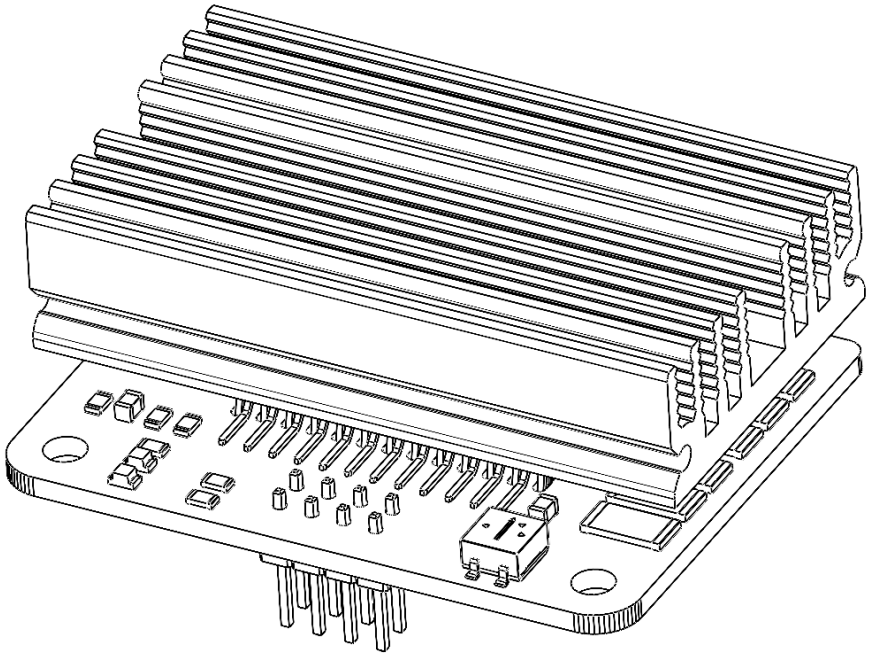
SERMATEK

ST-R1 Stepper Module

User Guide

English January, 2026



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1 DISCLAIMER AND COPYRIGHT

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2 Product Overview

The **ST-R1 Stepper Module** is a high-performance, compact stepper motor driver based on the **Toshiba TB6600HG** architecture. It is designed to provide precise positioning and reliable operation in **industrial environments**.

2.1 Applications

- Precision CNC Routers & Engravers
- 3D Printers & Additive Manufacturing
- Industrial Automation & Robotics (Pick-and-Place)
- Textile & Sewing Machinery
- Packaging & Labeling Systems
- Medical & Laboratory Equipment (Syringe Pumps, Analyzers)
- ATM & Vending Machines
- XYZ Plotters & Positioning Stages
- Educational & DIY Projects

2.2 Key Features

- **Compact Design**: Small footprint ($38mm \times 50mm$) for easy integration.
- **Wide Input Voltage**: Operates between 10V – 44V DC.
- **High Power Output**: Adjustable phase current up to 4.0 A (Peak).
- **Precision Control**: Selectable microstepping resolutions: Full, 1/2, 1/4, 1/8, 1/16.
- **Noise Immunity**: Optically isolated differential inputs (PUL / DIR / ENA / TQ).
- **Advanced Protection**: Hardware-based Over-Current (ISD), Thermal Shutdown (TSD), and Under-Voltage Lockout (UVLO).
- **Thermal Management**: Integrated aluminum heatsink and optimized copper PCB layout.
- **Versatile Mounting**: Standard 2.54mm pitch headers for direct PCB integration or use with the optional STB-R1 Base Board for terminal block connectivity.

3 Electrical Specifications and Operating Conditions

3.1 Recommended Operating Conditions

Values applicable for continuous duty.

Parameter	Min	Typical	Max	Unit
Supply Voltage (V+)	10	12-24	40	VDC
Output Current	0	1-2	4	A
Input Frequency (PUL)	-	-	50	kHz
Ambient Temperature	−20	25	60	$°C$
Heatsink Surface Temp.	-	-	110	$°C$

Note: For currents exceeding 3A, forced air cooling (fan) is recommended. A low-ESR capacitor (470μF or larger) should be placed on the power supply line close to the driver.

4 Signal Interface & Pin Description

The ST-R1 uses a standard 2.54mm pitch header interface. Some pins use multiple headers in parallel to support high current demands.

4.1 Control Signals (Logic Level: 3.3V / 5V)

The control inputs (PUL, DIR, ENA, TQ) are differential (line-driver compatible).

