



TB3106 Product Specification (On-Board Antenna)

revised description

dates	releases	descriptions
2020-06-10	V1.0	revised version
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Shenzhen Topband Co.

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One, OVERVIEW

TB3106 is a low-power embedded Bluetooth module developed by Shenzhen Topband Co. TB3106 integrates a high-performance RF transceiver, baseband, built-in 512KB FLASH and 48KB SRAM, with rich peripherals, programmable protocols and profiles, and support for OTA hardware upgrades and Bluetooth MESH networking.

The TB3106 integrates a DC-DC regulator and LDO with ultra-low power consumption, leakage current and high immunity to interference.

The TB3106 functional schematic is shown in Figure 1-1:

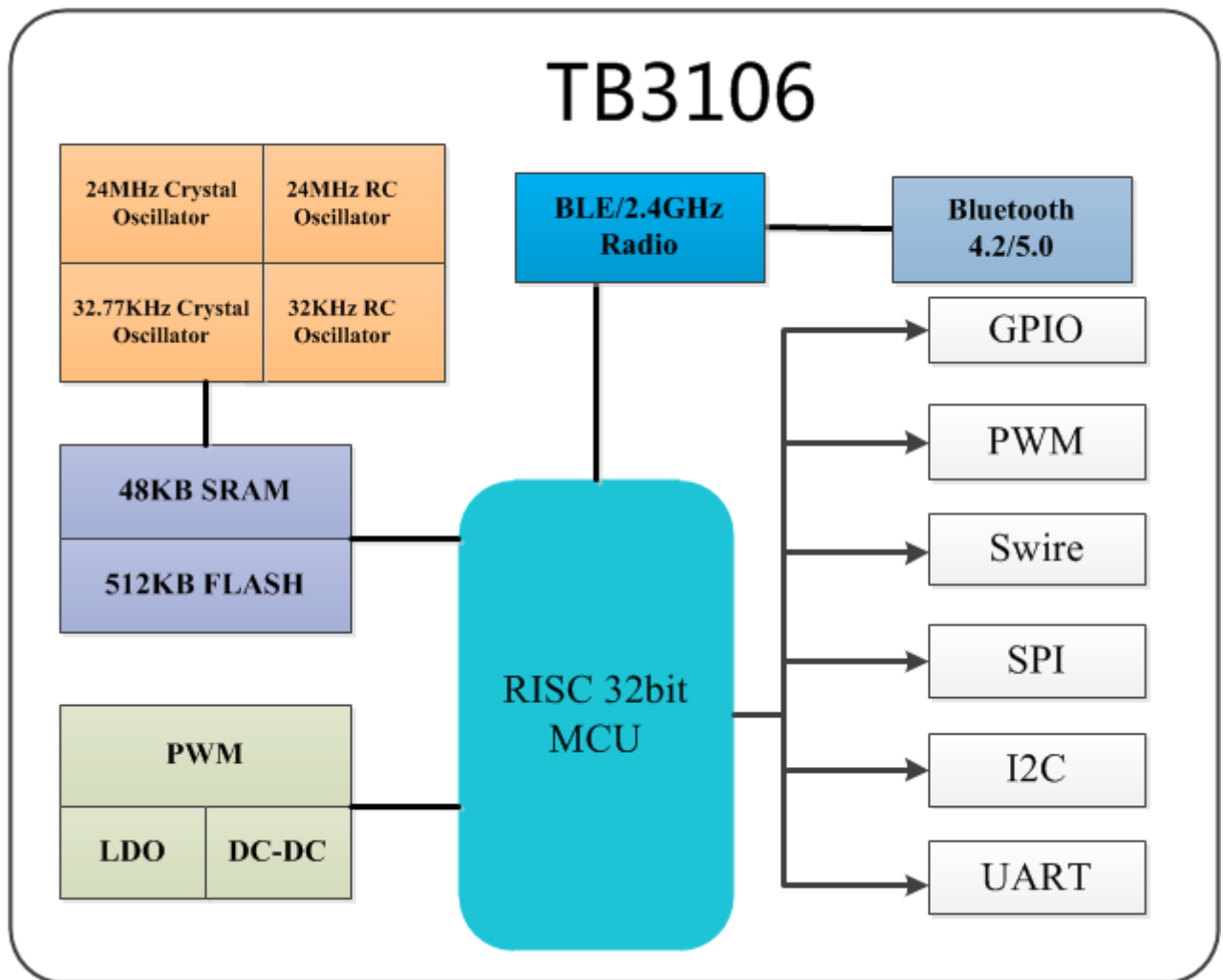


Figure 1-1 TB3106 Functional Principle Diagram

1.1 Product Features

- ☐ **Basic characteristics**
 - ☐ Compliant with Bluetooth 5.0 core specification
 - ☐ Low Power 2.4GHz Transceivers

