

# **EH-MC12**

Low Energy Module Data Sheet  
EH-20160823-DS Rev1.0



- **Bluetooth® Radio**

- Fully embedded Bluetooth® v4.2 single mode
- TX power +4 dbm, -90.5dbm RX sensitivity
- 128-bit encryption security
- Range up to 80m
- Integrated chip antenna or U.FL port
- Multipoint capability(2 devices at master)

- **Support Profiles**

- BLE (Master and slave) the same
- The generic attribute profile (GATT)
- Health care, Sports and fitness, Proximity sensing profiles
- Alerts and timer profiles
- Support audio G.722 codec
- HID (keyboards, remote)

- **User Interface**

- UART
- SPI master interface
- Debug SPI interface for programming
- I²C master controller
- 4 x quadrature decoders
- PWM 3D shutter control
- 5 x LED PWMs
- Keyboard scanner
- LCD glass drive
- 10 bit Aux ADC
- IR encoder
- 256 KB internal flash

- **General I/O**

- 15 general purpose I/Os
- 1 analogue I/O (10bit ADC)

- **Voltage supply: 1.4 -- 3.6V typical**

- **Small form factor: 17.70 x 11.95 x 2.2mm**

- **Operating temperature range: -30 °C to 80 °C**

Aug 23, 2016

## VERSION HISTORY

Version	Comment
V1.0	Current consumption added

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## 1. Description

EH-MC12 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 V4.2: 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 1.6uA(no RAM retention and external interrupts enabled) 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

- HID: keyboards, mice, touchpads, advanced remote controls with voice activation
- Sports and fitness sensors: heart rate, runner/cycle speed and cadence
- Health sensors: blood pressure, thermometer and glucose meters
- Mobile accessories: watches, proximity tags, alert tags and camera controls
- Smart home: heating/lighting control

## 3. EH-MC12 Product numbering

# EH-MC12X

- A. EH ----- Company Name(Ehong)
- B. MC12 ----- Module Name (Antenna)
- C. B ----- U.FL Connector

## 4. Electrical Characteristics

### 4.1 Recommended Operation Conditions

Operating Condition	Min	Typical	Max	Unit
Operating Temperature Range	-30	+20	+80	°C
Battery (VDD_BAT) operation	1.4	+3.0	+3.6	V
I/O Supply Voltage (VDD_PIO)	1.4	+3.0	+3.6	V
AIO input	0	-	+1.26	V
Frequency range	2402		2480	MHz

Table 1: Recommended Operation Conditions

### 4.2 Absolute Maximum Rating

Rating	Min	Max	Unit
Storage Temperature	-40	+85	°C
Battery (VBAT) operation*	0	3.6	V
I/O supply voltage	0	+3.6	V

Table 2: Absolute Maximum Rating

\* 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

Input Voltage Levels	Min	Typical	Max	Unit
V <sub>IL</sub> input logic level low	-	-	25% xVDD	V
V <sub>IH</sub> input logic level high	70% x VDD	-	-	V
T <sub>r</sub> /T <sub>f</sub>	-	-	25	ns
Output Voltage Levels	Min	Typical	Max	Unit
V <sub>OL</sub> output logic level low, I <sub>OL</sub> = 8.0mA(Max Drive Strength)	-	-	20%X VDD_PADS	V
V <sub>OH</sub> output logic level high, I <sub>OL</sub> = - 8.0 mA (Max Drive Strength)	80% x VDD	-	--	V
T <sub>r</sub> /T <sub>f</sub> (For 30pF load)	-	-	2	ns
Input and Tri-state Current	Min	Typical	Max	Unit
With strong pull-up	3.5	4.7	6.0	KΩ
With strong pull-down	3.5	4.7	6.0	KΩ

With weak pull-up	8	40	50	μA
With weak pull-down	10	40	50	μA
C <sub>I</sub> Input Capacitance	-	5	-	pF

