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# M2-JODY-W3

## M.2 card for JODY-W3 Wi-Fi 6 and Bluetooth 5.3

Data sheet





### Abstract

This technical data sheet describes the M2-JODY-W3 card module which offers 802.11/ac/ax and dual-mode Bluetooth 5.3 in an M.2 Key E form factor. The M2-JODY-W3 card provides all the features and functionality supported in the JODY-W3 module, with the added benefits associated with easy installation and replacement. The card can be inserted in a standard M.2 Key E slot without the need to solder the module on a host or carrier PCB.



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# Document information

| | | |
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| **Product status** | **Corresponding content status** | |
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| Functional sample | Draft | For functional testing. Revised and supplementary data will be published later. |
| In development / Prototype | Objective specification | Target values. Revised and supplementary data will be published later. |
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| Initial production | Early production information | Data from product verification. Revised and supplementary data may be published later. |
| Mass production / End of life | Production information | Document contains the final product specification. |

This document applies to the following products:

| **Product name** | **Type number** | **Chipset** | **IN/PCN reference** | **Product status** |
|---|---|---|---|---|
| M2-JODY-W377 | M2-JODY-W377-00C-00 | NXP 88W9098 | N/A | Initial production |

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# 1 Functional description

## 1.1 Overview

The M2-JODY-W3 card features the JODY-W3 multi-radio module, based on the NXP 88W9098 chipset. The type 2230 Key E M.2 card supports all features and functionality of the module on a convenient expansion card that plugs directly to the host platform.

Even though the M2-JODY-W3 card is of standard grade, the module variant used on the card is the JODY-W377-00B professional grade module.

## 1.2 Product features

As the M2-JODY-W3 card supports all the features that the integrated JODY-W3 module supports, this document aims to describe the extended features of the M2-JODY-W3 card specifically. For more information about the JODY-W3 module, see the JODY-W3 series datasheet [1]. Table 1 describes the features of card.

| | M2-JODY-W377 |
|---|---|
| **Grade** | |
| Automotive<br>Professional<br>Standard | • |
| **Radio** | |
| Bluetooth qualification | v5.3 |
| Bluetooth profiles | HCI |
| Bluetooth BR/EDR | • |
| Bluetooth Low Energy | • |
| Wi-Fi IEEE 802.11 standards | Wi-Fi 6 (802.11ax) |
| Wi-Fi 2.4 / 5 [GHz] | 2.4 and 5 |
| LTE filter | o |
| Bluetooth output power conducted [dBm] | 10 |
| Wi-Fi output power conducted [dBm] | 19 |
| Antenna type | 3 U.FL connectors |
| **OS support** | |
| Android / Linux drivers (from u-blox) | • |
| **Interfaces** | |
| UART[B] | 1 |
| PCIe[W] | 1 |
| SDIO [version] | v3 * |
| PCM / I2S (Bluetooth audio) | 1 |
| **Features** | |
| Micro Access Point [max connects] | 64 |
| AES hardware support | • |
| Wi-Fi direct | • |
| RF parameters in OTP memory | • |
| MAC addresses in OTP memory | • |
| Concurrent dual band | • |

B = For Bluetooth only
W = For Wi-Fi only
* = Requires minor hardware modification

**Table 1: Key features of the M2-JODY-W3 card module**



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## 1.3 Product description

| Product name | Description |
|---|---|
| M2-JODY-W3 | Standard grade M.2 card module with three antenna connectors and concurrent dual-band 2x2 2.4 GHz and 5 GHz 802.11ax, Bluetooth/Bluetooth Low Energy (LE) 5.3. NXP chipset 88W9098. |

**Table 2: Product description**

## 1.4 Block diagram

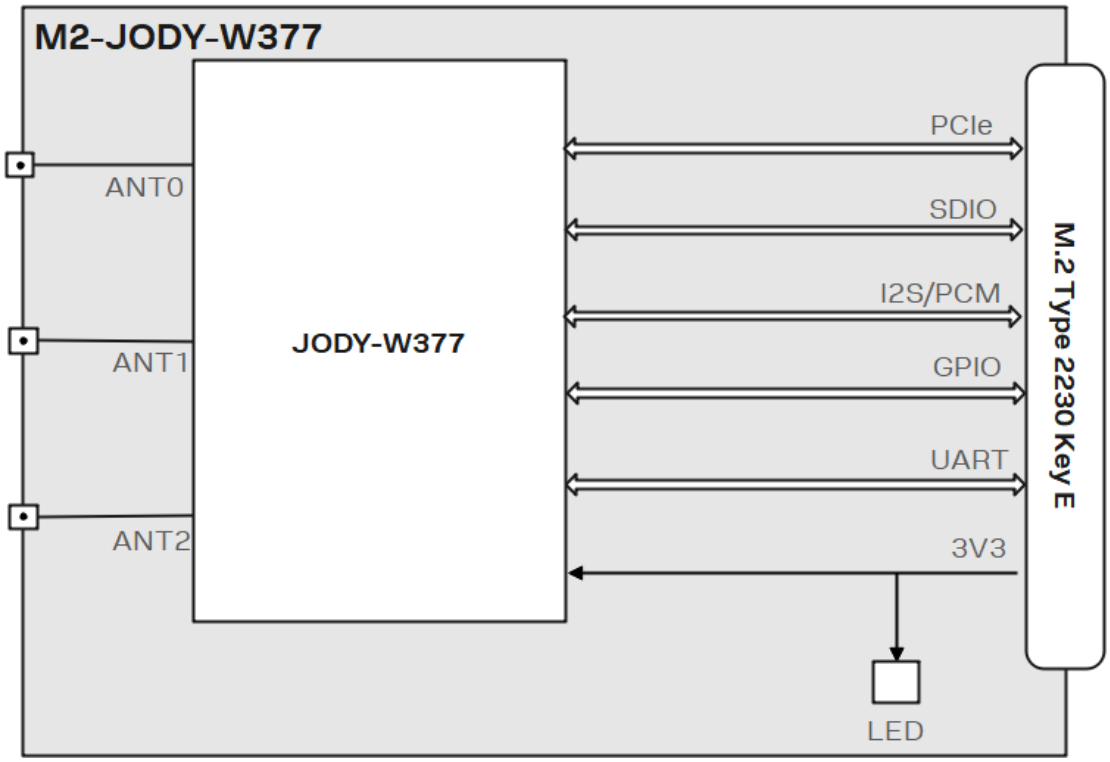



**Figure 1: Block diagram of the M2-JODY-W3 card module**



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# 2 Interfaces

The M2-JODY-W3 card supports all JODY-W3 module interfaces. For more information about these interfaces, see the JODY-W3 series data sheet [1].

## 2.1 Boot configuration pins

By default, the M2-JODY-W3 card is configured for using the PCIe interface for Wi-Fi and the UART interface for Bluetooth.

Host interface selection and firmware boot options are selected using the JODY-W3 module configuration pins (CONFIG[2:0]). The configuration settings for the available boot options are shown in Table 3.

| Pin name | Pin numbers | Configuration settings | | |
|---|---|---|---|---|
| CONFIG[2:0] | 6, 7, 8 | **Strap value** | **Wi-Fi** | **Bluetooth** |
| | | 000 | SDIO | UART |
| | | 001 | Reserved | reserved |
| | | 010* | Reserved | reserved |
| | | 011 | PCIe | UART |
| | | 100 | Reserved | reserved |
| | | 101 | Reserved | reserved |
| | | 110 | Reserved | reserved |
| | | 111 | Reserved | reserved |

**Table 3: Firmware boot options of the JODY-W3 module**

The M2-JODY-W3 card supports the same boot options as the JODY-W3 module. To set any CONFIG[2:0] configuration pin to logic-low level (“0”), it must be pulled down with a 51 kΩ resistor to GND. JODY-W3 has internal pull-up resistors and as a result, no external pull-up resistors is required to set a configuration pin to logic-high level (“1”).



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Figure 2 shows the “011” default configuration used to select the PCIe interface for Wi-Fi and UART interface for Bluetooth.

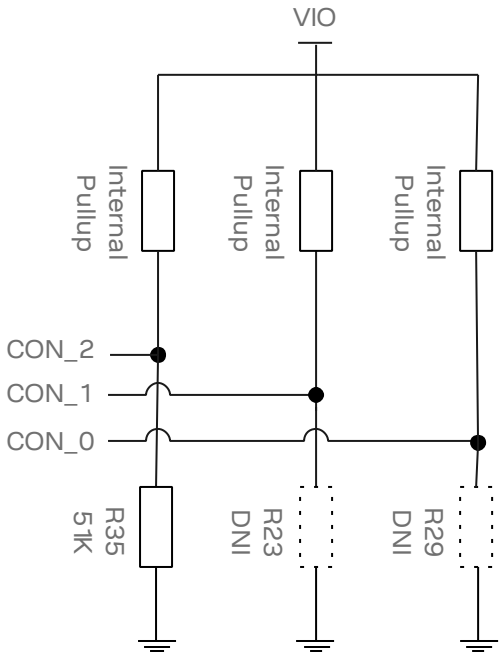



**Figure 2: Default configuration of the M2-JODY-W3 boot pins**

Figure 3 shows the physical locations of pulldown resistor positions, R23, R29 and R35. Mount resistors R23 and R29 to configure the host interface for Wi-Fi over SDIO and Bluetooth over UART operation.

