

CC1101 Wireless Module

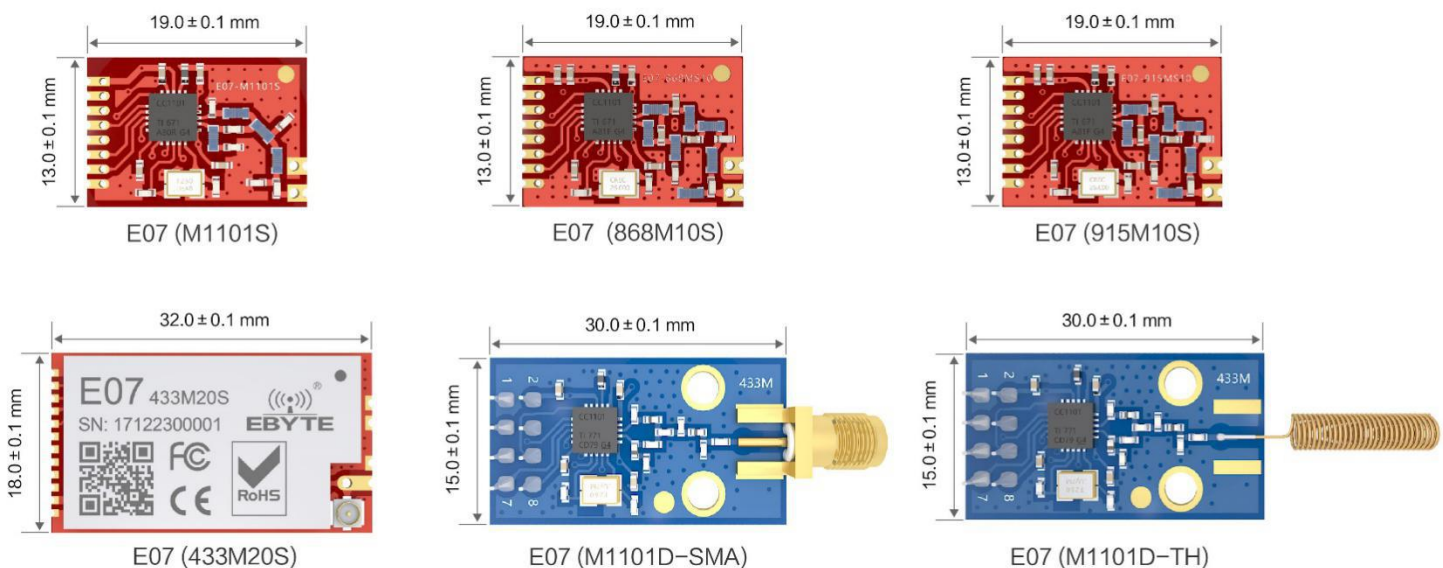
E07 Series

User Manual

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|---------|------------|-----------------|-----------|
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Brief Introduction



E07 series wireless transceiver module based on CC110 with 10mW transmitting power as default features small size and various package; With built-in PA, the power is 100mW; With SPI interface, module can be transmitter and receiver working at main ISM band including 433MH, 868 MHz, 915 MHz. It supports low power consumption development and with stable batch production, which enables E07 series suitable for various applications (especially for Hotel smart lock).

Based on originally imported RF chip CC1101 from TI in America, E07 series is with imported industrial components, lead-free process, stable performance, strong diffraction ability and small size via professional hardware design, thus the modules are convenient for all kinds of embedded development.

| Model | Antenna | Packing | Transmitting power | Distance |
|------------------|----------------|---------|--------------------|----------|
| E07 (M1101S) | Stamp hole | SMD | 10dBm | 1000m |
| E07 (868MS10) | Stamp hole | SMD | 10dBm | 1000m |
| E07 (915MS10) | Stamp hole | SMD | 10dBm | 1000m |
| E07 (433M20S) | Stamp hole/IPX | SMD | 20dBm | 2000m |
| E07 (M1101D-TH) | Spring antenna | DIP | 10dBm | 600m |
| E07 (M1101D-SMA) | SMA-K | DIP | 10dBm | 1000m |

