Bluetooth® technology low energy module

- **Bluetooth® radio**
- Fully embedded Bluetooth® v4.2 single mode
- TX power +4 dbm,-92dbm RX sensitivity@1M
- 128-bit encryption security
- Range up to 50m
- Integrated on board PCB antenna
- Multipoint capability(master and slave at the same time)

- **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)
- USB
- PWM(6 channel)

- **General I/O**
- 10 general purpose I/Os
- 7 analogue I/O (14bit ADC)
- **The price is cheap**
- **Single voltage supply: 3.3V typical**
- **Small form factor: 18.10 x 12.05x 2.2mm**
- **Operating temperature range: -40 °C to 85 °C**

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1. Contents

2. Table of Tables

3. Table of Figures

1. Description

EH-MC20 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 internal integration 32bit MCU and 128KB flash, external interface is rich （AIO,PWM,UART,USB）, and the price is cheap.

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-MC20 Product numbering

EH-MC20

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

B. MC20 ------------ Module Name

4. Electrical Characteristics

4.1. Recommended Operation Conditions

Table 1: Recommended Operation Conditions

Operating Condition	Min	Typical	Max	Unit
Operating Temperature Range	-40	--	+85	°C
Battery (VDD_BAT) operation	1.9	--	+3.6	V
I/O Supply Voltage (VDD_PIO)	1.9	--	+3.6	V
AIO input	0	-	+1.9	V
Frequency range	2402		2480	MHz

Table 2：Absolute Maximum Rating

4.2. Absolute Maximum Rating

Rating	Min	Max	Unit
Storage Temperature	-65	+150	°C
Battery (VBAT) operation*	-0.3	3.9	V
I/O supply voltage	-0.3	+VDD+0.3	V

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	**VSS**	-	0.3VDD	V
V_{IH} input logic level high	0.7 x VDD	-	VDD	V
Output Voltage Levels	**Min**	**Typical**	**Max**	**Unit**
V_{OL} output logic level low, I_{OL} = 4.0mA	VSS	-	0.3VDD	V
V_{OH} output logic level high, I_{OH} = -4.0mA	VDD-0.3	-	VDD	V

Table 4: AIO Characteristics

Input Voltage Levels	Min	Typical	Max	Unit
AIO	0	-	3.3	V

4.4. Power Consumption

The current consumption are measured at the VBAT

Table 5: Current Consumption

Item	Sym	Min	Typ	Max	Unit	condition
TX	I_{Tx}		15		mA	Continuous Tx Transmission 0db output power
RX	I_{RX}		12		mA	Continuous Tx reception
Suspend Current	I_{susp}	-	10	50	uA	IO wakeup
	I_{susp}	-	12	52	uA	Timer wakeup
Deep sleep Current	I_{deep}	-	2	5	uA	

