



Intel® Solid State Drive 665p Series

Product Specification

- Capacities: 1TB, 2TB
- PCIe* 3.0x4, NVMe*
- NAND: 96-layer Intel® 3D NAND Technology
- Form Factor: 80mm (single-sided) 2280-S3-M
- Thickness: S3 – up to 2.38 mm
- Weight: <10 grams
- Bandwidth Performance^{1,2}
 - Sequential Read: up to 2,000MB/s
 - Sequential Write: up to 2,000MB/s
- Read and Write IOPS^{1,2}
 - Random 4KB Reads: up to 250,000 IOPS
 - Random 4KB Writes: up to 250,000 IOPS
- AES 256-bit Encryption
- Pyrite 1.0, 2.0
- Additional Compatibility
 - Intel® SSD Toolbox with Intel® SSD Optimizer
 - Intel® Rapid Storage Technology
 - PCI Express* Revision 3.1
 - NVMe Express* Revision 1.3
- Power Management
 - 3.3V
 - PCIe Active State Power Management (ASPM)
 - NVMe Autonomous Power State Transition (APST)
 - L1.2
- Power³
 - Active (BAPCo MobileMark* 2014 Workload): 100 mW
 - Idle: 40 mW
 - L1.2 Sleep: 4 mW
- Temperature
 - Operating⁴: 0° C to 70° C
 - Non-Operating: -40° C to 85° C
- Reliability
 - Uncorrectable Bit Error Rate (UBER): <1 sector per 10¹⁵ bits read
 - Mean Time Between Failure (MTBF): 1.6 million hours
- Shock
 - operating: 1000 G/0.5 ms
 - non-operating: 1,500 G/0.5 ms
- Vibration
 - Operating: 2.17 GRMS (5-700Hz)
 - Non-operating: 3.13 GRMS (5-800Hz)
- Certifications and Declarations:
 - UL*
 - CE*
 - RCM*
 - BSMI*
 - KCC*
 - Microsoft* WHLK
 - VCCI*
 - Morocco Maghreb*
 - Ukraine EFUP*
 - China RoHS*
 - Canada ICES*
 - WEEE*
 - NVMe
 - PCIe
- Product Ecological Compliance
 - RoHS*

NOTES:

1. **IOMeter Test and System Configurations:** Intel® Core™ i7-8700K @ 3.70GHz, Gigabyte Z370 AORUS Gaming 5 motherboard, BIOS version: F6, BIOS ID: 8A0DAG0A, Chipset: Intel® INF 10.1.1.38, Memory: 16GB (2x8GB) DDR4-2666, Microsoft* Windows 10* Enterprise 64-bit using native NVMe* storage driver.
2. Performance values vary by capacity.
3. Power measured with PCIe ASPM and NVMe low power states.
4. As measured by temperature sensor, SMART/Health Info. Active airflow is recommended within the system for maintaining proper device operating temperatures on heavier workloads.



Ordering Information

Contact your local Intel sales representative for ordering information.

Revision History

Revision Number	Description	Revision Date
001	<ul style="list-style-type: none">Initial release	September 2019
002	<ul style="list-style-type: none">Updated PLA pin definitionCorrected operating temperature specificationRemoved L0s from the power state table	November 2019

Performance results are based on testing as of July 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

IOMeter Test and System Configurations: Intel® Core™ i7-8700K @ 3.70GHz, Gigabyte Z370 AORUS Gaming 5 motherboard, BIOS version: F6, BIOS ID: 8A0DAG0A, Chipset: Intel® INF 10.1.1.38, Memory: 16GB (2x8GB) DDR4-2666, Microsoft* Windows 10* Enterprise 64-bit using native NVMe* storage driver.

Performance results are based on testing as of October 28, 2019 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

All documented test results are obtained by Intel in compliance with JESD218 Standards; refer to individual sub-sections within this document for specific methodologies. See www.jedec.org for detailed definitions of JESD218 Standards.

Low Halogen applies only to brominated and chlorinated flame retardants (BFRs/CFRs) and PVC in the final product. Intel components as well as purchased components on the finished assembly meet JS-709 requirements, and the PCB/substrate meet IEC 61249-2-21 requirements. The replacement of halogenated flame retardants and/or PVC may not be better for the environment.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

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1 Introduction

This document describes the specifications and capabilities of the Intel® Solid State Drive 665p Series (Intel® SSD 665p Series).

