

Einführung Elektronik (PES-Board)

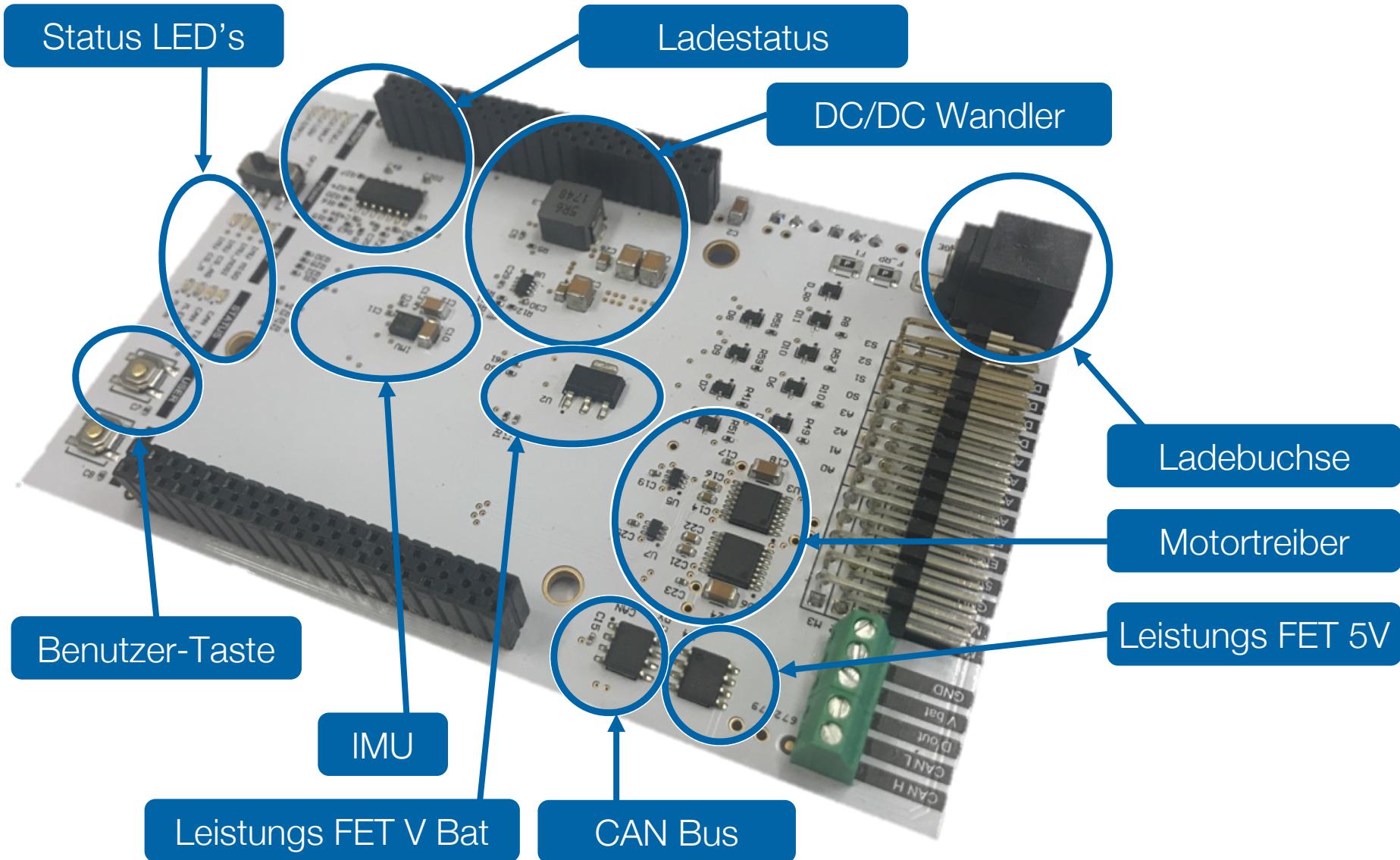
Toby Rotach, FS 2018 SW 2



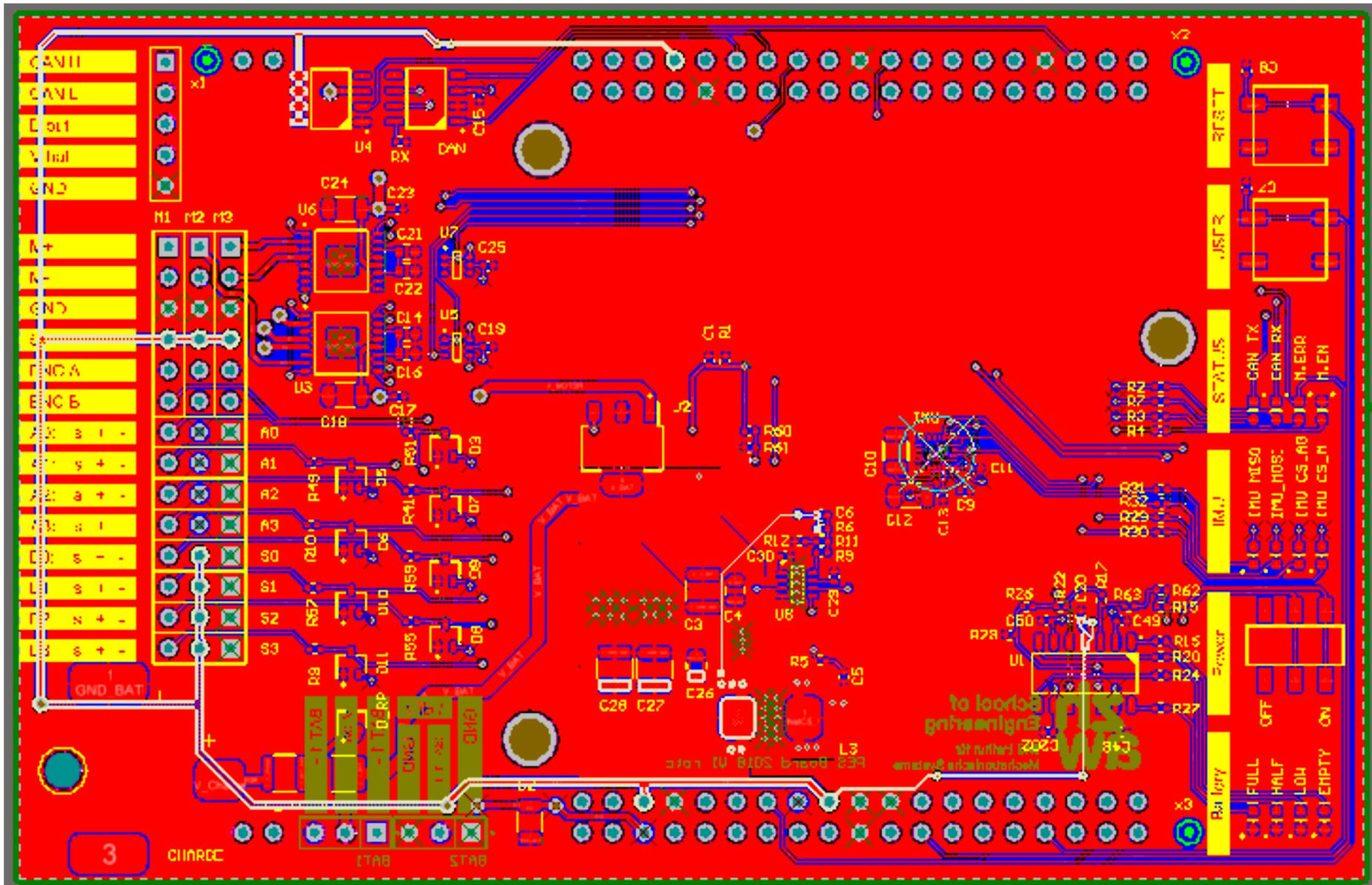
PES 2 Board – Funktionen

- Eine IMU (Inertial Measurement Unit mit Gyro, Beschleunigungssensoren und Magnetometer)
- Drei Motorentreiber für die direkte Ansteuerung von DC-Motoren (Nennstrom 1A)
- Drei Encoder-Counter um die Umdrehungszahlen einzulesen
- Vier digitale I/O, 3.3V (5V tolerant)
- Vier analoge Eingänge, 3.3V (5V tolerant)
- High Side Switch, 5V (Ausgangsstrom max. 1A)
- Stecker um die Motoren, Encoder, Sensoren anzuschliessen
- 12V NiMH Akkupak 2300mAh
- Ladebuchse und einfache Spannungsanzeige für den Akku

