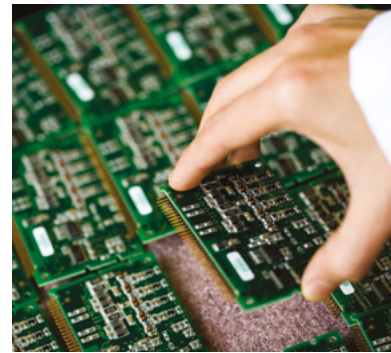
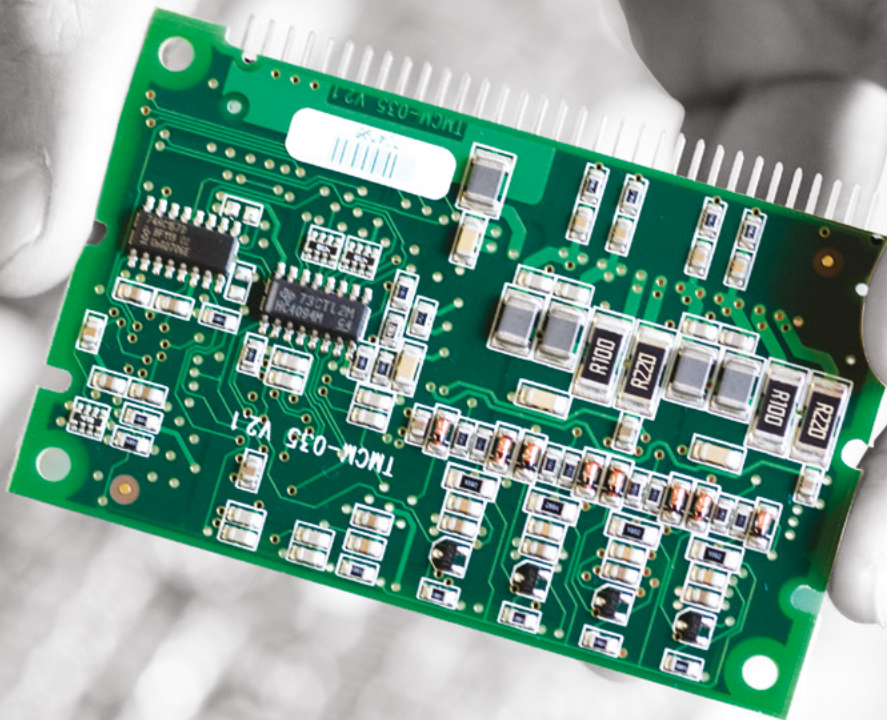


INTEGRATED CIRCUITS –
READY FOR YOUR APPLICATION
PRODUCT GUIDE 2016



TRINAMIC – SMART SOLUTIONS FOR MOTION CONTROL



TRINAMIC is a fabless semiconductor company and serves the market with self developed integrated circuits for the control of small electrical motors in a wide variety of applications. TRINAMIC's integrated circuits are manufactured to the highest standards in the world's most advanced manufacturing plants.

Based in Hamburg, Germany, TRINAMIC provides integrated Circuits and Modules for Motor and Motion Control to customers all over the world, most of them leaders in their Industry.

The use of small motors is increasing rapidly in many different types of products. In leading-edge industries such as biotechnology, lab automation, semiconductor handling equipment, CCTV and factory automation, TRINAMIC products control all kinds of embedded motion control systems.

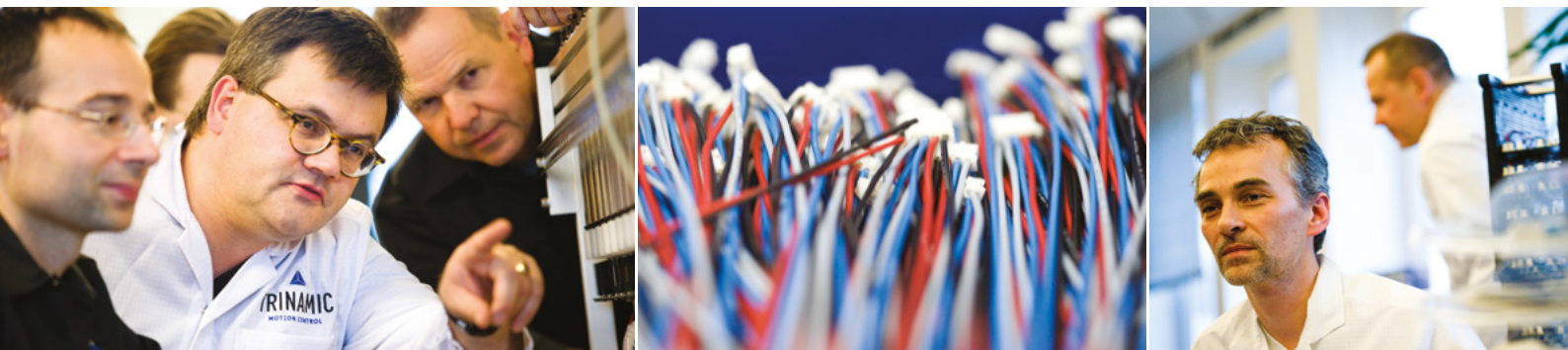
TRINAMIC's application-driven approach and deep application understanding means that customers do not need in-depth knowledge of motors, nor of control circuitry. Consequently, the design phase is simplified, resulting in significant labor and cost savings in development as well as a reduction in the total cost of ownership.

The patented stallGuard™ load detection enables precise and silent homing without any homing switches. Integrated diagnostic features can detect potential system faults to reduce downtime.

