µEZ® GUI Expansion Board Design Guide

Table of Contents

1.0 Introduction

This document provides basic guidelines for customers to follow when designing a custom Expansion Board for use with our µEZ GUI Family of products. Refer to the µEZ GUI User's Manual for detailed information on the Pin out of the Expansion Connector and power requirements.

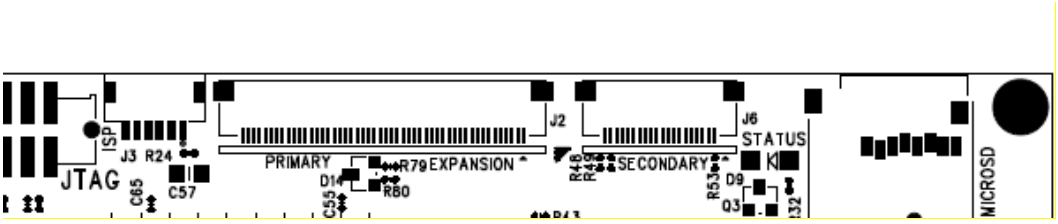
2.0 Board Layout and Connector Orientation

µEZ GUI products come with two expansion headers, shown in the diagrams below. These connectors include one 50-pin connector referred to as the "Primary Expansion" and one 20-pin connector referred to as the "Secondary Expansion". Altogether, these 70 pins provide power and functionality to the µEZ GUI device, bringing over a multitude of communication, status, and GPIO signals. When connecting a device with a cable (cable options shown in section 8), it is important to remember the orientation of pin 1 on each board.

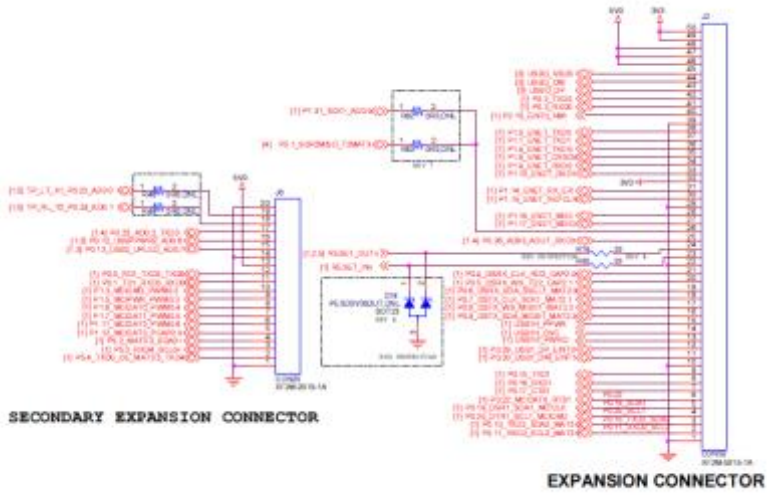
For example, the UEZGUI-1788-43WQR expansion connector is shown below. Note that on the 50-pin expansion connector, pin 50 represents the power plane 3V3 (3.3 Volts), and pin 1 is ground.

UEZGUI-1788-43WQR Expansion Connectors

(Note: Pin 1 on Right Hand Side of Connector – Top of Board Shown)

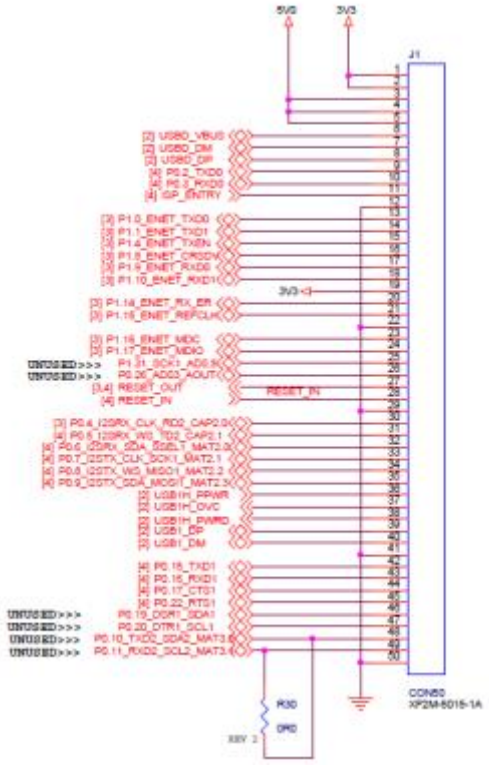


UEZGUI-1788-43WQR Expansion Connector Schematic



The expansion connector for the UEZGUI-EXP1, an expansion board designed by Future Designs, Inc. Pin 50 is now ground, and pin 1 is 3V3.

