Post Oak Technical Product Specification

LLM1v6PK

LLM1v6PKB

LLM1r6PK

LLM1r6PKB

Version 1.1, 11/2020

Preface

The purpose of this document is to provide a technical reference for customers and developers of the Simply NUC Post Oak family of products. Post Oak kit SKUs include the LLM1v6PK and LLM1r6PK, with board SKUs LLM1v6PKB and LLM1r6PKB.

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1 Description

1.1 Overview

The Simply NUC LLM1v6PK and LLM1r6PK (code named Post Oak) are mini-computers built with an AMD® Ryzen™ Embedded V1605B and R1606G accelerated processing processor, respectively, delivering innovation in a small space for embedded solutions. A wireless-AC card is installed into one of two M.2 slots, leaving the other available slot for a lightning fast SSD. The bottom of the chassis is designed to accommodate mounting options including DIN rail and VESA plate. There are also board SKU options available for embedded designs. Finally, whether its Windows® 10, Linux, or another OS, these systems are verified to run a wide range of operating systems so exact customer solutions can be built.

Post Oak is a mini-computer that is small in size with features that make it optimal for embedded solutions. Its rich feature set makes Post Oak ideal for mainstream performance usages such as on-premises edge analytics. It supports a wide power supply range (12 to 19VDC), offers two gigabit Ethernet ports, and three USB ports for I/O flexibility. With two DisplayPort and one HDMI ports Post Oak has plenty of bandwidth for sophisticated digital signage usages.

Built to stand the test of time, Simply NUC is committed to supporting the manufacture and sales of Post Oak in the same form, fit, and function for seven years from launch (August 2020). Post Oak also comes in a board SKU option with a serial port header and two USB headers enabling other embedded usages such as kiosk, vending machines, and Point-of Sale.

The Post Oak system has the following features:

- AMD® Ryzen™ V1605B or R1606G Processor
- AMD® Radeon™ Vega 8 Graphics
- Two DDR4-2400 SO-DIMM Sockets
- M.2 Slot for NVMe or SATA SSDs
- Two 10/100/1000Mbps Ethernet Ports
- M.2 Slot for Wi-Fi/ Bluetooth Radio
- Two DP Ports (4K, 60Hz)
- One HDMI Port (4k, 60Hz)
- One Front and Two Rear USB 3.2 Gen 2 Type-A Ports
- Combination Microphone/Headphone 3.5mm Jack
- Internal connector supporting SATA III
- Two On-Board USB 2.0 Headers
- Serial port header supporting RS-232, RS-422 or RS485
- Replaceable Lid for Expandable Functionality
- Simply NUC Universal Chassis
- 19VDC 65W Power Supply Adapter
- 12V – 19V Input Power Supply Range

1.2 Processor

The processor is the main differentiating factor among the Post Oak family of products. The APU features of the Post Oak family are found in Table 1.

Table 1: Post Oak APU Features

Post Oak Version	**LLM1v6PK**	**LLM1r6PK**
AMD APU	V1605B	R1606G
Cores	4	2
Threads	8	4
L1 Cache	4x 64KB (4-Way) I-Cache, 4x 32KB (8-Way) D-Cache	2x 64KB (4-Way) I-Cache, 2x 32KB (8-Way) D-Cache
L2 Cache	4x 512KB (8-Way)	2x 512KB (8-Way)
L3 Cache	4MB (16-way) Unified	
Base Speed (Turbo) [MHz]	2000 (3600)	2600 (3500)
TDP [W]	15	
Integrated Graphics	Radeon Vega 8	

1.3 Integrated Graphics Processing Unit

The Post Oak's Ryzen APU has an integrated Radeon Vega 8 graphics processing unit with features listed in Table 2.

