CRG1 Module Datasheet

Version: 20230625

Online Version

Contents

CRG1 is a low-power embedded Wi-Fi + Bluetooth Voice module that Tuya has developed. Embedded with the Wi-Fi network protocol stack and rich library functions, it consists of a highly integrated RF chip (W701P-VA2-CG). With the maximum CPU clock rate of 100 MHz, CRG1 also contains a low-power Real-M300 (KM4) microcontroller unit (MCU), a WLAN MAC, a 1T1R WLAN, a 8-MB pseudo-static random-access memory (PSRAM), 4-MB flash memory, and rich extensive peripherals.

1 Overview

CRG1 is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP. You can develop embedded Wi-Fi products as required.

1.1 Features

- Embedded low-power KM4 MCU, which can also function as an application processor
- Main clock rate: 100 MHz
- Working voltage: 3.0 to 3.6 V
- Peripherals: 8 (general-purpose input/output) GPIOs and 3 universal asynchronous receiver/transmitter (UART)
- Wi-Fi/Bluetooth connectivity
  - 802.11 B/G/N20
  - Channels 1 to 14@2.4 GHz (CH1 to 11 for US/CA and CH1 to 13 for EU/CN)
  - Support Bluetooth (Bluetooth Low Energy) 4.2
  - Support WEP, WPA, WPA2, and WPA2 PSK (AES) security modes
  - MAX EIRP: + 20dBm output power in 802.11b mode
  - Support SmartConfig functions for Android and iOS devices
  - Integrated voice chip wt2003hp8, supporting audio signal output
- Onboard PCB antenna
- Passed CE and FCC certifications
- Working temperature: -20℃ to 85℃

1.2 Applications

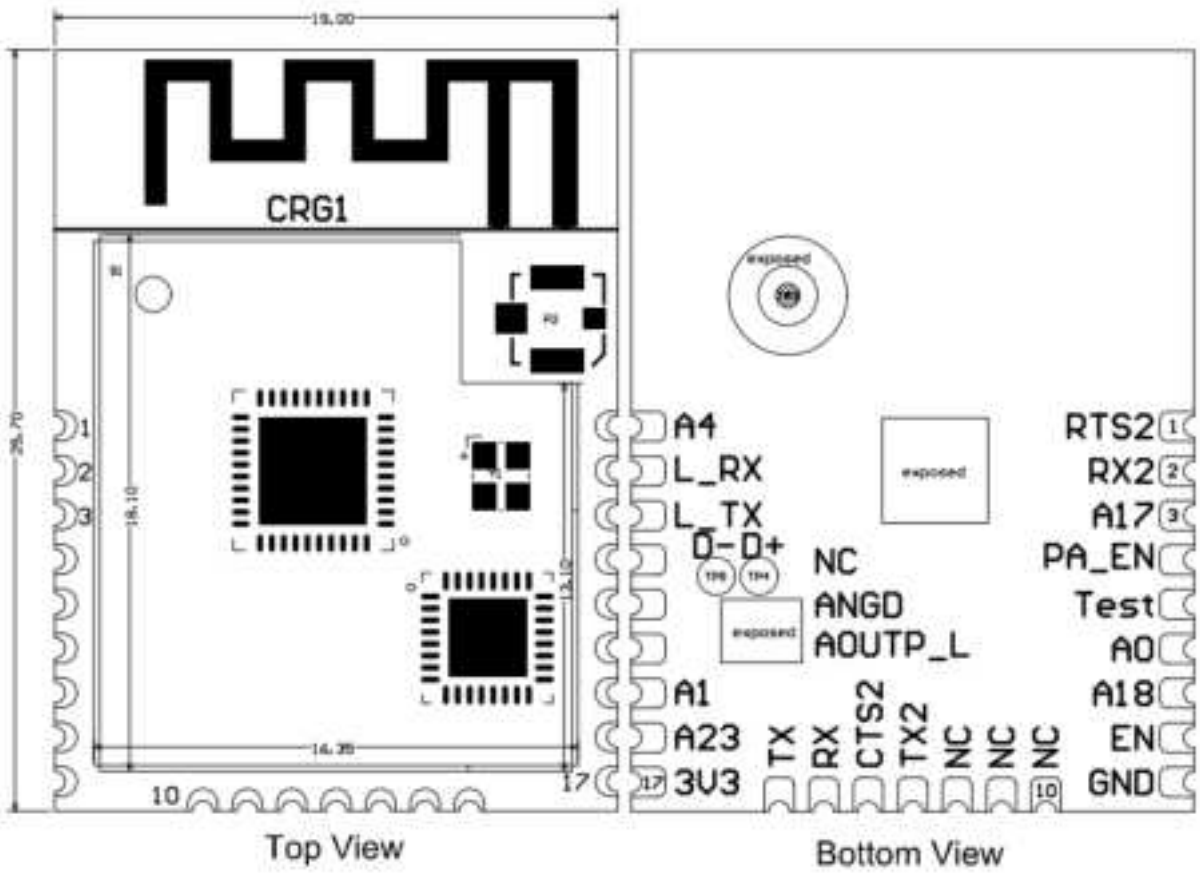
- Intelligent building
- Smart household and home appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
- Network camera
- Intelligent bus

