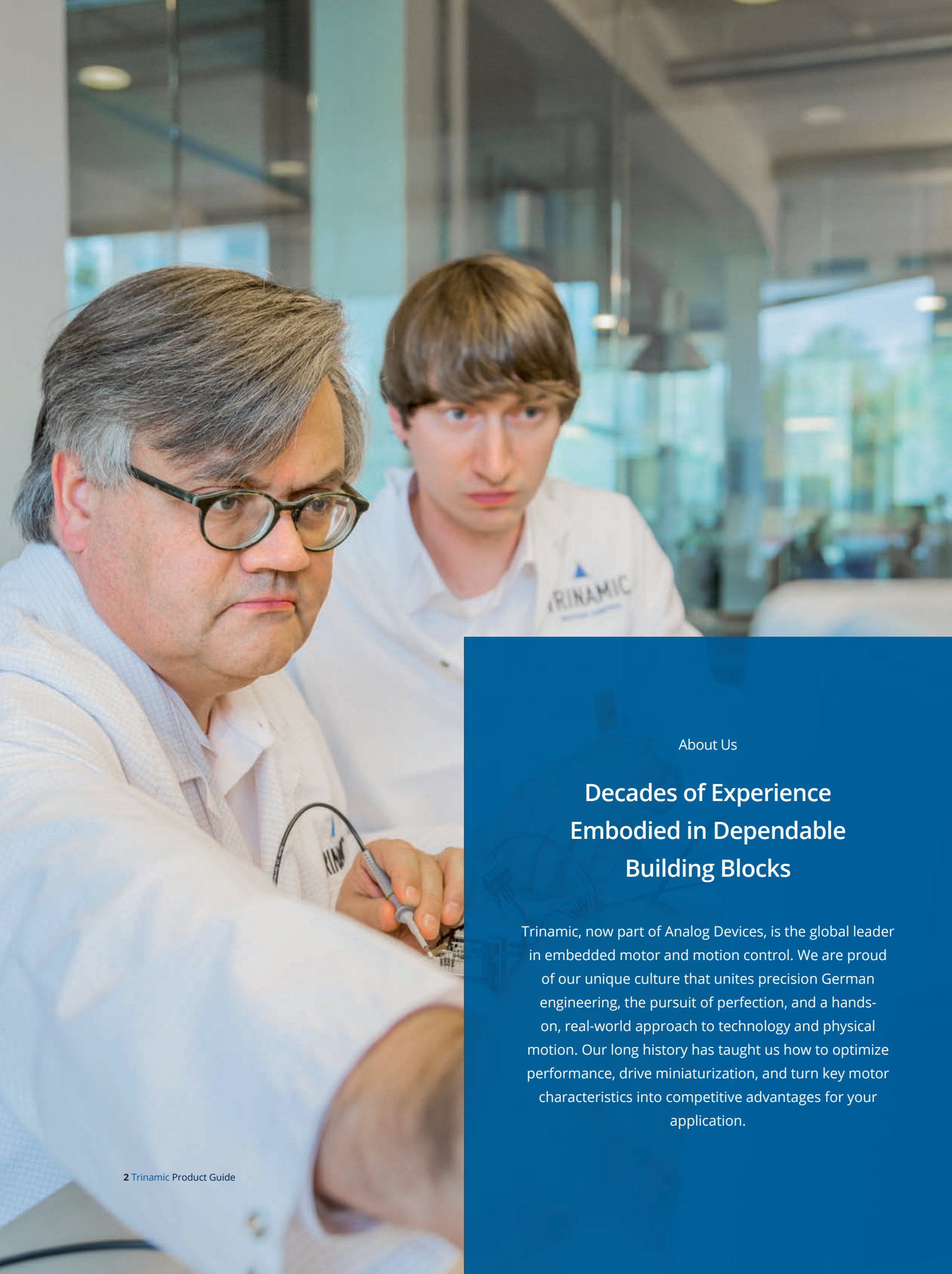
Product Guide 2021

Integrated Circuits

We transform
digital information
into **physical motion.**

TRINAMIC
Now part of Analog Devices

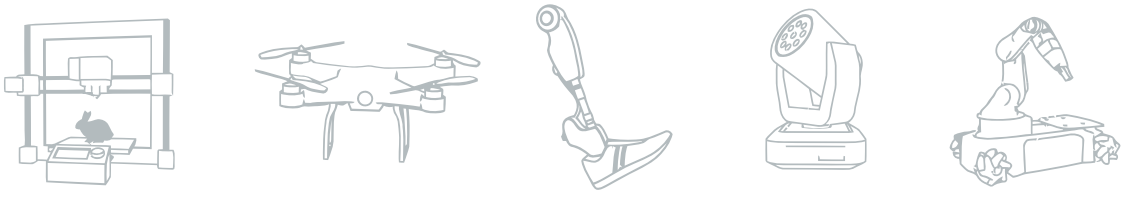


About Us

Decades of Experience Embodied in Dependable Building Blocks

Trinamic, now part of Analog Devices, is the global leader in embedded motor and motion control. We are proud of our unique culture that unites precision German engineering, the pursuit of perfection, and a hands-on, real-world approach to technology and physical motion. Our long history has taught us how to optimize performance, drive miniaturization, and turn key motor characteristics into competitive advantages for your application.

Amplify Your Product With Trinamic Technologies



"Electric motors are such an essential part of everyday life that consumption of these devices has continued to rise in recent years. The growing expanse of the middle class, coupled with increases in household automation and the number of electric motor-driven products around the home, are major drivers of growth."

Bryan Turnbough, analyst with IHS.

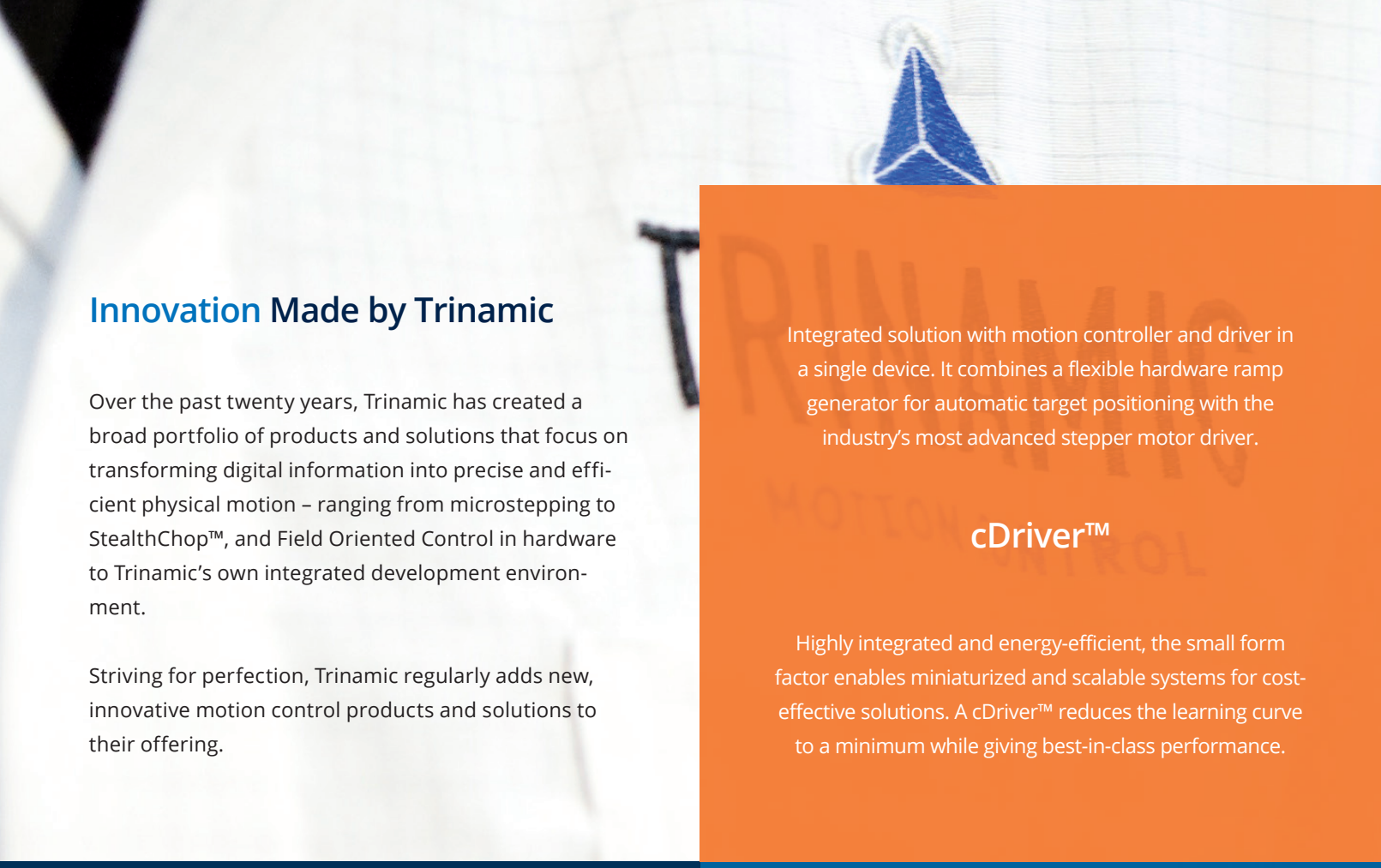
The trend towards automating all aspects of the human environment has resulted in an explosion in the deployment of controlled motion systems. But only when digital information can be transformed into perfect physical motion, previously infeasible use cases suddenly become possible, driving the 4th Industrial Revolution: robotics, IoT, 3D printers, prosthetics, lab automation, and light electric vehicles, to name just a few.

