

Oracle 6.8TB NVMe SSD and 3.84TB NVMe SSD (Release 2.0) User Guide



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Using This Documentation

- **Overview** – Provides late-breaking information and specifications about Oracle 6.8TB and 3.84TB (v2) NVMe SSDs
- **Audience** – System administrators, network administrators, and service technicians
- **Required knowledge** – Advanced understanding of server systems

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- [Feedback](#)
- [Product Documentation Library](#)
- [Oracle NVMe SSD Product Accessibility](#)

Feedback

Provide feedback about this documentation at: <https://www.oracle.com/goto/docfeedback>

Product Documentation Library

Documentation and resources for this product and related products are available at [Oracle Help Center](#).

Oracle NVMe SSD Product Accessibility

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For more information about Oracle's commitment to accessibility, go to <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

- [Documentation Accessibility](#)
- [Diversity and Inclusion](#)

Documentation Accessibility

Documentation for Oracle hardware is provided in HTML and PDF formats. The HTML documents are accessible using standard operating system controls and assistive technology. PDF documents are also provided, but are not an accessible format. PDF documents are considered support documents because the PDF content is available in accessible HTML format.

Product documentation provides figures, other types of images, and screenshots that do not rely on color for interpretation. Within the figures, callouts indicate the referenced component information. The callouts are mapped within a table to provide text descriptions of the referenced parts of the figures. In addition, alternative text is provided for all tables and images that provides the context of the information and images.

Note that screen readers might not always correctly read the code examples in the documentation. The conventions for writing code require that closing braces should appear on an otherwise empty line. However, some screen readers might not always read a line of text that consists solely of a bracket or brace.

The documentation might contain links to web sites of other companies and organizations that Oracle does not own or control. Oracle neither evaluates nor makes any representations regarding the accessibility of these web sites.

You can access the accessible HTML documentation for Oracle NVMe SSD products at [Oracle Help Center](#).

Diversity and Inclusion

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers and partners we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

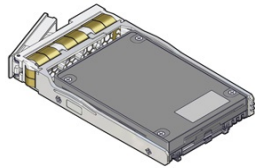
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Oracle 3.84 TB NVMe SSD v2 Product Information

This section contains late-breaking information about Oracle 3.84 TB NVMe SSD (solid state device) v2. Read this section before reading other Oracle 3.84 TB NVMe SSD documentation. Always refer to the latest version of the product information.

Review the software and firmware supported for Oracle 3.84 TB NVMe SSD v2s in the following sections. Review important information for configuring Oracle 3.84 TB NVMe SSD v2s. Check known issues and specifications.

For specific installation instructions, late-breaking information about the installation and use of Oracle 3.84 TB NVMe SSD with your server, supported firmware and operating systems, important operating notes, and known issues, refer to the latest platform product notes document. For detailed information about using this storage drive with your server, see the product notes for your server, available at [Oracle Help Center](#).



For detailed instructions on how to install Oracle 3.84 TB, 2.5-inch, NVMe Solid State Drive, refer to your server service documentation or drive enclosure documentation at [Oracle Help Center](#).

The Drive Bracket Assembly consists of the solid state drive assembled within the bracket assembly. The Drive Bracket Assembly should not be disassembled for any reason by the user.

Supported hardware and software topics are included in this section.

- [Supported Servers and Locations](#)
- [Minimum Supported 3.84 TB NVMe SSD Firmware Version](#)
- [Required Host Firmware](#)
- [Implementation Considerations](#)
- [Oracle 3.84 TB NVMe Solid State Drive v2 Specification](#)

Supported Servers and Locations

This section lists the servers that support Oracle 3.84 TB NVMe SSD v2s. For detailed information about using this card with your server, see the product notes for your server, available at [Oracle Help Center](#).

The following servers are supported for Oracle 3.84 TB NVMe SSD v2s.

x86 Servers	Number of NVMe SSDs	Slots Supported for Installing NVMe SSDs
Oracle Server X9-2	4 drive: 1 to 4	4 drive: 0-3 slots labeled NVMe0, NVMe1, NVMe2, NVMe3
Oracle Server X9-2L	4 drive: 1 to 4 8 drive: 1 to 8 12 drive: 1 to 12 1 CPU: Up to four 3.5-inch hot-pluggable PCIe Gen4 NVM-Express (NVMe) SSDs 2 CPU: Up to twelve 3.5-inch hot-pluggable SAS-3 HDDs, or up to twelve 2.5-inch hot-pluggable PCIe Gen4 NVM-Express (NVMe) SSDs	4 drive: Single CPU X9-2L supports up to 4 NVMe SSDs (Slots 0, 1, 5 and 5). Oracle PCIe Re-timer (Switch) Card is not required in a four NVMe drive configuration. 0-4 slots labeled NVMe0-NVMe4: NVMe0, NVMe1, NVMe2, NVMe3 8 drive: Dual CPU X9-2L configuration support up to 8 NVMe SSDs without Oracle PCIe Re-timer Card (Slots 0, 1, 2, 3, 4, 5, 6, and 7). 0-7 slots labeled NVMe0-NVMe11: NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7 12 drive: Dual CPU X9-2L configuration support up to 12 NVMe SSDs with Oracle PCIe Re-timer Cards (Slots 0-11). 0-11 slots labeled NVMe0-NVMe11: NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7, NVMe8, NVMe9, NVMe10, NVMe11
Oracle Server X8-8	1 to 4 in 4-CPU System 1 to 8 in 8-CPU System	4-CPU System System A: Slots 8,6,4,2 4-CPU System System B: Slots 16,14,12,10 8-CPU System Slots 16,8,14,6,12,4,10,2

SPARC Servers	Number of NVMe SSDs	Slots Supported for Installing NVMe SSDs
SPARC S7-2 Server	1 to 4	4 drive: 2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC S7-2L Server	8 drive: 1 to 4 12 drive: 1 to 12 SPARC S7-2L with 3.5-inch 12 drive configuration does not support Oracle 6.8 TB NVMe SSD operation. 24 drive: 1 to 4	8 drive: 2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3 12 drive: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7, NVMe8, NVMe9, NVMe10, NVMe11 24 drive: 3, 4, 19, 20. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC T8-1 Server	1 to 4	2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC T8-2 Server	1 to 4	2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC T8-4 Server	1 to 8 2 Oracle PCIe Switch Cards	0, 1, 2, 3, 4, 5, 6, 7. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7

Other servers and processors might be added to this list in the future, if they qualify. Check your server product notes for confirmation that your server has subsequently been qualified for device support.

Caution:

Any unsupported configuration causes the host to power off as soon as it is powered on. A fault is generated on the service processor when an unsupported configuration is detected. The fault clears after the unsupported configuration is fixed and the host is powered on.



Note:

Refer to your server product notes for up-to date information on supported servers, operating systems, and required patchsets.

Minimum Supported 3.84 TB NVMe SSD Firmware Version

Oracle 3.84 TB NVMe SSD v2s run with the minimum required firmware package listed in the following table.

Firmware	Minimum Required Drive Firmware Version	Recommended Drive Firmware Version
Oracle Solidigm-Aura10 SFF 3.84TB Location: Firmware/SSDPF2KX038T1S	9CV1R410	9CV1R410 Patch 36717444: SW 1.0.0 - FIRMWARE PACK

If you install Oracle 3.84 TB NVMe SSD v2s as an option, you must update firmware to version 9CV1R410, or a subsequent firmware release if available.



Note:

For best practice, install the latest device firmware versions.