1.1 Terminology

Table 1: Terminology

Term	Description
APST	Autonomous Power State Transitions
ASPM	Active State Power Management
GB	Gigabyte (1,000,000,000 bytes) Note: The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity is used for NAND flash management and maintenance purposes.
I/O	Input/Output
IOPS	Input/Output Operations Per Second
KB	Kilobyte (1,024 bytes)
LBA	Logical Block Address
MB	Megabyte (1,000,000 bytes)
MTBF	Mean Time Between Failures
Pyrite	A Trusted Computing Group (TCG) standard that defines an interface for setting password access privilege.
SLC	Single-level Cell
SMART	Self-Monitoring, Analysis and Reporting Technology
SSD	Solid State Drive
TCG	Trusted Computing Group
TYP	Typical
UBER	Uncorrectable Bit Error Rate



1.2 Reference Documents

Table 2: Standard References

Date or Rev. #	Title	Location
Sept 2010	Solid State Drive (SSD) Requirements and Endurance Test Method (JESD218)	http://www.jedec.org/standards-documents/docs/jesd218/
August 2015	TCG Pyrite Specification Version 1.0 rev 1.0	http://www.trustedcomputinggroup.com/
May 2017	NVM Express* Specification Revision 1.3	http://www.nvmexpress.org/
December 2015	PCI Express* Base Specification Revision 3.1	http://www.pcisig.org/
December 2016	PCI Express M.2 Specification Revision 1.1	http://www.pcisig.org/



2 Product Specifications

2.1 Capacity

Table 3: User Addressable Sectors

Capacity	Unformatted Capacity (Total User Addressable Sectors ¹ in LBA Mode)
1TB (1024GB)	2,000,409,264
2TB (2048GB)	4,000,797,360

NOTES:

1. Sector size is 512B per LBA.

2.2 Performance

Table 4: Burst Performance

Capacity	Random 4KB Read (up to) ¹	Random 4KB Write (up to) ¹	Sequential 128KB Read ¹	Sequential 128KB Write ¹
	IOPS	IOPS	MB/s	MB/s
1TB	160,000	250,000	2,000	1,925
2TB	250,000	250,000	2,000	2,000

NOTE:

1. Performance measured within the SLC cache buffer using IOMeter*. Sequential performance based on QD=64 and random performance based on four workers with QD=64 each.

Table 5: Latency

Specification	Intel® SSD 665p Series Type 2280
Power On To Ready ¹	500 ms (TYP)
Max Power On To Ready ²	< 10 sec

Note:

1. Power on to ready time assumes safe shutdown. Power on to ready is measured from time Vcc is applied until Controller Ready, CSTS.RDY = 1.
2. Max power on to ready time assumes unsafe shutdown. Based on statistical measurement of 95% quality of service.



2.3 Electrical Characteristics

Table 6: Operating Voltage and Power Consumption

Electrical Characteristics	Intel® SSD 665p Series Type 2280	
	1TB	2TB
Operating Voltage for 3.3 V (±5%)		
Min	3.14 V	
Max	3.47 V	
Rise Time (Max/Min)	100 ms / 0.1 ms	
Fall Time (Max/Min)	5 s / 1 ms	
Noise Tolerance	70 mV pp (10 Hz – 30 MHz)	
Min Off Time	1 s	
Power Consumption (TYP)		
Active ¹	100 mW	
Idle ²	25 mW	
L1.23	4 mW	
Thermal Power ⁴	5.0 W	6.0 W
Regulator Power ⁵	6 W	8.0 W

Note:

1. Active power measured during execution of MobileMark* 2014 with PCIe* ASPM*and NVMe* low power states.
2. Power consumption during PCIe L1.2 link state with NVMe PS3.
3. Power consumption during PCIe L1.2 link state with NVMe PS4 for lowest power consumption.
4. Power measured during 128kB sequential writes with Queue Depth 64 workload using 100 ms sample period. This represents power that would be thermal load on system during heavy workloads.
5. Power measured during 128kB sequential writes with Queue Depth 64 workload using 500 us sample period. This represents power that system power supply would have to regulate for proper device operation.



