Dell EMC PowerEdge T150

Technical Guide

Regulatory Model: E80S series
Regulatory Type: E80S001
March 2022
Rev. A01

Notes, cautions, and warnings

NOTE: A NOTE indicates important information that helps you make better use of your product.

CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

WARNING: A WARNING indicates a potential for property damage, personal injury, or death.

Contents

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System overview

The Dell™ PowerEdge™ T150 is Dell's latest single-socket, entry-level 4U mini-tower server that is purposely designed to serve general-purpose business applications for both Small and Medium Businesses (SMB) and Remote Office/Branch Office (ROBO).

The system features:

- Up to one Intel® Xeon® E-2300 series processor
- Four DDR4 DIMM slots, supports UDIMM 128 GB max, speeds up to 3200 MT/s
- Up to four SAS/SATA drives
- BOSS-S1
- Internal Boot: Internal USB port
- RAID: PERC 10.5 and PERC 11 SW and HW RAID
- Network interface technologies to cover Network Interface Card (NIC)
- PCI Express® (PCIe) 4.0 enabled expansion slots
- iDRAC9 with Lifecycle controller; Express, Enterprise, Datacenter, and OME advanced features
- Cabled AC power supply units

Topics:

Key workloads

PowerEdge T150 is versatile enough to address many customer segments and workloads that includes:

- File/print services
- Mail/messaging services and other collaboration and productivity applications
- Point of sale
- Data consolidation
- Web serving

New technologies

Table 1. New technologies

Technology	Detailed Description
Intel® Xeon® E-2300 series processor	Core count: Up to 8 cores per processor
3200 MT/s DDR4 Memory	• 4 DDR4 DIMM slots, supports UDIMM 128 GB max, speeds up to 3200 MT/s **NOTE:** For Pentium processor, maximum memory supported is 2666 MT/s. • Support Unregistered ECC DDR4 DIMMs only
Flex I/O	• LOM board, 2x 1 GbE with BCM5720 LAN controller • Rear I/O with 1 GbE Dedicated Management Network Port, USB 3.0 x1, USB 2.0 x5, and VGA port • Serial port
Chipset (CHPST)	"Intel C250 series" or "Intel C256 series"
Dedicated PERC	RAID: PERC 10.5 and PERC 11 SW and HW RAID

Table 1. New technologies (continued)

Technology	Detailed Description
iDRAC9 w/ Lifecycle Controller	The embedded systems management solution for Dell servers features hardware and firmware inventory and alerting, in-depth memory alerting, faster performance, a dedicated gigabit port and many more features. iDRAC9 with lifecycle controller: Express, Enterprise, Datacenter, and OME advanced feature
Power supplies	• 300 W Cabled Bronze 100-240 V AC • 400 W Cabled Platinum 100-240 V AC

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System features and generational comparison

The following table shows the comparison between the PowerEdge T150 with the PowerEdge T140:

Table 2. Feature comparison

Feature	PowerEdge T150	PowerEdge T140
Processor	Maximum one Intel® Xeon® E-2300 series processor with up to 8 cores per processor or one Intel Pentium processor with up to 2 cores	Maximum one Intel® Xeon® E-2200 product family processor with up to 6 cores per processor Maximum one Intel® Pentium® G5420 processor up to 2 cores per processor Maximum one Intel® Core i3® 9100 processor up to 4 cores per processor Maximum one Intel® Celeron® G4930 processor up to 2 cores per processor
Memory	• 4 DDR4 DIMM slots, supports UDIMM 128 GB max, speeds up to 3200 MT/s **NOTE:** For Pentium processor, maximum memory supported is 2666 MT/s. • Supports unregistered ECC DDR4 DIMMs only	• 4 DDR4 DIMM slots, supports UDIMM 64 GB max, speeds up to 2666 MT/s • Supports unregistered ECC DDR4 DIMMs only
Storage Drives	Front bays: • Up to 4 x 3.5-inch SAS/SATA (HDD/SSD) • Maximum 80 TB on 4 HDD configuration	Front bays: • Up to 4 x 3.5-inch SAS/SATA (HDD), max 16 TB
Storage Controllers	Internal controllers: PERC H345, H355, HBA355i, H755 External controllers: HBA355e Software RAID: S150	Internal controllers: PERC H330, H730p, HBA330 External controllers: 12 Gbps SAS HBA Software RAID: S140
PCIe Slots	PCI Express® (PCIe)4.0 expansion slots 2 x PCIe Gen 4 slots 2 x PCIe Gen 3 slots	4 x PCIe Gen 3 slots
Embedded NIC (LOM)	2 x 1 GbE	2 x 1 GbE
Networking options (OCP 3.0)	NA	NA
IO Ports	Front Ports • 1 x iDRAC Direct (Micro-AB USB) port • 1 x USB 3.0 Rear Ports • 5 x USB 2.0 • 1 x iDRAC ethernet port • 2 x ethernet port	Front Ports • 1 x Micro USB 2.0 (Dedicated iDRAC direct) • 1 x USB 3.0 Rear Ports • 4 x USB 2.0 • 1 x iDRAC ethernet port

Table 2. Feature comparison (continued)

Feature	PowerEdge T150	PowerEdge T140
	• 1 x USB 3.0 • 1 x Serial port • 1 x VGA Internal Ports • 1 x USB 3.0	• 2 x ethernet port • 2 x USB 3.0 • 1 x Serial port • 1 x VGA Internal Ports • 1 x USB 3.0
Form Factor	4U	4U
Power Supplies	• 300 W Cabled Bronze 100-240 V AC • 400 W Cabled Platinum 100-240 V AC	365 W Cabled Gold (100–240 V AC)
Embedded Management	• iDRAC9 with lifecycle controller: Express, Enterprise, Datacenter, and OME advanced feature. • iDRAC Direct • iDRAC RESTful API with Redfish • iDRAC Service Module	• iDRAC9 • iDRAC Direct • iDRAC RESTful API with Redfish
Front IO	• Power button w/LED x1 • ID button w/LED x1 • USB 3.0 x1 • iDRAC MGMT USB x1 • System Status LED x1	• Power button w/LED x1 • ID button w/LED x1 • USB 3.0 x1 • iDRAC MGMT USB x1 • System Status LED x1

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Chassis views and features

Topics:

- Chassis views

Chassis views

Front view of the system

Figure 1. Front view of the 4 x 3.5-inch drive system

1. Power button
2. System health and ID indicator
3. USB 3.0 port
4. iDRAC direct micro USB port
5. Optical drive (optional)

Rear view of the system

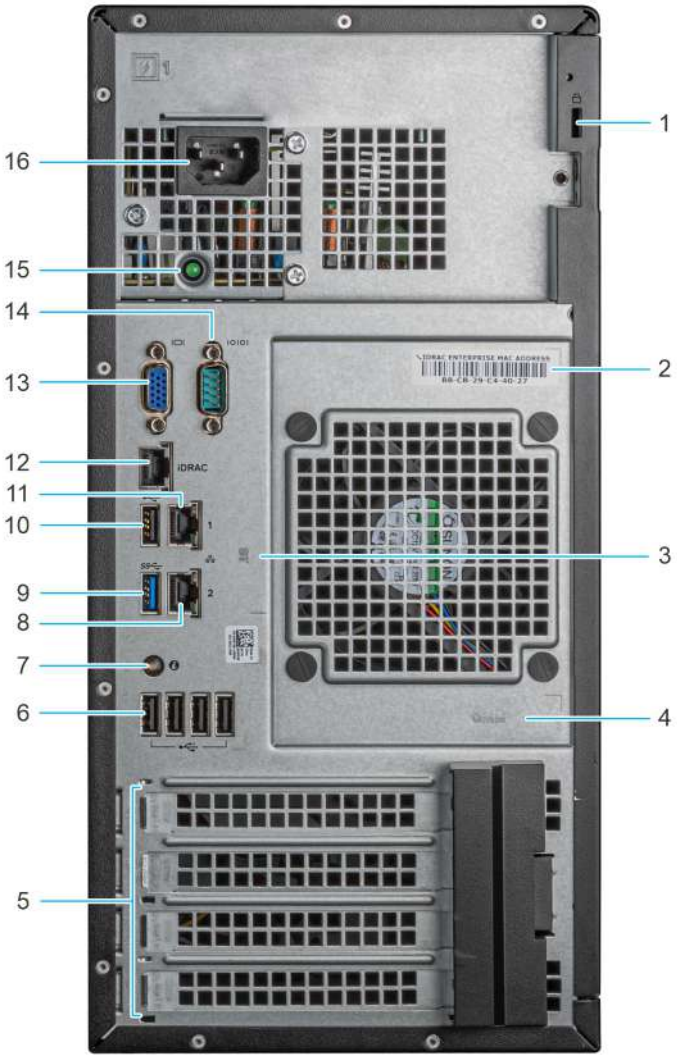

Figure 2. Rear view of the system

1. Security Cable Lock
2. iDRAC MAC address and iDRAC secure password label
3. Service Tag, Express Service Code, QRL label
4. OpenManage Mobile (OMM) label
5. PCIe expansion card slots (4)
6. USB 2.0 port (4)
7. System identification button
8. NIC port (Gb 2)
9. USB 3.0 port (1)
10. USB 2.0 port (1)
11. NIC port (Gb 1)
12. iDRAC ethernet port
13. VGA port