2 Module interfaces

2.1 Dimensions and package

CRG1 has 3 rows of pins with a spacing of 1.5 mm.

The CRG1 dimensions are 19±0.35 mm (W) × 25.7±0.35 mm (L) × 2.9±0.15 mm (H). The thickness of the PCB is 0.8±0.1 mm. The dimensions of CRG1 are as follows:



2.2 Pin definition

The definition of interface pins is shown in the following table:

Pin number	Symbol	I/O type	Function
1	RTS2	I/O	PA 20, which corresponds to Pin 1 and is a serial port Uart2 flow control request-to-send pin
2	RX2	I/O	PA 15, which corresponds to Pin 36 and Uart2_RX and is the docking serial port of a user’ s MCU
3	PA17	I/O	PA 17, which corresponds to Pin 38, is a hardware PWM and can be configured as a GPIO
4	PA_EN	I/O	Audio PA enable pin and busy signal output pin of on-board voice chip WT2003HP8
5	Test	I/O	Test pin is reserved for production test and has no other functions.

Pin number	Symbol	I/O type	Function
6	PA0	I/O	PA0, which corresponds to Pin 15, is a hardware PWM and can be configured as a GPIO, cannot be pulled up when powered on
7	PA18	I/O	PA18, which corresponds to Pin 39, is a hardware PWM and can be configured as a GPIO
8	EN	P	Enabling pin, which works at the voltage of 3.3V and is pulled up
9	GND	P	Power supply reference ground
10	NC	/	/
11	NC	/	/
12	NC	/	/
13	TX2	I/O	PA16, which corresponds to Pin 37 and Uart2_TX and is the docking serial port of a user’ s MCU

Pin number	Symbol	I/O type	Function
14	CTS2	I/O	PA19, which corresponds to Pin 40 and is a serial port Uart2 flow control clear-to-send pin
15	RX	I/O	PA13, which corresponds to Pin 33 and Uart0_RX and is the docking serial port of a user’ s MCU
16	TX	I/O	PA14, which corresponds to Pin 34 and Uart0_TX and is the docking serial port of a user’ s MCU
17	3V3	P	Power supply pin (3.3V)
18	PA23	I/O	PA 23, which corresponds to Pin 3, is a hardware PWM and can be configured as a GPIO, cannot be pulled up when powered on

Pin number	Symbol	I/O type	Function
19	PA1	I/O	PA 1, which corresponds to Pin 16, is a hardware PWM and can be configured as a GPIO, cannot be pulled up when powered on
20	AOUTP_L	I/O	Audio output pin of on-board voice chip WT2003HP8，Pin6
21	AGND	I/O	MIC_GND
22	NC	/	/
23	Log TX	I/O	PA3, which corresponds to Pin 19 and is used to print system logs
24	Log Rx	I/O	PA2, which corresponds to Pin 18 and is used to print system logs
25	PA4	I/O	PA4, which corresponds to Pin 20, is a hardware PWM and can be configured as a GPIO

> **Note**: P indicates a power supply pin and I/O indicates an input/output pin.