Nevertheless, efficiently turning digital information into physical motion requires more than just transferring data into movement. Motor control technology needs to be easy-to-implement. It demands flexibility to support evolving device capabilities. It requires learning capabilities to turn repetitive automation into intelligent movement. And it needs to fit increasingly small form factors to handle new use cases.

Trinamic, now part of Analog Devices, achieves these critical requirements by making the most advanced motion control as easy as 1-2-3. Our developer toolkits place decades of motor experience at the engineer's fingertips and our hardware building blocks remove complexity to ensure that even engineers without motion control experience can easily optimize motor designs and results to drive innovation faster.

Why do the most forward-thinking companies on the planet repeatedly choose Trinamic, now part of Analog Devices?

Of course, some choose us because of superior product features. However, the majority of our customers selects us because our sole focus on motion control provides access to deep application knowledge, enabling our customers to be the market leader.



Innovation Made by Trinamic

Over the past twenty years, Trinamic has created a broad portfolio of products and solutions that focus on transforming digital information into precise and efficient physical motion – ranging from microstepping to StealthChop™, and Field Oriented Control in hardware to Trinamic's own integrated development environment.

Striving for perfection, Trinamic regularly adds new, innovative motion control products and solutions to their offering.

Integrated solution with motion controller and driver in a single device. It combines a flexible hardware ramp generator for automatic target positioning with the industry's most advanced stepper motor driver.

cDriver™

Highly integrated and energy-efficient, the small form factor enables miniaturized and scalable systems for cost-effective solutions. A cDriver™ reduces the learning curve to a minimum while giving best-in-class performance.

A sensorless load measurement for stepper motors, StallGuard™ gives cost-effective real-time feedback on the load angle. It is the world's first sensorless load detection implemented in a standard stepper motor driver.

StallGuard™

Eliminating the need for reference or limit switches with sensorless homing, it reduces the cost and complexity of applications where precise referencing is required. The high-resolution feedback of StallGuard2™ also allows for a continuous condition monitoring of the system.

CoolStep™ sensorless load-dependent current control is based on the StallGuard™ load values. It always drives the motors at their optimum current and therefore enables to drive the motors in the most energy-efficient way.

CoolStep™

Without the need for any sensors, CoolStep™ eliminates the security current margin, boosts the motor, and avoids stall and step loss to improve reliability of the entire system.

StealthChop™ delivers exceptionally quiet stepper motor performance. Motors operating at low speed exhibit a phenomenon known as magnetostriction, which causes an audible high-pitch noise.

StealthChop™

Based on the current feedback, the chip regulates the voltage modulation to minimize current fluctuation. StealthChop™ applications have achieved noise levels of 10dB and more below classic current control.

Using SpreadCycle™, the microstep current sine wave is always well-formed with a smooth zero-crossing. Drivers with SpreadCycle eliminate the spike in the current waveform caused by the motor's back EMF.

SpreadCycle™

Stepper motors can be driven very fast without resonance effects with SpreadCycle. This reduces vibrations and improves efficiency as no energy is wasted to resonances.

The SixPoint™ ramping profile allows for faster positioning. It adds a freely configurable start/stop frequency to a linear motion profile plus a reduced acceleration value at high velocity.

SixPoint™

Advanced ramping profiles reduce the jerk at the end of a standard acceleration ramp. This makes it perfect for high-speed positioning and handling jerk-sensitive goods or objects with extensive inertia.

The Trinamic Motion Control Language is a programming language dedicated to motion control. It uses simple commands for positioning and setting all parameters of the motion controller, accelerating application development.

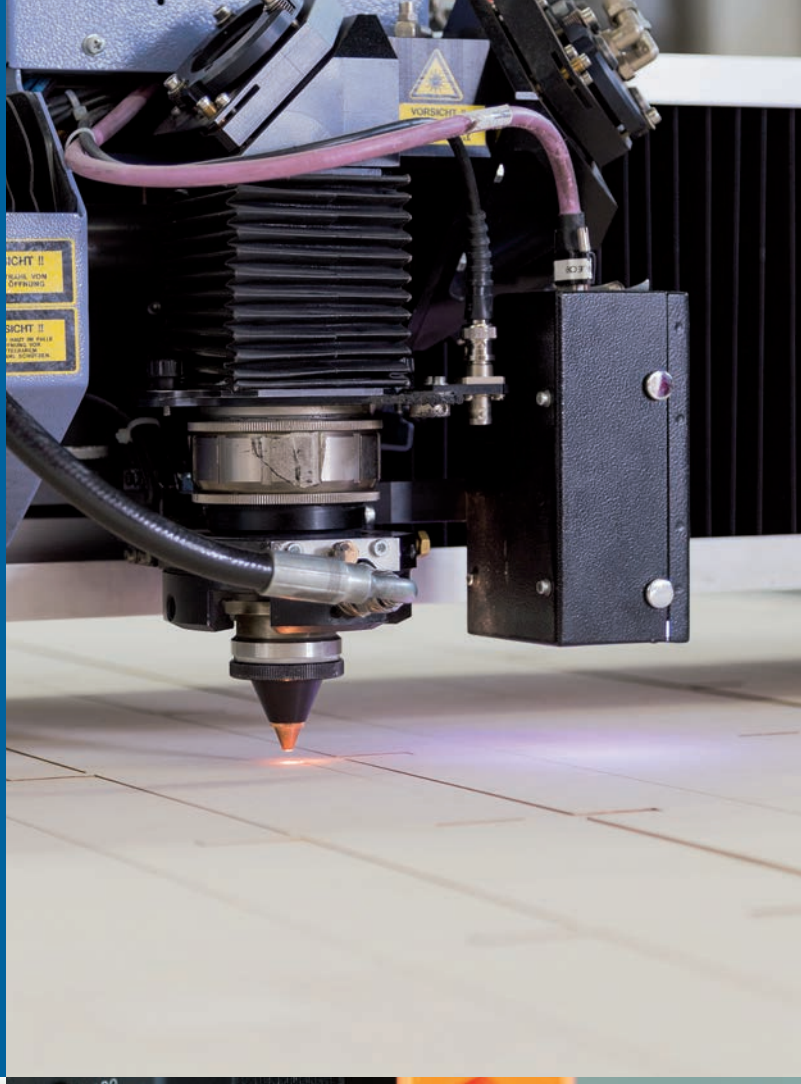
TMCL™

At the same time, it offers a comprehensive command set for all necessary motor control parameters. Supported by the TMCL-IDE, the integrated development environment, it allows quick integration into your own firmware.

