

M2-6398SV

802.11ac/a/b/g/n Industrial Grade

2T2R Wi-Fi and BT 5.0 Combo M.2

2230 Module



Wi-Fi/BT Solution M.2 2230 Module

M2-6398SV is a complete 802.11ac/a/b/g/n dual band 2T2R Industrial Grade(-30°C to 85°C) Wi-Fi with low power consumption M.2 2230 module. This module is a highly integrated wireless local area network (WLAN) and Bluetooth solution to let users enjoy the digital content through the latest wireless technology without using the extra cables and cords. It enables a high performance, cost effective, low power, compact solution. It can achieve up to a speed of 866Mbps with dual stream and 20, 40, 80 MHz channels with optional SGI (256 QAM modulation). In addition, all the rates specified in IEEE 802.11a/b/g/n are supported. Supports standard SDIO v3.0, compatible with SDIO v2.0 HOST interfaces.

Embedded Application

Applications include medical devices, security systems, industrial PC, Point of Sale, digital signs, STB, embedded/ tablet PC's, smart devices, thin client devices, Gaming machine, tablets, etc.

Key Feature

- 802.11ac/a/b/g/n dual-band radio with virtual-simultaneous dual-band operation
- Dual-stream spatial multiplexing up to 866Mbps data rate
- Client MU-MIMO
- Supports Industrial grade Operating Temperature
- Complies with Bluetooth Core Specification Version 5.0 with provisions for supporting future specifications. With Bluetooth Class 1 or Class2 transmitter operation.
- Supports extended synchronous connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets.
- Adaptive frequency hopping (AFH) for reducing radio frequency interference.
- Multiple drivers support for Linux and Android

Specification

Operating temperature	-30°C to 85°C
Storage temperature	-40°C to 125°C
WIFI Standards	IEEE 802.11ac/a/b/g/n (2T2R)
Chipset	Broadcom
Data Rate	802.11b: 11Mbps 802.11a/g: 54Mbps 802.11n: MCS0~15 802.11ac: MCS0~9
Operating Frequency	IEEE 802.11ac/a/b/g/n ISM Band: 2.400GHz~2.4835GHz Ch1~ 13 ISM Band:5.150GHz~5.850GHz 5.15~5.35GHz : Ch36 ~ Ch64 5.47~5.725GHz : Ch100 ~ Ch140 5.725~5.85GHz : Ch149 ~ Ch165 *Subject to local regulations
Interface	WLAN: SDIO V3.0/2.0
Modulation	Wi-Fi: 802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11n: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11a: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11ac: OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM)
Bluetooth Standards	Bluetooth 5.0
Data Rate	BDR、EDR(1Mbps & 2Mbps)、LE(1Mbps)、2LE(2Mbps)
Operating Frequency	2402 MHz ~ 2480 MHz 79 channels for classic、40 channels for BLE
Interface	BT:UART
Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK

Form Factor	M.2 2230
Dimension	22.0 x30.0 x2.75 mm
Weight	2.3g
Antenna	2 x IPEX MHF4 connectors

2.4GHz RF Specification

Conditions : VCC=3.3V ; Temp:25°C

Feature		Description			
WLAN Standard		IEEE 802.11 b/g/n & Wi-Fi compliant			
Frequency Range		2.400 GHz ~ 2.4835 GHz (2.4GHz ISM Band)			
Number of Channels		2.4GHz：Ch1 ~ Ch13			
Modulation		802.11b：DQPSK、DBPSK、CCK 802.11g/n：OFDM /64-QAM、16-QAM、QPSK、BPSK			
Output Power , tolerance ± 1.5 dB					
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard					
802.11b	1Mbps	2Mbps	5.5Mbps	11Mbps	
	17.5	17.5	17.5	17.5	
802.11g	6、9Mbps	12、18Mbps	24Mbps	36Mbps	48Mbps
	17.5	17.5	17	17	16.5
	54Mbps				
	16.5				
802.11n 20MHz	MCS0~2	MCS3	MCS4	MCS5	MCS6
	17.5	16.5	16.5	16	16
	MCS7				
	15.5				
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product					
Sensitivity, tolerance ± 2 dB					
CCK modulation PER ≤ 8%、OFDM modulation PER ≤ 10%					
802.11b	Data Rate	Spec.(dBm)			
	1Mbps	-96			
	2Mbps	-93			
	5.5Mbps	-91			
	11Mbps	-88			
802.11g SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)	
	6Mbps	-92	24Mbps	-84	
	9Mbps	-91	36Mbps	-81	
	12Mbps	-90	48Mbps	-78	
	18Mbps	-87	54Mbps	-76	

