# Datasheet

## Sona™ IF573

*Version 0.2*

# REVISION HISTORY

| Version | Date | Notes | Contributors | Approver |
|---|---|---|---|---|
| 0.1 | 8 June 2023 | Initial version | Various | Andy Ross |
| 0.2 | 13 July 2023 | Updates to Table 37: M.2 2230 E-Key pin definitions – WL_DEV_WAKE and BT_DEV_WAKE voltage | Jacky Kuo | Andrew Chen |
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# 1 SCOPE

This document describes key hardware aspects of the Laird Connectivity Sona™ IF573 series wireless modules providing either PCIe v3.0 Gen2 or SDIO 3.0 interface for WLAN connection and high-speed 4-wire UART interface for Bluetooth® connection. This document is intended to assist device manufacturers and related parties with the integration of this radio into their host devices. Data in this document is drawn from several sources and includes information found in the Infineon CYW55573MIWBGT data sheet issued on March 23, 2023, along with other documents provided by Infineon.

**Note:** **The information in this document is subject to change.** Please contact Laird Connectivity to obtain the most recent version of this document.

# 2 INTRODUCTION

## 2.1 General Description

The Sona IF573 series wireless module is an integrated, small form factor Wi-Fi/Bluetooth module that is optimized for low-power mobile devices, featuring:

- Wi-Fi 6E: Tri-band 2x2 MIMO IEEE 802.11a/b/g/n/ac/ax WLAN
- Bluetooth® 5.4: Dual Mode

The integration of all WLAN and Bluetooth functionality in a single package supports low cost and simple implementation along with flexibility for platform-specific customization. It is available in both M.2 2230 E-Key and M.2 1318 solder-down form factor.

This device is pre-calibrated and integrates the complete transmit/receive RF paths including bandpass filter, diplexer, switches, reference crystal oscillator, and power management units (PMU). Both variants support three integrated MHF4 connectors, with two ports for WLAN and one dedicated for Bluetooth. The M.2 1318 solder down module also supports an RF trace pin option for use with external antenna solutions. For a list of certified antennas see Certified Antennas in the datasheet.

The Sona IF573 series device supports IEEE 802.11ax tri-band (2.4/5/6 GHz) 2x2 MIMO with data rates up to MCS11 (287 Mbps PHY data rate for 2.4 GHz band and 1.2 Gbps PHY data rate for 5/6 GHz). The device has a dedicated Bluetooth port for best Wi-Fi + Bluetooth coexistence performance. The device's low power consumption, radio architecture and power management unit (PMU) proprietary power save technologies allow for extended battery life.

In addition, its tri-band IEEE 802.11ax and Bluetooth radio includes full digital MAC and baseband engines that handle all 802.11 CCK/OFDM/OFDMA® 2.4/5/6 GHz and Bluetooth 5.4 (Basic Rate, Enhanced Data Rate, and Bluetooth Low Energy) baseband and protocol processing.

The Sona IF573 series wireless modules include two product SKUs which have different RF paths. Please contact Laird Connectivity Sales/FAE for further information. Ordering information is listed in Table 1.

***Table 1: Product ordering information***

| Part Number | Description |
|---|---|
| 453-00117R | Sona IF573 1318 Module, MHF4, Tape and Reel |
| 453-00117C | Sona IF573 1318 Module, MHF4, Cut Tape |
| 453-00118R | Sona IF573 1318 Module, RF Trace Pin, Tape and Reel |
| 453-00118C | Sona IF573 1318 Module, RF Trace Pin, Cut Tape |
| 453-00119 | Sona IF573 M.2 2230 Module, Key E, SDIO/UART |
| 453-00120 | Sona IF573 M.2 2230 Module, Key E, PCIe/UART |
| 453-00119-K1 | Sona IF573 M.2 2230 Module Development Kit, SDIO/UART |
| 453-00120-K1 | Sona IF573 M.2 2230 Module Development Kit, PCIe/UART |





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# 3 SONA IF573 SERIES FEATURES SUMMARY

The Laird Connectivity Sona IF573 series device features are described in Table 2.

***Table 2: Sona IF573 series wireless module features***

| Feature | Description |
|---|---|
| **Radio Front End** | ▪ Integrates the complete transmit/receive RF paths including bandpass filter, diplexer, switches, reference crystal oscillator, and power manage unit (PMU)<br>▪ Supports tri-band (2.4/5/6 GHz)<br>▪ Supports 20/40/80 MHz channel bandwidth<br>▪ Supports 2x2 WLAN antenna configuration with dedicated Bluetooth antenna port |
| The *Bluetooth*® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. Any use of such marks by Laird Connectivity is under license. Other trademarks and trade names are those of their respective owners. | |
| **Power Management** | Two buck regulator, multiple LDO regulators, and a power management unit (PMU) are integrated into the CYW55573MIWBGT. All regulators are programmable via the PMU. These blocks simplify power supply design for Bluetooth and WLAN functions in embedded designs. |
| **Pre-Calibration** | RF system tested and calibrated in production |
| **Sleep Clock** | An external sleep clock of 32.768 kHz is required. |
| **Host Interface** | The Sona IF573 M.2 card provides two interfaces for customers to choose:<br>**1. SDIO/UART**, Wi-Fi section provides support for SDIO v3.0 and also is backward compatible with SDIO v2.0. Bluetooth section supports a high-speed 4-wire UART interface.<br>**2. PCIe/UART**, Wi-Fi section provides support for PCIe Gen2 (3.0 Compliant). Bluetooth section supports a high-speed 4-wire UART interface. |
| **Advanced WLAN** | ▪ IEEE 802.11a/b/g/n/ac/ax compliant, tri-band capable (2.4/5/6 GHz)<br>▪ 2x2 MIMO providing up to 1.2 Gbps PHY data rate for 5/6 GHz (1024-QAM modulation)<br>▪ 2x2 MIMO providing up to 287 Mbps PHY data rate for 2.4 GHz (1024-QAM modulation)<br>▪ Supports 20, 40, and 80 MHz channels with optional SGI (1024-QAM modulation)<br>▪ Background channel availability check (CAC) scan for immediate switch to candidate DFS channel<br>▪ On-chip power amplifiers and low-noise amplifiers for both bands<br>▪ Support wide variety of WLAN encryption: WPA/WPA2/WPA3/TKIP/AES and IEEE 802.11i compatibility |
| **Advanced Bluetooth** | ▪ Bluetooth 5.4 (BDR + EDR + Bluetooth LE)<br>▪ Dedicated Bluetooth RF path port<br>▪ Bluetooth Class 1 or Class 2 transmitter operation<br>▪ Support data rate: 1 Mbps (GFSK), 2 Mbps (π/4-DQPSK), 3 Mbps (8-DPSK), LE-1 Mbps, LE-2 Mbps, LE-LR-500K (S=2) and LE-LR-125K (S=8)<br>▪ Supports extended synchronous connections (eSCO) for enhanced voice quality by allowing for retransmission of dropped packets<br>▪ Adaptive frequency hopping (AFH) for reducing radio frequency interference<br>▪ Host controller interface (HCI) using a highspeed UART and PCM/I2S for audio data<br>▪ Low power consumption improves battery life of IoT and embedded devices<br>▪ Supports multiple simultaneous Advanced Audio Distribution Profiles (A2DP) for stereo sound<br>▪ On-chip memory includes 512 KB SRAM and 2 MB ROM |



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# 4 SPECIFICATIONS

***Table 3: Specifications***

| Feature | Description |
|---|---|
| **Physical Interface** | M.2 2230 E-Key standard form factor<br>M.2 1318 108-pin LGA package (including 8 thermal ground pads under the package) |
| **Wi-Fi Interface** | PCIe v3.0 Gen2<br>Secure Digital I/O 2.0/3.0 |
| **Bluetooth/BLE Interface** | Host Controller Interface (HCI) using high speed UART |
| **Main Chipset** | Infineon AIROC™ CYW55573MIWBGT |
| **Input Voltage Requirements** | Typical DC 3.3 V, operating range from DC 3.13V to 3.5V |
| **I/O Signalling Voltage** | Compliant with M.2 standard<br>Typical DC 1.8 V ± 5% |
| **Operating Temperature** | -40° to +85°C (-40° to +185°F)<br>Note:<br>Absolute junction temperature 125 °C limit is maintained through active thermal monitoring, throttling, and turning off one of the TX chains or both. |
| **Operating Humidity** | 10 to 90% (non-condensing) |
| **Storage Temperature** | -40° to +85°C (-40° to +185°F) |
| **Storage Humidity** | 10 to 90% (non-condensing) |
| **MSL (Moisture Sensitivity Level)** | 4 |
| **Maximum Electrostatic Discharge** | Conductive 8KV; Air coupled 12KV (follows EN61000-4-2) |
| **Size** | M.2 1318<br>▪ Length: 18 mm<br>▪ Width: 13 mm<br>▪ Thickness: 0.43 mm<br>M.2 E-Key<br>▪ Length: 30 mm<br>▪ Width: 22 mm<br>Thickness: 3.1 mm |
| **Weight – g (oz.)** | M.2 1318<br>▪ ~0.7<br>M.2 E-Key<br>▪ 3 |
| **Wi-Fi Media** | Direct Sequence-Spread Spectrum (DSSS)<br>Complementary Code Keying (CCK)<br>Orthogonal Frequency Division Multiplexing (OFDM)<br>Orthogonal Frequency Division Multiple Access (OFDMA) |
| **Bluetooth Media** | Frequency Hopping Spread Spectrum (FHSS) |
| **Wi-Fi Multimedia** | WMM<br>Wi-Fi Multimedia - PowerSave (WMM-PS with U-APSD)<br>WMM-Sequential Access (WMM-SA) |
| **Network Architecture Types** | Infrastructure (client operation) |
| **Wi-Fi Standards** | IEEE 802.11ax, 11ac, 11a/b/g/n, 11d/h, 11i, 11r, 11w, 11e, 11k, 11ai, 11v |
| **Bluetooth Standards** | Bluetooth 2.1 + EDR, 3.0, 4.2, 5.0, 5.1, 5.2, 5.3, 5.4 |





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| Feature | Description |
|---|---|
| **Wi-Fi Data Rates Supported** | Support 802.11 ax/ac/a/b/g/n 2x2 MU-MIMO.<br>802.11b (DSSS, CCK) 1, 2, 5.5, 11 Mbps<br>802.11a/g (OFDM) 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11n (OFDM, HT20/HT40, MCS0-15)<br>802.11ac (OFDM, VHT20, MCS0-8; OFDM, VHT40/HT80, MCS0-9)<br>802.11ax (2.4 GHz / OFDM / HE20 / MCS0-11; 2.4 GHz / OFDMA / HE20 / MCS0-11)<br>802.11ax (5 GHz, 6 GHz / OFDM / HE20, HE40, HE80 / MCS0-11;<br>5 GHz, 6 GHz / OFDMA / HE20, HE40, HE80 / MCS0-11) |
| **Modulation Table** | BPSK, QPSK, CCK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM |

**Modulation Type**

| MCS Index | | | Spatial Stream | Modulation | Coding | OFDM (IEEE 802.11n/ac) | | | | | | OFDM (IEEE 802.11ax) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 20MHz | | 40MHz | | 80MHz | | 20MHz | | | 40MHz | | | 80MHz | | |
| HT | VHT | HE | | | | 0.8us GI | 0.4us GI | 0.8us GI | 0.4us GI | 0.8us GI | 0.4us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI |
| 0 | 0 | 0 | 1 | BPSK | 1/2 | 6.5 | 7.2 | 13.5 | 15 | 29.3 | 32.5 | 8.6 | 8.1 | 7.3 | 17.2 | 16.3 | 14.6 | 36 | 34 | 30.6 |
| 1 | 1 | 1 | 1 | QPSK | 1/2 | 13 | 14.4 | 27 | 30 | 58.5 | 65 | 17.2 | 16.3 | 14.6 | 34.4 | 32.5 | 29.3 | 72.1 | 68.1 | 61.3 |
| 2 | 2 | 2 | 1 | QPSK | 3/4 | 19.5 | 21.7 | 40.5 | 45 | 87.8 | 97.5 | 25.8 | 24.4 | 21.9 | 51.6 | 48.8 | 43.9 | 108.1 | 102.1 | 91.9 |
| 3 | 3 | 3 | 1 | 16-QAM | 1/2 | 26 | 28.9 | 54 | 60 | 117 | 130 | 34.4 | 32.5 | 29.3 | 68.8 | 65 | 58.5 | 144.1 | 136.1 | 122.5 |
| 4 | 4 | 4 | 1 | 16-QAM | 3/4 | 39 | 43.3 | 81 | 90 | 175.5 | 195 | 51.6 | 48.8 | 43.9 | 103.2 | 97.5 | 87.8 | 216.2 | 204.2 | 183.8 |
| 5 | 5 | 5 | 1 | 64-QAM | 2/3 | 52 | 57.8 | 108 | 120 | 234 | 260 | 68.8 | 65 | 58.5 | 137.6 | 130 | 117 | 288.2 | 272.2 | 245 |
| 6 | 6 | 6 | 1 | 64-QAM | 3/4 | 58.5 | 65 | 121.5 | 135 | 263.3 | 292.5 | 77.4 | 73.1 | 65.8 | 154.9 | 146.3 | 131.6 | 324.3 | 306.3 | 275.6 |
| 7 | 7 | 7 | 1 | 64-QAM | 5/6 | 65 | 72.2 | 135 | 150 | 292.5 | 325 | 86 | 81.3 | 73.1 | 172.1 | 162.5 | 146.3 | 360.3 | 340.3 | 306.3 |
| | 8 | 8 | 1 | 256-QAM | 3/4 | 78 | 86.7 | 162 | 180 | 351 | 390 | 103.2 | 97.5 | 87.8 | 206.5 | 195 | 175.5 | 432.4 | 408.3 | 367.5 |
| | 9 | 9 | 1 | 256-QAM | 5/6 | N/A | N/A | 180 | 200 | 390 | 433.3 | 114.7 | 108.3 | 97.5 | 229.4 | 216.7 | 195 | 480.4 | 453.7 | 408.3 |
| | | 10 | 1 | 1024-QAM | 3/4 | | | | | | | 129 | 121.9 | 109.7 | 258.1 | 243.8 | 219.4 | 540.4 | 510.4 | 459.4 |
| | | 11 | 1 | 1024-QAM | 5/6 | | | | | | | 143.4 | 135.4 | 121.9 | 286.8 | 270.8 | 243.8 | 600.5 | 567.1 | 510.4 |
| 8 | 0 | 0 | 2 | BPSK | 1/2 | 13 | 14.4 | 27 | 30 | 58.5 | 65 | 17.2 | 16.3 | 14.6 | 34.4 | 32.5 | 29.3 | 72.1 | 68.1 | 61.3 |
| 9 | 1 | 1 | 2 | QPSK | 1/2 | 26 | 28.9 | 54 | 60 | 117 | 130 | 34.4 | 32.5 | 29.3 | 68.8 | 65 | 58.5 | 144.1 | 136.1 | 122.5 |
| 10 | 2 | 2 | 2 | QPSK | 3/4 | 39 | 43.3 | 81 | 90 | 175.5 | 195 | 51.6 | 48.8 | 43.9 | 103.2 | 97.5 | 87.8 | 216.2 | 204.2 | 183.8 |
| 11 | 3 | 3 | 2 | 16-QAM | 1/2 | 52 | 57.8 | 108 | 120 | 234 | 260 | 68.8 | 65 | 58.5 | 137.6 | 130 | 117 | 288.2 | 272.2 | 245 |
| 12 | 4 | 4 | 2 | 16-QAM | 3/4 | 78 | 86.7 | 162 | 180 | 351 | 390 | 103.2 | 97.5 | 87.8 | 206.5 | 195 | 175.5 | 432.4 | 408.3 | 367.5 |
| 13 | 5 | 5 | 2 | 64-QAM | 2/3 | 104 | 115.6 | 216 | 240 | 468 | 520 | 137.6 | 130 | 117 | 275.3 | 260 | 234 | 576.5 | 544.4 | 490 |
| 14 | 6 | 6 | 2 | 64-QAM | 3/4 | 117 | 130 | 243 | 270 | 526.5 | 585 | 154.9 | 146.3 | 131.6 | 309.7 | 292.5 | 263.3 | 648.5 | 612.5 | 551.3 |
| 15 | 7 | 7 | 2 | 64-QAM | 5/6 | 130 | 144.4 | 270 | 300 | 585 | 650 | 172.1 | 162.5 | 146.3 | 344.1 | 325 | 292.5 | 720.6 | 680.6 | 612.5 |
| | 8 | 8 | 2 | 256-QAM | 3/4 | 156 | 173.3 | 324 | 360 | 702 | 780 | 206.5 | 195 | 175.5 | 412.9 | 390 | 351 | 864.7 | 816.7 | 735 |
| | 9 | 9 | 2 | 256-QAM | 5/6 | N/A | N/A | 360 | 400 | 780 | 866.7 | 229.4 | 216.7 | 195 | 458.8 | 433.3 | 390 | 960.8 | 907.4 | 816.7 |
| | | 10 | 2 | 1024-QAM | 3/4 | | | | | | | 258.1 | 243.8 | 219.4 | 516.2 | 487.5 | 438.8 | 1080.9 | 1020.8 | 918.8 |
| | | 11 | 2 | 1024-QAM | 5/6 | | | | | | | 286.8 | 270.8 | 243.8 | 573.5 | 541.7 | 487.5 | 1201 | 1134.3 | 1020.8 |

**OFDMA (IEEE 802.11ax)**

| MCS Index | Spatial Stream | Modualtion | Coding | 26-tone RU | | | 52-tone RU | | | 106-tone RU | | | 242-tone RU | | | 484-tone RU | | | 996-tone RU | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HE | | | | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI | 0.8us GI | 1.6us GI | 3.2us GI |
| 0 | 1 | BPSK | 1/2 | 0.9 | 0.8 | 0.8 | 1.8 | 1.7 | 1.5 | 3.8 | 3.5 | 3.2 | 8.6 | 8.1 | 7.3 | 17.2 | 16.3 | 14.6 | 36 | 34 | 30.6 |
| 1 | 1 | QPSK | 1/2 | 1.8 | 1.7 | 1.5 | 3.5 | 3.3 | 3 | 7.5 | 7.1 | 6.4 | 17.2 | 16.3 | 14.6 | 34.4 | 32.5 | 29.3 | 72.1 | 68.1 | 61.3 |
| 2 | 1 | QPSK | 3/4 | 2.6 | 2.5 | 2.3 | 5.3 | 5 | 4.5 | 11.3 | 10.6 | 9.6 | 25.8 | 24.4 | 21.9 | 51.6 | 48.8 | 3.9 | 108.1 | 102.1 | 91.9 |
| 3 | 1 | 16-QAM | 1/2 | 3.5 | 3.3 | 3 | 7.1 | 6.7 | 6 | 15 | 14.2 | 12.8 | 34.4 | 32.5 | 29.3 | 68.8 | 65 | 58.5 | 144.1 | 136.1 | 122.5 |
| 4 | 1 | 16-QAM | 3/4 | 5.3 | 5 | 4.5 | 10.6 | 10 | 9 | 22.5 | 21.3 | 19.1 | 51.6 | 48.8 | 43.9 | 103.2 | 97.5 | 87.8 | 216.2 | 204.2 | 183.8 |
| 5 | 1 | 64-QAM | 2/3 | 7.1 | 6.7 | 6 | 14.1 | 13.3 | 12 | 30 | 8.3 | 25.5 | 68.8 | 65 | 58.5 | 137.6 | 130 | 117 | 288.2 | 272.2 | 245 |
| 6 | 1 | 64-QAM | 3/4 | 7.9 | 7.5 | 6.8 | 15.9 | 15 | 13.5 | 33.8 | 31.9 | 28.7 | 77.4 | 73.1 | 65.8 | 154.9 | 146.3 | 131.6 | 324.3 | 306.3 | 275.6 |
| 7 | 1 | 64-QAM | 5/6 | 8.8 | 8.3 | 7.5 | 17.6 | 16.7 | 15 | 37.5 | 35.4 | 31.9 | 86 | 81.3 | 73.1 | 172.1 | 162.5 | 146.3 | 360.3 | 340.3 | 306.3 |
| 8 | 1 | 256-QAM | 3/4 | 10.6 | 10 | 9 | 21.2 | 20 | 18 | 45 | 42.5 | 38.3 | 103.2 | 97.5 | 87.8 | 206.5 | 195 | 175.5 | 432.4 | 408.3 | 367.5 |
| 9 | 1 | 256-QAM | 5/6 | 11.8 | 11.1 | 10 | 3.5 | 22.2 | 20 | 50 | 47.2 | 42.5 | 114.7 | 108.3 | 97.5 | 229.4 | 216.7 | 195 | 480.4 | 53.7 | 408.3 |
| 10 | 1 | 1024-QAM | 3/4 | 13.2 | 12.5 | 11.3 | 26.5 | 25 | 22.5 | 56.3 | 53.1 | 47.8 | 129 | 121.9 | 1097 | 258.1 | 243.8 | 219.4 | 540.4 | 510.4 | 459.4 |
| 11 | 1 | 1024-QAM | 5/6 | 14.7 | 13.9 | 12.5 | 29.4 | 27.8 | 25 | 62.5 | 59 | 53.1 | 143.4 | 135.4 | 121.9 | 286.8 | 270.8 | 243.8 | 600.5 | 567.1 | 510.4 |
| 0 | 2 | BPSK | 1/2 | 1.8 | 1.7 | 1.5 | 3.5 | 3.3 | 3 | 7.5 | 7.1 | 6.4 | 17.2 | 16.3 | 14.6 | 34.4 | 32.5 | 29.3 | 72.1 | 68.1 | 61.3 |
| 1 | 2 | QPSK | 1/2 | 3.5 | 3.3 | 3 | 7.1 | 6.7 | 6 | 15 | 14.2 | 12.8 | 34.4 | 32.5 | 29.3 | 68.8 | 65 | 58.5 | 144.1 | 136.1 | 122.5 |
| 2 | 2 | QPSK | 3/4 | 5.3 | 5 | 4.5 | 10.6 | 10 | 9 | 22.5 | 21.3 | 19.1 | 51.6 | 48.8 | 43.9 | 103.2 | 97.5 | 87.8 | 216.2 | 204.2 | 183.8 |
| 3 | 2 | 16-QAM | 1/2 | 7.1 | 6.7 | 6 | 14.1 | 13.3 | 12 | 30 | 28.3 | 25.5 | 68.8 | 65 | 58.5 | 137.6 | 130 | 117 | 288.2 | 272.2 | 245 |
| 4 | 2 | 16-QAM | 3/4 | 10.6 | 10 | 9 | 21.2 | 20 | 18 | 45 | 42.5 | 38.3 | 103.2 | 97.5 | 87.8 | 206.5 | 195 | 175.5 | 432.4 | 408.3 | 367.5 |
| 5 | 2 | 64-QAM | 2/3 | 14.1 | 13.3 | 12 | 28.2 | 26.7 | 24 | 60 | 56.7 | 51 | 137.6 | 130 | 117 | 275.3 | 260 | 234 | 576.5 | 544.4 | 490 |
| 6 | 2 | 64-QAM | 3/4 | 15.9 | 15 | 13.5 | 31.8 | 30 | 27 | 67.5 | 63.8 | 57.4 | 154.9 | 146.3 | 131.6 | 309.7 | 292.5 | 263.3 | 648.5 | 612.5 | 551.3 |
| 7 | 2 | 64-QAM | 5/6 | 17.6 | 16.7 | 15 | 35.3 | 33.3 | 30 | 75 | 70.8 | 63.8 | 172.1 | 162.5 | 146.3 | 344.1 | 325 | 292.5 | 720.6 | 680.6 | 612.5 |
| 8 | 2 | 256-QAM | 3/4 | 21.2 | 20 | 18 | 42.4 | 40 | 36 | 90 | 85 | 76.5 | 206.5 | 195 | 175.5 | 412.9 | 390 | 351 | 864.7 | 816.7 | 735 |
| 9 | 2 | 256-QAM | 5/6 | 23.5 | 22.2 | 20 | 47.1 | 44.4 | 40 | 100 | 94.4 | 85 | 229.4 | 216.7 | 195 | 458.8 | 433.3 | 390 | 960.8 | 907.4 | 816.7 |
| 10 | 2 | 1024-QAM | 3/4 | 26.5 | 25 | 22.5 | 52.9 | 50 | 45 | 112.5 | 106.3 | 95.6 | 258.1 | 243.8 | 219.4 | 516.2 | 487.5 | 438.8 | 1080.9 | 1020.8 | 918.8 |
| 11 | 2 | 1024-QAM | 5/6 | 29.4 | 27.8 | 25 | 58.8 | 55.6 | 50 | 125 | 118.1 | 106.3 | 286.8 | 270.8 | 243.8 | 573.5 | 541.7 | 487.5 | 1201 | 1134.3 | 1020.8 |

| | |
|---|---|
| **802.11ax/ac/n Spatial Streams** | 2 (2x2 MU-MIMO) |
| **Bluetooth Data Rates Supported** | 1, 2, 3 Mbps |
| **Bluetooth Modulation** | GFSK @ 1 Mbps<br>Pi/4-DQPSK @ 2 Mbps<br>8-DPSK @ 3 Mbps |
| **Bluetooth LE Data Rates Supported** | 1, 2 Mbps, 500 Kbps (S=2), 125 Kbps (S=8) |
| **Bluetooth LE Modulation** | GFSK @ 1, 2 Mbps<br>GFSK @ 125, 500 Kbps |



