ThinkSystem RAID 9450 Series 24Gb Advanced RAID Adapters
Product Guide

The ThinkSystem RAID 9450 family of internal 24 Gbps SAS RAID controllers are high-performance RAID-on-chip (ROC) adapters. These adapters support SAS, SATA or NVMe drives, and support all major RAID levels including RAID-6 and RAID-60.

The family offers three port-counts:

- The ThinkSystem RAID 9450-8i supports up to eight internal drives
- The ThinkSystem RAID 9450-16i supports up to 16 internal drives
- The ThinkSystem RAID 9450-32i supports up to 32 internal drives

The ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter is shown in the following figure.

Figure 1. ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter

Did you know?

RAID on Chip-based controllers such as the RAID 9450 adapters have a dedicated processor that offloads all RAID functions from the server's CPU. With hardware acceleration for RAID 5 and 6 operations plus dedicated memory for caching, the 9450 series adapters are a high-performance RAID controller for ThinkSystem servers.

Part number information

The following table provides the ordering part numbers for the adapters.

Table 1. Part numbers and feature codes

Part number	Feature code	Description	Adaptec model
4Y37A97935	C6UH	ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter	SmartRAID 3254-8i
4Y37A97937	C6UK	ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter	SmartRAID 3258-16i
4Y37A97940	C6UN	ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter	SmartRAID Ultra 3258p-32i

The part numbers for the PCIe adapters include:

- RAID adapter with 3U full-height bracket attached
- 2U low-profile bracket (8i and 16i adapters only)
- Supercap power module

The following figure shows the ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter.
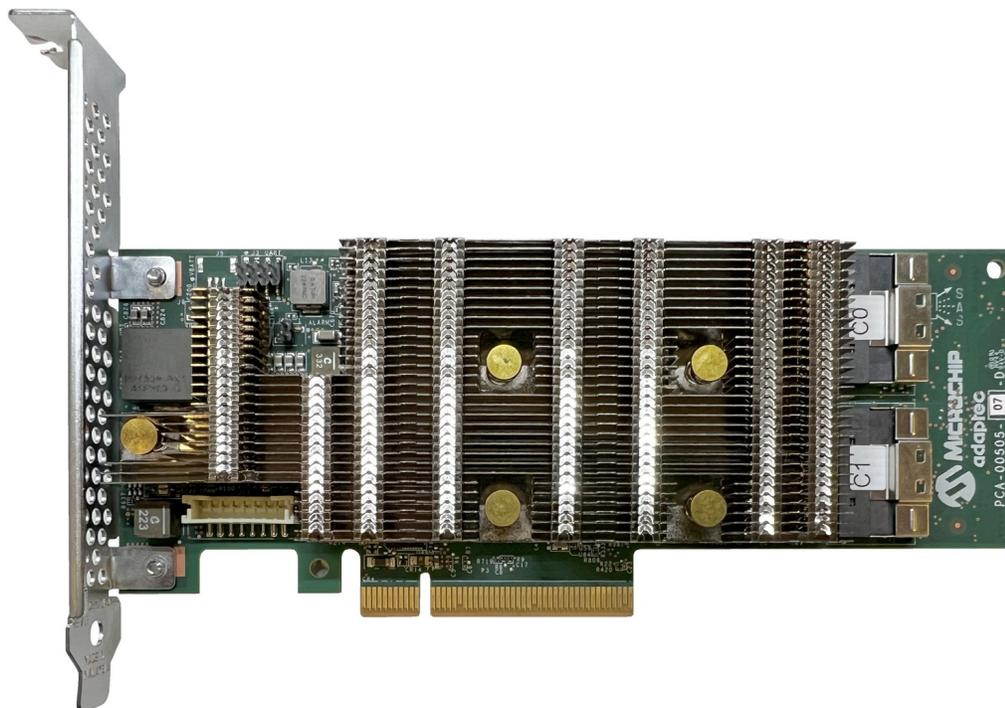
Figure 2. ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter

Technical specifications

The ThinkSystem RAID 9450 Series internal RAID adapters have the following specifications:

- 24 Gbps SAS/SATA RAID controllers, based on the Adaptec SmartRAID 3250 family of adapters
- Supports Tri-mode connectivity to drives: SAS, SATA or NVMe drive support
  - 9450-32i: NVMe support is available now
  - 9450-8i, 9450-16i: NVMe support is planned for 2025
- PCIe 4.0 x8 (8i, 16i adapters) or PCIe 4.0 x16 (32i adapter) host interface
- Slimline x8 connectors (SFF-8654) to drive backplanes
- Low profile (8i, 16i) or Full-height half-length (32i) form factor
- 4GB (8i) or 8GB (16i, 32i) of integrated flash-backed cache
- Native connectivity for up to 8, 16, or 32 internal SAS or SATA drives; Support up to 238 SAS/SATA drives via a SAS expander
- Support for intermixing SAS and SATA HDDs and SSDs. Mixing SAS and SATA drives in the same array is not supported. Mixing of HDDs and SSDs in the same array is not supported.
- Support for intermixing of 24 Gb/s, 12 Gb/s, and 6 Gb/s drives
- Standard support for RAID 0, 1, 10, 5, 50, 6, 60, RAID 1 Triple, and RAID 10 Triple
- Support for JBOD (non-RAID, called "raw" or "HBA mode" in Adaptec parlance) drive state
- Support for up to 64 arrays and 64 logical drives (virtual drives)
- Support for logical drive sizes greater than 2 TB.
- Configurable stripe size from 16 KB up to 1 MB
- Supports 512e, 512n and 4K sector formatted drives
- RAID ADM through triple mirroring, move array, and split mirroring
- Quick initialization
- Online capacity expansion
- Copyback hot spare
- Dynamic caching algorithm
- Native command queuing (NCQ)
- Background initialization
- Hot-plug drive support
- RAID level migration
- Hot spares (dedicated, autoreplace)
- Automatic/manual rebuild of hot spares
- S.M.A.R.T. support
- Dynamic sector repair
- Staggered drive spin-up
- Bootable array support
- Smart PQI driver with multiple queue and MSI-X support for all device drivers for all supported operating systems
- Secure boot support
- High performance adapters:
  - 9450-8i: 3.4M IOPS (random read with 4KB blocks), 14,800 MB/s bandwidth
  - 9450-16i: 3.4M IOPS (random read with 4KB blocks), 14,800 MB/s bandwidth

- 9450-32i: 3.5M IOPS (random read with 4KB blocks), 29,600 MB/s bandwidth

The following table compares the specifications of the RAID 9450 adapters.

Table 2. Specifications

Feature	RAID 9450-8i	RAID 9450-16i	RAID 9450-32i
Form factor	Low profile	Low profile	FHHL
Controller	SmartROC 3200	SmartROC 3200	SmartROC 3200
Adaptec equivalent	SmartRAID 3254-8i 4GB	SmartRAID 3258-16i 8GB	SmartRAID Ultra 3258p-32i 8GB
Host interface	PCIe 4.0 x8	PCIe 4.0 x8	PCIe 4.0 x16
Port interface	24 Gb/s SAS 6 Gb/s SATA 16 GT/s NVMe (Planned*)	24 Gb/s SAS 6 Gb/s SATA 16 GT/s NVMe (Planned*)	24 Gb/s SAS (Planned*) 6 Gb/s SATA (Planned*) 16 GT/s NVMe
Number of ports (native)	8	16	32
Port connectors	1x Slimline x8 (SFF-8654)	2x Slimline x8 (SFF-8654)	4x Slimline x8 (SFF-8654)
Drive interface	- SAS 24Gb, 12Gb, 6Gb - SATA 6Gb - NVMe U.2 x4 (Planned*)	- SAS 24Gb, 12Gb, 6Gb - SATA 6Gb - NVMe U.2 x4 (Planned*)	- SAS 24Gb, 12Gb, 6Gb (Planned*) - SATA 6Gb (Planned*) - NVMe U.2 x4
Drive type	HDD, SSD	HDD, SSD	HDD, SSD
Hot-swap drives	Yes	Yes	Yes
Max devices	SAS/SATA: 8 drives NVMe U.2 x4: 2 drives*	SAS/SATA: 16 drives NVMe U.2 x4: 4 drives*	SAS/SATA: 32 drives NVMe U.2 x4: 8 drives
RAID levels	0, 1, 10, 5, 50, 6, 60, 1 Triple, 10 Triple	0, 1, 10, 5, 50, 6, 60, 1 Triple, 10 Triple	0, 1, 10, 5, 50, 6, 60, 1 Triple, 10 Triple
JBOD drive state (HBA mode / Raw)	Yes	Yes	Yes
Cache	4GB (Standard)	8GB (Standard)	8GB (Standard)
Supercap cache protection with flash	Yes	Yes	Yes
SED support	Yes	Yes	Yes

