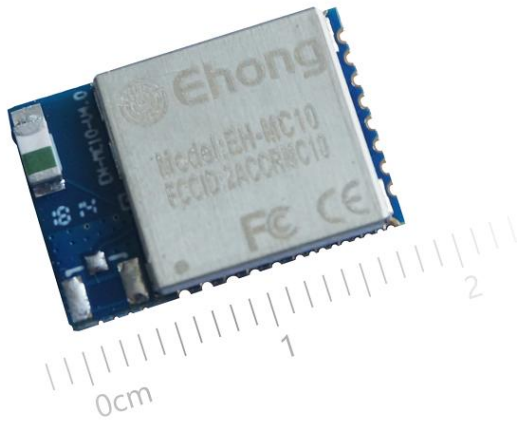
EH-MC10

Bluetooth® technology low energy module



- **Bluetooth® radio**
  - Fully embedded Bluetooth® v4.0 single mode
  - TX power +6 dbm,-92.5dbm RX sensitivity
  - 128-bit encryption security
  - Range up to 100m
  - Integrated chip antenna or U.FL port
  - Multipoint capability(2devices at master)
- **Support profiles**
  - BLE (Master and slave)
  - The generic attribute profile (GATT)
  - Health care, Sports and fitness, Proximity sensing profiles
  - Alerts and timer profiles
- **User interface**
  - Send AT command over UART
  - Firmware upgrade over the air (OTA)
  - Transmit data: 300kbps transmission speed (UART)
  - I2C interface(Master)
  - SPI
  - PWM(4 channal)
- **General I/O**
  - 10 general purpose I/Os
  - 3 analogue I/O (10bit ADC)
- **FCC and Bluetooth® qualified**
- **Single voltage supply: 3.3V typical**
- **Small form factor: 17.70 x 11.95x 2.2mm**
- **Operating temperature range: -40 °C to 85 °C**

Version 2.0
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1. Description

EH-MC10 Bluetooth® low energy single mode module is a single mode device targeted for low power sensors and accessories.

The module offers all Bluetooth® low energy features: radio, stack, profiles and application space for customer applications, so no external processor is needed. The module also provides flexible hardware interfaces to connect sensors, simple user interfaces or even displays directly to the module.

The module can be powered directly with a standard 3V coin cell batteries or pair of AAA batteries. In lowest power sleep mode it consumes only 600nA and will wake up in few hundred microseconds.

After buying Bluetooth® module, we provide free technical support APP of iOS system or APP Android system.

2. Applications

- Sports and fitness
- Healthcare
- Home entertainment
- Office and mobile accessories
- Automotive
- Commercial
- Watches
- Human interface devices

3. EH-MC10 Product numbering

EH-MC10X

A. EH ---------- Company Name(EHong)

B. MC10 ---------- Module Name

C. X ---------- A = Antenna B =U.FL

4. Electrical Characteristics

4.1. Recommended Operation Conditions

Table 1: Recommended Operation Conditions

Operating Condition	Min	Typical	Max	Unit
Operating Temperature Range	-30	--	+80	°C

Battery (VDD_BAT) operation	1.8	--	+3.6	V
I/O Supply Voltage (VDD_PIO)	1.2	--	+3.6	V
AIO input	0	-	+1.3	V
Frequency range	2402		2480	MHz

Table 2：Absolute Maximum Rating

4.2. Absolute Maximum Rating

Rating	Min	Max	Unit
Storage Temperature	-40	+85	°C
Battery (VBAT) operation*	1.8	3.6	V
I/O supply voltage	-0.4	+3.6	V
Other Terminal Voltages except RF	Vss-0.4	VBAT+0.4	V

* Short-term operation up to a maximum of 10% of product lifetime is permissible without damage, but output regulation and other specifications are not guaranteed in excess of 4.2V.

