

Intel® NUC 8 Essential Compute Element Intel® NUC 8 Pro Compute Element Product Specification

Revision 1.1

Regulatory Model: CM8CB

July 2020

Intel® NUC 8 Essential Compute Element CM8CCB4R, CM8PCB4R, Intel® NUC 8 Pro Compute Element CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N or CM8V7CB8N 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 this product specification

Revision History

| Revision | Revision History | Date |
|----------|--|--------------|
| 1.0 | First release | October 2019 |
| 1.1 | BIOS version number updated, processor stepping/spec updated, connector pin out changed. | July 2020 |
| | | |
| | | |

Disclaimer

This product specification applies only to the standard Intel® NUC 8 Essential/Pro Compute Element with BIOS identifier CBWHL357.86A or CBWHLMIV.86A.

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Preface

This Product Specification specifies the layout, components, connectors, power and environmental features for the Intel® NUC 8 Essential Compute Element CM8CCB4R, CM8PCB4R, Intel® NUC 8 Pro Compute Element CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N or CM8V7CB8N.



NOTE

In this document, the use of “Intel® NUC 8 Essential Compute Element” will refer to the CM8CCB4R or CM8PCB4R versions. The use of Intel® NUC 8 Pro Compute Element will refer to the CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N and CM8V7CB8N versions.

Intended Audience

This document is intended to provide technical information about Intel® NUC 8 Essential Compute Element CM8CCB4R, CM8PCB4R, Intel® NUC 8 Pro Compute Element CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N or CM8V7CB8N 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 CM8CCB4R, CM8PCB4R, CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N or CM8V7CB8N features |
| 2 | A technical description of the CM8CCB4R, CM8PCB4R, CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N or CM8V7CB8N |

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. |

Intel® NUC 8 Essential/Pro Compute Element Identification Information

Intel® NUC 8 Essential/Pro Compute Element Identification Information

| AA Revision | Product Code | Original BIOS Revision | Notes |
|-------------|--------------|------------------------|-------|
| K53739-203 | BKCM8CCB4R | CBWHL357.0058 | 1,2 |
| K53742-203 | BKCM8PCB4R | CBWHL357.0058 | 1,3 |
| K53744-203 | BKCM8I3CB4N | CBWHL357.0058 | 1,4 |
| K53746-203 | BKCM8I5CB8N | CBWHL357.0058 | 1,5 |
| K53774-203 | BKCM8V5CB8N | CBWHLMIV.0058 | 1,6 |
| K53740-203 | BKCM8I7CB8N | CBWHL357.0058 | 1,7 |
| K53738-203 | BKCM8V7CB8N | CBWHLMIV.0058 | 1,8 |

Notes:

- The AA number is found on the Mylar cover.
- The Intel® Celeron® 4305U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|-----------------------|----------|-----------|
| Intel® Celeron® 4305U | V0 | SRFA5 |

- The Intel® Pentium® Gold 5405U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|----------------------------|----------|-----------|
| Intel® Pentium® Gold 5405U | V0 | SRFG1 |

- The Intel® Core™ i3-8145U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|-----------------------|----------|-----------|
| Intel® Core™ i3-8145U | V0 | SRFFZ |

- The Intel® Core™ i5-8265U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|----------------------|----------|-----------|
| Intel Core™ i5-8265U | V0 | SRFFX |

- The Intel® Core™ i5-8365U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|-----------------------|----------|-----------|
| Intel® Core™ i5-8365U | V0 | SRF9Z |

- The Intel® Core™ i5-8365U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|-----------------------|----------|-----------|
| Intel® Core™ i7-8565U | V0 | SRFFW |

- The Intel® Core™ i5-8365U processor is used on this AA revision consisting of the following component:

| Device | Stepping | Spec Code |
|-----------------------|----------|-----------|
| Intel® Core™ i7-8665U | V0 | SRF9W |

Specification Changes or Clarifications

The table below indicates the Specification Changes or Specification Clarifications that apply to the Intel® NUC 8 Essential Compute Element CM8CCB4R, CM8PCB4R, Intel® NUC 8 Pro Compute Element CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N or CM8V7CB8N.

Specification Changes or Clarifications

| Date | Type of Change | Description of Changes or Clarifications |
|-----------|----------------------------|---|
| July 2020 | BIOS Version, connector | Clarified actual BIOS versions for current shipping products, changed pin numbers 214, 216, 220 and 222 to reserved |
| | | |

Errata

Current characterized errata, if any, will be documented in Section 3 of this Product Specification.

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1 Product Description

1.1 Overview

The Intel® NUC 8 Essential Compute Element and the Intel® NUC 8 Pro Compute Element are System-on-Module architecture optimized for integrated designs. The NUC 8 Essential/Pro Compute Element consists of the processor, memory, wireless, Bluetooth*, integrated heat shield and depending on the model may include storage and discrete TPM. See Table 1 for a summary.

The Intel® NUC 8 Essential Compute Element and the Intel® NUC 8 Pro Compute Element require a compatible carrier board in order to operate.

For information on compatible devices for use with the Intel® NUC 8 Essential Compute Element and the Intel® NUC 8 Pro Compute Element see <http://www.intel.com/NUCElements>.

1.2 Version Summary

There are two different versions of this model of Intel® NUC 8 Essential Compute Element and five different versions of this model of Intel® NUC 8 Pro Compute Element available which are summarized in Table 1. Unless otherwise noted in this document, not all features are available on all versions.

Table 1. Version Summary

| Version | Intel® vPro™ | Discrete TPM | Memory | Storage | Processor |
|----------------------|--------------|--------------|--------|---------|----------------------------|
| CM8CCB4R (Essential) | No | No | 4 GB | 64 GB | Intel® Celeron® 4305U |
| CM8PCB4R (Essential) | No | No | 4 GB | 64 GB | Intel® Pentium® Gold 5405U |
| CM8I3CB4N (Pro) | No | No | 4 GB | None | Intel® Core™ i3-8145U |
| CM8I5CB8N (Pro) | No | No | 8 GB | None | Intel® Core™ i5-8265U |
| CM8V5CB8N (Pro) | Yes | Yes | 8 GB | None | Intel® Core™ i5-8365U |
| CM8I7CB8N (Pro) | No | No | 8 GB | None | Intel® Core™ i7-8565U |
| CM8V7CB8N (Pro) | Yes | Yes | 8 GB | None | Intel® Core™ i7-8665U |



NOTE

Intel® NUC 8 Essential Compute Elements and Intel® NUC 8 Pro Compute Elements listed in Table 1 have been certified for use as a component in Information Technology Equipment in certain countries. The system integrator is responsible for testing and acquiring any additional country-specific regulatory approvals, including all system-wide certifications.



