DH141C V5 Server Node

Technical White Paper

Issue   01

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About This Document

Purpose

This document describes the DH141C V5 servers in terms of appearance, performance parameters, and component compatibility.

Intended Audience

This document is intended for presales 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.

Change History

Issue	Release Date	Change Description
01	2022-04-20	This issue is the first official release.

1 Product Overview

DH141C V5 server node (DH141C V5) is a 1 U liquid-cooled server node.

> **NOTICE**
>
> Two nodes need to be maintained at the same time.

The DH141C V5 delivers supreme performance and high storage density in limited space through innovative design. It is easy to manage and maintain.

DH141C V5 contains two nodes. One node supports one main board, and each node supports two 2.5" SAS/SATA drives, sixteen DIMMs, one standard PCIe card and one PCIe screw-in card, and two 10GE onboard NICs.

With powerful computing, large local storage, and high scalability of ports, the DH141C V5 is ideal for data center, cloud computing, big data, and Internet applications.

Figure 1-1 Appearance of the DH141C V5

2 Product Features

Performance and Scalability

- The Intel® Xeon® Scalable Skylake and Cascade Lake processors provide up to 28 cores, 3.8 GHz frequency, 38.5 MB L3 cache, and two 10.4 GT/s UPI links between processors, delivering the highest processing performance.

    - DH141C V5 contains two nodes. Each mainboard supports up to two processors with 56 cores and 112 threads to maximize the concurrent execution of multithreaded applications.

    - The L2 cache capacity is increased. Each core exclusively occupies 1 MB L2 cache, and at least 1.375 MB L3 cache.

    - The latest Intel Turbo Boost technology 2.0 enables processor cores to run at the maximum frequency during peak hours by temporarily going beyond the processor thermal design power (TDP).

    - Intel hyper-threading technology enables each processor core to run up to two threads, improving parallel computation capability.

    - The Intel virtualization technology integrates hardware-level virtualization functions to allow OS vendors to better use hardware to address virtualization workloads.

    - Intel advanced vector extensions AVX 2.0 and AVX-512 significantly accelerate floating-point performance for computing-intensive applications.

    - Intel DL Boost (VNNI) is supported to improve the performance of deep learning applications (for Cascade Lake CPU only).

- The 1.2 V DDR4 memory saves up to 20% energy than the last-generation 1.35 V DDR3L memory.

- DH141C V5 contains two nodes. Each mainboard supports a maximum of sixteen 2933 MT/s DDR4 ECC DIMMs. The DDR4 ECC DIMMs support registered dual in-line memory modules (RDIMMs) and Load-Reduced DIMMs (LRDIMMs), featuring high speed, increased availability, and a maximum memory capacity of 1 TB. In theory, the maximum memory bandwidth is 274.97 GB/s (for Cascade Lake CPU only).

- Integrated Intel I/O technology incorporates PCIe 3.0 controller into Intel® Xeon® Scalable processor, shortening the I/O latency and improving overall system performance.

- DH141C V5 contains two nodes. Each mainboard supports two SAS/SATA drives. The solid-state drives (SSDs) deliver higher I/O performance than hard disk drives (HDDs). An SSD supports approximately 100 times more IOPS than a typical HDD.

- DH141C V5 contains two nodes. Each mainboard supports one PCLe card, used for concurrent data access with high-bandwidth and low-latency.

Availability and Serviceability

- Carrier-class components with process expertise ensure high system reliability and availability.

- DH141C V5 contains two nodes. Each mainboard supports two hot-swappable 2.5-inch drives. It supports RAID 0 and RAID 1.

- DH141C V5 nodes provide power bus ports, backplane bus ports and liquid cooling bus ports. The out-of-band management network cables are routed to out-of-band management switches along cabinet enclosures through network ports on the panel.

- The iBMC WebUI, UID/HLY indicators on the front panel, and fault diagnosis LEDs allow simplified O&M, efficient troubleshooting, and higher availability.

- SSDs offer better reliability than HDDs, prolonging system uptime.

- The built-in iBMC monitors system parameters in real time, triggers alarms, and performs recovery actions to minimize 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.

- The integrated Unified Extensible Firmware Interface (UEFI) improves setup, configuration, and update efficiency and simplifies fault clearance.

- 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.

- The Intel Trusted Execution Technology provides enhanced security by using hardware-based defense against malicious software attacks, allowing an application to run in an isolated space from all other applications running on the OS.

Energy Efficiency

- The second-generation Intel® Xeon® Scalable processor greatly improves the performance and energy efficiency.

- Efficient voltage regulator down (VRD) power supplies for boards minimize the energy loss from DC-to-DC power conversion.

- Intel intelligent power capability allows a processor to be powered on or off based on service requirements.

- Low-voltage Intel® Xeon® Scalable processors consume less energy, ideally suitable for data centers and telecommunications environments constrained by power and thermal limitations.

- Staggered spin-up of drives reduces the server boot power consumption.

- The low-voltage 1.2 V DDR4 RDIMMs consume 20% less energy than 1.35 V DDR3 RDIMMs.

- The SSDs consume 80% less power than HDDs.

