

QYAI-AC-A100

AI Voice Interaction Module Technical Specification

English translation of the supplied Chinese specification. Model identifiers, numerical values, units, and engineering drawings are retained. Original drawing labels are explained in English alongside each figure.

1. Overview

QYAI-AC-A100 is a high-performance AI voice interaction module designed for applications requiring complex speech recognition and natural language processing. It integrates a dual-core floating-point DSP processor operating at up to 320MHz, with D-cache, I-cache, and MMU support.

The module supports single-antenna, 20MHz-bandwidth Wi-Fi 802.11b/g/n in AP and STA modes, and Bluetooth BR/EDR/BLE V5.3. Audio/video resources include ADC and DAC. Peripheral interfaces include DVP cameras, TF cards, DAC, USB, ADC, IIC, SPI, and PWM. An integrated PMU provides multiple low-power modes for battery-powered devices.

2. Features

Processing and memory

- Dual-core 32-bit DSP with single-precision floating-point and a mathematical acceleration engine; I-cache, D-cache, and MMU; maximum frequency 320MHz.
- Integrated 8MB Flash.
- Integrated 8MB SDRAM.

Peripheral interfaces

- GPIO, IIC, SPI, SDIO, PWM, MCPWM, and UART.
- USB 1.1 OTG controller.
- ADC, DAC, IIS, and ISC audio/video interfaces.
- 720P DVP camera interface.
- EMI, PAP, and SPI display interfaces; 8-bit 8080 MCU displays; RGB888 (8-bit) / RGB666 (6-bit) displays.
- Infrared remote control, touch input, watchdog, and timers.

Wi-Fi

- IEEE 802.11b/g/n; 802.11n supports MCS0-MCS7 and MCS32, 20MHz bandwidth, and 800ns / 400ns guard intervals.
- AP, STA, and monitor provisioning modes.
- AP mode supports multiple connected stations.
- STA mode stores multiple networks and selects the strongest available signal.
- Fast cold-start connection in STA mode.
- Power-save mode.
- Open System, WEP, WPA-PSK / WPA2-PSK with TKIP / AES / CCMP.
- Direct RF packet transmission and reception outside the 802.11 protocol.
- RF performance testing with instruments such as CMW270.
- Transmit power: DSSS 1M/s 17dBm; MCS0 16dBm; MCS7 12dBm.
- Receive sensitivity: DSSS 1M/s -95dBm; MCS0 -91dBm; MCS7 -72dBm.

Bluetooth

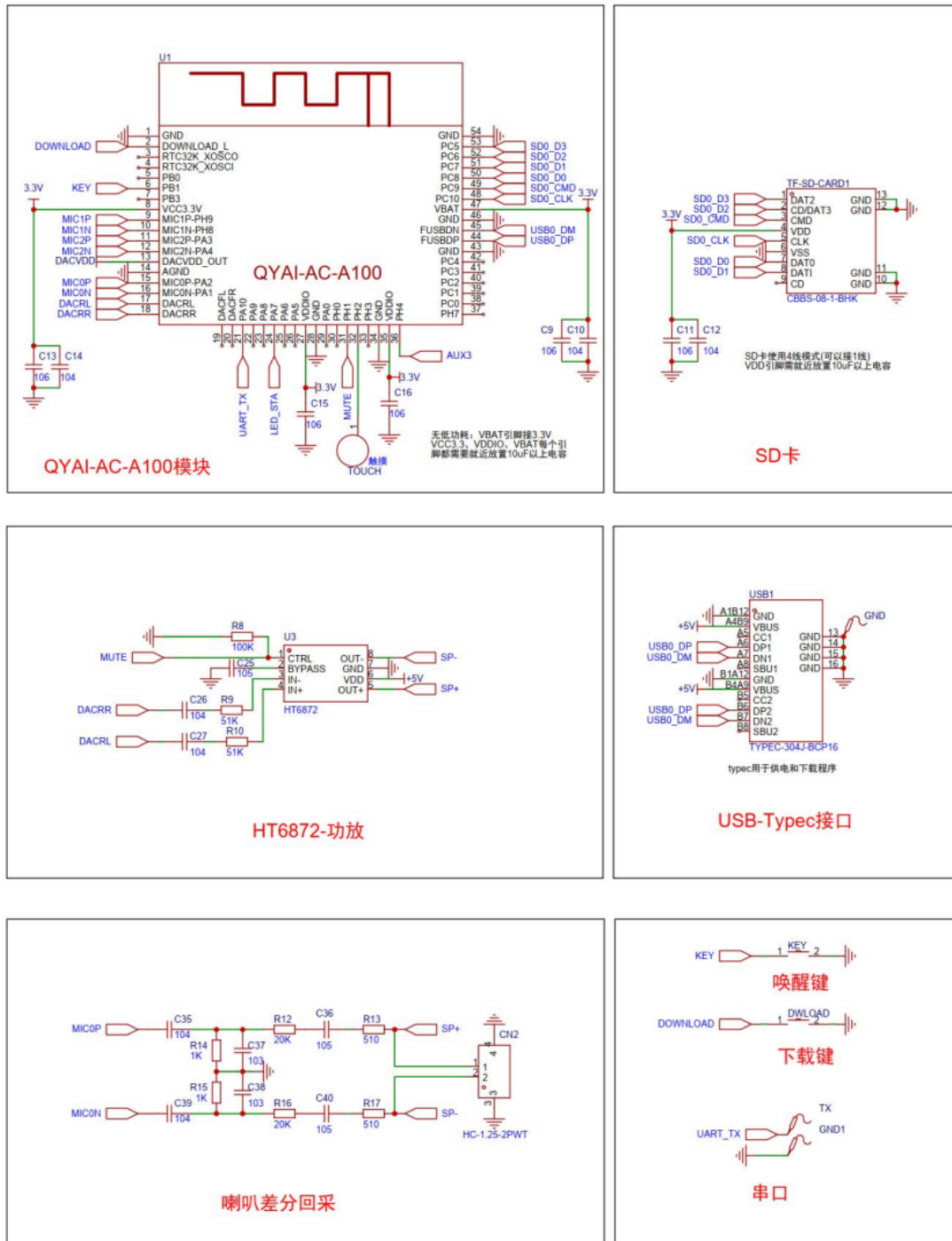
- Bluetooth V5.3 + BR + EDR + BLE.
- Piconet and scatternet support.
- Class 2 and Class 3 transmit power requirements.
- All GFSK and pi/4 DQPSK packet types.
- Transmit power: +15dBm.
- Receiver sensitivity: -93dBm.

