

M190/M195

LoRaWAN Module Datasheet

V1.0.1

EasyLinkin
Sensing the World

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1. Product Overview

M190/M195 module is our self-developed LoRa module. It is integrated with LoRaWAN protocol stack, compatible with LoRaWAN specification (V1.0.2, Class A/C) released by LoRa Alliance, which supports the connectivity function for different end devices. The module can support wide frequency: low band 470~510MHz or high band 862~932MHz.

With UART interface for data/command interaction with external devices, M190/M195 provides an easy way to access LoRaWAN network and explore wireless data applications.

M190/M195 module uses ST® SOC STM32WLE5xx chip(integrated with LoRa SX1262 chip),the difference is that M190 uses 128k flash but M195 uses 256k flash. They have many features as low power, long range and high anti- interference etc, which can be used in many applications as smart metering, smart city and smart building etc.

2. Features

- Low power consumption: minimum standby current 1.5uA
- High sensitivity: reach -139dBm@SF12/125KHz
- Anti-interference: high performance spread spectrum communication with efficient cycle interleaved error correction
- Compliant with LoRaWAN Specification 1.0.2

- Integrated LoRaWAN protocol stack, support Class A/Class C devices
- UART interface, stamp hole, support parameters configuration through AT command.

3. Applications

- Automated metering reading
- Home and building automation
- Smart agriculture
- Industrial automation.....

4. Specification

4.1 General Specification

Table 4-1: General Specification

Item	Specification	Description
Appearance	Model	M190-L/ M190-H, M195-L/ M195-H
	Picture	
Transmission	Protocol	LoRaWAN V1.0.2
	Topology	Star
	Device Type	Class A/C
	Activation Mode	OTAA/ABP
	Modulation	CSS (Chirp Spread Spectrum)
	Frequency Band	EU433MHz/CN470MHz/EU868MHz/US915MHz/AS923MHz
	Center Frequency	Can be customized
	Bandwidth	125/250/500KHz configurable
	Data Rate	0.018-37.5kbps
	RX Power	+22dBm (max)
	TX Sensitivity	-139dBm@SF12/125KHz
Interface	Supply Voltage	DC 3.3V (2.0-3.6V)
	IO	GPIO*4, UART*1, I2C*1 (Reserved)
	Baud Rate Of Serial Port	1200/2400/4800/9600/19200/38400/57600/115200bps, Default is 9600bps
	Antenna Interface	Stamp hole
	Antenna Type	Omni directional or Directional (Spring Antenna is recommended)
	Pin Encapsulation	Stamp hole
	Dimension	15.5(L)*15(W)*2.5(H)mm (SMA connector not included)
Others	Operating Environment	-40°C--85°C, 10%--90%RH
	Storage Environment	-40°C--105°C, 5%--95%RH

4.2 Electrical Specification

Table 4-2: Electrical Specification

(Operating voltage: 3.3V, Operating temperature:

Specification	Test Condition	Min	Typical	Max	Unit
Working Voltage	Guaranteed Max Output Power (22dBm)	2.0	3.3	3.6	V
Operating Current	TX, +22dBm	-	120	-	mA
	TX, +17dBm	-	78	-	mA
	RX	-	9.0	-	mA
	Standby (Class C)	-	8.0	-	mA
	Standby (Class A)	-	1.5	2.1	µA
Operating Frequency	Low Frequency	470	-	510	MHz
	High Frequency	862	-	932	MHz
Operating Temperature		-40	-	85	°C
Operating Humidity		10%	-	90%	RH
Transmit	OOK mode, Carrier output, PA_BOOST ON, 25±2°C				
Max Transmit Power	PA_BOOST Output Full Load Power	18	21.6	22	dBm
Second Harmonic		-	-40	-	dBm
Receiving	PER = 1%, CR = 4/5, CRC ON, Preamble Length = 12, Packet Length = 10				
Sensitivity	SF12, 125kHz	-	-139	-	dBm
Frequency Stability	±2ppm@-40°C~85°C				

