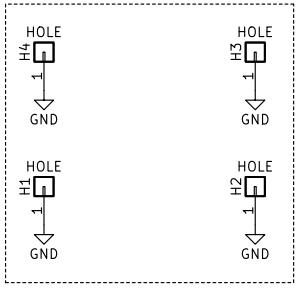


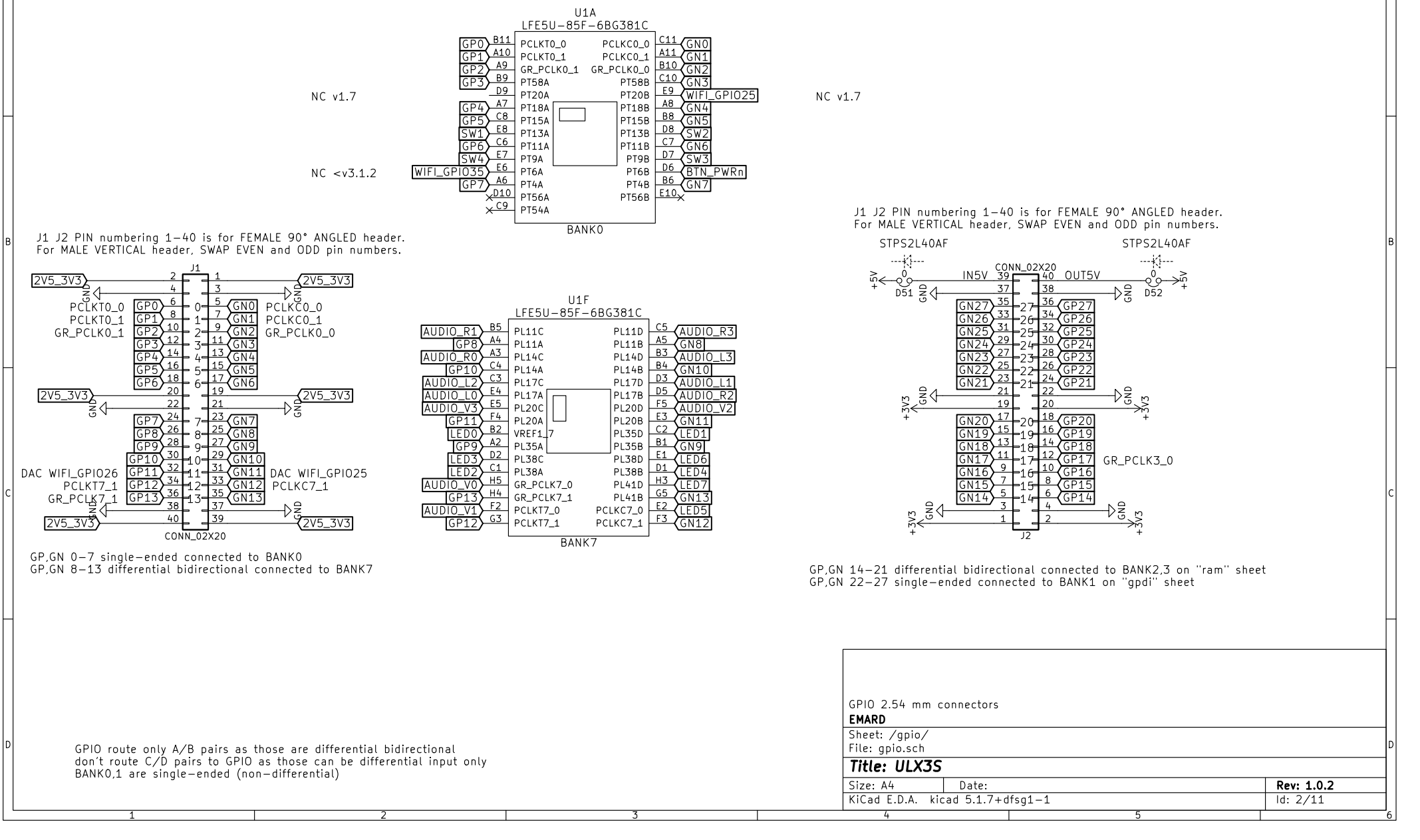
click on mouse pointer arrow on top of right toolbar
and double-click on sheet to open

