ODrive S1 Datasheet

The ODrive S1 brings ODrive's next-generation motion control ecosystem to every robot, with a 2kW continuous power output and a wide variety of encoder interfaces, all at an accessable price point and with a form factor smaller than a credit card.

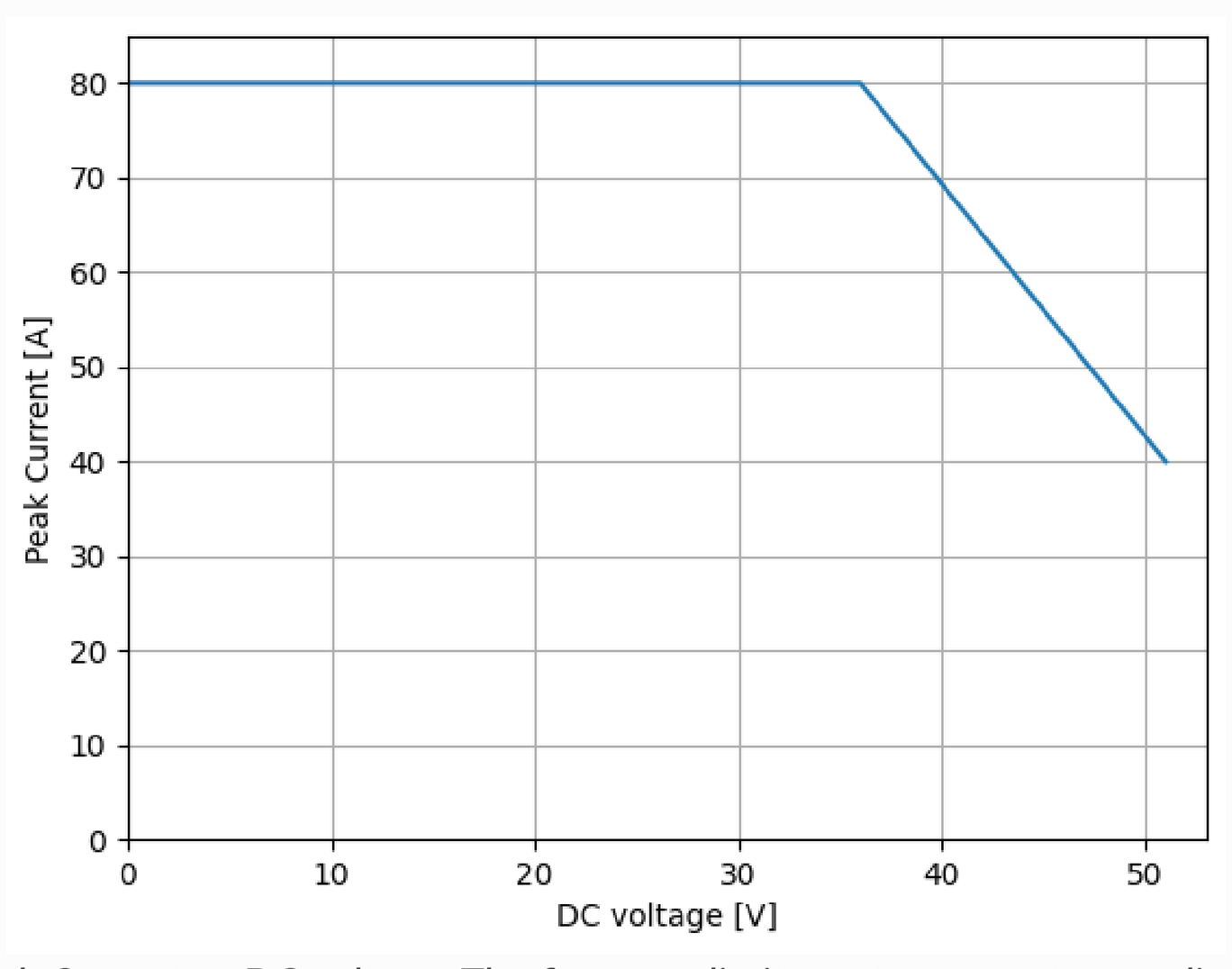
Electromechanical Specifications

Electrical

Note

All specifications are in 0∘C ≤ T_A ≤ 40∘C unless otherwise noted.

