

E104-MPE-04 PCI/104-Express Quad PCIe MiniCard Carrier User Manual



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IMPORTANT SAFE-HANDLING INFORMATION



WARNING: ESD-Sensitive Electronic Equipment!

Observe ESD-safe handling procedures when working with this product.

Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.

Always store this product in ESD-protective packaging when not in use.

Safe Handling Precautions

This module contains numerous I/O connectors that connect to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation and connection to other equipment. The list here describes common causes of failure found on boards returned to Diamond Systems for repair. This information is provided as a source of advice to help you prevent damaging your Diamond (or any vendor's) embedded computer boards.

ESD damage – This type of damage is almost impossible to detect, because there is no visual sign of failure or damage. The symptom is that the board simply stops working, because some component becomes defective. Usually the failure can be identified and the chip can be replaced.

To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

Damage during handling or storage – On some boards we have noticed physical damage from mishandling. A common observation is that a screwdriver slipped while installing the board, causing a gouge in the PCB surface and cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on what is near the corner. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge to avoid possible shorting from this type of damage. However these design rules are not sufficient to prevent damage in all situations.

A third cause of failure is when a metal screwdriver tip slips, or a screw drops onto the board while it is powered on, causing a short between a power pin and a signal pin on a component. This can cause overvoltage / power supply problems described below. To avoid this type of failure, only perform assembly operations when the system is powered off.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. However our boards are generally very dense, and if the board has components very close to the board edge, they can be damaged or even knocked off the board when the board tilts back in the rack. Diamond recommends that all our boards be stored only in individual ESD-safe packaging. If multiple boards are stored together, they should be contained in bins with dividers between boards. Do not pile boards on top of each other or cram too many boards into a small location. This can cause damage to connector pins or fragile components.

Power supply wired backwards – Our power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy each IC that is connected to the power supply. In this case the board will most likely will be unrepairable and must be replaced. A chip destroyed by reverse power or by excessive power will often have a visible hole on the top or show some deformation on the top surface due to vaporization inside the package. **Check twice before applying power!**

Bent connector pins – This type of problem is often only a cosmetic issue and is easily fixed by bending the pins back to their proper shape one at a time with needle-nose pliers. This situation can occur when pulling a ribbon cable off of a pin header. Note: If the pins are bent too severely, bending them back can cause them to weaken unacceptably or even break, and the connector must be replaced.

1. DESCRIPTION

The E104-MPE-04 PCI/104-Express PCIe MiniCard carrier module allows the use of up to four PCIe MiniCard I/O expansion modules in systems that provide PCI/104-Express[™] expansion stack locations.

This module is a PCI/104-Express compatible carrier module that provides a socket and host connectivity for four PCIe MiniCard modules using either PCIe or USB interfaces. The module utilizes 1:4 switch and hub components to provide full support to all sockets while consuming only a single lane of host SBC resources. SIM card support is provided for two sockets. All power is derived from the PCIe/104 connector +5V power tab. The PCI-104 connector is provided for pass-through connection but is not used by the module.

1.1 Features

- Sockets
- 4 or 2 PCIe MiniCard sockets with PCIe x1 and USB 2.0 interfaces
- Module support:
- Full size modules supported in all four sockets
- Half size modules supported in two sockets
- SIM cards supported in two sockets
- mSATA flashdisk supported in one socket
- LEDs provided for all 4 sockets
- Wireless disable function for each socket via jumpers
- Bus expansion

PCIe 1:4 switch for PCIe x1 links to 4 sockets USB 1:4 hub for USB links to 4 sockets PCIe to SATA converter for mSATA module support in 1 socket

1.2 Environmental / Mechanical

- ♦ Form factor PCI/104 Express with wings (4.500" W x 3.775" H)
- Host interface PCIe/104 OneBank[™] connector with PCIe and USB connections
 - PCI-104 stackthrough connector installed for pass-through purposes
 - Power +5VDC in via +5V power tab on PCIe/104 connector
- Operating temp -40°C to +85°C at outer surface of heat spreader
- ♦ Weight 2.5oz (70.9g)
- Ruggedization Board may be conformally coated

As a customization option, jumpers may be replaced with 0 ohm resistors for hardwired configuration

- Environmental
 - Shock: Compatible with MIL-STD-202G, Method 213-B, Table 213-1 Condition A, 50G / 11ms half sine, non-operational
 - Vibration: Compatible with MIL-STD-202G, Method 214A, Table 214-1, Condition D, 11.95G random vibration, 15 minutes per axis, operational

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2. BLOCK DIAGRAM



3. MECHANICAL DRAWING

The module is slightly larger than the PC/104 form factor. It has 0.475" extensions on left and right sides to provide more room for circuitry and I/O connectors plus .100" - .125" extensions on the top and bottom edges to provide additional room for I/O connectors.



