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Intel® NUC Kit/Mini PC NUC12SNKi72

Technical Product Specification

Regulatory Models: NUC12SNK (Kit, Mini PC)

September 2022

Revision History

Revision	Revision History	Date
1.0	Release of the Intel NUC NUC12SNKi72 Technical Product Specification	September 2022

Disclaimer

This product specification applies to only the standard Intel NUC12SNKi72 with BIOS identifier SNADL357.00XX.

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Preface

This Technical Product Specification (TPS) specifies the board layout, components, connectors, power and environmental requirements, and the BIOS for Intel® NUC Kit NUC12SNKi72. Some features are only available on Kit SKUs.

Intended Audience

The TPS is intended to provide detailed, technical information about Intel® NUC Kit NUC12SNKi72 and its components to the vendors, system integrators, and other engineers and technicians who need this level of information. It is specifically *not* intended for general audiences.

What This Document Contains

Chapter	Description
1	An overview of the features and specifications of the Intel® NUC NUC12SNKi72
2	The figures, layouts, and physical description of the Intel® NUC NUC12SNKi72 Board
3	Detailed descriptions of the features and specifications
4	Technical references and considerations
5	An overview of BIOS features and specifications of the Intel® NUC NUC12SNKi72

Typographical Conventions

This section contains information about the conventions used in this specification. Not all these symbols and abbreviations appear in all specifications of this type.

Notes, Cautions, and Warnings

NOTE

Notes call attention to important information.

CAUTION

Cautions are included to help you avoid damaging hardware or losing data.

Other Common Notation

#	Used after a signal name to identify an active-low signal (such as USBP0#)
GB	Gigabyte (1,073,741,824 bytes)
GB/s	Gigabytes per second
Gb/s	Gigabits per second
KB	Kilobyte (1024 bytes)
Kb	Kilobit (1024 bits)
kb/s	1000 bits per second
MB	Megabyte (1,048,576 bytes)
MB/s	Megabytes per second
Mb	Megabit (1,048,576 bits)
Mb/s	Megabits per second
TDP	Thermal Design Power
xxh	An address or data value ending with a lowercase h indicates a hexadecimal value.
x.x V	Volts. Voltages are DC unless otherwise specified.
x.x A	Amperes.
*	This symbol is used to indicate third-party brands and names that are the property of their respective owners.

Production Identification Information

Intel® NUC Product NUC12SNKi72 Identification Information

Product Name	Intel® NUC
NUC12SNKi72	NUC12SNKi72

Specification Changes or Clarifications

The table below indicates the Specification Changes or Specification Clarifications that apply to the Intel NUC Kit/Mini PC NUC12SNKi72.

Specification Changes or Clarifications

Date	Type of Change	Description of Changes or Clarifications

Errata

Current characterized errata, if any, are documented in a separate Specification Update. See http://www.intel.com/content/www/us/en/nuc/overview.html for the latest documentation.

Online Support

To Find Information About...	Visit this World Wide Web site:
Intel NUC Kit/Mini PC NUC12SNKi72	http://www.intel.com/NUC
Intel NUC Kit/Mini PC Support	http://www.intel.com/NUCSupport
High level details for Intel NUC Kit/Mini PC NUC12SNKi72	https://ark.intel.com
BIOS and driver updates	https://downloadcenter.intel.com
Tested memory	http://www.intel.com/NUCSupport
Integration information	http://www.intel.com/NUCSupport
Processor datasheet	https://ark.intel.com

Table of Contents

List of Figures

List of Tables

1   Product Description

1.1   Overview

The Intel® NUC 12 Enthusiast / Kit is a small form factor PC barebones kit. The NUC 12 Enthusiast Kits consists of the processor, chipset, memory slots, wireless, Bluetooth, M.2 storage slots, integrated heat sink and fan. See Table 1 for a summary.

1.1.1   Summary of Mini PC SKUs

Product Codes and MM#s for the SKUs below can be found at https://ark.intel.com.

Table 1. Mini PC SKUs

Product Name	Processor	GPU	AC Cord	RAM	Storage	OS
NUC12SNKi72	Intel® Core™ i7-12700H	A770M 16GB GDDR6	US	2 x 8 GB	1TB Gen4 NVMe SSD	Win 11 Home

1.1.2   Summary of Kit SKU

Product Codes and MM#s for the SKUs below can be found at https://ark.intel.com.

Table 2. Kit SKU

Product Name	Processor	GPU	AC Cord
NUC12SNKi72	Intel® Core™ i7-12700H	A770M 16GB GDDR6	US, EU, AU, CN or No Cord

1.1.3   Feature Summary

Table 3 summarizes the major features of Intel® NUC Mini PC Kit NUC12SNKi72.

Table 3. Feature Summary

Chassis Dimensions	9.1in. by 7.1in. by 2.6in. (230mm by 180mm x 65mm) (including feet)
	9.1in. by 7.1in. by 2.4in. (230mm by 180mm x 60mm) (not including feet)
Processor	Intel® NUC Mini Kits NUC12SNKi72 have a soldered-down 12th generation Intel® Core™ processor with 45 W TDP • Intel® Core™ i7-12700H processor, MM# 99AVA2 More information about Intel® processors can be found at https://ark.intel.com
Memory	Two 260-pin 1.2 V DDR4 SDRAM Small Outline Dual Inline Memory Module (SO-DIMM) sockets • Support for DDR4 3200 MHz SO-DIMMs • Support for 8 Gb and 16 Gb technology • Support for up to 64 GB of system memory with two SO-DIMMs using 32 GB memory modules • Support for non-ECC memory • Support for 1.2 V JEDEC memory only Note: 2 Gb and 4 Gb memory technology (SDRAM Density) is not supported More information about tested memory can be found at http://www.intel.com/NUCSupport
Graphics	Integrated graphics support for processors with Intel® Graphics Technology • One Type C Front panel connector • One Type C Back panel connector Discrete graphics support by Intel® Arc™ A770M • One Full Size High Definition Multimedia Interface* (HDMI 2.1 TMDS compatible) back panel connector • Two DisplayPort* Back panel connectors More information about Intel® Arc™ graphics processors can be found at https://ark.intel.com To obtain drivers visit https://downloadcenter.intel.com
Audio	Audio via digital display outputs • When using an encoded format (such as DTS-HD MA or Dolby True HD) the system supports a single 7.1 stream. When using an un-encoded format, the system supports 8 discrete, un-encoded channels per HDMI port simultaneously, for a total of 16 discrete/un-encoded channels. Realtek Audio via a stereo microphone/headphone 3.5mm jack on the front panel and 3.5 combination speaker/TOSLINK jack on the back panel To obtain drivers visit https://downloadcenter.intel.com
Storage	Two M.2 PCIe Gen4 connectors supporting M.2 22x80 (key type M) for NVMe only One M.2 PCIe Gen3 connector supporting M.2 22x80 (key type M) for SATA or NVMe SSD

