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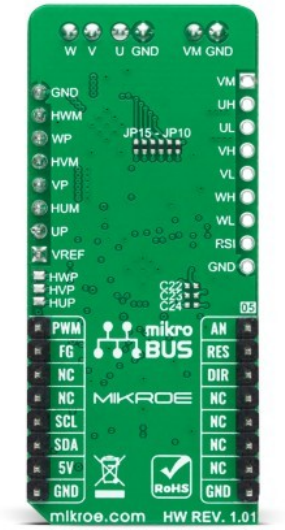
Brushless 8 Click





PID: MIKROE-4275

Brushless 8 Click is a compact add-on board suitable for controlling BLDC motors with any MCU. This board features the TC78B042FTG, a sine-wave PWM drive three-phase full-wave brushless motor controller from Toshiba Semiconductor. The TC78B042FTG has Toshiba's original automatic phase adjustment function, which secures both a high-efficiency fan motor drive and sine-wave drive that reduces noise at a wide range of motor rotation speeds, from almost 0rpm (rotations per minute) at Start-Up up to several 1.000rpm. This Click board™ makes the perfect solution for use in home appliances such as air-conditioners, air purifiers, and industrial equipment.

Brushless 8 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 8 Click is based on the TC78B042FTG, a three-phase brushless motor controller that offers high efficiency over a wide rotation range with automatic phase adjustment from Toshiba Semiconductor. This motor controller incorporates Toshiba's original developed Intelligent Phase Control that secures high-level efficiency for a wide range of rotation speeds. As a result, the new devices can be used with motor drivers that have various voltages and current capacities as well as being used in combination with intelligent power devices at the output stages. It uses a sine-wave drive system with a smooth current waveform that reduces noise and generates less noise and vibration than motors with a rectangular wave drive system.

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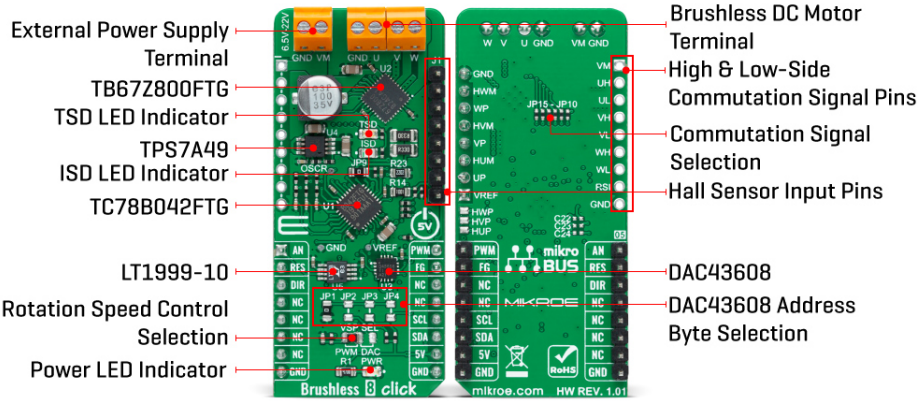

This Click board™ also contains a 3 channel Half-Bridge driver inverter, TB67Z800FTG from Toshiba Semiconductor, that receives its high and low side gate drive signals from TC78B042FTG and runs the connected Brushless DC Motor up to 22V/3A. For this type of application, more precisely for Brushless Click boards that require BLDC Motor with Hall Sensor for their work, Mikroe offers its users just one such motor, whose offer you can find here. The typical oscillation frequency is 9.22 MHz based on resistor R23 value 22kΩ drives the motor with 120° commutation. When the Hall signal indicates a rotation speed of 1 Hz or more, the motor rotates by estimating the rotor position according to the command of the LA pin. When rotation speed is less than 1Hz or the motor rotation direction is reversed, the motor is driven with 120° commutation.

The desired value on the previously mentioned LA pin as well as on other pins related to lead angle control, the TC78B042FTG obtains by the DAC3608, a low-power, eight-channel, digital-to-analog converter from Texas Instruments which establishes communication with MCU via I2C serial communication. Besides, the DAC43608 also allows the user to select a valid I2C address byte between 5V, GND, or I2C communication lines by positioning the jumper to an appropriate position marked from JP1 to JP4. As for the TC78B042FTG power supply, it is powered with a voltage value obtained by TPS7A49, an ultralow-noise linear regulator from Texas Instruments that converts an input value in the range of 6.5 to 22V to 6V that powers the main chip.

