



# Sequoia Technical Product Specification

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LLM1v8SQ

LLM1v6SQ

*Version 1.0, 08/25/2022*

# Preface

The purpose of this document is to provide a technical reference for customers and developers of the Simply NUC Sequoia family of products. Sequoia kit SKUs include LLM1v8SQ and LLM1v6SQ.

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# 1 Description

## 1.1 Overview

The Simply NUC LLM1v8SQ and LLM1v6SQ (code named Sequoia) is a mini computer built with an AMD Ryzen™ V1807B and V1606B processor, respectively.

Sequoia delivers innovation in a small space for embedded solutions. A wireless-AC card can be installed into one of three M.2 slots, leaving another key-B slot available for an LTE modem or PCIe SSD, and the final available slot for a lightning fast PCIe or SATA SSD. The bottom of the chassis is designed to accommodate DIN rail and VESA plate mounting options. Finally, whether it's Windows® 10, Linux, or another OS, these systems are verified to run a wide range of operating systems so you can build the exact solution your clients want.

Sequoia may be small in size, but not in toughness or reliability. Engineered and manufactured in Germany, it supports an automotive-grade power supply range (8 to 32Vdc) with locking connector, provides locking video port connectors, and withstands a maximum relative humidity of 95% @ 40°C and a wide operational temperature range of 0 to 60°C. Sequoia also features a built-in health monitoring system which includes controllable fan, hardware monitoring and a watchdog timer. When it comes to rugged environments, Sequoia is built to last.

Sequoia has several features that make it optimal for your embedded solutions. Simply NUC is committed to supporting the manufacture and sales of Sequoia in the same form, fit, and function for seven years from launch (Nov 2019). This work horse includes two serial ports, two gigabit Ethernet ports, two locking mini DisplayPorts, and Wi-Fi and cellular options to accommodate a plethora of embedded usages including AI, robotics, industrial computer, and Point-of-Sale.

Sequoia has the following features:

- AMD® Ryzen™ V1807B or V1605B Processor
- AMD® Radeon™ RX Vega 11 or Vega 8 Graphics
- Two DDR4-2400 SO-DIMM Sockets
- M.2 Slot for PCIe or SATA SSDs
- M.2 Slot for LTE Modem or PCIe SSD
- Two 10/100/1000Mbps Ethernet Ports
- M.2 Slot for Wi-Fi/Bluetooth Radio
- RP-SMA Dual-Band Antennas
- SIM Card Slot with Security Cover
- MicroSD Card Slot
- Two mDP++ (4k, 60Hz)
- Two Front USB 3.1 Gen 1 Type-A Ports
- One Rear USB 3.1 Gen 1 Type-A Port
- One Serial RS-232 Port and One Serial RS-485/RS-232 Port
- Optional 3.5mm Combination Microphone/Headphone Jack
- 19VDC 90W Power Supply Adapter
- 8V – 32V Input Power Supply Range

## 1.2 Processor

The Sequoia CPUs have the following features.

**Table 1: CPU Features**

Sequoia	LLM1v8SQ	LLM1v6SQ
Intel CPU	V1807B	V1605B
Cores	4	4
Threads	8	8
L1 Cache	4x 64KB (4-way) I-cache, 4x 32KB (8-way) D-cache	
L2 Cache	4x 512KB (8-way) Unified	
L3 Cache	4MB (16-way) Unified	
Base Speed (Turbo) [MHz]	3350 (3800)	2000 (3600)
TDP (Configurable)[W]	45	35
Integrated Graphics	AMD Radeon Vega 11	AMD Radeon Vega 8

## 1.3 Integrated Graphics Processing Unit

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

**Table 2: GPU Features**

Sequoia	LLM1v8SQ	LLM1v6SQ
GPU	AMD Radeon Vega 11	AMD Radeon Vega 8
GPU Speed [MHz]	1300	1100
GPU Compute Units	11 (704 Shader Processors)	8 (512 Shader Processors)
GFLOPs	1746	1126
Maximum 1080p Displays	4	
Maximum 4k Displays	2	
Maximum Single Display Resolution	4096 x 2160, 60Hz	
Display Interfaces	2x mDP 1.4	
Memory Size	System-Shared DDR4	
API Support	DirectX 12 (12_1), OpenGL 4.6, OpenCL 2.1, Vulkan 1.2, Shader Model 6.4	

## 1.4 Memory

Sequoia 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 Detect
- 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 DDR4-2666 data rates

## 1.5 Storage

Sequoia has one M.2 key-M slot for a 2242 storage module supporting either a SATA or PCIe SSD.

