



Predator II CoaXPress Frame Grabber

(Part-No. KY-FGP II)

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Hardware Reference
and Installation Guide

International Distributors

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Revision History

Version	Date	Notes
1.0	18/07/2018	Initial Release
1.1	19/02/2019	Minor corrections

2.1 Safety Precautions

With your *Predator II Single link CoaXPress Frame Grabber board* in hand, please take a minute to read carefully the precautions listed below in order to prevent unnecessary injuries to you or other personnel or cause damage to property.

- **Before using the product, read these safety precautions carefully to assure correct use.**
- **These precautions contain serious safety instructions that must be observed.**
- **After reading through this manual, be sure to act upon it to prevent misuse of product.**



Caution

<p>In the event of a failure, disconnect the power supply.</p> <p>If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately and contact our sales personnel for repair.</p>
--

<p>If an unpleasant smell or smoking occurs, disconnect the power supply.</p> <p>If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately. After verifying that no smoking is observed, contact our sales personnel for repair.</p>

<p>Do not disassemble, repair or modify the product.</p> <p>Otherwise, a fire or electric shock may occur due to a short circuit or heat generation. For inspection, modification or repair, contact our sales personnel.</p>
--

<p>Do not touch a cooling fan.</p> <p>As a cooling fan rotates in high speed, do not put your hand close to it. Otherwise, it may cause injury to persons. Never touch a rotating cooling fan.</p>

<p>Do not place the product on unstable locations.</p> <p>Otherwise, it may drop or fall, resulting in injury to persons or failure.</p>

<p>If the product is dropped or damaged, do not use it as is.</p> <p>Otherwise, a fire or electric shock may occur.</p>
--

<p>Do not touch the product with a metallic object.</p> <p>Otherwise, a fire or electric shock may occur.</p>
--

<p>Do not place the product in dusty or humid locations or where water may splash.</p> <p>Otherwise, a fire or electric shock may occur.</p>

<p>Do not get the product wet or touch it with a wet hand.</p> <p>Otherwise, the product may break down or it may cause a fire, smoking or electric shock.</p>

<p>Do not touch a connector on the product (gold-plated portion).</p> <p>Otherwise, the surface of a connector may be contaminated with sweat or skin oil, resulting in contact failure of a connector or it may cause a malfunction, fire or electric shock due to static</p>

electricity.

Do not use or place the product in the following locations.

- Humid and dusty locations
- Airless locations such as closet or bookshelf
- Locations which receive oily smoke or steam
- Locations close to heating equipment
- Closed inside of a car where the temperature becomes high
- Static electricity replete locations
- Locations close to water or chemicals

Otherwise, a fire, electric shock, accident or deformation may occur due to a short circuit or heat generation.

Do not place heavy things on the product.

Otherwise, the product may be damaged.

Be sure to drain static electricity from body before you touch any electronics component

The electronic circuits in your computer and the circuits on Predator II board are sensitive to static electricity and surges. Improper handling can seriously damage the circuits. In addition, do not let your clothing come in contact with the circuit boards or components.

Otherwise, the product may be damaged.

2.2 Disclaimer

This product should be used for interfacing of CoaXPress camera and acquiring of CoaXPress video streams. KAYA Instruments assumes no responsibility for any damages resulting from the use of this product for purposes other than those stated.

Even if the product is used properly, KAYA Instruments assumes no responsibility for any damages caused by the following:

- Earthquake, thunder, natural disaster or fire resulting from the use beyond our responsibility, acts caused by a third party or other accidents, the customer's willful or accidental misuse or use under other abnormal conditions.
- Secondary impact arising from use of this product or its unusable state (business interruption or others).
- Use of this product against the instructions given in this manual or malfunctions due to connection to other devices.

KAYA Instruments assumes no responsibility or liability for:

- Erasure or corruption of data arising from use of this product.
- Any consequences or other abnormalities arising from use of this product, or damage of this product not due to our responsibility or failure due to modification.

Repair of this product is carried out by replacing it on a chargeable basis, not repairing the faulty devices. However, non-chargeable replacement is offered for initial failure if such notification is received within two weeks after delivery of the product.

3.1 Overview

Predator II is low-cost **Frame Grabber** supporting CoaXPress 2.0 standard. The **Predator II** is capable of receiving video stream over a single CoaXPress link, for capturing video stream from a single link camera. **Predator II** supports standard CoaXPress bitrates up to 12.5 Gbps. This CoaXPress Frame Grabber is ideally suited for industrial, defense and aerospace Machine Vision Systems and applications. The **Predator II** can easily receive video streams on the CoaXPress link and transmit them to computer memory through the PCIe interface using DMA mechanism. This product also provides an external on bracket GPIO for machine control signals, such as triggers, shaft encoders, exposure control and general I/O, which can be control aside video stream receive.