4. FUNCTIONAL DESCRIPTION

4.1 PCIe MiniCard Sockets

The E104-MPE-04 provides four PCIe MiniCard sockets. The E104-MPE-02 provides two PCIe MiniCard sockets. All sockets support full size (51mm length) PCIe MiniCard modules. Two sockets, J5 and J8, also support half-size modules; however, only the full size mounting spacers are installed on these sockets. The module also provides SIM support for sockets J5 and J8 and mSATA flashdisk supported in socket J6 for solid state storage.

4.2 mSATA Flashdisk Support

Socket 1 (upper left corner) also supports the installation of an mSATA flashdisk. An onboard PCIe to SATA converter chip provides the SATA signals needed for the flashdisk. The socket auto-detects the type of module installed and provides the appropriate serial interface to support the module. The module must be installed prior to system boot in order for the BIOS to detect the device and support it.

The socket auto-detects the type of the module installed using CLKREQ (pin7) signal which is coming from the mini PCIe module. In default case the pin is pulled up to 3.3V. Pin status will be high when connecting mSATA device to the socket. It will be low when connecting to mPCIe device to the socket.

4.3 PCIe Connections

The module includes a 1:4 PCIe Gen 1 or 2 hub that provides PCIe x1 links to all 4 sockets. The upstream link is tied to the PCIe/104 connector per the PCI/104-Express specification. An on-board signal multiplexor selects the appropriate link from either the top or bottom PCIe/104 connector depending on whether the board is installed below or above the SBC.

4.4 USB Connections

The module includes a 1:4 USB 2.0 hub that provides USB ports to all four sockets. The upstream port is tied to the PCIe/104 connector per the PCI/104-Express specification. An on-board signal multiplexor selects the appropriate port from either the top or bottom PCIe/104 connector depending on whether the board is installed below or above the SBC.

4.5 PCI-104 Expansion

The module includes a PCI-104 passthrough connector to enable it to be installed in a PCI/104-Express stack in between the processor module and a PCI-104 I/O module. Other than +5V power and ground connectivity, this connector is not used by the module.

4.6 Power Supply

The module requires +5VDC input voltage per the PC/104 specification. The 5V and ground are derived from the PCIe/104 and PCI-104 connectors.

4.7 LED Indicators

The module provides LED indicators for each socket as described below. All LEDs are labeled in silkscreen with their function.

5V Power input:	green LED when 5VDC is applied
PCIe MiniCard socket:	3 green LEDs to support WWAN, WPAN, WLAN signals from each socket
SATA0 & SATA1:	green LEDs when active

The bank of LEDs is located at the bottom of the board at the right of the PCIe/104 OneBank connector and jumper block JP1. The LED indicators are arranged in the order shown below.

SATA0	SATA1	WAN J5	LAN J5	PAN J5	WAN J6	LAN J6	PAN J6	WAN J7	LAN J7	PAN J7	WAN J8	LAN J8	PAN J8	5V
-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	----

5. CONNECTORS AND JUMPERS

5.1 Connector and Jumper Lists

5.1.1 I/O Connectors

Connector	Function
J1	PCIe/104 bottom connector
J2	PCIe/104 top connector
J5	mPCIe socket 1 (available in both quad & dual models)
J6	mPCIe socket 2 (available in both quad & dual models)
J7	mPCIe socket 3 (available in both quad & dual models)
J8	mPCIe socket 4 (available in both quad & dual models)
J9	PCI/104 connector

5.1.2 Configuration Jumpers

Jumper	Description
JP1(1)	W_Disable1#
JP1(2)	W_Disable2#
JP1(3)	W_Disable3#
JP1(4)	W_Disable4#

5.1.3 SIM Card Connectors

There are two SIM card connectors on PCIe/104 MiniCard carrier board. These are connected to MiniCard sockets 1 and 4.

Connector	Description
J3	SIM card connector for MiniCard 4
J4	SIM card connector for MiniCard 1

5.2 Connector and Jumper Locations



E104-MPE-04 Bottom Side

5.3 PCIe/104 OneBank Connector (J2)

The PCIe/104 OneBank connector conforms to the PCIe/104 specification and allows the E104-MPE-04 module to be placed in any PCI/104-Express stack. The pinout for this connector is shown below.