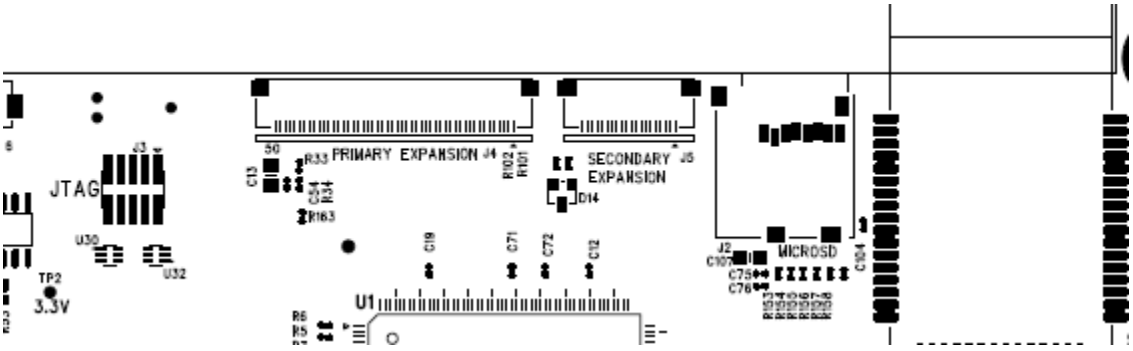
UEZGUI-EXP1 Expansion Connector Schematic



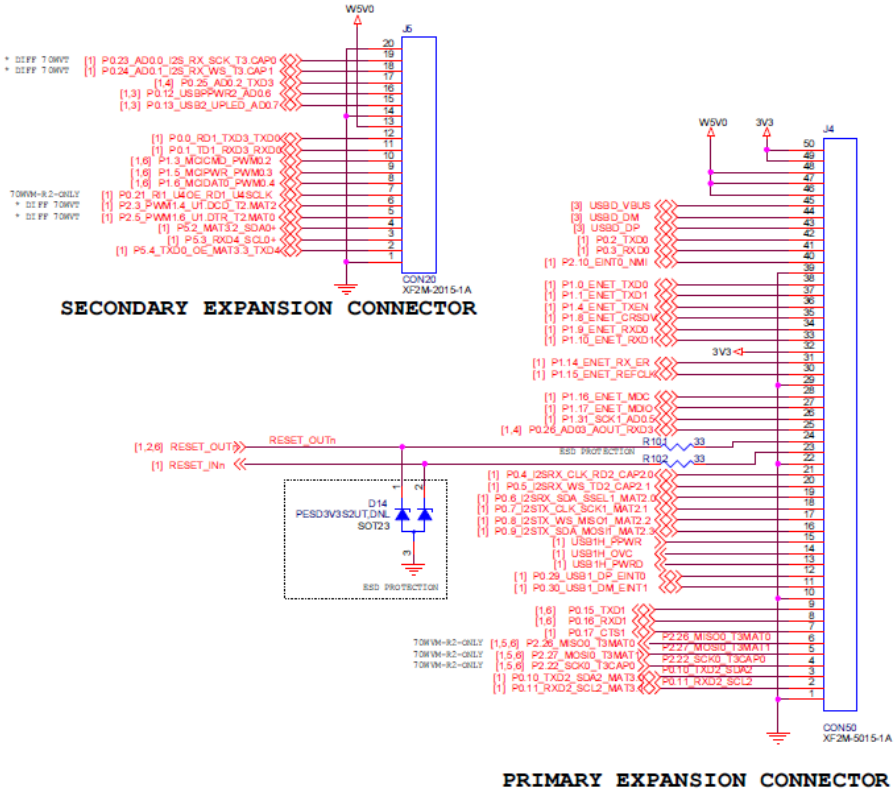
Below are further examples of the pinouts of µEZ GUI products, including their pin 1 designation on the PCB and their pinout on the Schematic. You can find this information and more in the product's User's Manual.

UEZGUI-1788-70WVM Expansion Connectors

(Note: Pin 1 on Right Hand Side of Connector – Top of Board Shown)

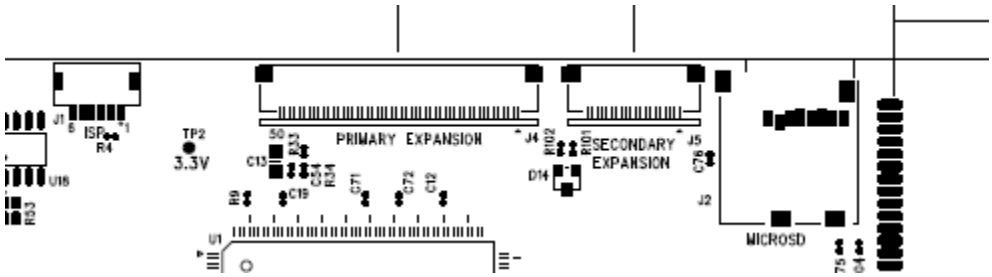


UEZGUI-1788-70WVM Expansion Connector Schematic



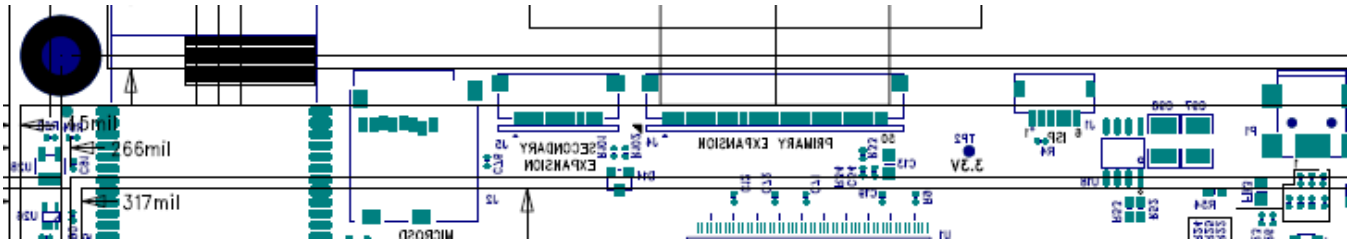
UEZGUI-1788-70WVT Expansion Connectors

(Note: Pin 1 on Right Hand Side – Bottom of Board Shown)

