



## PXle x8 Transparent Cable Module MXP909



MXP909 - PXle PCIe x8 Gen4 Transparent Peripheral Module Users Guide  
Version 1.e

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DO NOT USE INFORMATION IN THIS GUIDE TO DESIGN YOUR OWN PCI-SIG COMPLIANT PRODUCT, ALWAYS REFERENCE THE ORIGINAL PCI-SIG SPECIFICATION FOR DETAILS.

TO THE FULLEST EXTENT PERMITTED BY LAW, DOLPHIN WILL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS, LOST DATA, OR LOSS OF USE) ARISING OUT OF ANY USE OF DOLPHIN'S PRODUCTS, SOFTWARE OR SERVICE PROVIDED. DOLPHIN'S MAXIMUM LIABILITY WILL NOT EXCEED THE TOTAL AMOUNT PAID FOR THE PRODUCT BY THE PURCHASER.

PCI Express External Cabling specification 4.0 is, as of the release of MXP909 PCIe module, not completed and ratified by the PCI-SIG. The MXP909 PCIe x8 cable module is designed to the new specification, but Dolphin cannot guarantee the card will be compliant to the final 3.0 version. Dolphin firmware tools can update the CMI implementation.

### LIFE SUPPORT POLICY

DOLPHIN INTERCONNECT SOLUTIONS' PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES.

### ENVIRONMENTAL POLICY

Dolphin is minimizing the amount of printed documentation and software CDs in its shipments; please download additional documentation and software from [www.dolphinics.com](http://www.dolphinics.com).

### Scope

This version of the MXP909 PCIe module Users Guide is valid for BMC firmware version 2.4 and newer.

## Terms and Acronyms

Important terms and acronyms used in this manual

AOC	Active Optical Cable. PCIe fiber cable assembly available from Dolphin.
CMI	Cable Management Interface. The 2-wire management interface for communication between subsystems connected by a PCIe 4.0 cable. Details can be found in the PCI-SIG External Cabling Specification 4.0 (draft).
BMC	Board Management Controller - Microcontroller on the MXP909 PXIe module used to manage and implement the CMI communications.
eXpressWare	Dolphin's software stack for PCIe clustering and IO. Please visit <a href="http://www.dolphinics.com/software">http://www.dolphinics.com/software</a> for more information.
Lane	One PCI Express Lane contains a differential pair for transmission and a differential pair for reception.
Link	A collection of one or more PCI Express Lanes providing the communication path between an Upstream and Downstream Port.
PCIe 4.0 cable	Cable compliant to the preliminary PCI-SIG External Cabling Specification 4.0. Support for CMI.
Port	PCIe Cable port. The MXP909 PXIe module has four x4 ports, named P1, P2, P3, P4. Ports P1 and P2 can be merged to one x8 port. Ports P3 and P4 are unused. The physical ports are identified by text on the PCIe brackets.
Wake	A mechanism used by a downstream device to request the reapplication of PC main power when in the L2 Link state / Power mode.

## MXP909 PXIe Module High Level Specification

The MXP909 is a PXIe peripheral Transparent PCIe x8 Gen4 cable module and supports PCIe downlink connections to other PXIe chassis with a MXP924 or any other compliant PCIe transparent target device. The MXP909 supports PCIe Gen1, Gen2, Gen3 and Gen4 speeds and x1, x2, x4 and x8 link-widths. The module will operate at the highest common speed shared between the slot and the card (Gen4) and the widest common link-width up to x8.