2.4 Environmental Conditions

2.4.1 Temperature, Shock, Vibration

Table 7: Temperature, Shock, Vibration

Environmental Conditions	Range
Module Temperature Operating ¹ Non-operating ²	0° C – 70° C -40° C – 85° C
Temperature Gradient ³ Operating Non-operating	20 (TYP)° C/hr 30 (TYP)° C/hr
Humidity Operating Non-operating	5 – 95 % 5 – 95 %
Shock and Vibration	Range
Shock ⁴ Operating Non-operating	1,000 G (Max) at 0.5 msec 1,500 G (Max) at 0.5 msec
Vibration ⁵ Operating Non-operating	2.17 GRMS (5-700 Hz) Max 3.13 GRMS (5-800 Hz) Max

Note:

1. As measured by temperature sensor, SMART/Health Info. Active airflow is recommended within the system for maintaining proper device operating temperature on heavier workloads.
2. Please contact your Intel representative for details on the non-operating temperature range.
3. Temperature gradient measured without condensation.
4. Shock specifications assume SSD is mounted securely with the input vibration applied to the drive-mounting screws. Stimulus may be applied in the X, Y, or Z axis. Shock specification is measured using peak acceleration and pulse width value.
5. Vibration specifications assume the SSD is mounted securely with the input vibration applied to the drive-mounting screws. Stimulus may be applied in the X, Y, or Z axis. Vibration specification is measured using G Root Mean Squared (GRMS) value.

2.4.2 Altitude

The drive is not sensitive to changes in atmospheric pressure because it has no moving parts. Drive tested under non-operational conditions to pressures representative of -1K and +40K feet and operational conditions -1K to +15K feet.



2.5 Product Regulatory Compliance

The Intel® SSD 665p Series meets the regulatory or certification requirements as specified in the 665p Declaration of Conformity at <https://www.intel.com/content/www/us/en/declaration-of-conformity/cprs-doc/docs-ssd.html?wapkw=declaration+of+conformity>.

MDDS and BSMI RoHS can be found at:

- MDDS: <https://qdms.intel.com/MDDS/MDDSVIEW.aspx>
- BSMI RoHS Declaration: <https://www.intel.com/content/www/us/en/support/memory-and-storage/000025404.html>

2.6 Reliability

The 665p Series meets or exceeds endurance and data retention requirements as specified in the JESD218 specification.

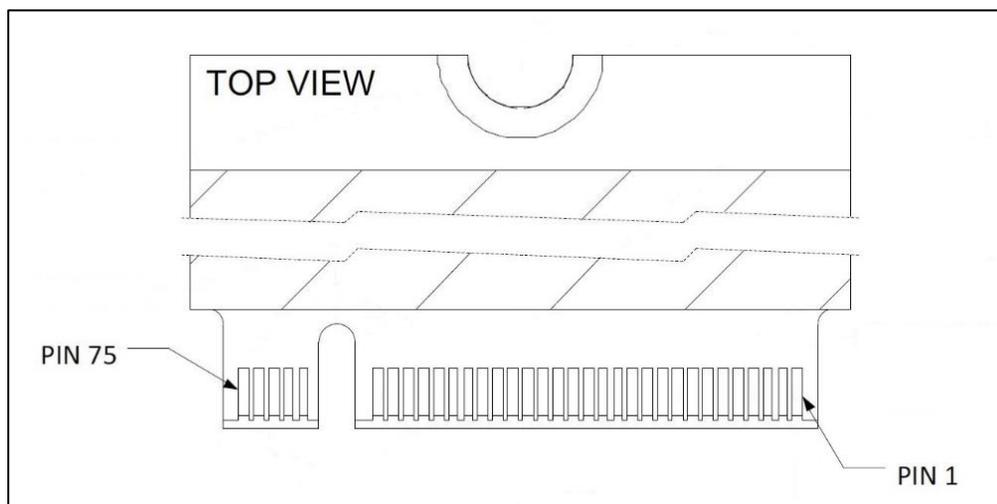
Table 8: Reliability Specifications

Parameter	Value	
Uncorrectable Bit Error Rate (UBER) Uncorrectable bit error rate will not exceed one sector in the specified number of bits read. In the unlikely event of a non-recoverable read error, the SSD will report it as a read failure to the host; the sector in error is considered corrupt and is not returned to the host.	< 1 sector per 10 ¹⁵ bits read	
Mean Time Between Failures (MTBF) Mean Time Between Failures is estimated based on Telcordia* methodology and demonstrated through Reliability Demonstration Test (RDT).	≥ 1.6 million hours	
Minimum Useful Life (Warranty) The SSD will have a minimum of five years of useful life under typical client workloads.	5 years	
Write Endurance Rating The SSD will meet the following host write endurance ratings as measured per JEDEC requirements	Capacity	TBW (Projected)
	1 TB	300 TB
	2 TB	600 TB
Insertion Cycles Maximum insertion/removal cycles on M.2 port	250 insertion/removal cycles	