### 1.5.1 SATA Interface

The M.2 slot is a key-M slot for a SATA 2242 M.2 module, up to 512GB in density. 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 2242 M.2 module, up to 2TB in density. The PCIe 3.0 x4 interface on the port has a theoretical maximum transfer rate of 4GBps.

## 1.6 Networking

### 1.6.1 RJ-45 Connector for Networking Interface (LAN1 & LAN2)

Sequoia has two Intel® I210-LM gigabit controllers that interface to on-board RJ-45 Ethernet connectors (LAN1 & LAN2) to provide gigabit Ethernet connections. The I210-LM controller features

- Integrated MAC + BASE-T PHY
- MDI (copper) support for standard IEEE 802.3 Ethernet interface for 1000BASE-T, 100BASE-TX, and 10BASE-T applications (802.3, 802.3u, and 802.3ab)
- Four transmit and four receive queues
- MDI lane swap
- IEEE 802.3 auto-negotiator
- IEEE 802.3x and IEEE 802.3z compliant flow control support
- Automatic crossover detection function (MDI/ MDI-X)
- Supports IEEE 802.3az – Energy Efficient Ethernet (EEE)
- Smart Power Down (SPD) at S0 no link/Sx no link
- MAC Power Management controls
- Power Management Protocol Offload (Proxying)



- Latency Tolerance Reporting (LTR)
- IP/TCP/UDP checksum offloads (Rx/ Tx)
- Transmit Segmentation Offloading (TSO)
- Legacy, Message Signal Interrupt (MSI) and Message Signal Interrupt Extension (MSI-X)
- RSS and MSI-X to lower CPU utilization in multi-core systems
- Advanced cable diagnostics, auto MDI-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

Sequoia 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 Sequoia is the Intel® Wireless-AC 9260 that features

- 2.4Ghz and 5Ghz bands
- Maximum bandwidth of 1.73Gbps
- 2x2 transmit/receive streams
- Supports IEEE WLAN standards IEEE 802.11a/b/d/e/g/h/i/k/r/w/ac
- Supports authentications WPA2 and WPA3, 802.1X (EAP-TLS, TTLS, PEAP, EAP-SIM, EAP-AKA, EAP-AKA')
- 64-bit and 128-bit WEP, TKIP, 128-bit AES-CCMP, 256-bit AES-GCMP encryptions supported
- Bluetooth® 5.1, BLE

## 2 Technical Reference

### 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	Identifier	Header
1	4 Pin power	9	M.2 Key E (2230)
2	x2 RJ 45	10	M.2 Key B (2242)
3	x 2USB 3.0	11	Molex LC-Display Backlight Connector
4	mDP 1.2	12	Reset header
5	mDP 1.2	13	USB 3.0
6	Audio Connector	14	LVDS Data Connector
7	M.2 Key M (2242)	15	USB 2.0 Header
8	DIMM Slot	16	CMOS Header

### 2.1.1.1 Battery Header

The battery header is a 1.25mm, 1x2 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, 1x4 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 Sequoia board can be used to power on and off the system in the absence of a Power-ON solution via the Front Panel header

## 2.1.2 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	Identifier	Header
1	Molex Feature Connector Detail	5	MicroSD Card Slot
2	LED Power	6	FAN Connector
3	Molex RS232/485 Connector Schematic	7	Molex USB internal Connector
4	MicroSD Card Slot	8	Molex RS232 Connector

