MICROCHIP®

Adaptec® Storage Board Solutions

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Smart Storage Performance, Power, Security and Reliability

With the massive growth of data centers, performance, power and reliability are more important considerations than ever.

Performance requirements are driven by both the increased adoption of flash-based SSDs and the increasing sizes of HDD arrays. Data centers are looking to take advantage of the performance that these flash-based drives promise, and require storage solutions that can deliver manageability and data availability without compromising performance.

Power is a significant component of a data center's operating expenses. Optimizing power for cold storage tiers in the data center, for example, delivers substantial benefits to the bottom line.

Data security has become one of the highest priorities for data centers and cloud computing environments as enterprises seek to safeguard customer information, classified company documentation and communications, financial records, employee payroll records, and other confidential data.

As more mission-critical data finds its way to data centers, end customers insist on reduced downtime, improved response times to issues, and a more positive end-user experience overall.

The Adaptec SmartRAID 3100, SmartHBA 2100 and HBA 1100 product families are based on the latest 28 nm SmartIOC 2100 and SmartROC 3100 storage controller integrated circuits (ICs). The SmartRAID 3162-8i /e adapter includes maxCrypto™, the industry's only data-at-rest controller-based encryption solution that, provides a superior solution over self-encrypting drives. Microchip's unified Smart Storage stack powers the entire family of products, leveraging core IP that has shipped in over 30 million servers. Microchip's Smart Storage stack delivers one of the industry's most reliable and highest-performing storage controller software platforms.

Microchip's Smart Storage adapters satisfy the most important needs of the modern data center: power, performance, security and reliability.

Technology Leadership with Data Encryption

Data security has become one of the highest priorities for data centers and cloud computing environments as they seek to safeguard customer information, classified company documentation and communications, financial records, employee payroll records, and other confidential data. Solutions for data-at-rest encryption are now a security requirement in many market segments such as health care, finance, e-commerce, federal government branches, and insurance—representing a significant overall percentage of the deployed storage. In fact, government legislation is now in place mandating data security and privacy, such as the Health Insurance Portability and Accountability Act, Gramm–Leach–Bliley Act, Sarbanes–Oxley Act, and the European Union General Data Protection Regulation.

Data center managers face the challenge of safeguarding data while still meeting continually-increasing performance demands for large-scale applications such as web serving, file serving, databases, online transaction processing (OLTP), machine learning, and high-performance computing (HPC).

Encryption is a method of encoding information so that it can only be read by using the proper key. The encryption process can be software-based or hardware-based. While the CPU is responsible for powering software-based encryption,
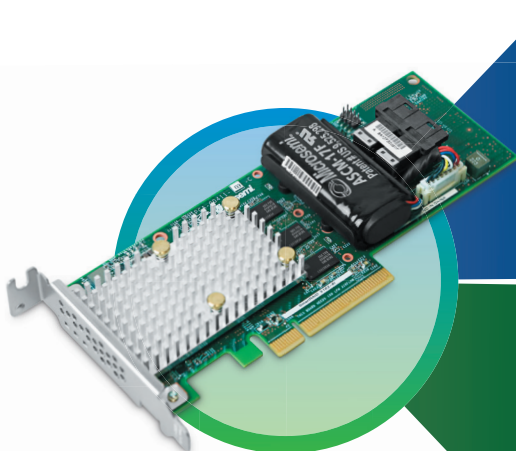
hardware-based encryption is performed within a chip located on the drive itself or on the storage adapter.

Software encryption comes at the expense of valuable CPU resources. Self-encrypting drives offer a high performance hardware-based solution but require significant operational overhead and do not provide the security and flexibility of controller-based encryption.

Available on the SmartRAID 3162-8i /e version of the Smart Storage series of storage adapters, maxCrypto hardware encryption delivers data protection with little to no impact on latency or I/O performance. Leveraging the SmartROC 3100 RAID-on-Chip (RoC) controller, the Smart Storage maxCrypto solution integrates seamlessly into existing storage infrastructures allows data centers to deploy a uniform, scalable encryption strategy across the enterprise.