5. Interface and Design Description

5.1 Block Diagram

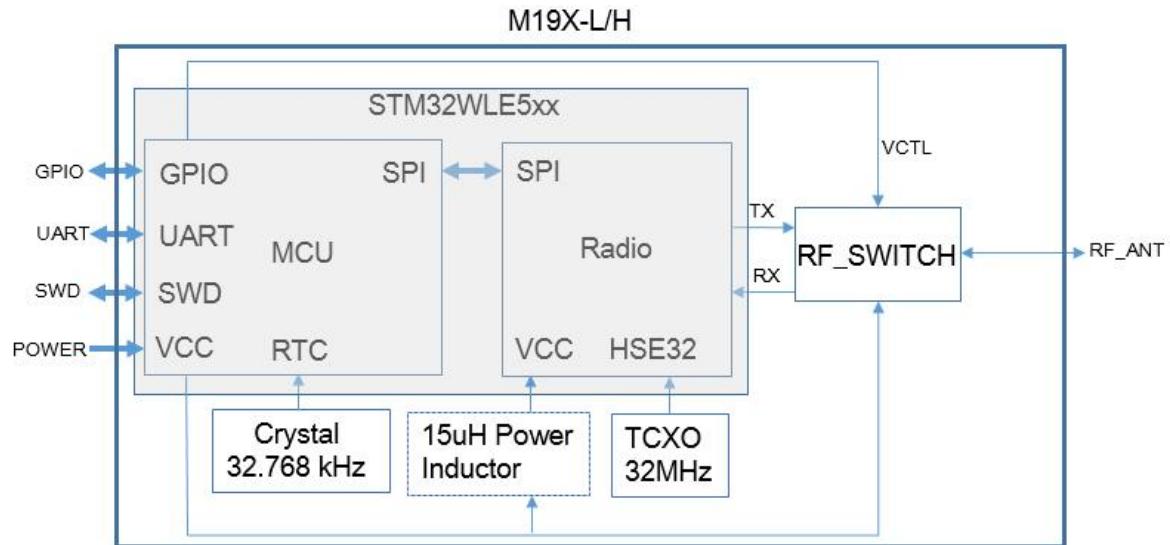


Figure 5-1: Block Diagram

5.2 Pin Diagram

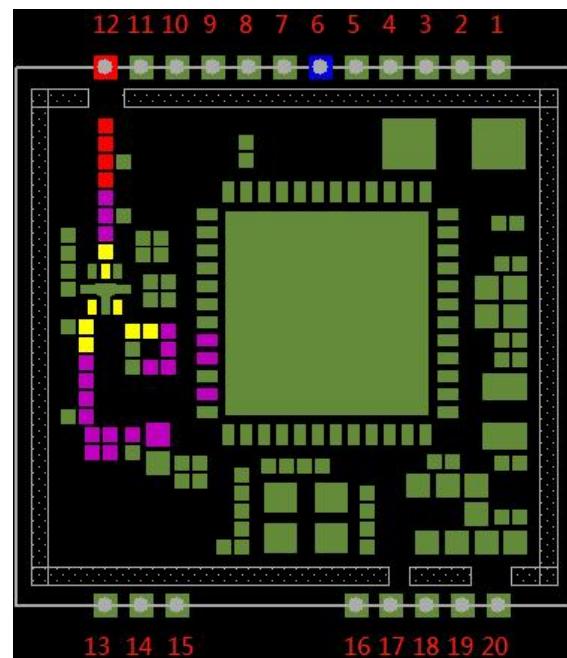


Figure 5-2: Pin Diagram

5.3 Pin Description

All the IO ports are compatible with CMOS and TTL.

Table 5-1: Pin Description

Pin Type	Pin Name	Pin Number	I/O	Description	Remark
DC IN	VCC	20	P	Supply voltage, Default: 3.3V	Make sure transient discharge current > 120mA, to avoid module reset when RF is transmitting.
	GND	11、13、14、19	P	Ground	
UART Port	TXD	2	O	TTL Voltage output, data transmit	
	RXD	1	I	TTL Voltage input, data receive	
GPIO	STATUS	5	O	Status indication: LOW Output: idle HIGH Output: busy In network joining process, output HIGH for 500ms once every 10s. In data transmission process, output HIGH for 50ms once every data transmission.	Attach external LED indicator. Imax=5mA
	AUX	9	I/O	TBD	NC
	SETA	10	I	Wake up input: When falling edge is detected, module will wake up, waiting for sleep or non- sleep command. If there is no command after waiting for 10s, module will be back to sleep automatically.	Before data transmission, drive high level voltage to lower, waiting for 5ms, then drive it higher. If PIN keeps in low voltage, module will in a continuous running state.
	SETB	3	O	Data transmit indication: Output Low voltage in 50ms before data transmit; Output High voltage if no data transmit happens after 10ms.	Only HIGH voltage detected, host MCU can enter sleep mode. Otherwise it will cause data loss.
ANT	RF ANT	12	RF	Antenna interface, 50Ω, connect to IPEX base	To use stamp hole, please reserve antenna matching circuit on PCB, ask Easylink engineer for more information.
Others	NRST	18	I	MCU Reset, low level voltage is valid	Power on reset circuit inside
	SWDIO	7	I/O	MCU write DATA	
	SWCLK	8	I	MCU write CLK	
	NC	4、6、15、16、17	--	RFU (Reserved)	Not connected

Note: IO Pin Definition: I--Input, O--Output, I/O--Input/Output, P--Power

5.4 Interface to Host MCU

5.4.1 STATUS pin can connect to external LED indicator. If this function is not needed, keep STATUS unconnected. It is OK to drop this function by no connection.;

