

Oracle® Flash Accelerator F640 PCIe Card User Guide



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Contents

- Using This Documentation** 9
 - Product Documentation Library 9
 - Feedback 9
- Product Overview** 11
 - Oracle Flash Accelerator F640 PCIe Card Overview 11
 - About Oracle Flash Accelerator F640 PCIe Card 12
 - Key Features 13
 - Characteristics 14
 - Status Indicators 15
 - Specifications 17
 - Product Specification 17
 - Environmental Specifications 19
 - Electrical Specifications 20
 - Reliability Specifications 21
 - Physical Dimensions 22
- Preparing Oracle F640 Flash Card for Installation** 25
 - ▼ Prepare for Installation 25
 - Required Tools 26
 - Ship Kit Contents 26
 - Observing Safety Precautions 27
 - General Safety Information 28
 - Safety Symbols 28
 - ESD Safety Measures 28
 - ▼ Perform ESD Prevention Measures 29
 - Oracle Flash Accelerator F640 PCIe Card Optimization Guidelines 29
 - Drive Volume Management 30

▼ Update Your System to the Latest Software Release	31
Installing Oracle Flash Accelerator F640 PCIe Card	33
Installation Overview	33
Oracle Flash Accelerator F640 PCIe Card Installation Tasks	34
▼ Install a New Oracle F640 Flash Card (Server Power-Off)	34
▼ Install a New Oracle F640 Flash Card (Server Power-On)	37
Servicing Oracle Flash Accelerator F640 PCIe Card	41
Service Overview	41
Component Serviceability	42
▼ View Installed Oracle Flash Accelerator F640 PCIe Cards in BIOS Setup Utility	43
▼ Replace Oracle F640 Flash Card (Server Power-Off)	46
▼ Replace Oracle F640 Flash Card (Server Power-On)	53
Troubleshooting Oracle F640 Flash Card Cooling	57
Technical Support	59
Index	61

Using This Documentation

- **Overview** – Provides specifications and describes how to install, administer, and service the Oracle Flash Accelerator F640 PCIe Card.
- **Audience** – Trained technicians and authorized service personnel who have been instructed on the hazards within the equipment and qualified to remove and replace hardware.
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware.

Product Documentation Library

Documentation and resources for this product and related products are available at: <https://www.oracle.com/goto/oraclevflashf640/docs>

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Product Overview

This section describes specifications and capabilities of Oracle Flash Accelerator F640 PCIe Card. Oracle Flash Accelerator F640 PCIe Card is also referred to as Oracle F640 Flash Card in this document.

Review the following product information topics before you install or service your Oracle F640 Flash Card.

Description	Links
Learn about Oracle Flash Accelerator F640 PCIe Card features and functions.	“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11
Review specifications and capabilities.	“Specifications” on page 17

Note - To install the card in a specific server, refer to your server documentation. For information about restrictions and use of Oracle Flash Accelerator F640 PCIe Cards on your server, see the most recent version of the server product notes.

Oracle Flash Accelerator F640 PCIe Card Overview

These topics provide an overview of Oracle Flash Accelerator F640 PCIe Card features and functions:

- [“About Oracle Flash Accelerator F640 PCIe Card” on page 12](#)
- [“Key Features” on page 13](#)
- [“Characteristics” on page 14](#)
- [“Status Indicators” on page 15](#)

About Oracle Flash Accelerator F640 PCIe Card

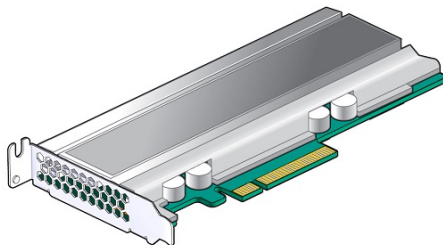
Oracle Flash Accelerator F640 PCIe Card is designed to deliver high-performance and reliable flash memory. This low-profile card interfaces with the server directly over Gen3 PCI Express (PCIe) and provides a high-bandwidth, low-latency, flash-based caching tier for various enterprise workloads. Oracle Flash Accelerator F640 Card integrates a high-performance Non-Volatile Memory Express (NVMe) controller interface. Oracle Flash Accelerator F640 PCIe Card is designed with advanced enterprise multi-level cell TLC 3D NAND 32-tier technology for high-level performance and write durability.

Oracle servers configured with this card can provide more than 2 million IOPS (input/output operations per second) to relational database management systems (RDMS) platforms. Oracle Flash Accelerator F640 PCIe Card delivers random read IOPS of 1379K and random write IOPS of 428K for 4KB operations. With PCIe Gen3 support and NVMe queuing interface, this 6.4 TB card delivers sequential read performance up to 6.5 GB/second and sequential write speeds up to 3.1 GB/second. The card connects to the server using eight lanes of PCIe Gen3 to connect directly to the flash bank, resulting in 5.5 GB/second throughput. Taking advantage of the direct path from the storage to the CPU by means of NVMe, Oracle Flash Accelerator F640 PCIe Card exhibits low average read latency of less than 13 μ seconds for sequential access to the storage drive.

Along with proactive health monitoring features, functions such as advanced error protection, overprovisioning, and wear leveling are provided to improve efficiency and increase data integrity. Battery-less power failure protection circuitry provides end-to-end data protection and 5-second power failure recovery.

Oracle Flash Accelerator F640 PCIe Card is a block storage device, with block sizing optimization capabilities. You can use the Oracle F640 Flash Card for either nonpersistent or persistent data.

The following illustration shows an Oracle Flash Accelerator F640 PCIe Card.



Related Information

- [“Specifications” on page 17](#)
- [“Key Features” on page 13](#)

Key Features

Oracle Flash Accelerator F640 PCIe Card has the following key features.

Key Feature	Description
Consistently high IOPS and throughput	■ Sequential read speeds of up to 6.5 GB/second. ■ Sequential write speeds of up to 3.1 GB/second. ■ Random read IOPS of 1397K for 4 KB operations. ■ Random write IOPS of 428K for 4 KB operations.
Sustained low latency	■ Sequential read latency of 8 µseconds. ■ Sequential write latency of 11 µseconds. ■ Less than 13 µsec for sequential access to the SSD. ■ Offers high-performance with low latency and a low CPU burden.
Variable sector size	Variable sector size enhancements.
End-to-end data-path 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.
Out-of-band management	Managed through the SMBUS.
Thermal throttling and monitoring	Provides continuous full bandwidth performance with flash memory module temperatures up to 73°C.
SMART Health reporting	Power is monitored using SMART (Self-Monitoring, Analysis, and Reporting Technology) attribute critical warning. Supports testing of the power loss capacitor.

Related Information

- [“Specifications” on page 17](#)
- [“Characteristics” on page 14](#)
- [“Status Indicators” on page 15](#)

Characteristics

Oracle Flash Accelerator F640 PCIe Card has the following hardware and software characteristics.

Characteristic	Value
Device name	■ 7335943 ■ ICDPC5ED2ORA6.4T
Manufacturing name	■ Oracle Flash Accelerator F640 PCIe Card ■ SSDPEDME064T4S
Style	■ Add-in card (AIC) form factor ■ Single slot x8 connector ■ Half-height, half-width, half-length, low-profile PCIe 3.0 board
User Capacity	6.4 TB
NAND	High-endurance Intel TLC 3D NAND flash memory 32-tier
Flash controllers	■ ASIC 1 Intel Flash Memory NVMe Controller ■ ASIC 2 Intel Flash Memory NVMe Controller Note - Both flash memory controllers enumerate.
Flash controller firmware	Intel custom and proprietary PCIe to NAND flash controller
Minimum operating system versions	x86 servers: ■ Oracle Linux 7.3[†] ■ Oracle Linux 6.9[‡] ■ Oracle VM 3.4.4 ■ Oracle Solaris 11.3 SRU 23 ■ Windows Server 2016 ■ Windows Server 2012 R2 ■ VMware ESXi 6.5 Update 1
Hardware, firmware, and software compatibility	Refer to: “Supported Hardware and Software” in Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes
Life monitoring capability	■ Provides alerts for proactive replacement of the drive before the endurance is depleted ■ Provides endurance remaining in NVMe SMART logs
Status indicators	Four red, yellow, and green LEDs on drive bracket indicate status See: “Status Indicators” on page 15
Server management utilities	■ Oracle Integrated Lights Out Management (ILOM). For information, refer to the product information page at: https://www.oracle.com/servers/technologies/integrated-lights-out-manager.html. For documentation, refer to the Oracle Integrated Lights Out Manager (ILOM) 5.0 Documentation Library at: https://www.oracle.com/goto/ilom/docs

Characteristic	Value
	You can find descriptions of new Oracle ILOM 5.0 features in the <i>Oracle ILOM Feature Updates and Release Notes</i>. ■ Oracle Hardware Management Pack, available with the Oracle Solaris OS or as a standalone product with other OS. For information, refer to the product information page at: https://www.oracle.com/servers/technologies/hardware-management-pack.html. For documentation and OS support matrix, refer to the Oracle Hardware Management Pack 2.4 Documentation Library at: https://www.oracle.com/goto/ohmp/docs Oracle Hardware Management Pack for Oracle Solaris 11.4 Documentation Library at https://docs.oracle.com/cd/E79568_01/index.html In addition, the following software is available to manage multiple systems in a data center: Oracle Enterprise Manager Ops Center, available software to manage multiple systems in a data center. For information, refer to the product information page at: https://www.oracle.com/enterprise-manager/technologies/. For documentation, refer to the Oracle Enterprise Manager Cloud Control Documentation Library at: https://docs.oracle.com/en/enterprise-manager/related-products.html For more information about management utilities, refer to the server documentation.