- PCI Express Base Specification, Rev. 4.0
- PCI Express External Cabling specification 4.0 (draft)
- PCI Express Gen4 16.0 GT/s per lane signaling – 128 GT/s total signaling.
- Compliant with PCI Express Gen1 through Gen4 IO systems, auto detection
- The MXP909 supports transparent connections to IO systems (Host operation)
- Quad SFF-8644 cable connector
  - Two upper ports enabled for PCIe connectivity
  - Two lower ports reserved for future use
  - Durability max total 250 mating cycles
- Support for two PCIe 4.0 SFF-8644 cables.
- Microchip Switchtec PM40028 PFX PCI Express Gen4 chipset
- 100 nanosecond cut-through latency port to port.
- Automatic Thermal Shutdown to avoid hardware damages (can be disabled)
- Support for active optical PCIe complaint fibers (AOC)
- Single Peripheral Slot 3U PXI Express, compliant to PXI -5 PXI Express Hardware Specification rev 1.1
- SRNS clocking, Prepared for SRIS clocking
- VAUX powered board management controllers for flexible configuration and cable management
- Flash recovery option. PFX Multi configuration support
- Relative Humidity: 5% - 95% (non- condensing)
- CE and FCC markings
- Made in Norway

## Packaging

The MXP909 product is delivered in a retail box, and includes the following components.

- MXP909 module
- Anti-static bag
- Getting started guide

## PXIe Slot

The MXP909 module can be placed in any compliant PXIe slots. The MXP909 supports PCIe Gen1, Gen2, Gen3 and Gen4 speeds. The default PXIe backplane configuration is x8. The module will auto configure the slot speed and width.

## MXP909 Module Configuration

The MXP909 cable ports can either be used as a single x4 / x8 or dual x4 port configuration.

The default DIP switch setting is transparent single x4 or single x8 operations. The lower two connectors marked P3 and P4 is not in use.

### Thermal Shutdown

The MXP909 module includes overheat protection. The BMC will automatically shut down the MXP909 module if a PCIe switch temperature beyond 105°C (221°F) is detected. Similarly, if an AOC is plugged in, the MXP909 module will automatically shut down if the max operating temperature announced by the connected AOC is violated by 15°C (59°F). Please consult the AOC data sheet for details. Please consult the AOC data sheet for details.

**NOTE:** The MXP909 module link LEDs will start flashing yellow when a PCIe switch temperature of 95°C (203°F) is reached or when the AOC reports a temperature 5°C (41°F) lower than the max operating temperature.

**NOTE:** The automatic shutdown can be disabled by setting DIP switch SW2-4. Prior to disabling the automatic shutdown, please ensure you have established proper airflow.

## Airflow - Operating Environment

To maximize lifetime for the product and maintain the warranty, please honor the specified operating temperature, and make sure the specified air flow is present.

**TIP:** After installing the Dolphin eXpressWare board management software, you can use the tool `dis_diag` to determine the actual board temperatures.

## Cable Connections

The MXP909 module is designed to support both long and short PCIe copper cables as well as PCIe active optical cables (AOC).

The MXP924 cable ports are compliant to the SFF-8644 industry specification and supports PCIe cables compliant to the PCIe External Cabling Specification 4.0. Two x4 cables are needed for full PCIe x8 connectivity. (Ports P3 and P4 are unused)

### PCI Express 4.0 Cables

When used with cables compliant to the new PCIe External Cable standard 4.0, the MXP909 module will transmit a CMI Reset message downstream. The module can be connected to an MXP924 module in Target mode or any PCIe device compliant to the new cable standard.

### CMI Functionality

The MXP909 module BMC firmware release 2.4 and newer supports the following CMI operations when used with PCIe 4.0 cables:

- Publishes card and CMI status information in readable memory map
- Supports sending CMI reset, wake and power status messages
- Supports receiving indicators (LED/messages).

### Active Optical PCIe Cables (AOC)

Dolphin offers active optical PCIe fiber cables up to 100 meters for the MXP909. CWAKE and CPOWERON is not supported using standard PCIe AOC cables.

# Installation

## Step 1 - Unpack board

The MXP909 module is shipped in an anti-static bag to prevent static electricity damage. The module should only be removed from the bag after ensuring that anti-static precautions are taken. Static electricity from your clothes or work environment can damage your MXP909 module or other PXIe components. Always wear a grounded anti-static wrist strap while the MXP909 module is removed from the anti-static bag until it is properly installed in the PXIe chassis.