* Planned for mid-2025: NVMe U.2 drive support with the 9450-8i and 9450-16i adapters; SAS/SATA support for 9450-32i

To compare these adapters to others in the ThinkSystem portfolio, see the ThinkSystem RAID Adapter and HBA Reference:
https://lenovopress.com/lp1288-thinksystem-raid-adapter-and-hba-reference

The following figure shows the ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter.

Figure 3. ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter

Features

Tri-Mode Support

The RAID 9450 adapter family offers tri-mode support, enabling seamless compatibility with SAS, SATA, and NVMe devices. This flexibility allows users to connect a wide range of storage devices, ensuring optimal performance and scalability for various applications.

The 9450-32i currently supports connectivity to NVMe U.2 drives with each having a PCIe Gen4 x4 connection. Support for U.2 drives on the 9450-8i and 9450-16i is planned.

High-Speed Connectivity

Equipped with a PCIe Gen 4 interface, the RAID 9450 adapter family provides high-speed connectivity with up to 24 Gb/s for SAS-4 and 16 Gb/s for NVMe devices. This ensures rapid data transfer rates and low latency, making it ideal for data-intensive tasks and high-performance computing environments. The adapter's advanced architecture supports the latest storage technologies, delivering exceptional throughput and efficiency.

Advanced RAID Capabilities

The RAID 9450 adapter family supports a wide range of RAID levels, including RAID 0, 1, 5, 6, 10, 50, and 60. This extensive RAID support provides robust data protection, redundancy, and performance optimization for various storage configurations. The adapter's advanced RAID features ensure that data is securely stored and easily recoverable, making it a reliable choice for enterprise environments.

The adapters also support additional RAID levels that offer enhanced redundancy and data protection.

- **RAID 1 Triple** is similar to RAID 1, but creates fault tolerance by maintaining redundant copies of data using three disk drives, rather than two. All three drives contain mirrored duplicated user data. If a drive fails, the remaining drives provide backup copies of the files and normal system operations are not interrupted.

- **RAID 10 Triple** is similar to RAID 10, but creates fault tolerance by maintaining redundant copies of data using at least six disk drives. Data is striped across two or more sets of RAID 1 (Triple) drives for rapid access. If a drive fails, the remaining drives provide backup copies of the files and normal system operations are not interrupted.

Dynamic Channel Multiplexing (DCM)

The RAID 9450 adapter family features Dynamic Channel Multiplexing (DCM) technology, which aggregates expander-attached SAS or SATA hard drives onto a 24G SAS infrastructure with near 100% link efficiency. This innovative technology enhances throughput and ensures unparalleled performance, making it ideal for high-capacity storage solutions that require efficient data handling.

