RTL8735BDM-A20-N04

MODULE DATASHEET

Rev. 1.2

Nov. 2025

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USING THIS DOCUMENT

This document is intended for the software engineer's reference and provides detailed programming information.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

ELECTROSTATIC DISCHARGE (ESD) WARNING

This product can be damaged by Electrostatic Discharge (ESD). When handling, care must be taken. Damage due to inappropriate handling is not covered by warranty.

Do not open the protective conductive packaging until you have read the following, and are at an approved anti-static workstation.

- Use an approved anti-static mat to cover your work surface
- Use a conductive wrist strap attached to a good earth ground
- Always discharge yourself by touching a grounded bare metal surface or approved anti-static mat before picking up an ESD-sensitive electronic component
- If working on a prototyping board, use a soldering iron or station that is marked as ESD-safe
- Always disconnect the microcontroller from the prototyping board when it is being worked on

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Revision History

Revision	Release Date	Summary
1.0	2024/12/05	Initial release
1.1	2025/5/25	Add IC series number
1.2	2025/11/12	Correct typo

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1. Module Overview

1.1. General Description

Ameba-IoT RTL8735BDM-A20-N04 is a highly integrated low power 802.11 a/b/g/n Wireless LAN (WLAN) and Bluetooth camera Module. It combines ARM v8M MCUs (500MHz and 2.23 DMIPS/MHz), WLAN MAC, a 1T1R capable WLAN baseband, Bluetooth MAC, RF, audio codec, ISP and H264/H265 encoder in a single chip. It provides useful high speed connectivity interfaces, such as USB 2.0 host, USB 2.0 device, and SD host interfaces. It also provides a bunch of configurable GPIOs which are configured as digital peripherals for different application and control usage.
The RTL8735BDM-A20-N04 module integrates internal memory for full Wi-Fi protocol functions. The embedded memory configuration also enables various application development.

1.2. Features

CPU and Internal Memory

- RTL8735BDM-AA4-CG (named RTL8735BDM thereafter) chipset embedded, Real-M500 (TM9) MCU up to 500MHz
- Embedded intelligent Engine 0.384TOPS,384 MAC, INT8/INT16 engine precision supported
- 768KB ROM on chip
- 512KB RAM on chip
- 128MB DDR2 Memory on chip
- Supports external flash interface

ISP and Video Encoding

- Support 12bit Bayer pattern input and 8bit YUY2 input from CMOS sensor
- Support MIPI CSI-2 four data lane
- Support 3DNR, 3A, Digital WDR, OSD
- Max 5-megapixel resolution for H.264/H.265 encoding
- Multiple streams real-time H.265/H.264/JPEG encoding

- H265 2M@30fps + H265 1M@30fps
- CBR/VBR rate control

Wi-Fi

- 802.11 a/b/g/n 1x1, 2.4GHz & 5GHz
- Center frequency range of operating channel: 2412MHz ~ 2484MHz, 5180MHz ~ 5825MHz
- Support 20MHz bandwidth, up to the data rate of MCS7
- Wi-Fi WEP, WPA, WPA2, WPA3, WPS; open, shared key, and pair-wise key authentication services
- Support low power Tx/Rx for short-range application
- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)

Bluetooth Low Energy

- Bluetooth Low Energy (BLE) 5.1
- Speed: 125Kbps, 500Kbps, 1Mbps, and 2Mbps
- Support LE secure connections
- Support LE scatternet
- Support 1 Master links/1 Slave link
- Co-existence RF design between Wi-Fi and Bluetooth

Peripherals

- 3x UART interface, baud rate up to 4MHz
- 2 x I2C, two speed modes: standard up to 10Kbps, fast up to 400Kbps
- 1 x SD Host for SD version 1.0-3.0 up to 2TB, bus frequency up to 100MHz
- 2 x SPI Master/Slave, speed up to 31.25MHz
- 1 x USB 2.0 Host HS/FS mode, 1 x USB 2.0 Device HS/FS mode
- 7 x PWM with configurable duration and duty cycle from 0 ~ 100%
- 29 x programmable GPIOs
- 2 x GDMA and each with maximum 6 channels

Antenna Option

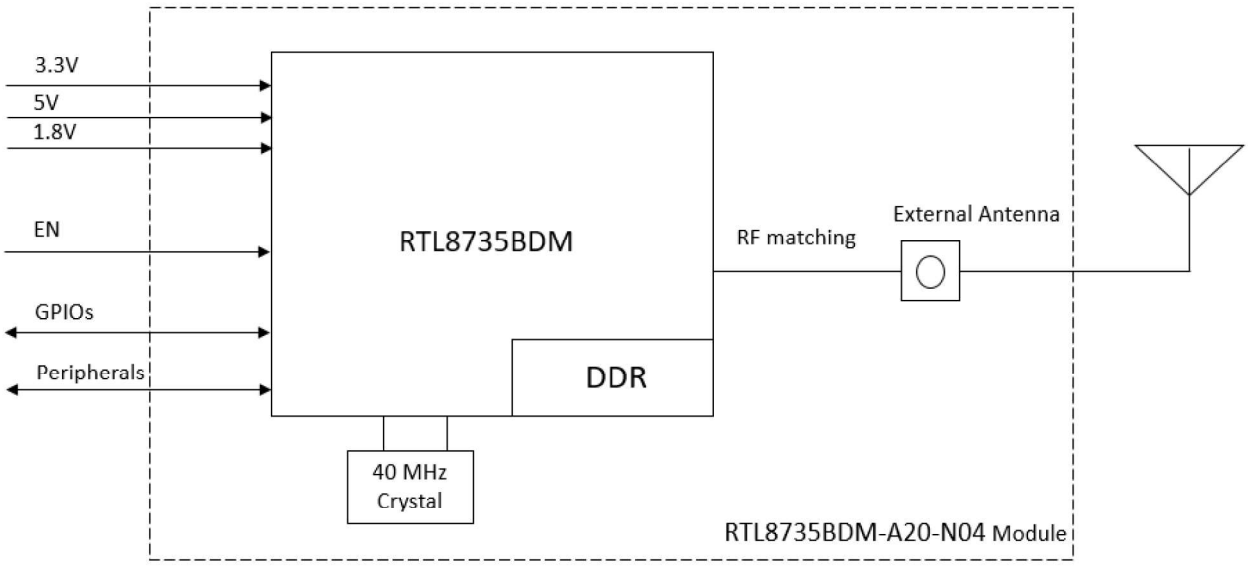
- External Antenna via an I-PEX 4 connector

Operating Conditions

- Operating input voltage: (3.3 ± 5%)V
- Operating ambient temperature: -20°C to 85°C

2. Module Block Diagram

This module includes the chipset, crystal component, and R/L/C components etc.



