Re-imagining Cellular IoT Solutions

Cavli C10QM LTE CAT 1/2G Mini PCIe Card

Hardware Manual
Release Version 1.2

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VERSION HISTORY

Version	Edit	Date
1.0	• Initial Version	28/07/2023
1.1	• Corrected the pin number for UART interface. • Made the appropriate change on Module characteristics table	27/09/2023
1.2	• USIM and USB reference circuits updated	28/8/2024

1 Introduction

This document is the hardware interface manual of the Mini PCIe version of the wireless solution product C10QM module, designed to describe the hardware components and functional characteristics of the module solution, application interface definition and use instructions, electrical performance and mechanical characteristics. This document and the other application documents combined will enable users to develop end devices with Cavli Modules.

2 Module Overview

2.1 Module introduction

The C10QM mini PCIe is a wireless communication module that integrates various network standards such as LTE CAT 1/2G and RF transceiver with PCI Express Mini Card 1.2 standard interface. It supports a maximum downlink rate of 10 Mbps and a maximum uplink rate of 5 Mbps. The module is based on ARM Cortex A7 processor. It has built-in multiple network protocols and supports Windows 7 and higher, embedded operating system such as Android 4.0 or higher.

The C10QM module can be used in the following applications:

- ✓ Vehicle telematics
- ✓ Asset tracking
- ✓ Fleet management
- ✓ Smart city and smart home applications
- ✓ Connected retail applications-point of sale devices, automated teller machines, vending machines etc.
- ✓ Industrial IOT – gateways, remote control & monitoring systems

2.2 Module characteristics

Table 2.1 Key Features

Characteristics		Description
Physical properties		50.9mm*30.0mm*3.78mm
Working voltage		2.5V–5.5V, Typical voltage 3.3V
Application Interface	USIM card	✓ Supports 1.8V/2.85V ✓ Supports hot swap function
	USB	✓ USB2.0 (High-Speed) interface works as Host and slave mode ✓ USB works as OTG Host. ✓ Data transfer rate up to 480Mbps
	UART	✓ UART3(4 line), UART4(2 line) and UART5(2 line) ✓ AT commands and data transfer ✓ The max baud rate is up to 921600bps. Default is 115200bps.
	PCM	✓ Supports 1x PCM interface
	I2C	✓ Compliant with I2C bus protocol
	Network Indication	✓ NETLIGHT_MC network status indication ✓ STATUS Module status
	GNSS	✓ GPS, GLONASS, BEIDOU, GALILEO, QZSS
Operating frequency band		**E.A:** LTE BANDS: 1/3/5/8/20/40 GSM BANDS: GSM900/ GSM1800 **N.A:** LTE BANDS: 2/4/5/12/13/25/26/66

	GSM BANDS: GSM900/ GSM1800
Data service	✓ FDD/TDD LTE CAT1 /2G ✓ DL 10 Mbps/ UL 5 Mbps (CAT 1) ✓ DL 236.8 Kbps / UL 236.8 Kbps (2G)
Antenna Interface	✓ MAIN x 1 ✓ GNSS x 1 ✓ Characteristic impedance 50 Ω
GNSS	✓ GPS ✓ GLONASS ✓ BeiDou ✓ Galileo ✓ QZSS
Virtual Network Card	Support USB virtual network card
Humidity	RH5% ~ RH95%
Operating temperature	Normal working temperature –30°C to + 75°C Extreme working temperature –40°C to +85°C Storage temperature –45°C to +90°C