TRINAMIC cherishes the core values of German engineering and is committed to reliability, not only concerning the products, but also with regard to business ethics and processes.

TRINAMIC's quality management system is certified according to ISO9001 and ISO13485 (medical).

Embedded in a network of strong strategic relationships with leading research institutions and industrial partners, TRINAMIC's research efforts are superior, geared entirely to the enhancement of product performance, to innovation and invention, at the same time increasing efficiency and reducing power consumption.



TRINAMIC's Motion Control Language (TMCL) makes it easy to develop motion control applications and allows for shorter development cycles and a short time to market.

TRINAMIC customers benefit from the company's extensive knowledge of motor physics and its library of intellectual property (IP), built over years of application knowledge.

Product development at TRINAMIC focuses on meeting customer demands for miniaturization, efficiency, diagnostic support and protection, all of which ensure the reliability of the complete system.

TRINAMIC is committed to energy efficient solutions. With industry leading technologies such as the patented coolStep™, TRINAMIC products add energy-saving to the ease of use and precision of stepper Motors.

With a history going back more than 20 years and a traditional private ownership of the company shares, TRINAMIC is able to give a commitment to long term availability.

Headquartered in Hamburg, Germany, TRINAMIC products are sold via a global distribution network.

[TRINAMIC Motion Control made easy](#)





INNOVATION – MADE BY TRINAMIC

TRINAMIC is an innovative company with over 20 years of experiences in design and marketing of motion control chips, modules, and mechatronic drives.

Within its history, TRINAMIC engineers have been granted many patents including Dual Interface Control, and Automatic Mixed Decay. Our innovations address the needs of the OEM market and provide ideal solutions for our customers' applications.

This significantly reduces project time and cost as well as design risk.

An average of 6 months faster time to market compared to an in-house development can be achieved.

stallGuard™

TRINAMIC's patented sensorless stall detection **stallGuard™** enables customers to detect mechanical overload conditions and stall conditions without external sensors, by measuring the load at a predefined point where a step loss has not yet occurred.

Thus, eliminates the need for reference or end switches. This reduces cost and complexity of applications, where a reference point is required. When compared to pure mechanical referencing, stress on the mechanic and noise is reduced.

stallGuard2™

Improved version of the successful **stallGuard™** feature. **stallGuard2™** is the world's first sensorless high resolution load detection implemented in a standard stepper motor driver. This gives the user easy and cost effective real

time feedback of his application. It enables to scan the motion system without additional sensors. This can help to find the right motor and mechanics during development phase or to detect abrasion or mechanical stiffness.

coolStep™

Sensorless load dependent current control using the **stallGuard2™** feature. First time **coolStep™** enables to drive a stepper motor in a energy efficient way. Up to now stepper motors are driven with constant current. The new TMC260, TMC261 and TMC262

stepper motor driver series detects the actual load of the motor and adjusts the current accordingly. This eliminates the security current margin and allow also to boost the motor avoiding stall and step loss to improve the reliability of the entire system.

dcStep™

dcStep™ closes the gap between fully featured closed Loop Stepper Motor Drives and cost efficient open Loop Systems. While most open loop Stepper Drives will loose steps in an overload situation, dcStep drives will reduce the speed in order to overcome the resistance. Thus

the integrity of the position counter is always given. With **dcStep™** a stepper motor will act similar as a dc Motor with regards to energy efficiency. **dcStep™** allows for auto ramping and turning the motor as fast as possible in the actual load situation.

spreadCycle™

New patent pending constant Toff chopper scheme. Using the spreadCycle chopper the μ Step current sine wave is always well formed with a smooth zero crossing. Due to this effect the

stepper motor can be driven very fast without resonance effects. All the **coolStep™** drivers are using this new technology.

stealthChop™

stealthChop™ is a new patent pending technology which delivers exceptionally quiet stepper motor performance. Trinamic's **stealthChop™** minimizes magnetostriction by implementing a PWM algorithm that relies

predominantly on voltage modulation for motor control at lower speeds. This technology minimizes PWM current fluctuation, which is the primary cause of low-speed hum.

TMCL™

TMCL™ – the TRINAMIC Motion Control Language – is a programming language dedicated to motion control applications. The software includes commands for moving one or more motor axes at certain velocities or to certain positions and for setting all relevant parameters of the motion controller. It is possible to access additional

general purpose digital and analog inputs and outputs. **TMCL™** is available on most TRINAMIC modules with integrated motion controller. Program development is supported by the **TMCL-IDE** – a PC based integrated development environment which is available free of charge.

Our engineering team and customer service offers:

- ▶ High-level specification, -jointly with customer
- ▶ Technical specification and system architecture
- ▶ ICs and PCB in-house design
- ▶ Software development
- ▶ Fast prototyping
- ▶ Testing and qualification
- ▶ Logistic warehouse
- ▶ After sales & technical support
- ▶ Online support forum: www.trinamic.com/ttdg
- ▶ RMA repair

RESPONSIBILITY – PROVIDED BY TRINAMIC

LONG LIFE AVAILABILITY

TRINAMIC offers lifecycles of up to 10 years for almost all of our products, which reduces costs of re-designing, re-qualification and re-certifying for our customers. This does not only save valuable resources but reduces time-to-market.

QUALITY

Today TRINAMIC has strategic alliances with partners to ensure access to the latest technologies and processes. TRINAMIC's QMS is ISO 9001:2000 certified by Germanischer Lloyd and EN ISO 13485 certified for "Medical Components" by Medcert.



TRINAMIC MEMBERSHIPS

TRINAMIC's ambitions are to commence different innovation platforms, where various industries and leading suppliers join forces to support, promote and advance the technology.