[†]With Unbreakable Enterprise Kernel Release 4 Update 4 (UEK R4u4) or the Red Hat Compatible Kernel

[‡]With Unbreakable Enterprise Kernel Release 4 Update 4 (UEK R4u4) or the Red Hat Compatible Kernel

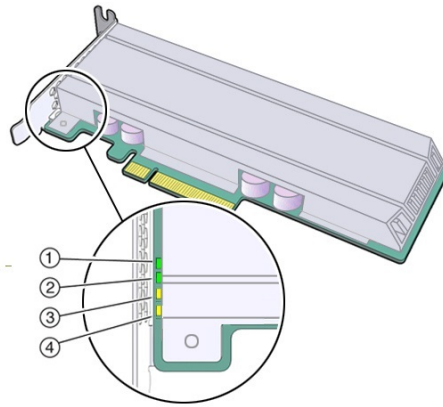
Related Information

- [“Specifications” on page 17](#)

Status Indicators

Use Oracle Flash Accelerator F640 PCIe Card status indicators to determine the status of each drive and perform service actions as required. Four status indicator LEDs are located on the drive bracket to indicate status and diagnose NVMe storage drive issues.

The following illustration shows status indicator LEDs for Oracle Flash Accelerator F640 PCIe Card.



Indicator	Color	Status
(1) ASIC 1	Green	Drive Activity indicator for controller ASIC 1 ■ OFF – Power is off, or normal operation. ■ STEADY ON (does not blink) – Drive is healthy. Drive is engaged and is receiving full power. Normal operation. Oracle Flash Accelerator F640 PCIe Card Activity LED status indicator LED 1 should be ON during idle. ■ BLINK at 250 msec high, 250 msec low – IO activity.
(2) ASIC 2	Green	Drive Activity indicator for controller ASIC 2 ■ OFF – Power is off, or normal operation. ■ STEADY ON (does not blink) – Drive is healthy. Drive is engaged and is receiving full power. Normal operation. Oracle Flash Accelerator F640 PCIe Card Activity LED status indicator LED 2 should be ON during idle. ■ BLINK at 250 msec high, 250 msec low – IO activity. Note - Both flash memory controllers enumerate.
(3) PCIe Link Status	Green Yellow	Green STEADY ON (does not blink) – Drive link is healthy. Normal operation. Green Drive IO (data input/output) activity ■ OFF – Normal operation. ■ BLINK at 250 msec high, 250 msec low – Drive IO activity. ■ STEADY ON – Idle IO, no activity, ON if idle. Yellow – Drive link sub-optimal The LED reports only secondary bus link status (behind internal switch) and does not report the status between the switch and host.

Indicator	Color	Status
(4) Health	Green	Green – Drive health:
	Yellow	■ OFF – Power is off, or drive is unhealthy; Service Action Required. ■ STEADY ON (does not blink) – Drive is healthy. Drive is engaged and is receiving full power. Normal operation.
	Red	Yellow – Drive Critical Warning: ■ OFF – Power is off, or drive is healthy. ■ STEADY ON (does not blink) – Drive critical warning. Red – Drive fail: ■ OFF – Power is off, or normal operation. ■ STEADY ON (does not blink) – Service Action Required. Drive is in disabled logical mode.

Related Information

- [“Service Overview” on page 41](#)

Specifications

The following sections provide the specifications and capabilities of Oracle Flash Accelerator F640 PCIe Card:

- [“Product Specification” on page 17](#)
- [“Environmental Specifications” on page 19](#)
- [“Electrical Specifications” on page 20](#)
- [“Reliability Specifications” on page 21](#)
- [“Physical Dimensions” on page 22](#)

Note - For server specifications, see the most recent version of the server product notes.

Product Specification

Oracle Flash Accelerator F640 PCIe Card general specifications are listed in the following table.

Specifications

Specification	Value
Capacity	Usable capacity 6.4 TB Unformatted capacity (total user addressable sectors in LBA mode) 12,502,446,768
PCIe	■ PCIe Gen3 half-height, half-width, single-slot x8 connector ■ Low-profile, half-height, and half-length PCIe 3.1 board ■ PCIe interface that complies with the PCI Express Base Specification 3.1 ■ PCI low-profile MD2 specification
Form factor	■ Add-in card (AIC) form factor ■ Single slot x8 connector ■ Half-height, half-width, half-length, low-profile PCIe 3.1 board
Performance ^{†‡}	■ Sequential read speeds of up to 6.5 GB/second ■ Sequential write speeds of up to 3.1 GB/second ■ Random read IOPS of 1379K for 4 KB operations. ■ Random write IOPS of 428K for 4 KB operations. Sequential Latency (typical) Read/Write: 79/14 µsec Random Latency (typical) Read/Write: 120/30 µsec Power On to Ready Latency (typical): 2 seconds
Components	■ High-endurance Intel TLC 3D NAND flash memory 32-tier ■ Two Intel flash memory NVMe controller ASICs
Reliability	■ Uncorrectable Bit Error Rate (UBER): 1 sector per 10¹⁷ bits read ■ Mean Time Between Failure (MTBF): 2 million hours ■ T10 DIF (data integrity field) end-to-end data protection See “Reliability Specifications” on page 21.
Power	■ 3.3V and 12V supply rail ■ Active/Idle (typical): Up to 25W/4W (typical) ■ Max Average Current: 2.1A (12V), 3.0A (3.3V) ■ Enhanced power-loss data protection ■ Oracle Flash Accelerator F640 PCIe Cards support NVMe specifications for RTD3 Resume Latency and RTD3 Entry Latency. RTD3R Resume latency allows 7.5 seconds of margin for devices to safely start before main power is applied to the device controller. RTD3E Entry latency allows 6 seconds of margin for active devices to safely shutdown before main power is removed from the device controller. See “Electrical Specifications” on page 20.
Certifications and declarations	UL, CE, C-Tick, BSMI, KCC, Microsoft WHCK, VCCI
Compliance	For compliance specifications, refer to the <i>Oracle Flash Accelerator F640 PCIe Card Safety and Compliance Guide</i>. ■ Compliance Model: SSDPECKE064T7 ■ NVM Express 1.2b ■ PCI Express Base Specification Rev 3.1

Specification	Value
	■ Enterprise SSD Form Factor Version 1.0a ■ PCI Express Card Electro-Mechanical (CEM) Specification Rev 3.0
Endurance rating	■ Up to 34.7 PBW (petabytes written) ■ 2.95 Drive Writes/day (JESD219 workload)
Altitude (simulated)	■ Operating: -1,000 to 10,000 ft ■ Non-operating: -1,000 to 40,000 ft
Temperature	■ Operating: ■ 0 to 55°C ambient, with specified airflow out of server through PCIe card slot ■ Temperature monitoring (in-band and by way of SMBUS) ■ Thermal throttling ■ Non-operating: -55 to 95°C
Airflow	More than 400 LFM (linear feet/minute, airflow towards IO bracket. Airflow out of server through PCIe card slot (55°C).
Weight	Up to 195 gm
Shock	50 G Trapezoidal, 170 in/s
Vibration	■ Operating: 2.17 GRMS (5-700Hz) ■ Non-operating: 3.13 GRMS (5-800Hz)
Product ecological compliance	RoHS

[†]Performance values vary by capacity and form factor.

[‡]30w power consumption; performance specifications apply to both compressible and incompressible data.

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)

Environmental Specifications

Oracle Flash Accelerator F640 PCIe Card operates and is stored in an environment defined by the parameters and specifications listed in the following table.

Specification	Value
Operating temperature	0 to 55°C with specified airflow
Non-operating temperature	Storage and transit environment: -55°C to 95°C (dry bulb)
Temperature monitoring	■ Temperature monitoring in-band and by way of SMBUS ■ See “Troubleshooting Oracle F640 Flash Card Cooling” on page 57 for more information on thermal throttling.

Specification	Value
Thermal sensors	- Thermal sensors on the storage drives monitor flash memory modules - Thermal sensor temperature cannot exceed 73°C - See illustration in “Troubleshooting Oracle F640 Flash Card Cooling” on page 57 for thermal sensor locations.
Dry bulb temperature	Maximum dry bulb temperature is derated by 3.3°C per 1000 m above 500 m
Altitude (Simulated)	- Operating: -1,000 to 10,000 ft - Non-operating: -1,000 to 40,000 ft
Relative humidity range	- Operational environment: 8% to 80% noncondensing - Storage and transit environment: 5% to 95% noncondensing - Non-operating: -20°C to 75°C noncondensing
Airflow requirement	More than 400 LFM (linear feet/minute) at 55°C, with airflow towards IO bracket

Note - For specific site planning guidelines and best practices, refer to the server documentation and product notes for your server. Refer to the system site planning guide, if available.

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)

Electrical Specifications

Oracle Flash Accelerator F640 PCIe Card electrical specifications are listed in the following table.

Specification	Value
Power feeds	3.3V and 12V Supply Rail
Enhanced power-loss data protection	Active/Idle: Up to 25W/4W (typical)
Power consumption	- Active Write - Average = 21.5W - Active Read - Average = 12.5W - Idle = 10W

Oracle Flash Accelerator F640 PCIe Card receives electrical power from the PCI Express +12 VDC and +3.3 VDC power rails as listed in the following table.