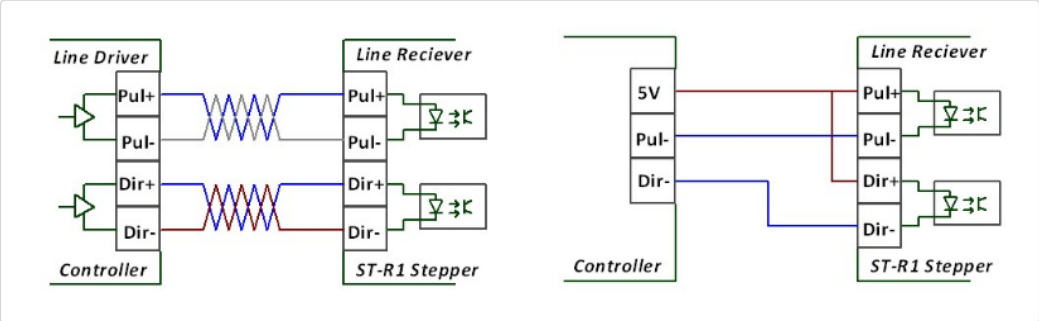

Fig. 1: Control signal diagram

- **PUL (Pulse)**: Stepper pulse input.
- **DIR (Direction)**: Direction control input.
- **ENA (Enable)**:
  - **Logic**: Active Low Disable.
  - **Function**: When a signal is applied, the motor power is cut (Free mode). When no signal is present, the motor is energized. Leave unconnected if not used.
- **TQ (Torque / Current Reduction)**:
  - **Logic**: Active High.
  - **Function**: When a signal is applied, the driver operates at the set nominal current (100%). When no signal is applied, the current is automatically reduced to approx. 30% to prevent overheating during idle states.
  - **Bypass**: To force 100% torque continuously, connect TQ(+) to +5V and TQ(-) to GND.

4.2 Pinout Map

Pin Name	Function	Note
TQ (+/-)	Torque Control	Diff. Input
ENA (+/-)	Enable Control	Diff. Input
PUL (+/-)	Pulse Signal	Diff. Input
DIR (+/-)	Direction Signal	Diff. Input
GND / V+	Power Supply	Input (10-44V)
A (+/-)	Motor Phase A	Output
B (+/-)	Motor Phase B	Output

5 Configuration & Settings

5.1 Microstep Settings

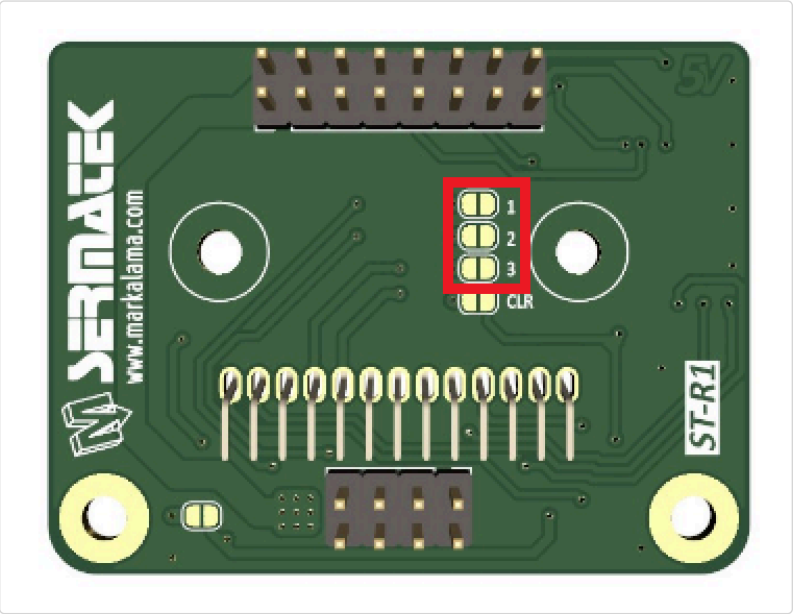

Fig. 2: Microstep setting pins

Microstepping is configured via solder jumpers (labeled 1, 2, 3) located on the bottom of the PCB. (ON = Soldered / OFF = Open)

Soldering was preferred for higher immunity against vibrations in industrial and heavy-duty applications.