Enhanced Security Features

The RAID 9450 adapter family include security features such as secure boot and secure updates. These security measures help protect the system from unauthorized access and ensure the integrity of the firmware and software. By incorporating robust security protocols, the RAID 9450 adapter family provides peace of mind for users who need to safeguard sensitive data and maintain compliance with industry standards. Note: Controller-based encryption (maxCrypto) is not supported.

The RAID 9450 adapter family also offers robust support for Self-Encrypting Drives (SEDs), accommodating SAS, SATA, and NVMe SEDs. The adapter can manage SEDs by providing the necessary credentials to unlock them, ensuring data security. It supports the use of SEDs as boot drives or MaxCache logical drives, offering flexibility in deployment. Additionally, the adapter has the capability to revert secured SEDs to their original factory state, which effectively erases all data on the drives, ensuring that sensitive information is not recoverable. This comprehensive SED support enhances data protection and security for various storage applications.

Support for Lenovo system management tools is listed in the following table.

Table 3. Support for key management features

Function	Lenovo XClarity Controller	Lenovo XClarity Provisioning Manager	Lenovo XClarity Essentials OneCLI (out-of-band)	Lenovo XClarity Essentials OneCLI (in-band)	Lenovo XClarity Administrator	Bare Metal Update / Bootable Media Creator
Adapter FRU Inventory Details	Supported	Supported	Supported	Supported	Supported	No support
Disk Inventory Details	Supported	Supported	Supported	Supported	Supported	No support
RAID Configuration	Supported	Supported	Supported	Supported	Supported	No support
Firmware Update	Supported	No support	Supported	Supported	Supported	Supported
Monitoring/ Events/ Log Capture	Supported*	Supported	Supported*	Supported	Supported*	No support

* No capture of controller firmware log

Server support

The following tables list the ThinkSystem servers that are compatible.

Table 4. Server support (Part 1 of 4)

Part Number	Description	AMD V3				2S Intel V3/V4				4S 8S Intel V3			Multi Node V3/V4			1S V3			
		SR635 V3 (7D9H / 7D9G)	SR655 V3 (7D9F / 7D9E)	SR645 V3 (7D9D / 7D9C)	SR665 V3 (7D9B / 7D9A)	ST650 V3 (7D7B / 7D7A)	SR630 V3 (7D72 / 7D73)	SR650 V3 (7D75 / 7D76)	SR630 V4 (7DG8 / 7DG9)	SR850 V3 (7D97 / 7D96)	SR860 V3 (7D94 / 7D93)	SR950 V3 (7DC5 / 7DC4)	SD535 V3 (7DD8 / 7DD1)	SD530 V3 (7DDA / 7DD3)	SD550 V3 (7DD9 / 7DD2)	ST45 V3 (7DH4 / 7DH5)	ST50 V3 (7DF4 / 7DF3)	ST250 V3 (7DCF / 7DCE)	SR250 V3 (7DCM / 7DCL)
4Y37A97935	ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N
4Y37A97937	ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N
4Y37A97940	ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N

Table 5. Server support (Part 2 of 4)

Part Number	Description	GPU Rich					Edge					Super Computing							1S Intel V2		
		SR670 V2 (7Z22 / 7Z23)	SR675 V3 (7D9Q / 7D9R)	SR680a V3 (7DHE)	SR685a V3 (7DHC)	SR780a V3 (7DJ5)	SE350 (7Z46 / 7D1X)	SE350 V2 (7DA9)	SE360 V2 (7DAM)	SE450 (7D8T)	SE455 V3 (7DBY)	SC750 V4 (7DDJ)	SC777 V4 (7DKA)	SD665 V3 (7D9P)	SD665-N V3 (7DAZ)	SD650 V3 (7D7M)	SD650-I V3 (7D7L)	SD650-N V3 (7D7N)	ST50 V2 (7D8K / 7D8J)	ST250 V2 (7D8G / 7D8F)	SR250 V2 (7D7R / 7D7Q)
4Y37A97935	ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4Y37A97937	ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4Y37A97940	ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 6. Server support (Part 3 of 4)

