Digital Repeater Controller V2

NOTES:
* This is an analog board that interfaces with two radios. A separate digital board based on the RP2040 is also required. A ribbon cable connects the two boards.
* The goal of this design is to do as little as possible in hardware.
* Many things that usually happen in hardware (or FPGA) will happen in software:
  - Audio routing between the two radios will happen in software.
  - Audio pre-emphasis/de-emphasis (if needed) will happen using DSP using digital filters.
  - CTCSS decoding (if needed) will happen in DSP.
  - CTCSS encoding (if needed) will happen in DSP.
  - DTMF decoding will happen in DSP.
  - CWID and other tone prompts will happen in DSP/software.
  - Voice IDs will happen in DSP/software.

Audio In 0
File: audio_in_0.kicad_sch

Audio In 1
File: audio_in_1.kicad_sch

ADC
File: adc.kicad_sch

DAC
File: dac.kicad_sch

Audio Out 0
File: audio_out_0.kicad_sch

Audio Out 1
File: audio_out_1.kicad_sch

Controls
File: controls.kicad_sch

Power
File: power.kicad_sch

Connectors

H1 MountingHole

H2 MountingHole

H3 MountingHole

H4 MountingHole

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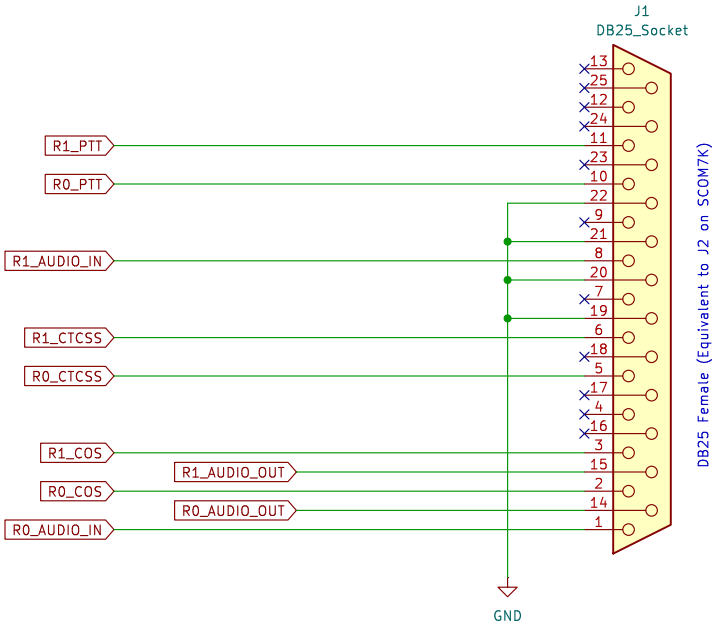
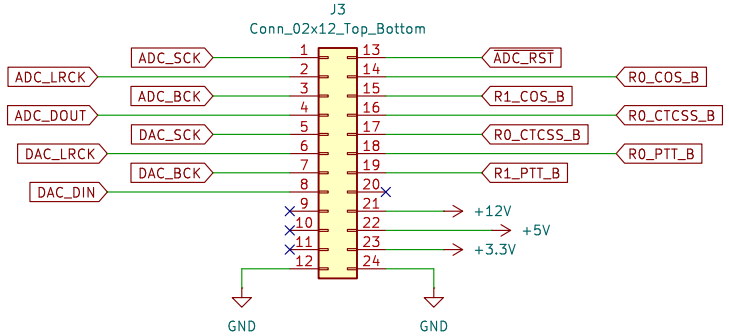
Sheet: /
File: if-2.kicad_sch

Title: Digital Repeater Controller

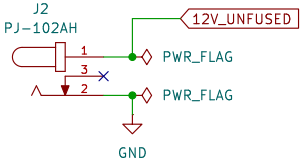
Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 1/10



DB25 To Radios



Ribbon Cable to Digital Board



5.5mm Power Connector
+12V on center pin

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Sheet: /Connectors/
File: connectors.kicad_sch