TRINAMIC is member of the following organizations:



TRINAMIC GREEN

We refer to the directive 2011/65/EU of the European Parliament and the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

That means, all electrical and electronic equipment put on the market by TRINAMIC are compliant with the RoHS directive currently valid



The EtherCAT Technology Group is a global organization in which OEM, End Users and Technology Providers join in order to support and promote the technology development. EtherCAT sets new standards for real-time performance and topology flexibility, whilst meeting or undercutting field bus cost levels.

www.ethercat.org



CiA is the international users' and manufacturers' group that develops and supports CANopen and other CAN-based higher-layer protocols. The nonprofit group was founded in 1992 to provide CAN-based technical, product and marketing information.

www.can-cia.de

APPLICATIONS



WHAT IS YOUR APPLICATION?

FACTORY AUTOMATION

- ▶ Textile
- ▶ Semiconductor Handling
- ▶ Chip feeder
- ▶ Pick & place machines
- ▶ Valves
- ▶ Electronic Manufacturing

MEDICAL & LAB AUTOMATION

- ▶ Analyzers
- ▶ Cryostats
- ▶ Eye inspection
- ▶ Dental milling
- ▶ Peristaltic pumps
- ▶ Liquid handling robots

**SECURITY**

- ▶ CCTV cameras
- ▶ X-Ray scanner
- ▶ Radar detection
- ▶ Access control systems

ROBOTICS

- ▶ Educational Robots
- ▶ Autonomous systems

BANKING & VENDING

- ▶ ATM
- ▶ Vending machines
- ▶ Cash recycler
- ▶ Automated retail systems

Desktop Manufacturing

- ▶ 3D Printing
- ▶ CNC Milling

OFFICE AUTOMATION

- ▶ POS printer
- ▶ Copy binder
- ▶ Copy machines
- ▶ Multi function printers
- ▶ Digital printing
- ▶ Paper handling

AEROSPACE & HOMELAND SECURITY

- ▶ Antenna positioning
- ▶ Long range high precision camera
- ▶ Border control

OTHERS

- ▶ Stage lighting
- ▶ Art installations

Stepper Motor System Architecture

Host

HMI controller, PC or PLC that communicate and control the decentralized motion control system via various field buses as CAN, serial or even real time Ethernet based bus systems as EtherCAT.

Microcontroller

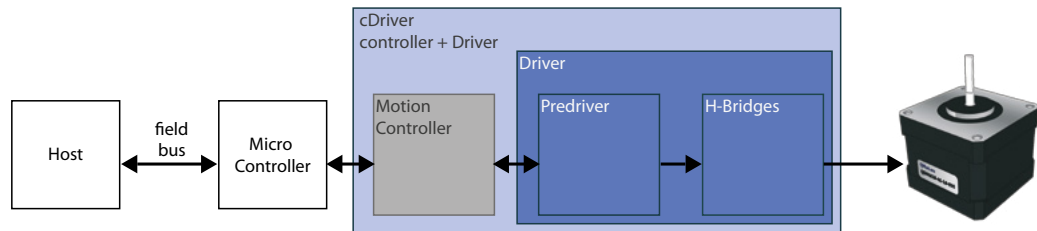
The usage of integrated motion controllers reduces the requirements to the MCU. Only a serial interface as SPI is needed.

Predriver

Integration of predrivers, sensing and protection circuitry. The predriver may also include microstep sequencing or commutation logic. Drivers with integrated microstep sequencing as the TMC26x family save external DAC and allow for simple step/direction Control.

Power Bridges (H-Bridges)

Power MOSFETs to drive motor coils. Typically in an H-bridge topology to switch motor-phases to power or GND.



Motion Controller

Integrated Logic Unit, that calculates ramping and positioning in safe and integrated hardware as TMC429 or TMC457. Dedicated Motion Controllers offload real time calculations from the MCU. Motion Controllers for SPI Chipset may also incorporate microstep sequencing units.

Driver

Single chip solution including predriver and power bridges in a single board-space saving package.

cDriver

Integrated solution with motion controller, pre-driver and driver in one single device.

Gate Driver

Gate Drivers provide sufficient current to drive gate charges of the power MOSFETs accurately and efficient.

ARCHITECTURE MOTION CONTROL SYSTEM

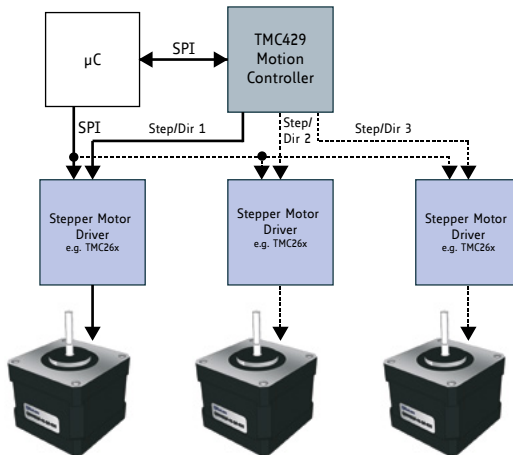
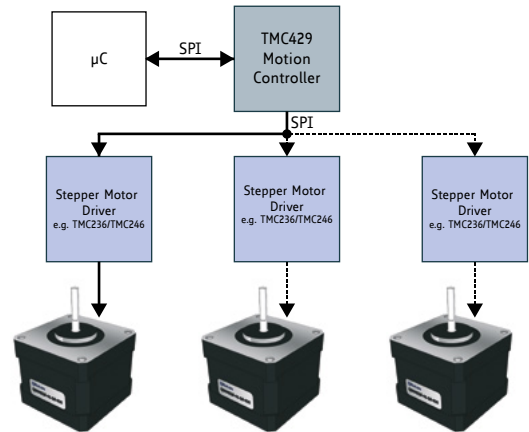
TRINAMIC Chipset Architecture

A single bidirectional interface for both motion commands and diagnostics keep the count of required lead traces low.

