EWM103-WF8723DU User Manual

RTL8723DU 2.4GHz Wireless Module



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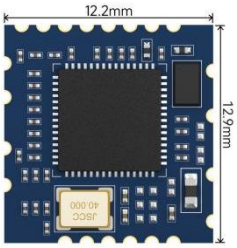
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I. Product Overview

1.1 Product Introduction



EWM103-WF8723DU is a low-cost, high-performance WiFi+BT dual-mode module based on Realtek RTL8723DU-CG. It complies with IEEE 802.11b/g/n standards and Bluetooth 4.2 protocol, with a maximum data rate of 150M bps , rich interfaces and powerful processors, providing a complete solution for integrated wireless LAN devices with high throughput performance.

1.2 Features

- The operating frequency band is 2.4GHz to 2.484GHz , and supports the global license-free ISM 2.4GHz band ;
- The wireless rate can reach up to 150Mbps;
- Comply with IEEE 802.11b/g/n protocol standards;
- Support Bluetooth dual mode, compatible with BT V 2.1/ V 4.2 ;
- Support 20/40 channel bandwidth;
- The communication interface is USB 2.0 ;
- Working temperature: -20～＋70℃;
- Widely used in the Internet of Things;

1.3 Application Scenarios

- Wifi video transmission;
- WiFi audio transmission;
- Router;
- Wifi repeater;
- Serial port forwarding and other general-purpose modules for smart homes;
- Cloud Service Application
- IoT Gateway ;

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II. Specifications

2.1 Basic parameters

RF parameters	Unit	Value	Remark
Transmit power	dBm	15～17 (typical value is 16)	
WiFi Protocols	-	IEEE 802.11b/g/n	
Bluetooth protocol version	-	V2.1/V4.2	
Reference distance	m	200	Antenna gain 5dBi , module communicates with device
Working frequency band	GHz	2.4～2.484	Supports the global license-free ISM 2.4GHz frequency band
Supply voltage	V	DC 3.3V±0.2V @ 500mA (Max)	
Operating temperature	℃	-20~70	
Operating humidity	RH	10%~95%	No condensation

2.2 Hardware Parameters

Hardware Parameters	Parameter Details	Remark
Chip	RTL8723DU-CG	-
Packaging	SMD	-
Antenna interface	Stamp Holes	Characteristic impedance is about 50 ohms
Communication interface	USB 2.0	
Size	12.9*12.2*1.9mm	The error size is ±0.2mm
Weight	0.51g	The error is ±0.1g

2.3 Electrical parameters

2.3.1 Recommended working conditions

Parameter	Min	Typ	Max	Units
Operating temperature	-20	25	70	℃
External Antenna Standing Wave	-	1.7	2.0	/

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Supply voltage	VDD33	3.1	3.3	3.5	V

2.3.2 I/ O interface power consumption specifications

Symbol	Parameter	Min	Type	Max	Unit
VIH	High level input	2.0	3.3	3.6	V
VIL	Low level input	-	0	0.9	V
VOH	High level output	2.97	-	3.3	V
VOL	Low level output	0	-	0.33	V

2.3.3 Current consumption

Test conditions	VDD33 Current (average value)		
	Type	Max	Unit
WLAN Unassociated (Linux Driver)	120	130	mA
2.4G 11b 1Mbps TX @ 17dBm (TX RF test)	320	330	mA
2.4G 11b 11Mbps TX @ 17dBm (TX RF test)	285	300	mA
2.4G HT20 MCS7 RX (RX RF test)	92	96	mA
2.4G HT40 MCS0 TX @ 17dBm (TX RF test)	240	250	mA
2.4G HT40 MCS7 TX @ 14dBm (TX RF test)	180	190	mA
BT BR_1M TX@4dBm	159	186	mA
BT BR_1M RX Active	138	165	mA
Note: Use electrical parameters VDD33=3.3V, operating temperature: 25℃			

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III. Mechanical Dimensions and Pin Definition