Specification	Min.	Typ.	Max.	Units	Conditions and Notes
DC Voltage	12	16-48	50.5	V	
AUX Logic Voltage	10	12	14	V	Optional
Operating Motor Current			20 40 40-80	A A A	Free air (T_A 25°C) Heat spreader plate (T_A 25°C) Peak, see below
ESD Protection		±30 ±13 ±8 ±8 ±6		kV	Power Lines, IEC 61000-4-2 CAN Lines, IEC 61000-4-2 Isolated Lines, IEC 61000-4-2 USB Lines, IEC 61000-4-2 All Other Lines, IEC 61000-4-2



ODrive S1 Peak Current vs DC voltage. The firmware limits motor current according to this curve depending on `dc_bus_overvoltage_trip_level`.

Connectors

Connector mating receptacles and crimps.

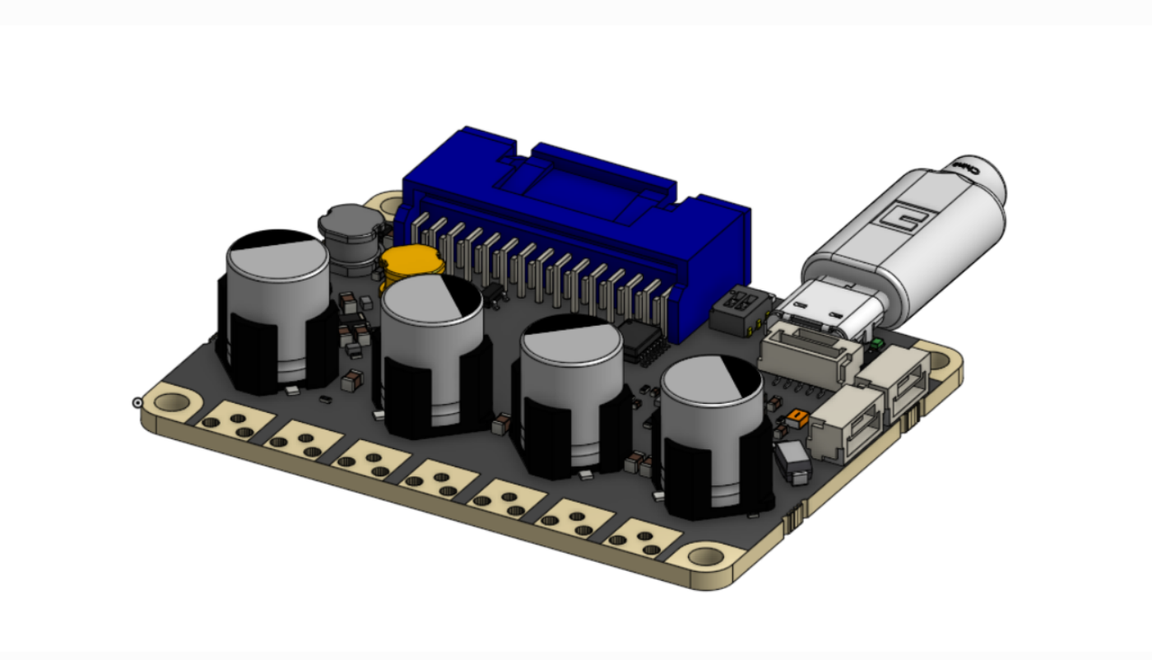
Connector	Description	Connector P/N	Mating Receptacle	Mating Crimp
Power	Optional Screw Terminal	TB005-762-07BE	N/A	N/A
J11	Unified I/O Header	S30B-PUDSS-1	PUDP-30V-S	SPUD-002T-P0
J16, J17	CAN Header	SM04B-GHS-TB	GHR-04V-S	SSHL-002T-P0.
J1	Debug Header	BM05B-GHS-TB	GHR-05V-S	SSHL-002T-P0.

Environmental

Specification	Value	Notes
Humidity	Non-Condensing	
Ingress Protection	IP20	with case

CAD

The ODrive S1 CAD model is available on the ODrive S1 OnShape page.

