

Spencer Anatomy Guide

What's on the board?

Circuit board

Welcome to Spencer's anatomy guide!

This guide will be helpful whether you already assembled your own voice assistant or still to do so.

We'll show you the main components on the board and their functions in the following few steps.

Let's start with exploring the board design...

Board design

Assembling Spencer is a fun experience by itself, and in addition to that, we wanted to make our boards look exciting.

Feel free to explore the recognizable CircuitMess elements on the back of the main board.

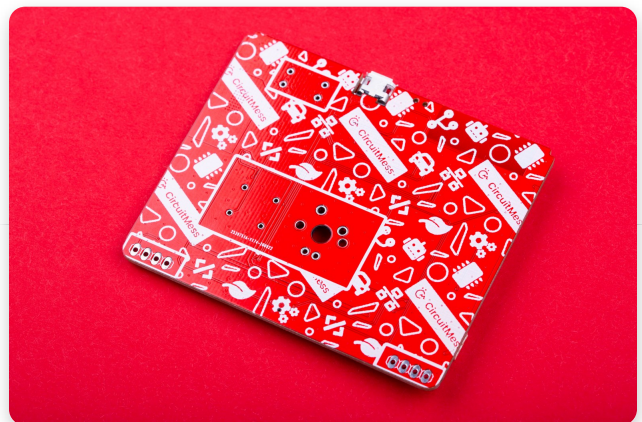
Cars, robots, circles, leaves, chips, you have it all here:

Exploring the main board

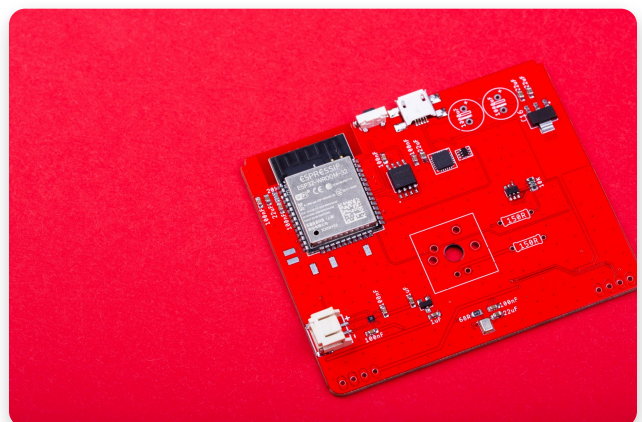
PCB stands for a printed circuit board.

Basically, this fiberglass board has copper traces on it, some protective paint, and insulating material.

Thanks to all the copper leads on the board, all the connected or soldered components can communicate with each other.



The design on the back of the main board



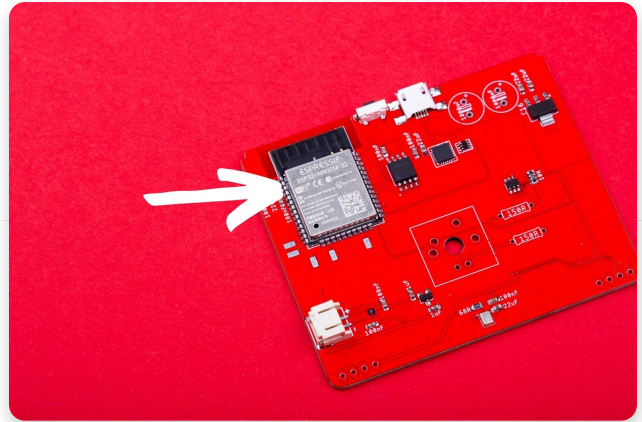
The front side of the board

ESP32 microcontroller

This microcontroller brings Spencer to life. You could say the ESP32 is like Spencer's brain because it controls sound processing and animations on the display.

Due to its complexity and sensitivity, this module is already soldered to Spencer's main board.

