Intel® NUC Kit/Mini PC
NUC11PHKi7C

Technical Product Specification

Regulatory Models: NUC11PH (Kit, Mini PC)

January 2021
Revision 1.0

Intel® NUC Board NUC11PH{X} may contain design defects or errors known as errata that may cause the product to deviate from published specifications. Current characterized errata, if any, are documented in Intel NUC Board NUC11PH{X} Specification Update.

Revision History

Revision	Revision History	Date
0.1	Preliminary release of the Intel NUC NUC11PH{X} Technical Product Specification	January 2021
1.0	Release of the Intel NUC NUC11PH{X} Technical Product Specification	

Disclaimer

This product specification applies to only the standard Intel NUC Board NUC11PH{X} with BIOS identifier PHTGL579.00XX.

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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 Kits NUC11PH{X}. Some features are only available on Kit SKUs.

Intended Audience

The TPS is intended to provide detailed, technical information about Intel® NUC Kit NUC11PH{X} 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 NUC11PH{X}
2	The figures, layouts, and physical description of the Intel® NUC NUC11PH{X} 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 NUC11PH{X}

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 Products NUC11PH{X} Identification Information

Product Name	Intel® NUC Board
NUC11PHKi7C	NUC11PHi7C

Specification Changes or Clarifications

The table below indicates the Specification Changes or Specification Clarifications that apply to the Intel NUC Kit/Mini PC NUC11PH{X}.

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 NUC11PH{X}	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 NUC11PH{X}	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
Regulatory documentation	https://www.intel.com.tw/content/www/tw/zh/support/articles/000057855.html

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1 Product Description

1.1 Overview

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.

Processor	GPU	AC Cord (C5)	RAM	Storage	OS	TPM
Intel® Core™ i7-1165G7	RTX2060 + 6GB GDDR6	US, EU, or No Cord	2 x 8 GB	512GB Optane H10	Win 10 Pro	WW
		CN			Win 10 Pro	CN
		-			-	-
		-			-	-
		-			-	-

1.1.2 Summary of Kit SKUs

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

Processor	GPU	AC Cord (C5)	TPM
Intel® Core™ i7-1165G7	RTX2060 + 6GB GDDR6	US, EU, UK, IN, AU or No Cord	WW
		CN	CN

1.1.3 Feature Summary

Table 1 summarizes the major features of Intel® NUC Mini PC, Kit and Board NUC11PH{X}.

Table 1. Feature Summary

Board Dimensions	8.22in by 5.37in (208.9mm by 136.4mm)
Chassis Dimensions	Chassis: 8.93in by 5.7in by 1.57in (227mm by 145mm x 40mm) (including feet)
Processor	Intel® NUC Mini PCs, and Kits NUC11PH{X} have a soldered-down 11th generation Intel® Core™ processor with up to 28 W TDP • Intel® Core™ i7-1165G7 processor, MM# 99A3D0 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 1866/2133/2400/3200 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 Intel® Graphics Technology • Two Type C Front and back panel connectors • Discrete graphics support by Nvidia RTX 2060 • One Full Size High Definition Multimedia Interface* (HDMI*) Back panel connectors • One Mini DisplayPort* back panel connectors • Two Type C Front and back panel connectors
Audio	Audio via digital display outputs • The following audio technologies are supported by the HDMI interfaces 192kHz/16-bit or 176. kHz/24-bit, 32 Channel • When using an encoded format (such as DTS-HD MA or Dolby True HD) the board supports a single 7.1 stream. When using an un-encoded format, the board supports 8 discrete, un-encoded channels per HDMI port simultaneously, for a total of 16 discrete/un-encoded channels. More information about software and drivers can be found at https://downloadcenter.intel.com
Storage	One M.2 PCIe Gen4 connector supporting M.2 22x80 (key type M) for NVMe only One M.2 connector supporting M.2 22x42 (key type B) for SATA SSD, PCIe x1 or USB 3.2 expandability

Communication	Intel® Wi-Fi 6 AX201 (Gig+) M.2 2230 add-in card via M.2 2230 (key type E) connector • 802.11ax, Dual Band, 2x2 Wi-Fi + Bluetooth v5.1 • Maximum transfer speed up to 2.4 Gbps • Supports PCIe and USB 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® i255-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) • Support for two RJ45 ports with the Dual LAN chassis option 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™ ports (front and back panel) • USB4 compliant • 15W and18W port bus power • 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 DP1.4a, 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 ports via Type C/Thunderbolt™ (Front and back panel) 6 x USB 3.2 Gen 2 ports (2 front panel and 4 back panel) 1 x USB 2.0 port (M.2 slot) 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 230W 19.5V adapter Power Input • $12V_{DC}$ to $24V_{DC}$ +/- 5% with DC transient voltage protection More information about the estimated power budget can be found in Section **Error! R eference source not found.** later in this document