Table 3: Digital I/O Characteristics

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

Table 4: AIO Characteristics

Condition	Class	Max Rating
Human Body Model Contact Discharge per JEDEC EIA/JESD22-A114	1C	2000V (all pins)
Charged Device Model Contact Discharge per JEDEC EIA/JESD22-C101	C1	500V (all pins)

Table 5 ESD Protection

## 4.4 Power Consumption

The current consumption are measured at the VBAT

Mode	Description	Total typical current at 3.3V (average)
Deep Sleep: No RAM Retention and External Interrupts Enabled	All functions are shut down. To wake the chip, toggle a pre-configured PIO.	1.6 μA
Deep Sleep: No RAM Retention with External Interrupts and Timer Enabled	VDD_PADS = ON VDD_BAT = ON	5.5 μA
Deep Sleep: 16 KB Data RAM Retention	VDD_PADS = ON VDD_BAT = ON RAM = ON Digital Circuits = ON SMPS = ON	10.5 μA
Deep Sleep: 16 KB Data RAM and 64 KB RAM Retention	VDD_PADS = ON VDD_BAT = ON RAM = ON Digital Circuits = ON SMPS = ON	12 μA
Idle: Shallow Sleep	VDD_PADS = ON VDD_BAT = ON RAM = ON Digital Circuits = ON MCU = IDLE <1 μs Wake-up Time	0.75 mA

Idle: Active	VDD_PADS = ON	1.3 mA
	VDD_BAT = ON	(Execution from Cache)
	RAM = ON	
	Digital Circuits = ON	13.5 mA
	MCU = IDLE	(Active SMEM Execution)
	<1 us Wake-up Time	
TX Active	0dBm Transmit Power	5 mA Average
RX Active	90.5dBm Sensitivity	5 mA Average

Table 6: Current Consumption

## 5. Pinout and Terminal Description

### 5.1 Pin Configuration

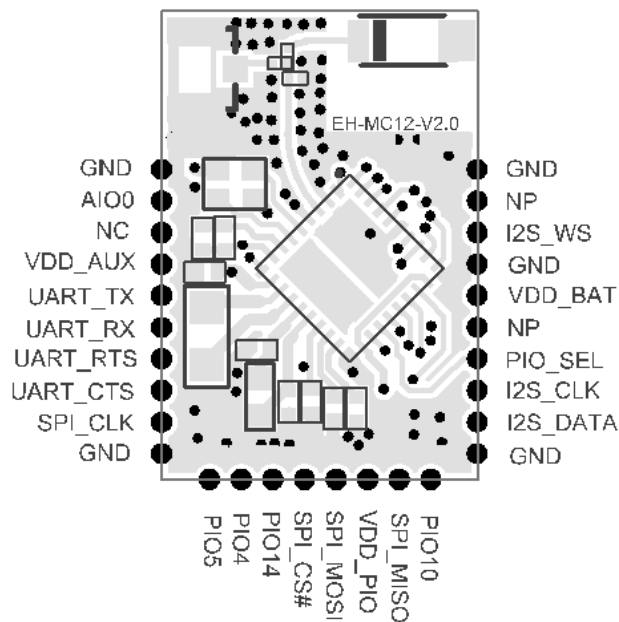


Figure 1: Pinout of EH-MC12

Symbol	Pin	PAD Type	Description
GND	1	Ground	Ground
AIO0	2	Unidirectional analogue	Analogue programmable input line.
NC	3	NC	NC
VDD_AUX	4	SMPS output for the auxiliary rail and AIO port.	SMPS output for the auxiliary rail and AIO port.
PIO8/UART_TX	5	Digital: Bidirectional with programmable strength internal pull-up / pull-down and LCD glass driving capability	UART data output/PIO Line
PIO9/UART_RX	6	Digital: Bidirectional with	UART data input/PIO Line