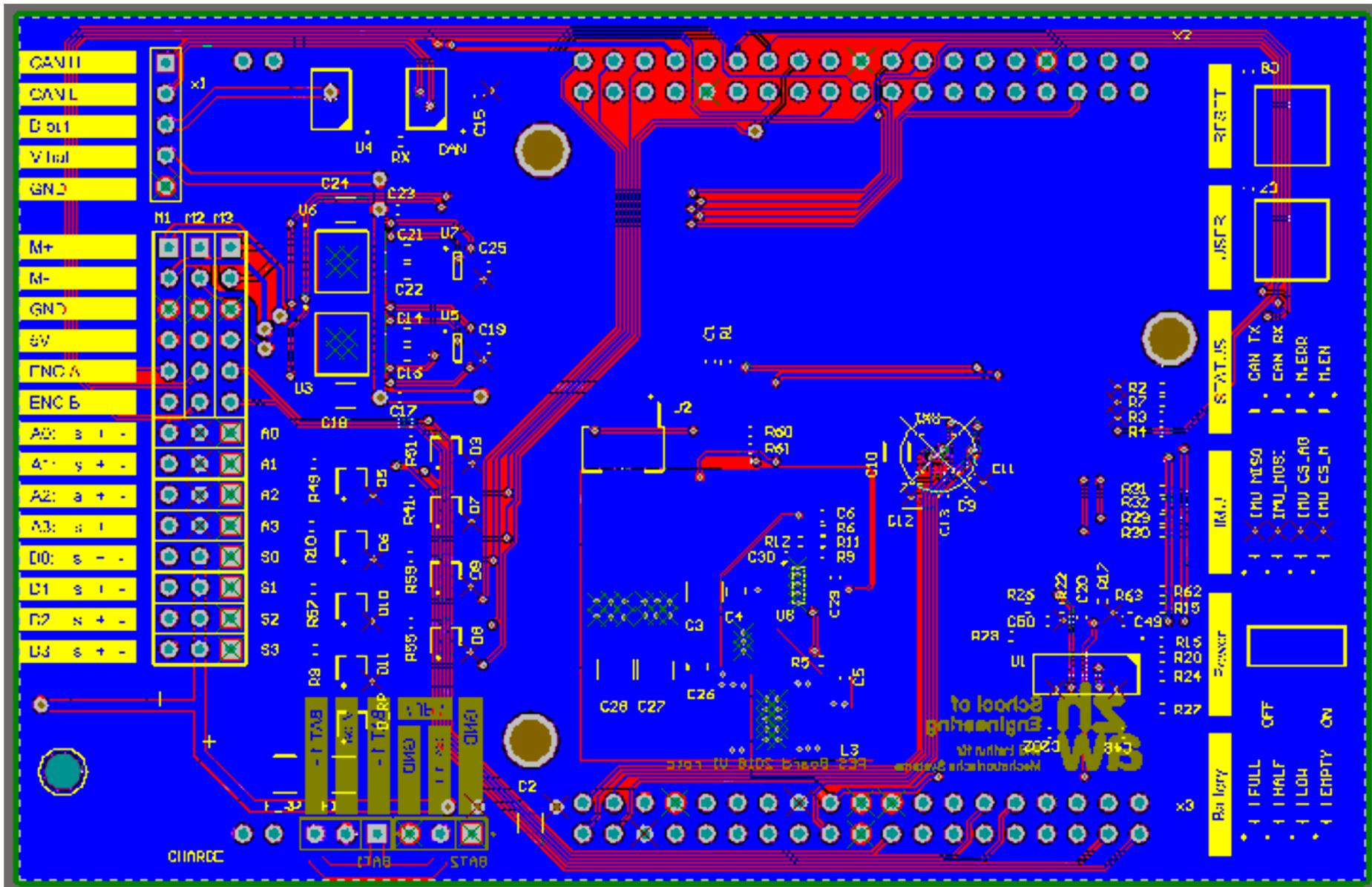
PES 2 Board - Komponenten



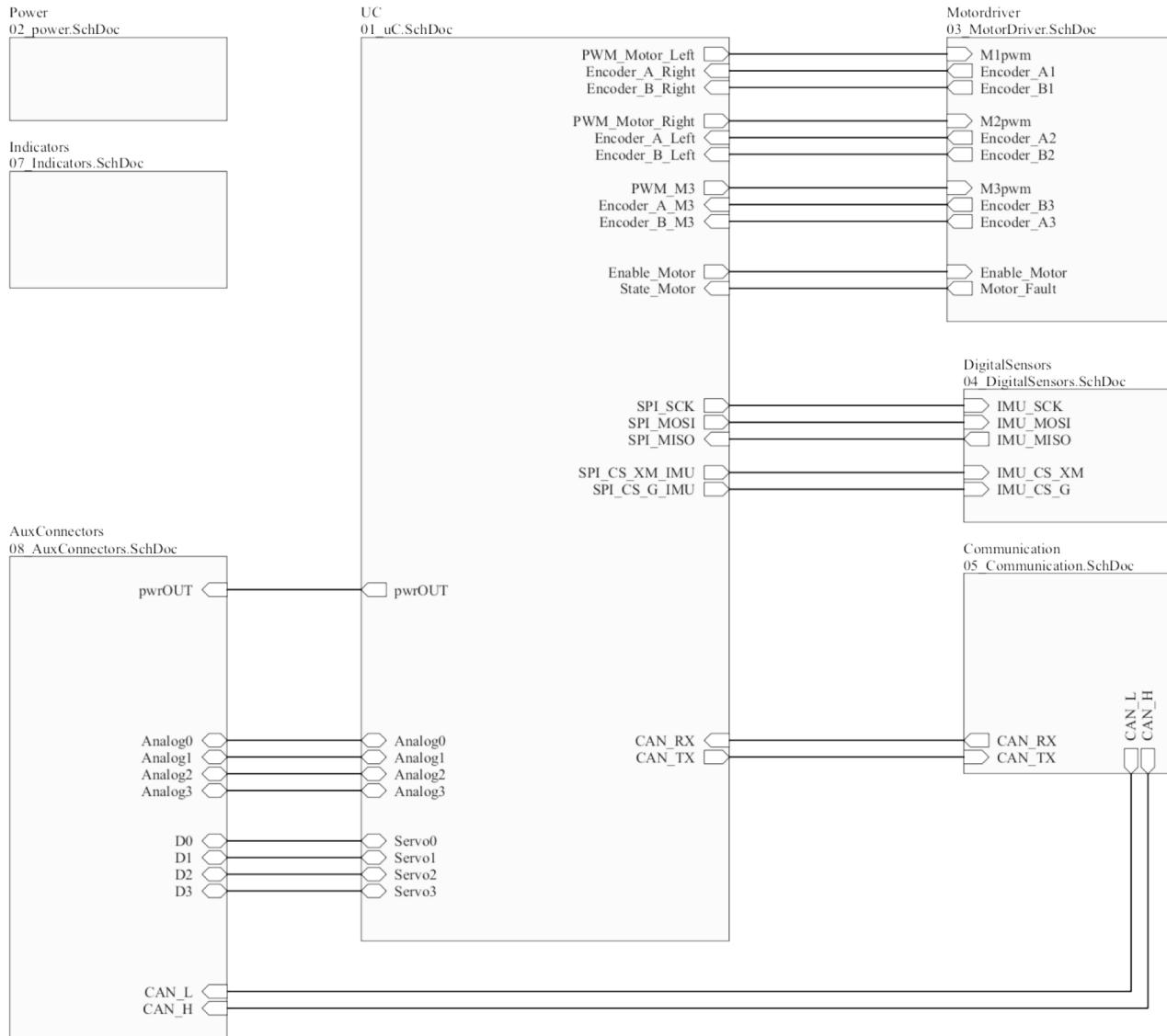
PES 2 Board – Layout Top Layer



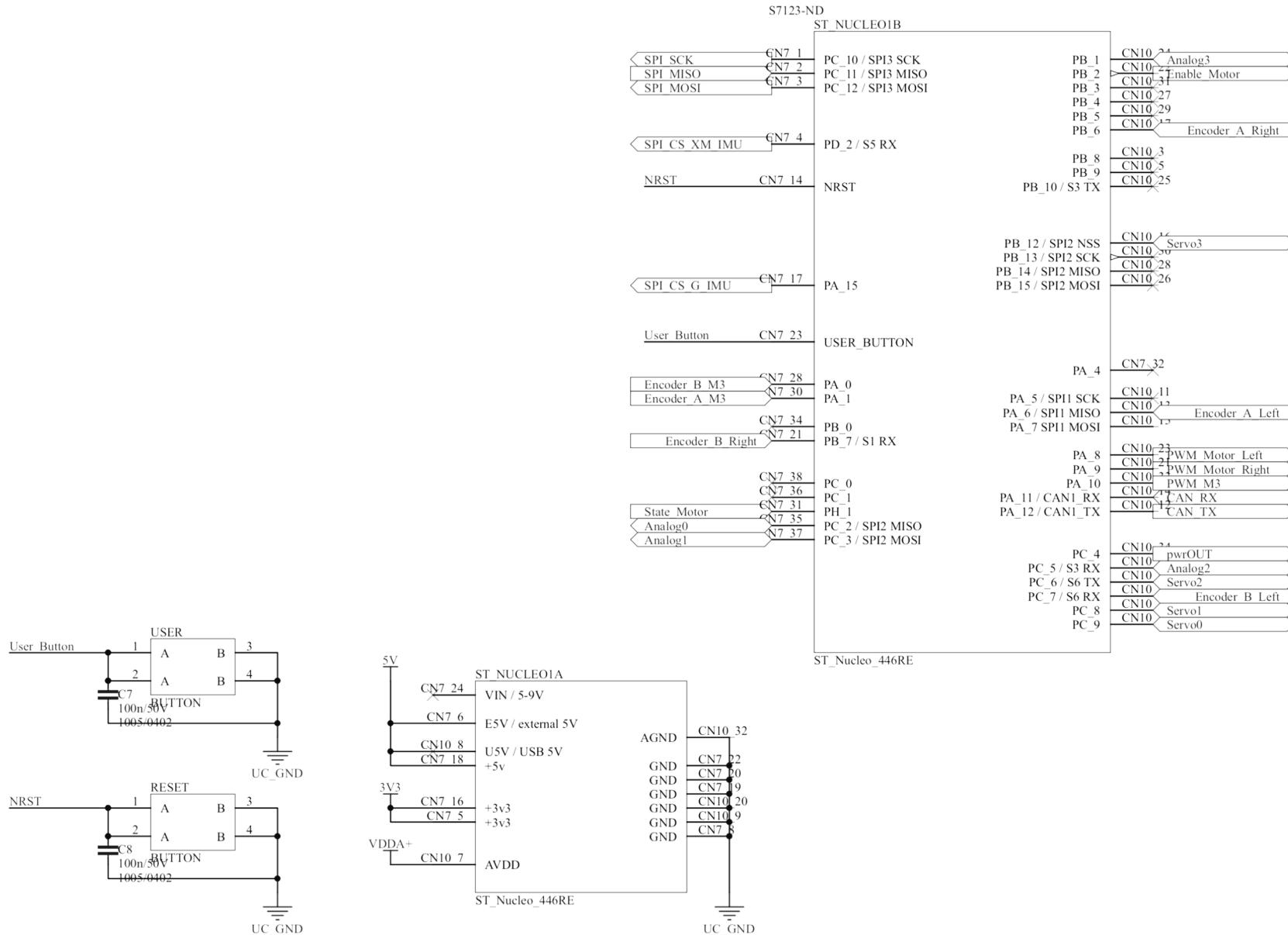
