E79-900DM2005S User Manual

CC1352P Dual Band SoC Wireless Module



Chengdu Ebyte Electronic Technology Co.,Ltd.

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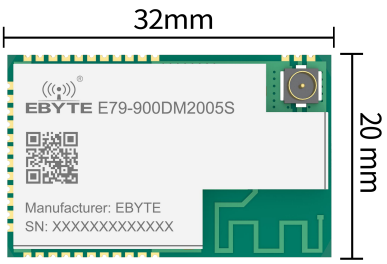
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1.Overview

1.1 Introduction



Based on TI CC1352P chip, E79-900DM2005S is a dual-band ARM-based RF SoC Module designed by Ebyte, with max transmitting power of 20dBm at SUB-1GHz and 5dBm at 2.4GHz. The module integrates a high-performance wireless transceiver and a low temperature drift industrial crystal oscillator.

Presenting all the IO interfaces of the micro-controller and integrating a powerful 48 MHz Arm ® Cortex ® -M4F processor, high-performance power amplifier, powerful peripherals and up to 26 GPIOs for multi-faceted development, The module can be developed into many application fields. It is an excellent choice for wireless micro-controller for Smart home, IoT upgrading and industrial automation etc.

The module is a hardware platform and cannot be used directly. Users need to conduct secondary development.

1.2 Main Features:

- Built-in high-performance low-power Arm ® Cortex ® -M4F processor with clock speeds up to 48MHz;
- Rich resources, 352KB FLASH, 80KB RAM;
- 2.1~3.8V power supply voltage, Above 3.3V can guarantee the best performance;
- Maximum transmitting power 20dBm@ SUB-1GHz/5dBm@ 2.4GHz, multi-level adjustable from software;
- Under ideal conditions, the communication distance can reach 1.5km@SUB-1GHz/120m@2.4G;
- Module contains 48M high speed crystal / 32.768k low speed crystal;
- Industrial grade standard design, support long-term use from -40 to +85 °C;
- Double antennas are optional (IPEX/stamp hole), users can choose according to your own needs;
- 2 pin cJTAG and JTAG debugging;
- Wireless upgrade (OTA);
- Dual-band sub-1GHz and 2.4GHz RF transceivers compatible with Bluetooth 5 and IEEE 802.15.4 PHY and MAC standards;
- Excellent receiver sensitivity: –122dBm (SimpleLink long-distance), –110dBm (50kbps), –103dBm (Low-Power Bluetooth 5 encoding).

1.3 Applications:

- Smart grid and automatic meter reading

– water meters, gas meters and electricity meters

– heat distribution table

– gateway

- Wireless sensor network

– Remote sensor security system, positioning system

- Industry

– Asset tracking and management

– Factory automation

– remote display

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- Wireless healthcare application
- Energy harvesting application
- Electronic shelf label (ESL)
- Home and building automation

– Wireless alert and security system

– Security lock

– Lighting control

– Motion detector

– Household appliances

– HVAC

– Garage door opener wireless remote control, drone

2. Parameters:

2.1 Limit Parameters:

Main Parameters	Value		Remarks
	Min.	Max	
Input Voltage(V)	0	3.8	Permanent damage occurred when voltage is over 3.8V
Blocking Power(dBm)	-	10	Low chance to be damaged for short-distance transceiving
Working Temp.(℃)	-40	+85	Industrial Grade

2.2 Working Parameters:

SUB-1GHz Parameters:

Main Parameters		Value			Remarks
		Min.	Typical	Max.	
Working Voltage(V)		2.1	3.3	3.8	Voltage above 3.3V can guaranty Max TX power
Tx Electrical Level(V)			3.3		5V TTL could cause permanent damage
Working Temp (℃)		-40	-	+85	Industrial Grade
Working Frequency (MHz)		861	-	941	Applicable for ISM channel
Power Consumption	TX Current(mA)		75		Instantaneous power
	RX Current(mA)		6.5		/
	Sleeping Current(μA)		2		Software off
Max TX Power(dBm)		19	20.0	20.5	/
RX Sensitivity(dBm)			-122		At 2.5 kbps air rate

2.4G Parameters:

