# **ADPT-MX-*** | xiX camera flex cable/Firefly adapters

Technical description

Version 1.6, 04/30/2021

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# 1. xiX adapters

## 1.1. Overview

This manual describes the pin assignment of the PCIe adapters of the XIMEA xPlatform.

The basic idea of these adapters is to connect PCIe devices (mainly cameras) with a computer (processing unit).

The signal levels of the described connectors as well as the different cables (iPass, flat ribbon and Firefly) and their usage are not explained here. For further information, please refer to the xiX camera series technical manual.

## 1.2. Supported IO signals and voltage levels

xiX cameras support different trigger inputs and outputs depending on your cable connection (X2G2, X4G2 or X4G3).

A basic distinction is made between optically isolated inputs/outputs and non-isolated (TTL-like) inputs/outputs.

The isolated inputs/outputs require their own reference grounding. The signal levels of the non-isolated inputs/outputs use the general ground level.

The non-isolated inputs/outputs can be defined as inputs or outputs by software.

In the xiX manual, the optically isolated inputs are referred to as IN1 - IN2 or OUT1 - OUT2 and the non-isolated inputs/outputs are referred to as INOUT1 - INOUT4.

The names of the trigger inputs and outputs compared to the short names printed on the adapters and the names used in the xiX manual are compared below:

| X2G2 | X4G2 | X4G3 / Firefly | xiX manual | description |
|---|---|---|---|---|
| GPI1 | GPI1 | GPI1 | IN1 | Opto-isolated Input 1 |
| - | GPI2 | - | IN2 | Opto-isolated Input 2 |
| GPO1 | GPO1 | GPO1 | OUT1 | Opto- isolated Output 1 |
| - | GPO2 | - | OUT2 | Opto- isolated Output 2 |
| ISO_GND | ISO_GND | ISO_GND | IN_OUT_GND | Ground for opto-isolated Inputs/Outputs |
| GPIO1 | GPIO1 | - | INOUT1 | Non-isolated I/O 1 |
| GPIO2 | GPIO2 | - | INOUT2 | Non-isolated I/O 2 |
| - | GPIO3 | - | INOUT3 | Non-isolated I/O 3 |
| - | GPIO4 | - | INOUT4 | Non-isolated I/O 4 |

*Table 1-1, available trigger in-/outputs per connection type*

The following signals are available on all adapters:

| X2G2 | description |
|---|---|
| PWR | Input voltage |
| GND | Input ground level |
| 3.3V | Generated +3.3 V level |

The PCIe adapters (ADPT-MX-X2G2-PCIE and ADPT-MX-X4G2-PCIE) also provide an additional voltage level:

| X2G2 | description |
|---|---|
| PCIE_12V | +12V from the PCIe bus |

The principle connection of the signals from the flat ribbon / Firefly cables to the adapters is shown in the following figure (not all signals are available with all adapters - see above):

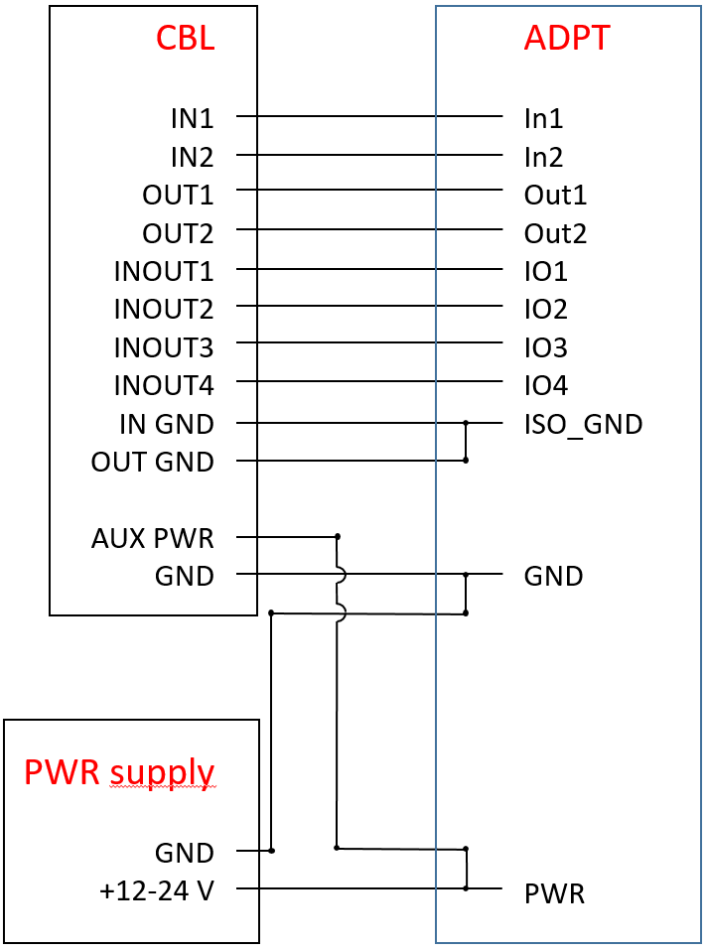


*Figure 1-1, principal signal connection cable / adapter*

## 1.3. Flat ribbon cable orientation

Several adapters are available in different versions, which differ in the orientation of the ribbon cable connections.

The cables can be plugged into the connector either parallel (horizontal) (-FL versions) or vertical (-FV versions) to the adapter board.

Either the ending -FL or -FV is added to the names of the adapters depending on the cable orientation.

There are no different cable orientations for the Firefly adapter.

The following pictures show the different variants:

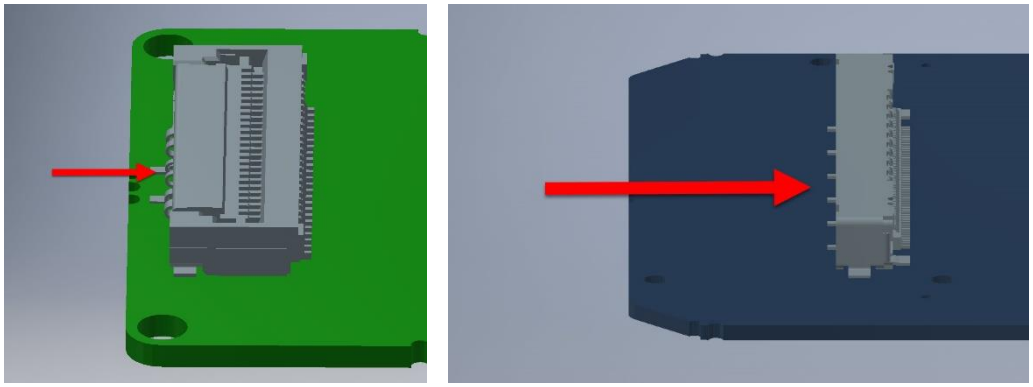

*Figure 1-2, flex cable orientation horizontal (-FL versions). Left: X2G2, right: X4G2*

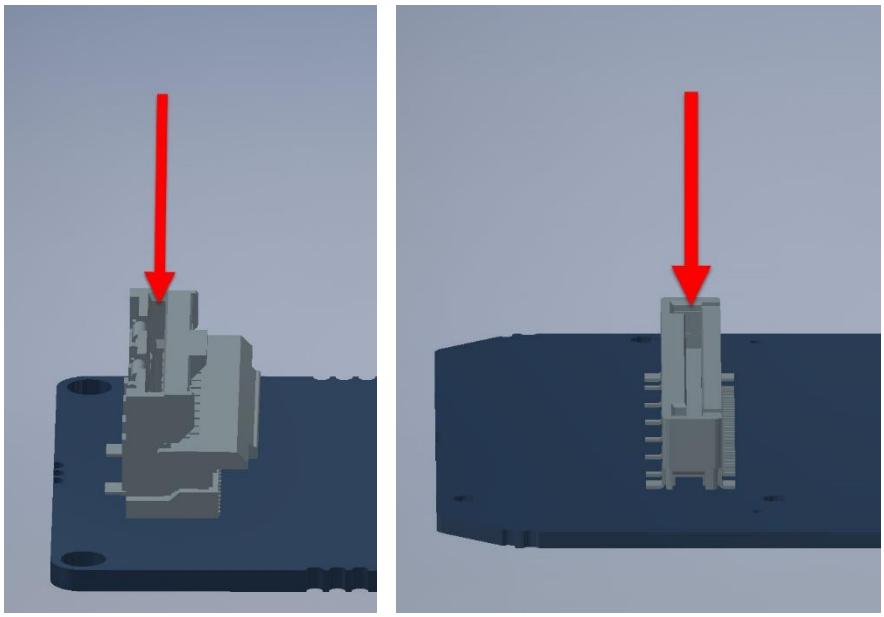

*Figure 1-3, flex cable orientation vertical (-FV versions). Left: X2G2, right: X4G2*

Cables PN: CBL-MQ-FL-xxx and CBL-MX-X2G2-xxx:

The camera and / or the computer interface can be destroyed in case of wrong cabling.