		programmable strength internal pull-up / pull-down and LCD glass driving capability	
PIO6/UART_RTS	7	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line UART ready to send data (active low output)
PIO7/UART_CTS	8	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line UART ready to receive data (active low input)
PIO0/SPI_CLK	9	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line Or debug SPI_CLK select by SPI_PIO_SEL
GND	10	Ground	Ground
PIO5/I2C_SDA	11	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	I2C data input/output or General programmable I/O
PIO4/I2C_SCL	12	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	I2C clock or General programmable I/O
PIO14	13	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line
PIO1/SPI_CS#	14	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line Or debug chip select, selected by SPI_PIO_SEL
PIO2/SPI_MOSI	15	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line Or debug SPI_MOSI, selected by SPI_PIO_SEL
VCC_PIO	16	Powered	PIO power supply
PIO3/SPI_MISO	17	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line Or debug SPI_MISO, selected by SPI_PIO_SEL
PIO10	18	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line
GND	19	Ground	Ground
I2S_DATA/PIO11	20	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line I2S output data

I2S_CLK/PIO12	21	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line I2S clock
SPI_PIO_S	22	Input with strong internal pull-down	Selects SPI debug
NP	23	NP	NP
VBAT	24	Power supply	Button cell battery or DC 1.8V to 3.6V
GND	25	Ground	Ground
I2S_WS/PIO13	26	Digital: Bidirectional with programmable strength internal pull_up / pull_down and LCD glass driving capability	Programmable input/output line I2S_ word select
NP	27	NP	NP
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.

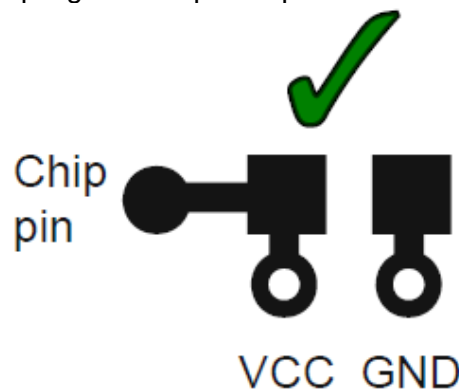


Figure 2: Power Supply PCB Design

### 6.2. PIO

15 lines of programmable bidirectional I/O are provided:

- May be set by the application code or used as an input or to wake the chip.
- Software-configurable as weak pull-up, weak pull-down, strong pull-up or strong pull-down.

- At reset all lines are inputs with weak pull-down.

### 6.3. AIO

EH-MC12 has 1 pin providing a unidirectional analogue programmable input line, AIO[0].10-bits.

**NOTE :** This pin does not provide an output capability.

### 6.4. PWMs

The module has 5 independently configurable PWM instances.

A multipurpose PWM generator provides 3 modes:

- Normal PWM mode:
  - For motor control and general purpose PWM
- 3D Shutter mode:
  - For 3D shutter control
  - Cycle accurate
  - 16bit resolution for all the configuration registers to be specified in clock cycles
  - New configuration applied on update register write or at a specific time (e.g. in response to radio traffic)
  - Variable offset after the reconfiguration can be applied
  - Configurable width of the external sync pulses
- LED mode:
  - For LED fading

### 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.

Parameter		Possible Values
Baud Rate	Minimum	1200 baud ( $\leq 2\%$ Error)
		9600 baud ( $\leq 1\%$ Error)
	Maximum	2M baud ( $\leq 1\%$ Error)
Parity		None, Odd or Even
Number of Stop Bits		1 or 2
Bits per Byte		8