- ☐ Integrated 32-bit core microprocessor running at up to 48MHz
- ☐ Built-in 512KB flash memory and 48 KB SRAM
- ☐ Integrated PA and LNA
- ☐ Operating Voltage 1.8~3.6V
- ☐ 24MHz crystal reference clock.
- ☐ **Rich peripheral interface**
 - ☐ 7 X UART
 - ☐ 6 X PWM
 - ☐ 4 X SPI
 - ☐ 4 X I2C
 - ☐ 6 X ADC
 - ☐ 2 X single wire debug interfaces
 - ☐ Up to 17 X GPIO
- ☐ **Bluetooth connectivity**
 - ☐ Maximum +8dBm output power
 - ☐ Supports unreadable protection mechanism for FLASH content
 - ☐ Support AES/ECC/CCM encryption mechanism
 - ☐ Supports cloud-based OTA upgrades.
 - ☐ Supports Tmall Genie connection
 - ☐ Supports MESH networking mode

1.2 Areas of application

- ☐ intelligent building
- ☐ smart home
- ☐ Intelligent Security
- ☐ Industrial Wireless Control
- ☐ Baby Monitor
- ☐ Wearable Electronics

II,

Electrical
parameters

Table 2-1 Normal working conditions

2.1 working
conditions

parametric	minimum value	typical value	maximum values	unit (of measure)	instructions
operating voltage	1.8	3.3	3.6	V	
operating temperature	-40	25	85	°C	
Operating humidity	10	-	90	%RH	
Storage temperature	-40	25	85	°C	

2.2 Power consumption parameters

Table 2-2 Power consumption parameters

paradigm	typical value	unit (of measure)
Active TX @0dBm (3.3V)/With DC-DC regulator	6.0	mA
Active TX @8dBm (3.3 V)/With DC-DC regulator	16.0	mA
Active TX @10dBm (3.3 V)/With DC-DC regulator	19.2	mA
Active TX @10.5dBm (3.3 V)/With DC-DC regulator	20.3	mA
Active RX (3.3 V) /With DC-DC regulator	6.0	mA
Sleep current (RF OFF, SRAM Retention)	1.4	uA
Deep sleep	0.4	uA

III, Radio Frequency Characteristics

3.1 Basic RF Characteristics

Table 3-1 RF RF Basic Characteristics

parametric	descriptions	minimum value	typical value	maximum values	unit (of measure)
Operate Frequency	operating	2400	-	2480	MHz

	frequency				
Modulation 20dB Bandwidth	modulation bandwidth	-	1	-	MHz
Maximum Received Signal	Maximum Received Strength	-	-20	-	dBm
Crystal frequency	crystal oscillator	-	24	-	MHz
RFSK Air data rate	transmission speed	-	1	2	Mbps

3.2 output power

Table 3-2 Output Power

parameters	minimum value	typical value	maximum values	unit (of measure)
output power	-20	0	8	dBm

3.3 receiver sensitivity

Table 3-4 Receiving Sensitivity

parameters	minimum value	typical value	maximum values	unit (of measure)
RXSENS@1 Mbps BER=0.001	-	-96	-97	dBm

IV, Module interface

4.1 Size Package

The external dimensions of TB3106 are 12.0mm (W) x 20mm (L) x 0.8mm (H) and its external dimensions are shown in Figure 4-1.

