

# **Intel<sup>®</sup> Solid-State Drive Toolbox 2.0**

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***User Guide***



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This document replaces and supersedes any and all prior Intel-supplied collateral, released prior to the date of this document, relating to the Intel® SSD Toolbox and Intel® SSD Optimizer.

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## 1.0 Overview

This guide describes the Intel® Solid-State Drive Toolbox (Intel® SSD Toolbox) 2.0.

Intel SSD Toolbox 2.0 allows you to perform the following tasks on Intel® Solid-State Drives (Intel® SSDs):

- Access Intel SSD management tools, including:
  - Intel® Solid-State Drive Optimizer (Intel® SSD Optimizer): Optimize the performance of your Intel SSD by using Trim functionality to remove deleted data files from NAND flash management blocks
  - System Configuration Tuner: Check your system configuration and tune settings for best performance, power efficiency, and endurance
  - Secure Erase: Permanently remove all data on an Intel SSD
- View drive information: View drive identification data for Intel SSDs and other drives installed in your system
- Check Self-Monitoring, Analysis, and Reporting Technology (SMART) attributes: Review SMART attributes, thresholds, and recommended actions for Intel SSDs and other drives installed in your system
- Run fast diagnostic scan: Check the basic functionality of your Intel SSD
- Run full diagnostic scan: Test the read/write functionality of the free space on your Intel SSD

Intel SSD Toolbox 2.0 scans for all available drives on your system, including Intel SSDs, non-Intel SSDs, and hard disk drives (HDDs). For non-Intel SSDs and HDDs, the tool displays industry standard device information only; therefore, only the following tasks are available:

- View drive information
- Check SMART attributes

## 1.1 Requirements

Intel SSD Toolbox 2.0 requires the following:

- Supported operating system:
  - Microsoft Windows\* 7
  - Windows\* XP
  - Windows Vista\*
- Microsoft\* .NET Framework version 2.0  
.NET Framework version 2.0 is included with Windows 7 and Windows Vista.  
If your system is running Windows XP, or does not have does not have version 2.0 of .NET Framework installed, Intel SSD Toolbox directs you to the appropriate place to obtain it during the installation.



- At least 12 megabytes (MB) of available space on the drive  
To determine whether the drive has enough available space:
  - Double-click **My Computer**
  - Right-click the drive you want to check and click **Properties** to display the amount of free space

## 1.2 Known Limitations

Review the following limitations before installing Intel SSD Toolbox.

- **RAID or Dynamic Disk Configurations**

Intel SSD Toolbox works with single SSDs, SSDs in a simple Dynamic Disk configuration, and SSDs that are part of Intel® Matrix Storage Manager or Intel® Rapid Storage Technology (Intel® RST) RAID configurations.

Intel SSD Toolbox provides limited functionality for SSDs that are part of RAID and Dynamic Disks configurations with multiple partitions: Intel SSD Optimizer and Secure Erase are not supported in these configurations.

- **Systems with Virtualization**

Intel SSD Toolbox 2.0 does not work on systems running in a virtualized environment as it cannot detect the SSDs.

- **SSD Formatted with FAT32 File System**

Intel SSD Optimizer does not work on SSDs formatted with file allocation system FAT32. New Technology File System (NTFS) is required to run Intel SSD Optimizer.

## 1.3 Known Issues

- **Cannot run Intel SSD Optimizer on RAID configurations**

Description: Some systems without a RAID configuration display the following error message when running Intel SSD Optimizer: "Cannot run the Intel SSD Optimizer on RAID Configurations." There is currently no workaround for this issue.

Known Systems Affected: Acer\* Aspire\* One ZA3 netbook, Dell\* Inspiron Mini 10 netbook

- **System becomes unresponsive after running Intel SSD Optimizer**

Description: After manually running the Intel SSD Optimizer, the affected system becomes unresponsive. If this occurs, power down your system and refrain from running the Intel SSD Optimizer.

Known System Affected: Acer Aspire One ZA3 netbook

- **Not all drives in a RAID array are recognized by Intel SSD Toolbox**

Description: Not all drives in a RAID configuration are recognized by Intel SSD Toolbox. Drive and SMART information may be obtained with another program.

Known Systems Affected: HP\* Compaq dc7800 Convertible Minitower PC, HP Compaq dc7800 Small Form Factor PC, HP Compaq dc7800 Ultra Slim Desktop PC



## 2.0 Installation and Start Up

### Download Intel® SSD Toolbox

1. Go to the Intel support website located at <http://www.intel.com/go/ssdtoolbox>.
2. Save the Intel SSD Toolbox 2.0 application (.msi file) to a folder on your computer.

Similar to a .zip file, the .msi file contains program items, including:

- Intel SSD Toolbox application
- License Agreement
- Intel SSD Toolbox documentation (this guide, Release Notes, README file)

### Install Intel SSD Toolbox

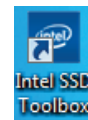
1. Double-click the downloaded .msi file to start the Intel SSD Toolbox setup wizard.
2. Click **Next** on the Welcome screen.
3. Click **Next** in the Intel SSD Toolbox Information window.
4. Review the Intel Software License Agreement, and click **I Agree > Next** to continue.
5. Accept the default location or click **Browse** to identify where you want to store the installation folder > **Next**.
6. Click **Next** to confirm the installation.  
The installation begins.
7. Click **Close** when the Installation Complete dialog box appears.

The Intel SSD Toolbox installs at the following default location:  
[Program Files\Intel\Intel Solid-State Drive Toolbox\](#)

### Start Intel SSD Toolbox

Start Intel SSD Toolbox one of two ways:

- Double-click the Intel SSD Toolbox icon on your desktop.
- Open the Windows **Start** menu > **Intel SSD Toolbox**.



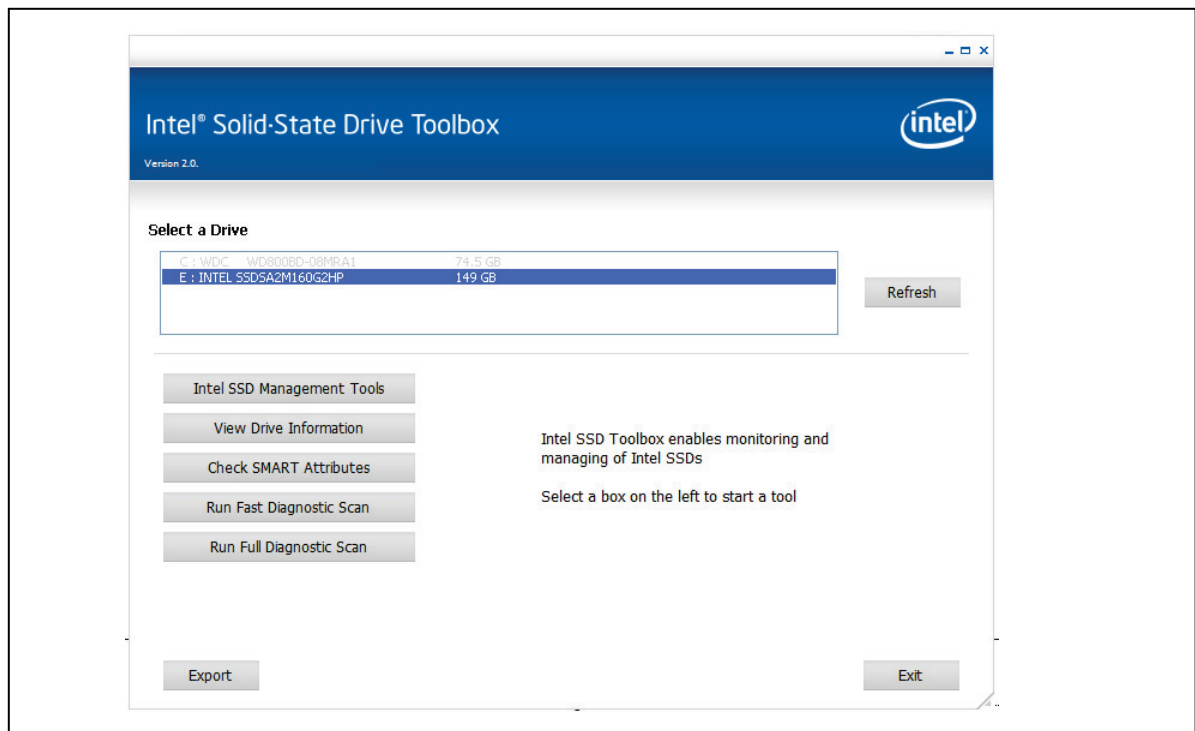
### 3.0 Intel SSD Toolbox Main Screen

When the Intel SSD Toolbox starts, it scans for all available drives on your system, including Intel® SSDs, non-Intel SSDs, and hard disk drives (HDDs).

The main screen displays the name and capacity of each detected drive, as well as the following options:

- **Intel SSD Management Tools** – Enables monitoring and managing of Intel SSDs associated with this computer.
- **View Drive Information** – Displays standard drive Identify Device information about the selected drive, including model number, serial number and firmware number.
- **Check SMART Attributes** - Lists SMART attributes, their respective thresholds and recommended actions for the selected drive.
- **Run Fast Diagnostic Scan** – Analyzes the first 1.5 GB of an Intel SSD to determine if there are any READ or WRITE errors.
- **Run Full Diagnostic Scan** – Analyzes an entire Intel SSD to determine if there are any READ or WRITE errors or any bad blocks.

**Figure 1. Intel SSD Toolbox Main Screen**







The main screen contains the following buttons:

- **Refresh** – Rescans your computer and displays the name and capacity of each drive found on your system.
- **Export** – Writes and saves the drive information and SMART data to a comma-separated value (.csv) file on your system. A .csv file can be opened in a program such as Microsoft Excel\*.
- **Exit** – Closes the Intel SSD Toolbox application.

### 3.1 Selecting a Drive

1. In the **Select a Drive** window, select the drive on which you want to run an activity.
2. Click an option.

If you select a non-Intel SSD or HDD, the only options available are: View Drive Information and Check SMART Attributes.

#### SSDs in a RAID Configuration

SSDs that are part of Intel® Matrix Storage Manager or Intel® Rapid Storage Technology (Intel® RST) RAID configurations are supported.

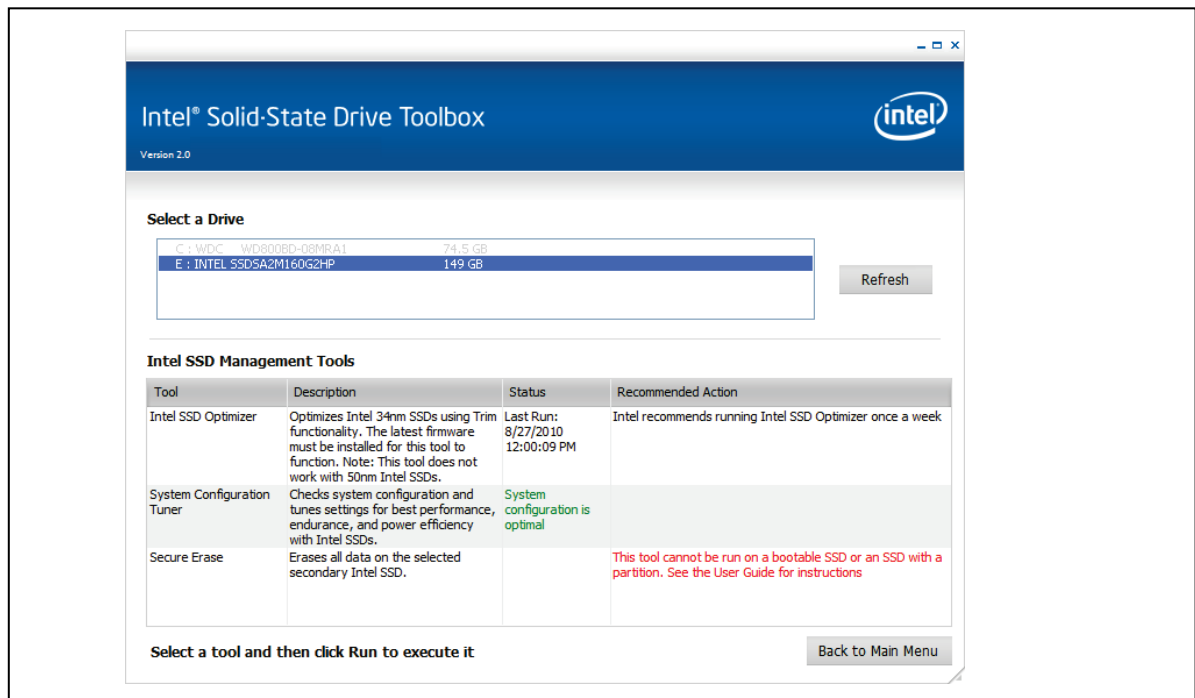
SSDs that are part of RAID and Dynamic Disks configurations with multiple partitions have limited functionality: Intel SSD Optimizer and Secure Erase tools are not supported.

