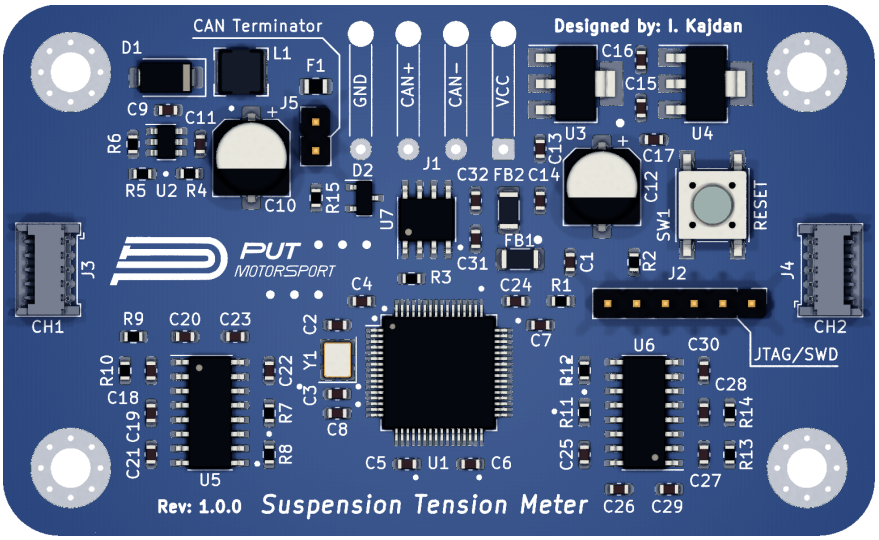
Enhancing Suspension Performance: Suspension Tension Meter

In the world of motorsports and vehicle engineering, precise measurement and data collection play a crucial role in optimizing performance. One of the devices that allows us to measure such data is a Suspension Tension Meter. It's a circuit designed to measure uniaxial forces acting on push-rods and transmit the collected data over the Controller Area Network (CAN) bus.



This PCB is a part of a larger-scale project undertaken by PUT Motorsport, the racing team associated with the Poznan University of Technology.
Since 2014, we have been continuously engaged in the design, manufacturing, and testing of racing cars. These cars undergo rigorous evaluation during international competitions, where teams from all over the world participate.
Lately, we were focused on developing and enhancing an autonomous car. A numerous design choices have been made throughout this process to optimize its performance and to make it adhere to the technical rules and regulations.

JLCPCB's commitment to excellence and dedication to innovation perfectly align with our team's goals and aspirations. As a leading PCB fabrication house, JLCPCB's support is invaluable in helping us achieve our objectives in the competitive world of motorsport.

At its heart, this advanced circuit is built around the STM32L4 microcontroller unit (MCU), renowned for its efficiency and versatility in embedded systems. The STM32L4 MCU forms the brain of the operation, orchestrating the collection and transmission of critical suspension data.
What makes the Suspension Tension Meter precise is the use of the NAU7802 precision low-power 24-Bit Dual-Channel Analog-to-Digital Converter (ADC). This specialized IC is engineered to provide precise measurements from strain gauge sensors, ensuring that the forces acting on the push-rods are accurately and reliably recorded.

