I/O capabilities could consist of 18 payload modules and two Ensemble SFM6102 modules, although not all chassis can support this maximum configuration. This configuration could include elements intended to acquire, digitize, process, exploit or disseminate data via the 10 Gigabit Ethernet data plane; it could also instantiate FPGA, CPU, GPU or ADC/DAC technology. With the net-centric capabilities of the Ensemble SFM6102, the processing subsystem can interface seamlessly with other system elements on the deployed embedded platform.

Ensemble SFM6102 modules are available in air-cooled (at various levels of ruggedization), conduction-cooled and Air Flow-By variants.

VPX-REDI

The VPX (VITA 46) standard defines 6U and 3U board formats with a modern high-performance connector set capable of supporting today's high-speed fabric interfaces. VPX is most attractive when paired with the Ruggedized Enhanced Design Implementation standard — REDI (VITA 48). The Ensemble SFM6102 module is implemented as a 6U conduction-cooledo or Air Flow-By implementation of VPX-REDI, with

air-cooled variants in the same OpenVPX form factor available for less rugged environments.

Targeted primarily for harsh-environment embedded applications, VPX-REDI offers extended mechanical configurations supporting higher functional density, such as Two-Level Maintenance (2LM). 2LM allows relatively unskilled maintenance personnel to replace a failed module and restore the system to an operational state in a limited time period.

Rugged Air Flow-By

Air- and conduction-cooled subsystems rely on filtration to remove contaminants from their cooling air streams. Mercury's Air Flow-By technology eliminates filtration with the most elegant cooling solution available within a sealed and rugged package. Fully compliant to VITA standards (including VITA 48.5), Air Flow-By maintains OpenVPX's 1-inch pitch requirement, is highly resilient to liquid and particle contamination, boosts SWaP, reduces operating temperature, extends MTBF by an order of magnitude and enables embedded deployment of the most powerful and reliable processing solutions. Ensemble SFM6102 modules are available as air-cooled (various levels of ruggedness), and rugged Air Flow-By and conduction-cooled variants.

Specifications

OpenVPX Slot Profiles

Default: SLT6-SWH-16U-20F-10.4.1
Soft jumper exists to allow support for SLT6-SWH-20U-19F-10.4.2

OpenVPX Module Profiles

When configured for slot profile SLT6-SWH-16U-20F-10.4.2, the Ensemble SFM6102   supports module profiles MOD6-SWH-16U-20F-12.4.2-4 or -5.
When configured for slot profile SLT6-SWH-20U-19F-10.4.1, the SFM6101 supports module profiles MOD6-SWH-20U-19F-12.4.1-4 or -5.

Module

Supports up to 18 OpenVPX payload modules
Data plane (per VITA 65)
  18 10 Gigabit Ethernet (10GBASE-BX4 or 10GBASE-KX4) to payload slots
  1 or 2 inter-switch serial 10 Gigabit Ethernet interfaces
Control plane
  16 Gigabit Ethernet links to control plane (improved to
  20 links via soft jumper; sacrifices 1 data plane interface)
Management plane
  I^2C bus between all switch and payload slots
Front-panel I/O via two 10 Gigabit Ethernet and two Gigabit Ethernet ports
  Single Gigabit Ethernet port only routed to backplane on conduction-cooled and Air Flow-By assemblies
Dual-sided PCB assembly
Designed for installation in VITA 46 and VITA 65 OpenVPX compliant chassis

Environmental

See Environmental Protections for Operation at the Tactical Edge for specific ruggedness levels and cooling options.

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