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iMCP HTSXM032L-22 Evaluation Board V2.0

Sigfox® Monarch RF System-in-Package Evaluation Board

Classification: PUBLIC

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SUMMARY

DOCUMENT INFO

This document provides the technical information about the iMCP HTSXMO32L-22 Evaluation Board.

1. GENERAL DESCRIPTION

The iMCP HTSXMO32L-22 Evaluation Board was designed to be a development platform and facilitate new users first contact with iMCP HT32SX as well as provide advanced user to start programming and developing products right away with minimal structure. All the HT32SX features are available on the evaluation board. Two supply options can be used: USB connection or an external battery. The evaluation board will automatically switch to USB power when it is available. The external battery makes the evaluation board portable, so it becomes easy to test the Sigfox connectivity anywhere you go.

2. FEATURES AND BENEFITS

2.1. KEY FEATURES

- iMCP HTSXMO32L-22
- 64kB of flash memory
- 8kB of RAM
- 32.768kHz external crystal for RTC applications
- Voltage regulator ranging from 2.7 to 6V
- USB to Serial converter
- External LiPoly Battery connector
- Compatibility with Adafruit Feather Wings
- SWD interface
- MCU bootloader
- 20 GPIOs
- 12-bit ADC
- 12-bit 1 channel DAC
- 2 USART, LPUART, USB 2.0, I^2C
- UF.I Antenna connector
- User LED for general purpose
- User Button for general purpose

2.2. POWER CONSUMPTION

- 1.4 mA (without HT32SX consumption)

2.3. RF - FREQUENCY BANDS

- RC1: Europe, Middle East and Africa 868.034 ~ 868.226 MHz
- RC2: North America and Brazil 902.104 ~ 902.296 MHz
- RC3: Japan 923.104 ~ 923.296 MHz
- RC4: Latin America and Asia Pacific 920.704 ~ 920.896 MHz
- RC5: South Korea 923.204 ~ 923.396 MHz
- RC6: India 865.104 ~ 865.296 MHz
- RC7: Russia 868.704 ~ 868.896 MHz

3. PINOUT INFORMATION

3.1. PIN DIAGRAM

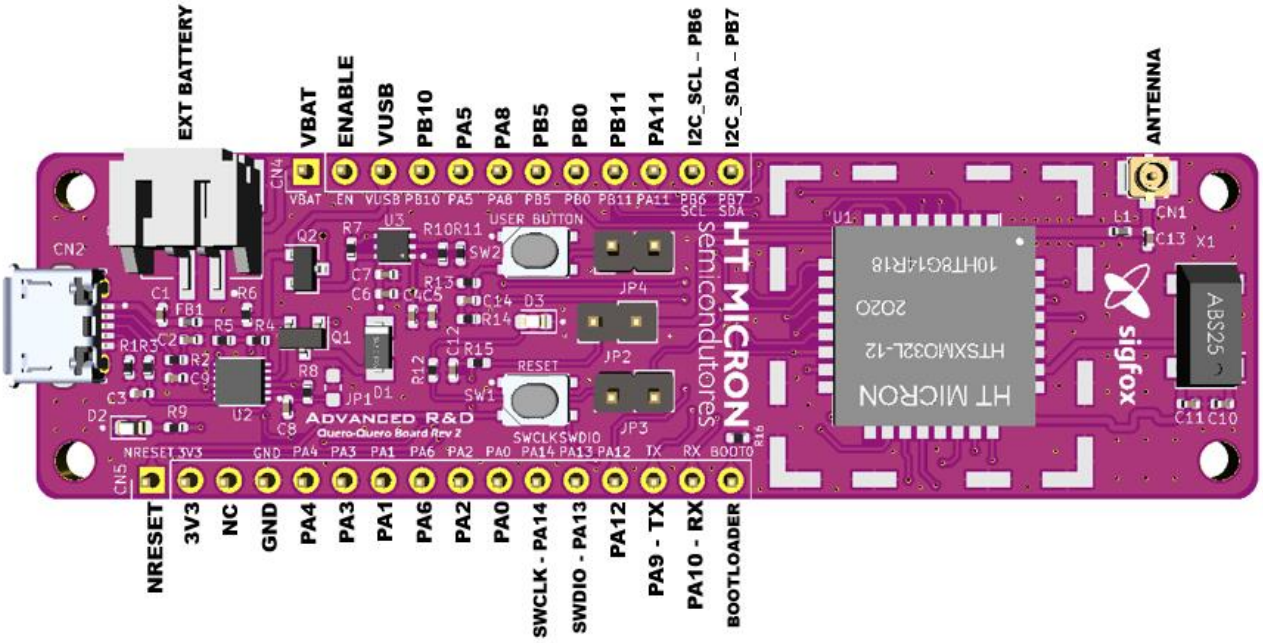

Figure 1: Pin Diagram

3.2. CONNECTIONS DESCRIPTION

Table 1: Detailed pin functions.

