Installation Instructions

Please note- The firmware only works with the ESP32S3 Lilygo t-displayS3 Touch.

Here are some links to related videos on YouTube.

https://youtu.be/HgioXrjpPSk?feature=shared

https://youtu.be/gyk2eq8ZymM?feature=shared

https://www.youtube.com/watch?v=cFctgusRfhY

Here is a link to the Espressif Flash Download Tools required for uploading the firmware:

https://www.espressif.com/en/support/download/other-tools

To upload the firmware please follow the following steps:

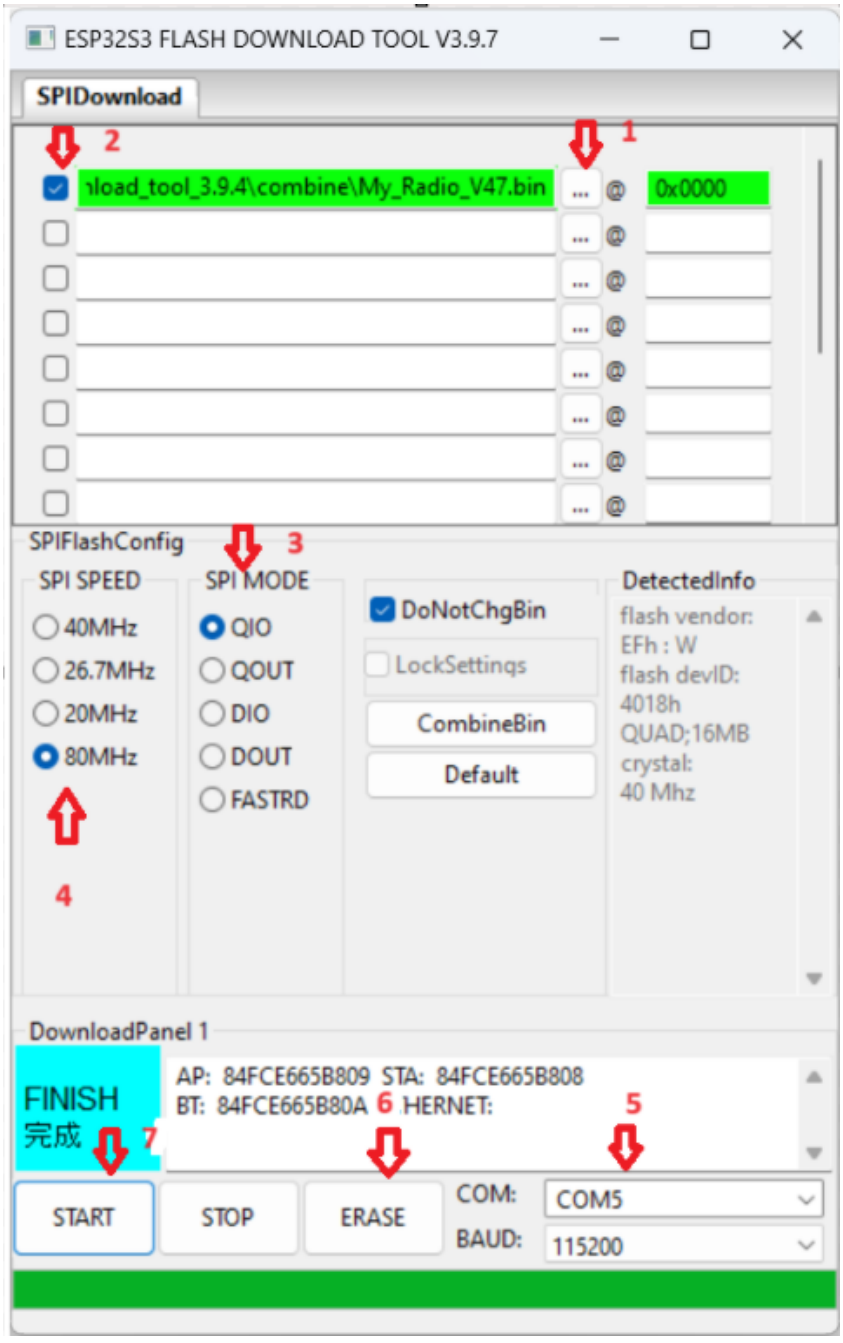
1. Download the Espressif Flash Tool or alternatively use the online tool https://espressif.github.io/esptool-js/
2. Choose Chip Type: ESP32-S3, WorkMode Develop and LoadMode USB
3. Press the tree dots to select the files as follows:

My_Radio.bin 0x0000

Make sure that all the lines are marked green. If not green use the check mark on the left side.

Here is a screenshot of the flash tool:

Make sure to select your designated com port (located at the right bottom side)

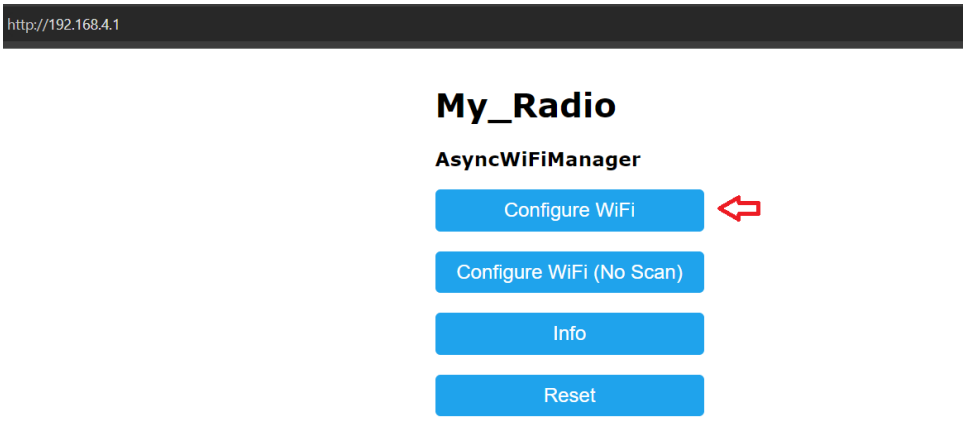


It is recommended to press first on Erase to clean the memory.