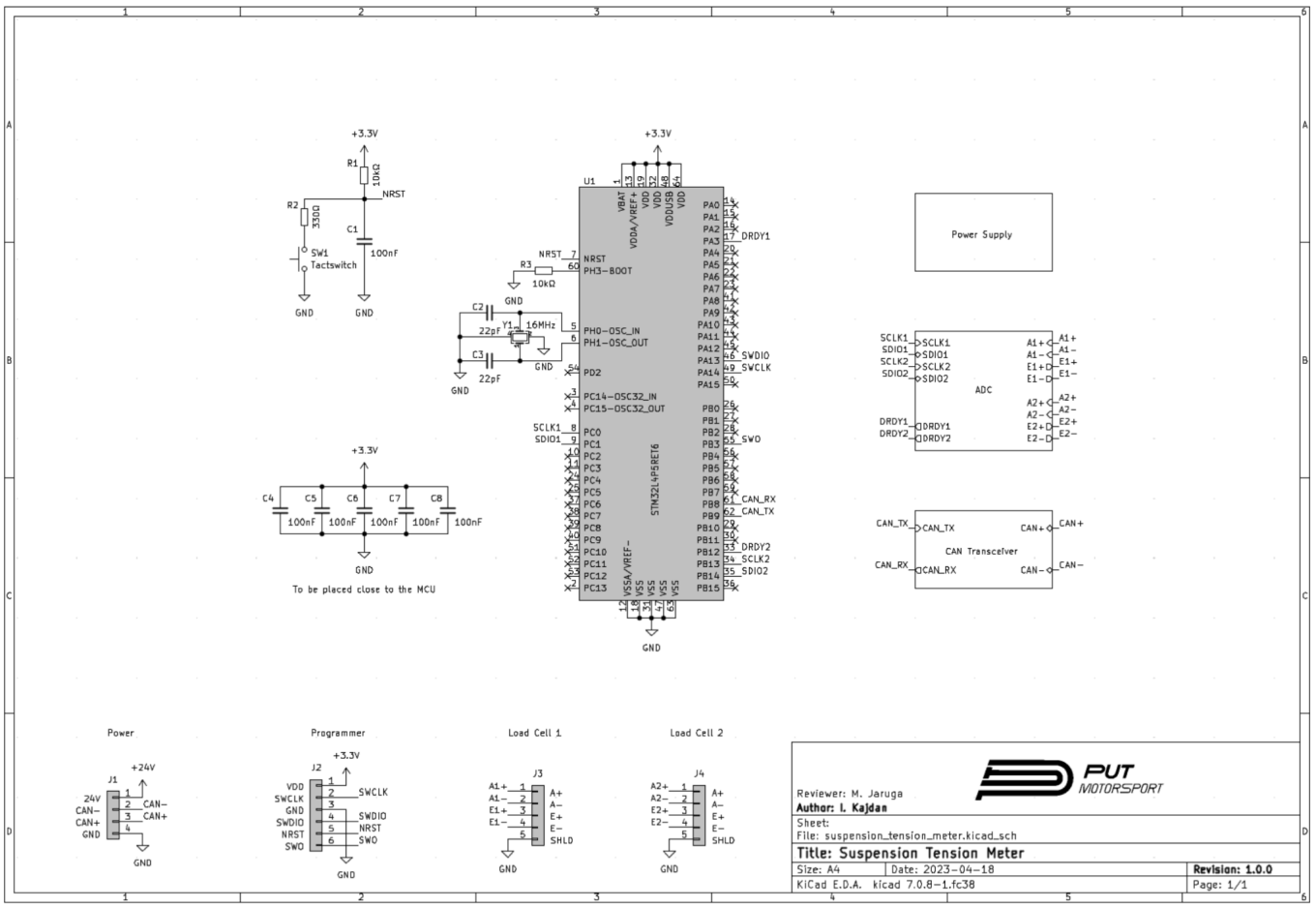
The key to the accuracy of this system lies in the high resolution and precision offered by the 24-bit ADC. It can capture even the slightest changes in tension with exceptional sensitivity, making it an invaluable tool for our engineers looking to fine-tune the suspension system.

As vehicles hurtle down the racetrack or navigate challenging terrains, the Suspension Tension Meter's ability to provide real-time data over the CAN bus opens up a world of possibilities. Having the telemetry data, we can use it to make adjustments to the suspension settings, optimizing the vehicle's handling and overall performance.

In the Suspension Tension Meter, the CAN interface serves as the backbone of data transfer, ensuring seamless communication between the circuit's STM32L4 MCU and other relevant components or systems within the vehicle. This integration allows real-time transmission of precise suspension data over the Controller Area Network. The CAN interface's deterministic and low-latency characteristics are essential in this context, enabling engineers and drivers to fine-tune the suspension settings in real time, enhancing the vehicle's handling and overall performance on the track.

The whole project including both the hardware, and the firmware is open source. The repository is available at PUT-Motorsport/PUTM_EV_SUSPENSION_TENSION_METER_2023.

Schematic



Reviewer: M. Jaruga
Author: I. Kajdan
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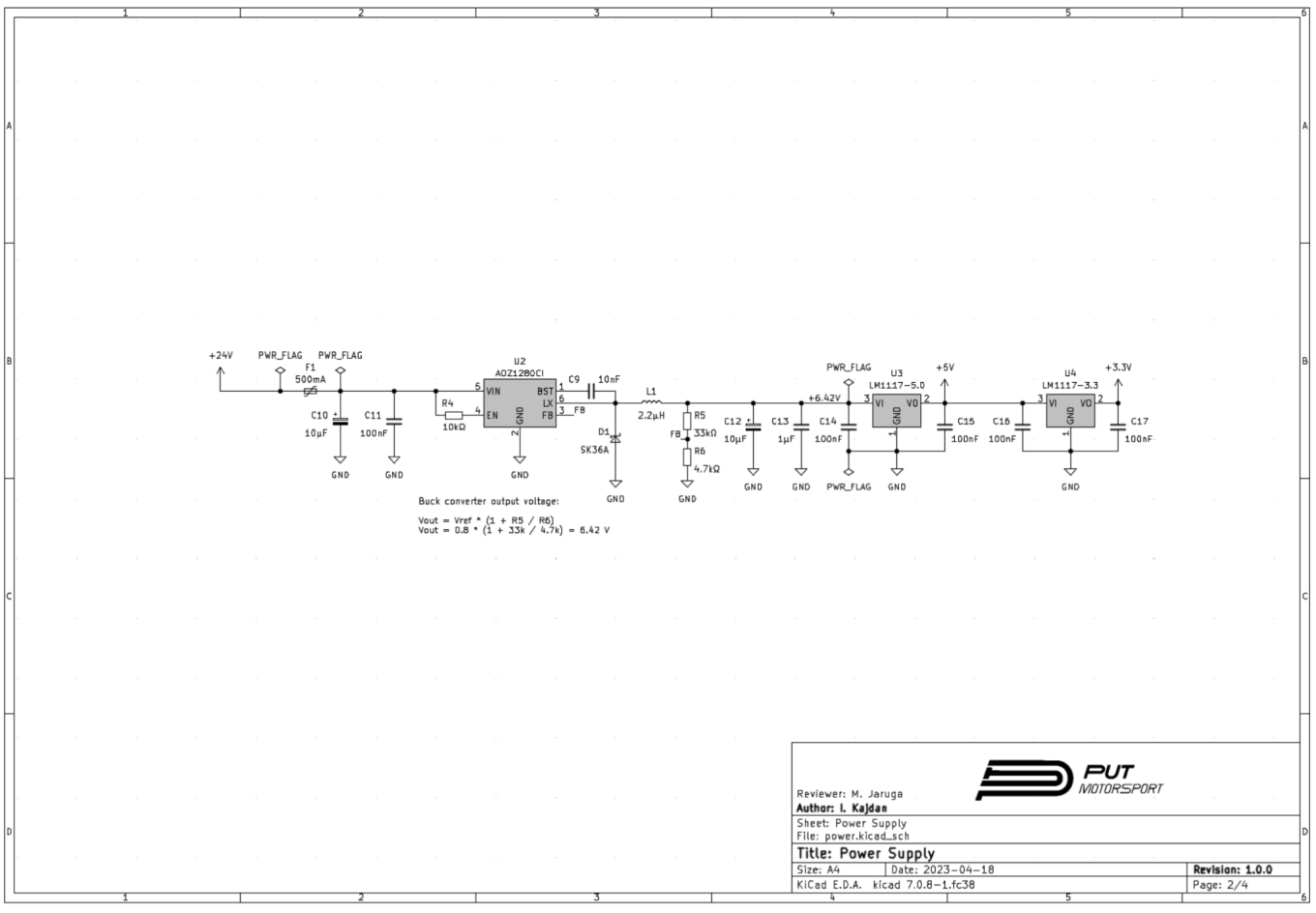
Title: Suspension Tension Meter
Size: A4 | Date: 2023-04-18 | **Revision: 1.0.0**
KiCad E.D.A. kicad 7.0.8-1.fc38 | Page: 1/1