14. Serial port
15. PSU Built-in Self Test (BIST) LED
16. Power supply unit plug

Inside the system

Figure 3. Inside view of the 4 x 3.5-inch drive system

1. Cabled Power Supply Unit (PSU)
2. Optical drive
3. Cabled drives (4)
4. System board
5. Expansion card retention latch
6. PCIe expansion card slots (4)
7. Intrusion switch
8. Fan
9. Memory module sockets

Quick Resource Locator

Figure 4. Quick resource locator for T150

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Processor

Topics:

Processor features

The following lists the features and functions that are in the upcoming Intel® Xeon E-2300 series processor offering:

- As an entry level server - Small businesses require reliability and security to support their critical business and customer data needs
- As an edge device or appliance - Edge servers or appliances with energy efficiency and performance at entry level prices
- As a secure cloud server - Protect the most sensitive portions of a workload or service with hardware-enhanced security

Supported processors

Table 3. Processor BIN stack

Processor	Clock Speed (GHz)	Cache (M)	Cores	Threads	Turbo	Memory Speed (MT/s)	Memory Capacity	TDP
E-2378G	2.8	16	8	16	Turbo	3200	128 GB	80 W
E-2378	2.6	16	8	16	Turbo	3200	128 GB	65 W
E-2356G	3.2	12	6	12	Turbo	3200	128 GB	80 W
E-2336	2.9	12	6	12	Turbo	3200	128 GB	65 W
E-2334	3.4	8	4	8	Turbo	3200	128 GB	65 W
E-2324G	3.1	8	4	4	Turbo	3200	128 GB	65 W
E-2314	2.8	8	4	4	Turbo	3200	128 GB	65 W
G6505	4.2	4	2	4	No Turbo	2666	128 GB	58 W
G6405T	3.5	4	2	4	No Turbo	2666	128 GB	35 W

NOTE: Graphics is not supported with E2300 series processors and cannot be enabled on Dell servers due to restriction in the chipset.

NOTE: Hyper-Threading is enabled by default on all Intel Xeon E-2300 series processors.

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Memory subsystem

T150 supports up to 4 DIMM slots, with up to UDIMM 128 GB of memory and speeds of up to 3200 MT/s.

Topics:

Supported memory

The table below lists the memory technologies supported by the platform.

Table 4. Supported memory technologies

Feature	T150 (DDR4)
DIMM Type	UDIMM
Transfer Speed	2666 MT/s, 2933 MT/s, and 3200 MT/s
Voltage	1.2 V (DDR4)

The following table lists the supported DIMMs for the T150 at launch. For the latest information about supported DIMMs, see the Memory NDA Deck. For information about memory configuration, post RTS, see the Dell EMC PowerEdge T150 Installation and Service Manual at www.dell.com/poweredgemanuals.

Memory speed

The table below lists the performance details for T150 based on the quantity and type of DIMMs per memory channel.

Table 5. DIMM performance

DIMM type	Rank	Capacity	DIMM rated voltage and speed	DIMMs per Channel (DPC)
UDIMM	1R	8 GB/16 GB	DDR4 (1.2 V), 3200 MT/s	3200 MT/s
	2R	32 GB	DDR4 (1.2 V), 3200 MT/s	3200 MT/s

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Storage

Topics:

Storage controllers

- PowerEdge Hardware RAID controllers (PERC) series 10, 11 are designed for:
  - Enhanced performance
  - Fault tolerance
  - Simplified management of RAID array drives
- PowerEdge controller series 10, 11 support older legacy SAS and SATA drive interfaces
- Dell S150 is software RAID solution for PowerEdge systems.

Table 6. PERC Series controller offerings

Performance Level	Controller and Description
Entry	S150 (SATA), SW RAID SATA
Value	H345, H355, HBA355 (Internal)
Premium Performance	H755
External Controllers	HBA355e

NOTE: For more information on the features of the Dell PowerEdge RAID controllers (PERC), Software RAID controllers, or BOSS card, and on deploying the cards, see the storage controller documentation at www.dell.com/storagecontrollermanuals.

NOTE: From December 2021, H355 will replace H345 as the entry raid controller. H345 will be deprecated in January 2022.

Storage controller feature matrix

Table 7. Storage controller feature matrix

Model and Form Factors	Interface Support	PCI Support	SAS Connection	Cache Memory Size	Write Back Cache	RAID Levels	Max Drive Support	RAID Support
PowerEdge Server-Storage Controllers (PERC & SAS HBA) Series 11								
H755 (SAS/SATA Only)	12 Gb/s SAS 6 Gb/s SAS/SATA 3 Gb/s SAS/SATA	PCIe Gen 4	2 x 8 Internal	8 GB NV	Flash-Backed Cache	0,1, 5, 6, 10, 50, 60	16/controller 50 with SAS Expander *Platform limit	Hardware RAID

Table 7. Storage controller feature matrix (continued)

Model and Form Factors	Interface Support	PCI Support	SAS Connection	Cache Memory Size	Write Back Cache	RAID Levels	Max Drive Support	RAID Support
H355 Adapter	12Gb/s SAS 6Gb/s SATA	PCIeGen 4	16 ports- 2 x8 Internal	No Cache	No Cache	0,1,1 0 Note[1]	Maximum 32 RAID, or 32 Non-RAID	Hardware RAID
HBA355i Adapter	12 Gb/s SAS 6 Gb/s SAS/SATA 3 Gb/s SAS/SATA	PCIe Gen 4	2 x 8 Internal	N/A	N/A	N/A	16/controller 50 with SAS Expander *Platform limit	N/A
HBA355e Adapter	12 Gb/s SAS 6 Gb/s SAS/SATA 3 Gb/s SAS/SATA	PCIe Gen 4	4 x 4 External	N/A	N/A	N/A	240	N/A
PowerEdge Server-Storage Controllers (PERC & SAS HBA) Series 10								
PERC H345	12 Gb/s SAS 6 Gb/s SATA	PCI-Express 3.1	16 ports- 2 x 8 Internal	No Cache	No Cache	0,1,1 0 Note[1]	Maximum 32 RAID, or 32 Non-RAID	Hardware RAID
PowerEdge Server-Storage Software RAID								
S150 Software RAID	6 Gb/s SATA	N/A	N/A	No Cache	No Cache	0,1, 5, 10	Maximum 12 SATA or 24 NVMe	Software RAID - Windows & Linux (Limited) Note [2]

NOTE:

1. RAID 5/50 removed from entry RAID card.
2. SWRAID support for Linus provides a pre-boot configuration utility to configure MDRAID and degraded boot capability. See User's Guide for details.

This document is updated as changes happen, so for the latest be sure to bookmark it rather than downloading an offline copy or refer to the Storage Controller Matrix.

Internal storage configuration

Please see the Factory Configuration Matrix on Sales Portal.

Server storage controllers User Guide

- Server-Storage Controllers User's Guides, click here

Internal USB

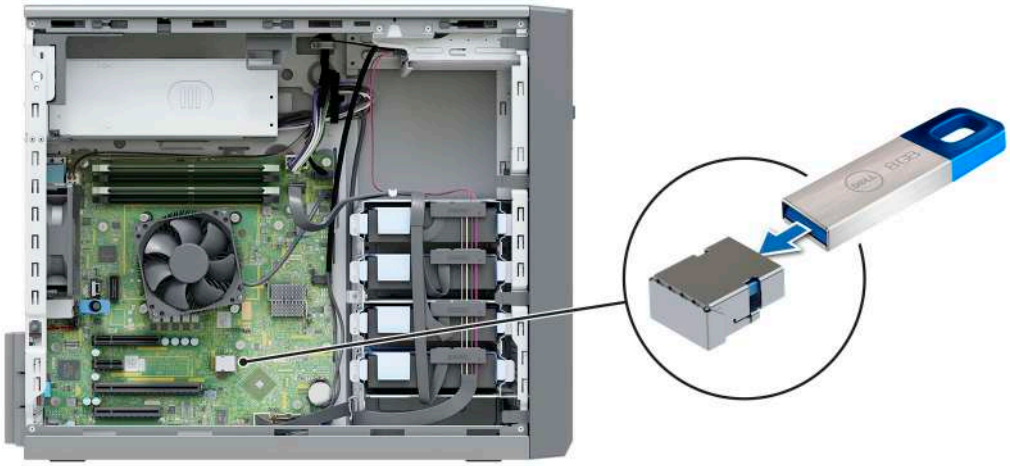

Figure 5. Internal USB connector

RAID - Redundant Array of Independent Disks

- Link to Help Me Choose: RAID Configuration here

Datasheets and PERC performance scaling decks

- Resource Page for Server-Storage (Sales Portal) click here
- PERC & SAS HBA Datasheets (To be updated)

Boot Optimized Storage Solution

Boot Optimized Storage Solution (BOSS) is a RAID solution that is designed for boot optimization and provides a separate RAID/SSD solution allowing customers to maximize server disk slots for data.

