Lenovo ThinkSystem ST650 V3 Server
Product Guide

The Lenovo ThinkSystem ST650 V3 is an ideal 2-socket 4U tower server for small businesses up to large enterprises that need industry-leading reliability, management, and security, as well as maximizing performance and flexibility for future growth. The ST650 V3 is based on the new 4th generation Intel Xeon Scalable processor family.

The ST650 V3 is designed to handle a wide range of workloads, such as databases, virtualization and cloud computing, virtual desktop infrastructure (VDI), infrastructure security, systems management, enterprise applications, collaboration/email, streaming media, web, and HPC.

Figure 1. Lenovo ThinkSystem ST650 V3

Did you know?

The ThinkSystem ST650 V3 is an enterprise-grade tower server with support for hot-swap power supplies, fans, and drives. It also offers full support of Lenovo XClarity Administrator for comprehensive systems management and includes the UEFI-based Lenovo XClarity Provisioning Manager for system setup and diagnosis, and the Lenovo XClarity Controller management processor for ongoing systems management and alerting. These tools make the ST650 V3 easy to deploy, integrate, service, and manage.

The ST650 V3 is a very storage-rich tower offering, supporting up to 32x 2.5-inch drives or up to 16x 3.5-inch drives. Support includes up to 24x NVMe drives. The tower server can also be converted to a 4U rack server if needed.

Key features

The ThinkSystem ST650 V3 is a high-performance dual-socket tower server based on the 4th Gen Intel Xeon Scalable processors, supporting a wide range of processors to suit a wide range of budgets and application requirements.

Scalability and performance

The ST650 V3 offers numerous features to boost performance, improve scalability and reduce costs:

- Supports one or two fourth-generation Intel Xeon Processor Scalable processors
  - Up to 32 cores and 64 threads
  - Core speeds of up to 3.7 GHz
  - TDP ratings of up to 250 W
- Support for DDR5 memory DIMMs to maximize the performance of the memory subsystem:
  - Up to 32 DDR5 memory DIMMs, 16 DIMMs per processor
  - 8 memory channels per processor (2 DIMMs per channel)
  - Supports 1 DIMM per channel operating at 4800 MHz
  - Supports 2 DIMMs per channel operating at 4400 MHz
  - Using 128GB 3DS RDIMMs, the server supports up to 4TB of system memory
- Supports up to eight single-width GPUs or four double-wide GPUs, for substantial processing power in a tower system.
- Supports a variety of front-accessible drive bays:
  - Up to 32x 2.5-inch hot-swap drive bays with two 5.25-inch media bays
  - Up to 12x 3.5-inch hot-swap drive bays with two 5.25-inch media bays
  - Up to 16x 3.5-inch hot-swap drive bays without the media bays
- Supports up to 24x NVMe drives to maximize drive I/O performance, in terms of throughput, bandwidth, and latency.
- Supports up to 12x SATA drives using the onboard SATA controller (no additional adapter needed), enabling lower cost, high capacity storage solution.
- Supports high-speed RAID controllers from Broadcom providing 12 Gb SAS connectivity to the drive backplanes. A variety of PCIe 3.0 and PCIe 4.0 RAID adapters are available, including custom form factor (CFF) adapters that are cabled and don't occupy a PCIe slot.
- Supports M.2 drives for convenient operating system boot functions or data storage. Available M.2 adapters support either one M.2 drive or two M.2 drives.
- The server has two integrated 10GBASE-T ports for 10 GbE networking as well as support for additional network adapter cards.
- The server offers PCI Express 5.0 I/O expansion capabilities that doubles the theoretical maximum bandwidth of PCIe 4.0 (32GT/s in each direction for PCIe Gen 5, compared to 16 GT/s with PCIe Gen 4 and 8 GT/s with PCIe Gen 3). A PCIe 5.0 x16 slot provides 128 GB/s bandwidth, enough to support a dual-port 200GbE network connection.
- Up to nine PCIe slots, five of which are PCIe 5.0.

Availability and serviceability

The ST650 V3 provides many features to simplify serviceability and increase system uptime:

- Designed to run 24 hours a day, 7 days a week
- The server offers Single Device Data Correction (SDDC, also known as Chipkill), Adaptive Double-Device Data Correction (ADDDC, also known as Redundant Bit Steering or RBS), and memory mirroring for redundancy in the event of a non-correctable memory failure. Note: ADDDC in not supported with 9x4 RDIMMs.
- The server offers hot-swap drives, supporting RAID redundancy for data protection and greater system uptime.

- Available M.2 adapters support RAID-1 (Intel VROC) which can enable two SATA or two NVMe M.2 drives to be configured as a redundant pair.
- The server has up to two hot-swap redundant power supplies and up to four large hot-swap redundant fans to provide availability for business-critical applications.
- The power-source-independent light path diagnostics uses LEDs to lead the technician to failed (or failing) components, which simplifies servicing, speeds up problem resolution, and helps improve system availability.
- Solid-state drives (SSDs) offer more reliability than traditional mechanical HDDs for greater uptime.
- Proactive Platform Alerts (including PFA and SMART alerts): Processors, voltage regulators, memory, internal storage (SAS/SATA HDDs and SSDs, NVMe SSDs, M.2 storage, flash storage adapters), fans, power supplies, RAID controllers, server ambient and subcomponent temperatures. Alerts can be surfaced through the XClarity Controller to managers such as Lenovo XClarity Administrator, VMware vCenter, and Microsoft System Center. These proactive alerts let you take appropriate actions in advance of possible failure, thereby increasing server uptime and application availability.
- The built-in XClarity Controller continuously monitors system parameters, triggers alerts, and performs recovery actions in case of failures to minimize downtime.
- Built-in diagnostics in UEFI, using Lenovo XClarity Provisioning Manager, speed up troubleshooting tasks to reduce service time.
- Lenovo XClarity Provisioning Manager supports diagnostics and can save service data to a USB key drive or remote CIFS share folder for troubleshooting and reduce service time.
- Auto restart in the event of a momentary loss of AC power (based on power policy setting in the XClarity Controller service processor)
- Offers a diagnostics port located at the rear of the server to allow you to attach an external diagnostics handset for enhanced systems management capabilities.
- Support for the XClarity Administrator Mobile app running on a supported smartphone and connected to the server through the service-enabled USB port, enables additional local systems management functions.
- Three-year or one-year customer-replaceable unit and onsite limited warranty, 9 x 5 next business day. Optional service upgrades are available.

Manageability and security

Systems management features simplify local and remote management of the ST650 V3:

- The server includes XClarity Controller 2 (XCC2) to monitor server availability. Optional upgrade to XCC Platinum to provide remote control (keyboard video mouse) functions, support for the mounting of remote media files (ISO and IMG image files), boot capture, power capping and new XCC2 Platinum features. New XCC2 Platinum features include System Guard, new security modes including a CNSA-compliant mode, FIPS 140-3 and NIST 800-193 support, and a new Neighbor Group feature.
- Toolless cover removal provides easy access to upgrades and serviceable parts, such as CPU, memory, and adapter cards.
- Lenovo XClarity Administrator offers comprehensive hardware management tools that help to increase uptime, reduce costs and improve productivity through advanced server management capabilities.
- UEFI-based Lenovo XClarity Provisioning Manager, accessible from F1 during boot, provides system inventory information, graphical UEFI Setup, platform update function, RAID Setup wizard, operating system installation function, and diagnostic functions.
- Support for Lenovo XClarity Energy Manager, which captures real-time power and temperature data from the server and provides automated controls to lower energy costs.

- An integrated industry-standard Unified Extensible Firmware Interface (UEFI) enables improved setup, configuration, and updates, and simplifies error handling.
- Support for industry standard management protocols, IPMI 2.0, SNMP 3.0, Redfish REST API, serial console via IPMI
- Available physical security features include a lockable front door and a chassis intrusion switch to help prevent unauthorized access and notify administrators when the server cover has been removed.
- An integrated hardware Trusted Platform Module (TPM) supporting TPM 2.0 enables advanced cryptographic functionality, such as digital signatures and remote attestation.
- Administrator and power-on passwords help protect from unauthorized access to the server.
- Supports Secure Boot to ensure only a digitally signed operating system can be used. Supported with HDDs and SSDs, as well as M.2 drives.
- Industry-standard Advanced Encryption Standard (AES) NI support for faster, stronger encryption.
- Intel Execute Disable Bit functionality can prevent certain classes of malicious buffer overflow attacks when combined with a supported operating system.
- Intel Trusted Execution Technology provides enhanced security through hardware-based resistance to malicious software attacks, allowing an application to run in its own isolated space, protected from all other software running on a system.

Energy efficiency

The ST650 V3 offers the following energy-efficiency features to save energy, reduce operational costs, and increase energy availability:

- Energy-efficient planar components help lower operational costs.
- High-efficiency power supplies with 80 PLUS Platinum and Titanium certifications
- Solid-state drives (SSDs) consume as much as 80% less power than traditional spinning 2.5-inch HDDs.
- The server uses hexagonal ventilation holes, which can be grouped more densely than round holes, providing more efficient airflow through the system and thus keeping your system cooler.
- Optional Lenovo XClarity Energy Manager provides advanced data center power notification, analysis, and policy-based management to help achieve lower heat output and reduced cooling needs.

Comparing the ST650 V3 to the ST650 V2

The ThinkSystem ST650 V3 improves on the previous generation ST650 V2, as summarized in the following table.

Table 1. Comparing the ThinkSystem ST650 V3 to the previous generation ST650 V2

Feature	ST650 V2	ST650 V3	Benefits
Processor	• 2x 3rd Gen Intel Xeon Scalable Processors • Core speeds up to 3.6 GHz • Up to 36 cores • TDP ratings up to 250W • 64x PCIe 4.0 lanes per processor	• 2x 4th Gen Intel Xeon Scalable Processors • Core speeds up to 3.7 GHz • Up to 32 cores • TDP ratings up to 250W • 80x PCIe 5.0 lanes per processor	• Latest generation processors • Increased performance • New PCIe 5.0 support means higher performance networking and NVMe storage

Feature	ST650 V2	ST650 V3	Benefits
Memory	• DDR4 memory operating up to 3200 MHz • 8 channels per CPU • 32 DIMMs (16 per processor), 2 DIMMs per channel • Supports RDIMMs and 3DS RDIMMs • Up to 4TB of system memory • Intel Optane Persistent Memory 200 Series	• DDR5 memory operating up to 4800 MHz • 8 channels per CPU • 32 DIMMs (16 per processor), 2 DIMMs per channel • Supports RDIMMs, 3DS RDIMMs and 9x4 RDIMMs • Up to 4TB of system memory • No persistent memory support	• New DDR5 memory offers significant performance improvements over DDR4 • Support for lower-cost 9x4 DIMMs
Internal storage	• Up to 16x 3.5” HS SAS/SATA (up to 8x optional NVMe SSDs) • Up to 32x 2.5” HS SAS/SATA (up to 16x optional NVMe SSDs) • Up to 12x 3.5” SS SATA • Optional 2x 5.25” drive bays for optical/backup drives • 2x Internal M.2 with RAID (hardware RAID or Intel VROC) • 8x Onboard NVMe ports • NVMe Retimer adapters for 16x NVMe	• Up to 16x 3.5” HS SAS/SATA (up to 16x optional NVMe SSDs) • Up to 32x 2.5” HS SAS/SATA (up to 24x optional NVMe SSDs) • No support for simple-swap drives • Optional 2x 5.25” drive bays for optical/backup drives • 2x Internal M.2 with RAID (Intel VROC) • 12x Onboard NVMe ports • NVMe Retimer adapters for 24x NVMe	• Flexible storage offerings • Up to 24x NVMe drives for high-performance storage • 2X performance improvement with PCIe Gen5 NVMe • Additional NVMe ports means no need for Retimer adapters, freeing up slots for other adapters
RAID	• 8-, 16- and 32-port RAID adapters with up to 8GB flash • Support for Lenovo and Broadcom adapters • Support for PCIe or Internal cabled (CFF) form factor adapters • Storage HBAs available • PCIe 3.0 and PCIe 4.0 adapter choices • Onboard SATA and NVMe support with VROC RAID	• 8-, 16- and 32-port RAID adapters with up to 8GB flash • Support for Lenovo and Broadcom adapters • Support for PCIe or Internal cabled (CFF) form factor adapters • Storage HBAs available • PCIe 3.0 and PCIe 4.0 adapter choices with support for Gen 5 adapters when available • Onboard SATA and NVMe support with VROC RAID	• Consistent RAID/HBA support • Flexible config solution • PCIe Gen 5 allows for greater storage performance
Networking	• 2x 10GbE embedded • 1GbE dedicated Management port • Additional PCIe adapters supported	• 2x 10GbE embedded • 1GbE dedicated Management port • Additional PCIe adapters supported	• 10GbE for built-in networking

Feature	ST650 V2	ST650 V3	Benefits
PCIe	• Supports PCIe Gen4 • Up to 9 slots total (1 is optional) • 4x PCIe Gen4 x16 slots • Up to 4x PCIe x8 (3x Gen4, 1x Gen3) • 1x PCIe Gen4 x4 slot • Separate M.2 adapter support	• Supports PCIe Gen5 • Up to 9 slots total • 5x PCIe Gen5 slots (three x16 slots and two x8 slots) • 4x PCIe Gen4 slots (one x16 slots and three x8 slots) • 12x onboard NVMe connectors (12 x Gen4) • Separate M.2 adapter support	• PCIe Gen 5 allows for greater I/O performance • Flexible PCIe offerings
GPU support	• Up to 4x active DW or 8x SW GPU adapters	• Up to 4x active DW or 8x SW GPU adapters	• Support for the latest GPUs
Management and security	• XClarity Controller • Support for full XClarity toolset including XClarity Administrator • Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) • Tamper Switch security solution (intrusion switch)	• Integrated XClarity Controller 2 • Support for full XClarity toolset including XClarity Administrator • Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) • Tamper Switch security solution (intrusion switch)	• New XCC2 offers improved management capabilities • Same system management tool with previous generation • Silicon-level security solution
Power	• 2x Hot-swap PSUs up to 2400W, Platinum • 750W Hot-swap Titanium PSU • 240V HVDC support for PRC customers • Active-Standby mode	• 2x Hot-swap PSUs up to 2600W, Platinum • Available in Titanium and Platinum efficiency levels • 1100W -48VDC Platinum general support • 240V HVDC support for PRC customers • Active-Standby mode	• Multiple PSU offerings to suit the configuration selected • New ErP Lot 9-compliant offerings

Components and connectors

The following figure shows the front of the server.

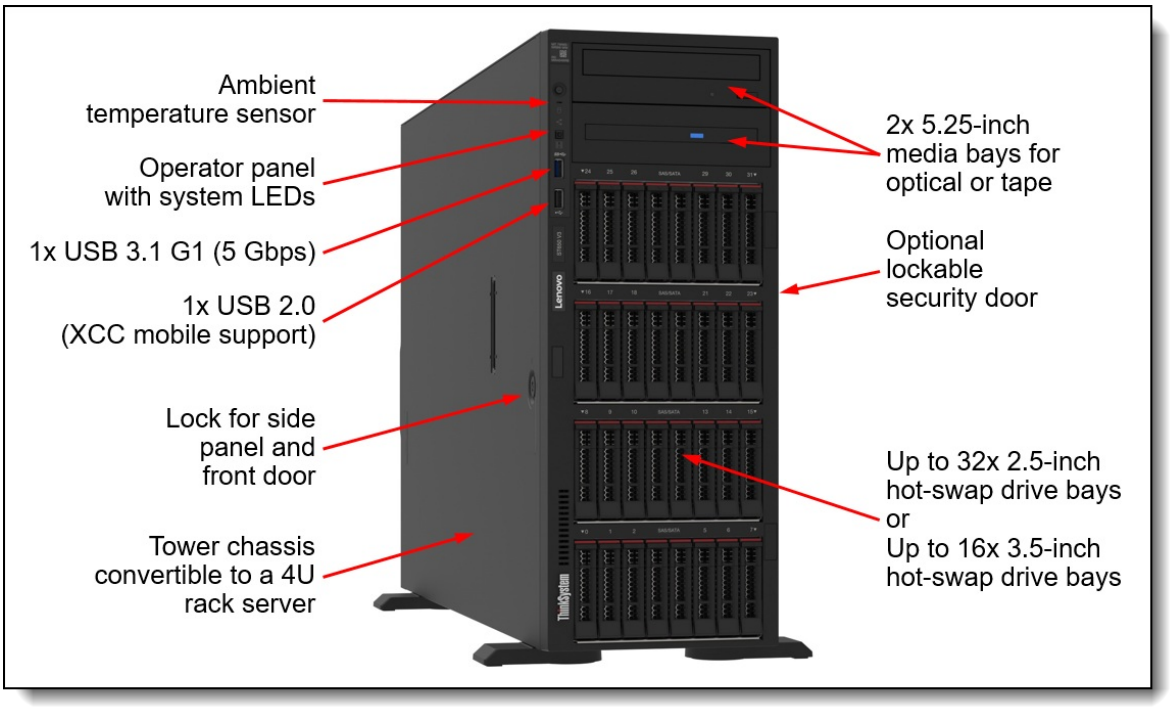

Figure 2. Front view of the ThinkSystem ST650 V3

The following figure shows the four drive bay combinations that the server supports.

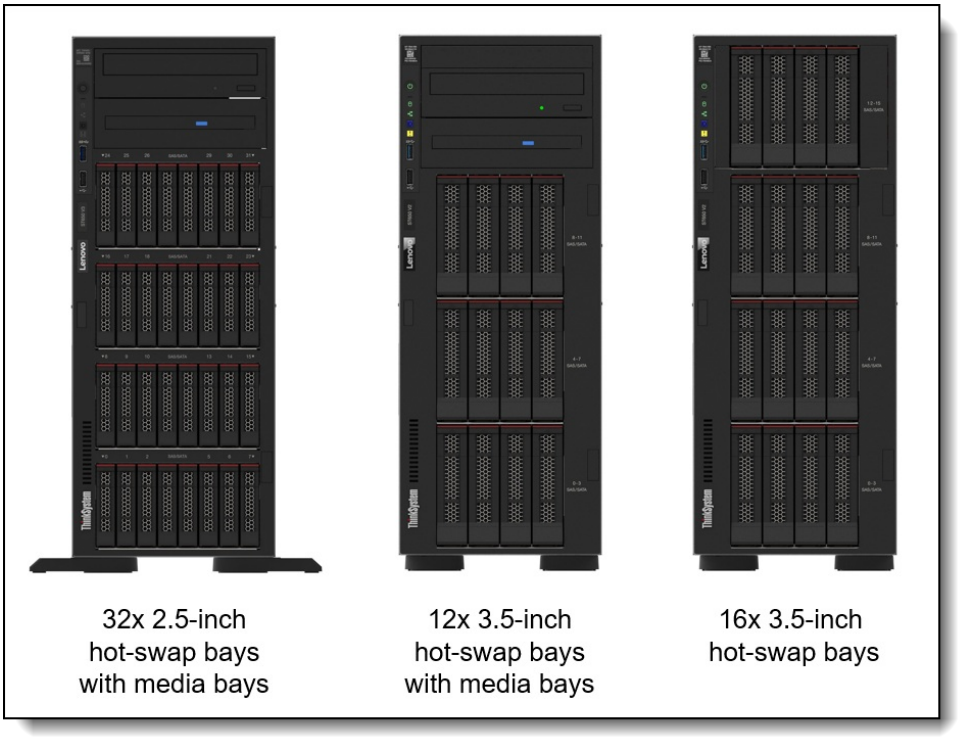

Figure 3. Drive bay combinations of the ThinkSystem ST650 V3

The following figure shows the components visible from the rear of the server.

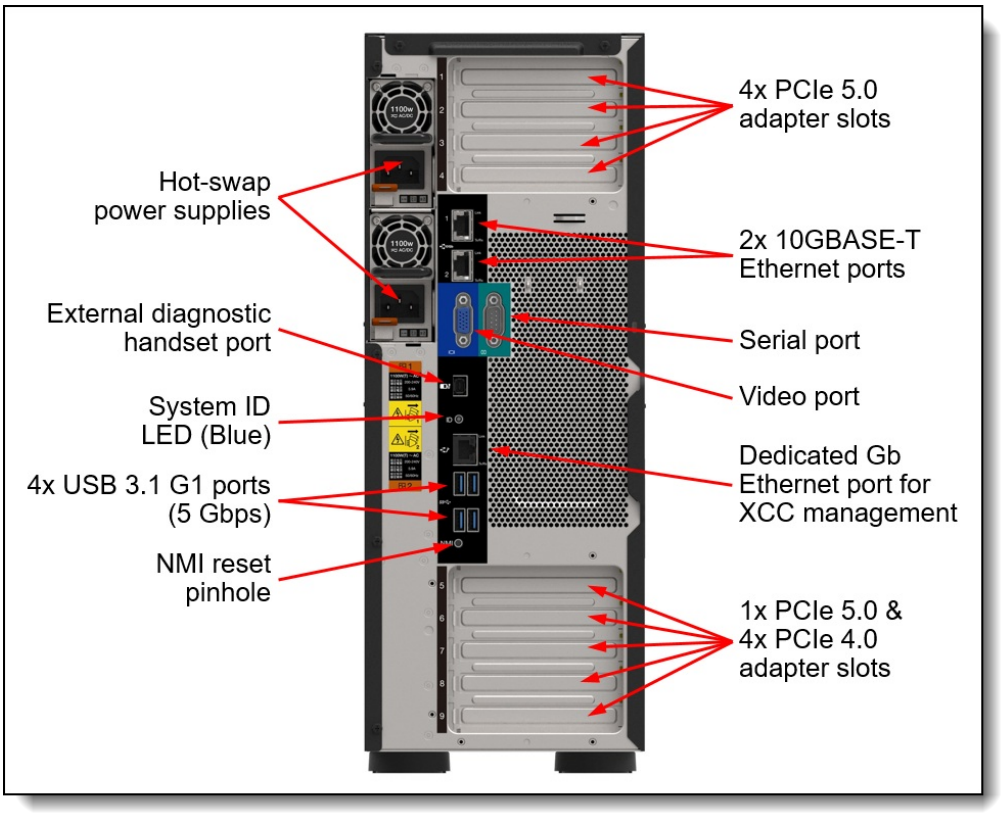

Figure 4. Rear view of the ThinkSystem ST650 V3

The following figure shows the locations of key components inside the server.

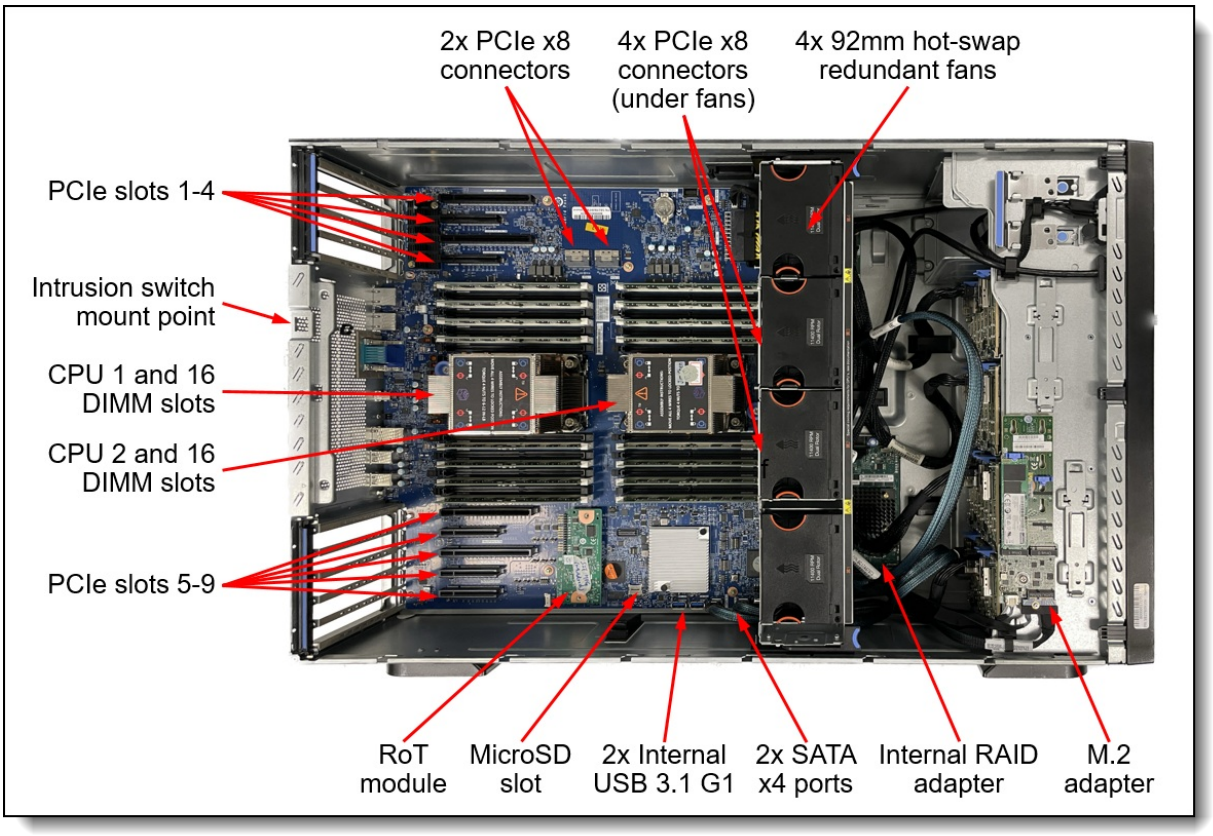

Figure 5. Internal view of the ThinkSystem ST650 V3

System architecture

The following figure shows the architectural block diagram of the ST650 V3, showing the major components and their connections.