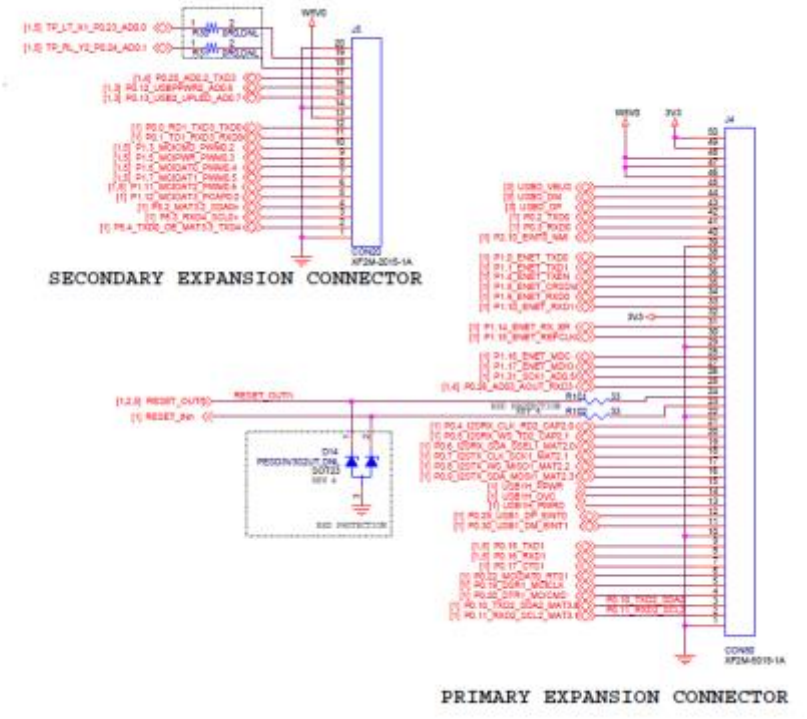


UEZGUI-1788-70WVT Expansion Connectors

(As seen from Top of Board)

