Intel® Optane™ Solid State Drive 900P Series

Installation Guide

October 2017

Ordering Information

Contact your local Intel sales representative for ordering information.

Revision History

Revision Number	Description	Revision Date
001	• Initial release	October 2017

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1   Overview

This guide describes how to install the Windows* operating system into the Intel® Optane™ SSD 900P Series, as a bootable medium in the computing platform.

Note: Datacenter usage, workloads or environments are not supported and will invalidate the warranty for the Intel® Optane™ SSD 900P Series.

The information in this document is intended to assist in the setup and preparation of the Intel® Optane™ SSD as the primary boot device, not a secondary storage device.

The Intel® Optane™ SSD 900P Series utilizes the PCIe* NVMe* interface. NVMe is a scalable non-volatile memory host interface that can help increase efficiency and reduce latency, while delivering high speed access to storage media connected through the PCIe bus, thus resulting in increased overall bandwidth. This high bandwidth bus technology is a data transport feature that has become an industry standard for a wide range of motherboard vendors today.

Table 1:   Terminology

Abbreviation	Term	Definition
CSM	Compatibility Support Module	A UEFI firmware feature that enables legacy BIOS-style booting by emulating a BIOS environment.
NVMe	Non-Volatile Memory Express	The next-generation specification used to access SSDs through the PCI Express* bus.
PCIe	Peripheral Component Interconnect Express	A standard connection found on most systems that supports the high speed of the NVMe SSD.
UEFI	Unified Extensible Firmware Interface	A specification for system firmware, meant to replace legacy BIOS, that provides software layer between the operating system and the system firmware.

Table 2:   References

Document	Location
NVMe Specification 1.0	http://nvmexpress.org/resources/specifications/
UEFI Specification	http://uefi.org/specifications

2   System Requirements

2.1   Software

2.1.1 Determining Compatibility

The information and instructions in this guide apply to Intel® SSD's that utilize the PCIe* with NVMe* Interface. Check that you have the latest instructions and compatibility information before attempting to install the Intel® SSD.

Setting up the NVMe SSD as the boot drive is not supported on every system configuration. Specific requirements must be met for a successful boot. To support the required UEFI NVMe driver, your system's firmware must be based on UEFI 2.3.1 or later. For Specific details about UEFI support and NVMe driver support in the OS, please see Sections 2.1.2 and 2.1.3.

If your system was purchased after 2012 or shipped with Windows* 8.1 or Windows* 10 pre-installed, it most likely supports UEFI. Check with your system vendor to verify.

2.1.2 UEFI BIOS Compatibility

Booting from an NVMe PCIe SSD is only supported on systems that support UEFI, a system firmware that endeavors to improve upon legacy BIOS and standardize system processes, such as booting, loading drivers, and more.

It is important that the operating system installer is booted in UEFI mode. Booting in UEFI allows the installer to create an entry in the UEFI boot menu and create a UEFI system partition on the boot device that will contain the bootloaders of installed operating systems. Upon start up, the boot manager will search the UEFI system partition for a valid operating system bootloader. This bootloader is then executed to load the operating system.

Windows 7 does not support native UEFI booting without a Compatibility Support Module. As a result, system compatibility is limited and varies by vendor.

To properly boot Windows 7 from an NVMe SSD, your system must support loading UEFI drivers when the Compatibility Support Module is enabled. To determine if your system is supported, check the following:

- Verify that the system BIOS Boot motherboard settings are configured to boot from UEFI devices. This is often the default on most modern motherboards. For the best chance of success, disable the legacy boot and select UEFI.

- Consult your motherboard vendor's support website to find the latest UEFI BIOS for your particular motherboard.

For maximum optimization, it is recommended to utilize PCIe Gen 3 x4.

2.1.3 Operating System Compatibility

Operating System compatibility is dependent on the availability of the NVMe driver. Specifically, later Windows* operating systems contain NVMe driver support in the latest versions of the OS. Windows 10* is recommended as it offers the most feature support.

Table 3:   Windows Compatibility

OS	Support	Additional Notes
Windows 10	Supported	Native NVMe support with Microsoft 'in-box' drivers
Windows 8.1*	Supported	Native NVMe support with Microsoft 'in-box' drivers
Windows 7*	Limited Support	Limited system compatibility and features. Requires additional drivers

Note: Linux* support depends on the Operating System, please consult your OS vendor for more information as support may be limited.

Intel also offers additional support for the Intel® Optane™ SSD 900P Series through the NVMe driver, available on the Intel Support site.

2.2   Hardware

NVMe hardware support is growing and becoming more of an industry standard specification, but there may still be several motherboards on the market that are not properly configured to boot from NVMe SSDs.

Successful motherboard BIOS configurations vary widely and are heavily dependent on the motherboard manufacturer. There is no specific set of options that will guarantee a successful boot. It is common that the BIOS settings of a typical motherboard will need to be adjusted. See the OEM's manual for further specific instructions on NVMe hardware compatibility.

