

# Datasheet

## Nitrogen8M Plus SMARC

*Version 0.1*

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## REVISION HISTORY

| Version | Date          | Notes               | Contributors | Approver    |
|---------|---------------|---------------------|--------------|-------------|
| 0.1     | 20 April 2023 | Preliminary Release | Gary Bisson  | Dan Kephart |
|         |               |                     |              |             |

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## 1 SCOPE

This document describes key hardware aspects of Boundary Device's Nitrogen8M Plus SMARC system-on-module which is based on the i.MX 8M Plus processor family and the Sterling™-LWB5+ Wi-Fi/BT combo radio. Data in this document is drawn from several sources and includes information found in the documentation for NXP's i.MX 8M Plus and our Sterling™-LWB5+.

**Note: Information in this document is subject to change. Contact us for the most updated version of this document.**

## 2 INTRODUCTION

The Nitrogen8M Plus SMARC is an integrated platform solution with Quad Cortex®-A53 processors operating up to 1.8 GHz and pre-certified dual-band 802.11 a/b/g/n/ac WLAN plus dual-mode Bluetooth® 5.2 Low Energy module.

Quad Arm® Cortex®-A53 processors are integrated with an NPU of 2.3 TOPS that greatly accelerates machine learning inference. The vision engine is composed of two MIPI-CSI camera inputs and an HDR-capable Image Signal Processor (ISP) capable of 375 MPixels/s. The advanced multimedia capabilities include several display interfaces, HDMI 2.0a (eARC), MIPI-DSI, and LVDS. These interfaces can utilize the onboard 1080p60 video encode and decode in H.265 and H.264 format, along with an onboard GPU that is a 3D and 2D graphic accelerator supporting 1 GPixel/s, OpenVG 1.1, Open GL ES3.1, Vulkan, and Open CL 1.2 FP. Multiple audio and microphone interfaces are available along with the audio processing capabilities of the HiFi 4 DSP operating at 800MHz for Immersive Audio and Voice systems.

The Nitrogen8M Plus SMARC features an Arm® Cortex®-M7 microcontroller running at 800 MHz for customer applications to offload the Cortex®-A53 processor for real time and low power operation. A variety of robust control networks for industrial applications are possible via CAN-FD interfaces, SPI, I2C, UART, USB 3.0, and dual Gb Ethernet.

The Nitrogen8M Plus SMARC includes the Sterling™-LWB5+ which is pre-calibrated and integrates the complete transmit/receive RF paths including diplexer, switches, reference crystal oscillator and power management units (PMU). One RF connector (MHF4) on the module provides the most flexibility of antenna selection and installation for the best antenna performance. Several high-performance antennas are certified with the Sterling™-LWB5+ onboard the Nitrogen8M Plus SMARC. A detailed antenna list is shown in the [Certified Antennas](#) section.

The Nitrogen8M Plus SMARC with the Sterling- provides IEEE 802.11 ac 1x1 SISO Wi-Fi capability with data rates up to MCS9 (433.3 Mbps) as well as a BT 5.2 radio solution. The radio interface is SDIO 3.0 for Wi-Fi and UART for Bluetooth for optimized power usage.

The Nitrogen8M Plus SMARC has several product SKUs providing different eMMC and LPDDR4 memory configurations, see Ordering Information section.

## 3 NITROGEN8M PLUS SMARC FEATURES SUMMARY

The Nitrogen8M Plus SMARC module is based on i.MX 8M Plus from NXP which offers a variety of interfaces and different memory configurations. Most of these interfaces are multiplexed and not able to be used simultaneously.

It complies with the [SMARC v2.1 specification from SGET](#).

Key features of Nitrogen8M Plus SMARC are described in [Table 1](#).

**Table 1: Key Features of Nitrogen8M Plus SMARC**

| Feature                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CPU                           | <p>Quad Cortex®-A53 processors operation up to 1.8 GHz</p> <ul style="list-style-type: none"> <li>32 KB L1 Instruction Cache</li> <li>32 KB L1 Data Cache</li> <li>512 KB unified L2 cache</li> </ul> <p>Cortex®-M7 core platform operating up to 800 MHz</p> <ul style="list-style-type: none"> <li>32 KB L1 Instruction Cache</li> <li>32 KB L1 Data Cache</li> <li>256 KB tightly coupled memory (TCM)</li> <li>ARM Neon™ extension</li> </ul>                                                                        |
| Image Sensor Processor (ISP)  | <ul style="list-style-type: none"> <li>375 Mpixel/s HDR ISP supporting configurations, such as 12MP@30fps, 4kp45, or 2x 1080p80</li> </ul>                                                                                                                                                                                                                                                                                                                                                                               |
| Memory interface              | <ul style="list-style-type: none"> <li>On module: 32-bits LPDDR4 with inline ECC (size, please refer to <a href="#">Ordering Information</a>)</li> <li>On module: 8-bits eMMC 5.1 with HS400 speed (size, please refer <a href="#">Ordering Information</a>)</li> <li>SPI</li> <li>FlexSPI Flash with support for XIP (for Cortex®-M7 in low-power mode) and support for either one Octal SPI, or parallel read mode of two identical Quad SPI FLASH devices.</li> </ul>                                                 |
| Graphic Processing Unit       | <p>GC7000UL with OpenCL and Vulkan support</p> <ul style="list-style-type: none"> <li>2 shaders</li> <li>166 million triangles/sec</li> <li>1.0 giga pixel/sec</li> <li>16 GFLOPs 32-bit</li> <li>Supports OpenGL ES 1.1, 2.0, 3.0, OpenCL 1.2, Vulkan</li> <li>Core clock frequency of 1000 MHz</li> <li>Shader clock frequency of 1000 MHz</li> </ul> <p>GC520L for 2D acceleration</p> <ul style="list-style-type: none"> <li>Render target compatibility between 3D and 2D GPU (super tile status buffer)</li> </ul> |
| Video Processing Unit         | <p>Video Decode</p> <ul style="list-style-type: none"> <li>1080p60 HEVC/H.265 Main, Main 10 (up to level 5.1)</li> <li>1080p60 VP9 Profile 0, 2</li> <li>1080p60 VP8</li> <li>1080p60 AVC/H.264 Baseline, Main, High decoder</li> </ul> <p>Video Encode</p> <ul style="list-style-type: none"> <li>1080p60 AVC/H.264 encoder</li> <li>1080p60 HEVC/H.265 encoder</li> </ul>                                                                                                                                              |
| Neutral Processing Unit (NPU) | <p>2.3 TOP/s Neural Network performance</p> <ul style="list-style-type: none"> <li>Keywords detect, noise reduction, beamforming</li> <li>Speech recognition (i.e., Deep Speech 2)</li> <li>Image recognition (i.e., ResNet-50)</li> </ul>                                                                                                                                                                                                                                                                               |
| HDMI 2.0a Tx                  | <p>HDMI 2.0a Tx supporting one display</p> <ul style="list-style-type: none"> <li>Resolutions of 720x480p60, 1280x720p60, 1920x1080p60, 3840x2160p30</li> <li>Pixel clock up to 297 MHz</li> </ul>                                                                                                                                                                                                                                                                                                                       |
| LCDIF Display Controller      | <p>Supports up to 1920x1200p60 display per LCDIF if no more than 2 instances used simultaneously, or 2x 1080p60 + 1x 4kp30 on HDMI if all 3 instances used simultaneously.</p> <ul style="list-style-type: none"> <li>One LCDIF drives MIPI DSI, up to UWHD and WUXGA</li> <li>One LCDIF drives LVDS Tx, up to 1920x1080p60</li> <li>One LCDIF drives HDMI Tx, up to 4kp30</li> </ul>                                                                                                                                    |
| MIPI Interface                | <p>Two MIPI-DSI Interfaces</p> <ul style="list-style-type: none"> <li>4-lane MIPI-DSI interface</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                               |

| Feature         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | <ul style="list-style-type: none"> <li>2-lane MIPI-DSI interface</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                 | <p>HDR ISP</p> <ul style="list-style-type: none"> <li>2x ISP supporting 375 Mpixel/s aggregate performance and up to 3-exposure HDR processing.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                 | <ul style="list-style-type: none"> <li>When one camera is used, supports up to 12MP@30fps or 4kp45</li> <li>When two cameras are used, each supports up to 1080p80</li> <li>Maximum resolution limited to resolutions achievable with a 250 MHz pixel clock and active pixel rate of 200 Mpixel/s with 24-bit RGB. This includes resolutions such as: <ul style="list-style-type: none"> <li>1080p60</li> <li>WUXGA (1920X1200) at 60 Hz</li> <li>1920x1440 at 60 Hz</li> <li>WHD (2560X1080) at 60 Hz</li> <li>MIPI DSI: WQHD (2560x1440) can be supported by reduced blanking mode</li> </ul> </li> </ul>                                                                                           |
| Audio           | <ul style="list-style-type: none"> <li>Cadence® Tensilica® HiFi 4 DSP, operating up to 800 MHz</li> <li>Two I2S (Optionally One as HAD)</li> <li>All ports support 49.152 MHz BCLK.</li> <li>ASRC supports processing 32 audio channels, 4 context groups, 8 kHz to 384 kHz sample rate, and 1/16 to 8x sample rate conversion ratio.</li> <li>eARC/ARC (HDMI)</li> </ul>                                                                                                                                                                                                                                                                                                                             |
| Connectivity    | <ul style="list-style-type: none"> <li>One PCI Express (PCIe) Gen3 Single Lane supporting Dual Mode Operation with PHY</li> <li>Two USB 3.0 Host interfaces (also supports USB 2.0)</li> <li>Two USB 2.0 Host interfaces (without integrated PHY) + One USB 2.0 OTG interface</li> <li>One Ultra Secure Digital Host Controller (uSDHC) interface</li> <li>Two Gigabit Ethernet controllers (both capable of simultaneous operation)</li> <li>Two Controller Area Network (FlexCAN) modules, each optionally supporting flexible data-rate (FD, available on Industrial parts only)</li> </ul> <p><b>Note:</b> Flexible Data (FD) mode supports MB operation only with no RX FIFO or DMA support.</p> |
|                 | <ul style="list-style-type: none"> <li>Three Universal Asynchronous Receiver/Transmitter (UART) modules</li> <li>Five I2C modules</li> <li>Three SPI modules</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Security        | <ul style="list-style-type: none"> <li>Resource Domain Controller (RDC)</li> <li>Arm® TrustZone® (TZ) architecture</li> <li>On-chip RAM (OCRAM) secure region protection using OCRAM controller</li> <li>High Assurance Boot (HAB)</li> <li>Cryptographic Acceleration and Assurance Module (CAAM)</li> <li>Secure Non-Volatile Storage (SNVS)</li> <li>Secure JTAG Controller (SJC)</li> </ul>                                                                                                                                                                                                                                                                                                       |
| Debug Interface | <ul style="list-style-type: none"> <li>Secure JTAG Controller (SJC)</li> <li>Two Debug UART port for Quad Cortex®-A53 processors and Cortex®-M7.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| RF output       | <p>RF output with MHF4 connector provides flexible of external antenna selection for optimize performance for both Wi-Fi and BT</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 4 BLOCK DIAGRAM

The figure below shows the block diagram of the Nitrogen8M Plus SMARC which contains the NXP i.MX 8M Plus processor, PMIC (PCA9450CHN) and the Sterling™-LWB5+ Wi-Fi/BT combo.