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1. Technical Parameter

1.1. General Parameter

| Model | Core IC | Size | Net Weight | Operating Temperature | Operating Humidity | Storage Temperature |
|------------------|---------|----------|------------|-----------------------|--------------------|---------------------|
| E07 (M1101S) | CC1101 | 13*19 mm | 0.8±0.1g | -40 ~ +85°C | 10% ~ 90% | -40 ~ +125°C |
| E07 (868MS10) | CC1101 | 13*19 mm | 0.8±0.1g | -40 ~ +85°C | 10% ~ 90% | -40 ~ +125°C |
| E07 (915MS10) | CC1101 | 13*19 mm | 0.8±0.1g | -40 ~ +85°C | 10% ~ 90% | -40 ~ +125°C |
| E07 (433M20S) | CC1101 | 18*32mm | 3.0g±0.1g | -40 ~ +85°C | 10% ~ 90% | -40 ~ +125°C |
| E07 (M1101D-TH) | CC1101 | 15*28 mm | 2.4±0.1g | -40 ~ +85°C | 10% ~ 90% | -40 ~ +125°C |
| E07 (M1101D-SMA) | CC1101 | 15*30 mm | 3.2g±0.1g | -40 ~ +85°C | 10% ~ 90% | -40 ~ +125°C |

1.2. Electrical Parameter

1.2.1. Transmitting current

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-----|------|--|
| E07 (M1101S) | 27 | 29 | 32 | mA | <ul style="list-style-type: none"> When designing current supply circuit, 30% margin is recommended to be remained so as to ensure long-term stable operation of the whole module; The current at the instant of transmitting may be high, but the total energy consumed may be lower due to very short transmitting time; When using external antenna, the impedance matching degree at different frequency points between antenna and module may affect the transmitting current value at different levels. |
| E07 (868MS10) | 35 | 38 | 42 | mA | |
| E07 (915MS10) | 34 | 37 | 41 | mA | |
| E07 (433M20S) | 90 | 100 | 110 | mA | |
| E07 (M1101D-TH) | 27 | 29 | 32 | mA | |
| E07 (M1101D-SMA) | 27 | 29 | 32 | mA | |

1.2.2. Receiving current

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-----|------|---|
| E07 (M1101S) | 16 | 18 | 20 | mA | <ul style="list-style-type: none"> The current consumed when the RF chip is only working at receiving mode is called as receiving current, the tested receiving current may be higher for some RF chips with communication protocol or the developers have loaded their own protocol to the whole module; The current at pure receiving mode will be mA level, users can realize μA level of receiving current through firmware development. |
| E07 (868MS10) | 18 | 20 | 22 | mA | |
| E07 (915MS10) | 18 | 20 | 22 | mA | |
| E07 (433M20S) | 18 | 20 | 22 | mA | |
| E07 (M1101D-TH) | 16 | 18 | 20 | mA | |
| E07 (M1101D-SMA) | 16 | 18 | 20 | mA | |

1.2.3. Turn-off current

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-----|---------|---|
| E07 (M1101S) | 0.3 | 0.6 | 2.1 | μ A | <ul style="list-style-type: none"> The turn-off current means the current consumed by CPU, RAM, Clock and some registers which remain operating. SoC is at very low power consumption status; The turn-off current is always lower than the current consumed when the power supply source of the whole module is at no-load status. |
| E07 (868MS10) | 0.3 | 0.6 | 2.1 | μ A | |
| E07 (915MS10) | 0.3 | 0.6 | 2.1 | μ A | |
| E07 (433M20S) | 1.4 | 2.0 | 2.2 | μ A | |
| E07 (M1101D-TH) | 0.3 | 0.6 | 2.1 | μ A | |
| E07 (M1101D-SMA) | 0.3 | 0.6 | 2.1 | μ A | |

1.2.4. Voltage supply

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-----|------|---|
| E07 (M1101S) | 1.8 | 3.3 | 3.6 | V DC | <ul style="list-style-type: none"> ● If the module stays at maximum voltage for a long time, it may be damaged; ● The power supply pin has certain surge-resistance ability, but the potential pulse is higher than the maximum power supply voltage; ● The power supply is not advisable to be below 3.0V, or the RF parameters will be influenced at different degree. |
| E07 (868MS10) | 1.8 | 3.3 | 3.6 | V DC | |
| E07 (915MS10) | 1.8 | 3.3 | 3.6 | V DC | |
| E07 (433M20S) | 2.1 | 3.3 | 3.6 | V DC | |
| E07 (M1101D-TH) | 1.8 | 3.3 | 3.6 | V DC | |
| E07 (M1101D-SMA) | 1.8 | 3.3 | 3.6 | V DC | |

