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RFID MODULE PCIE M.2 Quick Guide

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1 Introduction

The PCIe M.2 Module that comprises a completely in integrated solution for EPC Gen 2 / ISO18000-63 (formerly 18000-6C) application.

The PCIe M.2 Module was developed to make embedding UHF RFID reader capability easy. The PCIe M.2 Module builds on market-leading Indy reader chip technology and integrates all of the necessary components into a tiny package. It requires very few external components.

Model Number	Supported Regions	Operating Frequency
RU00-M06-X002	US	902.75MHz~927.25MHz
	JP	916.8MHz~920.4MHz
		920.6MHz, 920.8MHz

Table 1: Band configurations

2 Regulatory Statement

Federal Communication Commission Interference Statement

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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

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 requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm 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:MAD-RU00-M06". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Antenna information :

Antenna Net Gain(dBi)	Antenna Type	Connector type	Frequency range	Cable Loss(dB)
5.25	Patch	SMA Female	902MHz~928MHz	0.75

*The connector transformer is needed

3 System Block Diagram

An example of a PCIe M.2 Module system-level block diagram for an embedded application is shown in Figure 1.

Required connections:

- VCC and GND are required to power the PCIe M.2 Module.
- RF pin must be connected to the OEM antenna.
- USB 2.0 provides host communications to control the operation of the PCIe M.2 Module.

Recommended connections:

- LED1#: This signal is used to allow the add-in card to provide status indicators via LED devices that will be provided by the system.
- W_DISABLE1# : This signal allow users to disable, via a system-provided switch, the add-in card's radio operation in order to meet public safety regulations or when otherwise desired.
- FULL_CARD_POWER_OFF# : This signal is an Active Low input that is used to turn off the entire module.
- RESET#: This pin is active, the modem will immediately be placed in a Power On reset condition.

Optional connections:

- CONFIG0-4: These signals provide the means to indicate the specific configuration of the module as well as indication of whether a module is present or not.
(The PCIe M.2 Module default setting: CONFIG_0, 3 N/A, CONFIG_1, 2 Ground.)

