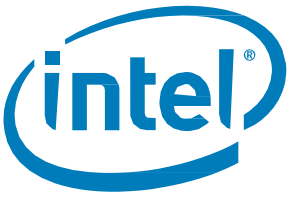
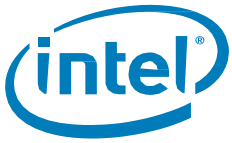


Intel® Solid State Drive Firmware Update Tool

Release Notes

April 2019
Revision 3.0.7

Document Number: 328292-030US



Intel® SSD Firmware Update Tool Revision History

Date	Software Revision	Description
April 2019	3.0.7	This revision adds a firmware update for Intel® Optane™ SSD 905P Series
February 2019	3.0.6	This revision adds a firmware update for the Intel® SSD 545s Series drives. In addition support secure erase for Intel® NVMe drives.
November 2018	3.0.5	This revision adds a firmware update for the Intel® SSD E 6100p Series drives.
October 2018	3.0.4	This revision adds a firmware update for the Intel® SSD 545s, Pro 5450s and E 5100s Series drives.
September 2018	3.0.3	This revision adds a firmware update for the Intel® SSD 760p and Pro 7600p Series drives.
August 2018	3.0.2	This revision adds a firmware update for the Intel® SSD 660p Series drives.
March 2018	3.0.1	This revision adds a firmware update for the Intel® SSD 540s, Pro 5400s, E 5400s and DC S3100 Series drives.
February 2018	3.0.0	This revision adds a firmware update for the Intel® SSD DC S4500/S4600 Series and Intel® SSD DC P4500/P4600 Series and Intel® SSD DC P4510/P4610 Series and Intel® Optane™ SSD DC P4800X Series devices along with following tool changes: • Convert interface from GUI to CLI only. Refer to latest user guide.
September 2017	2.2.3	This revision adds a firmware update for the Intel® SSD 545s and DC S3520 Series.
July 2017	2.2.2	This revision adds a firmware update for the Intel® SSD 540s and Pro 5400s Series.
May 2017	2.2.1	This revision adds a firmware update for the Intel® Optane™ Memory, the Intel® SSD 600p, Pro 6000p, E 6000p, 540s, Pro 5400s and E 5400s Series, and Intel® SSD DC P3100 and DC S3100. Known Limitation: Intel SSD Firmware Update Tool will not work on Intel® Optane™ Memory when configured as a system accelerator.
April 2017	2.2.0	This revision includes updates to the tool's bootable Linux environment addressing various loading issues seen on earlier versions. This revision adds firmware updates for the Intel® SSD 750, Intel® SSD Pro 5400s (80/120GB), Intel® SSD DC P3520 and Intel® SSD DC S3520 Series products.
December 2016	2.1.7	This revision adds a firmware update for the Intel® SSD 600p, Intel® SSD Pro 6000p, Intel® SSD E 6000p, Intel® SSD DC P3100, Intel® SSD DC S3610 and the Intel® SSD DC S3710 Series products.
October 2016	2.1.6	This revision adds a firmware update for the Intel® SSD 750 Series products.
July 2016	2.1.5	This revision adds a firmware update for the Intel® SSD 540s, E 5400s, Pro 5400s Series and the Intel® SSD DC S3100 Series products.
June 2016	2.1.3	This revision adds a firmware update for the Intel® SSD 540s, E 5400s Series and the Intel® SSD DC S3100 Series products.
March 2016	2.1.2	This revision adds a firmware update for the Intel® SSD DC S3700, DC S3500, DC S3710, DC S3610 and DC S3510 Series products.
November 2015	2.1.1	This revision adds a firmware update for the Intel® SSD 750 Series products.
October 2015	2.1.0	This revision adds a firmware update for the Intel® SSD 750, 535, and Pro 2500 Series and the Intel® SSD DC S3710, DC S3610, DC S3510, DC S3500 M.2 and DC S3500 HD Series drives along with the following tool changes: • Prevents firmware update on unhealthy drives • Added notification if drive in bootloader state • Added detection of PCIe* NVMe* products
December 2014	2.0.14	This revision clarified 512B/4KB support for the Intel® SSD DC S3700 and S3500 products. No firmware changes were made from the previous release.
July 2014	2.0.13	This revision fixes issues associated with working on several Apple* systems. No firmware changes were made from the previous release.