Operating Temperatures	0-40C 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)
Operating System (Mini PCs only)	Intel® NUC Mini PCs NUC11PH{X} can be purchased with Windows 10 Pro 64-bit preinstalled More information about available Intel® NUC Mini PCs NUC11PH{X} can be found in Section 1.1.1 Summary of Mini PC SKUs. For Product Codes and MM#s visit https://ark.intel.com
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 One processor fan header Fan sense input used to monitor fan activity Fan speed control

Table 2. 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
Sustained Operation	Qualified for 24x7 sustained operation
Auto CMOS Reset	
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.
Intel® Transparent Supply Chain	System level visibility and traceability of hardware and firmware that assures platform integrity throughout the compute lifecycle More information about Intel® TSC is available on https://www.intel.com/content/www/us/en/products/docs/servers/transparent-supply-chain.html

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 NUC11PH{X}.

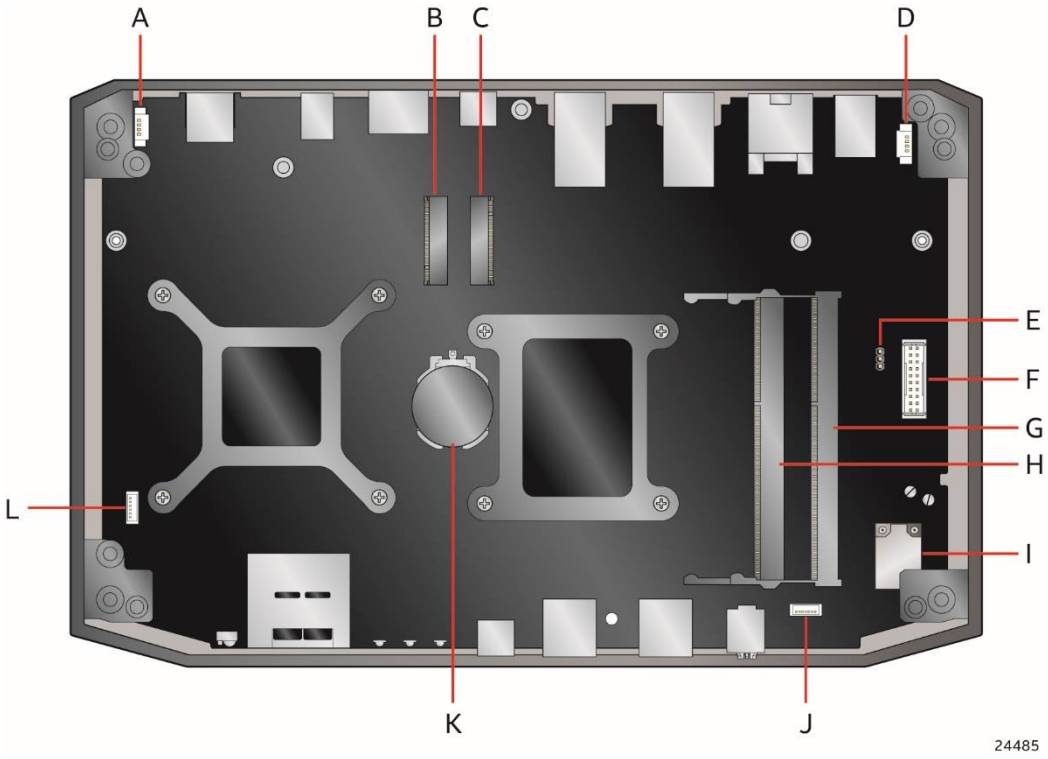


Figure 1. Major Board Components (Top)

Table 3. Components Shown in Figure 1

Item from Figure 1	Description
A	Fan Connector
B	M.2 2280 Module Connector (Key Type B) (NVMe/SATA)
C	M.2 2280 Module Connector (Key Type M) (NVMe Only)
D	Fan Connector
E	BIOS Security Header
F	Common I/O Header
G	DDR4 SO-DIMM 1 Socket

H	DDR4 SO-DIMM 0 Socket
I	AX201D Wifi Module
J	DMIC connector
K	CMOS Battery
L	RGB Header

2.1.2 Board Layout (Bottom)

No user configurable components on the bottom-side of Intel® NUC Board NUC11PH{X}.