## 4.0 Intel SSD Management Tools

From the main screen, select the Intel® SSD and click **Intel SSD Management Tools** to access the following:

- **Intel® SSD Optimizer:** Optimize the performance of your Intel SSD by removing deleted data files from NAND flash management blocks on the SSD using Trim functionality
- **System Configuration Tuner:** Check your system configuration and tune settings for best performance, endurance, and power efficiency with your Intel SSD
- **Secure Erase:** Permanently remove all data on an Intel SSD

**Figure 2. Intel SSD Management Tools Screen**



The screen displays the following fields and buttons:

- **Tool** – Lists the name of each management tool. Click on the name to select the tool.
- **Description** – Describes the purpose or function of the tool.
- **Status** – Displays the status of the tool.
- **Recommended Action** – Lists recommended action for running the tool.
- **Refresh** – Rescans your computer for available drives.
- **Back to Main Menu** – Returns to the main screen.



## 4.1 Intel SSD Optimizer

Use the Intel SSD Optimizer to help an Intel SSD retain its out-of-box performance by using Trim functionality to remove deleted data files from NAND flash management blocks on the SSD.

When files are deleted by a user, the operating system marks the files for deletion, but does not immediately physically erase the files. Because an SSD does not know which files are deleted, the SSD continues to think all files contain valid data. This situation causes the SSD to continue managing deleted files in addition to valid data in the drive.

By running the Intel SSD Optimizer, the tool identifies which files the user deleted and communicates that information to the SSD. This notification allows the SSD to clean up internal management space, thus eliminating the need to manage the deleted files.

**Note:** If your computer uses Microsoft\* Windows\* 7 and the standard Microsoft AHCI driver (the default setup for normal configurations without RAID), the Intel SSD Optimizer works; however, you do not need to use the Intel SSD Optimizer because Windows 7 implements the Trim functionality natively.

If your computer uses Windows 7 and Intel® Matrix Storage Manager version 8.x or Intel® Rapid Storage Technology driver version 9.5 or earlier (which can be used in place of the Microsoft AHCI driver), Trim functionality is not implemented, and Intel SSD Optimizer is required to enable Trim.

Intel Rapid Storage Technology driver version 9.6 supports the Windows 7 Trim command, but for non-RAID configurations only. In these configurations, Intel SSD Optimizer is not required to enable Trim.

### 4.1.1 Requirements

- Intel® Solid-State Drive X25-M, X25-V, or X18-M (34nm, G2)

Intel SSD Optimizer does not run on 50nm Intel SSDs. To identify your SSD, view the drive name in the Select a Drive window:

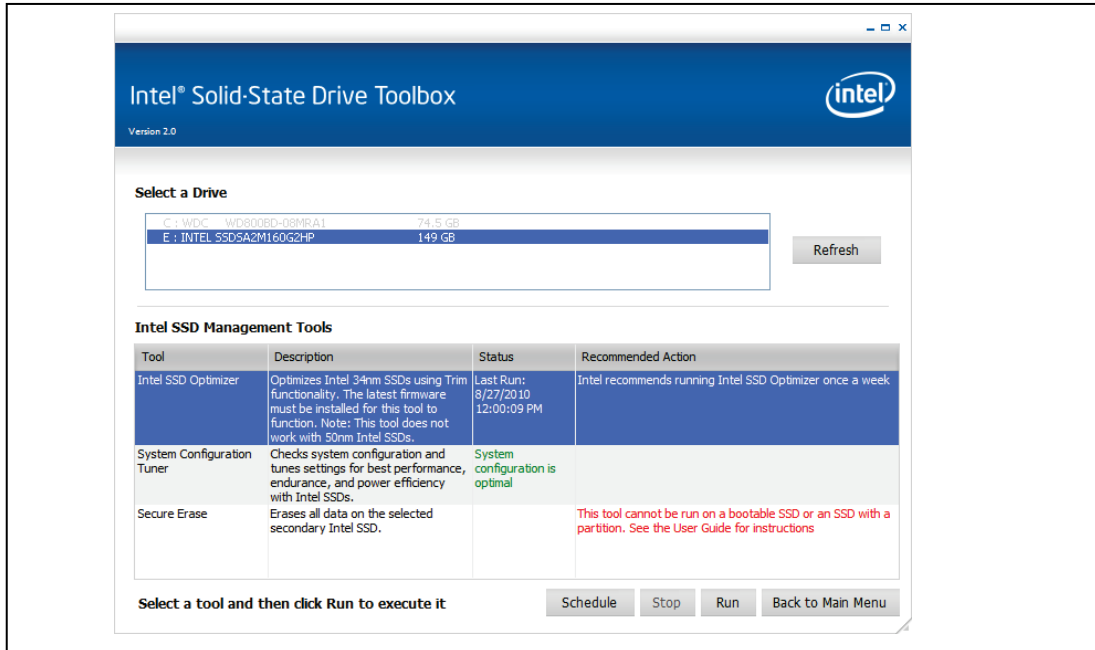
- **G1** indicates a 50nm SSD
- **G2** indicates a 34nm SSD

For example: SSSA2MH080**G1**HP or SSSA2M080**G2**ES

- Latest firmware installed

From the main screen, select the Intel SSD > **Intel SSD Management Tools** > **Intel SSD Optimizer**.

**Figure 3. Intel SSD Optimizer**



The Intel SSD Optimizer screen contains the following buttons:

- **Schedule** – Defines when and how often you want to run the Intel SSD Optimizer on the selected SSD.
- **Stop** – Halts the Intel SSD Optimizer on the selected SSD.
- **Run** – Launches the Intel SSD Optimizer on the selected SSD.
- **Back to Main Menu** – Returns to the Intel SSD Toolbox main screen.
- **Refresh** – Rescans your computer for available drives.

The Intel SSD Optimizer can be run two ways:

- Manually using the **Run** button.
- Automatically using the **Schedule** button.



## 4.1.2 Running the Intel SSD Optimizer Manually

Before running the Intel SSD Optimizer, review the following:

- Do not run the Intel SSD Optimizer when a backup is in session.
- Do not run the Intel SSD Optimizer if the SSDs are in a RAID array. See [Section 9.1.2](#) for more information.

To run the Intel SSD Optimizer:

1. Select the Intel SSD on the Intel SSD Management Tools screen.
2. Click **Intel SSD Optimizer**.
3. Click **Run**.
4. Review the warning text describing the tool requirements, and then click **Run**.

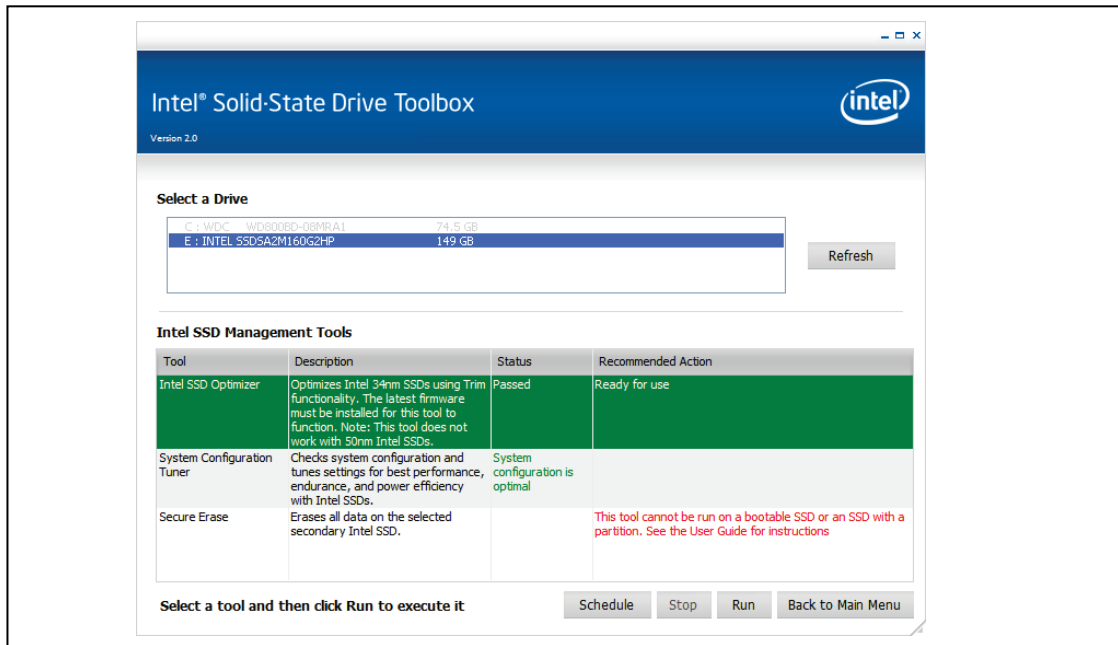
If you receive a warning message stating that the Intel SSD Optimizer has detected the presence of either RAID or encryption on the selected SSD, review the following:

- If the SSD is encrypted and is *not* in a RAID configuration, click **Accept** to continue running the Intel SSD Optimizer tool on the selected drive.
- If the SSD is in a RAID configuration, click **Decline** to stop running the tool. The Intel SSD Optimizer cannot be run on Intel SSDs in a RAID configuration.

The Intel SSD Optimizer starts. A progress bar shows the status of the tool.

When finished, view the status and recommended actions fields ([Figure 4](#)).

**Figure 4. Intel SSD Optimizer – Passed Screen**



- **Status** – Displays whether the program completed successfully. The *Passed* status remains displayed until the tool is closed and reopened, or another SSD is selected.
- **Recommended Action** – Identifies whether the SSD is ready for use.



### 4.1.3 Scheduling the Intel SSD Optimizer

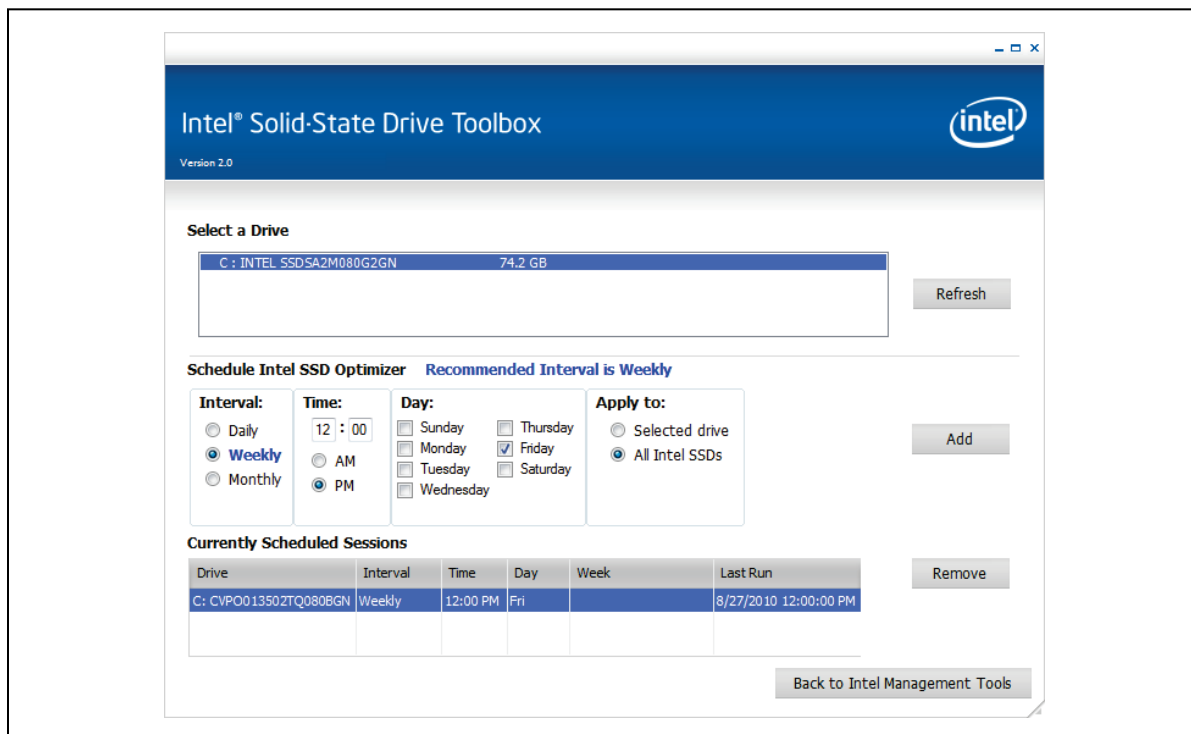
Before defining an automated schedule, review the following:

- Do not run the Intel SSD Optimizer if the SSDs are in a RAID array. See [Section 9.1.2](#) for more information.
- Ensure that Intel SSD Optimizer sessions are scheduled to run when the computer is on. The program does not wake up or turn on the computer to run an Intel SSD Optimizer session.
- Do not run the Intel SSD Optimizer when a backup is in session.

