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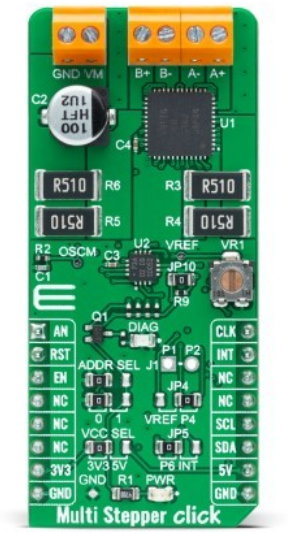
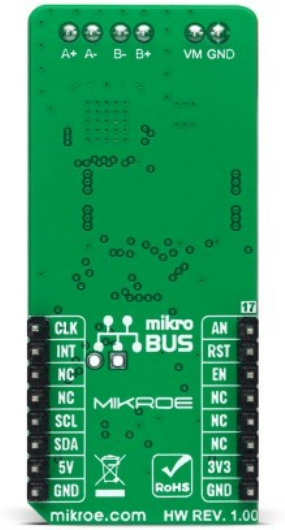
Multi Stepper Click - TB67S209





PID: MIKROE-5042

Multi Stepper Click is a compact add-on board that contains a bipolar stepper motor driver. This board features the TB67S209FTG, CLOCK-in controlled bipolar stepping motor driver from Toshiba Semiconductor. It supports a PWM constant-current control drive, selectable mixed decay mode, and allows from full-step up to 1/32 steps resolution for less motor noise and smoother control. It has a wide operating voltage range of 10V to 47V with an output current capacity of 3A maximum in addition to several built-in error detection circuits. This Click board™ makes the perfect solution for stepping motors in various applications such as office automation, commercial, and industrial equipment.

Multi Stepper 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?

Multi Stepper Click as its foundation uses the TB67S209FTG, a two-phase bipolar stepping motor driver using a PWM chopper from Toshiba Semiconductor. The TB67S209FTG comes with a built-in clock-in decoder (CLOCK-in controlled), which means that each up-edge of the CLK signal, routed to the PWM pin of the mikroBUS™ socket, will shift the motor's electrical angle per step. It also incorporates a low on-resistance MOSFET output stage, which can deliver a 2.8A current with a motor output voltage rating of 47V, in addition to integrated protection mechanisms such as over-current, over-temperature, and under-voltage detection. In addition, it allows from full-step up to 1/32 steps resolution, with the help of which motor noise can be significantly reduced with smoother operation and more precise control.

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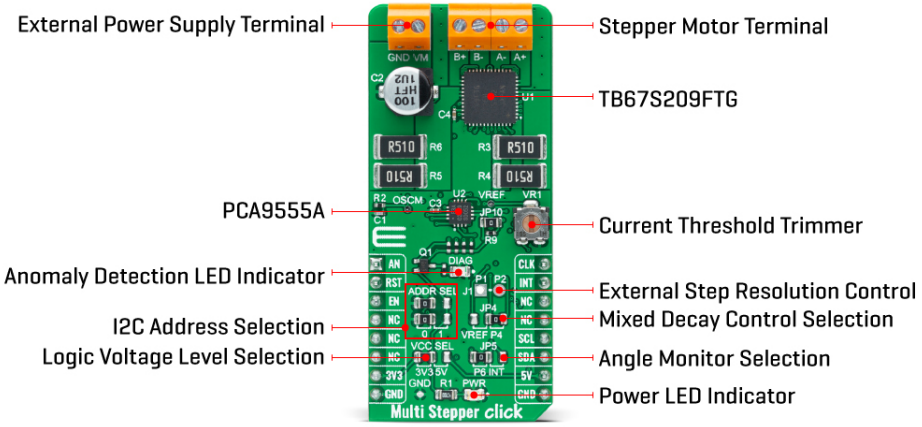

The TB67S209FTG supports selectable Mixed Decay mode. Though the Mixed Decay is determined by controlling two different types of decay (Fast Decay and Slow Decay), this function enables the user to select the ration of the Mixed Decay through the PCA9555A pins P4/P5. To allow both pins to be configurated by the expander, the SMD jumper labeled as JP4 must be positioned to an appropriate position marked as P4. Also, the motor current output value can be set manually using an onboard trimmer labeled as VR1, which sets the reference voltage in the range from 0V to 3.3V.

As mentioned before, the TB67S209FTG supports various step resolution configurations through its control signals. These control signals are provided through the PCA9555A port expander, which establishes communication with the MCU via the I2C serial interface. This Click board™ also allows a connection of external step-resolution control signals on the onboard header J1 on pins labeled as P1 and P2 for the device's DMODE1 and DMODE2 control. The PCA9555A also allows choosing the least significant bit (LSB) of its I2C slave address by positioning SMD jumpers labeled as ADDR SEL to an appropriate position marked as 0 and 1.

Also, this Click board™ has a Standby function, activated when all three step-resolution control signals are on its low logic state, used to switch to Standby mode by setting all motor control pins to a low logic state. When the Standby mode is active, the TB67S209FTG stops supplying the power to the internal oscillating circuit and motor output part (the motor drive cannot be performed).

