Emerald 2 Technical Product Specification

SKUs:

NUC13EMi3 / 1315U

NUC13EMi5 / 1340P

NUC13EMi7 / 1360P

Version 1.1

Date: 01/17/2024

Preface

The purpose of this document is to provide technical references and lower level technical details for customers and developers that will use the Simply NUC “Emerald 2” product. The available SKUs are for this product as follows;

- NUC13EMi3
- NUC13EMi5
- NUC13EMi7

Contents

Tables

Figures

1 Description

1.1 Overview

The Simply NUC Emerald 2 series of systems is a mini computer built with 13 Gen. Intel® processors, i.e. NUC13EMi3, NUC13EMi5, NUC13EMi7.

The Emerald 2 i3 featuring the Intel®1315U Processor and Intel® UHD Graphics has the versatility to span a vast number of applications to enable reliable performance in a small, lightweight package.

The Emerald 2 i7 and i5 featuring the Intel® 1360P i7, Intel® 1350P Processors respectively accompanied with the Intel® Iris Xe Graphics can deliver the power needed for any office computer while running multiple 4K displays to maximize efficiency.

All the Emerald 2 devices have a small form factor with great display output in the form of 3 HDMI ports and 1 USB-C that can be used as an Alt DP. Working from home or the office has never been easier with the lightweight design, making it easy to transport between locations for an optimized experience in both working environments. In addition, the slim chassis and sleek design is great for home office use or streaming movies at home.The small device can be hidden behind a monitor or mounted under a desk to help keep your desk clean and tidy.

Emerald 2 has the following features:

- Intel® Core™ i7-131360P, i5-131340P or i3-131315U Processor
- Intel Integrated graphics Iris Xe (for i7 and i5 variants) & Intel UHD for (for i3 variant)
- Dual Channel / Two DDR4-3200 MT/s / SO-DIMM Socket (ECC not supported)
- M.2 M-KEY Slot for PCIe SSD
- M.2 B-KEY Slot for SATA SSD
- One 10/100/1000/2500Mbps Ethernet Port
- One 10/100/1000Mbps Ethernet Port
- M.2 1216 for Wi-Fi / Bluetooth Radio
- Three HDMI Port (4k, 60Hz)
- One USB 3.2 Gen 1 Type-C Ports (both supporting Alt/DP Mode)
- Two Side USB 3.2 Gen 1 Type-A Ports
- Two Side USB 2.0 Type-A Ports
- 3.5mm Combination Microphone/Headphone Jack
- One Side TF card Port
- Replaceable Lid for Expandable Functionality
- Simply NUC Universal Chassis
- 19VDC / 5 Amp 57W Power Supply Adapter
- 12V – 22V Input Power Supply Range

1.2 Processor

The Emerald 2 CPUs have the following features.

Table 1: CPU Features

Emerald 2	NUC13EMI7	NUC13EMi5	NUC13EMi3
Intel CPU	i7-1360P	i5-1340P	i3-1315
Cores Total / E & P Cores	12 / 4P-8E	12 / 4P-8E	6 / 4P-2E
Threads	16	16	8
Processor Frequency	Max Turbo 5.00 GHz P-Core Max Turbo Frequency 5.00 GHz E-Core Max Turbo Frequency 3.70 GHz	Max Turbo 4.60 GHz P-Core Max Turbo Frequency 4.60 GHz E-Core Max Turbo Frequency 3.40 GHz	Max Turbo 4.50 GHz P-Core Max Turbo Frequency 4.50 GHz E-Core Max Turbo Frequency 3.3Ghz
Cache	18 MB Intel Smart Cache	12 MB Intel Smart Cache	10 MB Intel Smart Cache
Processor TDP	28 Watts	28 Watts	14 Watts
Integrated Graphics	Intel Iris Xe	Intel Iris Xe	Intel UHD for 13 Gen

