Sheet: STM32F777
File: STM32.sch

Sheet: Power Supply
File: PSU.sch

Sheet: Display
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TR-9 Open Source Digital Radio
Author: DB9MAT Mathis, SO3ALG Nikoloz, SP5WWP Wojciech

Sheet: /
File: Mainboard.sch

Title: TR-9 Mainboard

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Microcontroller

U1 — STM32F777VIT

OS1 — ECS-3225MV-160-CN-TR

ADC1_0 Microphone input
ADC3_1 FM demod input
ADC2_3 Battery voltage monitor

UART1 GPS
UART2 HMI
UART3 ESP8266-12
UART7 Debug

SPI1 Display
SPI2 ADF7021 data?

Q1 — BSS138

J4 — SWD

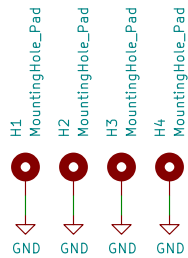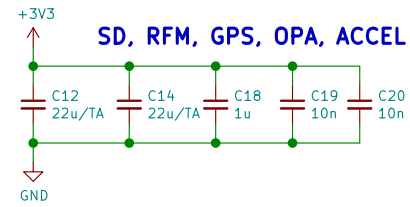J3 — USB_OTG

D5 — PMEG4005ET.215

U2 — USBLC6-2SC6

L1 — 100MHz
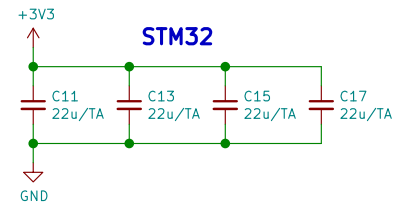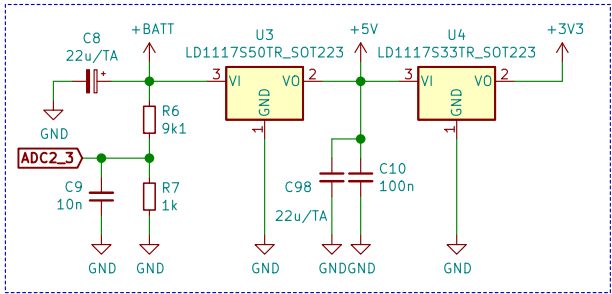
TODO: rework to include
* LiPo charger
* buck/boost for stable 7.5V to PA
* switching regulator to approx. 4V & 3.3V LDO
* more filtering
* Power switch

J5 BATT
F1 2A
J6 POT_PWR_SW
+BATT
D1 CGRM4007-G
GND GND GND

C8 22u/TA
+BATT
GND
R6 9k1
ADC2_3
C9 10n
R7 1k
GND GND

U3 LD1117S50TR_SOT223
VI GND VO
+5V
GND

C98 22u/TA
C10 100n
GNDGND

U4 LD1117S33TR_SOT223
VI GND VO
+3V3
GND

+3V3
STM32
C11 22u/TA
C13 22u/TA
C15 22u/TA
C17 22u/TA
GND

+3V3
SD, RFM, GPS, OPA, ACCEL
C12 22u/TA
C14 22u/TA
C18 1u
C19 10n
C20 10n
GND

H1 MountingHole_Pad
H2 MountingHole_Pad
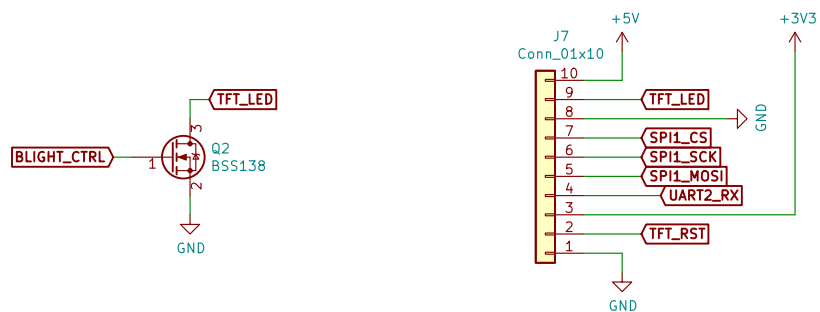H3 MountingHole_Pad
H4 MountingHole_Pad
GND GND GND GND

TR-9 Open Source Digital Radio
Author: DB9MAT Mathis, SO3ALG Nikoloz, SP5WWP Wojciech