3. Module Pin Definition

3.1. Module Pin Layout

This module has 90 pins.

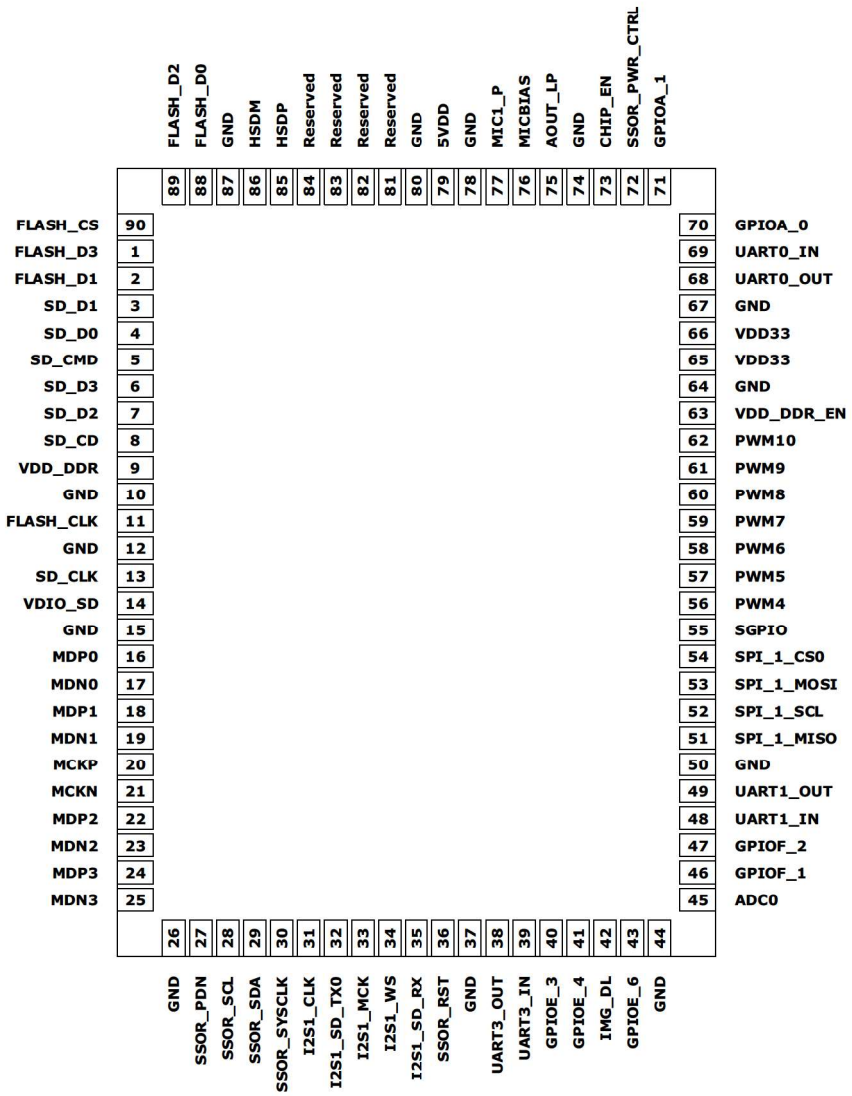


Figure 1 Module Pin Layout (top view)

3.2. Module Pin Description

3.2.1. Pin Description

Pin Name	Pin No.	Type	Description
FLASH_D3	1	IO	NOR/NAND Flash DAT3 signal. Multiplexed with GPIOC_1.
FLASH_D1	2	IO	NOR/NAND Flash DAT1 signal. Multiplexed with GPIOC_4.
SD_D1	3	IO	SD Data 1. Multiplexed with GPIOS_1.
SD_D0	4	IO	SD Data 0. Multiplexed with GPIOS_2.
SD_CMD	5	IO	SD Command. Multiplexed with GPIOS_3.
SD_D3	6	IO	SD Data 3. Multiplexed with GPIOS_5.
SD_D2	7	IO	SD Data 2. Multiplexed with GPIOS_6.
SD_CD	8	I	SD Card Detection. Multiplexed with GPIOS_4.
VDD_DDR	9	PI	1.8V/1.35V power input
GND	10	G	GROUND
FLASH_CLK	11	IO	NOR/NAND Flash CLK signal. Multiplexed with GPIOC_0.
GND	12	G	GROUND
SD_CLK	13	O	SD Bus clock. Multiplexed with GPIOS_0.
VDIO_SD	14	PO	3.3V/1.8V power (from PIN58) for GPIOS.
GND	15	G	GROUND
MDP0	16	I	MIPI sensor lane0 differential data positive input.
MDN0	17	I	MIPI sensor lane0 differential data negative input.
MDP1	18	I	MIPI sensor lane1 differential data positive input.
MDN1	19	I	MIPI sensor lane1 differential data negative input.
MCKP	20	I	MIPI sensor differential clock positive input.
MCKN	21	I	MIPI sensor differential clock negative input.
MDP2	22	I	MIPI sensor lane2 differential data positive input.
MDN2	23	I	MIPI sensor lane2 differential data negative input.
MDP3	24	I	MIPI sensor lane3 differential data positive input.
MDN3	25	I	MIPI sensor lane3 differential data negative input.
GND	26	G	GROUND
SSOR_PDN	27	O	Image sensor power down.
SSOR_SCL	28	IO	Image sensor I2C Serial-Clock.
SSOR_SDA	29	IO	Image sensor I2C Serial-Data.