1.2.5. Communication level

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-----|------|---|
| E07 (M1101S) | 1.8 | 3.3 | 3.6 | V DC | <ul style="list-style-type: none"> ● If the module stays at maximum communication level for a long time, it may be damaged; ● There are various ways to switch communication level, but it will affect the whole power consumption to a large extend. |
| E07 (868MS10) | 1.8 | 3.3 | 3.6 | V DC | |
| E07 (915MS10) | 1.8 | 3.3 | 3.6 | V DC | |
| E07 (433M20S) | 2.1 | 3.3 | 3.6 | V DC | |
| E07 (M1101D-TH) | 1.8 | 3.3 | 3.6 | V DC | |
| E07 (M1101D-SMA) | 1.8 | 3.3 | 3.6 | V DC | |

1.3. RF Parameter

1.3.1. Transmitting power

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-----|------|---|
| E07 (M1101S) | 9 | 10 | 11 | dBm | <ul style="list-style-type: none"> ● Due to the error of the materials, each LRC component has $\pm 0.1\%$ error, so error accumulation will occur since multiple LRC components are used in the whole RF circuit, and the transmitting currents will be different at different modules; ● The power consumption can be lowered by lowering the transmitting power, but the efficiency of the internal PA will be decreased by lowering transmitting power due to various reasons; ● The transmitting power will be lowered by lowering the power supply voltage. |
| E07 (868MS10) | 9 | 10 | 11 | dBm | |
| E07 (915MS10) | 9 | 10 | 11 | dBm | |
| E07 (433M20S) | 19 | 20 | 21 | dBm | |
| E07 (M1101D-TH) | 9 | 10 | 11 | dBm | |
| E07 (M1101D-SMA) | 9 | 10 | 11 | dBm | |

1.3.2. Receiving Sensitivity

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|------|------|------|------|---|
| E07 (M1101S) | -108 | -109 | -110 | dBm | <ul style="list-style-type: none"> ● The sensitivity is tested under the air data rate 1.3kbps; ● Due to the error of the materials, each LRC component has $\pm 0.1\%$ error, so error accumulation will occur since multiple LRC components are used in the whole RF circuit, and the transmitting currents will be different at different modules; ● The receiving sensitivity will be reduced and communication range will be shortened while increasing the air data rate. |
| E07 (868MS10) | -108 | -109 | -110 | dBm | |
| E07 (915MS10) | -108 | -109 | -110 | dBm | |
| E07 (433M20S) | -108 | -109 | -110 | dBm | |
| E07 (M1101D-TH) | -107 | -108 | -109 | dBm | |
| E07 (M1101D-SMA) | -107 | -108 | -109 | dBm | |

