

# Datasheet

## Tungsten510 SMARC

*Version 1.2*

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## Revision History

| Version | Date          | Notes                                                    | Contributors   | Approver      |
|---------|---------------|----------------------------------------------------------|----------------|---------------|
| 0.1     | 27 Mar 2024   | Preliminary Release                                      | Jody Van       | Gary Bisson   |
| 0.2     | 13 June 2024  | Added SMARC_CAR to orderable parts.                      | Dave Drogowski | Jonathan Kaye |
| 0.3     | 21 June 2024  | Added DC Consumption Data                                | Jody Van       | Jonathan Kaye |
| 0.4     | 3 July 2024   | Added <b>Reliability Test</b> information                | Connie Lin     | Jonathan Kaye |
| 1.0     | 17 Sep 2024   | Removed references to JTAG. Initial release.             | Dave Drogowski | Jody Van      |
| 1.1     | 13 Jan 2025   | Added Heatsink information<br>Updated Mechanical Drawing | Jody Van       | Gary Bisson   |
| 1.2     | 21 March 2025 | Updated heatsink part number and image                   | Jody Van       | Jonathan Kaye |

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## 1 Scope

This document describes key hardware aspects of Boundary Device's Tungsten510 SMARC system-on-module which is based on the MediaTek Genio 510 (MT8370) processor family and our Sona MT320, based on the the Filogic 320 (MT7921) Wi-Fi/BT combo radio.

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



## 2 Introduction

The Tungsten510 SMARC module uses the MediaTek Genio 510 (MT8370) processor which integrates a hexa-core CPU with 2 'big core' Arm Cortex-A78 CPUs and 4 'efficiency core' Cortex-A55 CPU, plus a highly capable Arm Mali-G57 GPU with up to 8GB of quad-channel LPDDR4 (X) memory.

The highly efficient, in-chip AI multi-processor (APU) offers 4 TOPS performance for Deep Learning (DL), Neural Network (NN) acceleration and Computer Vision (CV) applications when combined with high-detail cameras up to 32MP at 30fps (via in-chip ISP and MIPI-CSI interface). The MediaTek APU supports both efficiency focused INT8 and INT16, and precision focused FP16 tasks.

Using the advanced TSMC N6 (6nm-class) production process allows the Genio 510 to be exceptionally power efficient, enabling product designers to use fanless enclosures or even off-grid power solutions. Extensive platform integration plus a small footprint helps minimize BOM and development costs, accelerating time to market.

Support for up to 4K60 + FHD60 dual displays provide huge screen real-estate, while advanced multimedia encoding/decoding engines (4K75 decode, 4K30 encode), including AV1 decoding, makes the Genio 510 ideal for human-centric applications like interactive advertising, streaming audio and video services, and video conferencing.

A variety of robust control networks for industrial applications are possible via many interfaces: SPI, I2C, UART, USB 3.0, PCIe and Gigabit Ethernet.

The Tungsten510 SMARC with the MT7921 Wi-Fi/BT combo provides IEEE 802.11 ax 2x2 MIMO Wi-Fi capability and a BT 5.3 radio solution. The radio interface is SDIO 3.0 for Wi-Fi and Bluetooth for optimized power usage.

The Tungsten510 SMARC has several product SKUs providing different eMMC and LPDDR4 memory configurations, see Ordering Information section.

## 3 Tungsten510 SMARC Features Summary

The Tungsten510 SMARC module is based on MT8370 from MediaTek 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 Tungsten510 SMARC are described in **Table 1**.

**Table 1: Key Features of Tungsten510 SMARC**

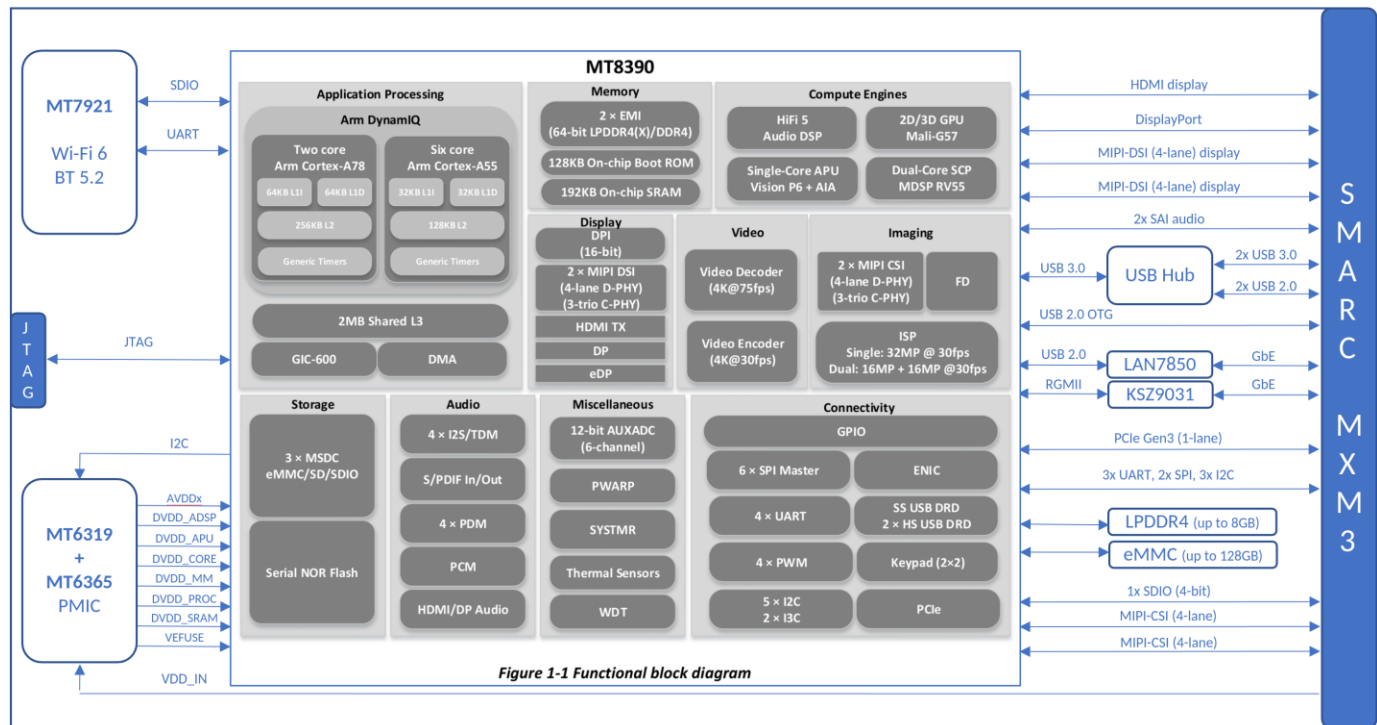
| Feature                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CPU</b>                     | <p>Dual-core Arm Cortex-A78 up to 2 GHz</p> <ul style="list-style-type: none"> <li>64 KB L1 Instruction Cache</li> <li>64 KB L1 Data Cache</li> <li>256KB private (not shared) L2 cache for each core</li> </ul> <p>Quad Cortex-A55 up to 2 GHz</p> <ul style="list-style-type: none"> <li>32 KB L1 Instruction Cache</li> <li>32 KB L1 Data Cache</li> <li>128KB private (not shared) L2 cache for each core</li> </ul>                                                                                                                                                                                                           |
| <b>Memory interface</b>        | <ul style="list-style-type: none"> <li>On module: Up to 8GB LPDDR4-3200 (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> </ul>                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Graphic Processing Unit</b> | <p>Graphics Accelerator Mali-G57 MC3 up to 950 MHz</p> <ul style="list-style-type: none"> <li>OpenGL ES 1.1, 2.0, and 3.2</li> <li>Vulkan 1.0 and 1.1</li> <li>OpenCL 1.0, 1.1, 1.2, 2.0, 2.1, 2.2</li> <li>Secure processing of Digital Rights Management (DRM) protected content</li> </ul>                                                                                                                                                                                                                                                                                                                                      |
| <b>Video Processing Unit</b>   | <p>Video Decoder (VDEC)</p> <ul style="list-style-type: none"> <li>4K75 HEVC/H.265 Main, Main 10 (up to level 5.1)</li> <li>4K75 AV1 Main profile (up to level 5.1)</li> <li>4K75 VP9 Profile 0 / 2</li> <li>4K75 H.264 Baseline, Main, High, High 10 profile</li> <li>1080p60 H.263 Baseline profile</li> <li>1080p60 VP8</li> <li>1080p60 MPEG-2 Main profile</li> <li>1080p60 MPEG-4 Simple, Advanced Simple Profile</li> <li>HEIF Main, Main 10 profile up to 16383 × 16383</li> </ul> <p>Video Encode (VENC)</p> <ul style="list-style-type: none"> <li>4K30 H.264 encoder</li> <li>4K30 HEVC/H.265 encoder</li> </ul>        |
| <b>AI Processing Unit</b>      | <p>Programmable Vision Processor Unit (APU – Cadence VP6) for both AI and CV</p> <ul style="list-style-type: none"> <li>TOPS performance: <ul style="list-style-type: none"> <li>Fix 8: 0.43 TOPS</li> <li>Fix 16: 0.11 TOPS</li> <li>FP16: 0.06 TOPS</li> <li>FP32: 0.03 TOPS</li> </ul> </li> </ul> <p>AIA for high computation demanding Neural Network (NN) applications</p> <ul style="list-style-type: none"> <li>TOPS performance <ul style="list-style-type: none"> <li>Fix 8 × Fix 8: 3.7 TOPS</li> <li>Fix 16 × Fix 8: 1.9 TOPS</li> <li>Fix 16 × Fix 16: 0.9 TOPS</li> <li>FP 16/BF 16: 0.9 TOPS</li> </ul> </li> </ul> |