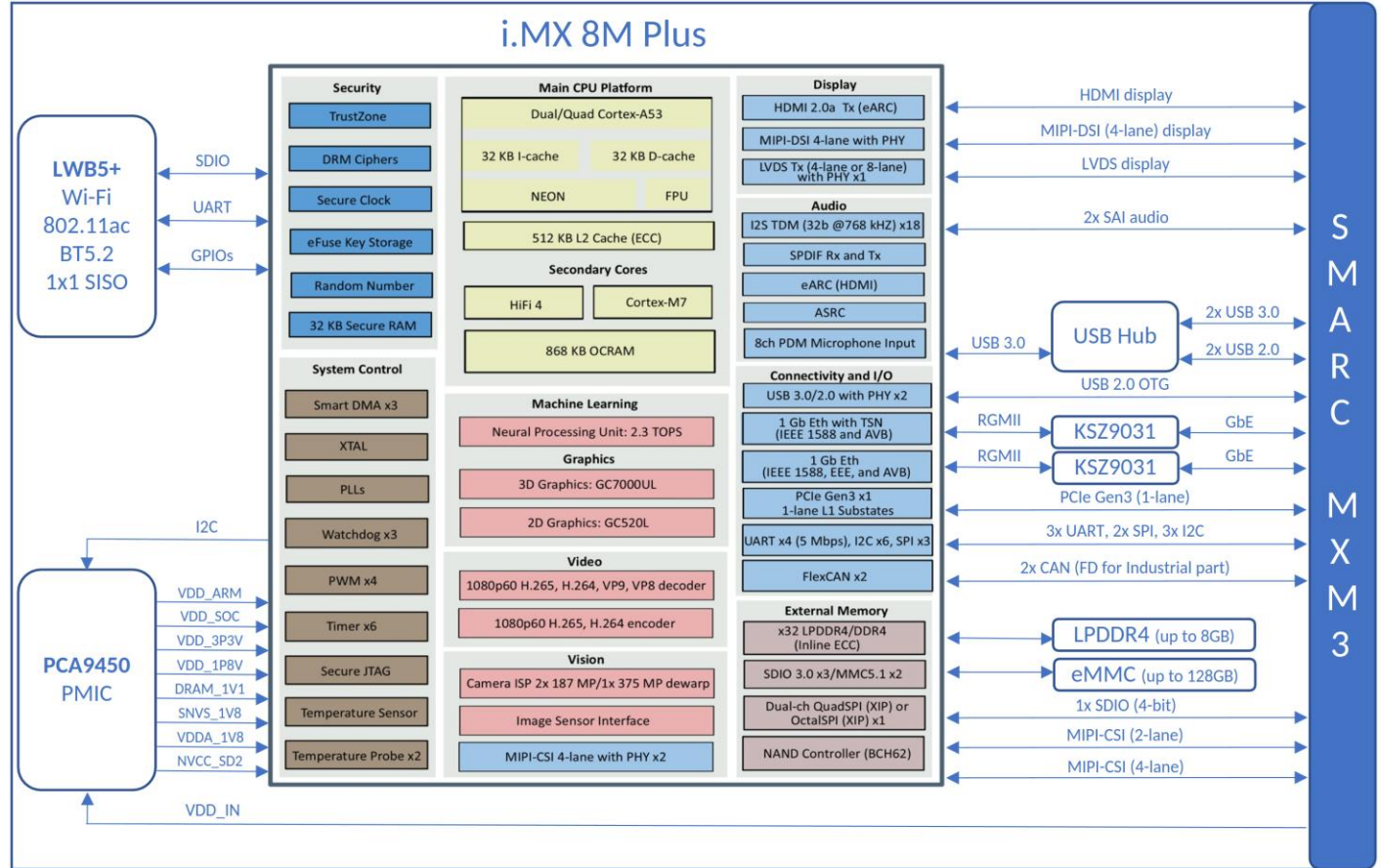


Figure 1: Nitrogen8MP SMARC block diagram

Detailed connections between the LWB5+ and the i.MX 8M Plus are detailed in Table 2 below.

Table 2: Sterling™-LWB5+ to i.MX 8M Plus Connections

|        | LWB5+                                  | i.MX8M Plus                             |
|--------|----------------------------------------|-----------------------------------------|
| SDIO   | SD_CLK/SD_CMD/SD_DATA0-3               | SD3_CLK/SD3_CMD/SD3_DATA0-3             |
| UART   | UART_SOUT/UART_SIN/UART_CTSn/UART_RTSn | UART1_RXD/UART1_TXD/UART3_RXD/UART3_TXD |
| CLK    | SUSCLK                                 | CLKOUT1                                 |
| BT_EN  | BT_REG_ON                              | NAND_CE2                                |
| BT_IRQ | BT_HOST_WAKE                           | SAI5_RXD0                               |
| WL_EN  | WL_REG_ON                              | NAND_CE3                                |
| WL_IRQ | GPIO_0                                 | NAND_DQS                                |

## 5 DC POWER TREE

The Nitrogen8M Plus SMARC requires a primary 5V power supply (VSYS) input. This supply is the main power domain to the on-module NXP PCA9450CHN power management IC (PMIC), which generates all required supply voltages for the module

components. The PMIC has 32.768KHz crystal oscillator and buffer built-in which generates the real-time clock (RTC) for the NXP processor and Wi-Fi radio.

## 5.1 Power Modes Diagram

NXP PCA9450CHN has eight power modes: OFF, READY, SNVS, RUN, STANDBY, PWRDN, PWRUP and FAULT\_SD. Below figure shows the state transition diagram showing the conditions to enter and exit each state.

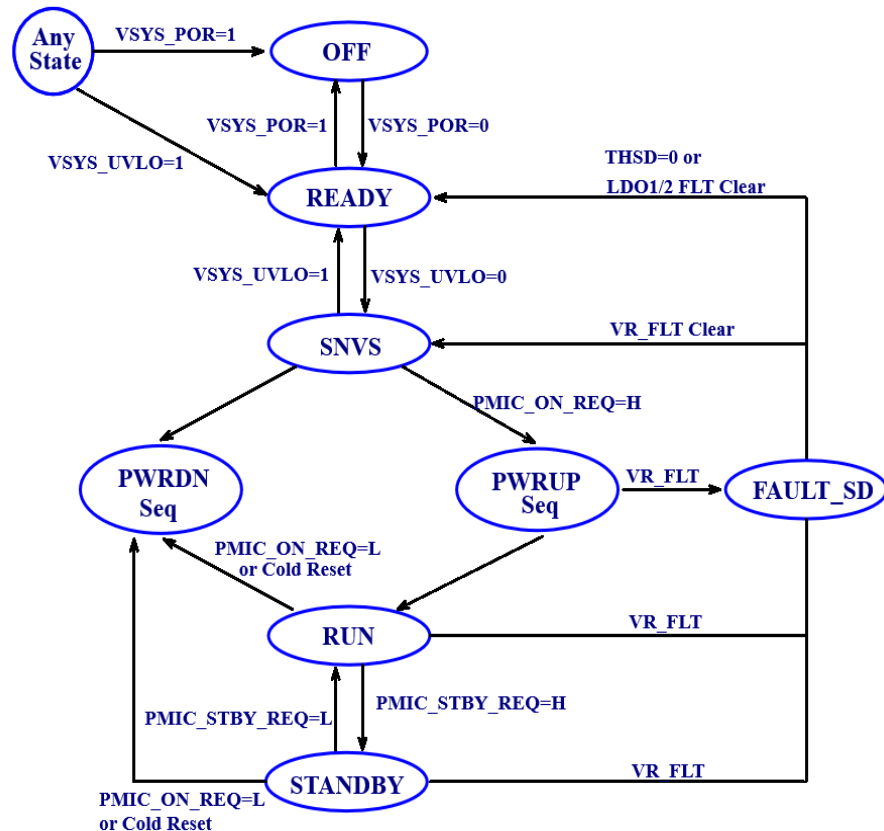


Figure 2: State transition diagram for PMIC

- **OFF mode:**  
PMIC will enter OFF mode from any state when the main power source VSYS\_5V falls below  $V_{sys\_POR}$  threshold (2.2 to 2.6V; typ.=2.4V). All regulators are OFF and all registers are reset in this mode.
- **READY Mode:**  
PMIC enters READY mode when VSYS\_5V is higher than  $V_{sys\_POR}$ . The internal LDO VINT is enabled and loads the MTP data to registers. Once the MTP data loading is complete, the state machine is ready to transition to SNVS mode.
- **SNVS Mode:**  
PMIC will enter SNVS (Secure Non-Volatile Storage mode) when VSYS\_5V exceeds the  $V_{sys\_UVLO}$  threshold. LDO1 is powered up and the 32.778KHz buffer starts running. RTC\_RESET\_B is pulled high after both LDO1 and LDO2 voltage come up.

**Note:** PMIC\_ON\_REQ input is masked until RTC\_RESET\_B is released. PMIC will start power up sequence if PMIC\_ON\_REQ is asserted high in this mode.

- **PWRUP Mode:**  
After RTC\_RESET\_B is released in SNVS mode, the PMIC starts power up with a pre-defined sequence with PMIC\_ON\_REQ asserted high.



During PWRUP mode, PMIC\_STBY\_REQ signal is masked until POR\_B is released. The PWRUP mode ends up releasing POR\_B and the PMIC is transitioned to RUN mode.

- **PWRDN Mode:**  
When PMIC\_ON\_REQ is low in RUN or STANDBY mode, PMIC enters PWRDN mode, where it starts with pulling down POR\_B. and then by turning off each power rail before transitioning to SNVS mode.
- **RUN Mode:**  
PMIC operates in RUN mode when PMIC\_ON\_REQ is driven high and PMIC\_STBY\_REQ is driven low. When PMIC\_STBY\_REQ is asserted high in this mode, it is transitioned to STANDBY mode. PMIC\_ON\_REQ is asserted low, it moves to PWRDN mode.
- **STANDBY Mode:**  
PMIC is transitioned to STANDBY mode from RUN mode when both PMIC\_ON\_REQ and PMIC\_STBY\_REQ are driven low. If PMIC\_ON\_REQ is asserted low, then it is transitioned to PWRDN mode. If PMIC\_STBY\_REQ is driven low, it is transitioned to RUN mode.

| Power Mode | VSYS_5V                    | PMIC_ON_REQ | PMIC_STBY_REQ |
|------------|----------------------------|-------------|---------------|
| OFF        | $VSYS\_5V < V_{SYS\_POR}$  | X           | X             |
| READY      | $VSYS\_5V > V_{SYS\_POR}$  | X           | X             |
| SNVS       | $VSYS\_5V > V_{SYS\_UVLO}$ | LOW         | X             |
| STANDBY    | $VSYS\_5V > V_{SYS\_UVLO}$ | HIGH        | HIGH          |
| RUN        | $VSYS\_5V > V_{SYS\_UVLO}$ | HIGH        | LOW           |

- **FAULT\_SD Mode:**  
PCA9450CHN has three kinds of Fault sources.
  - **Thermal shutdown:** Transition to SNVS mode or READY mode after FAULT\_SD mode.  
When junction temperature reaches 150°C, it enters FAULT\_SD mode after 120  $\mu$ s where regulators are tuned off simultaneously. It stays at FAULT\_SD mode until the junction temperature fall below 150°C, then move to READY state if any of LDO1 and LDO2 is fault is triggered. And it will move to SNVS mode if either LDO1 or LDO2 fault is triggered.
  - **Voltage regulator fault during power up:** Transition to READY mode after FAULT\_SD mode.  
Any POK of voltage regulator doesn't come up within 10ms after regulator is enabled during power up sequence, it stops power-up sequence and then moves into FAULT\_SD mode where all regulators are turned off.
  - **Voltage regulator fault in STBY and RUN MODE:** Move to FAULT\_SD mode in 100ms after fault is detected. Transition to SNVS mode or READY mode after FAULT\_SD mode.

## 6 BOOT MODE

The Nitrogen8M Plus SMARC module contains a switch (**SW1**) connected to BOOT\_MODE0 thus allowing to switch from internal fuses boot (eMMC by default) to USB serial downloader.

The other boot mode signals (BOOT\_MODE[1-3]) are exposed to the carrier to SMARC BOOT\_SEL[0-2] signals.