Required Host Firmware



Note:

Refer to [Firmware Downloads and Release History for Oracle Systems \(https://www.oracle.com/servers/technologies/firmware/release-history-jsp.html\)](https://www.oracle.com/servers/technologies/firmware/release-history-jsp.html)

Oracle 3.84 TB NVMe SSD v2s run with the minimum required host firmware listed in the following table.

x86 Driver	Minimum Required Host Firmware Version (Patch No.)	Recommended System Firmware Version (Patch No.)
Oracle Server X9-2	Patch 36010992: Oracle Server X9-2 SW 3.6.0 - FIRMWARE PACK	Patch 36279164: Oracle Server X9-2 SW 3.6.0.1 - FIRMWARE PACK or later
Oracle Server X9-2L	Patch 36011008: Oracle Server X9-2L SW 3.6.0 - FIRMWARE PACK	Patch 36279180: Oracle Server X9-2L SW 3.6.0.1 - FIRMWARE PACK or later
Oracle Server X8-8	Patch 36047385: Oracle Server X8-8 SW 3.6.0 - FIRMWARE PACK	Patch 36707018: Oracle Server X8-8 SW 3.7.0 - FIRMWARE PACK or later

SPARC Driver	Minimum Required System Firmware Version (Patch No.)	Recommended System Firmware Version (Patch No.)
SPARC S7-2 Server	Patch 35949310: FIRMWARE: SPARC S7-2 SUN SYSTEM FIRMWARE 9.10.7	Patch 36549129: FIRMWARE: SPARC S7-2 SUN SYSTEM FIRMWARE 9.10.8.a or later
SPARC S7-2L Server	Patch 35949311: FIRMWARE: SPARC S7-2L SUN SYSTEM FIRMWARE 9.10.7	Patch 36549124: FIRMWARE: SPARC S7-2L SUN SYSTEM FIRMWARE 9.10.8.a or later
SPARC T8-1 Server	Patch 35949304: FIRMWARE: SPARC T8-1 SUN SYSTEM FIRMWARE 9.10.7	Patch 36549209: FIRMWARE: SPARC T8-1 SUN SYSTEM FIRMWARE 9.10.8.a or later
SPARC T8-2 Server	Patch 35949305: FIRMWARE: SPARC T8-2 SUN SYSTEM FIRMWARE 9.10.7	Patch 36549120: FIRMWARE: SPARC T8-2 SUN SYSTEM FIRMWARE 9.10.8.a or later
SPARC T8-4 Server	Patch 35949306: FIRMWARE: SPARC T8-4 SUN SYSTEM FIRMWARE 9.10.7	Patch 36549121: FIRMWARE: SPARC T8-4 SUN SYSTEM FIRMWARE 9.10.8.a or later

Implementation Considerations

The following sections provide important information about configuring Oracle 3.84 TB NVMe SSD v2 in supported servers.

- [SSD Volume Management](#)

SSD Volume Management

A volume manager can present multiple SSD devices as one larger volume. Use the Automatic Storage Management (ASM) volume manager or other volume manager to concatenate multiple flash memory domains. For example, a volume manager can be used to concatenate four 3.84 TB domains into a single 15.36 TB volume.

Refer to the Automatic Storage Management documentation at <https://docs.oracle.com/en/database/oracle/oracle-database/19/ostmg/index.html>.

Oracle 3.84 TB NVMe Solid State Drive v2 Specification

This section provides the specification for Oracle 3.84 TB NVMe SSD v2s.

- [Oracle 3.84 TB v2, 2.5-inch, NVMe PCIe 4.0 Solid State Drive 8210609 Specification](#)

Oracle 3.84 TB v2, 2.5-inch, NVMe PCIe 4.0 Solid State Drive 8210609 Specification

NVMe Storage Drive **8210609** specifications are listed in the following table.

Table 2-1 3.84 TB 2.5-inch NVMe PCIe 4.0 SSD v2

Specification	Value
Device name	<ul style="list-style-type: none"> • Product Identifier: SSDPF2KX038T1S • Oracle Part Number: 8210609 • Device Identification: <ul style="list-style-type: none"> – PCIe Vendor ID: 0x8086 – PCIe Device ID: 0x0B60 – Subsystem PCIe Vendor ID: 0x108E – Subsystem ID 0x488E
Marketing Part Number	7605207: 3.84 TB 2.5-inch NVMe PCIe 4.0 SSD v2 mix use with 2.5-inch bracket
Manufacturing name	3.84TB Intel D7-P5520, 3D NAND TLC SFF 2.5-inch Solid State Drive
Form factors	<ul style="list-style-type: none"> • 2.5-inch SFF (small form factor): U.2 • SFF-8639 compatible connector
PCIe interface	PCIe Gen4 Interface, x4 lanes
Features	<ul style="list-style-type: none"> • NVMe PCIe Gen4 Interface • NVMe-MI rev 1.1 (MCTP) • VPD per NVMe-MI Ver 1.1 specification • Opal 2.0
Product Compliance	<ul style="list-style-type: none"> • NVM Express Specification Rev. 1.4 • PCI Express Base Specification Rev. 4.0 • Enterprise SSD Form Factor Version 1.0a • NVMe-MI Rev 1.1
Product ecological compliance	RoHS
Certifications and declarations	cUL-us, CE, TUV-GS, CB, CE, BSMI, KCC, Morocco, VCCI, RCM, FCC, IC

Table 2-2 Drive Capacity and Performance

Attribute	Value
Capacity, formatted	Default Formatted Capacity: 3,840,755,982,336 bytes Sector Size (LBA size): 512 bytes per sector
Capacity, unformatted	Unformatted Capacity (Total User Addressable LBA): 7,501,476,528 (max 3.84 TB)
Capacity, raw NAND	4416 GiB
Random 4 KB Read	1 M IOPS Typical 4 KB Random Read QD=1, Worker=1: 75us
Random 4 KB Write	Random 4 KB Write 200K IOPS Typical 4 KB Random Write QD=1, Worker=1: 15us
Sequential Read	128 KB, QD 128, Worker=1: 6,700 MB/s
Sequential Write	128 KB, QD 128, Worker=1: 3,600 MB/s
Interface data transfer rate	<ul style="list-style-type: none"> • Interface Data Rate: PCIe Gen 4 • Data Transfer Rate 16 GT/sec • Interface drivers/receivers SFF: 1x4 lanes

Table 2-3 Drive Usage Information

Usage	Description
Operating temperature (Case)	0 to 70 degrees Celsius
Non-Operating temperature	-40 to 85 degrees Celsius
Maximum temperature (SMART trip)	Thermal Throttling at 70 degrees Celsius (SMART) when approaching maximum temperature. Thermal Shutdown at 80 degrees Celsius (SMART)
Error rates	Uncorrectable Bit Error Rate (UBER): 1 sector per 10 ¹⁷ bits read
Data retention	3 months powered off at 40 degrees Celsius at end of rated endurance
Endurance	<ul style="list-style-type: none"> • Drive Writes Per Day (DWPD) for 5 years: 1 • PBW (at 4KB Random Write) 13.7 PB Refer to the JEDEC JESD218A standard for SSD device life and endurance measurement techniques.

Table 2-4 Drive Reliability

Attribute	Value
Component Design Life (Useful life)	5 years
MTBF	2,000,000 hours
Expected AFR (Annualized Failure Rate)	0.44% for normal 24x7 operating conditions

Table 2-5 Drive Electrical Specifications

Attribute	Value
Power On to Ready (no rebuild)	RTD3R: 4 seconds
Power On to Ready (full rebuild)	19 seconds
Supply Voltage / Tolerance	12 V +10%/-20% 3.3 Vaux +/-15%
Inrush Current	12 V, 1.5 A
Power Consumption	<ul style="list-style-type: none"> • Active Read: 15 W • Active Write: 15 W • Idle < 5 W • Max Burst: 20 W

Table 2-6 Drive Physical Characteristics

Height	Width	Depth	Weight
15.0 mm +/-0.5 mm	69.85 +/-0.25 mm	100.45 mm Max	165 +/- 5 g

Table 2-7 NVMe Solid State Drive Characteristics

Attribute	Value
Minimum operating system versions	Refer to the server product notes for minimum operating system versions, hardware, firmware, and software compatibility.
Life monitoring capability	<p>Provides alerts for proactive replacement of the drive before the endurance is depleted. Provides endurance remaining in NVMe SMART logs. SSD supports the standard method defined by NVMe for Solid State Drive to report NAND wear through the "Get Log" command SMART/Health Information Percentage Used field. The units are whole percentage of wear.</p> <p>Percentage Used: Contains a vendor specific estimate of the percentage of NVM subsystem life used based on the actual usage and the manufacturer's prediction of NVM life. A value of 100 indicates that the estimated endurance of the NVM in the NVM subsystem has been consumed, but may not indicate an NVM subsystem failure. The value is allowed to exceed 100. Percentages greater than 254 are represented as 255. This value is updated once per power-on hour (when the controller is not in a sleep state).</p> <p>Refer to the JEDEC JESD218A standard for SSD device life and endurance measurement techniques.</p>
End-to-End data-path protection	T10 DIF Type 0, Type 1, Type 2, Type 3, no performance impact. T10 DIF (data integrity field) end-to-end data protection includes multiple levels of data-path protection.
Enhanced power-loss data protection	Energy storage components complete buffered writes to the persistent flash storage in case of a sudden power loss.
Power loss protection capacitor self-test	Supports testing of the power loss capacitor. Power is monitored using SMART (Self-Monitoring, Analysis, and Reporting Technology) attribute critical warning.
Out-of-Band Management (SMBUS)	Managed through the SMBUS. Provides out-of-band management by means of SMBUS interface. This requires 3.3V auxiliary voltage. SMBUS access includes NVMe-MI, the VPD page and temperature sensor.
Hot-Plug Support	Supports PCIe presence detect and link-up detect. Device advanced power loss protection provides robust data integrity. During IOs, the storage drive integrated monitoring enables the integrity of already committed data on the media and commits acknowledged writes to the media.
Management utilities	For more information about management utilities, refer to the server documentation.