2.1.3 Front Panel

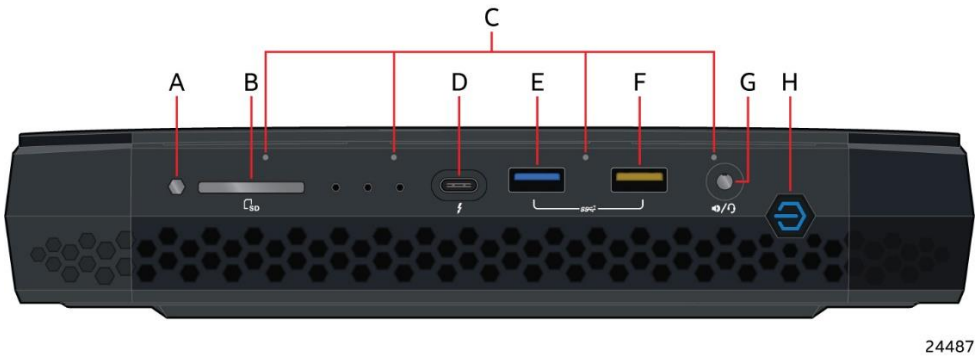


Figure 2. Front Panel Connectors

Table 4. Components Shown in Figure 2

Item from Figure 2	Description
A	IR Sensor
B	SD Card Reader
C	DMICs
D	Thunderbolt USB-C
E	USB 3.2 gen 2
F	USB 3.2 gen 2 2A peak current support
G	Audio
H	Power Button

2.1.4 Back Panel

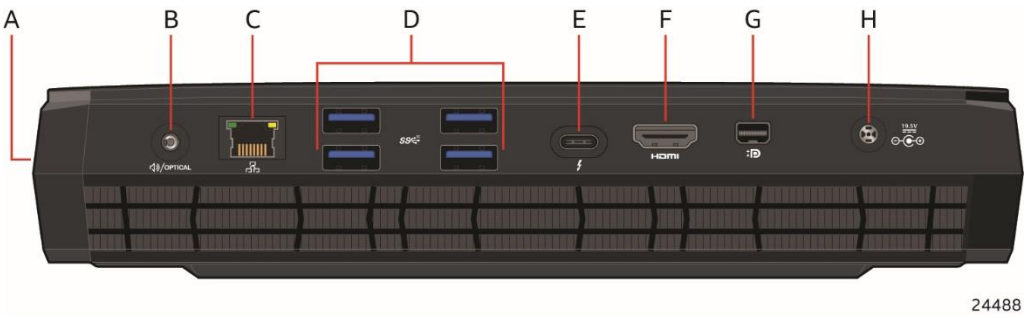


Figure 3. Back Panel Connectors

Table 5. Components Shown in Figure 3

Item from Figure 2	Description
A	Kensington Lock
B	Optical audio port
C	Ethernet
D	USB 3.2 gen 2
E	Thunderbolt USB-C
F	HDMI
G	Mini Display Port
H	Power Input