Title: Connectors

Size: USLetter	Date: 2025-03-16	**Rev: 2**
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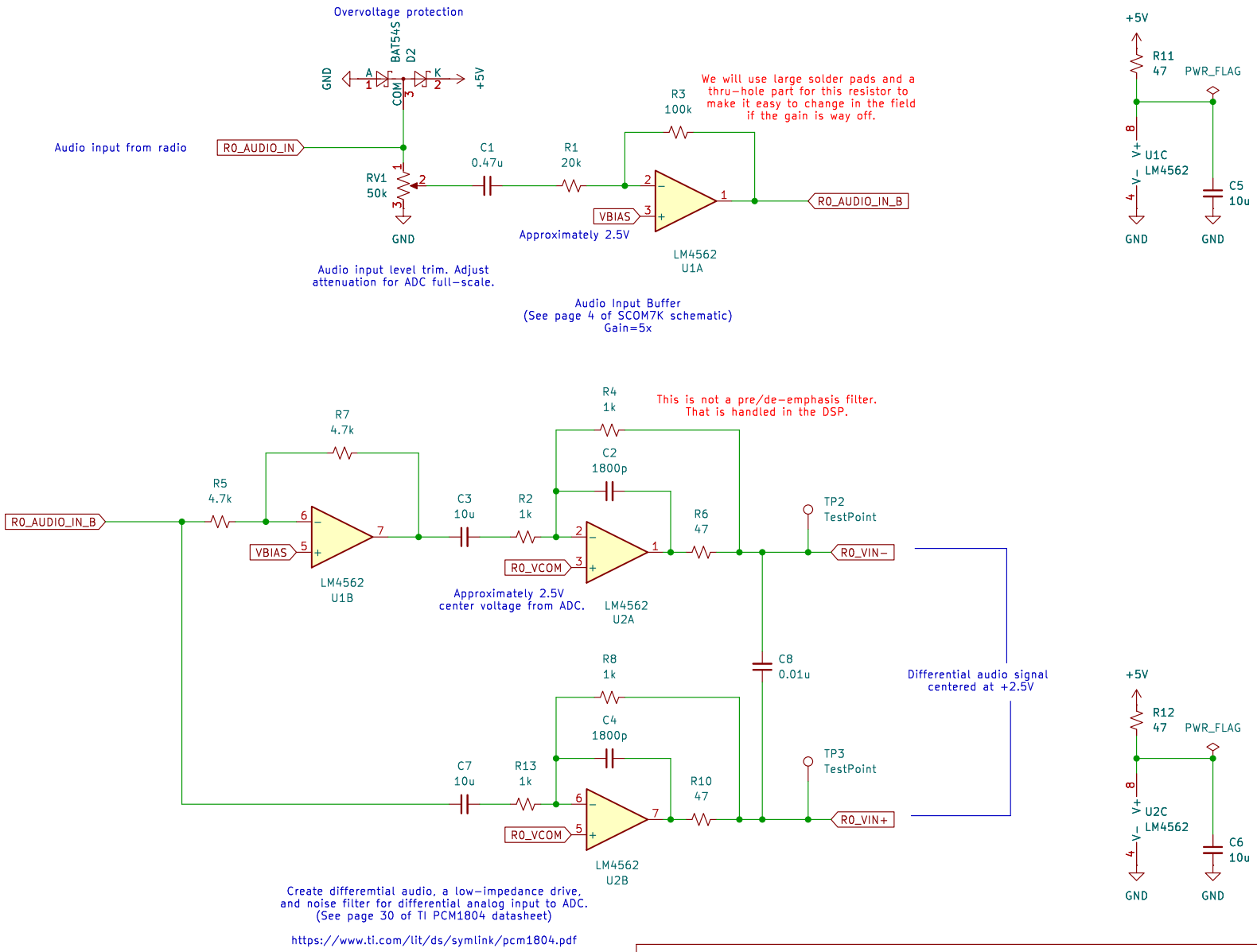

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Sheet: /Audio In 0/
File: audio_in_0.kicad_sch

Title: Audio Input Processing (Radio 0)

Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 3/10

(Will Be Copy of R0 Audio Input)