Table 2: Post Oak GPU Features

GPU Speed [MHz]	1100
GPU Compute Units	8 (512 Shader Processors)
GFLOPs	1226
Maximum Displays	4
Maximum Single Display Resolution	3840 x 2160, 60Hz
Display Interfaces	HDMI 2.0b, Two DP 1.4
Memory Size	System-Shared DDR4

API Support	DirectX 12 (12_1), OpenGL 4.6, OpenCL 2.0, Vulkan 1.2.131, Shader Model 6.4

1.4 Memory

The Post Oak board 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-DIMMs support (both single- and dual-sided)
- Minimum 4GB SO-DIMMs supported
- Up to 32GB SO-DIMMs support per socket for a maximum total of 64GB of system memory
- Support for DDR4-2133 and DDR4-2400 data rates

1.5 Storage

The Post Oak board has one M.2 key-M slot for a 2242 or 2260 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 or 2260 M.2 module, up to 2TB 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 or 2260 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 Networking Interface

The Post Oak board has a RealTek RTL8111H gigabit controller that interfaces to dual on-board RJ-45 Ethernet connectors to provide two gigabit Ethernet connections. The controller features

- Integrated 10/100/1000M transceiver
- Supports Giga Lite (500M) mode
- Auto-Negotiation with Next Page capability
- Supports pair swap/polarity/skew correction
- Crossover Detection & Auto-Correction

- Embedded OTP memory
- Supports hardware ECC (Error Correction Code) function
- Supports hardware CRC (Cyclic Redundancy Check) function
- Transmit/Receive on-chip buffer support
- Supports PCI MSI (Message Signaled Interrupt) and MSI-X
- Supports 25MHz or 48MHz Oscillator
- Built-in LDO regulator
- Supports power down/link down power saving/PHY disable mode
- Supports EMAC-393 ECMA ProxZzzy Standard for sleeping hosts
- XTAL-Less Wake-On-LAN
- Supports LTR (Latency Tolerance Reporting)
- Supports PCIe L1.Off and L1.Snooze
- Fully compatible with IEEE 802.3, IEEE 802.3u, IEEE 802.3ab
- Supports IEEE 802.1P Layer 2 Priority Encoding
- Supports IEEE 802.1Q VLAN tagging
- Supports IEEE 802.3az-2010 (EEE)
- Supports Full Duplex flow control (IEEE 802.3x)

1.6.2 Wireless Networking Interface

The Post Oak board 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 Post Oak is the Intel Dual-Band Wireless-AC 3168 that features

- 2.4Ghz and 5Ghz bands
- Maximum bandwidth of 433Mbps
- 1x1 transmit/receive streams
- Supports standards IEEE 802.11a/b/g/n/ac, 802.11d, 802.11e, 802.11i, 802.11h, 802.11w
- Supports seamless roaming between respective access points (802.11b, 802.11g, 802.11a/b/g, 802.11a/b/g/n, and 802.11ac)
- Supports authentications WPA and WPA2, 802.1X (EAP-TLS, TTLS, PEAP), EAP-SIM, EAP-AKA with protocols PAP, CHAP, TLS, GTC, MS-CHAP, MS-CHAPv2
- 64-bit and 128-bit WEP, AES-CCMP encryptions supported
- Dual Mode Bluetooth® 4.2, BLE

2 Technical Reference

2.1 Motherboard Headers

2.1.1 Headers – Top of Board

Headers on the top side of the motherboard in Figure 1 are defined in Table 3.

