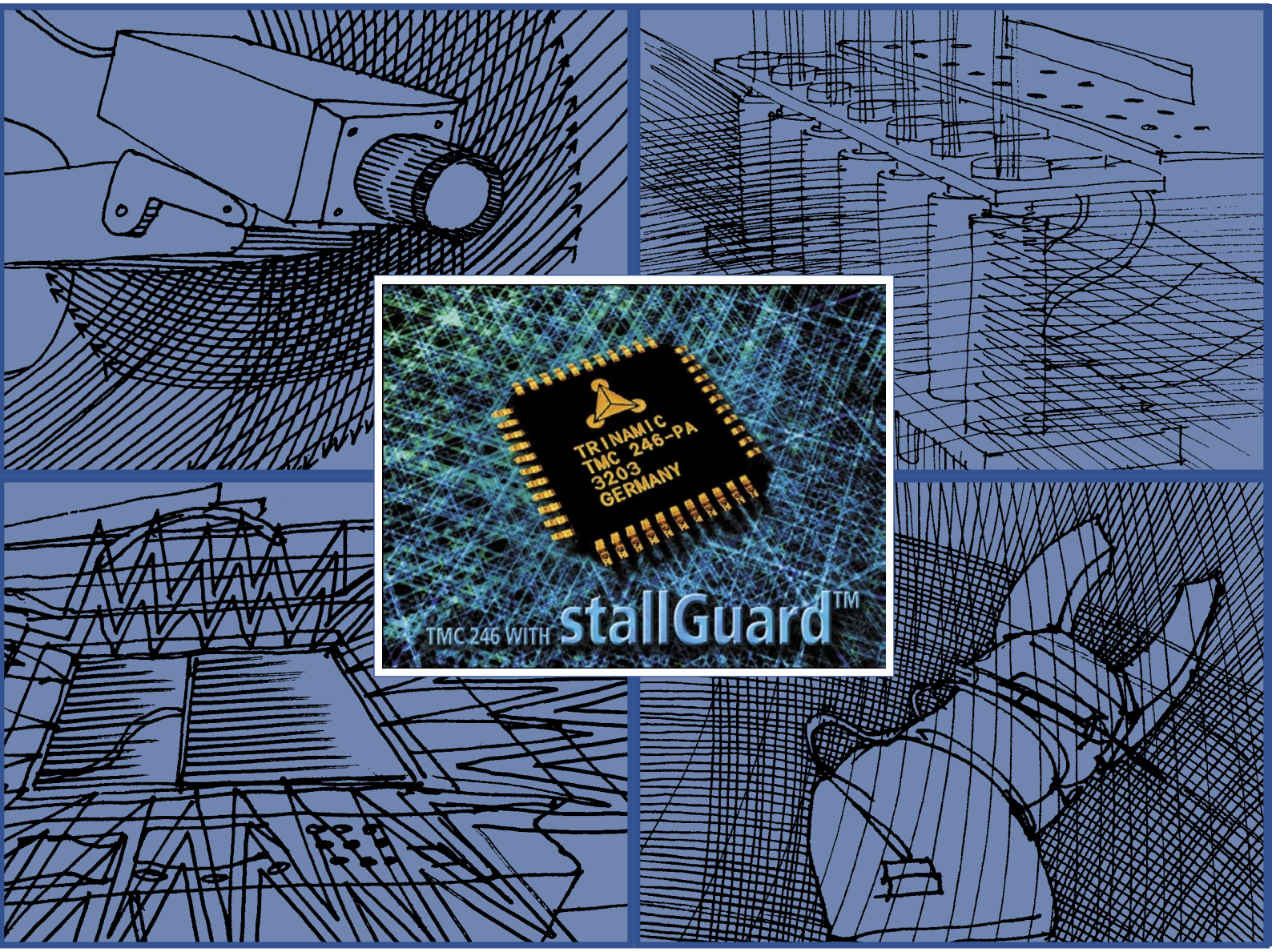
TRINAMIC
Integrated Circuits



- Lowest Power Dissipation
- Complete Motion Control Solutions
- StallGuard™
- Micro-Stepping

Trinamic offers comprehensive IC solutions to control and drive electric stepper motors. Trinamic focuses on developing Application Specific Standard Products (ASSPs) for motion control. These dedicated ICs offer a cost effective and efficient approach to time critical motion control tasks, this lowering the total system cost. Furthermore, time to market is reduced and software is significantly simplified ensuring reliability.

Extensive experience in IC design and drive technology enables us to effectively serve our customers. Our applications range from high volume automotive and computer peripherals to industrial embedded systems. If you are looking for the flexibility of designing in our motion control chip but lack the time, resources or volume, consider using our module solution. These modules are complete motion control solutions while retaining potential for customization.

