FusionServer 5288 V5 Server

Technical White Paper

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About This Document

Purpose

This document describes the FusionServer 5288 V5 rack server in terms of features, structure, specifications, and component hardware and software compatibility.

Intended Audience

This document is intended for pre-sales engineers.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

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Change History

Issue	Date	Description
11	2024-05-11	Updated **5.10.2 Drive Backplane**.
10	2024-03-29	Updated **6.1 Technical Specifications**.
09	2023-11-30	• Updated **10 Certifications**. • Added **11 Waste Product Recycling**. • Updated **A.4 Nameplate** .
08	2023-08-31	Updated **5.8 PSUs** .
07	2023-04-30	Updated **6.1 Technical Specifications**.
06	2022-11-30	Updated **A.4 Nameplate** .
05	2022-11-11	• Updated **6.3 Physical Specifications** . • Updated **8.1 Security**.
04	2022-08-12	Optimized **6.3 Physical Specifications** .
03	2022-06-25	• Added a figure that shows how to measure dimensions. • Added the description of the enhanced management chip (VB) and normal management chip. • Updated **6.1 Technical Specifications** and claimed support for U.2 drives. • Updated CE, UKCA, and CCC certification standards in **10 Certifications**. • Added **A.1 Chassis Label**.
02	2022-03-18	Added **10 Certifications**.
01	2021-12-20	This issue is the first official release.

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1 Product Introduction

FusionServer 5288 V5 (5288 V5) is a new-generation 4U dual-socket or single-socket storage server designed for media and entertainment, and finance fields.

The 5288 V5 is ideal for applications such as cold data storage, video surveillance, cloud storage, and big data processing.

The 5288 V5 delivers outstanding computing performance, exceptional flexibility, and unmatched storage expandability in a compact, dense design.

NOTE

For details about the 5288 V5 nameplate information, see **A.4 Nameplate** .

Figure 1-1 5288 V5

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2 Features

Performance and Scalability

- Powered by two Intel® Xeon® Scalable Skylake or Cascade Lake processors, the server provides up to 28 cores, 3.8 GHz frequency, a 38.5 MB L3 cache, and two 10.4 GT/s UPI links between the processors, which deliver supreme processing performance.
  - It supports up to two processors with 56 cores and 112 threads to maximize the concurrent execution of multithreaded applications.
  - An L2 cache is added. Each core can exclusively use 1 MB of L2 cache and at least 1.375 MB of L3 cache.
  - Intel Turbo Boost Technology 2.0 allows processor cores to run faster than the frequency specified in the Thermal Design Power (TDP) configuration if they are operating below power, current, and temperature specification limits.
  - Intel Hyper-Threading Technology enables each processor core to run up to two threads, improving parallel computation capability.
  - The hardware-assisted Intel® Virtualization Technology (Intel® VT) allows operating system (OS) vendors to better use hardware to address virtualization workloads.
  - Intel® Advanced Vector Extensions 512 (Intel AVX-512) significantly accelerates floating-point performance for computing-intensive applications.
  - The Cascade Lake processors support Intel® Deep Learning Boost vector neural network instructions (VNNI) to improve the performance of deep learning applications.
- The server supports double data rate 4 (DDR4) registered dual in-line memory modules (RDIMMs) and load-reduced DIMMs (LRDIMMs) with error checking and correcting (ECC). A server fully configured with twenty-four 2933 MT/s memory modules (only available with Cascade Lake processors) provides 3072 GB memory space and the maximum theoretical memory bandwidth of 249.9375 GB/s.
- A server supports a maximum of 12 Intel® Optane™ DC persistent memory modules (DCPMMs for short). When the DDR4 memory modules are used together, the server supports a maximum of 7.5 TB memory capacity (calculated based on a maximum of 128 GB capacity per DDR4 memory module and a maximum of 512 GB capacity per DCPMM).

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- Flexible drive configurations cater to a variety of business requirements and ensure high elasticity and scalability of storage resources.
- The use of all solid-state drives (SSDs) is supported. An SSD supports up to 100 times more I/O operations per second (IOPS) than a typical hard disk drive (HDD). The use of all SSDs provides higher I/O performance than the use of all HDDs or a combination of HDDs and SSDs.
- The LANs on motherboard (LOMs) and FlexIO cards provide a variety of ports to meet different networking requirements.
- With Intel integrated I/O, the Intel® Xeon® Scalable processors integrate the PCIe 3.0 controller to shortens I/O latency and improve overall system performance.
- The server supports up to eight PCIe 3.0 slots.

Availability and Serviceability

- Carrier-class components with process expertise ensure high system reliability and availability.
- The server uses hot-swappable SAS/SATA/NVMe drives. It supports RAID 0, 1, 1E, 10, 5, 50, 6, and 60, depending on the RAID controller card used. It also uses a supercapacitor to protect the RAID cache data against power failures.
- The SSDs offer better reliability than HDDs, ensuring continued system performance.
- The server provides simplified O&M and efficient troubleshooting through the UID/HLY LED indicators on the front panel, fault diagnosis LED, and iBMC WebUI.
- The iBMC monitors system parameters in real time, triggers alarms, and performs recovery actions in case of failures, minimizing system downtime.
- For more information about the warranty in the Chinese market, see **Warranty**.

Manageability and Security

- The built-in iBMC monitors server operating status and provides remote management.
- A password is required for accessing the BIOS, ensuring system boot and management security.
- The Network Controller Sideband Interface (NC-SI) allows a network port to serve as a management port and a service port for maximized return on investment (ROI) for customers. The NC-SI feature is disabled by default and can be enabled through the iBMC or BIOS.
- The integrated Unified Extensible Firmware Interface (UEFI) improves setup, configuration, and update efficiency and simplifies fault handling.
- Lockable server chassis panel ensures security of local data.
- The Advanced Encryption Standard–New Instruction (AES NI) algorithm allows faster and stronger encryption.
- Intel Execute Disable Bit (EDB) function prevents certain types of malicious buffer overflow attacks when working with a supported OS.
- Intel Trusted Execution Technology enhances security using hardware-based defense against malicious software attacks, allowing applications to run independently.

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- The trusted platform module (TPM) and trusted cryptography module (TCM) provide advanced encryption functions, such as digital signatures and remote authentication.
- The following requirements in NIST SP 800-147B are met:
  - The BIOS firmware digital signature update mechanism is supported. During the upgrade, the digital signature is verified to prevent unauthorized BIOS firmware upgrade.
  - The flash security protection mechanism is supported to prevent unauthorized modification of the flash memory in the OS.

NOTE

The service port with NC-SI enabled supports the following configuration:

- Configuring any port on the FlexIO card or PCIe NIC as the service port with NC-SI enabled. Host port 1 is configured by default.
- Enabling, disabling, and setting a virtual local area network (VLAN) ID for this port. The VLAN ID is **0** and disabled by default.
- Configuring IPv4 addresses (IPv4 address, subnet mask, and gateway) and IPv6 addresses (IPv6 address, prefix length, and gateway) for this port.

Energy Efficiency

- The 80 Plus Platinum power supply units (PSUs) of multiple power ratings provide 94% power efficiency at 50% load.
- The server supports active/standby power supplies and high-voltage DC (HVDC) for improved power supply efficiency.
- Efficient voltage regulator-down (VRD) power supplies for boards minimize the energy loss from DC/DC power conversion.
- Area-based, Proportional-Integral-Derivative (PID) intelligent fan speed adjustment and intelligent CPU frequency scaling optimize heat dissipation and reduce overall system power consumption.
- The improved thermal design with energy-efficient fans ensures optimal heat dissipation and reduces system power consumption.
- The server is protected with power capping and power control measures.
- Staggered spin-up for drives reduces the server boot power consumption.
- Intel® Intelligent Power Capability allows a processor to be powered on or off based on requirements.
- Low-voltage Intel® Xeon® Scalable processors consume less energy, ideally suited for data centers and telecommunications environments constrained by power and thermal limitations.
- SSDs consume 80% less power than HDDs.

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3 Physical Structure

Figure 3-1 5288 V5 physical structure

1	I/O module 1	2	I/O module 2
3	Rear drive	4	Rear-drive backplane
5	I/O module 3	6	Chassis
7	Power supply unit (PSU)	8	(Optional) built-in drive module[a]
9	(Optional) air duct[a]	10	Supercapacitor

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11	Front drive backplane	12	Front drive
13	Fan module bracket	14	Fan module
15	Heat sink	16	Processor
17	Memory	18	Mainboard
19	Cable organizer	20	TPM/TCM
21	RAID controller card	22	(Optional) FlexIO card
a: Install either the air duct or built-in drive module.			

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4 Logical Structure

Figure 4-1 5288 V5 logical structure

- The server supports one or two Intel® Xeon® Scalable processors.
- The server supports up to 24 memory modules.
- The CPUs (processors) interconnect with each other through two UPI links at a speed of up to 10.4 GT/s.
- Three PCIe riser cards connect to the processors through PCIe buses to provide ease of expandability and connection.
- The RAID controller card on the mainboard connects to CPU 1 through PCIe buses, and connects to the drive backplane through SAS high-speed cables. A variety of drive backplanes are provided to support different local storage configurations.
- The LBG-2 Platform Controller Hub (PCH) supports:
  - Two 10GE optical LOM ports or two 10GE electrical LOM ports
  - Two GE electrical LOM ports

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- Uses the BMC management chip, and supports a VGA, a management network port, a debugging serial port, and other management ports.
- The BMC management chip can be an enhanced management chip (VB) or an ordinary management chip.

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5 Hardware Description

5.1 Front Panel
5.2 Rear Panel
5.3 Processor
5.4 Memory
5.5 Storage
5.6 Network
5.7 I/O Expansion
5.8 PSUs
5.9 Fans
5.10 Boards

5.1 Front Panel

5.1.1 Appearance

Figure 5-1 Front view

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1	Left mounting ear	2	Drives
3	Slide-out label plate (with an SN label)	4	Right mounting ear

5.1.2 Indicators and Buttons

Indicator and Button Positions

Figure 5-2 Indicators and buttons on the front panel

1	LOM port 1 connection status indicator	2	LOM port 2 connection status indicator
3	LOM port 3 connection status indicator	4	LOM port 4 connection status indicator
5	Fault diagnosis LED	6	Health status indicator
7	UID button/indicator	8	Power button/indicator

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Indicator and Button Descriptions

Table 5-1 Description of indicators and buttons on the front panel

Sign	Indicator and Button	Description
888	Fault diagnosis LED	● **---**: The device is operating properly. ● Error code: A component is faulty. For details about error codes, see the ***FusionServer Rack Server iBMC Alarm Handling***. **NOTE** If multiple error codes are generated at the same time, the error codes are displayed in a loop. Each error code is displayed for 5 seconds.
	Power button/ indicator	Power indicator: ● Off: The device is not powered on. ● Steady green: The device is powered on. ● Blinking yellow: The iBMC is starting. The power button is locked and cannot be pressed. The iBMC is started in about 1 minute, and then the power indicator is steady yellow. ● Steady yellow: The device is standby. Power button: ● When the device is powered on, you can press this button to gracefully shut down the OS. **NOTE** For different OSs, you may need to shut down the OS as prompted. ● When the device is powered on, holding down this button for 6 seconds will forcibly power off the device. ● When the power indicator is steady yellow, you can press this button to power on the device.

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Sign	Indicator and Button	Description
	UID button/ indicator	The UID button/indicator helps identify and locate a device. UID indicator: ● Off: The device is not being located. ● Blinking or steady blue: The device is being located. UID button description: ● You can control the UID indicator status by pressing the UID button or using the iBMC. ● You can press this button to turn on or off the UID indicator. ● You can press and hold down this button for 4 to 6 seconds to reset the iBMC.
	Health status indicator	● Off: The device is powered off or is faulty. ● Blinking red at 1 Hz: A major alarm has been generated on the system. ● Blinking red at 5 Hz: A critical alarm has been generated on the system. ● Steady green: The device is operating properly.
	LOM port connection status indicator	Each indicator shows the connection status of an Ethernet LOM port. ● Off: The network port is not in use or has failed. ● Steady green: The network port is properly connected. **NOTE** ● The indicators correspond to two 10GE and two GE network ports on the mainboard. ● The LOM has a standby power supply and will not be powered off even if the service system is powered off. As long as the LOM ports are properly connected to other working network devices, the network ports will remain connected and the indicators are on.

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5.1.3 Ports

Port Positions

Figure 5-3 Ports on the front panel

1	USB 2.0 ports	-	-

Port Description

Table 5-2 Ports on the front panel

Port	Type	Quantity	Description
USB port	USB 2.0	2	Used to connect to a USB device. **NOTICE** Before connecting an external USB device, check that the USB device functions properly. The server may operate abnormally if an abnormal USB device is connected.

5.2 Rear Panel

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5.2.1 Appearance

Figure 5-4 Rear view

1	I/O module 1	2	I/O module 2
3	(Optional) FlexIO card	4	I/O module 3
5	PSU 1	6	PSU 2
7	Rear drives	-	-

NOTE

- I/O modules 1, 2 and 3 can be configured with drive modules or PCIe riser modules.
- The preceding figure is for reference only.

