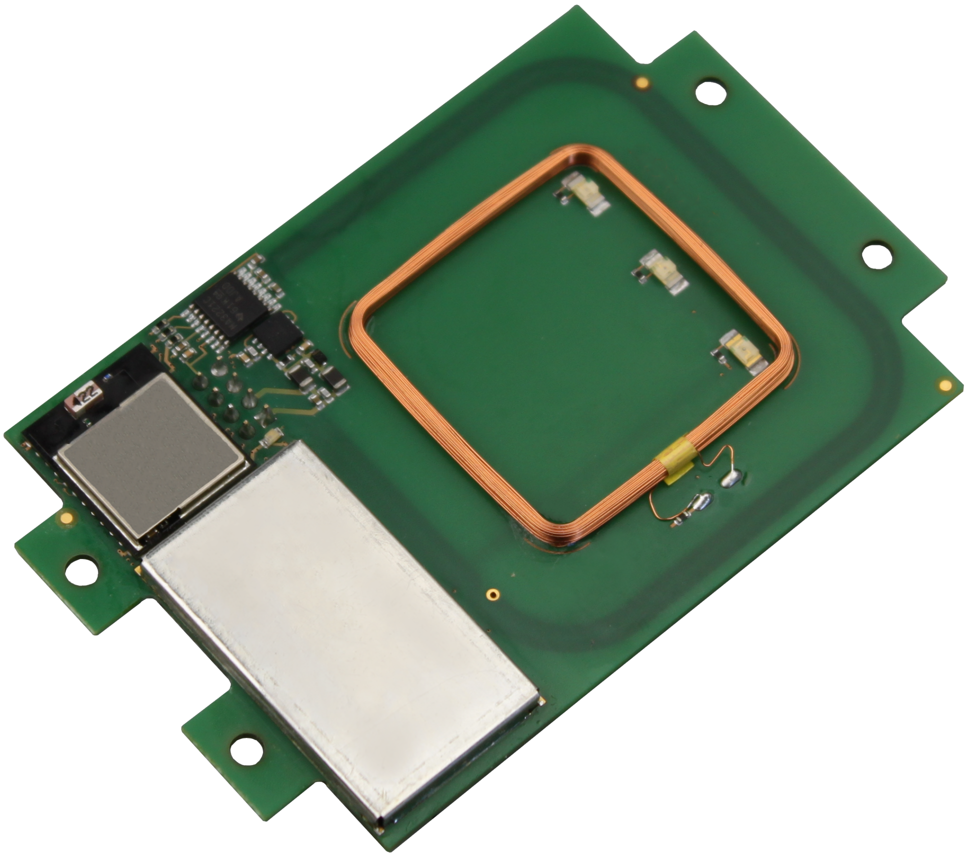
TWN4 MultiTech 2 BLE

Technical Handbook

DocRev9, April 29, 2022



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1 Introduction

The TWN4 MultiTech 2 BLE Module is a configurable Reader/Writer of RFID transponders. This addition to the TWN4 family offers the Bluetooth Low Energy (BLE) interface. The Module has both the low (125kHz, 134.2kHz) and high (13.56MHz) frequency antennas, allowing the User access to a wide range of RFID standards.

This Technical Handbook provides the details needed to get started using the TWN4 MultiTech 2 BLE. We begin with a functional overview of the board, listing the features and interface options available. We then proceed with short introduction to the BLE Standard itself and the details of its implementation on the board.

The custom User App can be loaded onto the module using the AppBlaster software. For more information regarding the programming of the TWN4 module please see a dedicated User Guide for AppBlaster.

2 TWN4 MultiTech 2 BLE PCB

2.1 Functional Overview

The TWN4 MultiTech 2 BLE is a complete RFID Reader system that requires a 5V power source and connection to host to work. The majority of the circuitry responsible for processing the RFID card information and executing the module firmware is shielded as shown on Figure 2.1. The device can be connected to the host via USB or RS232 interface; both use the same connector (DF11). The cable can be simply connected with no extra configuration required. The pinout for the DF11 connector is described in Table 2.2. A more generic breakout interface to the main controller is available; its pinout is shown on Table 2.1. The TWN4 MultiTech 2 BLE also offers 2 SAM slots and a speaker on board.

The TWN4 MultiTech 2 BLE can also interact with the User via Bluetooth Low-Energy interface. This development pack contains documentation on BLE protocol and API implemented on the module.

