TRIDENT IoT

TZM8202-02

Sub-GHz Z-Wave RF PCB Module

Overview

The TZM8202-02 is a low-cost fully integrated Z-Wave PCB module in a small 13.6 x 12.5 x 2.0mm form factor. It combines the CZ20 SoC from Trident IoT with a crystal and RF passive components to make this the ideal choice for single microcontroller Z-Wave and Z-Wave Long Range solutions.

To cater to the needs of Home Security and Industrial control applications, the TZM8202-02 offers 288 KB of SRAM and 1 MB of Flash and with its low sleep current in both active RF modes and power-down states, battery-operated devices enjoy extended lifespans.

Create new devices or simply upgrade your legacy ZM5202 designs with the pin-for-pin compatible TZM8202-02 and get all the features and benefits of the latest Z-Wave and Z-Wave Long range protocols.

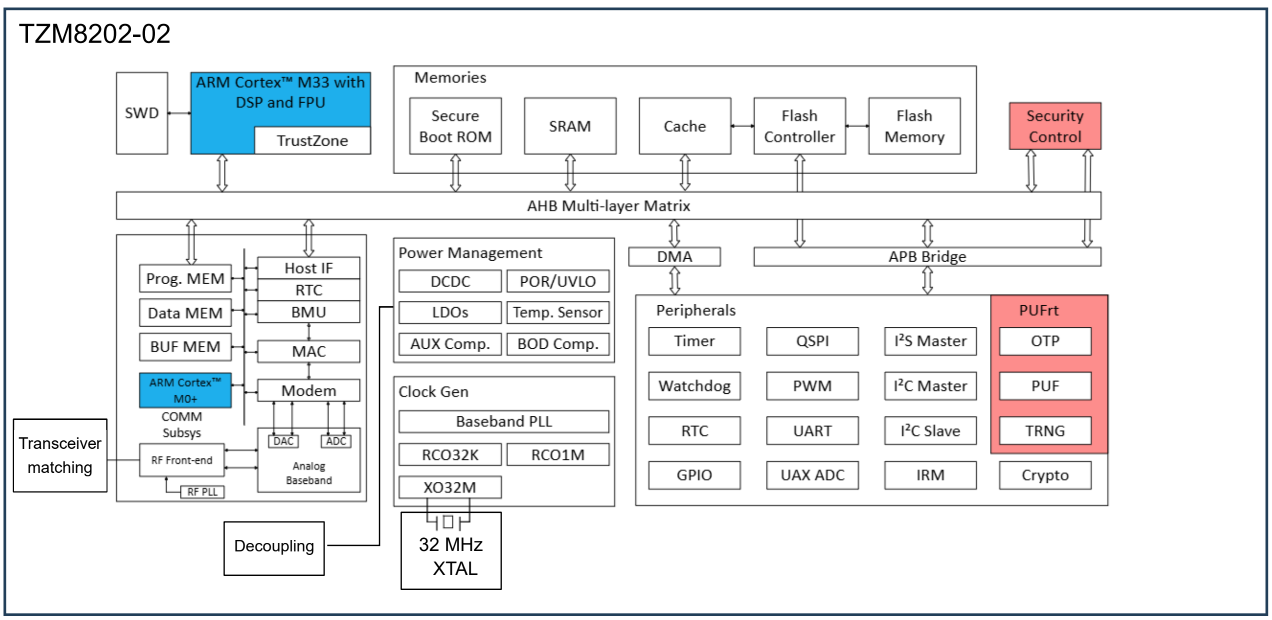


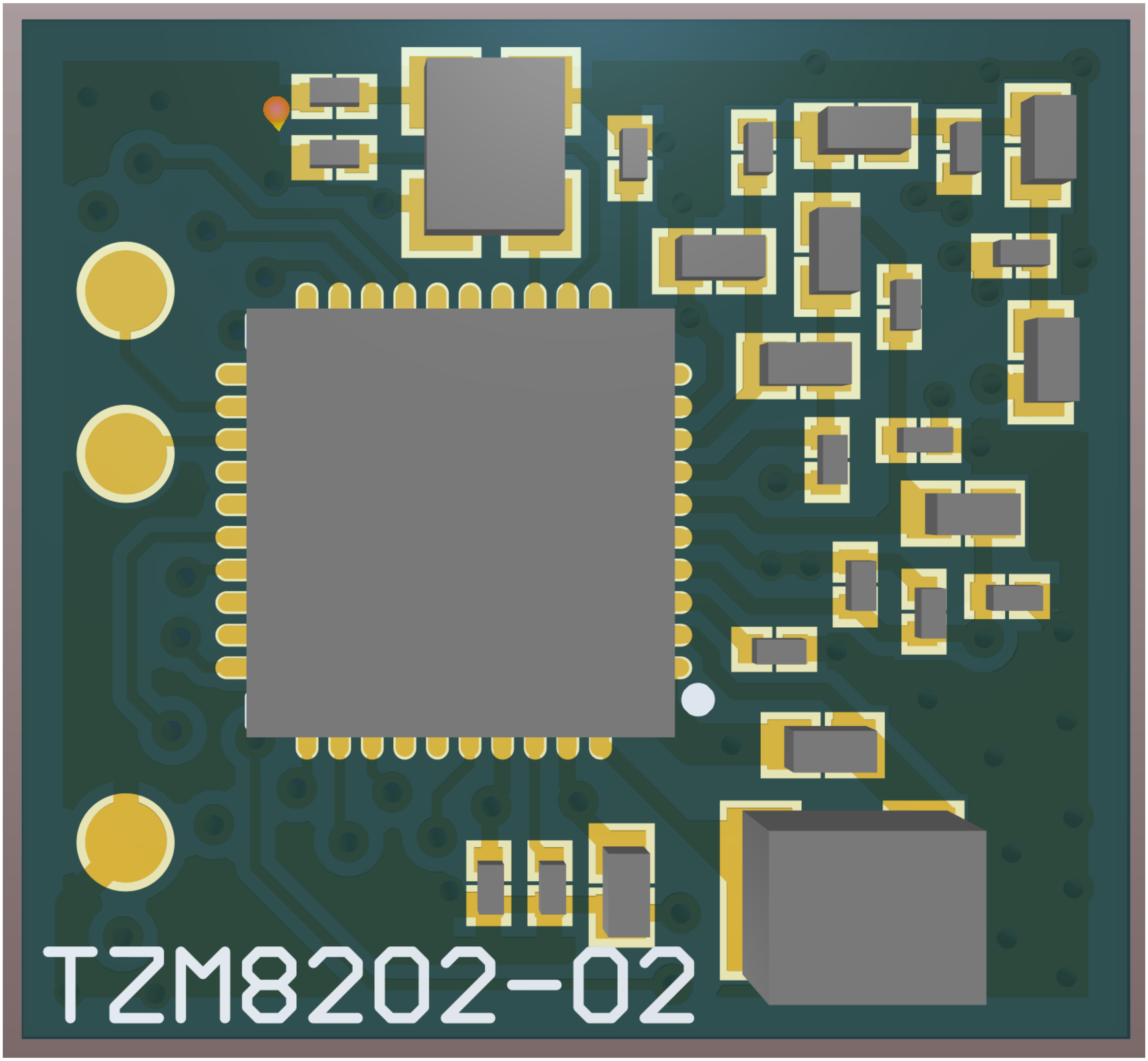
Figure 1 TZM8202-02 Block Diagram

Feature List

- Transmit Power
  - 20 dBm @ 3.3 V VDD_PA
- Receive Sensitivity
  - -112 dBm @ 9.6 kbps FSK
  - -110 dBm @ 40 kbps FSK
  - -107 dBm @ 100 kbps GFSK
  - -108 dBm @ 100 kbps DSSS O-QPSK
- Fractional-N PLL for precise RF channel tuning
- Supported Modulations
  - (G)FSK with configurable shaping
  - DSSS O-QPSK
- Supported Data Rates
  - 9.6 kbps FSK
  - 40 kbps FSK
  - 100 kbps GFSK
  - 100 kbps DSSS O-QPSK
- Low Power Consumption
  - 5.8 mA RX current
  - 83 mA TX current @ 20 dBm
  - 25 mA TX current @ 14 dBm
  - 4.0 uA in Sleep 1
  - 1.9 uA in Sleep 2