Controller-Based Encryption
Value Proposition versus Self-Encrypting Drives (SED)

maxCrypto

Controller-Based Encryption Delivers Superior Security & Flexibility

Superior Security vs. SED

- ✓ Prevents data snooping between controller and drives
- ✓ Re-key support for wrapping keys or data volume keys
- ✓ Encrypted controller cache

Superior Flexibility vs. SED

- ✓ Allows in-place encryption of existing data (volume remains available)
- ✓ No separate "special" (SED) drives for end-customers to manage
- ✓ 64 Logical Drive support for flexible mapping to OS Users and Applications

Each Product Family Has Unique, Differentiating Features

SmartRAID 3100

The SmartRAID 3100 is optimized for enterprise storage applications that require the highest level of data availability and data center applications that benefit from caching.

- Adapters with up to 24 ports using 28 nm SAS/SATA-optimized silicon, offering the industry's lowest power
- Zero Maintenance Cache protection (ZMCP) with a cache size up to 4 GB with integrated cache backup circuitry for optimal cost, thermal performance, and operating efficiency
- Board options without cache backup
- Mixed mode enables drives to be independently configured as raw drives or as part of a logical volume
- maxCache 4.0 included on 315x and 316x adapters
- maxCrypto controller-based encryption on the 3162-8i /e adapter

SmartHBA 2100

The SmartHBA 2100 is optimized for software-defined storage (SDS) applications that require hardware RAID for OS boot drives as well as entry-level RAID for SMBs.

- The only basic hardware RAID solution offering a fully featured, high-performance host bus adapter (HBA) for drives configured as raw drives, required for multi-path IO and SDS applications
- RAID levels 0, 1, 10, 5
- Industry's only basic hardware RAID solution with more than 8 ports
- Mixed mode enables drives to be independently configured as raw drives or as part of a logical volume
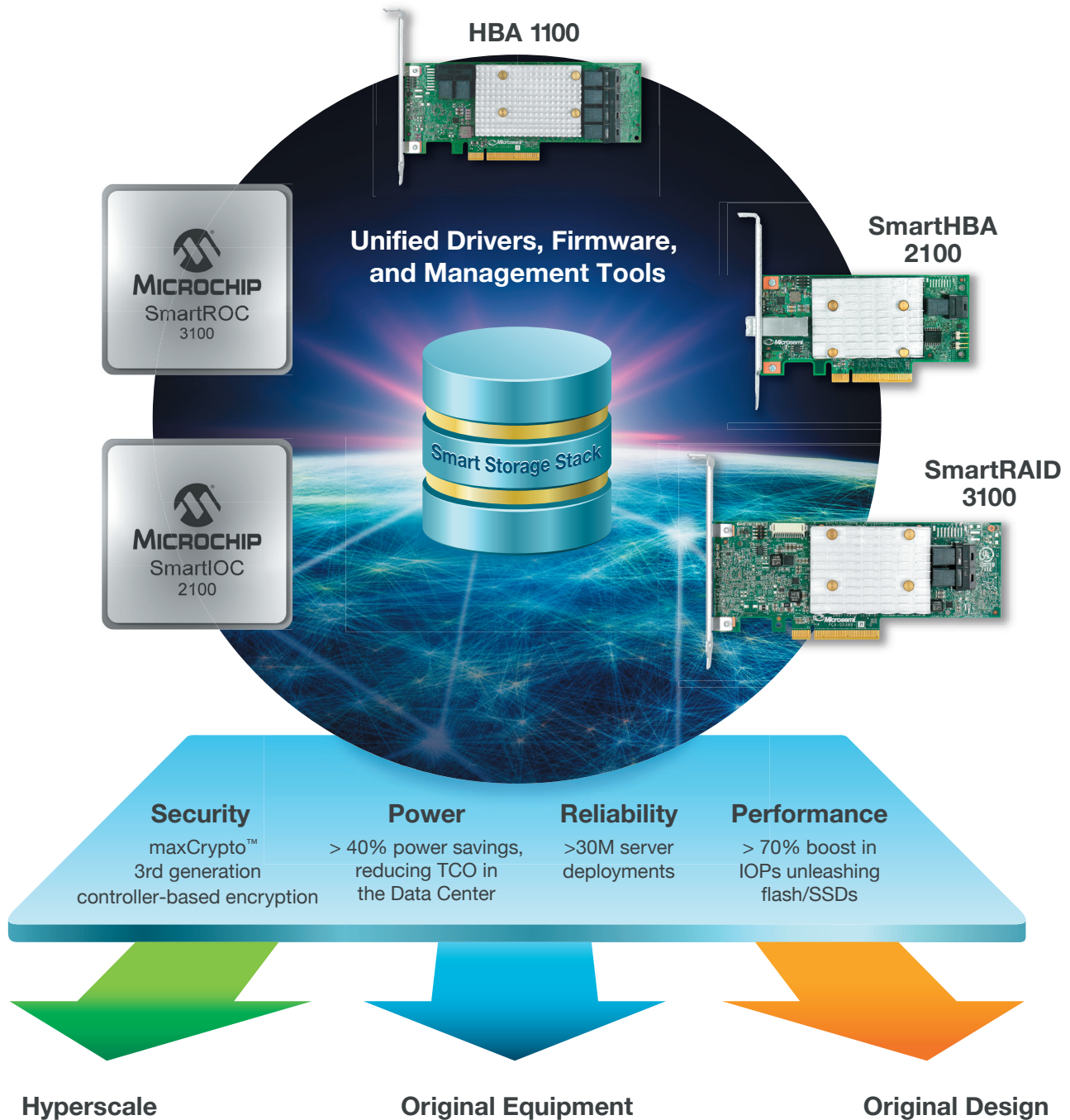