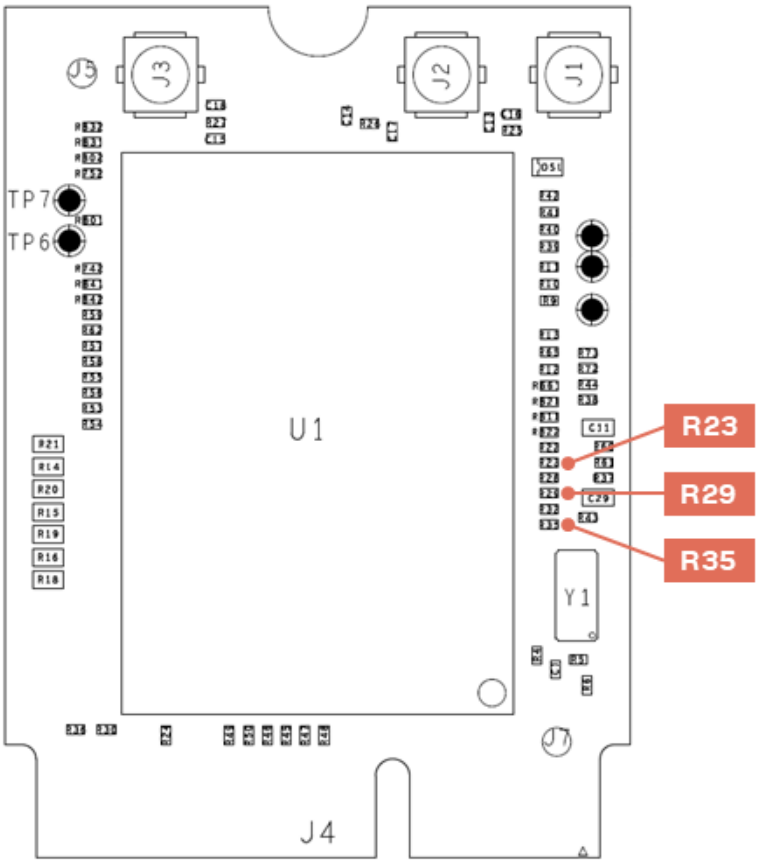



**Figure 3: Position of R23, R29 and R35 on M2-JODY-W3 (top side)**



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## 2.2 PCIe

The PCI Express interface complies with the PCIe 2.0 standard with 2.5/5 Gbps speeds and allows a host controller to access JODY-W3 Wi-Fi functionality using the PCIe bus protocol. For information about the parameters supported by the PCI Express interface, see the JODY-W3 data sheet [1].

## 2.3 SDIO

The SDIO device interface is conformant with the industry standard SDIO 3.0 specification (UHS-I up to 104 MB/s) and allows a host controller to access JODY-W3 Wi-Fi functionality using the SDIO bus protocol. The interface supports 4-bit SDIO transfer mode over the full clock range up to 208 MHz.

## 2.4 UART

JODY-W3 series modules support a high-speed UART interface that is conformant with the industry-standard 16550 specification. For information about the features and baud rates supported in the JODY-W3 series high-speed UART, see the JODY-W3 data sheet [1].

## 2.5 PCM/I2S

M2-JODY-W3 supports the full functionality of the JODY-W3 series PCM and I2S interfaces for audio. The pins of the PCM and I2S interfaces are shared.



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# 3 Pin definition

The M2-JODY-W3 card module implements the standard pinout of M.2 mechanical Type E sockets as defined by the PCI Express M.2 Specification [4]. In co-operation with NXP, the card fully supports the optional sideband and debug signals as defined by the NXP Wi-Fi/Bluetooth M.2 Key E Pinout Definition [5].

## 3.1 Pin assignment

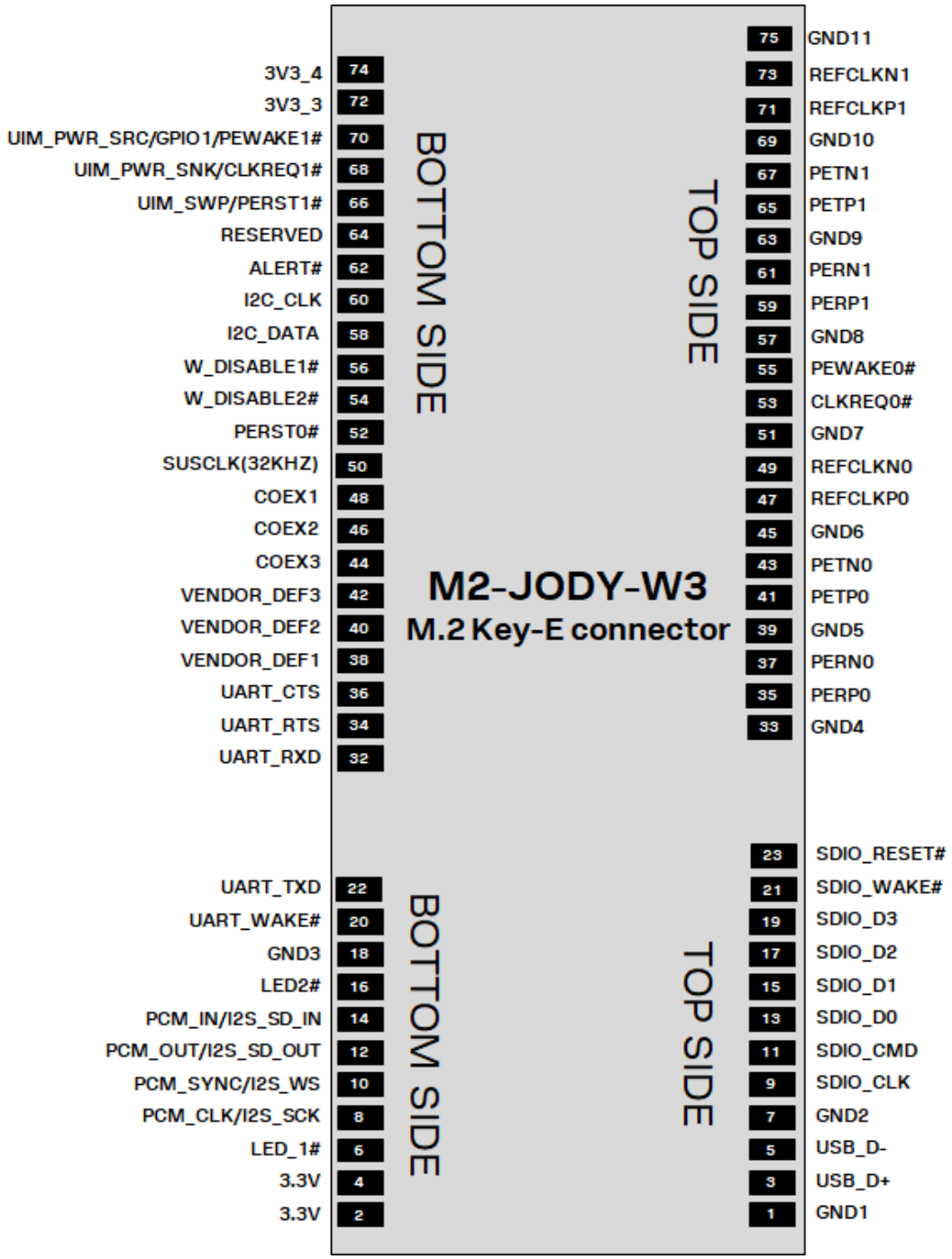



**Figure 4: M2-JODY-W3 pin assignment**



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## 3.2 Pin description

Table 4 and Table 5 describe the M2-JODY-W3 pins located at the top and bottom side of the M.2 card, respectively. The signal direction of the pins (inputs or outputs) is shown from the perspective of the M2-JODY-W3 card.