Connector	Number	Name	Alt. Functions	Type	Description
CN1	-	Antenna	-	RF I/O	RF input and output signal
CN2	-	Micro USB	-	-	USB connection for power and communication
CN3	-	Battery	-	Power	Input power from external battery
CN4	1	VBAT	-	Power	Battery output power
	2	ENABLE	-	Input	Voltage regulator Enable
	3	VUSB	-	Power	Output power from USB Bus
	4	PB10	LPUART1_TX	Digital I/O	USART interface
			TIM2_CH3	Digital I/O	General-purpose timer
	5	PA5	ADC_IN5	Analog I	ADC external input 5
			TIM2_CH1	Digital I/O	General-purpose timer
			TIM2_ETR	Digital I/O	General-purpose timer
			COMP1_INM5	Analog I	Comparator input
	6	PA8	USART1_CK	Digital I/O	USART interface
			USB_CSR_SYNC	Digital I/O	USB

			EVENT_OUT	Digital I/O	
	7	PB5	I2C1_SMBA	Digital I/O	I2C interface
			LPTIM1_IN1	Digital I/O	Low-power timer
			TIM22_CH2	Digital I/O	General-purpose timer
	8	PB0	ADC_IN0	Analog I	ADC external input 0
			VREF_OUT	Analog I/O	Output reference voltage
	9	PB11	LPUART1_RX	Digital I/O	Low-power USART interface
			TIM2_CH4	Digital I/O	General-purpose timer
			EVENTOUT	Digital I/O	
	10	PA11	USART1_CTS	Digital I/O	USART interface
			USB_DM	Digital I/O	USB
			COMP1_OUT	Analog O	Comparator output
			EVENT_OUT	Digital I/O	
	11	PB6	I2C1_SCL	Digital I/O	I2C interface
			USART1_TX	Digital I/O	USART interface
			LPTIM1_ETR	Digital I/O	Low-power timer
	12	PB7	I2C1_SDA	Digital I/O	I2C interface
			USART1_RX	Digital I/O	USART interface
			LPTIM1_IN2	Digital I/O	Low-power timer
CN5	1	NRESET	-	I/O	Bidirectional reset pin with embedded weak pull-up resistor
	2	3V3	-	Power	-
	3	NC	-	-	-
	4	GND	-	Ground	-
	5	PA4	DAC_OUT	Analog O	DAC analog output
			ADC_IN4	Analog I	ADC external input 4
			USART2_CK	Digital I/O	USART interface

			TIM22_ETR	Digital I/O	General-purpose timer
			COMP1_INM4	Analog I	Comparator input
	6	PA3	ADC_IN3	Analog I	ADC external input 3
			USART2_RX	Digital I/O	USART interface
			TIM2_CH4	Digital I/O	General-purpose timer
			TIM21_CH2	Digital I/O	General-purpose timer
	7	PA1	ADC_IN1	Analog I	ADC external input 1
			USART2_RTS_DE	Digital I/O	USART interface
			COMP1_INP	Analog I	Comparator input
			TIM21_ETR	Digital I/O	General-purpose timer
			EVENT_OUT	Digital I/O	
	8	PA6	ADC_IN6	Analog I	ADC external input 6
			LPUART1_CTS	Digital I/O	USART interface
			TIM22_CH1	Digital I/O	General-purpose timer
			COMP1_OUT	Analog O	Comparator output
			EVENT_OUT	Digital I/O	
	9	PA2	ADC_IN2	Analog I	ADC external input 2
			USART2_TX	Digital I/O	USART interface
			TIM21_CH1	Digital I/O	General-purpose timer
			TIM2_CH3	Digital I/O	General-purpose timer
	10	PA0	ADC_IN0	Analog I	ADC external input 0
			WKUP1	Digital I	MCU external wakeup input
			USART2_CTS	Digital I/O	USART interface
			TIM2_CH1	Digital I/O	General-purpose timer
	11	PA14	SWCLK	Digital O	Serial wire clock output
			USART2_TX	Digital I/O	USART interface
	12	PA13	SWDIO	Digital I/O	Serial wire
			USB_NOE	Digital I/O	USB

	13	PA12	USART1_RTS_DE	Digital I/O	USART interface
			USB_DP	Digital I/O	USB
			EVENT_OUT	Digital I/O	
	14	PA9	USART1_TX	Digital I/O	Serial wire
	15	PA10	USART1_RX	Digital I/O	Serial wire
	16	BOOT0	-	Digital I	Boot selection

3.3. Power Pins

Table 2: Power pins description.