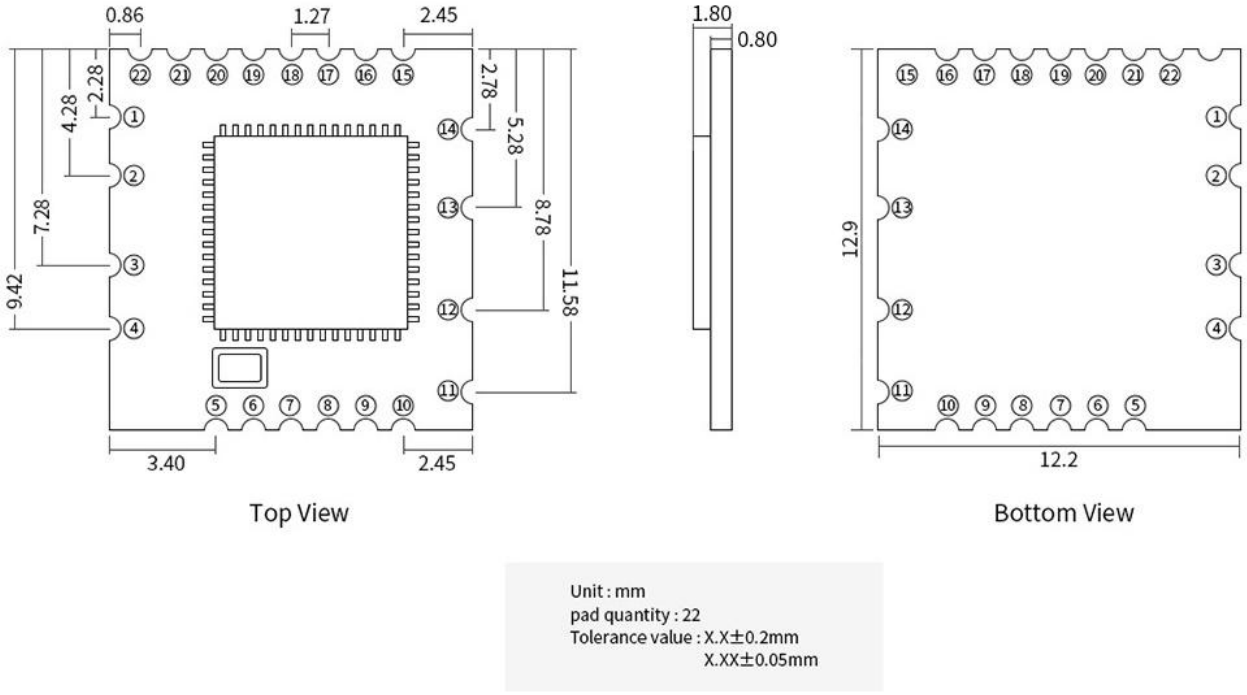


Figure 1 : EWM103-WF8723DU Dimensions

Serial number	Pin Name	Pin Type	Pin Function Description
1	GND	RF	RF Grounding
2	WLAN/BT_ANT	RF	RF PAD for WLAN/BT_ANT0
3	NC	-	NC (Reserved RF PAD for WLAN/BT_ANT1)
4	GND	RF	RF Grounding
5	BT_PCM_IN	I/O	Shared with GPIO0, general purpose input/output pin
6	BT_PCM_OUT	I/O	with GPIO 1 , general purpose input/output pin
7	BT_PCM_SYNC	I/O	Shared with GPIO2, general purpose input/output pin
8	BT_PCM_CLK	I/O	Shared with GPIO2, general purpose input/output pin
9	BT_WAKE_HOST	O	1.General purpose input / output GPIO14 2.Bluetooth device wakes up host output
10	HOST WAKE BT	I	1. General purpose input/output GPIO13 2. Use the host to wake up the input of this Bluetooth device