Resolution	Jumper 1	Jumper 2	Jumper 3	Description
1/1 (Full)	ON	OFF	OFF	Max torque, low precision
1/2	OFF	ON	OFF	Good torque balance
1/4	OFF	OFF	ON	Increased resolution
1/8	ON	OFF	ON	Quiet & precise motion
1/16	OFF	ON	ON	Max resolution, min vibration

5.2 Alarm & Protection (CLR Setting)

The ERR LED indicates active protection (Thermal or Over-current). The CLR Jumper determines the reset behavior.

CLR	Action	Description
Soldered (ON)	Automatic Recovery	The driver resumes operation automatically once the temperature drops or the fault clears.
Open (OFF)	Manual Recovery	Power must be cycled (turned off and on) to reset the driver after a fault.

Protection Thresholds:

- **Thermal (TSD)**: Cuts off at **160°C**, recovers at **90°C**.
- **Over-current (ISD)**: Triggers at approx. **6.5A**.

5.3 Output Current Adjustment

The output current is set via the onboard Trimpot.

- **Increase current**: Turn CW (Clockwise).
- **Decrease current**: Turn CCW (Counter-Clockwise).

6 STB-R1 Stepper Base Board

The STB-R1 is an expansion board designed to convert the ST-R1 module into a standalone driver with screw terminal connections. It comes connected to the ST-R1 step driver standardly.

6.1 Overview

- Compatibility: Designed specifically for the ST-R1 Module.
- Connectivity: Screw terminals for Motor, Power (24V), and Control Signals.
- Mounting: 4x M3 mounting holes ($50mm \times 65mm$ dimensions).
- Feature: Includes a stability capacitor and Power LED.

6.2 Logic Level Selection (TQ Signal Only)

The STB-R1 features jumpers (JP1, JP2, JP3) to adapt the TQ input voltage level. (Note: STEP, DIR, and ENA inputs on the base board remain 5V logic).

Jumper Setting	TQ Voltage Level	Application
JP1: ON / JP2, JP3: OFF	5V Logic	Microcontrollers (Arduino, STM32, etc.)
JP1: OFF / JP2, JP3: ON	24V Logic	PLCs and Industrial Controllers