Sheet: /Power Supply/
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Q2
BSS138

TFT_LED

BLIGHT_CTRL

GND

J7
Conn_01x10

+5V
+3V3

10
9 TFT_LED
8 GND
7 SPI1_CS
6 SPI1_SCK
5 SPI1_MOSI
4 UART2_RX
3
2 TFT_RST
1

GND

TODO: RX filtering

Voltage at this point should be 0.2-2V

U8C
HEF4066B
8 9
6
GND

U8D
HEF4066B
10 11
12
GND

+3V3
C79
10u
R37 47k   R40 47k
GND

U9
OPA340UA
ADC1_0
R38 4k7   R39 10k
MIC_AMP_IN
C78 6n8   C80 1u
GND   GND

+3V3
+3V3
GND

R35 820
C74 47n
R36 22
C76 22u
GND

RED D3   GREEN D4
R42 470   R43 470
LED_RED   LED_GRN

+3V3
R47 470   R48 10k
PTT
C90 100n
SW1 INT_PTT_SW
GND   GND

Pushing PTT on power up forces STM32 into DFU mode

+BATT
R30 47k   R32 47k

SPK_AMP_SEL
Q4 BSS138-transistors
FM_MOD_SEL
Q5 BSS138-transistors
GND   GND

U8A HEF4066B
1 2
FM_MOD

AUDIO_DAC
U8B HEF4066B
4 3
SPK_AMP

+BATT FB4 TBD
C82 10n   C84 1u   C85 100n
C86 220u
GND
C83 220n
GND

+3V3
R44 1k   R45 3k9
MIC_AMP_IN
+5V
J9 MIC_INT
C87 10u
GND

J10 MIC_EXT
+3V3
R49 10k   R50 470
PTT
C91 100n
GND

2.5mm MIC/PTT jack
3.5mm SPK jack
Kenwood standard

SPK_AMP
22k R41
RV1 50k/log
R57 2k1   C81 15n
U10 LM386
C89 220u
J11 SPK_INT
C88 47n
R46 10 0.5W
J12 SPK_EXT
GND   GND   GND   GND   GND   GND   GND   GND

BATT_ANALOG
1u C97
GND
C95 10n
U13 LM321
ADF_SWD
2k7 R58   2k7 R59
C72 220n
TBF R31
+3V3
R33 47k
ADC3_1
R34 47k
GND
0R R60
DNP R61
10n C96
GND   GND   GND

+BATT FB3 TBD
C73 10n   C75 1u   C77 100n
BATT_ANALOG
U8E HEF4066B
VDD 14
VSS 7
GND
GND

This circuit provides amplification/attenuation and adds
DC component to the analog FM demod output.
It is also a 2nd order Sallen-Key lowpass for antialiasing.