3. Applications

- Smart gateways, smart speakers, smart home control centers, and home appliances.
- Smart toys, personal care products, and digital clocks.
- Lighting systems and digital gift products.
- IP-customized products, Internet of Things applications, and more.

4. Module definition

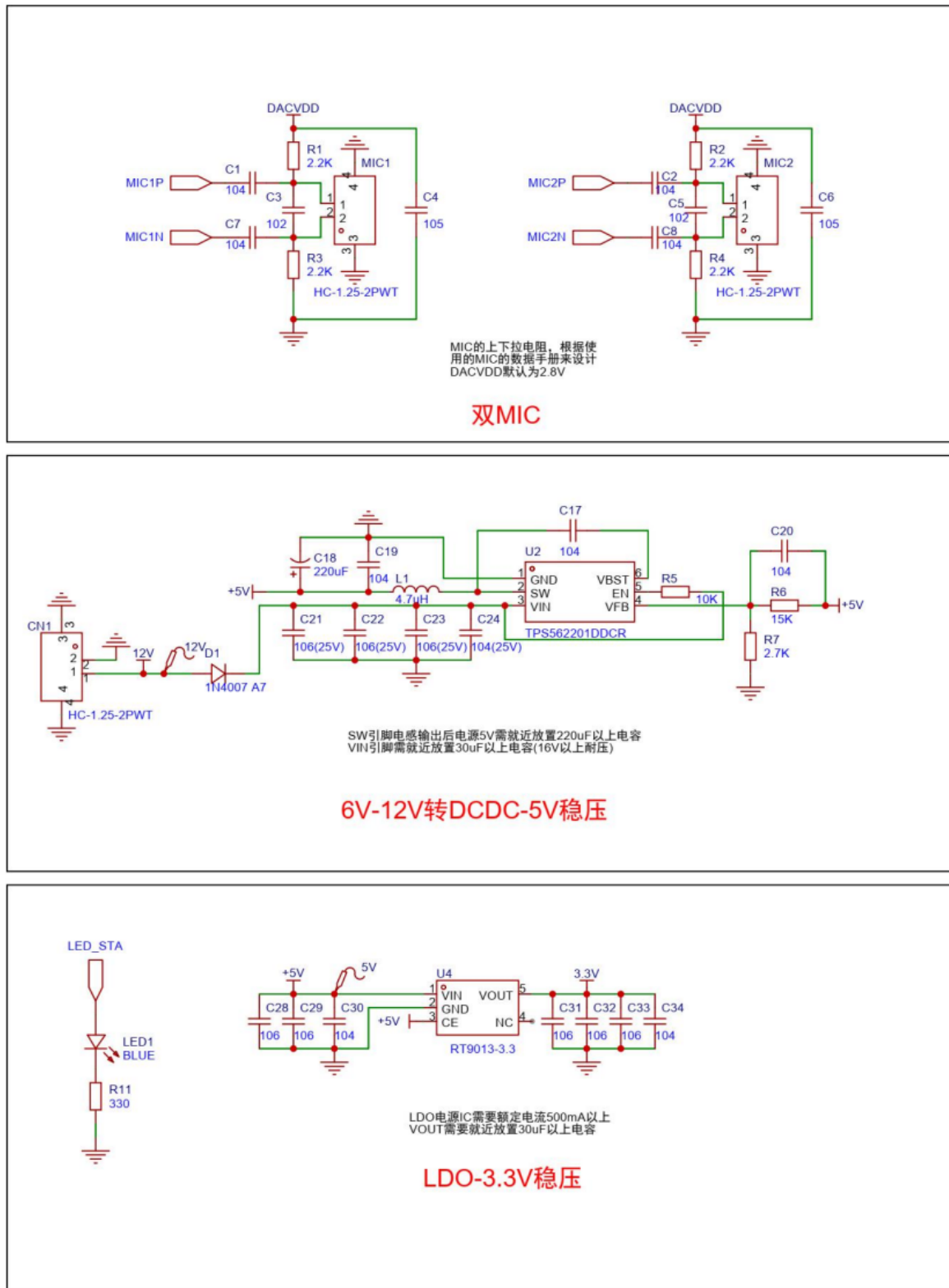
4.1 Reference schematics - signal interfaces