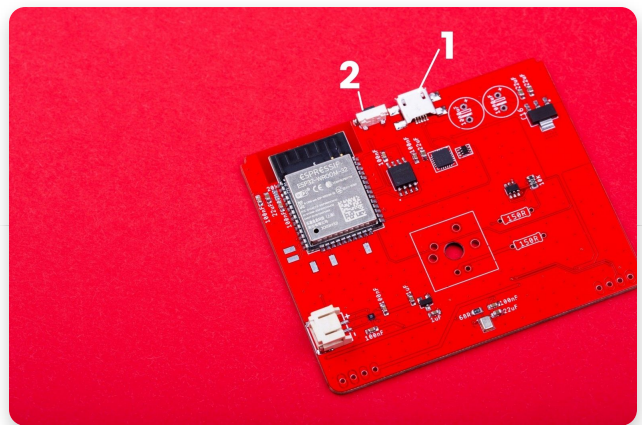
- [ESP32 datasheet](#)



ESP32 microcontroller

USB connector & reset button

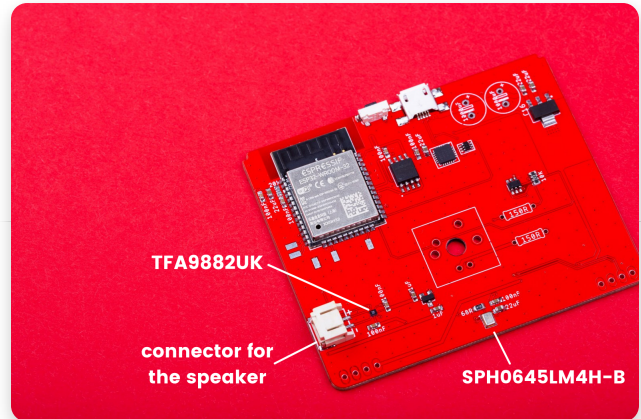
1. **USB connector:** This is a micro USB connector used for connecting your Spencer to the computer or any power supply. Thanks to this feature, Spencer can work without batteries.
2. **Reset button:** This one's pretty self-explanatory - the reset button is used for resetting the whole device. You can find this useful in case something gets frozen (which is hopefully never).



USB connector & reset button

More components on the board

- TFA9882UK: This little chip is Spencer's sound amplifier. It's located very close to the connector for the speaker which makes sense because it's right on the path a sound output makes from the microcontroller to the speaker.
- Connector for the speaker: This is a place where you should connect the speaker to the main board.
- SPH0645LM4H-B: Its name sounds complicated, but we could translate it to, simply, *Spencer's microphone*. It listens to all your commands and then sends this input to the ESP32 microcontroller that processes it and reacts with some output.

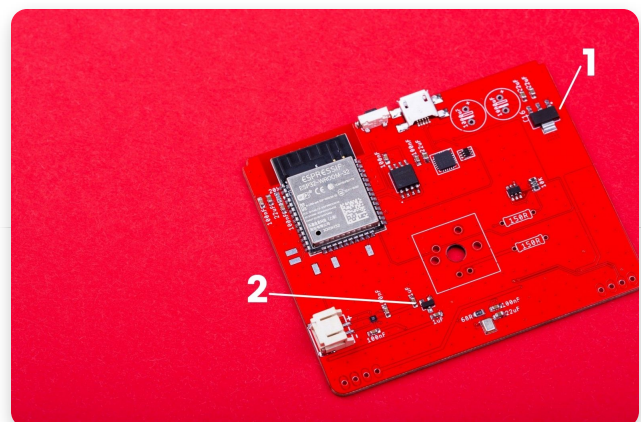


Components used for sound inputs and outputs

Voltage regulators

There are two voltage regulators that keep the voltages from a power supply within a range that is compatible with the other electrical components on Spencer's board.

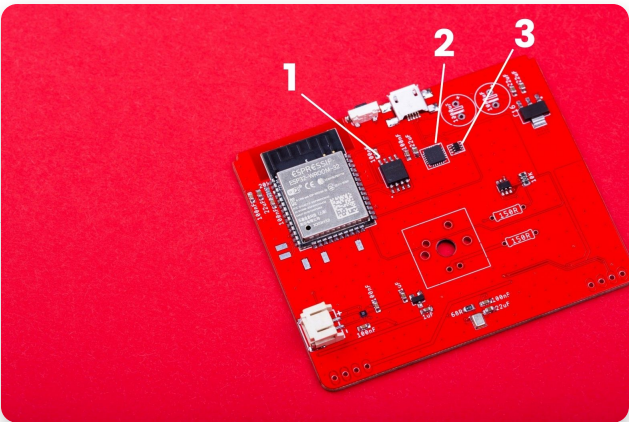
1. The big one – 3.3V
2. The smaller one – 1.8V



Voltage regulators

More chips and tricks

- 1. This chip is Spencer's flash memory - 16MB.
- 2. Chip CP2014 is important because it enables the connection to the computer. It's also used as a USB-TTL converter and you can find the same chip in [CircuitMess Jay-D](#).
- 3. This small chip between the CP2014 and the big voltage regulator is controlling the LED lights.



