emwicon

WMX7408

Wi-Fi 6 2.4GHz + 5GHz (DBS)
Mini PCIe 2x2 Module

Product Datasheet

Version: 0.2.2

2024/4/16

1 Overview

The WMX7408 enterprise module is a highly integrated mini PCIe module for wireless local area networks (WLANs). This module is built on the Resesas Celeno CL8040 chip and serves as an 802.11ax Wi-Fi 6 PCIe radio designed specifically for Enterprise Access Points and Campus deployments.

2 Feature

2.1 System

- Concurrent Dual Band, Dual Transceiver, Dual Function
- 2T2R+2T2R (total 4T4R) Flexible MIMO Architecture
- Up to 4.8Gbps data link speed
- Enhanced spectrum coverage, ready for UNII-4 (up to 5925 MHz)
- Low Power consumption with Advanced Power Management

2.2 WLAN

- Wi-Fi 6 (802.11ax) R2 support
- 802.11a/b/g/n/ac support
- DL/UL MU-OFDMA support
- DL/UL MU-MIMO support
- Beam Forming support
- Uplink Scheduling
- QAM 1024 (MCS 10, 11) modulation
- 20 / 40 / 80 / 160 MHz support in 5GHz
- 20 / 40 MHz support in 2.4GHz
- Target-Wait-Time
- Supports High Efficiency, Very High Throughput, High Throughput and Legacy
- WEP 64/128, WPA, WPA2, WPA3 (including 192-bit Enterprise mode), AES, TKIP
- Per Packet Dynamic Tx Power Control
- Optimal handling of strong interference (jammer) and near station signals
- QoS-WMM, WMM-PS, WMM-ACM
- Wi-Fi Direct, Wi-Fi Display, WPS 2.0, TDLS, Hotspot 2.0 support
- Support IEEE 802.11.d, h, e, I, k, r, v, w standards
- Multiple BSSID Support
- Dynamic Frequency Selection (DFS) in required bands and regulations
- WoWLAN support with GTK re-key

3   System Specification

3.1 Block Diagram
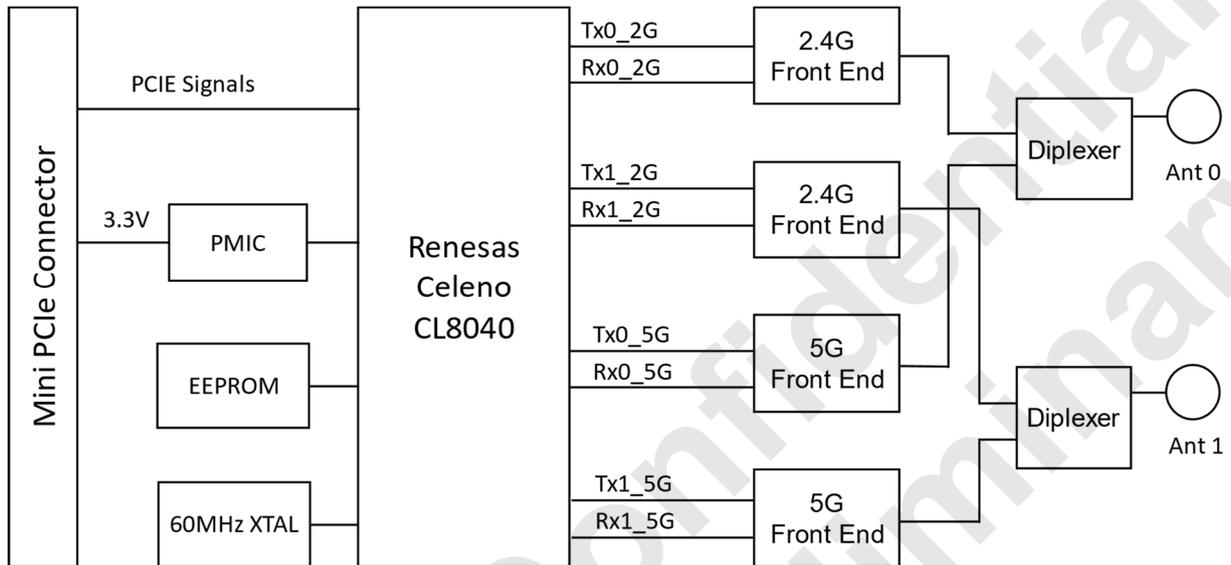
3.2 Chip Solution

- Resesas Celeno CL8040

3.3 Protocol & Interface

- PCIe Gen 3 interface for mini PCIe
- Antenna Port: U.FL(compatible) connector x2 for 2T2R