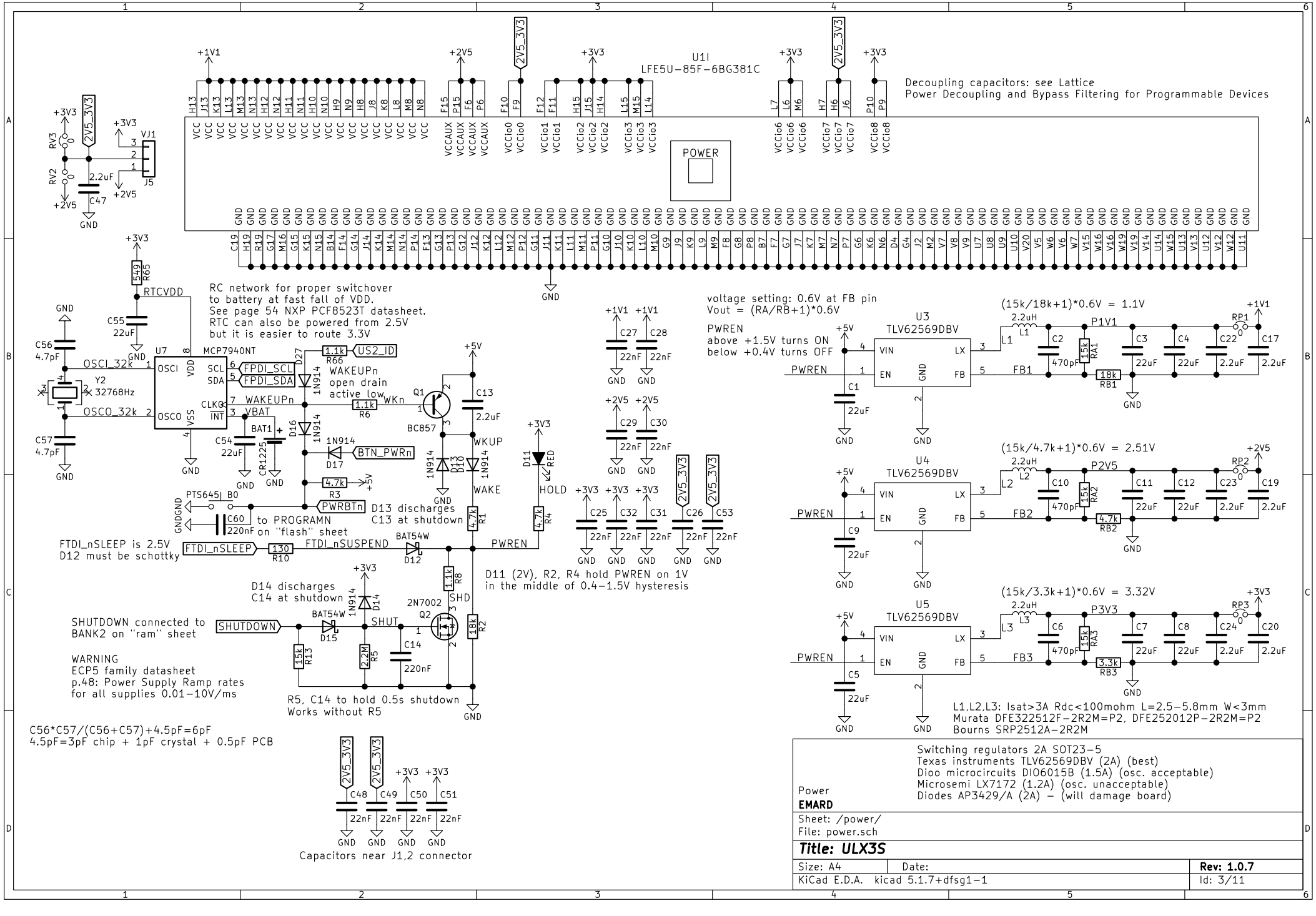
Sheet: power	Sheet: usb	Sheet: blinkey	Sheet: ram	Sheet: serdes
File: power.sch	File: usb.sch	File: blinkey.sch	File: ram.sch	File: serdes.sch
Sheet: gpio	**Sheet: gpdi**	**Sheet: analog**	**Sheet: wifi**	**Sheet: flash**
File: gpio.sch	File: gpdi.sch	File: analog.sch	File: wifi.sch	File: flash.sch

Root sheet
EMARD
Sheet: /
File: ulx3s.sch

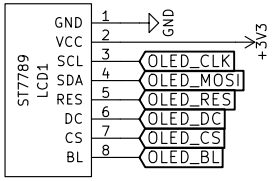
Title: ULX3S

Size: A4	Date:	**Rev: 3.1.4**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 1/11

