MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com

Stepper 31 Click





PID: MIKROE-7083

Stepper 31 Click is a two-phase bipolar stepper motor driver for precise motion control in embedded and industrial systems. It features the TB67S531FTG BiCD constant-current driver from Toshiba Semiconductor, operating from a 4.5V to 33V external motor supply and delivering up to 1.8A per channel. SPI-to-parallel control through the MCP23S17 enables step sequencing, decay-mode selection, status monitoring, and fault handling, while onboard controls provide adjustable current and selectable torque. Separate VM and motor-output terminals simplify power and winding connections. It is suitable for robotics, industrial automation, positioning equipment, motorized mechanisms, and other applications requiring accurate and reliable stepper motor control.

For more information about **Stepper 31 Click** visit the official product page.

How does it work?

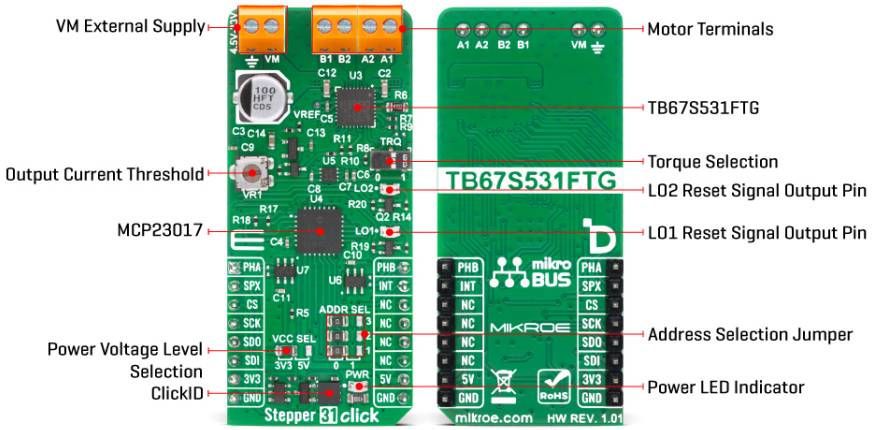
Stepper 31 Click is based on the TB67S531FTG, a BiCD constant-current two-phase bipolar stepper motor driver from Toshiba Semiconductor. The device combines control logic with DMOS power output transistors and is designed to operate a bipolar stepper motor from a single external VM power supply, thanks to its integrated regulator and charge pump. It supports a motor supply voltage range from 4.5V to 33V and an output current of up to 1.8A per channel, subject to operating temperature and thermal conditions. The output stage has a typical total ON-resistance of 0.8Ω (typ), measured across the upper and lower output transistors, helping to reduce power dissipation during motor operation.

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The TB67S531FTG regulates the motor winding current using PWM constant-current chopper control. Its Advanced Current Detect System (ACDS) provides current regulation without external current-sensing resistors, while Advanced Dynamic Mixed Decay (ADMD) monitors both the supply current and regenerated motor current to provide high-efficiency PWM constant-current control. The current threshold is determined by the VREF voltage generated by the MCP1501 precision voltage reference and adjusted using the onboard VR1 trimmer, according to the relationship IOUT = VREF × 0.556 (typ) at the 100% torque setting. Phase-input control supports full-step, half-step, and quarter-step operation by combining the PHASE_A and PHASE_B direction signals with the IN_A1, IN_A2, IN_B1, and IN_B2 current-level inputs. The DECAY1 and DECAY2 inputs provide a choice of mixed, slow, fast, or ADMD decay control, while the onboard 47kΩ oscillator-setting resistor establishes a typical chopping frequency of approximately 75kHz. Integrated protection functions include thermal shutdown, overcurrent detection, and undervoltage lockout, while the LO1 and LO2 open-drain outputs provide detailed fault-status information.

Since the TB67S531FTG is controlled through multiple parallel logic signals, Stepper 31 Click incorporates the MCP23S17T-E/ML, a 16-bit SPI I/O expander used to manage the driver's control and status lines. Communication with the host MCU uses the SCK, SDI, SDO, and CS pins, routed to the corresponding SPI clock, COPI, CIPO, and chip-select positions of the mikroBUS™ socket. Through the expander, the host can control the IN_A1, IN_A2, IN_B1, IN_B2, DECAY1, DECAY2, and TRQ inputs, select the source of the phase-control signals, and monitor the LO1 and LO2 fault outputs. The expander's interrupt output is routed to the INT pin, allowing the host MCU to respond to configured input-state changes. The PHA and PHB pins, routed to the AN and PWM positions of the mikroBUS™ socket, provide optional direct control of the current direction in motor phases A and B (Full Step only). Two 74LVC1G3157 analog switches select whether the PHASE_A and PHASE_B inputs are controlled directly through these mikroBUS™ pins or through the SPI expander. The SPX pin, routed to the RST position, controls the driver's active-low SLEEP_X input and the expander's RESET input. Driving SPX low places the motor driver in Sleep mode, turns off the output stage, and resets the expander, while a high logic level enables normal operation. The CS and SPX lines are also used by the onboard ClickID circuitry for identification communication.

