



SYSTEM-IN-PACKAGE



Basic functional check of the board after assembly

After the process of designing the PCB, making, assembling, and soldering the components on the board, it will be necessary to check if the soldering was done correctly, if there is a failure, a short caused during soldering, or even a wrong track or a defective component.

Tools to be used

Basically, two instruments should be used for the Test Board case:

- Digital Multimeter (Bench or Handheld).
- An adjustable DC source of 5V/3A or higher ideally benchtop, as shown in image 1.

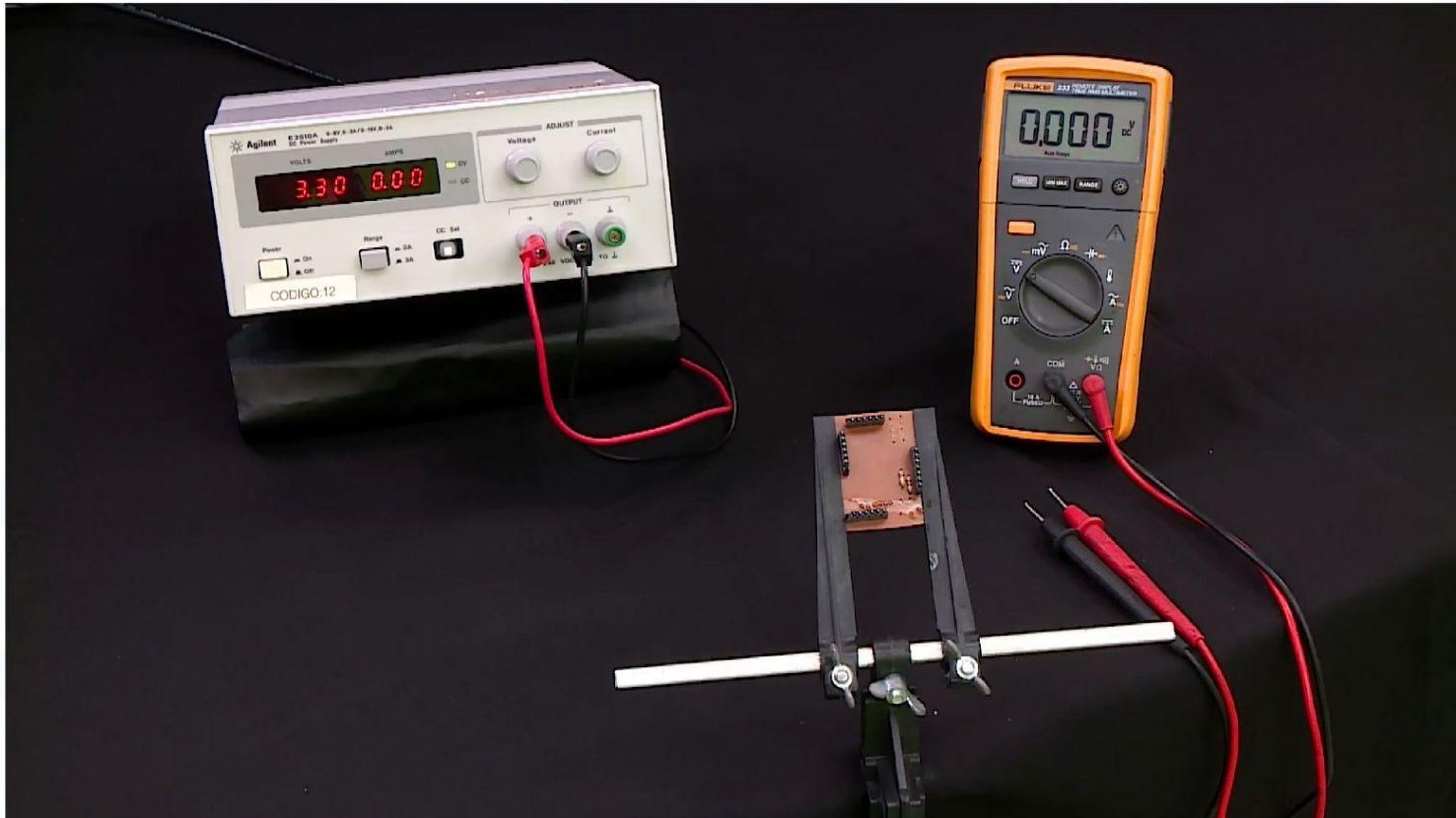


Image 01: Instruments: DC 5V or Higher Source (left), Benchtop Multimeter (right). *Source: The author*

- Continuity test

Continuity is the presence of a complete path for current flow. A closed switch that is operational, for example, has continuity. A continuity test is a quick check to see if a circuit is open or closed. Only a closed and complete circuit (that is turned on) has continuity.