1.3.3. Recommended operating frequency

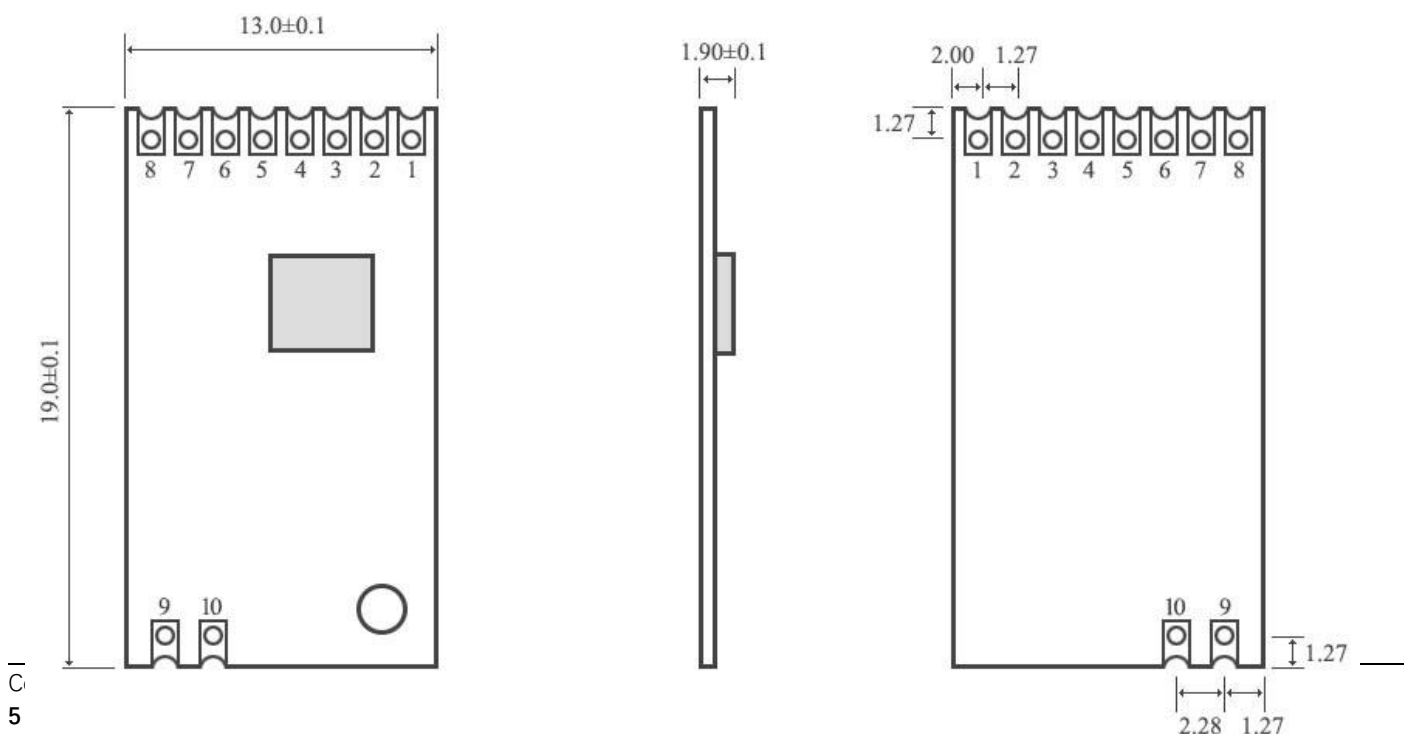
| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|-----|-------|------|--|
| E07 (M1101S) | 387 | 433 | 464 | MHz | <ul style="list-style-type: none"> ● To work within the recommended frequency can assure the modules to meet all the parameters; ● It is recommended to avoid the crowded integral frequency such as 433.0MHz, 868.0MHz, 915MHz etc. |
| E07 (868MS10) | 850 | 868 | 880.5 | MHz | |
| E07 (915MS10) | 900 | 915 | 925.5 | MHz | |
| E07 (433M20S) | 425 | 433 | 450.5 | MHz | |
| E07 (M1101D-TH) | 387 | 433 | 464 | MHz | |
| E07 (M1101D-SMA) | 387 | 433 | 464 | MHz | |

1.4. Tested Distance

| Model | Min | Typ | Max | Unit | Remarks |
|------------------|-----|------|------|------|--|
| E07 (M1101S) | 900 | 1000 | 1100 | m | <ul style="list-style-type: none"> ● The external antenna used is of 2.5dBi gain and vertical polarization. The height is 2.5 meters; ● The interval between each data packet is 2s, sending 100 packets with 30 bytes in each packet, the range at data lose rate of lower than 5% is valid range; ● In order to obtain meaningful and reproducible results, we conducted the tests in clear air with little electromagnetic interference at suburb areas ; ● Distance may be shorter with interference or obstacles. |
| E07 (868MS10) | 900 | 1000 | 1100 | m | |
| E07 (915MS10) | 900 | 1000 | 1100 | m | |
| E07 (433M20S) | 900 | 1000 | 1100 | m | |
| E07 (M1101D-TH) | 540 | 600 | 660 | m | |
| E07 (M1101D-SMA) | 900 | 1000 | 1100 | m | |