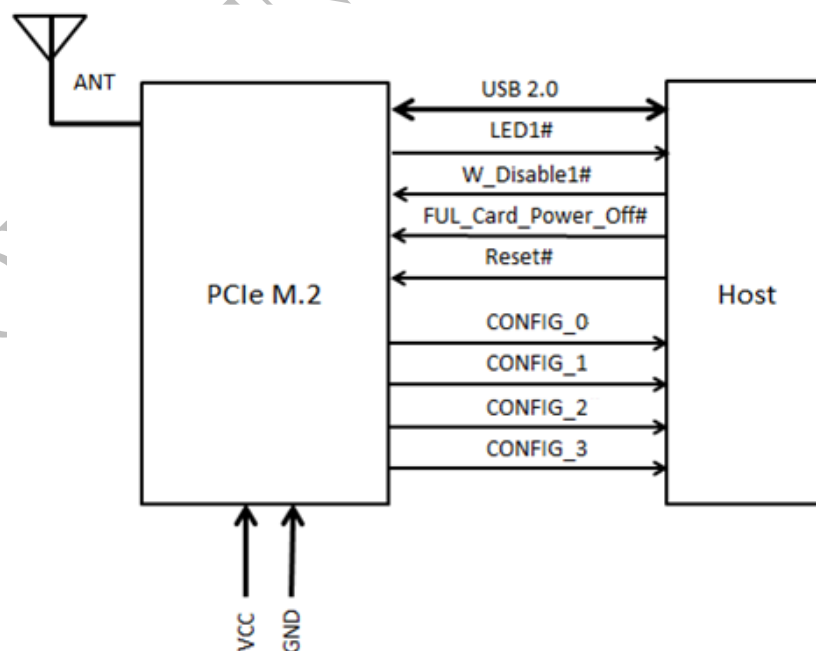


Figure 1: System Block Diagram

4 Specifications

Item	Description	Specifications
1	RFID Protocol & Profiles	EPCglobal UHF Class 1 Gen 2 / ISO18000-6C
2	Transmit Power	+10dBm to +27dBm
3	Transmit Power Accuracy	Room Temp. • +/- 1.0dB @ +24dBm~ +27dBm • +/- 1.5dB @ +10dBm ~+24dBm Low/High Temp. • +/- 1.5dB @ +24dBm ~+27dBm • +/- 2.0dB @ +10dBm ~+24dBm
4	Transmit Mask DRM Compliance	Compliance at +25 dBm
5	Support Regions	•US : 902MHz~928MHz •JP : 916.8MHz~920.8MHz
6	RF Antenna Port	MHF4(M)*1, mono-static
7	Return Loss at ports	12 dB
8	Receive Sensitivity at port	-74dBm @DRM profile, 15 dB antenna return loss, 27dBm output power.
9	Interference Rejection at port	+10dBm
10	DC Power Supply	3.135 V~4.4V
11	DC Power	Typ. 4.5 W at + 27 dBm
12	Power modes	Ready: MCU Ready only Standby : MCU and XCVR Ready W_Disable: Go to Ready mode Full_Card_Power_Off : Full Power Off
13	Digital Connector	PCIe M.2 form factor
14	Host Control Signal	USB 2.0 compliant with full speed operation
15	Software API	MTI Low Level Command set

Table 2: Specifications

5 Pin Configurations and Descriptions

The module is 75-pin PCIe M.2 Key B. The pin configurations are shown in Figure

74	3.3V	CONFIG_2	75
72	3.3V	GND	73
70	3.3V	GND	71
68	N/C	CONFIG_1	69
66	N/C	RESET#(I/1.8V)	67
64	N/C	N/C	65
62	N/C	N/C	63
60	N/C	N/C	61
58	N/C	N/C	59
56	N/C	GND	57
54	N/C	N/C	55
52	N/C	N/C	53
50	N/C	GND	51
48	N/C	N/C	49
46	N/C	N/C	47
44	N/C	GND	45
42	N/C	N/C	43
40	N/C	N/C	41
38	N/C	GND	39
36	N/C	N/C	37
34	N/C	N/C	35
32	N/C	GND	33
30	N/C	N/C	31
28	N/C	N/C	29
26	N/C	GND	27
24	N/C	N/C	25
22	N/C	N/C	23
20	N/C	CONFIG_0	21
18	Module Key	Module Key	19
16	Module Key	Module Key	17
14	Module Key	Module Key	15
12	Module Key	Module Key	13
10	LED1#(O/3.3V)	GND	11
8	W_DISABLE#(I/3.3V)	USB_D-	9
6	FULL_CARD_POWER_OFF#(I/1.8V)	USB_D+	7
4	3.3V	GND	5
2	3.3V	GND	3
		CONFIG_3	1

Figure 2: Pin Configurations

Pin Number	Pin Name	Type	Description
1	CONFIG_3	Output	N/A (*1)
2	3.3V	Power	Power Supply
3	GND	Ground	Ground
4	3.3V	Power	Power Supply
5	GND	Ground	Ground
6	FULL_CARD_POWER_OFF#	Input	General Purpose Input/Output (*2)
7	USB_D+	I/O	USB Data $\pm$ Differential defined in the USB 2.0 Specification
8	W_DISABLE1#	Input	General Purpose Input/Output
9	USB_D-	I/O	USB Data $\pm$ Differential defined in the USB 2.0 Specification
10	LED1#	Output	General Purpose Input/Output
11	GND	Ground	Ground
12,13,14,15,16,17,18,19	Module Key		N/A
20	N/C		N/A
21	CONFIG_0	Output	Ground (*1)
22,23,24,25,26	N/C		N/A
27	GND	Ground	Ground
28,29,30,31,32	N/C		N/A
33	GND	Ground	G
34,35,36,37,38	N/C		N/A
39	GND	Ground	Ground
40,41,42,43,44	N/C		N/A
45	GND	Ground	G
46,47,48,49,50	N/C		N/A
51	GND	Ground	Ground
52,53,54,55,56	N/C		N/A
57	GND	Ground	Ground
58,59,60,61,62,63,64,65,66	N/C		N/A
67	RESET#	Input	General Purpose Input/Output (*2)
68	N/C		N/A
69	CONFIG_1	Output	Ground (*1)
70	3.3V	Power	Power Supply
71	GND	Ground	Ground
72	3.3V	Power	Power Supply
73	GND	Ground	Ground
74	3.3V	Power	Power Supply
75	CONFIG_2	Output	N/A (*1)