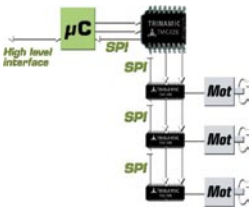
Driver and Controller ICs for Motion Control

Trinamic Motion Control ICs

Stepper Motor Position Controller ICs TMC428 & TMC453

	TMC428	TMC453
No. of Axes	1 to 3	1
Motor types controlled	2-phase stepper motors	2,3 and 5 phase stepper motors
µ-step Resolution	6-bit {64,32,16,4,2,1}	8-bit
Max. Step Frequency per Axis	20 kHz fullstep ~ 1 MHz µ-step	4 MHz
Ramp Shape	trapezoid	s-shaped, trapezoid or user defined
Supply Voltage	3.3V or 5V	5VDC
Interfaces	serial 4-wire, SPI™ compliant	Step/Dir, analog, I²C or 8-bit parallel
Temperature Range	-45°C to +125°C	-25°C to +85°C
Available Packages	SSOP16, DIL20, SOP24	PLCC68
Comment	-	Encoder Feedback, PID Controller for clodes loop operation

Trinamics controller ICs make the sophisticated control of several motors via an inexpensive processor possible. Together with the Trinamic 'Smart Power' Driver ICs TMC23x and TMC24x (StallGuard™) they form a complete motion control system.



The TMC428 controls up to three axes and offers an optimized and miniturized solution for any cost-sensitive system. Its unique design enables a significant cost reduction compared to standard systems.

The TMC453 provides a very comfortable and universal solution for industrial positioning control tasks: It features an integrated encoder interface and direct control of many output stages via analog and digital signals. The integrated PID controller enables the most sophisticated closed-loop operations.

Applications

TMC428

- Optical & fine mechanical devices
- Wafer handling
- Office automation
- Chip card reader
- Advanced Frontlight Systems

TMC453

- Plotters
- ATMs
- Production automation
- Monitoring cameras
- Wafer handling

Trinamic Controller/Driver ICs TMC211 & TMC222

The TMC211 and TMC222 are system-on-chip, which integrate a LIN / I²C interface, a positioning controller and a 800 mA, 2-phase stepper motor driver in a single chip. This stand alone stepper motor controller & driver is the ideal solution for systems with decentralized arrangements of the driver electronics. The appendant evaluation board available is mainly intended for direct attachment to the Trinamic USB2X interface converter which allows easy interfacing to a PC via USB interface.

Stepper Motor Controller

- 16-Bit positioning counter
- Configurable speed, position and acceleration
- Built-In ramp generator
- Digital switch input
- On-Chip OTP for storage of parameters

Integrated Driver

- Programmable coil current up to 800mA
- 4-Bit µ-stepping
- PWM current control with automatic fast- / slow decay mode

Serial Interface

- TMC211 : LIN Interface (rev 1.3)
- TMC222 : I²C-like Interface

Applications

- Optical & fine mechanical devices
- Wafer handling
- Office automation
- Chip card reader
- Plotters
- POS printer
- Mechanical power/frequency regulators
- AFS
- Valves in building automation (water/gas)
- HVAC
- Toys
- Paper leveller

Evaluation Board with USB2X

The TMC211/TMC222 **Evaluation Kit** includes the evaluation board, the USB2X adapter and a motor

Trinamic µ-stepping Driver ICs

Trinamics latest generation of 'Smart Power' ICs for stepper motors sets new standards. They all are provided with diagnosis and protection functions and are produced up to the highest standards. The TMC24x even feature the patented sensorless stall detection function StallGuard™!

Common Features of the TMC23x and TMC24x

- **Lowest power dissipation!**
- up to 64*) µ-steps
- SPI and analog interface
- Mixed decay for smooth motor operation
- Programmable slope control to reduce EM-emission
- Programmable chopper frequency via single capacitor or external clock
- Comprehensive protection & Diagnostics
  - Short circuit, over current, open load, two stage temperature