Reviewer: M. Jaruga
Author: I. Kajdan
Sheet: Power Supply
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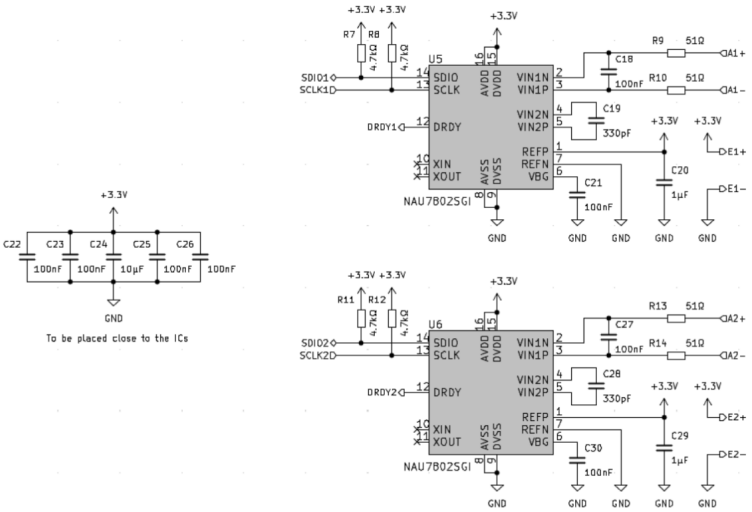