  - 1.2 uA in Deep Sleep
- Operating Range
  - 1.8 V to 3.6 V single supply voltage
  - -40 to +85 °C
- Power Managements
  - Buck DC/DC converter
  - LDO regulators
  - BOD comparator
- SoC System
  - ARM Cortex®-M33 up to 64 MHz with DSP extensions and FPU
  - 288 kB SRAM (192 kB available)
  - 1 MB Flash
- SoC Peripherals
  - DMA
  - Watchdog Timer
  - RTC Timer
  - 5x 32-bit Timer
  - 5x PWM
  - 2x UART
  - 2x SPI
  - I^2C Master/Slave
  - I^2S Master
  - 8x GPIO
  - 4 channel 12-bit, 350 kbps AUX ADC
  - External 32 MHz high frequency crystal
  - Internal low frequency RC oscillator
  - Temperature Sensor
- Security Function
  - Security Control
  - Secure PUF/OTP
  - TRNG
  - Hardware Crypto Engine supporting AES128/192/256, SHA224/SHA256, ECDH/ECDSA, ECJ-PAKE, and Curve25519
- Package
  - 12.6 x 13.5 x 2.0 mm PCB module
  - Halogen-free
  - Lead-free
  - RoHS 2.0
  - Reach Annex 14 and 17

Ordering Information

Part Number	Package	Shipping	Minimum Order Quantity	Full Carton Quantity
TZM8202-02	PCB Module	Tray (T)	1,124 pcs	7,344 pcs



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1. System Overview

1.1 Introduction

The TZM8202-02 module is a fully integrated module to add Z-Wave Long range functionality to legacy designs ZM5202 designs with pin-for-pin compatibility. The TZM8202 contains the T32CZ20 chip with built-in passives for decoupling, RF matching, and a reference crystal. The module requires a stable DC supply and an antenna matched to 50 ohms.