802.11g MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-95	24Mbps	-87
	9Mbps	-94	36Mbps	-84
	12Mbps	-93	48Mbps	-81
	18Mbps	-90	54Mbps	-78
802.11n_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-91	MCS4	-80
	MCS1	-89	MCS5	-78
	MCS2	-87	MCS6	-76
	MCS3	-83	MCS7	-74
802.11n_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-93	MCS5	-80
	MCS1	-92	MCS6	-78
	MCS2	-90	MCS7	-76
	MCS3	-87	MCS8	-92
	MCS4	-83	MCS15	-73
Maximum Input Level	802.11b : -10 dBm			
	802.11g/n : -20 dBm			

5GHz RF Specification

Conditions : VCC=3.3V ; Temp:25°C

Feature		Description			
WLAN Standard		IEEE 802.11a/n/ac & Wi-Fi compliant			
Frequency Range		5.15~5.35GHz 、 5.47~5.725GHz 、 5.725~5.85GHz (5GHz UNII Band)			
Number of Channels		5.15~5.35GHz ： Ch36 ~ Ch64 5.47~5.725GHz ： Ch100 ~ Ch140 5.725~5.85GHz ： Ch149 ~ Ch165			
Modulation		802.11a ： OFDM /64-QAM 、 16-QAM 、 QPSK 、 BPSK 802.11n ： OFDM /64-QAM 、 16-QAM 、 QPSK 、 BPSK 802.11ac ： OFDM /256-QAM 、 64-QAM 、 16-QAM 、 QPSK 、 BPSK			
Output Power , tolerance ± 2 dB					
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard					
802.11a	Frequency (MHz)	6~9Mbps	12~18Mbps	24Mbps	36Mbps
	5150~5350	16.5	16.5	16	16
	5470~5720	16.5	16.5	16	16
	5725~5845	16.5	16.5	16	16
	Frequency (MHz)	48Mbps	54Mbps		
	5150~5350	15.5	15.5		
	5470~5720	15.5	15.5		
	5725~5845	15.5	15.5		
802.11n 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	16	15.5	15.5
	5470~5720	16	16	15.5	15.5
	5725~5845	16	16	15.5	15.5
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	14.5	14.5		
	5470~5720	14.5	14.5		
	5725~5845	14.5	14.5		

802.11n 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	16	15.5	15.5
	5470~5720	16	16	15.5	15.5
	5725~5845	16	16	15.5	15.5
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	14.5	14.5		
	5470~5720	14.5	14.5		
	5725~5845	14.5	14.5		
802.11ac 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	16	15.5	15.5
	5470~5720	16	16	15.5	15.5
	5725~5845	16	16	15.5	15.5
	Frequency (MHz)	MCS6	MCS7	MCS8	
	5150~5350	14.5	14.5	12	
	5470~5720	14.5	14.5	12	
	5725~5845	14.5	14.5	12	
802.11ac 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	16	16	15.5	15.5
	5470~5720	16	16	15.5	15.5
	5725~5845	16	16	15.5	15.5
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	14.5	14.5	12	10
	5470~5720	14.5	14.5	12	10
	5725~5845	14.5	14.5	12	10
802.11ac 80MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	15	15	14	14
	5470~5720	15	15	14	14
	5725~5845	15	15	14	14
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	13	13	12	10
	5470~5720	13	13	12	10
	5725~5845	13	13	12	10
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.					

