

# BLDC FOC Click



PID: MIKROE-6858

**BLDC FOC Click** is a compact add-on board designed for code-free sensorless control of three-phase BLDC and PMSM motors. It is based on the [MCF8329A](#), a sensorless Field Oriented Control (FOC) three-phase BLDC gate driver from [Texas Instruments](#). It integrates three half-bridge gate drivers for driving onboard [STL120N4F6AG](#) power MOSFETs, supports a 5V to 30V input supply range, and features an internal charge pump, bootstrap circuit, and trickle charge pump for 100% duty cycle operation. It also offers configurable motor startup and stop options, closed-loop speed, power, current, or modulation index control, flux weakening, MTPA support, EEPROM-stored standalone configuration, and I2C communication with additional diagnostic, monitoring, and protection features. It is especially suitable for BLDC motor modules, cordless vacuum cleaners, appliance fans and pumps, washer and dishwasher pumps, and cordless garden and power tools.

For more information about **BLDC FOC Click** visit the official [product page](#).

## How does it work?

BLDC FOC Click is based on the MCF8329A, a sensorless Field Oriented Control (FOC) three-phase BLDC gate driver from Texas Instruments, created to drive Brushless-DC (BLDC) and Permanent Magnet Synchronous Motors (PMSM) without the need for firmware-based motor control algorithm development. The MCF8329A integrates three half-bridge gate drivers, each capable of driving the onboard STL120N4F6AG N-channel power MOSFETs from STMicroelectronics, built on the advanced STripFET™ F6 technology for reliable power switching. The MCF8329A generates the required gate drive voltages through an internal charge pump, while a bootstrap circuit ensures proper enhancement of the high-side MOSFETs during operation. In addition, the device includes a trickle charge pump that supports 100%

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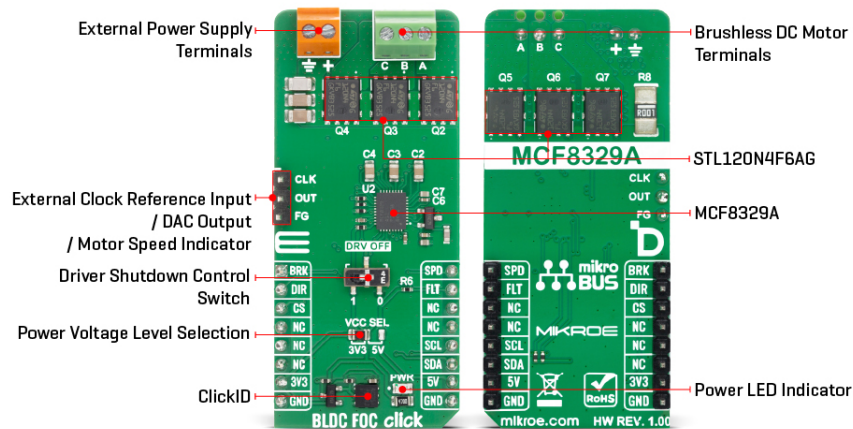


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duty cycle operation, making it suitable for demanding motor drive conditions where continuous high-side conduction is required.



The board operates from a single PVDD power supply terminal and supports a wide input voltage range from 5V to 30V. Thanks to its sensorless FOC architecture, BLDC FOC Click enables low-noise motor operation while reducing development complexity. This Click board is an excellent choice for BLDC motor modules, cordless vacuum cleaners, washer and dishwasher pumps, appliance fans and pumps, as well as cordless garden tools, power tools, and lawnmowers, where compact and simplified motor control is essential.

The MCF8329A also includes a rich set of advanced motor-control features that improve performance, and standalone usability in demanding BLDC and PMSM applications. It supports flux weakening control for extending motor operation beyond the base speed range, as well as forward and reverse windmilling support for more reliable startup behavior when the motor is already spinning. The device offers configurable motor startup and stop options, allowing optimization for different load conditions and system requirements. In addition, it supports optional closed-loop speed, power, current, or modulation index control, giving developers the freedom to tailor motor operation according to the needs of the target application.