The **Predator II** uses standard Micro-BNC connector as a CoaXPress interface to the camera. The Frame Grabber utilizes PCIe Gen2 x4 for communication with Host PC for video uploading and configuration.

3.2 Features

- Single CoaXPress link
- Camera controls and triggers
- Link LED indication on bracket
- Power over CoaXPress with 20W
- Multiple Frame Grabbers synchronization
- Micro-BNC connectors for CoaXPress link
- CoaXPress V2.0 compliant
- On board image processing
- GUI interface
- Supporting Windows and Linux OS
- API for developing custom applications
- Plug-ins modules for Matlab
- Gen<i>i</i>Cam compliant
- GenTL support
- Full or Half-height bracket

- 4Gb image buffer
- PCIe Gen2 x4 Half-length PCIe card
- Data rates up to 12.5 Gbps per link
- PCI Express Transfer Rate of up to 12.5 Gbps
- 0°C to 55°C operating environment temperature
- Flexible machine I/O:
 - 4 TTL configurable I/Os
 - 4 LVTTL configurable I/Os
 - 2 LVDS inputs
 - 2 LVDS outputs
 - 4 opto - isolated outputs
 - 4 opto - isolated inputs
 - 4 quadrature rotary encoder
- 4 programmable timers (Strobe Controller , exposure , etc)

3.3 Product Applications

- CoaXPress vision systems testing and development
- AOI
- 3D
- Broadcasting and sports analytics
- High-speed DVR

3.4 Related documents and accessories

Documents:

- Vision Point App User Manual
- Vision Point API Reference Book
- CoaXPress standard 2.0
- KAYA Frame Grabbers Programming Guide

Accessories:

- CoaXPress cables (Micro-BNC to Micro-BNC)
- CoaXPress cables (Micro-BNC to BNC)
- CoaXPress cables (Micro-BNC to DIN)

4.1 Example System Block Diagram

The Predator II Frame Grabber supports the following configuration and system topology.

Single CoaXPress link with up to
12.5 Gbps.

Maximum throughput to PCIe of
12.5 Gbps

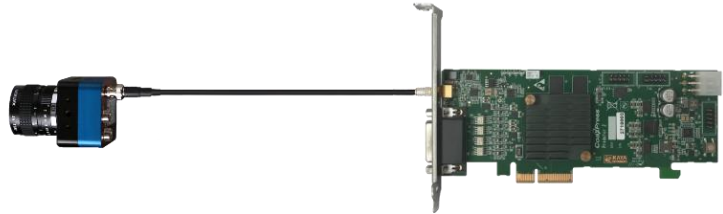


Figure 1: CoaXPress system block diagram

4.2 External View of the Board

Figure 2 shows the *Predator II Frame Grabber* board specification.

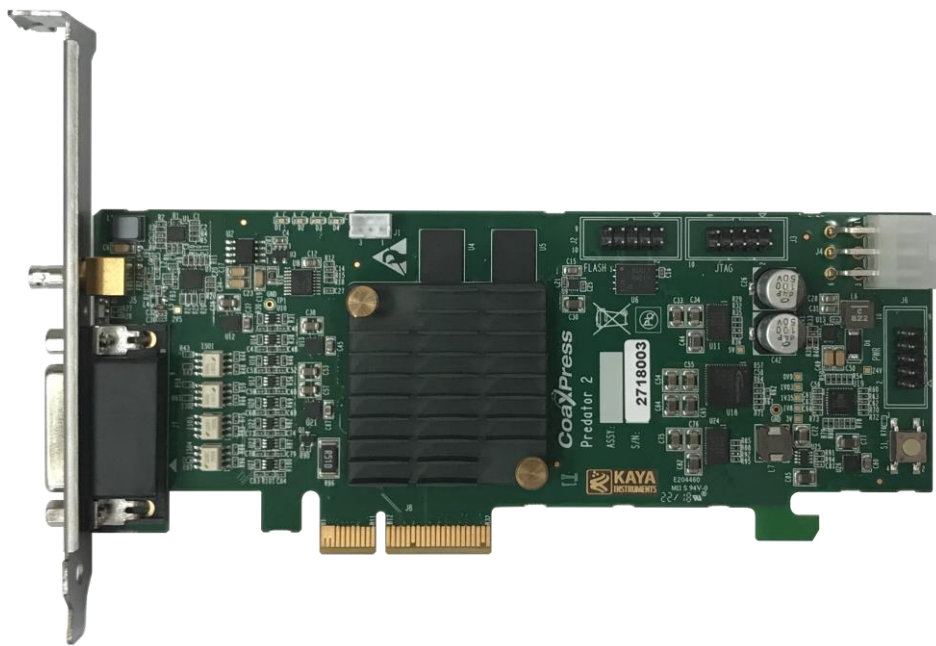


Figure 2: Predator II board external view

5.1 Essentials to get started

To begin using your Predator II Frame Grabber, you must have a computer with the following:

- ✓ Processor with an Intel 64-bit architecture, or equivalent.
- ✓ An available x4 (or x8 or x16) PCIe slot. Gen 2 support is recommended to faster data transfer.
- ✓ Vision Point Application installation

KAYA Instruments doesn't guarantee compatibility with all computers that have the above specifications. Please, consult KAYA representative for any specific issue.