4   WLAN Specification

4.1 WLAN Standard

- Wi-Fi 6 (802.11ax) R2 support
- 802.11a/b/g/n/ac support
- Support IEEE 802.11.d, h, e, I, k, r, v, w standards

4.2 Frequency Range

- Support 2.4GHz frequency range: 2412MHz ~ 2472MHz
- Support 5GHz frequency range: 5180MHz - 5925MHz

4.3 Band Width

- 20 MHz/40 MHz channel bandwidth for 2.4 GHz
- 20 MHz/40 MHz/80 MHz/160 MHz channel bandwidth for 5 GHz

4.4 Data Rate

- 2.4GHz

  802.11n HT40 2SS: 300Mbps

  802.11ax HE40 2SS: 573Mbps
- 5GHz

  802.11n HT40 2SS:300Mbps

  802.11ac VHT160 2SS: 1733Mbps

  802.11ax HE160 2SS: 2402Mbps

4.5 Modulation

- 802.11n:

  OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
- 802.11ac:

  OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM)
- 802.11ax:

  OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM)

4.6 Output Power & Sensitivity (TBD)

2.4GHz

2.4GHz 802.11b(dBm)		
Data Rate	Tx ± 2dB	Rx Sensitivity ± 2dB
1M	21.0	-93.0
11M	21.0	-90.0

2.4GHz 802.11g(dBm)		
Data Rate	Tx ± 2dB	Rx Sensitivity ± 2dB
6M	20.0	-91.0
54M	16.5	-76.0

2.4GHz 802.11n(dBm)				
Data Rate		Tx ± 2dB	Tx ± 2dB(2TX)	Rx Sensitivity ± 2dB
HT20	MCS 0	21.0	24.0	-90.0
	MCS 7	17.5	20.5	-75.0
HT40	MCS 0	21.0	24.0	-88.0
	MCS 7	17.5	20.5	-72.0

2.4GHz 802.11ax(dBm)				
Data Rate		Tx ± 2dB	Tx ± 2dB(2TX)	Rx Sensitivity ± 2dB
HE20	MCS 0	21.0	24.0	-90.0
	MCS 7	17.0	20.0	-76.0
	MCS 9	15.0	18.0	-72.0
	MCS 11	13.0	16.0	-65.0
HE40	MCS 0	21.0	24.0	-88.0
	MCS 7	16.0	19.0	-74.0
	MCS 9	14.0	17.0	-69.0
	MCS 11	12.0	15.0	-63.0

5GHz

5GHz 802.11a(dBm)		
Data Rate	Tx ± 2dB	Rx Sensitivity ± 2dB
6M	20.0	-91.0
54M	16.5	-75.0

5GHz 802.11ac(dBm)				
Data Rate		Tx ± 2dB	Tx ± 2dB(2TX)	Rx Sensitivity ± 2dB
VHT20	MCS 0	20.0	23.0	-91.0
	MCS 7	17.5	20.5	-74.0
	MCS 8	16.5	19.5	-70.0
VHT40	MCS 0	20.0	23.0	-90.0
	MCS 7	17.5	20.5	-71.0
	MCS 9	15.5	18.5	-65.0
VHT80	MCS 0	19.5	22.5	-85.0
	MCS 7	17.0	20.0	-68.0
	MCS 9	15.0	18.0	-62.0

5GHz 802.11ax(dBm)				
Data Rate		Tx ± 2dB	Tx ± 2dB(2TX)	Rx Sensitivity ± 2dB
HE20	MCS 0	19.5	22.5	-92.0
	MCS 7	17.0	20.0	-75.0
	MCS 9	15.0	18.0	-70.0
	MCS 11			
HE40	MCS 0	19.5	22.5	-88.0
	MCS 7	17.0	20.0	-73.0
	MCS 9	15.0	18.0	-67.0
	MCS 11			
HE80	MCS 0	19.5	22.5	-85.0
	MCS 7	17.0	20.0	-71.0
	MCS 9	15.0	18.0	-65.0
	MCS 11	13.0	16.0	-56.0
HE160	MCS 0	19.5	22.5	-81.0
	MCS 7	17.0	20.0	-62.0
	MCS 9	15.0	18.0	-59.0
	MCS 11	13.0	16.0	-52.0

5   Electrical Specification

5.1 Temperature

- Operating Temperature: -40°C to +85°C [1]
- Storage Temperature: -40°C to +105°C

5.2 Humidity

- Operating Humidity (non-condensing): 5% ~ 90%
- Storage Humidity (non-condensing): 5% ~ 90%

