Kotleta20 Datasheet

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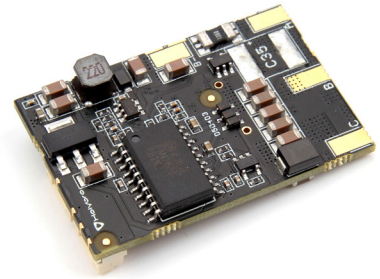

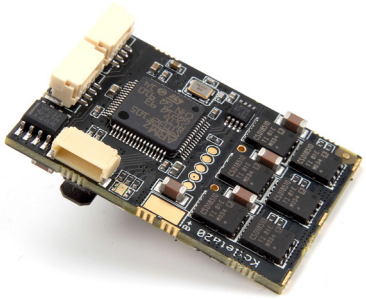

Overview

Kotleta 20 is an advanced sensorless BLDC propeller drive controller with CAN bus interface. It runs the Sapog* Firmware.

Kotleta 20 has one CAN bus with two sockets onboard.

Applications

- Propeller drives for light unmanned aerial vehicles.
- Pump and propeller drives for unmannedwatercraft.

Features

- Excellent dynamic characteristics.
- Regenerative braking and active freewheeling.
- 500 W continuous power output at 8.8 g weight.
- Optional RPM control loop (RPM governor).
- Self diagnostics and health status reporting.
- Highly configurable.
- Low noise and low current ripple due to the low-ESR embedded filtering capacitors and highfrequency PWM.
- Supported interfaces:
- CAN (ISO 11898-2)
- UART.
- RCPWM (analog PWM interface widely used in robotics).
- High quality assurance:
- Protection against unlicensed (counterfeit) production by means of a digital signature installed on every manufactured unit.
- Open source firmware - Sapog (3-clause BSD license).

*Refer to the Sapog Reference Manual for information about the firmware.

1. Overview

Kotleta 20 is an advanced controller of sensorless BLDC motors designed for use in cost sensitive applications. Its primary application domains include propulsion systems of electric unmanned aircraft and watercraft.

Kotleta 20 runs Sapog - an open source multiplatform BLDC controller rmware developed by Zubax Robotics. Please refer to the Sapog Reference Manual for its usage information. This datasheet is focused only on the hardware aspect of the product.

1.1. System integration

Kotleta 20 is a single supply device, which means that the device does not expose any power supply inputs except for the high power supply. The 5 V rails of the CAN interfaces are not used by the device; rather, they connect the 5 V rails of their respective CAN connector pairs directly together.

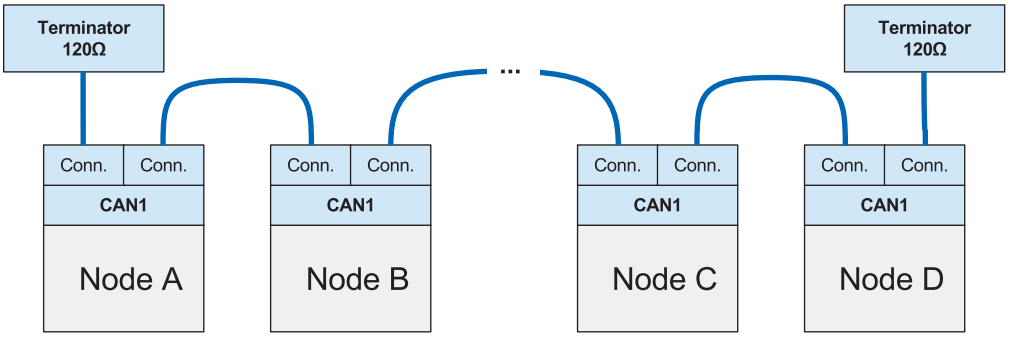

Figure 1.1: Connection of CAN nodes in non-redundant CAN bus conguration.

1.2 Quality assurance

Every manufactured Kotleta 20 undergoes an automated testing procedure that validates that the device is functioning as designed. The test log for every manufactured device is available on the web at https://device.zubax.com/device_info. This feature can be used to facilitate traceability of purchased devices and provide additional safety assurances.