Table 8: Possible UART Settings

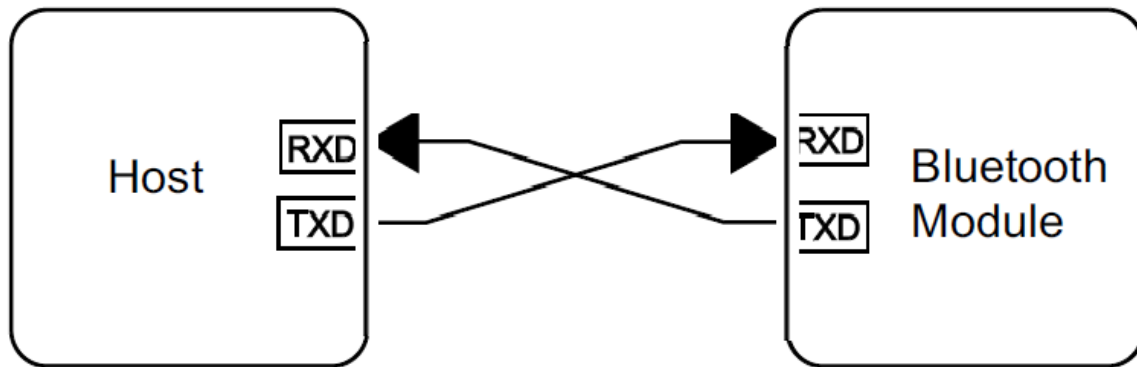


Figure 3: Connection To Host Device

Note: The maximum baud rate is 2400 baud during deep sleep.

## 6.6. I2C Master/ Slave

The module has 1 I<sup>2</sup>C master/slave general interface for communication with external peripherals and sensors:

- Maximum clock speed 1 MHz
- Data transmitting/receiving of variable byte length
- 7-bit and 10-bit addressing modes
- Configurable:
- PIO pins for SCL and SDA
- I<sup>2</sup>C clock: 100 kHz default (software-configurable) at 1:1 duty-cycle (asymmetric if required)
- Supports slave clock stretching
- Fast Mode and Fast Mode+ compatible.

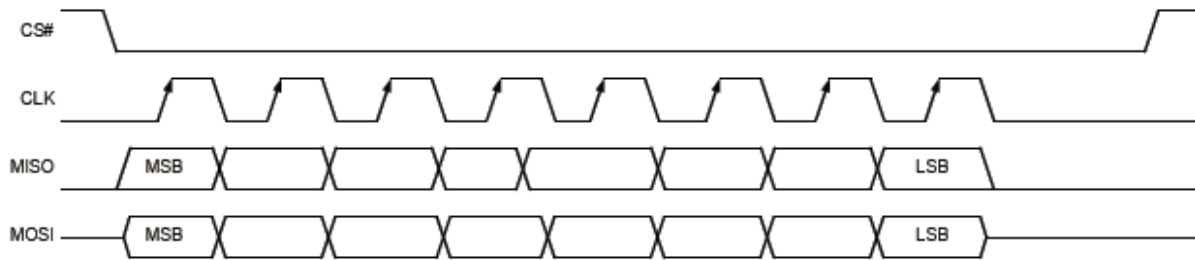
**NOTE** Strong pull is sufficient for I<sup>2</sup>C on all PIO pads.

## 6.7. SPI Master/slave(General)

The module has 1 SPI master/slave general interface for communication with other devices.

It supports:

- SPI master and slave
- All 4 modes supported
- 2 methods of transferring data to memory:
- DMA to/from memory:
- 8-bit or 16-bit word size
- Big and little-endian
- Software reads and writes to FIFOs: variable from 1 to 16 bits
- Interrupt callbacks to processor allow SPI as a slave to indicate that it requires service
- Deep sleep mode (depending on clock)

