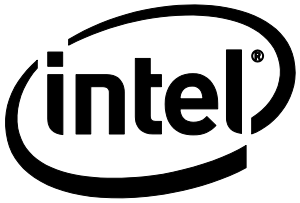

Intel® NUC Kit NUC8i7HV

Technical Product Specification

Regulatory Model: NUC8HV

October 2019

Order Number: J89400-009

Intel NUC Kit NUC8i7HV 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 Kit NUC8i7HV Specification Update.

Revision History

Revision	Revision History	Date
001	First release of the Intel NUC Kit NUC8i7HV Technical Product Specification	March 2018
002	Spec change	April 2018
003	Specification clarification	May 2018
004	Spec change	July 2018
005	Spec change	August 2018
006	Spec change	September 2018
007	Spec change	February 2019
008	Spec change	August 2019
009	Specification clarification	October 2019

Disclaimer

This product specification applies to only the standard Intel NUC Kit with BIOS identifier HNSKLi70.86A.

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Kit Identification Information

Basic Intel® NUC Kit NUC8i7HV Identification Information

SA Revision	Power Cord	Original BIOS Revision	Notes
J71485 – 502	No Power Cord	HNKBLi70.86A.0029	1,2,3
J71485 – 502	US Power Cord	HNKBLi70.86A.0029	1,2,3
J71485 – 502	EU Power Cord	HNKBLi70.86A.0029	1,2,3
J71485 – 502	UK Power Cord	HNKBLi70.86A.0029	1,2,3
J71485 – 502	AU Power Cord	HNKBLi70.86A.0029	1,2,3

Notes:

1. The SA number is found on a bottom side of the chassis.
2. The Intel® Core™ i7-8809G processor is used on this SA revision consisting of the following component:
3. For product revisions check intel QDMS - https://qdms.intel.com/Portal/SearchPCNDataBase.aspx

Device	Stepping	S-Spec Numbers
Intel Core i7-8809G	B0	SR3RL

Product Identification Information

Intel® NUC Products NUC8i7HVK{x} Identification Information

Product Name	Intel® NUC Board	Differentiating Features
NUC8i7HVK	NUC8i7HVB J71485 – xxx	Kit with Power Adapter
NUC8i7HVKVA{x}		Kit with Power Adapter, 1TB Intel® M.2 NVME SSD, 16GB DDR4-2400 SDRAM, Microsoft Windows 10 Home
NUC8i7HVKVAW		Kit with Power Adapter, 512GB Intel® M.2 NVME SSD, 8GB DDR4-2400 SDRAM, Microsoft Windows 10 Home

Specification Changes or Clarifications

The table below indicates the Specification Changes or Specification Clarifications that apply to the Intel NUC Board NUC8i7HV.

Specification Changes or Clarifications

Date	Type of Change	Description of Changes or Clarifications
April 2018	Specification change	Changed TBD86A to HNKBLi70.86A in the section "Overview of BIOS Features" > "Introduction" Changed hyperlink http://intel.com/TBD to https://downloadcenter.intel.com/download/27641 in the section "Overview of BIOS Features" > "System LED Functionality"
May 2018	Specification clarification	Corrected reference to Table 3 in "DisplayPort 1.2 Multi-Stream Transport Daisy-Chaining" section
July 2018	Spec change	Added SATA Power section to 2.2.3.1 Added 1.15 – Intel Platform Security Technologies Added 1.16 – Thunderbolt 3
August 2018	Spec change	Added "Product Identification Information" table
September 2018	Spec change	Added text to Wireless row of table in Feature Summary section: "Pre-installed M.2 module"
February 2019	Spec change	Added section 2.4.1 - Weights
August 2019	Spec change	Corrected environmental table Added QDMS link for product change notification information.
October 2019	Specification clarification	Clarified Board vs System environmental specifications.

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.

Preface

This Technical Product Specification (TPS) specifies the layout, components, connectors, power and environmental requirements, and the BIOS for Intel® NUC Kit NUC8i7HV.

NOTE

In this document, the use of "kit" will refer to Intel® NUC Kit NUC8i7HV.

Intended Audience

The TPS is intended to provide detailed, technical information about Intel® NUC Kit NUC8i7HV 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	A description of the hardware used on Intel NUC Kit NUC8i7HV
2	A map of the resources of the Intel NUC Kit NUC8i7HV
3	The features supported by the BIOS Setup program
4	A description of the BIOS error messages, beep codes, and POST codes
5	Regulatory compliance and battery disposal information

Typographical Conventions

This section contains information about the conventions used in this specification. Not all of 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.
*	This symbol is used to indicate third-party brands and names that are the property of their respective owners.

Contents

Figures

Tables

1 Product Description

1.1 Overview

1.1.1 Feature Summary

Table 1 summarizes the major features of Intel® NUC Kit NUC8i7HV.

Table 1. Feature Summary

Form Factor	8.66 inches by 5.51 inches by 1.57 inches (220 millimeters by 140 millimeters by 40 millimeters)
Processor	• A soldered-down 8th generation Intel® Core™ i7-8809G quad-core processor with up to a maximum 45 W TDP — Intel® HD Graphics 630 — Integrated memory controller
PCH	Intel® HM175 Platform Controller Hub
Memory	• Two 260-pin DDR4 SDRAM Small Outline Dual Inline Memory Module (SO-DIMM) sockets • Support for DDR4 2400 MHz SO-DIMMs • Support for 4 Gb and 8 Gb memory technology • Support for up to 32 GB of system memory with two SO-DIMMs • Support for non-ECC memory • Support for 1.2 V and 1.35 V low voltage JEDEC memory only Note: 2 Gb memory technology (SDRAM Density) is not compatible
Graphics	• Integrated graphics support for processors with Intel® Graphics Technology • Discrete graphics support by Radeon RX Vega M GH — Two Full Size High Definition Multimedia Interface* (HDMI*) Front and Back panel connectors — Two Mini DisplayPort* back panel connectors — Two Type C back panel connectors
Audio	• Intel® High Definition (Intel® HD) Audio via the HDMI v2.0, Mini DisplayPort 1.2 and Type C interfaces through the processor/Discrete GPU • Radeon High Definition Audio • Realtek HD Audio via a stereo microphone/headphone 3.5 mm jack on the front panel and 3.5mm combination speaker/TOSLINK jack on the back panel
Storage	Two SATA 6.0 Gb/s or Gen3 PCIe X4 AHCI, NVMe ports are reserved for M.2 storage modules supporting M.2 2242 and M.2 2280 (key type M) modules Note: Supports key type M (PCI Express* x1/x2/x4 and SATA)

continued

Table 1. Feature Summary (continued)

Peripheral Interfaces	• USB 3.1 Gen 2 Ports: — One Type-A port is implemented with an external front panel connector (blue), one Type C port is implemented with an external front panel connnector • USB 3.0 Ports: — One port is implemented with an external front panel connector (yellow charging capable) — Four ports are implemented with external back panel connectors (blue) — Two ports are implemented via an internal header (blue) — 1 port implemented via the external back panel Type C connector • USB 2.0 ports: — Two ports via an internal common IO header (white) — One port is reserved for the M.2 2230 Wireless module • Consumer Infrared (CIR)
Expansion Capabilities	• Two M.2 connectors supporting M.2 2242 (1 slot) and M.2 2280 (key type M both slots) modules • One Full Size SDXC Slot
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)
Instantly Available PC Technology	• Suspend to RAM support • Wake on PCI Express, LAN, front panel, CIR, and USB ports
LAN	Gigabit (10/100/1000 Mb/s) LAN subsystem using the Intel® Gigabit Ethernet Controller I219-LM Gigabit (10/100/1000 Mb/s) LAN subsystem using the Intel® Gigabit Ethernet Controller I210-at
Hardware Monitor Subsystem	Hardware monitoring subsystem, based on a ITE IT8987VG including: • Voltage sense to detect out of range power supply voltages • Thermal sense to detect out of range thermal values • Two processor fan headers • Fan sense input used to monitor fan activity • Fan speed control
Wireless	Intel® Dual Band Wireless-AC 8265 • 802.11ac, Dual Band, Wi-Fi + Bluetooth 4.2 • Supports Intel® Wireless Display 6.0 (WiDi) • Pre-installed M.2 module

1.1.2 Block Diagram

Figure 1 is a block diagram of the major functional areas of Intel NUC Kit NUC8i7HV.

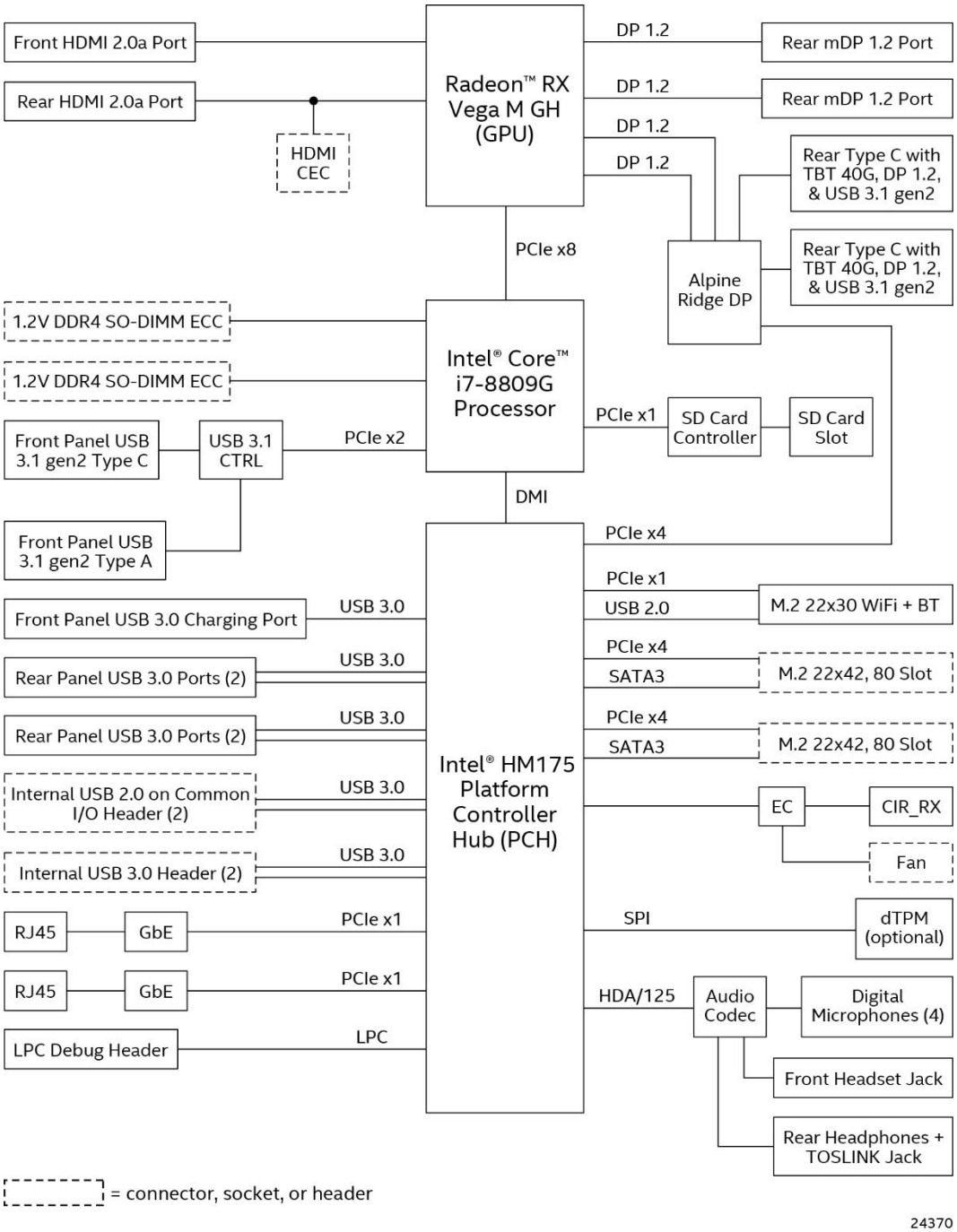


Figure 1. Block Diagram

1.2 Online Support

To find information about...	Visit this World Wide Web site:
Intel NUC Kit NUC8i7HV	http://www.intel.com/NUC
Intel NUC Kit Support	http://www.intel.com/NUCSupport
Available configurations for Intel NUC Kit NUC8i7HV	http://ark.intel.com
BIOS and driver updates	http://downloadcenter.intel.com
Tested memory	http://www.intel.com/NUCSupport
Integration information	http://www.intel.com/NUCSupport
Processor datasheet	http://ark.intel.com

1.3 Processor

A soldered-down 8th generation Intel® Core™ i7-8809G quad-core processor with up to a maximum 45 W TDP.