Dell provides the following BOSS card for this platform:

- BOSS S1

Figure 6. BOSS-S1 controller

BOSS feature matrix

Table 8. BOSS feature matrix

BOSS card	Drive Size	RAID levels	Stripe size	Virtual disk cache function	Maximum number of virtual disks	Maximum number of drives supported	Drive types	PCIe support	Disk cache policy	Support for Non-RAIDp disks	Cryptographic digital signature to verify firmware payload	Hot Plug
BOSS S1 Adapter	M.2 devices are read-intensive with 240 GB or 480 GB capacity	RAID 1	Supports default 64K stripe size only	Write through	1	2	6 Gbps M.2 SATA SSDs	Gen2	Drive default	Yes (supports up to two disks)	—	—

Datasheets

- BOSS S1

BOSS User Guides

- BOSS S1

Supported drives

The table that is shown below lists the internal drives that are supported by the T150. See Agile for the latest SDL.

Table 9. Supported drives

Form Factor	Type	Speed	Rotational Speed	Capacities
2.5-inch	SATA	6 GB	SSD	480 GB, 960 GB, 1.92 TB, 3.84 TB
2.5-inch	SAS / vSAS	12 GB	SSD	400 GB, 800 GB, 960 GB, 1.92 TB, 3.84 TB, 7.68 TB
2.5-inch	SAS	12 GB	10 K	600 GB, 1.2 TB, 2.4 TB
2.5-inch	SAS	12 GB	15 K	900 GB
3.5-inch	SAS	12 GB	7.2 K	2 TB, 4 TB, 8 TB, 12 TB, 16 TB, 20 TB
3.5-inch	SATA	6 GB	7.2 K	1 TB, 2 TB, 4 TB, 8 TB, 12 TB, 16 TB, 20 TB
M.2	SATA	6 GB	SSD	240 GB, 480 GB

Internal storage configurations

The PowerEdge T150 internal storage configuration available is 4 x 3.5-inch cabled SAS/SATA (HDD/SSD).

External storage

T150 supports the external storage device types that are listed in the table below:

Table 10. Support external storage devices

Device Type	Description
External Tape	Supports connection to external USB tape products
NAS/IDM appliance software	Supports NAS software stack
JBOD	Supports connection to 12 Gb MD-Series JBODs

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PCIe subsystem

Topics:

- PCIe risers
- PCIe slot power

PCIe risers

The T150 has a no riser option. Shown below are the riser offerings for the platform.

For a full list of supported cards and Slot priority, please see the PCIe Slot Priority Matrix found in the Agile. Slot Priority Matrix Agile P/N: RND20.

Figure 7. Expansion card

Table 11. Riser offering

Configuration number	Riser configuration	Number of processors	PERC type supported	Rear storage possible	Notes
0	NA	1	NA	No	1 x16 FH on Processor 1

PCIe slot power

Table 12. PCIe riser slot-power and aux power matrix

PCIe slots	Processor connection	Height	Length	Slot width	Power consumption
Slot 1	Processor 1	Full-height	Half-length	x8	25 W
Slot 2	Processor 1	Full-height	Half-length	x16	75 W
Slot 3	Platform Controller Hub	Full-height	Half-length	x1	10 W
Slot 4	Platform Controller Hub	Full-height	Half-length	x8	25 W

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Power, thermal, and acoustics

PowerEdge servers have an extensive collection of sensors that automatically track thermal activity, which helps regulate temperature thereby reducing server noise and power consumption. The table below lists the tools and technologies Dell offers to lower power consumption and increase energy efficiency.

Topics:

Power

Table 13. Power tools and technologies

Feature	Description
Power Supply Units(PSU) portfolio	Dell's PSU portfolio includes intelligent features such as dynamically optimizing efficiency while maintaining availability and redundancy. Find additional information in the Power supply units section.
Tools for right sizing	Enterprise Infrastructure Planning Tool (EIPT) is a tool that can help you determine the most efficient configuration possible. With Dell's EIPT, you can calculate the power consumption of your hardware, power infrastructure, and storage at a given workload. Learn more at www.dell.com/calc.
Industry Compliance	Dell's servers are compliant with all relevant industry certifications and guide lines, including 80 PLUS, Climate Savers and ENERGY STAR.
Power monitoring accuracy	PSU power monitoring improvements include: ● Dell's power monitoring accuracy is currently 1%, whereas the industry standard is 5% ● More accurate reporting of power ● Better performance under a power cap
Power capping	Use Dell's systems management to set the power cap limit for your systems to limit the output of a PSU and reduce system power consumption. Dell is the first hardware vendor to leverage Intel Node Manager for circuit-breaker fast capping.
Systems Management	iDRAC Enterprise and Datacenter provides server-level management that monitors, reports and controls power consumption at the processor, memory and system level. Dell OpenManage Power Center delivers group power management at the rack, row, and data center level for servers, power distribution units, and uninterruptible power supplies.
Active power management	Intel Node Manager is an embedded technology that provides individual server-level power reporting and power limiting functionality. Dell offers a complete power management solution comprised of Intel Node Manager accessed through Dell iDRAC9 Datacenter and OpenManage Power Center that allows policy-based management of power and thermal at the individual server, rack, and data center level. Hot spare reduces power consumption of redundant power supplies. Thermal control off a speed optimizes the thermal settings for your environment to reduce fan consumption and lower system power consumption. Idle power enables Dell servers to run as efficiently when idle as when at full workload.
Fresh Air cooling	Refer to ASHRAE A3/A4 Thermal Restriction.

Table 13. Power tools and technologies (continued)

Feature	Description
Rack infrastructure	Dell offers some of the industry's highest-efficiency power infrastructure solutions, including: • Power distribution units (PDUs) • Uninterruptible power supplies (UPSs) • Energy Smart containment rack enclosures Find additional information at: https://www.delltechnologies.com/en-us/servers/power-and-cooling.htm.

Power Supply Units

Energy Smart power supplies have intelligent features, such as the ability to dynamically optimize efficiency while maintaining availability and redundancy. Also featured are enhanced power-consumption reduction technologies, such as high-efficiency power conversion and advanced thermal-management techniques, and embedded power-management features, including high-accuracy power monitoring. The table below shows the power supply unit options that are available for the T150.

Table 14. PowerEdge T150 PSU specifications

PSU	Class	Heat dissipation (maximum)	Frequency	Voltage	AC		DC	Current
					High line 200–240 V	Low line 100–120 V		
300 W AC	Bronze	1024 BTU/hr	50/60 Hz	100–240 V AC, autoranging	300 W	300 W	NA	4.6 A
400 W AC (available only from Dec'21)	Platinum	1365 BTU/hr	50/60 Hz	100–240 V AC, autoranging	400 W	400 W	NA	5.4 A

NOTE: Heat dissipation is calculated using the PSU wattage rating.

NOTE: When selecting or upgrading the system configuration, to ensure optimum power utilization, verify the system power consumption with the Enterprise Infrastructure Planning Tool available at Dell.com/calc.

Thermal

PowerEdge servers have an extensive collection of sensors that automatically track thermal activity, which helps regulate temperature thereby reducing server noise and power consumption.

Thermal design

Thermal management of the platform helps deliver high performance with the right amount of cooling to components, while maintaining the lowest fan speeds possible. This is done across a wide range of ambient temperatures from 10°C to 35°C (50°F to 95°F) and to extended ambient temperature ranges.

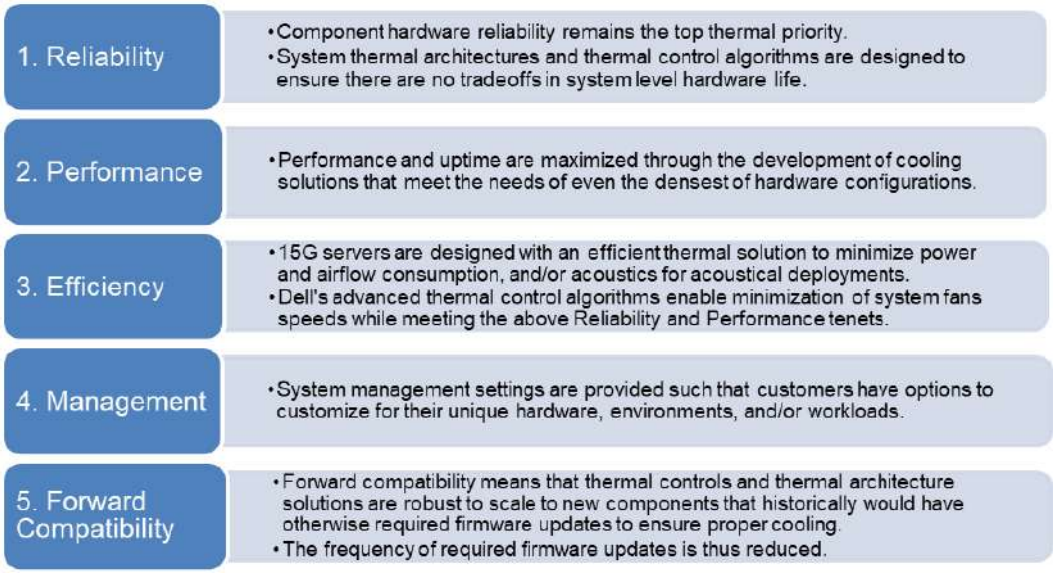

Figure 8. Thermal design characteristics

The thermal design of the PowerEdge T150 reflects the following:

- Optimized thermal design: The system layout is architected for optimum thermal design.
- System component placement and layout are designed to provide maximum airflow coverage to critical components with minimum expense of fan power.
- Comprehensive thermal management: The thermal control system regulates the fan speed based on several different responses from all system-component temperature sensors, as well as inventory for system configurations. Temperature monitoring includes components such as processors, DIMMs, chipset, the inlet air ambient, hard disk drives, and OCP.
- Open and closed loop thermal fan speed control: Open loop thermal control uses system configuration to determine fan speed based on inlet air ambient temperature. Closed loop thermal control method uses feedback temperatures to dynamically determine proper fan speeds.
- User-configurable settings: With the understanding and realization that every customer has unique set of circumstances or expectations from the system, in this generation of servers, we have introduced limited user- configurable settings residing in the iDRAC BIOS setup screen. For more information, see the Dell EMC PowerEdge T150 Installation and Service Manual at www.dell.com/poweredgemanuals and “Advanced Thermal Control: Optimizing across Environments and Power Goals” on Dell.com.
- Cooling redundancy: The T150 allows N+1 fan redundancy, allowing continuous operation with one fan failure in the system.