NOTE

For information on how to design a carrier board and/or an enclosure for the Intel® NUC 8 Essential Compute Element or the Intel® NUC 8 Pro Compute Element a design guide is available on [MyIntel](#).

1.3 Feature Summary

Table 2 summarizes the major features of the Intel® NUC 8 Essential and Intel® NUC 8 Pro Compute Elements.

Table 2. Feature Summary

| | |
|--|---|
| Size | 95 millimeters by 65 millimeters by 6 millimeters |
| Processor | <ul style="list-style-type: none"> • Soldered-down Intel® processor <ul style="list-style-type: none"> ○ Integrated graphics ○ Integrated memory controller ○ Integrated PCH • The following processors are supported <ul style="list-style-type: none"> ○ Intel® Celeron® 4305U ○ Intel® Pentium® Gold 5405U ○ Intel® Core™ i3-8145U ○ Intel® Core™ i5-8265U ○ Intel® Core™ i5-8365U ○ Intel® Core™ i7-8565U ○ Intel® Core™ i7-8665U |
| Memory | <ul style="list-style-type: none"> • Soldered-down dual-channel LPDDR3 memory • 4 GB total memory for CM8CCB4R, CM8PCB4R at 1866 MHz • 4GB total memory for CM8I3CB4N at 2133 MHz • 8 GB total memory for CM8I5CB8N, CM8V5CB8N, CM8I7CB8N and CM8V7CB8N at 2133 MHz |
| Graphics | <p>Integrated graphics support with Intel® HD Graphics Technology</p> <ul style="list-style-type: none"> • Two Digital Display Interface (DDI) lanes are available from the Compute Element connector that are configured as DisplayPort++ (HDMI can be supported on the carrier board) • High-Bandwidth Digital Content Protection support for content protection <ul style="list-style-type: none"> ○ HDCP 2.2 supported via DisplayPort* ○ HDCP 1.4 supported via HDMI* • Resolutions and refresh rates supported <ul style="list-style-type: none"> ○ Up to 4K @ 60Hz via DisplayPort ○ Up to 4K @ 30Hz via HDMI |
| Audio | Intel® High Definition (Intel® HD) Audio via the Digital Display Lanes using either DisplayPort or HDMI |
| Storage | 64GB soldered down eMMC 5.1 HS400 for CM8PCB4R and CM8CCB4R There is no onboard storage for CM8I3CB4N, CM8I5CB8N, CM8V5CB8N, CM8I7CB8N and CM8V7CB8N |
| BIOS | <ul style="list-style-type: none"> • 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) |
| Wireless LAN | <p>Soldered-down Intel® Dual Band Wireless-AC 9560</p> <ul style="list-style-type: none"> • 802.11a/b/g/n, 802.11ac, Bluetooth* 5.0 • Antennas are not included |
| Interfaces Supported via the Edge Connector | <ul style="list-style-type: none"> • 4 USB 3.1 (Gen 2*) • 3 USB 2.0 • 1 PCIe x1 (Gen 3) • 1 PCIe x4 (Gen 3) • 1 PCIe x4 (Gen 3) or SATA III (configurable) • 1 GbE PHY |

* USB 3.1 (Gen 1) is supported on the CM8PCB4R

| | |
|--|--|
| Advanced Technologies | <ul style="list-style-type: none"> • Intel® vPro™ Technology (CM8V5CB8N and CM8V7CB8N only) • Intel® Virtualization Technology (VT-x) • Intel® Virtualization for Directed I/O (VT-d) • Intel® VT-x with Extended Page Tables (EPT) • Intel® Speed Shift Technology • Intel® Turbo Boost Technology • Intel® Hyper-Threading Technology • Enhanced Intel® SpeedStep® Technology • Intel® Identity Protection Technology (Intel® IPT) • Intel® Platform Trust Technology (Intel® PTT) – (CM8CCB4R, CM8PCB4R, CM8I3CB4N, CM8I5CB8N and CM8I7CB8N only) |
| Security and Reliability | <ul style="list-style-type: none"> • Intel® Active Management Technology 11.0 (Intel® AMT) – (CM8V5CB8N and CM8V7CB8N only) • Intel® Trusted Execution Technology (Intel® TXT) – (CM8V5CB8N and CM8V7CB8N only) • Intel® Memory Protection Extensions (Intel® MPX) • Intel® Software Guard Extensions (Intel® SGX) • Intel® AES New Instructions • Execute Disable Bit • Nuvoton NPCT650AAAYx Discreet Trusted Platform Module 2.0 (TPM) – (CM8V5CB8N and CM8V7CB8N only) |
| Operating Systems Support (64-bit only) | <ul style="list-style-type: none"> • Windows* 10 Home • Windows 10 Pro • Windows 10 Enterprise • Windows 10 Education • Windows 10 IoT Enterprise • Some Linux* operating systems may be supported. Check with the specific Linux distribution to make sure that support is available for this platform. |
| Supported Connectors | <ul style="list-style-type: none"> • Lotes APCI0468-P001A01 Edge Mount Connector • Lotes APCI0468-P002A01 Edge Mount Connector • Lotes APCI0480-P001A01 Surface Mount Connector • Lotes APCI0480-P002A01 Surface Mount Connector |

To find information about...

