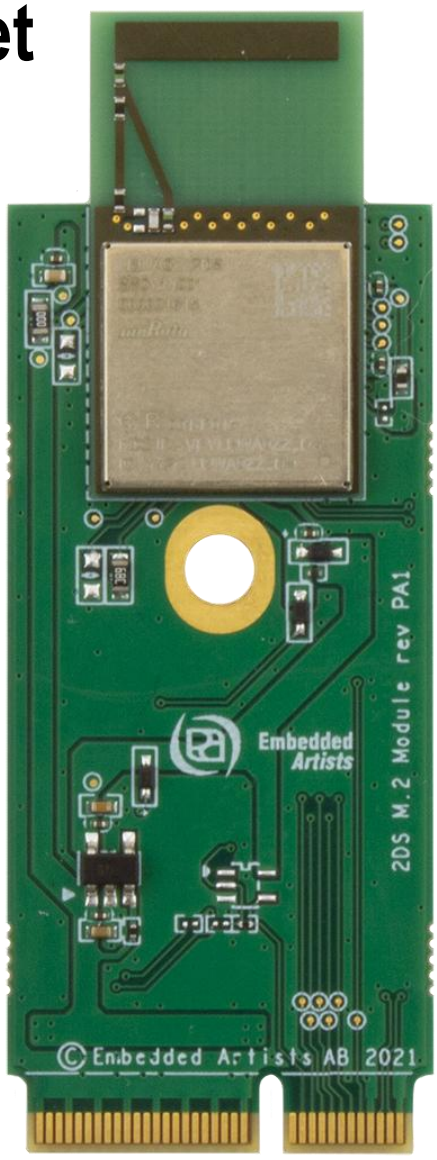
2DS M.2 Module Datasheet



- Wi-Fi 4, 802.11 b/g/n
- SDIO 2.0 interface, SDR25@50MHz
- Chipset: NXP 88W8801

Get Up-and-Running Quickly and
Start Developing Your Application On Day 1!

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Table of Contents

1 Document Revision History

Revision	*Date*	*Description*
PA1	2021-08-19	First version.

2 Introduction

This document is a datasheet that specifies and describes the *2DS M.2 module* mainly from a hardware point of view. Software related issues, like the Linux and WICED drivers, are not addressed. There are separate documents for that.

2.1 Benefits of Using an M.2 Module to get Wi-Fi Connectivity

There are several benefits to use an *M.2 module* to add connectivity to an embedded design:

- Drop-in, certified solution!
- Modular and flexible approach to evaluate different Wi-Fi solutions - with different trade-offs around performance, cost, power consumption, longevity, etc.
- Access to maintained software drivers (Linux and SDK) with responsive support from Murata.
- Supported by Embedded Artists' Developer's Kits for i.MX RT/6/7/8 development, including advanced debugging support on carrier boards
- One component to buy, instead of 40+
- No RF expertise is required
- Developed in close collaboration with Murata and NXP

2.2 More M.2 Related Information

For more information about the M.2 standard and Embedded Artists' adaptation, see: M.2 Primer

For more general information about the M.2 standard, see: https://en.wikipedia.org/wiki/M.2

The official M.2 specification (PCI Express M.2 Specification) is available from: www.pcisig.com

2.3 ESD Precaution and Handling

Please note that the M.2 module come without any case/box and all components are exposed for finger touches – and therefore extra attention must be paid to ESD (electrostatic discharge) precaution, for example use of static-free workstation and grounding strap. Only qualified personnel shall handle the product.

Make it a habit always to first touch the mounting hole (which is grounded) for a few seconds with both hands before touching any other parts of the boards. That way, you will have the same potential as the board and therefore minimize the risk for ESD.

In general touch as little as possible on the boards in order to minimize the risk of ESD damage. The only reasons to touch the board are when mounting/unmounting it on a carrier board.

Note that Embedded Artists does not replace modules that have been damaged by ESD.

2.4 Product Compliance

Visit Embedded Artists' website at http://www.embeddedartists.com/product_compliance for up to date information about product compliances such as CE, RoHS2, Conflict Minerals, REACH, etc.

3 Specification

This chapter lists some of the more important characteristics of the M.2 module, but it is not a full specification of performance and timing. The main component in the design is Murata's 2DS module (full part number: LBWA0ZZ2DS), which in turn is based around NXP's 88W8801 chipset.