Image 02: Continuity test. Source: The author.

During a continuity test, a digital multimeter sends a small current through the circuit to measure the resistance in the path of the path. A meter with a continuity beeper sounds briefly when it detects a closed circuit. The level of resistance needed to trigger the beep varies by meter, but most will indicate continuity with a measurement between 0-50 ohms.

More information about continuity testing can be found in the Fundamentals Track on **Verifying Electronic Circuit Performance with Test Equipment**.

Some possible problems that might be encountered during a PCB wake up

- Short Circuit

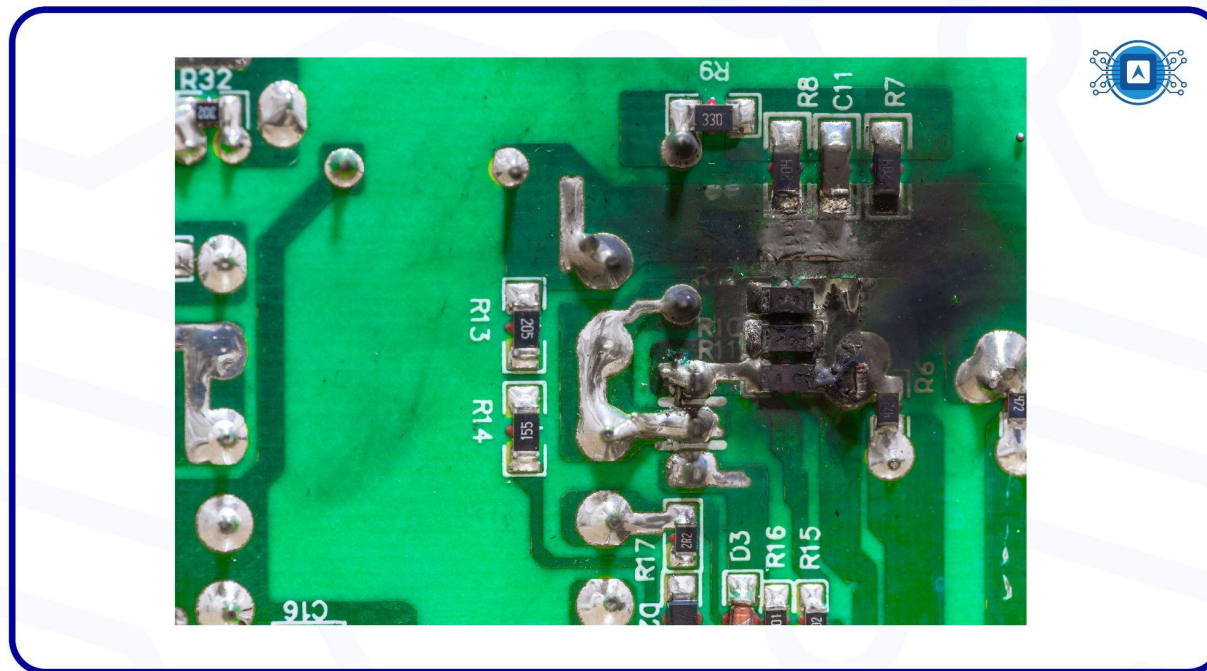


Image 03: Short Circuit. Source: Dreams Time

<<https://pt.dreamstime.com/electricidade-da-placa-de-circuito-do-pwb-procura-um-caminho-mais-curto-image103587035>>.

As can be seen in image 01, a short circuit can damage trails and components, so it is necessary to make an inspection with the aid of a magnifying glass when soldering the components to identify these possible shorts circuits.