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11	VDD33	P	Power supply 3.3V
12	USB2.0-DM	AI/O	USB2.0 data-
13	USB2.0-DP	AI/O	USB2.0 data+
14	GND	P	Grounding
15	NC	-	-
16	WL_D IS#	I	1. This pin is shared with GPIO9 and can be pulled low from the outside to shut down the RTL8723DU WLAN function when WL_D IS#. When this pin is invalid, the USB interface will be disabled . 2. This pin can also support the WLAN wireless shutdown function, and the host interface remains connected . 3. The level is pulled high by a 100K resistor internally .
17	BT_DIS#	I	1. Shared with GPIO11, this pin can be connected externally. When the "BT_D IS#" state is "pull Low", the RTL8723DU BT function is turned off . 2. This pin can also support BT Radio-off function while the host interface remains connected . 3. The level is pulled high by a 100K resistor internally .
18	NC	-	-
19	HOST WAKE WL	I	1. General purpose input/output GPIO8 2. Host wake-up WLAN input
20	WL_WAKE_HOST	O	1. General purpose input/output GPIO6 2. WLAN wake-up host output 3. The level is pulled high by a 100K resistor internally.
21	NC	-	-
22	NC	-	-

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IV. WiFi & Bluetooth RF parameter characteristics

4.1 WiFi 2.4G RF parameter characteristics

Characteristic	Parameter Details
Protocol Standards	IEEE 802.11b/g/n CSMA/CA
Working frequency band	2.4~2.484GHz (2.4GHz ISM Band)
Modulation	802.11b DSSS: CCK, DQPSK, DBPSK 802.11g OFDM: 64QAM,16QAM, QPSK, BPSK 802.11n OFDM: 64QAM,16QAM, QPSK, BPSK
Transfer rate	802.11b: 1, 2, 5.5, 11Mbps, 802.11g: 6,9,12,18,24,36,48,54Mbps, 802.11n-HT20: MCS0 ~7, 6.5 ~72.2Mbps, 802.11n-HT40: MCS0 ~7, 13~150Mbps,
Frequency deviation tolerance	≤±20ppm
Test environment parameters : VDD33=3.3V; operating temperature : 25℃	

4.2 WiFi transmission rate specifications

Transfer rate	Transmit power(dBm)	Power Deviation(dBm)	EVM(dB)
802.11b@1~11Mbps	Recommended Target TX Power 17	±2	≦-10
802.11g@6Mbps	Recommended Target TX Power 16	±2	≦-10
802.11g@54Mbps	Calibrated TX Power14	±2	≦-25
802.11n@HT20_MCS0	Recommended Target TX Power 16	±2	≦-10
802.11n@HT20_MCS7	Calibrated TX Power 14	±2	≦-28
802.11n@HT40_MCS0	Recommended Target TX Power 16	±2	≦-10

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802.11n@HT40_MCS7	Calibrated TX Power 14	±2	≦-28
Note: To calibrate the transmit power of certain rates, the user can define the target transmit power of other rates by modifying the configuration file of the driver software. The transmit power defined by the user must be the same as or lower than the recommended target transmit power.			

4.3 WiFi receiving rate specifications

Receiving rate	Min Input Level(dBm)	Max Input Level(dBm)	PER
802.11b@1Mbps	-92	-10	< 8%
802.11b@11Mbps	-86	-10	< 8%
802.11g@6Mbps	-89	-20	< 10%
802.11g@54Mbps	-72	-20	< 10%
802.11n@HT20_MCS0	-88	-20	< 10%
802.11n@HT20_MCS7	-69	-20	< 10%
802.11n@HT40_MCS0	-87	-20	< 10%
802.11n@HT40_MCS7	-67	-20	< 10%

4.4 Bluetooth RF parameter characteristics

Characteristic	Parameter Details
Protocol Standards	Bluetooth V2.1/V4.2
Working frequency band	2.4~2.484GHz (2.4GHz ISM Band)
Channel	Classic Bluetooth : Ch0~Ch78 (For 1MHz Channels); Bluetooth Low Energy : Ch0~Ch39 (For 2MHz Channels);
Power level	Classic Bluetooth : Class1; Bluetooth low energy : Class1.5;
Transmission rate & modulation method	BR_1Mbps: GFSK; EDR_2Mbps: π/4-DQPSK; EDR_3Mbps: 8DPSK; LE_1Mbps: GFSK (Uncoded);