For a full specification, see Murata's 2DS Module (LBWA0ZZ2DS) product page: https://wireless.murata.com/type-2ds.html and the LBWA0ZZ2DS datasheet: https://wireless.murata.com/datasheet?/RFM/data/type2ds.pdf

Module / Chipset	
Murata module	LBWA0ZZ2DS
Chipset	NXP 88W8801

Wi-Fi	
Standards	802.11b/g/n, Wi-Fi 4
Network	uAP and STA dual mode
Frequency	2.4GHz band
Data rates	11, 54, 72.2 Mbps
Host interface	SDIO 2.0, SDR12@24MHz, SDR25@50MHz

Powering			
Supply voltage to M.2 module **Note: Do not exceed minimum or maximum voltage. Module will be permanently damaged above this limit!**	**Min** 0.0V minimum 3.0V operating and RF specification	**Typ** 3.3V	**Max** 3.5V **Note** that LBWA0ZZ2DS module specification has higher maximum voltage (4.0V), but other components on the M.2 module limit the maximum voltage.
Peak current	550 mA max		The power supply must be designed for this peak current, which typically happen during the startup calibration process.
Receive mode current (WLAN)	72 / 94 mA typical / max		Note that current consumption varies widely between different operational modes.
Transmit mode current (WLAN)	335 / 417 mA typical / max		Note that current consumption varies widely between different operational modes.

Environmental Specification	
Operational Temperature	-40 to +85 degrees Celsius
Storage Temperature	-40 to +85 degrees Celsius

Relative Humidity (RH), operating and storage	10 - 90% non-condensing

3.1 Power Up Sequence

The supply voltage shall not rise (10 - 90%) faster than 40 microseconds and not slower than 100 milliseconds.

There is no specific timing requirement on the M.2 signal W_DISABLE1# (chipset signal PDN) during power-up, but it is recommended to keep the signal low until the module shall be initialized.

Before initializing the module, and after the supply voltage has reached specification level, it is recommended to pull the M.2 signal W_DISABLE1# low for at least 10 milliseconds and then high.

3.2 External Sleep Clock

No sleep clock signals is needed for the 2DS M.2 module.

3.3 Mechanical Dimensions

The M.2 module is of type: 2230-S3-E according to the M.2 nomenclature. This means width 22 mm, length 30mm, top side component height 1.5 mm and key-E connector. Note that the length is not the standard 30mm, but rather a non-standard 59mm. The table below lists the different dimensions and weight.

M.2 Module Dimension	Value (±0.15 mm)	Unit
Width	22	mm
Height	59	mm
PCB thickness	0.8	mm
Maximum component height on top side	1.5	mm
Maximum component height on bottom side	0	mm
Ground hole diameter	3.5	mm
Plating around ground hole, diameter	5.5	mm
Module weight	1.5 ±0.5 gram	gram

Embedded Artists has added a non-standard feature to the 2230 M.2 modules designed together with Murata, NXP and Infineon (former Cypress). The pictures below illustrates how the standard module size has been extended by 29 mm in the length direction in order to make room for the 2DS module "above" the GND mounting hole in the middle of the PCB.