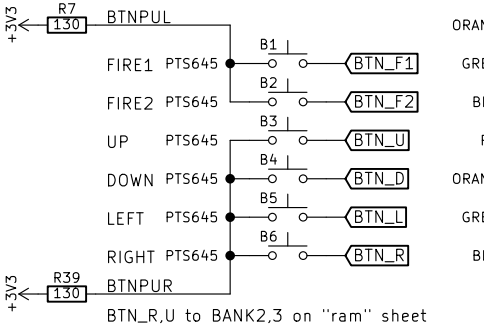

U1A
LFE5U-85F-6BG381C
NC v1.7
NC <v3.1.2
GP0 B11 PCLKT0_0
GP1 A10 PCLKT0_1
GP2 A9 GR_PCLK0_1
GP3 B9 PT58A
D9 PT20A
GP4 A7 PT18A
GP5 C8 PT15A
SW1 E8 PT13A
GP6 C6 PT11A
SW4 E7 PT9A
WIFI_GPIO35 E6 PT6A
GP7 A6 PT4A
D10 PT56A
C9 PT54A
C11 PCLKC0_0 GN0
A11 PCLKC0_1 GN1
B10 GR_PCLK0_0 GN2
C10 PT58B GN3
E9 PT20B WIFI_GPIO25
A8 PT18B GN4
B8 PT15B GN5
D8 PT13B SW2
C7 PT11B GN6
D7 PT9B SW3
D6 PT6B BTN_PWRn
B6 PT4B GN7
E10 PT56B
BANK0
NC v1.7
J1 J2 PIN numbering 1-40 is for FEMALE 90° ANGLED header.
For MALE VERTICAL header, SWAP EVEN and ODD pin numbers.
J1
2V5_3V3
GND
PCLKT0_0
PCLKT0_1
GR_PCLK0_1
GP0 GP1 GP2 GP3 GP4 GP5 GP6
GN0 GN1 GN2 GN3 GN4 GN5 GN6
PCLKC0_0
PCLKC0_1
GR_PCLK0_0
GP7 GP8 GP9 GP10 GP11 GP12 GP13
GN7 GN8 GN9 GN10 GN11 GN12 GN13
DAC WIFI_GPIO26
PCLKT7_1
GR_PCLK7_1
DAC WIFI_GPIO25
PCLKC7_1
CONN_02X20
U1F
LFE5U-85F-6BG381C
AUDIO_R1 B5 PL11C
GP8 A4 PL11A
AUDIO_R0 A3 PL14C
GP10 C4 PL14A
AUDIO_L2 C3 PL17C
AUDIO_L0 E4 PL17A
AUDIO_V3 E5 PL20C
GP11 F4 PL20A
LED0 B2 VREF1_7
GP9 A2 PL35A
LED3 D2 PL38C
LED2 C1 PL38A
AUDIO_V0 H5 GR_PCLK7_0
GP13 H4 GR_PCLK7_1
AUDIO_V1 F2 PCLKT7_0
GP12 G3 PCLKT7_1
C5 PL11D AUDIO_R3
A5 PL11B GN8
B3 PL14D AUDIO_L3
B4 PL14B GN10
D3 PL17D AUDIO_L1
D5 PL17B AUDIO_R2
F5 PL20D AUDIO_V2
E3 PL20B GN11
C2 PL35D LED1
B1 PL35B GN9
E1 PL38D LED6
D1 PL38B LED4
H3 PL41D LED7
G5 PL41B GN13
E2 PCLKC7_0 LED5
F3 PCLKC7_1 GN12
BANK7
J1 J2 PIN numbering 1-40 is for FEMALE 90° ANGLED header.
For MALE VERTICAL header, SWAP EVEN and ODD pin numbers.
STPS2L40AF
STPS2L40AF
+5V
D51
D52
GND
CONN_02X20
IN5V
OUT5V
GN27 GN26 GN25 GN24 GN23 GN22 GN21
GP27 GP26 GP25 GP24 GP23 GP22 GP21
+3V3
GN20 GN19 GN18 GN17 GN16 GN15 GN14
GP20 GP19 GP18 GP17 GP16 GP15 GP14
GR_PCLK3_0
J2
GP,GN 0-7 single-ended connected to BANK0
GP,GN 8-13 differential bidirectional connected to BANK7
GP,GN 14-21 differential bidirectional connected to BANK2,3 on "ram" sheet
GP,GN 22-27 single-ended connected to BANK1 on "gpdi" sheet
GPIO route only A/B pairs as those are differential bidirectional
don't route C/D pairs to GPIO as those can be differential input only
BANK0,1 are single-ended (non-differential)
GPIO 2.54 mm connectors
EMARD
Sheet: /gpio/
File: gpio.sch
Title: ULX3S
Size: A4
Date:
Rev: 1.0.2
KiCad E.D.A. kicad 5.1.7+dfsg1-1
Id: 2/11


U1I
LFE5U-85F-6BG381C
POWER
Decoupling capacitors: see Lattice
Power Decoupling and Bypass Filtering for Programmable Devices
RC network for proper switchover
to battery at fast fall of VDD.
See page 54 NXP PCF8523T datasheet.
RTC can also be powered from 2.5V
but it is easier to route 3.3V
MCP7940NT
WAKEUPn
open drain
active low
D13 discharges
C13 at shutdown
to PROGRAMN
on "flash" sheet
FTDI_nSLEEP is 2.5V
D12 must be schottky
D14 discharges
C14 at shutdown
SHUTDOWN connected to
BANK2 on "ram" sheet
WARNING
ECP5 family datasheet
p.48: Power Supply Ramp rates
for all supplies 0.01-10V/ms
R5, C14 to hold 0.5s shutdown
Works without R5
D11 (2V), R2, R4 hold PWREN on 1V
in the middle of 0.4-1.5V hysteresis
C56*C57/(C56+C57)+4.5pF=6pF
4.5pF=3pF chip + 1pF crystal + 0.5pF PCB
Capacitors near J1,2 connector
voltage setting: 0.6V at FB pin
Vout = (RA/RB+1)*0.6V
PWREN
above +1.5V turns ON
below +0.4V turns OFF
(15k/18k+1)*0.6V = 1.1V
(15k/4.7k+1)*0.6V = 2.51V
(15k/3.3k+1)*0.6V = 3.32V
L1,L2,L3: Isat>3A Rdc<100mohm L=2.5-5.8mm W<3mm
Murata DFE322512F-2R2M=P2, DFE252012P-2R2M=P2
Bourns SRP2512A-2R2M
Switching regulators 2A SOT23-5
Texas instruments TLV62569DBV (2A) (best)
Dioo microcircuits DIO6015B (1.5A) (osc. acceptable)
Microsemi LX7172 (1.2A) (osc. unacceptable)
Diodes AP3429/A (2A) - (will damage board)
Power
EMARD
Sheet: /power/
File: power.sch
Title: ULX3S
Size: A4
Date:
Rev: 1.0.7
KiCad E.D.A. kicad 5.1.7+dfsg1-1
Id: 3/11