Only one low speed SPI interface from the micro-controller enables extremely miniaturized and lean designs.

The SPI Chipset allows for a full control over microstepping tables and a seamless change of microstep resolutions on the fly is possible.

For optimized motor requirements the microstepping tables are adaptable in the motion controller.



Step and direction (S/D) drivers and motion controllers simplify the control of stepper motors.

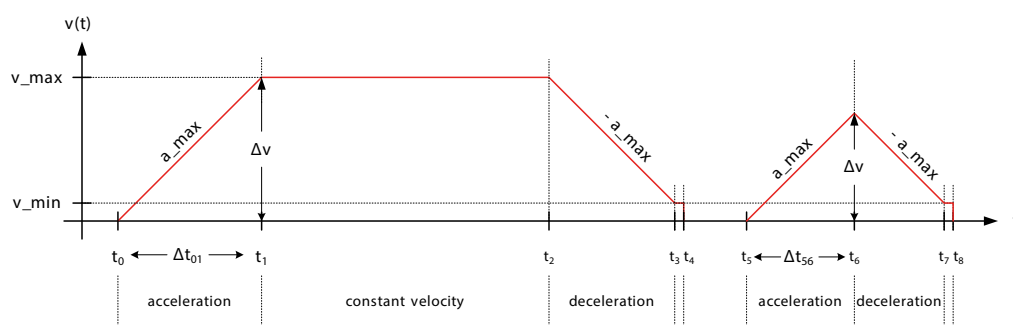
Step and direction interfaces are widespread in industry and thus allow for compatible solutions. Especially at high microstep resolutions and high step frequencies S/D architectures reduce required bandwidth compared to SPI or PWM interfaces.





SPI is used for setup and feedback channel for diagnostics down to the power stage.

Trapezoidal and Multiaxis Motion Controller

Driving a stepper motor at velocities higher than its physical start stop frequency requires a defined acceleration. For the great majority of positioning applications linear ramping profiles are sufficient.

TRINAMIC motion controllers with linear ramping allow for a fast and accurate positioning of one or several axes and offload the MCU from time-consuming real time tasks.

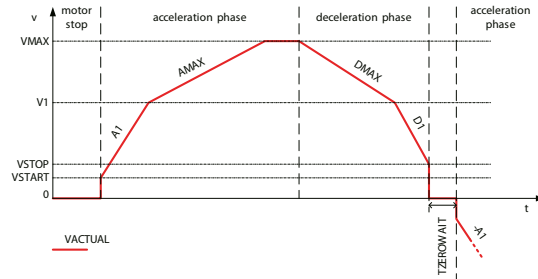
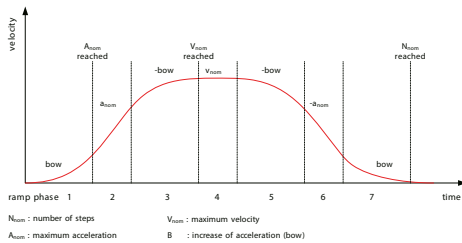


| PRODUCT |  TMC4210-I |  TMC429-I |  TMC429-LI |  TMC429-PI24 |
|--------------------------|---|--|---|---|
| Number of axes | 1 | 3 | 3 | 3 |
| Motor type | Stepper | Stepper | Stepper | Stepper |
| Driver interface | S/D | SPI | SPI or S/D | SPI |
| max Microstep resolution | 256 (S/D) | 64 (SPI) | 64 (SPI) 256 (S/D) | 64 (SPI) |
| Encoder Interface | - | - | - | - |
| chopSync™ | - | - | - | - |
| Ref. inputs | 2 | 3 x 2 | 3 x 2 | 3 x 2 |
| Supply voltage | 3.3V – 5V | 3.3V – 5V | 3.3V – 5V | 3.3V – 5V |
| Package | SSOP16 | SSOP16 | QFN32 (5x5) | SOP24 |
| Evaluation Board | TMC4210+2660-EVAL | TMC429+24X-EVAL | TMC429+26X-EVAL | |

DEDICATED MOTION CONTROLLER

Advanced Ramping Motion Controller

TRINAMICs advanced sixPoint™ ramping profile allows for faster positioning by adding a free configurable start/ stop frequency to a linear motion profile plus adding a reduced acceleration value at high velocity to reduce the jerk at the end of standard acceleration ramp.



For high speed positioning as well as for handling of jerk sensitive goods or objects with extensive inertia sinusoidal (S-shaped) ramping profiles might be necessary.