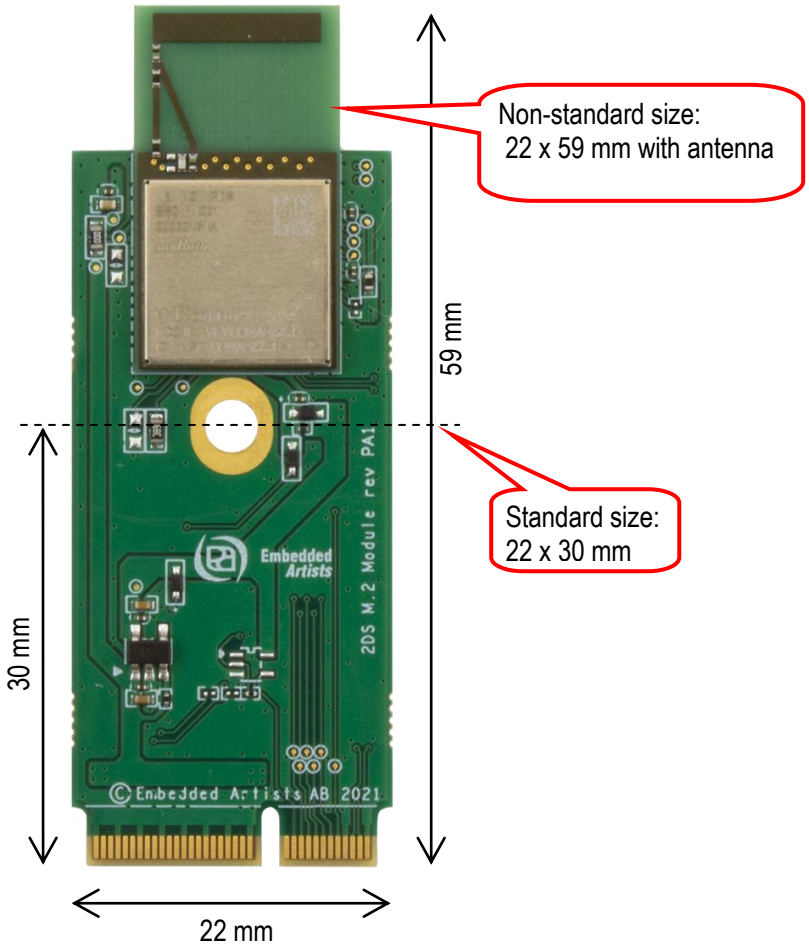

Figure 1 – M.2 Module Dimensions

3.4 M.2 Pinning

This section presents the pinning used for the M.2 module. It is essentially M.2 Key-E compliant with enhancements to support additional debug signals and 3.3V VDDIO override. The pin assignment for specific control and debug signals has been jointly defined by Embedded Artists, Murata, NXP and Infineon/Cypress.

The picture below illustrates the edge pin numbering. It starts on the right edge and alternates between top and bottom side. The removed pads in the keying notch count (but are obviously non-existing).