Reviewer: M. Jaruga
Author: I. Kajdan
Sheet: ADC
File: adc.kicad_sch

Title: ADC

Size: A4	Date: 2023-04-18	**Revision: 1.0.0**
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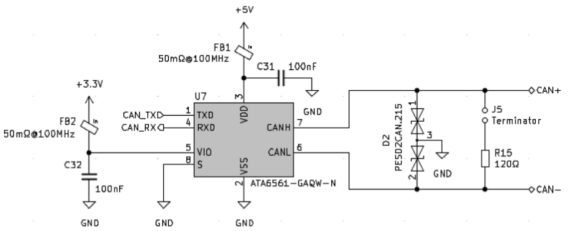
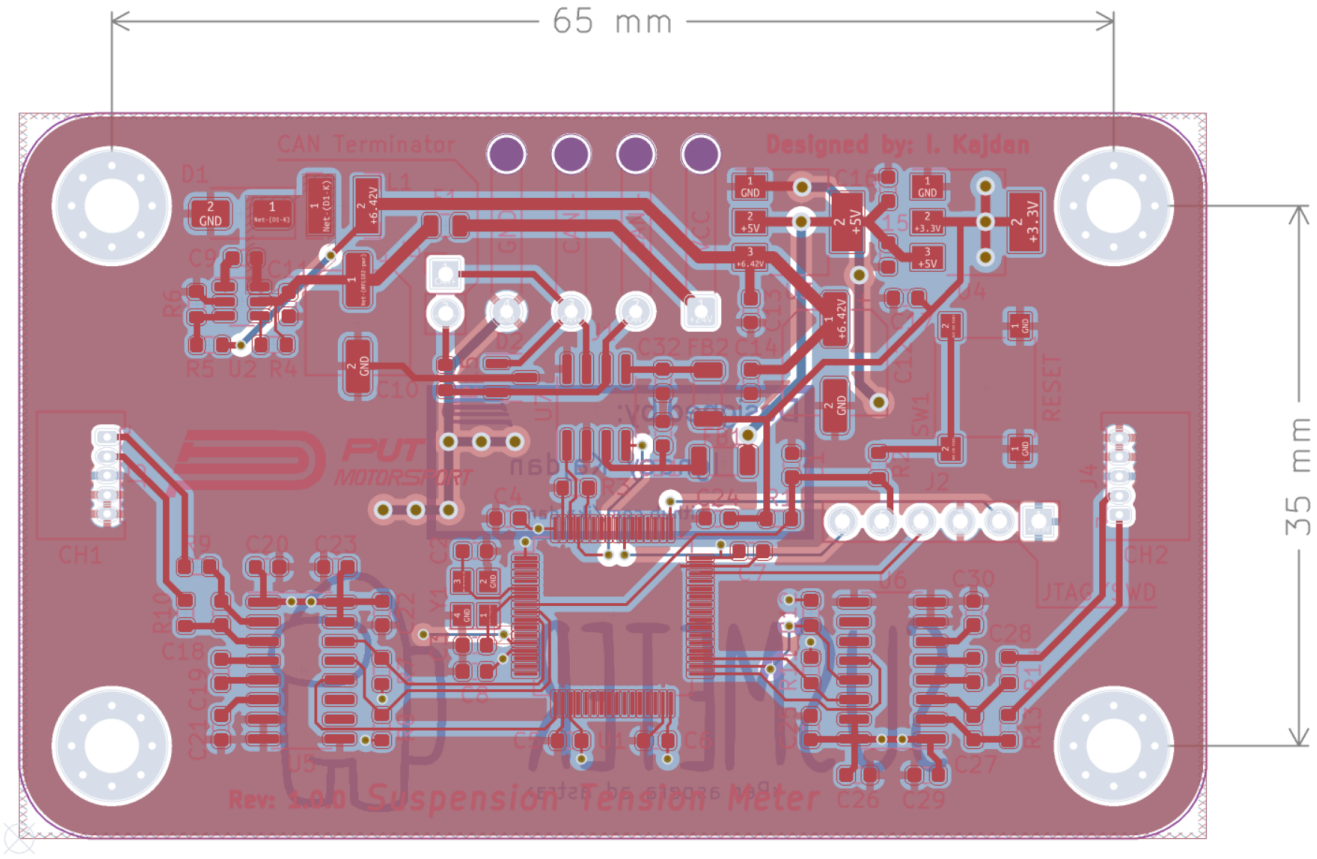


Reviewer: M. Jaruga
Author: I. Kajdan
Sheet: CAN Transceiver
File: can.kicad_sch

Title: CAN Transceiver

Size: A4	Date: 2023-04-18	**Revision: 1.0.0**
KiCad E.D.A. kicad 7.0.8-1.fc38		Page: 4/4

