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Brushless 12 Click

PID: MIKROE-4357

Brushless 12 Click is a compact add-on board suitable for controlling BLDC motors with any MCU. This board features the L6235, DMOS fully integrated 3-phase motor driver with overcurrent protection from STMicroelectronics. The L6235 combines isolated DMOS power transistors with CMOS and bipolar circuits on the same chip. It features a non-dissipative overcurrent protection on the high-side power MOSFETs and thermal shutdown and includes all the circuitry needed to drive a 3-phase brushless DC motor. This Click board™ makes the perfect solution for small home appliances, robotics, battery-powered systems, small cooling fans, and many more.

Brushless 12 Click is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

How does it work?

Brushless 12 Click is based on the L6235, fully integrated motor driver specifically developed to drive a wide range of BLDC motors with Hall effect sensors from STMicroelectronics. The L6235 includes a 3-phase DMOS bridge, an OFF-TIME PWM current controller, and the decoding logic for single-ended Hall sensors that generate the required sequence for the power stage, and other added features for safe operation and flexibility. It also has a built-in Over Current Detection (OCD) that allows protection against short circuits between the outputs and between output and ground.

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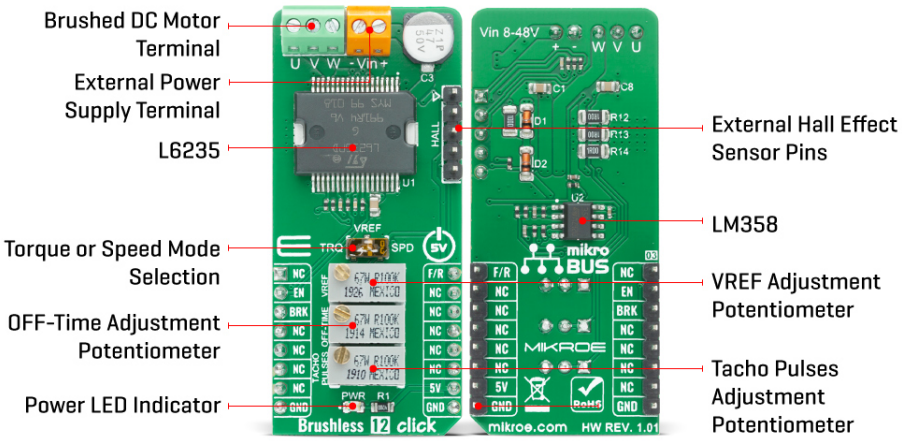

Integrated decoding logic of the L6235 provides the correct sequence on the three outputs labeled as U V W for motors with both 60° and 120° spaced Hall effect sensors signals. The sensor outputs are connected to the H1, H2, H3 inputs of the device through the header labeled as HALL. H1 input of the L6235 is internally connected to a monostable that provides a width pulse on the TACHO output. With a pull-up resistor on this output, the resulting waveform at the pin will be a square-wave whose frequency is proportional to the motor rotation speed, with an on-time set by the potentiometer VR1 labeled as TACHO. An additional potentiometer on this Click board™ VR2, labeled as OFF-TIME, can be used for a PWM current regulation capacity.

VR1 potentiometer defines the on-time integrated and compared to a voltage proportional to the desired speed by the Op-Amp LM358 also from STMicroelectronics. The output of the Op-Amp represents the speed error signal. Providing this signal to the VREF input of the L6235, which sets the current in the motor windings, the speed error will act on the motor modifying its torque to maintain the speed at a constant value. This feature of the L6235 can be selected by the switch labeled as VREF that allows the selection between Torque or Speed Mode.

Brushless 12 Click communicates with MCU using several GPIO pins. The RST pin of the mikroBUS™ socket labeled as EN represents the Enable function and serves as Chip Enable that turns OFF all power MOSFETs of the L6235. CS pin labeled as BRK switches ON all high-side power MOSFETs and allows the user to use the brake function. And the last GPIO pin routed to the PWM pin of the mikroBUS™ socket labeled as F/R selects the direction of the motor rotation. It also possesses two connectors, where one of them represents an external power supply labeled as VIN in the range from 8 to 48V maximum, and the next one labeled with U V W is a terminal on which the BLDC motor needs to be connected.

This Click board™ is designed to be operated only with a 5V logic voltage level. A proper logic voltage level conversion should be performed before the Click board™ is used with MCUs with different logic levels. However, the Click board™ comes equipped with a library that contains easy to use functions and an example code which can be used, as a reference, for further development.

Specifications

Type	Brushless
Applications	Can be used for small home appliances, robotics, battery-powered systems, small

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	cooling fans, and many more.
On-board modules	Brushless 12 Click is based on the L6235, fully integrated motor driver specifically developed to drive a wide range of BLDC motors with Hall effect sensors from STMicroelectronics.
Key Features	Overcurrent detection and protection, undervoltage lockout, PWM current controller, brake function, tachometer output for speed loop, thermal shutdown, and more.
Interface	GPIO,PWM
ClickID	No
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	5V,External

Pinout diagram

This table shows how the pinout on Brushless 12 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
	NC	1	AN	PWM	16	**F/R**	Forward/Reverse
Enable	**EN**	2	RST	INT	15	NC	
Brake	**BRK**	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	NC	
	NC	6	MOSI	SDA	11	NC	
	NC	7	3.3V	5V	10	**5V**	Power Supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
J1	HALL	Populated	External Hall Effect Sensor Pins
SW1	VREF	Right	Torque or Speed Mode Selection
TR1	VR1	-	Tacho Pulses Adjustment Potentiometer
TR2	VR2	-	OFF-Time Adjustment Potentiometer
TR3	VR3	-	VREF Adjustment Potentiometer

Brushless 12 Click electrical specifications

Description	Min	Typ	Max	Unit

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Supply Voltage VIN	7	-	52	V
Maximum Output Current	-	-	2.8	A
Switching frequency	-	-	100	kHz
Operating Temperature Range	-40	-	+150	°C

Software Support

We provide a library for the Brushless 12 Click on our LibStock page, as well as a demo application (example), developed using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Library Description

The library contains a basic functions for using Brushless 12 Click.

Key functions:

- void brushless12_power_mode (uint8_t mode) - Sets motor power mode
- void brushless12_work_mode (uint8_t state) - Sets motor work mode
- void brushless12_direction (uint8_t dir) - Sets motor direction

Examples description

The application is composed of three sections :

- System Initialization - Initializes all necessary GPIO pins
- Application Initialization - Initializes driver inti and enable motor
- Application Task - Every second toggles direction with the break.

The full application code, and ready to use projects can be found on our LibStock page.

Other mikroE Libraries used in the example:

- UART Library (LOG)

Additional notes and informations

Depending on the development board you are using, you may need USB UART click, USB UART 2 click or RS232 click to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika compilers, or any other terminal application of your choice, can be used to read the message.

mikroSDK

This Click board™ is supported with mikroSDK - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.

Resources

mikroBUS™

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mikroSDK

Click board™ Catalog

Click boards™

Downloads

Brushless 12 click example on Libstock

L6235 datasheet

LM358 datasheet

Brushless 12 click 2D and 3D files

Brushless 12 click schematic