Date	Software Revision	Description
February 2014	2.0.10	This revision adds firmware updates for both Intel® SSD DC S3700 and S3500 products.
December 2013	2.0.9	This revision adds a firmware update for all of the Intel® SSD 530 Series drives.
August 2013	2.0.6	This revision adds a firmware update for the Intel® SSD 530 Series. No other firmware changes were made from the previous release.
July 2013	2.0.4	This revision adds a firmware update for the Intel® SSD DC S3500 series. No other firmware changes were made from the previous release.
June 2013	2.0.3	This revision changes the Firmware Update Tool from a command line to a graphic user interface and adds the ability to update multiple Intel SSDs with a single button.
November 2012	1.9.3	This revision adds a firmware update for the Intel® SSD 335 series No other firmware changes were made from the previous release.
September 2011	1.9.2	This revision of the Firmware Update Tool: • Fixes issues associated with correctly detecting Intel SSDs in Apple* systems • Updates Intel 320 Series firmware specific to Lenovo* systems to the most current version. No other firmware changes were made from the previous release.

List of Intel® Optane™ Solid State Drives

Click on the appropriate Optane SSD to go to the firmware revision history for your drive:

Optane SSD	Latest Firmware Version(s)
Intel® Optane™ SSD 905P Series	E201043A

List of Intel® Optane™ Memory Devices

Click on the appropriate Memory to go to the firmware revision history for your unit:

Memory	Latest Firmware Version(s)
Intel® Optane™ Memory	K3110310

Intel® Optane™ Memory Revision History

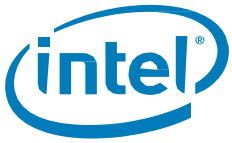
Date	Revision	Description
May 2017	K3110310	This firmware version contains fixes for intermittent enumeration issues.

List of Intel® Solid State Drives

NOTE: If you purchased your Intel SSD from an OEM, your firmware version may have a different naming. Contact your local OEM representative for the latest firmware revisions.

Click on the appropriate SSD to go to the firmware revision history for your drive:

Solid State Drive	Latest Firmware Version(s)
Intel® Solid State Drive DC P4510/P4610 Series	VDV10120
Intel® Solid State Drive DC P4500/P4600 Series	QDV10170
Intel® Solid State Drive DC P3520 Series	MDV10271



Solid State Drive	Latest Firmware Version(s)
Intel® Solid State Drive DC P3100 Series	119D
Intel® Solid State Drive DC S4500/S4600 Series	SCV10111
Intel® Solid State Drive DC S3710 Series	G2010160 – same as S3610
Intel® Solid State Drive DC S3700 Series	5DV12270
Intel® Solid State Drive DC S3610 Series	G2010160 – same as S3710
Intel® Solid State Drive DC S3520 Series	N2010121
Intel® Solid State Drive DC S3510 Series	G2010150
Intel® Solid State Drive DC S3500 Series	Default: D2012370 M.2: G2010150 HD: G2010150
Intel® Solid State Drive DC S3100 Series	042D
Intel® Solid State Drive E 6000p Series	121E
Intel® Solid State Drive E 5400s Series	042E
Intel® Solid State Drive E 5100s Series	LHF003E: 128GB and 256GB 2.5-inch/M.2 80mm LHF0A2E: 64GB 2.5-inch/M.2 80mm
Intel® Solid State Drive E 6100p Series	004E
Intel® Solid State Drive Pro 7600p Series	004P
Intel® Solid State Drive Pro 6000p Series	121P
Intel® Solid State Drive Pro 5450s Series	LHF004P: 256GB and 512GB 2.5inch/M.2 80mm LHF0B2P: 1TB 2.5inch
Intel® Solid State Drive Pro 5400s Series	042P 016P: 256GB/512GB
Intel® Solid State Drive Pro 2500 Series	M.2: TG16, 2.5-inch: TG21
Intel® Solid State Drive 760p Series	004C
Intel® Solid State Drive 750 Series	Firmware: 8EV101H0 Bootloader: 8B1B0133
Intel® Solid State Drive 660p Series	002C
Intel® Solid State Drive 600p Series	121C
Intel® Solid State Drive 545s Series	LHF004C: 128GB, 256GB and 512GB 2.5inch/M.2 80mm LHF0B2C: 1TB 2.5inch
Intel® Solid State Drive 540s Series	042C 016C: 256GB/512GB
Intel® Solid State Drive 535 Series	M.2: RG11 2.5-inch: RG21
Intel® Solid State Drive 530 Series	M.2: DC31, 2.5-inch: DC32, mSATA: DC33

