

Intel® NUC Kit/Mini PC NUC12SNKi72

Technical Product Specification
Regulatory Models: NUC12SNK (Kit, Mini PC)

October 2022

Intel® NUC12SNKi72 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 NUC12SNKi72 Specification Update.

Revision History

Revision	Revision History	Date
1.0	Release of the Intel NUC NUC12SNKi72 Technical Product Specification	September 2022
1.1	Fixed Errors	October 2022
1.2	Clarifications (Table 7.d, Section 3.2.4)	October 2022

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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...

Intel NUC Kit/Mini PC NUC12SNKi72

Intel NUC Kit/Mini PC Support

High level details for Intel NUC Kit/Mini PC
NUC12SNKi72

BIOS and driver updates

Tested memory

Integration information

Processor datasheet

Visit this World Wide Web site:

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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 12 th generation Intel® Core™ processor with 45 W TDP <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> One Type C Front panel connector One Type C Back panel connector Discrete graphics support by Intel® Arc™ A770M <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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

<p>Communication</p>	<p>Wireless connectivity using the Intel® Wi-Fi 6E AX1690i wireless networking module</p> <ul style="list-style-type: none"> • 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 <p>More information about Intel® wireless products can be found at https://ark.intel.com To obtain drivers visit https://downloadcenter.intel.com</p> <p>Gigabit (10/100/1000/2500 Mbps) LAN subsystem using the Intel® i225-LM Gigabit Ethernet Controller</p> <ul style="list-style-type: none"> • 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) <p>More information about Intel® Ethernet controllers can be found at https://ark.intel.com To obtain drivers visit https://downloadcenter.intel.com</p>
<p>Thunderbolt™</p>	<p>2 x Thunderbolt™ 4 ports (1 front and 1 back panel)</p> <ul style="list-style-type: none"> • 15W and 18W port bus power <ul style="list-style-type: none"> ○ Charging capability up to 5V @ 1.5A, 5V @ 3A and 9V @ 2A ○ 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 <p>TBT3 Tx/Rx rates: 40G (2x 20.625), 20G (2x 10.3125) PCI Express Tunnel: 32 Gbps</p> <p>USB4 Tx/Rx rates: 40G (2x 20), 20G (2x 10) USB3 Native: 10Gbps (1x10G) USB3 Tunnel: 10Gbps USB2: 480 Mbps</p> <p>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)</p> <p>More information about the location of the Thunderbolt™ ports can be found in Section 2.1.4 later in this document</p>
<p>USB Ports and Headers</p>	<p>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)</p> <p>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</p>
<p>Power</p>	<p>AC Adapter</p> <ul style="list-style-type: none"> • Ships with a 330W adapter • Adapter output: 19.5VDC @ 16.9 Amps

	<ul style="list-style-type: none"> System Power Input 19.5V_{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: <ul style="list-style-type: none"> 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.

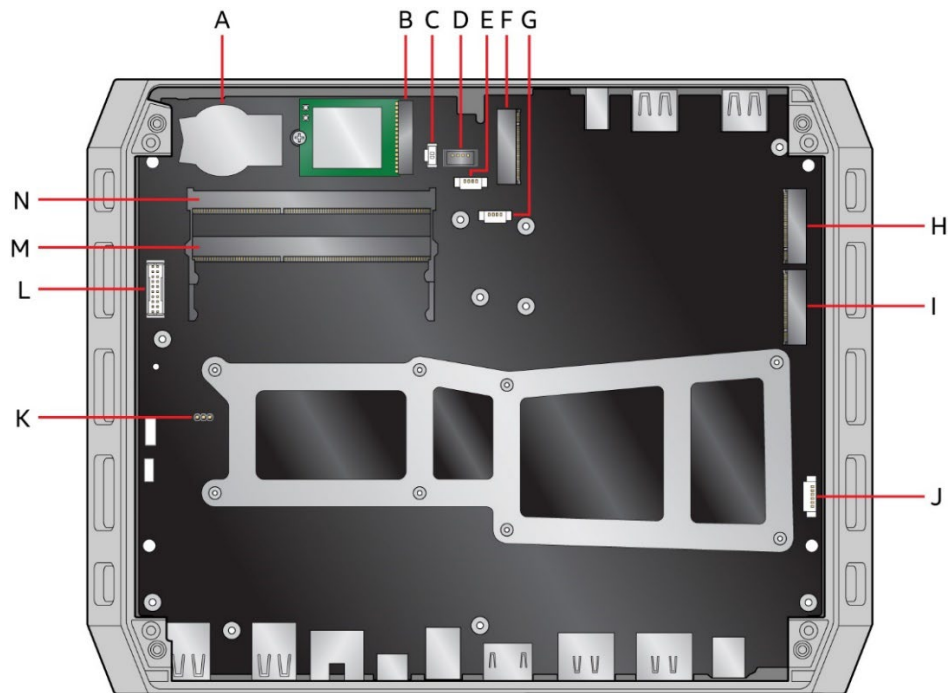


Figure 1. Major Board Components (Top)