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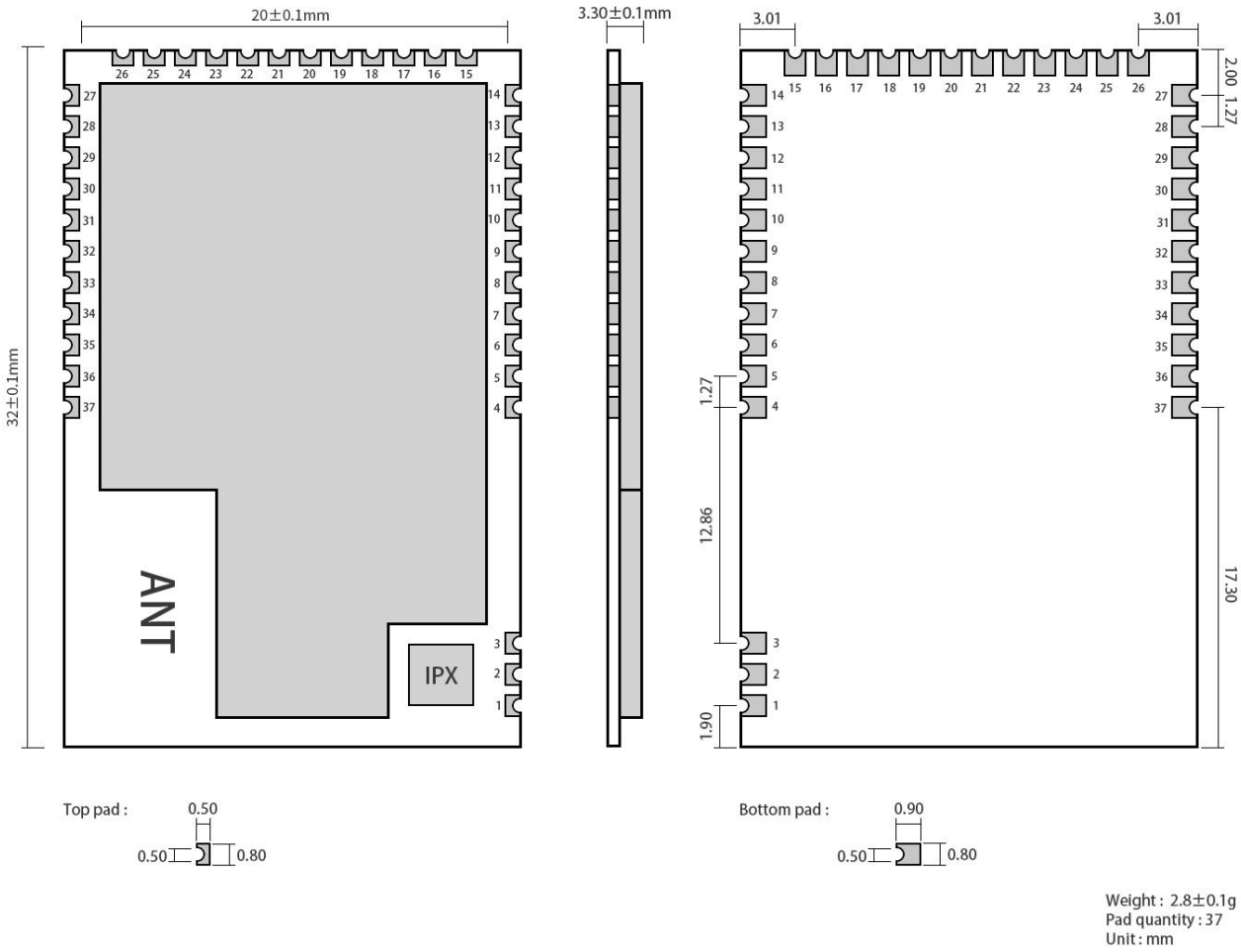
Main Parameters		Value			Remarks
		Min.	Typical	Max.	
Working Voltage(V)		1.8	3.3	3.8	Voltage above 3.3V can guaranty Max TX power
Tx Electrical Level(V)			3.3		5V TTL could cause permanent damage
Working Temp (℃)		-40	-	+85	Industrial Grade
Working Frequency (MHz)		2360	-	2500	Applicable for ISM channel
Power Consumption	TX Current(mA)	/	10.5	/	Instantaneous power
	RX Current(mA)	/	7.5	/	
Max TX Power(dBm)		4	4.5	5	/
RX Sensitivity(dBm)		/	-103	/	BLE 5 Coding

