Turing-P Bluetooth Module Specification

releases	modify	dates	Change agent
V1.0		2024.06	Jiang Wei

Contents

1. Summarize

Turing-P module is a module designed based on Telling Microelectronics' TLSR8253F512AT32 chip and RF front-end chip, with output power up to 22.5dbm, with the advantages of small size, low power consumption, low cost and long transmission distance. This module is suitable for use within the field of Bluetooth smart light control, and also integrates BLE, 802.15.4, 2.4GHz RF transceiver, which can make the connection between smart lights and Bluetooth cell phones and tablet PCs easily.

Characteristics

○32-bit high-performance MCU with clock speed up to 48MHz
Built-in 512kB program memory
○Data memory: 48kB on-chip SRAM
○24MHZ & 32.768KHz crystal oscillator, 32KHz/24MHz embedded RC oscillator
○IO interface:
SPI
I2C
UART with Hardware Flow Control
USB
Single Wire Swire Debug Port
○Up to 6 PWM
○Sensor:
14-bit ADC with PGA
temperature sensor

2. Electrical parameters

The following data is for reference only, specific measurement shall prevail

2.1 Limit parameters

parameters	notation	minimum value	maximum values	unit (of measure)	note
Supply Voltage	VDD	-0.3	3.6	V	
output voltage	Vout	0	VDD	V	
Storage temperature	Tstr	-65	150	℃	
welding temperature	Tsld		260	℃	

2.2 Recommended working parameters

parameters	notation	minimum value	typical value	maximum values	unit (of measure)	note
Supply Voltage	VDD	1.8	3.3	3.6	V	
operating temperature	Topr	-40		125	℃	

2.3 I/O Port Parameter Characterization

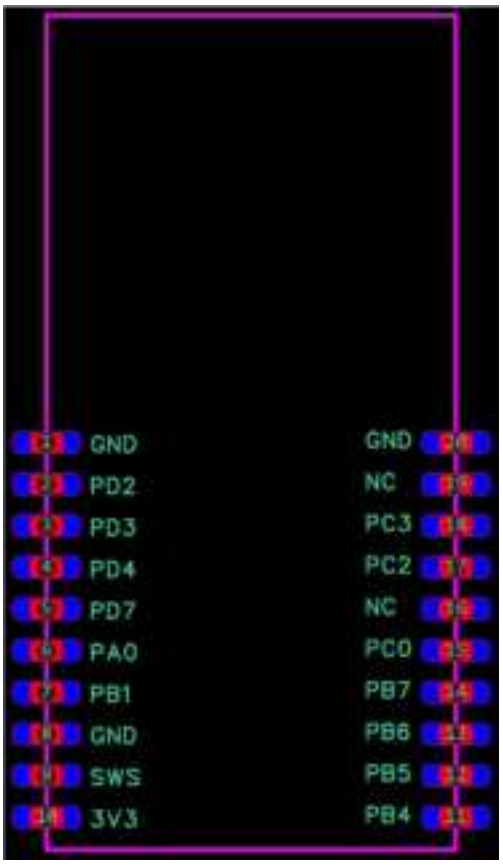
parameters	notation	minimum value	typical value	maximum values	unit (of measure)	note
Input High Level Voltage	Vih	0.7VDD		VDD	V	
Input Low Level Voltage	Vil	VSS		0.3VDD	V	
Output High Level Voltage	Voh	0.9VDD		VDD	V	
Output Low Level Voltage	Vol	VSS		0.1VDD	V	

2.4 RF parameters

parameters	minimum value	typical value	maximum values	unit (of measure)	note
RF Frequency Range	2402		2480	MHz	Programmable, 2MHz Step