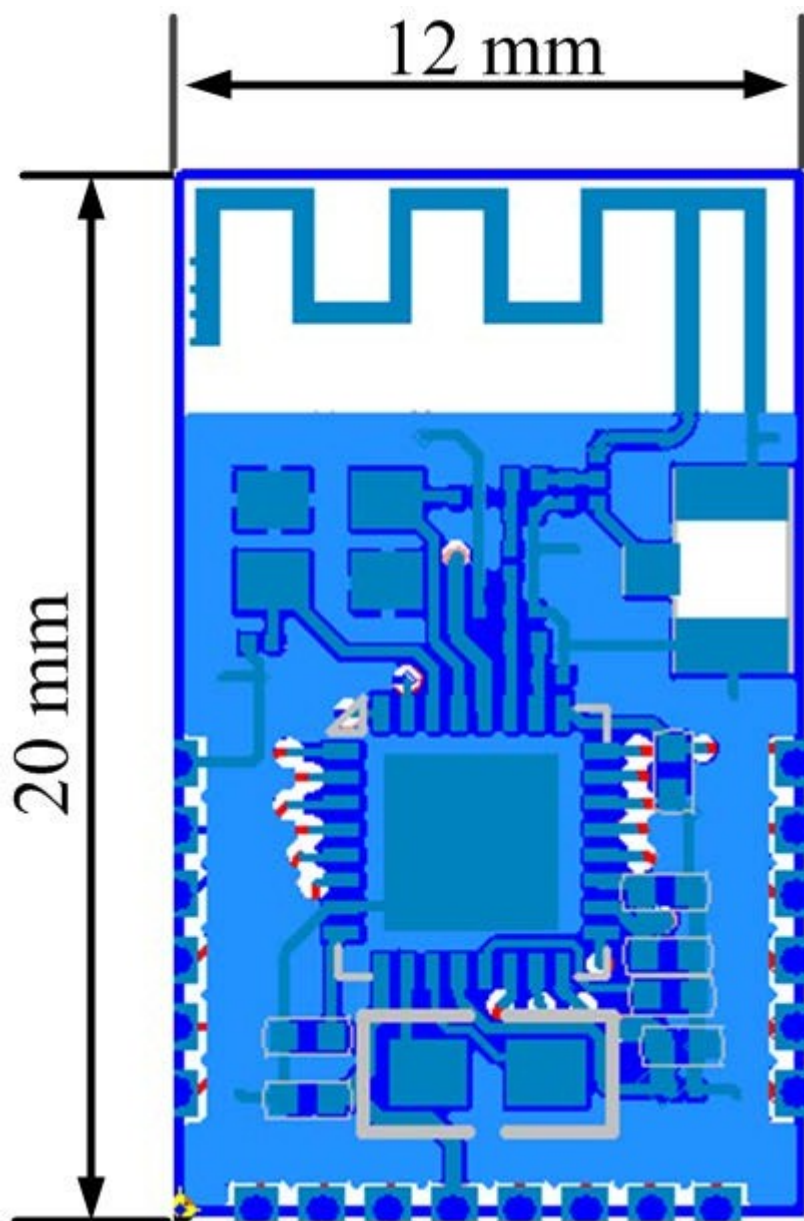


Figure 4-1 TB3106 Dimensional Drawing

4.2 Pin Definitions

The TB3106 pinout is shown in Figure 4-2 and the pinout description table is shown in Table 4-1.