PES 2 Board – Layout Bottom Layer



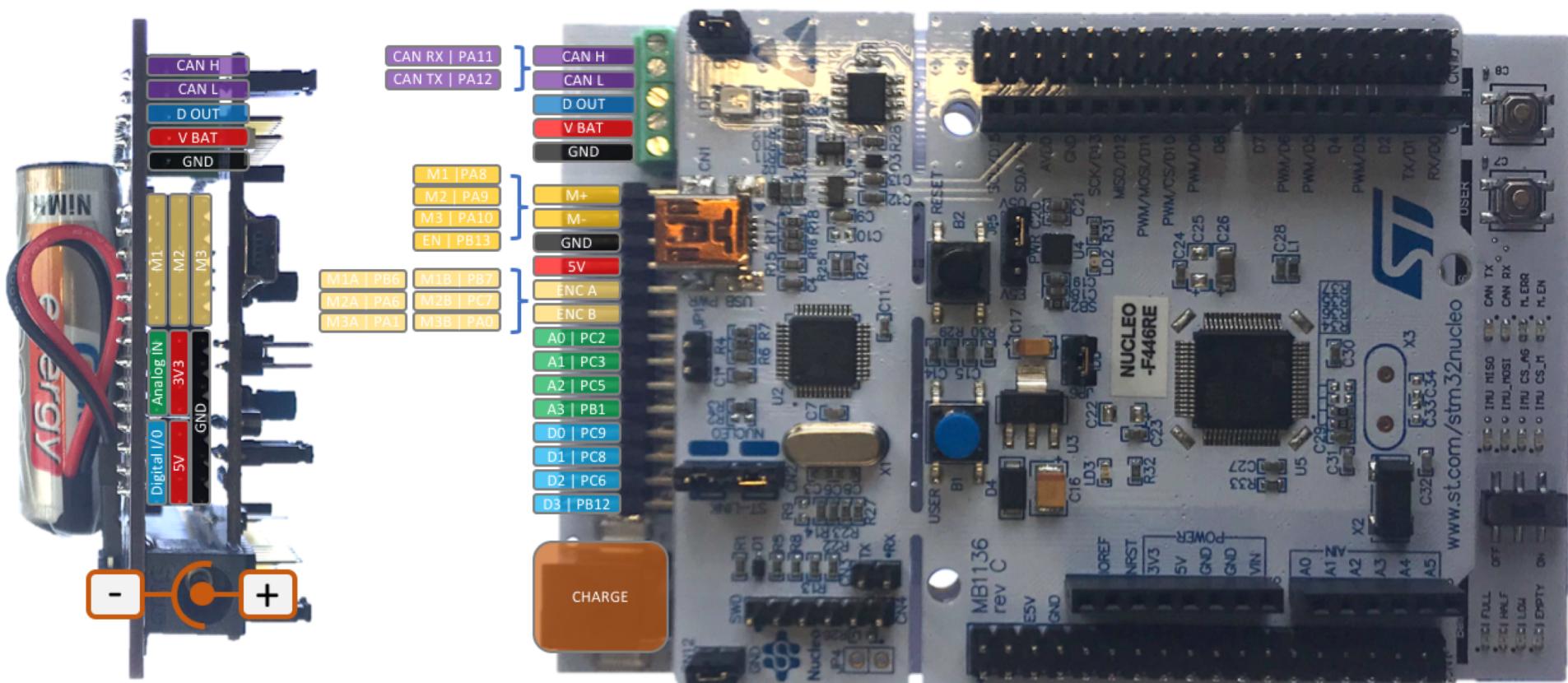
PES 2 Board - Baugruppen



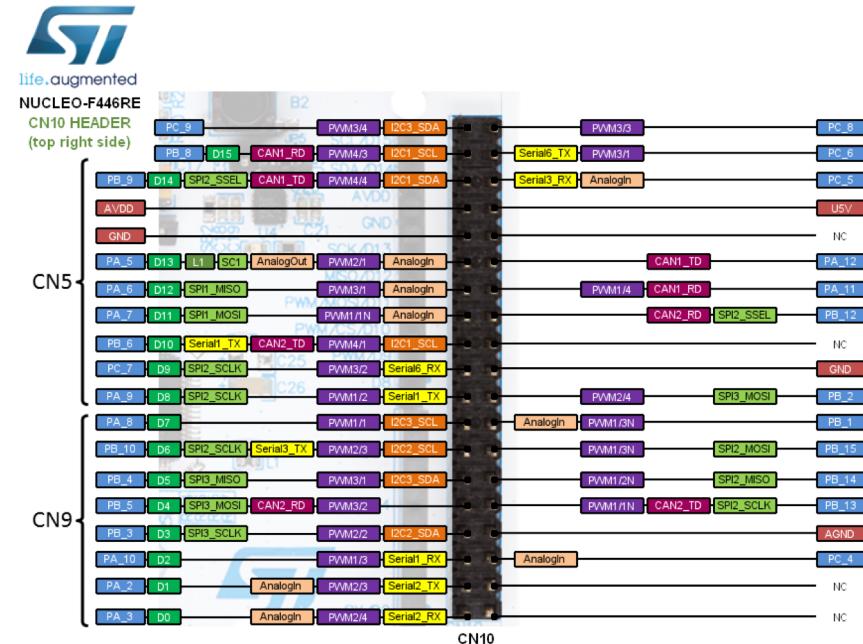
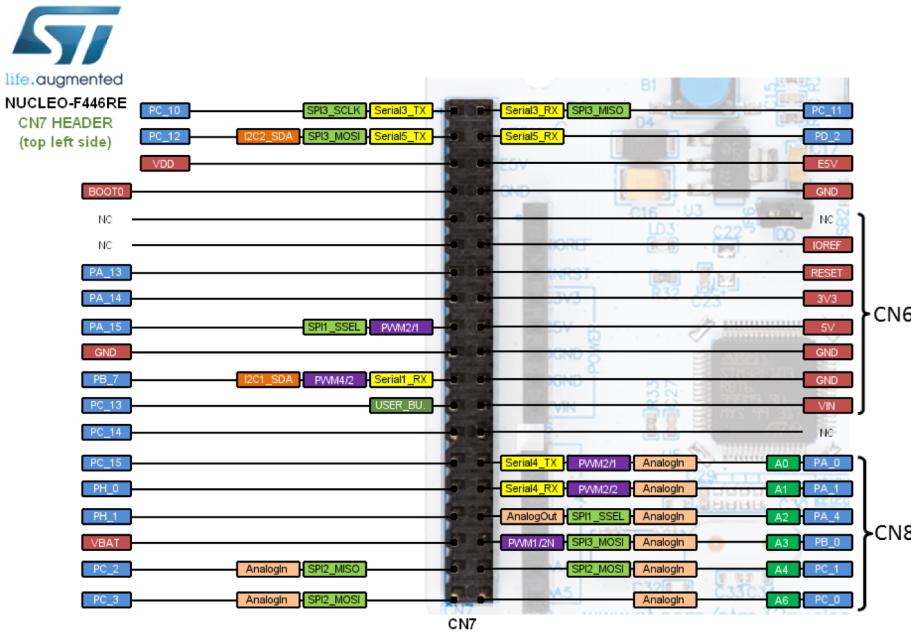
PES 2 Board – uC Anbindung