- Intel® NUC Elements
- Intel® NUC Element Support
- Intel® NUC Element Warranty Information
- Available configurations for Intel® NUC 8 Pro Compute Element
- Available configurations for Intel® NUC 8 Essential Compute Element
- Intel Processors
- Intel Graphics
- Intel Wireless
- Intel Technologies

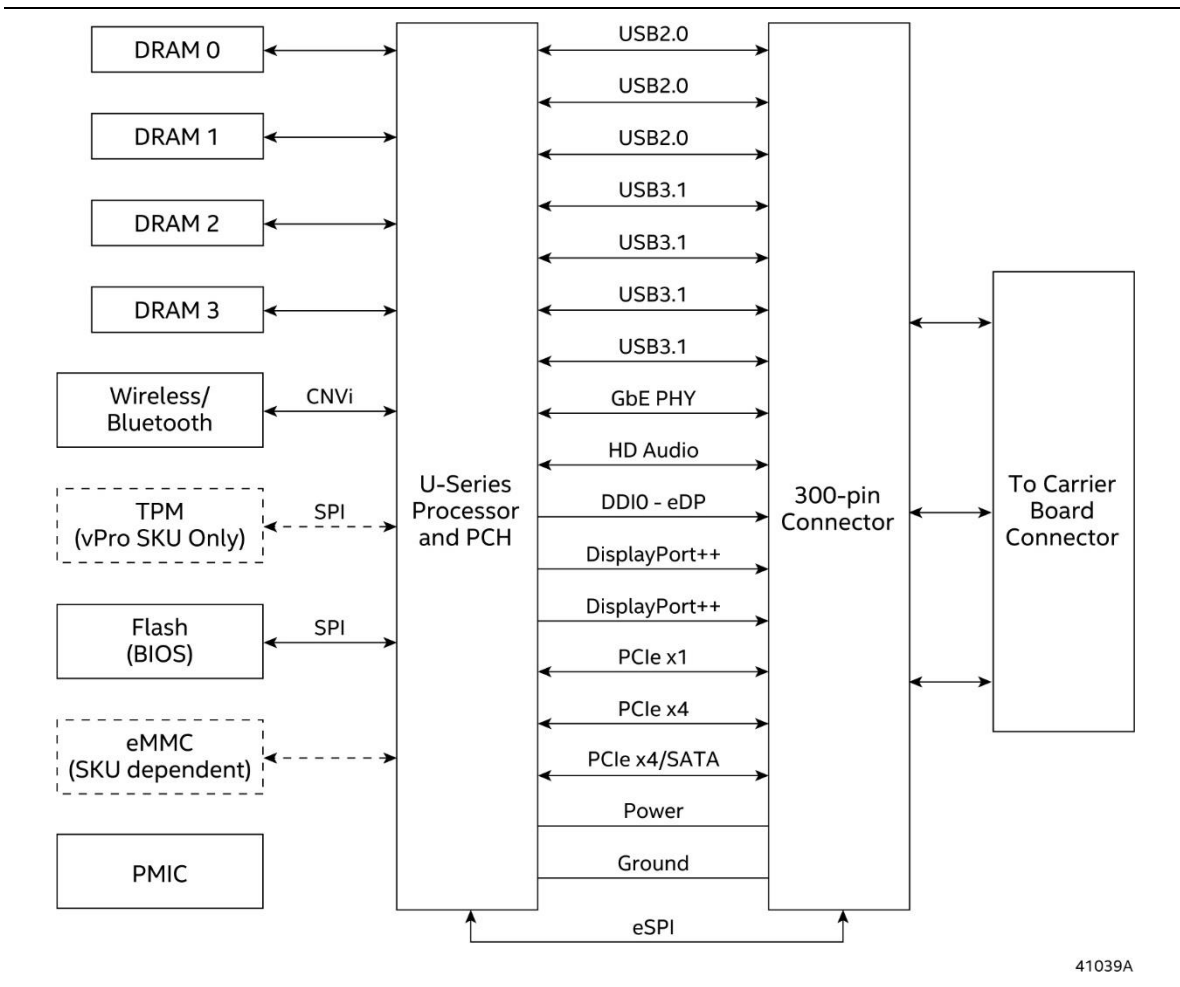
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2 Technical Reference

2.1 Block Diagram

Figure 1 is a block diagram of the major functional areas of Intel® NUC 8 Essential Compute Element and the Intel® NUC 8 Pro Compute Element.

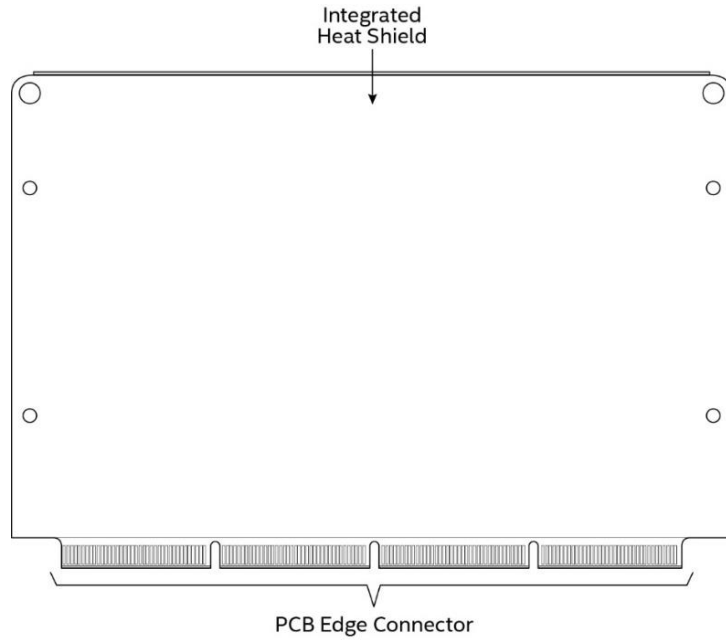


41039A

Figure 1. Block Diagram

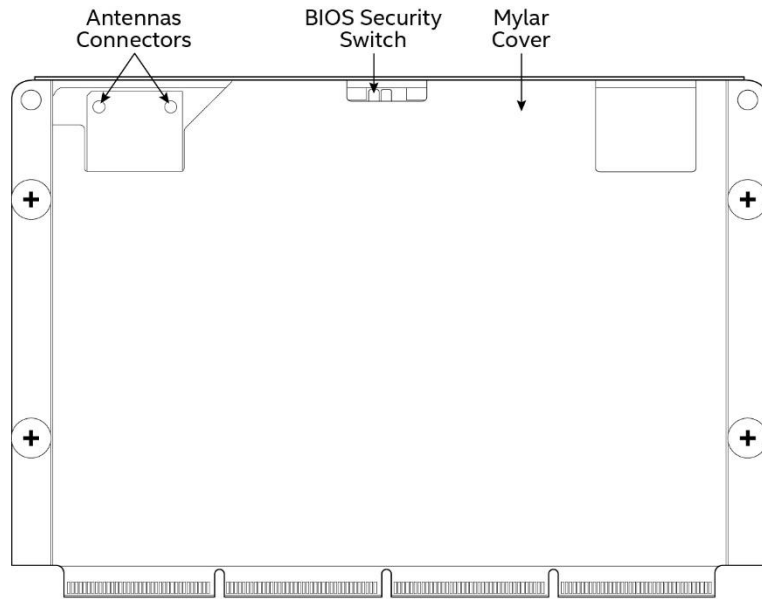
2.2 Compute Element Exterior

The NUC 8 Essential/Pro Compute Element has a set of gold fingered connections along one edge. On one side is the Integrated Heat Shield (IHS). On the other side is a Mylar cover for the PCB. See Figure 2 and Figure 3.