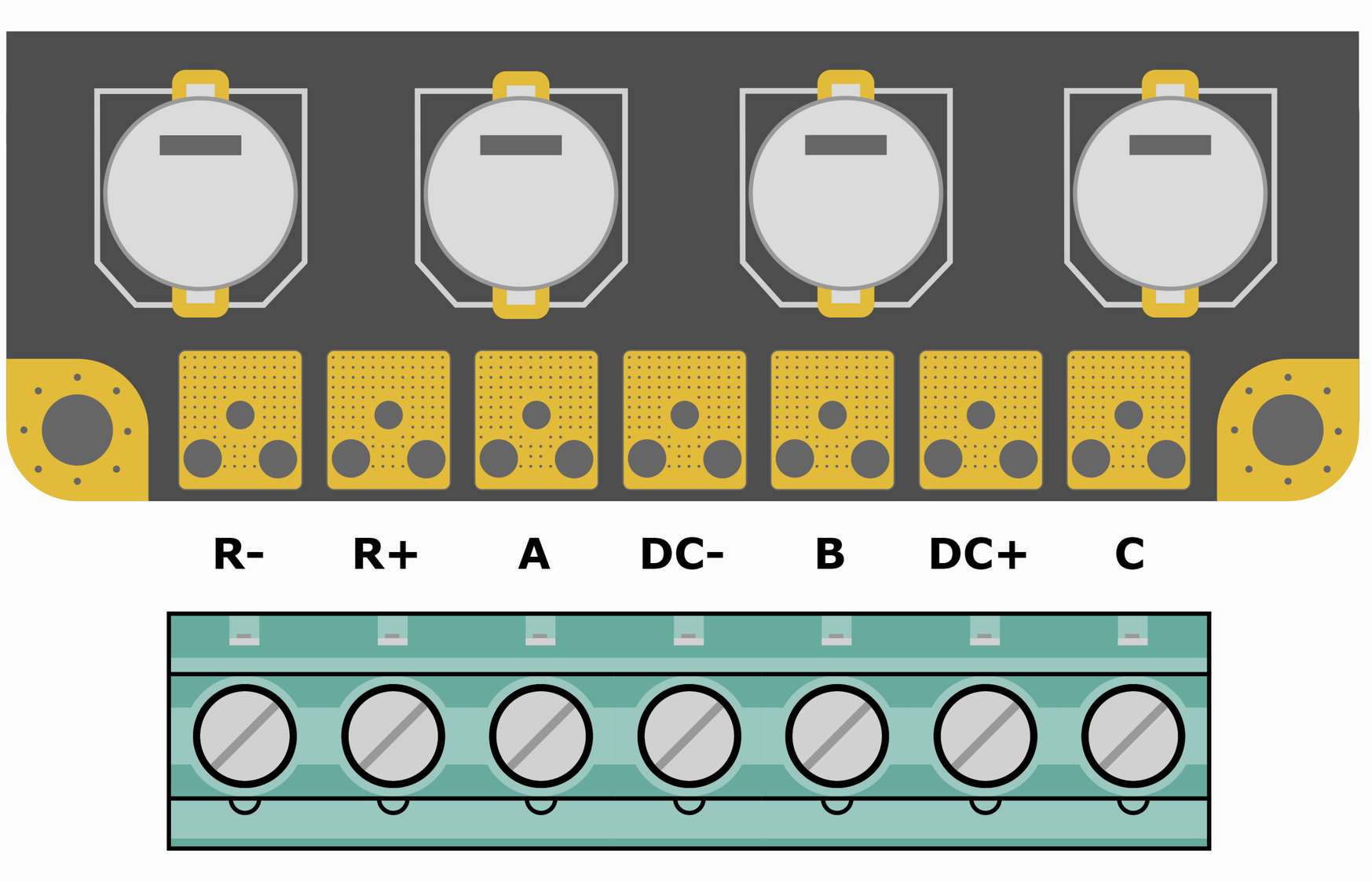


Pinout

Power Pads

Important

DC+- cannot tolerate reversed polarity, verify all power pad connections before energizing.