To upload the firmware, press the start button.

One time connecting process:

1. After successful upload press the reset button on the ESP32 or disconnect the USB cable and reconnect it.
2. Wait for few seconds until network scanning is completed.
3. Open the Wi-Fi settings in your phone or computer browser and search for My_Radio network.
4. Go to the following address **192.168.4.1.**



5. Press "Configure Wi-Fi", Find your network and connect to that network using your internet password and press the "Save" button. This will connect the radio permanently to your home network.
6. Press the reset button of the ESP32 controller and wait until the Spiff file system formatting is completed (you will get a message on the LCD Screen).
   a. When completed, looking at the RADIO LCD, you should be able to see the IP address that was assigned to your radio by your home router.
   b. Open your computer web browser and type that IP address.

c. Upload a single station or list of stations using the following format:

(example file with various stations can be found in the documentation folder, for testing just copy and paste that list).

Station Name 1, Station Address 1

Station Name 2, Station Address 2

Radio Ibiza, http://ibiza-smooth-jazz.vip-radios.fm:8033/stream-128kmp3-IbizaSmooth

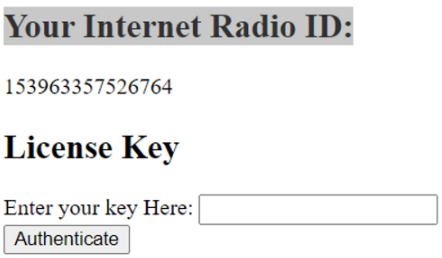
Roma Radio, http://nr9.newradio.it:9371/stream

You can find and copy station URL's in the following web sites:

- https://streamurl.link/
- https://fmstream.org/ (search for the desired station, click on it to start playing and copy the link from the player located at the bottom of the page)
- https://www.radio-browser.info/

or alternatively search YouTube for instruction video on how to get live radio streaming URLs. You can also have a look at https://radio.garden/ .

7. The last step - Open the web page. At the bottom left corner of the page, you will see the following.



The Station management system was tested and debugged only with Google chrome browser.

Please send me your RADIO ID to the following email **themicromaker@yahoo.com**

I will email you back the required License Key.

Web Interface Radio Station Manager access VIA Mobile Phone or PC/MAC

Radio Station Manager

Play Station

Enter Station Number:
PLAY

Play Previous Play Next

Current Station

Station Number: 114

Station Name: Exclusively Italy

Volume Control

Volume: 79

Audio Equalizer

Bass (dB): -1
Mid (dB): -1
Treble (dB): 6
Save

Audio Mode

Mono
Stereo
Apply

Screen Saver

Enable Screen Saver
Save

Total Stations Stored: 115

Enter Station Name:
Enter Station Address (URL):
Save

Enter Station Number to Erase:
Erase

Station 149
Station Name: Classical Music
Station Address: https://stream.epic-classical.com/classical-n

Station 150
Station Name: WFMT Classical
Station Address: https://wfmt.streamguys1.com/main-mp3

Station 151
Station Name: Radio Italy
Station Address: https://sphera.fluidstream.eu/rpd_hita.mp3

Station 152
Station Name: Top Italia
Station Address: http://streaming.cst98.com:8000/tir320.mp3

Station 153
Station Name: Nostalgia Italia
Station Address: https://scdn.nrjaudio.fm/adwz1/fr/30663/mp

Enter Station List (one entry per line in the format 'Station N

Use the following format:
Station Name 1,Station Address 1
Station Name 2,Station Address 2
My Favorite Station,http://123.456.789.0/stream
Awesome Hits Radio,http://stream.awesomehitsradio.com

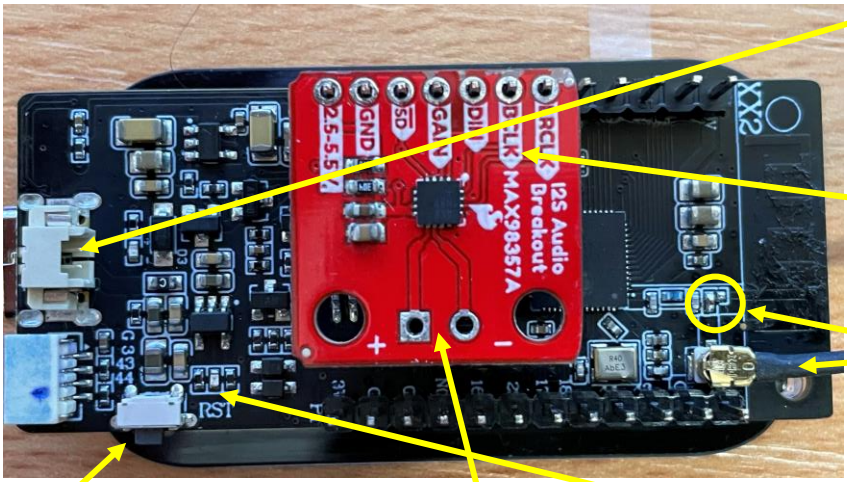
Update Stations

Connection Diagram

Following is the connection diagram for using the Max98357a chip (if you use pin header you don't need to connect wires as the pins are arranged correctly). Connect the I2S DAC to the following pins as shown in the picture: BCLK to pin 12, LRC to pin 11, DOUT to pin 13, VCC to 5V, GND to GND (Required by some other DACs - MCLK to pin 10).