2.2.1 Hardware Installation

The Intel® Optane™ SSD 900P Series is available in the 2.5-inch U.2 form factor and Add-in-Card (AIC) form factors. Each form factor has a unique set of steps to follow for proper installation in the motherboard or system.

Consult your motherboard/system vendor's user and installation guide for the proper connections. Carefully note the proper PCIe NVMe connectors available.

Additional installation tips can be found on the Intel support site: Physical Installation Instructions for Intel® Optane™ SSD 900P Series.

3 UEFI Configuration and Setup

3.1 Enabling the Compatibility Support

This is an example of how to configure the BIOS for CSM support in addition to configuring the boot options to enable UEFI.

Consult your specific motherboard vendor's User Guide or support site for the proper settings

Example

ASUS* Prime Z270-A BIOS Configuration

Specifications

Motherboard	ASUS Prime Z270-A*
Chipset	Intel® Z270 Chipset
BIOS Revision	0906 (3/24/2017)

Compatibility Notes

UEFI is a requirement across all windows installations and CSM needs to be enabled for the Windows 7 operating system.
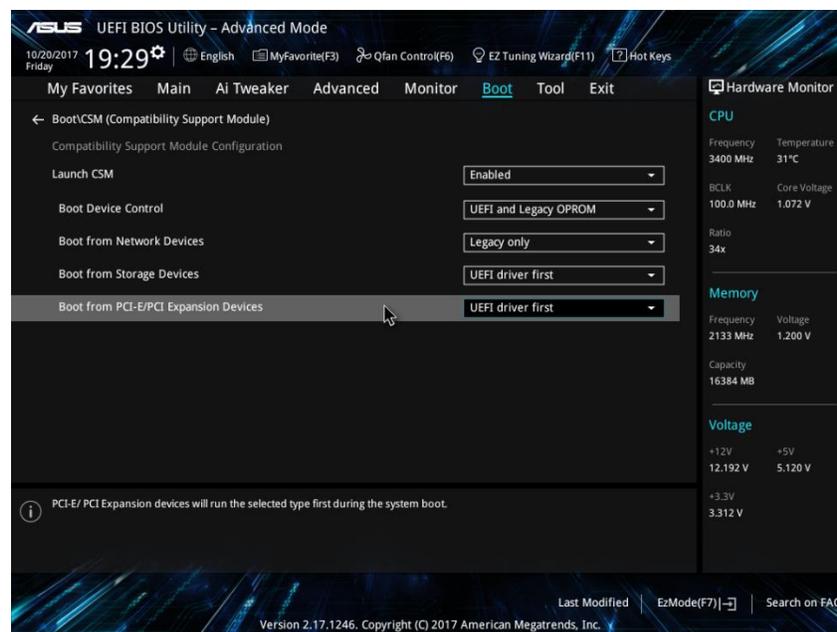
Windows 8.1/10*

Boot options must be configured to UEFI

Windows 7*

1. Open CSM (Compatibility Support Module) under the **Boot** tab
2. Verify that **Launch CSM** is *Enabled*
3. Set **Boot from Storage Devices** and **Boot from PCI-E/PCI Expansion Devices** to *UEFI driver first*

Figure 1: Required Configuration for Windows 7 Boot Support

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4 Windows Install Process

4.1 Windows 8 and Windows 10

The Windows 8.1* and Windows 10* operating systems offer native support for Intel® SSDs that utilize the PCIe* with NVMe* interface and have a standard installation process. Follow these steps for proper installation:

1. Ensure that your BIOS is configured to EFI (see section 2.2.2)
2. Boot from the Windows OS installation media (DVD or USB Key)

   Note: Follow the instructions from the board/system manufacturer to adjust the Boot Priority in the system BIOS for the Installation Media as required.
3. Follow the steps to install the OS to the Intel® Optane™ SSD

   Note: If the Intel® Optane™ SSD does not appear in the list of drives during the installation process, please contact your board/system manufacturer for the proper BIOS settings to enable this support
4. Boot the Windows operating system using the Intel® Optane™ SSD.
5. At this time we recommended installing the Intel NVMe driver available here: https://downloadcenter.intel.com/download/27231/NVMe-Drivers-for-Intel-SSDs?v-t

4.2 Windows 7

For the Windows 7* OS, support for SSDs that utilize the PCIe* with NVMe* interface was added at a later time, as a Windows Update.

As a result, the Windows 7 installation media will not detect the SSD. During installation an NVMe driver must be added in order for the OS to detect the drive properly.

For this installation, after ensuring that your BIOS is configured to CSM Enabled with UEFI, refer to Section 3, support for Storage devices, you will load the NVMe* Driver for Intel® SSD's during the OS installation process.