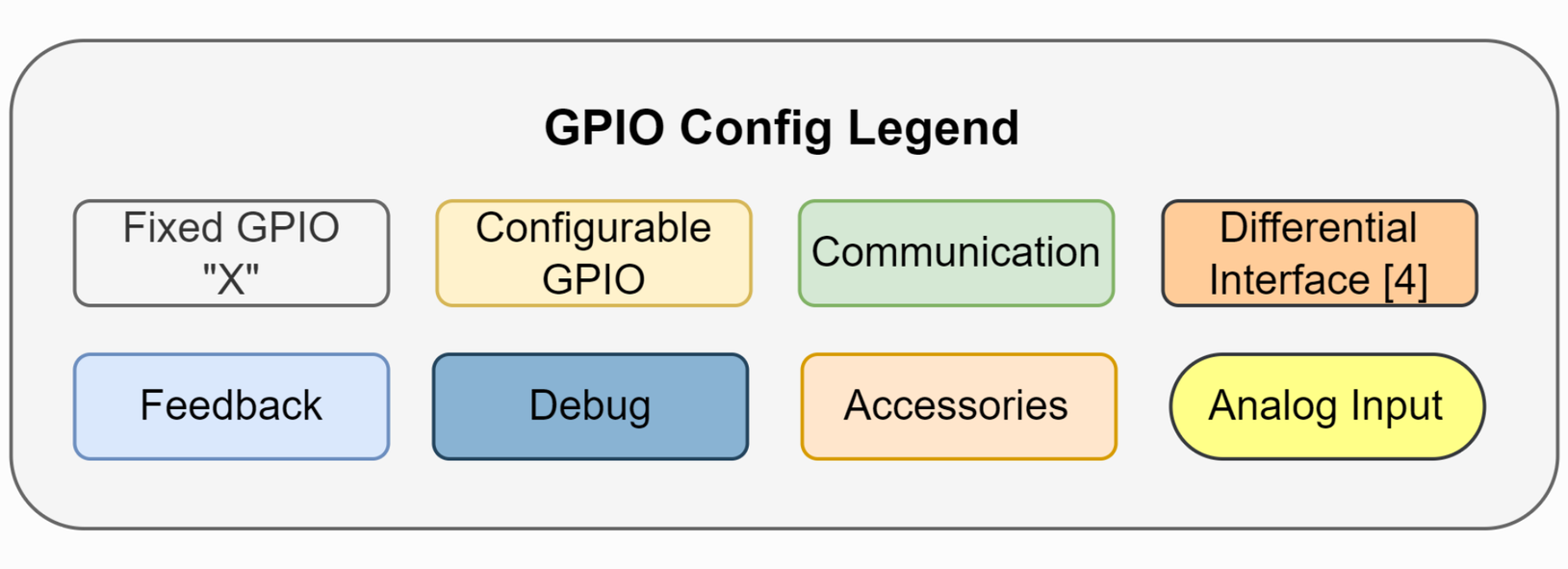


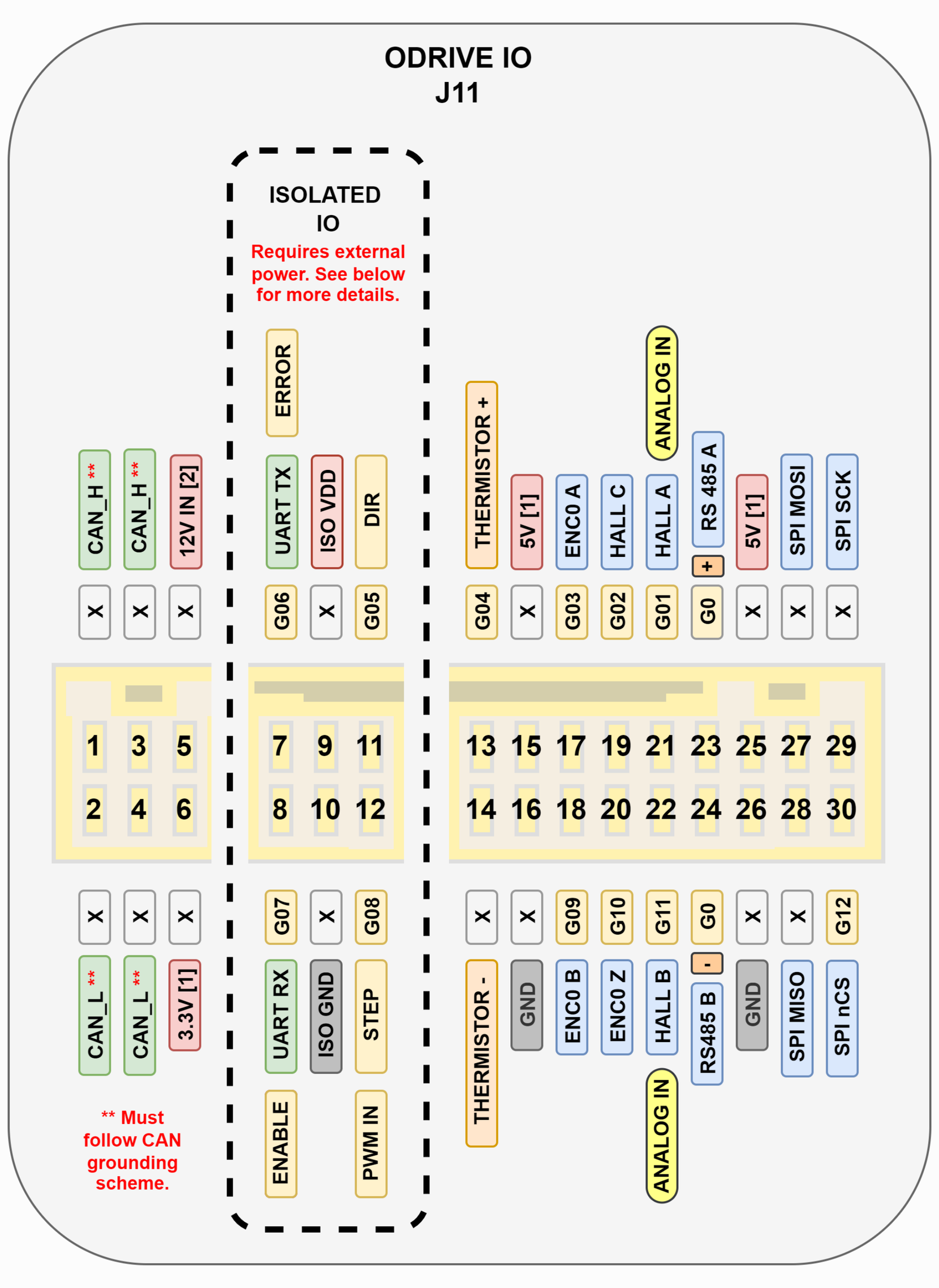
Pin	Description
R-	Brake resistor output
R+	Brake resistor output
A	Motor phase A
DC-	Power ground
B	Motor phase B
DC+	Power input, referenced to DC-
C	Motor phase C