Unpack the MXP909 module from the anti-static bag using proper anti-static procedures.

## Step 2 - Configure the Board for Proper Operation

Set the DIP switch settings for proper operation depending on the firmware. Please refer to the section Configuration and DIP Switches on page 10 for details.

## Step 3 - Ensure proper Airflow

Please pay proper attention to ensure the selected server / slot position provides the minimum required airflow.

**TIP:** Immediately after software installation, please use the dis\_diag tool to verify the temperature. If the chip temperature reported by dis\_diag exceeds 95°C, it is strongly recommended to improve the airflow.

## Step 4 - Install the MXP909 module

Before installing the module, make sure you are properly grounded to avoid static discharges that may destroy your computer or the PXIe module. Ensure you are properly grounded before opening your PXIe chassis or the anti-static bag containing the MXP909 module. Please follow your PXIe chassis manual on how to install a PXIe System switch module.



The MXP909 PXIe module supports PCI Express Gen1, Gen2, Gen3 and Gen4 backplanes. Please review the list of supported and approved PXIe chassis

## Step 5 - Installing and Removing the Cable

Installing and removing cables should be done with the PXIe chassis powered off.

### Connecting the Cable

Please carefully install the cable connector into the connector housing on the MXP909 module. Cable port 1 is located at the top of the face plate bracket. To install the cable, match the cable house with the connector on the MXP909 module. Use even pressure to insert the connector until it is secure. Adhere to ESD guidelines when installing the cables to ensure you don't damage the board. Computer cables should always use strain relief to protect the connected equipment from excessive force on the cable. This is especially important for cables between racks.

### Cable strain relief

Strain-relief on the PCIe cables are important to protect the PCIe card from fatigue loading and damage. The cable should be mechanically connected to the rack or cabinet. This is especially important for long heavy cables and cables going between cabinets and racks.

### Supported cable lengths

The MXP909 module supports both copper and active optical PCIe cables (AOC). Maximum lengths between two modules can be found in Table 1 below. The maximum distance may change when connecting to other PCIe products.

Cable	Speed	Max Distance
Copper PCIe 4.0 cables	Gen4	3 meters (4-5 meters being qualified)
PCIe Active Optical cables (AOC)	Gen4	100 meters

Table 1: Cable Specifications



### Disconnecting the Cable

Please carefully pull the release tab to release the cable from the locking latches and gently pull the cable out of the connector guides.

### Step 7 - Verify Installation & LEDs

The MXP909 PXIe module comes with 4 RGB LEDs which show the corresponding cable port status according to Table 2: LED below. The LEDs are visible through cut-outs in the front panel below each port.

LED color	Function
Off	No cable installed, or PXIe not powered
Yellow	Cable installed, no link
Yellow blinking	Temperature overheat warning, please immediately improve cooling to avoid thermal damages or system shutdown.
White	Cable installed, link operational Gen1 speed
Blue	Cable installed, link operational Gen2 speed
Green blinking	Cable installed, link operational Gen3 speed
Green	Cable installed, link operational Gen4 speed
Red blink	Link Reset

**Table 2: LED behavior**

## Operation

### Configuration and DIP Switches

The MXP909 module has two banks of 8 DIP switches. The default factory setting for the MXP909 module is Transparent Host mode, single (up to x8) link connection.

The MXP909 module has DIP switches for setting special modes or operations, the meaning of each DIP switch depends on the loaded firmware. Please carefully read the documentation shipped with the module before modifying any DIP switch settings. Please pay close attention to ON and OFF positions written on the DIP switch.

#### DIP Switches

Please leave all undocumented DIP switches in the default position. Table 3: DIP SW1 settings and Table 4: DIP-SW2 settings below shows all the various DIP switch settings for the MXP909 module.

Note: DIP switch configuration options may be changed in future versions. Please always consult the latest user guide for details. The table above is valid for version 1.5.