Turn power off and unlock the connector before inserting / detaching the cable to avoid any damage.

## 1.4. Power supply connector

Some adapters require power from a power source other than the computer to power the connected cameras.

A 2-pole connector (2.54mm) is used on the adapters for this purpose:

| | |
|---|---|
| Manufacturer: | TE connectivity |
| Manufacturer part-# | 640456-2 |

The counterpart can be used for a cable connection:

| | |
|---|---|
| Manufacturer: | TE connectivity |
| Manufacturer part-# | 3-640441-2 |

### 1.4.1. Power cable CBL-ADPT-PWR-0M10

For the standard power supplies supplied by XIMEA (BACS30M-24-C8, BACS60M-24-C8, PSU-GSM60B12-P1J and PSU-GSM60B24-P1J) we offer a short connection cable: CBL-ADPT-PWR-0M10

The DC-output plug (5.5 x 2.1 x 12mm) of the power supplies can be connected to this cable.

The connector on the cable is a DC power in socket female (OD5.5/ID2.1), Center +12 / +24 V

*Figure 1-4, power cable for the xiX adapter boards: CBL-ADPT-PWR-0M10*

## 1.5. Upstream and downstream directions

The target or downstream port is the port closer to the target (e.g. camera)

The host or upstream port is the port closer to the processing unit (e.g. computer or xSwitch).

## 1.6. Compatible cameras

The adapters described in this manual are designed to be compatible with all xiX cameras, dependent on their specific interface (X2G2, X4G2 or X4G3).

https://www.ximea.com/files/brochures/xiX-Embedded-multi-cameras-brochure-HQ.pdf

http://www.ximea.com/downloads/cb/manuals/xix_technical_manual.pdf

# 2. X2G2 flex cable adapters

These adapters are mainly designed to connect a small format xiX camera with a 2 lane Gen2 PCIe flex cable interface to a host system (PC, xEC2 or xSwitch).

## 2.1. ADPT-MX-X2G2-IPASS-HOST

Enables to connect a X2G2 target (camera) via a standard 4 lane PCIe fiber optics or fiber iPass cable to a host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X2G2 Flex - PCIe x2 Gen2 |
| Upstream Connector (to Host PC) | PCIe iPass x4 |

This adapter can be ordered as -FL version.

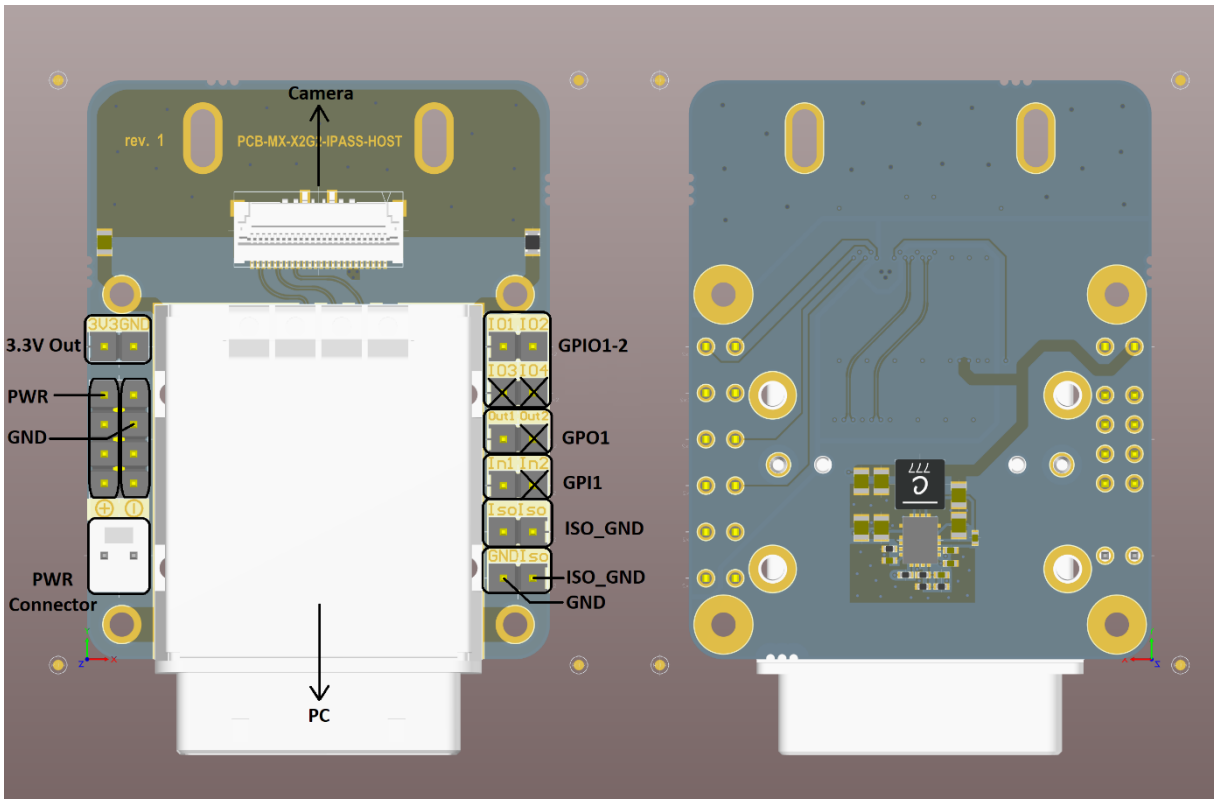


*Figure 2-1, ADPT-MX-X2G2-IPASS-HOST-FL*

## 2.2. ADPT-MX-X2G2-IPASS-TARGET

Enables to connect a 2 lane PCIe target (e.g. xiB camera), connected via a standard 4 lane PCIe fiber optics or fiber iPass cable, to a host system (or switch) via a X2G2 flex cable. Passes only 2 lanes from target.

| | |
|---|---|
| Downstream Connector (to Target Device) | PCIe iPass X4G2 |
| Upstream Connector (to Host PC or switch) | MX X2G2 Flex - PCIe x2 Gen2 |

This adapter can be ordered as -FL version.

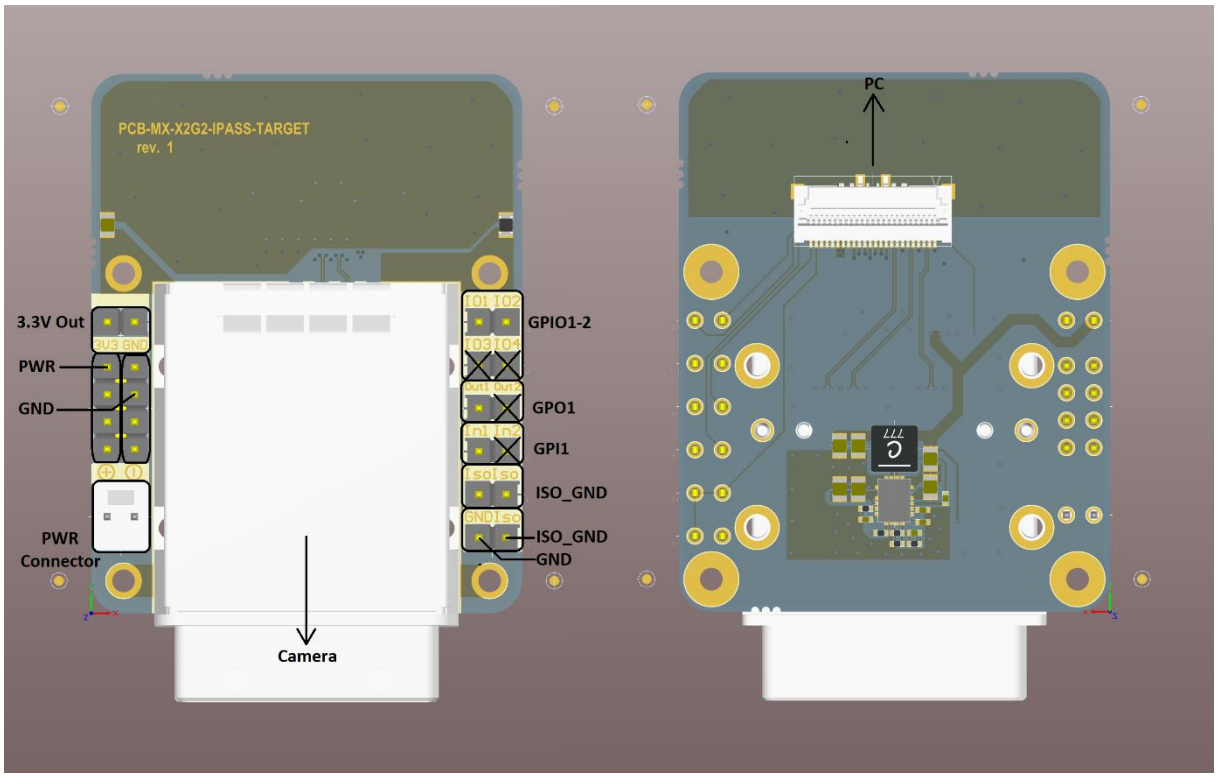


*Figure 2-2, ADPT-MX-X2G2-IPASS-TARGET-FL*

## 2.3. ADPT-MX-X2G2-M2

Enables to connect an X2G2 target (camera) directly to a PCIe M.2 port of the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X2G2 Flex - PCIe x2 Gen2 |
| Upstream Connector (to Host PC) | PCIe M.2 Card Edge Connector x4 |

This adapter can be ordered as -FL version.

