1 Features

- ESP32-C3 microcontroller with integrated 2.4 GHz Wi-Fi and Bluetooth Low Energy (BLE) for wireless configuration and real-time monitoring.
- Preloaded with VESC Express firmware for seamless integration with VESC controllers, supporting telemetry, diagnostics, and wireless firmware updates.
- Single cell li-ion battery management and protection.
- Wired and wireless charging support.
- 100 uA sleep current with fast wakeup support while the 3.3V and 5V rails are available.
- Hardware cell disconnect when the cell drops below 2.8V with less than 0.2 uA current draw. Reconnects the cell when wireless or wired charging is started.
- 3 analog inputs capable of reading 0V to 6V.
- 2 digital inputs that can be used for wakeup from deep sleep.
- CAN-bus interface for reliable, high-speed communication between multiple devices such as motor controllers, BMS units, and other CAN-enabled peripherals.
- Can be powered directly from USB for convenience during configuration, development, and bench testing.
- Compact form factor measuring only 24.3 mm × 49.0 mm and lightweight at just 7.5 g, ideal for applications where space and weight are critical.
- Two onboard fully programmable RGB LEDs.
- Charging LEDs for wireless charging as well as for wired charging.

2 Suggested Applications

- Custom wireless remote with wireless charging for easy VESC integration.
- Development board for wireless charging.

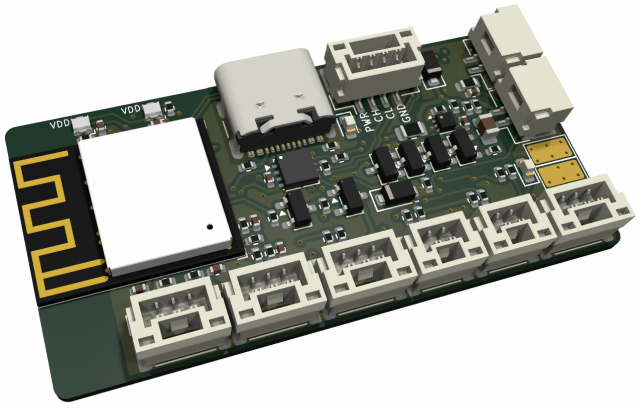


Figure 1: VESC Wcore

3 Description

The VESC Wcore is a small PCB several analog and digital inputs designed around charging an managing a singe-cell li-ion battery. All functions can be scripted in LispBM from VESC Tool while connected over USB or wirelessly using WiFi or Bluetooth 5.

Contents

1 Features **1**

2 Suggested Applications **1**

3 Description **1**

4 Specifications **3**
4.1 Recommended Operating Conditions . . . 3
4.2 Physical Properties . . . 3

5 Block Diagram **4**

6 Pinout and Wiring **4**
6.1 Pin Descriptions . . . 4

7 Charging **7**

8 LispBM Scripting **7**

9 Device Installation **9**
9.1 Installation Warnings . . . 9
9.2 Mechanical Dimensions . . . 10

10 Product Warranty **11**
10.1 Warranty Coverage . . . 11

11 Compliance & Regulatory Information **12**
11.1 CE Marking . . . 12
11.2 UKCA Marking . . . 12
11.3 WEEE Directive (2012/19/EU) . . . 12

4 Specifications

4.1 Recommended Operating Conditions

Parameter	Min	Max	Unit
Cell Voltage	2.8	4.2	V
Running Current	80	110[1]	mA
Sleep Current	90	110[2]	uA
Shutdown Current	0.1	0.2[3]	uA
Wireless Charging Current	200	900[4]	mA
Wired Charging Current	500	800	mA
Operating Temperature	-40	85	°C
Humidity		Non-condensing	-

4.2 Physical Properties

Parameter	Value	Unit
Length	24.3	mm
Width	49.0	mm
Height	16.9	mm
Mass	7.5	g

[1] WiFi and/or BLE connected cpu running. This will be higher with the LEDs on full brightness and/or with external LEDs connected.
[2] CPU in deep sleep, 5V and 3.3V rails still active
[3] After batter goes below 2.8V or on initial battery connect. 3.3V and 5V rails disabled. Need to connect a charger to leave this mode.
[4] Depends of wireless charger type, battery temperature and distance between charger and charging coil.

5 Block Diagram

A block diagram of the VESC Wcore is shown in figure 2. It is designed around charging and managing a single-cell Li-Ion battery. The cell is first connected to a protection IC that disconnects it if the current or voltage limits are exceeded. When the cell is disconnected by the protection IC the quiescent current drops to less than 0.2 uA which will prevent it from discharging to a level that damages the cell over a long time. Likewise, when first plugging in the cell it will start off being disconnected by the protection IC. When a wireless or USB charger is plugged in the cell gets connected to the rest of the circuit.