### 2.1.2.1 DDR4 SO-DIMM Sockets

The Red Oak 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-ECC, 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 both SATA III and PCI Express (PCIe) drives in a 2280 key-M module. SATA drives support a theoretical maximum transfer rate of 6Gbps, and 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	SUSCLK(32kHz) (O)(0/3.3V)	PEDET (NC-PCIe/GND-SATA)	69
66	CONNECTOR KEY	N/C	67
64	CONNECTOR KEY	CONNECTOR KEY	65
62	CONNECTOR KEY	CONNECTOR KEY	63
60	CONNECTOR KEY	CONNECTOR KEY	61
58	N/C	CONNECTOR KEY	59
56	N/C	GND	57
54	PEWAKE# (I/O)(0/3.3V) or N/C	REFCLKp	55
52	CLKREQ# (I/O)(0/3.3V) or N/C	REFCLKn	53
50	PERST# (O)(0/3.3V) or N/C	GND	51
48	N/C	PETp0/SATA-A+	49
46	N/C	PETn0/SATA-A-	47

Pin	Signal	Signal	Pin
44	N/C	GND	45
42	SMB_DATA	PERp0/SATA-B-	43
40	SMB_CLK	PERn0/SATA-B+	41
38	DEVSLP (O)	GND	39
36	N/C	PETp1	37
34	N/C	PETn1	35
32	N/C	GND	33
30	N/C	PERp1	31
28	N/C	PERn1	29
26	N/C	GND	27
24	N/C	PETp2	25
22	N/C	PETn2	23
20	N/C	GND	21
18	3.3V	PERp2	19
16	3.3V	PERn2	17
14	3.3V	GND	15
12	3.3V	PETp3	13
10	DAS/DSS# (I/O)/LED1# (I)(0/3.3V)	PETn3	11
8	USB_D-	GND	9
6	USB_D+	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 3168 dual-band Wireless-AC/Bluetooth v4.2 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	RESERVED/REFCLKn1	73
70	UIM_POWER_SRC/GPIO1/PEWAKE1#	RESERVED/REFCLKp1	71
68	UIM_POWER_SNK/CLKREQ1#	GND	69
66	UIM_SWP/PERST1#	RESERVED/PERn1	67
64	RESERVED	RESERVED/PERp1	65
62	ALERT# (I)(0/3.3V)	GND	63
60	I2C_CLK (O)(0/3.3V)	RESERVED/PETn1	61
58	I2C_DATA (I/O)(0/3.3V)	RESERVED/PETp1	59
56	W_DISABLE1# (O)(0/3.3V)	GND	57
54	W_DISABLE2# (O)(0/3.3V)	PEWAKE0# (I/O)(0/3.3V)	55
52	PERST0# (O)(0/3.3V)	CLKREQ0# (I/O)(0/3.3V)	53
50	SUSCLK(32kHz) (O)(0/3.3V)	GND	51
48	COEX1 (I/O)(0/1.8V)	REFCLKn0	49
46	COEX2 (I/O)(0/1.8V)	REFCLKp0	47
44	COEX3 (I/O)(0/1.8V)	GND	45
42	VENDOR DEFINED	PERn0-	43
40	VENDOR DEFINED	PERp0	41
38	VENDOR DEFINED	GND	39
36	UART CTS (O)(0/1.8V)	PETn0	37
34	UART RTS (I)(0/1.8V)	PETp0	35
32	UART RXD (O)(0/1.8V)	GND	33
30	CONNECTOR KEY	CONNECTOR KEY	31

Pin	Signal	Signal	Pin
28	CONNECTOR KEY	CONNECTOR KEY	29
26	CONNECTOR KEY	CONNECTOR KEY	27
24	CONNECTOR KEY	CONNECTOR KEY	25
22	UART TXD (I)(0/1.8V)	SDIO RESET# (O)(0/1.8V)	23
20	UART WAKE# (I)(0/3.3V)	SDIO WAKE# (I)(0/1.8V)	21
18	GND	SDIO DATA3(I/O)(0/1.8V)	19
16	LED2# (I)(OD)	SDIO DATA2(I/O)(0/1.8V)	17
14	PCM_IN/I2S SD_IN (I)(0/1.8V)	SDIO DATA1(I/O)(0/1.8V)	15
12	PCM_OUT/I2S SD_OUT (O)(0/1.8V)	SDIO DATA0(I/O)(0/1.8V)	13
10	PCM_SYNC/I2S WS (O/I)(0/1.8V)	SDIO CMD(I/O)(0/1.8V)	11
8	PCM_CLK/I2S SCK (O/I)(0/1.8V)	SDIO CLK(O)(0/1.8V)	9
6	LED1# (I)(OD)	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 1.25mm, 1x6, male header. This header is intended to connect to a serial RS-232 interface.