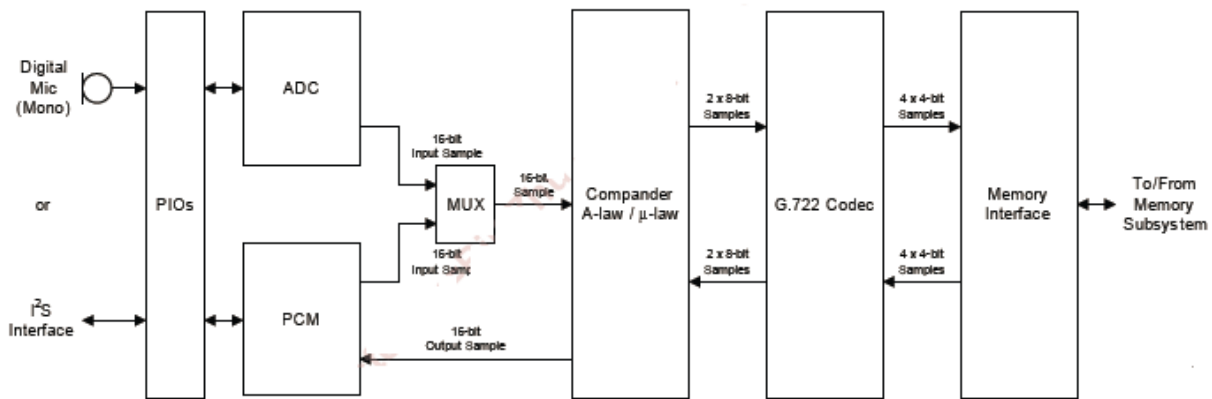


**Figure 4: SPI interface**

## 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.

## 6.9. Audio



**Figure 5: Reference Design**

**NOTE** Digital microphone and I²S input cannot be active at the same time.  
G.722 codec cannot encode and decode at the same time.

### 6.9.1. Digital Microphone

The module has 1 digital microphone input with:

- 1 or 2 Mbps sample rate
- Software selectable as left or right channel
- G.722 encoder or bypass option
- Audio routed to firmware only (not to I²S)
- Software supporting DMIC clock frequencies of 500 kHz, 1 MHz, 2 MHz, and 4 MHz

### 6.9.2. G.722 Codec

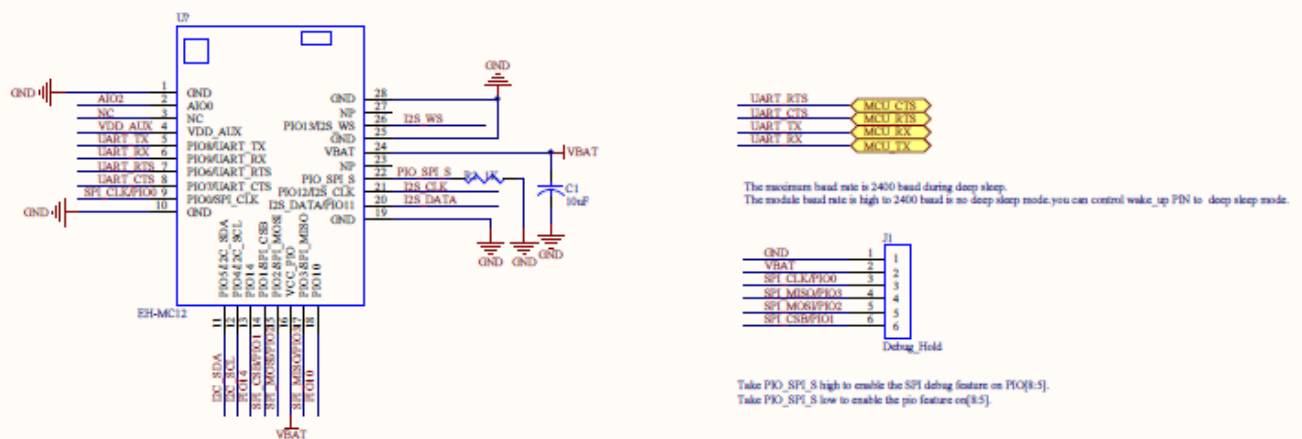
CSR1024 LGA has a G.722 Codec, featuring:

- Output: 48 kbps (optional 56 or 64 kbps)
- Input: 16 kHz/16bits (optional 8 kHz/8bits, 8 kHz/16bits and 16 kHz/8bits)
- Output produces 20 Byte blocks for easy GATT streaming

**NOTE:**

Analogue audio is not provided.