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Test environment parameters : VDD33=3.3V; operating temperature : 25℃

4.5 Bluetooth transmitter parameters

4.5.1 Transmit Power

Name	Min	Type	Max
BR_1M	0dBm	4dBm	6dBm
EDR_2/3M	0dBm	4dBm	6dBm
LE_1M	0dBm	4dBm	6dBm

4.5. 2 BR_1M (DH1) modulation characteristics

Name	Min	Type	Max
Δf1avg	140KHz	165.4kHz	175KHz
Δf2avg	140KHz	148.51kHz	175KHz
Δf2max	115KHz	154.7kHz	/
Δf2avg/Δf1avg	0.8	0.91	/

4.5.3 BR_1M (DH1) Initial carrier frequency tolerance

Name	Min	Type	Max
Init Freq Error	-75kHz	-10.3kHz	+75kHz

4.5.4 EDR_3M (3DH5) EDR carrier frequency stability and modulation accuracy

Name	Min	Type	Max
ωi	-75KHz	-9.03KHz	+75KHz
ωi + ωo	-75KHz	-9.86KHz	+75KHz
ωo	-10KHz	-0.81KHz	+10KHz
8DPSK RMS DEVM	/	0.042	0.13
8DPSK DEVM	/	0.09	0.25

4.5.5 LE_1M modulation characteristics

Name	Min	Type	Max

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Δf1avg	225KHz	259.87KHz	275KHz
Δf2avg	225KHz	244.49KHz	275KHz
Δf2max	185KHz	236.7KHz	/
Δf2avg/Δf1avg	0.8	0.93	/

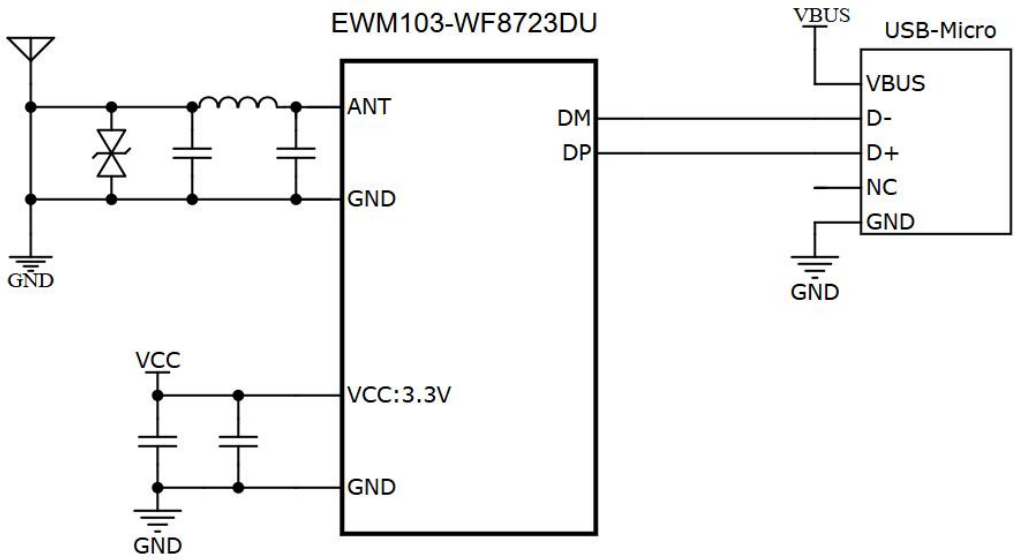
4.6 Bluetooth receiver parameters

Name	Sensitivity		Maximum Input Level	
	Input Level(Typ）	BER	Input Level(Typ）	BER
BR_1M (DH1)	-90dBm	≦0.1%	-5dBm	≦0.1%
EDR_3M (3DH5)	-85dBm	≦0.01%	-5dBm	≦0.1%

4.6.1 LE_1M receiver parameters

Name	Sensitivity		Maximum Input Level	
	Input Level(Typ）	P E	Input Level(Typ）	P E
LE_1M	-87dBm	≦5%	-5dBm	≦5%

