Mezzanine Design Guidelines

Version 1.0, July 2017

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Introduction

The 96Boards Consumer Edition (CE) Specification defines two versions of Mezzanine Boards - Small Modules (maximum area 85mmx54mm which do not exceed footprint of 96Boards CE main board) and Large Modules (no size limit). Mezzanine boards are designed to extend 96Boards capabilities. Examples of Mezzanine boards include: utilizing specific I/O interfaces, additional processing units exchange data and control with 96Boards hardware, or breakout of signals on the LS and HS connectors.

This guideline highlights considerations for Mezzanine PCBs to ensure compatibility, and wide community acceptance.

Naming Convention

The naming for Mezzanine boards to work with 96Boards family should follow below convention:

96B-[A][B]-V[C]-[D]

96B: This should be used as prefix for every Mezzanine board.
A: Specify the compatible board specification.

05 = Low-speed connector (standard in CE, IE & EE specifications)
10 = High-speed connector (standard in CE specification)
Others = Reserved for Future Edition(s)

B: Should be no longer than 20 Character summary of the board main functionality, such as UART, CAMERA, LCD etc. For multi-functional boards, the description could be the short summary of the application. E.g. robot, audio

C: Version number.

D: Should be no longer than 5 character string for vendor name to differentiate between similar mezzanines from different vendors. E.g. 96B-05SENSOR-V1.2-SEEED

Example: 96B-05UART-V1.1 is the 96Boards UART Mezzanine works for both CE and EE compliant boards.

Mechanical specifications and form factor

Due to the variety of expected Mezzanine designs, it is not mandatory to have the same form-factor as the 96Boards main board. These guidelines are provided to protect the Main Boards as well as consistency of Mezzanine designs.

- Connectors used are recommended to satisfy the board to board separation specification of 8.0mm (with 96Boards main board)
- All connectors are advised to be within 3mm of the edge of the board
- For mezzanines using only the LS expansion connector, use of a shrouded male mating connector on the mezzanine is strongly recommended. Use of a shrouded male connector is intended to prevent misaligned insertion
  Mezzanines using both LS and HS expansion connectors may use a shrouded low-speed connector, but this may not be required at the designer's discretion, since the HS connector provides the necessary mechanical alignment.
- Edges of the board are recommended for I/O connectors
- Mezzanine boards with four mounting holes are preferred. The locations of the four mounting holes must align with the 4 holes on the 96Boards main board.
- Mezzanine board kits which include four 8mm standoffs and eight 2.5mm screws to mechanically mount the mezzanine board are preferred
- A sample template project for a Mezzanine board is available on github

Large Boards

Large Boards have some additional mechanical considerations:

- Large Boards should be able to interoperate with both the CE Specification boards as well as the Extended CE Specification Boards. The Extended CE Specification permits areas with components taller than the 7mm board to board separation. Large Mezzanine boards should take these areas into account and provide clearance for the taller components
- Extended CE Boards may use tall connectors in the tall component region, clearance should alse be left for cables exiting from the tall region.

Small Boards

It is strongly recommended that Small Boards that are only attached to the LS connector are designed with at least one mounting hole to stabilize an installed board.

Stacking options

It is possible to design Mezzanines for stacking, this permits addition of more than one mezzanine board for additional system level functionality.

- When designing a stackable mezzanine board, the majority of signals should pass straight through from the lower board to the upper board.
  - All DC power and ground pins must pass straight through from board to board
  - All signals that are not used on a stackable mezzanine board must pass straight through from board to board
  - It is preferred that signals which can be shared by multiple boards (example I2C) pass straight through from board to board
  - It is preferred that signals that are dedicated to the stackable mezzanine board are not passed through to the next board in the stack.

- When designing a stackable mezzanine board, apart from header chosen need to satisfy board separation specification (8.0mm), any protruding components could block stacking also need to be revisited.
- Components require metal shield can need to avoid short circuiting adjacent PCBs.
- The bottom side of a stackable mezzanine must be designed with component heights which will not interfere with the maximum possible height of components on the 96Boards CE board. The bottom side LS (and optional HS) connector(s) must mate with the CE Board connectors.
- It is recommended that all connections from a stackable mezzanine board come from the edge of the board so that a stacked mezzanine does not block access to the connectors.

Test specification

It is recommended that the mezzanine board designer provides test scripts for the Mezzanine board. The test scripts it reduce the necessity of manual verification of the board as well providing a robust way for a production line to carry out automated testing of each mezzanine boards. The test scripts need to cover the following items:

- Board level sanity check points
- I/O interface tests
- Functionality test of more sophisticated logic on board (examples include: audio, Camera, microcontroller etc.)
- Stress test. For complex Mezzanine boards a stress test is required (examples: robotics control processor, mission critical units).

Power options

The CE Specification permits Mezzanine boards to draw up to 12.18 Watts of power (7 Watts from the SYS-DC-IN pins, 5 Watts from the 5.0V pins, and 0.18 Watts from the 1.8V pin). Provided overall power consumption of the mezzanine board is under 12.18 Watts then it may draw power from the processor board. If a mezzanine board requires more that 12.18 Watts, or if the draw on any one of the three supplies exceed the available power, then the mezzanine board must provide it's own supply. A Mezzanine board may provide power to the processor board backwards through the SYS-DCIN pins on the low-speed connector.

High power Mezzanine boards, such as motor control, very large display or robotics, which draw more than 12.18 Watts will require an external power supply. It is recommended that a separate AC-to-DC adapter be provided with the mezzanine board kit. It is preferred that high power mezzanine boards provide power to the CE Board backwards through the SYS_DCIN pins to simplify connection of the system, and to reduce power sequencing issues.

A Power supply mezzanine board (such as a battery pack and battery charger mezzanine board) may be used to power a 96Boards CE board. It is preferred that the the power supply

mezzanine board provides 12 Volts to the SYS_DCIN pins, although any valid SYS_DCIN voltage (8V to 18V) is permitted.

Mezzanine boards which require supply voltages other than the SYS_DCIN, 5V and 1.8V provided by the CE Board must provide onboard regulators.

Reset and Power Buttons

In general a mezzanine board will block access to the power and reset buttons on the CE Board. It is strongly recommended that the mezzanine board provides additional power and reset buttons that connect into the Power and Reset lines on the LS connector. The additional power and reset buttons provide easily accessible power-cycling options on the mezzanine board. It is recommended that the mezzanine board also resets itself when the reset button is pressed.

Configuration data

It is recommended that mezzanines needing configuration add an EEPROM (e.g. 32Kb I2C serial EEPROM) to store configuration data. This will be used, in the future, to auto configure the mainboard to utilise the mezzanine.
It is strongly recommended that this EEPROM is programmable without the need for any special tools using the standard i2c tools in Linux, CAT24M01WI-GT3 for example.

Thermal considerations

96Boards CE boards may dissipate significant power. It is recommended that the mezzanine board be designed considering this factor. If the mezzanine board has devices that are sensitive to heat, offsetting them away from the area between the low and high speed connectors or over the micro-SD/HDMI/USB connectors is advised.

Peripheral connectors

UART

UART1 on the LS connector is used on 96Boards as the default firmware/bringup UART. With that in mind, It is acceptable to implement below options for UART support.

- Use a stackable LS connector so the UART adapter can be attached on top
- Implement USB-UART circuit on the Mezzanine board
- Provide connections for an external UART adapter (such as the UART to USB cable)

Camera Interface

The 96Boards specifications include the Camera interface Addendum which specifies the preferred camera connector and pin layout when designing a Camera Mezzanine board.