- DH141C V5 supports intelligent frequency scaling of processors for energy conservation and consumption reduction.
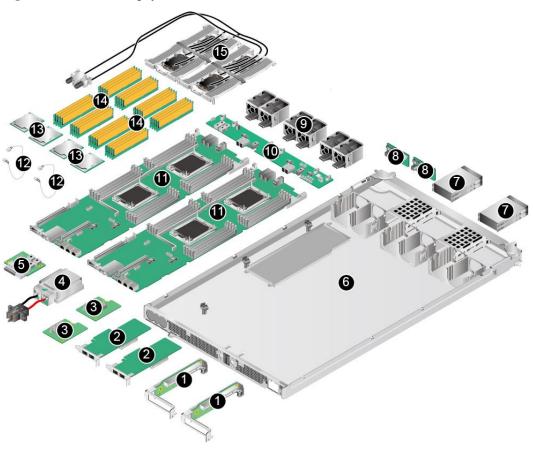
- The cellular ventilation holes on the node panel provide higher ventilation density than round holes, increasing the system cooling efficiency.

Liquid-Cooled Node Reliability

- The liquid cooling connectors connecting liquid-cooled server to cabinet knock-out unit must adopt quick connectors, namely plug and play, pull and break, leak-proof and automatically closed.
- Liquid-cooled node supports leakage monitoring to ensure that liquid leakage could be reported to the customer's network management system within 15 seconds to prevent service interruption.
- Liquid-cooled server nodes support self-isolation of the leakage. When a single node is faulty, it would not affect normal operation of other nodes in the cabinet.

3 Physical Structure

Figure 3-1 DH141C V5 physical structure

1	Riser module	2	PCIe card
3	RAID controller card	4	PSU module
5	Power adapter board	6	Chassis
7	Drive	8	Drive backplane
9	Fan module	10	Fan management board

11	Mainboard	12	Leakage detection cable
13	Processor	14	DIMM
15	Liquid cooling module	-	-

4 Logical Structure

Figure 4-1 DH141C V5 logical structure

- DH141C V5 contains two nodes. Each mainboard supports two Intel® Xeon® Scalable processors.
- DH141C V5 contains two nodes. Each mainboard supports 16 DIMMs.

- The processors interconnect with each other through two UltraPath Interconnect (UPI) links at a speed of up to 10.4 GT/s.

- Processors connect the standard PCIe cards with PCIe bus to provide service ports.

- The RAID controller card connects to the drive backplane through SAS signal cables and the mainboard through a connector.

- The iBMC connects to Platform Controller Hub through PCIe bus and LPC bus to provide management interfaces.

- The iBMC integrates the graphics card, video compression, and virtual media components to provide device management functions, such as server node power control, power supply detection, and KVM over IP.

5 Hardware Description

5.1 Front Panel

5.1.1 Front View

Figure 5-1 Front view

1	Ejector lever	2	Drive

5.1.2 Indicators and Buttons

Indicator and Button Positions

Figure 5-2 Front panel indicators and buttons

1	Connection status indicator of the aggregated network port	2	UID button/indicator (mainboard 1)
3	Power button/indicator (mainboard 1)	4	UID button/indicator (mainboard 2)
5	Power button/indicator (mainboard 2)	6	Data transmission status indicator of the aggregated network port

Indicator and Button Descriptions

For details of hard drive indicator description, see 5.5.3 Drive Indicators .

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

Silkscreen	Indicators and Buttons	Description
⏻	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 server node 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 server node is powered on, you can hold down this button for 6 seconds to forcibly power

Silkscreen	Indicators and Buttons	Description
		off the server node. • When the power indicator is steady yellow, you can press this button to power on the server node.
⊘	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.

⊚	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.
		NOTE
		  • After the iBMC is initialized, the UID indicator blinks a maximum of 255 seconds and then turns off by default. You can press the UID button to locate the device.
		  • When the UID indicator status is set to the blinking mode on iBMC, the indicator blinks for a maximum of 255 seconds and turns steady on.
		UID button:
		• 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.

-	Data transmission status indicator of the aggregated network port	• Off: No data is being transmitted. • Blinking yellow: Data is being transmitted.
-	Connection status indicator of the aggregated network port	• Off: The network port is not connected. • Steady green: The network port is connected properly.

5.1.3 Ports on the Front Panel

Port Position

Figure 5-3 Ports on the front panel

1	VGA port 1 (mainboard 1)	2	VGA port 2 (mainboard 2)
3	Serial port (mainboard 2)	4	USB port (mainboard 2)
5	Serial port (mainboard 1)	6	USB port (mainboard 1)
7	The aggregated network port	-	-

Port Descriptions
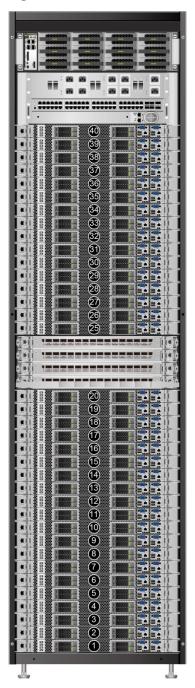
Table 5-2 Ports on the front panel descriptions

Name	Type	Quantity	Description
VGA port	DB15	2	Used to connect a display terminal, such as a monitor or KVM.
USB port	USB 2.0	4	Used to connect to a USB device. **NOTE** Before connecting an external USB device, ensure that the USB device functions properly. Otherwise, it may adversely impact the server.
The aggregated network port	RJ45	1	It is used for managing the servers. **NOTE** The aggregated network port network port is a GE port that does not support 100 Mbit/s.
Serial port	RJ45	2	Default operating system serial port used for debugging. You can configure it as the iBMC serial port by using the command lines.

5.1.4 Installation Position

DH141C V5 is installed in FusionPoD 700 rack-scale server full liquid cooling cabinet. Each cabinet houses up to 36 DH141C V5 server nodes, with U positions indicated in the figure. The number of configured server nodes depends on the actual power consumption.