Thanks to smooth, precise, and exceptionally quiet motor control, 3D printing matured into a technology that's accessible to consumers around the world.

Small Motors Are Ubiquitous!

However, they're only a small part of the motors around us. With industry-leading motion control that seamlessly blends into the environment, Trinamic provides best-in-class solutions for prosthetics, home automation, and portable devices of the future.



Wherever reliable positioning is required, Trinamic's dependable hardware building blocks form the system's foundation.

What is Your Application?

Trinamic's microsystems are suitable for all applications requiring controlled motion. Their products set the performance standard for applications like digital manufacturing, IoT, medical devices, robotics, and lab automation.

The Most Advanced Motion Control Is As Easy As 1-2-3

Trinamic's toolkits shorten design cycles and improve product experience. Let Trinamic take care of motion control, so you can focus on your core applications.

Get Started

With the modular evaluation system

All evaluation boards are based on proven open-source designs, including the Landungsbrücke interface board.

Open-Source

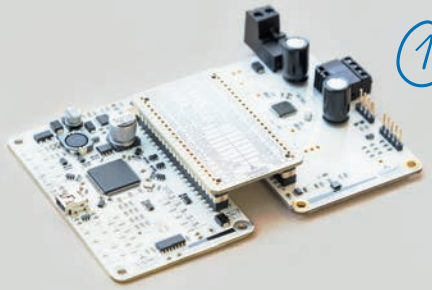
Simply download files for a quick design-in, and your prototype will be ready in no-time. Modify the firmware or use the stand-alone evaluation board with the API and control it with your own microcontroller.

Trinamic's free and easy to use integrated development environment is perfect for developing stand-alone TMCL™ applications and exploring the chip's feature set.

TMCL-IDE

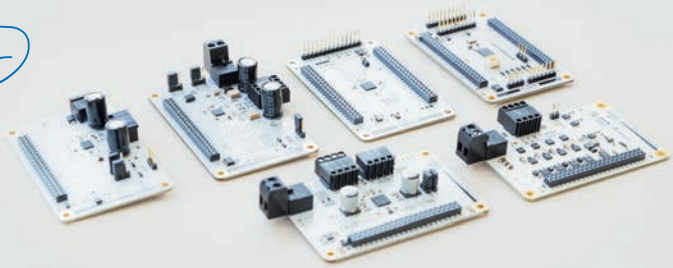
The flexible GUI supports the use of commands in direct mode, monitors real-time behavior visualized in graphs, and logs and stores data. Export all settings and integrate them directly into your own firmware project.

Start With the Interface Board



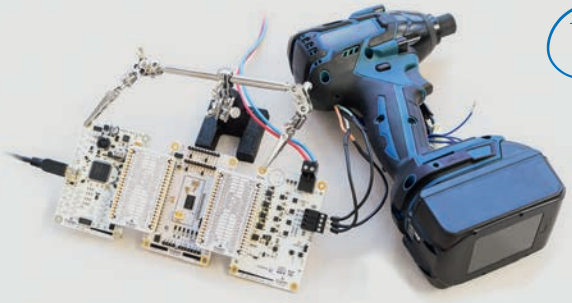
Each Trinamic Evaluation Kit consists of a Landungsbrücke interface board, connector board, and evaluation board. The interface board contains an NXP MK20 cortex M4 processor for communication with the evaluation board, forming the connection between your PC and Trinamic's powerful ICs.

Connect the Evaluation Board



Connect your preferred evaluation board with the interface board using the Eselsbrücke connector board. You can even combine a few together to copy your application's setup. All evaluation boards are proven open-source designs that reduce design time, resources, and time to market.

Discover Powerful Technology



Explore the full potential of Trinamic's solutions using the free TMCL-IDE software. This GUI-based development environment has simple commands for positioning and to set parameters. The ready-to-use code libraries can be repurposed to your own application to accelerate design-cycles.

Get started at

trinamic.com/eval-kits

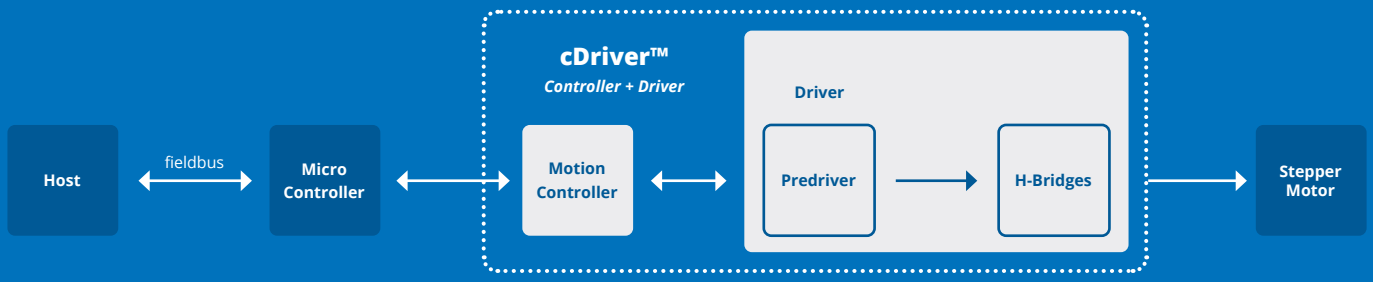
Software and Tools

Reference and Documentation

Support and Advice

Motion Control System Architecture

Stepper Motor System Architecture



Controller

Microcontroller: The usage of integrated motion controllers reduces the requirements for the MCU. Only a serial interface like SPI is needed.

Motion Controller: Dedicated motion controllers offload real-time calculations from the MCU. The integrated logic unit calculates ramping and positioning in proven, integrated hardware that's safe and secure. Motion controllers for SPI chipset may also incorporate microstep sequencing units.

Motor Driver

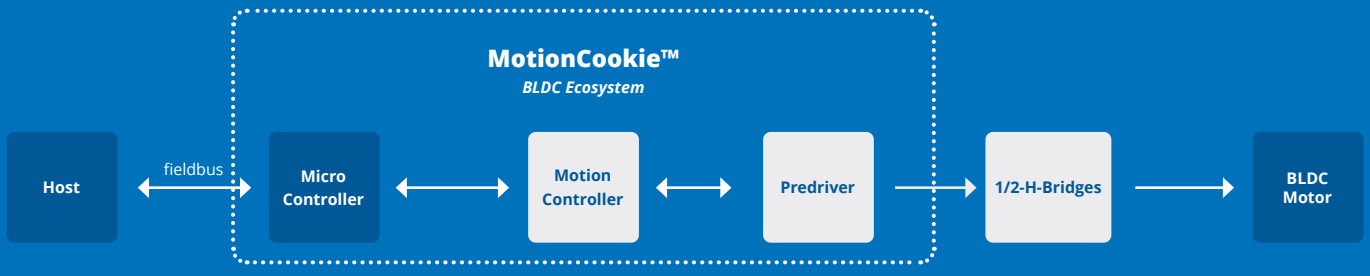
Predriver: Integration of predrivers, sensing, and protection circuitry. The predriver may also include microstep sequencing or commutation logic.

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

cDriver™: Integrated solution with motion controller, predriver, and driver in one single device.

MotionCookie™: System in a package (SiP) that bundles the performance of Trinamic ICs with proven firmware.