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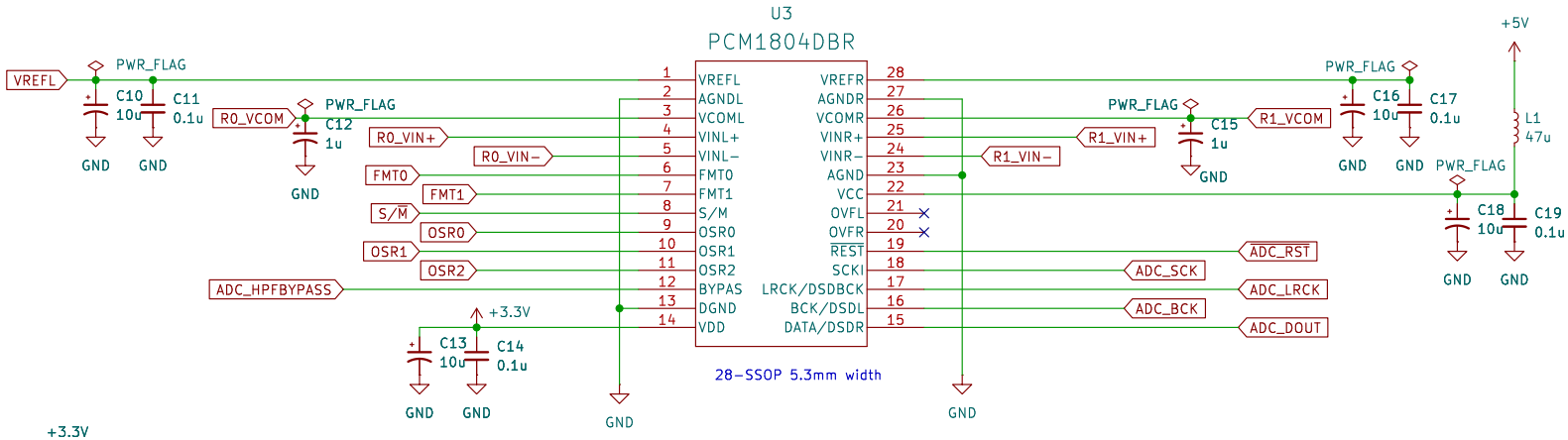
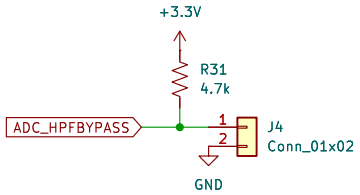
Sheet: /Audio In 1/
File: audio_in_1.kicad_sch

Title: Audio Input Processing (Radio 1)

Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 4/10

The TI PCM1804 is a 24-bit stereo analog to digital converter designed for audio applications. It contains an integrated low-pass anti-aliasing filter on the front-end with a cut-off around 20 kHz. Sample rate (f_S) will be 48,000 samples/second. Narrower filtering will be achieved in DSP.





HPF enabled by default, can be disabled for testing using this jumper block. NOTE: When HPF is enabled it's not possible to test the ADC with DC levels.

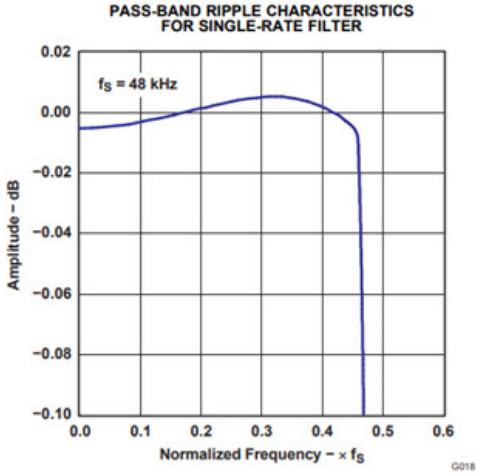
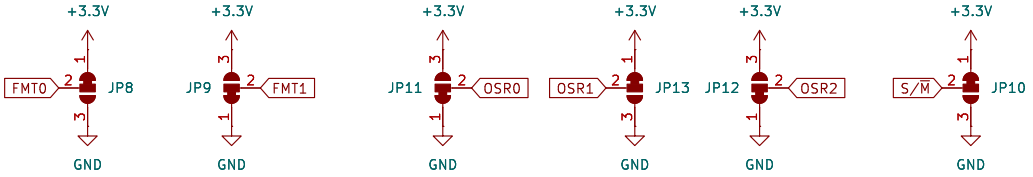


Figure 18.

