End User Guide

Solidigm Synergy™ Driver

April 2023

Revision 002

SOLIDIGM™

Ordering Information

Contact your local Solidigm sales representative for ordering information.

Revision History

Revision	Description	Date
001	• Initial Release	August 2022
002	• Added Uninstall Solidigm Synergy™ Driver • Added Solidigm™ P41 Plus SSD • DMA Remapping • Windows NVME Supported Features • Renamed HMC to Fast Lane • Quick Start steps for installing Solidigm Synergy™ Software	April 2023

Contents

1 Overview

This document supports customers to enable, configure, and evaluate Solidigm™ Storage Driver. This User guide consists of Supported features list, Solidigm package including (Storage Driver and Installer) Limitations (Hardware, Software, Configuration Limitation) and Power Management.

2 Solidigm Synergy™ Software Package

2.1 Solidigm Synergy™ Software Quick Start Steps

This section will define the steps to install Solidigm Synergy software, including Solidigm Synergy™ Driver and Solidigm Synergy™ Tool.

2.1.1 What is Solidigm Synergy™?

Solidigm Synergy is a free software suite for PCs running Microsoft Windows that unlocks innovative new features on Solidigm client SSDs. By closing the gap between the storage device and the rest of the system, Solidigm Synergy enables a more optimized user experience than hardware alone can provide.

There are two components of Solidigm Synergy, both optional but highly recommended:

The **Solidigm Synergy™ Driver** automatically boosts performance by making “under-the-hood” improvements to the connection between SSD and host system.

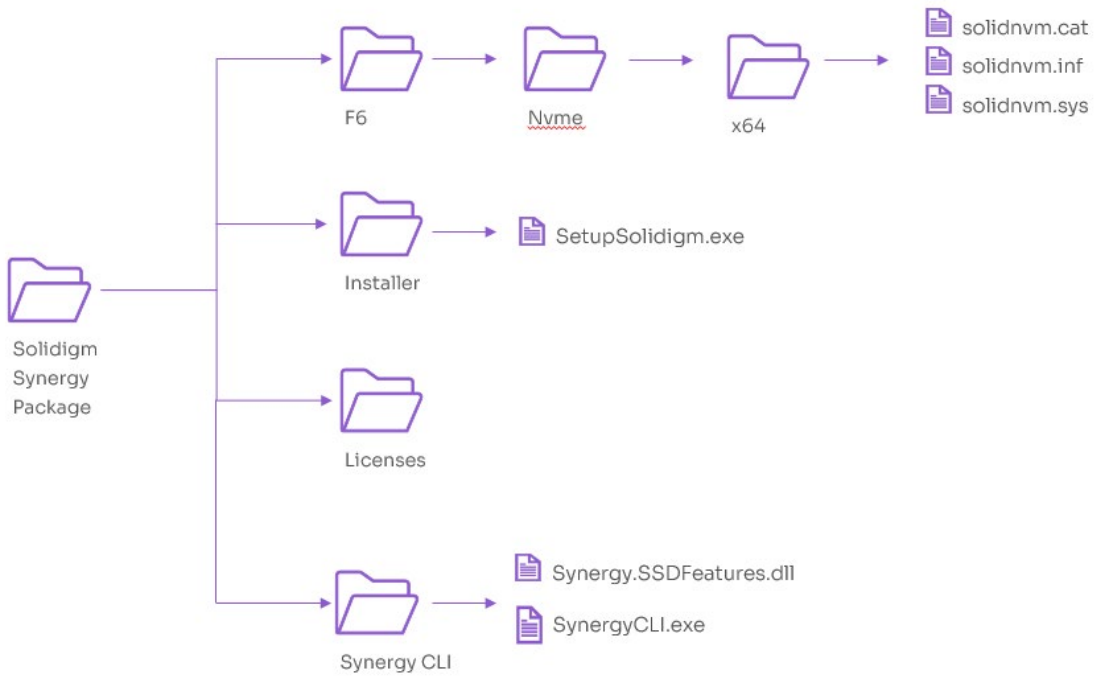
The **Solidigm Synergy™ Toolkit** offers a modern user interface for drive health and information reporting, plus the ability to manually trigger useful functions such as Diagnostic Scan and Secure Erase.

