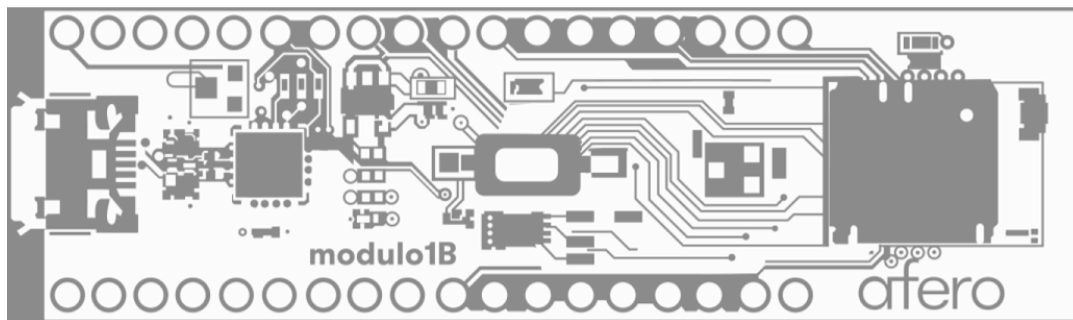




# Modulo-1B-TY Data Sheet

Modified: April 3, 2019



REVISION	DATE	AUTHOR	CHANGE DESCRIPTION
0.1	3 April 2019	SB, SR	Initial release

# Contents

<b>1. Introduction</b>	<b>3</b>
1.1 About Afero	3
1.2 Features	4
1.3 Block Diagram	5
<b>2. Pin Definitions</b>	<b>6</b>
2.1 Pinout	6
2.2 Pinout Diagram	7
2.3 Configuration Options	8
<b>3. DC Electrical Specification</b>	<b>8</b>
3.1 Absolute Maximum Rating	8
3.2 Recommended Operating Conditions	8
3.3 Standard Test Conditions	9
3.4 Typical Power Consumption	9
3.5 GPIO DC Characteristics	9
<b>4. RF Specification</b>	<b>10</b>
4.1 Bluetooth® Low Energy (BLE) Characteristics	10
<b>5. Environmental Specification</b>	<b>10</b>
5.1 Absolute Maximum Rating	10
5.2 Recommended Operating Conditions	10
<b>6. Mechanical Specification</b>	<b>11</b>
6.1 Mechanical Drawing	11
6.2 Antenna Keep-Out	12
6.3 Mechanical Characteristics	12
<b>7. Where to Obtain</b>	<b>12</b>
7.1 Design Files	12
7.2 Board Ordering Information	12
<b>8. Compliance Notices</b>	<b>13</b>
8.1 FCC	13
8.2 IC(ISED) Canada	13
8.3 MIC Japan	13

# 1. Introduction

Modulo-1B-TY is a development board for the ASR-1B Secure Bluetooth® low energy radio architecture, based on the nRF52832 BLE chipset. The board uses the pre-certified Taiyo Yuden EYSHCNZWZ module plus the Afero Hardware Security Module.

Modulo-1B-TY makes it easy to prototype and build connected products used in conjunction with the Afero IoT Platform. It enables ultra-low power connectivity for data communication. The product integrates a Bluetooth radio, RF front-end, a microcontroller running the Afero custom firmware, security IC, and crystal into a small package. This is an ideal solution for Internet of Things (IoT) applications.

## 1.1 About Afero

Afero builds integrated hardware, software, and cloud services for IoT connectivity and data analytics. The Afero turnkey platform incorporates a secure wireless module, scalable cloud services, and a range of development tools that enable companies and developers to quickly prototype and build connected devices.