Please refer to the T32CZ20 SoC Datasheet for system overview and electrical characteristics.

https://tridentiot.com/technology/zwave/

1.2 Radio

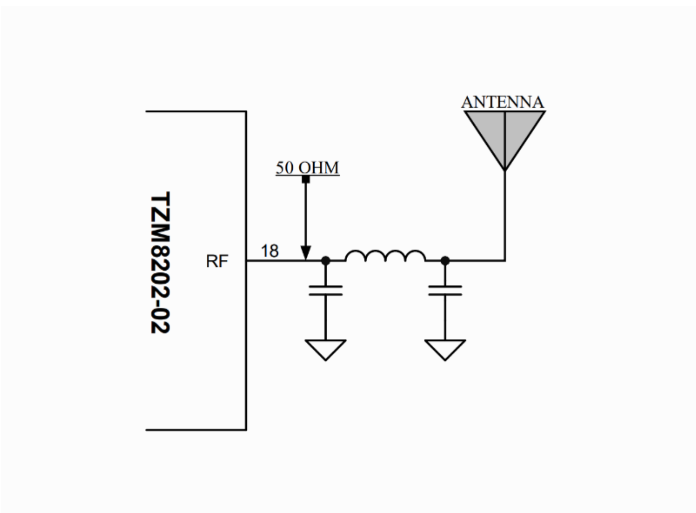
1.2.1 Antenna Interface

The TZM8202-02 antenna interface is a single RF I/O pad (pin 18 on the TZM8202-02 module) which is matched for a nominal impedance of 50 ohms for both transmit and receive. Since the antenna impedance in a completed product is not always 50 ohms, it is recommended that a “Pi” or a “T” matching network as shown in section 1.2.2 be included between the RF I/O pad of the TZM8202-02 module and the antenna. In most cases, a two element matching network will be sufficient, but since the antenna impedance may not be known at the time the PCB layout is designed, it is usually best to design in a “Pi” or “T” matching network to allow more flexibility in matching the antenna to 50 ohms later on.

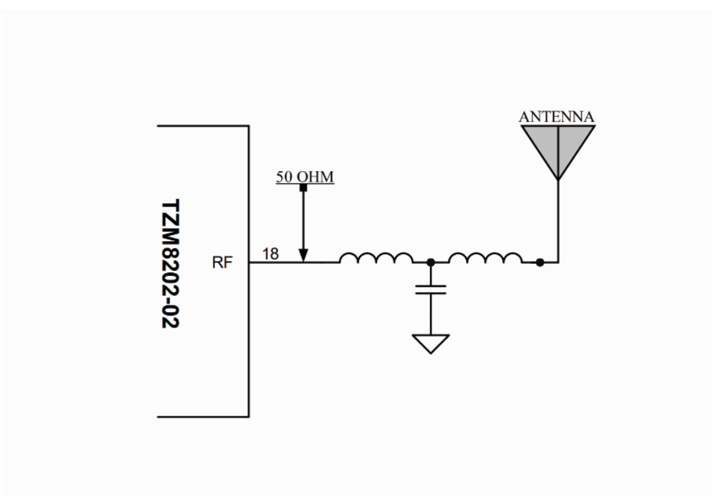
1.2.2 RF Matching

Since the TZM8202-02 module already contains the balun and low pass filtering required to implement the T32CZ20 IC, only a small network (usually two or three components) should be required to match the antenna to the TZM8202-02 module.

A Pi or T matching network as shown below is typically used. Although a high pass or low pass topology will work, the low pass topology (series inductance, shunt capacitance) is typically chosen since that will give additional harmonic rejection in transmit, potentially offering additional margin below FCC spurious emissions limits.



RF matching Pi network



RF matching T network

The process for designing the network usually involves the following steps:

1. Calibrating a Vector Network Analyzer (VNA) and using it to measure the impedance of the antenna in the complete product including case, batteries etc.

2. Using a Smith chart or other RF design software to determine component values needed in the matching network.

3. Adding in the matching network, measuring the antenna impedance through the matching network to verify that the impedance has been transformed to 50 ohms at the TZM8202-02 module.
4. Fine tuning the component values as needed until a good 50 ohm match is achieved.