PCB Layout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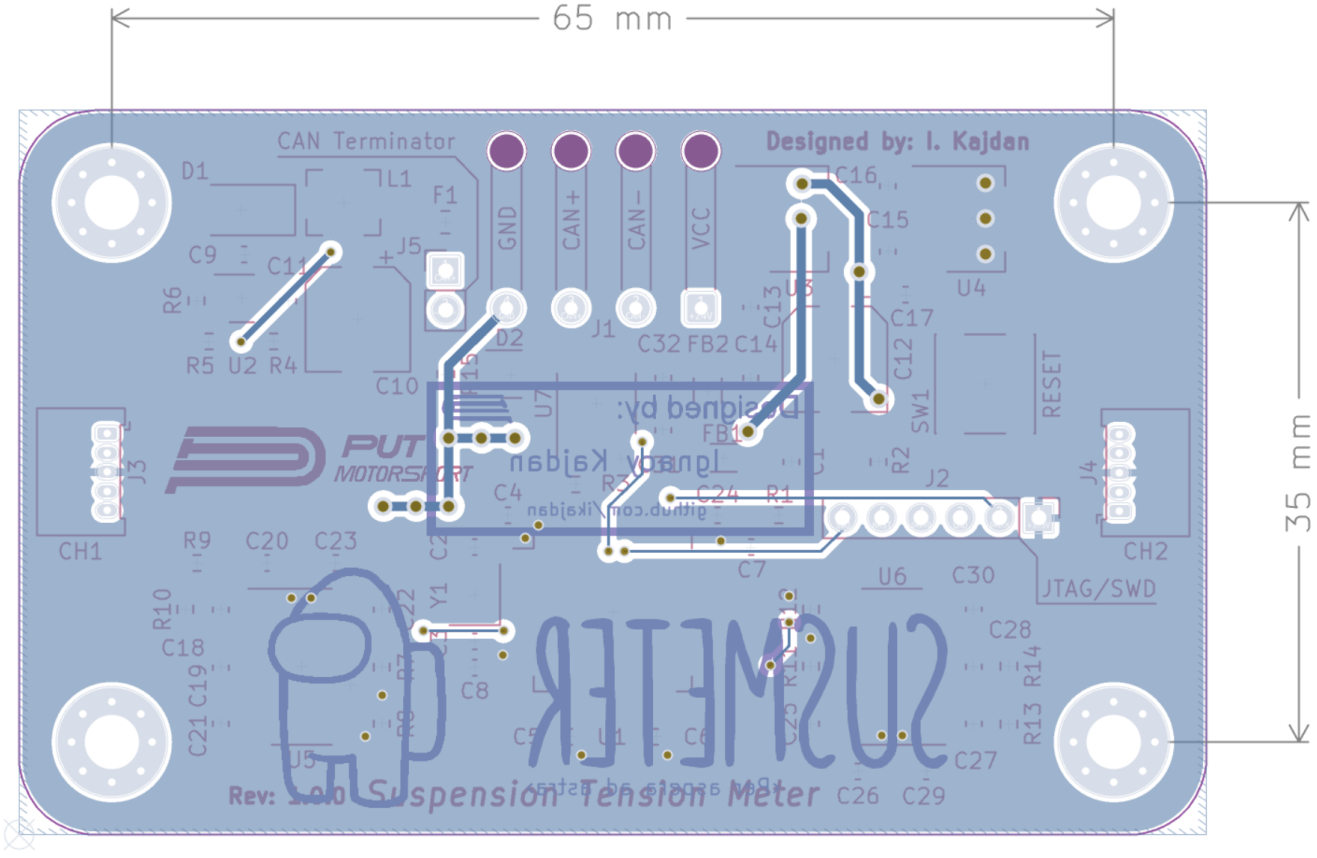
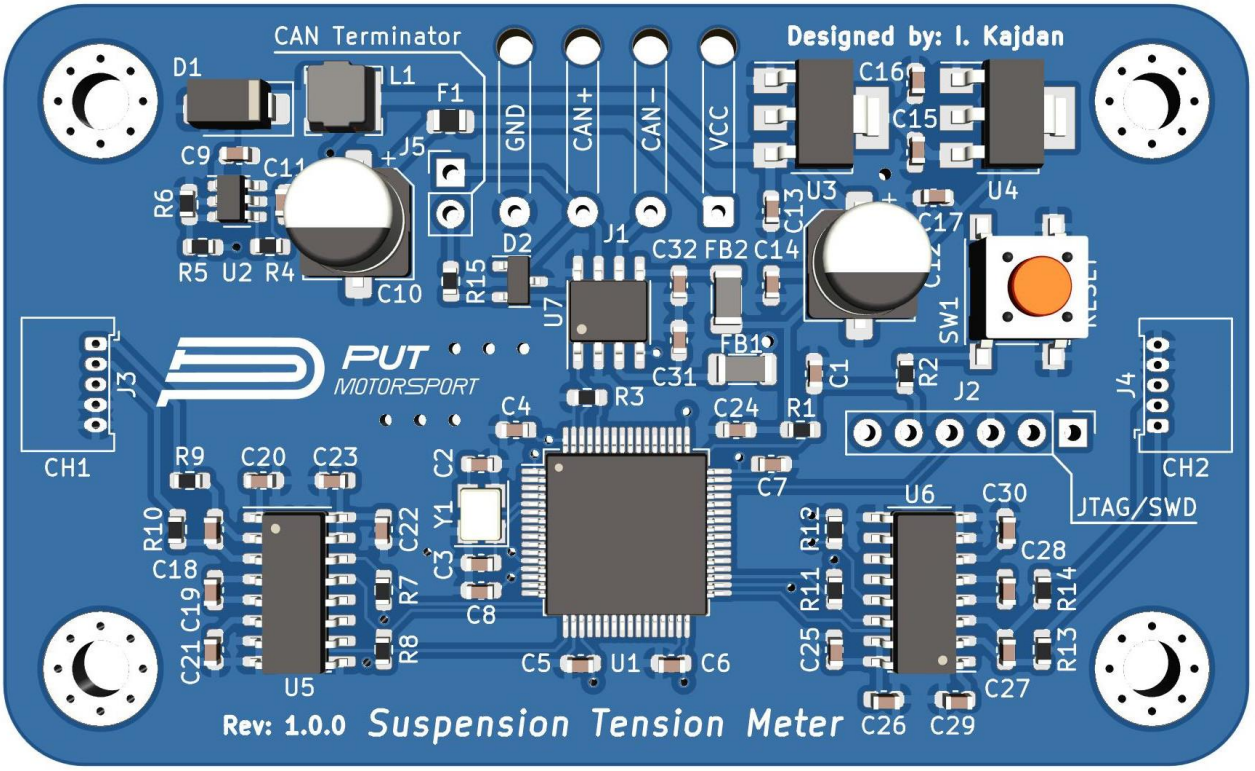