4.3. Input/Output Terminal Characteristics

Table 3: Digital I/O Characteristics

Input Voltage Levels	Min	Typical	Max	Unit
V_{IL} input logic level low	-0.4	-	0.4	V
V_{IH} input logic level high	0.7 x VDD	-	VDD + 0.4	V
T_r/T_f	-	-	25	ns
Output Voltage Levels	**Min**	**Typical**	**Max**	**Unit**
V_{OL} output logic level low, I_{OL} = 4.0mA	-	-	0.4	V
V_{OH} output logic level high, I_{OH} = -4.0mA	0.75 x VDD	-	--	V
T_r/T_f	-	-	5	ns
Input and Tri-state Current	**Min**	**Typical**	**Max**	**Unit**
With strong pull-up	-150	-40	-10	µA
With strong pull-down	10	40	150	µA
With weak pull-up	-5.0	-1.0	-0.33	µA
With weak pull-down	0.33	+1.0	5.0	µA
C_I Input Capacitance	1.0	-	5.0	pF

Table 4: AIO Characteristics

Input Voltage Levels	Min	Typical	Max	Unit
AIO	0	-	1.3	V

Table 5 ESD Protection

Condition	Class	Max Rating
Human Body Model Contact Discharge per JEDEC EIA/JESD22-A114	2	2000V (all pins)
Machine Model Contact Discharge per JEDEC EIA/JESD22-A115	200V	200V (all pins)
Charged Device Model Contact Discharge per JEDEC EIA/JESD22-C101	III	500V (all pins)

4.4. Power Consumption

The current consumption are measured at the VBAT

Table 6: Current Consumption

Mode	Description	Total typical current at 3.3V (average)
Dormant	All functions are shutdown. To wake up toggle the WAKE pin	<600nA
Hibernate	All functions are shutdown except for the sleep clock. The module can wake up on a timer on the sleep clock.	<1.5uA
Deep sleep	VDD=3.3V 1ms wake up time	<5uA
Idea	VDD=3.3V <1us wake up time	1mA
RF RX /TX active (0dBm)	VDD=3.3V VDD_PIO=3.3V	~16mA @3V peak

5. Pinout and Terminal Description

5.1. Pin Configuration

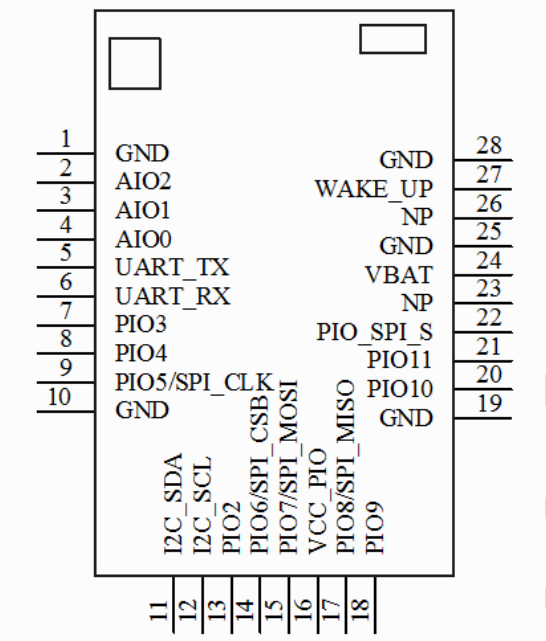

Figure 1： Pinout of EH-MC10

Symbol	Pin	PAD Type	Description
GND	1	Ground	Ground
AIO2	2	Bidirectional analogue	10bit Analogue programmable I/O line
AIO1	3	Bidirectional analogue	10bit Analogue programmable I/O line
AIO0	4	Bidirectional analogue	10bit Analogue programmable I/O line
UART_TX	5	CMOS output, tristate, with weak internal pull-up	UART data output
UART_RX	6	CMOS input with weak internal pull-down	UART data input
PIO3	7	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line PWM or LED Controls
PIO4	8	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line PWM or LED Controls
PIO5/SPI_CLK	9	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line Or debug SPI_CLK select by SPI_PIO_SEL
GND	10	Ground	Ground