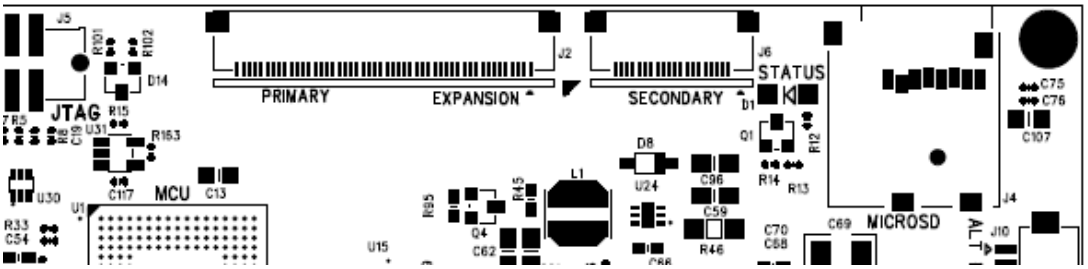


UEZGUI-1788-70WVT Expansion Connector Schematic

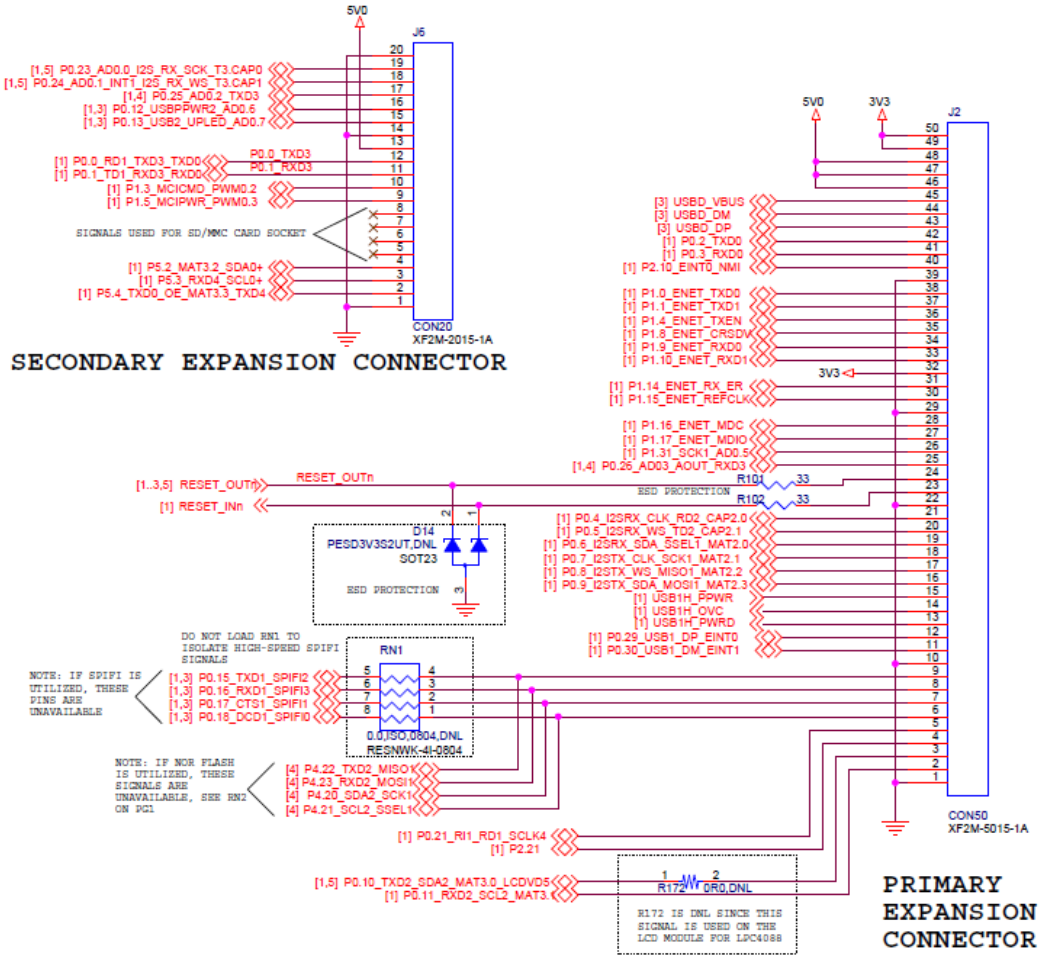


UEZGUI-4088-43WQN Expansion Connectors

(Note Pin 1 on Right Hand Side – Top of Board Shown)

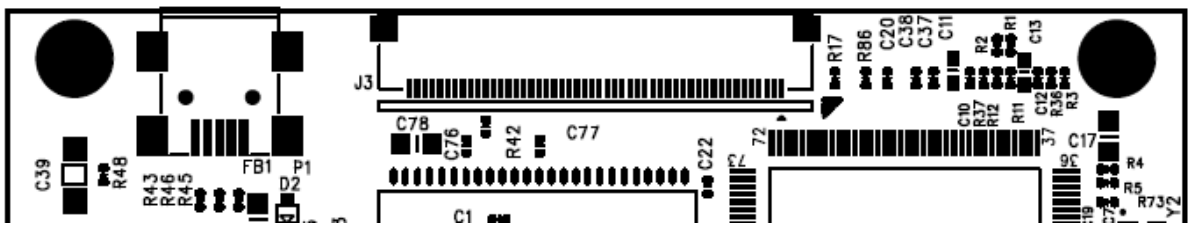


UEZGUI-4088-43WQN Expansion Connector Schematic

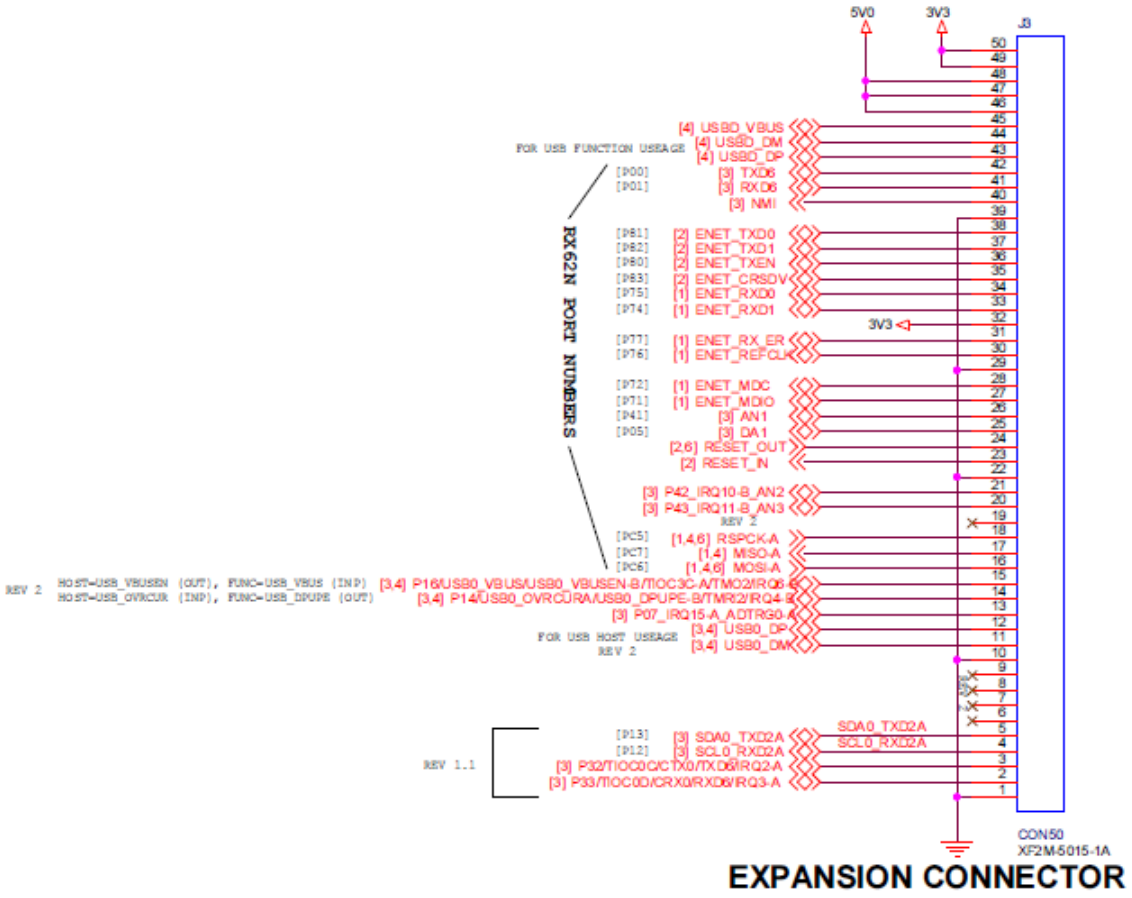


UEZGUI-35QT-RX62N Expansion Connectors

(Note: Pin 1 on Right Hand Side – Top of Board Shown)