TMC236 / TMC246

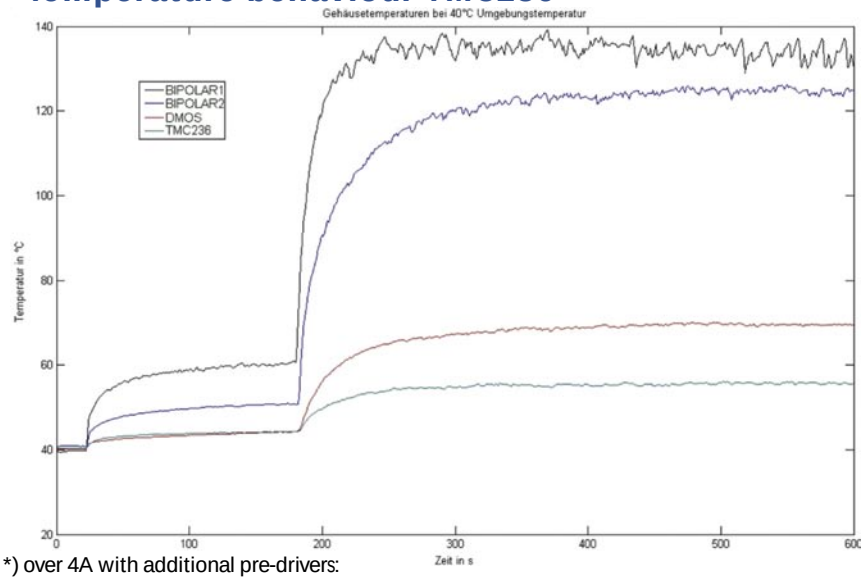
	TMC236	TMC246
Max. Motor Voltage	28.5V*)	28.5V*)
Max. Motor Current	1.5A	1.5A
Power MOSFETs	Integrated	Integrated
StallGuard™	-	YES
Package	QFP44	QFP44

*) over 40V under development

TMC239 / TMC249

	TMC239	TMC249
Max. Motor Voltage	Up to 75V	Up to 75V
Max. Motor Current	Up to 10A	Up to 10A
Power MOSFETs	External*)	External*)
StallGuard™	-	YES
Package	SO28	SO28

Temperature behaviour TMC236



*) over 4A with additional pre-drivers:
The TMC239 and TMC249 are combined with eight external Low-RDS-ON high efficiency MOSFETs for currents of up to 4 A and voltages of up to 28.5VDC. With additional external pre-drivers, motor current and voltage can be increased even further to up to 10A and 75VDC respectively.

Applications

Consumer Electronics

- Office automation
- Cash vending machines
- Mechanical entertainment

Industrial

- Laboratory automation
- Surveillance cameras, rotary antenna
- Electronic lens adjustment

Automotive

- Advanced front lighting system (AFS)
- Automotive HVAC system
- In-car display flaps

StallGuard™

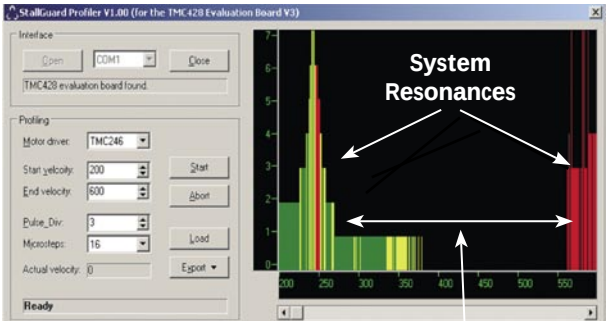
Trinamic's patented sensorless stall detection StallGuardTM enables customers to detect mechanical overload conditions and stall conditions without external sensors, by measuring the load (torque) on the axis of the motor at a predefined point prior to losing steps. Thus, eliminating the need for external optical encoders or reference switches. The load status of the motor is transmitted via the digital interface of the driver IC.

Features

- No limit switches needed
- Increases safety in human environment
- Reduces system costs
- Increases system safety
- Low noise during reference search

Applications

- Electrical gates
- In-car flaps
- Syringes
- Desktop CNC machines (for relative positioning



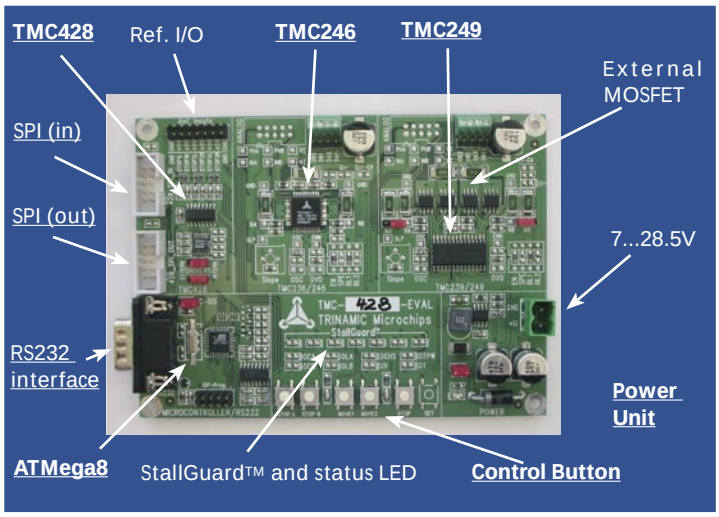
StallGuard™ Profiler

Optimal velocity for the use of StallGuard™ (V=280...550)

