



E28-2G4T12S User Manual

Wireless Module



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1. Product Overview

1.1 Brief Introduction

E28-2G4T12S is an UART module based on SEMTECH SX1281, it adopts transparent transmission and works at 2.4GHz band. It adopts GFSK modulations. It features SMD packing with PCB antenna interfaces, and its TTL output is 5V.

The module features data encryption and compression. The data transmitted in air features randomness, the data encryption algorism makes data interception meaningless, meanwhile, the data compression function could shorten the transmission duration and reduce the probability of data interference, thus improves the reliability and transmission efficiency.

1.2 Features

- Support various modulation such as GFSK Mode;
- Supporting high-speed continuous transmission, data without subcontracting;
- Support RSSI for evaluating signal quality
- Support fixed transmission/broadcast/monitoring
- Communication distance tested is up to 0.5km in ideal condition;
- Maximum transmitting power of 6.0dBm, Software adjustable
- Support the global license-free ISM 2.4GHz band.
- Support air data rate of 100kbps/1Mbps/2Mbps
- Low power consumption for battery supplied applications
- Support 2.3V~5.5V power supply, power supply over 5.5V can guarantee the best performance
- Industrial grade standard design, support -40 ~ 85 °C for working over a long time
- PCB antenna optional, good for secondary and embedded development.

1.3 Application

- Smart Home and Industrial Sensors;
- Security system, location System
- Wireless remote control; UAV
- Wireless Game Remote Controller
- Health care products
- Wireless voice, wireless headset;
- Automotive industry applications.

2. Technical Parameters

2.1 Limit parameter

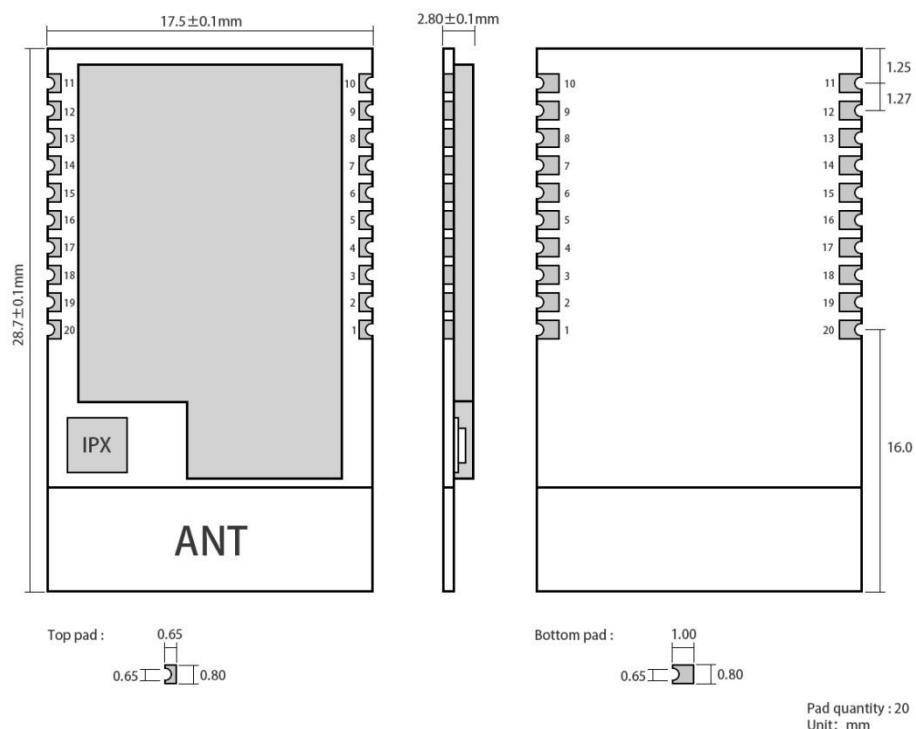
Main parameter	Performance		Note
	Min	Max	
Voltage supply [V]	2.3	5.5	Voltage over 5.5V will cause permanent damage to module
Operating temperature [°C]	-40	+85	-

2.2 Operating parameter

Main parameter	Performance			Note
	Min	Typ	Max	
Voltage supply [V]	2.3	5.0	5.5	$\geq 5.0V$ ensures output power
Operating temperature [°C]	-40	-	+85	-
Frequency [MHz]	2402	-	2480	ISM band
Power consumption	Transmitting current [mA]		46	Instant power consumption
	Receiving current [mA]		20	
	Turn-off current [μ A]		8	Software is shut down
Receiving sensitivity [dBm]	-130	-132	-134	Air data rate: 100kbps
Air data rate (bps)	100k	1M	2M	Defined by user via programming