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| Feature | Description |
|---|---|
| **Regulatory Certifications** | United States (FCC)<br>EU - Member countries of European Union (ETSI)<br>Great Britain (UKCA)<br>Canada (ISED)<br>Australia (RCM)<br>Japan (MIC) |
| **2.4 GHz Frequency Bands** | **EU:** 2.4 GHz to 2.483 GHz<br>**FCC/ISED:** 2.4 GHz to 2.473 GHz<br>**UKCA**: 2.4 GHz to 2.483 GHz<br>**MIC:** 2.4 GHz to 2.483 GHz<br>**RCM**: 2.4 GHz to 2.483 GHz |
| **2.4 GHz Operating Channels (Wi-Fi)** | **EU:** 13 (3 non-overlapping)<br>**FCC/ISED:** 11 (3 non-overlapping)<br>**UKCA**:13 (3 non-overlapping)<br>**MIC:** 13 (4 non-overlapping)<br>**RCM**: 13 (3 non-overlapping) |
| **5 GHz Frequency Bands** | **EU**<br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br>**FCC**<br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140/144)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br>**ISED**<br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/132/136/140/144)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165)<br>**UKCA**<br>5.15 GHz to 5.35 GHz (Ch36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.730 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140/144)<br>5.725 GHz to 5.850 GHz (Ch 149/153/157/161/165)<br>**MIC**<br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140)<br>**RCM**<br>5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64)<br>5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/132/136/140)<br>5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165) |
| **5 GHz Operating Channels (Wi-Fi)** | EU: 24 non-overlapping; FCC: 25 non-overlapping<br>ISED: 22 non-overlapping; MIC: 19 non-overlapping<br>RCM: 21 non-overlapping; UKCA: 25 non-overlapping |
| **6 GHz Frequency Bands** | **FCC / ISED**<br>UNII-5, 5.925 GHz to 6.415 GHz<br>UNII-6, 6.435 GHz to 6.515 GHz<br>UNII-7, 6.535 GHz to 6.875 GHz<br>UNII-8, 6.895 GHz to 7.115 GHz<br>**EU**<br>UNII-5, 5.945 GHz to 6.425 GHz<br>**UKCA**<br>UNII-5, 5.945 GHz to 6.425 GHz<br>**MIC**<br>UNII-5, 5.945 GHz to 6.425 GHz<br>**RCM**<br>UNII-5, 5.945 GHz to 6.425 GHz |



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| Feature | Description |
|---|---|
| **6 GHz Operating Channels (Wi-Fi)** | **FCC/ISED:** 59 non-overlapping<br>**ETSI/MIC/RCM/UKCA:** 24 non-overlapping |





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| Feature | Description | |
|---|---|---|
| **Typical Receiver Sensitivity** (PER <= 10%) ***Note:*** *All values nominal, +/- 3 dBm.* | **802.11a:** | |
| | 6 Mbps | -92 dBm |
| | 54 Mbps | -75 dBm |
| | **802.11b:** | |
| | 1 Mbps | -96 dBm (PER < 8%) |
| | 11 Mbps | -90 dBm (PER < 8%) |
| | **802.11g:** | |
| | 6 Mbps | -93 dBm |
| | 54 Mbps | -76 dBm |
| | **802.11n (2.4 GHz)** | |
| | 6.5 Mbps (MCS0; HT20) | -93 dBm |
| | 65 Mbps (MCS7; HT20) | -75 dBm |
| | **802.11ax (2.4 GHz)** | |
| | 7.3 Mbps (MCS0; HE20) | -93 dBm |
| | 121.9 Mbps (MCS11; HE20) | -62 dBm |
| | 7.3 Mbps (MCS0; HE20/RU242) | -93 dBm |
| | **802.11n (5 GHz)** | |
| | 6.5 Mbps (MCS0; HT20) | -93 dBm |
| | 65 Mbps (MCS7; HT20) | -73 dBm |
| | 13.5Mbps (MCS0; HT40) | -90 dBm |
| | 135Mbps (MCS7; HT40) | -71 dBm |
| | **802.11ac (5 GHz)** | |
| | 6.5 Mbps (MCS0; VHT20) | -93 dBm |
| | 78 Mbps (MCS8; VHT20) | -70 dBm |
| | 13.5 Mbps (MCS0; VHT40) | -90 dBm |
| | 180 Mbps (MCS9; VHT40) | -65 dBm |
| | 29.3 Mbps (MCS0; VHT80) | -87 dBm |
| | 390 Mbps (MCS9; VHT80) | -62 dBm |
| | **802.11ax (5 GHz)** | |
| | 7.3 Mbps (MCS0; HE20) | -90 dBm |
| | 121.9 Mbps (MCS11; HE20) | -60 dBm |
| | 7.3 Mbps (MCS0; HE20/RU242) | -90 dBm |
| | 14.6 Mbps (MCS0; HE40) | -88 dBm |
| | 243.8 Mbps (MCS11; HE40) | -58 dBm |
| | 14.6 Mbps (MCS0; HE40/RU484) | -88 dBm |
| | 30.6 Mbps (MCS0; HE80) | -87dBm |
| | 510.4 Mbps (MCS11; HE80) | -55 dBm |
| | 30.6 Mbps (MCS0; HE80/RU996) | -87 dBm |
| | **802.11ax (6 GHz, UNII-5)** | |
| | 6 Mbps | -90 dBm |
| | 24 Mbps | -83 dBm |
| | 7.3 Mbps (MCS0; HE20) | -90 dBm |
| | 121.9 Mbps (MCS11; HE20) | -60 dBm |
| | 7.3 Mbps (MCS0; HE20/RU242) | -90 dBm |
| | 14.6 Mbps (MCS0; HE40) | -89 dBm |
| | 243.8 Mbps (MCS11; HE40) | -56 dBm |
| | 14.6 Mbps (MCS0; HE40/RU484) | -89 dBm |
| | 30.6 Mbps (MCS0; HE80) | -87 dBm |
| | 510.4 Mbps (MCS11; HE80) | -54 dBm |
| | 30.6 Mbps (MCS0; HE80/RU996) | -87 dBm |



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| Feature | Description | |
|---|---|---|
| | **802.11ax (6 GHz, UNII-6)** | |
| | 6 Mbps | -89 dBm |
| | 24 Mbps | -82 dBm |
| | 7.3 Mbps (MCS0; HE20) | -89 dBm |
| | 121.9 Mbps (MCS11; HE20) | -59 dBm |
| | 7.3 Mbps (MCS0; HE20/RU242) | -89 dBm |
| | 14.6 Mbps (MCS0; HE40) | -88 dBm |
| | 243.8 Mbps (MCS11; HE40) | -55 dBm |
| | 14.6 Mbps (MCS0; HE40/RU484) | -88 dBm |
| | 30.6 Mbps (MCS0; HE80) | -85 dBm |
| | 510.4 Mbps (MCS11; HE80) | -54 dBm |
| | 30.6 Mbps (MCS0; HE80/RU996) | -85 dBm |
| | **802.11ax (6GHz, UNII-7)** | |
| | 6 Mbps | -86 dBm |
| | 24 Mbps | -81 dBm |
| | 7.3 Mbps (MCS0; HE20) | -86 dBm |
| | 121.9 Mbps (MCS11; HE20) | -58 dBm |
| | 7.3 Mbps (MCS0; HE20/RU242) | -86 dBm |
| | 14.6 Mbps (MCS0; HE40) | -85 dBm |
| | 243.8 Mbps (MCS11; HE40) | -55 dBm |
| | 14.6 Mbps (MCS0; HE40/RU484) | -85 dBm |
| | 30.6 Mbps (MCS0; HE80) | -84 dBm |
| | 510.4 Mbps (MCS11; HE80) | -52 dBm |
| | 30.6 Mbps (MCS0; HE80/RU996) | -84 dBm |
| | **802.11ax (6 GHz, UNII-8)** | |
| | 6 Mbps | -85 dBm |
| | 24 Mbps | -79 dBm |
| | 7.3 Mbps (MCS0; HE20) | -85 dBm |
| | 121.9 Mbps (MCS11; HE20) | -56 dBm |
| | 7.3 Mbps (MCS0; HE20/RU242) | -85 dBm |
| | 14.6 Mbps (MCS0; HE40) | -84 dBm |
| | 243.8 Mbps (MCS11; HE40) | -53 dBm |
| | 14.6 Mbps (MCS0; HE40/RU484) | -84 dBm |
| | 30.6 Mbps (MCS0; HE80) | -83 dBm |
| | 510.4 Mbps (MCS11; HE80) | -51 dBm |
| | 30.6 Mbps (MCS0; HE80/RU996) | -83 dBm |
| | **Bluetooth:** | |
| | 1 Mbps (1DH5) | -91 dBm |
| | 2Mbps (2DH5) | -93 dBm |
| | 3 Mbps (3DH5) | -87 dBm |
| | LE-1 Mbps | -95 dBm |
| | LE-2 Mbps | -92 dBm |
| | LE-LR (S=2) | -102 dBm |
| | LE-LR (S=8) | -107 dBm |
| **Operating Systems Supported** | Linux<br>Android | |
| **Security** | ▪ WPA, WPA2 (Enterprise) and WPA3 (Enterprise) support for powerful encryption and authentication<br>▪ AES and TKIP in hardware for faster data encryption and IEEE 802.11i compatibility<br>▪ Reference WLAN subsystem provides Wi-Fi Protected Setup (WPS) | |



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| Feature | Description | |
|---|---|---|
| **Compliance** | **EU** | |
| | EN 300 328 | EN 62368-1:2014 |
| | EN 301 489-1 | EN 300 440 |
| | EN 301 489-17 | EN 303 687 |
| | EN 301 893 | 2011/65/EU (RoHS) |
| | **FCC** | **ISED Canada** |
| | 47 CFR FCC Part 15.247 | RSS-247 |
| | 47 CFR FCC Part 15.407 | RSS-248 |
| | 47 CFR FCC Part 2.1091 | |
| | **AS/NZS** | **MIC** |
| | AS/NZS 4268:2017 | ARIB STD-T66/RCR STD-33 (2.4 GHz)<br>ARIB STD-T71 (5 GHz)<br>Article 2 Paragraph 1 of Item 80 :<br>LPI (ZR), 6 GHz |
| **Certifications** | ***Bluetooth*® SIG Qualification**<br>D063147 | |
| **Warranty** | One Year Warranty | |
| | ***All specifications are subject to change without notice*** | |





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# 5 WLAN Functional Description

## 5.1 Overview

The Sona IF573 series wireless module is designed based on the Infineon AIROC CYW55573MIWBGT Wi-Fi 6E chipset (dual-core 2x2 MIMO). It is optimized for high speed, reliability, and low-power embedded applications. It is integrated with tri-band WLAN (2.4/5/6 GHz) and Bluetooth 5.4. Its functionality is listed in Table 4.

***Table 4: WLAN functions***

| Feature | Description |
|---|---|
| **WLAN MAC** | ▪ Enhanced MAC for supporting IEEE 802.11a/b/g/n/ac/ax features<br>▪ Transmission and reception of HE-SU and HE-ER-SU PPDU<br>▪ Reception of HE-MU PPD -OFDMA/MU-MIMO frame<br>▪ Transmission of HE-TB PPDU (Uplink MU OFDMA)<br>▪ Transmission and reception of A-MPDUs/AMSDUs for very high throughput (VHT)<br>▪ Support for power management schemes, including WMM power-save, programmable state machine (PSM) operation<br>▪ Support for all ACK and Block-ACK policies as per standard<br>▪ Interframe space timing support, including RIFS<br>▪ Support for RTS/CTS and CTS-to-nowhere frame sequences for protecting frame exchanges<br>▪ Timing synchronization function (TSF), network allocation vector (NAV) maintenance, and target beacon transmission time (TBTT) generation in hardware and capturing the TSF timer on an external time synchronization pulse<br>▪ Hardware offload for cipher suites/encryption types WEP, TKIP(WPA), AES(WPA2), support for WPA3-SAE and key management<br>▪ Support for coexistence with Bluetooth<br>▪ RTS-CTS based BW signaling mechanism support |
| **WLAN Security** | ▪ WLAN Encryption features supported include:<br>– Temporal Key Integrity Protocol (TKIP)/Wired Equivalent Privacy (WEP)<br>– Advanced Encryption Standard (AES)/Wi-Fi Multi-Media (WMM)<br>– WLAN Authentication and Private Infrastructure (WPAI) |





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| Feature | Description |
|---|---|
| **WLAN Channel** | Channel frequency supported. |

| 2.4 GHz / 20 MHz | | 5 GHz / 20 MHz | | 5 GHz / 40 MHz | | 5 GHz / 80 MHz | |
|---|---|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 1 | 2412 | 36 | 5180 | 38 | 5190 | 42 | 5210 |
| 2 | 2417 | 40 | 5200 | 46 | 5230 | 58 | 5290 |
| 3 | 2422 | 44 | 5220 | 54 | 5270 | 106 | 5530 |
| 4 | 2427 | 48 | 5240 | 62 | 5310 | 122 | 5610 |
| 5 | 2432 | 52 | 5260 | 102 | 5510 | 138 | 5690 |
| 6 | 2437 | 56 | 5280 | 110 | 5550 | 155 | 5775 |
| 7 | 2442 | 60 | 5300 | 118 | 5590 | | |
| 8 | 2447 | 64 | 5320 | 126 | 5630 | | |
| 9 | 2452 | 100 | 5500 | 134 | 5670 | | |
| 10 | 2457 | 104 | 5520 | 142 | 5710 | | |
| 11 | 2462 | 108 | 5540 | 151 | 5755 | | |
| 12 | 2467 | 112 | 5560 | 159 | 5795 | | |
| 13 | 2472 | 116 | 5580 | | | | |
| | | 120 | 5600 | | | | |
| | | 124 | 5620 | | | | |
| | | 128 | 5640 | | | | |
| | | 132 | 5660 | | | | |
| | | 136 | 5680 | | | | |
| | | 140 | 5700 | | | | |
| | | 144 | 5720 | | | | |
| | | 149 | 5745 | | | | |
| | | 153 | 5765 | | | | |
| | | 157 | 5785 | | | | |
| | | 161 | 5805 | | | | |
| | | 165 | 5825 | | | | |

| 6 GHz / UNII-5 | | | | | |
|---|---|---|---|---|---|
| 20 MHz | | 40 MHz | | 80 MHz | |
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 1 | 5955 | 3 | 5965 | 7 | 5985 |
| 5 | 5975 | 11 | 6005 | 23 | 6065 |
| 9 | 5995 | 19 | 6045 | 39 | 6145 |
| 13 | 6015 | 27 | 6085 | 55 | 6225 |
| 17 | 6035 | 35 | 6125 | 71 | 6305 |
| 21 | 6055 | 43 | 6165 | 87 | 6385 |
| 25 | 6075 | 51 | 6205 | | |
| 29 | 6095 | 59 | 6245 | | |
| 33 | 6115 | 67 | 6285 | | |
| 37 | 6135 | 75 | 6325 | | |
| 41 | 6155 | 83 | 6365 | | |
| 45 | 6175 | 91 | 6405 | | |
| 49 | 6195 | | | | |
| 53 | 6215 | | | | |
| 57 | 6235 | | | | |
| 61 | 6255 | | | | |
| 65 | 6275 | | | | |
| 69 | 6295 | | | | |
| 73 | 6315 | | | | |
| 77 | 6335 | | | | |
| 81 | 6355 | | | | |
| 85 | 6375 | | | | |
| 89 | 6395 | | | | |
| 93 | 9415 | | | | |





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| Feature | Description |
|---|---|

| 6 GHz / UNII-6 | | | | | |
|---|---|---|---|---|---|
| 20 MHz | | 40 MHz | | 80 MHz | |
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 97 | 6435 | 99 | 6445 | 103 | 6465 |
| 101 | 6455 | 107 | 6485 | 119 | 6545 |
| 105 | 6475 | 115 | 6525 | | |
| 109 | 6495 | | | | |
| 113 | 6515 | | | | |

| 6 GHz / UNII-7 | | | | | |
|---|---|---|---|---|---|
| 20 MHz | | 40 MHz | | 80 MHz | |
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 117 | 6535 | 123 | 6565 | 135 | 6625 |
| 121 | 6555 | 131 | 6605 | 151 | 6705 |
| 125 | 6575 | 139 | 6645 | 167 | 6785 |
| 129 | 6595 | 147 | 6685 | 183 | 6865 |
| 133 | 6615 | 155 | 6725 | | |
| 137 | 6635 | 163 | 6765 | | |
| 141 | 6655 | 171 | 6805 | | |
| 145 | 6675 | 179 | 6845 | | |
| 149 | 6695 | 187 | 6885 | | |
| 153 | 6715 | | | | |
| 157 | 6735 | | | | |
| 161 | 6755 | | | | |
| 165 | 6775 | | | | |
| 169 | 6795 | | | | |
| 173 | 6815 | | | | |
| 177 | 6835 | | | | |
| 181 | 6855 | | | | |
| 185 | 6875 | | | | |

| 6 GHz / UNII-8 | | | | | |
|---|---|---|---|---|---|
| 20 MHz | | 40 MHz | | 80 MHz | |
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 189 | 6895 | 195 | 6925 | 199 | 6945 |
| 193 | 6915 | 203 | 6965 | 215 | 7025 |
| 197 | 6935 | 211 | 7005 | | |
| 201 | 6955 | 219 | 7045 | | |
| 205 | 6975 | 227 | 7085 | | |
| 209 | 6995 | | | | |
| 213 | 7015 | | | | |
| 217 | 7035 | | | | |
| 221 | 7055 | | | | |
| 225 | 7075 | | | | |
| 229 | 7095 | | | | |
| 233 | 7115 | | | | |





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# 6 BLUETOOTH FUNCTIONAL DESCRIPTION

The Sona IF573 series wireless module includes a fully integrated Bluetooth baseband/radio. Several features and functions are listed in Table 5.