The motor power supply is connected through the VM and GND screw terminal, while two additional two-pole screw terminals provide the A1/A2 and B1/B2 connections for the two motor windings. The VR1 trimmer allows manual adjustment of the VREF level and therefore the regulated motor-current threshold, with the adjusted voltage also available at the VREF test point. The TRQ switch selects between the driver's 100% and 50% torque settings without

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requiring a change to the VREF voltage. Three ADDR SEL jumpers configure the A0, A1, and A2 hardware-address inputs of the MCP23S17, with each jumper selectable between logic 0 and logic 1. A green PWR LED indicates the presence of the selected logic supply. The red LO1 LED indicates an overcurrent or overtemperature condition, while the orange LO2 LED is activated only by an overtemperature condition, allowing thermal shutdown to be distinguished from a general fault. Stepper 31 Click also includes the ClickID feature, enabling automatic identification of the board by a compatible host system.

Stepper 31 Click uses both standard mikroBUS™ power rails: the selected VCC logic level can be set to either 3.3V or 5V through the VCC SEL jumper, the ClickID circuitry uses the fixed 3.3V rail, and the MCP1501 reference circuit uses the fixed 5V rail. The motor output stage is powered separately from an external 4.5V to 33V supply connected to the VM terminal, with its ground connected to the board ground. Stepper 31 Click comes with a mikroSDK-compliant library containing easy-to-use functions and a ready-to-use code example, available for download and use as a reference for further development.

Specifications

Type	Stepper
Applications	Ideal for applications such as robotics, industrial automation, positioning equipment, motorized mechanisms, and precision motion-control systems
On-board modules	TB67S531FTG - BiCD constant-current two-phase bipolar stepper motor driver from Toshiba Semiconductor
Key Features	BiCD constant-current two-phase bipolar motor control, 4.5V to 33V motor supply, up to 1.8A per channel, full-, half-, and quarter-step operation, ACDS current regulation, mixed, slow, fast, and ADMD decay modes, adjustable current threshold, 50% or 100% torque selection, SPI control, integrated protection, and more
Interface	GPIO,PWM,SPI
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 31 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
Phase A	**PHA**	1	AN	PWM	16	**PHB**	Phase B
SLEEP_X/RESET	**SPX**	2	RST	INT	15	**INT**	Interrupt

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SPI Select / ID COMM	**CS**	3	CS	RX	14	NC	
SPI Clock	**SCK**	4	SCK	TX	13	NC	
SPI Data OUT	**SDO**	5	MISO	SCL	12	NC	
SPI Data IN	**SDI**	6	MOSI	SDA	11	NC	
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
JP1	VCC SEL	Left	Voltage Selection
JP2	ADDR SEL 1	Left	IO Expander ADDR SEL A0
JP3	ADDR SEL 2	Left	IO Expander ADDR SEL A1
JP4	ADDR SEL 3	Left	IO Expander ADDR SEL A2
LD3	LO2	-	LO2 error-detection flag indicator
LD2	LO1	-	LO1 error-detection flag indicator
SW1	TRQ	Right	Torque Change pin
VR1	VR1	-	Output Current Threshold

Stepper 31 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
VM External Supply Voltage	4.5	-	33	V
Output Current	-	-	1.8	A
Chopping Frequency	40	70	150	kHz
VREF Reference Voltage	0	-	3.6	V

Software Support

Stepper 31 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 Stepper 31 Click by driving a bipolar stepper motor in both directions for a specified number of steps.

Key Functions

- stepper31_cfg_setup This function initializes Click configuration structure to initial values.
- stepper31_init This function initializes all necessary pins and peripherals used for this Click board.

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- stepper31_default_cfg This function resets and verifies the expander, then applies the default motor and fault settings with both windings off.
- stepper31_set_direction This function stores the direction for the next drive_motor call.
- stepper31_set_step_mode This function selects the step resolution and resets the sequence index.
- stepper31_drive_motor This function drives the requested steps, then releases both windings.

Application Init

Initializes the logger and Click driver, verifies expander communication, and selects the stepping mode while leaving both motor windings off.

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 pause on mode change. Each move is logged before starting. The driver checks fault inputs during motion and de-energizes the windings when the move ends.

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

Downloads

Stepper 31 Click example package

Stepper 31 Click 2D and 3D files v101

Stepper 31 Click schematic v101

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TB67S531FTG datasheet

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