Main parameter	Description	Note
Distance	500m	Test condition: clear and open area, antenna gain: 4dBi Antenna height: 2.5m, air data rate: 100kbps
FIFO	121 byte	Max. Transmitting length per packet
	221 byte	Continuous transmission mode
Modulation	GFSK	
Interface	UART	TTL
Package	SMD	
Connector	1.27mm	
Size	17.5*28.7mm	
Antenna	PCB	50Ω Impedance

3. Dimension and Pin Definition



Pin No.	Pin Name	Pin Direction	Function
1	GND	Ground	Ground
2	NC		Disconnected
3	M0	Input	M2, M1 and M0 jointly decide the 8 operation modes. (cannot be floated, can be grounded if not used)
4	M1	Input	M2, M1 and M0 jointly decide the 8 operation modes. (cannot be floated, can be grounded if not used)
5	M2	Input	M2, M1 and M0 jointly decide the 8 operation modes. (cannot be floated, can be grounded if not used)
6	RXD	Input	TTL serial input, connected to external TXD output pin. Can be configured as open-drain or pull-up input, please refer to Parameter Configuration.
7	TXD	Output	TTL serial output, connected to external RXD input pin. Can be configured as open-drain or push-pull output, please refer to Parameter Configuration.
8	AUX	Output	Used to indicate the module operation status, when user wakes up the external MCU, it outputs low level during initialization after power on and self-check, can be configured as open-drain output or push-pull output, please refer to Parameter Configuration.(can be floated)
9	VCC		Module power source positive reference. Voltage range: 2.3 ~ 5.5V DC
10 ~ 11	GND	Ground	Ground
12 ~ 19	NC		Disconnected
20	GND	Ground	Ground

4. Hardware design

- It is recommended to use a DC stabilized power supply. The power supply ripple factor is as small as possible, and the module needs to be reliably grounded.
- Please pay attention to the correct connection of the positive and negative poles of the power supply. Reverse connection may cause permanent damage to the module
- Please check the power supply to ensure it is within the recommended voltage otherwise when it exceeds the maximum value the module will be permanently damaged
- Please check the stability of the power supply, the voltage can not be fluctuated frequently
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% of the margin, so the whole machine is beneficial for long-term stable operation
- 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 be avoided under the module. If it is necessary to pass through the module, assume that the module is soldered to the Top Layer, and the copper is spread on the Top Layer of the module contact part(well grounded), it must be close to the digital part of the module and routed in the Bottom Layer
- Assuming the module is soldered or placed over the Top Layer, it is wrong to randomly route over the Bottom Layer or other layers, which will affect the module's spurs and receiving sensitivity to varying degrees
- It is assumed that there are devices with large electromagnetic interference around the module that will greatly affect the performance. It is recommended to keep them away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done
- Assume that there are traces with large electromagnetic interference (high-frequency digital, high-frequency analog, power traces) around the module that will greatly affect the performance of the module. It is recommended to stay away from the module according to the strength of the interference. If necessary, appropriate isolation and shielding can be done.
- If the communication line uses a 5V level, a 1k-5.1k resistor must be connected in series (not recommended, there is still a risk of damage)
- Try to stay away from some physical layers such as TTL protocol at 2.4GHz , for example: USB3.0
- The mounting structure of antenna has a great influence on the performance of the module. It is necessary to ensure that the antenna is exposed, preferably vertically upward. When the module is mounted inside the case, use a good antenna extension cable to extend the antenna to the outside
- The antenna must not be installed inside the metal case, which will cause the transmission distance to be greatly weakened.

5. FAQ

5.1 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.

5.2 Module is easy to damage

- Please check the power supply source, ensure it is 2.3V~5.5V, voltage higher than 5.5V 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.

5.3 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.

FCC STATEMENT

Important Notice to OEM integrators

(Reference KDB 996369 D03 OEM Manual v01, 996369 D04 Module Integration Guide v02)

1. Applicable FCC rules:

This device complies with part 15.247 of the FCC Rules. This module is limited to OEM installation ONLY.

2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).

3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.

4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are compliant with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to Chengdu Ebyte that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: 2A8C3-E282G4T12S"

The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

(1) The antenna must be installed such that 20 cm is maintained between the antenna and users,

(2) The transmitter module may not be co-located with any other transmitter or antenna.

(3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Antenna type	Antenna Connector	Peak Gain
PCB	Integrated	4.0 dBi

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Information on test modes and additional testing requirements

1) The modular transmitter has been fully tested by the module grantee on the required number of channels, modulation types, and modes, it should not be necessary for the host installer to retest all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions). 2) 2) The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.

3) If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected.

4) Additional testing, Part 15 Sub part B disclaimer: The device is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation. When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 for further general testing details. The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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 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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

List of applicable FCC rules

This module has been tested and found to comply with part 15.247 requirements for Modular Approval.

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuit), then the grantee shall provide a notice stating that

the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

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