Datasheet

Sona™ NX611 Modules

Version 0.2

Revision History

Version	Date	Notes	Contributors	Approver
0.1	23 March 2023	Preliminary version	PGS	Andy Ross
0.2	04 June 2024	Updated RF Characteristics	Brian Petted	Andy Ross

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1 Scope

This document describes key hardware aspects of the Ezurio Sona™NX61X series wireless modules providing either SDIO for WLAN connection and UART/PCM 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 NXP NX611 and NX612 data sheets along with other documents provided from NXP.

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

2 General description

The Sona™NX61x series wireless modules are highly integrated 2.4/5 GHz dual-band 1x1 Wi-Fi 6, Bluetooth/Bluetooth Low Energy 5.4 single-chip solution optimized for a broad array of IoT and industrial applications.

This device is pre-calibrated and integrates the complete transmit/receive RF paths including diplexer, LNA's, RF switches, reference crystal oscillator, and power management units (PMU).

Sona™NX611 include a full-feature Wi-Fi subsystem powered by NXP's 802.11ax (Wi-Fi 6) technology bringing higher throughput, better network efficiency, lower latency, and improved range over previous generation Wi-Fi standards. The Wi-Fi subsystem integrates a Wi-Fi MAC, baseband, and direct-conversion radio with integrated PA, LNA, and transmit/receive switch removing the need for an RF front end module (FEMs), saving cost, and reducing system complexity.

The SONA™NX611 series wireless modules include several product SKUs with different form factor, integration levels and RF paths. Please contact Ezurio Sales/FAE for further information. Ordering information is listed in Table 1.

Table 1: Product ordering information

Part Number	Description
453-00155R	Module, Sona NX611 SIP, 2 RF Trace Pin, Tape and Reel
453-00155C	Module, Sona NX611 SIP, 2 RF Trace Pin, Cut Tape
453-00156R	Module, Sona NX611 SIP, 1 RF Trace Pin, Tape and Reel
453-00156C	Module, Sona NX611 SIP, 1 RF Trace Pin, Cut Tape
453-00157R	Module, Sona NX611 M.2 1216, 2 MHF4, Tape and Reel
453-00157C	Module, Sona NX611 M.2 1216, 1 MHF4, Cut Tape
453-00158R	Module, Sona NX611 M.2 1216, 1 MHF4, Tape and Reel
453-00158C	Module, Sona NX611 M.2 1216, 1 MHF4, Cut Tape
453-00165	Module, Sona NX611 M.2 2230, 2 MHF4
453-00166	Module, Sona NX611 M.2 2230, 1 MHF4
453-00180R	Module, Sona NX611, 1218, Integrated Antenna, Tape and Reel
453-00180C	Module, Sona NX611, 1218, Integrated Antenna, Cut Tape
453-00155-K1	Development Kit, Module, Sona NX611 SIP, 2 RF Trace Pin
453-00156-K1	Development Kit, Module, Sona NX611 SIP, 1 RF Trace Pin
453-00165-K1	Development Kit, Module, Sona NX611 M.2 2230, 2 MHF4
453-00166-K1	Development Kit, Module, Sona NX611 M.2 2230, 1 MHF4

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3 Key Features Summary

3.1 Wi-Fi key features

- IEEE 802.11a/b/g/n/ac/ax, 1x1 SISO 2.4 GHz and 5 GHz, up to 80 MHz channel bandwidth
- Peak data rates up to 480 Mbps
- Integrated high power PA up to +21 dBm transmit power
- Integrated LNA and T/R switches
- UL/DL OFDMA
- 802.11ax TWT (station only)
- 802.11ax ER, DCM
- WPA2 and WPA3 personal and enterprise security
- Support for Matter over Wi-Fi

3.2 Bluetooth key features

- Supports Bluetooth 5.2 (Class 1/Class 2) and Bluetooth Low Energy features
- Bluetooth 5.4 Certified
- Integrated high power PA up to +19 dBm transmit power for Bluetooth LE and BDR1，2，3
- Integrated high power PA up to +10 dBm transmit power for EDR
- BDR/EDR packet types—1 Mbps (GFSK), 2 Mbps (/4-DQPSK), 3 Mbps (8DPSK)
- Bluetooth LE long range (125/500 kbps) support
- Bluetooth LE 2 Mbps
- Bluetooth LE advertising extensions for improved capacity
- Isochronous channels (ISOC) supporting LE Audio and Auracast™ Broadcast Audio

3.3 Operating characteristics

- Supply voltage:
  - SIP - 3.3V and 1.8V
  - 1216 – 3.3V
  - 2230 – 3.3V
- Operating temperature: -40 to 85°C
- Storage temperature: -55 to 125°C

3.4 General features

- Package options
  - SIP 76 Pin LGA – 11 mm x 11 mm
  - 1216 96 Pin LGA– 12mm x 16 mm
  - 2230 75 Pin PCie M.2 – 22mm x 30 mm
- Simultaneous Wi-Fi, Bluetooth receive
  - Single and dual antenna/RF Pad configurations supported.
- • Simultaneous Wi-Fi and Bluetooth transmit
  - Dual antenna/RF pad configuration supported.
- • Coexistence
  - Internal coexistence between Wi-Fi and Bluetooth
  - External coexistence interface for connection to external radios such as LTE
- • Power management
  - Efficient power management system
  - Deep-sleep low-power mode
  - Integrated high-efficiency buck DC-DC converter.
  - Wake-up through GPIO, host interface, and RTC
- • One Time Programmable (OTP) memory to store the MAC address and calibration data
- • Security
  - Hardware root of trust
  - Authenticated and secured boot.
  - OTP-based life-cycle state support

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3.5 Internal block diagrams

3.5.1 Sona NX611 SIP- 2 RF Trace Pin

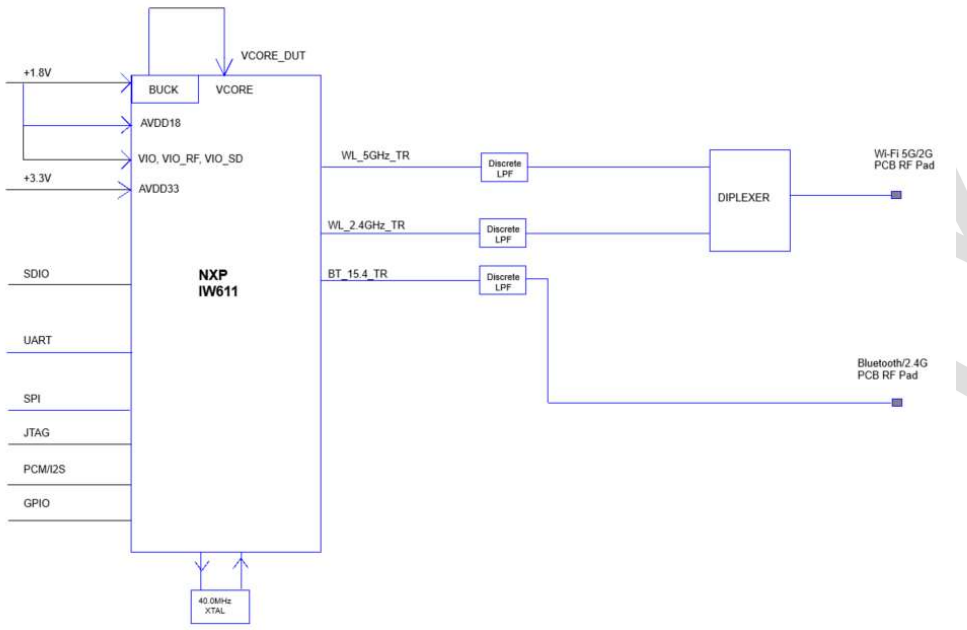

Figure 1: Sona NX611 SIP- 2 RF Trace Pin

3.5.2 Sona NX611 SIP- 1 RF Trace Pin

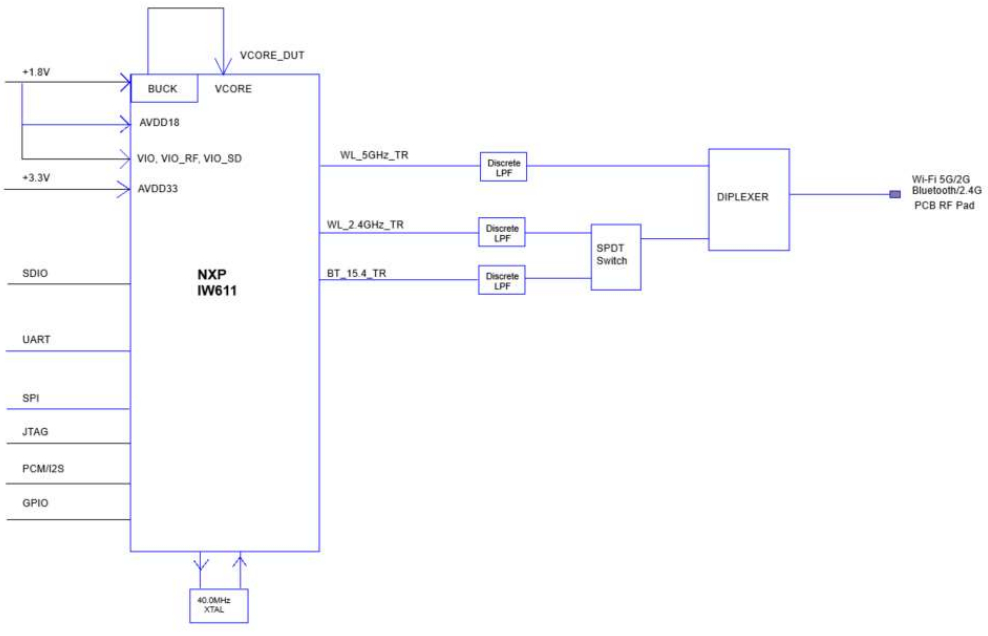

Figure 2: Sona NX611 SIP- 1 RF Trace Pin

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3.5.3 Sona NX611 1216 - 2 Trace Pin/MH4 Connector

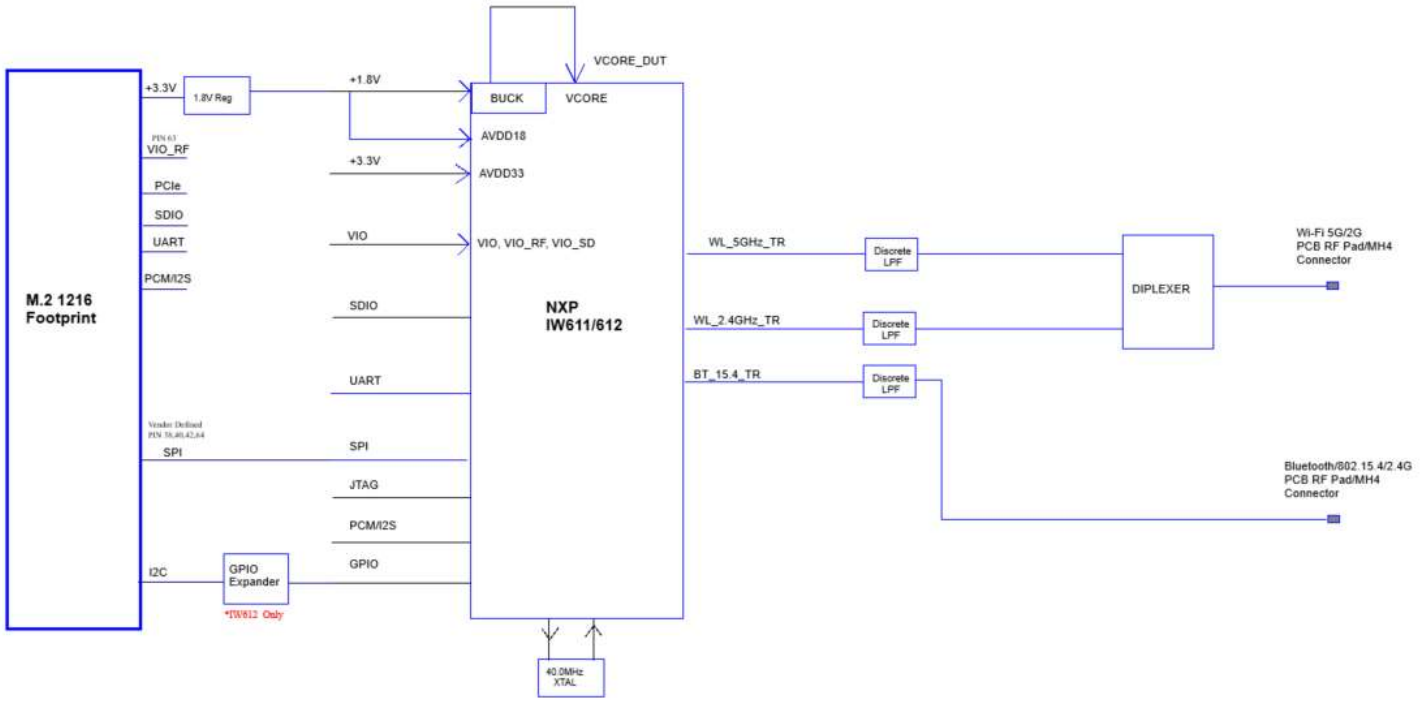

Figure 3: Sona NX611 1216 2 RF Trace Pin/MH4 Connector

3.5.3.1 Sona NX611 1216- 1 RF Trace Pin/MH4 Connector

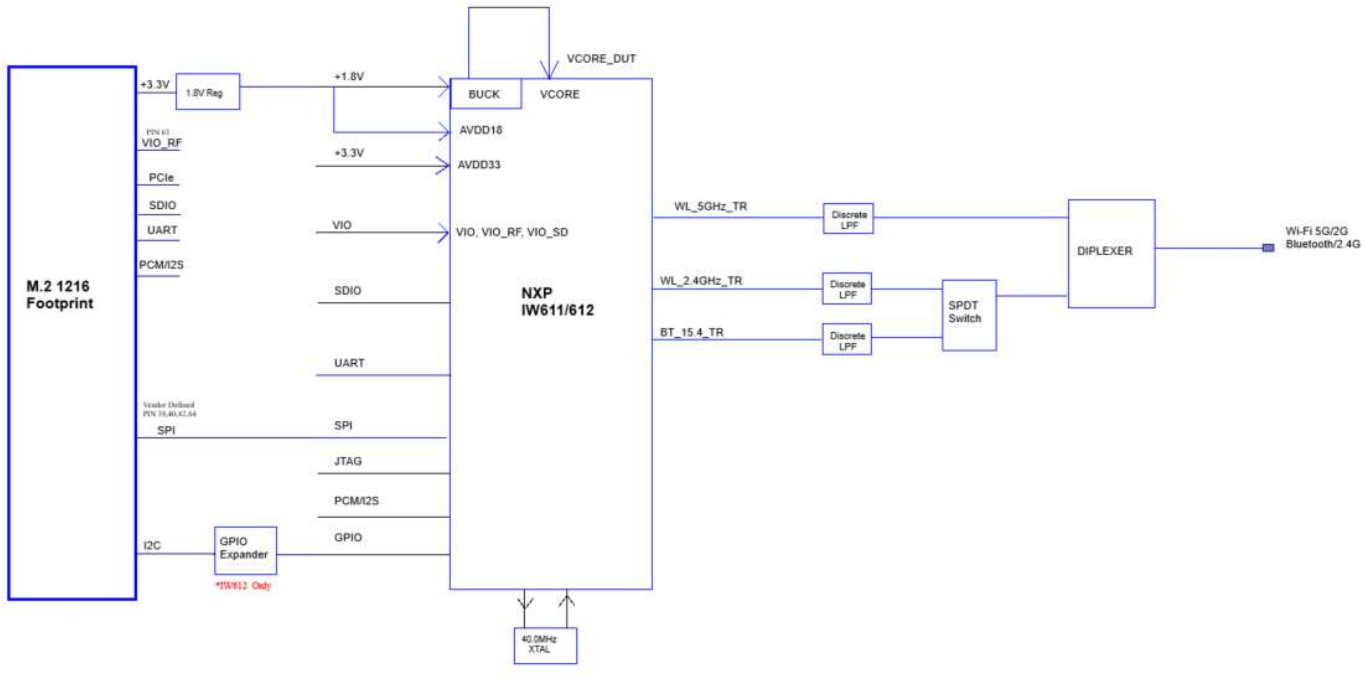

Figure 4: Sona NX611 1216 1 RF Trace Pin/MH4 Connector

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3.5.3.2 Sona NX611 1218 Chip Antenna

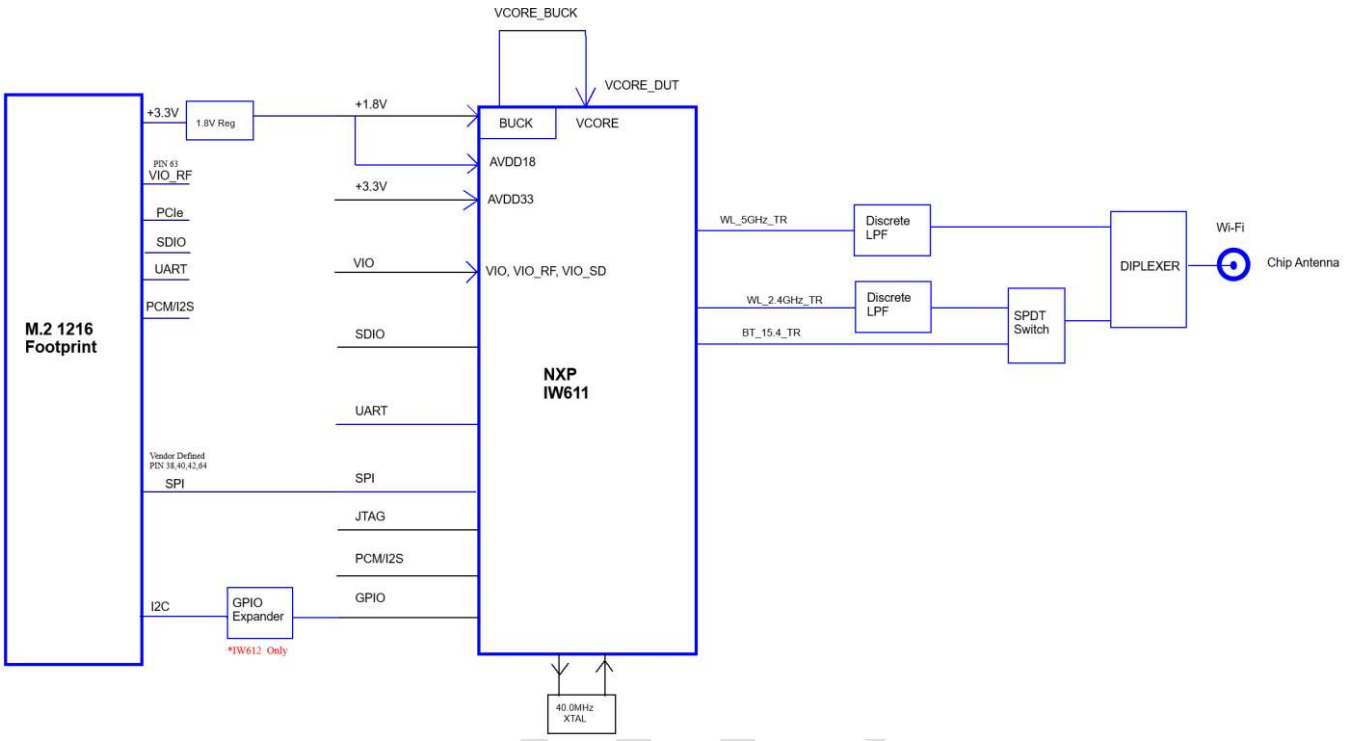

Figure 5: Sona NX611 1218 Chip Antenna

3.5.3.3 Sona NX611 M.2 2230- 2 MH4 Connector

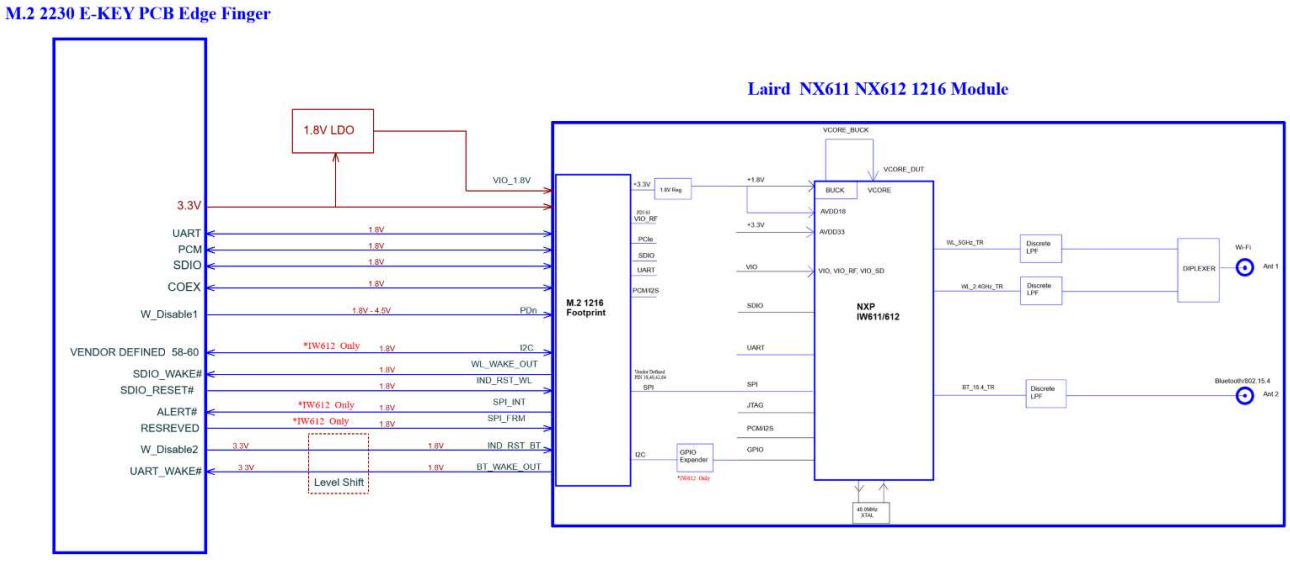

Figure 6: Sona NX611 M.2 2230 -2 MH4 Connector

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3.5.3.4 Sona NX611 M.2 2230- 1 MH4