Solid State Drive	Latest Firmware Version(s)
Intel® Solid State Drive 335 Series	335u
Intel® Solid State Drive 320 Series	4PC10362
Intel® X25-E (50nm) SSD	045C8855
Intel® X18-M/X25-M (50nm) SSD	045C8820
Intel® X18-M/X25-M/25-V (34nm) SSD	2CV102M3
Intel® Optane™ SSD DC P4800X Series	E2010324: 375GB E2010325: 750GB

Intel® Optane™ Solid State Drive 905P Series Revision History

Date	Firmware Revision	Description
April 2018	E201043A	The following changes are included in this firmware update: • Bug fixes for performance and UBER

Intel® Optane™ Solid State Drive DC P4800X Series Revision History

Date	Firmware Revision	Description
February 2018	E2010324 (375GB) EB3B0306 E2010325 (750GB) EB3B0309	The following changes are included in this firmware update: • Bug fixes from previous firmware on 375GB (from FW: E2010320) • Note that 750GB was qualified on firmware E2010325. There is no maintenance release past that FW. Additionally, there is limited applicability of this firmware on qual samples. Please reach out to Intel representative if your 750GB samples are on earlier revision than FW E2010325.

Intel® Solid State Drive DC P4510 and P4610 Series Revision History

Date	Firmware Revision	Description
February 2018	VDV10120 VB1B0053	The following changes are included in this firmware update: • Support for higher capacity 4, 8 TB SKUs. Unified binary for 1, 2, 4, 8 TB SKUs. • Other drive stability & functionality fixes.

Intel® Solid State Drive DC P4500 and P4600 Series Revision History

Date	Firmware Revision	Description
February 2018	QDV10170 QB1B0122	The following changes are included in this firmware update: • Fixed SATA CRC errors seen when running at 3Gbps • Corrected SMART 05h behavior • Fixed power consumption on Staggered Spin-up.

Intel® Solid State Drive DC P3520 Series Revision History

Date	Revision	Description
March 2017	MDV10271	This firmware versions contain the following enhancements: • Improvements to drive behavior during die offline events, LBA mismatches, handling errors during PLI events • Boot drive capability issue addressed

Intel® Solid State Drive DC P3100 Series Revision History

Date	Revision	Description
May 2017	119D	This firmware versions contain the following enhancements: • Improved link initializations This firmware versions contain fixes for the following issues: • Drive hangs intermittently after Format NVM command. • Format NVM command occasionally failing with PCIe ASPM enabled. • Data miscompare caused by intermittent data corruption during heavy write workload with small file transfer size. • Incorrect drive behavior for command with Forced Unit Access setting.
December 2016	109D	This firmware versions contain the following enhancements: • Improvements to PHY initialization process • Improved end of life management of bad blocks for better reliability This firmware versions contain fixes for the following issues: • Fixed potential issue of incorrect data may be read during resume from low power state

Intel® Solid State Drive DC S4500 and S4600 Series Revision History

Date	Firmware Revision	Description
February 2018	SCV10111 SBUB0018	The following changes are included in this firmware update: • Improved Random Read performance • Faster Secure Erase of the drive • Bug fixes from previous firmware SCV10100. Please see Intel SSD DC S4500 S4600 Series updated sightings report for all bug fixes in SCV10111

Intel® Solid State Drive DC S3710 and DC S3610 Series Revision History

Date	Revision	Description
December 2016	G2010160	This firmware version includes support for the ACS-3 command set.
March 2016	G2010150	The following changes are included in this firmware update: • Fixed SATA CRC errors seen when running at 3Gbps • Corrected SMART 05h behavior • Fixed power consumption on Staggered Spin-up. This latest firmware also includes a fix for a specific use condition where in certain cases if the device receives a command that violates the SATA protocol specification, the drive may ASSERT or stop responding to host commands (See Intel Advisory INTEL-SA-00050).
October 2015	G2010140	This release provides the following improvements: • Added support for SMART Attribute F3h • Modification to Secure Erase to include NAND Erase • Improvements to the Maximum Latency for all Sequential and Random Write workloads • Added a fourth PHY mode setting to accommodate long interconnects (> 8-inches)