2.3 Functional Block Diagram

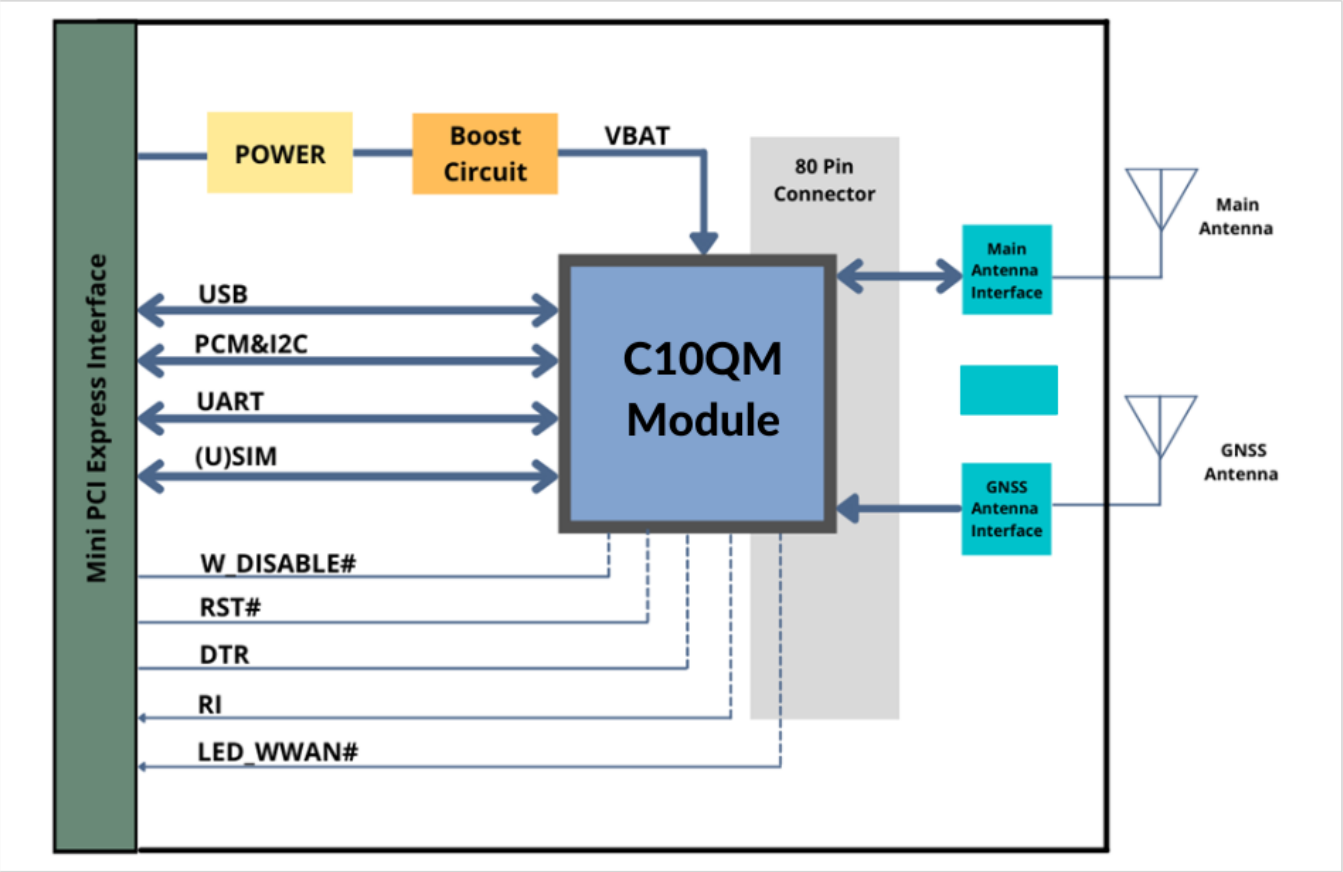


Figure 1 Functional block diagram

3 Interface Application description

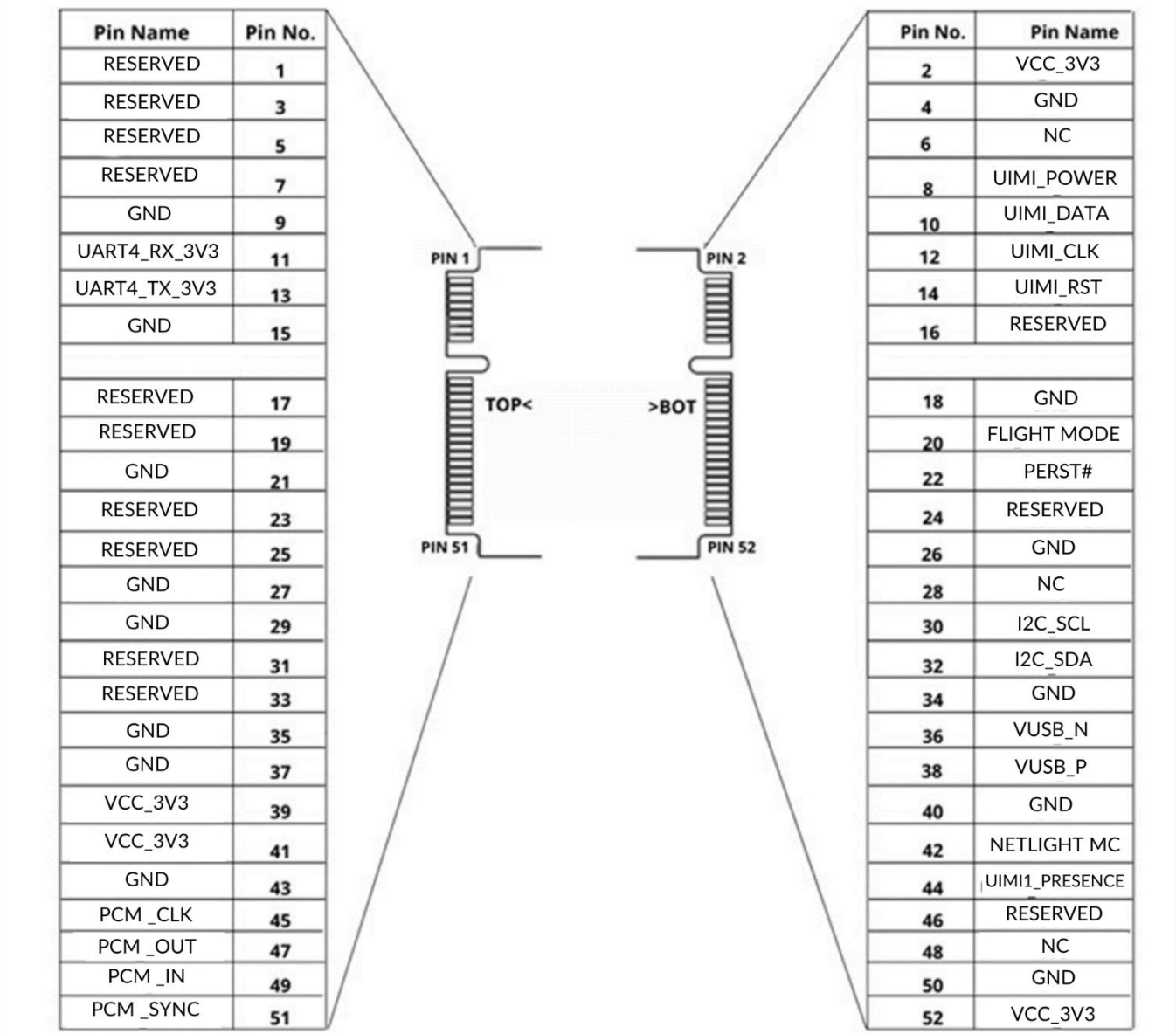
3.1 Chapter overview

This chapter mainly describes the interface definition and application of this module. It contains the following sections:

- Module interface
- Power supply
- USIM Card interface
- USB interface
- UART interface
- I2C interface
- Control signals
- Antenna interface
- SDIO Interface
- SPI
- GNSS Interface

4 mPCIe Interface Application Description

4.1 C10QM Mini PCIe Card Pin Layout



Pin Name	Pin No.
RESERVED	1
RESERVED	3
RESERVED	5
RESERVED	7
GND	9
UART4_RX_3V3	11
UART4_TX_3V3	13
GND	15
RESERVED	17
RESERVED	19
GND	21
RESERVED	23
RESERVED	25
GND	27
GND	29
RESERVED	31
RESERVED	33
GND	35
GND	37
VCC_3V3	39
VCC_3V3	41
GND	43
PCM _CLK	45
PCM _OUT	47
PCM _IN	49
PCM _SYNC	51

Pin No.	Pin Name
2	VCC_3V3
4	GND
6	NC
8	UIMI_POWER
10	UIMI_DATA
12	UIMI_CLK
14	UIMI_RST
16	RESERVED
18	GND
20	FLIGHT MODE
22	PERST#
24	RESERVED
26	GND
28	NC
30	I2C_SCL
32	I2C_SDA
34	GND
36	VUSB_N
38	VUSB_P
40	GND
42	NETLIGHT MC
44	UIMI1_PRESENCE
46	RESERVED
48	NC
50	GND
52	VCC_3V3

Figure 2 C10QM Mini PCIe Card Pin lay out

4.2 C10QM Pin Interface

The C10QM PCIe module has the LCC interface. The module interface definition is shown in the following table:

Table 4.1 Pin name

Pin No	C10QM Mini PCIe Pin Name	IO	Functional description	Remarks
1	RESERVED	-	Reserved	
2	VCC_3V3	PI	DC Supply	
3	RESERVED	-	Reserved	
4	GND	-	Mini Card ground	
5	RESERVED	-	Reserved	
6	NC	-	Not Connected	
7	RESERVED	-	Reserved	
8	UIM1_POWER	PO	Power supply for USIM	
9	GND		Mini Card Ground	
10	UIM1_DATA	IO	USIM card DATA	
11	UART4 _RX_3V3	DI	UART RECEIVER	
12	UIM1_CLK	DO	USIM Clock	
13	UART4_TX_3V3	DO	UART transceiver	
14	UIM1_RST	DO	USIM card reset	
15	GND	-	Mini Card Ground	
16	RESERVED	-	Reserved	
17	RESERVED	-	Reserved	