Figure 5-4 Position of the DH141C V5

5.2 Rear Panel

5.2.1 Rear View
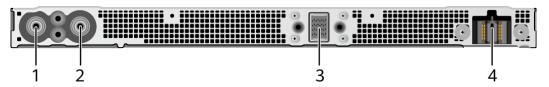
Figure 5-5 Rear view

5.2.2 Ports on the Rear Panel

Port Position

Figure 5-6 Ports on the rear panel:

1	Water inlet	2	Water outlet
3	Service signal port	4	48 V PSU socket

Port Descriptions

Table 5-3 Ports on the rear panel
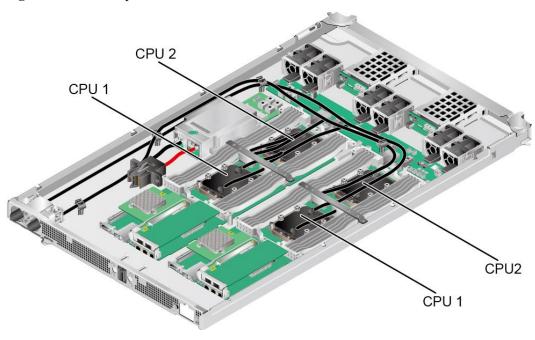
Name	Type	Quantity	Description
Service signal port	-	1	Used to connect cable backplane in the cabinet.
PSU port	-	1	Used to connect Busbar in the cabinet.

5.3 Processor

- DH141C V5 contains two nodes, and one node supports one mainboard.Each mainboard supports two processors.
- The processor supports heat dissipation by liquid cooling plate.
- Processors used in one server must be of the same model.

● For details about component options, consult the local sales representatives.

Figure 5-7 Processor positions
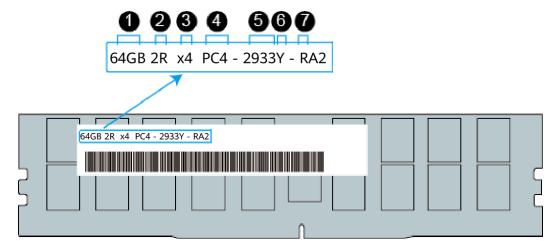
5.4 DIMM (DDR4)

5.4.1 Memory ID

You can determine the memory module properties based on the label attached to the memory module and the following figures and tables.

Figure 5-8 Memory ID

SN	Description	Example
1	Capacity	• 16 GB • 32 GB • 64 GB • 128 GB
2	Rank	• 1R: single-rank • 2R: dual-rank • 4R: quad-rank • 8R: octa-rank
3	Data width on DRAM	• X4: 4-bit • X8: 8-bit
4	Memory generation	• PC4 = DDR4
5	Maximum memory speed	• 2933MT/S • 3200MT/S
6	CAS latency	• W=CAS 20-20-20 • Y=CAS 21-21-21 • AA=CAS 22-22-22
7	DIMM type	• R: RDIMM • L: LRDIMM

5.4.2 Memory Subsystem Architecture

DH141C V5 contains two mainboards. The channels of each mainboard are shown as Table 5-4. Each mainboard supports two processors, each providing 16 memory slots. Each CPU 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 5-4 Channels

CPU	Memory Channel	Memory Slot
CPU1	1A (Primary)	DIMM000(A)
	1A	DIMM001(G)
	1B	DIMM010(B)
	1C	DIMM020(C)
	1D (Primary)	DIMM030(D)
	1D	DIMM031(H)
	1E	DIMM040(E)

CPU	Memory Channel	Memory Slot
	1F	DIMM050(F)
CPU2	2A (Primary)	DIMM100(A)
	2A	DIMM101(G)
	2B	DIMM110(B)
	2C	DIMM120(C)
	2D (Primary)	DIMM130(D)
	2D	DIMM131(H)
	2E	DIMM140(E)
	2F	DIMM150(F)

5.4.3 Memory Compatibility Information

Observe the following rules when configuring DDR4 memory modules:

> **NOTICE**
>
> - Nodes of a same server must use DDR4 memory with the same part number and the same operating speed, no less than any of the minimum value of the following parameters.
> - Memory speed supported by a CPU.
> - Maximum operating speed of a memory module.
> - Mixed use of different specifications(storage, bit width, rank, height and so on) of DDR4 memory is not supported.
> - For details about component options, consult the local sales representatives.

- The memory can be used with Intel® Xeon® Scalable Skylake and Cascade Lake Processors. The maximum memory storage supported by CPU varies according to the model of CPU.
  - Skylake CPU
    - M series CPUs support 1.5 TB memory storage per socket.
    - Non-M series CPUs support 768 GB memory storage per socket.
  - Cascade Lake CPU
    - L series CPUs support 4.5 TB memory storage per socket.
    - M series CPUs support 2 TB memory storage per socket.
    - Other series CPUs support 1 TB memory storage per socket.
- The calculation formula of total memory capacity supported is as follows: the total memory capacity equals sum of storage of all DDR4 memory.

> **NOTICE**
>
> The total memory capacity cannot exceed the maximum memory capacity supported by the CPUs.

- Maximum number of memory depends on the type of CPU, type of memory, number of ranks and operating voltage.

> 📖 **NOTE**
>
> Each memory channel supports a maximum of 8 ranks. The number of memory modules supported by each channel varies depending on the number of ranks supported by each channel:
>
> Number of memory modules supported by each channel ≤ Number of ranks supported by each memory channel/Number of ranks supported by each memory module.

- Each memory channel supports more than eight ranks for load-reduced DIMMs (LRDIMMs).