Communication	Wireless connectivity using the Intel® Wi-Fi 6E AX1690i wireless networking module • 802.11ax, Concurrent Dual Band, 2x2 Wi-Fi + Bluetooth 5.2 • Bands 2.4, 5, 6 GHz (160MHz) • Maximum Transfer speed up to 3.0 Gbps • M.2 2230 Hybrid Key E form factor • Supports OFDMA, MU-MIMO More information about Intel® wireless products can be found at https://ark.intel.com To obtain drivers visit https://downloadcenter.intel.com Gigabit (10/100/1000/2500 Mbps) LAN subsystem using the Intel® i225-LM Gigabit Ethernet Controller • PCIe 3.1 5GT/s support for x1 width (Lane) • Single-port integrated multi-gigabit (up to 2.5G) – standard IEEE 802.3 Ethernet Interface for 2500BASE-T, 1000BASE-T, 100BASE-TX, 10BASE-TE connections (IEEE 802.3, 802.3u, 802.3bz, and 802.3ab) • Supports Time Sensitive Networking (TSN) IEEE 802.1Qbu, 802.3br, 802.1Qbv, 802.1AS-REV, 802.1p,Q, and 802.1Qav • Full wake up support • Supports for packets up to 9.5 KB (Jumbo Frames) More information about Intel® Ethernet controllers can be found at https://ark.intel.com To obtain drivers visit https://downloadcenter.intel.com

Thunderbolt™	2 x Thunderbolt™ 4 ports (1 front and 1 back panel)
	• 15W and 18W port bus power
	    o Charging capabillity up to 5V @ 1.5A, 5V @ 3A and 9V @ 2A
	    o Power allocation is 1st come, 1st serve basis between first and second port e.g. if 1st port consumes 5V/1.5A then second port shall make 5V/3A available
	• Thunderbolt networking
	• Protocol support:
	PD Modes Supported: TBT3, USB4, USB3, DP-alt/MF
	
	TBT3 Tx/Rx rates: 40G (2x 20.625), 20G (2x 10.3125)
	PCI Express Tunnel: 32 Gbps
	
	USB4 Tx/Rx rates: 40G (2x 20), 20G (2x 10)
	USB3 Native: 10Gbps (1x10G)
	USB3 Tunnel: 10Gbps
	USB2: 480 Mpbs
	
	DP2.0 (1.4a certified), HBR3
	DisplayPort Tunneling:
	Port 2: 2 streams (~35 Gbps, Thunderbolt 4 certified)
	Port 1: 1 stream (~17 Gbps, Thunderbolt 3 certified)
	
	More information about the location of the Thunderbolt™ ports can be found in Section 2.1.4 later in this document

USB Ports and Headers	2 x USB 4 Type C/Thunderbolt4 (1 front and 1 back panel) 6 x USB 3.2 Gen 2 ports (2 front panel and 4 back panel) 2 x USB 2.0 ports (onboard common I/O header) More information about the location of the USB ports and headers can be found in Section 2 later in this document More information about the pinout of the USB ports and headers can be found in Section 4.1 later in this document
Power	AC Adapter • Ships with a 330W adapter • Adapter output: 19.5VDC @ 16.9 Amps

	• System Power Input19.5V$_{DC}$ +/- 5% with DC transient voltage protection;
Operating Temperatures	0-35°C external ambient operating temperature More information about environmental specifications can be found in Section 4.5 later in this document
BIOS	Intel® BIOS resident in the Serial Peripheral Interface (SPI) Flash device Support for Advanced Configuration and Power Interface (ACPI), Plug and Play, and System Management BIOS (SMBIOS)
Hardware Monitor Subsystem	Hardware monitoring subsystem including: • Voltage sense to detect out of range power supply voltages • Thermal sense to detect out of range thermal values • Two fan headers

Table 4. Additional Features

Chassis Expandability	No Chassis Expansion available
HDMI CEC API	CEC commands are supported on all HDMI ports for display power on/off and the BIOS provides an option to enable/disable the onboard CEC controls.
Delayed AC Start	There is a short delay after AC power is applied before unit is ready to power-up to protect the system after AC loss.

2   Product Layout

2.1   Board Layout

2.1.1   Board Layout (Top)

Figure 1 shows the location of the major components on the bottom of Intel® NUC Board
NUC12SNKi72.
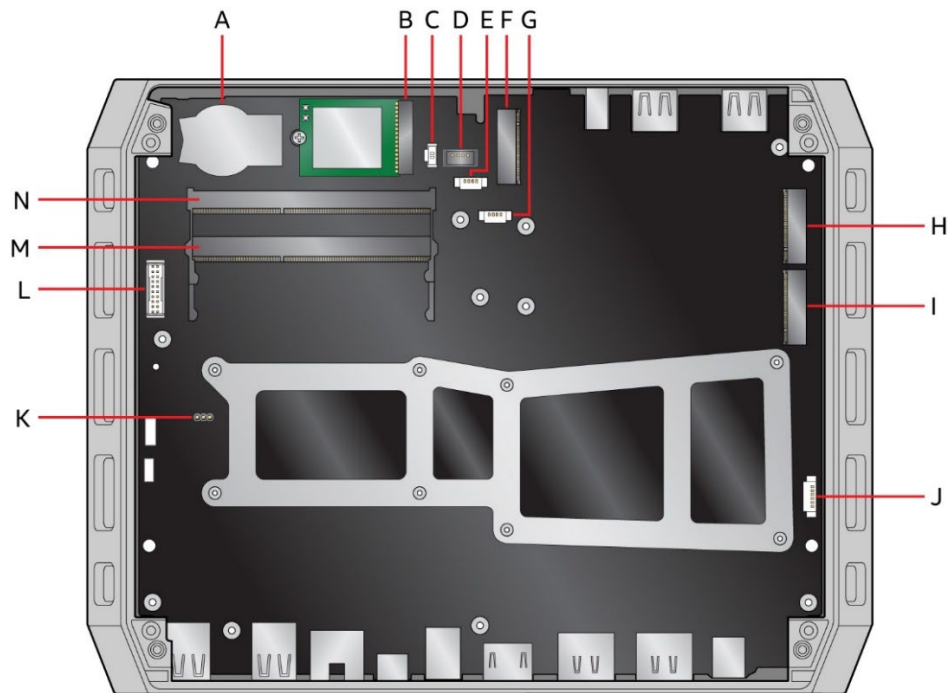
Figure 1. Major Board Components (Top)

Table 5. Components Shown in Figure 1

Item from Figure 1	Description
A	CMOS battery
B	M.2 2230 module connector (Key Type E) (WiFi)
C	CMOS battery header
D	DMIC connector
E	Fan connector
F	M.2 2280 module connector (NVMe/SATA)
G	Fan connector
H	M.2 2280 module connector (Key Type M) (NVMe Only)
I	M.2 2280 module connector (Key Type M) (NVMe Only)