Original engineering drawing, unchanged. Labels: QYAI-AC-A100 module; SD card; HT6872 power amplifier; USB Type-C connector; differential speaker feedback; wake button; download button; UART.

Drawing notes: without a battery, connect VBAT to 3.3V. Place capacitors of at least 10uF close to the VCC3.3V, VDDIO, and VBAT pins. The SD card uses the four-line mode (compatible with one-line mode); place a capacitor of at least 10uF near its VDD pin. Type-C is used for programming and firmware download.

4.1 Reference schematics - microphones and power



Original engineering drawing, unchanged. Labels: dual microphones; 6V-12V to DC 5V regulator; LDO 3.3V regulator.

Microphone pull-up and pull-down resistors must follow the microphone specification. DACVDD defaults to 2.8V. Place at least 220uF on the 5V supply after the SW inductor and at least 30uF near VIN, rated above 16V. The LDO must supply a stable current of at least 500mA; place at least 30uF near VOUT.

4.2 Electrical characteristics and performance

4.2.1 Electrical characteristics

Parameter	Name	Min	Typ	Max	Unit
Storage temperature	-	-65	25	150	°C
Operating temperature	-	-40	25	85	°C
Maximum soldering temperature (PC/JEDEC J-STD-020)	-	-	-	260	°C
Supply voltage	VDD3.3	3.3	3.3	3.6	V
Supply voltage	VDDIO	3.3	3.3	3.6	V
Supply voltage	VBAT	3.3	3.7	4.2	V
Operating current	-	-	140	300	mA

4.2.2 Wi-Fi RF characteristics - transmit

Refer to IEEE 802.11 for TX power limits. Conditions: 25°C; VBAT=3.7V; WfVDD33=3.3V; 2442MHz; 4-layer board. Min and Max are unspecified (-) for all following Wi-Fi values.

Mode	Rates	Typical TX power (dBm)
802.11b	1Mbps	18
802.11b	2Mbps	18
802.11b	5.5Mbps	18
802.11b	11Mbps	18
802.11g	6Mbps	18
802.11g	9Mbps	18
802.11g	12Mbps	18
802.11g	18Mbps	18
802.11g	24Mbps	17
802.11g	36Mbps	16
802.11g	48Mbps	15
802.11g	54Mbps	14
802.11n HT20	MCS0	18
802.11n HT20	MCS1	18
802.11n HT20	MCS2	18
802.11n HT20	MCS3	18
802.11n HT20	MCS4	16
802.11n HT20	MCS5	15
802.11n HT20	MCS6	14
802.11n HT20	MCS7	13

4.2.2 Wi-Fi RF characteristics - receive

Conditions: 25°C; VBAT=3.7V; WFDVDD33=3.3V; 2442MHz; 4-layer board. Min and Max are unspecified (-).

Mode / packet error rate	Rate	Typical sensitivity (dBm)
802.11b / 8% PER, 1024-octet PSDU	1Mbps	-97
802.11b / 8% PER, 1024-octet PSDU	2Mbps	-95
802.11b / 8% PER, 1024-octet PSDU	5.5Mbps	-93
802.11b / 8% PER, 1024-octet PSDU	11Mbps	-90
802.11g / 10% PER, 1024-octet PSDU	6Mbps	-92.5
802.11g / 10% PER, 1024-octet PSDU	9Mbps	-91
802.11g / 10% PER, 1024-octet PSDU	12Mbps	-89
802.11g / 10% PER, 1024-octet PSDU	18Mbps	-87
802.11g / 10% PER, 1024-octet PSDU	24Mbps	-84
802.11g / 10% PER, 1024-octet PSDU	36Mbps	-80
802.11g / 10% PER, 1024-octet PSDU	48Mbps	-77
802.11g / 10% PER, 1024-octet PSDU	54Mbps	-75.5
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS0	-92.5
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS1	-89
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS2	-87
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS3	-84
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS4	-80
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS5	-76
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS6	-75
802.11n 20MHz / 10% PER, 1024-octet PSDU	MCS7	-74