The type / size of the adapter is M.2 NGFF 2242 key M.

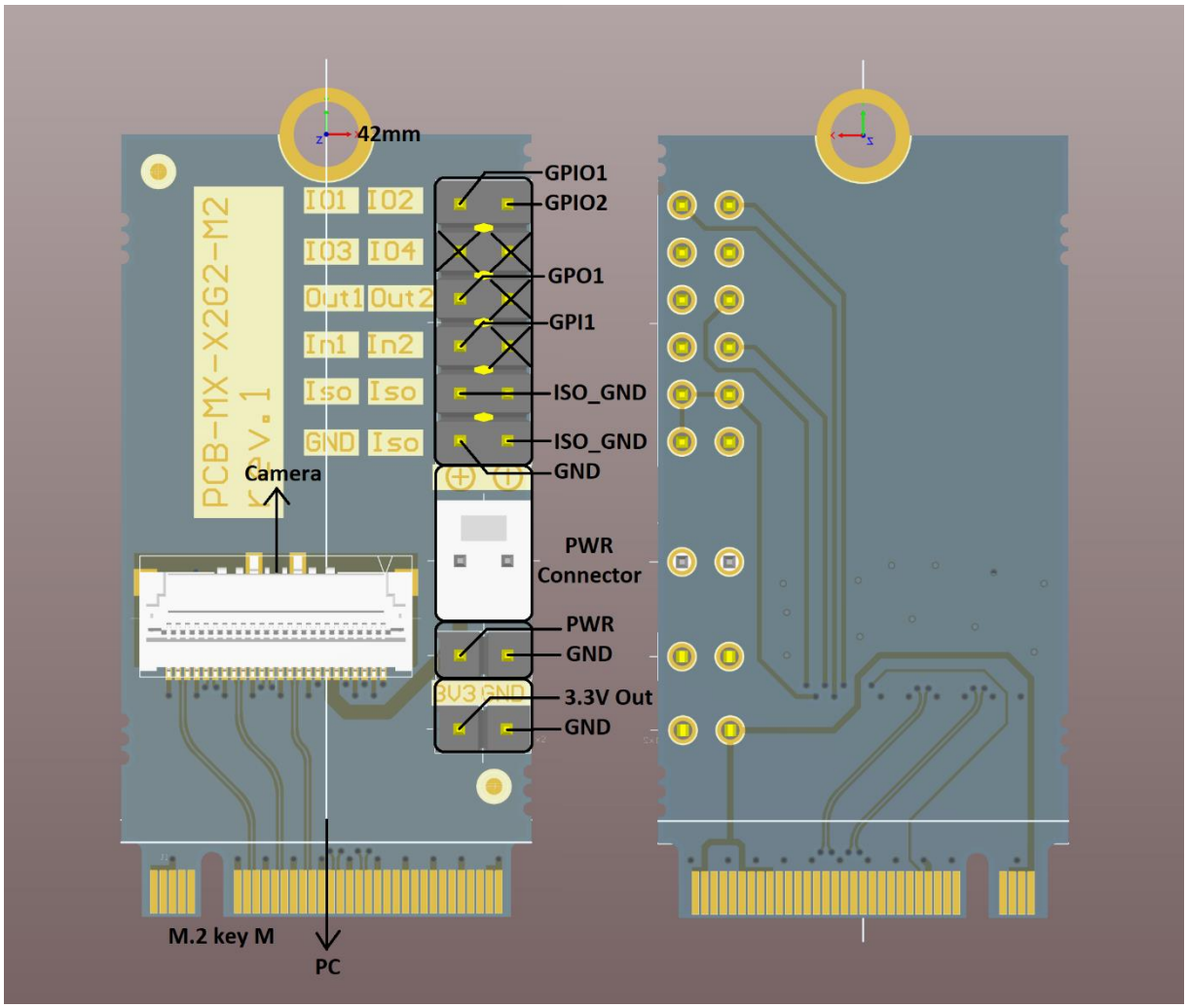


*Figure 2-3, ADPT-MX-X2G2-M2-FL*

## 2.4. ADPT-MX-X2G2-MINI-PCIE

Enables to connect an X2G2 target (camera) directly to a mini-PCIe port of the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X2G2 Flex - PCIe x2 Gen2 |
| Upstream Connector (to Host PC) | Mini PCIe Edge Connector x1 |

This adapter can be ordered as -FL version.

The size of the adapter is Half Mini-PCIe 26.8x30mm.

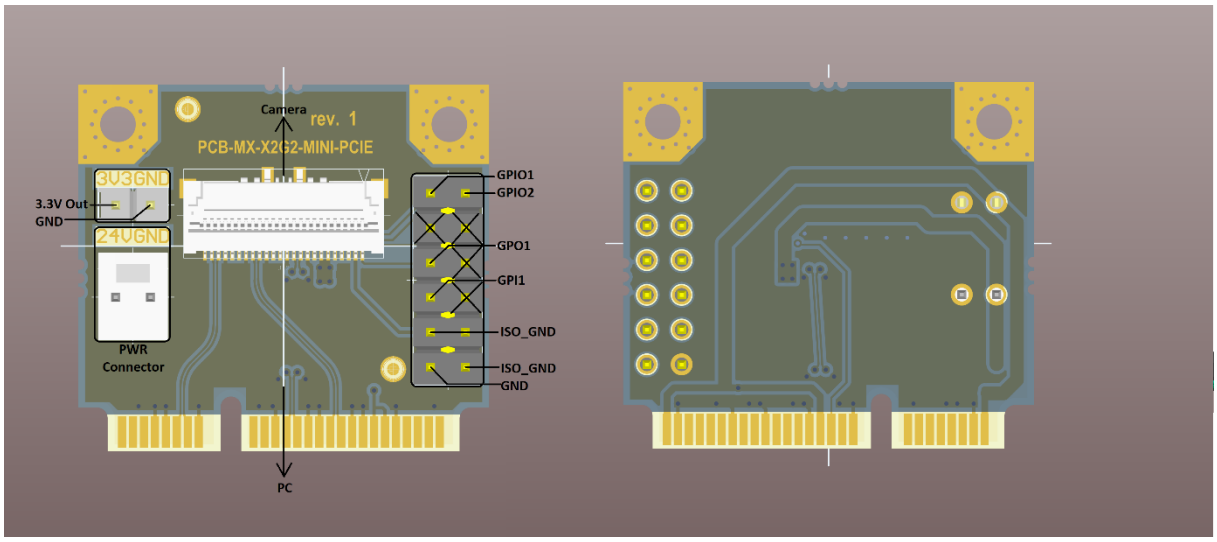


*Figure 2-4, ADPT-MX-X2G2-MINI-PCIE-FL*

## 2.5. ADPT-MX-X2G2-PCIE

Enables to connect an X2G2 target (camera) directly to a 4-lane PCIe slot of the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X2G2 Flex - PCIe x2 Gen2 |
| Upstream Connector (to Host PC) | PCIe Edge Connector x4 |

This adapter can be ordered as -FL version.