| Feature             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Display</b>      | <p>HDMI 2.0b Tx (HDMITX)</p> <ul style="list-style-type: none"> <li>Up to 4K60 resolution</li> <li>Compatible with Digital Visual Interface (DVI) 1.0</li> <li>High-bandwidth Digital Content Protection (HDCP) 1.4/HDCP 2.3 function</li> <li>Support Consumer Electronics Control (CEC)</li> </ul> <p>DisplayPort Interface (DPTX)</p> <ul style="list-style-type: none"> <li>DP v1.4 standard compliant</li> <li>4 lanes with up to 5.4 Gbps per lane</li> <li>Up to 4K60 (10-bit)</li> </ul> <p>Embedded DisplayPort Interface (EDPTX)</p> <ul style="list-style-type: none"> <li>eDP v1.2 standard compliant</li> <li>Up to 5.4 Gbps per lane</li> <li>Up to 1920x1440 @60Hz</li> </ul> <p>MIPI Display Serial Interfaces (2x 4-lane DSI)</p> <ul style="list-style-type: none"> <li>Throughput up to 1.2 Gbps per data lane</li> <li>Compliance with MIPI D-PHY Specification v1.2</li> <li>Compliance with MIPI C-PHY Specification v1.0</li> <li>Second MIPI-DSI requires a BOM change (removing eDP feature)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Imaging</b>      | <p>Camera Image Signal Processing (ISP)</p> <ul style="list-style-type: none"> <li>Single camera: 32MP @ 30fps</li> <li>Dual camera: 16MP + 16MP @ 30fps</li> <li>Video High Dynamic Range (HDR) with stagger HDR sensor: up to 16 MP at 30 fps</li> </ul> <p>Face Detection (FD)</p> <ul style="list-style-type: none"> <li>Input image formats: <ul style="list-style-type: none"> <li>YUV420: 2 plane</li> <li>YUV422: 2 plane (Y/UV, Y/VU)</li> <li>YUV422: 1 plane (YUYV, YVYU, UYVY, VYUY)</li> </ul> </li> <li>YUV to RGB888 format conversion</li> <li>Image up/down-scaling <ul style="list-style-type: none"> <li>Maximum resize width: 640 pixels</li> </ul> </li> </ul> <p>Camera Serial Interface (CSI)</p> <ul style="list-style-type: none"> <li>MIPI D-PHY Specification Revision 2.1</li> <li>MIPI C-PHY Specification Revision 1.2</li> <li>Primary CSI-2 interface (CSI0), can be used in the following configurations: <ul style="list-style-type: none"> <li>One 4-data lane interface in D-PHY mode, or</li> <li>Two 2-data lane interfaces in D-PHY mode, or</li> <li>One 3-trio interface in C-PHY mode, or</li> <li>Two 2-trio interfaces in C-PHY mode</li> </ul> </li> <li>Secondary CSI-2 interface (CSI1), can be used in one of the following configurations: <ul style="list-style-type: none"> <li>One 4-data lane interface in D-PHY mode, or</li> <li>One 3-trio interface in C-PHY mode</li> </ul> </li> <li>Pixel formats: RAW8/RAW10/RAW12/RAW14/YUV422 8-bit</li> </ul> |
| <b>Audio</b>        | <ul style="list-style-type: none"> <li>Two I2S interfaces</li> <li>Cadence® Tensilica® HiFi 5 Audio Engine Digital Signal Processor (DSP)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Connectivity</b> | <ul style="list-style-type: none"> <li>One PCI Express (PCIe) Gen2 Single Lane</li> <li>Two USB 3.0 Host interfaces (also supports USB 2.0)</li> <li>Two USB 2.0 Host interfaces</li> <li>One USB 2.0 OTG interface</li> <li>One Ultra Secure Digital Host Controller interface</li> <li>Two Gigabit Ethernet controller (1x RGMII, 1x USB)</li> <li>Three Universal Asynchronous Receiver/Transmitter (UART) modules</li> <li>Five I2C modules</li> <li>Three SPI modules</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Security</b>     | <ul style="list-style-type: none"> <li>Arm® TrustZone® (TZ) architecture</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Feature         | Description                                                                                                                                                                                                                                          |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Debug Interface | <ul style="list-style-type: none"> <li>Debug UART port</li> </ul>                                                                                                                                                                                    |
| RF output       | <ul style="list-style-type: none"> <li>Two RF output with MHF4 connectors provide flexible external antenna selection for optimized performance</li> <li>Main antenna: Support both Wi-Fi and BT</li> <li>Aux Antenna: Support Wi-Fi only</li> </ul> |

## 4 Block Diagram

The figure below shows the block diagram of the Tungsten510 SMARC which contains the MediaTek MT8370 processor, PMIC (MT6319 & MT6365) and the MT7921 Wi-Fi/BT combo.



**Figure 1: Tungsten510 SMARC block diagram**

Detailed connections between the MT7921 and the MT8370 are detailed in [Table 2](#) below.

**Table 2: MT7921 to MT8370 Connections**

|        | MT7921              | MT8370                             |
|--------|---------------------|------------------------------------|
| SDIO   | SD_CLK/SD_CMD/SD0-3 | MSDC2_CLK/ MSDC2_CMD/ MSDC2_DAT0-3 |
| PCM    | PCM_IN/OUT/SYNC/CLK | PCM_DI/DO/SYNC/CLK                 |
| CLK    | SUSCLK              | RTC32K_1V8_1                       |
| BT_EN  | W_DISABLE2#         | DPI_D14                            |
| BT_IRQ | BT_HOST_WAKE        | CMMRST1                            |
| WL_EN  | W_DISABLE1#         | CMMPDN1                            |
| WL_IRQ | SDIO_WAKE#          | GPIO08                             |

## 5 Boot mode

The MT8370 SoC can only boot from eMMC as detailed in [Table 3](#).

**Table 3: Boot mode combinations**

| AUD_SYNC_MOSI | BOOT MODE      |
|---------------|----------------|
| 0             | eMMC (default) |
| 1             | SPI NOR        |

## 6 Electrical Characteristic and Power Consumption

### 6.1 Absolute Maximum Ratings

[Table 4](#) summarizes the absolute maximum ratings and [Table 5](#) lists the recommended operating conditions for the Tungsten510 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                                   | -<br>2000 | +2000 | V    |

### 6.2 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 Ezurio](#) if you need information and guidance for thermal management.

## 6.3 DC current consumption

Several power saving modes are available and are listed in Table 6.

**Note:** These figures are estimates and subject to change.

**Table 6: Typical current consumption ( $V_{SYS} = 3.8V$ )**

| Mode             | Description                                                     | Current (Avg) |
|------------------|-----------------------------------------------------------------|---------------|
| RAM Suspend Mode | Memory is in self-refresh, CPU and wireless connection are off. | 69mA          |
| Stress Test      | Wi-Fi + Ethernet 1 & 2 + CPU/GPU + iPerf.                       | 1004mA        |
| Stress Test      | Wi-Fi + Ethernet 1 & 2 + iPerf.                                 | 544mA         |
| Idle (All CPU)   | Only CPU                                                        | 145mA         |

## 7 Module pin out and Pinmux table

Table 7: Pinout table for Tungsten510 SMARC edge connector (J2)

| SMARC Pin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                                                                  | I/O  | I/O Level  | Comments           |
|-------------|----------------|--------------------------------------------------------------------------------------------------------------------------------|------|------------|--------------------|
| P1          | SMB_ALERT#     | GPIO: <b>GPIO12</b><br>GPIO: TP_GPIO4_AO<br>SPI: SPIM4_CSB<br>HDMI: HDMITX20_HTPLG                                             | DI   | 1.8 to 5 V |                    |
| P2          | GND            | NA                                                                                                                             | -    | NA         |                    |
| P3          | CSI1_CK+       | CSI1A_L2P_T1B                                                                                                                  | DO   | 1.8V       |                    |
| P4          | CSI1_CK-       | CSI1A_L2N_T1C                                                                                                                  | DO   | 1.8V       |                    |
| P5          | GBE1_SDP       | NA                                                                                                                             | -    | NA         |                    |
| P6          | GBE0_SDP       | GPIO: <b>GPIO14</b><br>GPIO: TP_GPIO6_AO<br>SPI: SPIM4_MOSI<br>HDMI: HDMITX20_SCL                                              | DI/O | 3.3V       |                    |
| P7          | CSI1_RX0+      | CSI1A_L1P_T0C                                                                                                                  | DI   | 1.8V       |                    |
| P8          | CSI1_RX0-      | CSI1A_L1N_T1A                                                                                                                  | DI   | 1.8V       |                    |
| P9          | GND            | NA                                                                                                                             | -    | NA         |                    |
| P10         | CSI1_RX1+      | CSI1B_L0P_T0A                                                                                                                  | DI   | 1.8V       |                    |
| P11         | CSI1_RX1-      | CSI1B_L0N_T0B                                                                                                                  | DI   | 1.8V       |                    |
| P12         | GND            | NA                                                                                                                             | -    | NA         |                    |
| P13         | CSI1_RX2+      | CSI1A_L0P_T0A                                                                                                                  | DI   | 1.8V       |                    |
| P14         | CSI1_RX2-      | CSI1A_L0N_T0B                                                                                                                  | DI   | 1.8V       |                    |
| P15         | GND            | NA                                                                                                                             | -    | NA         |                    |
| P16         | CSI1_RX3+      | CSI1B_L1P_T0C                                                                                                                  | DI   | 1.8V       |                    |
| P17         | CSI1_RX3-      | CSI1B_L1N_T1A                                                                                                                  | DI   | 1.8V       |                    |
| P18         | GND            | NA                                                                                                                             | -    | NA         |                    |
| P19         | GBE0_MDI3-     | TXRXM_D                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P20         | GBE0_MDI3+     | TXRXP_D                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P21         | GBE0_LINK100#  | LED1                                                                                                                           | DO   | 3.3V       | From KSZ9031 (U13) |
| P22         | GBE0_LINK1000# | LED2                                                                                                                           | DO   | 3.3V       | From KSZ9031 (U13) |
| P23         | GBE0_MDI2-     | TXRXM_C                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P24         | GBE0_MDI2+     | TXRXP_C                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P25         | GBE0_LINK_ACT# | LED1                                                                                                                           | DO   | 3.3V       | From KSZ9031 (U13) |
| P26         | GBE0_MDI1-     | TXRXM_B                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P27         | GBE0_MDI1+     | TXRXP_B                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P28         | GBE0_CTREF     | TP28                                                                                                                           | -    | NA         | Test point         |
| P29         | GBE0_MDI0-     | TXRXM_A                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P30         | GBE0_MDI0+     | TXRXP_A                                                                                                                        | DI/O | 1.8V       | From KSZ9031 (U13) |
| P31         | SPI0_CS1#      | GPIO: <b>GPIO82</b><br>SPI: SPIM2_MISO<br>SPI: SCP_SPI2_MI<br>I2S: I2SO1_D0<br>UART: UCTS2<br>UART: TP_UCTS2_AO<br>PCM: PCM_DI | DO   | 1.8V       |                    |
| P32         | GND            | NA                                                                                                                             | -    | NA         |                    |