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-40	105	℃
VDD	Power supply voltage	-0.3	3.6	V
Static electricity discharge voltage (human body model)	TAMB-25℃	-	2	KV
Static electricity discharge voltage (machine model)	TAMB-25℃	-	0.5	KV

3.2 Working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working tempera-ture	-20	-	85	℃
VDD	Working voltage	3.0	-	3.6	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit	
VIL	I/O low level input	-	-	0.8	V	
VIH	I/O high level input	2.0	-	-	V	
VOL	I/O low level output		-	-	0.4	V
VOH	I/O high level output	2.4	-	-		V
Imax	I/O drive current	-	-	16	mA	
Cpad	Input pin capaci-tance	-	2	-	pF	

3.3 RF power consumption

TX power consumption:

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11b 11Mbps	17 dBm	222	256	mA
IRF	11b 11Mbps	18 dBm	237	272	mA
IRF	11g 54Mbps	15 dBm	155	225	mA

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11g 54Mbps	17.5 dBm	173	259	mA
IRF	11n BW20 MCS7	13 dBm	143	203	mA
IRF	11n BW20 MCS7	16.5 dBm	165	244	mA

RX power consumption:

Symbol	Mode	Average value	Peak value (Typical value)	Unit
IRF	11B 11M	62	67	mA
IRF	11G 54M	61	68	mA
IRF	11N HT20 MCS7	62	69	mA

3.4 Working power consumption

Working mode	Working status, TA = 25°C	Average value	Peak value (Typical value)	Unit
Quick network pairing state (EZ)	The module is in the fast network pairing state and the Wi-Fi indicator flashes fast	77	331	mA

Working mode	Working status, TA = 25°C	Average value	Peak value (Typical value)	Unit
Idle state	The module is connected to the network and the Wi-Fi indicator is always on	68	321	mA
Network connection operation state	The module is connected to the network and the Wi-Fi indicator is always on	67	316	mA
Disconnected state	The module is disconnected and the Wi-Fi indicator is dark	67	312	mA

4 RF parameters

4.1 Basic RF features

Parameter	Description
Frequency range	2.400 to 2.4835 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
Bluetooth standard	Bluetooth 4.2
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps)
Data transmission rate	11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps)
Data transmission rate	11n: HT20 MCS0 to 7
Antenna type	PCB antenna with a peak gain of 1.27 dBi

4.2 TX performance

TX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11b CCK Mode 1M	-	17.5	-	dBm
Average RF output power, 802.11g OFDM Mode 54M	-	14.5	-	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11n OFDM Mode MCS7	-	13.5	-	dBm
Average RF output power, Bluetooth 4.2 1M	-	6.5	-	dBm
Frequency error	-20	-	20	ppm
EVM@802.11b CCK 11 Mbps Mode 17.5 dBm	-	-	-10	dB
EVM@802.11g OFDM 54 Mbps Mode 14.5 dBm	-	-	-29	dB
EVM@802.11n OFDM MCS7 Mode 13.5 dBm	-	-	-30	dB

RX Performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 1M	-	-97	-	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-75	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-72	-	dBm
PER<10%, RX sensitivity, Bluetooth 4.2 1M	-	-93	-	dBm

5 Antenna information

5.1 Antenna type

CRG1 uses only an onboard PCB antenna with a peak gain of 1.27 dBi.