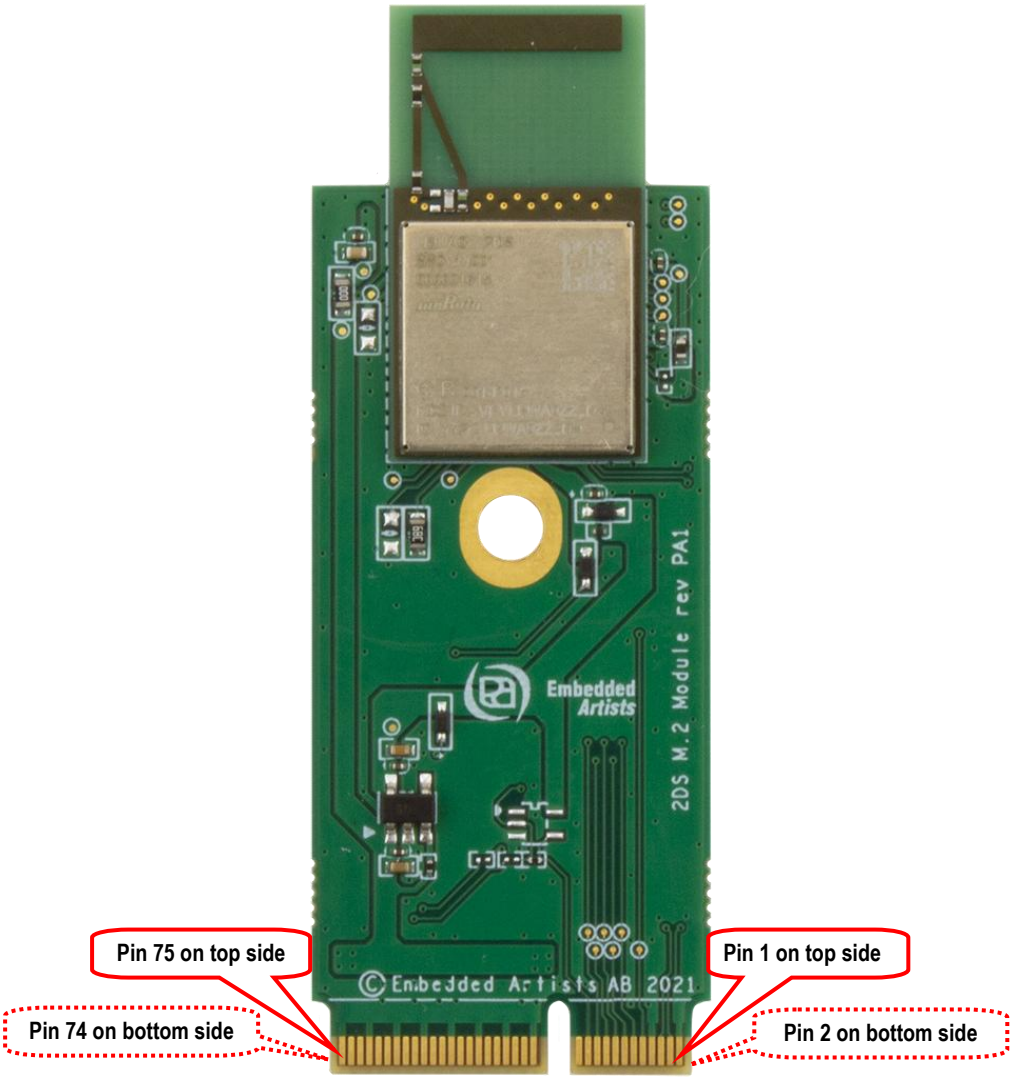

Figure 2 – M.2 Module Pin Numbering

The Wi-Fi interface uses the SDIO interface (and the 2DS module does not have a Bluetooth interface). The table below lists the pin usage for the 2DS M.2 modules. The column "When is signal needed" signals four different categories:

- Always: These signals shall always be connected.
- Wi-Fi: These signals shall always be connected then the Wi-Fi interface is used.
- Optional: These signals are optional to connect.

Pin #	Side of pcb	M.2 Name	Voltage Level and Signal Direction	When is signal needed	Note
1	Top	GND	GND	Always	Connect to ground
2	Bottom	3.3 V		Always	Power supply input. Connect to stable, low-noise 3.3V supply.
3	Top	USB_D+			Connected to 2DS module USB_DPLS, pin 4
4	Bottom	3.3 V		Always	Power supply input. Connect to stable, low-noise 3.3V supply.
5	Top	USB_D-			Connected to 2DS module USB_DMNS, pin 3
6	Bottom	LED_1#			Not connected.
7	Top	GND	GND	Always	Connect to ground.
8	Bottom	PCM_CLK			Not connected.
9	Top	SDIO CLK	1.8V Input to M.2	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_CLK Connected to 2DS module, signal SD_CLK, pin 62
10	Bottom	PCM_SYNC			Not connected.
11	Top	SDIO CMD	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_CMD Connected to 2DS module, signal SD_CMD, pin 63 Note: Require an external 10-100K ohm pullup
12	Bottom	PCM_OUT			Not connected.
13	Top	SDIO DATA0	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D0 Connected to 2DS module, signal SD_DAT0, pin 67 Note: Require an external 10-100K ohm pullup
14	Bottom	PCM_IN			Not connected.
15	Top	SDIO DATA1	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D1 Connected to 2DS module, signal SD_DAT1, pin 66 Note: Require an external 10-100K ohm pullup
16	Bottom	LED_2#			Not connected.
17	Top	SDIO DATA2	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D2 Connected to 2DSK module, signal SD_DAT2, pin 65 Note: Require an external 10-100K ohm pullup
18	Bottom	GND		Always	Connect to ground.
19	Top	SDIO DATA3	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D3 Connected to 2DSK module, signal SD_DAT3, pin 64 Note: Require an external 10-100K ohm pullup
20	Bottom	UART WAKE#			Not connected.
21	Top	SDIO WAKE#	1.8V OD output from M.2	Wi-Fi SDIO	For Wi-Fi SDIO interface WL_HOST_WAKE_L Connected to 2DS module, signal GPIO1, pin 58 Note: Require an external 10K pullup resistor to 1.8V
22	Bottom	UART TXD			Not connected.
23	Top	SDIO RESET#			Not connected.
24	Key, non existing				
25	Key, non existing				
26	Key, non existing				
27	Key, non existing				
28	Key, non existing				