5.4.2 Module can be connected to MCU directly. Please keep interface levels the same as IO level.

5.4.3 There is internal pull-up resistor in GPIO pins, please reserve external pull-up resistor with driving capability;

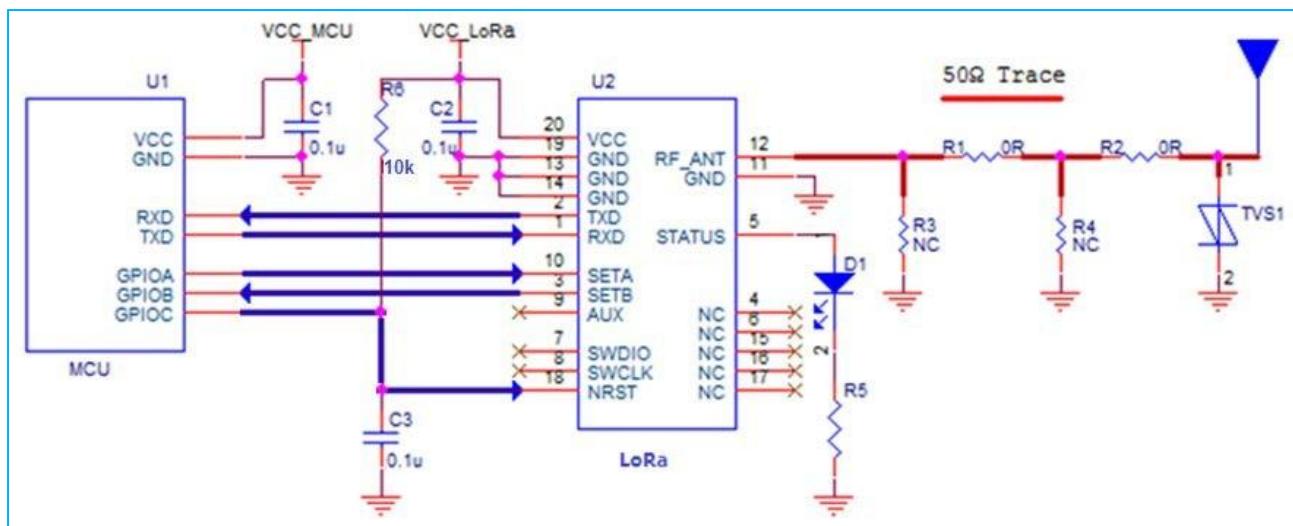


Figure 5-3: Typical application circuit

Instructions:

- Bold red line is the RF circuit matched with 50Ω . R1, R2, R3, R4 are reserved matching circuits. R1, R2 usually mounts 0Ω , R3 and R4 makes no connection; Reserve TVS for ESD protection of antenna ports, such as LXES15AAA1-153.
- Bold blue line is UART and IO circuits. Notes the level match and signal direction.

5.5 Antenna Matching Circuit

Because the working frequency is low, spring antenna bandwidth is narrow and the module can be easily affected by surrounding environment which will cause frequency offset, during the circuit design process, it is better to adopt SMT

soldering, add double L type or π type antenna matching line and complete 50Ω characteristic impedance of the micro-strip line. The antenna working performance can be improved by modifying the antenna matching value, which will help to improve transmission distance.

5.6 Antenna Selection

The antenna selection is depending on the device's type, antenna size, antenna cost and performance. The common antennas used in short distance are PCB antenna, ceramic chip antenna, spring antenna and whip antenna etc. Some key parameters should be taken into consideration for antenna selection: pattern, efficiency and bandwidth etc. The typical definition of antenna bandwidth is reflected wave attenuation less than -10dB or VSWR less than 2. The actual antenna performance needs match the PCB structure to achieve good results.

6. Product Function

6.1 LoRaWAN™ Protocol

LoRa is a spread spectrum modulation technology for LPWAN, developed and popularized by Semtech for long range bi-directional communications.

LoRaWAN™ Specification, defined by LoRa Alliance and based on open source MAC layer protocol, provides LPWA (Low Power Wide Area) wireless connectivity for low data rate, battery-powered devices and sensors.

According to different scenarios, M190/M195 can work in Class A or Class C mode:

6.1.1 Class A

Class A mode is suitable for battery-powered end devices with major uplink transmission.

This mode is the lowest power end-device system for applications that only require downlink communication from the server shortly after the end device has sent an uplink transmission. Downlink communications from the server at any other time will have to wait until the next scheduled uplink.