2.1.2 Solidigm Synergy Package

The Solidigm Synergy package structure has the following hierarchy:

- F6
  - NVMe
  - X64
    - Solidnvm.cat
    - Solidnvm.inf
    - Solidnvm.sys
- Installer
  - SetupSolidigm.exe
- License
- Synergy CLI
  - Synergy CLI
  - Synergy SSD feature DLL

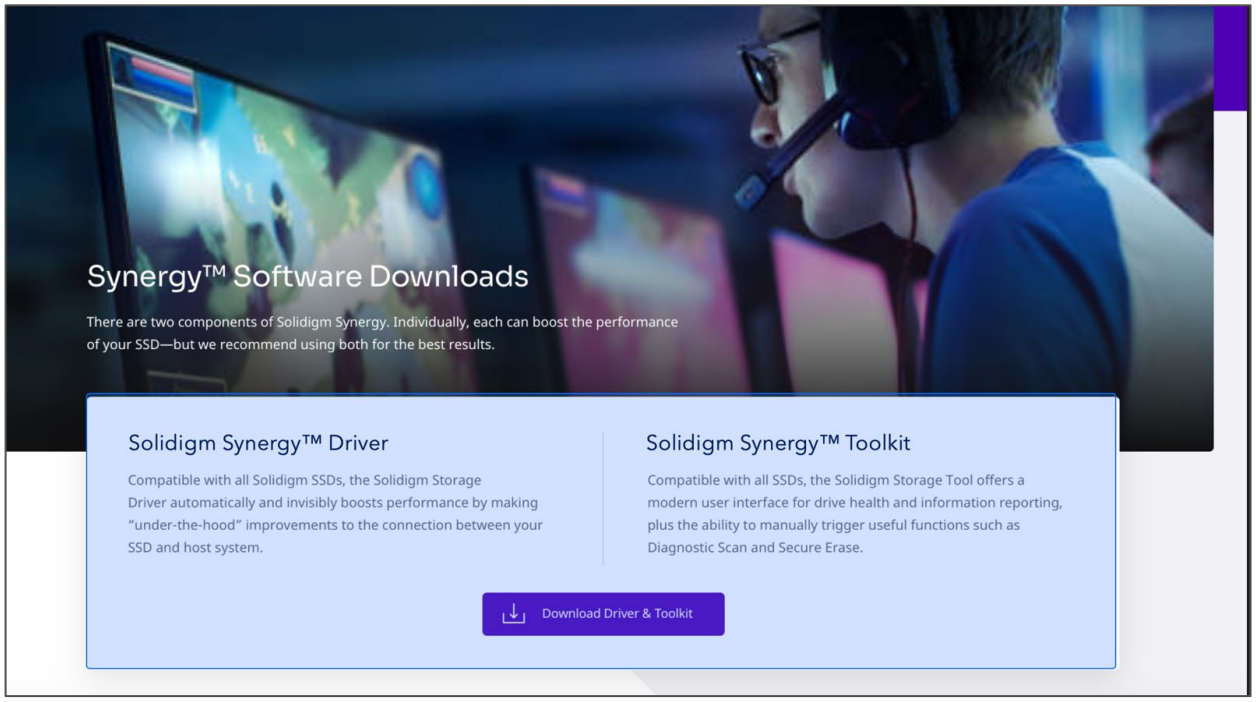
Figure 1: Solidigm Synergy Package Structure



2.1.3 How do I install Solidigm Synergy™?

The Solidigm Synergy Software is available to download at https://www.solidigm.com/synergy. You may choose to install either the Solidigm Synergy Driver or the Solidigm Synergy Toolkit independently, or both.

Figure 2: Free software at https://www.solidigm.com/synergy



Once you have downloaded the installer(s), follow the prompts to install the chosen component(s) on your system.