| SMARC Pin # | SMARC Pin Name | CPU PIN / Multiplexing (red = default muxing)                                                                              | I/O  | I/O Level   | Comments |
|-------------|----------------|----------------------------------------------------------------------------------------------------------------------------|------|-------------|----------|
| P33         | SDIO_WP        | GPIO: GPIO11<br>GPIO: TP_GPIO3_AO<br>SPDIF: SPDIF_OUT<br>I2S: I2SO1_D0<br>DMIC: DMIC2_DAT_R<br>CAM: CMVREF6                | DI   | 1.8 or 3.3V |          |
| P34         | SDIO_CMD       | GPIO: GPIO163<br>SDIO: MSDC1_CMD<br>SPDIF: SPDIF_OUT                                                                       | DI/O | 1.8 or 3.3V |          |
| P35         | SDIO_CD#       | GPIO: GPIO02<br>GPIO: TP_GPIO2_AO<br>SPI: SPIM5_MOSI<br>UART: URTS1<br>DMIC: DMIC3_DAT_R<br>I2S: I2SIN_WS<br>I2S: I2SO2_WS | DI   | 1.8 or 3.3V |          |
| P36         | SDIO_CK        | GPIO: GPIO164<br>SDIO: MSDC1_CLK<br>SPDIF: SPDIF_IN0                                                                       | DO   | 1.8 or 3.3V |          |
| P37         | SDIO_PWR_EN    | GPIO: GPIO111<br>I2S: I2SIN_D1<br>I2S: SPLIN_D1<br>DMIC: DMIC3_CLK<br>SPDIF: SPDIF_OUT                                     | DO   | 3.3V        |          |
| P38         | GND            | NA                                                                                                                         | -    | NA          |          |
| P39         | SDIO_D0        | GPIO: GPIO165<br>SDIO: MSDC1_DAT0<br>SPDIF: SPDIF_IN1                                                                      | DI/O | 1.8 or 3.3V |          |
| P40         | SDIO_D1        | GPIO: GPIO166<br>SDIO: MSDC1_DAT1<br>SPDIF: SPDIF_IN2                                                                      | DI/O | 1.8 or 3.3V |          |
| P41         | SDIO_D2        | GPIO: GPIO167<br>SDIO: MSDC1_DAT2<br>PWM: PWM_0                                                                            | DI/O | 1.8 or 3.3V |          |
| P42         | SDIO_D3        | GPIO: GPIO168<br>SDIO: MSDC1_DAT3<br>PWM: PWM_0<br>CLK: CLKM0                                                              | DI/O | 1.8 or 3.3V |          |
| P43         | SPI0_CS0#      | GPIO: GPIO75<br>SPI: SPIM1_CSB<br>SPI: SCP_SPI1_A_CS<br>TDM: TDMIN_MCK<br>I2C: SCP_SCL0<br>CAM: CMVREF6                    | DO   | 1.8V        |          |
| P44         | SPI0_CK        | GPIO: GPIO76<br>SPI: SPIM1_CLK<br>SPI: SCP_SPI1_A_CK<br>TDM: TDMIN_BCK<br>I2C: SCP_SDA0<br>CAM: CMVREF7                    | DO   | 1.8V        |          |
| P45         | SPI0_DIN       | GPIO: GPIO78<br>SPI: SPIM1_MISO<br>SPI: SCP_SPI1_A_MI<br>TDM: TDMIN_DI<br>I2C: SCP_SDA1                                    | DI   | 1.8V        |          |

| SMARC Pin # | SMARC Pin Name                          | CPU PIN / Multiplexing<br>(red = default muxing)                                                 | I/O  | I/O Level | Comments          |
|-------------|-----------------------------------------|--------------------------------------------------------------------------------------------------|------|-----------|-------------------|
| P46         | SPI0_DO                                 | GPIO: GPIO77<br>SPI: <b>SPIM1_MOSI</b><br>SPI: SCP_SPI1_A_MO<br>TDM: TDMIN_LRCK<br>I2C: SCP_SCL1 | DO   | 1.8V      |                   |
| P47         | GND                                     | NA                                                                                               | -    | NA        |                   |
| P48         | SATA_TX+                                | CSI0A_L0P_T0A                                                                                    | DI   | 1.8V      | SMARC exception   |
| P49         | SATA_TX-                                | CSI0A_L0N_T0B                                                                                    | DI   | 1.8V      | SMARC exception   |
| P50         | GND                                     | NA                                                                                               | -    | NA        |                   |
| P51         | SATA_RX+                                | CSI0B_L1P_T0C                                                                                    | DI   | 1.8V      | SMARC exception   |
| P52         | SATA_RX-                                | CSI0B_L1N_T1A                                                                                    | DI   | 1.8V      | SMARC exception   |
| P53         | GND                                     | NA                                                                                               | -    | NA        |                   |
| P54         | SPI1_CS0# /<br>ESPI_CS0# /<br>QSPI_CS0# | GPIO: GPIO69<br>SPI: <b>SPIM0_CSB</b><br>SPI: SCP_SPI0_CS<br>DMIC: DMIC3_CLK<br>CAM: CMVREF0     | DO   | 1.8V      |                   |
| P55         | SPI1_CS1# /<br>ESPI_CS1# /<br>QSPI_CS1# | GPIO: <b>GPIO91</b><br>USB: VBUSVALID_2P<br>UART: URXD3                                          | DO   | 1.8V      |                   |
| P56         | SPI1_CK / ESPI_CK<br>/ QSPI_CK          | GPIO: GPIO70<br>SPI: <b>SPIM0_CLK</b><br>SPI: SCP_SPI0_CK<br>DMIC: DMIC3_DAT<br>CAM: CMVREF1     | DO   | 1.8V      |                   |
| P57         | SPI1_DIN / ESPI_IO_0<br>/ QSPI_IO_0     | GPIO: GPIO72<br>SPI: <b>SPIM0_MISO</b><br>SPI: SCP_SPI0_MI<br>DMIC: DMIC4_CLK<br>CAM: CMVREF3    | DI   | 1.8V      |                   |
| P58         | SPI1_DO / ESPI_IO_1<br>/ QSPI_IO_1      | GPIO: GPIO71<br>SPI: <b>SPIM0_MOSI</b><br>SPI: SCP_SPI0_MO<br>DMIC: DMIC3_DAT_R<br>CAM: CMVREF2  | DO   | 1.8V      |                   |
| P59         | GND                                     | NA                                                                                               | -    | NA        |                   |
| P60         | USB0+                                   | USB_DP_P0                                                                                        | DI/O | 3.3V      |                   |
| P61         | USB0-                                   | USB_DM_P0                                                                                        | DI/O | 3.3V      |                   |
| P62         | USB0_EN_OC#                             | GPIO: <b>GPIO84</b><br>USB: USB_DRVVBUS                                                          | DI   | 3.3V      |                   |
| P63         | USB0_VBUS_DET                           | GPIO: GPIO85<br>USB: <b>VBUSVALID</b>                                                            | DI   | 5V        |                   |
| P64         | USB0_OTG_ID                             | GPIO: GPIO83<br>USB: <b>IDDIG</b>                                                                | 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      |                   |