BLDC Motor System Architecture

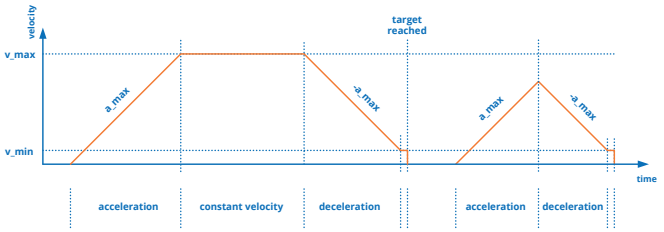


Ramping Profiles

Trapezoidal Ramping

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

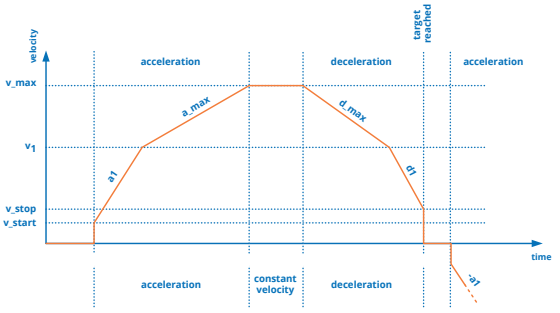
Trinamic's motion controllers with linear ramping allow for fast and accurate positioning of one or several axes, offloading the MCU from demanding real-time tasks.



SixPoint™ Ramping

Trinamic's advanced SixPoint™ ramping profile allows for faster positioning through additional acceleration segments.

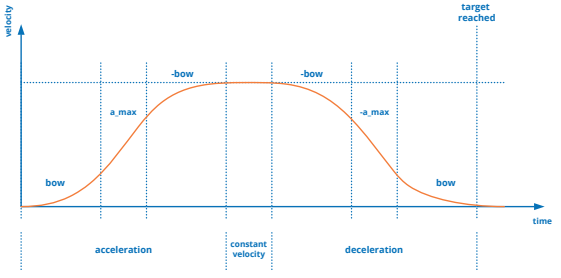
By adding the freely configurable start/stop frequency to a linear motion profile, SixPoint ramping mitigates the disadvantages of trapezoidal ramping. The reduced acceleration at the end of a standard acceleration ramp minimizes jerking, enabling higher speeds.



S-Shaped Ramping

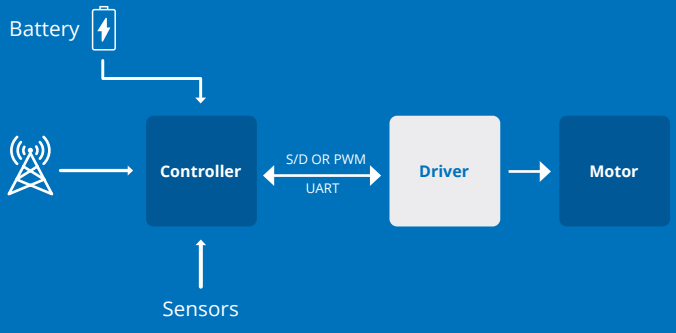
For high-speed positioning as well as for handling jerk-sensitive goods or objects with extensive inertia, sinusoidal (S-shaped) ramping profiles might be necessary.

The continuous acceleration and deceleration reduce any sudden movement and can be programmed to the application's needs for the best motion possible.



Energy-Efficient Motor Drivers

Battery-Powered



Small and Powerful

Driven by miniaturization, daily life is increasingly being automated. Shrinking electronics, however, are just one small piece of the puzzle for home automation and portable devices. Actuators also need to be silent and efficient to seamlessly blend into the environment.

Save battery life with lowest in class RDSon, reducing power dissipation and heat to a minimum, and Trinamic's highly efficient CoolStep™, automatically adjusting the motor current to the mechanical load.

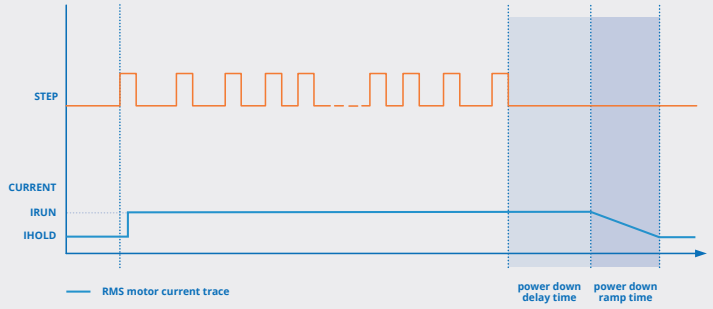


PRODUCT	TMC2300-LA	TMC6300-LA	TMC7300-LA
Number of axes	1	1	2 (1)
Motor type	2-Phase Stepper	3-Phase BLDC, PMSM	Brushed DC
Phase current (RMS)	1.2A	2A	2A (2.4A)
Motor supply voltage	2V (1.8V)...11V	2V (1.8V)...11V	2V (1.8V)...11V
Standby current draw	<50nA typ.	<50nA typ.	<50nA typ.
Max. microstep resolution	256	-	-
Controller interface	S/D + UART + digital	6 line HS & LS	PWM, UART
StallGuard4™	✓	-	-
CoolStep™	✓	-	-
StealthChop2™	✓	-	-
Pulse generator	✓	-	-
MicroPlyer™	✓	-	-
Current regulator	-	-	✓
Package	QFN20 (3x3)	QFN20 (3x3)	QFN20 (3x3)
Product status	active	active	active

Saving Battery Life

Small, silent, precise, and extremely efficient with a standby current draw of < 50nA (typ.), Trinamic's motor drivers for battery-powered applications set the standard for IoT and home automation. Together with the lowest in class RDSon of LS 170mΩ & HS 170mΩ (typ.), these motor driver ICs save battery life like no other.

As the chip doesn't compromise on performance, it's also ideal for turning once stationary devices into portable, battery-powered devices that are convenient to use.



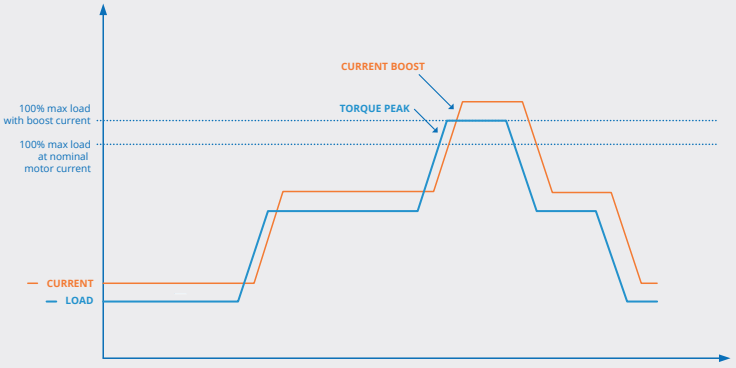
Automatic Standby Current Reduction

Even in IoT devices that only use the motor a few seconds per day, the motor current still claims a major part of the energy budget.

The TMC2300 stepper motor driver reduces the motor current after a defined delay time from the last step pulse. While maintaining the current position, this reduces the overall power consumption considerably.

Load-Dependent Current Control

Reducing the motor current to the minimum amount required for the actual load situation, CoolStep™ decreases the motor energy consumption by up to 90%. This further reduces heat generation and allows for smaller motors since less torque reserve is required.



Stepper Motor Drivers

Step/Direction Chipset

						
PRODUCT	**TMC2100-LA**	**TMC2130-LA**	**TMC2100-TA**	**TMC2130-TA**	**TMC2160A-TA**	**TMC2300-LA**
Number of axes	1	1	1	1	1	1
Stepper motor type	2-Phase	2-Phase	2-Phase	2-Phase	2-Phase	2-Phase
Phase current (RMS)	1.2A	1.2A	1.4A	1.4A	ext. MOSFETs	1.2A
Motor supply voltage	5V...46V	5V...46V	5V...46V	5V...46V	8V...60V	2V (1.8V)...11V
Max. microstep resolution	256	256	256	256	256	256
Controller interface	S/D + digital	SPI + S/D	S/D + digital	SPI + S/D	SPI + S/D	S/D + UART + digital
ChopSync™	-	✓	-	✓	✓	-
StallGuard2™	-	✓	-	✓	✓	-
StallGuard4™	-	-	-	-	-	✓
CoolStep™	-	✓	-	✓	✓	✓
SpreadCycle™ chopper	✓	✓	✓	✓	✓	-
StealthChop™	✓	✓	✓	✓	✓*	✓*
MicroPlyer™	✓	✓	✓	✓	✓	✓
Package	QFN36 (5x6)	QFN36 (5x6)	eTQFP48 (7x7)	eTQFP48 (7x7)	eTQFP48 (7x7)	QFN20 (3x3)
Product status	active	active	active	active	active	active

* StealthChop2™

Minimized Board Space

Trinamic's monolithic stepper motor drivers form powerful integrated systems by integrating a state-of-the-art microstepping sequencer and power drivers. Reducing the number of external components required, Trinamic's stepper drivers allow for the smallest systems.