HBA 1100

The HBA 1100 is optimized for SDS, cold storage, and raw high-performance connectivity.

- Adapters with up to 24 ports using 28 nm SAS/SATA-optimized silicon, offering the industry's lowest power
- Support for host-managed and host-aware shingled magnetic recording (SMR) drives
- Broad OS driver support, including inbox driver support
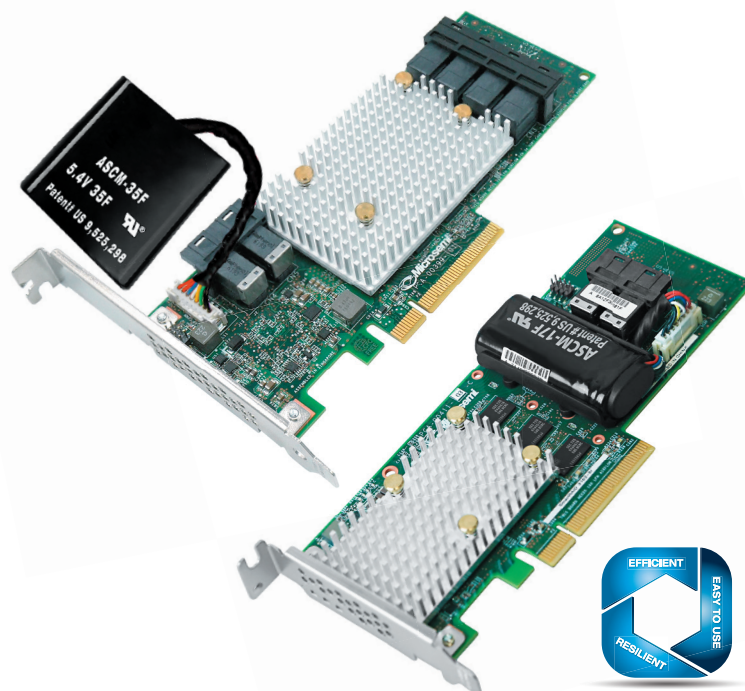- Performance of up to 1.7M IOPS