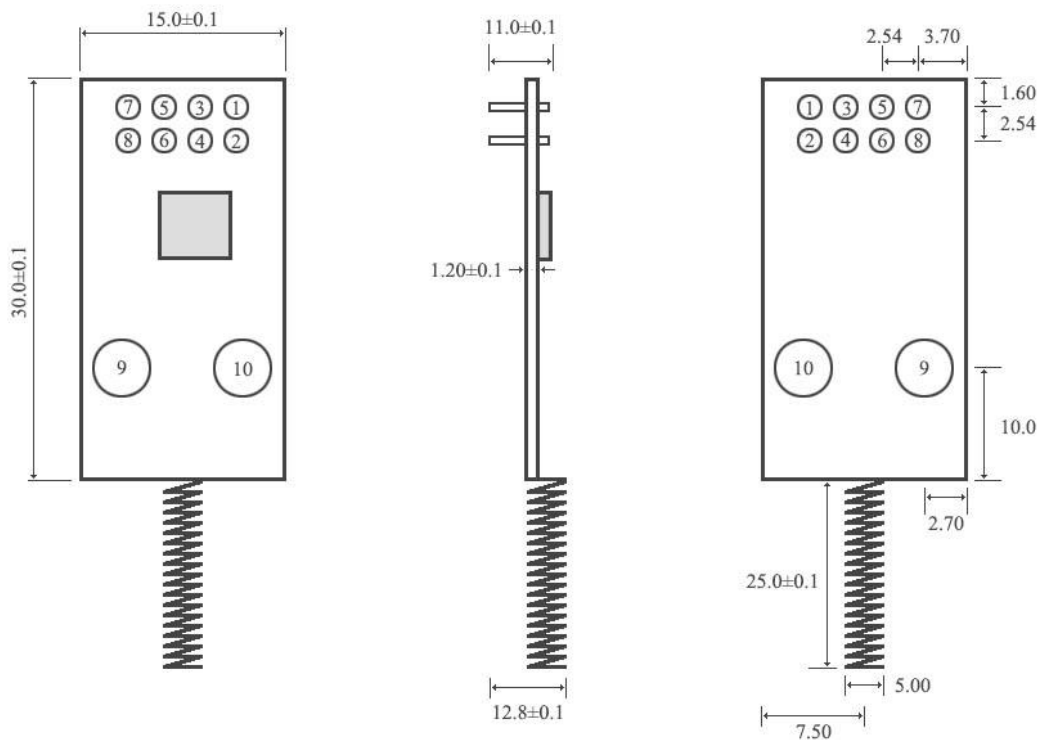
2. Mechanical Characteristics

2.1. E07 (M1101S)/ E07 (868MS10)/ E07 (915MS10)



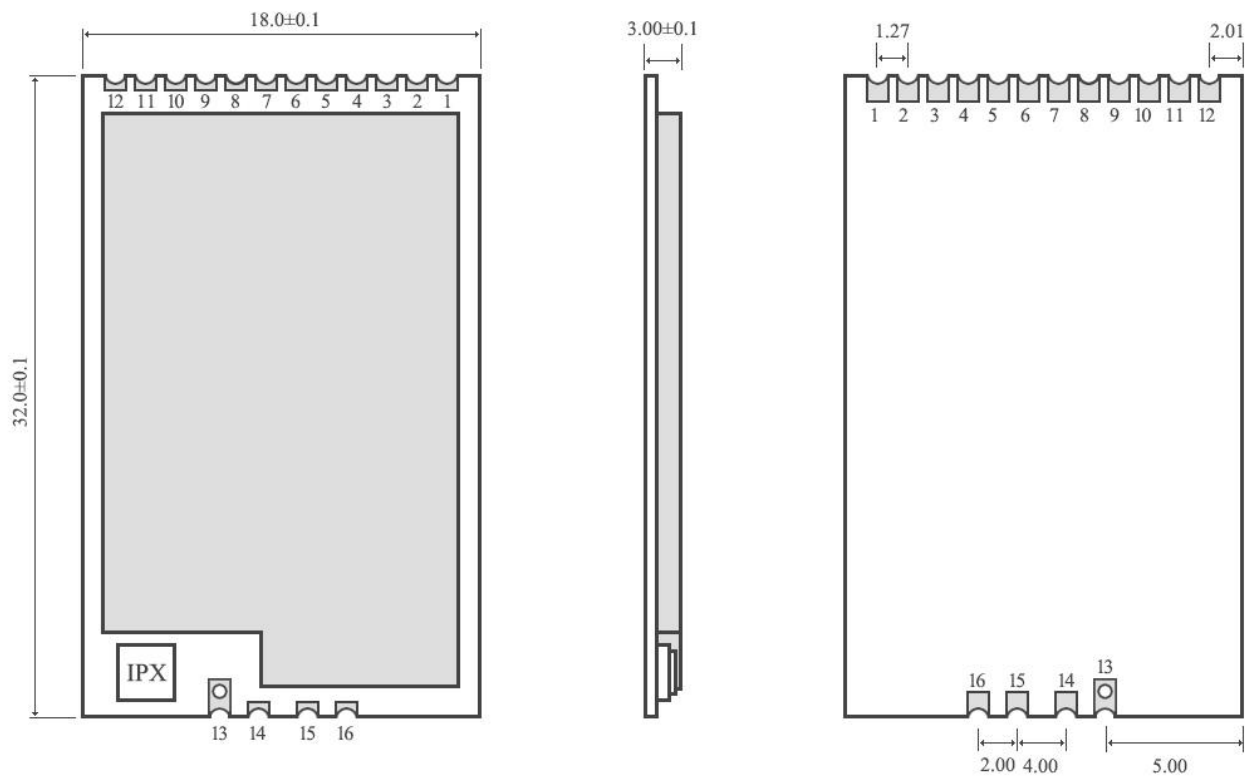
| Pin No. | Pin item | Pin direction | Pin application |
|---|-----------|---------------|--|
| 1 | VCC | | Power supply 1.8 V-3.6V DC |
| 2 | GDO0 | Output | Information Output pin |
| 3 | CSN | Input | Chip selection pin, for starting a SPI communication |
| 4 | SCK | Input | SPI clock pin |
| 5 | MOSI | Input | SPI data input pin |
| 6 | MISO/GDO1 | Output | SPI data output pin |
| 7 | GDO2 | Output | Information output pin |
| 8 | GND | | Ground, connecting to power ground reference |
| 9 | ANT | | Antenna |
| 10 | GND | | Ground, connecting to power ground reference |
| ★ Please see details about Pin Definition, Software Drive and Communication Protocol on <i>CC1101 Datasheet</i> from TI ★ | | | |