7 Mechanical Dimensions

7.1 ST-R1 Main Board

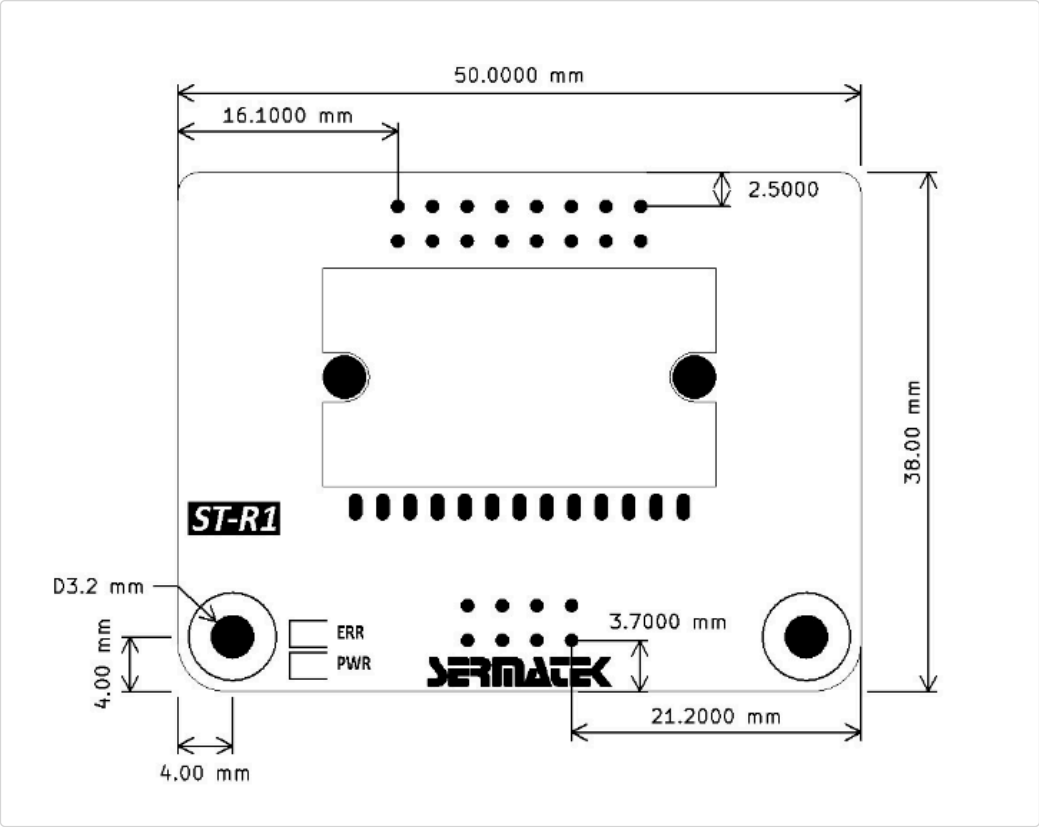

Fig. 3: ST-R1 Card Dimensions

- Depth: 17mm with heatsink

7.2 STB-R1 Bottom Board

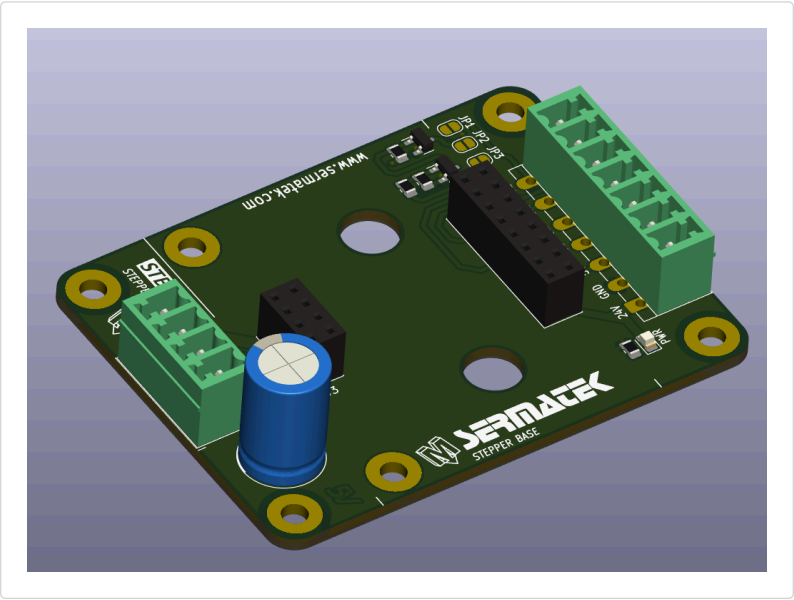

Fig. 4: STB-R1 3D Model

- Width: 50 mm
- Height: 65 mm
- Depth: 19 mm with screw terminals or 12 mm without screw terminals

7.3 Combined Dimensions

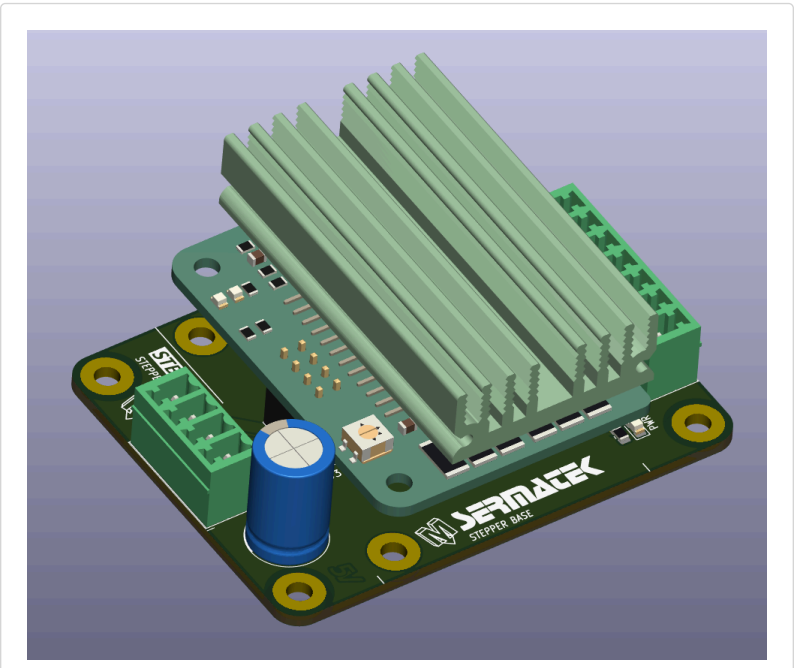

Fig. 5: STB-R1 3D Model

- Width: 50mm
- Height: 65mm
- Depth: 30 mm

For technical assistance, spare parts, or warranty claims, please contact SERMATEK directly.
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