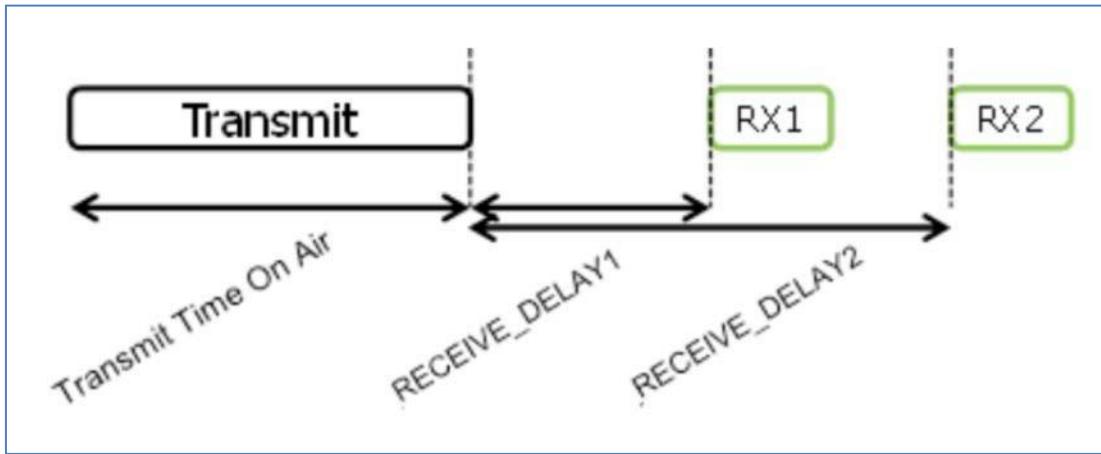


Figure 6-1: Class A Communication Profile

6.1.2 Class C

Class C mode has nearly continuously open receive windows, only closed when transmitting. Class C end-device will use more power to operate than Class A or Class B but they offer the lowest latency for server to end-device communication.

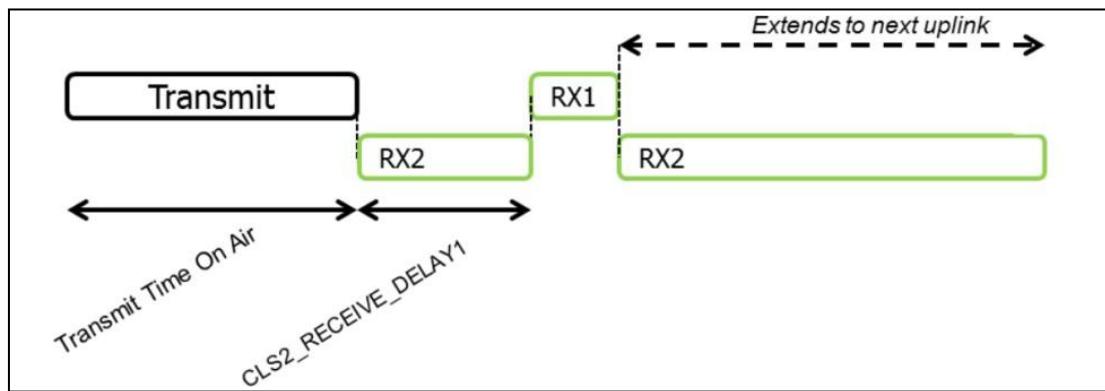


Figure 6-2: Class C Communication Profile

6.2 AT Mode Description

External host MCU can configure, control and transfer data using AT command via UART port on M190/M195, which shortens development time and speeds time to variety wireless application. For more details on AT command, please refer to < AT command function description>

The workflow of the host MCU control module is as follows.