5. Pinout and Terminal Description

5.1. Pin Configuration
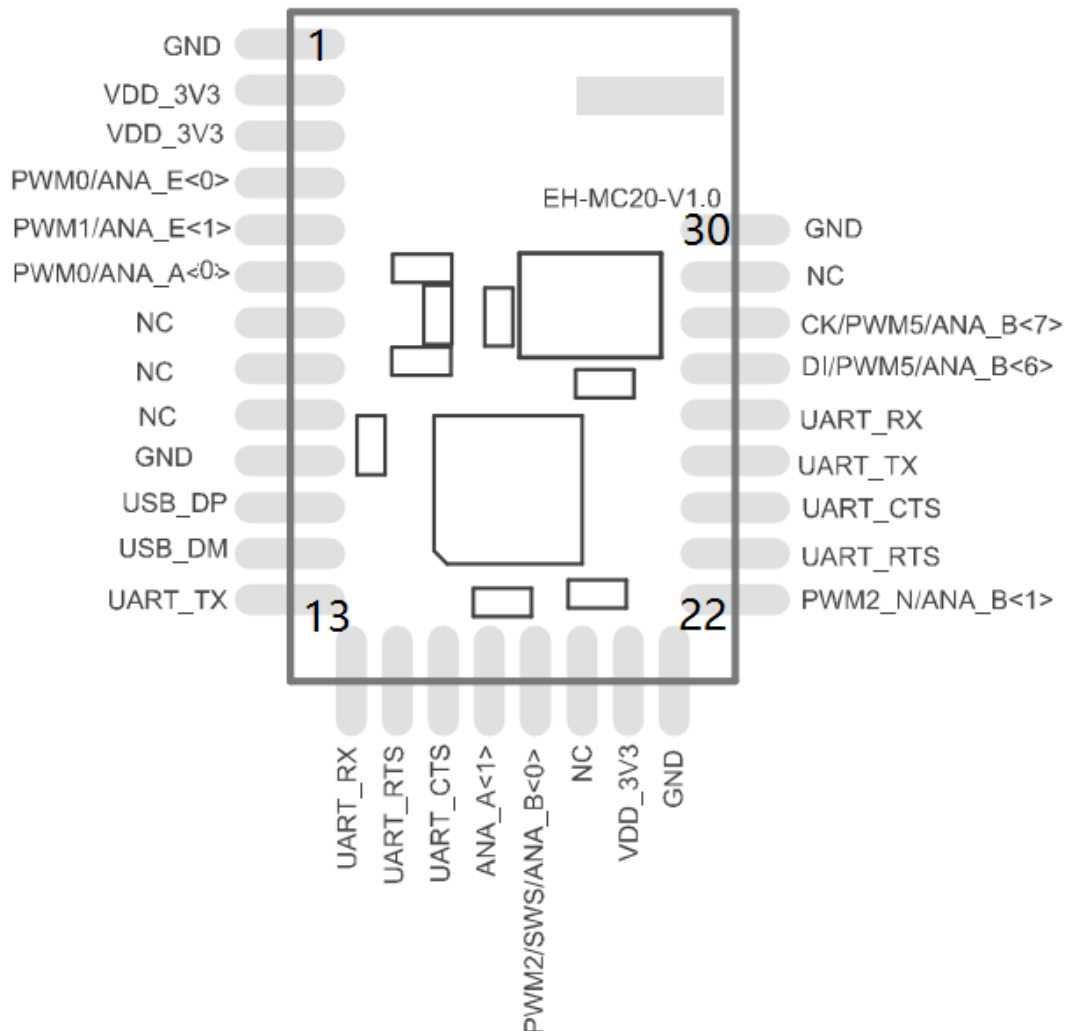
Figure 1： Pinout of EH-MC20

Symbol	Pin	PAD Type	Description
GND	1	Ground	Ground
VDD_3V3	2	Power supply	Button cell battery or DC 1.8V to 3.6V
VDD_3V3	3	Power supply	Button cell battery or DC 1.8V to 3.6V
PWM0/ANA_E(0)	4	Digital I/O	PWM0/GPIO/ANA_E0
PWM1/ANA_E(1)	5	Digital I/O	PWM1/GPIO/ANA_E1
PWM0/ANA_A(0)	6	Digital I/O	PWM0/GPIO/ANA_A0

NC	7	NC	NC
NC	8	NC	NC
NC	9	NC	NC
GND	10	Ground	Ground
USB_DP	11	Digital I/O	USB data positive/GPIO/ANA_E3
USB_DM	12	Digital I/O	USB data Minus/GPIO/ANA_E3
UART_TX	13	Digital I/O	UART_TX/PWM2/GPIO/ANA_C2 Optional 32KHz crystal output
UART_RX	14	Digital I/O	UART_TX/PWM3/GPIO/ANA_C3 Optional 32KHz crystal input
UART_RTS	15	Digital I/O	UART_RTS/PWM3/GPIO/ANA_C4
UART_CTS	16	Digital I/O	UART_RTS/PWM4/GPIO/ANA_C4
ANA_A(1)	17	Digital I/O	ANA_A1
PWM2/SW/ANA_B(0)	18	Digital I/O	PWM2/single wire slave/GPIO/ANA_B(0)
NC	19	NC	NC
VDD_3V3	20	Power Supply	Button cell battery or DC 1.8V to 3.6V
GND	21	Ground	Ground
PWM2_N/ANA_B(1)	22	Digital I/O	PWM2 inverting/GPIO/ANA_B1
UART_RTS	23	Digital I/O	UART_RTS/PWM3/GPIO/ANA_C4
UART_CTS	24	Digital I/O	UART_RTS/PWM4/GPIO/ANA_C4
UART_TX	25	Digital I/O	UART_TX/PWM2/GPIO/ANA_C2 Optional 32KHz crystal output
UART_RX	26	Digital I/O	UART_TX/PWM3/GPIO/ANA_C3 Optional 32KHz crystal input
DI/PWM5/ANA_B(6)	27	Digital I/O	I2C_SDA/PWM5/GPIO/ANA_B6