J	RGB header (top lid)
K	BIOS Security header
L	Common I/O header
M	DDR4 SO-DIMM 0 Socket
N	DDR4 SO-DIMM 1 Socket

2.1.2   Board Layout (Bottom)

No user configurable components on the bottom-side of Intel® NUC Board NUC12SNi72

2.1.3   Front Panel
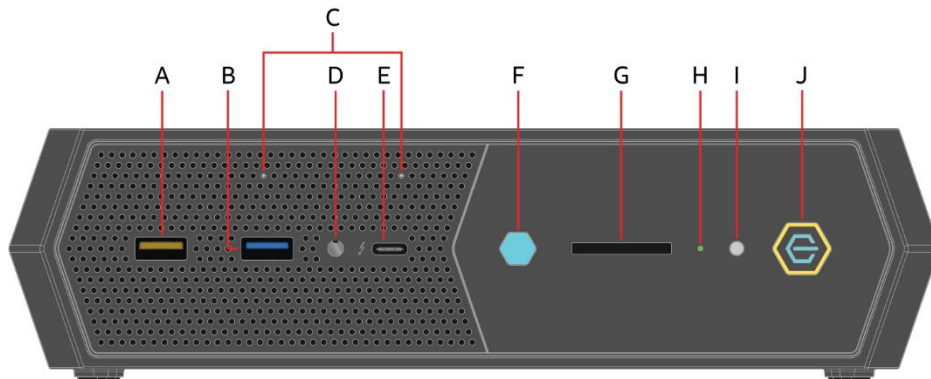
Figure 2. Front Panel Connectors

Table 6. Components Shown in Figure 2

Item from Figure 2	Description
A	USB 3.2 Gen 2, 2A peak current support (amber)
B	USB 3.2 Gen 2 (blue)
C	Digital Microphone
D	Headset audio port
E	Thunderbolt USB-C
F	HDD RGB LED
G	SD card reader
H	Network LED
I	CIR
J	Power button

2.1.4   Back Panel
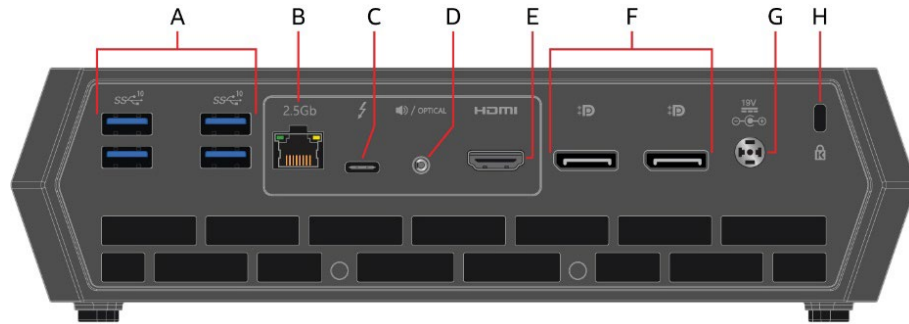
Figure 3. Back Panel Connectors

Table 7. Component Input Ports Shown in Figure 3

Item from Figure 2	Description
A	(4) USB 3.2 Gen 2 (blue)
B	Ethernet
C	Thunderbolt USB-C
D	3.5mm analog stereo / TOSLINK optical audio combination jack
E	HDMI
F	(2) DisplayPort
G	Power input
H	Kensington Lock

2.1.5   Block Diagram
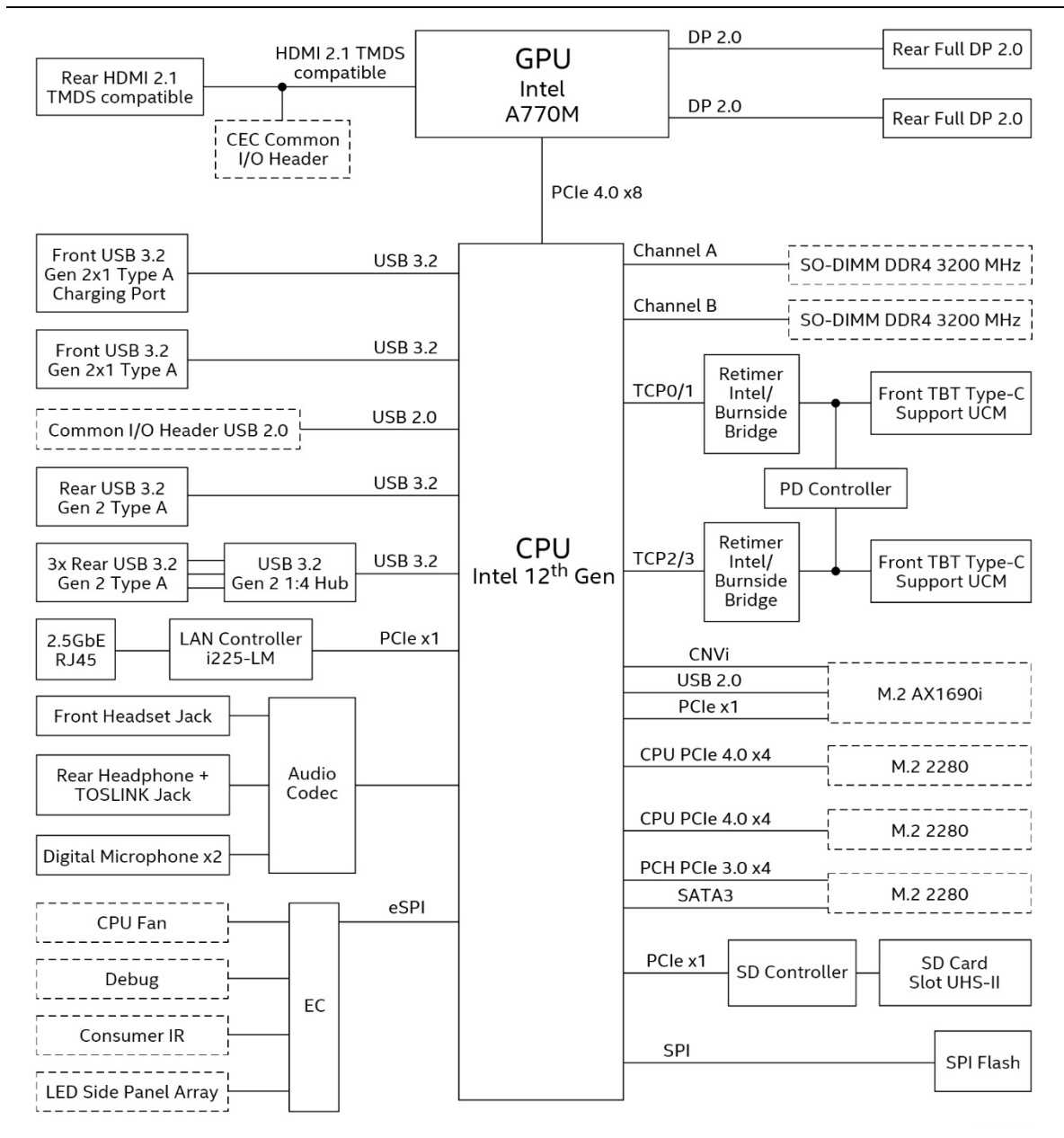
Figure 4. Block Diagram

3   Feature Descriptions

3.1   System Memory

Figure 1 illustrates the memory channel and SO-DIMM configuration.