Sensitivity, tolerance ± 2 dB				
CCK modulation PER $\leq 8\%$ 、 OFDM modulation PER $\leq 10\%$				
802.11a SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-91	24Mbps	-83
	9Mbps	-90	36Mbps	-80
	12Mbps	-88	48Mbps	-76
	18Mbps	-86	54Mbps	-74
802.11a MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-92	24Mbps	-86
	9Mbps	-91	36Mbps	-83
	12Mbps	-90	48Mbps	-78
	18Mbps	-89	54Mbps	-77
802.11n_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-90	MCS4	-79
	MCS1	-88	MCS5	-76
	MCS2	-86	MCS6	-73
	MCS3	-83	MCS7	-72
802.11n_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-92	MCS5	-78
	MCS1	-91	MCS6	-76
	MCS2	-89	MCS7	-75
	MCS3	-86	MCS8	-89
	MCS4	-82	MCS15	-70
802.11n_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS4	-77
	MCS1	-86	MCS5	-72
	MCS2	-83	MCS6	-70
	MCS3	-80	MCS7	-69
802.11n_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-72
	MCS3	-83	MCS8	-86
	MCS4	-79	MCS15	-67

802.11ac_20MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-90	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-86	MCS7	-70
	MCS3	-83	MCS8	-67
	MCS4	-79		
802.11ac_20MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0,NSS=1	-92	MCS6,NSS=1	-76
	MCS1,NSS=1	-91	MCS7,NSS=1	-75
	MCS2,NSS=1	-88	MCS8,NSS=1	-72
	MCS3,NSS=1	-85	MCS0,NSS=2	-88
	MCS4,NSS=1	-82	MCS8,NSS=2	-65
	MCS5,NSS=1	-77		
802.11ac_40MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS5	-72
	MCS1	-86	MCS6	-70
	MCS2	-83	MCS7	-69
	MCS3	-80	MCS8	-65
	MCS4	-76	MCS9	-63
802.11ac_40MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0,NSS=1	-90	MCS6,NSS=1	-73
	MCS1,NSS=1	-88	MCS7,NSS=1	-72
	MCS2,NSS=1	-86	MCS8,NSS=1	-68
	MCS3,NSS=1	-82	MCS9,NSS=1	-66
	MCS4,NSS=1	-79	MCS0,NSS=2	-86
	MCS5,NSS=1	-77	MCS9,NSS=2	-60
802.11ac_80MHz SISO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-85	MCS5	-68
	MCS1	-82	MCS6	-67
	MCS2	-79	MCS7	-65
	MCS3	-76	MCS8	-62
	MCS4	-73	MCS9	-60

802.11ac_80MHz MIMO	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0,NSS=1	-87	MCS6,NSS=1	-70
	MCS1,NSS=1	-85	MCS7,NSS=1	-68
	MCS2,NSS=1	-82	MCS8,NSS=1	-66
	MCS3,NSS=1	-79	MCS9,NSS=1	-63
	MCS4,NSS=1	-76	MCS0,NSS=2	-83
	MCS5,NSS=1	-71	MCS9,NSS=2	-58
Maximum Input Level	802.11a/n/ac : -30 dBm			