The Afero platform is vertically integrated, giving developers a solution that combines security and connectivity at the three key touch points for all connected devices:

- Product (embedded secure radio module)
- Mobile (app-level monitoring and control)
- Cloud (web API)

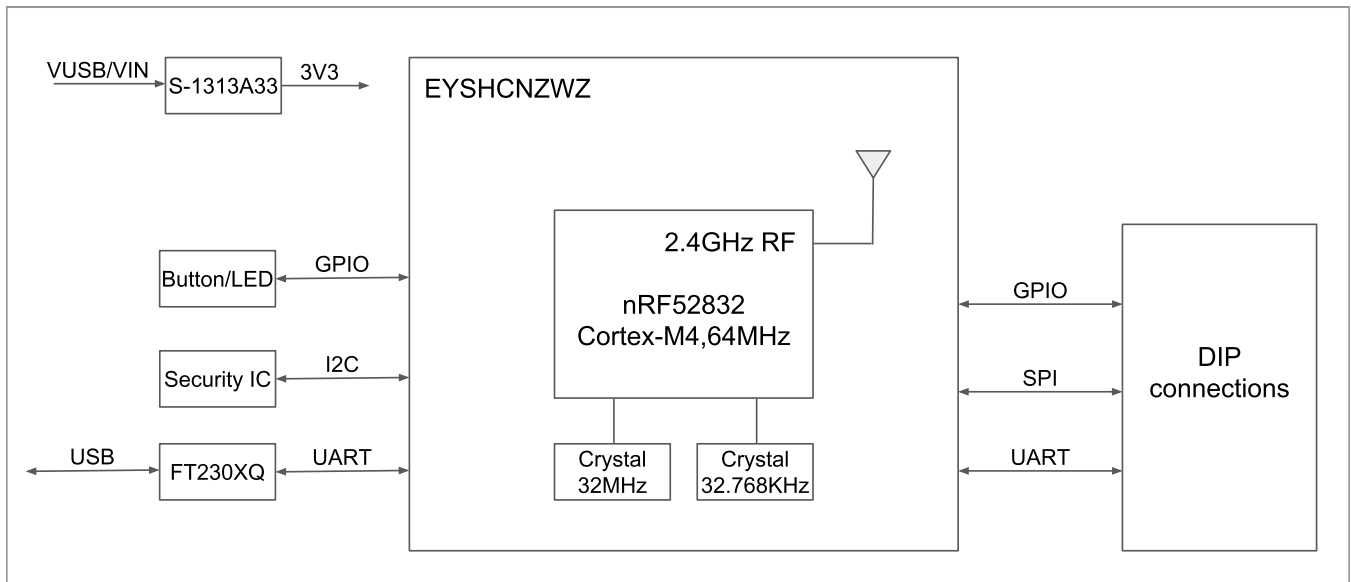
This vertical integration accelerates the creation of connected devices by minimizing the investment normally required for software development and testing – while ensuring a secure and scalable solution.

The Afero Secure Radio module (Modulo-1B-TY, P/N A-FGS-00017-00) comes programmed with authentication, encryption, and connection management software, ensuring a reliable connection to the Afero Cloud. The Afero mobile application, available for both Android and iOS phones, allows users to manage their smart devices and services from their phone. Afero Dynamic Hub Technology further extends users' control over their devices by providing a secure network that connects wirelessly to the Afero Cloud using LTE. Afero also offers a cross-platform SDK, enabling partners to incorporate the Afero technology into their own app.

## 1.2 Features

- Model name: Afero Modulo-1B-TY Secure BLE Radio Development Board
- Afero model number: Modulo-1B-TY
- Bluetooth radio: Bluetooth® low energy wireless technology (5.0)
- Number of antennas: One (1)
- Antenna configuration: On-module chip antenna
- Maximum transmit power: 4dBm
- Receive sensitivity: -96dBm
- Power consumption: 7.5mA(TX), 5.4mA(RX)
- Security features: Cryptographic co-processor with secure, hardware-based key storage
- Host interface: UART, SPI, 3.3V CMOS
- Interface pins: 4 GPIOs
- Power: Supplied via an input pin ( $V_{IN}$ : 4.0-5.5V) or via  $\mu$ USB connector
- Operating temperature: 0 - +85C
- Storage temperature: -40 - +85C
- Operating humidity: 10 to 80% RH, non-condensing
- Storage humidity: 5 to 90% RH, non-condensing
- LED indicators: One (1)
- Buttons: One (1)
- Dimensions: 62 x 18 x 12mm (L x W x H)
- Weight (Earth ABL): 7g
- Package: 600 mil DIP form factor
- Compliance: FCC/IC/TELEC