TMC457-BC



TMC4330-LA



TMC4331-LA

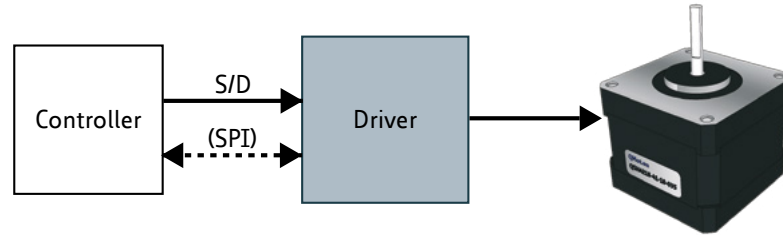


TMC4361A-LA

PRODUCT

| 1 | 1 | 1 | 1 | Number of axes |
|----------------|------------------|------------------|------------------|--------------------------|
| Stepper/ Piezo | Stepper | Stepper | Stepper | Motor type |
| SPI or S/D | S/D | SPI or S/D | SPI or S/D | Driver interface |
| 2048 | 256 | 256 | 256 | max Microstep resolution |
| ABN | ABN, SPI, SSI | - | ABN, SPI, SSI | Encoder Interface |
| - | ✓ | - | ✓ | Closed Loop Regulation |
| ✓ | ✓ | - | ✓ | PID Regulation |
| ✓ | ✓ | - | ✓ | chopSync™ |
| - | - | ✓ | ✓ | dcStep™ |
| 2 | 3 | 3 | 3 | Ref. inputs |
| 1 | 1 | 1 | 1 | S/D Input |
| 1.5V & 3.3V | 3.3V | 3.3V | 3.3V | Supply voltage |
| FBGA144 | QFN32 4x4mm | QFN32 4x4mm | QFN40 6x6mm | Package |
| active | preview | active | preview | Product Status |
| TMC457-EVAL | TMC4330-EVAL-KIT | TMC4331-EVAL-KIT | TMC4361-EVAL-KIT | Evaluation Board |

Drivers







The TMC21x0 family are TRINAMICs most autonomous stepper motor driver IC - series.

Drive the motor via Step and Direction signals. Trinamics sophisticated stealthChop chopper ensures noiseless operation combined with efficiency and best motor torque. Integrated power MOSFETs handle motor currents up to 1.2A RMS continuously or 2.5A short time peak current per coil.

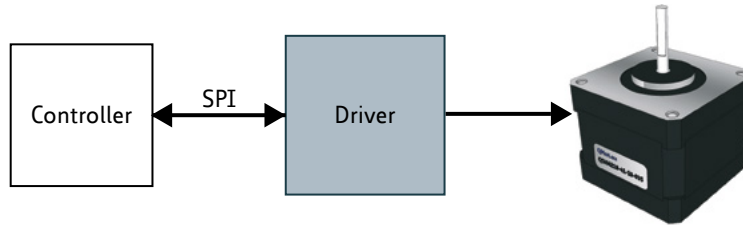
TMC2130 may be controlled via SPI or S/D, features and full diagnostics are available via SPI.

TMC2100 is designed for a Step & Direction control only. It provides market leading features while being configured by seven pins only.

| PRODUCT |  TMC2100-LA |  TMC2130-LA |  TMC2130-TA |  TMC2041-LA |
|---------------------------|---|---|---|---|
| No. of Axes | 1 | 1 | 1 | 2 |
| Stepper motor type | 2-Phase | 2-Phase | 2-Phase | 2-Phase |
| Phase Current (RMS) | 1.2A | 1.2A | 1.4A | 1.1A |
| Motor supply voltage | 5...46V | 5...46V | 5...46V | 4.75V...26V |
| Max. microstep resolution | 256 | 256 | 256 | 256 |
| Controller Interface | S/D + digital | S/D + SPI | S/D + SPI | S/D + SPI |
| chopSync™ | - | ✓ | ✓ | - |
| stallGuard2™ | - | ✓ | ✓ | ✓ |
| coolStep™ | - | ✓ | ✓ | ✓ |
| spreadCycle™ | ✓ | ✓ | ✓ | ✓ |
| stealthChop™ | ✓ | ✓ | ✓ | ✓ |
| microPlyer™ | ✓ | ✓ | ✓ | ✓ |
| Package | QFN36(5x6) | QFN36(5x6) | TQFP48 | QFN48 (7x7) |
| Evaluation Board | TMC2100-EVAL | TMC2130-EVAL | TMC2130-TA-EVAL | TMC2041-EVAL |
| Status | active | active | preview | preview |

STEPPER MOTOR DRIVERS

Drivers



TRINAMIC integrated stepper drivers build powerful monolithic solutions integrating predriver and power bridges. Reducing the count of required external components TRINAMIC stepper drivers allow for small and smallest motion control systems.

As all TRINAMIC stepper drivers have lowest power loss and do not require heatsinks in their

full specified current range, both the system power consumption and the total system cost can be reduced.

TRINAMIC stepper drivers come with the same software interfaces as corresponding predriver types reducing total development cost for heterogeneous systems.



TMC236A-PA



TMC246A-PA



TMC260-PA



TMC2660-PA



TMC261-PA

| | | | | | PRODUCT |
|--------------|--------------|--------------|--------------|--------------|---------------------------|
| 2-Phase | 2-Phase | 2-Phase | 2-Phase | 2-Phase | Stepper motor type |
| 1.1A | 1.1A | 1.4A | 2.8A | 1.4A | Phase current (RMS) |
| 7...34V | 7...34V | 9...40V | 9...30V | 9...60V | Motor supply voltage |
| 16 / 64 | 16 / 64 | 256 | 256 | 256 | Max. microstep resolution |
| analog / SPI | analog / SPI | SPI + S/D | SPI + S/D | SPI + S/D | Controller interface |
| 3.3...5V | 3.3...5V | 3.3...5V | 3.3...5V | 3.3...5V | Interface voltage |
| resistor | resistor | programmable | programmable | programmable | Slope control |
| ✓ | ✓ | - | - | - | chopSync™ |
| - | ✓ | - | - | - | stallGuard™ |
| - | - | ✓ | ✓ | ✓ | stallGuard2™ |
| - | - | ✓ | ✓ | ✓ | coolStep™ |
| - | - | ✓ | ✓ | ✓ | spreadCycle™ chopper |
| - | - | ✓ | ✓ | ✓ | microPlyer™ |
| int. | int. | int. | int. | int. | MOSFET Type |
| QFP44 | QFP44 | QFP44 | QFP44 | QFP44 | Package |