***Table 5: Bluetooth functions***

| Feature | Description |
|---|---|
| **Bluetooth Interface** | ▪ Voice interface:<br>– Supported by PCM transports and bi-directional operations.<br>– Sample rates 8k for NBS and 16k for WBS supported.<br>– Sample width is limited to 16-bits.<br>– Synchronization clock width of 1 or 3 (short or long)<br>– Bit clocks of 128k, 256k, 512k, 1024k and 2024k, the only difference being the number of 16bit slots.<br>– HFP samples can be taken from any available slot. Slot 0 is the default slot.<br>▪ High-Speed UART interface |
| **Bluetooth Core functionality** | ▪ Supports all Bluetooth 5.3 and 4.2 features<br>▪ Dual-mode Bluetooth low energy<br>▪ Bluetooth LE LE-2Mbps mode, LE-Long Range mode, Advertising Extensions, Slot Availability Masks<br>▪ Extended inquiry response (EIR): Shortens the time to retrieve the device name, specific profile, and operating mode<br>▪ Encryption pause resume (EPR): Enables the us of Bluetooth technology in a much more secure environment<br>▪ Sniff subrating (SSR): Optimizes power consumption for low duty cycle asymmetric data flow, which subsequently extends battery life.<br>▪ Secure simple pairing (SSP): Reduces the number of steps for connecting two devices, with minimal or no user interaction required.<br>▪ Link supervision time out (LSTO): Additional commands added to HCI and link management protocol (LMP) for improved link time-out supervision.<br>▪ QoS enhancements: Changes to data traffic control, which results in better link performance. Audio, human interface device (HID), bulk traffic. SCO, and enhanced SCO (eSCO) are improved with the erroneous data (ED) and packet boundary flag (PBF) enhancements. |
| **Bluetooth Features** | ▪ Supports features of Bluetooth Core Specification version 5.2:<br>– LE Isochronous Channels<br>– LE Power Control<br>▪ Supports features of Bluetooth Core Specification version 5.1:<br>– Direction Finding (AoA/AoD)<br>– Additional Advertising Channels<br>– Periodic Advertising Sync Transfer (PAST)<br>– GATT Caching<br>▪ Supports features of Bluetooth Core Specification version 5.0:<br>– LE 2Mbps<br>– LE Long Range (LE-LR)<br>– Stable Modulation Index for LE<br>– LE Advertising Extension<br>– Slot Availability Masks (SAM)<br>– Channel Selection Algorithm<br>– High Duty Cycle Non-Connectable Advertising<br>▪ Supports features of Bluetooth Core Specification version 4.0 + EDR<br>– Adaptive frequency hopping (AFH)<br>– Quality of service (QoS)<br>– Extended synchronous connections (eSCO) – Voice Connections<br>– Fast connect (interlaced page and inquiry scans)<br>– Secure simple pairing (SSP) |





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| Feature | Description |
|---|---|
| | – Sniff subrating (SSR)<br>– Encryption pause resume (EPR)<br>– Extended inquiry response (EIR)<br>– Link supervision timeout (LST)<br>▪ Multipoint operation with up to seven active slaves<br>– Maximum of seven simultaneous active ACL links<br>– Maximum of three simultaneous active SCO and eSCO connections with scattement support<br>▪ High-speed HCI UART transport support with low-power out-of-band BT_DEV_WAKE and BT_HOST_WAKE signaling. |





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# 7 BLOCK DIAGRAMS

## 7.1 M.2 1318 Solder-down

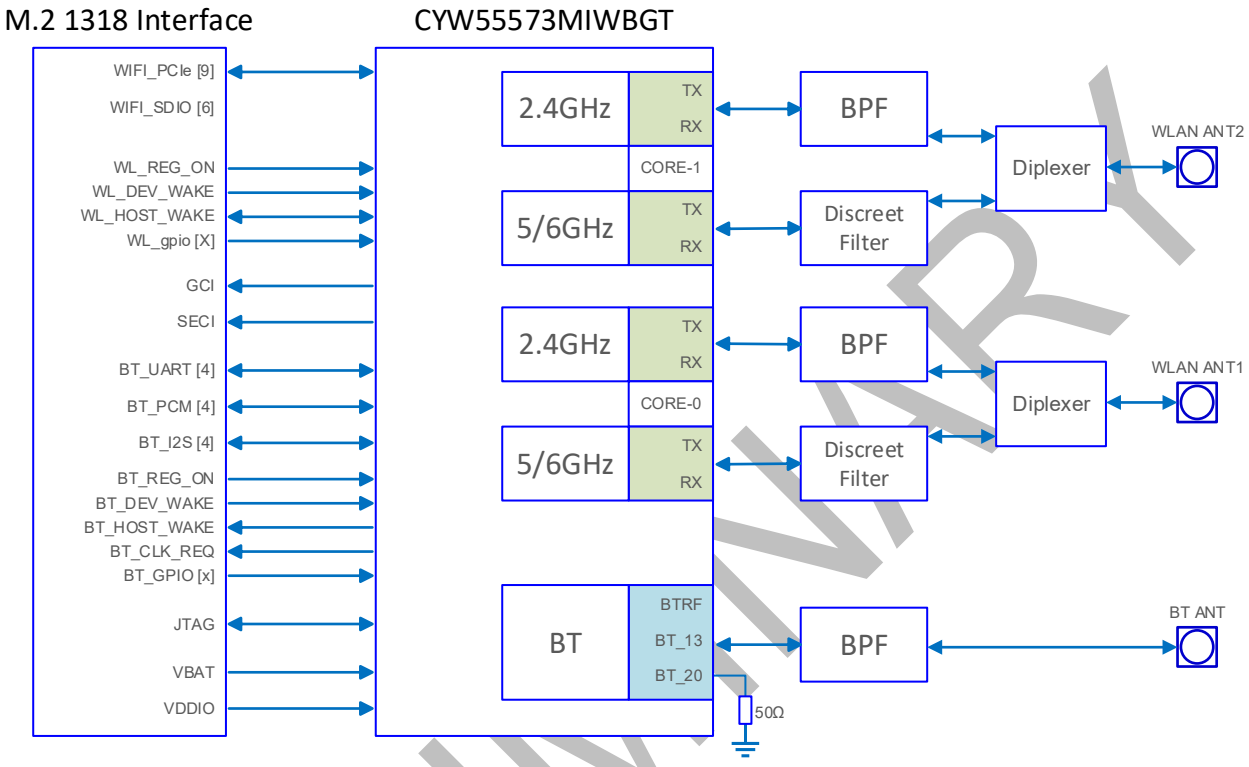


***Figure 1: M.2 1318***





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## 7.2 M.2 2230 E-Key

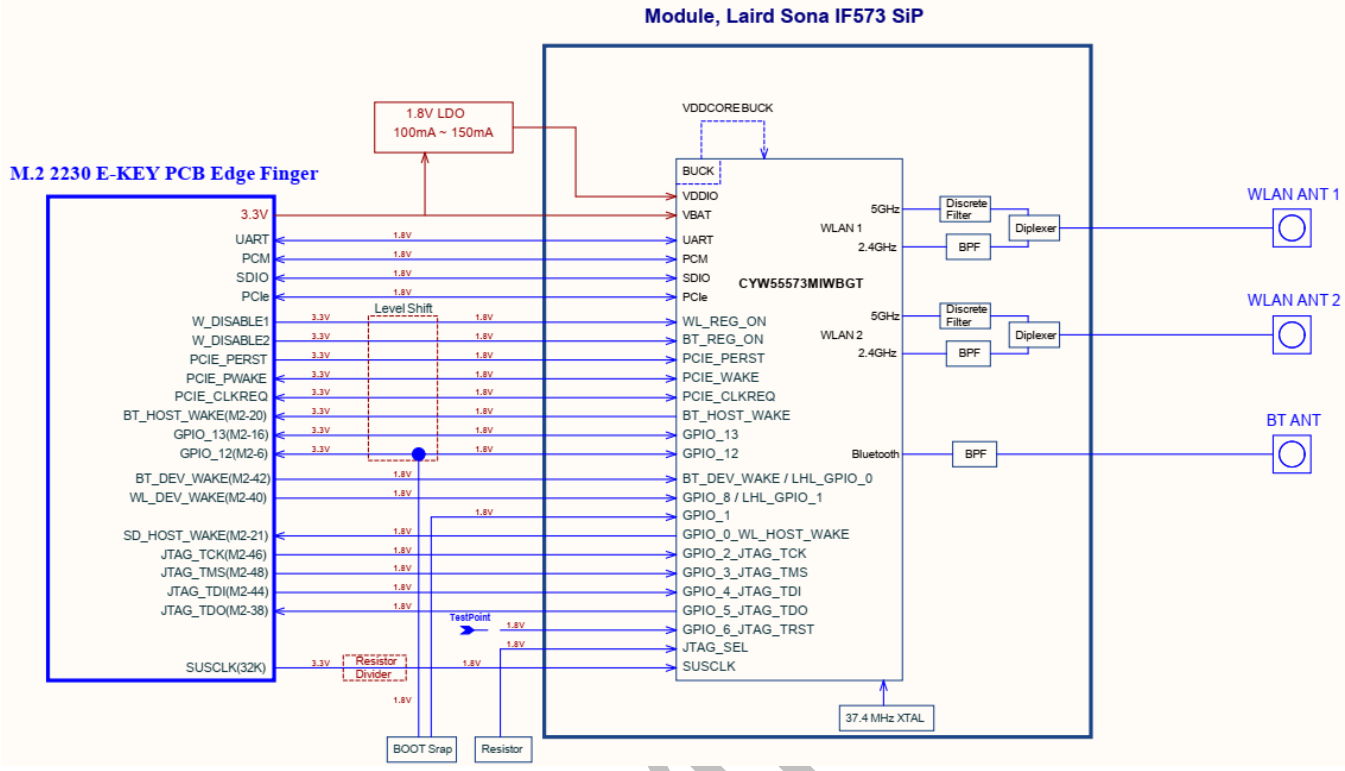


***Figure 2: M.2 2230 E-Key***

# 8 Electrical Characteristics

## 8.1 Absolute Maximum Ratings

Table 6 summarizes the absolute maximum ratings and Table 7 lists the recommended operating conditions for the Sona IF573 series wireless module. 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 6: Absolute maximum ratings***

| Symbol (Domain) | Description | Max Rating | Unit |
|---|---|---|---|
| VBAT | External DC power supply (M.2 1318) | +6.0 | V |
| VDDIO | DC supply voltage for digital I/O (M.2 1318) | 2.2 | V |
| 3V3 | External 3.3V power supply (M.2 2230 E-Key) | 4.0 | V |
| Storage | Storage temperature | -40 to +125 | °C |
| Antenna | Maximum RF input (reference to 50-Ω input) | +10 | dBm |
| ESD | Electrostatic discharge tolerance | 2000 | V |





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## 8.2 Recommended Operating Conditions

***Table 7: Recommended operating conditions***

| Symbol (Domain) | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| VBAT | External DC power supply | 3.13 | 3.3 | 3.47 | V |
| VDDIO | DC supply voltage for digital I/O | 1.71 | 1.8 | 1.89 | V |
| T-ambient | Ambient temperature | -40 | 25 | +85 | °C |

## 8.3 DC Electrical Characteristics

Table 8 list the general DC electrical characteristics over recommended operating conditions (unless otherwise specified).

***Table 8: General DC electrical characteristics (For 1.8V operation VDDIO)***

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VIH | High Level Input Voltage | — | 0.65 x VDDIO | — | — | V |
| VIL | Low Level Input Voltage | — | — | — | 0.35 x VDDIO | V |
| VOH | Output high Voltage | — | VDDIO – 0.4 | — | — | V |
| VOL | Output low Voltage | — | — | — | 0.45 | V |

## 8.4 WLAN Radio Receiver Characteristics

Table 9, Table 10, and Table 11 summarize the Sona IF573 series wireless module receiver characteristics.

***Table 9: WLAN receiver characteristics for 2.4 GHz single chain operation***

| Item | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Frequency Range | Receive input frequency range | — | 2.412 | — | 2.484 | GHz |
| Modulation Type | Sensitivity | | | | | |
| | CCK, 1 Mbps | See Note[1] | — | -96 | — | dBm |
| | CCK, 11 Mbps | | — | -90 | — | |
| | OFDM, 6 Mbps | | — | -93 | — | |
| | OFDM, 54 Mbps | | — | -76 | — | |
| | HT20, MCS0 | | — | -93 | — | |
| | HT20, MCS7 | | — | -75 | — | |
| | HE20, MCS0 | | — | -93 | — | |
| | HE20, MCS11 | | — | -62 | — | |
| ACI - OFDM [Difference between interfering and desired signal (25 MHz apart)] | Adjacent channel rejection | | | | | |
| | OFDM, 6 Mbps | See Note[1] | — | 30 | — | dB |
| | OFDM, 54 Mbps | | — | 15 | — | |
| ACI – 11n MCS0-7 [Difference between interfering and desired signal (25 MHz apart)] | HT20, MCS0 | | — | 30 | — | ` |
| | HT20, MCS7 | | — | 10 | — | |
| ACI – 11ax MCS0-11 [Difference between interfering and desired signal (25 MHz apart)] | HE20, MCS0 | | — | 30 | — | |
| | HE20, MCS7 | | — | 10 | — | |
| | HE20, MCS11 | | — | TBD | — | |





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***Table 10: WLAN receiver characteristics for 5 GHz single chain operation***

| Item | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Frequency Range | Receive input frequency range | — | 5.15 | — | 5.825 | GHz |
| Modulation Type | Sensitivity | | | | | |
| | OFDM, 6 Mbps | See Note[1] | — | -92 | — | dBm |
| | OFDM, 54 Mbps | | — | -75 | — | |
| | HT20, MCS0 | | — | -93 | — | |
| | HT20, MCS7 | | — | -73 | — | |
| | HT40, MCS0 | | — | -90 | — | |
| | HT40, MCS7 | | — | -71 | — | |
| | VHT20, MCS0 | | — | -93 | — | |
| | VHT20, MCS8 | | — | -70 | — | |
| | VHT40, MCS0 | | — | -90 | — | |
| | VHT40, MCS9 | | — | -65 | — | |
| | VHT80, MCS0 | | — | -87 | — | |
| | VHT80, MCS9 | | — | -62 | — | |
| | HE20, MCS0 | | — | -92 | — | |
| | HE20, MCS11 | | — | -60 | — | |
| | HE40, MCS0 | | — | -90 | — | |
| | HE40, MCS11 | | — | -58 | — | |
| | HE80, MCS0 | | — | -87 | — | |
| | HE80, MCS11 | | — | -55 | — | |
| ACI - OFDM [Difference between interfering and desired signal (20 MHz apart)] | Adjacent channel rejection | | | | | |
| | OFDM, 6 Mbps | See Note[1] | — | 25 | — | dB |
| | OFDM, 54 Mbps | | — | 5 | — | |
| ACI – MCS0-11 [Difference between interfering and desired signal (20 MHz apart)] | MCS0 | See Note[1] | — | 25 | — | dB |
| | MCS7 | | — | 5 | — | |
| | MCS11 | | — | TBD | — | |
| ACI – MCS0-11 [Difference between interfering and desired signal (40 MHz apart)] | MCS0 | See Note[1] | — | 24 | — | dB |
| | MCS7 | | — | 5 | — | |
| | MCS11 | | — | TBD | — | |
| ACI – MCS0-11 [Difference between interfering and desired signal (80 MHz apart)] | MCS0 | See Note[1] | — | TBD | — | dB |
| | MCS7 | | — | TBD | — | |
| | MCS11 | | — | TBD | — | |



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***Table 11: WLAN receiver characteristics for 6 GHz single chain operation***

| Item | Parameter | Conditions | Typical (Sensitivity) | | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | UNII-5 | UNII-6 | UNII-7 | UNII-8 | |
| Frequency Range | Receive input frequency range | — | 5950 - 6415 | 6435 - 6515 | 6535 - 6875 | 6895 - 7115 | MHz |
| Modulation Type | OFDM, 6Mbps | See Note[1] | -92 | -91 | -90 | -88 | dBm |
| | OFDM, 24Mbps | | -83 | -82 | -81 | -79 | |
| | HE20, MCS0 | | -92 | -91 | -90 | -89 | |
| | HE20, MCS7 | | -74 | -73 | -72 | -70 | |
| | HE20, MCS8 | | -69 | -68 | -67 | -66 | |
| | HE20, MCS9 | | -68 | -67 | -66 | -64 | |
| | HE20, MCS11 | | -60 | -59 | -58 | -56 | |
| | HE40, MCS0 | | -90 | -89 | -88 | -86 | |
| | HE40, MCS7 | | -71 | -70 | -69 | -67 | |
| | HE40, MCS8 | | -67 | -66 | -65 | -63 | |
| | HE40, MCS9 | | -65 | -64 | -63 | -61 | |
| | HE40, MCS11 | | -56 | -55 | -55 | -53 | |
| | HE80, MCS0 | | -87 | -85 | -84 | -83 | |
| | HE80, MCS7 | | -68 | -67 | -65 | -64 | |
| | HE80, MCS8 | | -64 | -63 | -62 | -60 | |
| | HE80, MCS9 | | -62 | -61 | -60 | -58 | |
| | HE80, MCS11 | | -54 | -54 | -52 | -51 | |
| ACI - OFDM [Difference between interfering and desired signal (20 MHz apart)] | 6 Mbps | See Note[1] | 25 | 25 | 25 | 25 | dB |
| ACI – MCS0-11 [Difference between interfering and desired signal (20 MHz apart)] | MCS0 | See Note[1] | 25 | 25 | 25 | 25 | |
| | MCS7 | | 5 | 5 | 5 | 5 | |
| | MCS9 | | TBD | TBD | TBD | TBD | |
| | MCS11 | | TBD | TBD | TBD | TBD | |
| ACI – MCS0-11 [Difference between interfering and desired signal (40 MHz apart)] | MCS0 | See Note[1] | 24 | 24 | 24 | 24 | |
| | MCS7 | | 5 | 5 | 5 | 5 | |
| | MCS9 | | TBD | TBD | TBD | TBD | |
| | MCS11 | | TBD | TBD | TBD | TBD | |

**Note 1**: Performance data are measured in single chain operation.





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## 8.7 WLAN Transmitter Characteristics

Table 12 through Table 21 summarize the Sona IF573 series wireless module transmitter characteristics.

***Table 12: WLAN transmitter characteristics for 2.4 GHz operation (VBAT = 3.3V, VDDIO = 1.8V)***

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Ftx | Transmit output frequency range | — | 2.402 | — | 2.484 | GHz |
| Pout | Output power | See Note[2] | — | — | — | — |
| | 11b mask compliant | 1-11Mbps | — | 18 | — | dBm |
| | 11g mask compliant | 6-24Mbps | — | 18 | — | |
| | 11g mask compliant | 36-48Mbps | — | 17 | — | |
| | 11g EVM compliant | 54Mbps | — | 16 | — | |
| | 11n HT20 mask compliant | MCS0-4 | — | 16 | — | |
| | 11n HT20 mask compliant | MCS5-6 | — | 15 | — | |
| | 11n HT20 EVM compliant | MCS7 | — | 14 | — | |
| | 11ax HE20 mask compliant | MCS0-4 | — | 16 | — | |
| | 11ax HE20 mask compliant | MCS5-6 | — | 15 | — | |
| | 11ax HE20 EVM compliant | MCS7 | — | 14 | — | |
| | 11ax HE20 EVM compliant | MCS8 | — | 12.5 | — | |
| | 11ax HE20 EVM compliant | MCS9 | — | 11.5 | — | |
| | 11ax HE20 EVM compliant | MCS10-11 | — | 10.5 | — | |
| ATx | Transmit power accuracy at 25 ℃ | — | -2.0 | — | +2.0 | dB |

***Table 13: WLAN current consumption on 2.4 GHz (VBAT = 3.3V, VDDIO = 1.8V, BT_REG_ON = Low)***

| Modulation | Data Rate | Spatial Stream | Output Power (dBm) | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|---|---|
| CCK | 1 Mbps | 1 | 19.5 | 392 | 6.71 |
| BPSK | 6 Mbps | 1 | 19.5 | 378 | 6.71 |
| 64-QAM | HT20 MCS7 | 1 | 15.5 | 305 | 6.4 |
| 64-QAM | HT20 MCS15 | 2 | 15.5 | 470 | 9.82 |
| 256-QAM | HE20 MCS9 | 2 | 13 | 415 | 9.76 |
| 1024-QAM | HE20 MCS11 | 2 | 102 | 398 | 9.68 |





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***Table 14: WLAN transmitter characteristics for 5 GHz operation (VBAT=3.3V, VDDIO=1.8V)***

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Ftx | Transmit output frequency range | — | 5.15 | — | 5.925 | GHz |
| Pout | Output power | See Note[2] | — | — | — | — |
| | 11a mask compliant | 6-48Mbps | — | 17 | — | dBm |
| | 11a EVM compliant | 54Mbps | — | 16 | — | |
| | 11n HT20 mask compliant | MCS0-5 | — | 17 | — | |
| | 11n HT20 EVM compliant | MCS6-7 | — | 16 | — | |
| | 11n HT40 mask compliant | MCS0-5 | — | 16 | — | |
| | 11n HT40 EVM compliant | MCS6-7 | — | 15 | — | |
| | 11ac VHT20 mask compliant | MCS0-5 | — | 17 | — | |
| | 11ac VHT20 EVM compliant | MCS6-7 | — | 16 | — | |
| | 11ac VHT20 EVM compliant | MCS8 | — | 14 | — | |
| | 11ac VHT40 mask compliant | MCS0-5 | — | 16 | — | |
| | 11ac VHT40 EVM compliant | MCS6-7 | — | 15 | — | |
| | 11ac VHT40 EVM compliant | MCS8-9 | — | 12 | — | |
| | 11ac VHT80 mask compliant | MCS0-5 | — | 16 | — | |
| | 11ac VHT80 EVM compliant | MCS6-7 | — | 15 | — | |
| | 11ac VHT80 EVM compliant | MCS8-9 | — | 12 | — | |
| | 11ax HE20 mask compliant | MCS0-5 | — | 17 | — | |
| | 11ax HE20 EVM compliant | MCS6-7 | — | 16 | — | |
| | 11ax HE20 EVM compliant | MCS8-9 | — | 14 | — | |
| | 11ax HE20 EVM compliant | MCS10-11 | — | 13 | — | |
| | 11ax HE40 mask compliant | MCS0-5 | — | 16 | — | |
| | 11ax HE40 EVM compliant | MCS6-7 | — | 15 | — | |
| | 11ax HE40 EVM compliant | MCS8-9 | — | 12 | — | |
| | 11ax HE40 EVM compliant | MCS10-11 | — | 11.5 | — | |
| | 11ax HE80 mask compliant | MCS0-5 | — | 16 | — | |
| | 11ax HE80 EVM compliant | MCS6-7 | — | 15 | — | |
| | 11ax HE80 EVM compliant | MCS8-9 | — | 12 | — | |
| | 11ax HE80 EVM compliant | MCS10-11 | — | 11 | — | |
| ATx | Transmit power accuracy at 25 ℃ | — | -2.0 | — | +2.0 | dB |





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***Table 15: WLAN current consumption on 5 GHz (VBAT = 3.3V, VDDIO = 1.8V, BT_REG_ON = Low)***

| Modulation | Bandwidth (MHz) | Data Rate | Spatial Stream | Output Power (dBm) | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|---|---|---|
| BPSK | 20 | 6 Mbps | 1 | 18.5 | 496 | 6.81 |
| 64-QAM | 20 | 54 Mbps | 1 | 17.5 | 457 | 6.51 |
| BPSK | 20 | MCS0 | 2 | 18.5 | 830 | 11.27 |
| 64-QAM | 20 | MCS7 | 2 | 17.5 | 740 | 10.47 |
| 256-QAM | 20 | MCS9 | 2 | 15.5 | 685 | 10.35 |
| 1024-QAM | 20 | MCS11 | 2 | 14.5 | 645 | 10.26 |
| BPSK | 40 | MCS0 | 2 | 17.5 | 825 | 11.12 |
| 64-QAM | 40 | MCS7 | 2 | 16.5 | 741 | 10.31 |
| 256-QAM | 40 | MCS9 | 2 | 13.5 | 665 | 10.21 |
| 1024-QAM | 40 | MCS11 | 2 | 13 | 655 | 10.22 |
| BPSK | 80 | MCS0 | 2 | 17.5 | 865 | 10.99 |
| 64-QAM | 80 | MCS7 | 2 | 16.5 | 740 | 10.27 |
| 256-QAM | 80 | MCS9 | 2 | 13.5 | 705 | 10.17 |
| 1024-QAM | 80 | MCS11 | 2 | 12.5 | 680 | 10.17 |

***Table 16: WLAN transmitter characteristics for UNII-5 and UNII-6 operation (VBAT = 3.3V, VDDIO = 1.8V)***

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Ftx | Transmit output frequency range | — | 5.925 | — | 6.53 | GHz |
| Pout | Output power | See Note[2] | — | — | — | — |
| | 11a mask compliant | 6-24Mbps | — | 15.5 | — | dBm |
| | 11ax HE20 mask compliant | MCS0-6 | — | 15.5 | — | |
| | 11ax HE20 EVM compliant | MCS7 | — | 15 | — | |
| | 11ax HE20 EVM compliant | MCS8 | — | 14.5 | — | |
| | 11ax HE20 EVM compliant | MCS9-11 | — | 12 | — | |
| | 11ax HE40 mask compliant | MCS0-6 | — | 15.5 | — | |
| | 11ax HE40 EVM compliant | MCS7 | — | 14 | — | |
| | 11ax HE40 EVM compliant | MCS8 | — | 12.5 | — | |
| | 11ax HE40 EVM compliant | MCS9 | — | 12 | — | |
| | 11ax HE40 EVM compliant | MCS10-11 | — | 11 | — | |
| | 11ax HE80 mask compliant | MCS0-6 | — | 15 | — | |
| | 11ax HE80 EVM compliant | MCS7 | — | 14 | — | |
| | 11ax HE80 EVM compliant | MCS8 | — | 12 | — | |
| | 11ax HE80 EVM compliant | MCS9 | — | 11 | — | |
| | 11ax HE80 EVM compliant | MCS10-11 | — | 10 | — | |
| ATx | Transmit power accuracy at 25 ℃ | — | -2.0 | — | +2.0 | dB |