## 1.3 Block Diagram

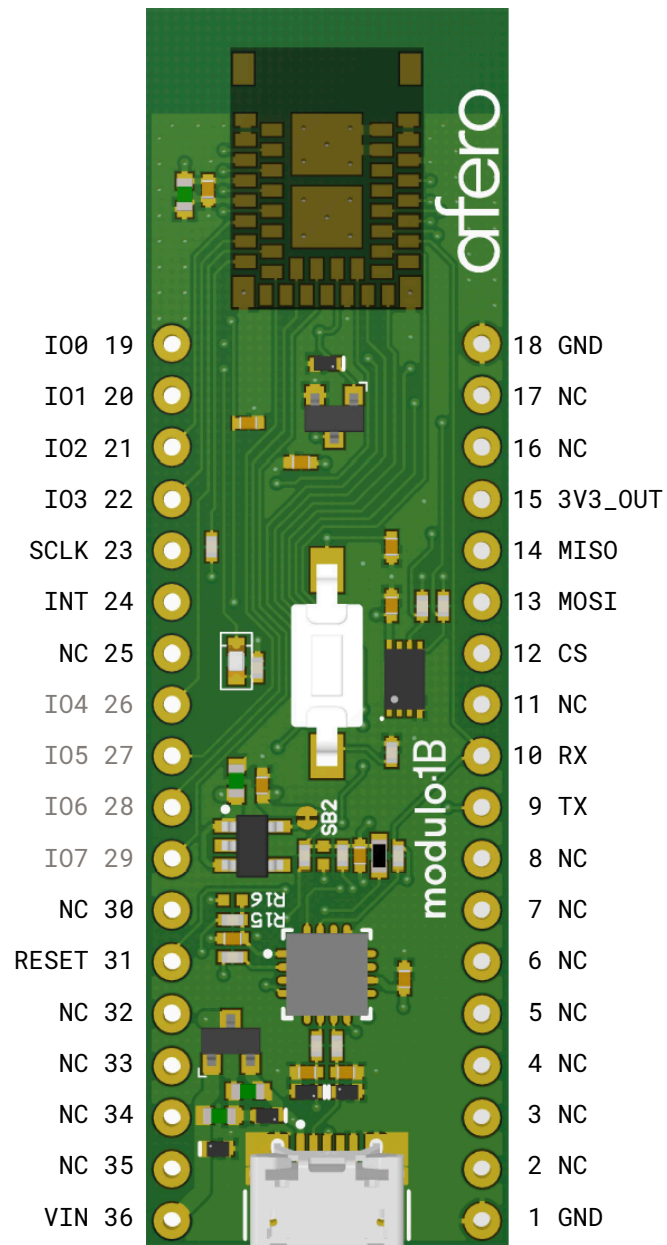


## 2. Pin Definitions

### 2.1 Pinout

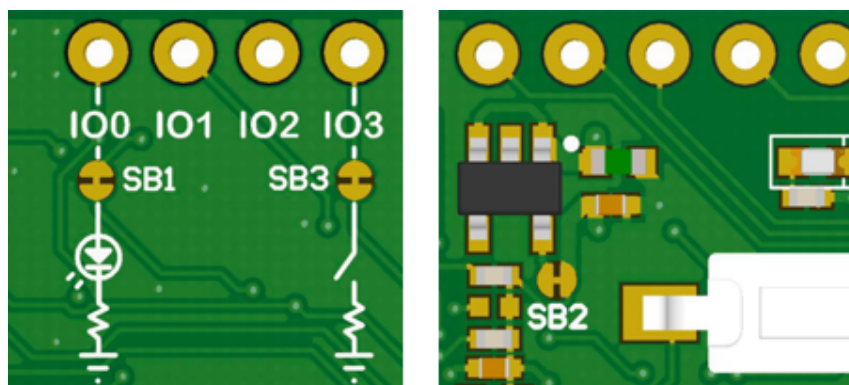
PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	GND	Ground	19	IO0	General Purpose I/O
2	NC		20	IO1	General Purpose I/O
3	NC		21	IO2	General Purpose I/O
4	NC		22	IO3	General Purpose I/O
5	NC		23	SCLK	SPI Clock
6	NC		24	INT	Host Interrupt Active Low
7	NC		25	NC	
8	NC		26	IO4	RESERVED
9	TX	Host UART Transmit	27	IO5	RESERVED
10	RX	Host UART Receive	28	IO6	RESERVED
11	NC		29	IO7	RESERVED
12	CS	SPI Chip Select	30	NC	
13	MOSI	SPI Transmit	31	RESET	Reset Active Low
14	MISO	SPI Receive	32	NC	
15	3V3_OUT	Internal 3V3 LDO Power Rail	33	NC	
16	NC		34	NC	
17	NC		35	NC	
18	GND	Ground	36	V <sub>IN</sub>	External Power Input