Table 3: Pin Configurations

(*1) CONFIG_0, 3 connector to N/A, CONFIG_1, 2 connector to Ground Main Host interface for WWAN-PCIe

(*2) General Purpose Input / Output voltage is 1.8V

➤ Package Mechanical Outline

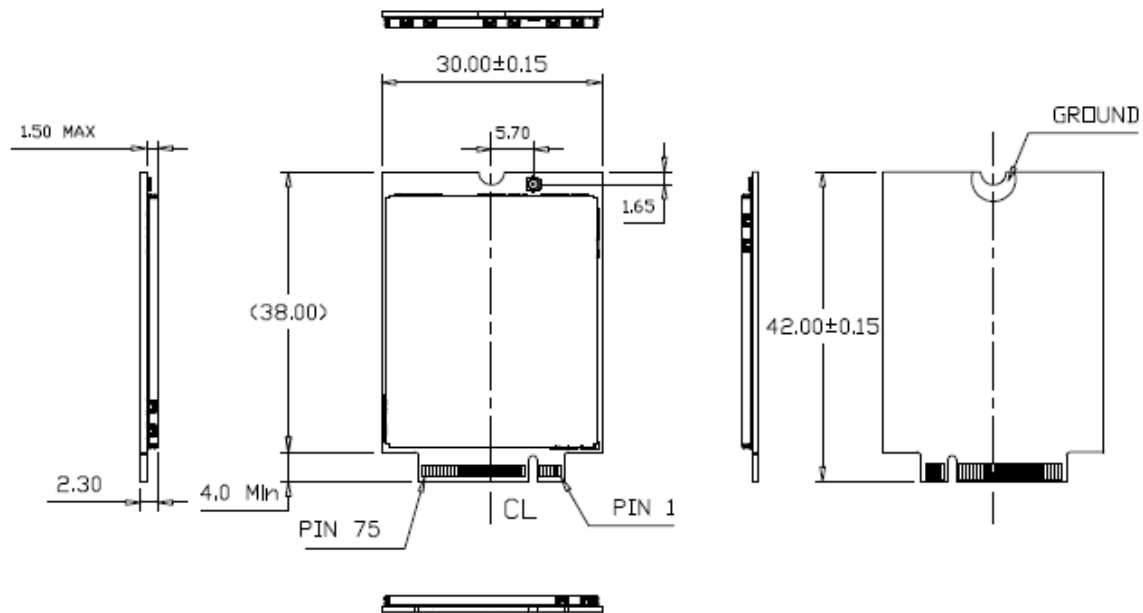


Figure 3: Package Mechanical Outline

7 Interfacing to the PCIe M.2 Module

➤ Power and Ground

All circuits on the PCIe M.2 Module are powered from inputs at pin 2, 4, 70, 72 and 74. The PCIe M.2 Module operates with any supply voltage between 3.135 and 4.4V, The Power pins follow PCIe M.2 design rule.

➤ Communication

The PCIe M.2 Module has one USB 2.0 ports. The USB are compatible with a standard USB 2.0. The user's host processor issues IRI commands to the HOST USB, which can be configured for any standard USB 2.0.