5.2 Power supplies

The Predator II board receives its power directly from PCIe slot of the motherboard.

According to PCIe standard 2.0, the board might consume up to 10W of power, while actual power consumption depends on usage mode and interfaces.

In order to support PoCXP feature the board is capable of supplying up to 20W of power per each CoaXPress link.

The PSU connector (standard PCI power connector), located on the top right side of the board. It may be used to supply PoCXP power for connected cameras.

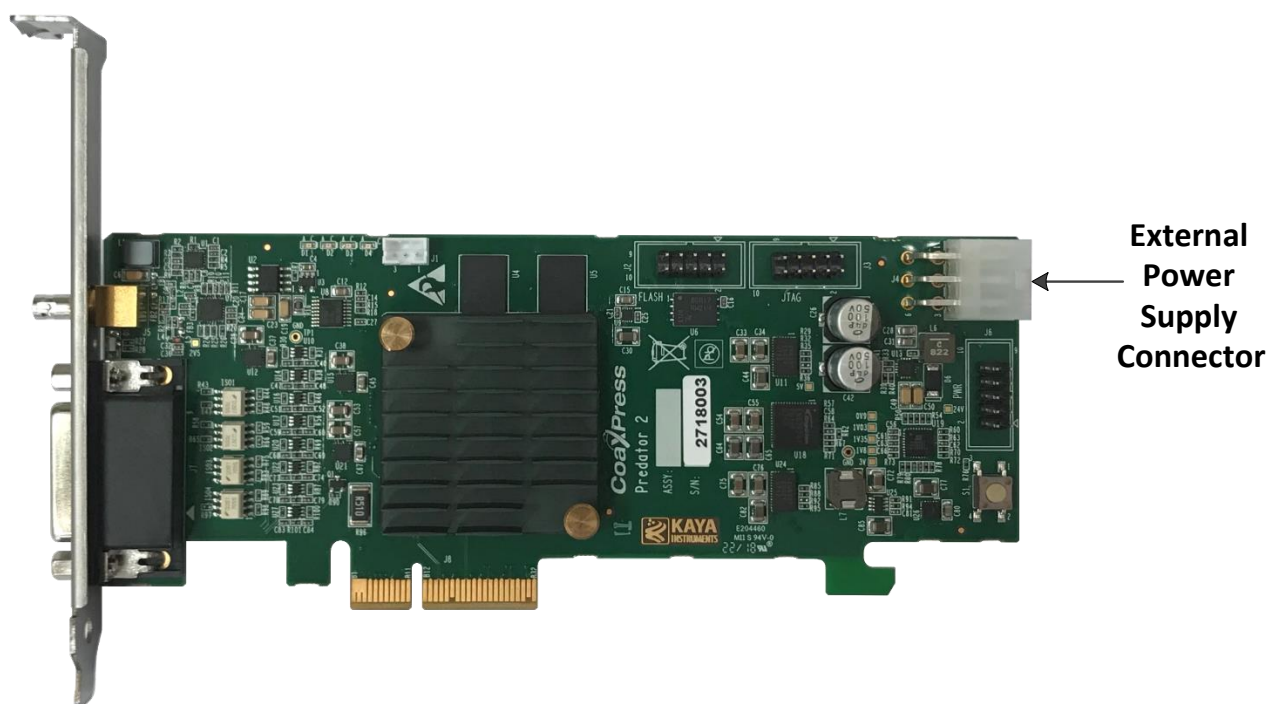


Figure 3: External Power supply connector

5.3 Mechanical dimensions

The Predator II board is a Low profile PCIe card according to PCI Express Card Electromechanical Specification.

This card can be installed in both Standard Height and Low profile computers, simply by replacing the bracket.

The exact board mechanical dimensions are as defined in Figure 4.

For more detailed information please, contact KAYA Instruments representative.