- Intel HD Graphics 630
- Integrated memory controller

NOTE

There are specific requirements for providing power to the processor. Refer to Section 2.5.1 on page 51 for information on power supply requirements.

1.4 Platform Controller Hub (PCH)

A soldered-down Intel HM175 Platform Controller Hub with Direct Media Interface (DMI) interconnect provides interfaces to the processor and the USB, SATA, LAN, PCI Express interfaces. The HM175 is a centralized controller for the kit's I/O paths.

1.4.1 Direct Media Interface (DMI)

Direct Media Interface (DMI) is the chip-to-chip connection between the processor and PCH. This high-speed interface integrates advanced priority-based servicing allowing for concurrent traffic and true isochronous transfer capabilities.

1.5 System Memory

The kit has two 260-pin SO-DIMM sockets and supports the following memory features:

- 1.2V / 1.35V DDR4 SDRAM SO-DIMMs with gold plated contacts
- Two independent memory channels with interleaved mode support
- Unbuffered, single-sided or double-sided SO-DIMMs
- 32 GB maximum total system memory. Refer to Section 2.1.1 on page 37 for information on the total amount of addressable memory.
- Minimum recommended total system memory: 4096 MB
- Non-ECC SO-DIMMs
- Serial Presence Detect
- DDR4 2400 MHz SDRAM SO-DIMMs

NOTE

To be fully compliant with all applicable DDR SDRAM memory specifications, the kit should be populated with SO-DIMMs that support the Serial Presence Detect (SPD) data structure. This allows the BIOS to read the SPD data and program the chipset to accurately configure memory settings for optimum performance. If non-SPD memory is installed, the BIOS will attempt to correctly configure the memory settings, but performance and reliability may be impacted or the SO-DIMMs may not function under the determined frequency.

Table 2 lists the supported SO-DIMM configurations.

Table 2. Supported DDR4/-RS Non-ECC SO-DIMM Module Configurations

Raw Card Version	DIMM Capacity	DRAM Device Technology	DRAM Organization	# of DRAM Devices	# of Ranks	# of Row/Col Address Bits	# of Banks Inside DRAM	Page Size
A	4GB	4Gb	512M x 8	8	1	15/10	16	8K
A	8GB	8Gb	1024M x 8	8	1	16/10	16	8K
B	8GB	4Gb	512M x 8	16	2	15/10	16	8K
B	16GB	8Gb	1024M x 8	16	2	16/10	16	8K
C	2GB	4Gb	256M x 16	4	1	15/10	8	8K
C	4GB	8Gb	512M x 16	4	1	16/10	8	8K
E	8GB	4Gb	512M x 8	16	2	15/10	16	8K
E	16GB	8Gb	1024M x 8	16	2	16/10	16	8K

For information about...	Refer to:
Tested Memory	http://www.intel.com/NUCSupport

1.5.1 Memory Configurations

The processor supports the following types of memory organization:

- **Dual channel (Interleaved) mode**. This mode offers the highest throughput for real world applications. Dual channel mode is enabled when the installed memory capacities of both SO-DIMM channels are equal. Technology and device width can vary from one channel to the other but the installed memory capacity for each channel must be equal. If different speed SO-DIMMs are used between channels, the slowest memory timing will be used.
- **Single channel (Asymmetric) mode**. This mode is equivalent to single channel bandwidth operation for real world applications. This mode is used when only a single SO-DIMM is installed or the memory capacities are unequal. Technology and device width can vary from one channel to the other. If different speed SO-DIMMs are used between channels, the slowest memory timing will be used.

For information about...	Refer to:
Memory Configuration Examples	http://www.intel.com/NUCSupport

Figure 2 illustrates the memory channel and SO-DIMM configuration.

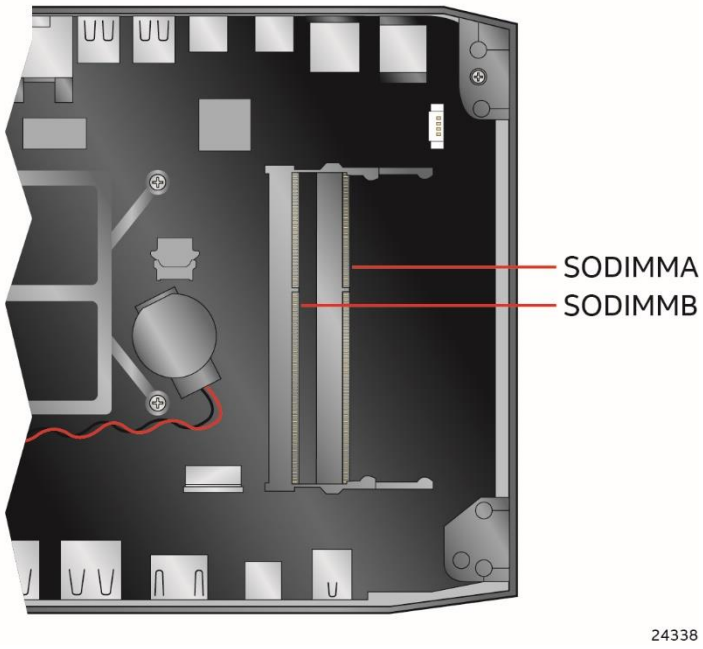


Figure 2. Memory Channel and SO-DIMM Configuration

1.6 Graphics Capabilities

The kit supports graphics computing through Intel® HD™ Graphics 630.

1.6.1 Intel Integrated Graphics

The kit supports integrated graphics processing via the processor.

1.6.1.1 Intel® High Definition (Intel® HD) Graphics

The Intel HD graphics controller features the following:

- 3D Features
  - — DirectX* 12.1 support
  - — OpenGL* 4.4 support
  - — OpenCL* 2.1, OpenCL 2.0, OpenCL 1.2 support
- Video:
- Next Generation Intel® Clear Video Technology HD support is a collection of video playback and enhancement features that improve the end user's viewing experience
- Encode/transcode HD content
- DirectX* Video Acceleration (DXVA) support for accelerating video processing
- Full AVC/VC1/MPEG2/HEVC HW Encode/Decode
- Intel HD Graphics with Advanced Hardware Video Transcoding (Intel® Quick Sync Video)


*The graphics outputs of the NUC8i7HV are not physically connected to the HD Graphics 630.

NOTE

Intel Quick Sync Video is enabled by an appropriate software application.

1.6.2 Radeon RX Vega M

The kit supports graphics processing via discrete on package Radeon RX Vega M GH graphics processor.

1.6.2.1 Radeon™ RX Vega M GH Graphics

The Radeon RX Vega M GH Graphics controller features the following:

- 3D Features
  - — DirectX* 12 (Direct3D feature level 12.0 support)
  - — OpenGL* 4.5 support
  - — OpenCL* 2.0 support
  - — Vulkan 1.0

Decode:

- HEVC Main Profile@level 5.1
- HEVC Main10 Profile@level 5.1
- H.264 Constrained Baseline Profile@level 5.2
- H.264 Main Profile@level 5.2

- H.264 High Profile@level 5.2
- H.264 Stereo High Profile@level 5.2
- VC1 Simple & Main Profile@High Level(VLD)
- VC1 Advanced Profile@level 3(VLD)
- MPEG2 Main Profile@High level(IDCT/VLD)
- MPEG4 Part 2 Advanced Simple Profile@level 5
- MJPEG 1080p@60fps

Encode:

- H.264 Constrained Baseline Profile@level 5.2
- H.264 Main Profile@level 5.2
- H.264 High Profile@level 5.2
- HEVC user program up to Main Profile@level 6.2 for offline encode; HEVC Main Profile@level 5.1 in real time

1.6.2.2 Video Memory Allocation

Intel® Dynamic Video Memory Technology (DVMT) is a method for dynamically allocating system memory for use as graphics memory to balance 2D/3D graphics and system performance. If your computer is configured to use DVMT, graphics memory is allocated based on system requirements and application demands (up to the configured maximum amount). When memory is no longer needed by an application, the dynamically allocated portion of memory is returned to the operating system for other uses.

1.6.2.3 High Definition Multimedia Interface* (HDMI*)

The HDMI ports support standard, enhanced, or high definition video, plus multi-channel digital audio on a single cable. The ports are compatible with all ATSC and DVB HDTV standards and supports eight full range channels at 24-bit/192 kHz audio of lossless audio formats. The maximum supported resolution is 4096 x 2160 @ 60 Hz, 24 bpp. The HDMI ports are compliant with the HDMI 2.0b specification.

For information about	Refer to
HDMI technology	http://www.hdmi.org

1.6.2.4 DisplayPort* via Mini DisplayPort and Type C

DisplayPort is a digital communication interface that utilizes differential signaling to achieve a high bandwidth bus interface designed to support connections between PCs and monitors, projectors, and TV displays. DisplayPort is suitable for display connections between consumer electronics devices such as high definition optical disc players, set top boxes, and TV displays. The Mini DisplayPort and Type C connectors are compliant with the DisplayPort 1.2 specification and have a maximum supported resolution of 4096 x 2160 @ 60Hz 24bpp.

DisplayPort output supports Multi-Stream Transport (MST) which allows for multiple independent video streams (daisy-chain connection with multiple monitors) over a single DisplayPort. This will require the use of displays that support DisplayPort 1.2 specification and allow for this feature.

For information about	Refer to
DisplayPort technology	http://www.displayport.org

1.6.2.4.1 DisplayPort 1.2 Multi-Stream Transport Daisy-Chaining

Error! Reference source not found. lists the maximum resolutions available when using DisplayPort 1.2 Multi-Stream Transport.

Table 3. Mini DisplayPort and Type C DisplayPort Multi-Streaming Resolutions

DisplayPort Usage Models	Monitor 1	Monitor 2	Monitor 3
3 Monitors	1920 x 1200 @ 60 Hz	1920 x 1200 @ 60 Hz	1920 x 1200 @ 60 Hz
2 Monitors	2560 x 1600 @ 60 Hz	2560 x 1600 @ 60 Hz	
3 Monitors (with DisplayPort 1.2 hub)	1920 x 1080 @ 60 Hz	1920 x 1080 @ 60 Hz	1920 x 1080 @ 60 Hz

1.6.2.5 Multiple DisplayPort, Type C and HDMI Configurations

Multiple Mini DisplayPort, Type C, and HDMI configurations feature the following:

- Six independent displays with 4K support
  — Two Mini DisplayPort, Two HDMI and Two Type C (rear Thunderbolt 3)
- Eyefinity Display

Table 4. Multiple Display Configuration Maximum Resolutions

Single Display HDMI	**Single Display Mini DisplayPort**	**Single DisplayPort (rear Type C)**
4096 x 2160 @ 60 Hz	4096 x 2160 @ 60 Hz	4096 x 2160 @ 60 Hz
Dual Display HDMI	**Dual Display Mini DisplayPort**	**Dual DisplayPort (Rear Type C)**
4096 x 2160 @ 60 Hz	5120 x 2880 @ 60 Hz **	5120 x 2880 @ 60 Hz **
Triple Display – Any Combination of Available Ports	**Quadruple Display – Any Combination of Available Ports***	**Quintuple Display – Any Combination of Available Ports***
4096 x 2160 @ 60 Hz (Type C) 4096 x 2160 @ 60 Hz (Mini DisplayPort) 4096 x 2160 @ 60Hz (HDMI)	4096 x 2160 @ 60 Hz (Type C) 4096 x 2160 @ 60 Hz (Mini DisplayPort) 4096 x 2160 @ 60Hz (HDMI)	4096 x 2160 @ 60 Hz (Type C) 4096 x 2160 @ 60 Hz (Mini DisplayPort) 4096 x 2160 @ 60Hz (HDMI)
Sextuple Display – Any Combination of Available Ports*		
4096 x 2160 @ 30 Hz (Type C) 4096 x 2160 @ 30 Hz (Mini DisplayPort) 4096 x 2160 @ 30Hz (HDMI)		

Note Number of Displays can be influenced by default DPM states of the Radeon RX Vega M GH GPU.