To schedule the Intel SSD Optimizer:

1. Manually run the Intel SSD Optimizer Tool, as described in [Section 4.1.2](#). Once the manual run is successful, you can set an automated scheduled operation.
2. Select the Intel SSD on the Intel SSD Management tools screen.
3. Click **Intel SSD Optimizer**.
4. Click **Schedule**.

**Figure 5. Schedule Intel SSD Optimizer Screen**





5. Set the following fields:
  - **Interval** – Determine how often to run the tool: Daily, Weekly or Monthly. Depending on the option you select, the screen changes to request additional scheduling information. Intel suggests running the tool weekly to help optimize performance.
  - **Time** – Set the time to run the tool.
  - **Day** – If you select Weekly or Monthly, select the day of the week to run the tool.
  - **Week** – If you select Monthly, select the week to run the tool.
  - **Apply to** – Identify whether the tool should be ran on a selected Intel SSD or on all Intel SSDs in the system.
6. Click **Add**.
7. Review the warning text and click **Schedule**.

The Intel SSD Optimizer scans the computer to determine if the selected SSD has a RAID configuration or is using an encryption scheme. If detected, a warning message appears.

- If the SSD is encrypted and is not in a RAID configuration, click **Accept** to continue the optimization schedule.
- If the SSD is in a RAID configuration, click **Decline** to stop running the tool.

The new schedule appears in the **Currently Scheduled Sessions** section.

When the scheduled session starts, an icon with a message screen appears in the task tray notifying you that the Intel SSD Optimizer is running. Upon completion, the icon disappears.

**Note:** The first time you schedule a session, the Last Run column displays *Never* because there were no previously scheduled runs. After a scheduled session finishes, the column displays the date of the latest successfully completed run for that SSD. The screen only displays the Last Run status for scheduled sessions, not manually initiated runs.

The scheduling screen contains the following buttons:

- **Add** – Allows you to schedule running the Intel SSD Optimizer on one or more Intel SSDs. After entering the scheduling information, click **Add** to update the list of Currently Scheduled Sessions.
- **Remove** – Deletes a scheduled session. Select the schedule you want to delete, and click **Remove**. The tool deletes the schedule information and redisplay the updated list in the Currently Scheduled Sessions section.
- **Back to Intel Management Tools** – Returns to the Intel SSD Management Tools screen.



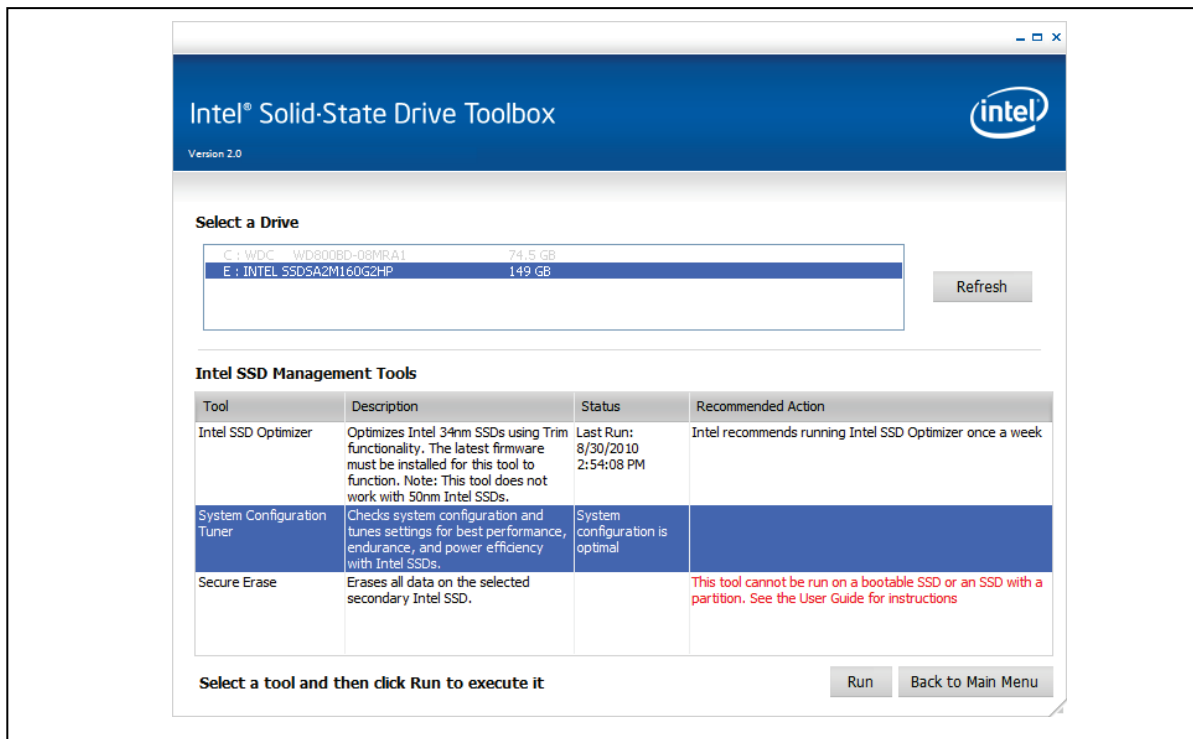


## 4.2 System Configuration Tuner

Use this option to check your system configuration and tune settings to improve performance, power, and endurance on an Intel SSD.

From the main screen, select the Intel SSD > **Intel SSD Management Tools** > **System Configuration Tuner**.

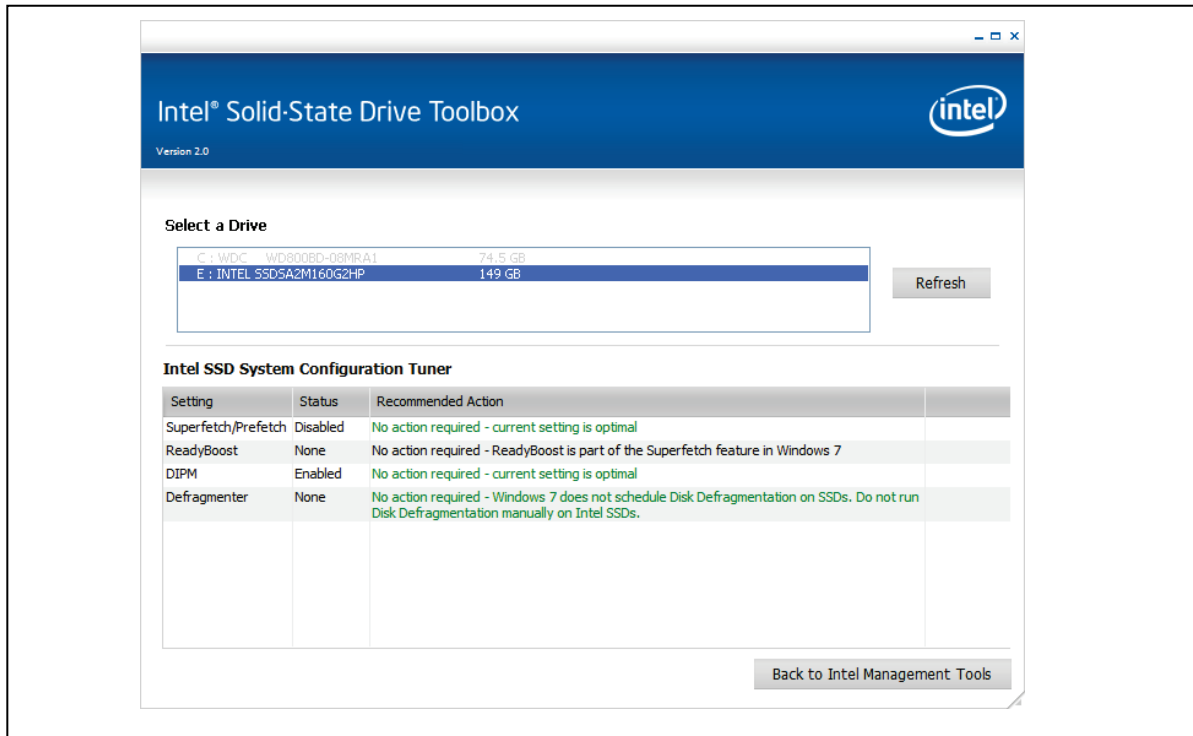
**Figure 6. System Configuration Tuner**



The Status column displays a summary of your current system configuration:

- System Configuration is optimal (no tuning required) or
  - System configuration is NOT optimal (tuning is recommended)
1. Click **Run** to open the System Configuration Tuner screen.

**Figure 7. Intel SSD System Configuration Tuner screen**



The Intel SSD System Configuration Tuner screen displays the following fields:

- **Setting** –The name of the service that can be optimized for use with the selected Intel SSD:
  - **Superfetch/Prefetch:** In Windows 7 and Windows Vista, Superfetch\* tracks and copies your most frequently used applications to system memory to reduce load times. Superfetch is based on the similar Prefetch feature available in Windows XP. Superfetch/Prefetch is not needed on an Intel SSD and should be disabled for optimal performance.
  - **ReadyBoost:** In Windows Vista, ReadyBoost\* is a feature that uses any flash memory device connected to your system as a drive for disk caching. It is also used to facilitate SuperFetch. In Windows 7, ReadyBoost is part of SuperFetch; in Windows XP, ReadyBoost is not installed. ReadyBoost is not needed on an Intel SSD and should be disabled for optimal performance.
  - **DIPM:** For Intel SSDs, Device Initiated Power Management (DIPM) is the most efficient power management method for managing SATA link power. With DIPM, link management is handled by the drive (the drive knows best how long a specific command might take to complete and is best equipped to request a link power management state change while processing the command). DIPM should be enabled on Intel SSDs for optimal performance.



- **Defragmenter:** Windows Disk Defragmenter rearranges files stored on a disk to occupy contiguous storage locations to increase access speed and optimize the time it takes to read and write files to and from the disk. In Windows 7 and Windows Vista, Disk Defragmenter should be disabled on Intel SSDs. In Windows XP, Disk Defragmenter cannot be disabled. Make sure to unschedule Disk Defragmenter on any Intel SSD(s).
  - **Status** –The current status of the service and if any action can be taken to optimize the service.
  - **Recommended Action** –The action required to optimize the service. If a service can be optimized, **Tune It!** appears next to the setting.
2. Click **Tune It!** next to the setting you want to optimize.
  3. Depending on your system configuration and operating system, perform these additional tasks to optimize performance:

#### Dual-drive systems (HDD + SSD)

- Install your most frequently used applications on the Intel SSD.
- Run and schedule Disk Defragmenter on HDDs only.
- Verify that Disk Defragmenter does not run and is not scheduled to run on Intel SSD(s). In Windows XP, this requires that you check the following:  
Open Windows XP Scheduled Tasks and search for **defrag.exe** or other third-party defragmenter tools and make sure the tool is not scheduled to run. Scheduled Tasks is available in **Start > All Programs > Accessories > System Tools**. See the Windows XP documentation for instructions.