TMC429+TMC24X-EVAL

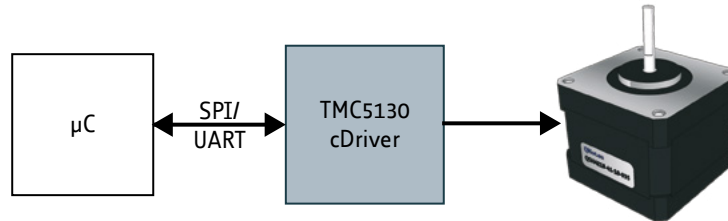
TMC429+TMC26X-EVAL

TMC429+TMC26X-EVAL

TMC429+TMC26X-EVAL

Evaluation Board

TMC5130 cDriver



The TMC5130A is a high performance stepper motor controller and driver IC with serial communication interfaces. It combines a flexible ramp generator for automatic target positioning with industries' most advanced stepper motor driver.

Based on TRINAMICs sophisticated stealthChop chopper, the driver ensures absolutely noiseless operation combined with maximum efficiency and best motor torque.

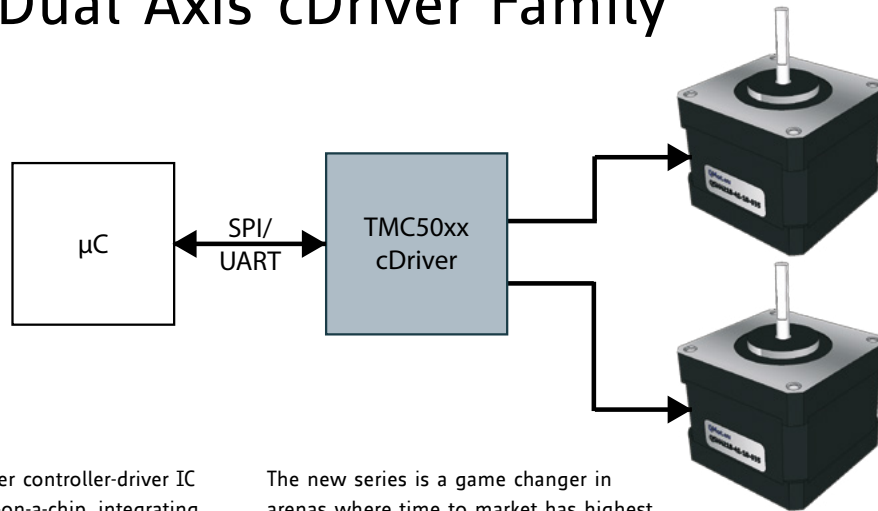
High integration, high energy efficiency and a small form factor enable miniaturized and scalable systems for cost effective solutions. The complete solution reduces learning curve to a minimum while giving best performance in class.



| PRODUCT | TMC5130A-TA |
|---------------------------|------------------------|
| No. of Axes | 1 |
| Stepper motor type | 2-Phase |
| Phase Current (RMS) | 1.4A |
| Supply voltage | 5..46V |
| Max. microstep resolution | 256 |
| sixPoint™ Ramp Generator | ✓ |
| stallGuard2™ | ✓ |
| spreadCycle™ | ✓ |
| stealthChop™ | ✓ |
| coolStep™ | ✓ |
| dcStep™ | ✓ |
| Encoder Interface | ✓ |
| µC Interface | SPI / single wire UART |
| Package | QFP48 |





INTEGRATED MOTION CONTROLLER AND DRIVER

TMC50xx Dual Axis cDriver Family

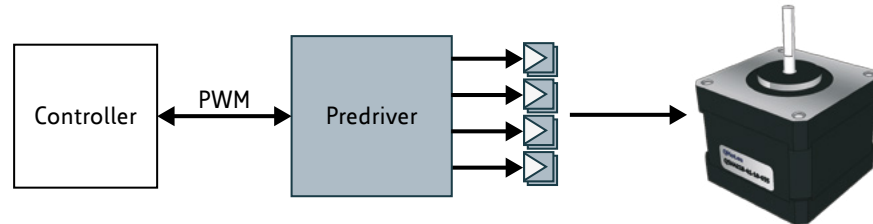


TRINAMIC's dual axis stepper controller-driver IC series are powerful system-on-a-chip, integrating sophisticated ramp-generators and two power stages plus best-in-class diagnostics and protection in a tiny 7 by 7mm² QFN package.

The new series is a game changer in arenas where time to market has highest priority, but miniaturization and cost are of importance.

|  TMC5031-LA |  TMC5041-LA |  TMC5062-LA |  TMC5072-LA | PRODUCT |
|---|---|---|---|---------------------------|
| 2 | 2 | 2 | 2 | No. of Axes |
| 2-Phase | 2-Phase | 2/3-Phase | 2-Phase | Stepper motor type |
| 1.1A | 1.1A | 1.1A | 2x1.1A / 1x2.2A | Phase Current (RMS) |
| 4.75V...16V | 4.75V...26V | 4.75V...20V | 4.75V...26V | Supply Voltage |
| 256 | 256 | 256 | 256 | Max. microstep resolution |
| ✓ | ✓ | ✓ | ✓ | sixPoint™ Ramp Generator |
| ✓ | ✓ | ✓ | ✓ | stallGuard2™ |
| ✓ | ✓ | ✓ | ✓ | spreadCycle™ |
| - | ✓ | - | ✓ | stealthChop™ |
| ✓ | ✓ | ✓ | ✓ | coolStep™ |
| - | - | ✓ | ✓ | dcStep™ |
| - | - | ✓ | ✓ | Encoder Interface |
| SPI | SPI | SPI / single wire UART | SPI / single wire UART | µC Interface |
| QFN48 (7x7) | QFN48 (7x7) | QFN48 (7x7) | QFN48 (7x7) | Package |

Predrivers



Designs with predriver and external MOSFETs or integrated H-bridges allow for flexible designs for high or highest current designs perfectly matched to your motors.