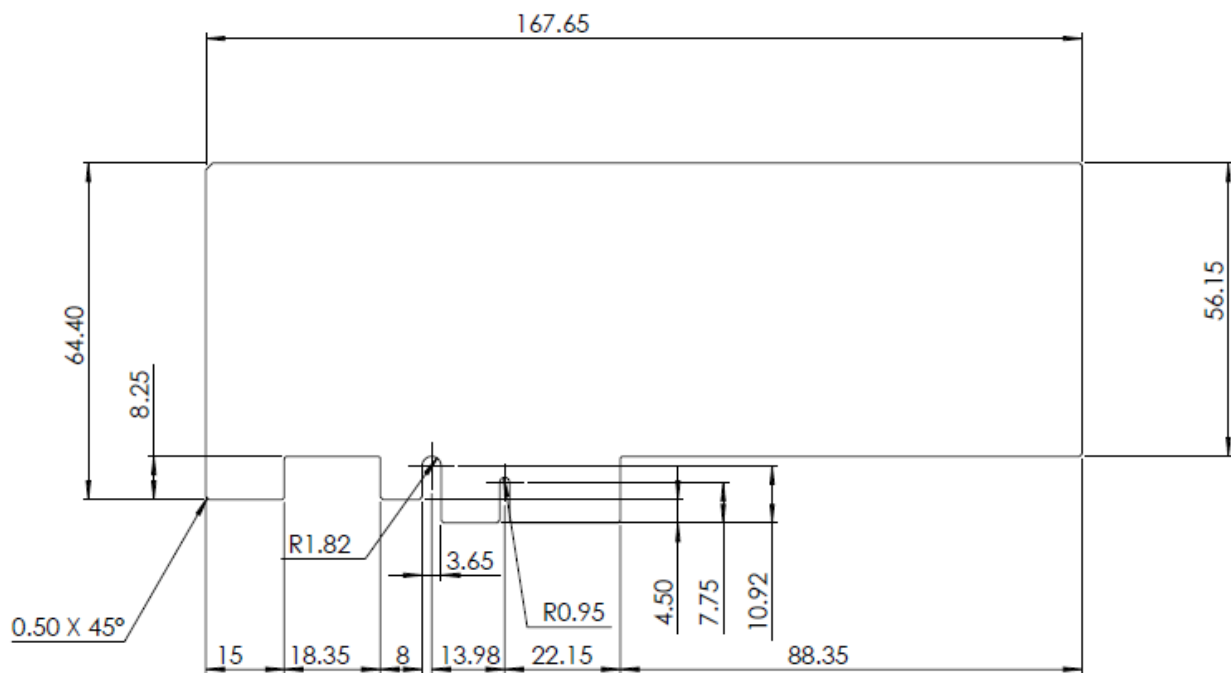


Figure 4: PCB Mechanical Dimensions

6.1 Installation instructions

Predator II board is standard PCIe card with 4 lanes connector.

It can be installed in any PCIe Gen2 connector of the motherboard with 4 lanes and up.

Note: Board should be installed before you install your software.

1. Before installing, turn off the power of the computer and its peripherals.
2. Firmly insert the Predator II board to PCIe connector of the motherboard.
3. Anchor the PCIe bracket to the computer chassis using M3 screw.
4. Verify the Predator II board inserted correctly to the PCIe slot.
5. Connect external power supply to dedicated connector (J13).
6. Power on the computer.
7. After OS is up, you will be asked to install a driver for new Multimedia Device.

At this stage, you should Cancel the installation.

Under Windows and Linux the compatible drivers for Predator II board will be installed during installation of Vision Point App software.

You can install and use multiple Predator II boards in a single computer.

The number of Predator boards that can be installed in a computer depends on the number of available PCIe slots.

6.2 Connecting to CoaXPress output connectors

Predator II board implements CoaXPress standard Micro-BNC connectors for CoaXPress interface. When attaching cables to your Predator II Frame Grabber, you must use 75 Ω coaxial cables. For best performance, it's recommended to use high quality cables, such as Belden 1694A and Belden 4855A.

6.3 Predator II LEDs

The CoaXPress link of the Frame Grabber equipped with indication bi-color LED.

The LED behaves according to the defined in section 5.4 of the CXP standard. The possible LED's states described in Table 1.

LED state	Description
Solid orange	System is not initialized
Slow pulse red	No camera is connected
Fast flash alternate green / orange	Connection detection in progress, PoCXP active
Fast flash orange	Connection detection in progress, PoCXP not in use
Solid red	PoCXP over-current
Solid green	Camera is connected, no data being transferred
Slow pulse orange	Camera connected. Waiting for trigger event
Fast flash green	Camera connected , data is being transferred
Slow flash alternate green / orange	Connection test packets being sent

Table 1: CoaXPress link status LED

In addition to CoaXPress link LED, the Predator II Board is equipped with status LEDs.