This allows more combinations as shown in [Table 3](#).

**Table 3: Boot mode combinations**

| BOOT_MODE3 | BOOT_MODE2 | BOOT_MODE1 | BOOT_MODE0 | BOOT MODE                                   |
|------------|------------|------------|------------|---------------------------------------------|
| 0          | 0          | 0          | 0          | Boot from Internal Fuses                    |
| 0          | 0          | 0          | 1          | USB Serial Download                         |
| 0          | 0          | 1          | 0          | uSDHC3 (eMMC boot only, SD3 8-bit) Default. |
| 0          | 0          | 1          | 1          | uSDHC2 (SD boot, SD2)                       |
| 0          | 1          | 0          | 0          | NAND 8-bit single device 256 pages.         |
| 0          | 1          | 0          | 1          | NAND 8-bit single device 512 pages          |
| 0          | 1          | 1          | 0          | QSPI 3B Read                                |
| 0          | 1          | 1          | 1          | QSPI Hyperflash 3.3V                        |
| 1          | 0          | 0          | 0          | ECSPI Boot                                  |

| BOOT_MODE3 | BOOT_MODE2 | BOOT_MODE1 | BOOT_MODE0 | BOOT MODE                                         |
|------------|------------|------------|------------|---------------------------------------------------|
| 1          | 0          | 0          | 1          | Reserved                                          |
| 1          | 0          | 1          | 0          | Reserved                                          |
| 1          | 0          | 1          | 1          | Reserved                                          |
| 1          | 1          | 0          | 0          | Reserved (Boot on I2C connected to BOOT PIN[3:2]) |
| 1          | 1          | 0          | 1          | Reserved                                          |
| 1          | 1          | 1          | 0          | Infinite Loop Mode                                |
| 1          | 1          | 1          | 1          | Test Mode                                         |

**Caution:** BOOT\_MODE0, BOOT\_MODE1, BOOT\_MODE2, BOOT\_MODE3, JTAG\_MOD and POR\_B must be pulled to “111111” for i.MX8M Plus to enter Boundary Scan Mode.

## 7 ELECTRICAL CHARACTERISTIC AND POWER CONSUMPTION

### 7.1 Absolute Maximum Ratings

Table 4 summarizes the absolute maximum ratings and Table 5 lists the recommended operating conditions for the Nitrogen8M Plus SMARC product series. Absolute maximum ratings are those values beyond which damage to the device can occur. Functional operation under these conditions, or at any other condition beyond those indicated in the operational sections of this document, is not recommended.

**Note:** Maximum rating for signals follows the supply domain of the signals.

**Table 4: Absolute maximum ratings**

| Symbol (Domain)                | Parameter                                                           | Min.  | Max   | Unit |
|--------------------------------|---------------------------------------------------------------------|-------|-------|------|
| VSYS_5V                        | Input voltage for the SOM                                           | -0.5  | +6.0  | V    |
| I/O Input/output voltage range | Any I/O pin referred to VDD_1V8; VDDA_1V8; WI-FI_1V8; NVCC_SNVS_1V8 | -0.3  | +2.1  | V    |
| I/O Input/output voltage range | Any I/O pin referred to VDD_3V3; VSD_3V3; NVCC_SD2                  | -0.3  | +3.6  | V    |
| T <sub>STORAGE</sub>           | Storage Temperature Range                                           | -40   | +125  | °C   |
| ANT0; ANT1                     | Maximum RF input (reference to 50-Ω input)                          | NA    | +10   | dBm  |
| ESD                            | Electrostatic discharge tolerance                                   | -2000 | +2000 | V    |

### 7.2 Recommended Operating Conditions

**Table 5: Recommended Operating Conditions**

| Symbol (Domain)                | Parameter                                                           | Min  | Typ | Max  | Unit |
|--------------------------------|---------------------------------------------------------------------|------|-----|------|------|
| VSYS_5V                        | Input voltage for the SOM                                           | 3.3  | 5.0 | 5.5  | V    |
| I/O Input/output voltage range | Any I/O pin referred to VDD_1V8; VDDA_1V8; WI-FI_1V8; NVCC_SNVS_1V8 | 1.71 | 1.8 | 1.89 | V    |
| I/O Input/output voltage range | Any I/O pin referred to VDD_3V3; VSD_3V3; NVCC_SD2                  | 3.0  | 3.3 | 3.6  | V    |
| T-ambient                      | Operating Ambient temperature                                       | -40  | 25  | 85   | °C   |

**Note:** The operating ambient temperature ratings are highly dependent on the design-case, such as the enclosure design, system design, processor activity, GPU/VPU activity, and peripherals used.

Running over 70° C ambient temperature typically requires the implementation of thermal management strategies such as passive (heatsink/spreader). Please contact Boundary Devices if you need information and guidance for thermal management.

## 7.3 DC current consumption

Several power saving modes are available and are listed in [Table 6](#).

**Table 6: Typical current consumption**

| Mode                           | Description                                                                                                           | Current (Avg) |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------|
| Power Saving mode              | CPU is on, Stay on Wi-Fi connection only.                                                                             | 431mA         |
| RAM suspend mode               | CPU is on, memory and wireless connection are off.                                                                    | 7.7mA         |
| Linux graceful power down mode | All circuits are off.<br>Only the NVCC_SNVS_1V8 PMU is alive and ONOFF pin is accessible to allow turn on of the SOM. | 154uA         |

## 8 MODULE PIN OUT AND PINMUX TABLE

[Table 7](#) lists the pin multiplexing (PIN-MUX) of the Nitrogen8M Plus SMARC. Most of the pin names on the SOM are same as the pin names of the connected NXP processor. The "Pin Number" column shows the relationship of the SOM pin number to the NXP processor pin number.

**PO = Power Output, PI = Power Input, DI = Digital Input, DO = Digital Output, DIO = Bi-directional Digital Port, GND = Ground**

NXP process has configurable internal Pull-up (PU) and pull-down (PD) resistor whose values are listed below. During a reset condition, the PU and PD state are pre-defined and cannot be changed.

**Table 7: Resistor characteristics**

| Parameter               | Conditions        | Min | Typ | Max | Unit       |
|-------------------------|-------------------|-----|-----|-----|------------|
| Pull-up (PU) resistor   | VDD=1.65 to 1.95V | 12  | 22  | 49  | k $\Omega$ |
| Pull-down (PD) resistor | Temp=0 to 95°C    | 13  | 23  | 48  | k $\Omega$ |
| Pull-up (PU) resistor   | VDD=3.0 to 3.6V   | 18  | 37  | 72  | k $\Omega$ |
| Pull-down (PD) resistor | Temp=0 to 95°C    | 24  | 43  | 87  | k $\Omega$ |

Pin configuration for the i.MX is achieved using a suite of evaluation and configuration tools that assists users from initial evaluation to production software development. Users can download the tool from the NXP website:  
[https://www.nxp.com/design/designs/config-tools-for-i-mx-applications-processors:CONFIG-TOOLS-IMX?tab=Design\\_Tools\\_Tab](https://www.nxp.com/design/designs/config-tools-for-i-mx-applications-processors:CONFIG-TOOLS-IMX?tab=Design_Tools_Tab)

**Table 8: Pinout table for Nitrogen8M Plus SMARC edge connector (J2)**

| SMARCPin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                        | I/O  | I/O Level  | Comments |
|------------|----------------|--------------------------------------------------------------------------------------|------|------------|----------|
| P1         | SMB_ALERT#     | GPIO: GPIO4_IO02<br>SAI: SAI1_RXD0<br>PDM: PDM_BIT_STREAM00<br>ENET1: 1588_EVENT1_IN | DI   | 1.8 to 5 V |          |
| P2         | GND            | NA                                                                                   | -    | NA         |          |
| P3         | CSI1_CK+       | MIPI_CSI2_CLK_P                                                                      | DO   | 1.8V       |          |
| P4         | CSI1_CK-       | MIPI_CSI2_CLK_N                                                                      | DO   | 1.8V       |          |
| P5         | GBE1_SDP       | GPIO: GPIO4_IO01<br>SAI: SAI1_RXC<br>PDM: PDM_CLK<br>ENET1: 1588_EVENT0_OUT          | DI/O | 3.3V       |          |

| SMARCPin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                                                                            | I/O  | I/O Level   | Comments          |
|------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|-------------------|
| P6         | GBE0_SDP       | GPIO: GPIO1_IO09<br>ENET: 1588_EVENT0_OUT<br>PWM: PWM2_OUT<br>ISP: ISP_SHUTTER_OPEN_1<br>USDHC: USDHC3_RESET_B<br>DMA: SDMA2_EXT_EVENT00 | DI/O | 3.3V        |                   |
| P7         | CSI1_RX0+      | MIPI_CSI2_D0_P                                                                                                                           | DI   | 1.8V        |                   |
| P8         | CSI1_RX0-      | MIPI_CSI2_D0_N                                                                                                                           | DI   | 1.8V        |                   |
| P9         | GND            | NA                                                                                                                                       | -    | NA          |                   |
| P10        | CSI1_RX1+      | MIPI_CSI2_D1_P                                                                                                                           | DI   | 1.8V        |                   |
| P11        | CSI1_RX1-      | MIPI_CSI2_D1_N                                                                                                                           | DI   | 1.8V        |                   |
| P12        | GND            | NA                                                                                                                                       | -    | NA          |                   |
| P13        | CSI1_RX2+      | MIPI_CSI2_D2_P                                                                                                                           | DI   | 1.8V        |                   |
| P14        | CSI1_RX2-      | MIPI_CSI2_D2_N                                                                                                                           | DI   | 1.8V        |                   |
| P15        | GND            | NA                                                                                                                                       | -    | NA          |                   |
| P16        | CSI1_RX3+      | MIPI_CSI2_D3_P                                                                                                                           | DI   | 1.8V        |                   |
| P17        | CSI1_RX3-      | MIPI_CSI2_D3_N                                                                                                                           | DI   | 1.8V        |                   |
| P18        | GND            | NA                                                                                                                                       | -    | NA          |                   |
| P19        | GBE0_MDI3-     | TXRXM_D                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P20        | GBE0_MDI3+     | TXRXP_D                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P21        | GBE0_LINK100#  | LED1                                                                                                                                     | DO   | 3.3V        | From KSZ9031 (U8) |
| P22        | GBE0_LINK1000# | LED2                                                                                                                                     | DO   | 3.3V        | From KSZ9031 (U8) |
| P23        | GBE0_MDI2-     | TXRXM_C                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P24        | GBE0_MDI2+     | TXRXP_C                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P25        | GBE0_LINK_ACT# | LED1                                                                                                                                     | DO   | 3.3V        | From KSZ9031 (U8) |
| P26        | GBE0_MDI1-     | TXRXM_B                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P27        | GBE0_MDI1+     | TXRXP_B                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P28        | GBE0_CTREF     | TP28                                                                                                                                     | -    | NA          | Test point        |
| P29        | GBE0_MDI0-     | TXRXM_A                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P30        | GBE0_MDI0+     | TXRXP_A                                                                                                                                  | DI/O | 1.8V        | From KSZ9031 (U8) |
| P31        | SPI0_CS1#      | GPIO: GPIO1_IO01<br>PWM: PWM1_OUT<br>ISP: ISP_SHUTTER_TRIG_0<br>CLK: CCM_EXT_CLK2                                                        | DO   | 1.8V        |                   |
| P32        | GND            | NA                                                                                                                                       | -    | NA          |                   |
| P33        | SDIO_WP        | USDHC: USDHC2_WP<br>GPIO: GPIO2_IO20<br>DEBUG: CORESIGHT_EVENT1                                                                          | DI   | 1.8 or 3.3V |                   |
| P34        | SDIO_CMD       | USDHC: USDHC2_CMD<br>SPI: ECSP12_MOSI                                                                                                    | DI/O | 1.8 or 3.3V |                   |