With TRINAMICs unique advanced current control capabilities all TRINAMIC stepper drivers and pre-drivers provide precise and smooth microstepping.

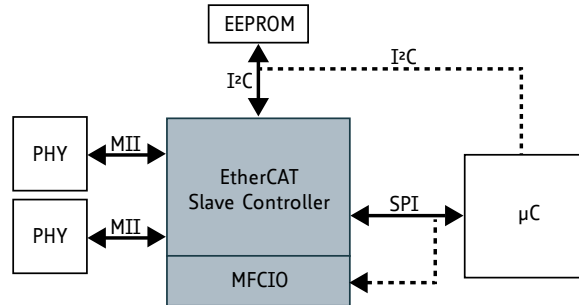
All TRINAMIC predrivers provide full diagnostics via SPI.

| PRODUCT | TMC239A-SA | TMC248-LA | TMC249A-SA | TMC249A-LA | TMC262-LA | TMC389-LA |
|---------------------------|--------------|--------------------|--------------------|--------------|--------------|--------------|
| Stepper motor type | 2-Phase | 2-Phase | 2-Phase | 2-Phase | 2-Phase | 3-Phase |
| Phase current (RMS) | up to 6A | up to 6A | up to 6A | up to 6A | up to 8A | up to 8A |
| Motor supply voltage | 7...34V | 7...34V | 7...34V | 7...34V | 9...60V | 9...60V |
| Max. microstep resolution | 16 / 64 | 16 / 64 | 16 / 64 | 16 / 64 | 256 | 1024/6 |
| Controller interface | analog / SPI | analog / SPI | analog / SPI | analog / SPI | SPI + S/D | SPI + S/D |
| Interface voltage | 3.3...5V | 3.3...5V | 3.3...5V | 3.3...5V | 3.3...5V | 3.3...5V |
| Slope control | resistor | resistor | resistor | resistor | programmable | programmable |
| chopSync™ | ✓ | ✓ | ✓ | ✓ | - | - |
| stallGuard™ | - | ✓ | ✓ | ✓ | - | - |
| stallGuard2™ | - | - | - | - | ✓ | ✓ |
| coolStep™ | - | - | - | - | ✓ | ✓ |
| spreadCycle™ chopper | - | - | - | - | ✓ | ✓ |
| microPlyer™ | - | - | - | - | ✓ | ✓ |
| MOSFET Type | N & P | N & P | N & P | N & P | N & P | N & P |
| Package | SO28 | QFN28(5x5) | SO28 | QFN32(7x7) | QFN32(5x5) | QFN32(5x5) |
| Evaluation Board | | TMC429+TMC24X-EVAL | TMC429+TMC24X-EVAL | | TMC262-EVAL | TMC389-EVAL |

FIELD BUS INTERFACES

EtherCAT Slave Controller

TMC846x is a family of EtherCAT slave controller IC (ESC). Besides the slave controller - with its proven conformance to the EtherCAT standard - TMC8461 comes with a sophisticated multifunction I/O (MFCIO) block optimized for embedded motion- and motor control applications.



The MFCIO may be accessed directly from the EtherCAT bus or via SPI-interface from the local host MCU.