In addition to the I2C communication, several GPIO pins connected to the mikroBUS™ socket are also used. The Enable pin, labeled as EN and routed to the CS pin of the mikroBUS™ socket, optimizes power consumption used for power ON/OFF purposes. Also, a simple rotation direction function routed to the AN pin on the mikroBUS™ socket allows MCU to manage the direction of the stepper motor (clockwise or counterclockwise), while the RST pin of the mikroBUS™ socket initializes an electrical angle in the internal counter to set an initial position.

When it comes to angle monitoring, this Click board™ has a dual way of monitoring selected by positioning SMD jumper labeled as JP5 to an appropriate position marked as P6 or INT, which choose to monitor via expander or INT pin of the mikroBUS™ socket. In that case, such anomaly is indicated by a red LED marked as DIAG and via P7 pin over the I2C INT to the mikroBUS™ INT pin proceeding JP5 is set to P6.

Multi Stepper Click supports an external power supply for the TB67S209FTG, which can be connected to the input terminal labeled as VM and should be within the range of 10V to 47V,

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while the stepper motor coils can be connected to the terminals labeled as B+, B-, A-, and A+.

This Click board™ can operate with both 3.3V and 5V logic voltage levels selected via the VCC SEL jumper. This way, it is allowed for both 3.3V and 5V capable MCUs to use communication lines properly. However, the 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	Stepper
Applications	Can be used for stepping motors in various applications such as office automation, commercial, and industrial equipment
On-board modules	TB67S209FTG - CLOCK-in controlled bipolar stepping motor driver from Toshiba Semiconductor
Key Features	Low power consumption, capable of controlling 1 bipolar stepping motor, from full-step up to 1/32 steps resolution, built-in clock decoder, selectable mixed decay mode, integrated error detection circuits, and more
Interface	GPIO,I2C
ClickID	No
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V or 5V,External
Driving Signal	Clock
Voltage Max	50V
Current Max	4A
Micro Step	32
RDSOn	0.49
ADMD	No
MO	Yes
Error Signal (LO)	Yes
ULVO	Yes

Pinout diagram

This table shows how the pinout on Multi Stepper Click - TB67S209 corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
Rotation Direction	**AN**	1	AN	PWM	16	**CLK**	Clock Signal
Reset	**RST**	2	RST	INT	15	**INT**	Interrupt
Enable	**EN**	3	CS	RX	14	NC	

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	NC	4	SCK	TX	13	NC	
	NC	5	MISO	SCL	12	**SCL**	I2C Clock
	NC	6	MOSI	SDA	11	**SDA**	I2C Data
Power Supply	**3.3V**	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
LD2	DIAG	-	Anomaly Detection LED Indicator
JP1-JP2	ADDR SEL	Left	I2C Address Selection 0/1: Left position 0, Right position 1
JP3	VCC SEL	Left	Logic Level Voltage Selection 3V3/5V: Left position 3V3, Right position 5V
JP4	JP4	Right	Mixed Decay Mode Control Selection VREF/P4: Left position VREF, Right position P4
JP5	JP5	Left	Angle Monitoring Selection P6/INT: Left position P6, Right position INT
JP10	JP10	Populated	Angle Monitoring via Expander
J1	J1	Unpopulated	External Step Resolution Signals Connection Header
VR1	VR1	-	Current Threshold Trimmer
TP1	VREF	-	Voltage Reference Testpoint
TP2	OSCM	-	Oscillating Circuit Crequency Testpoint
TP3	GND	-	Ground Testpoint

Multi Stepper Click - TB67S209 electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage VCC	3.3	-	5	V
External Supply Voltage VM	10	24	47	V
Motor Output Current	-	2.8	-	A
Motor Output Voltage	10	-	47	V
Operating Temperature Range	-20	+25	+85	°C

Software Support

We provide a library for the Multi Stepper TB67S209 Click as well as a demo application

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(example), developed using MikroElektronika compilers. The demo can run on all the main MikroElektronika development boards.

Package can be downloaded/installed directly from NECTO Studio Package Manager(recommended way), downloaded from our LibStock™ or found on Mikroe github account.

Library Description

This library contains API for Multi Stepper TB67S209 Click driver.

Key functions

- multisteppertb67s209_set_step_mode This function sets the step mode resolution settings.
- multisteppertb67s209_drive_motor This function drives the motor for the specific number of steps at the selected speed.
- multisteppertb67s209_set_direction This function sets the motor direction by setting the AN pin logic state.

Example Description

This example demonstrates the use of the Multi Stepper TB67S209 Click board™ by driving the motor in both directions for a desired number of steps.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager(recommended way), downloaded from our LibStock™ or found on Mikroe github account.

Other Mikroe Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.MultiStepperTB67S209

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. UART terminal is available in all MikroElektronika compilers.

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

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Downloads

Multi Stepper Click - TB67S209 schematic

TB67S209FTG datasheet

PCA9555A datasheet

Multi Stepper Click - TB67S209 2D and 3D files

Multi Stepper Click - TB67S209 example on Libstock