V. Recommended Circuit Diagram



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VI. Frequently Asked Questions

6.1 The transmission distance is not ideal

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly ;
- Temperature, humidity, and co-channel interference can increase the communication packet loss rate ;
- The ground absorbs and reflects radio waves, so the test results are poor when close to the ground ;
- Seawater has a strong ability to absorb radio waves, so the test effect at the seaside is poor ;
- If there are metal objects near the antenna, or the antenna is placed in a metal shell, the signal attenuation will be very serious ;
- The power register is set incorrectly, or the air rate is set too high (the higher the air rate, the closer the distance) ;
- The power supply voltage is lower than the recommended value at room temperature. The lower the voltage, the lower the power output .
- This causes poor matching between the antenna and the module or quality issues with the antenna itself.

6.2 Modules are vulnerable to damage

- Please check the power supply to ensure that it is within the recommended power supply voltage. If it exceeds the maximum value, the module will be permanently damaged .
- Please check the stability of the power supply. The voltage should not fluctuate greatly or frequently .
- Please ensure anti-static operation during installation and use, as high-frequency components are sensitive to static electricity ;
- Please ensure that the humidity is not too high during installation and use, as some components are humidity sensitive devices ;
- If there is no special requirement, it is not recommended to use it at too high or too low temperature.

VII. Welding Operation Instructions

7.1 Reflow temperature

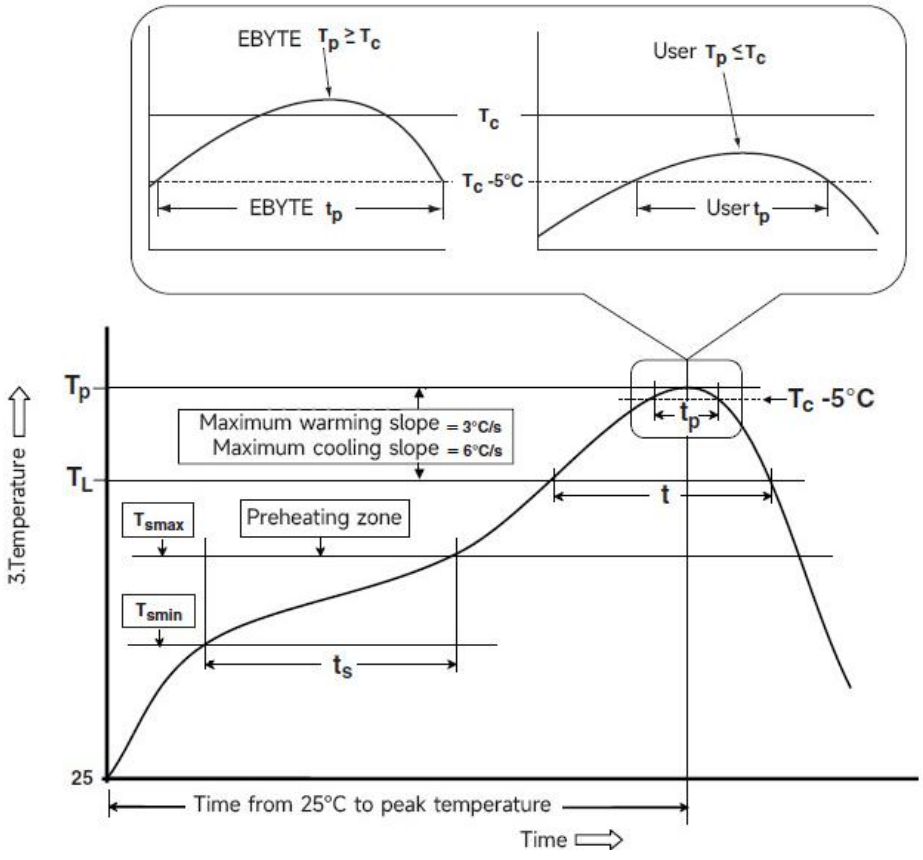
Reflow profile characteristics		Leaded process assembly	Lead-free assembly
Preheating/keeping	Minimum temperature (Tsmin)	100℃	150℃
	Maximum temperature (Tsmax)	150℃	200℃
	Time (Tsmin~Tsmin)	60-120 seconds	60-120 seconds
Heating slope (TL~Tp)		3℃/sec, max.	3℃/sec, max.