Bluetooth Specification

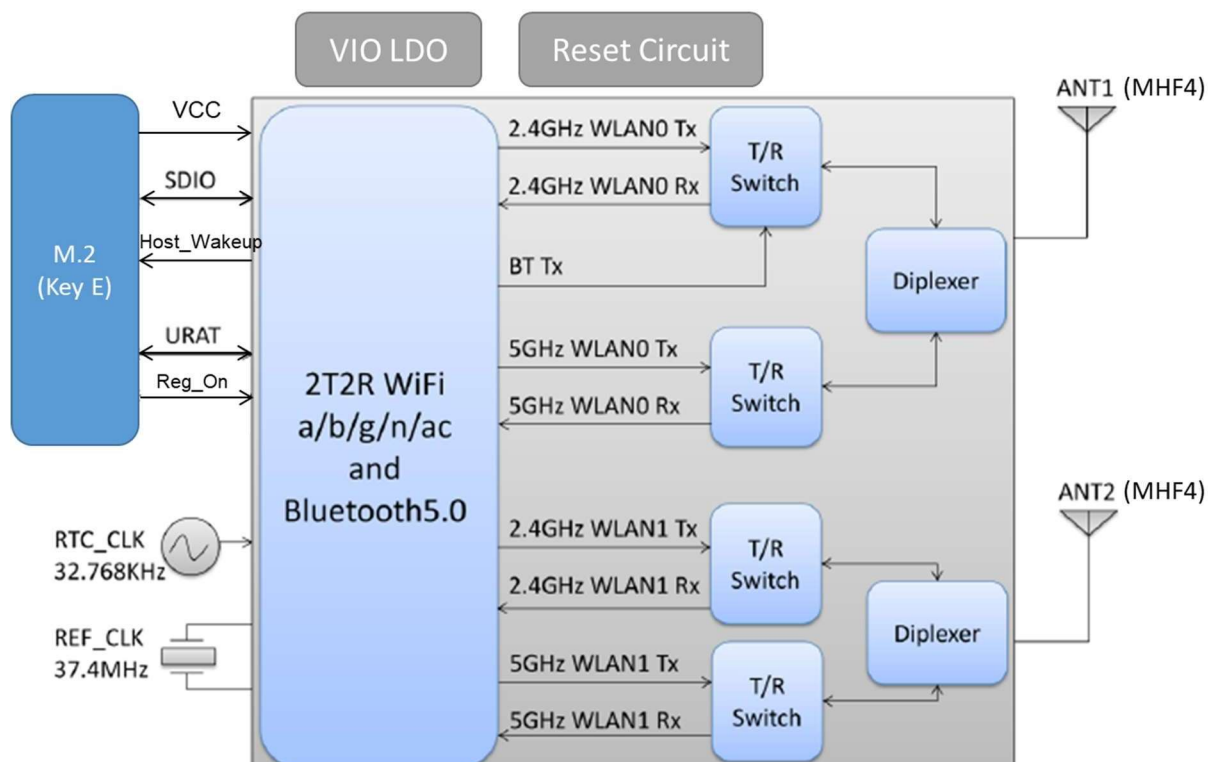
Conditions : VCC=3.3V ; Temp:25°C

Feature	Description
General Specification	
Bluetooth Standard	BDR 、 EDR(1Mbps & 2Mbps) 、 LE(1Mbps) 、 2LE(2Mbps)
Host Interface	UART
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	79 channels for classic 、 40 channels for BLE
Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK
RF Specification	
Output Power , tolerance ± 1.5 dB	
	CL1 (dBm)
BDR Output Power	7
EDR Output Power	6
BLE Output Power	6
Sensitivity, tolerance ± 2 dB	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-90 dBm
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-92 dBm

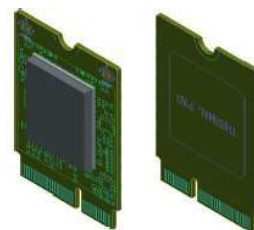
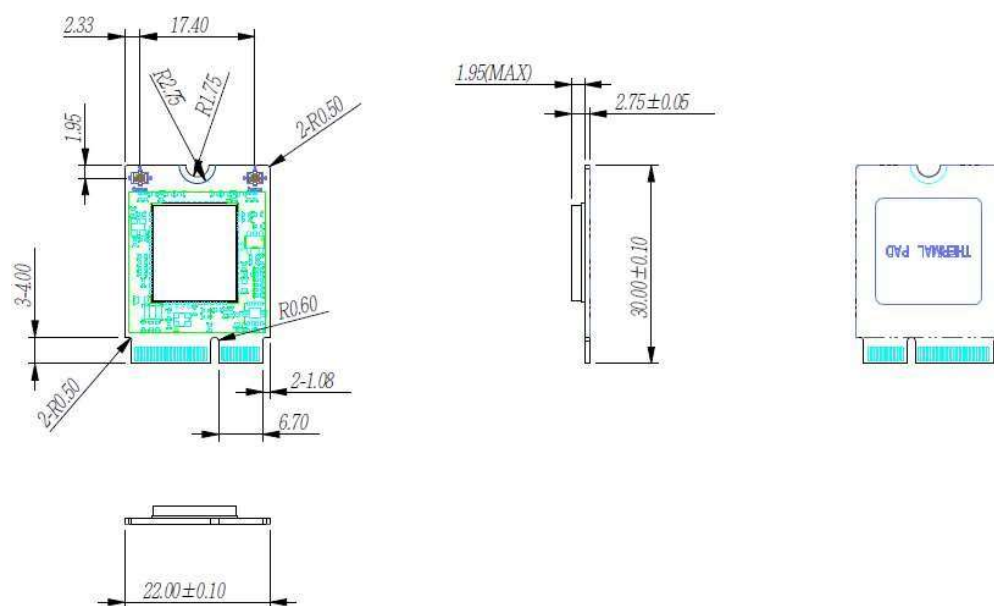
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-87 dBm
Sensitivity @ PER=30.8% for LE (1Mbps)	-92 dBm
Sensitivity @ PER=30.8% for 2LE (2Mbps)	-92 dBm
Maximum Input Level	GFSK (1Mbps):-20dBm
	$\pi/4$ -DQPSK (2Mbps) :-20dBm
	8DPSK (3Mbps) :-20dBm