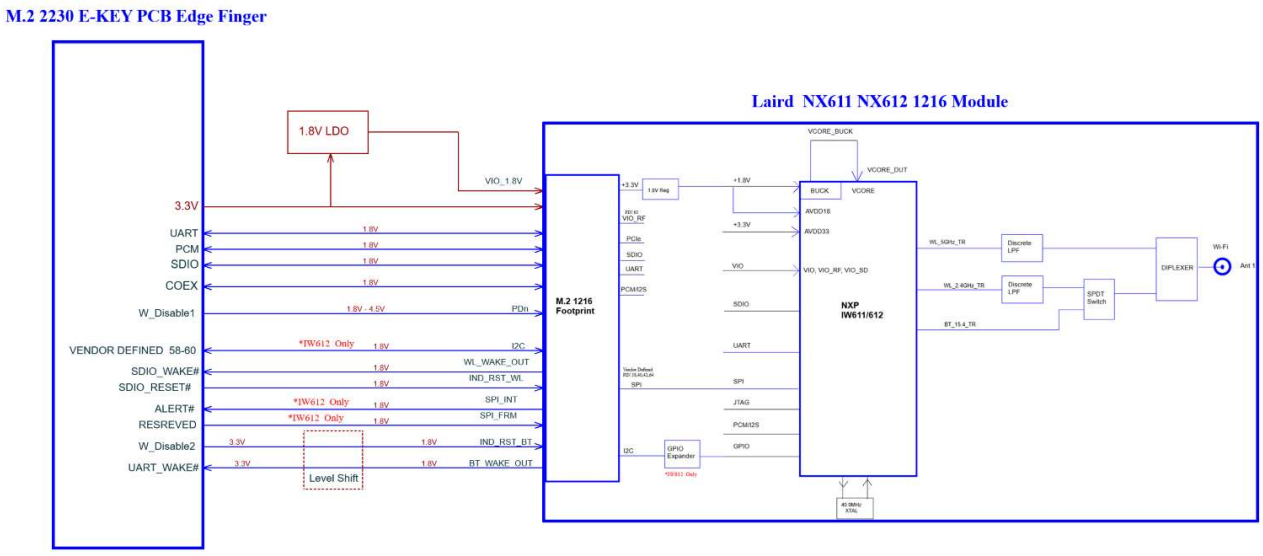

Figure 7: Sona NX611 M.2 2230 -1 MH4 Connector

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4 Pin Information

4.1 Pin List Sona NX611 SIP Package

Table 2: Pin List Sona NX611 SIP

Pin #	Pin Name	Description
1	GND	Ground
2	VIO_SD	SDIO Power Supply
3	GND	Ground
4	SD_CMD	SD Command/response (input/output)
5	SD_CLK	SD Clock input
6	SD_DAT[1]	SD Data line bit[1]
7	SD_DAT[3]	SD Data line bit[3]
8	GND	Ground
9	SD_DAT[2]	SD Data line bit[2]
10	SD_DAT[0]	SD Data line bit[0]
11	GPIO[21]/SD_INT	SDIO interrupt signal (output).
12	BUCK_SENSE	Internal buck voltage. (for troubleshooting only)
13	VIO	1.8V/3.3V digital I/O power supply
14	GPIO[8]/UART_CTS	UART clear-to-send input signal (active low)
15	GPIO[10]/UART_RX	UART serial input signal.
16	GPIO[9]/UART_RTS	UART request-to-send output signal (active low).
17	GPIO[11]/UART_TX	UART serial output signal.
18	GPIO[13]/EXT_REQ	External radio request input signal (COEX)
19	GPIO[12]/EXT_STATE	External radio state input signal (COEX)
20	GND	Ground
21	GPIO[14]/EXT_GNT	External radio grant output signal (COEX)
22	GPIO[15]/EXT_PRI	External radio input priority signal (COEX)
23	GPIO[0]/XOSC_EN	Oscillator enable (output)
24	GPIO[20]/EXT_FREQ	External radio frequency input signal (COEX)
25	CONFIG_HOST[1]	NC
26	CONFIG_HOST[0]	NC
27	GND	Ground
28	GPIO[4]/PCM_CLK	PCM data clock (output if master, input if slave)
29	GPIO[3]/PCM_MCLK	PCM clock output signal (optional)
30	GPIO[5]/PCM_DOUT	PCM transmit data signal (output)
31	GPIO[6]/PCM_DIN	PCM receive data signal (input)
32	GPIO[7]/PCM_SYNC	PCM frame sync (output if master, input if slave)
33	GPIO[2]/IND_RST_BT	Independent software reset for Bluetooth (input)
34	GPIO[1]/IND_RST_WL	Independent software reset for Wi-Fi (input)
35	GND	Ground

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36	AVDD18	1.8V analog power supply
37	AVDD18	1.8V analog power supply
38	GND	Ground
39	GND	Ground
40	PDn	Full Power-down (input) (active low)
41	GND	Ground
42	GND	Ground
43	GND	Ground
44	RF_TR_5	Wi-Fi transmit/receive (5 GHz)
45	GND	Ground
46	AVDD33	3.3V analog power supply
47	AVDD33	3.3V analog power supply
48	GND	Ground
49	GND	Ground
50	GND	Ground
51	GND	Ground
52	BRF_ANT	Bluetooth radio transmit/receive interface
53	GND	Ground
54	GND	Ground
55	GND	Ground
56	GPIO[26]/WCI-2_SOUT	Receive signal from external radio (input) (COEX)
57	GPIO[25]/WCI-2_SIN	Transmit signal to external radio (output) (COEX)
58	GND	Ground
59	RF_CNTL4	RF control line 4
60	RF_CNTL3	RF control line 3
61	RF_CNTL2	RF control line 2
62	RF_CNTL1	RF control line 1
63	RF_CNTL0	RF control line 0
64	GPIO[18]/BT_WAKE_IN	
65	GPIO[19]/BT_WAKE_OUT	Bluetooth wake-up signal (output).
66	GPIO[17]/WL_WAKE_OUT	Wi-Fi radio wake-up signal (output).
67	GPIO[16]/WL_WAKE_IN	Wi-Fi radio wake-up signal (input)
68	GND	Ground
69	GPIO[22]	I/O
70	GPIO[23]	I/O
71	GPIO[24]	I/O
72	GPIO[27]	I/O
73	GPIO[29]/JTAG_TMS	JTAG controller select (input)
74	GPIO[31]/JTAG_TDO	JTAG test data signal (output)
75	GPIO[28]/JTAG_TCK	JTAG test clock signal (input)

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76	GPIO[30]/JTAG_TDI	JTAG test data signal (input)
G1	GND	Ground

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4.2 Pin List Sona NX611 1216 and 1218 Chip Antenna Package

Table 3: Pin List Sona NX611 1216/1218 Chip Antenna

Pin #	PCIe M.2 Name	Pin Name NX611 1216	Pin Name NX611 1218	Comment
1	UIM_POWER_SRC/GPIO1	UNUSED	UNUSED	NO CONNECTION
2	UIM_POWER_SNK	UNUSED	UNUSED	NO CONNECTION
3	UIM_SWP	UNUSED	UNUSED	NO CONNECTION
4	3.3V	3.3V	3.3V	
5	3.3V	3.3V	3.3V	
6	GND	Ground	Ground	
7	RESERVED	UNUSED	UNUSED	NO CONNECTION
8	ALERT#	UNUSED	UNUSED	NO CONNECTION
9	I2C_CLK	UNUSED	UNUSED	NO CONNECTION
10	I2C_DATA	UNUSED	UNUSED	NO CONNECTION
11	COEX_RXD	COEX_RXD	COEX_RXD	
12	COEX_TXD	COEX_TXD	COEX_TXD	
13	COEX3	UNUSED	UNUSED	
14	SYSCLK/GNSS_0	UNUSED	UNUSED	
15	TX_BLANKING/GNSS_1	UNUSED	UNUSED	
16	RESERVED	UNUSED	UNUSED	
17	GND	Ground	Ground	
18	RESERVED	UNUSED	UNUSED	
19	RESERVED	UNUSED	UNUSED	
20	GND	Ground	Ground	
21	PETn1	UNUSED	UNUSED	
22	PETp1	UNUSED	UNUSED	
23	GND	Ground	Ground	
24	PERn1	UNUSED	UNUSED	
25	PERp1	UNUSED	UNUSED	
26	GND	Ground	Ground	
27	SUSCLK(32kHz)	UNUSED	UNUSED	
28	W_DISABLE1#	PDn	PDn	
29	PEWAKE#	UNUSED	UNUSED	
30	CLKREQ#	UNUSED	UNUSED	
31	PERST#	UNUSED	UNUSED	
32	GND	Ground	Ground	
33	REFCLKn0	UNUSED	UNUSED	
34	REFCLKp0	UNUSED	UNUSED	
35	GND	Ground	Ground	

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36	PETn0	UNUSED	UNUSED	
37	PETp0	UNUSED	UNUSED	
38	GND	Ground	Ground	
39	PERn0	UNUSED	UNUSED	NO CONNECTION
40	PERp0	UNUSED	UNUSED	NO CONNECTION
41	GND	Ground	Ground	
42	VENDOR DEFINED	EXT_PRI	EXT_PRI	
43	VENDOR DEFINED	BT_WAKE_IN	BT_WAKE_IN	
44	VENDOR DEFINED	WL_WAKE_IN	WL_WAKE_IN	
45	SDIO RESET#	IND_RST_WL	IND_RST_WL	
46	SDIO WAKE#	WL_WAKE_OUT	WL_WAKE_OUT	
47	SDIO DATA3	SDIO DATA3	SDIO DATA3	
48	SDIO DATA2	SDIO DATA2	SDIO DATA2	
49	SDIO DATA1	SDIO DATA1	SDIO DATA1	
50	SDIO DATA0	SDIO DATA0	SDIO DATA0	
51	SDIO CMD	SDIO CMD	SDIO CMD	
52	SDIO CLK	SDIO CLK	SDIO CLK	
53	UART WAKE#	BT_WAKE_OUT	BT_WAKE_OUT	
54	UART CTS	UART CTS	UART CTS	
55	UART Tx	UART Tx	UART Tx	
56	UART Rx	UART Rx	UART Rx	
57	UART RTS	UART RTS	UART RTS	
58	PCM_SYNC/I2S_WS	PCM_SYNC/I2S_WS	PCM_SYNC/I2S_WS	
59	PCM_IN/I2S_SD_IN	PCM_IN/I2S_SD_IN	PCM_IN/I2S_SD_IN	
60	PCM_OUT/I2S_SD_OUT	PCM_OUT/I2S_SD_OUT	PCM_OUT/I2S_SD_OUT	
61	PCM_CLK/I2S_SCK	PCM_CLK/I2S_SCK	PCM_CLK/I2S_SCK	
62	GND	Ground	Ground	
63	W_DISABLE2#	IND_RST_BT	IND_RST_BT	
64	LED_2#	UNUSED	UNUSED	NO CONNECTION
65	LED_1#	UNUSED	UNUSED	NO CONNECTION
66	RESERVED/VIO_1.8	VIO_1.8	VIO_1.8	
67	RESERVED	UNUSED	UNUSED	NO CONNECTION
68	GND	Ground	Ground	
69	USB_D-	UNUSED	UNUSED	NO CONNECTION
70	USB_D+	UNUSED	UNUSED	NO CONNECTION
71	GND	Ground	Ground	
72	3.3V	3.3V	3.3V	
73	3.3V	3.3V	3.3V	
74	GND	Ground	Ground	

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75	GND	Ground	Ground	
76	GND/VIO_CFG	UNUSED	UNUSED	NO CONNECTION
77	GND	Ground	NA	No Pin On 1218 Module
78	GND	Ground	NA	No Pin On 1218 Module
79	GND	Ground	NA	No Pin On 1218 Module
80	GND	Ground	NA	No Pin On 1218 Module
81	WL_C2	UNUSED	NA	No Pin On 1218 Module
82	GND	Ground	NA	No Pin On 1218 Module
83	GND	Ground	NA	No Pin On 1218 Module
84	GND	Ground	NA	No Pin On 1218 Module
85	GND	Ground	NA	No Pin On 1218 Module
86	WL_C0	UNUSED	NA	No Pin On 1218 Module
87	GND	Ground	NA	No Pin On 1218 Module
88	GND	Ground	NA	No Pin On 1218 Module
89	GND	Ground	NA	No Pin On 1218 Module
90	GND	Ground	NA	No Pin On 1218 Module
91	GND	Ground	NA	No Pin On 1218 Module
92	WL_C1	UNUSD	NA	No Pin On 1218 Module
93	GND	Ground	NA	No Pin On 1218 Module
94	GND	Ground	NA	No Pin On 1218 Module
95	GND	Ground	NA	No Pin On 1218 Module
96	GND	Ground	NA	No Pin On 1218 Module
G1	GND	Ground	Ground	

4.3 Pin List Sona NX61x M.2 2230 Key E Module

Table 4: NX611 M.2 2230 Key E Pin Definition

Pin #	PCIe M.2 2230 Name	Pin Name NX611 2230	Comment
1	GND	GND	
2	3.3 V	3.3 V	
3	USB_D+	UNUSED	Do Not Connect
4	3.3 V	3.3 V	
5	USB_D-	UNUSED	Do Not Connect
6	LED_1# (I) (OD)	UNUSED	Do Not Connect
7	GND	GND	
8	PCM_CLK/I2S_SCK (I/O) (0/1.8V)	PCM_CLK/I2S_SCK (I/O) (0/1.8V)	
9	SDIO_CLK/SYSCLK (I) (0/1.8V)	SDIO_CLK/SYSCLK (I) (0/1.8V)	
10	PCM_SYNC/I2S_WS (I/O) (0/1.8V)	PCM_SYNC/I2S_WS (I/O) (0/1.8V)	
11	SDIO_CMD (I/O) (0/1.8V)	SDIO_CMD (I/O) (0/1.8V)	
12	PCM_OUT/I2S_SD_OUT (O) (0/1.8V)	PCM_OUT/I2S_SD_OUT (O) (0/1.8V)	
13	SDIO_DATA0 (I/O) (0/1.8V)	SDIO_DATA0 (I/O) (0/1.8V)	

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14	PCM_IN/I2S_SD_IN (I) (0/1.8V)	PCM_IN/I2S_SD_IN (I) (0/1.8V)	
15	SDIO_DATA1 (I/O) (0/1.8V)	SDIO_DATA1 (I/O) (0/1.8V)	
16	LED_2# (I) (OD)	UNUSED	NO CONNECTION
17	SDIO_DATA2 (I/O) (0/1.8V)	SDIO_DATA2 (I/O) (0/1.8V)	
18	VIO_CFG/GND	VIO_CFG/GND	
19	SDIO_DATA3 (I/O) (0/1.8V)	SDIO_DATA3 (I/O) (0/1.8V)	
20	BT_15.4_WAKE_OUT	BT_15.4_WAKE_OUT	
21	WL_WAKE_OUT:	WL_WAKE_OUT:	
22	UART_RXD (I) (0/1.8V)	UART_RXD (I) (0/1.8V)	
23	IND_RST_WL(I)	IND_RST_WL(I)	
24-31	CONNECTOR KEY E	CONNECTOR KEY E	No Pins
32	UART_RXD (I) (0/1.8V)	UART_RXD (I) (0/1.8V)	
33	GND	GND	
34	UART_RTS (O) (0/1.8V)	UART_RTS (O) (0/1.8V)	
35	PETp0	UNUSED	
36	VENDOR DEFINED	UART_CTS (I) (0/1.8V)	
37	PERn0	UNUSED	NO CONNECTION
38	VENDOR DEFINED	UNUSED	NO CONNECTION
39	GND	GND	
40	VENDOR DEFINED	WL_WAKE_IN	
41	PETp0	UNUSED	NO CONNECTION
42	VENDOR DEFINED	BT_WAKE_IN	
43	PETn0	UNUSED	NO CONNECTION
44	COEX3 (I/O) (0/1.8V)	UNUSED	NO CONNECTION
45	GND	GND	
46	COEX_TXD (O) (0/1.8V)	COEX_TXD (O) (0/1.8V)	
47	REFCLKp0	UNUSED	NO CONNECTION
48	COEX_RXD (I) (0/1.8V)	COEX_RXD (I) (0/1.8V)	
49	REFCLKn0	UNUSED	NO CONNECTION
50	SUSCLK (I) (0/1.8V/3.3V)	UNUSED	NO CONNECTION
51	GND	GND	
52	PERST0# (I) (0/1.8V/3.3V)	UNUSED	NO CONNECTION
53	CLKREQ0# (I/O) (0/1.8V/3.3V)	UNUSED	NO CONNECTION
54	IND_RST_BT (I)	IND_RST_BT (I)	
55	PEWAKE0# (I/O) (0/1.8V/3.3V)	UNUSED	NO CONNECTION
56	PDn (I)	PDn (I)	
57	GND	GND	
58	I2C_DATA (I/O) (0/1.8 V)	I2C_DATA (I/O) (0/1.8 V)	
59	RESERVED	UNUSED	NO CONNECTION
60	I2C_CLK (O) (0/1.8 V)	I2C_CLK (O) (0/1.8 V)	

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61	RESERVED	UNUSED	NO CONNECTION
62	ALERT# (I) (0/1.8 V)	UNUSED	NO CONNECTION
63	GND	GND	
64	RESERVED/VIO 1.8V	VIO 1.8V	
65	RESERVED	UNUSED	NO CONNECTION
66	UIM_SWP/PERST1#	UNUSED	NO CONNECTION
67	RESERVED	UNUSED	NO CONNECTION
68	UIM_POWER_SNK/CLKREQ1#	UNUSED	NO CONNECTION
69	GND	GND	
70	UIM_POWER_SRC/GPIO_1/PEWAKE1#	UNUSED	NO CONNECTION
71	RESERVED	UNUSED	NO CONNECTION
72	3.3 V	3.3 V	
73	RESERVED	UNUSED	NO CONNECTION
74	3.3 V	3.3 V	
75	GND	GND	

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5 Pin Information

5.1 Sona NX611 SIP Module

5.1.1 Sona NX611 SIP Module

Figure 8: Top Side (453-00156 shown)

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5.1.2 Mechanical Specifications Sona NX611 SIP Module

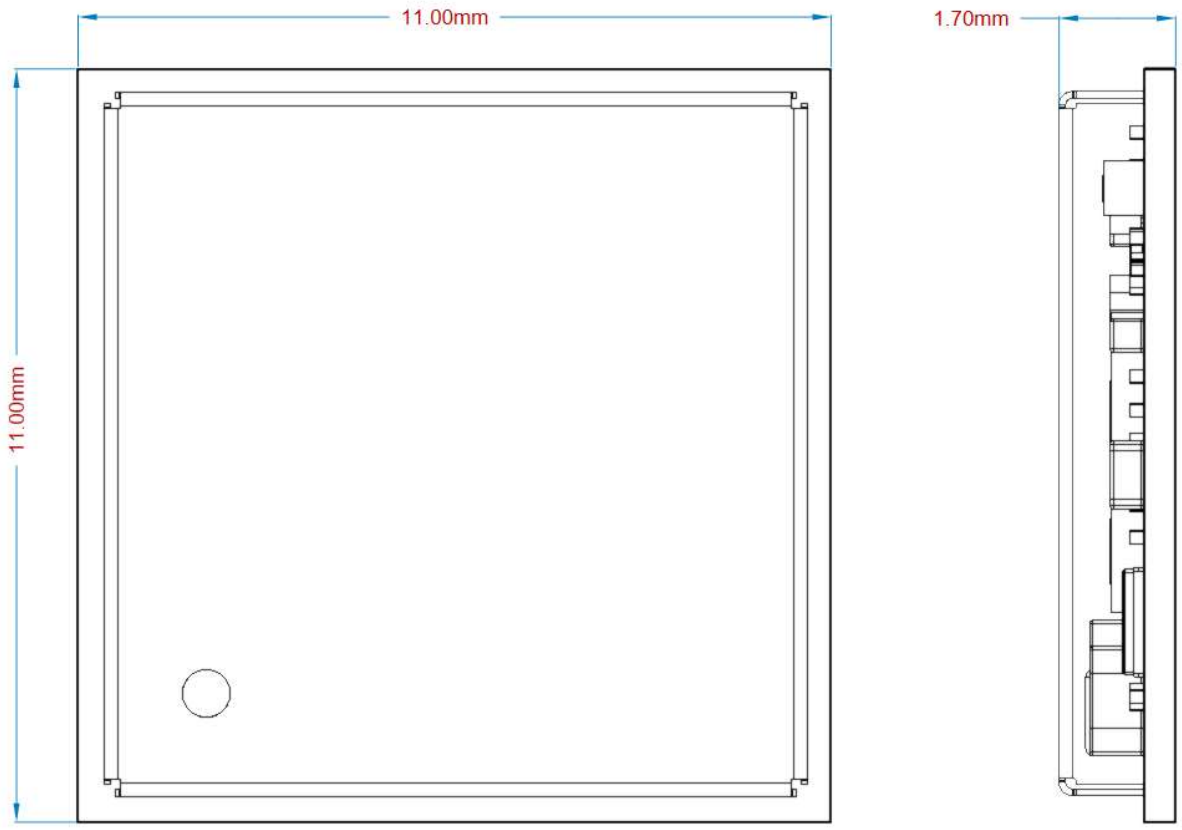

Figure 9: Sona SIP Module Dimensions

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5.1.3 SIP PCB Footprint

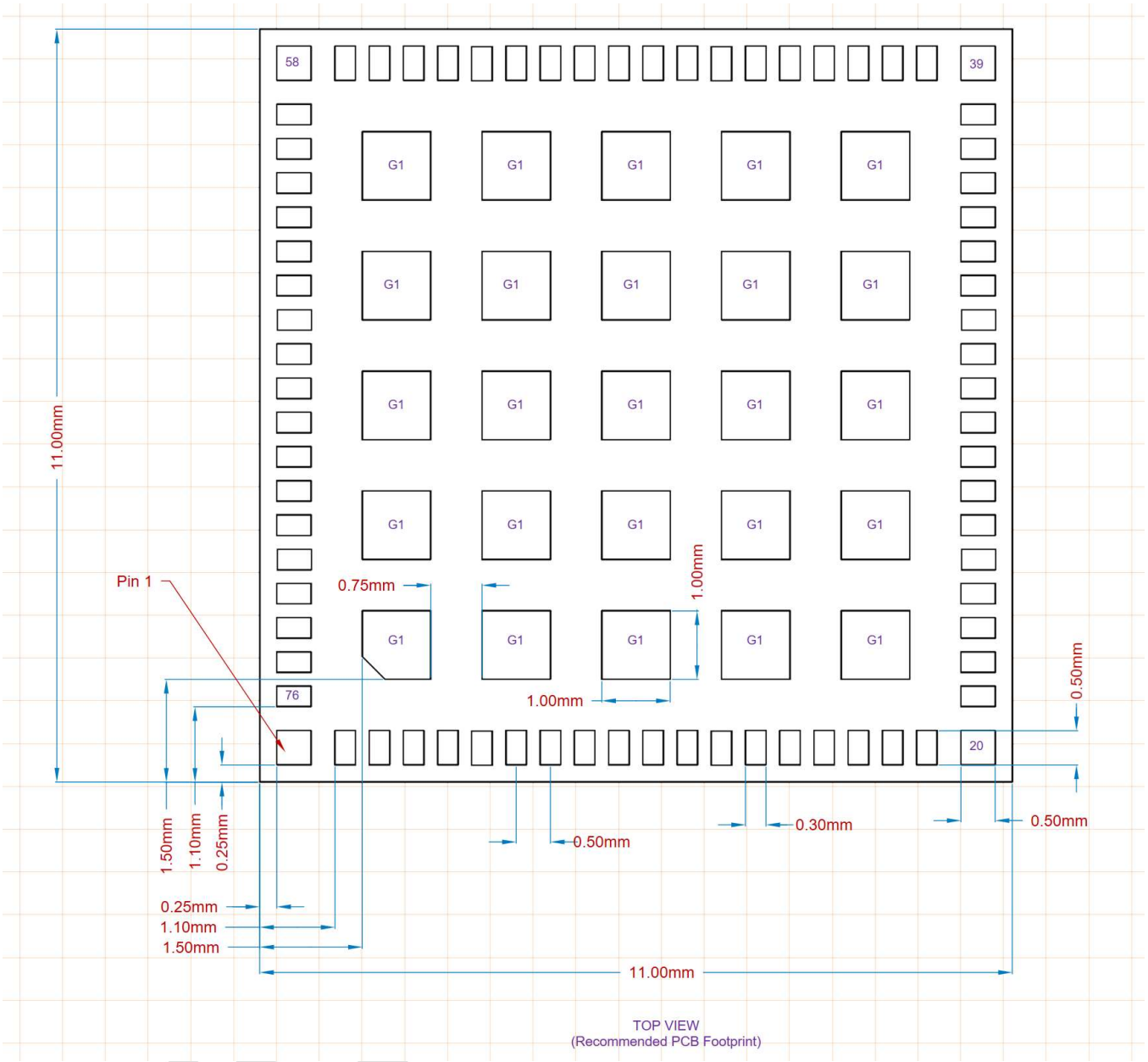

Figure 10: SIP PCB Footprint

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5.2 Sona NX611 1216 Modules

5.2.1 Sona NX611 1216 2 Port

Figure 11: Sona 453-00157

5.2.2 Sona NX611 1216 1 Port

Figure 12: Sona 453-00158

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5.2.3 Mechanical Specifications Sona NX611 M.2 1216 Module