4 Pin and Signal Descriptions

4.1 Pin Locations

Figure 2: Layout of Signal and Power Segment Pins (odd pins top; even pins bottom)





4.2 Signal Descriptions

Table 9: M.2 PCIe* Pin Definitions

Pin	Function	Definition
P1	GND	Ground
P2	3.3V	3.3 V Source
P3	GND	Ground
P4	3.3V	3.3 V Source
P5	PETn3	PCIe Host Receiver Differential Pair Lane 3
P6	NC	No Connect
P7	PETp3	PCIe Host Receiver Differential Pair Lane 3
P8	PLN	Power loss protection
P9	GND	Ground
P10	LED1#	Device Activity Signal
P11	PERn3	PCIe Host Transmitter Differential Pair Lane 3
P12	3.3V	3.3 V Source
P13	PERp3	PCIe Host Transmitter Differential Pair Lane 3
P14	3.3V	3.3 V Source
P15	GND	No Ground
P16	3.3V	3.3 V Source
P17	PETn2	PCIe Host Receiver Differential Pair Lane 2
P18	3.3V	3.3 V Source
P19	PETp2	PCIe Host Receiver Differential Pair Lane 2
P20	NC	No Connect
P21	GND	Ground
P22	NC	No Connect
P23	PERn2	PCIe Host Transmitter Differential Pair Lane 2
P24	NC	No Connect
P25	PERp2	PCIe Host Transmitter Differential Pair Lane 2
P26	NC	No Connect
P27	GND	Ground
P28	NC	No Connect
P29	PETn1	PCIe Host Receiver Differential Pair Lane 1
P30	NC	No Connect
P31	PETp1	PCIe Host Receiver Differential Pair Lane 1
P32	NC	No Connect
P33	GND	Ground
P34	NC	No Connect
P35	PERn1	PCIe Host Transmitter Differential Pair Lane 1
P36	NC	No Connect
P37	PERp1	PCIe Host Transmitter Differential Pair Lane 1
P38	NC	DevSleep Pin
P39	GND	Ground



Pin	Function	Definition
P40	NC	No Connect
P41	PETn0	PCIe Host Receiver Differential Pair Lane 0
P42	NC	No Connect
P43	PETp0	PCIe Host Receiver Differential Pair Lane 0
P44	NC	No Connect
P45	GND	Ground
P46	NC	No Connect
P47	PERn0	PCIe Host Transmitter Differential Pair Lane 0
P48	NC	No Connect
P49	PERp0	PCIe Host Transmitter Differential Pair Lane 0
P50	PERST#	PCIe Reset – functional reset signal to the device
P51	GND	Ground
P52	CLKREQ#	Clock Request – reference clock request signal; L1 PM substate request
P53	REFCLKn	PCIe reference clock signal differential pair
P54	PEWAKE# - Not Used	PCIe PME Wake – No Connect on Device
P55	REFCLKp	PCIe reference clock signal differential pair
P56	MFG DATA	Reserved for SSD Vendor. No Connect for Platform.
P57	GND	Ground
P58	MFG_CLK	Reserved for SSD Vendor. No Connect for Platform.
P59	Module Key	No Connect
P60	Module Key	No Connect
P61	Module Key	No Connect
P62	Module Key	No Connect
P63	Module Key	No Connect
P64	Module Key	No Connect
P65	Module Key	No Connect
P66	Module Key	No Connect
P67	NC	No Connect
P68	NC	No Connect
P69	NC	No Connect
P70	3.3V	3.3 V Source
P71	GND	Ground
P72	3.3V	3.3 V Source
P73	GND	Ground
P74	3.3V	3.3 V Source
P75	GND	Ground



5 Supported Command and Feature Sets

The 665p Series supports all mandatory NVMe* commands defined in the NVMe revision 1.3 specification. The mandatory and optional commands are defined in this section.

5.1 Supported NVMe* Commands

Supported Admin Commands:

- Delete I/O Submission Queue
- Create I/O Submission Queue
- Get Log Page
- Delete I/O Completion Queue
- Create I/O Completion Queue
- Identify
- Abort
- Set Features
- Get Features
- Asynchronous Event Request
- Firmware Commit
- Firmware Image Download
- Device Self-test
- Format NVM
- Security Send
- Security Receive
- Sanitize

Supported NVM Commands:

- Flush
- Write
- Read
- Write Uncorrectable (4K only)
- Compare
- Write Zeroes
- Trim



5.2 Power Management

The 665p Series supports both PCIe* ASPM* and NVMe APST*. NVMe Power States supported are listed in the following table.