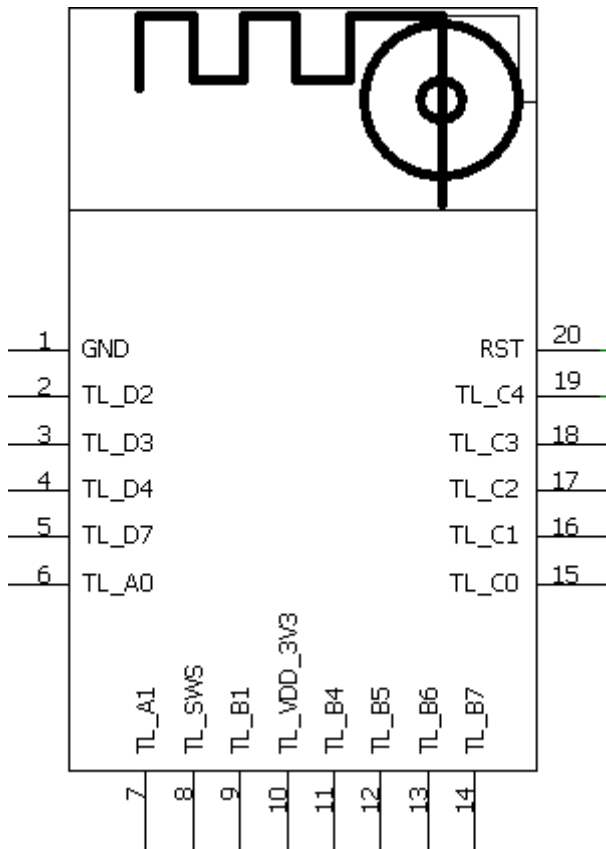


Figure 4-2 Module Pin Distribution

Table 4-1 Module Pin Function Description

pinout	name (of a thing)	typology	Functional Description
1	GND	P	GND
2	TL_D2	I/O	GPIO/PWM3/SPI
3	TL_D3	I/O	GPIO/UART_TX
4	TL_D4	I/O	GPIO/PWM2_N/SWM
5	TL_D7	I/O	GPIO/UART_TX/SPI_CLK
6	TL_A0	I/O	GPIO/UART_RX/PWM0_N
7	TL_A1	I/O	GPIO
8	TL_SWS	I/O	SWS/GPIO
9	TL_B1	I/O	PWM4/UART_TX/GPIO/ADC
10	TL_VDD	P	3.3V supply
11	TL_B4	I/O	GPIO/PWM4/ADC
12	TL_B5	I/O	GPIO/PWM5/ADC
13	TL_B6	I/O	GPIO/SPI_DI/ ADC
14	TL_B7	I/O	GPIO/SPI_DO/UART_RX/ADC
15	TL_C0	I/O	GPIO/I2C/PMW4_N

16	TL_C1	I/O	GPIO/I2C/PWM0	TB3106 Product
17	TL_C2	I/O	GPIO/UART_TX/I2C_SCK	
18	TL_C3	I/O	GPIO/UART_RX/PWM1/I2C	
19	TL_C4	I/O	GPIO/PWM2/ ADC	
20	RST	I	Module reset	

Note: TL_VDD/TL_SWS/GND are used together as the software burn port to burn the programme for the module.

V, Antenna information

5.1 Antenna type

The TB3106 comes with a PCB antenna as well as an IPX antenna.

5.2 Reduced antenna interference

Wireless signals including Bluetooth applications are greatly affected by the surrounding environment, such as trees, metal and other obstacles will have a certain degree of absorption of wireless signals, so that in practice, the distance of data transmission is affected by a certain degree.

The TB3106 needs to be placed in an enclosure with an existing system. It is not recommended to install it in a metal enclosure as it is shielded against radio frequency signals.

The antenna part of TB3106 has PCB antenna, because the metal will weaken the function of the antenna, when laying out the board for the module, it is strictly forbidden to lay the ground and run the wires under the antenna of the module, and it is better if it can be dug out.

