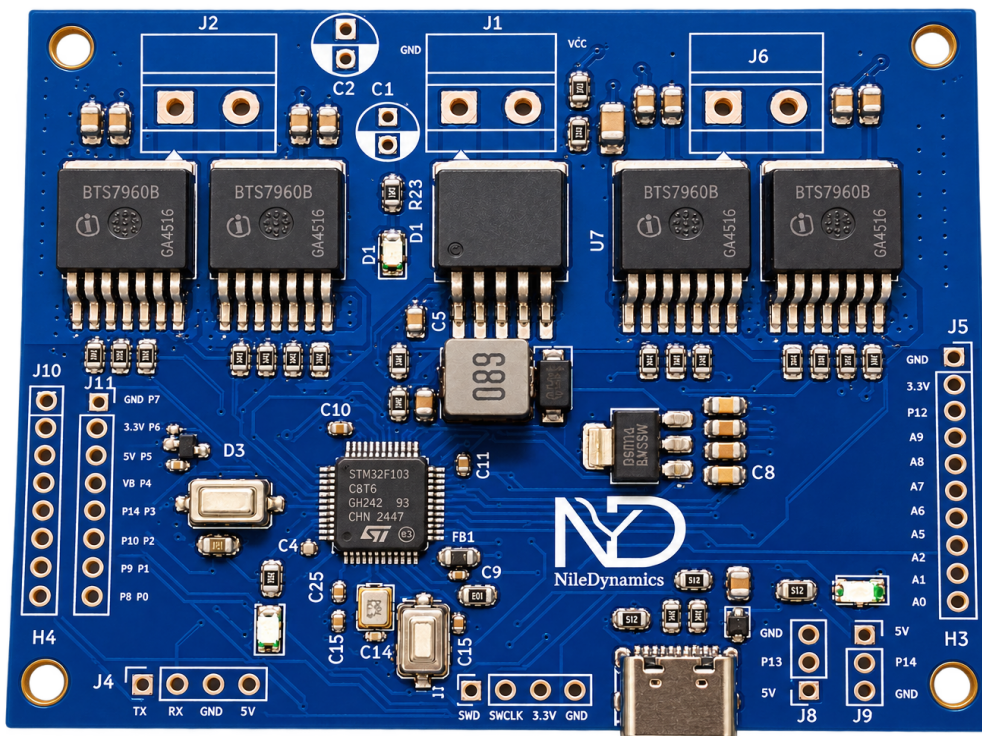


Aspire Board

Dual-Channel Motor Control
Development Board



2

Motor channels

72 MHz

Cortex-M3

USB-C

DFU + telemetry

DATASHEET Rev. 1.0 | January 2026

STM32F103C8T6 · Four BTS7960B half-bridges · Independent current feedback

1 Overview

Aspire Board combines an STM32F103C8T6 microcontroller, two independent full H-bridge motor channels, and current and supply-voltage sensing on one development platform. USB connectivity supports firmware upload through the on-board bootloader and a virtual COM port for live telemetry.

Key features

- **Motor control.** Two bidirectional outputs built from four BTS7960B half-bridges. Four synchronous PWM channels share TIM4.
- **Processing.** ARM Cortex-M3 at 72 MHz, with 64 KB flash and 20 KB SRAM.
- **Sensing.** Independent current feedback for each motor and a dedicated VCC_SENSE channel for the motor supply.
- **Encoder inputs.** Two single-channel inputs, one per motor. These are not an A/B quadrature pair.
- **Connectivity.** USB 2.0 full-speed device with DFU bootloader and virtual COM port; SWD debugging on dedicated pins.
- **Expansion.** 13 digital I/O and 7 analog inputs listed in the source draft, with timer, SPI, I2C and USART alternate functions. Board functions share pins.

Shared resources. TIM4 is reserved for motor PWM. ADC1 is shared with board sensing. A5 carries Motor B current feedback and must not be driven by another signal.

2 Potential applications

Differential-drive robotics

Independent left/right motor control with current feedback for traction and stall detection.

Conveyors and actuators

Bidirectional control and current limiting for belts, linear actuators and small conveyors.

Automated test fixtures

Current signatures support pass/fail assessment of moving mechanisms.

Robotic arms and gimbals

Two axes per board with encoder inputs for closed-loop position control.