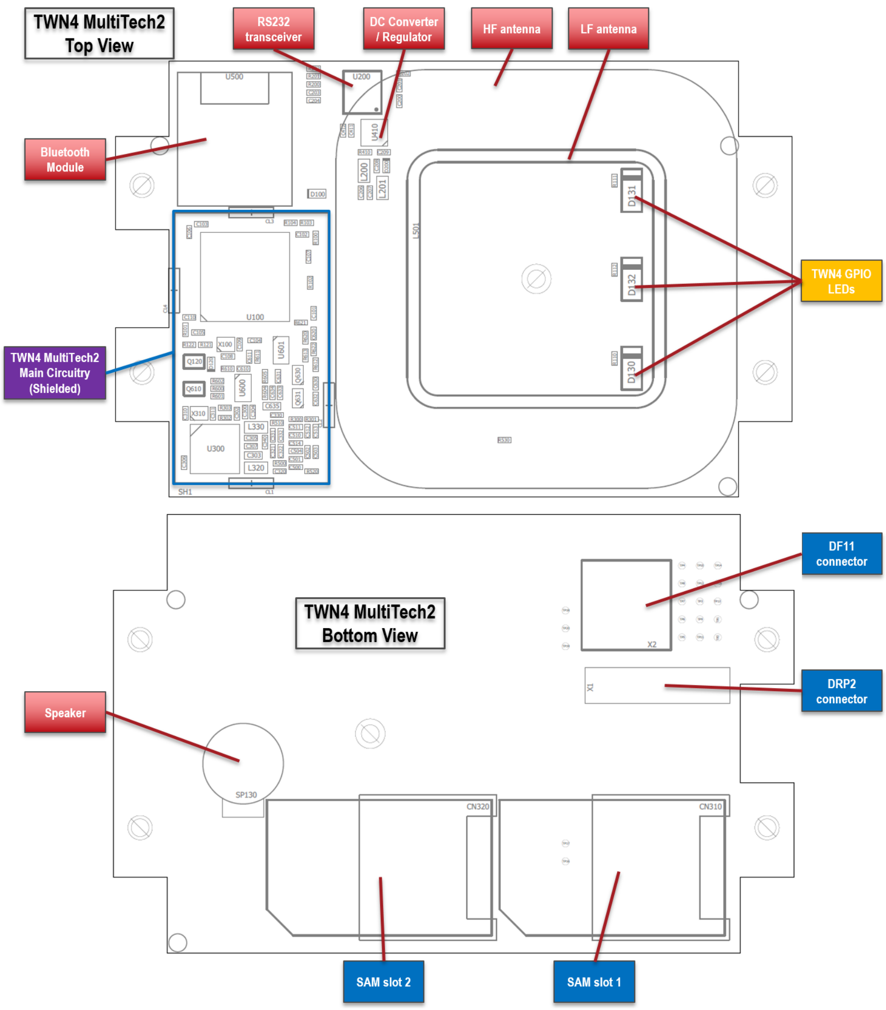

Figure 2.1: TWN4 MultiTech 2 BLE View Functional

2.2 Dimensions

Figure 2.2 provides the physical dimensions of the TWN4 MultiTech 2 BLE. All dimensions in mm unless otherwise stated.