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***Table 17: WLAN current consumption on UNII-5 band (VBAT = 3.3V, VDDIO = 1.8V, BT_REG_ON = Low)***

| Modulation | Bandwidth (MHz) | Data Rate | Spatial Stream | Output Power (dBm) | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|---|---|---|
| BPSK | 20 | 6 Mbps | 1 | 17 | 436 | 6.71 |
| 64-QAM | 20 | 24 Mbps | 1 | 17 | 430 | 6.58 |
| BPSK | 20 | MCS0 | 2 | 17 | 815 | 11.28 |
| 64-QAM | 20 | MCS7 | 2 | 16.5 | 745 | 10.46 |
| 256-QAM | 20 | MCS9 | 2 | 13.5 | 644 | 10.37 |
| 1024-QAM | 20 | MCS11 | 2 | 13.5 | 640 | 10.26 |
| BPSK | 40 | MCS0 | 2 | 17 | 831 | 11.06 |
| 64-QAM | 40 | MCS7 | 2 | 15.5 | 714 | 10.25 |
| 256-QAM | 40 | MCS9 | 2 | 13.5 | 650 | 10.19 |
| 1024-QAM | 40 | MCS11 | 2 | 12.5 | 626 | 10.19 |
| BPSK | 80 | MCS0 | 2 | 16.5 | 840 | 10.89 |
| 64-QAM | 80 | MCS7 | 2 | 15.5 | 750 | 10.21 |
| 256-QAM | 80 | MCS9 | 2 | 12.5 | 662 | 10.14 |
| 1024-QAM | 80 | MCS11 | 2 | 11.5 | 640 | 10.15 |

***Table 18: WLAN current consumption on UNII-6 band (VBAT = 3.3V, VDDIO = 1.8V, BT_REG_ON = Low)***

| Modulation | Bandwidth (MHz) | Data Rate | Spatial Stream | Output Power (dBm) | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|---|---|---|
| BPSK | 20 | 6 Mbps | 1 | 17 | 426 | 6.71 |
| 64-QAM | 20 | 24 Mbps | 1 | 17 | 417 | 6.59 |
| BPSK | 20 | MCS0 | 2 | 17 | 775 | 11.29 |
| 64-QAM | 20 | MCS7 | 2 | 16.5 | 705 | 10.48 |
| 256-QAM | 20 | MCS9 | 2 | 13.5 | 610 | 10.4 |
| 1024-QAM | 20 | MCS11 | 2 | 13.5 | 606 | 10.28 |
| BPSK | 40 | MCS0 | 2 | 17 | 785 | 11.1 |
| 64-QAM | 40 | MCS7 | 2 | 15.5 | 677 | 10.31 |
| 256-QAM | 40 | MCS9 | 2 | 13.5 | 617 | 10.21 |
| 1024-QAM | 40 | MCS11 | 2 | 12.5 | 599 | 10.2 |
| BPSK | 80 | MCS0 | 2 | 16.5 | 802 | 10.92 |
| 64-QAM | 80 | MCS7 | 2 | 15.5 | 717 | 10.24 |
| 256-QAM | 80 | MCS9 | 2 | 12.5 | 635 | 10.18 |
| 1024-QAM | 80 | MCS11 | 2 | 11.5 | 620 | 10.16 |





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***Table 19: WLAN transmitter characteristics for UNII-7 and UNII-8 operation (VBAT = 3.3V, VDDIO = 1.8V)***

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Ftx | Transmit output frequency range | — | 6.53 | — | 7.125 | GHz |
| Pout | Output power | See Note[2] | — | — | — | — |
| | 11a mask compliant | 6-24Mbps | — | 15 | — | dBm |
| | 11ax HE20 mask compliant | MCS0-6 | — | 15 | — | |
| | 11ax HE20 EVM compliant | MCS7 | — | 13 | — | |
| | 11ax HE20 EVM compliant | MCS8 | — | 12 | — | |
| | 11ax HE20 EVM compliant | MCS9-11 | — | 10.5 | — | |
| | 11ax HE40 mask compliant | MCS0-6 | — | 15 | — | |
| | 11ax HE40 EVM compliant | MCS7 | — | 12 | — | |
| | 11ax HE40 EVM compliant | MCS8 | — | 11 | — | |
| | 11ax HE40 EVM compliant | MCS9 | — | 10 | — | |
| | 11ax HE40 EVM compliant | MCS10-11 | — | 8.5 | — | |
| | 11ax HE80 mask compliant | MCS0-6 | — | 14.5 | — | |
| | 11ax HE80 EVM compliant | MCS7 | — | 11 | — | |
| | 11ax HE80 EVM compliant | MCS8 | — | 10 | — | |
| | 11ax HE80 EVM compliant | MCS9-11 | — | 8.5 | — | |
| ATx | Transmit power accuracy at 25 ℃ | — | -2.0 | — | +2.0 | dB |

***Table 20: WLAN current consumption on UNII-7 band (VBAT = 3.3V, VDDIO = 1.8V, BT_REG_ON = Low)***

| Modulation | Bandwidth (MHz) | Data Rate | Spatial Stream | Output Power (dBm) | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|---|---|---|
| BPSK | 20 | 6 Mbps | 1 | 16.5 | 401 | 6.72 |
| 64-QAM | 20 | 24 Mbps | 1 | 16.5 | 395 | 6.6 |
| BPSK | 20 | MCS0 | 2 | 16.5 | 732 | 11.33 |
| 64-QAM | 20 | MCS7 | 2 | 14.5 | 648 | 10.53 |
| 256-QAM | 20 | MCS9 | 2 | 12 | 580 | 10.45 |
| 1024-QAM | 20 | MCS11 | 2 | 12 | 575 | 10.33 |
| BPSK | 40 | MCS0 | 2 | 16.5 | 745 | 11.13 |
| 64-QAM | 40 | MCS7 | 2 | 13.5 | 610 | 10.35 |
| 256-QAM | 40 | MCS9 | 2 | 11.5 | 575 | 10.29 |
| 1024-QAM | 40 | MCS11 | 2 | 10 | 555 | 10.28 |
| BPSK | 80 | MCS0 | 2 | 16 | 761 | 10.95 |
| 64-QAM | 80 | MCS7 | 2 | 12.5 | 632 | 10.27 |
| 256-QAM | 80 | MCS9 | 2 | 10 | 597 | 10.22 |
| 1024-QAM | 80 | MCS11 | 2 | 10 | 597 | 10.19 |





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***Table 21: WLAN current consumption on UNII-8 band (VBAT = 3.3V, VDDIO = 1.8V, BT_REG_ON = Low)***

| Modulation | Bandwidth (MHz) | Data Rate | Spatial Stream | Output Power (dBm) | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|---|---|---|
| BPSK | 20 | 6 Mbps | 1 | 16.5 | 406 | 6.72 |
| 64-QAM | 20 | 24 Mbps | 1 | 16.5 | 398 | 6.6 |
| BPSK | 20 | MCS0 | 2 | 16.5 | 761 | 11.33 |
| 64-QAM | 20 | MCS7 | 2 | 14.5 | 682 | 10.55 |
| 256-QAM | 20 | MCS9 | 2 | 12 | 610 | 10.46 |
| 1024-QAM | 20 | MCS11 | 2 | 12 | 601 | 10.35 |
| BPSK | 40 | MCS0 | 2 | 16.5 | 800 | 11.15 |
| 64-QAM | 40 | MCS7 | 2 | 13.5 | 640 | 10.37 |
| 256-QAM | 40 | MCS9 | 2 | 11.5 | 599 | 10.29 |
| 1024-QAM | 40 | MCS11 | 2 | 10 | 582 | 10.29 |
| BPSK | 80 | MCS0 | 2 | 16 | 808 | 10.96 |
| 64-QAM | 80 | MCS7 | 2 | 12.5 | 663 | 10.28 |
| 256-QAM | 80 | MCS9 | 2 | 10 | 625 | 10.19 |
| 1024-QAM | 80 | MCS11 | 2 | 10 | 626 | 10.21 |

**Note2:** Final TX power values on each channel may be further limited by regulatory requirements.





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# 9 BLUETOOTH RADIO CHARACTERISTICS

Table 22 through Table 26 describe the performance of the Bluetooth transmitter and receiver and the current consumption at 25°C.

***Table 22: BR / EDR transmitter performance (VBAT = 3.3V, VDDIO = 1.8V)***

| Test Parameter | | Min | Typ | Max | BT Spec. | Unit |
|---|---|---|---|---|---|---|
| Maximum RF Output Power | GFSK | — | — | 7 | 0 ~ +20 | dBm |
| | π/4-DQPSK | — | 3 | — | | |
| | 8-DPSK | — | 3 | — | | |
| Frequency Range | | 2.4 | — | 2.4835 | 2.4 ≤ f ≤ 2.4835 | GHz |
| 20 dB Bandwidth | | — | 914.5 | — | ≤ 1000 | KHz |
| Δf1avg Maximum Modulation | | 140 | 154 | 175 | 140 < Δf1avg < 175 | KHz |
| Δf2max Minimum Modulation | | 115 | 147 | — | ≥ 115 | KHz |
| Δf2avg/Δf1avg | | — | 0.95 | — | ≥ 0.80 | — |
| Initial Carrier Frequency | | — | ± 25 | ± 75 | ≤ ± 75 | KHz |
| Frequency Drift (DH1 packet) | | — | ± 8 | ± 25 | ± 25 | KHz |
| Frequency Drift (DH3 packet) | | — | ± 8 | ± 40 | ± 40 | KHz |
| Frequency Drift (DH5 packet) | | — | ± 8 | ± 40 | ± 40 | KHz |
| Drift rate | | — | 5 | 20 | 20 | KHz/50us |
| EDR ωi | | — | — | ± 75 | ≤ ± 75 | KHz |
| EDR ω0 | | — | — | ± 10 | ≤ ± 10 | KHz |
| EDR (ωi + ω0) | | — | — | ± 75 | ≤ ± 75 | KHz |
| RMS DEVM for π/4-DQPSK | | — | — | ≤ 0.2 | ≤ 0.2 | — |
| RMS DEVM for 8-DPSK | | — | — | ≤ 0.13 | ≤ 0.13 | — |
| Peak DEVM for π/4-DQPSK | | — | — | ≤ 0.35 | ≤ 0.35 | — |
| Peak DEVM for 8-DPSK | | — | — | ≤ 0.25 | ≤ 0.25 | — |
| 99% DEVM for π/4-DQPSK | | — | — | ≤ 0.30 | ≤ 0.30 | — |
| 99% DEVM for 8-DPSK | | — | — | ≤ 0.20 | ≤ 0.20 | — |
| EDR In-Band Spurious Emission | \|M-N\| ≥ 2.5 MHz | — | -43 | -40 | < -40 | dBm |
| | 1.5 MHz < \|M-N\| < 2.5 MHz | — | -31 | -20 | ≤ -20 | dBm |
| | 1.0 MHz < \|M-N\| < 1.5 MHz | — | -38 | -26 | ≤ -26 | dBm |





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***Table 23: Basic Rate receiver performance (VBAT = 3.3V, VDDIO = 1.8V)***

| Test Parameter | | Min | Typ | Max | Bluetooth Spec. | Unit |
|---|---|---|---|---|---|---|
| Sensitivity (1DH5) | BER ≤ 0.1% | — | -91 | — | ≤ -70 | dBm |
| Maximum Input | BER ≤ 0.1% | — | — | -20 | ≥ -20 | dBm |
| Interference Performance | Co-Channel | — | 8.5 | 11 | 11 | dB |
| | C/I 1 MHz adjacent channel | — | -1.4 | 0 | 0 | dB |
| | C/I 2 MHz adjacent channel | — | -41 | -30 | -30 | dB |
| | C/I ≥ 3 MHz adjacent channel | — | -42.5 | -40 | -40 | dB |
| | C/I image channel | — | -31.5 | -9 | -9 | dB |
| | C/I 1-MHz adjacent to image channel | — | -44.5 | -20 | -20 | dB |

***Table 24: Enhanced Data Rate receiver performance (VBAT = 3.3V, VDDIO = 1.8V)***

| Test Parameter | | Min | Typ | Max | Bluetooth Spec. | Unit |
|---|---|---|---|---|---|---|
| Sensitivity (BER ≤ 0.01%) | π/4-DQPSK | — | -93 | — | ≤ -70 | dBm |
| | 8-DPSK | — | -87 | — | ≤ -70 | dBm |
| Maximum Input (BER ≤ 0.1%) | π/4-DQPSK | — | — | -20 | ≥ -20 | dBm |
| | 8-DPSK | — | — | -20 | ≥ -20 | dBm |
| C/I Co-Channel (BER ≤ 0.1%) | π/4-DQPSK | — | 10.5 | 13 | ≤ ±13 | dB |
| | 8-DPSK | — | 18 | 21 | ≤ ±21 | dB |
| C/I 1 MHz adjacent Channel | π/4-DQPSK | — | -6.5 | 0 | ≤ 0 | dB |
| | 8-DPSK | — | -1 | 5 | ≤5 | dB |
| C/I 2 MHz adjacent Channel | π/4-DQPSK | — | -38.5 | -30 | ≤ -30 | dB |
| | 8-DPSK | — | -36.5 | -25 | ≤ -25 | dB |
| C/I ≥ 3 MHz adjacent Channel | π/4-DQPSK | — | -42.5 | -40 | ≤ -40 | dB |
| | 8-DPSK | — | -41.5 | -33 | ≤ -33 | dB |
| C/I image channel | π/4-DQPSK | — | -30 | -7 | ≤ -7 | dB |
| | 8-DPSK | — | -22.5 | 0 | ≤ 0 | dB |
| C/I 1 MHz adjacent to image channel | π/4-DQPSK | — | -47.5 | -20 | ≤ -20 | dB |
| | 8-DPSK | — | -41.5 | -13 | ≤ -13 | dB |
| Out-of-Band Blocking Performance (CW) BER ≤ 0.1% | 30-2000MHz | — | -10 | — | — | dBm |
| | 2-2.399GHz | — | -27 | — | — | dBm |
| | 2.484-3GHz | — | -27 | — | — | dBm |
| | 3-12.75GHz | — | -10 | — | — | dBm |





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***Table 25: BLE RF Specifications (VBAT = 3.3V, VDDIO = 1.8V)***

| Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Frequency range | — | | 2402 | — | 2480 | MHz |
| Rx sensitivity[1] | GFSK, PER ≤ 30.8% | 1 Mbps | — | -95 | — | dBm |
| | | 2 Mbps | — | -92 | — | dBm |
| | | 500 Kbps | — | -102 | — | dBm |
| | | 125 Kbps | — | -107 | — | dBm |
| Tx power[2] | — | | — | — | 7 | dBm |
| Δf1 average | 1 Mbps | | 225 | 255 | 275.5 | KHz |
| | 2 Mbps | | 450 | 500 | 550 | KHz |
| | 125 Kbps | | 225 | 255 | 275 | KHz |
| Δf2 average | 1 Mbps | | 185 | 230 | — | KHz |
| Δf2 maximum[3] | 2 Mbps | | 370 | 450 | — | KHz |
| Δf1 average (Stable Modulation) | 1 Mbps | | 247.5 | 250 | 252.5 | KHz |
| | 2 Mbps | | 495 | 500 | 550 | KHz |
| | 125 Kbps | | 247.5 | 250 | 252.5 | KHz |
| $\frac{\Delta f2\ avg}{\Delta f1\ avg}$ ratio | 1 Mbps | | 0.8 | 1.0 | — | % |
| | 2 Mbps | | 0.8 | 1.0 | — | % |

***Table 26: Bluetooth transmitter current consumption (VBAT = 3.3V, VDDIO = 1.8V, WL_REG_ON = OFF)***

| Operation Mode | Data Rate | VBAT Current Consumption (mA) | VIO Current Consumption (mA) |
|---|---|---|---|
| Basic Data Rate | 1DH5 | 18.9 | 0.76 |
| Enhanced Data Rate | 2DH5 | 18.4 | 0.77 |
| | 3DH5 | 18.3 | 0.77 |
| Low-Energy | 1 Mbps | 20.3 | 0.76 |
| | 2 Mbps | 13.4 | 0.71 |
| | 500 Kbps | 17.9 | 0.75 |
| | 125 Kbps | 23.6 | 0.78 |

**Notes:**

[1] Dirty Tx is Off.

[2] The Bluetooth LE TX power cannot exceed 10 dBm EIRP specification limit. The front-end losses and antenna gain/loss must be factored in so as not to exceed the limit.

[3] At least 99.9% of all Δf2 maximum frequency values recorded over 10 packets must be greater than 185 KHz.





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# 10 HOST INTERFACE SPECIFICATIONS

## 10.1 SDIO Specifications

The Sona IF573 series wireless module SDIO host interface pins are powered from the VDDIO voltage supply, which is set internally at 1.8V on the M.2 module. The SDIO electrical specifications are identical for the 1-bit SDIO and 4-bit SDIO modes.

**Note**: The SDIO host signals must be 1.8V at all times as defined by the M.2 standard.

### 10.1.1 Default Speed, High-Speed Modes

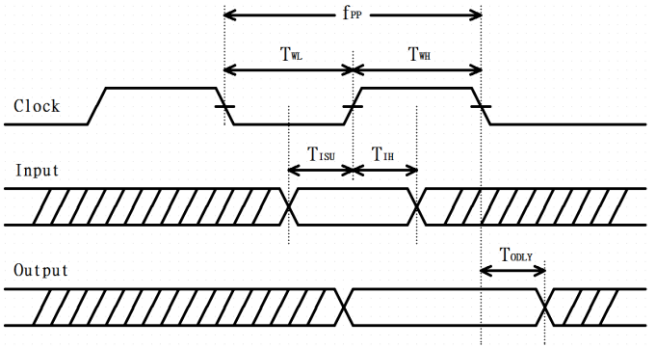


*Figure 3: SDIO protocol timing diagram - Default mode (1.8V)*

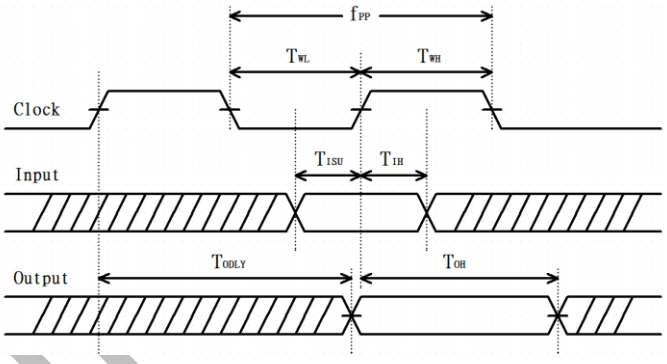


*Figure 4: SDIO protocol timing diagram – High-Speed mode (1.8V)*

**Note:** Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

***Table 27: SDIO timing requirements***

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| fPP | Clock Frequency | Default Speed | 0 | - | 25 | MHz |
| | | High-Speed | 0 | - | 50 | |
| TWL | Clock low time | Default Speed | 10 | - | - | ns |
| | | High-Speed | 7 | - | - | |
| TWH | Clock high time | Default Speed | 10 | - | - | ns |
| | | High-Speed | 7 | - | - | |
| TISU | Input Setup time | Default Speed | 5 | - | - | ns |
| | | High-Speed | 6 | - | - | |
| TIH | Input Hold time | Default Speed | 5 | - | - | ns |
| | | High-Speed | 2 | - | - | |
| TODLY | Output delay time | Default Speed | - | - | 14 | ns |
| | CL≦40pF (1 card) | High-Speed | - | - | 14 | |
| TOH | Output hold time | High-Speed | 0 | - | - | ns |





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### 10.1.2 SDR12, SDR25, SDR50 Modes (up to 100 MHz) (1.8V)

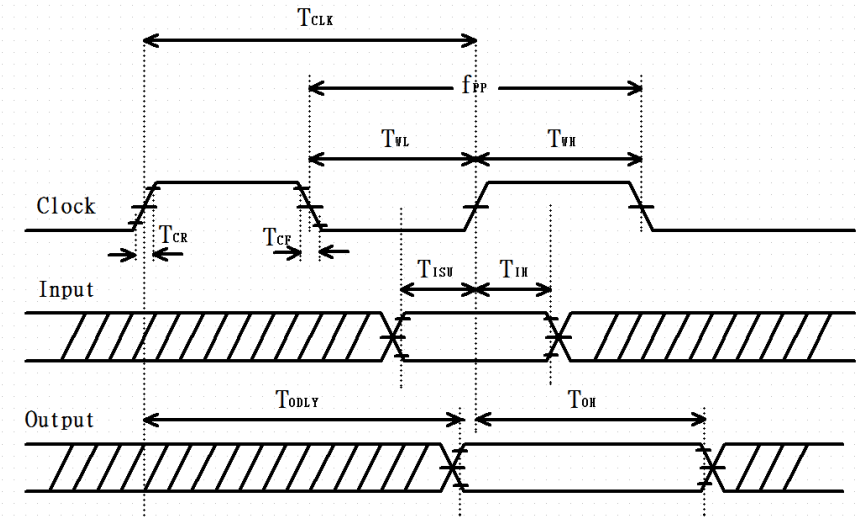


***Figure 5: SDIO protocol timing Diagram – SDR12, SDR25, SDR50 modes (up to 100 MHz) (1.8V)***

**Note:** Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

***Table 28: SDIO timing requirements - SDR12, SDR25, SDR50 modes (up to 100 MHz) (1.8V)***

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| fPP | Clock Frequency | SDR12/25/50 | 25 | - | 100 | MHz |
| TISU | Input setup time | SDR12/25/50 | 3 | -- | - | ns |
| TIH | Input Hold time | SDR12/25/50 | 0.8 | - | - | ns |
| TCLK | Clock Time | SDR12/25/50 | 10 | - | 40 | ns |
| TCR, TCF | Raise time, Fall time<br>TCR, TCF <2ns (max) at 100MHz<br>CCARD=10pF | SDR12/25/50 | - | - | 0.2*TCLK | ns |
| TODLY | Output delay time<br>CL≦30pF | SDR12/25/50 | - | - | 7.5 | ns |
| TOH | Output hold time<br>CL=15pF | SDR12/25/50 | 1.5 | - | - | ns |





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### 10.1.3 SDR104 Mode (208 MHz) (1.8V)

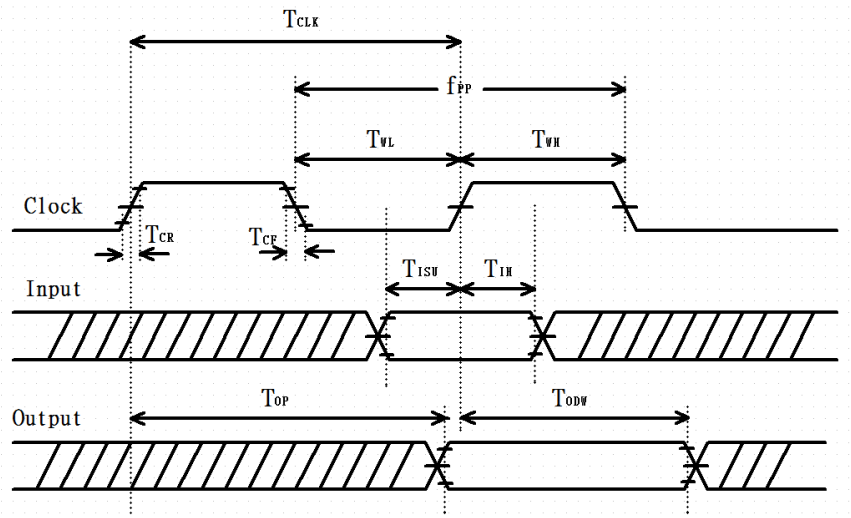


***Figure 6: SDIO protocol timing Diagram - SDR104 mode (up to 208 MHz) (1.8V)***

**Note:** Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

***Table 29: SDIO timing requirements - SDR104 mode (up to 208MHz) (1.8V)***

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| fPP | Clock Frequency | SDR104 | 0 | - | 208 | MHz |
| TISU | Input setup time | SDR104 | 1.4 | -- | - | ns |
| TIH | Input Hold time | SDR104 | 0.8 | - | - | ns |
| TCLK | Clock Time | SDR104 | 4.8 | - | - | ns |
| TCR, TCF | Raise time, Fall time<br>TCR, TCF <0.96ns (max) at 208MHz<br>CCARD=10pF | SDR104 | - | - | 0.2*TCLK | ns |
| TOP | Card Output phase | SDR104 | 0 | - | 10 | ns |
| TODW | Output timing pf variable data window | SDR12/25/50 | 2.88 | - | - | ns |





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## 10.2 PCI Express Interface

The Sona IF573 series wireless module supports the PCIe interface, which provides high-performance serial I/O interconnects and is also protocol compliant and electrically compatible with the PCI Express Base Specification v3.0 running at Gen2 speeds.