41017

Figure 2. Integrated Heat Shield Side



41016

Figure 3. Mylar Side

2.3 Connector

The NUC 8 Essential/Pro Compute Element gold finger edge connector mates with the following LOTES* connectors shown in Table 3.

Table 3. LOTES Connector Options

| Part Number | Description |
|------------------|---|
| APCI0468-P001A01 | Edge Mount, LCP_Black, Copper Alloy, Au_15u" |
| APCI0468-P002A01 | Edge Mount, LCP_Black, Copper Alloy, Au_30u" |
| APCI0480-P001A01 | Surface Mount, LCP_Black, Copper Alloy, Au_15u" |
| APCI0480-P002A01 | Surface Mount, LCP_Black, Copper Alloy, Au_30u" |

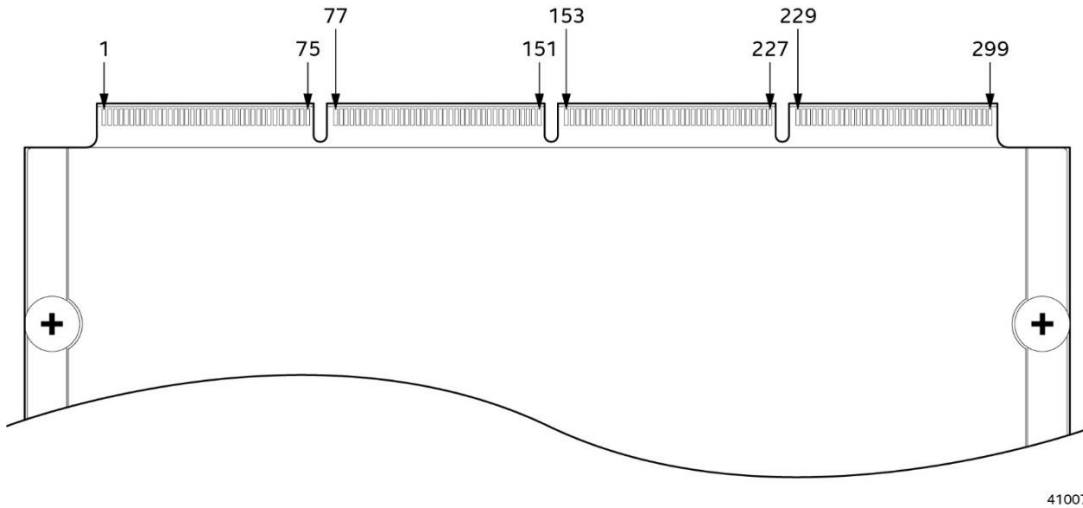


Figure 4. Connector with Pinout – Mylar Side

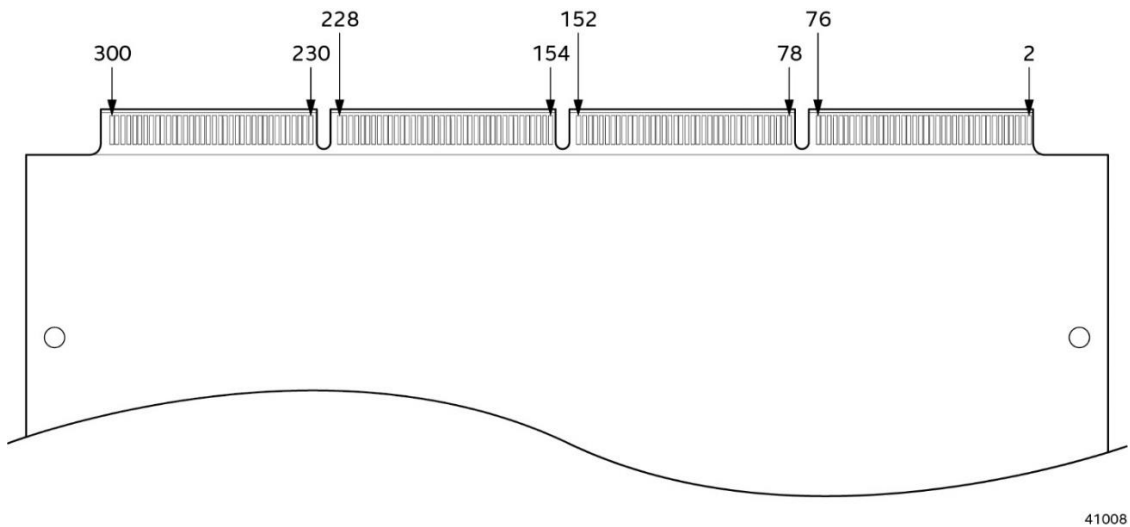


Figure 5. Connector with Pinout – IHS Side

2.3.1 Connector Pin-Out

The below tables list the pin numbers and their signals:

Table 4. Connector Segment One with Pin Numbers and Signals

| Pin | Signal | Pin | Signal |
|-----|------------------|-----|---------------------|
| 1 | VBAT_PWR | 2 | GND |
| 3 | VBAT_PWR | 4 | DDI2_Lane0_Dn |
| 5 | VBAT_PWR | 6 | DDI2_Lane0_Dp |
| 7 | VBAT_PWR | 8 | GND |
| 9 | VBAT_PWR | 10 | DDI2_Lane1_Dn |
| 11 | VBAT_PWR | 12 | DDI2_Lane1_Dp |
| 13 | VBAT_PWR | 14 | GND |
| 15 | VBAT_PWR | 16 | DDI2_Lane2_Dn |
| 17 | VBAT_PWR | 18 | DDI2_Lane2_Dp |
| 19 | VBAT_PWR | 20 | GND |
| 21 | No Connect | 22 | DDI2_Lane3_Dn |
| 23 | COIN_RTC_3p3V_IN | 24 | DDI2_Lane3_Dp |
| 25 | RSVD | 26 | GND |
| 27 | PCIe_SRC0_CLK_Dn | 28 | DDI1_Lane0_Dn |
| 29 | PCIe_SRC0_CLK_Dp | 30 | DDI1_Lane0_Dp |
| 31 | GND | 32 | GND |
| 33 | PCIe_SRC1_CLK_Dn | 34 | DDI1_Lane1_Dn |
| 35 | PCIe_SRC1_CLK_Dp | 36 | DDI1_Lane1_Dp |
| 37 | GND | 38 | GND |
| 39 | PCIe_SRC2_CLK_Dn | 40 | DDI1_Lane2_Dn |
| 41 | PCIe_SRC2_CLK_Dp | 42 | DDI1_Lane2_Dp |
| 43 | GND | 44 | GND |
| 45 | PCIe_SRC3_CLK_Dn | 46 | DDI1_Lane3_Dn |
| 47 | PCIe_SRC3_CLK_Dp | 48 | DDI1_Lane3_Dp |
| 49 | GND | 50 | GND |
| 51 | RSVD | 52 | DDI1_AUX_Dn |
| 53 | RSVD | 54 | DDI1_AUX_Dp |
| 55 | GND | 56 | DDI1_HPD_Q |
| 57 | CLKREQ_SRC0_N | 58 | DG_CIO_PLUG_EVENT_N |
| 59 | CLKREQ_SRC1_N | 60 | RSVD |
| 61 | CLKREQ_SRC2_N | 62 | GND |
| 63 | CLKREQ_SRC3_N | 64 | SUSCLK |
| 65 | RSVD | 66 | GND |
| 67 | GND | 68 | ACPRESENT |
| 69 | DDI2_AUX_Dp | 70 | BATLOW# |
| 71 | DDI2_AUX_Dn | 72 | INTRUDER |
| 73 | DDI2_HPD_Q | 74 | THRMTRIP# |
| 75 | GND | 76 | Psys_Input |

Table 5. Connector Segment Two with Pin Numbers and Signals

| Pin | Signal | Pin | Signal |
|-----|---------------------------|-----|---------------------|
| 77 | GND | 78 | GND |
| 79 | PCIE13_M2_SSD_RX_Dn | 80 | eDP_Tx0_Dn |
| 81 | PCIE13_M2_SSD_RX_Dp | 82 | eDP_Tx0_Dp |
| 83 | GND | 84 | GND |
| 85 | PCIE13_M2_SSD_R_TX_Dn | 86 | eDP_Tx1_Dn |
| 87 | PCIE13_M2_SSD_R_TX_Dp | 88 | eDP_Tx1_Dp |
| 89 | GND | 90 | GND |
| 91 | PCIE14_M2_SSD_RX_Dn | 92 | eDP_Tx2_Dn |
| 93 | PCIE14_M2_SSD_RX_Dp | 94 | eDP_Tx2_Dp |
| 95 | GND | 96 | GND |
| 97 | PCIE14_M2_SSD_TX_Dn | 98 | eDP_Tx3_Dn |
| 99 | PCIE14_M2_SSD_TX_Dp | 100 | eDP_Tx3_Dp |
| 101 | GND | 102 | GND |
| 103 | PCIE15_M2_SSD_RX_Dn | 104 | eDP_AUX_Dn |
| 105 | PCIE15_M2_SSD_RX_Dp | 106 | eDP_AUX_Dp |
| 107 | GND | 108 | eDP_HPD_Q |
| 109 | PCIE15_M2_SSD_TX_Dn | 110 | GND |
| 111 | PCIE15_M2_SSD_TX_Dp | 112 | eDP_VDD_En |
| 113 | GND | 114 | eDP_BKLT_Ctrl |
| 115 | PCIE16_SATA2_M2_SSD_RX_Dn | 116 | eDP_BKLT_En |
| 117 | PCIE16_SATA2_M2_SSD_RX_Dp | 118 | GND |
| 119 | GND | 120 | DDC1_CTRL_CK |
| 121 | PCIE16_SATA2_M2_SSD_RX_Dn | 122 | DDC1_CTRL_DATA |
| 123 | PCIE16_SATA2_M2_SSD_TX_Dp | 124 | DDC2_CTRL_CK |
| 125 | GND | 126 | DDC2_CTRL_DATA |
| 127 | RSVD | 128 | RSVD |
| 129 | RSVD | 130 | GND |
| 131 | GND | 132 | HDA_SYNC |
| 133 | RSVD | 134 | HDA_BCLK |
| 135 | RSVD | 136 | HDA_SDO |
| 137 | GND | 138 | HDA_SDIO |
| 139 | PCIE10_P1_RX_Dn | 140 | HDA_SDI1/SNDW1_DATA |
| 141 | PCIE10_P1_RX_Dp | 142 | HDA_RSTB/SNDW1_CLK |
| 143 | GND | 144 | PCH_SPKR |
| 145 | PCIE10_P1_TX_Dn | 146 | GND/DETECT |
| 147 | PCIE10_P1_TX_Dp | 148 | RSVD |
| 149 | GND | 150 | RSVD |
| 151 | DG_PERST_N | 152 | RSVD |