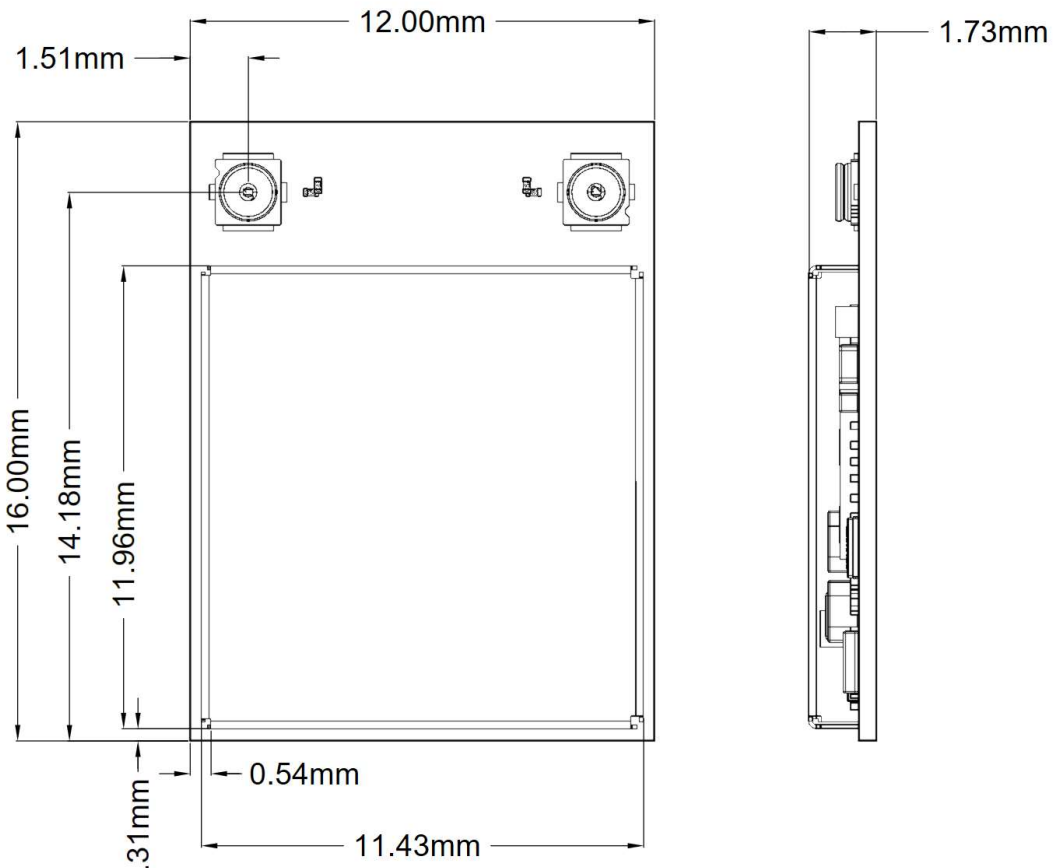

Figure 13: Sona M.2 1216 Module Dimensions

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5.2.4 Sona 1216 PCB Footprint

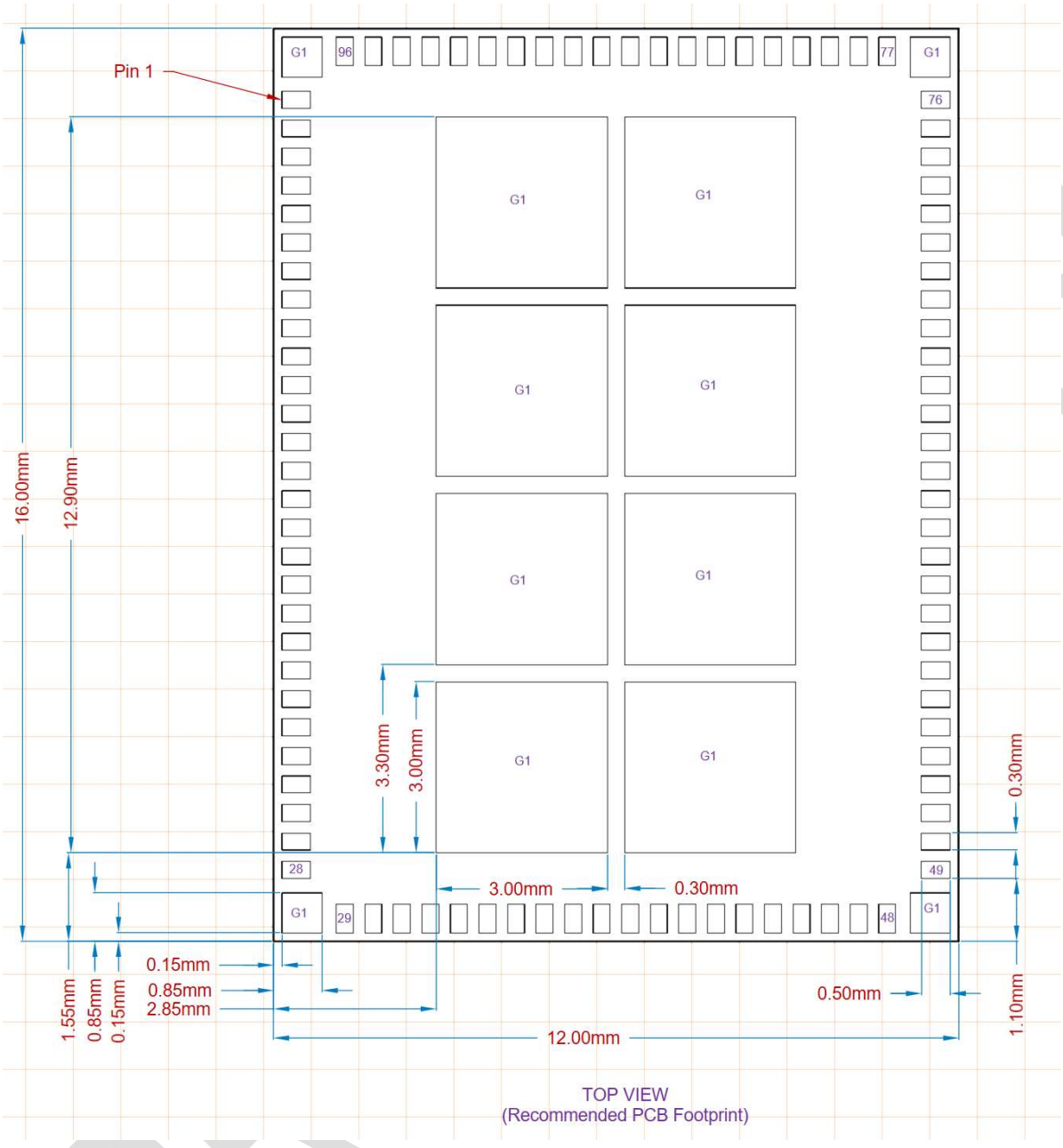

Figure 14: Sona M.2 1216 Footprint

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5.3 Sona NX611 1218 Chip Antenna Module

5.3.1 Sona NX611 1218 Chip Antenna Module

Figure 15: Sona 453-00158

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5.3.2 Mechanical Specifications Sona NX611 1218 Chip Antenna Module

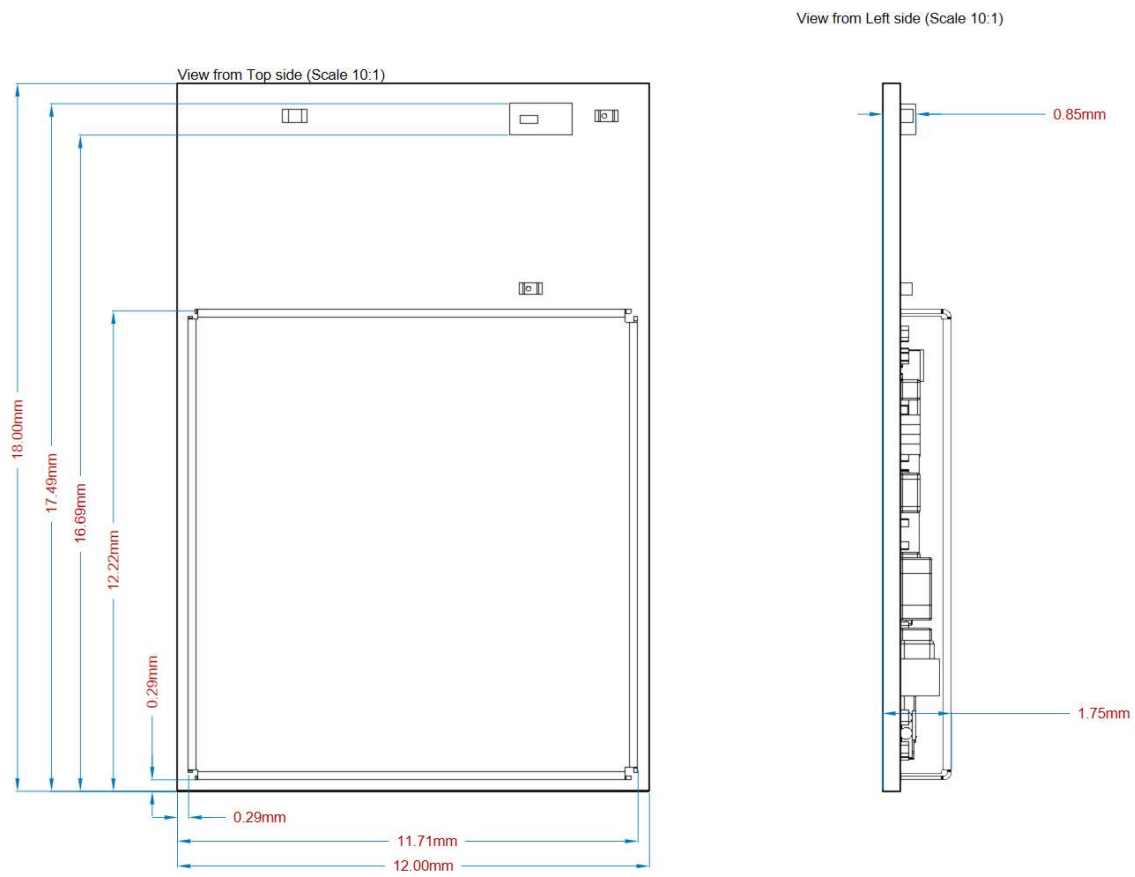

Figure 16: Sona 1218 Chip Antenna Module Dimensions

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5.3.3 Mechanical Specifications Sonna 1218 Chip Antenna Module

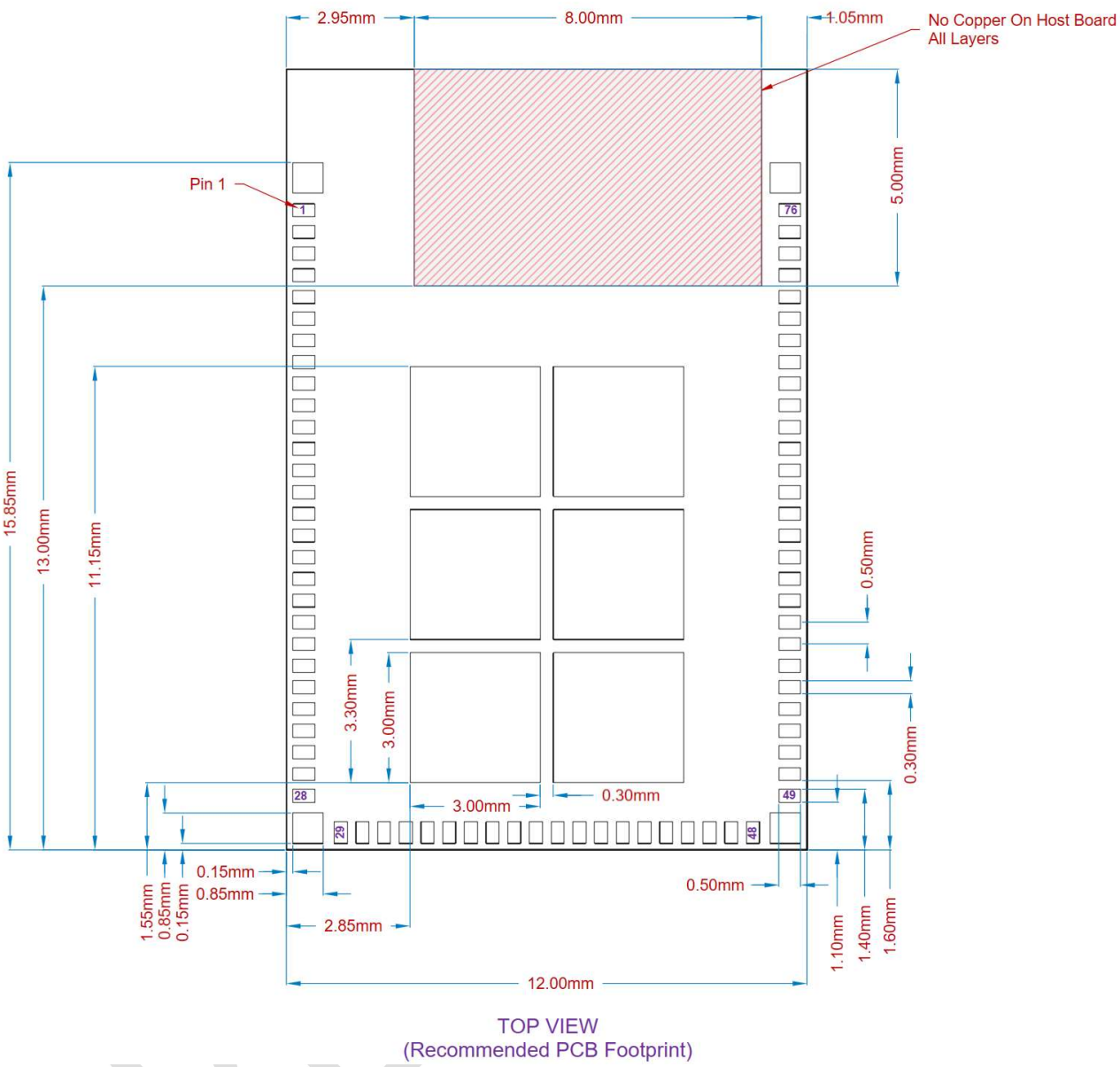

Figure 17: Sona 1218 Chip Antenna Footprint

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5.4 Sona NX611 M.2 2230 Key E Module

5.4.1 Sona NX611 2230 1 Port

Figure 18: Top Side (453-00166 shown)

5.4.2 Sona NX611 2230 2 Port

Figure 19: Top Side (453-00165 shown)

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5.4.3 M.2 2230 Pinout

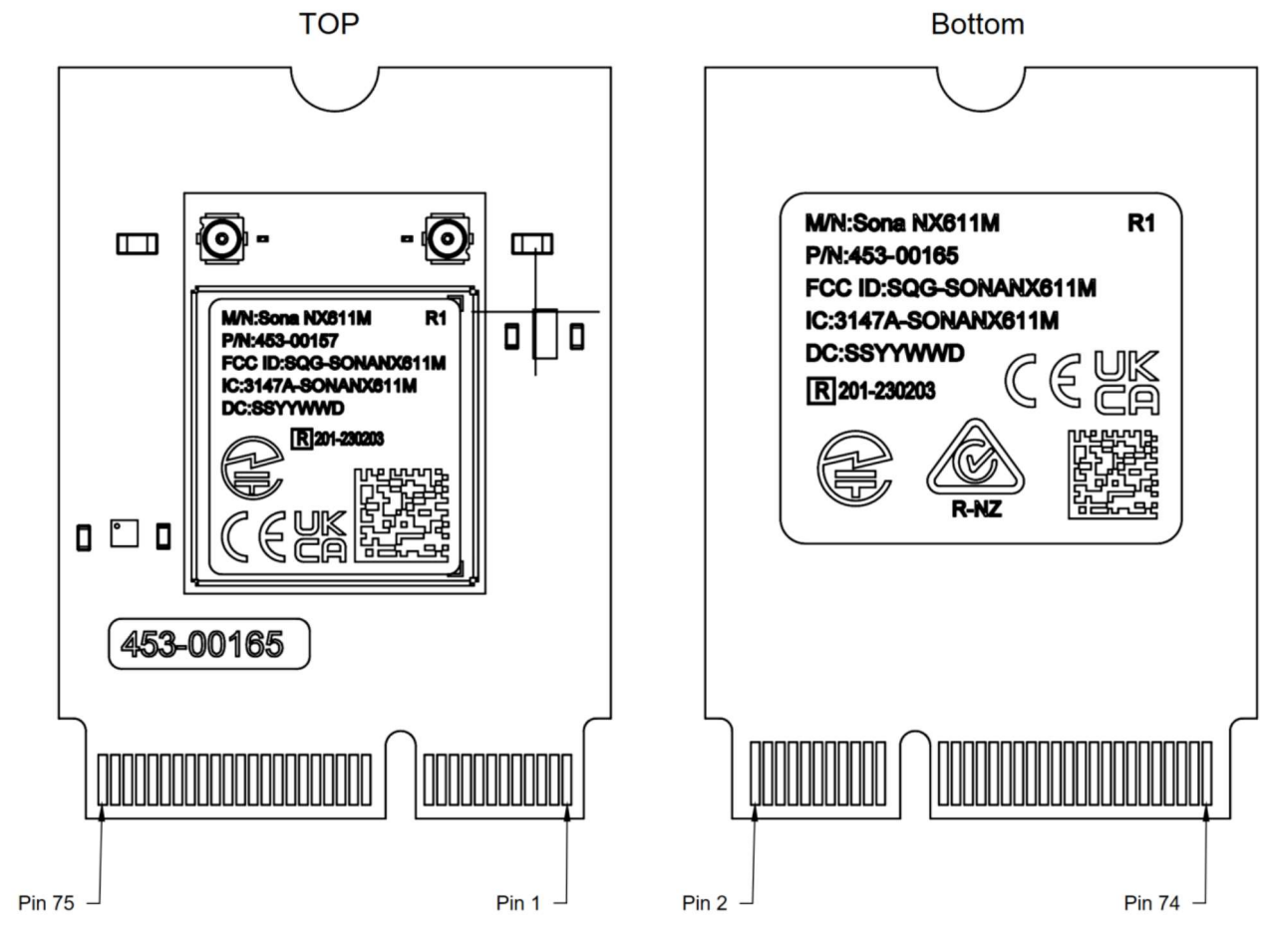

Figure 20: Sona M.2 2230 Module

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5.4.4 Mechanical Specifications Sona NX611 M.2 2230 Module

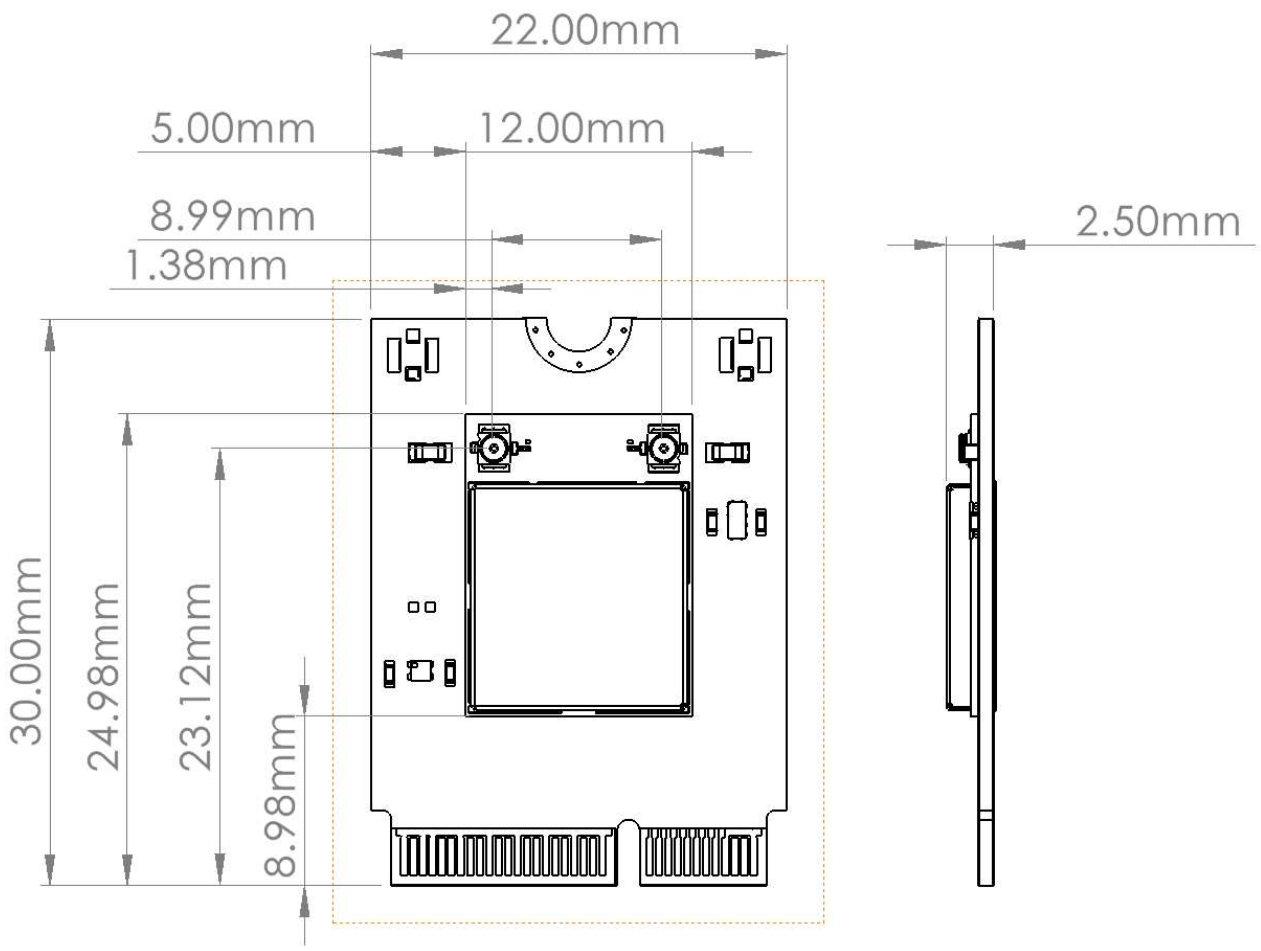

Figure 21: Sona M.2 2230 Module Dimensions

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5.4.5 M.2 2230 Key E Mounting

The Sona NX611 M.2 2230 Module connects to the host via a standard PCI EXPRESS M2 connector.

