MAVID-3M Datasheet

(Multi-protocol Audio Voice IoT Device)

Revision: 1.7

Libre Wireless Technologies Private Limited

librewireless.com

Circuit diagrams and other information relating to Libre Wireless Technologies products are included as a means of illustrating typical applications. Consequently, complete information sufficient for construction purposes is not necessarily given. Although the information has been checked and is believed to be accurate, no responsibility is assumed for inaccuracies. Libre Wireless Technologies reserves the right to make changes to specifications and product descriptions at any time without notice. Contact your local Libre Wireless Technologies sales office to obtain the latest specifications before placing your product order. The provision of this information does not convey to the purchaser of the described semiconductor devices any licenses under any patent rights or other intellectual property rights of Libre Wireless Technologies or others. All sales are expressly conditional on your agreement to the terms and conditions of the most recently dated version of Libre Wireless Technologies standard Terms of Sale Agreement dated before the date of your order (the "Terms of Sale Agreement"). The product may contain design defects or errors known as anomalies which may cause the product's functions to deviate from published specifications. Anomaly sheets are available upon request. Libre Wireless Technologies products are not designed, intended, authorized or warranted for use in any life support or other application where product failure could cause or contribute to personal injury or severe property damage. Any and all such uses without prior written approval of an Officer of Libre Wireless Technologies and further testing and/or modification will be fully at the risk of the customer. Copies of this document or other Libre Wireless Technologies literature, as well as the Terms of Sale Agreement, may be obtained by visiting Libre Wireless Technologies website.

LIBRE WIRELESS TECHNOLOGIES DISCLAIMS AND EXCLUDES ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION ANY AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, AND AGAINST INFRINGEMENT AND THE LIKE, AND ANY AND ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR USAGE OF TRADE. IN NO EVENT SHALL LIBRE WIRELESS TECHNOLOGIES BE LIABLE FOR ANY DIRECT, INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES; OR FOR LOST DATA, PROFITS, SAVINGS OR REVENUES OF ANY KIND; REGARDLESS OF THE FORM OF ACTION, WHETHER BASED ON CONTRACT; TORT; NEGLIGENCE OF LIBRE WIRELESS TECHNOLOGIES OR OTHERS; STRICT LIABILITY; BREACH OF WARRANTY; OR OTHERWISE; WHETHER OR NOT ANY REMEDY OF BUYER IS HELD TO HAVE FAILED OF ITS ESSENTIAL PURPOSE, AND WHETHER OR NOT LIBRE WIRELESS TECHNOLOGIES HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES

Table of Contents

1. Document Revision History

Revision	Date	Description of change	Author
1.7	July 20, 2022	Updated Ordering Information	Chandravel
1.6	Feb 17, 2022	Updated Ordering Information	Chandravel
1.5	Sep 28, 2021	Updated MAVID-3M module image	Chandravel
1.4	July 07, 2021	Updated power numbers	Chandravel
1.3	May 31, 2021	Updated MAVID 3M module image	Chandravel
1.2	May 23, 2021	Added Ordering Information section	Chandravel

2. Overview

Libre Wireless, MAVID-3M module is a low power module targeted for IoT, voice/AI and audio streaming applications. The efficient low power mode states enable MAVID-3M well suitable for portable battery powered devices.

The module provides 2.4 GHz Wi-Fi connectivity, BLE 5.0, Voice Front End with 2/3 MIC Far field Voice recognition, Noise reduction and Echo cancellation.

3. MAVID–3M Features and Spec

3.1 Generic Features

- ARM Cortex-M4 @ 192 MHz
- Open SDK Voice/AI, IoT, Audio on Free RTOS Operating System
- 1x UART (currently used for debugging)
- 2x SPI (QSPI for Flash, SPI for Voice Front End)
- 1x I2C
- Supports up to 16 GPIO's
- 1x I2S Serial audio interface
- Hi-Resolution Audio (up to 192 KHz/24 bits) stereo supported
- LPCM, MP3, HE-AAC decode capability
- Crypto Engine for AES 128, 192, 256. DES, 3DES, MD5, SHA-1,224,256,384,512, True Random number generator
- Two/three Mic Far Field voice. Noise reduction (Beam Forming) and AEC
- Up to three Digital MIC
- Internal 4MB SRAM
- External QSPI flash4MB (XIP)
- 1x1, 802.11n 2.4GHz WLAN
- BLE 5.0
- Wi-Fi/BLE coexistence
- Antenna diversity
- Requires multiple voltage domains (VBAT / 3.3 V and 1.8 V)