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

Table 5-5 DDR4 memory specifications

Parameter		Value
Maximum capacity per DDR4 memory module (GB)		64
Rated speed (MT/s)		2933
Operating voltage (V)		1.2
Maximum number of DDR4 memory modules in a node[a]		32
Maximum DDR4 memory capacity of the node (GB)[b]		2048
Maximum operating speed (MT/s)	1DPC[c]	2933[d]
	2DPC	2666

- a: The maximum number of DDR4 memory modules is based on four-processor configuration in two nodes.
- b: Maximum DDR4 memory capacity supported varies according to the type of CPU. In this example, maximum DDR4 memory capacity supported is the value in full memory configuration.
- c: DIMM per channel (DPC) indicates the number of memory modules per channel.
- d: When configured with Cascade Lake CPU, the maximum operating speed of memory modules is 2933 MT/s. When configured with Skylake CPU, the maximum operating speed of memory modules is 2666 MT/s.

5.4.4 Memory Installation Rules

- Observe the following rules when configuring DDR4 memory modules:
  - Do not use memory modules with different specifications together.
  - Install filler memory modules in vacant slots.

- Observe the following rules when configuring DDR4 memory modules in specific operating mode:
  - Installation rules for the memory sparing mode
    - Comply with the general installation guidelines.
    - The spare configuration of each channel must be valid.
    - Different channels can have different spare configurations.
    - Each populated channel must have a spare rank.
  - Installation rules for the memory mirroring mode
    - Comply with the general installation guidelines.
    - Each processor supports two Integrated Memory Controllers (IMCs). Each IMC provides two channels at least (channel 1 and channel 2 or channel 1, channel 2 and channel 3) for installing memory modules. 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.
  - Installation rules for the memory patrol mode
    - Comply with the general installation guidelines.
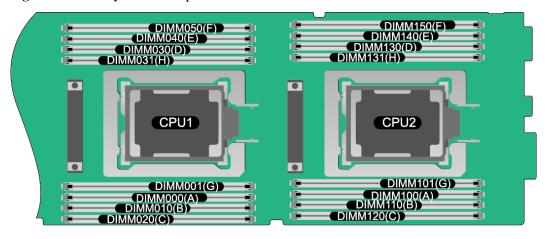
5.4.5 Memory Installation Positions

Each mainboard provides 16 memory slots, and DH141C V5 can house up to 32 DDR4 memory modules in total. To maximize performance, it is recommended to use balanced memory configuration.

NOTICE

Memory slots of CPU1 must be configured with at least one DDR4 memory module.

Figure 5-9 Memory installation position

Figure 5-10 DDR4 memory module 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
CPU 1	A	DIMM000(A)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM001(G)													•	•	•	•
	B	DIMM010(B)			•	•	•	•	•	•	•	•	•	•	•	•	•	•
	C	DIMM020(C)				•	•				•	•	•	•	•	•	•	•
	D	DIMM030(D)						•	•	•	•	•	•	•	•	•	•	•
		DIMM031(H)															•	•
	E	DIMM040(E)						•	•	•	•	•	•	•	•	•	•	•
	F	DIMM050(F)											•	•	•	•	•	•
CPU 2	A	DIMM100(A)		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
		DIMM101(G)													•	•	•	•
	B	DIMM110(B)				•	•	•	•	•	•	•	•	•	•	•	•	•
	C	DIMM120(C)					•	•			•	•	•	•	•	•	•	•
	D	DIMM130(D)							•	•	•	•	•	•	•	•	•	•
		DIMM131(H)																•
	E	DIMM140(E)							•	•	•	•	•	•	•	•	•	•
	F	DIMM150(F)												•	•	•	•	•

5.4.6 Memory Protection Technologies
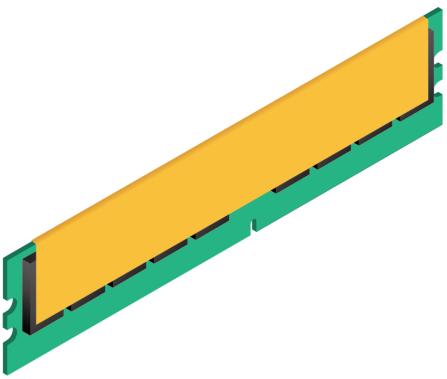
The following memory protection technologies are supported:

- ECC
- Full Mirror
- Address Range Mirror
- SDDC
- SDDC+1
- Rank Sparing Mode
- Static Virtual Lockstep
- Failed DIMM Isolation
- Memory Thermal Throttling
- Memory Address Parity Protection
- Memory Demand/Patrol Scrubbing
- Device Tagging
- Data Scrambling
- ADDDC
- ADDDC+1

5.4.7 Memory Liquid Cooling

The memory is liquid-cooled and dissipated through the contact of the double-coated thermal pad with the cold plate, and the cold plate does not need to be removed when the memory is inserted or removed.

Figure 5-11 Memory appearance

5.5 Storage

5.5.1 Drive Configurations

Table 5-6 Drive configurations

Configuration	Maximum Number of Front Drives	Drive Management Mode
Front drives	4 SAS/SATA drives are supported.	RAID controller card[1]
• [1]: Each RAID controller card manages two drives. • For details about component options, consult the local sales representatives.		

5.5.2 Drive Slot Number

Figure 5-12 Drive slot number
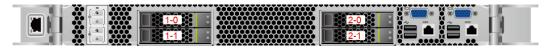
Table 5-7 Drive slot number

Physical Number	iBMC Screen Display	BIOS Screen Display
1-0	0	4
1-1	1	5
2-0	0	4
2-1	1	5

5.5.3 Drive Indicators

SAS/SATA Drive Indicators

Figure 5-13 SAS/SATA drive indicators

Hard drive fault indicator

Hard drive active indicator
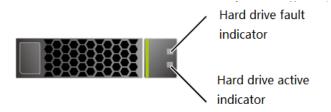
Table 5-8 SAS/SATA drive indicators descriptions

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

Activity Indicator (Green)	Fault Indicator (Yellow)	Description
Steady on	Steady on	The hard drive in the RAID array is faulty.