Intel® Solid State Drive DC S3700 Series Revision History

Date	Revision	Description
March 2016	5DV12270	This latest firmware include a fix for a specific use condition where in certain cases if the device receives a command that violates the SATA protocol specification, the drive may ASSERT or stop responding to host commands. (See Intel Advisory INTEL-SA-00050).
February 2014	0270	This release provides the following improvements: • In the unlikely event that a drive fails, the drive will now report the correct serial number and actual capacity. The error code is available in ID block word 140 and GPL address 0xDD. • When a power-off is less than 500ms the drive will automatically reset and allow proper drive enumeration. • Support for the reporting of both 512B and 4KB physical sector size. The default setting is 4K as reported in Word 106 of the identifying drive data. The default sector size can be changed by using the Intel® Solid State Drive Data Center Tool. • As blocks are retired, the SMART E8h value will decrease linearly. • After a power cycle, timed workload variables will resume from the last saved values and update after 60 minutes and every minute thereafter. • SMART Attribute 05h now has a normalized value of 100. • SMART Attribute C2h now reports the correct temperature.
June 2013	0265	This release addresses the following issues: • The drive may exhibit longer latency behind certain HBA/RAID cards under specific sequential workloads. • SMART attribute EAh was not correctly incrementing. • Drive returns incorrect response or becomes unresponsive to an LBA write above 32bit address.

Intel® Solid State Drive DC S3520 Series Revision History

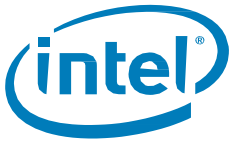
Date	Revision	Description
September 2017	N2010121	These firmware versions contain fixes for the following issues: • Subsequent firmware updates no longer require a power cycle of the system. • Drive may enter a disabled logical state or report SMART AFh failure if powered on after storage in certain conditions. • Drive may enter disabled logical state when executing SMART Extended self-test routine in captive mode. • Sanitize feature set cannot be re-enabled following an SSP disable and COMRESET • Misc. sightings closure and improvement on product health.
March 2017	N2010112 (2.5" only)	These firmware versions contain fixes for the following issues: • Correction to SMART attribute BBh and F1h increment behavior • Fix to drive behavior when power loss occurs during Secure Erase • Fixed issue where SCT Extended Status Code, Action Code and Function Code were not being cleared on a COMRESET • Fix to address occasional Standby Immediate failure • Legacy ATA commands not relevant in ACS-3 no longer aborted • Correction to drive behavior when running SMART self-test using Smartctl* and ABORT command received

Intel® Solid State Drive DC S3510 Series Revision History

Date	Revision	Description
March 2016	G2010150	The following changes are included in this firmware update: • Fixed SATA CRC errors seen when running at 3Gbps • Corrected SMART 05h behavior • Fixed power consumption on Staggered Spin-up. This latest firmware also includes a fix for a specific use condition where in certain cases if the device receives a command that violates the SATA protocol specification, the drive may ASSERT or stop responding to host commands (See Intel Advisory INTEL-SA-00050).
October 2015	G2010140	This release provides the following improvements: • Added support for SMART Attribute F3h • Modification to Secure Erase to include NAND Erase • Improvements to the Maximum Latency for all Sequential and Random Write workloads • Added a fourth PHY mode setting to accommodate long interconnects (> 8-inches)

Intel® Solid State Drive DC S3500 Series Revision History

Date	Revision	Description
March 2016	For DC S3500 M.2, DC S3500 HD only G2010150 For DC S3500 only D2012370	These latest firmware versions include a fix for a specific use condition where in certain cases if the device receives a command that violates the SATA protocol specification, the drive may ASSERT or stop responding to host commands (See Intel Advisory INTEL-SA-00050).
October 2015	For DC S3500 M.2 DC S3500 HD only G2010140	This firmware release is only applicable for the Intel® SSD DC S3500 M.2 and DC S3500 HD Series drives. This release provides the following improvements: • Added support for SMART Attribute F3h • Modification to Secure Erase to include NAND Erase • Improvements to the Maximum Latency for all Sequential and Random Write workloads • Added a fourth PHY mode setting to accommodate long interconnects (> 8-inches)
February 2014	0370	This release provides the following improvements: • In the unlikely event that a drive fails, the drive will now report the correct serial number and actual capacity. The error code is available in ID block word 140 and GPL address 0xDD. • When a power-off is less than 500ms the drive will automatically reset and allow proper drive enumeration. • Support for the reporting of both 512B and 4KB physical sector size. The default setting is 4K as reported in Word 106 of the identifying drive data. The default sector size can be changed by using the Intel® Solid State Drive Data Center Tool. • As blocks are retired, the SMART E8h value will decrease linearly. • After a power cycle, timed workload variables will resume from the last saved values and update after 60 minutes and every minute thereafter. • SMART Attribute 05h now has a normalized value of 100. • SMART Attribute C2h now reports the correct temperature.
July 2013	0355	This release provides an update to the SMART Error Log after download microcode command is executed. Other ongoing improvements were made to address manufacturability and IOPs consistency.