Refer to the below photo: it is possible to solder the DAC directly to the ESP32 in the following way (the pins are already aligned)

After soldering the DAC to the pins you only need to connect a speaker to the + and - signs (speaker pins) on the DAC module.



Battery connector. Female connector can be found inside the microcontroller box.

DAC+AMP Solder that way, no need for wires

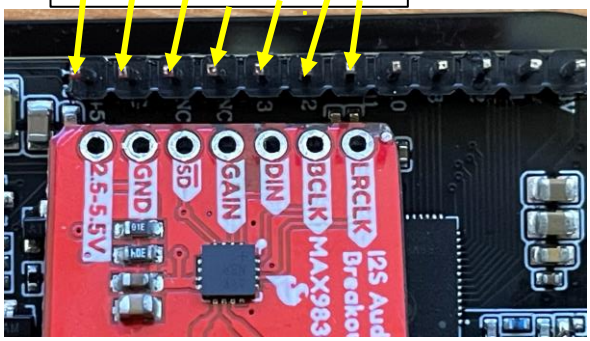
External Antenna - requires switching jumper to external antenna

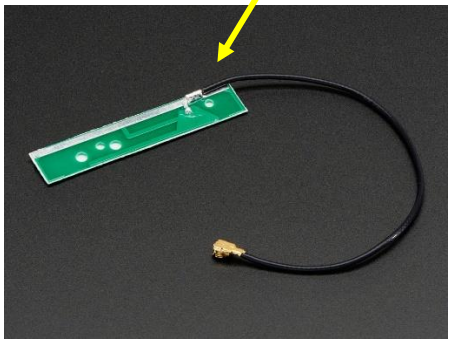
Reset Button

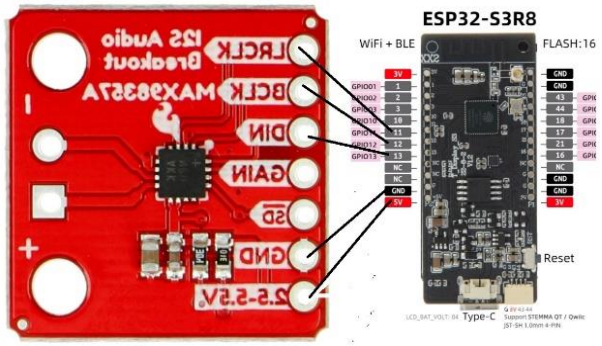
Speaker 5W Preferable

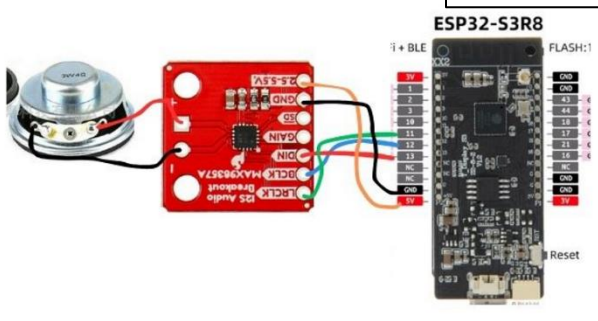
Battery charging RED LED. Glue the supplied light conducting Acrylc Tube above the LED. Make sure the light is visible outside of the enclosure. Alternatively, you can replaced the onboard LED with an external LED but this requires some micro soldering skills (not recommended).

5V GND NC NC 13 12 11



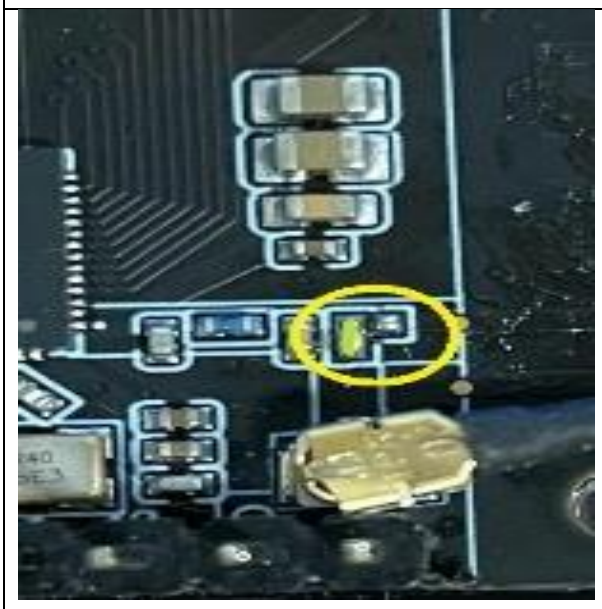






Notes:

1. The boot_app0.bin file is included with the Lilygo flash tool in the bin directory.
2. An I2S DAC is required for this project, Amplifier is optional. In general, all 16 bit DACs that have the DIN, BLCK and LRC pins. PCM5102A delivers stereophonic good results.
3. For some stations that don't play, and their URL starts with https:// try changing it to http:// and check if it is working.
4. **Important Note: The WIFI Internal antenna of this LilyGo Board is not optimal. It is essential to use antenna to enhance the Radio Reception when your router is far away.** For the antenna to work you will need to move on the PCB the 0 ohm resistor (short) from external antenna to internal antenna (you don't need the actual 0 ohm resistor just short it). You can refer to this article for detailed explanation: https://randomnerdtutorials.com/esp32-cam-connect-external-antenna/ Or YouTube video https://www.youtube.com/watch?v=aBTZuvg5sM8

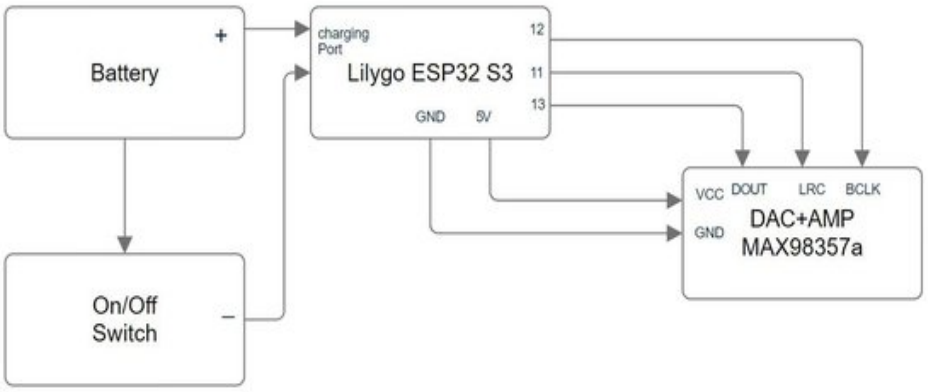
For External Antenna	For Internal Antenna
	

Installation & Components Layout

After uploading the firmware and soldering the Max98357a as described above and testing that the radio is working you can start mounting all the components inside the enclosure.

1. Place the enclosure on a flat surface face down. Place the LCD screen in its designated location with the LCD facing down making sure it is flashed with the enclosure surface.
2. Using a hot glue gun drop a little glue on each corner of the LCD back side to secure it to the enclosure.
3. Place the speaker on the left corner of the enclosure and use the hot glue to secure it. Make sure not to drop glue inside the speaker as it will affect its performance. Also make sure that the speaker terminals don't interfere with the battery holder (try to fit both at the same time just to make sure they fit together).
4. Place and glue the battery holder on the bottom of the enclosure (red wire + , should be on the left side closer to the speaker).
5. Place and glue the antenna on the inside top of the enclosure by pealing the glue cover sticker of the antenna. Now you can connect it to the microcontroller board using the UTX connector (make sure to follow the instructions above on how to switch from internal antenna to external antenna). Using external antenna is not mandatory as you can still use the internal antenna and completely skip this process but it will affect the Wi-Fi reception distance.
6. Place the switch inside the enclosure and connect it between the microcontroller and the battery using the designated cable which can be found inside the microcontroller box.
7. Install the battery and connect the USB charging cable. You will see a red LED lighting. Find the small Acrylic tube located inside the enclosure. Place it right above the RED charging indicator LED (see photo ABOVE) and make sure that the light penetrate to the outside of the enclosure. Using hot glue secure it to the right place.
8. After making sure all the components are secured closed the lid by popping it in.

Connection Diagram



- To reset Wi-Fi settings - Press the reset button and IO14 (Key) button together. Release the reset button while keep pressing IO14 for at least 3 seconds until you get a message on the LCD that Wi-Fi setting has been erased (The Key - IO14 button is located on the left bottom side- see photo).
- To activate boot mode – sometimes it is required when upgrading the firmware. press the boot button together with the reset button. Release the reset button while keep pressing the boot button. Now release the boot button. You will see a black screen. The radio is now in boot mode.

If you don't have access to the reset button you can press one of the above buttons (IO14 or boot buttons depend on what you need to achieve) and while pressing power on the radio.

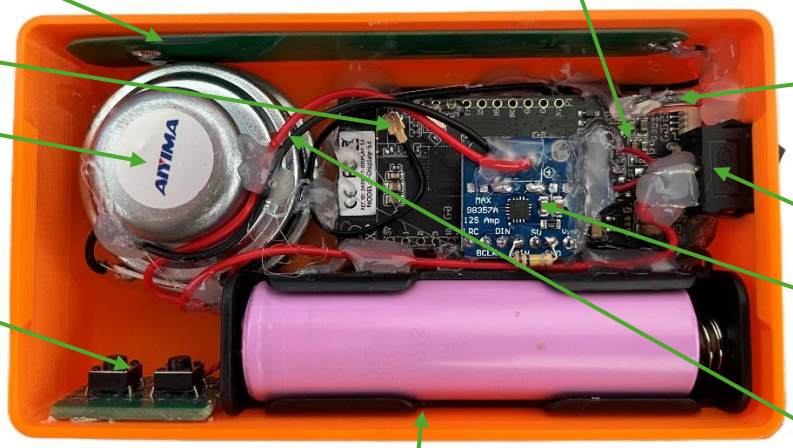
Wi-Fi Antenna.