It should also be noted that the PCB layout can also impact how the matching network works. Long traces can act as transmission lines with characteristic impedances which depend on trace width and PCB thickness. It is generally simplest to keep the layout as tight as possible without any long traces that need to be accounted for in the matching network design. Good grounding is also required to assure that the matching network will work as expected. All ground connections in the matching network should go directly to the ground plane whenever possible and should have a short low inductance path back to the ground connections on the TZM8202-02 module and to any ground plane that serves as counterpoise to the antenna.

1.2.3 General Radio Considerations

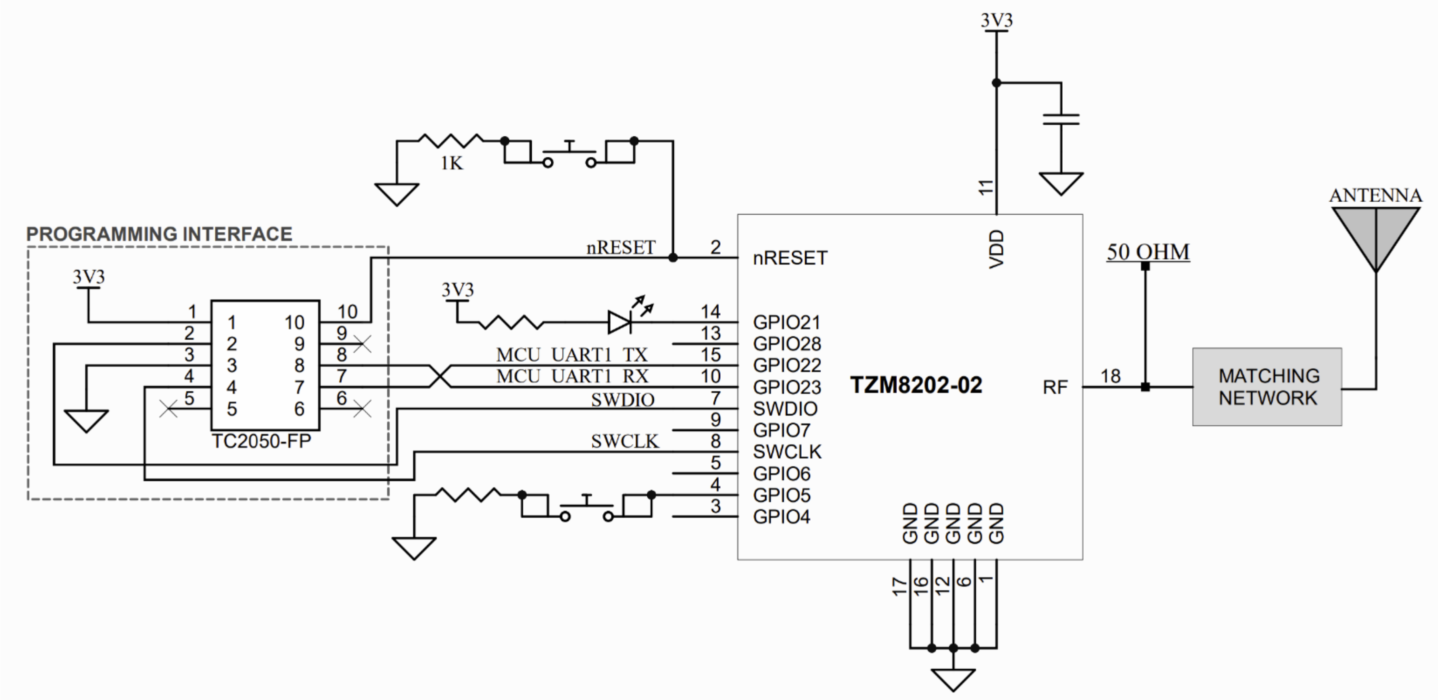
There are numerous factors that can affect the performance and reliability of a Z-Wave communication system. One of these factors is the type of antenna used and the implementation of the antenna within or on the product. Antennas that function as monopoles are very dependent on the counterpoise provided by the design (usually the ground plane of the PCB) in order to operate efficiently. These antennas include meandering antennas, ¼ wave antennas, printed “F” antennas, helical antennas, some chip antennas and SMA monopole antennas. If the ground plane that the antennas has available to work against is much smaller than ¼ wavelength (about 3.2 inches) in at least one direction, the performance of the antenna can be affected. Some antennas such as loop type chip antennas and sleeve dipole SMA antennas can generally be less dependent on the ground plane for predictable operation. When using chip antennas, always follow the application information closely and note the size of the ground plane in the reference designs provided by the chip antenna vendor. The antenna will usually perform best when placed near the outside edges of the product with as much open space (space free of conductive materials etc) as possible surrounding it.