2.1.5 Block Diagram

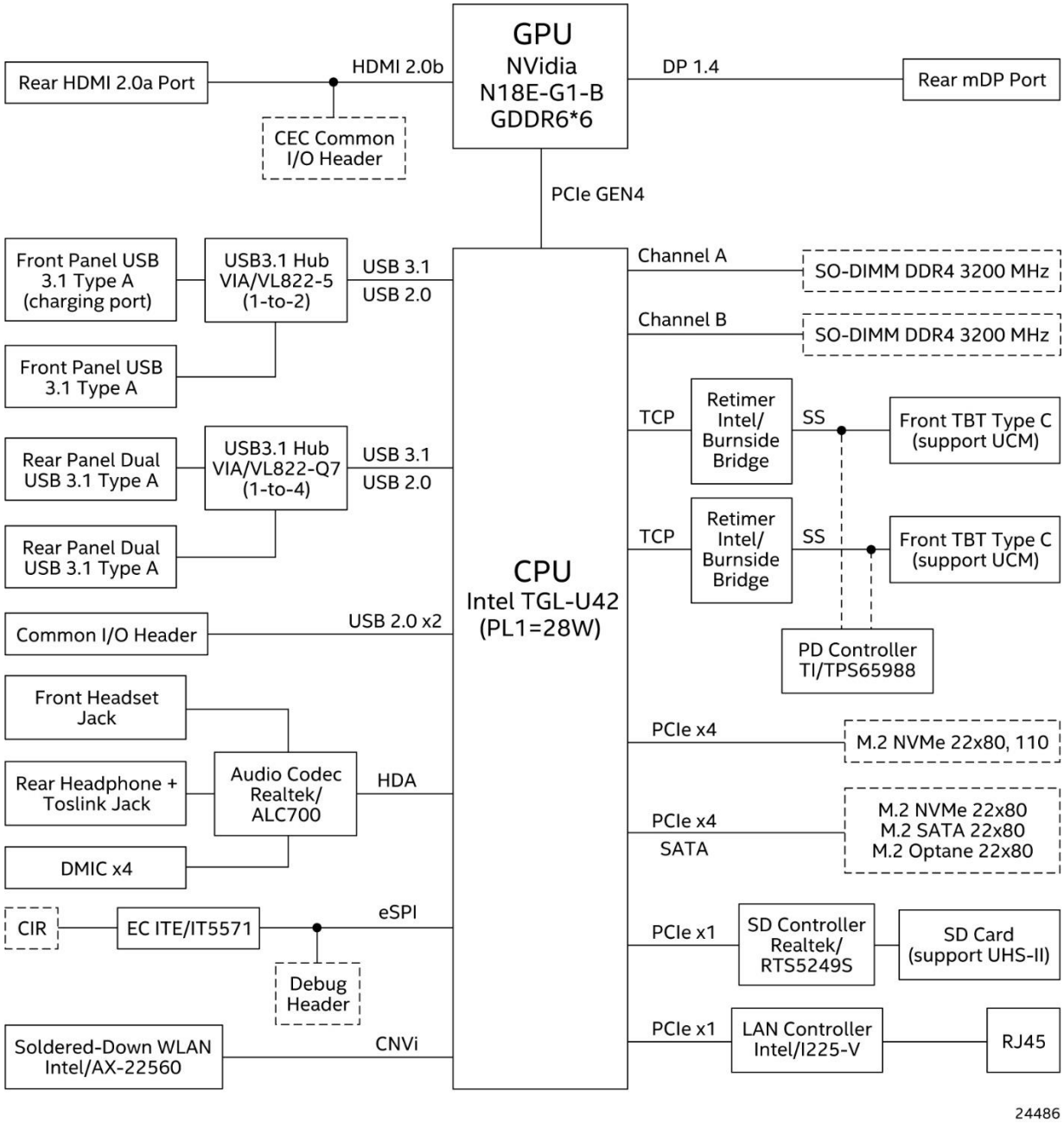


Figure 4. Block Diagram

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 NUC11PH{X} can be purchased with 2 x 8 GB DDR4 3200 MHz SODIMMs included. More information about available Intel® NUC Mini PCs NUC11PH{X} 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® NUC Boards NUC11PH{X} support Intel® Iris® Xe Graphics.

3.2.1 General Power and Memory Guidance for Optimal Graphics Performance

Intel® NUC Boards NUC11PH{X} graphics 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
    - 128bit (Dual Channel) memory is better performing than 64bit (Single Channel) memory
    - A full list of tested memory modules are available on https://compatibleproducts.intel.com

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: Intel Media SDK, MFT filters
    - Full HW accelerated video encoding for AVC/HEVC/VP9/JPEG
- Max HDMI resolution 4096x2304 at 60Hz
- Max DP resolution 7680x4320 at 60Hz
- Up to four simultaneous displays
- Four display pipes – supporting blending, color adjustments, scaling and dithering
- Direct 3D* 2015, Direct3D* 12
- OpenGL* 4.5
- Open CL* 2.1
- HDR (High Dynamic Range) support

- HDCP (High-bandwidth Digital Content Protection) 2.2 and 1.4

3.2.3 Intel® UHD Graphics for 11th Gen Intel Processors

Intel® UHD Graphics for 11th Gen Intel Processors features the following:

- DirectX* 12.1 support
- OpenGL* 4.5 support
- Max HDMI resolution 4096x2304 at 60Hz
- Max DP resolution 7680x4320 at 60Hz
- OpenCL* 2.0 support

3.3 Integrated Audio

HDMI and DP interfaces can carry audio along with video. The processor supports three HD audio streams over four digital ports simultaneously. The processor supports the following audio formats over HDMI and DP:

- AC-3 Dolby* Digital
- Dolby* Digital Plus
- DTS-HD*
- LPCM, 192 kHz/24 bit, 6 channel
- Dolby* TrueHD, DTS-HD Master Audio*

Audio drivers are built into the Graphics driver and are available from Intel's website.

