Ajile
Light Industries

Ajile FX3 USB3.0 Controller Hardware User's Guide

AJL-FX3-01-02

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Revision History

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1.0 - Introduction

1.1 - Board Overview

Congratulations on your choice of the Ajile AJL-FX3-01-02 USB3.0 controller board. This controller board provides a complete USB3.0 solution compatible with the boards that support the Ajile AJP+ fabric interconnect, providing high-speed USB connectivity for Ajile applications. Based on a Cypress Semiconductor FX3 USB3.0 controller, peak bandwidths of up to xxxx (in) and xxxx (out) can be achieved for maximum performance. The use of an integrated USB3.0 signal re-driver ensures optimum cable compatibility

Internally operating from a single +5 VDC power supply, all required voltages necessary for operation are generated using low-noise linear regulators to ensure consistent, glitch-free operation in reliable active service. Primary power can be supplied in two ways: +5 VDC power can be applied to the AJP power port, or +5-24 VDC can be applied to the external power input (if present). In both cases, +5 VDC is provided to operate the USB3.0 controller, however if external power (+5-24 VDC) is used, the AJP power port is re-purposed to be capable of sourcing +5 VDC power to other boards in the system.

Overview of Ajile FX3 USB3.0 Controller Board Features

- *Cypress Semiconductor FX3 controller supports both USB3.0 and USB2.0*
- *Linear internal power regulation with split power rails for maximum performance*
- *USB3.0 re-driver for optimum cable compatibility*
- *High-speed AJP+ interface – single-ended mode (xxGB/sec in, xxGB/sec out)*
- *Selectable AJP+ interface voltage (2.5v/1.8v) for maximum compatibility*
- *Operates from a single +5v supply for all functionality, with flexible power options*
- *Optional +5-24v external power input can generate +5v power for external boards*
- *Status indicators for board power state*
- *Extremely compact size*

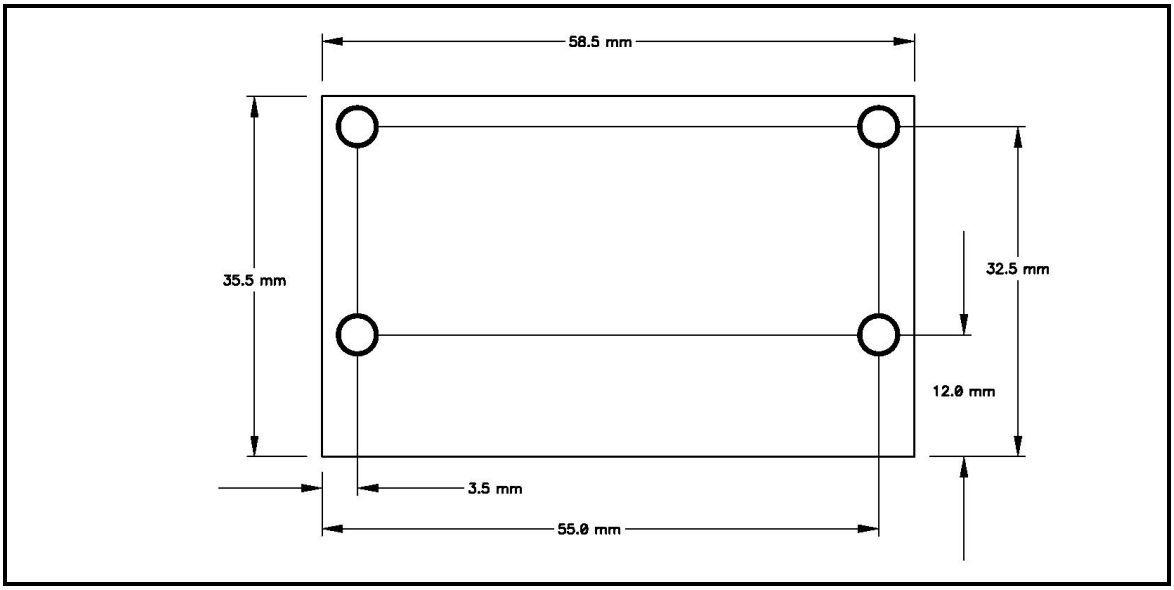
The form factor of this board is designed for highest component and power density, and features a mounting pattern compatible with other Ajile system boards allowing for convenient board-stacking when used as part of a multi-board module. Since the AJP+ interface is used in single-ended mode, micro-coax AJP+ cable assemblies can be used for best form and fit in an end-use application if flat-flex cables cause mechanical issues.