3.1.1   Intel® NUC Mini PC Memory Information

Intel® NUC Mini PCs NUC12SNKi72VA can be purchased with 2 x 8 GB DDR4 3200 MHz SODIMMs included. More information about available Intel® NUC Mini PC NUC12SNKi72VA can be found in Section 1.1.1 Summary of Mini PC SKUs. For Product Codes and MM#s visit https://ark.intel.com.

3.2   Processor Graphics Subsystem

Intel® NUC12SNKi72 supports Intel® Iris® Xe Graphics.

3.2.1   General Power and Memory Guidance for Optimal Graphics Performance

Intel® NUC12SNKi72 performance is significantly impacted by power levels and memory selection. For the best performance:

- Allow for higher system power level budgets
- Recommend DDR4-3200 128bit 2Rx8
    - o   128bit (Dual Channel) memory is better performing than 64bit (Single Channel) memory
    - o   A full list of tested memory modules is available on https://compatibleproducts.intel.com
- Maximum multiple display utilization will require 2Rx32 (64GB system RAM)

3.2.2   Intel® Iris® Xe Graphics

Intel® Iris® Xe Graphics supports the following features:

- The HW decode is exposed by the graphics driver using the following APIs: Direct3D* 9 Video API (DXVA2), Direct3D11 Video API, Intel Media SDK, MFT filters, Intel VA API
- Full HW accelerated video decoding for AVC/VC1/MPEG2/HEVC/VP9/JPEG/AV1
- The HW encode is exposed by the graphics driver using the following APIs:
    - o   Intel® Media SDK, MFT filters
    - o   Full HW accelerated video encoding for AVC/HEVC/VP9/JPEG
- Four display pipes – supporting blending, color adjustments, scaling and dithering
- Direct 3D* 2015, Direct3D* 12
- OpenGL* 4.6
- Open CL* 3.0
- HDR (High Dynamic Range) support
- HDCP (High-bandwidth Digital Content Protection) 2.2 and 1.4

3.2.3   Intel® Arc™ Graphics

The kit supports graphics processing via discrete packages using the following Intel Arc graphics processors:

A770M (16GB GDDR6 VRAM)

The Intel Arc Graphics controller features the following supported technologies:

- Ray Tracing
- Adaptive Sync
- Variable Rate Shading (VRS)
- Full HW accelerated video decoding for AVC/VC1/MPEG2/HEVC/VP9/JPEG/AV1
- The HW encode is exposed by the graphics driver using the following APIs:
    - Intel® Media SDK, MFT filters
    - Full HW accelerated video encoding for AVC/HEVC/VP9/JPEG
- APIs:
    - DirectX 12 Ultimate (12.2)
    - OpenGL support up to 4.6
    - OpenCL 3.0
    - Vulkan 1.3

3.2.4   Display Features

Multiple DisplayPort, USB Type C (Thunderbolt 4), and HDMI configurations feature the following port designations:

- One HDMI, Two DisplayPort (DP) and Two USB Type C (1 front and 1 rear Thunderbolt 4)
- Each port individual standalone can support the following max resolutions at given frequency:
    - HDMI: 3840 x 2160 @ 60 Hz
    - DisplayPort1 (Back Panel): 3840 x 2160 @ 144 Hz; 7680 x 4320 @ 30Hz
    - DisplayPort2 (Back Panel): 3840 x 2160 @ 144 Hz; 7680 x 4320 @ 30Hz
    - Type C port (Front Panel): 3840 x 2160 @ 144 Hz; 7680 x 4320 @ 30Hz
    - Type C port (Back Panel): 3840 x 2160 @ 144 Hz; 7680 x 4320 @ 30Hz

NOTE

- *Up to five 4K (3840 x 2160) resolution monitors can be utilized with frequencies up to 144 Hz for DisplayPort/Type C and 60Hz for HDMI (3200 MHz dual channel configuration RAM required)*

- *Two 8K (7680×4320) @ 60Hz monitors can be utilized via 2 TBT- DP cables for one monitor, and/or 2 DP-DP cables for a second monitor. (3200 MHz dual channel configuration RAM required)*

3.3   Integrated Audio

HDMI, Thunderbolt and DP interfaces can carry audio along with video. The GPU supports four HD audio streams over four digital ports simultaneously.

The processor supports the following audio formats over Thunderbolt:

- AC-3 Dolby* Digital

- Dolby* Digital Plus
- DTS-HD*
- LPCM, 192 kHz/24 bit, 6 channel
- Dolby* TrueHD, DTS-HD Master Audio*

3.3.1 Discrete Audio

The integrated Realtek ALC274 audio subsystem supports the following features:

- Digital microphone array (DMIC)
- Analog line-out/Analog headphone/Analog Microphone (front panel jack)
- 3.5mm analog stereo / TOSLINK optical audio combination jack (back panel jack)
  - Analog speakers (stereo) or Digital optical audio
  - SPDIF optical out formats up to compressed 5.1/7.1 Dolby Digital Plus
- Support for 44.1kHz/48kHz/96kHz sample rates on all analog inputs

3.3.2 Audio Software

Audio software and drivers are available from Intel's World Wide Web Site.

For information about	Refer to
Obtaining NUC software and drivers	https://downloadcenter.intel.com/

3.4 SDXC Card Reader

The kit has a standard Secure Digital (SD) card reader that supports the Secure Digital eXtended Capacity (SDXC) format, 7.0 specification with SD Express bus support. SD Card sizes supported: SDXC (64GB to 2TB), SDHC (4GB-32GB), SD (2GB and less).

3.5 Real-Time Clock Subsystem

A coin-cell battery (CR2032) powers the real-time clock and CMOS memory. When the computer is not plugged into a wall socket, the battery has an estimated life of three years. When the computer is plugged in, the standby current from the power supply extends the life of the battery. The clock is accurate to ± 13 minutes/year at 25 ºC with 3.3 VSB applied via the power supply 5 V STBY rail.

NOTE

If the battery and AC power fail, date and time values will be reset and the user will be notified during the POST.

When the voltage drops below a certain level, the BIOS Setup program settings stored in CMOS RAM (for example, the date and time) might not be accurate. Replace the battery with an equivalent battery.

3.6   LAN Subsystem

3.6.1   RJ-45 LAN Connector with Integrated LEDs

Two LEDs are built into the RJ-45 LAN connector (shown in Figure 5).