With the latest current-control technologies and industry-leading feature set, you can create silent, efficient, precise, and cost-efficient applications.






TMC2202-WA	TMC2208-LA	TMC2209-LA	TMC2224-LA	TMC2225-SA	TMC2226-SA	PRODUCT
1	1	1	1	1	1	**Number of axes**
2-Phase	2-Phase	2-Phase	2-Phase	2-Phase	2-Phase	**Stepper motor type**
1.4A	1.4A	2.0A	1.4A	1.4A	2.0A	**Phase current (RMS)**
5V...36V	5V...36V	5V...29V	5V...36V	5V...36V	5V...29V	**Motor supply voltage**
256	256	256	256	256	256	**Max. microstep resolution**
S/D + UART + digital	S/D + UART + digital	S/D + UART + digital	S/D + UART + digital	S/D + UART + digital	S/D + UART + digital	**Controller interface**
-	-	-	-	-	-	**ChopSync™**
-	-	-	-	-	-	**StallGuard2™**
-	-	✓	-	-	✓	**StallGuard4™**
-	-	✓	-	-	✓	**CoolStep™**
✓	✓	✓	✓	✓	✓	**SpreadCycle™ chopper**
✓	✓	✓	✓	✓	✓	**StealthChop2™**
✓	✓	✓	✓	✓	✓	**MicroPlyer™**
QFN32 (5x5)	QFN28 (5x5)	QFN28 (5x5)	QFN28 (5x5)	HTSSOP28 (9.7x4.4)	HTSSOP28 (9.7x4.4)	**Package**
active	active	active	active	active	active	**Product status**

Stepper Motor Drivers

SPI Chipset

PRODUCT	TMC236B-PA	TMC246B-PA	TMC260C-PA	TMC261C-PA	TMC2660C-PA	TMC262C-LA
Number of axes	1	1	1	1	1	1
Stepper motor type	2-Phase	2-Phase	2-Phase	2-Phase	2-Phase	2-Phase
Phase current (RMS)	1.1A	1.1A	1.4A	1.4A	2.2A (2.8A)	ext. MOSFETs
Motor supply voltage	7V...34V	7V...34V	5V...40V	5V...60V	5V...30V	5V...60V
Max. microstep resolution	16, 64	16, 64	256	256	256	256
Controller interface	analog, SPI	analog, SPI	SPI + S/D + digital	SPI + S/D + digital	SPI + S/D + digital	SPI + S/D + digital
Differential Current Sensing	-	-	-	-	-	✓
ChopSync™	✓	✓	-	-	-	-
StallGuard™	-	✓	✓*	✓*	✓*	✓*
CoolStep™	-	-	✓	✓	✓	✓
SpreadCycle™ chopper	-	-	✓	✓	✓	✓
MicroPlyer™	-	-	✓	✓	✓	✓
MOSFET type	internal TrenchFET	internal TrenchFET	internal TrenchFET	internal TrenchFET	internal TrenchFET	N + P
Package	QFP44 (10x10)	QFP44 (10x10)	QFP44 (10x10)	QFP44 (10x10)	QFP44 (10x10)	QFN32 (5x5)
Product status	active	active	active	active	active	active

* StallGuard2™

Low Power Dissipation

Using the lowest RDSon TrenchFET switches, Trinamic's stepper drivers reduce power loss and eliminate the need for heatsinks when used in their full specified current range. This decreases both the system's power consumption and total system cost.

Allowing for powerful, flexible designs with a high current profile that perfectly matches the motor, the chips greatly reduce design complexity and development time. Advanced diagnostic functions complete the package, providing continuous system condition monitoring.

TMC239A-SA	TMC249A-LA	TMC249A-SA	TMC2590-TA	PRODUCT
2	1	1	1	**Number of axes**
2-Phase	2-Phase	2-Phase	2-Phase	**Stepper motor type**
ext. MOSFETs	ext. MOSFETs	ext. MOSFETs	ext. MOSFETs	**Phase current (RMS)**
7V...34V	7V...36V	7V...36V	5V...60V	**Motor supply voltage**
16, 64	16, 64	16, 64	256	**Max. microstep resolution**
analog, SPI	analog, SPI	analog, SPI	SPI + S/D + digital	**Controller interface**
-	-	-	✓	**Differential Current Sensing**
✓	✓	-	-	**ChopSync™**
-	✓	✓	✓*	**StallGuard™**
-	-	-	✓	**CoolStep™**
-	-	-	✓	**SpreadCycle™ chopper**
-	-	-	✓	**MicroPlyer™**
N + P	N + P	N + P	N + P	**MOSFET type**
SO28 (18x7.5)	QFN32 (7x7)	SO28 (18x7.5)	TQFP32-EP (5x5)	**Package**
active	active	active	active	**Product status**

* StallGuard2™

Integrated Motion Controller and Stepper Driver

Single-Axis cDriver™

Digital to Physical

Trinamic's cDriver™ is an integrated solution with a motion controller and driver in a single device. It combines a sophisticated ramp generator for automatic target positioning with the industry's most advanced stepper motor driver.

High integration, high energy efficiency, and a small form factor enable miniaturized and scalable systems for cost-effective solutions. Trinamic's cDrivers transform digital information into perfect physical motion.



PRODUCT	TMC5130A-TA	TMC5160A-TA	TMC5160A-WA
Number of axes	1	1	1
Stepper motor type	2-Phase	2-Phase	2-Phase
Phase current (RMS)	1.4A	up to 20A (ext. MOSFETs)	up to 20A (ext. MOSFETs)
Motor supply voltage	5V...46V	8V...60V	8V...60V
Max. microstep resolution	256	256	256
Controller interface	SPI + S/D, UART	SPI + S/D, UART	SPI + S/D, UART
Encoder interface	✓	✓	✓
StallGuard2™	✓	✓	✓
CoolStep™	✓	✓	✓
SpreadCycle™ chopper	✓	✓	✓
StealthChop™	✓	✓*	✓*
Ramp generator	SixPoint™, trapezoidal	SixPoint™, trapezoidal	SixPoint™, trapezoidal
DcStep™	✓	✓	✓
Package	eTQFP48 (7x7)	eTQFP48 (7x7)	QFN56 (8x8)
Product status	active	active	active

* StealthChop2™

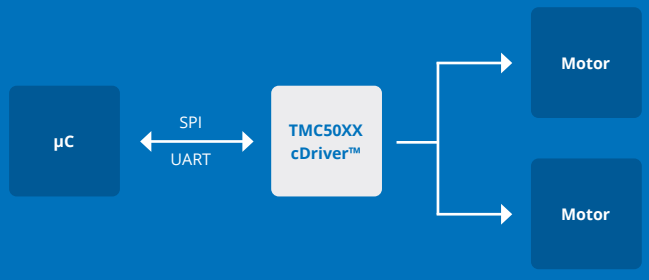
Compact Multi-Axis

For all applications like surveillance cameras, office automation equipment, or infusion pumps that demand multiple dependable motors and a small build volume, dual-axis cDriver™ chips are the perfect solution.

A high level of integration at a low cost per axis reduces system cost. Integrated advanced ramp controllers shorten development cycles and minimize cost of ownership.