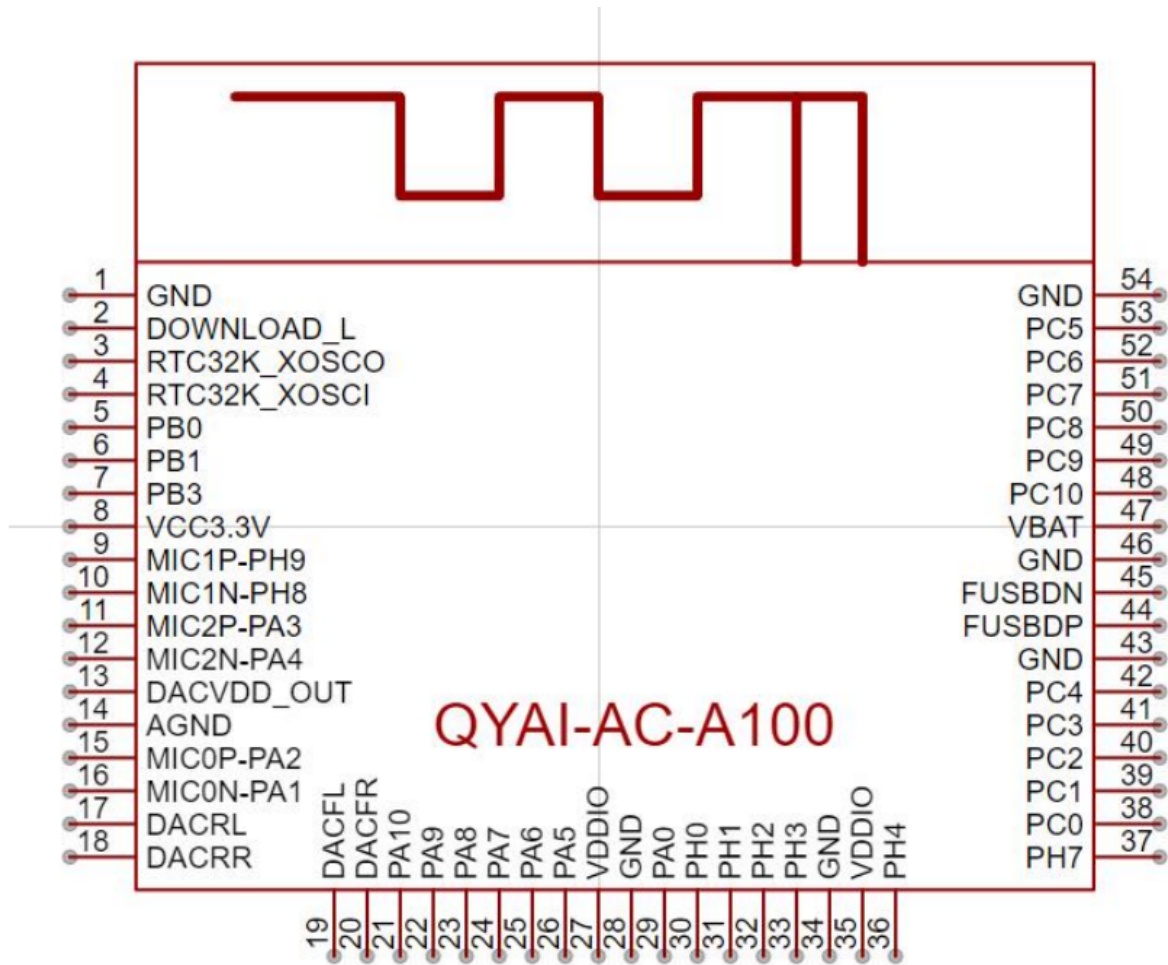
Maximum receive level: -8dBm (typical) at 1Mbps, 11Mbps, 6Mbps, 54Mbps, MCS0, and MCS7; minimum and maximum unspecified.

4.2.3 Bluetooth RF characteristics

Conditions: 25°C; VBAT=3.7V; WfVDD33=3.3V; 4-layer board. All values below are in dBm; minimum unspecified.

Type	Parameter	Typ	Max
BDR	Output power	18	20
BDR	Sensitivity (BER=0.1%)	-92	-
EDR	Output power	18	18.5
EDR	Sensitivity (BER=0.1%)	-91	-
BLE	Output power	18	19.5
BLE	1M sensitivity (PER=30.8%)	-95	-
BLE	2M sensitivity (PER=30.8%)	-89	-
BLE	Long Range S8 sensitivity (PER=30.8%)	-104	-
BLE	Long Range S2 sensitivity (PER=30.8%)	-100	-

4.3 Pin definitions



Original pinout, unchanged. Pin names in the source drawing and table are reproduced as supplied, including differences in naming.