- **Open circuit by solderless component**

Another example is terminals with little or no soldering, which can cause open circuits where there is no current flow through the components as shown in image 04.

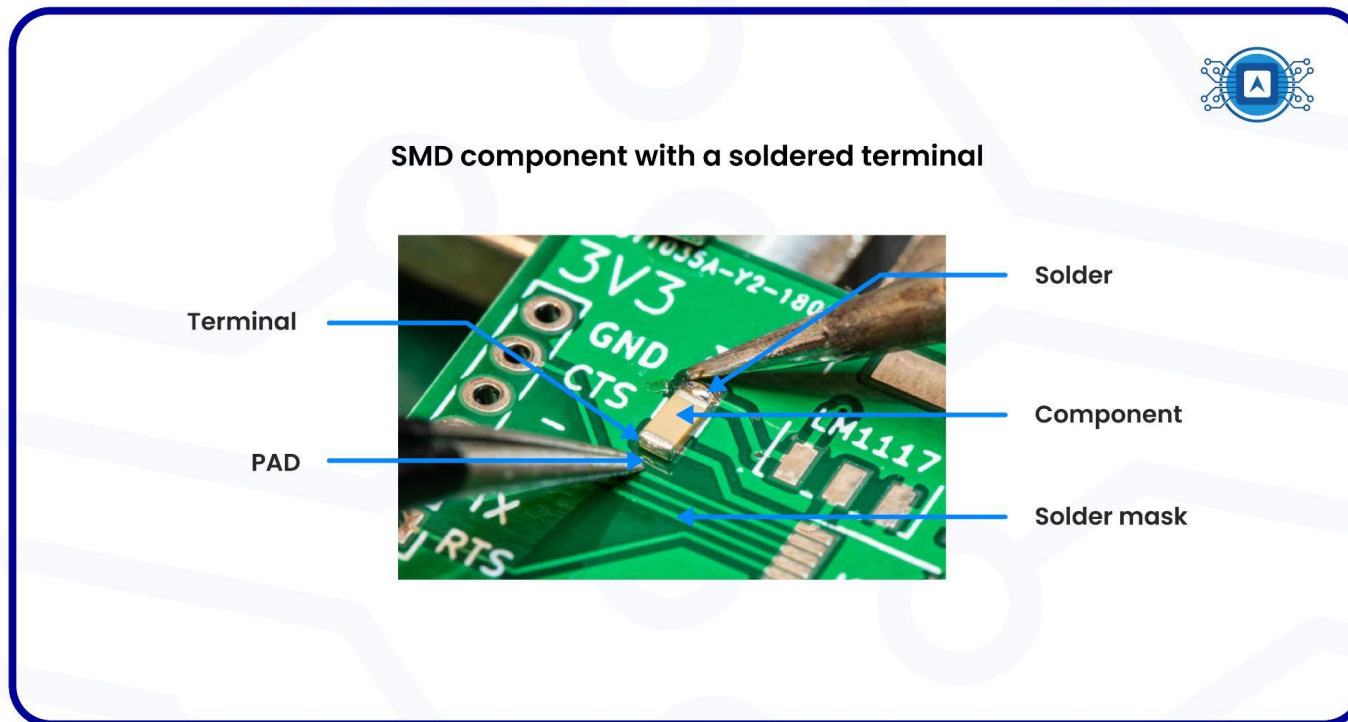


Image 04: Solderless terminal. Source: *Gadgetronic* <<https://www.gadgetronicx.com/smd-soldering-tools-techniques/>>.

Points to Check on the Test Board

Now let's identify from the electrical schematic which measuring points we are going to check. The main points are:

Points that should be checked:

1. Line between 3V3 and GND

Check for a short using a multimeter, because if there is a short, the circuit current will rise, damaging tracks and components.

2. TX/RX lines of the FTDI board and the Breakout board

A possible short between these two tracks, can cause the FTDI and the chip to not communicate any data.

3. GND-GND points

This check must be made that there is a connection between the grounding points, because in case of open points there can also be failures in the operation of the circuit.