#### DIP-Switch SW1 settings

SW1 DIP no.	Description	ON	OFF	Default
1-8	Configuration selector, details below			OFF

Table 3: DIP SW1 settings

#### DIP-Switch SW2 settings

SW2 DIP no.	Description	ON	OFF	Default
1	Reserved, leave in Default OFF			OFF
2	Enable Wake	Enable PCIe WAKE	PCIe Wake Disabled	OFF
3	Reserved, leave in Default OFF			OFF
4	Disable thermal shutdown	Thermal shutdown disabled	Shut down the switch if critical temperature reached.	OFF
5-8	Reserved, leave in Default OFF			OFF



Table 4: DIP-SW2 settings

## DIP switch Settings

The following DIP Switch settings should be considered when configuring the MXP909 PXIe module for Transparent Target operation:

### DIP Switch settings for MXP909 PXIe module operation – DIP-Switch-1

The following DIP-1 Switch settings should be considered when configuring the MXP909 PXIe module:

Config	Use Case	Configuration MXP909 PXIe module	DIP SW1	DIP switch view
0	A	Single Transparent Host One x4 / x8 downstream port (P1+P2)	(all off)  (Shipping Default)	
1	B	Transparent Host Two x4 downstream ports (P1, P2)	1: ON	

## Use Cases

The MXP908 module may be used to connect a PXle chassis to one or more PXle chassis having a MXP924 installed. The DIP switch settings are summarized in section Configuration and DIP Switches on page 10. DIP-Switch settings for the MXP924 module can be found in the MXP924 Users Guide available from [www.dolphinics.com/mx](http://www.dolphinics.com/mx)

### Use Case A - Connecting two PXle chassis – PCIe Gen 4.0 x8

The master PXle system has a MXP909 module adapter configured for Transparent Host operation and a direct x4 or x8 link to PXle system having a MXP924 installed in the System Switch slot.

The MXP909 module DIP-1 Switch should be set to Config 0: Single Transparent Host config.

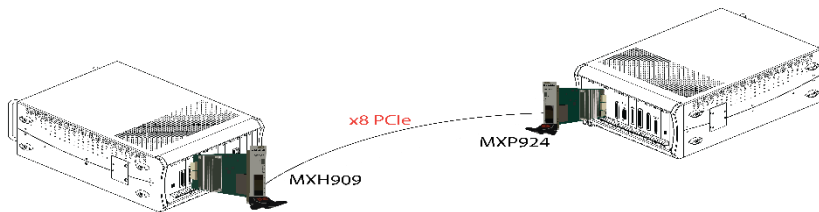


Figure 1: Use Case A

MXP909 module Host card ports	MXP924 Switch ports
P1	P1
P2	P2

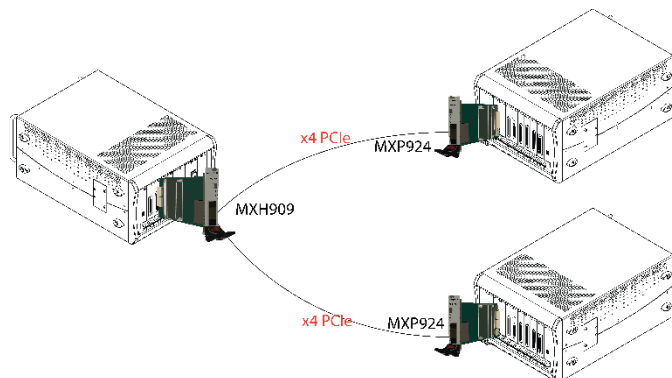
Table 5: Required x8 cabling

Always connect a cable from Port #x to Port #x  
A failure to connect any of the cables will cause the link to re-train to x4.

### Use Case B – Connecting tree PXle chassis – PCIe Gen 4.0 x4

The master PXle chassis has MXP909 module configured for Transparent Host operation – dual x4 and two x4 links connecting two PXle systems utilizing MXP924's. Please note, always use MXP924 port P1 and P2 on both systems. If you are only using an x4 connection, please only use port P1 on both systems.