Parameters	Value	Remarks
Reference Range	1500m@SUB-1GHz	Conditions: Clear Sky, Antenna Gain 5dBi, Antenna Height 2.5m, Air rate 1kbps
	120m@2.4G	Conditions: Clear Sky, Antenna Gain 5dBi, Antenna Height 2.5m, Air rate 1Mbps
TCXO Frequency	48MHz/32.768k	High rate at 48MHz/Low Rate at 32.768k
Protocol	GFSK	/
Encapsulation	SMD	/
Interface Type	1.27mm Stamp Hole	/
IC Model	CC1352P1F3RGZ	/
FLASH	352KB	/
RAM	80KB	/
Core	Arm ® Cortex ® -M4F	/
Size	32*20mm	/
Antenna Interfaces	IPEX/Stamp Hole@sub-1G, PCB Antenna@2.4G	Equivalent Impedance is around 50Ω

3. Sizes and Pins Definition

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No.	Name	Type	Functions
1	GND	Input/Output	Ground wire, connected to the power reference ground
2	ANT	Input/Output	Antenna interface, stamp hole (50 ohm characteristic impedance)
3	GND	Input/Output	Ground wire, connected to the power reference ground
4	GND	Input/Output	Ground wire, connected to the power reference ground
5	DIO_7	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
6	DIO_8	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
7	DIO_9	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
8	DIO_10	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
9	DIO_11	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
10	DIO_12	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
11	DIO_13	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
12	DIO_14	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
13	DIO_15	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
14	GND	Input/Output	Ground wire, connected to the power reference ground
15	GND	Input/Output	Ground wire, connected to the power reference ground
16	JTAG_TMSC	Input/Output	JTAG_TMSC
17	JTAG_TCKC	Input	JTAG_TCKC

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18	DIO_16	Input/Output	Configurable universal IO, JYAG Port (see CC1352P1F3RGZ Manual)
19	DIO_17	Input/Output	Configurable universal IO, JYAG Port (see CC1352P1F3RGZ Manual)
20	DIO_18	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
21	DIO_19	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
22	DIO_20	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
23	DIO_21	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
24	DIO_22	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
25	RESET_N	Input	Reset Pin
26	GND	Input/Output	Ground wire, connected to the power reference ground
27	GND	Input/Output	Ground wire, connected to the power reference ground
28	DIO_23	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
29	DIO_28	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
30	DIO_27	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
31	DIO_24	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
32	DIO_25	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
33	DIO_26	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
34	DIO_29	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
35	DIO_30	Input/Output	Configurable universal IO Port (see CC1352P1F3RGZ Manual)
36	VCC	Input/Output	Module power supply positive reference voltage, voltage range 1.8 ~ 3.8V
37	GND	Input/Output	Ground wire, connected to the power reference ground

4. Programming and Testing:

No	Name	Notice
1	Burning Program	The module is a SOC module, comes with a GPIO port, please download program by XDS100 downloader.
2	Test Board	Not available from Ebyte

5. User Guide

5.1 Notice for Hardware

- It is recommended to use DC stabilized power supply. The power supply ripple factor should be as small as possible, and the module should be reliably grounded.
- Please ensure that the positive and negative poles of the power supply are properly connected. If the reverse connection is made, the module may be permanently damaged.
- Please ensure the power supply voltage is within the working voltage range. If the maximum voltage is exceeded, the module will be permanently damaged.
- Please check the stability of the power supply, and the voltage cannot be fluctuated frequently;
- When designing the power supply circuit for the module, it is recommended to reserve more than 30% of the margin to

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achieve long-term stable operation of the system;

- The installation location of the module should be as far away as possible from the power supply, transformers, high-frequency wiring and other parts with large electromagnetic interference;
- High-frequency digital routing, high-frequency analog routing, and power routing must avoid module locations. If the wiring must pass under the module, assuming that the module is soldered to the Top Layer, the area where the module is in contact with the Top Layer should be covered with copper (all copper is well grounded), and the area must be close to the digital part of the module and routed in the Bottom Layer;
- If the module is soldered or placed in the Top Layer, it is wrong to randomly route on the Bottom Layer or other layers, which will affect the spurs and receiving sensitivity of the module to varying degrees;
- If there is a device with large electromagnetic interference around the module, it will greatly affect the performance of the module. It is recommended to maintain the distance from the module according to the strength of the interference. If circumstances permit, it is recommended to do proper isolation and shielding;
- If there are wirings with large electromagnetic interference around the module (such as high frequency digital, high frequency analog, power line), the performance of the module will be greatly affected. It is recommended to do proper isolation and shielding;
- Try to keep the module away from some physical layers such as the 2.4GHz TTL protocol, for example: USB3.0;
- The antenna installation structure has a great influence on the performance of the module. Make sure that the antenna is exposed and preferably vertical. When the module is installed inside the casing, it is recommended to use a good antenna extension cable to extend the antenna to the outside of the casing;
- The antenna must not be installed inside the metal case, which will greatly reduce the transmission distance.