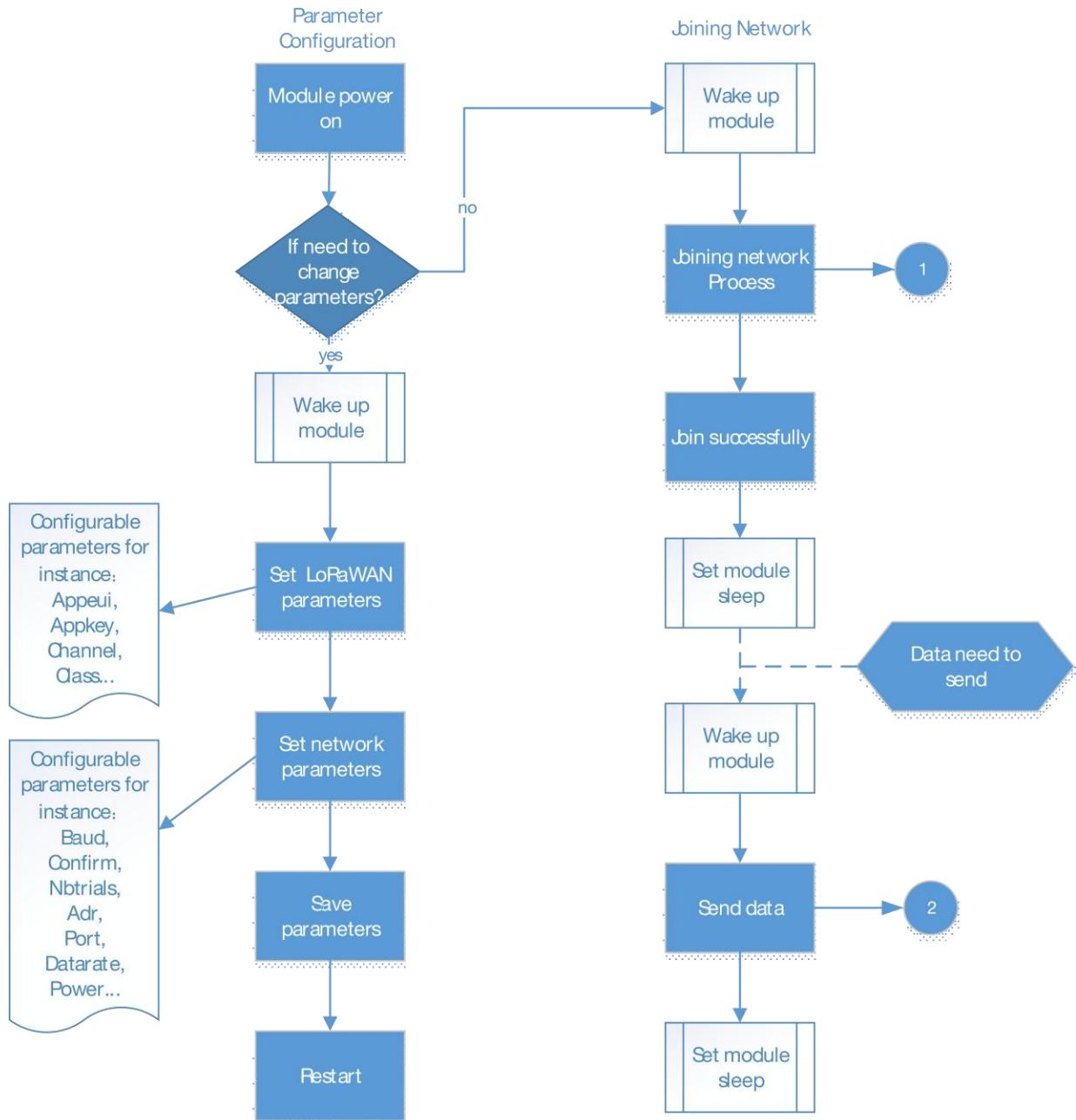


Figure 6-3: Workflow Process

For first use, Host MCU need configure LoRa parameters once poweron, then restart the module. The joining network process is as below,

- When module is powered on, it will enter the joining process.
- After joining network successfully, it will enter the sleep mode.
- Once data is up, module will wake up by host MCU and enter data transmission process.