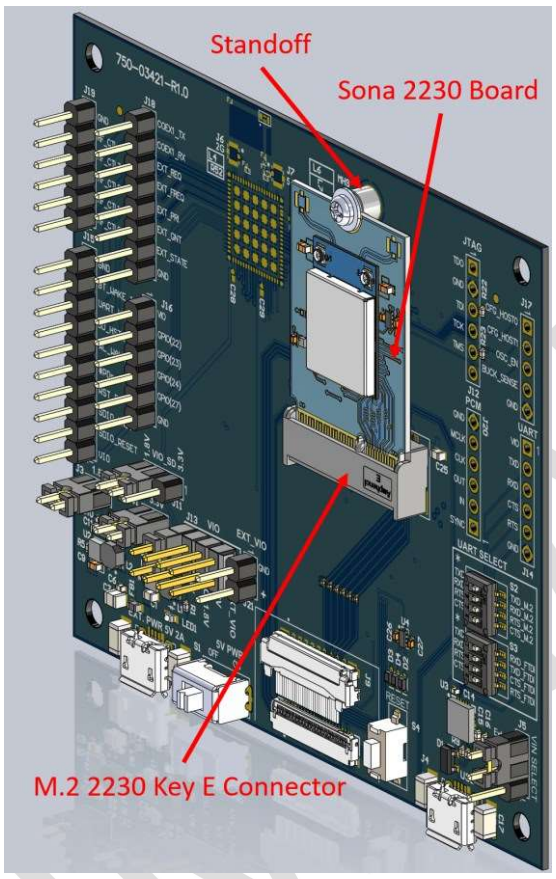

Figure 22: Sona NX611 Module Mounted to Dev Board

5.4.6 Mounting Connectors and Standoffs

Table 5: M.2 2230 Key E Connectors and Standoffs

M.2 Key-E Connector	Connector Height	Stand-off
KYOCERA 24-6411-067-101-894E	2.3 mm	EMI STOP F50M16-041525P1D4M
AMP MDT420E01001	2.5 mm	Alink, N0254020A
JAE SM3ZS067U310AERxxxx	3.1 mm	JAE SM3ZS067U310-NUT1-Rxxxx

6 Specifications

Table 6: SONA™NX61X Specifications

Feature	Description
Physical Interface	SIP- 76-pin LGA package (plus 25 thermal ground pads under the package) 1216- 96-pin LGA, Meets PCIe M.2 Type 1216-S3 Mechanical Outline 2230 Key E package Meets PCIe M.2 Type 2230 Key Mechanical Outline
Wi-Fi Interface	SDIO 3.0 - 1-bit or 4-bit Secure Digital I/O
Bluetooth/BLE Interface	Host Controller Interface (HCI) using high speed UART
Main Chip	NXP NX611 or NX612

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Input Voltage Requirements	SIP- 76-pin LGA package 3.3V nominal 3.3V Typ, 3.14V Min, 3.46V Max 1.8V nominal 1.8V Typ, 1.71V Min, 1.89V Max 1216- 96-pin LGA 3.3V nominal 3.3V Typ, 3.14V Min, 3.46V Max 2230 Key E package 3.3V nominal 3.3V Typ, 3.14V Min, 3.46V Max
I/O Signalling Voltage	Set to 3.3V or 1.8V, by the power domains connected to VIO and VIO_SD
Operating Temperature	-40° to +85°C (-40° to +185°F)
Operating Humidity	Less than 85% RH (non-condensing)
Storage Temperature	-40° to +85°C (-40° to +185°F)
Storage Humidity	Less than 60% RH (non-condensing)
MSL (Moisture Sensitivity Level)	MSL4 (SIP), MSL1 (M2)
Maximum Electrostatic Discharge	Conductive 4KV; Air coupled 8KV (follow EN61000-4-2)
Size – mm (in.)	SIP- 76-pin LGA package Length: 11mm Width: 11mm Thickness: 1.7mm 1216- 96-pin LGA Length: 16mm Width: 12mm Thickness: 1.72mm 2230 Key E package Length: 30mm Width: 22mm Thickness: 2.8mm
Weight – g (oz.)	SIP- 76-pin LGA package TBD 1216- 96-pin LGA TBD 2230 Key E package TBD
Regulatory Certifications	United States (FCC) EU - Member countries of European Union (ETSI) ISED (Canada) Australia New Zealand Japan
2.4 GHz Frequency Bands	EU: 2.4 GHz to 2.483 GHz FCC/ISED: 2.4 GHz to 2.473 GHz MIC: 2.4 GHz to 2.495 GHz RCM: 2.4 GHz to 2.483 GHz
2.4 GHz Operating Channels	EU: 13 (3 non-overlapping)

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(Wi-Fi)	FCC/ISED: 11 (3 non-overlapping) MIC: 14 (4 non-overlapping) RCM: 13 (3 non-overlapping)	
5 GHz Frequency Bands	EU 5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64) 5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140) 5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165) FCC 5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64) 5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140/144 5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165) ISED 5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64) 5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/132/136/140/144 5.725 GHz to 5.85 GHz (Ch 149/153/157/161/165) MIC 5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64) 5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/120/124/128/132/136/140) RCM 5.15 GHz to 5.35 GHz (Ch 36/40/44/48/52/56/60/64) 5.47 GHz to 5.725 GHz (Ch 100/104/108/112/116/132/136/140 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 ISED: 22 non-overlapping; MIC: 19 non-overlapping RCM: 21 non-overlapping	
Operating Systems Supported	Linux Android	
Compliance	**EU**	
	EN 300 328 EN 301 489-1 EN 301 489-17 EN 301 893	EN 62368-1:2014 EN 300 440 2011/65/EU (RoHS)
	FCC	
	47 CFR FCC Part 15.247 47 CFR FCC Part 15.407	47 CFR FCC Part 2.1091
	ISED Canada	
	RSS-247	
	AS/NZS	
	AS/NZS 4268:2017	
Certifications (Pending)	Bluetooth® SIG Qualification	
Warranty	One Year Warranty	

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7 WI-Fi Subsystem

7.1 IEEE 802.11 standards

- 802.11ax 1x1 SU OFDMA
- 802.11ac Wave 1/2 backward compatible
- 802.11n/a/g/b backward compatible
- 802.11az accurate ranging
- 802.11e quality of service
- 802.11h transmit power control
- 802.11h DFS radar pulse detection
- 802.11i enhanced security
- 802.11k radio resource measurement
- 802.11mc precise indoor location positioning
- 802.11r fast hand-off for AP roaming
- 802.11u Hotspot 2.0 (STA mode only)
- 802.11v BTM frame transmission/reception
- 802.11w protected management frames
- 802.11z tunneled direct link setup
- Fully supports clients (stations) implementing IEEE Power Save mode

7.2 Wi-Fi MAC

- 802.11ax
- Trigger Frame Formats
  - Basic trigger frame
  - MU-BAR, MU-RTS, Beamforming Report Poll (BFRP), BSR Poll (BSRP) trigger variant
  - Trigger frame MAC padding
- • HE Variants of HT Control
  - Basic format
  - UL Power Headroom
  - Receive Operation Mode control subfield
- HE MU Frame Exchange Sequences
- MU Acknowledgment (ACK)
- M-BA and C-BA Variants in BA Frames
- MU-RTS/CTS Procedures
- Target Wait Time Scheduling
- HE Dual-NAV
- UL Carrier Sensing
- Buffer Status Reports in response to BSRP trigger frames
- Operating Mode Indication (OMI)
- Multiple-BSS/Station
- A-MPDU Rx (de-aggregation) and Tx (aggregation) (supports single-MPDU A-MPDU)
- Management information base counters
- Transmit rate adaptation
- Mobile hotspot

7.3 Wi-Fi baseband

- 802.11ax backward compatible with 802.11ac/n/a/g/b technology
- Bandwidth support
  - 20 MHz
  - 40 MHz
  - 80 MHz
- Modulation and Coding Schemes (MCS)
  - 802.11ax—MCS0~11
  - 802.11ac—MCS0~9
  - 802.11n—MCS0~7
  - Dual Sub-Carrier Modulation (DCM)

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  - MCS0
  - BCC and LDPC coding
- Frame Formats
  - 802.11ax HE_SU (Tx/Rx)
  - 802.11ax HE_MU (Rx)
  - 802.11ax HE_ER_SU (Tx/Rx)
  - 802.11ax HE_TB (Tx)
  - 802.11ac VHT
  - 802.11n HT
  - 802.11a (including dup/quad modes)
  - 802.11g (including dup mode)
  - 802.11b
- Aggressive Packet Extension
- Range Extension
- Receiver Beam Change
- Guard Interval Modes
  - 1x HE-LTF with 0.8 us GI
  - 1x HE-LTF with 1.6 us GI (for UL TB PPDU)
  - 2x HE-LTF with 0.8 us GI
  - 2x HE-LTF with 1.6 us GI
  - 4x HE-LTF with 3.2 us GI
  - 4x HE-LTF with 0.8 us GI
- Dynamic Frequency Selection (DFS) (radar detection)
- Optional 802.11ac and 802.11n features:
  - 20/40/80 MHz coexistence with middle-packet detection (GI detection) for enhanced CCA
  - LDPC transmission and reception for both 802.11ac and 802.11n
  - Short guard interval (0.4 us)
  - RIFS on receive path for 802.11n packets
  - VHT MU-PPDU (receive)
- Spectral intelligence
  - Spectrum monitoring
  - DFS assist to reduce false detections
  - Interference identification/classification
- Power save features

7.4 Wi-Fi radio

- 5 GHz and 2.4 GHz Wi-Fi band operation
- 802.11ax
- Integrated PA, LNA

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7.5 RF channels

7.5.1 RF conversion values for 2.4 GHz and 5 GHz Wi-Fi channels

Table 7: RF conversion values for 2.4 GHz and 5 GHz Wi-Fi channels

Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
2.4 GHz Channels					
1	2412 MHz	2	2417 MHz	3	2422 MHz
4	2427 MHz	5	2432 MHz	6	2437 MHz
7	2442 MHz	8	2447 MHz	9	2452 MHz
10	2457 MHz	11	2462 MHz	12	2467 MHz
13	2472 MHz	14(JP)	2484 MHz		
5 GHz Channels					
8(JP)	5040 MHz	12(JP)	5060 MHz	16(JP)	5080 MHz
34(JP)	5170 MHz	38(JP)	5190 MHz	42(JP)	5210 MHz
46(JP)	5230 MHz	184(JP)	5920 MHz	188(JP)	4940 MHz
192(JP)	4960 MHz	196(JP)	4980 MHz		
36	5180 MHz	40	5200 MHz	44	5220 MHz
48	5240 MHz	52	5260 MHz	56	5280 MHz
60	5300 MHz	64	5320 MHz	100	5500 MHz
104	5520 MHz	108	5540 MHz	112	5560 MHz
116	5580 MHz	120	5600 MHz	124	5620 MHz
128	5640 MHz	132	5660 MHz	136	5680 MHz
140	5700 MHz	144	5720 MHz	149	5745 MHz
153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	169	5845 MHz	173	5865MHz

7.6 Wi-Fi encryption

- Support WPA3, WPA2 and WPA
- Data Frame Encryption/Decryption
  - Advanced Encryption Standard (AES) / Counter-Mode/CBC-MAC Protocol (CCMP)
  - Advanced Encryption Standard (AES) / Galois/Counter Mode Protocol (GCMP)
  - WLAN Authentication and Privacy Infrastructure (WAPI)
- Management Frame Encryption/Decryption for broadcast/multicast packets
  - Advanced Encryption Standard (AES) / Cipher-based Message Authentication Code (CMAC)
  - BIP-GMAC
- Management Frame Encryption/Decryption for unicast packets
  - AES/CCMP
  - AES/GCMP

7.7 Transmit Beamforming (TxBF)

- 802.11ax/ac/n Explicit Beamform
  - Supports sounding feedback for up to 4x4 Beamformer

7.8 Wi-Fi host interface

- SDIO 3.0 (4-bit SDIO and 1-bit SDIO) with transfer rates up to SDR104 (208 MHz)

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8 Bluetooth Subsystem

The SONA™NX61X series wireless module includes a fully integrated Bluetooth baseband/radio.

8.1 Bluetooth features

- Bluetooth 5.2 features
- Bluetooth Class 2
- Bluetooth Class 1
- Single-ended, shared Tx/Rx path for Bluetooth
- I2S/PCM interface for voice applications
- Baseband/radio BDR/EDR packet types—1 Mbps (GFSK), 2 Mbps (/4-DQPSK), 3 Mbps (8DPSK)
- Fully functional Bluetooth baseband—AFH, forward error correction, header error control, access code correlation, CRC, encryption bit stream generation, and whitening
- Interlaced scan for faster connection setup
- Simultaneous active ACL connection support
- Automatic ACL packet type selection
- Full central and peripheral piconet support
- Scatternet support
- Standard UART HCI transport layer
- HCI layer to integrate with profile stack
- SCO/eSCO links with hardware accelerated audio signal processing and hardware supported PPEC algorithm for speech quality improvement
- All standard SCO/eSCO voice coding
- A2DP support
- All standard pairing, authentication, link key, and encryption operations
- Standard Bluetooth power-saving mechanisms (hold, sniff modes, and sniff subrating)
- Enhanced Power Control (EPC)
- Channel Quality Driven Data Rate (CQDDR)
- Wideband Speech (WBS) support (2 WBS links)
- Encryption (AES) support

8.2 Bluetooth Low Energy (LE) features

- Bluetooth LE 5.4
- Supports up to 16 simultaneous central/peripheral connections
- Wi-Fi/Bluetooth coexistence protocol support
- Shared RF with BDR/EDR
- Encryption (AES) support
- Intelligent Adaptive Frequency Hopping (AFH)
- Bluetooth LE Privacy 1.3
- Bluetooth LE Secure Connection
- Bluetooth LE Data Length Extension
- Bluetooth LE Advertising Extension
- Bluetooth LE Long Range
- Bluetooth LE 2 Mbps
- Bluetooth LE power control
- Isochronous channels[4] (ISOC) supporting LE Audio and Auracast™ Broadcast Audio
- Bluetooth LE isochronous channels[1]

[1] Bluetooth LE audio supported with external host running Low Complexity Communication codec (LC3) through HCI interface.

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8.3 Bluetooth Host interface

- High-Speed UART with support up to 3 Mbps baud rate

8.4 Digital Audio interfaces

8.4.1 I2S/PCM interface

- PCM pins shared with I2S pins
- Central or peripheral mode
- I2S (Inter-IC Sound) interface for audio data connection to Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC)
- 3-state I2S interface capability
- I2S central and peripheral modes
- I2S pins shared with PCM pins
- Supports clock speeds of 4.096 MHz, 2.048 MHz, and 2 MHz

8.4.2 I2S/PCM interface signals

Table 8: Audio Interface Pins

Pin Name	Type	Description	GPIO
PCM_DOUT / I2S_DOUT	O	PCM/I2S data out	GPIO[5]
PCM_DIN / I2S_DIN	I	PCM/I2S data in	GPIO[6]
PCM_CLK / I2S_BLCK	I/O	PCM/I2S clock, can be output (if central) or input (if peripheral)	GPIO[4]
PCM_SYNC / I2S_LRCLK	I/O	PCM/I2S sync, can be output (if central) or input (if peripheral)	GPIO[7]
PCM_MCLK / I2S_CCLK	O	Optional clock pins	GPIO[3]

8.4.3 Clock frequency and audio data resolutions

Audio data may arrive with different input data formats with different sampling rates.

In master mode, the I2S interface uses an audio input clock of 4.096 MHz or 2.048 MHz to provide the appropriate M clock (MCLK) and bit clock (I2S_BCLK) frequency to match the sampling rates of each audio data format. The sampling rates can be 8 kHz to 16 kHz.

In slave mode, the I2S interface does not provide the bit clock (I2S_BCLK) but it can provide the M clock (MCLK).

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9 Electrical Characteristics

9.1 Absolute Maximum Ratings

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 9: Absolute maximum ratings

Symbol (Domain)	Parameter	Max Rating	Unit
VIO_SD	WLAN host SDIO interface I/O supply (for 1.8V system) (for 3.3V system)	2.16 3.96	V
VIO	I/O configuration power supply (for 1.8V system) (for 3.3V system)	2.16 3.96	V
AVDD33	External DC power supply	3.96	V
Storage	Storage temperature	-55 +125	°C
ESD	Electrostatic discharge tolerance	2000	V

9.2 Recommended Operating Conditions

Table 10: Recommended operating conditions

Symbol (Domain)	Parameter	Min	Typ	Max	Unit
VIO_SD	WLAN and Bluetooth host interface I/O supply	1.71/3.14	1.8/3.3	1.89/3.46	V
VIO	I/O supply for the RF switch control pads	1.71/3.14	1.8/3.3	1.89/3.46	V
AVDD33	External DC power supply	3.14	3.3	3.46	V
T-ambient	Ambient temperature	-40	25	85	°C

9.3 General DC Electrical Characteristics

Table 11 and Table 12 list the general DC electrical characteristics over recommended operating conditions (unless otherwise specified).

Table 11: General DC electrical characteristics (For 1.8V or 3.3V operation VIO)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VIH	High Level Input Voltage	—	0.7*VIO	—	VIO+0.4	V
VIL	Low Level Input Voltage	—	-0.4	—	0.3*VIO	V
VOH	Output high Voltage	—	VIO-0.4	—	—	V
VOL	Output low Voltage	—	—	—	0.4	V

Table 12: General DC electrical characteristics (For 1.8V or 3.3V operation VIO_SD)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VIH	High Level Input Voltage	—	0.7*VIO_SD	—	VIO_SD+0.4	V
VIL	Low Level Input Voltage	—	-0.4	—	0.3*VIO_SD	V
VOH	Output high Voltage	—	VIO_SD-0.4	—	—	V
VOL	Output low Voltage	—	—	—	0.4	V

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9.4 Sona NX611 SIP Module Current Consumption

Note: Unless otherwise stated, all specifications are at 25°C, nominal voltage, and typical value with SDIO 3.0, measured on Dev Kit, Sona NX611 SIP, 1 RF Trace Pin Part Number 453-00156-K1.

Table 13: 25 MHz clock (4-bit mode).

Mode	Conditions	1.8V	3.3V	Unit
Power down				
Power Down	-	0.019	0.007	mA
Sleep Mode				
Bluetooth only in deep sleep mode	-	TBD	TBD	mA
Wi-Fi only in deep sleep mode	SDIO 3.0 200 MHz VIO = 1.8 V	0.36	0.02	mA
Wi-Fi and Bluetooth in deep sleep Mode	-	TBD	TBD	mA
Bluetooth LE current consumption				
Bluetooth LE peak transmit [3]	1 Mbps @ 6 dBm	177	.179	mA
Bluetooth LE peak receive[4][5]	1 Mbps	TBD	TBD	mA
Bluetooth current consumption [2]				
Bluetooth peak transmit[6]	@ 6 dBm DH5	167	.116	mA
Bluetooth peak receive[4][7]	BDR , DH5	TBD	TBD	mA
2.4 GHz Wi-Fi receive[8]				
2.4 GHz 802.11b 11 Mbps	—	94	0.065	mA
2.4 GHz 802.11g 54 Mbps	—	102	0.065	mA
2.4 GHz 802.11n 20 MHz MCS7	—	102	0.065	mA
2.4 GHz 802.11n 40 MHz MCS7	—	117	0.065	mA
2.4 GHz 802.11ax 20 MHz MCS11	—	105	0.065	mA
2.4 GHz 802.11ax 40 MHz MCS11	—	119	0.065	mA
5 GHz Wi-Fi receive[8]			0.065	
5 GHz 802.11a 54 Mbps	—	117	0.065	mA
5 GHz 802.11n 20 MHz MCS7	—	117	0.065	mA
5 GHz 802.11n 40 MHz MCS7	—	126	0.065	mA
5 GHz 802.11ac 40 MHz MCS9	—	146	0.065	mA
5 GHz 802.11ac 80 MHz MCS9	—	167	0.065	mA
5 GHz 802.11ax 20 MHz MCS11	—	117	0.065	mA
5 GHz 802.11ax 40 MHz MCS11	—	146	0.065	mA
5 GHz 802.11ax 80 MHz MCS11	—	1	0.065	mA
2.4 GHz Wi-Fi transmit[8]				
2.4 GHz 802.11b 11 Mbps @ 18 dBm	—	149	220	mA
2.4 GHz 802.11g 54 Mbps @ 16 dBm	—	160	178	mA
2.4 GHz 802.11n 20 MHz MCS7 @ 15 dBm	—	159	163	mA
2.4 GHz 802.11n 40 MHz MCS7 @ 15 dBm	—	163	156	mA
2.4 GHz 802.11ax 20 MHz MCS11 @ 13 dBm	—	163	149	mA

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2.4 GHz 802.11ax 40 MHz MCS11 @ 13 dBm	—	163	174	mA
5 GHz Wi-Fi transmit[8]				
5 GHz 802.11a 6 Mbps @ 16 dBm	—	226	261	mA
5 GHz 802.11a 54 Mbps @ 16 dBm	—	218	244	mA
5 GHz 802.11n 20 MHz MCS7 @ 14 dBm	—	213	201	mA
5 GHz 802.11n 40 MHz MCS7 @ 14 dBm	—	214	202	mA
5 GHz 802.11ac 20 MHz MCS8 @ 14 dBm	—	213	201	mA
5 GHz 802.11ac 40 MHz MCS9 @ 12 dBm	—	203	163	mA
5 GHz 802.11ac 80 MHz MCS9 @ 12 dBm	—	216	156	mA
5 GHz 802.11ax 20 MHz MCS11 @ 10 dBm	—	197	140	mA
5 GHz 802.11ax 40 MHz MCS11 @ 10 dBm	—	202	142	mA
5 GHz 802.11ax 80 MH MCS11 @ 10 dBm	—	218	144	mA
Peak current				
Peak current during device initialization	—	371	139	mA

[1] SDIO host interface connected
[2] Wi-Fi enabled, SDIO host interface connected
[3] The peak transmit current remains the same across all Bluetooth LE data rates at the same transmit power level
[4] Single antenna configuration
[5] The peak receive current remains the same across all Bluetooth LE data rates
[6] The peak transmit current remains the same across all Bluetooth data rates at the same transmit power level
[7] The peak receive current remains the same across all Bluetooth data rates
[8] Bluetooth enabled
[9] Frame length in IEEE-PS current measurement: 5 GHz: 207 Bytes, 2.4 GHz: 222 Bytes
[10] Maximum value

9.5 Sona NX611 1216/M.2 2230 Module Current Consumption

Note: Unless otherwise stated, all specifications are at 25°C, nominal voltage, and typical value with SDIO 3.0, measured on Dev Kit, Sona NX611 M.2 2230, 1 MHF4 Part Number 453-00166-K1.

Table 14: 25 MHz clock (4-bit mode).