3.2 WLAN Features

- IEEE 802.11 b/g/n (2.4GHz, 1x1)
- Supports 20 Mhz,40 MHz bandwidth in 2.4 GHz band.
- Supports short GI and all data rates of 802.11n including MCS0 to MCS7
- Wi-Fi security WEP, WPA2, WPS
- Support Soft AP and sniffer modes
- Supports digital pre-distortion to enhance PA performance
- RX antenna diversity
- Integrated 2.4 GHz PA, LNA and T/R switch
- Single ended RFIO with integrated balun
- Supports an optional LNA and PA
- Dedicated high performance 32-bit RISC CPU up to 160 MHz clock to run WLAN firmware

3.3 Bluetooth Features

- Support BLE (Bluetooth Low Energy) 5.0
- Support BLE 1M
- Support BLE extended advertising
- Support 8 data link connection
- Support 128bit AES
- Four PWM channels
- Integrates baseband, radio for Mesh Controllers, mobile payments and wearable device applications
- Ultra-low power consumption

3.4 Voice Front End Features

- Dual Core DSP (Cadence Tensilica based audio centric DSP core)
- Dedicated to run Wake Word, Noise Reduction (beam forming) and AEC algorithms as per requirement
- 2/3 MIC far field voice recognition
- Room to offload the main Application processor for dedicated tasks as per requirements
- Can support custom Wake words and Local commands in edge as per the requirements
- Will support digital sound processing capability for audio output path (e.g.: Equalizer, DRC)
- Low power, low-latency, and high-performance algorithm processing at the edge
- Xtensa HiFi 3 instruction sets enable extensive voice and audio capabilities including voice user interfacing and ambient sound processing

3.5 Platform Features

MAVID-3M comes with extensive software SDK features for Voice/AI, Audio and Multi-protocol IoT control applications. These include system level control and data transfer and bridging features as well as core networking connectivity and OTA features.

Below are the feature highlights for the MAVID-3M Device and please refer to the full "MAVID-3M Feature List" for details of supported features.

- Complete Low Power AVS "Mic-to-Cloud" Solution (Amazon AVS)
- 802.11n 1x1, BLE 5.0 complaint
- Network configuration using BLE and WI-FI direct
- Secure OTA Firmware Update
- IoT Stack for AWS or custom IoT Application, Device cloud for back end support
- Android and iOS Application for device on boarding and other functionalities
- Self-Hosting; no external MCU required
- Three Mic Far Field & Wake Word detection with AEC and Beamforming
- Hardware Crypto core + OTP
- Advanced low power state & battery management

5. MAVID-3M: Power modes and Consumption

Table 1: MAVID-3M Device Power Consumption

Input Voltage /Battery (v)	Sub System	Operating Mode	Response Time	Power (mW)
3.3	Active Wi-Fi Streaming from AVS cloud. Total consumption of Wi-Fi/BLE Concurrent, Voice DSP Noise Reduction & AEC	Active State	Always On, Immediate	183
3.3	Ideal Mode	Wi-Fi Connected but music is not streaming	Always On, Immediate	165