Pins	Description
VBAT	Positive voltage is available from external battery or an external power supply can be used
VUSB	Positive 5V from USB is available when the USB cable is connected
EN	Phis pin is pulled up to enable voltage regulator. If connected to the ground the voltage regulator is turned off
CN3	JST-PH connector for external Lipoly battery
3V3	Output voltage from voltage regulator. A peak of 500mA can be supplied
GND	Common ground for the board and components.

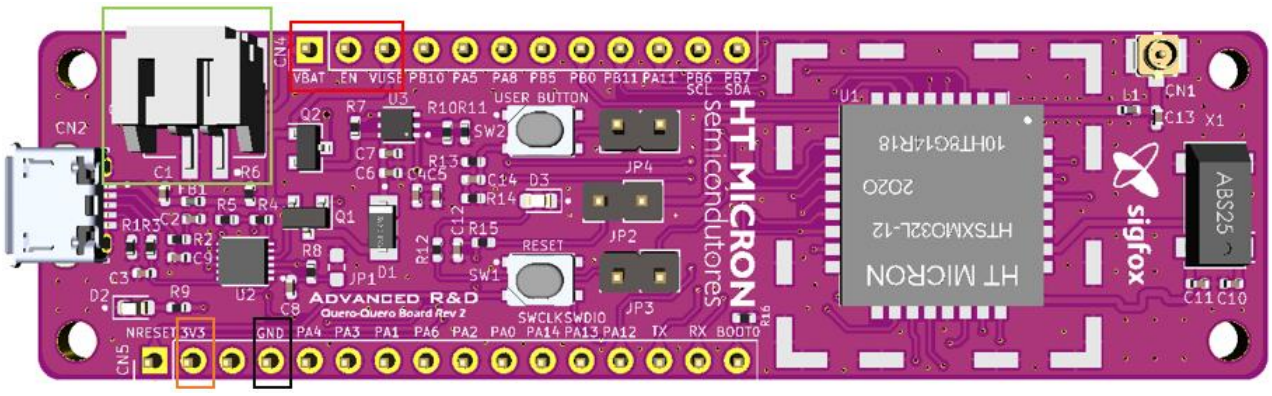

Figure 2: Power pins

3.4. Other Pins

Table 3: Other pins description.

Pins	Description
I²C	Serial interface. Alternative functions are also available on these pins. These pins can also be used as GPIO
SWD	Serial Wire Debug interface to programming and debug the HT32SX. These pins can also be used as GPIO
TX/RX	These pins can be used to communicate with HT32SX through Serial 1. Alternative functions are also available on these pins. These pins can also be used as GPIO

Boot0	This pin is pulled down. When connected to VDD during HT32SX powering up allow access to programming HT32SX flash memory through the serial interface.