Another consideration is noise and interference. Whenever possible, the TZM8202-02 module and the antenna should be placed as far away as possible from internal noise sources such as switching regulators, high speed microprocessors and high speed data buses. Good design practices such as continuous ground planes (this can require additional PCB layers) and good filtering and decoupling can help to reduce the overall noise floor in the product and optimize radio performance.

In some cases, external sources of interference can also be a consideration. In cases where the TZM8202-02 module may be connected to an efficient outside antenna which is exposed to very strong signals close to the 900 MHz band, adding a 900 MHz band pass filter (SAW filter etc) between the TZM8202-02 module and the antenna may be advisable.

2 Application Circuits

2.1 Typical Application



3 Pin Functionality

3.1 Pin Functionality

Table 4.1 Pin Functionality of TZM8202-02

No.	Pin Name	Type	Description
1, 6, 12, 16, 17	GND	Ground	Ground. Must be connected to the ground plane
2	RESET_N	DI	External Reset Input
3	GPIO4	DIO	multi-function digital I/O
4	GPIO5	DIO	multi-function digital I/O
5	GPIO6	DIO	multi-function digital I/O
7	GPIO11	DIO	SWDIO
8	GPIO10	DIO	SWCLK
9	GPIO7	DIO	multi-function digital I/O
10	GPIO23	DIO	multi-function digital I/O
11	VDD	Power	Module Power Supply
13	GPIO28	DIO	multi-function digital I/O
14	GPIO21	DIO	multi-function digital I/O
15	GPIO22	DIO	multi-function digital I/O
18	RF	DIO	RF input and output

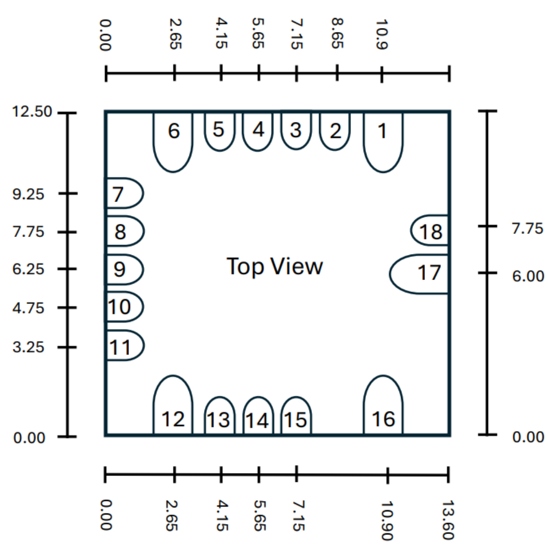
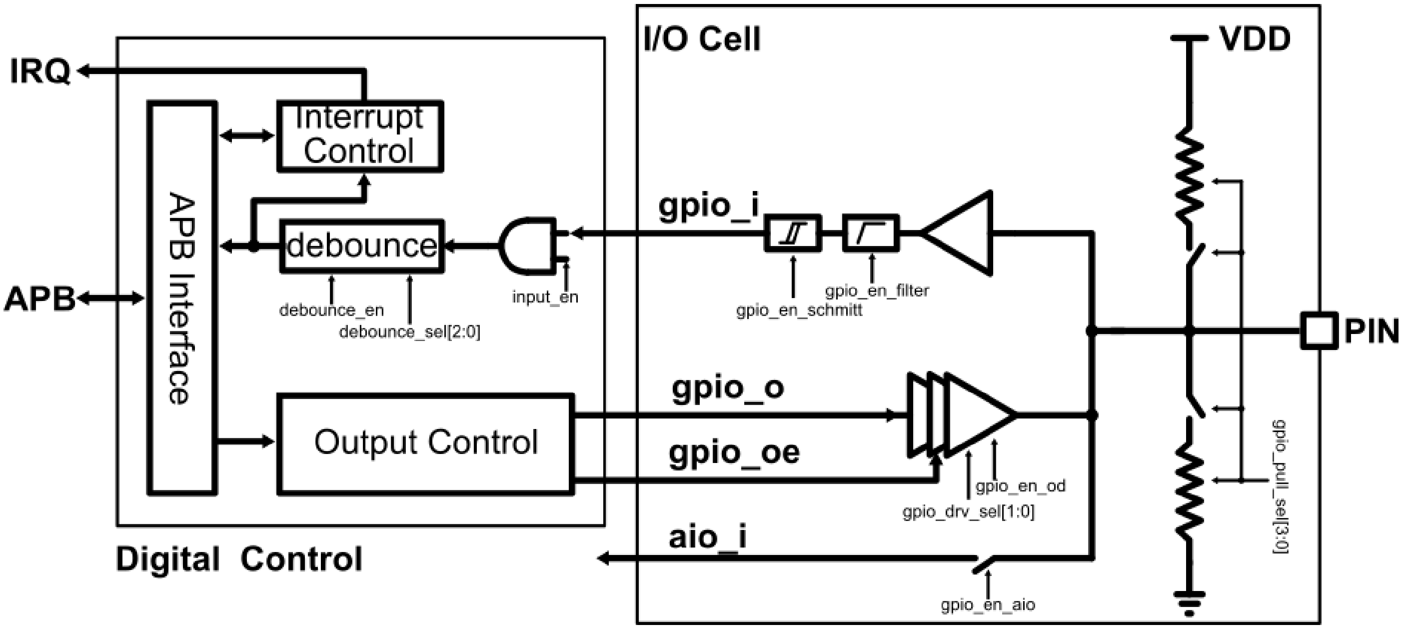