UEZGUI-35QT-RX62N Expansion Connector Schematic



3.0 Power Supply

There are two methods of powering a system based on the µEZ GUI;

a) 5VDC Power into the µEZ GUI, either via µEZ GUI connector or from the expansion board interface connectors
b) Power into the expansion board and 5VDC out to the µEZ GUI

Method a) allows an expansion board to be designed possibly without a separate power supply if it can be powered by 5V & 3.3V from the µEZ GUI. The 'system' 5VDC may be provided either by the Mini-B USB connector or Alternate Power/Comm connector of the µEZ GUI, or via the expansion connector from the expansion board.

Method b) allows the µEZ GUI system to be powered by a voltage greater than 5VDC by utilizing a DC-to-DC power supply on the expansion board to generate the required regulated 5VDC for the µEZ GUI. It is still possible for the µEZ GUI to provide the 3.3VDC power to the expansion board, thus only requiring a single DC-to-DC to create the 5VDC.

- Smaller µEZ GUIs (i.e. 3.5" & 4.3") can provide a maximum of 300mA of 3.3V power over the expansion connectors. Larger µEZ GUIs (i.e. 5.6" & larger) are typically capable of providing a maximum of 100mA of 3.3V power over the expansion connectors. (see the user's manuals for the most up-to-date power information)
- If more power is needed for the expansion board:
    - The primary power input (i.e. 5V) should be located on the Expansion Board rather than on the µEZ GUI.
    - The expansion board should be designed with a separate 3.3V voltage regulator.
    - Ensure the 3.3V voltage rails of the µEZ GUI & Expansion Board are not connected together.
    - The µEZ GUI should be powered using 5V from the Expansion Board over the 70 pin breakout, instead of powering the Expansion Board from the µEZ GUI unit.

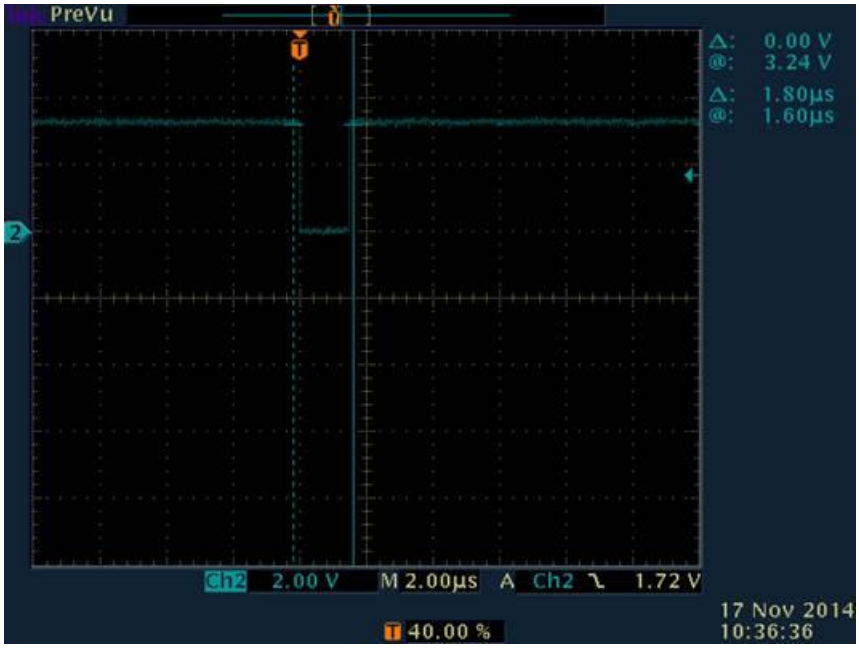
4.0 Reset

4.1 Reset Input/Output

The µEZ GUI includes an on board power-on reset circuit connected directly to the processor. This power-on reset circuit includes a push button switch for user reset capability. In addition, there is a signal available on the expansion connector to allow for off board activation of the reset signal to the CPU.

4.2 Software Reset

A software reset can be generated using the internal Watchdog Timer on the CPU, but due to the architecture of the NXP LPC1700/4300 Microcontrollers, the RESET_OUTn pulse may be too short for some devices to properly reset. The image below shows the pulse generated by the CPU when the Watchdog Timer is tripped.



RESET_OUTn Pulse on a uEZGUI-1788-43WQR-BA Rev 7

As you can see from the image the pulse is only 1.8µs. For many applications this will be sufficient, but some devices may require longer resets to properly initialize.

4.2.1 *Example Part with Longer Reset Time*

The LAN8720 Ethernet PHY is an example of a part that requires a longer reset time. Excerpt from the LAN8720 data sheet:

5.3.6.1 Hardware Reset

Hardware reset is asserted by driving the nRST input low.