CK/PWM5/ANA_B(7)	28	Digital I/O	I2C_CLK/PWM5 inverting/GPIO/ANA_B7
NC	29	NC	NC
GND	30	Ground	Ground

Table 6：PIN Terminal Description

Note:
A. UART_TX > PIN13 and PIN25 are the same PIN and feature.
B. UART_RX>PIN14 and PIN26 are the same PIN and feature.
C. UART_RTS>PIN15 and PIN23 are the same PIN and feature.
D. UART_CTS>PIN16 and PIN24 are the same PIN and feature

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
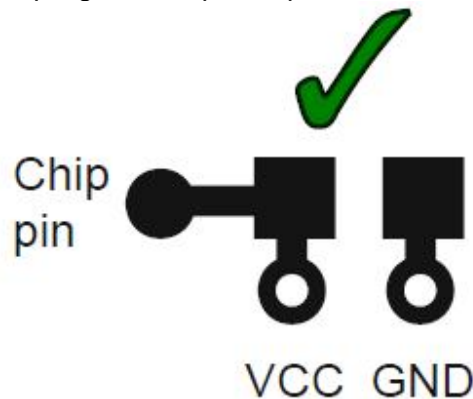- Capacitor prevents noise coupling back to power plane.

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Figure 2： Power Supply PCB Design

6.2. PIO

14 PIOs are provided . They are powered from VDD.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.

6.3. AIO

14 AIOs are provided. They can be connected to internal 14 bits ADC. Their functions depend on software.

6.4. PWM

6 PIOs 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 and Support UART hardware flow control.The UART interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

Table 7: Possible UART Settings

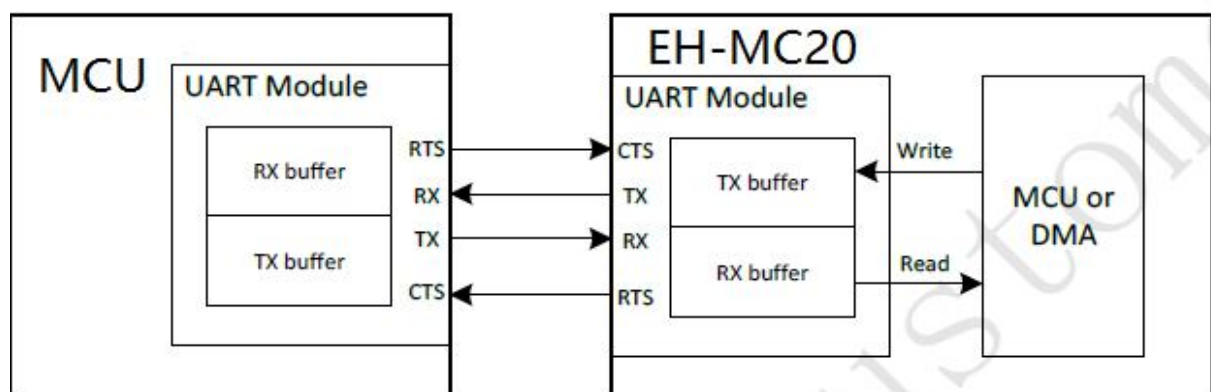| Parameter		Possible Values
Baud Rate	Minimum	1200 baud (≤2%Error)
		9600 baud (≤1%Error)
	Maximum	2M baud (≤1%Error)
Flow Control		RTS/CTS
Parity		None, Odd or Even
Number of Stop Bits		1 or 2
Bits per Byte		8

Figure 3： Connection To Host device

6.6. USB interface

USB interface compatible with USB 2.0 full speed mode, support 9 endpoints, support ISP (In-system programming) Via USB port.