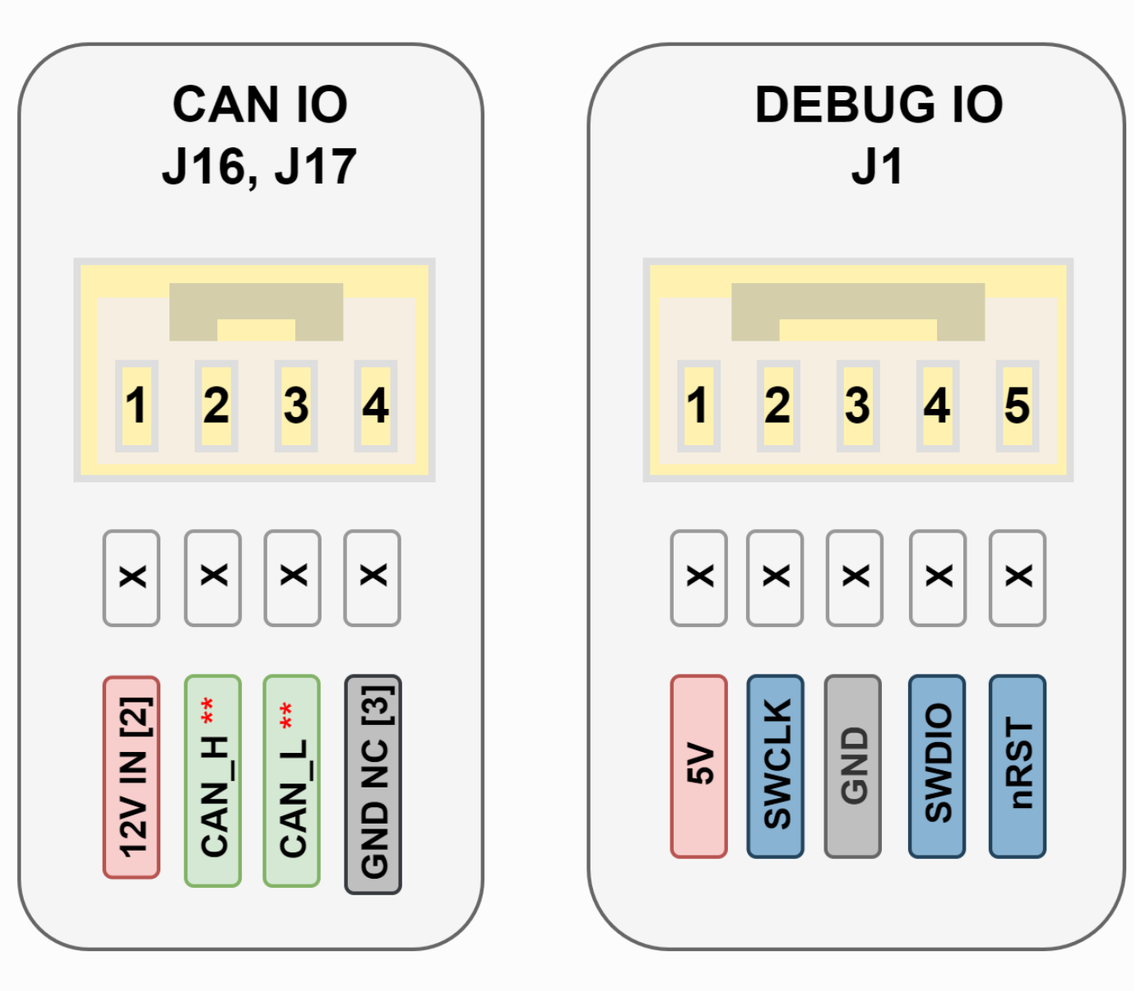
The motor phase connections A/B/C can be connected in any order.