3. Pin Definitions

3.1 Pinout



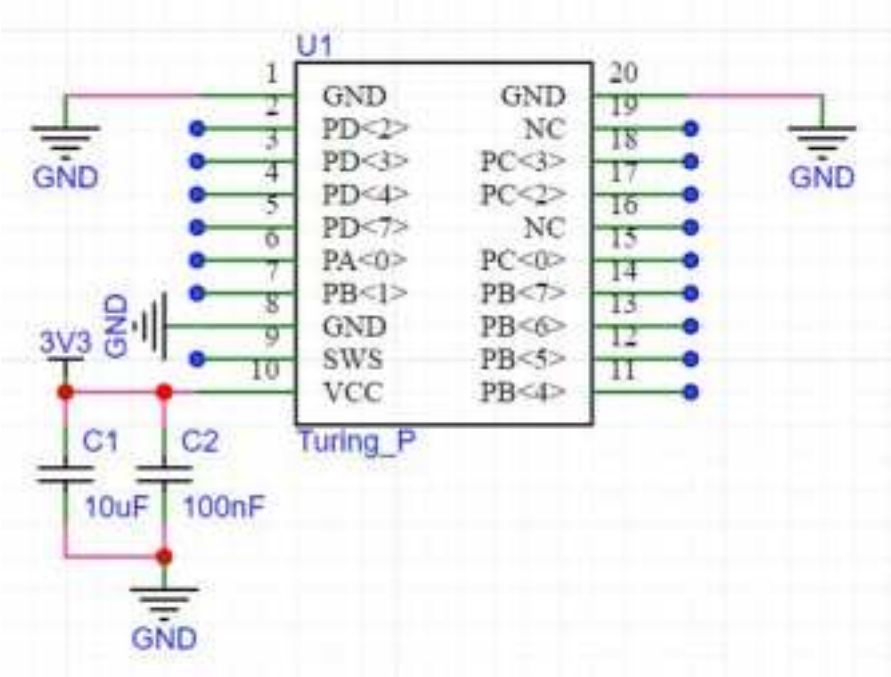
3.2 Pin Function

serial number	pinout	typology	descriptive
1	GND	GND	Digital ground
2	PD[2]	Digital I/O	SPI chip select (Active low) / I2S left right channel select / PWM3 output / GPIO PD[2]
3	PD[3]	Digital I/O	PWM1 inverting output / I2S serial data input / UART 7816 TRX (UART_TX) / GPIO PD[3]
4	PD[4]	Digital I/O	Single wire master / I2S serial data output / PWM2 Inverting output / GPIO PD[4]
5	PD[7]	Digital I/O	SPI clock (I2C_SCK) / I2S bit clock / UART 7816 TRX (UART_TX) / GPIO PD[7]
6	PA[0]	Digital I/O	DMIC data input / PWM0 inverting output / UART_RX / GPIO PA[0]