5.2.2 Indicators

Indicator Positions

Figure 5-5 Indicators on the rear panel

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1	LOM port indicator	2	LOM port indicator
3	Data transmission status indicator of the management network port	4	Connection status indicator of the management network port
5	UID Indicator	6	PSU indicator

Indicator Description

Table 5-3 Description of indicators on the rear panel

Indicator	Description
LOM port indicator	For details, see **5.6.1 LOMs** .
PSU indicator	● Off: No power is supplied. ● Blinking green at 1 Hz: – The input is normal, and the server is standby. – The input is overvoltage or undervoltage. – The PSU is in deep hibernation mode. ● Blinking green at 4 Hz: The firmware is being upgraded online. ● Steady green: The power input and output are normal. ● Steady orange: The input is normal, but no power output is supplied. **NOTE** The possible causes of no power output are as follows: ● Power supply overtemperature protection ● Power output overcurrent or short-circuit ● Output overvoltage ● Short-circuit protection ● Device failure (excluding failure of all devices)
UID Indicator	The UID indicator helps identify and locate a device. ● Off: The device is not being located. ● Blinking or steady blue: The device is being located. **NOTE** You can turn on or off the UID indicator by pressing the UID button or remotely running a command on the iBMC CLI.
Data transmission status indicator of the management network port	● Off: No data is being transmitted. ● Blinking yellow: Data is being transmitted.

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Indicator	Description
Connection status indicator of the management network port	• Off: The network port is not connected. • Steady green: The network port is properly connected.

5.2.3 Ports

Port Positions

Figure 5-6 Ports on the rear panel

1	LOM port 1	2	VGA port
3	LOM port 2	4	Management network port
5	Serial port	6	USB 3.0 port
7	PSU socket	8	-

Port Description

Table 5-4 Description of ports on the rear panel

Tool	Type	Quantity	Description
LOM port 1	10GE SFP+ or 10GE BASE-T	4	10GE LOM service ports (optical/electrical). Use the optical or electrical ports based on service requirements. For details, see **5.6.1 LOMs** .

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Tool	Type	Quantity	Description
LOM port 2	1000BASE-T	2	GE LOM service ports (electrical). For details, see **5.6.1 LOMs** .
VGA port	DB15	1	Used to connect a display terminal, such as a monitor or KVM.
Serial port	RJ45	1	Default operating system serial port used for debugging. You can also set it as the iBMC serial port by using the iBMC command. **NOTE** The port uses 3-wire serial communication interface, and the default baud rate is 115,200 bit/s.
Management network port	1000BASE-T	1	Used for server management. **NOTE** ● The management network port is a GE port that supports 100 Mbit/s and 1000 Mbit/s auto-negotiation.
USB port	USB 3.0	2	Used to connect to a USB device. **NOTICE** Before connecting an external USB device, check that the USB device functions properly. The server may operate abnormally if an abnormal USB device is connected.
PSU socket	-	2	Used to connect to the power distribution unit (PDU) in the cabinet. You can select the number of power supply units (PSUs) as required. **NOTE** ● When determining the quantity of PSUs, ensure that the rated power of the PSUs is greater than that of the server. ● If only one PSU is used, **Predicted PSU Status** cannot be set to **Active/Standby** on the iBMC WebUI.

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5.3 Processor

- The server supports one or two processors.
- If only one processor is required, install it in socket **CPU1**.
- The same model of processors must be used in a server.
- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.

Figure 5-7 Processor positions

5.4 Memory

5.4.1 DDR4 Memory

5.4.1.1 Memory Identifier

You can determine the memory module properties based on the label attached to the memory module.

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Figure 5-8 Memory identifier

Callout	Description	Definition
1	Capacity of the memory module	• 8 GB • 16 GB • 32 GB • 64 GB • 128 GB
2	Number of ranks of the memory module	• 1R: single-rank • 2R: dual-rank • 4R: quad-rank • 8R: octal-rank
3	Data width on the DRAM	• X4: 4-bit • X8: 8-bit
4	Type of the memory interface	• PC3: DDR3 • PC4: DDR4
5	Maximum memory speed	• 2133 MT/S • 2400 MT/S • 2666 MT/S • 2933 MT/S • 3200 MT/S
6	Column Access Strobe (CAS) latency	• P: 15 • T: 17
7	DIMM type	• R: RDIMM • L: LRDIMM

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5.4.1.2 Memory Subsystem Architecture

The 5288 V5 provides 24 memory slots. Each processor integrates six memory channels.

Install the memory modules in the primary memory channels first. If the primary memory channel is not populated, the memory modules in secondary memory channels cannot be used.

Table 5-5 Memory channels

CPU	Memory Channel	Memory Slot
CPU 1	A (primary)	DIMM000(A)
	A	DIMM001(G)
	B (primary)	DIMM010(B)
	B	DIMM011(H)
	C (primary)	DIMM020(C)
	C	DIMM021(I)
	D (primary)	DIMM030(D)
	D	DIMM031(J)
	E (primary)	DIMM040(E)
	E	DIMM041(K)
	F (primary)	DIMM050(F)
	F	DIMM051(L)
CPU 2	A (primary)	DIMM100(A)
	A	DIMM101(G)
	B (primary)	DIMM110(B)
	B	DIMM111(H)
	C (primary)	DIMM120(C)
	C	DIMM121(I)
	D (primary)	DIMM130(D)
	D	DIMM131(J)
	E (primary)	DIMM140(E)
	E	DIMM141(K)
	F (primary)	DIMM150(F)
	F	DIMM151(L)

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5.4.1.3 Memory Compatibility

Observe the following rules when configuring DDR4 DIMMs:

NOTICE

- A server must use the same model of DDR4 DIMMs, and all the DIMMs operate at the same speed, which is the smallest value of:
  - Memory speed supported by a processor
  - Maximum operating speed of a DIMM
- The DDR4 DIMMs of different types (RDIMM and LRDIMM) and specifications (capacity, bit width, rank, and height) cannot be used together.
- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.

- The memory can be used with Intel® Xeon® Scalable Skylake and Cascade Lake processors. The maximum memory capacity supported varies depending on the processor model.
  - Skylake processors
    - M processors: 1.5 TB/socket
    - Other processors: 768 GB/socket
  - Cascade Lake processors
    - L processors: 4.5 TB/socket
    - M processors: 2 TB/socket
    - Other processors: 1 TB/socket
- The total memory capacity is the sum of the capacity of all DDR4 DIMMs.

NOTICE

- The total memory capacity cannot exceed the maximum memory capacity supported by the CPUs.
- The total memory capacity refers to the capacity when DDR4 DIMMs are fully configured. For details about the memory capacity when DCPMMs are used together with DDR4 DIMMs, see **5.4.2.3 Memory Compatibility**.

- Use the **Compatibility List** to determine the capacity type of a single memory module.
- The maximum number of DIMMs supported by a server varies depending on the CPU type, memory type, rank quantity, and operating voltage.

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NOTE

Each memory channel supports a maximum of 8 ranks. The number of DIMMs supported by each channel varies depending on the number of ranks supported by each channel:

Number of DIMMs supported by each channel ≤ Number of ranks supported by each memory channel/Number of ranks supported by each DIMM

- A memory channel supports more than eight ranks for LRDIMMs.

NOTE

A quad-rank LRDIMM generates the same electrical load as a single-rank RDIMM on a memory bus.

Table 5-6 DDR4 memory specifications

Parameter		Specifications
Maximum capacity per DDR4 DIMM (GB)		128
Rated speed (MT/s)		2933
Operating voltage (V)		1.2
Maximum number of DDR4 DIMMs in a server[a]		24
Maximum DDR4 memory capacity of the server (GB)[b]		3072
Maximum operating speed (MT/s)	1DPC[c]	2933[d]
	2DPC	2666

- a: The maximum number of DDR4 memory modules is based on dual-processor configuration. The value is halved for a server with only one processor.
- b: The maximum DDR4 memory capacity varies depending on the processor type. The value listed in this table is based on the assumption that DIMMs are fully configured.
- c: DPC (DIMM per channel) indicates the number of DIMMs per channel.
- d: If the Cascade Lake processor is used, the maximum operating speed of a DIMM can reach 2933 MT/s. If the Skylake processor is used, the maximum operating speed of a DIMM can reach 2666 MT/s only. Different CPUs possess different specifications, For details about the CPU parameters, see the Intel official website.
- The information listed in this table is for reference only. For details, consult the local sales representative.

5.4.1.4 DIMM Installation Rules

NOTE

This section applies to a server fully configured with DDR4 DIMMs. If DCPMMs are used together, see **5.4.2.4 DIMM Installation Rules**.

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- Observe the following when configuring DDR4 memory modules:
  - Install memory modules only when corresponding processors are installed.
  - Do not install LRDIMMs and RDIMMs in the same server.
  - Install filler memory modules in vacant slots.
- Observe the following when configuring DDR4 memory modules in specific operating mode:
  - Memory sparing mode
    - Comply with the general installation guidelines.
    - Each memory channel must have a valid online spare configuration.
    - The channels can have different online spare configurations.
    - Each populated channel must have a spare rank.
  - Memory mirroring mode
    - Comply with the general installation guidelines.
    - Each processor supports two integrated memory controllers (IMCs). At least two channels of each IMC are used for installing memory modules (channels 1 and 2, or channels 1, 2, and 3). The installed memory modules must be identical in size and organization.
    - For a multi-processor configuration, each processor must have a valid memory mirroring configuration.
  - Memory scrubbing mode
    - Comply with the general installation guidelines.

5.4.1.5 Memory Installation Positions

A 5288 V5 supports a maximum of 24 DDR4 DIMMs. To maximize the performance, balance the total memory capacity between the installed processors and load the channels similarly whenever possible.

NOTICE

At least one DDR4 DIMM must be installed in the memory slots corresponding to CPU 1.

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Figure 5-9 Memory slots

Figure 5-10 DDR4 memory installation guidelines (1 processor)

CPU	Channel	DIMM Slot	Number of DIMMs (✓: recommended ○: not recommended)											
			✓	✓	✓	✓	○	✓	○	✓	○	○	○	✓
			1	2	3	4	5	6	7	8	9	10	11	12
CPU 1	A	DIMM000(A)	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM001(G)							•	•	•	•	•	•
	B	DIMM010(B)		•	•	•	•	•	•	•	•	•	•	•
		DIMM011(H)								•	•	•	•	•
	C	DIMM020(C)			•		•	•	•		•	•	•	•
		DIMM021(I)									•		•	•
	D	DIMM030(D)				•	•	•	•	•	•	•	•	•
		DIMM031(J)								•		•	•	•
	E	DIMM040(E)				•	•	•	•	•	•	•	•	•
		DIMM041(K)								•		•	•	•
	F	DIMM050(F)						•	•		•	•	•	•
		DIMM051(L)												•

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Figure 5-11 DDR4 memory installation guidelines (2 processors)

CPU	Channel	DIMM Slot	Number of DIMMs (✓: recommended ○: not recommended)																							
			○	✓	○	✓	○	✓	○	✓	○	○	○	✓	○	○	○	✓	○	○	○	○	○	○	○	✓
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CPU1	A	DIMM000(A)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM001(G)													•	•	•	•	•	•	•	•	•	•	•	•
	B	DIMM010(B)			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM011(H)															•	•	•	•	•	•	•	•	•	•
	C	DIMM020(C)					•	•			•	•	•	•	•	•			•	•	•	•	•	•	•	•
		DIMM021(I)																	•	•			•	•	•	•
	D	DIMM030(D)							•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM031(J)															•	•			•	•	•	•	•	•
	E	DIMM040(E)							•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM041(K)															•	•			•	•	•	•	•	•
	F	DIMM050(F)											•	•	•	•			•	•	•	•	•	•	•	•
		DIMM051(L)																							•	•
CPU2	A	DIMM100(A)		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM101(G)														•	•	•	•	•	•	•	•	•	•	•
	B	DIMM110(B)				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM111(H)																•	•	•	•	•	•	•	•	•
	C	DIMM120(C)						•	•			•	•	•	•	•	•			•	•	•	•	•	•	•
		DIMM121(I)																		•	•			•	•	•
	D	DIMM130(D)								•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM131(J)																•	•			•	•	•	•	•
	E	DIMM140(E)								•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM141(K)																•	•			•	•	•	•	•
	F	DIMM150(F)												•	•	•	•			•	•	•	•	•	•	•
		DIMM151(L)																								•

5.4.1.6 Memory Protection Technologies

The following memory protection technologies are supported:

- ECC
- Full mirroring
- Address range mirroring
- SDDC
- SDDC+1
- Rank sparing mode
- Static virtual lockstep
- Faulty DIMM isolation
- Memory thermal throttling
- Memory address parity protection
- Memory demand/patrol scrubbing
- Device tagging
- Data scrambling
- Adaptive double device data correction (ADDDC)
- ADDDC+1

5.4.2 DCPMM

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5.4.2.1 Memory Identifier

Figure 5-12 Memory identifier

Callout	Description	Example
1	Component name	Intel® DCPMM
2	Serial number	8089-A2-1839-00001931
3	Model	NMA1XBD612GQS
4	Capacity	• 128 GB • 256 GB • 512 GB
5	SN QR code	8089-A2-1839-00001931

5.4.2.2 Memory Subsystem Architecture

The 5288 V5 provides 24 memory slots. Each processor integrates six memory channels, and each memory channel supports up to one DCPMM.