| Pin no. | Pin name | Pin type | Voltage | Description |
|---|---|---|---|---|
| 1 | GND1 | GND | | Ground |
| 3 | USB_D+ | NC | | USB data + serial data interface. Not connected |
| 5 | USB_D- | NC | | USB data - serial data interface. Not connected |
| 7 | GND2 | GND | | Ground |
| 9 | SDIO_CLK | I | 1.8V | SDIO Clock |
| 11 | SDIO_CMD | I/O | 1.8V | SDIO Command |
| 13 | SDIO_D0 | I/O | 1.8V | SDIO Data 1 |
| 15 | SDIO_D1 | I/O | 1.8V | SDIO Data 2 |
| 17 | SDIO_D2 | I/O | 1.8V | SDIO Data 3 |
| 19 | SDIO_D3 | I/O | 1.8V | SDIO Data 4 |
| 21 | SDIO_WAKE# | NC | VIO | NXP usage: **WLAN_WAKE_HOST**. Sideband signal used by the Wi-Fi radio to wake up the platform. Active Low by default. Connect to Host GPIO Open drain. Pullup required on platform |
| 23 | SDIO_RESET# | I | VIO | NXP usage: **WLAN_INDEPENDENT_RESET**. Sideband signal to independently reset the Wi-Fi radio. Active Low by default. Connect to Host GPIO |
| | | | | M.2 Key E connector notch |
| 33 | GND4 | GND | | Ground |
| 35 | PERP0 | I | 1.8V | PCIe RX |
| 37 | PERN0 | I | 1.8V | PCIe RX |
| 39 | GND5 | GND | | Ground |
| 41 | PETP0 | O | 1.8V | PCIe TX |
| 43 | PETN0 | O | 1.8V | PCIe TX |
| 45 | GND6 | GND | | Ground |
| 47 | REFCLKP0 | O | 1.8V | PCIe Reference Clock |
| 49 | REFCLKN0 | O | 1.8V | PCIe Reference Clock |
| 51 | GND7 | GND | | Ground |
| 53 | CLKREQ0# | I/O | 3.3V | PCIe Clock Request |
| 55 | PEWAKE0# | I/O | 3.3V | PCIe PME Wake |
| 57 | GND8 | GND | | Ground |
| 59 | PERP1 | NC | 1.8V | PCIe RX. Not connected |
| 61 | PERN1 | NC | 1.8V | PCIe RX. Not connected |
| 63 | GND9 | GND | | Ground |
| 65 | PETP1 | NC | 1.8V | PCIe TX. Not connected |
| 67 | PETN1 | NC | 1.8V | PCIe TX. Not connected |
| 69 | GND10 | GND | | Ground |



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| Pin no. | Pin name | Pin type | Voltage | Description |
|---|---|---|---|---|
| 71 | REFCLKP1 | NC | 1.8V | PCIe Reference Clock. Not connected |
| 73 | REFCLKN1 | NC | 1.8V | PCIe Reference Clock. Not connected |
| 75 | GND11 | GND | | Ground |

**Table 4: M2-JODY-W3 pinout – top side**

| Pin no. | Pin name | Pin type | Voltage | Description |
|---|---|---|---|---|
| 2 | 3.3V | P | 3.3V | Supply voltage pin |
| 4 | 3.3V | P | 3.3V | Supply voltage pin |
| 6 | LED_1# | NC | | Not connected |
| 8 | PCM_CLK/I2S_SCK | I/O | VIO | PCM data clock |
| 10 | PCM_SYNC/I2S_WS | I/O | VIO | PCM frame sync |
| 12 | PCM_OUT/I2S_SD_OUT | O | VIO | PCM data output |
| 14 | PCM_IN/I2S_SD_IN | I | VIO | PCM data input |
| 16 | LED2# | NC | | Not connected |
| 18 | GND3 | GND | | Ground |
| 20 | UART_WAKE# | O | 3.3V | NXP usage: **BT_WAKE_HOST**. Sideband signal used by the Bluetooth radio to wake up the platform. Active Low by default. Connect to Host GPIO Open drain. Pullup required on platform. |
| 22 | UART_TXD | O | VIO | UART transmit. Connected to host platform UART receive (UART_RXD) |
| M.2 Key E connector notch | | | | |
| 32 | UART_RXD | I | VIO | UART receive. Connected to host platform UART transmit (UART_TXD) |
| 34 | UART_RTS | O | VIO | UART Request-To-Send. Connected to host platform UART Clear-To-Send (UART_CTS) |
| 36 | UART_CTS | I | VIO | UART Clear-To-Send. Connected to host platform UART Request-To-Send (UART_RTS) |
| 38 | VENDOR_DEF1 | I/O | VIO | NXP usage: **JTAG_TDO**. Used for debug. Connected to JTAG header on platform |
| 40 | VENDOR_DEF2 | I | VIO | NXP usage: **DEV_WLAN_WAKE**. Sideband signal used by the platform to wake up the Wi-Fi radio. Active Low. Connect to Host GPIO |
| 42 | VENDOR_DEF3 | I | VIO | NXP usage: **DEV_BT_WAKE**. Sideband signal used by the platform to wake up the Bluetooth radio. Active Low. Connect to Host GPIO |
| 44 | COEX3 | I/O | VIO | NXP usage: **JTAG_TDI** Used for debug. Connected to header on platform |
| 46 | COEX2 | I/O | VIO | NXP usage: **JTAG_TCK**. Used for debug. Connected to header on platform |
| 48 | COEX1 | I/O | VIO | NXP usage: **JTAG_TMS**. Used for debug. Connected to header on platform |
| 50 | SUSCLK(32KHZ) | NC | | Not connected |
| 52 | PERST0# | I | 3.3V | PCIe host indication to reset the device |
| 54 | W_DISABLE2# | I | 3.3V | NXP usage: **BT_INDEPENDENT_RESET**. Sideband signal to independently reset the Bluetooth radio. Active Low by default. Connected to Host GPIO |



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| Pin no. | Pin name | Pin type | Voltage | Description |
|---|---|---|---|---|
| 56 | W_DISABLE1# | I | 3.3V | NXP usage. **PDn**. Full Power-down for the Wi-Fi/BT radio: High = normal mode, Low = full power-down mode. Connect to Host GPIO |
| 58 | I2C_DATA | NC | | I2C data. Not connected |
| 60 | I2C_CLK | NC | | I2C clock. Not connected |
| 62 | ALERT# | NC | | Not connected |
| 64 | RESERVED | NC | | Not connected |
| 66 | UIM_SWP/PERST1# | NC | | Not connected |
| 68 | UIM_PWR_SNK/CLKREQ1# | NC | | Not connected |
| 70 | UIM_PWR_SRC/GPIO1/PEWAKE1# | NC | | Not connected |
| 72 | 3V3_3 | P | 3.3V | Supply voltage pin |
| 74 | 3V3_4 | P | 3.3V | Supply voltage pin |

**Table 5: M2-JODY-W3 pinout (bottom side)**



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# 4 Electrical specifications

⚠ Stressing the device above one or more of the Absolute maximum ratings can cause permanent damage. These are stress ratings only. Operating the module at these or at any conditions other than those specified in the Operating conditions should be avoided. Exposure to absolute maximum rating conditions for extended periods can affect device reliability.

☞ All given application information is only advisory and does not form part of the specification.

## 4.1 Absolute maximum ratings

| Symbol | Description | Min. | Max. | Units |
|---|---|---|---|---|
| 3V3 | Power supply voltage | -0.3 | 4.0 | V |
| $T_{STORAGE}$ | Storage temperature | -40 | +85 | °C |

**Table 6: Absolute maximum ratings**

## 4.2 Maximum ESD ratings

| Applicability | Min. | Max. | Units |
|---|---|---|---|
| Human Body Model (HBM), according to ANSI/ESDA/JEDEC JS-001 | -1500 | +1500 | V |
| Charged Device Model (CDM), according to ANSI/ESDA/JEDEC JS-002 | -500 | +500 | V |

**Table17: Maximum ESD ratings**

## 4.3 Operating conditions

| Symbol | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| 3V3 | Power supply voltage | 3.135 | 3.3 | 3.465 | V |
| $T_A$ | Ambient operating temperature | -40 | - | +85 | °C |
| Ripple Noise | Peak-to-peak voltage ripple on all supply lines. | - | - | 10 | mV |

**Table 18: Operating conditions**

## 4.1 Power consumption

| Peak current condition | Temperature | Supply current | Units |
|---|---|---|---|
| Active transmission at max. rated output power (WiFi) | Room temperature | 2 | A |
| Active transmission at max. rated output power (Bluetooth) | Room temperature | 0.2 | A |
| Firmware initialization | Room temperature | 1.5 | A |

**Table 19: Peak current consumption**



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## 4.2 Digital pad ratings

| Symbol | Parameter | VIO | Min. | Max. | Units |
|---|---|---|---|---|---|
| $V_{IH}$ | Input high voltage | 1.8 V or 3.3 V | 0.7*VIO | VIO+0.4 | V |
| $V_{IL}$ | Input low voltage | 1.8 V or 3.3 V | -0.4 | 0.3*VIO | V |
| $V_{HYS}$ | Input hysteresis | 1.8 V or 3.3 V | 100 | - | mV |
| $V_{OH}$ | Output high voltage | 1.8 V or 3.3V | VIO-0.4 | - | V |
| $V_{OH}$ | Output low voltage | 1.8 V or 3.3 V | - | 0.4 | V |