18	GND	-	Mini Card ground	
19	RESERVED	-	Reserved	
20	FLIGHT MODE	DI	Flight mode	
21	GND	-	Mini Card ground	
22	PERST#	-	Functional reset to the card	
23	RESERVED	-	Reserved	
24	RESERVED	-	Reserved	
25	RESERVED	-	Reserved	
26	GND	-	Mini Card ground	
27	GND	-	Mini Card ground	
28	NC	-	Not connected	
29	GND	-	Mini Card ground	
30	I2C_SCL	DO	I2C bus clock output	
31	RESERVED	-	Reserved	
32	I2C_SDA	DIO	I2C bus data input and output	
33	RESERVED	-	Reserved	
34	GND	-	Mini Card ground	
35	GND	-	Mini Card ground	
36	VUSB_N	IO	USB differential signal	
37	GND	-	Mini Card Ground	
38	VUSB_P	IO	USB differential signal +	
39	VCC_3V3	PI	Module Input Voltage	
40	GND	-	Mini Card ground	
41	VCC_3V3	PI	Module Input Voltage	

42	NETLIGHT MC	DO	Net light	
43	GND	-	Mini Card Ground	
44	UIMI1_PRESENCE	DI	Detect the presence of USIM	
45	PCM_CLK	DO	PCM Clock pulse	
46	RESERVED	-	Reserved	
47	PCM_OUT	DO	PCM data output	
48	NC	-	Not connected	
49	PCM_IN	DI	PCM data input	
50	GND	-	Mini Card ground	
51	PCM_SYNC	DO	PCM frame sync	
52	VCC_3V3	PI	3.3 DC supply	

Table 4.2 IO parameter definition

Pin No	Pin Type
IO	Two-way input and output
PI	power input
PO	Power Output
AI	Analog input
AO	Analog output
DI	Digital input
DO	Digital output
OD	Leaky open circuit

4.3 Power Supply

The following table shows the pin definition of VCC pins and ground pins.

Table 4.3 VCC and GND Pin Definition

Pin No.	Pin Name	IO	Power Domain	Description
2,52,39,41	VCC		3.6V-4.5V	3.8V DC supply
2,9,18,15,21,26,27,29, 34,35,37,40,43,50	GND			Mini Card ground

The typical supply voltage of C10QM Mini PCIe is 3.3V. Therefore, the power supply must be able to provide enough current, and a bypass capacitor of no less than 470μF with low ESR should be used to prevent the voltage from dropping.

4.4 USIM Card interface

The C10QM module provides a USIM card interface compatible with the ISO 7816-3 standard. The USIM card power supply is provided by the module's internal power manager and supports 1.8V/3.0V.

Table 4.4 USIM Pin Definition

Pin No.	Pin Name	IO	Power Domain		Description
8	UIM1_POWER	PO	1.8V	Vmax=1.9V Vmin=1.7V	USIM card power supply
			3.0V	Vmax=3.05V Vmin=2.7V IOmax=50mA	
10	UIM1_DATA	IO	1.8V	VILmax=0.6V VIHmin=1.2V VOLmax=0.45 VOHmin=1.35	USIM card data

			3.0V	VILmax=1.0V VIHmin=1.95V VOLmax=0.45 VOHmin=2.55	
12	UIM1_CLK	DO	1.8V	VOLmax=0.45 VOHmin=1.35	USIM card clock
			3.0V	VOLmax=0.45 VOHmin=2.55	
14	UIM1_RST	DO	1.8V	VOLmax=0.45 VOHmin=1.35	USIM card reset
			3.0V	VOLmax=0.45 VOHmin=2.55	
44	UIM1_PRSENCE	DI	1.8		Sim Detect

C10QM Mini PCIe supports 1.8V and 3.0V USIM cards. The following figure shows a reference design for a 6-pin USIM connector.

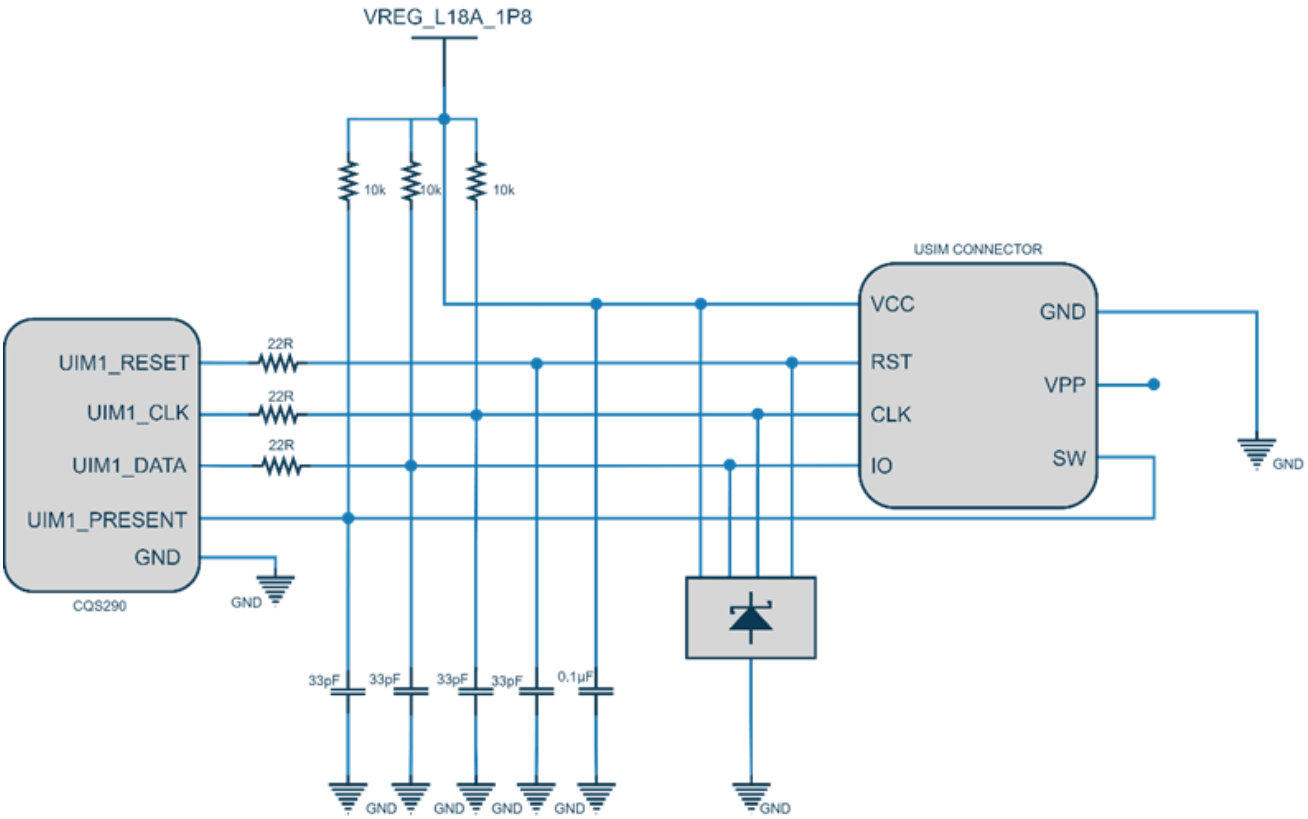


Figure 3 USIM connector reference circuit

In order to enhance the reliability and availability of the USIM card in your application, please follow the criteria below in the USIM circuit design:

- ✓ Keep the layout of USIM cards as close to the module as possible.
- ✓ Keep USIM card signal away from RF and power supply alignment.
- ✓ To avoid transient voltage overload, the USIM interface requires a 1.8V (use an external power source) through a 22R resistor in series with each other on the signal line path.