SMART STORAGE PLATFORM
BRILLIANT CONNECTIVITY

HBA 1100

MICROCHIP
SmartROC
3100

**SmartHBA
2100**

**Unified Drivers, Firmware,
and Management Tools**

Smart Storage Stack

MICROCHIP
SmartIOC
2100

**SmartRAID
3100**

Security	Power	Reliability	Performance
maxCrypto™ 3rd generation controller-based encryption	> 40% power savings, reducing TCO in the Data Center	>30M server deployments	> 70% boost in IOPs unleashing flash/SSDs

Hyperscale   **Original Equipment**   **Original Design**

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SmartRAID 3100 RAID Adapters

The 12 Gbps SmartRAID 3100 adapters, coupled with 12 Gbps SSDs, provide maximum read/write bandwidth and IOPS for the most performance-hungry transactional and database applications. The onboard DRAM-based read and write cache accelerates RAID and spinning media. Furthermore, the SmartRAID 3100, built upon the unified Smart Storage stack, unlocks all features and performance of the HBA 1100 when the drives are configured as raw devices.

The newest addition to the family, the SmartRAID 3162-8i /e, provides the industry's only data-at-rest controller-based encryption solution. maxCrypto encrypts data on RAID arrays and single drive RAID 0 with AES 256 encryption. It works at line speed, accelerated by silicon engines, with all SAS and SATA devices that are supported in RAID (SSDs and HDDs). It supports local encryption key management, and provides a superior solution over self-encrypting drives.

SmartRAID 3100 Specifications

All products listed in the following table contain an 8-lane PCIe Gen3 host bus interface, a SmartROC 3100 processor, an MD2 low-profile form factor, dimensions of 2.535" H × 6.6" L (64 mm × 167 mm), and can be scaled to a maximum of 256 SAS/SATA devices*. OS support for Microsoft Windows®, Red Hat Linux, SUSE Linux, Fedora, Debian Linux, Ubuntu Linux, Sun Solaris, FreeBSD, VMware ESXi, open-source Linux drivers and inbox drivers. The latest drivers are available at storage.microsemi.com/en-us/support/start.

Product	Ordering Part Number	RAID Levels	SAS/SATA Ports	Connectors	Cache	SSD Cache	Cache Protection
SmartRAID 3162-8i	2299800-R		8 internal	2 (×4) SFF-8643	2 GB DDR4/ 2100 MHz	maxCache™ 4.0	Embedded Flash backup On board ASCM-17F supercap
SmartRAID 3162-8i /e	2299600-R		8 internal	2 (×4) SFF-8643	2 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup On board ASCM-17F supercap
SmartRAID 3154-24i	2294700-R		24 internal	6 (×4) SFF-8643	4 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3154-8i16e	2294600-R		8 internal/ 16 external	2 (×4) SFF-8643 4 (×4) SFF-8644	4 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3154-16i	2295000-R	Hardware RAID 0, 1, 5, 6, 10, 50, 60, 1 ADM and 10 ADM	16 internal	4 (×4) SFF-8643	4 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3154-8i8e	2295100-R		8 internal/ 8 external	2 (×4) SFF-8643 2 (×4) SFF-8644	4 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3154-8e	2290800-R		8 external	2 (×4) SFF-8644	4 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3154-8i	2291000-R		8 internal	2 (×4) SFF-8643	4 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3152-8i	2290200-R		8 internal	2 (×4) SFF-8643	2 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3102-8i	2294800-R		8 internal	2 (×4) SFF-8643	2 GB DDR4/ 2100 MHz	NA	NA
SmartRAID 3151-4i	2294900-R		4 internal	1 (×4) SFF-8643	1 GB DDR4/ 2100 MHz	maxCache 4.0	Embedded Flash backup Tethered ASCM-35F supercap
SmartRAID 3101-4i	2291700-R		4 internal	1 (×4) SFF-8643	1 GB DDR4/ 2100 MHz	NA	NA

*238 SSD/HDD maximum. Remaining device count is reserved for expanders and enclosure management.

For more information, visit www.microsemi.com/product-directory/smart-storage-platform/4323-12g-smartraid-3100-series-adapters

SmartHBA 2100 Host Bus Adapters

The SmartHBA 2100 series is part of the Smart Storage Solutions family, forged through the convergence of Microchip SAS/SATA protocol controller expertise, more than 30 years of board innovation, and the new Smart Storage stack.