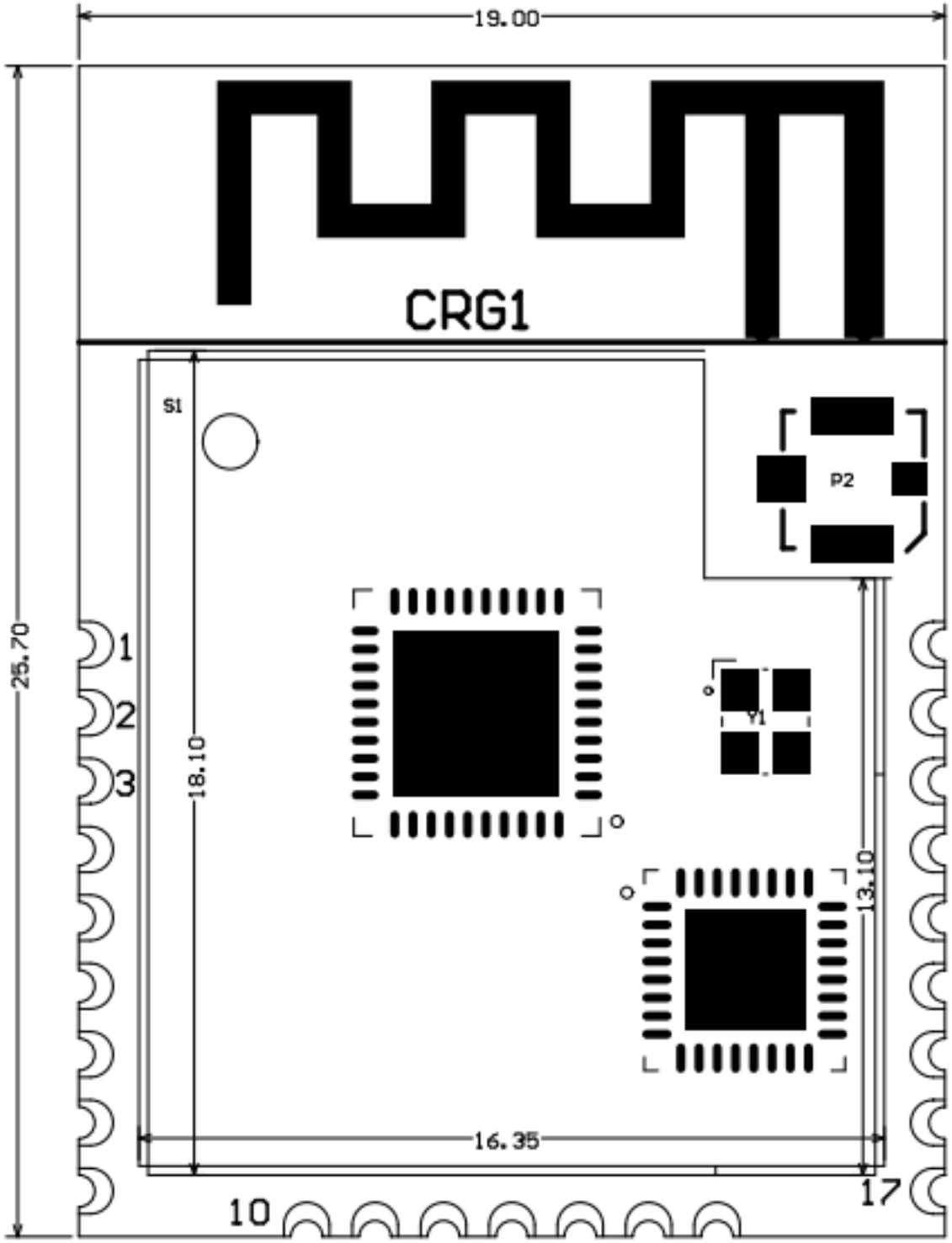
5.2 Antenna interference reduction

To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

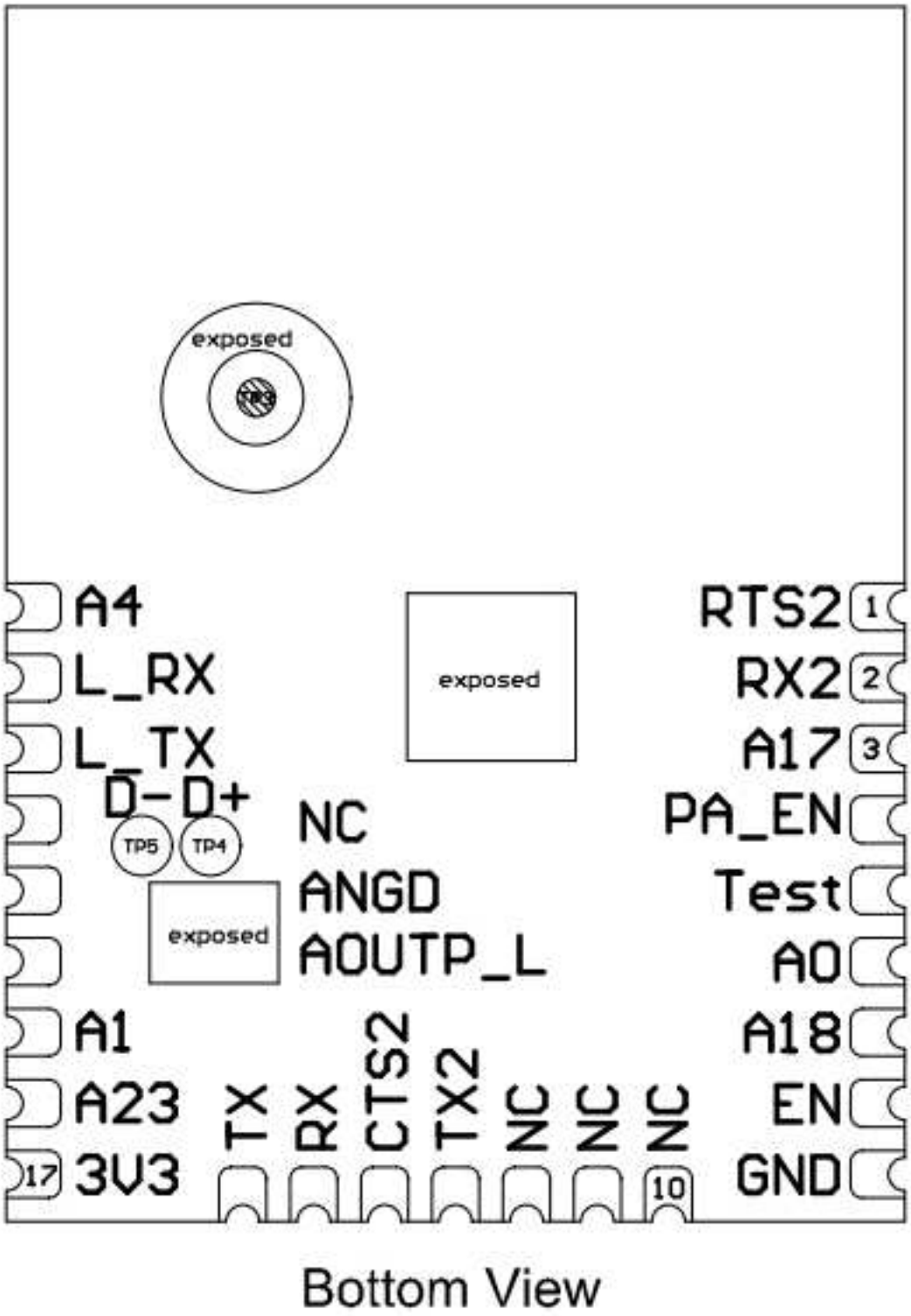
6 Packaging information and production instructions