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

3.4 SATA Interface

The board provides the following SATA interfaces:

- One SATA 6.0 Gb/s combined Data and Power connector (blue)

The PCH provides independent SATA ports with a theoretical maximum transfer rate of 6 Gb/s. A point-to-point interface is used for host to device connections.

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

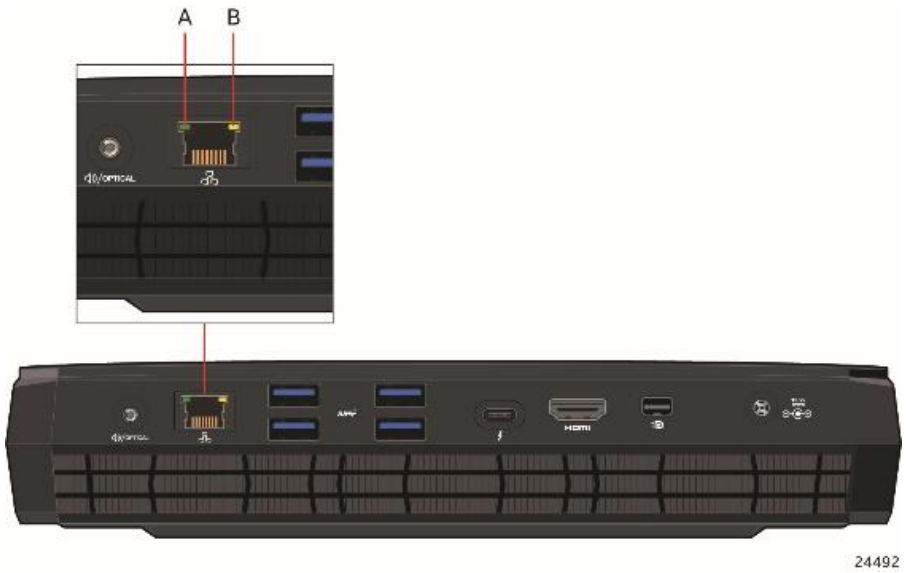
If the battery and AC power fail, date and time values will be reset and the user will be notified during the POST.

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 one. **Error! Reference source not found.** on page **Error! Bookmark not defined.** shows the location of the 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 6 describes the LED states when the board is powered up and the LAN subsystem is operating.

Table 6. 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

3.7 Hardware Management Subsystem

3.7.1 Fan Monitoring

Fan monitoring can be implemented using third-party software.

3.7.2 System States and Power States

Table 7 describes the ACPI states supported by the processor.

Table 7. 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 lists the devices or specific events that can wake the computer from specific states.

Table 8. 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. 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 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 board.

4.1.1 Signal Tables for the Connectors and Headers

Table 9. SATA Combined Data/Power Header

Pin	Signal Name	Pin	Signal Name
1	+5V (2A total for pins 1, 2, 3, 4 (0.5A per pin))	2	+5V (2A total for pins 1, 2, 3, 4 (0.5A per pin))
3	+5V (2A total for pins 1, 2, 3, 4 (0.5A per pin))	4	+5V (2A total for pins 1, 2, 3, 4 (0.5A per pin))
5	NC	6	NC
7	NC	8	DEVSLP
9	GND	10	GND
11	SATA_RX_P	12	SATA_RX_N
13	GND	14	SATA_TX_N
15	SATA_TX_P	16	GND

Connector is vertical 0.5mm contact pitch ZIF FPC/FFC with lock

Table 10. 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)
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
46	N/C	47	PETn0
44	N/C	45	GND
42	N/C	43	PERp0
40	N/C	41	PERn0
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	N/C	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

Table 11. M.2 2230 Module (Mechanical Key E) Connector

Pin	Signal Name	Pin	Signal Name
74	3.3V (2A total for pins 74, 72, 4, 2 (0.5A per pin))	75	GND
72	3.3V (2A total for pins 74, 72, 4, 2 (0.5A per pin))	73	WT_CLKP
70	UIM_POWER_SRC/GPIO1/PEWAKE1#	71	WT_CLKN
68	CLKREQ1#	69	GND
66	PERST1#	67	WTD0P
64	REFCLK0	65	WTD0N
62	ALERT#/A4WP_IRQ# (I)(0/3.3)	63	GND
60	I2C CLK/A4WP_I2C_CLK (O)(0/3.3)	61	WT_D1P