5.3 Power Consumption

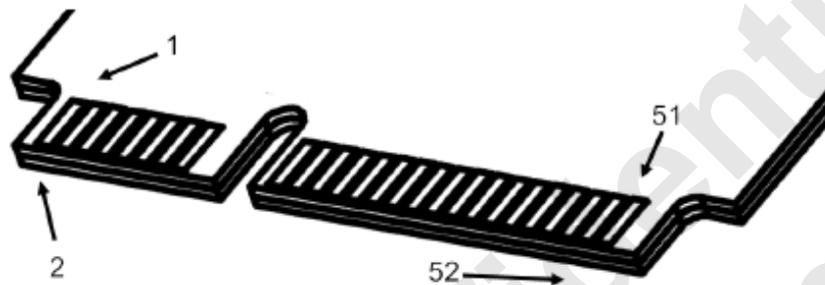- Max power consumption 10W (25°C)

5.4 Operating Voltage

- Mini PCIe 3.3V

Note:

*1. The module max case temperature of 110°C, and it is recommended to maintain the ambient temperature below 85°C. the thermal solution please reference Item 10 "Recommended Thermal Solution."

6 Pin Assignment

6.1 Module Pinout

6.2 Module Pin Define

PIN	Pin Name	Design Status	PIN	Pin Name	Design Status
1	WAKE#	NC	2	+3.3Vaux	3V3
3	COEX1	NC	4	GND	GND
5	COEX2	NC	6	+1.5V	NC
7	CLKREQ#	NC	8	UIM_PWR	NC
9	GND	GND	10	UIM_DATA	NC
11	REFCLK-	PCIE_REFCLKN	12	UIM_CLK	NC
13	REFCLK+	PCIE_REFCLKP	14	UIM_RESET	NC
15	GND	GND	16	UIM_VPP	NC
17	Reserved	NC	18	GND	GND
19	Reserved	NC	20	W_DISABLE#	NC
21	GND	GND	22	PERST#	PCIE_RESET
23	PETn0	PCIE_TXN	24	+3.3Vaux	3V3
25	PETp0	PCIE_TXP	26	GND	GND
27	GND	GND	28	+1.5V	NC
29	GND	GND	30	SMB_CLK	NC
31	PERn0	PCIE_RXN	32	SMB_DATA	NC
33	PERp0	PCIE_RXP	34	GND	GND
35	GND	GND	36	USB_D-	NC
37	Reserved	GND	38	USB_D+	NC
39	+3.3Vaux	3V3	40	GND	GND
41	+3.3Vaux	3V3	42	LED_WWAN	NC
43	GND	GND	44	LED_WLAN	NC

45	RESERVED	NC	46	LED_WPAN	NC
47	RESERVED	NC	48	+1.5V	NC
49	RESERVED	NC	50	GND	GND
51	RESERVED	NC	52	+3.3Vaux	3V3

6.3 Pin Description

Design Name	I/O	Description
PCIE_ RESET	I	RESET (active low)
PCIE_REFCLKP	I	External reference clock from PCIe RC
PCIE_REFCLKN	I	
PCIE_RXP	I	PCIe receive input differential signals
PCIE_RXN	I	
PCIE_TXP	O	PCIe transmit output differential signals
PCIE_TXN	O	