Application Support

Trinamic offers to all its integrated circuits comprehensive evaluation boards to make evaluation even easier. Set up you board in 10 minutes and start testing immediately. The boards come with all the components required for developing a positioning system using Trinamic ICs: The respective evaluation board, programming and evaluation software for Windows OS (9X, XP, NT4.0, 2000), documentation and a RS232 cable (motors optional). Using these plug-and-play systems the user is able to integrate the circuit in his own applications directly.

New Evaluation Board



Versions of the New Evaluation Board

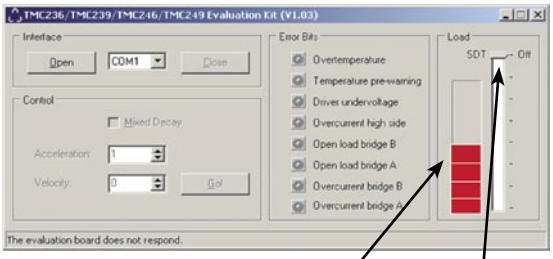
1. TMC246 v2.0 (28.5 V / 1.5 A)
   - only TMC246, including status & StallGuard™ LED

2. TMC249 v2.0 (28.5 V / 3.0 A)
   - only TMC249, including status & StallGuard™ LED

3. TMC428 v3.0 (28.5 V / 1.5 A and 3.0 A)
   - new board, completely assembled, no LED
   (TMC428, TMC246, TMC249)

All boards include PC software, StallGuard™, RS232 cable and documentation on CD. Motors can be ordered separately.

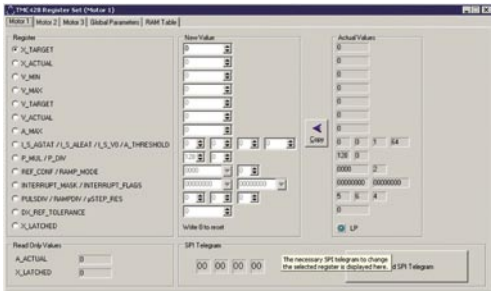
Evaluation Software



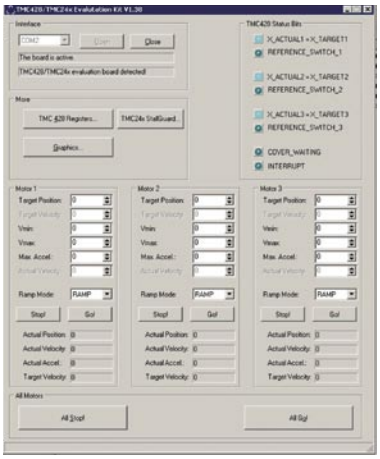
StallGuard™ Demo Software

3-bit load angle indicator
(negative torque indicator)

Threshold to stop motor
(demonstration purpose)



Register Panel



Main Motion Control Panel

Ordering Information

Order Code	Desciption
TMC428-I	3 axis Controller IC - SSOP16
TMC428-PI24	3 axis Controller IC - SOP24
TMC428-DI20	3 axis Controller IC - DIL20
TMC429-Eval	TMC428 -Evaluation Board
TMC453-PI	1 axis Controller IC - PLCC68
TMC453-Eval	TMC453 Evaluation Board
TMC211-SA	Driver/Controller IC with LIN -SO20
TMC222-SI	Driver/Controller IC with I2C - SO20
TMC211-Evalboard	TMC211 Evaluation Board with LIN interface
TMC211-Evalkit	TMC211 Evaluation Kit with LIN interface, incl. USB2X adapter & motor
TMC222-Evalboard	TMC222 Evaluation Board with I2C interface
TMC222-Evalkit	TMC211 Evaluation Kit with I2C interface, incl. USB2X adapter & motor

Order Code	Description
TMC236-PA	TMC236 Driver IC -QFP44
TMC239-SA	TMC239 Driver IC - SO28
TMC236-Eval	TMC236 Evaluation Board
TMC239-Eval	TMC239 Evaluation Board
TMC246-PA	TMC246 Driver IC with SG - QFP44
TMC249-SA	TMC249 Driver IC with SG - SO28
TMC246-Eval	TMC246 Evaluation Board with SG
TMC249-Eval	TMC249 Evaluation Board with SG

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