4.3 Pin definitions - pins 1-27

Pin	Name	I/O	Function
1	GND	-	Ground
2	DOWNLOAD_L	-	Firmware download control, active low. Download data interfaces: FUSBNP and FUSBDM.
3	XTAL32K_OUT	I/O	32K crystal pin or general-purpose GPIO
4	XTAL32K_IN	I/O	32K crystal pin or general-purpose GPIO
5	PB0	I/O	general-purpose GPIO
6	PB1	I/O	ADC3; hold for 8 seconds to reset; general-purpose GPIO; recommended for buttons
7	PB3	I/O	PWM_CH6L ; UART1_TXC ; general-purpose GPIO
8	VCC3.3V	P	3.3V supply input
9	MIC_1P-PH9	AI	Analog MIC1 P input; general-purpose GPIO
10	MIC_1N-PH8	AI	Analog MIC1 N input; general-purpose GPIO
11	MIC_2P-PA3	AI	Analog MIC2 P input; general-purpose GPIO
12	MIC_2N-PA4	AI	Analog MIC2 N input; general-purpose GPIO
13	DACVDD_OUT	P	Analog microphone power output
14	AGND	-	Analog ground
15	MIC_0P-PA2	AI	Analog MIC0 P input; audio AEC P input
16	MIC_0N-PA1	AI	Analog MIC0 N input; audio AEC N input
17	DACRL	AO	Left audio channel differential output P
18	DACRR	AO	Left audio channel differential output N
19	DACFL	AO	Right audio channel differential output P
20	DACFR	AO	Right audio channel differential output N
21	PA10	I/O	ADC ; general-purpose GPIO
22	PA9	I/O	SD0_DAT0B ; general-purpose GPIO; recommended for SD cards
23	PA8	I/O	SD0_CLKB ; general-purpose GPIO; recommended for SD cards
24	PA7	I/O	SD0_CMDB ; general-purpose GPIO; recommended for SD cards
25	PA6	I/O	UART0_RXA ; general-purpose GPIO; recommended for UART
26	PA5	I/O	UART0_TXA ; general-purpose GPIO; recommended for UART
27	VDDIO	P	3.3V supply input