Pin Name	Pin No.	Type	Description
SSOR_SYSCLK	30	O	Image sensor Master Clock.
I2S1_CLK	31	IO	Digital Audio bit Clock. Multiplexed with GPIOD_14.
I2S1_CD_TX0	32	IO	Digital Audio serial data out. Multiplexed with GPIOD_15.
I2S1_MCK	33	IO	Digital Audio Master Clock. Multiplexed with GPIOD_16.
I2S1_WS	34	IO	Digital Audio Word select. Multiplexed with GPIOD_17.
I2S1_SD_RX	35	IO	Digital Audio serial data input. Multiplexed with GPIOD_18.
SSOR_RST	36	O	Image sensor Reset.
GND	37	G	GROUND
UART3_OUT	38	IO	Transmit Asynchronous Data Output 3.
UART3_IN	39	IO	Receiving Asynchronous Data Input 3.
GPIOE_3	40	IO	GPIO Pin.
GPIOE_4	41	IO	GPIO Pin.
IMG_DL	42	IO	Image download pin. Connect a 10K resistor to VDD33.
GPIOE_6	43	IO	GPIO Pin.
GND	44	G	GROUND
ADC0	45	IO	ADC converter input chancel 0. Multiplexed with GPIOF_0.
GPIOF_1	46	IO	GPIO Pin.
GPIOF_2	47	IO	GPIO Pin.
UART1_IN	48	IO	Log Input.
UART1_OUT	49	IO	Log Output.
GND	50	G	GROUND
SPI_1_MISO	51	IO	Serial Peripheral Interface: Master Input, Slave Output. Multiplexed with GPIOF_5.
SPI_1_SCL	52	IO	Serial Peripheral Interface: Serial Clock. Multiplexed with GPIOF_6.
SPI_1_MOSI	53	IO	Serial Peripheral Interface: Master Output, Slave Input. Multiplexed with GPIOF_7.
SPI_1_CS0	54	IO	Serial Peripheral Interface: Chip select. Multiplexed with GPIOF_8.
SGPIO	55	IO	Serial GPIO pin. Multiplexed with GPIOF_9.
PWM4	56	IO	Pulse-width modulation 4. Multiplexed with GPIOF_10.
PWM5	57	IO	Pulse-width modulation 5. Multiplexed with GPIOF_11.
PWM6	58	IO	Pulse-width modulation 6. Multiplexed with GPIOF_12.
PWM7	59	IO	Pulse-width modulation 7. Multiplexed with GPIOF_13.

Pin Name	Pin No.	Type	Description
PWM8	60	IO	Pulse-width modulation 8. Multiplexed with GPIOF_14.
PWM9	61	IO	Pulse-width modulation 9. Multiplexed with GPIOF_15.
PWM10	62	IO	Pulse-width modulation 10. Multiplexed with GPIOF_16.
VDD_DDR_EN	63	IO	VDD_DDR power enable.
GND	64	G	GROUND
VDD33	65	PI	3.3V power input for module.
VDD33	66	PI	3.3V power input for module.
GND	67	G	GROUND
UART0_OUT	68	IO	Transmit Asynchronous Data Output. Multiplexed with GPIOA_2
UART0_IN	69	IO	Receiving Asynchronous Data Input. Multiplexed with GPIOA_1
GPIOA_0	70	IO	GPIO Pin.
GPIOA_1	71	IO	GPIO Pin.
SSOR_PWR_CTRL	72	IO	Image Sensor Power Control.
CHIP_EN	73	I	Whole chip enable control. When asserted, chip function is enabled; when de-asserted, whole chip is shutdown.
GND	74	G	GROUND
AOUT_LP	75	O	Speaker output positive signal.
MICBIAS	76	PO	Microphone bias output.
MIC1_P	77	I	MIC input positive signal.
GND	78	G	GROUND
5VDD	79	PI	5V power input for module.
GND	80	G	GROUND
Reserved	81		Reserved
Reserved	82		Reserved
Reserved	83		Reserved
Reserved	84		Reserved
HSDP	85	IO	High-Speed USB D+ signal. Shared with GPIOB_0.
HSDM	86	IO	High-Speed USB D- signal. Shared with GPIOB_1.
GND	87	G	GROUND
FLASH_D0	88	IO	NOR/NAND Flash DAT0 signal. Multiplexed with GPIOC_2.
FLASH_D2	89	IO	NOR/NAND Flash DAT2 signal. Multiplexed with GPIOC_3.
FLASH_CS	90	IO	NOR/NAND Flash CS signal. Multiplexed with GPIOC_5.

NOTE:

P: power supply

I: input

O: output

3.2.2. Strapping Pins

This module's strapping pins:

Pin Name	Pin No.	Type	Description
SSOR_PWR_CTRL	72	IO	0 : Normal operation mode 1 : Enter into load code mode

4. RF Characteristic

Supported WLAN channels are based on different regions. For example, in the US/Canada, channels 1–11 are supported, while in Europe, channels 1–13 are supported.
The maximum output power will be limited by the regulations of different countries.