PES 2 Board - Peripherie



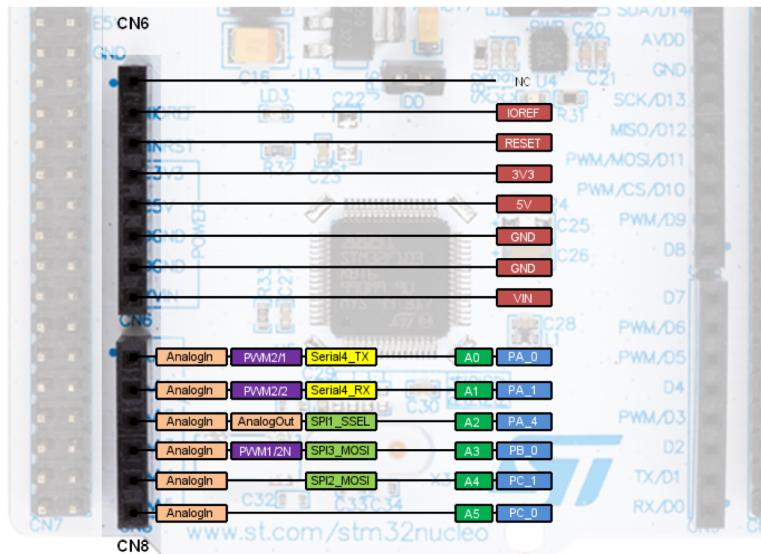
PES 2 Board – ST Morpho Headers



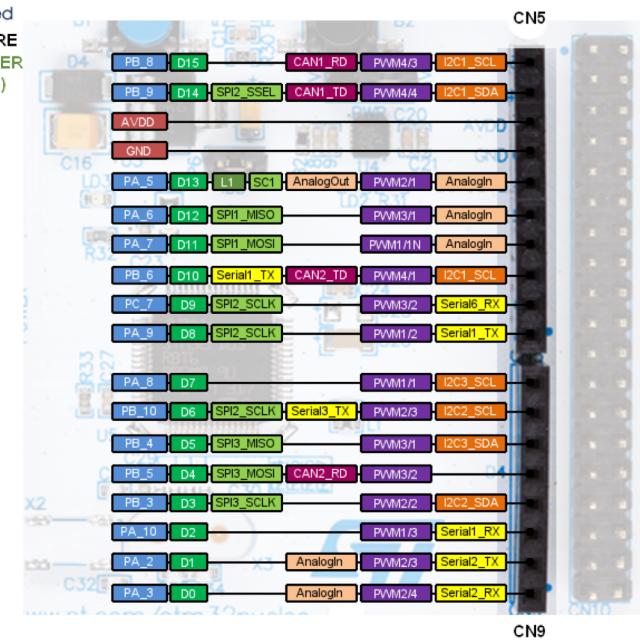
PES 2 Board – Arduino Headers



life.augmented
NUCLEO-F446RE
ARDUINO HEADER
(top left side)

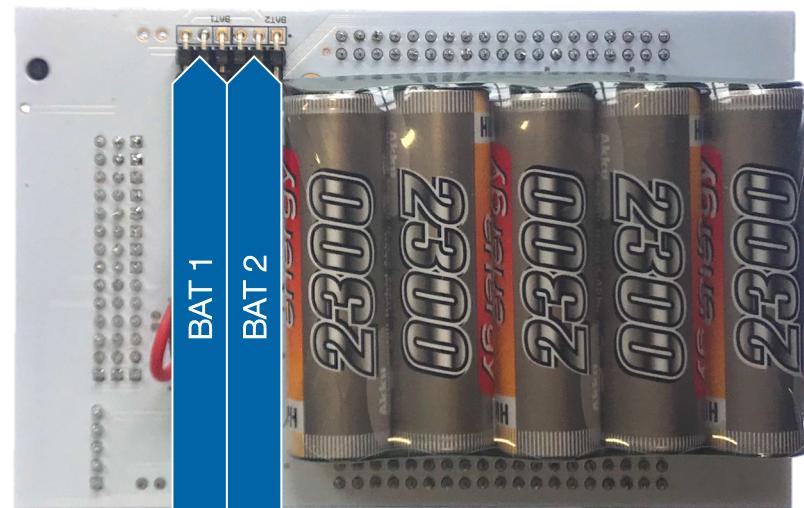
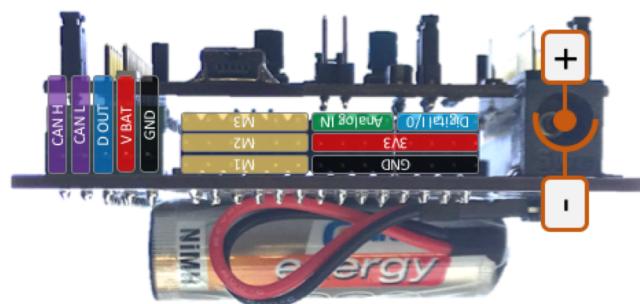
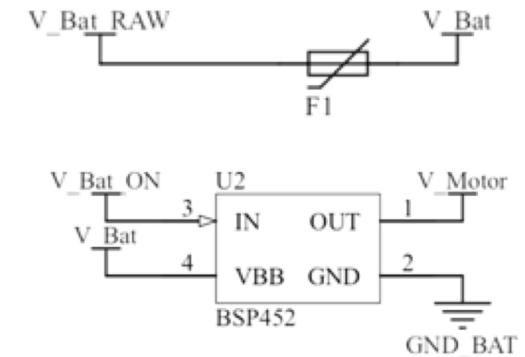
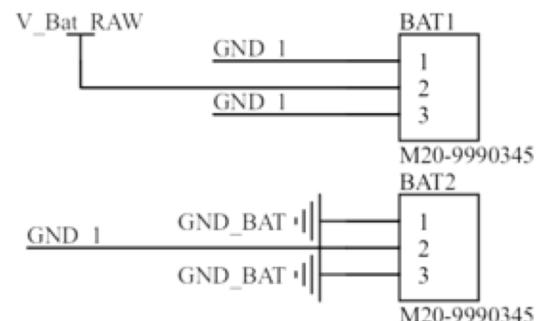
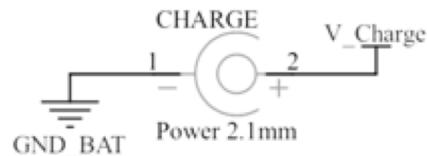


life.augmented
NUCLEO-F446RE
ARDUINO HEADER
(top right side)