Figure 3: Welcome to the software installer page, click Next to install

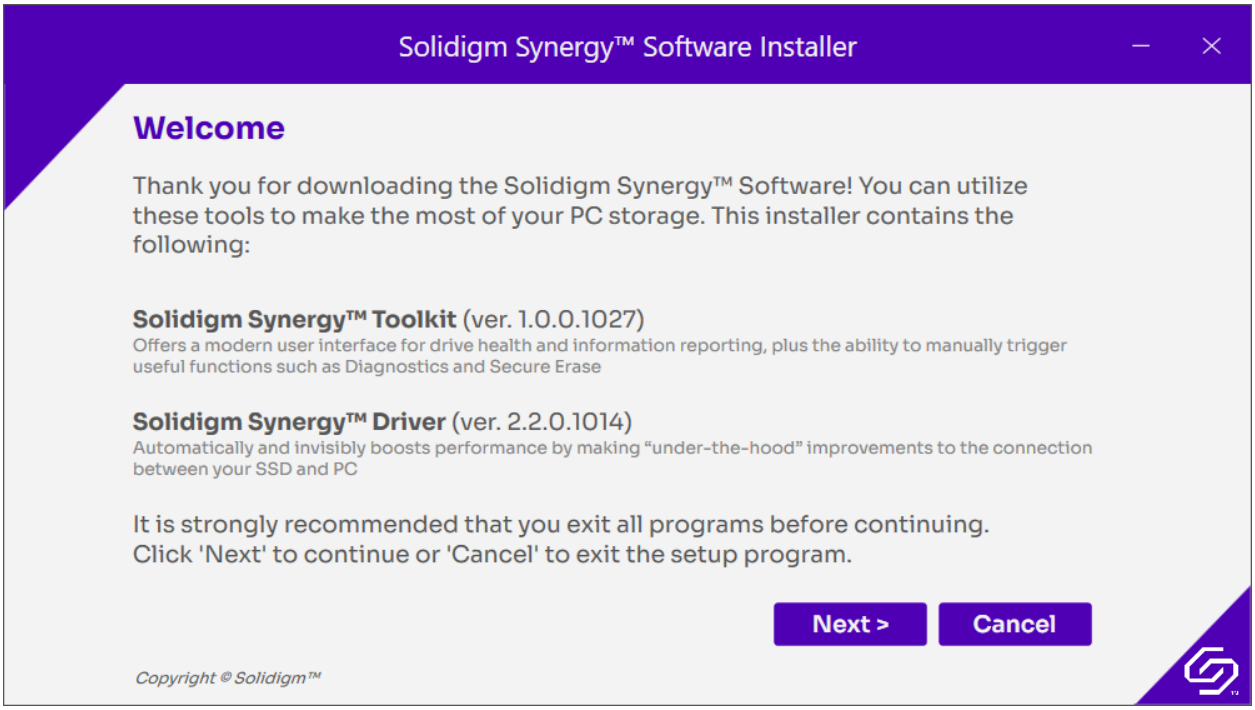


Figure 4: License page, click Next to install

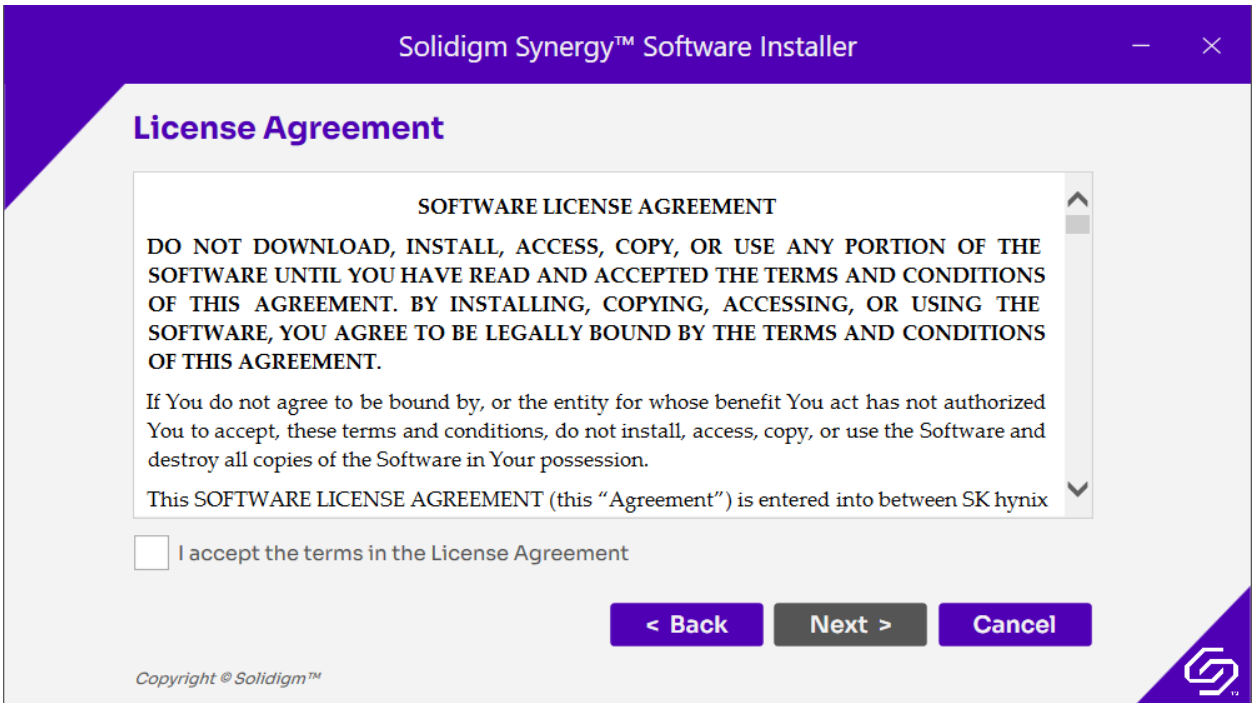


Figure 5: After the License page, select the checkboxes to install driver.exe or tool.exe or both