DCPMMs must be used with DDR4 memory modules.

Table 5-7 Memory channels

CPU	Memory Channel	Memory Slot
CPU 1	A (primary)	DIMM000(A)

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CPU	Memory Channel	Memory Slot
	A	DIMM001(G)
	B (primary)	DIMM010(B)
	B	DIMM011(H)
	C (primary)	DIMM020(C)
	C	DIMM021(I)
	D (primary)	DIMM030(D)
	D	DIMM031(J)
	E (primary)	DIMM040(E)
	E	DIMM041(K)
	F (primary)	DIMM050(F)
	F	DIMM051(L)
CPU 2	A (primary)	DIMM100(A)
	A	DIMM101(G)
	B (primary)	DIMM110(B)
	B	DIMM111(H)
	C (primary)	DIMM120(C)
	C	DIMM121(I)
	D (primary)	DIMM130(D)
	D	DIMM131(J)
	E (primary)	DIMM140(E)
	E	DIMM141(K)
	F (primary)	DIMM150(F)
	F	DIMM151(L)

5.4.2.3 Memory Compatibility

Observe the following rules when configuring DC persistent memory modules (DCPMMs):

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NOTICE

- The DCPMMs must be used with the DDR4 memory modules. For details, see the ***FusionServer PMem 200-Barlow Pass User Guide***.
- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.

- The memory must be used with Intel® Xeon® Scalable Cascade Lake processors. The maximum memory capacity supported varies depending on the processor model.
  - L processors: 4.5 TB/socket
  - M processors: 2 TB/socket
  - Other processors: 1 TB/socket
- The DCPMM can work only in App Direct Mode (AD) and Memory Mode (MM). The total supported memory capacity is calculated as follows:
  - DCPMM in AD mode

    Total memory capacity = Total capacity of all DCPMMs + Total capacity of all DDR4 memory modules
  - DCPMM in MM mode

    Total memory capacity = Total capacity of all DCPMMs (The DDR4 memory modules are used as the cache and therefore are not calculated as memory capacity.)

NOTICE

- The total memory capacity cannot exceed the maximum memory capacity supported by the CPUs.
- For details about the AD and MM modes, see "Operating Modes" in ***FusionServer PMem 200-Barlow Pass User Guide***.

- Use the **Compatibility List** to determine the capacity type of a single memory module.

Table 5-8 DCPMM specifications

Item	Specifications		
Capacity per DCPMM (GB)	128	256	512
Rated speed (MT/s)	2666	2666	2666
Operating voltage (V)	1.2	1.2	1.2
Maximum number of DCPMMs in a server[a]	12	12	12
Maximum capacity of the server (GB)[b]	2304	4608	7680

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Item	Specifications		
Maximum operating speed (MT/s)	2666	2666	2666

- a: The maximum number of DCPMMs is based on dual-processor configuration. The value is halved for a server with only one processor.
- b: The maximum memory capacity varies depending on the CPU type and DCPMM working mode. The value listed in this table is based on the assumption that 12 DCPMMs and 12 DDR4 memory modules are used with the L series CPUs and the DCPMMs work in AD mode.
- The information listed in this table is for reference only. For details, consult the local sales representative.

5.4.2.4 DIMM Installation Rules

- The following are general guidelines for DCPMM installation:
  - The DDR4 memory modules used with the DCPMMs include RDIMMs and LRDIMMs.
  - The DCPMMs used in a server must have the same part number (P/N code).
  - The DDR4 memory modules used with the DCPMMs in a server must have the same P/N code.
- Observe the following when configuring DCPMMs in specific operating mode:

  MM mode:

  On the same server, it is recommended that the ratio of FM to NM be 2:1 to 16:1.

  NOTE

  - Near memory (NM): capacity of DDR4 DIMMs used as the cache.
  - Far memory (FM): capacity of the DCPMMs in MM.
- The mapping between the DCPMM and CPU is as follows:
  - DCPMMs require Cascade Lake Gold/Platinum/Silver (4215 model) CPUs.
  - Table 5-9 lists the maximum memory capacity supported by different CPUs.

Table 5-9 Maximum memory capacity supported by a CPU

CPU Type	Maximum Memory Capacity Supported by a CPU (DDR4 and DCPMM Capacities)
Full-series	1 TB
M series	2 TB
L series	4.5 TB

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5.4.2.5 Memory Installation Positions

A 5288 V5 supports a maximum of 12 DCPMMs. The DCPMMs must be used with DDR4 DIMMs.

Figure 5-13 Memory slots

Figure 5-14 DCPMM and DDR4 memory configuration guidelines (1 processor)

CPU	Channel		DIMM Slot	Configurations in Different Modes (●: DDR4 DIMM ○: DCPMM)							
				AD	MM	AD	MM	AD	MM	AD	MM
				2-2-2		2-2-1		2-1-1		1-1-1	
CPU1	IMC0	A	DIMM000(A)	●		●		●		●	
			DIMM001(G)	○		○		○			
		B	DIMM010(B)	●		●		●		●	
			DIMM011(H)	○		○					
		C	DIMM020(C)	●		●		●		○	
			DIMM021(I)	○							
	IMC1	D	DIMM030(D)	●		●		●		●	
			DIMM031(J)	○		○		○			
		E	DIMM040(E)	●		●		●		●	
			DIMM041(K)	○		○					
		F	DIMM050(F)	●		●		●		○	
			DIMM051(L)	○							

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Figure 5-15 DCPMM and DDR4 memory configuration guidelines (2 processors)

CPU	Channel		DIMM Slot	Configurations in Different Modes (●: DDR4 DIMM ○: DCPMM)							
				AD	MM	AD	MM	AD	MM	AD	MM
				2-2-2		2-2-1		2-1-1		1-1-1	
CPU1	IMC0	A	DIMM000(A)	●		●		●		●	
			DIMM001(G)	○		○		○			
		B	DIMM010(B)	●		●		●		●	
			DIMM011(H)	○		○					
		C	DIMM020(C)	●		●		●		○	
			DIMM021(I)	○							
	IMC1	D	DIMM030(D)	●		●		●		●	
			DIMM031(J)	○		○		○			
		E	DIMM040(E)	●		●		●		●	
			DIMM041(K)	○		○					
		F	DIMM050(F)	●		●		●		○	
			DIMM051(L)	○							
CPU2	IMC0	A	DIMM100(A)	●		●		●		●	
			DIMM101(G)	○		○		○			
		B	DIMM110(B)	●		●		●		●	
			DIMM111(H)	○		○					
		C	DIMM120(C)	●		●		●		○	
			DIMM121(I)	○							
	IMC1	D	DIMM130(D)	●		●		●		●	
			DIMM131(J)	○		○		○			
		E	DIMM140(E)	●		●		●		●	
			DIMM141(K)	○		○					
		F	DIMM150(F)	●		●		●		○	
			DIMM151(L)	○							

Figure 5-16 DCPMM and DDR4 memory configuration guidelines

DCPMM and DDR4 Memory Configuration Guidelines					
Capacity per DCPMM	Single iMC Installation Method	Matchable Capacity per DDR4 Memory			
		16 GB	32 GB	64 GB	128 GB
128 GB	2-2-2	√	√	√	
	2-2-1	√	√		
	2-1-1	√			
	1-1-1	√	√		
256 GB	2-2-2	√	√	√	√
	2-2-1	√	√	√	
	2-1-1	√	√		
	1-1-1	√	√	√	
512 GB	2-2-2		√	√	√
	2-2-1		√	√	√
	2-1-1	√	√	√	
	1-1-1	√	√	√	√

5.4.2.6 Memory Protection Technologies

The following memory protection technologies are supported:

- DCPMM error detection and correction
- DCPMM persistent memory address range scrub (ARS)
- DCPMM data poison
- DCPMM DDR-T fault tolerance

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- Faulty DCPMM isolation

5.5 Storage

5.5.1 Drive Configurations

Table 5-10 Drive configuration

Configuration	Maximum Number of Front Drives (pcs)	Maximum Number of Rear Drives (pcs)	Maximum Number of Built-in Drives (pcs)	Common Drive Management Mode
Single RAID configuration 1.	● Front drive (24 x 3.5") : 24 – Slots 0 to 23 support only SAS/ SATA drives.	● I/O module 1 (2 x 3.5") : 2 – Slots 40 to 41 support only SAS/ SATA[a] drives. ● I/O module 2 (2 x 3.5") : 2 – Slots 42 to 43 support only SAS/ SATA drives. ● I/O module 3 (4 x 2.5") : 4 – Slots 44 to 47 support SAS/ SATA/ NVMe[b] drives. ● Rear drive (12 x 3.5") : 12 – Slots 24 to 31 support only SAS or SATA drives.	● Internal drive (4 x 3.5") : 4 – Slots 36 to 39 support only SAS/ SATA[d] drives.	1 x screw-in RAID controller card. Screw-in RAID controller card: Connector installed on the mainboard

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Configuration	Maximum Number of Front Drives (pcs)	Maximum Number of Rear Drives (pcs)	Maximum Number of Built-in Drives (pcs)	Common Drive Management Mode
		– Slots 32 to 35 support SAS/ SATA/ NVMe[c] drives.		
Single RAID configuration 2.	● Front drive (24 x 3.5") : 24 – Slots 0 to 23 support only SAS/ SATA drives.	● I/O module 2 (2 x 3.5") : 2 – Slots 42 to 43 support only SAS/ SATA drives. ● I/O module 3 (4 x 2.5") : 4 – Slots 44 to 47 support SAS/ SATA/ NVMe[b] drives. ● Rear hard disk (12 x 3.5") : 12 – Slots 24 to 31 support only SAS or SATA drives. – Slots 32 to 35 support SAS/ SATA/ NVMe[c] drives	● Internal drive (4 x 3.5") : 4 – Slots 36 to 39 support only SAS/ SATA[d] drives.	1 x RAID controller card. Standard RAID controller card: It must be configured in slot 3.

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Configuration	Maximum Number of Front Drives (pcs)	Maximum Number of Rear Drives (pcs)	Maximum Number of Built-in Drives (pcs)	Common Drive Management Mode
Dual RAID Configuration 1.	● Front drive (24 x 3.5") : 24 – Slots 0 to 23 support only SAS/ SATA drives.	● I/O module 2 (2 x 3.5") : 2 – Slots 42 to 43 support only SAS/ SATA drives. ● I/O module 3 (4 x 2.5") : 4 – Slots 44 to 47 support NVMe drives. ● Rear drive (12 x 3.5") : 12 – Rear slots 0 to 11 support only SAS/ SATA drives.	-	2 x RAID controller card[e] 1. Screw-in RAID controller card: Connector installed on the mainboard. 2. Standard RAID controller card: It must be configured in slot 3.

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Configuration	Maximum Number of Front Drives (pcs)	Maximum Number of Rear Drives (pcs)	Maximum Number of Built-in Drives (pcs)	Common Drive Management Mode
Dual RAID configuration 2.	● Front drive (24 x 3.5") : 24 – Slots 0 to 23 support only SAS/SATA drives.	● I/O module 3 (4 x 2.5") : 4 – Slots 44 to 47 support NVMe drives ● Rear drive (12 x 3.5") : 12 – Rear slots 0 to 11 support only SAS/SATA drives	-	2 x RAID controller card Standard RAID controller card: It must be configured in slot 3 and 6

- a: When the rear drives (slot 32 to slot 35) are configured with NVMe drives, the location of IO module 1 needs to be fixed with an NVMe adapter card and cannot be configured with hard drives.
- b: I/O module 3 supports SAS/SATA drives only when the Avago SAS3416iMR RAID controller card is configured.
- c: When internal drives are configured, rear drives (slots 32 to 35) cannot be configured with NVMe drives.
- d: Built-in drives are supported only when the Avago SAS3416iMR RAID controller card is configured.
- e: The front drives and I/O module 2 are managed by one RAID controller card, and the rear drives are managed by another RAID controller card.
- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.

5.5.2 Drive Numbering

- Single-RAID configuration

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Figure 5-17 Drive numbering

- Dual-RAID configuration

Figure 5-18 Drive numbering

5.5.3 Drive Indicators

SAS/SATA Drive Indicators

Figure 5-19 SAS/SATA drive indicators

Table 5-11 Description of SAS/SATA drive indicators

Activity Indicator (Green)	Fault Indicator (Yellow)	Description
Off	Off	The drive is not in position.
Steady on	Off	The drive is detected.

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Activity Indicator (Green)	Fault Indicator (Yellow)	Description
Blinking at 4 Hz	Off	Data is being read or written normally, or data on the primary drive is being rebuilt.
Steady on	Blinking at 1 Hz	The drive is being located.
Blinking at 1 Hz	Blinking at 1 Hz	Data on the secondary drive is being rebuilt.
Off	Steady on	A member drive in the RAID array is removed.
Steady on	Steady on	The drive is faulty.

NVMe Drive Indicators

Figure 5-20 NVMe drive indicators

- If the VMD function is enabled and the latest VMD driver is installed, the NVMe drives support surprise hot swap.