Educational motion control

Observable current, voltage and speed telemetry for teaching PWM, PID and feedback.

Pump and fan drives

Speed regulation with motor-supply monitoring.

Motor characterisation

Synchronised sampling for winding resistance, stall current and load curves.

Rapid prototyping

Control, power and sensing integrated on one board.

3 Electrical ratings

Use the recommended values as the operating reference. Absolute maximum ratings are stress limits and do not imply guaranteed operation.

3.1 Recommended operating conditions

Symbol	Parameter	Recommended	Unit
V_{CC}	Motor supply voltage	24	V
I_{PH}	Continuous current per phase - no heatsink	5	A
$I_{PH(TM)}$	Continuous current per phase - thermal management	14	A
f_{PWM}	PWM switching frequency	8	kHz
V_{5V}	5 V rail input voltage	5.0	V
V_{3V3}	3.3 V rail input voltage	3.3	V

PWM and thermal handling. The source recommends 8 kHz to limit driver switching losses. Increasing frequency towards 20 kHz raises dissipation and requires current derating. Higher-current operation requires suitable heatsinking and airflow.

3.2 Absolute maximum ratings

Stresses beyond these limits may cause permanent damage. Prolonged exposure to absolute maximum conditions may affect reliability.

Symbol	Parameter	Stress limit	Unit
$V_{CC(max)}$	Motor supply voltage	30	V
$I_{PH(max)}$	Continuous current per phase - no heatsink	8	A
$I_{PH(max,TM)}$	Continuous current per phase - thermal management	20	A
$f_{PWM(max)}$	PWM switching frequency	20	kHz
$V_{5V(max)}$	5 V rail input voltage	6.5	V
$V_{3V3(max)}$	3.3 V rail input voltage	3.6	V
T_{max}	Operating temperature	120	°C

Current stress limits. The 8 A value applies to a bare board in still air; the 20 A value requires heatsinking and airflow sufficient to keep the driver junction temperature within limits. Verify sustained operation thermally in the intended enclosure.

Header supply rails: the 3.3 V and 5 V header connections are regulator outputs. See the connector notes before wiring.

4 Board and connector map

The motor supply enters at J1. J2 drives Motor A; J6 drives Motor B. The board view below identifies the remaining headers and interfaces.