6.7. I2C Master

The module can act as an I2C master when configured by software. The module PIN27 and PIN28 two PIOs can be configured as I2C_SCL and I2C_SDA.
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6.8. SPI Debug

The module support single wire interface SWM(single wire master) and SWS(single wire slave) represent the master and slave device of the single wire communication system developed by Ehong. The maximum data rate can be up to 2Mbps.

7. Reference Design
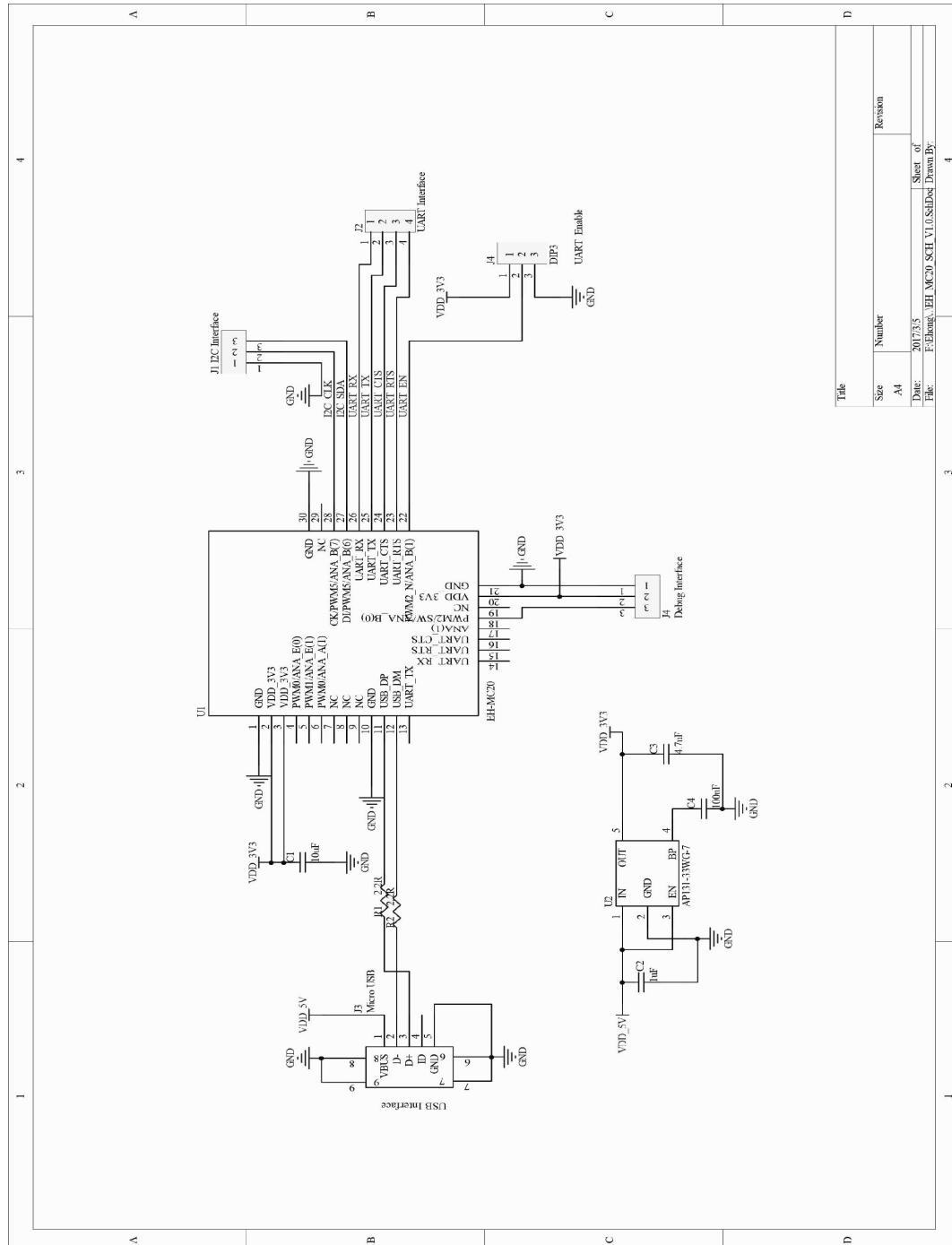
Figure 4： Reference Design

Note:

Please keep pulling up the WAKE pin during sending data to the module.