| SMARCPin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                                                                                                                                         | I/O  | I/O Level   | Comments |
|------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|----------|
|            |                | <b>UART:</b> UART4_DCE_TX<br><b>UART:</b> UART4_DTE_RX<br><b>PDM:</b> AUDIOMIX_PDM_CLK<br><b>GPIO:</b> GPIO2_IO14                                                                                     |      |             |          |
| P35        | SDIO_CD#       | <b>USDHC:</b> <b>USDHC2_CD_B</b><br><b>GPIO:</b> GPIO2_IO12                                                                                                                                           | DI   | 1.8 or 3.3V |          |
| P36        | SDIO_CK        | <b>USDHC:</b> <b>USDHC2_CLK</b><br><b>SPI:</b> ECSP12_SCLK<br><b>UART:</b> UART4_DCE_RX<br><b>UART:</b> UART4_DTE_TX<br><b>PDM:</b> AUDIOMIX_PDM_CLK<br><b>GPIO:</b> GPIO2_IO13                       | DO   | 1.8 or 3.3V |          |
| P37        | SDIO_PWR_EN    | <b>USDHC:</b> <b>USDHC2_CD_B</b><br><b>GPIO:</b> GPIO2_IO12<br><b>DEBUG:</b> SRC_SYSTEM_RESET                                                                                                         | DO   | 3.3V        |          |
| P38        | GND            | NA                                                                                                                                                                                                    | -    | NA          |          |
| P39        | SDIO_D0        | <b>USDHC:</b> <b>USDHC2_DATA0</b><br><b>I2C:</b> I2C4_SDA<br><b>UART:</b> UART2_DCE_RX<br><b>UART:</b> UART2_DTE_TX<br><b>PDM:</b> AUDIOMIX_PDM_BIT_STREAM00<br><b>GPIO:</b> GPIO2_IO15               | DI/O | 1.8 or 3.3V |          |
| P40        | SDIO_D1        | <b>USDHC:</b> <b>USDHC2_DATA1</b><br><b>I2C:</b> I2C4_SCL<br><b>UART:</b> UART2_DCE_TX<br><b>UART:</b> UART2_DTE_RX<br><b>PDM:</b> AUDIOMIX_PDM_BIT_STREAM01<br><b>GPIO:</b> GPIO2_IO16               | DI/O | 1.8 or 3.3V |          |
| P41        | SDIO_D2        | <b>USDHC:</b> <b>USDHC2_DATA2</b><br><b>SPI:</b> ECSP12_SS0<br><b>SPDIF:</b> AUDIOMIX_SPDIF1_OUT<br><b>PDM:</b> AUDIOMIX_PDM_BIT_STREAM04<br><b>GPIO:</b> GPIO2_IO17                                  | DI/O | 1.8 or 3.3V |          |
| P42        | SDIO_D3        | <b>USDHC:</b> <b>USDHC2_DATA3</b><br><b>SPI:</b> ECSP12_MISO<br><b>SPDIF:</b> AUDIOMIX_SPDIF1_IN<br><b>PDM:</b> AUDIOMIX_PDM_BIT_STREAM03<br><b>GPIO:</b> GPIO2_IO18<br><b>DEBUG:</b> SRC_EARLY_RESET | DI/O | 1.8 or 3.3V |          |
| P43        | SPI0_CS0#      | <b>SPI:</b> <b>ECSP11_SS0</b><br><b>UART:</b> UART3_DCE_RTS<br><b>UART:</b> UART3_DTE_CTS<br><b>I2C:</b> I2C2_SDA<br><b>SAI:</b> AUDIOMIX_SAI7_TX_SYNC<br><b>GPIO:</b> GPIO5_IO09                     | DO   | 1.8V        |          |
| P44        | SPI0_CK        | <b>SPI:</b> <b>ECSP11_SCLK</b><br><b>UART:</b> UART3_DCE_RX<br><b>UART:</b> UART3_DTE_TX<br><b>I2C:</b> I2C1_SCL                                                                                      | DO   | 1.8V        |          |

| SMARCPin # | SMARC Pin Name                          | CPU PIN / Multiplexing (red = default muxing)                                                                                                    | I/O | I/O Level | Comments |
|------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------|----------|
|            |                                         | SAI: AUDIOMIX_SAI7_RX_SYNC<br>GPIO: GPIO5_IO06                                                                                                   |     |           |          |
| P45        | SPI0_DIN                                | SPI: ECSP11_MISO<br>UART: UART3_DCE_CTS<br>UART: UART3_DTE_RTS<br>I2C: I2C2_SCL<br>SAI: AUDIOMIX_SAI7_RX_DATA00<br>GPIO: GPIO5_IO08              | DI  | 1.8V      |          |
| P46        | SPI0_DO                                 | SPI: ECSP11_MOSI<br>UART: UART3_DCE_TX<br>UART: UART3_DTE_RX<br>I2C: I2C1_SDA<br>SAI: AUDIOMIX_SAI7_RX_BCLK<br>GPIO: GPIO5_IO07                  | DO  | 1.8V      |          |
| P47        | GND                                     | NA                                                                                                                                               | -   | NA        |          |
| P48        | SATA_TX+                                | NA                                                                                                                                               | -   | NA        |          |
| P49        | SATA_TX-                                | NA                                                                                                                                               | -   | NA        |          |
| P50        | GND                                     | NA                                                                                                                                               | -   | NA        |          |
| P51        | SATA_RX+                                | NA                                                                                                                                               | -   | NA        |          |
| P52        | SATA_RX-                                | NA                                                                                                                                               | -   | NA        |          |
| P53        | GND                                     | NA                                                                                                                                               | -   | NA        |          |
| P54        | SPI1_CS0# /<br>ESPI_CS0# /<br>QSPI_CS0# | SPI: ECSP12_SS0<br>UART: UART4_DCE_RTS<br>UART: UART4_DTE_CTS<br>I2C: I2C4_SDA<br>CLK: CCM_CLK02<br>GPIO: GPIO5_IO13                             | DO  | 1.8V      |          |
| P55        | SPI1_CS1# /<br>ESPI_CS1# /<br>QSPI_CS1# | SAI: AUDIOMIX_SAI1_MCLK<br>SAI: AUDIOMIX_SAI1_TX_BCLK<br>ENET: ENET1_TX_CLK<br>GPIO: GPIO5_IO09                                                  | DO  | 1.8V      |          |
| P56        | SPI1_CK / ESPI_CK /<br>QSPI_CK          | SPI: ECSP12_SCLK<br>UART: UART4_DCE_RX<br>UART: UART4_DTE_TX<br>I2C: I2C3_SCL<br>SAI: AUDIOMIX_SAI7_TX_BCLK<br>GPIO: GPIO5_IO10                  | DO  | 1.8V      |          |
| P57        | SPI1_DIN /<br>ESPI_IO_1 /<br>QSPI_IO_1  | SPI: ECSP12_MISO<br>UART: UART4_DCE_CTS<br>UART: UART4_DTE_RTS<br>I2C: I2C4_SCL<br>SAI: AUDIOMIX_SAI7_MCLK<br>CLK: CCM_CLK01<br>GPIO: GPIO5_IO12 | DI  | 1.8V      |          |
| P58        | SPI1_DO / ESPI_IO_0<br>/ QSPI_IO_0      | SPI: ECSP12_MOSI<br>UART: UART4_DCE_TX<br>UART: UART4_DTE_RX                                                                                     | DO  | 1.8V      |          |

| SMARCPin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                | I/O  | I/O Level | Comments          |
|------------|----------------|------------------------------------------------------------------------------|------|-----------|-------------------|
|            |                | I2C: I2C3_SDA<br>SAI: AUDIOMIX_SAI7_TX_DATA00<br>GPIO: GPIO5_IO11            |      |           |                   |
| P59        | GND            | NA                                                                           | -    | NA        |                   |
| P60        | USB0+          | USB1_D_P                                                                     | DI/O | 3.3V      |                   |
| P61        | USB0-          | USB1_D_N                                                                     | DI/O | 3.3V      |                   |
| P62        | USB0_EN_OC#    | GPIO: GPIO1_IO13<br>USB: USB1_OTG_OC<br>PWM: PWM2_OUT                        | DI   | 3.3V      |                   |
| P63        | USB0_VBUS_DET  | USB1_VBUS                                                                    | DI   | 5V        |                   |
| P64        | USB0_OTG_ID    | USB1_ID                                                                      | DI   | 3.3V      |                   |
| P65        | USB1+          | USB2DN_DP2                                                                   | DI/O | 3.3V      | From USB Hub (U9) |
| P66        | USB1-          | USB2DN_DM2                                                                   | DI/O | 3.3V      | From USB Hub (U9) |
| P67        | USB1_EN_OC#    | PRT_CTL2                                                                     | DI   | 3.3V      | From USB Hub (U9) |
| P68        | GND            | NA                                                                           | -    | NA        |                   |
| P69        | USB2+          | USB2DN_DP3                                                                   | DI/O | 3.3V      | From USB Hub (U9) |
| P70        | USB2-          | USB2DN_DM3                                                                   | DI/O | 3.3V      | From USB Hub (U9) |
| P71        | USB2_EN_OC#    | PRT_CTL3                                                                     | DI   | 3.3V      | From USB Hub (U9) |
| P72        | RSVD           | CLKOUT2                                                                      | DO   | 1.8V      |                   |
| P73        | RSVD           | NA                                                                           | -    | NA        |                   |
| P74        | USB3_EN_OC#    | PRT_CTL1                                                                     | DI   | 3.3V      | From USB Hub (U9) |
| P75        | PCIE_A_RST#    | NA                                                                           | -    | NA        |                   |
| P76        | USB4_EN_OC#    | PRT_CTL4                                                                     | DI   | 3.3V      | From USB Hub (U9) |
| P77        | PCIE_B_CKREQ#  | NA                                                                           | -    | NA        |                   |
| P78        | PCIE_A_CKREQ#  | SAI: AUDIOMIX_SAI1_RX_SYNC<br>ENET: ENET1_1588_EVENT0_IN<br>GPIO: GPIO4_IO00 | DI/O | 3.3V      |                   |
| P79        | GND            | NA                                                                           | -    | NA        |                   |
| P80        | PCIE_C_REFCK+  | NA                                                                           | -    | NA        |                   |
| P81        | PCIE_C_REFCK-  | NA                                                                           | -    | NA        |                   |
| P82        | GND            | NA                                                                           | -    | NA        |                   |
| P83        | PCIE_A_REFCK+  | PCIE_REF_PAD_CLK_P                                                           | DO   | 1.8V      |                   |
| P84        | PCIE_A_REFCK-  | PCIE_REF_PAD_CLK_N                                                           | DO   | 1.8V      |                   |
| P85        | GND            | NA                                                                           | -    | NA        |                   |
| P86        | PCIE_A_RX+     | PCIE_RXN_P                                                                   | DO   | 1.8V      |                   |
| P87        | PCIE_A_RX-     | PCIE_RXN_N                                                                   | DO   | 1.8V      |                   |
| P88        | GND            | NA                                                                           | -    | NA        |                   |
| P89        | PCIE_A_TX+     | PCIE_TXN_P                                                                   | DO   | 1.8V      |                   |