In order to offer good ESD protection, it is recommended to add a TVS diode whose parasitic capacitance should be not more than 50pF. The 22ohm resistors should be added in series between the module and the USIM card so as to suppress the EMI spurious transmission and enhance the ESD protection. The 33pF capacitors are used for filtering interference of high frequency signals. Please note that the USIM peripheral circuit should be close to the USIM connector. The pull-up resistor on USIM_DATA line can improve anti-jamming capability when long layout trace and sensitive occasion are applied and should be placed close to the connector.

4.5 USB interface

The C10QM module USB interface supports USB2.0 high-speed protocol, only in slave mode, and does not support USB charging mode. USB input and output traces must comply with the USB2.0 feature. The input power supply of USB_VBUS is 3.3V - 5V. The USB interface is used to update the firmware of the module. The following table shows the pin definition of USB interface.

Table 4.5 USB Pin Definition

Pin No.	Pin Name	I/O	Description	Comment
38	USB_DP	IO	USB differential signal +	Require differential impedance of 90Ω
36	USB_DM	IO	USB differential signal	Require differential impedance of 90Ω

The following figure shows a reference circuit of the USB interface.

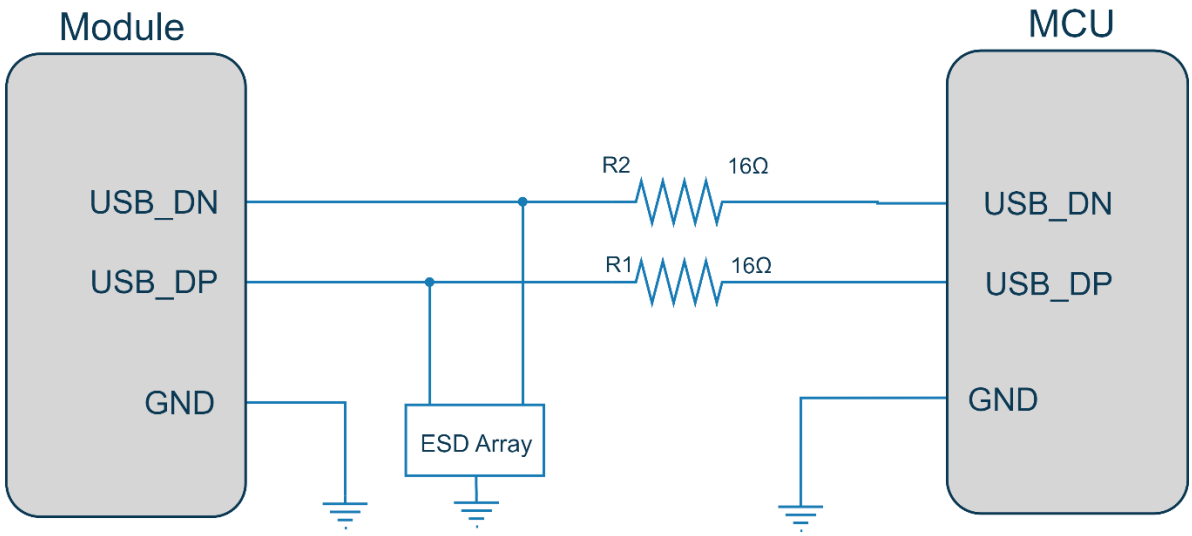


Figure 4 USB connection design circuit diagram

The components R1, R2, R3 and R4 must be placed close to the module, and then these resistors should be placed close to each other. The extra stubs of trace must be as short as possible.

- ✓ In order to ensure the USB interface design corresponding with the USB 2.0 specification, please comply with the following principles:
- ✓ It is important to route the USB signal traces as differential pairs with total grounding. The impedance of the USB differential trace is 90ohm.
- ✓ Do not route signal traces under crystals, oscillators, magnetic devices or RF signal traces. It is important to route the USB differential traces in the inner layer with ground shielding, and not only upper and lower layer but also right and left side should be shielded.
- ✓ If you use the USB connector, you should keep the ESD components as close to the USB connector as possible. Pay attention to the influence of junction capacitance of ESD components on USB data lines. Typically, the capacitance value should be less than 2pF.
- ✓ Keep USB data test points traces short to avoid noise coupled on USB data lines. If possible, reserve 0R resistor on these two lines.

The USB interface bus supply voltage is provided internally by the module and does not need to be externally supplied. At the same time, since the USB interface of the module does not provide USB bus power, the module can only be used as a slave device of the USB bus device.

4.6 UART Interface

The UART interface supports upto 4Mbps baud rate. The default is 115200bps. This interface can be used for AT command communication.

The following table shows the pin definition of the UART4 interface in the Mini PCIe card:

Table 4.6 Pin Definition of the UART Interface

Pin No.	C10QM Mini PCIe Pin Name	I/O	Power Domain		Description
11	UART4_RX_3V3	DI	3.3V	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V	UART receive data
13	UART4_TX_3V3	DO	3.3V	VOLmax=0.45V VOHmin=1.35V	UART transmit data

4.7 I2C Bus

The C10QM module provides a set of hardware bidirectional serial buses with an I2C interface

Table 4.7 Audio and I2C Pin Definition

Pin No.	Pin Name	I/O	Power Domain	Description
30	I2C_SCL	OD	1.8V	I2C serial clock, requires external pull-up to 1.8V
32	I2C_SDA	OD	1.8V	I2C serial data, requires external pull-up to 1.8V

4.8 Audio interface (PCM)

The following table shows the pin definition of PCM interface that can be applied in audio codec design.

Table 4.8 Audio Interface Pin Definition

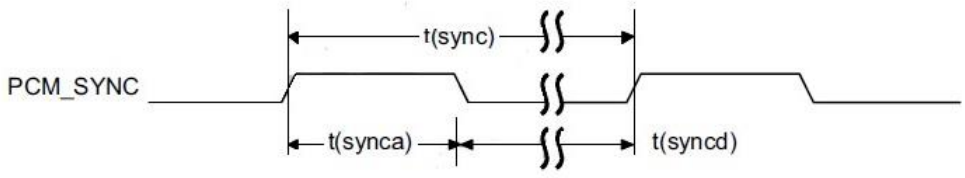
Pin No	C10QM Mini PCIe Pin Name	I/O	Power Domain		Description
45	PCM CLK	DO	1.8V	VOLmax=0.4V VOHmin=1.3V	PCM clock signal
47	PCM_DOUT	DO	1.8V	VOLmax=0.45V VOHmin=1.35V	PCM data output
49	PCM_IN	DI	1.8V	VILmin=-0.3V VILmax=0.6V VIHmin=1.2V VIHmax=2.0V	PCM data input
51	PCM_SYNC	DO	1.8V	VOLmax=0.45V VOHmin=1.35V	PCM frame sync

C10QM Mini PCIe provides one PCM digital interface, which supports the following modes:

- ✓ Primary mode (short sync, works as either master or slave)
- ✓ Auxiliary mode (long sync, works as master only)

In primary mode, the data is sampled on the falling edge of the PCM_CLK and transmitted on the rising edge; the PCM_SYNC falling edge represents the MSB. In this mode, PCM_CLK supports 128, 256, 512, 1024 and 2048 kHz for different speed codecs.