➤ RF

The PCIe M.2 Module is configured for monostatic operation, which requires only a single RF port for full duplex communication. The output must be routed to the antenna via 50 ohm. To maximize the radiated power (and corresponding communication range), the length of the transmission line between PCIe M.2 Module and antenna should be made as short as possible.

➤ W_Disable1#

W_Disable1# is wireless disable signals that are provided for wireless communications add-in cards. This signal allow users to disable, via a system-provided switch, the add-in card's radio operation in order to meet public safety regulations or when otherwise desired. Implementation of wireless disable signals is applicable to systems and all add-in cards that implement radio frequency capabilities.

➤ Full_Card_Power_Off#

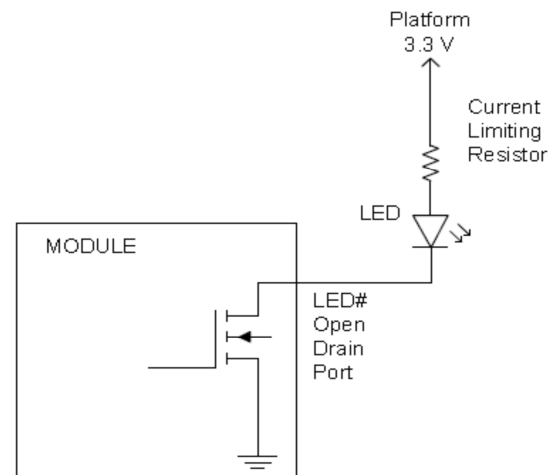
FULL_CARD_POWER_OFF# signal is an Active Low input that is used to turn off the entire module. When the input signal is asserted high (1.19 V) the Module will be enabled. When the input signal is driven low signal (≤ 0.2 V) or Tri-stated, it will force the module to shut down.

➤ Reset#

Asynchronous RESET# pin, active low. Whenever this pin is active, the modem will immediately be placed in a Power On reset condition. Care should be taken not to activate this pin unless there is a critical failure and all other methods of regaining control and/or communication with the PCIe M.2 Module have failed. When the input signal is asserted high (1.19 V) the Module will be operation mode. When the input signal is driven low signal (≤ 0.2 V) the Module will be reset PCIe M.2 Module.

➤ LED_1#

Open drain, active low signal. This signals is used to allow the add-in card to provide status indicators via LED devices that will be provided by the system.



8 Operating the PCIe M.2 Module

Once the required hardware connections are made to the PCIe M.2 Module, the unit can be operated with simple software routines running on the OEM's host processor. The host software issues commands to configure the reader, set the reader's idle mode and to start and stop various Gen2 RFID reader operations.

An example of the sequence of events starting at reader power-up is:

1. Apply 3.135V~4.4V power to the PCIe M.2 Module.
2. Establish a connection to the device via the host software.
3. Configure the reader. Critical parameters are:
 - a. Region of operation
When configured for a specific region, the PCIe M.2 Module can operate only according to the air interface standards for that region. Key communication parameters are not adjustable by the user but are inherent in the PCIe M.2 Module firmware. The FCC regional operation is the default for the device. NOTE: The OEM is strictly forbidden to operate the PCIe M.2 Module in a regional mode other than that in which the device is located. Applicable agency certification must be obtained by the OEM for their product to operate in the region in which it is located. The modular certification of the PCIe M.2 Module in the U.S. may only be utilized by OEM's that follow all guidelines set forth in this document.
 - b. RF output power
The PCIe M.2 Module output power must be set to a level between 10 and 27dBm. The default power is set to the reader's maximum allowable of 27dBm.
4. Initiate an RFID operation.
Gen2 RFID operations including Inventory, Read, Write, Lock and Kill are initiated with a command.
5. Set the PCIe M.2 Module standby mode.
When the PCIe M.2 Module is not executing an RFID operation, it assumes a low power state until another RFID function is initiated by the host.

9 Revision History

Version Number	Description	Revision Date
1.0.0	Initial release	15-Sep-17

Table 4: Revision history