Integrated Motion Controller and Stepper Driver

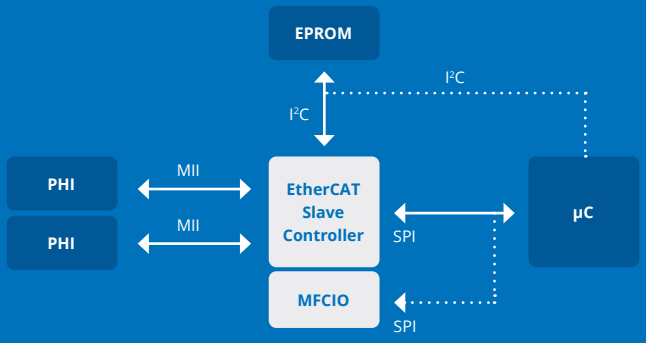
Dual-Axis cDriver™



TMC5031-LA	TMC5041-LA	TMC5062-LA	TMC5072-LA	PRODUCT
2	2	2	2	**Number of axes**
2-Phase	2-Phase	2,3-Phase	2-Phase	**Stepper motor type**
2x 1.1A	2x 1.1A	2x 1.1A / 1x 2.2A	2x 1.1A / 1x 2.2A	**Phase current (RMS)**
5V...16V	5V...26V	5V...20V	5V...26V	**Motor supply voltage**
256	256	256	256	**Max. microstep resolution**
SPI	SPI	SPI + S/D, UART	SPI + S/D, UART	**Controller interface**
-	-	✓	✓	**Encoder interface**
✓	✓	✓	✓	**StallGuard2™**
✓	✓	✓	✓	**CoolStep™**
✓	✓	✓	✓	**SpreadCycle™ chopper**
-	✓	-	✓	**StealthChop™**
SixPoint™, trapezoidal	SixPoint™, trapezoidal	SixPoint™, trapezoidal	SixPoint™, trapezoidal	**Ramp generator**
-	-	✓	✓	**DcStep™**
QFN48 (7x7)	QFN48 (7x7)	QFN48 (7x7)	QFN48 (7x7)	**Package**
active	active	active	active	**Product status**

Fieldbus Interfaces

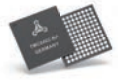
EtherCAT Slave Controller



Real-Time Communications

EtherCAT is a high performance, low cost, easy to use industrial Ethernet technology with a flexible topology. It's the fastest industrial Ethernet technology that synchronizes with nanosecond accuracy.

Trinamic slave controllers connect peripherals optimized for embedded motion and motor control applications to the fast fieldbus and allow for accurate synchronization of distributed drives.

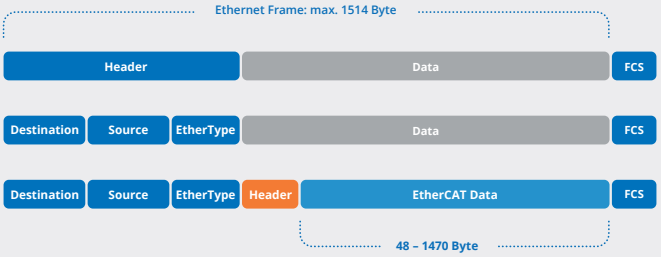


PRODUCT	TMC8461-BA	TMC8462-BA
Operating voltage	3.3V / 5V...24V	3.3V / 5V...24V
Controller interface	SPI (30Mbit/s)	SPI (30Mbit/s)
Bus interface	2x MII	2x int. Phy
Encoder interface	✓	✓
Process data memory	16K	16K
Sync manager	8	8
Fieldbus memory management unit	8	8
Distributed clocks	64bit	64bit
Multi-function I/Os	24 (incl. 8x HV)	24 (incl. 8x HV)
Integrated DC/DC regulator	2x 500mA	2x 500mA
Step/Direction output	✓	✓
SPI master	✓	✓
I²C master	✓	✓
Package	BGA144 (10x10)	BGA121 (9x9)
Product status	active	active

Powered by Beckhoff Slave Stack Code

Widely adopted as communication protocol for industrial applications, EtherCAT offers a flexible topology uniquely suited for complex industrial systems. Over 4,800 companies world-wide endorse the exceptionally stable standard, making it ideal for products with a long life-cycle.

By using the original slave stack code by Beckhoff, Trinamic EtherCAT slave controllers can effortlessly communicate with all other EtherCAT devices.

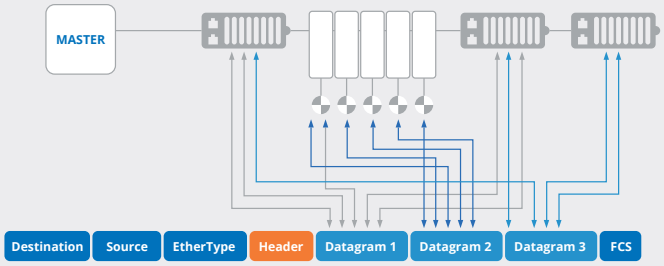


Extended Feature Set

Extending the feature set of EtherCAT's core technology, the slave controllers come with a broad array of peripherals and features:

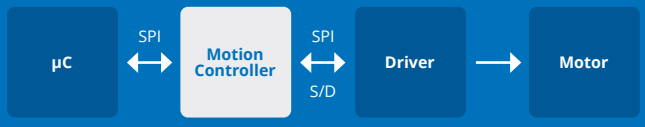
- An integrated smart-peripherals block accessible from an MCU or EtherCAT master

- An SPI master and encoder interface in addition to the PWM unit and Step/Dir interface, that can be directly mapped to the PDO (Process Data Object) by the memory manager. This unique SPI interface enables latency-free read from an ADC or encoder or write to a DAC.



Dedicated Motion Controller

Trapezoidal and Multi-Axis



SPI Chipset

A single bi-directional interface for motion commands and diagnostics keeps the count of required lead traces low. With one low-speed SPI interface from the microcontroller, it enables extremely miniaturized and lean designs.

The SPI chipset gives full control over microstepping tables, making a seamless change of microstep resolution on the fly possible. For optimized motor control, microstepping tables are adaptable in the motion controller.




PRODUCT	TMC4210-I	TMC429-I	TMC429-LI	TMC429-PI24
Number of axes	1	3	3	3
Motor type	Stepper	Stepper	Stepper	Stepper
Operating voltage	3.3V...5V	3.3V...5V	3.3V...5V	3.3V...5V
Microstep resolution	S/D	64 (SPI)	64 (SPI) , 256 (S/D)	64 (SPI) , 256 (S/D)
Controller interface	SPI	SPI	SPI	SPI
Driver interface	S/D	SPI	SPI, S/D	SPI
Encoder interface	-	-	-	-
Closed-loop control	-	-	-	-
ChopSync™	-	-	-	-
DcStep™	-	-	-	-
Trapezoidal ramp generator	✓	✓	✓	✓
Advanced ramp generator	-	-	-	-
Ref. inputs	2	3 x 2	3 x 2	3 x 2
Package	SSOP16 (5x4)	SSOP16 (5x4)	QFN32 (5x5)	SOP24 (15.5x10.5)
Product status	active	active	active	active

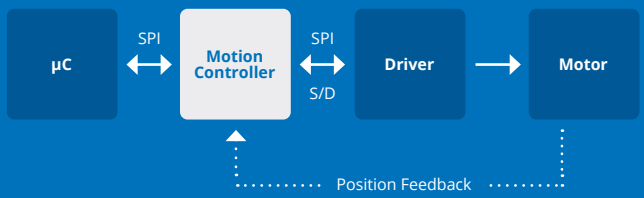
Step and Direction Chipset

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

Since the interfaces are widespread in the industry, S/D offers many compatible solutions. Especially at high micro-step resolutions and step frequencies, S/D architectures reduce the required bandwidth compared to SPI or PWM interfaces.