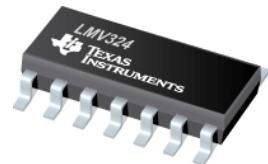
PES 2 Board – Pinmap komplett

PES 2 Board - Leistung



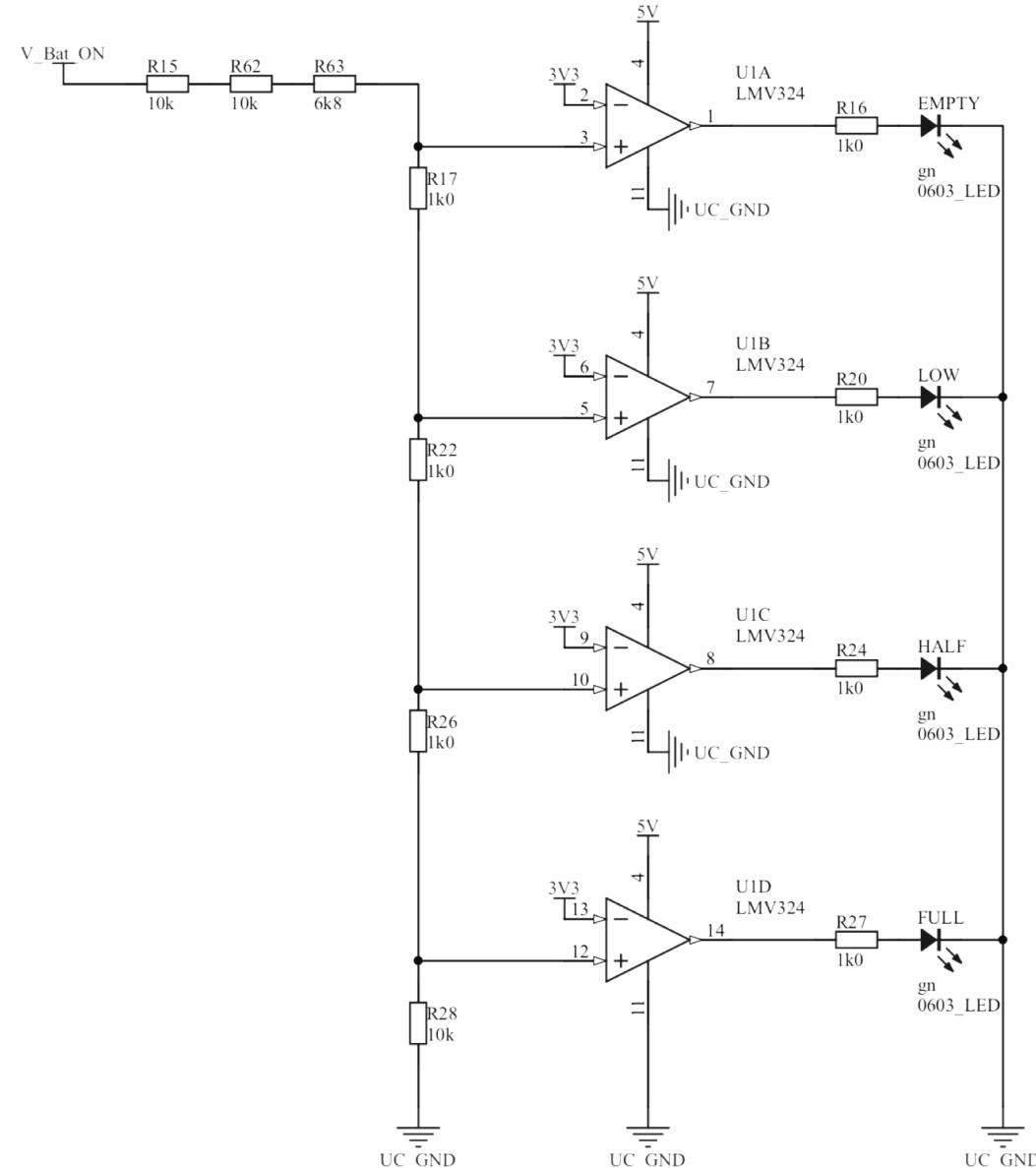
PES 2 Board - Ladungsanzeige

LMV 324D



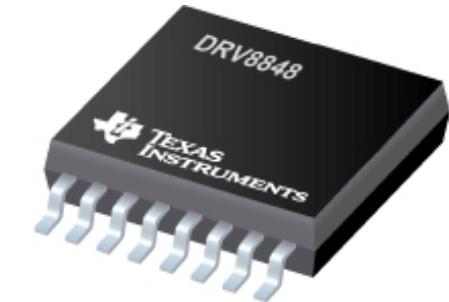
Quad Operational Amplifier

- Full: 13.1V
- Half: 11.9V
- Low: 10.9V
- Empty: 10.1V

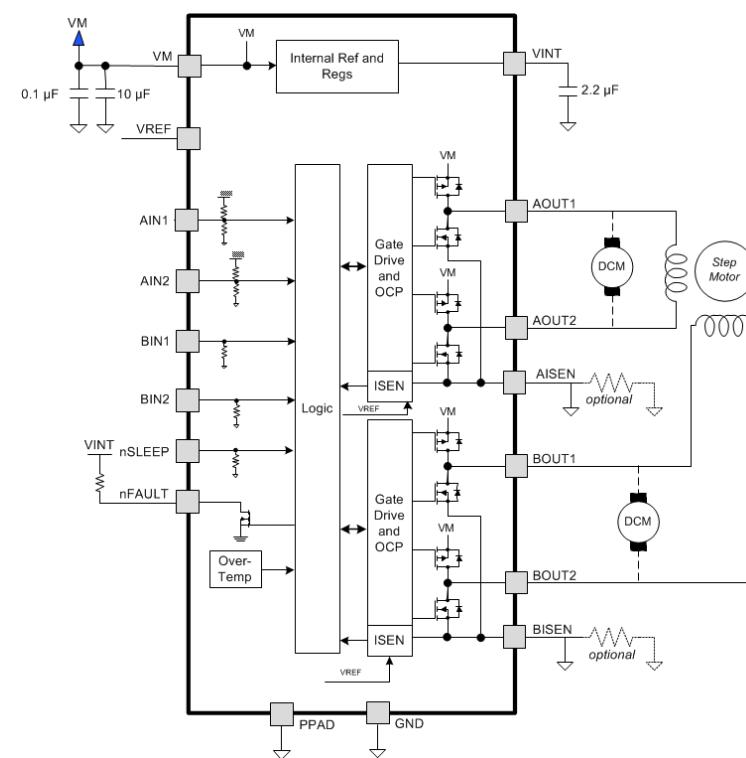


Der Antrieb - Treiber IC

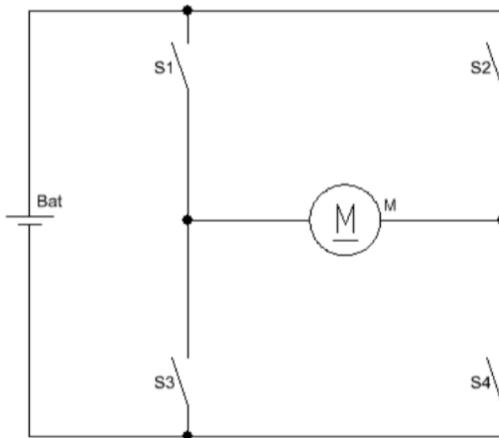
Treiber: TI DRV 8848
2A Dual H-Bridge Motor Driver (PWM Control)



- 2x Vollbrückentreiber
- Betriebsspannung: 4 – 18V
- 2x 1A Nennstrom

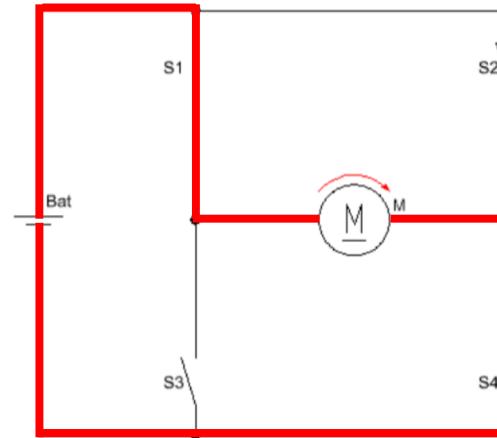


Der Antrieb - Vollbrückenschaltung



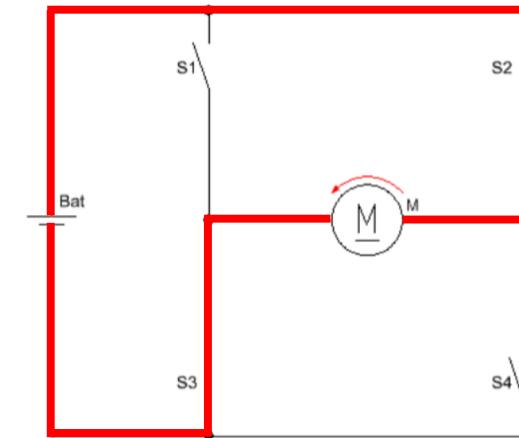
Stillstand:

$$\begin{aligned} S1 &= 0 \mid S2 = 0 \\ S3 &= 0 \mid S4 = 0 \end{aligned}$$



Rechtsläufig:

$$\begin{aligned} S1 &= 1 \mid S2 = 0 \\ S3 &= 0 \mid S4 = 1 \end{aligned}$$

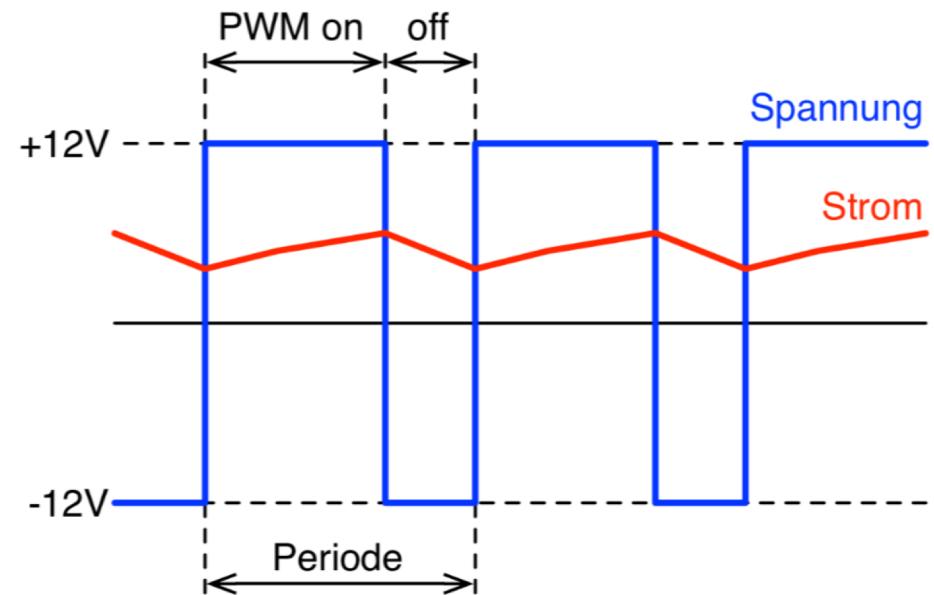
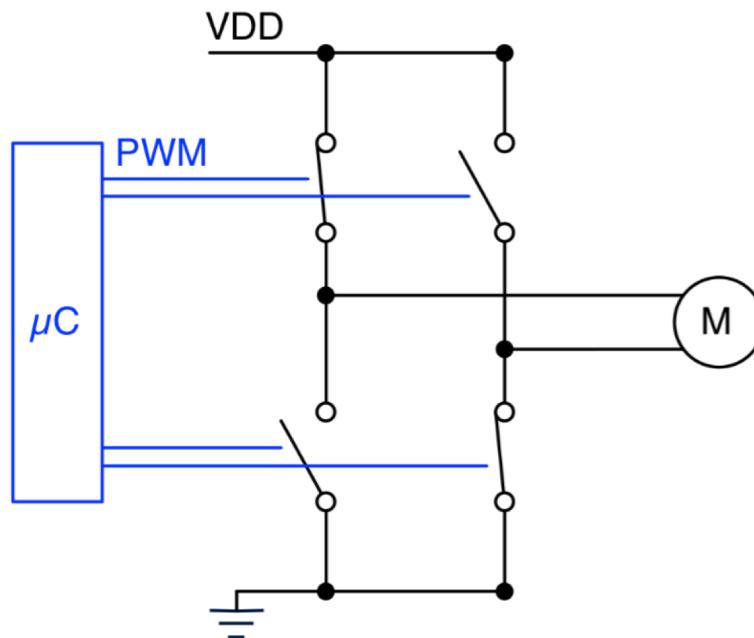