  NOTE: The cooling performance may vary depending on ambient temperature and configurations
- Environmental Specifications: The optimized thermal management makes the T150 reliable under a wide range of operating environments.

Thermal restrictions

ASHRAE A4 environment

- 3.5-inch hard drive count is restricted to 2x drives per chassis

Acoustics

Acoustical design

Dell EMC PowerEdge delivers sound quality and smooth transient response in addition to sound power levels and sound pressure levels oriented to deployment environments.

Sound quality describes how disturbing or pleasing a person finds a sound, as a function of a variety of psycho-acoustical metrics and thresholds. Tone prominence is one such metric.

Transient response refers to how sound changes with time.

Sound power level, sound pressure level and loudness refer to amplitude of sound.

A reference for comparison to sound pressure levels and loudness for familiar noise sources is given in the table below.

Table 15. Acoustical Reference Points and Output Comparisons

Value measured at your ears		Equivalent familiar noise experience
LpA, dBA, re 20µPa	**Loudness, sones**	
90	80	Loud concert
75	40	Data center, vacuum cleaner, voice must be elevated to be heard
60	10	Conversation levels
45	4	Whispering, open office layout, normal living room
35	2	Quiet office
30	1	Quiet library
20	0	Recording studio

For more information about PowerEdge acoustical design and metrics, see Understanding Acoustical Data and Causes of Sound in Dell Enterprise Products.

PowerEdge T150 acoustics

T150 configuration specification is in ENG0020655. (See the category definitions.)

Dell typically categorizes servers in five categories of acoustically acceptable usage:

- Category 1: Table-top in Office Environment
- Category 2: Floor-standing in Office Environment
- Category 3: General Use Space
- Category 4: Attended Data Center
- Category 5: Unattended Data Center

T150 is required to adhere to the acoustical Category 1.

Category 1: Table-top in Office Environment

When Dell determines that a specific Enterprise product is to be used on a table-top in office environment, for example, on a desk around a seated user's head height, then the acoustical specification of the following table applies. Small, light-weight towers are examples of these types of products.

Table 16. Dell Enterprise Category 1, "Table-top in Office Environment" acoustical specification category.

Measurement Position re AC0158	Metric, re AC0159	Test Modes, re AC0159 (note must be in steady state, see AC0159, except where noted below)			
		Standby in 23±2° C Ambient	**Idle in 23±2° C Ambient**	**Operating in 23±2° C Ambient – if not otherwise specified in the program's configuration document, then processor and hard drive operating modes are required**	**Simulate (that is, set fan speeds representative) for Idle at 28° C & 35° C Ambient, and for 100% loading and maximum configuration, at 35° C Ambient**
Sound Power	LWA,m, B	≤ 4.2	≤ 4.7	≤ 5.0	Report
Sound Quality (both positions must meet limits): Front Binaural HEAD and Rear Microphone	Tones, Hz, dB	No prominent tones per criteria D.10.6 and D.10.8 of ECMA-74			Report tones
	Tonality, tu	≤ 0.35	≤ 0.35	≤ 0.35	Report
	Dell Modulation, %	≤ 35	≤ 35	≤ 35	Report
	Loudness, sones	Report	Report	Report	Report
	LpA-single point, dBA	Report	Report	Report	Report
Front Binaural HEAD	Transients	• Oscillation (see AC0159), if observed, during 20-minute steady-state observation, must adhere to the following two criteria: ○ Max. {ΔLpA} < 3.0 dB ○ Event count < 3 for "1.5 dB < ΔLpA < 3.0 dB" ○ Acoustical Jump (see AC0159), during air mover speed transition from Idle to Operating Mode must be ≤ 15 dB. • Startup behavior ○ Report Startup behavior re. AC0159 ○ Startup must proceed smoothly, that is, no sudden or large jumps, and fan speed during startup must not exceed 50% of its maximum • Transient inputs: Report time-history sound pressure levels re AC0159 "Train of Step Functions on Processor"			N/A
Any	Other	No rattles, squeaks, or unexpected noises Sound should be "even" around the EUT (one side should not be dramatically louder than another) Unless otherwise specified, the "default" thermal-related settings shall be selected for BIOS and iDRAC. Specific operating conditions will be defined in "Configurations & Configuration Dependencies" for each platform.			
Sound Pressure	LpA-reported, dBA, re AC0158 and program configuration document	Report for all mics	Report for all mics	Report for all mics	Report for all mics

Acoustical performance

Dell EMC PowerEdge T150 is a tower server appropriate for quiet office environment. The acoustical output is usually not noticeable in a typical office environment.

Table 17. Acoustical configurations of T150

Configuration	Entry	Economy	Volume
Processor	1x Intel Rocket Lake, 65 W	1x Intel Rocket Lake, 65 W	1x Intel Rocket Lake, 65 W
Processor Quantity	1	1	1
Memory	8 GB UDIMM	16 GB UDIMM	16 GB UDIMM
Memory Quantity	1	2	2
Apache Pass	N/A	N/A	N/A
NVDIMM	N/A	N/A	N/A
Storage	3.5-inch SATA 1-TB HDD (Client) HDD	3.5-inch SATA 2-TB HDD	3.5-inch SATA 2-TB HDDs
Storage Quantity	1	1	4
Backplane	4x 3.5-inch Cabled	4x 3.5-inch Cabled	4x 3.5-inch Cabled
Power Supply Unit	300 W	300 W	300 W
Power Supply Quantity	1	1	1
PCI 1	N/A	N/A	PERC H355
Other	N/A	N/A	ODD

Table 18. Acoustical performance of T150 acoustical configurations

Configuration		Entry	Volume	Feature rich
Acoustical Performance: Idle/ Operating @ 25 °C Ambient				
$L_{wA,m}$ (B)	Idle	3.6	3.6	3.6
	Operating	3.6	3.6	3.6
K_v (B)	Idle	0.4	0.4	0.4
	Operating	0.4	0.4	0.4
$L_{pA,m}$ (dB)	Idle	25	25	25
	Operating	25	25	25
Prominent tones		No prominent tones in Idle and Operating		
Acoustical Performance: Idle @ 28 °C Ambient				
$L_{wA,m}$ (B)		3.6	3.6	3.6
K_v (B)		0.4	0.4	0.4
$L_{pA,m}$ (dB)		25	25	25
Acoustical Performance: Max. Loading @ 35 °C Ambient				
$L_{wA,m}$ (B)		3.6	3.6	3.6
K_v (B)		0.4	0.4	0.4
$L_{pA,m}$ (dB)		25	25	25

$L_{wA,m}$: The declared mean A-weighted sound power level (LwA) is calculated per section 5.2 of ISO 9296 (2017) with data collected using the methods described in ISO 7779 (2010). Data presented here may not be fully compliant with ISO 7779.

$L_{pA,m}$: The declared mean A-weighted emission sound pressure level is at the bystander position per section 5.3 of ISO 9296 (2017) and measured using methods described in ISO 7779 (2010). The system is placed in a 24U rack enclosure, 25 cm above a reflective floor. Data presented here may not be fully compliant with ISO 7779.

Prominent tones: Criteria of D.6 and D.11 of ECMA-74 are followed to determine if discrete tones are prominent and to report them, if so.

Idle mode: The steady-state condition in which the server is energized but not operating any intended function.

Operating mode: The maximum of the steady state acoustical output at 50% of Processor TDP or active HDDs per C.9.3.2 in ECMA-74 .

PowerEdge acoustical dependencies

Some product features impact acoustical server output more than others.

The following features are considered strong drivers of acoustical response, thus configurations, or operating conditions that include these features may increase air mover speed and acoustical output of the server:

- Ambient temperature: Dell EMC evaluates the acoustical performance of servers in a 23 ±2°C environment. Ambient temperatures more than 25°C will have higher acoustical output and may experience larger fluctuations between state changes.
- Processor thermal design power (TDP): Higher wattage processors may require more airflow to cool under load and thus increase the potential acoustical output of the system.
- Storage type: As T150 fan speed is well controlled for acoustics, noise from rotational storage media (HDDs) can be noticeable in a quiet environment. For users sensitive to acoustics, SSD or Client HDDs are recommended.
- System thermal profile selection in BIOS or iDRAC GUI:
  - Default Thermal Profile, generally provides a lower air mover speed thus lower acoustical output than those of other thermal profiles.
  - Maximum Performance (Performance Optimized), will result in higher acoustical output.
- BOSS module: If any BOSS module is installed and “Maximum Performance (Performance Optimized)” is selected, fan speed and acoustical noise may significantly increase at IDLE condition.