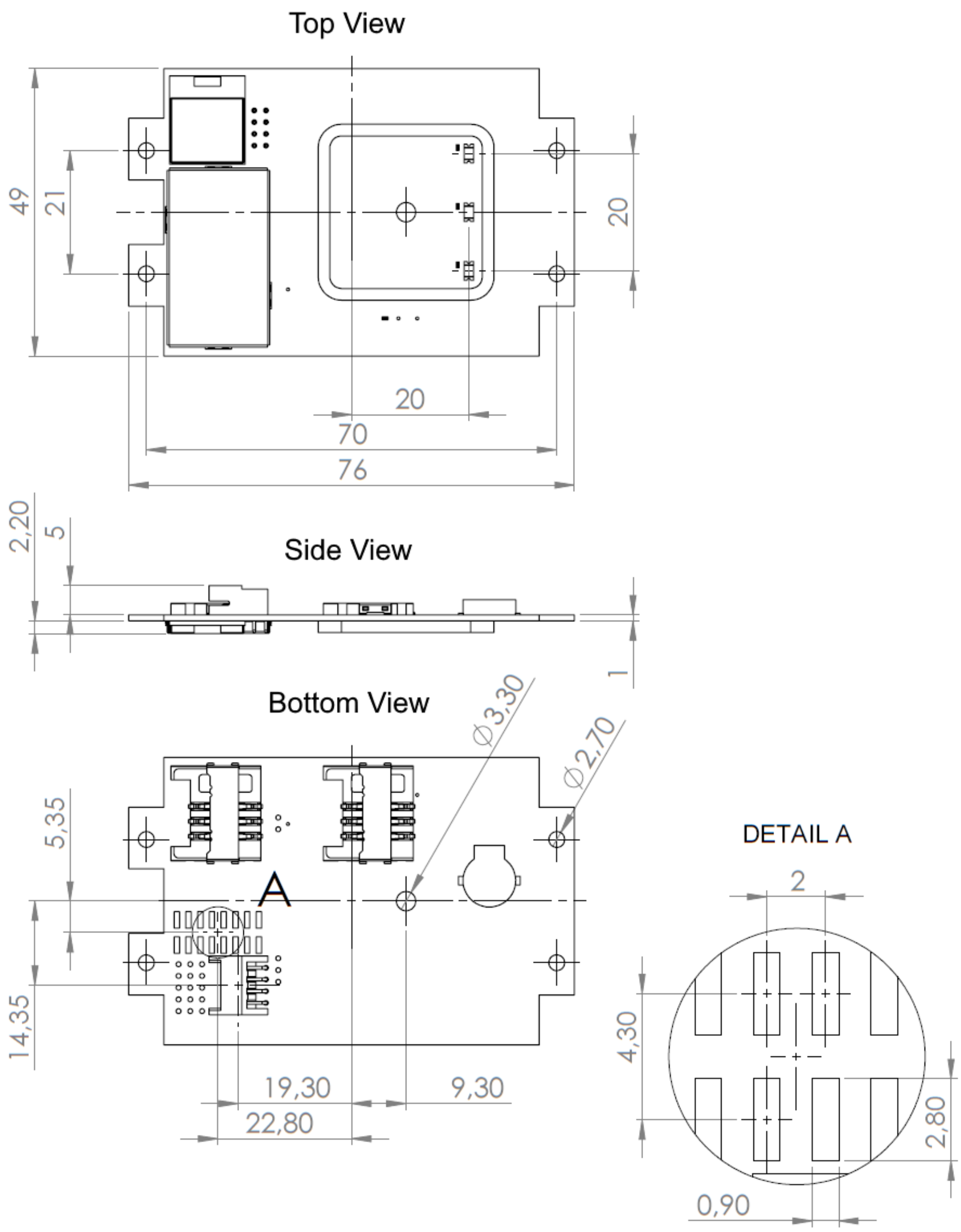

Figure 2.2: PCB Dimensions

2.3 Pinout

2.3.1 Generic Interface (X1)

The module provides a generic access port that allows the User to bypass the main DF11 connector and interact with the TWN4 MultiTech 2 BLE microcontroller directly. The port name is DRP2 and the polarity of its pins is shown on Figure 2.3. The pinout is provided in Table 2.1.

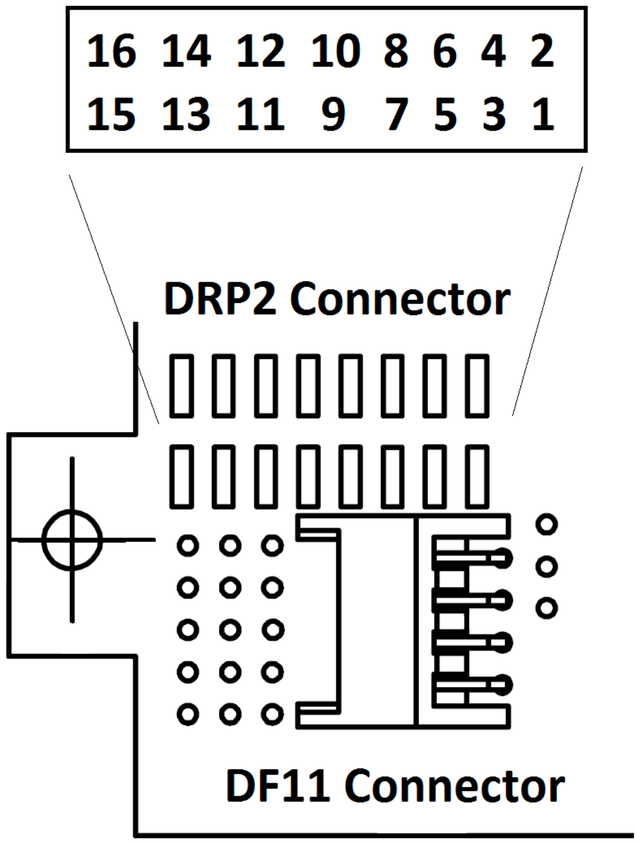

Figure 2.3: Generic Port Polarity

Pin	Pin Name	Function
1	GND	Ground
2	USB_D+	USB Data +
3	Supply 5V	Powers the 5V circuitry on board. Input to 3.3V Regulator.
4	USB_D-	USB Data -
5	VCC 3.3V	Direct access to 3.3V supply net after Regulator. Microcontroller and majority of circuitry is powered by this.
6	COM1_RX	COM1 RX Single-ended port
7	I2C_SCL	I2C Clock
8	COM1_TX	COM1 TX Single-ended port
9	I2C_SDA	I2C Data
10	GPIO3	direct access to microcontroller
11	RESET-	Active-low reset to the microcontroller
12	GPIO4	direct access to microcontroller
13	PWRDWN-	Active-low powerdown to 3.3V Converter/Regulator
14	GPIO5	direct access to microcontroller
15	GPIO6	direct access to microcontroller
16	GPIO7	Active-low reset to BLE module