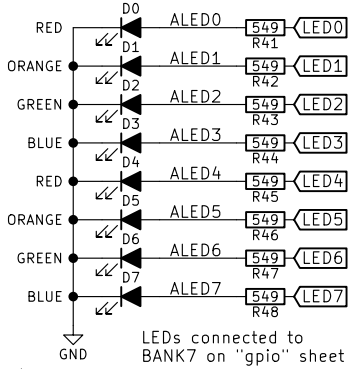
ST7789/SSD1331/SSD1351/SSD1306
compatible LCD/OLED 0.96/1.3/1.54" PCB
14x14 units
1 unit = 2.54 mm



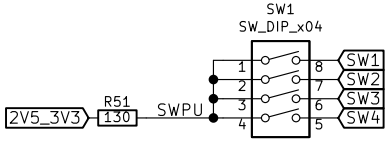
OLED connected to
BANK6 on "usb" sheet



BTN_R,U to BANK2,3 on "ram" sheet
BTN_F1,F2,D,L to BANK8 on "flash" sheet

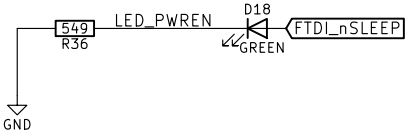


LEDs connected to
BANK7 on "gpio" sheet

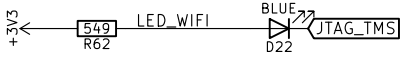


DIP switch connected to
BANK0 on 'gpio' sheet

To fix issues with FT231XS rev A,B,C
Short-circuit D18 LED, but then
board cannot keep awake by USB.
chip rev D works properly
See TN140_FT231X Errata



TXLED blinks when FPGA sends data to FTDI

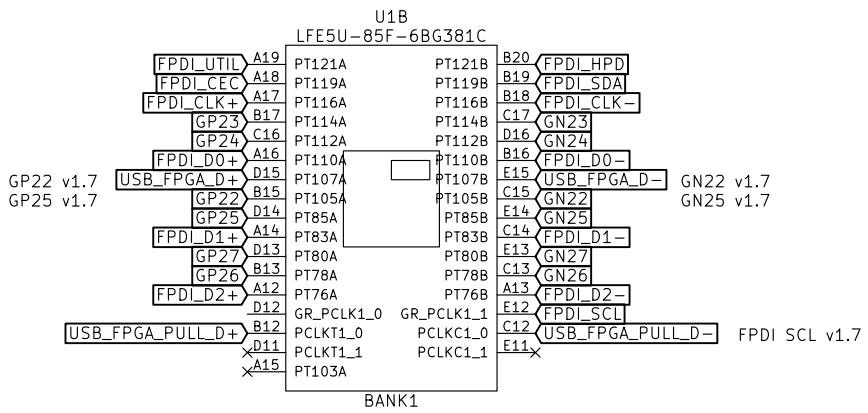


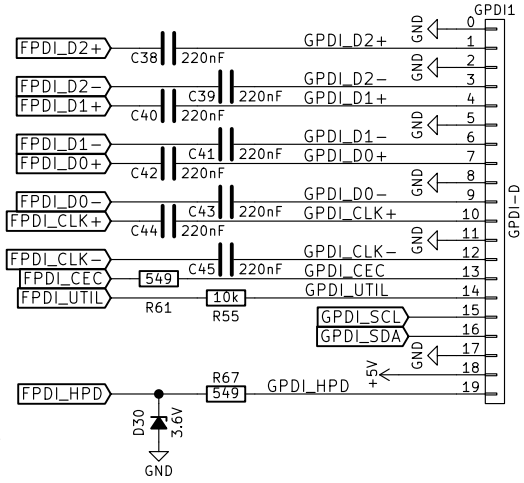
WIFI_GPIO2 v1.7, WIFI_GPIO5 <v3.1

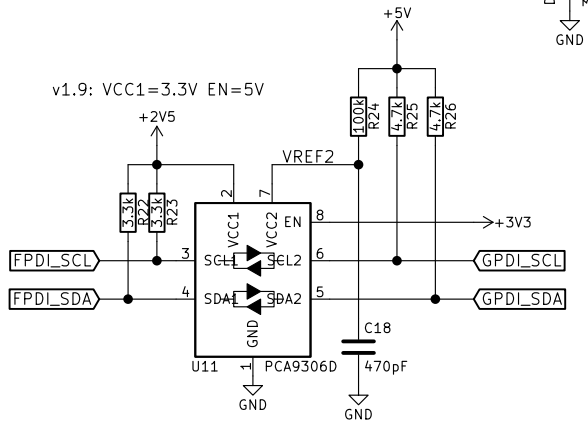
Buttons, LEDs, OLED display
EMARD
Sheet: /blinkey/
File: blinkey.sch