Table 6. Connector Segment Three with Pin Numbers and Signals

| Pin | Signal | Pin | Signal |
|-----|-----------------|-----|-----------------|
| 153 | SML0_CLK | 154 | SML0_DATA |
| 155 | GND | 156 | GND |
| 157 | RSVD | 158 | USB2_P1_Dn |
| 159 | RSVD | 160 | USB2_P1_Dp |
| 161 | GND | 162 | GND |
| 163 | RSVD | 164 | USB2_P2_Dn |
| 165 | RSVD | 166 | USB2_P2_Dp |
| 167 | GND | 168 | GND |
| 169 | PCIE9_LAN_RX_Dn | 170 | USB2_P3_Dn |
| 171 | PCIE9_LAN_RX_Dp | 172 | USB2_P3_Dp |
| 173 | GND | 174 | GND |
| 175 | PCIE9_LAN_TX_Dn | 176 | USB2_P4_Dn |
| 177 | PCIE9_LAN_TX_Dp | 178 | USB2_P4_Dp |
| 179 | GND | 180 | GND |
| 181 | PCIE5_X4_RX_Dn | 182 | USB_OC_0_N |
| 183 | PCIE5_X4_RX_Dp | 184 | LAN_WAKE_N |
| 185 | GND | 186 | PCH_EC_SLPSUS_L |
| 187 | PCIE5_X4_TX_Dn | 188 | PCH_EC_SLP_S0 |
| 189 | PCIE5_X4_TX_Dp | 190 | WIFI_DISABLE_N |
| 191 | GND | 192 | LAN_DISABLE_N |
| 193 | PCIE6_X4_RX_Dn | 194 | GND |
| 195 | PCIE6_X4_RX_Dp | 196 | ESPI_IO_0 |
| 197 | GND | 198 | ESPI_IO_1 |
| 199 | PCIE6_X4_TX_Dn | 200 | ESPI_IO_2 |
| 201 | PCIE6_X4_TX_Dp | 202 | ESPI_IO_3 |
| 203 | GND | 204 | ESPI_CS_N |
| 205 | PCIE7_X4_RX_Dn | 206 | ESPI_RESET_N |
| 207 | PCIE7_X4_RX_Dp | 208 | GND |
| 209 | GND | 210 | ESPI_CLK |
| 211 | PCIE7_X4_TX_Dn | 212 | GND |
| 213 | PCIE7_X4_TX_Dp | 214 | RSVD |
| 215 | GND | 216 | RSVD |
| 217 | PCIE8_X4_RX_Dn | 218 | GND |
| 219 | PCIE8_X4_RX_Dp | 220 | RSVD |
| 221 | GND | 222 | RSVD |
| 223 | PCIE8_X4_TX_Dn | 224 | GND |
| 225 | PCIE8_X4_TX_Dp | 226 | PECI |
| 227 | GND | 228 | GND |

Table 7. Connector Segment Four with Pin Numbers and Signal

| Pin | Signal | Pin | Signal |
|-----|----------------|-----|-----------------------|
| 229 | SML1_CLK | 230 | SMB_CLK |
| 231 | SML1_DATA | 232 | SMB_DATA |
| 233 | GND | 234 | SMB_ALERT_N |
| 235 | USB3_P1_TX_Dp | 236 | GND |
| 237 | USB3_P1_TX_Dn | 238 | SML0_ALERT_N |
| 239 | GND | 240 | SML1_ALERT_N |
| 241 | USB3_P1_RX_Dp | 242 | GND |
| 243 | USB3_P1_RX_Dn | 244 | DG_PCIE_WAKE_N |
| 245 | GND | 246 | PCH_SATA2_PEDET |
| 247 | USB3_P2_TX_Dp | 248 | DG_RTD3_PWR_EN |
| 249 | USB3_P2_TX_Dn | 250 | PCH_M2_DEVSPLP |
| 251 | GND | 252 | PCH_PCIE_WAKE_N |
| 253 | USB3_P2_RX_Dp | 254 | PCH_SATA_LED_CTRL |
| 255 | USB3_P2_RX_Dn | 256 | PROCHOT_N |
| 257 | GND | 258 | PCH_EC_ME_CONFIG |
| 259 | USB3_P3_TX_Dp | 260 | RSMRST_N |
| 261 | USB3_P3_TX_Dn | 262 | SYS_RESET_N |
| 263 | GND | 264 | PWRBTN_N |
| 265 | USB3_P3_RX_Dp | 266 | GND |
| 267 | USB3_P3_RX_Dn | 268 | ISH_I2C0_SDA |
| 269 | GND | 270 | ISH_I2C0_SCL |
| 271 | USB31_P4_TX_Dp | 272 | GND |
| 273 | USB31_P4_TX_Dn | 274 | ISH_I2C1_SDA |
| 275 | GND | 276 | ISH_I2C1_SCL |
| 277 | USB31_P4_RX_Dp | 278 | GND |
| 279 | USB31_P4_RX_Dn | 280 | ISH_GPIO_0 |
| 281 | GND | 282 | ISH_GPIO_1 |
| 283 | USB2_P5_Dp | 284 | ISH_GPIO_2 |
| 285 | USB2_P5_Dn | 286 | ISH_GPIO_3 |
| 287 | GND | 288 | ISH_GPIO_4/I2C1_IRQ_N |
| 289 | USB2_P6_Dp | 290 | GND |
| 291 | USB2_P6_Dn | 292 | I2C0_SDA |
| 293 | GND | 294 | I2C0_SCL |
| 295 | USB2_P7_Dp | 296 | GND |
| 297 | USB2_P7_Dn | 298 | I2C1_SDA |
| 299 | GND | 300 | I2C1_SCL |

2.4 Antenna Connection

The NUC 8 Essential/Pro Compute Element wireless module does not have any antennas connected. For wireless and Bluetooth operation appropriate antennas will be required. Depending on the enclosure design internal or external antennas can be supported. Figure 6 shows the location of the two antenna connectors on the Mylar side.