In addition to I2C communication, several GPIO pins connected to the mikroBUS™ socket pins are also used. The DIR pin, routed on the CS pin of the mikroBUS™ socket, is used to select the direction of motor rotation, while the control of the motor rotation speed itself can be chosen via the VSP SEL jumper. With this jumper, the user has the option of the rotation speed control using a PWM signal or using a value obtained by the DAC43608. The pin marked with RES routed at the RST pin of the mikroBUS™ socket can be used for Error detection more precisely for enabling or disabling commutation outputs. The FG pin at the INT pin of the mikroBUS™ socket represents the rotating pulse based on the selectable number of pulses per revolution. And the last pin labeled as AN provides accurate current monitoring via LT1999-10, a high-voltage, bidirectional current sense amplifier from Analog Devices.

There are also 2 headers on the board that contain both W, V, and U-phase Hall input signals, as well as a header with High & Low-side commutation signals. Besides, it has 2 LED indicators labeled as ISD and TSD intended for thermal shutdown and over-current protection.

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

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different logic levels.

Specifications

Type	Brushless
Applications	Can be used in home appliances such as air-conditioner fans, air purifiers, and industrial equipment.
On-board modules	Brushless 8 Click is based on the TC78B042FTG, a three-phase brushless motor controller that offers high efficiency over a wide rotation range without phase adjustment from Toshiba Semiconductor.
Key Features	Sine-wave PWM control, automatic lead angle control (InPAC), Hall sensor input, rotation switch, output current limit, built-in motor lock detection, and more.
Interface	Analog,GPIO,I2C,PWM
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	5V

Pinout diagram

This table shows how the pinout on Brushless 8 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS™				Pin	Notes
Current Monitor	**AN**	1	AN	PWM	16	**PWM**	PWM Signal
Error Detection	**RES**	2	RST	INT	15	**FG**	Hall Signal Rotation Pulse
Forward/Reverse Direction	**DIR**	3	CS	RX	14	NC	
	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	**SCL**	I2C Clock
	NC	6	MOSI	SDA	11	**SDA**	I2C Data
	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
JP8	VSP SEL	Left	Rotation Speed Control Selection

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			PWM/DAC: Left position PWM, Right position DAC
JP1-JP4	JP1-JP4	JP1 Populated	DAC43608 Address Byte Selection
LD2	TSD	-	TSD LED Indicator
LD3	ISD	-	ISD LED Indicator
J1	HALL	Populated	Hall Sensor Input Pins
J2	-	Unpopulated	High & Low-Side Commutation Signals Pins

Brushless 8 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	6.5	-	22	V
Maximum Output Voltage	-	-	18	V
Maximum Output Current	-	-	3	A
Operating Frequency	6.8	9.22	15.5	MHz
Power Dissipation	-	-	4.25	W
Operating Temperature Range	-40	-	+115	°C

Software Support

We provide a library for the Brushless 8 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

This library contains API for Brushless 8 Click driver.

Standard key functions

- void brushless8_cfg_setup (brushless8_cfg_t *cfg) - Config Object Initialization function.
- BRUSHLESS8_RETVAL brushless8_init (brushless8_t *ctx, brushless8_cfg_t *cfg) - Initialization function.
- void brushless8_default_cfg (brushless8_t *ctx) - Click Default Configuration function.

Key functions:

- uint16_t brushless8_dac_read_data (brushless8_t *ctx, uint8_t reg) - Brushless 8 I2C read function.
- void brushless8_set_direction (brushless8_t *ctx, uint8_t status) - Brushless 8 dir pin setting.
- void brushless8_set_duty_cycle (brushless8_t *ctx, float duty_cycle) - Sets PWM duty cycle.

Examples description

This example demonstrates the use of Brushless 8 Click board™.

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Application Init

The demo application is composed of two sections :

Initializes the Click board™ to appropriate settings based on selected mode.

Initialization settings are sent through I2C bus and the motor itself is controlled via PWM or DAC over I2C.

Modes:

- BRUSHLESS8_PWM
- BRUSHLESS8_DAC

Application Task

This example demonstrates the use of Brushless 8 Click board™. Brushless 8 Click communicates with the device via I2C driver in order to set adequate voltage level for connected motor. Current PWM/DAC settings being output are sent via logger.

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

Other mikroE Libraries used in the example:

- I2C
- PWM

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™

mikroSDK

Click board™ Catalog

Click Boards™

Downloads

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Brushless 8 click 2D and 3D files

TB67Z800FTG datasheet

TC78B042FTG datasheet

Brushless 8 click schematic

DAC43608 datasheet

Brushless 8 click example on Libstock

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