Intel® Solid State Drive DC S3100 Series Revision History

Date	Revision	Description
March 2018	042D	This firmware version contains fixes for the following issues: • Fixed issue that, in some extreme cases, may result in user losing access to drive.
May 2017	041D	This firmware versions contain the following enhancements: • Optimized SATA signal integrity • Optimized behavior entering and resuming from low-power states This firmware versions contain fixes for the following issues: • Intermittent errors when resuming from unsafe shutdown • Fixed issues around use in Connected Standby • Fixes to intermittent boot error in Linux • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00079)
July 2016	036D	This firmware release provides the following change • Fixes issue that BSOD occurs during S3/S4 resume on systems supporting devsleep • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00055)
June 2016	031D	This firmware release provides the following changes: • Corrected SMART AAh, E8h, ABh, and ACh behavior • Corrected DIPM enabled after COMRESET issue • Corrected errant FIS causing BSOD when Write Cache disabled • Corrected SATA NCQ Command Error log reporting issue • Mitigated a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00053).

Intel® Solid State Drive E 6000p Series Revision History

Date	Revision	Description
May 2017	121E	This firmware versions contain the following enhancements: • Improved link initializations This firmware versions contain fixes for the following issues: • Drive hangs intermittently after Format NVM command. • Format NVM command occasionally failing with PCIe ASPM enabled. • Data miscompare caused by intermittent data corruption during heavy write workload with small file transfer size. • Incorrect drive behavior for command with Forced Unit Access setting.
December 2016	109E	This firmware versions contain the following enhancements: • Improvements to PHY initialization process • Improved end of life management of bad blocks for better reliability These firmware versions contain fixes for the following issues: • Fixed potential issue of incorrect data may be read during resume from low power state

Intel® Solid State Drive E 5400s Series Revision History

Date	Revision	Description
March 2018	042E	This firmware version contains fixes for the following issues: • Fixed issue that, in some extreme cases, may result in user losing access to drive.
May 2017	041E	This firmware versions contain the following enhancements: • Optimized SATA signal integrity • Optimized behavior entering and resuming from low-power states This firmware versions contain fixes for the following issues: • Intermittent errors when resuming from unsafe shutdown • Fixed issues around use in Connected Standby • Fixes to intermittent boot error in Linux • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00079)
July 2016	036E	This firmware release provides the following change • Fixes issue that BSOD occurs during S3/S4 resume on systems supporting devsleep • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00055)
June 2016	031E	This firmware release provides the following changes: • Corrected SMART AAh, E8h, ABh, and ACh behavior • Corrected DIPM enabled after COMRESET issue • Corrected errant FIS causing BSOD when Write Cache disabled • Corrected SATA NCQ Command Error log reporting issue • Mitigated a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00053).

Intel® Solid State Drive E 5100s Series Revision History

Date	Revision	Description

October 2018	LHF003E
	LHF0A2E
		This firmware version contains fixes for the following enhancements:
		• Improved SMART E8/E9 implementation
		• Improved NAND data refresh algorithms
		• Improved SSD recovery flows from unsafe shutdown scenarios
		• Optimized firmware policies to:
		  ○ Prevent premature retirement of NAND blocks as bad
		  ○ Manage media page count changes during power state transitions
		  ○ Handle FW flows when E2E errors are triggered during secure erase operation

Intel® Solid State Drive E 6100p Series Revision History

Date	Revision	Description
November 2018	004E	This firmware version contains fixes for the following enhancements: • Fixed PS4 power state transition issue causing system BSOD or system hang • Fixed intermittent system hang caused by pin based interrupt issue with shared resources • Improvements to enable NVM Subsystem Reset • Fixed unexpected power loss SMART reporting • Enhanced error logging for SSD failure analysis • Improved NAND refresh algorithms • Improved software full disk encryption time

Intel® Solid State Drive Pro 7600p Series Revision History

Date	Revision	Description
September 2018	004P	This firmware versions contain the following enhancements: • Fixed PS4 power state transition issue causing system BSOD or system hang • Fixed intermittent system hang caused by pin based interrupt issue with shared resources • Improvements to enable NVM Subsystem Reset • Fixed unexpected power loss SMART reporting • Enhanced error logging for SSD failure analysis • Improved NAND refresh algorithms • Improved software full disk encryption time