TMC8460-BI



TMC8461-BA

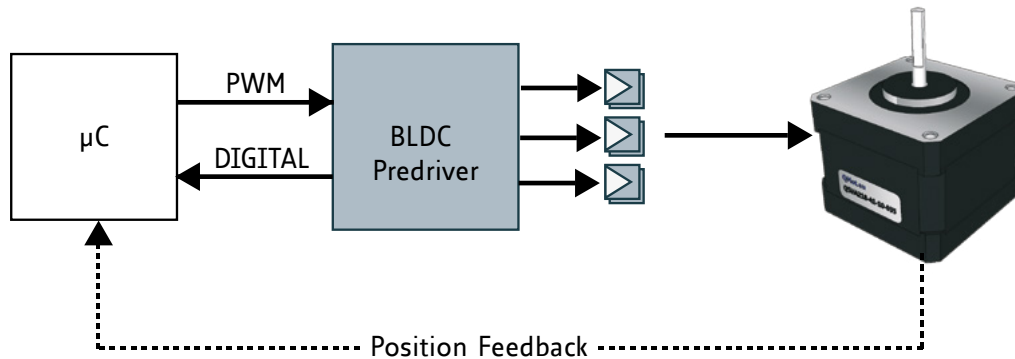


TMC8462-BA

PRODUCT

| | | | |
|----------------|-------------------------|-------------------------|--------------------------------------|
| 1.2V + 3.3V | 3.3V only, or 5V to 35V | 3.3V only, or 5V to 35V | Operating Voltage |
| 2 MII | 2 MII | 2 integrated ETH PHYs | EtherCAT interface |
| 6 | 8 | 8 | FMMUs |
| 6 | 8 | 8 | Syncmanager |
| 16k | 16k | 16k | Process Data RAM |
| 64Bit | 64Bit | 64Bit | Distributed Clocks |
| SPI (30Mbit/s) | SPI (30Mbit/s) | SPI (30Mbit/s) | Process Data Interface |
| 8 | 24 | 24 | Multi -Function I/Os |
| - | 8 x 100mA | 8 x 100mA | High Voltage IOs (3V3 to 24V) |
| ✓ | ✓ | ✓ | Watchdog |
| - | 1 | 1 | DAC Output |
| a/b/n | a+/a-/b+/b-/n+/n- | a+/a-/b+/b-/n+/n- | Encoder Input |
| 1 | 3 | 3 | Step/ Dir Output |
| 3 | 4 | 4 | PWM Outputs |
| ✓ | ✓ | ✓ | SPI Master Interface |
| - | ✓ | ✓ | I2C Interface |
| ✓ | ✓ | ✓ | Watchdog |
| 16MHz | 16MHz / 25MHz | 16MHz / 25MHz | Clock Output |
| BGA VFGG400 | LGA144 (10x10) | LGA121 (9x9) | Package |
| active | preview | preview | Status |

3 Phase Predrivers



The use of BLDC motors as replacement for brushed DC motors is increasing both in EMC critical applications and in applications with highest requirements on energy efficiency.

With a sinewave commutation or field oriented control BLDC motors build silent and efficient drives for heating and ventilation or equipped with a high resolution feedback system and field oriented control also powerful servo drives.


TMC603A-LA

TMC6130-LA

| PRODUCT | TMC603A-LA | TMC6130-LA |
|----------------------------------|--------------------------|--------------|
| Motor type | 3-Phase | 3-Phase |
| Gate Current | 150mA | 1A |
| Motor supply voltage | 12...50V | 4.5...28V |
| Interface | PWM | PWM / SPI |
| Current sensing | sense resistor or MOSFET | single Shunt |
| Short to GND Protection | ✓ | ✓ |
| Integrated switching regulator | 12V | - |
| Integrated linear regulator | 5V | 12V, 3.3V |
| Internal break before make logic | ✓ | - |
| Slope control | ✓ | - |
| Package | QFN52 (8x8) | QFN32 (5x5) |
| Evaluation Board | TMC603-EVAL | TMC6130-EVAL |
| Status | active | active |

POWER SWITCHES

TRINAMIC Motor Driver MOSFET

MB0413A replaces six discrete MOSFET switches and allows for tighter packaging in a servo drive unit. A full high current three phase power stage can be designed on a reduced boardspace with minimum measures of 50x50mm using the powerful 3-Phase PWM gate driver TMC6130-LA.

The powerswitch module layout is optimized for low stray inductance reducing switching losses and causing fewer voltage overshoot. One large contact area on the top of the powerbridge establishes a good thermal connection to a housing or the matching heatsink available at Trinamic.

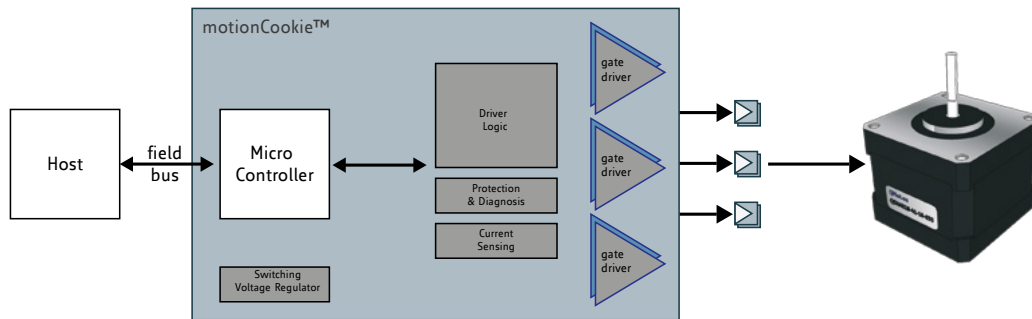


MB00413A

PRODUCT

| | |
|------------------|---------------------------|
| 40V | Voltage |
| 90A (24V) | Typ. Phase Current |
| 130A | Continuous Drain Current |
| | RDSON N(4.5V) |
| 1.44mΩ | RDSON N (10V) |
| | RDSON P(10V) |
| B6-bridge-module | Package |
| 40x20 | Footprint |
| 6xN | FET Type |
| - | Dual Fullbridge Footprint |
| active | Status |

Servo Controller Microsystem



TMCC160 motionCookie™ integrates a powerful gate driver and a Cortex-M4 microprocessor with an integrated field oriented control (FOC) firmware. To keep hardware-design as simple as possible and keep component count low, the SMT microsystem TMCC160-motionCookie contains all core components of an embedded motion control system.

Besides the integrated powerful Cortex M4, which runs the field oriented current control algorithms, the ramp controllers and the protocol-stacks, TMCC160 comes with a powerful integrated gate-driver for gate currents up to $\pm 1\text{A}$ and masters N-channel powerswitches for BLDC or PMSM drives with a power of some 10W to 1kW at 24V supply voltage.



| PRODUCT | TMCC160-LC |
|--------------------------------|---------------------------|
| Motor type | BLDC/ PMSM |
| Gate Current | 1A |
| Motor supply voltage | 4.5...28V |
| Interface | SPI + RS232 + RS485 + CAN |
| TMCL Protocol | ✓ |
| Field Oriented Control | ✓ |
| Velocity Control | ✓ |
| Position control | ✓ |
| Hall Sensor Support | ✓ |
| Encoder Support | a/b/n incremental |
| Integrated Step-Down Converter | 3.3V/ 500mA |
| Evaluation Board | TMCC160-EVAL |
| Status | active |

Disclaimer

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