1.3 Integrated Graphics Processing Unit

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

Table 2: GPU Features

Emerald 2	NUC13EMi7	NUC13EMi5	NUC13EMi3
GPU	Intel Iris Xe	Intel Iris Xe	Intel UHD *for 13th Gen*
GPU Speed	1.50 GHz	1.45 GHz	1.25 GHz
GPU Execution Units	96	*60*	64
Graphics / Displays Output	eDP 1.4b, DP 1.4a, HDMI 2.1	eDP 1.4b, DP 1.4a, HDMI 2.1	eDP 1.3b, DP 1.4a, HDMI 2.1
Maximum Resolution	4096 x 2304 @ 60Hz 7690 x 4320 @ 60 Hz 4096 x 2304 @ 120 Hx	4096 x 2304 @ 60Hz 7690 x 4320 @ 60 Hz 4096 x 2304 @ 120 Hx	4096 x 2304 @ 60Hz 7690 x 4320 @ 60 Hz 4096 x 2304 @ 120 Hx
Maximum Single Display Resolution	7680 x 4320, 60Hz		
Memory Size	System-Shared DDR4 (Up to 64 Gig) Note: ECC memory not Supported		
API Support	DirectX 12 (12_1), OpenGL 4.6, OpenCL 2.0, Vulkan 1.1, Shader Model 6.4		

1.4 Memory

Emerald 2 has two SO-DIMM sockets for system memory with the following features:

- 1.2V LP-DDR4 SDRAM SO-DIMMs / Dual Channel supported
    - interleaved supported
- Serial Presence Detect
- Unbuffered SO-DIMM support (both single & dual-sided)
- Minimum 4GB SO-DIMM supported
- Up to 32 GB SO-DIMMs per socket for a maximum total of 64GB
- Support for DDR4-3200 - MT/s data rate

1.5 Storage

Emerald 2 has one M.2 “M” Key slot for a 2280 storage module supporting either a SATA or PCIe SSD and a SATA high speed header available for storage expansion.

SATA Interface

The M.2 slot is a “M” key slot for a SATA 2280 M.2 module, up to 8TB in density. The SATA header can be connected to a 2.5” HDD or SSD drive, up to 4TB in density. These SATA III ports each have a theoretical maximum transfer rate of 6Gbps.

PCIe Interface

The M.2 slot is a “M” key slot for a 2280 PCIE 4 SSD and one M.2 Key-B slot for 2242 SATA3 SSD.

The M.2 slot is a “B”key slot for a SATA3 2242 M.2 module, up to 2TB in density.
The SATA III port has a theoretical maximum transfer rate of 6Gbps.
The M.2 slot is a M key-lot for an PCIe4 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

RJ-45 Connector For Networking Interface (LAN1)

Emeralds has an Intel I225LM gigabit controller that interfaces to on-board RJ-45 Ethernet connector.

(LAN1) to provide gigabit Ethernet connections. The I225LM controller features Integrated MAC + BASE-T PHY

- MDI standard IEEE 802.3 Ethernet interface for 2500BASE-T, 1000BASE-T, 100BASE TX, and 10BASE-TE
- MDI / Medium Dependent Interface lane swap supported
- IEEE 802.3 auto-negotiator
- IEEE 802.3x and IEEE 802.3z compliant flow control support w/ 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.

RJ-45 Connector For Networking Interface (LAN2)

Emerald 2 also has an Intel I219LM gigabit controller that interfaces to on-board RJ-45 Ethernet connector.

