Chapel Rock Technical Product Specification

LLN12CRv7

LLN12CRv7B

LLN12CRv5

LLN12CRv5B

Version 1.0, 09/15/2022

● Preface

The purpose of this document is to provide a technical reference for customers and developers of the Simply NUC Chapel Rock family of products. Chapel Rock kit SKUs include LLN12CRv7, and LLN12CRv5, with board SKUs LLN12CRv7B, and LLN12CRv5B.

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1   Description

1.1   Overview

The Simply NUC LLN12CRi7,and LLN12CRi5 (code named Chapel Rock) is a mini computer built with a 12th Generation Intel® Core i7, and i5 processor, respectively.

Chapel Rock is an ultracompact Long Life NUC that delivers powerful performance for embedded, edge and IoT applications. Featuring the latest 12th Gen Intel® Core™ embedded processors with Intel® Graphics, and support for high-speed 3200MHz DDR4 memory, Chapel Rock is built to withstand the test of time with a 7-year commitment on supply. This NUC is ready to take on demanding workloads, providing long term reliability

Create dynamic digital display installations with Chapel Rock via the HDMI, Display Port and two USB Type-C ports supporting a single 8K display or up to four 4K displays simultaneously. It is also suitable for Intelligent Edge Computing with dual Ethernet with speeds up to 2.5Gb, Wi-Fi 6 (802.11ax) networking ensures stable high-speed data transfers even in crowded networking environments, dual USB-C ports support data and DisplayPort functionality over a single cable. New on-processor Dual-Video Decode Boxes allow the 12th Gen processors to ingest up to 40 simultaneous video streams at 1080p. AI-Inferencing with built-in Vector Neural Network instructions boost deep learning performance.

The Intel® Embedded technologies in Chapel Rock have been enhanced specifically for IoT, you'll get optimized performance at every point, practical ways to use artificial intelligence, broad connectivity support, and a built-in foundation of security to help protect your data and systems.

 Chapel Rock has the following features:

- Intel® Core™v7-1265UE, or v5-1245UE.
- Intel Iris Xe (for i7 and i5 variants) and Intel UHD
- Two 260-pin SO-DIMM Sockets.
- M.2 key-M Slot for PCIe Gen4 x4 for SSD.
- Two 10/100/1000/2500Mbps Ethernet Ports.
- M.2 key-E Slot for Wi-Fi/ Bluetooth Radio.
- One DisplayPort (4k, 60Hz).
- One HDMI Port (4k, 60Hz).
- One Front USB 3.2 Gen 2 Type-C Port (supporting DP Alt Mode).
- One Front USB 3.2 Gen 2 Type-C Port (supporting Thunderbolt).
- Two Front USB 3.2 Gen 2 Type-A Ports.
- Two Rear USB 3.2 Gen 2 Type-A Ports.
- 3.5mm Combination Microphone/Headphone Jack.
- Internal SATA III Connector.
- Internal Dual USB 2.0 Header.
- Internal Serial Port Header Supporting RS-232/422/485.
- Replaceable Lid for Expandable Functionality.
- Simply NUC Universal Chassis.
- 19VDC 90W Power Supply Adapter.
- 12V – 19V Input Power Supply Range.

1.2   Processor

The Chapel Rock CPUs have the following features.

Table 1: CPU Features

Chapel Rock	LLN12CRv7	LLN12CRv5
Intel CPU	i7-1265UE	i5-1245UE
Performance Cores	2	2
Efficiency Cores	8	8
Total Cores	10	10
Threads	12	12
L1 Cache	2x 32KB + 8x 64KB I-cache, 2x 48KB + 8x 32KB D-cache	2x 32KB + 8x 64KB I-cache, 2x 48KB + 8x 32KB D-cache
L2 Cache	2x 1.25MB + 2x 2MB	2x 1.25MB + 2x 2MB
L3 Cache	12MB Unified	12MB Unified
Base Speed (Turbo) [MHz]	2600 (4700)	2500 (4400)
TDP (Configurable)[W]	15W	
Integrated Graphics	Intel Iris Xe Graphics	Intel Iris Xe Graphics

1.3   Integrated Graphics Processing Unit

The Chapel Rock CPU has an integrated Intel graphics processing unit with the following features.