5.4 SIM Connector (J3, J4)

Connectors J3 and J4 on the bottom side of the E104-MPE-04 allow a SIM module to be inserted into the system instead of a PCIe MiniCard module. Only one or the other is allowed. This is an industry standard connector.

Connector	Description
J3	SIM card connector for MiniCard socket 4
J4	SIM card connector for MiniCard socket 1

			-
VCC	1	4	GND
Reset	2	5	NC
Clock	3	6	I/O Data

SIM Connector Pinout

SIM Connector: SF7W006S1BE1000

5.5 PCIe/104 MiniCard Sockets (J5, J6, J7, J8)

The E104-MPE-04 PCIe MiniCard carrier has the following MiniCard sockets:

- PCIe-104 MiniCard socket 1 (J5, upper right)
- PCIe-104/mSATA MiniCard socket 2 (J6, upper left)
- PCIe-104 MiniCard socket 3 (J7, lower left)
- PCIe-104 MiniCard socket 4 (J8, lower right)

The E104-MPE-02 PCIe MiniCard carrier has the following two sockets:

- PCIe-104 MiniCard socket 1 (J5, upper right)
- PCIe-104/mSATA MiniCard socket 2 (J6, upper left)

The MiniCard sockets have the pin out shown below. MiniCard socket 1 (upper right) and MiniCard socket 4 (lower right) are identical and have the SIM interface pinout. MiniCard socket 2 (upper left) supports both mPCIe and mSATA interfaces.

PCle MiniCard	mSATA / MiniCard			Without SIM Interface	With SIM Interface
		1	2	+3.3V	+3.3V
		3	4	Gnd	Gnd
		5	6	+1.5V	+1.5V
Clkreq-	Clkreq-	7	8		UIM_PWR
Gnd	Gnd	9	10		UIM_DATA
PCIe Clk-	PCIe Clk-	11	12		UIM_CLK
PCIe Clk+	PCIe Clk+	13	14		UIM_RESET
Gnd	Gnd	15	16		
		KI	EY		
		17	18	Gnd	Gnd
		19	20	W_Disable#	W_Disable#
Gnd	Gnd	21	22	PCIe Reset#-	PCIe Reset#-
PCle RX-	SATA RX-	23	24	+3.3V	+3.3V
PCle RX+	SATA RX+	25	26	Gnd	Gnd
Gnd	Gnd	27	28	+1.5V	+1.5V
Gnd	Gnd	29	30	SMB Clk	SMB Clk
PCle TX-	SATA TX-	31	32	SMB Data	SMB Data
PCle TX+	SATA TX+	33	34	Gnd	Gnd
Gnd	Gnd	35	36	USB -	USB -
Gnd	Gnd	37	38	USB +	USB +
+3.3V	+3.3V	39	40	Gnd	Gnd
+3.3V	+3.3V	41	42	WWAN LED#-	WWAN LED#-
Ground	Ground	43	44	WLAN LED#	WLAN LED#
		45	46	WPAN LED#	WPAN LED#
		47	48	+1.5V	+1.5V
Pull-up to +3.3V	Pull-up to +3.3V	49	50	Gnd	Gnd
		51	52	+3.3V	+3.3V

Connector: JAE MM60-52B1-E1-R650 mSATA / PCIe MiniCard socket

5.6 PCI/104 Connector (J9)

The module contains a stackthrough PCI-104 connector on the top side in the standard position as described by the latest version of the PC/104-*Plus* specification. The pinout for this connector is shown below. The E104-MPE-04 does not use any signals from this connector.

PCI/104 Connector Pinout								
J9								
Pin	Α	В	С	D				
1	GND/5.0V KEY ²	Reserved	+5	AD00				
2	VI/O	AD02	AD01	+5V				
3	AD05	GND	AD04	AD03				
4	C/BE0*	AD07	GND	AD06				
5	GND	AD09	AD08	GND				
6	AD11	VI/O	AD10	M66EN				
7	AD14	AD13	GND	AD12				
8	+3.3V	C/BE1*	AD15	+3.3V				
9	SERR*	GND	SB0*	PAR				
10	GND	PERR*	+3.3V	SDONE				
11	STOP*	+3.3V	LOCK*	GND				
12	+3.3V	TRDY*	GND	DEVSEL*				
13	FRAME*	GND	IRDY*	+3.3V				
14	GND	AD16	+3.3V	C/BE2*				
15	AD18	+3.3V	AD17	GND				
16	AD21	AD20	GND	AD19				
17	+3.3V	AD23	AD22	+3.3V				
18	IDSEL0	GND	IDSEL1	IDSEL2				
19	AD24	C/BE3*	VI/O	IDSEL3				
20	GND	AD26	AD25	GND				
21	AD29	+5V	AD28	AD27				
22	+5V	AD30	GND	AD31				
23	REQ0*	GND	REQ1*	VI/O				
24	GND	REQ2*	+5V	GNT0*				
25	GNT1*	VI/O	GNT2*	GND				
26	+5V	CLK0	GND	CLK1				
27	CLK2	+5V	CLK3	GND				
28	GND	INTD*	+5V	RST*				
29	+12V	INTA*	INTB*	INTC*				
30	-12V	Reserved	Reserved	GND/3.3V KEY ²				