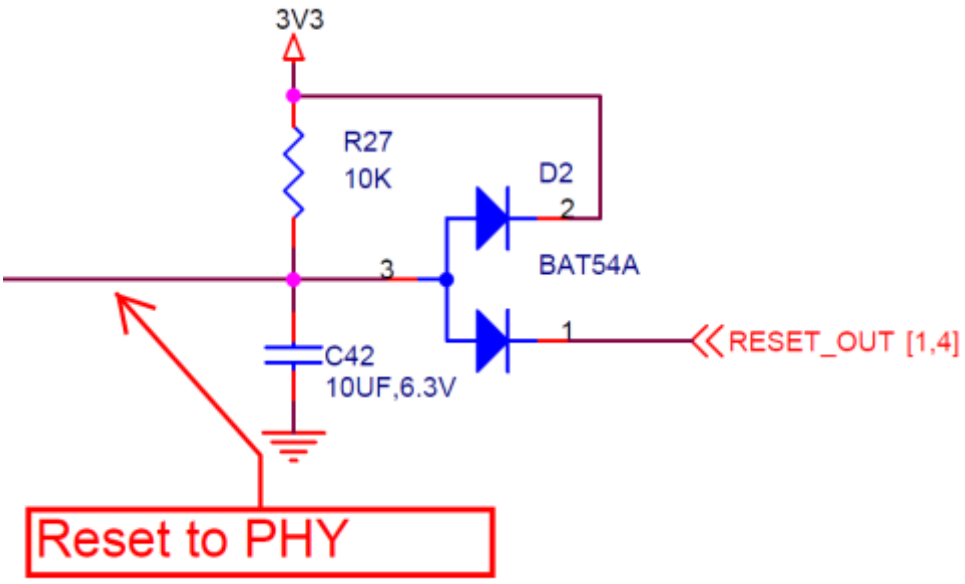
When the nRST input is driven by an external source, it should be held LOW for at least 100 us to ensure that the transceiver is properly reset. During a hardware reset an external clock ***must*** be supplied to the XTAL1/CLKIN signal.

This LAN8720 part will not properly reset from a Watchdog Timer software reset and may cause the application to lock up when the Ethernet Control block is powered on.

4.2.2 Solutions

4.2.2.1 Signal Stretching

It is possible to generate a stretch reset pulse using a simple RC network as shown below;



4.2.2.2 Dedicated MCU output GPIO Reset to the Device

Connect a MCU GPIO signal to the device RESET input signal with a weak pull up resister, usually 10KΩ. When the application software needs to initiate a reset, the application should pull the GPIO pin low and delay for the required reset time and before then tripping the Watchdog. Optionally, the GPIO pin may also be toggled on startup before the device is initialized. The drawback to this configuration is the lack of a power-on reset.

4.2.2.3 Dedicated MCU output GPIO Reset Loopback to the MCU

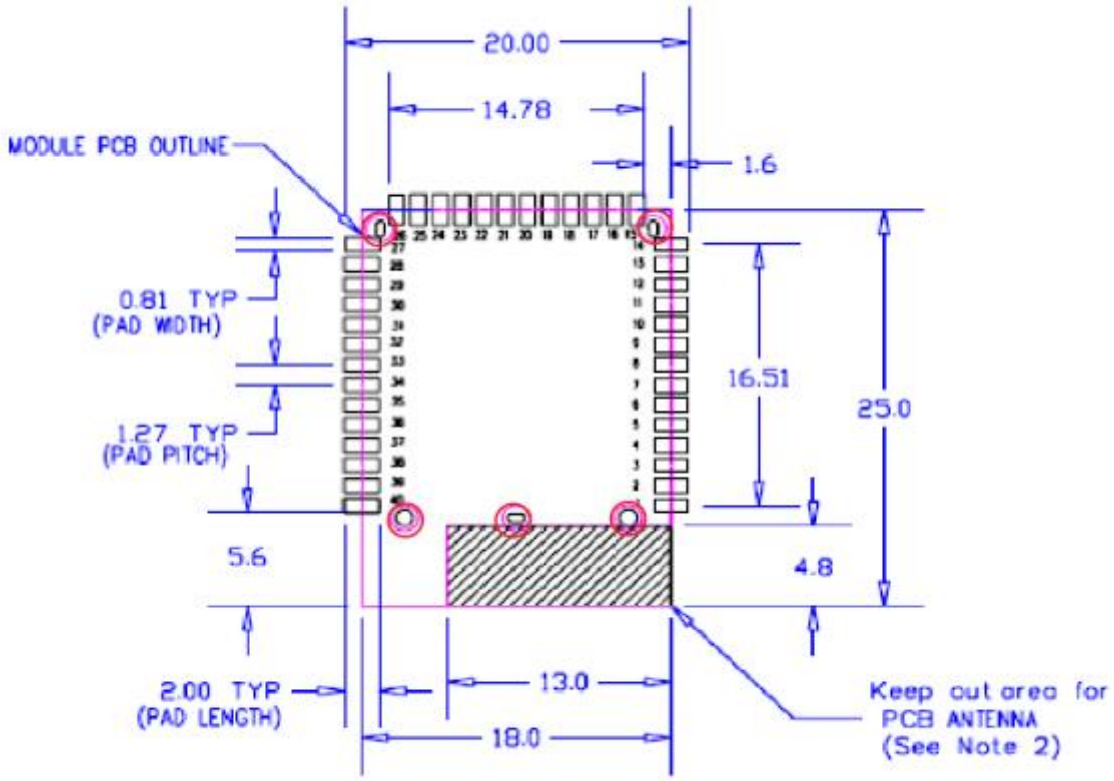
Connect a MCU GPIO signal to RESET_INn of the MCU. When the application software needs to initiate a reset, the application simply sets this GPIO pin LOW, thus simulating the pushbutton reset has been depressed. When the MCU goes into reset, the GPIO pin will be reset, reverting to the default Quasi Bidirectional input mode with weak pullup. The Power Reset circuitry will ensure the proper reset pulse width. The drawback to this configuration is the potential for an accidental system reset via inadvertent toggling of this pin.