**Table 22: DC characteristics VIO**

## 4.3 Radio specifications

### 4.3.1 Bluetooth

| Parameter | Specification |
|---|---|
| RF Frequency Range | 2.4 – 2.5 GHz |
| Supported Modes | Bluetooth 5.3<br>Bluetooth Low Energy (LE)<br>- LE long range<br>- Shared RF with BR/EDR<br>- 2 Mbps LE |
| Modulation | 1 Mbit/s: GFSK (BR)<br>2 Mbit/s: π/4 DQPSK (EDR)<br>3 Mbit/s: 8DQPSK (EDR) |
| Transmit Power | BDR: +10 dBm ± 2 dB |
| | EDR: +7 dBm ± 2 dB |
| | Bluetooth LE: +8 dBm ± 2 dB |
| Sensitivity | DH5: -94 dBm (De-sense of 5.5 dB at 2440 MHz, 2 dB at 2480 MHz) |
| | 3DH5: -87 dBm (De-sense of 6 dB at 2440 MHz, 2 dB at 2480 MHz) |
| | LR8: -106 dBm (De-sense of 11dB at 2440 MHz, 5 dB at 2480 MHz) |
| | LR2: -105 dBm (De-sense of 11dB at 2440 MHz, 5 dB at 2480 MHz) |
| | LE1M: -101 dBm (De-sense of 10 dB at 2440 MHz, 4 dB at 2480 MHz) |
| | LE2M: -98 dBm (De-sense of 5 dB at 2440 MHz, 1 dB at 2480 MHz) |

**Table 7: Bluetooth radio parameters**

### 4.3.2 Wi-Fi

M2-JODY-W3 cards support dual-band Wi-Fi with 802.11a/b/g/n/ac/ax operation in the 2.4 GHz and 5 GHz radio bands.

| Parameter | Operation Mode | Specification |
|---|---|---|
| RF Frequency range | 802.11b/g/n/ax | 2.400 – 2.500 GHz |
| | 802.11a/n/ac/ax | 4.900 – 5.925 GHz |
| Modulation | 802.11b | CCK and DSSS |
| | 802.11a/g/n/ac/ax | OFDM |
| Supported data rates | 802.11b | 1, 2, 5.5, 11 Mbit/s |
| | 802.11a/g | 6, 9, 12, 18, 24, 36, 48, 54 Mbit/s |
| | 802.11n SISO and MIMO | MCS0 – MCS15 and MCS 32 (duplicate 6 Mbps) |
| | 802.11ac SISO and MIMO | MCS0 – MCS9 |
| | 802.11ax SISO and MIMO | MCS0 – MCS11 |



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| Parameter | Operation Mode | Specification |
|---|---|---|
| Supported channel bandwidth | 802.11ac/ax | 20, 40, 80 MHz |
| Supported guard interval (GI) | 802.11n/ac | 400, 800 ns |
| | 802.11ax | 800, 1600 ns |
| | 802.11ac | Short guard interval supported |

**Table 8: Wi-Fi radio parameters**

| Parameter | | Operation Mode | 802.11 EVM limit | Specification (typ. Output power tolerance ± 2 dB) |
|---|---|---|---|---|
| Maximum transmit power | 2.4 GHz | DSSS/CCK | -9.1 dB | 19 dBm |
| | | OFDM, BPSK | -8 dB | 17 dBm |
| | | OFDM, QPSK | -13 dB | 17 dBm |
| | | OFDM, 16-QAM | -19 dB | 17 dBm |
| | | OFDM, 64-QAM, 3/4 | -25 dB | 16 dBm |
| | | OFDM, 64-QAM, 5/6 | -27 dB | 16 dBm |
| | | OFDM, 256-QAM, 3/4 | -30 dB | 16 dBm |
| | | OFDM, 256-QAM, 5/6 | -32 dB | 16 dBm |
| | 5 GHz | OFDM, BPSK | -5 dB | 16 dBm |
| | | OFDM, QPSK | -13 dB | 16 dBm |
| | | OFDM, 16-QAM | -19 dB | 16 dBm |
| | | OFDM, 64-QAM, 3/4 | -25 dB | 16 dBm |
| | | OFDM, 64-QAM, 5/6 | -27 dB | 15 dBm |
| | | OFDM, 256-QAM, 3/4 | -30 dB | 15 dBm |
| | | OFDM, 256-QAM, 5/6 | -32 dB | 14 dBm |
| | | OFDMA, 1024-QAM, 3/4 | -35 dB | 13 dBm |
| | | OFDMA, 1024-QAM, 5/6 | -35 dB | 13 dBm |

**Table 9: Wi-Fi radio maximum transmit power parameter**

| Parameter | Band | Operating mode | Data rate | Bandwidth | Specification |
|---|---|---|---|---|---|
| Sensitivity | 2.4 GHz | 802.11b | 1 Mbps / 2 Mbps | 20 MHz | -97 dBm / -94 dBm |
| | | | 5.5 Mbps / 11 Mbps | | -92 dBm / -89 dBm |
| | | 802.11g | 6 Mbps / 9 Mbps | 20 MHz | -91 dBm / -90 dBm |
| | | | 12 Mbps / 18 Mbps | | -89 dBm / -87 dBm |
| | | | 24 Mbps / 36 Mbps | | -84 dBm / -80 dBm |
| | | | 48 Mbps / 54 Mbps | | -76 dBm / -72 dBm |
| | | 802.11n | MCS0 / MCS1 | 20 MHz | -91 dBm / -88 dBm |
| | | | MCS2 / MCS3 | | -86 dBm / -84 dBm |
| | | | MCS4 / MCS5 | | -80 dBm / -76 dBm |
| | | | MCS6 / MCS7 | | -74 dBm / -73 dBm |
| | | | MCS0 / MCS1 | 40 MHz | -89 dBm / -86 dBm |
| | | | MCS2 / MCS3 | | -84 dBm / -81 dBm |
| | | | MCS4 / MCS5 | | -77 dBm / -73 dBm |
| | | | MCS6 / MCS7 | | -72 dBm / -70 dBm |
| | | 802.11ac | MCS0 / MCS1 | 20 MHz | -91 dBm / -88 dBm |
| | | | MCS2 / MCS3 | | -86 dBm / -83 dBm |



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| Parameter | Band | Operating mode | Data rate | Bandwidth | Specification |
|---|---|---|---|---|---|
| | | | MCS4 / MCS5 | | -80 dBm / -75 dBm |
| | | | MCS6 / MCS7 | | -74 dBm / -73 dBm |
| | | | MCS8 | | -68 dBm |
| | | | MCS0 / MCS1 | 40 MHz | -88 dBm / -86 dBm |
| | | | MCS2 / MCS3 | | -84 dBm / -81 dBm |
| | | | MCS4 / MCS5 | | -77 dBm / -73 dBm |
| | | | MCS6 / MCS7 | | -72 dBm / -70 dBm |
| | | | MCS8 / MCS9 | | -66 dBm / -64 dBm |
| | | 802.11ax | MCS0 / MCS1 | 20 MHz | -91 dBm / -89 dBm |
| | | | MCS2 / MCS3 | | -87 dBm / -84 dBm |
| | | | MCS4 / MCS5 | | -81 dBm / -77 dBm |
| | | | MCS6 / MCS7 | | -76 dBm / -75 dBm |
| | | | MCS8 / MCS9 | | -70 dBm / -69 dBm |
| | | | MCS10 / MCS11 | | -63 dBm / -62 dBm |
| | | | MCS0 / MCS1 | 40 MHz | -89 dBm / -86 dBm |
| | | | MCS2 / MCS3 | | -85 dBm / -81 dBm |
| | | | MCS4 / MCS5 | | -79 dBm / -75 dBm |
| | | | MCS6 / MCS7 | | -73 dBm / -72 dBm |
| | | | MCS8 / MCS9 | | -68 dBm / -66 dBm |
| | | | MCS10 / MCS11 | | -63 dBm / -62 dBm |
| | 5 GHz | 802.11a | 6Mbps/9Mbps | 20 MHz | -90 dBm / -89 dBm |
| | | | 12 Mbps/18 Mbps | | -88 dBm / -86 dBm |
| | | | 24 Mbps/36 Mbps | | -83 dBm / -80 dBm |
| | | | 48 Mbps/54 Mbps | | -75 dBm / -74 dBm |
| | | 802.11n | MCS0 / MCS1 | 20 MHz | -90 dBm / -88 dBm |
| | | | MCS2 / MCS3 | | -85 dBm / -82 dBm |
| | | | MCS4 / MCS5 | | -79 dBm / -75 dBm |
| | | | MCS6 / MCS7 | | -73 dBm / -72 dBm |
| | | | MCS0 / MCS1 | 40 MHz | -88 dBm / -85 dBm |
| | | | MCS2 / MCS3 | | -83 dBm / -80 dBm |
| | | | MCS4 / MCS5 | | -77 dBm / -72 dBm |
| | | | MCS6 / MCS7 | | -71 dBm / -70 dBm |
| | | 802.11ac | MCS0/MCS1 | 20 MHz | -90 dBm / -88 dBm |
| | | | MCS2/MCS3 | | -85 dBm / -83 dBm |
| | | | MCS4/MCS5 | | -79 dBm / -75 dBm |
| | | | MCS6/MCS7 | | -73 dBm / -72 dBm |
| | | | MCS8 | | -68 dBm |
| | | | MCS0/MCS1 | 40 MHz | -88 dBm / -85 dBm |
| | | | MCS2/MCS3 | | -83 dBm / -80 dBm |
| | | | MCS4/MCS5 | | -76 dBm / -72 dBm |
| | | | MCS6/MCS7 | | -71 dBm / -70 dBm |
| | | | MCS8/MCS9 | | -65 dBm / -64 dBm |
| | | | MCS0/MCS1 | 80 MHz | -85 dBm / -82 dBm |
| | | | MCS2/MCS3 | | -80 dBm / -77 dBm |
| | | | MCS4/MCS5 | | -73 dBm / -69 dBm |