8. Layout and Soldering Considerations

8.1. Soldering Recommendations

EH-MC20 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.
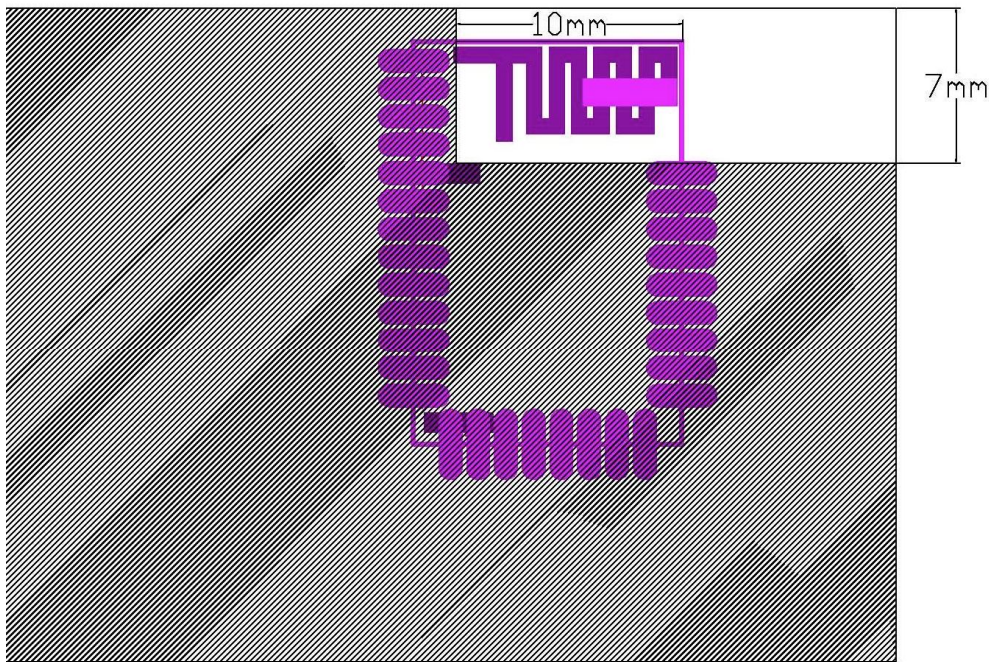