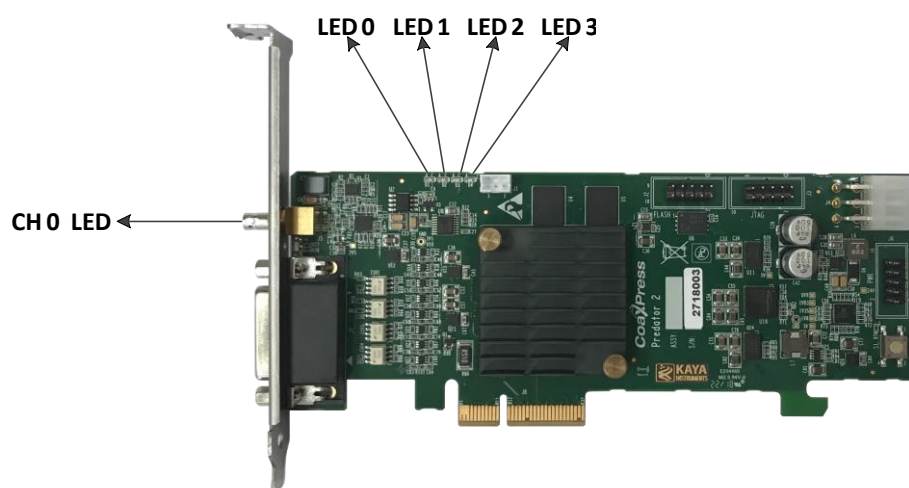


Figure 5: Predator II Board LED's locations

Board Status LEDs functionality is described in Table 2:

LED #	Description
LED 0	Alive led. Blinks when the board receives clock from PCIe
LED 1	PCIe L0 state. When lit, indicates that the PCIe interface is powered up at active state.
LED 2	Gen2 PCIe indicator. When lit indicates that PCIe is working as Gen2. When not lit the boards works as PCIe Gen1
LED 3	Lane's indicator. When lit, indicates that all 4 PCIe lanes are up. If not lit, only one lane is up.

Table 2: Board status LED's

6.4 Predator II Hardware Reference

This chapter provides information on Predator II board hardware. It covers architecture, features and pin assignments for various connectors.

6.5 Predator II Board Block Diagram

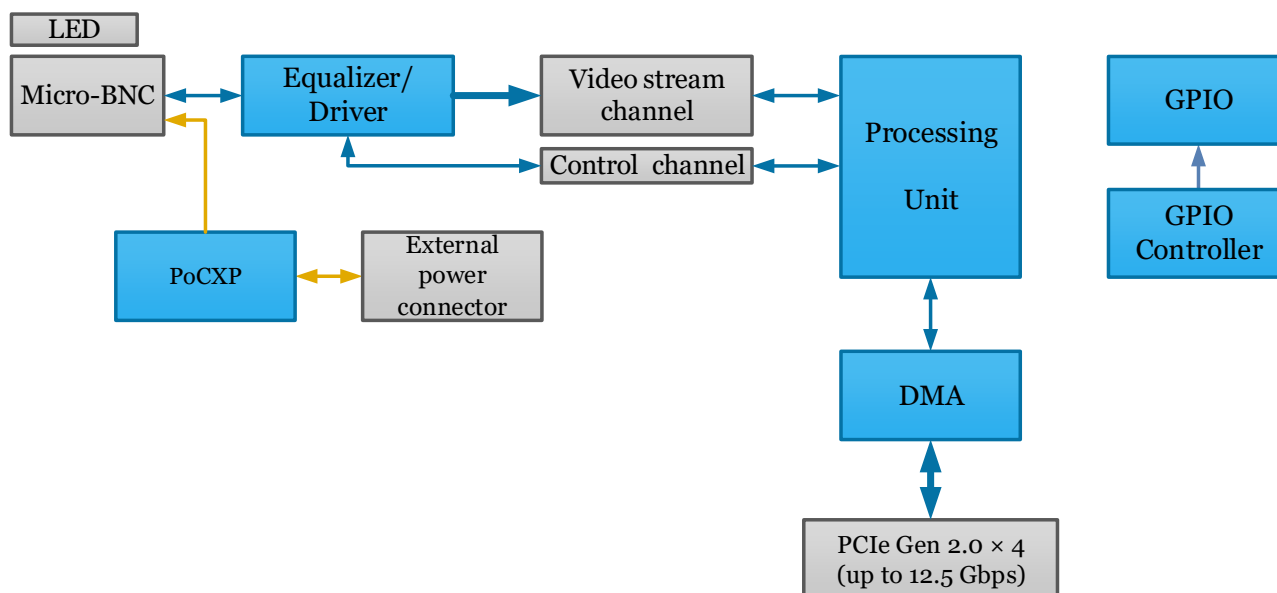


Figure 6: Predator II Board Block Diagram

6.6 Video stream acquisition

Predator II is designed to acquire different video streams compliant with CoaXPress standard 2.0 single CoaXPress link.

When connected to Camera, the Frame Grabber communicates with it to determine link parameters, such as data rate.

For different options please refer to Vision Point Application User Manual.

6.7 Auxiliary Input/Output signals

The Predator II board provides an external on bracket GPIO for machine control signals such as CoaXPress triggers, shaft encoders, exposure control and general I/O, which can be controlled aside the video stream acquisition. The Predator II board uses a standard HD DB26 D-sub Panel Mount connector (26-pin 3-row, through hole, right angle).