Mode	Conditions	1.8V_VIO	3.3V	Unit
Power down				
Power Down	-	1.7	.348	mA
Sleep Mode				
Bluetooth only in deep sleep mode	-	TBD	TBD	mA
Wi-Fi only in deep sleep mode	SDIO 3.0 200 MHz VIO = 1.8 V	TBD	TBD	mA
Wi-Fi and Bluetooth in deep sleep Mode	-	TBD	TBD	mA
Bluetooth LE current consumption				
Bluetooth LE peak transmit [3]	1 Mbps @ 6 dBm	0.014	106	mA
Bluetooth LE peak receive[4][5]	1 Mbps	.009	75	mA
Bluetooth current consumption [2]				
Bluetooth peak transmit[6]	@ 6 dBm DH5	.009	113	mA
Bluetooth peak receive[4][7]	BDR , DH5	.009	75	mA
2.4 GHz Wi-Fi receive[8]				
2.4 GHz 802.11b 11 Mbps	—	.009	56	mA
2.4 GHz 802.11g 54 Mbps	—	.009	59	mA

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2.4 GHz 802.11n 20 MHz MCS7	—	.009	61	mA
2.4 GHz 802.11n 40 MHz MCS7	—	.009	62	mA
2.4 GHz 802.11ax 20 MHz MCS11	—	.009	63	mA
2.4 GHz 802.11ax 40 MHz MCS11	—	.009	66	mA
5 GHz Wi-Fi receive[8]				
5 GHz 802.11a 54 Mbps	—	.009	62	mA
5 GHz 802.11n 20 MHz MCS7	—	.009	68	mA
5 GHz 802.11n 40 MHz MCS7	—	.009	65	mA
5 GHz 802.11ac 40 MHz MCS9	—	.009	83	mA
5 GHz 802.11ac 80 MHz MCS9	—	.009	92	mA
5 GHz 802.11ax 20 MHz MCS11	—	.009	70	mA
5 GHz 802.11ax 40 MHz MCS11	—	.009	79	mA
5 GHz 802.11ax 80 MHz MCS11	—	.009	96	mA
2.4 GHz Wi-Fi transmit[8]				
2.4 GHz 802.11b 11 Mbps @ 18 dBm	—	.009	296	mA
2.4 GHz 802.11g 54 Mbps @ 16 dBm	—	.009	258	mA
2.4 GHz 802.11n 20 MHz MCS7 @ 15 dBm	—	.009	252	mA
2.4 GHz 802.11n 40 MHz MCS7 @ 15 dBm	—	.009	248	mA
2.4 GHz 802.11ax 20 MHz MCS11 @ 13 dBm	—	.009	231	mA
2.4 GHz 802.11ax 40 MHz MCS11 @ 13 dBm	—	.009	229	mA
5 GHz Wi-Fi transmit[8]				
5 GHz 802.11a 6 Mbps @ 16 dBm	—	.009	331	mA
5 GHz 802.11a 54 Mbps @ 16 dBm	—	.009	314	mA
5 GHz 802.11n 20 MHz MCS7 @ 14 dBm	—	.009	292	mA
5 GHz 802.11n 40 MHz MCS7 @ 14 dBm	—	.009	293	mA
5 GHz 802.11ac 20 MHz MCS8 @ 14 dBm	—	.009	292	mA
5 GHz 802.11ac 40 MHz MCS9 @ 12 dBm	—	.009	273	mA
5 GHz 802.11ac 80 MHz MCS9 @ 12 dBm	—	.009	268	mA
5 GHz 802.11ax 20 MHz MCS11 @ 10 dBm	—	.009	254	mA
5 GHz 802.11ax 40 MHz MCS11 @ 10 dBm	—	.009	248	mA
5 GHz 802.11ax 80 MH MCS11 @ 10 dBm	—	.009	262	mA
Peak current				
Peak current during device initialization		571	.140	mA

[1] SDIO host interface connected
[2] Wi-Fi enabled, SDIO host interface connected
[3] The peak transmit current remains the same across all Bluetooth LE data rates at the same transmit power level
[4] Single antenna configuration
[5] The peak receive current remains the same across all Bluetooth LE data rates
[6] The peak transmit current remains the same across all Bluetooth data rates at the same transmit power level
[7] The peak receive current remains the same across all Bluetooth data rates
[8] Bluetooth enabled
[9] Frame length in IEEE-PS current measurement: 5 GHz: 207 Bytes, 2.4 GHz: 222 Bytes
[10] Maximum value

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10 RF Characteristics

10.1 WLAN Radio Receiver Characteristics

Table 15: Typical WLAN receiver characteristics for 2.4 GHz Band, WLAN Channels 1-11, single chain operation at 25 degrees C, ambient temperature.

2.4 GHz Wi-Fi Receive Sensitivity	Conditions	1-Port	2-Port	Unit
2.4 GHz 802.11b 1 Mbps	8% PER	-96.5	-97.5	dBm
2.4 GHz 802.11b 11 Mbps	8% PER	-88.0	-89.0	dBm
2.4 GHz 802.11g 6 Mbps	10% PER	-91.0	-92.0	dBm
2.4 GHz 802.11g 54 Mbps	10% PER	-74.5	-75.5	dBm
2.4 GHz 802.11n 20 MHz MCS0	10% PER	-90.5	-91.5	dBm
2.4 GHz 802.11n 20 MHz MCS7	10% PER	-71	-72	dBm
2.4 GHz 802.11n 40 MHz MCS0	10% PER	-87.5	-88.5	dBm
2.4 GHz 802.11n 40 MHz MCS7	10% PER	-68.5	-69.5	dBm
2.4 GHz 802.11ax 20 MHz MCS0	10% PER	-91	-92	dBm
2.4 GHz 802.11ax 20 MHz MCS11	10% PER	-61.5	-62.5	dBm
2.4 GHz 802.11ax 40 MHz MCS0	10% PER	-87.5	-88.5	dBm
2.4 GHz 802.11ax 40 MHz MCS11	10% PER	-59.5	-60.5	dBm
2.4 GHz Receiver maximum input level (MIL)	**Conditions**	**1-port**	**2-port**	**Unit**
Receiver maximum input level DSSS	802.11b DSSS MIL	0	0	dBm
Receiver maximum input level CCK	802.11b CCK MIL	0	0	dBm
Receiver maximum input level OFDM	OFDM MIL	-10	-10	dBm
Receiver adjacent channel interference (ACI)	**Conditions**	**1-port**	**2-port**	**Unit**
Receiver ACI 802.11b	20 MHz 1 Mbps	53	53	dB
Receiver ACI 802.11b	20 MHz 11 Mbps	47.7	47.7	dB
Receiver ACI 802.11g	20 MHz 6 Mbps	30.3	30.3	dB
Receiver ACI 802.11g	20 MHz 54 Mbps	27.3	27.3	dB
Receiver ACI 802.11n	20 MHz MCS0 Nss1 BCC	41	41	dB
Receiver ACI 802.11n	20 MHz MCS7 Nss1 BCC	27.3	27.3	dB
Receiver ACI 802.11ax	20 MHz MCS0 Nss1 LDPC[1]	30.3	30.3	dB
Receiver ACI 802.11ax	20 MHz MCS11 Nss1 LDPC[1]	7	7	dB
Receiver Alternate Adjacent channel interference (AACI)	**Conditions**	**1-port**	**2-port**	**Unit**
Receiver AACI 802.11b	20 MHz 1 Mbps	53	53	dB
Receiver AACI 802.11b	20 MHz 11 Mbps	49	49	dB
Receiver AACI 802.11g	20 MHz 6 Mbps	49	49	dB
Receiver AACI 802.11g	20 MHz 54 Mbps	33.3	33.3	dB
Receiver AACI 802.11n	20 MHz MCS0 Nss1 BCC	49.7	49.7	dB
Receiver AACI 802.11n	20 MHz MCS7 Nss1 BCC	32.3	32.3	dB
Receiver AACI 802.11ax	20 MHz MCS0 Nss1 LDPC[1]	48.7	48.7	dB
Receiver AACI 802.11ax	20 MHz MCS11 Nss1 LDPC[1]	23.3	23.3	dB

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Table 16: Typical WLAN receiver characteristics for 5 GHz Channels 36-48, 52-64,100-140,149-165, Band, Channels single chain operation at 25 degrees C ambient temperature.

5 GHz Wi-Fi Receive Sensitivity	Conditions	1- and 2-port	Unit
5 GHz 802.11a 6 Mbps	10% PER	-89.5	dBm
5 GHz 802.11a 54 Mbps	10% PER	-72.5	dBm
5 GHz 802.11n 20 MHz MCS0	10% PER	-88.5	dBm
5 GHz 802.11n 20 MHz MCS7	10% PER	-69.0	dBm
5 GHz 802.11n 40 MHz MCS0	10% PER	-85.5	dBm
5 GHz 802.11n 40 MHz MCS7	10% PER	-66.5	dBm
5 GHz 802.11ac 20 MHz MCS0	10% PER	-89.5	dBm
5 GHz 802.11ac 20 MHz MCS8	10% PER	-66.5	dBm
5 GHz 802.11ac 40 MHz MCS0	10% PER	-86.0	dBm
5 GHz 802.11ac 40 MHz MCS9	10% PER	-63.5	dBm
5 GHz 802.11ac 80 MHz MCS0	10% PER	-82.5	dBm
5 GHz 802.11ac 80 MHz MCS9	10% PER	-60.5	dBm
5 GHz 802.11ax 20 MHz MCS0	10% PER	-89.5	dBm
5 GHz 802.11ax 20 MHz MCS11	10% PER	-68.0	dBm
5 GHz 802.11ax 40 MHz MCS0	10% PER	-82.5	dBm
5 GHz 802.11ax 40 MHz MCS11	10% PER	-57.5	dBm
5 GHz 802.11ax 80 MHz MCS0	10% PER	-82.5	dBm
5 GHz 802.11ax 80 MHz MCS11	10% PER	-60.5	dBm
5 GHz Receiver Maximum Input Level (MIL)	**Conditions**	**1- and 2-port**	**Unit**
5 GHz Receiver maximum input level OFDM	OFDM MIL	-10	dBm
Receiver adjacent channel interference (ACI)	**Conditions**	**1- and 2-port**	**Unit**
Receiver ACI 802.11a	20 MHz 6 Mbps	23	dBm
Receiver ACI 802.11a	20 MHz 54 Mbps	15.7	dBm
Receiver ACI 802.11n	20 MHz MCS0 Nss1 BCC	28	dBm
Receiver ACI 802.11n	20 MHz MCS7 Nss1 BCC	10	dBm
Receiver ACI 802.11n	40 MHz MCS0 Nss1 BCC	27.3	dBm
Receiver ACI 802.11n	40 MHz MCS7 Nss1 BCC	13	dBm
Receiver ACI 802.11ac	20 MHz MCS0 Nss1 LDPC	31.3	dBm
Receiver ACI 802.11ac	20 MHz MCS9 Nss1 LDPC	15	dBm
Receiver ACI 802.11ac	40 MHz MCS0 Nss1 LDPC	29.7	dBm
Receiver ACI 802.11ac	40 MHz MCS9 Nss1 LDPC	12.3	dBm
Receiver ACI 802.11ac	80 MHz MCS0 Nss1 LDPC	25	dBm
Receiver ACI 802.11ac	80 MHz MCS9 Nss1 LDPC	13	dBm
Receiver AACI 802.11a	20 MHz 6 Mbps	47.3	dB
Receiver AACI 802.11a	20 MHz 54 Mbps	27.7	dB
Receiver AACI 802.11n	20 MHz MCS0 Nss1 BCC	46.3	dB
Receiver AACI 802.11n	20 MHz MCS7 Nss1 BCC	30	dB
Receiver AACI 802.11n	40 MHz MCS0 Nss1 BCC	45	dB

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Receiver Alternate Adjacent channel interference (ACI)	Conditions	1- and 2-port	Unit
Receiver AACI 802.11a	20 MHz 6 Mbps	47.3	dB
Receiver AACI 802.11a	20 MHz 54 Mbps	27.7	dB
Receiver AACI 802.11n	20 MHz MCS0 Nss1 BCC	46.3	dB
Receiver AACI 802.11n	20 MHz MCS7 Nss1 BCC	30	dB
Receiver AACI 802.11n	40 MHz MCS0 Nss1 BCC	45	dB
Receiver AACI 802.11n	40 MHz MCS7 Nss1 BCC	27	dB
Receiver AACI 802.11ac	20 MHz MCS0 Nss1 LDPC	45.7	dB
Receiver AACI 802.11ac	20 MHz MCS9 Nss1 LDPC	29.3	dB
Receiver AACI 802.11ac	40 MHz MCS0 Nss1 LDPC	44.7	dB
Receiver AACI 802.11ac	40 MHz MCS9 Nss1 LDPC	23	dB
Receiver AACI 802.11ac	80 MHz MCS0 Nss1 LDPC	43.3	dB
Receiver AACI 802.11ac	80 MHz MCS9 Nss1 LDPC	24	dB
Receiver AACI 802.11ax	20 MHz MCS0 Nss1 LDPC[1]	48	dB
Receiver AACI 802.11ax	20 MHz MCS11 Nss1 LDPC[1]	21.3	dB
Receiver AACI 802.11ax	40 MHz MCS0 Nss1 LDPC[1]	45	dB
Receiver AACI 802.11ax	40 MHz MCS11 Nss1 LDPC[1]	19.7	dB
Receiver AACI 802.11ax	80 MHz MCS0 Nss1 LDPC[1]	44	dB
Receiver AACI 802.11ax	80 MHz MCS11 Nss1 LDPC[1]	18.3	dB

10.2 WLAN Transmitter Characteristics

Table 17: Typical WLAN transmitter characteristics for 2.4 GHz band operation (VDD=3.3V, VIO=1.8V), WLAN Channels 1-11, single chain operation at 25 degrees C, ambient temperature.

2.4 GHz Wi-Fi Transmit Power	Conditions	1-Port	2-Port	Unit
2.4 GHz 802.11b 1 Mbps	-9.1 dB, EVM, Mask Compliance	18	18	dBm
2.4 GHz 802.11b 11 Mbps	-9.1 dB, EVM, Mask Compliance	18	18	dBm
2.4 GHz 802.11g 6 Mbps	- 5 dB, EVM, Mask Compliance	14	14	dBm
2.4 GHz 802.11g 54 Mbps	-25 dB, EVM, Mask Compliance	14	14	dBm
2.4 GHz 802.11n 20 MHz MCS0	- 5 dB, EVM, Mask Compliance	14	14	dBm
2.4 GHz 802.11n 20 MHz MCS7	-27 dB, EVM, Mask Compliance	14	14	dBm
2.4 GHz 802.11n 40 MHz MCS0	- 5 dB, EVM, Mask Compliance	12	12	dBm
2.4 GHz 802.11n 40 MHz MCS7	- 27 dB, EVM, Mask Compliance	12	12	dBm
2.4 GHz 802.11ax 20 MHz MCS0	- 5 dB, EVM, Mask Compliance	13	13	dBm
2.4 GHz 802.11ax 20 MHz MCS11	- 35 dB, EVM, Mask Compliance	13	13	dBm
2.4 GHz 802.11ax 40 MHz MCS0	- 5 dB, EVM, Mask Compliance	13	13	dBm
2.4 GHz 802.11ax 40 MHz MCS11	- 35 dB, EVM, Mask Compliance	11	11	dBm

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Table 18: Typical WLAN Transmitter characteristics for 5 GHz band operation, (VDD=3.3V, VIO=1.8V), Channels 36-48, 52-64,100-140,149-165, Band, Channels single chain operation at 25 degrees C ambient.

5 GHz Wi-Fi Transmit Power	Conditions	1- and 2-port	Unit
5 GHz 802.11a 6 Mbps	-5 dB, EVM, Mask Compliance	16	dBm
5 GHz 802.11a 54 Mbps	-25 dB, EVM, Mask Compliance	16	dBm
5 GHz 802.11n 20 MHz MCS0	-5 dB, EVM, Mask Compliance	14	dBm
5 GHz 802.11n 20 MHz MCS7	-5 dB, EVM, Mask Compliance	14	dBm
5 GHz 802.11n 40 MHz MCS0	-5 dB, EVM, Mask Compliance	13	dBm
5 GHz 802.11n 40 MHz MCS7	-27 dB, EVM, Mask Compliance	13	dBm
5 GHz 802.11ac 20 MHz MCS0	-5 dB, EVM, Mask Compliance	14	dBm
5 GHz 802.11ac 20 MHz MCS8	-30 dB, EVM, Mask Compliance	14	dBm
5 GHz 802.11ac 40 MHz MCS0	-5 dB, EVM, Mask Compliance	13	dBm
5 GHz 802.11ac 40 MHz MCS9	-32 dB, EVM, Mask Compliance	13	dBm
5 GHz 802.11ac 80 MHz MCS0	-5 dB, EVM, Mask Compliance	11	dBm
5 GHz 802.11ac 80 MHz MCS9	-32 dB, EVM, Mask Compliance	11	dBm
5 GHz 802.11ax 20 MHz MCS0	-5 dB, EVM, Mask Compliance	13	dBm
5 GHz 802.11ax 20 MHz MCS11	-35 dB, EVM, Mask Compliance	10	dBm
5 GHz 802.11ax 40 MHz MCS0	-5 dB, EVM, Mask Compliance	13	dBm
5 GHz 802.11ax 40 MHz MCS11	-35 dB, EVM, Mask Compliance	10	dBm
5 GHz 802.11ax 80 MHz MCS0	-5 dB, EVM, Mask Compliance	10	dBm
5 GHz 802.11ax 80 MHz MCS11	-35 dB, EVM, Mask Compliance	10	dBm

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11 Bluetooth subsystem

11.1 Bluetooth/Bluetooth LE receiver performance

Table 19: Typical Bluetooth/Bluetooth LE receiver performance at AVDD33=3.3 VDC and VIO=1.8 V, 25 degrees C, ambient temperature.

Parameter	Conditions	Min	Typ	Max	Unit
Frequency range	--	2400	--	2483.5	MHz
Receiver sensitivity	**Conditions**	**1-Port**		**2-Port**	**Unit**
BDR 1 Mbps	0.1% BER, 1DH5	-92		-93	dBm
EDR 2 Mbps	0.01% BER,2DH5	-91		-92	dBm
EDR 3 Mbps	0.01% BER,3DH5	-86		-87	dBm
Bluetooth LE 1 Mbps	0.1% BER, 37 Packet Payload, TX Impairments [1]	-95.5		-96.5	dBm
Bluetooth LE 2 Mbps	0.1% BER, 37 Packet Payload, TX Impairments [1]	-93		-94	dBm
Bluetooth LR 500 Kbps	0.1% BER, 37 Packet Payload, TX Impairments [1]	-97		-98	dBm
Bluetooth LR 125 Kbps	0.1% BER, 37 Packet Payload, TX Impairments [1]	-102		-103	dBm
Receiver maximum input level (MIL)	**Conditions**	**1-Port**		**2-Port**	**Unit**
BDR 1 Mbps	[2]	-2		-3	dBm
EDR 2 Mbps	[3]	-5		-6	dBm
EDR 3 Mbps	[4]	-5		-6	dBm
Bluetooth LE 1 Mbps	[5]	-2		-3	dBm
Bluetooth LE 2 Mbps	[6]	-2		-3	dBm
Bluetooth LR 500 Kbps	[7]	-2		-3	dBm
Bluetooth LR 125 Kbps	[8]	-2		-3	dBm
Receiver Adjacent-/Co- Channel Interference (ACI/CCI)					
BDR 1 Mbps					
Receiver ACI @ -5 MHz (image -1)	BDR 1 Mbps	-38		-38	dB
Receiver ACI @ -4 MHz (image)	BDR 1 Mbps	-26		-26	dB
Receiver ACI @ -3 MHz (image +1)	BDR 1 Mbps	-41		-41	dB
Receiver ACI @ -2 MHz	BDR 1 Mbps	-46		-46	dB
Receiver ACI @ -1 MHz	BDR 1 Mbps	-9		-9	dB
Receiver CCI	BDR 1 Mbps	11		11	dB
Receiver ACI @ +1 MHz	BDR 1 Mbps	-11		-11	dB
Receiver ACI @ +2 MHz	BDR 1 Mbps	-49		-49	dB
Receiver ACI @ +3 MHz	BDR 1 Mbps	-52		-52	dB
BDR 2 Mbps					
Receiver ACI @ -5 MHz (image -1)	BDR 2 Mbps	-42		-42	dB
Receiver ACI @ -4 MHz (image)	BDR 2 Mbps	-28		-28	dB
Receiver ACI @ -3 MHz (image +1)	BDR 2 Mbps	-41		-41	dB
Receiver ACI @ -2 MHz	BDR 2 Mbps	-46		-46	dB
Receiver ACI @ -1 MHz	BDR 2 Mbps	-9		-9	dB
Receiver CCI	BDR 2 Mbps	10		10	dB
Receiver ACI @ +1 MHz	BDR 2 Mbps	-11		-11	dB
Receiver ACI @ +2 MHz	BDR 2 Mbps	-49		-49	dB
Receiver ACI @ +3 MHz	BDR 2 Mbps	-52		-52	dB

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BDR 3 Mbps				
Receiver ACI @ -5 MHz (image -1)	BDR 3 Mbps	-38	-38	dB
Receiver ACI @ -4 MHz (image)	BDR 3 Mbps	-20	-20	dB
Receiver ACI @ -3 MHz (image +1)	BDR 3 Mbps	-38	-38	dB
Receiver ACI @ -2 MHz	BDR 3 Mbps	-41	-41	dB
Receiver ACI @ -1 MHz	BDR 3 Mbps	-8	-8	dB
Receiver CCI	BDR 3 Mbps	16	16	dB
Receiver ACI @ +1 MHz	BDR 3 Mbps	-8	-8	dB
Receiver ACI @ +2 MHz	BDR 3 Mbps	-42	-42	dB
Receiver ACI @ +3 MHz	BDR 3 Mbps	-48	-48	dB
Bluetooth LE 1 Mbps				
Receiver ACI @ -5 MHz (image -1)	BLE 1 Mbps	-39	-39	dB
Receiver ACI @ -4 MHz (image)	BLE 1 Mbps	-28	-28	dB
Receiver ACI @ -3 MHz (image +1)	BLE 1 Mbps	-38	-38	dB
Receiver ACI @ -2 MHz	BLE 1 Mbps	-45	-45	dB
Receiver ACI @ -1 MHz	BLE 1 Mbps	-3	-3	dB
Receiver CCI	BLE 1 Mbps	9	9	dB
Receiver ACI @ +1 Mbps	BLE 1 Mbps	-9	-9	dB
Receiver ACI @ +2 Mbps	BLE 1 Mbps	-50	-50	dB
Receiver ACI @ +3 Mbps	BLE 1 Mbps	-52	-52	dB
Bluetooth LE 2 Mbps				
Receiver ACI @ -6 MHz (image -2)	BLE 2 Mbps	-51	-51	dB
Receiver ACI @ -4 MHz (image)	BLE 2 Mbps	-29	-29	dB
Receiver ACI @ -2 MHz	BLE 2 Mbps	-19	-19	dB
Receiver CCI	BLE 2 Mbps	8	8	dB
Receiver ACI @+2 Mbps	BLE 2 Mbps	-29	-29	dB
Receiver ACI @ +4 Mbps	BLE 2 Mbps	-51	-51	dB
Receiver ACI @ +6 Mbps	BLE 2 Mbps	-55	-55	dB
Bluetooth LR 500 kbps				
Receiver ACI @ -5 MHz (image -1)	Bluetooth LR 500 kbps	-40	-40	dB
Receiver ACI @ -4 MHz (image)	Bluetooth LR 500 kbps	-28	-28	dB
Receiver ACI @ -3 MHz (image +1)	Bluetooth LR 500 kbps	-38	-38	dB
Receiver ACI @ -2 MHz	Bluetooth LR 500 kbps	-48	-48	dB
Receiver ACI @ -1 MHz	Bluetooth LR 500 kbps	-5	-5	dB
Receiver CCI	Bluetooth LR 500 kbps	9	9	dB
Receiver ACI @ 1 Mbps	Bluetooth LR 500 kbps	-11	-11	dB
Receiver ACI @ 2 Mbps	Bluetooth LR 500 kbps	-51	-51	dB
Receiver ACI @ 3 Mbps	Bluetooth LR 500 kbps	-55	-55	dB
Bluetooth LR 125 kbps				
Receiver ACI @ -5 MHz (image -1)	Bluetooth LR 125 kbps	-41	-41	dB
Receiver ACI @ -4 MHz (image)	Bluetooth LR 125 kbps	-28	-28	dB
Receiver ACI @ -3 MHz (image +1)	Bluetooth LR 125 kbps	-39	-39	dB
Receiver ACI @ -2 MHz	Bluetooth LR 125 kbps	-49	-49	dB
Receiver ACI @ -1 MHz	Bluetooth LR 125 kbps	-5	-5	dB
Receiver CCI	Bluetooth LR 125 kbps	9	9	dB

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Receiver ACI @ 1 Mbps	Bluetooth LR 125 kbps	-12	-12	dB
Receiver ACI @ 2 Mbps	Bluetooth LR 125 kbps	-55	-55	dB
Receiver ACI @ 3 Mbps	Bluetooth LR 125 kbps	-60	-60	dB

[1] Bluetooth/Bluetooth LE receiver refers to Dirty Tx. That is, the transmitter has impairments as specified by the Bluetooth SIG standard.
[2] De-sense of 2.7 dB at 2440 MHz, 0.5 dB at 2480 MHz
[3] De-sense of 3.4 dB at 2440 MHz, 1.2 dB at 2480 MHz
[4] De-sense of 3.6 dB at 2440 MHz, 1.1 dB at 2480 MHz
[5] De-sense of 3.8 dB at 2440 MHz, 0.8 dB at 2480 MHz
[6] De-sense of 2.1 dB at 2440 MHz, 0.6 dB at 2480 MHz
[7] De-sense of 3.4 dB at 2440 MHz, 0.6 dB at 2480 MHz
[8] De-sense of 5.3 dB at 2440 MHz, 1 dB at 2480 MHz

11.2 Bluetooth/Bluetooth LE Transmitter performance

Table 20: Typical Bluetooth/Bluetooth LE Transmitter performance at AVDD33=3.3 VDC and VIO=1.8 V, 25 degrees C, ambient temperature.