29	Key, non existing				
30	Key, non existing				
31	Key, non existing				
32	Bottom	UART_RXD			Not connected.
33	Top	GND		Always	Connect to ground.
34	Bottom	UART_RTS			Not connected.
35	Top	PERp0			Not connected.
36	Bottom	UART_CTS			Not connected.
37	Top	PERn0			Not connected.
38	Bottom	VENDOR DEFINED	1.8V I/O	Optional	Connected to 2DS module, pin 49 Note: Signal can be JTAG_TDO
39	Top	GND		Always	Connect to ground.
40	Bottom	VENDOR DEFINED			Not connected.
41	Top	PETp0			Not connected.
42	Bottom	VENDOR DEFINED			Not connected.
43	Top	PETn0			Not connected.
44	Bottom	COEX3	1.8V I/O	Optional	Connected to 2DS module, pin 51 Note: Signal can be JTAG_TDI
45	Top	GND		Always	Connect to ground.
46	Bottom	COEX_TXD	1.8V I/O	Optional	Connected to 2DS module, pin 50 Note: Signal can be JTAG_TCK
47	Top	REFCLKp0			Not connected.
48	Bottom	COEX_RXD	1.8V I/O	Optional	Connected to 2DS module, pin 48 Note: Signal can be JTAG_TMS
49	Top	REFCLKn0			Not connected.
50	Bottom	SUSCLK			Not connected.
51	Top	GND		Always	Connect to ground.
52	Bottom	PERST0#			Not connected.
53	Top	CLKREQ0#			Not connected.
54	Bottom	W_DISABLE2#			Not connected.
55	Top	PEWAKE0#			Not connected.
56	Bottom	W_DISABLE1#	3.3V input to M.2	Always	Connected to 2DS module, via series diode, signal PDN, pin 8 High = module enabled, Low = module disabled
57	Top	GND		Always	Connect to ground.
58	Bottom	I2C_SDA			Not connected.
59	Top	Reserved			Not connected.
60	Bottom	I2C_CLK			Not connected.
61	Top	Reserved			Not connected.
62	Bottom	ALERT#			Not connected.
63	Top	GND		Always	Connect to ground.
64	Bottom	RESERVED		Optional	Optional supply voltage input for control and data signal voltage level. Apply a stable, low-noise, 3.3V / 100mA supply

				to set 3.3V voltage level on all signals.
65	Top	Reserved		Not connected.
66	Bottom	UIM_SWP		Not connected.
67	Top	Reserved		Not connected.
68	Bottom	UIM_POWER_ SNK		Not connected.
69	Top	GND	Always	Connect to ground.
70	Bottom	UIM_POWER_ SRC/GPIO_1		Not connected.
71	Top	Reserved		Not connected.
72	Bottom	3.3 V	Always	Power supply input. Connect to stable, low-noise 3.3V supply.
73	Top	Reserved		Not connected.
74	Bottom	3.3 V	Always	Power supply input. Connect to stable, low-noise 3.3V supply.
75	Top	GND	Always	Connect to ground.

3.5 VDDIO Override Feature

The M.2 standard specify 1.8V logic level on several of the data and control signals. It is possible to override the voltage level for the 1.8V signals via pin 64. Apply a 3.3V / 100 mA supply to pin 64 in order to get 3.3V voltage level on all data and control signals.

3.6 Test Points

There are some test points that can be of interest to probe for debugging purposes, as illustrated in the picture below.