Organization of the PCIe core is in logical layers: Transaction Layer, Data Link Layer, and Physical Layer, as shown in Figure 1Figure 7. A configuration or link management block is provided for enumerating the PCIe configuration space and supporting generation and reception of System Management Messages by communicating with PCIe layers.

Each layer is partitioned into dedicated transmit and receive units that allow point-to-point communication between the host and Sona IF573 device. The transmit side processes outbound packets whereas the receive side processes inbound packets. Packets are formed and generated in the Transaction and Data Link Layer for transmission onto the high-speed links and onto the receiving device. A header is added at the beginning to indicate the packet type and any other optional fields.

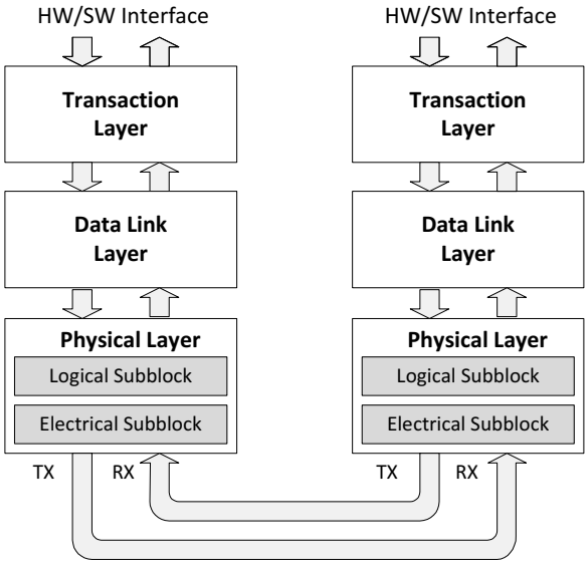


***Figure 7: PCI Express Layer Model***





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## 10.3 PCM Interface Specifications

### 10.3.1 PCM Interface

The Sona IF573 series wireless module supports a PCM interface. The PCM interface on the Sona IF573 series wireless module can connect to linear PCM codec devices in Master/Slave mode. In Master mode, the Sona IF573 generates the BT_PCM_CLK and BT_PCM_SYNC signals, and in Slave mode, these signals are provided by another master on the PCM interface and are input to the Sona IF573 module.

The configuration of the PCM interface may be adjusted by the host through the use of vendor-specific HCI commands.

### 10.3.2 PCM Interface Timing

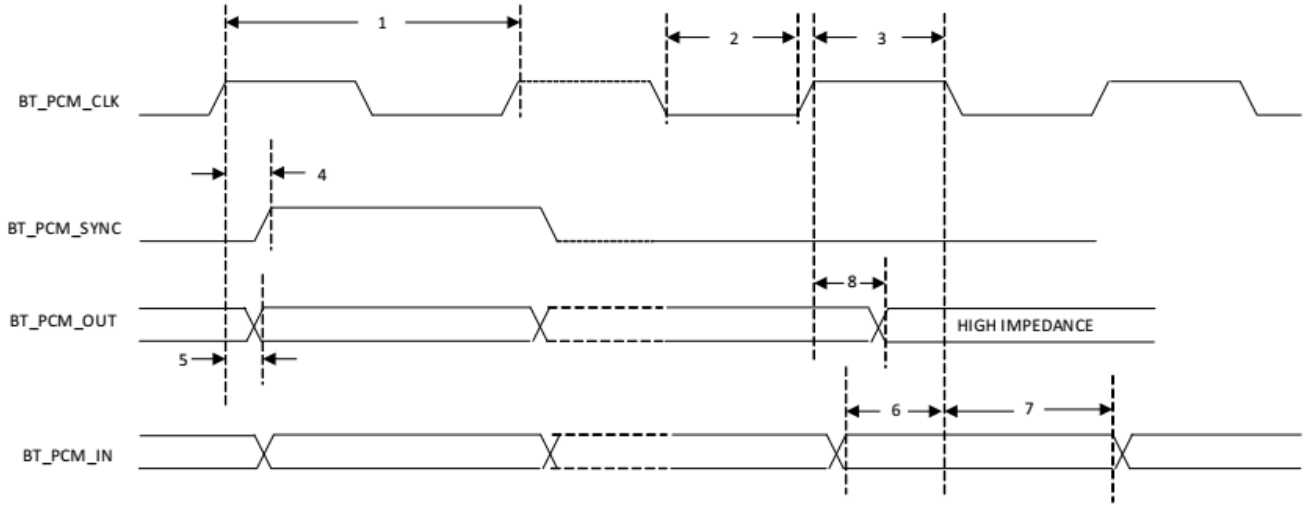


***Figure 8: PCM timing specification – Short Frames Sync, Master Mode***

***Table 30: PCM timing specification – Short Frames Sync, Master Mode***

| Reference | Characteristics | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | - | - | 12.0 | MHz |
| 2 | PCM bit clock LOW | 41.0 | - | - | ns |
| 3 | PCM bit clock HIGH | 41.0 | - | - | ns |
| 4 | BT_PCM_SYNC delay | 0 | - | 25.0 | ns |
| 5 | BT_PCM_OUT delay | 0 | - | 25.0 | ns |
| 6 | BT_PCM_IN setup | 8.0 | - | - | ns |
| 7 | BT_PCM_IN hold | 8.0 | - | - | ns |
| 8 | Delay from rising edge of BT_PCM_CLK during last bit period to BT_PCM_OUT becoming high impedance | 0 | - | 25.0 | ns |



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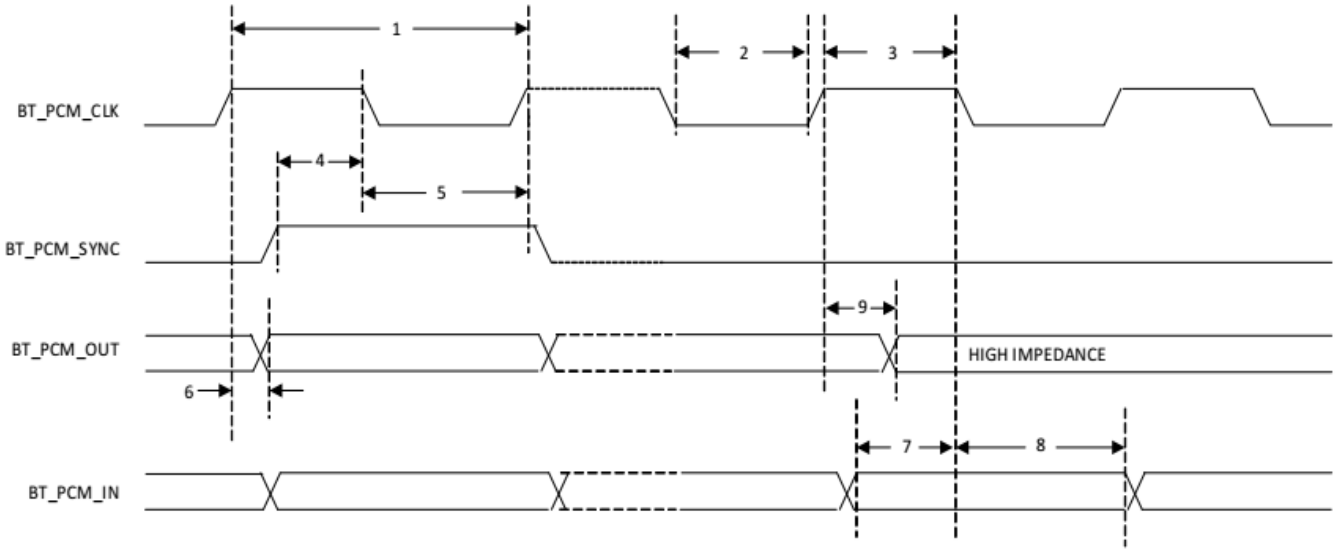


***Figure 9: PCM timing specification – Short Frame Sync, Slave Mode***

***Table 31: PCM timing specification – Short Frame Sync, Slave Mode***

| Reference | Characteristics | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | - | - | 12.0 | MHz |
| 2 | PCM bit clock LOW | 41.0 | - | - | ns |
| 3 | PCM bit clock HIGH | 41.0 | - | - | ns |
| 4 | BT_PCM_SYNC setup | 8.0 | - | - | ns |
| 5 | BT_PCM_SYNC hold | 8.0 | - | - | ns |
| 6 | BT_PCM_OUT delay | 0 | - | 25.0 | ns |
| 7 | BT_PCM_IN setup | 8.0 | - | - | ns |
| 8 | BT_PCM_IN hold | 8.0 | - | - | ns |
| 9 | Delay from rising edge of BT_PCM_CLK during last bit period to BT_PCM_OUT becoming high impedance | 0 | - | 25.0 | ns |





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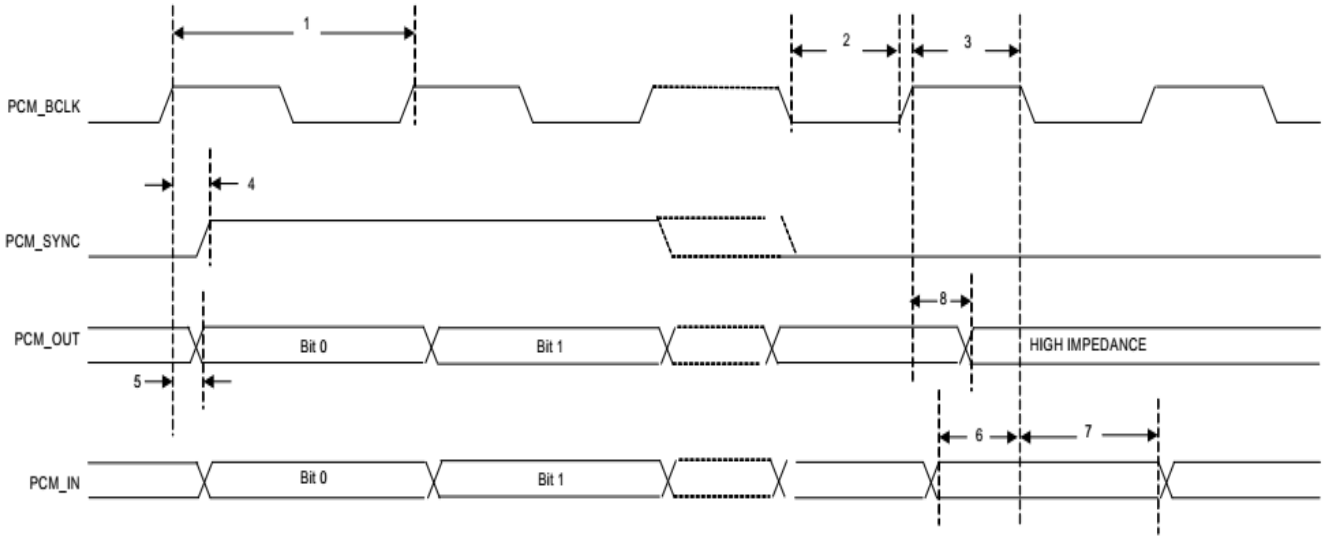


***Figure 10: PCM timing specification – Long Frame Sync, Master Mode***

***Table 32: PCM timing specification – Long Frame Sync, Master Mode***

| Reference | Characteristics | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | - | - | 12.0 | MHz |
| 2 | PCM bit clock LOW | 41.0 | - | - | ns |
| 3 | PCM bit clock HIGH | 41.0 | - | - | ns |
| 4 | BT_PCM_SYNC delay | 0 | - | 25.0 | ns |
| 5 | BT_PCM_OUT delay | 0 | - | 25.0 | ns |
| 6 | BT_PCM_IN setup | 8.0 | - | - | ns |
| 7 | BT_PCM_IN hold | 8.0 | - | - | ns |
| 8 | Delay from rising edge of BT_PCM_CLK during last bit period to BT_PCM_OUT becoming high impedance | 0 | - | 25.0 | ns |





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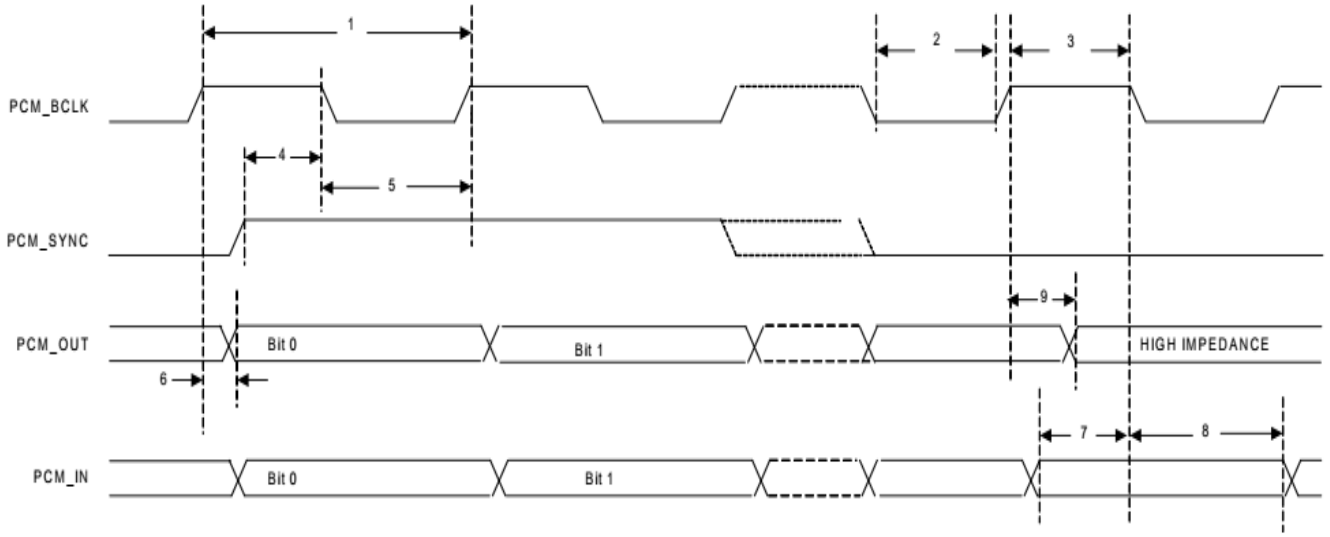


***Figure 11: PCM timing specification – Long Frame Sync, Slave Mode***

***Table 33: PCM timing specification – Long Frame Sync, Slave Mode***

| Reference | Characteristics | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | - | - | 12.0 | MHz |
| 2 | PCM bit clock LOW | 41.0 | - | - | ns |
| 3 | PCM bit clock HIGH | 41.0 | - | - | ns |
| 4 | BT_PCM_SYNC setup | 8.0 | - | - | ns |
| 5 | BT_PCM_SYNC hold | 8.0 | - | - | ns |
| 6 | BT_PCM_OUT delay | 0 | - | 25.0 | ns |
| 7 | BT_PCM_IN setup | 8.0 | - | - | ns |
| 8 | BT_PCM_IN hold | 8.0 | - | - | ns |
| 9 | Delay from rising edge of BT_PCM_CLK during last bit period to BT_PCM_OUT becoming high impedance | 0 | - | 25.0 | ns |





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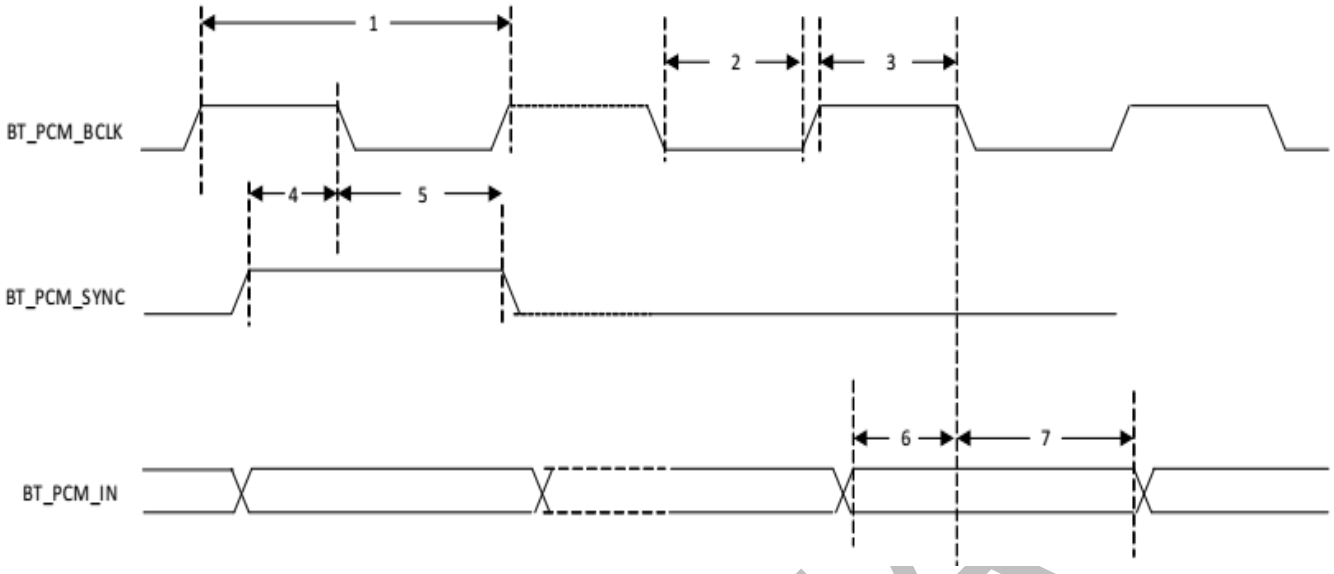


***Figure 12: PCM timing specification – Short Frame Sync, Receive Only, Burst Mode***

***Table 34: PCM timing specification – Short Frame Sync, Receive Only, Burst Mode***

| Reference | Characteristics | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | - | - | 24.0 | MHz |
| 2 | PCM bit clock LOW | 20.8 | - | - | ns |
| 3 | PCM bit clock HIGH | 20.8 | - | - | ns |
| 4 | BT_PCM_SYNC setup | 8.0 | - | - | ns |
| 5 | BT_PCM_SYNC hold | 8.0 | - | - | ns |
| 6 | BT_PCM_IN setup | 8.0 | - | - | ns |
| 7 | BT_PCM_IN hold | 8.0 | - | - | ns |





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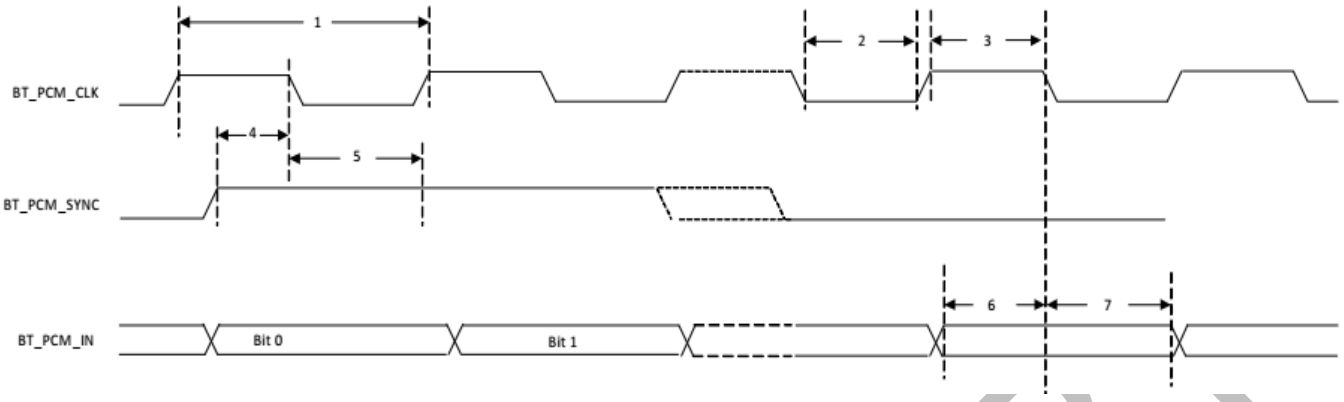


***Figure 13: PCM timing specification – Long Frame Sync, Receive Only, Burst Mode***

***Table 35: PCM timing specification – Long Frame Sync, Receive Only, Burst Mode***

| Reference | Characteristics | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| 1 | PCM bit clock frequency | - | - | 24.0 | MHz |
| 2 | PCM bit clock LOW | 20.8 | - | - | ns |
| 3 | PCM bit clock HIGH | 20.8 | - | - | ns |
| 4 | BT_PCM_SYNC setup | 8.0 | - | - | ns |
| 5 | BT_PCM_SYNC hold | 8.0 | - | - | ns |
| 6 | BT_PCM_IN setup | 8.0 | - | - | ns |
| 7 | BT_PCM_IN hold | 8.0 | - | - | ns |

## 10.4 JTAG Interface

The Sona IF573 supports the JTAG interface for use with proprietary debug and characterization test tools during board bring-up.

**Note:** The JTAG interface is disabled by default and not exposed on the M.2 2230 E-Key interface.





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# 11 Power-Up Sequence and Timing

Sona IF573 has two signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN, and internal regulator block.

## 11.1 Description of Control Signals

- WL_REG_ON: Used to power up the WLAN. When this pin is high, the internal regulators are enabled and the WLAN section is out of reset. When this pin is low the WLAN section is in reset. This signal is connected to the W_DISABLE1# pin on the M.2 interface.
- BT_REG_ON: Used to power up the Bluetooth section. If both the BT_REG_ON and WL_REG_ON pins are low, the regulators are disabled. When this pin is low and WL_REG_ON is high, the Bluetooth section is in reset. This signal is connected to the W_DISABLE2# pin on the M.2 interface.
- **M.2 1318** - VBAT and VDDIO should not rise 10% - 90% faster than 40 microseconds.
- **M.2 1318** - VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.
- Do not access the digital interface for at least 150 milliseconds after VDDC and VDDIO are available.