6.1 Mechanical dimensions

The mechanical dimensions of the PCB of CRG1 are 19±0.35mm (W)×25.7±0.35mm (L) ×0.8±0.1mm (H). The following figure shows the mechanical dimensions of CRG1:



Top View

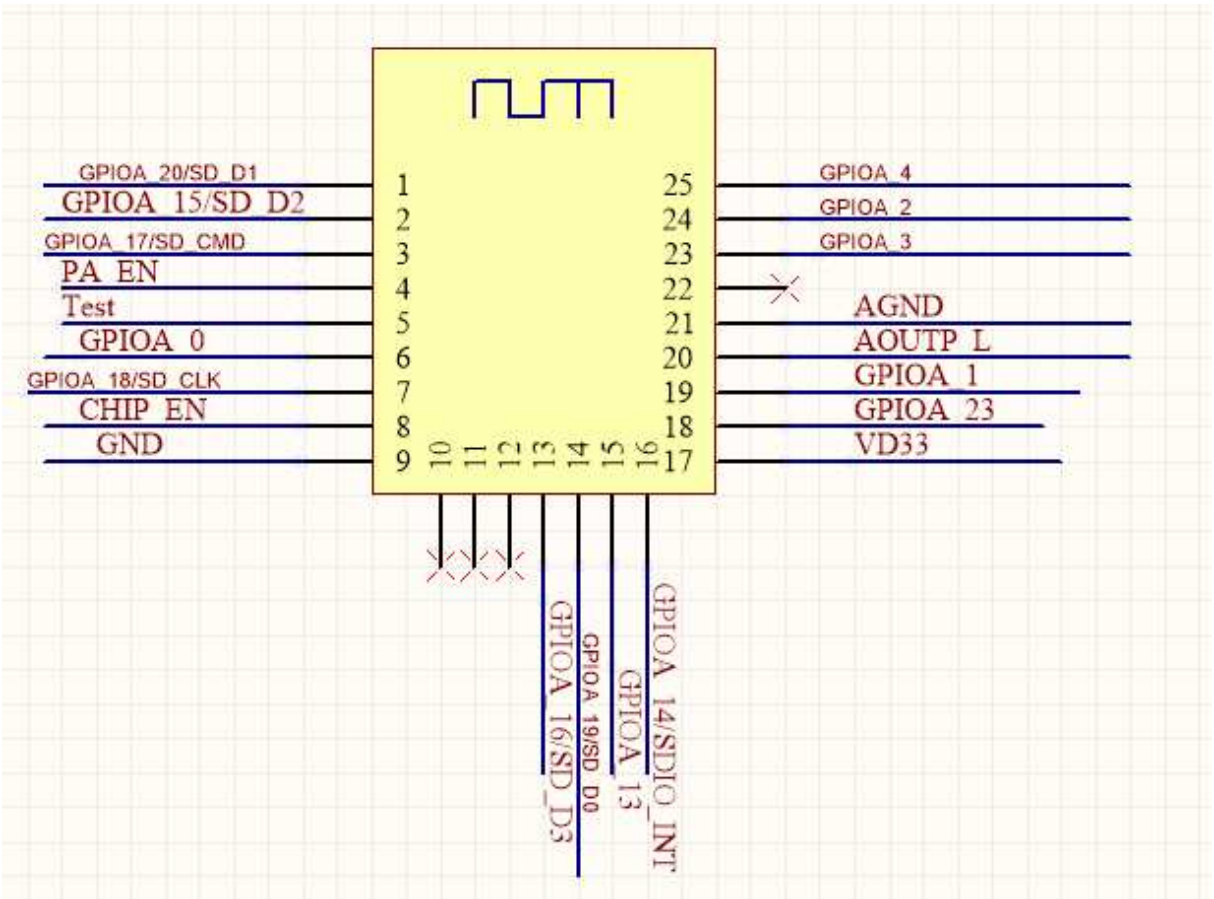

exposed
A4
L_RX
L_TX
D- D+
TP5
TP4
exposed
NC
ANGD
AOUTP_L
exposed