VI, Packaging information and production guidance

6.1 Mechanical dimensions

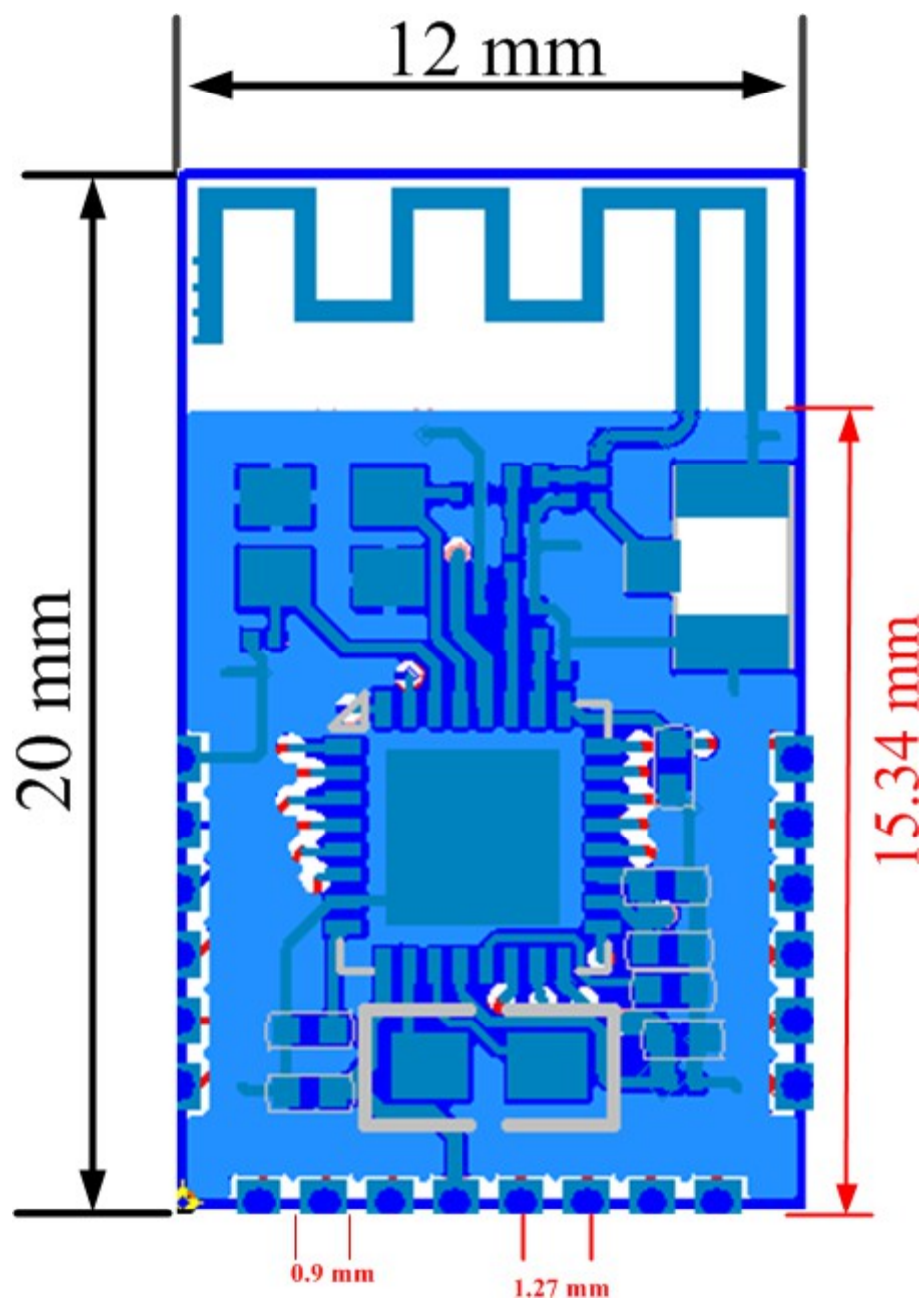


Figure 6-1 Mechanical Dimensions of TB3106

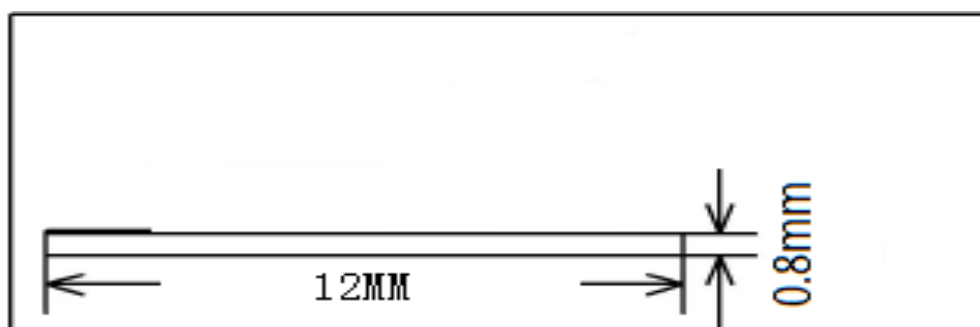


Figure 6-2 TB3106 Side View

6.2 Production Guidelines

The factory TB3106 is stored under the following conditions: it must be mounted by an SMT machine and unpacked with the firmware burned in.

Patch must be completed within 24 hours, otherwise to re-vacuum packaging, baking module before the patch.