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| Parameter | Band | Operating mode | Data rate | Bandwidth | Specification |
|---|---|---|---|---|---|
| | | | MCS6/MCS7 | | -68 dBm / -66 dBm |
| | | | MCS8/MCS9 | | -62 dBm / -61 dBm |
| | | 802.11ax | MCS0 / MCS1 | 20 MHz | -90 dBm / -88 dBm |
| | | | MCS2 / MCS3 | | -87 dBm / -83 dBm |
| | | | MCS4 / MCS5 | | -81 dBm / -76 dBm |
| | | | MCS6 / MCS7 | | -75 dBm / -74 dBm |
| | | | MCS8 / MCS9 | | -69 dBm / -68 dBm |
| | | | MCS10 / MCS11 | | -63 dBm / -62 dBm |
| | | | MCS0 / MCS1 | 40 MHz | -88 dBm / -86 dBm |
| | | | MCS2 / MCS3 | | -84 dBm / -81 dBm |
| | | | MCS4 / MCS5 | | -78 dBm / -74 dBm |
| | | | MCS6 / MCS7 | | -73 dBm / -72 dBm |
| | | | MCS8 / MCS9 | | -67 dBm / -66 dBm |
| | | | MCS10 / MCS11 | | -62 dBm / -59 dBm |
| | | | MCS0 / MCS1 | 80 MHz | -85 dBm / -83 dBm |
| | | | MCS2 / MCS3 | | -81 dBm / -77 dBm |
| | | | MCS4 / MCS5 | | -76 dBm / -71 dBm |
| | | | MCS6 / MCS7 | | -70 dBm / -69 dBm |
| | | | MCS8 / MCS9 | | -65 dBm / -63 dBm |
| | | | MCS10 / MCS11 | | -59 dBm / -57 dBm |

**Table 10: Wi-Fi radio sensitivity**



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# 5 Antenna connectors

The M2-JODY-W3 card features three U.FL connectors, with one for each of the three antenna pins:

- Connectors J2 and J3 are connected to JODY-W3 pins 24 and 29 (**ANT0** and **ANT1** respectively) for Wi-Fi operation.
- Connector J1 is connected to JODY-W3 pin 21 (pin name **ANT2**) for Bluetooth.

The location of the U.FL connectors on the M.2 card is shown in Figure 5.

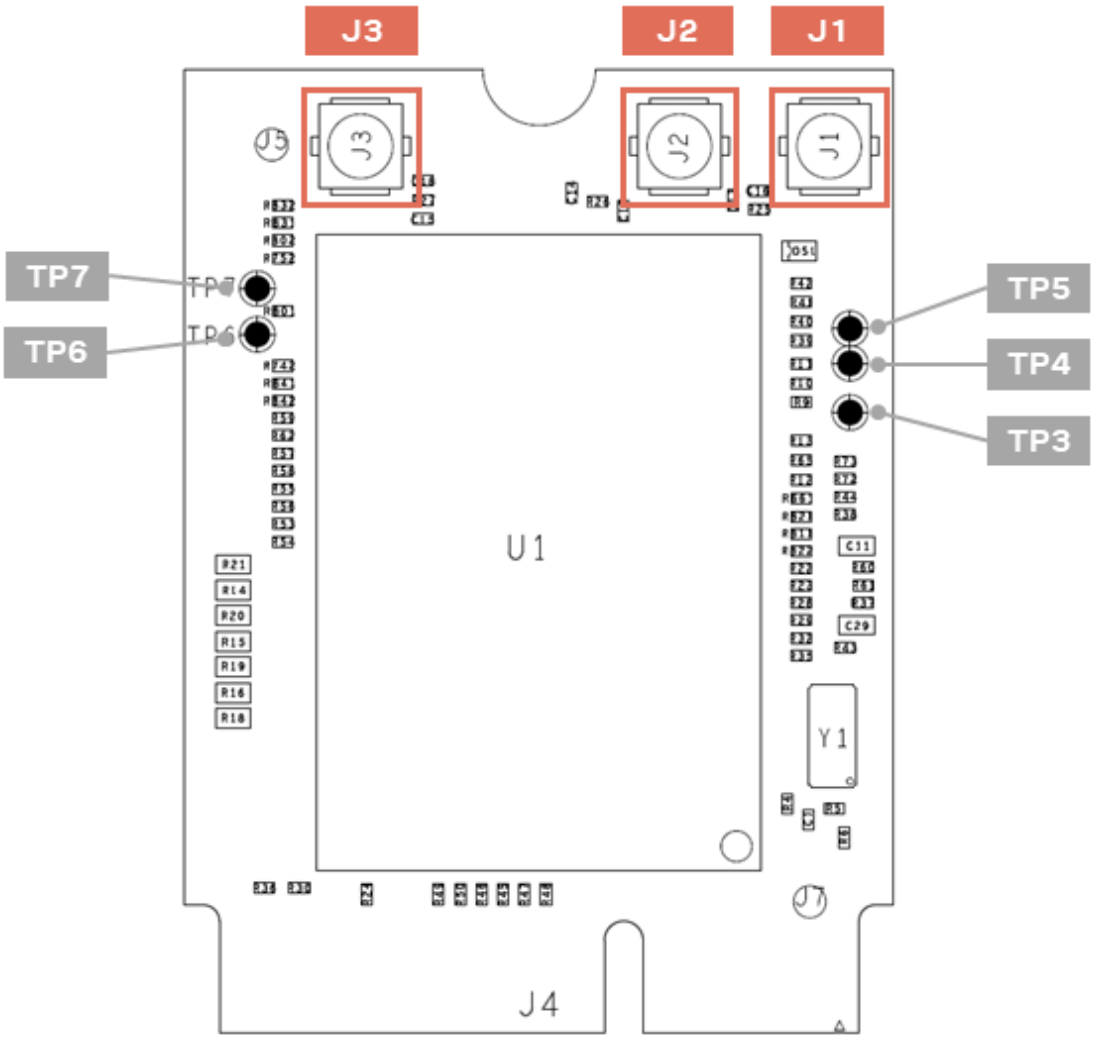



**Figure 5: Location of M2-JODY-W3 antenna U.FL connectors**

Given the small size and low profile of the U.FL connector, be sure to follow the manufacturer's instructions to avoid any damage when mating and un-mating the connector. See also the U.FL series guideline [6] and U.FL series data sheet [7].



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# 6 Voltages

The M2-JODY-W3 card requires a **3.3 V power supply**. The card takes the 3.3 V supply from the **3.3V** pins on the M.2 connector, while the 1.8 V supply is generated by the on-card DC-DC converter.

The default setting for **VIO** is 1.8 V but can be changed to 3.3 V by moving the 0 Ω resistor in position R1 to R7 (default = DNI), as shown in Figure 6. Note that R1 and R7 share a common pad. Only one of the two resistors R1 and R7 should be present at any time.

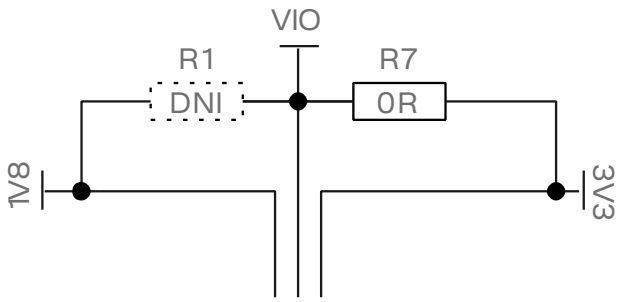



**Figure 6: Placement of 0 Ω resistor to change VIO from 1.8 V to 3.3 V**

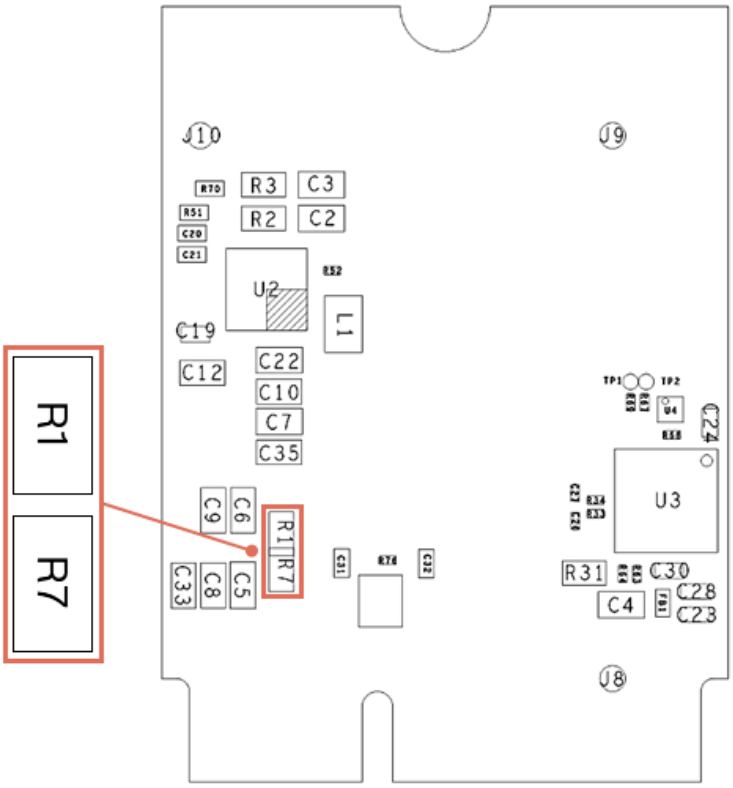



**Figure 7: Position of R1 and R7 on M2-JODY-W3 (bottom side)**



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An on-card level-shifter (as shown in Figure 8) translates M.2 signals **W_DISABLE1#**, **W_DISABLE2#** and **UART_WAKE#** from 3.3 V to VIO.