Red wire of the battery charging cable (inside the microcontroller box) should be connected to the switch. The black cable should be connected to the batter holder black cable.

Wi-Fi Connector on the board

Light Conductor Acrylic Tube Placed above the Charging Indicator Red LED Its other end place in the hole and set flash with the outside of the enclosure

Speaker



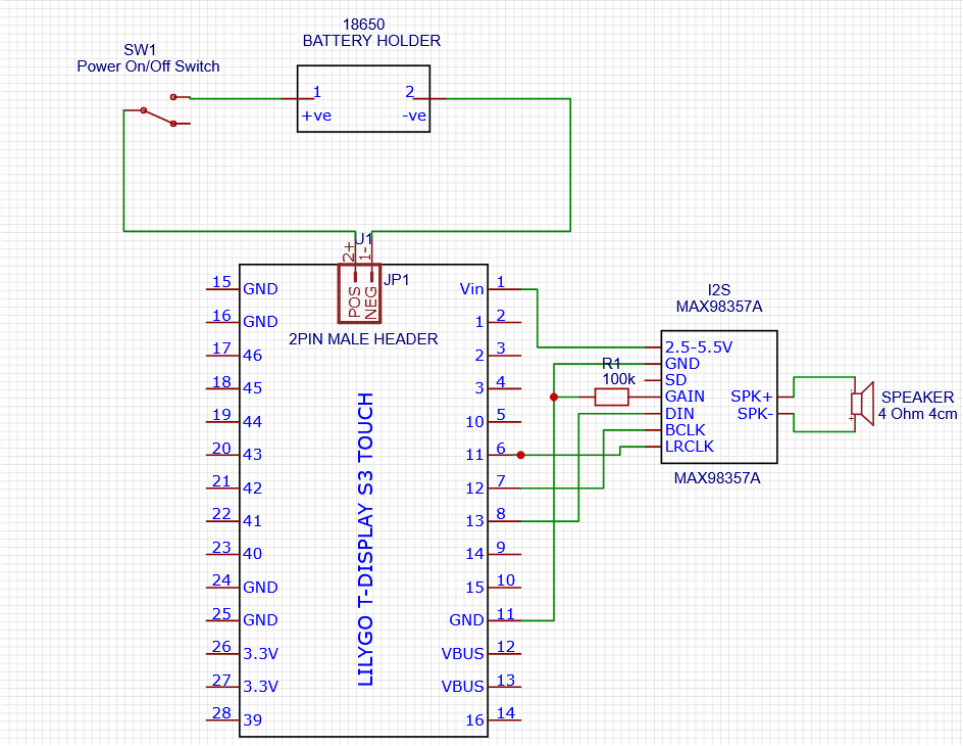
(Optional) Boot and Key buttons transferred from the front of the microcontroller board. In the new version of the enclosure there are two miniature holes in the front of the enclosure

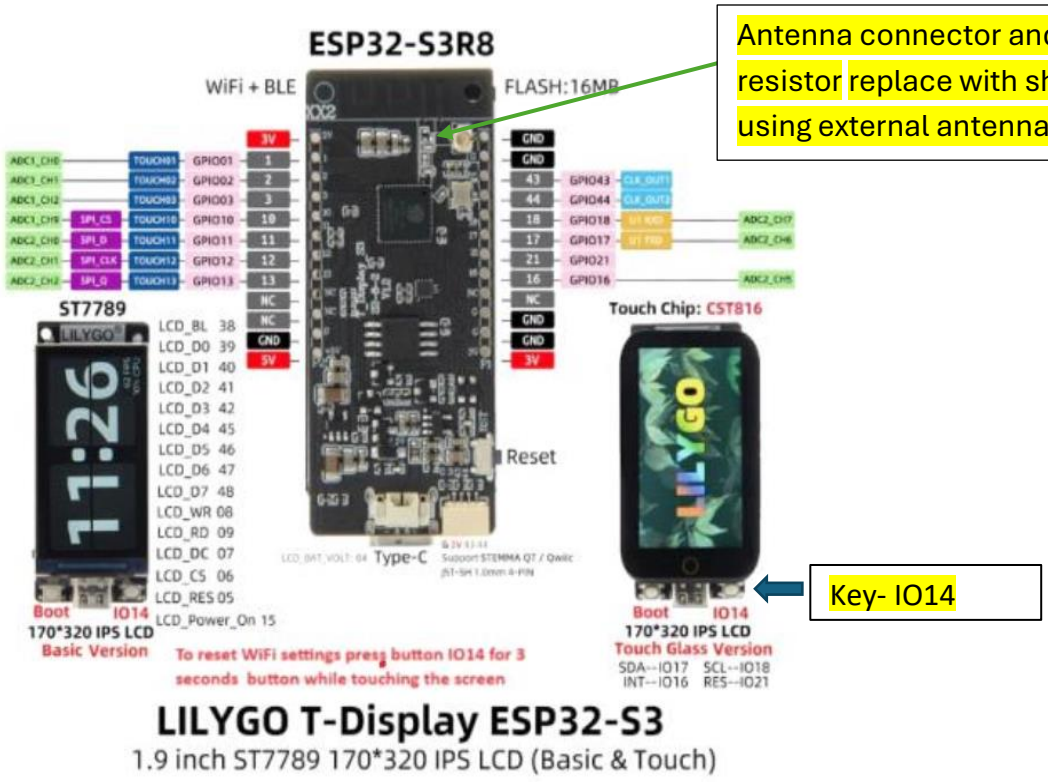
On/Off switch

MAX98537a Module

Speaker cables. Connect red wire between the module + to the right side of the speaker marked with +. Connect black wire to the module – and the left side of the speaker marked with -