Table 10: Supported NVMe* Power States

SSD Power State	NVMe Power State	PCIe Link
Active/Idle	PS0	L0/L1
Active/Idle (Light Throttle)	PS1	L0/L1
Active/Idle (Heavy Throttle)	PS2	L0/L1
Slumber	PS3	L1/L1.2
Sleep	PS4	L1/L1.2

5.3 NVMe* Set Features Support

Table 11: Supported NVMe* Set Features

Feature Identifier	Description
01h	Arbitration
02h	Power Management
03h	LBA Range Type
04h	Temperature Threshold
05h	Error Recovery
06h	Volatile Write Cache
07h	Number of Queues
08h	Interrupt Coalescing
09h	Interrupt Vector Configuration
0Ah	Write Atomicity Normal
0Bh	Asynchronous Event Configuration
0Ch	Autonomous Power State Transition
0Eh	Timestamp
10h	Host Controlled Thermal Management
11h	Non-Operational Power State Config
80h	Software Progress Marker



5.4 Security Features

5.4.1 Sanitization Methods

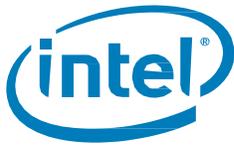
Sanitization refers to a process that renders data inaccessible. Various sanitization methods are listed below:

Table 12: Supported Format NVM Modes and Definitions

Secure Erase Mode	Definition
User Data Erase	Full NAND erase of user available space and spare area
Cryptographic Erase	Cryptographically erase data by deleting encryption key

5.4.2 TCG Pyrite* SSC Support

The 665p Series supports the TCG Pyrite SSC Specification Version 2.0. This support complies with the necessary commands needed to enable NVMe drive password protection on systems with UEFI* implementations. (Check your system user manual or customer support for drive password capability.)



5.5 SMART Attributes

The following table lists the SMART Health Info supported by the 665p Series.

Table 13: SMART Attributes

Byte	# of Bytes	Attribute	Description
0	1	Critical Warning: These bits if set, flag various warning sources. Bit 0: Available Spare is below Threshold Bit 1: Temperature has exceeded Threshold Bit 2: Reliability is degraded due to excessive media or internal errors Bit 3: Media is placed in Read- Only Mode Bit 4: Not supported. Bits 5-7: Reserved	Any of the critical warning can be tied to asynchronous event notification.
1	2	Temperature: Overall Device current temperature in Kelvin.	Reports module temperature
3	1	Available Spare: Contains a normalized percentage (0 to 100%) of the remaining spare capacity available	Starts from 100 and decrements.
4	1	Available Spare Threshold	Threshold is set to 10%.
5	1	Percentage Used Estimate (Value allowed to exceed 100%)	A value of 100 indicates that the estimated endurance of the device has been consumed, but may not indicate a device failure. The value is allowed to exceed 100. Percentages greater than 254 shall be represented as 255. This value shall be updated once per power-on hour (when the controller is not in a sleep state).
32	16	Data Units Read (in LBAs)	Contains the number of 512 byte data units the host has read from the controller; this value does not include metadata. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes read) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data read to 512 byte units.
48	16	Data Units Write (in LBAs)	Contains the number of 512 byte data units the host has written to the controller; this value does not include metadata. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes written) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data written to 512 byte units. For the NVM command set, logical blocks written as part of Write operations shall be included in this value. Write Uncorrectable commands shall not impact this value.
64	16	Host Read Commands	Contains the number of read commands issued to the controller.
80	16	Host Write Commands	Contains the number of write commands issued to the controller.