Dedicated Motion Controller

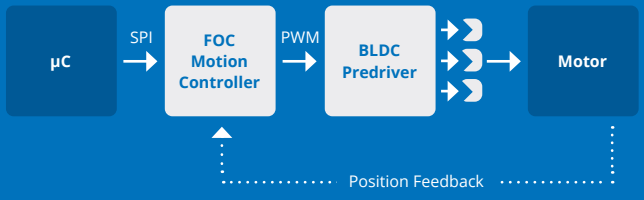
Advanced Ramping and Closed-Loop



TMC457-BC	TMC4361A-LA	PRODUCT
1	1	**Number of axes**
Stepper, Piezo	Stepper	**Motor type**
1.5V + 3.3V	3.3V / 5V	**Operating voltage**
2048 , S/D	256 , S/D	**Microstep resolution**
SPI	SPI	**Controller interface**
SPI, S/D	SPI, S/D, PWM	**Driver interface**
ABN	ABN, SPI, SSI	**Encoder interface**
-	✓	**Closed-loop control**
✓	✓	**ChopSync™**
-	✓	**DcStep™**
✓	✓	**Trapezoidal ramp generator**
S-Shaped	SixPoint™, S-Shaped	**Advanced ramp generator**
2	3	**Ref. inputs**
FBGA144 (13x13)	QFN40 (6x6)	**Package**
active	active	**Product status**

Dedicated Motion Controller

Embedded Servo Controller



Outstanding Dynamics

Servo controllers are key in industry-leading applications with synchronous drives. And with field oriented control integrated in reliable building blocks, Engineers can now implement a servo controller in a day.

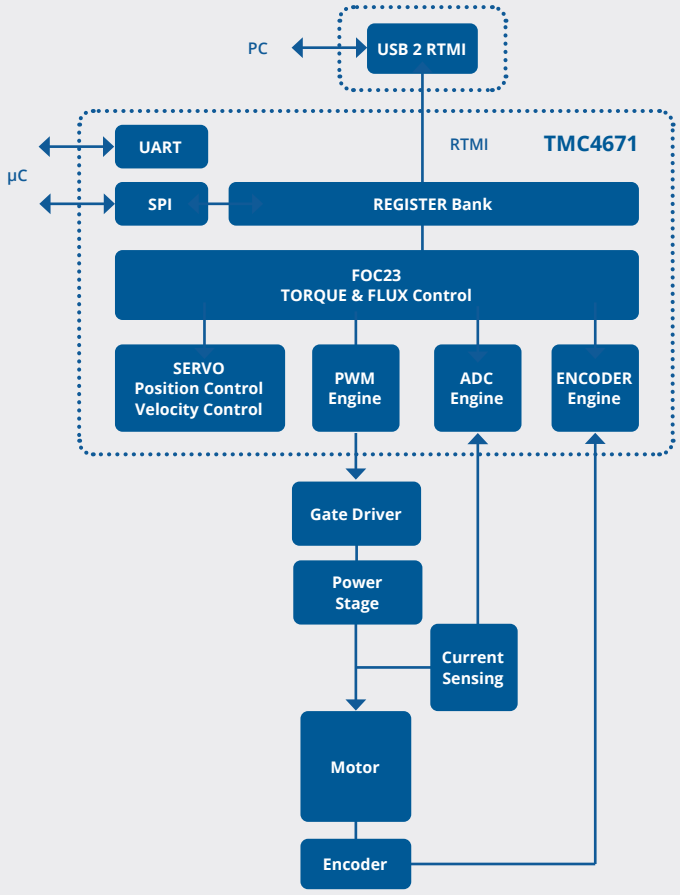
Trinamic's fully integrated servo controller ICs significantly reduce development time. With all time-critical calculations in hardware, just a few lines of code are needed to develop dynamic servo systems.

PRODUCT	TMC4671-LA	TMC8670-BI
Number of axes	1	1
Motor type	PMSM, 2-Phase Stepper, BLDC, DC	3-Phase BLDC, 2-Phase Stepper
Controller interface	SPI, S/D, UART, RTMI	SPI, UART
Bus interface	-	2x MII for EtherCAT
Bus protocol	-	CANopen over EtherCAT (CoE)
Operating voltage	3.3V + 5V	1.2V + 3.3V
Encoder interface	2x Incremental ABN, Digital Hall, Analog Hall, Analog SinCos	2x Incremental ABN, Digital Hall, Analog Hall, Analog SinCos
Dual encoder support	✓	✓
Field oriented control	✓	✓
Current loop frequency	25kHz...100kHz	25kHz...100kHz
Velocity loop frequency	25kHz...100kHz	4kHz
Position loop frequency	25kHz...100kHz	4kHz
Ramp generator	-	-
Package	QFN76 (10.5x6.5)	FCSG325 (11x11)
Product status	active	active

Field-Oriented Control

The most efficient way to drive electrical motors is field oriented control (FOC). Also called vector control, it eliminates torqe and velocity ripple of BLDC motors by phasing out the magnetic fields of the rotor. This results in efficient BLDC drives offering higher torque, higher speed, and smoother control.

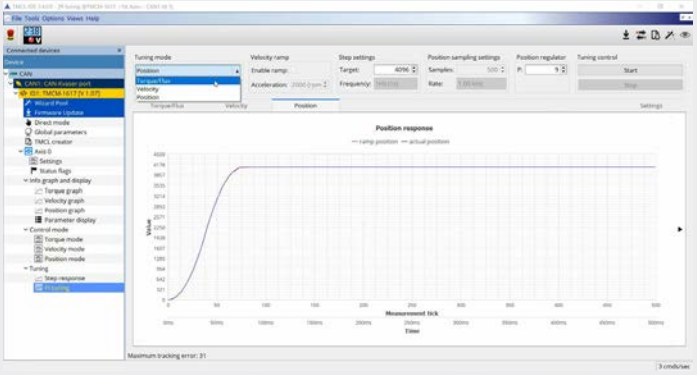
Dedicated hardware building blocks like the TMC4671, however, offer much more than higher torque, speed, and dynamics. Tuned correctly, the torque, velocity, and position parameters can be used for health checks and adjusted in real time to meet consumer demands.



Speed Up Motor Drive Commissioning

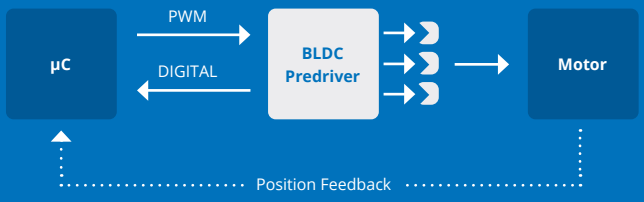
Allocating valuable resources to program field-oriented control in software is now a thing of the past. Instead, the fully integrated servo controller IC takes care of all control loops in hardware, converting AC signals to DC using Clarke and Park transformations.

To complete the toolkit for servo controllers, a graphical user interface allows for easy setup of all values, including the PI parameters for your application. Featuring an auto-tuning tool, it speeds up motor drive commissioning of dynamic servo drives with highest efficiency.