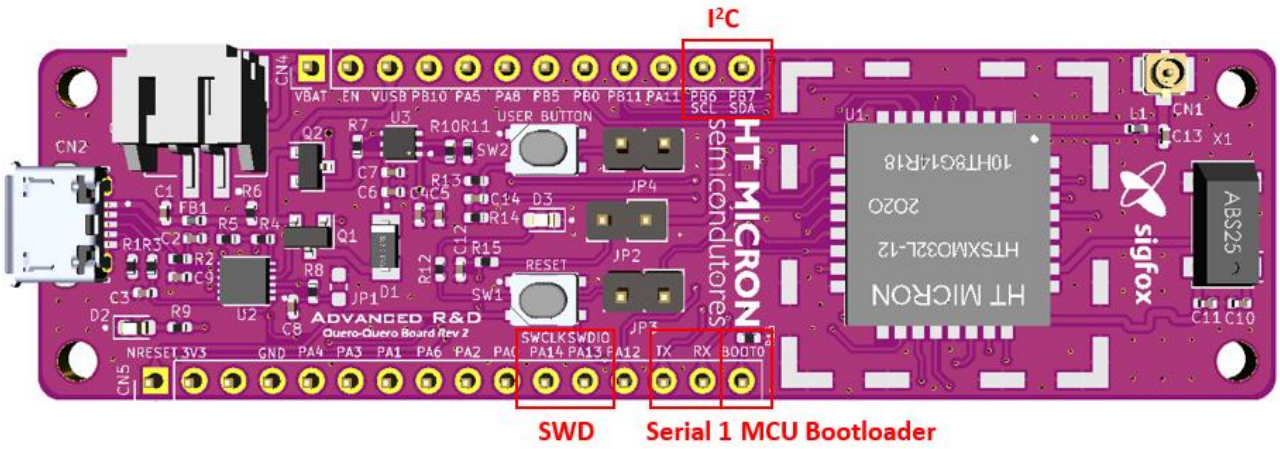

Figure 3: Other pins.

4. STATIC CHARACTERISTICS

4.1. GENERAL OPERATING RANGE

Table 4: General operating conditions.

Parameter	Conditions	Min	Typ.	Max	Unit
Supply Voltage	-	2.7	3.3	6.0	V
Supply Current	-	-	-	500	mA
Operating Temperature	-	-20	-	70	°C
External XTAL Frequency	-	-	-	32.768	kHz

Remark: the voltage regulator can handle an input ranging from 1.5 to 6.0V. However, the iMCP operation voltages range is from 2.7 to 3.6V. The evaluation board is provided with a resistor pair that sets the voltage regulator output to 3.3V, therefore, consider the supply voltage informed above to get a proper operation from the iMCP HT32SX.

4.2. POWER CONSUMPTION

Characteristics measured over recommended operating conditions unless otherwise specified. Typical values are referred to 25 °C temperature, output regulator voltage 3.3 V.

Table 5: Power Consumption.

Parameter	Conditions	Min	Typ.	Max	Unit
Supply current	JP4 Open (iMCP turned off)	-	1.4	-	mA

iMCP HT32SX V2.2 current consumption depends on the operation mode. To get complete HT32SX V2.2 information, please refer to HT32SX datasheet.

4.3. EXTERNAL CLOCK RESONATOR

The external clock resonator can be of high speed (1-25MHz) or low speed (32.768kHz), which can be connected to pins 25 and 26 of the iMCP HT32SX V2.2. On the Evaluation Board, it is provided a 32.768kHz clock resonator, which can be changed by a high speed one, according to the application necessity. The connection diagram is shown below. For CL10 and CL11, it is recommended to use high-quality ceramic capacitors in the 5pF to 25 pF range (typ.), designed for high-frequency applications, and selected to match the requirements of the crystal or resonator. CL1 and CL2 include PCB and the MCU pin capacitances.

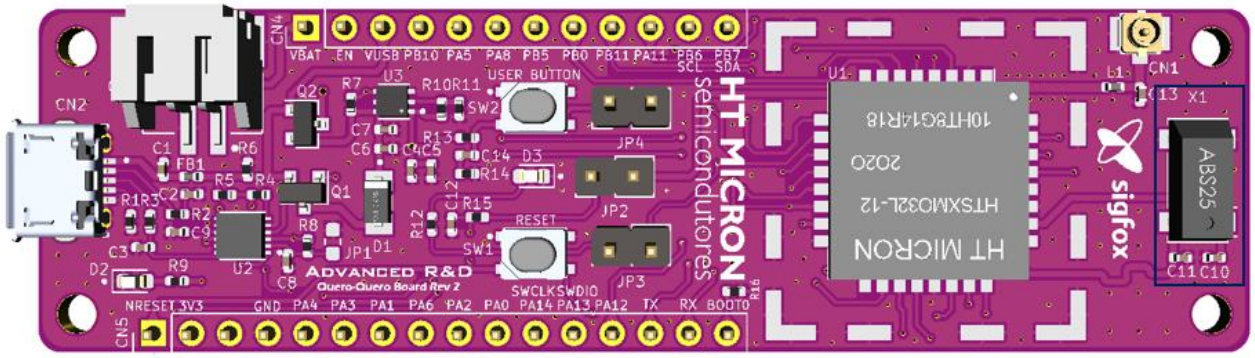

Figure 4: Oscillator position.