Note Dual DisplayPort 5120 x 2800 @ 60 Hz refers to dual port monitors, and further requires 2 DisplayPort connections to enumerate at that resolution.

For information about	**Refer to**
Multiple display maximum resolutions	https://www-ssl.intel.com/content/www/us/en/processors/core/CoreTechnicalResources.html

1.6.2.6 High-bandwidth Digital Content Protection (HDCP)

HDCP is the technology for protecting high definition content against unauthorized copy or interception between a source (computer, digital set top boxes, etc.) and the sink (panels, monitor, and TVs). The PCH supports HDCP 1.4 and HDCP 2.2 for content protection over wired displays using the Mini DisplayPort and HDMI 2.0. The Thunderbolt Type C based DisplayPort configuration will support up to HDCP1.4.

1.6.2.7 Integrated Audio Provided by the HDMI and Mini DisplayPort Interfaces

The HDMI and Mini DisplayPort interfaces from the GPU support audio. The processor supports two High Definition audio streams on two digital ports simultaneously.

Table 5 shows the specific audio technologies supported by the GPU.

Table 5. Audio Formats Supported by the HDMI and Mini DisplayPort Interfaces

Audio Formats	HDMI	Mini DisplayPort or Thunderbolt 3
AC3 – Dolby* Digital	Yes	Yes
Dolby Digital Plus	Yes	Yes
DTS-HD*	Yes	Yes
LPCM, 192 kHz/24 bit, 8 channel	Yes	Yes
Dolby True HD, DTS-HD Master Audio* (Lossless Blu-ray Disc Audio Format)	Yes	Yes

1.7 USB

The USB port arrangement is as follows:

- USB 3.0 ports (maximum current is 900 mA for each blue port, 1.5 A for the yellow charging port):
  - Two ports are implemented with external front panel connectors (one blue and one yellow charging capable)
  - Four ports are implemented with external back panel connectors (blue)
  - Two ports are implmented with an internal header (blue)
  - Two ports are implemented with the external black panel Type C connectors

All the USB 3.0 ports are super-speed, high-speed, full-speed, and low-speed capable.

- USB 2.0 ports (maximum current is 500 mA for each port of the white header (1 A total):
  - Two ports via internal common IO header (white)
  - One port is reserved for the M.2 2230 Wireless module

All the USB 2.0 ports are high-speed, full-speed, and low-speed capable.

NOTE

Computer systems that have an unshielded cable attached to a USB port may not meet FCC Class B requirements, even if no device is attached to the cable. Use a shielded cable that meets the requirements for full-speed devices.

NOTE

The yellow USB charging port can be set in the BIOS to "Charging Only." However this affects only USB 2.0 devices and transfers and does not affect USB 3.0 devices and transfers.

For information about	Refer to
The location of the USB connectors on the back panel	Figure 7, page 40
The location of the front panel USB headers	Figure 6, page 38

1.8 Storage Interface

The kit provides the following storage interface options via 2 M.2 2242 and M.2 2280 (key type M) connectors:

- SATA 6.0 Gb/s ports are reserved for the M.2 storage modules supporting M.2 2242 and M.2 2280 (key type M) modules
  - — 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.
- Gen 3 PCIe X4 AHCI, NVMe ports are reserved for the M.2 storage modules supporting M.2 2242 and M.2 2280 (key type M) modules

1.8.1 AHCI Mode

The kit supports AHCI storage mode.

NOTE

In order to use AHCI mode, AHCI must be enabled in the BIOS. Microsoft Windows* 10 includes the necessary AHCI drivers without the need to install separate AHCI drivers during the operating system installation process; however, it is always good practice to update the AHCI drivers to the latest available by Intel.*

1.8.2 Intel® Rapid Storage Technology / SATA RAID

The PCH supports Intel® Rapid Storage Technology, providing both AHCI and integrated RAID functionality. The RAID capability provides high-performance RAID 0 and 1 functionality on all SATA ports. Other RAID features include hot spare support and SMART alerting. Software components include an Option ROM for pre-boot configuration and boot functionality, a Microsoft Windows compatible driver, and a user interface for configuration and management of the RAID capability of the PCH.

NOTE

In order to use supported RAID features, you must first enable RAID in the BIOS.

1.9 SDXC Card Reader

The kit has a standard Secure Digital (SD) card reader that supports the Secure Digital eXtended Capacity (SDXC) format, 3.01 specification with UHS-I support. SD Card sizes supported from 8GB to 128GB.

1.10 Real-Time Clock

A coin-cell battery (CR2032) powers the real-time clock and CMOS memory. When the kit is not plugged into a wall socket, the battery has an estimated life of three years. When the kit 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

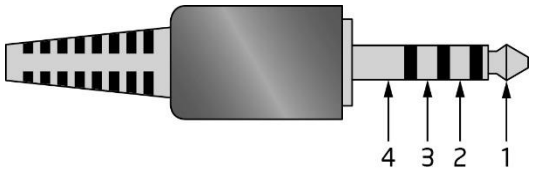
If the battery and AC power fail, date and time values will be reset and the user will be notified during the POST.

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. Figure 12 on page 40 shows the location of the battery.

1.11 Audio

The integrated Realtek ALC700 audio subsystem supports the following features:

- Digital microphone array (DMICS) connectors (internal)
- Analog line-out/Analog Headphone/Analog Microphone (front panel jack)
- Analog stereo line-out/TOSLINK out (back panel jack)
  - — Analog Speakers only (Stereo)
  - — SPDIF optical output formats up to compressed 5.1/7.1
- Support for 44.1 kHz/48 kHz/96 kHz/192 kHz sample rates on all analog outputs
- Support for 44.1 kHz/48 kHz/96 kHz sample rates on all analog inputs
- Front Panel Audio Jack Support (see Figure 3 for 3.5 mm audio jack pin out):
  - — Speakers only (Stereo)
  - — Headphones only (Stereo)
  - — Microphone only (mono)
  - — Combo Headphone (Stereo)/Microphone (mono)



Pin Number	Pin Name	Description
1	Tip	Left Audio Out
2	Ring	Right Audio Out
3	Ring	Common/Ground
4	Sleeve	Audio In/MIC

Figure 3. 4-Pin 3.5 mm (1/8 inch) Audio Jack Pin Out

NOTE

The analog circuit of the front panel audio connector is designed to power headphones or amplified speakers only. Poor audio quality occurs if passive (non-amplified) speakers are connected to this output.

1.11.1 Audio Software

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

For information about	Refer to
Obtaining Audio software and drivers	http://downloadcenter.intel.com

1.12 LAN

The onboard LAN consists of the following:

- Intel Gigabit Ethernet Controller I219-LM (10/100/1000 Mb/s)
- Intel Gigabit Ethernet Controller I210-AT (10/100/1000 Mb/s)
- RJ-45 LAN connectors with integrated status LEDs

Additional features of the LAN subsystem include:

- CSMA/CD protocol engine
- LAN connect interface between the Processor and the LAN controller
- Power management capabilities
  - — ACPI technology support
  - — LAN wake capabilities
- LAN subsystem software

1.12.1 Intel® Gigabit Ethernet Controller I219-LM

The Intel Gigabit Ethernet Controller I219-LM supports the following features:

- Compliant with the 1 Gb/s Ethernet 802.3, 802.3u, 802.3z, 802.3ab specifications
- Multi-speed operation: 10/100/1000 Mb/s
- Full-duplex operation at 10/100/1000 Mb/s; Half-duplex operation at 10/100 Mb/s
- Flow control support compliant with the 802.3X specification as well as the specific operation of asymmetrical flow control defined by 802.3z
- VLAN support compliant with the 802.1q specification
- Supports Jumbo Frames (up to 9 kB)
  - — IEEE 1588 supports (Precision Time Protocol)
- MAC address filters: perfect match unicast filters, multicast hash filtering, broadcast filter, and promiscuous mode

1.12.2 Intel® Gigabit Ethernet Controller I210-AT

The Intel Gigabit Ethernet Controller I210-at supports the following features:

- Compliant with the 1 Gb/s Ethernet 802.3, 802.3u, 802.3z, 802.3ab specifications
- Multi-speed operation: 10/100/1000 Mb/s
- Full-duplex operation at 10/100/1000 Mb/s; Half-duplex operation at 10/100 Mb/s
- Flow control support compliant with the 802.3X specification as well as the specific operation of asymmetrical flow control defined by 802.3z
- Supports Jumbo Frames (up to 9 kB)
  - — IEEE 1588 supports (Precision Time Protocol)

- MAC address filters: perfect match unicast filters, multicast hash filtering, broadcast filter, and promiscuous mode

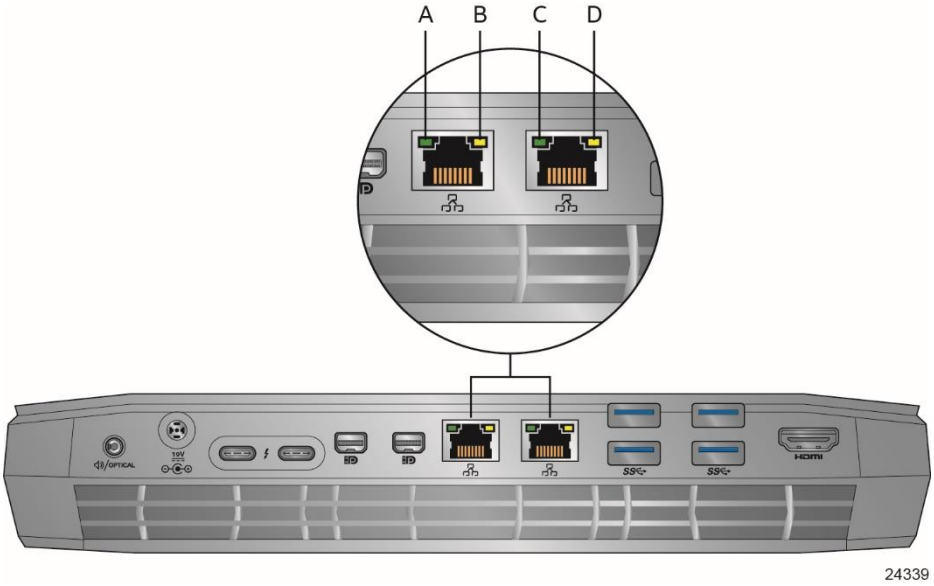
1.12.3 LAN Software

LAN software and drivers are available from Intel's World Wide Web site.

For information about	Refer to
Obtaining LAN software and drivers	http://downloadcenter.intel.com

1.12.4 RJ-45 LAN Connector with Integrated LEDs

Two LEDs are built into the RJ-45 LAN connector (shown in Figure 4).