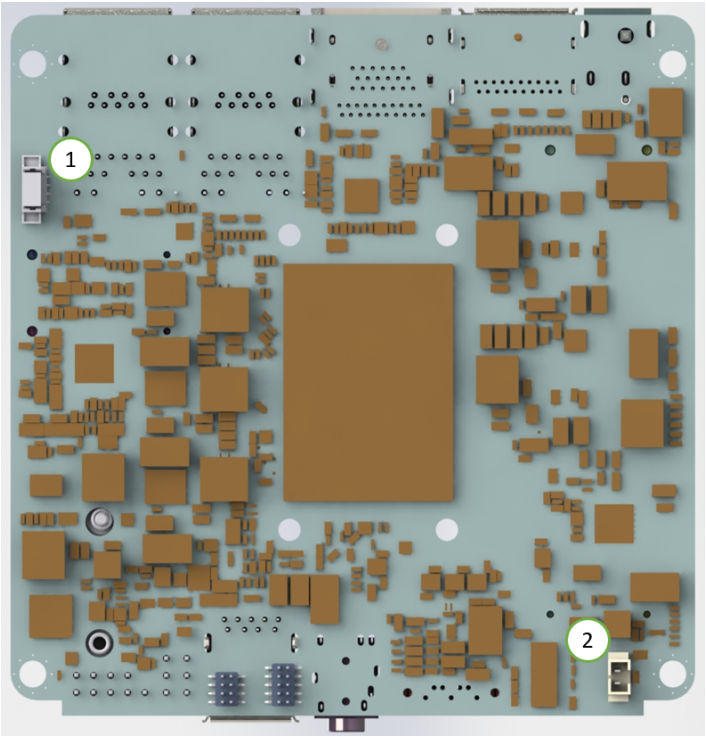

Figure 1: Top Side Header Locations

Table 3: Top Side HeadersDefinitions

Identifier	Header
1	APU Fan Header
2	Battery Header

2.1.1.1 APU Fan Header

The APU fan header is a 1.25mm, 1x4 4-circuit, male header. The fan header is intended for a CPU cooling fan that can be speed detected and controlled, as well as displayed in the Hardware Monitor section of the BIOS. The fan is automatically powered off when the system enters S3, S4 or S5 mode.

Table 4: CPU Fan Header Pinout

Pin	Signal Definition
1	Sense
2	GND
3	Control
4	5V

2.1.1.2 Battery Header

The battery header is a 1.25mm, 1x2 2-circuit, male header. The battery header is intended as an input power supply from a coin-cell battery to power CMOS memory.

2.1.2 Headers – Bottom of Board

Headers on the top side of the motherboard in Figure 2 are defined in Table 5.

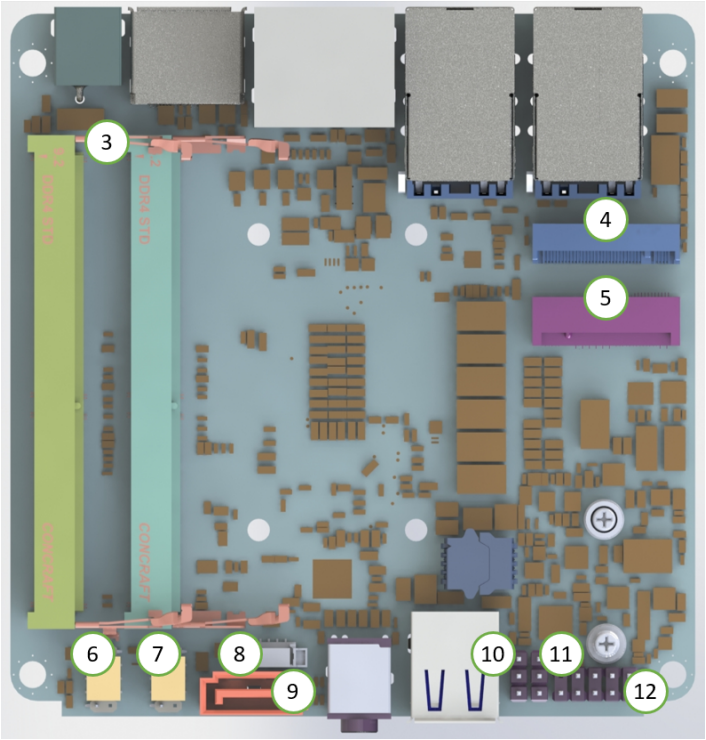

Figure 2: Bottom Side Header Locations

Table 5: Bottom-Side Header Definitions

Identifier	Header
3	DDR4 SO-DIMM Sockets
4	M.2 for Storage
5	M.2 for Radio
6	Front Panel Header
7	COM Header