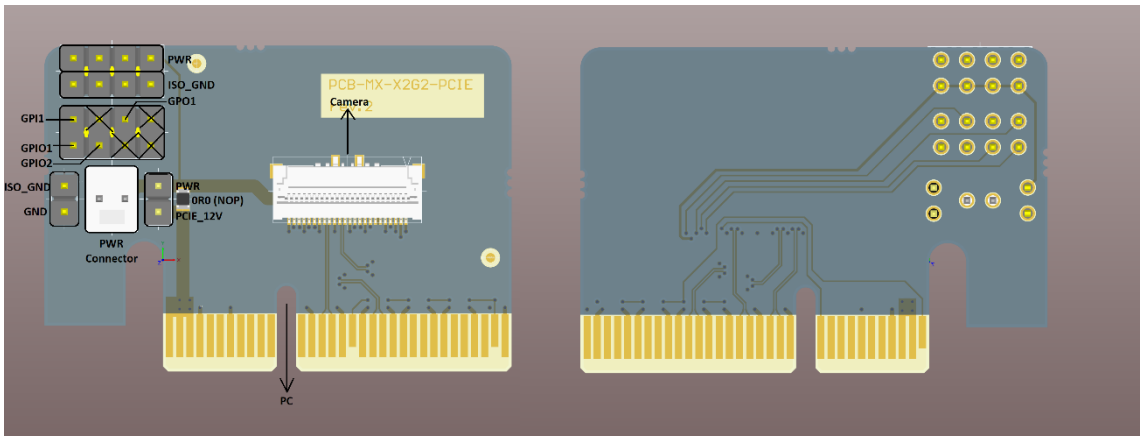


*Figure 2-5, ADPT-MX-X2G2-PCIE-FL*

The connected camera can be powered either by the PCIe bus or by a power supply.

The standard is that a power supply is used to supply power to the camera. In this case, no jumper should be plugged into the position highlighted in the following figure.

If the camera is to be powered by the PCIe bus, the jumper must be plugged in to establish a connection to the 12V pin of the PCIe bus.

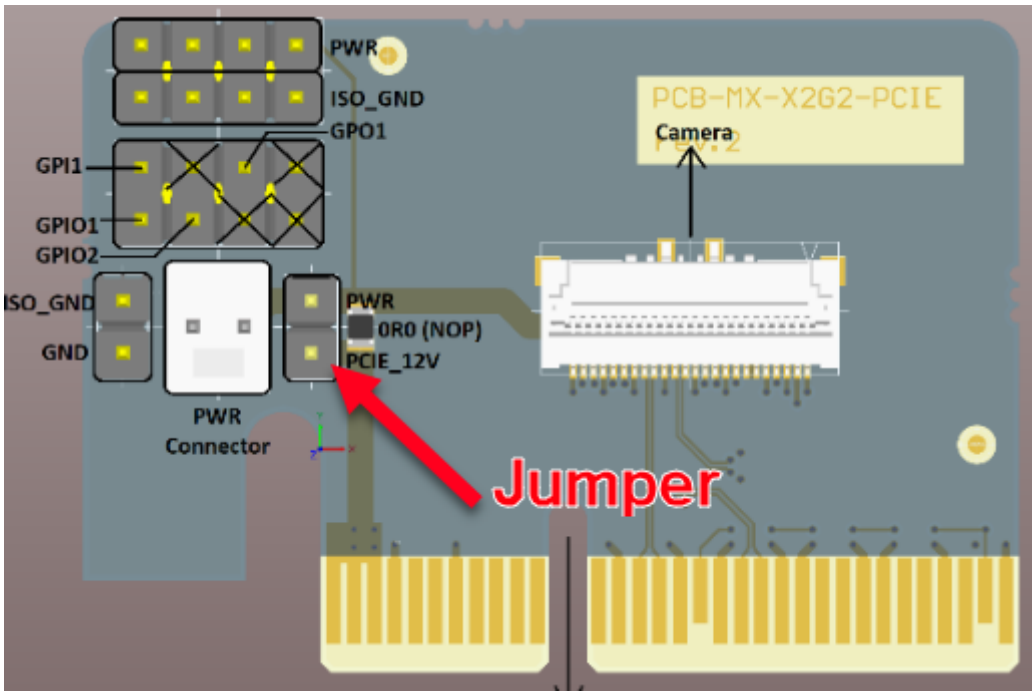


*Figure 2-6, ADPT-MX-X2G2-PCIE-FL – power jumper position*

# 3. X4G2 camera adapters

These adapters are mainly designed to connect a large format xiX camera (X4G2) to a host system (PC, xEC2 or xSwitch).

## 3.1. ADPT-MX-X4G2-IPASS-HOST

Enables to connect a X4G2 target (camera) via a standard 4 lane PCIe fiber optics or fiber iPass cable to a host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X4G2 Flex - PCIe x4 Gen2 |
| Upstream Connector (to Host PC) | PCIe iPass x4 |

This adapter can be ordered as -FL and as –FV version.

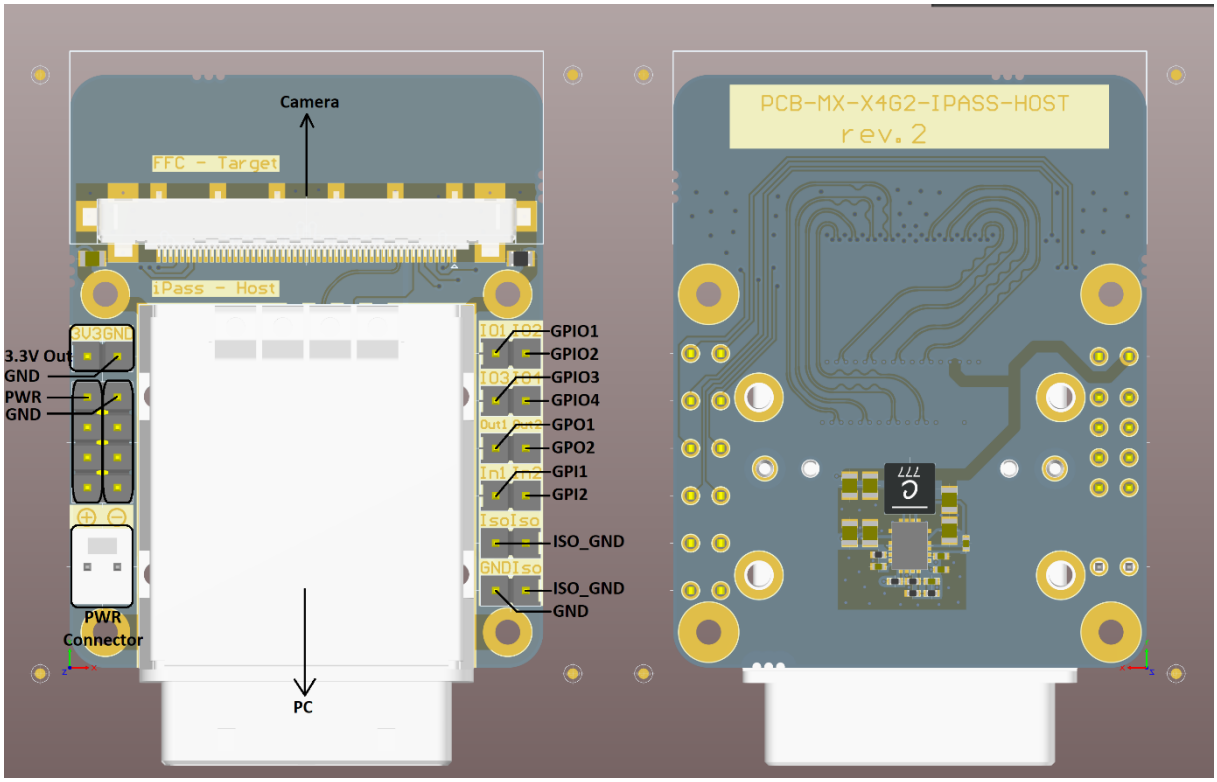


*Figure 3-1, ADPT-MX-X4G2-IPASS-HOST-FL*

## 3.2. ADPT-MX-X4G2-IPASS-TARGET

Enables to connect a 4 lane PCIe target (e.g. xiB camera) via a standard 4 lane PCIe fiber optics or fiber iPass cable, to a host system via a X4G2 flex cable.

| | |
|---|---|
| Downstream Connector (to Target Device) | PCIe iPass X4G2 - PCIe x4 Gen2 |
| Upstream Connector (to Host PC) | MX X4G2 Flex - PCIe x4 Gen2 |

This adapter can be ordered as -FL and as –FV version.