Linksläufig:

$$\begin{aligned} S1 &= 0 \mid S2 = 1 \\ S3 &= 1 \mid S4 = 0 \end{aligned}$$

Der Antrieb - Ansteuerung

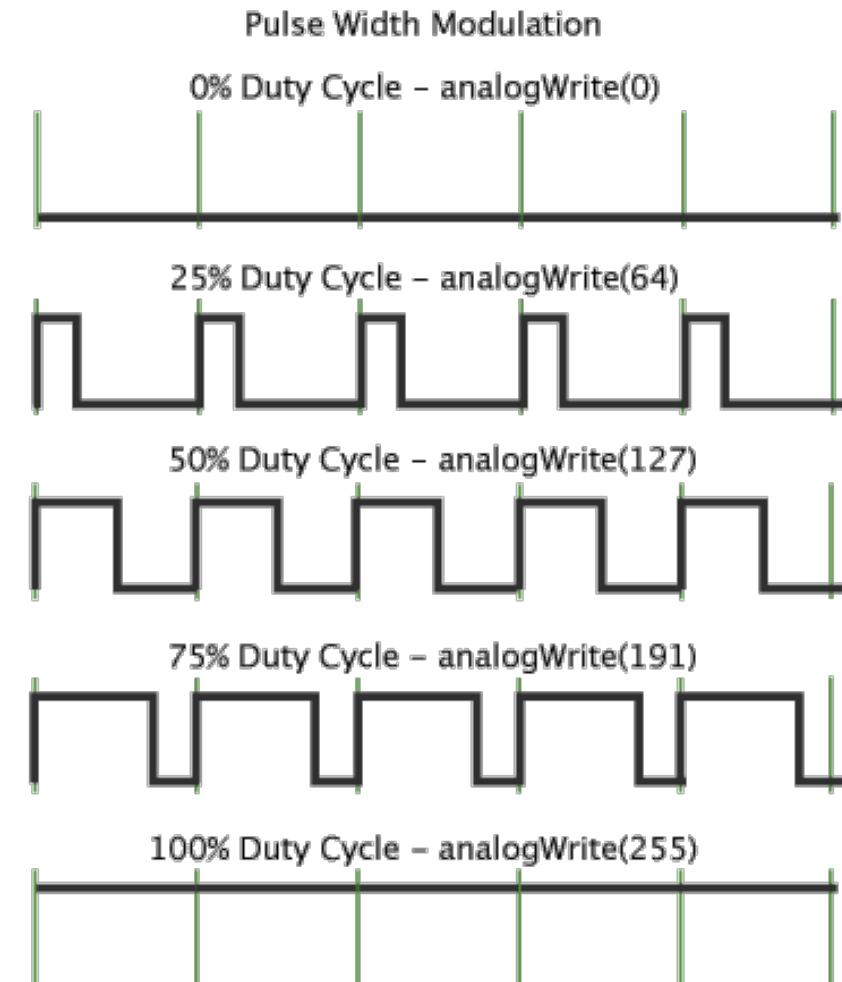
- Ansteuerung mit PWM Signal des Mikrokontrollers:
 - Die Phasenspannung entspricht abwechselungsweise der positiven oder negativen Versorgungsspannung



Der Antrieb - Pulsweiten Modulation

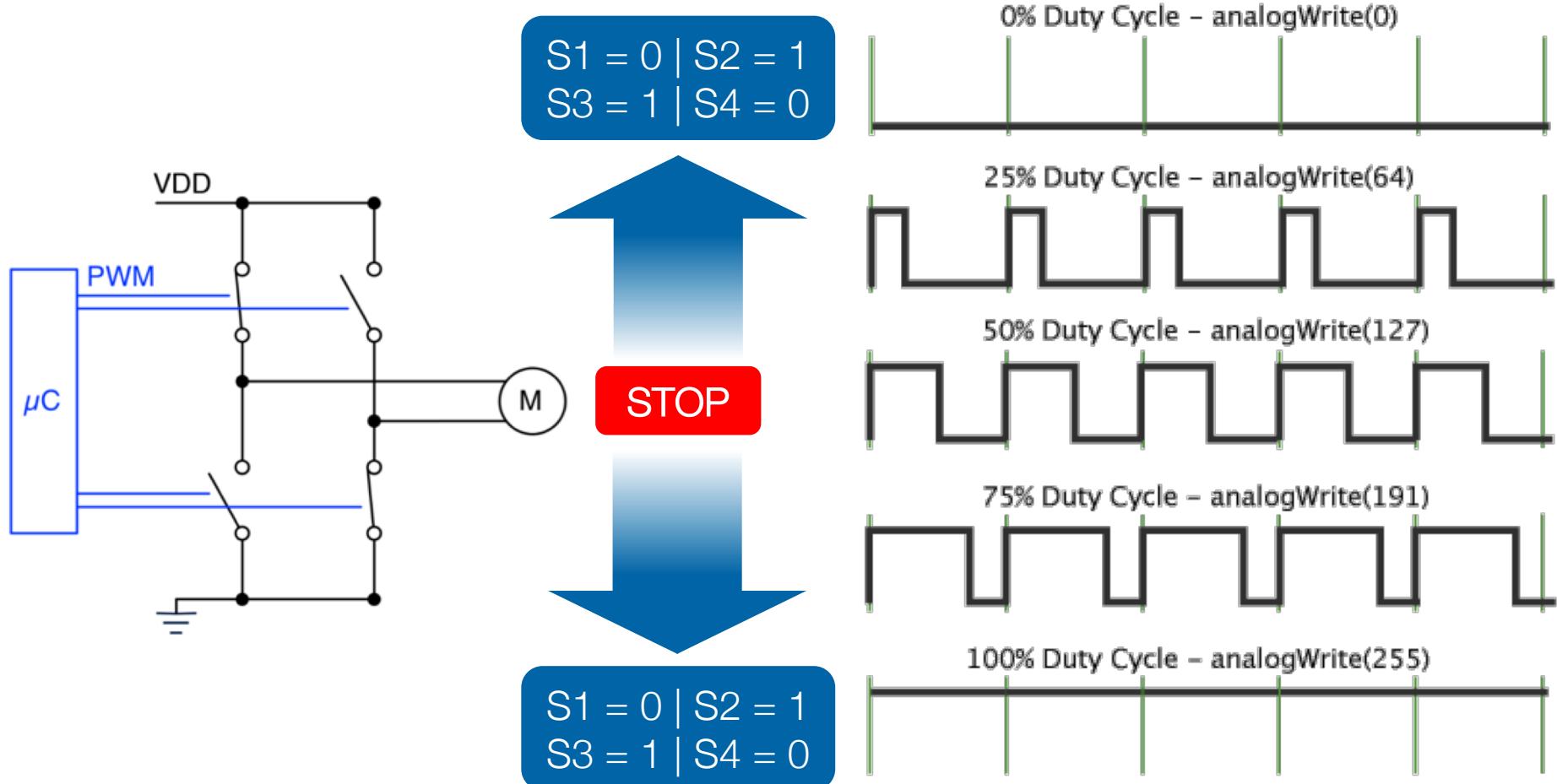
Das Signal wiederholt sich periodisch.