Table 5-12 NVMe drive indicators (VMD enabled)

Activity Indicator (Green)	Fault Indicator (Yellow)	Description
Off	Off	The NVMe drive cannot be detected.
Steady on	Off	The NVMe drive is working properly.
Blinking at 2 Hz	Off	Data is being read from or written to the NVMe SSD.
Steady on	Blinking at 2 Hz	The NVMe drive is being located.
Steady on/Off	Steady on	The NVMe drive is faulty.

- If the VMD function is disabled, NVMe drives support only orderly hot swap.

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Table 5-13 NVMe drive indicators (VMD disabled)

Activity Indicator (Green)	Fault Indicator (Yellow)	Description
Off	Off	The NVMe drive cannot be detected.
Steady on	Off	The NVMe drive is working properly.
Blinking at 2 Hz	Off	Data is being read from or written to the NVMe drive.
Off	Blinking at 2 Hz	The NVMe drive is being located or hot-swapped.
Off	Blinking at 0.5 Hz	The hot removal process is complete, and the NVMe drive is removable.
Steady on/Off	Steady on	The NVMe drive is faulty.

M.2 FRU Indicators

Figure 5-21 M.2 FRU indicators

Table 5-14 M.2 FRU indicator description

Indicator	Description
M.2 FRU fault indicator	• Off: The M.2 FRU is running properly. • Blinking yellow: The M.2 FRU is being located, or RAID is being rebuilt. • Steady yellow: The M.2 FRU is faulty or not detected.
M.2 FRU activity indicator	• Off: The M.2 FRU is not in position or is faulty. • Blinking green or light green: Data is being read, written, or synchronized. • Steady green or light green: The M.2 FRU is inactive.

5.5.4 RAID Controller Card

The RAID controller card supports RAID configuration, RAID level migration, and drive roaming.

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- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.
- For details about the RAID controller card, see **V5 Server RAID Controller Card User Guide**.

5.6 Network

5.6.1 LOMs

LOMs provide network expansion capabilities.

Table 5-15 LOM description

NIC Type	Chip Model	Port Type	Number of Ports	Rate Negotiation Mode	Supported Rates	Rates Not Supported
LOMs	X722	10GE optical port	2	Auto-negotiation 10,000 Mbit/s (full duplex)	10000M	10/100/1000M
		10GE electrical port	2	Auto-negotiation 1000 Mbit/s (full duplex)	1000M	10/100M
				Auto-negotiation 10,000 Mbit/s (full duplex)	10000M	10/100M
		GE electrical port	2	Auto-negotiation 1000 Mbit/s (full duplex)	1000M	10/100M

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NIC Type	Chip Model	Port Type	Number of Ports	Rate Negotiation Mode	Supported Rates	Rates Not Supported
• Use **Compatibility List** to obtain information about the cables and optical modules supported by the LOM ports. • The LOM ports support NC-SI, WOL, and PXE. • The LOM ports do not support forced rates. • The electrical LOM ports cannot be connected to power over Ethernet (PoE) devices (such as a switch with PoE enabled). Connecting a LOM port to a PoE device may cause link communication failure or even damage the NIC. • The electrical LOM ports (GE electrical ports) do not support SR-IOV. • Forcibly powering off a server will cause intermittent NC-SI disconnection and disable the WOL function of the LOM ports. To restore the NC-SI connection, refresh the iBMC WebUI.						

Figure 5-22 LOM port

1	(Optional) 10GE optical port (LOM port 1)	2	(Optional) 10GE optical port (LOM port 2)
3	(Optional) 10GE electrical port (LOM port 1)	4	(Optional) 10GE electrical port (LOM port 2)
5	GE electrical port (LOM GE port 3)	6	GE electrical port (LOM GE port 4)

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Indicator Positions

Figure 5-23 LOM indicators

1	Connection status indicator/Data transmission status indicator for a 10GE optical port	2	Data transmission rate indicator for a 10GE optical port
3	Data transmission rate indicator for a 10GE electrical port	4	Connection status indicator/Data transmission status indicator for a 10GE electric port
5	Data transmission status indicator of a GE electrical port	6	Connection status indicator of a GE electrical port

Indicator Description

Table 5-16 LOM indicators

Indicator	Description
Connection status indicator/Data transmission status indicator for a 10GE optical port	• Off: The network port is not connected. • Blinking green: Data is being transmitted. • Steady green: The network port is properly connected.
Data transmission rate indicator for a 10GE optical port	• Off: The network port is not connected. • Steady green: The data transmission rate is 10 Gbit/s.
Connection status indicator/Data transmission status indicator for a 10GE electric port	• Off: The network port is not connected. • Blinking green: Data is being transmitted. • Steady green: The network port is properly connected.

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Indicator	Description
Data transmission rate indicator for a 10GE electrical port	● Off: The network port is not connected. ● Steady green: The data transmission rate of the link is 10 Gbit/s. ● Steady yellow: The data transmission rate of the link is 1 Gbit/s.
Connection status indicator of a GE electrical port	● Off: The network port is not connected. ● Steady green: The network port is properly connected.
Data transmission status indicator of a GE electrical port	● Off: Inactive. ● Steady yellow: Active, but no data is being transmitted. ● Blinking yellow: Data is being transmitted.

5.6.2 FlexIO Cards

FlexIO cards provide network expansion capabilities.

- The FlexIO card (with electrical ports) cannot be connected to power over Ethernet (PoE) devices (such as a switch with PoE enabled). Otherwise, link communication failure or even damage to the FlexIO card may be caused.
- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.
- When IB cards are used to build an IB network, ensure that the IPoIB modes of the IB cards at both ends of the network are the same. For details, contact technical support.

Table 5-17 FlexIO cards supported by the 5288 V5 (example)

NIC Model	Chip Model	Port Type	Number of Ports	Support NC-SI/WOL/PXE
SM210	5719	GE electrical port	4	√
SM211	i350	GE electrical port	2	√
SM212	i350	GE electrical port	4	√
SM233	X540	10GE electrical port	2	√
SM251	CX3	56G IB optical port	2	×

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NIC Model	Chip Model	Port Type	Number of Ports	Support NC-SI/WOL/PXE
SM252	CX3	56G IB optical port	1	×
SM330	X710	10GE optical port	2	√
SM380	CX4	25GE optical port	2	√

Indicator Positions

- SM210/SM212 with four GE electrical ports

Figure 5-24 SM210/SM212 network port indicators

- SM211 with two GE electrical ports

Figure 5-25 SM211 network port indicators

- SM233 with two 10GE electrical ports

Figure 5-26 SM233 network port indicators

- SM252 with one 56G IB optical port

Figure 5-27 SM252 network port indicators

- SM251 with two 56G IB optical ports

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Figure 5-28 SM251 network port indicators

- SM330 with two 10GE optical port/SM380 with two 25GE optical ports

Figure 5-29 SM330/SM380 network port indicators

Table 5-18 FlexIO card indicator description

Port Type	Indicator	Status
GE electrical port	Data transmission status indicator	● Off: No data is being transmitted. ● Blinking yellow: Data is being transmitted.
	Connection status indicators	● Off: The network port is not connected. ● Steady green: The network port is properly connected.
10GE electrical port	Transmission rate indicator	● Off: The data transmission rate is 10/100 Mbit/s. ● Steady green: The data transmission rate is 10 Gbit/s. ● Steady yellow: The data transmission rate is 1 Gbit/s.
	Connection status indicator/Data transmission status indicator	● Off: No data is being transmitted or the network port is not connected. ● Blinking green: Data is being transmitted. ● Steady green: The network port is properly connected.
10GE optical port	Transmission rate indicator	● Off: The network port is not connected or the data transmission rate is 100 Mbit/s. ● Steady green: The data transmission rate is 10 Gbit/s. ● Steady yellow: The data transmission rate is 1 Gbit/s.

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Port Type	Indicator	Status
	Connection status indicator/Data transmission status indicator	• Off: The network port is not connected. • Blinking green: Data is being transmitted. • Steady green: The network port is connected properly.
25GE optical port	Transmission rate indicator	• Off: The network port is not connected. • Steady green: The data transmission rate is 25 Gbit/s. • Steady yellow: The data transmission rate is 10 Gbit/s.
	Connection status indicator/Data transmission status indicator	• Off: The network port is not connected. • Blinking green: Data is being transmitted. • Steady green: The network port is properly connected.
56G IB optical port	Connection status indicators	• Off: No physical link is set up. • Blinking green: The physical link is abnormal. • Steady green: The physical link is normal.
	Data transmission status indicator	• Off: No logical link is set up. • Blinking yellow: Data is being transmitted. • Steady yellow: The logical link is normal but no data is being transmitted.

5.7 I/O Expansion

5.7.1 PCIe Cards

PCIe cards provide ease of expandability and connection.

- The electrical ports provided by PCIe NICs cannot be connected to power over Ethernet (PoE) devices (such as a switch with PoE enabled). Connecting such an electrical port to a PoE device may cause link communication failure or even damage the NIC.
- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.

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- When IB cards are used to build an IB network, ensure that the IPoIB modes of the IB cards at both ends of the network are the same. For details, contact technical support.

5.7.2 PCIe Slots

PCIe Slots

Figure 5-30 PCIe slots

- I/O module 1 provides slots 1 to 3. If a dual-slot PCIe riser module is used, slot 2 is unavailable.
- I/O module 2 provides slots 4 to 6. If a dual-slot PCIe riser module is used, slot 5 is unavailable.
- I/O module 3 provides slots 7 to 8. If a single-slot PCIe riser module is used, slot 8 is unavailable.

NOTE

Observe the following rules when configuring GPU PCIe cards:

- The 5288 V5 supports only P4 GPU x8 cards, which must be installed in the three-slot PCIe riser module in I/O module 1 or 2.
- If four P4 GPU cards are configured:
  - The GPU cards fit into slots 1, 2, 4, and 5.
  - The processor power can reach 205 W.
  - The GPU cards support the highest temperature of 30°C in stack installation and 35°C in non-stack installation.
- If six P4 GPU cards are configured:
  - The GPU cards fit into slots 1 to 6.
  - The processor power must be lower than 130 W.
  - The GPU cards support the highest temperature of 30°C in stack installation and 35°C in non-stack installation.

PCIe Riser Modules

- PCIe riser module 1 (universal)
  - Provides PCIe slots 1 and 3 when installed in I/O module 1.
  - Provides PCIe slots 4 and 6 when installed in I/O module 2.

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Figure 5-31 PCIe riser module 1

- PCIe riser module 2 (universal)
  - Provides PCIe slots 1, 2, and 3 when installed in I/O module 1.
  - Provides PCIe slots 4, 5, and 6 when installed in I/O module 2.

Figure 5-32 PCIe riser module 2

- PCIe riser module 3 (for PCIe SSD cards only)
  - Provides PCIe slots 1, 2, and 3 when installed in I/O module 1.

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– Provides PCIe slots 4, 5, and 6 when installed in I/O module 2.

Figure 5-33 PCIe riser module 3

- PCIe riser module 4 (for P4 GPU cards only)
  – Provides PCIe slots 1, 2, and 3 when installed in I/O module 1.
  – Provides PCIe slots 4, 5, and 6 when installed in I/O module 2.

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Figure 5-34 PCIe riser module 4

- PCIe riser module 5

  Provides PCIe slots 7 and 8 when installed in I/O module 3.

Figure 5-35 PCIe riser module 5

- PCIe riser module 6

  Provides PCIe slot 7 when installed in I/O module 3.

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Figure 5-36 PCIe riser module 6

- PCIe riser module 7
  Provides PCIe slot 3 when installed in I/O module 1.

Figure 5-37 PCIe riser module 7

5.7.3 PCIe Slot Description

NOTE

The PCIe slots mapping to a vacant CPU socket are unavailable.

Table 5-19 PCIe slot description

PCIe Slot	CPU	PCIe Standards	Connector Width	Bus Width	Port No.	Root Port (B/D/F)	Device (B/D/F)	Slot Size
RAID controller card	CPU 1	PCIe 3.0	x8	x8	Port1C	17/02/0	1C/00/0	-
LOM	CPU 1	PCIe 3.0	x8	x8	Port1A	17/00/0	1A/00/0	-
FlexIO card	CPU 2	PCIe 3.0	x8	x8	Port2A	AE/00/0	AF/00/0	-
Slot 1	CPU 1	PCIe 3.0	x16	● 2-slot PRM: x16 ● 3-slot PRM: x8	Port2A	3A/00/0	3B/00/0	FHFL
Slot 2	CPU 1	PCIe 3.0	x16	● 2-slot PRM: N/A ● 3-slot PRM: x8	Port2C	3A/02/0	3D/00/0	● 2-slot PRM: N/A ● 3-slot PRM: FHFL
Slot 3	CPU 1	PCIe 3.0	x16	x8	Port3A	5D/00/0	5E/00/0	FHHL

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PCIe Slot	CPU	PCIe Standards	Connector Width	Bus Width	Port No.	Root Port (B/D/F)	Device (B/D/F)	Slot Size
Slot 4	CPU 2	PCIe 3.0	x16	• 2-slot PRM: x16 • 3-slot PRM: x8	Port1A	85/00/0	86/00/0	FHFL
Slot 5	CPU 2	PCIe 3.0	x16	• 2-slot PRM: N/A • 3-slot PRM: x8	Port1C	85/02/0	89/00/0	• 2-slot PRM: N/A • 3-slot PRM: FHFL
Slot 6	CPU 2	PCIe 3.0	x16	x8	Port2C	AE/02/0	B2/00/0	FHHL
Slot 7	CPU 2	PCIe 3.0	x16	• Single-slot PRM: x16 • 2-slot PRM: x8	Port3A	D7/00/0	D8/00/0	HHHL

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PCIe Slot	CPU	PCIe Standards	Connector Width	Bus Width	Port No.	Root Port (B/D/F)	Device (B/D/F)	Slot Size
Slot 8	CPU 2	PCIe 3.0	x8	• Single-slot PRM: N/A • 2-slot PRM: x8	Port3C	D7/02/0	DB/00/0	HHHL

- The B/D/F (Bus/Device/Function Number) values are the default values when the server is fully configured with PCIe devices. The values may vary if the server is not fully configured with PCIe devices or if a PCIe card with a PCI bridge is configured.
- Root Port (B/D/F) indicates the B/D/F of an internal PCIe root port of the processor.
- Device (B/D/F) indicates the B/D/F (displayed on the OS) of an onboard or extended PCIe device.
- The PCIe x16 slots are backward compatible with PCIe x8, PCIe x4, and PCIe x1 cards. The PCIe cards are not forward compatible. That is, the PCIe slot width cannot be smaller than the PCIe card link width.
- Full-height full-length PCIe slots are backward compatible with full-height half-length and half-height half-length PCIe cards. Full-height half-length PCIe slots are backward compatible with half-height half-length PCIe cards.
- All slots support PCIe cards of up to 75 W. The power of a PCIe card varies depending on its model.