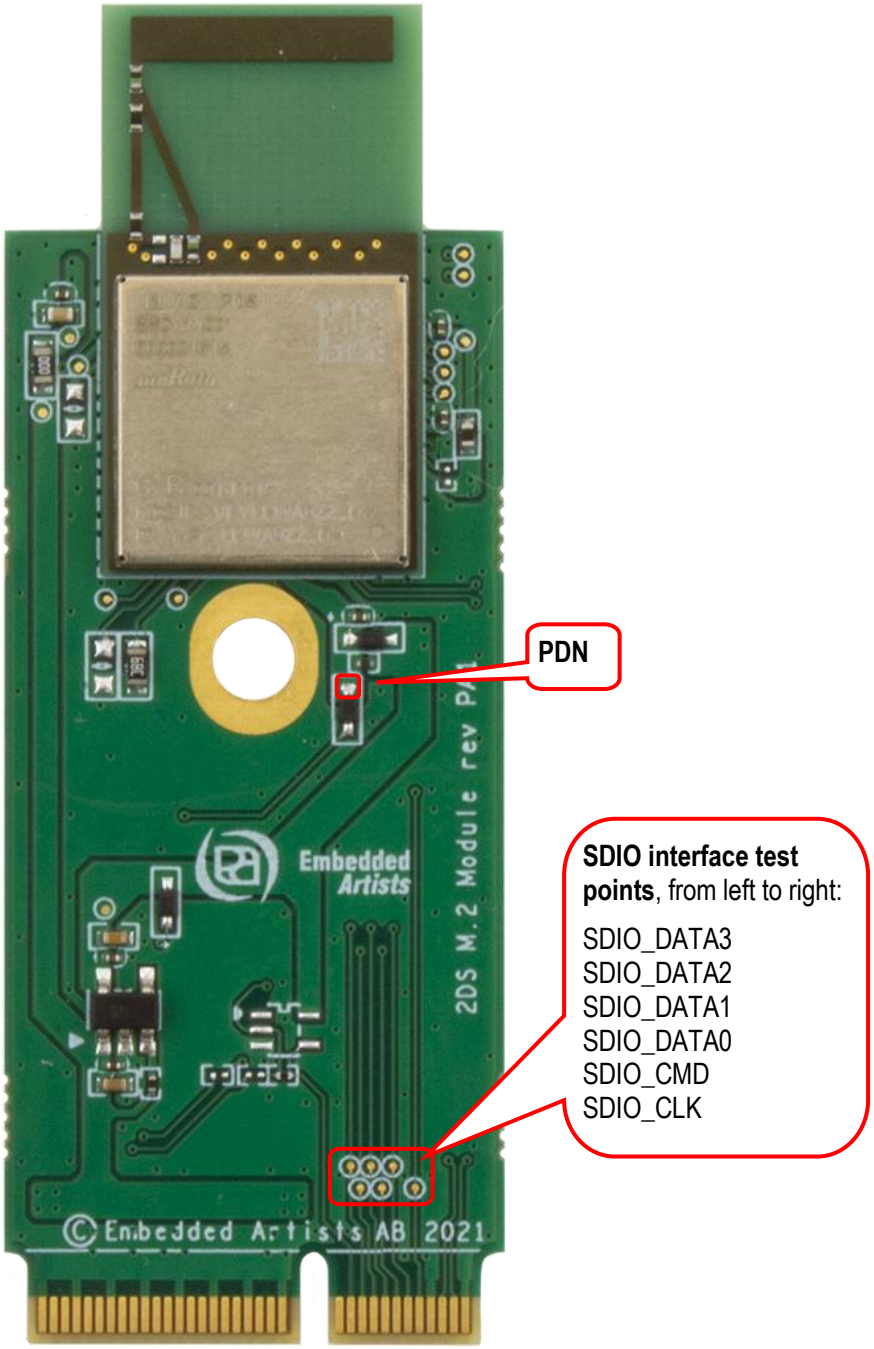

Figure 3 – 2DS M.2 Module Test Points

3.7 Wi-Fi Interface Selection

It is possible to configure the Wi-Fi interface of the module; either SDIO (default) or USB. The picture below illustrates the location of the controlling resistor. Note that there is no publicly available driver that supports the USB interface. It is currently only available for specific high-volume customers (and this is out of control of Embedded Artists).