Item	Description
A	Link LED (Green)
B	Data Rate LED (Green/Yellow)
C	Link LED (Green)
D	Data Rate LED (Green/Yellow)

Figure 4. 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.
		On	LAN link is established.
		Blinking	LAN activity is occurring.
Data Rate	Green/Yellow	Off	10 Mb/s data rate is selected.
		Green	100 Mb/s data rate is selected.
		Yellow	1000 Mb/s data rate is selected.

1.12.5 Wireless Network Module

The Intel Dual Band Wireless-AC 8265 module provides hi-speed wireless connectivity provided with the following capabilities:

- Compliant IEEE 802.11abgn, 802.11ac, 802.11d, 802.11e, 802.11i, 802.11h, 802.11w specifications
- Maximum bandwidth of 867 Mbps
- Dual Mode Bluetooth* 4.2
- OS certified with : Microsoft Windows 10, Linux* (most features not available on Linux)
- Wi-Fi Direct* for peer to peer device connections
- Wi-Fi Miracast Source
- Intel® Wireless Display 6.0
- Wi-Fi Direct for peer to peer device connections
- Authentication: WPA and WPA2, 802.1X (EAP-TLS, TTLS, PEAP, LEAP, EAP-FAST), EAP-SIM, EAP-AKA
- Encryption: 64-bit and 128-bit WEP, AES-CCMP, TKIP, WPA2, AES-CCMP

For information about	Refer to
Obtaining WLAN software and drivers	http://downloadcenter.intel.com
Full Specifications	http://intel.com/wireless

1.13 Hardware Management Subsystem

The hardware management features enable the board to be compatible with the Wired for Management (WfM) specification. The kit has several hardware management features, including thermal and voltage monitoring.

For information about	Refer to
Wired for Management (WfM) Specification	www.intel.com/design/archives/wfm/

1.13.1 Hardware Monitoring

The hardware monitoring and fan control subsystem is based on an ITE IT8987VG/BX, which supports the following:

- Processor and system ambient temperature monitoring
- Chassis fan speed monitoring
- Voltage monitoring of +5 V, +3.3 V, Memory Vcc (V_SM), +Vccp,
- SMBus interface
- Storage activity monitoring
- Network activity monitoring

1.13.2 Fan Monitoring

Fan monitoring can be implemented using third-party software.

1.13.3 Thermal Solution

Figure 5 shows the location of the fan headers used for the thermal solution.

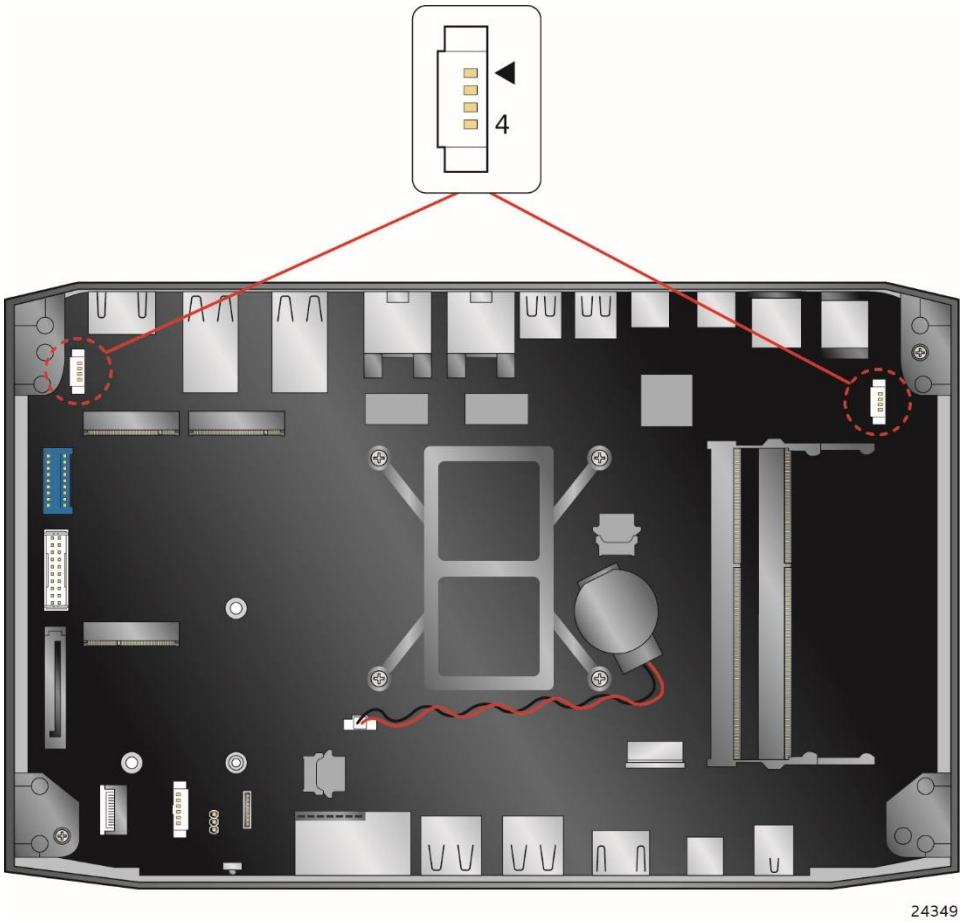


Figure 5. Thermal Solution and Fan Header

1.14 Power Management

Power management is implemented at several levels, including:

- Software support through Advanced Configuration and Power Interface (ACPI)
- Hardware support:
  - Power Input
  - Instantly Available PC technology
  - LAN wake capabilities
  - Wake from USB
  - WAKE# signal wake-up support
  - Wake from S5
  - Wake from CIR

1.14.1 ACPI

ACPI gives the operating system direct control over the power management and Plug and Play functions of a computer. The use of ACPI with this kit requires an operating system that provides full ACPI support. ACPI features include:

- Plug and Play (including bus and device enumeration)
- Power management control of individual devices, add-in boards (some add-in boards may require an ACPI-aware driver), video displays, and hard disk drives
- Methods for achieving less than 15-watt system operation in the power-on/standby sleeping state
- A Soft-off feature that enables the operating system to power-off the kit
- Support for multiple wake-up events (see Table 9 on page 33)
- Support for a front panel power and sleep mode switch

Table 7 lists the system states based on how long the power switch is pressed, depending on how ACPI is configured with an ACPI-aware operating system.

Table 7. Effects of Pressing the Power Switch

If the system is in this state...	...and the power switch is pressed for	...the system enters this state
Off (ACPI G2/G5 – Soft off)	Less than four seconds	Power-on (ACPI G0 – working state)
On (ACPI G0 – working state)	Less than four seconds	Soft-off/Standby (ACPI G1 – sleeping state) Note
On (ACPI G0 – working state)	More than six seconds	Fail safe power-off (ACPI G2/G5 – Soft off)
Sleep (ACPI G1 – sleeping state)	Less than four seconds	Wake-up (ACPI G0 – working state)
Sleep (ACPI G1 – sleeping state)	More than six seconds	Power-off (ACPI G2/G5 – Soft off)

Note: Depending on power management settings in the operating system.

1.14.1.1 System States and Power States

Under ACPI, the operating system directs all system and device power state transitions. The operating system puts devices in and out of low-power states based on user preferences and knowledge of how devices are being used by applications. Devices that are not being used can be turned off. The operating system uses information from applications and user settings to put the system as a whole into a low-power state.

Table 8 lists the power states supported by the kit along with the associated system power targets. See the ACPI specification for a complete description of the various system and power states.

Table 8. Power States and Targeted System Power

Global States	Sleeping States	Processor States	Device States	Targeted System Power (Note 1)
G0 – working state	S0 – working	C0 – working	D0 – working state.	Full power > 30 W
G1 – sleeping state	S3 – Suspend to RAM. Context saved to RAM.	No power	D3 – no power except for wake-up logic.	Power < 5 W (Note 2)
G1 – sleeping state	S4 – Suspend to disk. Context saved to disk.	No power	D3 – no power except for wake-up logic.	Power < 5 W (Note 2)
G2/S5	S5 – Soft off. Context not saved. Cold boot is required.	No power	D3 – no power except for wake-up logic.	Power < 5 W (Note 2)
G3 – mechanical off AC power is disconnected from the computer.	No power to the system.	No power	D3 – no power for wake-up logic, except when provided by battery or external source.	No power to the system. Service can be performed safely.

Notes:

1. Total system power is dependent on the system configuration, including add-in boards and peripherals powered by the system chassis' power supply.
2. Dependent on the standby power consumption of wake-up devices used in the system.

1.14.1.2 Wake-up Devices and Events

Table 9 lists the devices or specific events that can wake the kit from specific states.

Table 9. Wake-up Devices and Events

Devices/events that wake up the system…	…from this sleep state	Comments
Power switch	S3, S4, S5[1]	
RTC alarm	S3, S4, S5[1]	Monitor to remain in sleep state
LAN	S3, S4, S5[1, 3]	"S5 WOL after G3" must be supported; monitor to remain in sleep state
USB	S3, S4, S5[1, 2, 3]	Wake S4, S5 controlled by BIOS option (not after G3)
WAKE#	S3, S4, S5[1]	Via WAKE; monitor to remain in sleep state
Consumer IR	S3, S4, S5[1, 3]	Will not wake when in Deep S4/S5 sleep state
Bluetooth	N/A	Wake from Bluetooth is not supported

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 10 Fast startup will block wake from LAN, USB, and CIR 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.

1.14.2 Hardware Support

The kit provides several power management hardware features, including:

- Wake from Power Button signal
- Instantly Available PC technology
- LAN wake capabilities
- Wake from USB (not after G3)
- WAKE# signal wake-up support
- Wake from S5
- Wake from CIR

NOTE

The use of Wake from USB from an ACPI state requires an operating system that provides full ACPI support.

1.14.2.1 Power Input

When resuming from an AC power failure, the kit returns to the power state it was in before power was interrupted (on or off). The kit's response can be set using the Last Power State feature in the BIOS Setup program's Boot menu.

1.14.2.2 Instantly Available PC Technology

Instantly Available PC technology enables the kit to enter the ACPI S3 (Suspend-to-RAM) sleep-state. While in the S3 sleep-state, the computer will appear to be off (the power supply is only supplying Standby power, and the front panel LED will be amber or secondary color if dual colored, or off if single colored.) When signaled by a wake-up device or event, the system quickly returns to its last known wake state. Table 9 on page 33 lists the devices and events that can wake the computer from the S3 state.

The use of Instantly Available PC technology requires operating system support and drivers for any installed M.2 add-in card.

1.14.2.3 LAN Wake Capabilities

LAN wake capabilities enable remote wake-up of the kit through a network. The LAN subsystem monitors network traffic at the Media Independent Interface. Upon detecting a Magic Packet* frame, the LAN subsystem asserts a wake-up signal that powers up the kit.

1.14.2.4 Wake from USB

USB bus activity wakes the computer from an ACPI S3 state (not after G3).

NOTE

Wake from USB requires the use of a USB peripheral that supports Wake from USB.

1.14.2.5 WAKE# Signal Wake-up Support

When the WAKE# signal on the PCI Express bus is asserted, the kit wakes from an ACPI S3, S4, or S5 state.

1.14.2.6 Wake from S5

When the RTC Date and Time is set in the BIOS, the kit will automatically wake from an ACPI S5 state.

1.14.2.7 Wake from Consumer IR

CIR activity wakes the kit from an ACPI S3, S4, or S5 state.

1.15 Intel Platform Security Technologies

Intel platform security technologies provides tools and resources to help the user protect their information by creating a safer computing environment.

NOTE

Software with security capability is required to take advantage of Intel platform security technologies.

1.15.1 Intel® Virtualization Technology

Intel Virtualization Technology (Intel® VT) is a hardware-assisted technology that, when combined with software-based virtualization solutions, provides maximum system utilization by consolidating multiple environments into a single server or client.

