View on common design guidelines/practices
BEST PRACTICES

- Documentation
- Design
- Open
- Tools
- Wish list
Each project should have all of its documentation available from one place. This increases re-use and feedback.

Good documentation reduces the workload and shows a professional image of the project.
What

- One-paragraph description
- Main specifications, image
- Project info (design files, design description, FAQ, Users, issues)
- Contacts
- Status table

Where

- Open Hardware Repository
  - ohwr.org
  - (a gitlab instance)
  - Example: https://ohwr.org/project/func-dio-3chttl/a/wiki
fmc-dio-5chttl FMC 5-channel Digital I/O module

The fmc-dio-5chttl 5-channel digital I/O module is a simple board for digital I/O on LEMO connectors. It has been designed for testing White Rabbit functionality as part of the SPEC Demonstration Package for White Rabbit (manual), and it can be used for other general purpose applications too.

Functional specifications

- 5 input/output ports with independently programmable direction (Lemo 00 connectors).
- Output levels: LV TTL capable of driving +2.5 V over a 50-Ohm load. At power-up the outputs are in Hi-Z state.
- Input levels: any logic standard from Vih = 1 V to Vih = 5 V (threshold programmable for each input independently).
- Output Rise/fall times: max. 2 ns.
- I/O bandwidth: 200 MHz.
- Programmable 50-Ohm input termination in each channel.
- LVDS I/O on the carrier side.
- One of the inputs is capable of driving a global clock net in the carrier's FPGA.
Project information

- Official production documentation: EDMS EDA-02408
- Notes on the hardware design
- Software
- Frequently Asked Questions
- Users

Contacts

Commercial producers

- FMC DIO, Seven Solutions, Spain
- FMC DIO Sch TTL a, Crestrch, Poland
- Fmc dio Schtla, INCAA Computers, Netherlands.

Project

- Erik van der Bij - CERN - General question about project
- Tom Wlostowski - CERN - Designer

Project Status

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>27-05-2011</td>
<td>Start of brainstorming.</td>
</tr>
<tr>
<td>19-07-2011</td>
<td>Five cards built. Has some bugs.</td>
</tr>
<tr>
<td>20-09-2011</td>
<td>Updated schematics in SVN. Will pass through CERN's design office.</td>
</tr>
<tr>
<td>12-10-2011</td>
<td>Production documentation available in EDMS. Project closed.</td>
</tr>
<tr>
<td>07-11-2011</td>
<td>Seven Solutions will produce and commercialise the cards.</td>
</tr>
</tbody>
</table>
CFFID - FMC DIO 5ch

FMC digital input/output card with 5 channels.

The fmc-dio-Schittlo 5-channel digital I/O module is a simple board for digital I/O on LEMO connectors. It has been designed for test, while Rabbit functionality as part of the SPEC Demonstration Package for White Rabbit (Manual), and can be used for other general-purpose applications too.

<table>
<thead>
<tr>
<th>Primary Type Name</th>
<th>HCCFFID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Active</td>
</tr>
<tr>
<td>Project page</td>
<td><a href="https://ohwr.org/project/fmc-dio-5chttliawikis">https://ohwr.org/project/fmc-dio-5chttliawikis</a></td>
</tr>
<tr>
<td>Jumper Settings</td>
<td></td>
</tr>
<tr>
<td>Person in Charge</td>
<td>Tom Włostowski</td>
</tr>
<tr>
<td>Driver (afs path)</td>
<td>Current Version</td>
</tr>
</tbody>
</table>
DESIGN (1)

- Design based on standards (FMC, VME, PCIe, cPCI)

- Heavily based on FMC as we support many bus systems (VME, PCIe, mTCA, PXIe)
  - People know standards, more likely to re-use or design for it
  - Mezzanine: small and easier to route cards, eases assembly

- Try to make cards somewhat generic so more re-use
DESIGN (2)

- Use only CERN libraries (precise, IPC norms, often used and debugged already)
- Every design should go through the design office
  - Saves time
  - Design for Manufacturing
  - Standardised production documentation in EDMS, unique EDA reference
  - Eases production as each component and PCB precisely specified
- Review in every phase (specification, schematics, PCB)
  - Document review comments as Issues
OPEN HARDWARE

○ Most of our designs are licensed under CERN Open Hardware License

○ Makes it easier to re-use, also for CERN colleagues

○ Automatically gives a higher priority to write documentation

○ Makes you get more feedback and get a better product
  ○ Bug reports, obsolescence
  ○ Free reviews, hints, tips, new contacts in other fields and technology transfer

○ If also commercially available: may have a stock, no load on you to produce for others
TOOLS

- Mostly Altium, some KiCad
- Production Test System environment - https://ohwr.org/project/pts/wikis
  - OHR site is practical for engineers and is stimulating
  - Let me know if you’d like to make an Open project!
- Helpful entry points for electronics design - https://ohwr.org/project/ed/wikis
- Design review checklist - https://ohwr.org/project/ed/wikis/schematics-checklist
- IPT template for electronics production price enquiry
WISH LIST

- A site where we can find all CERN designs, with documentation, status, etc.

- Example schematic snippets: FPGA powering, input protections, std connectors, ...

- A tool to find commonly used components

- Common framework for setting up Production Test Systems

- Use cern-electronics and electronics-forum for more:
  - discuss a new design you want to start
  - invite people for a coffee
  - share experience – bugs seen, reliability problems, near misses, ...
CONCLUSIONS

- Documentation
- Reviews
- Design office
- Open Hardware helps in many aspects