The 5V and 3.3V buck-boost regulators are on all the time (as long as the cell is connected by the protection IC) and provide power rails for all components. In sleep mode with the power rails active the current draw is around 100 uA.

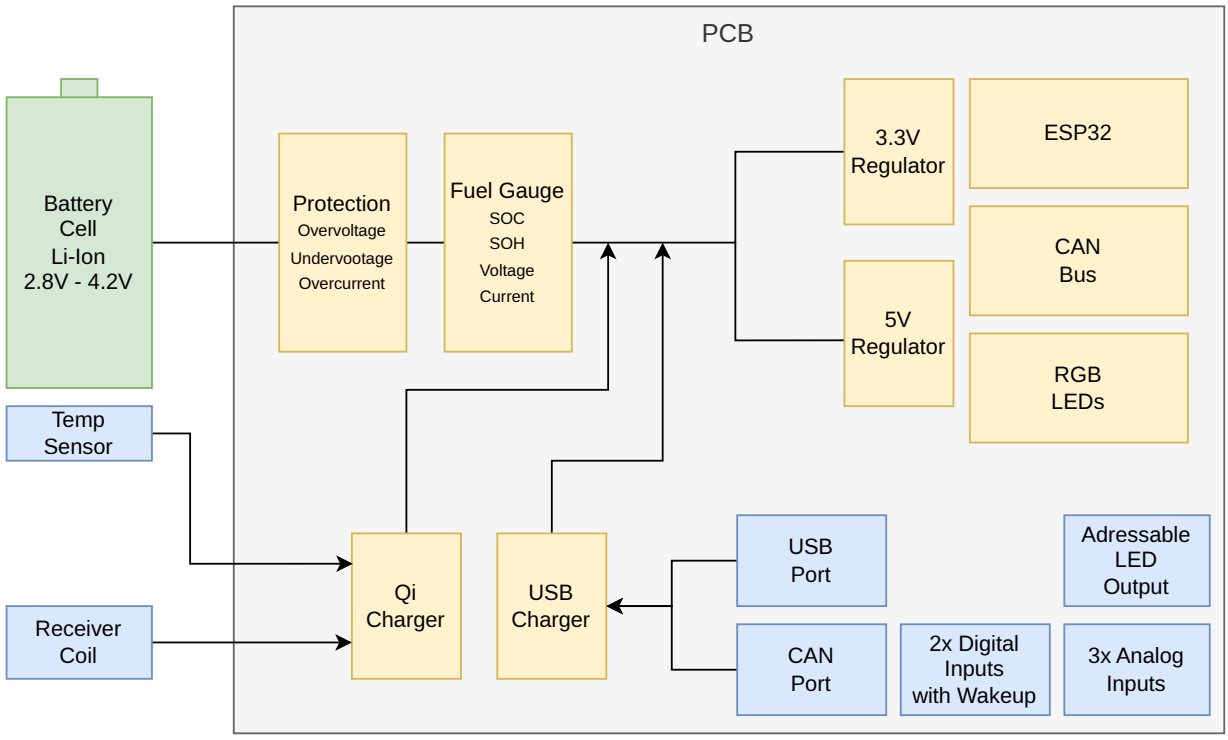


Figure 2: Block diagram of the VESC Wcore.

6 Pinout and Wiring

6.1 Pin Descriptions

The VESC Wcore has a several JST-GH connectors for which the pin functions and limits are described in Table 2. Figure 3 shows where the connectors are and what the pin numbers are.

Pin	Name	Function	Limits	CPU Pin
CAN & Power				
1	VCharge	Charge Input[1]	5V 1A	-
2	CANH	CAN High	±60V	-
3	CANL	CAN Low	±60V	-