NOTE

A processor with Intel VT does not guarantee that virtualization will work on your system. Intel VT requires a computer system with a chipset, BIOS, enabling software and/or operating system, device drivers, and applications designed for this feature.

For information about	Refer to
Intel Virtualization Technology	http://www.intel.com/technology/virtualization/technology.htm

1.15.2 Intel® Platform Trust Technology

Intel® Platform Trust Technology (Intel® PTT) is a platform functionality for credential storage and key management. Intel® PTT supports Microsoft* BitLocker* Drive Encryption for hard drive encryption and supports all Microsoft requirements for firmware Trusted Platform Module (fTPM) 2.0.

NOTE

Support for fTPM version 2.0 requires a UEFI-enabled operating system, such as Microsoft Windows* 10.*

CAUTION

BIOS recovery using the BIOS security jumper clears Intel® Platform Trust Technology (Intel® PTT) keys. These keys will not be restored after the BIOS recovery.

For information about	Refer to
Intel Platform Trust Technology	http://www.intel.com/content/dam/www/public/us/en/documents/white-papers/enterprise-security-platform-trust-technology-white-paper.pdf

1.16 Thunderbolt 3

The board supports two Thunderbolt™ 3 ports sharing up to 40Gbps of data throughput. Each port can support one 4k (60Hz) monitor output, USB3.1 (Gen 2) connection and charging capabilities up to 5V at 3A via the back panel USB Type-C connectors. Item C in figure 7 shows the location of the rear panel USB Type-C ports.

For information about	Refer to
Thunderbolt™ 3 information	https://www.intel.com/content/www/us/en/support/articles/000027040/mini-pcs/intel-nuc-kits.html http://www.intel.com/Thunderbolt

2 Technical Reference

2.1 Memory Resources

2.1.1 Addressable Memory

The kit utilizes 32 GB of addressable system memory. Typically the address space that is allocated for PCI Conventional bus add-in cards, PCI Express configuration space, BIOS (SPI Flash device), and chipset overhead resides above the top of DRAM (total system memory). On a system that has 32 GB of system memory installed, it is not possible to use all of the installed memory due to system address space being allocated for other system critical functions. These functions include the following:

- BIOS/SPI Flash device (64 Mb)
- Local APIC (19 MB)
- Direct Media Interface (40 MB)
- PCI Express configuration space (256 MB)
- PCH base address registers PCI Express ports (up to 256 MB)
- Memory-mapped I/O that is dynamically allocated for M.2 add-in cards (256 MB)
- Integrated graphics shared memory (up to 512 MB; 64 MB by default)

The kit provides the capability to reclaim the physical memory overlapped by the memory mapped I/O logical address space. The kit remaps physical memory from the top of usable DRAM boundary to the 4 GB boundary to an equivalent sized logical address range located just above the 4 GB boundary. All installed system memory can be used when there is no overlap of system addresses.

2.2 Connectors and Headers

⚠ **CAUTION**

Only the following connectors and headers have overcurrent protection: back panel and front panel USB.

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

This section describes the connectors and headers. The connectors and headers can be divided into these groups:

- Front panel connectors
- Back panel connectors
- Top-Side headers and connectors

2.2.1 Front Panel Connectors

Figure 6 shows the location of the components on the front of the Intel NUC Kit NUC8i7HV chassis.

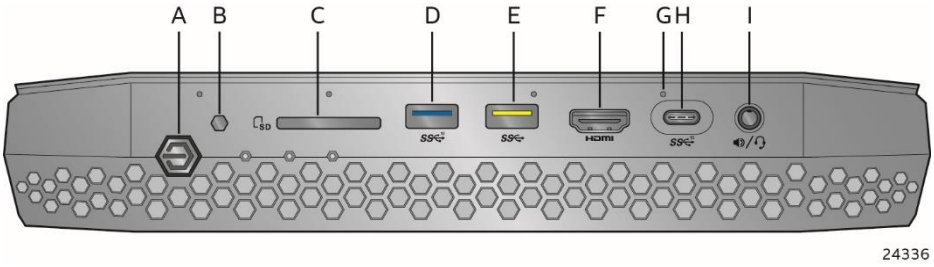


Figure 6. Front Panel Layout

Table 10. Components Shown in Figure 6

Item from Figure 6	Description
A	Power on/off button/LED
B	Consumer Infrared (CIR)
C	SDXC card reader slot
D	Front USB Port USB 3.1 Gen 2
E	Front USB Port USB 3.0 / Charging
F	HDMI Port
G	Digital Microphones
H	USB Type-C port
I	Speaker/Headset

2.2.1.1 Consumer Infrared (CIR) Sensor

The Consumer Infrared (CIR) sensor on the front panel provides features that are designed to comply with Microsoft Consumer Infrared usage models (RC-6).

The CIR feature is made up of the receiving sensor. The receiving sensor consists of a filtered translated infrared input compliant with Microsoft CIR specifications.

Customers are required to provide their own media center compatible remote or smart phone application for use with the Intel NUC. The Location of the CIR is called out as Item B in Table 10 above.

2.2.1.2 Digital Microphone Array

The digital microphone array consists of quad front facing digital microphones located across the front panel to implement the far-field algorithm to minimize acoustic interference. Item E from Figure 12 referencing shows the location of the digital microphone array connector. Table 18 lists the signal names of the DMIC connector. See item G from Figure 6 the physical locations of the DMIC array on the Intel NUC Kit NUC8i7HVK chassis.

2.2.2 Back Panel Connectors

Figure 7 shows the location of the components on the back of the Intel NUC Kit NUC8i7HV chassis.

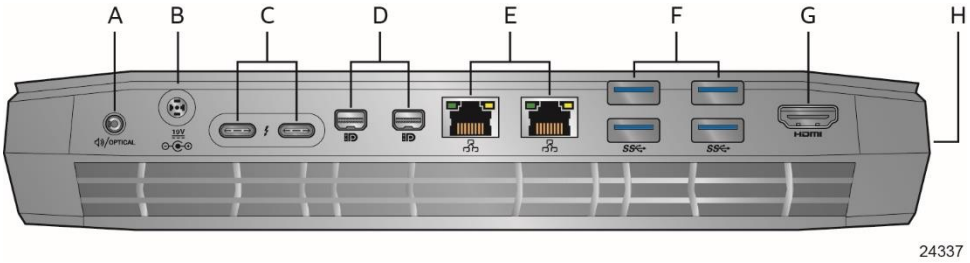


Figure 7. Back Panel Layout

Table 11. Components Shown in Figure 7

Item from Figure 7	Description
A	Speaker/SPDIF
B	19.5v DC power input jack
C	Thunderbolt™ 3 port (Type C)
D	Mini DisplayPort connectors
E	Ethernet Ports
F	USB 3.0 Ports
G	HDMI Connector
H	Anti-Theft key lock hole (located on side of unit)

2.2.3 USB and I/O Headers

Figure 8 shows the location of the USB and I/O headers on the top-side of Intel NUC Kit NUC8i7HV.

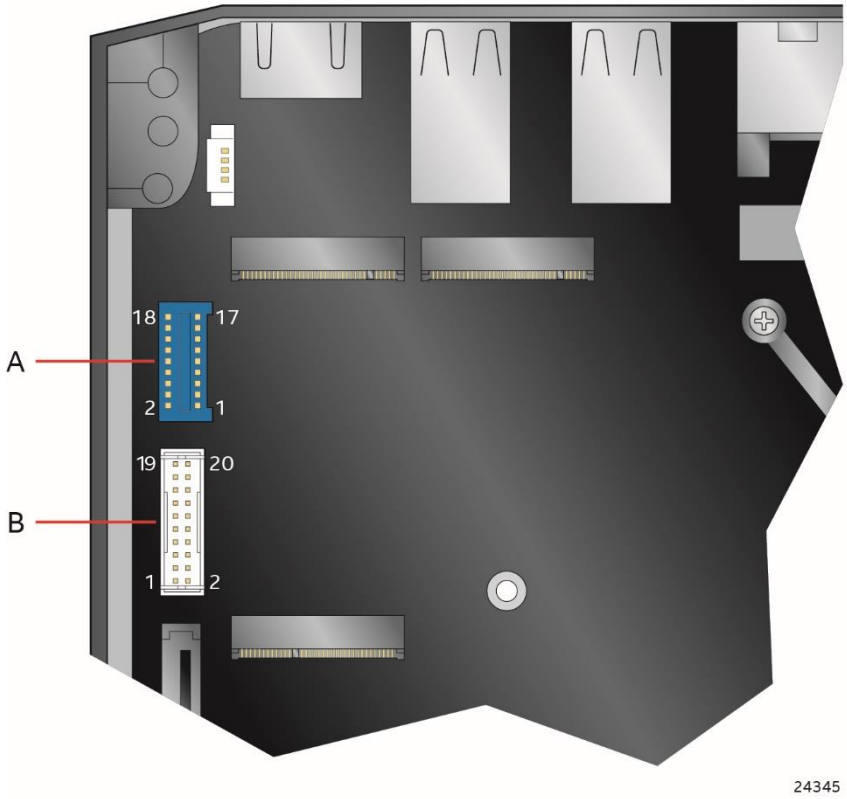


Figure 8. Headers and Connectors (Top)

Table 12. Headers and Connectors Shown in Figure 8

Item from Figure 8	Description
A	Front panel USB 3.0 header (1.25 mm pitch) (blue)
B	Internal Common IO header (1.25 mm pitch) (white)

2.2.3.1 Internal 15-pin Auxiliary SATA power connector.

The board has an internal 15-pin auxiliary SATA (male) power connector available for expansion purposes through additional storage or other custom solutions. Location is designated in Table 13-I referenced by Figure 11.

Table 13. Auxiliary SATA power connector pin out

Pin #	Signal Name	

1	3.3 V DC	
2	3.3 V DC	
3	3.3 V DC	
4	Ground	
5	Ground	
6	Ground	
7	5 V DC	
8	5 V DC	
9	5 V DC	
10	Ground	
11	Ground	
12	Ground	
13	12 V DC	
14	12 V DC	
15	12 V DC	

The 15-pin auxiliary SATA power connector follows the standard pin-out for SATA power connectors with 12V, 5V, 3.3V, and GND/common.

The board power supplied through the Auxiliary SATA power connector is rated at a maximum of:

- *1.5 Amps from 12V rail*
- *1.0 Amps from 5V rail*
- *1.0 Amps from 3.3V rail*

NOTE

The power that is provided by the 15-pin auxiliary SATA power connector is calculated into the power reading that is used to govern the overall system power consumption state. System may experience power throttling at an earlier than normal state as a result.

CAUTION

Do not install or remove the SATA power connector with the power on. Always turn off the power and unplug the power cord from the computer before connecting the auxiliary SATA power connector. Otherwise, the board could be damaged.

2.2.3.2 Internal USB 3.0 Header (1.25 mm Pitch)

Figure 9 is a connection diagram for internal USB .30 header.

NOTE

- *The +5 V DC power on the USB header is fused.*
- *Use only an internal USB connector that conforms to the USB 3.0 specification for high-speed USB devices.*

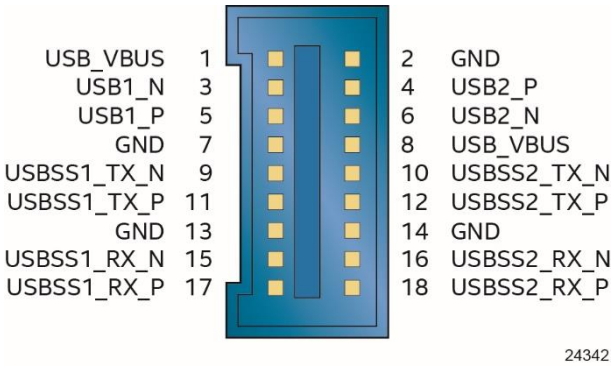


Figure 9. USB 3.0 Internal Header (1.25 mm Pitch)

NOTE

Connector is Molex part number 5041871874, 1.25 mm pitch header, surface mount, vertical.