4.1. Wi-Fi Radio Standard

Wi-Fi Wireless Standard	Description
Wi-Fi frequency range	2412MHz ~ 2484MHz (2.4GHz ISM Band) 5180MHz ~ 5850MHz (5GHz)
Wi-Fi wireless standard	IEEE 802.11a/b/g/n
Wi-Fi wireless standard Modulation	DSSS, DBPSK, DQPSK, CCK and OFDM (BPSK/QPSK/16-QAM/64-QAM)
Wi-Fi wireless data rate	802.11a: 6/9/12/18/24/36/48/54 Mbps 802.11b: 1/2/5.5/11 Mbps 802.11g: 6/9/12/18/24/36/48/54 Mbps 802.11n: HT20 MCS 0~7

4.1.1. Wi-Fi 2.4GHz Band RF Transmitter Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	-	2412	-	2484	MHz
TX power at the antenna port for the highest power level (25^0C)	1 Mbps DSSS	-	20	-	dBm
	11 Mbps DSSS	-	19	-	dBm
	6 Mbps OFDM	-	19.5	-	dBm
	54 Mbps OFDM	-	17	-	dBm
	HT20 MCS0	-	19	-	dBm
	HT20 MCS7	-	16	-	dBm
Tx EVM	1 Mbps DSSS	-	8	-	%
	11 Mbps DSSS	-	8	-	%
	6 Mbps OFDM	-	-5	-	dB

	54 Mbps OFDM	-	-25	-	dB
	HT20 MCS0	-	-5	-	dB
	HT20 MCS7	-	-28	-	dB
Carrier Suppression		-	-	-30	dBc

4.1.2. Wi-Fi 2.4GHz Band RF Receiver Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	-	2412	-	2484	MHz
802.11b Rx Sensitivity (8% PER)	1 Mbps DSSS	-	-95	-	dBm
	2 Mbps DSSS	-	-92	-	dBm
	5.5 Mbps DSSS	-	-89	-	dBm
	11 Mbps DSSS	-	-86	-	dBm
802.11g Rx Sensitivity (10% PER)	6 Mbps OFDM	-	-90	-	dBm
	9 Mbps OFDM	-	-89	-	dBm
	12 Mbps OFDM	-	-88	-	dBm
	18 Mbps OFDM	-	-86	-	dBm
	24 Mbps OFDM	-	-83	-	dBm
	36 Mbps OFDM	-	-79	-	dBm
	48 Mbps OFDM	-	-75	-	dBm
	54 Mbps OFDM	-	-73	-	dBm
802.11n Rx Sensitivity (10% PER)	HT20 MCS0	-	-89	-	dBm
	HT20 MCS1	-	-87	-	dBm
	HT20 MCS2	-	-86	-	dBm
	HT20 MCS3	-	-82	-	dBm
	HT20 MCS4	-	-79	-	dBm
	HT20 MCS5	-	-74	-	dBm
	HT20 MCS6	-	-73	-	dBm
	HT20 MCS7	-	-72	-	dBm
Maximum Receive Level	1 Mbps DSSS	-	-	0	dBm
	11 Mbps DSSS	-	-	0	dBm
	6 Mbps OFDM	-	-	0	dBm

	54 Mbps OFDM	-	-	0	dBm
	MCS0	-	-	0	dBm
	MCS7	-	-	0	dBm

4.1.3. Wi-Fi 5GHz Band RF Transmitter Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	-	5180	-	5850	MHz
TX power at the antenna port for the highest power level (25^0C)	6 Mbps OFDM	-	19.5	-	dBm
	54 Mbps OFDM	-	17	-	dBm
	HT20 MCS0	-	19	-	dBm
	HT20 MCS7	-	16	-	dBm
Tx EVM	6 Mbps OFDM	-	-5	-	dB
	54 Mbps OFDM	-	-25	-	dB
	HT20 MCS0	-	-5	-	dB
	HT20 MCS7	-	-28	-	dB
Carrier Suppression		-	-	-30	dBc

4.1.4. Wi-Fi 5GHz Band RF Receiver Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	-	5180	-	5825	MHz
802.11g Rx Sensitivity (10% PER)	6 Mbps OFDM	-	-91	-	dBm
	9 Mbps OFDM	-	-90	-	dBm
	12 Mbps OFDM	-	-88	-	dBm
	18 Mbps OFDM	-	-85	-	dBm
	24 Mbps OFDM	-	-82	-	dBm
	36 Mbps OFDM	-	-79	-	dBm
	48 Mbps OFDM	-	-75	-	dBm
	54 Mbps OFDM	-	-73	-	dBm
802.11n Rx Sensitivity	HT20 MCS0	-	-91	-	dBm

(10% PER)	HT20 MCS1	-	-88	-	dBm
	HT20 MCS2	-	-85	-	dBm
	HT20 MCS3	-	-82	-	dBm
	HT20 MCS4	-	-79	-	dBm
	HT20 MCS5	-	-74	-	dBm
	HT20 MCS6	-	-73	-	dBm
	HT20 MCS7	-	-71	-	dBm
Maximum Receive Level	6 Mbps DSSS	-	-	0	dBm
	54 Mbps DSSS	-	-	0	dBm
	MCS0	-	-	0	dBm
	MCS7	-	-	0	dBm

4.2. Bluetooth LE radio Standard

4.2.1. Bluetooth LE RF Transmitter Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	-	2402	-	2480	MHz
Tx Output Power	LE1M		8		dBm
	LE2M				
Modulation Characteristics (LE1M)	Δf1avg	225	-	275	kHz
	Δf2avg	185	-	-	kHz
	Modulation Index (Δf2avg./Δf1avg.)	0.8	-	-	
Modulation Characteristics (LE2M)	Δf1avg	450	-	550	kHz
	Δf1avg	370	-	-	kHz
	Modulation Index (Δf2avg./Δf1avg.)	0.8	-	-	
Modulation Characteristics Stable Modulation (LE1M)	Δf1avg	247.5	-	252.5	kHz
	Δf2avg	185	-	-	kHz
	Modulation Index (Δf2avg./Δf1avg.)	0.8	-	-	
Modulation Characteristics Stable	Δf1avg	495	-	505	kHz
	Δf2avg	370	-	-	kHz