Item	Description
A	Link LED (Green)
B	Data Rate LED (Green/Yellow)
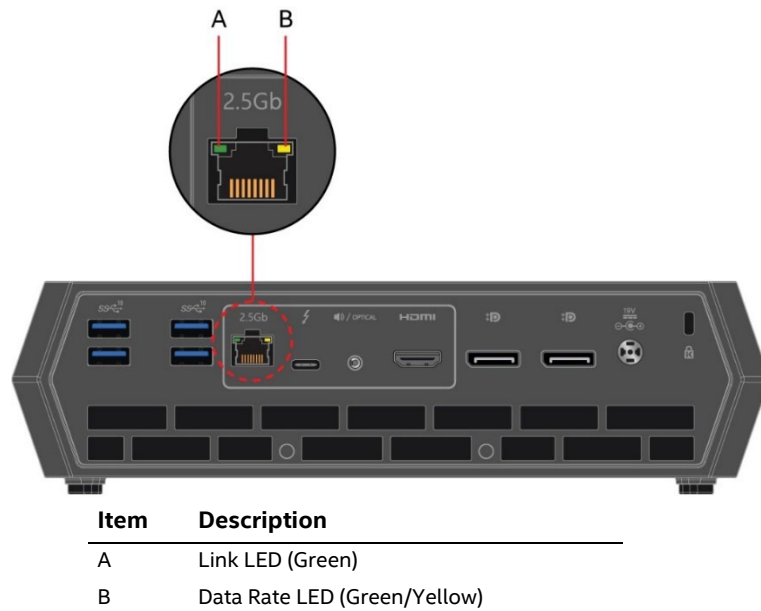
Figure 5. LAN Connector LED Locations

Table 8 describes the LED states when the system is powered up and the LAN subsystem is operating.

Table 8. LAN Connector LED States

LED	LED Color	LED State	Condition
Link	Green	Off	LAN link is not established
		Solid	LAN link is established
		Blinking	LAN activity is occurring
Data Rate	Green/Yellow	Off	10/100 Mb/s data rate is selected
		Green	1000 Mb/s data rate is selected
		Yellow	2500 Mb/s data rate is selected

3.6.2   Wireless Network Module

The Intel® Killer™ Wi-Fi 6E AX1690i module provides hi-speed wireless connectivity with the following capabilities:

- Bluetooth 5.2
- Bands: 2.4, 5, 6 GHz (160MHz)
- MU-MIMO
- OFDMA

More information about Intel® wireless products can be found at https://ark.intel.com
To obtain drivers visit https://downloadcenter.intel.com

3.7 Hardware Management Subsystem

3.7.1 Fan Monitoring

Fan monitoring can be implemented using NUC Software Studio (NSS).

3.7.2 System States and Power States

Table 9 describes the ACPI states supported by the processor.

Table 9. Systems States

State	Description
G0/S0/C0	**Full On:** CPU operating. Individual devices may be shut to save power. The different CPU operating levels are defined by Cx states.
GO/S0/Cx	**Cx State:** CPU manages C-states by itself and can be in lower power states.
G1	**Suspend-To-RAM (STR):** The system context is maintained in system DRAM, but power is shut to non-critical circuits. Memory is retained and refreshes continue. All external clocks are shut off; RTC clock and international oscillator clocks are still toggling.
G1/S4	**Suspend-To-Disk (STD):** The context of the system is maintained on the disk. All power is then shut to the system except to the logic required to resume. Externally appears the same as S5 but may have different wake events.
G2/S5	**Soft Off:** System context not maintained. All power is shut except for the logic required to restart. A full boot is required when waking.
G3	**Mechanical Off:** System context not maintained. All power shut except for the RTC. No "Wake" events are possible because the system does not have any power. This state occurs if the user removes the batteries, turns off a mechanical switch, or if the system power supply is at a level that is insufficient to power the "waking" logic.

3.7.2.1 Wake-up Devices and Events

Table 10 lists the devices or specific events that can wake the computer from specific states.

Table 10. Wake-up Devices and Events

Devices/events that wake up the system…	…from this sleep state	Comments
Power switch	S0iX, S4, S5[1]	
RTC alarm	S0iX, S4, S5[1]	Option for monitor to remain in sleep state
LAN	S0iX, S4, S5[1, 3]	"S5 WOL after G3" is supported; monitor to remain in sleep state
WIFI	S0iX, S4, S5[1, 3]	
Bluetooth	S0iX, S4[1]	
USB	S0iX, S4, S5[1, 2, 3]	Wake S4, S5 controlled by BIOS option (not after G3)
PCIe	S0iX, S4[1]	Via WAKE; monitor to remain in sleep state
HDMI CEC	S0iX, S4, S5[1]	Wake S4, S5 controlled by BIOS option

Notes:

1. S0iX represents Microsoft Modern Standby
2. S4 implies operating system support only.
2. Will not wake from Deep S4/S5. USB S4/S5 Power is controlled by BIOS. USB S5 wake is controlled by BIOS. USB S4 wake is controlled by OS driver, not just BIOS option.
3. Windows Fast startup will block wake from LAN and USB from S5.

NOTE

The use of these wake-up events from an ACPI state requires an operating system that provides full ACPI support. In addition, software, drivers, and peripherals must fully support ACPI wake events.

4   Technical Reference

4.1   Signal Tables for the Connectors and Headers

⚠ **CAUTION**

Only the following connectors and headers have overcurrent protection: back panel USB Type A and Type C, front panel USB, internal USB headers, internal power header, and DC Vin jack.

All other connectors and headers are not overcurrent protected and should connect only to devices inside the computer's chassis, such as fans and internal peripherals. Do not use these connectors or headers to power devices external to the computer's chassis. A fault in the load presented by the external devices could cause damage to the computer, the power cable, and the external devices themselves.

Furthermore, improper connection of USB header single wire connectors may eventually overload the overcurrent protection and cause damage to the system.

4.1.1   M.2 2280 Module Connector

Table 11. describes the M.2 2280 connector signals. SSD support is provided via PCIe Gen4 NVMe on CPU attached and PCIe Gen3 NVMe/SATA on PCH attached. See Figure 2. for location of respective M.2 2280 module connectors.