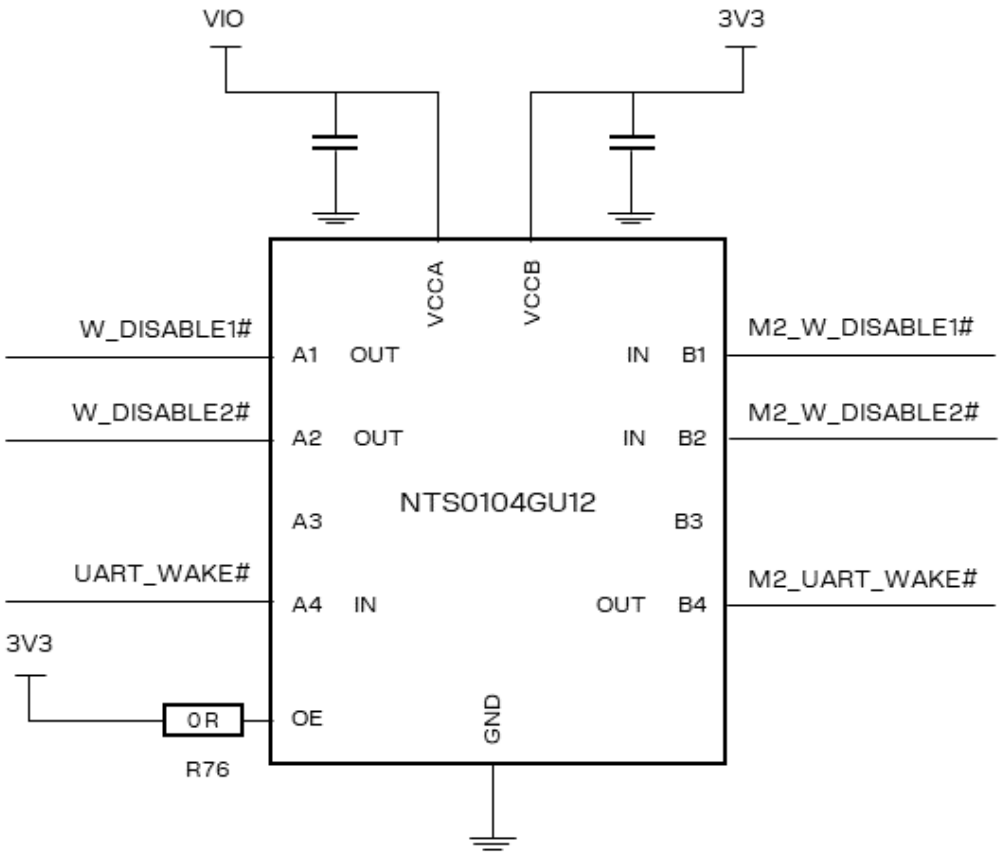



**Figure 8: VIO-to-3.3 V level shifter showing VCCA and VCCB**

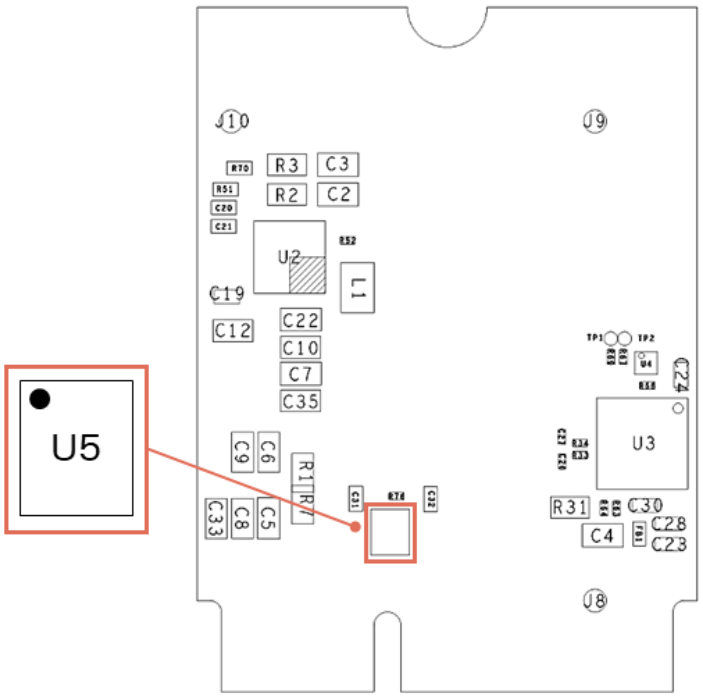



**Figure 9: Position of VIO-to-3.3 V level shifter on M2-JODY-W3 (bottom side)**



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# 7 Test points

On-card test points TP1, TP2, and TP3, allow NXP sideband signals to be probed, as shown on Table 11. For information that describes how these signals are used in NXP platforms, see the tables shown in the pin description and the NXP M.2 Key E Pinout Definition [5].

| Test point # | M.2 pin# | NXP usage |
|---|---|---|
| TP1 | 21 | WLAN_WAKE_HOST |
| TP2 | 20 | BT_WAKE_HOST |
| TP3 | 23 | WLAN_INDEPENDENT_RESET |

**Table 11: M.2 pin number and functionality of the M2-JODY-W3 cards test points**



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# 8 Mechanical specification

## 8.1 Physical dimensions

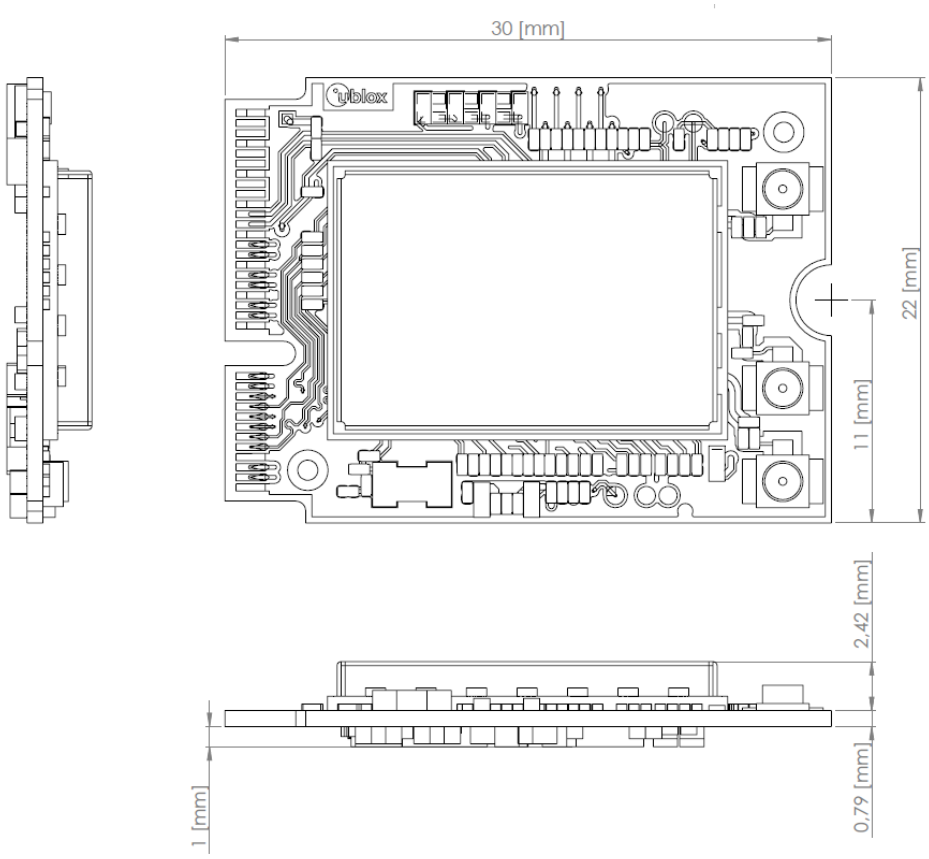



**Figure 10: Physical dimensions of the M2-JODY-W3 card**



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# 9 Software

M2-JODY-W3 cards are based on the NXP 88W9098 chipset and the drivers and firmware required to operate JODY-W2 series modules are developed by NXP. A firmware binary is downloaded by the host operating system driver at start-up.