Specification	12 V Operating Characteristics	3.3 V Operating Characteristics	3.3 V aux Operating Characteristics
Operating voltage range	12 V (+10%/-20%)	3.3 V (+/-10%)	3.3 V (+/-10%)
Rise time (max/min)	50ms/1ms	50ms/1ms	50ms/1ms
Fall time (max/min)	5s/1ms	5s/1ms	5s/1ms
Noise level	1000 mV pp at 10 Hz – 100 KHz 100 mV pp at 100 KHz – 20 MHz	300 mV pp at 10 Hz – 100 KHz 50 mV pp at 100 KHz – 20 MHz	300 mV pp at 10Hz – 100 KHz 50 mV pp at 100KHz – 20 MHz
Minimum off time	3s	3s	3s
Inrush current (typical peak)	1.5 A	1.5 A	1.5 A
Maximum average current	2.1 A	3.0 A	1 mA

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)

Reliability Specifications

Oracle Flash Accelerator F640 PCIe Card reliability specifications are listed in the following table.

Specification	Value
Uncorrectable Bit Error Rate (UBER)	Uncorrectable bit error rate will not exceed one sector in the specified number of bits read. In the unlikely event of a non-recoverable read error, the storage drive will report it as a read failure to the host; the sector in error is considered corrupt and is not returned to the host. < 1 sector per 10 ¹⁷ bits read
Mean Time Between Failures (MTBF)	2 million hours Mean Time Between Failures is estimated based on Telcordia methodology and demonstrated through Reliability Demonstration Test (RDT).
Data Retention	The time period for retaining data in the NAND at maximum rated endurance. Three months power-off retention once storage drive reaches rated write endurance at 40°C.

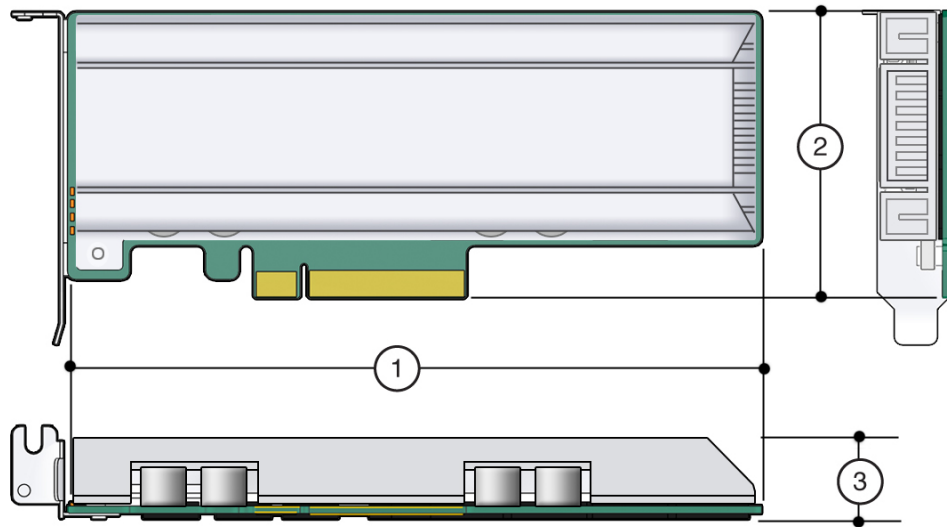
Specification	Value
Endurance Rating	■ Up to 34.47 PBW (petabytes written) Endurance rating verification is defined to establish UBER <1E-64 at 60% upper confidence limit. ■ 2.95 Drive Writes/day (JESD219 workload) The number of drive writes such that the storage drive meets the requirements according to the JESD219 standard.
Temperature Sensor	Internal temperature sensor with an accuracy of +/-2°C over a range of -10°C to +85°C. Internal temperature sensor can be monitored using NVMe Health Log. The sensor has an accuracy of +/- 3°C over a range of -20°C to 125°C. SMBUS temperature sensor is not reported in NVMe Health Log. Drive provides out-of-band access to temperature by means of SMBUS.
Out-of-Band Management (SMBUS)	Provides out-of-band management by means of SMBUS interface. This requires 3.3V auxiliary voltage. SMBUS access includes 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 SSD's integrated monitoring enables the integrity of already committed data on the media and commits acknowledged writes to the media. See “Servicing Oracle Flash Accelerator F640 PCIe Card” on page 41.

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)
- [“Servicing Oracle Flash Accelerator F640 PCIe Card” on page 41](#)

Physical Dimensions

The following diagram shows Oracle Flash Accelerator F640 PCIe Card physical dimensions.



Specification	Dimension
(1) Length	166.78 mm maximum (6.59 in.)
(2) Width	68.9 mm (2.21 +/- 0.0098 in.)
(3) Height	30 mm (.67 in.)
Weight	195 g maximum (6.87 oz)

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)

Preparing Oracle F640 Flash Card for Installation

This section contains information about preparing Oracle Flash Accelerator F640 PCIe Card for installation.

Description	Links
Prepare for installation.	“Prepare for Installation” on page 25
Gather the required tools.	“Required Tools” on page 26
Unpack the shipping kit.	“Ship Kit Contents” on page 26
Review safety information.	“Observing Safety Precautions” on page 27
Review electrostatic discharge (ESD) safety measures.	“ESD Safety Measures” on page 28
Review Oracle F640 Flash Card optimization guidelines.	“Oracle Flash Accelerator F640 PCIe Card Optimization Guidelines” on page 29
Update your system to the latest software release.	“Update Your System to the Latest Software Release” on page 31

Note - To install the card in a specific server, refer to your server documentation. For information about restrictions and use of Oracle Flash Accelerator F640 PCIe Cards on your server, see the most recent version of the server product notes.

▼ Prepare for Installation

1. **Gather the required tools.**
See [“Required Tools” on page 26](#).
2. **Unpack the ship kit that includes the card.**
 - a. **Unpack the card in a static-free environment.**

See [“Ship Kit Contents” on page 26](#).

- b. Remove the card from its packaging and place the drive on an antistatic mat, using good antistatic grounding procedures.**

See [“ESD Safety Measures” on page 28](#).

- 3. Carefully inspect the card for shipment damage.**

If you detect any damage, contact Oracle Technical Support or your reseller support representative. See [“Technical Support” on page 59](#).

Required Tools

You will need the following tools for most service operations:

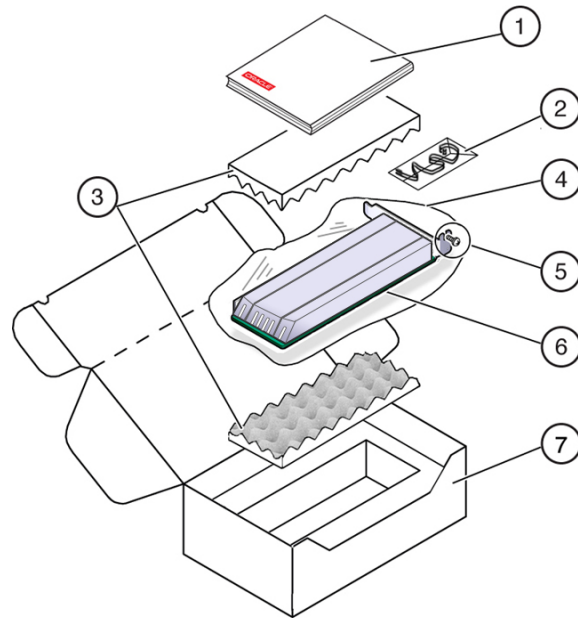
- Antistatic wrist strap
- Antistatic mat
- No. 1 Phillips screwdriver

Related Information

- [“ESD Safety Measures” on page 28](#)

Ship Kit Contents

The Oracle Flash Accelerator F640 PCIe Card ship kit contains the components shown in the following illustration.



1. Documentation
2. Antistatic wrist strap (Note: Not included in some ship kits)
3. Foam
4. Antistatic bag
5. Bracket screw
6. Oracle Flash Accelerator F640 PCIe Card with low profile PCIe mounting bracket
7. Packaging

Observing Safety Precautions

This section contains safety information about preventing equipment damage and personnel injury.

- [“General Safety Information” on page 28](#)
- [“Safety Symbols” on page 28](#)
- [“ESD Safety Measures” on page 28](#)
- [“Perform ESD Prevention Measures” on page 29](#)

General Safety Information

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions and instructions marked on the equipment.
- Follow all cautions and instructions described in the documentation shipped with your system, and described in the server safety information.
- Follow the electrostatic discharge safety practices as described in this section.
- Handle the card by the edges.

Safety Symbols

Note the meanings of the following symbols that might appear in this document.



Caution - There is a risk of personal injury or equipment damage. To avoid personal injury and equipment damage, follow the instructions.



Caution - Hot surface. Avoid contact. Surfaces are hot and might cause personal injury if touched.



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

ESD Safety Measures

Circuit boards and drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Electrostatic discharge (ESD) sensitive devices, such as the drives, require special handling.

- Place ESD-sensitive components, such as printed circuit boards and cards on an antistatic mat (not provided).
- Wear an antistatic wrist strap when handling ESD-sensitive components.
- See [“Perform ESD Prevention Measures” on page 29](#).



Caution - Possible component damage. Do not touch components along connector edges.

