



## Applications

- Direct Attached SAS/SATA/PCIe ROC solutions for server and storage applications
- SAS RAID host bus adapter
- Cost effective, single chip solution for entry-level RAID storage systems supporting up to 16 direct attach drives
- Storage Processor option for external storage applications
- Utilize PCIe attached SSDs with confidence of industry leading device management and error recovery

## Key Features

- High performance IOP
- Dual Core ARM A15
  - 32 KB L1 I/D Caches
  - 1 MB shared L2 Cache
  - 6 MB On Chip Memory Exclusive-OR hardware engine for RAID 5
- RAID 6 hardware acceleration

# SAS3516 Tri-Mode ROC

## PCIe to 16-port SAS/SATA/PCIe ROC featuring Tri-Mode SerDes Technology

### Broadcom Introduces High-Performance, 16-port Tri-Mode SAS/SATA/ PCIe RAID-on-Chip (ROCs); Ideal for Entry and Mid-Range Servers

Broadcom storage offers the industry's broadest portfolio of storage solutions, backed by decades of experience and trusted by the world's leading server and storage suppliers. Broadcom provides the building blocks for storage solutions that help customers understand, prioritize, store and protect critical data.

The 12 Gb/s SAS portfolio includes MegaRAID® controller cards, host bus adapters (HBAs), advanced software options and SAS storage ICs, including RAID-on-Chip (ROCs), I/O controllers and expanders.

## Overview

The SAS3516 is the fifth generation of Serial Attached SCSI (SAS) RAID-on-Chip (ROCs) based on the industry-leading Fusion-MPT (Message Passing Technology) architecture. This next-generation ROC, which delivers enhanced performance and power reductions over previous generations, features Tri-Mode SerDes Technology that enables a seamless operation of PCIe, SAS or SATA storage devices from any system design.

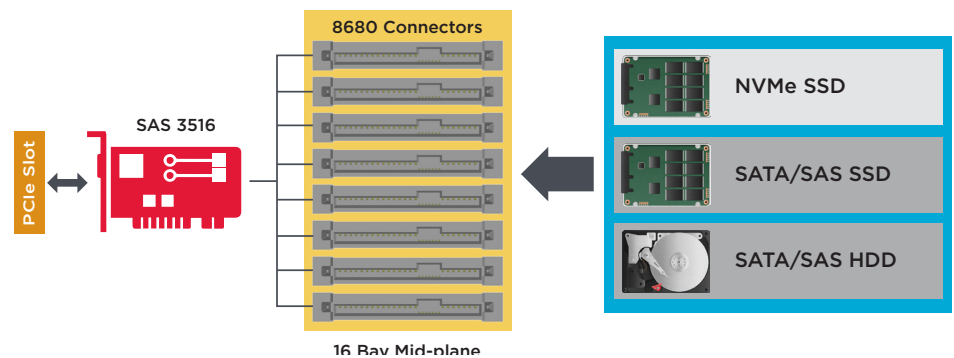
The SAS3516 host interface supports 8 PCI Express (PCIe) lanes and complies with the PCIe 3.1 specification that extends the PCIe data rates up to 8.0 GT/s per lane, and is backward compatible to 5.0/2.5 GT/s. It also incorporates End-to-End CRC (ECRC) with Advanced Error Reporting (AER) in lane and polarity reversal, power management, hot plug support, and MSI/ MSI-X and legacy interrupt generation.

The introduction of PCIe devices executing NVMe command sets to the existing SAS/SATA infrastructure makes industry standard hot-pluggable drive bays even more versatile. The 16-port Tri-Mode ROC device interface provides SAS data transfer rates of 12, 6, and 3 Gb/s per lane, or SATA at 6 and 3 Gb/s data transfer rates per lane, or PCIe data transfer rates of 8, 5, and 2.5 Gb/s. The device automatically negotiates between the speeds and protocols. T-10 Data Protection Model (T-10 End to End Data Protection (EEDP) for early detection of and recovery from data corruption, and Spread Spectrum Clocking (SSC) for EMI reduction are supported. Additional features include SAS 2.1 power management and DataBolt Technology allowing users to take advantage of 12 Gb/s speeds while utilizing existing 6 Gb/s drives and backplanes.

