Tsubame_D Module Specification Document

1 Overview

The Tsubame_D module features compact size, low power consumption, cost-effectiveness, and long transmission range . It is suitable for Bluetooth smart lighting control , integrating BLE, enabling seamless connectivity between smart lighting and Bluetooth-enabled smartphones/tablets.

1.1 Features

○32-bit high-performance MCU (up to 96MHZ clock speed)
○1MB embedded flash memory
○128KB on-chip SRAM
○24MHz & 32KHz crystal oscillators, 32KHz embedded RC oscillator
○IO Interfaces：

       Up to 17 GPIOs
       ADC
       I2C
       UART
       USB
○Up to 6 PWM channels

2．Electrical　Parameters

The following data is for reference only; actual measurements may vary.

2.1 Absolute Maximum Ratings

PARAAMETER	SYMBOL	MIN	MAX	UNIT	REMARKS
Supply Voltage	VDD	-0.3	4.3	V	For >3.6V, use a 4.7 Ω current-limiting resistor
Output Voltage	Vout	0	VDD	V	
Storage Temperature	Tstr	-65	105	℃	
Soldering Temperature	Tsld		260	℃	

2.2 Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	REMARKS
Supply Voltage	VDD	1.8	3.3	4.3	V	For >3.6V, use a 4.7 Ω current-limiting resistor
Operating Temperature	Topr	-40		85	℃	

2.3 I/O Port Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	REMARKS
Input High Voltage	Vih	0.7VDD		VDD	V	
Input Low Voltage	Vil	VSS		0.3VDD	V	
Output High Voltage	Voh	0.9VDD		VDD	V	
Output Low Voltage	Vol	VSS		0.1VDD	V	
Receive Mode Current	RX		3.3		mA	@3.3V DC
Transmit Mode Current	TX		3.9		mA	@3.3V DC
Sleep Mode Current			3.7		uA	Supports I/O wake-up
Peak Startup Current	IMAX		12		mA	@3.3V DC

2.4 RF Parameters

PARAMETER	MIN	TYP	MAX	UNIT	REMARKS
RF Frequency Range	2402		2480	MHz	Programmable, 2MHz step
Communication Distance		1		M	Open outdoor environment
RF Connector					IPEX Gen 1