| SMARCPin # | SMARC Pin Name           | CPU PIN / Multiplexing<br>(red = default muxing) | I/O  | I/O Level | Comments                                                       |
|------------|--------------------------|--------------------------------------------------|------|-----------|----------------------------------------------------------------|
| P90        | PCIE_A_TX-               | PCIE_TXN_N                                       | DO   | 1.8V      |                                                                |
| P91        | GND                      | NA                                               | -    | NA        |                                                                |
| P92        | HDMI_D2+ / DP1_LANE0+    | HDMI_TX2_P                                       | DO   | 1.8V      |                                                                |
| P93        | HDMI_D2- / DP1_LANE0-    | HDMI_TX2_N                                       | DO   | 1.8V      |                                                                |
| P94        | GND                      | NA                                               | -    | NA        |                                                                |
| P95        | HDMI_D1+ / DP1_LANE1+    | HDMI_TX1_P                                       | DO   | 1.8V      |                                                                |
| P96        | HDMI_D1- / DP1_LANE1-    | HDMI_TX1_N                                       | DO   | 1.8V      |                                                                |
| P97        | GND                      | NA                                               | -    | NA        |                                                                |
| P98        | HDMI_D0+ / DP1_LANE2+    | HDMI_TX0_P                                       | DO   | 1.8V      |                                                                |
| P99        | HDMI_D0- / DP1_LANE2-    | HDMI_TX0_N                                       | DO   | 1.8V      |                                                                |
| P100       | GND                      | NA                                               | -    | NA        |                                                                |
| P101       | HDMI_CK+ / DP1_LANE3+    | HDMI_TXC_P                                       | DO   | 1.8V      |                                                                |
| P102       | HDMI_CK- / DP1_LANE3-    | HDMI_TXC_N                                       | DO   | 1.8V      |                                                                |
| P103       | GND                      | NA                                               | -    | NA        |                                                                |
| P104       | HDMI_HPD / DP1_HPD       | HDMI_HPD                                         | DI   | 1.8V      |                                                                |
| P105       | HDMI_CTRL_CK / DP1_AUX+  | HDMI_DDC_SCL                                     | DI/O | 1.8V      |                                                                |
| P106       | HDMI_CTRL_DAT / DP1_AUX- | HDMI_DDC_SDA                                     | DI/O | 1.8V      |                                                                |
| P107       | DP1_AUX_SEL              | NA                                               | -    | NA        | Can be connected to HDMI_CEC if R125 is stuffed (not standard) |
| P108       | GPIO0 / CAM0_PWR#        | GPA0                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P109       | GPIO1 / CAM1_PWR#        | GPA1                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P110       | GPIO2 / CAM0_RST#        | GPA2                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P111       | GPIO3 / CAM1_RST#        | GPA3                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P112       | GPIO4 / HDA_RST#         | GPA4                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P113       | GPIO5 / PWM_OUT          | GPA5                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P114       | GPIO6 / TACHIN           | GPA6                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P115       | GPIO7                    | GPA7                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P116       | GPIO8                    | GPB1                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P117       | GPIO9                    | GPB2                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P118       | GPIO10                   | GPB3                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |
| P119       | GPIO11                   | GPB4                                             | DI/O | 1.8V      | From GPIO expander (U14)                                       |

| SMARCPin # | SMARC Pin Name | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                                                | I/O  | I/O Level | Comments                 |
|------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|--------------------------|
| P120       | GND            | NA                                                                                                                                                                                              | -    | NA        |                          |
| P121       | I2C_PM_CK      | <b>I2C: I2C4_CLK</b><br>PWM: PWM2_OUT<br>PCI: PCIE_CLKREQ_B<br>SPI: ECSP12_MISO<br>GPIO: GPIO5_IO20                                                                                             | DI/O | 1.8V      |                          |
| P122       | I2C_PM_DAT     | <b>I2C: I2C4_SDA</b><br>PWM: PWM1_OUT<br>SPI: ECSP12_SS0<br>GPIO: GPIO5_IO21                                                                                                                    | DI/O | 1.8V      |                          |
| P123       | BOOT_SEL0#     | BOOT_MODE1                                                                                                                                                                                      | DI   | 1.8V      | 10k pull-down            |
| P124       | BOOT_SEL1#     | BOOT_MODE2                                                                                                                                                                                      | DI   | 1.8V      | 10k pull-down            |
| P125       | BOOT_SEL2#     | BOOT_MODE3                                                                                                                                                                                      | DI   | 1.8V      | 10k pull-down            |
| P126       | RESET_OUT#     | GPB5                                                                                                                                                                                            | DI/O | 1.8V      | From GPIO expander (U14) |
| P127       | RESET_IN#      | POR_B                                                                                                                                                                                           | DI   | 1.8V      |                          |
| P128       | POWER_BTN#     | ONOFF                                                                                                                                                                                           | DI   | 1.8 - 5V  |                          |
| P129       | SER0_TX        | <b>UART: UART4_DCE_TX</b><br>UART: UART4_DTE_RX<br>UART: UART2_DCE_RTS<br>UART: UART2_DTE_CTS<br>TIMER: GPT1_CAPTURE1<br>I2C: I2C6_SDA<br>GPIO: GPIO5_IO29                                      | DO   | 1.8V      |                          |
| P130       | SER0_RX        | <b>UART: UART4_DCE_RX</b><br>UART: UART4_DTE_TX<br>UART: UART2_DCE_CTS<br>UART: UART2_DTE_RTS<br>PCI: PCIE_CLKREQ_B<br>TIMER: GPT1_COMPARE1<br>I2C: I2C6_SCL<br>GPIO: GPIO5_IO28                | DI   | 1.8V      |                          |
| P131       | SER0_RTS#      | <b>NAND: NAND_DATA03</b><br>SPI: FLEXSPI_A_DATA03<br>SDHC: USDHC3_WP<br><b>UART: UART4_DCE_RTS</b><br>UART: UART4_DTE_CTS<br>ISP: ISP_FL_TRIG_1<br>GPIO: GPIO3_IO09<br>DEBUG: CORESIGHT_TRACE07 | DI   | 1.8V      |                          |
| P132       | SER0_CTS#      | <b>NAND: NAND_DATA02</b><br>SPI: FLEXSPI_A_DATA02<br>SDHC: USDHC3_CD_B<br><b>UART: UART4_DCE_CTS</b><br>UART: UART4_DTE_RTS<br>I2C: I2C4_SDA<br>GPIO: GPIO3_IO08<br>DEBUG: CORESIGHT_TRACE06    | DO   | 1.8V      |                          |

| SMARCPin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                                                                                                                                         | I/O | I/O Level | Comments |
|------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------|----------|
| P133       | GND            | NA                                                                                                                                                                                                    | -   | NA        |          |
| P134       | SER1_TX        | UART: <b>UART2_DCE_TX</b><br>UART: UART2_DTE_RX<br>SPI: ECPI53_SS0<br>TIMER: GPT1_COMPARE2<br>GPIO: GPIO5_IO25                                                                                        | DO  | 1.8V      |          |
| P135       | SER1_RX        | UART: <b>UART2_DCE_TX</b><br>UART: UART2_DTE_RX<br>SPI: ECPI53_SS0<br>TIMER: GPT1_COMPARE2<br>GPIO: GPIO5_IO24                                                                                        | DI  | 1.8V      |          |
| P136       | SER2_TX        | SPI: ECPI51_MOSI<br>UART: <b>UART3_DCE_TX</b><br>UART: UART3_DTE_RX<br>I2C: I2C1_SDA<br>SAI: AUDIOMIX_SAI7_RX_BCLK<br>GPIO: GPIO5_IO07                                                                | DO  | 1.8V      |          |
| P137       | SER2_RX        | SPI: ECPI51_SCLK<br>UART: <b>UART3_DCE_RX</b><br>UART: UART3_DTE_TX<br>I2C: I2C1_SCL<br>SAI: AUDIOMIX_SAI7_RX_SYNC<br>GPIO: GPIO5_IO06                                                                | DI  | 1.8V      |          |
| P138       | SER2_RTS#      | NA                                                                                                                                                                                                    | -   | NA        |          |
| P139       | SER2_CTS#      | NA                                                                                                                                                                                                    | -   | NA        |          |
| P140       | SER3_TX        | NA                                                                                                                                                                                                    | -   | NA        |          |
| P141       | SER3_RX        | NA                                                                                                                                                                                                    | -   | NA        |          |
| P142       | GND            | NA                                                                                                                                                                                                    | -   | NA        |          |
| P143       | CAN0_TX        | SAI: AUDIOMIX_SAI5_RX_DATA01<br>SAI: AUDIOMIX_SAI1_TX_DATA03<br>SAI: AUDIOMIX_SAI1_TX_SYNC<br>SAI: AUDIOMIX_SAI5_TX_SYNC<br>PDM: AUDIOMIX_PDM_BIT_STREAM01<br>GPIO: GPIO3_IO22<br>CAN: <b>CAN1_TX</b> | DO  | 1.8V      |          |
| P144       | CAN0_RX        | SAI: AUDIOMIX_SAI5_RX_DATA02<br>SAI: AUDIOMIX_SAI1_TX_DATA04<br>SAI: AUDIOMIX_SAI1_TX_SYNC<br>SAI: AUDIOMIX_SAI5_TX_BCLK<br>PDM: AUDIOMIX_PDM_BIT_STREAM02<br>GPIO: GPIO3_IO23<br>CAN: <b>CAN1_RX</b> | DI  | 1.8V      |          |
| P145       | CAN1_TX        | SAI: AUDIOMIX_SAI5_RX_DATA03<br>SAI: AUDIOMIX_SAI1_TX_DATA05<br>SAI: AUDIOMIX_SAI1_TX_SYNC<br>SAI: AUDIOMIX_SAI5_TX_DATA00<br>PDM: AUDIOMIX_PDM_BIT_STREAM03<br>GPIO: GPIO3_IO24                      | DO  | 1.8V      |          |

| SMARCPin #          | SMARC Pin Name          | CPU PIN / Multiplexing (red = default muxing)                                                                               | I/O  | I/O Level   | Comments                |
|---------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------|------|-------------|-------------------------|
| <b>CAN: CAN2_TX</b> |                         |                                                                                                                             |      |             |                         |
| P146                | CAN1_RX                 | SAI: AUDIOMIX_SAI5_MCLK<br>SAI: AUDIOMIX_SAI1_TX_BCLK<br>PWM: PWM1_OUT<br>I2C: I2C5_SDA<br>GPIO: GPIO3_IO25<br>CAN: CAN2_RX | DI   | 1.8V        |                         |
| P147                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P148                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P149                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P150                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P151                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P152                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P153                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P154                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P155                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| P156                | VDD_IN                  | VSYS                                                                                                                        | A    | 3.0 - 5.25V |                         |
| S1                  | CSI1_TX+ / I2C_CAM1_CK  | SC1                                                                                                                         | DO   | 1.8V        | From I2C expander (U13) |
| S2                  | CSI1_TX- / I2C_CAM1_DAT | SD1                                                                                                                         | DI/O | 1.8V        | From I2C expander (U13) |
| S3                  | GND                     | NA                                                                                                                          | -    | NA          |                         |
| S4                  | RSVD                    | NA                                                                                                                          | -    | NA          |                         |
| S5                  | I2C_CAM0_CK / CSIO_TX+  | SC0                                                                                                                         | DO   | 1.8V        | From I2C expander (U13) |
| S6                  | CAM_MCK                 | SPDIF: AUDIOMIX_SPDIF1_OUT<br>PWM: PWM3_OUT<br>I2C: I2C5_SCL<br>TIMER: GPT1_COMPARE1<br>CAN: CAN1_TX<br>GPIO: GPIO5_IO03    | DO   | 1.8V        |                         |
| S7                  | I2C_CAM0_DAT / CSIO_TX- | SD0                                                                                                                         | DI/O | 1.8V        | From I2C expander (U13) |
| S8                  | CSIO_CK+                | MIPI_CSI1_CLK_P                                                                                                             | DO   | 1.8V        |                         |
| S9                  | CSIO_CK-                | MIPI_CSI1_CLK_N                                                                                                             | DO   | 1.8V        |                         |
| S10                 | GND                     | NA                                                                                                                          | -    | NA          |                         |
| S11                 | CSIO_RX0+               | MIPI_CSI1_D0_P                                                                                                              | DI   | 1.8V        |                         |
| S12                 | CSIO_RX0-               | MIPI_CSI1_D0_N                                                                                                              | DI   | 1.8V        |                         |
| S13                 | GND                     | NA                                                                                                                          | -    | NA          |                         |
| S14                 | CSIO_RX1+               | MIPI_CSI1_D1_P                                                                                                              | DI   | 1.8V        |                         |
| S15                 | CSIO_RX1-               | MIPI_CSI1_D1_N                                                                                                              | DI   | 1.8V        |                         |
| S16                 | GND                     | NA                                                                                                                          | -    | NA          |                         |