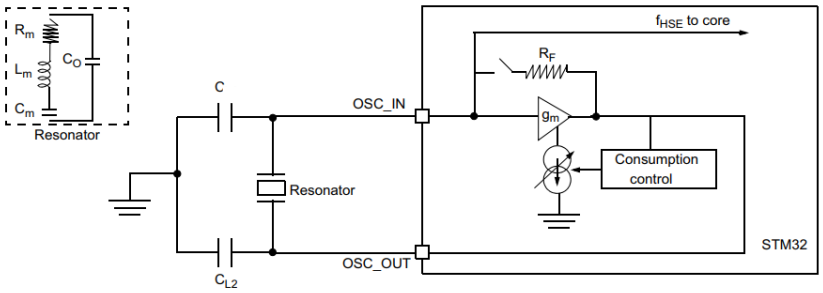

Figure 5: Oscillator circuit diagram.

5. RF CHARACTERISTICS

An external LC matching network is added to the board to improve the output power level of the antenna pin in the HT32SX version 2.2 (series inductor and shunt capacitor). The recommended values and specifications are shown below.

- SMD ceramic inductor 5.6nH +-0.3nH 0402 size
- SMD ceramic capacitor 4.7pF +-0.1pF 0402 size

The reference PCB material specification is a two-layer FR4 1.6mm 1 Oz copper.

Table 6: Expected TX max. output power. TA = 25°C based on characterization; not tested in production. Output voltage regulator set to 3.3V;

Parameter	Min	Typ.	Max	Unit
RF Characteristics				
RF Frequency	865.2	902.2	923.3	MHz
Tx max. output power	13.2	25.1	12.2	dBm

For detailed information about HT32SX V2.2 RF characteristics, please refer to HT32SX V2.2 datasheet.

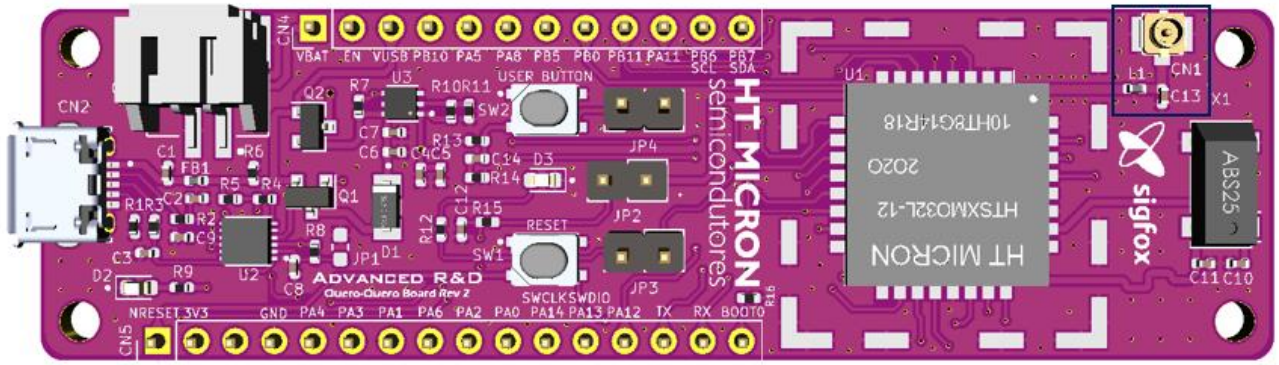

Figure 6: uFL connector positioning.

6. JUMPERS

Table 7: Jumpers identification.

Jumper	Identification	Description
JP1	USB/Serial Converter Reset	This jumper provides the reset function for the USB to Serial converter when short-circuited.
JP2	iMCP Current Measurement	This jumper can be used to measure the current consumption drained only by the iMCP HT32SX on different operation conditions.
JP3	User LED	This jumper allows the disconnection of User LED from PA5 to avoid disturbances when using this Pin as GPIO for other purposes.
JP4	User Button	This jumper allows the disconnection of User Button from PA6 to avoid disturbances when using this Pin as GPIO for other purposes.