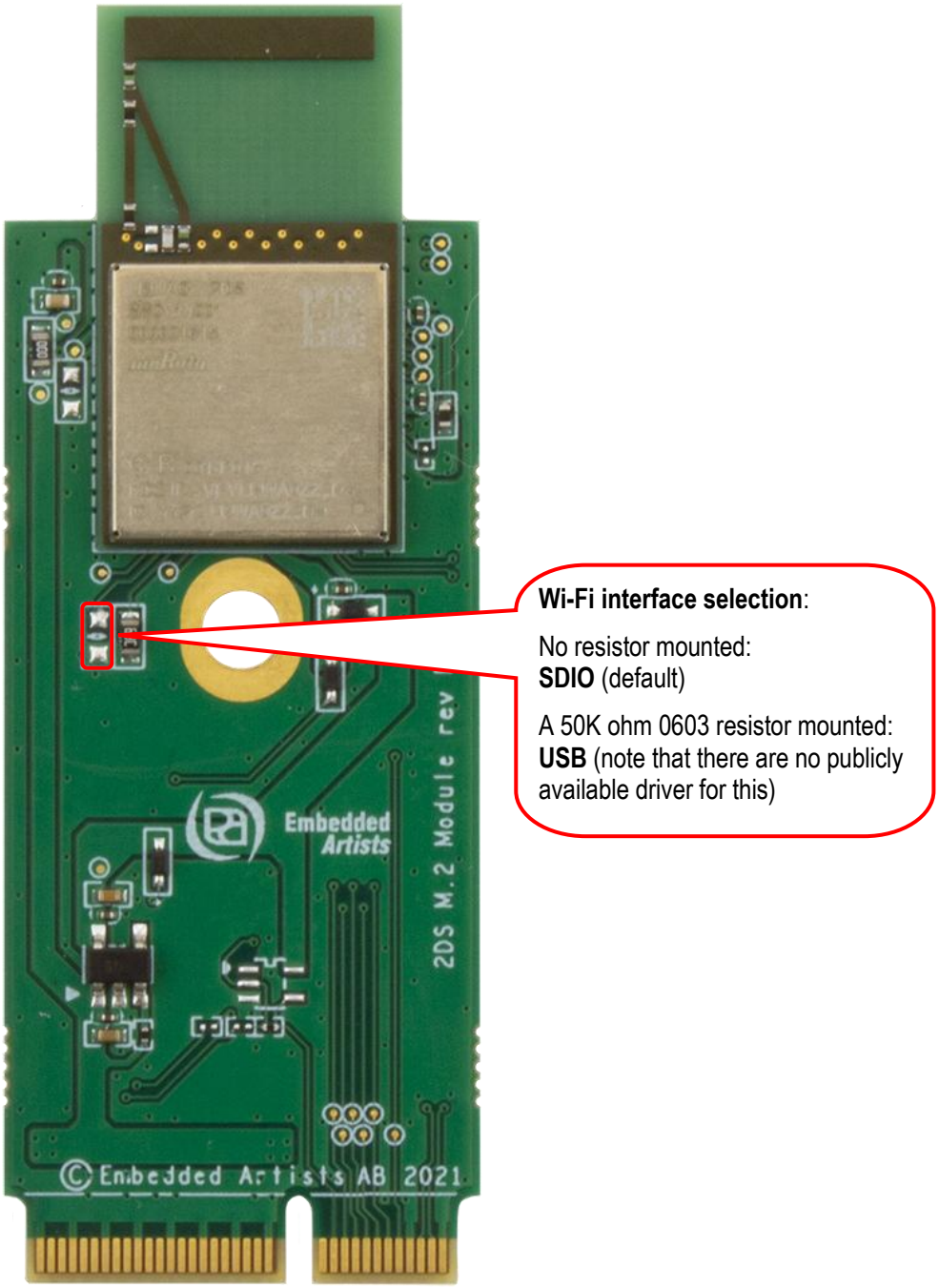

Figure 4 – 2DS M.2 Module Wi-Fi Interface Selector

3.8 Current Consumption Measurements

It is possible to measure the currents of the power supplies to the 2DS module, VBAT and VIO/VIO_SD. VBAT is the 3.3V the is supplied to the M.2 interface and VIO/VIO_SD is an on-board generated 1.8V. VIO/VIO_SD is generated from the supplied 3.3V.

Note that zero ohm resistors are mounted by default. Select a series resistor with as low resistance as possible to keep the voltage drop to a minimum. Keep the drop below 100mV. VBAT can be slightly above 1 Amp in peak which means that maximum series resistance is 100 milliOhm for the VBAT resistor. For VIO/VIO_SD the current is lower so a 1 ohm resistor can be a suitable value.