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Sheet: /Audio/
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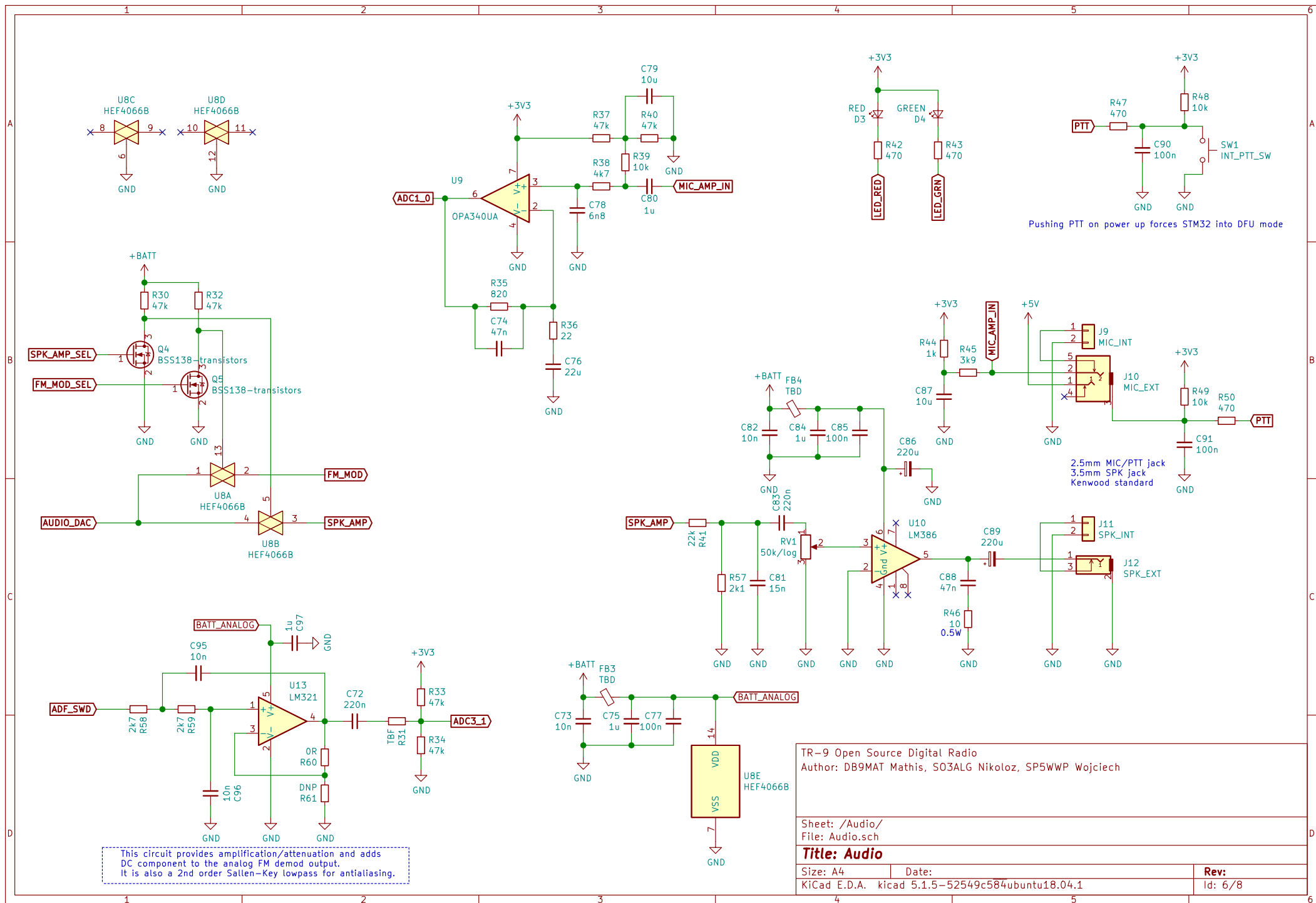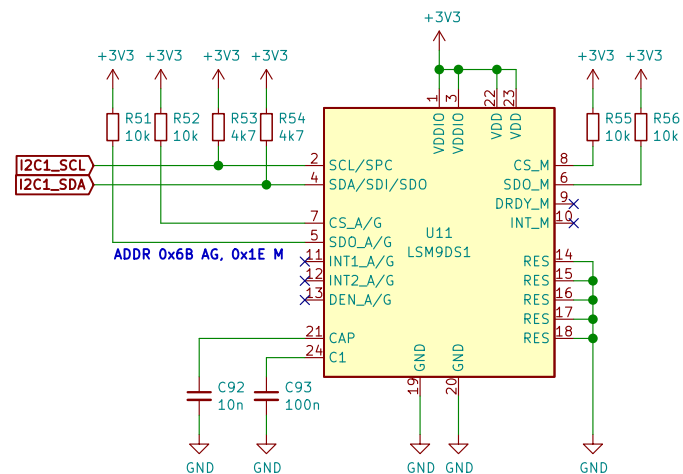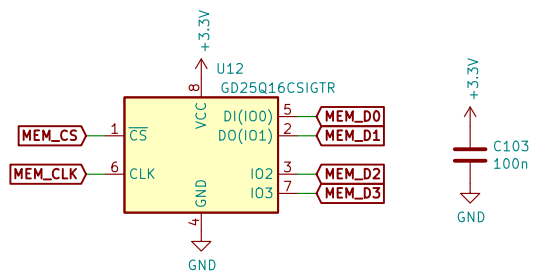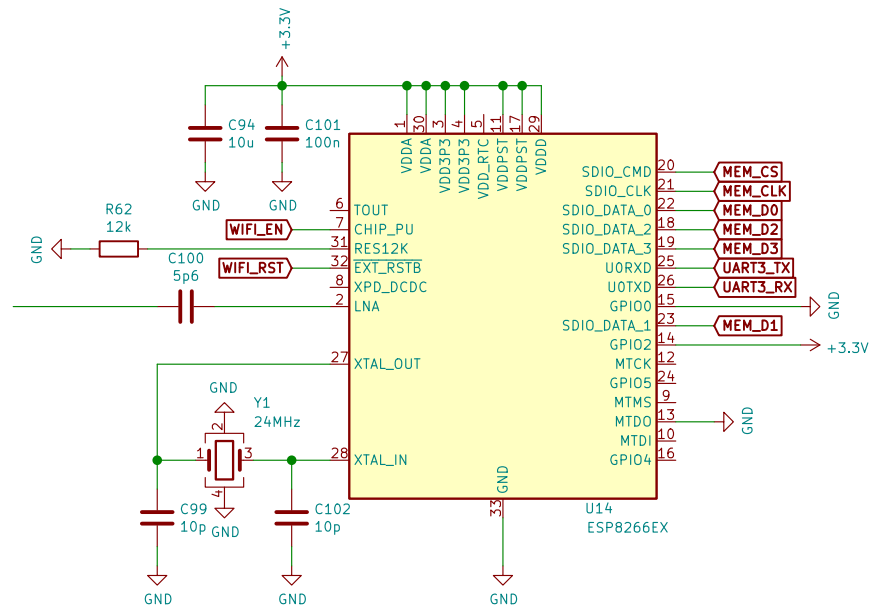KiCad E.D.A. kicad 5.1.5-52549c584ubuntu18.04.1
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J13
GPS_CONN