5.8 PSUs

- The server supports one or two PSUs.
- The server supports AC or DC PSUs.
- The PSUs are hot-swappable.
- The server supports two PSUs in 1+1 redundancy.
- The same model of PSUs must be used in a server.
- The PSUs are protected against short circuit. Double-pole fuse is provided for the PSUs with dual input live wires.
- If the DC power supply is used, purchase the DC power supply that meets the requirements of the safety standards or the DC power supply that has passed the CCC certification.

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- Contact your local sales representative or use the **Compatibility List** to determine the components to be used.

NOTE

- When one or two 900 W AC Titanium PSUs are configured and the input voltage ranges from 100 V AC to 127 V AC, the output power decreases to 550 W.
- When one or two 1500 W AC Platinum PSUs are configured, When the input voltage ranges from 100 V AC to 127 V AC, the output power decreases to 1000 W.

Figure 5-38 PSU positions

5.9 Fans

- The server supports four fan modules.
- The fan modules are hot-swappable.
- The server tolerates failure of a single fan.
- The fan speed can be adjusted.
- The same model of fan modules must be used in a server.

Figure 5-39 Fan module positions

5.10 Boards

5.10.1 Mainboard

NOTE

- BOM code for mainboards of enhanced management chip (VB): 0302021706, 0302Y076.
- BOM code for mainboards of normal management chip: 03024AFQ, 03026NEA, 06410432, 03024CXS, 03029JRP, 06410436, 06410592.

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Figure 5-40 5288 V5 mainboard (BOM: 03024AFQ, 03026NEA, 03024CXS, 03029JRP, 0302021706, 0302Y076, 06410432, 06410436, 06410592)

1	USB 3.0 port (USB 3.0 CONN/J169)	2	UID indicator (D6020)
3	Serial port	4	Management network port
5	GE electrical port	6	GE electrical port
7	VGA connector (VGA CONN/J112)	8	10GE optical port (10GE PORT2/J132) or 10GE electrical port (10GE PORT2/J101)[a]
9	10GE optical port (10GE PORT1/J131) or 10GE electrical port (10GE PORT1/J100)[a]	10	VROC key port (J130)[b]

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11	PCIe riser 1 slot (corresponding to CPU 1/ J108)	12	Rear drive backplane power connector 2 (REAR BP PWR2/J126)
13	NC-SI connector (NCSI CONN/J99)	14	SATA signal connector 2 (SATA2/J71)
15	SATA signal connector 1 (SATA1/J67)	16	CPU 1 slimline connector (CPU1 SLIMELINE/J170)
17	Mini SAS HD connector C (MINIHD PORT C/J85)	18	Mini SAS HD connector B (MINIHD PORT B/J84)
19	Mini SAS HD connector A (MINIHD PORT A/J86)	20	Rear drive backplane power connector 1 (REAR BP PWR1/J127)
21	USB 3.0 port (FRONT USB3.0/J173)	22	Right mounting ears connector (RCIC/RCIF/ RCIG BOARD/J167)
23	TPM/TCM port (TPM CONN/J55)	24	LCD connector (LCD CONN/J87)
25	VGA connector (VGA BOARD/J160)	26	Fan 4 connector (2U FAN4/ J148)
27	Fan 3 connector (2U FAN3/ J145)	28	Fan 2 connector (2U FAN2/ J146)
29	Fan 1 connector (1U/2U FAN1/J105)	30	Drive backplane connector (HDD BP CONN/J162)
31	RTC battery (CMOS BATTERY/U4042)	32	Inner drive power connector (INNER HDD PWR/171)
33	Drive backplane power connector 1 (HDD BP PWR2/J128)	34	Drive backplane power connector 2 (HDD BP PWR2/J166)
35	Rear drive backplane power connector 3 (REAR BP PWR3/J172)	36	Rear 4 x 2.5" drive backplane low-speed signal connector (REAR 4*2.5 HDD BP/J164)
37	CPU2 slimline A connector (CPU2 SLIMLINE A/J140)	38	CPU2 slimline B connector (CPU2 SLIMLINE B/J139)
39	PSU 2 connector (J157)	40	PSU 1 connector (J156)
41	Inner drive low-speed signal connector (INNER HDD BP/J122)	42	Left mounting ear connector (LCIA BOARD/ J161)
43	Jumper (J176)[c]	44	I/O NIC connectors (IO BOARD/J159/J158)

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45	Screw-in RAID controller card connector (RAID CARD/J48)	46	PCIe riser 2 slot (corresponding to CPU2/ J155)
● a: "10GE optical port" corresponds to the mainboard (BOM: 03024AFQ and 03026NEA) integrated with two 10GE optical ports and two GE electrical ports. "10GE electrical port" corresponds to the mainboard (BOM: 03024CXS and 03029JRP) integrated with two 10GE and two GE electrical ports. ● b: The port is reserved. ● c:COM_SW(ON) is used to change the connection direction of the physical serial port. BMC_RCV(ON) is used to restore the default iBMC configuration (for iBMC V350 and later versions, restoring the default iBMC configuration through a jumper is not supported).			

5.10.2 Drive Backplane

Front-Drive Backplanes

- 24 x 3.5" drive EXP backplane

Figure 5-41 24 x 3.5" drive backplane (BOM: 03024QEK, 03029TSF, 0302Y155)

No.	Connector	No.	Connector
1	Signal connector (REAR BP0/J32)	2	Mini-SAS HD connector (PORT B/J29)
3	Mini-SAS HD connector (PORT A/J28)	4	Mini-SAS HD connector (REAR PORT/J31)
5	Signal connector (MAIN BOARD/J1)	6	Signal connector (REAR BP1/J35)

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No.	Connector	No.	Connector
7	Power connector (POWER/J61)	8	Power connector 3 (POWER3/J68)
9	Mini-SAS connector (PORT C/J65)	10	Mini-SAS connector (PORT B/J64)
11	Mini-SAS connector (PORT A/J63)	12	Signal connector (HDDBP/J36)
13	Power connector 2 (POWER2/J69)	-	-

Built-in-Drive Backplane

- Built-in-Drive pass-through Backplane (4xSAS/SATA/NVMe)

Figure 5-42 Built-in-drive backplane (4xSAS/SATA/NVMe)(BOM: 03024MBJ)

No.	Connector	No.	Connector
1	Mini-SAS HD connector (PORT A/J3)	2	Backplane signal cable connector (INNER HDD BP/J1)
3	Power connector (INNER HDD PWR/J2)	-	-

Rear-Drive Backplanes

- 2 x 3.5" drive pass-through backplane

Figure 5-43 2 x 3.5" drive backplane (BOM: 03022HYE)

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No.	Connector	No.	Connector
1	Mini-SAS HD connector (J3)	2	Indicator signal cable connector (J24)
3	Power connector (J1)	-	-

- 4 x 2.5" drive pass-through backplane

Figure 5-44 4 x 2.5" drive backplane (BOM: 03024BPV and 03029TDR)

No.	Connector	No.	Connector
1	Power connector (REAR BP POWR3/J22)	2	Mini-SAS HD connector (Port A/J2)
3	Slimline A connector (SLIMLINE A/J8)	4	Slimline B connector (SLIMLINE B/J9)
5	Backplane signal cable connector (HDD BP/J23)	-	-

- 12 x 3.5" drive pass-through backplane (for single-RAID configuration)

Figure 5-45 12 x 3.5" drive pass-through backplane (for single-RAID configuration)(BOM: 03023TYQ, 0302010501)

No.	Connector	No.	Connector
1	Signal connector (J30)	2	Mini-SAS connector (PORT C/J36)

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No.	Connector	No.	Connector
3	Mini-SAS HD connector (PORT 1/J15)	4	Mini-SAS HD connector (PORT 2/J14)
5	Mini-SAS HD connector (PORT 3/J13)	6	Mini-SAS connector (PORT B/J29)
7	Mini-SAS HD connector (PORT 0/J3)	8	Signal connector (HDDBP/J1)
9	Mini-SAS connector (PORT A/J28)	10	Signal connector (REAR BP1/J31)
11	Power connector (HDDBP/J24)	-	-

NOTE

- PCIe signal cables are connected to Mini-SAS HD connectors 3, 4, 5, and 7.

- 12 x 3.5" drive EXP backplane (for dual-RAID configuration)

Figure 5-46 12 x 3.5" drive backplane (BOM: 03024SBX, 03029WFB)

No.	Connector	No.	Connector
1	Signal connector (REAR BP0/J32)	2	Mini-SAS HD connector (PORT 3/J37)
3	Mini-SAS HD connector (PORT 2/J39)	4	Mini-SAS HD connector (PORT 1/J36)
5	Mini-SAS HD connector (PORT 0/J38)	6	Mini-SAS HD connector (REAR PORT/J31)
7	Mini-SAS HD connector (PORT A/J28)	8	Signal connector (HDD BP/J1)
9	Power connector (POWER/J24)	10	Signal connector (REAR BP1/J35)
11	Mini-SAS HD connector (PORT B/J29)	-	-

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NOTE

- PCIe signal cables are connected to Mini-SAS HD connectors 2, 3, 4, and 5.
- SAS signal cables are connected to Mini-SAS HD connectors 6, 7, and 11.

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6 Product Specifications

6.1 Technical Specifications
6.2 Environmental Specifications
6.3 Physical Specifications

6.1 Technical Specifications

Table 6-1 Technical Specifications

Component	Specifications
Form factor	4U rack server
Chipset	Intel® C622
Processor	Supports one or two processors. ● Intel® Xeon® Scalable (Skylake and Cascade Lake) processors ● Built-in memory controller and six memory channels ● Built-in PCIe controller, supporting PCIe 3.0 and 48 lanes per processor ● Two UPI buses between processors, providing up to 10.4GT/s transmission per channel ● Up to 28 cores per processor ● Max. 3.8 GHz ● Min. 1.375 MB L3 cache per core ● Max. 205 W TDP **NOTE** The preceding information is for reference only. Use the **Compatibility List** to obtain specific information.

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Component	Specifications
DIMM	Supports 24 memory modules of the following types: ● Up to 24 DDR4 memory modules – Compatible with 3200 MT/s DDR4 memory modules. The actual memory speed is subject to Intel CPU specifications. – RDIMM and LRDIMM support – The DDR4 memory modules of different types (RDIMM and LRDIMM) and specifications (capacity, bit width, rank, and height) cannot be used together. ● Up to 12 DCPMMs – The DCPMMs must be used with DDR4 memory modules together. – The DCPMMs support the AD or MM mode. – Max. 2666 MT/s memory speed – The DCPMMs of different specifications cannot be used together. – For details about the DCPMMs, see the ***FusionServer PMem 200-Barlow Pass User Guide***. **NOTE** The preceding information is for reference only. Use the **Compatibility List** to obtain specific information.

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Component	Specifications
Storage	Supports a variety of drive configurations. For details, see **5.5.1 Drive Configurations**. ● Supports two M.2 SSDs. – M.2 SSDs are supported for RAID 0/1 and hot swap without opening the chassis cover is supported when the server is configured with an Avago SAS3004iMR RAID controller card. – The drive letter of the M.2 SSDs managed by the Avago SAS3004iMR RAID controller card can be set to **sda** by modifying the GRUB parameters only when the RAID controller card is used with an SR130 or SR760IT-M RAID controller card. **NOTE** ● The M.2 SSD module is used only as the boot device when the OS is installed. Small-capacity (32 GB or 64 GB) M.2 SSDs do not support logging due to poor endurance. If a small-capacity M.2 SSD is used as the boot device, a dedicated log drive or log server is required for logging. For example, you can dump VMware logs in either of the following ways: ● Redirect **/scratch**. For details, see **https://kb.vmware.com/s/article/1033696**. ● Configure syslog. For details, see **https://kb.vmware.com/s/article/2003322**. ● The M.2 SSD cannot be used to store data due to poor endurance. In write-intensive applications, the M.2 SSD will wear out in a short time. Use enterprise-level high endurance (HE) SSDs or HDDs for data storage. ● The M.2 SSD is not recommended for write-intensive service software due to poor endurance. ● Do not use the M.2 SSD as the cache. ● Supports hot swap of SAS/SATA/NVMe U.2 drives. **NOTE** The NVMe drives support: ● Surprise hot swap if the VMD function is enabled and the latest Intel VMD driver is installed. ● Orderly hot swap if the VMD function is disabled. ● Supports a variety of RAID controller cards. Use the **Compatibility List** to obtain information about the specific RAID controller cards supported. – The RAID controller card supports RAID configuration, RAID level migration, and drive roaming. – The RAID controller card does not occupy a standard PCIe slot. For details about the RAID controller card, see **V5 Server RAID Controller Card User Guide**.