Table 2-8 LED Status Indicator Characteristics

LED	Color	Normal operation	Status
(1) Ready to Remove	Blue	OFF – The drive has not been prepared for removal. Normal operation.	STEADY ON – The drive is in standby power state. The drive can be removed safely during a hot-plug operation. A lit Ready to Remove indicator indicates that service action is allowed on the drive.

Table 2-8 (Cont.) LED Status Indicator Characteristics

LED	Color	Normal operation	Status
(2) Service Action Required	Amber	OFF – Normal operation.	<p>STEADY ON – Service action is required. The system has detected a fault with the drive.</p> <p>BLINKING – Locator. Status indicator blinks on and off to locate drive.</p>
(3) Power/OK/Activity	Green	STEADY ON (does not blink) – Drive is engaged and is receiving full power. Normal operation.	<p>RANDOM BLINKING – There is drive activity. Status indicator blinks on and off to indicate activity.</p> <p>OFF – Power is off, or installed drive is not recognized by the system.</p>

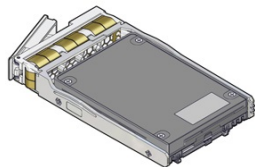
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Oracle 6.8 TB NVMe SSD Product Information

This section contains late-breaking information about Oracle 6.8 TB NVMe SSD (solid state devices). Read this section before reading other Oracle 6.8 TB NVMe SSD documentation. Always refer to the latest version of the product information.

Review the software and firmware supported for Oracle 6.8 TB NVMe SSDs in the following sections. Review important information for configuring Oracle 6.8 TB NVMe SSDs. Check known issues and specifications.

For specific installation instructions, late-breaking information about the installation and use of Oracle 6.8 TB NVMe SSD with your server, supported firmware and operating systems, important operating notes, and known issues, refer to the latest platform product notes document. For detailed information about using this storage drive with your server, see the product notes for your server, available at [Oracle Help Center](#).



For detailed instructions on how to install Oracle 6.8 Tbyte, 2.5-inch, NVMe Solid State Drive, refer to your server service documentation or drive enclosure documentation at [Oracle Help Center](#).

The Drive Bracket Assembly consists of the solid state drive assembled within the bracket assembly. The Drive Bracket Assembly should not be disassembled for any reason by the user.

Supported hardware and software topics are included in this section.

- [Supported Servers and Locations](#)
- [Minimum Supported 6.8 TB NVMe SSD Firmware Version](#)
- [Required Host Firmware](#)
- [Implementation Considerations](#)
- [Oracle 6.8 TB NVMe Solid State Drive Specification](#)

Supported Servers and Locations

This section lists the servers that support Oracle 6.8 TB NVMe SSDs. For detailed information about using this card with your server, see the product notes for your server, available at [Oracle Help Center](#).

The following servers are supported for Oracle 6.8 TB NVMe SSDs.

x86 Servers	Number of NVMe SSDs	Slots Supported for Installing NVMe SSDs
Oracle Server X9-2	4 drive: 1 to 4	4 drive: 0-3 slots labeled NVMe0, NVMe1, NVMe2, NVMe3
Oracle Server X9-2L	4 drive: 1 to 4 8 drive: 1 to 8 12 drive: 1 to 12 1 CPU: Up to four 3.5-inch hot-pluggable PCIe Gen4 NVM-Express (NVMe) SSDs 2 CPU: Up to twelve 3.5-inch hot-pluggable SAS-3 HDDs, or up to twelve 2.5-inch hot-pluggable PCIe Gen4 NVM-Express (NVMe) SSDs	4 drive: Single CPU X9-2L supports up to 4 NVMe SSDs (Slots 0, 1, 5 and 5). Oracle PCIe Re-timer (Switch) Card is not required in a four NVMe drive configuration. 0-4 slots labeled NVMe0-NVMe4: NVMe0, NVMe1, NVMe2, NVMe3 8 drive: Dual CPU X9-2L configuration support up to 8 NVMe SSDs without Oracle PCIe Re-timer Card (Slots 0, 1, 2, 3, 4, 5, 6, and 7). 0-7 slots labeled NVMe0-NVMe11: NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7 12 drive: Dual CPU X9-2L configuration support up to 12 NVMe SSDs with Oracle PCIe Re-timer Cards (Slots 0-11). 0-11 slots labeled NVMe0-NVMe11: NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7, NVMe8, NVMe9, NVMe10, NVMe11
Oracle Server X8-8	1 to 4 in 4-CPU System 1 to 8 in 8-CPU System	4-CPU System System A: Slots 8,6,4,2 4-CPU System System B: Slots 16,14,12,10 8-CPU System Slots 16,8,14,6,12,4,10,2

SPARC Servers	Number of NVMe SSDs	Slots Supported for Installing NVMe SSDs
SPARC S7-2 Server	1 to 4	4 drive: 2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC S7-2L Server	8 drive: 1 to 4 12 drive: 1 to 12 SPARC S7-2L with 3.5-inch 12 drive configuration does not support Oracle 6.8 TB NVMe SSD operation. 24 drive: 1 to 4	8 drive: 2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3 12 drive: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7, NVMe8, NVMe9, NVMe10, NVMe11 24 drive: 3, 4, 19, 20. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC T8-1 Server	1 to 4	2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC T8-2 Server	1 to 4	2, 3, 4, 5. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3
SPARC T8-4 Server	1 to 8 2 Oracle PCIe Switch Cards	0, 1, 2, 3, 4, 5, 6, 7. Slots labeled NVMe0, NVMe1, NVMe2, NVMe3 NVMe4, NVMe5, NVMe6, NVMe7

Other servers and processors might be added to this list in the future, if they qualify. Check your server product notes for confirmation that your server has subsequently been qualified for device support.

▲ Caution:

Any unsupported configuration causes the host to power off as soon as it is powered on. A fault is generated on the service processor when an unsupported configuration is detected. The fault clears after the unsupported configuration is fixed and the host is powered on.



Note:

Refer to your server product notes for up-to date information on supported servers, operating systems, and required patchsets.

Minimum Supported 6.8 TB NVMe SSD Firmware Version

Oracle 6.8 TB NVMe SSDs run with the minimum required firmware package listed in the following table.

Firmware	Minimum Required Drive Firmware Version	Recommended Drive Firmware Version
Oracle Solidigm-Aura10 SFF 6.8TB Location: Firmware/SSDPF2KX038T1S	9CV1R410	9CV1R410 Patch 36717444: SW 1.0.0 - FIRMWARE PACK

If you install Oracle 6.8 TB NVMe SSDs as an option, you must update firmware to version 9CV1R410, or a subsequent firmware release if available.



Note:

For best practice, install the latest device firmware versions.