| SMARC Pin # | SMARC Pin Name              | CPU PIN / Multiplexing<br>(red = default muxing)  | I/O  | I/O Level | Comments          |
|-------------|-----------------------------|---------------------------------------------------|------|-----------|-------------------|
| P73         | RSVD                        | NA                                                | -    | NA        |                   |
| P74         | USB3_EN_OC#                 | PRT_CTL1                                          | DI   | 3.3V      | From USB Hub (U9) |
| P75         | PCIE_A_RST#                 | <b>GPIO:</b> GPIO48<br><b>PCI:</b> <b>PERSTN</b>  | -    | NA        |                   |
| P76         | USB4_EN_OC#                 | PRT_CTL4                                          | DI   | 3.3V      | From USB Hub (U9) |
| P77         | PCIE_B_CKREQ#               | NA                                                | -    | NA        |                   |
| P78         | PCIE_A_CKREQ#               | <b>GPIO:</b> GPIO49<br><b>PCI:</b> <b>CLKREQN</b> | 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_CKP                                          | DO   | 1.8V      |                   |
| P84         | PCIE_A_REFCK-               | PCIE_CKN                                          | DO   | 1.8V      |                   |
| P85         | GND                         | NA                                                | -    | NA        |                   |
| P86         | PCIE_A_RX+                  | PCIE_LN0_RXP                                      | DO   | 1.8V      |                   |
| P87         | PCIE_A_RX-                  | PCIE_LN0_RXN                                      | DO   | 1.8V      |                   |
| P88         | GND                         | NA                                                | -    | NA        |                   |
| P89         | PCIE_A_TX+                  | PCIE_LN0_TXP                                      | DO   | 1.8V      |                   |
| P90         | PCIE_A_TX-                  | PCIE_LN0_TXN                                      | DO   | 1.8V      |                   |
| P91         | GND                         | NA                                                | -    | NA        |                   |
| P92         | HDMI_D2+ /<br>DP1_LANE0+    | HDMITX21_CH2_P                                    | DO   | 1.8V      |                   |
| P93         | HDMI_D2- /<br>DP1_LANE0-    | HDMITX21_CH2_M                                    | DO   | 1.8V      |                   |
| P94         | GND                         | NA                                                | -    | NA        |                   |
| P95         | HDMI_D1+ /<br>DP1_LANE1+    | HDMITX21_CH1_P                                    | DO   | 1.8V      |                   |
| P96         | HDMI_D1- /<br>DP1_LANE1-    | HDMITX21_CH1_M                                    | DO   | 1.8V      |                   |
| P97         | GND                         | NA                                                | -    | NA        |                   |
| P98         | HDMI_D0+ /<br>DP1_LANE2+    | HDMITX21_CH0_P                                    | DO   | 1.8V      |                   |
| P99         | HDMI_D0- /<br>DP1_LANE2-    | HDMITX21_CH0_M                                    | DO   | 1.8V      |                   |
| P100        | GND                         | NA                                                | -    | NA        |                   |
| P101        | HDMI_CK+ /<br>DP1_LANE3+    | HDMITX21_CH2_P                                    | DO   | 1.8V      |                   |
| P102        | HDMI_CK- /<br>DP1_LANE3-    | HDMITX21_CH2_M                                    | DO   | 1.8V      |                   |
| P103        | GND                         | NA                                                | -    | NA        |                   |
| P104        | HDMI_HPD /<br>DP1_HPD       | HDMITX_HTPLG                                      | DI   | 1.8V      |                   |
| P105        | HDMI_CTRL_CK /<br>DP1_AUX+  | HDMITX_SCL                                        | DI/O | 1.8V      |                   |
| P106        | HDMI_CTRL_DAT /<br>DP1_AUX- | HDMITX_SDA                                        | DI/O | 1.8V      |                   |
| P107        | DP1_AUX_SEL                 | HDMITX_CEC                                        | DI/O | 1.8V      | SMARC exception   |

| SMARC Pin # | SMARC Pin Name    | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                   | I/O  | I/O Level | Comments |
|-------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------|------|-----------|----------|
| P108        | GPIO0 / CAM0_PWR# | GPIO: <b>GPIO0</b><br>GPIO: TP_GPIO0_AO<br>SPI: SPIM5_CSB<br>UART: UTXD1<br>DMIC: DMIC3_CLK<br>I2S: I2SIN_MCK<br>I2S: I2SO2_MCK    | DI/O | 1.8V      |          |
| P109        | GPIO1 / CAM1_PWR# | GPIO: <b>GPIO1</b><br>GPIO: TP_GPIO1_AO<br>SPI: SPIM5_CLK<br>UART: URXD1<br>DMIC: DMIC3_DAT<br>I2S: I2SIN_BCK<br>I2S: I2SO2_BCK    | DI/O | 1.8V      |          |
| P110        | GPIO2 / CAM0_RST# | GPIO: <b>GPIO50</b><br>HDMI: HDMITX20_PWR5V<br>USB: IDDIG_1P                                                                       | DI/O | 1.8V      |          |
| P111        | GPIO3 / CAM1_RST# | GPIO: <b>GPIO3</b><br>GPIO: TP_GPIO3_AO<br>SPI: SPIM5_MISO<br>UART: UCTS1<br>DMIC: DMIC4_CLK<br>I2S: I2SIN_D0<br>I2S: I2SO2_D0     | DI/O | 1.8V      |          |
| P112        | GPIO4 / HDA_RST#  | GPIO: <b>GPIO4</b><br>GPIO: TP_GPIO4_AO<br>SPDIF: SPDIF_IN2<br>I2S: I2SO1_MCK<br>DMIC: DMIC4_DAT<br>I2S: I2SIN_D1<br>I2S: I2SO2_D1 | DI/O | 1.8V      |          |
| P113        | GPIO5 / PWM_OUT   | GPIO: GPIO10<br>GPIO: TP_GPIO2_AO<br>SPI: SPIM3_MISO<br>TDMIN: TDMIN_DI<br>DMIC: DMIC2_DAT<br>CAM: CMFLASH1<br>PWM: <b>PWM_1</b>   | DI/O | 1.8V      |          |
| P114        | GPIO6 / TACHIN    | GPIO: <b>GPIO6</b><br>GPIO: TP_GPIO6_AO<br>SPDIF: SPDIF_IN0<br>I2S: I2SO1_WS<br>DMIC: DMIC1_CLK<br>I2S: I2SIN_D3<br>I2S: I2SO2_D3  | DI/O | 1.8V      |          |
| P115        | GPIO7             | GPIO: <b>GPIO7</b><br>GPIO: TP_GPIO7_AO<br>SPI: SPIM3_CSB<br>TDMIN: TDMIN_MCK<br>DMIC: DMIC1_DAT<br>CAM: CMVREF0<br>CAM: CLKM0     | DI/O | 1.8V      |          |

| SMARC Pin # | SMARC Pin Name | CPU PIN / Multiplexing<br>(red = default muxing)                                                                           | I/O  | I/O Level | Comments                                   |
|-------------|----------------|----------------------------------------------------------------------------------------------------------------------------|------|-----------|--------------------------------------------|
| P116        | GPIO8          | GPIO: GPIO9<br>GPIO: TP_GPIO1_AO<br>SPI: SPIM3_MOSI<br>TDMIN: TDMIN_LRCK<br>DMIC: DMIC2_CLK<br>CAM: CMFLASH0<br>PMW: PWM_0 | DI/O | 1.8V      |                                            |
| P117        | GPIO9          | GPIO: GPIO43<br>KP: KPCOL1<br>DP: DP_TX_HPD<br>CAM: CMFLASH2                                                               | DI/O | 1.8V      |                                            |
| P118        | GPIO10         | GPIO: GPIO44<br>KP: KPROW0                                                                                                 | DI/O | 1.8V      |                                            |
| P119        | GPIO11         | GPIO: GPIO45<br>KP: KPROW1<br>EDP: EDP_TX_HPD<br>CAM: CMFLASH3<br>I2S: I2SIN_MCK                                           | DI/O | 1.8V      |                                            |
| P120        | GND            | NA                                                                                                                         | -    | NA        |                                            |
| P121        | I2C_PM_CK      | GPIO: GPIO57<br>I2C: SCL1                                                                                                  | DI/O | 1.8V      |                                            |
| P122        | I2C_PM_DAT     | GPIO: GPIO58<br>I2C: SDA1                                                                                                  | DI/O | 1.8V      |                                            |
| P123        | BOOT_SEL0#     | NA                                                                                                                         | -    | NA        |                                            |
| P124        | BOOT_SEL1#     | NA                                                                                                                         | -    | NA        |                                            |
| P125        | BOOT_SEL2#     | NA                                                                                                                         | -    | NA        |                                            |
| P126        | RESET_OUT#     | GPIO: GPIO130<br>DMIC: DMIC2_DAT_R<br>SPI: SPINOR_IO3<br>SPDIF: SPDIF_IN2<br>TCSYS: LVTS_SDI                               | DI/O | 1.8V      |                                            |
| P127        | RESET_IN#      | SYSRSTB                                                                                                                    | DI   | 1.8V      | AND gated with MT6365 (U200) RESETB signal |
| P128        | POWER_BTN#     | PWRKEY                                                                                                                     | DI   | 1.8 - 5V  | From MT6365 PMIC (U200)                    |
| P129        | SER0_TX        | GPIO: GPIO33<br>UART: UTXD1<br>UART: URTS2<br>UART: TP_UTXD1_AO                                                            | DO   | 1.8V      |                                            |
| P130        | SER0_RX        | GPIO: GPIO34<br>UART: URXD1<br>UART: UCTS2<br>UART: TP_URXD1_AO                                                            | DI   | 1.8V      |                                            |
| P131        | SER0_RTS#      | GPIO: GPIO35<br>UART: UTXD2<br>UART: URTS1<br>UART: TP_URTS1_AO<br>UART: TP_UTXD2_AO                                       | DI   | 1.8V      |                                            |
| P132        | SER0_CTS#      | GPIO: GPIO36<br>UART: URXD2<br>UART: UCTS1<br>UART: TP_UCTS1_AO<br>UART: TP_URXD2_AO                                       | DO   | 1.8V      |                                            |
| P133        | GND            | NA                                                                                                                         | -    | NA        |                                            |