I2C_SDA	11	Bi-directional tristate with weak internal pull-up	I2C data input/output or SPI serial flash data output(SF_OUT)
I2C_SCL	12	Input with weak internal pull-up	I2C clock or SPI serial flash clock output (SF_CLK)
PIO2	13	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
PIO6/SPI_CSB	14	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line Or debug chip select, selected by SPI_PIO_SEL
PIO7/SPI_MOSI	15	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line Or debug SPI_MOSI, selected by SPI_PIO_SEL
VCC_PIO	16	Powered	PIO power supply
PIO8/SPI_MISO	17	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line Or debug SPI_MISO, selected by SPI_PIO_SEL
PIO9	18	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line PWM or LED Controls
GND	19	Ground	Ground
PIO10	20	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line PWM or LED Controls
PIO11	21	Bi-directional with programmable strength internal pull-up/down	Programmable input/output line
SPI_PIO_S	22	Input with strong internal pull-down	Selects SPI debug on (8:5)
NP	23	NP	NP
VBAT	24	Power supply	Button cell battery or DC 1.8V to 3.6V
GND	25	Ground	Ground
NP	26	NP	NP
WAKE_UP	27	Input has no internal pull-up or pull-down use external pull-down	Set high to wake the module from hibernate. Use an external pull-down for this pin.
GND	28	Ground	Ground

Table 7： PIN Terminal Description

6. Physical Interfaces

6.1. Power Supply

- The module power supply 3v coin cell batteries or DC 3.3v
- Power supply pin connection capacitor to chip and pin as far as possible close
- Capacitor decouples power to the chip
- Capacitor prevents noise coupling back to power plane.

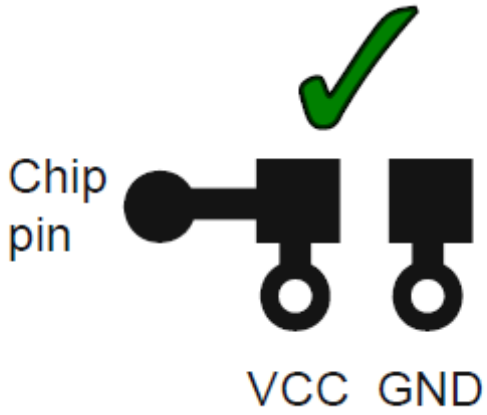

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Figure 2： Power Supply PCB Design

6.2. PIO

10 PIOs are provided (4 are multiplexed with SPI debug interface). They are powered from VDD_PIO.
PIO lines are software-configurable as weak pull-up, weak pull-down, strong pull-up or strong pull-down.
Note:
At reset all PIO lines are inputs with weak pull-downs.
Any of the PIO lines can be configured as interrupt request lines or as wake-up lines from sleep modes.

6.3. AIO

3 AIOs are provided. They can be connected to internal 10 bits ADC. Their functions depend on software. They can be used to read or output a voltage between 0V to 1.3V. Each of them can be used as a digital output with special firmware.

6.4. PWM

4 PIOs (PIO3, PIO4, PIO9, and PIO10) can be driven by internal PWM module. The PWM module also works while the module is sleep. So it can be used as a LED flasher. These functions are controlled by special firmware.

6.5. UART

This is a standard UART interface for communicating with other serial devices. The UART interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

Table 8: Possible UART Settings

Parameter		Possible Values
Baud Rate	Minimum	1200 baud (≤2%Error)
		9600 baud (≤1%Error)
	Maximum	2M baud (≤1%Error)
Flow Control		RTS/CTS or None
Parity		None, Odd or Even
Number of Stop Bits		1 or 2
Bits per Byte		8

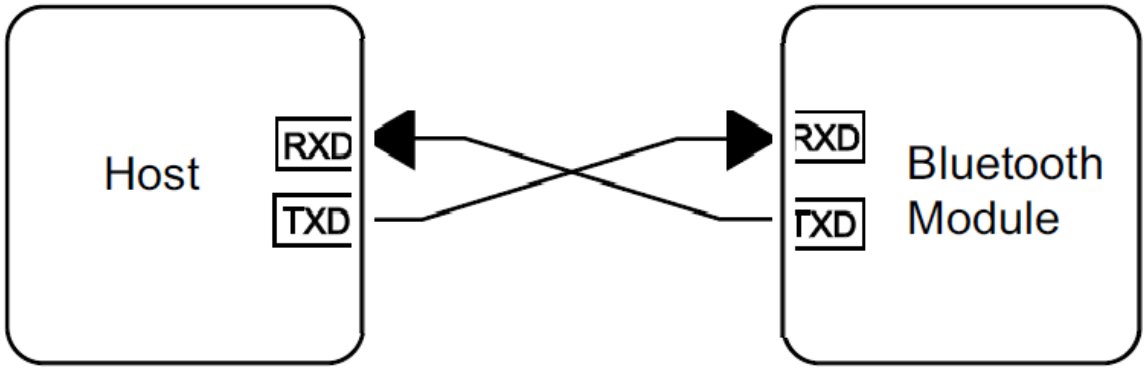

Figure 3: Connection To Host device

6.6. I2C Master

The module can act as an I2C master when configured by software. Any two PIOs can be configured as I2C_SCL and I2C_SDA.