#### SSD-only systems

Verify that Disk Defragmenter does not run and is not scheduled to run on Intel SSD(s). In Windows XP, this requires that you check the following:

Open Windows XP Scheduled Tasks and search for **defrag.exe** or other third-party defragmenter tools and make sure the tool is not scheduled to run. Scheduled Tasks is available in **Start > All Programs > Accessories > System Tools**. See the Windows XP documentation for instructions.

#### Mobile systems with shock sensor

Verify that Shock Sensor on your mobile system is disabled. Intel SSDs are not affected with performance degradation caused by shock or vibration in specified limits, and therefore can run with Shock Sensor disabled. See the Intel Solid-State Drive Product Manual datasheet for specified limits. See your system documentation for information on disabling this feature.



### **Intel SSDs in RAID Arrays**

To obtain higher performance from RAID arrays consisting of Intel SSDs, make sure Write Back Cache is enabled. However, be aware that enabling Write Back Cache increases the chance of data loss during a power-loss event. See your system documentation for information on disabling this feature.

### **Mobile systems without Intel® Rapid Storage Technology (Intel® RST) or Intel® Matrix Storage Manager**

Enable DIPM on your mobile system. See your system documentation for instructions.



## 4.3 Secure Erase

Use this option to permanently erase all data on an Intel SSD.

**CAUTION:** Secure Erase is an unrecoverable operation that permanently deletes all data on an Intel SSD. Secure Erase is an addition to the existing *format drive* command present in computer operating systems. Once you run Secure Erase on an Intel SSD, there is no possibility to recover data from the SSD.

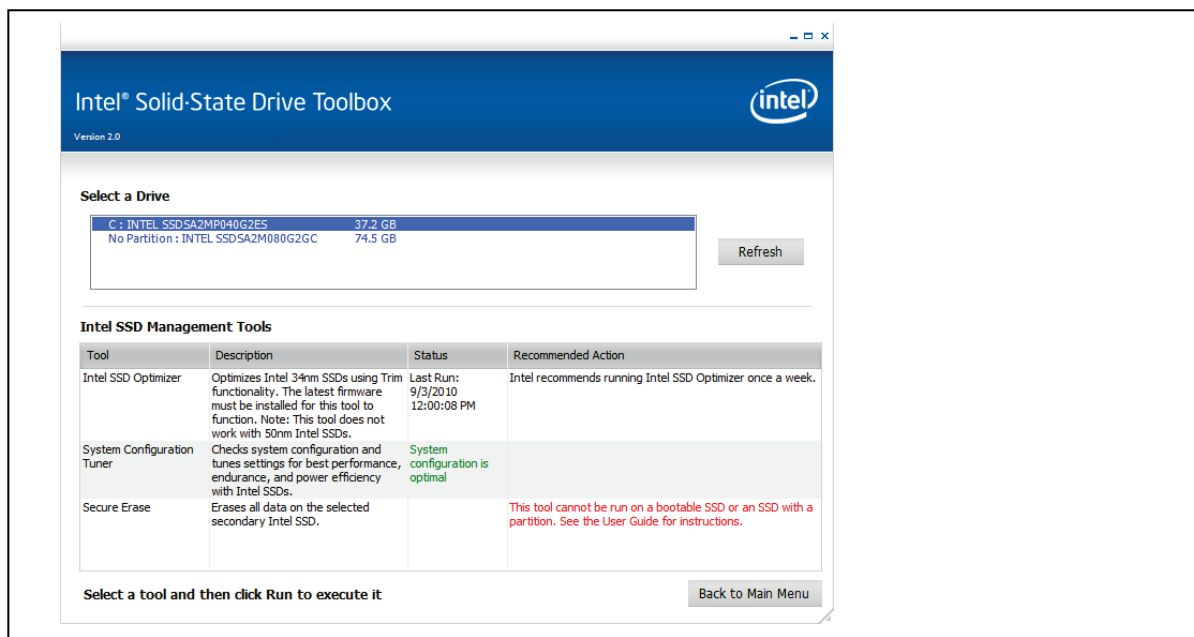
### 4.3.1 Requirements

To run Secure Erase on an SSD:

- Any drive passwords on the SSD must be removed before starting the Secure Erase procedure.
- The SSD must be the secondary drive in the system.
- The system must allow access to the SATA cable connected to the SSD.
- Secure Erase cannot be run on a bootable SSD or on an SSD with a partition.
- You must first delete all partitions on the SSD before performing Secure Erase. See [Section 4.3.3, "Deleting a Partition"](#) for instructions.

From the main screen, select the Intel SSD > **Intel SSD Management Tools** > **Secure Erase**.

**Figure 8. Secure Erase Screen**





The Secure Erase screen contains the following options:

- **Refresh** – Rescans your computer and displays the name and capacity of each drive found on your system.
- **Run** – Runs Secure Erase on the selected Intel SSD.
- **Back to Main Menu** – Returns to the Intel SSD Toolbox main screen.

### 4.3.2 Performing a Secure Erase

Before performing Secure Erase, review the requirements in [Section 4.3.1](#).

To perform a Secure Erase:

1. Select the SSD on the Intel SSD Management Tools screen.
2. If the SSD contains a partition, a warning message appears ([Figure 9](#)).

**Figure 9. Secure Erase – Partition Warning**

Secure Erase	Erases all data on the selected secondary Intel SSD.		This tool cannot be run on a bootable SSD or an SSD with a partition. See the User Guide for instructions
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3. Delete the partition. See [Section 4.3.3, “Deleting a Partition”, on page 24](#) for instructions.  
**Note:** Intel SSD Toolbox can remain open and running on the system while you delete the partition on the SSD.
4. After deleting the partition, click **Refresh** on the SSD Management Tools screen.
5. Select the SSD again.

The ATA Security warning appears ([Figure 10](#)).

**Figure 10. Secure Erase – ATA Security Enabled**

Secure Erase	Erases all data on the selected secondary Intel SSD.		ATA Security is enabled. Secure Erase cannot run until security is disabled. To disable security, power-cycle the SSD while the Intel Solid-State Drive Toolbox is running
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6. Unplug the SATA cable from the SSD and reconnect it while Intel SSD Toolbox is running.

This process power-cycles the SSD, which resets ATA Security and unlocks the SSD.

Depending on your system configuration, this may require that you physically remove the SSD from the system.



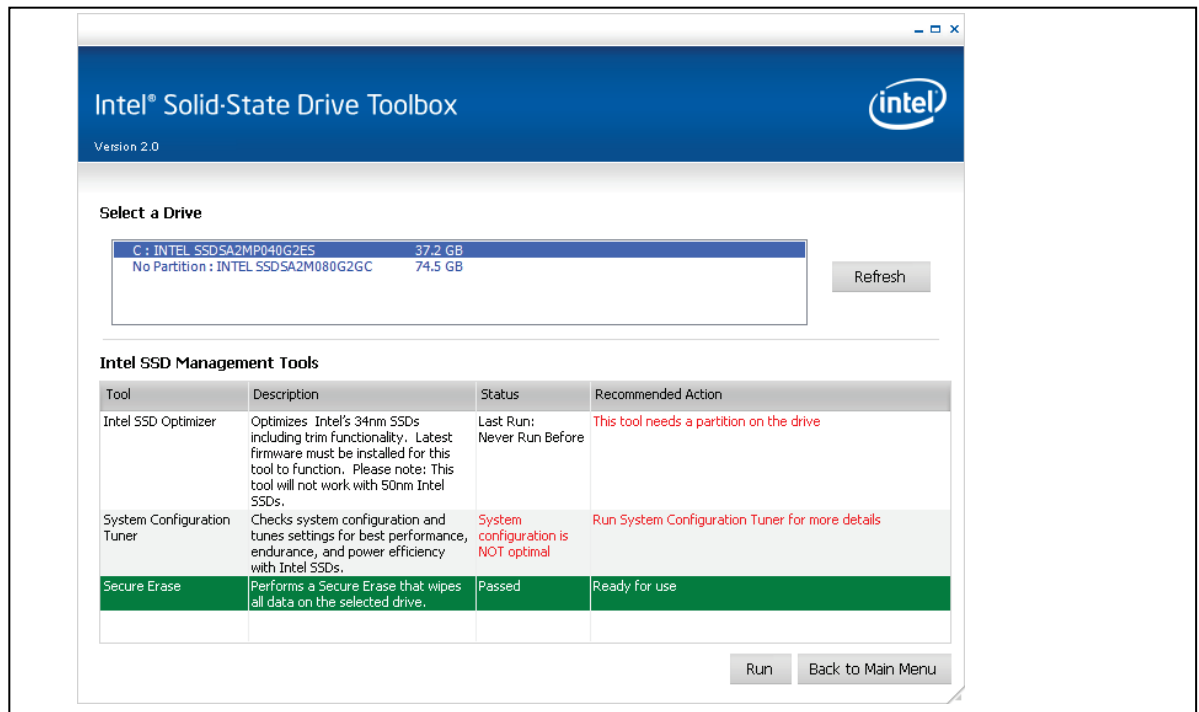
7. Click **Refresh** after unplugging and plugging in the SSD.
  8. Select the SSD again on the Intel SSD Management Tools screen.
  9. Click **Run**.
- A warning message appears.
10. Review the warning message, and click **Run** to start Secure Erase.

Secure Erase starts on the selected SSD. A progress bar shows the status of the operation. The process can take 1-2 minutes, depending on drive capacity.

**IMPORTANT:** Your system may appear to stop responding during this operation. Do not power off or disconnect power from your system during this operation, as this can damage the SSD.

When finished, view the status and recommended actions fields.

**Figure 11. Secure Erase Passed Screen**



- **Status** – Displays whether the Secure Erase completed successfully. *Passed* indicates the drive was successfully erased and is ready to be formatted for use.
- **Recommended Action** – Identifies whether the SSD is ready for use.

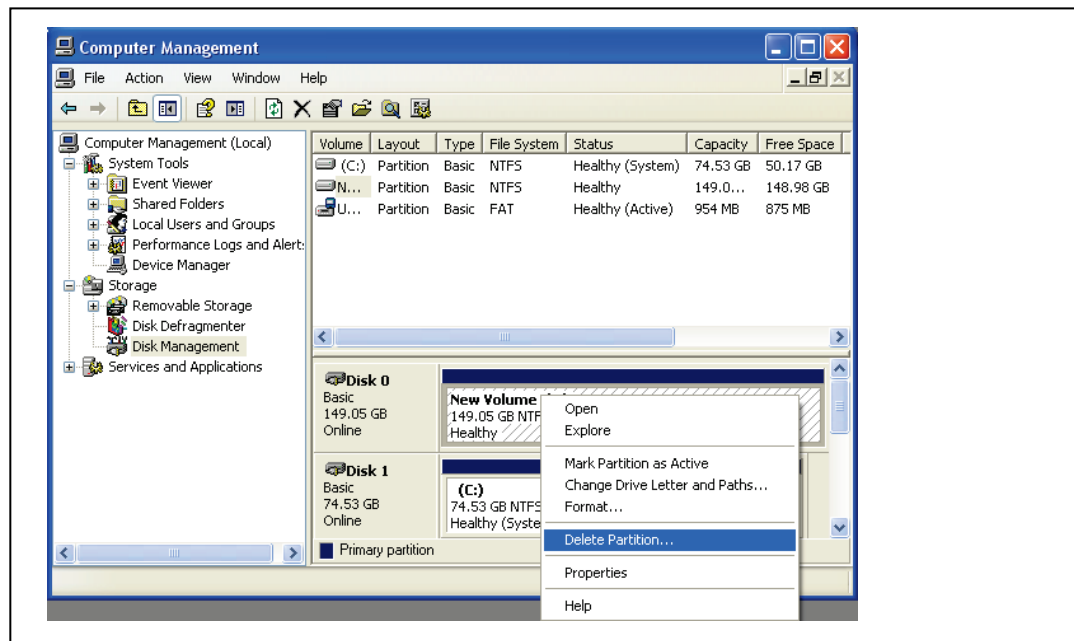
### 4.3.3 Deleting a Partition

This section describes how to delete a partition from an SSD in preparation for running Secure Erase.