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

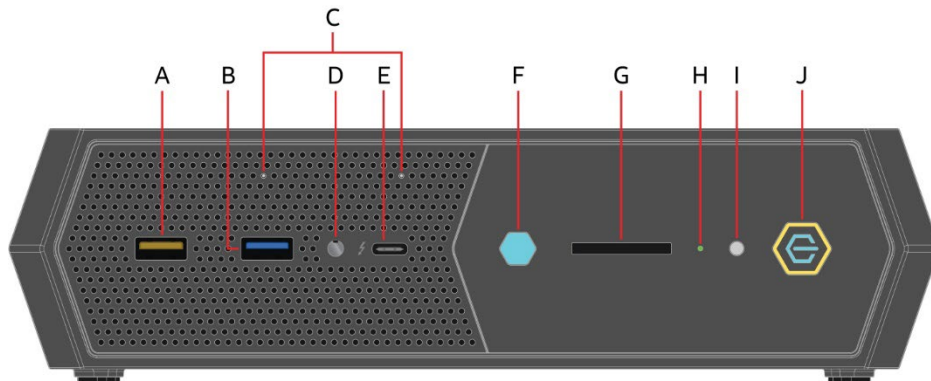


Figure 2. Front Panel Connectors

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

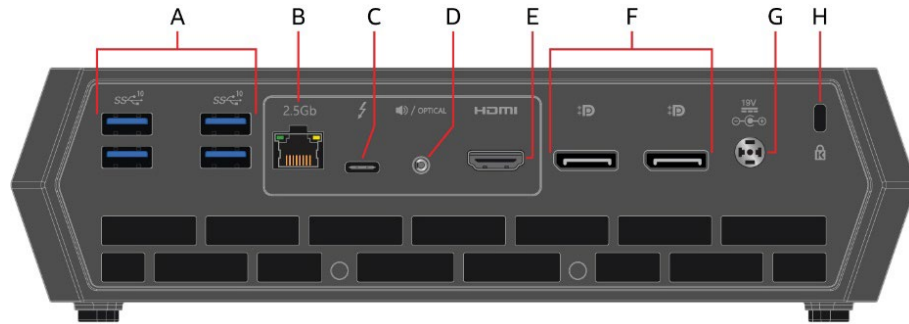


Figure 3. Back Panel Connectors

Table 7. Component Input Ports Shown in Figure 3

Item from Figure 3	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 (red illumination)
E	HDMI
F	(2) DisplayPort
G	Power input
H	Kensington Lock