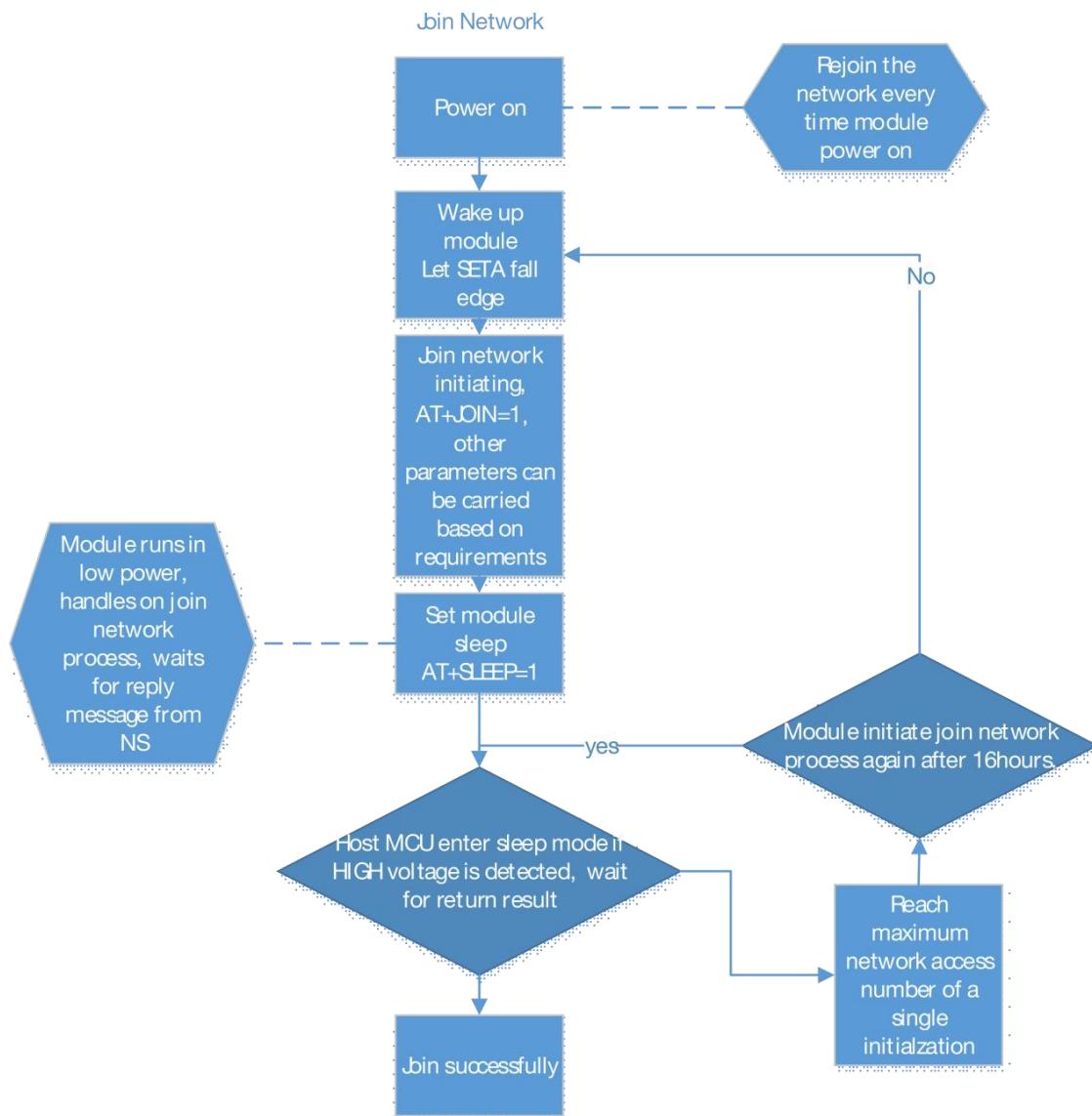


Figure 6-4: Module Joining Network Process

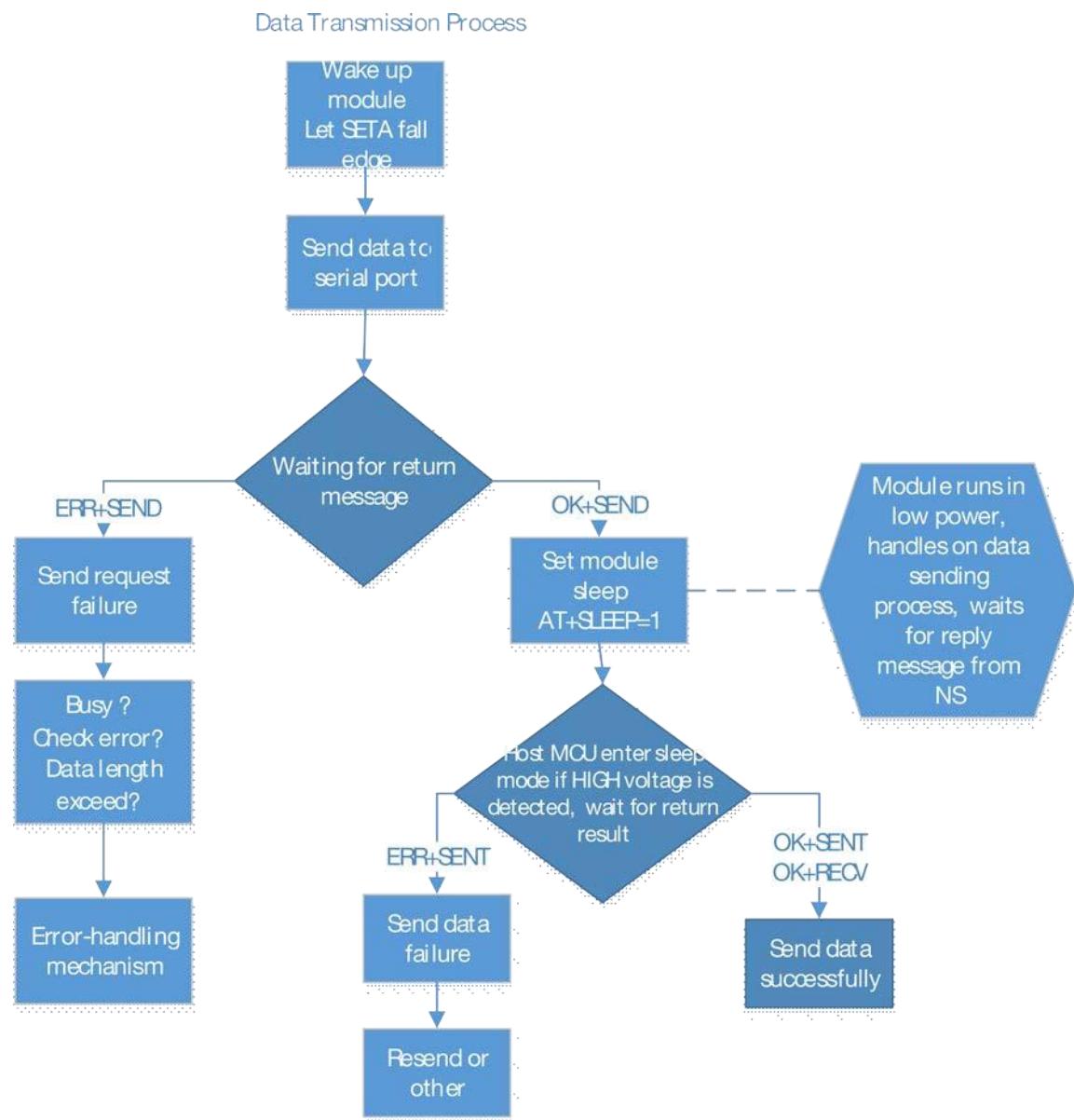


Figure 6-5: Data Transmission Process

To save as much power as possible, please set the module in sleep mode once data transmission is done. The module will wake up in the next service cycle..