Configuration Solder Bridges



FMT=I2S by default

OSR=010, 384*f_S by default

Slave by default

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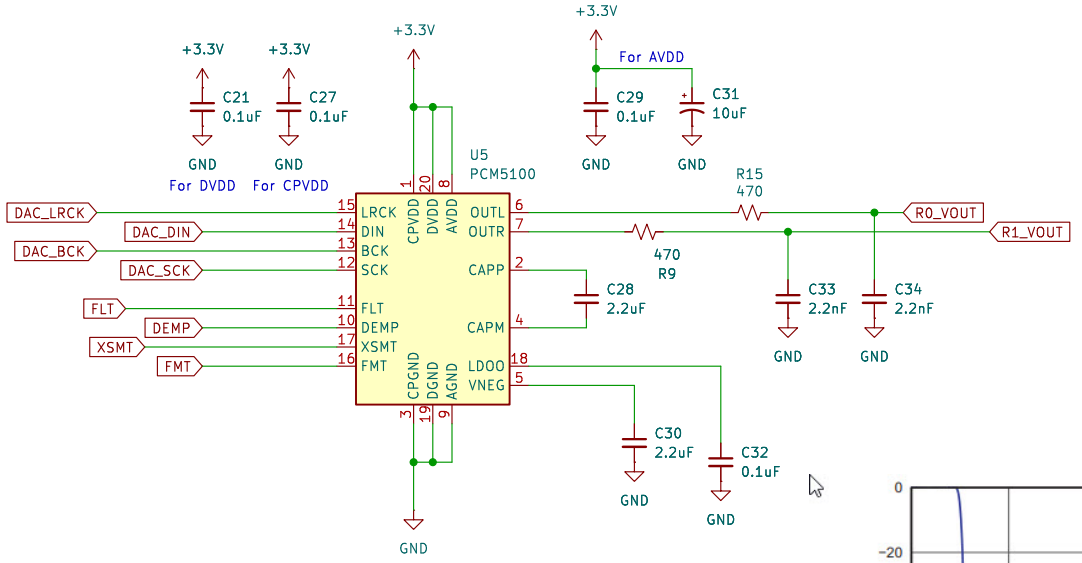
Sheet: /ADC/
File: adc.kicad_sch

Title: Analog To Digital Converter

Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 5/10

The TI PCM5100 is a 24-bit stereo digital to analog converter designed for audio applications. It contains an integrated low-pass interpolation filter on the back-end with a cut-off around 20 kHz. Sample rate (f_S) will be 48,000 samples/second. Narrower filtering will be achieved in DSP.



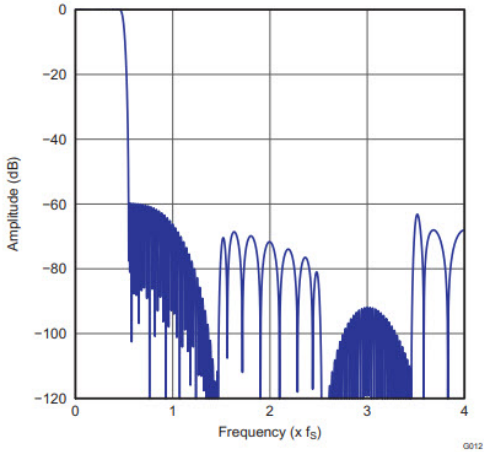
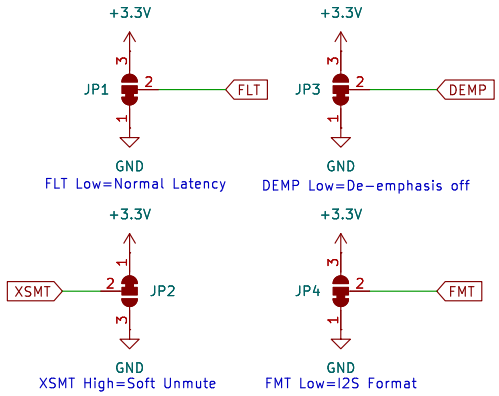


Figure 16. Normal x8 Interpolation Filter Frequency Response

Configuration Solder Bridges



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Sheet: /DAC/
File: dac.kicad_sch