8	SATA Power Header
9	SATA III Connector
10	Clear CMOS Jumper
11	Auto Power On Jumper
12	USB 2.0 Header

2.1.2.1 DDR4 SO-DIMM Sockets

The Post 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
- DDR4-2400 speeds for a peak transfer rate of 19200MBps
- Non-ECC, unbuffered, single- or dual-sided SO-DIMMs
- 4GB to 64GB of total system memory
- Serial Presence Detect (SPD)
- Single rank DDR4 SDRAM organizations 1Gx8 or 512Mx16
- Dual rank DDR4 SDRAM organizations 1Gx8 or 512Mx8

2.1.2.2 M.2 for Storage

The M.2 storage socket supports both SATA III and NVM Express (NVMe) drives in a 2242 or 2260 key-M module. SATA drives support a theoretical maximum transfer rate of 6Gbps, and PCIe drives with PCIe Gen 3 and can deliver up to 4GBps 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
44	N/C	GND	45
42	N/C	PERp0/SATA-B-	43
40	N/C	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	N/C	GND	9

6	N/C	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 Post Oak 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
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 Front Panel Header

The front panel male header (2x5, 2.00m pitch) on the Post Oak motherboard is intended to connect the front panel switches and LEDs.

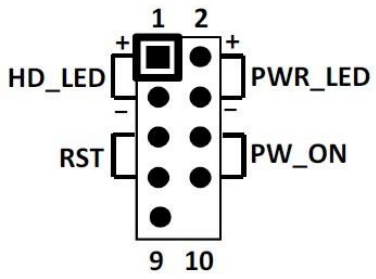

Figure 3: Front Panel Header

Table 8: 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. Note that the HD_LED supports SATA HDD only.

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

Table 9: Power LED System Status

System Status	Power LED status
S0	LED is on
S3	LED will blink
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.

2.1.2.5 COM Header

The serial port male header (2x5, 2.00m pitch) on the Post Oak motherboard is intended to connect to a RS-232, RS-422 or RS-485 interface.

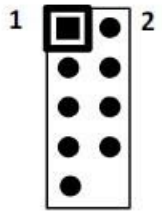

Figure 4: COM Header

Table 10: COM Header Pinout

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

2.1.2.6 SATA Power Header

The SATA power header is a 1.25mm, 1x4 4-circuit, male header used to provide 5V power to the SATA III connector.

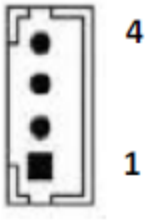

Figure 5: SATA Power Header

Table 11: SATA Power Header Pinout

Pin	Signal Definition
1	GND
2	GND
3	5V
4	5V

2.1.2.7 SATA III Connector

The SATA III connector is a standard SATA plug that can be used to connect a single SATA drive to the motherboard at speeds of up to 6Gbps.

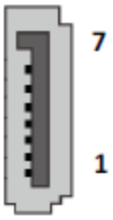

Figure 6: SATA III Connector

Table 12: SATA III Connector Pinout

Pin	Signal Definition
1	GND
2	TX+

3	TX-
4	GND
5	RX+
6	RX+
7	GND

2.1.2.8 Clear CMOS Jumper

The Post Oak motherboard has a three pin (2.54mm pitch) 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.

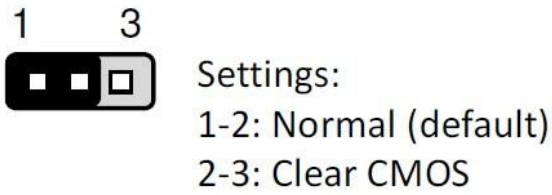

Figure 7: CMOS Header Settings

To clear the CMOS,

1. Turn off the system.
2. Move the jumper from the “1-2” position to the “2-3” position for a few seconds.
3. Replace the jumper back to the “1-2” position.
4. Turn on the system and hold down the <DELETE> key to enter the BIOS setup.

2.1.2.9 Auto Power On Jumper

The Post Oak motherboard has a three pin (2.54mm pitch) male header for a 2-pin jumper that can be used to enable or disable the auto power-on feature.