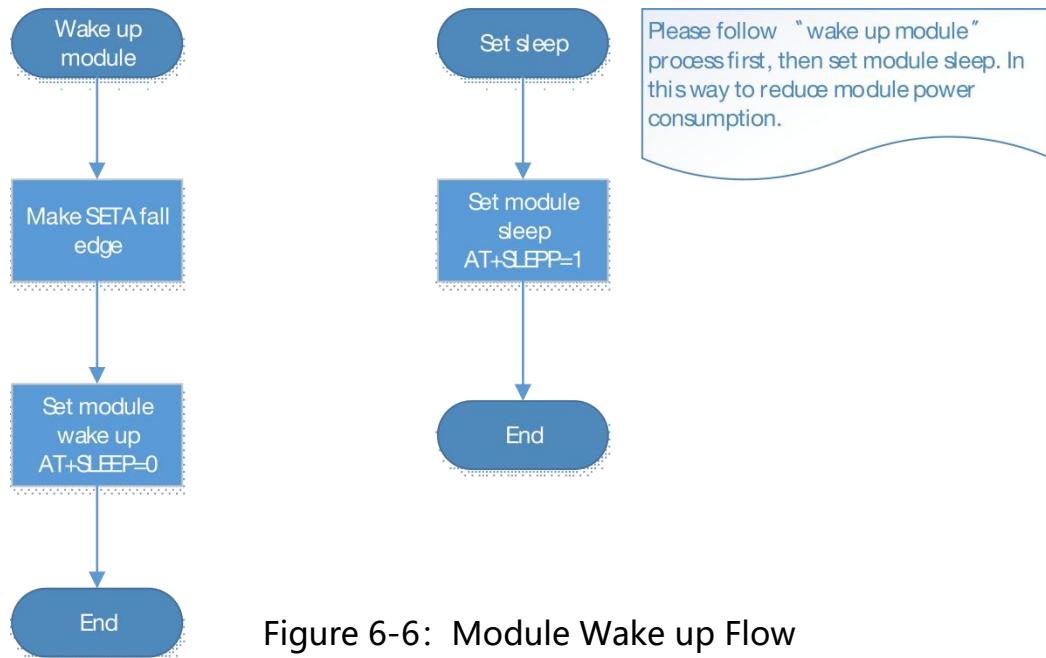


Figure 6-6: Module Wake up Flow

7. Mechanical Parameter

7.1 Outline

The top and bottom view of M190 module are shown below.



Figure 7-1: Top View

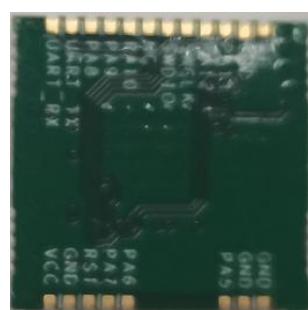


Figure 7-2: Bottom View

The top and bottom view of M195 module are shown below.



Figure 7-3: Top View

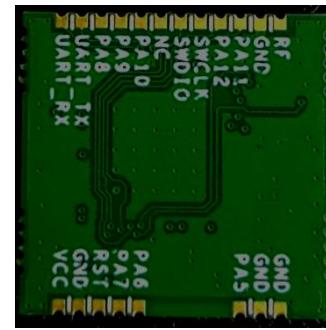


Figure 7-4: Bottom View

7.2 Package Dimension

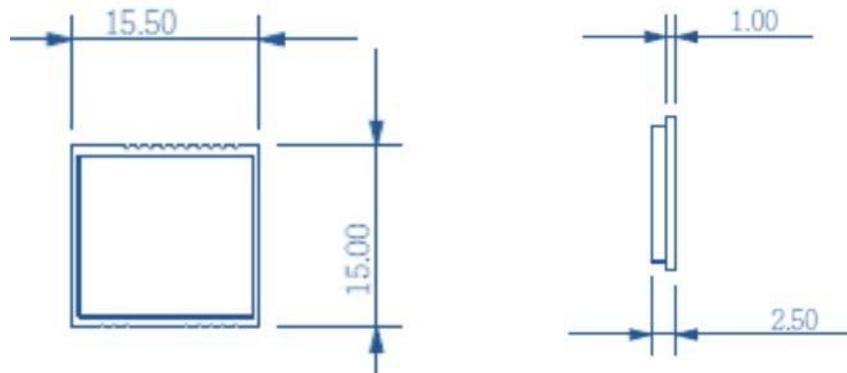


Figure 7-5: M190/M195 Dimension (Unit: mm)