The MXP909 module DIP-1 Switch should be Config 1: Single Target config or Config 1: Transparent Host – dual x4.



Master PXle Chassis MXP909 module ports	MXP924 Switch Target 1 ports	MXP924 Switch Target 2 ports
P1	P1	
P2		P1

Table 6: Required x4 cabling

## Firmware Upgrade

The MXP909 module design uses a Board Management Controller (BMC) to implement the PCIe CMI protocol, reset and other maintenance functions. Dolphin may from time to time publish updated firmware for the BMC, card configuration and the PCIe switch.

**WARNING:** Please note that standard Microsemi tools (ChipLink) cannot be used to upgrade the firmware as this will violate the warranty. Please contact Dolphin for instructions on how to upgrade the MXP909 module firmware.

**Note:** Please consult the MXP909 module Firmware Release Note for details on supported configurations.

## Identifying the PXle module

The MXP909 module has a label-sticker with the serial number in the format 'MXP909-YY-ZZZZZ', where YY denotes the revision (e.g. CC) and ZZZZZ denotes the serialized production number (e.g. 012345) – this whole string makes up the serial number of the module (i.e. MXP909 module-CC-012345).

You can also get this information using `lspci` in Linux:

First, identify the devices for the Dolphin MXH909 card:

```
# lspci | grep "Device 4028"
01:00.0 PCI bridge: PMC-Sierra Inc. Device 4028
01:00.1 Bridge: PMC-Sierra Inc. Device 4028
02:00.0 PCI bridge: PMC-Sierra Inc. Device 4028
```

Then run `lspci` and identify the module. It will show up as something like

```
# lspci -s 1:0:0 -v
01:00.0 PCI bridge: PMC-Sierra Inc. Device 4028 (prog-if 00 [Normal decode])
  Flags: bus master, fast devsel, latency 0, IRQ 122
  Bus: primary=01, secondary=02, subordinate=03, sec-latency=0
  I/O behind bridge: 00002000-00002fff
  Prefetchable memory behind bridge: 00000000c8000000-00000000c81fffff
  Capabilities: [40] Express Upstream Port, MSI 00
  Capabilities: [7c] MSI: Enable+ Count=1/8 Maskable- 64bit+
  Capabilities: [8c] Power Management version 3
  Capabilities: [94] Subsystem: Dolphin Interconnect Solutions AS Device 0924
  Capabilities: [100] Advanced Error Reporting
  Capabilities: [148] Power Budgeting <?>
  Capabilities: [158] #12
  Capabilities: [188] #19
  Capabilities: [1b4] Device Serial Number 00-00-43-43-00-00-00-24
  Capabilities: [1c0] Latency Tolerance Reporting
  Capabilities: [1c8] Access Control Services
  Capabilities: [1f0] #25
  Capabilities: [1fc] #26
  Capabilities: [23c] #27
  Capabilities: [7f8] Vendor Specific Information: ID=ffff Rev=1 Len=808 <?>
  Kernel driver in use: pcieport
  Kernel modules: shpchp
```

Second, do

```
# lspci -s 1:0.0 -v | grep -E "Subsystem|Serial"
Capabilities: [a4] Subsystem: Dolphin Interconnect Solutions AS Device 0909
Capabilities: [100] Device Serial Number 00-00-43-43-00-00-00-ff
```

This shows the module as revision 0x4242 (hexadecimal values of the 'CC' letters in the ASCII table), with the production number 0x000000ff (00000255 in decimal).

## Support

More information about the product, support and software download can be found at <http://www.dolphinics.com/mx>. For general support questions, please contact Dolphin via the Jira Service Management portal: <https://www.dolphinics.com/csp>.

## Technical Information

### Board revision history

The following table gives a general overview of the hardware revision history.