BLDC Predrivers

3-Phase Predrivers



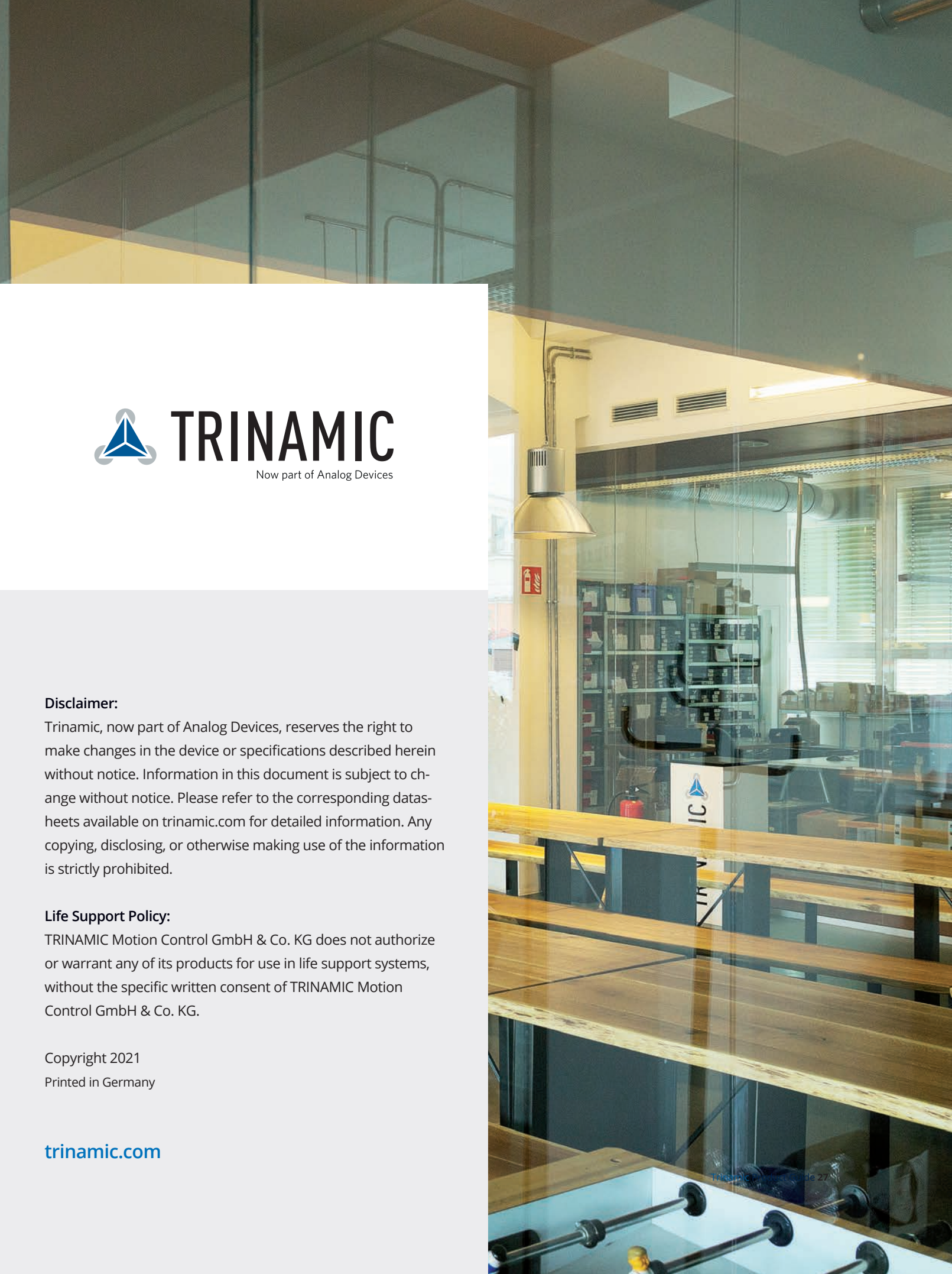
Powerful Servos

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

With a sinewave commutation, BLDC motors form silent and efficient drives for heating and ventilation. Equipped with a high-resolution feedback system and field oriented control, they are the best solution for powerful servo drives.




PRODUCT	TMC6100-LA	TMC6140-LA	TMC6200-TA	TMC6300-LA
Number of axes	1	1	1	1
Motor type	3-Phase BLDC, PMSM	3-Phase BLDC, PMSM	3-Phase BLDC, PMSM	3-Phase BLDC, PMSM
Gate current	0.5A / 1A / 1.5A	0.5A / 1A	0.5A / 1A / 1.5A	-
Motor supply voltage	8V...60V	6V...30V	8V...60V	2V (1.8V)...11V
Controller interface	3/6 line HS & LS, SPI	6 line HS & LS, UART-TxD	3/6 line HS & LS, SPI	6 line HS & LS
Shunt amplifier	-	triple	triple	-
Short to GND protection	✓	✓	✓	✓
Switching regulator	-	3.3 V, 500 mA	-	-
Linear regulator	5V, 12V	5V, 10V	5V, 12V	1.8V
Low side charge pump	-	✓	-	-
Break before make logic	✓	✓	✓	✓
Slope control	✓	✓	✓	-
MOSFET type	N	N	N	N
Package	QFN37 (7x7)	QFN36 (5x6)	eTQFP48 (7x7)	QFN20 (3x3)
Product status	active	active	active	active



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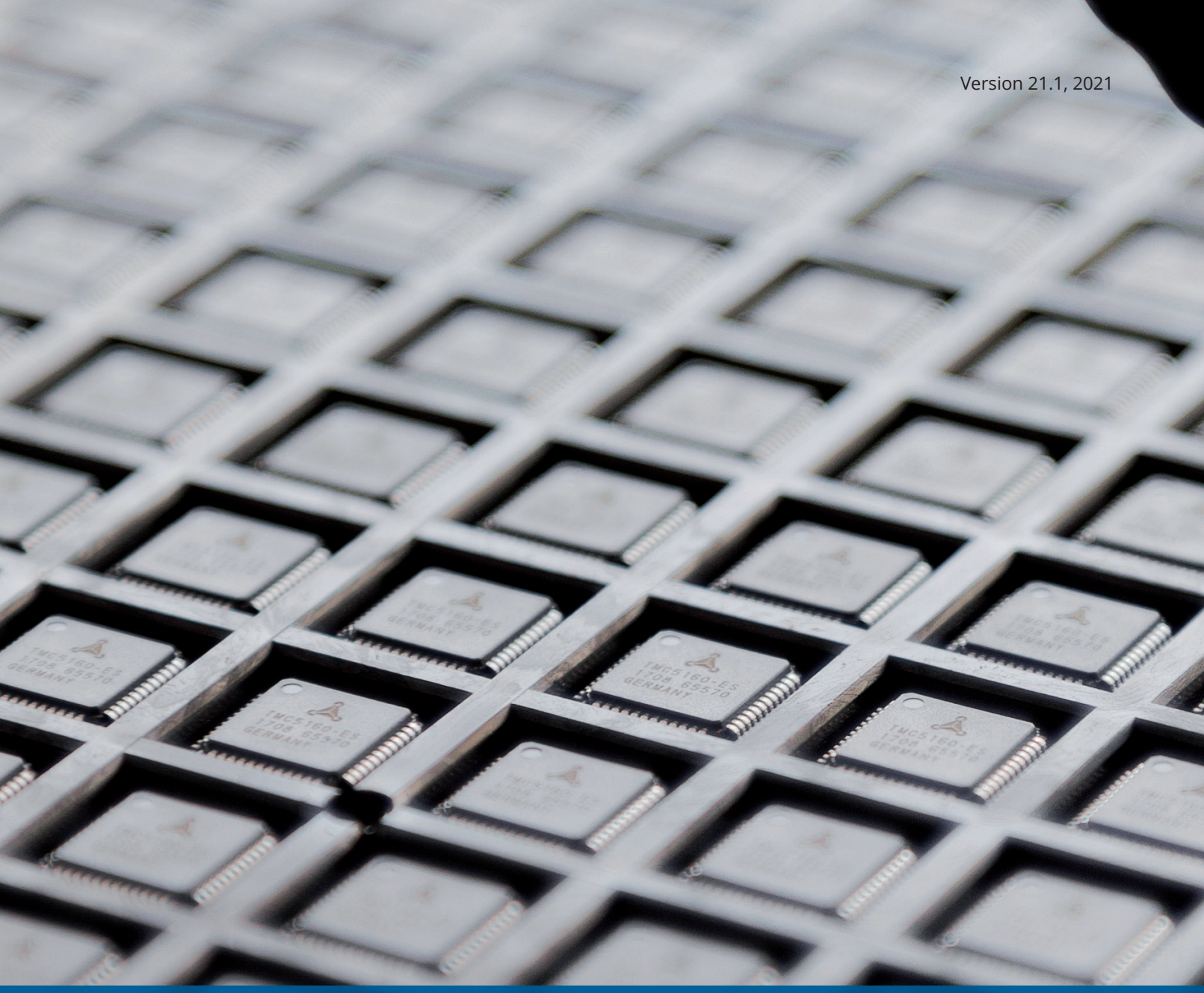

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