5.2 Programming

- The core of this module is CC1352P, and the user can operate according to the CC1352P chip manual.
- Recommended parameters of frequency accuracy

```
#ifndef SET_CCFG_MODE_CONF_XOSC_CAPARRAY_DELTA
#define SET_CCFG_MODE_CONF_XOSC_CAPARRAY_DELTA        0xFA
#endif
```

Adjust the parameter of SET_CCFG_MODE_CONF_XOSC_CAPARRAY_DELTA in ccfg.c file to 0xFA

- Power grading: 20dBm, 17dBm, 14dBm, 11dBm, power configuration code is as follows:

20dBm - The code is as follows：

```
// Overrides for CMD_PROP_RADIO_DIV_SETUP_PA
uint32_t pOverridesTx20[] =
{
// The TX Power element should always be the first in the list
TX20_POWER_OVERRIDE(0x0020AA1B),
// The ANADIV radio parameter based on the LO divider (0) and front-end (0) settings
(uint32_t)0x11C10703,
// override_phy_tx_pa_ramp_genfsk_hpa.xml
// Tx: Configure PA ramping, set wait time before turning off (0x1F ticks of 16/24 us = 20.3 us).
```

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```
HW_REG_OVERRIDE(0x6028,0x001F),
(uint32_t)0xFFFFFFFF
};
```

17dBm - The code is as follows：

```
// Overrides for CMD_PROP_RADIO_DIV_SETUP_PA
uint32_t pOverridesTx20[] =
{
// The TX Power element should always be the first in the list
TX20_POWER_OVERRIDE(0x00086618),
// The ANADIV radio parameter based on the LO divider (0) and front-end (0) settings
(uint32_t)0x11C10703,
// override_phy_tx_pa_ramp_genfsk_hpa.xml
// Tx: Configure PA ramping, set wait time before turning off (0x1F ticks of 16/24 us = 20.3 us).
HW_REG_OVERRIDE(0x6028,0x001F),
(uint32_t)0xFFFFFFFF
};
```

14dBm - The code is as follows

```
// Overrides for CMD_PROP_RADIO_DIV_SETUP_PA
uint32_t pOverridesTx20[] =
{
// The TX Power element should always be the first in the list
TX20_POWER_OVERRIDE(0x0004420E),
// The ANADIV radio parameter based on the LO divider (0) and front-end (0) settings
(uint32_t)0x11C10703,
// override_phy_tx_pa_ramp_genfsk_hpa.xml
// Tx: Configure PA ramping, set wait time before turning off (0x1F ticks of 16/24 us = 20.3 us).
HW_REG_OVERRIDE(0x6028,0x001F),
(uint32_t)0xFFFFFFFF
};
```

11dBm – The code is as follows