2.2. E07 (M1101D-TH)/ E07 (M1101D-SMA)



| Pin No. | Pin item | Pin direction | Pin application |
|---|-----------|---------------|--|
| 1 | GND | | Ground, connecting to power ground reference |
| 2 | VCC | | Power supply 1.8 V-3.6V DC |
| 3 | GDO0 | Output | Information output pin |
| 4 | CSN | Input | Chip selection pin, for starting a SPI communication |
| 5 | SCK | Input | SPI clock pin |
| 6 | MOSI | Input | SPI data input pin |
| 7 | MISO/GDO1 | Output | SPI data output pin |
| 8 | GDO2 | Output | Information output pin |
| ★ Please see details about Pin Definition, Software Drive and Communication Protocol on <i>CC1101 Datasheet</i> from TI ★ | | | |

2.3. E07 (433M20S)



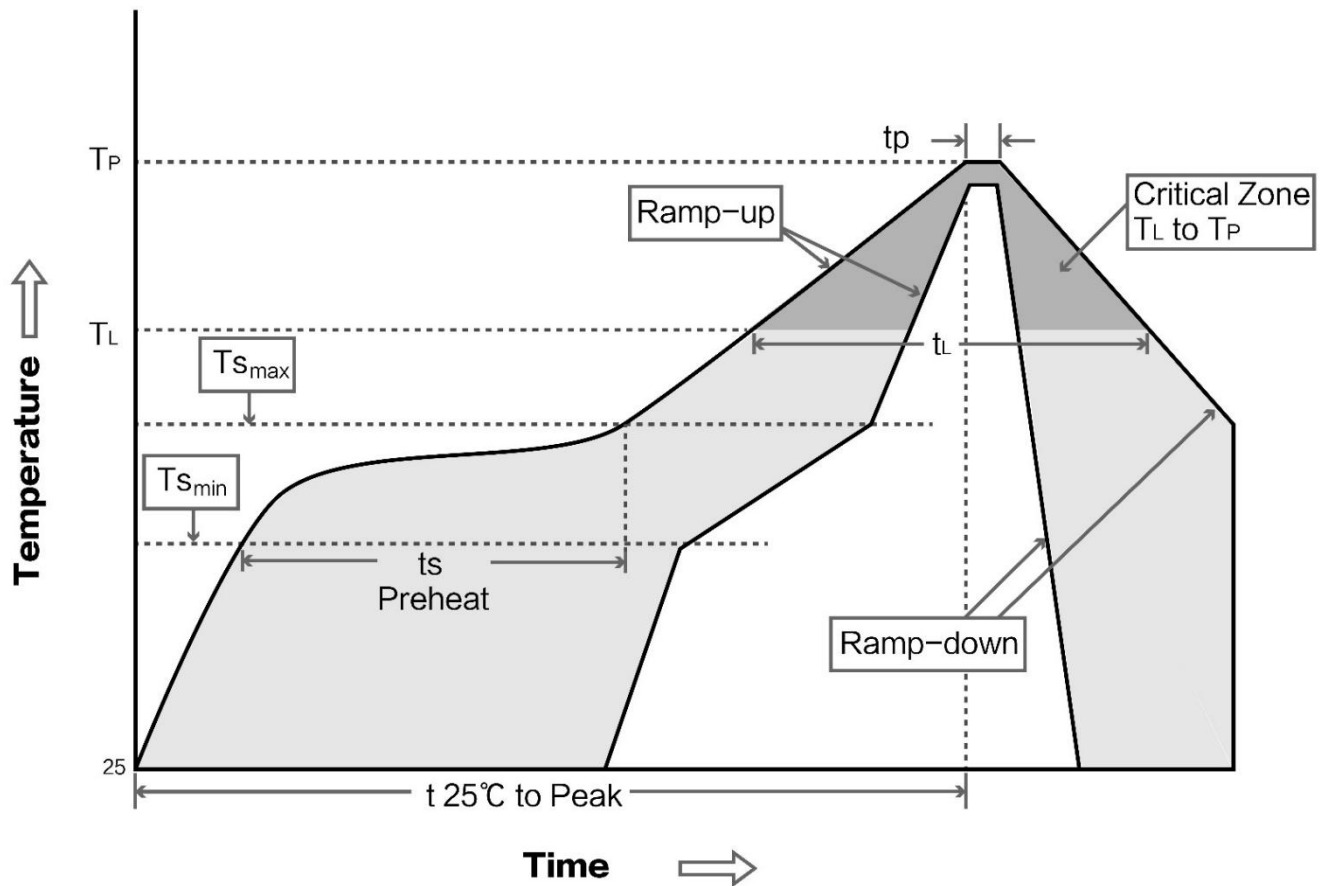
| Pin No. | Pin item | Pin direction | Pin application |
|---|-----------|---------------|--|
| 1 | GND | | Ground, connecting to power ground reference |
| 2 | MOSI | Input | SPI data input pin |
| 3 | SCK | Input | SPI clock pin |
| 4 | MISO/GDO1 | Output | SPI data output pin |
| 5 | GDO2 | Output | Information output pin |
| 6 | GDO0 | Output | Information output pin |
| 7 | CSN | Output | Chip selection pin, for starting a SPI communication |
| 8 | TX_EN | Input | TX control pin |
| 9 | RX_EN | Input | RX control pin |
| 10 | NC | | N/A |
| 11 | VCC | | Power supply 1.8 V-3.6V DC |
| 12 | GND | | Ground, connecting to power ground reference |
| 13 | ANT | | Antenna |
| 14 | GND | | Ground, connecting to power ground reference |
| 15 | GND | | Ground, connecting to power ground reference |
| 16 | GND | | Ground, connecting to power ground reference |
| ★ Please see details about Pin Definition, Software Drive and Communication Protocol on <i>CC1101 Datasheet</i> from TI ★ | | | |