The following figure shows the timing relationship in primary mode with 8 kHz PCM_SYNC and 2048 kHz PCM_CLK.



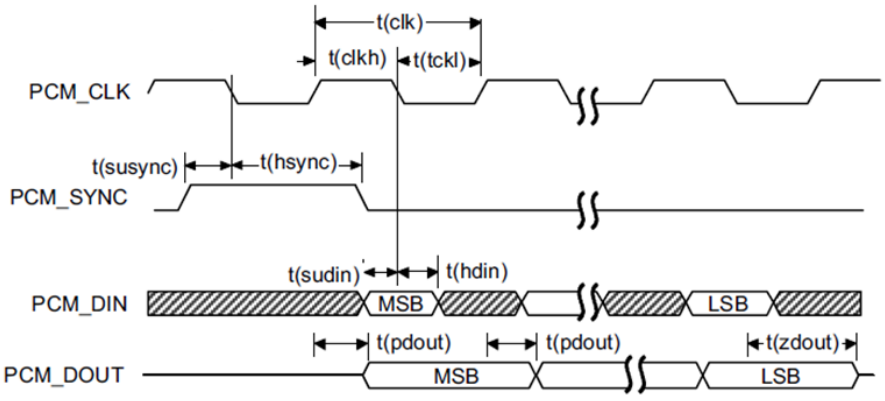


Figure 5 PCM Short frame mode timing diagram

In auxiliary mode, the data is sampled on the falling edge of the PCM_CLK and transmitted on the rising edge; while the PCM_SYNC rising edge represents the MSB. In this mode, PCM interface operates with a 128 kHz PCM_CLK and an 8 kHz, 50% duty cycle PCM_SYNC only.

Clock and mode can be configured by AT command, and the default configuration is master mode using short sync data format with 2048 kHz PCM_CLK and 8 kHz PCM_SYNC. In addition, C10QM Mini PCIe's firmware has integrated the configuration on some PCM codec's application with I2C interface. The following figure shows a reference design of PCM interface with an external codec IC.

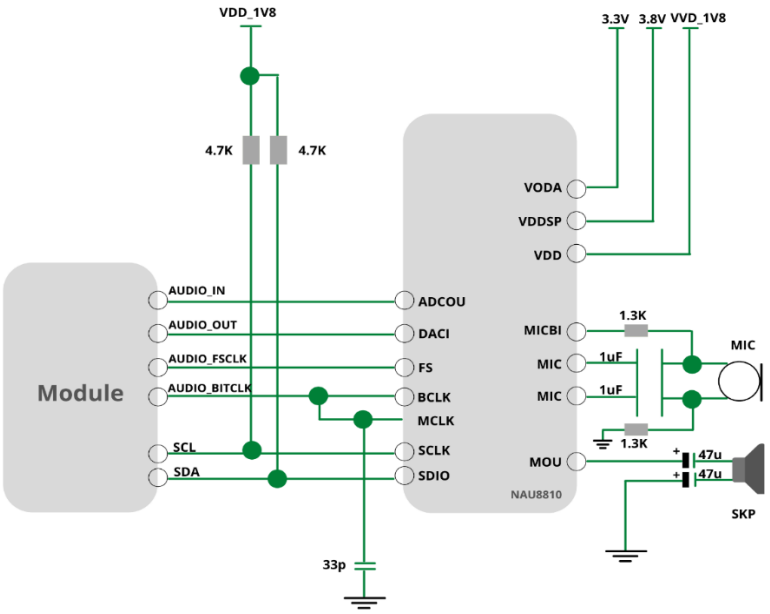


Figure 6 Reference Circuit of Audio Application with Audio Codec

4.9 Control and indicator signals

The following table shows the pin definition of control signals.

Table 4.9 Control Signal Pin Definition

Pin No.	C10QM Mini PCIe Pin Name	I/O	Power Domain	Description
20	W_DISABLE# /FLIGHT MODE	DI	1.8V	Disable wireless communications. pull-up by default, active low.
22	PERST#	DI	1.8V	Functional reset to the card; active low.
42	NETLIGHT_MC	DO	1.8V	Active-low LED signal for indicating the state of the module.

4.9.1 FLIGHT MODE (W_DISABLE#) Signal

C10QM Mini PCIe provides FLIGHT MODE signal to enable and disable wireless communications through hardware operation. The following table shows the radio operational states of the module

Table 4.10 Radio Operational States

FLIGHT MODE	Radio Operation	Module operation mode
High Level	Enabled	Normal mode
Low Level	Disabled	Airplane mode

4.9.2 PERST#

The PERST# signal can be used to force a hardware reset on the card. You can reset the module by driving the PERST# to a low-level voltage with the time frame of 150~460ms and then releasing it.

4.9.3 NETLIGHT_MC (LED_WWAN#) Signal

The NETLIGHT_MC (LED_WWAN#) signal of C10QM Mini PCIe is used to indicate the network status of the module, which can absorb the current up to 40mA. According to the following circuit, in order to reduce the current of the LED, a resistor must be placed in series with the LED. The LED is emitting light when the NETLIGHT_MC output signal is active low.

LED network indicator light reference design chart is as follows:

Figure 7 Circuit diagram of network indicator

The following table shows the indications of network status of the LED_WWAN# signal.

Table 4.11 Indications of Network Status

LED_WWAN# (NETLIGHT)	Description
Low Level (Light on)	Registered on network
High impedance (Light off)	No network coverage or not registered W_DISABLE# signal is at a low level. (Disable the RF) AT+CFUN=0, AT+CFUN=4

5 80 Pin Connector*

***optional**

The Mini PCIe card contains an 80-pin male connector. The following table shows the pin description of the connector:

Table 5.1 Pin description

Pin No.	C10QM Pin name	IO	Description
1	GND	-	Ground
2	GND	-	Ground
3	RESERVED	-	Reserved
4	RESERVED	-	Reserved
5	GND	-	Ground
6	GND	-	Ground
7	RESERVED	-	Reserved
8	RESERVED	-	Reserved
9	GND	-	Ground
10	GND	-	Ground
11	RESERVED	-	Reserved
12	RESERVED	-	Reserved
13	GND	-	Ground
14	GND	-	Ground
15	RESERVED	-	Reserved
16	RESERVED	-	Reserved