2.2.3.3 Internal Common IO Header (1.25 mm Pitch)

Figure 10 is a connection diagram for internal Common IO header.

NOTE

- *The +5 V DC power on the USB header is fused.*
- *Use only an internal USB connector that conforms to the USB 2.0 specification for high-speed USB devices.*

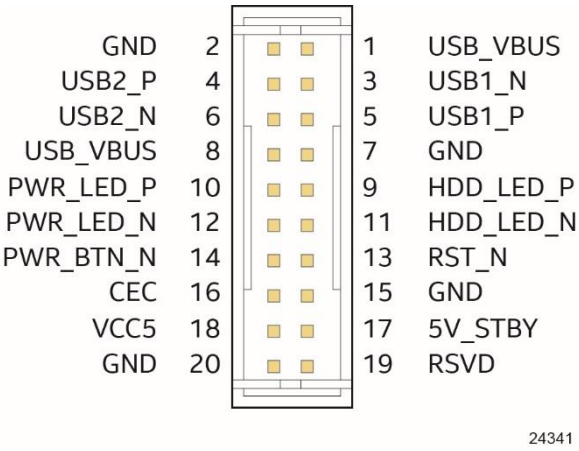


Figure 10. Connection Diagram for the Internal IO Common Header (1.25 mm Pitch)

NOTE

Pin number 13 on the connector is an output. The PCH asserts RST_N (out) to reset devices attached to front panel header. Asserted during power-up and when software initiates a hard reset.

NOTE

Connector is Entry part number 3950K-J20C-00L, 1.25 mm pitch header, surface mount, vertical.

2.2.3.3.1 Consumer Electronics Control (CEC) Header

The Consumer Electronics Control (CEC) is a 500 Mb/s bi-directional serial bus designed to be used for controlling multiple HDMI devices with a single remote control.

For information about	Refer to
HDMI CEC technology	http://www.hdmi.org/pdf/whitepaper/DesigningCECintoYourNextHDMIProduct.pdf

Figure 11 shows the location of all user addressable headers and connectors on the top-side of the Intel NUC Kit NUC8i7HV.

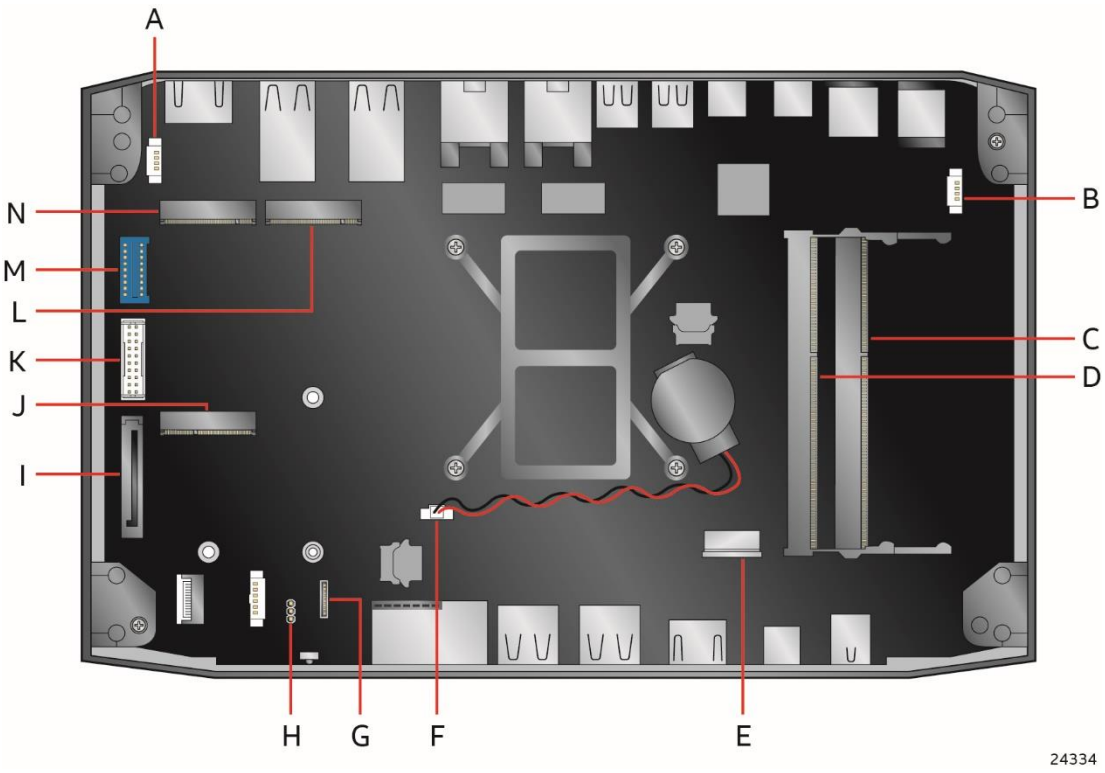


Figure 11. Additional Headers and Connectors

Table 14. Headers and Connectors Shown in Figure 11

Item from Figure 11	Description
A	Fan Header 1
B	Fan Header 2M.2 connector B (key type M) for 2242 and 2280 modules
C	SODIMM A M.2 connector A (key type M) for 2242 and 2280 modules
D	SODIMM B
E	Digital Microphone Header
F	RTC Battery Header (2pin)
G	RGB LED Header for Top Lid
H	BIOS Security Jumper
I	Auxiliary SATA Power Header
J	M.2 Key E (pre-populated with 2230 WIFI Solution)
K	Internal Common IO Header
L	M.2 connector A (key type M) for 2242 and 2280 modules
M	Internal USB 3.0 Header
N	M.2 connector B (key type M) for 2280 modules

2.2.3.4 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 12 shows the BIOS Security Jumper. The 3-pin jumper determines the BIOS Security program's mode.

Table 15 describes the jumper settings for the three modes: normal, lockdown, and configuration.

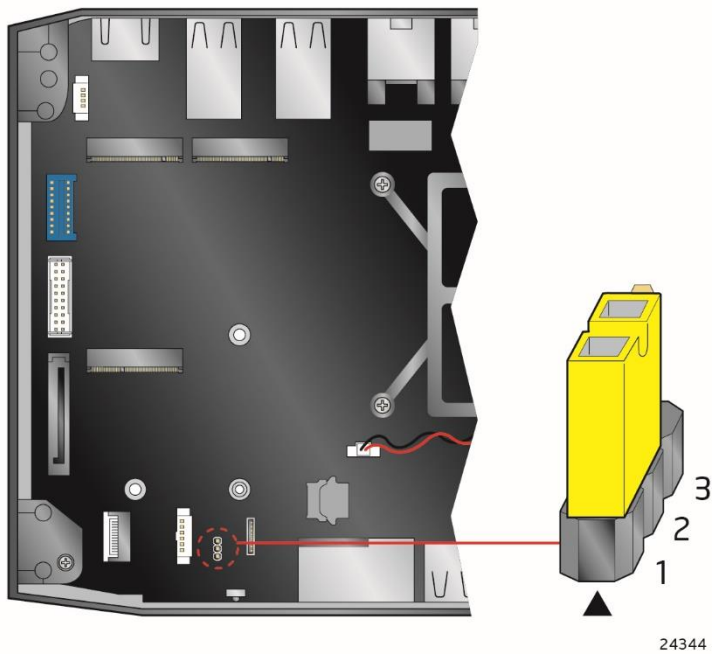


Figure 12. BIOS Security Jumper

Table 15 lists the settings for the jumper.

Table 15. 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 3.7.4 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 (selected Power Button Menu options): [1] Suppress this menu until the BIOS Security Jumper is replaced. [2] Clear BIOS User and Supervisor Passwords. See Section 3.7.4 Power Button Menu.

2.2.3.5 Add-in Card Connectors

The kit supports M.2 2242 and 2280 (key type M) modules.

- Supports M.2 SSD SATA-III drives
  - — Maximum bandwidth is approximately 540 MB/s
- Supports M.2 SSD Gen 3 PCIe AHCI, NVMe drives (PCIe x1, x2, and x4)
  - — Using PCIe x4 M.2 SSD maximum bandwidth is approximately 4000 MB/s

Table 16. M.2 2280 Module (key type M) Connectors

Pin	Signal Name	Pin	Signal Name
74	3.3V	75	GND
72	3.3V	73	GND
70	3.3V	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

continued

Table 16. M.2 2280 Module (key type M) Connectors (continued)

Pin	Signal Name	Pin	Signal Name
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	19	PERp2
16	3.3V	17	PERn2
14	3.3V	15	GND
12	3.3V	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	5	PERn3
2	3.3V	3	GND
		1	GND

2.2.3.6 Kit Dimensions

Figure 13 illustrates the dimensions for the kit. Dimensions are given in millimeters.

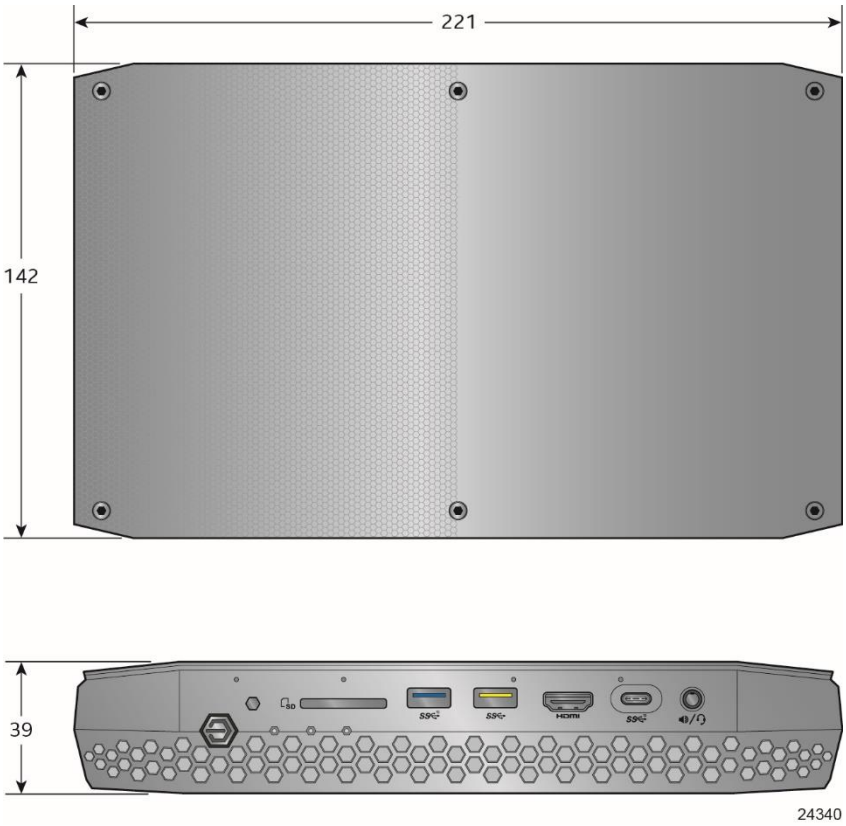


Figure 13. Kit Dimensions

2.3 VESA Bracket

Figure 14 illustrates how to install the VESA mount bracket included with the kit.

