

## Stepper 24 Click



PID: MIKROE-6254

Stepper 24 Click is a compact add-on board designed to drive small stepping motors in consumer electronics and industrial equipment applications. This board features the TB67S589FTG, a BiCD constant-current 2-phase bipolar stepping motor driver IC from Toshiba Semiconductor. Key features include a PWM chopper-type 2-phase bipolar drive system, high withstand voltage of up to 34V operating, and a maximum operating current of 2.7A per phase. The board also integrates safety mechanisms such as over-temperature, over-current, and low-supply voltage detection. Additional control is provided by the PCA9555A port expander via I2C, enabling functions like decay and torque modes, step resolution settings, and many more. This Click board™ offers efficient and precise control of stepping motors for enhanced performance and reliability in various applications.

### How does it work?

Stepper 24 Click is based on the TB67S589FTG, a BiCD constant-current 2-phase bipolar stepping motor driver IC from Toshiba Semiconductor. The TB67S589FTG features a PWM chopper-type 2-phase bipolar drive system and leverages the BiCD process with MOSFETs for output power transistors. Noteworthy features include the Advanced Dynamic Mixed Decay (ADMD) function for efficient PWM constant-current drive, high withstand voltage, and current capability withstanding voltage of up to 34V operating supplied externally via the VM terminal within a range of 10 to 34V, supporting a maximum operating current of 2.7A per phase (absolute maximum rating of 3A). It also integrates safety mechanisms such as over-temperature detection (TSD), over-current detection (ISD), and low supply voltage detection (UVLO). This Click board™ makes the perfect solution for small stepping motors in various applications such as consumer electronics and industrial equipment.

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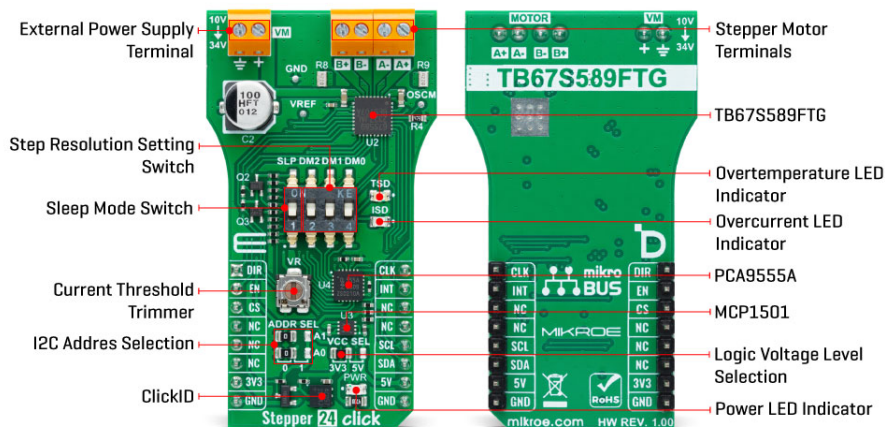
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The current value in the PWM constant-current mode is set by the reference voltage obtained by the [MCP1501](#), a high-precision voltage regulator. Also, the current threshold point of the TB67S589FTG, alongside MCP1501, can be set manually using an onboard trimmer labeled VR. The control of the Stepper 24 Click is managed through specific pins on the mikroBUS™ socket: The CLK clock signal, routed to the default PWM position, advances the motor's current step and electrical angle with each rising edge. The Enable pin, EN pin, controls the activation state of the output A and B stepping motor drive channels. Additionally, the DIR pin determines the rotation direction of the stepping motor, with a HIGH logic level indicating forward rotation and a LOW logic level indicating reverse rotation.

Due to the limited number of control pins on the mikroBUS™ for managing the TB67S589FTG, the Stepper 24 Click also incorporates the [PCA9555A](#) port expander. This port expander, interfacing via the I2C interface, provides additional control over the TB67S589FTG and its functions. One of the key functions enabled through this port expander is the Decay mode. The selectable mixed decay function allows to switch between four decay modes MIXED, SLOW, FAST, and ADMD (Advanced Dynamic Mixed Decay technology from Toshiba). This optimization enhances the performance and efficiency of the stepping motor.