| SMARC Pin # | SMARC Pin Name          | CPU PIN / Multiplexing (red = default muxing)                                                               | I/O  | I/O Level   | Comments |
|-------------|-------------------------|-------------------------------------------------------------------------------------------------------------|------|-------------|----------|
| P134        | SER1_TX                 | GPIO: GPIO31<br>UART: <b>UTXD0</b><br>UART: TP_UTXD1_AO<br>UART: TP_UTXD2_AO                                | DO   | 1.8V        |          |
| P135        | SER1_RX                 | GPIO: GPIO32<br>UART: <b>URXD0</b><br>UART: TP_URXD1_AO<br>UART: TP_URXD2_AO                                | DI   | 1.8V        |          |
| P136        | SER2_TX                 | GPIO: GPIO16<br>GPIO: TP_GPIO0_AO<br>UART: <b>UTXD3</b><br>HDMI: HDMITX20_PWR5V                             | DO   | 1.8V        |          |
| P137        | SER2_RX                 | GPIO: GPIO17<br>GPIO: TP_GPIO1_AO<br>UART: <b>URXD3</b><br>CAM: CMFLASH2<br>EDP: EDP_TX_HPD<br>CAM: CMVREF7 | 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                 | NA                                                                                                          | -    | NA          |          |
| P144        | CAN0_RX                 | NA                                                                                                          | -    | NA          |          |
| P145        | CAN1_TX                 | NA                                                                                                          | -    | NA          |          |
| P146        | CAN1_RX                 | NA                                                                                                          | -    | NA          |          |
| 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  | GPIO: GPIO63<br>I2C: <b>SCL4</b>                                                                            | DO   | 1.8V        |          |
| S2          | CSI1_TX- / I2C_CAM1_DAT | GPIO: GPIO64<br>I2C: <b>SDA4</b>                                                                            | DI/O | 1.8V        |          |
| S3          | GND                     | NA                                                                                                          | -    | NA          |          |
| S4          | RSVD                    | NA                                                                                                          | -    | NA          |          |
| S5          | I2C_CAM0_CK / CSI0_TX-  | GPIO: GPIO61<br>I2C: <b>SCL3</b><br>I2C: SCP_SCL0<br>I2C: SCP_SCL1                                          | DO   | 1.8V        |          |
| S6          | CAM_MCK                 | GPIO: GPIO23<br>CAM: <b>CMMCLK1</b><br>PWM: PWM_2<br>GPIO: TP_GPIO7_AO<br>DP: DP_TX_HPD                     | DO   | 1.8V        |          |

| SMARC Pin # | SMARC Pin Name            | CPU PIN / Multiplexing (red = default muxing)                                                           | I/O  | I/O Level | Comments           |
|-------------|---------------------------|---------------------------------------------------------------------------------------------------------|------|-----------|--------------------|
| S7          | I2C_CAM0_DAT / CSI0_TX+   | GPIO: GPIO62<br>I2C: SDA3<br>I2C: SCP_SDA0<br>I2C: SCP_SDA1                                             | DI/O | 1.8V      |                    |
| S8          | CSI0_CK+                  | CSI0A_L2P_T1B                                                                                           | DO   | 1.8V      |                    |
| S9          | CSI0_CK-                  | CSI0A_L2N_T1C                                                                                           | DO   | 1.8V      |                    |
| S10         | GND                       | NA                                                                                                      | -    | NA        |                    |
| S11         | CSI0_RX0+                 | CSI0A_L1P_T0C                                                                                           | DI   | 1.8V      |                    |
| S12         | CSI0_RX0-                 | CSI0A_L1N_T1A                                                                                           | DI   | 1.8V      |                    |
| S13         | GND                       | NA                                                                                                      | -    | NA        |                    |
| S14         | CSI0_RX1+                 | CSI0B_L0P_T0A                                                                                           | DI   | 1.8V      |                    |
| S15         | CSI0_RX1-                 | CSI0B_L0N_T0B                                                                                           | DI   | 1.8V      |                    |
| S16         | GND                       | NA                                                                                                      | -    | NA        |                    |
| S17         | GBE1_MDI0+                | TR0_P                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S18         | GBE1_MDI0-                | TR0_N                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S19         | GBE1_LINK100#             | LED1                                                                                                    | DO   | 3.3V      | From LAN7850 (U14) |
| S20         | GBE1_MDI1+                | TR1_P                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S21         | GBE1_MDI1-                | TR1_N                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S22         | GBE1_LINK1000#            | LED0                                                                                                    | DO   | 3.3V      | From LAN7850 (U14) |
| S23         | GBE1_MDI2+                | TR2_P                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S24         | GBE1_MDI2-                | TR2_N                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S25         | GND                       | NA                                                                                                      | -    | NA        |                    |
| S26         | GBE1_MDI3+                | TR3_P                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S27         | GBE1_MDI3-                | TR3_N                                                                                                   | DI/O | 1.8V      | From LAN7850 (U14) |
| S28         | GBE1_CTREF                | NA                                                                                                      | -    | NA        |                    |
| S29         | PCIE_D_TX+ / SERDES_0_TX+ | NA                                                                                                      | -    | NA        |                    |
| S30         | PCIE_D_TX- / SERDES_0_TX- | NA                                                                                                      | -    | NA        |                    |
| S31         | GBE1_LINK_ACT#            | LED2                                                                                                    | DO   | 3.3V      |                    |
| S32         | PCIE_D_RX+ / SERDES_0_RX+ | NA                                                                                                      | -    | NA        |                    |
| S33         | PCIE_D_RX- / 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                 | GPIO: GPIO119<br>I2S: I2SO2_D2<br>I2S: I2SIN_D2<br>UART: UTXD3<br>TDMIN: TDMIN_LRCK<br>I2S: I2SO1_MCK   | DO   | 1.8V      |                    |
| S39         | I2S0_LRCK                 | GPIO: GPIO112<br>I2S: I2SIN_D2<br>I2S: SPLIN_D2<br>DMIC: DMIC3_DAT<br>TDMIN: TDMIN_MCK<br>I2S: I2SO1_WS | DI/O | 1.8V      |                    |

| SMARC Pin # | SMARC Pin Name       | CPU PIN / Multiplexing (red = default muxing)                                                                              | I/O  | I/O Level | Comments |
|-------------|----------------------|----------------------------------------------------------------------------------------------------------------------------|------|-----------|----------|
| S40         | I2S0_SDOUT           | GPIO: GPIO113<br>I2S: I2SIN_D3<br>I2S: SPLIN_D3<br>DMIC: DMIC3_DAT_R<br>TDMIN: TDMIN_BCK<br>I2S: I2S01_D0                  | DO   | 1.8V      |          |
| S41         | I2S0_SDIN            | GPIO: GPIO110<br>I2S: I2SIN_D0<br>SPLIN: SPLIN_D0<br>DMIC: DMIC4_DAT_R<br>CAM: CMVREF7<br>AUXIF: AUXIF_CLK1                | DI   | 1.8V      |          |
| S42         | I2S0_CK              | GPIO: GPIO120<br>I2S: I2S02_D3<br>I2S: I2SIN_D3<br>UART: URXD3<br>TDMIN: TDMIN_DI<br>I2S: I2S01_BCK                        | DI/O | 1.8V      |          |
| S43         | ESPI_ALERT0#         | GPIO: GPIO81<br>SPI: SPIM2_MOSI<br>SCPI: SCP_SPI2_MO<br>I2S: I2S01_WS<br>UART: URTS2<br>UART: TP_URTS2_AO<br>PCM: PCM_DO   | DI/O | 1.8V      |          |
| S44         | ESPI_ALERT1#         | GPIO: GPIO79<br>SPI: SPIM2_CSB<br>SCPI: SCP_SPI2_CS<br>I2S: I2S01_MCK<br>UART: UTXD2<br>UART: TP_UTXD2_AO<br>PCM: PCM_SYNC | DI/O | 1.8V      |          |
| S45         | MDIO_CLK             | NA                                                                                                                         | DI/O | 1.8V      |          |
| S46         | MDIO_DAT             | NA                                                                                                                         | DI/O | 1.8V      |          |
| S47         | GND                  | NA                                                                                                                         | -    | NA        |          |
| S48         | I2C_GP_CK            | GPIO: GPIO55<br>I2C: SCL0<br>I2C: SCP_SCL0<br>I2C: SCP_SCL1                                                                | DO   | 1.8V      |          |
| S49         | I2C_GP_DAT           | GPIO: GPIO56<br>I2C: SDA0<br>I2C: SCP_SDA0<br>I2C: SCP_SDA1                                                                | DI/O | 1.8V      |          |
| S50         | I2S2_LRCK / HDA_SYNC | GPIO: GPIO109<br>I2S: I2SIN_WS<br>I2S: SPLIN_BCK<br>DMIC: DMIC4_DAT<br>CAM: CMVREF6<br>AUXIF: AUXIF_ST1                    | DI/O | 1.8V      |          |
| S51         | I2S2_SDOUT / HDA_SDO | GPIO: GPIO117<br>I2S: I2S02_D0<br>I2S: I2SIN_D0                                                                            | DO   | 1.8V      |          |
| S52         | I2S2_SDIN / HDA_SDI  | GPIO: GPIO118<br>I2S: I2S02_D1<br>I2S: I2SIN_D1                                                                            | DI   | 1.8V      |          |