Title: ULX3S

Size: A4	Date:	**Rev: 1.0.3**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 4/11







i2c shared with RTC
on "power" sheet

PCB v1.8.1 and higher accept FCI 10029449-111RLF
www.amphenol-icc.com
mouser PN: 649-10029449-111RLF
http://portal.fciconnect.com/Comergent/fci/drawing/10029449.pdf

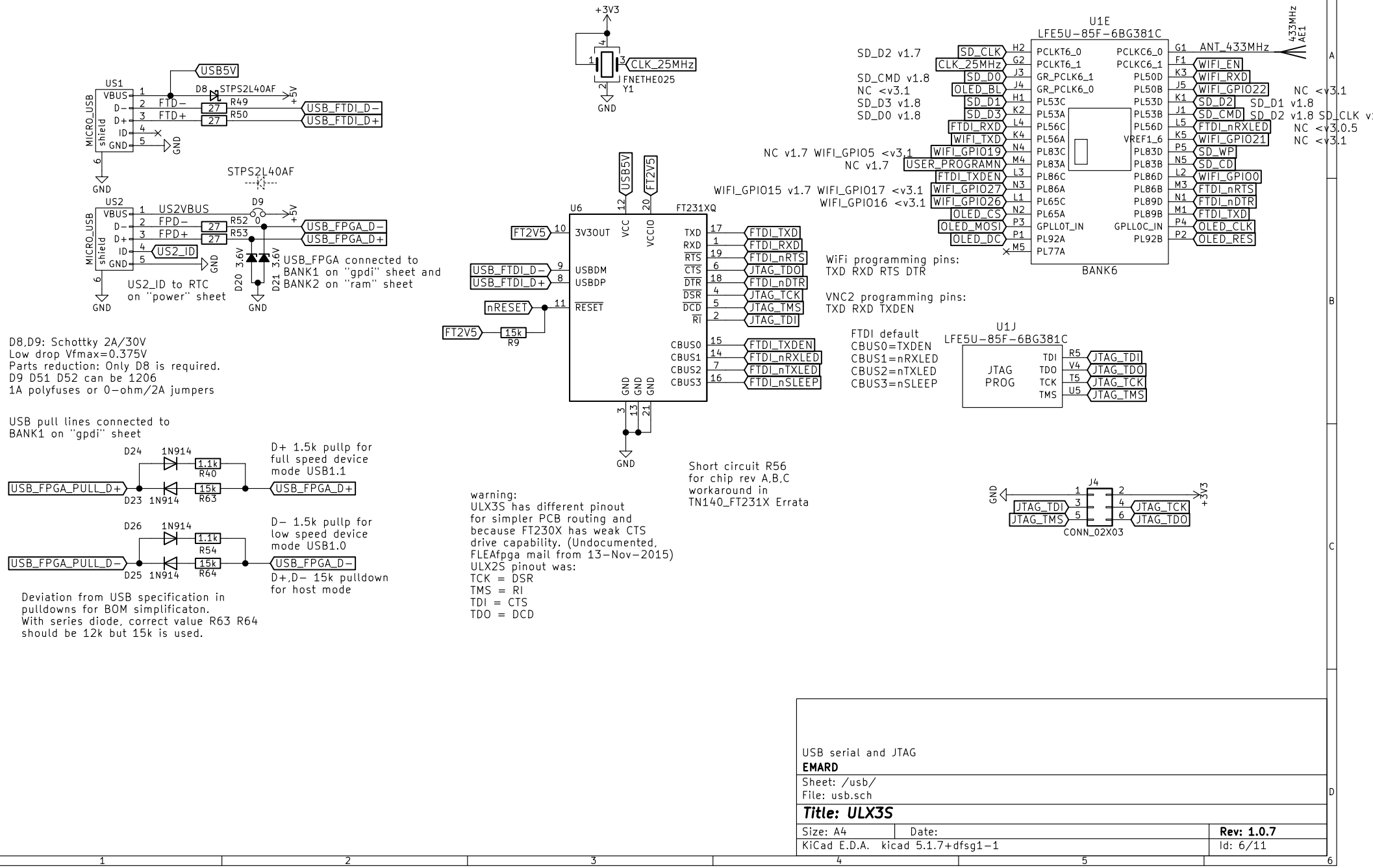
PCB v1.7 and v1.8 accept
mouser PN: 538-47151-1001 (Molex)
https://www.molex.com/pdm_docs/sd/471511001_sd.pdf
mouser PN: 710-685119134923 (Wurth)
https://katalog.we-online.com/em/datasheet/685119134923.pdf