The Ajile AJL-FX3-01-02 is designed for reliable, high-performance service as part of Ajile applications requiring high-speed USB3.0 connectivity, requiring only that a host AJP+ port be available on the interconnecting device.

1.2 - Basic Installation and Mounting

Four (4) mounting holes are provided to suitably affix the board to a support plate or chassis in the end-use device. Note that these holes are in a standard configuration to allow for stacking of Ajile boards for prototyping or production. Overall board dimensions and hole locations are as noted below:

Ajile FX3 USB3.0 Controller, Mechanical Dimensions for Mounting, Top View



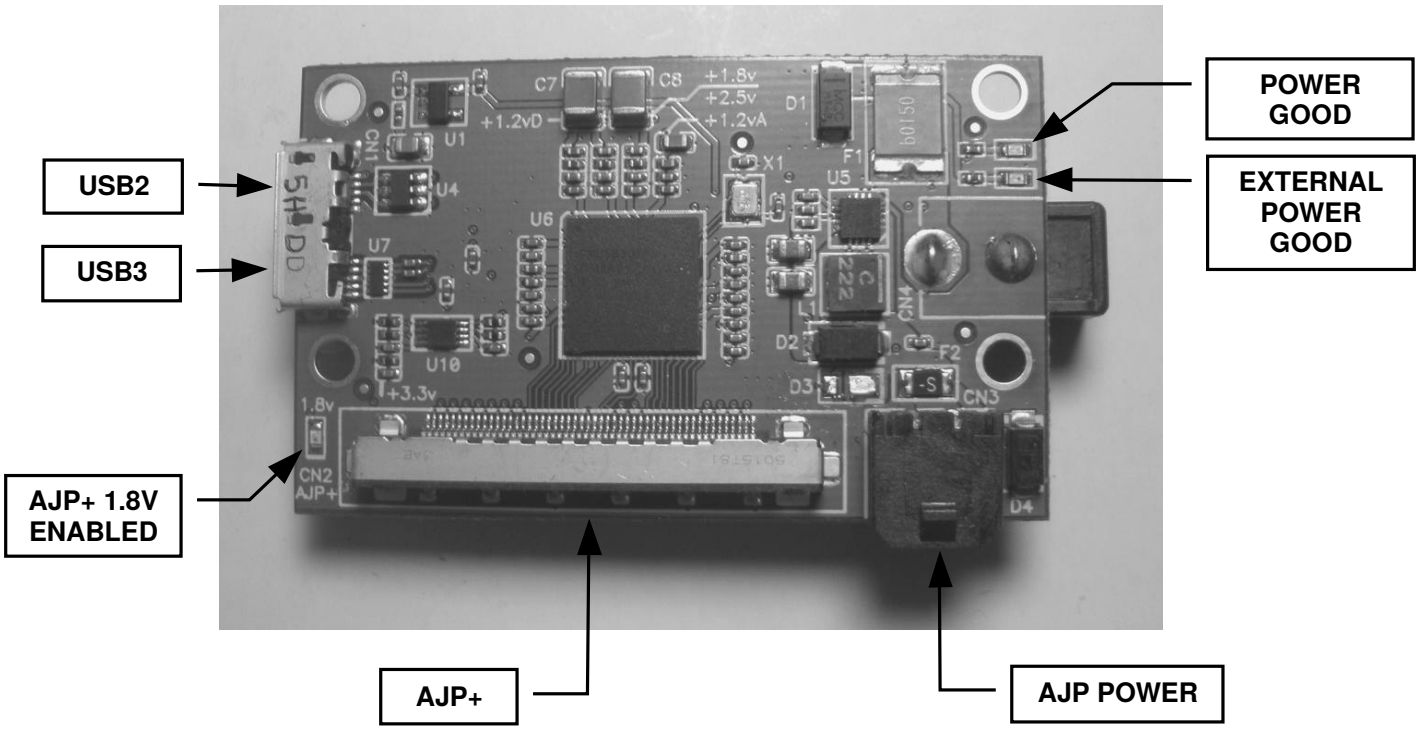
Note that these dimensions are circuit-board dimensions, and do not take into account peripheral space required for connectors. Mounting should also take into consideration overall cooling considerations and issues. These are noted below.

