

About Me(@regymm)

- Physics undergrad finished last year
- FPGA, PCB design, RISC-V, osdev, scavenge & tweak, NetHack, webcomic...
- SDR: too interesting to ignore...



Today

- Background that I don't understand much
- My work: openwifi to PYNQ-Z1
- About "modern" hardware DIY at home

Background

- Xilinx ZYNQ + ADI AD936X is very capable
- 7010 CLG225 + AD9363 => PlutoSDR
- 7020 CLG400 above + AD9364 => openwifiSp

Background

- Price is a problem
 - Zedboard + FMCOMMS3 \$1300
 - ADRV9364-Z7020 + Carrier \$800
 - ANTSDR E310 \$300
 - PlutoSDR \$150

- PYNQ-Z1 \$200?
 - Do I really need another ZYNQ for SDR?
 - Or an extension can made it?





- AD936X requirements
 - ~21 GPIO at 1.8V/2.5V
 - 16 LVDS diffpairs @ ~120 MHz DDR
- What PYNQ-Z1 has
 - ~49 GPIO at 3.3V, poorly routed
 - 2x HDMI, each 4 diffpairs, 50R* pullup terminaion
 - 2x PMOD, each 4 diffpairs w/ 200R* series and ESD diodes*
 *can be removed/hacked but I don't want to

- AD936X requirements
- ~21 GPIO at 1.8V/2.5V
 16 LVDS diffpairs @ ~40 MHz DDR
 What PYNQ-Z1 has LVDS to single-ended(TX)
 ~49 GPIO at 3.3V, poorly routed
 2x HDMI, each 4 diffpairs, 50R* pullup terminaion
 3.3V to 1.8V
 2x PMOD, each 4 diffpairs w/ 200R* series and ESD diodes*

*can be removed/hacked but I don't want to

Hack 9363 to 9364 is bad but...



• RF frontend based on kangyuzhe666/ZYNQ7010-7020_AD9363



- Firmware porting based on ANTSDR
 - checklist: adi-hdl(IO, ps7, xdc), u-boot, kernel, dts
- Stick to 1 RX 1TX mode(TX can run ~50 MHz DDR at most)
- ... and afaik everything works
 - Openwifi 5G hotspot/client
 - GQRX FM
 - ADS-B

• Other boards?



4 PMODs RX & TX, 5th PMOD => 8 IOs, MIPI => 8 Ios, MIO?

Picture from digilent.com



Some 42 PL IOs, 100 M Eth too bad

Picture from https://github.com/xjtuecho/EBAZ4205

About "modern" HW DIY at home

- Manufacture at JLCPCB/... leaded 4-layer 0.8mm BGA should be affordable
- "Refurbished" chips on Taobao/Aliexpress
- Soldering iron(936 or hakko T12 clone) + heatgun + solder paste + flux



About "modern" HW DIY at home

• BGA?



Thanks!

- Dr. Jiao's nice help & invitation to FOSDEM
- kangyuzhe666's SDR
- Various discussion groups

Q & A

Contact

- GitHub repo for PYNQSDR: github.com/regymm/PYNQSDR
- My Twitter: @regymm0
- My Telegram: @regymm0 Channel: t.me/xtalhart

*For later viewers: it's recommended to watch the talk, many important stuffs are not shown in this slides

*Proudly made with LibreOffice