Figure 4.1 TZM8202-02 Pinout

3.2 GPIO

The TZM8202-02's GPIO pins are highly configurable to be outputs or inputs with configurable pull-up or pull-down resistors, configurable hardware debounce, and configurable Schottky filter. Each GPIO input can be configured to have rising-edge and/or falling-edge interrupts which can also be wakeup sources in low-power modes.

Figure 4.2 Block Diagram of GPIO



3.2.1 GPIO Inputs

Each GPIO input can be individually configured to have:

- Either a pull-up or pull-down resistor of 1M/100k/10k Ohms
- Schmitt trigger for hysteresis
- Hardware Debounce
- Hardware Filter
- Falling or Rising-Edge Interrupts
- To wake up the SoC from deep sleep

3.2.2 GPIO Peripheral Map

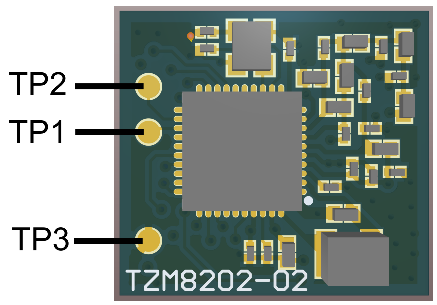
GPIOx	DEFAULT	Analog	UART0	UART1	UART2	I2CM0	I2CM1	I2CS	I2S	QSPI0	QSPI1	PWMx	IRDM
4	GPIO			TX		SCL	SCL	SCL	MCLK, SDO	DATA2, CSN1	DATA0	0-4	
5	GPIO			RX		SDA	SDA	SDA	MCLK, SDI	DATA3	DATA1, CSN1	0-4	
6	GPIO			TX	TX	SCL	SCL	SCL	SDI, BCK	SCK	SCK	0-4	
7	GPIO			RX	RX	SDA	SDA	SDA	SDO, WCK	CSN0	CSN0	0-4	
10	SWCLK			TX	TX	SCL	SCL		BCK	SCK, CSN1	SCK	0-4	
11	SWDIO			RX	RX	SDA	SDA		WCK	CSN0	CSN0	0-4	OUT
16	UART0_RX		RX	RX	RX	SCL	SCL	SCL	SDI	DATA0	DATA0	0-4	OUT
17	UART0_TX		TX	TX	TX	SDA	SDA	SDA	SDO	DATA1	DATA1	0-4	OUT
21	GPIO	AN0		CTS	RX	SDA	SDA	SDA	WCK	CSN0	CSN0	0-4	OUT
22	GPIO	AN1		TX	TX	SCL	SCL	SCL	SDO	DATA0	DATA0	0-4	OUT
23	GPIO	AN2		RX	RX	SDA	SDA	SDA	SDI	DATA1	DATA1	0-4	OUT
28	GPIO	AN4		TX	TX	SCL	SCL	SCL	BCK	SCK	SCK	0-4	OUT

Table 3.2.2 GPIO Peripheral Availability

3.3 Test Point Functionality

Table 4.2 Pin Functionality of TZM8202-02

No.	Pin Name	Type	Description
TP1	GPIO16	DIO	UART RX default
TP2	GPIO17	DIO	UART TX default
TP3	GND	Ground	Ground



4 Package Specifications

4.1 Package Dimensions

Table 5.1 Dimensions TZM8202-02

Dimensions	
Length	13.6 mm ± 0.15 mm
Width	12.5 mm ± 0.15 mm
Height	2.0 mm ± 0.15 mm