| SMARCPin # | SMARC Pin Name               | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                                                                             | I/O  | I/O Level | Comments           |
|------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|--------------------|
| S17        | GBE1_MDIO+                   | TXRXP_A                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S18        | GBE1_MDIO-                   | TXRXM_A                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S19        | GBE1_LINK100#                | LED1                                                                                                                                                                                                                         | DO   | 3.3V      | From KSZ9031 (U16) |
| S20        | GBE1_MDI1+                   | TXRXP_B                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S21        | GBE1_MDI1-                   | TXRXM_B                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S22        | GBE1_LINK1000#               | LED2                                                                                                                                                                                                                         | DO   | 3.3V      | From KSZ9031 (U16) |
| S23        | GBE1_MDI2+                   | TXRXP_C                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S24        | GBE1_MDI2-                   | TXRXM_C                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S25        | GND                          | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S26        | GBE1_MDI3+                   | TXRXP_D                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S27        | GBE1_MDI3-                   | TXRXM_D                                                                                                                                                                                                                      | DI/O | 1.8V      | From KSZ9031 (U16) |
| S28        | GBE1_CTREF                   | TP34                                                                                                                                                                                                                         | -    | NA        | Test point         |
| S29        | PCIE_D_TX+ /<br>SERDES_0_TX+ | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S30        | PCIE_D_TX- /<br>SERDES_0_TX- | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S31        | GBE1_LINK_ACT#               | LED1                                                                                                                                                                                                                         | DO   | 3.3V      |                    |
| S32        | PCIE_D_RX+ /<br>SERDES_0_RX+ | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S33        | PCIE_D_RX- /<br>SERDES_0_RX- | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S34        | GND                          | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S35        | USB4+                        | USB2DN_DP4                                                                                                                                                                                                                   | DI/O | 3.3V      | From USB Hub (U9)  |
| S36        | USB4-                        | USB2DN_DM4                                                                                                                                                                                                                   | DI/O | 3.3V      | From USB Hub (U9)  |
| S37        | USB3_VBUS_DET                | NA                                                                                                                                                                                                                           | -    | NA        |                    |
| S38        | AUDIO_MCK                    | SAI: AUDIOMIX_SAI3_MCLK<br>PWM: PWM4_OUT<br>SAI: AUDIOMIX_SAI5_MCLK<br>SPDIF: AUDIOMIX_SPDIF1_OUT<br>GPIO: GPIO5_IO02<br>SPDIF: AUDIOMIX_SPDIF1_IN                                                                           | DO   | 1.8V      |                    |
| S39        | I2S0_LRCK                    | SAI: AUDIOMIX_SAI3_TX_SYNC<br>SAI: AUDIOMIX_SAI2_TX_DATA01<br>SAI: AUDIOMIX_SAI5_RX_DATA01<br>SAI: AUDIOMIX_SAI3_TX_DATA01<br>UART: UART2_DCE_RX<br>UART: UART2_DTE_TX<br>GPIO: GPIO4_IO31<br>PDM: AUDIOMIX_PDM_BIT_STREAM03 | DI/O | 1.8V      |                    |
| S40        | I2S0_SDOUT                   | SAI: AUDIOMIX_SAI3_TX_DATA00<br>SAI: AUDIOMIX_SAI2_TX_DATA03<br>SAI: AUDIOMIX_SAI5_RX_DATA03<br>TIMER: GPT1_CAPTURE2<br>SPDIF: AUDIOMIX_SPDIF1_EXT_CLK                                                                       | DO   | 1.8V      |                    |

| SMARCPin #       | SMARC Pin Name        | CPU PIN / Multiplexing (red = default muxing)                                                                                                                                                                                           | I/O  | I/O Level | Comments |
|------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|----------|
| GPIO: GPIO5_IO01 |                       |                                                                                                                                                                                                                                         |      |           |          |
| S41              | I2S0_SDIN             | SAI: <b>AUDIOMIX_SAI3_RX_DATA00</b><br>SAI: AUDIOMIX_SAI2_RX_DATA03<br>SAI: AUDIOMIX_SAI5_RX_DATA00<br>UART: UART2_DCE_RTS<br>UART: UART2_DTE_CTS<br>GPIO: GPIO4_IO30<br>PDM: AUDIOMIX_PDM_BIT_STREAM01                                 | DI   | 1.8V      |          |
| S42              | I2S0_CK               | SAI: <b>AUDIOMIX_SAI3_TX_BCLK</b><br>SAI: AUDIOMIX_SAI2_TX_DATA02<br>SAI: AUDIOMIX_SAI5_RX_DATA02<br>TIMER: GPT1_CAPTURE1<br>UART: UART2_DCE_TX<br>UART: UART2_DTE_RX<br>GPIO: GPIO5_IO00<br>PDM: AUDIOMIX_PDM_BIT_STREAM02             | DI/O | 1.8V      |          |
| S43              | ESPI_ALERT0#          | NA                                                                                                                                                                                                                                      | -    | NA        |          |
| S44              | ESPI_ALERT1#          | NA                                                                                                                                                                                                                                      | -    | NA        |          |
| S45              | MDIO_CLK              | NA                                                                                                                                                                                                                                      | -    | NA        |          |
| S46              | MDIO_DAT              | NA                                                                                                                                                                                                                                      | -    | NA        |          |
| S47              | GND                   | NA                                                                                                                                                                                                                                      | -    | NA        |          |
| S48              | I2C_GP_CK             | I2C: <b>I2C2_SCL</b><br>ENET: ENET_QOS_1588_EVENT1_IN<br>SDHC: USDHC3_CD_B<br>SPI: ECSP11_MISO<br>ENET: ENET_QOS_1588_EVENT1_AUX_IN<br>GPIO: GPIO5_IO16                                                                                 | DO   | 1.8V      |          |
| S49              | I2C_GP_DAT            | I2C: <b>I2C2_SDA</b><br>ENET: ENET_QOS_1588_EVENT1_OUT<br>SDHC: USDHC3_WP<br>SPI: ECSP11_SS0<br>GPIO: GPIO5_IO17                                                                                                                        | DI/O | 1.8V      |          |
| S50              | I2S2_LRCK / HDA_SYNC  | SAI: <b>AUDIOMIX_SAI2_TX_SYNC</b><br>SAI: AUDIOMIX_SAI5_TX_DATA01<br>ENET: ENET_QOS_1588_EVENT3_OUT<br>SAI: AUDIOMIX_SAI2_TX_DATA01<br>UART: UART1_DCE_CTS<br>UART: UART1_DTE_RTS<br>GPIO: GPIO4_IO24<br>PDM: AUDIOMIX_PDM_BIT_STREAM02 | DI/O | 1.8V      |          |
| S51              | I2S2_SDOOUT / HDA_SDO | SAI: <b>AUDIOMIX_SAI2_TX_DATA00</b><br>SAI: AUDIOMIX_SAI5_TX_DATA03<br>ENET: ENET_QOS_1588_EVENT2_IN<br>CAN: CAN2_TX<br>ENET: ENET_QOS_1588_EVENT2_AUX_IN<br>GPIO: GPIO4_IO26                                                           | DO   | 1.8V      |          |
| S52              | I2S2_SDIN / HDA_SDI   | SAI: <b>AUDIOMIX_SAI2_RX_DATA00</b><br>SAI: AUDIOMIX_SAI5_TX_DATA00                                                                                                                                                                     | DI   | 1.8V      |          |

| SMARCPin # | SMARC Pin Name           | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                                                       | I/O  | I/O Level | Comments          |
|------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|-------------------|
|            |                          | ENET: ENET_QOS_1588_EVENT2_OUT<br>SAI: AUDIOMIX_SAI2_TX_DATA01<br>UART: UART1_DCE_RTS<br>UART: UART1_DTE_CTS<br>GPIO: GPIO4_IO23<br>PDM: AUDIOMIX_PDM_BIT_STREAM03                                     |      |           |                   |
| S53        | I2S2_CK / HDA_CK         | SAI: AUDIOMIX_SAI2_TX_BCLK<br>SAI: AUDIOMIX_SAI5_RX_BCLK<br>CAN: CAN1_TX<br>UART: UART1_DCE_RX<br>UART: UART1_DTE_TX<br>GPIO: GPIO4_IO22<br>PDM: AUDIOMIX_PDM_BIT_STREAM01                             | DI/O | 1.8V      |                   |
| S54        | SATA_ACT#                | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S55        | USB5_EN_OC#              | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S56        | ESPI_IO_2 /<br>QSPI_IO_2 | GPIO: GPIO1_IO15<br>USB: USB2_OC<br>SDHC: USDHC3_WP<br>PWM: PWM4_OUT<br>CLK: CCM_CLKO2                                                                                                                 | DI/O | 1.8V      |                   |
| S57        | ESPI_IO_3 /<br>QSPI_IO_3 | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S58        | ESPI_RESET#              | SAI: AUDIOMIX_SAI3_RX_BCLK<br>SAI: AUDIOMIX_SAI2_RX_DATA02<br>SAI: AUDIOMIX_SAI5_RX_BCLK<br>TIMER: GPT1_CLK<br>UART: UART2_DCE_CTS<br>UART: UART2_DTE_RTS<br>GPIO: GPIO4_IO29<br>PDM: AUDIOMIX_PDM_CLK | DI/O | 1.8V      | <                 |
| S59        | USB5+                    | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S60        | USB5-                    | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S61        | GND                      | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S62        | USB3_SSTX+               | USB3DN_TXDP1                                                                                                                                                                                           | DI/O | 3.3V      | From USB Hub (U9) |
| S63        | USB3_SSTX-               | USB3DN_TXDM1                                                                                                                                                                                           | DI/O | 3.3V      | From USB Hub (U9) |
| S64        | GND                      | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S65        | USB3_SSRX+               | USB3DN_RXDP1                                                                                                                                                                                           | DI/O | 3.3V      | From USB Hub (U9) |
| S66        | USB3_SSRX-               | USB3DN_RXDM1                                                                                                                                                                                           | DI/O | 3.3V      | From USB Hub (U9) |
| S67        | GND                      | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S68        | USB3+                    | USB2DN_DP1                                                                                                                                                                                             | DI/O | 3.3V      | From USB Hub (U9) |
| S69        | USB3-                    | USB2DN_DM1                                                                                                                                                                                             | DI/O | 3.3V      | From USB Hub (U9) |
| S70        | GND                      | NA                                                                                                                                                                                                     | -    | NA        |                   |
| S71        | USB2_SSTX+               | USB3DN_TXDP3                                                                                                                                                                                           | DI/O | 3.3V      | From USB Hub (U9) |
| S72        | USB2_SSTX-               | USB3DN_TXDM3                                                                                                                                                                                           | DI/O | 3.3V      | From USB Hub (U9) |