58	I2C DATA/A4WP_I2C_DATA (I/O)(0/3.3)	59	WT_D1N
56	W_DISABLE1# (O)(0/3.3V)	57	GND
54	W_DISABLE2# (O)(0/3.3V)	55	PEWAKE0# (I/O)(0/3.3V)
52	PERST0# (O)(0/3.3V)	53	CLKREQ0# (I/O)(0/3.3V)
50	SUSCLK(32kHz) (O)(0/3.3V)	51	GND
48	COEX1 (I/O)(0/1.8V)	49	REFCLKN0
46	COEX2(I/O)(0/1.8V)	47	REFCLKP0
44	COEX3(I/O)(0/1.8V)	45	GND
42	CLink_CLK (I/O)	43	PERn0
40	CLink_DATA (I/O)	41	PERp0
38	C-Link RESET* (I) (0/3.3V)	39	GND
36	UART RTS/BRI_DT (I) (0/1.8V)	37	PETn0
34	UART CTS (O) (0/1.8V)	35	PETp0
32	UART TXD/RGI_DT (I) (0/1.8V)	33	GND
30	Connector Key	31	Connector Key
28	Connector Key	29	Connector Key
26	Connector Key	27	Connector Key
24	Connector Key	25	Connector Key
22	UART RXD/BRI_RSP (O) (0/1.8V)	23	WGR_CLKP
20	UART WAKE# (O) (0/3.3V)	21	WGR_CLKN
18	GND/LNA_EN	19	GND
16	BT_LED (LED2#)	17	WGR_D0P
14	PCM_OUT/I2SSD_OUT/CLKREQ0	15	WGR_D0N
12	PCM_IN/I2SSD_IN	13	GND
10	PCM_SYNC/I2SWS/RF_RESET_B	11	WGR_D1P
8	PCM_CLK/I2SSCK	9	WGR_D1N
6	LED1#	7	GND
4	3.3V (2A total for pins 74, 72, 4, 2 (0.5A per pin))	5	USB_D-
2	3.3V (2A total for pins 74, 72, 4, 2 (0.5A per pin))	3	USB_D+
		1	GND

4.1.1.1 Common IO Header (1.25 mm Pitch)

This section describes the functions of the front panel header. Table 12 lists the signal names of the front panel header. Figure is a connection diagram for the front panel header.

Table 12. Front Panel Header (2.0 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

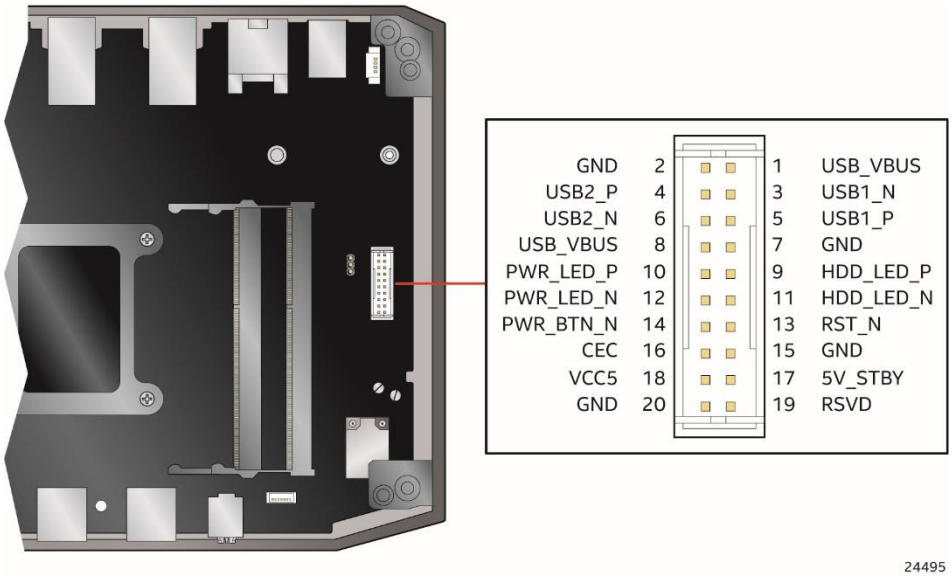


Figure 6. Common IO Header (1.25 mm Pitch)

4.1.1.2 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 board could be damaged.