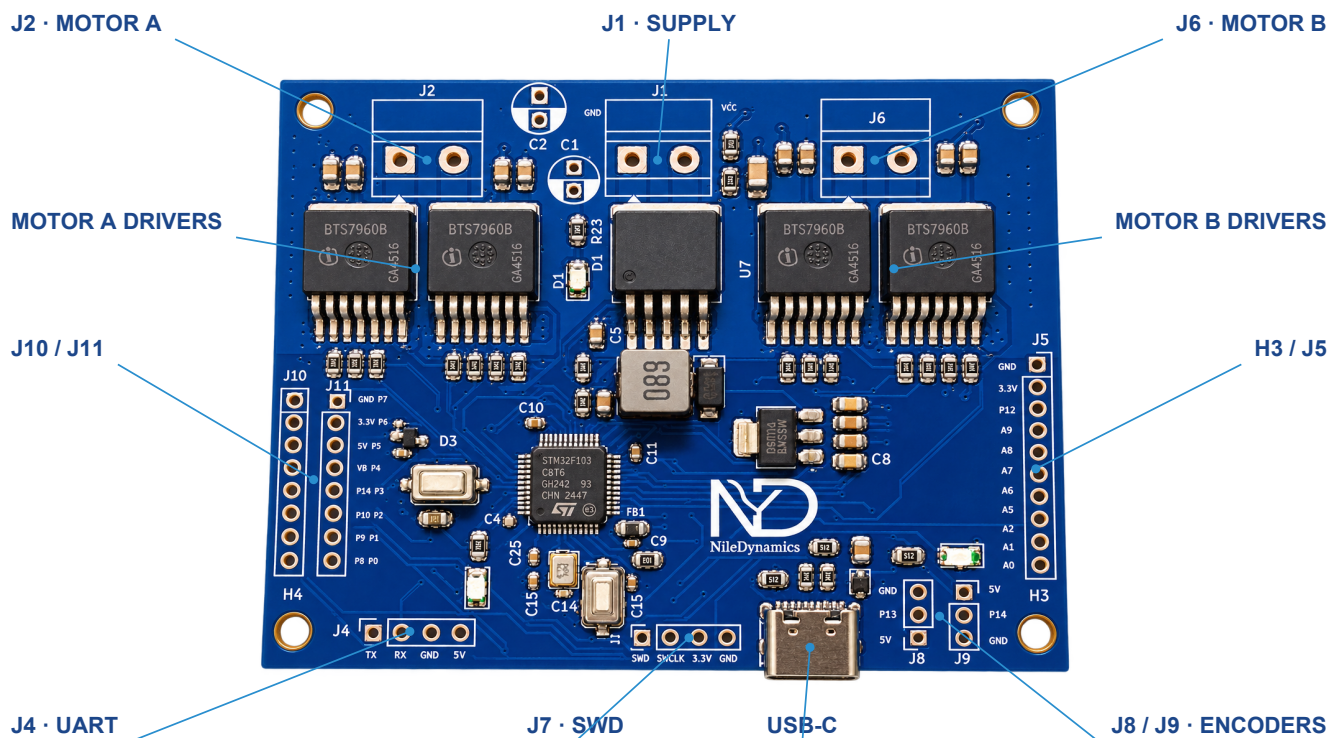


Figure 1. Aspire Board, viewed from the component side.

Connector reference

Connector	Pins	Function
J1	VCC, GND	Motor supply input; centre terminal block
J2	OUT1, OUT2	Motor A output; left terminal block
J6	OUT1, OUT2	Motor B output; right terminal block
J4	TX, RX, GND, 5V	UART: TX = PA9, RX = PA10; shared with P1 / P2
J7	SWD, SWCLK, 3.3V, GND	Debug: SWDIO = PA13; SWCLK = PA14
J8	GND, P13, 5V	Motor A encoder; P13 = PA15
J9	5V, P14, GND	Motor B encoder; P14 = PB3; shared with left bank
USB-C	D-, D+, VBUS, GND	USB 2.0 full-speed; PA11 / PA12; DFU + virtual COM

5 Expansion headers

5.1 Left bank - J10 / J11

Rows follow the board silkscreen order, top to bottom. Digital pins share alternate functions.

Label	MCU pin	Function	Notes / alternates
GND	-	Ground	Board common
3.3V	-	3.3 V rail	Regulated logic supply, output
5V	-	5 V rail	Regulated supply, output
VB	-	VBAT	Backup-domain supply input
P14	PB3	Motor B encoder / digital I/O	Shared with J9; TIM2_CH2 after remap
P10	PB14	Digital I/O	SPI2_MISO, TIM1_CH2N
P9	PB13	Digital I/O	SPI2_SCK, TIM1_CH1N
P8	PB12	Digital I/O	SPI2_NSS, TIM1_BKIN
P7	PB11	Digital I/O	USART3_RX, I2C2_SDA
P6	PB10	Digital I/O	USART3_TX, I2C2_SCL
P5	PB5	Digital I/O	TIM3_CH2 (remap), I2C1_SMBA
P4	PB4	Digital I/O	NJTRST; requires JTAG remap
P3	PB2	Digital I/O	BOOT1
P2	PA10	Digital I/O	USART1_RX; shared with J4 RX
P1	PA9	Digital I/O	USART1_TX; shared with J4 TX
P0	PA8	Digital I/O	TIM1_CH1, MCO

Generated code applies the JTAG remap for P3 / P4 use. The 3.3 V and 5 V pins are regulator outputs.

5.2 Right bank - H3 / J5

Label	MCU pin	ADC channel	Function / alternates
GND	-	-	Ground
3.3V	-	-	3.3 V rail; regulator output
P12	PC13	-	On-board LED; 3 mA max drive
A9	PB1	ADC12_IN9	Analog in; TIM3_CH4
A8	PB0	ADC12_IN8	Analog in; TIM3_CH3
A7	PA7	ADC12_IN7	Analog in; TIM3_CH2, SPI1_MOSI
A6	PA6	ADC12_IN6	Analog in; TIM3_CH1, SPI1_MISO
A5	PA5	ADC12_IN5	Motor B current sense; monitoring only
A2	PA2	ADC12_IN2	Analog in; TIM2_CH3, USART2_TX
A1	PA1	ADC12_IN1	Analog in; TIM2_CH2
A0	PA0	ADC12_IN0	Analog in; TIM2_CH1, WKUP

A5 is not a spare analog input. Driving PA5 corrupts Motor B current feedback. A4 (Motor A current sense) and A3 (VCC_SENSE) serve board functions and are not exposed, according to the connector description.