Table 2: GPU Features

Chapel Rock	LLN12CRi7	LLN12CRi5
GPU	Intel Iris Xe (96EU)	Intel Iris Xe (80EU)
GPU Speed [MHz]	1250	1200
GPU Compute Units	96 (768 Shader Processors)	80 (640 Shader Processors)
GFLOPs	2150	1664
Maximum 1080p Displays	4	4
Maximum 4k Displays	4	4

Chapel Rock	LLN12CRi7	LLN12CRi5
Maximum Single Display Resolution	7680×4320, 60Hz	
Display Interfaces	HDMI 2.0b, DP 1.4a, 1x USB-C (DP 1.4a via DP Alt Mode), 1x USB-C (Thunderbolt)	
Memory Size	System-Shared DDR4	
API Support	DirectX 12 (12_1), OpenGL 4.6, OpenCL 3.0, Vulkan 1.3, Shader Model 6.4	

1.4   Memory

Chapel Rock has two SO-DIMM sockets for system memory with the following features:

- 1.2V LP-DDR4 SDRAM SO-DIMMs supported
- Two memory channels with interleaved support.
- Serial Presence Detection.
- Unbuffered SO-DIMM support (both single- and dual-sided)
- Minimum 4GB SO-DIMM supported.
- Up to 32GB SO-DIMMs supported per socket for a maximum total of 64GB of system memory
- Support for DDR4-3200 data rates.

1.5   Storage

Chapel Rock has one M.2 key-M slot for a 2280 storage module supporting PCIe SSD and a SATA III port connector supports SATA data cables for internal storage devices.

1.5.1 SATA Interface

The SATA III port has a theoretical maximum transfer rate of 6Gbps.

1.5.2 PCIe Interface

The M.2 slot is a key-M slot for an PCIe 2280 M.2 module, up to 8TB in density. The PCIe 4.0 x4
 interface on the port has a theoretical maximum transfer rate of 8GBps.

1.6   Networking

1.6.1 RJ-45 Connectors for Networking Interface (LAN1/LAN2)

Chapel Rock has dual Intel I225LM 2.5 gigabit controllers that interfaces to on-board RJ-45 Ethernet connectors (LAN1/LAN2) to provide 2.5 gigabit Ethernet connections. The I225LM controller features:

- Integrated MAC + BASE-T PHY.
- MDI (Copper) standard IEEE 802.3 Ethernet interface for 2500BASE-T, 1000BASE-T, 100BASE-TX, and 10BASE-TE applications (802.3, 802.3u, 802.3bz, and 802.3ab).
- MDI lane swap.
- IEEE 802.3 auto-negotiator.
- IEEE 802.3x and IEEE 802.3z compliant flow control support with software-controllable Rx thresholds and Tx pause frames.
- Automatic crossover detection function (MDI/ MDI-X).
- IEEE 1588 protocol and 802.1AS implementation.
- Supporting Time Sensitive Networking (TSN) Capabilities (IEEE 802.1Qbu, 802.3br, 802.1Qbv, 802.1AS-REV, 802.1p, Q, and 802.1Qav).
- Supports IEEE 802.3az – Energy Efficient Ethernet (EEE).
- Smart Power Down (SPD) at S0 no link/Sx no link.
- Full wake up support (APM and ACPI).
- MAC Power Management controls.
- Power Management Protocol Offload (Proxying).
- Latency Tolerance Reporting (LTR.)
- TCP/UDP, Ipv4 checksum offloads (Rx/ Tx).
- Transmit Segmentation Offloading (TSO) (Ipv4, Ipv6).
- Legacy, Message Signal Interrupt (MSI) and Message Signal Interrupt Extension (MSI-X).
- Support for packets up to 9.5 KB (Jumbo Frames).
- Descriptor ring management hardware for Transmit and Receive.

1.6.2 Wireless Networking Interface

Chapel Rock has one M.2 key-E slot for a removable 2230 wireless module supporting a dual-banded radio with wireless and Bluetooth protocols. The radio module included with Chapel Rock is the Intel Wi-Fi 6 AX200 that features.