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Component	Specifications
	● Supports SAS HBA cards or SAS RAID controller card (with a 1 GB, 2 GB, or 4 GB cache) to improve storage performance and data security. **NOTE** If the BIOS is in legacy mode, the 4K drive cannot be used as the boot drive.
Network	Supports expansion capability of multiple types of networks. ● LOM – Supports two 10GE optical ports and two GE electrical ports via the NIC chip integrated on the mainboard. – Supports two 10GE electrical ports and two GE electrical ports via the NIC chip integrated on the mainboard. – The LOM ports support NC-SI, WOL, and PXE. ● FlexIO card – Supports on-demand configuration. – Supports a variety of FlexIO cards. Use the **Compatibility List** to obtain information about the specific FlexIO cards supported. – When IB cards are used to build an IB network, ensure that the IPoIB modes of the IB cards at both ends of the network are the same. For details, contact technical support. **NOTE** ● The electrical ports provided by LOMs, FlexIO cards, and PCIe NICs cannot be connected to PoE devices (such as a switch with PoE enabled). Connecting such an electrical port to a PoE device may cause link communication failure or even damage the NIC. ● Forcibly powering off a server will cause intermittent NC-SI disconnection and disable the WOL function of the LOM ports. To restore the NC-SI connection, refresh the iBMC WebUI.

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Component	Specifications
I/O expansion	10 PCIe 3.0 slots: ● One slot dedicated for a screw-in RAID controller card, one dedicated for a FlexIO card, and eight for standard PCIe cards. For details, see **5.7.2 PCIe Slots** and **5.7.3 PCIe Slot Description**. ● Support PCIe SSD cards to bolster I/O performance for applications such as searching, caching, and download services. ● When IB cards are used to build an IB network, ensure that the IPoIB modes of the IB cards at both ends of the network are the same. For details, contact technical support. **NOTE** The preceding information is for reference only. Use the **Compatibility List** to obtain specific information.
Port	Supports a variety of ports. ● Ports on the front panel: – Two USB 2.0 ports ● Ports on the rear panel: – Two USB 3.0 ports – One DB15 VGA port – One RJ45 serial port – One RJ45 system management port – Two GE electrical ports – Two 10GE electrical ports or 10GE optical ports ● Built-in ports: – One USB 3.0 port – Two SATA ports **NOTE** You are not advised to install the operating system on the USB storage media.
Video card	An SM750 video chip with 32 MB display memory is integrated on the mainboard. The maximum display resolution is 1920 x 1200 at 60 Hz with 16 M colors. **NOTE** ● SM750 is not supported by servers running the Windows Server 2019 or Windows Server 2019 Hyper-V operating systems that are in secure boot mode. ● The integrated video card can provide the maximum display resolution (1920 x 1200) only after the video card driver matching the operating system version is installed. Otherwise, only the default resolution supported by the operating system is provided.

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Component	Specifications
System management	● Supports UEFI. ● Supports iBMC. ● Supports NC-SI. ● Supports integration with third-party management systems.
Security feature	● Power-on password ● Administrator password ● TCM (only in China)/TPM ● Secure boot ● Front bezel (optional)

6.2 Environmental Specifications

Table 6-2 Environmental specifications

Category	Specifications
Temperature	● Operating temperature: 5°C to 40°C (41°F to 104°F) (ASHRAE Classes A1 to A3 compliant) ● Storage temperature (within three months): –30°C to +60°C (–22°F to +140°F) ● Storage temperature (within six months): –15°C to +45°C (5°F to 113°F) ● Storage temperature (within one year): –10°C to +35°C (14°F to 95°F) ● Maximum rate of temperature change: 20°C (36°F) per hour, 5°C (9°F) per 15 minutes **NOTE** The highest operating temperature varies depending on the server configuration. For details, see **A.3 Operating Temperature Limitations**.
Relative humidity (RH, non-condensing)	● Operating humidity: 8% to 90% ● Storage humidity (within three months): 8% to 85% ● Storage humidity (within six months): 8% to 80% ● Storage humidity (within one year): 20% to 75% ● Maximum change rate: 20%/h
Air volume	≥ 273 cubic feet per minute (CFM)

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Category	Specifications
Operating altitude	≤3050m ● When the server configuration complies with ASHRAE Classes A1 and A2 and the altitude is above 900 m (2952.76 ft), the highest operating temperature decreases by 1°C (1.8°F) for every increase of 300 m (984.25 ft). ● When the configuration complies with ASHRAE Class A3 standards and the altitude is above 900 m (2952.76 ft.), the highest operating temperature decreases by 1°C (1.8°F) for every increase of 175 m (574.14 ft.). ● HDDs cannot be used at an altitude of over 3050 m (10006.44 ft).
Corrosive gaseous contaminant	Maximum corrosion product thickness growth rate: ● Copper corrosion rate test: 300 Å/month (meeting level G1 requirements of the ANSI/ISA-71.04-2013 standard on gaseous corrosion) ● Silver corrosion rate test: 200 Å/month
Particle contaminant	● The equipment room environment meets the requirements of ISO 14664-1 Class 8. ● There is no explosive, conductive, magnetic, or corrosive dust in the equipment room. **NOTE** It is recommended that the particulate pollution in the equipment room be monitored by a professional agency.
Acoustic noise	The declared A-weighted sound power levels (LWAd) and declared average bystander position A-weighted sound pressure levels (LpAm) listed are measured at 23°C (73.4°F) in accordance with ISO 7779 (ECMA 74) and reported in accordance with ISO 9296 (ECMA 109). ● Idle: – LWAd: 6.04 Bels – LpAm: 46.0 dBA ● Operating: – LWAd: 6.51 Bels – LpAm: 50.7 dBA **NOTE** The noise generated during operation varies depending on the server configuration, load, and ambient temperature.

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NOTE

SSDs and HDDs (including NL-SAS, SAS, and SATA) cannot be preserved for a long time in the power-off state. Data may be lost or faults may occur if the preservation duration exceeds the specified maximum duration. When drives are preserved under the storage temperature and humidity specified in the preceding table, the following preservation time is recommended:

- Maximum preservation duration of SSDs:
  - 12 months in power-off state without data stored
  - 3 months in power-off state with data stored
- Maximum preservation duration of HDDs:
  - 6 months in unpacked/packed and powered-off state
- The maximum preservation duration is determined according to the preservation specifications provided by drive vendors. For details, see the manuals provided by drive vendors.

6.3 Physical Specifications

Table 6-3 Physical specifications

Item	Description
Dimensions (H x W x D)	175 mm x 447 mm x 748 mm (6.89 in. x 17.60 in. x 29.45 in.) **Figure 6-1** Physical dimensions **NOTE** See **Figure 6-1** for methods in measuring physical dimensions of the chassis.

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Item	Description
Installation dimension requirements	● Requirements for cabinet installation: 19-inch standard cabinet compliant with the International Electrotechnical Commission (IEC) 297 standard – Cabinet width: 482.6 mm (19.00 in.) – Cabinet depth ≥ 1000 mm (39.37 in.) ● Requirements for guide rail installation: – L-shaped guide rails: apply only to our company's cabinets. – Adjustable L-shaped guide rail: apply to cabinets with a distance of 543.5 mm to 848.5 mm (21.40 in. to 33.41 in.) between the front and rear mounting bars. – Ball bearing rail kit: applies to cabinets with a distance of 610 mm to 914 mm (24.02 in. to 35.98 in.) between the front and rear mounting bars.
Fully equipped weight	● Net weight: 65 kg (143.30 lb) ● Packaging materials: 5 kg (11.02 lb)
Energy consumption	The power consumption parameters vary with server configurations, including the configurations complying with energy-related products (ErP) requirements. Use the **Power Calculator** to obtain specific information.

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7 Software and Hardware Compatibility

Use the **Compatibility List** to obtain information about the operating systems and hardware supported.

NOTICE

- If incompatible components are used, the device may be abnormal. This fault is beyond the scope of technical support and warranty.
- The performance of servers is closely related to application software, basic middleware software, and hardware. The slight differences of the application software, middleware basic software, and hardware may cause performance inconsistency between the application layer and test software layer.
  - If the customer has requirements on the performance of specific application software, contact sales personnel to apply for POC tests in the pre-sales phase to determine detailed software and hardware configurations.
  - If the customer has requirements on hardware performance consistency, specify the specific configuration requirements (for example, specific drive models, RAID controller cards, or firmware versions) in the pre-sales phase.

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8 Safety Instructions

8.1 Security

8.2 Maintenance and Warranty

8.1 Security

General Statement

- Comply with local laws and regulations when installing devices. These Safety Instructions are only a supplement.
- The "DANGER", "WARNING", and "CAUTION" information in this document does not represent all the safety instructions, but supplements to the safety instructions.
- Observe all safety instructions provided on the device labels when installing hardware. Follow them in conjunction with these Safety Instructions.
- Only qualified personnel are allowed to perform special tasks, such as performing high-voltage operations and driving a forklift.

WARNING

If this device works in a residential environment, the wireless interference may be generated.

Human Safety

- This equipment is not suitable for use in places where children may be present.
- Only certified or authorized personnel are allowed to install the device.
- Discontinue any dangerous operations and take protective measures. Report anything that could cause personal injury or device damage to a project supervisor.
- Do not move devices or install racks and power cables in hazardous weather conditions.

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- Do not carry the weight that is over the maximum load per person allowed by local laws or regulations. Before moving or installing equipment, check the maximum equipment weight and arrange required personnel.
- Wear clean protective gloves, ESD clothing, a protective hat, and protective shoes, as shown in **Figure 8-1**.

Figure 8-1 Safety work wear

- Before touching a device, wear ESD clothing and gloves (or wrist strap), and remove any conductive objects (such as watches and jewelry). **Figure 8-2** shows conductive objects that must be removed before you touch a device.

Figure 8-2 Removing conductive objects

Figure 8-3 shows how to wear an ESD wrist strap.

a. Put your hands into the ESD wrist strap.
b. Tighten the strap buckle and ensure that the ESD wrist strap is in contact with your skin.
c. Insert the ground terminal attached to the ESD wrist strap into the jack on the grounded rack or chassis.

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Figure 8-3 Wearing an ESD wrist strap

- Exercise caution when using tools.
- If the installation position of the device is higher than the shoulders of the installation personnel, use a vehicle such as a lift to facilitate installation. Prevent the equipment from falling down and causing personal injury or damage to the equipment.
- The equipment is powered by high-voltage power sources. Direct or indirect contact (especially through damp objects) with high-voltage power sources may result in serious injury or death.
- Ground the equipment before powering it on. Otherwise, personal injury may be caused by high electricity leakage.
- When a ladder is used, ensure that another person holds the ladder steady to prevent accidents.
- When connecting, testing, or replacing an optical cable, do not look into the optical port without eye protection.

Equipment Safety

- Use the recommended power cables at all times.
- Use power cables only for dedicated servers. Do not use them for other devices.
- Before operating equipment, wear ESD clothes and gloves to prevent electrostatic-sensitive devices from being damaged by ESD.
- When moving a device, hold the bottom of the device. Do not hold the handles of the installed modules, such as the PSUs, fan modules, drives, and the mainboard. Handle the equipment with care.
- Exercise caution when using tools that could cause personal injury.
- If the device is configured with active and standby PSUs, connect power cables of active and standby PSUs to different power distribution units (PDUs) to ensure reliable system operating.
- Ground the equipment before powering it on.

Transportation Precautions

Improper transportation may damage equipment. Contact the manufacturer for precautions before attempting transportation.

Transportation precautions include but are not limited to:

- The logistics company engaged to transport the device must be reliable and comply with international standards for transporting electronics. Ensure that the

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equipment being transported is always kept upright. Take necessary precautions to prevent collisions, corrosion, package damage, damp conditions and pollution.

- Transport the equipment in its original packaging.
- If the original packaging is unavailable, package heavy, bulky parts (such as chassis and blades) and fragile parts (such as PCIe GPUs and SSDs) separately.

  NOTE

  Use **Compatibility List** to obtain information abut the components supported by a node or server.
- Power off all devices before transportation.

Maximum Weight Carried by a Person

CAUTION

To reduce the risk of personal injury, comply with local regulations with regard to the maximum weight one person is permitted to carry.

Table 8-1 lists the maximum weight one person is permitted to carry as stipulated by a number of organizations.