Parameter	Conditions	Min	Typ	Max	Unit
Frequency range	--	2400	--	2483.5	MHz
Transmitter Power	**Conditions**	**1-Port**		**2-Port**	**Unit**
BDR 1 Mbps	Mask Compliant	5		6	dBm
EDR 2 Mbps	Mask and EVM Compliant	2		3	dBm
EDR 3 Mbps	Mask and EVM Compliant	2		3	dBm
Bluetooth LE 1 Mbps	-	5		6	dBm
Mask Compliant	-	5		6	dBm
Bluetooth LR 500 Kbps	-	5		6	dBm
Bluetooth LR 125 Kbps	-	5		6	dBm

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12 Host Interface Specifications

12.1 SDIO Specifications

The SONA™NX61X series wireless module SDIO host interface pins are powered from the VIO_SD voltage supply. The SDIO electrical specifications are identical for the 1-bit SDIO and 4-bit SDIO modes.

12.1.1 Default Speed, High-Speed Modes

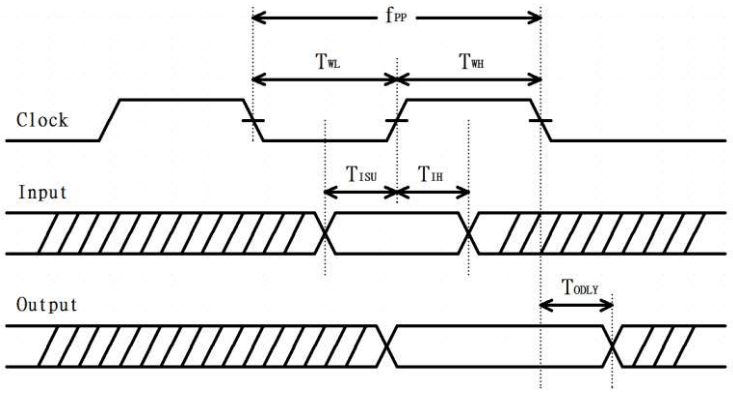

Figure 23: SDIO protocol timing diagram--- default mode (3.3V)

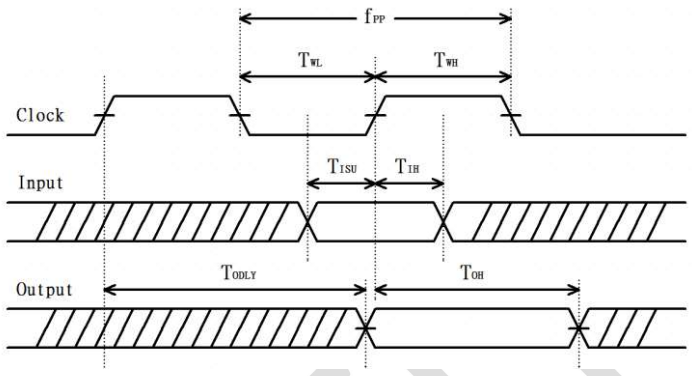

Figure 24: SDIO protocol timing diagram--- High-Speed mode (3.3V)

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

Table 21: 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	2.5	-	-	ns

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12.1.2 SDR12, SDR25, SDR50 Mode (up to 100 MHz) (1.8V)

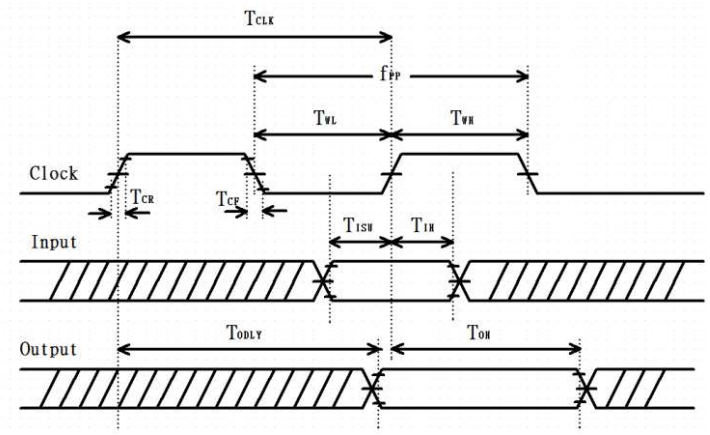

Figure 25: SDIO protocol timing diagram--- SDR12, SDR25, SDR50 modes (up to 100 MHz) (1.8V)

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

Table 22: 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 TCR, TCF < 2ns (max) at 100 MHz CCARD=10pF	SDR12/25/50	-	-	0.2*TCLK	ns
TODLY	Output delay time CL≦30pF	SDR12/25/50	-	-	7.5	ns
TOH	Output hold time CL=15pF	SDR12/25/50	1.5	-	-	ns

12.1.3 SDR104 Mode (208 MHz) (1.8V)

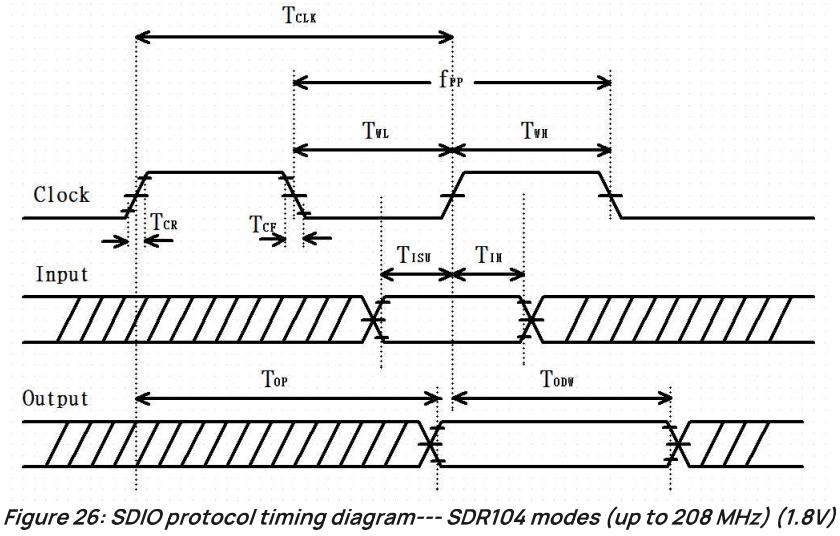

Figure 26: SDIO protocol timing diagram--- SDR104 modes (up to 208 MHz) (1.8V)

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

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Table 23: SDIO timing requirements -- SDR104 modes (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 TCR, TCF < 0.96ns (max) at 208 MHz CCARD = 10pF	SDR104	-	-	0.2*TCLK	ns
TOP	Card output phase	SDR104	0	-	10	ns
TODW	Output timing pf variable data window	SDR12/25/SDR50	2.88	-	-	ns

12.1.4 DDR50 Mode (50 MHz) (1.8V)

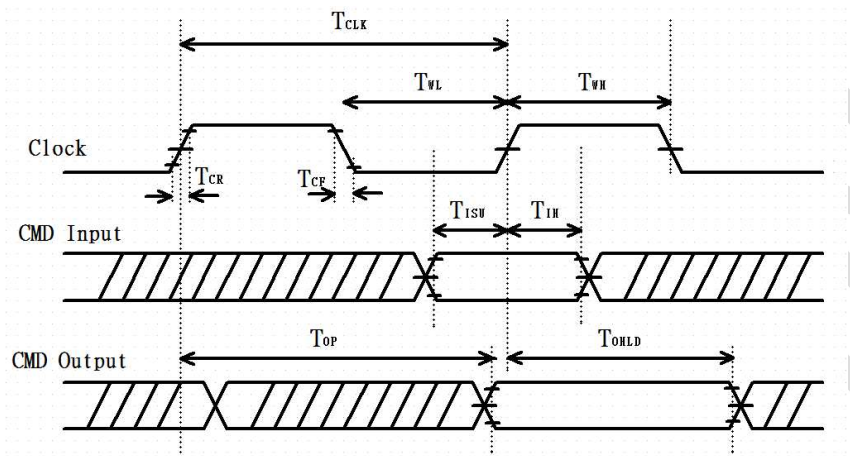

Figure 27: SDIO CMD timing diagram--- DDR50 modes (50 MHz) (1.8V)

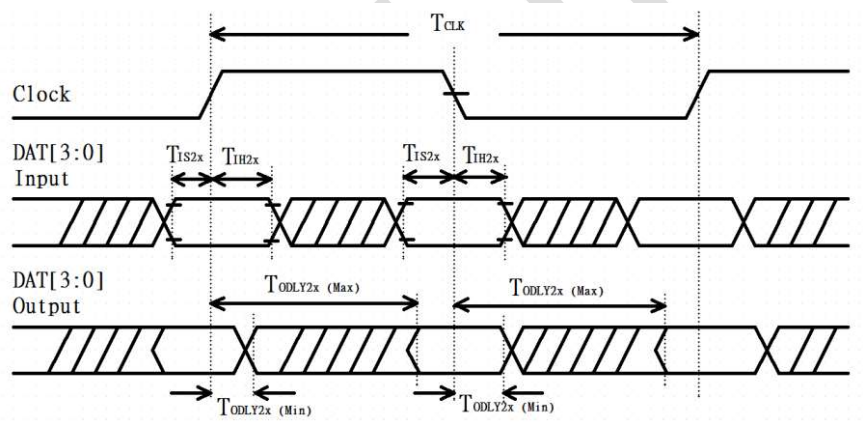

Figure 28: SDIO DAT[3:0] timing diagram--- DDR50 modes (50 MHz) (1.8V)

Note: In DDR50 mode, DAT[3:0] lines are samples on both edges of the clock (not applicable for CMD line)

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Europe: +44-1628-858-940
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Table 24: SDIO timing requirements - DDR50 modes (50 MHz)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
Clock						
TCLK	Clock time 50MHz (max) between rising edge	DDR50	20	--	--	ns
TCR, TCF	Rise time, fall time TCR, TCF ‹4.00ns (max) at 50MHz. CCARD=10pF	DDR50	--	--	0.2*TCLK	ns
Clock Duty	--	DDR50	45	--	55	%
CMD Input (referenced to clock rising edge)						
TIS	Input setup time CCARD≦10pF (1 card)	DDR50	6	--	--	ns
TIH	Input hold time CCARD≦10pF (1 card)	DDR50	0.8	--	--	ns
CMD Output (referenced to clock rising and failing edge)						
TODLY	Output delay time during data transfer mode CL≦30pF (1 card)	DDR50	--	--	13.7	ns
TOHLD	Output hold time CL≥15pF (1 card)	DDR50	1.5	--	--	ns
DAT[3:0] Input (referenced to clock rising and failing edges)						
TIS2X	Input setup time CCARD≦10pF (1 card)	DDR50	3	--	--	ns
TIH2X	Input hold time CCARD≦10pF (1 card)	DDR50	0.8	--	--	ns
DAT[3:0] Output (referenced to clock rising and failing edges)						
TODLY2X (max)	Output delay time during data transfer mode CL≦25pF (1 card)	DDR50	--	--	7.0	ns
TODLY2X (min)	Output hold time CL≥15pF (1 card))	DDR50	1.5	--	--	ns

Table 25: SDIO internal pull-up/pull-down specifications

Parameter	Condition	Min.	Typ.	Max.	Unit
Internal nominal pull-up/pull-down resistance	--	70	100	140	kΩ

12.2 High-Speed UART Specifications

The Sterling 70 supports a high-speed Universal Asynchronous Receiver/Transmitter (UART) interface, compliant to the industry standard 16550 specification. High-speed baud rates are supported to provide the physical transport between the device and the host for exchanging Bluetooth data.

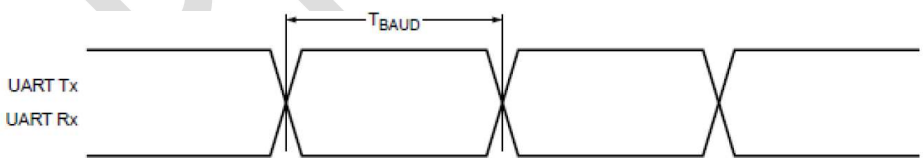

Figure 29: UART timing diagram

Table 26: PCM timing specification - master mode

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
T_{BAUD}	Baud rate	26MHz input clock	250	--	--	ns

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12.3 PCM Interface Specifications

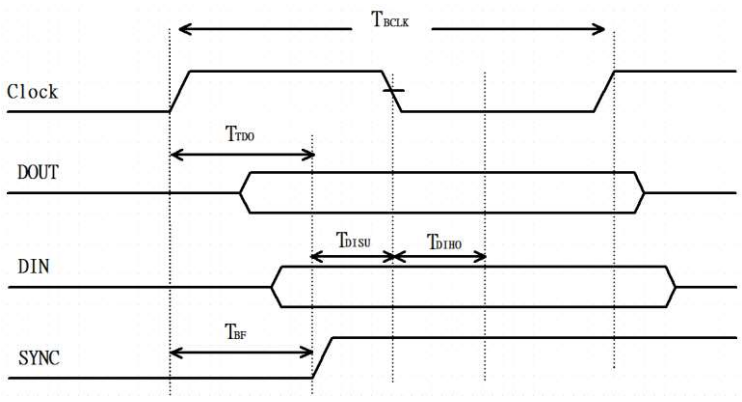

Figure 30: PCM timing specification – master mode

Table 27: PCM timing specification – master mode

Symbol	Parameter	Min.	Typ.	Max.	Unit
FBCLK	-	-	2/2.048	-	MHz
Duty CycleBCLK	-	0.4	0.5	0.6	-
TBCLK rise/fall	-	-	3	-	ns
TDO	-	-	-	15	ns
TDISU	-	20	-	-	ns
TDIHO	-	15	-	-	ns
TBF	-	-	-	15	ns

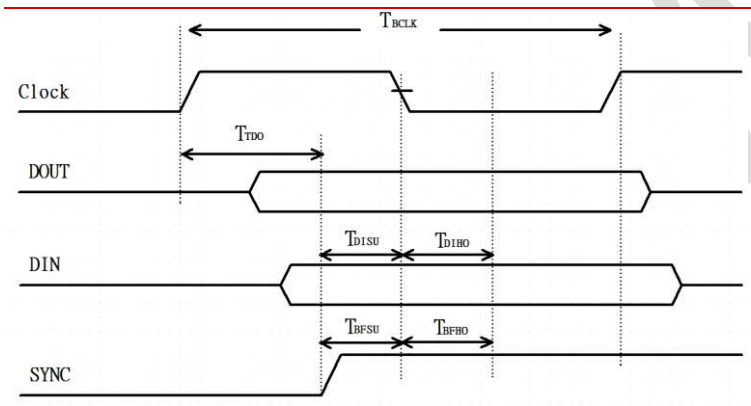

Figure 31: PCM timing specification – slave mode

Table 28: PCM timing specification – slave mode

Symbol	Parameter	Min.	Typ.	Max.	Unit
FBCLK	-	-	2/2.048	-	MHz
Duty CycleBCLK	-	0.4	0.5	0.6	-
TBCLK rise/fall	-	-	3	-	ns
TDO	-	-	-	30	ns
TDISU	-	15	-	-	ns
TDIHO	-	10	-	-	ns
TBFSU	-	15	-	-	ns
TBFHO	-	10	-	-	ns

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13 Application Note for Surface Mount Modules

13.1 Introduction

Ezurio'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.

13.2 Base SIP Module Shipping

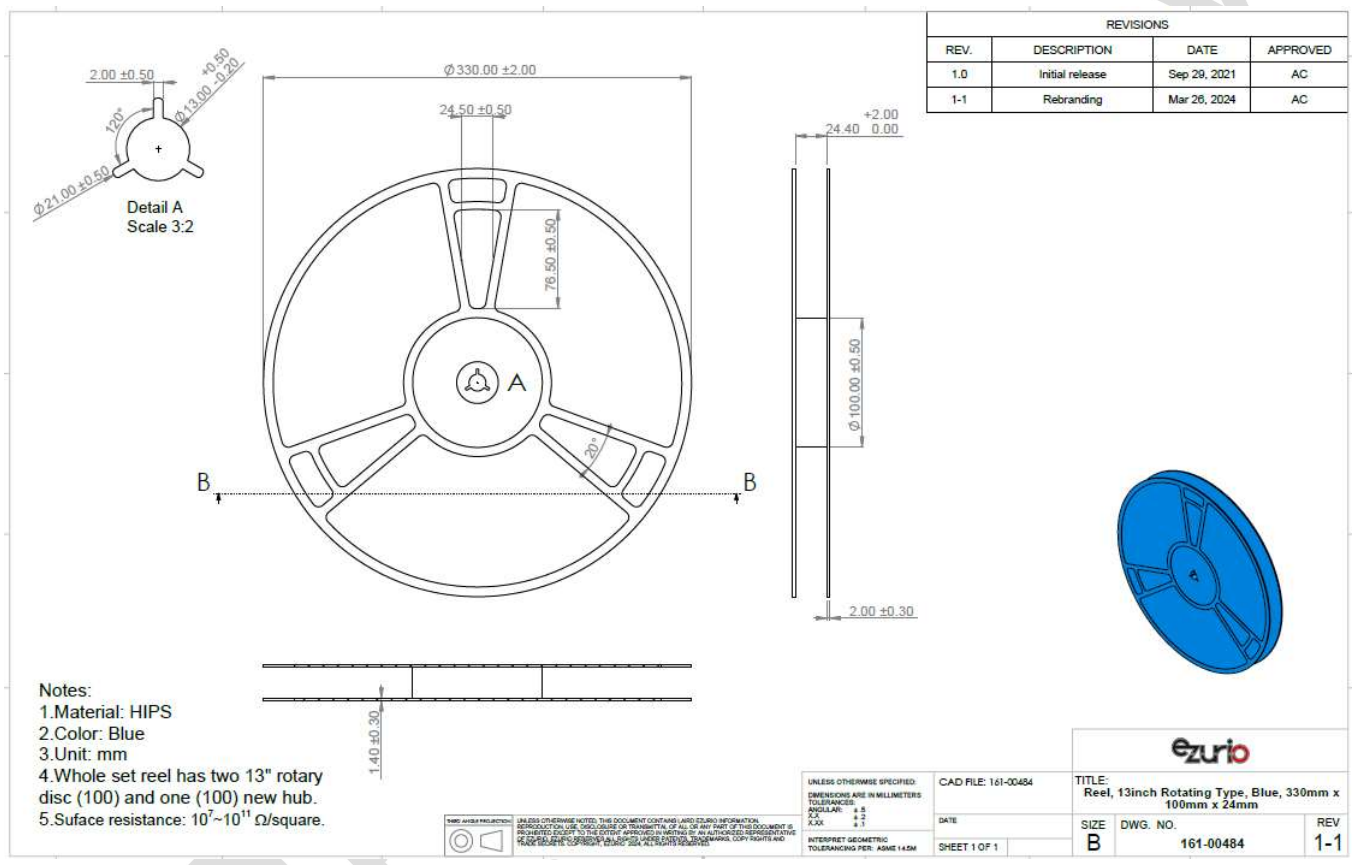
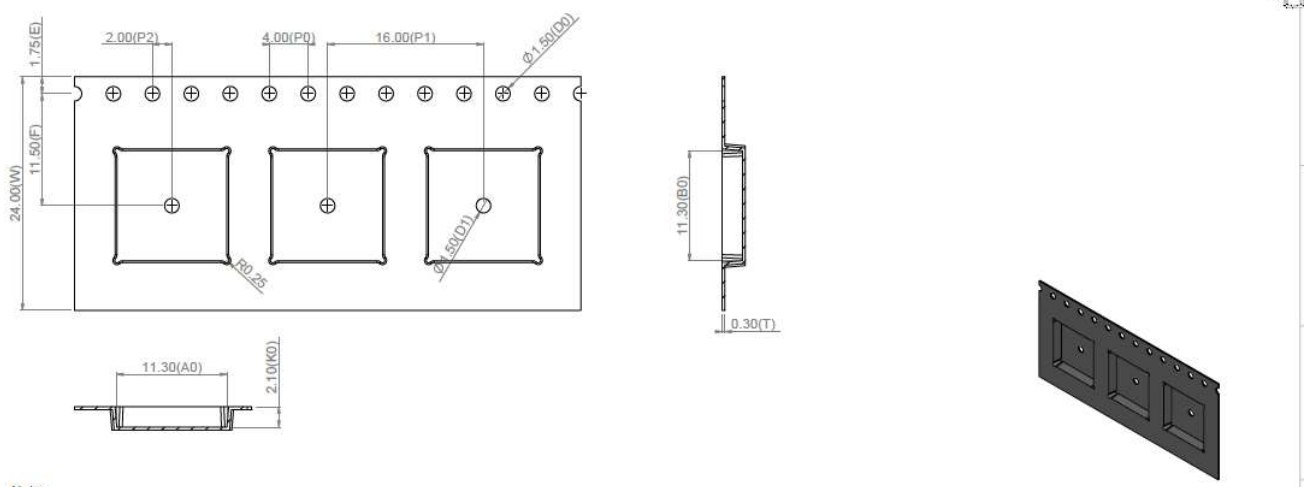


Figure 32: Reel Specification (Sona NX611 SIP)

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

ITRM	A0	B0	K0	P0	P1	P2	T	E	F	D0	D1	W	10P0
DIM	11.30	11.30	2.10	4.00	16.00	2.00	0.30	1.75	11.50	1.50	1.50	24.00	40.00
TOLE	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.10	+0.10 -0.00	±0.10	±0.30	±0.20

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
1-1	Initial release	Jun 21, 2023	AC



Notes:
1.Material: Conductive polystyrene, Black
2.Thickness : 0.30±0.05mm.
3.10 sprocket hole pitch cumulative tolerance ±0.20.
4.Carrier camber is within 1 mm in 250 mm.
5. All dimensions meet EIA-481 requirements.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES:
ANGULAR: ±.5
X.X ±.2
X.XX ±.1
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M

CAD FILE: 161-00559
DATE Jun 21, 2023
SHEET 1 OF 1

TITLE: Carrier Tape, Conductive Polystyrene, Black, 11.3mm x 11.3mm x 2.1mm
SIZE B | DWG. NO. 161-00559 | REV 1-1

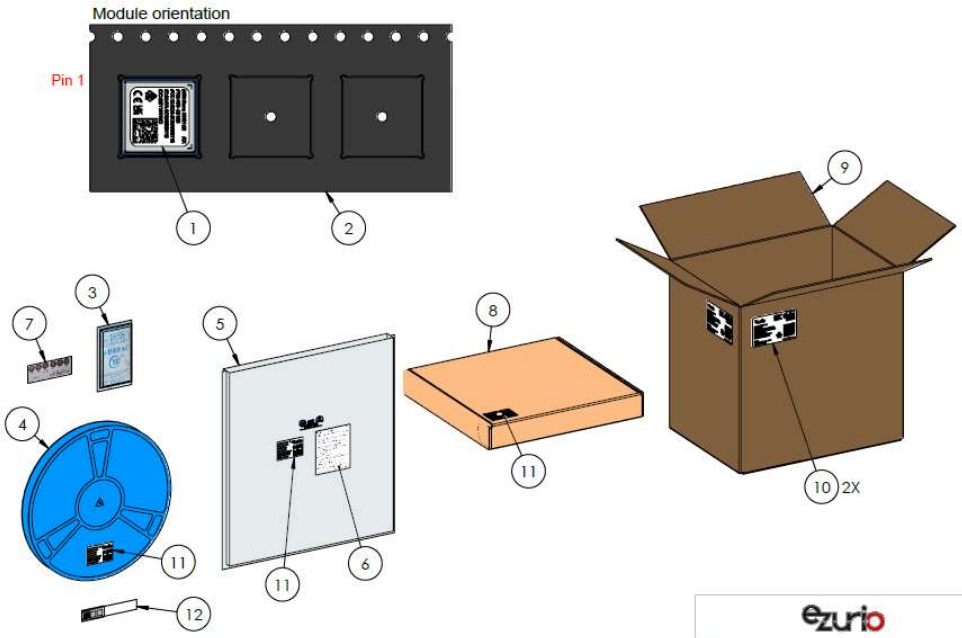
Figure 33: Tape specifications (Sona NX611 SIP)

There are 1,000 SONA™NX61X SIP modules taped in a reel (and packaged in a pizza box) and five boxes per carton (5,000 modules per carton). Reel, boxes, and carton are labeled with the appropriate labels.