The following software options are available for the card:

- Open-source Linux/Android driver (`mxm_mwifiex`) for mainstream use is available free of charge and already integrated into the Linux BSP for NXP i.MX application processors
- Proprietary Linux/Android drivers providing different feature packs. The drivers are distributed by u-blox to customers that have signed a limited use license agreement (LULA-M) [8] with u-blox. The driver package can be signed electronically and is also available directly from NXP. Contact your local support team for further information.

M2-JODY-W3 software packages typically include:

- Source code that includes dedicated Linux kernel drivers for Wi-Fi and Bluetooth
- Dedicated firmware images that are uploaded to the device during initialization
- Various configuration tools
- Laboratory and manufacturing tools for RF testing.



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# 10 Approvals

M2-JODY-W3 cards are designed to comply with the regulatory demands of the Federal Communications Commission (FCC), Industry Canada (IC), UK Conformity Assessed (UKCA), and European standards for CE marking.[1]

For detailed information about regulatory compliance requirements of end products that use M2-JODY-W3 modules, see the JODY-W3 system integration manual [2].

## 10.1 Configuration of Wi-Fi transmit power limits

JODY-W3 modules contain calibration data for the output power limits in OTP. This calibration data enables the module to achieve maximum transmit power levels that still pass the required EVM and spectral mask limits. The maximum transmit-power levels that can be used in an end-product also depend on:

- Regulatory domain limits
- Restricted band of usage
- Gain of the antenna and antenna trace design

A configuration file on the host system and the utility `mlanutl` is used to reduce the transmit power levels as required.

☞ Transmit power limit configuration files are provided by u-blox for the certified regulatory domains which addresses the reference designs and the approved antennas.

⚠ The correct transmit power limits must be applied to the module after startup of the host system or change of the regulatory domain during runtime.

### 10.1.1 Wi-Fi power table

The Wi-Fi power table defines the transmit power levels for the Wi-Fi radio. The power levels are based on regulatory compliance, IEEE 802.11 requirements, and product design constraints. The TX power table can be adjusted to achieve the highest transmit power level for each Wi-Fi channel, bandwidth, and modulation within the constraints defined by the certification.

The Wi-Fi power table is defined in a transmit power configuration file, `txpwrlimit_cfg_XX.conf`, where "`XX`" stands for the alpha2 country code. It allows developers to fine tune specific transmit power levels for the Wi-Fi radio, including:

- Band (2G and 5G)
- Channel
- Modulation rate (CCK and OFDM)
- Bandwidth (20, 40, and 80 MHz)

☞ Transmit power configuration files for each completed certification are included in the Yocto meta-layer. Transmit power config files are named as per the name of the certification region, for example `txpwrlimit_cfg_ETSI.conf`. The configuration files are used by the recipe in the meta-layer to derive binary files, which can be automatically loaded by the driver, for each country in the certification region, such as, Germany (DE), France (FR), and so on.

For the exact power limits used for the various certifications, see the Appendix: Wi-Fi Tx output power limits. The JODY-W3 system integration manual [2] contains details about configuring Wi-Fi Tx output power limits along with examples.

[1] All approvals pending



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# 11 Product handling

## 11.1 Packaging

Packaged and shipped in trays containing multiple M.2 cards.

## 11.2 Shipment, storage, and handling

For more information regarding shipment, storage, and handling see the Packaging information reference guide [3].

### 11.2.1 ESD handling precautions

M2-JODY-W3 cards are Electrostatic Sensitive Devices (ESD) that demand the observance of special handling precautions against electrostatic damage. Failure to observe the precautions can result in severe damage to the card.

M2-JODY-W3 cards are manufactured through a highly automated process, which complies with IEC61340-5-1 (STM5.2-1999 Class M1 devices) standard. In compliance with the following European regulations, proper measures must be taken to protect M2-JODY-W3 from ESD events on any pin that might be exposed to the end user:

- ESD testing standard CENELEC EN 61000-4-2
- Radio equipment standard ETSI EN 301 489-1

The minimum requirements that must be met to satisfy European regulations are described in Table 12.

| Application | Category | Immunity level |
|---|---|---|
| All exposed surfaces of the radio equipment and ancillary equipment in a representative configuration of the end product. | Contact discharge | 4 kV |
| | Air discharge | 8 kV |

**Table 12: ESD immunity ratings based on EN 61000-4-2**

Compliance with standard protection level specified in EN 61000-4-2 is achieved by including proper ESD protection in the production line and close to all areas that are accessible to the end user.



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# 12 Labeling and ordering

The labels applied to M2-JODY-W3 cards include important product information.

Figure 11 shows the label applied to M2-JODY-W3 cards. Each of the given label references are described in Table 13.

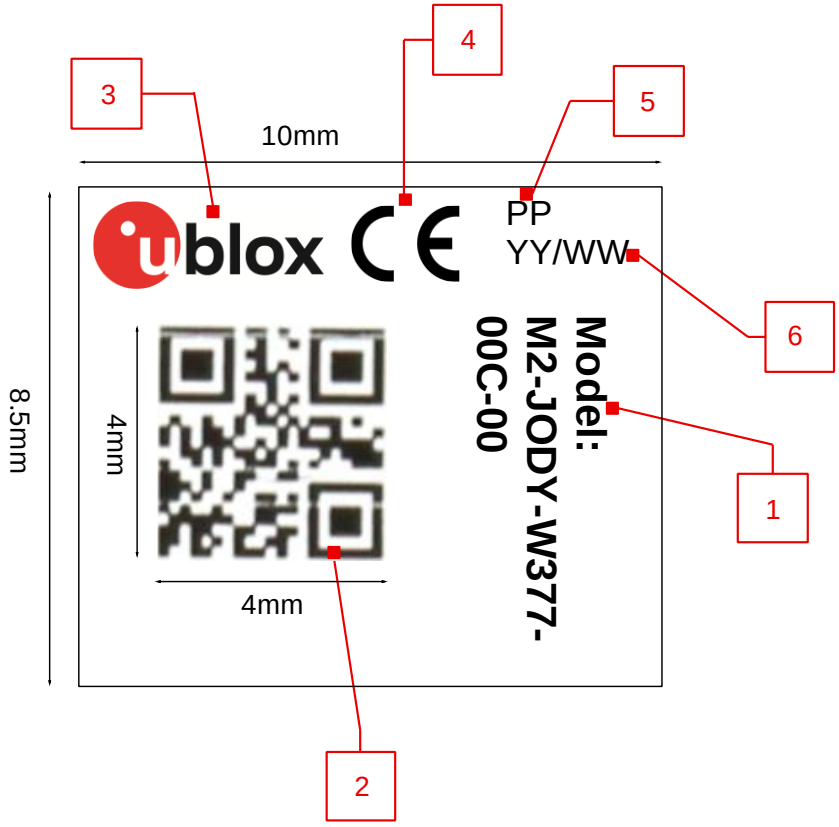



**Figure 11. Product label format with dimensions**

| Reference | Description |
|---|---|
| 1 | Text in bold font: “Model:” type number with the product version |
| 2 | DataMatrix (product identifier, serial number, datacode)<br>• Product identifier: 3 digits defined by EMS<br>• Serial number<br>Datacode: 4 digits |
| 3 | Company logo and trademark |
| 4 | Placeholder for CE marking (when certified) |
| 5 | Panel position number |
| 6 | Production date YY/WW (year/week) |

**Table 13. M2-JODY-W3 card label description**



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## 12.1 Ordering codes

| Ordering code | Product name | Product |
|---|---|---|
| M2-JODY-W377-00C | M2-JODY-W377 | M.2 key E card (2230) with three antenna U.FL connectors and concurrent dual-band 2x2 2.4 GHz and 5 GHz 802.11ax, Bluetooth/Bluetooth LE 5.3. Operational temperature -40 $^{0}$C to +85 $^{0}$C, standard grade module with NXP chipset 88W9098. Packaged in tray containing multiple M.2 cards. |

**Table 14: Product ordering codes**

☞ Product changes affecting form, fit, or function are documented by u-blox. Visit our website for a list of Product Change Notifications (PCNs).