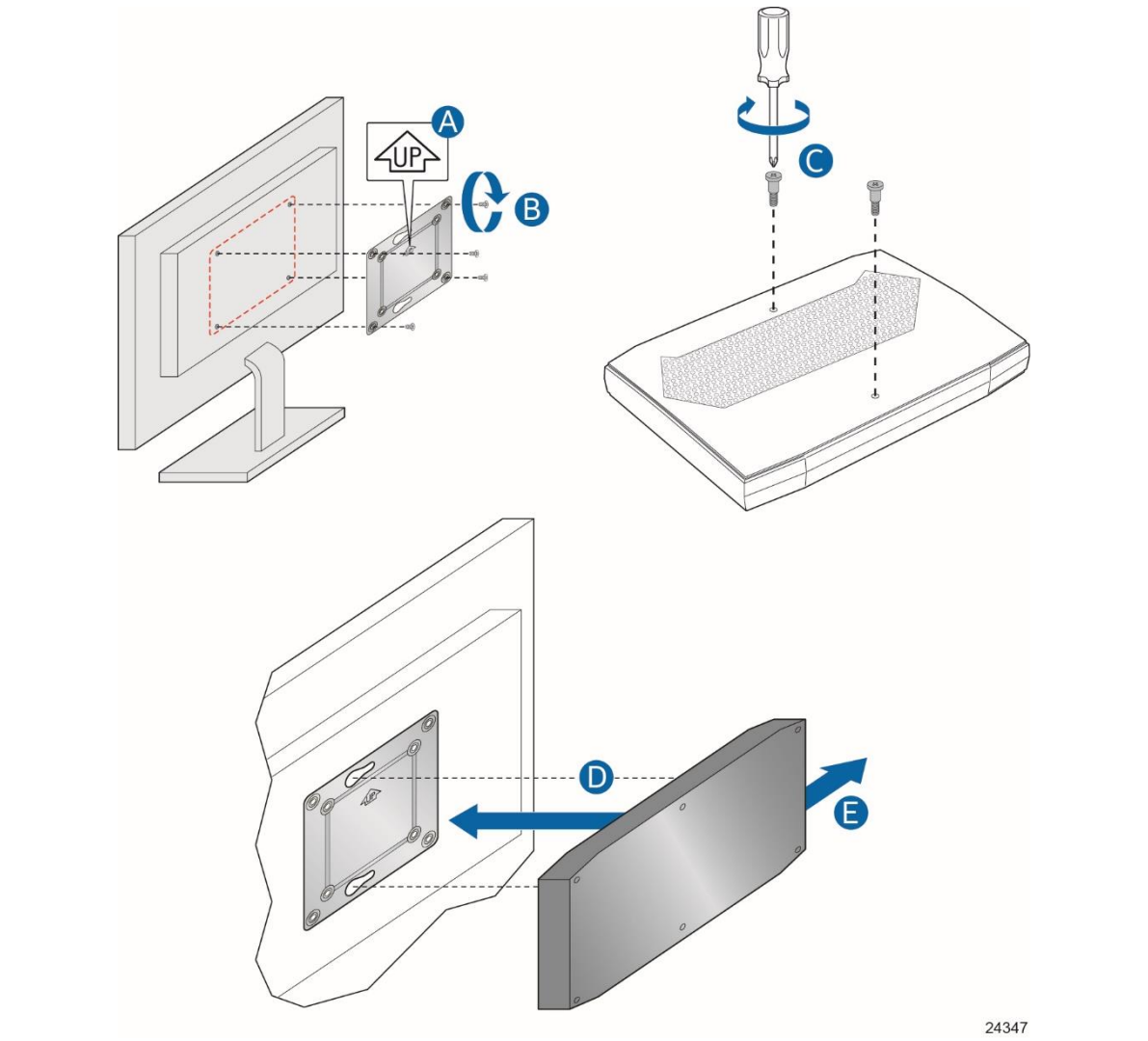


Figure 14. Install VESA Bracket

Figure 15 shows the dimensions of the VESA bracket. Dimensions are given in millimeters.

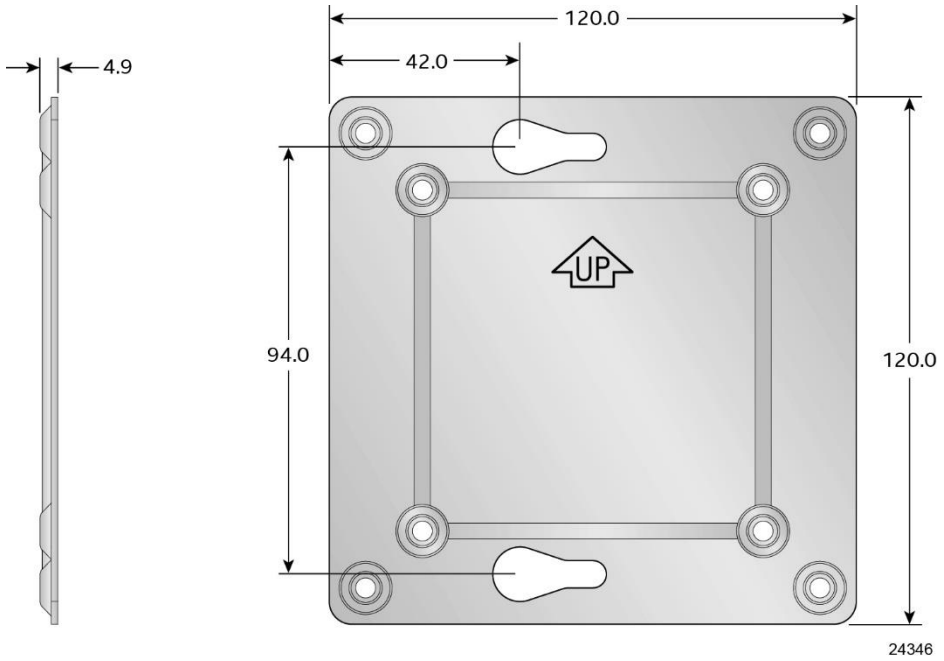


Figure 15. VESA Bracket Dimensions

2.4 Mechanical Considerations

2.4.1 Weights

Table 17 lists select weights of boards and kits.

Table 17. Select Weights

Item	Weight (in kg)
Board with Thermal Solution	0.2
Tall Kit (includes Board Assembly)	0.6
Tall Mini PC (includes Board Assembly, memory, and drive)	0.6

2.5 Power Supply

The NUC8i7HV uses an AC to DC power adapter with a six foot attached cable with a barrel connector. Figure 16 shows the power adapter and plugs that may be included with the kit.

- 100-240V AC Input 50-60 Hz 3.5 A
- 19.5V 11.8 A DC output
- 3-pin AC Power Cord Plug

AC power cord options are as follows:

- No AC Power Cord
- US AC Power Cord
- UK AC Power Cord
- EU AC Power Cord
- AU AC Power Cord

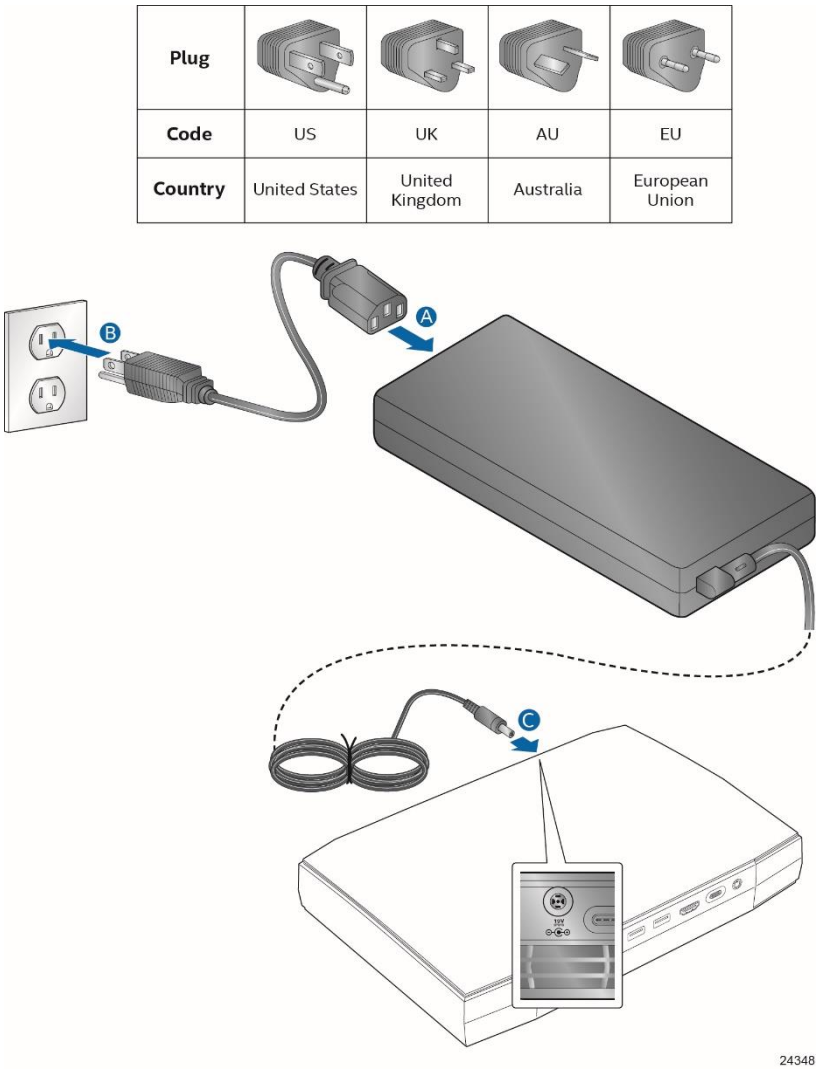


Figure 16. Power Adapter and Plugs Included with the Kit

2.5.1 Power Supply Connector

The kit has the following power supply connector:

- **External Power Supply** – the kit can be powered through a 19.5v DC connector on the back panel (see Figure 16, C). The back panel DC connector is compatible with a 7.4mm/OD (outer diameter) and 5.0 mm/ID (inner diameter) plug, where the inner 0.8mm contact is +19.5 (±10%) V DC and the shell is GND. The maximum current rating is 11.8 A.

NOTE

External power voltage, 19.5v DC, is dependent on the type of power brick used.

2.5.1.1.1 Power Sensing Circuit

The kit has a power sensing circuit that:

- Manages CPU power usage to maintain system power consumption below 230 W.
- Designed for use with 230 W AC-DC adapters.

NOTE

It is recommended that you disable this feature (via BIOS option) when using an AC-DC adapter greater than 230 W.

2.5.2 Fan Header Current Capability

Table 18 lists the current capability of the fan header.

Table 18. Dual Fan Header Current Capability

Fan Header	Maximum Available Current
Processor fan 1	0.75 A
Processor fan 2	0.75 A

2.6 Reliability

The Mean Time Between Failures (MTBF) prediction is calculated using component and subassembly random failure rates. The calculation is based on the Telcordia SR-332 Issue 2, Method I, Case 3, 55 ºC ambient. The MTBF prediction is used to estimate repair rates and spare parts requirements. The MTBF for Intel NUC8i7HV Kit is TBD Hours.

2.7 Environmental

Table 19 lists the environmental specifications.

Table 19. Environmental Specifications

Parameter	Specification		
Temperature			
Non-Operating	-40 °C to +60 °C		
Operating	0 °C to +35 °C 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.		
Shock			
Unpackaged	50 g trapezoidal waveform		
	Velocity change of 170 inches/s²		
Packaged	Half sine 2 millisecond		
	Product Weight (pounds)	Free Fall (inches)	Velocity Change (inches/s²)
	<20	36	167
	21-40	30	152
	41-80	24	136
	81-100	18	118
Vibration			
Unpackaged	5 Hz to 20 Hz: 0.001 g²/Hz sloping up to 0.01 g²/Hz		
	20 Hz to 500 Hz: 0.01 g²/Hz (flat)		
	Input acceleration is 2.20 g RMS		
Packaged	5 Hz to 40 Hz: 0.015 g²/Hz (flat)		
	40 Hz to 500 Hz: 0.015 g²/Hz sloping down to 0.00015 g²/Hz		
	Input acceleration is 1.09 g RMS		

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.