These steps logically delete a partition, which makes all data unavailable on the SSD. These steps can be performed while Intel SSD Toolbox is running.

1. Right-click **My Computer** > **Manage** > **Disk Management**.
2. Select the SSD that contains the partition.
3. Locate the partition on the SSD (indicated by a drive letter), right-click on the partition and select **Delete Partition** or **Delete Volume**.

**Figure 12. Disk Management**



4. Confirm the deletion.





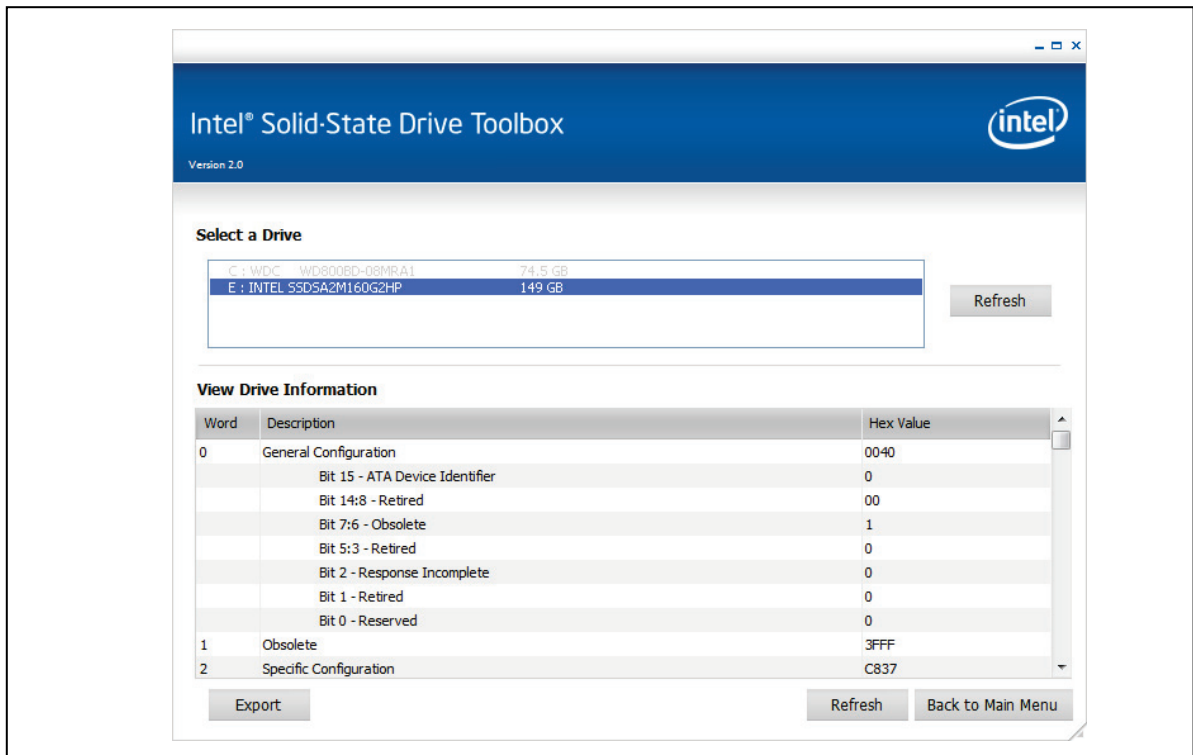
## 5.0 View Drive Information

Use this option to view and export standard Identify Device data for Intel SSDs and other drives, including:

- **Serial Number** – Identifies production information about the device
- **Firmware Version** – Displays the current firmware installed on the drive
- **Model Number** – Provides such information as device type, bus architecture, form factor and density

From the main screen, select the drive > **View Drive Information**.

**Figure 13. View Drive Information Screen**



The screen displays the following fields:

- **Word** – Identifies the word(s) assigned to a specific drive information value.
- **Description** – Provides the name and bit information, if needed, for each drive information value.
- **Hex Value** – Reports the hexadecimal value for each piece of drive information.



The screen contains the following buttons:

- **Export** – Writes and saves the drive information and SMART data to a comma-separated value (.csv) file on your system.
- **Refresh** – Reloads the information for the selected drive.
- **Back to Main Menu** – Returns to the Intel SSD Toolbox main screen.

## 5.1 Viewing Data

Scroll down to view all values on the screen. The information displayed is generated by an ATA IDENTIFY DEVICE command. See [Section 10.0, "Reference Documents"](#) for information about ATA specifications.

The following table identifies the most commonly referenced information.

**Table 1. Common Device Information**

Word	Description
10-19	Serial Number
23-26	Firmware Version
27-45	Model Number
76	Serial ATA Capabilities Bit 15 – 13: Reserved Bit 12: Native Command Queuing Priority Information Support Bit 11: Unload While NCQ Commands Outstanding Support Bit 10: Phy Event Counters Support Bit 9: Receipt of Host-Initiated Interface Power Management Requests Support Bit 8: Native Command Queuing Support Bit 7 – 3: Reserved Bit 2: Serial ATA Gen2 Signaling Speed (3.0 Gbps) Support Bit 1: Serial ATA Gen1 Signaling Speed (1.5 Gbps) Support Bit 0:



Word	Description
78	Serial ATA Features Supported Bit 15 – 7: Reserved Bit 6: Software Settings Preservation Supported Bit 5: Reserved Bit 4: In-Order Data Delivery Supported Bit 3: Device Initiating Interface Power Management (DIPM) Supported Bit 2: DMA Setup Auto-Activate Optimization Supported Bit 1: Non-Zero Buffer Offsets in DMA Setup FIS Supported Bit 0: Must be set to zero (0)
79	Serial ATA Features Enabled Bit 15 – 7: Reserved Bit 6: SSP Enabled Bit 5: Reserved Bit 4: In-Order Data Delivery Enabled Bit 3: Device Initiating Interface Power Management (DIPM) Enabled Bit 2: DMA Setup Auto-Activate Optimization Supported Bit 1: Non-Zero Buffer Offsets in DMA Setup FIS Enabled Bit 0: Must be set to zero (0)

**Note:** For more information about ATA specifications, see [Section 10.0, "Reference Documents"](#).

## 5.2 Exporting Data

Click **Export** to write the data to a .csv file. The .csv file can be opened in a program such as Microsoft Excel.

## 5.3 Refreshing Data

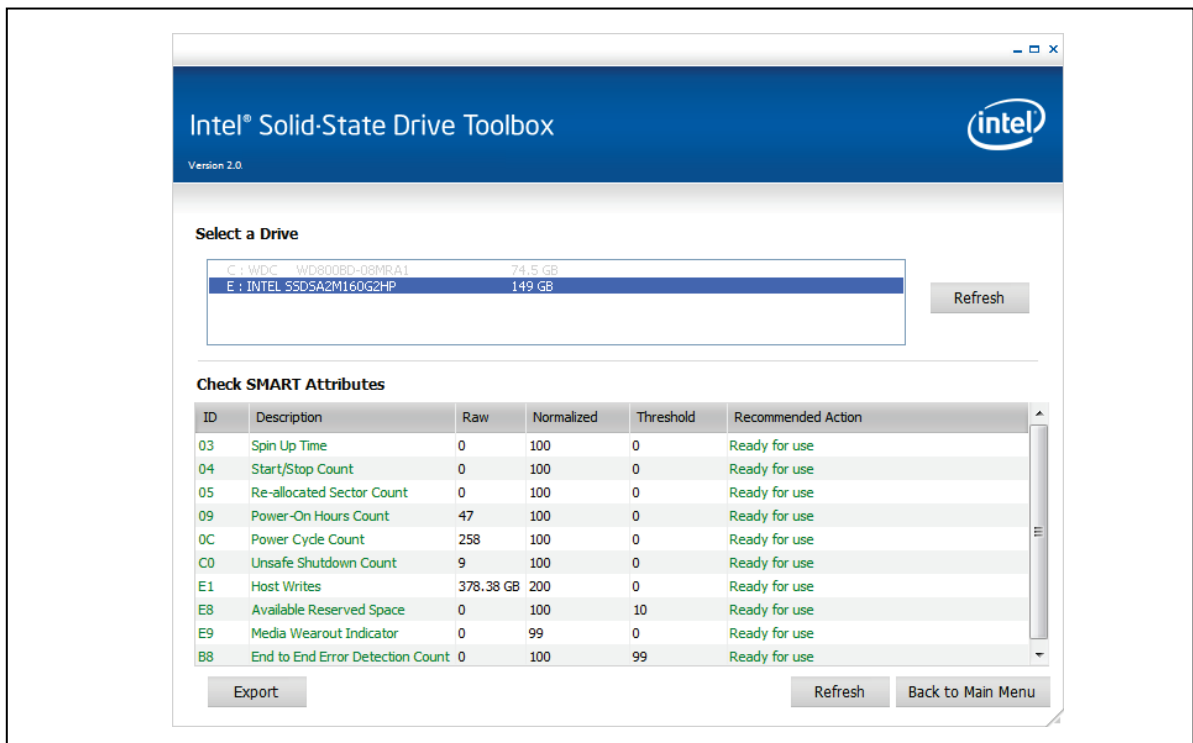
Click **Refresh** to reissue the ATA IDENTIFY DEVICE command and redisplay the information for the selected drive.

## 6.0 Check SMART Attributes

Use this option to view the available SMART attributes, their values and thresholds, and any recommended actions on any drive installed in your system.

From the main screen, select the drive > **Check SMART Attributes**.

**Figure 14. Check SMART Attributes Screen**



The screen displays the following fields:

- **ID** –The hexadecimal name of the SMART attribute.
- **Description** –The name of the SMART attribute.
- **Raw** –The raw value assigned to the SMART attribute by the manufacturer of the drive.
- **Normalized** – The value of an attribute adjusted to a scale spanning typical increments of 100 to 1, or 200 to 1.
- **Threshold** –The lowest acceptable normalized value for the drive.
- **Recommended Action** – Identifies whether the system can use the SSD for processing.



The screen contains the following buttons:

- **Export** – Writes the drive information and SMART data to a .csv file on your system.
- **Refresh** – Reloads the SMART data for the selected drive.
- **Back to Main Menu** – Returns you to the Intel SSD Toolbox main screen.

## 6.1 Viewing SMART Data

Each drive operates under a predefined set of attributes and corresponding threshold values, of which the drive should not pass during normal operation. Each attribute has a raw value (defined by the manufacturer) and a normalized value.

For more details on the attribute structure, see the ATA-3, 5 and 7 specifications (refer to [Section 10.0, "Reference Documents"](#) for information about ATA specifications).

The following table defines the SMART attributes displayed on the screen.

**Table 2. SMART Attribute Definitions**

Attribute	Definition																														
Spin Up Time	The average time it takes the spindle to spin up. Since an SSD has no moveable parts, this attribute reports a fixed raw value of zero (0) and a fixed normalized value of 100. Use the Raw value for this attribute.																														
Start/Stop Count	This type of event is not an issue for SSDs. However, hard disk drives can experience only a finite number of these events and, therefore, must be tracked. This attribute reports a fixed value of zero (0) and a fixed normalized value of 100. Use the Raw value for this attribute.																														
Re-allocated Sector Count	<p>This attribute shows the number of retired blocks since leaving the factory (also known as a grown defect count).</p> <p>The lithography (litho) of your drive determines which count you should use. Refer to the drive name in the Select a Drive window: "G1" indicates a 50nm SSD; "G2" indicates a 34nm SSD.</p> <p>For 50nm SSDs, the normalized value has an initial value of 100 but counts up from 1 for every four grown defects. The normalized value of this attribute becomes 1 when there are four grown defects; the value is 2 when there are eight grown defects, etc. For example:</p> <table style="margin-left: 40px;"> <thead> <tr> <th>Word</th> <th>Raw Value</th> <th>Normalized Value of Attribute 05</th> </tr> </thead> <tbody> <tr> <td>0-3</td> <td>0</td> <td>100</td> </tr> <tr> <td>4-7</td> <td>0</td> <td>1</td> </tr> <tr> <td>8-11</td> <td>0</td> <td>2</td> </tr> <tr> <td>...</td> <td>...</td> <td>...</td> </tr> </tbody> </table> <p>For 34nm SSDs, the raw value increments for every grown defect. For example:</p> <table style="margin-left: 40px;"> <thead> <tr> <th>Word</th> <th>Raw Value</th> <th>Normalized Value of Attribute 05</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>100</td> </tr> <tr> <td>1</td> <td>1</td> <td>100</td> </tr> <tr> <td>2</td> <td>2</td> <td>100</td> </tr> <tr> <td>...</td> <td>...</td> <td>...</td> </tr> </tbody> </table>	Word	Raw Value	Normalized Value of Attribute 05	0-3	0	100	4-7	0	1	8-11	0	2	...	...	...	Word	Raw Value	Normalized Value of Attribute 05	0	0	100	1	1	100	2	2	100	...	...	...
Word	Raw Value	Normalized Value of Attribute 05																													
0-3	0	100																													
4-7	0	1																													
8-11	0	2																													
...	...	...																													
Word	Raw Value	Normalized Value of Attribute 05																													
0	0	100																													
1	1	100																													
2	2	100																													
...	...	...																													