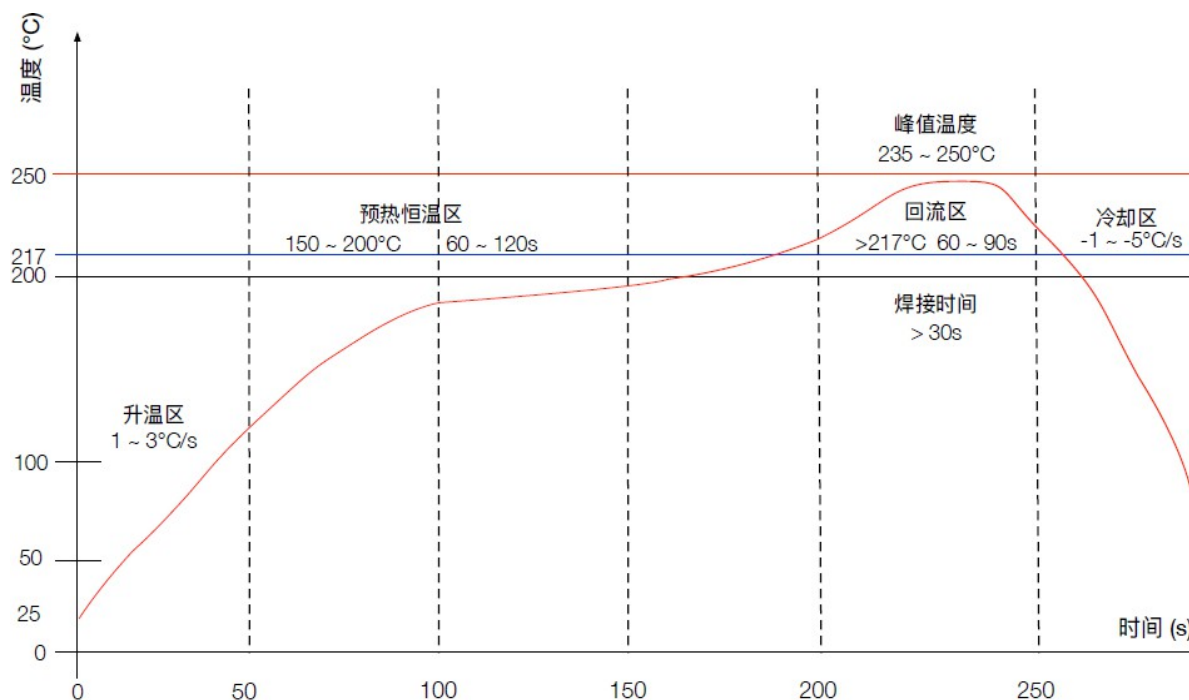
- ☐ SMT requires instrumentation
 - ☐ Reflow Bonder
 - ☐ AOI Monitor
 - ☐ Calibre 6-8mm Nozzle
- ☐ Equipment needed for baking
 - ☐ Cabinet Baking Oven
 - ☐ Anti-static, high temperature resistant pallets
 - ☐ Anti-static and high temperature resistant gloves

The factory TB3106 storage conditions are as follows:

- ☐ Moisture barrier bags must be stored in an environment where the temperature is $<30^{\circ}\text{C}$ and the humidity is $<85\% \text{ RH}$.
- ☐ The shelf life of the product in dry packaging should be 6 months from the date of sealing of the package.
- ☐ Static rings must be worn by all station operators during the entire production process.
- ☐ When operating, prevent the module from getting wet or dirty.

6.3 Reflow Temperature Profile

It is recommended that lead-free soldering be used with no more than two reflows. The reflow temperature profile is shown in Figure 6-3 below.



升温区 — 温度: 25 ~ 150°C 时间: 60 ~ 90s 升温斜率: 1 ~ 3°C/s

预热恒温区 — 温度: 150 ~ 200°C 时间: 60 ~ 120s

回流焊接区 — 温度: >217°C 时间: 60 ~ 90s; 峰值温度: 235 ~ 250°C 时间: 30 ~ 70s

冷却区 — 温度: 峰值温度 ~ 180°C 降温斜率: -1 ~ -5°C/s

焊料 — 锡银铜合金无铅焊料 (SAC305)

Figure 6-3 Reflow Soldering Temperature Profile

6.4 reference circuit

The TB3106 user reference circuit is shown in Figure 6-4 Power Reference Circuit.