3 Overview of BIOS Features

3.1 Introduction

The kit uses Intel® Visual BIOS that is stored in the Serial Peripheral Interface Flash Memory (SPI Flash) and can be updated using a disk-based program. The SPI Flash contains the Visual BIOS Setup program, POST, the PCI auto-configuration utility, LAN EEPROM information, and Plug and Play support.

The BIOS displays a message during POST identifying the type of BIOS and a revision code. The initial production BIOSs are identified as HNKBLi70.86A.

The Visual BIOS Setup program can be used to view and change the BIOS settings for the computer. The BIOS Setup program is accessed by pressing the <F2> key after the Power-On Self-Test (POST) memory test begins and before the operating system boot begins.

NOTE

The maintenance menu is displayed only when the kit is in configure mode. Section 2.2.3.4 on page 46 shows how to put the kit in configure mode.

3.2 BIOS Flash Memory Organization

The Serial Peripheral Interface Flash Memory (SPI Flash) includes a 64 Mb flash memory device.

3.3 System Management BIOS (SMBIOS)

SMBIOS is a Desktop Management Interface (DMI) compliant method for managing computers in a managed network.

The main component of SMBIOS is the Management Information Format (MIF) database, which contains information about the computing system and its components. Using SMBIOS, a system administrator can obtain the system types, capabilities, operational status, and installation dates for system components. The MIF database defines the data and provides the method for accessing this information. The BIOS enables applications such as third-party management software to use SMBIOS. The BIOS stores and reports the following SMBIOS information:

- BIOS data, such as the BIOS revision level
- Fixed-system data, such as peripherals, serial numbers, and asset tags
- Resource data, such as memory size, cache size, and processor speed
- Dynamic data, such as event detection and error logging

Non-Plug and Play operating systems require an additional interface for obtaining the SMBIOS information. The BIOS supports an SMBIOS table interface for such operating systems. Using this support, an SMBIOS service-level application running on a non-Plug and Play operating system can obtain the SMBIOS information. Additional kit information can be found in the BIOS under the Additional Information header under the Main BIOS page.

3.4 Legacy USB Support

Legacy USB support enables 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.

Legacy USB support operates as follows:

1. When you apply power to the computer, legacy support is disabled.
2. POST begins.
3. Legacy USB support is enabled by the BIOS allowing you to use a USB keyboard to enter and configure the BIOS Setup program and the maintenance menu.
4. POST completes.
5. The operating system loads. While the operating system is loading, USB keyboards and mice are recognized and may be used to configure the operating system. (Keyboards and mice are not recognized during this period if Legacy USB support was set to Disabled in the BIOS Setup program.)
6. After the operating system loads the USB drivers, all legacy and non-legacy USB devices are recognized by the operating system, and Legacy USB support from the BIOS is no longer used.

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.

3.5 BIOS Updates

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

- Intel Express BIOS Update Utility, which enables automated updating while in the Windows environment. Using this utility, the BIOS can be updated from a file on a hard disk, a USB drive (a flash drive or a USB hard drive), or a CD-ROM, or from the file location on the Web.
- Intel Flash Memory Update Utility, which requires booting from DOS. Using this utility, the BIOS can be updated from a file on a hard disk, a USB drive (a flash drive or a USB hard drive), or a CD-ROM.
- Intel® F7 switch during POST allows a user to select where the BIOS .bio file is located and perform the update from that location/device. Similar to performing a BIOS Recovery without removing the BIOS configuration jumper.
- Intel® Visual BIOS has an option to update the BIOS from a valid .bio file located on a hard disk or USB drive. Enter Intel Visual BIOS by pressing <F2> during POST.
- Using Front Panel menu option

Both utilities verify that the updated BIOS matches the target system to prevent accidentally installing an incompatible BIOS.

NOTE

Review the instructions distributed with the upgrade utility before attempting a BIOS update.

For information about	Refer to
BIOS update utilities	http://support.intel.com/support/motherboards/desktop/sb/CS-034499.htm

3.5.1 Language Support

The BIOS Setup program and help messages are supported in US English. Check the Intel web site for support.

3.6 BIOS Recovery

It is unlikely that anything will interrupt a BIOS update; however, if an interruption occurs, the BIOS could be damaged. Table 20 lists the drives and media types that can and cannot be used for BIOS recovery. The BIOS recovery media does not need to be made bootable.

Table 20. Acceptable Drives/Media Types for BIOS Recovery

Media Type (Note)	Can be used for BIOS recovery?
Hard disk drive (connected to USB)	Yes
CD/DVD drive (connected to USB)	Yes
USB flash drive	Yes
USB diskette drive (with a 1.4 MB diskette)	No (BIOS update file is bigger than 1.4 MB size limit)

NOTE

Supported file systems for BIOS recovery:

- *NTFS (sparse, compressed, or encrypted files are not supported)*
- *FAT32*
- *FAT16*
- *FAT12*
- *ISO 9660*

For information about	Refer to
BIOS recovery	http://www.intel.com/support/motherboards/desktop/sb/cs-034524.htm

3.7 Boot Options

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

3.7.1 Network Boot

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.

3.7.2 Booting Without Attached Devices

For use in embedded applications, the BIOS has been designed so that after passing the POST, the operating system loader is invoked even if the following devices are not present:

- Video Display
- Keyboard
- Mouse

3.7.3 Changing the Default Boot Device During POST

Pressing the <F10> key during POST causes a boot device menu to be displayed. This menu displays the list of available boot devices. Table 21 lists the boot device menu options.

Table 21. Boot Device Menu Options

Boot Device Menu Function Keys	Description
<↑> or <↓>	Selects a default boot device
<Enter>	Exits the menu, and boots from the selected device
<Esc>	Exits the menu and boots according to the boot priority defined through BIOS setup

3.7.4 Power Button Menu

As an alternative to Back-to-BIOS Mode or normal POST Hotkeys, the user can use the power button to access a menu. The Power Button Menu is accessible via the following sequence:

1. System is in S4/S5/G2
2. User pushes the power button and holds it down for 3 seconds
3. The system will emit three short beeps from the front panel (FP) audio port, then stop to signal the user to release the power button. The FP power button LED will also change from Blue to Amber when the user can 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:

[ESC] Normal Boot
[F2] Intel Visual BIOS
[F3] Disable Fast Boot
[F4] BIOS Recovery
[F7] Update BIOS
[F10] Enter Boot Menu
[F12] Network Boot

[F2] Enter Setup is displayed instead if Visual BIOS is not supported.

[F3] Disable Fast Boot is only displayed if at least one Fast Boot optimization is enabled.

[F9] Remote Assistance is only displayed if Remote Assistance is supported.

If an unrecognized key is hit, then the BIOS will beep 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.

If Disable Fast Boot is selected, the BIOS will disable all Fast Boot optimizations and reset the system.

3.8 Hard Disk Drive Password Security Feature

The Hard Disk Drive Password Security feature blocks read and write accesses to the hard disk drive until the correct password is given. Hard Disk Drive Passwords are set in BIOS SETUP and are prompted for during BIOS POST. For convenient support of S3 resume, 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 19 characters in length.

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

The Master Key hard disk drive password, when installed, will not lock the drive. The Master Key hard disk drive password exists as an unlock override in the event that the User hard disk drive password is forgotten. Only the installation of the User hard disk drive password will cause a hard disk to be locked upon a system power-cycle.

Table 22 shows the effects of setting the Hard Disk Drive Passwords.

Table 22. Master Key and User Hard Drive Password Functions

Password Set	Password During Boot
Neither	None
Master only	None
User only	User only
Master and User Set	Master or 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 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 hard disk drive password attempt, the system will halt with the message:

Hard Disk Drive Password Entry Error

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

NOTE

As implemented on Intel NUC Kit NUC8i7HV, Hard Disk Drive Password Security is only supported on SATA port 0 (M.2). The passwords are stored on the hard disk drive so if the drive is relocated to another computer that does not support Hard Disk Drive Password Security feature, the drive will not be accessible.

Currently, there is no industry standard for implementing Hard Disk Drive Password Security on AHCI or NVME drives. Hard drive encryption can still be implemented and does not require Hard Disk Drive Password Security.

3.9 BIOS Security Features

The BIOS includes security features that restrict access to the BIOS Setup program and who can boot the computer. A supervisor password and a user password can be set for the BIOS Setup program and for booting 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 the supervisor mode.
- The user password gives restricted access to view and change Setup options in the BIOS Setup program. This is the 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 password or the user password to access Setup. Users have access to Setup respective to which password is entered.
- Setting the user password restricts who can boot the computer. The password prompt will be displayed before the computer is booted. 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, and 0-9. Passwords may be up to 20 characters in length.
- To clear a set password, enter a blank password after entering the existing password.

Table 23 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 23. Supervisor and User Password Functions

Password Set	Supervisor Mode	User Mode	Setup Options	Password to Enter Setup	Password During Boot
Neither	Can change all options (Note)	Can change all options (Note)	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

Note: If no password is set, any user can change all Setup options.

3.10 System LED Functionality

The NUC system includes configurable RGB LED functionality in both the top cover skull lid as well as the front panel status LEDs. The LEDs in both the Top and the Front panel are software configurable with the WMI command set.

Error! Reference source not found. shows the default location and behavior configurations of the RGB LEDs that are present on the system.

Table 24. Default RGB LED Locations and Behaviors

Location	Default Behavior	Default Colors
Front panel Power Button	Power Status, S0 and S3.	S0 – Blue solid, S3 – Blue Blinking
Front Panel LED 1	Storage Disk Activity	Default Off, flash red during activity
Front Panel LED 2	Ethernet Activity	Default On when Network connected, Flash Off during activity
Front Panel LED 3	System Performance	Green Transitions to Red, measures power consumption based on
Top Cover Skull Outline	Power Status, S0 and S3.	S0 – Blue Solid, S3 – Blue Blinking
Top Cover Eyes	Power Status, S0 and S3.	S0 – Blue Solid, S3 – Blue Blinking
For more behaviors please download the Intel NUC LED Companion Application from https://downloadcenter.intel.com/download/27641		

4 Error Messages and Blink Codes

4.1 Front-panel Power LED Blink Codes

Whenever a recoverable error occurs during POST, the BIOS causes the kit's front panel power LED to blink an error message describing the problem (see Table 25).

Table 25. Front-panel Power LED Blink Codes

Type	Pattern	Note
Power-on	Solid on primary color. Indicates S0 state.	Default to On; can be disabled via BIOS Setup
S3 Standby	Blink primary color .25 seconds on, .25 seconds off, indefinitely. Indicates S3 state.	Default behavior; can be changed via BIOS Setup
Intel Ready Mode	Solid secondary color	Default behavior; can be changed via BIOS Setup
BIOS update in progress	Off when the update begins, then primary color on for 0.5 seconds, then off for 0.5 seconds. The pattern repeats until the BIOS update is complete.	
Memory error	On-off (1.0 second each) three times, then 2.5-second pause (off), entire pattern repeats (blinks and pause) until the system is powered off.	
Thermal trip warning	Blink primary color .25 seconds on, .25 seconds off, .25 seconds on, .25 seconds off. This will result in a total of 16 blinks (blink for 8 seconds).	

4.2 BIOS Error Messages

Table 26 lists the error messages and provides a brief description of each.

Table 26. BIOS Error Messages

Error Message	Explanation
CMOS Battery Low	The battery may be losing power. Replace the battery soon.
CMOS Checksum Bad	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 memory may be bad.
No Boot Device Available	System did not find a device to boot.

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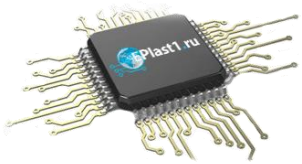
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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