5.6 Network

5.6.1 LOMs

The Lans on Motherboard (LOMs) support network expansion capabilities.

Table 5-9 LOMs supported by DH141C V5

LOM Model	Chip Model	Network Port Type	Network Port Quantity	Rate Negotiation Mode	Supported Rate	Rate Not Supported
LOM	X722	10GE optical port	4	Auto-negotiation 10000 Mbit/s (full duplex)	10,000 Mbit/s	10/100/1000 Mbit/s

- For details about the cables and optical modules supported by the LOMs, contact technical support.
- The LOM ports do not support forced rates.
- Forcibly powering off a server will disable the wake on LAN (WOL) function of the LOM ports.

5.7 I/O Expansion

5.7.1 PCIe Card

PCIe card provides system ports expansion function.

For details about component options, consult the local sales representatives.

5.7.2 PCIe Slots

The PCIe slots provided by the PCIe Riser module is shown as Figure 5-14

Figure 5-14 PCIe riser module

5.7.3 PCIe Slot Description

DH141C V5 contains two nodes. Each mainboard supports one RAID controller card and one standard PCIe card.

Table 5-10 PCIe slot description

PCIe Slots	CPU	PCIe Standard	Connector Width	Bus Width	Port Number	B/D/F	Device Size
RAID controller card	CPU1	PCIe 3.0	x8	x8	Port1C	1c/00/0	-
LOM	CPU1	PCIe 3.0	-	x8	Port1A	17/00/0	-
Slot2	CPU1	PCIe 3.0	x16	x16	Port2A	3a/00/0	Half-height half-length
• The B/D/F (Bus/Device/Function Number) is the default value when the server is fully							

PCIe Slots	CPU	PCIe Standard	Connector Width	Bus Width	Port Number	B/D/F	Device Size
configured with PCIe components. The value may differ if the server is not fully configured with PCIe cards or if a PCIe card with a PCI bridge is configured.							
• The PCIe x16 slots are compatible with PCIe x16, PCIe x8, PCIe x4, and PCIe x1 cards. The PCIe cards are not forward compatible, which means the bandwidth of PCIe slots cannot be less than that of PCIe cards.							
• Power supply capability of any slot can support PCIe card. The power of PCIe card varies according to the model type of PCIe card.							
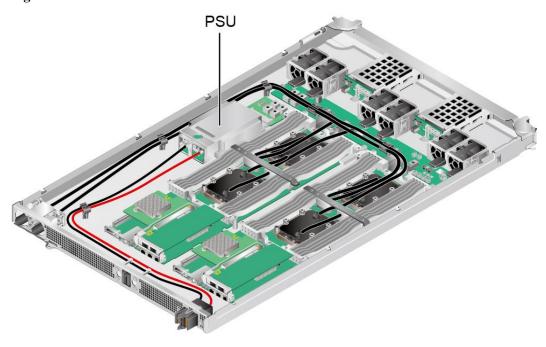
5.8 PSUs

1600 W rated power, with a 48 V to 12 V voltage transformer to meet the power supply requirement of dual nodes.

Figure 5-15 Positions of the PSUs

5.9 Fan Modules
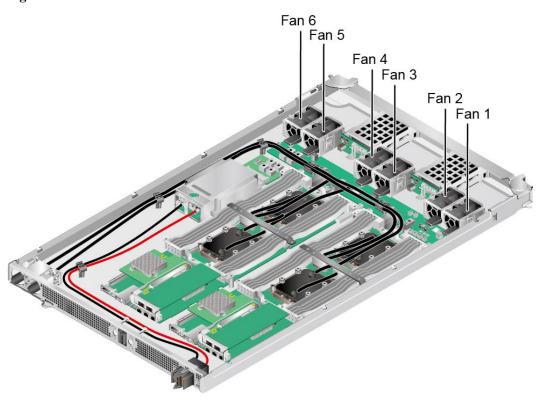
- DH141C V5 supports six fan modules.
- Supports single faulty fan.

> **NOTICE**
>
> The temperature is 5°C (9°F) lower than the rated value when a single fan is faulty.

- The fan speed can be adjusted.
- Fan modules configured in a server node must have the same part number.

Figure 5-16 Positions of fan modules
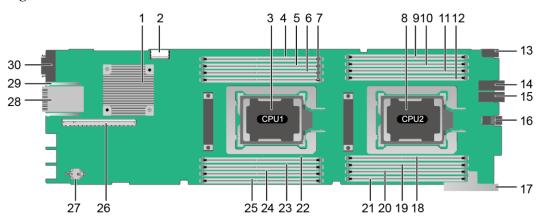
5.10 Board

5.10.1 Mainboard

DH141C V5 contains two completely the same mainboards.