2.1.5 Block Diagram

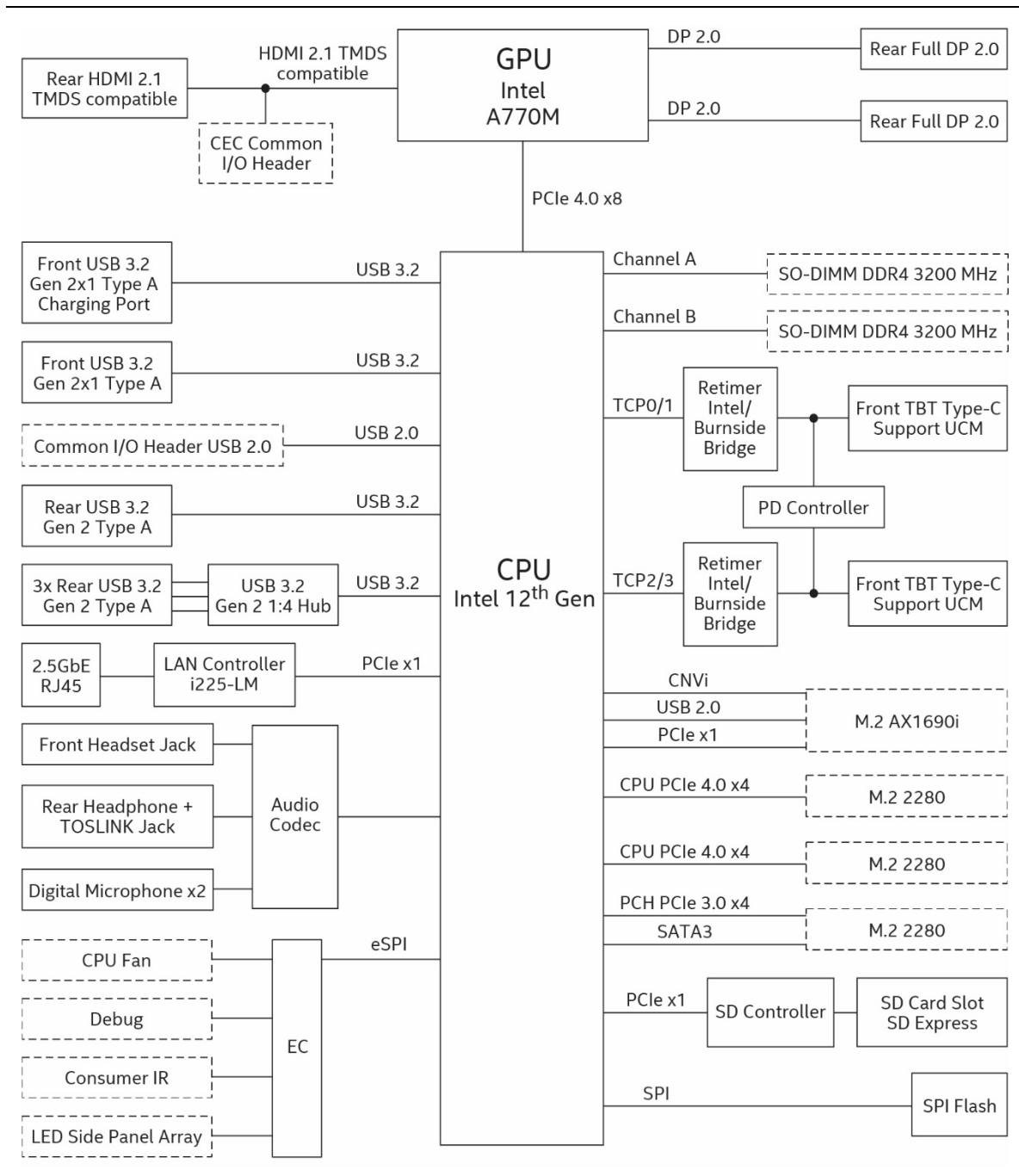


Figure 4. Block Diagram

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
 - 128bit (Dual Channel) memory is better performing than 64bit (Single Channel) memory
 - 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:
 - Intel® Media SDK, MFT filters
 - 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; 64GB (2x32GB) DDR4 3200 MHz dual channel configuration RAM required.*
- *Two 8K (7680x4320) @ 60Hz monitors can be utilized via 2 TBT- DP cables for one monitor, and/or 2 DP-DP cables for a second monitor; 64GB (2x32GB) DDR4 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 °C 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).

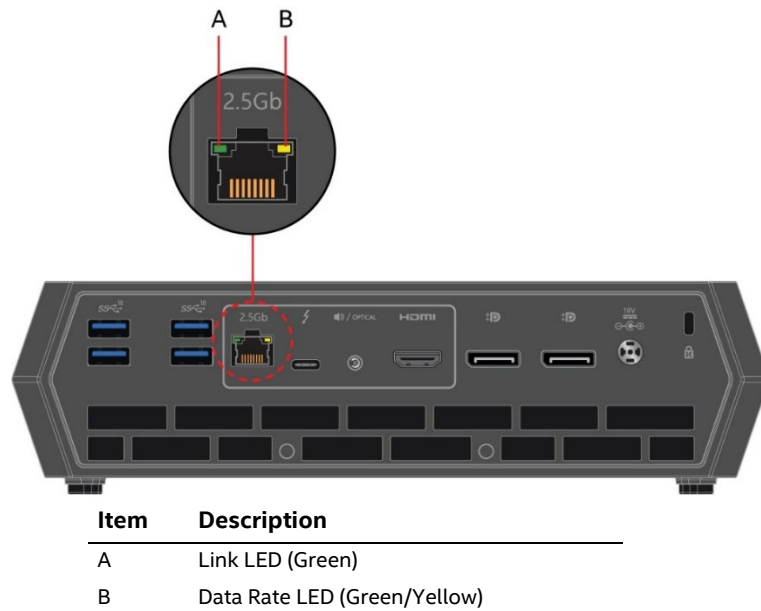


Figure 5. LAN Connector LED Locations

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.
G0/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.

4.1.2 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

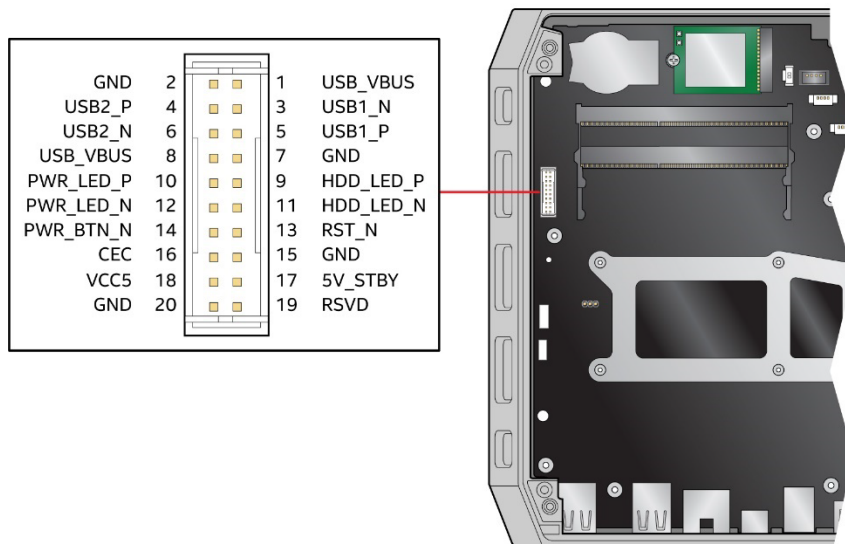


Figure 6. Common IO Header (1.25 mm Pitch)

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.