+3V3

1		+3V3
2	UART1_TX	
3	UART1_RX	
4	GPS_EN	
5		GND

C16
10u/TA

GND

J15
DBG_CONN

1	UART7_TX	
2	UART7_RX	
3		GND

J14
Micro_SD_Card

+3V3

1	DAT2	SD_D2
2	DAT3/CD	SD_D3
3	CMD	SD_CMD
4	VDD	
5	CLK	SD_CLK
6	VSS	
7	DAT0	SD_D0
8	DAT1	SD_D1
9	SHIELD	GND

GND   GND

U11
LSM9DS1

ADDR 0x6B AG, 0x1E M

I2C1_SCL
I2C1_SDA

R51 10k R52 10k R53 4k7 R54 4k7 R55 10k R56 10k

+3V3 +3V3 +3V3 +3V3   +3V3   +3V3 +3V3

Pin	Signal
2	SCL/SPC
4	SDA/SDI/SDO
7	CS_A/G
5	SDO_A/G
11	INT1_A/G
12	INT2_A/G
13	DEN_A/G
21	CAP
24	C1
8	CS_M
6	SDO_M
9	DRDY_M
10	INT_M
14	RES
15	RES
16	RES
17	RES
18	RES
1	VDDIO
3	VDDIO
22	VDD
23	VDD
19	GND
20	GND

C92 10n   C93 100n

GND GND   GND GND   GND

Sheet: /Connections/
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Title: Connections

TR-9 Open Source Digital Radio
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+3.3V

C94
10u

C101
100n

GND GND

R62
12k

GND

WIFI_EN

C100
5p6

WIFI_RST

GND
Y1
24MHz

C99
10p

GND

C102
10p

GND

GND

U14
ESP8266EX

VDDA VDDA VDD3P3 VDD3P3 VDD_RTC VDDPST VDDPST VDDD
1 30 3 4 5 11 17 29

6 TOUT
7 CHIP_PU
31 RES12K
32 EXT_RSTB
8 XPD_DCDC
2 LNA

27 XTAL_OUT
28 XTAL_IN

SDIO_CMD   20 MEM_CS
SDIO_CLK   21 MEM_CLK
SDIO_DATA_0   22 MEM_D0
SDIO_DATA_2   18 MEM_D2
SDIO_DATA_3   19 MEM_D3
U0RXD   25 UART3_TX
U0TXD   26 UART3_RX
GPIO0   15 GND
SDIO_DATA_1   23 MEM_D1
GPIO2   14 +3.3V
MTCK   12
GPIO5   24
MTMS   9
MTDO   13 GND
MTDI   10
GPIO4   16

GND
33

U12
GD25Q16CSIGTR

+3.3V
8 VCC

MEM_CS   1 CS   DI(IO0) 5 MEM_D0
                   DO(IO1) 2 MEM_D1
MEM_CLK 6 CLK   IO2   3 MEM_D2
                   IO3   7 MEM_D3
GND
4

+3.3V

C103
100n

GND

TR-9 Open Source Digital Radio
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Sheet: /Modules/
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