## 2.2 Pinout Diagram



## 2.3 Configuration Options

SOLDER BRIDGE #	DESCRIPTION
SB1	LED(D2) is connected to pin IO0 and is active high. LED will turn on when the pin is set high. User can disconnect LED from the pin by cutting the SB1.
SB2	User can measure current on 3V3_OUT rail by cutting the SB2 and applying current meter to each end of SB2.
SB3	Button(S1) is connected to pin IO3 and is active low. Pressing the button will indicate input value 0. User can disconnect the button from the pin by cutting the SB3.



## 3. DC Electrical Specification

### 3.1 Absolute Maximum Rating

DESCRIPTION	MIN	MAX	UNIT
$V_{IN}$	-0.3	6.0	V
3V3	-0.3	$V_{IN} + 0.3$	V
$I_{3V3}$ (3.3V Out)	200	240	mA

### 3.2 Recommended Operating Conditions

PARAMETER	MIN	MAX	UNIT
$V_{IN}$	4.0	5.5	V
3V3	3.27	3.33	V
$I_{3V3}$ (3.3V Out)		200	mA



### 3.3 Standard Test Conditions

Ambient Conditions: 25°C +/- 5°C, 65%RH +/- 10%

Power Supply:  $V_{IN}$  5V +/- 5%

### 3.4 Typical Power Consumption

POWER CONSUMPTION	MIN	TYP	MAX	UNIT
Sleep (No RF operations)		20		uA
TX only			7.5	mA
RX only			5.4	mA
Standby (250ms period advertisement)		60		uA

### 3.5 GPIO DC Characteristics

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
$V_{IL}$	Low-Level Input Voltage	All Pins	0		$0.3 \times 3V3$	V
$V_{IH}$	High-Level Input Voltage	All Pins	$0.7 \times 3V3$		3V3	V
$V_{OL}$	Low-Level Output Voltage	All Pins	0		0.4	V
$V_{OH}$	High-Level Output Voltage	All Pins	$3V3 - 0.4$		3V3	V
$I_{OL}$	Sink Current	$V_{OL\_Max}$	1	2	4	mA
$I_{OH}$	Source Current	$V_{OH\_Min}$	1	2	4	mA
$R_{PULLUP}$	Pull-up Resistor	All Pins	11	13	16	kΩ
$R_{PULLDOWN}$	Pull-down Resistor	All Pins	11	13	16	kΩ

## 4. RF Specification

Conditions: 25°C,  $V_{IN}=5V$ , Parameters measured at RF connector.

### 4.1 Bluetooth® Low Energy (BLE) Characteristics

ITEMS	MIN	TYP	MAX
Specification	Bluetooth® 5.0		
Mode	Bluetooth® Low Energy		
Frequency Range	2402 – 2480 MHz		
TX CHARACTERISTICS			
Max Output Power		4dBm	6dBm
RX CHARACTERISTICS			
Receive Sensitivity			-96dBm