- 2.4Ghz and 5Ghz bands.
- Maximum bandwidth of 2.4Gbps
- 2x2 transmit/receive streams.
- Supports IEEE WLAN standards IEEE 802.11a/b/d/e/g/h/i/k/n/r/u/v/w/ac/ax
- Supports authentications WPA and WPA2, 802.1X EAP-TLS, EAP-TTLS/MSCHAPv2, PEAPv0-MSCHAPv2 (EAP-SIM, EAP-AKA, EAP-AKA')
- 64-bit and 128-bit WEP,TKIP, 128-bit AES-CCMP, 256-bit AES-GCMP encryption supported
- Bluetooth® 5.2, BLE.

2   Technical Reference

2.1   Motherboard Headers

2.1.1 Headers – Top of Board

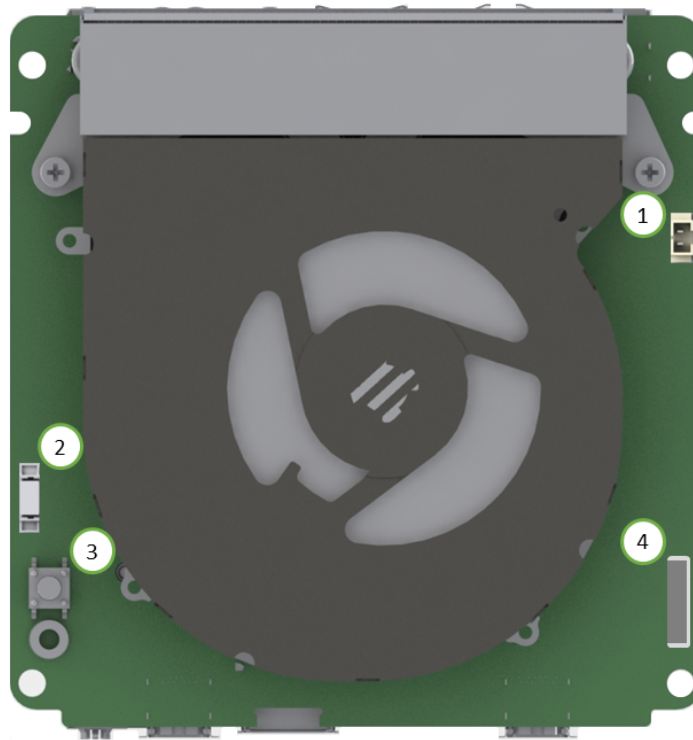Headers on the top side of the motherboard are defined below.

Figure 1: Top Side Header Locations

Table 3: Top Side Header Definitions

Identifier	Header
1	Battery Header
2	APU Fan Header
3	Power Button
4	eSPI Connector

2.1.1.1   Battery Header

The battery header is a 1.25mm, 1×2 2-circuit, male header. The battery header is an input power supply from a coin-cell battery to power CMOS memory.

2.1.1.2   APU Fan Header

The APU fan header is a 1.25mm, 1×4 4-circuit, male header. The header is for a CPU cooling fan that can be speed detected and controlled, as well as displayed in the Hardware Monitor section of the BIOS.

Table 4: CPU Fan Header Pinout

Pin	Signal Definition
1	GND
2	5V
3	Fan Speed
4	Fan Speed Control

2.1.1.3   Power Button

The power button on the APU side of the Chapel Rock board can be used to power on and off the system in the absence of a Power-ON solution via the Front Panel header.

2.1.1.4   eSPI Connector

eSPI is an all-in-one bus that was designed to replace the LPC bus as well as the SPI bus, SMbus and sideband signals.