Figure 5: Clearance area of antenna
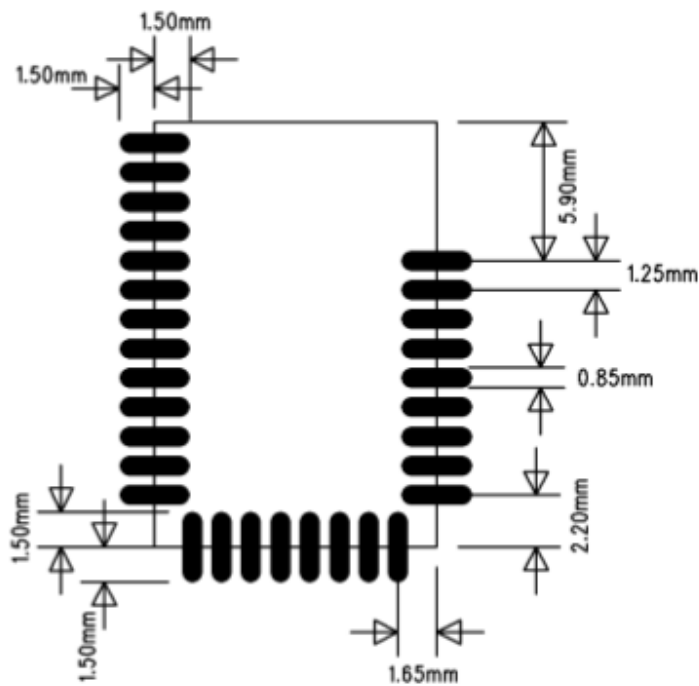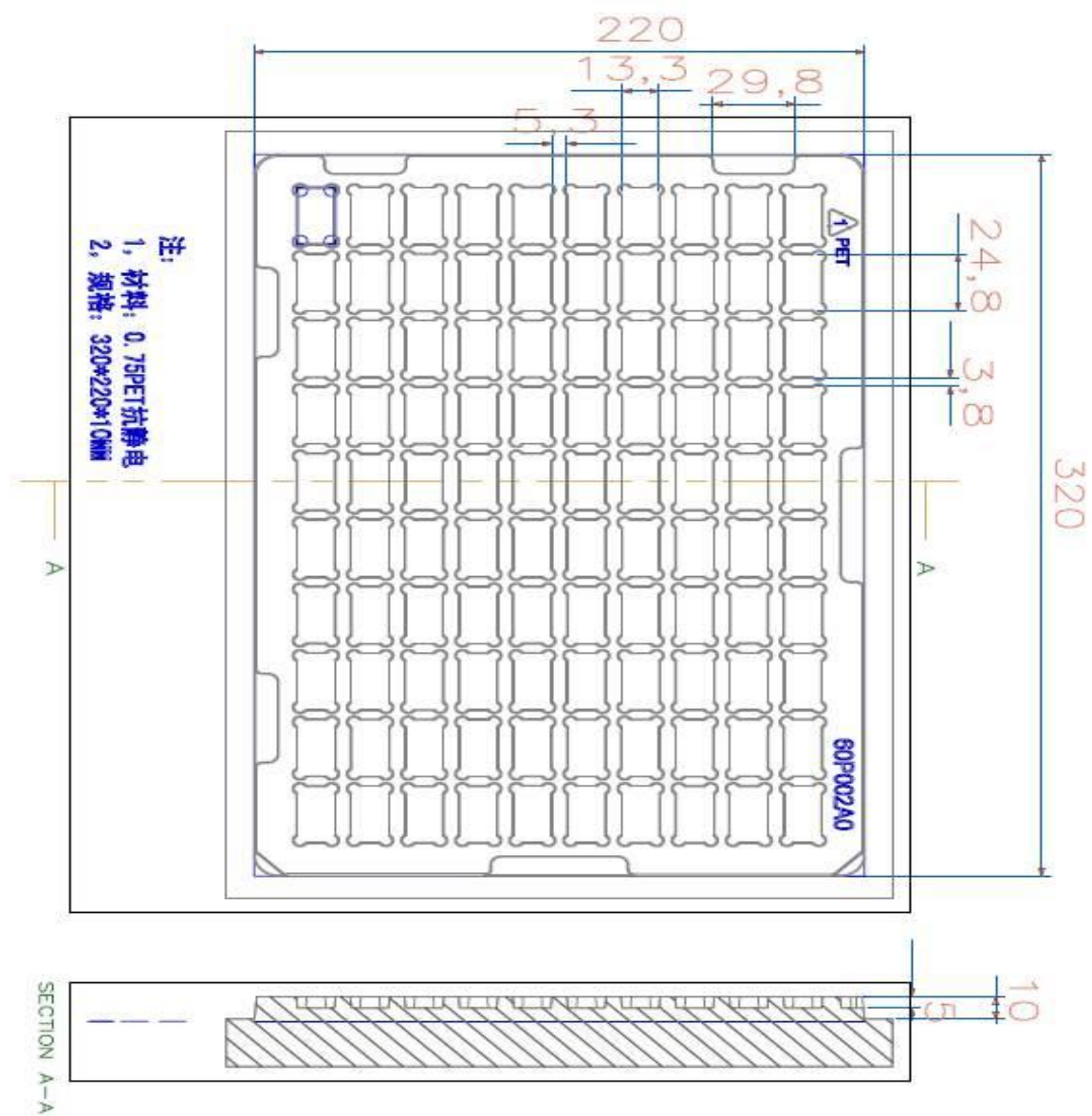
9. Mechanical and PCB Footprint Characteristics

