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Stepper 28 Click

PID: MIKROE-6723

Stepper 28 Click is a compact add-on board that provides precise control of 2-phase bipolar stepper motors. It is based on the TB67S559FTG, a BiCD constant-current 2-phase bipolar stepping motor driver IC from Toshiba Semiconductor. This driver integrates DMOSFET output transistors with low ON resistance, supports motor supply voltages from 8.2V to 44V, and delivers up to 2.7A output current, while incorporating technologies such as Advanced Current Detect System (ACDS) for resistor-less current sensing and Advanced Dynamic Mixed Decay (ADMD) for optimized dynamically current regulation. It supports full-step to 1/32 steps resolution for less motor noise and smoother control in addition to several anomaly detection indicators. This Click board™ is ideal for office automation equipment, point of sale (POS) terminals, vending machines, surveillance cameras, industrial equipment, and more.

For more information about **Stepper 28 Click** visit the official product page.

How does it work?

Stepper 28 Click is based on the TB67S559FTG, a PWM chopper-type 2-phase bipolar stepping motor driver IC from Toshiba Semiconductor designed using the BiCD process, integrating DMOSFETs as output power transistors. It supports motor drive with a single power supply ranging from 8.2V to 44V and delivers up to 2.7A maximum current output with a built-in regulator for internal IC supply. The TB67S559FTG incorporates Advanced Current Detect System (ACDS) technology, eliminating the need for external current detection resistors, and Advanced Dynamic Mixed Decay (ADMD) functionality, and protections like over-temperature, over-current, and under-voltage lockout. It also supports full-step to 1/32 step resolutions for less motor noise and smoother control, with a built-in mixed decay mode which helps to

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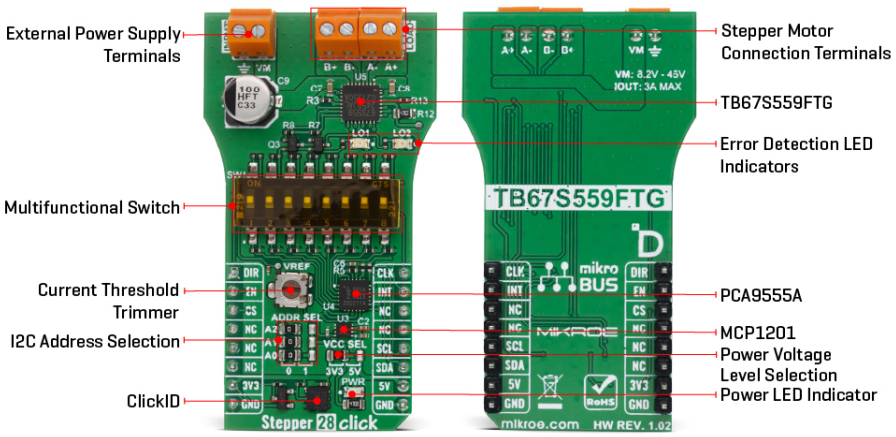
stabilize the current waveforms.



Thanks to the micro steps capability the TB67S559FTG supports, motor noise can be significantly reduced with smoother operation and more precise control. It is suited for driving 2-phase bipolar stepper motors in industrial automation, office equipment, and robotics applications. The current value is set by the reference voltage value 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 28 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 TB67S559FTG, the Stepper 28 Click also incorporates the PCA9555A port expander. This port expander, interfacing via the I2C interface, provides additional control over the TB67S559FTG 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 IC’s TRQx 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 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 for Torque Control; 4,5 for Decay Mode Control; 6,7,8 for

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Step Resolution Setting) allows for easy and efficient management of the board's operations.

The board also includes two LED error signalling indicators: a LO1 red LED is active when overcurrent or overtemperature occurs, while LO2 is only active when overtemperature occurs (to differentiate the LO1 general error signal). The PCA9555A also allows choosing the least significant bit (LSB) of its I2C address by positioning SMD jumpers labeled as ADDR SEL to an appropriate position marked as 0 and 1, alongside its interrupt feature routed to the INT pin of the mikroBUS™ socket. The INT pin signals the host MCU in cases such as overcurrent and overtemperature conditions (in addition to LED indicators for visual detection of these states), as well as the MO pin status that indicates the achievement of the initial electrical angle position.

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 office automation equipment, point of sale (POS) terminals, vending machines, surveillance cameras, industrial equipment, and more
On-board modules	TB67S559FTG - BiCD constant-current 2-phase bipolar stepping motor driver IC from Toshiba Semiconductor
Key Features	BiCD process integration with DMOSFET output transistors and low ON resistance, Advanced Current Detect System for resistor-less current sensing, Advanced Dynamic Mixed Decay function, step resolutions from full-step to 1/32, manual current threshold adjustment via onboard trimmer, selectable decay modes, torque control with selectable levels, Sleep mode, and more
Interface	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 28 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikro BUS	Pin	Notes

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Rotation Direction Control	**DIR**	1	AN	PWM	16	**CLK**	Step Clock
Output Enable	**EN**	2	RST	INT	15	**INT**	Interrupt
ID COMM	**CS**	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
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	LO1	-	Overcurrent or Overtemperature State LED Indicator
LD3	LO2	-	Only Overtemperature State LED Indicator
JP1	VCC SEL	Left	Power Voltage Level Selection 3V3/5V: Left position 3V3, Right position 5V
JP2-JP4	ADDR SEL	Left	I2C Address Selection 0/1: Left position 0, Right position 1
SW1	POS 1	-	Sleep Mode Control Switch
SW1	POS 2-3	-	Torque Control Switch
SW1	POS 4-5	-	Decay Mode Control Switch
SW1	POS 6-7-8	-	Step Resolution Control Switch
VR1	VREF	-	Current Threshold Trimmer

Stepper 28 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
External Supply Voltage	8.2	24	44	V
Output Current	-	-	2.7	A

Software Support

Stepper 28 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 use of the Stepper 28 Click board by driving the motor in both

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directions for a desired number of steps.

Key Functions

- stepper28_cfg_setup This function initializes Click configuration structure to initial values.
- stepper28_init This function initializes all necessary pins and peripherals used for this Click board.
- stepper28_default_cfg This function executes a default configuration of Stepper 28 Click board.
- stepper28_set_direction This function sets the motor direction by setting the DIR pin logic state.
- stepper28_set_step_mode This function sets the step mode resolution settings.
- stepper28_drive_motor This function drives the motor for the specific number of steps at the selected speed.

Application Init

Initializes the driver and performs the Click default configuration.

Application Task

Drives the motor clockwise for 200 full steps and then counter-clockwise for 200 half steps and 400 quarter steps with a 1 second delay on driving mode change. All data is being 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

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Downloads

Stepper 28 click example package

TB67S559FTG datasheet

Stepper 28 click 2D and 3D files v102

Stepper 28 click schematic v102