2.1.2 Headers – Bottom of Board

Headers on the top side of the motherboard are defined below.
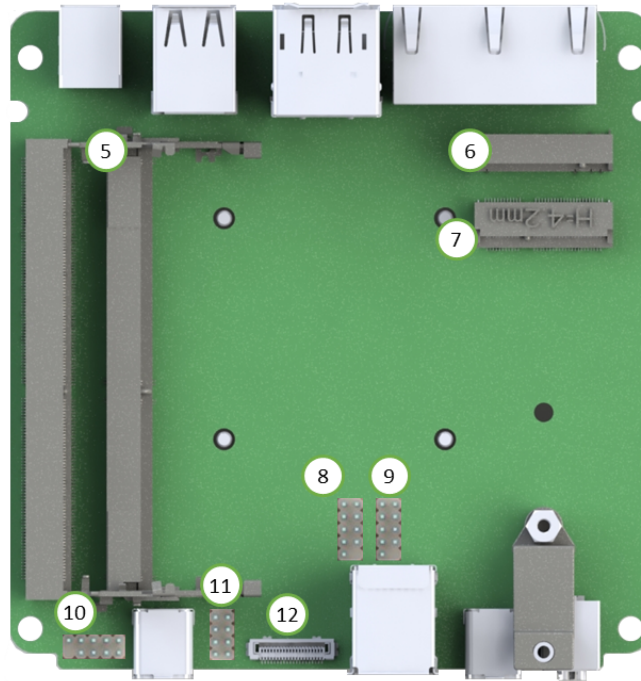
Figure 2: Bottom Side Header Locations

Table 5: Bottom-Side Header Definitions

Identifier	Header
5	DDR4 SO-DIMM Socket
6	M.2 for Storage
7	M.2 for Radio
8	COM Header
9	USB2 Header
10	Front Panel Header
11	ATX/AT & Clear CMOS Jumper
12	SATA-III Connector

2.1.2.1 DDR4 SO-DIMM Sockets

The Chapel Rock motherboard has two 260-pin SO-DIMM sockets for DDR4 memory and supports the following features:

- 1.2v DDR4 DIMMs with dual channel architecture
- DDR4-3200 speeds for a peak transfer rate of 25600MBps
- Non-CC, Unbuffered, single- or dual-sided SO-DIMMs
- 4GB to 64GB of total system memory
- Serial Presence Detect (SPD)
- DDR4 SDRAM organizations 1Rx8, 1Rx16 and 2Rx8 supported

2.1.2.2 M.2 for Storage

The M.2 storage socket supports PCI Express (PCIe) drives in a 2280 key-M module. PCIe drives utilizing PCIe Gen 4 can deliver up to 8GBps bandwidth.

Table 6: M.2 Key-M SSD Pinout

Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	GND	73
70	3.3V	GND	71
68	N/A	PEDET	69
66	CONNECTOR KEY	N/A	67
64	CONNECTOR KEY	CONNECTOR KEY	65
62	CONNECTOR KEY	CONNECTOR KEY	63
60	CONNECTOR KEY	CONNECTOR KEY	61
58	N/A	CONNECTOR KEY	59
56	N/A	GND	57
54	WAKE#	PEFCLKp	55
52	CLKREQ#	PEFCLKn	53
50	PERST#	GND	51
48	N/A	PETp0	49

Pin	Signal	Signal	Pin
46	N/A	PETn0	47
44	N/A	GND	45
42	SMB_DATA	PERp0	43
40	SMB_CLK	PERn0	41
38	N/A	GND	39
36	N/A	PETp1	37
34	N/A	PETn1	35
32	N/A	GND	33
30	N/A	PERp1	31
28	N/A	PERn1	29
26	N/A	GND	27
24	N/A	PETp2	25
22	N/A	PETn2	23
20	N/A	GND	21
18	3.3V	PERp2	19
16	3.3V	PERn2	17
14	3.3V	GND	15
12	3.3V	PETp3	13
10	N/A	PETn3	11
8	N/A	GND	9
6	N/A	PERp3	7
4	3.3V	PERn3	5
2	3.3V	GND	3
		GND	1

2.1.2.3 M.2 for Radio

The M.2 radio socket supports a wireless radio in a 2230 key-E module. The system includes an Intel AX200 dual-band Wi-Fi 6/Bluetooth v5.2 radio which can be removed, if necessary.