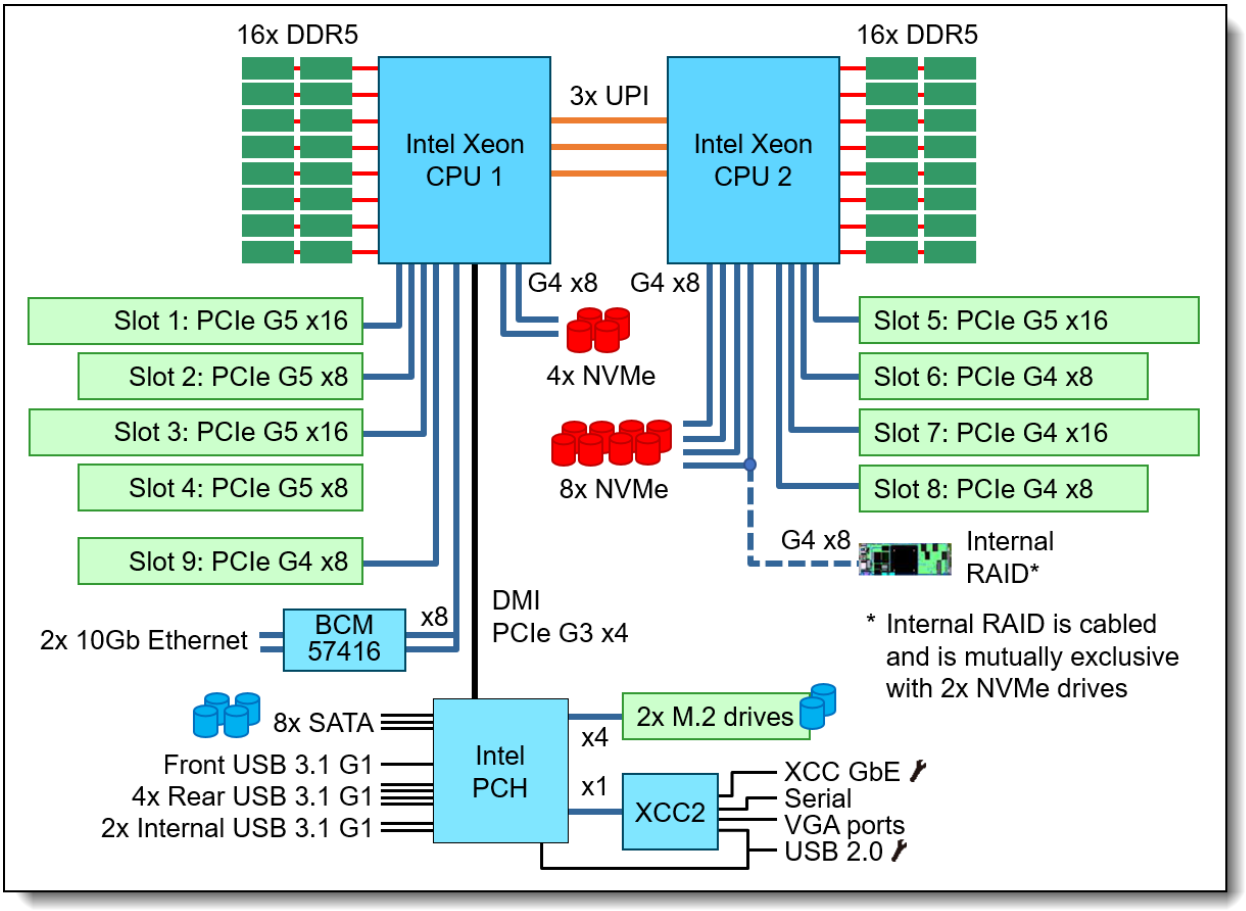

Figure 6. ST650 V3 system architectural block diagram

Standard specifications

The following table lists the standard specifications.

Table 2. Standard specifications

Components	Specification
Machine types	7D7B - 1 year warranty 7D7A - 3 year warranty
Form factor	Tower or 4U Rack
Processor	One or two 4th-generation Intel Xeon Scalable processor (formerly codenamed "Sapphire Rapids"). Supports processors up to 32 cores, core speeds of up to 3.7 GHz, and TDP ratings of up to 250 W.
Chipset	Intel C741 "Emmitsburg" chipset, part of the platform codenamed "Eagle Stream"
Memory	32 DIMM slots with two processors (16 DIMM slots per processor). Each processor has 8 memory channels, with 2 DIMMs per channel (DPC). Lenovo TruDDR5 RDIMMs, 9x4 RDIMMs, and 3DS RDIMMs are supported. DIMMs operate at up to 4800 MHz at 1 DPC and up to 4400 MHz at 2 DPC.

Components	Specification
Persistent memory	No support
Memory maximum	Up to 4TB by using 32x 128GB 3DS RDIMMs
Memory protection	ECC, SDDC (for x4-based memory DIMMs), ADDDC (for x4-based memory DIMMs excluding 9x4 RDIMMs, requires Platinum or Gold processors), and memory mirroring.
Disk drive bays	2.5-inch drive bays: • Up to 32x 2.5-inch hot-swap bays (24x NVMe) plus 2x 5.25-inch media bays 3.5-inch drive bays: • Up to 16x 3.5-inch hot-swap bays (16x NVMe) (no media bays) • Up to 12x 3.5-inch hot-swap bays (12x NVMe) plus 2x 5.25-inch media bays Internal drives for OS boot or drive storage: • Internal M.2 module supporting up to two M.2 drives

Maximum internal storage	• 2.5-inch drives:
	  ◦ 245.76TB using 32x 7.68TB 2.5-inch SAS/SATA SSDs
	  ◦ 92.16TB using 24x 3.84TB 2.5-inch NVMe SSDs
	  ◦ 76.8TB using 32x 2.4TB 2.5-inch HDDs
	• 3.5-inch drives:
	  ◦ 320TB using 16x 20TB 3.5-inch HDDs
	  ◦ 122.88TB using 16x 7.68TB 3.5-inch SAS/SATA SSDs
	  ◦ 61.44TB using 16x 3.84TB 3.5-inch NVMe SSDs

Storage controller	• 8x onboard SATA ports (Intel VROC SATA RAID, formerly known as Intel RSTe RAID)
	• Up to 12x onboard NVMe ports (includes Intel VROC NVMe RAID, with optional license for non-Intel NVMe SSDs)
	• NVMe Retimer Adapter (supports Intel VROC NVMe RAID)
	• 12 Gb SAS/SATA RAID adapters
	  ◦ 8, 16 or 32 ports
	  ◦ Up to 8GB flash-backed cache
	  ◦ PCIe 4.0 or PCIe 3.0 host interface
	• 12 Gb SAS/SATA HBA (non-RAID)
	  ◦ 8-port and 16-port
	  ◦ PCIe 4.0 or PCIe 3.0 host interface

Optical drive and tape drive bays	Two half-height 5.25-inch media bays, available in most configurations. Supports two of LTO tape drive, RDX drive, or slim DVD-RW optical drive.
Network interfaces	Two onboard 10GBASE-T Ethernet RJ45 ports based on a Broadcom BCM57416 controller. Additional dedicated Gigabit port for remote management via the XClarity Controller (XCC) management processor.

Components	Specification
PCI Expansion slots	9x PCIe slots: 5x PCIe 5.0 and 4x PCIe 4.0 slots. All nine slots are mounted on the system board. Slots 1-8 are full height, full length (FHFL); slot 9 is full height, half length (FHHL). Slots 4-8 require CPU 2 installed. • Slot 1: PCIe 5.0 x16 (CPU 1) • Slot 2: PCIe 5.0 x8 (x8 physical slot) (CPU 1) • Slot 3: PCIe 5.0 x16 (CPU 1) • Slot 4: PCIe 5.0 x8 (x8 physical slot) (CPU 1) • Slot 5: PCIe 5.0 x16 (CPU 2) • Slot 6: PCIe 4.0 x8 (x8 physical slot) (CPU 2) • Slot 7: PCIe 4.0 x16 (CPU 2) • Slot 8: PCIe 4.0 x8 (x8 physical slot) (CPU 2) • Slot 9: PCIe 4.0 x8 (x8 physical slot) (CPU 1) The server also supports the installation of a RAID adapter or HBA in a dedicated area that does not consume any of the PCIe slots. See the location of the Internal RAID adapter (cabled) in the Internal view of the server.
GPU support	Supports up to 8x single-wide GPUs or up to 4x double-wide GPUs
Ports	Front: 1x USB 3.2 G1 (5 Gb/s) port, 1x USB 2.0 port (also for XCC local management) Rear: 2x 10GBASE-T RJ45 Ethernet ports, 4x USB 3.2 G1 (5 Gb/s) ports, 1x VGA video port, 1x DB-9 COM serial port, 1x 1GbE RJ-45 systems management port for XCC remote management, External diagnostics port Internal: 2x USB 3.2 G1 connector for operating system or license key purposes
Cooling	Up to 4x single-rotor or dual-rotor hot swap 92 mm fans, configuration dependent. Fans are N+1 redundant. One additional fan integrated in each power supply.
Power supply	Up to two hot-swap redundant AC power supplies, 80 PLUS Platinum or 80 PLUS Titanium certification. 750 W, 1100 W, 1800 W and 2600 W AC options, supporting 220 V AC. 750 W and 1100 W options also support 110V input supply. In China only, all power supply options support 240 V DC.
Video	Embedded graphics with 16 MB memory with 2D hardware accelerator, integrated into the XClarity Controller 2 management controller. Maximum resolution is 1920x1200 32bpp at 60Hz.
Hot-swap parts	Drives, power supplies, and fans.
Systems management	Operator panel with status LEDs. Optional External Diagnostics Handset with LCD display. XClarity Controller 2 (XCC2) embedded management controller , XClarity Administrator centralized infrastructure delivery, XClarity Integrator plugins, and XClarity Energy Manager centralized server power management. Optional XClarity Controller Platinum to enable remote control and other functions.
Security features	Power-on password, administrator's password, Root of Trust module supporting TPM 2.0 and Platform Firmware Resiliency (PFR). Optional lockable front security door and optional chassis intrusion switch.
Operating systems supported	Microsoft Windows Server, Red Hat Enterprise Linux, SUSE Linux Enterprise Server, VMware ESXi. See the Operating system support section for specifics.
Limited warranty	Three-year or one-year (model dependent) customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD).
Service and support	Optional service upgrades are available through Lenovo Services: 4-hour or 2-hour response time, 6-hour fix time, 1-year or 2-year warranty extension, software support for Lenovo hardware and some third-party applications.

Components	Specification
Dimensions	Width: 175 mm (6.9 in.), height: 462 mm (18.2 in.), depth: 734 mm (28.9 in.). See Physical and electrical specifications for details.
Weight	39.1 kg (86.2 lb) maximum

Models

ThinkSystem ST650 V3 models can be configured by using the Lenovo Data Center Solution Configurator (DCSC).

Topics in this section:

- CTO models
- Base feature codes
- Preconfigured models

CTO models

ThinkSystem ST650 V3 models can be configured by using the Lenovo Data Center Solution Configurator (DCSC).

Preconfigured server models may also be available for the ST650 V3, however these are region-specific; that is, each region may define their own server models, and not all server models are available in every region.

The following table lists the base CTO models of the ThinkSystem ST650 V3 server.

Table 3. Base CTO models

Machine Type/Model	Description
7D7ACTO1WW	ThinkSystem ST650 V3 – 3-year Warranty
7D7BCTO1WW	ThinkSystem ST650 V3 – 1-year Warranty

The following table lists the base CTO models of the ThinkSystem ST658 V3 server, which has the same features as the ST650 V3 but is only available in China.

Table 4. Base CTO model of the ST658 V3

Machine Type/Model	Description
7D7CCTO1WW	ThinkSystem ST658 V3 – 3-year Warranty (PRC only)

Base feature codes

Models of the ST650 V3 are defined based on whether the server has 2.5-inch drive bays at the front (called the 2.5-inch chassis) or whether it has 3.5-inch drive bays at the front (called the 3.5-inch chassis). For models, the feature codes for these chassis bases are as listed in the following table.

Table 5. Chassis base feature codes

Feature code	Description
BNW0	ThinkSystem ST650 V3 - 2.5" Chassis Base
BNW1	ThinkSystem ST650 V3 - 3.5" Chassis Base

Preconfigured models

The following tables list the available preconfigured models, grouped by region.

- Models for Australia and New Zealand
- Models for EMEA region
- Models for USA and Canada

Refer to the Specifications section for information about standard features of the server.

Models for Australia and New Zealand

Table 6. Models for Australia and New Zealand

Model	Intel Xeon Scalable processor†	Memory	RAID	Drive bays	Top bay	XCC	Intru. sw.	Fans	Power supplies	Power cords
TopSeller models with a 3-year warranty (machine type 7D7A)										
7D7AA01MAU	1x Silver 4410Y 12C 150W 2.0G	1x 16GB	5350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Std	No	3x Perf	1x750W	Yes
7D7AA01QAU	1x Silver 4410Y 12C 150W 2.0G	1x 16GB	9350-8i	4x 3.5" SAS Open bay	4x 3.5"; No media	Std	No	3x Perf	1x750W	Yes
7D7AA01RAU	1x Silver 4410Y 12C 150W 2.0G	1x 16GB	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Std	No	3x Perf	1x750W	Yes
7D7AA01SAU	1x Silver 4410Y 12C 150W 2.0G	1x 16GB	9350-16i	4x 3.5" SAS Open bay	4x 3.5"; No media	Std	No	3x Perf	1x750W	Yes
7D7AA01LAU	1x Gold 5416S 16C 150W 2.0G	1x 32GB 2Rx8	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Std	No	3x Perf	1x750W	Yes
7D7AA01NAU	1x Gold 5418Y 24C 185W 2.0G	1x 32GB 2Rx8	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Std	No	3x Perf	1x750W	Yes

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

Models for EMEA region

Table 7. Models for EMEA region

Model	Intel Xeon Scalable processor†	Memory	RAID	Drive bays	Top bay	XCC	Intru. sw.	Fans	Power supplies	Power cords
Standard models with a 3-year warranty (machine type 7D7A)										
7D7AA019EA	1x Bronze 3408U 8C 125W 1.8G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01JEA	1x Bronze 3408U 8C 125W 1.8G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01AEA	1x Silver 4410Y 12C 150W 2.0G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01KEA	1x Silver 4410Y 12C 150W 2.0G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01BEA	1x Silver 4416+ 20C 165W 2.0G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01CEA	1x Gold 5415+ 8C 150W 2.9G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01PEA	1x Gold 5415+ 8C 150W 2.9G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01DEA	1x Gold 5416S 16C 150W 2.0G	1x 32GB 1Rx4	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	3x Std	1x1100W Titanium	Yes
7D7AA01EEA	1x Gold 6426Y 16C 185W 2.5G	1x 64GB	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	4x Perf	1x1100W Titanium	Yes
7D7AA01FEA	1x Gold 6438Y+ 32C 205W 2.0G	1x 64GB	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	Yes	4x Perf	1x1100W Titanium	Yes

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

Models for USA and Canada

Table 8. Models for USA and Canada

Model	Intel Xeon Scalable processor†	Memory	RAID	Drive bays	Top bay	XCC	Intru. sw.	Fans	Power supplies	Power cords
Standard models with a 3-year warranty (machine type 7D7A)										
7D7A1009NA	1x Silver 4410T 10C 150W 2.7G	1x 32GB 2Rx8	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	No	4x Std	1x750W	Yes
7D7A1007NA	1x Silver 4410Y 12C 150W 2.0G	1x 32GB 2Rx8	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	No	4x Std	1x750W	Yes
7D7A1005NA	1x Silver 4416+ 20C 165W 2.0G	1x 32GB 2Rx8	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	No	4x Std	1x750W	Yes
7D7A1008NA	1x Gold 6426Y 16C 185W 2.5G	1x 32GB 2Rx8	9350-8i	8x 2.5" SAS Open bay	2x Media; Open bay	Plat	No	4x Std	1x750W	Yes

† Processor description: Processor model, number of cores, thermal design power (TDP), core frequency

Processors

The ST650 V3 supports processors in the third-generation Intel Xeon Scalable Processor family. The server supports one or two processors.

Topics in this section:

- Processor options
- Processor features
- One-processor configurations
- Thermal restrictions by processor
- UEFI operating modes

Processor options

All supported processors have the following characteristics:

- 8 DDR5 memory channels at 2 DIMMs per channel
- Up to 3 UPI links between processors at 16 GT/s
- 80 PCIe 5.0 I/O lanes

The following table lists the processors that are currently supported by the ST650 V3.

Table 9. ST650 V3 processor support

Part number	Feature code	SKU	Description	Quantity supported
CTO only	BQ68	3408U	Intel Xeon Bronze 3408U 8C 125W 1.8GHz Processor	1*
4XG7A85277	BQ64	4410T	ThinkSystem ST650 V3 Intel Xeon Silver 4410T 10C 150W 2.7GHz Processor Option Kit w/o Fan	2
4XG7A85282	BQ67	4410Y	ThinkSystem ST650 V3 Intel Xeon Silver 4410Y 12C 150W 2.0GHz Processor Option Kit w/o Fan	2
4XG7A85296	BQ69	4416+	ThinkSystem ST650 V3 Intel Xeon Silver 4416+ 20C 165W 2.0GHz Processor Option Kit w/o Fan	2
CTO only	BQ6J	5411N	Intel Xeon Gold 5411N 24C 165W 1.9GHz Processor	1*
CTO only	BU1V	5412U	Intel Xeon Gold 5412U 24C 185W 2.1GHz Processor	1*
4XG7A85293	BQ63	5415+	ThinkSystem ST650 V3 Intel Xeon Gold 5415+ 8C 150W 2.9GHz Processor Option Kit w/o Fan	2
4XG7A85298	BQ6L	5416S	ThinkSystem ST650 V3 Intel Xeon Gold 5416S 16C 150W 2.0GHz Processor Option Kit w/o Fan	2
4XG7A85287	BQ6H	5418N	ThinkSystem ST650 V3 Intel Xeon Gold 5418N 24C 165W 1.8GHz Processor Option Kit w/o Fan	2
4XG7A85281	BQ66	5418Y	ThinkSystem ST650 V3 Intel Xeon Gold 5418Y 24C 185W 2.0GHz Processor Option Kit w/o Fan	2
4XG7A85279	BQ65	5420+	ThinkSystem ST650 V3 Intel Xeon Gold 5420+ 28C 205W 2.0GHz Processor Option Kit w/o Fan	2
CTO only	BPPD	6414U	Intel Xeon Gold 6414U 32C 250W 2.0GHz Processor	1*
4XG7A85285	BQ6C	6416H	ThinkSystem ST650 V3 Intel Xeon Gold 6416H 18C 165W 2.2GHz Processor Option Kit w/o Fan	2
4XG7A85284	BQ6B	6418H	ThinkSystem ST650 V3 Intel Xeon Gold 6418H 24C 185W 2.1GHz Processor Option Kit w/o Fan	2
CTO only	BQ6G	6421N	Intel Xeon Gold 6421N 32C 185W 1.8GHz Processor	1*

Part number	Feature code	SKU	Description	Quantity supported
4XG7A85288	BPQF	6426Y	ThinkSystem ST650 V3 Intel Xeon Gold 6426Y 16C 185W 2.5GHz Processor Option Kit w/o Fan	2
4XG7A85289	BQ6F	6428N	ThinkSystem ST650 V3 Intel Xeon Gold 6428N 32C 185W 1.8GHz Processor Option Kit w/o Fan	2
4XG7A85278	BPQC	6434	ThinkSystem ST650 V3 Intel Xeon Gold 6434 8C 195W 3.7GHz Processor Option Kit w/o Fan	2
4XG7A85286	BQ6E	6434H	ThinkSystem ST650 V3 Intel Xeon Gold 6434H 8C 195W 3.7GHz Processor Option Kit w/o Fan	2
4XG7A85290	BQ6K	6438M	ThinkSystem ST650 V3 Intel Xeon Gold 6438M 32C 205W 2.2GHz Processor Option Kit w/o Fan	2
4XG7A85297	BQ6D	6438N	ThinkSystem ST650 V3 Intel Xeon Gold 6438N 32C 205W 2.0GHz Processor Option Kit w/o Fan	2
4XG7A85291	BQ62	6438Y+	ThinkSystem ST650 V3 Intel Xeon Gold 6438Y+ 32C 205W 2.0GHz Processor Option Kit w/o Fan	2
4XG7A85294	BPQE	6442Y	ThinkSystem ST650 V3 Intel Xeon Gold 6442Y 24C 225W 2.6GHz Processor Option Kit w/o Fan	2
4XG7A85295	BQ6A	6448H	ThinkSystem ST650 V3 Intel Xeon Gold 6448H 32C 250W 2.4GHz Processor Option Kit w/o Fan	2
4XG7A85292	BPQD	6448Y	ThinkSystem ST650 V3 Intel Xeon Gold 6448Y 32C 225W 2.1GHz Processor Option Kit w/o Fan	2
4XG7A85280	BPPG	8450H	ThinkSystem ST650 V3 Intel Xeon Platinum 8450H 28C 250W 2.0GHz Processor Option Kit w/o Fan	2

* These processors are single-socket capable processors and are only available in configure-to-order builds or in preconfigured models. Not available as option part numbers.

Configuration notes:

- Processor options include a heatsink but do not include a system fan

Processor features

The 4th Gen Intel Xeon Scalable processors introduce new embedded accelerators to add even more processing capability:

- QuickAssist Technology (Intel QAT)
  Help reduce system resource consumption by providing accelerated cryptography, key protection, and data compression with Intel QuickAssist Technology (Intel QAT). By offloading encryption and decryption, this built-in accelerator helps free up processor cores and helps systems serve a larger number of clients.
- Intel Dynamic Load Balancer (Intel DLB)
  Improve the system performance related to handling network data on multi-core Intel Xeon Scalable processors. Intel Dynamic Load Balancer (Intel DLB) enables the efficient distribution of network processing across multiple CPU cores/threads and dynamically distributes network data across multiple CPU cores for processing as the system load varies. Intel DLB also restores the order of networking data packets processed simultaneously on CPU cores.

- Intel Data Streaming Accelerator (Intel DSA)
  Drive high performance for storage, networking, and data-intensive workloads by improving streaming data movement and transformation operations. Intel Data Streaming Accelerator (Intel DSA) is designed to offload the most common data movement tasks that cause overhead in data center-scale deployments. Intel DSA helps speed up data movement across the CPU, memory, and caches, as well as all attached memory, storage, and network devices.

- Intel In-Memory Analytics Accelerator (Intel IAA)
  Run database and analytics workloads faster, with potentially greater power efficiency. Intel In-Memory Analytics Accelerator (Intel IAA) increases query throughput and decreases the memory footprint for in-memory database and big data analytics workloads. Intel IAA is ideal for in-memory databases, open source databases and data stores like RocksDB, Redis, Cassandra, and MySQL.

4th Gen Intel Xeon Scalable processors also support a separate and encrypted memory space, known as the SGX Enclave, for use by Intel Software Guard Extensions (SGX). The size of the SGX Enclave supported varies by processor model. Intel SGX offers hardware-based memory encryption that isolates specific application code and data in memory. It allows user-level code to allocate private regions of memory (enclaves) which are designed to be protected from processes running at higher privilege levels.

The following table summarizes the key features of all supported processors in the ST650 V3.

Table 10. Processor features

CPU model	Cores/ threads	Core speed (Base / TB max†)	L3 cache*	Max memory speed	UPI 2.0 links & speed	TDP	Accelerators				SGX Enclave Size
							QAT	DLB	DSA	IAA	
3408U	8 / 8**	1.8 / 1.9 GHz	22.5 MB*	4000 MHz	None‡	125W	0	0	1	0	64GB
4410T	10 / 20	2.7 / 4.0 GHz	26.25 MB*	4000 MHz	2 / 16 GT/s	150W	0	0	1	0	64GB
4410Y	12 / 24	2.0 / 3.9 GHz	30 MB*	4000 MHz	2 / 16 GT/s	150W	0	0	1	0	64GB
4416+	20 / 40	2.0 / 3.9 GHz	37.5 MB	4000 MHz	2 / 16 GT/s	165W	1	1	1	1	64GB
5411N	24 / 48	1.9 / 3.9 GHz	45 MB	4400 MHz	None‡	165W	2	2	1	0	128GB
5412U	24 / 48	2.1 / 3.9 GHz	45 MB	4400 MHz	None‡	185W	0	0	1	0	128GB
5415+	8 / 16	2.9 / 4.1 GHz	22.5 MB*	4400 MHz	3 / 16 GT/s	150W	1	1	1	1	128GB
5416S	16 / 32	2.0 / 4.0 GHz	30 MB	4400 MHz	3 / 16 GT/s	150W	2	2	1	0	128GB
5418N	24 / 48	1.8 / 3.8 GHz	45 MB	4000 MHz	3 / 16 GT/s	165W	2	2	1	0	128GB
5418Y	24 / 48	2.0 / 3.8 GHz	45 MB	4400 MHz	3 / 16 GT/s	185W	0	0	1	0	128GB
5420+	28 / 56	2.0 / 4.1 GHz	52.5 MB	4400 MHz	3 / 16 GT/s	205W	1	1	1	1	128GB
6414U	32 / 64	2.0 / 3.4 GHz	60 MB	4800 MHz	None‡	250W	0	0	1	0	128GB
6416H	18 / 36	2.2 / 4.2 GHz	45 MB*	4800 MHz	3 / 16 GT/s	165W	0	0	1	1	512GB
6418H	24 / 48	2.1 / 4.0 GHz	60 MB*	4800 MHz	3 / 16 GT/s	185W	0	0	1	1	512GB
6421N	32 / 64	1.8 / 3.6 GHz	60 MB	4400 MHz	None‡	185W	0	0	1	0	128GB
6426Y	16 / 32	2.5 / 4.1 GHz	37.5 MB*	4800 MHz	3 / 16 GT/s	185W	0	0	1	0	128GB
6428N	32 / 64	1.8 / 3.8 GHz	60 MB	4000 MHz	3 / 16 GT/s	185W	2	2	1	0	128GB
6434	8 / 16	3.7 / 4.1 GHz	22.5 MB*	4800 MHz	3 / 16 GT/s	195W	0	0	1	0	128GB
6434H	8 / 16	3.7 / 4.1 GHz	22.5 MB*	4800 MHz	3 / 16 GT/s	195W	0	0	1	1	512GB
6438M	32 / 64	2.2 / 3.9 GHz	60 MB	4800 MHz	3 / 16 GT/s	205W	0	0	1	1	128GB
6438N	32 / 64	2.0 / 3.6 GHz	60 MB	4800 MHz	3 / 16 GT/s	205W	2	2	1	0	128GB
6438Y+	32 / 64	2.0 / 4.0 GHz	60 MB	4800 MHz	3 / 16 GT/s	205W	1	1	1	1	128GB
6442Y	24 / 48	2.6 / 4.0 GHz	60 MB*	4800 MHz	3 / 16 GT/s	225W	0	0	1	0	128GB
6448H	32 / 64	2.4 / 4.1 GHz	60 MB	4800 MHz	3 / 16 GT/s	250W	2	2	1	1	512GB
6448Y	32 / 64	2.1 / 4.1 GHz	60 MB	4800 MHz	3 / 16 GT/s	225W	0	0	1	0	128GB
8450H	28 / 56	2.0 / 3.5 GHz	75 MB*	4800 MHz	4 / 16 GT/s	250W	0	0	4	4	512GB

† The maximum single-core frequency at with the processor is capable of operating
* L3 cache is 1.875 MB per core or larger. Processors with a larger L3 cache per core are marked with an *
** Bronze 3408U processor does not support Hyper-Threading Technology
‡ SKUs with a U suffix as well as some other SKUs have no UPI links and are are single-socket only

One-processor configurations

The ST650 V3 can be used with only one processor installed. Most core functions of the server (including the XClarity Controller) are connected to processor 1 as shown in the System architecture section.

With only one processor, the server has the following capabilities:

- 16 memory DIMMs for a 2TB maximum
- Slots 1-4 and slot 9 are available; Slot 5-8 are not available

Drive support is as follows:

- SAS/SATA drives are supported - 2.5-inch or 3.5-inch
- NVMe drives are supported, up to 4 drives (3.5-inch only)
- M.2 drives are supported

Controller support is as follows:

- 8x onboard SATA
- 4x onboard NVMe
- RAID adapters/HBAs installed in slots 1-4 and slot 9

Thermal restrictions by processor

Processors with a high TDP value require a lower ambient temperature. See the Operating environment section for details.