3. Production Guidance

3.1 Reflow Soldering Temperature

| Profile Feature | Sn-Pb Assembly | Pb-Free Assembly |
|--|----------------|------------------|
| Solder Paste | Sn63/Pb37 | Sn96.5/Ag3/Cu0.5 |
| Preheat Temperature min (T_{smin}) | 100°C | 150°C |
| Preheat temperature max (T_{smax}) | 150°C | 200°C |
| Preheat Time (T_{smin} to T_{smax})(t_s) | 60-120 sec | 60-120 sec |
| Average ramp-up rate(T_{smax} to T_p) | 3°C/second max | 3°C/second max |
| Liquidous Temperature (T_L) | 183°C | 217°C |
| Time (t_L) Maintained Above (T_L) | 60-90 sec | 30-90 sec |
| Peak temperature (T_p) | 220-235°C | 230-250°C |
| Average ramp-down rate (T_p to T_{smax}) | 6°C/second max | 6°C/second max |
| Time 25°C to peak temperature | 6 minutes max | 8 minutes max |

3.2 Reflow Soldering Curve



4. FAQ

4.1 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.
- Seawater 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 the recommended value, the lower the voltage, the lower the transmitting power.
- Due to antenna quality or poor matching between antenna and module.

4.2 Module is easy to damage

- Please check the power supply source, ensure it is within the recommended value, voltage higher than that 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 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.

5. Important Notes

- All rights to interpret and modify this manual belong to Ebyte.
- This manual will be updated based on the upgrade of firmware and hardware, please refer to the latest version.
- Please refer to our website for new product information

6. About Us

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