Required Host Firmware



Note:

Refer to [Firmware Downloads and Release History for Oracle Systems \(https://www.oracle.com/servers/technologies/firmware/release-history-jsp.html\)](https://www.oracle.com/servers/technologies/firmware/release-history-jsp.html)

Oracle 6.8 TB NVMe SSDs run with the minimum required host firmware listed in the following table.

x86 Driver	Minimum Required Host Firmware Version (Patch No.)	Recommended System Firmware Version (Patch No.)
Oracle Server X9-2	Patch 36010992: Oracle Server X9-2 SW 3.6.0 - FIRMWARE PACK	Patch 36010992: Oracle Server X9-2 SW 3.6.0 - FIRMWARE PACK or later
Oracle Server X9-2L	Patch 36011008: Oracle Server X9-2L SW 3.6.0 - FIRMWARE PACK	Patch 36011008: Oracle Server X9-2L SW 3.6.0 - FIRMWARE PACK or later
Oracle Server X8-8	Patch 36047385: Oracle Server X8-8 SW 3.6.0 - FIRMWARE PACK	Patch 36047385: Oracle Server X8-8 SW 3.6.0 - FIRMWARE PACK or later

SPARC Driver	Minimum Required System Firmware Version (Patch No.)	Recommended System Firmware Version (Patch No.)
SPARC S7-2 Server	Patch 35949310: FIRMWARE: SPARC S7-2 SUN SYSTEM FIRMWARE 9.10.7	Patch 35949310: FIRMWARE: SPARC S7-2 SUN SYSTEM FIRMWARE 9.10.7 or later
SPARC S7-2L Server	Patch 35949311: FIRMWARE: SPARC S7-2L SUN SYSTEM FIRMWARE 9.10.7	Patch 35949311: FIRMWARE: SPARC S7-2L SUN SYSTEM FIRMWARE 9.10.7 or later
SPARC T8-1 Server	Patch 35949304: FIRMWARE: SPARC T8-1 SUN SYSTEM FIRMWARE 9.10.7	Patch 35949304: FIRMWARE: SPARC T8-1 SUN SYSTEM FIRMWARE 9.10.7 or later
SPARC T8-2 Server	Patch 35949305: FIRMWARE: SPARC T8-2 SUN SYSTEM FIRMWARE 9.10.7	Patch 35949305: FIRMWARE: SPARC T8-2 SUN SYSTEM FIRMWARE 9.10.7 or later
SPARC T8-4 Server	Patch 35949306: FIRMWARE: SPARC T8-4 SUN SYSTEM FIRMWARE 9.10.7	Patch 35949306: FIRMWARE: SPARC T8-4 SUN SYSTEM FIRMWARE 9.10.7 or later

Implementation Considerations

The following sections provide important information about configuring Oracle 6.8 TB NVMe SSDs in supported servers.

- [SSD Volume Management](#)

SSD Volume Management

A volume manager can present multiple SSD devices as one larger volume. Use the Automatic Storage Management (ASM) volume manager or other volume manager to concatenate multiple flash memory domains. For example, a volume manager can be used to concatenate four 6.8 TB domains into a single 27.2 TB volume.

Refer to the Automatic Storage Management documentation at <https://docs.oracle.com/en/database/oracle/oracle-database/19/ostmg/index.html>.

Oracle 6.8 TB NVMe Solid State Drive Specification

This section provides the specification for Oracle 6.8 Tbyte NVMe Solid State Drives.

- [Oracle 6.8 TB, 2.5-inch, NVMe Solid State Drive 8210610 Specification](#)

Oracle 6.8 TB, 2.5-inch, NVMe Solid State Drive 8210610 Specification

NVMe Storage Drive **8210610** specifications are listed in the following table.

Table 3-1 6.8 TB (max 15.36 TB) 2.5-inch NVMe PCIe 4.0 SSD v2

Specification	Value
Device name	<ul style="list-style-type: none"> • Product Identifier: SSDPF2KX076T1S • Oracle Part Number: 8210610 • Device Identification: <ul style="list-style-type: none"> – PCIe Vendor ID: 0x8086 – PCIe Device ID: 0x0B60 – Subsystem PCIe Vendor ID: 0x108e – Subsystem ID 0x488F

Table 3-1 (Cont.) 6.8 TB (max 15.36 TB) 2.5-inch NVMe PCIe 4.0 SSD v2

Specification	Value
Marketing Part Number	7605206: 6.8 TB (max 15.36 TB) 2.5-inch NVMe PCIe 4.0 SSD v2 mix use with 2.5-inch bracket
Manufacturing name	6.8TB Intel D7-P5520, 3D NAND TLC SFF 2.5-inch Solid State Drive
Form factors	<ul style="list-style-type: none"> 2.5-inch SFF (small form factor): U.2 SFF-8639 compatible connector
PCIe interface	PCIe Gen4 Interface, x4 lanes
Features	<ul style="list-style-type: none"> NVMe PCIe Gen4 Interface NVMe-MI rev 1.1 (MCTP) VPD per NVMe-MI Ver 1.0a specification Opal 2.0
Product Compliance	<ul style="list-style-type: none"> NVM Express Specification Rev. 1.4 PCI Express Base Specification Rev. 4.0 Enterprise SSD Form Factor Version 1.0a NVMe-MI Rev 1.1
Product ecological compliance	RoHS
Certifications and declarations	cUL-us, CE, TUV-GS, CB, CE, BSMI, KCC, Morocco, VCCI, RCM, FCC, IC

Table 3-2 Drive Capacity and Performance

Attribute	Value
Capacity, formatted	Default Formatted Capacity: 6,801,330,364,416 bytes Sector Size (LBA size): 512 bytes per sector
Capacity, unformatted	Unformatted Capacity (Total User Addressable LBA): 13283848368 (max 7.68 TB)
Capacity, raw NAND	8448 GiB
Random 4 KB Read	1 M IOPS Typical 4 KB Random Read QD=1, Worker=1: 75us
Random 4 KB Write	Random 4 KB Write 220K IOPS Typical 4 KB Random Write QD=1, Worker=1: 15us
Sequential Read	128 KB, QD 128, Worker=1: 7,100 MB/s
Sequential Write	128 KB, QD 128, Worker=1: 4,200 MB/s
Interface data transfer rate	<ul style="list-style-type: none"> Interface Data Rate: PCIe Gen 4 Data Transfer Rate 16 GT/sec Interface drivers/receivers SFF: 1x4 lanes

Table 3-3 Drive Usage Information

Usage	Description
Operating temperature (Case)	0 to 70 degrees Celsius

Table 3-3 (Cont.) Drive Usage Information

Usage	Description
Non-Operating temperature	-40 to 85 degrees Celsius
Maximum temperature (SMART trip)	Thermal Throttling at 70 degrees Celsius (SMART) when approaching maximum temperature. Thermal Shutdown at 80 degrees Celsius (SMART)
Error rates	Uncorrectable Bit Error Rate (UBER): 1 sector per 10 ¹⁷ bits read
Data retention	3 months powered off at 40 degrees Celsius at end of rated endurance
Endurance	<ul style="list-style-type: none"> • Drive Writes Per Day (DWPD) for 5 years: 1 • PBW (at 4KB Random Write) 34 PB Refer to the JEDEC JESD218A standard for SSD device life and endurance measurement techniques.

Table 3-4 Drive Reliability

Attribute	Value
Component Design Life (Useful life)	5 years
MTBF	2,000,000 hours
Expected AFR (Annualized Failure Rate)	0.44% for normal 24x7 operating conditions

Table 3-5 Drive Electrical Specifications

Attribute	Value
Power On to Ready (no rebuild)	RTD3R: 10 seconds
Power On to Ready (full rebuild)	20 seconds
Supply Voltage / Tolerance	12 V +10%/-20% 3.3 Vaux +/-15%
Inrush Current	12 V, 1.5 A
Power Consumption	<ul style="list-style-type: none"> • Active Read: 25 W • Active Write: 25 W • Idle < 5 W • Max Burst: 25 W

Table 3-6 Drive Physical Characteristics

Height	Width	Depth	Weight
15.0 mm +/-0.5 mm	69.85 +/-0.25 mm	100.45 mm Max	165 +/- 5 g

Table 3-7 NVMe Solid State Drive Characteristics

Attribute	Value
Minimum operating system versions	Refer to the server product notes for minimum operating system versions, hardware, firmware, and software compatibility.
Life monitoring capability	<p>Provides alerts for proactive replacement of the drive before the endurance is depleted. Provides endurance remaining in NVMe SMART logs. SSD supports the standard method defined by NVMe for Solid State Drive to report NAND wear through the "Get Log" command SMART/Health Information Percentage Used field. The units are whole percentage of wear.</p> <p>Percentage Used: Contains a vendor specific estimate of the percentage of NVM subsystem life used based on the actual usage and the manufacturer's prediction of NVM life. A value of 100 indicates that the estimated endurance of the NVM in the NVM subsystem has been consumed, but may not indicate an NVM subsystem failure. The value is allowed to exceed 100. Percentages greater than 254 are represented as 255. This value is updated once per power-on hour (when the controller is not in a sleep state).</p> <p>Refer to the JEDEC JESD218A standard for SSD device life and endurance measurement techniques.</p>
End-to-End data-path protection	T10 DIF Type 0, Type 1, Type 2, Type 3, no performance impact. T10 DIF (data integrity field) end-to-end data protection includes multiple levels of data-path protection.
Enhanced power-loss data protection	Energy storage components complete buffered writes to the persistent flash storage in case of a sudden power loss.
Power loss protection capacitor self-test	Supports testing of the power loss capacitor. Power is monitored using SMART (Self-Monitoring, Analysis, and Reporting Technology) attribute critical warning.
Out-of-Band Management (SMBUS)	Managed through the SMBUS. Provides out-of-band management by means of SMBUS interface. This requires 3.3V auxiliary voltage. SMBUS access includes NVMe-MI, the VPD page and temperature sensor.
Hot-Plug Support	Supports PCIe presence detect and link-up detect. Device advanced power loss protection provides robust data integrity. During IOs, the storage drive integrated monitoring enables the integrity of already committed data on the media and commits acknowledged writes to the media.
Management utilities	For more information about management utilities, refer to the server documentation.