UEFI operating modes

The ST650 V3 offers preset operating modes that affect energy consumption and performance. These modes are a collection of predefined low-level UEFI settings that simplify the task of tuning the server to suit your business and workload requirements.

The following table lists the feature codes that allow you to specify the mode you wish to preset in the factory for CTO orders.

Table 11. UEFI operating mode presets in DCSC

Feature code	Description
BFYB	Operating mode selection for: "Maximum Performance Mode"
BFYC	Operating mode selection for: "Minimal Power Mode"
BFYD	Operating mode selection for: "Efficiency Favoring Power Savings Mode"
BFYE	Operating mode selection for: "Efficiency - Favoring Performance Mode"

The preset modes for the ST650 V3 are as follows:

- **Maximum Performance Mode** (feature BFYB): Achieves maximum performance but with higher power consumption and lower energy efficiency.
- **Minimal Power Mode** (feature BFYC): Minimize the absolute power consumption of the system.
- **Efficiency Favoring Power Savings Mode** (feature BFYD): Maximize the performance/watt efficiency with a bias towards power savings. This is the favored mode for SPECpower benchmark testing, for example.

- **Efficiency Favoring Performance Mode** (feature BFYE): Maximize the performance/watt efficiency with a bias towards performance. This is the favored mode for Energy Star certification, for example.

For details about these preset modes, and all other performance and power efficiency UEFI settings offered in the ST650 V3, see the paper "Tuning UEFI Settings for Performance and Energy Efficiency on Intel Xeon Scalable Processor-Based ThinkSystem Servers", available from https://lenovopress.lenovo.com/lp1477.

Memory options

The ST650 V3 uses Lenovo TruDDR5 memory operating at up to 4800 MHz. The server supports up to 32 DIMMs with 2 processors. The processors have 8 memory channels and support 2 DIMMs per channel (DPC). The server supports up to 4TB of memory using 32x 128GB 3DS RDIMMs and two processors.

DIMMs operate at up to 4800 MHz at 1 DPC and up to 4400 MHz at 2 DPC, depending on the memory bus speed of the processor selected. See the Processor features section for specifics.

The following table lists the memory options that are available for the server.

Lenovo TruDDR5 memory uses the highest quality components that are sourced from Tier 1 DRAM suppliers and only memory that meets the strict requirements of Lenovo is selected. It is compatibility tested and tuned to maximize performance and reliability. From a service and support standpoint, Lenovo TruDDR5 memory automatically assumes the system warranty, and Lenovo provides service and support worldwide.

Table 12. Memory options

Part number	Feature code	Description
9x4 RDIMMs - 4800 MHz		
4X77A77483	BNW5	ThinkSystem 32GB TruDDR5 4800MHz (1Rx4) 9x4 RDIMM
4X77A77033	BKTN	ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 9x4 RDIMM
10x4 RDIMMs - 4800 MHz		
4X77A77030	BNF6	ThinkSystem 32GB TruDDR5 4800MHz (1Rx4) 10x4 RDIMM
4X77A77032	BNF9	ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM
x8 RDIMMs - 4800 MHz		
4X77A77029	BKTL	ThinkSystem 16GB TruDDR5 4800MHz (1Rx8) RDIMM
4X77A77031	BKTM	ThinkSystem 32GB TruDDR5 4800MHz (2Rx8) RDIMM
3DS RDIMMs - 4800 MHz		
4X77A77034	BNFC	ThinkSystem 128GB TruDDR5 4800MHz (4Rx4) 3DS RDIMM v2

9x4 RDIMMs (also known as Optimized or EC4 RDIMMs) are a new lower-cost DDR5 memory option supported in ThinkSystem V3 servers. 9x4 DIMMs offer the same performance as standard RDIMMs (known as 10x4 or EC8 modules), however they support lower fault-tolerance characteristics. Standard RDIMMs and 3DS RDIMMs support two 40-bit subchannels (that is, a total of 80 bits), whereas 9x4 RDIMMs support two 36-bit subchannels (a total of 72 bits). The extra bits in the subchannels allow standard RDIMMs and 3DS RDIMMs to support Single Device Data Correction (SDDC), however 9x4 RDIMMs do not support SDDC. Note, however, that all DDR5 DIMMs, including 9x4 RDIMMs, support Bounded Fault correction, which enables the server to correct most common types of DRAM failures.

For more information on DDR5 memory, see the Lenovo Press paper, *Introduction to DDR5 Memory*, available from https://lenovopress.com/lp1618.

The following rules apply when selecting the memory configuration:

- The ST650 V3 only supports quantities of 1, 2, 4, 6, 8, 12, or 16 DIMMs per processor; other quantities not supported

- DIMMs operate at up to 4800 MHz at 1 DIMM per channel and up to 4400 MHz at 2 DIMMs per channel
- The server supports three types of DIMMs: 9x4 RDIMMs, RDIMMs, and 3DS RDIMMs; UDIMMs and LRDIMMs are not supported
- Mixing of DIMM types is not supported (9x4 DIMMs with 10x4 RDIMMs, 9x4 DIMMs with 3DS RDIMMs, 10x4 RDIMMs with 3DS RDIMMs)
- Mixing x4 and x8 DIMMs is not supported
- Mixing of DIMM rank counts is supported. Follow the required installation order installing the DIMMs with the higher rank counts first.
- Mixing of DIMM capacities is supported, however only two different capacities are supported across all channels of the processor. Follow the required installation order installing the larger DIMMs first.

For best performance, consider the following:

- Ensure the memory installed is at least the same speed as the memory bus of the selected processor.
- Populate all 8 memory channels.

The following memory protection technologies are supported:

- ECC detection/correction
- Bounded Fault detection/correction
- SDDC (for x4-based memory DIMMs; look for "x4" in the DIMM description)
- ADDDC (for 10x4-based memory DIMMs, not supported with 9x4 DIMMs)
- Memory mirroring

See the Lenovo Press article "RAS Features of the Lenovo ThinkSystem Intel Servers" for more information about memory RAS features: https://lenovopress.lenovo.com/lp1711-ras-features-of-the-lenovo-thinksystem-intel-servers

If memory channel mirroring is used, then DIMMs must be installed in pairs (minimum of one pair per processor), and both DIMMs in the pair must be identical in type and size. 50% of the installed capacity is available to the operating system. Memory rank sparing is not supported.

Persistent memory

The ST650 V3 does not support Persistent memory.

Internal storage

The ST650 V3 supports 2.5-inch or 3.5-inch hot-swap drives, at the front of the server, in a variety of drive bay configurations. Some drive bay configurations are supported with two 5.25-inch media bays for tape, RDX or optical drives.

The server also supports one or two M.2 drives, installed in an M.2 adapter internal to the server.

In this section:

- Drive bays
- NVMe drive support
- Backplanes
- Storage configurations
- Field upgrades
- M.2 drives

Drive bays

The ST650 V3 supports the drive bay configurations shown in the following figure.

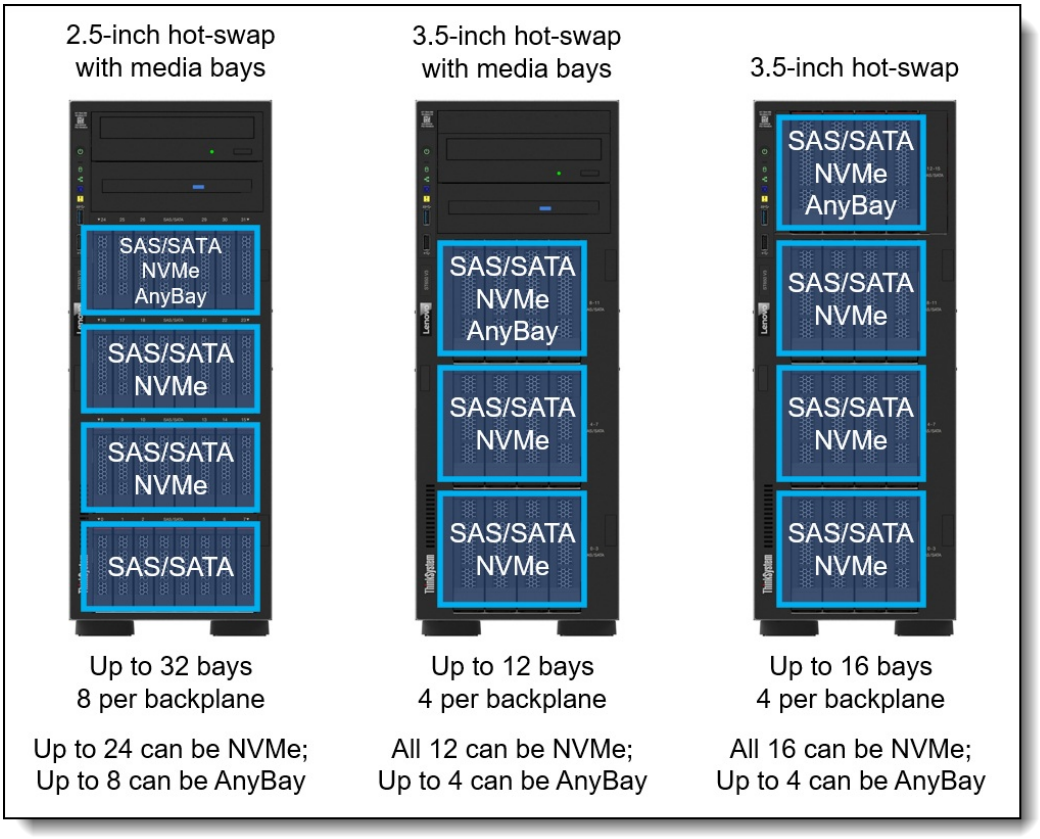

Figure 7. ST650 V3 drive bays

The configurations are as follows:

- 2.5-inch hot-swap drive bays
  - Up to 32 drive bays, 8 drives per backplane
  - All 32 drives can be SAS or SATA
  - 24 drives (3 backplanes) can be NVMe drive bays
  - 8 drives (1 backplane) can be AnyBay drive bays
  - Optional support for 2 media bays

- 12x 3.5-inch hot-swap drive bays
  - Up to 12 drive bays, 4 drives per backplane
  - All 12 drives can be SAS or SATA
  - All 12 drives can be NVMe
  - Up to 4 drives (1 backplane) can be AnyBay drive bays
  - Optional support for 2 media bays
  - Can be upgraded to 16x 3.5-inch drive bays by removing the media bays and installing ThinkSystem ST650 V2/V3 3.5" SAS/SATA 4-Bay Drive Bay 4 Cage Kit (4XF7A79787)
- 16x 3.5-inch hot-swap drive bays
  - Up to 16 drive bays, 4 drives per backplane
  - All 16 drives can be SAS or SATA
  - All 16 drives can be NVMe
  - Up to 4 drives (1 backplane) can be AnyBay drive bays
  - No support for 2 media bays

Simple-swap bays: The ST650 V3 does not support simple-swap drive bays

It is also possible to configure a server without any drives or backplanes. Drives and backplanes can be added in the field as described in the field upgrades section.

NVMe drive support

The ST650 V3 supports NVMe drives to maximize storage performance.

The server has 12x onboard NVMe ports with 2 processors installed (4x onboard NVMe ports with 1 processor installed).

Depending on the configuration, NVMe drives are connected ether to onboard NVMe ports or to retimer adapters installed in PCIe slots.

- 2.5-inch drive configurations:
  - Up to 24 NVMe drives without oversubscription (that is, each x4 drive has a full x4 (4 lanes) connection to the processor)
  - Up to 12 drives can be connected to onboard PCIe Gen4 NVMe ports
  - Other drives in the configuration are connected via retimer adapters
- 3.5-inch hot-swap drive configurations:
  - Up to 16 NVMe drives without oversubscription (that is, each x4 drive has a full x4 (4 lanes) connection to the processor)
  - Up to 12 drives can be connected to onboard PCIe Gen4 NVMe ports
  - Alternatively, drives can be configured using retimer adapters

Backplanes

The backplanes used to provide the drive bays are listed in the following table.

The table also lists the ordering information for the media bay that provides two 5.25-inch drive bays at the top of the server for a tape drive or optical drive. The media bays are not available when 16x 3.5-inch drive bays are configured.

Field upgrades: All backplanes are available as part numbers for field upgrades complete with the necessary cables, as listed in the table and described in the Field upgrades section below.

Table 13. Backplanes for drive bays

Part number*	Feature code	Description	Maximum supported
2.5-inch hot-swap			
4C57A82405	B8LU	ThinkSystem ST650 V3 2.5" SAS/SATA 8-Bay Backplane Kit	4
4C57A82406	BH8D	ThinkSystem ST650 V3 2.5" NVMe 8-Bay Backplane Kit	3
4C57A82407	BH8B	ThinkSystem ST650 V3 2.5" AnyBay 8-Bay Backplane Kit	1
3.5-inch hot-swap			
4C57A82402	BA5Q	ThinkSystem ST650 V3 3.5" SAS/SATA 4-Bay Backplane Kit	4
4C57A82403	BCQS	ThinkSystem ST650 V3 3.5" NVMe 4-Bay Backplane Kit	4
4C57A82404	BA5R	ThinkSystem ST650 V3 3.5" AnyBay 4-Bay Backplane Kit	1
Media bay			
4M27A60829	BA5W	ThinkSystem ST650 V2/V3 3.5" Chassis Media Bay Enablement Kit	1

* Part numbers include cables and other components as described in the Field upgrades section.

Storage configurations

This section describes the various combinations of front and rear drives that the server supports, as well as M.2 support.

In this section:

- Overview of configurations
- Details - Configurations with 3.5-inch front drive bays
- Details - Configurations with 2.5-inch front drive bays

Overview of configurations

The following tables summarize the storage configurations for the ST650 V3.

Storage configurations - 3.5-inch front drives

The following table summarizes the configurations that use 3.5-inch front drive bays.

Click to jump down to the details of the 3.5-inch configurations.

Table 14. Storage configurations - 3.5-inch front drives

Config	Total drives (NVMe)	SAS/SATA	AnyBay	NVMe	Backplanes
1	4 (0)	4	0	0	1x 4x3.5" SAS/SATA (BA5Q)
2	8 (0)	8	0	0	2x 4x3.5" SAS/SATA (BA5Q)
3	12 (0)	12	0	0	3x 4x3.5" SAS/SATA (BA5Q)
4	16 (0)	16	0	0	4x 4x3.5" SAS/SATA (BA5Q)
5	4 (0)	4	0	0	1x 4x3.5" SAS/SATA (BA5Q)
6	8 (0)	8	0	0	2x 4x3.5" SAS/SATA (BA5Q)
7	4 (4)	0	0	4	1x 4x3.5" NVMe (BCQS)
8	8 (8)	0	0	8	2x 4x3.5" NVMe (BCQS)
9	12 (12)	0	0	12	3x 4x3.5" NVMe (BCQS)
10	16 (16)	0	0	16	4x 4x3.5" NVMe (BCQS)
11	16 (16)	0	4	12	1x 4x3.5" AnyBay (BA5R) + 3x 4x3.5" NVMe (BCQS)
12	12 (4)	8	0	4	2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)
13	12 (4)	8	4	0	2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R)
14	16 (4)	12	0	4	3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)
15	16 (4)	12	4	0	3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R)

Storage configurations - 2.5-inch front drives

The following table summarizes the configurations that use 2.5-inch front drive bays.

Click to jump down to the details of the 2.5-inch configurations .

Table 15. Storage configurations - 2.5-inch front drives

Config	Total drives (NVMe)	SAS/SATA	AnyBay	NVMe	Backplanes
16	8 (0)	8	0	0	1x 8x2.5" SAS/SATA (B8LU)
17	8 (0)	8	0	0	1x 8x2.5" SAS/SATA (B8LU)
18	16 (0)	16	0	0	2x 8x2.5" SAS/SATA (B8LU)
19	24 (0)	24	0	0	3x 8x2.5" SAS/SATA (B8LU)
20	32 (0)	32	0	0	4x 8x2.5" SAS/SATA (B8LU)
21	8 (8)	0	8	0	1x 8x2.5" AnyBay (BH8B)
22	8 (8)	0	0	8	1x 8x2.5" NVMe (BH8D)
23	16 (16)	0	0	16	2x 8x2.5" NVMe (BH8D)
24	24 (24)	0	0	24	3x 8x2.5" NVMe (BH8D)
25	16 (16)	0	8	8	1x 8x2.5" AnyBay (BH8B) + 1x 8x2.5" NVMe (BH8D)
26	24 (24)	0	8	16	1x 8x2.5" AnyBay (BH8B) + 2x 8x2.5" NVMe (BH8D)
27	32 (8)	24	8	0	3x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B)
28	24 (8)	16	8	0	2x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B)
29	16 (8)	8	8	0	1x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B)

Details - 3.5-inch front bays

The following table lists the detailed configurations that use 3.5-inch front drive bays.

Click to go back to the overview of 3.5-inch configurations.

Table 16. Details - 3.5-inch front bays

Cfg	CPUs	SAS/SATA	AnyBay	NVMe	Backplanes	Supported controllers
1-1	1 or 2	4	0	0	1x 4x3.5" SAS/SATA (BA5Q)	1x (9350-8i or 5350-8i or 4350-8i)
1-2	1 or 2					1x (940-8i or 540-8i or 440-8i)
1-3	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
1-4	1 or 2					1x (940-16i or 540-16i or 440-16i)
2-1	1 or 2	8	0	0	2x 4x3.5" SAS/SATA (BA5Q)	1x (9350-8i or 5350-8i or 4350-8i)
2-2	1 or 2					1x (940-8i or 540-8i or 440-8i)
2-3	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
2-4	1 or 2					1x (940-16i or 540-16i or 440-16i)
3-1	1 or 2	12	0	0	3x 4x3.5" SAS/SATA (BA5Q)	2x (9350-8i or 5350-8i or 4350-8i)
3-2	1 or 2					2x (940-8i or 540-8i or 440-8i)
3-3	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
3-4	1 or 2					1x (940-16i or 540-16i or 440-16i)
3-5	2 only					1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
3-6	1 only					1x (940-16i CFF or 9350-16i CFF)
4-1	1 or 2	16	0	0	4x 4x3.5" SAS/SATA (BA5Q)	2x (9350-8i or 5350-8i or 4350-8i)
4-2	1 or 2					2x (940-8i or 540-8i or 440-8i)
4-3	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
4-4	1 or 2					1x (940-16i or 540-16i or 440-16i)
4-5	2 only					1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
4-6	1 only					1x (940-16i CFF or 9350-16i CFF)
4-7	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
4-8	1 or 2					1x (940-16i or 540-16i or 440-16i)
4-9	2 only					1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
4-10	1 only					1x (940-16i CFF or 9350-16i CFF)
5	1 or 2	4	0	0	1x 4x3.5" SAS/SATA (BA5Q)	1x OB SATA (SATA drives only, no SAS)
6	1 or 2	8	0	0	2x 4x3.5" SAS/SATA (BA5Q)	2x OB SATA (SATA drives only, no SAS)
7-1	1 or 2	0	0	4	1x 4x3.5" NVMe (BCQS)	OB NVMe
7-2	2 only					OB NVMe
8-1	2 only	0	0	8	2x 4x3.5" NVMe (BCQS)	OB NVMe
8-2	2 only					OB NVMe
9-1	2 only	0	0	12	3x 4x3.5" NVMe (BCQS)	OB NVMe
9-2	2 only					OB NVMe + 1x Retimer
10	2 only	0	0	16	4x 4x3.5" NVMe (BCQS)	OB NVMe + 1x Retimer
11-1	2 only	0	4	12	1x 4x3.5" AnyBay (BA5R) + 3x 4x3.5" NVMe (BCQS)	OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 1x Retimer
11-2	2 only					OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 1x Retimer
12-1	1 or 2	8	0	4	2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)	OB NVMe + 2x OB SATA (SATA drives only, no SAS)
12-2	1 or 2					OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i)

Cfg	CPUs	SAS/SATA	AnyBay	NVMe	Backplanes	Supported controllers
12-3	1 or 2					OB NVMe + 1x (940-8i or 540-8i or 440-8i)
12-4	2 only					OB NVMe + 2x OB SATA (SATA drives only, no SAS)
12-5	2 only					OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i)
12-6	2 only					OB NVMe + 1x (940-8i or 540-8i or 440-8i)
13-1	1 or 2	8	4	0	2x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R)	OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)
13-2	1 or 2					OB NVMe + 2x (940-8i or 540-8i or 440-8i)
13-3	1 or 2					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
13-4	1 or 2					OB NVMe + 1x (940-16i or 540-16i or 440-16i)
13-5	2 only					OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
13-6	2 only					OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)
13-7	2 only					OB NVMe + 2x (940-8i or 540-8i or 440-8i)
13-8	2 only					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
13-9	2 only					OB NVMe + 1x (940-16i or 540-16i or 440-16i)
13-10	2 only					OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
14-1	1 or 2	12	0	4	3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" NVMe (BCQS)	OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)
14-2	1 or 2					OB NVMe + 2x (940-8i or 540-8i or 440-8i)
14-3	1 or 2					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
14-4	1 or 2					OB NVMe + 1x (940-16i or 540-16i or 440-16i)
14-5	2 only					OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
14-6	1 or 2					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
14-7	1 or 2					OB NVMe + 1x (940-16i or 540-16i or 440-16i)
14-8	2 only					OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
15-1	1 or 2	12	4	0	3x 4x3.5" SAS/SATA (BA5Q) + 1x 4x3.5" AnyBay (BA5R)	OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)
15-2	1 or 2					OB NVMe + 2x (940-8i or 540-8i or 440-8i)
15-3	1 or 2					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
15-4	1 or 2					OB NVMe + 1x (940-16i or 540-16i or 440-16i)
15-5	2 only					OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
15-6	1 or 2					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
15-7	1 or 2					OB NVMe + 1x (940-16i or 540-16i or 440-16i)
15-8	2 only					OB NVMe + 1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)

Details - 2.5-inch front bays

The following table lists the detailed configurations that use 2.5-inch front drive bays.

Click to go back to the overview of 2.5-inch configurations.

Table 17. Details - 2.5-inch front bays

Cfg	CPUs	SAS/SATA	AnyBay	NVMe	Backplanes	Supported controllers
16	1 or 2	8	0	0	1x 8x2.5" SAS/SATA (B8LU)	2x OB SATA (SATA drives only, no SAS)
17-1	1 or 2	8	0	0	1x 8x2.5" SAS/SATA (B8LU)	1x (9350-8i or 5350-8i or 4350-8i)
17-2	1 or 2					1x (940-8i or 540-8i or 440-8i)
17-3	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
17-4	1 or 2					1x (940-16i or 540-16i or 440-16i)
17-5	2 only					1x (440-16i CFF or 940-16i CFF or 9350-16i CFF or 9350-8i CFF or 5350-8i CFF)
17-6	1 only					1x (940-16i CFF or 9350-16i CFF or 9350-8i CFF or 5350-8i CFF)
18-1	1 or 2	16	0	0	2x 8x2.5" SAS/SATA (B8LU)	2x (9350-8i or 5350-8i or 4350-8i)
18-2	1 or 2					2x (940-8i or 540-8i or 440-8i)
18-3	1 or 2					1x (9350-16i or 5350-16i or 4350-16i)
18-4	1 or 2					1x (940-16i or 540-16i or 440-16i)
18-5	2 only					1x (440-16i CFF or 940-16i CFF or 9350-16i CFF)
18-6	1 only					1x (940-16i CFF or 9350-16i CFF)
19-1	1 or 2	24	0	0	3x 8x2.5" SAS/SATA (B8LU)	1x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i)
19-2	1 or 2					1x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)
19-3	1 or 2					3x (9350-8i or 5350-8i or 4350-8i)
19-4	1 or 2					3x (940-8i or 540-8i or 440-8i)
19-5	1 or 2					1x 940-32i
20-1	1 or 2	32	0	0	4x 8x2.5" SAS/SATA (B8LU)	2x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i)
20-2	1 or 2					2x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)
20-3	1 or 2					2x (9350-16i or 5350-16i or 4350-16i)
20-4	1 or 2					2x (940-16i or 540-16i or 440-16i)
20-5	1 or 2					1x 940-32i
20-6	1 or 2					1x 940-32i
20-7	2 only					1x (9350-16i or 5350-16i or 4350-16i) + 1x 9350-16i CFF
20-8	1 only					1x (9350-16i or 5350-16i or 4350-16i) + 1x 9350-16i CFF
20-9	2 only					1x (940-16i or 540-16i or 440-16i) + 1x (440-16i CFF or 940-16i CFF)
20-10	1 only					1x (940-16i or 540-16i or 440-16i) + 1x 940-16i CFF
21-1	2 only	0	8	0	1x 8x2.5" AnyBay (BH8B)	OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i)
21-2	2 only					OB NVMe + 1x (940-8i or 540-8i or 440-8i)
22	2 only	0	0	8	1x 8x2.5" NVMe (BH8D)	OB NVMe
23	2 only	0	0	16	2x 8x2.5" NVMe (BH8D)	OB NVMe + 1x Retimer
24	2 only	0	0	24	3x 8x2.5" NVMe (BH8D)	OB NVMe + 3x Retimer
25-1	2 only	0	8	8	1x 8x2.5" AnyBay (BH8B) + 1x 8x2.5" NVMe (BH8D)	OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 1x Retimer
25-2	2 only					OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 1x Retimer
26-1	2 only	0	8	16	1x 8x2.5" AnyBay (BH8B) + 2x 8x2.5" NVMe (BH8D)	OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 3x Retimer

Cfg	CPUs	SAS/SATA	AnyBay	NVMe	Backplanes	Supported controllers
26-2	2 only					OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 3x Retimer
27-1	2 only	24	8	0	3x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B)	OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i)
27-2	2 only					OB NVMe + 2x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)
27-3	2 only					OB NVMe + 2x (9350-16i or 5350-16i or 4350-16i)
27-4	2 only					OB NVMe + 2x (940-16i or 540-16i or 440-16i)
27-5	2 only					OB NVMe + 1x 940-32i
27-6	2 only					OB NVMe + 1x 940-32i
27-7	2 only					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i) + 1x 9350-16i CFF
27-8	2 only					OB NVMe + 1x (940-16i or 540-16i or 440-16i) + 1x (440-16i CFF or 940-16i CFF)
28-1	2 only	16	8	0	2x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B)	OB NVMe + 1x (9350-8i or 5350-8i or 4350-8i) + 1x (9350-16i or 5350-16i or 4350-16i)
28-2	2 only					OB NVMe + 1x (940-8i or 540-8i or 440-8i) + 1x (940-16i or 540-16i or 440-16i)
28-3	2 only					OB NVMe + 3x (9350-8i or 5350-8i or 4350-8i)
28-4	2 only					OB NVMe + 3x (940-8i or 540-8i or 440-8i)
28-5	2 only					OB NVMe + 1x 940-32i
29-1	2 only	8	8	0	1x 8x2.5" SAS/SATA (B8LU) + 1x 8x2.5" AnyBay (BH8B)	OB NVMe + 2x (9350-8i or 5350-8i or 4350-8i)
29-2	2 only					OB NVMe + 2x (940-8i or 540-8i or 440-8i)
29-3	2 only					OB NVMe + 1x (9350-16i or 5350-16i or 4350-16i)
29-4	2 only					OB NVMe + 1x (940-16i or 540-16i or 440-16i)

Field upgrades

The ST650 V3 is orderable without drive bays, allowing you to add a backplane, cabling and controllers as field upgrades. The server also supports upgrading some configurations by adding additional drive bay backplanes (for example, upgrading from 8 to 16x 2.5-inch drive bays).