| SMARCPin # | SMARC Pin Name               | CPU PIN / Multiplexing<br>(red = default muxing) | I/O  | I/O Level | Comments          |
|------------|------------------------------|--------------------------------------------------|------|-----------|-------------------|
| S73        | GND                          | NA                                               | -    | NA        |                   |
| S74        | USB2_SSRX+                   | USB3DN_RXDP3                                     | DI/O | 3.3V      | From USB Hub (U9) |
| S75        | USB2_SSRX-                   | USB3DN_RXDM3                                     | DI/O | 3.3V      | From USB Hub (U9) |
| S76        | PCIE_B_RST#                  | NA                                               | -    | NA        |                   |
| S77        | PCIE_C_RST#                  | NA                                               | -    | NA        |                   |
| S78        | PCIE_C_RX+ /<br>SERDES_1_RX+ | NA                                               | -    | NA        |                   |
| S79        | PCIE_C_RX- /<br>SERDES_1_RX- | NA                                               | -    | NA        |                   |
| S80        | GND                          | NA                                               | -    | NA        |                   |
| S81        | PCIE_C_TX+ /<br>SERDES_1_TX+ | NA                                               | -    | NA        |                   |
| S82        | PCIE_C_TX- /<br>SERDES_1_TX- | NA                                               | -    | NA        |                   |
| S83        | GND                          | NA                                               | -    | NA        |                   |
| S84        | PCIE_B_REFCK+                | NA                                               | -    | NA        |                   |
| S85        | PCIE_B_REFCK-                | NA                                               | -    | NA        |                   |
| S86        | GND                          | NA                                               | -    | NA        |                   |
| S87        | PCIE_B_RX+                   | NA                                               | -    | NA        |                   |
| S88        | PCIE_B_RX-                   | NA                                               | -    | NA        |                   |
| S89        | GND                          | NA                                               | -    | NA        |                   |
| S90        | PCIE_B_TX+                   | NA                                               | -    | NA        |                   |
| S91        | PCIE_B_TX-                   | NA                                               | -    | NA        |                   |
| S92        | GND                          | NA                                               | -    | NA        |                   |
| S93        | DPO_LANE0+                   | NA                                               | -    | NA        |                   |
| S94        | DPO_LANE0-                   | NA                                               | -    | NA        |                   |
| S95        | DPO_AUX_SEL                  | NA                                               | -    | NA        |                   |
| S96        | DPO_LANE1+                   | NA                                               | -    | NA        |                   |
| S97        | DPO_LANE1-                   | NA                                               | -    | NA        |                   |
| S98        | DPO_HPD                      | NA                                               | -    | NA        |                   |
| S99        | DPO_LANE2+                   | NA                                               | -    | NA        |                   |
| S100       | DPO_LANE2-                   | NA                                               | -    | NA        |                   |
| S101       | GND                          | NA                                               | -    | NA        |                   |
| S102       | DPO_LANE3+                   | NA                                               | -    | NA        |                   |
| S103       | DPO_LANE3-                   | NA                                               | -    | NA        |                   |
| S104       | USB3_OTG_ID                  | NA                                               | -    | NA        |                   |
| S105       | DPO_AUX+                     | NA                                               | -    | NA        |                   |
| S106       | DPO_AUX-                     | NA                                               | -    | NA        |                   |
| S107       | LCD1_BKLT_EN                 | <b>NAND</b> : NAND_CLE                           | DI/O | 1.8V      |                   |



| SMARCPin # | SMARC Pin Name                          | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                                       | I/O  | I/O Level | Comments   |
|------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|------------|
|            |                                         | <b>SPI:</b> FLEXSPI_B_SCLK<br><b>SDHC:</b> USDHC3_DATA7<br><b>UART:</b> UART4_DCE_RX<br><b>UART:</b> UART4_DTE_TX<br><b>GPIO:</b> <b>GPIO3_IO05</b><br><b>DEBUG:</b> CORESIGHT_TRACE03 |      |           |            |
| S108       | LVDS1_CK+ /<br>eDP1_AUX+ /<br>DSI1_CLK+ | LVDS1_CLK_P                                                                                                                                                                            | DO   | 1.8V      |            |
| S109       | LVDS1_CK- /<br>eDP1_AUX- /<br>DSI1_CLK- | LVDS1_CLK_N                                                                                                                                                                            | DO   | 1.8V      |            |
| S110       | GND                                     | NA                                                                                                                                                                                     | -    | NA        |            |
| S111       | LVDS1_0+ /<br>eDP1_TX0+ /<br>DSI1_D0+   | LVDS1_TX0_P                                                                                                                                                                            | DO   | 1.8V      |            |
| S112       | LVDS1_0- /<br>eDP1_TX0- /<br>DSI1_D0-   | LVDS1_TX0_N                                                                                                                                                                            | DO   | 1.8V      |            |
| S113       | eDP1_HPD / DSI1_TE                      | TP27                                                                                                                                                                                   | -    | NA        | Test point |
| S114       | LVDS1_1+ /<br>eDP1_TX1+ /<br>DSI1_D1+   | LVDS1_TX1_P                                                                                                                                                                            | DO   | 1.8V      |            |
| S115       | LVDS1_1- /<br>eDP1_TX1- /<br>DSI1_D1-   | LVDS1_TX1_N                                                                                                                                                                            | DO   | 1.8V      |            |
| S116       | LCD1_VDD_EN                             | <b>GPIO:</b> <b>GPIO1_IO05</b><br><b>M7:</b> M7_NMI<br><b>ISP:</b> ISP_FL_TRIG_1<br><b>CLK:</b> CCM_PMIC_READY                                                                         | DI/O | 1.8V      |            |
| S117       | LVDS1_2+ /<br>eDP1_TX2+ /<br>DSI1_D2+   | LVDS1_TX2_P                                                                                                                                                                            | DO   | 1.8V      |            |
| S118       | LVDS1_2- /<br>eDP1_TX2- /<br>DSI1_D2-   | LVDS1_TX2_N                                                                                                                                                                            | DO   | 1.8V      |            |
| S119       | GND                                     | NA                                                                                                                                                                                     | -    | NA        |            |
| S120       | LVDS1_3+ /<br>eDP1_TX3+ /<br>DSI1_D3+   | LVDS1_TX3_P                                                                                                                                                                            | DO   | 1.8V      |            |
| S121       | LVDS1_3- /<br>eDP1_TX3- /<br>DSI1_D3-   | LVDS1_TX3_N                                                                                                                                                                            | DO   | 1.8V      |            |
| S122       | LCD1_BKLT_PWM                           | <b>TIMER:</b> GPT1_COMPARE3<br><b>GPIO:</b> GPIO5_IO05<br><b>SPDIF:</b> AUDIOMIX_SPDIF1_EXT_CLK<br><b>PWM:</b> <b>PWM1_OUT</b>                                                         | DO   | 1.8V      |            |
| S123       | GPIO13                                  | <b>GPIO:</b> <b>GPIO1_IO00</b><br><b>CCM:</b> CCM_ENET_PHY_REF_CLK_ROOT<br><b>ISP:</b> ISP_FL_TRIG_0<br><b>SAI:</b> ANAMIX_REF_CLK_32K<br><b>CCM:</b> CCM_EXT_CLK1                     | DI/O | 1.8V      |            |

| SMARCPin # | SMARC Pin Name                           | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                                                         | I/O  | I/O Level | Comments |
|------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|----------|
| S124       | GND                                      | NA                                                                                                                                                                                                       | -    | NA        |          |
| S125       | LVDS0_0+ /<br>eDP0_TX0+ /<br>DSIO_D0+    | MIPI_DSI1_D0_P                                                                                                                                                                                           | DO   | 1.8V      |          |
| S126       | LVDS0_0- /<br>eDP0_TX0- /<br>DSIO_D0-    | MIPI_DSI1_D0_N                                                                                                                                                                                           | DO   | 1.8V      |          |
| S127       | LCD0_BKLT_EN                             | <b>NAND:</b> NAND_RE_B<br><b>SPI:</b> FLEXSPI_B_DQS<br><b>SDHC:</b> USDHC3_DATA4<br><b>UART:</b> UART4_DCE_TX<br><b>UART:</b> UART4_DTE_RX<br><b>GPIO:</b> GPIO3_IO15<br><b>DEBUG:</b> CORESIGHT_TRACE13 | DO   | 1.8V      |          |
| S128       | LVDS0_1+ /<br>eDP0_TX1+ /<br>DSIO_D1+    | MIPI_DSI1_D1_P                                                                                                                                                                                           | DO   | 1.8V      |          |
| S129       | LVDS0_1- /<br>eDP0_TX1- /<br>DSIO_D1-    | MIPI_DSI1_D1_N                                                                                                                                                                                           | DO   | 1.8V      |          |
| S130       | GND                                      | NA                                                                                                                                                                                                       | -    | NA        |          |
| S131       | LVDS0_2+ /<br>eDP0_TX2+ /<br>DSIO_D2+    | MIPI_DSI1_D2_P                                                                                                                                                                                           | DO   | 1.8V      |          |
| S132       | LVDS0_2- /<br>eDP0_TX2- /<br>DSIO_D2-    | MIPI_DSI1_D2_N                                                                                                                                                                                           | DO   | 1.8V      |          |
| S133       | LCD0_VDD_EN                              | <b>SAI:</b> AUDIOMIX_SAI1_RX_DATA01<br><b>PDM:</b> AUDIOMIX_PDM_BIT_STREAM01<br><b>ENET:</b> ENET1_1588_EVENT1_OUT<br><b>GPIO:</b> GPIO4_IO03                                                            | DO   | 1.8V      |          |
| S134       | LVDS0_CLK+ /<br>eDP0_AUX+ /<br>DSIO_CLK+ | MIPI_DSI1_CLK_P                                                                                                                                                                                          | DO   | 1.8V      |          |
| S135       | LVDS0_CLK- /<br>eDP0_AUX- /<br>DSIO_CLK- | MIPI_DSI1_CLK_N                                                                                                                                                                                          | DO   | 1.8V      |          |
| S136       | GND                                      | NA                                                                                                                                                                                                       | -    | NA        |          |
| S137       | LVDS0_3+ /<br>eDP0_TX3+ /<br>DSIO_D3+    | MIPI_DSI1_D3_P                                                                                                                                                                                           | DO   | 1.8V      |          |
| S138       | LVDS0_3- /<br>eDP0_TX3- /<br>DSIO_D3-    | MIPI_DSI1_D3_N                                                                                                                                                                                           | DO   | 1.8V      |          |
| S139       | I2C_LCD_CK                               | NA                                                                                                                                                                                                       | -    | NA        |          |
| S140       | I2C_LCD_DAT                              | NA                                                                                                                                                                                                       | -    | NA        |          |
| S141       | LCD0_BKLT_PWM                            | <b>SPDIF:</b> AUDIOMIX_SPDIF1_IN<br><b>PWM:</b> PWM2_OUT<br><b>I2C:</b> I2C5_SDA<br><b>TIMER:</b> GPT1_COMPARE2<br><b>CAN:</b> CAN1_RX                                                                   | DI/O | 1.8V      |          |