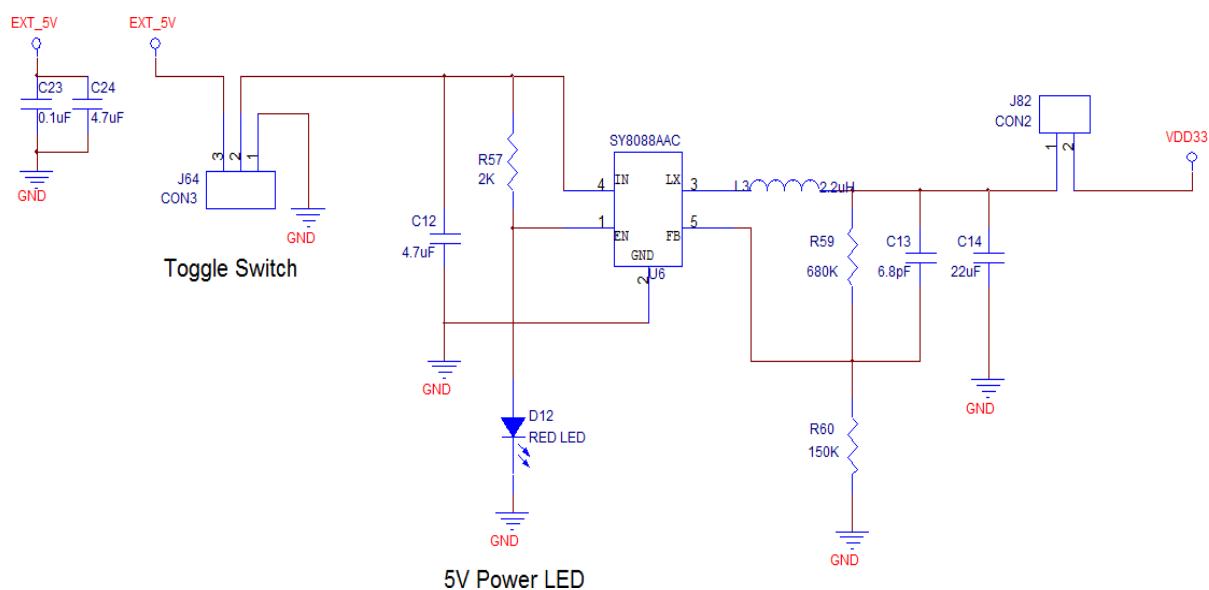


Figure 6-4 Power Supply Reference Circuit Diagram

6.5 Peripheral Alignment Recommendations

The TB3106 integrates high-speed GPIOs and peripheral interfaces, which may generate significant switching noise. If some applications require high power consumption and EMI characteristics, it is recommended to connect 10~100 ohm resistors in series on the digital I/O lines. This will suppress overshoot and smooth out the signal when switching the power supply, and this practice also provides some protection against electrostatic discharge (ESD)

During the application of the module, please pay attention to avoid the influence of external lines and other sources of interference on the module, and avoid the formation of series connection between the power supply circuit of the module and the high power circuit unit, so as to improve the RF performance of the whole machine.

FCC Statement

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.

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 Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC Part 15 Subpart C and Subpart F has been investigated. It is applicable to the modular transmitter

2.3 Specific Operational Use Conditions - Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

- The antenna must be installed such that 20cm is maintained between the antenna and users,
- The transmitter module may not be co-located with any other transmitter or antenna.

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.4 Limited Module Procedures

Not applicable

2.5 Trace Antenna Designs

Not applicable

2.6 RF Exposure Considerations

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment can be used as portable exposure without any restriction.

2.7 Antenna Type and Gain

The module only used PCB antenna and maximum antenna gain is -1.00dBi.

Only antennas of the same type with equal or lower gain may also be used with this module.

Other types of antennas and/or higher gain antennas may require the additional authorization for operation.

2.8 End Product Labelling Compliance Information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: **2ADDW-TB3106**". The FCC ID can be used only when all FCC compliance requirements are met.

2.9 Information on Test Modes and Additional Testing Requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new FCC authorization.

Host manufacturer installed this modular with single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C, 15.209, 15.207 requirement, only if the test result comply with FCC part 15C, 15.209, 15.207 requirement, then the host can be sold legally.

2.10 Additional testing, Part 15 Subpart B Disclaimer

This transmitter modular us tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rules requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rules requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this modular installed.

2.11 Manual Information to The End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The host integrator must follow the integration instructions provided in this document and ensure that the composite system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB Publication 996369.

OEM/Host Manufacturer Responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and RF Exposure essential requirements of the FCC rules.

2.12 How to Make Changes - Important Note

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.