Table 11. M.2 2280 Module (Mechanical Key M) Connector

Pin	Signal Name	Pin	Signal Name
74	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	75	GND
72	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	73	GND
70	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	71	GND
68	SUSCLK(32kHz) (O)(0/3.3V)	69	PEDET (NC-PCIe/GND-SATA)
66	Connector Key	67	N/C
64	Connector Key	65	Connector Key
62	Connector Key	63	Connector Key
60	Connector Key	61	Connector Key
58	N/C	59	Connector Key
56	N/C	57	GND
54	PEWAKE# (I/O)(0/3.3V) or N/C	55	REFCLKP
52	CLKREQ# (I/O)(0/3.3V) or N/C	53	REFCLKN
50	PERST# (O)(0/3.3V) or N/C	51	GND
48	N/C	49	PETp0/SATA-A+
46	N/C	47	PETn0/SATA-A-
44	N/C	45	GND
42	N/C	43	PERp0/SATA-B-
40	N/C	41	PERn0/SATA-B+
38	DEVSLP (O)	39	GND
36	N/C	37	PETp1
34	N/C	35	PETn1
32	N/C	33	GND
30	N/C	31	PERp1
28	N/C	29	PERn1
26	N/C	27	GND
24	N/C	25	PETp2
22	N/C	23	PETn2
20	N/C	21	GND
18	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	19	PERp2
16	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	17	PERn2
14	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	15	GND
12	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	13	PETp3
10	DAS/DSS# (I/O)/LED1# (I)(0/3.3V)	11	PETn3
8	PLN	9	GND
6	N/C	7	PERp3
4	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	5	PERn3
2	3.3V (4A total for pins 74, 72, 70, 18, 16, 14, 12, 4, 2 (0.5A per pin))	3	GND
		1	GND

NOTE

PCIe Gen3 NVMe/SATA connector will support either NVMe or SATA based on Table 11 pin configuration

4.1.2   Common IO Header

This section describes the functions of the common IO header.

Table 12 lists the signal names of the common IO header. Figure 6. is a connection diagram for the common IO header.

Table 12. Common IO Header (1.25 mm Pitch)

Pin	Description	Pin	Description
1	USB_VBUS	2	GND
3	USB1_N	4	USB2_P
5	USB1_P	6	USB2_N
7	GND	8	USB_VBUS
9	HDD_LED_P	10	PWR_LED_P
11	HDD_LED_N	12	PWR_LED_N
13	RST_N	14	PWR_BTN_N
15	GND	16	CEC
17	5V_STBY	18	VCC5
19	RSVD	20	GND
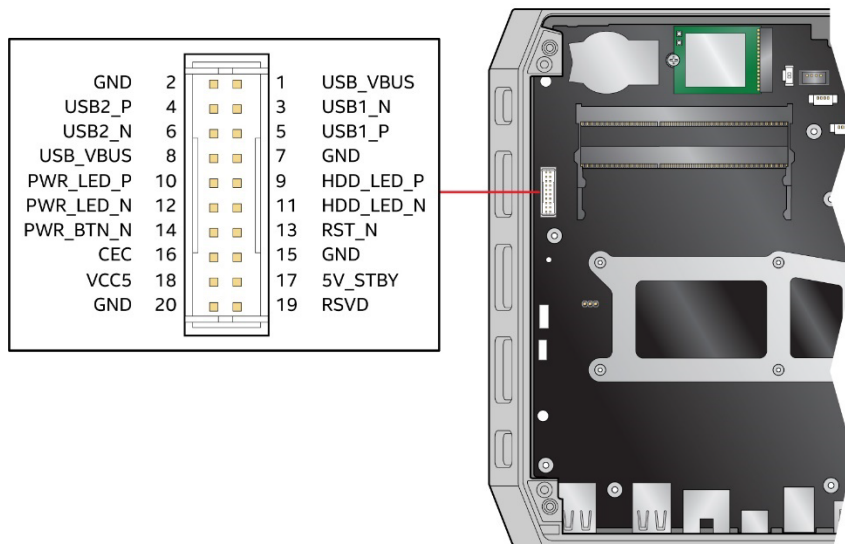
Figure 6. Common IO Header (1.25 mm Pitch)

4.1.3   BIOS Security Jumper

⚠ **CAUTION**

Do not move a jumper with the power on. Always turn off the power and unplug the power cord from the computer before changing a jumper setting. Otherwise, the system could be damaged.

Figure 7. shows the location of the BIOS Security Jumper. The 3-pin jumper determines the BIOS Security program's mode.

Figure 7. Location of the BIOS Security Jumper

Table 13 describes the jumper settings for the three modes: normal, lockdown, and configuration.

Table 13. BIOS Security Jumper Settings

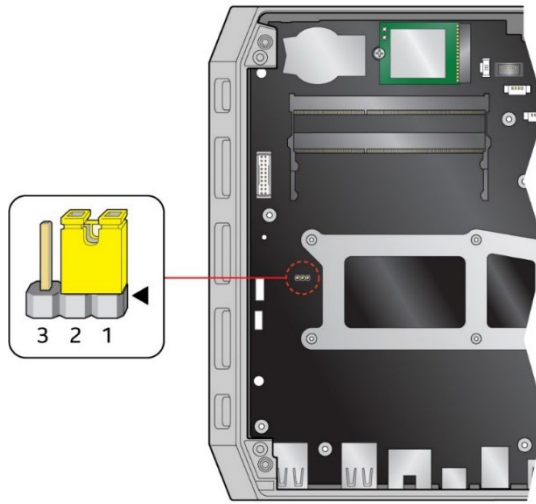| Function/Mode	Jumper Setting	Configuration
Normal	1-2	The BIOS uses current configuration information and passwords for booting.
Lockdown	2-3	The BIOS uses current configuration information and passwords for booting, except: • All POST Hotkeys are suppressed (prompts are not displayed and keys are not accepted. For example, F2 for Setup, F10 for the Boot Menu). • Power Button Menu is not available (see Section 5.4.2 Power Button Menu). BIOS updates are not available except for automatic Recovery due to flash corruption.
Configuration	None	BIOS Recovery Update process if a matching *.bio file is found. Recovery Update can be cancelled by pressing the Esc key. If the Recovery Update was cancelled or a matching *.bio file was not found, a Config Menu will be displayed. The Config Menu consists of the following (followed by the Power Button Menu selections): [1] Suppress this menu until the BIOS Security Jumper is replaced. [2] Clear BIOS User and Supervisor Passwords. [3] Reset Intel® AMT to default factory settings. [4] Clear Trusted Platform Module. Warning: Data encrypted with the TPM will no longer be accessible if the TPM is cleared. [F2] Intel® Visual BIOS. [F4] BIOS Recovery. See Section 5.4.2 Power Button Menu

4.1.4   Fan Header Current Capability

Table 14 lists the current capability of the fan headers.

Table 14. Fan Header Current Capability

Fan Header	Maximum Available Current
Processor fan	1 A

4.1.5   Power Supply Connectors

The system has the following power supply connectors:

- **External Power Supply** – the kit can be powered through a 19.5v DC connector on the back panel. The back-panel DC connector is compatible with a 7.4mm/OD and 5.0mm/ID plug, where the inner 0.8mm contact is +19.5V DC (±5%) and the shell is GND.

NOTE

External power voltage, 19.5 V DC (±5%), is dependent on the type of power brick used.