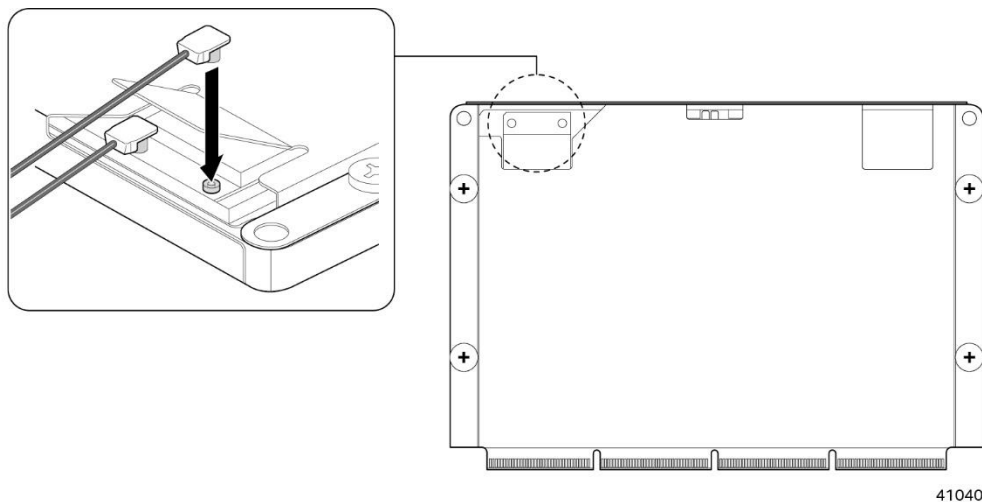


Figure 6. Location of the Antenna Connectors

The wireless module uses a standard 2x2 mm size RF micro coaxial receptacle (connector) with an outer diameter of 1.5 mm as defined in the PCI-E M.2 Specification. Specific plugs should be selected to suit the assembly allowable mating height and cable diameter. Refer to the PCI-E M.2 Specification for the minimum requirements of the compatible RF connectors and mating plugs.

- Receptacle physical outline is 2mm x 2mm x 0.6mm
- Receptacle outer diameter is 1.5mm

2.5 BIOS Security Switch

Figure 7 shows the location of the BIOS Security Switch. The 3-position switch determines the BIOS Security program's mode.



CAUTION

Do not change the switch with the power on. Always turn off the power and unplug the power cord from the carrier board before changing a switch setting. Otherwise, the board could be damaged.

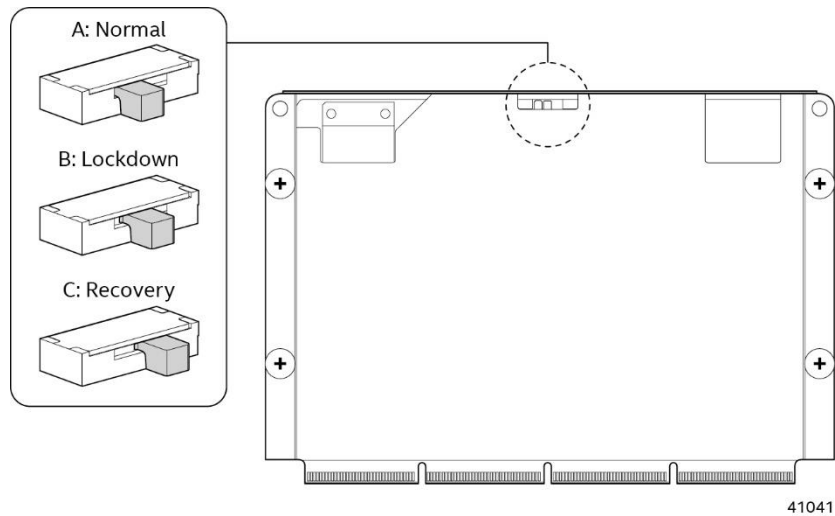


Figure 7. Location of the BIOS Security Switch

Table 8 lists the switch settings for the three modes: normal, lockdown, and recovery/configuration.

Table 8. BIOS Security Switch Settings

| Function/Mode | Switch Setting | Configuration |
|------------------------|----------------|--|
| Normal | A | The BIOS uses current configuration information and passwords for booting. |
| Lockdown | B | <p>The BIOS uses current configuration information and passwords for booting, except:</p> <ul style="list-style-type: none"> 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. <p>BIOS updates are not available except for automatic Recovery due to flash corruption.</p> |
| Recovery/Configuration | C | <p>BIOS Recovery Update process if a matching *.CAP file is found. Recovery Update can be cancelled by pressing the Esc key.</p> <p>If the Recovery Update was cancelled or a matching *.CAP file was not found, a Configuration Menu will be displayed. The Configuration Menu consists of the following options:</p> <p>[1] Suppress this menu until the BIOS Security Switch is set to normal.</p> <p>[2] Clear BIOS User and Supervisor Passwords.</p> <p>[3] Clear Trusted Platform Module (vPro SKU only) Warning: Data encrypted with the TPM will no longer be accessible if the TPM is cleared</p> <p>[F2] BIOS Setup</p> <p>[F4] BIOS Recovery</p> |

2.6 Power

The Intel® NUC 8 Essential/Pro Compute Element requires a DC input from the carrier board via the connector. The carrier board must provide the proper voltage and current as listed below:

- Voltage: 5.7-20 V DC +/-5%
- Current (RMS max): 3.0-10.6 A
- Current (Peak): 12 A



CAUTION

It is strongly recommended to make sure that the carrier board power source is disconnected before installing or removing the Intel® NUC 8 Essential/Pro Compute Element into the carrier board connector. Installing or removing the Intel® NUC 8 Essential/Pro Compute Element while a power source is connected to the carrier board may cause damage to the Intel® NUC 8 Essential/Pro Compute Element, operating system corruption, create a no boot condition or result in data loss.

2.7 Mechanical

The following figures illustrate the mechanical form factor for the NUC 8 Essential/Pro Compute Element. All dimensions are shown in millimeters (mm).

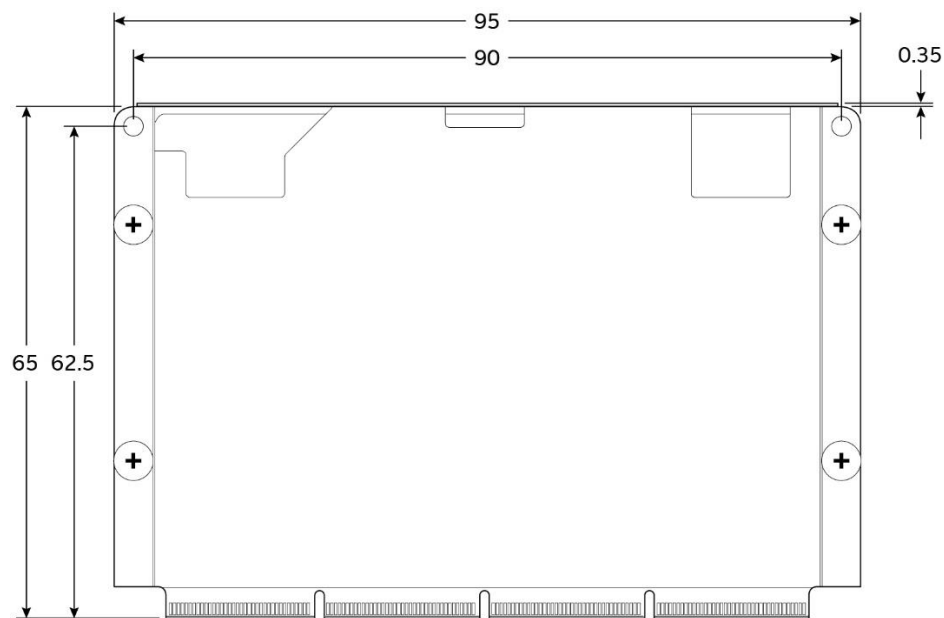
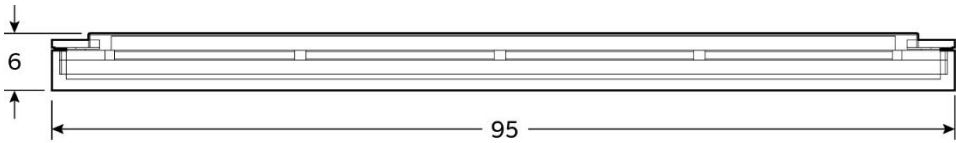