▼ Perform ESD Prevention Measures

1. **Prepare an antistatic surface to set parts on during the removal, installation, or replacement processes.**

Place ESD-sensitive components such as the printed circuit boards on an antistatic mat. The following items can be used as an antistatic mat:

- Antistatic bag used to wrap a replacement part
- ESD mat
- A disposable ESD mat (shipped with some replacement parts or optional system components)

2. **Attach an antistatic wrist strap (not provided).**

When servicing or removing server components, attach an antistatic strap to your wrist and then to a metal area on the chassis.

Related Information

- [“ESD Safety Measures” on page 28](#)

Oracle Flash Accelerator F640 PCIe Card Optimization Guidelines

To optimize performance, observe the following guidelines when setting up Oracle Flash Accelerator F640 PCIe Cards in a server.

- Block size can be configured through a server operating system or file system and is set to a default size with Oracle databases.
- Oracle Flash Accelerator F640 PCIe Card is designed to provide best performance for data transfers that are multiples of 4k size and using addresses that are 4k aligned. Partitions should be aligned to start on 4k boundaries.

- The ZFS file system might require manual alignment. Oracle Flash Accelerator F640 PCIe Card has a maximum transfer size of 128k. IO requests for larger transfer sizes will be broken into transfer sizes of size 128k or smaller. For optimal performance, transfer sizes should be limited to 128k to avoid additional overhead associated with breaking into smaller transfer sizes.
- Oracle Flash Accelerator F640 PCIe Card should be formatted using a label of type EFI (format -e command).

Ensure that when the EFI label is created by ZFS, the default start sector is 256, which aligns S1 with 128k (if the block size is 512). The vtoc label default cylinder size is 50176 (224*224) blocks. If the block size is 512, the default Oracle Solaris operating system partition aligns with 512k. For example: $50176 * 512 = 49 * 512 * 1024$.

Specify and ensure 4k alignment: The default start sector of 34 for EFI labels is not a 4k aligned value. Use the partition subcommand of the Oracle Solaris format command to change the start sector to 256, or any other 128k aligned value. Note that there are 512B per sector.
- The ZFS file system automatically aligns partitions to start on 8k boundaries when a full disk is allocated to ZFS (recommended). If you allocate individual EFI partitions to a ZFS pool, ensure that the partition is 4k-aligned as discussed above. For optimal performance of ZFS with Oracle Flash Accelerator F640 PCIe Card, refer to the ZFS documentation.
- For highest performance, ensure that the system meets the physical, environmental, and electrical specifications listed in “Specifications” on page 17.

Related Information

- “Preparing Oracle F640 Flash Card for Installation” on page 25
- Tuning ZFS When Using Flash Storage: http://docs.oracle.com/cd/E26502_01/html/E29022/chapterzfs-flash.html

Drive Volume Management

A volume manager can present multiple card 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 6.4 TB domains into a single 25.6 TB volume.

For more information about ASM, refer to *Oracle Database Administrator's Guide, Release 18c*.

▼ Update Your System to the Latest Software Release

It is highly recommended that you update your system to the latest software release before you use the system. Software releases often include bug fixes, and updating ensures that your server software is compatible with the latest server firmware and other component firmware and software.

Note - System firmware update releases include Oracle Flash Accelerator F640 PCIe Card component firmware updates. When system firmware updates, as described in the server documentation, Oracle Flash Accelerator F640 PCIe Card firmware automatically updates.

1. **Check the Oracle Flash Accelerator F640 PCIe Card Product Notes for the latest firmware requirements. The most up-to-date Product Notes document is available at: <https://www.oracle.com/goto/oracleflashf640/docs>**
2. **Download and install any firmware updates required to support the card, host bus adapter (HBA), drive backplane, system BIOS, or OBP/system (SPARC) firmware.**

You can download the latest firmware and software updates from My Oracle Support at <https://support.oracle.com>.

For information about downloading card firmware and software from My Oracle Support, refer to “Accessing Software Updates and Firmware Downloads” in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*.

Refer also to the “Getting Server Firmware and Software Updates” in the server Installation Guide documentation.

Related Information

- “Download the Device Software Package” in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*
- “Update the NVMe Storage Drive Firmware” in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*
- “Verify Oracle Oracle Flash Accelerator F640 PCIe Card Operation” in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*
- “Technical Support” on page 59

Installing Oracle Flash Accelerator F640 PCIe Card

This section contains information about installing Oracle Flash Accelerator F640 PCIe Card into a server PCIe slot.

Description	Links
Review installation tasks and performance tuning information before installing card.	“Installation Overview” on page 33
Install a new card into a server when the card is cold-plug inserted into a PCIe slot.	“Install a New Oracle F640 Flash Card (Server Power-Off)” on page 34
Install a new card into a server when the card is hot-plug inserted into a PCIe carrier.	“Install a New Oracle F640 Flash Card (Server Power-On)” on page 37

Installation Overview

Read this overview information section before installing the Oracle Flash Accelerator F640 PCIe Card into a server.

For information on how to install your Oracle F640 Flash Card, refer to your server documentation. Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card installation instructions and additional information.

The bracket assembly should not be disassembled for any reason by the user.



Caution - Hazardous voltages are present. Refer to the server service manual for PCIe card installation instructions.

Oracle Flash Accelerator F640 PCIe Card Installation Tasks

To install your Oracle Flash Accelerator F640 PCIe Card into a server system, refer to the steps described in the following table.

Steps	Task	See
1.	Prepare the Oracle F640 Flash Card for installation. Carefully unpack the card. Inspect the card for damage. Follow ESD precautions.	“Preparing Oracle F640 Flash Card for Installation” on page 25
2.	Insert the Oracle F640 Flash Card in an available PCIe slot with server power in the off state.	“Install a New Oracle F640 Flash Card (Server Power-Off)” on page 34
	or	or
	Insert the Oracle F640 Flash Card in an available PCIe carrier with server power in the on state.	“Install a New Oracle F640 Flash Card (Server Power-On)” on page 37

Related Information

- [“Service Overview” on page 41](#)
- [“Install a New Oracle F640 Flash Card \(Server Power-Off\)” on page 34](#)
- [“Install a New Oracle F640 Flash Card \(Server Power-On\)” on page 37](#)
- [“Replace Oracle F640 Flash Card \(Server Power-Off\)” on page 46](#)
- [“Replace Oracle F640 Flash Card \(Server Power-On\)” on page 53](#)

▼ Install a New Oracle F640 Flash Card (Server Power-Off)

To install a new Oracle Flash Accelerator F640 PCIe Card into a supported server:

Note - Refer to the server service manual for PCIe card installation instructions.

1. **Prepare Oracle F640 Flash Card for installation.**
See [“Preparing Oracle F640 Flash Card for Installation” on page 25](#).
2. **Back up your data, as required, before changing your server configuration.**
3. **Identify a supported and available PCIe slot in the server.**

Refer to the server service manual for PCIe slot locations in the server.

Refer to [“Supported Hardware and Software”](#) in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*.

4. Prepare the server for service.

Refer to the server service manual for detailed instructions.



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F640 PCIe Card to facilitate airflow. Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card installation instructions.

a. Take antistatic measures.

See [“ESD Safety Measures”](#) on page 28.

b. Remove the server from active operation.

c. Power down (turn off) the server.

d. Disconnect all power cords from the server power supplies.

e. Remove the cover from the chassis.

5. Record the serial number of Oracle F640 Flash Cards and the PCIe slot number where the cards will be installed.

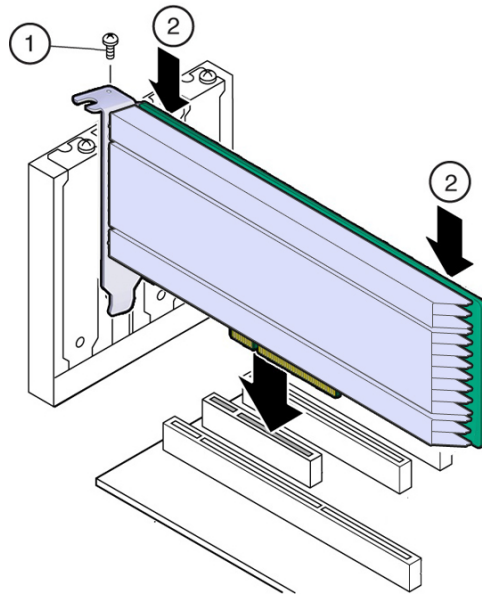
This server slot information can be used at a later time for identifying Oracle F640 Flash Cards from the console. Refer to the server service manual for identification information.

6. Insert Oracle F640 Flash Card in the supported PCIe slot.

a. Remove the blank bracket panel on the server chassis that aligns with the empty PCIe slot. Save the bracket screw, if applicable.

b. Press down gently, but firmly, to properly seat the card in the slot.

The following figure shows how to insert Oracle F640 Flash Card in a PCI Express slot.



Note - Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card installation instructions.

7. Secure the card bracket to the server chassis.

Engage the server retention mechanism to secure the card to the server chassis.
Or, install the bracket screw, as required to secure the card to the server chassis.

8. Return the server to service.

Refer to the server service manual for detailed instructions.

- a. Replace the cover, if applicable.**
- b. Reconnect the power cord and any network cables.**
- c. Power on the system.**

The card hardware insertion is complete.

9. Configure the server for the new Oracle F640 Flash Card.

Refer to the server administration guide or the operating system documentation for detailed instructions.