Figure 5-17 Mainboard
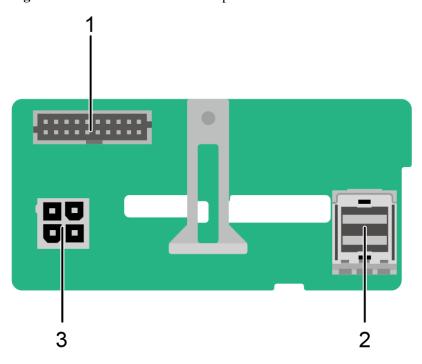
1	South bridge	2	RAID controller card connector
3	CPU1	4	DIMM050 connector
5	DIMM040 connector	6	DIMM030 connector
7	DIMM031 connector	8	CPU2
9	DIMM150 connector	10	DIMM140 connector
11	DIMM130 connector	12	DIMM131 connector
13	Left guide sleeve	14	Power connector
15	Power connector	16	Signal connector
17	Right guide sleeve	18	DIMM101 connector
19	DIMM100 connector	20	DIMM110 connector
21	DIMM120 connector	22	DIMM001 connector
23	DIMM000 connector	24	DIMM010 connector
25	DIMM020 connector	26	PCIe Riser slots
27	Battery	28	Two 10GE optical ports
29	Optical port indicator	30	High-density connector

5.10.2 Drive Backplane

Front-drive backplane

Figure 5-18 2 × SAS/SATA drive backplane

1	Drive backplane signal connector (HDD BP/J21)	2	Mini-SAS HD connector (PORT A/J3)
3	Power connector (HDD PWR/J2)	-	-

6 Specifications

6.1 Technical Specifications

Table 6-1 Technical specifications

Component	Specifications
Form factor	1 U dual-node liquid-cooled server
Chip set	Intel® C622
Processors	DH141C V5 contains two nodes, and one node supports one mainboard.Each mainboard supports two processors. • Intel® Xeon® Scalable Skylake and Cascade Lake processors are supported. • Each processor integrates a memory controller, supporting six memory channels. • Each processor integrates a built-in PCIe controller, supporting PCIe 3.0 and 48 lanes per processor. • The processors are interconnected through two UltraPath Interconnect (UPI) buses at 10.4 GT/s. • Each processor supports up to 28 cores. • Each processor provides up to 3.8 GHz frequency. • Minimum L3 cache per core is 1.375 MB. • Maximum thermal design power is 205 W. • Liquid cooling heat dissipation is supported.
Memory	Each mainboard provides 16 memory slots, and DH141C V5 can house up to 32 DDR4 memory modules in total. • Maximum memory speed is 2933 MT/s.

Component	Specifications
	• The memory module type can be either RDIMM or LRDIMM. • The DDR4 memory modules of different types (RDIMM or LRDIMM) and specifications (capacity, bit width, rank, and height) cannot be used together. • Liquid cooling heat dissipation is supported.
Storage	DH141C V5 contains two nodes, and one node supports one mainboard. Each mainboard supports 2 x SAS/SATA drives. • For details, see 5.5.1 Drive Configurations . • The drives are hot-swappable. RAID controller card • For details about the supported types of RAID controller cards, contact technical support. • Functions are available such as RAID state migration, disk roaming, self-diagnosis and web-based configuration. For details, see *V5 Server RAID Controller Card User Guide*.
Network	DH141C V5 supports LOMs. • The mainboard integrates two 10 GE optical ports. • The LOM supports WOL and PXE functions.
I/O Expansion	DH141C V5 contains two nodes, and one node supports one mainboard.Each mainboard supports three PCIe 3.0 expansion slots. For details, see 5.7.2 PCIe Slots and 5.7.3 PCIe Slot Description .
Port	Ports on the front panel: • Two VGA ports • Four USB ports • One aggregated network port • Two serial ports
Graphics 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** • When the server OS is Windows Server 2019 or Windows Server 2019 Hyper-V, and the server is at the safe startup mode, SM750 video chip is not supported. • 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.
System management	• UEFI • iBMC • Integration with third-party management systems

Component	Specifications
Security feature	• Power-on password. • Administrator password. • Secure boot.

6.2 Environmental Specifications

Table 6-2 Environmental specifications

Item	Specifications

Temperature	• Operating temperature: 5°C to 45°C (41°F to 113°F)(ASHRAE Classes A1 to A4 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 temperature change rate: 20°C (36°F) per hour, 5°C (9°F) per 15 minutes
	NOTE
	  • The maximum operating temperature is 5°C (9°F) lower than the rated value when a single fan is faulty.
	  • Empty water inside the equipment for long-term storage.

The maximum air volume required for heat dissipation for a single node	75 CFM
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 humidity change rate: 20%/h
Altitude	≤ 3050 m • When the configuration complies with ASHRAE Class A1 and A2, and the operating altitude is above 900 m (2952.76 ft), the operating temperature decreases by 1°C (1.8°F) for every increase of 300 m (984.25 ft). • When the server configuration complies with ASHRAE Class A3 standards and the altitude is above 900 m (2,952.76 ft.), the operating temperature decreases by 1°C (1.8°F) for every increase of 175 m (574.15 ft).

Item	Specifications
	• When the configuration complies with ASHRAE Class A4 standards and the altitude is above 900 m (2,952.76 ft.), the operating temperature decreases by 1°C (1.8°F) for every increase of 125 m (410.10 ft.).
Corrosive airborne contaminant	Maximum growth rate of the corrosion product thickness: • 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	• 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 pollutants in the equipment room be monitored by a professional organization.

6.3 Physical Specifications

Table 6-3 Physical specifications

Item	Description
Dimensions (H x W x D)	43 mm x 537 mm x 900 mm (1.69 in. x 21.14 in. x 35.43 in.)
Full configuration weight	• Net weight: 28 Kg (61.72 lb) • Packaging material weight: 3.6 kg (7.93 Ib)
Energy consumption	The power consumption parameters vary with server configurations, including the configurations complying with energy-related products (ErP) requirements.

7 Software and Hardware Compatibility

For details about the OS and hardware, contact the local sales representatives.