Methods to reduce acoustical output

T150 is designed for use in data centers, some users may prefer to use it in a quieter setting. The following is a list of means to do so.

NOTE: In most cases, the idle air mover speed of the system cannot be lowered without changing the configuration of the system, and in some cases, even a configuration change may not reduce idle air mover speeds.

- Enable sound cap in IDRAC GUI: Sound cap, a setting in the BIOS, can be toggled on/off during boot up. When enabled, sound cap reduces the acoustics of the system at the expense of some performance.
- Reduce ambient temperature: Lowering the ambient temperature allows the system to cool components more efficiently than at higher ambient temperatures.
- Set target in Third-party PCIe card options: Dell EMC provides airflow customization for third-party PCIe adapters that are installed in PowerEdge platforms. If automatic cooling response is above desired levels (LFM) based on the card specifications, a different LFM target can be set using PCIe Airflow Settings options in iDRAC GUI.
- Replace third-party PCI cards with similar Dell supported temperature-controlled cards, if available. Dell EMC works diligently with card vendors to validate and develop PCI cards to meet Dell EMC’s exacting standards for thermal performance.
- Replace HDDs with SDDs

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Supported operating systems

The PowerEdge T150 system supports the following operating systems:

- Canonical Ubuntu Server LTS
- VMware ESXi
- Microsoft Windows Server with Hyper-V
- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server

For more information, go to www.dell.com/ossupport.

10

Dell EMC OpenManage systems management

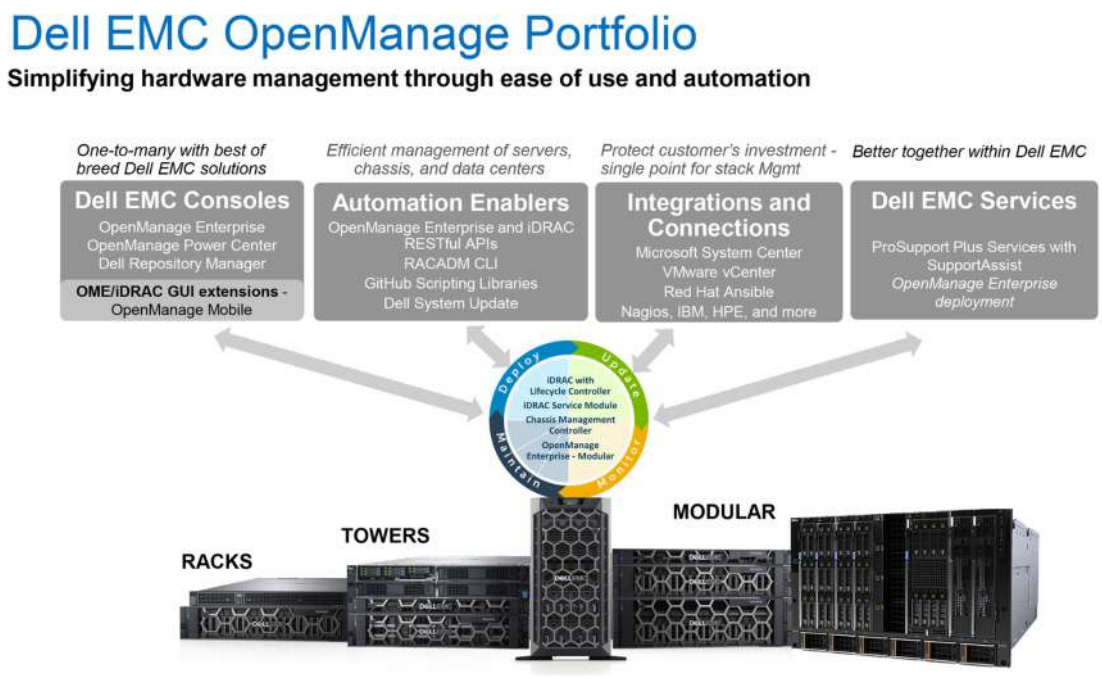

Figure 9. Dell EMC OpenManage Portfolio

Dell EMC delivers management solutions that help IT Administrators effectively deploy, update, monitor, and manage IT assets. OpenManage solutions and tools enable you to quickly respond to problems by helping them to manage Dell EMC servers effectively and efficiently; in physical, virtual, local, and remote environments, operating in-band, and out-of-band (agent-free). The OpenManage portfolio includes innovative embedded management tools such as the integrated Dell Remote Access Controller (iDRAC), Chassis Management Controller and Consoles like OpenManage Enterprise, OpenManage Power Manager plug in, and tools like Repository Manager.

Dell EMC has developed comprehensive systems management solutions based on open standards and has integrated with management consoles that can perform advanced management of Dell hardware. Dell EMC has connected or integrated the advanced management capabilities of Dell hardware into offerings from the industry's top systems management vendors and frameworks such as Ansible, thus making Dell EMC platforms easy to deploy, update, monitor, and manage.

The key tools for managing Dell EMC PowerEdge servers are iDRAC and the one-to-many OpenManage Enterprise console. OpenManage Enterprise helps the system administrators in complete lifecycle management of multiple generations of PowerEdge servers. Other tools such as Repository Manager, which enables simple yet comprehensive change management.

OpenManage tools integrate with systems management framework from other vendors such as VMware, Microsoft, Ansible, and ServiceNow. This enables you to use the skills of the IT staff to efficiently manage Dell EMC PowerEdge servers.

Topics:

Server and Chassis Managers

- Integrated Dell Remote Access Controller (iDRAC)
- iDRAC Service Module (iSM)

Dell EMC consoles

- Dell EMC OpenManage Enterprise
- Dell EMC Repository Manager (DRM)
- Dell EMC OpenManage Enterprise Power Manager plugin to OpenManage Enterprise
- Dell EMC OpenManage Mobile (OMM)

Automation Enablers

- OpenManage Ansible Modules
- iDRAC RESTful APIs (Redfish)
- Standards-based APIs (Python, PowerShell)
- RACADM Command Line Interface (CLI)
- GitHub Scripting Libraries

Integration with third-party consoles

- Dell EMC OpenManage Integrations with Microsoft System Center
- Dell EMC OpenManage Integration for VMware vCenter (OMIVV)
- Dell EMC OpenManage Ansible Modules
- Dell EMC OpenManage Integration with ServiceNow

Connections for third-party consoles

- Micro Focus and other HPE tools
- OpenManage Connection for IBM Tivoli
- OpenManage Plug-in for Nagios Core and XI

Dell EMC Update Utilities

- Dell System Update (DSU)
- Dell EMC Repository Manager (DRM)
- Dell EMC Update Packages (DUP)
- Dell EMC Server Update Utility (SUU)
- Dell EMC Platform Specific Bootable ISO (PSBI)

Dell resources

For additional information about white papers, videos, blogs, forums, technical material, tools, usage examples, and other information, go to the OpenManage page at https://www.dell.com/openmanagemanuals or the following product pages:

Table 19. Dell resources

Resource	Location
Integrated Dell Remote Access Controller (iDRAC)	https://www.dell.com/idracmanuals
iDRAC Service Module (iSM)	https://www.dell.com/support/kbdoc/000178050/
OpenManage Ansible Modules	https://www.dell.com/support/kbdoc/000177308/
OpenManage Essentials (OME)	https://www.dell.com/support/kbdoc/000175879/
OpenManage Mobile (OMM)	https://www.dell.com/support/kbdoc/000176046
OpenManage Integration for VMware vCenter (OMIVV)	https://www.dell.com/support/kbdoc/000176981/
OpenManage Integration for Microsoft System Center (OMIMSSC)	https://www.dell.com/support/kbdoc/000147399
Dell EMC Repository Manager (DRM)	https://www.dell.com/support/kbdoc/000177083
Dell EMC System Update (DSU)	https://www.dell.com/support/kbdoc/000130590
Dell EMC Platform Specific Bootable ISO (PSBI)	Dell.com/support/article/sln296511
Dell EMC Chassis Management Controller (CMC)	www.dell.com/support/article/sln311283
OpenManage Connections for Partner Consoles	https://www.dell.com/support/kbdoc/000146912
OpenManage Enterprise Power Manager	https://www.dell.com/support/kbdoc/000176254
OpenManage Integration with ServiceNow (OMISNOW)	Dell.com/support/article/sln317784

NOTE: Features may vary by server. Please refer to the product page on https://www.dell.com/manuals for details.

11

Dell Technologies Services

Dell Technologies Services include a wide, customizable range of service choices to simplify the assessment, design, implementation, management and maintenance of IT environments and to help you transition from platform to platform. Depending on your current business requirements and the level of service right for you, we provide factory, on-site, remote, modular, and specialized services that fit your needs and budget. We'll help with a little or a lot—your choice—and provide access to our global resources.

For more information, see DellEMC.com/Services.