| SMARC Pin # | SMARC Pin Name               | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                            | I/O  | I/O Level | Comments          |
|-------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|-------------------|
| S53         | I2S2_CK / HDA_CK             | <b>GPIO:</b> GPIO115<br><b>I2S:</b> I2SO2_BCK<br><b>I2S:</b> I2SIN_BCK                                                                      | DI/O | 1.8V      |                   |
| S54         | SATA_ACT#                    | NA                                                                                                                                          | -    | NA        |                   |
| S55         | USB5_EN_OC#                  | NA                                                                                                                                          | -    | NA        |                   |
| S56         | ESPI_IO_2 /<br>QSPI_IO_2     | <b>GPIO:</b> GPIO73<br><b>SPI:</b> SPIM0_MIO2<br><b>UART:</b> UTXD3<br><b>DMIC:</b> DMIC4_DAT<br><b>CLK:</b> CLKM0<br><b>CAM:</b> CMVREF4   | DI/O | 1.8V      |                   |
| S57         | ESPI_IO_3 /<br>QSPI_IO_3     | <b>GPIO:</b> GPIO74<br><b>SPI:</b> SPIM0_MIO3<br><b>UART:</b> URXD3<br><b>DMIC:</b> DMIC4_DAT_R<br><b>CLK:</b> CLKM1<br><b>CAM:</b> CMVREF5 | DI/O | 1.8V      |                   |
| S58         | ESPI_RESET#                  | <b>GPIO:</b> GPIO114<br><b>I2S:</b> I2SO2_MCK<br><b>I2S:</b> I2SIN_MCK                                                                      | 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) |
| 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        |                   |

| SMARC Pin # | SMARC Pin Name                          | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                       | I/O  | I/O Level | Comments                  |
|-------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|---------------------------|
| 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+                              | DP_LN0_TXP                                                                                                                                                             | AIO  | 1.2V      |                           |
| S94         | DPO_LANE0-                              | DP_LN0_TXN                                                                                                                                                             | AIO  | 1.2V      |                           |
| S95         | DPO_AUX_SEL                             | <b>GPIO: GPIO150</b><br><b>DPI: DPI_CK</b><br><b>GBE: GBE_AUX_PPS1</b><br><b>I2S: I2SO1_D0</b><br><b>CAM: CMVREF3</b><br><b>SPDIF: SPDIF_IN2</b><br><b>UART: URXD3</b> | DI   | 1.8V      |                           |
| S96         | DPO_LANE1+                              | DP_LN1_TXP                                                                                                                                                             | AIO  | 1.2V      |                           |
| S97         | DPO_LANE1-                              | DP_LN1_TXN                                                                                                                                                             | AIO  | 1.2V      |                           |
| S98         | DPO_HPDP                                | <b>GPIO: GPIO46</b><br><b>DP: DP_TX_HPDP</b><br><b>PWM: PWM_0</b><br><b>USB: VBUSVALID_2P</b>                                                                          | DI   | 1.8V      |                           |
| S99         | DPO_LANE2+                              | DP_LN2_TXP                                                                                                                                                             | AIO  | 1.2V      |                           |
| S100        | DPO_LANE2-                              | DP_LN2_TXN                                                                                                                                                             | AIO  | 1.2V      |                           |
| S101        | GND                                     | NA                                                                                                                                                                     | -    | NA        |                           |
| S102        | DPO_LANE3+                              | DP_LN3_TXP                                                                                                                                                             | AIO  | 1.2V      |                           |
| S103        | DPO_LANE3-                              | DP_LN3_TXN                                                                                                                                                             | AIO  | 1.2V      |                           |
| S104        | USB3_OTG_ID                             | NA                                                                                                                                                                     | -    | NA        |                           |
| S105        | DPO_AUX+                                | DPAUXP                                                                                                                                                                 | AIO  | 1.2V      |                           |
| S106        | DPO_AUX-                                | DPAUXN                                                                                                                                                                 | AIO  | 1.2V      |                           |
| S107        | LCD1_BKLT_EN                            | <b>GPIO: GPIO15</b><br><b>GPIO: TP_GPIO7_AO</b><br><b>SPI: SPIM4_MISO</b><br><b>HDMI: HDMITX20_SDA</b>                                                                 | DI/O | 1.8V      |                           |
| S108        | LVDS1_CK+ /<br>eDP1_AUX+ /<br>DSI1_CLK+ | EDPAUXP                                                                                                                                                                | DO   | 1.8V      | DSI1_CKP_T1B (BOM change) |
| S109        | LVDS1_CK- /<br>eDP1_AUX- /<br>DSI1_CLK- | EDPAUXN                                                                                                                                                                | DO   | 1.8V      | DSI1_CKN_T1C (BOM change) |
| S110        | GND                                     | NA                                                                                                                                                                     | -    | NA        |                           |
| S111        | LVDS1_0+ /<br>eDP1_TX0+ /<br>DSI1_D0+   | EDP_LN0_TXP                                                                                                                                                            | DO   | 1.8V      | DSI1_D0P_T0C (BOM change) |
| S112        | LVDS1_0- /<br>eDP1_TX0- /<br>DSI1_D0-   | EDP_LN0_TXN                                                                                                                                                            | DO   | 1.8V      | DSI1_D0N_T1A (BOM change) |
| S113        | eDP1_HPDP / DSI1_TE                     | <b>GPIO: GPIO26</b><br><b>DSI: DSI_TE</b><br><b>DSI: DSI1_TE</b><br><b>EDP: EDP_TX_HPDP</b>                                                                            | DI   | 1.8V      |                           |

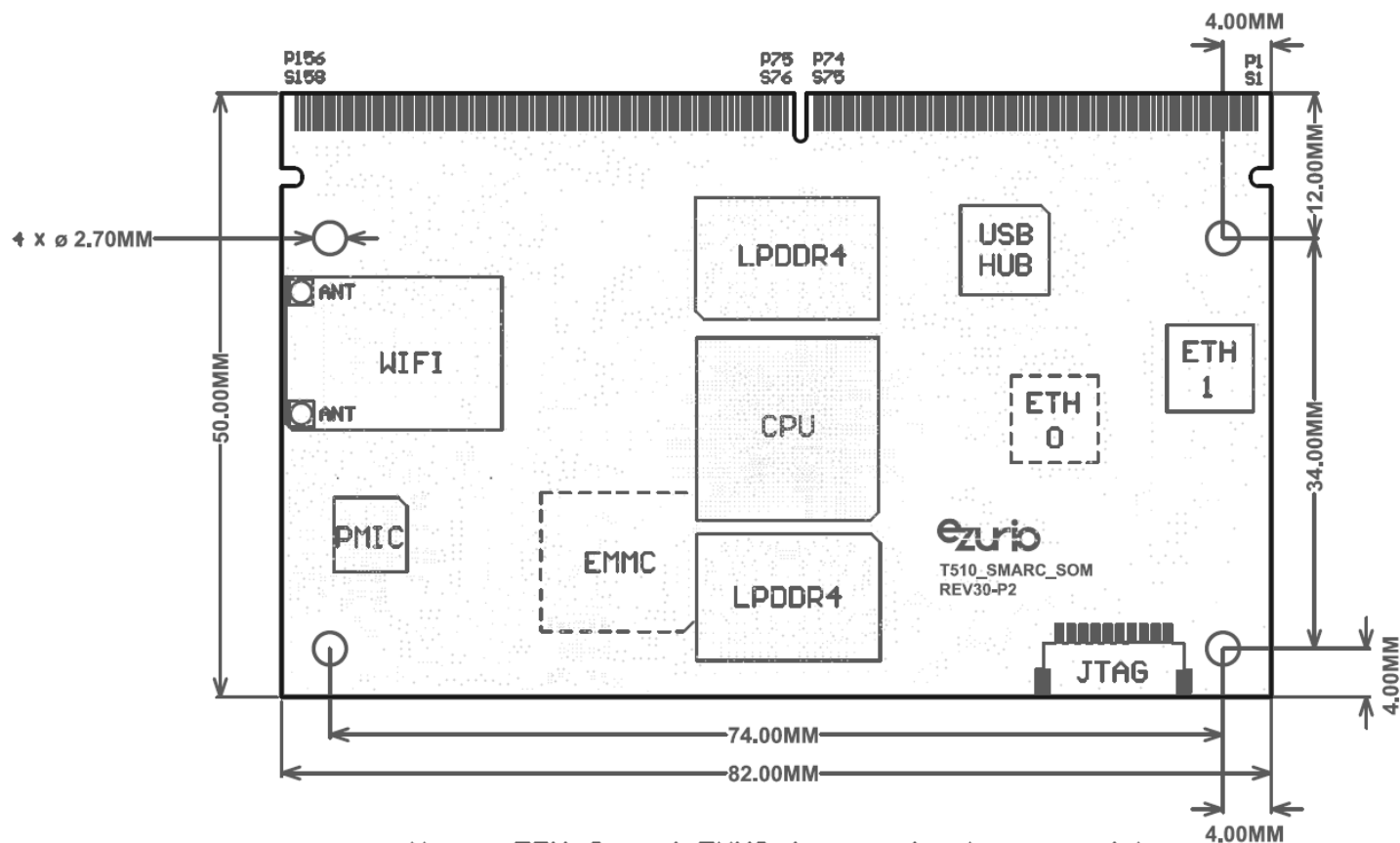
| SMARC Pin # | SMARC Pin Name                        | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                               | I/O  | I/O Level | Comments                  |
|-------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|---------------------------|
| S114        | LVDS1_1+ /<br>eDP1_TX1+ /<br>DSI1_D1+ | EDP_LN1_TXP                                                                                                                                                                    | DO   | 1.8V      | DSI1_D1P_T2A (BOM change) |
| S115        | LVDS1_1- / eDP1_TX1- /<br>DSI1_D1-    | EDP_LN1_TXN                                                                                                                                                                    | DO   | 1.8V      | DSI1_D1N_T2B (BOM change) |
| S116        | LCD1_VDD_EN                           | <b>GPIO:</b> GPIO28<br><b>DSI:</b> DSI1_TE<br><b>DSI:</b> DSI1_TE<br><b>EDP:</b> EDP_TX_HPD<br><b>CAM:</b> CMVREF3<br><b>PWM:</b> PWM_3                                        | DI/O | 1.8V      |                           |
| S117        | LVDS1_2+ /<br>eDP1_TX2+ /<br>DSI1_D2+ | NA                                                                                                                                                                             | DO   | 1.8V      | DSI1_D2P_T0A (BOM change) |
| S118        | LVDS1_2- /<br>eDP1_TX2- /<br>DSI1_D2- | NA                                                                                                                                                                             | DO   | 1.8V      | DSI1_D2N_T0B (BOM change) |
| S119        | GND                                   | NA                                                                                                                                                                             | -    | NA        |                           |
| S120        | LVDS1_3+ /<br>eDP1_TX3+ /<br>DSI1_D3+ | NA                                                                                                                                                                             | DO   | 1.8V      | DSI1_D3P_T2C (BOM change) |
| S121        | LVDS1_3- /<br>eDP1_TX3- /<br>DSI1_D3- | NA                                                                                                                                                                             | DO   | 1.8V      | DSI1_D3N (BOM change)     |
| S122        | LCD1_BKLT_PWM                         | <b>GPIO:</b> GPIO30<br><b>DISP:</b> DISP_PWM1<br><b>DISP:</b> DISP_PWM0<br><b>CAM:</b> CMFLASH3<br><b>PWM:</b> PWM_1                                                           | DO   | 1.8V      |                           |
| S123        | GPIO13                                | <b>GPIO:</b> GPIO5<br><b>GPIO:</b> TP_GPIO5_AO<br><b>SPDIF:</b> SPDIF_IN1<br><b>I2S:</b> I2S01_BCK<br><b>DMIC:</b> DMIC4_DAT_R<br><b>I2S:</b> I2SIN_D2<br><b>I2S:</b> I2S02_D2 | DI/O | 1.8V      |                           |
| S124        | GND                                   | NA                                                                                                                                                                             | -    | NA        |                           |
| S125        | LVDS0_0+ /<br>eDP0_TX0+ /<br>DSI0_D0+ | DSI0_D0P_T0C                                                                                                                                                                   | DO   | 1.8V      |                           |
| S126        | LVDS0_0- /<br>eDP0_TX0- /<br>DSI0_D0- | DSI0_D0N_T1A                                                                                                                                                                   | DO   | 1.8V      |                           |
| S127        | LCD0_BKLT_EN                          | <b>GPIO:</b> GPIO146<br><b>DPI:</b> DPI_D15<br><b>GBE:</b> GBE_RXER<br><b>CAM:</b> CMFLASH1<br><b>SPI:</b> SPIM3_MISO<br><b>GBE:</b> GBE_AUX_PPS3                              | DO   | 1.8V      |                           |
| S128        | LVDS0_1+ /<br>eDP0_TX1+ /<br>DSI0_D1+ | DSI0_D1P_T2A                                                                                                                                                                   | DO   | 1.8V      |                           |
| S129        | LVDS0_1- /<br>eDP0_TX1- /<br>DSI0_D1- | DSI0_D1N_T2B                                                                                                                                                                   | DO   | 1.8V      |                           |