17	RESERVED	-	Reserved
18	RESERVED	-	Reserved
19	JTAG_TCK	DI	Test clock (Not for customer)
20	JTAG_TDO	DO	Test data output (Not for customer)
21	JTAG_TMS	IO	Test mode select (Not for customer)
22	JTAG_TDI	DI	Test data input (Not for customer)
23	RESERVED	-	Reserved
24	RESERVED	-	Reserved
25	RESERVED	-	Reserved
26	RESERVED	-	Reserved
27	RESERVED	-	Reserved
28	RESERVED	-	Reserved
29	RESERVED	-	Reserved
30	RESERVED	-	Reserved
31	RESERVED	-	Reserved
32	RESERVED	-	Reserved
33	RESERVED	-	Reserved
34	RESERVED	-	Reserved
35	RESERVED	-	Reserved
36	RESERVED	-	Reserved
37	RESERVED	-	Reserved
38	RESERVED	-	Reserved

39	RESERVED	-	Reserved
40	GND	-	Ground
41	VDD_EXT 1.8 V	PO	Module Output
42	RESERVED	-	Reserved
43	RESERVED	-	Reserved
44	NETLIGHT	DO	Network status indication
45	POWERKEY	PI	Power Key
46	NC	-	Not Connected
47	STATUS	DO	Module status indication
48	RESERVED	-	Reserved
49	NC	-	Not Connected
50	RESERVED	-	Reserved
51	RESERVED	-	Reserved
52	RESERVED	-	Reserved
53	RESERVED	-	Reserved
54	RESERVED	-	Reserved
55	RESERVED	-	Reserved
56	UART3_TXD	DO	Data transmission
57	UART3_RXD	DI	Data reception
58	RESERVED	-	Reserved
59	RESERVED	-	Reserved
60	RESERVED	-	Reserved

61	RESERVED	-	Reserved
62	RESERVED	-	Reserved
63	RESERVED	-	Reserved
64	RESERVED	-	Reserved
65	RESERVED	-	Reserved
66	DBGUART RXD	DI	Data transmission
67	DBGUART TXD	DO	Data reception
68	NC	-	Not Connected
69	RESERVED	-	Reserved
70	RESERVED	-	Reserved
71	RESERVED	-	Reserved
72	RESERVED	-	Reserved
73	RESERVED	-	Reserved
74	RESERVED	-	Reserved
75	RESERVED	-	Reserved
76	RESERVED	-	Reserved
77	RESERVED	-	Reserved
78	RESERVED	-	Reserved
79	RESERVED	-	Reserved
80	GND	-	Ground

5.1 UART 1

The pins 67 and 68 of the module are UART1 serial port pins. UART1 serial interface can only be used as the debug UART of the module. The pins are defined as follows.

Table 5.2 UART1 interface pin definition in the 80-pin connector

Pin No.	Signal name in the 80-pin connector	I/O	Description	Parameter	Level value (V)			Remark
					min	typical	max	
66	UART1_RX	DI	Data reception	VIH	1.3	1.8	1.9	1.8V voltage domain
				VIL	-0.3		0.6	
67	UART1_TX	DO	Data transmission	VOH	1.3	1.8	1.9	1.8V voltage domain
				VOL	0		0.45	

5.2 UART 3

The pins 57 AND 58 of the C10QM module are UART3 serial port pins. UART3 serial interface can be used to interact with peripheral devices.

The UART interface is defined as follows：

Table 5.3 UART 3 pin definition in the 80-pin connector

Pin No.	Signal name in the 80-pin connector	I/O	Description	Parameter	Level value (V)			Remark
					min	typical	max	
57	UART3_RX	DI	Data reception	VIH	1.3	1.8	1.9	1.8V voltage domain
				VIL	-0.3		0.6	
56	UART3_TX	DO	Data transmission	VOH	1.3	1.8	1.9	1.8V voltage domain
				VOL	0		0.45	

5.3 JTAG Interface

Table 5.4 JTAG interface pin definition in the 80-pin connector

Pin	Signal name in the 80-pin connector	I/O	Description
19	JTAG_TCK	DI	Test clock (Not for customer)
21	JTAG_TMS	IO	Test mode select (Not for customer)
22	JTAG_TDI	DI	Test data input (Not for customer)
20	JTAG_TDO	DO	Test data output (Not for customer)

5.4 Control and Indication signals on 80 Pin connector

The following table shows the pin definition of control signals.

Table 5.5 C I Signals on 80 pin connector interface pin definition in the 80-pin connector

Pin	Signal name in the 80-pin connector	I/O	Description
44	Net light	DO	Network status Indication
45	Power key	DI	Used to Power On module
47	Status	DO	Module Status Indication

5.4.1 NETLIGHT

NETLIGHT signal used to indicate the network status of the module. It is the 44th in the 80-pin male connector.

5.4.2 POWER KEY

The 45th pin of the C10QM mPCI module is POWER_ON pin. The module can be powered on by pulling down the POWER_KEY LOW for at least 500ms.

5.4.3 STATUS

C10QM Mini PCIe provides STATUS signal to indicate the state of the module. It is the 47th pin in the 80-pin male connector.

6 Antenna interface

C10QM Mini PCIe antenna interfaces include a main antenna interface and a GNSS antenna interface. GNSS function is enabled by default. Both main antenna and GNSS antenna are connected to a U.FL connector.

Table 6.1 Antenna Definition

U.FL Connector	Antenna	Network Type
U.FL 1	LTE MAIN	✓ Cellular (Tx + Rx)
U.FL 2	LTE DIVERSITY	✓ Cellular (Rx only)
U.FL 3	GNSS	✓ GPS ✓ GLONASS ✓ Galileo ✓ BeiDou ✓ QZSS ✓ L1

7 Overall technical indicators

7.1 Chapter overview

The C10QM mini PCIe RF overall specifications include the following sections:

- Power supply requirements
- IO requirements
- ESD Characteristics
- GNSS requirements
- Antenna requirements

7.2 Power Supply Requirements

The input voltage of C10QM Mini PCIe is 3.3 specified by PCI Express Mini CEM Specifications.

The following table shows the power supply requirements of C10QM Mini PCIe:

Table 7.1 Power Supply Requirements

Parameter	Description	Min.	Typ.	Max.	Unit
VCC	Power Supply	2.5	3.3	5.5	V

7.3 IO Requirements

The following table shows the IO requirements of C10QM Mini PCIe.

Table 7.2 IO Requirements

Parameter	Description	Typical	Unit
VIO	Input Output Voltage	1.8V	V

7.4 ESD Characteristics

The following table shows the ESD characteristics of C10QM Mini PCIe:

Table 7.3 ESD Characteristics

Parameter	Contact Discharge	Air Discharge	Unit
Power Supply and GND	+/-5	+/-10	kV
Antenna Interface	+/-4	+/-8	kV
USB Interface	+/-4	+/-8	kV
USIM Interface	+/-4	+/-8	kV
Others	+/-0.5	+/-1	kV

7.5 Antenna Requirements

C10QM Mini PCIe antenna interfaces include a main antenna interface and a GNSS antenna interface. GNSS function is enabled by default. Both main antenna and GNSS antenna are connected to a U.FL connector.