6 Motor and sensing signals

TIM4 supplies synchronous PWM to both motors. Each channel also has enable, current sense and encoder signals.

6.1 Motor A

Signal	MCU pin	Function	Notes
MOTOR_A_PWM1	PB6	Forward PWM	TIM4_CH1; duty = speed, CW
MOTOR_A_PWM2	PB7	Reverse PWM	TIM4_CH2; duty = speed, CCW
MOTOR_A_ENABLE	PC14	Driver enable	Output low disables channel
MOTOR_A_CURRENT	PA4	Current sense	ADC12_IN4; analog input
MOTOR_A_ENCODER (P13)	PA15	Encoder input	Single channel; TIM2_CH1 after remap

6.2 Motor B

Signal	MCU pin	Function	Notes
MOTOR_B_PWM1	PB8	Forward PWM	TIM4_CH3; duty = speed, CW
MOTOR_B_PWM2	PB9	Reverse PWM	TIM4_CH4; duty = speed, CCW
MOTOR_B_ENABLE	PC15	Driver enable	Output low disables channel
MOTOR_B_CURRENT	PA5	Current sense	ADC12_IN5; analog input
MOTOR_B_ENCODER (P14)	PB3	Encoder input	Single channel; TIM2_CH2 after remap

6.3 Shared power and interfaces

Terminal / signal	MCU pin	Function	Notes
VCC / GND	-	Motor supply	8-30 V DC; feeds board regulators
MOTOR A OUT1 / OUT2	-	Motor A output	Bidirectional; polarity set by active PWM
MOTOR B OUT1 / OUT2	-	Motor B output	Bidirectional; polarity set by active PWM
VCC_SENSE	PA3	Supply monitor	ADC12_IN3; on-board divider
USB D- / D+	PA11 / PA12	USB device	DFU bootloader + virtual COM
SWDIO / SWCLK	PA13 / PA14	Debug	Retained with JTAG remap in use

Encoder interpretation. Inputs are independent single-channel signals, one per motor. They cannot measure rotation direction by themselves. Speed comes from pulse interval; direction is taken from the commanded state.

7 STM32F103C8T6 reference

Header labels can share board functions. Use the connector descriptions to determine physical access and pin conflicts. Port B and system pins continue on page 8.

Port A

MCU pin	Board designation	Assigned function	Draft availability
PA0	A0	General-purpose analog input	Header
PA1	A1	General-purpose analog input	Header
PA2	A2	General-purpose analog input	Header
PA3	VCC_SENSE	Supply monitoring	Header*
PA4	MOTOR_A_CURRENT	Motor A current sense	Header*
PA5	MOTOR_B_CURRENT	Motor B current sense	Header
PA6	A6	General-purpose analog input	Header
PA7	A7	General-purpose analog input	Header
PA8	P0	General-purpose digital I/O	Header
PA9	P1	General-purpose digital I/O	Header
PA10	P2	General-purpose digital I/O	Header
PA11	USB D-	USB device	Internal
PA12	USB D+	USB device	Internal
PA13	SWDIO	Debug	Internal*
PA14	SWCLK	Debug	Internal*
PA15	P13 / ENC_A	Motor A encoder	Header

Peripheral reservations

Peripheral	Reserved for	Available to the user
TIM4	All four motor PWM channels	Fully committed when either motor is in use
ADC1	Motor current and VCC sensing	Remaining channels available; peripheral is shared
USB	DFU bootloader and virtual COM	Shared; CDC port is user-accessible
TIM2	Encoder inputs after remap	Available when encoders are unused
TIM1, TIM3	-	Available
SPI1, SPI2, I2C1, I2C2	-	Available subject to assigned pin conflicts
USART1, USART2, USART3	-	Available on the header pins listed

* Draft availability labels require reconciliation; see page 8.