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

NO.	ITEM NUMBER	REV.	DESCRIPTION	QTY.
1	453-00155	1-1	Module, Sona NX611 SIP, 2 RF Trace Pin	1000
2	161-00559	1-1	Carrier Tape, Conductive Polystyrene, Black, 11.3mm x 11.3mm x 2.1mm	1
3	161-00282	1-1	Desiccant, Silica Gel, 60g, 140mm x 80mm	1
4	161-00484	1-1	Reel, 13inch Rotating Type, Blue, 330mm x 100mm x 24mm	1
5	161-00389	1-1	Bag, ESD and Moisture Barrier, Silver, 400mm x 430mm x 0.14mm	1
6	160-01816	1-1	Label, Blank Moisture Sensitivity Level, 95mm x 80mm	1
7	161-00281	1-1	Humidity Indicator Card, Minimum 60% RH, Six Spot Indication, 38mm x 102mm	1
8	161-00391	1-1	Box, Single-Wall Corrugated B Flute, 355mm x 338mm x 50mm	1
9	161-00392	1-1	Carton, Double-Wall Corrugated AB Flute, 375mm x 285mm x 360mm	1
10	160-00036	1-0	Label, Standard Shipping Box, CE Mark, Pictogram, UKCA, RCM, 4in x 2.5in	2
11	160-00007	1-0	Label, Product Identifier, NX611 Series, 60mm x 40mm	3
12	161-00561	1-1	Cover Tape, Anti-static Polyester, 21.5mm x 0.05mm	1

REVISIONS			
REV.	REVISION NOTE	RELEASE DATE	REVISED BY
1-0	Initial release	Dec 26, 2023	IT



Notes:
1.Put the Module in the carrier tape and cover the tape.
2.Put the Reel, Desiccant and Humidity Indicator Card in the ESD bag.
3.Put the packed ESD bag (vacuum) in the box.
4.Put five boxes in the carton.
(If less that five reels are purchased, insert empty boxes or cardboard to consume the volume of the carton.)
5.Module packaging quantity:
Per Reel: 1000 PCS
Per Carton: 5000PCS

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS TOLERANCES: ANGULAR: ± .5 X.X ± .2 X.XX ± .1 INTERPRET GEOMETRIC TOLERANCING PER: ASME 14.5M	CAD FILE: 453-00155R DATE SHEET 1 OF 1	TITLE: Module, Sona NX611 SIP, 2 RF Trace Pin, Tape and Reel	
		SIZE B	DWG. NO. 453-00155R REV 1-0

Figure 34: SONA™NX611 SIP module packaging process, 453-00155R

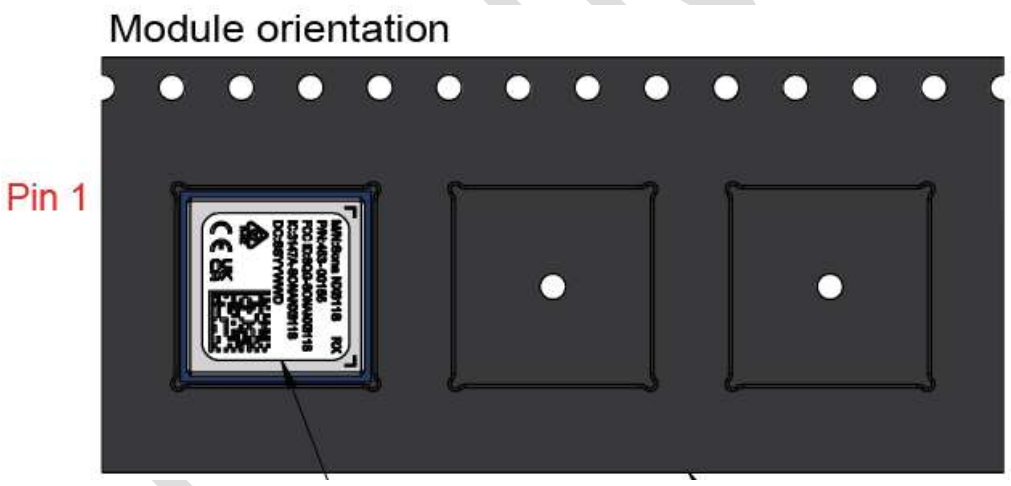


Figure 35: Sona NX611 SIP Module Orientation in Carrier Tape Pocket

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Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

13.3 Base 1216 Module Shipping

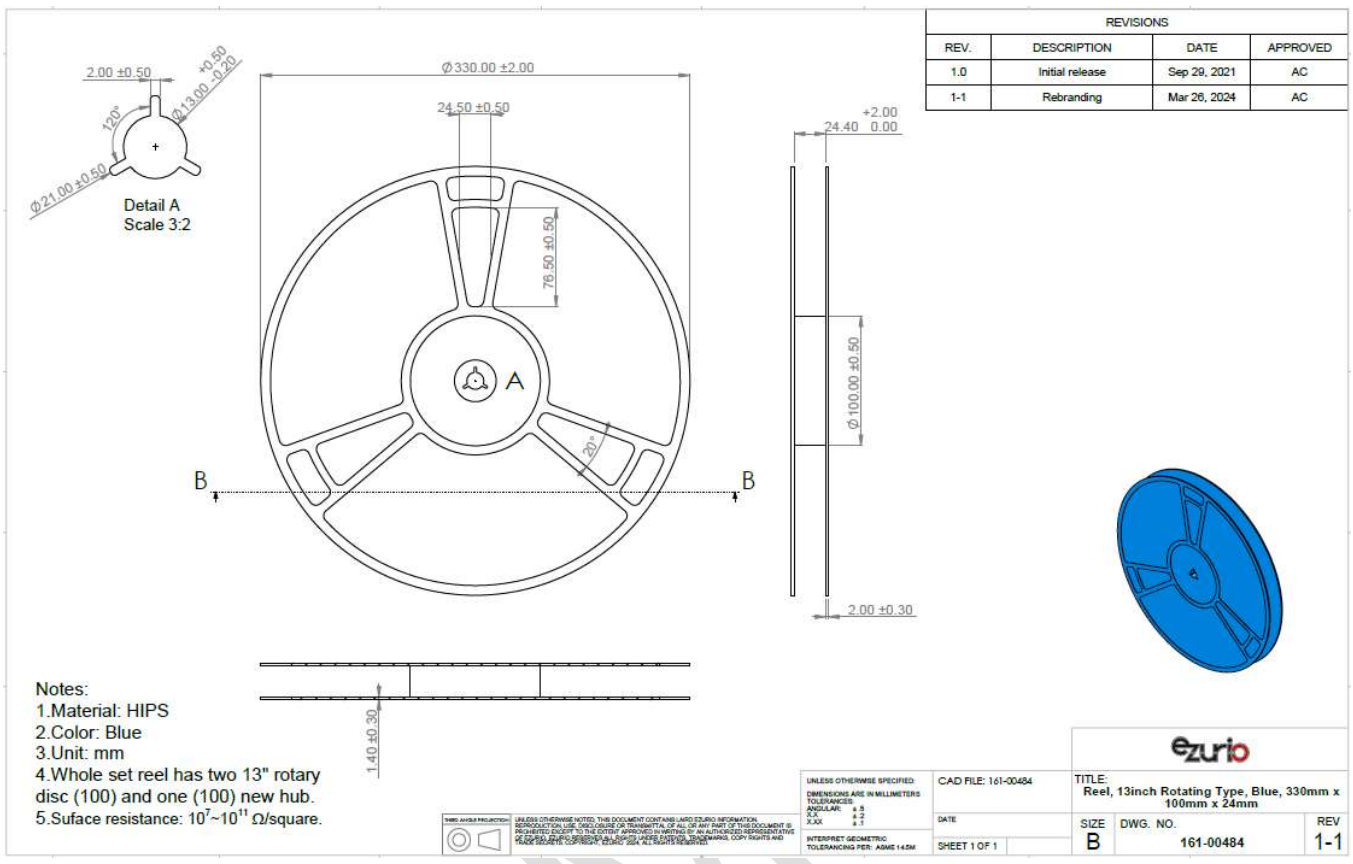
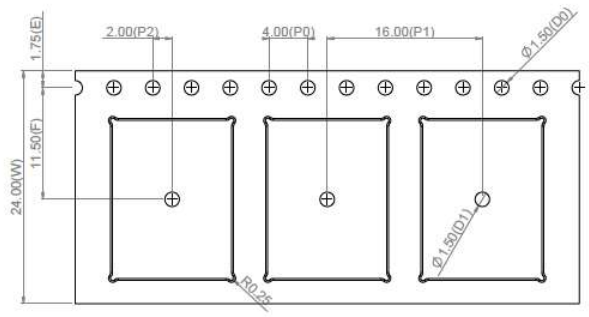


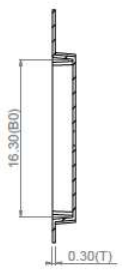
Figure 36: Reel Specification (Sona NX611 1216)

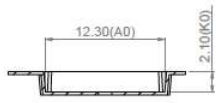
Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

ITRM	A0	B0	K0	P0	P1	P2	T	E	F	D0	D1	W	10P0
DIM	12.30	16.30	2.10	4.00	16.00	2.00	0.30	1.75	11.50	1.50	1.50	24.00	40.00
TOLE	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.05	±0.10	±0.10	+0.10 -0.00	±0.10	±0.30	±0.20

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
1-1	Initial release	Jun 21, 2023	AC







Notes:
1.Material: Conductive polystyrene, Black
2.Thickness : 0.30±0.05mm.
3.10 sprocket hole pitch cumulative tolerance ±0.20.
4.Carrier camber is within 1 mm in 250 mm.
5. All dimensions meet EIA-481 requirements.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES:
ANGULAR: ± .5
X.X ± .2
X.XX ± .1
INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5M

CAD FILE: 161-00558
DATE
SHEET 1 OF 1

TITLE: Carrier Tape, Conductive Polystyrene, Black, 12.3mm x 16.3mm x 2.1mm
SIZE B | DWG. NO. 161-00558 | REV 1-1

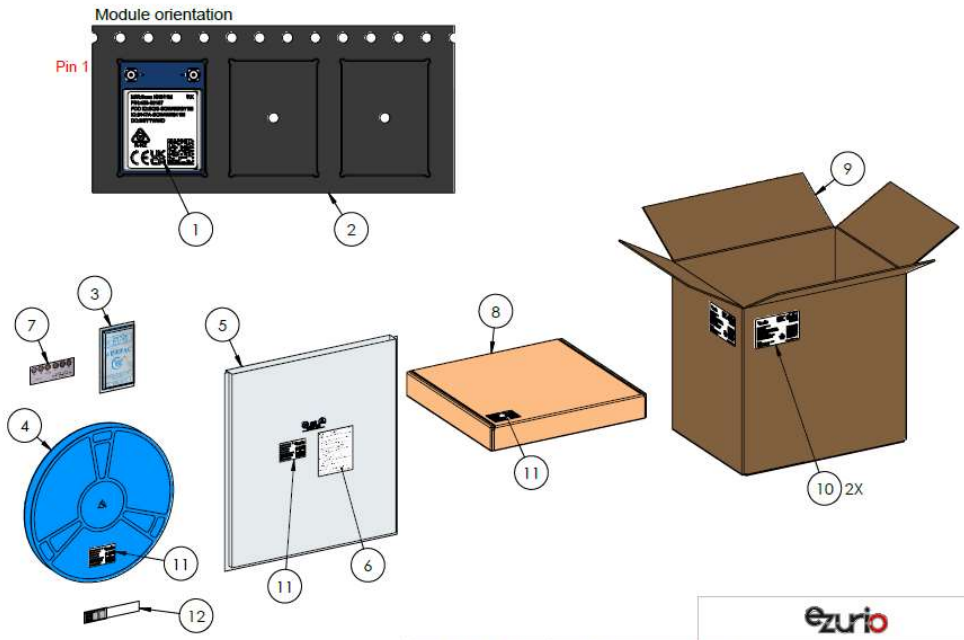
Figure 37: Tape specifications (Sona NX611 1216)

There are 1,000 SONA™NX61X 1216 modules taped in a reel (and packaged in a pizza box) and five boxes per carton (5,000 modules per carton). Reel, boxes, and carton are labeled with the appropriate labels.

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

NO.	ITEM NUMBER	REV.	DESCRIPTION	QTY.
1	453-00157	1-2	Module, Sona NX611 M.2 1216, 2 MHF4	1000
2	161-00558	1-1	Carrier Tape, Conductive Polystyrene, Black, 12.3mm x 16.3mm x 2.1mm	1
3	161-00282	1-1	Desiccant, Silica Gel, 60g, 140mm x 80mm	1
4	161-00484	1-1	Reel, 13inch Rotating Type, Blue, 330mm x 100mm x 24mm	1
5	161-00389	1-1	Bag, ESD and Moisture Barrier, Silver, 400mm x 430mm x 0.14mm	1
6	160-01816	1-1	Label, Blank Moisture Sensitivity Level, 95mm x 80mm	1
7	161-00281	1-1	Humidity Indicator Card, Minimum 60% RH, Six Spot Indication, 38mm x 102mm	1
8	161-00391	1-1	Box, Single-Wall Corrugated B Flute, 355mm x 338mm x 50mm	1
9	161-00392	1-1	Carton, Double-Wall Corrugated AB Flute, 375mm x 285mm x 380mm	1
10	160-00036	1-0	Label, Standard Shipping Box, CE Mark, Pictogram, UKCA, RCM, 4in x 2.5in	2
11	160-00007	1-0	Label, Product Identifier, NX611 Series, 60mm x 40mm	3
12	161-00561	1-1	Cover Tape, Anti-static Polyester, 21.5mm x 0.05mm	1

REVISIONS			
REV.	REVISION NOTE	RELEASE DATE	REVISED BY
1-0	Initial release	Dec 26, 2023	IT



Notes:
1.Put the Module in the carrier tape and cover the tape.
2.Put the Reel, Desiccant and Humidity Indicator Card in the ESD bag.
3.Put the packed ESD bag (vacuum) in the box.
4.Put five boxes in the carton.
(If less that five reels are purchased, insert empty boxes or cardboard to consume the volume of the carton.)
5.Module packaging quantity:
Per Reel: 1000 PCS
Per Carton: 5000PCS

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES:
ANGULAR: ± .5
X.X ± .2
X.XX ± .1
INTERPRET GEOMETRIC TOLERANCING PER: ASME 14.5M
CAD FILE: 453-00157R
DATE
SHEET 1 OF 1
TITLE: Module, Sona NX611 M.2 1216, 2 MHF4, Tape and Reel
SIZE B
DWG. NO. 453-00157R
REV 1-0

Figure 38: SONA™NX61X 1216 module packaging process, 453-00157R

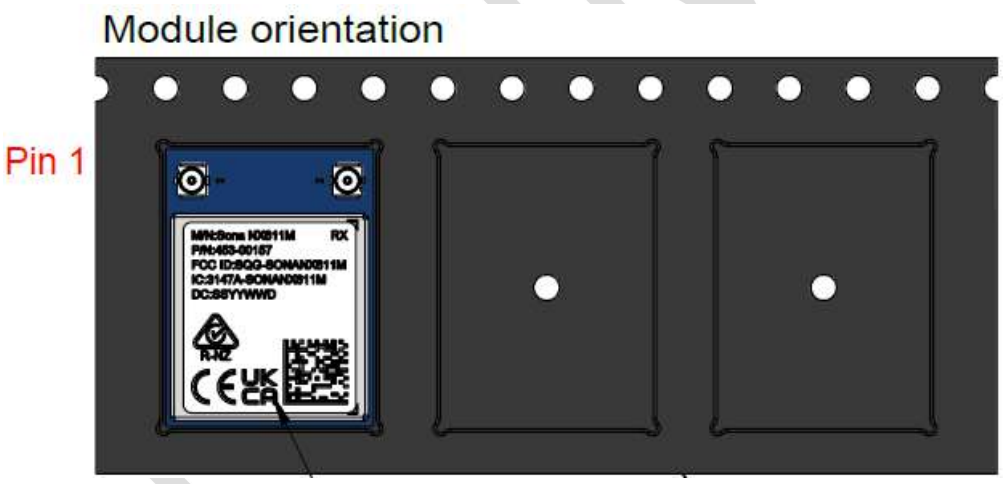


Figure 39: Sona NX611 1216 Module Orientation in Tape Carrier Pocket

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13.4 Base 2230 Module Shipping

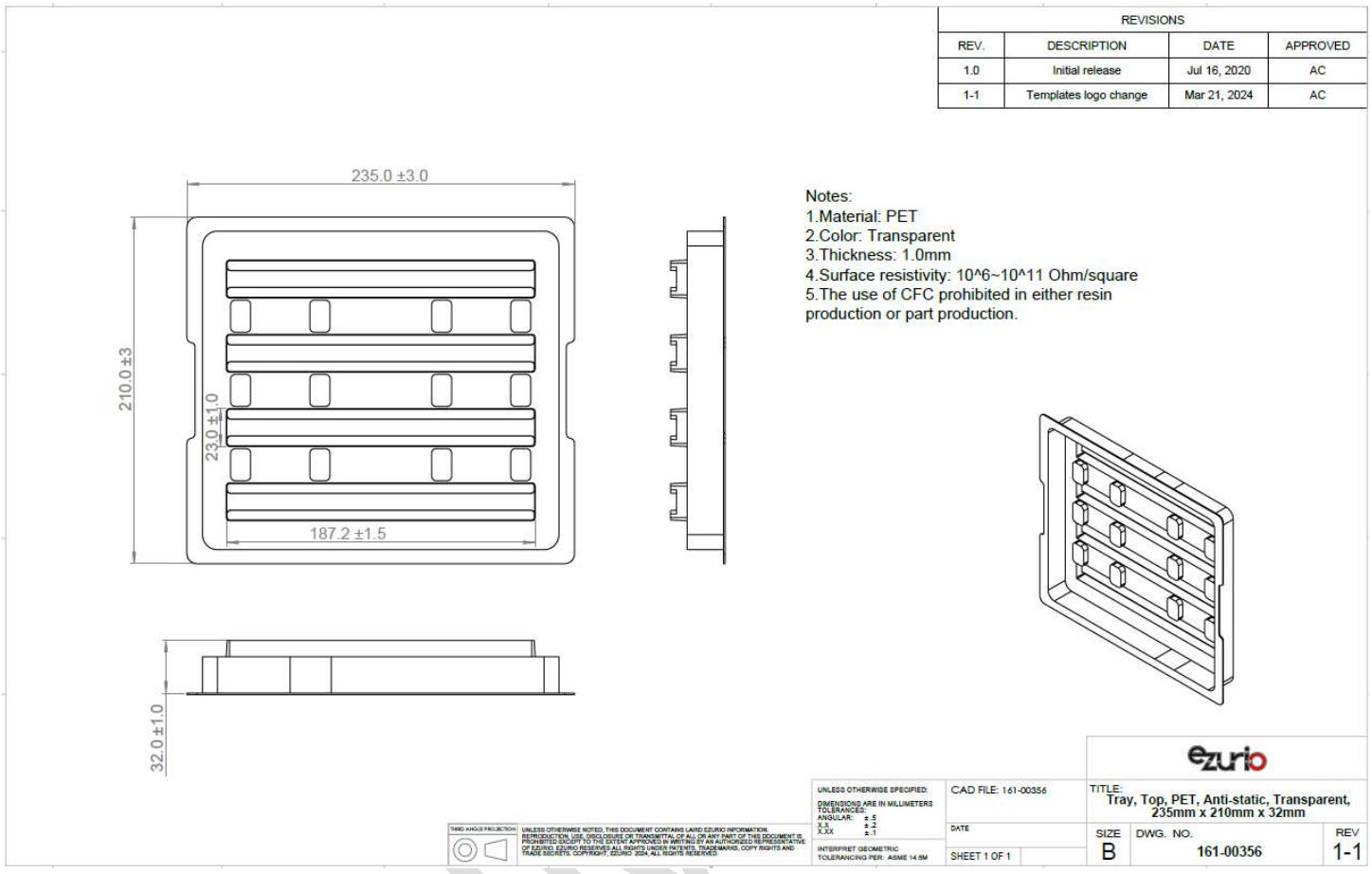

Figure 40: Shipping Tray, Top (Sona NX611 M.2 2230)