| SMARC Pin # | SMARC Pin Name                          | CPU PIN / Multiplexing<br>(red = default muxing)                                                                                                                            | I/O  | I/O Level | Comments           |
|-------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|--------------------|
| S130        | GND                                     | NA                                                                                                                                                                          | -    | NA        |                    |
| S131        | LVDS0_2+ /<br>eDP0_TX2+ /<br>DSI0_D2+   | DSI0_D2P_T0A                                                                                                                                                                | DO   | 1.8V      |                    |
| S132        | LVDS0_2- /<br>eDP0_TX2- /<br>DSI0_D2-   | DSI0_D2N_T0B                                                                                                                                                                | DO   | 1.8V      |                    |
| S133        | LCD0_VDD_EN                             | <b>GPIO:</b> GPIO25<br><b>LCM:</b> LCM_RST<br><b>LCM:</b> LCM1_RST<br><b>DP:</b> DP_TX_HPD                                                                                  | DO   | 1.8V      |                    |
| S134        | LVDS0_CK+ /<br>eDP0_AUX+ /<br>DSI0_CLK+ | DSI0_CKP_T1B                                                                                                                                                                | DO   | 1.8V      |                    |
| S135        | LVDS0_CK- /<br>eDP0_AUX- /<br>DSI0_CLK- | DSI0_CKN_T1C                                                                                                                                                                | DO   | 1.8V      |                    |
| S136        | GND                                     | NA                                                                                                                                                                          | -    | NA        |                    |
| S137        | LVDS0_3+ /<br>eDP0_TX3+ /<br>DSI0_D3+   | DSI0_D3P_T2C                                                                                                                                                                | DO   | 1.8V      |                    |
| S138        | LVDS0_3- /<br>eDP0_TX3- /<br>DSI0_D3-   | DSI0_D3N                                                                                                                                                                    | DO   | 1.8V      |                    |
| S139        | I2C_LCD_CK                              | NA                                                                                                                                                                          | -    | NA        |                    |
| S140        | I2C_LCD_DAT                             | NA                                                                                                                                                                          | -    | NA        |                    |
| S141        | LCD0_BKLT_PWM                           | <b>GPIO:</b> GPIO29<br><b>DISP:</b> DISP_PWM0<br><b>DISP:</b> DISP_PWM1                                                                                                     | DI/O | 1.8V      |                    |
| S142        | GPIO12                                  | <b>GPIO:</b> GPIO42<br><b>KP:</b> KPCOL0                                                                                                                                    | DI/O | 1.8V      |                    |
| S143        | GND                                     | NA                                                                                                                                                                          | -    | NA        |                    |
| S144        | eDP0_HPD / DSI0_TE                      | <b>GPIO:</b> GPIO19<br><b>GPIO:</b> TP_GPIO3_AO<br><b>CAM:</b> CMFLASH1<br><b>CAM:</b> CMVREF5<br><b>TDMIN:</b> TDMIN_BCK<br><b>UART:</b> URXD1<br><b>UART:</b> TP_URXD1_AO | DI/O | 1.8V      |                    |
| S145        | WDT_TIME_OUT#                           | <b>GPIO:</b> GPIO100<br><b>WDOG:</b> WATCHDOG                                                                                                                               | DO   | 1.8V      |                    |
| S146        | PCIE_WAKE#                              | <b>GPIO:</b> GPIO47<br><b>PCI:</b> WAKEN                                                                                                                                    | DI   | 3.3V      |                    |
| S147        | VDD_RTC                                 | VRTC28                                                                                                                                                                      | A    | 1.8V      | From MT6365 (U200) |
| S148        | LID#                                    | <b>GPIO:</b> GPIO65<br><b>I2C:</b> SCL5<br><b>I2C:</b> SCP_SCL0<br><b>I2C:</b> SCP_SCL1                                                                                     | DI   | 1.8 - 5V  |                    |
| S149        | SLEEP#                                  | <b>GPIO:</b> GPIO66<br><b>I2C:</b> SDA5<br><b>I2C:</b> SCP_SDA0<br><b>I2C:</b> SCP_SDA1                                                                                     | DI   | 1.8 - 5V  |                    |