The auxiliary signal of Predator II board can be used to initiate on-board events, transmitted to other devices or rerouted from other signals, such as CoaXPress triggers and GPIO's.

Additionally, these auxiliary signals can be used to communicate with complex devices, such as encoders, strobe controls and drive controls.

The GPIO's can be controlled from the Vision Point API and be set as a trigger sources. The API enables routing of any input to any output as well as to the CoaXPress Trigger lines. Please see a KAYA Frame Grabbers Programming Guide for more information regarding the GPIO configuration.

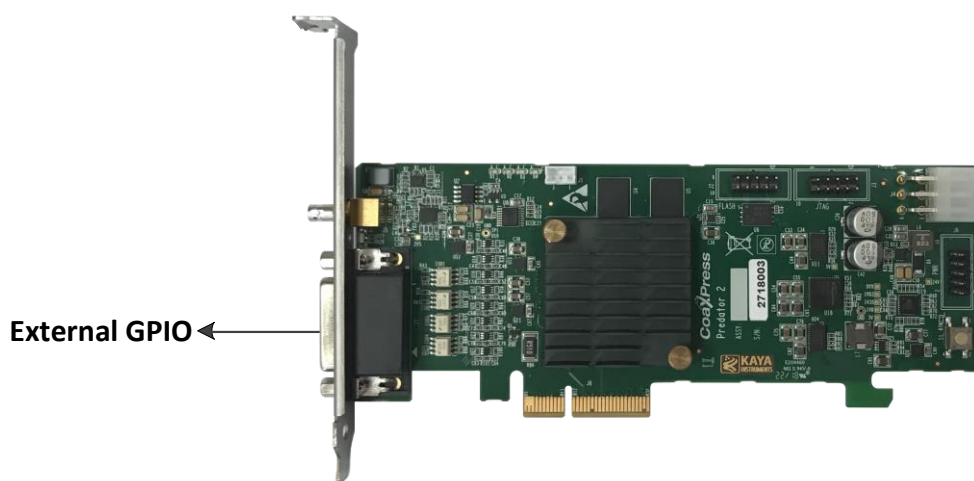


Figure 7: GPIO connectors location

The electrical connection of the GPIO connector is described following principal schematic diagram:

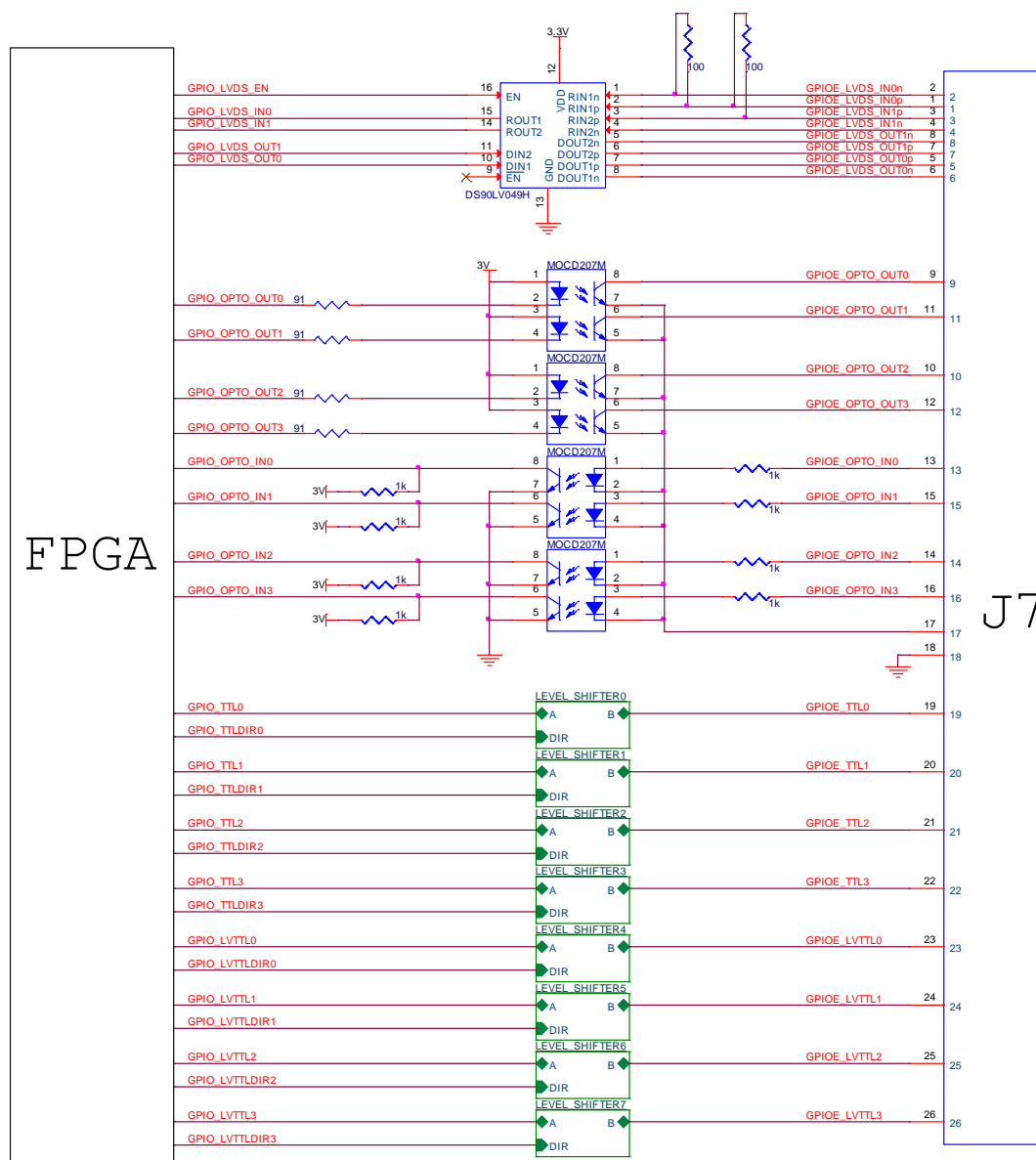


Figure 8: GPIO Connector schematic

The level shifters are described in Figure 9.

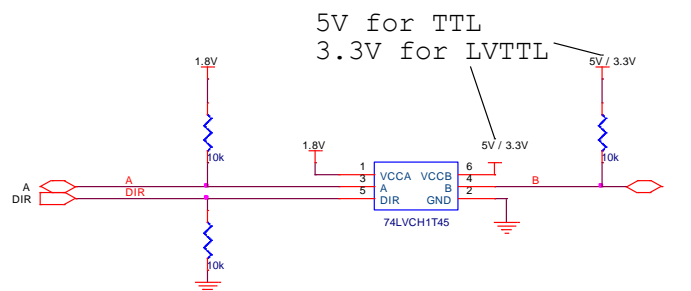


Figure 9: Level shifters schematic

The pinout of IO connector is as described in Table 3.

Pin Number	Signal Name	Function	Electrical Standard	Description
1	LVDS Input 0p	LVDS input	LVDS	Positive signal of LVDS pair
2	LVDS Input 0n	LVDS input	LVDS	Negative signal of LVDS pair
3	LVDS Input 1p	LVDS input	LVDS	Positive signal of LVDS pair
4	LVDS Input 1n	LVDS input	LVDS	Negative signal of LVDS pair
5	LVDS Output 0p	LVDS output	LVDS	Positive signal of LVDS pair
6	LVDS Output 0n	LVDS output	LVDS	Negative signal of LVDS pair
7	LVDS Output 1p	LVDS output	LVDS	Positive signal of LVDS pair
8	LVDS Output 1n	LVDS output	LVDS	Negative signal of LVDS pair
9	OptoCoupled Output 0	Opto-Isolated output	Up to 70V	Optically isolated outputs
10	OptoCoupled Output 1	Opto-Isolated output	Up to 70V	Optically isolated outputs
11	OptoCoupled Output 2	Opto-Isolated output	Up to 70V	Optically isolated outputs
12	OptoCoupled Output 3	Opto-Isolated output	Up to 70V	Optically isolated outputs
13	OptoCoupled Input 0	Opto-Isolated input	Up to 70V	Optically isolated inputs
14	OptoCoupled Input 1	Opto-Isolated input	Up to 70V	Optically isolated inputs
15	OptoCoupled Input 2	Opto-Isolated input	Up to 70V	Optically isolated inputs

16	OptoCoupled Input 3	Opto-Isolated input	Up to 70V	Optically isolated inputs
17	OptoCoupled GND	External GND		Ground signal for opto-isolated signals on this connector.
18	GND	Board GND		Reference ground signal
19	TTL 0	GPIO	TTL (Open-drain)	General Purpose IO
20	TTL 1	GPIO	TTL (Open-drain)	General Purpose IO
21	TTL 2	GPIO	TTL (Open-drain)	General Purpose IO
22	TTL 3	GPIO	TTL (Open-drain)	General Purpose IO
23	LVTTL 0	GPIO	LVTTL	General Purpose IO
24	LVTTL 1	GPIO	LVTTL	General Purpose IO
25	LVTTL 2	GPIO	LVTTL	General Purpose IO
26	LVTTL 3	GPIO	LVTTL	General Purpose IO

Table 3: GPIO connector pinout

6.8 Absolute maximum ratings

Specification	Values
3.3V power supply	-1.0V to +7.0V
12V power supply	-0.3V to 14V
Storage temperature	-55°C to 125°C
Operating ambient temperature	0°C to 50°C