## 7. Reference Design



### Figure 6: 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.

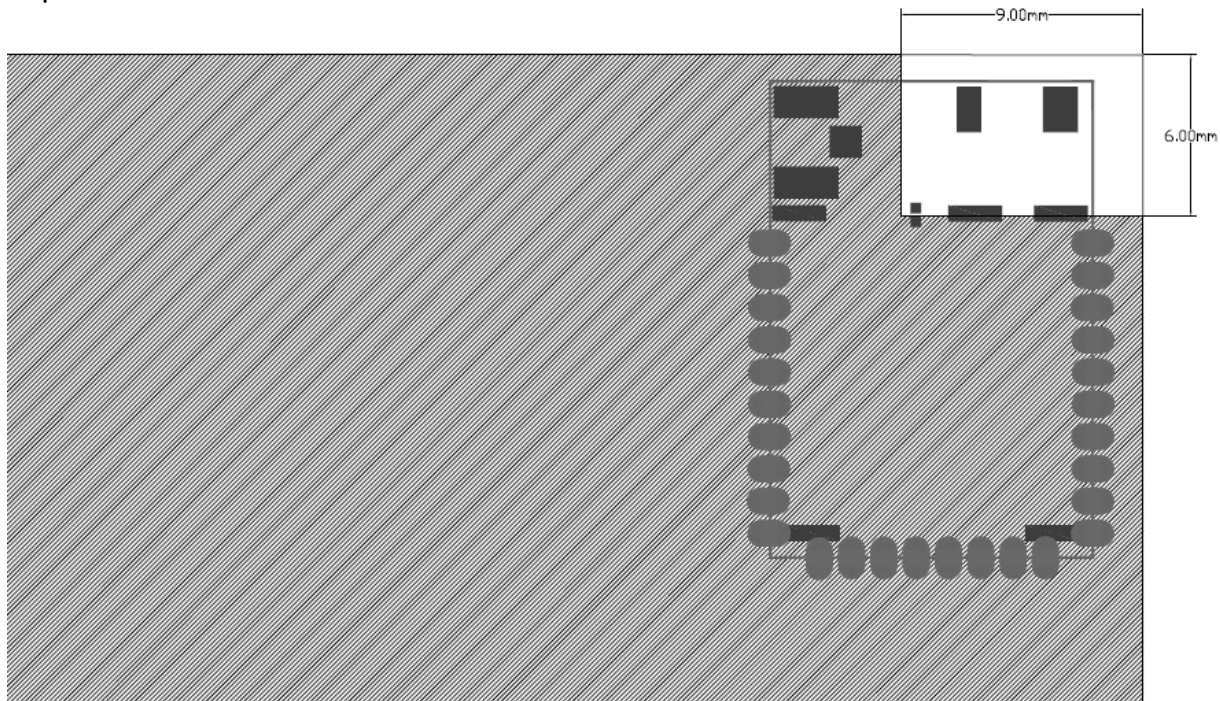
- Refer to technical documentations of particular solder paste for profile configurations



- 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 7: Clearance area of antenna**