MXP909 module revision	Capabilities
MXP909-BB	<ul style="list-style-type: none"> <li>Initial version for testing. Not available</li> </ul>
MXP909-CD	<ul style="list-style-type: none"> <li>Production version</li> </ul>

### PCIe Cable Port Signals

The external PCI Express SFF-8644 cable connector supports the following signals:

- PETpN/PETnN: PCI Express Transmitter pairs, labeled where N is the Lane number (starting with 0); "p" is the true signal while "n" is the complement signal.
- PERpN/PERnN: PCI Express Receiver pairs, labeled where N is the Lane number (starting with 0); "p" is the true signal while "n" is the complement signal.
- PWR: Power to support AOC and signal conditioning components within the cable assembly.
- MGTPWR: Power supplied to the connector for cable management components that are needed while the link is not active. This needs to be active if the subsystem has power.
- CBLPRSNT#: Cable present detect, an active-low signal pulled-down by the cable when it is inserted into the MXP909 module connector.
- CADDR: Signal used to configure the upstream cable management device address.
- CINT#: Signal asserted by the cable assembly to indicate a need for service via the CMI controller.
- CMISDA: Management interface data line. Used for both initial link setup and sideband messages when used with CMI compliant cables.
- CMISCL: Management interface clock line. Used for both initial link setup and sideband messages when used with CMI compliant cables.

### External PCIe x4 Cable Connector Pin-Out

	Column								
Row	9	8	7	6	5	4	3	2	1
D	GND	PETn2	PETp2	GND	PETn1	PETp1	GND	MGTPWR	PWR
C	GND	PETn3	PETp3	GND	PETn0	PETp0	GND	CMISDA	CMISCL
B	GND	PERn2	PERp2	GND	PERn1	PERp1	GND	CBLPRSNT#	PWR
A	GND	PERn3	PERp3	GND	PERn0	PERp0	GND	CINT#	CADDR

Table 7; External PCIe x4 cable Pin-Out

### PCIe Cable Port Mapping

The MXP909 module has a quad SFF-8644 connector. Only P1 and P2 are connected.

## Compliance and Regulatory Testing

### *EMC Compliance*

The MXP909 module is tested to comply with the following standards:

- EN 61326-1:2013
- EN 61000-6-1 :2007
- KS C IEC 61326-1:2008
- KS C IEC 61000-6-1:2002
- 47 CFR Part 15. Subpart B (Clause 15.107 and 15.109) in conjunction with ANSI C63.4:2014



This does not ensure that it will comply with these standards in any random PXIe chassis. It is the responsibility of the integrator to ensure that their products are compliant with all regulations where their product will be used.

### *FCC Class A*

This equipment is tested to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.



### *RoHS Compliance*

The MXP909 module is RoHS compliant. A Compliance certificate issued by the manufacturer is available upon request.



### *WEEE Notice*

The MXP909 module is labelled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to products to indicate that the product is not to be thrown away but returned to your local approved WEEE waste collector.



## Limited Warranty

Dolphin Interconnect Solutions warrants this product to be free from manufacturing defects under the following terms:

### Warranty Period

The warranty applies for one (1) year from the date of purchase. Extended warranty is available.

### Coverage

To the extent permitted by applicable law, this warranty does not apply to:

- Damage caused by operator error or non-compliance with instructions available for the product.
- Use or attempt to use or program firmware not approved by Dolphin.
- Damage due to accidents, abuse, misuse, improper handling or installation, moisture, corrosive environments, high voltage surges, shipping, or abnormal working conditions.
- Damage caused by acts of nature, e.g. floods, storms, fire, or earthquakes.
- Damage caused by any power source out of range or not provided with the product.
- Normal wear and tear.
- Attempts to repair, modify, open, or upgrade the product by personnel or agents not authorized by Dolphin.
- Products for which the serial number label has been tampered with or removed.
- Damage to the product caused by products not supplied by Dolphin.

### Service Procedure

In the event that the product proves defective during the Warranty Period, you should contact the seller that supplied you with the product, or if you purchased it directly from Dolphin, visit <https://www.dolphinics.com/csp> to obtain a valid RMA number and instructions. Products returned to Dolphin without a proper RMA number will not be serviced under this warranty.