Note* : The Bluetooth BDR output power is able to be configured by firmware (hcd file).

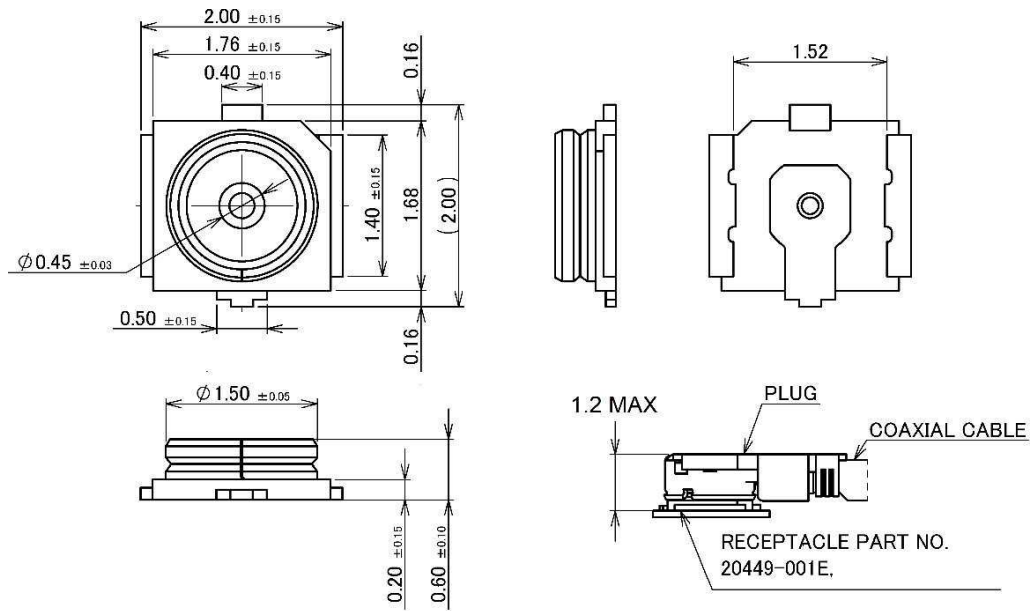
Block Diagram



Mechanical Diagram (mm)