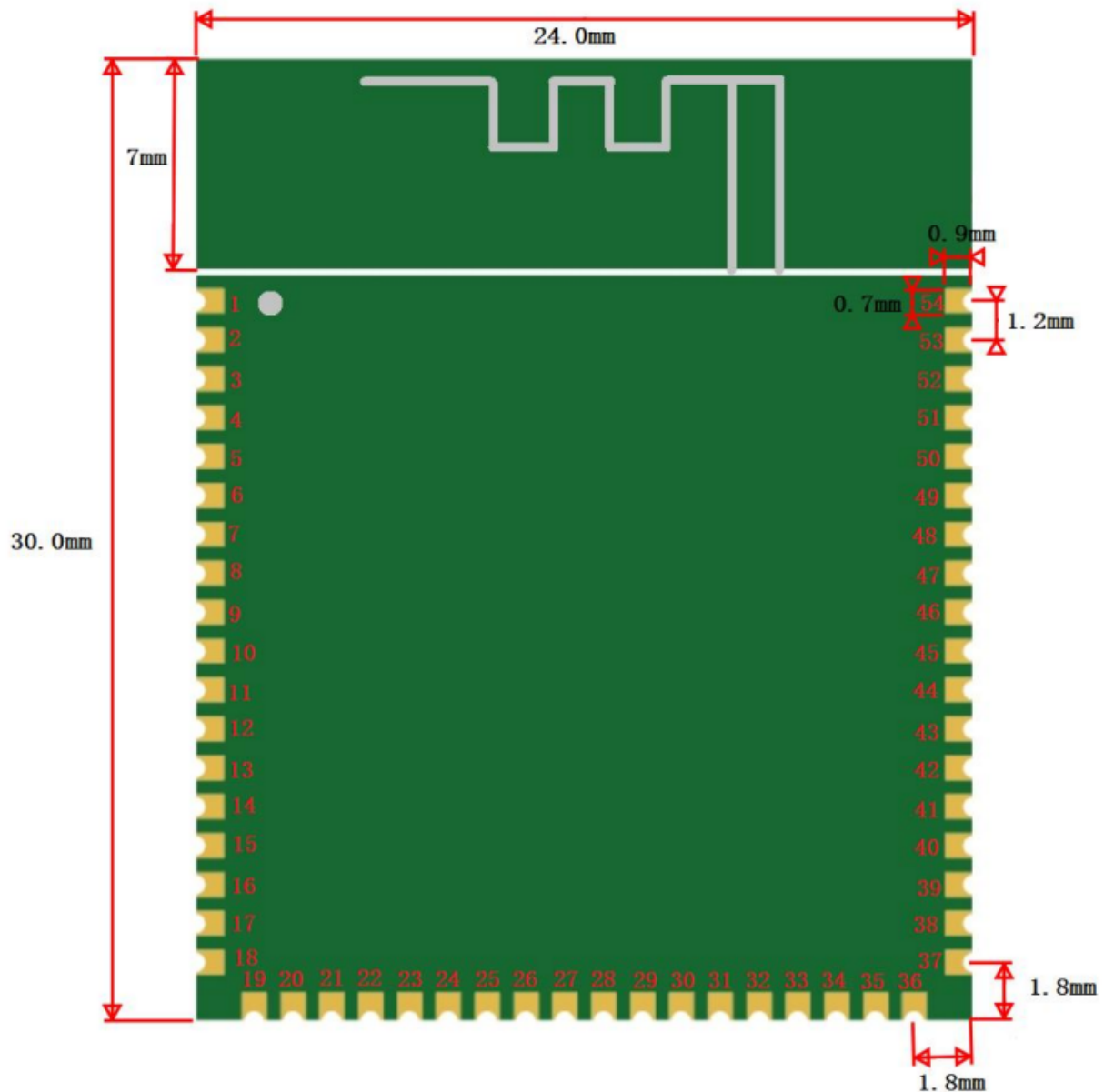
4.3 Pin definitions - pins 28-54

Pin	Name	I/O	Function
28	GND	-	Ground
29	PA0	I/O	AUX0 (LINE_IN) ; general-purpose GPIO
30	PH0	I/O	SPI2_CLKA ; PWM_CH3H ; TOUCH_CH11 ; SD0_DAT0C ; general-purpose GPIO
31	PH1	I/O	SPI2_DOA ; PWM_CH3L ; TOUCH_CH12 ; SD0_CMDC ; general-purpose GPIO
32	PH2	I/O	SPI2_DIA ; UART2_TXA ; TOUCH_CH13 ; SD0_CLKC ; general-purpose GPIO
33	PH3	I/O	ADC11 ; UART2_RXA ; PWM_CH5H ; TOUCH_CH14 ; general-purpose GPIO
34	GND	-	Ground
35	VDDIO	P	3.3V supply input
36	PH4	I/O	AUX3 (LINE_IN) ; general-purpose GPIO
37	PH7	I/O	AUX1 (LINE_IN) ; PWM_CH5L ; general-purpose GPIO
38	PC0	I/O	CAMERA0_D0 ; LCD_RGB_IMD_D7_B ; general-purpose GPIO
39	PC1	I/O	CAMERA0_D1 ; LCD_MCU_PAP_D8_A ; LCD_MCU_EMI_D0 ; LCD_RGB_IMD_D6_B ; general-purpose GPIO
40	PC2	I/O	CAMERA0_D2 ; LCD_MCU_PAP_D9_A ; LCD_MCU_EMI_D1 ; LCD_RGB_IMD_D5_B ; general-purpose GPIO
41	PC3	I/O	CAMERA0_D3 ; LCD_MCU_PAP_D10_A ; LCD_MCU_EMI_D2 ; LCD_RGB_IMD_D4_B ; general-purpose GPIO
42	PC4	I/O	CAMERA0_D4 ; LCD_MCU_PAP_D11_A ; LCD_MCU_EMI_D3 ; LCD_RGB_IMD_D3_B ; general-purpose GPIO
43	GND	-	Ground
44	FUSB_DP	AI/O	USB1.1_D+ ; general-purpose GPIO
45	FUSB_DN	AI/O	USB1.1_D- ; general-purpose GPIO
46	GND	-	Ground
47	VBAT	P	Battery supply input (3.7V-4.2V); connect 3.3V for low-power use without a battery
48	PC10	I/O	CAMERA0_SYNC1 ; LCD_MCU_PAP_RD_A ; LCD_MCU_EMI_WR ; LCD_RGB_IMD_SYNC1_B ; general-purpose GPIO
49	PC9	I/O	CAMERA0_SYNC0 ; LCD_MCU_PAP_WR_A ; LCD_RGB_IMD_SYNC0_B ; general-purpose GPIO
50	PC8	I/O	CAMERA0_PCLK ; LCD_MCU_PAP_D15_A ; LCD_MCU_EMI_D7 ; LCD_RGB_IMD_CLK_B ; general-purpose GPIO
51	PC7	I/O	CAMERA0_D7 ; LCD_MCU_PAP_D14_A ; LCD_MCU_EMI_D6 ; LCD_RGB_IMD_D0_B ; general-purpose GPIO
52	PC6	I/O	CAMERA0_D6 ; LCD_MCU_PAP_D13_A ; LCD_MCU_EMI_D5 ; LCD_RGB_IMD_D1_B ; general-purpose GPIO
53	PC5	I/O	CAMERA0_D5 ; LCD_MCU_PAP_D12_A ; LCD_MCU_EMI_D4 ; LCD_RGB_IMD_D2_B ; general-purpose GPIO
54	GND	-	Ground

4.4 Package dimensions

Three rows of pins, 1.2 ± 0.1mm pitch, 54 pins total. Module dimensions as specified: 30 ± 0.25mm (W) × 24 ± 0.25mm (L) × 0.8 ± 0.25mm (H).