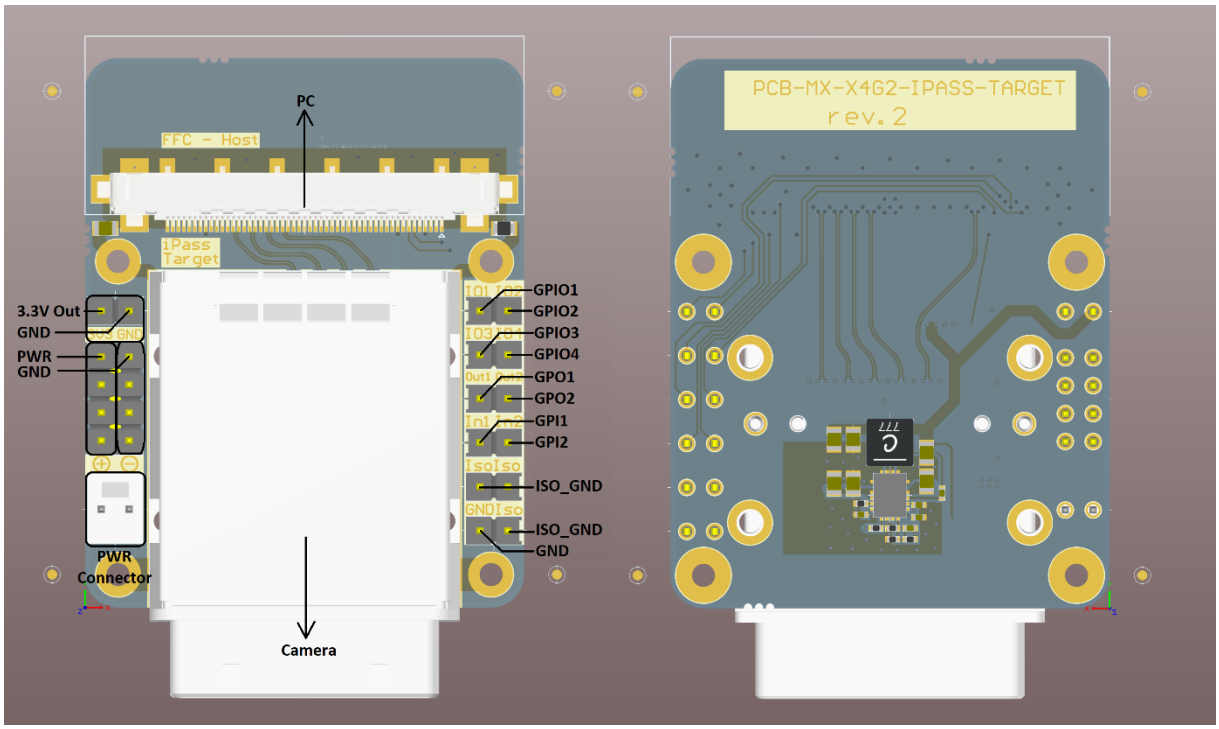


*Figure 3-2, ADPT-MX-X4G2-IPASS-TARGET-FL*

## 3.3. ADPT-MX-X4G2-M2

Enables to connect an X4G2 target (camera) directly to a PCIe M.2 port of the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X4G2 Flex - PCIe x4 Gen2 |
| Upstream Connector (to Host PC) | PCIe M.2 Card Edge Connector x4 |

This adapter can be ordered as -FL and as –FV version.

The type / size of the adapter is M.2 NGFF 2242 key M.

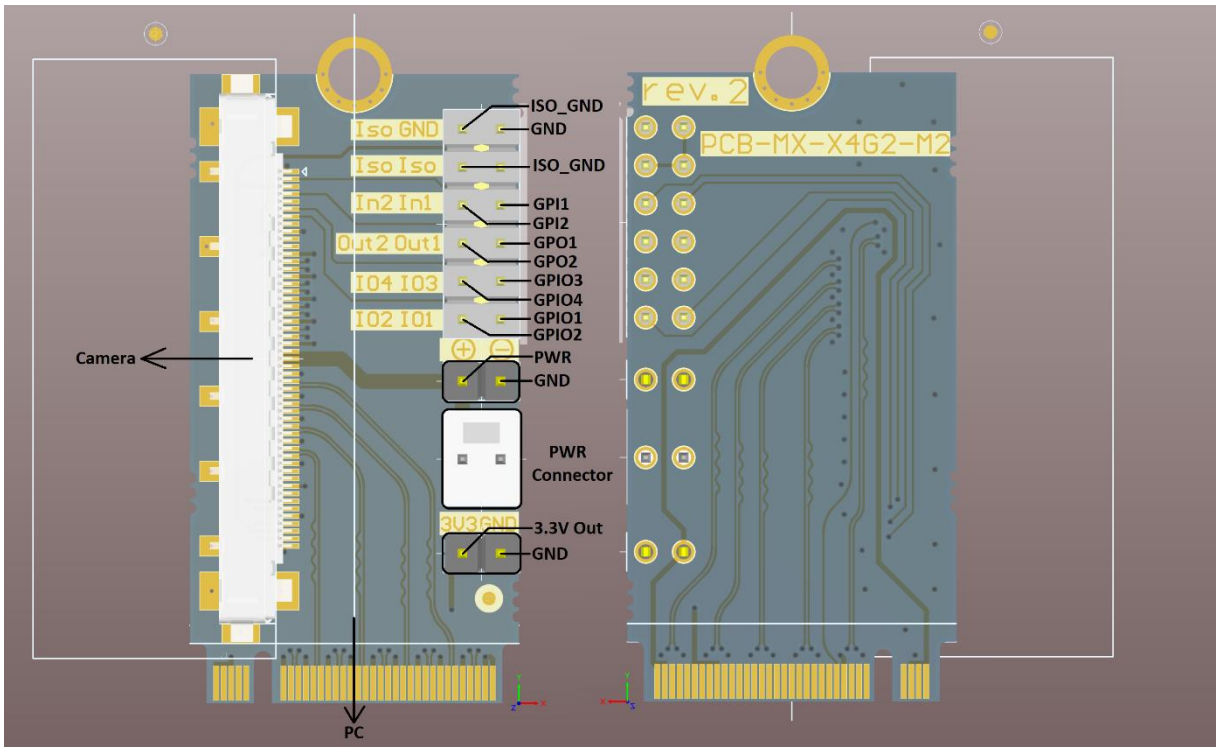


*Figure 3-3, ADPT-MX-X4G2-M2-FL*

## 3.4. ADPT-MX-X4G2-MINI-PCIE

Enables to connect an X4G2 target (camera) directly to a mini-PCIe port of the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X4G2 Flex - PCIe x4 Gen2 |
| Upstream Connector (to Host PC) | Mini PCIe Edge Connector x1 |

This adapter can be ordered as -FL and as –FV version.

The size of the adapter is basically Half Mini-PCIe 26.8x30mm.

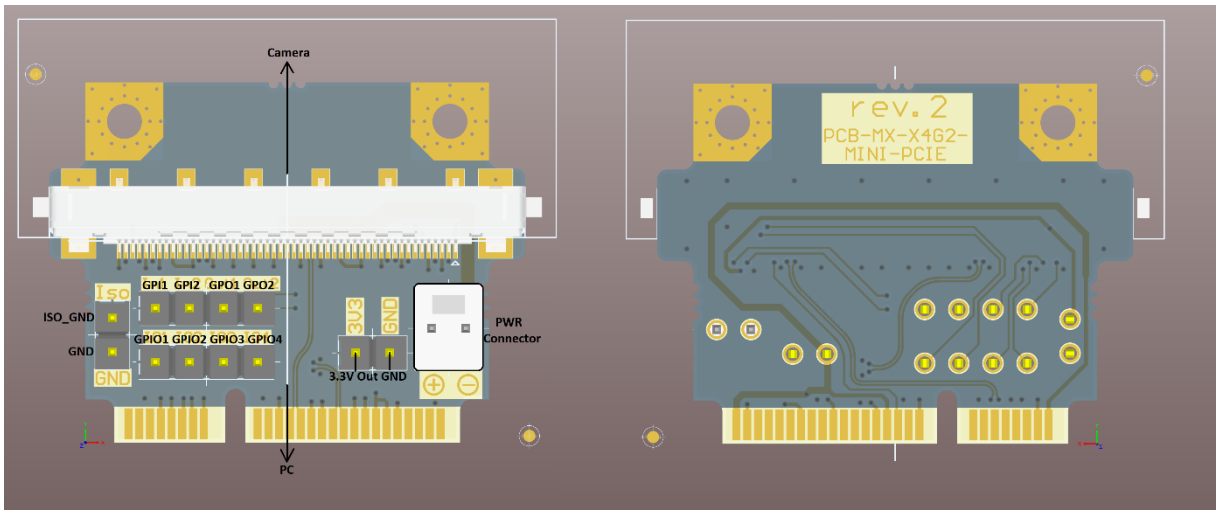


*Figure 3-4, ADPT-MX-X4G2-MINI-PCIE-FL*

## 3.5. ADPT-MX-X4G2-PCIE

Enables to connect an X4G2 target (camera) directly to a 4-lane PCIe slot of the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X4G2 Flex - PCIe x4 Gen2 |
| Upstream Connector (to Host PC) | PCIe Edge Connector x4 |

This adapter can be ordered as -FL and as –FV version.