Table 3-8 LED Status Indicator Characteristics

LED	Color	Normal operation	Status
(1) Ready to Remove	Blue	OFF – The drive has not been prepared for removal. Normal operation.	STEADY ON – The drive is in standby power state. The drive can be removed safely during a hot-plug operation. A lit Ready to Remove indicator indicates that service action is allowed on the drive.

Table 3-8 (Cont.) LED Status Indicator Characteristics

LED	Color	Normal operation	Status
(2) Service Action Required	Amber	OFF – Normal operation.	<p>STEADY ON – Service action is required. The system has detected a fault with the drive.</p> <p>BLINKING – Locator. Status indicator blinks on and off to locate drive.</p>
(3) Power/OK/Activity	Green	STEADY ON (does not blink) – Drive is engaged and is receiving full power. Normal operation.	<p>RANDOM BLINKING – There is drive activity. Status indicator blinks on and off to indicate activity.</p> <p>OFF – Power is off, or installed drive is not recognized by the system.</p>

4

Updating Oracle 6.8 TB and 3.84 TB NVMe SSD Software and Firmware

This section provides information on updating Oracle 6.8TB NVMe SSD and 3.84TB NVMe SSD v2 firmware and software.

- [Keep Drivers and Firmware Up to Date](#)
- [Server Management Tools](#)
- [Download the Device Software Package](#)
- [Update the NVMe Storage Drive Firmware](#)
- [Verify Oracle 6.8TB and 3.84TB NVMe SSD Operation](#)
- [Known Issues](#)

Keep Drivers and Firmware Up to Date

This section provides information on updating NVMe SSD drivers, firmware and software.

Product patches, updates and firmware are available on [My Oracle Support](#) from the Patches and Updates tab. Refer to the server documentation to check for updates to the device firmware.

Server Management Tools

The following management tools are available for the server:

- **Oracle Integrated Lights Out Manager (ILOM)**, Preinstalled service processor (SP) with integrated firmware. No installation required. Some initial configuration is required. For information, refer to the product information page at [Oracle Integrated Lights Out Manager](#). For documentation, refer to [Oracle ILOM Documentation](#).
- **Oracle Hardware Management Pack**, available with the Oracle Solaris OS or as a standalone product with other OS. Monitor hardware through the host operating system, either remotely or locally using command-line interface tools. For information, refer to the product information page at [Oracle Hardware Management Pack](#). For documentation and OS support matrix, refer to Oracle Hardware Management Pack Documentation at [Servers Documentation Systems Management](#).
- **Oracle Enterprise Manager Ops Center**, available software to manage multiple systems in a data center. For information, refer to the product information page at [Oracle Enterprise Manager](#). For documentation, refer to Oracle Enterprise Manager Cloud Control Documentation at [Oracle Enterprise Manager Cloud Control](#).

Download the Device Software Package

To find the device software package, access My Oracle Support and download the latest software package for Oracle 6.8TB and 3.84TB NVMe SSDs.

1. Go to [My Oracle Support](#).
2. Sign in to My Oracle Support.
3. At the top of the page, click the Patches & Updates tab.
The Patch Search pane appears at the right of the screen.
4. Within the Search tab area, click Number/Name or Bug Number (Simple).
The Search tab area appears with search fields.
5. In the Product field, enter the patch number for 6.8TB or 3.84TB NVMe PCIE SSD.
3.84TB [Minimum Supported 3.84 TB NVMe SSD Firmware Version](#)
6.8TB [Minimum Supported 6.8 TB NVMe SSD Firmware Version](#)
6. Click Search.
The Patch Search Results screen appears, listing the patch for the software release.
7. To review the ReadMe file for this patch, click *ReadMe*.
8. To download the patch for the software release, click *Download*.
9. In the File Download dialog box, click the patch zip file name.
The patch for the software release downloads. The download is an archive zip file, which you must extract to find the directory containing the image.pkg file.

Update the NVMe Storage Drive Firmware

- Update your system to the latest software release.
- Verify that the latest supported software release of Oracle Hardware Management Pack is installed on the host.
For CLI command instructions, refer to [Oracle Hardware Management Pack documentation](#).

This procedure provides instructions to update Oracle 6.8TB and 3.84TB NVMe SSD NAND flash controller firmware for the host on supported Oracle Linux and Oracle Solaris operating systems. Oracle 6.8TB and 3.84TB NVMe SSD firmware is updated as a single package using Oracle Hardware Management Pack utility command-line interface (CLI) tools.



Note:

Refer to the server documentation product notes for detailed instructions on system software updates.

1. Check Oracle 6.8TB or 3.84TB NVMe SSD Product Information for the latest firmware requirements.
3.84TB [Minimum Supported 3.84 TB NVMe SSD Firmware Version](#)
6.8TB [Minimum Supported 6.8 TB NVMe SSD Firmware Version](#)
2. Log in to the target system.
For detailed instructions, refer to the server installation documentation. For example, to log in to the target system through SSH or through Oracle ILOM Remote System Console Plus, do one of the following:

- If you are using an SSH client connection.
 - a. From a shell command line in a terminal window, establish an SSH connection to the server host.
Type: `ssh root@hostname` , where *hostname* can be the DNS name or the IP address for the server host.
 - b. Log in to the system using an account with root access.
 - c. Proceed to Step 3.
- If you are using a remote system console, first refer to *Start Serial Console Redirection and Log In to Host Server OS* server administration documentation and then perform these steps.
To launch an Oracle ILOM Remote System Console Plus session, refer to *Launching Remote KVMS Redirection Sessions* in the server administration documentation.
 - a. Access the host console. Establish a remote connection to the host console.
Start an Oracle ILOM serial console session, type:
`--> start /HOST/console`
`Are you sure you want to start /HOST/console (y/n)? y`
 - b. Ensure that the server is powered on and booted.
 - c. Access the operating system command-line interface.
You issue Oracle Hardware Management Pack commands from the operating system command-line interface.
 - d. Proceed to Step 3.
- 3. Download and store any firmware image file updates on the server that are required to support Oracle 6.8TB or 3.84TB NVMe SSDs.
 - a. Download firmware image files from [My Oracle Support](#).
See [Download the Device Software Package](#).
 - b. Copy the downloaded firmware image files to the target system root directory.
- 4. Identify all Oracle 6.8TB and 3.84TB NVMe SSDs and controller firmware versions in the server.
 - a. Type: `# fwupdate list controller`

In the following examples, NVMe SSD controllers `c0-c10` are enumerated in the output returned by the above command.

```
# fwupdate list controller
```

```
WARNING: Due to strict MMIO memory settings in the running kernel some network controllers may not be accessible.
```

```
See Hardware Management Pack documentation regarding iomem kernel settings required for firmware update of these devices.
```

```
=====
CONTROLLER
=====
ID   Type   Manufacturer   Model   Product Name   FW
Version
      BIOS Version   EFI Version   FCODE Version   Package Version
NVDATA Version   XML Support
```

```

-----
c0    NVMe    Intel      0x0b60    INTEL SSDPF2NV307TZS
ACV1R380
c1    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c2    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c3    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c4    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c5    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c6    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c7    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c8    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c9    NVMe    Intel      0x0b60    INTEL SSDPFCKE064T9S
2CV1RC50
c10   NVMe    Intel      0x0b60    INTEL SSDPFCKE064T9S
2CV1RC50
c11   SAS     Samsung   0xa826    MZWLO7T6HBLA-00AU3
OPPA1R5Q
c12   SAS     0x025e   0x0b60    SOLIDIGM SBFPPF2BV307TOC
5CV1R077
c13   SAS     0x025e   0x0b60    SOLIDIGM SBFPPF2BV614TOC
5CV1R077
c14   SAS     0x1344   0x51c3    Micron_7450_MTFDKBA480TFR
E2MU200
c15   NVMe    Samsung   0xa80a    SAMSUNG MZVL2480HBJD-00A07
GDB7302Q

```

- b. Verify that the firmware package files that are installed in NVMe SSDs require updating.