Byte	# of Bytes	Attribute	Description
96	16	Controller Busy Time (in minutes)	Contains the amount of time the controller is busy with I/O commands. The controller is busy when there is a command outstanding to an I/O Queue (specifically, a command was issued by way of an I/O Submission Queue Tail doorbell write and the corresponding completion queue entry has not been posted yet to the associated I/O Completion Queue). This value is reported in minutes.
112	16	Power Cycles	Contains the number of power cycles.
128	16	Power On Hours	Contains the number of power-on hours. This does not include time that the controller was powered and in a low power state condition.
144	16	Unsafe shutdowns	Contains the number of unsafe shutdowns. This count is incremented when a shutdown notification (CC.SHN) is not received prior to loss of power.
160	16	Media Errors	Contains the number of occurrences where the controller detected an unrecovered data integrity error. Errors such as uncorrectable ECC, CRC checksum failure, or LBA tag mismatch are included in this field.
176	16	Number of Error Information Log Entries	Contains the number of Error Information log entries over the life of the controller.
192	4	Warning Composite Temperature Time	Contains the amount of time in minutes that the controller is operational and the Composite Temperature is greater than or equal to the Warning Composite Temperature Threshold (WCTEMP) field and less than the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure.
196	4	Critical Composite Temperature Time	Contains the amount of time in minutes that the controller is operational and the Composite Temperature is greater the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure.
216	4	Thermal Management Temperature 1 Transition Count	Contains the number of times the controller transitioned to lower power active power states. A value of zero, indicates that this transition has never occurred or this field is not implemented.
220	4	Thermal Management Temperature 2 Transition Count	Contains the number of times the controller transitioned to lower power active power states. A value of zero, indicates that this transition has never occurred or this field is not implemented.
224	4	Total Time For Thermal Management Temperature 1	Contains the number of seconds that the controller had transitioned to lower power active power states
228	4	Total Time For Thermal Management Temperature 2	Contains the number of seconds that the controller had transitioned to lower power active power states

6 Certifications and Declarations

The following table describes the device certifications supported by the 665p Series.

Table 14: Device Certifications and Declarations

Certification	Description
CE Compliant 	European Economic Area (EEA): Compliance with the essential requirements of EC Council Directives Low Voltage Directive (LVD) 2014/35/EU and EMC Directive 2014/30/EU. Compliance with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
EU WEEE 	Compliance with Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)
UL Recognized 	Certified Underwriters Laboratories, Inc. Bi-National Component Recognition; UL 60950-1, 2nd Edition, 2014-10-14 [Information Technology Equipment - Safety - Part 1: General Requirements]. CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-010 (Information Technology Equipment - Safety - Part 1: General Requirements) These products have been Complimentary Recognized to UL/CSA 62368-1, 2nd Edition [Audio/video, information and communication technology equipment - Part 1: Safety requirements]
Australia / New Zealand: RCM 	Compliance with the Australia/New Zealand Standard(s) AS/NZ CISPR 32:2015 and AS/NZ CISPR 22:2009 +A1:2010, In compliance with the Radiocommunications Act 1992 as part of the ACMA's Electromagnetic Compatibility (EMC) Regulatory Arrangement and RSM Radiocommunications (EMC Standards) Notice 2015.
Taiwan BSMI 	Compliance to the Taiwan EMC standard CNS 13438: Information technology equipment - Radio disturbance Characteristics - limits and methods of measurement, as amended on June 1, 2006, is harmonized with CISPR 22: 2005.04. Compliance to the Taiwan CNS 15663 [Guidance to reduction of the restricted chemical substances in electrical and electronic equipment (EEE)].
Korea KCC 	Compliance with paragraph 1 of Article 11 of the Electromagnetic Compatibility Control Regulation and meets the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Ministry of Information and Communication Republic of Korea.

<p>Morocco Maghreb</p> 	<p>Compliant with Decree # 2574-14 (EMC) on electromagnetic compatibility</p>
<p>Japan VCCI</p> 	<p>Voluntary Control Council for Interface to cope with disturbance problems caused by personal computers or facsimile.</p>
<p>Canada ICES-3 / NMB-3</p>	<p>Compliance with Innovation, Science and Economic Development Canada standard ICES-003.</p>
<p>China EFUP</p> 	<p>China Environmentally Friendly Use Period (EFUP) symbol. Compliance with GB/T 26572: Requirements on concentration limits for certain restricted substances in electrical and electronic products.</p>
<p>Ukraine RoHS</p> 	<p>Compliant with TECHNICAL REGULATION on the restriction of the use of certain hazardous substances in electrical and electronic equipment APPROVED by Resolution of the Cabinet of Ministers of Ukraine of 10 March 2017 No. 139.</p>
<p>Low Halogen</p>	<p>Applies only to brominated and chlorinated flame retardants (BFRs/CFRs) and PVC in the final product. Intel components as well as purchased components on the finished assembly meet JS-709 requirements, and the PCB/substrate meet IEC 61249-2-21 requirements. The replacement of halogenated flame retardants and/or PVC may not be better for the environment.</p>
<p>PCIe*</p>	<p>Indicates compliance with PCI-SIG Organization testing requirements.</p>
<p>NVMe*</p>	<p>Indicates compliance with UNH-IOL testing for NVMe compliance.</p>
<p>Microsoft WHCK</p>	<p>Microsoft Windows Hardware Certification Kit</p>



7 Appendix

7.1 NVMe* Identify Controller Info

The following table describes the sector data returned from an identify device command.