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

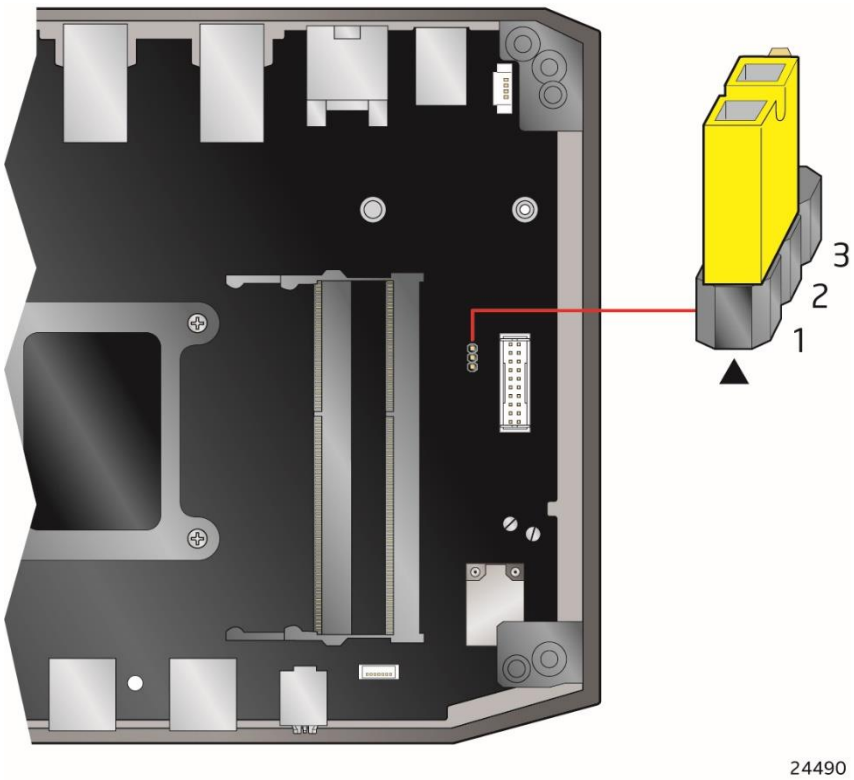


Figure 7. Location of the BIOS Security Jumper

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

4.1.1.3 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

4.1.1.4 Power Supply Connectors

The board has the following power supply connectors:

- **External Power Supply** – the board can be powered through a 12-24 V DC connector on the back panel. The back-panel DC connector is compatible with a 5.5 mm/OD (outer diameter) and 2.5 mm/ID (inner diameter) plug, where the inner contact is +12-24 V DC and the shell is GND. The maximum current rating is 10 A.

NOTE

External power voltage, 12-24 (±5%) V DC, is dependent on the type of power brick used. System power requirements will depend on actual system configurations chosen by the integrator, as well as end user expansion preferences. It is the system integrator's responsibility to ensure an appropriate power budget for the system configuration is properly assessed based on the system-level components chosen.

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 8.93in by 5.7in by 1.57in [227 millimeters by 145 millimeters by 40 millimeters].