Table 8-1 Maximum weight carried per person

Organization	Weight (kg/lb)
European Committee for Standardization (CEN)	25/55.13
International Organization for Standardization (ISO)	25/55.13
National Institute for Occupational Safety and Health (NIOSH)	23/50.72
Health and Safety Executive (HSE)	25/55.13

For more information about safety instructions, see **Server Safety Information**.

8.2 Maintenance and Warranty

For details about the maintenance policy, visit **Customer Support Service**.

For details about the warranty policy, visit **Warranty**.

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9 System Management

The server uses the next-generation Intelligent Baseboard Management Controller (iBMC) to implement remote server management. The iBMC complies with IPMI 2.0 and provides highly reliable hardware monitoring and management.

Features

The iBMC supports the following features and protocols:

- KVM and text console redirection
- Remote virtual media
- IPMI
- SNMP
- Common information model (CIM)
- Redfish
- Browser-based login

Specifications

Table 9-1 iBMC specifications

Specifications	Description
Management interface	Integrates with any standard management system through the following interfaces: ● IPMI ● CLI ● HTTPS ● SNMP ● Redfish
Fault Detection	Detects and accurately locates faults in a field replaceable unit (FRU).

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Specifications	Description
System watchdog	Supports BIOS POST, OS watchdog, and automatic system reset after fault timeout. Users can enable or disable these features individually.
Setting of boot device	Supports out-of-band configuration for the boot device.
Alarm management	Supports alarm management and reports alarms using the SNMP trap, SMTP, and syslog service to ensure 24/7 operating.
Integrated virtual KVM	Provides remote maintenance measures and VNC service for troubleshooting.
Integrated virtual media	Virtualizes local media devices, images, USB keys, and folders into media devices on a remote server, simplifying OS installation. (The virtual DVD-ROM drive supports a maximum transmission rate of 8 MB/s.)
WebUI	Provides a user-friendly graphical user interface (GUI), which simplifies users' configuration and query operations.
Fault reproduction	Reproduces faults to facilitate fault diagnosis.
Screen snapshots and videos	Allows users to view screenshots and videos without login, facilitating routine preventive maintenance inspection (PMI).
Black Box	Allows users to enable or disable the black box function and download black box data.
DNS/LDAP	Supports domain management and directory services, which significantly simplify network and configuration management.
Dual-image backup	Allows a boot from the backup image when the active software crashes.
Device asset management	Provides intelligent asset management, supporting unified management and stocktaking of assets in use.
Intelligent power management	Uses the power capping technology to increase deployment density, and uses dynamic energy saving to lower operating expenses.
IPv6	Supports IPv6 to help build an all-IPv6 environment.
Network Controller Sideband Interface (NC-SI)	Supports NC-SI, allowing access to the iBMC through the service network port.

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10 Certifications

Country/Region	Certification	Standards
Europe	WEEE	2012/19/EU
Europe	REACH	EC NO. 1907/2006
Europe	CE	Safety: EN 62368-1:2014+A11:2017 EMC: EN 55032:2015+A11:2020 CISPR 32:2015+A1:2019 EN IEC 61000-3-2:2019+A1:2021 EN 61000-3-3:2013+A1:2019 EN 55035:2017+A11:2020 CISPR 35:2016 EN 55024:2010+A1:2015 CISPR 24:2010+A1:2015 ETSI EN 300 386 V1.6.1:2012 ETSI EN 300 386 V2.1.1:2016 RoHS: EN IEC 63000:2018 ErP: Commission Regulation(EU) 424/2019
Russia	EAC&GOST	ГОСТ CISPR 32-2015 ГОСТ CISPR 24-2013 ГОСТ 30804 3.2-2013 ГОСТ 30804 3.3-2013 ГОСТ 15150-69

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Country/Region	Certification	Standards
UK	UKCA	Safety: EN 62368-1:2014+A11:2017 EMC: EN 55032:2015+A11:2020 CISPR 32:2015+A1:2019 EN IEC 61000-3-2:2019+A1:2021 EN 61000-3-3:2013+A1:2019 EN 55035:2017+A11:2020 CISPR 35:2016 EN 55024:2010+A1:2015 CISPR 24:2010+A1:2015 ETSI EN 300 386 V1.6.1:2012 ETSI EN 300 386 V2.1.1:2016 RoHS: BS EN IEC 63000:2018 ErP: Commission Regulation(EU) 424/2019
China	CCC	GB 17625.1-2022 GB 4943.1-2022 GB/T 9254.1-2021 (Class A)
China	RoHS	SJ/T-11364 GB/T 26572
North America	NRTL	UL 62368-1:2014 CAN/CSA-C22.2 NO.62368-1-14
US	FCC	FCC PART 15
Canada	IC	ICES-003
Japan	VCCI	VCCI 32-1
Global	CB	IEC 62368-1:2014

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11 Waste Product Recycling

If product users need product recycling service provided by xFusion after products are scrapped, contact technical support for services.

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A Appendix

A.1 Chassis Label

NOTE

The label information and location are for reference only. For details, see the actual product.

A.1.1 On the Front Top

Figure A-1 Chassis head label

1	Nameplate	2	Certificate
3	Quick access tag	4	SN **NOTE** For details, see **A.2 Product SN**.

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5	Slide-out label plate **NOTE** The label locations vary with server models or configurations. For details, see **5.1.1 Appearance**.	6	SN **NOTE** For details, see **A.2 Product SN**.
7	Reserved space for custom label	8	Pressure-proof label **NOTE** This label indicates that do not place any objects on top of a rack-mounted device.

A.1.1.1 Nameplate

Figure A-2 Nameplate example

Table A-1 Nameplate description

No.	Description
1	Server Model For details, see **A.4 Nameplate** .
2	Device names
3	Power Supply Requirements
4	Enterprise Standard No.
5	Vendor Information
6	Authentication ID

A.1.1.2 Certificate

Figure A-3 Sample certificate

Table A-2 Certificate description

No.	Description
1	Order
2	No. **NOTE** For details, see **Figure A-4** and **Table A-3**.
3	QC inspector
4	Production date
5	No. Barcode

Figure A-4 Sample certificate No.

Table A-3 Certificate No. Description

No.	Description
1	The value for this digit is **P**, which is fixed.
2	The value for this digit is **Z**, which is fixed.
3	• **Y**: indicates a server. • **B**: indicates a semi-finished server. • **N**: indicates a spare part.

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No.	Description
4	The value is **0**. This digit is a reserved digit.
5	Indicates the year (two digits).
6	Indicates the month (one digit). ● Digits 1 to 9 indicate January to September, respectively. ● Letters A to C indicate October to December, respectively.
7	Indicates the day (one digit). ● Digits 1 to 9 indicate the 1st to 9th ● Letters A to H indicate the 10th to 17th. ● Letters J to N indicate the 18th to 22nd. ● Letters P to Y indicate the 23rd to 31st
8	Indicates the hour (one digit). ● Digits 0 to 9 indicate 0:00 to 9:00. ● Letters A to H indicate 10:00 to 17:00. ● Letters J to N indicate 18:00 to 22:00. ● Letters P to Q indicate 23:00 to 24:00.
9	Indicates the serial number (two digits).
10	Indicates the manufacturing serial number (five digits).

A.1.1.3 Sample Quick Access Tags

Figure A-5 Sample quick access tags

Table A-4 Quick access tab description

No.	Description
1	IP address of the iBMC management network port
2	Subnet mask of the iBMC management network port

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No.	Description
3	Default iBMC user name
4	Default iBMC password
5	Default BIOS password
6	Technical support website
7	P/N Code
8	QR Code **NOTE** Scan the QR code to obtain technical support resources.

A.1.2 Chassis Tail Label

Figure A-6 Chassis tail label

NOTE

For details about the warning label, see **Server Safety Information**.

A.1.3 Chassis Internal Label

Figure A-7 Chassis internal label

NOTE

- The quick guide is located on the inside of the chassis cover. It describes how to remove the mainboard components, important components of the chassis, precautions, and QR codes of technical resources. The pictures are for reference only. For details, see the actual product.
- The quick guide is optional. For details, see the actual product.

A.2 Product SN

The serial number (SN) on the slide-out label plate uniquely identifies a device. The SN is required when you contact technical support. **Figure A-8** and **Figure A-9** show the SN formats.

- SN example 1

Figure A-8 SN example 1

- SN example 2

Figure A-9 SN example 2

Table A-5 SN example description

No.	Description
1	ESN ID (two characters), which can only be **21**.
2	Material ID (eight characters), that is, the processing code.
3	Vendor code (two characters), that is, the code of the processing place.

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No.	Description
4	Year and month (two characters). ● The first character indicates the year. – Digits 1 to 9 indicate years 2001 to 2009, respectively. – Letters A to H indicate years 2010 to 2017, respectively. – Letters J to N indicate years 2018 to 2022, respectively. – Letters P to Y indicate years 2023 to 2032, respectively. **NOTE** The years from 2010 are represented by upper-case letters excluding I, O, and Z because the three letters are similar to the digits 1, 0, and 2. ● The second character indicates the month. – Digits 1 to 9 indicate January to September, respectively. – Letters A to C indicate October to December, respectively.
5	Serial number (six digits).
6	RoHS compliance (one character). **Y** indicates RoHS compliant.
7	Internal model (product name) of the board. The model format varies according to the actual situation.

A.3 Operating Temperature Limitations

Table A-6 Operating temperature limitations

Configuration	Max. 30°C (86°F)	Max. 35°C (95°F)	Max. 40°C (104°F)
Single RAID configuration (with built-in drives)	● Platinum 8180/8168/8280/8270/8268 and Gold 6154/6151/6254 processors not supported	Options not supported: ● Platinum 8180/8168/8280/8270/8268 and Gold 6154/6151/6254 processors ● I/O modules 1 and 2 configured with drives ● I/O module 3 configured with NVMe drives ● Built-in drives ● PCIe SSD cards	Options supported: ● Platinum 8153/8253, Gold 6152/6140/6126/5118/5218, and other processors lower than 105 W Options not supported: ● I/O modules 1 and 2 configured with drives ● I/O module 3 configured with NVMe drives ● PCIe SSD cards

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Configuration	Max. 30°C (86°F)	Max. 35°C (95°F)	Max. 40°C (104°F)
Single-RAID configuration (without built-in drives)	● All options supported	Options not supported: ● I/O modules 1 and 2 configured with drives ● I/O module 3 configured with NVMe drives ● Built-in drives ● PCIe SSD cards	Options not supported: ● Platinum 8180/8168/8280/8270/8268 and Gold 6154/6151/6144/6146/6254/6244 processors ● I/O modules 1 and 2 configured with drives ● I/O module 3 configured with NVMe drives ● Built-in drives ● NVMe drives in slots 32 to 35 ● PCIe SSD cards
Dual-RAID configuration	● All options supported	Options not supported: ● I/O modules 1 and 2 configured with drives ● I/O module 3 configured with NVMe drives ● Built-in drives ● PCIe SSD cards	Options not supported: ● Platinum 8180/8168/8280/8270/8268 and Gold 6154/6151/6144/6146/6254/6244 processors ● I/O modules 1 and 2 configured with drives ● I/O module 3 configured with NVMe drives ● Built-in drives ● NVMe drives in slots 32 to 35 ● PCIe SSD cards

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NOTE

- When a single fan is faulty:
  - The maximum operating temperature is 5°C (9°F) lower than the rated value.
  - Drive performance will be affected if rear NVMe drives are configured.
- If P4 GPU cards are configured:
  - The processor power consumption must be lower than 130 W if the server is configured with six P4 GPU cards.
  - The processor power consumption of the processor must be lower than 205 W if the server is configured with four P4 GPU cards. In addition, the P4 GPU cards must be installed in slots: Slot 1, 2, 4, and 5.
  - The server supports the maximum operating temperature of 30°C (86°F) if the P4 GPU cards are stacked and supports 35°C (95°F) if the P4 GPU cards are not stacked.

A.4 Nameplate

Certified Model	Usage Restrictions
H52H-05	Global
5288 V5	Global
Note: The nameplate depends on the actual product.	

A.5 RAS Features

The server supports a variety of Reliability, Availability, and Serviceability (RAS) features. You can configure these features for better performance.

For details about how to configure these features, see the **Server Purley Platform BIOS Parameter Reference**.

Table A-7 Supported RAS features

Module	Feature	Description
CPU	Corrected Machine Check Interrupt (CMCI)	Corrects error-triggered interrupts.
Memory	Failed DIMM Isolation	Identifies faulty DIMMs to facilitate isolation and replacement of the faulty DIMMs.
	Memory Thermal Throttling	Automatically adjusts the memory temperature to prevent the memory from being damaged due to overheat.
	Rank Sparing	Uses some memory ranks for backup to prevent the system from breaking down due to uncorrectable errors.