To identify NVMe controllers that need updated firmware image files, view the `FW Version` column in the output from the `fwupdate list controller` command.

In the example, NVMe SSD controller `c6` shows firmware version `9CV1R409`, while other NVMe controllers show firmware version `9CV1R410`. NVMe SSD controllers `c1` through `c5`, `c7` and `c8` are enumerated in the output returned by the above command.

```
# fwupdate list controller
```

```
WARNING: Due to strict MMIO memory settings in the running kernel some
network controllers may not be accessible.
```

```
See Hardware Management Pack documentation regarding iomem kernel
settings required for firmware update of these devices.
```

```
=====CONTROLLER=====
```

```
ID    Type    Manufacturer    Model    Product Name    FW Version
BIOS Version EFI Version FCODE Version Package Version NVDATA Version
XML Support
```

```
-----
-----
```

c0	NVMe	Intel	0x0b60	INTEL SSDPF2NV307TZS	ACV1R380
c1	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c2	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c3	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c4	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c5	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c6	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R409
c7	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c8	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T1S	9CV1R410
c9	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T9S	2CV1RC50
c10	NVMe	Intel	0x0b60	INTEL SSDPFCKE064T9S	2CV1RC50
c11	SAS	Samsung	0xa826	MZWLO7T6HBLA-00AU3	OPPA1R5Q
c12	SAS	0x025e	0x0b60	SOLIDIGM SBFPF2BV307TOC	5CV1R077
c13	SAS	0x025e	0x0b60	SOLIDIGM SBFPF2BV614TOC	5CV1R077
c14	SAS	0x1344	0x51c3	Micron_7450_MTFDKBA480TFR	E2MU200
c15	NVMe	Samsung	0xa80a	SAMSUNG MZVL2480HBJD-00A07GDB7302Q	

- c. View the Firmware Revision in the output from the `nvmeadm list -v` command.

To identify NVMe controllers and current firmware versions type:

```
# nvmeadm list -v
```

In the following example, controller `SUNW-NVME-3` shows firmware version `9CV1R410` in the output returned by the above command.

```
# nvmeadm list -v
SUNW-NVME-1
    PCI Vendor ID:          0x8086
    Serial Number:         PHAC2453005D30PGGN
    Model Number:         INTEL SSDPF2NV307TZS
    Firmware Revision:     ACV1R380
    Number of Namespaces: 128
SUNW-NVME-2
    PCI Vendor ID:          0x144d
    Serial Number:         S77GNG0W200069
    Model Number:         MZWLO7T6HBLA-00AU3
    Firmware Revision:     OPPA1R5Q
    Number of Namespaces: 64
SUNW-NVME-3
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233001G6P4AGN-1
    Model Number:         INTEL SSDPFCKE064T1S
    Firmware Revision:     9CV1R410
    Number of Namespaces: 128
SUNW-NVME-4
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233001G6P4AGN-2
    Model Number:         INTEL SSDPFCKE064T1S
    Firmware Revision:     9CV1R410
    Number of Namespaces: 128
SUNW-NVME-5
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233000L6P4AGN-1
    Model Number:         INTEL SSDPFCKE064T1S
    Firmware Revision:     9CV1R410
    Number of Namespaces: 128
```

```

SUNW-NVME-6
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233000L6P4AGN-2
    Model Number:         INTEL SSDPFCKE064T1S
    Firmware Revision:    9CV1R410
    Number of Namespaces: 128

SUNW-NVME-7
    PCI Vendor ID:          0x8086
    Serial Number:         PHAG0145001V6P4CGN-1
    Model Number:         INTEL SSDPFCKE064T9S
    Firmware Revision:    2CV1RC50
    Number of Namespaces: 128

SUNW-NVME-8
    PCI Vendor ID:          0x8086
    Serial Number:         PHAG0145001V6P4CGN-2
    Model Number:         INTEL SSDPFCKE064T9S
    Firmware Revision:    2CV1RC50
    Number of Namespaces: 128

SUNW-NVME-9
    PCI Vendor ID:          0x025e
    Serial Number:         PHA43285002330PHGN
    Model Number:         SOLIDIGM SBFPP2BV307TOC
    Firmware Revision:    5CV1R077
    Number of Namespaces: 128

SUNW-NVME-10
    PCI Vendor ID:          0x025e
    Serial Number:         PHA43313000161PIGN
    Model Number:         SOLIDIGM SBFPP2BV614TOC
    Firmware Revision:    5CV1R077
    Number of Namespaces: 128

SUNW-NVME-11
    PCI Vendor ID:          0x1344
    Serial Number:         22303B4BB3B8
    Model Number:         Micron_7450_MTFDKBA480TFR
    Firmware Revision:    E2MU200
    Number of Namespaces: 132

SUNW-NVME-12
    PCI Vendor ID:          0x144d
    Serial Number:         S78UNE0TA00279
    Model Number:         SAMSUNG MZVL2480HBJD-00A07
    Firmware Revision:    GDB7302Q
    Number of Namespaces: 32

SUNW-NVME-13
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233001H6P4AGN-1
    Model Number:         INTEL SSDPFCKE064T1S
    Firmware Revision:    9CV1R410
    Number of Namespaces: 128

SUNW-NVME-14
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233001H6P4AGN-2
    Model Number:         INTEL SSDPFCKE064T1S
    Firmware Revision:    9CV1R410
    Number of Namespaces: 128

SUNW-NVME-15
    PCI Vendor ID:          0x8086

```

```

Serial Number:          PHAZ2233000T6P4AGN-1
Model Number:          INTEL SSDPFCKE064T1S
Firmware Revision:     9CV1R410
Number of Namespaces:  128
SUNW-NVME-16
PCI Vendor ID:         0x8086
Serial Number:          PHAZ2233000T6P4AGN-2
Model Number:          INTEL SSDPFCKE064T1S
Firmware Revision:     9CV1R410
Number of Namespaces:  128

```

5. Quiesce Oracle 6.8TB and 3.84TB NVMe SSD devices.

Before removing a drive, manually quiesce I/O and device usage.

 **Caution:**

System hang or data loss. Before updating device firmware, ensure that the device is quiesced and the following events are not occurring:

- The operating system is not accessing the disk (for example, the system boot disk).
- An application is not accessing the disk (for example, a database application).

6. Update the selected 6.8TB and 3.84TB NVMe SSDs with the specified firmware package.

The `fwupdate` command can update firmware for all similar devices in the system utilizing an XML metadata file. This method is called Automatic Mode and is the recommended method for upgrades.

 **Note:**

Alternately, if you determine that each device must be updated with a separate `fwupdate` command, perform the `fwupdate` Automatic Single Drive method, or the `fwupdate` Manual method (if an XML metadata file is not available). For CLI command instructions, refer to [Oracle Hardware Management Pack documentation](#).

a. Verify that an XML metadata file is available for the server.

An XML metadata file must be included with the firmware update package to use Automatic Mode. Refer to the update package Release Notes.

b. To update device firmware on Oracle 6.8TB or 3.84TB NVMe SSDs, type `fwupdate update controller -x metadata.xml`.

```

# fwupdate update controller -x metadata.xml
The following components will be upgraded as shown:
=====
IDPriority Action      Status      Old Firmware Ver.   Proposed
Ver.              New Firmware Ver.   System Reboot
-----

```

```
-----
c71Check FW      Success      9CV1R410      9CV1R410      N/A None
c81Check FW      Success      9CV1R410      9CV1R410      N/A None
      System Reset
Do you wish to process all of the above component upgrades? [y/n]?
```

If the current firmware package version on the selected drive is higher than the specified firmware package version, the command returns an error. For error codes, refer to [Oracle Hardware Management Pack documentation](#).

- c. To upgrade the firmware packages and process all of the above component upgrades, type *y*.

```
Updating c1: Success
Updating c2: Success
Verifying all priority 1 updates
Execution Summary
=====
IDPriority Action      Status      Old Firmware Ver.   Proposed
Ver.      New Firmware Ver.   System Reboot
-----
c71Check FW      Success      9CV1R410      9CV1R410      N/A None
c81Check FW      Success      9CV1R410      9CV1R410      N/A None
System Reboot required for some applied firmware
Do you wish to automatically reboot now? [y/n]?
```

- d. Type *y* to reboot the host server to initialize the firmware update.