18650 Battery + battery holder. The + side of the battery holder should be placed on the left side. The Red wire should be connected to the on/off switch





LILYGO T-Display ESP32-S3

1.9 inch ST7789 170*320 IPS LCD (Basic & Touch)

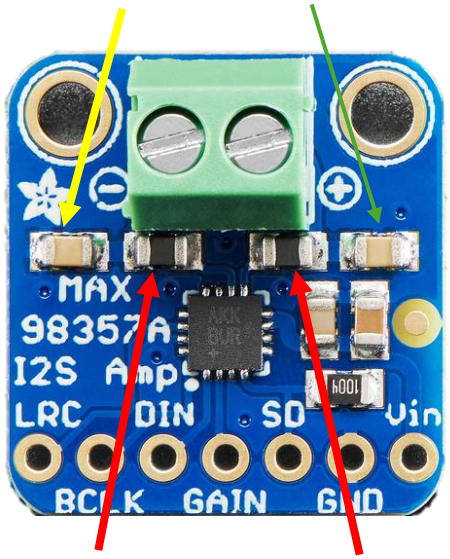
Enclosure V2

Two miniature holes in the front of the enclosure Key and Boot buttons

MAX98357A Module Sound Improvement (Optional)

For slight clearer sound

Remove these 2 capacitors



Remove these 2 ferrites and solder short between the peds instead.

For increasing the MAX98357a amplification connect the **Gain** pin to the **GND** pin for additional +3db.

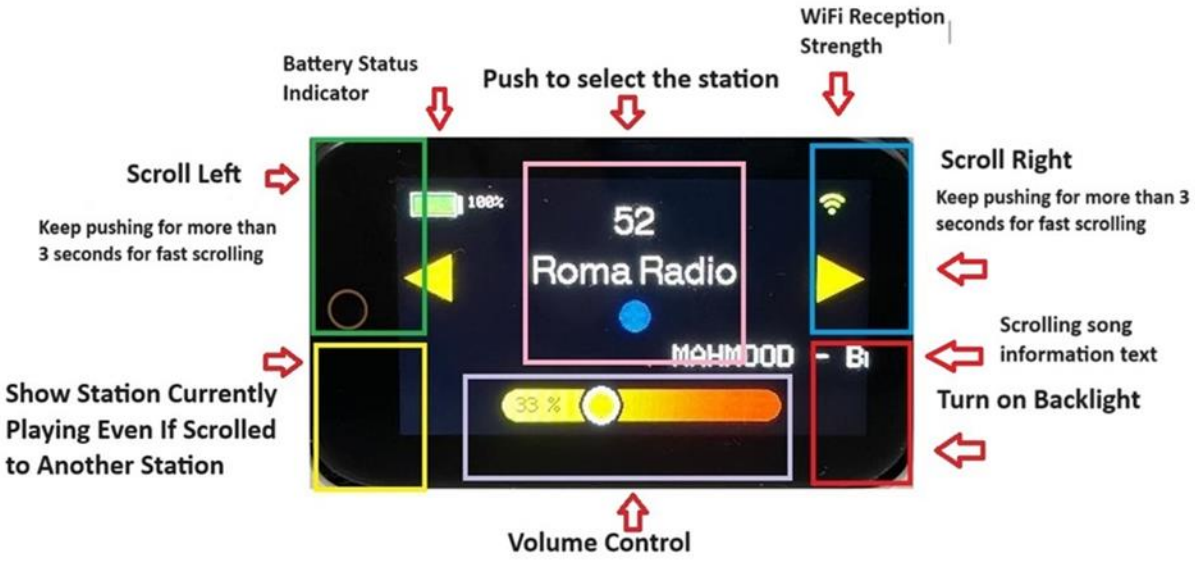
OR

Connect 100k ohm resistor betwenn **Gain** to **GND** for additional +6db.

Gain Selection	
GAIN_SLOT	GAIN
Connect to GND through 100kΩ resistor	+15 dB
Connect to GND	+12 dB
Unconnected (Default)	+9 dB
Connect to VDD	+6 dB
Connect to VDD through 100kΩ resistor	+3 dB