- a. **If applicable, perform any required commands for your system to install the device driver for the new Oracle F640 Flash Card.**
- b. **If applicable, perform any required commands for your system to recognize the new Oracle F640 Flash Card.**
- c. **Verify successful installation of Oracle F640 Flash Card through your server operating system.**

When the installation is complete, the Oracle Flash Accelerator F640 PCIe Card is visible to your server operating system.

- d. **Configure the system to maximize flash technology.**

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Optimization Guidelines” on page 29](#)
- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)
- [“Installation Overview” on page 33](#)
- [“Service Overview” on page 41](#)
- [“Replace Oracle F640 Flash Card \(Server Power-Off\)” on page 46](#)
- [“Replace Oracle F640 Flash Card \(Server Power-On\)” on page 53](#)

▼ Install a New Oracle F640 Flash Card (Server Power-On)

To install a new Oracle Flash Accelerator F640 PCIe Card in a supported powered-on server when the card is hot-plug inserted into an empty PCIe carrier:

Note - Refer to the server service manual for PCIe card installation instructions.

1. **Prepare the Oracle F640 Flash Card for installation.**
See [“Preparing Oracle F640 Flash Card for Installation” on page 25](#).
2. **Back up your data, as required, before changing your server configuration.**
3. **Identify a supported and available PCIe carrier in the server.**

Refer to the server service manual for PCIe carrier and slot locations in the server.

Refer to [“Supported Hardware and Software” in Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes](#).

4. Prepare the server for service.

Refer to the server service manual for detailed instructions.

a. Remove the domain from active operation, as required.

b. Take antistatic measures.

See [“ESD Safety Measures” on page 28](#).

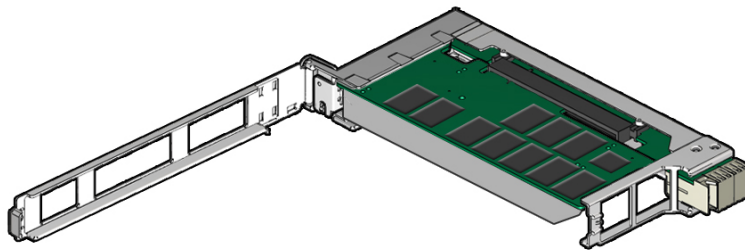
5. Remove the carrier from the server slot.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F640 PCIe Card to facilitate airflow. Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card installation instructions.

6. Record the serial number of Oracle F640 Flash Card and the PCIe slot number where the card will be installed.

This server slot information can be used at a later time for identifying Oracle F640 Flash Cards from the console. Refer to the server service manual for server slot information.

7. Install Oracle F640 Flash Card in the carrier.



- a. **Unlatch and swing open the arm of the PCIe card carrier, and insert the new Oracle F640 Flash Card until the bottom connector is firmly seated in the carrier's connector.**

The card is correctly seated only when the notch at the top of the card bracket fits around a guide post on the carrier.



Caution - Do not twist or turn the PCIe card as you insert it into the carrier. The card's connector must be fully seated in the carrier's slot before you attempt to close the top cover.

Note - If the PCIe card includes a mounting screw, do not use the mounting screw. The carrier does not accept mounting screws.

- b. **Close the top of the carrier.**

The green latch should click into place. If the top is difficult to close, verify that the notch of the card bracket or filler panel fits around the guide post.

8. **Insert the carrier into the server chassis.**

Refer to the server service manual for detailed instructions.

9. **Return the server to service.**

Refer to the server service manual for detailed instructions.

10. **Configure the server for the new Oracle F640 Flash Card.**

Refer to the server documentation library for detailed instructions. Refer to the server administration guide or the operating system documentation detailed NVMe SSD configuration instructions.

- a. **If applicable, perform any required commands for your system to install the device driver for the new Oracle F640 Flash Card.**

- b. **If applicable, perform any required commands for your system to recognize the new Oracle F640 Flash Card.**

- c. **Verify successful installation of the Oracle F640 Flash Card through the server operating system.**

When the installation is complete, the Oracle Flash Accelerator F640 PCIe Card is visible to the server operating system.

- d. **Configure the system to maximize flash technology.**

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Optimization Guidelines” on page 29](#)
- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)
- [“Installation Overview” on page 33](#)
- [“Service Overview” on page 41](#)

Servicing Oracle Flash Accelerator F640 PCIe Card

This section provides service information and procedures for Oracle Flash Accelerator F640 PCIe Card.

Description	Links
Review service task and troubleshooting information.	“Service Overview” on page 41
Review NVMe drive component serviceability information.	“Component Serviceability” on page 42
Remove and replace Oracle F640 Flash Cards.	“Replace Oracle F640 Flash Card (Server Power-Off)” on page 46
	“Replace Oracle F640 Flash Card (Server Power-On)” on page 53
Troubleshoot Oracle F640 Flash Card thermal issues.	“Troubleshooting Oracle F640 Flash Card Cooling” on page 57
Contact Technical Support.	“Technical Support” on page 59

Service Overview

For service, Oracle Flash Accelerator F640 PCIe Card contains updatable flash ROM for storing the BIOS and firmware, as well as NVRAM for storing nonvolatile configuration data. Use Oracle Hardware Management Pack to monitor and service Oracle F640 Flash Cards. You can also use Oracle Hardware Management Pack for troubleshooting. See Server Management in [“Characteristics” on page 14](#) and refer to [“Server Management Tools” in Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes](#).

In addition, you can monitor Oracle Flash Accelerator F640 PCIe Card health and flash media drive life through card bracket status indicator LEDs. Oracle F640 Flash Card has four status indicator LEDs on the card bracket to indicate activity, drive health, and status. See [“Status Indicators” on page 15](#).

Oracle Flash Accelerator F640 PCIe Card requires no periodic maintenance. For data protection, Oracle F640 Flash Card is designed with energy storage components to complete buffered writes to the persistent flash storage in case of a sudden power loss. These energy storage components are designed for the life of Oracle F640 Flash Card and do not require periodic maintenance.

Note - Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card removal and replacement instructions. Refer to the server documentation for additional Oracle F640 Flash Card service and firmware download information.

Component Serviceability

The following service actions can be performed on an Oracle F640 Flash Card.

- Unmount an NVMe storage drive
- Remove an NVMe storage drive from the server
- Verify removal of an NVMe storage drive
- Install an NVMe storage drive in the server
- Power on an NVMe storage drive and attach a device driver



Caution - Hazardous voltages are present. Disconnect the server from the main power and from any networks before servicing the card to avoid electrical shock.

Refer to the server documentation for additional service information. Late-breaking information and known issues for this product are included in the [“Oracle Flash Accelerator F640 PCIe Card Product Notes”](#) in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*.

Components are either hot serviceable or cold serviceable. Hot-service capability allows you to safely remove this component while the server is running. Cold-service capability requires a powered off state, therefore you need to remove power from the server.

Components are designated either CRU (customer-replaceable unit) or FRU (field-replaceable unit). CRU service capability allows trained technicians and authorized field service personnel to service this component. FRU service capability allows only authorized service personnel to service this component.

Oracle F640 Flash Card is a CRU.

The following table lists the serviceability of NVMe components and directs you to replacement instructions.

Component	Serviceability	Replacement Instructions
Oracle Flash Accelerator F640 PCIe Card	Cold for servers with motherboard PCIe connections or Hot for servers with PCIe carriers.	“Installing Oracle Flash Accelerator F640 PCIe Card” on page 33 Note - Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card removal and replacement instructions.
	CRU	“Replace Oracle F640 Flash Card (Server Power-Off)” on page 46 “Replace Oracle F640 Flash Card (Server Power-On)” on page 53 For instructions on safe installation and removal of Oracle F640 Flash Cards, refer to the server service manual.

Related Information

- [“Oracle Flash Accelerator F640 PCIe Card Overview” on page 11](#)
- [“Technical Support” on page 59](#)

▼ View Installed Oracle Flash Accelerator F640 PCIe Cards in BIOS Setup Utility

You can install an operating system on Oracle Flash Accelerator F640 PCIe Card without any additional configuration. All installed Oracle Flash Accelerator F640 PCIe Card controllers (two per card) are visible to an operating system installer program.

You can use the BIOS Setup Utility to see a list of installed Oracle Flash Accelerator F640 PCIe Cards.

Note - Oracle Flash Accelerator F640 PCIe Cards support two controllers. Two separate 3.2 TB devices appear in the BIOS Setup Utility, and in operating system installation programs.

1. **Configure the server for a one-time boot to BIOS.**

a. Access the Oracle ILOM web interface.

For instructions, refer to the server installation guide or Oracle ILOM documentation.

b. Navigate to Host Management → Host Control.

c. Select BIOS from the drop-down list, and select Save.

This causes the server to boot to BIOS on the next boot.

2. Access a system console.

For more information, refer to *Oracle X7 Series Servers Administration Guide* at <https://www.oracle.com/goto/x86admindiag/docs>.