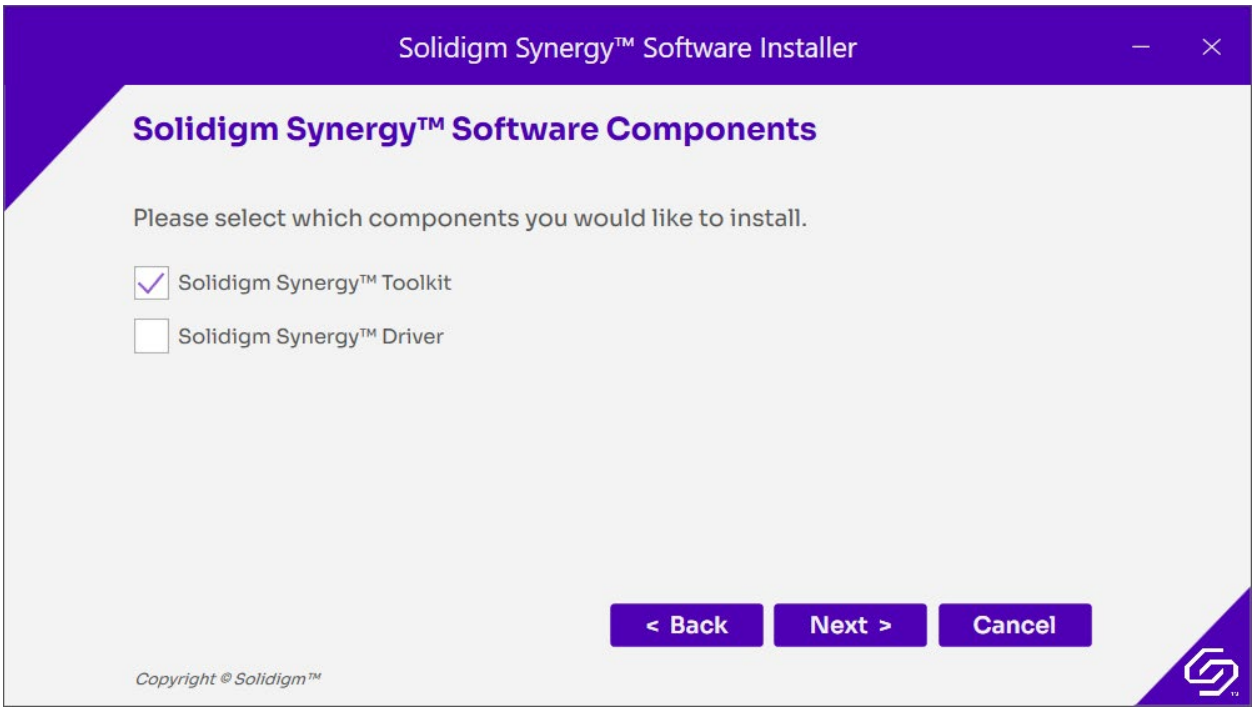
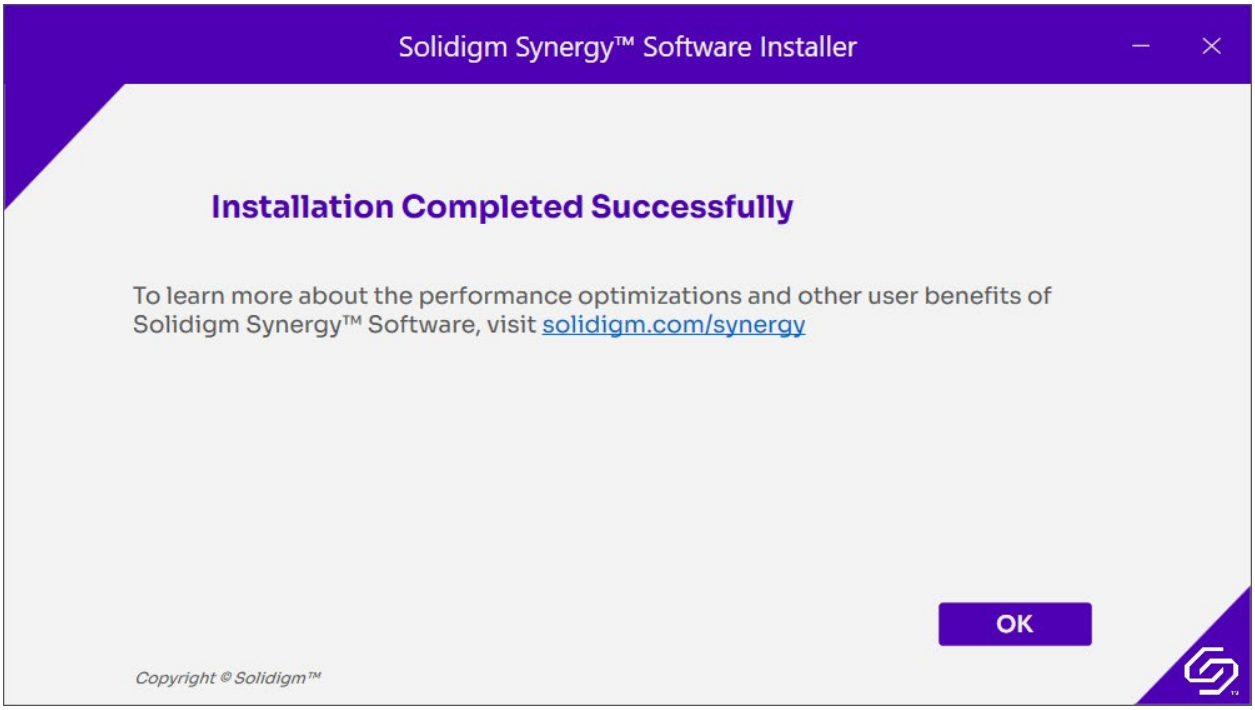