6.7. SPI Master

The module can act as an SPI master (mode 0) when configured by software. Any four PIOs can be configured as SPI_CLK, SPI_CS#, SPI_DIN and SPI_DOUT. The clock rate of the software SPI is around 470kHz.

6.8. SPI Debug

The SPI Debug interface is chosen when SPI_PIO_S is high. The interface is used to program and debug the module. So always place test points or header on PCB for this interface and SPI_PIO_SEL.

7. Reference Design

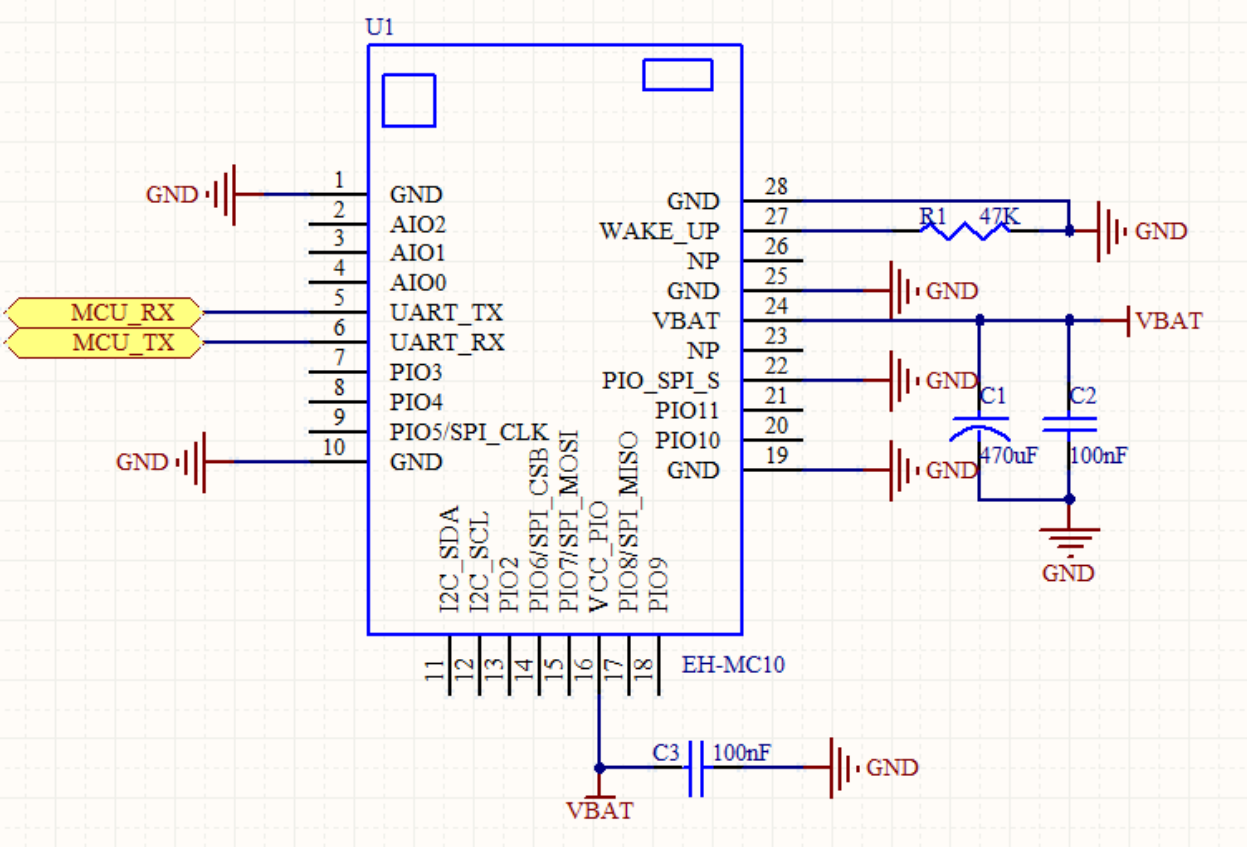

Figure 4: Reference Design

8. Layout and Soldering Considerations

8.1. Soldering Recommendations

EH-MC10 is compatible with industrial standard reflow profile for Pb-free solders. The reflow profile used is dependent on the thermal mass of the entire populated PCB, heat transfer efficiency of the oven and particular type of solder paste used. Consult the datasheet of particular solder paste for profile configurations.
Comply will give following recommendations for soldering the module to ensure reliable solder joint and operation of the module after soldering. Since the profile used is

process and layout dependent, the optimum profile should be studied case by case. Thus following recommendation should be taken as a starting point guide.

- Refer to technical documentations of particular solder paste for profile configurations
- Avoid using more than one flow.
- Reliability of the solder joint and self-alignment of the component are dependent on the solder volume. Minimum of 150um stencil thickness is recommended.
- Aperture size of the stencil should be 1:1 with the pad size.
- A low residue, “no clean” solder paste should be used due to low mounted height of the component.

8.2. Layout Guidelines

For optimal performance of the antenna place the module at the corner of the PCB as shown in the figure 3. Do not place any metal (traces, components, battery etc.) within the clearance area of the antenna. Connect all the GND pins directly to a solid GND plane. Place the GND vias as close to the GND pins as possible. Use good layout practices to avoid any excessive noise coupling to signal lines or supply voltage lines. Avoid placing plastic or any other dielectric material closer than 6 mm from the antenna. Any dielectric closer than 6 mm from the antenna will detune the antenna to lower frequencies.