3. Pin Definitions

3.1 Pin Diagram
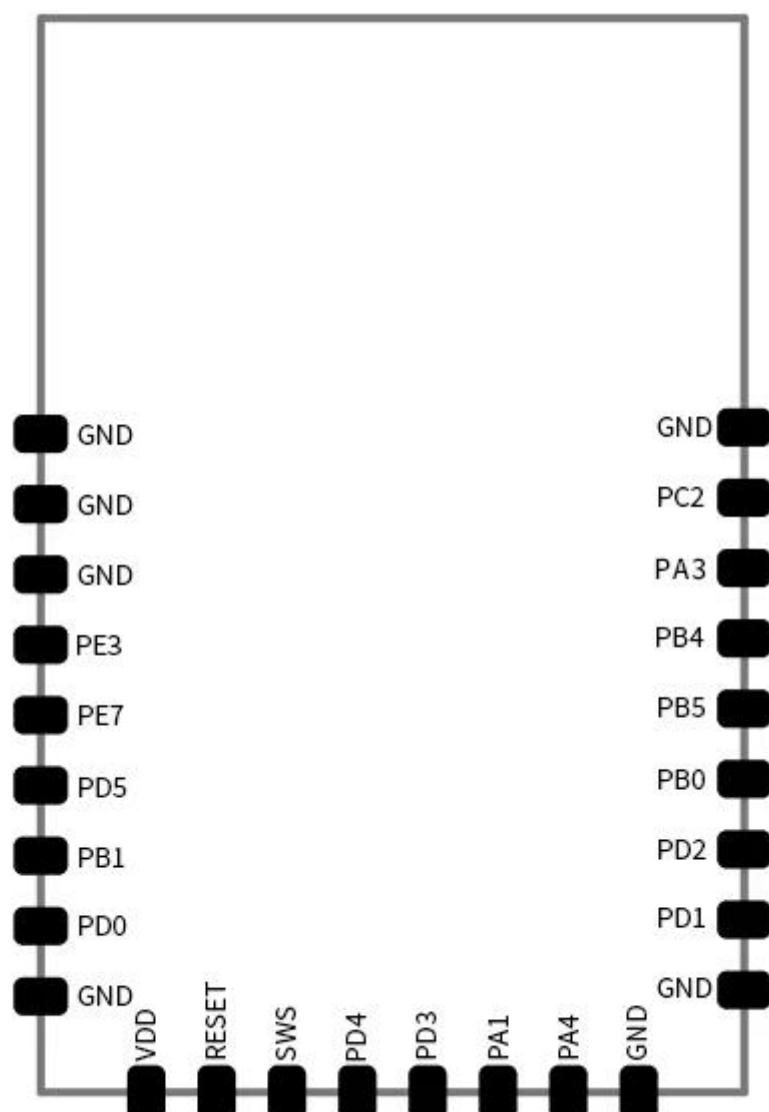
3.2 Pin Functions

PIN NO.	PIN NAME	TYPE	DESCRIPTION
1	GND	GND	Digital ground
2	GND	GND	Digital ground
3	GND	GND	Digital ground
4	PE3	Digital I/O	General purpose IO

| 5	PE7	Digital I/O	General purpose IO
6	PD5	Digital I/O	General purpose IO/SWCDIO
7	PB1	Digital I/O	General purpose IO/SWCLK/ADCIN
8	PD0	Digital I/O	General purpose IO/ADCIN
9	GND	GND	Digital ground
10	VDD	POWER	Connect to an external 3.3V power supply
11	RESET	Analog	RESET
12	SWS	Digital I/O	General purpose IO
13	PD4	Digital I/O	General purpose IO
14	PD3	Digital I/O	General purpose IO
15	PA1	Digital I/O	General purpose IO/UART_RX
16	PA4	Digital I/O	General purpose IO/UART_TX
17	GND	GND	Digital ground
18	GND	GND	Digital ground
19	PD1	Digital I/O	General purpose IO/ADCIN
20	PD2	Digital I/O	General purpose IO
21	PB0	Digital I/O	General purpose IO/ADCIN
22	PB5	Digital I/O	General purpose IO/PWM3/ADCIN
23	PB4	Digital I/O	General purpose IO/PWM2/ADCIN
24	PA3	Digital I/O	General purpose IO/PWM0
25	PC2	Digital I/O	General purpose IO/PWM1
26	GND	GND	Digital ground

a. "General purpose IO" SUPPORTS 74 functional mappings, including:

RX_CYC2LNA,ATSEL_5,ATSEL_4,ATSEL_3,ATSEL_2,ATSEL_1,ATSEL_0,BT_STATUS,BT_ACTIVITY,WIFI_DENY, TX_CYC2PA,SWM_IO,RZ_TX,TMR1_CMP,TMR0_CMP,SSPI_SO,SSPI_SI,SSPI_CK,SSPI_CN,IR_LEARN,SDM1_N, SDM1_P,SDM0_N,SDM0_P,DMIC0_DAT,DMIC0_CLK,I2S2_CLK,I2S2_DAT1,I2S2_LR1,I2S2_DAT0,I2S2_LR0, I2S2_BCK,I2S2_CLK,CLK_7816,UART2_RTX,UART2_TX,UART2_RTS,UART2_CTS,UART1_RTX,UART1_TX, UART1_RTS,UART1_CTS,UART0_RXT,UART0_TX,UART0_RTS,UART0_CTS,I2C1_SCL,I2C1_SDA,I2C_SDA, I2C_SCL,GSPI_MOSI,GSPI_MISO,GSPI_IO2,GSPI_IO3,GSPI_CK,GSPI_CN0,GSPI_CN3,GSPI_CN2,GSPI_CN1, MSPI_CN1,MSPI_CN3,MSPI_CN2,PWM5_N,PWM4_N,PWM3_N,PWM2_N,PWM1_N,PWM0_N,PWM5, PWM4,PWM3,PWM2,PWM1,PWM0.

b. "RESET"(active low)-Use a 10K pull-up resistor if unused.

c. "SWS"(programming pin)-Recommended to connect to an external pad.