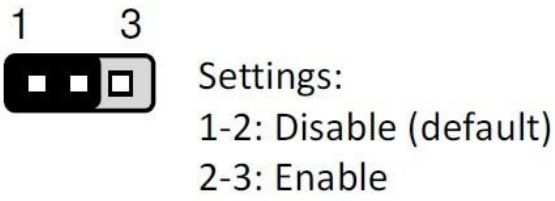

Figure 8: Auto Power On Header

Table 13: Auto Power On Header Settings

Pins	Setting
1-2	*DISABLE*: Press power button manually to power on after power input is connected to power source (Default)
2-3	*ENABLE*: Automatically power on when power is applied to the power input

2.1.2.10 USB 2.0 Header

The Post Oak motherboard has one on-board 10-pin (2x5, 2.54mm pitch) male header that can be used to connect to two external USB 2.0 devices.

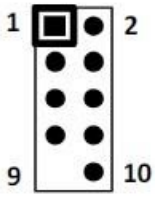

Figure 9: USB 2.0 Header

Table 14: USB 2.0 Header Pinout

Pin	Signal
1	VCC
2	VCC
3	USB0-
4	USB1-
5	USB0+
6	USB1+
7	GND

8	GND
9	Empty
10	No Connect

2.2 Chassis I/O Connectors

2.2.1 Connectors - Front Panel

Connector locations shown on the front side of the motherboard in Figure 10 are defined in Table 15.

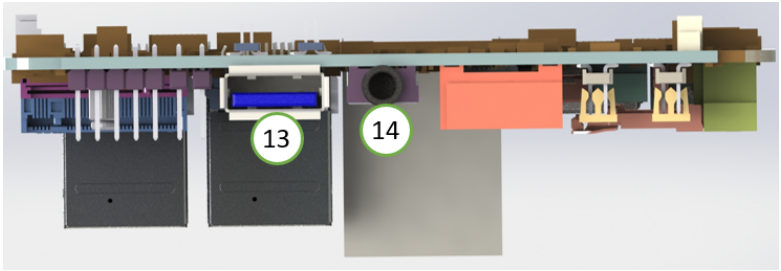

Figure 10: Front Side Connections

Table 15: Front Side Connections Defined

Identifier	Connector
13	USB 3.2 Gen2 Type-A
14	Audio Jack

The USB 3.2 Gen2 Type-A port on the front of the board supports transfer speed up to 10Gbps.

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.

2.2.2 Connectors - Rear Panel

Connector locations shown on the back side of the motherboard in Figure 11 are defined in Table 16.

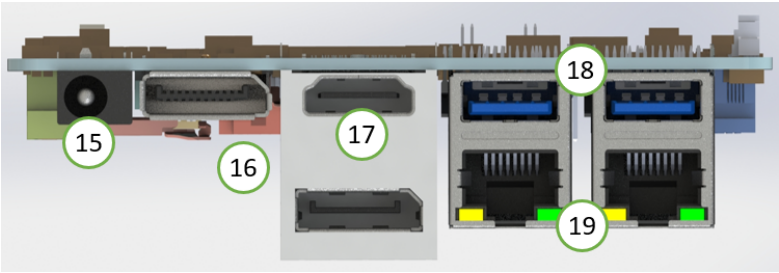

Figure 11: Back Side Connections

Table 16: Back Side Connections Defined

Identifier	Connector
15	DC Power Input
16	Dual DisplayPort
17	HDMI Port
18	Dual USB 3.2 Gen2 Type-A
19	Dual RJ-45 for Gigabit Ethernet

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

The two DisplayPort 1.4 ports can each support a maximum resolution 3840 x 2160, 60Hz.

The HDMI 2.0b port can also support a maximum resolution 3840 x 2160, 60Hz.

The two USB 3.2 Gen 2 Type-A ports on the back of the board support transfer speeds up to 10Gbps.

The on-board dual RJ-45 gigabit Ethernet ports are controlled by a Realtek RTL8111H gigabit controller.

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 12.