1.3 Accessories

Package included:

- Kotleta 20 ESC*4 (Combo)
- 100 mm long 16 AWG wires(Red) *4
- 100 mm long 16 AWG wires(Black)*4
- Electrolytic capacito: 220uF 35v *4
- 4 to 4 pin cable (CAN) *4
- 6 to 6 pin cable(Debug) *1
- Micro termination plug *1

2. Characteristics

2.1 Absolute maximum ratings

Stresses that exceed the limits specied in this section may cause permanent damage to the device. Proper operation of the device within the limits specied in this section is not implied.

Table 2.1: Absolute maximum ratings

Symbol	Parameter	Min	Max	Unit
Vinv	Supply voltage	-0.3	25	V
Toper	Operating temperature	-50	125	°C
	UART/RCPWM input voltage	-0.3	5	V
	CAN H/L input voltage	-4	16	V

2.2 Environmental conditions

Table 2.2: Environmental conditions

Symbol	Parameter	Note	Min	Max	Unit
Toper	Operating temperature		-40	105	°C
Tstor	Storage temperature		-40	50	°C
øope	Operating humidity	Condensation not permitted	0	100	%RH
hoper	Operating altitude	Above mean sea level (MSL)		10	km

2.3 Reliability

Please contact Holybro for additional reliability and safety information.

Table 2.3: Reliability

Symbol	Parameter	Typ	Unit
MTTF	Mean time to failure	20000	hours

2.4 Power characteristics

Table 2.4: Power characteristics

Symbol	Parameter	Min	Typ	Max	Unit
P	Continuous power(input = 24			500	W
Ppeak	Peak power			1000	W
I inv	Continuous DC current			20	A
Iinv-peak	Peak DC current			55	A
Iidle	Idle current consumption		50		mA
Vinv	Supply voltage	9	14.8	26	V
VTVS	TVSbcircuit activation voltage	19		26	V
ETVS	TVS circuit energy absorption capability		5		J
θJA	Junction-to-air thermal resistance		50		K/W
RDS-on	FET drain-source on-state resistance		0.79	1.2	mΩ
Rphase	Cumulative resistance of the inverter per phase		3.5		mΩ
	Inverter temperature measurement error	-6		+6	°C
	Inverter temperature measurement range	-55		125	°C

2.4.1 Regenerative braking

During regenerative braking, the device performs energy transfer from the motor to the power supply network. If the self resistance of the power supply network is not sufficiently low, the regenerative energy transfer may lead to an increase of the supply voltage beyond the safe operating limits. This event will trigger activation of the transient voltage suppression (TVS) circuit, which will absorb some of the excessive energy. If the amount of recovered energy exceeds the absorption capabilities of the power supply network and the TVS circuit, the device may incur a fatal damage.

Generally, batteries are capable of absorbing the energy recovered during braking without issues. Problems may arise if the device is powered from a source that does not permit high reverse currents, such as laboratory power supplies. In that case it is advised to install additional buffer capacitors to act as an energy storage during braking.

2.4.2 Power connectors

Kotleta 20 is equipped with bullet 3.5 mm power connectors. Input power is provided via male connectors soldered on 100 mm long 16 AWG wires. The motor phases are connected via female connectors soldered on 100 mm long 16 AWG wires. Additional connection options are available upon request

2.5 Communication interfaces

2.5.1 CAN bus

The device is equipped with ISO 11898-2 CAN 2.0A/B interface. The power rails of the connector pairs are not connected to the device's internal circuitry, since Kotleta 20 does not consume or provide power to the CAN bus.

The device does not terminate the CAN bus internally.