Loading Drivers in Windows Installation

1. Inject the USB 3.0 drivers into the Windows 7* installation image files on the installation media as described in Section 4.2.1
2. Download the NVMe* Driver for Intel® SSD's and place on the Windows 7* installation media, or other USB drive.
3. Boot from the Windows 7* installation media (Making sure to have the UEFI Boot media as Priority 1 in the System BIOS)

   Note: You will not be able to see the SSD in the drive list. This is because Windows does not have the required drivers
4. Click **Load driver**
5. Browse to the driver you copied to the separate media
6. Select the appropriate driver and click **Next**

   The Intel® Optane™ SSD 900P drive should now be listed as an installation target
7. Continue with the installation

4.2.1   USB 3.0 Driver Inject

Note: USB 3.0 drivers are backward compatible with USB 2.0.

Intel recommends using the DISM commands within the Command Prompt

For the GUI method, you can use applications such as Intel's Windows 7* USB 3.0 Creator Utility: (https://downloadcenter.intel.com/download/25476/Windows-7-USB-3-0-Creator- Utility?product=89190)

Using the DISM commands, the provided USB drivers must be injected into the windows 7 ISO image. The following steps are vital in order to see the NVMe driver directories on the USB install key.

1. Create a temporary working directory, such as `C:\Win7USB`

2. In your working directory, create two sub-directories called "USBDriver" and "Mount"

3. Extract your USB driver files into your "USBDriver" subdirectory

4. From your Windows 7 install key , copy the "install.wim" and "boot.wim" files from the "sources" directory on your install key to the working directory `C:\Win7USB`.

5. Open a command prompt as administrator, and change to your working directory.
For Example*:* `cd C:\Win7USB`

6. Based on the version of Windows 7 you have available, determine which index number to modify

   Choose the index that matches the Windows 7 version you have. To determine the index, run the following command:

   `dism /get-wiminfo /wimfile:install.wim`

   To modify "boot.wim" after modifying "install.wim" run the following command and follow subsequent steps:

   `dism /get-wiminfo /wimfile:boot.wim`

   Using index 3 for this example:

```
C:\Win7USB>dism /get-wiminfo /wimfile:install.wim

Deployment Image Servicing and Management tool
Version: 6.1.7600.16385

Details for image : install.wim

Index : 1
Name : Windows 7 HOMEBASIC
Description : Windows 7 HOMEBASIC
Size : 11,710,161,360 bytes

Index : 2
Name : Windows 7 HOMEPREMIUM
Description : Windows 7 HOMEPREMIUM
Size : 12,222,587,449 bytes

Index : 3
Name : Windows 7 PROFESSIONAL
Description : Windows 7 PROFESSIONAL
Size : 12,131,063,436 bytes

Index : 4
Name : Windows 7 ULTIMATE
Description : Windows 7 ULTIMATE
Size : 12,285,492,779 bytes

The operation completed successfully.

C:\Win7USB>
```

7. Modify the "install.wim" file by running these commands:

    ```
    dism /mount-wim /wimfile:install.wim /index:3 /mountdir:mount
    dism /image:mount /add-package: [Path of the USBDriver files] i.e C:\Win7USB\USBDriver
    dism /get-packages /image:mount
    dism /unmount-wim /mountdir:mount /commit
    ```

8. Modify the "boot.wim" file by running these commands

    ```
    dism /mount-wim /wimfile:boot.wim /index:3 /mountdir:mount
    dism /image:mount /add-driver:C:\Win7USB\USB3 /recurse
    dism /get-drivers /image:mount
    dism /unmount-wim /mountdir:mount /commit
    ```

9. Now take your updated "install.wim" and "boot.wim" in the working directory and copy it back to the "sources" directory on your install key.

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5 Installation System Confirmation

After the drive boots on its own, then it is confirmed that the drive will boot as a bootable medium.

For further management, SSD utility software tools are provided.

- **Intel® SSD Toolbox**
  The Intel® Solid State Drive Toolbox (Intel® SSD Toolbox) is drive management software that allows you to view current drive information for Intel® Solid State Drives (Intel® SSDs). The tool can be used to assess the drive health, update the firmware, check SMART attributes, and more.

  https://downloadcenter.intel.com/download/27130?v=t

- **CrystalDiskInfo***
  CrystalDiskInfo is a software tool for SSDs that provides a complete report of SMART data, as well as a current temperature and health status. This tool can also be utilized to gather basic information such as buffer size, firmware, and serial numbers. More advanced options such as command time out, end-to-end error reads, and relocation event count can be utilized for determining drive endurance and enabling analysis over the life of the drive.

  https://crystalmark.info/?lang=en

- **CrystalDiskMark***
  CrystalDiskMark is a benchmark software tool that allows you to measure sequential reads/writes as well as other benchmarking options for further management. This tool is useful because it allows you check if your drive is running at optimal levels, displaying the results in a user-friendly graph interface, and refers to common benchmarking figures such as MB/s and IOPS. This is an essential tool for testing key features, such as read/write speeds for large files up to 512KB and requires minimal configuration.

  https://crystalmark.info/?lang=en

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