Part Number	Description	2S Intel V2			AMD V1					Dense V2				4S V2		8S	4S V1		
		ST650 V2 (7Z75 / 7Z74)	SR630 V2 (7Z70 / 7Z71)	SR650 V2 (7Z72 / 7Z73)	SR635 (7Y98 / 7Y99)	SR655 (7Y00 / 7Z01)	SR655 Client OS	SR645 (7D2Y / 7D2X)	SR665 (7D2W / 7D2V)	SD630 V2 (7D1K)	SD650 V2 (7D1M)	SD650-N V2 (7D1N)	SN550 V2 (7Z69)	SR850 V2 (7D31 / 7D32)	SR860 V2 (7Z59 / 7Z60)	SR950 (7X11 / 7X12)	SR850 (7X18 / 7X19)	SR850P (7D2F / 2D2G)	SR860 (7X69 / 7X70)
4Y37A97935	ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4Y37A97937	ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4Y37A97940	ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 7. Server support (Part 4 of 4)

Part Number	Description	1S Intel V1				2S Intel V1								Dense V1			
		ST50 (7Y48 / 7Y50)	ST250 (7Y45 / 7Y46)	SR150 (7Y54)	SR250 (7Y52 / 7Y51)	ST550 (7X09 / 7X10)	SR530 (7X07 / 7X08)	SR550 (7X03 / 7X04)	SR570 (7Y02 / 7Y03)	SR590 (7X98 / 7X99)	SR630 (7X01 / 7X02)	SR650 (7X05 / 7X06)	SR670 (7Y36 / 7Y37)	SD530 (7X21)	SD650 (7X58)	SN550 (7X16)	SN850 (7X15)
4Y37A97935	ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4Y37A97937	ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4Y37A97940	ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Warranty

The adapters carry a 1-year limited warranty. When installed in a supported ThinkSystem server, the adapter assumes the server's base warranty and any warranty upgrades.

Physical specification

The ThinkSystem RAID 9450-8i 4GB Flash PCIe Gen4 24Gb Adapter has the following dimensions and weight:

- Height: 69 mm (2.7 inches)
- Length: 167 mm (6.6 inches)
- Weight: 185g

The ThinkSystem RAID 9450-16i 8GB Flash PCIe Gen4 24Gb Adapter has the following dimensions and weight:

- Height: 69 mm (2.7 inches)
- Length: 167 mm (6.6 inches)
- Weight: 185g

The ThinkSystem RAID 9450-32i 8GB Flash PCIe Gen4 24Gb Adapter has the following dimensions and weight:

- Height: 112 mm (4.4 inches)
- Length: 168 mm (6.6 inches)
- Weight: 340g

Operating environment

The adapters are supported in the following environment:

- Operating:
  - Temperature: 0°C to 55°C (32°F to 131°F)
  - Relative humidity: 20% to 80% (non-condensing)
  - Altitude: Up to 3,000 meters

Agency approvals

The adapters have the following agency approvals:

- FCC Part 15 Class A
- Australia/New Zealand (AS/NZS 3548)
- Canada (ICES-003 Class B)
- Europe (EN55032/EN55024)
- Japan VCCI
- Korea KCC
- RoHS compliant
- EN/IEC/UL 60950
- USA (FCC 47 CFR part 15 Subpart B class B)

Related publications and links

For more information, see the following documents:

- Adaptec product page and user guides:
  https://storage.microsemi.com/en-us/support/raid/sas_raid/asr-3254-8i/

- Lenovo ThinkSystem product publications:
  http://pubs.lenovo.com

- ServerProven hardware compatibility:
  https://serverproven.lenovo.com/

- Lenovo ThinkSystem RAID Adapter and HBA Reference
  https://lenovopress.com/lp1288-thinksystem-raid-adapter-and-hba-reference

Related product families

Product families related to this document are the following:

- RAID Adapters

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