Modulation (LE2M)	Modulation Index (Δf2avg./Δf1avg.)	0.8	-	-	

4.2.2. Bluetooth LE RF Receiver Specification

Parameter	Condition	Min.	Typ.	Max.	Unit
Frequency Range	-	2402	-	2480	MHz
Rx Sensitivity @30.8% PER	LE1M		-90		dBm
	LE2M		-88		dBm

5. Module Electrical Characteristics

5.1. Module Operating Conditions

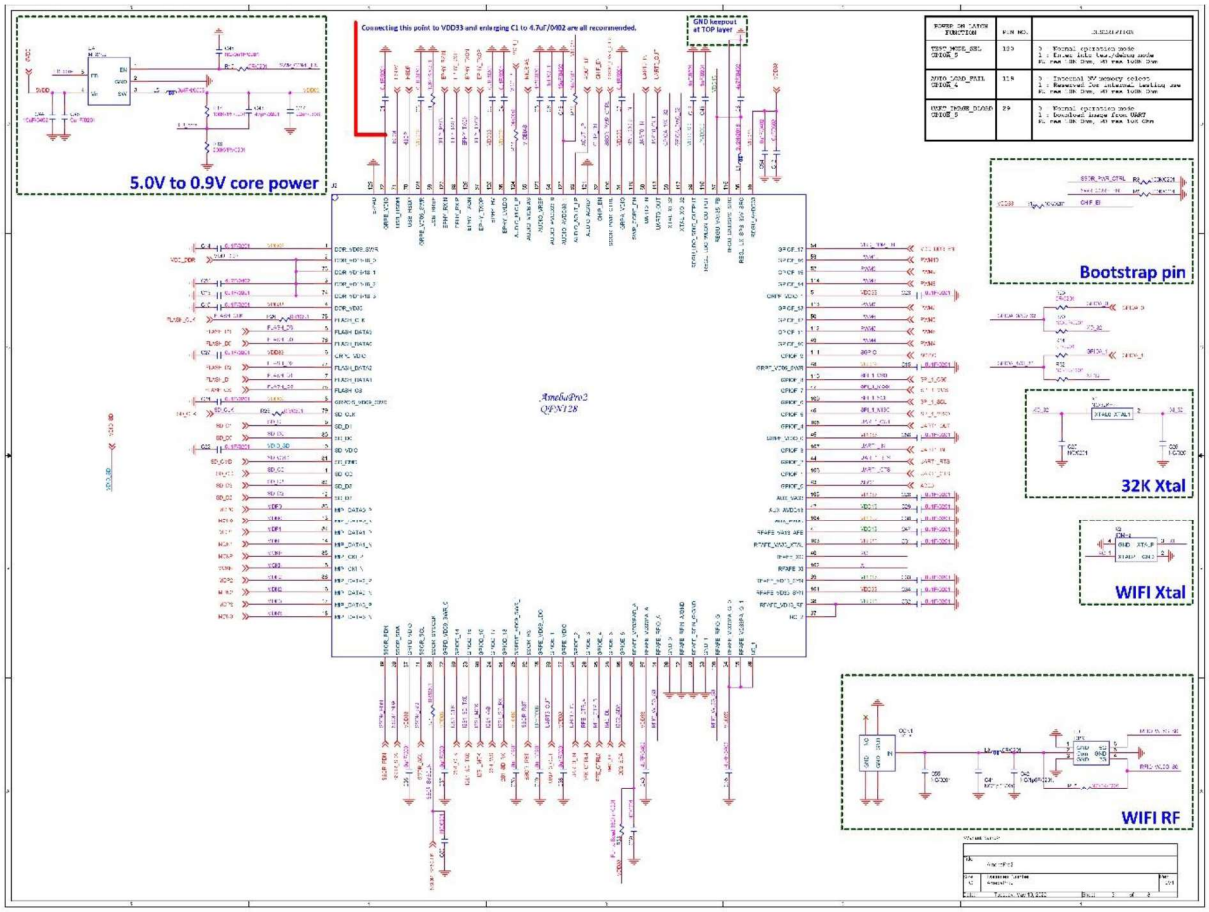
Symbol	Parameter	Min.	Typ.	Max.	Unit
VDD33	Power supply voltage	3.135	3.3	3.465	V
5VDD		4.75	5	5.25	V
Ta	Ambient operating temperature	-20		85	^{0}C
Ts	Storage temperature	-40		125	^{0}C