3. Power on or reset the server.

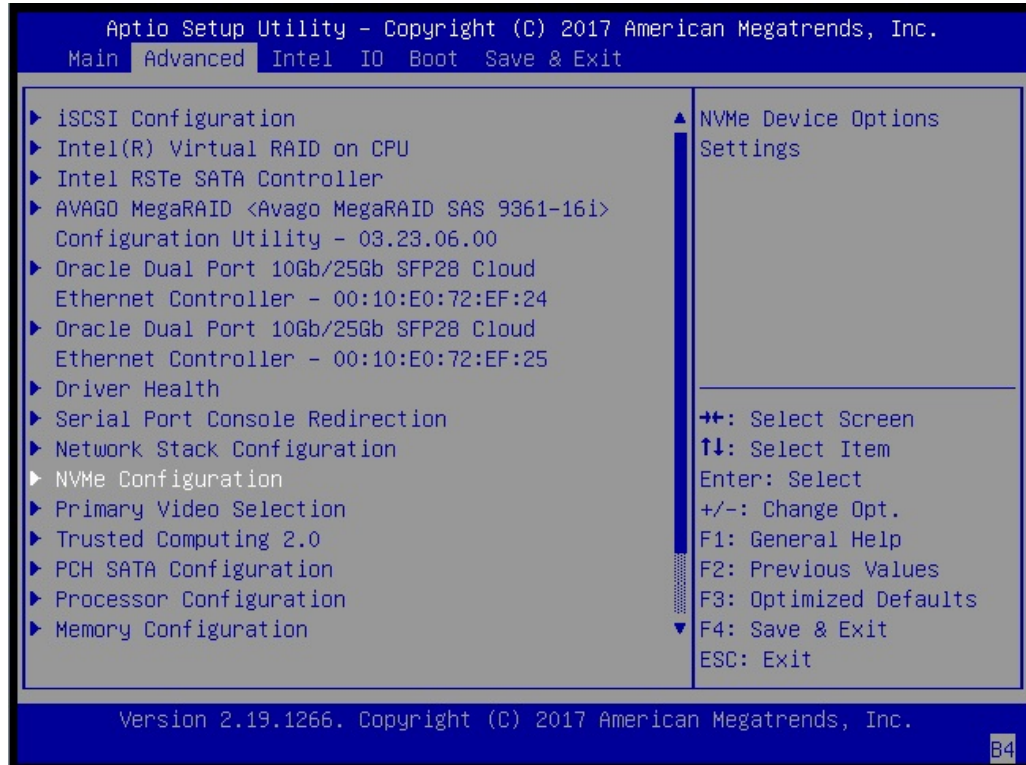
For example, to reset the server:

- **From the local server**, press the On/Standby button on the front panel of the server for approximately 1 second to power off the server, and then press the On/Standby button again to power on the server.
- **From the Oracle ILOM web interface**, select Host Management → Power Control, and in the Select Action list box, select Power On. Click Save, and then click OK.
- **From the Oracle ILOM CLI**, type: `reset /System`.

The system boots to the BIOS Setup Utility.

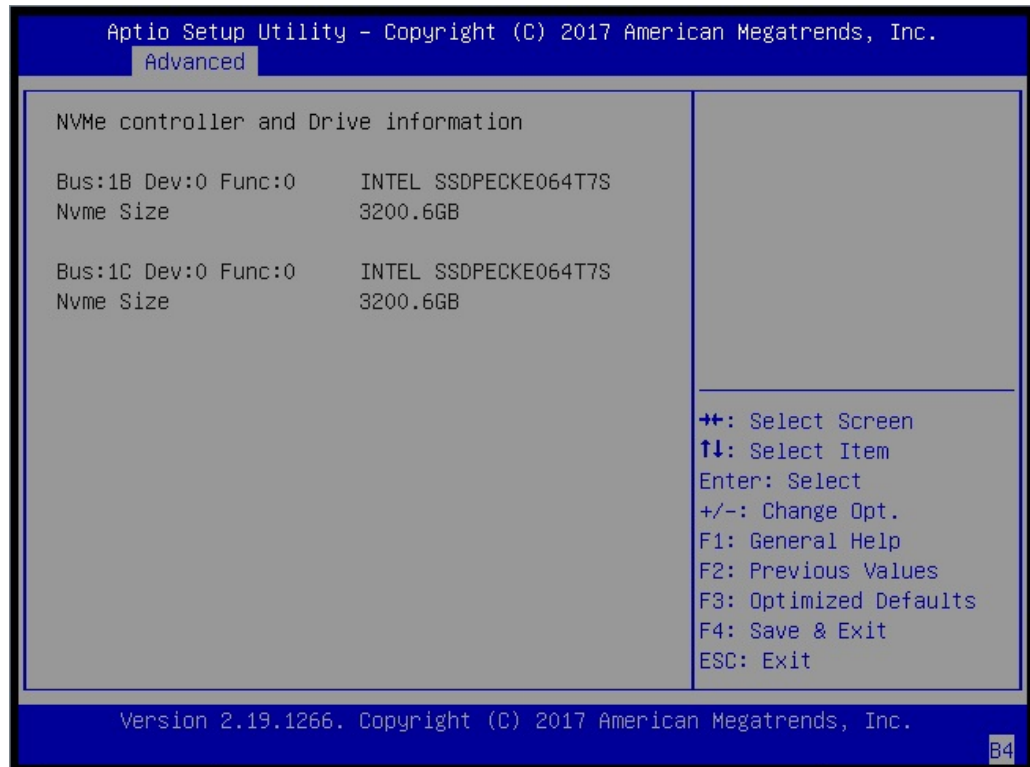
Note - The steps and screens in this procedure are examples. What you actually see might differ depending on your system's equipment and configuration.

4. **Navigate to the BIOS Setup Utility Advanced page.**



5. **Select NVMe Configuration.**

A list of installed Oracle Flash Accelerator F640 PCIe Cards appears.



▼ Replace Oracle F640 Flash Card (Server Power-Off)

Replace an existing Oracle Flash Accelerator F640 PCIe Card if the drive fails or the usable drive life has been exceeded.



Caution - Possible data loss. Exceeding the maximum number of Oracle Flash Accelerator F640 PCIe Cards or placing cards in unsupported slots results in a host platform error report and shutdown.



Caution - Possible component damage. Circuit boards and drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components along their connector edges. These procedures require that you handle components that are sensitive to electrostatic discharge. This sensitivity can cause the components to fail. To avoid damage, ensure that you follow antistatic practices as described in [“ESD Safety Measures” on page 28](#).



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F640 PCIe Card to facilitate airflow. Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card removal and replacement instructions.

The following steps provide an example procedure. Follow the server service manual for detailed instructions.

1. **Prepare the server operating system, as required, before you remove drives.**
 - Follow the server service manual instructions for orderly shutdown during NVMe storage drive insertion and removal service actions.
 - Unmount Oracle F640 Flash Cards. Refer to the server service manual for detailed instructions.
2. **Observe the status indicator LEDs on the back panel of the server to verify which Oracle F640 Flash Card in the server requires replacement.**
 - See [“Status Indicators” on page 15](#).
 - ASIC 1 status – Solid Green (operational)
 - ASIC 2 status – Solid Green (operational)
 - PCIe Link Activity – Green (Blinks, IO activity); Amber (Solid, idle)
 - Drive Health – Green (operational); Yellow (Pre-fail); Red (non-operational)
 - Note where the PCIe cards are installed.
3. **Prepare the server for service.**

Refer to the server service manual for detailed instructions.



Caution - Hazardous voltages are present. Disconnect the server from the main power and from any networks before installing the card to avoid electrical shock.

- a. **Remove the server from active operation.**



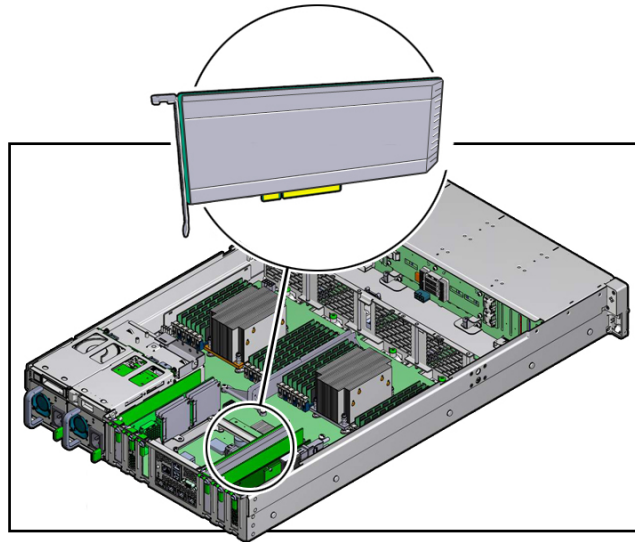
Caution - Possible data loss. Exceeding the maximum number of Oracle Flash Accelerator F640 PCIe Cards or placing cards in unsupported slots results in a host platform error report and shutdown.

- b. **Power down (turn off) the server.**
- c. **Take antistatic measures.**
See [“ESD Safety Measures” on page 28.](#)
- d. **Disconnect all power cords from the server power supplies.**
- e. **Remove the cover from the chassis.**
Your server chassis might use another configuration.