A few more chips...

LED board

Spencer's LED matrix is quite impressive because it enables you to show all the different animations that you can program in CircuitBlocks.

Do you want to guess how many LED lights are there on the board? (*scroll down to find the answer*)

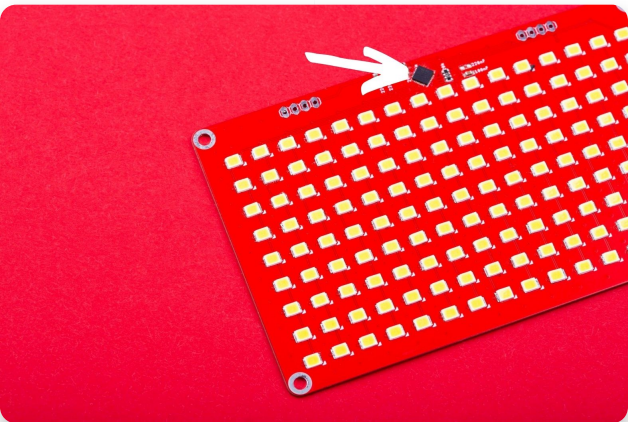
There is still that cool design on the back of the board:



Spencer's LED grid consists of 144 small LED lights that light up depending on your chosen animation or Spencer's answer to your command.

This particular model of the lights is called HL-AM-2835H489W-S1-08HL-HR3.

The small component that's pointed in the photo is **the LED driver** called IS31FL37.

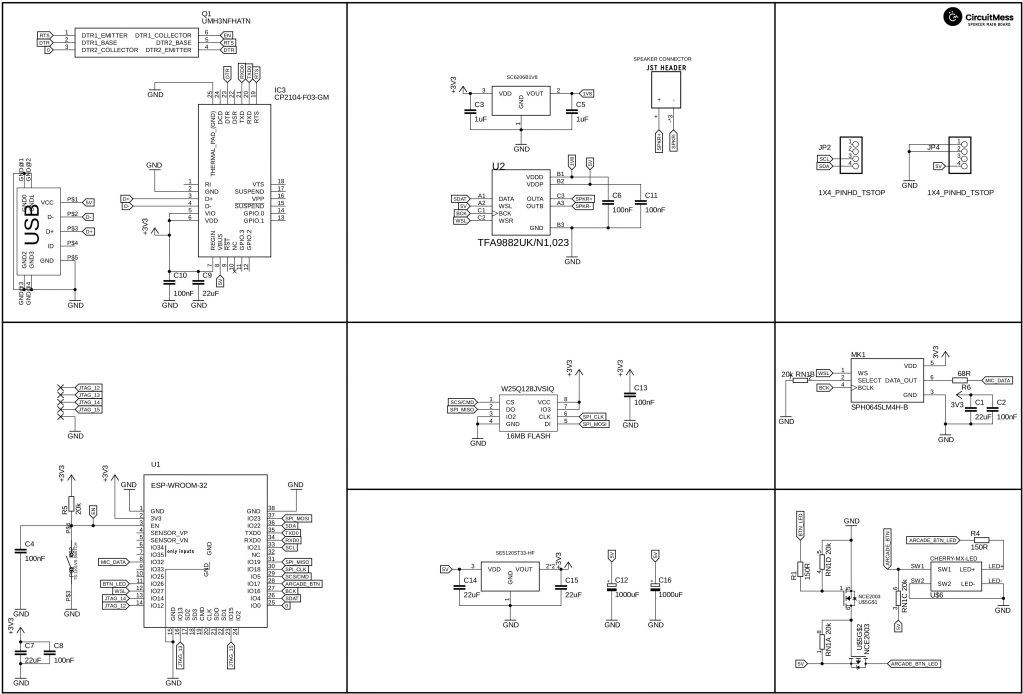


Schematics

Circuit board

Spencer's circuit board schematics

For the best experience, open the photo in the new tab and zoom in.



LED board

Spencer's LED board schematics

For the best experience, open the photo in the new tab and zoom in.