```
// Overrides for CMD_PROP_RADIO_DIV_SETUP_PA
uint32_t pOverridesTx20[] =
{
// The TX Power element should always be the first in the list
TX20_POWER_OVERRIDE(0x00042E07),
// The ANADIV radio parameter based on the LO divider (0) and front-end (0) settings
(uint32_t)0x11C10703,
// override_phy_tx_pa_ramp_genfsk_hpa.xml
// Tx: Configure PA ramping, set wait time before turning off (0x1F ticks of 16/24 us = 20.3 us).
HW_REG_OVERRIDE(0x6028,0x001F),
(uint32_t)0xFFFFFFFF
```

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};

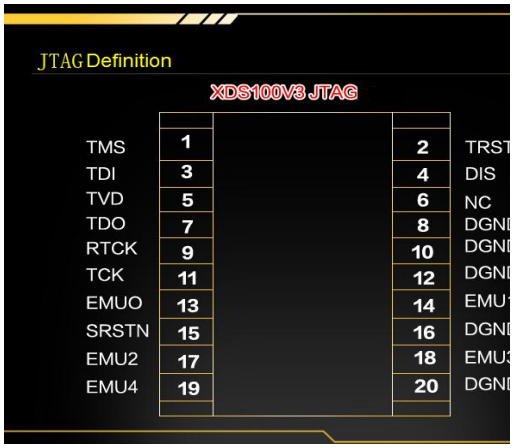
Note:

- The chip used inside the module is DC/DC mode.
- The Sub-1G band module comes with our own RF switch. Please follow the truth table strictly.

Truth Table

DIO_6	DIO_5	Transmit(TX)	Receive(RX)
Low	High	ON	OFF
High	Low	OFF	ON

- Burning program: The module is a SOC module with its own GPIO port. Download the program using the XDS100 downloader.
- Program download interface definition:



E79 Pins	XDS100 Interfaces
JATG_TMSC	TMS
JTAG_TCKC	TCK
RESET_N	SRSTN
GND	DGND
VCC	TVD

6. FAQ

6.1 Communication range is too short

- The communication distance will be affected when obstacle exists.
- Data lose rate will be affected by temperature, humidity and co-channel interference.
- The ground will absorb and reflect wireless radio wave, so the performance will be poor when testing near ground.
- Sea water has great ability in absorbing wireless radio wave, so performance will be poor when testing near the sea.
- The signal will be affected when the antenna is near metal object or put in a metal case.
- Power register was set incorrectly, air data rate is set as too high (the higher the air data rate, the shorter the distance).
- The power supply low voltage under room temperature is lower than 2.5V, the lower the voltage, the lower the transmitting power.
- Due to antenna quality or poor matching between antenna and module.

6.2 Module is easy to damage

- Please check the power supply source, ensure it is 2.0V~3.6V, voltage higher than 3.6V will damage the module.
- Please check the stability of power source, the voltage cannot fluctuate too much.