7 MCU reference (continued)

Port B

MCU pin	Board designation	Assigned function	Draft availability
PB0	A8	General-purpose analog input	Header
PB1	A9	General-purpose analog input	Header
PB2	P3	General-purpose digital I/O	Header
PB3	P14 / ENC_B	Motor B encoder	Header
PB4	P4	General-purpose digital I/O	Header
PB5	P5	General-purpose digital I/O	Header
PB6	MOTOR_A_PWM1	Motor A PWM (TIM4_CH1)	Header*
PB7	MOTOR_A_PWM2	Motor A PWM (TIM4_CH2)	Header*
PB8	MOTOR_B_PWM1	Motor B PWM (TIM4_CH3)	Header*
PB9	MOTOR_B_PWM2	Motor B PWM (TIM4_CH4)	Header*
PB10	P6	General-purpose digital I/O	Header
PB11	P7	General-purpose digital I/O	Header
PB12	P8	General-purpose digital I/O	Header
PB13	P9	General-purpose digital I/O	Header
PB14	P10	General-purpose digital I/O	Header
PB15	P11	General-purpose digital I/O	Header*

Ports C / D and system pins

MCU pin	Board designation	Assigned function	Draft availability
PC13	P12 / LED	On-board LED	Header
PC14	MOTOR_A_ENABLE	Motor A driver enable	Header*
PC15	MOTOR_B_ENABLE	Motor B driver enable	Header*
PD0	-	HSE crystal in	Internal
PD1	-	HSE crystal out	Internal
NRST	-	Reset	Internal
BOOT0	-	Boot mode select	Internal

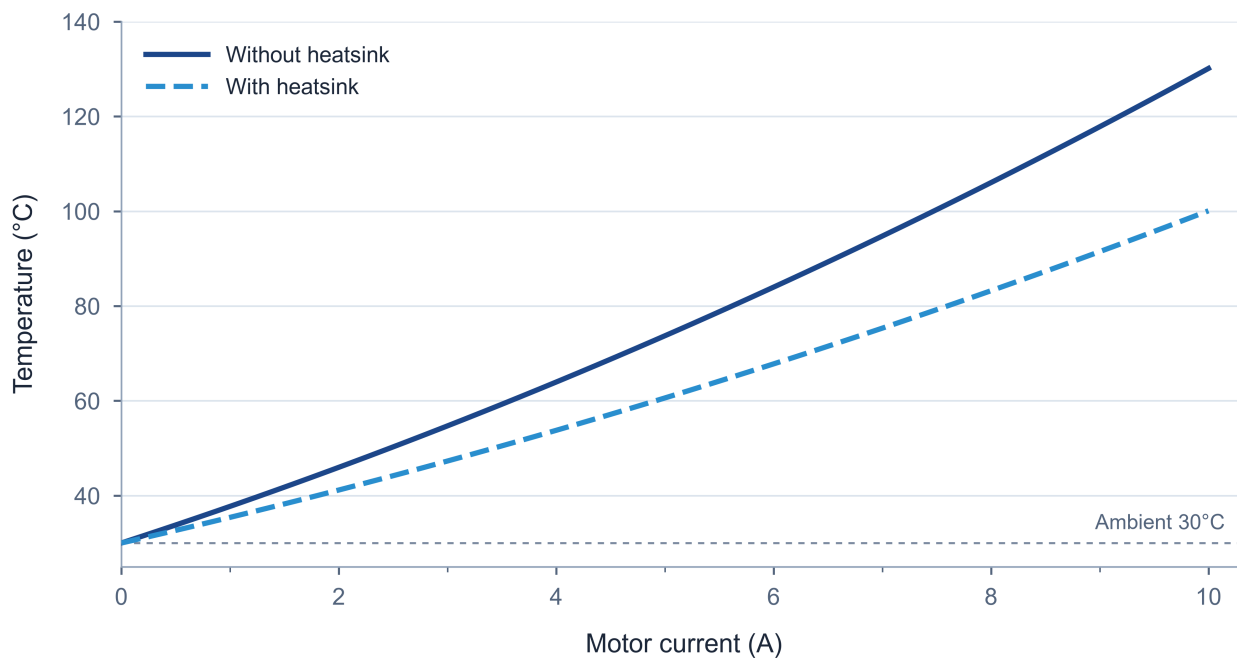
Reference notes

Draft availability (*). PA3 / PA4 are labelled Header in the source mapping but described as unexposed in the connector text. SWD is labelled Internal despite J7. PWM, enable and P11 header access also needs confirmation. These labels do not imply spare general-purpose I/O.

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8 Thermal curves

MOSFET top temperature



Bottom metal pad temperature