A 5-point configurable reference profile is also supported, enabling finer adjustment of motor response and performance behavior across different operating regions. To improve system robustness, the MCF8329A integrates anti-voltage surge protection to help prevent overvoltage conditions, while automatic dead time compensation enhances acoustic performance and contributes to quieter motor operation. The device also supports maximum torque per ampere (MTPA) control for torque optimization, along with offline motor back-EMF measurement that simplifies motor characterization and setup. An independent driver shutdown path controllable via the DRV OFF switch adds an extra layer of control and safety in system operation.

The algorithm configuration can be stored in nonvolatile EEPROM, allowing the device to operate in a fully stand-alone mode once configured, without requiring continuous MCU supervision. Motor current measurement is handled through an integrated current-sensing amplifier that supports the use of a single external shunt resistor, helping reduce component count while maintaining accurate current feedback for effective motor control.

The MCF8329A communicates with the host MCU through an I2C interface with support for bus speeds up to 400kHz. In addition, the board uses several control and status signals: the FLT pin for fault condition indication, the BRK pin for brake control, the DIR pin for rotational direction

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selection, and the SPD multifunction input, which can be used for device sleep and wake control, as well as for device control through analog, PWM, or frequency-based reference input. The MCF8329A also supports optional fault diagnostics over the I2C interface, giving the host MCU additional insight into system conditions and fault behavior. To ensure reliable and safe operation, the device integrates multiple protection mechanisms intended to safeguard the driver, motor, and surrounding system against common fault events.

These protection features include supply undervoltage lockout (UVLO), three different types of motor lock detection, over-current protection (OCP), and thermal shutdown (TSD). In addition, the board includes a 3-pin header that provides access to several useful monitoring and reference functions. Through this header, the CLK pin can accept an external clock reference input when operating in external clock reference mode, the OUT pin can be used for variable monitoring through DAC output, and the FG pin serves as a motor speed indicator, offering valuable feedback for observation, tuning, and application-level monitoring.

This Click board™ can operate with either 3.3V or 5V logic voltage levels selected via the VCC SEL jumper. This way, both 3.3V and 5V capable MCUs can use the communication lines properly. Also, this Click board™ comes equipped with a library containing easy-to-use functions and an example code that can be used as a reference for further development.

## Specifications

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type             | Brushless                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Applications     | Ideal for BLDC motor modules, cordless vacuum cleaners, appliance fans and pumps, washer and dishwasher pumps, and cordless garden and power tools                                                                                                                                                                                                                                                                                                                                 |
| On-board modules | MCF8329A - sensorless Field Oriented Control (FOC) three-phase BLDC gate driver from Texas Instruments                                                                                                                                                                                                                                                                                                                                                                             |
| Key Features     | Code-free sensorless FOC control for three-phase BLDC and PMSM motors, three integrated half-bridge gate drivers, onboard N-channel power MOSFETs, internal charge pump with bootstrap circuit, trickle charge pump for 100% duty cycle operation, flux weakening control, forward and reverse windmilling support, configurable motor startup and stop options, closed-loop speed, power, current, and modulation index control, 5-point configurable reference profile, and more |
| Interface        | GPIO,I2C                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Feature          | ClickID                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Compatibility    | mikroBUS™                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Click board size | L (57.15 x 25.4 mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Input Voltage    | 3.3V or 5V,External                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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## Pinout diagram