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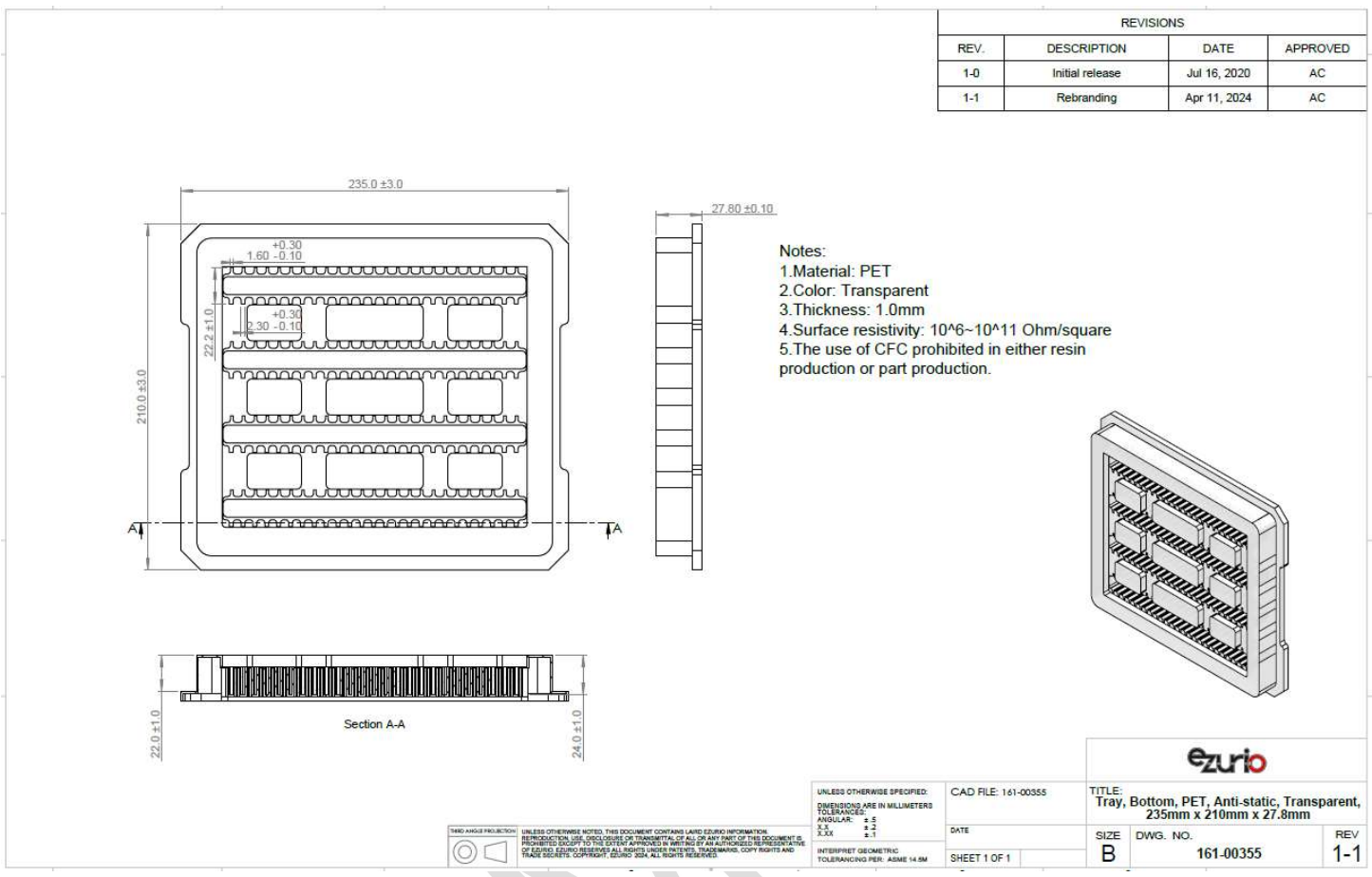

Figure 41: Shipping Tray, Bottom (Sona NX611 M.2 2230)

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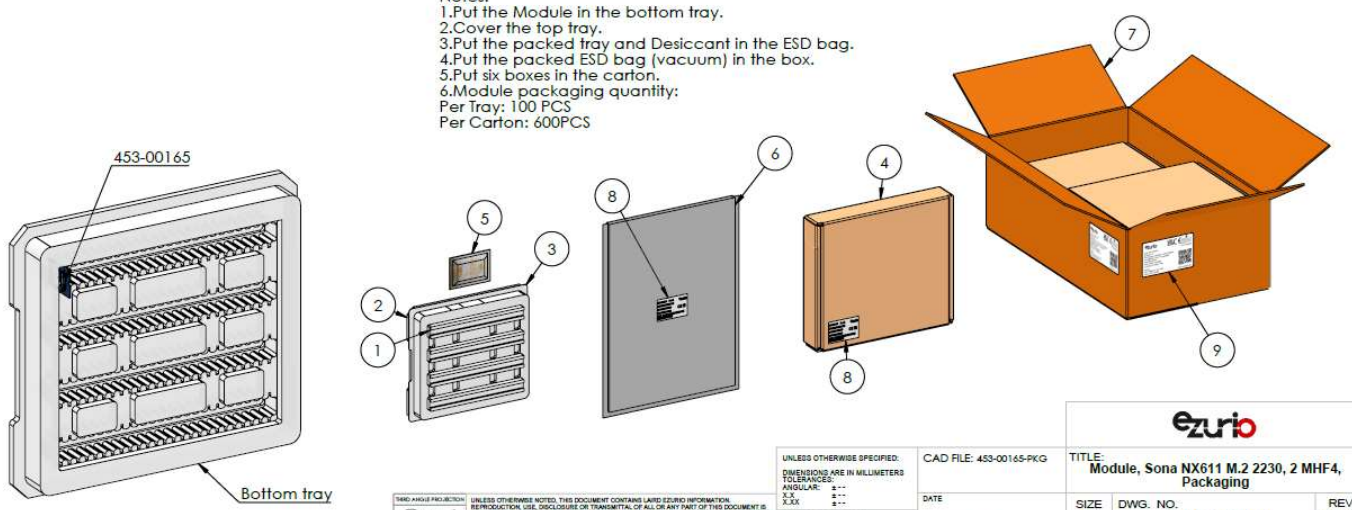
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

NO.	ITEM NUMBER	REV.	DESCRIPTION	QTY.
1	453-00165	1-1	Module, Sona NX611 M.2 2230, 2 MHF4	600
2	161-00355	1-1	Tray, Bottom, PET, Anti-static, Transparent, 235mm x 210mm x 27.8mm	6
3	161-00356	1-1	Tray, Top, PET, Anti-static, Transparent, 235mm x 210mm x 32mm	6
4	161-00007	1-0	Box, Kraft, B Flute, 265mm x 233mm x 45mm	6
5	161-00361	1.0	Desiccant, Silica Gel, 10g, 58mm x 80mm	6
6	161-00358	1-1	Bag, ESD and Moisture Barrier, Silver, 270mm x 380mm x 0.09mm	6
7	161-00010	1.0	Carton, Kraft, BC Flute, 486mm x 280mm x 183mm	1
8	160-00007	1-0	Label, Product Identifier, NX611 Series, 60mm x 40mm	12
9	160-02053	3-4	Label, Standard Shipping Box, CE Mark, Pictogram, 4in x 2.5in	2

REVISIONS			
REV.	REVISION NOTE	RELEASED DATE	REVISED BY
0-1	Initial release	Mar 5, 2024	IT

Notes:
1.Put the Module in the bottom tray.
2.Cover the top tray.
3.Put the packed tray and Desiccant in the ESD bag.
4.Put the packed ESD bag (vacuum) in the box.
5.Put six boxes in the carton.
6.Module packaging quantity:
Per Tray: 100 PCS
Per Carton: 600PCS



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
TOLERANCES:
ANGULAR: ±---
X.X ±---
X.XX ±---
INTERPRET GEOMETRIC TOLERANCING PER: ASME 14.5M
THIRD ANGLE PROJECTION
CAD FILE: 453-00165-PKG
DATE
SHEET 1 OF 1
TITLE: Module, Sona NX611 M.2 2230, 2 MHF4, Packaging
SIZE B
DWG. NO. 453-00165-PKG
REV 0-1

Figure 42: SONA™NX61X M.2 2230 module packaging process, 453-00165

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13.5 Labelling

The following labels are located on the anti-static bag. Sona NX611 SIPs and 1216 modules are MSL4 modules.

Figure 43: Anti-static bag label, 160-01816

The following label is located on the pizza box.

Figure 44: Product identifier box label, 160-00007

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

Figure 45: Master carton package label, 160-00036

13.6 Required Storage Conditions

13.6.1 Prior to Opening the Dry Packing

The following are required storage conditions ***prior* to opening the dry packing**:

- Normal temperature: 5~40°C
- Normal humidity: 80% (Relative humidity) or less
- Storage period: One year or less

Note: Humidity means relative humidity.

13.6.2 After Opening the Dry Packing

The following are required storage conditions ***after* opening the dry packing** (to prevent moisture absorption):

- Storage conditions for one-time soldering:
  - Temperature: 5-25°C
  - Humidity: 60% or less
  - Period: 72 hours or less after opening
- Storage conditions for two-time soldering
  - Storage conditions following opening and prior to performing the 1st reflow:
    - Temperature: 5-25°C
    - Humidity: 60% or less
    - Period: A hours or less after opening
  - Storage conditions following completion of the 1st reflow and prior to performing the 2nd reflow
    - Temperature: 5-25°C
    - Humidity: 60% or less
    - Period: B hours or less after completion of the 1st reflow

Note: Should keep A+B within 72 hours.

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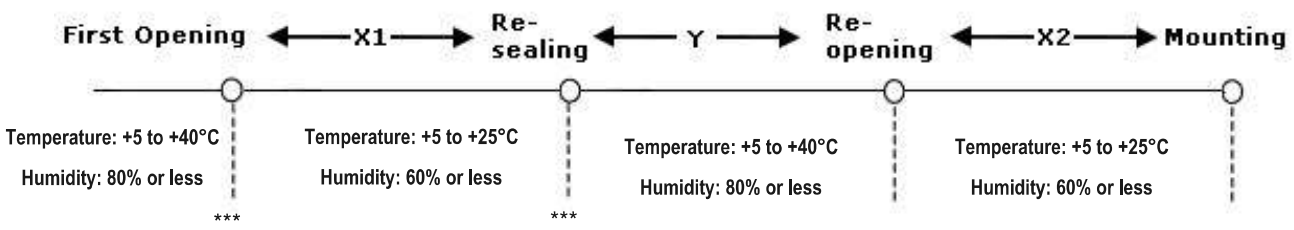
13.6.3 Temporary Storage Requirements after Opening

The following are temporary storage requirements after opening:

- Only re-store the devices *once* prior to soldering.
- Use a dry box or place desiccant (with a blue humidity indicator) with the devices and perform dry packing again using vacuumed heat-sealing.

The following indicate the required storage period, temperature, and humidity for this temporary storage:

- Storage temperature and humidity:



*** - External atmosphere temperature and humidity of the dry packing

- Storage period:
  - X1+X2 – Refer to After Opening the Dry Packing storage requirements. Keep is X1+X2 within 72 hours.
  - Y – Keep within two weeks or less.

13.7 Baking Conditions

Baking conditions and processes for the module follow the J-STD-033 standard which includes the following:

- The calculated shelf life in a sealed bag is 12 months at <40°C and <80% relative humidity.
- Once the packaging is opened, the SiP must be mounted (per MSL4/Moisture Sensitivity Level 4) within 72 hours at <30 °C and <60% relative humidity.
- If the SiP is not mounted within 72 hours or if, when the dry pack is opened, the humidity indicator card displays >10% humidity, then the product must be baked for 48 hours at 125 °C (±5 °C).

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13.8 Surface Mount Conditions SIP Modules

The following soldering conditions are recommended to ensure device quality.

13.8.1 Soldering

Note: When soldering, the stencil thickness should be ≥ 0.1 mm.

Convection reflow or IR/Convection reflow (one-time soldering or two-time soldering in air or nitrogen environment)

- Measuring point – IC package surface
- Temperature profile:

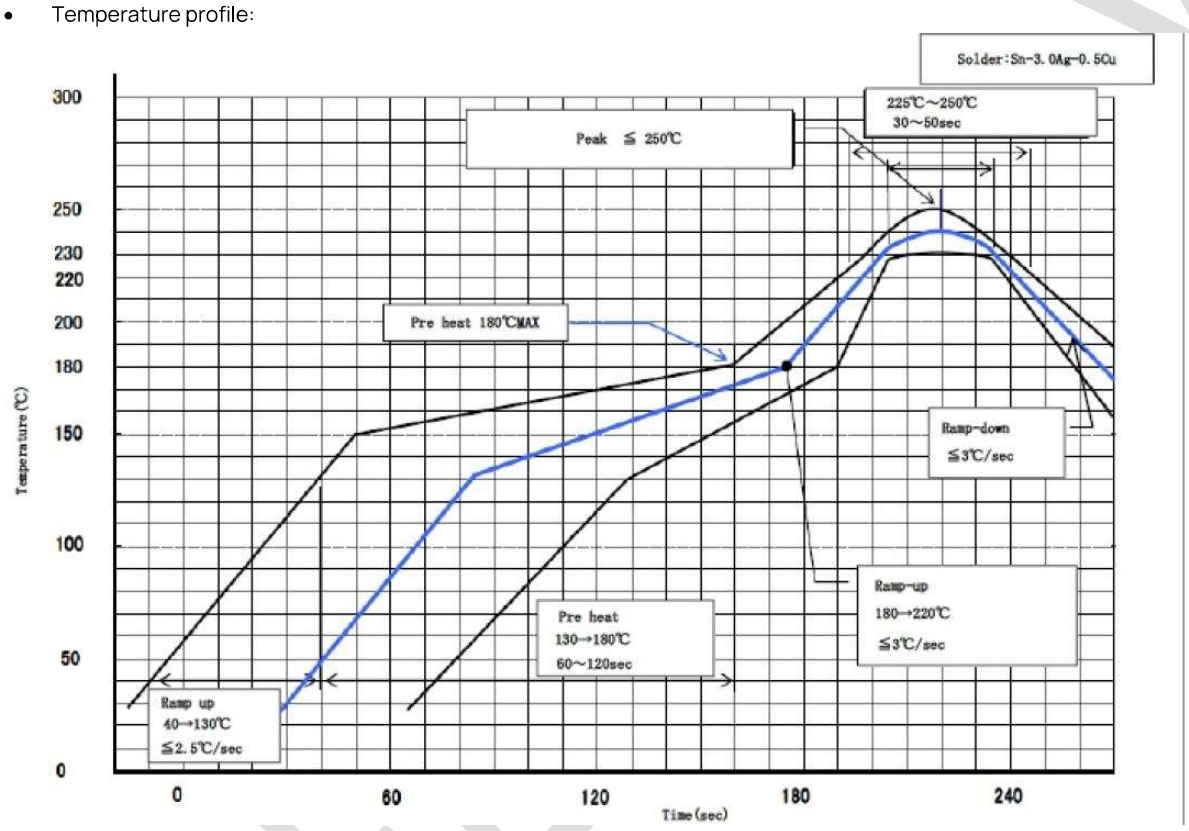

Figure 46: Temperature profile

- Ramp-up: 40-130 °C. Less than 2.5 °C/sec
- Pre heat: 130-180 °C 60-120 sec, 180 °C MAX
- Ramp-up: 180-220 °C. Less than 3 °C/sec
- Peak Temperature: MAX 250 °C
  - 225 °C ~ 250 °C, 30 ~ 50 sec
- Ramp-down: Less than 3 °C/sec

13.8.2 Cautions When Removing Modules from the Platform for RMA

- Bake the platform before removing the SIP from the platform. Reference baking conditions.
- Remove the SIP by using a hot air gun. This process should be carried out by a skilled technician.

Suggestion conditions:

- One-side component platform:
  - Set the hot plate at 280 °C.
  - Put the platform on the hot plate for 8~10 seconds.
  - Remove the SIP from platform.
- Two-side components platform:

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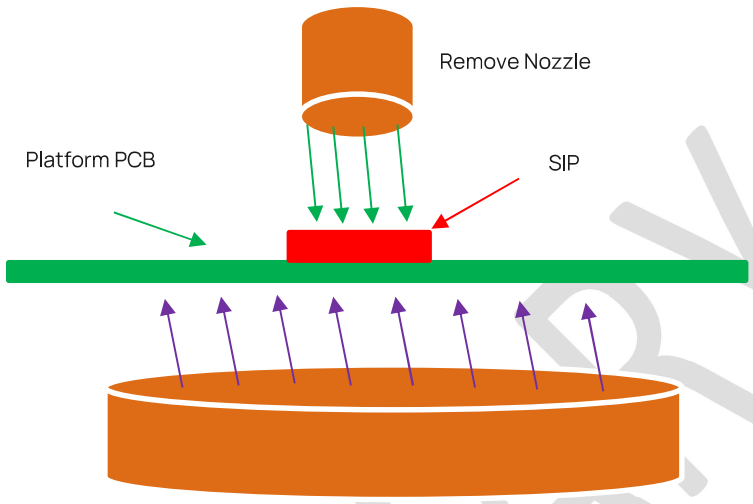
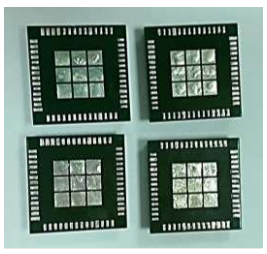
- Use two hot air guns
- On the bottom side, use a pre-heated nozzle (temperature setting of 200~250 °C) at a suitable distance from the platform PCB.
- On the top side, apply a remove nozzle (temperature setting of 330 °C). Heat the SIP until it can be removed from platform PCB.



- Remove the residue solder under the bottom side of SIP. (Note: Alternate module pictured as an example)



(Not accepted for RMA)

(Accepted for RMA analysis)

Example SIP with residue solder on the bottom ***Example Module, not SONA™NX61X module without residue solder***

- Remove and clean the residue flux as needed.

13.8.3 Precautions for Use

- Opening/handing/removing must be done on an anti-ESD treated workbench. All workers must also have undergone anti-ESD treatment.
- The devices should be mounted within one year of the date of delivery.
- The SONA™NX61X SIP modules are MSL level 4.
- The SONA™NX61X M2 modules are MSL level 1.

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14 Reliability Test

14.1 Climatic And Dynamic Reliability Test

Table 29: Climatic and Dynamic Reliability Test Results for Sona NX611 Modules

Test Item	Specification	Standard	Test Result
Thermal Shock	Temperature: -40 ~ 85℃ Ramp time: Less than 10 seconds. Dwell Time: 10 minutes Number of Cycles: 350 times	*JESD22-A106 *IEC 60068-2-14 for dwell time and number of cycles	Pass
Vibration Non-operating Unpackaged device	Vibration Wave Form: Sine Waveform Vibration frequency / Displacement: 20-80 Hz/1.5mm Vibration frequency / Acceleration: 80-2000 Hz/20g Cycle Time: 4 min/cycle Number of Cycles: 4 cycle/axis Vibration Axes：X, Y and Z (Rotate each axis on vertical vibration table)	JEDEC 22-B103B (2016)	Pass
Mechanical Shock Non-operating Unpackaged device	Pulse shape: Half-sine waveform Impact acceleration: 1500 g Pulse duration: 0.5 ms Number of shocks: 30 shocks (5 shocks for each face) Orientation: Bottom, top, left, right, front and rear faces	JEDEC 22-B110B.01 (2019)	Pass

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14.2 Reliability MTBF Prediction

Table 30: MTBF Predictions for Sona NX611 Modules

Ezurio Part Number	Environment	Standard	Test Result 45 °C (Hours)
453-00155R 453-00155C 453-00156R 453-00156C	Ground, Fixed, Uncontrolled	Telcordia Issue 3	4,020,768
453-00157R 453-00157C 453-00158R 453-00158C	Ground, Fixed, Uncontrolled	Telcordia Issue 3	2,668,324
453-00165 453-00166	Ground, Fixed, Uncontrolled	Telcordia Issue 3	3,600,089
453-00155R 453-00155C 453-00156R 453-00156C	Mobile, Fixed, Uncontrolled	Telcordia Issue 3	1,507,788
453-00157R 453-00157C 453-00158R 453-00158C	Mobile, Fixed, Uncontrolled	Telcordia Issue 3	1,000,622
453-00165 453-00166	Mobile, Fixed, Uncontrolled	Telcordia Issue 3	1,350,033

Ezurio Part Number	Environment	Standard	Test Result 85 °C (Hours)
453-00155R 453-00155C 453-00156R 453-00156C	Ground, Fixed, Uncontrolled	Telcordia Issue 3	865,986
453-00157R 453-00157C 453-00158R 453-00158C	Ground, Fixed, Uncontrolled	Telcordia Issue 3	567,761
453-00165 453-00166	Ground, Fixed, Uncontrolled	Telcordia Issue 3	772,686
453-00155R 453-00155C 453-00156R 453-00156C	Mobile, Fixed, Uncontrolled	Telcordia Issue 3	324,745
453-00157R 453-00157C 453-00158R 453-00158C	Mobile, Fixed, Uncontrolled	Telcordia Issue 3	210,660
453-00165 453-00166	Mobile, Fixed, Uncontrolled	Telcordia Issue 3	289,757

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15 Regulatory

Note: For complete regulatory information, refer to the SONA™ NX61X Regulatory Information document (coming soon) which is also available from the SONA™ NX61X product page.

The SONA™NX61X holds current certifications in the following countries:

Table 31: SONA™NX61X countries with certification (SIP)

Country/Region	Regulatory ID
USA (FCC)	SQG-SONANX611S
EU	N/A
Canada (ISED)	3147A-SONANX611S
Japan (MIC)	TBD
Australia	N/A
New Zealand	N/A

Table 32: SONA™NX61X countries with certification (M.2 1216 Module and M.2 2230 Module)

Country/Region	Regulatory ID
USA (FCC)	SQG-SONANX611M
EU	N/A
Canada (ISED)	3147A-SONANX611M
Japan (MIC)	TBD
Australia	N/A
New Zealand	N/A

Table 33: SONA™NX61X Approved Antenna

Manufacturer	Model	Ezurio Part Number	Type	Connector	Peak Gain (dBi)		
					2.4 GHz	5 GHz	6 GHz
Ezurio (Laird Connectivity)	FlexMIMO 6E	EFD2471A3S-10MH4L	PIFA	MHF4L	2.2	3.8	3.3
Ezurio (Laird Connectivity)	FlexPIFA 6E	EFB2471A3S-10MH4L	PIFA	MHF4L	2.2	3.9	3.8
Ezurio (Laird Connectivity)	Mini NanoBlade Flex 6 GHz	EMF2471A3S-10MH4L	PCB Dipole	MHF4L	2.4	4.4	5.2
Joymax Inc.	Dipole 6E	TWX-100BRS3B	Dipole	RP-SMA	2.0	4.0	4.0
Ezurio (Laird Connectivity)	FlexPIFA	001-0021	PIFA	MHF4L	2.5	3.0	N/A
TDK	Multilayer Antenna	ANT162442DT-2001A2	Chip Antenna	N/A	2.0	1.0	N/A

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16 Additional Information

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

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