5.2. Module DC Characteristics

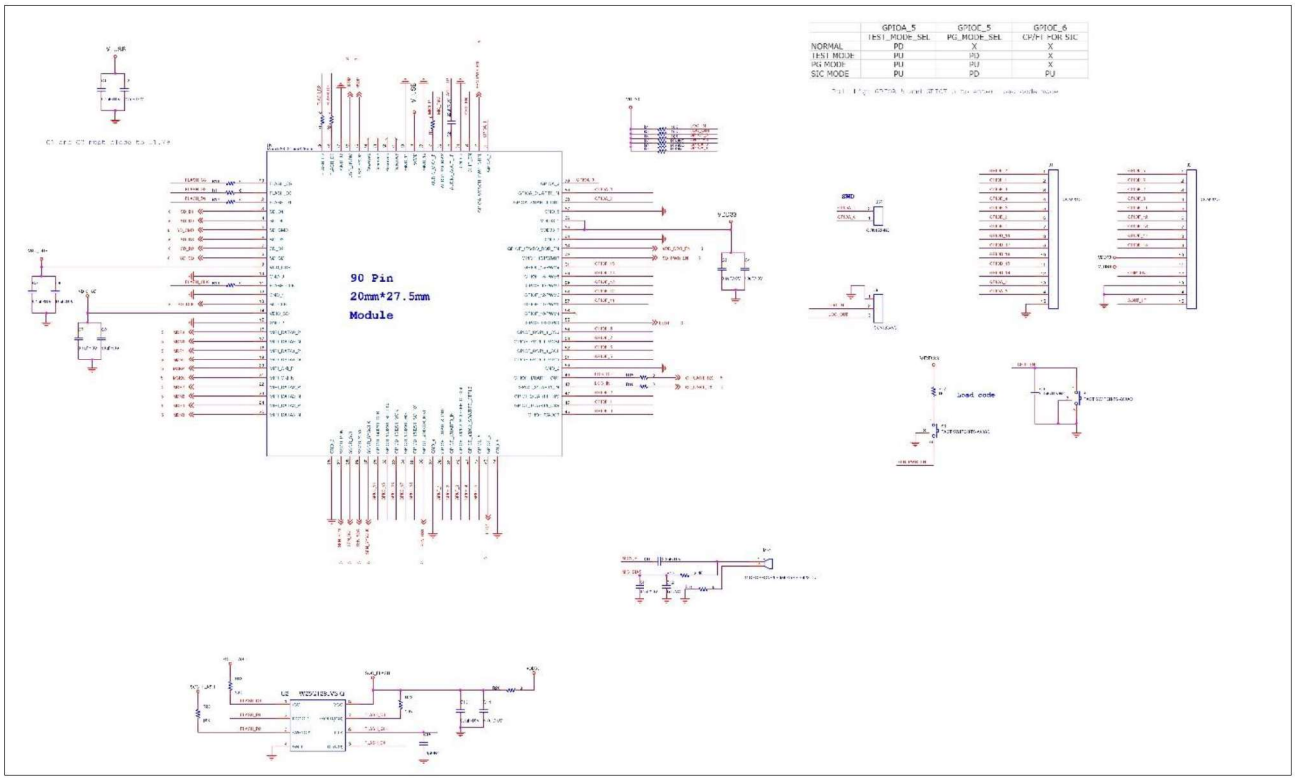
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
VIH	Input-High Voltage	LVTTL	2.0	-	-	V
VIL	Input-Low Voltage	LVTTL	-	-	0.8	V
VOH	Output-High Voltage	LVTTL	2.4	-	-	V
VOL	Output-Low Voltage	LVTTL	-	-	0.4	V
VT+	Schmitt-trigger High Level	-	1.78	1.87	1.97	V
VT-	Schmitt-trigger Low Level	-	1.36	1.45	1.56	V
IIL	Input-Leakage Current	VIN=3.3V or 0	-10	±1	10	μA

6. Module Schematics

6.1. Module Internal Schematics



6.2. Module Reference Schematics

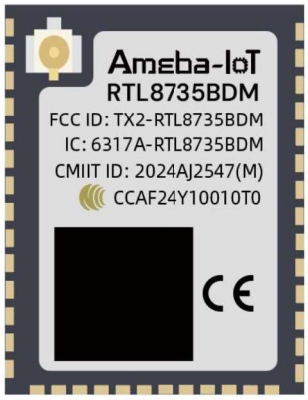


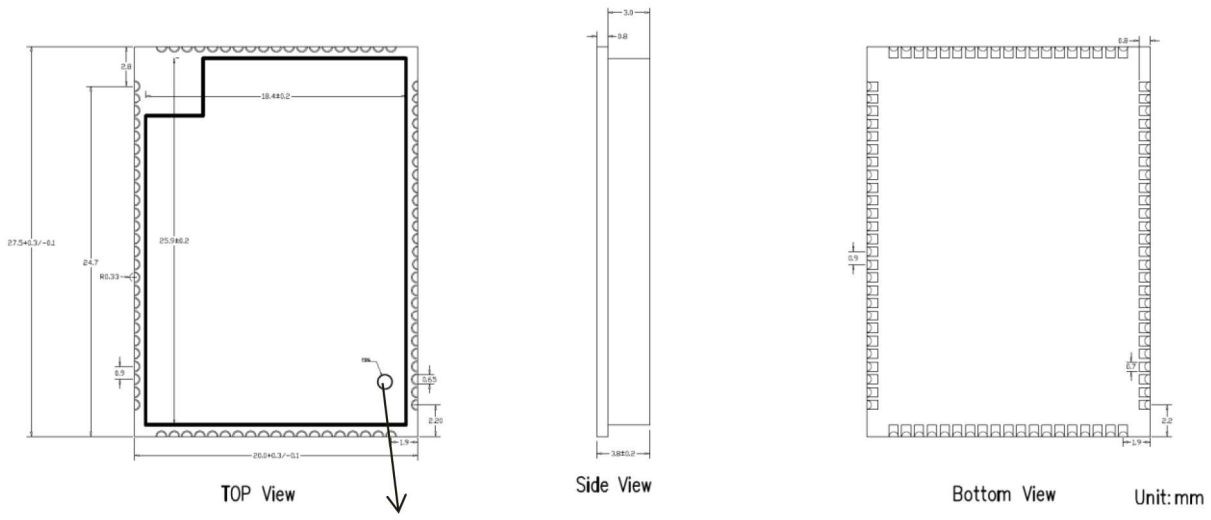
7. Mechanical Dimensions

7.1. Physical Dimension

Module dimension: L x W x H: 27.5 x 20 (+0.3/-0.1)mm x 3.8± 0.2mm (H)