Table 7: M.2 Key-E Pinout

Pin	Signal	Signal	Pin
74	3.3V	GND	75
72	3.3V	CNV_WT_CLK+	73
70	N/A	CNV_WT_CLK-	71
68	N/A	GND	69
66	N/A	CNV_WT_D0+	67
64	N/A	CNV_WT_D0-	65
62	N/A	GND	63
60	SMB_CLK	CNV_WT_D1+	61
58	SMB_DATA	CNV_WT_D1-	59
56	W_DISABLE2#	GND	57
54	W_DISABLE1#	WAKE#	55
52	PERST0#	CLKREQ#	53
50	SUSCLK	GND	51
48	N/A	PEFCLKn	49
46	N/A	PEFCLKp	47
44	N/A	GND	45
42	N/A	PERn	43
40	N/A	PERp	41
38	N/A	GND	39
36	CNV_BRI_DT	PETn	37
34	CNV_RGI_RSP	PETp	35

Pin	Signal	Signal	Pin
32	CNV_BGI_DT	GND	33
30	CONNECTOR KEY	CONNECTOR KEY	31
28	CONNECTOR KEY	CONNECTOR KEY	29
26	CONNECTOR KEY	CONNECTOR KEY	27
24	CONNECTOR KEY	CONNECTOR KEY	25
22	CNV_BRI_RSP	CNV_WGR_CLK+	23
20	N/A	CNV_WGR_CLK-	21
18	GND	GND	19
16	N/A	CNV_WGR_D0+	17
14	MODEM_CLKREQ	CNV_WGR_D0-	15
12	N/A	GND	13
10	CNV_RF_RESET	CNV_WGR_D1+	11
8	N/A	CNV_WGR_D1-	9
6	N/A	GND	7
4	3.3V	USB_D-	5
2	3.3V	USB_D+	3
		GND	1

2.1.2.4   COM Header

The COM header is a 2.00mm, 2×5 9-circuit, male header. This header is intended to connect to a serial RS-232 interface.
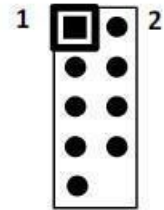

Figure 3: COM Header

Table 8: COM Header Pinout

Pin	RS-232 Signal
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI#
10	Empty

2.1.2.5　USB 2.0 Header

The motherboard has one on-board 2.00mm, 2×5 9-circuit, male header that can be used to connect to two external USB 2.0 devices.
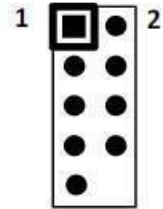
Figure 4: USB 2.0 Header

Table 9: USB 2.0 Header Pinout

Pin	Signal
1	VCC
2	VCC
3	USB0-
4	USB1-
5	USB0+
6	USB1+
7	GND
8	GND
9	No Connect
10	Empty

2.1.2.6 Front Panel Header

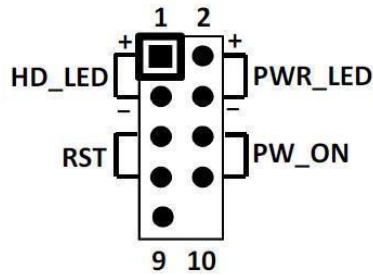The front panel header is a 2.00mm, 2×5 9-circuit, male header. It connects to the front panel switches and LEDs.

Figure 5: Front Panel Header

Table 10: Front Panel Header Pinout

Pin	Header	Signal
1	HD_LED	HD_PWR
3		HD_Active
2	PWR_LED	PWR LED+
4		PWR LED-
5	RESET	GND
7		RST BTN
6	PW_ON	PWR BTN
8		GND
9	No Connect	+5V
10	Empty	Empty

The HD_LED pins attach to a hard disk drive indicator LED to show the activity status of the hard disks.

The Power LED lit by the PWR_LED pins indicates the status of the system.

Table 11: Power LED System Status

System Status	Power LED status
S0	LED is on
S1	LED will blink
S3	LED is off
S4	LED is off
S5	LED is off

The RESET pins attach to a front panel RESET switch to restart the system when the switch is pressed.

The PW_ON pins attach to the front panel Power switch to turn the system on and off when the switch is pressed.