Operation Instructions

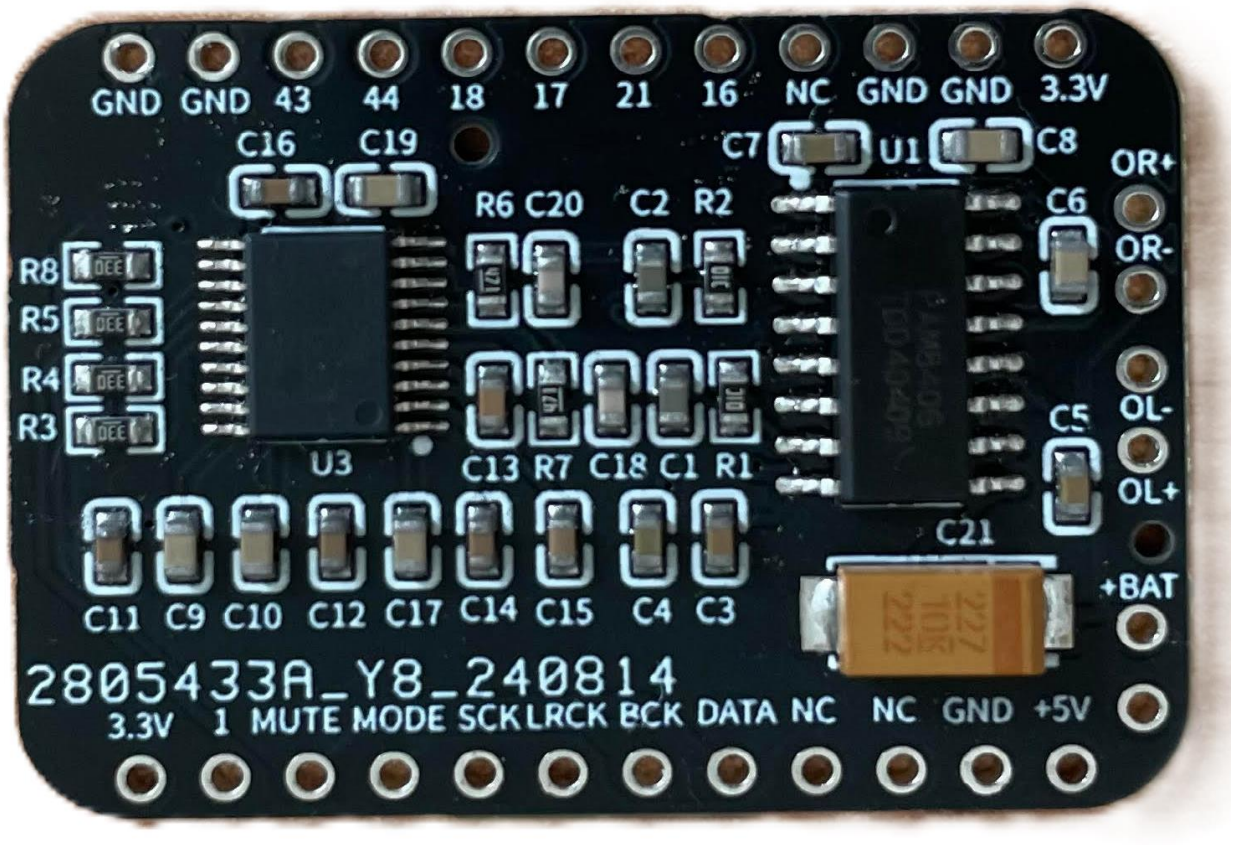
Screen Functions



- You can charge the battery using a standard 5V USB-C charger.
- **When using the following connection topology, in order to charge the battery it is required to leave the On/Off switch in the On position while charging the battery.**
- You can listen to the radio while charging the battery or you can switch to **Silent Charging Mode**. Just choose your preferred option from the web station management system. The radio automatically detects when a USB-C cable is connected.
    - Unchecked Mode - you can listen to the radio while charging.
    - Checked Mode - once you connect the USB-C cable the radio will go to sleep mode while keep charging. To wake up the radio take out the USB cable and tap the screen.
- To fast scroll stations you should press left or right arrows on the LCD for more than 3 seconds.
    -