Upgrade path: The key criteria for upgrade support is to ensure that the target configuration is one of the supported drive bay configurations as listed in the Storage configurations section.

To add drive bays you will need to order the appropriate backplane kit(s). Backplane kits include the necessary cables.

The following table lists the part numbers for drive backplanes and the media bay cage. For more information, see the Internal Cable Routing section of the Users Guide, available from: http://pubs.lenovo.com/st650-v3/internal_cable_routing

Table 18. Field upgrades for drives bay backplanes

Part number	Description
2.5-inch backplane kits (includes cables)	
4C57A82407	ThinkSystem ST650 V3 2.5" AnyBay 8-Bay Backplane Kit
4C57A82406	ThinkSystem ST650 V3 2.5" NVMe 8-Bay Backplane Kit
4C57A82405	ThinkSystem ST650 V3 2.5" SAS/SATA 8-Bay Backplane Kit
3.5-inch backplane kits (includes cables)	
4C57A82404	ThinkSystem ST650 V3 3.5" AnyBay 4-Bay Backplane Kit
4C57A82403	ThinkSystem ST650 V3 3.5" NVMe 4-Bay Backplane Kit
4C57A82402	ThinkSystem ST650 V3 3.5" SAS/SATA 4-Bay Backplane Kit
Replace media bay with 4x 3.5-inch drive bays	
4XF7A79787	ThinkSystem ST650 V2/V3 3.5" SAS/SATA 4-Bay Drive Bay 4 Cage Kit • 1x Cage for 4x 3.5-inch drive bays • 4x 3.5-inch drive bay fillers

When adding drive bays, you will also need to add the appropriate storage controller(s). Consult the tables in the Controller selections section to determine what controller sections are supported and what additional controllers you will need. Controllers are described in the Controllers for internal storage section.

Some field upgrades require additional cable kits, as described in the following table.

Table 19. Cable kits for field upgrades related to drive bays

Part number	Description	Purpose
4Z57A82408	ThinkSystem ST650 V3 Internal HBA/RAID Adapter Cable Kit	To add an internal (CFF) storage adapter (HBA or RAID adapter) to a configuration. Either replacing an existing adapter in a rear PCIe slot, or adding the CFF adapter to a server without any storage adapter installed.
4Z57A16098	ThinkSystem ST650 V2 Retimer Cable Kit for 3.5" HDD	NVMe cable required when you add a 3.5-inch AnyBay or NVMe backplane and want to connect it to an NVMe retimer adapter.
4Z57A16104	ThinkSystem ST650 V2 Retimer Cable Kit for 2.5" HDD	NVMe cable required when you add a 2.5-inch AnyBay or NVMe backplane and want to connect it to an NVMe retimer adapter.
4Z57A82409	ThinkSystem ST650 V3 HW RAID/HBA Adapter Cable Kit	Your existing configuration uses the onboard SATA ports and you wish to upgrade to a RAID adapter or HBA installed in one of the rear PCIe slots.

M.2 drives

The ST650 V3 supports one or two M.2 form-factor SATA or NVMe drives for use as an operating system boot solution or as additional storage. The M.2 drives install into an M.2 module which is mounted on the side of the drive bays.

The supported M.2 modules are listed in the following table.

Table 20. M.2 modules

Part number	Feature code	Description	SATA drives	NVMe drives	RAID	Max qty
4Y37A09738	B5XJ	ThinkSystem M.2 SATA/NVMe 2-Bay Enablement Kit	Yes	Yes (x1 lane)	VROC	1
4Y37A09750	B8P9	ThinkSystem M.2 NVMe 2-Bay RAID Enablement Kit	No	Yes (x1 lane)	Integrated	1

Supported drives are listed in the Internal drive options section.

Configuration rules:

- The use of NVMe M.2 drives requires performance (dual-rotor) cooling fans

The ThinkSystem M.2 SATA/NVMe 2-Bay Enablement Kit (4Y37A09738) has the following features:

- Supports one or two M.2 drives, either SATA or NVMe
- When two drives installed, they must be either both SATA or both NVMe
- Support 42mm, 60mm, 80mm and 110mm drive form factors (2242, 2260, 2280 and 22110)
- JBOD native support; RAID can be enabled via Intel VROC (no built-in RAID support)
- Either 6Gbps SATA or PCIe 3.0 x1 interface to the drives depending on the drives installed
- Supports monitoring and reporting of events and temperature through I2C
- Firmware update via Lenovo firmware update tools

The ThinkSystem M.2 NVMe 2-Bay RAID Enablement Kit (4Y37A09750) has the following features:

- Supports one or two NVMe M.2 drives
- Support 42mm, 60mm, 80mm and 110mm drive form factors (2242, 2260, 2280 and 22110)
- RAID support via an onboard Marvell 88NR2241 NVMe RAID Controller
- With 1 drive, supports single-drive RAID-0
- With 2 drives, supports 2-drive RAID-0, 2-drive RAID-1, or two single-drive RAID-0 arrays
- PCIe 3.0 x2 host interface; PCIe 3.0 x1 connection to each drive
- Management and configuration support via UEFI and OS-based tools
- Supports monitoring and reporting of events and temperature through I2C
- Firmware update via Lenovo firmware update tools

For field upgrades, the ST650 V3 also requires an additional M.2 cable kit. Ordering information is listed in the following table.

Table 21. M.2 Cable for field upgrades

Part number	Description
4Z57A16099	ThinkSystem ST650 V2 M.2 Cable Kit • M.2 Signal & Power Cable, 280mm

Controllers for internal storage

The ST650 V3 offers a variety of controller options for internal 2.5-inch and 3.5-inch drives:

- Onboard SATA ports with software RAID support (Intel VROC SATA RAID, formerly known as Intel RSTe)
- Onboard NVMe ports with software RAID support (Intel VROC NVMe RAID)
- RAID adapters and HBAs for SAS/SATA drives (PCIe slot-based)
- RAID adapters and HBAs for SAS/SATA drives (cabled in a dedicated space)

The following table lists the adapters used for the internal storage of the server.

As well as supporting RAID adapters and HBAs that install in a PCIe slot, the ST650 V3 supports a internal adapter (also known as CFF or custom form factor adapter) that is mounted internally in the server and cabled to one of the onboard NVMe ports. The adapter is mounted adjacent to the drive bays and in front of the fans, and does not occupy a standard PCIe slot. See the Internal view for the location.

Table 22. Internal storage adapter support

Part number	Feature code	Description	PCIe lanes	Max qty	Slots supported	Form factor	Power module (supercap)
Onboard SATA - up to 8 drives - Intel VROC SATA RAID (Intel RSTe)							
None	AVV0	On Board SATA Software RAID Mode	-	1	Not applicable	-	No
Onboard NVMe - up to 12 drives - Intel VROC NVMe RAID							
4L47A83669	BR9B	Intel VROC (VMD NVMe RAID) Standard	-	1	Not applicable	-	No
4L47A39164	B96G	Intel VROC (VMD NVMe RAID) Premium	-	1	Not applicable	-	No
SAS HBA - PCIe Gen 3							
4Y37A72481	BJHJ	ThinkSystem 4350-16i SAS/SATA 12Gb HBA	PCIe x8	2	All slots	LP	No
4Y37A72480	BJHH	ThinkSystem 4350-8i SAS/SATA 12Gb HBA	PCIe x8	4	All slots	LP	No
SAS HBA - PCIe Gen 4							
4Y37A78601	BM51	ThinkSystem 440-8i SAS/SATA PCIe Gen4 12Gb HBA	PCIe x8	4	All slots	LP	No
4Y37A78602	BM50	ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb HBA	PCIe x8	2	All slots	LP	No
4Y37A09725	B8P1	ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA	PCIe x8	1	Cabled (CFF)	CFF	No
RAID controllers - PCIe Gen 3							
4Y37A72482	BJHK	ThinkSystem RAID 5350-8i PCIe 12Gb Adapter	PCIe x8	3	All slots	LP	No
4Y37A84028	BRQV	ThinkSystem RAID 5350-8i PCIe 12Gb Internal Adapter	PCIe x8	1	Cabled (CFF)	CFF	No
4Y37A72483	BJHL	ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Adapter	PCIe x8	3	All slots	LP	Included
4Y37A72484	BJHM	ThinkSystem RAID 9350-8i 2GB Flash PCIe 12Gb Internal Adapter	PCIe x8	1	Cabled (CFF)	CFF	Included

Part number	Feature code	Description	PCIe lanes	Max qty	Slots supported	Form factor	Power module (supercap)
4Y37A72485	BJHN	ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Adapter	PCIe x8	2	All slots	LP	Included
4Y37A72486	BJHP	ThinkSystem RAID 9350-16i 4GB Flash PCIe 12Gb Internal Adapter	PCIe x8	1	Cabled (CFF)	CFF	Included
RAID controllers - PCIe Gen 4							
4Y37A78834	BMFT	ThinkSystem RAID 540-8i PCIe Gen4 12Gb Adapter	PCIe x8	3	All slots	LP	No
4Y37A78835	BNAX	ThinkSystem RAID 540-16i PCIe Gen4 12Gb Adapter	PCIe x8	2	All slots	LP	No
4Y37A09728	B8NY	ThinkSystem RAID 940-8i 4GB Flash PCIe Gen4 12Gb Adapter	PCIe x8	3	All slots	LP	Included
4Y37A78600	BM35	ThinkSystem RAID 940-16i 4GB Flash PCIe Gen4 12Gb Adapter for U.3	PCIe x8	2	All slots	LP	Included
4Y37A09730	B8NZ	ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Adapter	PCIe x8	2	All slots	LP	Included
4Y37A09735	B8P0	ThinkSystem RAID 940-16i 8GB Flash PCIe Gen4 12Gb Internal Adapter	PCIe x8	1	Cabled (CFF)	CFF	Included
4Y37A09733	B8P8	ThinkSystem RAID 940-32i 8GB Flash PCIe Gen4 12Gb Adapter	PCIe x8	1	5-9	FHHL	Included
NVMe adapters - PCIe Gen 4							
4C57A65446	B98C	ThinkSystem 4-Port PCIe Gen4 NVMe Retimer Adapter	PCIe x16	3	1,3,5,7	LP	No

Configuration notes:

- **Supercap support limits the number of RAID adapters installable** : RAID 9350 and 940 adapters include a power module (supercap) to power the flash memory. The server supports up to 4 supercaps, mounted on the side of the drive bays. The number of supercaps supported also determines the maximum number of RAID adapters with flash that can be installed in the server.
- **E810 Ethernet and X350 RAID/HBAs**: The use of both an Intel E810 network adapter and an X350 HBA/RAID adapter (9350, 5350 and 4350) is currently not supported in ThinkSystem servers. For details see Support Tip HT513226. Planned support for this combination of adapters is 4Q/2023 (SI 23-2).

The onboard SATA controller has the following features:

- Controller integrated into the Intel PCH
- Supports up to 8 SATA drives
- 6 Gbps SATA host interface
- Supports RAID-0, 1, 5, 10 (Intel VROC SATA RAID, previously known as RSTe)
- Supports JBOD
- Supports HDDs and SSDs; can be mixed

The onboard NVMe support has the following features:

- Controller integrated into the Intel processor
- Supports up to 12 NVMe drives
- Each drive has PCIe 4.0 x4 host interface
- Supports JBOD - Intel and non-Intel NVMe SSDs
- Supports RAID-0, 1, 10 on Intel and non-Intel NVMe SSDs - Intel VROC Standard

- VROC Premium adds RAID-5 support on Intel and non-Intel NVMe SSDs

Intel VROC onboard RAID

Intel VROC (Virtual RAID on CPU) is a feature of the Intel processor that enables RAID support.

There are two separate functions of VROC in the ST650 V3:

- Intel VROC SATA RAID, formerly known as Intel RSTe
- Intel VROC NVMe RAID

VROC SATA RAID (RSTe) is available and supported with all SATA drives, both SATA SSDs and SATA HDDs. It offers a 6 Gb/s connection to each drive and on the ST650 V3 implements RAID levels 0, 1, 5, and 10. RAID 1 is limited to 2 drives per array, and RAID 10 is limited to 4 drives per array. Hot-spare functionality is also supported.

VROC NVMe RAID offers RAID support for any NVMe drives directly connected to the ports on the server's system board or via adapters such as NVMe retimers or NVMe switch adapters. On the ST650 V3, it implements RAID levels 0, 1, 10 and optionally RAID 5. RAID 1 is limited to 2 drives per array, and RAID 10 is limited to 4 drives per array. Hot-spare functionality is also supported.

Performance tip: For best performance with VROC NVMe RAID, the drives in an array should all be connected to the same processor. Spanning processors is possible however performance will be unpredictable and should be evaluated based on your workload.

The ST650 V3 supports the VROC NVMe RAID offerings listed in the following table. The VROC Standard offering supports RAID 0, 1, and 10, however RAID 5 is not supported.

Tip: These feature codes and part numbers are only for VROC RAID using NVMe drives, not SATA drives

Table 23. VROC subsection

Part number	Feature code	Description	Intel SSDs	Non-Intel SSDs	RAID 0	RAID 1	RAID 10	RAID 5
4L47A83669	BR9B	Intel VROC (VMD NVMe RAID) Standard	Yes	Yes	Yes	Yes	Yes	No
4L47A39164	B96G	Intel VROC (VMD NVMe RAID) Premium	Yes	Yes	Yes	Yes	Yes	Yes

The part number(s) listed in the table enables field upgrades. These are fulfilled as a Feature on Demand (FoD) license and is activated via the XCC management processor user interface.

Virtualization support: Virtualization support for Intel VROC is as follows:

- **VROC SATA RAID (RSTe)**: VROC SATA RAID is not supported by virtualization hypervisors such as ESXi, KVM, Xen, and Hyper-V. Virtualization is only supported on the onboard SATA ports in AHCI (non-RAID) mode.
- **VROC (VMD) NVMe RAID**: VROC (VMD) NVMe RAID is supported by ESXi, KVM, Xen, and Hyper-V. ESXi support is limited to RAID 1 only; other RAID levels are not supported. Windows and Linux OSes support VROC RAID NVMe, both for host boot functions and for guest OS function, and RAID-0, 1, 5, and 10 are supported.

For specifications about the RAID adapters and HBAs supported by the ST650 V3, see the ThinkSystem RAID Adapter and HBA Comparison, available from: https://lenovopress.com/lp1288-lenovo-thinksystem-raid-adapter-and-hba-reference#st650-v3-support=ST650%2520V3

For details about these adapters, see the relevant product guide:

- SAS HBAs: https://lenovopress.com/servers/options/hba
- RAID adapters: https://lenovopress.com/servers/options/raid

Internal drive options

The following tables list the drive options for internal storage of the server.

2.5-inch hot-swap drives:

- 2.5-inch hot-swap 12 Gb SAS HDDs
- 2.5-inch hot-swap 24 Gb SAS SSDs
- 2.5-inch hot-swap 6 Gb SATA SSDs
- 2.5-inch hot-swap PCIe 4.0 NVMe SSDs

3.5-inch hot-swap drives:

- 3.5-inch hot-swap 12 Gb SAS HDDs
- 3.5-inch hot-swap 6 Gb SATA HDDs
- 3.5-inch hot-swap 24 Gb SAS SSDs
- 3.5-inch hot-swap 6 Gb SATA SSDs
- 3.5-inch hot-swap PCIe 4.0 NVMe SSDs

M.2 drives:

- M.2 SATA drives
- M.2 PCIe 4.0 NVMe drives

M.2 drive support: The use of M.2 drives requires an additional adapter as described in the M.2 drives subsection.

SED support: The tables include a column to indicate which drives support SED encryption. The encryption functionality can be disabled if needed. Note: Not all SED-enabled drives have "SED" in the description.

Table 24. 2.5-inch hot-swap 12 Gb SAS HDDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch hot-swap HDDs - 12 Gb SAS 15K				
7XB7A00021	AULV	ThinkSystem 2.5" 300GB 15K SAS 12Gb Hot Swap 512n HDD	No	32
7XB7A00022	AULW	ThinkSystem 2.5" 600GB 15K SAS 12Gb Hot Swap 512n HDD	No	32
7XB7A00023	AULX	ThinkSystem 2.5" 900GB 15K SAS 12Gb Hot Swap 512e HDD	No	32
2.5-inch hot-swap HDDs - 12 Gb SAS 10K				
7XB7A00025	AULZ	ThinkSystem 2.5" 600GB 10K SAS 12Gb Hot Swap 512n HDD	No	32
7XB7A00027	AUM1	ThinkSystem 2.5" 1.2TB 10K SAS 12Gb Hot Swap 512n HDD	No	32
7XB7A00028	AUM2	ThinkSystem 2.5" 1.8TB 10K SAS 12Gb Hot Swap 512e HDD	No	32
4XB7A83970	BRG7	ThinkSystem 2.5" 2.4TB 10K SAS 12Gb Hot Swap 512e HDD v2	No	32
2.5-inch hot-swap SED HDDs - 12 Gb SAS 10K				
7XB7A00031	AUM5	ThinkSystem 2.5" 600GB 10K SAS 12Gb Hot Swap 512n HDD SED	Support	32
7XB7A00033	B0YX	ThinkSystem 2.5" 1.2TB 10K SAS 12Gb Hot Swap 512n HDD SED	Support	32

Table 25. 2.5-inch hot-swap 24 Gb SAS SSDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch hot-swap SSDs - 24 Gb SAS - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A80340	BNW8	ThinkSystem 2.5" PM1655 800GB Mixed Use SAS 24Gb HS SSD	Support	32
4XB7A80341	BNW9	ThinkSystem 2.5" PM1655 1.6TB Mixed Use SAS 24Gb HS SSD	Support	32
4XB7A80342	BNW6	ThinkSystem 2.5" PM1655 3.2TB Mixed Use SAS 24Gb HS SSD	Support	32
2.5-inch hot-swap SSDs - 24 Gb SAS - Read Intensive/Entry/Capacity (<3 DWPD)				
4XB7A80318	BNWC	ThinkSystem 2.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Support	32
4XB7A80319	BNWE	ThinkSystem 2.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Support	32
4XB7A80320	BNWF	ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Support	32

Table 26. 2.5-inch hot-swap 6 Gb SATA SSDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch hot-swap SSDs - 6 Gb SATA - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A82289	BQ21	ThinkSystem 2.5" 5400 MAX 480GB Mixed Use SATA 6Gb HS SSD	Support	32
4XB7A82290	BQ24	ThinkSystem 2.5" 5400 MAX 960GB Mixed Use SATA 6Gb HS SSD	Support	32
4XB7A82291	BQ22	ThinkSystem 2.5" 5400 MAX 1.92TB Mixed Use SATA 6Gb HS SSD	Support	32
4XB7A82292	BQ23	ThinkSystem 2.5" 5400 MAX 3.84TB Mixed Use SATA 6Gb HS SSD	Support	32
4XB7A17125	BA7Q	ThinkSystem 2.5" S4620 480GB Mixed Use SATA 6Gb HS SSD	No	32
4XB7A17126	BA4T	ThinkSystem 2.5" S4620 960GB Mixed Use SATA 6Gb HS SSD	No	32
4XB7A17127	BA4U	ThinkSystem 2.5" S4620 1.92TB Mixed Use SATA 6Gb HS SSD	No	32
4XB7A17128	BK7L	ThinkSystem 2.5" S4620 3.84TB Mixed Use SATA 6Gb HS SSD	No	32
2.5-inch hot-swap SSDs - 6 Gb SATA - Read Intensive/Entry (<3 DWPD)				
4XB7A82258	BQ1Q	ThinkSystem 2.5" 5400 PRO 240GB Read Intensive SATA 6Gb HS SSD	Support	32
4XB7A82259	BQ1P	ThinkSystem 2.5" 5400 PRO 480GB Read Intensive SATA 6Gb HS SSD	Support	32
4XB7A82260	BQ1R	ThinkSystem 2.5" 5400 PRO 960GB Read Intensive SATA 6Gb HS SSD	Support	32
4XB7A82261	BQ1X	ThinkSystem 2.5" 5400 PRO 1.92TB Read Intensive SATA 6Gb HS SSD	Support	32
4XB7A82262	BQ1S	ThinkSystem 2.5" 5400 PRO 3.84TB Read Intensive SATA 6Gb HS SSD	Support	32
4XB7A82263	BQ1T	ThinkSystem 2.5" 5400 PRO 7.68TB Read Intensive SATA 6Gb HS SSD	Support	32
4XB7A17072	B99D	ThinkSystem 2.5" S4520 240GB Read Intensive SATA 6Gb HS SSD	No	32
4XB7A17101	BA7G	ThinkSystem 2.5" S4520 480GB Read Intensive SATA 6Gb HS SSD	No	32
4XB7A17102	BA7H	ThinkSystem 2.5" S4520 960GB Read Intensive SATA 6Gb HS SSD	No	32
4XB7A17103	BA7J	ThinkSystem 2.5" S4520 1.92TB Read Intensive SATA 6Gb HS SSD	No	32
4XB7A17104	BK77	ThinkSystem 2.5" S4520 3.84TB Read Intensive SATA 6Gb HS SSD	No	32
4XB7A17105	BK78	ThinkSystem 2.5" S4520 7.68TB Read Intensive SATA 6Gb HS SSD	No	32

Table 27. 2.5-inch hot-swap PCIe 4.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A17129	BNEG	ThinkSystem 2.5" U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	Support	24
4XB7A17130	BNEH	ThinkSystem 2.5" U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	Support	24
2.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A13941	BMGD	ThinkSystem 2.5" U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	Support	24
4XB7A13942	BMGE	ThinkSystem 2.5" U.2 P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	Support	24

Note: NVMe PCIe SSDs support surprise hot removal and hot insertion, provided the operating system supports PCIe SSD hot-swap.

Table 28. 3.5-inch hot-swap 12 Gb SAS HDDs

Part number	Feature code	Description	SED support	Max Qty
3.5-inch hot-swap HDDs - 12 Gb NL SAS				
7XB7A00042	AUU5	ThinkSystem 3.5" 2TB 7.2K SAS 12Gb Hot Swap 512n HDD	No	16
7XB7A00043	AUU6	ThinkSystem 3.5" 4TB 7.2K SAS 12Gb Hot Swap 512n HDD	No	16
7XB7A00044	AUU7	ThinkSystem 3.5" 6TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
7XB7A00045	B0YR	ThinkSystem 3.5" 8TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
7XB7A00046	AUUG	ThinkSystem 3.5" 10TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
7XB7A00067	B117	ThinkSystem 3.5" 12TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
4XB7A13906	B496	ThinkSystem 3.5" 14TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
4XB7A13911	B7EZ	ThinkSystem 3.5" 16TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
4XB7A38266	BCFP	ThinkSystem 3.5" 18TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16
4XB7A80353	BPKU	ThinkSystem 3.5" 20TB 7.2K SAS 12Gb Hot Swap 512e HDD	No	16

Table 29. 3.5-inch hot-swap 6 Gb SATA HDDs

Part number	Feature code	Description	SED support	Max Qty
3.5-inch hot-swap HDDs - 6 Gb NL SATA				
7XB7A00049	AUUF	ThinkSystem 3.5" 1TB 7.2K SATA 6Gb Hot Swap 512n HDD	No	16
7XB7A00050	AUUD	ThinkSystem 3.5" 2TB 7.2K SATA 6Gb Hot Swap 512n HDD	No	16
7XB7A00051	AUU8	ThinkSystem 3.5" 4TB 7.2K SATA 6Gb Hot Swap 512n HDD	No	16
7XB7A00052	AUUA	ThinkSystem 3.5" 6TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
7XB7A00053	AUU9	ThinkSystem 3.5" 8TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
7XB7A00054	AUUB	ThinkSystem 3.5" 10TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
7XB7A00068	B118	ThinkSystem 3.5" 12TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
4XB7A13907	B497	ThinkSystem 3.5" 14TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
4XB7A13914	B7F0	ThinkSystem 3.5" 16TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
4XB7A38130	BCFH	ThinkSystem 3.5" 18TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16
4XB7A80354	BPKV	ThinkSystem 3.5" 20TB 7.2K SATA 6Gb Hot Swap 512e HDD	No	16

Table 30. 3.5-inch hot-swap 24 Gb SAS SSDs

Part number	Feature code	Description	SED support	Max Qty
3.5-inch hot-swap SSDs - 24 Gb SAS - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A80344	BNW7	ThinkSystem 3.5" PM1655 800GB Mixed Use SAS 24Gb HS SSD	Support	16
4XB7A80345	BNWA	ThinkSystem 3.5" PM1655 1.6TB Mixed Use SAS 24Gb HS SSD	Support	16
4XB7A80346	BNWB	ThinkSystem 3.5" PM1655 3.2TB Mixed Use SAS 24Gb HS SSD	Support	16
3.5-inch hot-swap SSDs - 24 Gb SAS - Read Intensive/Entry/Capacity (<3 DWPD)				
4XB7A80324	BNWD	ThinkSystem 3.5" PM1653 960GB Read Intensive SAS 24Gb HS SSD	Support	16
4XB7A80325	BNWG	ThinkSystem 3.5" PM1653 1.92TB Read Intensive SAS 24Gb HS SSD	Support	16
4XB7A80326	BNWH	ThinkSystem 3.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD	Support	16

Table 31. 3.5-inch hot-swap 6 Gb SATA SSDs

Part number	Feature code	Description	SED support	Max Qty
3.5-inch hot-swap SSDs - 6 Gb SATA - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A17137	BA4W	ThinkSystem 3.5" S4620 480GB Mixed Use SATA 6Gb HS SSD	No	16
4XB7A17138	BA4X	ThinkSystem 3.5" S4620 960GB Mixed Use SATA 6Gb HS SSD	No	16
4XB7A17139	BA4Y	ThinkSystem 3.5" S4620 1.92TB Mixed Use SATA 6Gb HS SSD	No	16
4XB7A17140	BK7P	ThinkSystem 3.5" S4620 3.84TB Mixed Use SATA 6Gb HS SSD	No	16
3.5-inch hot-swap SSDs - 6 Gb SATA - Read Intensive/Entry (<3 DWPD)				
4XB7A17118	BA7K	ThinkSystem 3.5" S4520 240GB Read Intensive SATA 6Gb HS SSD	No	16
4XB7A17119	BA7L	ThinkSystem 3.5" S4520 480GB Read Intensive SATA 6Gb HS SSD	No	16
4XB7A17120	BA7M	ThinkSystem 3.5" S4520 960GB Read Intensive SATA 6Gb HS SSD	No	16
4XB7A17121	BA7N	ThinkSystem 3.5" S4520 1.92TB Read Intensive SATA 6Gb HS SSD	No	16
4XB7A17122	BK7F	ThinkSystem 3.5" S4520 3.84TB Read Intensive SATA 6Gb HS SSD	No	16
4XB7A17123	BK7G	ThinkSystem 3.5" S4520 7.68TB Read Intensive SATA 6Gb HS SSD	No	16

Table 32. 3.5-inch hot-swap PCIe 4.0 NVMe SSDs

Part number	Feature code	Description	SED support	Max Qty
3.5-inch SSDs - U.2 PCIe 4.0 NVMe - Mixed Use/Mainstream (3-5 DWPD)				
4XB7A17141	BNEK	ThinkSystem 3.5" U.2 P5620 1.6TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	Support	16
4XB7A17143	BNEM	ThinkSystem 3.5" U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD	Support	16
3.5-inch SSDs - U.2 PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A13632	BNES	ThinkSystem 3.5" U.2 P5520 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	Support	16
4XB7A76777	BNET	ThinkSystem 3.5" U.2 P5520 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	Support	16

Note: NVMe PCIe SSDs support surprise hot removal and hot insertion, provided the operating system supports PCIe SSD hot-swap.