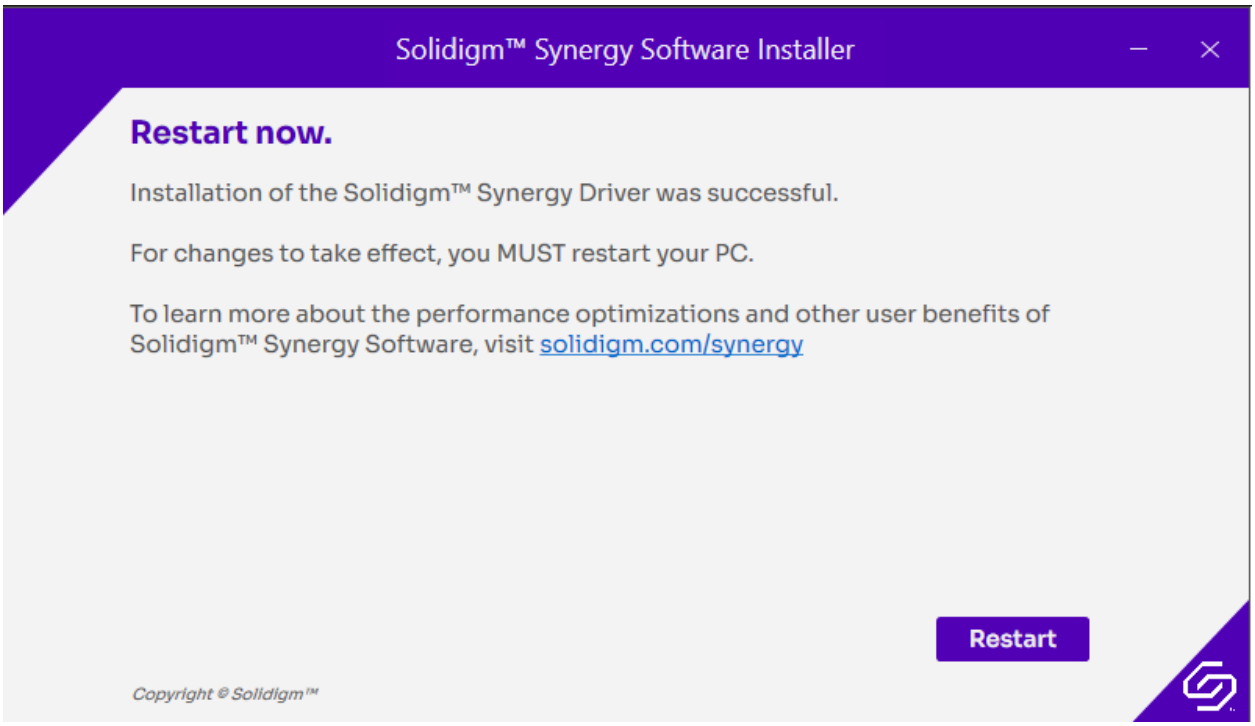