4	GND	Ground	-	-
In 1				
1	5V-SW	Switched 5V[2]	5V 1A	-
2	ADC	Analog In[3]	6V	ADC0 / GPIO0
3	GND	Ground	1A	-
In 2				
1	5V-SW	Switched 5V[2]	5V 1A	-
2	ADC	Analog In[3]	6V	ADC1 / GPIO1
3	GND	Ground	1A	-
In 3				
1	5V-SW	Switched 5V[2]	5V 1A	-
2	ADC	Analog In[4]	6V	ADC3 / GPIO3
3	GND	Ground	1A	-
In 4				
1	ADC / GPIO	IO / ADC / Wakeup [5]	3.3V	ADC4 / GPIO4
2	GND	Ground	1A	-
In 5				
1	GPIO	IO / Wakeup [5]	3.3V	GPIO5
2	GND	Ground	1A	-
LED				
1	5V-SW	Switched 5V[2]	5V 1A	-
2	Data	LED Data[7]	3.3V	-
3	GND	Ground	1A	-
Charge Coil				
1	Coil 1	Coil 1	-	-
2	Coil 2	Coil 2	-	-
Batt				
1	B-	Battery Minus	4.2V 1A	-
2	B+	Battery Plus	4.2V 1A	-
Temp				
1	Temp[6]	Temp 1	-	-
2	Temp[6]	Temp 2	-	-

Table 2: Pin-functions of the VESC Wcore

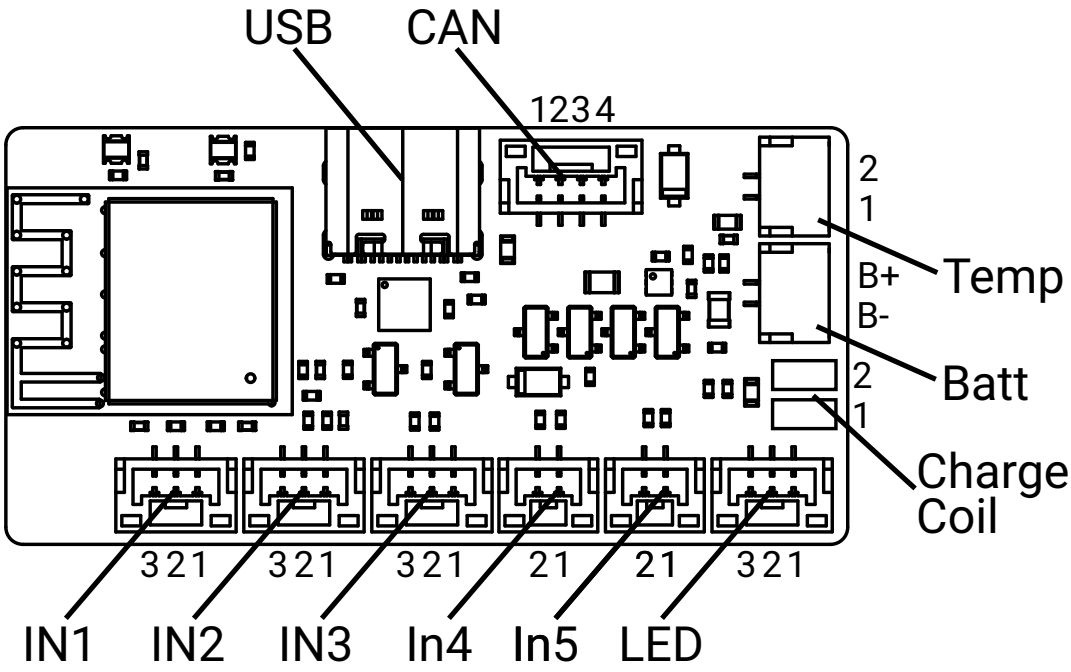


Figure 3: Connector locations and pin numbers on the VESC Wcore.

[1]Used for charging the battery with about 900 mA. Will not use the temperature sensor and the charge current is added to the wireless charging current.

[2]This 5V line is switched with a MOSFET and disabled by default. It can be enabled by writing 1 to GPIO10. Note that the combined current of all 5V lines must not exceed 1A.

[3]This input has a voltage divider with two 10k resistors and a 100nF capacitor for filtering. The measured voltage on the ADC will be half of the voltage on the pin.

[4]This input has a voltage divider with two 10k resistors (no filtering capacitor). The measured voltage on the ADC will be half of the voltage on the pin.

[5]This pin has a 1k series resistor and 10k pull-up to 3.3V. The sleep mode must be configured so that this pin is left floating while sleeping to avoid draining the battery slowly.

[6]Connect a 10K 3380K NTC thermistor to these to these pins and mount it close to the battery cell. Note that leaving these pins unconnected will prevent the wireless charging from working.

[7]Output from the last addressable LED on the PCB. The PCB uses XL-1615RGBC-RF LEDs, so for best compatibility the same should be used when using external LEDs.

7 Charging

The VESC Wcore supports both wired and wireless charging, even simultaneously. Care should be taken when using both chargers at the same time as the charging current will be added together, which can overheat the connector and/or the battery cell. Recommended is to only use one charger at a time.