Attribute	Definition
Power-On Hours Count	<p>This attribute reports the cumulative number of power-on hours over the life of the device. Use the Raw value for this attribute.</p> <p>Note: The On/Off status of the device initiated power management (DIPM) feature affects the number of hours reported.</p> <ul style="list-style-type: none"><li>• If DIPM is turned "On", the recorded value for power-on hours does not include the time that the device is in a "slumber" state.</li><li>• If DIPM is turned "Off", the recorded value for power-on hours should match the clock time, as all three device states are counted: active, idle and slumber.</li></ul>
Power Cycle Count	<p>This attribute reports the cumulative number of power cycle events (power on/off cycles) over the life of the device. Use the Raw value for this attribute.</p>
Unsafe Shutdown Count	<p>This attribute reports the cumulative number of unsafe (unclean) shutdown events over the life of the device. An unsafe shutdown occurs whenever the device is powered off without STANDBY IMMEDIATE being the last command. Use the Raw value for this attribute.</p>
Host Writes	<p>This attribute reports the total number of sectors written by the host system. The raw value is increased by 1 for every 65,536 sectors written by the host. Use the Raw value for this attribute.</p>
Available Reserved Space	<p>This attribute reports the number of reserve blocks remaining. The attribute value begins at 100 (64h), which indicates that the reserved space is 100 percent available. The threshold value for this attribute is 10 percent availability, which indicates that the drive is close to its end of life. Use the Normalized value for this attribute.</p>
Media Wearout Indicator	<p>This attribute reports the number of cycles the NAND media has experienced.</p> <p>The normalized value declines linearly from 100 to 1 as the average erase cycle count increases from 0 to the maximum rated cycles.</p> <p>Once the normalized value reaches 1, the number does not decrease, although it is likely that significant additional wear can be put on the device. Use the Normalized value for this attribute.</p>
End to End Error Detection Count	<p>This attribute is only available for 34nm, G2 SSDs and counts the number of times errors are encountered during logical block addressing (LBA) tag checks on the data path within the drive. Use the Normalized value for this attribute.</p>

## 6.2 Exporting SMART Data to a File

1. Click **Export** to write the drive information and SMART data to a .csv file.
2. Enter a file name and location for the file.
3. Click **Save**.

## 6.3 Refreshing SMART Data

Click **Refresh** to reissue the ATA IDENTIFY DEVICE command and redisplay the information for the selected drive.



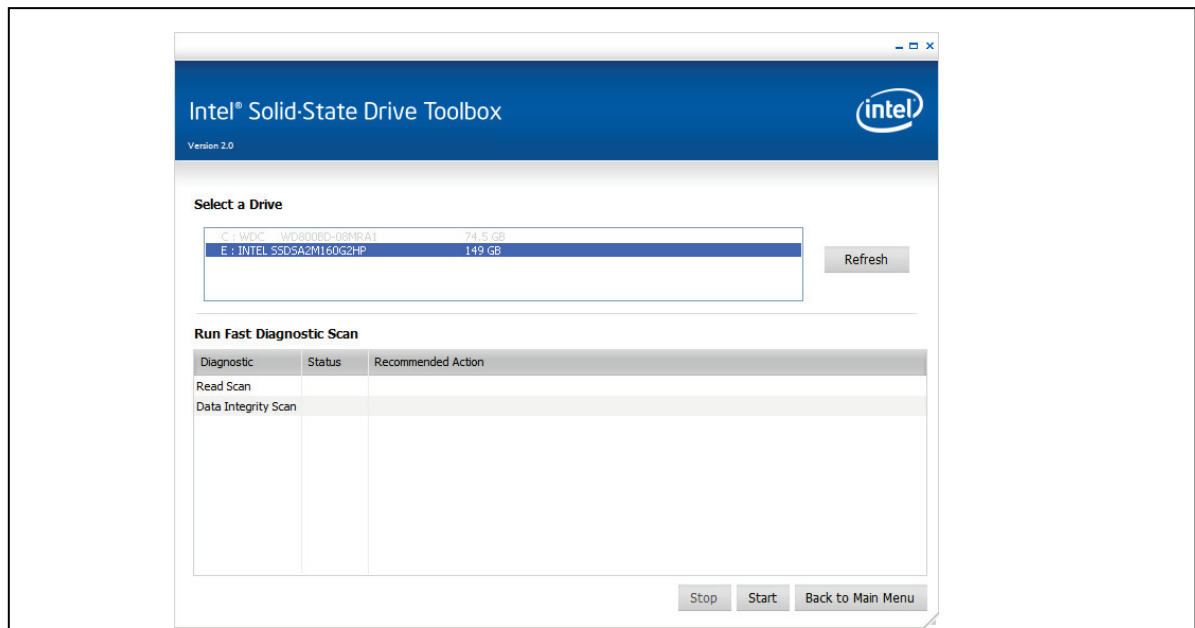
## 7.0 Run Fast Diagnostic Scan

Use this option to perform a quick check on the health of an Intel SSD.

The scan checks 1.5 GB of the SSD for READ errors. The scan then creates 1 GB of random data and then compares it for data integrity. The scan takes approximately three to five minutes to complete and requires a minimum of 5GB of unutilized space to run.

From the main screen, select the Intel SSD > **Run Fast Diagnostic Scan**.

**Figure 15. Run Fast Diagnostic Scan Screen**



The screen contains the following fields and buttons:

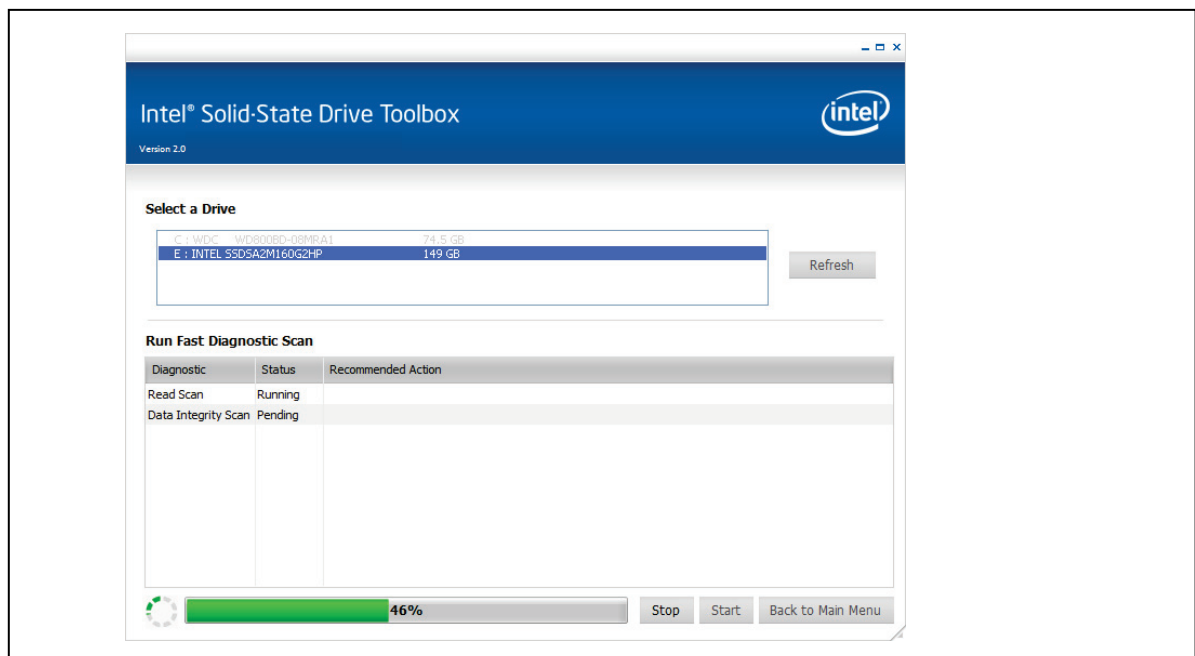
- **Diagnostic** – Lists the name of the available scans.
- **Status** – Reports the progress of the scan. Initially blank, the field is populated while running the scan.
- **Recommended Action** – Identifies whether the system can use the drive for processing. Initially blank, the field is populated after each scan finishes.
- **Stop** – Halts the scan on the selected drive.
- **Start** – Launches the Fast Diagnostic Scan.
- **Back to Main Menu** – Returns to the Intel SSD Toolbox main screen.
- **Refresh** – Rescans your computer and displays the name and capacity of each drive found on your system.

To run the fast diagnostic scan:

1. Select the Intel SSD.
2. Click **Start**.

The fast diagnostic scan starts. A progress bar shows the status of the scan. When finished, view the Status and Recommended Actions fields.

**Figure 16. Run Fast Diagnostic Scan Progress Screen**



- **Status** – Displays whether the scan completed successfully or encountered a problem.
- **Recommended Action** –If the scan encountered a problem, the screen displays the corresponding error message and next step information. See [Section 9.2, “Fast or Full Diagnostic Scan Errors”](#) for more information.





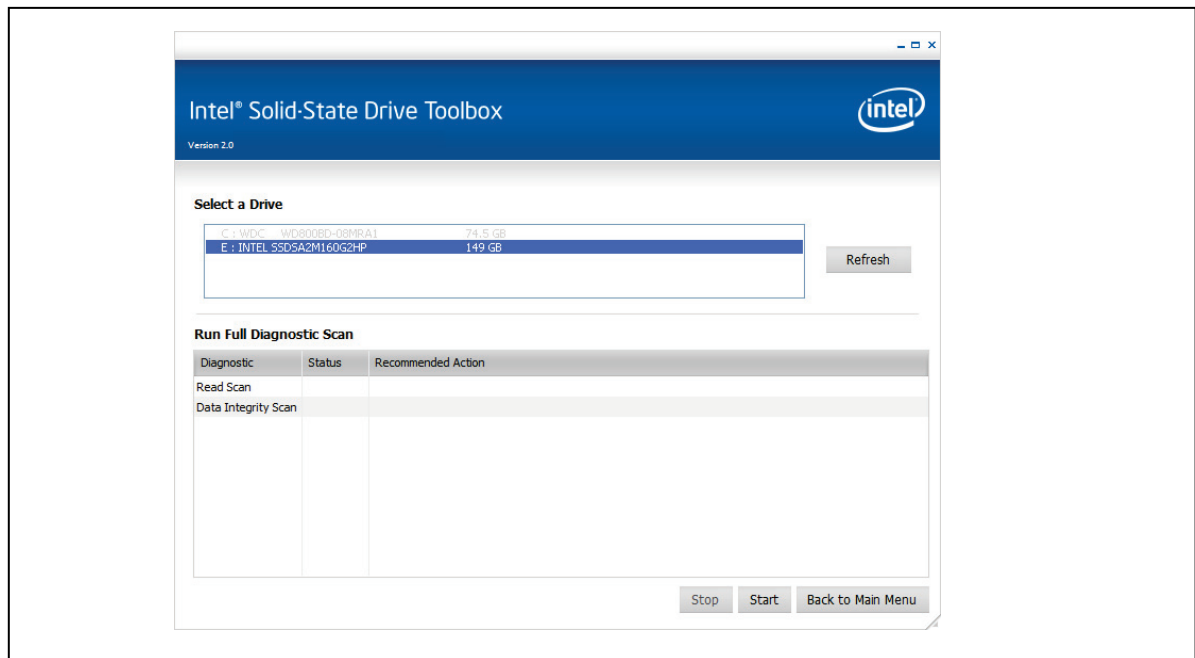
## 8.0 Run Full Diagnostic Scan

Use this option to perform an overall health evaluation on an Intel SSD.