Figure 6: Installation completion will be displayed from the tool



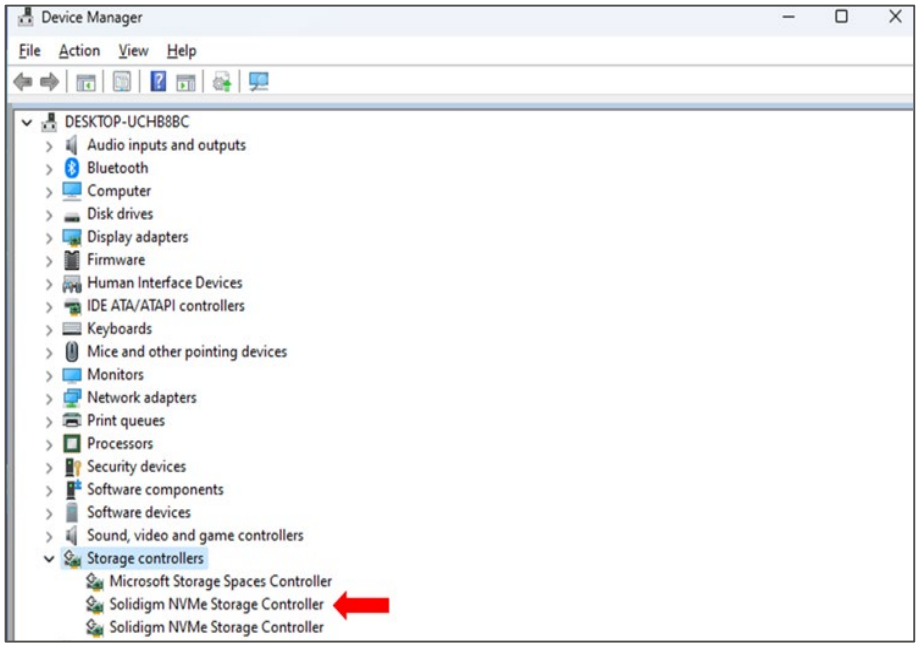
The driver installation process will prompt you to restart your PC.

Figure 7: Restart your PC to complete the driver installation



Once installation is complete, you can verify the driver is present on your system by opening the Windows Device Manager and checking under the Storage controllers drop-down list for an entry titled Solidigm NVMe Storage Controller. If it's there, you're good to go.

Figure 8: Confirm the driver correctly installed in the Windows Device Manager



2.2 Installer

The installer is a software component used for installation and maintenance of both the Solidigm Synergy™ Driver and Solidigm Synergy™ Toolkit on Windows operating systems. The executable filename is SetupSolidigm.exe.

The following command line parameters are available:

Table 1: Installer Command Line Parameters

Parameters	Description
[-help][-?]	Display this help for command-line options.
[-report][-r] <path>	Changes the default log directory path. The **-accepteula** flag must be provided with the silent flag (**-s**).
[-report] <directory>	Path to directory where log files will be saved.
[-reportfile] <filename>	Path and log filename where installer information will be written to.
[-accepteula]	You must accept the End User License Agreement (EULA) and provide this flag when installing in silent mode.
[-onlyapp][-a]	Install only Solidigm Synergy™ Tool application.
[-onlydriver][-o]	Install only Solidigm Synergy™ Driver.

3 Supported Features

Here we will provide an overview of the key features of the Solidigm Synergy™ Driver.

3.1 Fast Lane

Fast Lane, previously known as Host-Managed Caching, is supported on the **Solidigm P41 Plus.**

The purpose of Fast Lane is to improve performance consistency over lifetime of an SSD by keeping the user's most frequently used data on the fastest area of the drive (SLC cache), while the rest of the data resides in slower bulk storage (QLC). It significantly improves utilization of SLC cache within the drive and speeds up access to the user's most frequently used data.

This feature is available in both the Solidigm UI and CLI.

Fast Lane is enabled on supported drives by default, but it can be disabled using the CLI or UI or by adding a registry key.

3.1.1 Via Solidigm Synergy™ Tool CLI

```
set [-help|h] [-output|o (text|nvmxml|json)] -ssd
(Index|SerialNumber|PhysicalPath) FastlaneEnabled = ('true'|'false')
```