Table 33. M.2 SATA drives

Part number	Feature code	Description	SED support	Max Qty
M.2 SSDs - 6 Gb SATA - Read Intensive/Entry (<3 DWPD)				
4XB7A82286	BQ1Z	ThinkSystem M.2 5400 PRO 240GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A82287	BQ1Y	ThinkSystem M.2 5400 PRO 480GB Read Intensive SATA 6Gb NHS SSD	Support	2
4XB7A82288	BQ20	ThinkSystem M.2 5400 PRO 960GB Read Intensive SATA 6Gb NHS SSD	Support	2
7N47A00130	AUUV	ThinkSystem M.2 128GB SATA 6Gbps Non-Hot Swap SSD	No	2

Table 34. M.2 PCIe 4.0 NVMe drives

Part number	Feature code	Description	SED support	Max Qty
M.2 SSDs - PCIe 4.0 NVMe - Read Intensive/Entry (<3 DWPD)				
4XB7A13999	BKSR	ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	Support	2

USB memory key

For general portable storage needs, the server also supports the USB memory key option that is listed in the following table.

Table 35. USB memory key

Part number	Feature	Description
4X77A77065	BNWN	ThinkSystem USB 32GB USB 3.0 Flash Drive

Optical drives and backup units

For most configurations, the ST650 V3 has two 5.25-inch half-height drive bays for internal optical drives or backup units. The only configuration that does not support these media bays is the configuration with 4x 2.5-inch backplanes as described in the Internal storage section.

The drives and media supported by the server are listed in the following table.

LTO tape drive in a rack conversion kit : The ST650 V3 is supported installed on its side in a rack mount kit, however the use of an LTO tape drive in this configuration is supported but not recommended.

Table 36. Internal optical drives and backup units

Part number	Feature code	Description	Maximum supported
Optical drives			
4XA7A81755	B36S	ThinkSystem 9.5mm Ultra-Slim USB DVD-RW v2	1
LTO tape drives			
4T27A80487	B4BM	ThinkSystem Internal Half High LTO Gen8 SAS Tape Drive v2	1
LTO media			
4TP7A09619	B4BN	ThinkSystem LTO Gen8 12TB Tape	Not applicable
RDX drive and cartridges			
4T27A80485	AVF6	ThinkSystem Internal RDX USB 3.0 Dock v2	1
7T27A01501	AVF6	ThinkSystem Internal RDX USB 3.0 Dock	1
7TP7A01601	AVF8	ThinkSystem RDX 500GB Cartridge	Not applicable
7TP7A01602	AVF1	ThinkSystem RDX 1TB Cartridge	Not applicable
7TP7A04318	AXD1	ThinkSystem RDX 4TB Cartridge	Not applicable
7TP7A01603	AVF0	ThinkSystem RDX 2TB Cartridge	Not applicable

For field upgrades, the kits listed in the following table are available.

Table 37. Internal optical drives and backup units

Part number	Description	Purpose
4M27A60829	ThinkSystem ST650 V2/V3 3.5" Chassis Media Bay Enablement Kit • 2-bay 5.25" ODD/Tape Cage • Cage for 1x Slim ODD • ODD filler/bezel • Tape filler/bezel	Provides the cage necessary to house two 5.25-inch drives, plus an inner cage for the slim optical drive. Also include blank bezels when a bay is not in use. Order tape drives and cables separately.
4Z57A16101	ThinkSystem ST650 V2/V3 Optical Disk Drive Cable Kit • Slim ODD Bezel • USB Cable for Slim ODD	Provides the USB cable needed to connect the optical drive
4Z57A82624	ThinkSystem ST650 V2/V3 Tape Drive Cable Kit for X30 HBA	Provides the power cable and SAS cable to connect the tape drive to an 4350-8i/16i SAS HBA. Order the SAS HBA separately.
4Z57A82626	ThinkSystem ST650 V2/V3 Tape Drive Cable Kit for X40 HBA	Provides the power cable and SAS cable to connect the tape drive to an 440-8i/16i SAS HBA. Order the SAS HBA separately.

The ST650 V3 also supports external drives. External tape and RDX drives are described in the External backup units section.

The server supports the external USB optical drive listed in the following table.

Table 38. External optical drive

Part number	Feature code	Description
7XA7A05926	AVV8	ThinkSystem External USB DVD RW Optical Disk Drive

The drive is based on the Lenovo Slim DVD Burner DB65 drive and supports the following formats: DVD-RAM, DVD-RW, DVD+RW, DVD+R, DVD-R, DVD-ROM, DVD-R DL, CD-RW, CD-R, CD-ROM.

I/O expansion

The ST650 V3 supports a total of 9x PCIe slots: 5x PCIe 5.0 and 4x PCIe 4.0 slots. All nine slots are mounted on the system board. Slots 1-8 are full height, full length (FHFL); slot 9 is full height, half length (FHHL). Slots 4-8 require CPU 2 installed.

- Slot 1: PCIe 5.0 x16 (CPU 1)
- Slot 2: PCIe 5.0 x8 (x8 physical slot) (CPU 1)
- Slot 3: PCIe 5.0 x16 (CPU 1)
- Slot 4: PCIe 5.0 x8 (x8 physical slot) (CPU 1)
- Slot 5: PCIe 5.0 x16 (CPU 2)
- Slot 6: PCIe 4.0 x8 (x8 physical slot) (CPU 2)
- Slot 7: PCIe 4.0 x16 (CPU 2)
- Slot 8: PCIe 4.0 x8 (x8 physical slot) (CPU 2)
- Slot 9: PCIe 4.0 x8 (x8 physical slot) (CPU 1)

The slots are shown in the following figure.

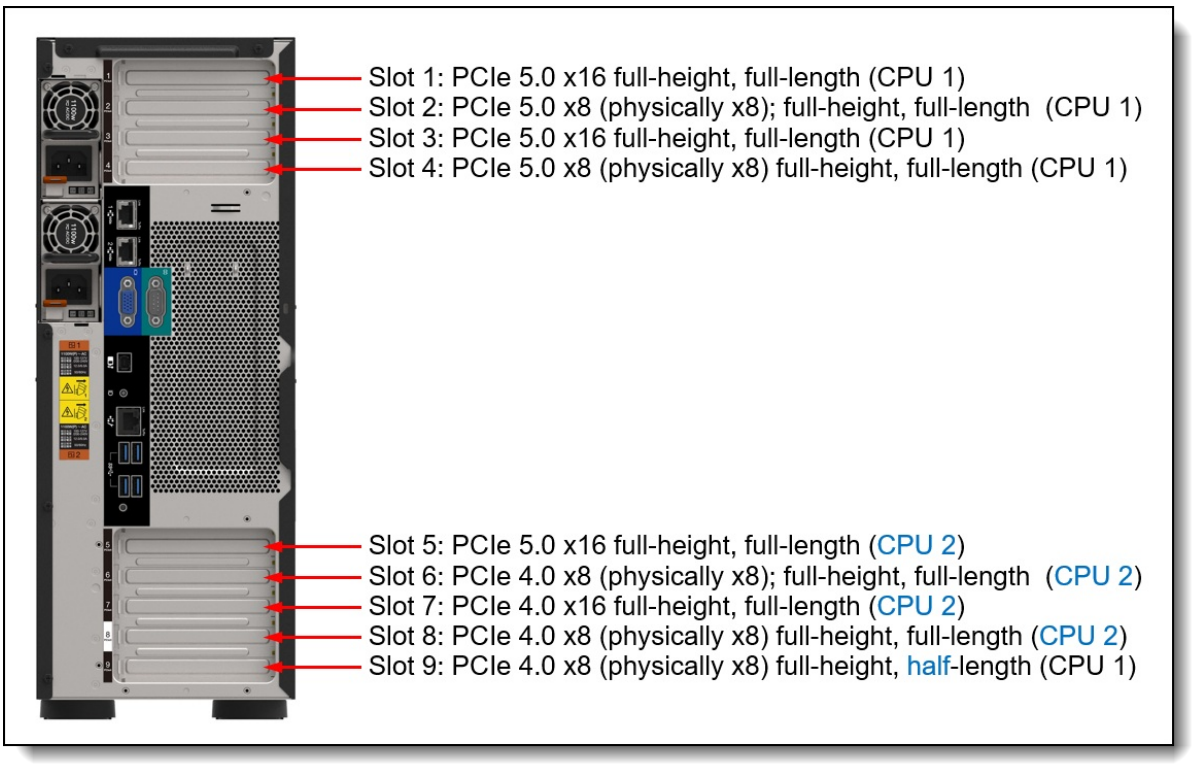

Figure 8. ST650 V3 PCIe slots

For GPUs, additional components may be required. See the GPU adapters section for details.

Network adapters

The ST650 V3 has two integrated 10GBASE-T ports for 1/10Gb Ethernet connectivity, based on the Broadcom BCM57416 controller.

The controller has the following features:

- General features
  - PCIe 3.0 x8 host interface
  - Supports 10GbE and 1GbE
    - 10GBASE-T IEEE 802.3an support
    - 1000BASE-T IEEE 802.3ab support
  - Supports IPv4 and IPv6
  - Broadcom TruFlow flow processing engine
- Virtualization features
  - SR-IOV support with up to 128 VFs
  - VXLAN, NVGRE, Geneve, GRE encapsulation and decapsulation
  - vSwitch acceleration
  - Multiqueue, NetQueue, and VMQ
  - Tunnel-aware stateless offloads
  - Message Signal Interrupts (MSI-X) support
- Ethernet features:
  - IPv4 and IPv6 offloads
  - TCP, UDP, and IP checksum offloads
  - Large Send Offload (LSO)
  - Large Receive Offload (LRO)
  - TCP Segmentation Offload (TSO)
  - Receive-side Scaling (RSS)
  - Transmit-side Scaling (TSS)
  - VLAN insertion/removal
  - Interrupt coalescing
  - Jumbo frames up to 9 KB
  - Network boot-PXE, UEFI
  - iSCSI boot
  - Data Plan Development Kit (DPDK) support
- Remote Direct Memory Access (RDMA):
  - Supports RDMA over converged Ethernet (RoCE) specifications
- Data Center Bridging / Converged Enhanced Ethernet (DCB/CEE):
  - Hardware Offloads of Ethernet TCP/IP
  - 802.1Qbb Priority Flow Control (PFC)
  - 802.1 Qaz Enhanced Transmission Selection (ETS)
  - 802.1 Qaz Data Center Bridging Exchange (DCBX)
- Management:
  - SMBus 2.0
  - MCTP over SMBus
  - NC-SI support
  - Wake on LAN (WOL)

The ST650 V3 also supports network adapters that can be installed in the regular PCIe slots.

Table 39. Supported PCIe Network Adapters

Part number	Feature code	Description	PCIe lanes	Max qty	Slots supported	Form factor
Gigabit Ethernet						
7ZT7A00484	AUZV	ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter	PCIe x4	7	2-4, 6-8	LP
7ZT7A00535	AUZW	ThinkSystem I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter	PCIe x4	7	2-4, 6-8	LP
10 Gb Ethernet - 10GBASE-T						
7ZT7A00496	AUKP	ThinkSystem Broadcom 57416 10GBASE-T 2-Port PCIe Ethernet Adapter	PCIe x8	7	2-4, 6-8	LP
4XC7A80266	BNWL	ThinkSystem Intel X710-T2L 10GBase-T 2-Port PCIe Ethernet Adapter	PCIe x8	7	2-4, 6-8	LP
4XC7A79699	BMXB	ThinkSystem Intel X710-T4L 10GBase-T 4-Port PCIe Ethernet Adapter	PCIe x8	7	2-4, 6-8	LP
25 Gb Ethernet						
4XC7A08238	BK1H	ThinkSystem Broadcom 57414 10/25GbE SFP28 2-port PCIe Ethernet Adapter	PCIe x8	9	All slots	LP
4XC7A80566	BNWM	ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port PCIe Ethernet Adapter	PCIe x16	9	All slots	LP
4XC7A62580	BE4U	ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-Port PCIe Ethernet Adapter	PCIe x8	9	All slots	LP
100 Gb Ethernet / HDR100 InfiniBand						
4XC7A08297	BK1J	ThinkSystem Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter	PCIe x16	4	1,3,5,7	LP

For more information, including the transceivers and cables that each adapter supports, see the list of Lenovo Press Product Guides in the Networking adapters category: https://lenovopress.com/servers/options/ethernet

Configuration requirements:

- Adapters with a x16 host interface require a x16 slot to maximize performance
- PCIe Gen5 adapters will require a Gen5 riser to maximize performance
- **E810 Ethernet and X350 RAID/HBAs**: The use of both an Intel E810 network adapter and an X350 HBA/RAID adapter (9350, 5350 and 4350) is currently not supported in ThinkSystem servers. For details see Support Tip HT513226. Planned support for this combination of adapters is 4Q/2023 (SI 23-2).

Fibre Channel host bus adapters

The following table lists the Fibre Channel HBAs supported by the ST650 V3.

Table 40. Fibre Channel HBAs

Part number	Feature code	Description	PCIe lanes	Max qty	Slots supported	Form factor
32 Gb Fibre Channel HBAs						
4XC7A76498	BJ3G	ThinkSystem Emulex LPe35000 32Gb 1-port PCIe Fibre Channel Adapter v2	PCIe x8	9	All slots	LP
4XC7A76525	BJ3H	ThinkSystem Emulex LPe35002 32Gb 2-port PCIe Fibre Channel Adapter V2	PCIe x8	9	All slots	LP
16 Gb Fibre Channel HBAs						
01CV840	ATZV	Emulex 16Gb Gen6 FC Dual-port HBA	PCIe x8	9	All slots	LP
01CV830	ATZU	Emulex 16Gb Gen6 FC Single-port HBA	PCIe x8	9	All slots	LP

For more information, see the list of Lenovo Press Product Guides in the Host bus adapters category:
https://lenovopress.com/servers/options/hba

SAS adapters for external storage

The following table lists SAS HBAs and RAID adapters supported by ST650 V3 server for use with external storage.

Table 41. Adapters for external storage

Part number	Feature code	Description	PCIe lanes	Max qty	Slots supported	Form factor	Supercap
External SAS HBAs							
4Y37A78837	BNWK	ThinkSystem 440-8e SAS/SATA PCIe Gen4 12Gb HBA	PCIe x8	9	All slots	LP	No
4Y37A09724	B8P7	ThinkSystem 440-16e SAS/SATA PCIe Gen4 12Gb HBA	PCIe x8	9	All slots	LP	No
External RAID adapters							
4Y37A78836	BNWJ	ThinkSystem RAID 940-8e 4GB Flash PCIe Gen4 12Gb Adapter	PCIe x8	4	All slots	LP	Included

* See below regarding supercap requirements

For a comparison of the functions of the supported external storage adapters, see the ThinkSystem RAID Adapter and HBA Reference:
https://lenovopress.com/lp1288#st650-v3-support=ST650%20V3&internal-or-external-ports=External

The RAID 940-8e uses a flash power module (supercap), which can be installed in one of four locations on the air baffle in the server. The number of 940-8e RAID adapters supported is based on how many supercaps can be installed in the server. If an internal 940i or 9350i RAID adapter with flash power modules is installed, the maximum number of 940-8e adapters supported is reduced by 1.

For more information, see the list of Lenovo Press Product Guides in the Host bus adapters and RAID adapters categories:

https://lenovopress.com/servers/options/hba
https://lenovopress.com/servers/options/raid

Flash storage adapters

The ST650 V3 currently does not support flash storage adapters.

GPU adapters

The ST650 V3 supports the following graphics processing units (GPUs).

Table 42. Supported GPUs

Part number	Feature code	Description	TDP	PCIe lanes	Max qty	Slots supported	Form factor	Aux power
Single-wide GPUs								
CTO only	BP05	ThinkSystem NVIDIA A2 16GB PCIe Gen4 Passive GPU	60W	PCIe x8	8	1-8	LP	No
4X67A81547	BQZT	ThinkSystem NVIDIA A2 16GB PCIe Gen4 Passive GPU w/o CEC	60W	PCIe x8	8	1-8	LP	No
4X67A84824	BS2C	ThinkSystem NVIDIA L4 24GB PCIe Gen4 Passive GPU	72W	PCIe x16	8	1-8	LP	No
Double-wide GPUs								
4X67A76720	BMT9	ThinkSystem NVIDIA RTX A2000 12GB PCIe Active GPU	70W	PCIe x16	4	1,3,5,7	FHHL	No
4X67A76726	BNFD	ThinkSystem NVIDIA RTX A4500 20GB PCIe Active GPU	200W	PCIe x16	4	1,3,5,7	FHFL	Yes
4X67A71310	BFT0	ThinkSystem NVIDIA RTX A6000 48GB PCIe Active GPU	300W	PCIe x16	4	1,3,5,7	FHFL	Yes
NVLink for double-wide GPUs								
4X67A71309	BG3F	ThinkSystem NVIDIA Ampere NVLink 2-Slot Bridge	-	-	2	-	-	-

Configuration rules:

- Some NVIDIA A Series GPUs are available as two feature codes, one with a CEC chip and one without a CEC chip (ones without the CEC chip have "w/o CEC" in the name). The CEC is a secondary Hardware Root of Trust (RoT) module that provides an additional layer of security, which can be used by customers who have high regulatory requirements or high security standards. NVIDIA uses a multi-layered security model and hence the protection offered by the primary Root of Trust embedded in the GPU is expected to be sufficient for most customers. The CEC defeatured products still offer Secure Boot, Secure Firmware Update, Firmware Rollback Protection, and In-Band Firmware Update Disable. Specifically, without the CEC chip, the GPU does not support Key Revocation or Firmware Attestation. CEC and non-CEC GPUs of the same type of GPU can be mixed in field upgrades.
- All GPUs installed in a zone must be identical
- When a double-wide GPU is installed in slot 1, 3, 5 or 7, the adjacent slot 2, 4, 6 or 8 respectively is not available
- Dual-rotor cooling fans are required

- Backplane support:
  - Double-wide GPUs: only two backplanes are supported and no optical drive or tape drive can be installed
  - Single-wide GPUs: four backplanes supported (4 dual-rotor fans required)
- When the NVIDIA A2 or NVIDIA L4 are installed, an air duct (4XF7A82410, BPHW) must also be installed in the zone to properly direct airflow. The use of this air duct means that all other adapters installed in the zone can only be low-profile adapters. Full-length adapters are not supported.
- The following rules apply to all double-wide GPUs:
  - When a GPU is installed in Zone 1 (upper slots, slots 1-4), a RAID card, HBA or Retimer cannot also be installed in that zone
  - When a GPU is installed in Zone 2 (lower slots, slots 5-9), a RAID card, HBA or Retimer cannot be installed in slots 5-8. Slot 9 can, however, be used to install the storage adapter

For information about these GPUs, see the ThinkSystem GPU Summary, available at:
https://lenovopress.com/lp0768-thinksystem-thinkagile-gpu-summary

GPU field upgrades

The following table lists the field upgrades for GPUs including auxiliary power cables for double-wide GPUs.

Zones: PCIe slots in the server are grouped into zones:

- Zone 1 = slots 1, 2, 3, 4 (upper slots)
- Zone 2 = slots 5, 6, 7, 8, 9 (lower slots)

Table 43. GPU field upgrades

Part number	Feature code	Description	Purpose
4M27A60836	BJL8	ThinkSystem ST650 V2/V3 Full Length PCIe Holder Kit • 2x adapter brackets • 1x GPU filler See below for drawings of these components.	1-2 kit needed per server, if full-length GPUs are installed. The two brackets mount on the fan cage to secure the ends of full-length adapters that are installed. The left bracket is for slots in zone 1 and the right bracket is for zone 2. The GPU filler is needed in a zone for proper airflow when there is only 1x DW GPU installed in that zone. If there are 2x DW GPUs in a zone, then the filler is not needed. 1x kit is needed for most configurations. 2x kits are only needed when 2x DW GPUs are installed, one in zone 1 and one in zone 2.
4M27A11843	BGDD	ThinkSystem ST650 V2/V3 Low Profile GPU Thermal Kit • 1x filler sponge See below for a drawing of this component.	1 kit needed for each zone, if an NVIDIA A2 or L4 is installed in that zone. The kit contains a sponge that is mounted to the underside of the server cover and is needed for proper cooling when A2/L4 GPUs are installed. **Note**: Once a sponge is installed in a zone, only low profile adapters can be installed in that zone. Full-height adapters are not supported.

Part number	Feature code	Description	Purpose
4XF7A82410	BPHW	ThinkSystem ST650 V2/V3 GPU Airduct Kit • 1x Air duct for Zone 1 (slots 1-4) • 1x Air duct for Zone 2 (slots 5-8) See below for drawings of these components.	1 kit needed per server, if NVIDIA A2 or L4 GPUs are installed. The kit contains two air ducts which are mounted on the fan cage to properly route air flow from the low-profile GPU adapters. The air duct for a zone is only needed when an A2 or L4 is installed in that zone. **Note**: Once an air duct is installed in a zone, only low profile adapters can be installed in that zone. Full-height adapters are not supported.
4Z57A82608	BUN8	ThinkSystem ST650 V2/V3 RTX A4500 GPU Power Cable Kit • 320mm power cable for slots 1-4 • 660 mm power cable for slots 5-8	1 kit needed per A4500 GPU. Auxiliary power cable for NVIDIA RTX A4500. Use the cable that matches the slot where the GPU is installed.
4Z57A60816	BB42	ThinkSystem ST650 V2/V3 RTX A6000 GPU Power Cable Kit • 320mm power cable for slots 1-4 • 660 mm power cable for slots 5-8	1 kit needed per A6000 GPU. Auxiliary power cable for NVIDIA RTX A6000. Use the cable that matches the slot where the GPU is installed.

The following figure shows the components of ThinkSystem ST650 V2/V3 Full Length PCIe Holder Kit (4M27A60836).

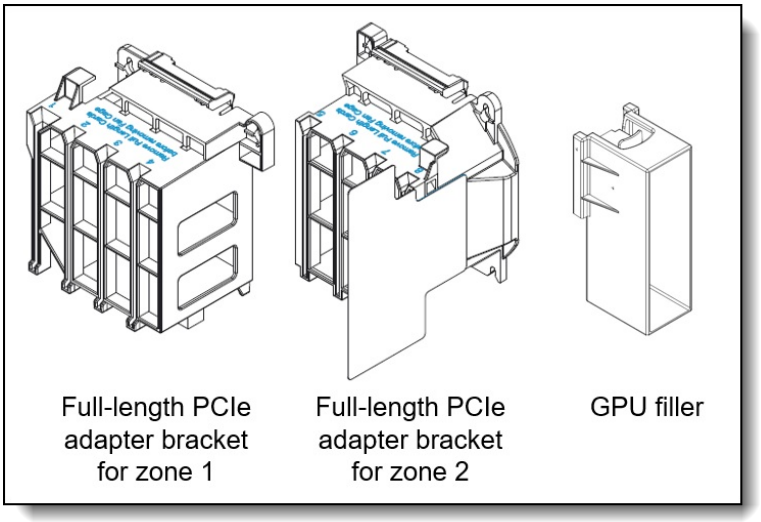

Figure 9. ThinkSystem ST650 V2/V3 Full Length PCIe Holder Kit (4M27A60836)

The following figure shows the components of ThinkSystem ST650 V2/V3 Low Profile GPU Thermal Kit (4M27A11843) and ThinkSystem ST650 V2/V3 GPU Airduct Kit (4XF7A82410).

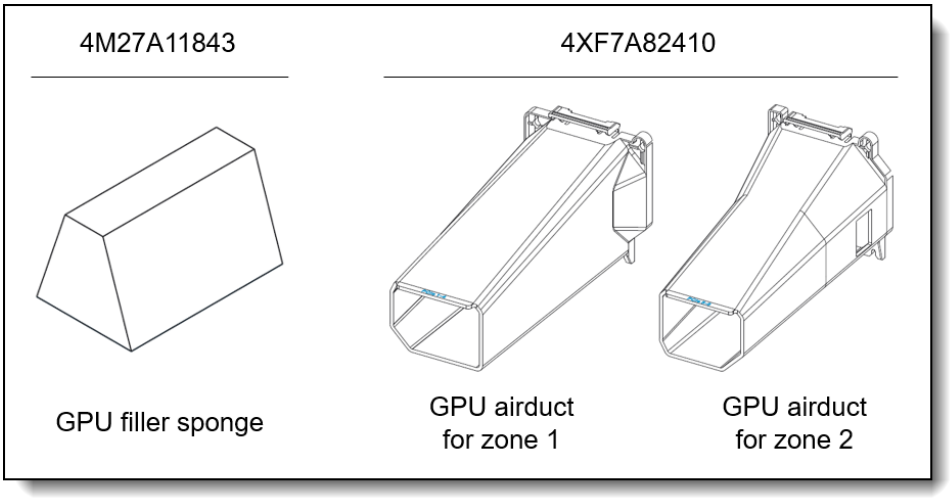

Figure 10. ThinkSystem ST650 V2/V3 Low Profile GPU Thermal Kit (4M27A11843) and ThinkSystem ST650 V2/V3 GPU Airduct Kit (4XF7A82410)

Cooling

The ST650 V3 server has up to 4x hot-swap variable-speed 92 mm fans, either Performance or Standard fans, depending on the configuration. Performance fans are dual-rotor counter-rotating units that have two separate spinning fan rotors, one in front of the other, which rotate in opposite directions. Standard fans are single-rotor units.

Performance fans are N+1 rotor redundant and in the event of a rotor failure, the system will continue with no loss of performance provided the ambient temperature is 27 °C or lower. If the ambient temperature is above 27 °C, performance may be degraded. Standard fans are not redundant, and in the event of a fan failure, the server will continue however performance will be degraded.

The server also has one or two additional fans integrated in each of the two power supplies.

Depending on the configuration, Standard fans will be sufficient to provide the necessary air flow, however for CTO orders it will be possible in the DCSC configurator to override the default selection and select Performance fans. Fan types cannot be mixed. Ordering information is listed in the following table.