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Module	Feature	Description
	Memory Address Parity Protection	Detects memory command and address errors.
	Memory Demand and Patrol Scrubbing	Corrects correctable errors upon detection. If these errors are not corrected in a timely manner, uncorrectable errors may occur.
	Memory Mirroring	Provides high reliability for the system via mirroring.
	Single Device Data Correction (SDDC)	Corrects single-chip multi-bit errors to improve memory reliability.
	Device Tagging	Degrades and rectifies memory faults to improve memory availability.
	Data Scrambling	Optimizes data flow distribution to reduce the error probability and improve memory data flow reliability and address error detection.
PCIe	PCIe Advanced Error Reporting	Provides a PCIe advanced error reporting mechanism to improve server serviceability.
UPI	Intel UPI Link Level Retry	Provides a retry mechanism to improve the reliability of UPI links.
	Intel UPI Protocol Protection via CRC	Provides cyclic redundancy check (CRC) protection for UPI data packets to improve system reliability.
System	Core Disable For FRB (Fault Resilient Boot)	Isolates a faulty CPU core during startup to improve system reliability and availability.
	Corrupt Data Containment Mode	Marks the memory storage unit when a data error occurs to limit the impact on the running program and improve system reliability.
	Socket disable for FRB (Fault Resilient Boot)	Isolates a faulty socket during the BIOS startup process to improve system reliability.
	Architected Error Records	With the features such as eMCA, the BIOS collects error information recorded in hardware registers in compliance with UEFI specifications, notifies the OS through the APEI interface of the ACPI, and locates the error unit, improving system availability.

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Module	Feature	Description
	Error Injection Support	Implements fault injection to verify RAS features.
	Machine Check Architecture (MCA)	Provides a software repair function to rectify uncorrectable errors to improve system availability.
	Enhanced Machine Check Architecture (eMCA): Gen2	Improves system availability.
	OOB access to MCA registers	The out-of-band system can access MCA registers through the PECI. When a fatal error occurs in the system, the out-of-band system can collect onsite data to facilitate subsequent fault analysis and locating and improve system serviceability.
	BIOS Abstraction Layer for Error Handling	The BIOS processes errors and reports error information to the OS based on specifications, improving system serviceability.
	BIOS-based Predictive Failure Analysis (PFA)	The OS takes the lead. The BIOS provides information about physical memory error units. The OS tracks, predicts, and handles the errors.

A.6 Sensor List

Sensor	Description	Component
Inlet Temp	Air inlet temperature	Left mounting ear
Outlet Temp	Air outlet temperature	Mainboard
PCH Temp	PCH bridge temperature	Mainboard
CPU*N* Core Rem	CPU core temperature	CPU*N* *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* DTS	CPU DTS value	CPU*N* *N* indicates the CPU number. The value is **1** or **2**.

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Sensor	Description	Component
CPU*N* Margin	CPU Margin	CPU*N* *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* VDDQ Temp	CPU VDDQ temperature	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* VRD Temp	CPU VRD temperature	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* MEM Temp	CPU DIMM temperature	DIMMs of CPU *N* *N* indicates the CPU number. The value is **1** or **2**.
SYS 3.3V	Mainboard 3.3 V voltage	Mainboard
SYS 5V	Mainboard 5.0 V voltage	Mainboard
SYS 12V_1	Mainboard 12.0 V voltage	Mainboard
SYS 12V_2	Mainboard 12.0 V voltage	Mainboard
CPU*N* VCore	1.8 V CPU voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* DDR VDDQ	1.2 V DIMM voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* DDR VDDQ2	1.2 V DIMM voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* VSA	CPU VSA voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.

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Sensor	Description	Component
CPU*N* VCCIO	CPU VCCIO voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* VMCP	CPU VMCP voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
PCH VPVNN	PCH VPVNN voltage	Mainboard
PCH PRIM 1V05	PCH PRIM voltage	Mainboard
CPU*N* VCCP	CPU VCCP voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* DDR VPP1	VPP_ABC voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* DDR VPP2	VPP_DEF voltage	Mainboard *N* indicates the CPU number. The value is **1** or **2**.
FAN*N* Speed	Fan speed sensor	Fan module *N* *N* indicates the fan module number. The value ranges from **1** to **4**.
Power	Server input power	PSU
PS*N* VIN	PSU*N* input voltage	PSU*N* *N* indicates the PSU number. The value is **1** or **2**.
Disks Temp	Drive maximum temperature	Drive
Powern	PSU input power	PSU*N* *N* indicates the PSU number. The value is **1** or **2**.
PCH Status	PCH chip fault diagnosis health status	Mainboard

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Sensor	Description	Component
CPU*N* QPI Link	CPU QPI link fault diagnosis health status	Mainboard or CPU*N* *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* Prochot	CPU Prochot	CPU*N* *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* Status	CPU status	CPU*N* *N* indicates the CPU number. The value is **1** or **2**.
CPU*N* Memory	CPU memory status	DIMMs of CPU *N* *N* indicates the CPU number. The value is **1** or **2**.
FAN*N* Status	Fan status	Fan module *N* *N* indicates the fan module number. The value ranges from **1** to **4**.
DIMM*N*	DIMM status	DIMM*N* *N* indicates the DIMM slot number.
RTC Battery	RTC battery status. An alarm is generated when the voltage is lower than 1 V.	RTC battery
PCIE Status	PCIe status	PCIe card
Power Button	Power button pressed state	Mainboard and power button
Watchdog2	Watchdog timer	Mainboard
Mngmnt Health	Management subsystem health status	Management module
UID Button	UID button status	Mainboard
PwrOk Sig. Drop	Voltage dip status	Mainboard
PwrOn TimeOut	Power-on timeout	Mainboard
PwrCap Status	Power capping status	Mainboard
HDD Backplane	Entity presence	Drive backplane

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Sensor	Description	Component
HDD BP Status	Drive backplane health status	Drive backplane
Riser*N* Card	Entity presence	Riser card *N* *N* indicates the riser card number. The value ranges from **1** to **3**.
SAS Cable	Entity presence	SAS high-speed cable
FAN*N* Presence	Fan presence	Fan module *N* *N* indicates the fan module number. The value ranges from **1** to **4**.
RAID Presence	RAID controller card presence	RAID controller card
LCD Status	LCD health status	LCD
LCD Presence	LCD presence	LCD
PS Redundancy	Redundancy failure due to PSU removal	PSU
NIC# Status	NIC fault diagnosis health status	LOM port
Port# Link Down	Network port link status	LOM port
PS*N* Status	PSU status	PSU*N* *N* indicates the PSU number. The value is **1** or **2**.
PS*N* Fan Status	PSU fan status	PSU *N* *N* indicates the PSU number. The value is **1** or **2**.
PS*N* Temp Status	PSU presence	PSU *N* indicates the PSU number. The value is **1** or **2**.
DISK*N*	Drive status	Drive *N* *N* indicates the drive slot number. The value ranges from **0** to **47**.
LOM P1 Link Down	LOM	LOM
LOM P2 Link Down	LOM	LOM

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Sensor	Description	Component
LOM P3 Link Down	LOM	LOM
LOM P4 Link Down	LOM	LOM
PCIe RAID$ Temp	PCIe RAID controller card temperature	PCIe RAID controller card
M2 Temp(PCIe$)	Maximum temperature of all M.2 drives of the RAID controller card	PCIe RAID controller card
RAID Temp	RAID controller card temperature	RAID controller card
RAID Status	RAID controller card health status	RAID controller card
RAID PCIE ERR	RAID controller card fault diagnosis health status	RAID controller card
IB$ TEMP	IB adapter temperature	IB card
PCIe$ OP Temp	PCIe card optical module temperature	PCIe card
PCIe NIC$ Temp	PCIe card chip temperature	PCIe card
PCIe FC$ Temp	PCIe card chip temperature	PCIe card
PS$ Inlet Temp	PSU air inlet temperature	PSU
NIC$ Presence	LOM presence	FlexIO

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B Glossary

B.1 A-E

E

ejector lever	A part on the panel of a device used to facilitate installation or removal of the device.
Ethernet	A baseband local area network (LAN) architecture developed by Xerox Corporation by partnering with Intel and DEC. Ethernet uses the Carrier Sense Multiple Access/Collision Detection (CSMA/CD) access method and allows data transfer over various cables at 10 Mbit/s. The Ethernet specification is the basis for the IEEE 802.3 standard.

B.2 F-J

G

Gigabit Ethernet (GE)	An extension and enhancement of traditional shared media Ethernet standards. It is compatible with 10M and 100M Ethernet and complies with IEEE 802.3z standards.

H

hot swap	Replacing or adding components without stopping or shutting down the system.

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B.3 K-O

K

KVM	A hardware device that provides public keyboard, video and mouse (KVM).

B.4 P-T

P

panel	An external component (including but not limited to ejector levers, indicators, and ports) on the front or rear of the server. It seals the front and rear of the chassis to ensure optimal ventilation and electromagnetic compatibility (EMC).
Peripheral Component Interconnect Express (PCIe)	A computer bus PCI, which uses the existing PCI programming concepts and communication standards, but builds a faster serial communication system. Intel is the main sponsor for PCIe. PCIe is used only for internal interconnection. A PCI system can be transformed to a PCIe one by modifying the physical layer instead of software. PCIe delivers a faster speed and can replace almost all AGP and PCI buses.

R

redundancy	A mechanism that allows a backup device to automatically take over services from a faulty device to ensure uninterrupted running of the system.
redundant array of independent disks (RAID)	A storage technology that combines multiple physical drives into a logical unit for the purposes of data redundancy and performance improvement.

S

server	A special computer that provides services for clients over a network.
system event log (SEL)	Event records stored in the system used for subsequent fault diagnosis and system recovery.

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B.5 U-Z

U

U	A unit defined in International Electrotechnical Commission (IEC) 60297-1 to measure the height of a cabinet or chassis. 1 U = 44.45 mm
UltraPath Interconnect (UPI)	A point-to-point processor interconnect developed by Intel.

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C Acronyms and Abbreviations

C.1 A-E

A

AC	alternating current
AES	Advanced Encryption Standard New Instruction Set
ARP	Address Resolution Protocol
AVX	Advanced Vector Extensions

B

BBU	backup battery unit
BIOS	Basic Input/Output System

C

CD	calendar day
CE	Conformite Europeenne
CIM	Common Information Model
CLI	command-line interface

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D

DC	direct current
DCPMM	DC persistent memory module
DDR3	Double Data Rate 3
DDR4	Double Data Rate 4
DDDC	double device data correction
DEMT	Dynamic Energy Management Technology
DIMM	dual in-line memory module
DRAM	dynamic random-access memory
DVD	digital video disc

E

ECC	error checking and correcting
ECMA	European Computer Manufacturer Association
EDB	Execute Disable Bit
EN	European Efficiency
ERP	enterprise resource planning
ETS	European Telecommunication Standards

C.2 F-J

F

FB-DIMM	Fully Buffered DIMM
FC	Fiber Channel
FCC	Federal Communications Commission
FCoE	Fibre Channel over Ethernet
FTP	File Transfer Protocol

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G

GE	Gigabit Ethernet
GPIO	General Purpose Input/Output
GPU	graphics processing unit

H

HA	high availability
HDD	hard disk drive
HPC	high-performance computing
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure

I

iBMC	intelligent baseboard management controller
IC	Industry Canada
ICMP	Internet Control Message Protocol
IDC	Internet Data Center
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Message Protocol
IOPS	input/output operations per second
IP	Internet Protocol
IPC	intelligent power capability
IPMB	Intelligent Platform Management Bus
IPMI	Intelligent Platform Management Interface

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C.3 K-O

K

KVM	keyboard, video, and mouse

L

LC	Lucent connector
LRDIMM	load-reduced dual in-line memory module
LED	light emitting diode
LOM	LAN on motherboard

M

MAC	media access control
MMC	module management controller

N

NBD	next business day
NC-SI	Network Controller Sideband Interface

C.4 P-T

P

PCIe	Peripheral Component Interconnect Express
PDU	power distribution unit
PHY	physical layer
PMBUS	power management bus
POK	power OK
PWM	pulse-width modulation

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PXE	Preboot Execution Environment

Q

QPI	Quick Path Interconnect

R

RAID	redundant array of independent disks
RAS	reliability, availability and serviceability
RDIMM	registered dual in-line memory module
REACH	Registration Evaluation and Authorization of Chemicals
RJ45	registered jack 45
RoHS	Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

S

SAS	Serial Attached Small Computer System Interface
SATA	Serial Advanced Technology Attachment
SCM	supply chain management
SDDC	single device data correction
SERDES	serializer/deserializer
SGMII	serial gigabit media independent interface
SMI	serial management interface
SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
SOL	serial over LAN
SONCAP	Standards Organization of Nigeria-Conformity Assessment Program
SSD	solid-state drive
SSE	Streaming SIMD Extensions

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T

TACH	tachometer signal
TBT	Turbo Boost Technology
TCG	Trusted Computing Group
TCM	trusted cryptography module
TCO	total cost of ownership
TDP	thermal design power
TELNET	Telecommunication Network Protocol
TET	Trusted Execution Technology
TFM	TransFlash module
TFTP	Trivial File Transfer Protocol
TOE	TCP offload engine
TPM	trusted platform module

C.5 U-Z

U

UDIMM	unbuffered dual in-line memory module
UEFI	Unified Extensible Firmware Interface
UID	unit identification light
UL	Underwriter Laboratories Inc.
USB	Universal Serial Bus

V

VCCI	Voluntary Control Council for Interference by Information Technology Equipment
VGA	Video Graphics Array
VLAN	virtual local area network
VRD	voltage regulator-down

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W

WEEE	waste electrical and electronic equipment
WSMAN	Web Service Management

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