For wireless charging, most standard Qi chargers should work when using the included charging coil. Note that changing the charging coil likely requires tuning the matching capacitors on the PCB for the inductance of the new coil.

8 LispBM Scripting

The VESC Wcore does not come with any default functionality and at this time there are no ready-to-use packages available for it, so the intended application has to be implemented using LispBM scripting from VESC Tool. The first step is to power the device, which can be done from USB or from the power input on the CAN & Power connector. Once the device has power, a connection to it can be made from VESC Tool over USB, WiFi or CAN-bus. Further instructions on how to establish a VESC Tool connection can be found at `https://www.vesclabs.com/category/getting-started/`

Once VESC Tool is connected, all scripting can be done from the LispBM Scripting page. On the bottom tab bar of that page many examples can be found to get started and complete documentation for all functions and extensions can be found at `https://github.com/vedderb/bldc/blob/master/lispBM/README.md`

The following script sleeps when IN5 and GND are not bridged, so make sure to bridge them during development. By polling data in VESC Tool you can see the battery voltage and battery current in real time. It also shows how to control the on-board LEDs and how to configure the fuel BQ27441 gauge for monitoring the SOC and SOH of a 4.5 Ah 21700-cell.

```
(import "pkg@://vesc_packages/lib_bq27441/bq27441.vescpkg" 'bq27441)
(read-eval-program bq27441)

(def ts-chg 0)
(def ts-no-chg 0)
(def time-chg-last 0.0)
(def time-no-chg-last 0.0)

(def ledbuf (rgbled-buffer 2 0 1))

@const-start

(defun bq-config () {
  (bq-set-sealed false) ; Make sure that device is not sealed
  (bq-set-cfgupdate t) ; Enter configuration update mode
  (bq-set-capacity 4500) ; 4500 mAh capacity
  (bq-set-energy (* 4500 3.7)) ; 4500 * 3.7 mWh energy
  (bq-set-terminate-voltage 3.0) ; 3.0 V is 0% SOC
  (bq-soft-reset) ; Reset after applying configuration
})

(defun main () {
  ; LED and ADC enable
  (gpio-configure 10 'pin-mode-out)
  (gpio-write 10 1)

  ; LEDs on PCB
  (rgbled-init 2)
  (rgbled-color ledbuf 0 (color-make 0.3 0.3 0.3))
  (rgbled-color ledbuf 1 (color-make 0.3 0.3 0.3))
  (rgbled-update ledbuf)

  ; i2c-rate 100k, pin7 is SDA, pin8 is SCL
  (bq-init 'rate-100k 7 8)

  (gpio-configure 5 'pin-mode-in-pu)
```

```
  (if (= (gpio-read 5) 1) {
    ;(sleep 5)
    (sleep-config-wakeup-pin 5 0)
    (sleep-deep 10)
  })

  (def t-start (secs-since 0))

  ; This means the configuration isn't done
  ; TODO: Use status register
  (if (< (bq-cap-full) 2000) {
    (bq-config)
  })

  (loopwhile-thd 200 t {
    (def i-bat (bq-i-avg))
    (def v-bat (bq-v))
    (def soc (bq-soc))

    (if (< i-bat 0.1)
    {
      (setq ts-chg (systime))
      (if (> (secs-since ts-no-chg) 2.0) {
        (setq time-no-chg-last (secs-since ts-no-chg))
      })
    }
    {
      (setq ts-no-chg (systime))
      (if (> (secs-since ts-chg) 2.0) {
        (setq time-chg-last (secs-since ts-chg))
      })
    }
    )

    (if (= (gpio-read 5) 1) {
      ;(sleep 5)
      (sleep-config-wakeup-pin 5 0)
      (sleep-deep 10)
    })

    (sleep 0.1)
  })
})

(image-save)
(main)
```