(LAN2) to provide gigabit Ethernet connections. The I219LM controller features

- 10 BASE-T IEEE 802.3 specification compliance
- 100 BASE-TX IEEE 802.3 specification compliance
- 1000 BASE-T IEEE 802.3 specification compliance
- Energy Efficient Ethernet (EEE)
- IEEE 802.3az support [Low Power Idle (LPI) mode]
- IEEE 802.3u auto-negotiation conformance
- Supports carrier extension (half duplex)
- Advanced digital baseline wander correction
- Automatic MDI/MDIX crossover at all speeds of operation
- Automatic polarity correction
- MDC/MDIO management interface
- 802.1as/1588 conformance
- Power Optimizer Support
- Network proxy/ARP Offload support
- Jumbo Frames (up to 9 kB)
- 802.1Q & 802.1p
- Receive Side Scaling (RSS)
- Two Queues (Tx & Rx)
- Ultra Low Power at cable disconnect
    - Reduced power consumption during normal operation and power down modes
    - Low Power Link-Up (LPLU)
- Supports APM (Wake on LAN) an ACPI

Wireless Networking Interface

Emerald 2 uses an intel Ax201 module

By implementing the new 802.11ax standard, with its unique features such as OFDMA, 1024QAM, Target Wake Time (TWT) and spatial reuse, the Intel® Wi-Fi 6 AX201 module enables smooth streaming of high resolution videos, fewer dropped connections, and faster connections farther away from the router and in dense environments. When using Wi-Fi 6 technology with 1024QAM and 160MHz channels, the Intel® Wi-Fi 6 AX201 module can deliver nearly 3x higher peak data rates4 (up to 2.4Gbps) and up to 4x capacity improvement in dense or congested environments compared to 802.11ac5 . Intel® Wi-Fi 6 AX201 module supports the new WPA3* security features, enabling next generation authentication and military-grade encryption.

Bluetooth Wireless Interface

Bluetooth® 5.2 provides 4x6 range over Bluetooth® 4.2 using the same Tx power, enabling coverage throughout the home. Bluetooth® 5.2 also doubles data rate speed for faster transmissions, thereby reducing the overall power consumption6. Additionally, Bluetooth® 5.2 adds new, enhanced data broadcasting, enabling seamless location-based services and simpler pairing for Bluetooth® devices.

2 Technical Reference

2.1 Motherboard Headers

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

Figure 2: Bottom Side Header Locations

Pin	Header	Identifier	Pin
1	DC Power Jack	M.2 B-Key slot for storage(2242)	12

2	RJ45 2.5GbE	Front Panel Wafer	13
3	RJ45 1GbE	SIM-Card Connector	14
4	HDMI A PORT	2.5 inch HDD-Power Wafer	15
5	3.5mm Audio Jack	SATA Data Connector	16
6	USB3.0 A PORT	CMOS battery Wafer	17
7	USB-C PORT	Always Power on Jumper	18
8	USB2.0 A PORT	Fan Wafer	19
9	TF Card PORT	Clear CMOS Button	20
10	DDR4 SODIMM Socket	USB2.0 Wafer	21
11	M.2 M-key slot for storage (2280)		

Table 3: Bottom-Side Header Definitions

DDR4 SO-DIMM Sockets

The Emerald 2 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

M.2 For Storage

The M.2 storage socket(M-KEY) supports PCI Express (PCIe) drives in a 2280 key-M module. PCIe drives utilizing 4X PCIe Gen4 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	NC	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	SMB_DATA	PERp0/SATA-B-	43
40	SMB_CLK	PERn0/SATA-B+	41
38	DEVSLP (O)	GND	39
36	N/C	PETp1	37

Pin	Signal	Signal	Pin
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

M.2 B-Key Slot For Storage

The M.2 storage socket(B-Key) supports SATA3 drives in a 2242 key-B module or Sierra 4G module （EM7411. SATA drives can deliver up to 6Gbps bandwidth.