4.1 Package Design
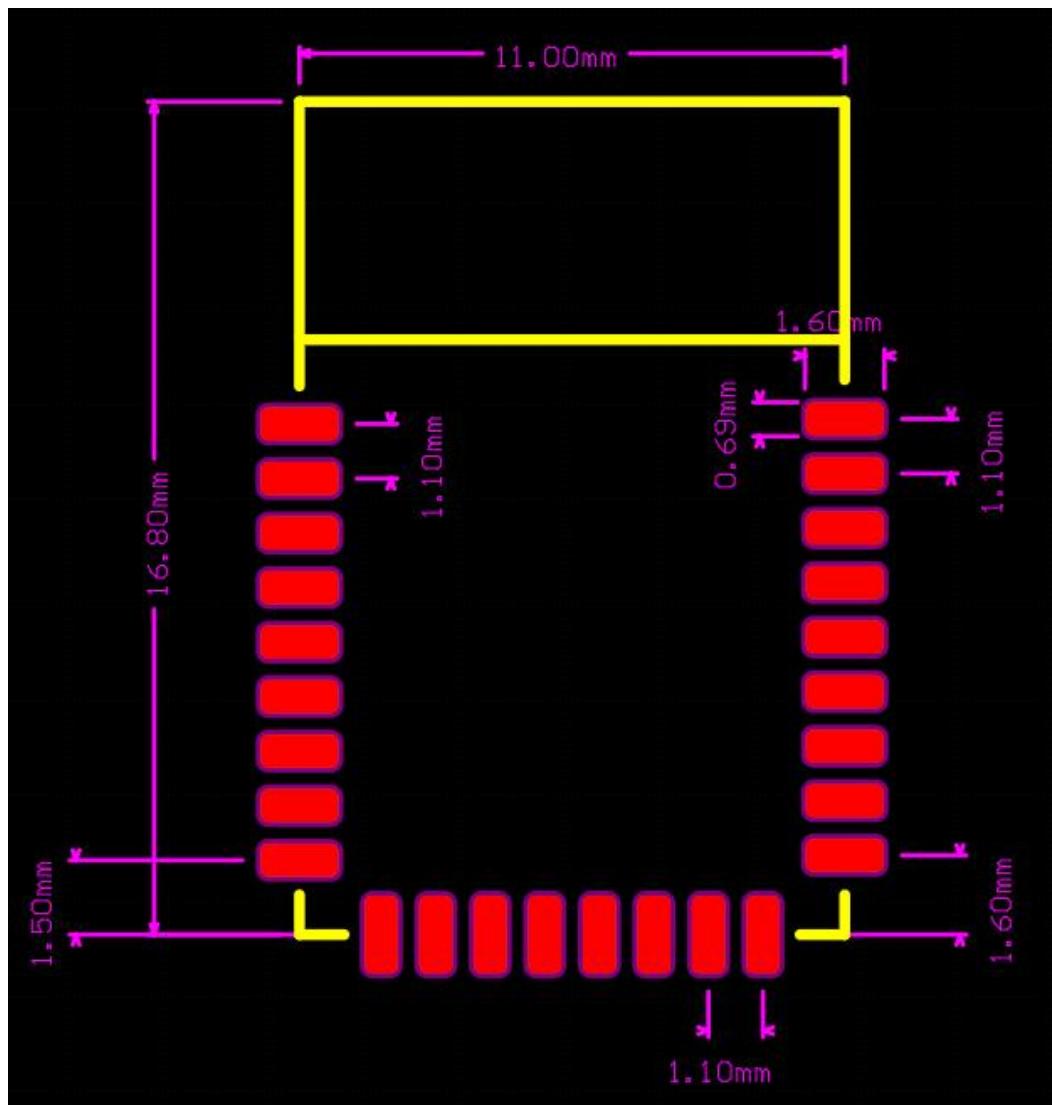
4.1 Module Layout Guidelines

The PCB layout shall be designed in accordance with the following guidelines.
The RF antenna area (twice the module width) must be kept clear or unpopulated when placing the module on the PCB, with no high-frequency signals, vias, or copper pours allowed.
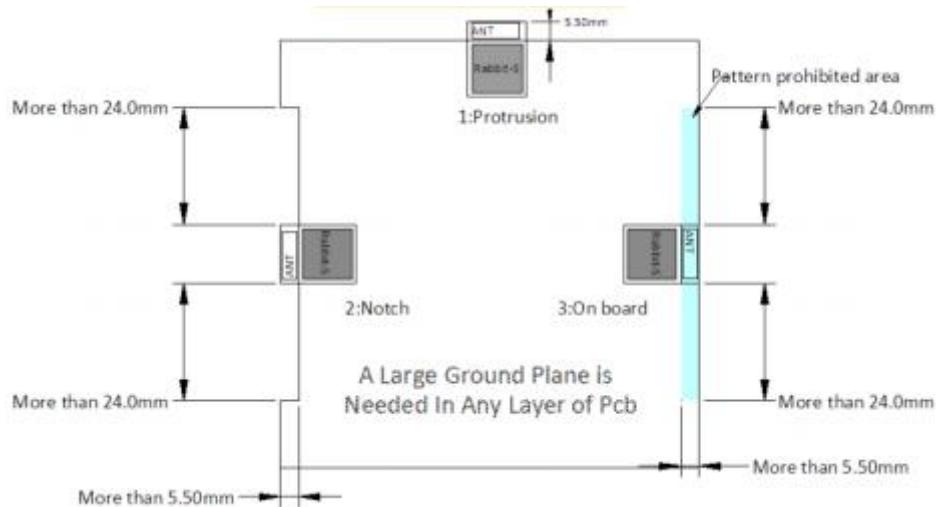
5．Physical Dimensions

5.1 Module Dimensions
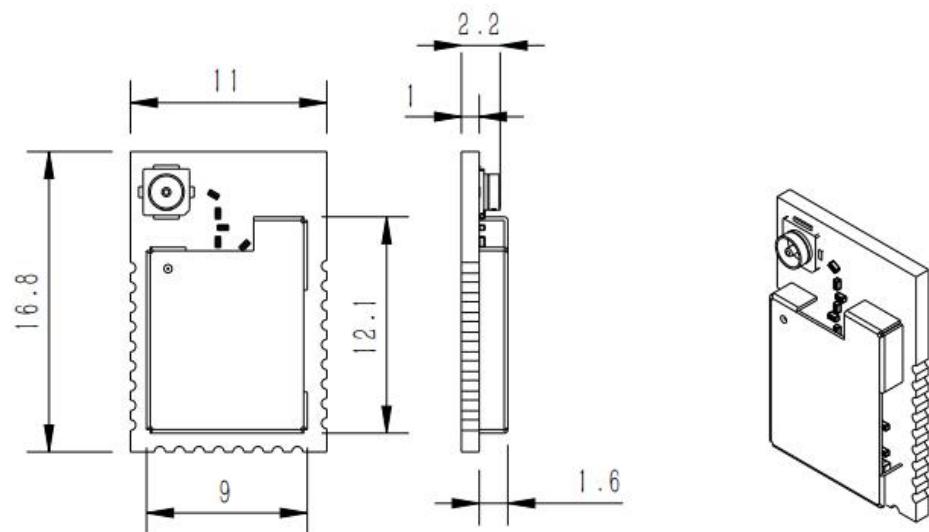
5.2 Physical Image

Front View   Back View

FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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, and

(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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

OEM instructions

1. Applicable FCC rules
   This device complies with part 15.247 of the FCC Rules.

   a. The specific operational use conditions
      This module can be used in IoT devices. The input voltage to the module is nominally 3.3 V_{DC}. The operational ambient temperature of the module is

      $-40 \sim 85\ °C$

2. Limited module procedures
   N/A

3. Trace antenna design
   N/A

4. RF exposure considerations
   The equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

5. Antenna
   Antenna type: Monopole Antenna, Peak antenna gain -0.8 dBi;

6. Label and compliance information
   An exterior label on OEM's end product can use wording such as the following:
   "Contains FCC ID: 2BQXR-HSEBT5C1 "

7. Information on test modes and additional testing requirements

1) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).

2) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

3) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected .

4) Additional testing, Part 15 Sub part B disclaimer:
   The device is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation When testing the host product, all the transmitters must be operating.

The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 for further general testing details. The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.