Intel® Solid State Drive Pro 6000p Series Revision History

Date	Revision	Description
May 2017	121P	This firmware versions contain the following enhancements: • Improved link initializations This firmware versions contain fixes for the following issues: • Drive hangs intermittently after Format NVM command. • Format NVM command occasionally failing with PCIe ASPM enabled. • Data miscompare caused by intermittent data corruption during heavy write workload with small file transfer size. • Incorrect drive behavior for command with Forced Unit Access setting. • Mitigates a security vulnerability INTEL-SA-00078
December 2016	109P	This firmware versions contain the following enhancements: • Improvements to PHY initialization process • Improved end of life management of bad blocks for better reliability These firmware versions contain fixes for the following issues: • Fixed potential issue of incorrect data may be read during resume from low power state

Intel® Solid State Drive Pro 5450s Series Revision History

Date	Revision	Description

October 2018	LHF004P
	LHF0B2P
		This firmware version contains fixes for the following enhancements:
		• Improved SMART E8/E9 implementation
		• Improved NAND data refresh algorithms
		• Improved SSD recovery flows from unsafe shutdown scenarios
		• Optimized firmware policies to:
		  ○ Prevent premature retirement of NAND blocks as bad
		  ○ Manage media page count changes during power state transitions
		  ○ Handle FW flows when E2E errors are triggered during secure erase operation

Intel® Solid State Drive Pro 5400s Series Revision History

Date	Revision	Description
March 2018	042P/016P	This firmware version contains fixes for the following issues: • Fixed issue that, in some extreme cases, may result in user losing access to drive.
July 2017	041P/015P	Added support for 256GB/512GB skus: - same firmware changes as listed below.
May 2017		This firmware versions contain the following enhancements: • Optimized SATA signal integrity • Optimized behavior entering and resuming from low-power states This firmware versions contain fixes for the following issues: • Intermittent errors when resuming from unsafe shutdown • Fixed issues around use in Connected Standby • Fixes to intermittent boot error in Linux • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00079)
March 2017	036P	Added support for missing 80/120GB skus – same firmware changes as listed below.
July 2016		This firmware release provides the following changes: • Fixes issue that BSOD occurs during S3/S4 resume on systems supporting devsleep • Fixes drive issues occurring when using WinMagic* software with drive Opal security • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00055)

Intel® Solid State Drive Pro 2500 Series Revision History

Date	Revision	Description
October 2015	M.2 – TG16, 2.5" – TG21	This firmware release provides the following changes: • Devsleep wake optimizations for more robust resume after devsleep • Fix for Windows' disk error occurring after devsleep on systems with ATA user password • Fix for I/O abort due to Sanitize Freeze Lock after COMRESET • Fix for Drive Self-Test reporting incorrect status after test abort

Intel® Solid State Drive 760p Series Revision History

Date	Revision	Description
September 2018	004C	This firmware version contains the following enhancement: • Fixed PS4 power state transition issue causing system BSOD or system hang • Fixed intermittent system hang caused by pin based interrupt issue with shared resources • Improvements to enable NVM Subsystem Reset • Fixed unexpected power loss SMART reporting • Enhanced error logging for SSD failure analysis • Improved NAND refresh algorithms • Improved software full disk encryption time

Intel® Solid State Drive 750 Series Revision History

Date	Revision	Description
March 2017	8EV101H0 8B1B0133	This firmware version contains fixes for the following issues: • XN022 Assert Fixes • Sequential read performance improvement at end of life from firmware 8EV101F0 • Misc. sightings closure and improvement on product health.
October 2016	8EV101F0 8B1B0133	This version provides a firmware and bootloader update for the Intel® SSD 750 Series. This firmware version contains fixes for the following issues • Added NVME IO Queue Metrics log page support • Added Secure Erase Command Monitoring log page support • Updated Secure Erase Command User Data Erase option • Fix for drive entering disable logical mode after frequent, repeated O/S reboots • Prefetch activate/deactivate logic enhancement • Fix for sequential read performance decay • Fix for formatting 4k+DIF causing read errors when using Intel SPDK • Misc. sightings closure and improvement on product health.
November 2015	8EV10174 8B1B0131	The latest firmware revision is 8EV10174. The latest bootloader revision is 8B1B0131 (no change). This firmware version contains fixes for the following issue: • Fixed LED behavior to appear LED-On when drive active and LED-Off when drive idle. • Fix for some use cases where user data may be inaccessible or at risk of loss. (see Intel Advisory INTEL-SA-00047) • Misc. sightings closure and improvement on product health
October 2015	8EV10171 8B1B0131	The latest firmware revision is 8EV10171. The latest bootloader revision is 8B1B0131. This firmware and bootloader version contains fixes for the following issues: • Vendor Unique Command to change SM BUS address on “NVMe™ Basic Management Command” • Improved TRIM IOPS operation • In-field Drive Configuration Update capability • Windows* Driver update with bug fixes • Misc. sightings closure and improvement on product health