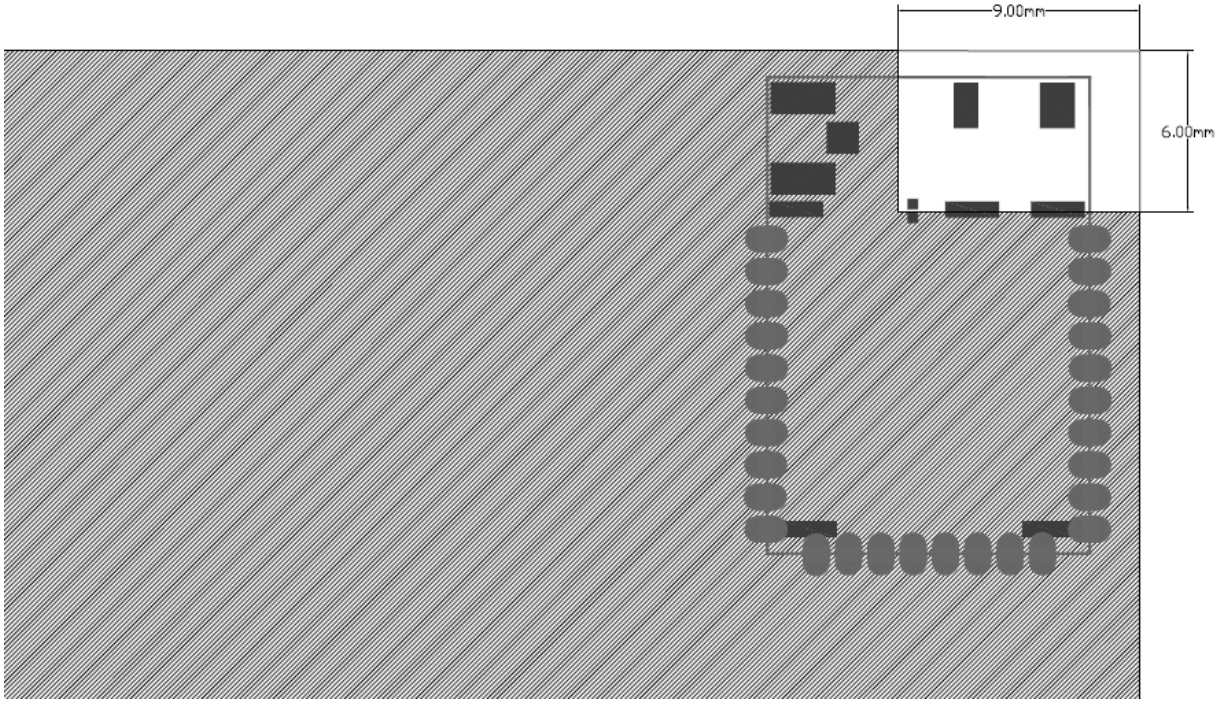

Figure 5: Clearance area of antenna

9. Mechanical and PCB Footprint Characteristics

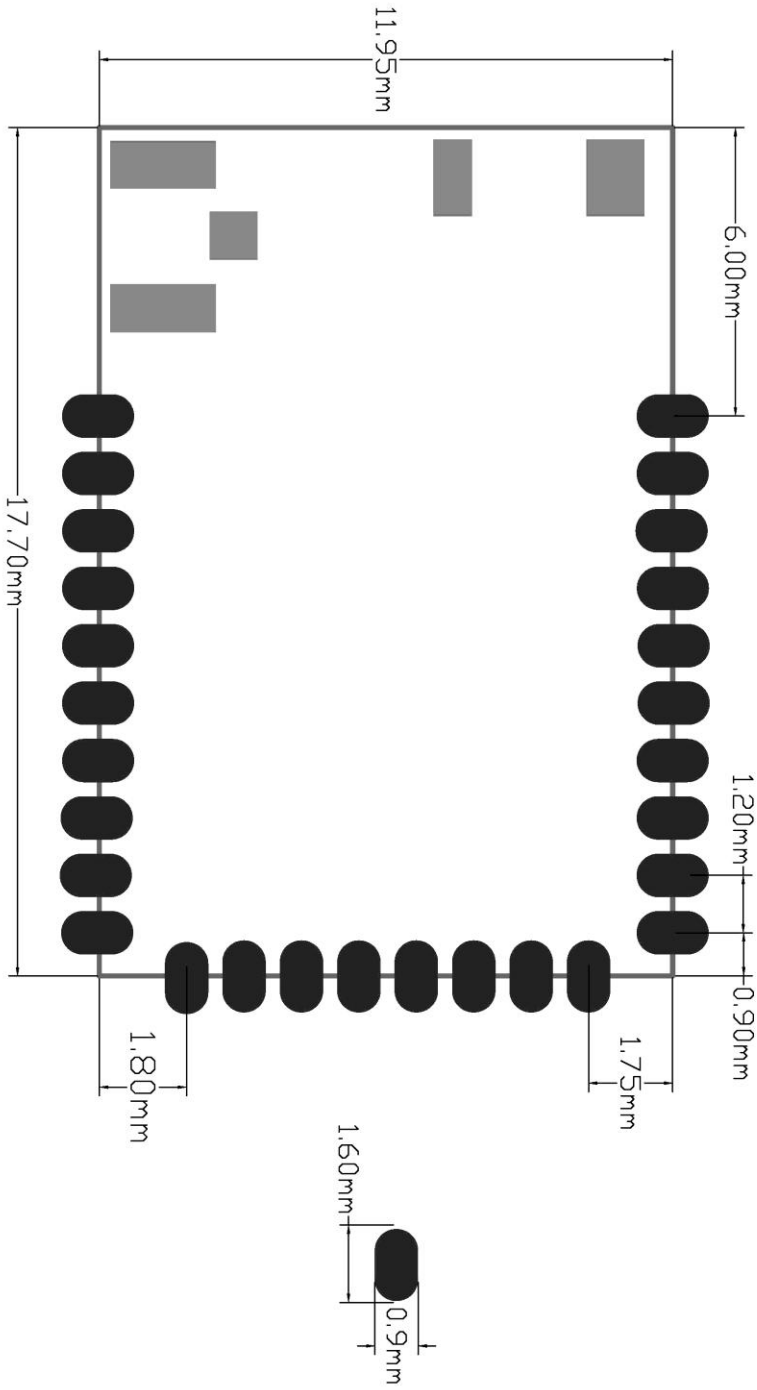

Figure 6： Physical Dimensions and Recommended Footprint (Unit: mm, Deviation:0.02mm)

10. Reflow Profile

The soldering profile depends on various parameters necessitating a set up for each application. The data here is given only for guidance on solder reflow.