## 11.2 Control Signal Timing Diagrams

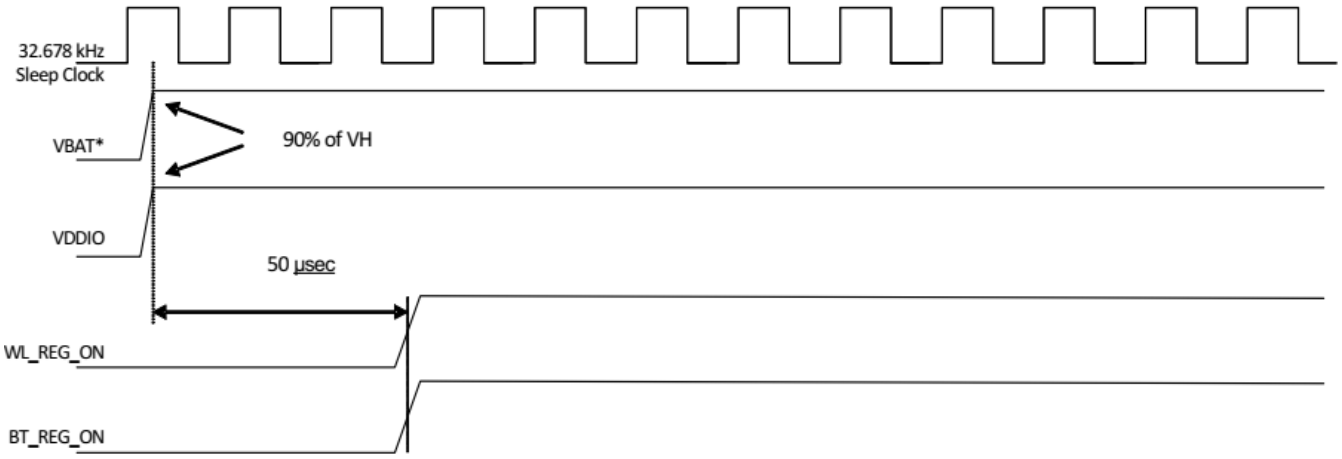


***Figure 14: WL_REG_ON = ON, BT_REG_ON = ON***

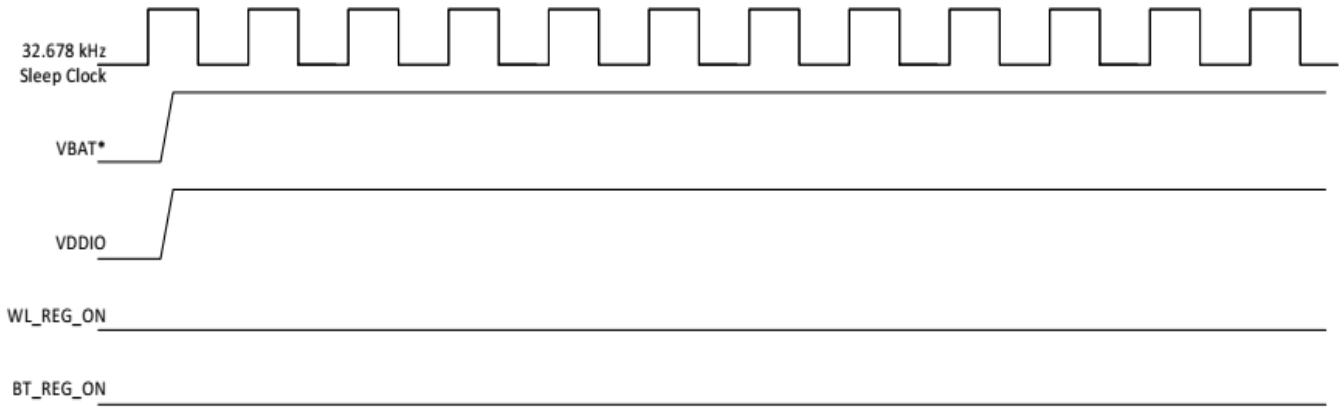


***Figure 15: WL_REG_ON = OFF, BT_REG_ON = OFF***





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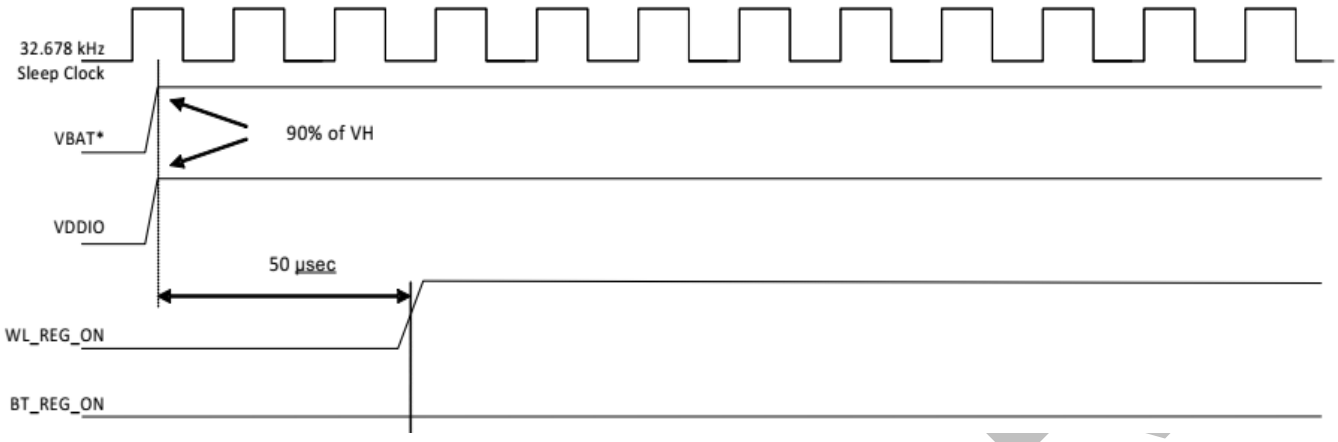


***Figure 16: WL_REG_ON = ON, BT_REG_ON = OFF***

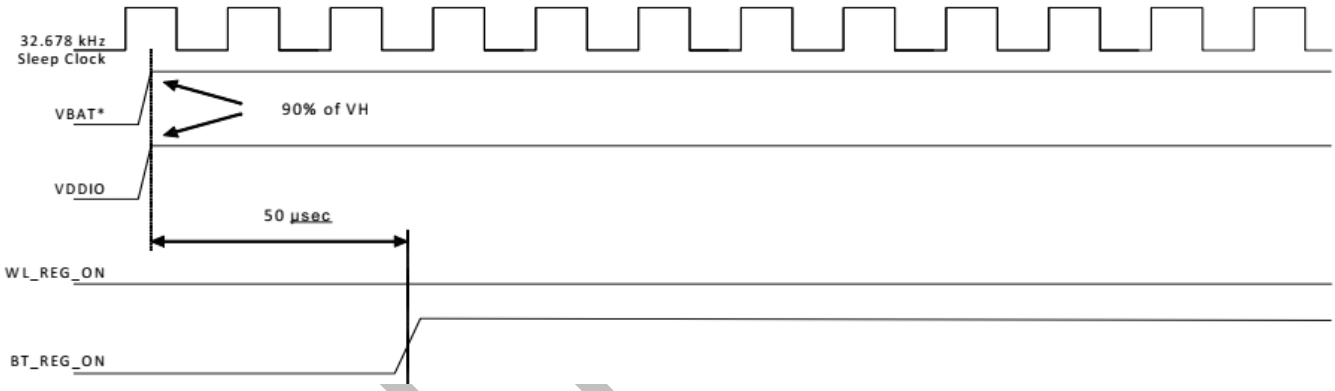


***Figure 17: WL_REG_ON = OFF, BT_REG_ON = ON***





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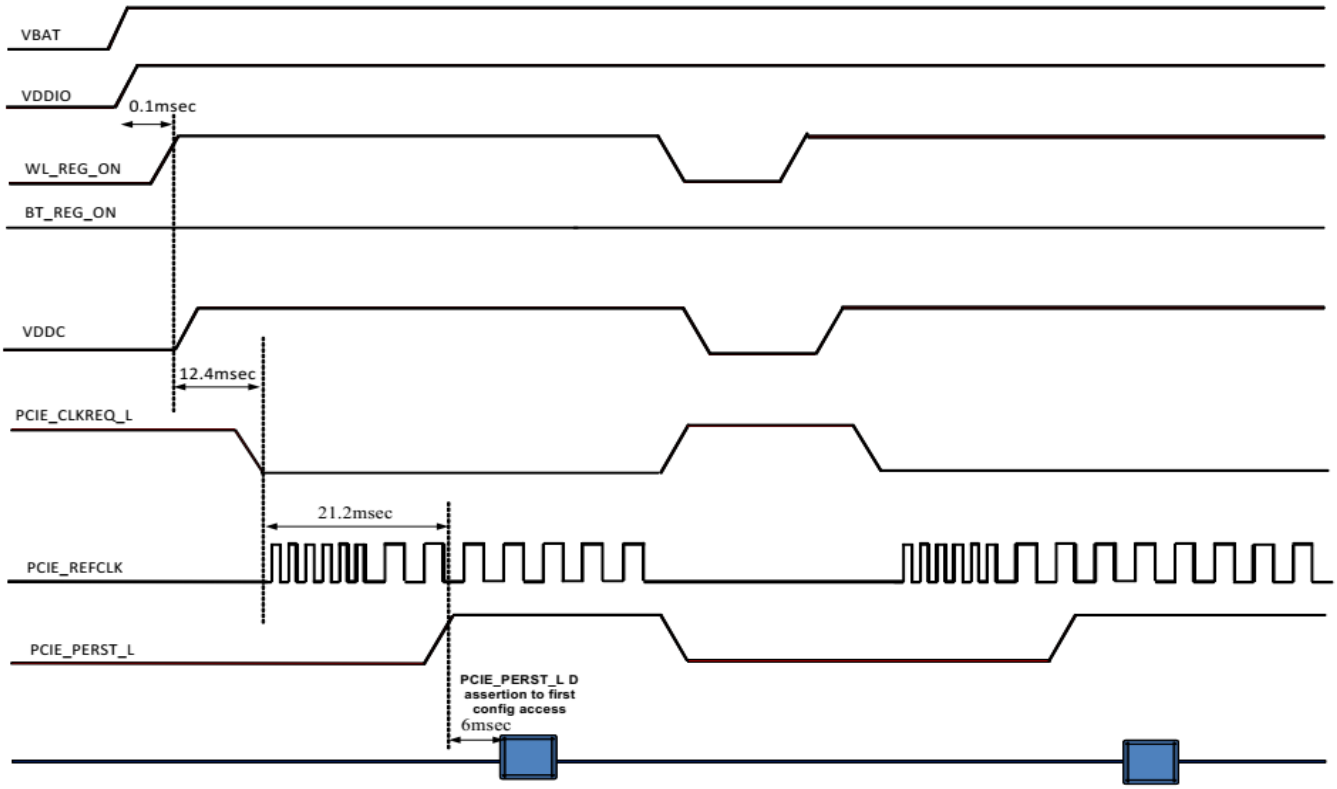


***Figure 18: WLAN Power-Up Sequence for PCIe Host***

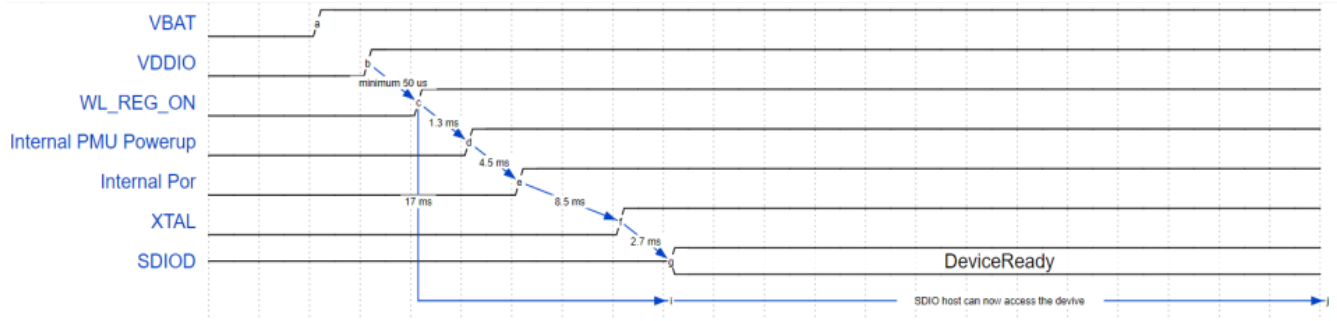


***Figure 19: WLAN Boot-Up Sequence for SDIO Host***





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# 12 Pin Definitions

## 12.1 M.2 1318 Solder-down

***Table 36: M.2 1318 pin definitions***

| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 1 | UIM_POWER_SRC/GPIO1 | - | - | NA | - |
| 2 | UIM_POWER_SNK | - | - | NA | - |
| 3 | UIM_SWP | - | - | NA | - |
| 4 | 3.3V | PWR | 3.3V | Power Supply Input | - |
| 5 | 3.3V | PWR | 3.3V | Power Supply Input | - |
| 6 | GND | - | - | Ground | GND |
| 7 | RESERVED | - | - | NA | - |
| 8 | ALERT | - | - | NA | - |
| 9 | I2C_CLK | - | - | NA | - |
| 10 | I2C_DATA | - | - | NA | - |
| 11 | COEX_RXD | I | VDDIO | WLAN_JTAG_TMS | NC |
| 12 | COEX_TXD | I | VDDIO | WLAN_JTAG_TCK | NC |
| 13 | COEX3 | I | VDDIO | WLAN_JTAG_TDI | NC |
| 14 | SYSCLK/GNSS_0 | - | - | NA | - |
| 15 | TX_BLANKING/GNSS_1 | - | - | NA | - |
| 16 | RESERVED | - | - | NA | - |
| 17 | GND | - | - | Ground | GND |
| 18 | RESERVED | I | VDDIO | ▪ SDIO mode: WL_DEV_WAKE<br>▪ PCIe mode: Reserved | NC |
| 19 | RESERVED | O | VDDIO | WLAN_JTAG_TDO | NC |
| 20 | GND | - | - | Ground | GND |
| 21 | RESERVED | I | VDDIO | Reserved | NC |
| 22 | RESERVED | I | VDDIO | ▪ PCIe mode: WL_DEV_WAKE<br>▪ SDIO mode: Reserved | NC |
| 23 | GND | - | - | Ground | GND |
| 24 | GPIO_1 | I | VDDIO | WLAN Interface Select<br>▪ Pull to VDDIO for PCIe<br>▪ Pull to GND for SDIO | - |
| 25 | RESERVED | I | VDDIO | JTAG_SEL<br>Reserved<br>**Must be pulled to GND for normal operation** | GND |
| 26 | GND | - | - | Ground | GND |
| 27 | SUSCLK(32kHz) | I | VDDIO | External Sleep Clock (32.768 kHz)<br>**This clock must be provided** | - |





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| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 28 | W_DISABLE1# | I | VDDIO | This pin controls the internal WL_REG_ON signal and has an internal 200K pull-down.<br>**This pin must be driven/pulled high to enable WLAN**<br>Recommend controlling this signal via host GPIO for optimal power control. | NC |
| 29 | PEWAKE# | O | VBAT | PCI power management event output. Used to request a change in the device or system power state. The assertion and de-assertion of this signal are asynchronous to the PCIe reference clock. | NC |
| 30 | CLKREQ# | O | VBAT | PCIe clock request signal which indicates when the REFCLK to the PCIe interface can be gated.<br>▪ 1 = the clock can be gated.<br>▪ 0 = the clock is required. | NC |
| 31 | PERST# | I | VBAT | PCIe System Reset | NC |
| 32 | GND | - | - | Ground | GND |
| 33 | REFCLKn0 | I | VBAT | PCIE Differential Pair Clock Source (100 MHz) Negative Input. | NC |
| 34 | REFCLKp0 | I | VBAT | PCIE Differential Pair Clock Source (100 MHz) Positive Input. | NC |
| 35 | GND | - | - | Ground | GND |
| 36 | PETn0 | O | VBAT | PCIE Transmitter Differential Pair Negative Output | NC |
| 37 | PETp0 | O | VBAT | PCIE Transmitter Differential Pair Positive Output | NC |
| 38 | GND | - | - | Ground | GND |
| 39 | PERn0 | I | VBAT | PCIE Receiver Differential Pair Negative Input | NC |
| 40 | PERp0 | I | VBAT | PCIE Receiver Differential Pair Positive Input | NC |
| 41 | GND | - | - | Ground | GND |
| 42 | VENDOR DEFINED | PWR | VDDIO | 1.8V IO Supply for all digital I/O | - |
| 43 | VENDOR DEFINED | - | - | NA | - |
| 44 | VENDOR DEFINED | - | - | NA | - |
| 45 | SDIO RESET# | - | - | NA | - |
| 46 | SDIO WAKE# | O | VDDIO | WL_HOST_WAKE<br>Reserved | NC |
| 47 | SDIO DATA3 | I/O | VDDIO | SDIO Data line 3 | NC |
| 48 | SDIO DATA2 | I/O | VDDIO | SDIO Data line 2 | NC |
| 49 | SDIO DATA1 | I/O | VDDIO | SDIO Data line 1 | NC |
| 50 | SDIO DATA0 | I/O | VDDIO | SDIO Data line 0 | NC |
| 51 | SDIO CMD | I/O | VDDIO | SDIO command line | NC |
| 52 | SDIO CLK | I | VDDIO | SDIO Clock Input | NC |
| 53 | UART WAKE# | O | VDDIO | BT_HOST_WAKE<br>Reserved | NC |





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| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 54 | UART CTS | I | VDDIO | BT UART CTS<br>**Hardware handshake is required** | - |
| 55 | UART_Tx | O | VDDIO | BT UART Transmit | - |
| 56 | UART_Rx | I | VDDIO | BT UART Receive | - |
| 57 | UART_RTS | O | VDDIO | BT UART RTS<br>**Hardware handshake is required** | - |
| 58 | PCMFR1 | I/O | VDDIO | BT_PCM Sync.<br>Master mode: Generated by radio<br>Slave mode: Generated by external host | NC |
| 59 | PCMIN | I | VDDIO | BT_PCM data input. | NC |
| 60 | PCMOUT | O | VDDIO | BT_PCM data output | NC |
| 61 | PCMCLK | I/O | VDDIO | BT_PCM Clock<br>Master mode: Generated by radio<br>Save mode: Generated by external host | NC |
| 62 | GND | - | - | Ground | GND |
| 63 | W_DISABLE2# | I | VDDIO | This pin controls the internal BT_REG_ON signal and has an internal 200K pull-down.<br>**This pin must be controlled by host GPIO** | NC |
| 64 | LED_2# | I/O | VDDIO | Reserved | NC |
| 65 | LED_1# | I/O | VDDIO | BT Interface Select/GPIO_12<br>**This pin must be pulled high** | - |
| 66 | RESERVED | I | VDDIO | BT_DEV_WAKE<br>Reserved | NC |
| 67 | RESERVED | I | VDDIO | WLAN_JTAG_TRST<br>Reserved | NC |
| 68 | GND | - | - | Ground | GND |
| 69 | USB_D- | - | - | NA | NC |
| 70 | USB_D+ | - | - | NA | NC |
| 71 | GND | - | - | Ground | GND |
| 72 | 3.3V | PWR | 3.3V | Power Supply Input | - |
| 73 | 3.3V | PWR | 3.3V | Power Supply Input | - |
| 74~78 | GND | - | - | Ground | GND |
| 79 | BT_S | - | - | Bluetooth RF for trace antenna variant<br>Unused for MHF4 antenna connector variant | - |
| 80~85 | GND | - | - | Ground | GND |
| 86 | WL_C0 | - | - | WLAN RF Antenna 0 for trace antenna variant<br>Unused for MHF4 antenna connector variant | |
| 87~93 | GND | - | - | Ground | GND |
| 94 | WL_C1 | - | - | WLAN RF Antenna 1 for trace antenna variant<br>Unused for MHF4 antenna connector variant | |





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| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 95~96 | GND | - | - | Ground | GND |
| G1~G10 | GND | - | - | Ground | GND |

## 12.2 M.2 2230 E-Key

***Table 37: M.2 2230 E-Key pin definitions***

| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 1 | GND | - | - | Ground | GND |
| 2 | 3.3V | PWR I/P | 3.3V | DC supply voltage for module. Operational is 3.13V to 3.6V | - |
| 3 | USB_D+ | - | - | NA | NC |
| 4 | 3.3V | PWR I/P | 3.3V | DC supply voltage for module. Operational is 3.13V to 3.6V | - |
| 5 | USB_D- | - | - | NA | NC |
| 6 | LED1# | I/O | 3.3V | GPIO_12 Reserved | NC |
| 7 | GND | - | - | Ground | GND |
| 8 | PCM_CLK | I/O | 1.8V | PCM clock. Can be master (Output) or slave (Input) | NC |
| 9 | SDIO CLK | I | 1.8V | SDIO clock input | NC |
| 10 | PCM_SYNC | I/O | 1.8V | PCM Sync. Can be master (Output) or slave (Input) | NC |
| 11 | SDIO CMD | I/O | 1.8V | SDIO command line | NC |
| 12 | PCM_OUT | O | 1.8V | PCM data output. | NC |
| 13 | SDIO DATA0 | I/O | 1.8V | SDIO data lin0 | NC |
| 14 | PCM_IN | I | 1.8V | PCM data input. | NC |
| 15 | SDIO DATA1 | I/O | 1.8V | SDIO data lin1 | NC |
| 16 | LED2# | I/O | 3.3V | GPIO_13 Reserved | NC |
| 17 | SDIO DATA2 | I/O | 1.8V | SDIO data lin2 | NC |
| 18 | GND | - | - | Ground | GND |
| 19 | SDIO DATA3 | I/O | 1.8V | SDIO data lin3 | NC |
| 20 | UART WAKE# | O | 3.3V | BT_HOST_WAKE Reserved | NC |
| 21 | SDIO WAKE# | O | 1.8V | WL_HOST_WAKE Reserved | NC |
| 22 | UART_TXD | O | 1.8V | BT UART Transmit | NC |
| 23 | SDIO RESET# | - | - | NC | NC |
| 32 | UART_RXD | I | 1.8V | BT UART Receive | NC |
| 33 | GND | - | - | Ground | GND |



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| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 34 | UART_RTS | O | 1.8V | BT UART RTS<br>**Hardware handshake is required** | NC |
| 35 | PERp0 | I | 3.3V | PCIE Receiver Differential Pair Positive Input | NC |
| 36 | UART_CTS | I | 1.8V | BT UART CTS<br>**Hardware handshake is required** | NC |
| 37 | PERn0 | I | 3.3V | PCIE Receiver Differential Pair Negative Input | NC |
| 38 | VENDER DEFINED38 | O | 1.8V | WLAN_JTAG_TDO<br>Reserved | NC |
| 39 | GND | - | - | Ground | GND |
| 40 | VENDER DEFINED40 | I | 1.8V | WL_DEV_WAKE<br>Reserved | NC |
| 41 | PETp0 | O | 3.3V | PCIE Transmitter Differential Pair Positive Output | NC |
| 42 | VENDER DEFINED42 | I | 1.8V | BT_DEV_WAKE<br>Reserved | NC |
| 43 | PETn0 | O | 3.3V | PCIE Transmitter Differential Pair Negative Output | NC |
| 44 | COEX3 | I | 1.8V | WLAN_JTAG_TDI<br>Reserved | NC |
| 45 | GND | - | - | Ground | GND |
| 46 | COEX2 | I | 1.8V | WLAN_JTAG_TCK<br>Reserved | NC |
| 47 | REFCLKp0 | I | 1.8V | PCIE Differential Pair Clock Source (100 MHz) Positive Input. | NC |
| 48 | COEX1 | I | 1.8V | WLAN_JTAG_TMS<br>Reserved | NC |
| 49 | REFCLKn0 | I | 3.3V | PCIE Differential Pair Clock Source (100 MHz) Negative Input. | NC |
| 50 | SUSCLK | I | 3.3V | External Sleep Clock (32.768 kHz)<br>**This clock must be provided** | - |
| 51 | GND | - | - | Ground | GND |
| 52 | PERST0# | I | 3.3V | PCIe System Reset | NC |
| 53 | CLKREQ0# | O | 3.3V | PCIe clock request signal which indicates when the REFCLK to the PCIe interface can be gated. | NC |
| 54 | W_DISABLE2# | I | 3.3V | This pin controls the internal BT_REG_ON signal and has a 10K pull-up on the M.2 2230 module.<br>**This pin must be controlled by host GPIO** | NC |
| 55 | PEWAKE0# | O | 3.3V | PCI power management event output. Used to request a change in the device or system power state. The assertion and deassertion of this signal is asynchronous to the PCIe reference clock. | NC |
| 56 | W_DISABLE1# | I | 3.3 V | This pin controls the internal WL_REG_ON signal and has a 10K pull-up on the M.2 2230 module.<br>Recommend controlling this signal via host GPIO for optimal power control. | NC |



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| Pin # | Name | Type | Voltage Ref. | Function | If Not Used |
|---|---|---|---|---|---|
| 57 | GND | - | - | Ground | GND |
| 58 | I2C DATA | - | - | NC | NC |
| 59 | RESERVED | - | - | NC | NC |
| 60 | I2C CLK | - | - | NC | NC |
| 61 | RESERVED | - | - | NC | NC |
| 62 | ALERT# | - | - | NC | NC |
| 63 | GND | - | - | Ground | GND |
| 64 | RESERVED | - | - | NC | NC |
| 65 | RESERVED | - | - | NC | NC |
| 66 | UIM_SWP | - | - | NC | NC |
| 67 | RESERVED | - | - | NC | NC |
| 68 | UIM_POWER_SNK | - | - | NC | NC |
| 69 | GND | - | - | Ground | GND |
| 70 | UIM_POWER_SRC | - | - | NC | NC |
| 71 | RESERVED | - | - | NC | NC |
| 72 | 3.3V | PWR I/P | 3.3V | DC supply voltage for module. Operational is 3.13V to 3.6V | -- |
| 73 | RESERVED | - | - | NC | NC |
| 74 | 3.3V | PWR I/P | 3.3V | DC supply voltage for module. Operational is 3.13V to 3.6V | -- |
| 75 | GND | - | - | Ground | GND |

**Note** The transmit/receive differential pairs of the PCIe bus include "PERp0", "PERn0", "PETp0" and "PETn0", which have a built-in decoupling capacitor.