Figure 3: RS232 Header

Table 8: RS232 Header Pinout

Pin	RS-232 Signal
1	RXD1
2	RTS1_m
3	TXD1
4	CTS1_m
5	VCC
6	GND

### 2.1.2.5 RS232/485 Connector

The motherboard has one multipurpose COM header that does both RS232 and RS485.



Figure 4: RS232/485 Connector

Table 9: RS232/485 Connector Pinout

Pin	Signal RS232	Signal RS485-FDX	Signal RS485/HDX (Windows 10 only)
1	-	RS485-TX_N	RS485-RX/TX_N
2	-	-	-
3	RXD0	RS485-TX_P	RS485-RX/TX_P
4	RXD0_m	-	-
5	TXD0	RS485-TX_P	-

Pin	Signal RS232	Signal RS485-FDX	Signal RS485/HDX (Windows 10 only)
6	CTS0_m	-	-
7	-	RS485-TX_N	-
8	-	-	-
9	VCC	VCC	VCC
10	GND	GND	GND

### 2.1.2.6 USB Internal Header

The front panel header is a 1x9 1.25 header.



Figure 5: USB Internal Header

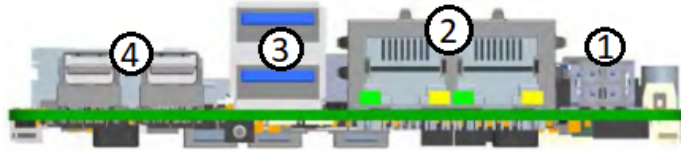
Table 10: USB Internal Header Pinout

Pin	Header
1	VCC_USBSS_4_INT
3	USB2_4_INT_N
2	USB2_4_INT_P
4	GND0_USBSS_4
5	USBSS_4_INT_TX_N
7	USBSS_4_INT_TX_P
6	GND1_USBSS_4
8	USBSS_4_INT_RX_N
9	USBSS_4_INT_RX_P

## 2.2 Chassis I/O Connectors

### 2.2.1 Connectors – Front Panel

Front-side connector locations are shown below.



**Figure 8: Front Side Connector Locations**

**Table 13: Front Side Connections Defined**

Identifier	Connector
1	Power Connector
2	Dual RJ45
3	Dual USB 3.2 Gen2 Type-A
4	mDp 1.2