Table 44. Cooling fan options

Part number	Feature code	Description	Quantity required	
			1 CPU	2 CPUs
4M27A60831	BA5S	ThinkSystem ST650 V2 Standard Fan Kit (single-rotor fans)	3 or 4	4
4M27A60832	BA5T	ThinkSystem ST650 V2 Performance Fan Kit (dual-rotor fans)	3 or 4	4

The use of 4x dual-rotor fans supports all configurations, however the use of 3x fans or the use of single-rotor fans is supported under the following conditions:

- 3x single-rotor fans can be used in the following conditions
  - Processor: 1x CPU, TDP < 200W
  - Memory: Total memory ≤ 64GB
  - No GPUs installed
  - Backplanes: only 2 backplanes installed (8x 3.5-inch or 16x 2.5-inch)
  - Drive types: SAS/SATA only
  - PCIe slots: No restriction
  - M.2: No support for M.2
- 3x double-rotor fans can be used in the following conditions (all must apply):
  - Processor: 1x CPU (no TDP restriction)
  - Memory: Total memory ≤ 128GB
  - GPUs: up to 2 double-wide or 4 single-wide
  - Backplanes: only 2 backplanes installed (8x 3.5-inch or 16x 2.5-inch)
  - Drive types: SAS/SATA only
  - PCIe slots: No restriction
  - M.2: No restriction
- 4x single-rotor fans can be used in the following conditions (all must apply):
  - Processor: 1 or 2 CPUs, TDP < 200W
  - Memory: Total memory ≤ 64GB
  - GPUs: No support
  - Backplanes: No restriction
  - Drive types: SAS/SATA only
  - PCIe slots: No restriction
  - M.2: No support for M.2

Power supplies

The ST650 V3 supports up to two redundant hot-swap power supplies.

The power supply choices are listed in the following table. Both power supplies used in server must be identical.

Tip: When configuring a server in the DCSC configurator, power consumption is calculated precisely by interfacing with Lenovo Capacity Planner. You can therefore select the appropriate power supply for your configuration. However, do consider future upgrades that may require additional power needs.

Table 45. Power supply options

Part number	Feature code	Description	Connector	Max qty	110V AC	220V AC	240V DC PRC only
AC input power - 80 PLUS Titanium efficiency							
4P57A72666	BLKH	ThinkSystem 1100W 230V Titanium Hot-Swap Gen2 Power Supply	C13	2	No	Yes	Yes
4P57A78359	BPK9	ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply	C13	2	No	Yes	Yes
4P57A72667	BKTJ	ThinkSystem 2600W 230V Titanium Hot-Swap Gen2 Power Supply	C19	2	No	Yes	Yes
AC input power - 80 PLUS Platinum efficiency							
4P57A72670	BNFG	ThinkSystem 750W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3	C13	2	Yes	Yes	Yes
4P57A72671	BNFH	ThinkSystem 1100W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3	C13	2	Yes	Yes	Yes
4P57A78362	BMUF	ThinkSystem 1800W 230V Platinum Hot-Swap Gen2 Power Supply v2	C13	2	No	Yes	Yes

Supported power supplies are auto-sensing dual-voltage units, supporting both 110V AC (100-127V 50/60 Hz) and 220V AC (200-240V 50/60 Hz) power. For China customers, all power supplies support 240V DC. Power supplies up to 1800W have a C14 connector. Power supplies 2400W and above have a C19 connector.

Power supply options do not include a line cord. For server configurations, the inclusion of a power cord is model dependent. Configure-to-order models can be configured without power cords if desired.

Power supply LEDs

The supported hot-swap power supplies have the following LEDs:

- Power input LED:
  - Green: The power supply is connected to the AC power source
  - Off: The power supply is disconnected from the AC power source or a power problem has occurred
- Power output LED:
  - Green: The server is on and the power supply is working normally
  - Blinking green: The power supply is in Zero-output/Standby mode (see below)
  - Off: The server is powered off, or the power supply is not working properly
- Power supply error LED:
  - Off: The power supply is working normally
  - Yellow: The power supply has failed

Zero-output mode: When Zero-output mode (also known as Standby mode or Cold Redundancy mode) is configured in XCC and the server power load is sufficiently low, one of the installed power supplies enters into the Standby state while the other one delivers entire load. When the power load increases, the standby power supply will switch to Active state to provide sufficient power to the server. Zero-output mode can be enabled or disabled in the XClarity Controller web interface, Server Configuration > Power Policy. If you select Disable, then both power supplies will be in the Active state.

Power cords

Line cords and rack power cables with C13 connectors can be ordered as listed in the following table.

110V customers: If you plan to use the 1100W power supply with a 110V power source, select a power cable that is rated above 10A. Power cables that are rated at 10A or below are not supported with 110V power.

Table 46. Power cords

Part number	Feature code	Description
Rack cables - C13 to C14		
SL67B08593	BPHZ	0.5m, 10A/100-250V, C13 to C14 Jumper Cord
00Y3043	A4VP	1.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08367	B0N5	1.0m, 13A/100-250V, C13 to C14 Jumper Cord
39Y7937	6201	1.5m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08368	B0N6	1.5m, 13A/100-250V, C13 to C14 Jumper Cord
4L67A08365	B0N4	2.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08369	6570	2.0m, 13A/100-250V, C13 to C14 Jumper Cord
4L67A08366	6311	2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08370	6400	2.8m, 13A/100-250V, C13 to C14 Jumper Cord
39Y7932	6263	4.3m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable
4L67A08371	6583	4.3m, 13A/100-250V, C13 to C14 Rack Power Cable
Rack cables - C13 to C14 (Y-cable)		
00Y3046	A4VQ	1.345m, 2X C13 to C14 Jumper Cord, Rack Power Cable
00Y3047	A4VR	2.054m, 2X C13 to C14 Jumper Cord, Rack Power Cable
Rack cables - C13 to C20		
39Y7938	6204	2.8m, 10A/100-250V, C13 to IEC 320-C20 Rack Power Cable
Rack cables - C13 to C20 (Y-cable)		
47C2491	A3SW	1.2m, 16A/100-250V, 2 Short C13s to Short C20 Rack Power Cable
47C2492	A3SX	2.5m, 16A/100-250V, 2 Long C13s to Short C20 Rack Power Cable
47C2493	A3SY	2.8m, 16A/100-250V, 2 Short C13s to Long C20 Rack Power Cable
47C2494	A3SZ	4.1m, 16A/100-250V, 2 Long C13s to Long C20 Rack Power Cable
Line cords		
39Y7930	6222	2.8m, 10A/250V, C13 to IRAM 2073 (Argentina) Line Cord
81Y2384	6492	4.3m 10A/220V, C13 to IRAM 2073 (Argentina) Line Cord
39Y7924	6211	2.8m, 10A/250V, C13 to AS/NZ 3112 (Australia/NZ) Line Cord
81Y2383	6574	4.3m, 10A/230V, C13 to AS/NZS 3112 (Aus/NZ) Line Cord
69Y1988	6532	2.8m, 10A/250V, C13 to NBR 14136 (Brazil) Line Cord
81Y2387	6404	4.3m, 10A/250V, C13 - 2P+Gnd (Brazil) Line Cord
39Y7928	6210	2.8m, 220-240V, C13 to GB 2099.1 (China) Line Cord
81Y2378	6580	4.3m, 10A/220V, C13 to GB 2099.1 (China) Line Cord
39Y7918	6213	2.8m, 10A/250V, C13 to DK2-5a (Denmark) Line Cord
81Y2382	6575	4.3m, 10A/230V, C13 to DK2-5a (Denmark) Line Cord
39Y7917	6212	2.8m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord

Part number	Feature code	Description
81Y2376	6572	4.3m, 10A/230V, C13 to CEE7-VII (Europe) Line Cord
39Y7927	6269	2.8m, 10A/250V, C13(2P+Gnd) (India) Line Cord
81Y2386	6567	4.3m, 10A/240V, C13 to IS 6538 (India) Line Cord
39Y7920	6218	2.8m, 10A/250V, C13 to SI 32 (Israel) Line Cord
81Y2381	6579	4.3m, 10A/230V, C13 to SI 32 (Israel) Line Cord
39Y7921	6217	2.8m, 220-240V, C13 to CEI 23-16 (Italy/Chile) Line Cord
81Y2380	6493	4.3m, 10A/230V, C13 to CEI 23-16 (Italy/Chile) Line Cord
46M2593	A1RE	2.8m, 12A/125V, C13 to JIS C-8303 (Japan) Line Cord
4L67A08362	6495	4.3m, 12A/200V, C13 to JIS C-8303 (Japan) Line Cord
39Y7926	6335	4.3m, 12A/100V, C13 to JIS C-8303 (Japan) Line Cord
39Y7922	6214	2.8m, 10A/250V, C13 to SABS 164 (S Africa) Line Cord
81Y2379	6576	4.3m, 10A/230V, C13 to SABS 164 (South Africa) Line Cord
39Y7925	6219	2.8m, 220-240V, C13 to KETI (S Korea) Line Cord
81Y2385	6494	4.3m, 12A/220V, C13 to KSC 8305 (S. Korea) Line Cord
39Y7919	6216	2.8m, 10A/250V, C13 to SEV 1011-S24507 (Swiss) Line Cord
81Y2390	6578	4.3m, 10A/230V, C13 to SEV 1011-S24507 (Sws) Line Cord
23R7158	6386	2.8m, 10A/125V, C13 to CNS 10917-3 (Taiwan) Line Cord
81Y2375	6317	2.8m, 10A/240V, C13 to CNS 10917-3 (Taiwan) Line Cord
81Y2374	6402	2.8m, 13A/125V, C13 to CNS 60799 (Taiwan) Line Cord
4L67A08363	AX8B	4.3m, 10A 125V, C13 to CNS 10917 (Taiwan) Line Cord
81Y2389	6531	4.3m, 10A/250V, C13 to 76 CNS 10917-3 (Taiwan) Line Cord
81Y2388	6530	4.3m, 13A/125V, C13 to CNS 10917 (Taiwan) Line Cord
39Y7923	6215	2.8m, 10A/250V, C13 to BS 1363/A (UK) Line Cord
81Y2377	6577	4.3m, 10A/230V, C13 to BS 1363/A (UK) Line Cord
90Y3016	6313	2.8m, 10A/120V, C13 to NEMA 5-15P (US) Line Cord
46M2592	A1RF	2.8m, 10A/250V, C13 to NEMA 6-15P Line Cord
00WH545	6401	2.8m, 13A/120V, C13 to NEMA 5-15P (US) Line Cord
4L67A08359	6370	4.3m, 10A/125V, C13 to NEMA 5-15P (US) Line Cord
4L67A08361	6373	4.3m, 10A/250V, C13 to NEMA 6-15P (US) Line Cord
4L67A08360	AX8A	4.3m, 13A/120V, C13 to NEMA 5-15P (US) Line Cord

Power cords (C19 connectors)

Line cords and rack power cables with C19 connectors can be ordered as listed in the following table.

Table 47. Power cords (C19 connectors)

Part number	Feature code	Description
Rack cables		
4L67A86677	BPJ0	0.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86678	B4L0	1.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86679	B4L1	1.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
4L67A86680	B4L2	2.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable

Part number	Feature code	Description
39Y7916	6252	2.5m, 16A/100-240V, C19 to IEC 320-C20 Rack Power Cable
4L67A86681	B4L3	4.3m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable
Line cords		
40K9777	6276	4.3m, 220-240V, C19 to IRAM 2073 (Argentina) Line cord
40K9773	6284	4.3m, 220-240V, C19 to AS/NZS 3112 (Aus/NZ) Line cord
40K9775	6277	4.3m, 250V, C19 to NBR 14136 (Brazil) Line Cord
40K9774	6288	4.3m, 220-240V, C19 to GB2099.1 (China) Line cord
40K9769	6283	4.3m, 16A/230V, C19 to IEC 309-P+N+G (Den/Sws) Line Cord
40K9766	6279	4.3m, 220-240V, C19 to CEE7-VII (European) Line cord
40K9776	6285	4.3m, 220-240V, C19 to IS6538 (India) Line cord
40K9771	6282	4.3m, 220-240V, C19 to SI 32 (Israel) Line cord
40K9768	6281	4.3m, 220-240V, C19 to CEI 23-16 (Italy) Line cord
40K9770	6280	4.3m, 220-240V, C19 to SABS 164 (South Africa) Line cord
41Y9231	6289	4.3m, 15A/250V, C19 to KSC 8305 (S. Korea) Line Cord
81Y2391	6549	4.3m, 16A/230V, C19 to SEV 1011 (Sws) Line Cord
41Y9230	6287	4.3m, 16A/250V, C19 to CNS 10917-3 (Taiwan) Line Cord
40K9767	6278	4.3m, 220-240V, C19 to BS 1363/A w/13A fuse (UK) Line Cord
40K9772	6275	4.3m, 16A/208V, C19 to NEMA L6-20P (US) Line Cord
00D7197	A1NV	4.3m, 15A/250V, C19 to NEMA 6-15P (US) Line Cord

Systems management

The ST650 V3 contains an integrated service processor, XClarity Controller 2 (XCC2), which provides advanced control, monitoring, and alerting functions. The XCC2 is based on the AST2600 baseboard management controller (BMC) using a dual-core ARM Cortex A7 32-bit RISC service processor running at 1.2 GHz.

Topics in this section:

- Local management
- System status with XClarity Mobile
- Remote management
- XCC2 Platinum
- Lenovo XClarity Provisioning Manager
- Lenovo XClarity Administrator
- Lenovo XClarity Integrators
- Lenovo XClarity Essentials
- Lenovo XClarity Energy Manager
- Lenovo Capacity Planner

Local management

The ST650 V3 offers a front operator panel with key LED status indicators, as shown in the following figure.

Tips:

- The Network LED only shows network activity of the two 10GBASE-T ports
- The Drive LED is non-functioning in the ST650 V3

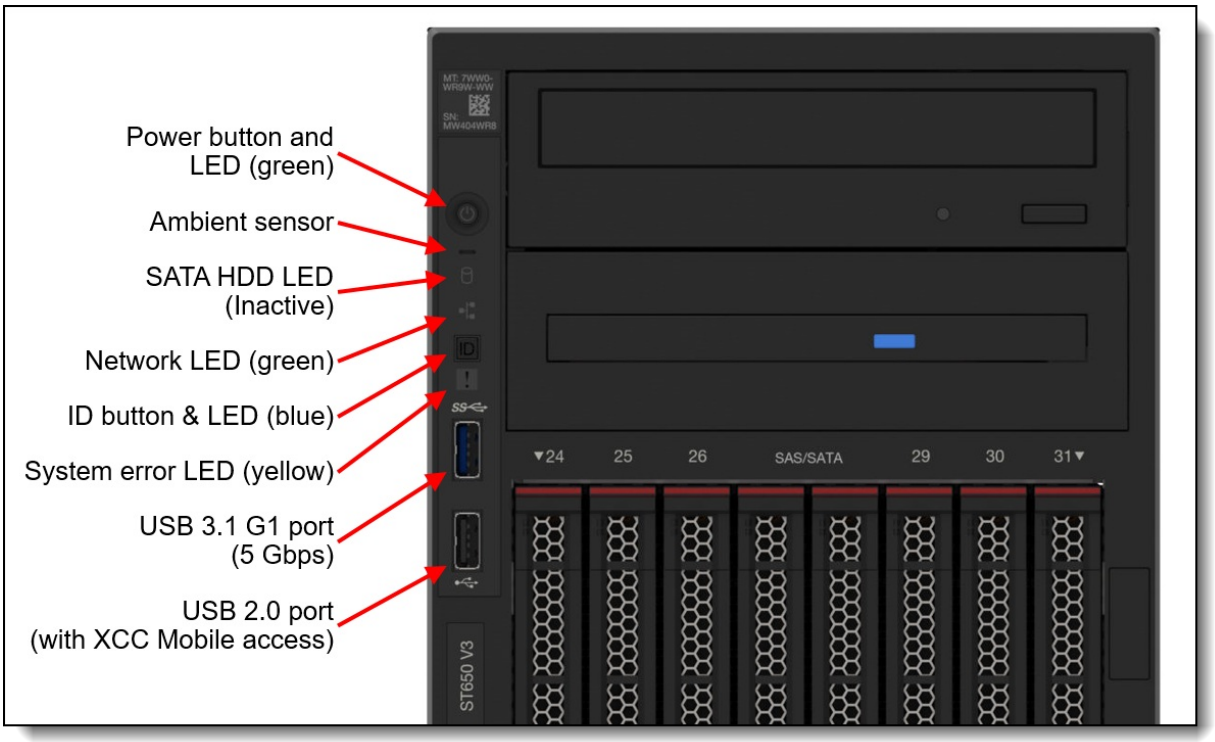

Figure 11. ST650 V3 front operator panel

When you press the ID button on the front panel, the blue system ID LEDs on both the front and rear of the server are lit to help you locate the server among other servers. You also can turn on the system ID LEDs using a remote management program for server presence detection.

Light path diagnostics

The server offers light path diagnostics. If an environmental condition exceeds a threshold or if a system component fails, XCC lights LEDs inside the server to help you diagnose the problem and find the failing part. The server has fault LEDs next to the following components:

- Each memory DIMM
- Each drive bay
- Each power supply

External Diagnostics Handset

The ST650 V3 also has a port at the rear of the server to connect an External Diagnostics Handset as shown in the following figure.

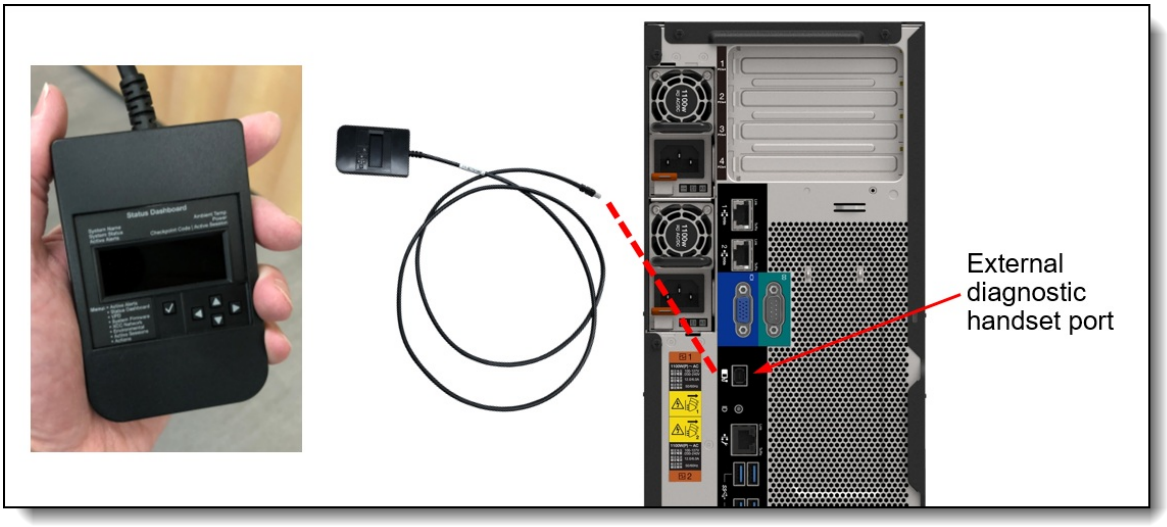

Figure 12. ST650 V3 External Diagnostics Handset

The External Diagnostics Handset and allows quick access to system status, firmware, network, and health information. The LCD display on the panel and the function buttons give you access to the following information:

- Active alerts
- Status Dashboard
- System VPD: machine type & mode, serial number, UUID string
- System firmware levels: UEFI and XCC firmware
- XCC network information: hostname, MAC address, IP address, DNS addresses
- Environmental data: Ambient temperature, CPU temperature, AC input voltage, estimated power consumption
- Active XCC sessions
- System reset action

The handset has a magnet on the back of it to allow you to easily mount it on a convenient place on any rack cabinet. Many other ThinkSystem V2 and V3 servers also support the External Diagnostics Handset allowing you to share a handset between multiple systems.

Ordering information for the External Diagnostics Handset with is listed in the following table.

Table 48. External Diagnostics Handset ordering information

Part number	Feature code	Description
4TA7A64874	BEUX	ThinkSystem External Diagnostics Handset

System status with XClarity Mobile

The XClarity Mobile app includes a tethering function where you can connect your Android or iOS device to the server via USB to see the status of the server.

The steps to connect the mobile device are as follows:

1. Enable USB Management on the server, by holding down the ID button for 3 seconds (or pressing the dedicated USB management button if one is present)
2. Connect the mobile device via a USB cable to the server's USB port with the management symbol
3. In iOS or Android settings, enable Personal Hotspot or USB Tethering
4. Launch the Lenovo XClarity Mobile app

Once connected you can see the following information:

- Server status including error logs (read only, no login required)
- Server management functions (XClarity login credentials required)

Remote management

The server offers a dedicated RJ45 port at the rear of the server for remote management via the XClarity Controller management processor. The port supports 10/100/1000 Mbps speeds.

Remote server management is provided through industry-standard interfaces:

- Intelligent Platform Management Interface (IPMI) Version 2.0
- Simple Network Management Protocol (SNMP) Version 3 (no SET commands; no SNMP v1)
- Common Information Model (CIM-XML)
- Representational State Transfer (REST) support
- Redfish support (DMTF compliant)
- Web browser - HTML 5-based browser interface (Java and ActiveX not required) using a responsive design (content optimized for device being used - laptop, tablet, phone) with NLS support

The ST650 V3 offers a MicroSD card port on the system board to enable the use of a MicroSD card for additional storage for use with the XCC2 controller. XCC2 can use the storage as a Remote Disc on Card (RDOC) device (up to 4GB of storage). It can also be used to store firmware updates (including N-1 firmware history) for ease of deployment.

Tip: Without a MicroSD card installed, the XCC2 controller will have 100MB of available RDOC storage.

Ordering information for the supported Micro SD card is listed in the following table.

Table 49. MicroSD card

Part number	Feature code	Description
4X77A77064	BNWP	ThinkSystem MicroSD 32GB Class 10 Flash Memory Card

IPMI via the Ethernet port (IPMI over LAN) is supported, however it is disabled by default. For CTO orders you can specify whether you want to the feature enabled or disabled in the factory, using the feature codes listed in the following table.

Table 50. IPMI-over-LAN settings

Feature code	Description
B7XZ	Disable IPMI-over-LAN (default)
B7Y0	Enable IPMI-over-LAN

XCC2 Platinum

The XCC2 service processor in the ST650 V3 supports an upgrade to the Platinum level of features. Compared to the XCC functions of ThinkSystem V2 and earlier systems, Platinum adds the same features as Enterprise and Advanced levels in ThinkSystem V2, plus additional features.

XCC2 Platinum adds the following Enterprise and Advanced functions:

- Remotely viewing video with graphics resolutions up to 1600x1200 at 75 Hz with up to 23 bits per pixel, regardless of the system state
- Remotely accessing the server using the keyboard and mouse from a remote client
- International keyboard mapping support
- Syslog alerting
- Redirecting serial console via SSH
- Component replacement log (Maintenance History log)
- Access restriction (IP address blocking)
- Lenovo SED security key management
- Displaying graphics for real-time and historical power usage data and temperature
- Boot video capture and crash video capture
- Virtual console collaboration - Ability for up to 6 remote users to be log into the remote session simultaneously
- Remote console Java client
- Mapping the ISO and image files located on the local client as virtual drives for use by the server
- Mounting the remote ISO and image files via HTTPS, SFTP, CIFS, and NFS
- Power capping
- System utilization data and graphic view
- Single sign on with Lenovo XClarity Administrator
- Update firmware from a repository
- License for XClarity Energy Manager

XCC2 Platinum also adds the following features that are new to XCC2:

- System Guard - Monitor hardware inventory for unexpected component changes, and simply log the event or prevent booting
- Enterprise Strict Security mode - Enforces CNSA 1.0 level security
- Neighbor Group - Enables administrators to manage and synchronize configurations and firmware level across multiple servers

Ordering information is listed in the following table. XCC2 Platinum is a software license upgrade - no additional hardware is required.

Table 51. XCC2 Platinum license upgrade

Part number	Feature code	Description
7S0X000KWW	SBCV	Lenovo XClarity Controller 2 (XCC2) Platinum Upgrade

With XCC2 Platinum, for CTO orders, you can request that System Guard be enabled in the factory and the first configuration snapshot be recorded. To add this to an order, select feature code listed in the following table. The selection is made in the Security tab of the DCSC configurator.

Table 52. Enable System Guard in the factory (CTO orders)

Feature code	Description
BUT2	Install System Guard

For more information about System Guard, see https://pubs.lenovo.com/xcc2/NN1ia_c_systemguard

Lenovo XClarity Provisioning Manager

Lenovo XClarity Provisioning Manager (LXPM) is a UEFI-based application embedded in ThinkSystem servers and accessible via the F1 key during system boot.

LXPM provides the following functions:

- Graphical UEFI Setup
- System inventory information and VPD update
- System firmware updates (UEFI and XCC)
- RAID setup wizard
- OS installation wizard (including unattended OS installation)
- Diagnostics functions

Lenovo XClarity Administrator

Lenovo XClarity Administrator is a centralized resource management solution designed to reduce complexity, speed response, and enhance the availability of Lenovo systems and solutions. It provides agent-free hardware management for ThinkSystem servers, in addition to ThinkServer, System x, and Flex System servers. The administration dashboard is based on HTML 5 and allows fast location of resources so tasks can be run quickly.

Because Lenovo XClarity Administrator does not require any agent software to be installed on the managed endpoints, there are no CPU cycles spent on agent execution, and no memory is used, which means that up to 1GB of RAM and 1 - 2% CPU usage is saved, compared to a typical managed system where an agent is required.

Lenovo XClarity Administrator is an optional software component for the ST650 V3. The software can be downloaded and used at no charge to discover and monitor the ST650 V3 and to manage firmware upgrades.

If software support is required for Lenovo XClarity Administrator, or premium features such as configuration management and operating system deployment are required, Lenovo XClarity Pro software subscription should be ordered. Lenovo XClarity Pro is licensed on a per managed system basis, that is, each managed Lenovo system requires a license.

The following table lists the Lenovo XClarity software license options.

Table 53. Lenovo XClarity Pro ordering information

Part number	Feature code	Description
00MT201	1339	Lenovo XClarity Pro, per Managed Endpoint w/1 Yr SW S&S
00MT202	1340	Lenovo XClarity Pro, per Managed Endpoint w/3 Yr SW S&S
00MT203	1341	Lenovo XClarity Pro, per Managed Endpoint w/5 Yr SW S&S
7S0X000HWW	SAYV	Lenovo XClarity Pro, per Managed Endpoint w/6 Yr SW S&S
7S0X000JWW	SAYW	Lenovo XClarity Pro, per Managed Endpoint w/7 Yr SW S&S

Lenovo XClarity Administrator offers the following standard features that are available at no charge:

- Auto-discovery and monitoring of Lenovo systems
- Firmware updates and compliance enforcement
- External alerts and notifications via SNMP traps, syslog remote logging, and e-mail
- Secure connections to managed endpoints
- NIST 800-131A or FIPS 140-2 compliant cryptographic standards between the management solution and managed endpoints
- Integration into existing higher-level management systems such as cloud automation and orchestration tools through REST APIs, providing extensive external visibility and control over hardware resources
- An intuitive, easy-to-use GUI
- Scripting with Windows PowerShell, providing command-line visibility and control over hardware resources

Lenovo XClarity Administrator offers the following premium features that require an optional Pro license:

- Pattern-based configuration management that allows to define configurations once and apply repeatedly without errors when deploying new servers or redeploying existing servers without disrupting the fabric
- Bare-metal deployment of operating systems and hypervisors to streamline infrastructure provisioning

For more information, refer to the Lenovo XClarity Administrator Product Guide:
http://lenovopress.com/tips1200

Lenovo XClarity Integrators

Lenovo also offers software plug-in modules, Lenovo XClarity Integrators, to manage physical infrastructure from leading external virtualization management software tools including those from Microsoft and VMware.