5.0 Wi-Fi Modules

Due to the sensitivity of these modules special considerations need to be made for the board design.

5.1 GainSpan®

Refer to www.gainspan.com for the latest information and datasheets for the module being used.



GS2100Mxx Module

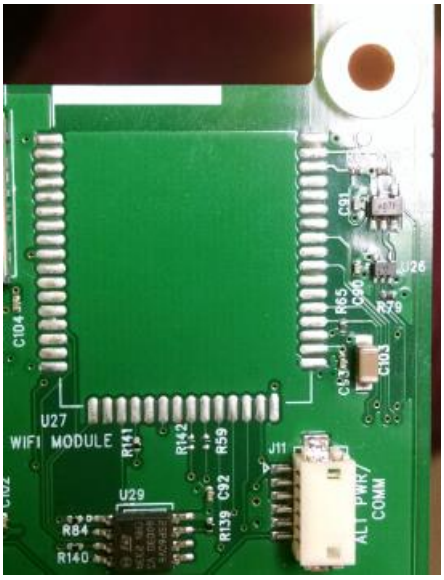
Notes:

1. All Dimensions are in millimeters (mm). Tolerances for .x is +/- 0.4 and for .xx is +/- 0.10.
2. Absolutely no metal trace or ground layer underneath this area. If using ceramic antenna, it is recommended to have only air under this area. Hang antenna over edge of base board or cut notch in base board.

Notes from the Datasheet

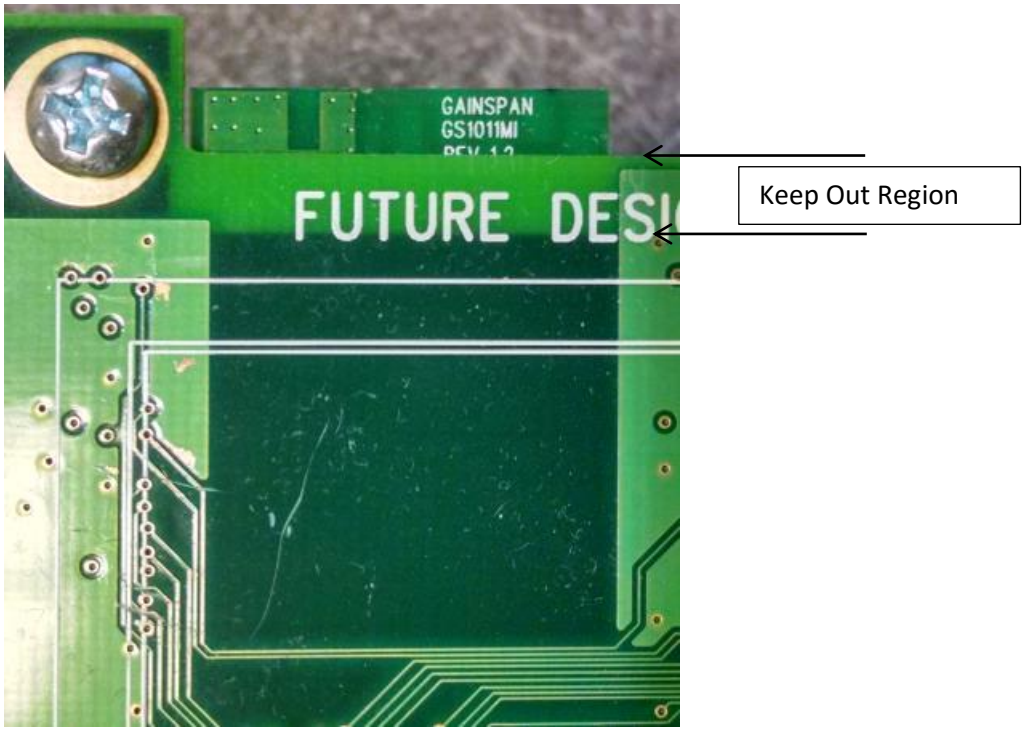
5.1.1 µEZ GUI Examples

All µEZ GUI devicess adhere to the recommendation made by GainSpan. Below are some example placements using GS1011MIP modules.



UEZGUI-1788-70WVT-BA Rev 5.0

UEZGUI-1788-70WVM-BA Rev 1.1 with GainSpan Module (component view)



UEZGUI-1788-70WVM-BA Rev 1.1 with GainSpan Module (front view)

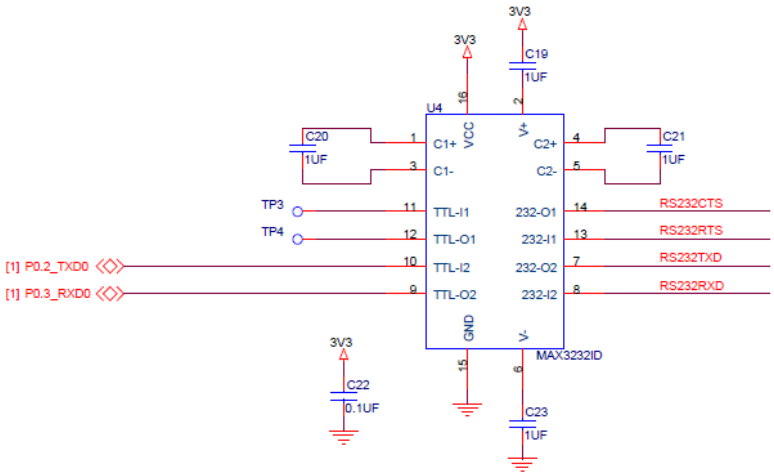
6.0 Ethernet

It is recommended that the PHY be placed as close as possible to the expansion connector and that the Flex Cable used is no longer than 3.0”. Due to the frequency of these signals, the traces should be both impedance and length matched for the most reliable communication. Long traces and long cables can degrade the performance, especially when running at 100Base-T data rates.