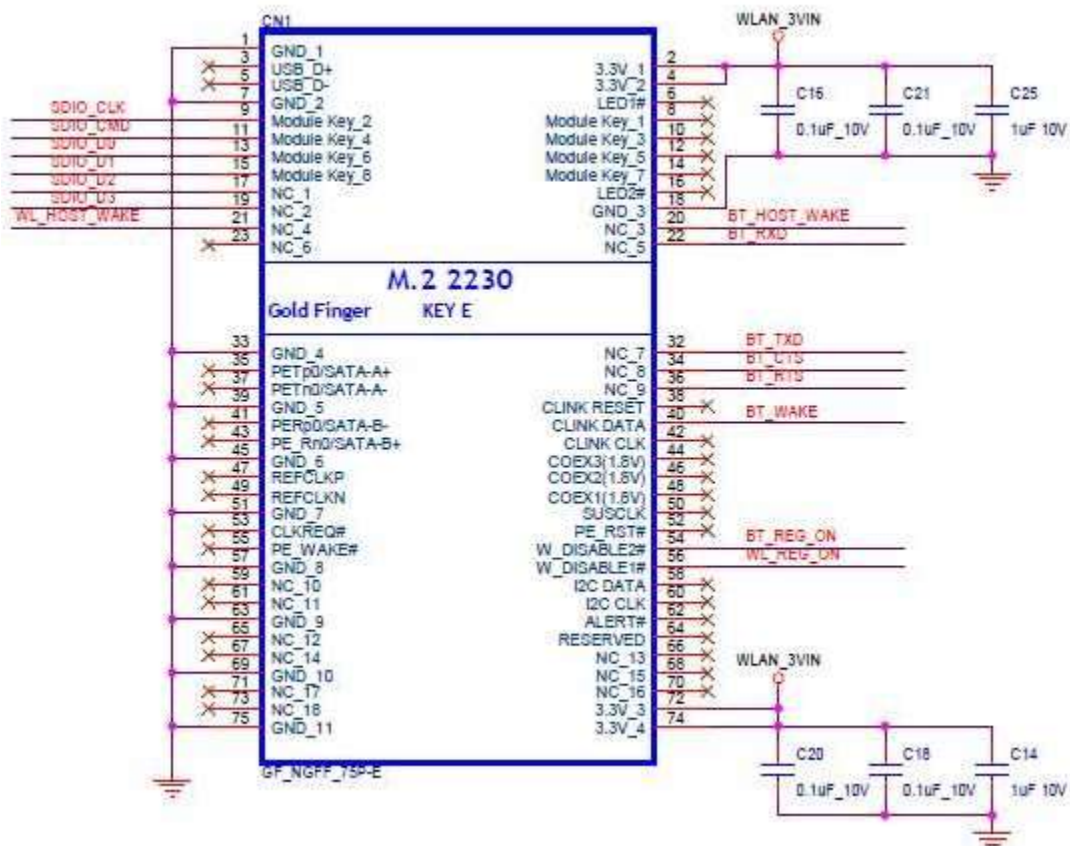


MHF4 connector spec.



Unit: mm

Pin Assignment



Pin Assignment

TOP			
Pin#	Pin Name	Type	Description
1	GND	G	Ground connections
3	NC	-	No connect
5	NC	-	No connect
7	GND	G	Ground connections
9	SDIO_CLK	I/O	SDIO clock line
11	SDIO_CMD	I/O	SDIO command line
13	SDIO_D0	I/O	SDIO data line 0
15	SDIO_D1	I/O	SDIO data line 1
17	SDIO_D2	I/O	SDIO data line 2
19	SDIO_D3	I/O	SDIO data line 3
21	WL_HOST_WAKE	O	WLAN wake up HOST
23	NC	-	No connect
25	Module Key	-	Mechanical Key
27	Module Key	-	Mechanical Key
29	Module Key	-	Mechanical Key
31	Module Key	-	Mechanical Key
33	GND	G	Ground connections
35	NC	-	No connect
37	NC	-	No connect
39	GND	G	Ground connections
41	NC	-	No connect
43	NC	-	No connect
45	GND	G	Ground connections
47	NC	-	No connect
49	NC	-	No connect
51	GND	G	Ground connections
53	NC	-	No connect
55	NC	-	No connect

Pin Assignment

TOP			
Pin#	Pin Name	Type	Description
57	GND	G	Ground connections
59	NC	-	No connect
61	NC	-	No connect
63	GND	G	Ground connections
65	NC	-	No connect
67	NC	-	No connect
69	GND	G	Ground connections
71	NC	-	No connect
73	NC	-	No connect