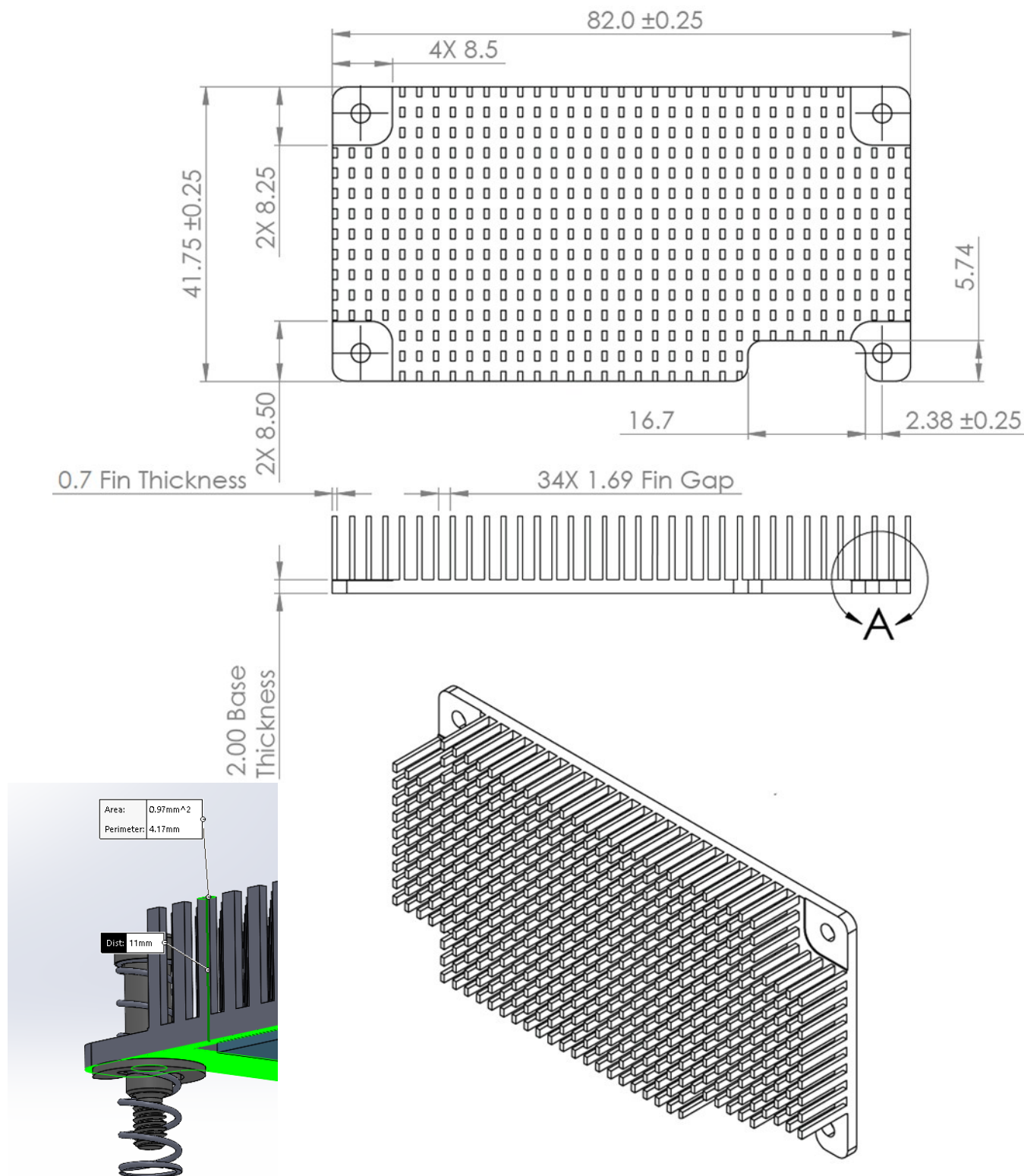
| SMARC Pin # | SMARC Pin Name  | CPU PIN / Multiplexing<br>(red = default muxing)                                                                       | I/O | I/O Level | Comments |
|-------------|-----------------|------------------------------------------------------------------------------------------------------------------------|-----|-----------|----------|
| S150        | VIN_PWR_BAD#    | GPIO: GPIO86<br>USB: IDDIG_1P<br>UART: UTXD1<br>UART: URTS2<br>PWM: PWM_2<br>GPIO: TP_GPIO4_AO<br>AUXIF: AUXIF_ST0     | DI  | VDD_IN    |          |
| S151        | CHARGING#       | GPIO: GPIO88<br>USB: VBUSVALID_1P<br>UART: UTXD2<br>UART: URTS1<br>CLK: CLKM2<br>GPIO: TP_GPIO6_AO<br>AUXIF: AUXIF_ST1 | DI  | 1.8 - 5V  |          |
| S152        | CHARGER_PRSENT# | GPIO: GPIO129<br>DMIC: DMIC2_DAT<br>SPI: SPINOR_IO2<br>SPDIF: SPDIF_IN1<br>TCSYS: LVTS_SCK                             | DI  | 1.8 - 5V  |          |
| S153        | CARRIER_STBY#   | GPIO: GPIO128<br>DMIC: DMIC2_CLK<br>SPI: SPINOR_IO1<br>TDMIN: TDMIN_DI<br>TCSYS: LVTS_SCF                              | DO  | 1.8V      |          |
| S154        | CARRIER_PWR_ON  | GPIO: GPIO127<br>DMIC: DMIC1_DAT_R<br>SPI: SPINOR_IO0<br>TDMIN: TDMIN_LRCK<br>TCSYS: LVTS_26M                          | DO  | 1.8V      |          |
| S155        | FORCE_RECOV#    | GPIO: GPIO126<br>DMIC: DMIC1_DAT<br>SPI: SPINOR_CS<br>TDMIN: TDMIN_BCK<br>TCSYS: LVTS_SDO                              | DI  | 1.8V      |          |
| S156        | BATLOW#         | GPIO: GPIO125<br>DMIC: DMIC1_CLK<br>SPI: SPINOR_CK<br>TDMIN: TDMIN_MCK<br>TCSYS: LVTS_FOUT                             | DI  | 1.8 - 5V  |          |
| S157        | TEST#           | GPIO: GPIO149<br>DPI: DPI_DE<br>GBE: GBE_AUX_PPS0<br>I2S: I2SO1_WS<br>CAM: CMVREF2<br>SPDIF: SPDIF_IN1<br>UART: UTXD3  | DI  | 1.8 - 5V  |          |
| S158        | GND             | NA                                                                                                                     | -   | NA        |          |

## 8 Mechanical and PCB footprint specification

The Tungsten510 SMARC module dimensions are 82 x 50 mm. Detail drawings are shown below.



## 9 Heatsink



Part Number: 450-00222 | Material: Aluminum

Note: The heatsink for T700 and T510 share the same part number

## 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 Ordering Information

| Order Model                     | Description                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| T510_SMARC_SOM_4r16e            | SMARC SOM: MT8370 / 4GB / 16GB eMMC / 0 °C to +70 °C / Without Wireless                                                 |
| T510_SMARC_SOM_4r16e_i          | SMARC SOM: MT8370 / 4GB / 16GB eMMC / -40 °C to +85 °C / Without Wireless                                               |
| T510_SMARC_SOM_4r16e_MT320_2M   | SMARC SOM: MT8370 / 4GB / 16GB eMMC / 0 °C to +70 °C / Sona MT320 / 2x MHF4L                                            |
| T510_SMARC_SOM_4r16e_MT320_2M_i | SMARC SOM: MT8370 / 4GB / 16GB eMMC / 0 °C to +85 °C / Sona MT320 / 2x MHF4L                                            |
| T510_SMARC_SOM_8r16e            | SMARC SOM: MT8370 / 8GB / 16GB eMMC / 0 °C to +70 °C / Without Wireless                                                 |
| T510_SMARC_SOM_8r16e_i          | SMARC SOM: MT8370 / 8GB / 16GB eMMC / -40 °C to +85 °C / Without Wireless                                               |
| T510_SMARC_SOM_8r16e_MT320_2M   | SMARC SOM: MT8370 / 8GB / 16GB eMMC / 0 °C to +70 °C / Sona MT320 / 2x MHF4L                                            |
| T510_SMARC_SOM_8r16e_MT320_2M_i | SMARC SOM: MT8370 / 8GB / 16GB eMMC / 0 °C to +85 °C / Sona MT320 / 2x MHF4L                                            |
| 450-00222                       | Heatsink for Tungsten 700 & 510 SMARC families                                                                          |
| SMARC_CAR                       | Kit - Universal SMARC Carrier Board.<br>Includes 3x EFB2471A3S-10MH4L and 2x 001-0021 antennas, power supply, DB9 cable |
| SMARC_CAR_BRD                   | Universal Carrier Board - SMARC (Note - SOM sold separately)                                                            |

## 12 Reliability Test

### 12.1 Dynamic Reliability Test

*Table 8: Dynamic Reliability Test Results for Tungsten510 Modules*

| Test Item                                           | Specification                                                                                                                                                                                                                                                                            | Standard                 | Test Result |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------|
| Vibration<br>Non-Operating Unpackaged device        | Vibration Wave Form: Sine Waveform<br>Vibration frequency / Displacement: 20-80 Hz/1.5mm<br>Vibration frequency / Acceleration: 80-2000 Hz/20g<br>Cycle Time: 4 min/cycle<br>Number of Cycles: 4 cycle/axis<br>Vibration Axes: X, Y and Z (Rotate each axis on vertical vibration table) | JEDEC 22-B103B (2016)    | Pass        |
| Mechanical Shock<br>Non-Operating Unpackaged device | Pulse shape: Half-sine waveform<br>Impact acceleration: 1500 g<br>Pulse duration: 0.5 ms<br>Number of shocks: 30 shocks (5 shocks for each face)<br>Orientation: Bottom, top, left, right, front, and rear faces                                                                         | JEDEC 22-B110B.01 (2019) | Pass        |

## 13 Regulatory

Radio certifications for SOMs with wireless options are held under the specific wireless module listings:

| Order Model with Wireless       | Module Product Page        | RIG                                               |
|---------------------------------|----------------------------|---------------------------------------------------|
| T510_SMARC_SOM_4r16e_MT320_2M   | <a href="#">Sona MT320</a> | <a href="#">Sona MT320 Regulatory information</a> |
| T510_SMARC_SOM_4r16e_MT320_2M_i | <a href="#">Sona MT320</a> | <a href="#">Sona MT320 Regulatory information</a> |
| T510_SMARC_SOM_8r16e_MT320_2M   | <a href="#">Sona MT320</a> | <a href="#">Sona MT320 Regulatory information</a> |
| T510_SMARC_SOM_8r16e_MT320_2M_i | <a href="#">Sona MT320</a> | <a href="#">Sona MT320 Regulatory information</a> |

## 14 Additional Information

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

|                          |                                                                                               |
|--------------------------|-----------------------------------------------------------------------------------------------|
| <b>Headquarters</b>      | Ezurio<br>50 S. Main St. Suite 1100<br>Akron, OH 44308 USA                                    |
| <b>Website</b>           | <a href="http://www.ezurio.com">http://www.ezurio.com</a>                                     |
| <b>Technical Support</b> | <a href="http://www.ezurio.com/resources/support">http://www.ezurio.com/resources/support</a> |
| <b>Sales Contact</b>     | <a href="http://www.ezurio.com/contact">http://www.ezurio.com/contact</a>                     |

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