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# 13 Host Platform Implementation Details

## 13.1 M.2 1318 WLAN Interface Selection

The Sona IF573 M.2 1318 module must be configured for either PCIe or SDIO WLAN interface. Configuration is done with resistor strapping as specified in Table 38.

***Table 38: Wi-Fi host interface configuration table***

| WLAN/Bluetooth Interface | GPIO_1 (Pin24) | LED_1# (Pin 65) |
|---|---|---|
| PCIe / UART | H | H |
| SDIO /UART | L | H |

**Note:** The M.2 2230 E-Key module strapping is implemented on the M.2 carrier board.

## 13.2 Bluetooth Interface Requirements

The CYW55573 Bluetooth CPU core requires the UART_CTS input to be held low at the point the BT_REG_ON (W_DISABLE2#) signal goes high to enable secure firmware download. In addition, the HCI interface uses the standard H4 protocol which requires four-wire hardware handshaking.

This requires that the host implement GPIO control over BT_REG_ON/W_DISABLE2# and implement full RTS/CTS handshaking.

## 13.3 Low Power Clock

The Sona IF573 requires a 32KHz clock on the SUSCLK input. This clock drives various internal state machines and must be provided by the host even if low power operation is not needed.

## 13.4 M.2 1318 WL_DEV_WAKE Mapping

The WL_DEV_WAKE feature is mapped to different pins on the M.2 1318 module depending on the WLAN interface selection. See Table 39 for details.

***Table 39: M.2 1318 WL_DEV_WAKE Mapping***

| WLAN Interface | M.2 1318 Pin | Internal GPIO |
|---|---|---|
| PCIe | 22 | GPIO_8 |
| SDIO | 18 | LHL_GPIO1 |

**Note:** This feature is subject to software support and not currently implemented.





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# 14 MECHANICAL SPECIFICATIONS

## 14.1 M.2 1318

Module dimensions of Sona IF573 M.2 1318 package is 18 x 13 x 1.9 mm. Detailed drawings are shown in Figure 20

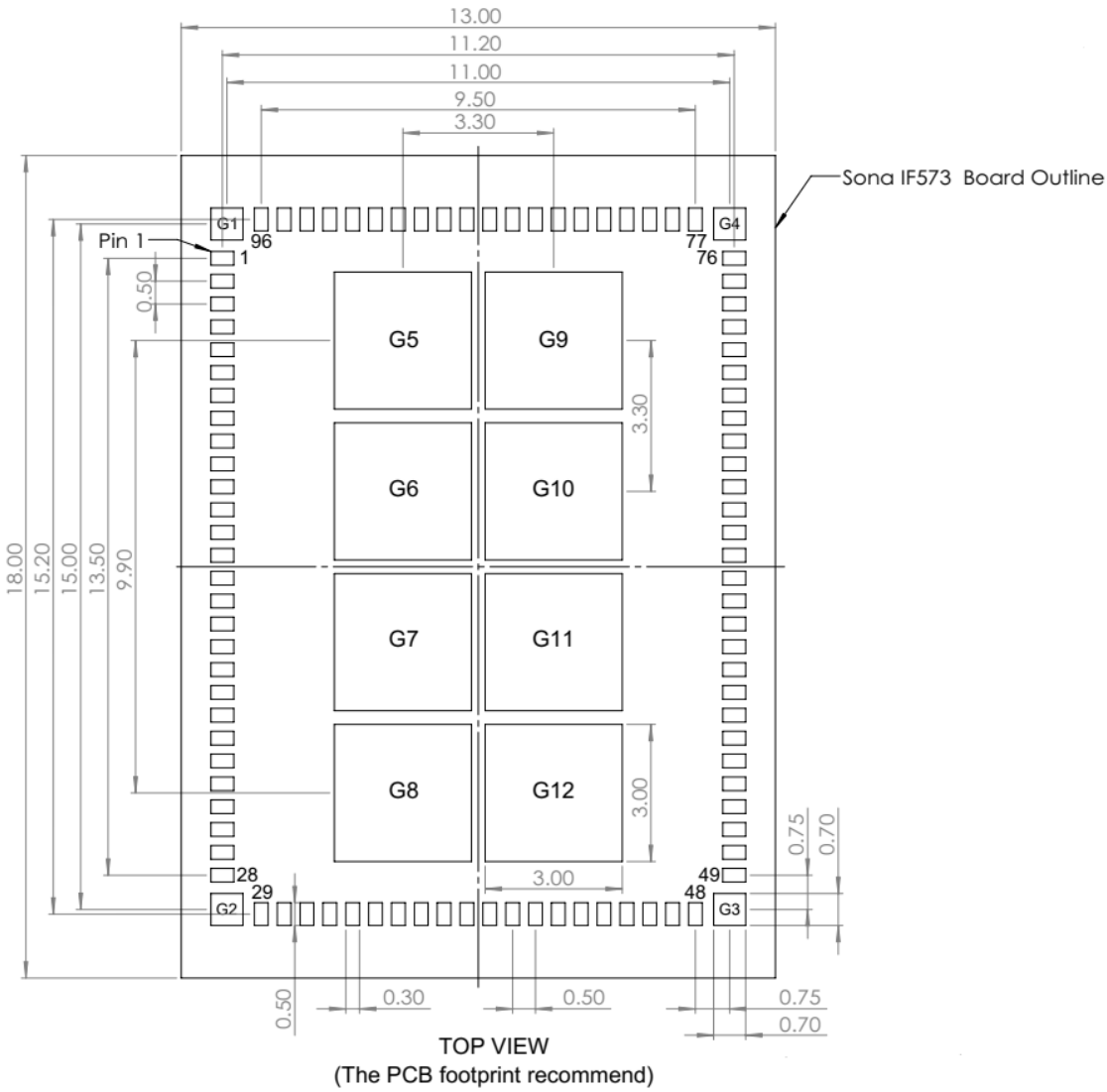


***Figure 20: M.2 1318***



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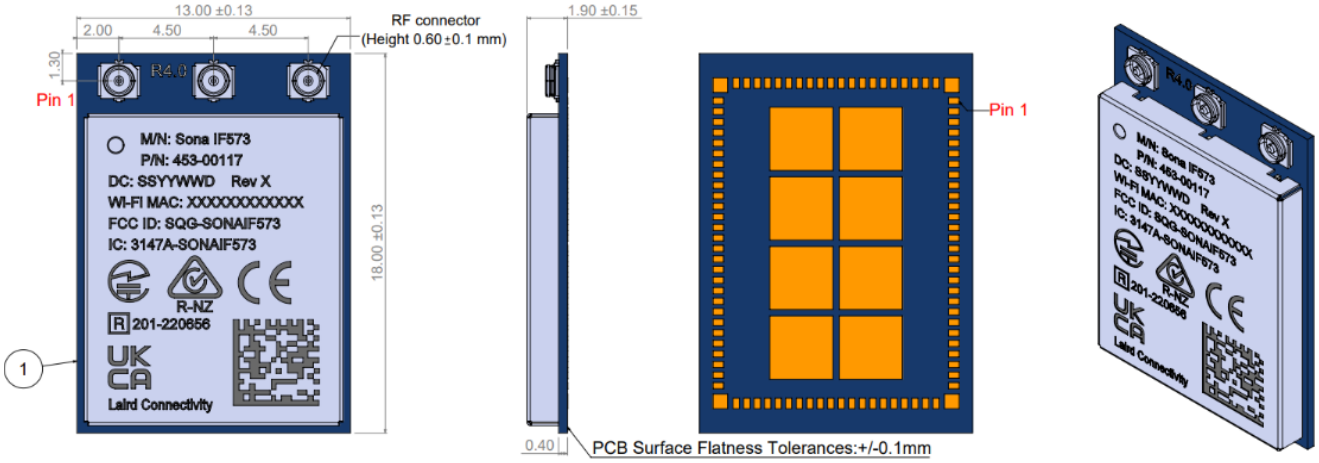


***Figure 21: M.2 1318 (MHF4 variant) – Top View***

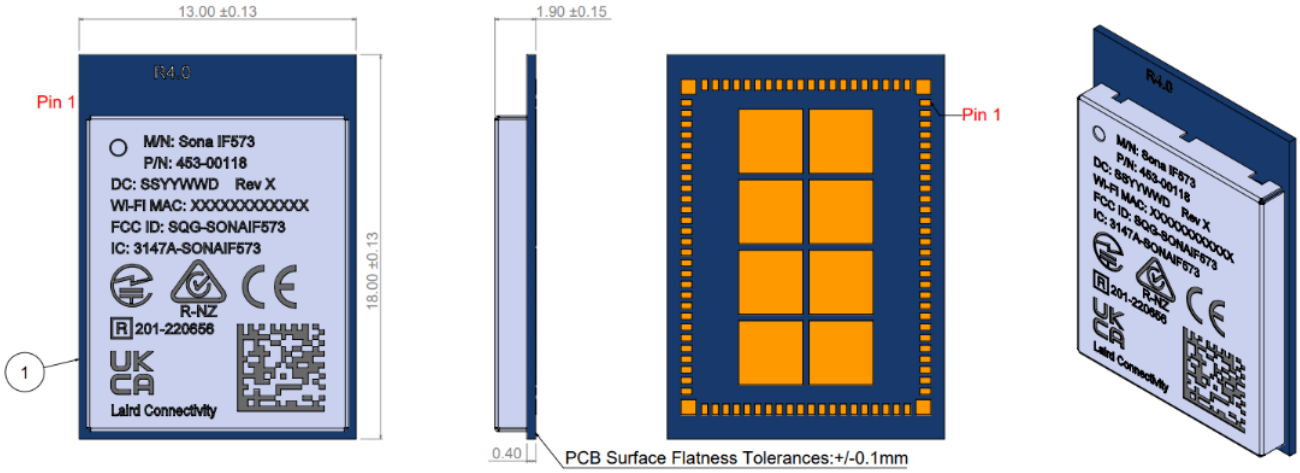


***Figure 22: M.2 1318 (trace antenna variant) – Top View***





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## 14.2 M.2 2230 E-Key

Module dimensions of Sona IF573 M.2 2230 E-Key module is 22 x 30 x 2.7 mm. Detailed drawings are shown in Figure 23.

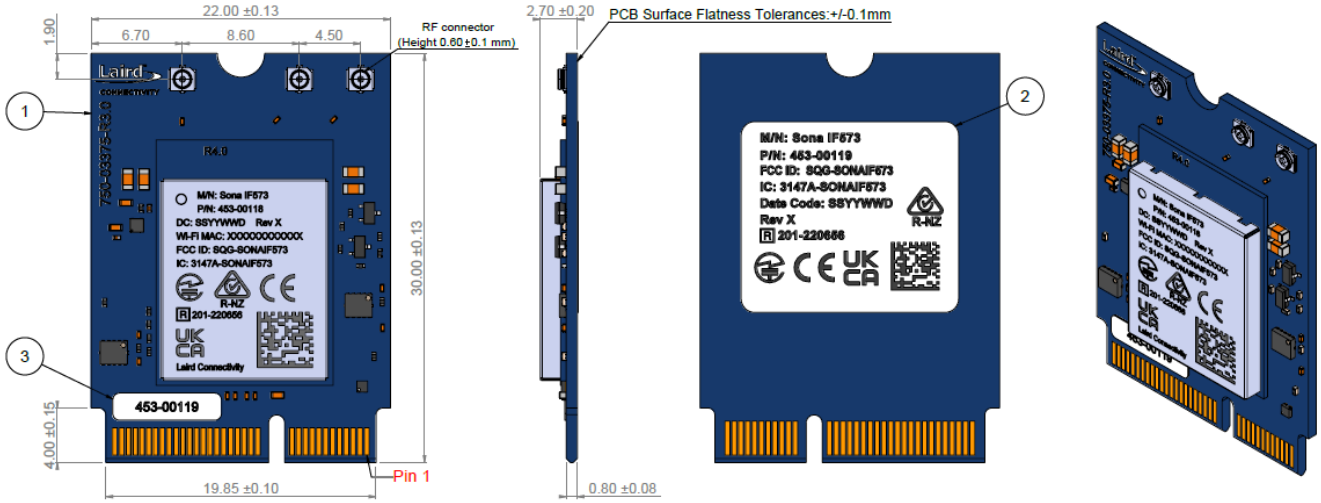


***Figure 23: Sona IF573 M.2 2230***

**Note:** The Wi-Fi MAC address is located on the product label.
The last digit of Wi-Fi MAC address is assigned to either *0, 2, 4, 6, 8, A, C, E.*
The BT MAC address is the Wi-Fi MAC address plus 1.

## 14.3 M.2 2230 E-Key Mounting

The Sona IF573 M.2 2230 E-Key module connects to the host via a standard PCI EXPRESS M2 connector.

Kyocera's 6411 series provides 1.8mm, 2.3mm and 3.2mm connector heights. JAE's SM3 series provides 1.2mm, 2.15mm, 3.1mm and 4.1mm connector heights.

The Sona IF573 M.2 2230 E-Key module is a single-sided component module so we recommend the connectors listed in Table 40.

***Table 40: Recommended M.2 2230 E-Key Connectors***

| M.2 Key-E Connector | Connector Height |
|---|---|
| KYOCERA 24-6411-067-101-894E | 2.3 mm |
| JAE SM3ZS067U310AERxxxx | 3.1 mm |

The corresponding standoffs are listed in Table 41.

***Table 41: Recommended M.2 E-Key Standoffs***

| M.2 Key-E Connector | Stand-off |
|---|---|
| KYOCERA 24-6411-067-101-894E | EMI STOP F50M16-041525P1D4M |
| JAE SM3ZS067U310AERxxxx | JAE SM3ZS067U310-NUT1-Rxxxx |

Detailed layout and stencil opening are show in Figure 24.





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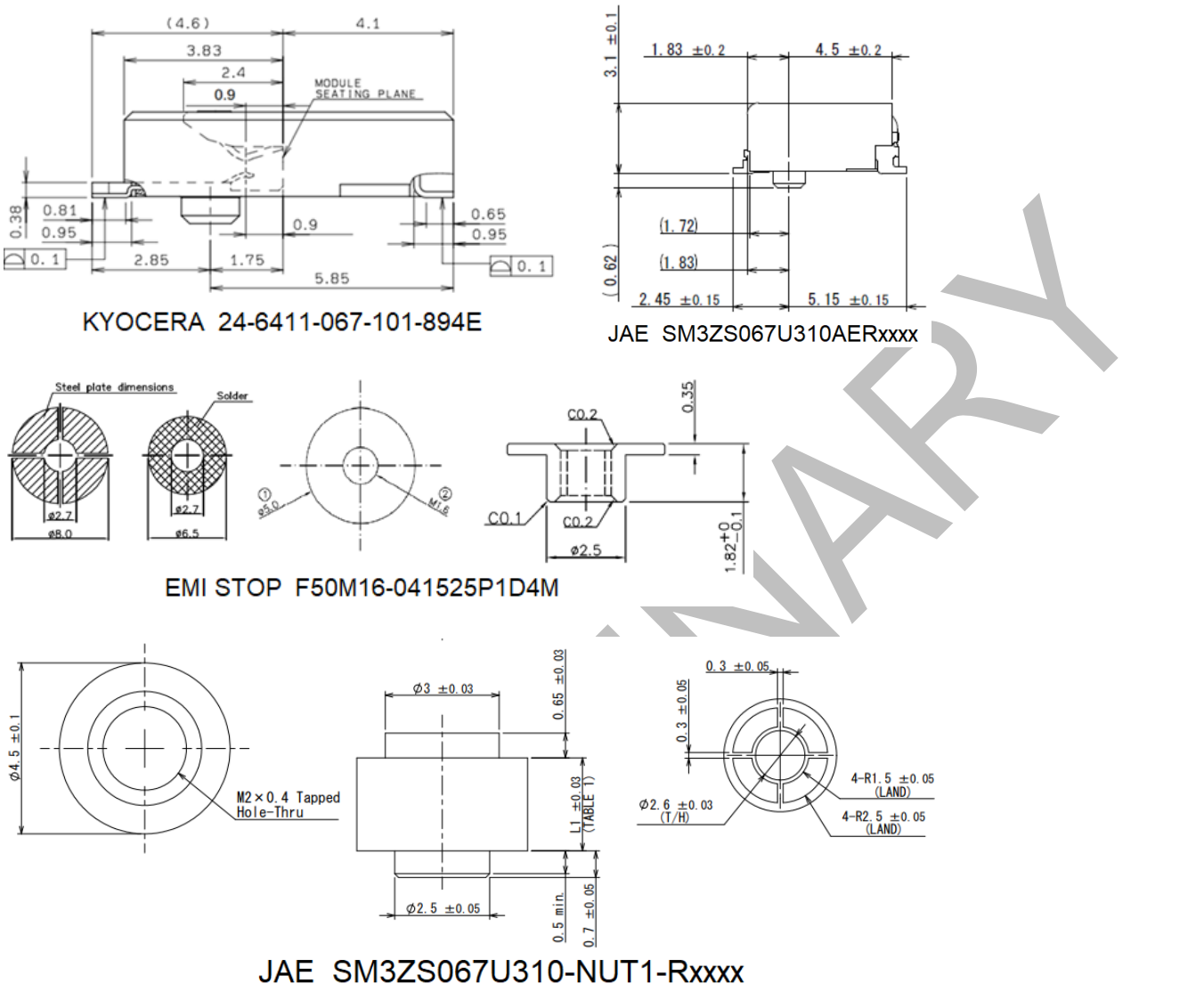


***Figure 24: M.2 2230 E-Key connector/standoff mounting***





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# 15 RF Layout Design Guidelines

The following is a list of RF layout design guidelines and recommendation when installing a Laird Connectivity radio into your device.

- Do not run antenna cables directly above or directly below the radio.
- Do not place any parts or run any high-speed digital lines below the radio.
- Ensure that there is the maximum allowable spacing separating the antenna connectors on the Laird Connectivity radio from the antenna. In addition, do not place antennas directly above or directly below the radio.
- Laird Connectivity recommends the use of a double-shielded cable for the connection between the radio and the antenna elements.
- Be sure to put a 10uF/16V/0603 capacitor on EACH 3.3V power pin. Place the capacitor as close as possible to the pin to ensure correct PMU operation.
- Use proper electro-static-discharge (ESD) procedures when installing the Laird Connectivity radio module. To avoid negatively impacting Tx power and receiver sensitivity, do not cover the antennas with metallic objects or components.

# 16 Application Notes

## 16.1 Introduction

Laird Connectivity's surface mount modules are designed to conform to all major manufacturing guidelines. This application note is intended to provide additional guidance beyond the information that is presented in the user manual. This application note is considered a living document and will be updated as new information is presented.

The modules are designed to meet the needs of several commercial and industrial applications. They are easy to manufacture and conform to current automated manufacturing processes.