## Key Features (con't)

- RAID Features
  - MegaRAID support with activation key
  - RAID levels 0, 1, 5, 6, 10, 50 and 60
- DRAM back-up at power fail using ONFI (Open NAND Flash Interface)
  - Supports bad block management
- Tri-Mode (SAS/SATA/PCIe) device ports
  - 16 port SAS+SATA controller
  - Supports 12, 6, and 3 Gb/s SAS and 6, 3 SATA data transfer rates
  - Spread spectrum clocking
  - Supports SSP, SMP, STP and SATA protocols
  - SAS/SATA device support
  - Supports narrow and wide ports
    - T-10 End to End Data Protection (EEDP)
    - T-10 Optical Support
    - SAS 2.1 power management
    - Supports up to 2,000 SAS/SATA devices
    - Supports DataBolt bandwidth aggregation Technology
    - Up to 8 PCIe links. Each link supporting x4, x2, x1 link widths, supporting 8.0 GT/s (PCIe Gen3) per lane
  - Separate Refclk Independent SSC (SRIS)
    - PCIe application layer supports NVMe
    - Up to 16 PCIe devices behind a switch supported

## SFF-8680 “Tri-Mode Universal Bay” Topology



The SAS3516 ROC integrates a 72-bit, DDR4-2133 DRAM interface and supports hardware acceleration engines for RAID 5 and RAID 6 parity calculations. The ROC supports two high performance dual-core ARM A15 processors that achieves 4200 Dhrystone MIPS (DMIPS) resulting in a cost-effective ROC ideal for entry and mid-range servers. Broadcom offers a full featured RAID implementation. MegaRAID hardware RAID (0, 1, 5, 6, 10, 50, 60) is ideal for high performance and high availability applications. The ROC can support up to 2,000 SAS or SATA devices and 10,000 outstanding IOs and can achieve over 1 million IOs per second. It supports up to 4 direct attached PCIe devices and complies with PCIe 3.1 specifications, PCIe Dynamic Power allocation (DPA), ECRC, and AER with compatible devices. The ROC also supports NVMe over PCIe to attached PCIe devices.

Broadcom provides a complete suite of industry standard operating system drivers and also supports Virtual Operating Systems with device emulation and para-virtualization.

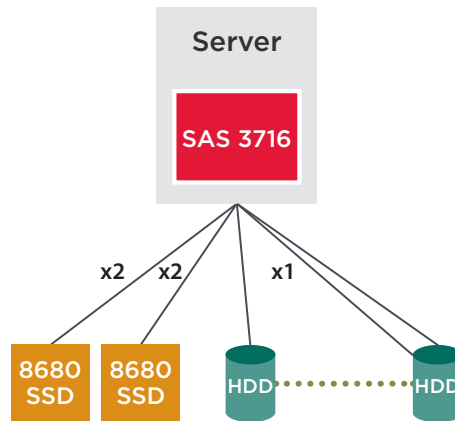
## Key Features (con't)

- PCIe 3.1 Host Interface
  - Supports x8, x4, x2, x1 PCIe lanes at a transfer rate up to 8.0 GT/s per lane, full duplex
  - Lane and polarity reversal
  - Supports End-to-End CRC (ECRC) and Advanced Error Reporting (AER)
  - PCIe hot plug support
  - Variable PCIe bandwidth negotiation
- Advanced Power Management support
  - Slumber and Partial power mode support for SAS and SATA devices
  - Programmable SAS link power down
  - Variable PCIe bandwidth negotiation
- External memory interface support
  - SPI based Flash ROM
- Communication Interfaces
  - I<sup>2</sup>C interfaces for enclosure management services
  - UART and Ethernet interface for debug
- SFF-8485 Compliant, SGPIO
- JTAG support
- Package (estimated) 27 mm

## Fusion-MPT Architecture Overview

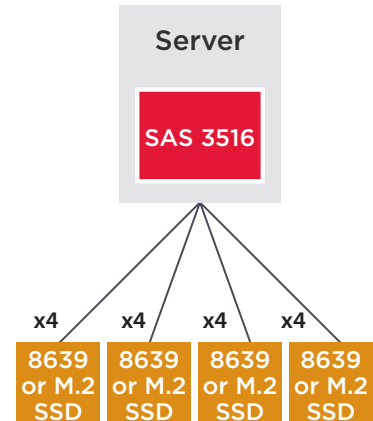
Fusion-MPT architecture marks the next generation of I/O architecture designed to deliver the highest performance available today while reducing time to market, integration, and certification time. Fusion-MPT devices are high performance, cost-effective protocol controllers that represent the newest system-level integration technology in intelligent I/O processors from Broadcom.

**Figure 1: Direct Attach with PCIe, SAS, and SATA RAID volumes behind a single controller in servers with multiple drive bays**



Mix PCIe / SAS / SATA HDD or SSD in any combination utilizing 16 phys

**Figure 2: Direct Attach with PCIe SSDs for application acceleration in servers**



Mix PCIe / SAS / SATA HDD or SSD in any combination utilizing 16 phys

**Figure 3: SAS 3516 Block Diagram**