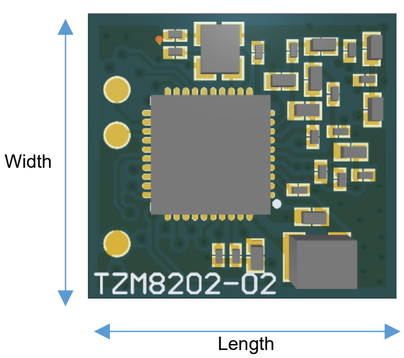


Figure 5.1.1 Top View of TZM8202-02

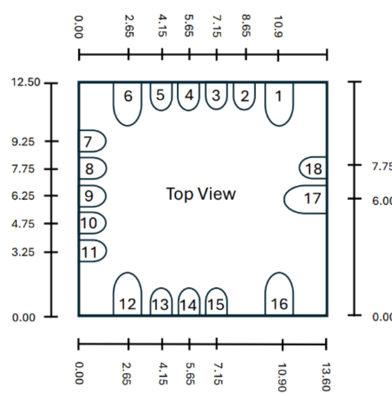


Figure 5.1.2 Top View of Land Pattern

4.2 Package Marking TZM8202-02

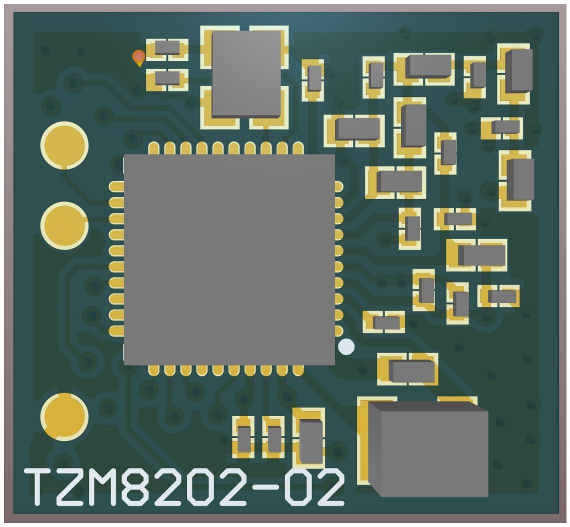
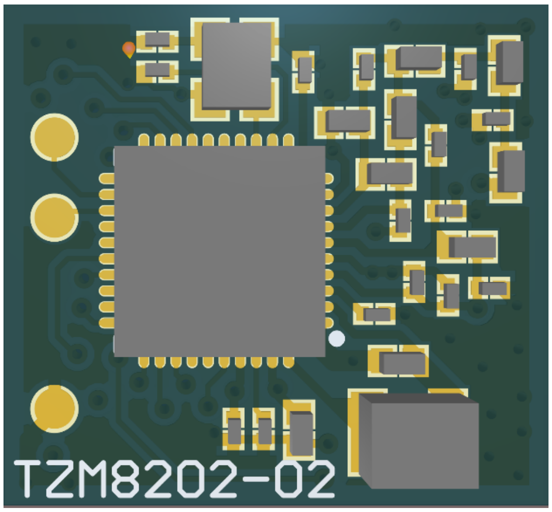


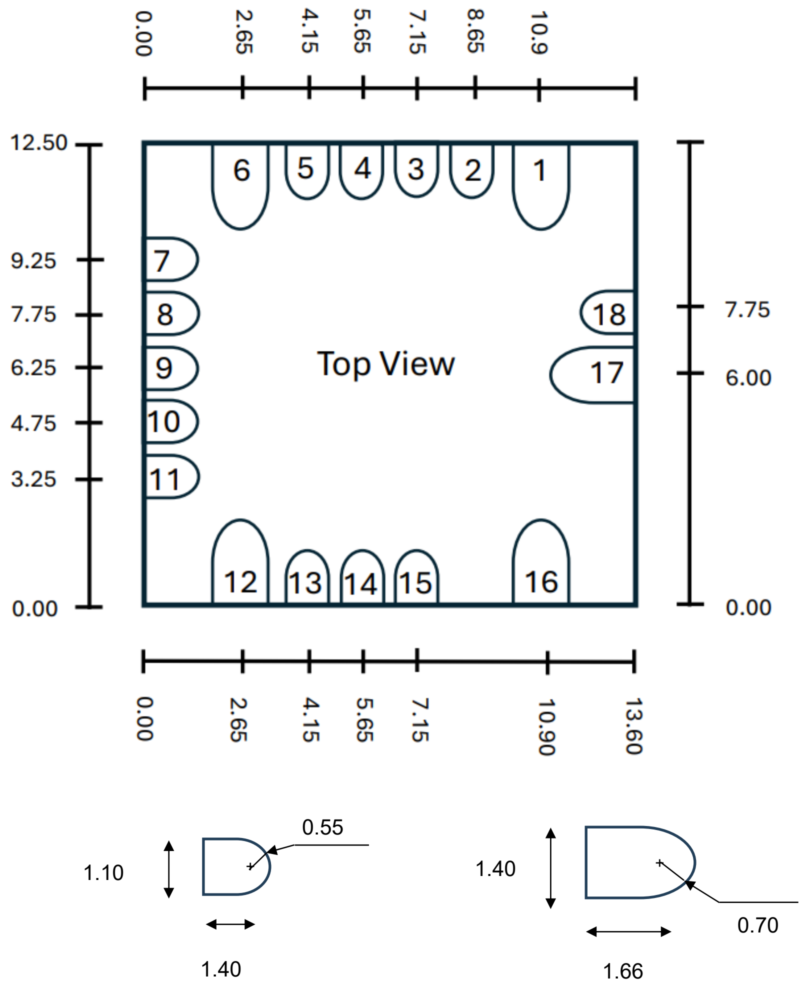
Figure 11 T32CZ20 Package Marking

Mark Method	Silkscreen
Font Size	Model Number：8.9mm x 1.2mm
Line 1 Marking	Model Number: Bottom-left justified.