4.2　　Mechanical Considerations

4.2.1　　　　Form Factor

Figure 8 illustrates the mechanical form factor for the system. Dimensions are given in inches [millimeters]. The outer dimensions are 9.1in. x 7.1in. x 2.4in. (230mm x 180mm x 60mm) not including feet.
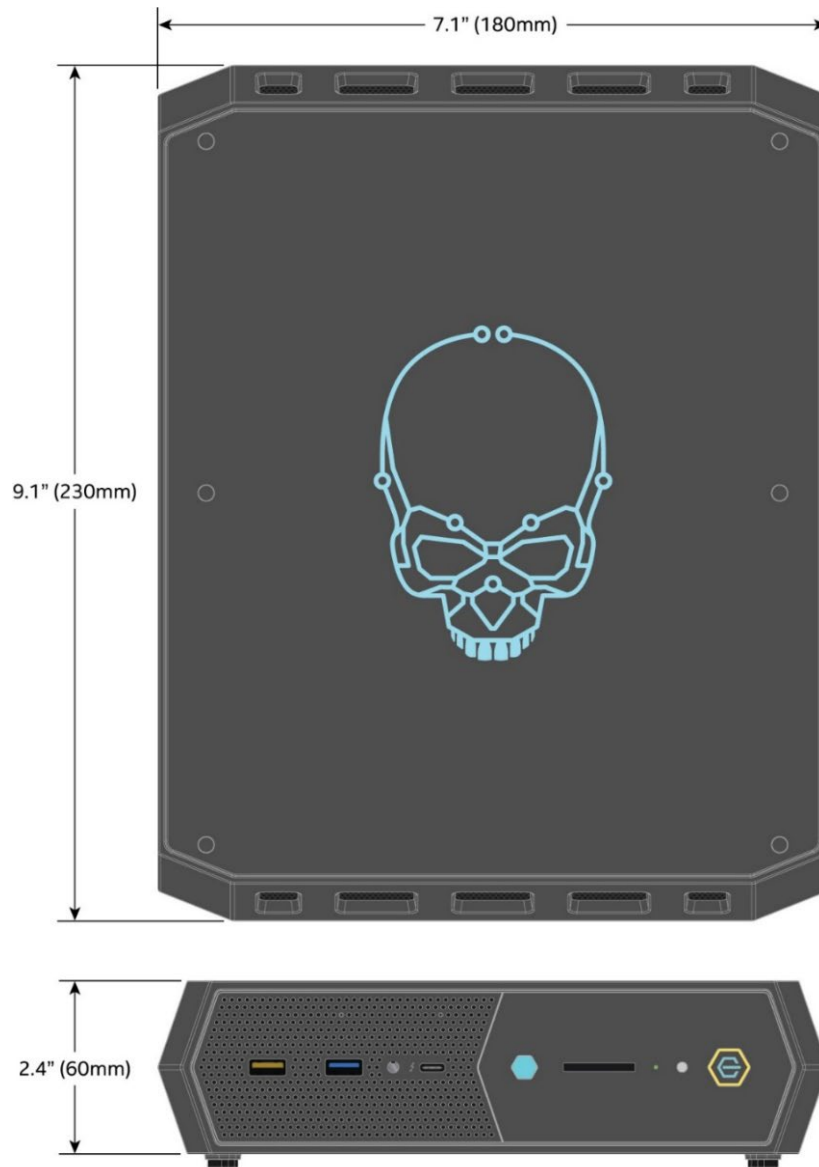

Figure 8. System Dimensions

4.3   Thermal Considerations

⚠ **CAUTION**

Failure to ensure appropriate airflow may result in reduced performance of both the processor and/or voltage regulator or, in some instances, damage to the system.

All responsibility for determining the adequacy of any thermal or system design remains solely with the system integrator. Intel makes no warranties or representations that merely following the instructions presented in this document will result in a system with adequate thermal performance.

⚠ **CAUTION**

Ensure that the ambient temperature does not exceed the system's maximum operating temperature. Failure to do so could cause components to exceed their maximum case temperature and malfunction. For information about the maximum operating temperature, see the environmental specifications in Section 4.5.

⚠ **CAUTION**

Ensure that proper airflow is maintained in the processor voltage regulator circuit. Failure to do so may result in shorter than expected product lifetime.

4.4   Reliability

The demonstrated Mean Time Between Failures (MTBF) is done through 24/7 testing. Full Intel® NUC systems in chassis with memory, SSD or HDD, and fans are run at 100% on time for 90 days continuously while running system wide stress inducing software in a 35 °C ambient air temperature chamber. The demonstrated MTBF for Intel NUC system NUC12SNKi72 is TBD.

4.5   Environmental

Table 15 lists the environmental specifications for the system.

⚠ **CAUTION**

If the external ambient temperature exceeds 35°C, further thermal testing is required to ensure components do not exceed their maximum operating temperature.

Table 15. Environmental Specifications

Parameter	Specification		
Temperature			
Sustained Storage Limits (i.e. warehouse)	-20 °C to +40 °C		
Short Duration Limits (i.e. shipping)	-40 °C to +60 °C		
Ambient Operating – NUC Kit*	0 °C to +35 °C		
	* Processor performance may automatically decrease when the system operates in the top 5 °C of the ambient operating temperature ranges above.		
Shock (System)			
Unpackaged	50 g trapezoidal waveform		
	Velocity change of 170 inches/s²		
Packaged	Free fall package drop machine set to the height determined by the weight of the package.		
	Product Weight (pounds)	Non-palletized Product drop height (inches)	Palletized drop heights (single product) (inches)
	<20	36	N/A
	21-40	30	N/A
	41-80	24	N/A
	81-100	18	12
	100-120	12	9
Vibration (System)			
Unpackaged/Packaged	Random profile 5 Hz @ 0.001 g^2/Hz to 20 Hz @ 0.01 g^2/Hz (slope up)		
	20 Hz to 500Hz @ 0.01 g^2/Hz (flat)		
	Input acceleration is 2.20gRMS		

Note: The operating temperature of the system may be determined by measuring the air temperature from the junction of the heatsink fins and fan, next to the attachment screw, in a closed chassis, while the system is in operation.

Note: Before attempting to operate this system, the overall temperature of the system must be above the minimum operating temperature specified. It is recommended that the system temperature be at least room temperature before attempting to power on the system. The operating and non-operating environment must avoid condensing humidity.

5 Overview of BIOS Features

5.1 Introduction

The system uses an Intel AMI BIOS core that is stored in the Serial Peripheral Interface Flash Memory (SPI Flash) and can be updated through multiple methods (see Section 5.3). The SPI Flash contains the BIOS Setup program, POST, the PCI auto-configuration utility, LAN EEPROM information, and Plug and Play support. The SPI Flash includes a 32 MB flash memory device.

The BIOS Setup program can be used to view and change the identification information and the BIOS settings for the system. The BIOS Setup program is accessed by pressing <F2> after the POST memory test beings and before the operating system boots.