## 5. Environmental Specification

### 5.1 Absolute Maximum Rating

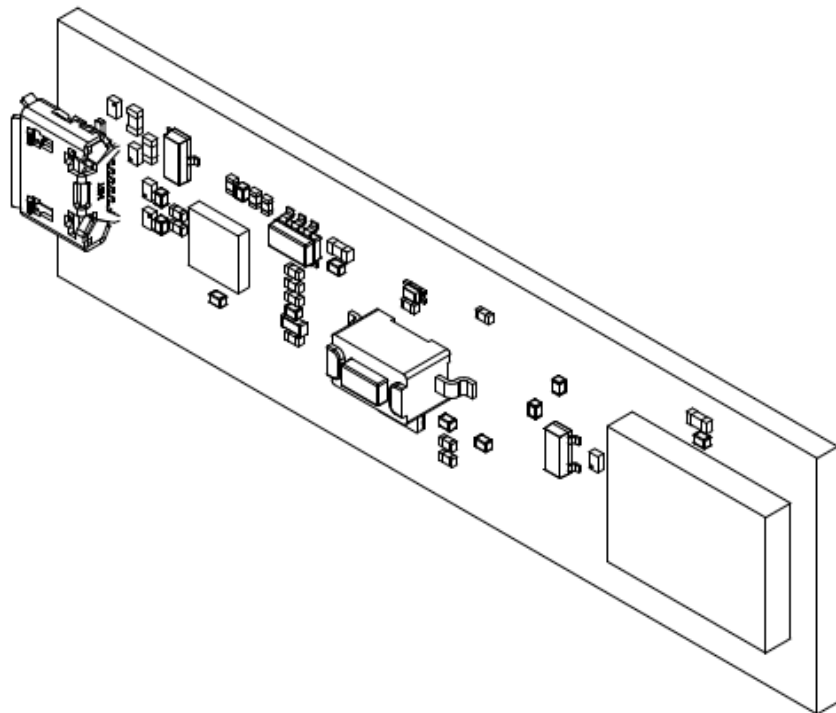
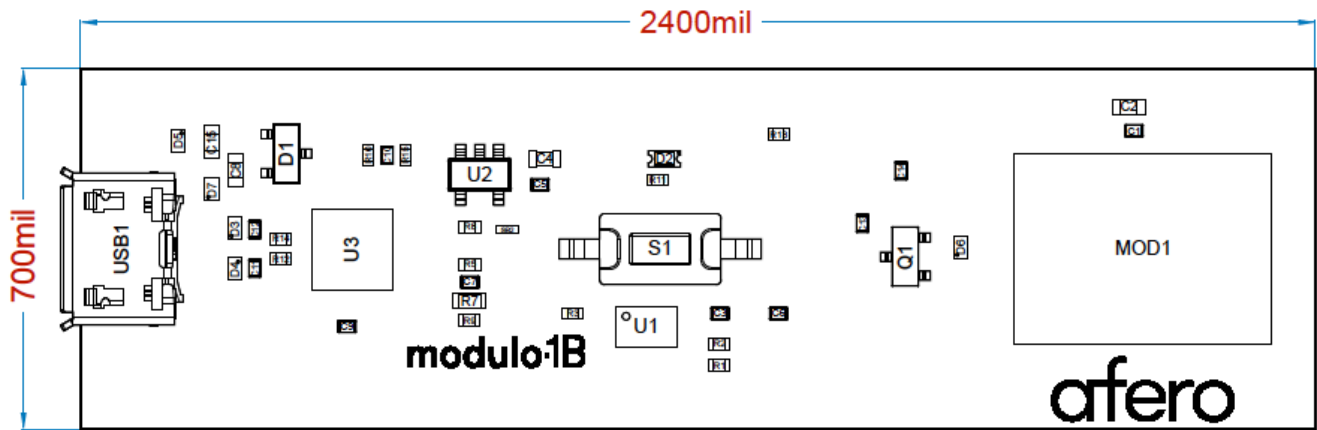
DESCRIPTION	MIN	MAX	UNIT
Storage Temperature	-40	85	°C
Storage Humidity, Non-Condensing	5	90	%RH
Operating Temperature	0	85	°C
Operating Humidity, Non-Condensing	10	80	%RH