> **NOTICE**
>
> If incompatible components are used, the device may be abnormal. Such a fault is beyond the scope of technical support and warranty.

8 Safety Instructions

8.1 Security

General Statement

- Comply with local laws and regulations when installing equipment. 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 device labels.
- Operators of special types of work (such as electricians, operators of electric forklifts, and so on.) must be certified or authorized by the local government or authority.
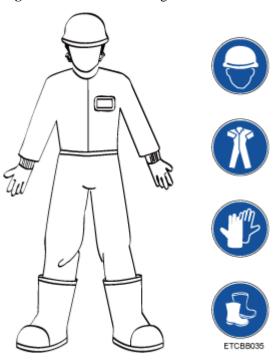
> ⚠ WARNING
>
> If this device works in a residential environment, the wireless interference may be generated.

Personal Safety

- Only certified or authorized personnel are allowed to install equipment.
- 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 cabinets and power cables in hazardous weather conditions.
- For lifting or carrying hardware, ensure load limits and manpower provisions conform to legal specifications. 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 Protective clothing

- 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.
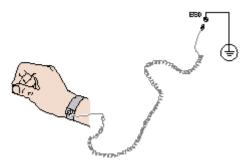
Figure 8-2 Removing conductive objects

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

a. Secure the ESD wrist strap around your wrist.

b. Fasten 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 cabinet or chassis.

Figure 8-3 Wearing an ESD wrist strap

- Exercise caution when using tools that could cause personal injury.
- If the installation position of a device is higher than the shoulders of the installation personnel, use a vehicle such as a lift to facilitate installation. Prevent the device from falling down and causing personal injury or damage to the device.
- 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, high voltage leakage current may cause personal injury.
- When a ladder is used, ensure that another person holds the ladder steady to prevent accidents.
- Do not look into optical ports without eye protection when installing, testing, or replacing optical cables.

Equipment Safety

- Use the recommended power cables at all times.
- Power cables are used 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 to prevent damage to the device when using tools during installation or maintenance.
- Connect the primary and secondary power cables to different power distribution units (PDUs) to ensure reliable system operation.
- Ground a device before powering it on. Otherwise, high voltage leakage current may cause device damage.

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 equipment being

transported is always kept upright. Take necessary precautions to prevent collisions, corrosion, damp, pollution, or package damage.

- Transport each device 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 cards and optical modules) separately.

📖 **NOTE**

For details about the components supported by the server, contact the local sales representatives.

- Ensure that all devices are powered off before transportation.

Maximum Weight Carried by a Person

⚠️ CAUTION

The maximum weight allowed to be carried by a single person is subject to local laws or regulations. The markings on the device and the descriptions in the documentation are for reference only.

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
General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ)	• Male: 15/33.08 • Female: 10/22.05

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

8.2 Maintenance and Warranty

For details about maintenance, see xFusion Super-Care Services.

For details about warranty, see xFusion Warranty Policy.

9 System Management

The product integrates the latest iBMC intelligent management system (iBMC), which is a remote server management system. It has hardware monitor and management function with high reliability.

The main features of iBMC are as follows:

- Multiple management interfaces for system integration

  The iBMC provides the following standard interfaces to meet various system integration requirements:

  – Data Center Manageability Interface (DCMI) V1.5

  – Intelligent Platform Management Interface (IPMI) V1.5/V2.0

  – Command-line interface (CLI)

  – Redfish interface

  – Hypertext Transfer Protocol Secure (HTTPS) interface

  – Simple Network Management Protocol (SNMP) interface

- Fault monitoring and diagnosis

  The iBMC detects hidden risks and ensures stable, uninterrupted 24/7 system operation by providing the following features:

  – System breakdown screenshots and video playback: helping identify the cause of system breakdown

  – Screen snapshots and videos: simplifying routine preventive maintenance, recording, and auditing

  – Fault diagnosis & management (FDM): providing precise fault diagnosis based on components, facilitating positioning and replacement of faulty parts

  – Report of alarms by syslog, trap, and email: facilitating report of server alarms to the upper-layer network management system (NMS) and helping users learn about server alarms in a timely manner

- Security management

  – The iBMC uses image mirroring to improve system security. Even if the running software breaks down, the system can start from the backup image.

  – Diversified user security control interfaces ensure login security.

  – The iBMC supports import and replacement of multiple types of certificates to ensure data transmission security.

- System maintenance interfaces

- The iBMC supports keyboard, video, and mouse (KVM) and virtual media to facilitate remote maintenance.
- Smart Provisioning implements DVD-free OS installation, RAID configuration, and upgrades, simplifying server installation and configuration.

- Diversified network protocols
  - The iBMC supports the Network Time Protocol (NTP) to facilitate time settings and ensure time synchronization.
  - The iBMC supports domain management and directory services to simplify network management.

- Intelligent power supply management
  - Power capping helps improve deployment density.
  - Dynamic energy saving helps reduce the operating expense (OPEX).

- License management

  License management allows advanced features to be used by authorized users.

  The advanced edition of the iBMC provides the following features:
  - Deploy OS through the Redfish interface.
  - Collect the original data of intelligent diagnostics through the Redfish interface.

For details about iBMC, see FusionPoD Server Node iBMC User Guide.

A Appendix

A.1 Product SN

The serial number (SN) on the right of the server front panel uniquely identifies a device. The SN is required when you contact technical support.

Figure A-1 SN example

Table A-1 SN description

SN	Description
1	SN ID (two characters), which can only be 21.
2	Material identification code (eight digits), that is, processing code.
3	Vendor code (two digits), that is, the code of the processing place.
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.