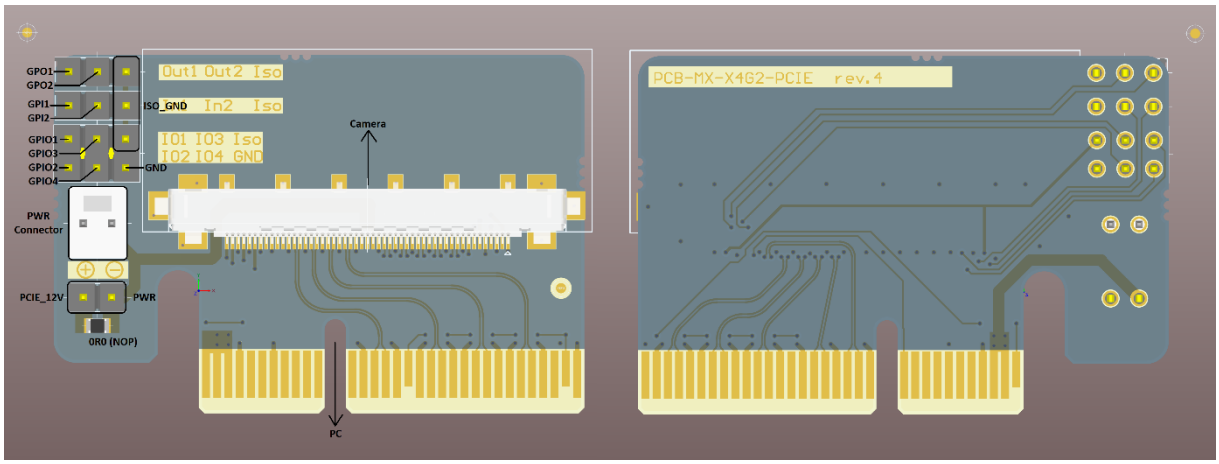


*Figure 3-5, ADPT-MX-X4G2-PCIE-FL*

The connected camera can be powered either by the PCIe bus or by a power supply.

The standard is that a power supply is used to supply power to the camera. In this case, no jumper should be plugged into the position highlighted in the following figure.

If the camera is to be powered by the PCIe bus, the jumper must be plugged in to establish a connection to the 12V pin of the PCIe bus.

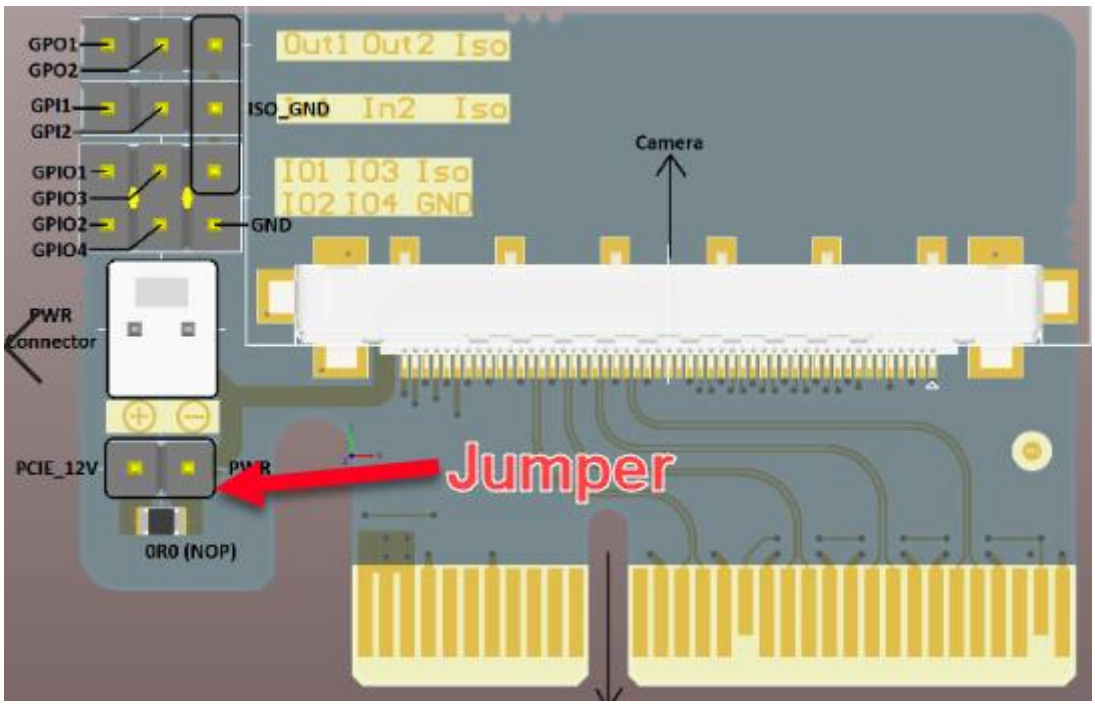


*Figure 3-6, ADPT-MX-X4G2-PCIE-FL – power jumper position*

## 3.6. ADPT-MX-X4G2-FV-X4G3-FF

Enables to connect an X4G2 target (camera) to a 4-lane Firefly connector towards the host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | PCIe iPass X4G2 - PCIe x4 Gen2 |
| Upstream Connector (to Host PC) | MX X4G3 FF Firefly (ECUE/PCUO) – up to PCIe x4 Gen3 |

This adapter can be ordered as –FV version.

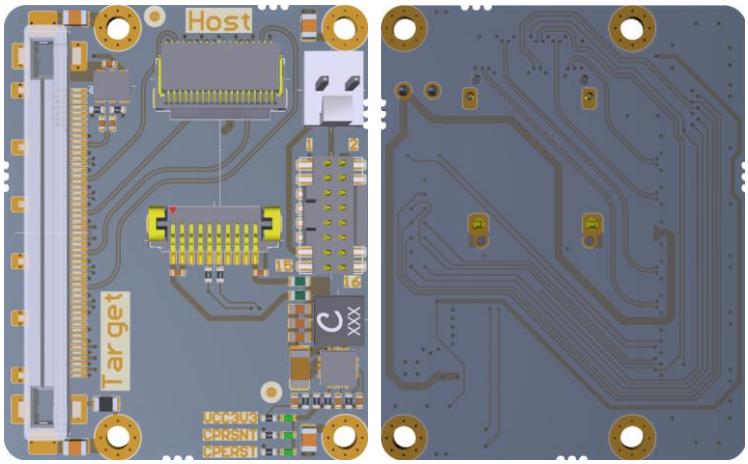


*Figure 3-7, 3.6.ADPT-MX-X4G2-FV-X4G3-FF*

The connected camera can be powered by a power supply.

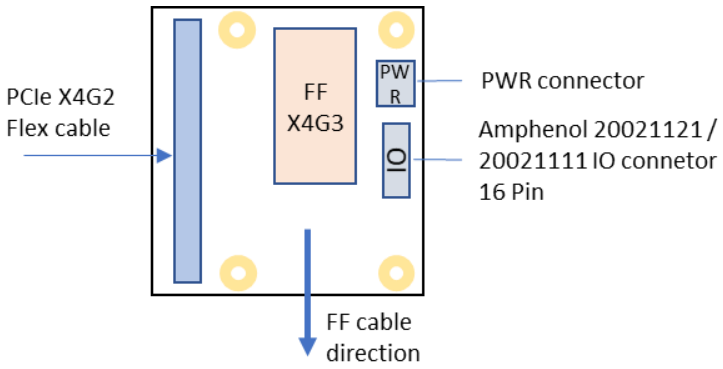


*Figure 3-8, ADPT-MX-X4G2-FV-X4G3-FF – connector position*

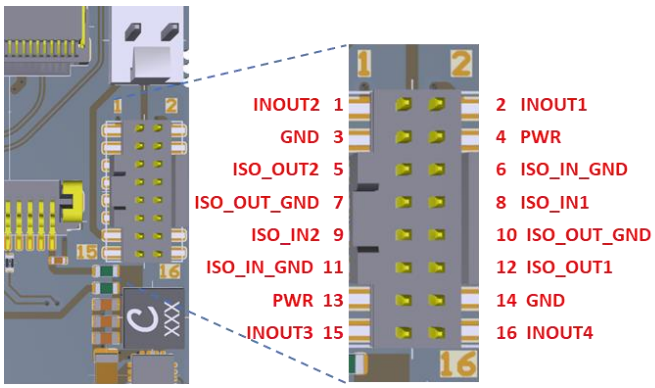


*Figure 3-9, ADPT-MX-X4G2-FV-X4G3-FF –I/O power jumper position*

# 4. Firefly camera adapters

These adapters are mainly designed to connect a xiX camera with a Firefly connector to a host system (PC, xEC2 or xSwitch).