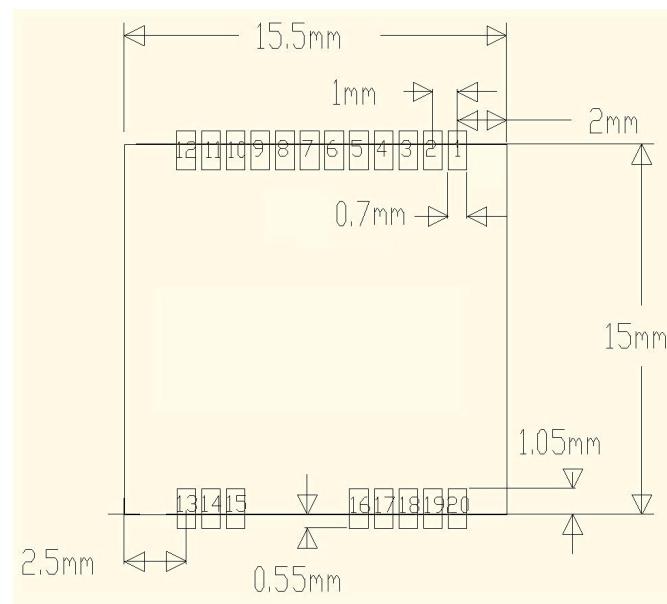
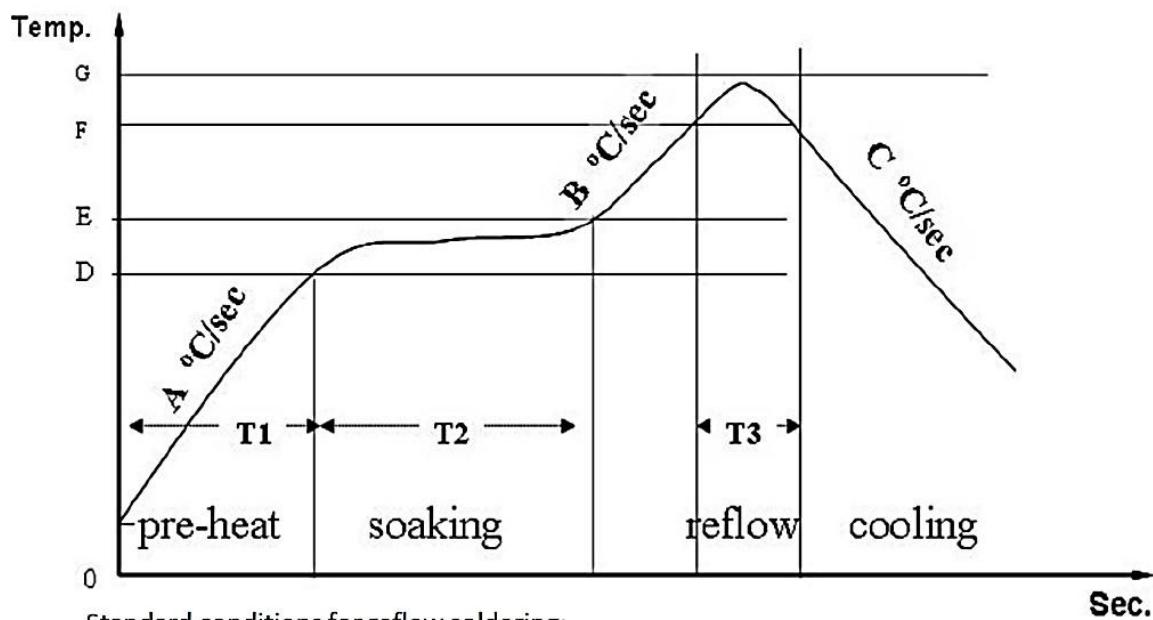


Figure 7-6: M190/M195 PCB Pin Size

8. Thermal Reflow Profile



Standard conditions for reflow soldering:

- a. Pre-heating Ramp (A) (Initial temperature: 150°C): 1~2.5°C/sec;
- b. Soaking Time (T2) (150°C~180°C): 60sec~100sec;
- c. Peak Temperature (G): 230~250°C;
- d. Reflow Time (T3) (>220°C): 30~60 sec;
- e. Ramp-up Rate (B): 0~2.5°C/ sec;
- f. Ramp-down Rate (C): 1~3°C/ sec.

9. Module model description



Model	Nameplate Printing	Frequency Band
M190-L	M190(L)	470-510MHz
M190-H	M190(H)	862~932MHz
M195-L	M195(L)	470-510MHz
M195-H	M195(H)	862~932MHz

Support

If you have any question with our module, please contact us for support.

Contact Information:

Email: support@easylinkin.io

Website: www.easylinkin.io