Das Tastverhältnis (duty cycle) wird für jeden Motor separat angegeben

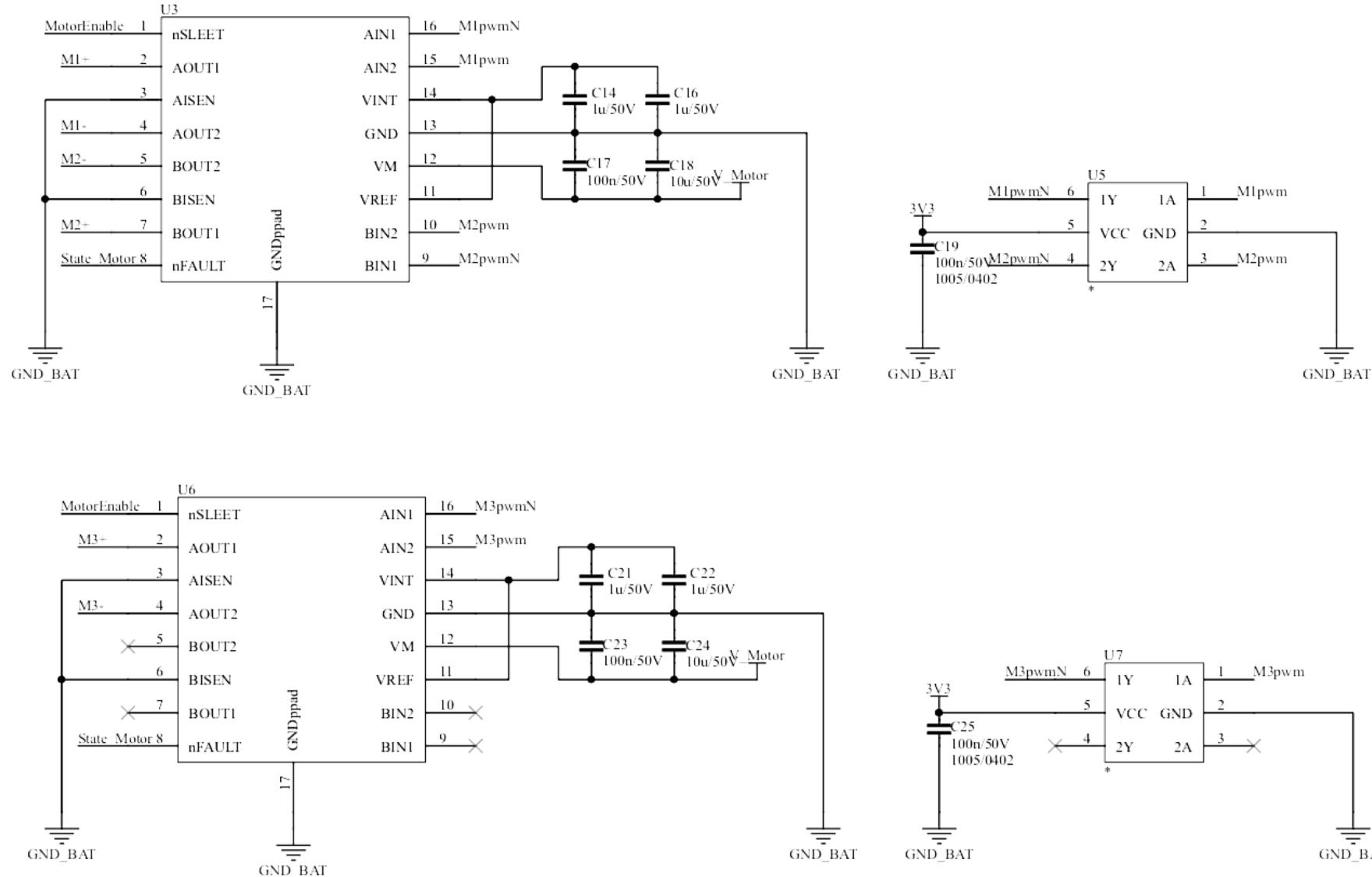


Der Antrieb - Pulsweiten Modulation

Komplementäre Ansteuerung von S1/S4 und S2/S3

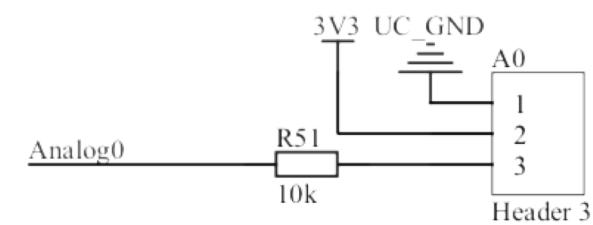
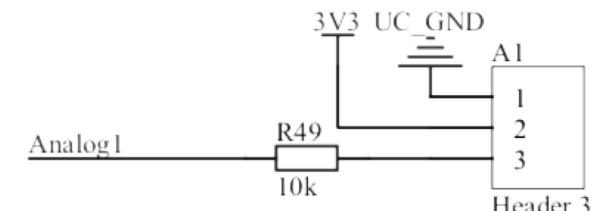
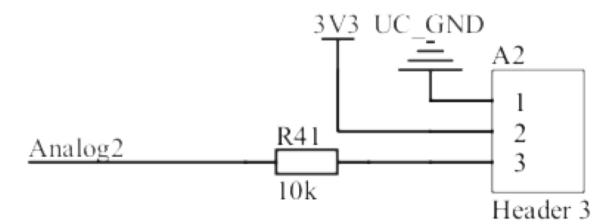
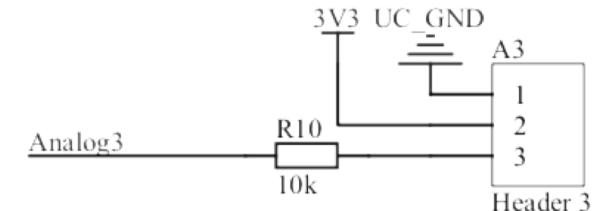
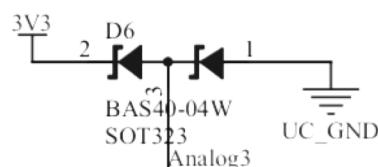
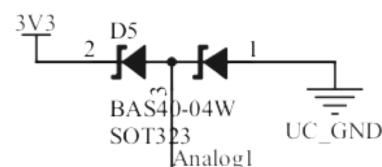
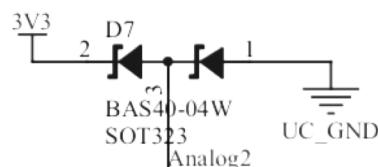
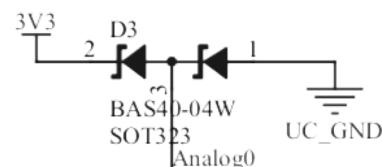


Der Antrieb - Schaltung



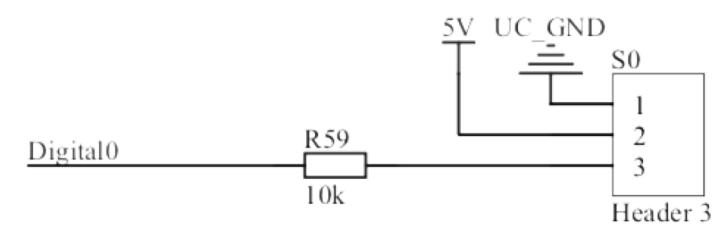
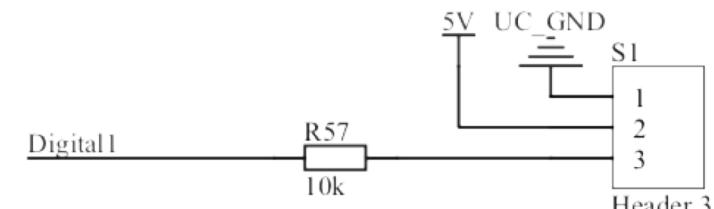
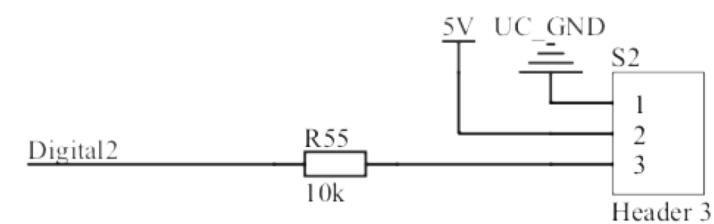
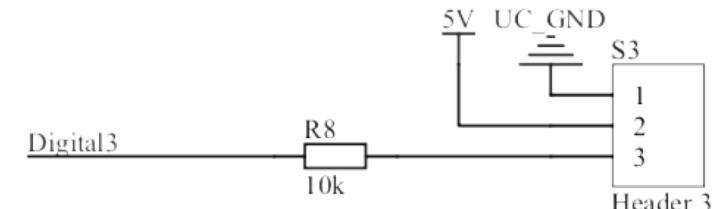
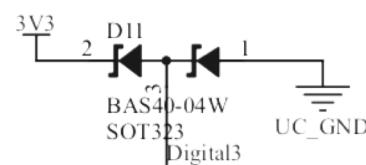
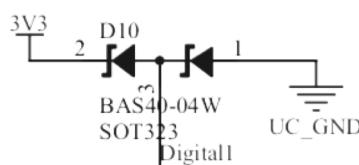
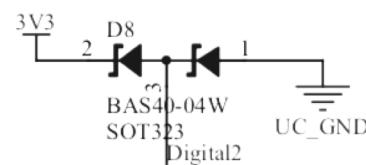
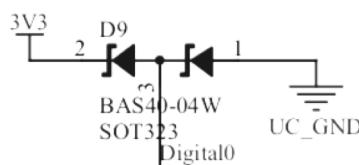
Analog IN

- ESD Schutzdioden:
Überspannungsschutz
- 10k Eingangswiderstand:
Strombegrenzung



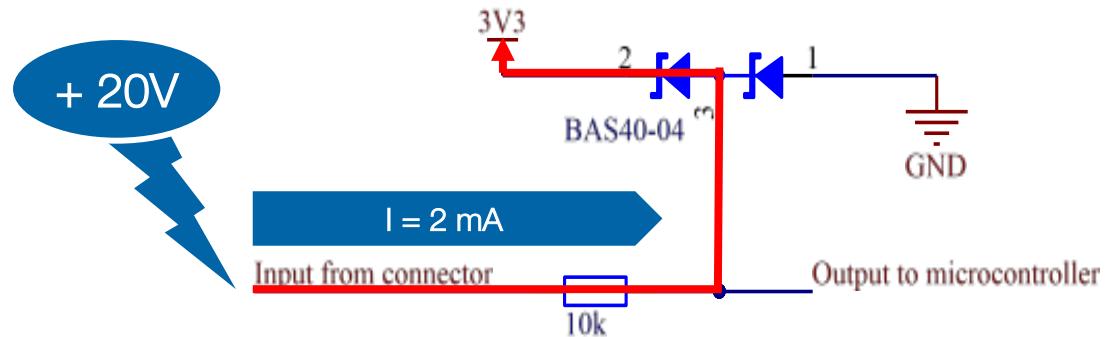
Digital I/O

- ESD Schutzdiode: *Überspannungsschutz*
- 10k Eingangswiderstand: *Strombegrenzung*