Pin	Signal	Signal	Pin
74	3V3	NC	75
72	3V3	GND	73
70	3V3	GND	71
68	NC	NC	69
66	NC	WWAN-RESET/Pull high	67
64	NC	NC	65
62	NC	NC	63
60	NC	NC	61
58	NC	NC	59
56	NC	GND	57
54	NC	NC	55
52	NC	NC	53
50	NC	GND	51
48	NC	SATA-TXP	49
46	NC	SATA-TXN	47
44	NC	GND	45
42	NC	SATA-RXN	43
40	NC	SATA-RXP	41
38	NC	GND	39
36	SIM-PWR	USB3.0-TXP	37
34	SIM-DATA	USB3.0-TXN	35
32	SIM-CLK	GND	33
30	SIM-RST	USB3.0-RXP	31
28	NC	USB3.0-RXN	29

26	NC	GND	27
24	NC	NC	25
22	NC	NC	23
20	NC	NC	21
18	CONNECTOR KEY	CONNECTOR KEY	19
16	CONNECTOR KEY	CONNECTOR KEY	17
14	CONNECTOR KEY	CONNECTOR KEY	15
12	CONNECTOR KEY	CONNECTOR KEY	13
10	WWAN-LED driver	GND	11
8	WWAN-DISABLE	USB2.0-DM	9
6	WWAN-FULL-CARD-POWER-ON/OFF	USB2.0-DP	7
4	3V3	GND	5
2	3V3	GND	3
		NC	1

Front Panel

Front panel connector is 1.25mm pitch and 6 Pin wafer.

Pin	Signal
1	3V3
2	Work led(work:light sleep:blind/0:light)
3	Standby led（standby：light/0:light）
4	Power key (standby and sleep,press it,power on/0:ACTIVE)
5	IR in (remote receiver)
6	GND

SATA Power Header

The motherboard has a 2.54mm, 1x2, 2-circuit, male header used to provide 5V power to the SATA III connector.

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.

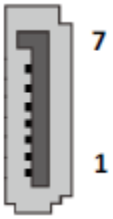


Figure 6: SATA III Connector

Table 5: SATA III Connector Pinout

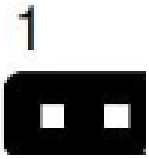
Pin	Signal Definition
1	GND
2	TX+
3	TX-
4	GND
5	RX
6	RX+
7	GND

POE Module Header

The two POE module headers are intended only for use with the optional POE module. The module mounts and connects to the motherboard through these two headers.

Clear CMOS Button

1. CMOS battery Wafer
2. It is a 2 pin and 1.25mm pitch wafer connector.Connect CMOS battery



Pin	Signal
1	CMOS BATTERY INPUT PIN, 2V---3.3V active
2	GND

2.2 Chassis I/O Connectors

Connectors - Side Panel

Front-side connector locations are shown below.

Figure 8: Side Connector Locations

Table 13: Side Connections Defined

Identifier	Connector
1	SD card Reader
2	Dual USB 2.0 Gen2 Type-A
3	USB 3. Gen2 Type-C
4	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 1.2a via DP Alt Mode to display output with a maximum output resolution of 4096 x 2160, 60Hz.

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
1	Wi-Fi Antenna
2	DC Power Connector
3	RJ-45 for Gigabit Ethernet (LAN1)
4	RJ-45 for 2.5 Gigabit Ethernet (LAN2)
5	Kensington Lock
6	HDMI
7	3.5mm Audio port

2.3 Mechanical Dimensions

The dimensions of PCB board is 148x105x1.2mm

PCB Chassis Mount

The dimensions of PCB board is 148x105x1.2mm

3 Environmental Specifications

Table 15: Environmental Specifications

Condition	Specification
Input Voltage	19V ±10%
Input Voltage Connector	5.5 x 2.5mm Barrel Plug
Recommended PSU Wattage	24W
Operating Temperature	0°C– 30°C
Operating Humidity	5% – 90%
Storage Temperature	-10°C – 50°C
Storage Humidity	5% – 90%

4 Version History

Version	Date	Comments
0.9	*01/11/24*	*Initial Release For Review & Comment…*
1.0	*01/12/24*	*Initial Release*
1.1	*01/17/24*	*Updating the mid =-range Processor SKU to the 1340P variant…*