The SmartHBA 2100 series uniquely combines the capabilities of a full-featured HBA, like the HBA 1100, with those of a basic hardware RAID adapter. With an optimal mix of resiliency, efficiency, and ease-of-use, it adds the robustness of true host-offloading hardware RAID, offers open-source driver compatibility, and comes with a full set of storage management tools.

Resiliency, Efficiency and Data Availability

The SmartHBA 2100 is an ideal solution for server-based storage systems that require maximum bandwidth and I/O connectivity, low power consumption, high reliability, plus options for data availability. The Smart Software stack even allows a combination of RAID and raw devices. This is useful in SDS environments where hardware RAID significantly increases OS boot reliability, but full HBA features and performance are otherwise needed.

The SmartHBA 2100 offers over 40 percent power savings compared to prior generations and significant power advantages over competing solutions, giving it the lowest total cost of ownership (TCO) for an HBA/basic RAID solution. It delivers a robust and scalable solution that can handle the toughest system workloads and configurations, from an array of high-performance SSDs to high-capacity HDDs. The SmartHBA 2100 can be used with or without SAS expanders.

Maximum Performance

The SmartHBA 2100 series provides the highest levels of storage performance and scalability for next-generation data centers. The SmartHBA 2100 provides connectivity to large numbers of storage devices, including HDDs, SSDs and SMR drives. These adapters can aggregate the performance of devices to the limits of the PCIe Gen3 host bus at 6.6 Gbps, and achieve up to 1.7M IOPS and 60 percent higher IOPS performance with SATA devices without additional overhead or latency.

SmartHBA 2100 Specifications

All products listed in the following table contain an 8-lane PCIe Gen3 host bus interface, a SmartIOC 2100 processor, an MD2 low-profile form factor and can be scaled to a maximum of 256 SAS/SATA devices*. OS support for Microsoft Windows, Red Hat, SuSE, CentOS, Ubuntu, VMware ESXi, FreeBSD, Solaris, Citrix Xen Server, and open-source Linux drivers. The latest drivers and OS support are available at storage.microsemi.com/en-us/support/start.

Product	Ordering Part Number	Dimensions	SAS/SATA Ports	Connectors	RAID Levels	Caching
SmartHBA 2100-24i	2301600-R	2.535" H × 6.6" L (64 mm × 167 mm)	24 internal	6 (×4) SFF-8643	Hardware RAID 0, 1, 10, 5	NA
SmartHBA 2100-16i	2302100-R	2.535" H × 6.6" L (64 mm × 167 mm)	16 internal	4 (×4) SFF-8643		
SmartHBA 2100-8i8e	2301900-R	2.535" H × 6.6" L (64 mm × 167 mm)	8 internal/ 8 external	2 (×4) SFF-8643/ 2 (×4) SFF-8644		
SmartHBA 2100-8i	2290400-R	2.535" H × 6.6" L (64 mm × 167 mm)	8 internal	2 (×4) SFF-8643		
SmartHBA 2100 4i4e	2292200-R	2.535" H × 5.2" L (64 mm × 132.08 mm)	4 internal/ 4 external	1 (×4) SFF-8643/ 1 (×4) SFF-8644		

*238 SSD/HDD maximum. Remaining device count is reserved for expanders and enclosure management.

For more information, visit www.microsemi.com/product-directory/smart-storage-platform/4324-12g-smarthba-2100-series-adapters