Topics:

Dell EMC ProDeploy Enterprise Suite

ProDeploy Enterprise Suite gets your server out of the box and into optimized production—fast. Our elite deployment engineers with broad and deep experience utilizing best-in-class processes along with our established global scale can help you around the clock and around the globe. From simple to the most complex server installations and software integration, we take the guess work and risk out of deploying your new server technology.

		Basic Deployment	ProDeploy	ProDeploy Plus
Pre-deployment	Single point of contact for project management	-	●	In-region
	Site readiness review	-	●	●
	Implementation planning	-	●	●
	SAM engagement for ProSupport Plus entitled devices	-	-	●
Deployment	Deployment service hours	Business hours	24x7	24x7
	Remote guidance for hardware installation or Onsite hardware installation and packaging material removal	Onsite	Remote or Onsite	Onsite
	Install and configure system software	-	Remote	Onsite
	Install support software and connect with Dell Technologies	-	●	●
	Project documentation with knowledge transfer	-	●	●
Post-deployment	Deployment verification	-	●	●
	Configuration data transfer to Dell EMC technical support	-	●	●
	30-days of post-deployment configuration assistance	-	-	●
	Training credits for Dell EMC Education Services	-	-	●

Figure 10. ProDeploy Enterprise Suite capabilities

NOTE: Hardware installation not applicable on selected software products.

Dell EMC ProDeploy Plus

From beginning to end, ProDeploy Plus provides the skill and scale needed to successfully execute demanding deployments in today's complex IT environments. Certified Dell EMC experts start with extensive environmental assessments and detailed migration planning and recommendations. Software installation includes set up of most versions of Dell EMC SupportAssist and OpenManage system management utilities. Post-deployment configuration assistance, testing, and product orientation services are also available.

Dell EMC ProDeploy

ProDeploy provides full service installation and configuration of both server hardware and system software by certified deployment engineers including set up of leading operating systems and hypervisors as well as most versions of Dell EMC SupportAssist and OpenManage system management utilities. To prepare for the deployment, we conduct a site readiness review and implementation planning exercise. System testing, validation, and full project documentation with knowledge transfer complete the process.

Basic Deployment

Basic Deployment delivers worry-free professional installation by experienced technicians who know Dell EMC servers inside and out.

Dell EMC Server Configuration Services

With Dell EMC Rack Integration and other Dell EMC PowerEdge Server Configuration Services, you save time by receiving your systems racked, cabled, tested, and ready to integrate into the data center. Dell EMC staff pre-configure RAID, BIOS and iDRAC settings, install system images, and even install third-party hardware and software.

For more information, see Server Configuration Services.

Dell EMC Residency Services

Residency Services helps customers transition to new capabilities quickly with the assistance of on-site or remote Dell EMC experts whose priorities and time you control. Residency experts can provide post implementation management and knowledge transfer related to a new technology acquisition or day-to-day operational management of the IT infrastructure.

Dell EMC Remote Consulting Services

When you are in the final stages of your PowerEdge server implementation, you can rely on Dell EMC Remote Consulting Services and our certified technical experts to help you optimize your configuration with best practices for your software, virtualization, server, storage, networking, and systems management.

Dell EMC Data Migration Service

Protect your business and data with our single point of contact to manage your data migration project. Your project manager will work with our experienced team of experts to create a plan using industry-leading tools and proven processes based on global best practices to migrate your existing files and data so your business system get up and running quickly and smoothly.

Dell EMC ProSupport Enterprise Suite

With the ProSupport Enterprise Suite, we help keep your IT systems running smoothly, so you can focus on running your business. We will help maintain peak performance and availability of your most essential workloads. ProSupport Enterprise Suite is a suite of support services that enable you to build the solution that is right for your organization.

Choose support models based on how you use technology and where you want to allocate resources. From the desktop to the data center, address everyday IT challenges, such as unplanned downtime, mission-critical needs, data and asset protection, support planning, resource allocation, software application management and more. Optimize IT resources by choosing the right support model.

Figure 11. Dell EMC ProSupport Enterprise Suite

Dell EMC ProSupport Plus for Enterprise

When you purchase your PowerEdge server, we recommend ProSupport Plus, our proactive and preventative support service for your business-critical systems. ProSupport Plus provides you with all the benefits of ProSupport, plus the following:

- An assigned Services Account Manager who knows your business and your environment
- Immediate advanced troubleshooting from an engineer who understands your PowerEdge server
- Personalized, preventive recommendations based on analysis of support trends and best practices from across the Dell Technologies infrastructure solutions customer base to reduce support issues and improve performance
- Predictive analysis for issue prevention and optimization enabled by SupportAssist
- Proactive monitoring, issue detection, notification, and automated case creation for accelerated issue resolution enabled by SupportAssist
- On-demand reporting and analytics-based recommendations enabled by SupportAssist and TechDirect

Dell EMC ProSupport for Enterprise

Our ProSupport service offers highly trained experts around the clock and around the globe to address your IT needs. We help minimize disruptions and maximize availability of PowerEdge server workloads with:

- 24x7 support through phone, chat and online
- Predictive, automated tools and innovative technology
- A central point of accountability for all hardware and software issues
- Collaborative 3rd party support
- Hypervisor, operating system and application support
- Consistent experience regardless of where you are located or what language you speak
- Optional onsite parts and labor response options including next business day or four-hour mission critical

NOTE: Subject to service offer country availability.

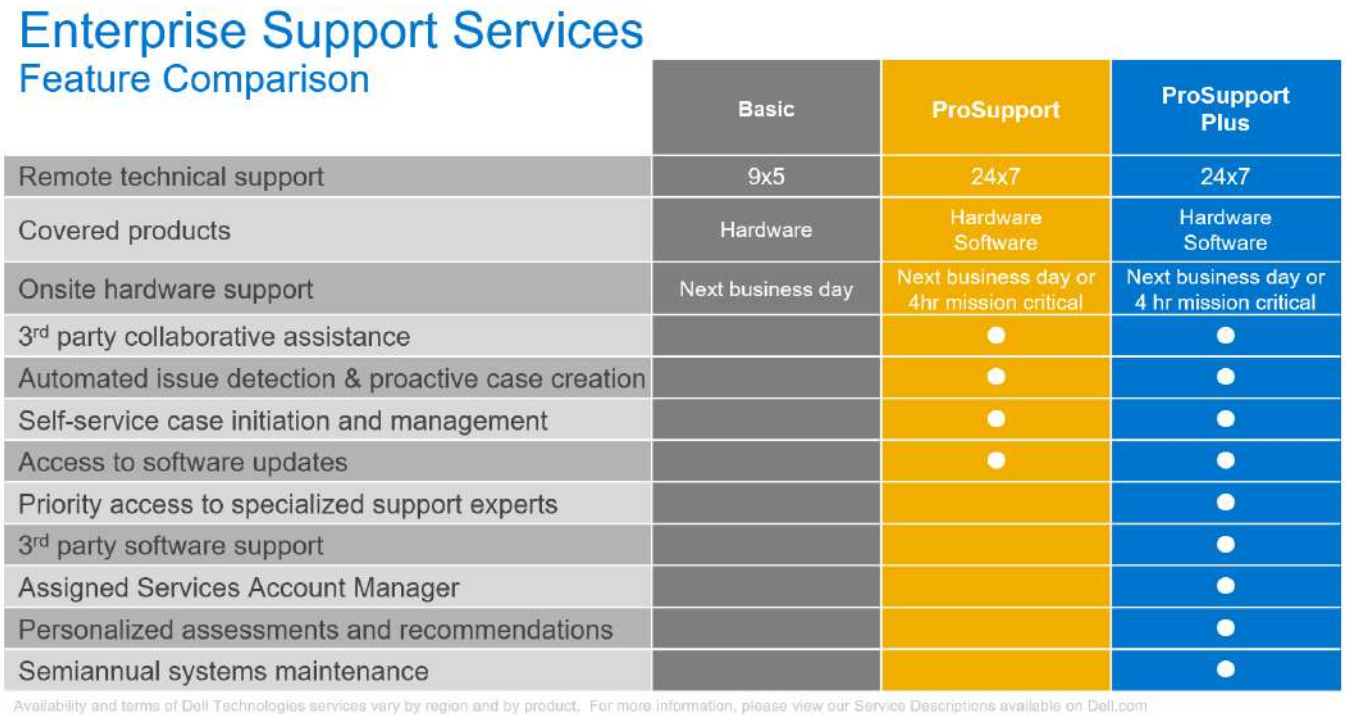

Figure 12. Dell EMC Enterprise Support model

Dell EMC ProSupport One for Data Center

ProSupport One for Data Center offers flexible site-wide support for large and distributed data centers with more than 1,000 assets. This offering is built on standard ProSupport components that leverage our global scale but are tailored to your company's needs. While not for everyone, this service option offers a truly unique solution for Dell Technologies largest customers with the most complex environments.

- Team of assigned Services Account Managers with remote, on-site options
- Assigned ProSupport One technical and field engineers who are trained on your environment and configurations
- On-demand reporting and analytics-based recommendations enabled by SupportAssist and TechDirect
- Flexible on-site support and parts options that fit your operational model
- A tailored support plan and training for your operations staff

ProSupport for HPC

The ProSupport for HPC provides solution-aware support including:

- Access to senior HPC experts
- Advanced HPC cluster assistance: performance, interoperability & configuration
- Enhanced HPC solution level end-to-end support
- Remote pre-support engagement with HPC Specialists during ProDeploy implementation

Learn more at DellEMC.com/HPC-Services.