SN	Description
	– Letters A to C indicate October to December, respectively.
5	Sequence number (six characters).
6	RoHS compliance (one character). Y indicates environmental-friendly processing.
7	Internal model, that is, product name.

A.2 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 RAS features configuration, see *FusionPoD Server Node BIOS Parameter Reference (V5)* or *FusionPoD Server Node BIOS Parameter Reference (V6)*

Table A-2 Supported RAS features

Module Name	Feature	Description
CPU	Corrected machine check interrupt (CMCI)	This feature corrects error-triggered interrupts.
Memory	Failed DIMM isolation	This feature identifies the faulty DIMM, which helps isolate the faulty DIMM from others and replace it.
	Memory thermal throttling	This feature automatically adjusts DIMM temperatures to avoid DIMM damage due to overheat.
	Rank sparing	This feature uses some memory ranks as backup ranks to prevent the system from crashing due to uncorrectable errors.
	Memory address parity protection	This feature detects memory command and address errors.
	Memory demand and patrol scrubbing	This feature provides the memory patrol function for promptly correcting correctable errors upon detection. If these errors are not corrected promptly, uncorrectable errors may occur.
	Memory mirroring	This feature improves system reliability.
	Single device data correction (SDDC)	This feature provides a single-device, multi-bit error correction capability to improve memory reliability.
	Device tagging	This feature degrades and rectifies DIMM device faults to improve DIMM availability.

Module Name	Feature	Description
	Data scrambling	This feature optimizes data stream distribution and reduces the error possibility to improve the reliability of data streams in the memory and the capability to detect address errors.
PCIe	PCIe advanced error reporting	This feature reports PCIe advanced errors and improves server serviceability.
UPI	Intel UPI link level retry	This feature provides a retry mechanism upon errors to improve UPI reliability.
	Intel UPI protocol protection via CRC	This feature provides cyclic redundancy check (CRC) protection for UPI packets to improve system reliability.
System	Core disable for fault resilient boot (FRB)	This feature isolates the faulty CPU during startup to improve system reliability and availability.
	Corrupt data containment mode	This feature identifies the memory storage unit that contains corrupted data to minimize the impact on the running programs and improve system reliability.
	Socket disable for FRB (fault resilient boot)	This feature isolates the faulty socket during startup to improve system reliability.
	Architected error records	With the eMCA feature, the BIOS collects error information recorded in hardware registers in compliance with UEFI specifications, sends the error information to the OS over the APEI of the Advanced Configuration and Power Interface (ACPI), and locates the error unit, improving system availability.
	Error injection support	This feature injects errors to verify various RAS features.
	Machine check architecture (MCA)	This feature provides software recovery for uncorrectable errors, which improves system availability.
	Enhanced MCA (eMCA): Gen2	This feature improves system availability.
	OOB access to MCA registers	The out-of-band system accesses MCA registers by using the Platform Environment Control Interface (PECI). If a fatal error occurs in the system, the out-of-band system collects onsite data to facilitate fault analysis and locating and improve system serviceability.

Module Name	Feature	Description
	BIOS abstraction layer for error handling	The basic input/output system (BIOS) processes errors and reports the error information to the OS and iBMC in compliance with specifications to improve system serviceability.
	BIOS-based predictive failure analysis (PFA)	The BIOS provides physical unit information for DIMM errors, and the OS traces and predicts errors, and isolates error memory pages.

B Term

B.1 A-E

B

BMC	It collects, processes, and stores sensor signals, and monitors the operating status of components. The BMC provides the hardware status and alarm information about the managed objects to the management system so that the management system can implement unified management of the devices.
Busbar	A electrical conductor which can serve as the connection between various circuits.

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 10 Mbit/s and 100 Mbit/s Ethernet and complies with IEEE 802.3z standards.

H

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

B.3 K-O

K

KVM	A hardware device that provides public video, keyboard 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. PCIe is based on the existing PCI system. Therefore, the existing PCI system can be converted into PCIe only by modifying the physical layer without modifying the software. PCIe has a faster rate. It can replace almost all existing internal buses (including AGP and PCI).

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

Serial advanced technology	SATA is the serial structure evolved from parallel bus of ATA.

attachment (SATA)	
Server	A special computer that provides services for clients over a network.
System event log (SEL)	System event log. A non-volatile storage area and associated interfaces for storing system events for later retrieval.

T

Trusted cryptography module (TCM)	Mirco controller of storing keys, passwords and digital certificates. It can ensure the security of data stored in computer to prevent attack from external software or entity theft.
Trusted platform module (TPM)	Root of trust provided by the computer platform is a safe micro processor featuring password function.

B.5 U-Z

U

U	A unit defined in International Electrotechnical Commission (IEC) 60297-1 to measure the height of a cabinet, chassis, or subrack. 1 U = 44.45 mm = 1.75 in.
UltraPath Interconnect (UPI)	A point-to-point processor interconnect developed by Intel.

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
BMC	Baseboard Management Controller

C

CD	Calendar Day
CE	Conformite Europeenne
CIM	Common Information Model
CLI	Command-Line Interface

D

DC	Direct Current

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
DTS	Digital Thermal Sensor
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

FCC	Federal Communications Commission
FTP	File Transfer Protocol

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

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

O

OS	Operating System

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
PXE	Preboot Execution Environment

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 Extension

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	Trans Flash module
TFTP	Trivial File Transfer Protocol
TOE	TCP Offload Engine
TPM	Trusted Platform Module

C.5 U-Z

U

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

W

WEEE	Waste Electrical and Electronic Equipment
WSMAN	Web Service Management