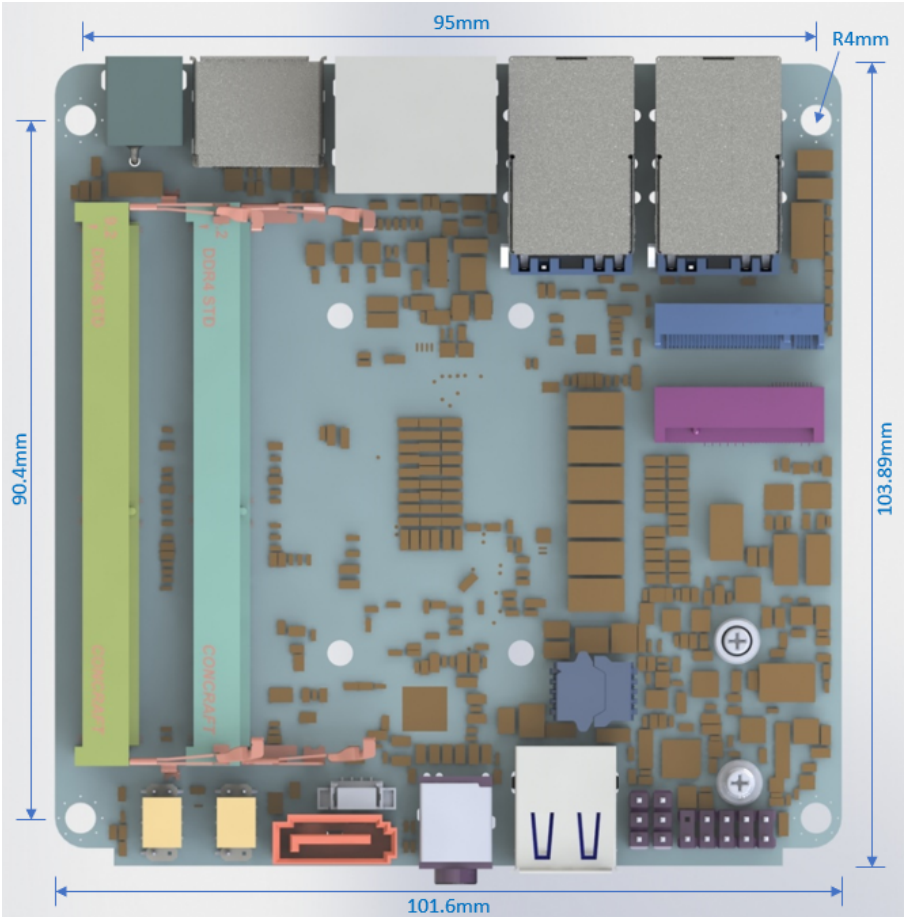

Figure 12: Motherboard Dimensions

2.3.2 Motherboard Height

The maximum height of a populated Post Oak system is shown in Figure 13.

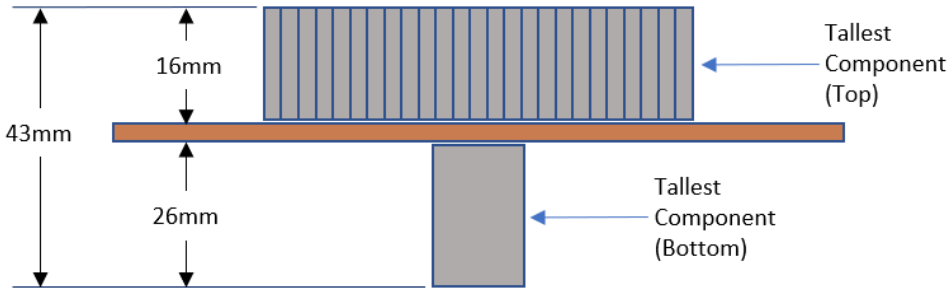

Figure 13: Motherboard Height Dimensions

3 Version History

Version	Date	Comments
1.0	Sep 2020	Initial release.
1.1	Nov 2020	Updated dimensions in Figure 12: Motherboard Dimensions.