4. Points between 3V3 and another 3V3

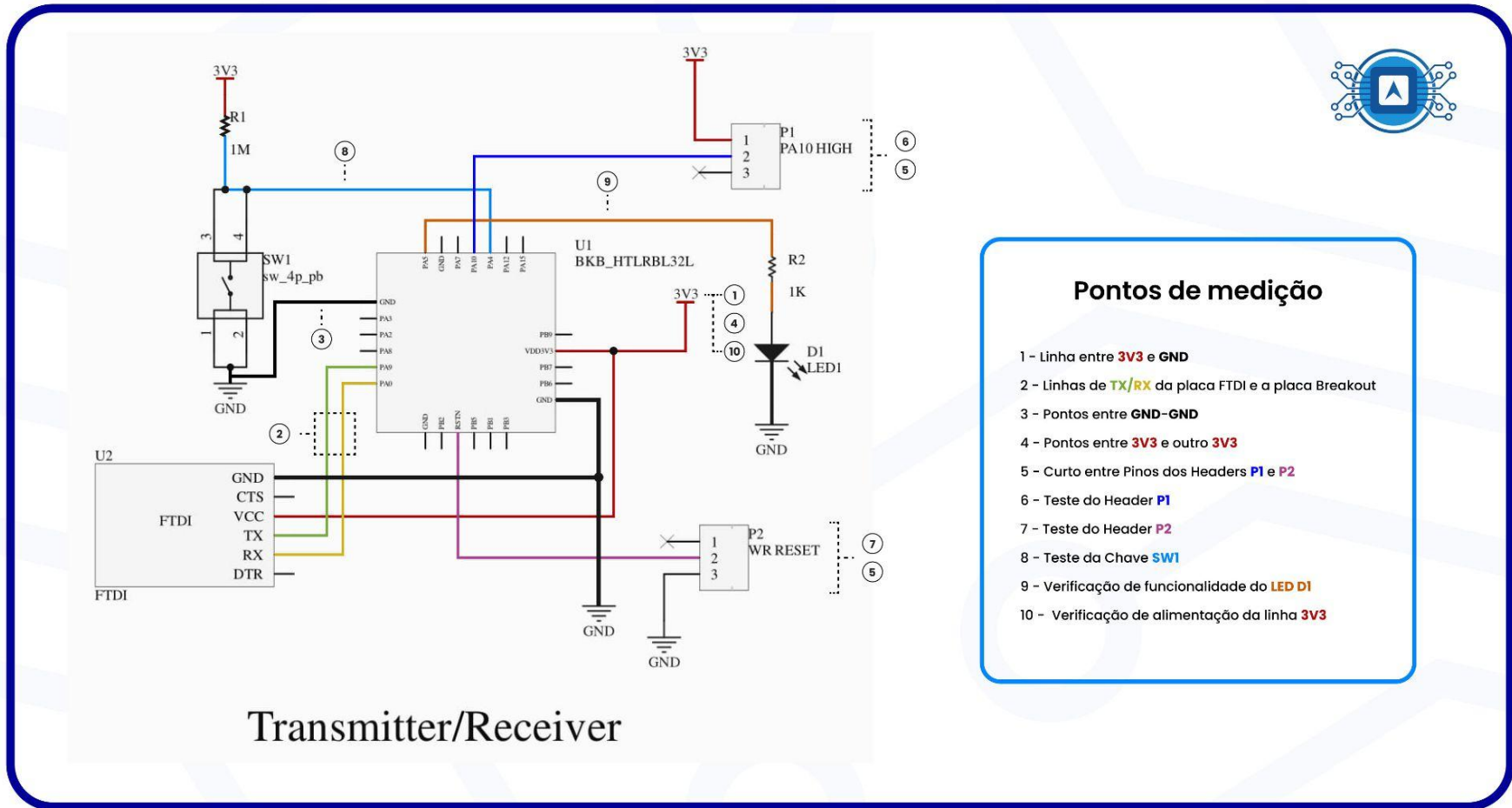
As well as checking that the grounding points are open, the power supply points have to be connected together, so that no malfunction of the circuit can occur.

5. Short between P1 and P2 Headers Pins

Tracks that are too close together or solder filets can cause unwanted shorts between connector pins, causing the circuit to malfunction at some point during operation.