HBA 1100 Host Bus Adapters

The HBA 1100 is part of the Smart Storage Solutions family, forged through the convergence of Microchip's SAS/SATA protocol controller expertise, more than 30 years of board innovation, and acquired smart IP technology.
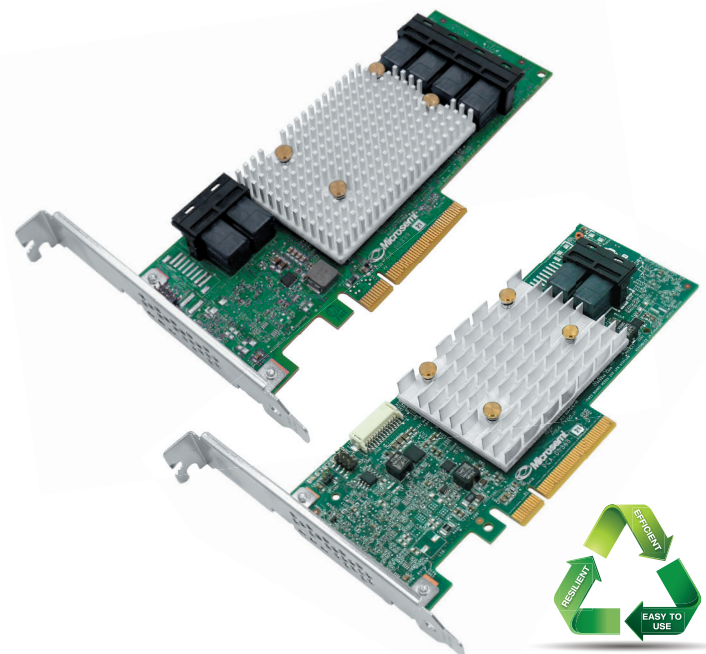
Optimized for New Devices and New Use Cases

The HBA 1100 supports SMR HDDs and their specific command sets (ZAC/ZBC for SAS/SATA SMR drives), enabling cost-efficient solutions for warm and cold storage applications. It also supports the latest SAS and SATA SSDs. The HBA 1100 is also optimized for software-defined storage solutions, such as Microsoft Storage Spaces Direct, VMWare vSAN and OpenStack Swift/Ceph.

Maximum Performance

The HBA 1100 series provides the highest levels of storage performance and scalability for next-generation data centers. Using the new SmartPQI host OS device drivers that are optimized for low latency solid-state drives, HBA 1100 adapters can aggregate the performance of devices to the limits of the PCIe Gen3 host bus at 6.6 Gbps, and achieve up to 1.7M

IOPS and 60 percent higher IOPS perfoTrmance with SATA devices without additional overhead or latency.

The HBA 1100-24i, with 24 internal ports, delivers the lowest latency and highest performance when connected to SSDs, with no need for expanders in most rack server applications.

HBA 1100 Specifications

All products listed in the following table contain an 8-lane PCIe Gen3 bus interface, a SmartIOC 2100 processor, an MD2 low-profile form factor, and can be scaled to a maximum of 256 SAS/SATA devices*. OS support for Microsoft Windows, Red Hat, SuSE, CentOS, Ubuntu, and VMware ESXi, FreeBSD, Solaris, and Citrix XEN Server. The latest drivers are available at storage.microsemi.com/en-us/support/start.

Product	Ordering Part Number	Dimensions	SAS/SATA Ports	Connectors
HBA 1100-24i	2293800-R	2.535" H × 6.6" L (64 mm × 167 mm)	24 internal	6 (×4) SFF-8643
HBA 1100-16i	2293500-R	2.535" H × 6.6" L (64 mm × 167 mm)	16 internal	4 (×4) SFF-8643
HBA 1100-16e	2293600-R	2.535" H × 6.6" L (64 mm × 167 mm	16 external	4 (×4) SFF-8644
HBA 1100- 8i8e	2293700-R	2.535" H × 6.6" L (64 mm × 167 mm)	8 internal/ 8 external	2 (×4) SFF-8643/ 2 (×4) SFF-8644
HBA 1100-8i	2293200-R	2.535" H × 6.6" L (64 mm × 167 mm)	8 internal	2 (×4) SFF-8643
HBA 1100-8e	2293300-R	2.535" H × 6.6" L (64 mm × 167 mm)	8 external	2 (×4) SFF-8644
HBA 1100-4i	2293400-R	2.535" H × 5.2" L (64 mm × 132.08 mm)	4 internal	1 (×4) SFF-8643

*238 SSD/HDD maximum. Remaining device count is reserved for expanders and enclosure management.