Digital Video and Ethernet
General Purpose Differential Interface
EMARD

Sheet: /gpdi/
File: gpdi.sch

Title: ULX3S

Size: A4	Date:	**Rev: 1.0.3**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 5/11



USB serial and JTAG

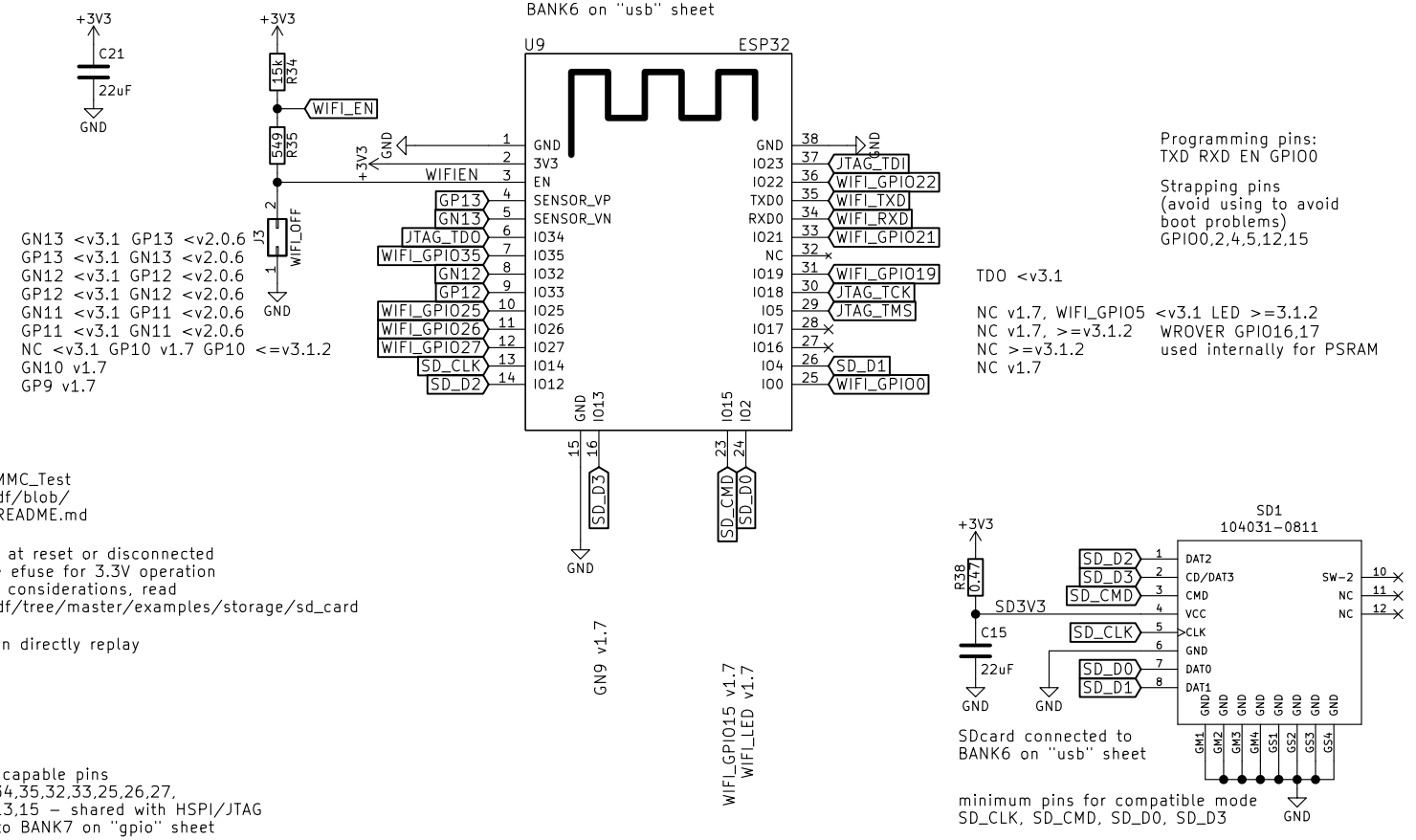
EMARD

Sheet: /usb/

File: usb.sch

Title: ULX3S

Size: A4	Date:	**Rev: 1.0.7**
KiCad E.D.A. kicad 5.1.7+dfsg1−1		Id: 6/11



WIFI module ESP32

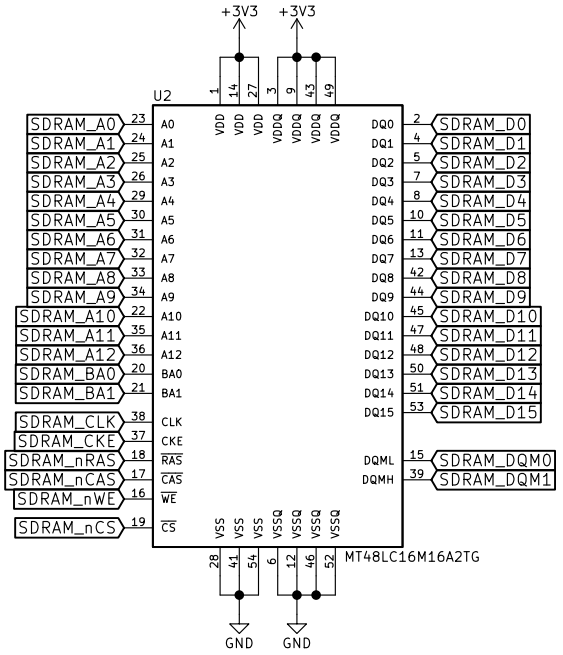
EMARD

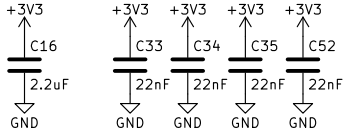
Sheet: /wifi/

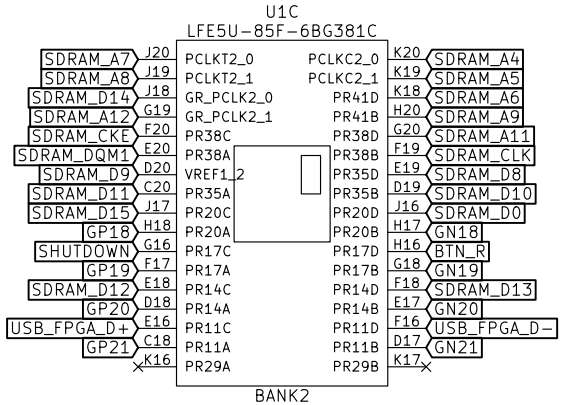
File: wifi.sch

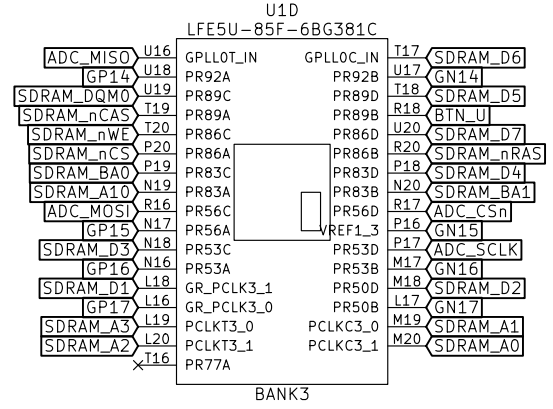
Title: ULX3S

Size: A4	Date:	**Rev: 1.0.8**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 7/11