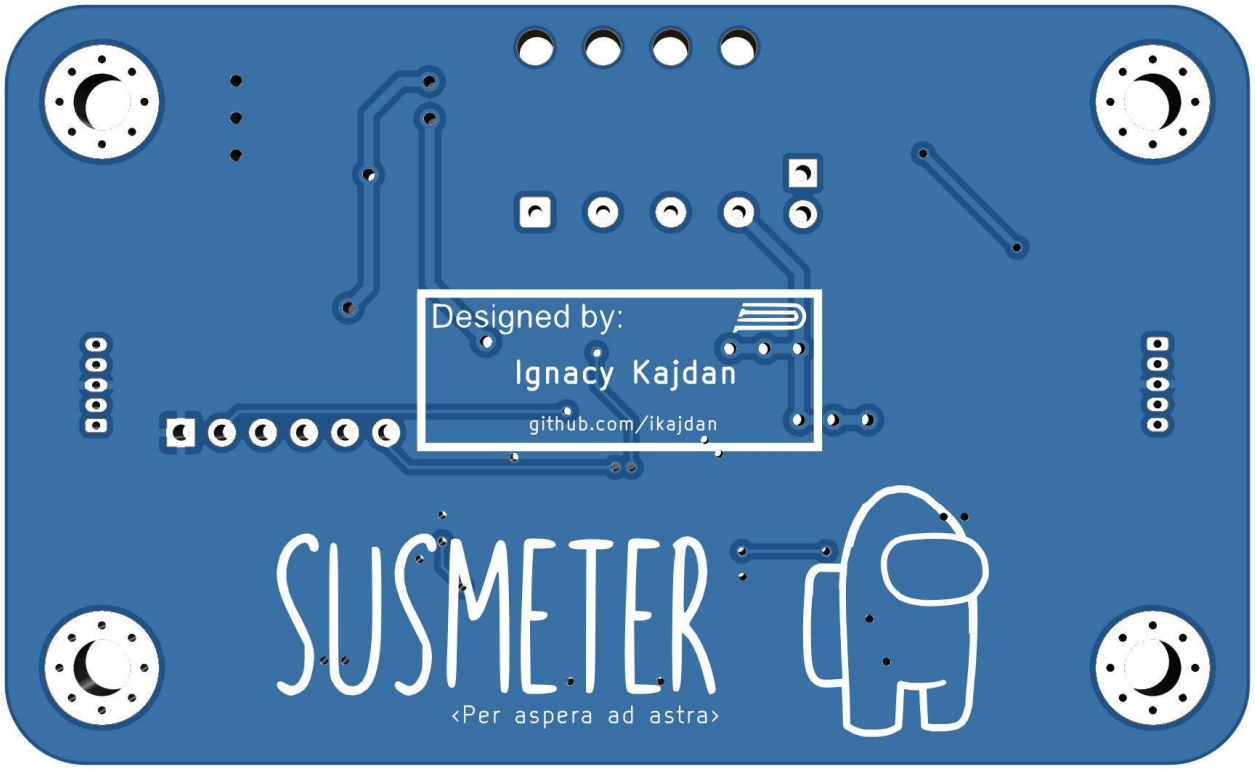
35 mm
CAN Terminator
Designed by: I. Kajdan
PUT MOTORSPORT
Rev: 1.0.0
Suspension Tension Meter