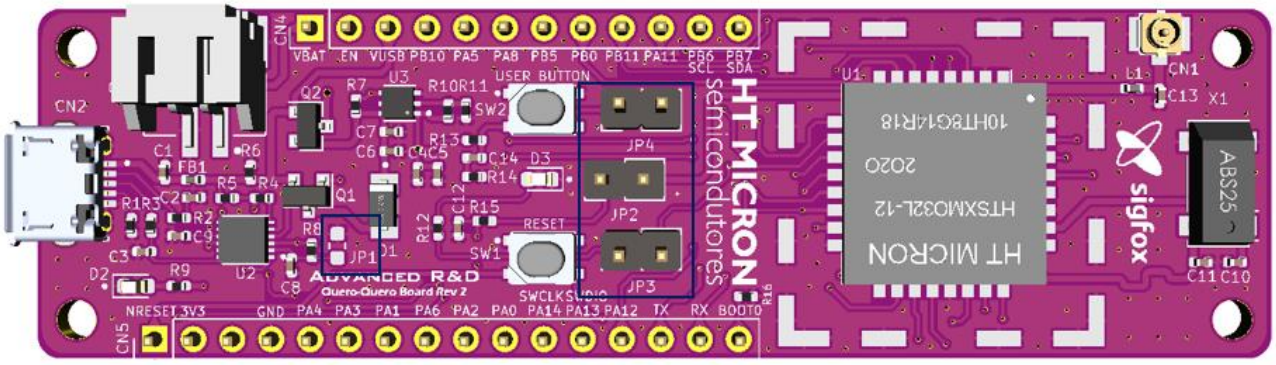

Figure 7: Jumpers positioning.

7. BOARD DIMMENSIONS

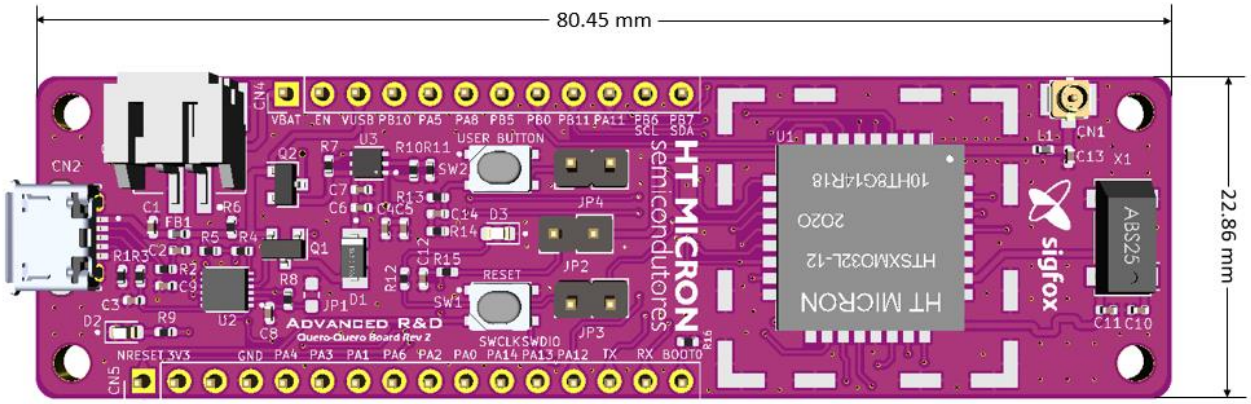

Figure 8: Board dimensions.

8. ORDERING INFORMATION

Table 8: Detailed pin functions.

Type number	Package		
	Name	Description	Version
EVB-SXF-02	Sigfox HT32SX-22 EVB	iMCP HTSXMO32L-22 Evaluation Board	2.0

ABBREVIATIONS

Table 9: Abbreviations

Acronym	Description
ADC	Analog to Digital Converter
AES	Advanced Encryption Standard
API	Application Program Interface
CLK	Clock
EEPROM	Electrically-Erasable Programmable Read Only Memory
FIFO	First in First Out
GPIO	General Purpose Input Output
ID	Identification
IF	Intermediate frequency
IO	Input Output
MSL	Moisture sensitivity level
PCB	Printed-Circuit Board
PHY	Physical
SPI-bus	Serial Peripheral Interface -bus
PWM	Pulse Width Modulation
RAM	Random Access Memory
RC	Remote Control
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Receive Signal Strength Indication
RX	Receiver
SCL	Serial Clock
SDA	Serial Data
TX	Transmitter

LIST OF FIGURES

LIST OF TABLES

REVISION HISTORY

Version	Date	Changes	Authors
00	03/12/2020	- Initial draft	MC
01	18/12/2020	- Review and updates	WH
02	12/01/2020	- Corrections and template update.	MC
03	26/01/2020	- Classification changed to Public	MC

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