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Liquidus temperature (TL)	183℃	217℃
Keep time above TL	60~ 90 seconds	60~ 90 seconds
Package peak temperature Tp	Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.	Users must not exceed the temperature stated on the product's "Moisture Sensitivity" label.
The time (Tp) within 5°C of the specified classification temperature (Tc) is shown in the figure below.	20 seconds	30 seconds
Cooling slope (Tp~TL)	6℃/sec, max.	6℃/sec, max.
Time from room temperature to peak temperature	6 minutes, longest	8 minutes, longest
※The peak temperature (Tp) tolerance of the temperature curve is defined as the upper limit of the user.		

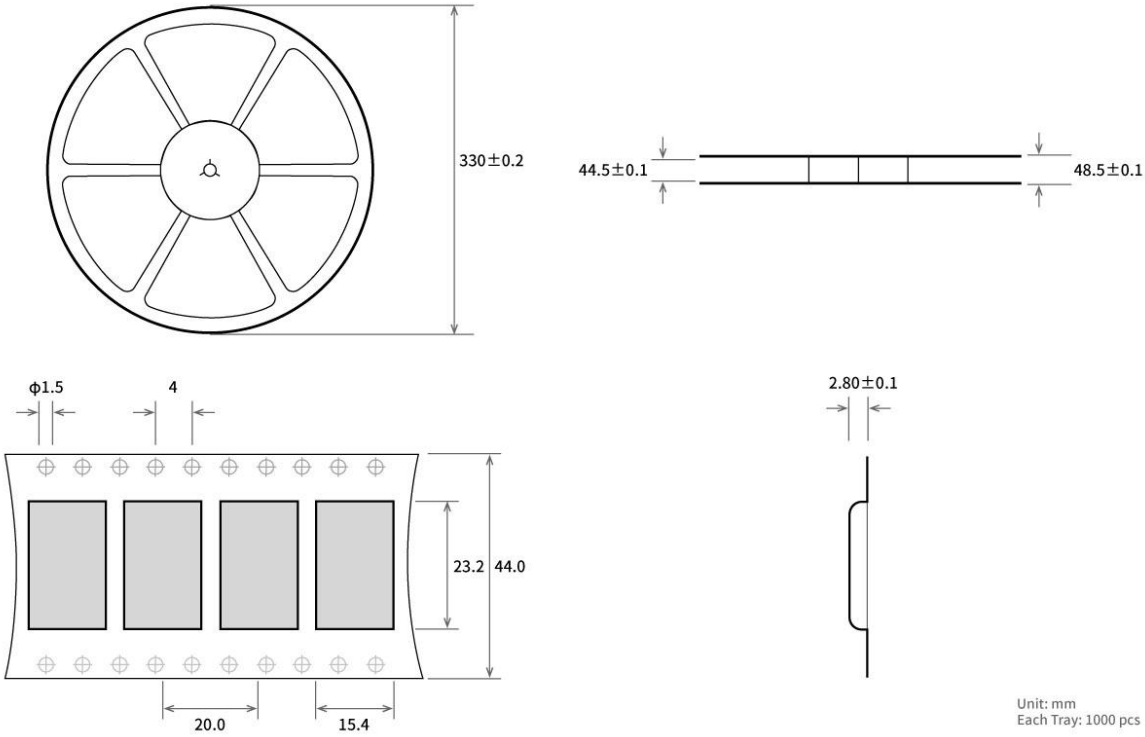
7.2 Reflow Oven Curve



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VIII. Bulk Packaging Methods



Revision History

Version	Revision Date	Revision Notes	Maintainer
1.0	2024-11-17	Initial release	Hao

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