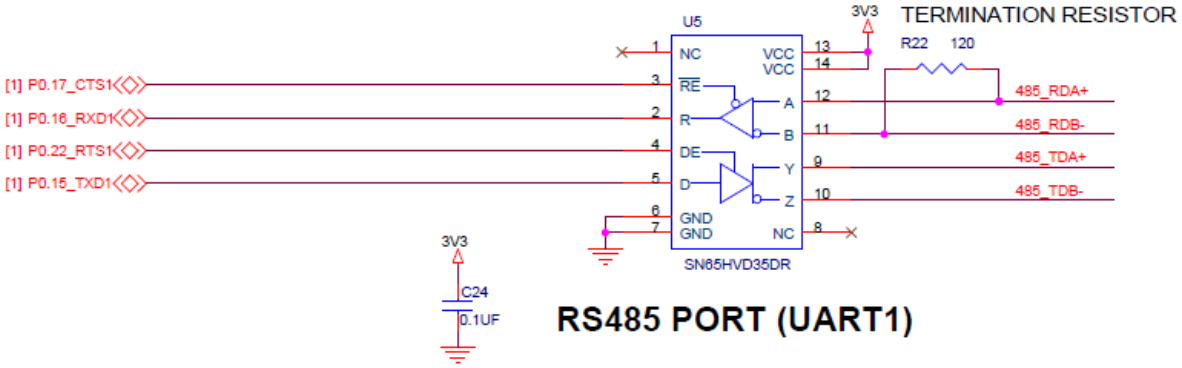
Should mechanical restraints require a longer cable, the software will most likely need to be manually set to 10Base-T for lower data rates, however, this option is not recommended by FDI.

7.0 Serial Port (UART-based)

For serial based communications, UART ports in both RS232 and RS485 configurations are available over the expansion connector from µEZ GUI devices. The following example shows the UEZGUI-EXP1-DK UART connection, demonstrating a possible use-case for Serial communication.



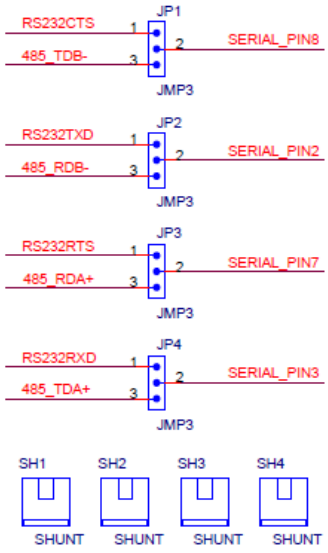
RS232 PORT (UART0)

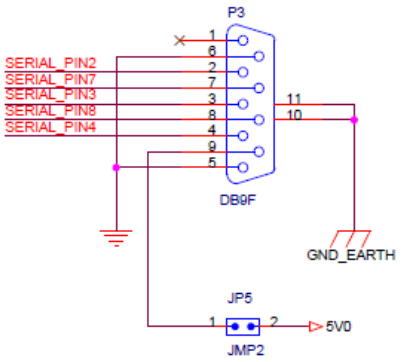


RS485 PORT (UART1)

JUMPER 1-2 FOR RS232 ON UART0
JUMPER 2-3 FOR RS485 ON UART1

DEFAULT 1-2





JUMPER HERE FOR POWER THROUGH DB9 (IN OR OUT) TYPICALLY FOR RS485 OPERATION

8.0 Slave MCU

For complex expansion boards, with significant control input/outputs, it is recommended to use a 'Slave MCU' thus freeing up the µEZ GUI MCU to handle the user interface. Example slave MCU would be an LPC1768 for medium complexity or LPC1224 for improved noise immunity in industrial applications.

The communications link between the µEZ GUI and the slave MCU could be UART, I2C, or even SPI. Selection of the communication interface should be given careful evaluation for criteria such as latency, bandwidth, and complexity.

FDI supports slave MCUs in custom design services and can even provide slave MCU firmware update capability via the FDI Bootloader Product.

9.0 Expansion Board FPC Cables

The following table provides example part numbers for the expansion cables:

Description	Mfg	Mfg PN	Digi-Key Pn
3" 20-pin 0.5mm	Molex	21020-0209	WM10226-ND
6" 20-pin 0.5mm	Molex	21020-0215	WM10218-ND
3" 50-pin 0.5mm	Molex	21020-7650	WM10231-ND
6" 50-pin 0.5mm	Molex	21020-0548	WM10223-ND

Note: These lengths are only recommendations. The actual lengths utilized will be dependent on the expansion board circuitry, layouts and general environment of the application. It is up to the customer to test and validate the functional operation and use of the expansion connectors