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# Appendix

# A Wi-Fi Tx output power limits

## A.1. FCC/ISED regulatory domain

### A.1.1. Wi-Fi Output power for 2.4 GHz band

| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 1 | CCK and DSSS | 20 MHz | 1, 2, 5.5, 11 Mbps | 19 dBm |
| 2 | CCK and DSSS | 20 MHz | 1, 2, 5.5, 11 Mbps | 20 dBm |
| 3 - 10 | CCK and DSSS | 20 MHz | 1, 2, 5.5, 11 Mbps | 21 dBm |
| 11 | CCK and DSSS | 20 MHz | 1, 2, 5.5, 11 Mbps | 19 dBm |
| 1 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 14 dBm |
| 2 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 15 dBm |
| 3 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 16 dBm |
| 4 - 9 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 17 dBm |
| 10 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 15 dBm |
| 11 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 13 dBm |
| 1 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 2 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 15 dBm |
| 3 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 16 dBm |
| 4 - 8 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 17 dBm |
| 9 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 16 dBm |
| 10 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 11 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 13 dBm |
| 3 - 8 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 13 dBm |
| 9 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 12 dBm |
| 1 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 13 dBm |
| 2 - 3 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 15 dBm |
| 4 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 16 dBm |
| 5 - 8 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 17 dBm |
| 9 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 16 dBm |
| 10 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 11 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 12 dBm |
| 3 - 6 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 13 dBm |
| 7 - 9 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 12 dBm |

**Table 15: FCC Wi-Fi power table for operation in the 2.4 GHz band in SISO mode**



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| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 1 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 13 dBm |
| 2 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 3 - 9 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 15 dBm |
| 10 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 13 dBm |
| 11 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 12 dBm |
| 3 - 8 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 12 dBm |
| 9 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 11 dBm |
| 1 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 12 dBm |
| 2 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 13 dBm |
| 3 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 4 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 15 dBm |
| 5 - 8 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 16 dBm |
| 9 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 10 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 13 dBm |
| 11 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 11 dBm |
| 3 - 6 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 12 dBm |
| 7 - 9 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 11 dBm |

**Table 16: FCC Wi-Fi power table for operation in the 2.4 GHz band in MIMO mode**

## A.1.2. Wi-Fi output power for 5 GHz band

| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 36 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 16 dBm |
| 40 - 48 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 17 dBm |
| 52- 60 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 18 dBm |
| 64 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 16 dBm |
| 36 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 40 - 60 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 17 dBm |
| 64 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 36 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 40 - 60 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 17 dBm |
| 64 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 36 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 40 - 60 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 15 dBm |
| 64 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 38 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 13 dBm |
| 46 - 54 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 16 dBm |
| 62 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 13 dBm |
| 38 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 13 dBm |
| 46 - 54 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 16 dBm |
| 62 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 13 dBm |
| 38 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 13 dBm |
| 46 - 54 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 15 dBm |
| 62 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 13 dBm |
| 42, 58 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 12 dBm |
| 42, 58 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 12 dBm |

**Table 17: FCC Wi-Fi power table for operation in the 5 GHz U-NII-1 and U-NII-2A bands in SISO mode**



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| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 36 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 40 - 48 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 15 dBm |
| 52 - 60 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 17 dBm |
| 64 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 36 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 40 - 48 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 15 dBm |
| 52 - 60 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 17 dBm |
| 64 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 36 - 48 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 52 - 60 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 15 dBm |
| 64 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 38 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 12 dBm |
| 46 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 15 dBm |
| 54 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 16 dBm |
| 62 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 12 dBm |
| 38 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 12 dBm |
| 46 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 15 dBm |
| 54 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 16 dBm |
| 62 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 12 dBm |
| 38 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 12 dBm |
| 46 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 14 dBm |
| 54 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 15 dBm |
| 62 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 12 dBm |
| 42, 58 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 11 dBm |
| 42, 58 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 11 dBm |

**Table 18: FCC Wi-Fi power table for operation in the 5 GHz U-NII-1 and U-NII-2A bands in MIMO mode**



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| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 100 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 15 dBm |
| 104 - 136 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 18 dBm |
| 140 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 15 dBm |
| 100 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 15 dBm |
| 104 - 136 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 17 dBm |
| 140 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 100 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 15 dBm |
| 104 - 136 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 17 dBm |
| 140 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 100 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 104 - 136 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 15 dBm |
| 140 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 102 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 12 dBm |
| 110 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 16 dBm |
| 134 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 15 dBm |
| 142 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 14 dBm |
| 102 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 12 dBm |
| 110 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 16 dBm |
| 134 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 14 dBm |
| 102 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 12 dBm |
| 110 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 15 dBm |
| 134 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 15 dBm |
| 142 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 13 dBm |
| 106 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 12 dBm |
| 138 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 15 dBm |
| 106 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 12 dBm |
| 138 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 14 dBm |

**Table 19: FCC Wi-Fi power table for operation in the 5 GHz U-NII-2e band in SISO mode**



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| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 100 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 104 - 136 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 17 dBm |
| 140 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 14 dBm |
| 100 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 104 - 136 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 17 dBm |
| 140 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 100 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 104 - 136 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 15 dBm |
| 140 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 102 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 11 dBm |
| 110 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 16 dBm |
| 134, 142 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 15 dBm |
| 102 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 11 dBm |
| 110 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 16 dBm |
| 134 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 15 dBm |
| 142 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 16 dBm |
| 102 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 11 dBm |
| 110, 134, 142 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 15 dBm |
| 106 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 11 dBm |
| 138 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 16 dBm |
| 106 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 11 dBm |
| 138 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 15 dBm |

**Table 20: FCC Wi-Fi power table for operation in the 5 GHz U-NII-2e band in MIMO mode**

| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 144 - 165 | OFDM | 20 MHz | 6, 9, 12, 18, 24, 36, 48, 54 Mbps | 16 dBm |
| 144, 149 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 16 dBm |
| 153 - 165 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 15 dBm |
| 140 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 14 dBm |
| 144 - 165 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 15 dBm |
| 144 - 165 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 14 dBm |
| 151, 159 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 14 dBm |
| 151, 159 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 14 dBm |
| 151 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 13 dBm |
| 159 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 12 dBm |
| 155 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 15 dBm |
| 155 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 15 dBm |

**Table 21: FCC Wi-Fi power table for operation in the 5 GHz U-NII-3 band in SISO mode**



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| Channel | Modulation | Channel bandwidth | Data rates | Maximum power setting |
|---|---|---|---|---|
| 144 - 153 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 17 dBm |
| 157 - 165 | OFDM | 20 MHz | HT20 MCS0-MCS7 | 15 dBm |
| 144 - 153 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 17 dBm |
| 157 - 165 | OFDM | 20 MHz | VHT20 MCS0-MCS8 | 15 dBm |
| 144 - 153 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 15 dBm |
| 157 - 165 | OFDM | 20 MHz | HE20 MCS0-MCS11 | 13 dBm |
| 151 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 15 dBm |
| 159 | OFDM | 40 MHz | HT40 MCS0-MCS7 | 14 dBm |
| 151, 159 | OFDM | 40 MHz | VHT40 MCS0-MCS9 | 16 dBm |
| 151 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 15 dBm |
| 159 | OFDM | 40 MHz | HE40 MCS0-MCS11 | 13 dBm |
| 155 | OFDM | 80 MHz | VHT80 MCS0-MCS9 | 15 dBm |
| 155 | OFDM | 80 MHz | HE80 MCS0-MCS11 | 13 dBm |

**Table 22: FCC Wi-Fi power table for operation in the 5 GHz U-NII-3 band in MIMO mode**

# B Glossary

| Abbreviation | Definition |
|---|---|
| BLE | Bluetooth Low Energy |
| BSP | Board Support Package |
| BT | Bluetooth |
| DNI | Do Not Insert |
| I2S | Inter-IC-Sound |
| IC | Integrated Circuit |
| MIMO | Multiple Input, Multiple Output |
| PCIe | Peripheral Component Interconnect Express |
| PCM | Pulse Code Modulation |
| SDIO | Secure Digital Input Output |
| SISO | Single Input, Single Output |
| TBD | To be defined / determined |
| UART | Universal Asynchronous Receiver-Transmitter |
| USB | Universal Serial Bus |
| VIO | Input /Output Voltage |
| U.FL | Low-profile SMT coaxial connector |

**Table 23: Explanation of the abbreviations and terms used**



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# Related documentation

[1] JODY-W3 series data sheet, UBX-19010615
[2] JODY-W3 system integration manual, UBX-19011209
[3] Packaging information reference guide, UBX-14001652
[4] PCI Express M.2 Specification Revision 4.0, Version 1.0, November 5, 2020
[5] Wi-Fi/Bluetooth M.2 Key E Pinout Definition – NXP Application Note AN13049, Rev.1, November 12, 2020
[6] Hirose Electric Co. LTD - U.FL Series Catalog, August, 2021
[7] Hirose Electric Co. LTD - U.FL Series Specification Sheet, June 19, 2020
[8] u-blox Limited Use License Agreement (LULA-M)

☞ For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

# Revision history

| Revision | Date | Name | Comments |
|---|---|---|---|
| R01 | 26-Feb-2021 | gima | Initial release |
| R02 | 19-Apr-2021 | gima | Updated pinout description table |
| R03 | 3-May-2023 | gmet | Updated figures and tables with latest product information. Added Software, Approvals, Product handling, and Labeling and ordering chapters. |
| R04 | 27-Dec-2022 | gmet | Added Electrical Specifications. Updated Software, ESD handling and Approvals. Added Wi-Fi TX output power limits table in Appendix A |
| R05 | 03-May-2023 | gmet | Updated Electrical Specifications |

# Contact

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