2.1.2.7   ATX/AT & Clear CMOS Jumper

The motherboard has a 2.54mm, 2×4 8-circuit, male header for a 2-pin jumper that can be used to clear the CMOS data and reconfigure the system back to the default values stored in the ROM BIOS.
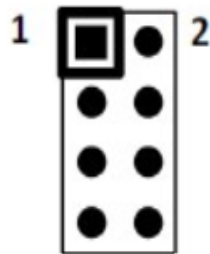
1-2: SIO AT Mode
(Default Open: SIO ATX Mode)
4-6: Clear CMOS
3-4: Auto Clear CMOS
5-7: DACC*

2.1.2.8   SATA-III Connector

The motherboard has a 0.5mm 20-pin WTB LVDS connector with which to attach a SATA-III storage device.

Figure 6: SATA Connector

Table 12: SATA Connector Pinout

Pin	Signal
1	GND
2	TX+
3	TX-
4	GND
5	GND
6	RX-
7	RX+
8	GND
9	GND
10	GND
11	No Connect
12	5V
13	5V
14	5V
15	5V
16	5V
17	No Connect
18	GND
19	GND
20	GND

2.2 Chassis I/O Connectors

2.2.1 Connectors – Front Panel

Front-side connector locations are shown below.

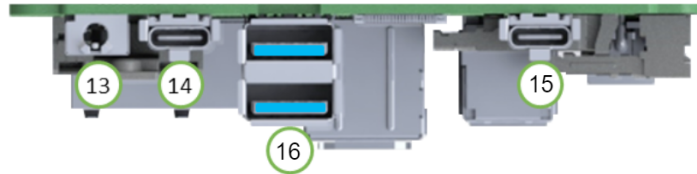**Figure 7: Front Side Connector Locations**

Table 12: Front Side Connections Defined

Identifier	Connector
13	Audio Jack
14	USB 3.2 Gen2 Type-C port
15	Thunderbolt Type-C Port
16	Dual USB 3.2 Gen2 Type-A

The 3.5mm audio jack supports two-channel high-definition audio output and a microphone input in both TRRS (CTIA/AHJ and OMTP) standards. The TRRS standard used is auto-detectable by the hardware.

The two USB 3.2 Gen2 Type-A and Type-C ports on the front of the board support transfer speeds up to 10Gbps. The dual Type-C ports also support DP 1.4 via DP Alt Mode and Thunderbolt to display output with a maximum output resolution of 4096×2160, 60Hz.

2.2.2 Connectors – Rear Panel

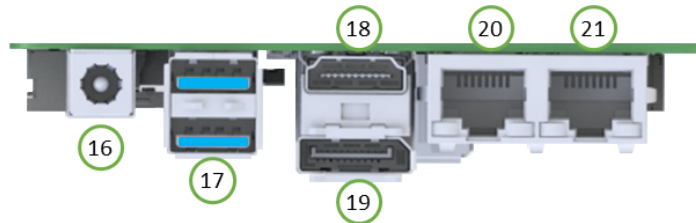Connector locations shown on the back side of the motherboard are shown below.

Figure 8: Back Side Connector Locations

Table 13: Back Side Connections Defined

Identifier	Connector
16	DC Power Input
17	Dual USB 3.2 Gen2 Type-A
18	HDMI Port
19	DisplayPort
20	RJ-45 for 2.5 Gigabit Ethernet (LAN2)
21	RJ-45 for 2.5 Gigabit Ethernet (LAN1)

The system has a 12-19VDC input with 10% tolerance.

The two USB 3.2 Gen2 Type-A ports support transfer speeds up to 10Gbps. Two USB 3.2 Gen2 Type-C ports support transfer speeds up to 10Gbps. The dual Type-C ports also support DP 1.4a via DP Alt Mode and Thunderbolt to display output with a maximum output resolution of 4096×2160, 60Hz.

The HDMI 2.0b port can support a maximum output resolution 4096×2160, 60Hz.

The DisplayPort 1.4a port can support a maximum output resolution of 4096×2160, 60Hz.

The dual on-board RJ-45 2.5 gigabit Ethernet ports are controlled by an Intel I225LM gigabit controller. For more information on the controller refer to RJ-45 Connector for Networking Interface (LAN1/LAN2).