## 4.1. ADPT-MX-X4G3-FF-IPASS-HOST

Enables to connect a X2G2 or X4G3 target (camera) with a Firefly connector via a standard 4 lane PCIe fiber optics or fiber iPass cable to a host system.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X4G3 FF Firefly (ECUE/PCUO) – up to PCIe x4 Gen3 |
| Upstream Connector (to Host PC) | PCIe iPass x4 |

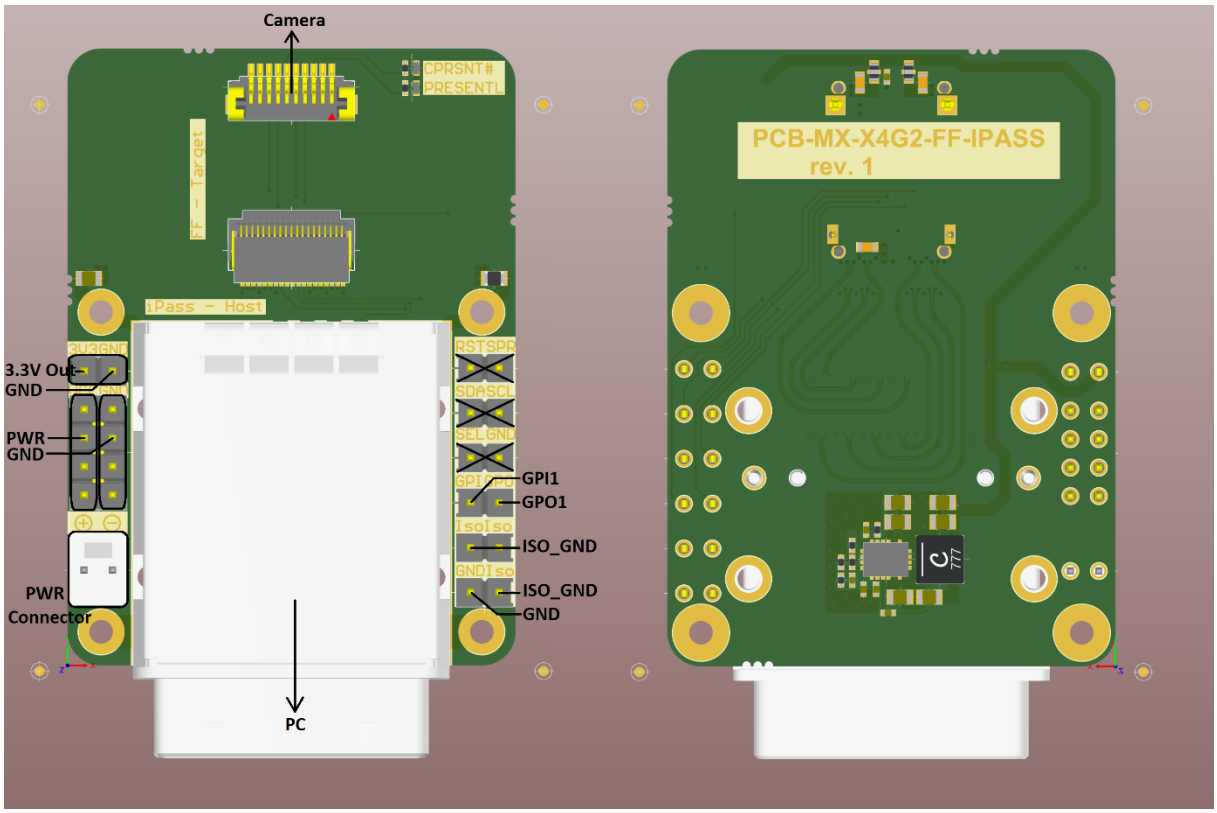


*Figure 4-1, ADPT-MX-X4G3-FF-IPASS-HOST*

## 4.2. ADPT-MX-X4G3-FF-M2-AVM

Used to connect a X2G2 or X4G3 target (camera) with a Firefly connector to a M.2 connector on a host system. The adapter is designed to connect xiX cameras to an Auvidea JN30 Jetson Nano carrier board.

| | |
|---|---|
| Downstream Connector (to Target Device) | MX X4G3 FF Firefly (ECUE/PCUO) – up to PCIe x4 Gen3 |
| Upstream Connector (to Host PC) | PCIe M.2 Card Edge Connector x4 |

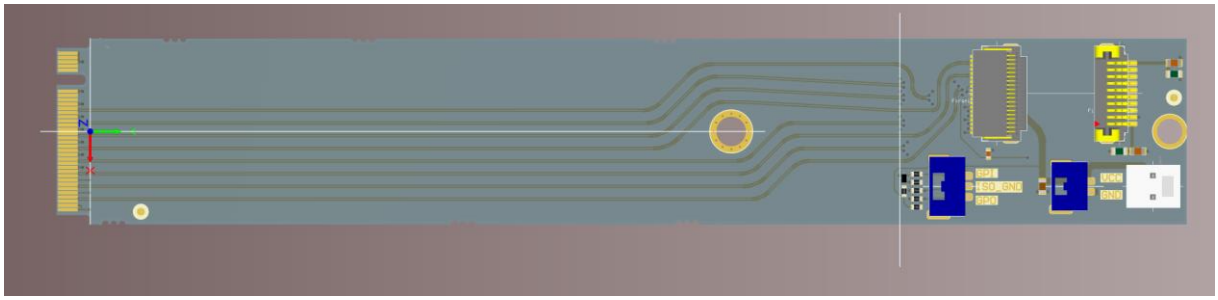

*Figure 4-2, ADPT-MX-X4G3-FF-M2-AVM*

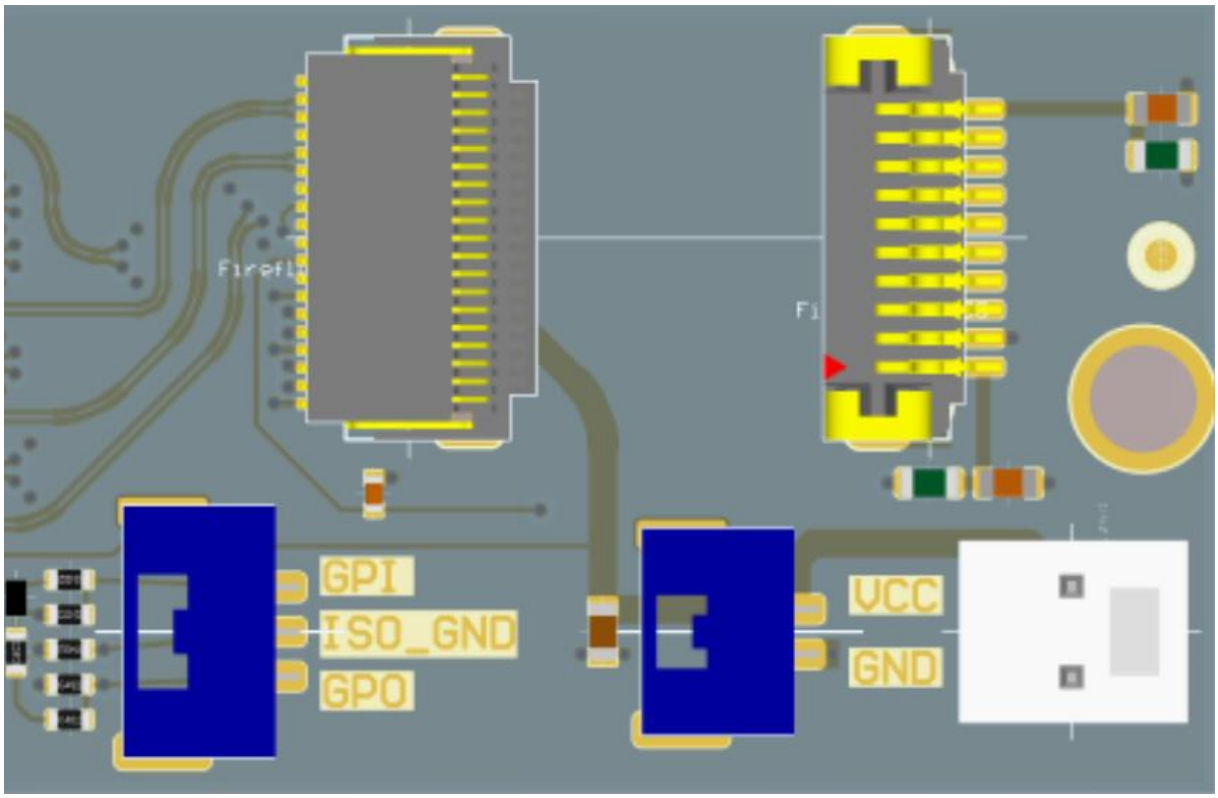


*Figure 4-3, ADPT-MX-X4G3-FF-M2-AVM – Detail power / IO-connectors*

The small power and IO-connectors (blue in the above drawing) are:

| | |
|---|---|
| PWR | JST BM02B |
| IO | JST BM03B |

Mating IO/PWR connectors:

2pin - GHR-02V-S

3pin - GHR-03V-S

Pre-crimped wires (GH series):

5cm- AGHGH28K51

10cm- AGHGH28K102

15cm- AGHGH28K152

20cm- AGHGH28K203

25cm- AGHGH28K254

30cm- AGHGH28K305

### 4.2.1. SSC configuration

FireFly cable does not transport PCIe spread spectrum clock (SSC) and the xiX camera is using locally generated 100MHz fixed frequency clock instead.