Title: Digital to Analog Converter

Size: USLetter	Date: 2025-03-16	**Rev: 2**
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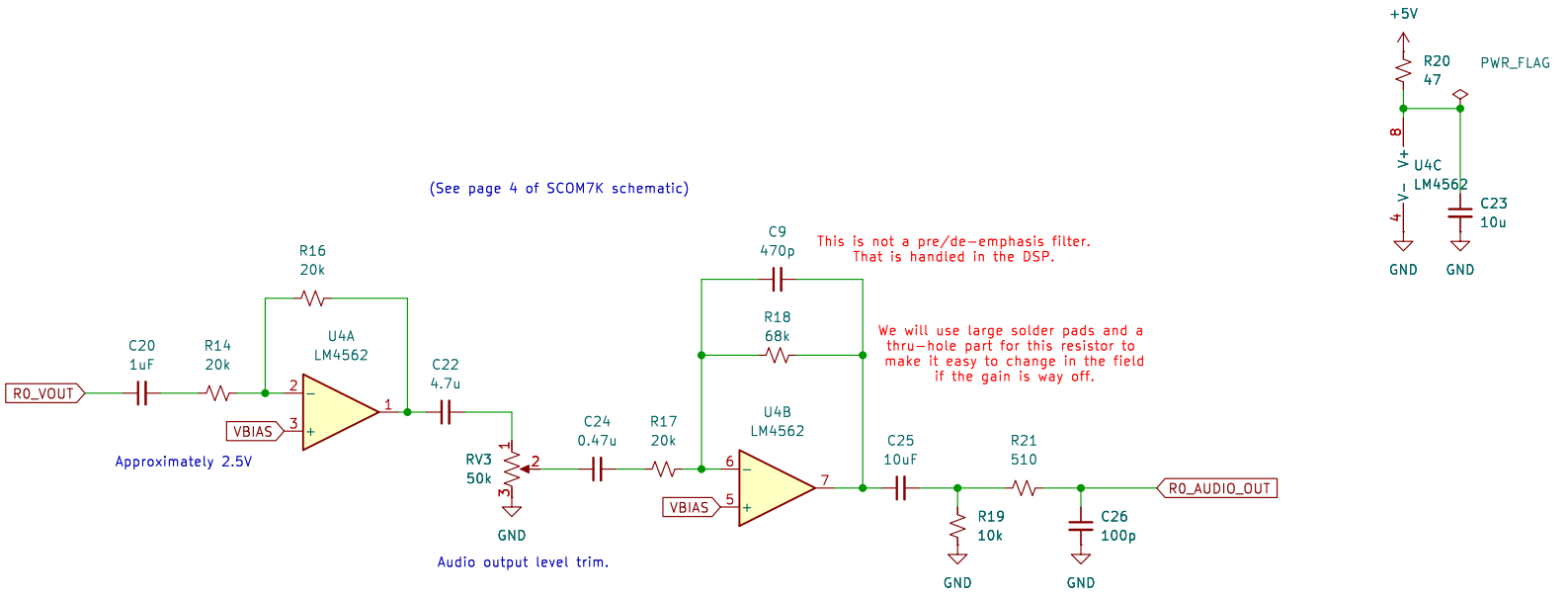

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Sheet: /Audio Out 0/
File: audio_out_0.kicad_sch

Title: Audio Output Processing (Radio 0)

Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 7/10

(Will Be Copy of R0 Audio Output)

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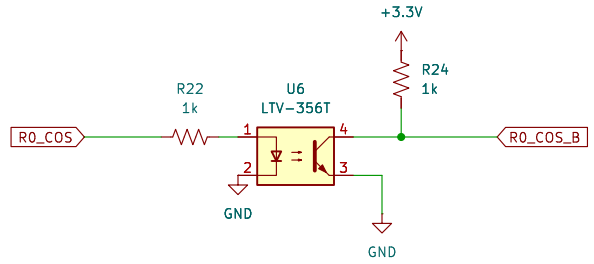
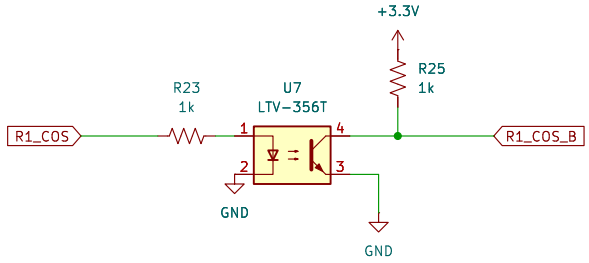
Sheet: /Audio Out 1/
File: audio_out_1.kicad_sch

Title: Audio Output Processing (Radio 0)