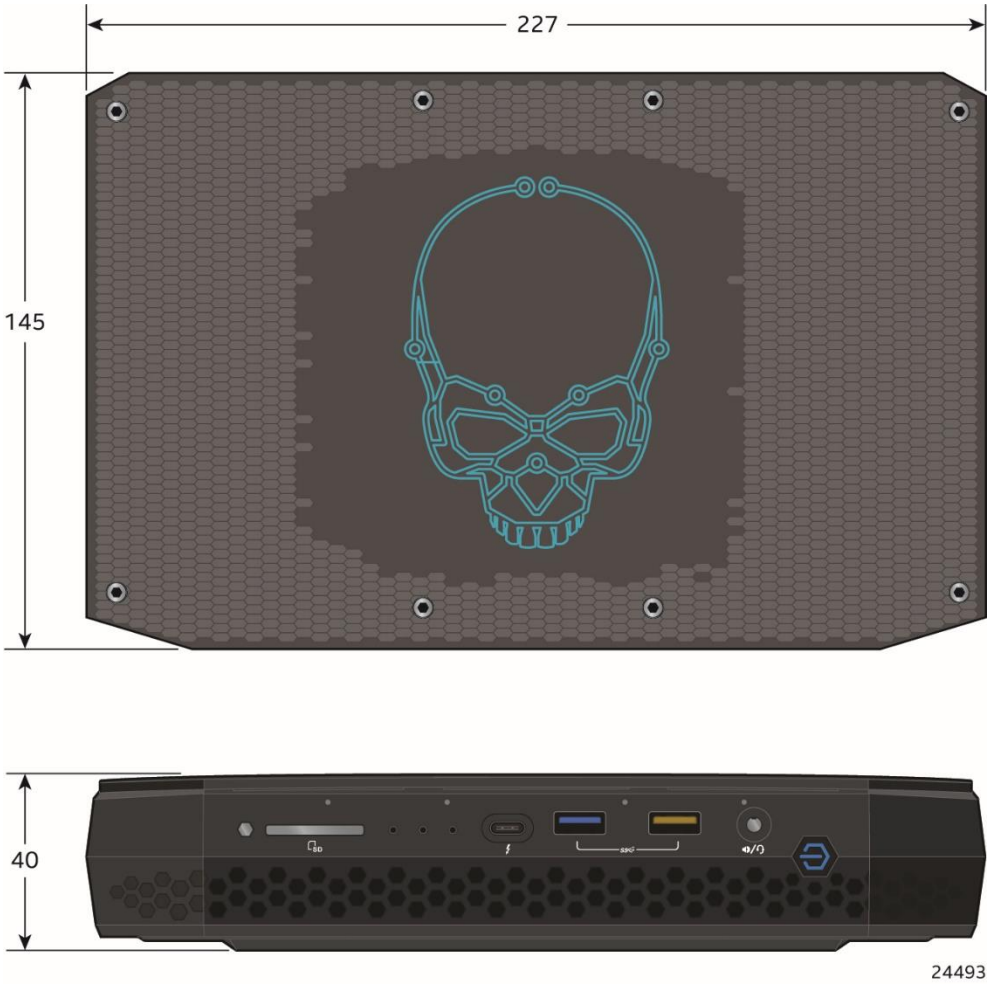


Figure 8. System Dimensions

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 board.

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 board'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 ran at 100% on time for 90 days continuously while running system wide stress inducing software in a 40 °C ambient air temperature chamber. The demonstrated MTBF for Intel NUC Board NUC11PH{X} is >50,000 hours.

4.5 Environmental

Table 16 lists the environmental specifications for the board.

CAUTION

If the external ambient temperature exceeds 40 °C, further thermal testing is required to ensure components do not exceed their maximum operating temperature.

Table 16. 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 +40 °C		
Ambient Operating – NUC Board*	0 °C to +40 °C		
	* Processor performance may automatically decrease when the system operates in the top 5 °C of the ambient operating temperature ranges above.		
Shock (Board)			
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	Random profile 5 Hz to 40 Hz @ 0.015 g^2/Hz to 500 Hz @ 0.00015 g^2/Hz(slope down)		

	Input acceleration is 1.09 gRMS
Packaged	Random profile 5 Hz to 40 Hz @ 0.015 g^2/Hz to 500 Hz @ 0.00015 g^2/Hz(slope down)
	Input acceleration is 1.09 gRMS

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

5 Overview of BIOS Features

5.1 Introduction

The board 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 Hard Disk Drive Password Security Feature

The Hard Disk Drive Password Security feature blocks ready and write access to the hard disk drive until the correct password is given. Hard disk drive passwords are set in BIOS Setup and are prompted for BIOS POST. For convenient support for resuming from S3, the system BIOS will automatically unlock drives on resume from S3. Valid password characters are A-Z, a-z, and 0-9. Passwords may be up to 32 characters in length.

The User hard disk drive password, when set, will be required on each power cycle until the Master Key or User hard disk drive password is submitted.

The Master Key hard disk drive password, when set, will not lock the drive. The Master Key hard disk drive password exists as an unlock override if the User hard disk drive password is forgotten. Only the User hard disk drive password, when set, will cause a hard disk to be locked on a system power cycle. Table show the effects of setting the hard disk drive passwords.

Table 18. Master Key and User Hard Disk Drive Password Functions

Password Set	Password During Boot
Neither	None
Master only	None
User only	User only
Master and User Set	User

During every POST, if a User hard disk drive password is set, POST execution will pause with the following prompt to force the User to enter the Master Key or the User hard disk drive password:

"Enter Hard Disk Drive Password:"

Upon successful entry of the Master Key or User hard disk drive password, the system will continue with normal POST.

If the hard disk drive password is not correctly entered, the system will go back to the above prompt. The User will have three attempts to correctly enter the hard disk drive password. After the third unsuccessful attempt, the system will halt with the following message:

"Hard Disk Drive Password Entry Error"

A manual power cycle will be required to resume system operation.

NOTE *As implemented on the Intel NUC11PH{X} board, the hard disk drive password security feature is only supported on the SATA Port 0 (M.2) or the SATA port 1 (onboard SATA connector).*

5.6 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 19. 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

5.7 BIOS Error Messages

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

Table 20. 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.