4. **Identify the physical location of Oracle F640 Flash Cards that you want to remove.**

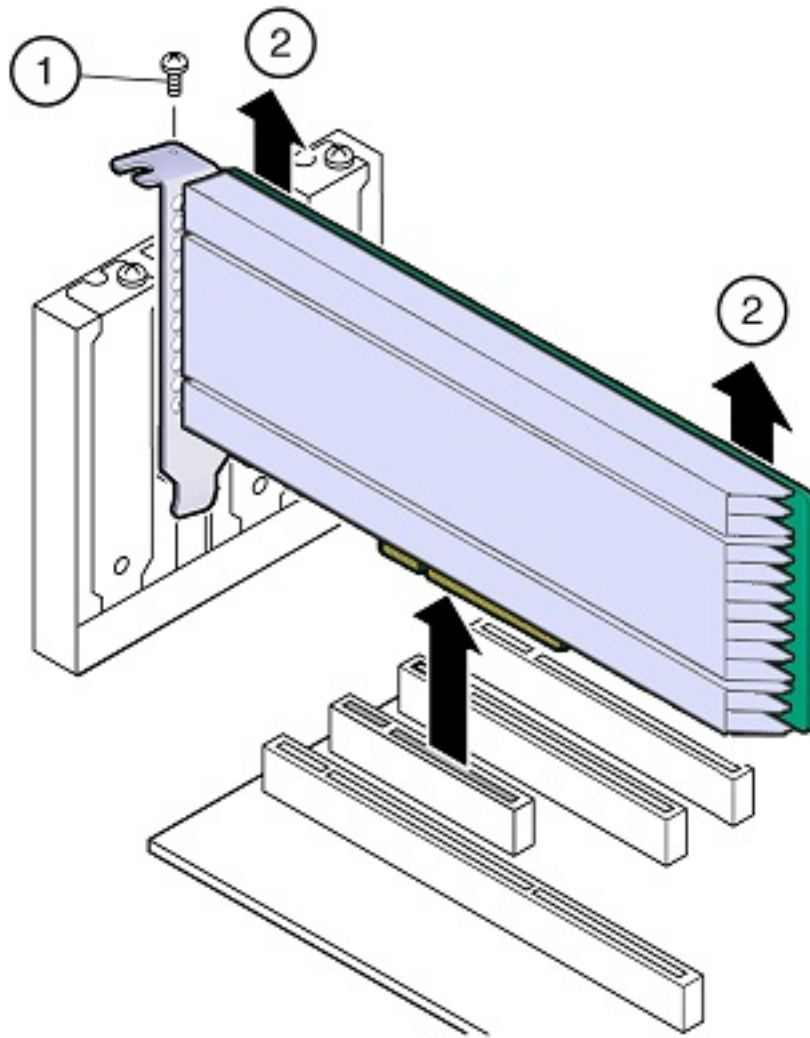
Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F640 PCIe Card to facilitate airflow. Refer to the server service manual for instructions.

Refer to [“Supported Hardware and Software”](#) in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*.



5. **Remove the bracket from the server chassis [1].**
Remove the bracket screw.
6. **Remove the card from the server chassis [2].**

Carefully lift the card out of the PCIe slot to remove the card.



Caution - Hot surface during operation and after. Avoid contact. Surfaces are hot and might cause personal injury if touched.

Note - When you remove a PCIe card, you should replace it with another PCIe card or a PCIe filler panel. Installing PCIe filler panels in vacant PCIe slots helps reduce the level of electromagnetic interference (EMI) emitted by the server.

7. Place the PCIe card on an antistatic mat.

8. Locate the proper PCIe slot for the card you are replacing.

If necessary, remove the PCIe filler panel from the slot.

9. Insert the replacement card in the supported PCIe slot.

Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F640 PCIe Card to facilitate airflow.

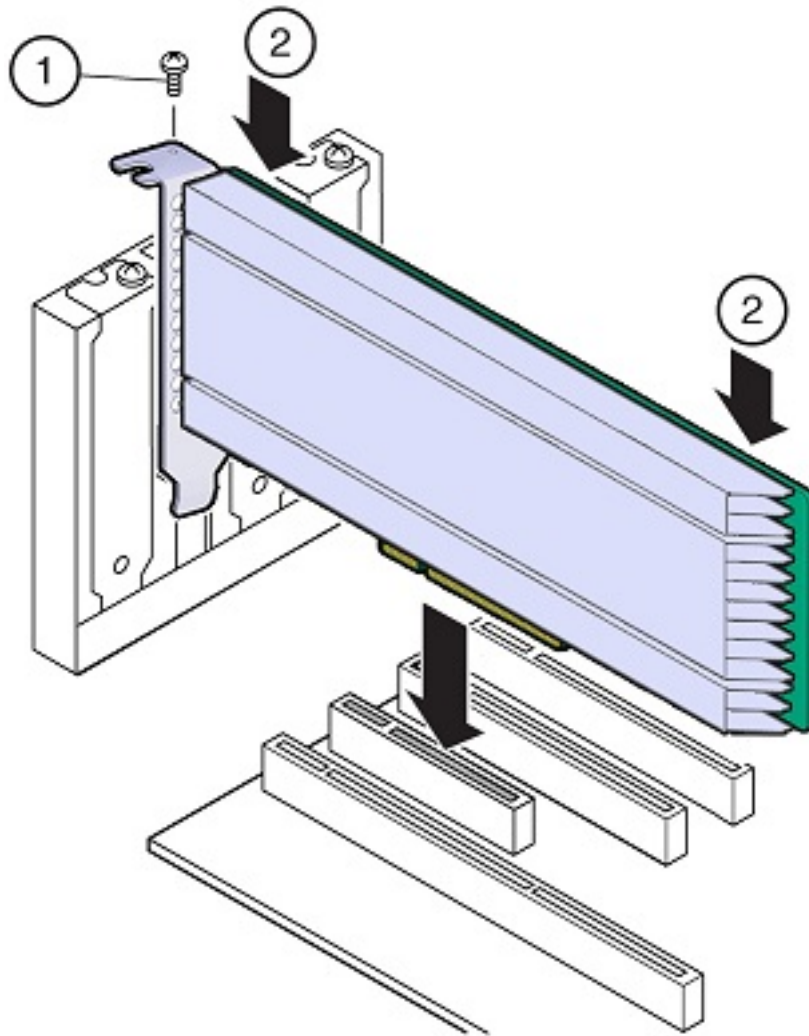
Your server chassis might contain a card riser or other configuration. Refer to the server service manual for card installation instructions.

a. Remove the blank bracket panel on the server chassis that aligns with the empty PCIe slot [1].

Save the bracket screw, if applicable.

b. Press down gently, but firmly, to properly seat the card in the slot [2].

The following figure shows how to insert the card in a PCIe slot.



Your server chassis might contain a card riser or other configuration. Refer to the server service manual for card installation instructions.

10. Secure the card bracket to the server chassis.

Install the bracket screw, as required to secure the card to the server chassis.

Or, engage the server retention mechanism to secure the card to the server chassis.

11. Return the server to service.

Refer to the server service manual for detailed instructions.

a. Replace the cover.

Your server chassis might use another configuration.

b. Reconnect the power cord and any network cables.

c. Power on the system.

The card hardware insertion is complete.

12. Configure Oracle F640 Flash Card and verify drive availability.

- Follow the server service manual instructions for Oracle F640 Flash Card NVMe storage drive configuration and identification.
- Use appropriate software commands to return the system to an operational state:
 - Power on Oracle F640 Flash Card, as required.
 - Attach a device driver, as required.
 - Re-activate mirror if manual intervention is required.
 - Re-sync mirror if manual intervention is required.

13. Verify that the Fail LED is not lit and that the green Health LED is lit on the card that you installed.

See [“Status Indicators” on page 15.](#)

▼ Replace Oracle F640 Flash Card (Server Power-On)

Replace an existing Oracle Flash Accelerator F640 PCIe Card if the drive fails or the usable drive life has been exceeded.



Caution - Possible data loss. Exceeding the maximum number of Oracle 6.4TB NVMe PCIe Flash Cards or placing cards in unsupported slots results in a host platform error report and shutdown.



Caution - Possible component damage. Circuit boards and drives contain electronic components that are extremely sensitive to static electricity. Ordinary amounts of static electricity from clothing or the work environment can destroy the components located on these boards. Do not touch the components along their connector edges. These procedures require that you handle components that are sensitive to electrostatic discharge. This sensitivity can cause the components to fail. To avoid damage, ensure that you follow antistatic practices as described in “[ESD Safety Measures](#)” on page 28.



Caution - Hazardous voltages are present. To reduce the risk of electric shock and danger to personal health, follow the instructions.

Note - Your server chassis might require a PCIe carrier extension for each installed Oracle Flash Accelerator F640 PCIe Card to facilitate airflow. Your server chassis might contain a card carrier or other configuration. Refer to the server service manual for PCIe card removal and replacement instructions.

The following steps provide an example procedure. Follow the server service manual detailed instructions.

1. Take antistatic measures.

See “[ESD Safety Measures](#)” on page 28.

2. Prepare the server operating system, as required, before you remove drives.

Some Oracle F640 Flash Cards are hot-service components that can be replaced at any time if the card is not currently in use. Follow the server service manual instructions for orderly shutdown during NVMe storage drive insertion and removal service actions.

Unmount Oracle F640 Flash Cards. Refer to the server service manual for instructions.

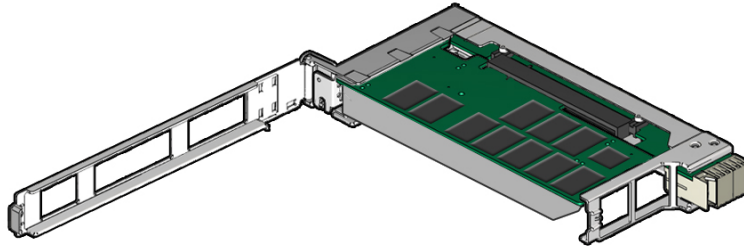
3. Identify the physical location of the carrier and Oracle F640 Flash Card that you want to remove.