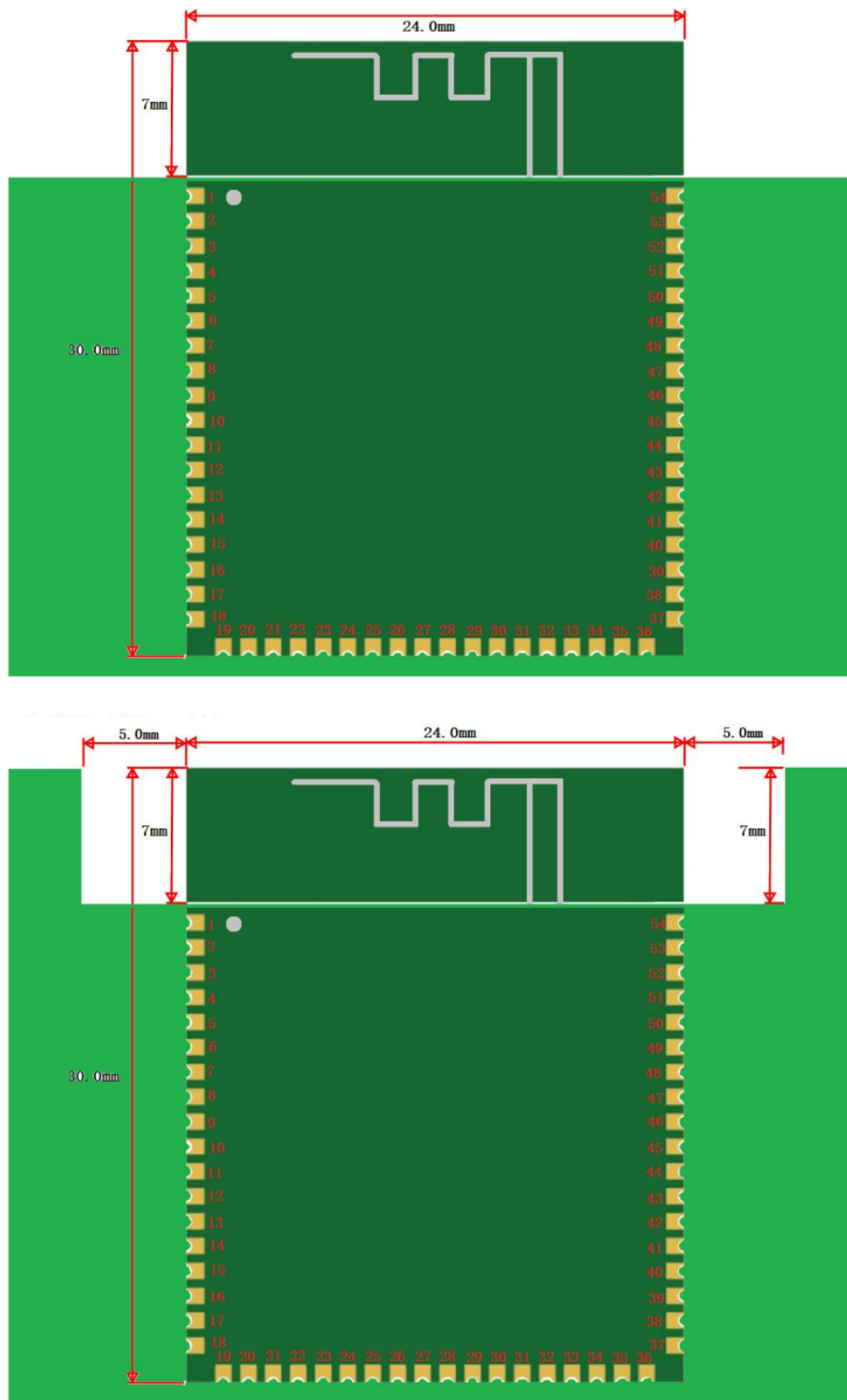
Recommended PCB footprint (original drawing):



Drawing dimensions: 24.0mm across, 30.0mm along the module; antenna area 7mm; pad width 0.9mm; marked clearance 0.7mm; pitch 1.2mm; corner dimensions 1.8mm. The source text and drawing use different width/length orientations; both are retained.