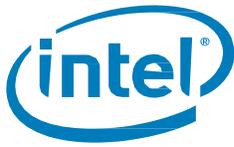
Table 15: Identify Controller Info

Bytes	F = Fixed V = Variable X = Both	Default Value	Interpretation	Description
1-0	F	8086h	Contains the company vendor identifier that is assigned by the PCI SIG	PCI Vendor ID (VID)
3-2	F	8086h	Contains the company vendor identifier that is assigned by the PCI SIG for subsystem	PCI Subsystem Vendor ID (SSVID)
23-4	V	varies	Contains the serial number for the NVM subsystem	Serial Number (SN)
63-24	V	varies	Contains the model number for the NVM subsystem	Model Number (MN)
71-64	V	varies	Contains the currently active firmware revision for the NVM subsystem	Firmware Revision (FR)
72	F	6h	Recommended Arbitration Burst size equals 1	Recommended Arbitration Burst (RAB)
75-73	F	5CD2E4h	Contains the Organization Unique Identifier (OUI) for the controller vendor	IEEE OUI Identifier (IEEE)
76	X	0h	No of multiple PCI Express interfaces connected to the host, bit 0 determines multiple interface	Multi-Interface Capabilities (MIC)
77	F	05h	Supports MDTs of 256K	Maximum Data Transfer Size (MDTS)
79-78	F	01h	NVM subsystem unique Controller ID equals 1	Controller ID (CNTLID)
83-80	F	10300h	Supports NVMe 1.3 version	Version (VER)
87-84	F	7A120h	RTD3 resume time is 500ms	RTD3 Resume Latency (RTD3R)
91-88	F	1E8480h	RTD3 entry latency is 2000ms	RTD3 Entry Latency (RTD3E)
95-92	F	200h	Supports sending FW Activation Notices	Optional Asynchronous Events Supported (OAES)
99-96	F	02h	Does not support host control	Controller Attributes (CTRATT)
111-100	F			Reserved
127-112	F	0h	ID not implemented	FRU Globally Unique ID (FGUID)
239-128	F			Reserved
255-240	F			Refer to NVMe MI Spec
257-256	F	0017h	Supports DST, Security Send/Receive, Format NVM and Firmware Activate/Download	Optional Admin Command Support (OACS)
258	F	03h	Supports up to 4 concurrently outstanding abort commands	Abort Command Limit (ACL)



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Bytes	F = Fixed V = Variable X = Both	Default Value	Interpretation	Description
259	F	07h	Supports up to 7 concurrently outstanding asynchronous event requests	Asynchronous Event Request Limit (AERL)
260	X	14h	Supports FW activation w/o reset Two slots; Read/write capable	Firmware Updates (FRMW)
261	X	Fh	Supports Telemetry log pages, ext Get Log, Command Effects log, and SMART/Health Log Support per namespace	Log Page Attributes (LPA)
262	F	FFh	Number of Error Information log entries equals 256	Error Log Page Entries (ELPE)
263	F	04h	Number of NVM Express power states equal 5	Number of Power States Support (NPSS)
264	F	0h	Configuration settings for Admin Vendor Specific command handling	Admin Vendor Specific Command Configuration (AVSCC)
265	F	01h	Supports APST	Autonomous Power State Transition Attributes (APSTA)
267-266	F	015Eh	Warning temperature is 77° C	Warning Composite Temperature Threshold (WCTEMP)
269-268	F	0161h	Critical temperature is 80° C	Critical Composite Temperature Threshold (CCTEMP)
271-270	F	32h	Maximum time for FW activation is 5 sec	Maximum Time for Firmware Activation (MTFA)
275-272	F	0h	Host Memory Buffer not supported	Host Memory Buffer Preferred Size (HMPRE)
279-276	F	0h	Host Memory Buffer not supported	Host Memory Buffer Minimum Size (HMMIN)
295-280	F	0h	Namespace Management not supported	Total NVM Capacity (TNVMCAP)
311-296	F	0h	Namespace Management not supported	Unallocated NVM Capacity (UNVMCAP)
315-312	F	NA	Replay Protected Memory Block not supported	Replay Protected Memory Block Support (RPMBS)
317-316	F	05h	Extended DST time is 5 min	Extended Device Self-test Time (EDSTT)
318	F	01h	Supports only one DST operation	Device Self-Test Options (DSTO)
319	F	00h	Granularity is 4kB	FW Update Granularity (FWUG)
321-320	F	0h	KAS not supported	Keep Alive Support (KAS)
323-322	F	01h	HCTM is supported	Host Control Thermal Manage Attr (HCTMA)
325-324	F	12Fh	Min Temp setting is 30C	Min Thermal Manage Temp (MNTMT))
327-326	F	15Ch	Max Temp setting is 75C	Max Thermal Manage Temp (MXTMT))
331-328	F	03h	Supports Block and Crypto Erase	Sanitize Capabilities (SANICAP)
511-332	F			Reserved
512	F	66h	Submission queue entry size is 64 Byte	Submission Queue Entry Size (SQES)
513	F	44h	Completion queue entry size is 16 Byte	Completion Queue Entry Size (CQES)