PCIe spread spectrum clock (SSC) that is enabled by default in Jetson Nano build which cannot be synchronized.

The PCIe SSC must be disabled on the NVIDIA Jetson Nano for proper camera operation:

https://devtalk.nvidia.com/default/topic/1065396/spread-sprectum-clock-ssc-related-queries/>

```
#include "tegra186-platforms/tegra186-quill-clock.dtsi"
#include "tegra186-platforms/tegra186-quill-soctherm.dtsi"

{
     clocks {
        clock@plle {
          clk-id = <TEGRA186_CLK_PLLE>;
          /* disable ssc on PLLE */
          pll_freq_table = <38400000 100000000 2 125 24 (-1) (-1) (-1) (-1)>;
        };
     };
};
```

# 5. X2G2 NVMe SSD adapters

## 5.1. ADPT-MX-X2G2-M2SSD

X2G2 connectors on xPlatform devices like xSwitch, Phoxi-board or xEC2 can be used to connect a NVMe M.2 SSD to store data. The cable required to connect the adapter to one of the PCIe slots is the same as for connecting the PCIe camera. The “CAM” side of the cable has to be connected to this adapter (if applicable, check your cable)!

| | |
|---|---|
| Downstream Connector (to Target Device) | PCIe M.2 key M Card - e.g. M.2 NVME SSD |
| Upstream Connector (to Host PC) | MX X2G2 Flex - PCIe x2 Gen2 |

This adapter can be ordered as -FL version.

The type / size of the adapter is M.2 NGFF NVMe SSD 2280 key M.

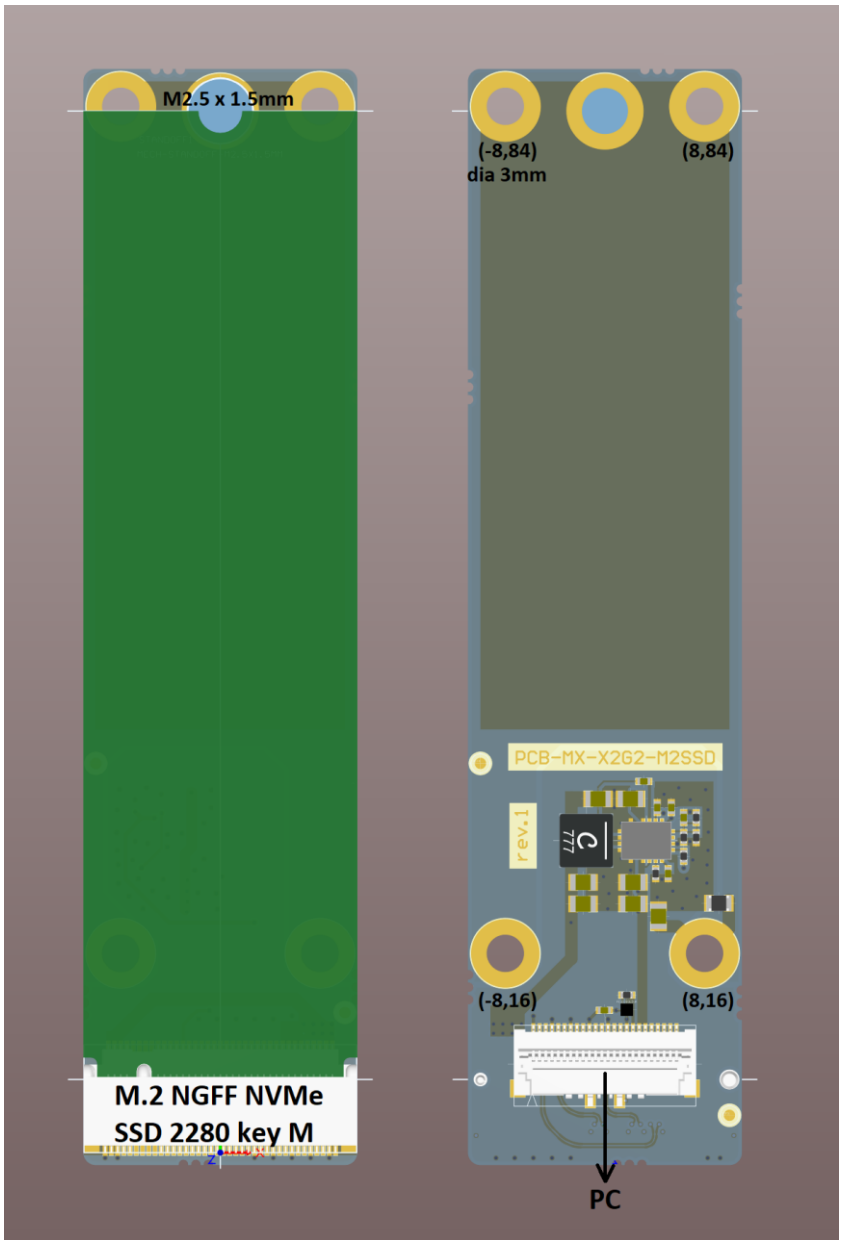


*Figure 5-1, ADPT-MX-X2G2-M2SSD-FL*

# 6. X2G2 / X4G2 adapters

## 6.1. ADPT-MX-X2G2-X4G2

This adapter allows to connect

MX X2G2 Flex target devices to MX X4G2 Flex host devices

and

MX X4G2 Flex target devices to MX X2G2 Flex host devices

The adapter is populated on both sides, because the pinouts for upstream and downstream ports are different. The direction of the connection is marked on the respective side.

X2G2 and X4G2 camera connectors offer different GPIOs. When using the adapter, the following IO signals can be used:

Non-isolated IOs: INOUT1, INOUT2

Opto-isolated IOs: IN1, OUT1

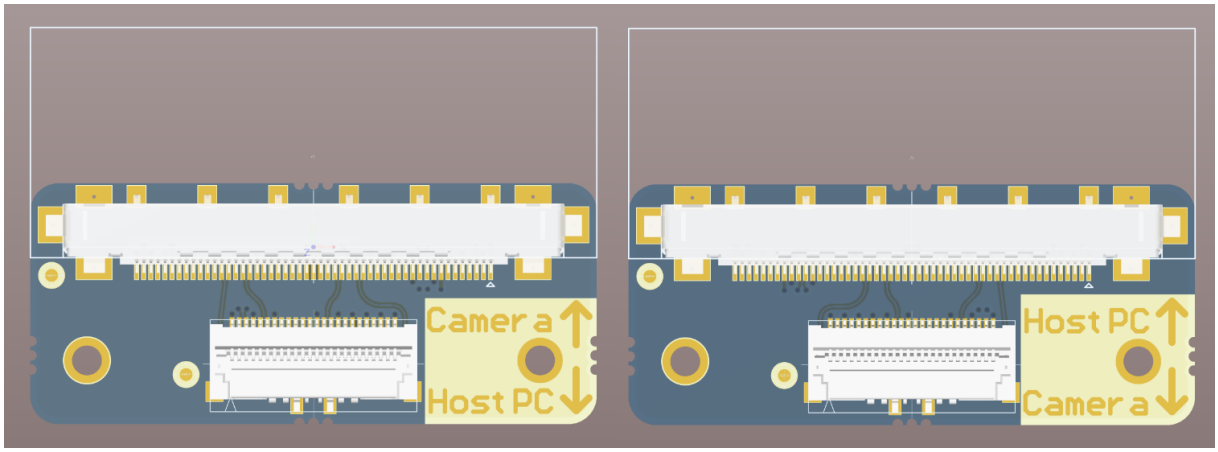


*Figure 6-1, ADPT-MX-X2G2-X4G2*

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