Table 4: Absolute maximum ratings

Specification	Minimum voltage [V]	Maximum voltage [V]
LVDS	-0.3	3.6
Opto-isolated (in)	-6	60
Opto-isolated (out)	-7	70
TTL	-0.5	6.5
LVTTL	-0.5	6.5

Note: The maximum current that the Opto-isolated (out) IOs can support is 150mA

Table 5: Absolute maximum ratings for GPIO

6.9 Electrical characteristics for board IO's:

Symbol	Parameter	Condition	Pin	MIN	Typ	MAX	Units
$ V_{OD} $	Differential Output Voltage	$R_L = 100 \Omega$	D _{OUT-} D _{OUT+}	250	350	450	mV
ΔV_{OD}	Change in Magnitude of V_{OD} for Complementary Output States				1	35	mV
V_{OS}	Offset Voltage			1.125	1.23	1.375	V
ΔV_{OS}	Change in Magnitude of V_{OS} for Complementary Output States				1	25	mV
I_{OS}	Output Short Circuit Current ⁽⁴⁾	ENABLED, $D_{IN} = V_{DD}$, $D_{OUT+} = 0 V$ or $D_{IN} = GND$, $D_{OUT-} = 0 V$			-5.8	-9.0	mA
I_{OSD}	Differential Output Short Circuit Current ⁽⁴⁾	ENABLED, $V_{OD} = 0 V$			-5.8	-9.0	mA
I_{OFF}	Power-off Leakage	$V_{OUT} = 0 V$ or $3.6 V$ $V_{DD} = 0 V$ or Open		-20	± 1	+20	μA
I_{OZ}	Output TRI-STATE Current	$EN = 0 V$ and $EN = V_{DD}$ $V_{OUT} = 0 V$ or V_{DD}		-10	± 1	+10	μA

Table 6: LVDS Output DC specifications (Driver Outputs)

Symbol	Parameter	Condition	Pin	MIN	Typ	MAX	Units
V_{TH}	Differential Input High Threshold	$V_{CM} = 1.2 V, 0.05 V, 2.35 V$	R _{IN+} R _{IN-}		-15	35	mV
V_{TL}	Differential Input Low Threshold			-100	-15		mV
V_{CMR}	Common-Mode Voltage Range	$V_{ID} = 100 mV$, $V_{DD} = 3.3 V$		0.05		3	V
I_{IN}	Input Current	$V_{DD} = 3.6 V$ $V_{IN} = 0 V$ or $2.8 V$		-12	± 4	+12	μA
		$V_{DD} = 0 V$ $V_{IN} = 0 V$ or $2.8 V$ or $3.6 V$		-10	± 1	+10	μA

Table 7: LVDS Input DC specifications (Receiver Inputs)

Symbol	Parameter	Test condition (note 1)	MIN	MAX	Units
V_{IH}	Input High Voltage	$V_{OUT} \geq V_{OH (min)}$ or	2	5.5	V
V_{IL}	Input Low Voltage	$V_{OUT} \leq V_{OL (max)}$	0	0.8	V
I_{IN}	Input Current	$V_{IN} = 0 V$ or $V_{IN} = V_{DD}$		± 1	μA

Note: Vdd = 3.3V, unless specified otherwise

Table 8: LVTTL input specifications

Symbol	Parameter	Test condition	MIN	MAX	Units
V_{OH}	Output High Voltage	$V_{DD} = \min, I_{OH} = -2 \text{ mA}$	2.4		V
V_{OL}	Output Low Voltage	$V_{DD} = \min, I_{OL} = 2 \text{ mA}$		0.55	V

Note: $V_{DD} = 3.3\text{V}$, unless specified otherwise

Table 9: LVTTL output specifications

Symbol	Parameter	Test condition (note 1)	MIN	MAX	Units
V_{IH}	Input High Voltage	$V_{OUT} \geq V_{OH(\min)}$ or	3.5	5.5	V
V_{IL}	Input Low Voltage	$V_{OUT} \leq V_{OL(\max)}$ 0	0	1.5	V
I_{IN}	Input Current	$V_{IN} = 0 \text{ V}$ or $V_{IN} = V_{DD}$		± 1	μA

Note: $V_{DD} = 5\text{V}$, unless specified otherwise

Table 10: TTL input specifications

Symbol	Parameter	Test condition	MIN	MAX	Units
V_{OH}	Output High Voltage	$V_{DD} = \min, I_{OH} = -2 \text{ mA}$	3.8		V
V_{OL}	Output Low Voltage	$V_{DD} = \min, I_{OL} = 2 \text{ mA}$		0.55	V

Note: $V_{DD} = 5\text{V}$, unless specified otherwise

Table 11: TTL output specifications

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