7   Mechanical Specification

7.1 Module Outline Drawing

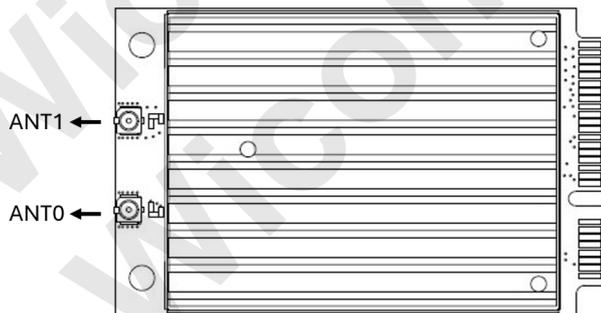Heat Sink
Thermal pad
Shielding cover
Shielding frame
Thermal pad
PCBA
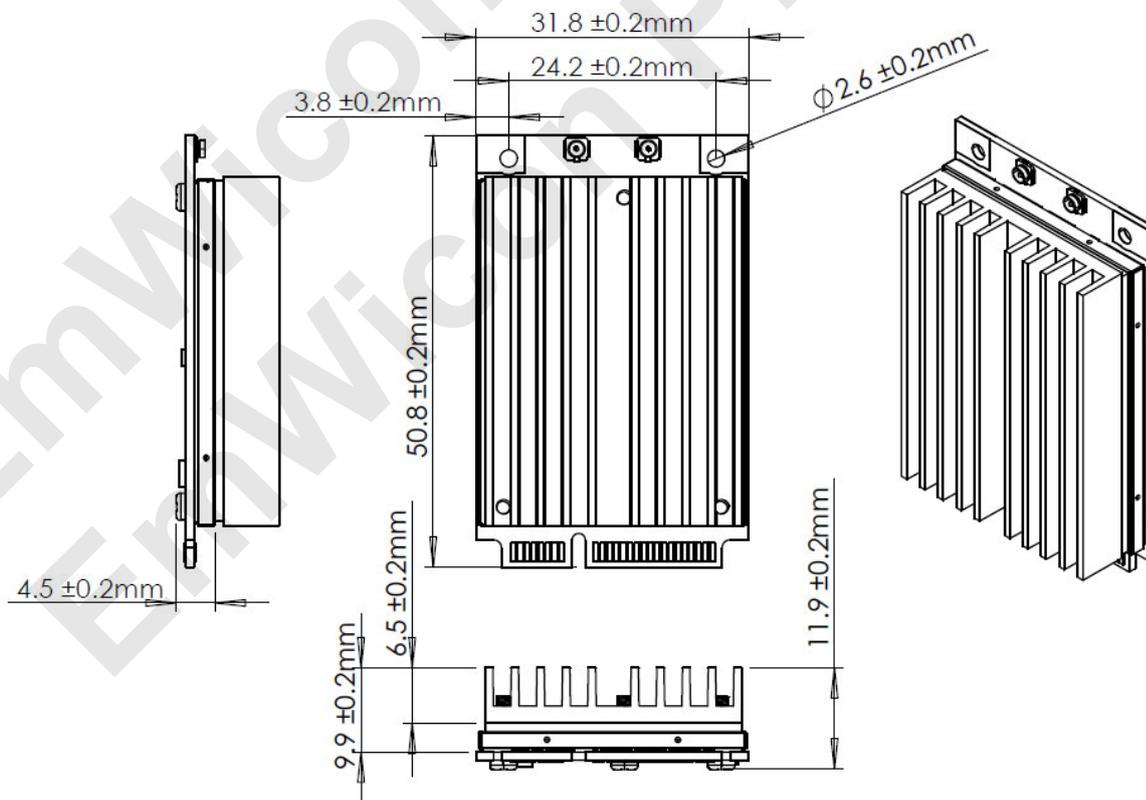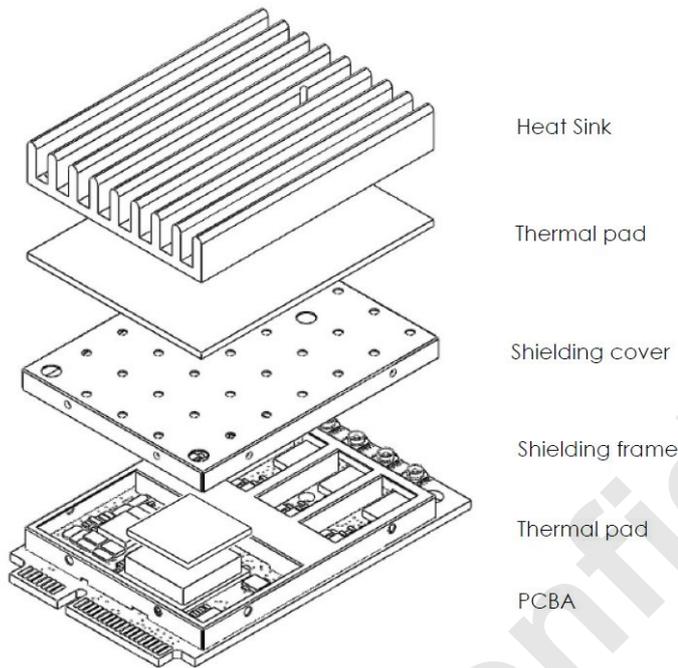
7.2 Interface & Dimension

- Mini PCIe full size
- Typical Dimension: (W)31.8mm x (L)50.8mm x (H)11.9mm

7.3 Antenna Connector

ANT1
ANT0

Pin Name	Description
ANT0	RF Antenna 0 for Wi-Fi 2.4GHz and 5GHz
ANT1	RF Antenna 1 for Wi-Fi 2.4GHz and 5GHz