RTS2
RX2
A17
PA_EN
Test
A0
A18
EN
GND
1
2
3
A1
A23
3V3
17
TX
RX
CTS2
TX2
NC
NC
NC
10

Bottom View

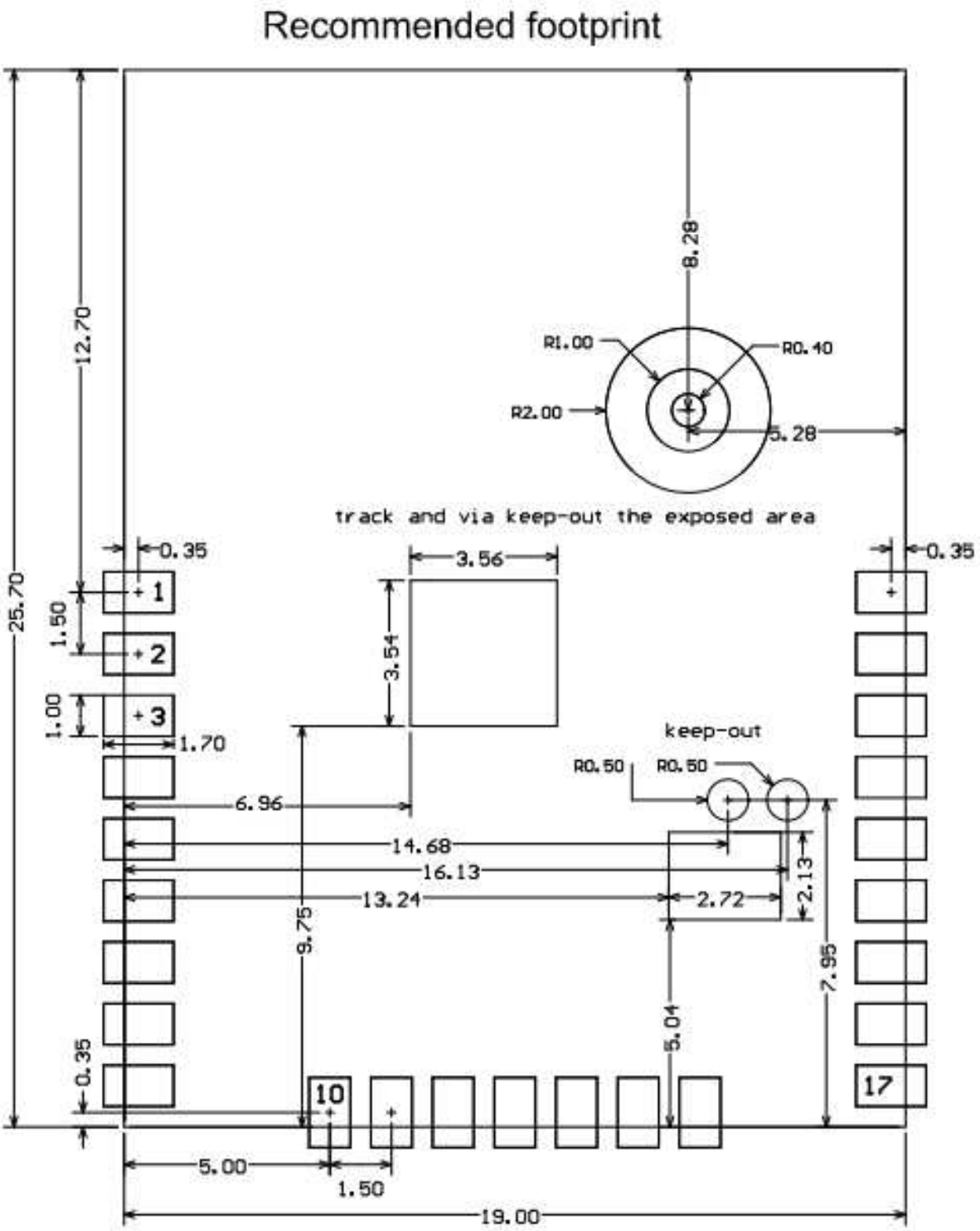
> **Note**: The default dimensional tolerance is ±0.35 mm. If you have specific requirements on dimensions, make them clear in the module datasheet after communication.