For more information, visit www.microsemi.com/product-directory/host-bus-adapters/4054-hba-1100

Adaptec 12 Gbps RAID Adapters

The 12 Gbps PCIe Gen3 Series 8 family of SAS/SATA RAID adapters meet storage needs, from entry-level to the most performance-hungry transactional database applications. Storage innovations available within the Series 8 family include performance-accelerating maxCache SSD solutions for Series 8Q; cache-protecting zero maintenance cache protection for Series 8Q and Series 8; hybrid RAID solutions for managing both HDDs and SSDs; and the maxView storage manager, which makes it simple to monitor and configure all Series 8 adapters.

Series 8 family products are available for shipment, although SmartRAID 3100 or SmartHBA 2100 are recommended for new designs.

Series 8 Specifications

All products listed in the following table contain an 8-lane PCIe Gen3 host bus interface, a 12 Gbps RoC processor, an MD2 low-profile form factor, dimensions of 2.535" H × 6.6" L (64 mm × 167 mm), and can be scaled to a maximum of 256 SAS/SATA devices*. OS support for Microsoft Windows, Red Hat Linux, SUSE Linux, Fedora, Debian Linux, Ubuntu Linux, Sun Solaris, FreeBSD, and VMware ESXi. The latest drivers are available at storage.microsemi.com/en-us/support/start.

Product	Ordering Part Number	RAID Levels	SAS/SATA Ports	Connectors	Cache	SSD Cache	Cache Protection
RAID 81605ZQ	2281600-R	Hardware RAID 0, 1, 1E, 5, 6, 10, 50, 60 Hybrid RAID 1, 10	16 internal	4 internal SFF-8643	1024 MB	maxCache™ 3.0	Flash backup embedded AFM-700 Supercap (included)
RAID 8885Q	2277100-R		8 internal 8 external	2 internal SFF-8643/ 2 external SFF-8644	1024 MB	maxCache 3.0	AFM-700 (included)
RAID 81605Z	2287101-R		16 internal	4 internal SFF-8643	1024 MB	NA	Flash backup embedded AFM-700 Supercap (included)
RAID 8885	2277000-R		8 internal 8 external	2 internal SFF-8643/ 2 external SFF-8644	1024 MB	NA	AFM-700 (optional) 2275400-R
RAID 8805	2277500-R		8 internal	2 internal SFF-8643	1024 MB	NA	AFM-700 (optional) 2275400-R
RAID 8405	2277600-R		4 internal	1 internal SFF-8643	1024 MB	NA	AFM-700 (optional) 2275400-R
RAID 8805E	2294001-R	Hardware RAID 0, 1, 10 Hybrid RAID 1, 10	8 internal	2 internal SFF-8643	512 MB	NA	NA
RAID 8405E	2293901-R		4 internal	1 internal SFF-8643	512 MB	NA	NA

*238 SSD/HDD maximum. Remaining device count is reserved for expanders and enclosure management.

For more information, visit www.microsemi.com/product-directory/raid-adapters/4022-series8

Adaptec SAS Expander Card

The 12 Gbps 82885T SAS expander card offers a scalable connectivity/fanout option for additional drives when used in conjunction with a SAS RAID adapter or SAS HBA. The 82885T SAS expander card offers 36 ports in a low-profile MD2 form factor. Of the 28 internal ports, four ports are dedicated for a controller, and the rest are available for connection to SAS or SATA drives. The eight external ports are available for optional connections to external JBODs or a SAS adapter.

Configuration Flexibility

The 82885T mounts internally to any available PCIe slot, away from the backplane, and features mini-SAS HD connectors out the top for cabling flexibility in dense server environments. The 82885T enables a low-cost drive expansion solution when mated with a RAID adapter or HBA. The expander draws power from the PCIe slot (requires 4 or more lanes), but there is no data transfer to the slot. Alternatively, power can also be supplied to the expander card through a standard 4-pin auxiliary power connector.

Enclosure Management Support

The 82885T supports SGPIO and SES2 enclosure management, allowing enclosure information to be routed from all daisy-chained 82885T cards to the HBA or RAID adapter. All device and slot mapping information is provided to the HBA or RAID adapter by the last 82885T card in the chain.