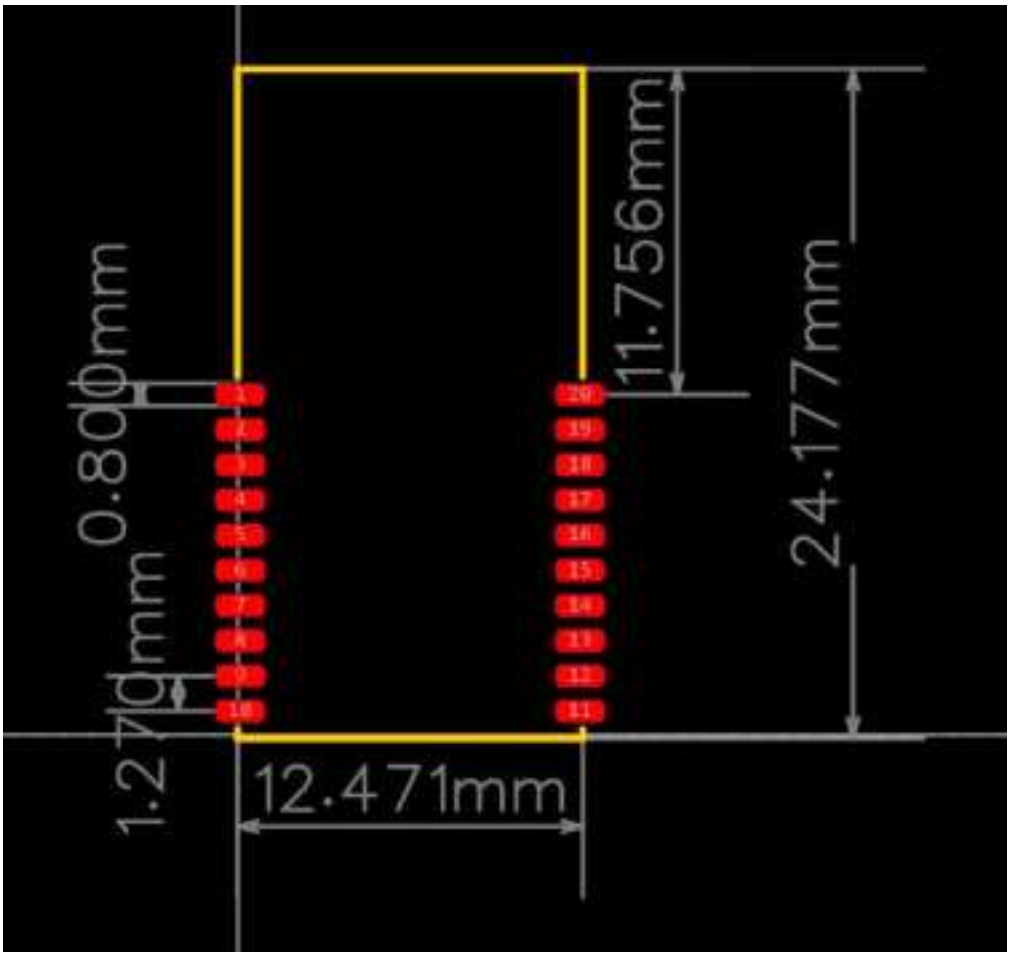
7	PB[1]	Digital I/O	PWM4 output / UART_TX / Antenna select pin 2 / Low Power comparator input / SAR ADC input / GPIO PB[1]
8	GND	GND	Digital ground
9	PA[7]	Digital I/O	Single wire slave/ UART_RTS / GPIO PA[7]
10	VDD	POWER	Connect to an external 3.3V power supply
11	PB[4]	Digital I/O	SDM positive output 0 / PWM4 output / Low power Comparator input / SAR ADC input / GPIO PB[4].
12	PB[5]	Digital I/O	SDM negative output 0 / PWM5 output / Low power Comparator input / SAR ADC input / GPIO PB[5].
13	PB[6]	Digital I/O	SDM positive output 1 / SPI data input (I2C_SDA) / UART_RTS / Low power comparator input / SAR ADC input / GPIO PB[6]
14	PB[7]	Digital I/O	SDM negative output 1 / SPI data output / UART_RX / Low power comparator input / SAR ADC input / GPIO PB[7]
15	PC[0]	Digital I/O	I2C serial data / PWM4 inverting output / UART_RTS / PGA left channel positive input / GPIO PC[0]
16	NC		
17	PC[2]	Digital I/O	PWM0 output / UART 7816 TRX (UART_TX) / I2C serial data / (optional) 32kHz crystal output / PGA right channel positive input / GPIO PC[2]
18	PC[3]	Digital I/O	PWM1 output / UART_RX / I2C serial clock / (optional) 32kHz crystal input / PGA right channel negative input / GPIO PC[3]
19	NC		
20	GND	GND	Digital ground

4. reference design

4.1 Schematic Design

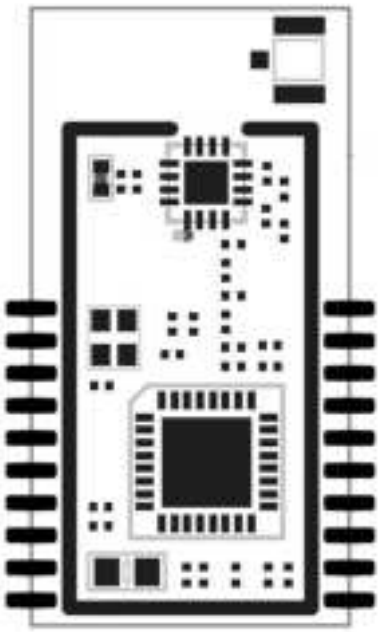


4.2 Package Design



5. Exterior Dimensions

5.1 Module size



5.2 Appearance

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

(Reference KDB 996369 D03 OEM Manual v01, 996369 D04 Module Integration Guide v02)

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

2. The specific operational use conditions
   This module can be used in IoT devices. The input voltage to the module is nominally 1.8~3.6V_{DC}. The operational ambient temperature of the module is -20 °C ~ +45 °C. The external antenna is NOT allowed.

3. Limited module procedures
   N/A

4. Trace antenna design
   N/A

5. 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.

6. Antenna
   Antenna type: Omni antenna; Peak antenna gain:-0.80 dBi

7. Label and compliance information
   An exterior label on OEM's end product can use wording such as the following: "Contains FCC ID: 2AXD8TURING-P "

8. 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.