SDRAM memory

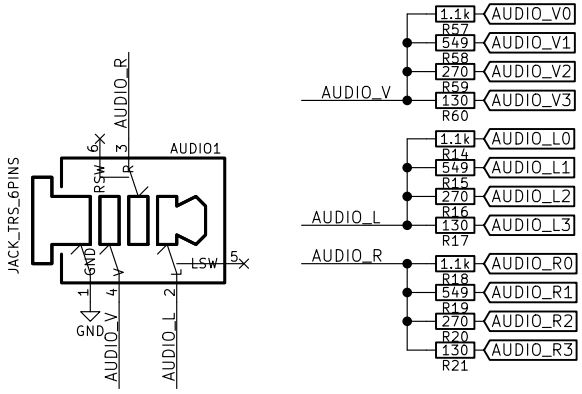
EMARD

Sheet: /ram/

File: ram.sch

Title: ULX3S

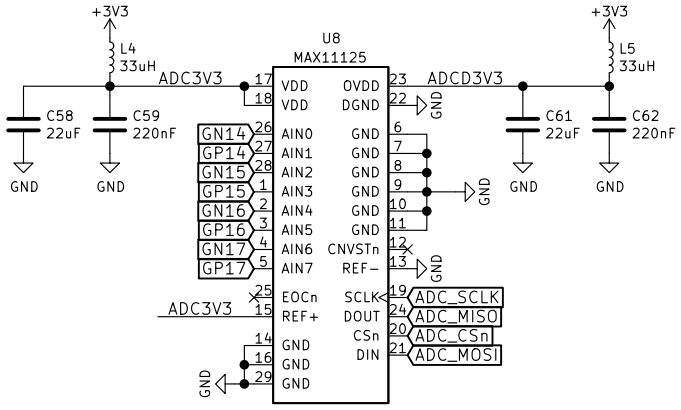
Size: A4	Date:	**Rev: 1.0.0**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 8/11



JACK pinout for SJ-43516-SMT-TR
http://www.cui.com/product/resource/sj-4351x-smt-series.pdf
pin 1 - sleeve (GND)
pin 2 - tip (left channel)
pin 3 - ring1 (right channel)
pin 4 - ring2 (video)
pin 5 - tip switch
pin 6 - ring1 switch

Audio connected to
BANK7 on "gpio" sheet

Output resistance: 75 ohm
Internal resistance of FPGA pin: 10 ohm
1/(1/(130+10)+1/(270+10)+1/(549+10)+1/(1100+10))=74.6