FastlaneEnabled = (true|fase) (Required) Specify whether to enable or disable

true: Enable Fast Lane

false: Disable Fast Lane

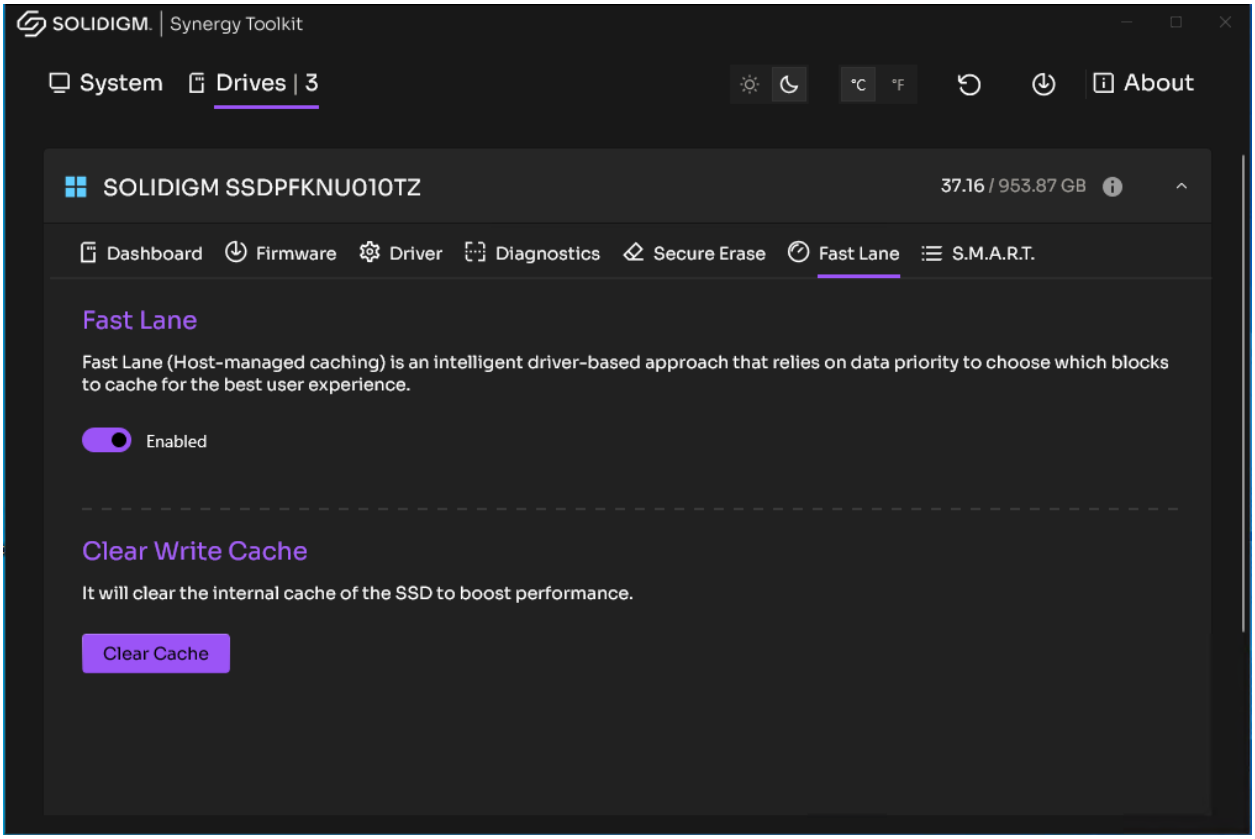
Limitations: To successfully execute this command, the driver and SSD must support this feature. After sending Fast Lane enable/disable, a reboot is necessary to perform operation successfully.

Currently, the Fast Lane feature is enabled by default. In the CLI tool user can also check the status of Fast Lane if enabled or disabled.

3.1.2 Via Solidigm Synergy™ Toolkit GUI

User can enable/disable Fast Lane by using Solidigm Synergy™ Tool by clicking enable/disable button via GUI. It will become visible to user if the drive supports Fast Lane.

Figure 9: Fast Lane options to enable or disable in the GUI



3.2 DMA Remapping

Windows has a Memory Access Protection feature (Kernel DMA Protection, or DMAr) that enables the OS to protect the system against malicious DMA attacks by DMA capable devices, during the boot process or via devices connected to easily accessible internal/external DMA-capable ports, such as M.2 PCIe slots and Thunderbolt 3, during OS runtime. The Solidigm Synergy Driver is compatible with this feature.

3.3 Windows NVMe Features Supported

3.3.1 NVMe Command Error Logging

The Solidigm Synergy Driver will log following information in the Windows Event Log:

- When any command is completed with non-success status, the following information will be logged:
  - Command set
  - Opcode

    - SCT
    - SC
    - Controller Status (CSTS)
- When there is an asynchronous notification, the following information will be logged:
    - Asynchronous event type
    - Asynchronous event information
    - Log page Identifier
    - Log page binary content

3.3.2 Command Effects Log for Identifying Commands

The Solidigm Synergy Driver supports NVMe passthrough IOCTLs. The IOCTL allows the driver to send NVMe commands directly to the device. Because commands can impact device behaviour, IOs are blocked until the command is completed. Any command is always sent to the device without any validation. This can be improved by getting information from the controller for which commands the IOs must be blocked. Additionally, if the command is not supported by the controller, it can be rejected without sending it to the device.

4 Solidigm Synergy™ Driver API

The Solidigm Synergy™ Driver has an API to allow communication with user application.