2.3　Mechanical Dimensions

2.3.1　PCB Chassis Mount

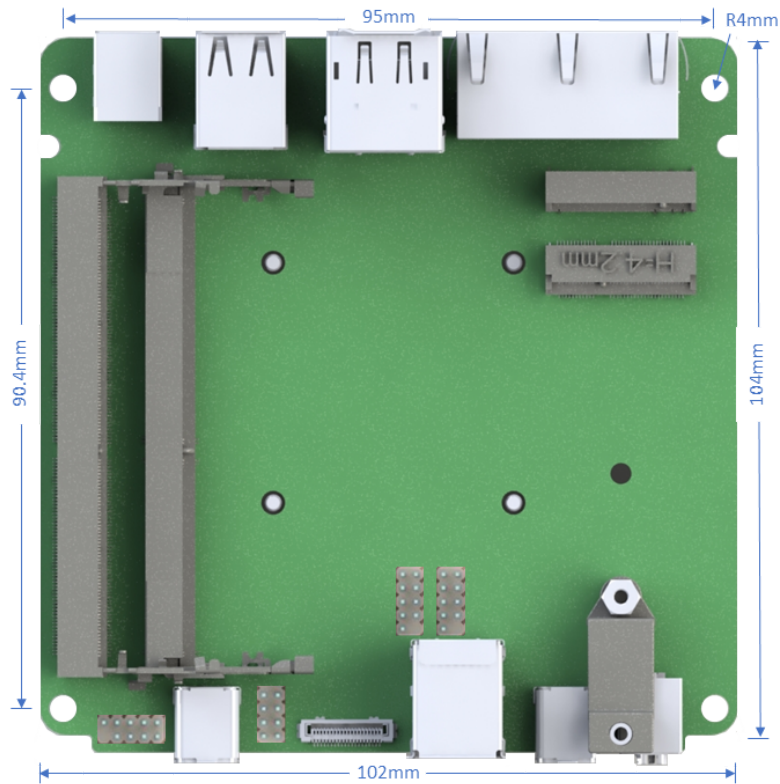The dimensions for the PCB to securely mount into a chassis are given in Figure 9.

Figure 9: Motherboard Dimensions

2.3.2　System Height
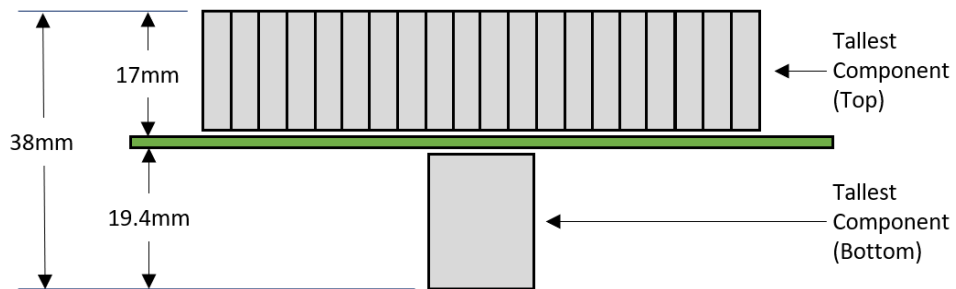
The maximum height of a populated system is shown below.

Figure 10: System Height

2.3.3 Chassis Dimensions

2.3.4 Chassis Weight

The weight of the device with the chassis, 2 sticks of RAM, and an SSD is 450G.

3   Environmental Specifications

Table 14: Environmental Specifications

Condition	Specification
Input Voltage	12V – 19V ±10%
Input Voltage Connector	5.5×2.5mm Barrel Plug
Recommended PSU Wattage	90W
Operating Temperature	0°C– 60°C
Operating Humidity	5% – 90%
Storage Temperature	-40°C – 85°C
Storage Humidity	5% – 90%

4 Version History

Version	Date	Comments
0.1	08/08/22	Copied from Topaz 2 v1.0. Replaced all "Topaz-2" references with "Chapel Rock". Updated CPU features and GPU table.
0.2	09/13/22	Copied from Chimney Rock v 0.1. Replaced "Chimney Rock 2" with "Chapel Rock"
1.0	09/15/22	Updated section 2.1.1.2 and 2.1.1.3 Reformatted reference images Update Pagination
1.1	2/22/2023	Added chassis dimensions and system weight
1.2	3/3/2023	Removed products not being sold