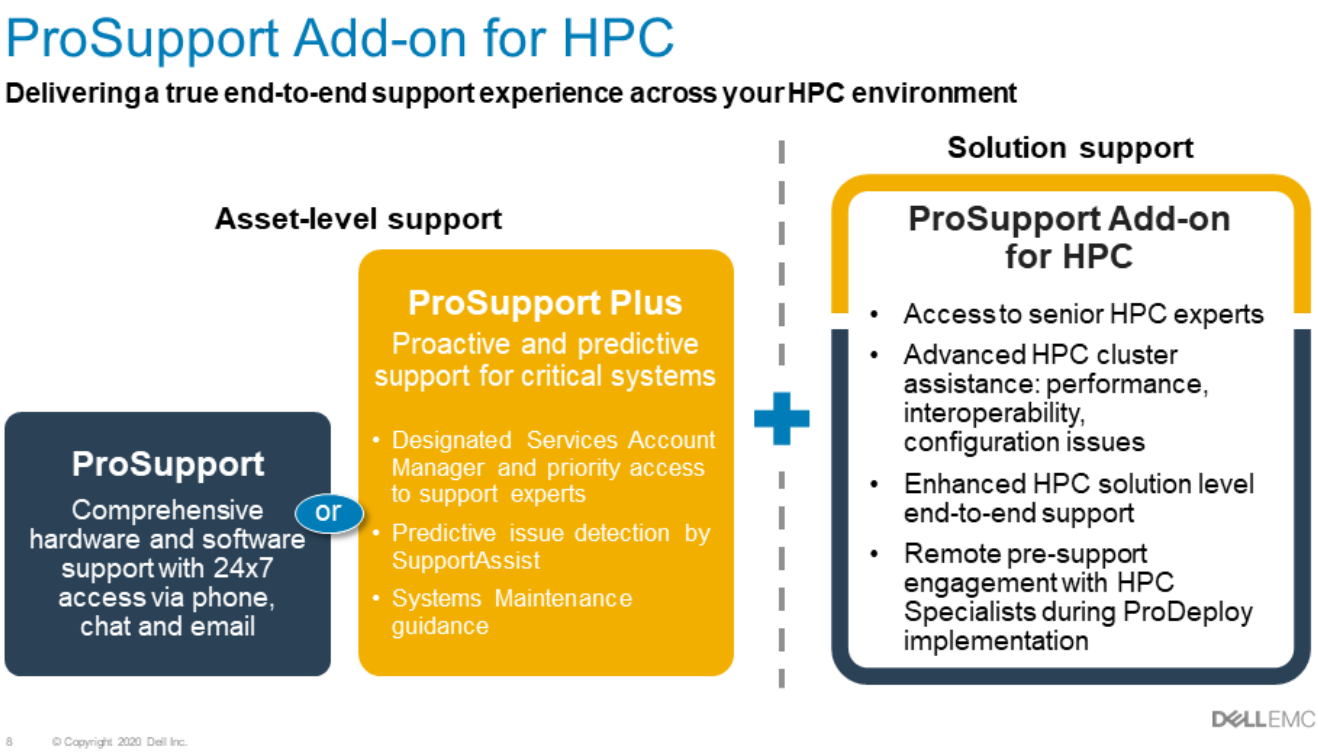

Figure 13. ProSupport for HPC

Support Technologies

Powering your support experience with predictive, data-driven technologies.

Dell EMC SupportAssist

The best time to solve a problem is before it happens. The automated proactive and predictive technology SupportAssist helps reduce steps and time to resolution, often detecting issues before they become a crisis. Benefits include:

- Value—SupportAssist is available to all customers at no additional charge
- Improve productivity—replace manual, high-effort routines with automated support
- Accelerate time to resolution—receive issue alerts, automatic case creation, and proactive contact from Dell EMC experts
- Gain insight and control—optimize enterprise devices with on-demand ProSupport Plus reporting in TechDirect, and get predictive issue detection before the problem starts

NOTE: SupportAssist is included with all support plans, but features vary based on service level agreement.

	Basic Hardware Warranty	ProSupport	ProSupport Plus
Automated issue detection and system state information collection	•	•	•
Proactive, automated case creation and notification		•	•
Predictive issue detection for failure prevention			•
Recommendation reporting available on-demand in TechDirect			•

Figure 14. SupportAssist model

Get started at Dell.com/SupportAssist

Dell EMC TechDirect

Boost IT team productivity when supporting Dell EMC systems. With over 1.4 million self-dispatches processed each year, TechDirect has proven its effectiveness as a support tool. You can:

- Self-dispatch replacement parts
- Request technical support
- Integrate APIs into your help desk

Or, access all your Dell EMC certification and authorization requirements. Train your staff on Dell EMC products, as TechDirect allows you to:

- Download study guides
- Schedule certification and authorization exams
- View transcripts of completed courses and exams

Register at techdirect.dell.

Dell Technologies Education Services

Build the IT skills required to influence the transformational outcomes of the business. Enable talent and empower teams with the right skills to lead and execute transformational strategy that drives competitive advantage. Leverage the training and certification required for real transformation.

Dell Technologies Education Services offers PowerEdge server training and certifications designed to help you achieve more from your hardware investment. The curriculum delivers the information and the practical, hands-on skills that you and your team need to confidently install, configure, manage, and troubleshoot your Dell EMC servers. To learn more or register for a class today, see LearnDell.com/Server.

Dell Technologies Consulting Services

Our expert consultants help you transform faster, and quickly achieve business outcomes for the high value workloads Dell EMC PowerEdge systems can handle.

From strategy to full-scale implementation, Dell Technologies Consulting can help you determine how to execute your IT, workforce, or application transformation.

We use prescriptive approaches and proven methodologies combined with Dell Technologies' portfolio and partner ecosystem to help you achieve real business outcomes. From multi-cloud, applications, DevOps, and infrastructure transformations, to business resiliency, data center modernization, analytics, workforce collaboration, and user experiences—we're here to help.

Dell EMC Managed Services

Reduce the cost, complexity, and risk of managing IT. Focus your resources on digital innovation and transformation while our experts help optimize your IT operations and investment with managed services backed by guaranteed service levels.

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Appendix A: Additional specifications

Topics:

- Chassis dimension
- Chassis weight
- USB ports specifications
- Power Supply Units
- NIC port specifications
- Environmental specifications

Chassis dimension

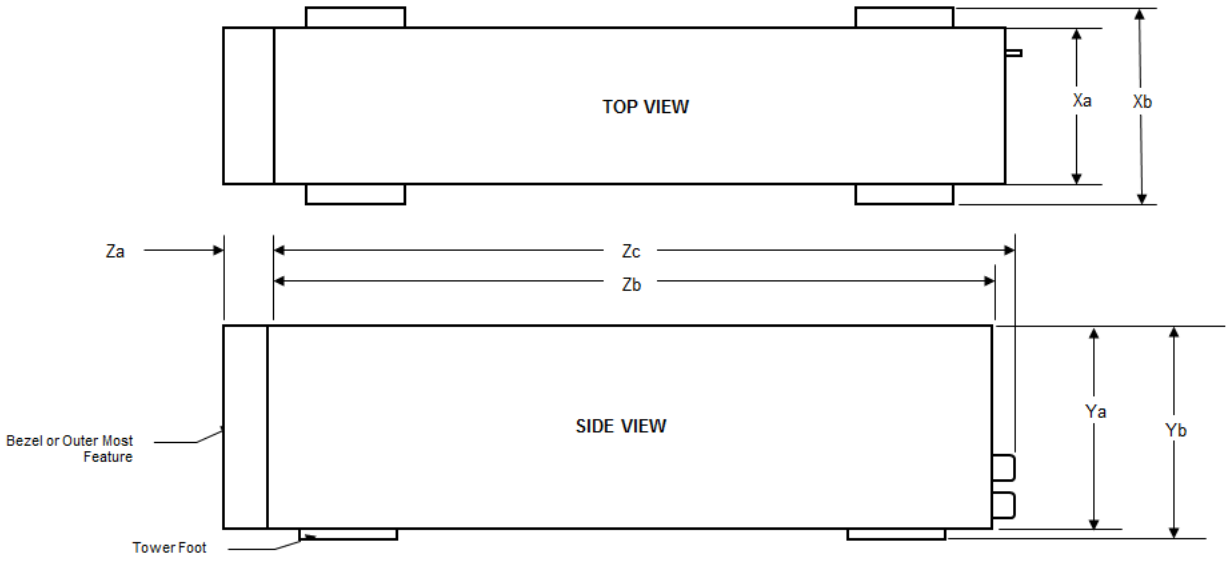

Figure 15. PowerEdge T150 chassis dimensions

Table 20. Chassis dimensions

Drives	Xa	Xb	Ya	Yb	Yc	Za	Zb	Zc
4 x 3.5-inch	175 mm (6.88 inches)	NA	360 mm (14.17 inches)	362.9 mm (14.28 inches)	NA	With bezel : 35 mm (17 inches) Without bezel : NA	400 mm (15.74 inches)	418.75 mm (16.48 inches)

NOTE: Zb is the nominal rear wall external surface where the system board I/O connectors reside.