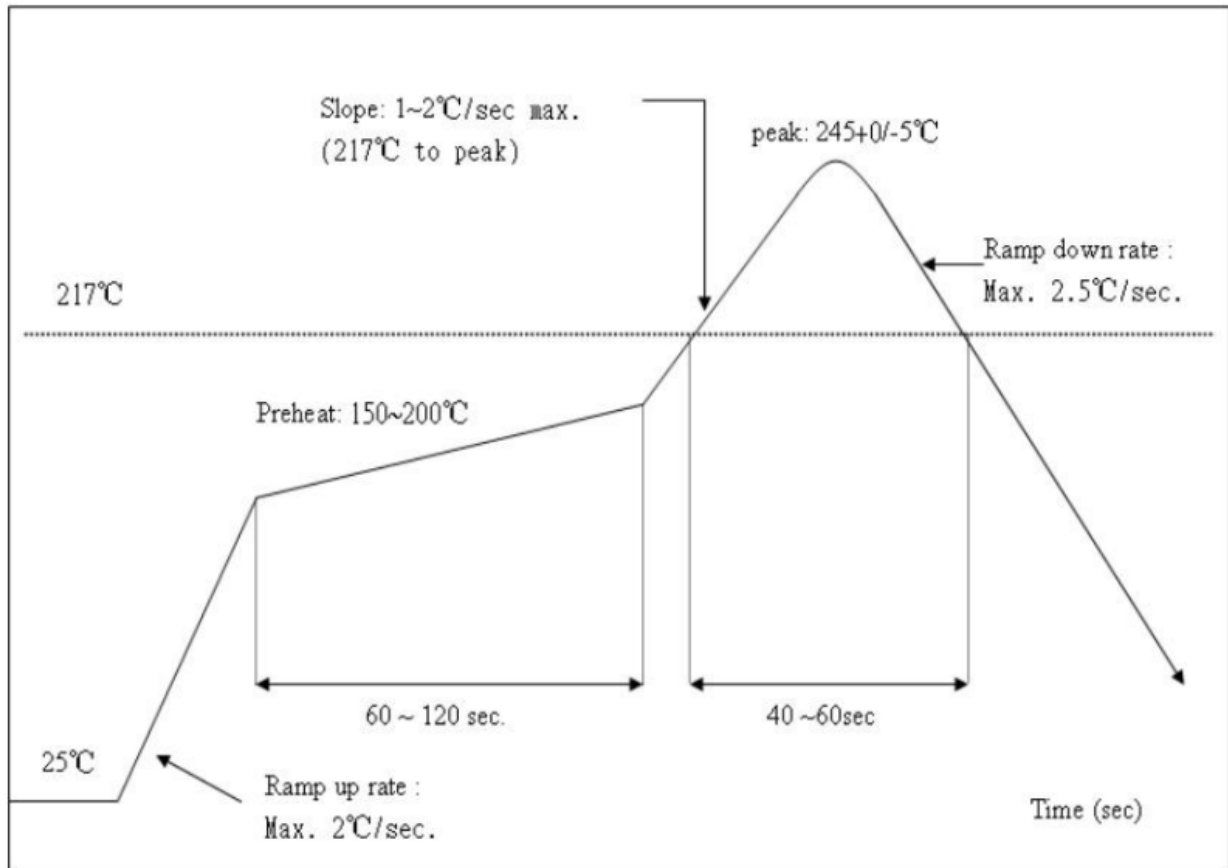
4.4 Recommended carrier PCB layouts

Original layouts, unchanged. Both show a 24.0mm × 30.0mm module and a 7mm antenna area. The second layout shows an additional 5.0mm clearance on each side of the antenna area.



5. Reflow soldering profile

Following IPC/JEDEC guidance, the source recommends an oven temperature no higher than 250°C and no more than two reflow cycles. The recommended profile is reproduced below.



Profile labels: start 25°C; ramp-up maximum 2°C/s; preheat 150-200°C for 60-120 seconds; 217°C threshold; slope 1-2°C/s maximum from 217°C to peak; peak 245°C (+0/-5°C); 40-60 seconds above 217°C; ramp-down maximum 2.5°C/s.

6. AI model interaction

- Supports languages used in 86 countries, covering 97% of the global population; the domestic version supports Chinese and English.
- Customizable voices, product scenarios, and roles.
- Rapid agent development using no-code, low-code, and high-code workflows.
- Model-based speech synthesis with emotional expression and more human-like interaction.
- Model-based voice replication using recordings only seconds long for custom voices.
- Permanently free voice interaction experience.

7. Server capabilities

- Complete cloud-connected product forms with extensive customization.
- Custom integration with domestic and international large language models for fast connection across frameworks.
- Domestic and international servers to meet low-latency voice interaction requirements in different regions.

Translation note: feature and service statements reproduce the supplied specification. RF summary values in section 2 differ from detailed tables in section 4.2; no values have been reconciled or changed. Confirm the applicable product revision and service terms with the supplier.