6.2 Recommended PCB footprint

The following figure is a schematic diagram of CRG1 which shows how pins correspond to each other:



The following is the diagram of the packaging of the PCB of CRG1:


Recommended footprint
8.28
12.70
R1.00
R0.40
R2.00
5.28
track and via keep-out the exposed area
0.35
3.56
0.35
25.70
1.50
1
2
3.54
1.00
3
1.70
keep-out
R0.50
R0.50
6.96
14.68
16.13
13.24
2.72
2.13
9.75
7.95
5.04
0.35
10
17
5.00
1.50
19.00

6.3 Production instructions

1. The Tuya SMT module should be mounted by the SMT device. After being unpacked, it should be soldered within 24 hours. Otherwise, it should be put into the drying cupboard where the RH is not greater than 10%; or it needs to be packaged under vacuum again and the exposure time needs to be recorded (the total exposure time cannot exceed 168 hours).

    - SMT devices:
        - Mounter
        - SPI
        - Reflow soldering machine
        - Thermal profiler
        - Automated optical inspection (AOI) equipment
    - Baking devices:
        - Cabinet oven
        - Anti-electrostatic and heat-resistant trays
        - Anti-electrostatic and heat-resistant gloves

2. Storage conditions for a delivered module:

    - The moisture-proof bag must be placed in an environment where the temperature is below 40°C and the relative humidity is lower than 90%.
    - The shelf life of a dry-packaged product is 12 months from the date when the product is packaged and sealed.
    - There is a humidity indicator card (HIC) in the packaging bag.

Figure 1: HIC-SMT module.png

3. The module needs to be baked in the following cases:

    - The packaging bag is damaged before unpacking.

- There is no HIC in the packaging bag.
- After unpacking, circles of 10% and above on the HIC become pink.
- The total exposure time has lasted for over 168 hours since unpacking.
- More than 12 months have passed since the sealing of the bag.

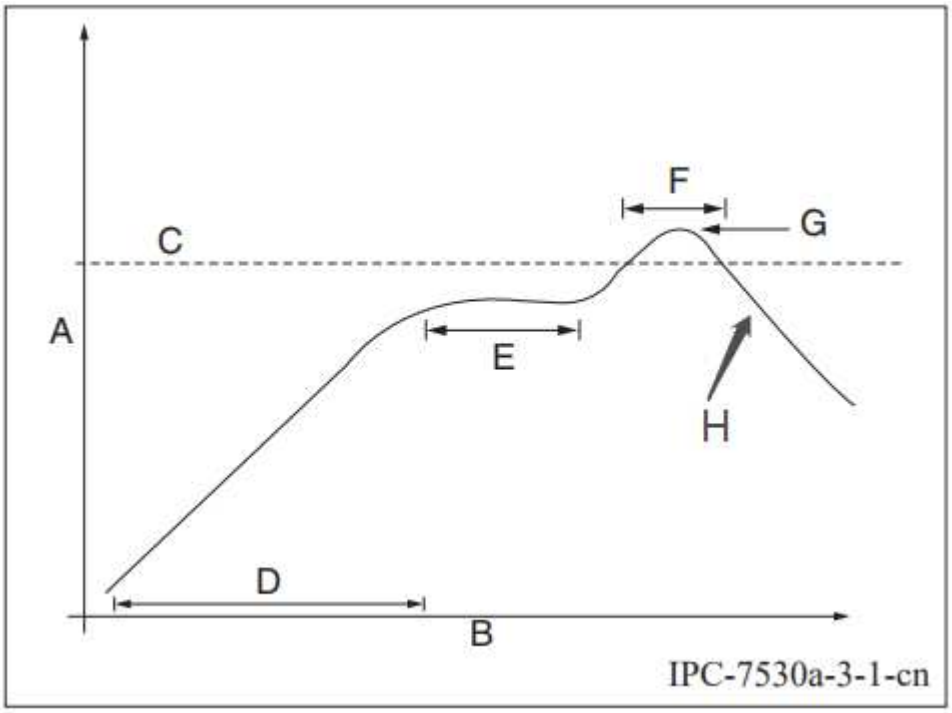
4. Baking settings:

   - Temperature: 40°C and ≤ 5% RH for reel package and 125°C and ≤5% RH for tray package (please use the heat-resistant tray rather than plastic container)
   - Time: 168 hours for reel package and 12 hours for tray package
   - Alarm temperature: 50°C for reel package and 135°C for tray package
   - Production-ready temperature after natural cooling: < 36°C
   - Re-baking situation: If a module remains unused for over 168 hours after being baked, it needs to be baked again.
   - If a batch of modules is not baked within 168 hours, do not use wave soldering to solder them. Because these modules are Level-3 moisture-sensitive devices, they are very likely to get damp when exposed beyond the allowable time. In this case, if they are soldered at high temperatures, it may result in device failure or poor soldering.

5. In the whole production process, take electrostatic discharge (ESD) protective measures.
6. To guarantee the passing rate, it is recommended that you use the SPI and AOI to monitor the quality of solder paste printing and mounting.

6.4 Recommended oven temperature curve

Set oven temperatures according to the following temperature curve of reflow soldering. The peak temperature is 245°C.



- A: Temperature axis
- B: Time axis
- C: Liquidus temperature: 217 to 220°C
- D: Ramp-up slope: 1 to 3°C/s
- E: Duration of constant temperature: 60 to 120s; the range of constant temperature: 150 to 200°C
- F: Duration above the liquidus: 50 to 70s
- G: Peak temperature: 235 to 245°C
- H: Ramp-down slope: 1 to 4°C/s

> **Note**: The above curve is just an example of the solder paste SAC305. For more details about other solder pastes, please refer to Recommended oven temperature curve in the solder paste specifications.

6.5 Storage conditions

Caution

This bag contains

MOISTURE-SENSITIVE DEVICES

LEVEL

3

If blank, see adjacent bar code label

1. Calculated shelf life in sealed bag: 12 months at <40˚C and <90% relative humidity (RH)
2. Peak package body temperature: 260 ˚C
   If blank, see adjacent bar code label
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be
   a) Mounted within: 168 hours of factory conditions
      If blank, see adjacent bar code label
      ≤30˚C/60% RH, or
   b) Stored per J-STD-033
4. Devices require bake, before mounting, if:
   a) Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at 23 ± 5˚C
   b) 3a or 3b are not met
5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: See Production Date

If blank, see adjacent bar code label

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

7 MOQ and packaging information

Product model	MOQ (pcs)	Packing method	The number of modules per reel	The number of reels per carton
CRG1	3600	Tape reel	900	4

8 Appendix: Statement

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user' s authority to operate this device.

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.

Note: This device has been tested and found to comply with the limits for a Class B digital device, according to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used following 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 device does cause harmful interference to radio or television reception, which can be determined by turning the device 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 device and receiver.
- Connect the device to 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.

Radiation Exposure Statement

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

Important Note

This radio module must not be installed to co-locate and operate simultaneously with other radios in the host system except by following FCC multi-transmitter product procedures. Additional testing and device authorization may be required to operate simultaneously with other radios.

The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible to the end-user.

The host product manufacturer is responsible for compliance with any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

The end-user manual shall include all required regulatory information/warnings as shown in this manual, including “This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body”.

This device has got an FCC ID: 2ANDL-CRG1. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-CRG1”.

This device is intended only for OEM integrators under the following conditions:

The antenna must be installed such that 20cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna.

As long as the 2 conditions above are met, further transmitter tests 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.

Declaration of Conformity European Notice

Hereby, Hangzhou Tuya Information Technology Co., Ltd declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU,2011/65/EU. A copy of the Declaration of Conformity can be found at https://www.tuya.com.

This product must not be disposed of as normal household waste, in accordance with the EU directive for waste electrical and electronic equipment (WEEE-2012/19/EU). Instead, it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point.

The device could be used with a separation distance of 20cm from the human body.