Table 2.5: CAN bus connectors pinout

Pin no	Type	Name	Comment
1	Power	PWR	Not connected to the device's circuits internally.
2	Input/Output	CAN H	
3	Input/Output	CAN L	
4	Ground	GND	

Table 2.6: Characteristics of CAN bus interfaces

Symbol	Parameter	Min	Typ	Max	Unit
	Bit rate	20		1000	Kbps
	Positive-going input threshold voltage		750	900	mV
	Negative-going input threshold voltage	500	600		mV
	Differential output voltage, dominant	1.5	2.0	3.0	V
	Differential output voltage, recessive	-120	0	12	mV
	Bus power rail voltage	-10		10	V
	Inter-connector current	-1		1	A
	Connector resistance during device lifetime		30	50	mΩ

2.5.2 Dronecode debug port

The device features a Dronecode debug port available via the standard Dronecode Mini debug connector (DCD-M). The Dronecode debug port provides access to the device's CLI5 via UART, and to the RCPWM input which is shared with the UART RX line.
UART and RCPWM must not be used simultaneously. If RCPWM is activated, it is prohibited to connect UART, as that may cause unpredictable behavior of the RCPWM interface.

2.5.3 RCPWM input

The RCPWM interface has a dedicated connection point near the edge of the PCB, suitable for soldering wires directly to it. This connection point is connected directly to the UART RX / RCPWM RX pin, and so it does not constitute an independent interface. Same conditions and limitations apply.

2.6 Indication

Kotleta 20 is equipped with a single RGB LED indicator for purposes of status indication. The LED is located on the bottom side near the edge of the PCB.

2.7 Mechanical characteristics

Table 2.9: Mechanical characteristics

Symbol	Parameter	Note	Typ	Unit
m	Mass	Power connectors not included	8.8	g

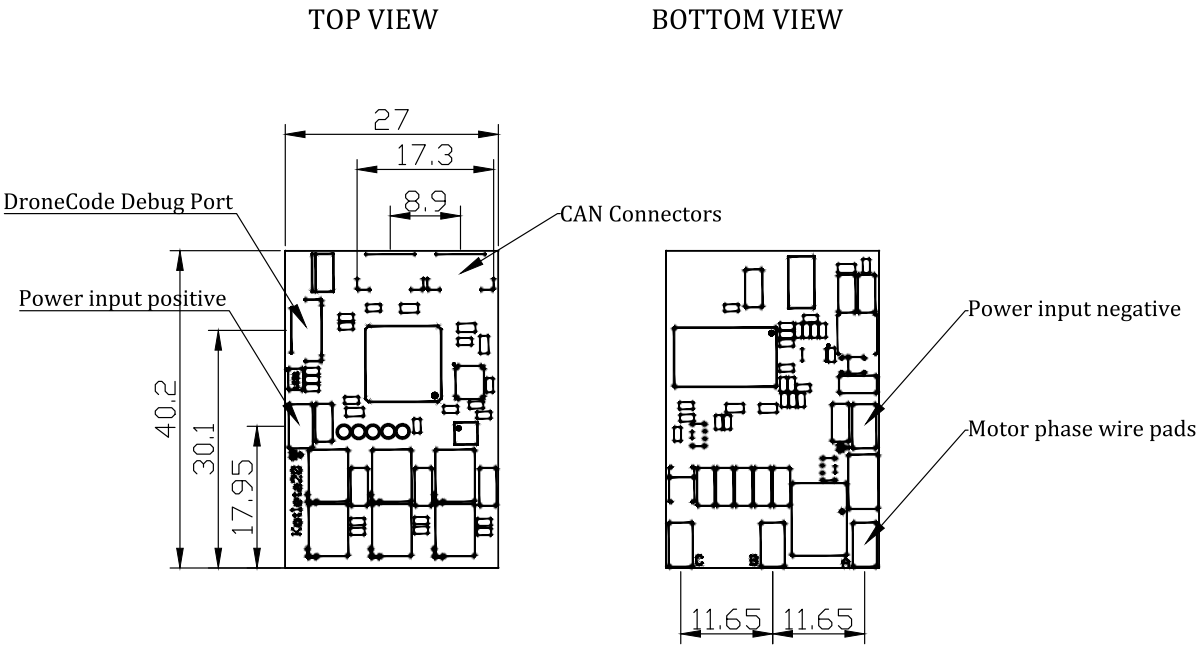

Figure 2.1: PCB drawing.