65 mm
35 mm
CAN Terminator
Designed by: I. Kajdan
GND
CAN+
CAN−
VCC
PUT MOTORSPORT
RESET
JTAG/SWD
CH1
CH2
Rev: 1.0.0
Suspension Tension Meter

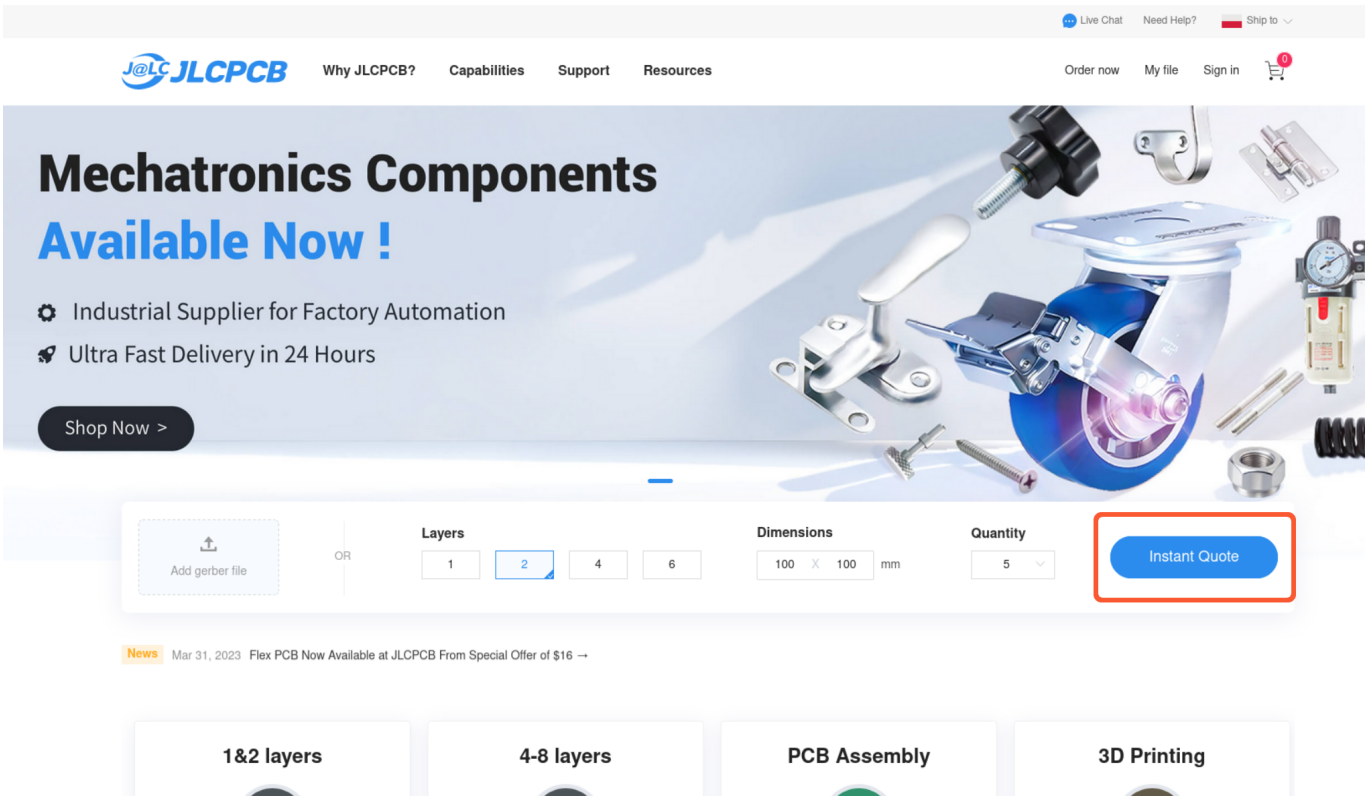
3D Render


CAN Terminator
Designed by: I. Kajdan
GND
CAN+
CAN−
VCC
PUT
MOTORSPORT
CH1
CH2
JTAG/SWD
Rev: 1.0.0
Suspension Tension Meter