Figure 8. Mylar Side



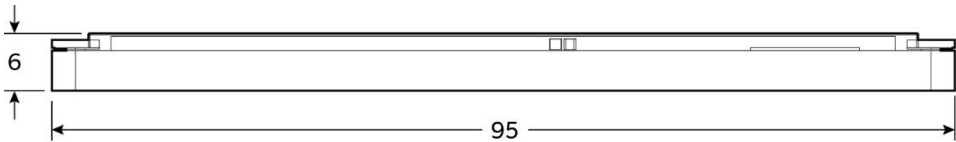
41002

Figure 9. Integrated Heat Shield Side



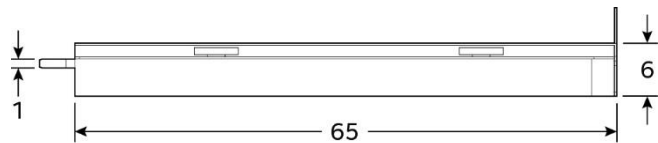
41005

Figure 10. Front (Showing Connector)



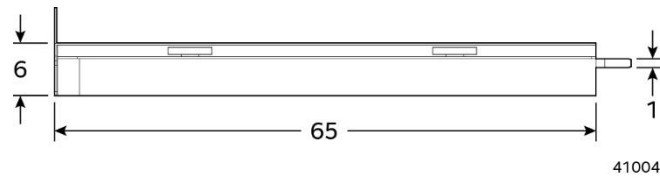
41006

Figure 11. Back



41003

Figure 12. Left

**Figure 13. Right**

2.8 Thermal

The fundamental design of the Intel® NUC 8 Essential/Pro Compute Element relies on the carrier board enclosure for proper cooling. Both internal components and external skin temperatures are critical parameters in proper cooling, and should be considered in any design. For best cooling performance, direct contact with a thermal management device to the bottom of the Compute Element such as a heatsink or enclosure surface is recommended. This can be accomplished with active or passive cooling design approaches. Non-contact convection only cooling may be possible but will likely result in performance limitations or compromises in skin temperature levels relative to a conductive design approach.

The Integrated Heat Spreader side of the Compute Element is the primary heat source. To provide adequate cooling of the Compute Element while maintaining safe skin temperatures a thermal solution that contacts the entire metal portion of the Integrated Heat Spreader is recommended. Localized contact with the primary heat source on the Compute Element bottom is not recommended as the location is subject to change with different generations of the Compute Element. The Mylar side of the Compute Element does not typically require contact with a thermal solution, however proper air flow over the top of the Compute Element is recommended. The below information is critical for the design of a thermal solution.

- The Thermal Design Power (TDP) of the processors used in the NUC 8 Essential Compute Element and the NUC 8 Pro Compute Element is 15W.
- The Power Limit 1 (PL1) default setting in the BIOS of the NUC 8 Essential Compute Element and the NUC 8 Pro Compute Element is 15.
- The Junction Temperature Range (T_j) of the processor used in the NUC 8 Essential Compute Element and the NUC 8 Pro Compute Element is 0°C -100°C.
- The TDP specification temperature range of the processor used in the NUC 8 Essential Compute Element and the NUC 8 Pro Compute Element is 35°C -100°C

2.9 Environmental

Table 9 lists the environmental specifications for the Intel® NUC 8 Essential/Pro Compute Element.

Table 9. Environmental Specifications

| Parameter | Specification | |
|--------------------|--|--------------------|
| Temperature | | |
| Non-Operating | -40 °C to +60 °C | |
| Operating | Ambient operating temperature limitations are a function of the carrier board and carrier board enclosure design and as such a specific number cannot be provided. | |
| Shock | | |
| Unpackaged | 25 g trapezoidal waveform | |
| | Velocity change of 250 inches/s ² | |
| Packaged | Free fall package drop machine set to the height determined by the weight of the package. | |
| | Product Weight (pounds) | Free Fall (inches) |
| | <20 | 36 |
| | 21-40 | 30 |
| | 41-80 | 24 |
| | 81-100 | 18 |
| Vibration | | |
| Unpackaged | 5 Hz to 20 Hz: 0.01 g ² /Hz sloping up to 20 Hz @ 0.02 g ² /Hz | |
| | 20 Hz to 500 Hz: 0.02 g ² /Hz (flat) | |
| | Input acceleration is 3.13 g RMS | |
| Packaged | 40 Hz to 500 Hz: 0.015 g ² /Hz sloping down to 0.00015 g ² /Hz | |
| | Input acceleration is 1.09 g RMS | |

Note: Before attempting to operate the Intel® NUC Essential/Pro 8 Compute Element, 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 NUC Essential/Pro 8 Compute Element. The operating and non-operating environment must avoid condensing humidity.

3 Characterized Errata

This section of the document communicates product Errata for the Intel® NUC 8 Essential Compute Element and the Intel® NUC 8 Pro Compute Element.

Errata are design defects or deviations from current published specifications for a given product. Published errata may or may not be corrected. Hardware and software designed to be used with any given processor stepping must assume that all errata documented for that process stepping are present on all devices.

There are no characterized errata at this time.