5 PCB Mounting and Soldering

5.1 Recommended PCB Mounting Pattern

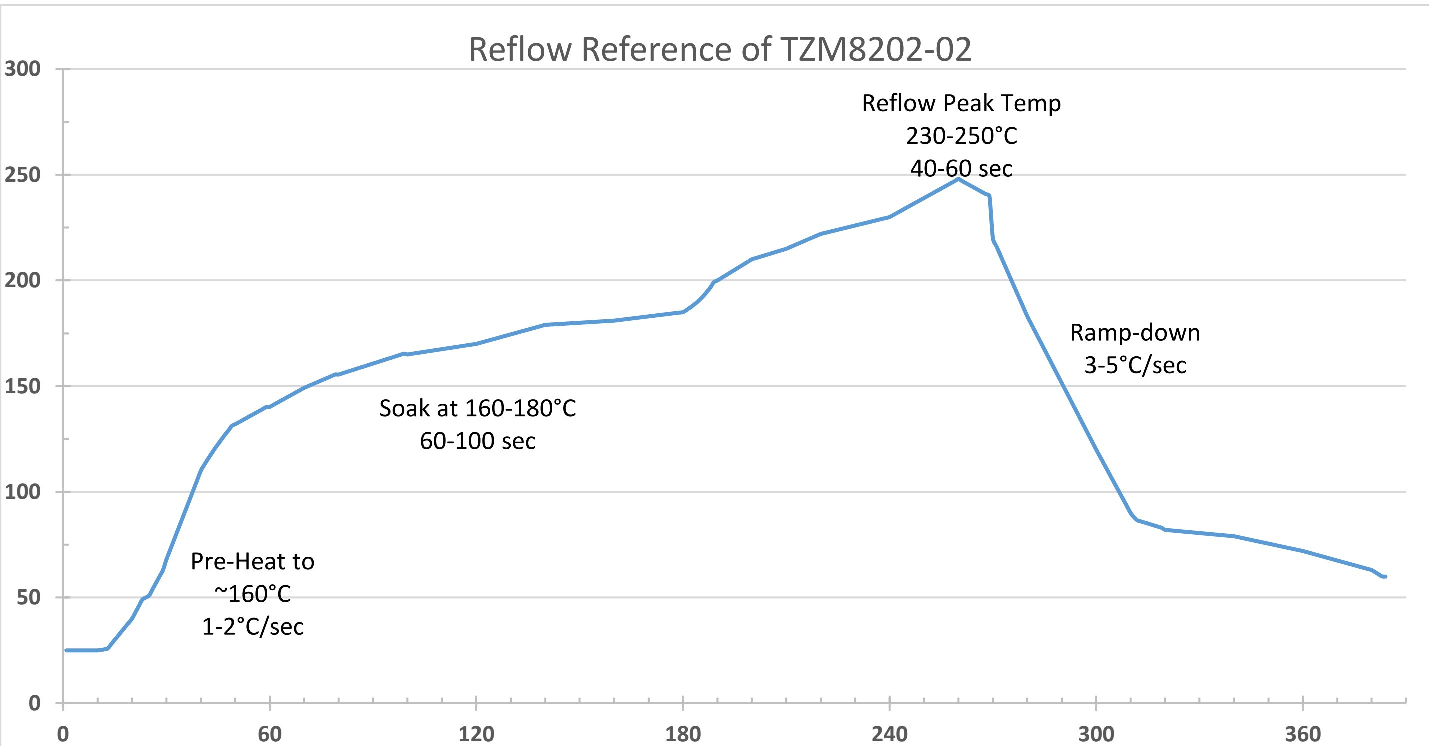




All Dimension in mm

5.2 Soldering Information

PCB solder mask expansion from landing pad edge	0.1 mm
PCB paste mask expansion from landing pad edge	0.0 mm
PCB process	Pb-free



Reflow time	Soak time	Peak temperature	Time above liquidus (TAL), 30~150 °C
30 ~ 90 Seconds	**60 ~ 100 Seconds**	**230~250 °C**	**1~5 °C /sec**

6 Revision History

Revision	Date	Description
01	12/1/2025	Initial version.

7 Contact Us

Contact Information	
Contact	www.TridentIoT.com
Sales	sales@tridentiot.com
Technical Support	support@tridentiot.com