Intel® Solid State Drive 660p Series Revision History

Date	Revision	Description
August 2018	002C	This firmware version contains the following enhancement: • Refined Power Management behavior and enhanced power state transitions.

Intel® Solid State Drive 600p Series Revision History

Date	Revision	Description
May 2017	121C	This firmware versions contain the following enhancements: • Improved link initializations This firmware versions contain fixes for the following issues: • Drive hangs intermittently after Format NVM command. • Format NVM command occasionally failing with PCIe ASPM enabled. • Data miscompare caused by intermittent data corruption during heavy write workload with small file transfer size. • Incorrect drive behavior for command with Forced Unit Access setting.
December 2016	109C	This firmware versions contain the following enhancements: • Optimized drive shutdown sequence for better handling during poor system shutdown • Improved power on behavior when resuming from an unsafe shutdown. • Improvements to PS3 resume behavior • Improvements to PHY initialization process • Improvements to PERST# and CLKREQ# detection for corner case issues • Improved end of life management of bad blocks for better reliability These firmware versions contain fixes for the following issues: • Fixed potential issue of incorrect data may be read during resume from low power state

Intel® Solid State Drive 545s Series Revision History

Date	Revision	Description
February 2019	LHF0B2C	This firmware version contains fix for the following issue: • Fixed firmware update configuration for 1TB 2.5-inch SKU that were missing in previous versions of Intel® SSD FUT.

October 2018	LHF004C
	LHF0B2C
		This firmware version contains fixes for the following enhancements:
		• Improved SMART E8/E9 implementation
		• Improved NAND data refresh algorithms
		• Improved SSD recovery flows from unsafe shutdown scenarios
		• Optimized firmware policies to:
		  ○ Prevent premature retirement of NAND blocks as bad
		  ○ Manage media page count changes during power state transitions
		  ○ Handle FW flows when E2E errors are triggered during secure erase operation

September 2017	LHF002C	These firmware versions contain the following enhancements: • Improved drive behavior during unsafe shutdown scenarios • Improved drive behavior with non-aligned 4K workloads • Improved garbage collection capabilities • Updates to SMART table to provide persistent SMART behavior during power cycle, firmware upgrade and secure erase Optimized Power Management behavior with DIPM enabled and transition to different power states

Intel® Solid State Drive 540s Series Revision History

Date	Revision	Description
March 2018	042C/016C	This firmware version contains fixes for the following issues: • Fixed issue that, in some extreme cases, may result in user losing access to drive.
July 2017	041C/015C	Added support for 256GB/512GB skus: - same firmware changes as listed below.
May 2017		This firmware versions contain the following enhancements: • Optimized SATA signal integrity • Optimized behavior entering and resuming from low-power states This firmware versions contain fixes for the following issues: • Intermittent errors when resuming from unsafe shutdown • Fixed issues around use in Connected Standby • Fixes to intermittent boot error in Linux Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00079)
July 2016	036C	This firmware release provides the following change • Fixes issue that BSOD occurs during S3/S4 resume on systems supporting devsleep • Mitigates a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00055)

Date	Revision	Description
June 2016	031C	This firmware release provides the following changes: • Corrected SMART AAh, E8h, ABh, and ACh behavior • Corrected DIPM enabled after COMRESET issue • Corrected errant FIS causing BSOD when Write Cache disabled • Corrected SATA NCQ Command Error log reporting issue • Mitigated a security vulnerability which in some cases resulted in corruption of user's data (see Intel Advisory INTEL-SA-00053).