## 9. Mechanical and PCB Footprint Characteristics

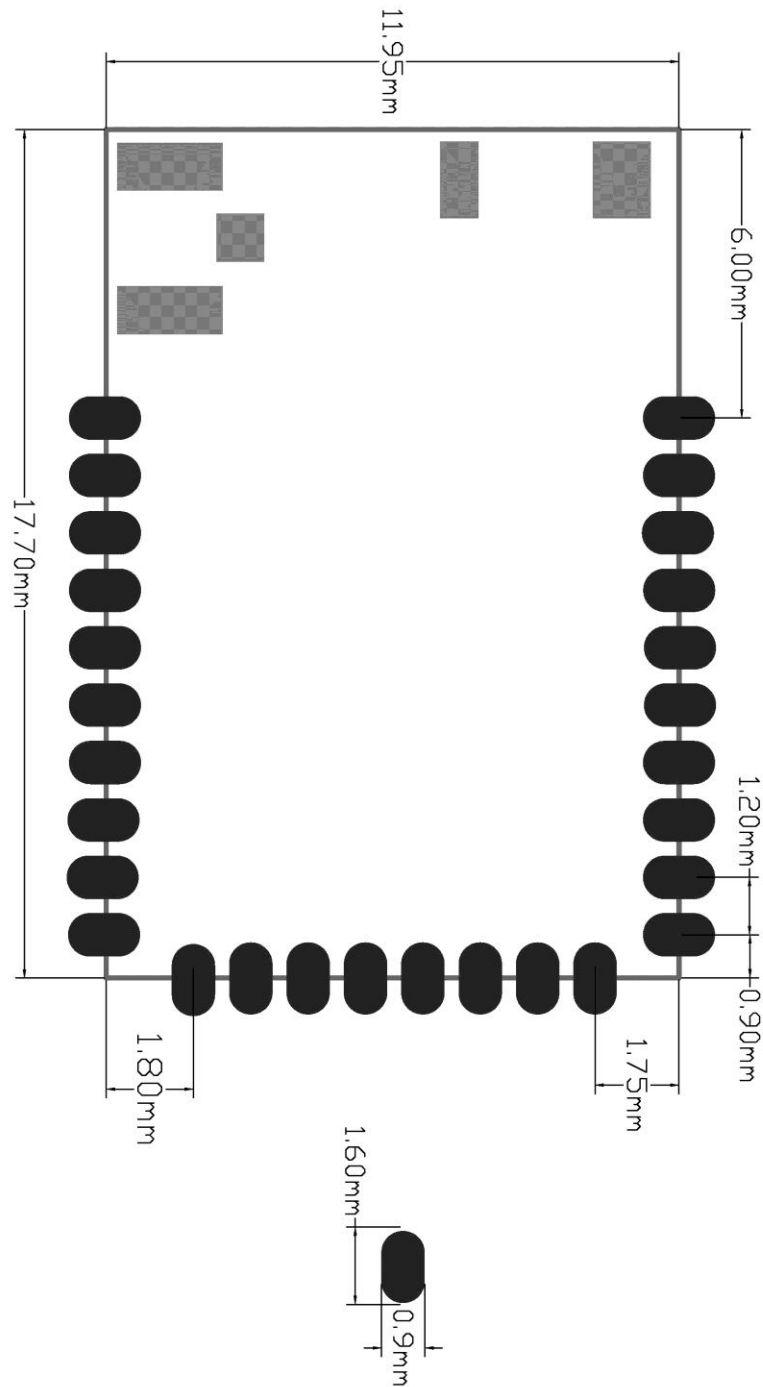
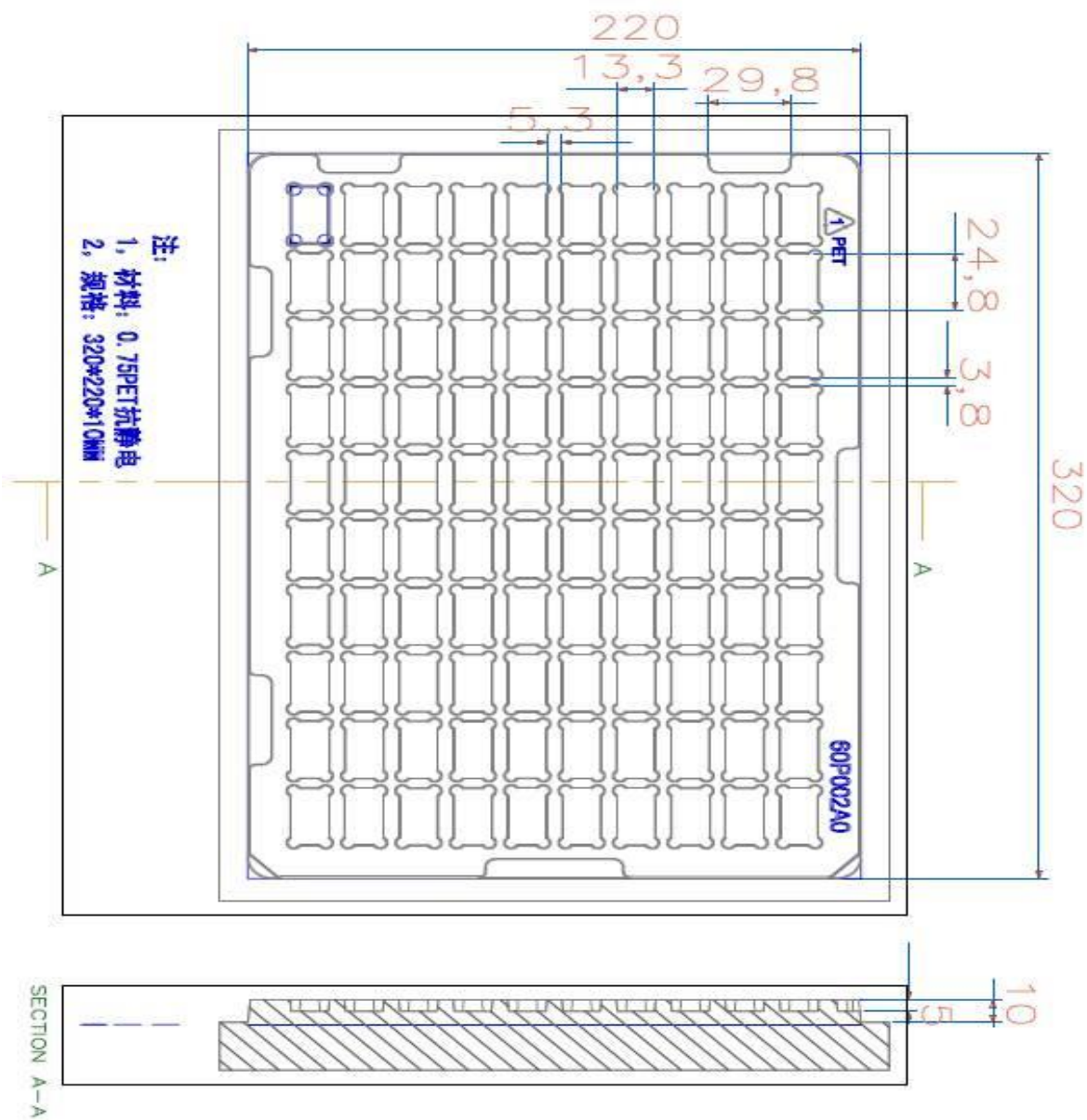


Figure 8: Physical Dimensions and Recommended Footprint (Unit: mm, Deviation:0.02mm)



## 10. Packaging



**Figure 9: EH-MC10 Packaging (Pallet)**

packaging for the pallet, one packaging quantity is 100 PCS。

## 11. Soldering Recommendations

EH-MC12 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.

SMT stencil making requirements

- ✧ If Bluetooth module PIN pitch  $\geq 0.25\text{mm}$  and other component PIN pitch  $\geq 0.25\text{mm}$ , so you choose SMT stencil thickness **0.15mm**.
- ✧ If Bluetooth module PIN pitch  $\geq 0.25\text{mm}$  and other component PIN pitch  $\leq 0.25\text{mm}$ , so you choose SMT Ladder stencil Bluetooth module thickness **0.15mm** other component thickness **0.13mm**.
- ✧ Solder pad open via ratio **Length 1:1.2, width 1:1**.

## 12. Contact Information

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