After checking every logical block address (LBA) for READ errors, the scan uses the free space to write random data and then reads it back to ensure data integrity. This scan can take an hour or more to run, depending on the amount of free space on the drive, and requires a minimum of 5GB of unutilized space to run.

From the main screen, select the Intel SSD > **Run Full Diagnostic Scan**.

**Figure 17. Run Full Diagnostic Scan Screen**



The screen contains the following fields and buttons:

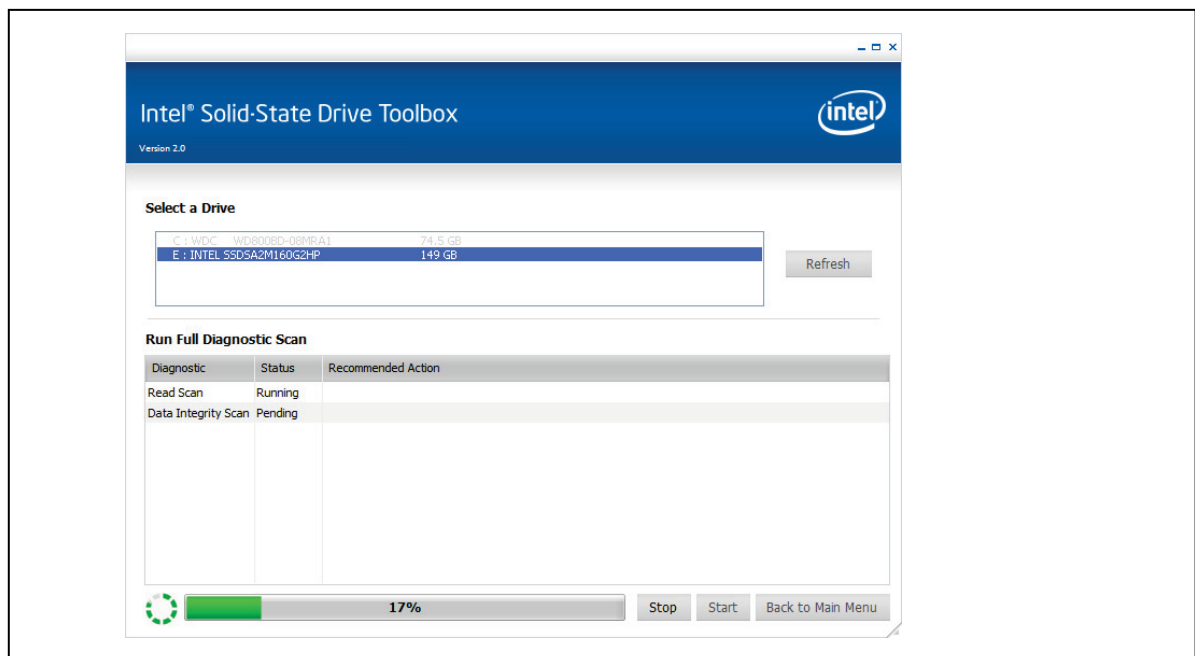
- **Diagnostics** – Lists the name of the available scans.
- **Status** – Reports the progress of the scan. Initially blank, the field is populated while running the scan.
- **Recommended Action** – Identifies whether the system can use the drive for processing. Initially blank, the field is populated after each scan finishes.
- **Stop** – Halts scan on the selected drive.
- **Start** – Launches the Full Diagnostic Scan.
- **Back to Main Menu** – Returns to the Intel SSD Toolbox main screen.
- **Refresh** – Rescans your computer and displays the name and capacity of each drive found on your system.

To run the full diagnostic scan:

1. Select the Intel SSD.
2. Click **Start**.

The full diagnostic scan starts. A progress bar shows the status of the scan. When finished, view the Status and Recommended Actions fields.

**Figure 18. Run Full Diagnostic Scan Progress Screen**



- **Status** – Displays whether the scan completed successfully or encountered a problem.
- **Recommended Action** –If the scan encountered a problem, the screen displays the corresponding error message and next step information. See [Section 9.2, “Fast or Full Diagnostic Scan Errors”](#) for more information.



## 9.0 Troubleshooting

This section describes solutions to error messages you may encounter when using Intel SSD Toolbox 2.0

### 9.1 Intel SSD Optimizer Error Messages

#### 9.1.1 This tool is not supported on the selected drive

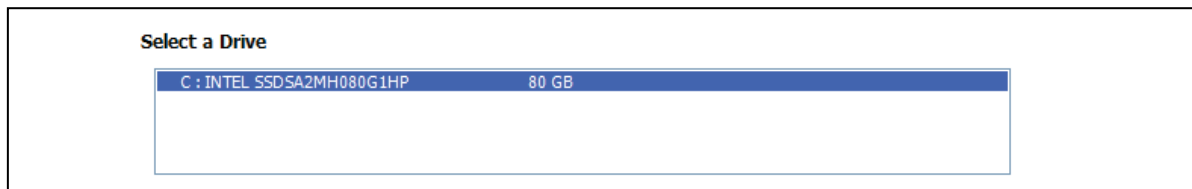
If your Intel SSD does not have the latest firmware installed or if the SSD's lithography is 50nm (G1), the program displays the following message:

**This tool is not supported on the selected drive.**

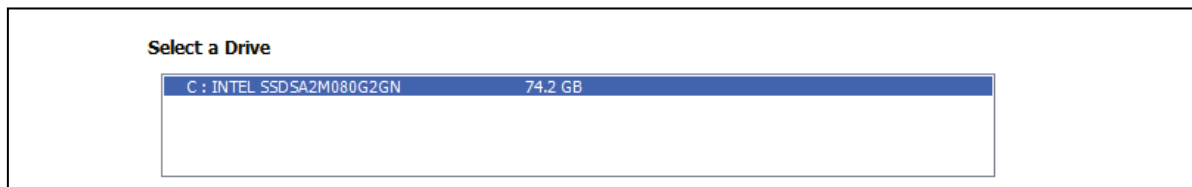
To determine your SSD's lithography, see the drive name in the Select a Drive window:

- If the drive name contains **G1**, the drive is 50nm (see [Figure 19](#))
- If the drive name contains **G2**, the drive is 34nm (see [Figure 20](#))

**Figure 19. 50nm SSD Example**



**Figure 20. 34nm SSD Example**



### 9.1.2 Cannot run the Intel SSD Optimizer on RAID Configurations

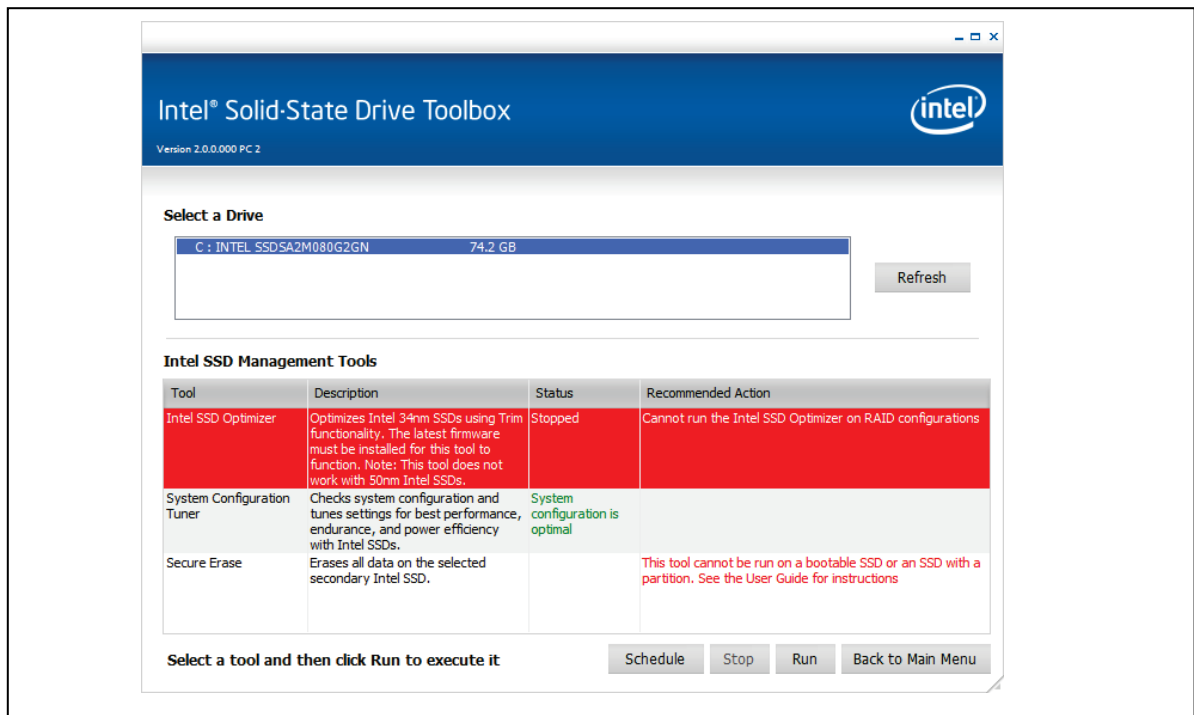
Intel SSD Optimizer cannot run on Intel SSDs in RAID Configurations.

Intel SSD Toolbox checks for RAID configurations at startup. However, because not all RAID configurations can be detected at startup, the tool runs a second check when starting the Intel SSD Optimizer.

If the SSD is in a RAID configuration, Intel SSD Optimizer highlights in red and displays the following error message:

**Cannot run the Intel SSD Optimizer on RAID configurations.**

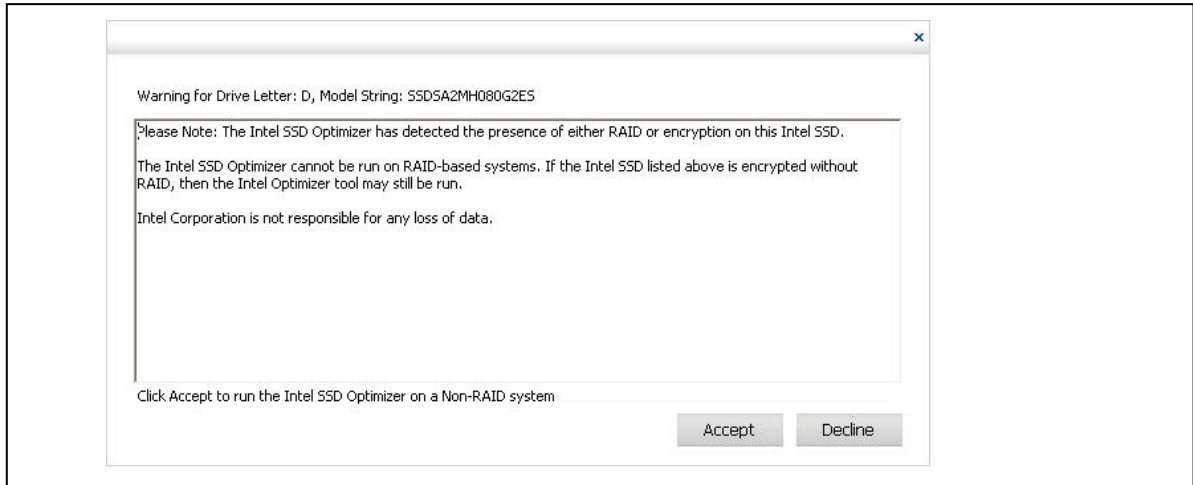
**Figure 21. SSD With RAID Configuration**



Even if the second check does not detect a RAID configuration, the SSD may still be part of a RAID configuration, or, the SSD may be using an encryption scheme. In this case, the Intel SSD Toolbox displays the following screen and prompts you to identify whether the SSD is part of a RAID configuration or is encrypted.