Table 2.1: Generic Interface DRP2 Port (X1) Pin Configuration

2.3.2 Main Interface (X2)

Pin	Pin Name	Function
1	UGND	USB Ground. Fed to main Ground through noise-reduction circuit.
2	USB_D+	USB Data +
3	UVCC	USB VCC (5V). When using RS232, connect this to external 5V supply.
4	USB_D-	USB Data -
5	V24_RXD	RS232 RXD (Input)
6	GND	Ground
7	V24_TXD	RS232 TXD (Output)
8	Hostsense	Active-low, enables RS232 transceiver. Short to Pin 6 (GND) when using RS232.

Table 2.2: Main Interface DF11 Port (X2) Pin Configuration

2.4 Versions

Various versions of TWN4 MultiTech 2 are available: One full-featured version and three cost-optimized versions which support LF (125kHz, 134.2kHz) and/or HF (13.56MHz) transponders. Table 2.3 lists the different features of the corresponding model:

Feature	**TWN4 MultiTech 2 BLE**	**TWN4 MultiTech 2**	**TWN4 MultiTech 2 LF**	**TWN4 MultiTech 2 HF**
LF	√	√	√	-
HF	√	√	-	√
BLE	√	-	-	-
Nr of SAM-Slots	2	2	-	1

Table 2.3: Different features of TWN4 MultiTech 2 Versions

3 Bluetooth Low Energy (BLE) Feature

The traditional Bluetooth standard is convenient for constant-flow media transfer applications such as video streaming. The Bluetooth Low Energy standard was introduced for applications requiring a lower power consumption profile. Data is sent in bursts, followed by periods of electrical idle.

The TWN4 MultiTech 2 BLE uses the BGM111 module from Silicon Labs. The chip implements the Physical, Link and L2CAP Layers of the BLE Protocol. The API is implemented within the firmware of the main TWN4 microcontroller. The 2 chips interact via the COM2 port of the microcontroller, thereby rendering this port unavailable for custom user functions.

Devices supporting the BLE standard communicate using a protocol named *Generic Attribute Profile (GATT)*. GATT defines two roles: Server and Client. A GATT Server stores attributes of the device and sends them to a Client upon request. The TWN4 MultiTech 2 BLE acts as a GATT server, receiving requests for information from the link partner (ex. cellphone) and transmitting relevant attributes back.

For more information regarding the Bluetooth Low Energy Standard please see document *"Designing for Bluetooth Low Energy"*[1] from Silicon Labs.

For the description of all the BLE-related commands available, please see the TWN4 API document.

4 Power states and current consumption breakdown

The TWN4 MultiTech 2 BLE supports 3 power states that can be used to reduce the current consumption of the reader when the application calls for it.

In Normal state the reader can accommodate a request to search for a high-/low-frequency tag, perform a BLE action or interact with peripherals on short notice; the current consumption in this state is the highest.

In Sleep state the reader is not capable of any of the above, but consumes considerably less current. The reader can be woken by communication on USB/COM ports, predefined timeout, or a Low-Power-Card-Detection (LPCD) event and taken to Normal state.

In Stop state the reader consumes the least current and can be woken up via external/internal interrupt, or a Low-Power-Card-Detection (LPCD) event and taken to Normal state.

Changing the LPCD poll time will change the current consumption, which can be estimated with the following formula:

$$I_{LPCD} = 0.5mA + \frac{0.1mAs}{t_{Poll}[s]}$$

The first section of Table 4.1 shows the expected *typical* current draw in the 3 states described above, depending on the reader interface used. The second section of the table lists the *maximum* additional current drawn by the device's peripherals; these values are to be added to those in the "Normal Idle" base state. It is assumed that a +5V DC Power Source is used.

Host Connection	USB	UART-TTL
Typical Consumption in Base System States		
Normal Idle	65	59
Sleep	15	6,8
Sleep LPCD Option	15,3	7,0
Stop	N/A	0,45
Stop LPCD Option	N/A	0,8
Maximum Consumption by Function wrt. Normal Idle System State		
SearchTag-HF	+140	
SearchTag-LF	+25	
RS232	+4	
BLE Active Packet Reception	+9	
BLE Active Transmission (0 dBm output power)	+9	
BLE Active Transmission (8 dBm output power)	+24	
Speaker Constant Tone	+80	
LED (Red)	+2	
LED (Green)	+6	
LED (Yellow)	+8	

Table 4.1: Current Consumption Breakdown given +5V DC Supply (mA)

5 Disclaimer

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6 Bibliography

1. Silicon Labs Website. Application Note *"Designing for Bluetooth Low Energy Applications"*, taken from http://www.silabs.com on 24. January, 2017