6. P1 Header Test

A test that can be done is to check the connection between P1(DI07) and 3V3, and by setting the jumper to position 1, the beep sound should be heard



Pontos de medição

- 1 - Linha entre **3V3** e **GND**
- 2 - Linhas de **TX/RX** da placa FTDI e a placa Breakout
- 3 - Pontos entre **GND-GND**
- 4 - Pontos entre **3V3** e outro **3V3**
- 5 - Curto entre Pinos dos Headers **P1** e **P2**
- 6 - Teste do Header **P1**
- 7 - Teste do Header **P2**
- 8 - Teste da Chave **SW1**
- 9 - Verificação de funcionalidade do **LED D1**
- 10 - Verificação de alimentação da linha **3V3**

Image 05: Test Board circuit. Source: *The Author*.

7. P2 Header Test

The same can be done on the RESET line P2 by connecting it to GND and setting the jumper to position 2.

8. SW1 Switch Test

We can also do a SW1 switch check by connecting terminals PA4 and GND on the board, then press the button and you should hear the beep.



Image 06: Checking with a multimeter. Source: *The Author*.

9. Functionality check of LED D1

In this check we will inject a voltage of 3V3 at some points on the board to simulate current flow at these points. To do this it is necessary to set the voltage source to 3.3V and inject this voltage at PA5 the red terminal and the black terminal at a GND pin of the board. At this point it is expected that the LED will light up.

10. 3.3V line power verification

Finally, apply the 3.3V voltage to the VDD3V pin and the GND tip to the PCB Ground and then measure with the multimeter on the DC voltage scale the 3.3V voltage at other points of the board.

- SiP Operational Test

- After checking the circuit with the indicated steps, we can connect the FTDI board and the breakout board;
- Connect the USB cable to the computer;
- This concludes the Test Board verification step.

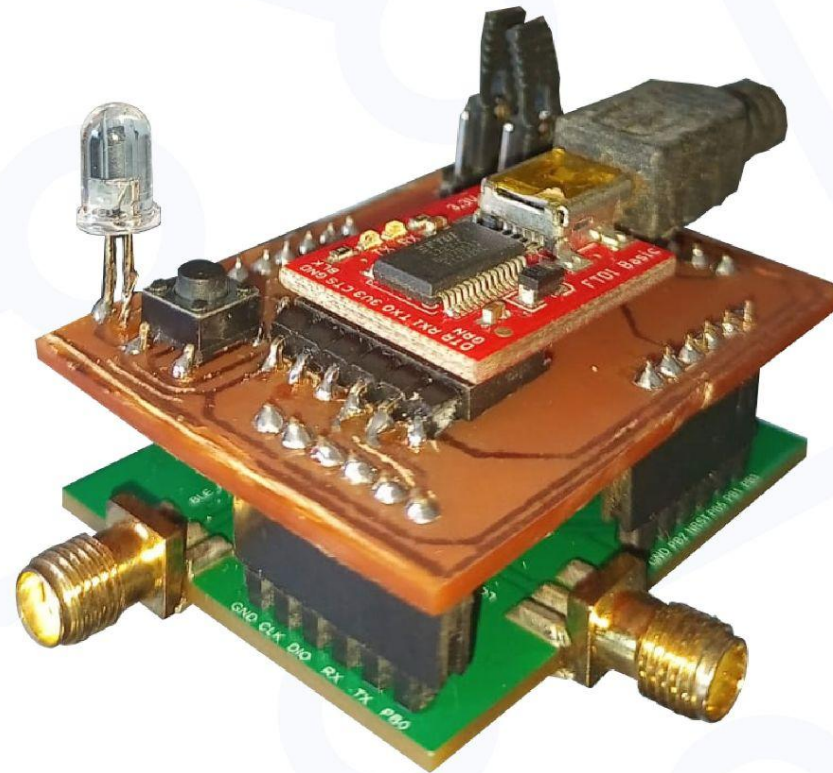


Image 07: Assembled Test Board. Source: *The Author*.

References

HOW Conduct a Short Circuit Test for PCBs. In: Altium webpage. [S. l.], 23 nov. 2020. Available at: < <https://resources.altium.com/p/how-test-short-circuit-pcb> >. Accessed on July 29th 2022.

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