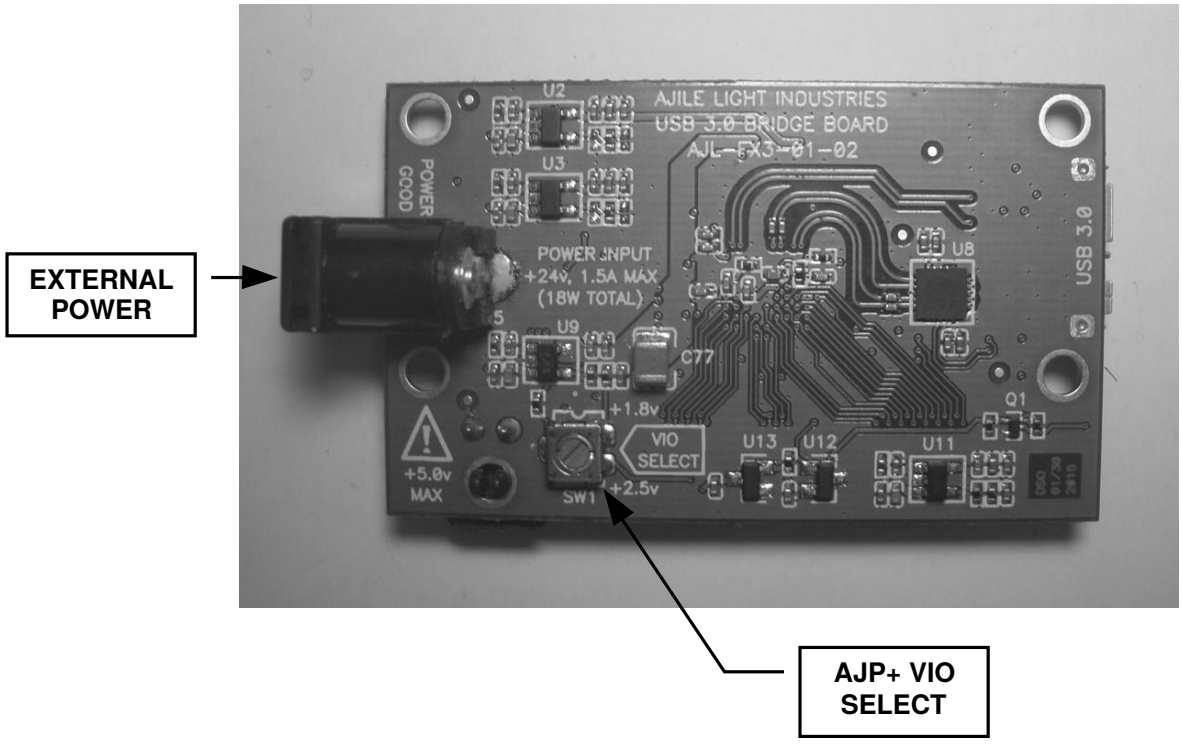
1.3 - Cooling

The Ajile FX3 controller should not encounter any thermal issues in stock form provided that the unit is not enclosed in a zone of stagnant air, as some measure of convective cooling is required. When external power is used, the power dissipated in the board is increased by the heat-load of the power converter, and for situations where thermal performance is critical it is suggested that the board use AJP power as it's primary source rather than external power to minimize this heat load. For extreme situations, a heat-sink can be applied to the FX3 controller chip itself.