4.1 Introduction to Storage IOCTL on Windows

This is an introduction for Windows IOCTL and will help user to implement the Solidigm Synergy™ Storage API.

4.1.1 Windows NVMe IOCTLs Support

Solidigm Synergy™ Driver implements following IOCTLs:

- IOCTL_STORAGE_QUERY_PROPERTY
- IOCTL_STORAGE_PROTOCOL_COMMAND
- IOCTL_STORAGE_SET_TEMPERATURE_THRESHOLD
- IOCTL_STORAGE_SET_PROPERTY
- IOCTL_STORAGE_FIRMWARE_GET_INFO
- IOCTL_STORAGE_FIRMWARE_DOWNLOAD
- IOCTL_STORAGE_FIRMWARE_ACTIVATE

4.2 Additional Driver Features Supported

The driver supports the following additional features:

- Host Memory Buffer (HMB)
- 512B and 4KB LBA support
- RTD3 support

5 Limitations

Solidigm Synergy™ driver package comes with the following limitations:

5.1 Hardware Limitations

The following NVMe drives are validated on the Solidigm Synergy™ driver:

- Intel SSD 665p
- Intel SSD 670p
- Solidigm™ P41 Plus
- Solidigm™ P44 Pro

5.2 Software Limitations

The following Microsoft Windows versions are supported by the Solidigm Synergy™ driver:

- Windows 11
- Windows 10
- Windows PE

5.3 Configuration Limitations

The Solidigm Synergy™ Driver does not support:

- Volume Management Device (VMD) enabled ports
- RAID configurations

6 Power Management Support

This chapter describes platform power management features provided by the Solidigm Synergy™ Driver.

6.1 Modern Standby Support

To meet constantly increasing number of systems capable of S0 low power idle, the Solidigm Synergy™ Driver allows NVMe drives to enter DRIPS phase during Modern Standby. To achieve high percentage value of Hardware DRIPS during Modern Standby the driver takes advantage of RTD3 feature. On Modern Standby session entry, aggressive RTD3 policy is set to enable the drive to achieve low power states easily. Based on platform configuration, NVMe drives will reach D3Cold or D3Hot power state. Aggressive RTD3 policy is revoked on Modern Standby session exit. Minimum RTD3 idle wait times for both Modern Standby and S0 states can be adjusted via registry keys.

6.2 Directed PoFx (DFx) Support

Directed PoFx (DFx) is an optional directed power model provided by the Windows run-time power management framework starting from version 3. With DFx, the operating system directs device stacks to enter their appropriate low-power idle states when the system transitions to idle and thereby enables the system to enter low power more reliably. The objective is to make systems more power-efficient and to reduce energy consumption for Windows devices across form factors. DFx currently supports D-state management only. DFx skips any device subtree with an F-state constraint.

6.3 Dynamic APST Feature

Autonomous Power State Transition (APST) is a mechanism for the Solidigm Synergy™ Driver to configure the NVMe controller to automatically transition between power states on certain conditions without software intervention. Additionally, as the driver has the capability to detect if the system is operating on the battery (DC) or plugged in (AC), based on the status of AC versus DC, the driver sets the APST ITPT setting to performance or power mode. If there is a change in status of AC versus DC, the driver will issue Set Feature APST to change the settings to the drive. The driver disables APST when the system is in Performance mode. For each power state, both operational and non-operational, ITPS is set to the last non-operational state.

7 Switch or Uninstall Solidigm Synergy™ Driver

7.1 Switch via Windows Device Manager

To switch back to the Microsoft default disk driver after the Solidigm Synergy™ Driver has been installed, complete either of the following options. Options may be grayed out; option 1 is always recommended.

1. Update Driver Option

   In Device Manager, select Solidigm NVMe Storage Controller. Right-click and go to Properties. Select the "Update Driver" option and proceed to "Browse my computer for drivers." Select "Let me pick from a list of available drivers on my computer," then "Standard NVM Express Controller."

2. Rollback Driver

   In Device Manager, select Solidigm Storage Controller. Right-click and go to Properties. Select the "Rollback Driver" option and proceed.

Note: Both operations will only switch the driver on a single-disk controller.

7.2 Uninstalling the Solidigm Synergy™ Driver

In Windows Device Manager, change View to "Devices by driver." Find the Solidigm Synergy™ Driver .inf entry (solidnvm.inf). Right-click on it, select Remove Driver, and hit Remove.

Warning! Do not check the box that says "Attempt to remove the driver for this device" to uninstall or switch the driver for the selected Solidigm NVMe Storage Controller. If the selected storage controller is active on a boot device, it will cause a BSOD loop during the next reboot and successful booting will not be possible.