- 7. Re-access the console. See step 2.

For more instructions, refer to the server Installation Guide.

- 8. Verify that the updated firmware package is installed in 6.8TB and 3.84TB NVMe SSDs.

- a. Type the following from a terminal: `# fwupdate list controller`
NVMe SSDs are displayed.

```
# fwupdate list controller
```

```
WARNING: Due to strict MMIO memory settings in the running kernel some
network controllers may not be accessible.
```

```
      See Hardware Management Pack documentation regarding iomem
kernel settings required for
      firmware update of these devices.
```

```
=====
CONTROLLER
=====
ID   Type   Manufacturer   Model      Product Name      FW
Version
      BIOS Version   EFI Version   FCODE Version   Package Version
NVDATA Version   XML Support
-----
c0   NVMe   Intel          0x0b60     INTEL SSDPF2NV307T2S
ACV1R380
c1   NVMe   Intel          0x0b60     INTEL SSDPFCKE064T1S
```

```

9CV1R410
c2    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c3    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c4    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c5    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c6    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c7    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c8    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c9    NVMe    Intel    0x0b60    INTEL SSDPFCKE064T9S
2CV1RC50
c10   NVMe    Intel    0x0b60    INTEL SSDPFCKE064T9S
2CV1RC50
c11   SAS     Samsung  0xa826    MZWLO7T6HBLA-00AU3
OPPA1R5Q
c12   SAS     0x025e  0x0b60    SOLIDIGM SBFPPF2BV307TOC
5CV1R077
c13   SAS     0x025e  0x0b60    SOLIDIGM SBFPPF2BV614TOC
5CV1R077
c14   SAS     0x1344  0x51c3    Micron_7450_MTFDKBA480TFR
E2MU200
c15   NVMe    Samsung  0xa80a    SAMSUNG MZVL2480HBJD-00A07
GDB7302Q

```

- b. Verify host recognition of all NVMe SSDs by checking ID enumeration.
 - c. Ensure that the expected NVMe SSD firmware was updated in the output returned by the above command.
9. Verify Oracle 6.8TB and 3.84TB NVMe SSD operation.
See [Verify Oracle 6.8TB and 3.84TB NVMe SSD Operation](#).
 10. Repeat the firmware upgrade process until 6.8TB and 3.84TB NVMe SSDs have the most up to date firmware release.

3.84TB [Minimum Supported 3.84 TB NVMe SSD Firmware Version](#)

6.8TB [Minimum Supported 6.8 TB NVMe SSD Firmware Version](#)

Verify Oracle 6.8TB and 3.84TB NVMe SSD Operation

- Verify that Oracle Hardware Management Pack is installed on the host. For CLI command instructions, refer to [Oracle Hardware Management Pack documentation Oracle Server CLI Tools User's Guide](#).
- Ensure that you have access to the server (either directly or over the network).

This procedure provides instructions to verify Oracle 6.8TB and 3.84TB (v2) NVMe SSD operation on the host for supported Oracle Linux and Oracle Solaris operating systems. Verify Oracle 6.8TB and 3.84TB (v2) NVMe SSD operation using Oracle Hardware Management Pack utility CLI tools.

1. Observe Oracle 6.8TB and 3.84TB NVMe SSD status indicator LEDs.

Verify that the Fault-Service Required NVMe SSD status indicator is not lit and that the green Power status indicator is lit on the NVMe SSDs that you updated. LED status indicators are: Green (operational), Amber (faulty disk), Blue (SSD has been prepared for removal).

Refer to *LED Status Indicator Characteristics in Oracle 6.8TB and 3.84TB, 2.5-inch, NVMe Solid State Drive Specifications*.

2. Log in to the target system.

For detailed instructions, refer to the server installation guide. For example, to log in to the target system through SSH or through Oracle ILOM Remote System Console Plus, do one of the following:

- SSH client connection:

- a. From a shell command line in a terminal window, establish an SSH connection to the server host.

Type: `ssh root@hostname` , where *hostname* can be the DNS name or the IP address for the server host.

- b. Log in to the system using an account with root access.
- c. Proceed to Step 3.

- Remote system console:

First refer to *Start Serial Console Redirection and Log In to Host Server OS* at [Oracle ILOM Documentation](#) and then perform these steps.

If you are using a remote system console, refer to the server administration documentation and perform these steps.

- a. Establish a remote connection to the host console.

Start an Oracle ILOM serial console session, type: `-> start /HOST/console`
`Are you sure you want to start /HOST/console (y/n)? y`

To launch an Oracle ILOM Remote System Console Plus session, refer to *Launching Remote KVMS Redirection Sessions* in the server administration documentation.

- b. Ensure that the server is powered on and booted.
- c. Access the operating system command-line interface.

You issue Oracle Hardware Management Pack commands from the operating system command-line interface.

- d. Proceed to Step 3.

3. Identify all Oracle 6.8TB and 3.84TB NVMe SSDs and verify that the latest firmware packages are installed.

- a. Type the following command: `# fwupdate list controller`

In the following example, device controllers are enumerated in the output returned by the above command.

```
# fwupdate list controller

=====
CONTROLLER
=====
ID      Type      Manufacturer      Model      Product Name      FW
```



```

Version
-----
---
c0    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c1    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c2    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c3    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c4    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c5    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c6    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c7    NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51
c8    NVMe   Intel      0x0b60    INTEL SSDPF2KX153T1S
9CV1R410
c9    NVMe   Intel      0x0b60    INTEL SSDPF2KX153T1S
9CV1R410
c10   NVMe   Intel      0x0b60    INTEL SSDPF2KX076T9S
2CV1RC51

```

```
# fwupdate list controller
```

```

WARNING: Due to strict MMIO memory settings in the running kernel some
network controllers may not be accessible.
        See Hardware Management Pack documentation regarding iomem
kernel settings required for
        firmware update of these devices.

```

```

=====
CONTROLLER
=====
ID    Type   Manufacturer  Model    Product Name          FW
Version
-----
---
c0    NVMe   Intel      0x0b60    INTEL SSDPF2NV307TZS
ACV1R380
c1    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c2    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c3    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c4    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c5    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c6    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c7    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S

```

```

9CV1R410
c8    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T1S
9CV1R410
c9    NVMe   Intel      0x0b60    INTEL SSDPFCKE064T9S
2CV1RC50
c10   NVMe   Intel      0x0b60    INTEL SSDPFCKE064T9S
2CV1RC50

```

- b. Verify host recognition of all Oracle 6.8TB and 3.84TB NVMe SSDs by checking controller ID enumeration.

In the above example, Oracle 6.8TB and 3.84TB NVMe SSD controllers `c1` to `c10` are enumerated in the output returned by the above command.

- c. Ensure that all Oracle 6.8TB and 3.84TB NVMe SSDs firmware revisions are current in the output returned by the above command.

[3.84TB Minimum Supported 3.84 TB NVMe SSD Firmware Version](#)

[6.8TB Minimum Supported 6.8 TB NVMe SSD Firmware Version](#)

4. Check NVMe device status.

To identify NVMe controllers and current firmware versions, type: `# nvmeadm list -v`

To identify NVMe controllers that have updated firmware, view the **Firmware Revision** row in the output from the `nvmeadm list -v` command.