### 5.2 Recommended Operating Conditions

PARAMETER	MIN	MAX	UNIT
Operating Temperature Range	0	70	°C

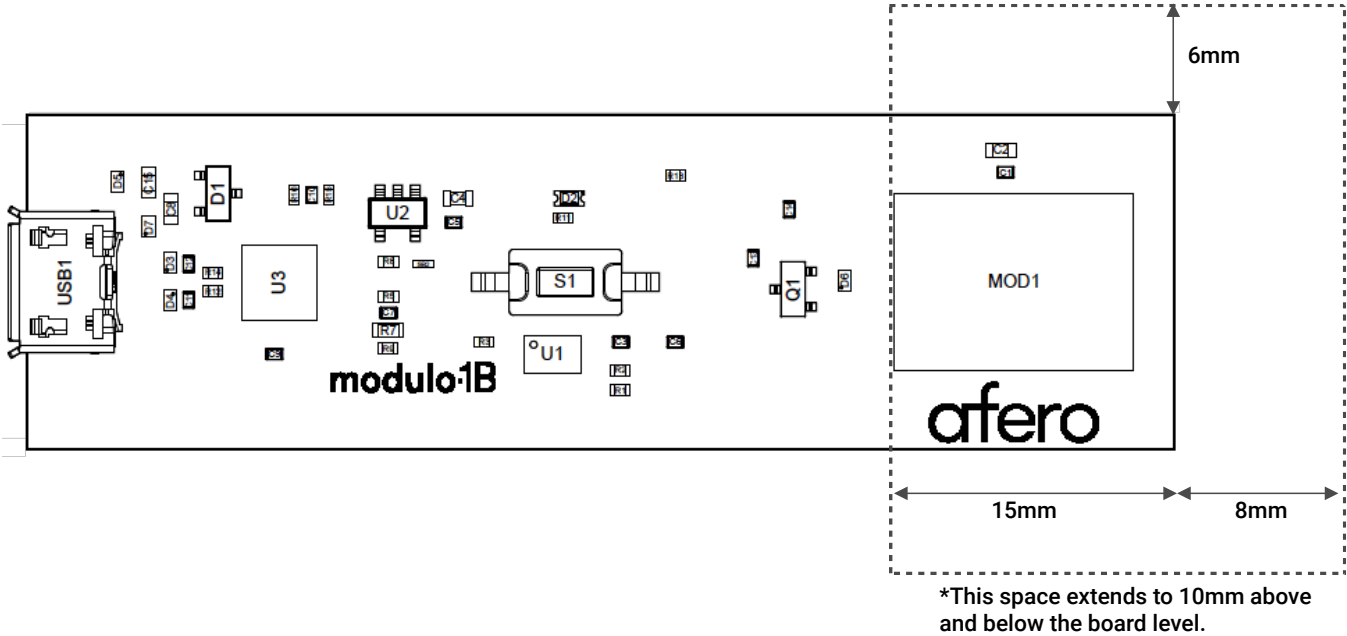
## 6. Mechanical Specification

### 6.1 Mechanical Drawing



## 6.2 Antenna Keep-Out

To preserve antenna performance, keep materials away from the antenna element. The dimensioned box shows an example antenna keep-out region. Infringing on this keep-out should be done with direction from an RF engineer to best retain RF performance.



## 6.3 Mechanical Characteristics

ITEM	TEST CONDITIONS
Assembly	No defects of wiring, soldering, and assembling
Appearance	No dirt, rust, corrosion, or foreign material
Mass	7g +/- 1g

# 7. Where to Obtain

## 7.1 Design Files

Complete Modulo-1B-TY design files are available at [this GitHub link](#). The design files are open-sourced under the Apache 2.0 license.

## 7.2 Board Ordering Information

MODULE	PART NUMBER	NOTES
Modulo-1B-TY	A-FGS-00017-00	Header pins installed

## 8. Compliance Notices

### 8.1 FCC

Contains FCC ID: RYYEYSHCN

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.

### 8.2 IC(ISED) Canada

Contains IC: 4389B-EYSHCN

This device complies with Industry Canada's licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### 8.3 MIC Japan

Contains EYSHCN: 001-A10745

This product installs a radio system which has been approved as a radio station in a low power data communication system based on the Radio Law.

**Afero reserves the right to make changes to the specifications  
and functionality of this product.**