- Please make sure antistatic measure are taken when installing and using, high frequency devices have electrostatic

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susceptibility.

- Please ensure the humidity is within limited range, some parts are sensitive to humidity.
- Please avoid using modules under too high or too low temperature.

6.3 BER (Bit Error Rate) is high

- There are co-channel signal interference nearby, please be away from interference sources or modify frequency and channel to avoid interference;
- Poor power supply may cause messy code. Make sure that the power supply is reliable.
- The extension line and feeder quality are poor or too long, so the bit error rate is high;

7.Production Guidance

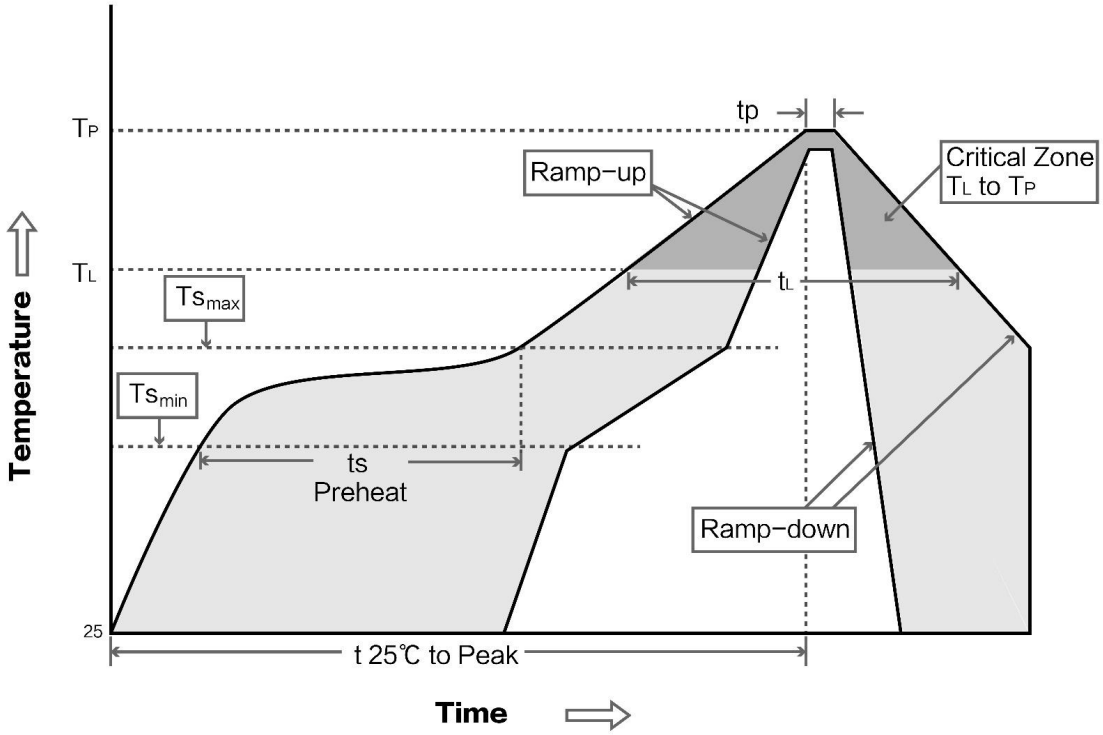
7.1 Reflow Soldering Temperature

Profile Feature	Curve characteristics	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Solder paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	Min preheating temp.	100℃	150℃
Preheat temperature max (Tsmax)	Mx preheating temp.	150℃	200℃
Preheat Time (Tsmin to Tsmax)(ts)	Preheating time	60-120 sec	60-120 sec
Average ramp-up rate(Tsmax to Tp)	Average ramp-up rate	3℃/second max	3℃/second max
Liquidous Temperature (TL)	Liquid phase temp.	183℃	217℃
Time(tL)Maintained Above(TL)	Time below liquid phase line	60-90 sec	30-90 sec
Peak temperature(Tp)	Peak temp.	220-235℃	230-250℃
Average ramp-down rate(Tp to Tsmax)	Average ramp-down rate	6℃/second max	6℃/second max
Time 25℃ to peak temperature	Time to peak temperature for 25℃	6 minutes max	8 minutes max

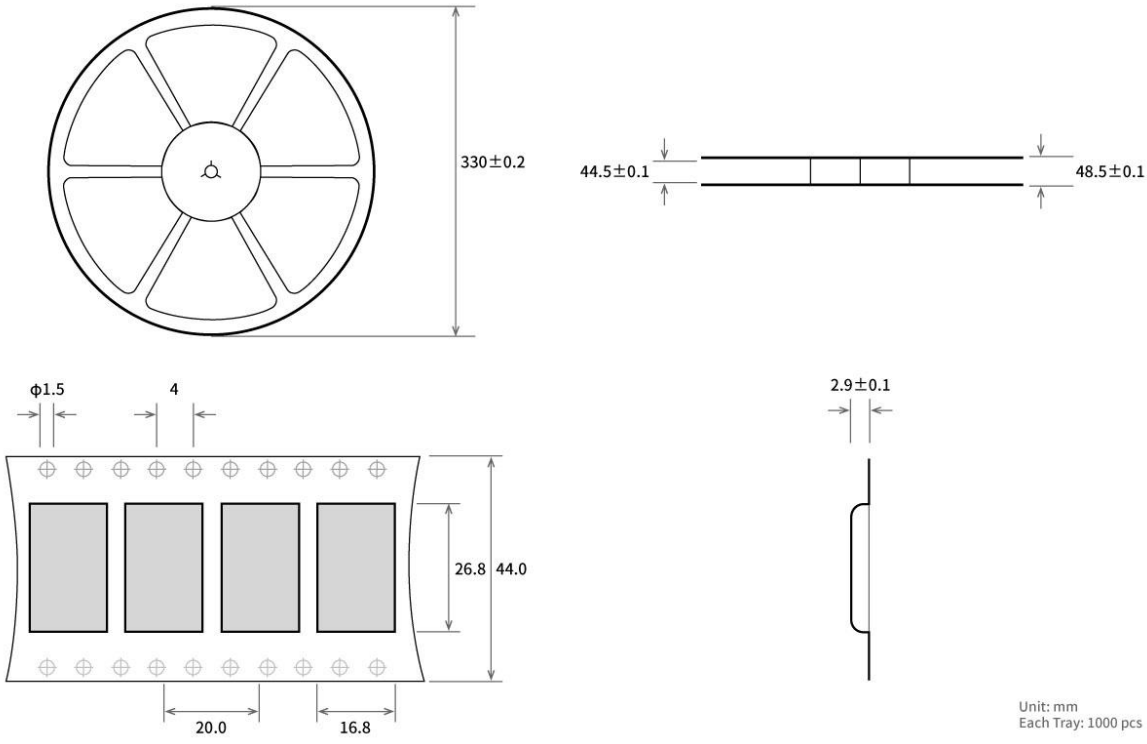
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7.2 Reflow soldering curve



8.Package for Batch Order



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9.Revision History

Version	Date	Description	Issued by
1.1	2019-12-14		Ren

About us

Website: www.ebyte.com Sales: info@cdebyte.com Support: support@cdebyte.com

Tel: +86-28-61399028 Ext. 812 Fax: +86-28-64146160

Address: Innovation Center B333~D347, 4# XI-XIN road,High-tech district (west), Chengdu, Sichuan, China

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