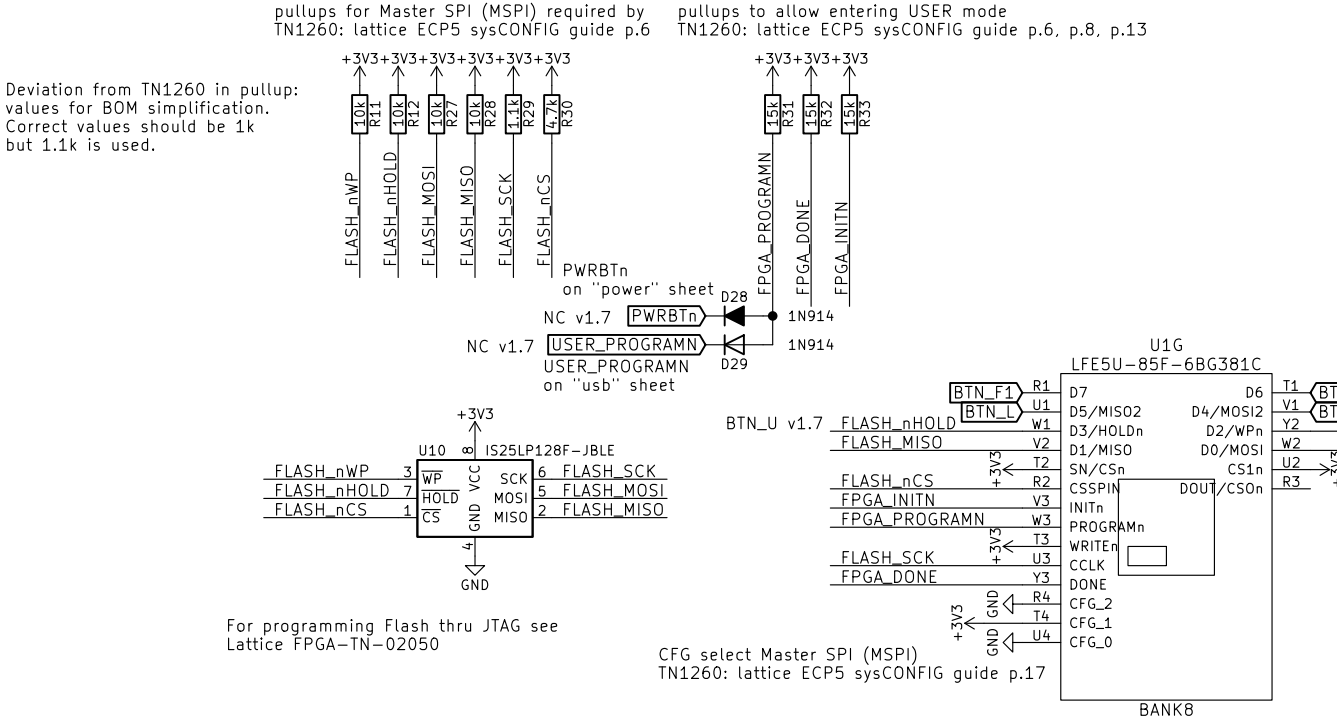
ADC SPI connected to
BANK3 of "ram" sheet

Analog audio and video
EMARD

Sheet: /analog/
File: analog.sch

Title: ULX3S

Size: A4	Date:	**Rev: 1.0.4**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 9/11



SPI flash

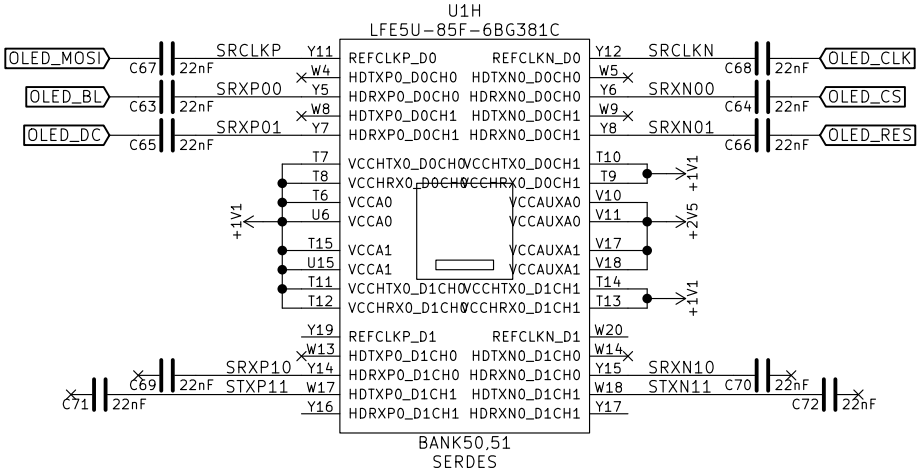
EMARD

Sheet: /flash/

File: flash.sch

Title: ULX3S

Size: A4	Date:	**Rev: 1.0.6**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 10/11



serdes **EMARD**		
Sheet: /serdes/ File: serdes.sch		
Title: ULX3S		
Size: A4	Date:	**Rev: 1.0.3**
KiCad E.D.A. kicad 5.1.7+dfsg1-1		Id: 11/11