These integrators are offered at no charge, however if software support is required, a Lenovo XClarity Pro software subscription license should be ordered.

Lenovo XClarity Integrators offer the following additional features:

- Ability to discover, manage, and monitor Lenovo server hardware from VMware vCenter or Microsoft System Center
- Deployment of firmware updates and configuration patterns to Lenovo x86 rack servers and Flex System from the virtualization management tool
- Non-disruptive server maintenance in clustered environments that reduces workload downtime by dynamically migrating workloads from affected hosts during rolling server updates or reboots
- Greater service level uptime and assurance in clustered environments during unplanned hardware events by dynamically triggering workload migration from impacted hosts when impending hardware failures are predicted

For more information about all the available Lenovo XClarity Integrators, see the Lenovo XClarity Administrator Product Guide: https://lenovopress.com/tips1200-lenovo-xclarity-administrator

Lenovo XClarity Essentials

Lenovo offers the following XClarity Essentials software tools that can help you set up, use, and maintain the server at no additional cost:

- Lenovo Essentials OneCLI

  OneCLI is a collection of server management tools that uses a command line interface program to manage firmware, hardware, and operating systems. It provides functions to collect full system health information (including health status), configure system settings, and update system firmware and drivers.

- Lenovo Essentials UpdateXpress

  The UpdateXpress tool is a standalone GUI application for firmware and device driver updates that enables you to maintain your server firmware and device drivers up-to-date and help you avoid unnecessary server outages. The tool acquires and deploys individual updates and UpdateXpress System Packs (UXSPs) which are integration-tested bundles.

- Lenovo Essentials Bootable Media Creator

  The Bootable Media Creator (BOMC) tool is used to create bootable media for offline firmware update.

For more information and downloads, visit the Lenovo XClarity Essentials web page: http://support.lenovo.com/us/en/documents/LNVO-center

Lenovo XClarity Energy Manager

Lenovo XClarity Energy Manager (LXEM) is a power and temperature management solution for data centers. It is an agent-free, web-based console that enables you to monitor and manage power consumption and temperature in your data center through the management console. It enables server density and data center capacity to be increased through the use of power capping.

LXEM is a licensed product. A single-node LXEM license is included with the XClarity Controller Platinum upgrade as described in the Remote Management section. If your server does not have the XCC Platinum upgrade, Energy Manager licenses can be ordered as shown in the following table.

Table 54. Lenovo XClarity Energy Manager

Part number	Description
4L40E51621	Lenovo XClarity Energy Manager Node License (1 license needed per server)

For more information about XClarity Energy Manager, see the following resources:

- Lenovo Support page:
  https://datacentersupport.lenovo.com/us/en/solutions/lnvo-lxem
- Lenovo Information Center:
  https://sysmgt.lenovofiles.com/help/topic/LXEM/lxem_overview.html?cp=4

Lenovo Capacity Planner

Lenovo Capacity Planner is a power consumption evaluation tool that enhances data center planning by enabling IT administrators and pre-sales professionals to understand various power characteristics of racks, servers, and other devices. Capacity Planner can dynamically calculate the power consumption, current, British Thermal Unit (BTU), and volt-ampere (VA) rating at the rack level, improving the planning efficiency for large scale deployments.

For more information, refer to the Capacity Planner web page:
http://datacentersupport.lenovo.com/us/en/solutions/lnvo-lcp

Security

Topics in this section:

- Security features
- Platform Firmware Resiliency - Lenovo ThinkShield
- Intel Transparent Supply Chain
- Security standards

Security features

The ST650 V3 server offers the following electronic security features:

- Secure Boot function of the Intel Xeon processor
- Support for Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) - see the Platform Firmware Resiliency section
- Firmware signature processes compliant with FIPS and NIST requirements
- System Guard (part of XCC Platinum) - Proactive monitoring of hardware inventory for unexpected component changes
- Administrator and power-on password
- Integrated Trusted Platform Module (TPM) supporting TPM 2.0
- Self-encrypting drives (SEDs) with support for enterprise key managers - see the SED encryption key management section

The ST650 V3 offers the following mechanical security features:

- Lockable side cover to help prevent access to internal components
- Optional chassis intrusion switch
- Optional lockable front security door (not supported with the tower is converted to a 4U rack server)

The server is NIST SP 800-147B compliant.

The optional lockable front security door is shown in the following figure and includes a key that enables you to secure the drives and system controls thereby reducing the chance of unauthorized or accidental access to the server.

Figure 13. Lockable front security door

The following table lists the security options for the ST650 V3.

Table 55. Security features

Part number	Feature code	Description
4M27A60834	BA5U	ThinkSystem ST650 V2 Security Door
4Z57A60817	BB4F	ThinkSystem ST650 V2/V3 Chassis Intrusion Cable Kit

Platform Firmware Resiliency - Lenovo ThinkShield

Lenovo's ThinkShield Security is a transparent and comprehensive approach to security that extends to all dimensions of our data center products: from development, to supply chain, and through the entire product lifecycle.

The ThinkSystem ST650 V3 includes Platform Firmware Resiliency (PFR) hardware Root of Trust (RoT) which enables the system to be NIST SP800-193 compliant. This offering further enhances key platform subsystem protections against unauthorized firmware updates and corruption, to restore firmware to an integral state, and to closely monitor firmware for possible compromise from cyber attacks.

PFR operates upon the following server components:

- UEFI image – the low-level server firmware that connects the operating system to the server hardware
- XCC image – the management “engine” software that controls and reports on the server status separate from the server operating system
- FPGA image – the code that runs the server’s lowest level hardware controller on the motherboard

The Lenovo Platform Root of Trust Hardware performs the following three main functions:

- Detection – Measures the firmware and updates for authenticity
- Recovery – Recovers a corrupted image to a known-safe image
- Protection – Monitors the system to ensure the known-good firmware is not maliciously written

These enhanced protection capabilities are implemented using a dedicated, discrete security processor whose implementation has been rigorously validated by leading third-party security firms. Security evaluation results and design details are available for customer review – providing unprecedented transparency and assurance.

The ST650 V3 includes support for Secure Boot, a UEFI firmware security feature developed by the UEFI Consortium that ensures only immutable and signed software are loaded during the boot time. The use of Secure Boot helps prevent malicious code from being loaded and helps prevent attacks, such as the installation of rootkits. Lenovo offers the capability to enable secure boot in the factory, to ensure end-to-end protection. Alternatively, Secure Boot can be left disabled in the factory, allowing the customer to enable it themselves at a later point, if desired.

The following table lists the relevant feature code(s).

Table 56. Secure Boot options

Part number	Feature code	Description	Purpose
CTO only	BPKQ	TPM 2.0 with Secure Boot	Configure the system in the factory with Secure Boot enabled.
CTO only	BPKR	TPM 2.0	Configure the system without Secure Boot enabled. Customers can enable Secure Boot later if desired.

Tip: If Secure Boot is not enabled in the factory, it can be enabled later by the customer. However once Secure Boot is enabled, it cannot be disabled.

Intel Transparent Supply Chain

Add a layer of protection in your data center and have peace of mind that the server hardware you bring into it is safe authentic and with documented, testable, and provable origin.

Lenovo has one of the world's best supply chains, as ranked by Gartner Group, backed by extensive and mature supply chain security programs that exceed industry norms and US Government standards. Now we are the first Tier 1 manufacturer to offer Intel® Transparent Supply Chain in partnership with Intel, offering you an unprecedented degree of supply chain transparency and assurance.

To enable Intel Transparent Supply Chain for the Intel-based servers in your order, add the following feature code in the DCSC configurator, under the Security tab.

Table 57. Intel Transparent Supply Chain ordering information

Feature code	Description
BB0P	Intel Transparent Supply Chain

For more information on this offering, see the paper *Introduction to Intel Transparent Supply Chain on Lenovo ThinkSystem Servers*, available from https://lenovopress.com/lp1434-introduction-to-intel-transparent-supply-chain-on-thinksystem-servers.

Security standards

The ST650 V3 supports the following security standards and capabilities:

- **Industry Standard Security Capabilities**
  - Intel CPU Enablement
    - AES-NI (Advanced Encryption Standard New Instructions)
    - CBnT (Converged Boot Guard and Trusted Execution Technology)
    - CET (Control flow Enforcement Technology)
    - Hardware-based side channel attack resilience enhancements
    - MKTME/TME (Multi-Key Total Memory Encryption)
    - SGX (Software Guard eXtensions)
    - SGX-TEM (Trusted Environment Mode)
    - TDX (Trust Domain Extensions)
    - TXT (Trusted eXecution Technology)
    - VT (Virtualization Technology)
    - XD (eXecute Disable)
  - Microsoft Windows Security Enablement
    - Credential Guard
    - Device Guard
    - Host Guardian Service
  - TCG (Trusted Computing Group) TPM (Trusted Platform Module) 2.0
  - UEFI (Unified Extensible Firmware Interface) Forum Secure Boot
- **Hardware Root of Trust and Security**
  - Independent security subsystem providing platform-wide NIST SP800-193 compliant Platform Firmware Resilience (PFR)
  - Management domain RoT supplemented by the Secure Boot features of XCC
- **Platform Security**

  For more information on platform security, see the paper “How to Harden the Security of your ThinkSystem Server and Management Applications” available from https://lenovopress.com/lp1260-how-to-harden-the-security-of-your-thinksystem-server.

  - Boot and run-time firmware integrity monitoring with rollback to known-good firmware (e.g., “self-healing”)
  - Non-volatile storage bus security monitoring and filtering
  - Resilient firmware implementation, such as to detect and defeat unauthorized flash writes or SMM (System Management Mode) memory incursions
  - Patented IPMI KCS channel privileged access authorization (USPTO Patent# 11,256,810)
  - Host and management domain authorization, including integration with CyberArk for enterprise password management
  - KMIP (Key Management Interoperability Protocol) compliant, including support for IBM SKLM and Thales KeySecure
  - Reduced “out of box” attack surface
  - Configurable network services
  - FIPS 140-3 (in progress) validated cryptography for XCC
  - CNSA Suite 1.0 Quantum-resistant cryptography for XCC
  - Lenovo System Guard
- **Standards Compliance and/or Support**
  - NIST SP800-131A rev 2 “Transitioning the Use of Cryptographic Algorithms and Key Lengths”
  - NIST SP800-147B “BIOS Protection Guidelines for Servers”
  - NIST SP800-193 “Platform Firmware Resiliency Guidelines”

    - ISO/IEC 11889 “Trusted Platform Module Library”
    - Common Criteria TCG Protection Profile for “PC Client Specific TPM 2.0”
    - European Union Commission Regulation 2019/424 (“ErP Lot 9”) “Ecodesign Requirements for Servers and Data Storage Products” Secure Data Deletion
    - Optional FIPS 140-2 validated Self-Encrypting Disks (SEDs) with external KMIP-based key management
- **Product and Supply Chain Security**
    - Suppliers validated through Lenovo’s Trusted Supplier Program
    - Developed in accordance with Lenovo’s Secure Development Lifecycle (LSDL)
    - Continuous firmware security validation through automated testing, including static code analysis, dynamic network and web vulnerability testing, software composition analysis, and subsystem-specific testing, such as UEFI security configuration validation
    - Ongoing security reviews by US-based security experts, with attestation letters available from our third-party security partners
    - Digitally signed firmware, stored and built on US-based infrastructure and signed on US-based Hardware Security Modules (HSMs)
    - Manufacturing transparency via Intel Transparent Supply Chain (for details, see https://lenovopress.com/lp1434-introduction-to-intel-transparent-supply-chain-on-lenovo-thinksystem-servers)
    - TAA (Trade Agreements Act) compliant manufacturing, by default in Mexico for North American markets with additional US and EU manufacturing options
    - US 2019 NDAA (National Defense Authorization Act) Section 889 compliant

Keyboards and Mice

The following table lists the supported full-sized USB keyboards and mice available for Lenovo ThinkSystem servers.

The keyboards have the following features:

- Full-sized 104-key keyboard with 3 special Windows keys
- 3 LEDs for caps lock, scroll lock and num lock
- Wired USB connection with 1.8m cable
- Adjustable feet at the rear of the keyboard

Tip: For keyboards that fit in the rack-mounted console kit, see the KVM console options section, or the ThinkSystem 18.5-inch LCD Console product guide

Table 58. Lenovo Preferred Pro USB Full-sized keyboards - ThinkSystem

Part number	Feature code	Description
Mice		
7M57A04698	B0LN	ThinkSystem Optical Wheel Mouse - USB
Keyboards		
7ZB7A05521	AXTM	ThinkSystem Pref. Pro II USB Keyboard - Arabic
7ZB7A05520	AXTN	ThinkSystem Pref. Pro II USB Keyboard - Arabic/French
7ZB7A05519	AXTP	ThinkSystem Pref. Pro II USB Keyboard - Belgium/French
7ZB7A05518	AXTQ	ThinkSystem Pref. Pro II USB Keyboard - Belgium/UK
7ZB7A05517	AXTR	ThinkSystem Pref. Pro II USB Keyboard - Brazil/Portuguese

Part number	Feature code	Description
7ZB7A05515	AXTS	ThinkSystem Pref. Pro II USB Keyboard - Bulgarian
7ZB7A05511	AXTU	ThinkSystem Pref. Pro II USB Keyboard - Czech
7ZB7A05509	AXTV	ThinkSystem Pref. Pro II USB Keyboard - Danish
7ZB7A05508	AXTW	ThinkSystem Pref. Pro II USB Keyboard - Dutch
7ZB7A05506	AXTX	ThinkSystem Pref. Pro II USB Keyboard - French
7ZB7A05496	AXTZ	ThinkSystem Pref. Pro II USB Keyboard - French Canadian French
7ZB7A05504	AXTY	ThinkSystem Pref. Pro II USB Keyboard - French Canadian Multilingual
7ZB7A05495	AXU0	ThinkSystem Pref. Pro II USB Keyboard - German
7ZB7A05494	AXU1	ThinkSystem Pref. Pro II USB Keyboard - Greek
7ZB7A05493	AXU2	ThinkSystem Pref. Pro II USB Keyboard - Hebrew
7ZB7A05492	AXU3	ThinkSystem Pref. Pro II USB Keyboard - Hungarian
7ZB7A05491	AXU4	ThinkSystem Pref. Pro II USB Keyboard - Iceland
7ZB7A05490	AXU5	ThinkSystem Pref. Pro II USB Keyboard - Italy
7ZB7A05489	AXU6	ThinkSystem Pref. Pro II USB Keyboard -Japanese
7ZB7A05488	AXU7	ThinkSystem Pref. Pro II USB Keyboard - Korean
7ZB7A05487	AXU8	ThinkSystem Pref. Pro II USB Keyboard - LA Spanish
7ZB7A05486	AXU9	ThinkSystem Pref. Pro II USB Keyboard - Norwegian
7ZB7A05485	AXUA	ThinkSystem Pref. Pro II USB Keyboard - Polish
7ZB7A05484	AXUB	ThinkSystem Pref. Pro II USB Keyboard- Portugese
7ZB7A05483	AXUC	ThinkSystem Pref. Pro II USB Keyboard - Romanian
7ZB7A05482	AXUD	ThinkSystem Pref. Pro II USB Keyboard - Russian/Cy
7ZB7A05481	AXUE	ThinkSystem Pref. Pro II USB Keyboard - Serbian/Cyrilic
7ZB7A05480	AXUF	ThinkSystem Pref. Pro II USB Keyboard - Slovak
7ZB7A05471	AXUQ	ThinkSystem Pref. Pro II USB Keyboard - Slovenian
7ZB7A05479	AXUG	ThinkSystem Pref. Pro II USB Keyboard - Spanish
7ZB7A05478	AXUH	ThinkSystem Pref. Pro II USB Keyboard- Swedish/Finn
7ZB7A05477	AXUJ	ThinkSystem Pref. Pro II USB Keyboard - Swiss, F/G
7ZB7A05476	AXUK	ThinkSystem Pref. Pro II USB Keyboard - Thailand
7ZB7A05513	AXTT	ThinkSystem Pref. Pro II USB Keyboard - Trad Chinese/US
7ZB7A05474	AXUM	ThinkSystem Pref. Pro II USB Keyboard - Turkish 179
7ZB7A05475	AXUL	ThinkSystem Pref. Pro II USB Keyboard - Turkish 440
7ZB7A05473	AXUN	ThinkSystem Pref. Pro II USB Keyboard - UK English
7ZB7A05522	AXTL	ThinkSystem Pref. Pro II USB Keyboard - US English
7ZB7A05472	AXUP	ThinkSystem Pref. Pro II USB Keyboard - US Euro

Rack installation

The ST650 V3 can also be installed in the rack with the Rack Enablement Kit. The resulting server is a 4U rack-mountable server, as shown in the following figure.

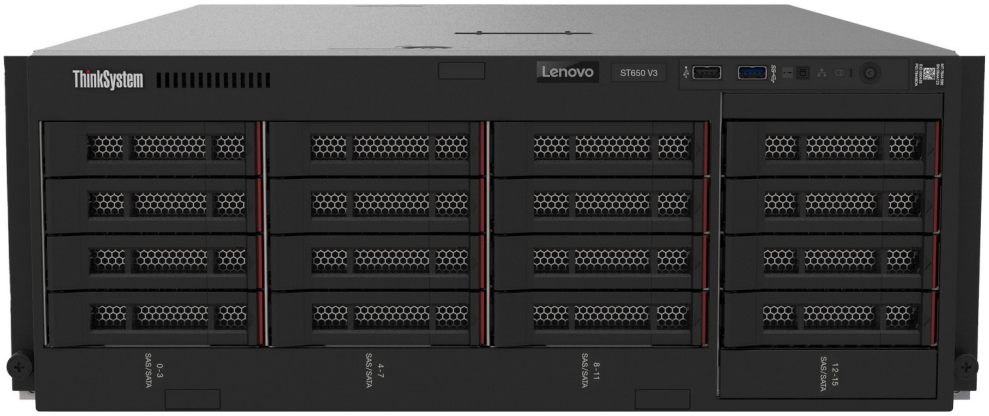

Figure 14. ThinkSystem ST650 V3 with Rack Conversion Kit installed

The part numbers are summarized in the following table.

No CMA support: The ST650 V3 does not support the use of a cable management arm.

Table 59. Rack installation options

Part number	Feature code	Description and contents
4M27A60835	BA5Z	ThinkSystem ST650 V2/V3 Tower to Rack Conversion Kit • Tower to Rack Conversion Kit (EIA brackets, labels) • Static Rail • Rail Mylar (affix to rails to reduce friction)

The rail kit has the specifications listed in the following table.

Table 60. Rail kit specifications

Feature	ThinkSystem ST650 V2/V3 Static Rail
Part number	Part of 4M27A60835 (Feature code BA5V)
Rail type	Static (fixed, no slide)
Toolless installation	Yes
Cable Management Arm (CMA) support	No support
In-rack server maintenance	No
1U PDU support	Yes
0U PDU support	Limited*
Rack type	Lenovo and IBM 4-post, IEC standard-compliant
Mounting holes	Square or round
Mounting flange thickness	2 mm - 3.3 mm (0.08 - 0.13 in.)
Supported rack range	559 mm - 914 mm (22 - 36 in.)
Rail length***	600 mm (23.6 in.)

* For 0U PDU support, the rack must be at least 1100 mm (43.31 in.) deep.
*** Measured when mounted on the rack, from the front surface of the front mounting flange to the rearmost point of the rail.

Supported rack cabinets are listed in the Rack cabinets section.

If you configured your server as a rack server, but later wish to convert it to a tower, use the kit in the following table to add the recommended stabilization feet.

Table 61. Stabilization feet for ST650 V3

Part number	Description
4M27A60833	ThinkSystem ST650 V2 Rack to Tower Conversion Kit • Contains 4 stabilization feet

Operating system support

The server supports the following operating systems:

- Microsoft Windows Server 2019
- Microsoft Windows Server 2022
- Red Hat Enterprise Linux 8.6
- Red Hat Enterprise Linux 8.7
- Red Hat Enterprise Linux 9.0
- Red Hat Enterprise Linux 9.1
- SUSE Linux Enterprise Server 15 SP4
- SUSE Linux Enterprise Server 15 Xen SP4
- Ubuntu 22.04 LTS 64-bit
- VMware ESXi 7.0 U3
- VMware ESXi 8.0 U1

For a complete list of supported, certified and tested operating systems, plus additional details and links to relevant web sites, see the Operating System Interoperability Guide:
https://lenovopress.com/osig#servers=st650-v3-7d7b-7d7a

For configure-to-order configurations, the server can be preloaded with VMware ESXi installed on M.2 cards. Ordering information is listed in the following table.

Table 62. VMware ESXi preload

Part number	Feature code	Description
CTO only	BMEY	VMware ESXi 7.0 U3 (Factory Installed)
CTO only	BQ8S	VMware ESXi 8.0 U1 (Factory Installed)

You can download supported VMware vSphere hypervisor images from the following web page and load it on the M.2 drives drives using the instructions provided:
https://vmware.lenovo.com/content/custom_iso/

Physical and electrical specifications

The ST650 V3 has the following overall physical dimensions, including tower feet, excluding components that extend outside the standard chassis, such as power supply handles:

- Width: 175 mm (6.9 inches)
- Height: 462 mm (18.2 inches)
- Depth: 734 mm (28.9 inches)

The following table lists the detailed dimensions. See the figure below for the definition of each dimension.

Table 63. Detailed dimensions

Dimension	Description
175 mm	X_a = Width, using widest features (not including feet)
248 mm	X_b = Width, between the outer edges of the feet
462 mm	Y_a = Height, from bottom of feet to top of chassis body
448 mm	Y_b = Height, from bottom of chassis body to top of chassis body
713 mm	Z_a = Depth, from front door to most rearward I/O port surface
734 mm	Z_b = Depth, from front door to deepest feature of the chassis body feature
758 mm	Z_c = Depth, from front door to deepest feature such as power supply handle
23 mm	Z_e = Depth, front door to front plate of chassis body

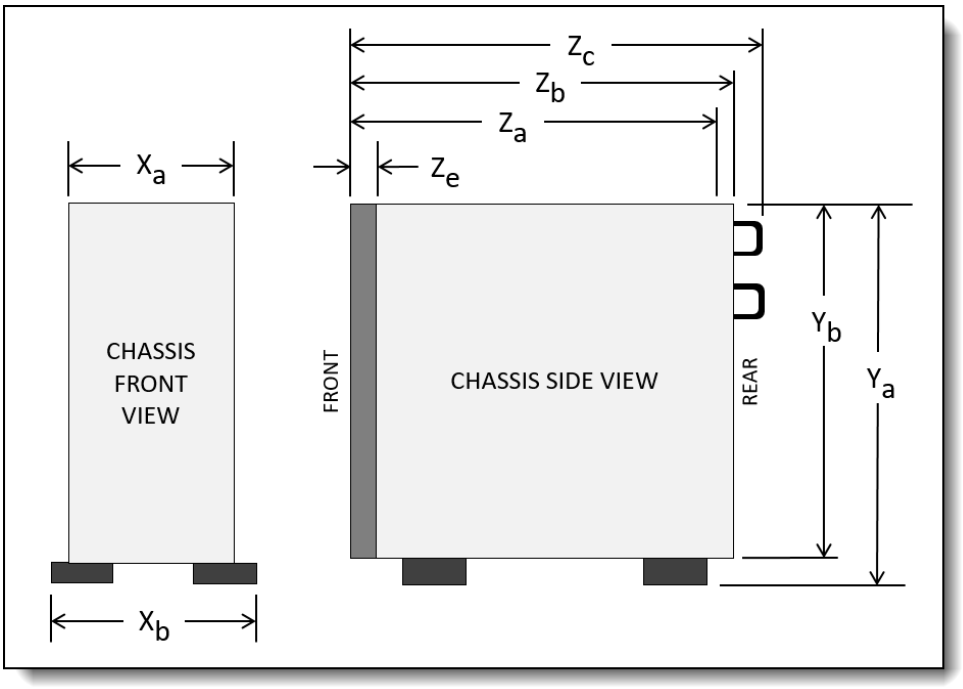

Figure 15. Server dimension

The shipping dimensions (cardboard packaging) of the ST650 V3 are as follows:

- Width: 597 mm (23.5 inches)
- Height: 374 mm (14.7 inches)
- Depth: 996 mm (39.2 inches)

The server has the following weight:

- Maximum weight: 39.1 kg (86.2 lb)

Electrical specifications for AC input power supplies:

- Input voltage:
  - 100 to 127 (nominal) Vac, 50 Hz or 60 Hz
  - 200 to 240 (nominal) Vac, 50 Hz or 60 Hz
  - 180 to 300 Vdc (China only)
- Inlet current: See the following table.

Table 64. Maximum inlet current

Part number	Description	100V AC	200V AC	220V AC	240V DC
AC input power - 80 PLUS Titanium efficiency					
4P57A72666	ThinkSystem 1100W 230V Titanium Hot-Swap Gen2 Power Supply	No support	5.9A	5.3A	5A
4P57A78359	ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply	No support	9.7A	8.7A	8.3A
4P57A72667	ThinkSystem 2600W 230V Titanium Hot-Swap Gen2 Power Supply	No support	13.2A	13A	11.9A
AC input power - 80 PLUS Platinum efficiency					
4P57A72670	ThinkSystem 750W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3	8.4A	4.1A	3.69A	3.5A
4P57A72671	ThinkSystem 1100W 230V/115V Platinum Hot-Swap Gen2 Power Supply v3	12A	6A	5.4A	5.1A
4P57A78362	ThinkSystem 1800W 230V Platinum Hot-Swap Gen2 Power Supply v2	No support	10A	9.1A	9A

Operating environment

The ST650 V3 server complies with ASHRAE Class A2 specifications with most configurations, and depending on the hardware configuration, also complies with ASHRAE Class A3 and Class A4 specifications.

Topics in this section:

- Temperature and humidity
- Acoustical noise emissions
- Shock and vibration
- Particulate contamination

Temperature and humidity

The server is supported in the following environment:

- Air temperature:
  - Operating:
    - ASHRAE Class A2: 10°C to 35°C (50°F to 95°F); the maximum ambient temperature decreases by 1°C for every 300 m (984 ft) increase in altitude above 900 m (2,953 ft).
    - ASHRAE Class A3: 5°C to 40°C (41°F to 104°F); the maximum ambient temperature decreases by 1°C for every 175 m (574 ft) increase in altitude above 900 m (2,953 ft).
    - ASHRAE Class A4: 5°C to 45°C (41°F to 113°F); the maximum ambient temperature decreases by 1°C for every 125 m (410 ft) increase in altitude above 900 m (2,953 ft).
  - Server off: 5°C to 45°C (41°F to 113°F)
  - Shipment/storage: -40°C to 60°C (-40°F to 140°F)
- Maximum altitude: 3,050 m (10,000 ft)
- Relative Humidity (non-condensing):
  - Operating
    - ASHRAE Class A2: 8% to 80%; maximum dew point: 21°C (70°F)
    - ASHRAE Class A3: 8% to 85%; maximum dew point: 24°C (75°F)
    - ASHRAE Class A4: 8% to 90%; maximum dew point: 24°C (75°F)
  - Shipment/storage: 8% to 90%

The following table lists ambient temperature requirements by component type.