Bytes	F = Fixed V = Variable X = Both	Default Value	Interpretation	Description
515-514	F	0h	Not used	Max Outstanding Commands (MAXCMD)
519-516	F	01h	Supports single namespace	Number of Namespaces (NN)
521-520	F	5Fh	Supports Timestamp, Save field, Write Zeroes Dataset Management, Write Uncorrectable, and Compare optional NVMe commands.	Optional NVM Command Support (ONCS)
523-522	F	0h	Fused commands not supported	Fused Operation Support (FUSES)
524	F	04h	Supports Crypto Erase and format of entire drive, not per namespace	Format NVM Attributes (FNA):
525	F	01h	Volatile write cache is present	Volatile Write Cache (VWC)
527-526	F	0h	Atomic write size for controller during normal equals to 512B	Atomic Write Unit Normal (AWUN)
529-528	F	0h	Indicates the atomic write size for the controller during a power fail condition equals 512B	Atomic Write Unit Power Fail (AWUPF)
530	X	0h	Not supported	NVM Vendor Specific Command Configuration (NVSCC)
531	F			Reserved
533-532	F	0h	Not supported	Atomic Compare and Write Unit (ACWU)
535-534	F			Reserved
539-536	F	0h	Scatter Gather List not supported	SGL Support (SGLS)
767-540	F			Reserved
1023-768	F	0h	Not supported	NVM Subsystem NVMe Qualified Name (SUBNQN)
1791-1024	F			Reserved
2047-1792	F	0h	Not supported	NVMe over Fabric
2079-2048	V		Indicates the characteristics of power state 0	Power State 0 Descriptor (PSD0)
2111-2080	V		Indicates the characteristics of power state 1	Power State 1 Descriptor (PSD1)
2143-2112	V		Indicates the characteristics of power state 2	Power State 2 Descriptor (PSD2)
2175-2144	V		Indicates the characteristics of power state 3	Power State 3 Descriptor (PSD3)
2207-2176	V		Indicates the characteristics of power state 4	Power State 4 Descriptor (PSD4)

Note:

F = Fixed. The content of the word is fixed and does not change. For removable media devices, these values may change when media is removed or changed.

V = Variable. The state of at least one bit in a word is variable and may change, depending on the state of the device or the commands executed by the device.

X = F or V. The content of the word may be fixed or variable.



7.2 Models

The following table lists the available M.2 single-sided models of the 665p Series.

Table 16: Available Models

Model String	Capacity
SSDPEKNW010T9	1024GB
SSDPEKNW020T9	2048GB

7.3 PCIe* IDs

Table 17: PCIe* IDs

ID Name	Description	Value	PCIe Register Location	Identify Controller Location
Vendor ID (VID)	Vendor ID assigned by PCI-SIG	0x8086h	PCI Header Offset 00h (bits 15:00)	Bytes 01:00h
Device ID (DID)	Device ID assigned by vendor	0xFAF0h	PCI Header Offset 00h (bits 31:16)	NA
Subsystem Vendor ID	Indicates Sub-system vendor ID	0x8086h	PCI Header Offset 2Ch (bits 15:00)	Bytes 03:02h
Subsystem ID	Sub-system identifier	0x390E	PCI Header Offset 2Ch (bits 31:16)	NA