In the following example, controller `SUNW-NVME-3` shows firmware version `9CV1R410` in the output returned by the above command.

```

# nvmeadm list -v
SUNW-NVME-1
    PCI Vendor ID:          0x8086
    Serial Number:         PHAC2453005D30PGGN
    Model Number:          INTEL SSDPF2NV307TZS
    Firmware Revision:     ACV1R380
    Number of Namespaces:  128
SUNW-NVME-2
    PCI Vendor ID:          0x144d
    Serial Number:         S77GNG0W200069
    Model Number:          MZWLO7T6HBLA-00AU3
    Firmware Revision:     OPPA1R5Q
    Number of Namespaces:  64
SUNW-NVME-3
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233001G6P4AGN-1
    Model Number:          INTEL SSDPFCKE064T1S
    Firmware Revision:     9CV1R410
    Number of Namespaces:  128
SUNW-NVME-4
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233001G6P4AGN-2
    Model Number:          INTEL SSDPFCKE064T1S
    Firmware Revision:     9CV1R410
    Number of Namespaces:  128
SUNW-NVME-5
    PCI Vendor ID:          0x8086
    Serial Number:         PHAZ2233000L6P4AGN-1
    Model Number:          INTEL SSDPFCKE064T1S

```

```

        Firmware Revision:          9CV1R410
        Number of Namespaces:       128
SUNW-NVME-6
        PCI Vendor ID:              0x8086
        Serial Number:              PHAZ2233000L6P4AGN-2
        Model Number:               INTEL SSDPFCKE064T1S
        Firmware Revision:          9CV1R410
        Number of Namespaces:       128
SUNW-NVME-7
        PCI Vendor ID:              0x8086
        Serial Number:              PHAG0145001V6P4CGN-1
        Model Number:               INTEL SSDPFCKE064T9S
        Firmware Revision:          2CV1RC50
        Number of Namespaces:       128
SUNW-NVME-8
        PCI Vendor ID:              0x8086
        Serial Number:              PHAG0145001V6P4CGN-2
        Model Number:               INTEL SSDPFCKE064T9S
        Firmware Revision:          2CV1RC50
        Number of Namespaces:       128
SUNW-NVME-9
        PCI Vendor ID:              0x025e
        Serial Number:              PHA43285002330PHGN
        Model Number:               SOLIDIGM SBPFF2BV307TOC
        Firmware Revision:          5CV1R077
        Number of Namespaces:       128
SUNW-NVME-10
        PCI Vendor ID:              0x025e
        Serial Number:              PHA43313000161PIGN
        Model Number:               SOLIDIGM SBPFF2BV614TOC
        Firmware Revision:          5CV1R077
        Number of Namespaces:       128
SUNW-NVME-11
        PCI Vendor ID:              0x1344
        Serial Number:              22303B4BB3B8
        Model Number:               Micron_7450_MTFDKBA480TFR
        Firmware Revision:          E2MU200
        Number of Namespaces:       132
SUNW-NVME-12
        PCI Vendor ID:              0x144d
        Serial Number:              S78UNE0TA00279
        Model Number:               SAMSUNG MZVL2480HBJD-00A07
        Firmware Revision:          GDB7302Q
        Number of Namespaces:       32
SUNW-NVME-13
        PCI Vendor ID:              0x8086
        Serial Number:              PHAZ2233001H6P4AGN-1
        Model Number:               INTEL SSDPFCKE064T1S
        Firmware Revision:          9CV1R410
        Number of Namespaces:       128
SUNW-NVME-14
        PCI Vendor ID:              0x8086
        Serial Number:              PHAZ2233001H6P4AGN-2
        Model Number:               INTEL SSDPFCKE064T1S
        Firmware Revision:          9CV1R410
        Number of Namespaces:       128

```

```

SUNW-NVME-15
  PCI Vendor ID:          0x8086
  Serial Number:         PHAZ2233000T6P4AGN-1
  Model Number:          INTEL SSDPFCKE064T1S
  Firmware Revision:     9CV1R410
  Number of Namespaces:  128
SUNW-NVME-16
  PCI Vendor ID:          0x8086
  Serial Number:         PHAZ2233000T6P4AGN-2
  Model Number:          INTEL SSDPFCKE064T1S
  Firmware Revision:     9CV1R410
  Number of Namespaces:  128

```

5. Check the health of Oracle 6.8TB and 3.84TB TB NVMe SSDs.

To check the selected 6.8TB and 3.84TB NVMe SSD health and SMART (Self-Monitoring, Analysis, and Reporting Technology) information, type: `# nvmeadm getlog -h`

The `Critical Warning` field should be zero. A non-zero `Critical Warning` field indicates a SMART Trip.

Ensure that the NVMe SSDs have remaining drive life (`Percentage Used`) in the output returned by the above command.

```

# nvmeadm getlog -h
SUNW-NVME-1
SMART/Health Information:
  Critical Warning: 0
  Temperature: 315 Kelvin
  Available Spare: 100 percent
  Available Spare Threshold: 10 percent
  Percentage Used: 0 percent
  Data Unit Read: 0x2fa1c314 of 512k bytes.
  Data Unit Written: 0x23bd12c7 of 512k bytes.
  Number of Host Read Commands: 0x3f0bb9308
  Number of Host Write Commands: 0x1c2433434
  Controller Busy Time in Minutes: 0x525
  Number of Power Cycle: 0x56e
  Number of Power On Hours: 0x55f
  Number of Unsafe Shutdown: 0x307
  Number of Media Errors: 0x0
  Number of Error Info Log Entries: 0x0

SUNW-NVME-2
SMART/Health Information:
  Critical Warning: 0
  Temperature: 310 Kelvin
  Available Spare: 99 percent
  Available Spare Threshold: 10 percent
  Percentage Used: 1 percent
  Data Unit Read: 0x138a818a of 512k bytes.
  Data Unit Written: 0x2d71a25d of 512k bytes.
  Number of Host Read Commands: 0xe75e59ca
  Number of Host Write Commands: 0x7a604b45c
  Controller Busy Time in Minutes: 0xe0
  Number of Power Cycle: 0x89
  Number of Power On Hours: 0x1443

```

```
Number of Unsafe Shutdown: 0x78
Number of Media Errors: 0x0
Number of Error Info Log Entries: 0x0
```

Known Issues

This section describes important operating issues and known hardware and software issues for Oracle NVMe SSDs.

Supplementary and workaround information for Oracle NVMe SSDs is included. Specific Bug ID identification numbers are provided for service personnel.

- [Secure Erase Drives Before Use](#)

Secure Erase Drives Before Use

Oracle 6.8TB and 3.84TB (NVMe SSDs may report uncorrectable errors or assert after not being powered for three or more months. For best practice, secure erase Oracle 6.8TB and 3.84TB NVMe SSDs before use (especially if use is reading from the card as a test) and especially if 6.8TB and 3.84TB NVMe SSDs have been unpowered for more than three months. If the NAND media is not refreshed for approximately three months, the drive may experience media errors.

Over time, the drive firmware policy refreshes the media in the background while it remains powered-on. If the drive has been powered on long enough for the background refresh policy to be applied to all bits, the drive is not at risk for this issue. The time required to refresh all the bits is approximately 14 days and varies by product.

If the number of bits experiencing this issue exceeds the error-correction code (ECC) capability, it may result in an uncorrectable read error. If the uncorrectable read errors occur during normal drive operation, the drive will report an increased number of SMART media errors to the host.

Workaround:

Secure erase the drive to return the drive to service. Secure erase frees and reuses all blocks starting with an empty Flash Translation Layer table (FTL). Any LBAs that may have held data that may have degraded are now released as free blocks to be reused.

Select one of the following methods before use of the drive for operation or test. An off-line server can be used.

Choose one of the erase options:

- Secure erase the drive, using the `nvmeadmin` utility.
- Download and use third party utilities to secure erase the drive.
- Wait two weeks for a media refresh while the drive is powered-on before using the drive.

Caution:

All data will be destroyed after an erase.

Secure Erase Drive Using `nvmeadmin` Utility

To secure erase the drive, using the Oracle Hardware Management Pack NVMe admin utility:

1. Stop all IO to the NVMe device before attempting this action.
2. To securely erase all namespaces, type: `# nvmeadm erase -s -a controller_name`. For example: `# nvmeadm erase -s -a SUNW-NVME-1`
3. List all server devices.
4. Verify drive health.

For CLI command instructions, refer to [Oracle Hardware Management Pack documentation Oracle Server CLI Tools User's Guide](#).

Secure Erase Drive Using Third-party Utilities

To secure erase the drive before use, using the Solidigm Storage Tool utility, if available:

1. Install the Solidigm Storage Tool.
2. Stop all IO to the NVMe device before attempting this action.
3. Use the `-secure_erase` option to erase all the data on the drive.

```
ssm -drive_index 1 -secure_erase
```

4. The user is prompted unless the `-force` option is used:

```
WARNING: You have selected to secure erase the drive!  
Proceed with the secure erase? (Y/N)
```

5. If the drive contains a partition, the prompt contains a second warning message:

```
WARNING: You have selected to secure erase the drive!  
WARNING: Tool has detected as partition on the drive!  
Proceed with the secure erase? (Y/N)
```

6. To bypass the warning prompts, use the `-force` option:

```
ssm -drive_index 1 -secure_erase -force
```

7. List all server devices.
8. Verify drive health.