Chassis weight

Table 21. PowerEdge T150 system weight

System configuration	Maximum weight (with all drives/SSDs)
4 x 3.5-inch system	11.68 kg (25.74 lbs.)

USB ports specifications

Table 22. PowerEdge T150 USB ports specifications

Front		Rear		Internal	
USB port type	**No. of ports**	**USB port type**	**No. of ports**	**USB port type**	**No. of ports**
USB 3.0 - compliant port	One	USB 2.0 - compliant port	Five	Internal USB 3.0 - compliant port	One
iDRAC Direct port (Micro-AB USB 2.0-compliant port)	One	USB 3.0 - compliant port	One		

NOTE: The micro USB 2.0 compliant port can only be used as an iDRAC Direct or a management port.

Power Supply Units

Energy Smart power supplies have intelligent features, such as the ability to dynamically optimize efficiency while maintaining availability and redundancy. Also featured are enhanced power-consumption reduction technologies, such as high-efficiency power conversion and advanced thermal-management techniques, and embedded power-management features, including high-accuracy power monitoring. The table below shows the power supply unit options that are available for the T150.

Table 23. PowerEdge T150 PSU specifications

PSU	Class	Heat dissipation (maximum)	Frequency	Voltage	AC		DC	Current
					High line 200–240 V	Low line 100–120 V		
300 W AC	Bronze	1024 BTU/hr	50/60 Hz	100–240 V AC, autoranging	300 W	300 W	NA	4.6 A
400 W AC (available only from Dec'21)	Platinum	1365 BTU/hr	50/60 Hz	100–240 V AC, autoranging	400 W	400 W	NA	5.4 A

NOTE: Heat dissipation is calculated using the PSU wattage rating.

NOTE: When selecting or upgrading the system configuration, to ensure optimum power utilization, verify the system power consumption with the Enterprise Infrastructure Planning Tool available at Dell.com/calc.

NIC port specifications

The PowerEdge T150 system supports up to two 10/100/1000 Mbps Network Interface Controller (NIC) ports embedded on Motherboard.

Table 24. PowerEdge T150 NIC port specification

Feature	Specification
LOM	1 GbE x 2

Environmental specifications

NOTE: For additional information about environmental certifications, refer to the Product Environmental Datasheet located with the Documentation > Regulatory Information on www.dell.com/support/home.

Table 25. Operational climatic range category A2

Temperature	Specifications
Allowable continuous operations	
Temperature ranges for altitudes <= 900 m (<= 2953 ft)	10–35°C (50–95°F) with no direct sunlight on the equipment
Humidity percent ranges (non-condensing at all times)	8% RH with -12°C minimum dew point to 80% RH with 21°C (69.8°F) maximum dew point
Operational altitude de-rating	Maximum temperature is reduced by 1°C/300 m (1.8°F/984 Ft) above 900 m (2953 Ft)

Table 26. Operational climatic range category A4

Temperature	Specifications
Allowable continuous operations	
Temperature ranges for altitudes <= 900 m (<= 2953 ft)	5–45°C (41–113°F) with no direct sunlight on the equipment
Humidity percent ranges (non-condensing at all times)	8% RH with -12°C minimum dew point to 90% RH with 24°C (75.2°F) maximum dew point
Operational altitude de-rating	Maximum temperature is reduced by 1°C/125 m (33.8°F/410 Ft) above 900 m (2953 Ft)

Table 27. Shared requirements across all categories

Temperature	Specifications
Allowable continuous operations	
Maximum temperature gradient (applies to both operation and non-operation)	20°C in an hour* (36°F in an hour) and 5°C in 15 minutes (9°F in 15 minutes), 5°C in an hour* (9°F in an hour) for tape **NOTE:** * - Per ASHRAE thermal guidelines for tape hardware these are not instantaneous rates of temperature change.
Non-operational temperature limits	-40 to 65°C (-40 to 149°F)
Non-operational humidity limits	5% to 95% RH with 27°C (80.6°F) maximum dew point
Maximum non-operational altitude	12,000 meters (39,370 ft)
Maximum operational altitude	3,048 meters (10,000 ft)

Table 28. Maximum vibration specifications

Maximum vibration	Specifications
Operating	0.21 G_{rms} at 5 Hz to 500 Hz for 10 minutes (all x, y, and z axes)
Storage	1.88 G_{rms} at 10 Hz to 500 Hz for 15 minutes (all six sides tested)

Table 29. Maximum shock pulse specifications

Maximum shock pulse	Specifications
Operating	Six consecutively executed shock pulses in the positive and negative x, y, and z axis of 6 G for up to 11 milliseconds
Storage	Six consecutively executed shock pulses in the positive and negative x, y, and z axis (one pulse on each side of the system) of 71 G for up to 2 milliseconds

Particulate and gaseous contamination specifications

The following table defines the limitations that prevent the damage to the IT equipment and/or, or both failure from particulate and gaseous contamination. If the levels of particulate or gaseous pollution exceed the specified limitations and results in equipment damage or failure, you must rectify the environmental conditions. Remediation of environmental conditions is the responsibility of the customer.

Table 30. Particulate contamination specifications

Particulate contamination	Specifications
Air filtration	Data center air filtration as defined by ISO Class 8 per ISO 14644-1 with a 95% upper confidence limit. **NOTE:** This condition applies to data center environments only. Air filtration requirements do not apply to IT equipment designed to be used outside a data center, in environments such as an office or factory floor. **NOTE:** Air entering the data center must have MERV11 or MERV13 filtration.
Conductive dust	Air must be free of conductive dust, zinc whiskers, or other conductive particles. **NOTE:** This condition applies to data center and non-data center environments.
Corrosive dust	• Air must be free of corrosive dust. • Residual dust present in the air must have a deliquescent point less than 60% relative humidity **NOTE:** This condition applies to data center and non-data center environments.

Table 31. Gaseous contamination specifications

Gaseous contamination	Specifications
Copper Coupon Corrosion rate	<300 Å/month per Class G1 as defined by ANSI/ISA71.04-2013
Silver Coupon Corrosion rate	<200 Å/month as defined by ANSI/ISA71.04-2013

NOTE: Maximum corrosive contaminant levels measured at ≤50% relative humidity.

Thermal air restrictions

- Non Dell qualified peripheral cards or peripheral cards greater than 25 W are not supported
- GPU is not supported
- The operating temperature is for a maximum altitude of 950 m for fresh air cooling
- Supports maximum x2 HDD only

NOTE: DIMM blank is not required.

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Appendix B. Standards compliance

The system conforms to the following industry standards.

Table 32. Industry standard documents

Standard	URL for information and specifications
ACPIAdvance Configuration and Power Interface Specification, v2.0c	https://uefi.org/specsandtesttools
Ethernet IEEE 802.3-2005	https://standards.ieee.org/
HDGHardware Design Guide Version 3.0 for Microsoft Windows Server	microsoft.com/whdc/system/platform/pcdesign/desguide/serverdg.mspx
IPMI Intelligent Platform Management Interface, v2.0	intel.com/design/servers/ipmi
DDR4 Memory DDR4 SDRAM Specification	jedec.org/standards-documents/docs/jesd79-4.pdf
PCI Express PCI Express Base Specification Rev. 2.0 and 3.0	pcisig.com/specifications/pciexpress
PMBus Power System Management Protocol Specification, v1.2	http://pmbus.org/Assets/PDFS/Public/PMBus_Specification_Part_I_Rev_1-1_20070205.pdf
SAS Serial Attached SCSI, v1.1	http://www.t10.org/
SATA Serial ATA Rev. 2.6; SATA II, SATA 1.0a Extensions, Rev. 1.2	sata-io.org
SMBIOS System Management BIOS Reference Specification, v2.7	dmtf.org/standards/smbios
TPM Trusted Platform Module Specification, v1.2 and v2.0	trustedcomputinggroup.org
UEFI Unified Extensible Firmware Interface Specification, v2.1	uefi.org/specifications
USB Universal Serial Bus Specification, Rev. 2.0	usb.org/developers/docs

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Appendix C Additional resources

Table 33. Additional resources

Resource	Description of contents	Location
Installation and Service Manual	This manual, available in PDF format, provides the following information: • Chassis features • System Setup program • System indicator codes • System BIOS • Remove and replace procedures • Diagnostics • Jumpers and connectors	Dell.com/Support/Manuals
Getting Started Guide	This guide ships with the system, and is also available in PDF format. This guide provides the following information: • Initial setup steps	Dell.com/Support/Manuals
Rack Installation Guide	This document ships with the rack kits, and provides instructions for installing a server in a rack.	Dell.com/Support/Manuals
System Information Label	The system information label documents the system board layout and system jumper settings. Text is minimized due to space limitations and translation considerations. The label size is standardized across platforms.	Inside the system chassis cover
Quick Resource Locator (QRL)	This code on the chassis can be scanned by a phone application to access additional information and resources for the server, including videos, reference materials, service tag information, and Dell EMC contact information.	Inside the system chassis cover
Enterprise Infrastructure Planning Tool (EIPT)	The Dell EMC online EIPT enables easier and more meaningful estimates to help you determine the most efficient configuration possible. Use EIPT to calculate the power consumption of your hardware, power infrastructure, and storage.	Dell.com/calc