6. Package Information

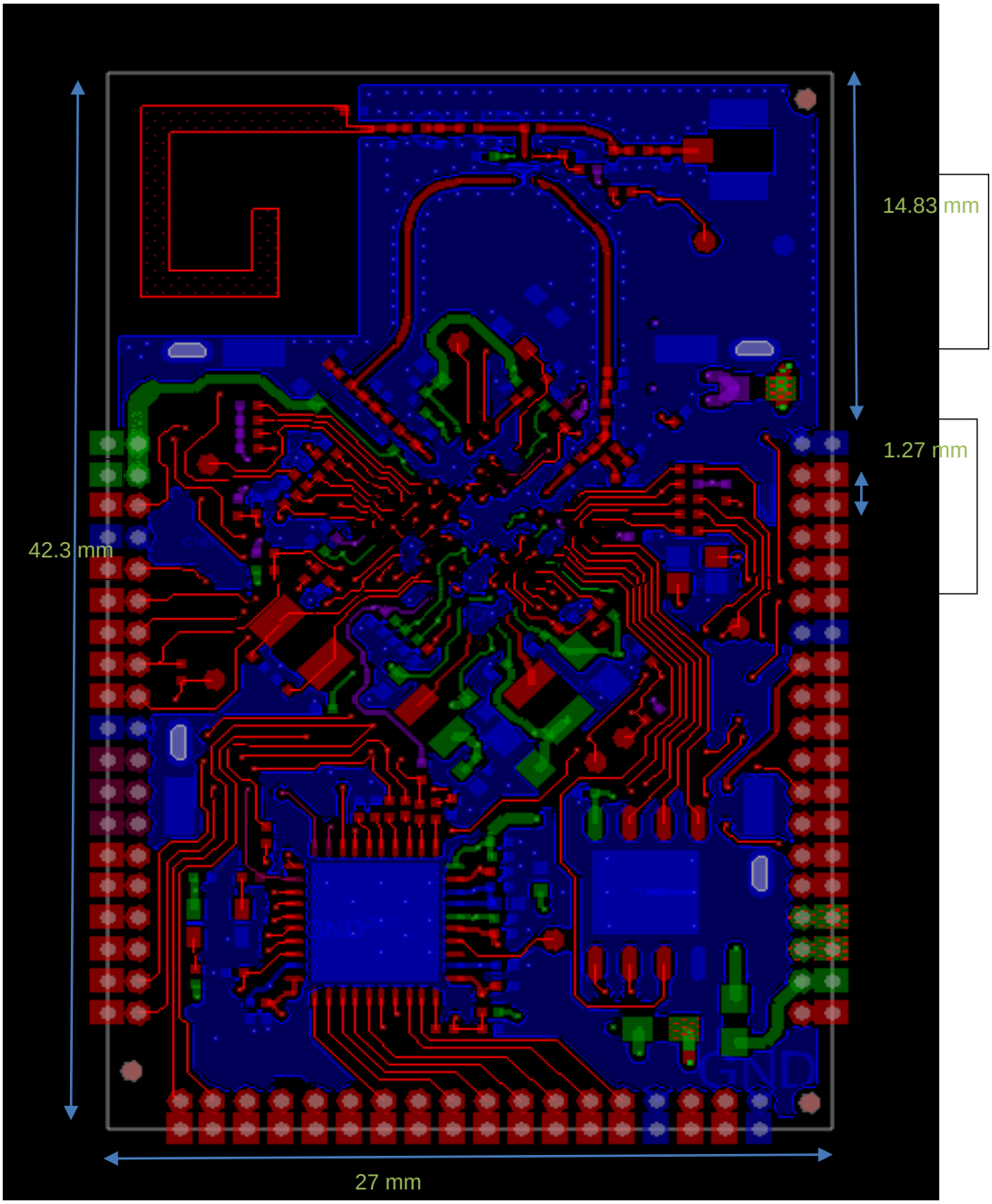

Figure 6-1: MAVID–3M Module Mechanical Dimension

8. Pin Description

Pin No.	Signal Name	Signal Type	Description
1	3V3	Power	3V3
2	3V3	Power	3V3
3	GPIO4_B	GPIO4_B	GPIO
4	GND	GND	GND
5	GPIO0_B	Output	GPO
6	GPIO9_B	Output	GPO
7	PWR_OFF	Output	For Power off circuit
8	CHIP_EN	Input	Chip reset
9	MIC_PWR_CTRL	Output	For Mic power control
10	GND	GND	GND
11	I2S_MCLK	Output	I2S Master Clock
12	I2S_LRCLK	Input/ Output	I2S LRCLK
13	I2S_BCLK	Input/ Output	I2S BCLK
14	PORTA_RXD	Input	AEC reference Data
15	I2S_TXD	Output	I2S data out
16	I2S_RXD	Input	I2S data in
17	I2S_PORTA_TXD	Output	Optional/Additional I2S data out
18	SPI_MISO	Input	SPI MISO
19	SPI_CLK	Output	SPI CLK
20	SPI_CS	Output	SPI CS
21	SPI_MOSI	Output	SPI MOSI