Universal Compatibility with Existing Storage Infrastructure

The 82885T is fully compatible with Adaptec 12 Gbps and 6 Gbps RAID adapters and HBAs, allowing seamless integration and management within an end-to-end Adaptec solution. The 82885T is also compatible with third-party adapters and HBAs, and has also been tested for interoperability with a wide variety of SAS and SATA HDDs and SSDs.

Adaptec SAS Expander Card Specifications

Product	Ordering Part Number	Ports	Connector	Form Factor	Dimensions	PCIe Slot Power	Auxiliary Power Connector
82885T	2283400-R	28 internal/ 8 external	7 × SFF-8643, 2 × SFF-8644	MD2–low profile	2.535" H × 6.6" L (64 mm × 167 mm)	Through PCIe ×4 interface	Yes

For more information, visit www.microsemi.com/product-directory/storage/3707-sas-expander-cards

Adaptec 12 Gbps and 6 Gbps SAS HD Cables

Adaptec SmartRAID 3100, SmartHBA 2100, HBA 1100, HBA 1000 and Series 8/8Q/8E RAID adapters are configured with mini-SAS HD connectors to allow for maximum performance and connectivity in a MD2 low-profile form factor. Pick the right cable for your internal or external storage solution.

Internal Cables

		Connector to Adapter	12 Gbps Internal	6 Gbps Internal			
Connector to End Device			SFF-8643	SFF-8087	SFF-8482	SATA	SATA right angle
Internal	**Supported Products** SmartRAID 3162 -8i SmartRAID 3162-8i /e SmartRAID 3154-8i16e/8i8e SmartRAID 3154-24i/16i/8i SmartRAID 3152-8i SmartRAID 3102-8i SmartRAID 3151-4i SmartRAID 3101-4i SmartHBA 2100-8i8e/4i4e SmartHBA 2100-24i/8i HBA 1100-24i/16i/8i/4i ASR-81605ZQ ASR-8405 ASR-8405E ASR-8805E ASR-8885Q ASR-8885 ASR-8805	SFF-8643 right angle	ACK-I-rA-HDmSAS-HDmSAS Part # 1 meter: 2282800-R Part # .5 meter: 2282500-R	ACK-I-rA-HDmSAS-mSAS Part # .8 meter: 2280200-R Part # .5 meter: 2281300-R	ACK-I-rA-HDmSAS-4SAS-SB Part # .8 meter: 2279600-R	ACK-I-rA-HDmSAS-4SATA-SB Part # .8 meter: 2280000-R	ACK-I-rA-HDmSAS-4rASATA-SB Part # .8 meter: 2279900-R
		SFF-8643	ACK-I-HDmSAS-HDmSAS Part # 1 meter: 2282100-R Part # .5 meter: 2282200-R	ACK-I-HDmSAS-mSAS Part # 1 meter: 2279700-R Part # .5 meter: 2281200-R	ACK-I-HDmSAS-4SAS-SB Part # .8 meter: 2280100-R	ACK-I-HDmSAS-4SATA-SB Part # .8 meter: 2279800-R	

External Cables

		Connector to Adapter	12 Gbps External	6 Gbps External			12 Gbps External	6 Gbps External
External	**Supported Products** SmartRAID 3154-8i16e/8i8e/8e SmartHBA 2100-8i8e/4i4e HBA 1100-8e ASR 8885/8885Q	SFF-8644	ACK-E-HDmSAS-HDmSAS Part # 2 meters: 2282600-R	ACK-E-HDmSAS-mSAS Part # 2 meters: 2280300-R		Connector to End Device	SFF-8644 External	SFF-8088 External

For more information, visit www.microsemi.com/product-directory/storage-boards/3686-cables-accessories

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If additional training interests you, Microchip offers several resources including in-depth technical training and reference material, self-paced tutorials and significant online resources.

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- Developer Help Website: www.microchip.com/developerhelp
- Technical Training Centers: www.microchip.com/seminars

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