Table 65. Ambient temperature requirements

	Ambient temperature of 25°C or lower		Ambient temperature of 30°C or lower		Ambient temperature of 35°C or lower	Ambient temperature of 40°C or lower	Ambient temperature of 45°C or lower
Processor TDP	All supported	All supported	Max 195W	All supported	Max 195W	Max 150W	Max 125W
Memory	32x DIMMs, each 64 GB or less	All supported	32x DIMMs, each 64 GB or less	All supported	32x DIMMs, each 64 GB or less	32x DIMMs, each 32 GB or less	32x DIMMs, each 32 GB or less
Drive backplane/drive types	All supported	All supported	All supported	All supported	All supported	SATA SSDs/HDDs only; No SAS, NVMe or AnyBay	SATA SSDs only; No SAS, NVMe or AnyBay, no HDDs
Drive backplane quantities	All supported	2x backplanes maximum	All supported	2x backplanes maximum	All supported	3.5" drives: 2 backplane (8 drives) 2.5" drives: 1 backplane (8 drives)	3.5" drives: 2 backplane (8 drives) 2.5" drives: 1 backplane (8 drives)
M.2	All supported	All supported	All supported	All supported	All supported	No M.2 support	No M.2 support
GPUs	SW GPUs only; no DW GPUs	All supported	SW GPUs only; no DW GPUs	All supported	No GPU support	No GPU support	No GPU support
PCI card	All supported	All supported	All supported	All supported	All supported	Only support: • ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter • ThinkSystem Intel I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter	Only support: • ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter • ThinkSystem Intel I350-T4 PCIe 1Gb 4-Port RJ45 Ethernet Adapter
LTO tape drive	All supported	All supported	All supported	All supported	All supported	No LTO support	No LTO support

Acoustical noise emissions

The ST650 V3 server has the following acoustic noise emissions declaration:

- Sound power level (L_{WAd}):
  - Idling: 5.2 Bel (Minimum), 5.8 Bel (Typical), 6.4 Bel (GPU rich), 6.4 Bel (Storage rich)
  - Operating: 5.2 Bel (Minimum), 5.8 Bel (Typical), 7.6 Bel (GPU rich), 7.2 Bel (Storage rich)
- Sound pressure level (L_{pAm}):
  - Idling: 37 dBA (Minimum), 41 dBA (Typical), 48 dBA (GPU rich), 48 dBA (Storage rich)
  - Operating: 37 dBA (Minimum), 41 dBA (Typical), 59 dBA (GPU rich), 56 dBA (Storage rich)

Notes:

- These sound levels were measured in controlled acoustical environments according to procedures specified by ISO7779 and are reported in accordance with ISO 9296.
- The declared acoustic sound levels are based on the following configurations, which may change depending on configuration/conditions：
  - Minimum configuration: 1x 125W CPU, 4x 16GB RDIMM, 4x 3.5” SAS HDD, SW RAID, 2x onboard 10GB LAN ports, 1x 750W PSU
  - Typical configuration: 2x 150W CPU, 4x 32GB RDIMM, 8x 3.5” SAS HDD, RAID 940-8i, 2x onboard 10GB LAN ports, 2x 750W PSU
  - GPU rich configuration: 2x 150W CPU, 32x 64GB RDIMM, 8x 3.5” SAS HDD, 1xRAID 940-8i, 2x onboard 10GB LAN ports ,8x NVDIA A2 GPU, 2x 1800W PSU
  - Storage rich configuration: 2x 195W CPU, 32x 64GB RDIMM, 32x 2.5” SAS HDD, 2x RAID 940-16i, 2x onboard 10GB LAN ports, 2x 1800W PSU
- Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room; the noise levels from other equipment; the room ambient temperature, and employee's location in relation to the equipment. Further, compliance with such government regulations depends on a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. Lenovo recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

Shock and vibration

The server has the following vibration and shock limits:

- Vibration:
  - Operating: 0.21 G rms at 5 Hz to 500 Hz for 15 minutes across 3 axes
  - Non-operating: 1.04 G rms at 2 Hz to 200 Hz for 15 minutes across 6 surfaces
- Shock:
  - Operating: 15 G for 3 milliseconds in each direction (positive and negative X, Y, and Z axes)
  - Non-operating:
    - Server weight 12 kg - 22 kg: 50 G for 152 in./sec velocity change across 6 surfaces
    - Server weight 23 kg - 31 kg: 35 G for 152 in./sec velocity change across 6 surfaces
    - Server weight 32 kg - 68 kg: 35 G for 136 in./sec velocity change across 6 surfaces

Particulate contamination

Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might damage the system that might cause the system to malfunction or stop working altogether.

The following specifications indicate the limits of particulates that the system can tolerate:

- Reactive gases:
  - The copper reactivity level shall be less than 200 Angstroms per month (Å/month)
  - The silver reactivity level shall be less than 200 Å/month
- Airborne particulates:
  - The room air should be continuously filtered with MERV 8 filters.
  - Air entering a data center should be filtered with MERV 11 or preferably MERV 13 filters.
  - The deliquescent relative humidity of the particulate contamination should be more than 60% RH
  - Environment must be free of zinc whiskers

For additional information, see the Specifications section of the documentation for the server, available from the Lenovo Documents site, https://pubs.lenovo.com/

Warranty and Support

The ST650 V3 has a 1-year or 3-year warranty based on the machine type of the system:

- 7D7B - 1 year warranty
- 7D7A - 3 year warranty

The standard warranty terms are customer-replaceable unit (CRU) and onsite (for field-replaceable units FRUs only) with standard call center support during normal business hours and 9x5 Next Business Day Parts Delivered.

Lenovo's additional support services provide a sophisticated, unified support structure for your data center, with an experience consistently ranked number one in customer satisfaction worldwide. Available offerings include:

- **Premier Support**

  Premier Support provides a Lenovo-owned customer experience and delivers direct access to technicians skilled in hardware, software, and advanced troubleshooting, in addition to the following:

  - Direct technician-to-technician access through a dedicated phone line
  - 24x7x365 remote support
  - Single point of contact service
  - End to end case management
  - Third-party collaborative software support
  - Online case tools and live chat support
  - On-demand remote system analysis

- **Warranty Upgrade (Preconfigured Support)**

  Services are available to meet the on-site response time targets that match the criticality of your systems.

  - 3, 4, or 5 years of service coverage
  - 1-year or 2-year post-warranty extensions
  - **Foundation Service**: 9x5 service coverage with next business day onsite response. YourDrive YourData is an optional extra (see below).
  - **Essential Service:** 24x7 service coverage with 4-hour onsite response or 24-hour committed repair (available only in select markets). Bundled with YourDrive YourData.
  - **Advanced Service:** 24x7 service coverage with 2-hour onsite response or 6-hour committed repair (available only in select markets). Bundled with YourDrive YourData.

- **Managed Services**

  Lenovo Managed Services provides continuous 24x7 remote monitoring (plus 24x7 call center availability) and proactive management of your data center using state-of-the-art tools, systems, and practices by a team of highly skilled and experienced Lenovo services professionals.

  Quarterly reviews check error logs, verify firmware & OS device driver levels, and software as needed. We'll also maintain records of latest patches, critical updates, and firmware levels, to ensure you systems are providing business value through optimized performance.

- **Technical Account Management (TAM)**

  A Lenovo Technical Account Manager helps you optimize the operation of your data center based on a deep understanding of your business. You gain direct access to your Lenovo TAM, who serves as your single point of contact to expedite service requests, provide status updates, and furnish reports to track incidents over time. In addition, your TAM will help proactively make service recommendations and manage your service relationship with Lenovo to make certain your needs are met.

- **Enterprise Server Software Support**

  Enterprise Software Support is an additional support service providing customers with software support on Microsoft, Red Hat, SUSE, and VMware applications and systems. Around the clock availability for critical problems plus unlimited calls and incidents helps customers address challenges fast, without incremental costs. Support staff can answer troubleshooting and diagnostic questions, address product comparability and interoperability issues, isolate causes of problems, report defects to software vendors, and more.

- **YourDrive YourData**

  Lenovo's YourDrive YourData is a multi-drive retention offering that ensures your data is always under your control, regardless of the number of drives that are installed in your Lenovo server. In the unlikely event of a drive failure, you retain possession of your drive while Lenovo replaces the failed drive part. Your data stays safely on your premises, in your hands. The YourDrive YourData service can be purchased in convenient bundles and is optional with Foundation Service. It is bundled with Essential Service and Advanced Service.

- **Health Check**

  Having a trusted partner who can perform regular and detailed health checks is central to maintaining efficiency and ensuring that your systems and business are always running at their best. Health Check supports Lenovo-branded server, storage, and networking devices, as well as select Lenovo-supported products from other vendors that are sold by Lenovo or a Lenovo-Authorized Reseller.

Examples of region-specific warranty terms are second or longer business day parts delivery or parts-only base warranty.

If warranty terms and conditions include onsite labor for repair or replacement of parts, Lenovo will dispatch a service technician to the customer site to perform the replacement. Onsite labor under base warranty is limited to labor for replacement of parts that have been determined to be field-replaceable units (FRUs). Parts that are determined to be customer-replaceable units (CRUs) do not include onsite labor under base warranty.

If warranty terms include parts-only base warranty, Lenovo is responsible for delivering only replacement parts that are under base warranty (including FRUs) that will be sent to a requested location for self-service. Parts-only service does not include a service technician being dispatched onsite. Parts must be changed at customer's own cost and labor and defective parts must be returned following the instructions supplied with the spare parts.

Lenovo Service offerings are region-specific. Not all preconfigured support and upgrade options are available in every region. For information about Lenovo service upgrade offerings that are available in your region, refer to the following resources:

- Service part numbers in Lenovo Data Center Solution Configurator (DCSC):
  http://dcsc.lenovo.com/#/services
- Lenovo Services Availability Locator
  http://lenovolocator.com/

For service definitions, region-specific details, and service limitations, please refer to the following documents:

- Lenovo Statement of Limited Warranty for Infrastructure Solutions Group (ISG) Servers and System Storage
  http://pcsupport.lenovo.com/us/en/solutions/ht503310
- Lenovo Data Center Services Agreement
  http://support.lenovo.com/us/en/solutions/ht116628

Services

Lenovo Services is a dedicated partner to your success. Our goal is to reduce your capital outlays, mitigate your IT risks, and accelerate your time to productivity.

Note: Some service options may not be available in all markets or regions. For more information, go to https://www.lenovo.com/services. For information about Lenovo service upgrade offerings that are available in your region, contact your local Lenovo sales representative or business partner.

Here's a more in-depth look at what we can do for you:

- **Asset Recovery Services**

  Asset Recovery Services (ARS) helps customers recover the maximum value from their end-of-life equipment in a cost-effective and secure way. On top of simplifying the transition from old to new equipment, ARS mitigates environmental and data security risks associated with data center equipment disposal. Lenovo ARS is a cash-back solution for equipment based on its remaining market value, yielding maximum value from aging assets and lowering total cost of ownership for your customers. For more information, see the ARS page, https://lenovopress.com/lp1266-reduce-e-waste-and-grow-your-bottom-line-with-lenovo-ars.

- **Assessment Services**

  An Assessment helps solve your IT challenges through an onsite, multi-day session with a Lenovo technology expert. We perform a tools-based assessment which provides a comprehensive and thorough review of a company's environment and technology systems. In addition to the technology based functional requirements, the consultant also discusses and records the non-functional business requirements, challenges, and constraints. Assessments help organizations like yours, no matter how large or small, get a better return on your IT investment and overcome challenges in the ever-changing technology landscape.

- **Design Services**

  Professional Services consultants perform infrastructure design and implementation planning to support your strategy. The high-level architectures provided by the assessment service are turned into low level designs and wiring diagrams, which are reviewed and approved prior to implementation. The implementation plan will demonstrate an outcome-based proposal to provide business capabilities through infrastructure with a risk-mitigated project plan.

- **Basic Hardware Installation**

  Lenovo experts can seamlessly manage the physical installation of your server, storage, or networking hardware. Working at a time convenient for you (business hours or off shift), the technician will unpack and inspect the systems on your site, install options, mount in a rack cabinet, connect to power and network, check and update firmware to the latest levels, verify operation, and dispose of the packaging, allowing your team to focus on other priorities.

- **Deployment Services**

  When investing in new IT infrastructures, you need to ensure your business will see quick time to value with little to no disruption. Lenovo deployments are designed by development and engineering teams who know our Products & Solutions better than anyone else, and our technicians own the process from delivery to completion. Lenovo will conduct remote preparation and planning, configure & integrate systems, validate systems, verify and update appliance firmware, train on administrative tasks, and provide post-deployment documentation. Customer's IT teams leverage our skills to enable IT staff to transform with higher level roles and tasks.

- **Integration, Migration, and Expansion Services**

  Move existing physical & virtual workloads easily, or determine technical requirements to support increased workloads while maximizing performance. Includes tuning, validation, and documenting ongoing run processes. Leverage migration assessment planning documents to perform necessary migrations.

Regulatory compliance

The ST650 V3 conforms to the following standards:

- ANSI/UL 62368-1
- IEC 62368-1 (CB Certificate and CB Test Report)
- FCC - Verified to comply with Part 15 of the FCC Rules, Class A
- Canada ICES-003, issue 7, Class A
- CSA C22.2 No. 62368-1
- CISPR 32, Class A, CISPR 35
- Japan VCCI, Class A
- Taiwan BSMI CNS15936, Class A; CNS15598-1; Section 5 of CNS15663
- CE, UKCA Mark (EN55032 Class A, EN62368-1, EN55024, EN55035, EN61000-3-2, EN61000-3-3, (EU) 2019/424, and EN IEC 63000 (RoHS))
- Korea KN32, Class A, KN35
- Russia, Belorussia and Kazakhstan, TP EAC 037/2016 (for RoHS)
- Russia, Belorussia and Kazakhstan, EAC: TP TC 004/2011 (for Safety); TP TC 020/2011 (for EMC)
- Australia/New Zealand AS/NZS CISPR 32, Class A; AS/NZS 62368.1
- UL Green Guard, UL2819
- Energy Star 3.0
- EPEAT (NSF/ ANSI 426) Bronze
- China CCC certificate, GB17625.1; GB4943.1; GB/T9254
- China CECP certificate, CQC3135
- China CELP certificate, HJ 2507-2011
- Japanese Energy-Saving Act
- Mexico NOM-019
- TUV-GS (EN62368-1, and EK1-ITB2000)
- India BIS 13252 (Part 1)
- Germany GS
- Brazil INMETRO
- South Africa NRCS LOA
- Ukraine UkrCEPRO
- Morocco CMIM Certification (CM)
- EU2019/424 Energy Related Product (ErP Lot9)

External drive enclosures

The server supports attachment to external drive enclosures using a RAID controller with external ports or a SAS host bus adapter. Adapters supported by the server are listed in the SAS adapters for external storage section.

Note: Information provided in this section is for ordering reference purposes only. For the operating system and adapter support details, refer to the interoperability matrix for a particular storage enclosure that can be found on the Lenovo Data Center Support web site:
http://datacentersupport.lenovo.com

Table 66. External drive enclosures

Model	Description
4587HC1	Lenovo Storage D1212 Disk Expansion Enclosure (2U enclosure wth 12x LFF drive bays)
4587HC2	Lenovo Storage D1224 Disk Expansion Enclosure (2U enclosure wth 24x SFF drive bays)
6413HC1	Lenovo Storage D3284 High Density Expansion Enclosure (5U enclosure wth 84x LFF drive bays)
7DAHCTO1WW	Lenovo ThinkSystem D4390 Direct Attached Storage (4U enclosure wth 90x LFF drive bays)

For details about supported drives, adapters, and cables, see the following Lenovo Press Product Guides:

- Lenovo Storage D1212 and D1224
  http://lenovopress.lenovo.com/lp0512
- Lenovo Storage D3284
  http://lenovopress.lenovo.com/lp0513
- Lenovo ThinkSystem D4390
  https://lenovopress.lenovo.com/lp1681

External storage systems

Lenovo offers the ThinkSystem DE Series and ThinkSystem DM Series external storage systems for high-performance storage. See the DE Series and DM Series product guides for specific controller models, expansion enclosures and configuration options:

- ThinkSystem DE Series Storage
  https://lenovopress.com/storage/thinksystem/de-series#rt=product-guide
- ThinkSystem DM Series Storage
  https://lenovopress.com/storage/thinksystem/dm-series#rt=product-guide
- ThinkSystem DG Series Storage
  https://lenovopress.com/storage/thinksystem/dg-series#rt=product-guide

External backup units

The following table lists the external backup options that are offered by Lenovo.

Table 67. External backup options

Part number	Description
External RDX USB drives	
4T27A10725	ThinkSystem RDX External USB 3.0 Dock
External SAS tape backup drives	
6160S7E	IBM TS2270 Tape Drive Model H7S
6160S8E	IBM TS2280 Tape Drive Model H8S
6160S9E	IBM TS2290 Tape Drive Model H9S
External SAS tape backup autoloaders	
6171S7R	IBM TS2900 Tape Autoloader w/LTO7 HH SAS
6171S8R	IBM TS2900 Tape Autoloader w/LTO8 HH SAS
6171S9R	IBM TS2900 Tape Autoloader w/LTO9 HH SAS
External tape backup libraries	
6741A1F	IBM TS4300 3U Tape Library-Base Unit
6741A3F	IBM TS4300 3U Tape Library-Expansion Unit
Full High 8 Gb Fibre Channel for TS4300	
01KP938	LTO 7 FH Fibre Channel Drive
01KP954	LTO 8 FH Fibre Channel Drive
02JH837	LTO 9 FH Fibre Channel Drive
Half High 8 Gb Fibre Channel for TS4300	
01KP936	LTO 7 HH Fibre Channel Drive
01KP952	LTO 8 HH Fibre Channel Drive
02JH835	LTO 9 HH Fibre Channel Drive
Half High 6 Gb SAS for TS4300	
01KP937	LTO 7 HH SAS Drive
01KP953	LTO 8 HH SAS Drive
02JH836	LTO 9 HH SAS Drive

For more information, see the list of Product Guides in the Backup units category:
https://lenovopress.com/servers/options/backup

Fibre Channel SAN switches

Lenovo offers the ThinkSystem DB Series of Fibre Channel SAN switches for high-performance storage expansion. See the DB Series product guides for models and configuration options:

- ThinkSystem DB Series SAN Switches:
  https://lenovopress.com/storage/switches/rack#rt=product-guide

Uninterruptible power supply units

The following table lists the uninterruptible power supply (UPS) units that are offered by Lenovo.

Table 68. Uninterruptible power supply units

Part number	Description
Tower UPS units	
55951AX	T1kVA Tower UPS (100-125VAC)
55951KX	T1kVA Tower UPS (200-240VAC)
55952AX	T1.5kVA Tower UPS (100-125VAC)
55952KX	T1.5kVA Tower UPS (200-240VAC)
Rack-mounted or tower UPS units	
55941AX	RT1.5kVA 2U Rack or Tower UPS (100-125VAC)
55941KX	RT1.5kVA 2U Rack or Tower UPS (200-240VAC)
55942AX	RT2.2kVA 2U Rack or Tower UPS (100-125VAC)
55942KX	RT2.2kVA 2U Rack or Tower UPS (200-240VAC)
55943AX	RT3kVA 2U Rack or Tower UPS (100-125VAC)
55943KX	RT3kVA 2U Rack or Tower UPS (200-240VAC)
55945KX	RT5kVA 3U Rack or Tower UPS (200-240VAC)
55946KX	RT6kVA 3U Rack or Tower UPS (200-240VAC)
55948KX	RT8kVA 6U Rack or Tower UPS (200-240VAC)
55949KX	RT11kVA 6U Rack or Tower UPS (200-240VAC)
55948PX	RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
55949PX	RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
Rack-mounted UPS units	
55943KT†	ThinkSystem RT3kVA 2U Standard UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)
55943LT†	ThinkSystem RT3kVA 2U Long Backup UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)
55946KT†	ThinkSystem RT6kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)
5594XKT†	ThinkSystem RT10kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)

† Only available in China and the Asia Pacific market.

For more information, see the list of Product Guides in the UPS category:
https://lenovopress.com/servers/options/ups

Power distribution units

The following table lists the power distribution units (PDUs) that are offered by Lenovo.

Table 69. Power distribution units

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
0U Basic PDUs															
00YJ776	ATZY	0U 36 C13/6 C19 24A 1 Phase PDU	N	Y	Y	N	N	N	N	N	N	Y	Y	Y	N
00YJ777	ATZZ	0U 36 C13/6 C19 32A 1 Phase PDU	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y
0U Switched and Monitored PDUs															
00YJ783	AU04	0U 12 C13/12 C19 Switched and Monitored 48A 3 Phase PDU	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	N
00YJ781	AU03	0U 20 C13/4 C19 Switched and Monitored 24A 1 Phase PDU	N	N	Y	N	Y	N	Y	N	N	Y	Y	Y	N
1U Switched and Monitored PDUs															
4PU7A81117	BNDV	1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - ETL	N	N	N	N	N	N	N	N	N	N	N	Y	N
4PU7A77467	BLC4	1U 18 C19/C13 Switched and Monitored 80A 3P Delta PDU	N	N	N	N	N	N	N	N	N	Y	N	Y	N
4PU7A77469	BLC6	1U 12 C19/C13 switched and monitored 60A 3P Delta PDU	N	N	N	N	N	N	N	N	N	N	N	Y	N
4PU7A77468	BLC5	1U 12 C19/C13 switched and monitored 32A 3P WYE PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
4PU7A81118	BNDW	1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - CE	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
1U Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)															
71763NU	6051	Ultra Density Enterprise C19/C13 PDU 60A/208V/3PH	N	N	Y	N	N	N	N	N	N	Y	Y	Y	N
71762NX	6091	Ultra Density Enterprise C19/C13 PDU Module	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U C13 Enterprise PDUs (12x IEC 320 C13 outlets)															
39Y8941	6010	DPI C13 Enterprise PDU Module (WW)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U Front-end PDUs (3x IEC 320 C19 outlets)															
39Y8938	6002	DPI Single-phase 30A/120V Front-end PDU (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8939	6003	DPI Single-phase 30A/208V Front-end PDU (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8934	6005	DPI Single-phase 32A/230V Front-end PDU (International)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8940	6004	DPI Single-phase 60A/208V Front-end PDU (US)	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N
39Y8935	6006	DPI Single-phase 63A/230V Front-end PDU (International)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U NEMA PDUs (6x NEMA 5-15R outlets)															
39Y8905	5900	DPI 100-127V NEMA PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
Line cords for 1U PDUs that ship without a line cord															
40K9611	6504	4.3m, 32A/380-415V, EPDU/IEC 309 3P+N+G 3ph wye (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9612	6502	4.3m, 32A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9613	6503	4.3m, 63A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9614	6500	4.3m, 30A/208V, EPDU to NEMA L6-30P (US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9615	6501	4.3m, 60A/208V, EPDU to IEC 309 2P+G (US) Line Cord	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	N
40K9617	6505	4.3m, 32A/230V, Souriau UTG Female to AS/NZ 3112 (Aus/NZ) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9618	6506	4.3m, 32A/250V, Souriau UTG Female to KSC 8305 (S. Korea) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

For more information, see the Lenovo Press documents in the PDU category:
https://lenovopress.com/servers/options/pdu

Rack cabinets

The following table lists the supported rack cabinets.

Table 70. Rack cabinets

Part number	Description
93072RX	25U Standard Rack (1000mm)
93072PX	25U Static S2 Standard Rack (1000mm)
7D6DA007WW	ThinkSystem 42U Onyx Primary Heavy Duty Rack Cabinet (1200mm)
7D6DA008WW	ThinkSystem 42U Pearl Primary Heavy Duty Rack Cabinet (1200mm)
93604PX	42U 1200mm Deep Dynamic Rack
93614PX	42U 1200mm Deep Static Rack
93634PX	42U 1100mm Dynamic Rack
93634EX	42U 1100mm Dynamic Expansion Rack
93074RX	42U Standard Rack (1000mm)
7D6EA009WW	ThinkSystem 48U Onyx Primary Heavy Duty Rack Cabinet (1200mm)
7D6EA00AWW	ThinkSystem 48U Pearl Primary Heavy Duty Rack Cabinet (1200mm)

For specifications about these racks, see the Lenovo Rack Cabinet Reference, available from:
https://lenovopress.com/lp1287-lenovo-rack-cabinet-reference

For more information, see the list of Product Guides in the Rack cabinets category:
https://lenovopress.com/servers/options/racks

KVM console options

The following table lists the supported KVM consoles.

Table 71. KVM console

Part number	Description
4XF7A84188	ThinkSystem 18.5" LCD Console (with US English keyboard)

The following table lists the available KVM switches and the options that are supported with them.

Table 73. KVM switches and options

Part number	Description
KVM Console switches	
1754D2X	Global 4x2x32 Console Manager (GCM32)
1754D1X	Global 2x2x16 Console Manager (GCM16)
1754A2X	Local 2x16 Console Manager (LCM16)
1754A1X	Local 1x8 Console Manager (LCM8)
Cables for GCM and LCM Console switches	
46M5383	Virtual Media Conversion Option Gen2 (VCO2)
46M5382	Serial Conversion Option (SCO)

For more information, see the list of Product Guides in the KVM Switches and Consoles category:
http://lenovopress.com/servers/options/kvm

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Related publications and links

For more information, see these resources:

- ThinkSystem ST650 V3 product page:
  https://www.lenovo.com/us/en/p/servers-storage/servers/towers/thinksystem-st650-v3/len21ts0022
- ThinkSystem ST650 V3 datasheet
  https://lenovopress.lenovo.com/ds0144
- Interactive 3D Tour of the ThinkSystem ST650 V3:
  https://lenovopress.lenovo.com/lp1624
- ThinkSystem ST650 V3 drivers and support
  http://datacentersupport.lenovo.com/products/servers/thinksystem/st650v3/7d7a/downloads
- ThinkSystem ST650 V3 product publications:
  https://pubs.lenovo.com/st650-v3/
  - User Guide, which includes:
    - System Configuration Guide
    - Hardware Maintenance Guide
  - Rack Installation Guides
  - Messages and Codes Reference
  - UEFI Manual for ThinkSystem Servers
- User Guides for options:
  https://serveroption.lenovo.com
- ServerProven hardware compatibility:
  http://serverproven.lenovo.com

Related product families

Product families related to this document are the following:

- 2-Socket Tower Servers
- ThinkSystem ST650 V3 Server

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