Pin No.	Signal Name	Signal Type	Description
22	PTT/SETUP	Input/Output	Button PTT / Setup
23	MIC_PWR_ON/OFF	Input/Output	Button MIC / Power
24	CHG_STATUS	Input/Output	For Battery charging Indication
25	PLAY/PAUSE	Input/Output	Button Play / Pause
26	DSP_GPIO0	Input/Output	Knowles DSP GPIO
27	DSP_GPIO1	Input/Output	Knowles DSP GPIO
28	DM1_CLK	Output	Digital MIC Data
29	DM1_DATA	Input	Digital MIC Clock
30	DM0_CLK	Output	Digital MIC Clock
31	DM0_DATA	Input	Digital MIC Data
32	DSP_D_UART_TX	Output	Knowles DSP UART TX
33	DSP_D_UART_RX	Input	Knowles DSP UART RX
34	GND	GND	GND
35	UART1_TX	Output	UART1_TX
36	UART1_RX	Input	UART1_RX
37	GND	GND	GND
38	NC	NC	NC
39	1V8	Power	1.8V
40	VDD_IO	Power	To connect 3V3 or 1V8 to Knowles
41	VDD_IO	Power	To connect 3V3 or 1V8 to Knowles
42	LED_RED	Output	AVS LED_RED
43	LED_GREEN	Output	AVS LED_GREEN
44	LED_BLUE	Output	AVS LED_BLUE

Pin No.	Signal Name	Signal Type	Description
45	RTC_EINT	Input	Real Time Clock External Interrupt
46	CODEC_RST	Output	To enable/disable EXT CODEC
47	GPIO8_B	Output	GPIO
48	BTVBAT	Power	3V3 Battery Input
49	VRTC	Power	Connect 3V coin battery
50	GND	GND	GND
51	ADC1	Analog	Analog
52	I2C0_SCL	Output	I2C SCL
53	I2C0_SDA	Input/Output	I2C SDA
54	DEBUG_URXD	Input	Debug log
55	DEBUG_UTXD	Output	Debug log
56	GND	GND	GND

FCC regulatory conformance

FCC ID: 2ADBM-MAVID-3M

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help

NOTE: Unauthorized changes will result in loss of device operating privileges.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

IC regulatory conformance

IC: 20276-MAVID3M

This device complies with CAN ICES-003 (B)/NMB-003(B).This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.
Cet appareil est conforme à la norme CAN ICES-003 (B)/NMB-003 (B).
Cet appareil contient des émetteurs / récepteurs exempt (s) de licence qui sont conformes aux RSS exemptes de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:

(1) Cet appareil ne doit pas provoquer d'interférences.
(2) Cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

RF Exposure
This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
Cet équipement est conforme aux limites d'exposition aux rayonnements de la IC établies pour unenvironnement non contrôé. Cet équipement doit être installé et fonctionner à au moins 20cm de distance d'un radiateur ou de votre corps.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) NOTES

OEM must certify the final end product to comply with unintentional radiators (FCC Sections 07 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2ADBM-MAVID-3M". Additionally, the following statement should be included on the label and in the final product's user manual: "This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interferences, and

(2) this device must accept any interference received, including interference that may cause undesired operation."

The module is limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end-use operational conditions, including simultaneous transmission operations. When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application. When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY.

Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user

IC labeling requirement for the final end product:

The final end product must be labeled in a visible area with the following

“Contains IC: 20276-MAVID3M”

The Host Marketing Name (HMN) must be indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online.

Unauthorized modifications could void the user's authority to operate the equipment.

This radio transmitter [IC: 20276-MAVID3M] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Frequency range	Manufacturer	Peak gain	Impedance	Antenna type
2400-2483.5MHz	Libre Wireless Technologies, Inc.	0.81dBi	50Ω	PCB Antenna
2400-2483.5MHz	Libre Wireless Technologies, Inc.	1.50dBi	50Ω	PCB Antenna