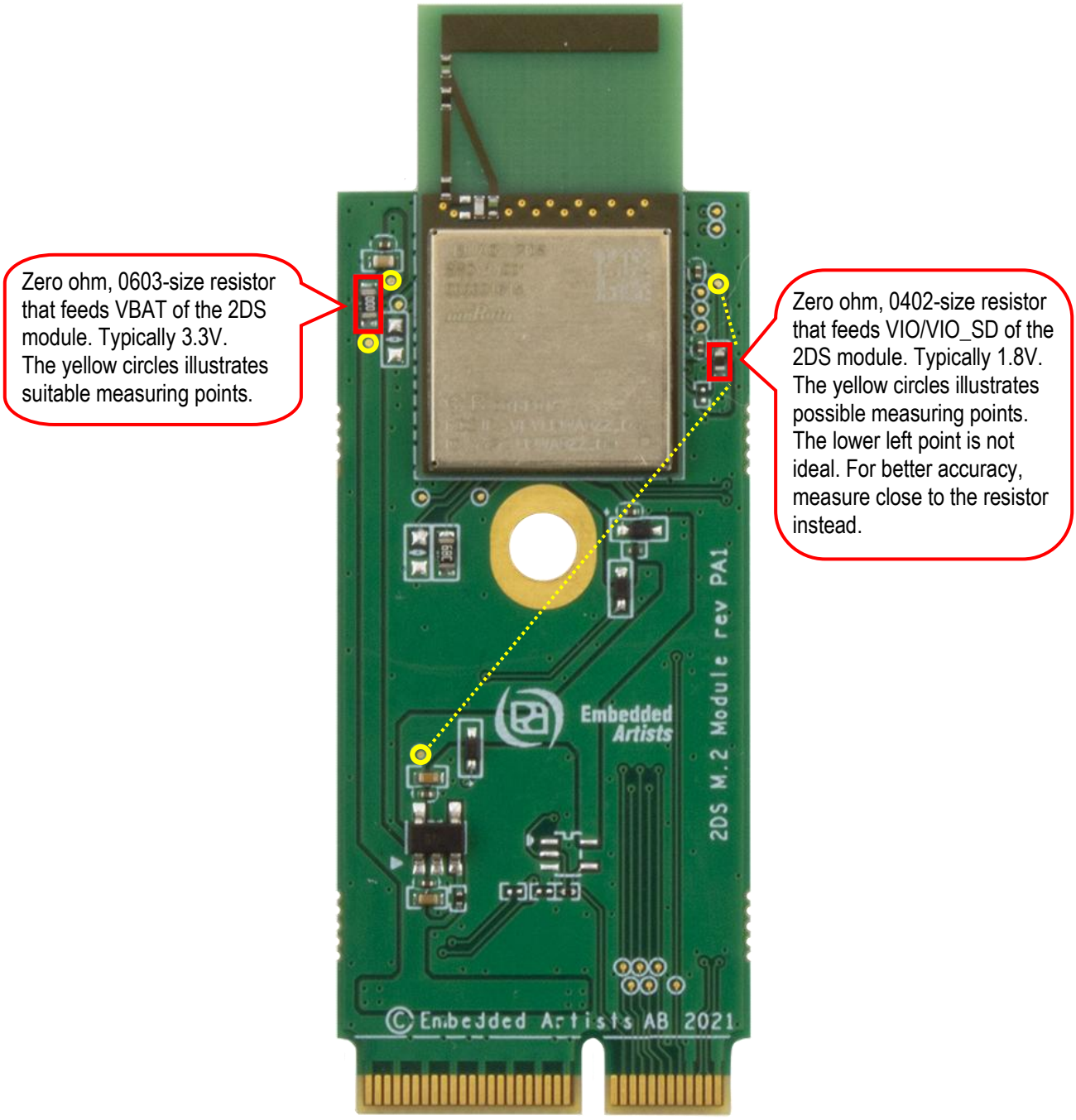

Figure 5 – Current Measurement

4 Antenna

This chapter addresses the antenna side of the module. The 2DS module contains an on-board, reference certified pcb trace antenna. This antenna is the one that is used in the final product. For details, consult the 2DS datasheet from Murata.

5 Support

Embedded Artists supports customers that use our M.2 module in combination with Embedded Artists' Computer-on-Modules, (u)COM, based on NXP's i.MX RT/6/7/8 families.

For other platforms, support is provided by Murata via their Community Support Forum:
https://community.murata.com/s/topic/0TO5F0000002TLWWA2/connectivity-modules

6 Regulatory

The Murata 2DS module is reference certified. For details, consult the 2DS datasheet from Murata.

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