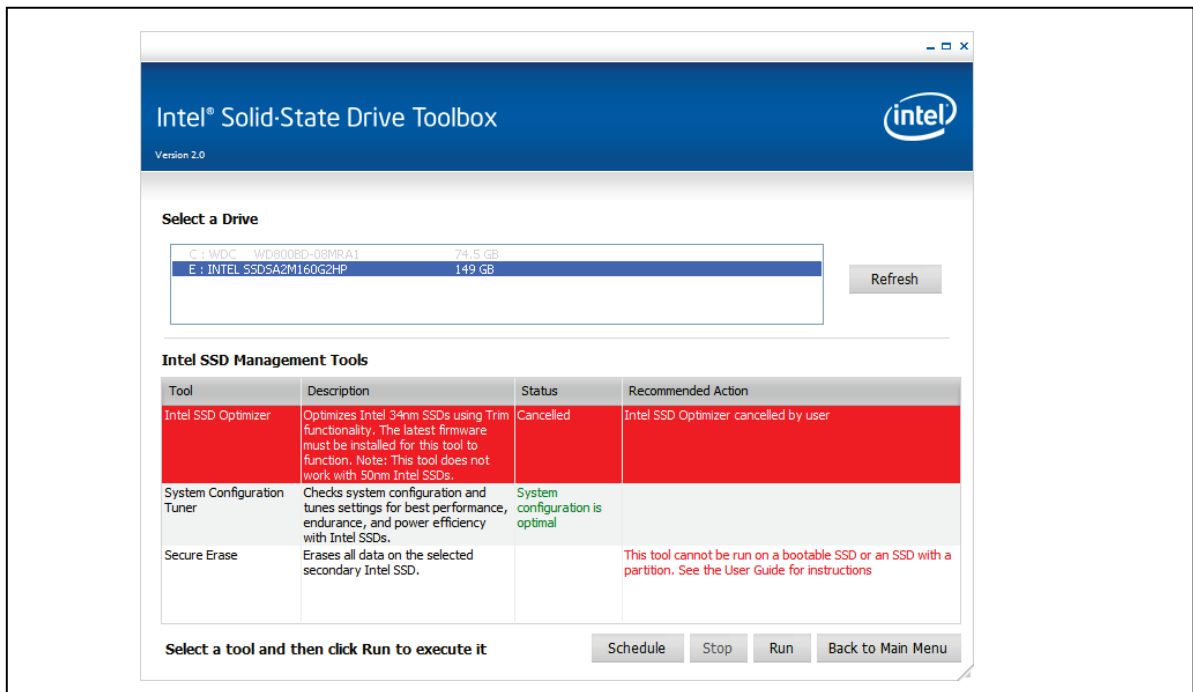
**Figure 22. Warning screen**



If the SSD is encrypted and is *not* in a RAID configuration, click **Accept** to continue running the Intel SSD Optimizer tool on the selected drive.

If the SSD is in a RAID configuration, click **Decline** to stop running the tool. The program then displays the following cancellation screen:

**Figure 23. Cancelled Intel SSD Optimizer Tool Screen**



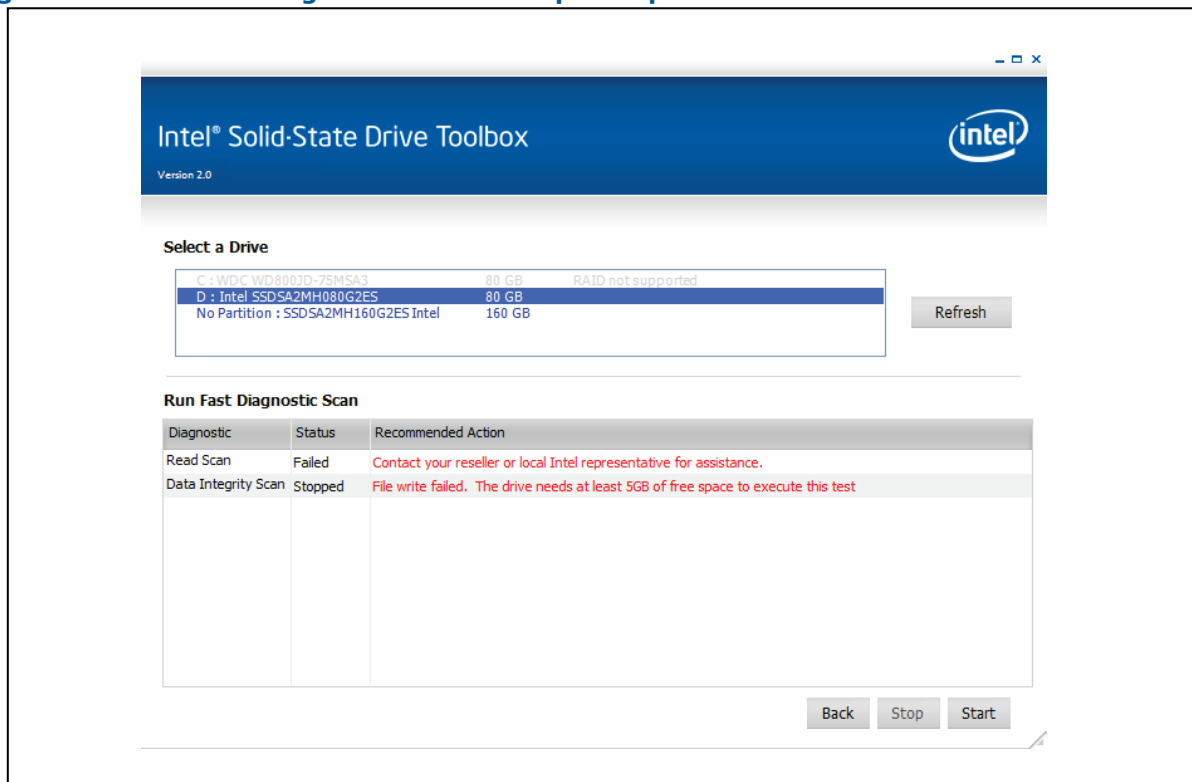
## 9.2 Fast or Full Diagnostic Scan Errors

### 9.2.1 Inadequate Amount of Free Space

To run the Fast or Full Diagnostic Scan, the Intel SSD needs a minimum of 5GB of free space. If the SSD does not have the minimum free space, the following error appears:

**File write failed. The drive needs at least 5GB of free space to execute the tool.**

**Figure 24. Error Message Screen – Inadequate Space to Run Test**

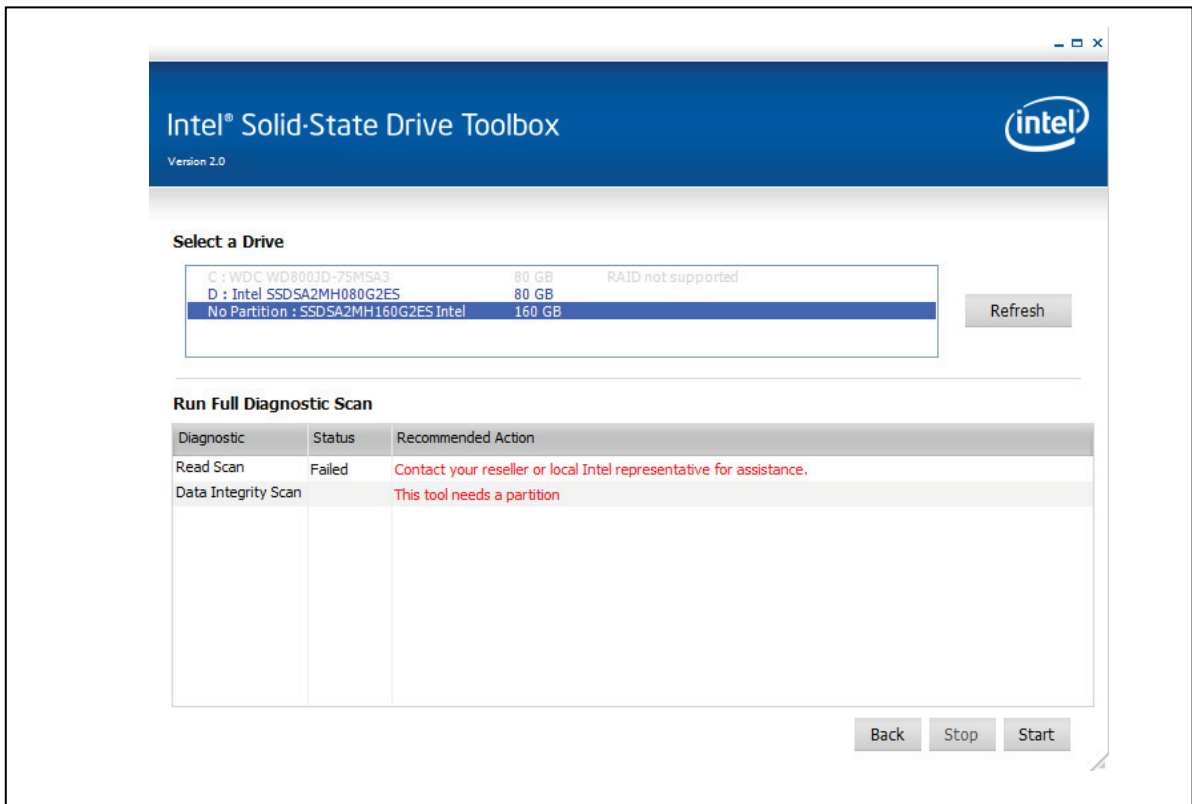




### 9.2.2 No Partition

For the Fast Diagnostic Scan or Full Diagnostic Scan to function properly, the scan requires a partitioned area to create and validate random data.

**Figure 25. Error Message Screen – No Partition**





## 10.0 Reference Documents

Use [Table 3](#) to identify standards information referenced in this guide.

**Table 3. Standards References**

Document	Document No./Location
ATA-7 Volume 1 Specification, April 2004	<a href="http://www.t13.org/Documents/UploadedDocuments/docs2007/D1532v1r4b-AT_Attachment_with_Packet_Interface_-_7_Volume_1.pdf">http://www.t13.org/Documents/UploadedDocuments/docs2007/D1532v1r4b-AT_Attachment_with_Packet_Interface_-_7_Volume_1.pdf</a>
ATA-5 Specification, February 2000	<a href="http://www.t13.org/Documents/UploadedDocuments/project/d1321r3-ATA-ATAPI-5.pdf">http://www.t13.org/Documents/UploadedDocuments/project/d1321r3-ATA-ATAPI-5.pdf</a>
ATA-3 Specification, January 1997	<a href="http://www.t10.org/t13/project/d2008r7b-ATA-3.pdf">http://www.t10.org/t13/project/d2008r7b-ATA-3.pdf</a> Expired and withdrawn in 2002
SATA Rev 2.6 Specification, February 2007	<a href="http://www.sata-io.org">http://www.sata-io.org</a>
SFF-8035i Specification	<a href="http://www.cotsworks.com/PDFs/SFF-8053.pdf">http://www.cotsworks.com/PDFs/SFF-8053.pdf</a>

## 11.0 Additional Information

For more information on Intel SSDs, see the corresponding documentation.

**Table 4. Related Documentation**

Document	Document No./Location
Intel® High Performance SATA SSD SMART Features User Guide	320520-US
Intel® High Performance SATA Solid State Drive S.M.A.R.T. Features User Guide 34nm Product Line	322737-US
Intel® X25-V SATA Solid-State Drive Product Manual	322736-US
Intel® X25-E SATA Solid-State Drive Product Manual	319984-US
Intel® X18-M/X25-M SATA Solid-State Drive – 34nm Product Line Product Manual	322296-US
Intel® X18-M/X25-M SATA Solid-State Drive Product Manual	319765-US





## 12.0 Glossary

**Table 5. Terms and Acronyms**

<b>Term</b>	<b>Description</b>
AHCI	Advanced Host Controller Interface
ATA	Advanced Technology Attachment
DIPM	Device Initiated Power Management
FAT32	File Allocation Table
Gbps	Gigabits per second
NTSF	New Technology File System
RAID	Redundant Array of Independent Disks
SATA	Serial ATA
SMART	Self-Monitoring, Analysis, and Reporting Technology: an open standard for developing hard drives and software systems that automatically monitors a hard drive's health and reports potential problems.
SSD	Solid-State Drive
Trim	A TRIM command allows an operating system to inform a solid-state drive which data blocks are no longer in use, such as those left by a deleted file, and can be deleted.

## 13.0 Revision History

**Table 6. Document Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description</b>
September 2010	001	Initial release