Intel® Solid State Drive 535 Series Revision History

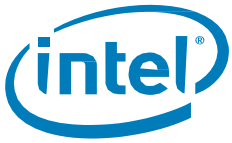
Date	Revision	Description
October 2015	M.2 – RG11, 2.5" – RG21	This firmware release provides the following changes: • Fix for Windows' disk error occurring after devsleep on systems with ATA user password • Fix for I/O abort due to Sanitize Freeze Lock after COMRESET • Fix for Drive Self-Test reporting incorrect status after test abort

Intel® Solid State Drive 530 Series Revision History

Date	Revision	Description
December 2013	M.2 – DC31, 2.5" – DC32, mSATA – DC33	This firmware release provides the following changes: • Default Software Settings Preservation (SSP) for DIPM is changed from a default = on, to a DEFAULT = OFF. This addresses situations in older systems where the drive was not found after a warm reset causing blue screens. • Corrects an occasional miss-reporting of SMART attribute E3h (Timed Workload Read/Write ratio). • The drive no longer increments SMART 0Ch (Power Cycle Count) after a SECURE ERASE operation.
August 2013	2.5" – DC12, mSATA – DC13	This firmware release addresses an occasional drive hang after resume from Link Power Management slumber state.

Intel® Solid State Drive 335 Series Revision History

Date	Revision	Description
June 2013	335u	This firmware revision has several continuous improvement optimizations intended to provide the best possible user experience with the Intel SSD.
November 2012	335t	This release adds a firmware update for the Intel SSD 335 Series fixing the following issue : - Incorrect reporting of the E9h media wear indicator value.



Intel® Solid State Drive 320 Series Revision History

Date	Revision	Description
August 2011	4PC10362	This firmware revision fixes various issues related to the BAD_CTX 13x (8MB capacity) problems associated with unsafe power-loss situations.

Intel® X25-E (50nm product) Revision History

Date	Revision	Description
August 2011	No Change	No changes to Intel X25-E SATA SSD 50nm products. The most current firmware remains at 045C8855.
January 2011	No Change	No changes to Intel X25-E SATA SSD 50nm products. The most current firmware remains at 045C8855.
November 2009	045C8855	This firmware revision has several continuous improvement optimizations intended to provide the best possible user experience with the Intel SSD.
October 2009	No Change	No change to Intel X25-E SATA SSD 50nm products. The most current firmware remains at 045C8850.
August 2009	045C8850	This firmware revision is for Intel X25-E SATA SSD 50nm products only and has several continuous improvement optimizations intended to provide the best possible user experience with the Intel SSD.

Intel® X18-M/X25-M (50nm product) Revision History

Date	Revision	Description
August 2011	No Change	No changes to Intel X18-M/X25-M SATA SSD 50nm products. The most current firmware remains at 045C8820.
January 2011	No Change	No changes to Intel X18-M/X25-M SATA SSD 50nm products. The most current firmware remains at 045C8820.
November 2009	No Change	No changes to Intel X18-M/X25-M SATA SSD 50nm products. The most current firmware remains at 045C8820.
October 2009	No Change	No changes to Intel X18-M/X25-M SATA SSD 50nm products. The most current firmware remains at 045C8820.
August 2009	No Change	No changes to Intel X18-M/X25-M SATA SSD 50nm products. The most current firmware remains at 045C8820.
August 2009	No change	No changes to Intel X18-M/X25-M SATA SSD 50nm products. The most current firmware remains at 045C8820.
April 2009	045C8820	This firmware revision has several continuous improvement optimizations intended to provide the best possible user experience with the Intel SSD.

Intel® X18-M/X25-M/X25-V (34nm product) Revision History

Date	Revision	Description
August 2011	2CV102M3	No changes to Intel X18-M/X25-M SATA SSD 34nm products. The most current firmware remains at 2CV102M3.
January 2011	2CV102M3	This firmware revision fixes enumeration and slow boot issues on SATA 6Gb/s controllers, adds improvements to S.M.A.R.T. attributes for more accurate reporting of drive health, along with improved NCQ capability.
November 2009	2CV102HD	This firmware revision includes several continuous improvement optimizations intended to provide the best possible user experience with the Intel SSD.
October 2009	2CV102HA	This firmware revision supports the ATA Data Set Management Command "Trim". Also, this firmware revision includes several continuous improvement optimizations that provide for increased write performance on 160GB drives.
August 2009	No Change	No changes to Intel X18-M/X25-M SATA SSD 34nm products. The most current firmware remains at 2CV102G9.
August 2009	2CV102G9	This firmware revision is for Intel X25-M SATA SSD 34nm products only (Intel X18-M SATA SSD 34nm products do not require this firmware update) and fixes the following two issues: 1) System hangs with BIOS drive password enabled. 2) System inoperable when BIOS drive password disabled or changed.