For more information on the PCI/104-Express specification, visit the PC/104 Embedded Consortium website, at http://www.pc104.org.

5.7 Wireless Disable Jumper Block (JP1)

The wireless disable signal on each of the PCIe MiniCard sockets is connected to jumper block JP1. The pin pair labeled 1 corresponds to Socket 1 and so on.

The default configuration of JP1 is no jumpers installed so wireless functionality is enabled on all four sockets. Insertion of a jumper in one of the jumper locations disables wireless functionality for that particular socket.

_	J	IP1		
	0	0	0	0
	0	0	0	0
	1	2	3	4
	Socket 1	Socket 2	Socket 3	Socket 4

6. INSTALLING MODULES

6.1 Full Size PCIe MiniCards and mSATA Modules

To install a full size PCIe MiniCard into any socket, or mSATA module into Socket 2:

- 1. Orient the module so the edge fingers line up with the connector. Note that the card may only be inserted one way.
- 2. Holding the card at a 45 degree angle up from horizontal, slowly insert the edge fingers into the socket.
- 3. Once the board is fully inserted, push it downward flat onto the standoffs on the carrier board.
- 4. Using two screws from the hardware kit, secure the module to the carrier by inserting the two screws into the two holes at the end of the module away from the connector and tighten.

Note that when a full size PCIe MiniCard is installed in connector J3 or J4, a PCIe MiniCard cannot be installed in Socket 1 or Socket 4 respectively.

6.2 Half Size PCIe MiniCards

To install a half size PCIe MiniCard into Socket 1 or Socket 4:

- 1. Using one standoff and screw from the hardware kit, insert the screw from the bottom side of the carrier board through the hole located between the connector and standoff and secure the standoff.
- 2. Repeat step 1 to secure the second standoff on the board.
- 3. Orient the half size PCIe MiniCard module so the edge fingers line up with the connector. Note that the card may only be inserted one way.
- 4. Holding the card at a 45 degree angle up from horizontal, slowly insert the edge fingers into the socket.
- 5. Once the board is fully inserted, push it downward flat onto the standoffs on the carrier board.
- 6. Using two screws from the hardware kit, secure the module to the carrier by inserting the two screws into the two holes at the end of the module away from the connector and tighten.



E104-MPE-04 with two full size PCIe MiniCards installed in Sockets 3 and 4

6.3 SIM Cards

SIM cards are installed on the bottom side of the E104-MPE-04 in connectors J3 and/or J4. Refer to the figure shown at the bottom of page 10. Note that when a SIM card is installed in connector J3 or J4, a PCIe MiniCard cannot be installed in Socket 1 or Socket 4 respectively.

7. SPECIFICATIONS

7.1 PCI/104-Express PCIe MiniCard Carrier

General

Number of PCIe MiniCard sockets	4
Host Interface	 PCIe/104 OneBank[™] connector with PCIe and USB connections
	 PCI-104 stackthrough connector installed for pass-through purposes
Bus Expansion	PCIe 1:4 switch for PCIe x1 links to 4 sockets
	 USB 1:4 hub for USB links to 4 sockets
	 PCIe to SATA converter for mSATA module support in 1 socket
MiniCard size	Full and half size cards supported
SIM support	2 sockets support SIM cards
LEDs	Provided for all 4 sockets

Mechanical/Environmental

Power Input	+5VDC ±5% via +5V power tab on PCIe/104 connector
Power consumption	
Dimensions	PCI/104 Express form factor with wings
	4.5" W x 3.775" H (114mm x 96mm)
Weight	2.5oz (70.9g)
Operating temperature	-40°C to +85°C (-40°F to +185°F)
Operating humidity	5% to 95% non-condensing
Shock	MIL-STD-202G compatible
Vibration	MIL-STD-202G compatible
RoHS	Compliant