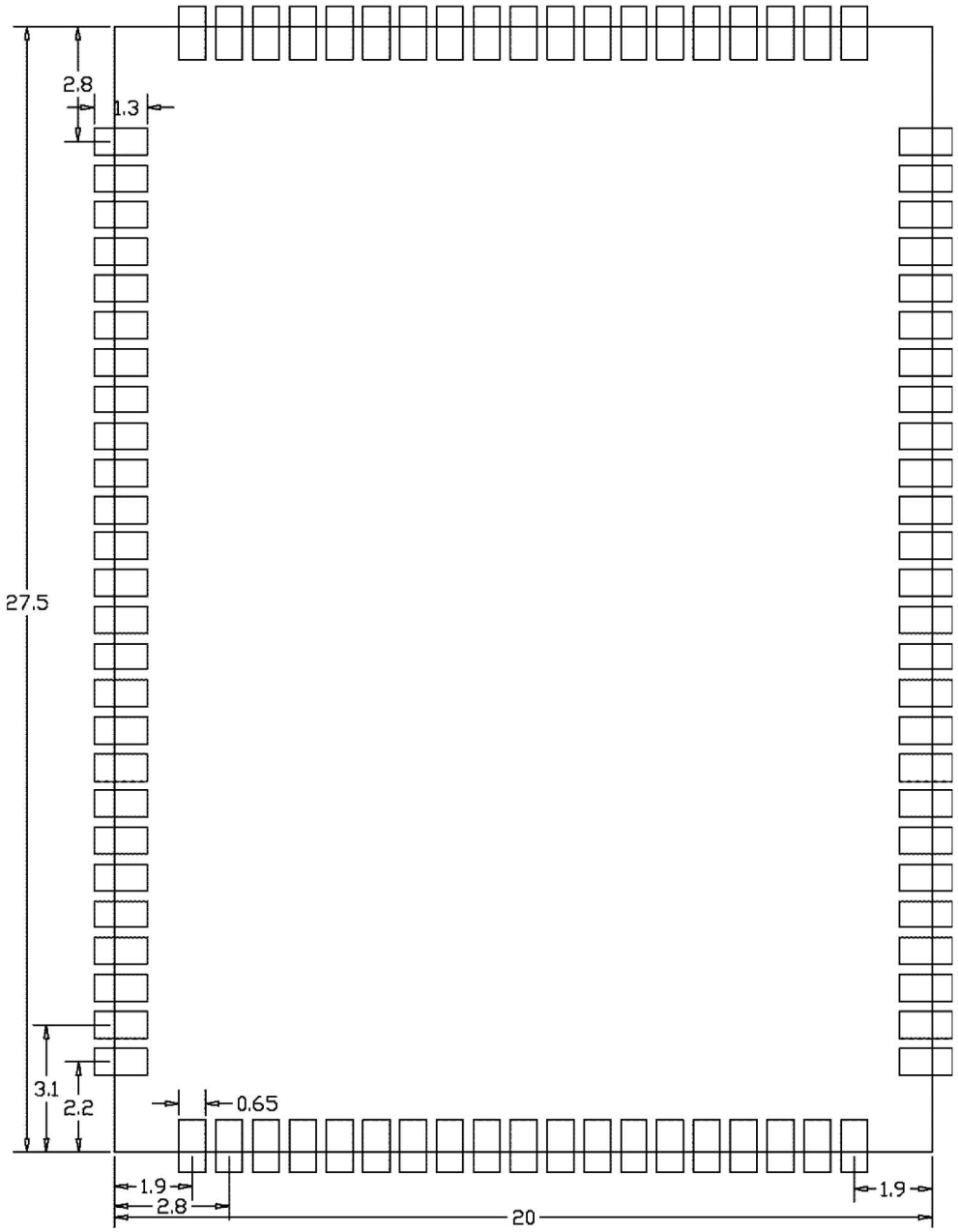
Weight: 2.64g



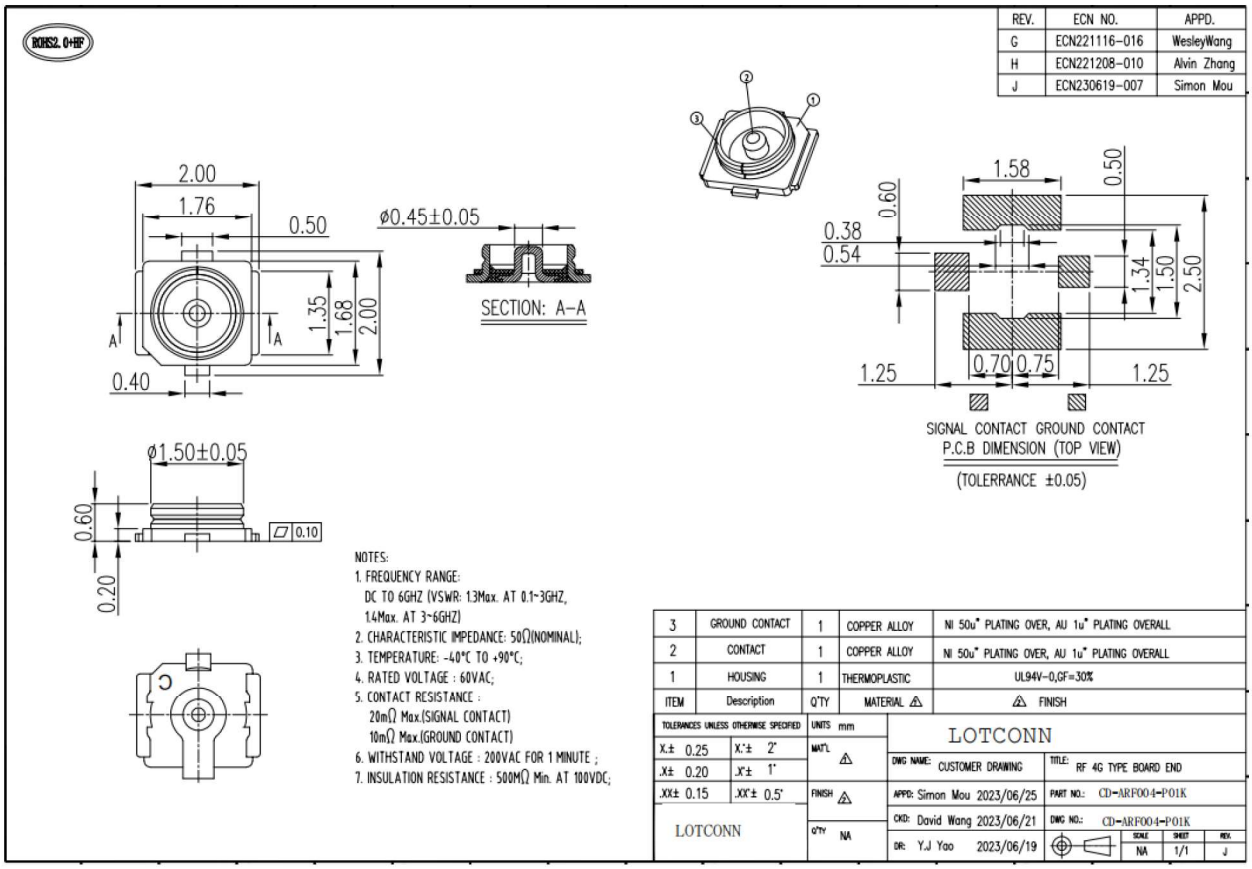


Circle FOR PIN 1， IDENTIFICATION IN THIS AREA

7.2. Layout Recommendation



7.3. Antenna Connector Specification



8. Product Handling

8.1. Storage Conditions

The storage conditions for a delivered module:
Moisture sensitive level (MSL): 3
in according with standard IPC/JEDEC J-STD-020, take care all the relatives requirements for using this kind of components.
Moreover, the customer has to take care of the following conditions:
(a) Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)
(b) Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5
(c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition "IPC/JEDEC J-STD-033A paragraph 5.2" is respected
(d) Baking is required if conditions b) or c) are not respected
(e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more

8.2. Production Instructions

The module can be packaged with the SMT process according to the customer's PCB designed to be SMT-packaged. After being unpacked, the module must be soldered within 24 hours. Otherwise, it needs to be put into the drying cupboard where the relative humidity is not greater than 10%; or it needs to be packaged again under vacuum and the exposure time needs to be recorded (the total exposure time cannot exceed 168 hours).