Custom Made Module

Stereo PCM5102a DAC + Stereo 2x6W Amplifier

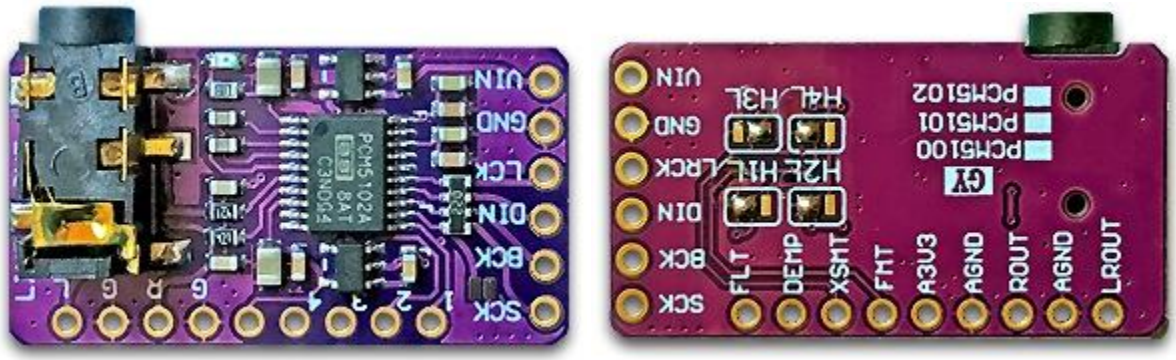


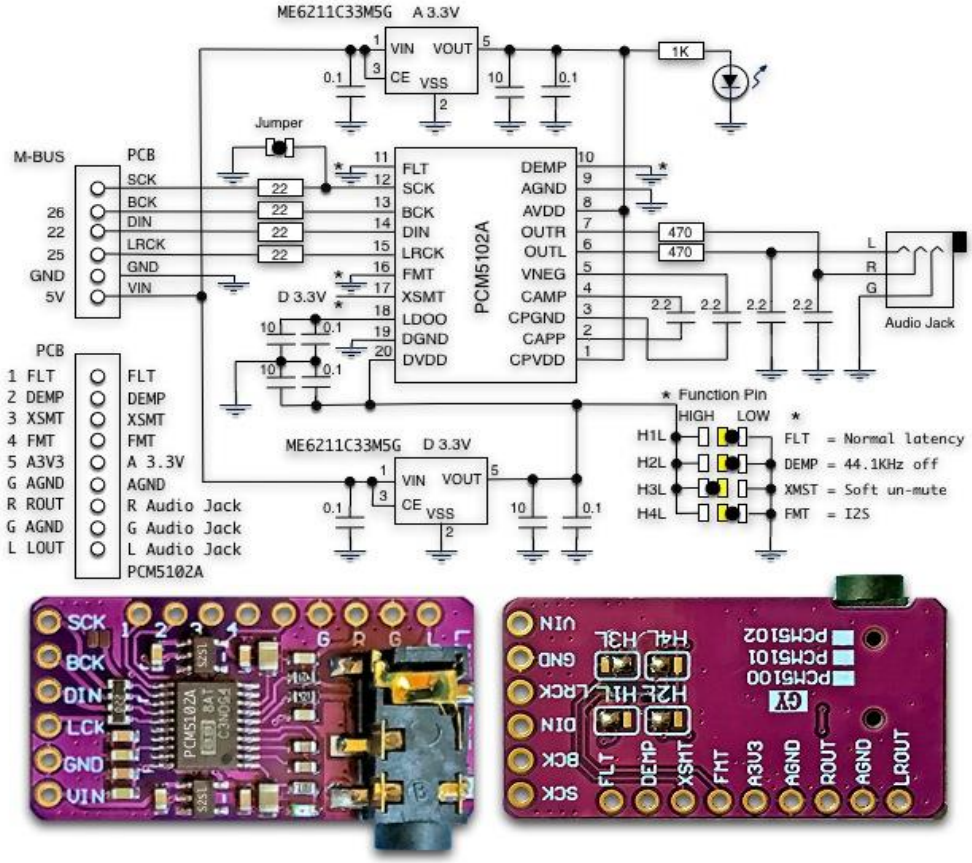
This is a proprietary Stereo DAC + Amplifier in one module. This Module was designed specifically for that Internet Radio. It was designed to sit on top of the Lilygo T-Display S3 Microcontroller in order to simplify connectivity. The only wires required are for the two stereo speakers. This is a Stereo alternative to the Mono MAX98357a module offered with the KIT.

This module utilizes the excellent quality Stereo PCM5102a DAC combined with the PAM8406 powerful 2x6W Stereo Amplifier.

Using a Standard Of The Shelf Stereo PCM5102A DAC Instead of the MAX98357a

The standard, of the shelf PCM5102A I2S DAC Module can be used instead of the Max98357a module but this module provide only headphone output. A separate amplifier is required. Power supply (VIN) is 5Vdc or connect the A3.3v to the 3V3 Pin of the microcontroller.

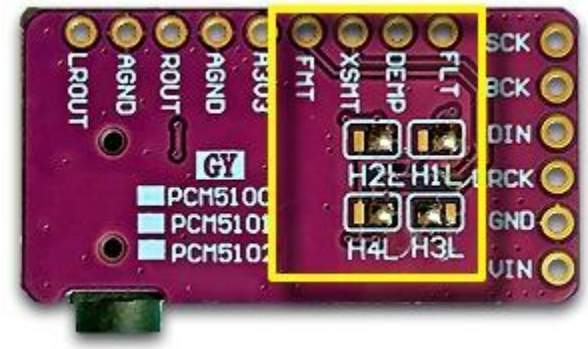




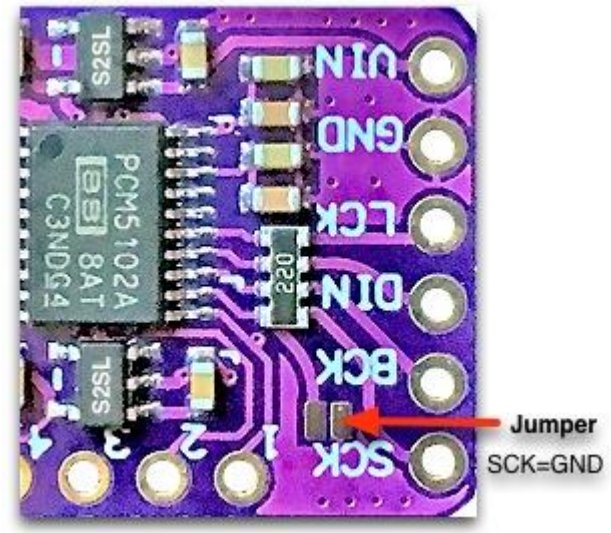
PIN FUNCTIONS: Select = RED: Selected state at time of purchase.

Make sure the soldered jumpers are set as in the photo below.

H	Name	Description	LOW (GND)	HIGH (D 3.3V)
H1L	FLT	Filter select	**Normal latency**	Low latency
H2L	MUTE	De-emphasis control for 44.1kHz sampling rate	**Off**	On
H3L	XMST	Soft mute control	Soft mute	**soft un-mute**
H4L	FMT	Audio format selection	**I2S**	Left justified



Connecting SCK-GND on the board with the wiring below. Generate the system clock using the PCM5102A's internal PLL. This is required to Prevents dielectric noise (if exist). It might work fine even if not connected.



Note that this DAC doesn't have an internal amplifier. It only has an internal pre-amplifier that can drive headphone. In order to use speakers you will need to connect it to an external amplifier or amplifier module.