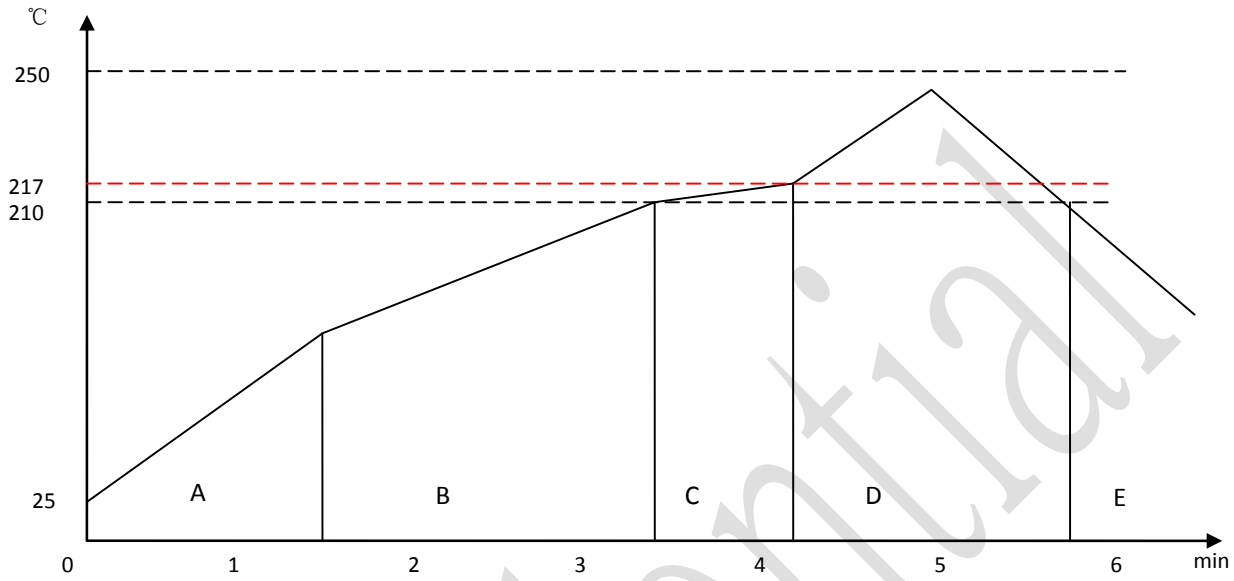

Figure 7: Recommended Reflow Profile

Pre-heat zone (A) — This zone raises the temperature at a controlled rate, **typically 0.5 – 2 °C/s**. The purpose of this zone is to preheat the PCB board and components to 120 ~ 150 °C. This stage is required to distribute the heat uniformly to the PCB board and completely remove solvent to reduce the heat shock to components.

Equilibrium Zone 1 (B) — In this stage the flux becomes soft and uniformly encapsulates solder particles and spread over PCB board, preventing them from being re-oxidized. Also with elevation of temperature and liquefaction of flux, each activator and rosin get activated and start eliminating oxide film formed on the surface of each solder particle and PCB board. **The temperature is recommended to be 150° to 210° for 60 to 120 second for this zone**.

Equilibrium Zone 2 (c) (optional) — In order to resolve the upright component issue, it is recommended to keep the temperature in 210 – 217 ° for about 20 to 30 second.

Reflow Zone (D) — The profile in the figure is designed for Sn/Ag3.0/Cu0.5. It can be a reference for other lead-free solder. The peak temperature should be high enough to achieve good wetting but not so high as to cause component discoloration or damage. Excessive soldering time can lead to intermetallic growth which can result in a brittle joint. The recommended peak temperature (Tp) is 230 ~ 250 °C. The soldering time should be 30 to 90 second when the temperature is above 217 °C.

Cooling Zone (E) — The cooling ate should be fast, to keep the solder grains small which will give a longerlasting joint. **Typical cooling rate should be 4 °C**.

11. Contact Information

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