Your server chassis might contain a card riser or other configuration. Refer to the server service manual for instructions.

Refer to “[Supported Hardware and Software](#)” in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes* at <https://www.oracle.com/goto/oracleflashf640/docs>.

4. Observe the status indicator LEDs on the server to verify which Oracle F640 Flash Card in the server requires replacement.

- See [“Status Indicators” on page 15.](#)
 - ASIC 1 status- Solid Green (operational)
 - ASIC 2 status- Solid Green (operational)
 - PCIe Link Activity- Green (Blinks, IO activity); Amber (Solid, idle)
 - Drive Health- Green (operational); Yellow (Pre-fail); Red (non-operational)
 - If necessary, note where the PCIe cards are installed.
5. **Remove the carrier from the server slot.**
 6. **Carefully remove Oracle F640 Flash Card from the carrier.**



- a. **Press the green tab to unlock the carrier latch and open the top of the PCIe carrier.**
- b. **Slide the card from the slot.**



Caution - Avoid twisting, tilting, or pulling unevenly on the PCIe card, which could damage the carrier slot or components on the PCIe carrier circuit board.

7. **Place the card on an antistatic mat.**
See [“ESD Safety Measures” on page 28.](#)
8. **Locate the PCIe slot in the carrier for the card you are replacing.**
If necessary, remove the PCIe filler panel from the slot.
9. **Insert the replacement card in the carrier, in the supported PCIe slot.**

- a. **Remove the blank bracket panel on the carrier that aligns with the empty PCIe slot (optional).**

Save the bracket screw, if applicable.

- b. **Press down gently, but firmly, to properly seat the card in the slot.**

10. **Secure the card bracket to the carrier.**

Note - If the PCIe card includes a mounting screw, do not use the mounting screw. The carrier does not accept mounting screws.

Engage the server retention mechanism to secure the card to the carrier.

11. **Insert the carrier into the server chassis, in the supported PCIe slot.**

12. **For hot-plug service actions, configure Oracle F640 Flash Card and verify drive availability.**

- Follow the server service manual instructions for Oracle F640 Flash Card NVMe storage drive configuration and identification.
- Use appropriate software commands to return the system to an operational state:
 - Power on Oracle F640 Flash Card, as required.
 - Attach a device driver, as required.
 - Re-activate mirror if manual intervention is required.
 - Re-sync mirror if manual intervention is required.

13. **At a terminal, use the `hotplug` command to ensure that the card is connected.**

For example:

```
# hotplug list /SYS/CMIOU0/PCIE1
[/SYS/CMIOU0/PCIE1]  ENABLED
network@0 <pci.0,0> ONLINE
network@0,1 <pci.0,1> ONLINE
network@0,2 <pci.0,2> ONLINE
network@0,3 <pci.0,3> ONLINE
```

14. **Verify that the Fail LED is not lit and that the green Health LED is lit on the card that you installed.**

See [“Status Indicators” on page 15](#).

Related Information

- [“Product Overview” on page 11](#)

Troubleshooting Oracle F640 Flash Card Cooling

Maintaining the proper internal operating temperature of the server is crucial to the health of the server. To prevent server shutdown and damage to components, address overtemperature and hardware-related issues as soon as they occur.

Use the status indicator LEDs to determine the status of Oracle Flash Accelerator F640 PCIe Card. The LEDs provide key status information to diagnose Oracle F640 Flash Card issues. See [“Status Indicators” on page 15](#).

Oracle F640 Flash Card is designed to provide continuous full bandwidth performance with temperatures up to 73°C. Qualified host platforms with required software updates operate with sufficient margin to the maximum temperature under worst case environments. Should the system exceed the maximum operating temperature, or a system fault occur that causes internal temperatures of the flash memory modules to rise above this limit, Oracle F640 Flash Card responds as follows:

- 73°C – Drive write throttling is engaged to reduce Oracle F640 Flash Card power.
 - Oracle F640 Flash Card amber status indicator LED is lit, Service Action Required.
 - Temperature warning is displayed in utility output.
- 78°C – Additional drive write throttling is engaged.
 - Oracle F640 Flash Card amber status indicator LED is lit, Service Action Required.
 - Critical temperature status is displayed in utility output.



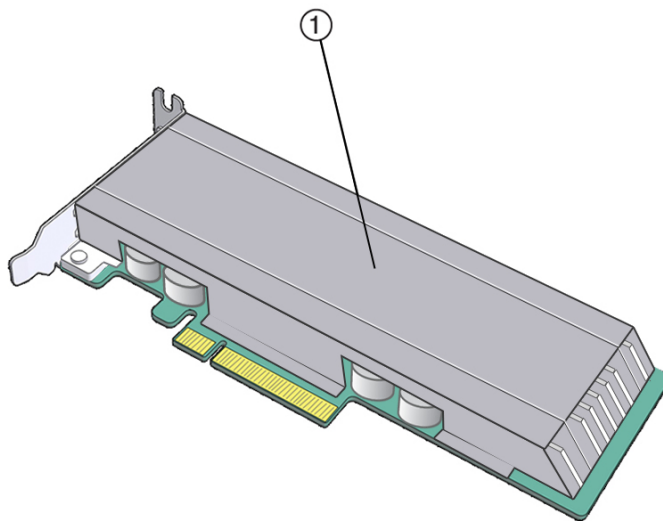
Caution - Sustained critical temperatures might cause data loss.

Oracle Flash Accelerator F640 PCIe Cards have an internal temperature sensor with an accuracy of +/-2°C over a range of -10°C to +85°C which can be monitored using the NVMe Health Log. For more information on sensor reading, refer to the SMART attributes. In addition, Oracle F640 Flash Cards provide out-of-band access to temperature by means of an SMBUS. The sensor has an accuracy of +/-3°C over a range of -20°C to 125°C. SMBUS temperature sensor is not reported in NVMe Health Log. Oracle F640 Flash Card thermal parameters are:

- Tstart – Throttling starts

- Tmax – Maximum throttling is applied
- Pmaxdrop – Maximum drop allowed determined by the internal setting
- Thysteresis – 2°C set during the cooling phase to prevent rapid oscillations between throttle states. The temperature must reach the hysteresis level to return the power ceiling back to previous levels.

The following image shows Oracle F640 Flash Card temperature sensor location.



(1): Oracle F640 Flash Card temperature sensor location

Refer to the server documentation for additional service information.

Related Information

- [“Status Indicators” on page 15](#)
- [“Product Overview” on page 11](#)
- [“Technical Support” on page 59](#)

Technical Support

For assistance installing, configuring, or running Oracle Flash Accelerator F640 PCIe Card, contact Technical Support.

Go to <https://www.oracle.com/support/>. Please have your server Customer Support ID (CSI) ready. Sign in to My Oracle Support to open a service request. You must have purchased support to access My Oracle Support.

Related Information

- [“Supported Hardware and Software” in *Oracle Flash Accelerator F640 PCIe Card and Oracle 6.4 TB NVMe SSD Product Notes*.](#)

Index

A

about the card, 12
activity, 15
automatic storage management, 30

B

BIOS Setup Utility, 43

C

capabilities, 17
capacity, 14
card installation, 33
characteristics, 14
cold service, 42
compatibility, 14
components, 14, 42
controller, 14
critical temperature, 57
customer-replaceable unit (CRU), 42

D

data-path protection, 13
description, 12
device name, 14
dimensions, 22
drive write throttling, 57

E

EFI label, 29

electrical specifications, 17, 20
electrostatic discharge (ESD)
 antistatic wrist strap, 28
 preventing using an antistatic mat, 28
 safety measures, 28
environmental specifications, 17, 19

F

features, key, 13
feedback, 9
field-replaceable unit (FRU), 42
firmware, 41

H

hardware, 14
host system, 31
hot service, 42

I

indicators, 15, 57
insertion, 46, 53
inspecting, 25
install Oracle F640 Flash Card, 37
 server power-off, 34
 server power-on, 37
installation, 33
 overview, 33
 task map, 34
IOPS, 12, 13

K

key features, 13

L

latency, 13

LEDs, 15, 57

life monitoring, 14

M

maintenance, 41

manufacturing name, 14

N

name

device, 14

manufacturing, 14

NAND, 14

new card installation, 34

NVMe, 12

NVMe Health Log, 57

O

operating system installation, 43

operating systems, 14

optimization, 29

Oracle F640 Flash Card, 11

overview, 11

P

physical specifications, 17

power loss, 13

precautions, 27

prepare for installation, 25

preparing card for installation, 25

prevention measures, ESD, 29

product notes, 9

product overview, 11

product specifications, 17

R

reliability specifications, 17, 21

removal, 46, 53

replacement, 46, 53

replacement instructions, 42

S

safety

ESD, 28

information, 28

precautions, 27

symbols, 28

service information, 41

service overview, 41

serviceability, 42

servicing cards, 41

ship kit, 26

SMART, 13

SMART attributes, 57

SMBUS temperature sensor, 57

software, 14

specifications, 17

SSD description, 12

status, 15, 57

storage drives, indicators, 15

style, form factor, 14

symbols, 28

T

task map

installation, 34

technical support, 59

temperature sensor, 57

tools required for service, 26

troubleshooting, 41, 57

U

- unpacking, 25
- updating firmware, 31
- updating host system, 31
- utilities, 14

V

- viewing cards, 43
- volume manager, 30

Z

- ZFS file system, 29