### 2.2.2 Connectors – Rear Panel

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



**Figure 9: Back Side Connector Locations**

**Table 14: Back Side Connections Defined**

Identifier	Connector
5	USB 3.2 Gen2 Type-A

## 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 10.

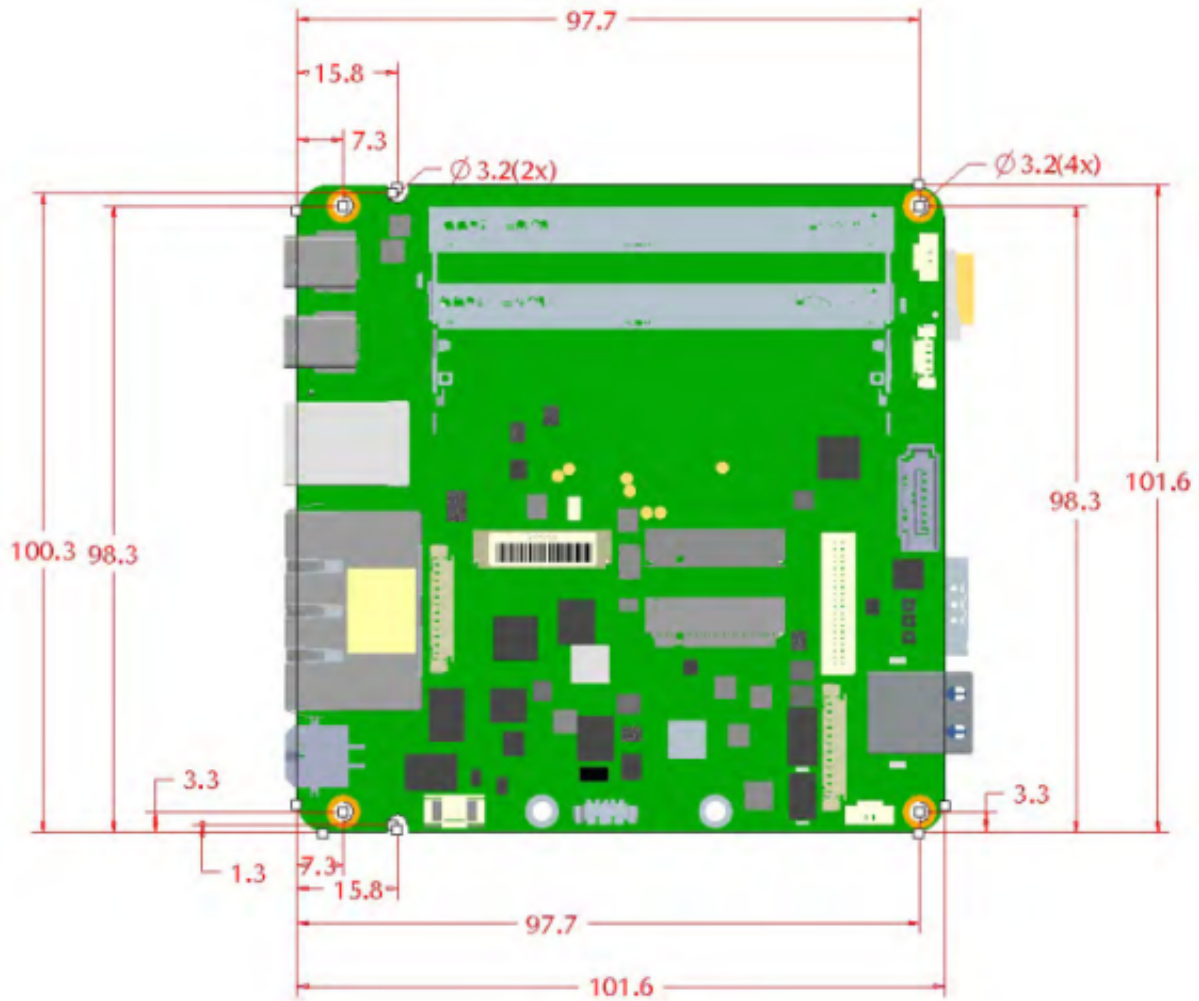


Figure 10: Motherboard Dimensions

### 3 Environmental Specifications

**Table 15: Environmental Specifications**

Condition	Specification
Input Voltage	12V – 19V ±10%
Input Voltage Connector	5.5 x 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
0.0	10/28/20	<i>Copied from Ruby v0.6. Renamed Board as Sequoia and added appropriate Model Numbers Updated CPU and GPU Tables Updated names of GbE Controllers</i>
0.1	11/02/20	<i>Updated ATX/AT Mode Jumper description Updated Network Controller chips to the Intel I2**LM chips Updated Intel I2**LM chips' feature lists Added MB Images Front Panel Audio references removed Added MB Dimensions and Mount Hole Size</i>
0.2	11/03/20	<i>Confirmed support for only RS232 Updated Storage to show PCIe Gen 4 support on M.2 Corrected &amp; updated <a href="#">Table 8: COM Header Pinout</a> Corrected DP version &amp; output resolution in <a href="#">Connectors – Rear Panel</a> Corrected Networking chip vendor in <a href="#">Connectors – Rear Panel</a></i>
0.3	11/23/20	<i>Updated <a href="#">Table 2: GPU Features</a> with 1080p &amp; 4k monitor information Updated maximum SATA storage density to 2TB in <a href="#">SATA Interface</a> Added SDRAM organizations to <a href="#">DDR4 SO-DIMM Sockets</a> Added <a href="#">Environmental Specifications</a> section</i>
0.4		<i>Updated <a href="#">Overview</a></i>  <b><u>STILL Need:</u></b>
0.5	8/24/2022	<i>Updated pictures and data fields</i>
1.0	8/25/2022	<i>Reformatted pages, images and tables.. Checked document technically. Initial release</i>