SMT devices needed:

- Mounter
- SPI
- Reflow soldering machine
- Thermal profiler
- Automated optical inspection (AOI) equipment

Baking devices needed:

- Cabinet oven
- Anti-electrostatic and heat-resistant trays
- Anti-electrostatic and heat-resistant gloves

Baking settings:

- Temperature: 40°C and ≤ 5% RH for reel package and 125°C and ≤5% RH for tray package (use the heat-resistant tray rather than a 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 the 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.

In the whole production process, take electrostatic discharge (ESD) protective measures.

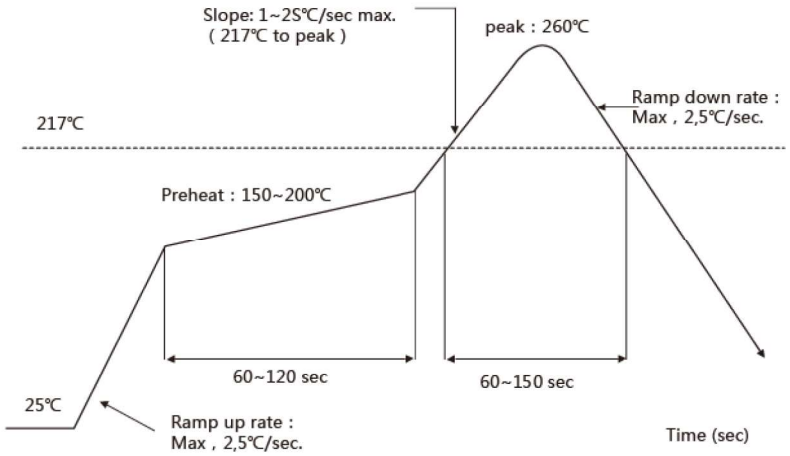
To guarantee the passing rate, it is recommended to use the SPI and AOI to monitor the quality of solder paste printing and mounting.

8.3. Recommended Oven Temperature Curve

Referred to IPC/JEDEC standard.

Peak Temperature : <260°C

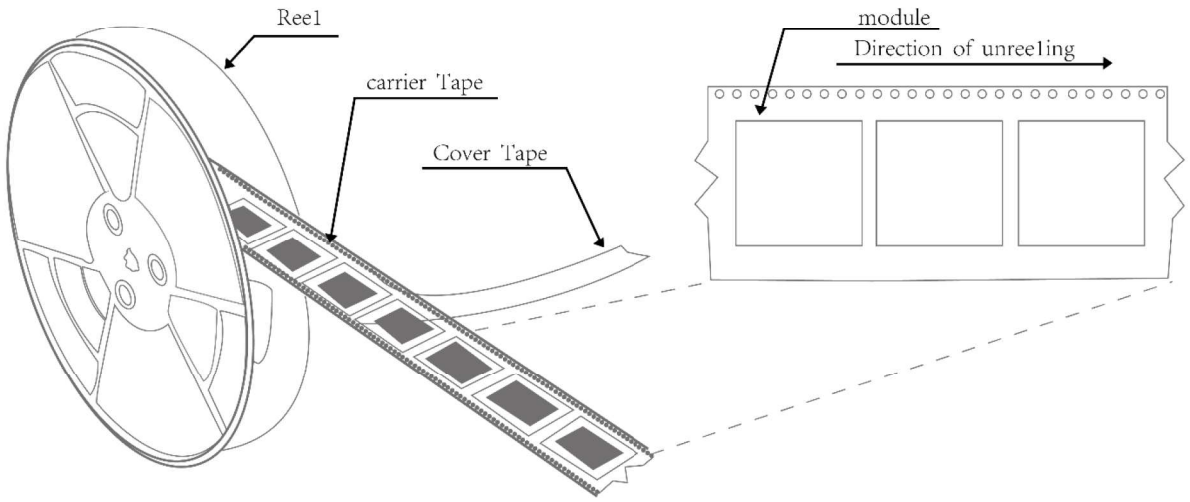
Number of Times : ≤2 times



9. Package

9.1. Reel

One roll of 500 units



9.2. Carrier Tape Detail