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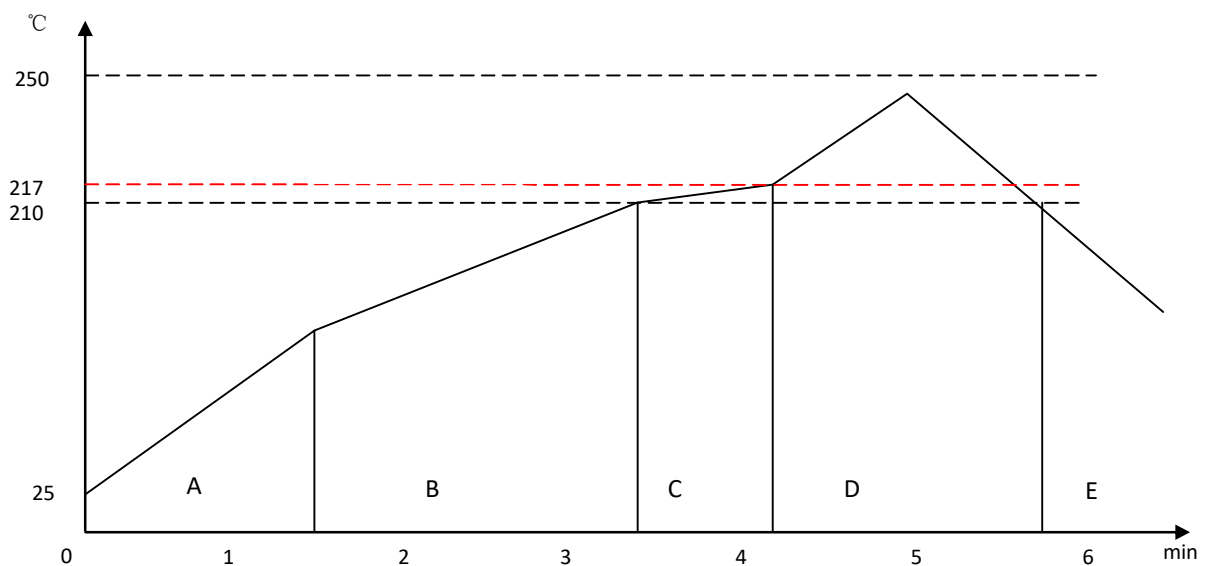
10. Packaging

Figure 7: EH-MC20 Packaging（Pallet）

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

11. 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 8: 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**.

12.   Contact Information

Sales: sales@ehlink.com.cn
Technical support: support@ehlink.com.cn
Phone: +86 21 64769993
Fax: +86 21 64765833
Street address: Rom1505, Blk 1st ,No.833 South Hong mei Rd ,Ming hang district shanghai

FCC/IC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module.
For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to
show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's
intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has
to apply the appropriate equipment authorization (e.g. Verification) for the new host device per
definition in §15.101.

Integrator is reminded to assure that these installation instructions
will not be made available to the end-user of the final host device.

The final host device, into which this RF Module isintegrated" hasto be labelled
with an auxilliary lable stating the FCC IDofthe RF Module,such as
"Contains FCC ID:2ACCRMC20

"This device complies with part 15 of the FCC rules. Operation is subject to the following two
conditions:
(1)this devicemay not cause harmful interference, and
(2)this devicemust accept any interference received, including
interference thatmay cause undesired operation."

"Changes or modifications to this unit not expressly
approved by the party responsible for compliance could
void the user's authority to operate the equipment."

the Integrator will be responsible to satisfy SAR/ RF Exposure requirements,
when the module integrated into the host device.

The final host device, into which this RF Module isintegrated" hasto be labelled
with an auxilliary lable stating the IC ofthe RF Module,such as
"Contains transmitter module IC:20625-EHMC20

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is
subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause
undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils
radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le
brouillage est susceptible d'en compromettre le fonctionnement.

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

This transmitter/module must not be collocated or operating in conjunction with

any other antenna or transmitter.

Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.

2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.

3) The module contains power supply regulation on the module.

4) The module contains a permanently attached antenna.

5) The module demonstrates compliance in a stand-alone configuration.

6) The module is labeled with its permanently affixed FCC ID label

7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.

8) The module complies with RF exposure requirements.