For use in an assembly, overall cooling should be analyzed as part of the system and optimized for the requirements noted.

1.4 - External Connections, Indicators, and Adjustments





1.4.1 - USB connector

This is a standard micro-USB3.0 style cable connector. This board is configured to act as a USB device only, and does not support any host connectivity. The connector is split into two sub-connectors, one of which is compatible with standard micro-USB2.0 style cable connectors and supports USB2.0 connectivity at reduced throughput.

Note that this board requires external power to operate fully and boot into operation, and unexpected enumeration of the USB device may occur if a board is connected via USB cable only without external power. With external power, however, it is possible to re-enumerate and reset the port by removal and insertion of the external USB cable in a normal fashion.

1.4.2 - AJP+

The main data connection to the Ajile FS3 USB3.0 controller is provided through a 51-pin flat-flex cable connected to CN2. This cable has no orientation issues, and just needs to be physically connected to another AJP/AJP+ port. Since these cables are polarized and cannot be inserted incorrectly, wiring becomes simply physically connecting the cable to an appropriate port on another Ajile device.

In this application, the port is configured as an AJP+ port, with all defined pins configured as single-ended and connected to the data interface on the FX3 controller.

1.4.3 - AJP Power

The Ajile USB3.0 controller internally requires a raw power input of +4.5-5v for correct operation. One source of power is the 2-pin connector at CN3, which can either sink or source this power. If external power is used, +5v is available on this port to power external Ajile devices since the external power input is converted to AJP power internally. When external power is not used, +4.5-5v AJP power must be applied to this port from another source for correct board operation.

1.4.4 - External power

This is an external power input when this board is used with external power. Input voltage can range between +5v and +24v, with up to 1.5A maximum current depending on system power requirements.

1.4.5 - Status indicators

A number of LED indicators are present on the Ajle FX3 USB3.0 controller to indicate board state. These indicators are summarized as follows:

Ajile DMD Controller LED Indicators

LED	Colour	Function
External Power Good	Orange	Indicates state of the external +5-24v power input
Power Good	Green	Indicates state of 3.3v board internal main power
AJP +1.8v	Yellow	Indicates that the AJP+ port is operating at 1.8v when lit. When dark, indicates AJP+ port operating >1.8v.

1.4.5.1 - External Power Good

When powering the Ajile USB controller from external power, this LED indicator will light orange to indicate presence of this power. Since external power can range over a large input voltage, the relative brightness of the LED can be used as a simple indicator to indicate this voltage as a diagnostic aid to primary power issues.

1.4.5.2 - Power Good

This indicator shows the internal core voltage state of the USB3.0 controller. When lit, it indicates that internal primary power is present and good. Note that if power is derived from the AJP Power port, there will be no 'External Power Good' (orange) LED indicated since AJP power is injected after this external power regulator but before board power distribution. Under normal conditions utilizing external power however, both the orange and green LED's should be lit.

1.4.5.3 - AJP +1.8v

When lit, this LED indicates that the AJP+ port is currently running at an I/O voltage of +1.8v. The 'VIO Select' switch on the bottom side of the board assembly can select this voltage. If a voltage other than +1.8v is selected, the LED is extinguished indicating high-voltage port (typically +2.5v) operation.

1.4.6 - VIO Select

This rotary switch is used to select AJP+ VIO voltage. As noted above, if +1.8v is selected as this voltage, there is a yellow indicator light that indicates this state near the AJP+ connector. For this board the alternate voltage option is 2.5v, and actual voltage selection is made by turning the slotted arrow in the center of the switch assembly with a small screwdriver until the arrow points at the desired VIO voltage.