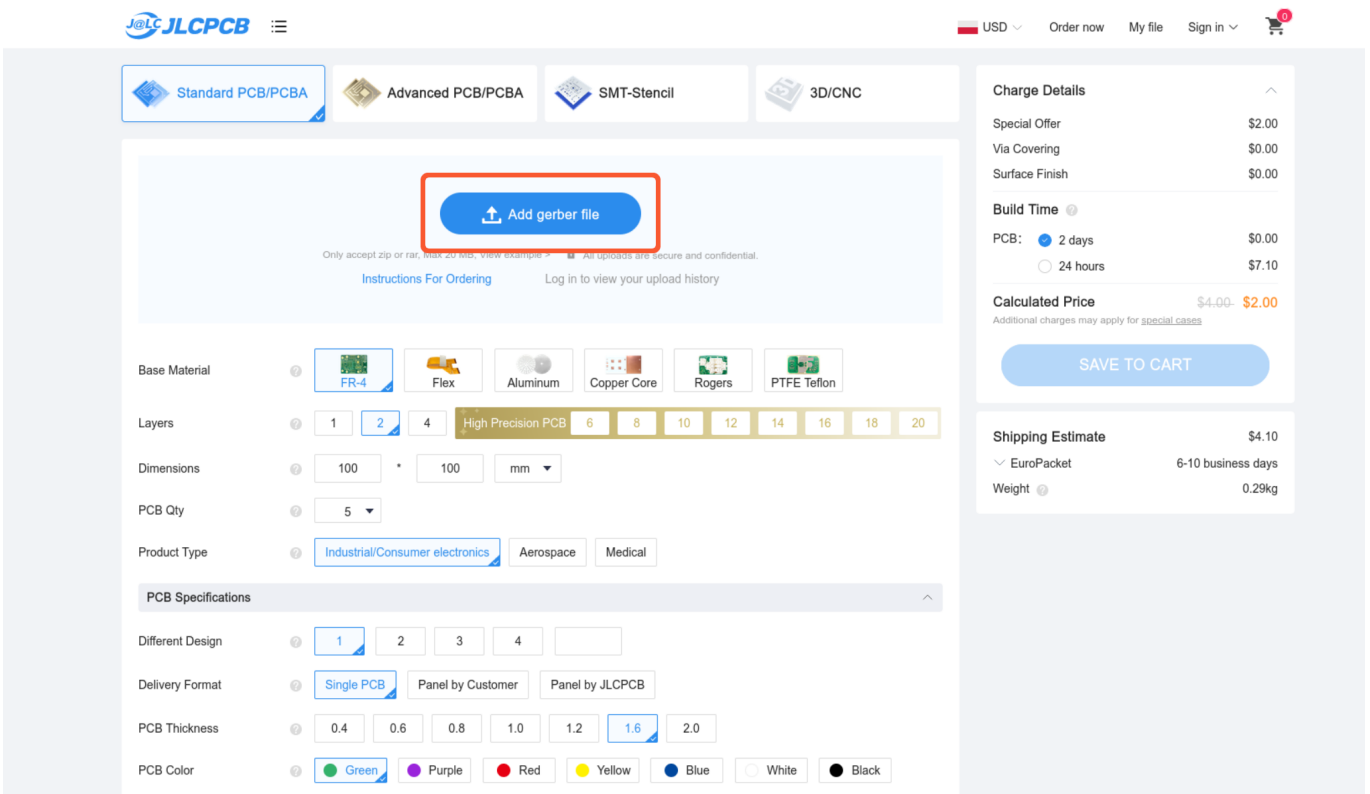

Designed by:
Ignacy Kajdan
github.com/ikajdan
SUSMETER
‹Per aspera ad astra›

Ordering a PCB from JLCPCB

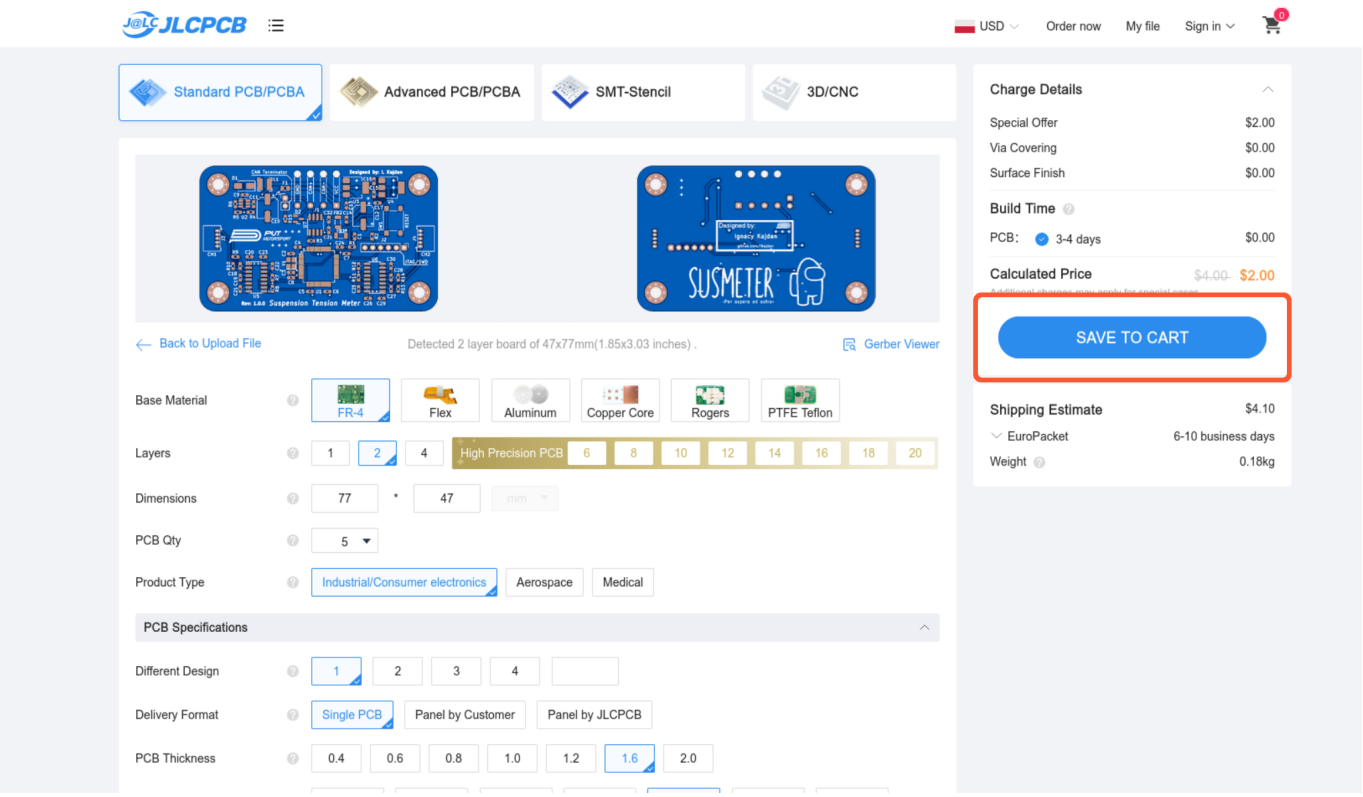
Now that we've got our PCB design done, it's time to place an order.
For that, you just have to go to jlcpcb.com, and click on the *"Instant Quote"* button.



You don't have to worry about any settings for now — you will be able to adjust every option on the next page.



Upload the production files using the *“Add Gerber File”* button. After that, you will be able to see a preview of your PCB.
Some options will be adjusted according to your design.



Next, you can change the settings according to your preferences. Every option here is clearly marked and described. Hover over a question mark to get a detailed description.
After the last glance at your PCB using the “*Gerber View”* function, you can now place your order.
In the case of this project, it was only $2 for 5, 2-layers PCBs! It only takes around 3 to 4 days to manufacture such board. (The production time has been extended from the usual 2 days due to the choice of a custom solder mask color).
To place the order, click on the *“SAVE TO CART”* button. Fast and cheap, right?

Why we Choose JLCPCB

JLCPCB (Shenzhen JLC Electronics Co., Ltd.), is one of the largest PCB prototype enterprises in China and a high-tech manufacturer specializing in a quick PCB prototype and small-batch PCB production. JLCPCB's dedication to quality is unmistakable. We are delighted to have found a partner that combines **premium quality** with **low prices** and **fast production times**.
In short, if you're looking for a PCB fabrication house that offers a winning combination of top-notch results, low prices, and rapid production times, look no further than JLCPCB. Our PCB projects have never been more efficient and cost-effective, and we are thrilled with the experience.

Thank you, JLCPCB! ❤️