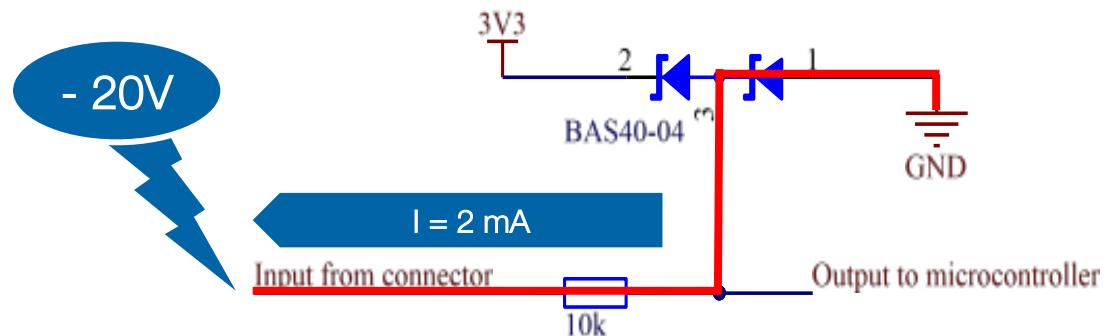


Schutzschaltung - Detail

- Überspannung



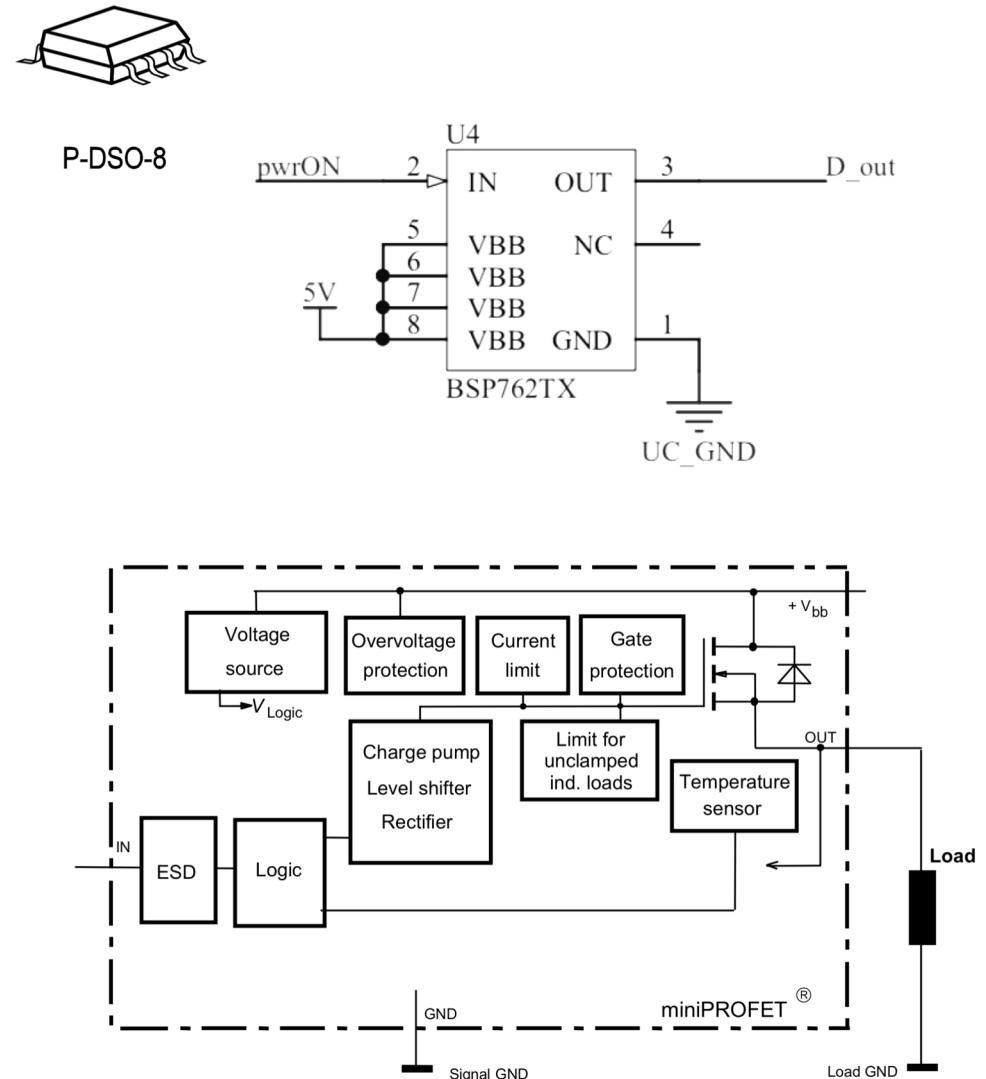
- Verpolung



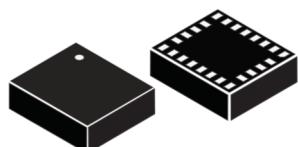
High Side Switch

Treiber: Infineon BSP 762 T
Smart Power High Side Switch

- Treiber für ohmsche, induktive und kapazitive Lasten
- Betriebsspannung: 5 – 34V
- 2A Nennstrom
→ Auf PES Board max. 1A!!!

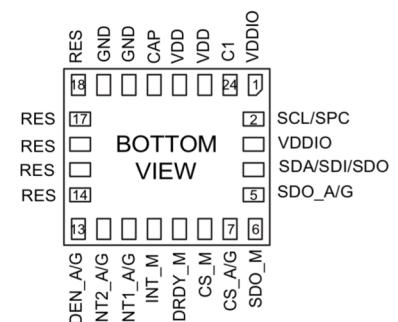
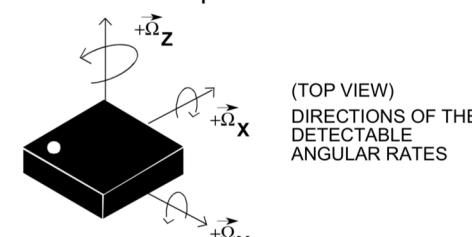
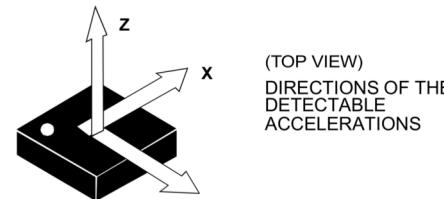
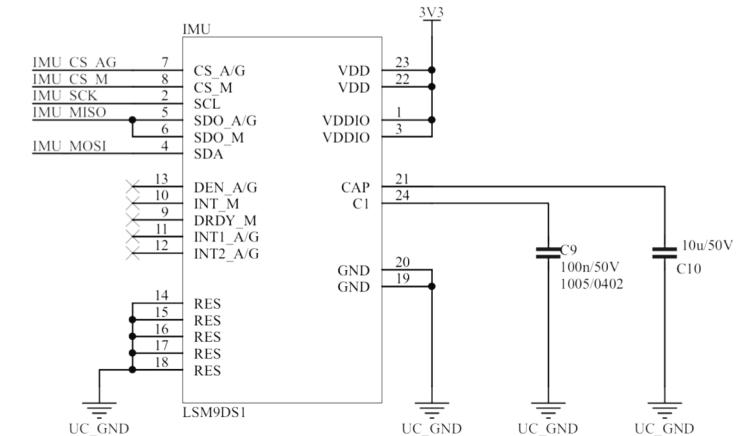


9-DOF IMU: ST LSM9DS1 MEMS Sensor



LGA-24L (3.5x3x1.0 mm)

- 3-Achsen Beschleunigung
- 3-Achsen Gyro (Drehrate)
- 3-Achsen Kompass
- Schnittstelle: SPI



Euer PES 2 Set – Viel Spass!



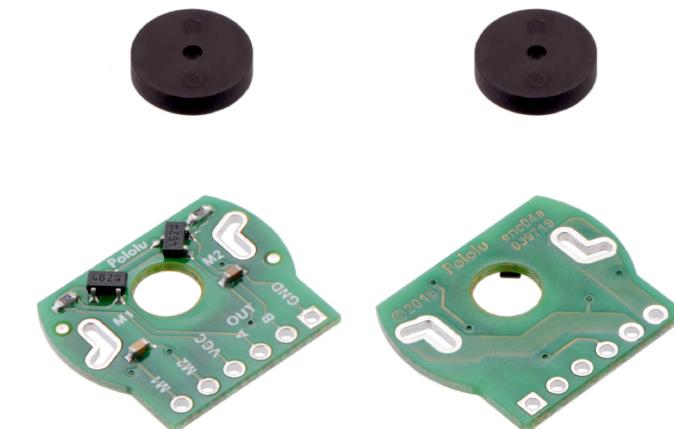
DC Getriebemotor mit Encoder

- 20D mm Metal Gearmotors 12V
Preis ca. 23 \$ (Stück)

→ ACHTUNG! Dual-Shaft Version wählen!

Rated Voltage	Brush Type	Stall Current @ Rated Voltage	No-Load Speed @ Rated Voltage	Approximate Stall Torque @ Rated Voltage	Single-Shaft (Gearbox Only)	Dual-Shaft (Gearbox & Motor)
12 V	long-life carbon (CB)	1.6 A	570 RPM	26 oz-in	25:1 12V CB	25:1 12V CB dual shaft
			450 RPM	33 oz-in	31:1 12V CB	31:1 12V CB dual shaft
			225 RPM	58 oz-in	63:1 12V CB	63:1 12V CB dual shaft
			180 RPM	75 oz-in	78:1 12V CB	78:1 12V CB dual shaft
			140 RPM	85 oz-in	100:1 12V CB	100:1 12V CB dual shaft
			110 RPM	110 oz-in	125:1 12V CB	125:1 12V CB dual shaft
			90 RPM	130 oz-in	156:1 12V CB	156:1 12V CB dual shaft
			72 RPM	160 oz-in	195:1 12V CB	195:1 12V CB dual shaft
			57 RPM	200 oz-in	250:1 12V CB	250:1 12V CB dual shaft
			45 RPM	250 oz-in	313:1 12V CB	313:1 12V CB dual shaft
			36 RPM	290 oz-in	391:1 12V CB	391:1 12V CB dual shaft
			29 RPM	350 oz-in	488:1 12V CB	488:1 12V CB dual shaft

- Magnetic Encoder Pair Kit for 20D mm Metal Gearmotors, 20 CPR, 2.7-18V
Preis ca. 9 \$ (Paar)



- Erhältlich bei www.pololu.com

Sensorik – Anbieter und Info

- <https://www.pololu.com>
- <https://www.adafruit.com>
- <https://www.sparkfun.com>
- <https://www.seedstudio.com>
- <https://www.robotshop.com>
- <https://boxtec.ch>
- <https://www.play-zone.ch>
- <http://farnell.ch>
- <https://www.mouser.ch>
- <https://www.digikey.com>
- <https://www.conrad.ch>
- <https://www.distrelec.ch>