Logic Pins

- Digital mode is a general purpose mode that can be used for these functions: step, dir, enable, encoder index, hall effect encoder, SPI encoder nCS.
- All GPIO pins are 5V tolerant, except if you power the isolator with 3.3V, then **ISOLATED IO** inputs are rated to 3.3V nominal.







GPIO Properties

Additional notes and properties for each GPIO pin

- **G0**: This pin is driven at RS422 logic levels, and cannot be used as a logic input. This pin cannot be used if an external SPI encoder is used. The + and - pins are complementary outputs.
- **G01, G02, G11**: The HALL pins have a 2.7kΩ pullup to +5V and low pass filter (τ=4.25us), and cannot be used in DIGITAL_PULL_DOWN mode. When used as an output, the logic low level will be 500mV.
- **G03, G09, G10**: The ENC0 pins have a 2.7kΩ pullup to +5V, and cannot be used in DIGITAL_PULL_DOWN mode. When used as an output, the logic low level will be 500mV.
- **G04**: The THERMISTOR+ pin has an internal 1kΩ pullup to 3.3V for use in a thermistor sense circuit. It cannot be used in DIGITAL_PULL_DOWN mode.
- **G12**: This pin can only be used as a SPI nCS pin, and should not be configured as a user-controlled input or output.
- **G05, G07, G08**: See ISOLATED IO section for required information using isolated pins. These pins are connected to a digital isolator, and can be used as GPIO inputs only. There is a 1.5MΩ pull-down integrated to the isolator, and pull up/down configuration has no effect.
- **G06**: See ISOLATED IO section for required information using isolated pins. This pins is connected to a digital isolator, and can be used as a GPIO output only.

Notes

Note

The letter G and the zero padding are not used in `odrivetool` or the web GUI, i.e. *G09* would be represented by only the number *9*.

- 5V outputs: combined draw max 150mA
- 3.3V output: max draw 150mA
- **[1]** 5V and 3.3V can be switched on and off internally. (feature coming soon!)
- The RS485 and SPI feedback interfaces are mutually exclusive on S1 – **a RS485 and external SPI encoder cannot be used at the same time**
- THERMISTOR + has an integrated 1k ohm voltage divider.
- **[2]** 12V in is optional and is used to power the ODrive logic, enabling communication before the main power supply is connected. Allowed voltage range: 10V-14V. Referenced to DC-. This voltage range is a hard limit, and inrush and overvoltage protection must be guaranteed.
- **[3]** GNC NC offers a common connection for the CAN bus ground, it is not connected internally
- **[4]** Differential interface used for RS-485 encoders.

User Facing Pins (Gxx)

- Locations for all pins that can be configured using `GpioMode`.
- **Inputs:**

  G0-G03, G06, G09-G12

- **Outputs:**

  G0-G03, G05, G07-G11

Note

Inputs and outputs are not mutually exclusive.

ISOLATED IO (G05-G08)

- GND ISO and V+ ISO must be connected to your other board.
- V+ ISO is a power **Input** to the isolated interface, which you should power with 3.3V or 5V.
- Input and output levels are 3.3V if you supply 3.3V, and are 5V if you supply 5V. Inputs are not 5V tolerant if you supply 3.3V.
- UART: (TX)-Transmit data from ODrive, (RX)-Recieve data to ODrive.
- The isolated inputs don't have a built-in pull-up/pull-down resistor (neither user configurable nor fixed). Setting the GPIO mode to `DIGITAL_PULL_UP` or `DIGITAL_PULL_DOWN` on these pins has the same effect as `DIGITAL`.