Additionally, the Torque mode pins set the motor's torque by adjusting the logical levels of both TRQ pins. It is possible to set the torque to 100%, 75%, 50%, or 25% without changing the reference voltage level of the current regulator. The RST pin resets the electrical angle in the internal counter to an initial position. Furthermore, the MO pin indicates the achievement of the initial electrical angle position.

Besides these functions, the port expander also controls the DMODE pins, which set the step resolution to full, half-step, quarter-step, 1/8, 1/16, or 1/32. The Sleep mode function allows switching between power-saving mode (consumes only 0.03uA typical) and normal operation mode. By setting the Sleep mode and then returning to the normal operation mode, it is possible to recover from the forced OFF-state caused by the overheating or over-current detection circuit operation. Alternatively these functions can also be controlled via a multifunctional switch, where selecting a particular switch position (1 for Sleep Mode; 2, 3, 4 for Step Resolution Setting) allows for easy and efficient management of the board's operations.

The board also includes two LED status indicators: a TSD orange LED for overtemperature conditions and an ISD red LED for overcurrent conditions. The PCA9538A 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, alongside its interrupt feature routed

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to the INT pin of the mikroBUS™ socket.


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	Stepper
Applications	Ideal for consumer electronics and industrial equipment applications
On-board modules	TB67S589FTG - BiCD constant-current 2-phase bipolar stepping motor driver from Toshiba Semiconductor
Key Features	BiCD constant-current 2-phase bipolar drive system, high voltage support, integrated safety mechanisms, additional control via port expander, decay and torque mode control, step resolution selection, Sleep mode, LED indicators for overtemperature and overcurrent conditions, and more
Interface	GPIO,I2C,PWM
Feature	ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V or 5V,External

## Pinout diagram

This table shows how the pinout on Stepper 24 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
Rotation Direction Control	<b>DIR</b>	1	AN	PWM	16	<b>CLK</b>	Step Clock
Output Enable	<b>EN</b>	2	RST	INT	15	<b>INT</b>	Interrupt
ID COMM	<b>CS</b>	3	CS	RX	14	NC	
		4	SCK	TX	13	NC	
		5	MISO	SCL	12	<b>SCL</b>	I2C Clock
		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
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LD1	PWR	-	Power LED Indicator
LD2	TSD	-	Overtemperature LED Indicator
LD3	ISD	-	Overcurrent LED Indicator
JP1	VCC SEL	Left	Logic Voltage Level Selection 3V3/5V: Left position 3V3, Right position 5V
JP2-JP3	ADDR SEL	Left	I2C Address Selection 0/1: Left position 0, Right position 1
VR	VR	-	Current Threshold Trimmer
SW1	POS 1	Lower	Sleep Mode Setting Switch
SW1	POS 2-4	Lower	Step Resolution Setting Switch

## Stepper 23 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
External Power Supply	10	-	34	V
Maximum Output Current	-	-	2.7	A

## Software Support

We provide a library for the Stepper 24 Click as well as a demo application (example), developed using MIKROE [compilers](#). The demo can run on all the main MIKROE [development boards](#).

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

## Library Description

This library contains API for Stepper 24 Click driver.

### Key functions

- `stepper24_set_direction` This function sets the motor direction by setting the DIR pin logic state.
- `stepper24_set_step_mode` This function sets the step mode resolution settings.
- `stepper24_drive_motor` This function drives the motor for the specific number of steps at the selected speed.

## Example Description

This example demonstrates the use of the Stepper 24 Click board™ by driving the motor in

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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), downloaded from our [LibStock™](#) or found on [MIKROE github account](#).

Other MIKROE Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.Stepper24

## 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 MIKROE [compilers](#).

## mikroSDK

This Click board™ is supported with [mikroSDK](#) - MIKROE 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™](#)

[ClickID](#)

## Downloads

[MCP1501 datasheet](#)

[PCA9555A datasheet](#)

[Stepper 24 click example on Libstock](#)

[Stepper 24 click 2D and 3D files v100](#)

[TB67S589FTG datasheet](#)

[Stepper 24 click schematic v100](#)

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