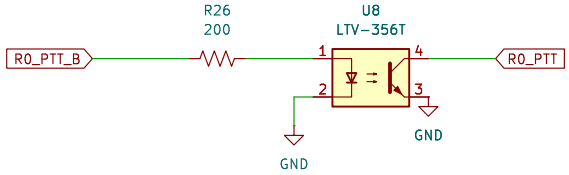
Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 8/10

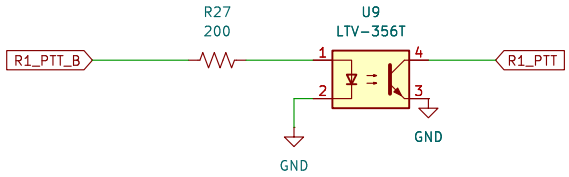




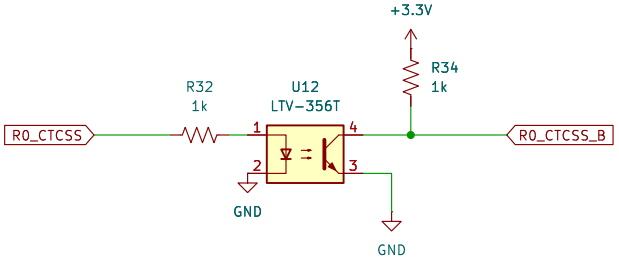
Converts radio COS signals to 3.3V logic.

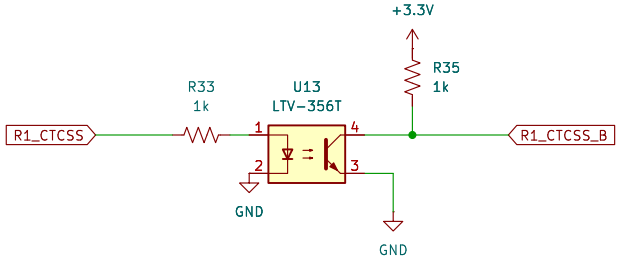
TODO: Validate max current on LTV-353T input.





Converts 3.3V logic to pull PTT to ground.





Converts radio CTCSS signals to 3.3V logic.

TODO: Validate max current on LTV-353T input.

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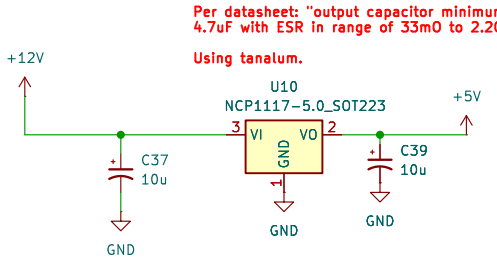
Sheet: /Controls/

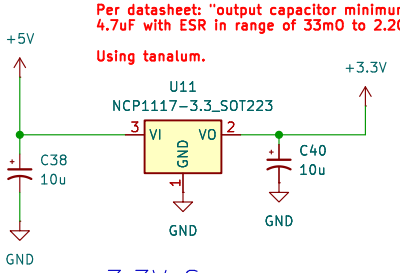
File: controls.kicad_sch

Title: COS/CTCSS/PTT Controls

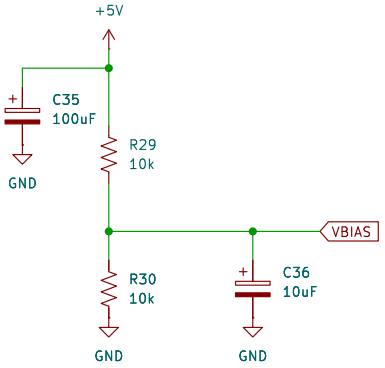
Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 9/10



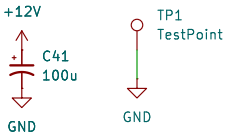
+5V Source

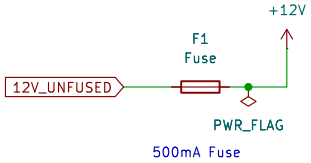


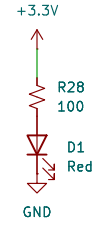
+3.3V Source



+2.5V Bias Source







Power LED

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Sheet: /Power/
File: power.kicad_sch

Title: Power

Size: USLetter	Date: 2025-03-16	**Rev: 2**
KiCad E.D.A. 9.0.0		Id: 10/10