Pin Assignment

BOTTOM			
Pin#	Pin Name	Type	Description
2	3.3Vaux	P	VDD system power supply input. Rating 3.0V~3.8V (Ipeak=2000mA)
4	3.3Vaux	P	VDD system power supply input. Rating 3.0V~3.8V (Ipeak=2000mA)
6	NC	-	No connect
8	NC	-	No connect
10	NC	-	No connect
12	NC	-	No connect
14	NC	-	No connect
16	NC	-	No connect
18	GND	G	Ground connections
20	BT_HOST_WAKE	O	BT wake up Host (1.8V)
22	BT_UART_RXD	I	BT_UART_RXD
24	Module Key	-	Mechanical Key
26	Module Key	-	Mechanical Key
28	Module Key	-	Mechanical Key
30	Module Key	-	Mechanical Key

Pin Assignment

BOTTOM			
Pin#	Pin Name	Type	Description
32	BT_UART_TXD	O	BT_UART_TXD
34	BT_UART_CTS_N	I	Bluetooth UART interface
36	BT_UART_RTS_N	O	Bluetooth UART interface
38	NC	-	No connect
40	BT_WAKE	I	HOST wake-up Bluetooth device
42	NC	-	No connect
44	NC	-	No connect
46	NC	-	No connect
48	NC	-	No connect
50	NC	-	No connect
52	NC	-	No connect
54	BT_REG_ON	I	Low asserting reset for Bluetooth core
56	WL_REG_ON	I	Low asserting reset for WiFi core
58	NC	-	No connect
60	NC	-	No connect
62	NC	-	No connect
64	NC	-	No connect
66	NC	-	No connect
68	NC	-	No connect
70	NC	-	No connect
72	3.3Vaux	P	VDD system power supply input. Rating 3.0V~3.8V (I _{peak} =2000mA)
74	3.3Vaux	P	VDD system power supply input. Rating 3.0V~3.8V (I _{peak} =2000mA)

Certification

Dipole Ant.

- ☒ FCC (ID: ZWM-M2-6398SV)
- ☒ CE (RED EN 300 328 V2.2.2 / EN 301 893 V2.1.1)
- ☒ IC
- ☒ MIC
- ☐ NCC
- ☐ ASNZS

Ordering Information

Product Name	Part Number	Description
UTI_M2_6398SV	TBC	TBC

Optional Accessory

TBC

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID: ZWM-M2-6398SV " and "Contains IC: 11883A-M26398SV "

CAUTION:

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

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.

***Information for the OEMs and Integrators :**

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

The module can be used to installation in other host.

the transmitter module may not be colocated with any other transmit or antenna. The module shall be only used with the integral antenna(s) that has been originally tested and certified with this module. 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 requirement with this module installed (for example, digital device emission, PC peripheral requirements, etc.)

The final end product must be labeled in a visible area with the following: "Contains FCC ID: ZWM-M2-6398SV".The equipment complies with FCC RF exposure limits set forth for an uncontrolled environment. The equipment must not be co-located or operating in conjunction with any other antenna or transmitter.

Canada, Industry Canada (IC) Notices

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Canada, avis d'Industry Canada (IC)

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Caution:

i. the device for operation in the band 5150–5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;⁴

ii. for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;

iii. for devices with detachable antenna(s), the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate; and

iv. where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 shall be clearly indicated.

- i. les dispositifs fonctionnant dans la bande de 5 150 à 5 250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;
- ii. pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis pour les dispositifs utilisant les bandes de 5 250 à 5 350 MHz et de 5 470 à 5 725 MHz doit être conforme à la limite de la p.i.r.e.;
- iii. pour les dispositifs munis d'antennes amovibles, le gain maximal d'antenne permis (pour les dispositifs utilisant la bande de 5 725 à 5 850 MHz) doit être conforme à la limite de la p.i.r.e. spécifiée, selon le cas;
- iv. lorsqu'il y a lieu, les types d'antennes (s'il y en a plusieurs), les numéros de modèle de l'antenne et les pires angles d'inclinaison nécessaires pour rester conforme à l'exigence de la p.i.r.e. applicable au masque d'élévation, énoncée à la section 6.2.2.3, doivent être clairement indiqués.