The following table shows the requirement on the main antenna and GNSS antenna:

Table 7.4 Antenna indicator requirements

Frequency band	Standing wave ratio	Antenna gain	Effectiveness	TRP	TIS
B1 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B2 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B3 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B4 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B5 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B8 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B12 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B13 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B20 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B25 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B26 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B40 TDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
B66 FDD	<2:1	〉-2.5dbi	〉40%	>16.5	<-88
GSM 900	<2:1	〉-2.5dbi	〉40%	>29	<-102
GSM 1800	<2:1	〉-2.5dbi	〉40%	>26	<-102

8 Dimensions and Packaging

8.1 Mechanical Dimensions of C10QM Mini PCIe

The following figure shows the standard dimensions (top and bottom view) of Mini PCI Express:

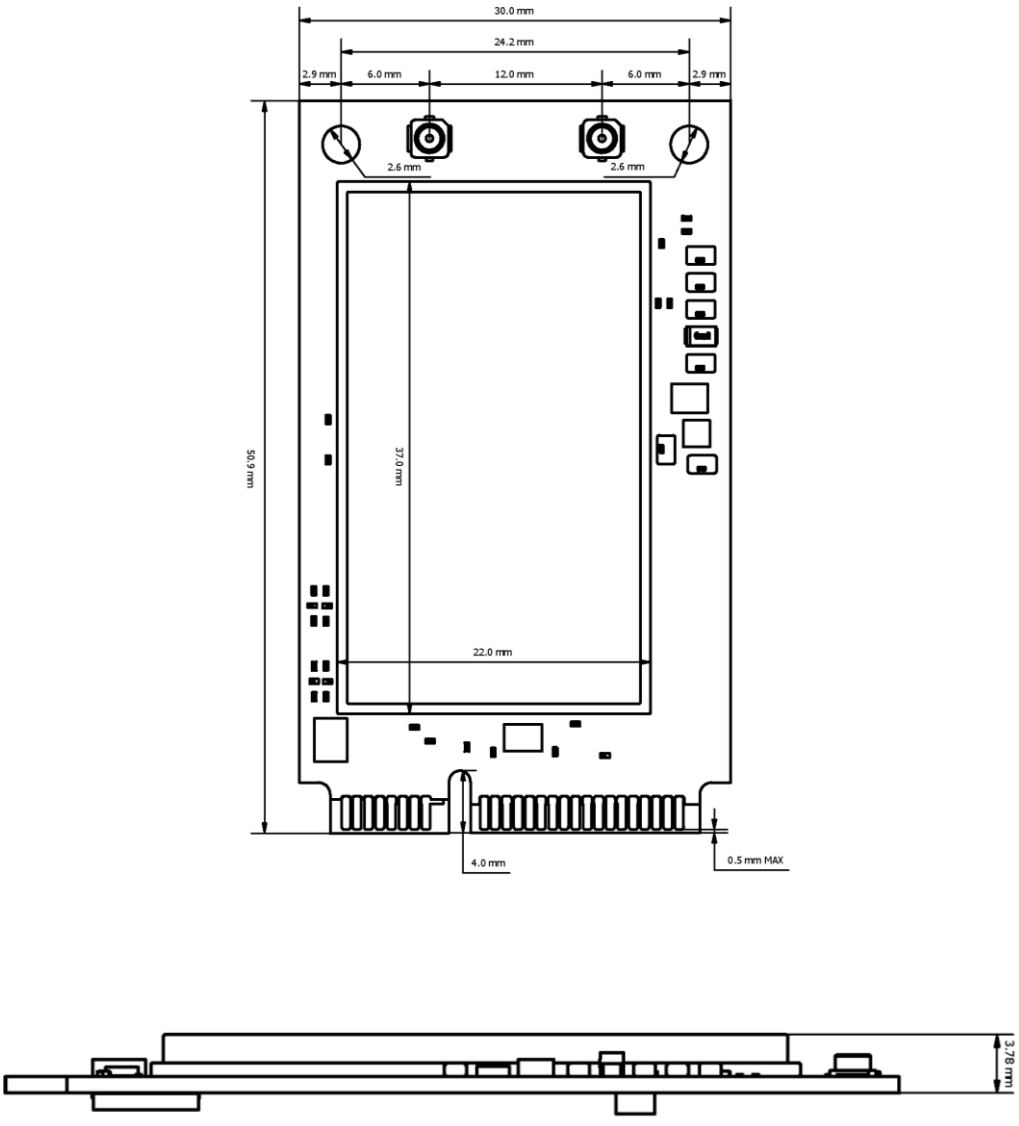


Figure 8 Standard dimensions of Mini PCIe

C10QM Mini PCIe adopts a standard Mini PCI Express connector. The following figure takes the Molex 679100002 as an example:

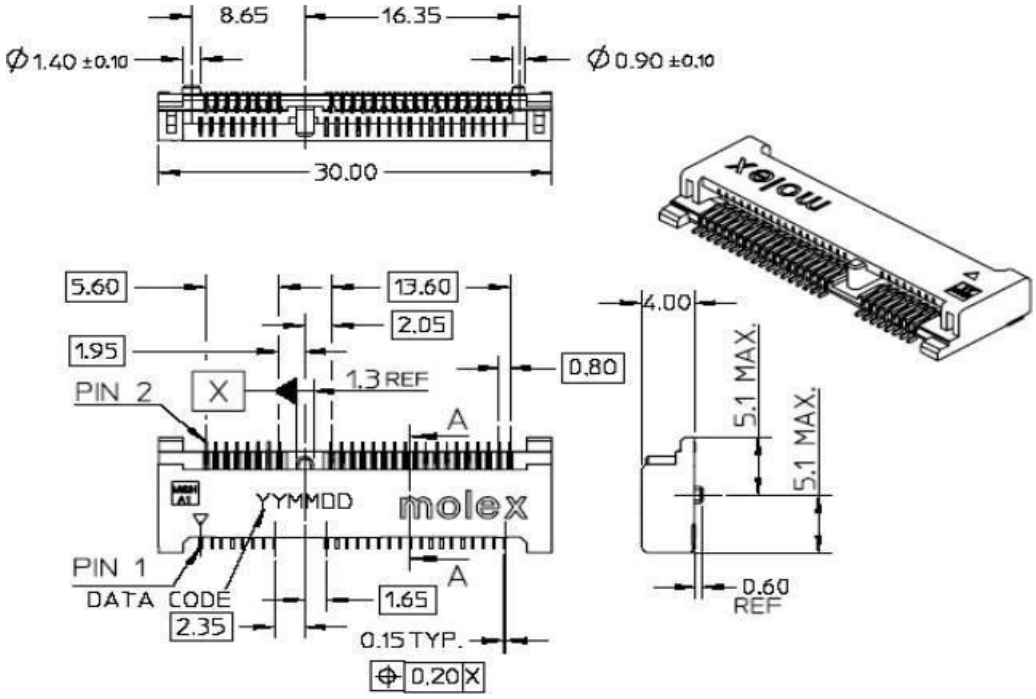


Figure 9 Molex 679100002 example figure

9 Ordering Information

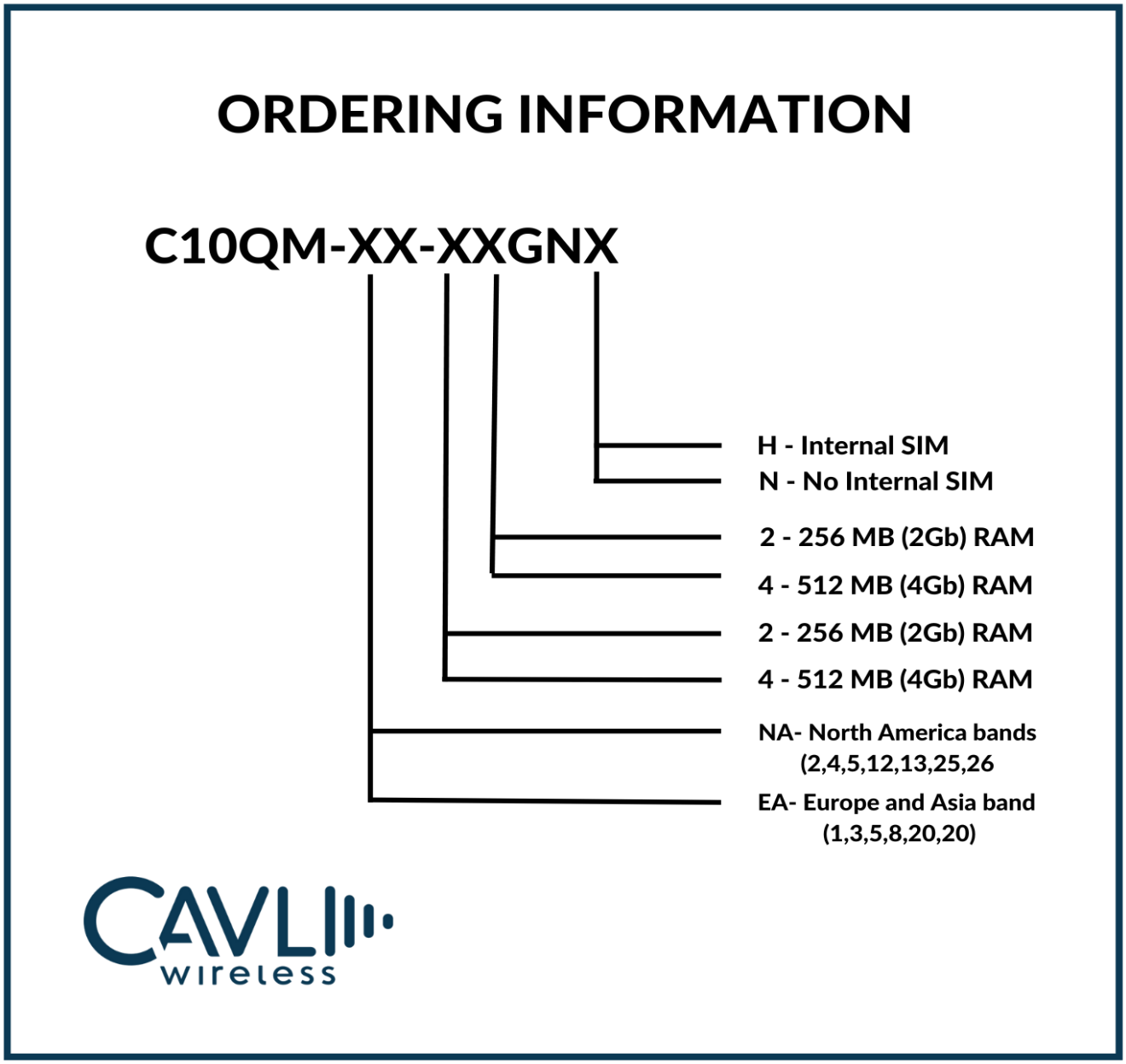


Figure 10 Ordering Information

10 Appendix

10.1 Chapter overview

- Abbreviations
- Safety and precautions

10.2 Abbreviations

Table 10.1 Abbreviations

Abbreviations	Full name
3GPP	Third Generation Partnership Project
AP	Access Point
AMR	Adaptive Multi-rate
BER	Bit Error Rate
CCC	China Compulsory Certification
CDMA	Code Division Multiple Access
CE	European Conformity
CSD	Circuit Switched Data
CTS	Clear to Send
DC	Direct Current
DTR	Data Terminal Ready
DL	Down Link
DTE	Data Terminal Equipment
DRX	Discontinuous Reception
EDGE	Enhanced Data Rate for GSM Evolution
EU	European Union
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
FCC	Federal Communications Commission
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication

HSDPA	High-Speed Downlink Packet Access
HSPA	Enhanced High Speed Packet Access
HSUPA	High Speed Up-link Packet Access
IMEI	International Mobile Equipment Identity
LED	Light-Emitting Diode
LTE	Long Term Evolution
NC	Not Connected
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDU	Protocol Data Unit
PMU	Power Management Unit
PPP	Point-to-point protocol
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RoHS	Restriction of the Use of Certain Hazardous Substances
SMS	Short Message Service
TIS	Total Isotropic Sensitivity
TVS	Transient Voltage Suppressor
TX	Transmitting Direction
UART	Universal Asynchronous Receiver-Transmitter
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identity Module
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio
WWAN	Wireless Wide Area Network

10.3 Safety and precautions

In order to use the wireless device safely, the terminal device informs the user of the relevant safety information:

- ✓ **Interference:** When the use of wireless devices is prohibited or the use of the device may cause interference and security of the electronic device, turn off the wireless device. Because the terminal will send and receive RF signals when it is powered on. It can interfere with TV, radio, computer or other electrical equipment.
- ✓ **Medical equipment:** In medical and health care facilities where the use of wireless devices is prohibited in the express text, please follow the regulations of the site and turn off the device. Some wireless devices may interfere with the medical device, causing the medical device to malfunction or cause errors. If interference occurs, turn off the wireless device and consult a physician.
- ✓ **Flammable and explosive areas:** In flammable and explosive areas, please turn off your wireless device and follow the relevant label instructions to avoid an explosion or fire. For example; gas stations, fuel zones, chemical products areas, chemical transportation and storage facilities, areas with explosion hazard signs, areas with “turn off radio equipment” signs, etc.
- ✓ **Traffic Safety:** Please comply with local laws or regulations in your country or region regarding the use of wireless devices when driving a vehicle.
- ✓ **Aviation Safety:** When flying, please follow the airline's regulations and regulations regarding the use of wireless devices. Before taking off, turn off the wireless device to prevent wireless signals from interfering with aircraft control signals.
- ✓ **Environmental Protection:** Please comply with local laws regarding the handling of equipment packaging materials, equipment or accessories, and support recycling operations.
- ✓ **Emergency call:** This device uses wireless signals for propagation. Therefore, there is no guarantee that the network can be connected in all situations.