8   Product Appearance

8.1 Product Picture
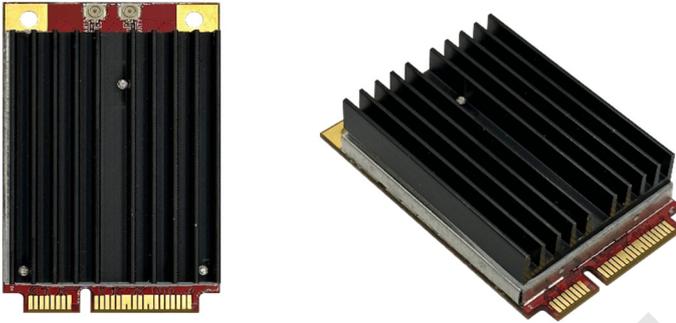
8.2 Label Define

Item	Description
Size	30x5mm
Model	Product Model Name
MAC	Wi-Fi Mac Address
SN	Product Serial Number

9   Software & Driver

9.1 Driver Support

- Linux kernel 5.15

9.2 Platform Support List

- Intel x86
- NXP LS1046
- Openwrt(TBD)

9.3 RF Tool

- RF test tool consultant service available

10 Recommended Thermal Solution

10.1   Introduction:

The Renesas Celeno CL8040 chip has a maximum case temperature (TCase) of 110°C, and it is recommended to maintain the ambient temperature below 85°C.

When the chip temperature over 110°C, the chip activates its protection mechanism, halting RF transmission. RF transmission resumes once the temperature drops below 95°C. Therefore, we recommend implementing an effective heat dissipation solution to ensure the module operates normally.

10.2   Common Heat Dissipation Solutions:

• Adding a fan to increase heat dissipation and effectively address heat accumulation issues.

• Directing the heat source of the module to the exterior of the casing to improve heat dissipation efficiency.

10.3   Recommended Heat Dissipation Solution:

The standard module is equipped with heat sinks located above the module. We suggest users add heat sinks below the module to redirect the heat source to the baseplate, which then dissipates the heat to the exterior of the casing. Refer to the schematic diagram below:
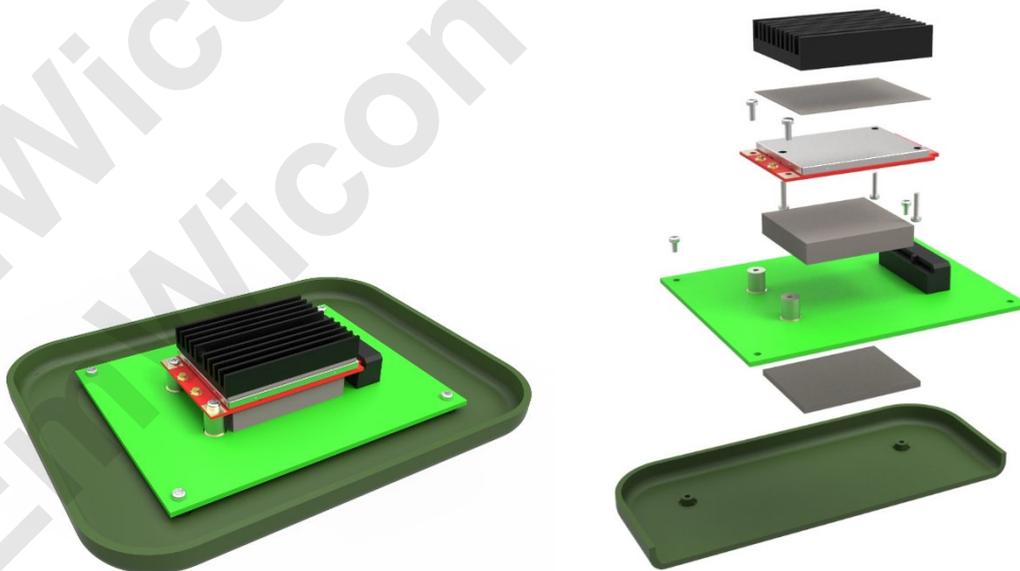
By implementing the recommended heat dissipation solutions outlined above, it is possible to effectively reduce chip temperature and ensure system stability and performance.

11 Certification

CE/FCC/IC (TBD)

Package Information

● One module per one static bag

● One static bags in one lattice and 100pcs per inner box

● 5 inner boxes per 1 carton and 500pcs per carton

MEAS:466X384X460MM

12 Ordering Information

12.1   Main Parts

Part Number	Description
WMX7408	Wi-Fi 6 2.4GHz + 5GHz (DBS) Mini PCIe 2x2 Module

12.2   Accessories

Part Number	Description
ATD6251	Dipole Antenna 2dBi 2.4GHz/5GHz
ATD6351	Dipole Antenna 3dBi 2.4GHz/5GHz
ATD6551	Dipole Antenna 5dBi 2.4GHz/5GHz
AC11501	Cable IPEX to SMA, 150mm