9 Device Installation

9.1 Installation Warnings

- **Installation must be performed by qualified personnel** with experience in high-voltage battery systems and VESC-based motor controllers.
- **Read and fully understand all instructions, datasheets, and safety warnings** before beginning installation.
- **Gather all necessary tools and materials** including the device, wiring harnesses, connectors, insulation materials, and personal protective equipment.
- **Ensure the motor controller and motor system are prepared and properly arranged** with correct wiring paths and secure mounting.
- **Securely mount the device using threadlock** in a location protected from vibration, moisture, dust, and direct heat sources.
- **Do not install the device in locations exposed to water, condensation, or flammable materials.**
- **Install motor temperature sensors as required,** in order for the motor protection to ramp down the current smoothly when the motor is about to overheat.
- **Only use manufacturer-specified connectors and cables** to ensure safe and reliable connections.
- **Verify correct polarity for all connections.** Incorrect wiring can cause irreversible damage to the device, battery pack, or connected equipment. **Double-check the wiring diagram before proceeding.**
- **Insulate all exposed terminals and wiring** to prevent accidental short circuits or electric shock.
- **Keep metal objects and tools away from the device and power terminals during installation** to avoid accidental bridging of electrical contacts.
- **Tidy up and secure all cables** with cable ties or routing guides to prevent movement and wear.
- **Do not drill, cut, or modify the device enclosure or circuit board.** Unauthorized modifications may void the warranty and compromise safety or functionality.
- **Double-check all connections and wiring against the provided diagrams** before applying power to the system.
- **When powering up the system for the first time, do so in a controlled environment with appropriate protective equipment.** Be prepared to disconnect power immediately if any abnormal behaviour is observed.

9.2 Mechanical Dimensions

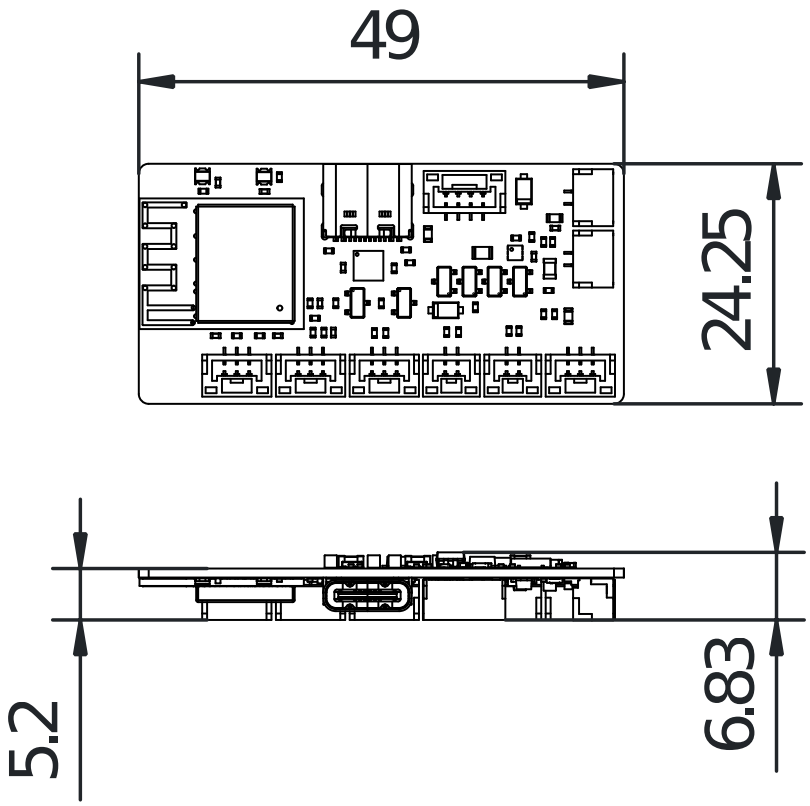


Figure 4: VESC Wcore Dimensions shown in mm.

10 Product Warranty

10.1 Warranty Coverage

Please find the warranty information regarding VESC Labs products using the following link:
`https://www.vesclabs.com/warranty-and-returns-policy/`

11 Compliance & Regulatory Information

11.1 CE Marking

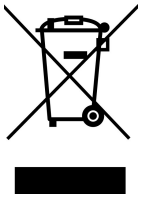
This product meets the requirements of all applicable EU directives and regulations and complies with the essential health, safety, and environmental protection requirements as set out in relevant legislation. It is CE marked in accordance with:

- **Directive 2014/30/EU** – Electromagnetic Compatibility (EMC)
- **Directive 2014/35/EU** – Low Voltage Directive (LVD)
- **Directive 2011/65/EU** – Restriction of Hazardous Substances (RoHS)

11.2 UKCA Marking

This product is compliant with UK regulations and bears the UKCA marking, confirming its conformity with the applicable statutory requirements in Great Britain. It meets the relevant provisions of:

- Electrical Equipment (Safety) Regulations 2016
- Electromagnetic Compatibility Regulations 2016
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

11.3 WEEE Directive (2012/19/EU)

This product is compliant with the Waste Electrical and Electronic Equipment (WEEE) Directive. It should not be disposed of with unsorted municipal waste and must be collected separately for proper treatment and recycling. Please contact your local distributor or relevant waste authority for information on recycling options and collection facilities.