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## 16.2 Shipping and Labelling

### 16.2.1 M.2 1218 Solder-Down

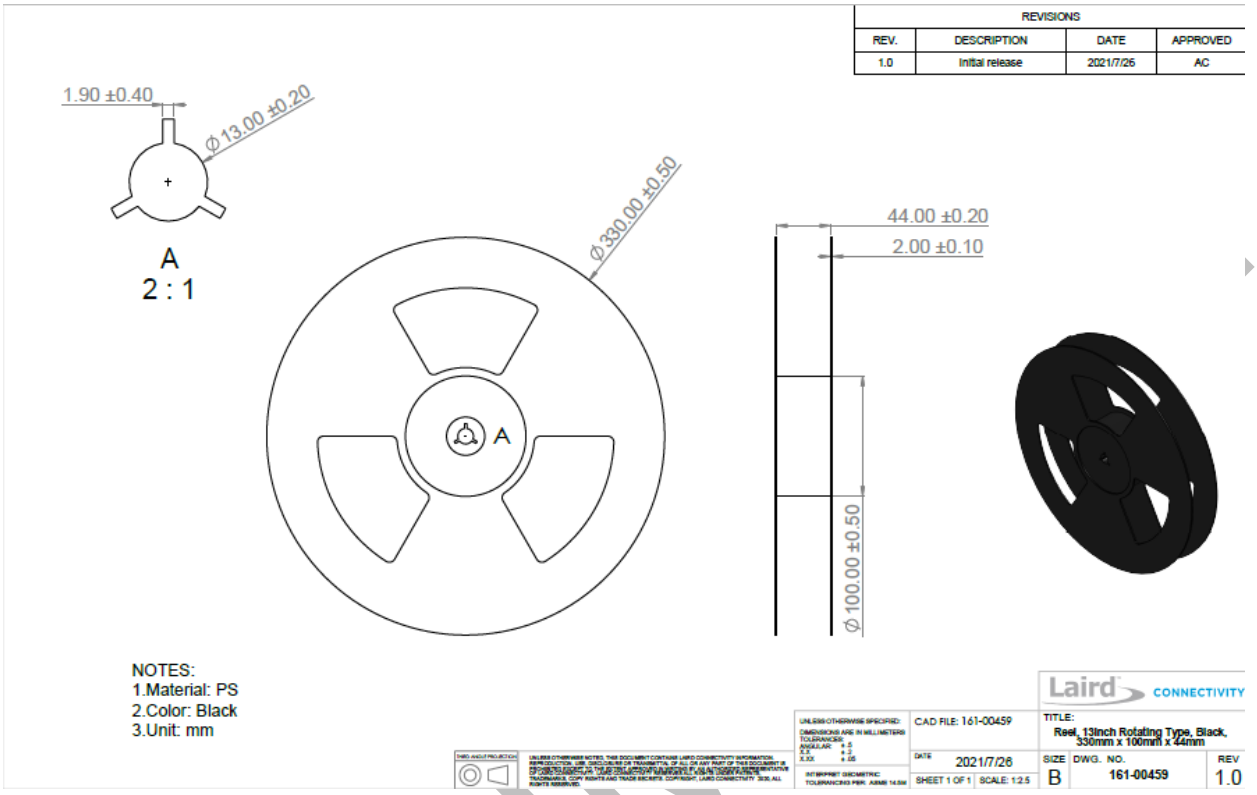


***Figure 25: Sona IF573 Reel specifications, 161-00459: Sona IF573 Reel specifications, 161-00459***





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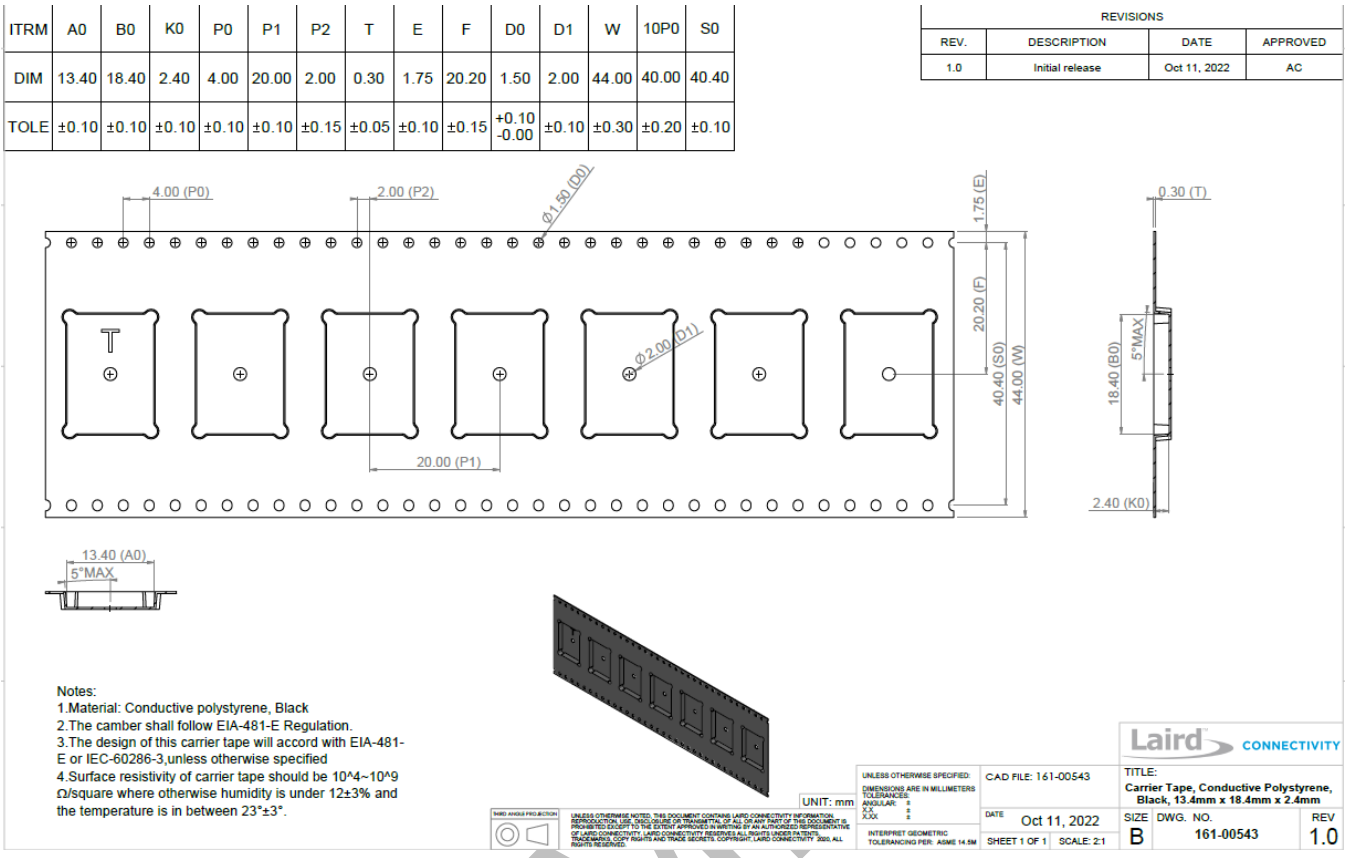


***Figure 26: Sona IF573 Tape specifications, 161-00543***

There are 1,000 Sona IF573 modules taped in a reel (and packaged in a pizza box) and three boxes per carton (3,000 modules per carton). Reel, boxes, and carton are labeled with the appropriate labels. See Figure 27 for more information.





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| ITEM NO. | PART NUMBER | REV. | DESCRIPTION | QTY. |
|---|---|---|---|---|
| 1 | 453-00117 | 1.0 | Module, Sona IF573, MIMO, MHF4 | 1000 |
| 2 | 161-00543 | 1.0 | Carrier Tape, Conductive Polystyrene, Black, 13.4mm x 18.4mm x 2.4mm | 1 |
| 3 | 161-00528 | 1.0 | Cover Tape, Anti-static Polyester, 37.5mm x 0.05mm | 1 |
| 4 | 161-00506 | 1.0 | Desiccant, Silica Gel, 66g, 110mm x 120mm | 1 |
| 5 | 161-00510 | 1.0 | Humidity Indicator Card, Minimum 60% RH, Three Spot Indication, 75mm x 50mm, J-STD-033 Rev D | 1 |
| 6 | 161-00544 | 1.0 | Bag, ESD and Moisture Barrier, Silver, 420mm x 475mm x 0.15mm | 1 |
| 7 | 160-02008 | 1.1 | Label, Blank Moisture Sensitivity Level, 4in x 4in | 1 |
| 8 | 161-00507 | 1.0 | Box, Single-Wall Corrugated E Flute, 362mm x 344mm x 83mm | 1 |
| 9 | 161-00459 | 1.0 | Reel, 13inch Rotating Type, Black, 330mm x 100mm x 44mm | 1 |
| 10 | 161-00508 | 1.0 | Carton, AB Flute, 365mm x 383mm x 279mm | 1 |
| 11 | 160-02371 | 1.0 | Label, Product Identifier, Sona IF573, 89mm x 51mm | 3 |
| 12 | 160-02372 | 1.0 | Label, Carton Product Identifier, Sona IF573, 101mm x 64mm | 2 |

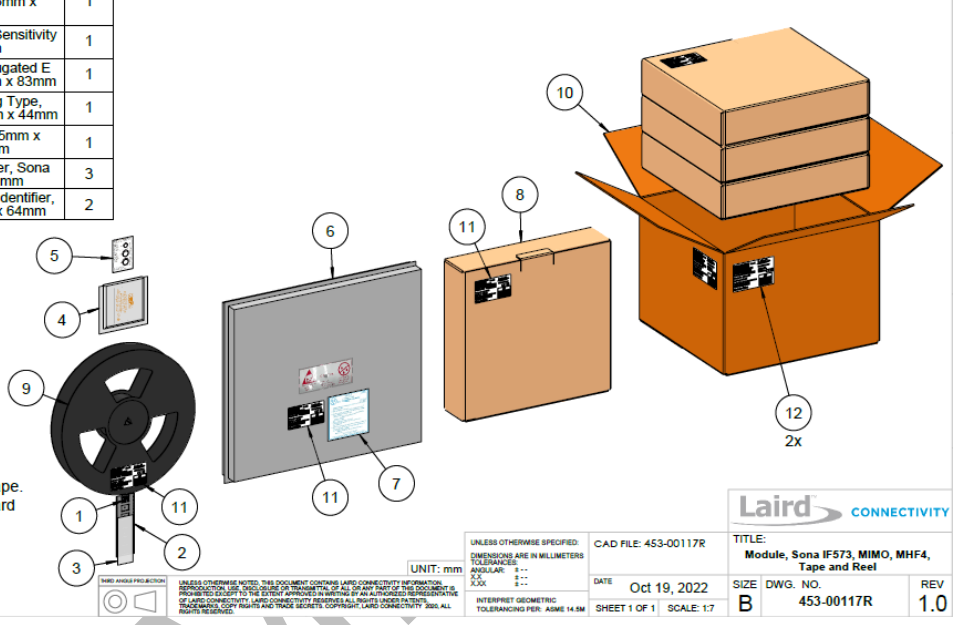


***Figure 27: Sona IF573 packaging processes, 453-00117R***





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The following labels are located on the antistatic bag.

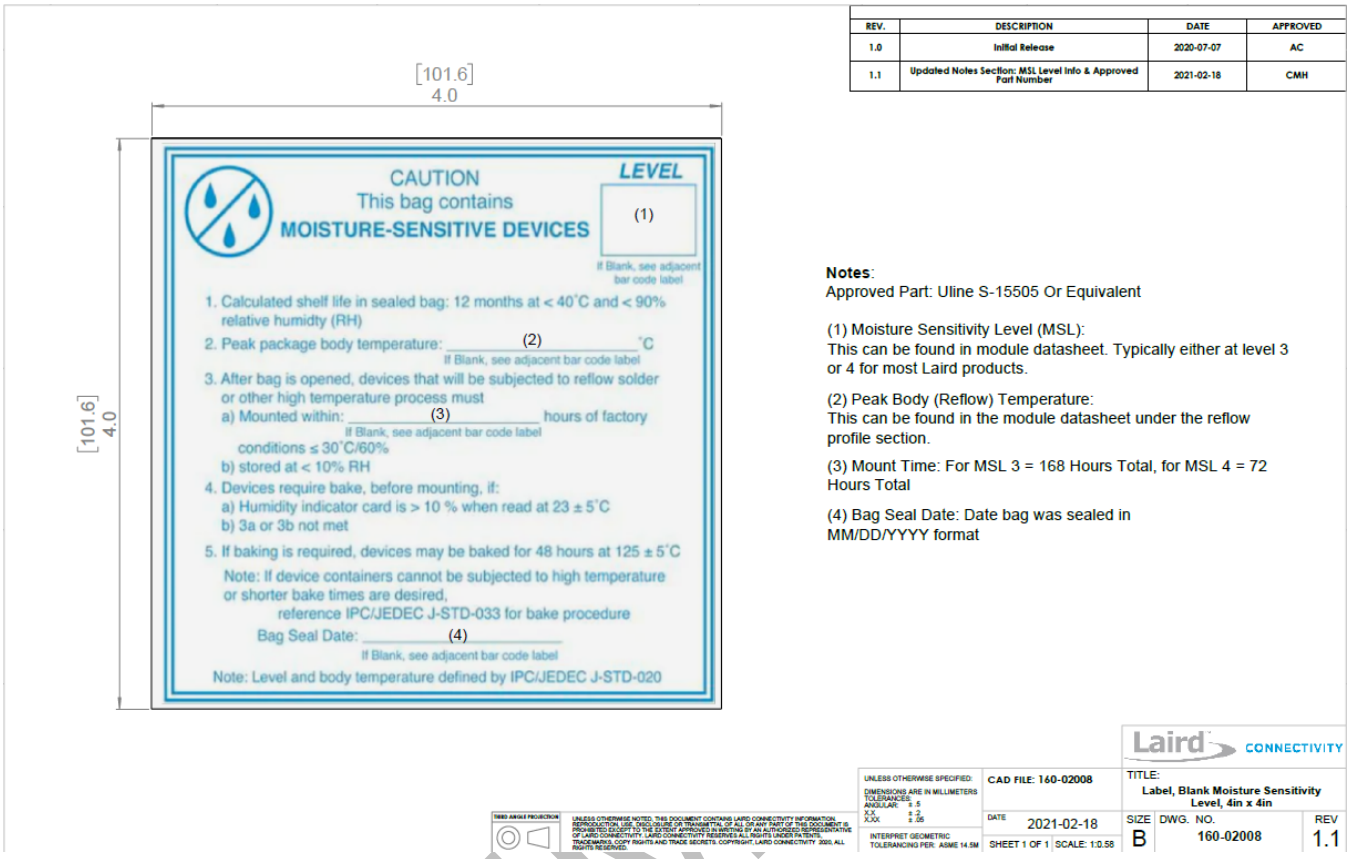


***Figure 28: Sona IF573 Moisture Sensitivity Level Label, 160-02008***





**Americas**: +1-800-492-2320
**Europe**: +44-1628-858-940
**Hong Kong**: +852-2762-4823

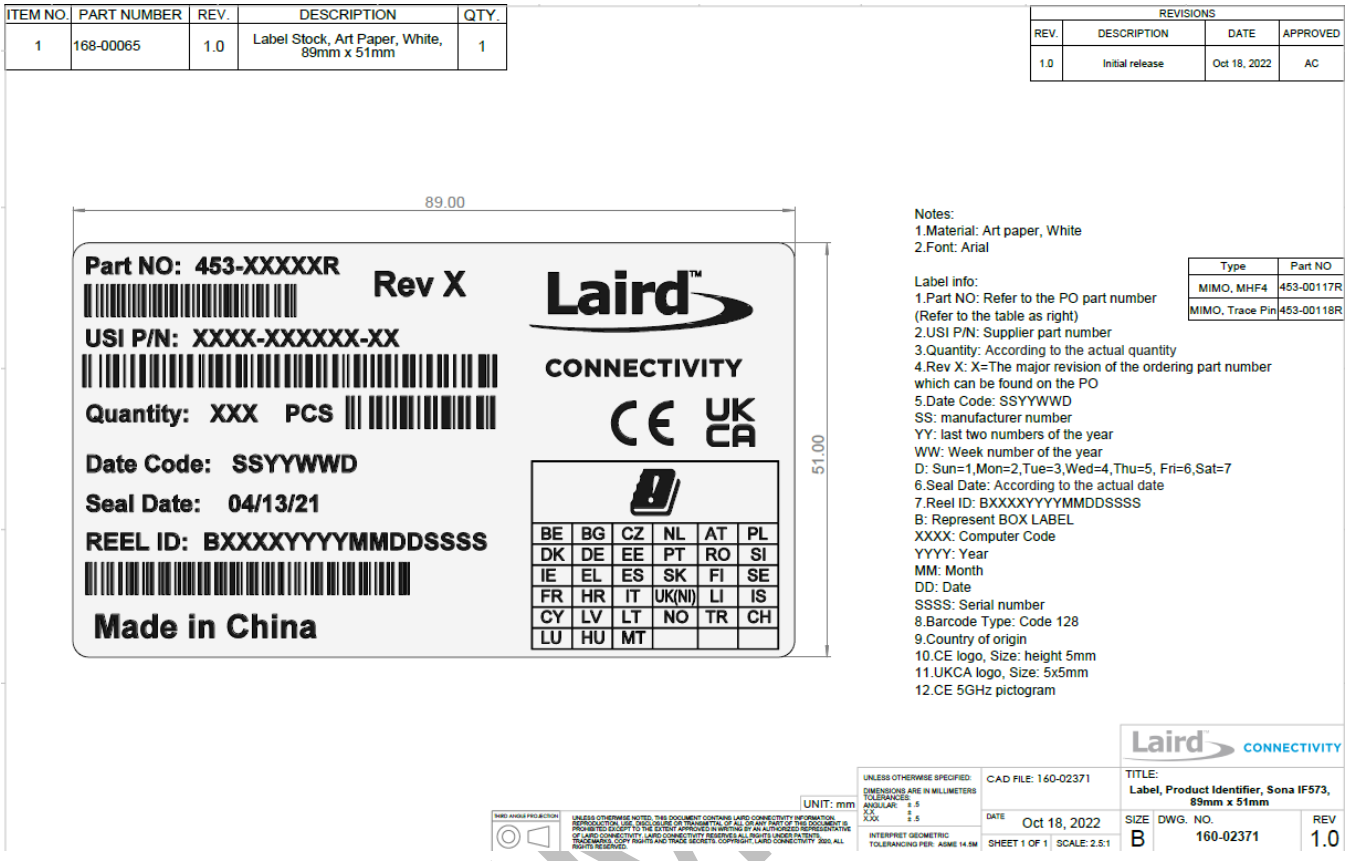


***Figure 29: Sona IF573 Bag and Box Product Identifier Label, 160-02371***





**Americas**: +1-800-492-2320
**Europe**: +44-1628-858-940
**Hong Kong**: +852-2762-4823

The following label is located on the pizza box.

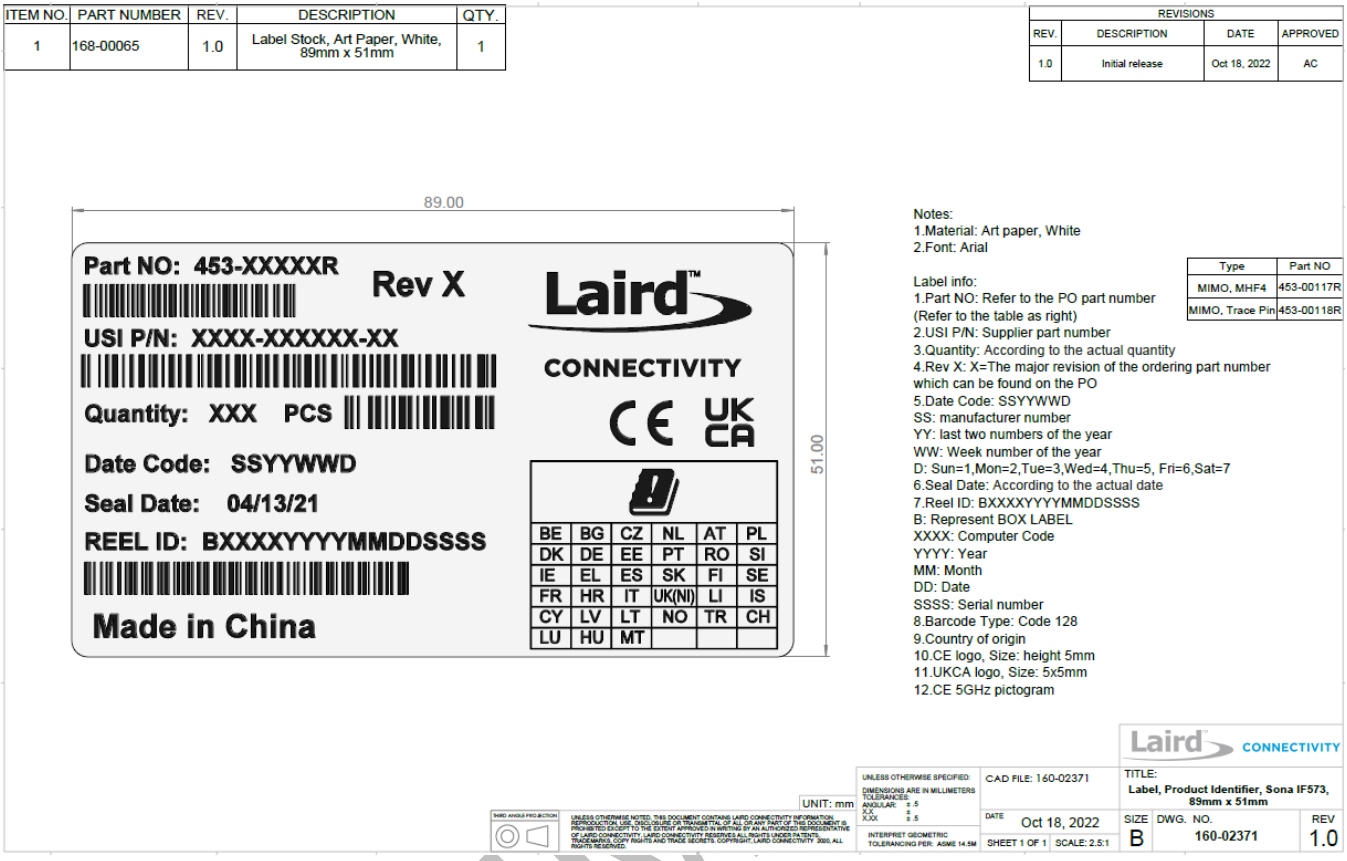


***Figure 30: Sona IF573 Bag and Box Product Identifier Label, 160-02371***





**Americas**: +1-800-492-2320
**Europe**: +44-1628-858-940
**Hong Kong**: +852-2762-4823

The following package label is located on adjacent sides of the master carton.

| ITEM NO. | PART NUMBER | REV. | DESCRIPTION | QTY. |
|---|---|---|---|---|
| 1 | 168-00066 | 1.0 | Label Stock, Art Paper, White, 101mm x 64mm | 1 |

| REVISIONS | | | |
|---|---|---|---|
| REV. | DESCRIPTION | DATE | APPROVED |
| 1.0 | Initial release | Oct 18, 2022 | AC |


Notes:
1.Material: Art paper, White
2.Font: Arial

Label info:
1.Part NO: Refer to the PO part number (Refer to the table as right)

| Type | Part NO |
|---|---|
| MIMO, MHF4 | 453-00117R |
| MIMO, Trace Pin | 453-00118R |

2.USI P/N: Supplier part number
3.Quantity: According to the actual quantity
4.Rev X: X=The major revision of the ordering part number which can be found on the PO
5.Date Code: SSYYWWD
SS: manufacturer number
YY: last two numbers of the year
WW: Week number of the year
D: Sun=1,Mon=2,Tue=3,Wed=4,Thu=5, Fri=6,Sat=7
6.Seal Date: According to the actual date
7.Carton NO: CXXXXYYYYMMDDSSSS
C: Represent Carton LABEL
XXXX: Computer Code
YYYY: Year
MM: Month
DD: Date
SSSS: Serial number
8.Barcode Type: Code 128
9.Country of origin
10.CE logo, Size: height 5mm
11.UKCA logo, Size: 5x5mm
12.CE 5GHz pictogram
13.Laird connectivity address

Laird CONNECTIVITY

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS TOLERANCES: ANGULAR: ± .5 X.X ± .5 X.XX ± .5 INTERPRET GEOMETRIC TOLERANCING PER: ASME 14.5M
UNIT: mm
CAD FILE: 160-02372
DATE: Oct 18, 2022
SHEET 1 OF 1
SCALE: 2:1
TITLE: Label, Carton Product Identifier, Sona IF573, 101mm x 64mm
SIZE: B
DWG. NO.: 160-02372
REV: 1.0



***Figure 31: Sona IF573 Carton Product Identifier Label, 160-0273***





**Americas**: +1-800-492-2320
**Europe**: +44-1628-858-940
**Hong Kong**: +852-2762-4823