This table shows how the pinout on BLDC FOC Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

| Notes             | Pin         |  mikroBUS |      |     |    | Pin        | Notes               |
|-------------------|-------------|--------------------------------------------------------------------------------------------|------|-----|----|------------|---------------------|
| Brake             | <b>BRK</b>  | 1                                                                                          | AN   | PWM | 16 | <b>SPD</b> | Multifunctional Pin |
| Direction Control | <b>DIR</b>  | 2                                                                                          | RST  | INT | 15 | <b>FLT</b> | Fault Indicator     |
| ID COMM           | <b>CS</b>   | 3                                                                                          | CS   | RX  | 14 | NC         |                     |
|                   | NC          | 4                                                                                          | SCK  | TX  | 13 | NC         |                     |
|                   | NC          | 5                                                                                          | MISO | SCL | 12 | <b>SCL</b> | I2C Clock           |
|                   | NC          | 6                                                                                          | MOSI | SDA | 11 | <b>SDA</b> | I2C Data            |
| Power Supply      | <b>3.3V</b> | 7                                                                                          | 3.3V | 5V  | 10 | <b>5V</b>  | Power Supply        |
| Ground            | <b>GND</b>  | 8                                                                                          | GND  | GND | 9  | <b>GND</b> | Ground              |

## Onboard settings and indicators

| Label | Name    | Default | Description                                                                |
|-------|---------|---------|----------------------------------------------------------------------------|
| LD1   | PWR     | -       | Power LED Indicator                                                        |
| JP1   | VCC SEL | Left    | Power Voltage Level Selection 3V3/5V: Left position 3V3, Right position 5V |
| SW1   | DRV OFF | Right   | Driver Shutdown Control Selection 1/0: Left position 1, Right position 0   |

## BLDC FOC Click electrical specifications

| Description           | Min | Typ | Max | Unit |
|-----------------------|-----|-----|-----|------|
| Supply Voltage        | 3.3 | -   | 5   | V    |
| External Power Supply | 5   | -   | 30  | V    |

## Software Support

[BLDC FOC Click](#) demo application is developed using the [NECTO Studio](#), ensuring compatibility with [mikroSDK](#)'s open-source libraries and tools. Designed for plug-and-play implementation and testing, the demo is fully compatible with all development, starter, and mikromedia boards featuring a [mikroBUS™](#) socket.

## Example Description

This example demonstrates the control of an A2212/13T 1000KV motor using the BLDC FOC Click board. The example showcases basic motor operations, including speed adjustments, direction switching, and fault handling. The motor speed is controlled by varying the PWM duty cycle.

## Key Functions

- `bldcfoc_cfg_setup` This function initializes Click configuration structure to initial values.
- `bldcfoc_init` This function initializes all necessary pins and peripherals used for this Click

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board.

- `bldcfoc_default_cfg` This function executes a default configuration of BLDC FOC Click board.
- `bldcfoc_set_duty_cycle` This function sets the PWM duty cycle in percentages ( Range[ 0..1 ] ).
- `bldcfoc_pull_brake` This function pulls brake by setting the BRAKE pin to high logic state.
- `bldcfoc_switch_direction` This function switches the direction of motor rotation by toggling the DIR pin logic state.

## Application Init

Initializes the logger and configures the Click board.

## Application Task

Adjusts the motor's duty cycle to control its speed, alternating between increasing and decreasing duty values. Fault conditions are checked and resolved to maintain stable operation. Additional motor controls, such as switching direction and braking, are triggered based on the duty cycle limits. Each step will be logged on the USB UART where you can track the program flow.

## Application Output

This Click board can be interfaced and monitored in two ways:

- Application Output - Use the "Application Output" window in Debug mode for real-time data monitoring. Set it up properly by following [this tutorial](#).
- UART Terminal - Monitor data via the UART Terminal using a [USB to UART converter](#). For detailed instructions, check out [this tutorial](#).

## Additional Notes and Information

The complete application code and a ready-to-use project are available through the NECTO Studio Package Manager for direct installation in the [NECTO Studio](#). The application code can also be found on the MIKROE [GitHub](#) account.

## Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click boards™](#)

[ClickID](#)

## Downloads

[BLDC FOC click example package](#)

[BLDC FOC click 2D and 3D files v100](#)

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[BLDC FOC click schematic v100](#)

[MCF8329A datasheet](#)

[STL120N4F6AG datasheet](#)

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