5.2 Legacy USB Support

Legacy USB support enables the USB devices to be used even when the operating system's USB drivers are not yet available. Legacy USB support is used to access the BIOS setup program and to install an operating system that supports USB. By default, Legacy USB support is set to Enabled.

To install an operating system that supports USB, verify that Legacy USB support in the BIOS Setup program is set to Enabled and follow the operating system's installation instructions.

5.3 BIOS Updates

The BIOS can be updated using one of the following methods:

1. Express BIOS (Windows-based) Update
2. F7 Update
3. Power Button Menu Update
4. iFlash Update
5. UEFI Shell Update

More information and instructions on how to use each of these methods can be found at BIOS Update and Recovery Instructions. All BIOS update files for Intel NUCs are available on Download Center.

5.3.1 BIOS Recovery

It is unlikely that anything will interrupt a BIOS update; however, if an interruption occurs the BIOS could be unstable. Table 16 lists the drives and media types that can be used for BIOS recovery. The BIOS recovery media does not need to be made bootable. More information about BIOS recovery methods and instructions can be found at BIOS Update and Recovery Instructions.

Table 16. Acceptable Drives/Media Type for BIOS Recovery

Media Type [(Note)]	Can be used for BIOS recovery?
Hard disk drive (connected to USB)	Yes
USB flash drive	Yes
NVME SSD (M.2 interface)	Yes

NOTE *Supported file systems for BIOS recovery: NTFS (sparse, compressed, or encrypted files are not supported), FAT32, EXT*

5.4   Boot Options

In the BIOS Setup program, the user can choose to boot from a hard drive, removeable driver, or the network. The default setting is for the hard drive to be the first boot device, the removeable drive second, and the network third.

NOTE *The network can be selected as a boot device. This selection allows booting from the onboard LAN or a network add-in card with a remote boot ROM installed. Pressing the <F12> key during POST automatically forces booting from the LAN. To use this key during POST, the User Access Level in the BIOS Setup program's Security menu must be set to Full.*

5.4.1   Boot Device Selection During Post

Pressing the <F10> key during POST causes a boot device menu to be displayed. The menu displays the list of available boot devices.

5.4.2   Power Button Menu

As an alternative to Configuration Mode or normal POST hotkeys, the user can use the power button to access a menu with BIOS and boot options. The Power Button Menu is accessible via the following sequence:

1. System is in S4/S5 (not G3)
2. User pushes the power button and holds it down for 3 seconds
3. The Front Panel Power Button LED will be on for the first 3 seconds. After 3 seconds, the LED will begin to blink in the following pattern: 0.25 seconds off, 0.25 seconds on, 0.25 seconds off to signal the user to release the power button
4. User releases the power button before the 4-second shutdown override
    If this boot path is taken, the BIOS will use default settings, ignoring settings in VPD where possible. At the point where Setup Entry/Boot would be in the normal boot path, the BIOS will display the following prompt and wait for a keystroke:

    If an unrecognized key is hit, then the BIOS will do nothing and wait for another keystroke. If one of the listed hotkeys is hit, the BIOS will follow the indicated boot path. Password requirements must still be honored.

Table 17. Power Button Menu Options

Keystroke	Option	Description
[ESC]	Normal Boot	
[F2]	BIOS Setup Menu	
[F3]	Disable Fast Boot	Note: Will only be displayed if at least one Fast Boot optimization is enabled.
		If Disable Fast Boot is selected, the BIOS will disable all Fast Boot optimizations and reset the system.

[F4]	BIOS Recovery	The BIOS will search for a matching .CAP file from the \EFI\Intel folder in the supported media with the supported file system. If a matching recovery capsule is found, the BIOS will display the following: **BIOS will Recover to <BIOSID> in 20 seconds.** **[ESC] Cancel Recovery** Recovery will proceed if not cancelled via the ESC key within 20 seconds. The BIOS shall display the recovery progress. If a BIOS .CAP file was not detected (or the BIOS Recovery was cancelled) then the BIOS will reset the system and continue normally to POST.
[F5]	Restore BIOS Settings	The BIOS will restore the current setup settings and the current defaults to the build time defaults in the case of a boot issue caused by setup variable changes.
[F7]	Update BIOS	BIOS Update during the BDS phrase. The BIOS will update independent of any OS loading and provides a menu UI accessible during boot up. This is not a recovery tool and will not overwrite a corrupt BIOS or ME firmware.
[F9]	Remote Assistance	Note: Will only be displayed if Remote Assistance is supported.
[F10]	Enter Boot Menu	
[F12]	Network Boot	

5.5   BIOS Security Features

The BIOS includes security features that restrict access to the BIOS Setup program and who can boot the computer. A Supervisor and User password can be set for the BIOS Setup program and for botting the computer, with the following restrictions:

- The Supervisor password gives unrestricted access to view and change all the Setup options in the BIOS Setup program. This is Supervisor Mode.
- The User password gives restricted access to view and change Setup options in the BIOS Setup program. This is User Mode.
- If only the Supervisor password is set, pressing the <Enter> key at the password prompt of the BIOS Setup program allows the user restricted access to Setup.
- If both the Supervisor and User passwords are set, users can enter either the Supervisor or User password to access Setup. Users have access to Setup regardless to which password is used.
- Setting the User password restricts who can boot the computer. The password prompt will be displayed before the computer boots. If only the Supervisor password is set, the computer boots without asking for a password. If both passwords are set, the user can enter either password to boot the computer.
- For enhanced security, use different passwords for the Supervisor and User passwords.
- Valid password characters are A-Z, a-z, 0-9, and special characters. Passwords may be up to 20 characters in length.
- To clear a set password, enter a blank password after entering the existing password.

Table shows the effects of setting the Supervisor password and User password. This table is for reference only and is not displayed on the screen.

Table 18. Supervisor and User Password Functions

Password Set	Supervisor Mode	User Mode	Setup Options	Password to Enter Setup	Password During Boot
Neither	Any user can change all options	Any user can change all options	None	None	None
Supervisor only	Can change all options	Can change a limited number of options	Supervisor Password	Supervisor	None
User only	N/A	Can change all options	Enter Password Clear User Password	User	User
Supervisor and User set	Can change all options	Can change a limited number of options	Supervisor Password Enter Password	Supervisor or User	Supervisor or User

5.6 BIOS Error Messages

Table 19 lists the error messages and provides a brief description of each.

Table 19. BIOS Error Messages

Error Message	Explanation
CMOS Battery Failure	The battery may be losing power. Replace the battery soon.
CMOS Checksum Error	The CMOS checksum is incorrect. CMOS memory may have been corrupted. Run Setup to reset values.
Memory Size Decreased	Memory size has decreased since the last boot. If no memory was removed, then the memory may be bad.
CMOS Timer Not Set	The battery may be losing power. Replace the battery soon.
Processor Thermal Trip	Processor overheated.
Auto RTC Reset	The system triggers RTC clear to recover the system back to the normal condition from consecutive boot failure.