| SMARCPin #       | SMARC Pin Name     | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                                                            | I/O  | I/O Level | Comments                 |
|------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|--------------------------|
| GPIO: GPIO5_IO04 |                    |                                                                                                                                                                                                             |      |           |                          |
| S142             | GPIO12             | NAND: NAND_CE1_B<br>SPI: FLEXSPI_A_SS1_B<br>USDHC: USDHC3_STROBE<br>I2C: I2C4_SCL<br>GPIO: GPIO3_IO02<br>DEBUG: CORESIGHT_TRACE00                                                                           | DI/O | 1.8V      |                          |
| S143             | GND                | NA                                                                                                                                                                                                          | -    | NA        |                          |
| S144             | eDP0_HPD / DSI0_TE | TP26                                                                                                                                                                                                        | -    | NA        | Test point               |
| S145             | WDT_TIME_OUT#      | WD0G_B                                                                                                                                                                                                      | DO   | 1.8V      |                          |
| S146             | PCIE_WAKE#         | SAI: AUDIOMIX_SAI3_RX_SYNC<br>SAI: AUDIOMIX_SAI2_RX_DATA01<br>SAI: AUDIOMIX_SAI5_RX_SYNC<br>SAI: AUDIOMIX_SAI3_RX_DATA01<br>SPDIF: AUDIOMIX_SPDIF1_IN<br>GPIO: GPIO4_IO28<br>PDM: AUDIOMIX_PDM_BIT_STREAM00 | DI   | 3.3V      |                          |
| S147             | VDD_RTC            | NVCC_SNVS                                                                                                                                                                                                   | A    | 1.8V      |                          |
| S148             | LID#               | GPIO: GPIO1_IO11<br>USB: USB2_ID<br>PWM: PWM2_OUT<br>SDHC: USDHC3_VSELECT<br>CLK: CCM_PMIC_READY                                                                                                            | DI   | 1.8 - 5V  |                          |
| S149             | SLEEP#             | GPIO: GPIO1_IO08<br>ENET: ENET_QOS_1588_EVENT0_IN<br>PWM: PWM1_OUT<br>ISP: ISP_PRELIGHT_TRIG_1<br>ENET: ENET_QOS_1588_EVENT0_AUX_IN<br>SDHC: USDHC2_RESET_B                                                 | DI   | 1.8 - 5V  |                          |
| S150             | VIN_PWR_BAD#       | PMIC_RST_B                                                                                                                                                                                                  | DI   | VDD_IN    |                          |
| S151             | CHARGING#          | GPB6                                                                                                                                                                                                        | DI   | 1.8 - 5V  | From GPIO expander (U14) |
| S152             | CHARGER_PRSENT#    | SAI: AUDIOMIX_SAI1_TX_DATA07<br>SAI: AUDIOMIX_SAI6_MCLK<br>PDM: AUDIOMIX_PDM_CLK<br>ENET: ENET1_TX_ER<br>GPIO: GPIO4_IO19                                                                                   | DI   | 1.8 - 5V  |                          |
| S153             | CARRIER_STBY#      | GPIO: GPIO1_IO09<br>ENET: ENET_QOS_1588_EVENT0_OUT<br>PWM: PWM2_OUT<br>ISP: ISP_SHUTTER_OPEN_1<br>SDHC: USDHC3_RESET_B<br>DMA: SDMA2_EXT_EVENT00                                                            | DO   | 1.8V      |                          |
| S154             | CARRIER_PWR_ON     | GPIO: GPIO1_IO10<br>USB: USB1_ID<br>PWM: PWM3_OUT                                                                                                                                                           | DO   | 1.8V      |                          |
| S155             | FORCE_RECOV#       | SAI: AUDIOMIX_SAI1_TX_DATA06<br>SAI: AUDIOMIX_SAI6_RX_SYNC                                                                                                                                                  | DI   | 1.8V      |                          |

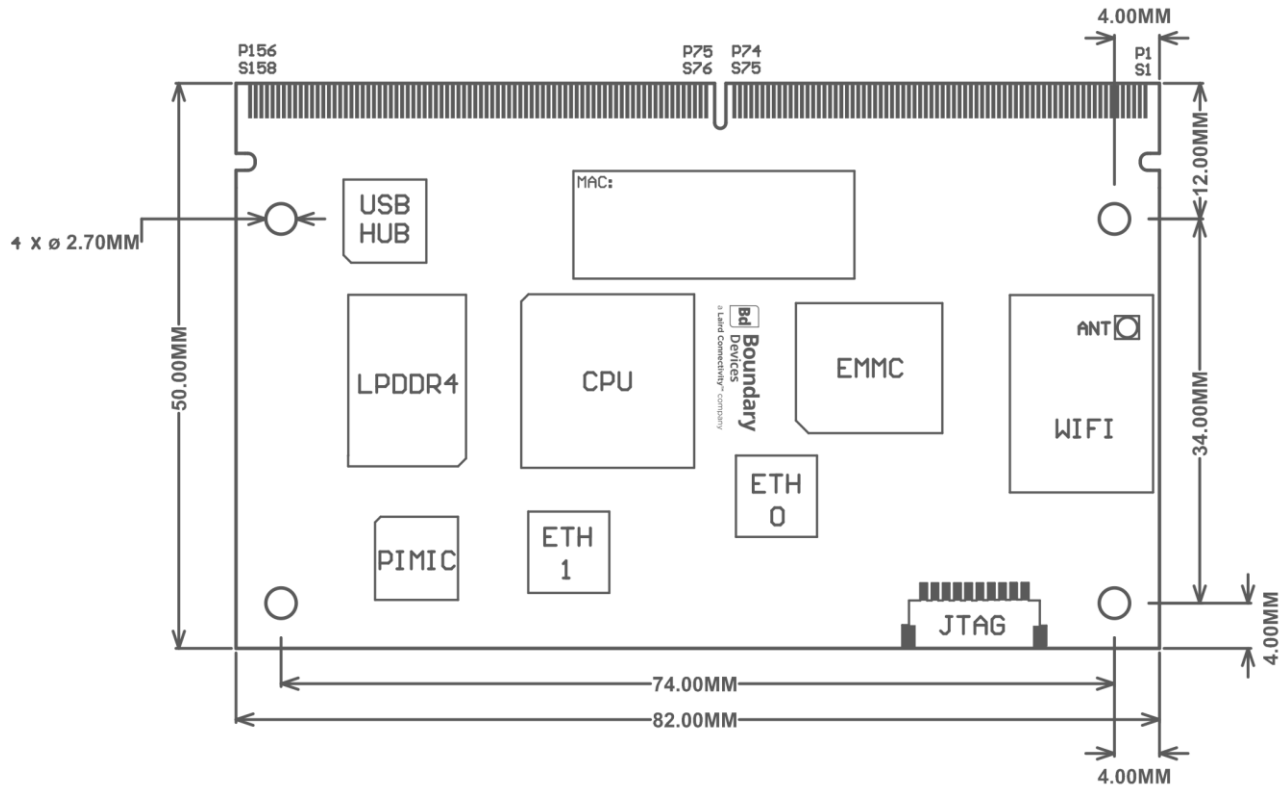
| SMARCPin #                                                                               | SMARC Pin Name | CPU PIN / Multiplexing<br>(red = default muxing) | I/O | I/O Level | Comments                 |
|------------------------------------------------------------------------------------------|----------------|--------------------------------------------------|-----|-----------|--------------------------|
| <b>SAI:</b> AUDIOMIX_SAI6_TX_SYNC<br><b>ENET:</b> ENET1_RX_ER<br><b>GPIO:</b> GPIO4_IO18 |                |                                                  |     |           |                          |
| S156                                                                                     | BATLOW#        | GPB7                                             | DI  | 1.8 - 5V  | From GPIO expander (U14) |
| S157                                                                                     | TEST#          | TP43                                             | DI  | 1.8 - 5V  | Test point               |
| S158                                                                                     | GND            | NA                                               | -   | NA        |                          |

**Table 8: Pinout table for Nitrogen8M Plus SMARC JTAG connector (J1)**

| Pin # | Pin Name       | CPU PIN / Multiplexing | I/O | I/O Level | Comments                 |
|-------|----------------|------------------------|-----|-----------|--------------------------|
| 1     | VDD_JTAG       | VDD_1P8V               | DO  | 1.8V      |                          |
| 2     | JTAG_TRST#     | TP14                   | -   | NA        | Test point               |
| 3     | JTAG_TMS       | JTAG_TMS               | DI  | 1.8V      |                          |
| 4     | JTAG_TDO       | JTAG_TDO               | DO  | 1.8V      |                          |
| 5     | JTAG_TDI       | JTAG_TDI               | DI  | 1.8V      |                          |
| 6     | JTAG_TCK       | JTAG_TCK               | DI  | 1.8V      |                          |
| 7     | JTAG_RTCK      | TP15                   | DI  | 1.8V      |                          |
| 8     | JTAG_RESET_IN# | GPB0                   | DI  | 1.8V      | From GPIO expander (U14) |
| 9     | MFG_MODE#      | NA                     | -   | 1.8V      |                          |
| 10    | GND            | GND                    | -   | NA        |                          |

## 9 MECHANICAL AND PCB FOOTPRINT SPECIFICATION

Module dimensions of the Nitrogen8M Plus SMARC are 82 x 50 mm. Detail drawings are shown below.



## 10 STORAGE INSTRUCTIONS

### Required Storage Conditions:

- **Prior to Opening the Dry Packing**  
The following are required storage conditions prior to opening the dry packing:
  - Normal temperature: 5~40°C
  - Normal humidity: 80% (Relative humidity) or less
  - Storage period: One year or less

## 11 REGULATORY

### Regulatory IDs Summary

| Model                 | US/FCC       | Canada/IC      | Japan      |
|-----------------------|--------------|----------------|------------|
| Nitrogen8M Plus SMARC | SQG-LWB5PLUS | 3147A-LWB5PLUS | 201-200402 |

## 12 CERTIFIED ANTENNAS

The Nitrogen8M Plus SMARC contains the Sterling LWSB5+ module, which was certified with the following antennas.

| Manufacturer       | Model                      | Laird Connectivity<br>Part Number | Type         | Connector    | Peak Gain |          |
|--------------------|----------------------------|-----------------------------------|--------------|--------------|-----------|----------|
|                    |                            |                                   |              |              | 2.4 GHz   | 5GHz     |
| TE Connectivity    | 2.4/5.5 GHz Dipole Antenna | 001-0009                          | Dipole       | RP-SMA       | 2 dBi     | 2 dBi    |
| Laird Connectivity | FlexPIFA                   | 001-0021                          | PIFA         | MHF4L        | 2.5 dBi   | 3 dBi    |
| Laird Connectivity | Mini NanoBlade Flex        | EMF2449A1-10MH4L                  | PCB Dipole   | MHF4L        | 2.78 dBi  | 3.38 dBi |
| Laird Connectivity | NanoBlade                  | ENB2449A1-10MH4L                  | PCB Dipole   | MHF4L        | 2 dBi     | 3.9 dBi  |
| ACX                | AD1608-A2455AAT/LF         | N/A                               | Chip Antenna | MHF4L        | 1 dBi     | 4 dBi    |
| Laird Connectivity | MHF4L Jumper               | CARSMF10AMH4L-001                 | N/A          | SMA to MHF4L |           |          |

## 13 ORDERING INFORMATION

| Order Model                     | Description                                                              |
|---------------------------------|--------------------------------------------------------------------------|
| <b>N8MP_SMARC_SOM_2r16eWB</b>   | SMARC SOM: i.MX8M Quad Plus / 2GB / 16GB eMMC / LWB5+                    |
| <b>N8MP_SMARC_SOM_4r16eWB</b>   | SMARC SOM: i.MX8M Quad Plus / 4GB / 16GB eMMC / LWB5+                    |
| <b>N8MP_SMARC_SOM_2r16eWB_i</b> | SMARC SOM: i.MX8M Quad Plus / 2GB / 16GB eMMC / LWB5+ / Industrial Temp  |
| <b>N8MP_SMARC_SOM_4r16eWB_i</b> | SMARC SOM: i.MX8M Quad Plus / 4GB / 16GB eMMC / LWB5+ / Industrial Temp  |
| <b>N8MP_SMARC_SOM_8r16eWB</b>   | SMARC SOM: i.MX8M Quad Plus / 8GB / 16GB eMMC / LWB5+ (MOQ requirements) |
| <b>SMARC_CAR_BRD</b>            | Universal Carrier Board - SMARC (Note - SOM sold separately)             |

## 14 ADDITIONAL ASSISTANCE

Please contact your local sales representative or our support team for further assistance:

Boundary Devices Support Center: <https://boundarydevices.com/support/>

Email: [support@boundarydevices.com](mailto:support@boundarydevices.com)

Phone: Americas: +1-800-492-2320

Europe: +44-1628-858-940

Hong Kong: +852-2762-4823

Web: <https://www.lairdconnect.com/products>

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**Note:** Information contained in this document is subject to change.

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