

TRINAMIC MOTION CONTROL

# IC PRODUCTS

**TMC332**

**HIGH PRECISION SEQUENCER**

**DEC-2008**

Webinar 16-DEC-2008

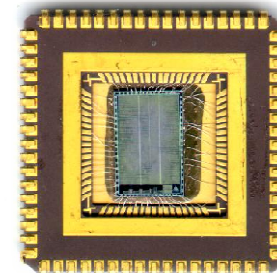
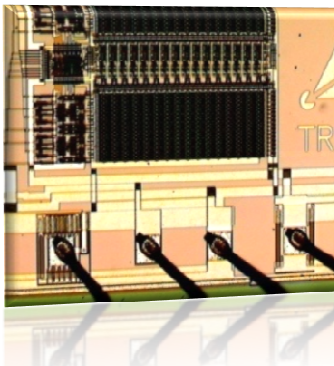


## TRINAMIC: Key Facts



German Company – privately owned, engineer driven, fast growing

Sole focus: Integrated Circuits and Modules for electric motors

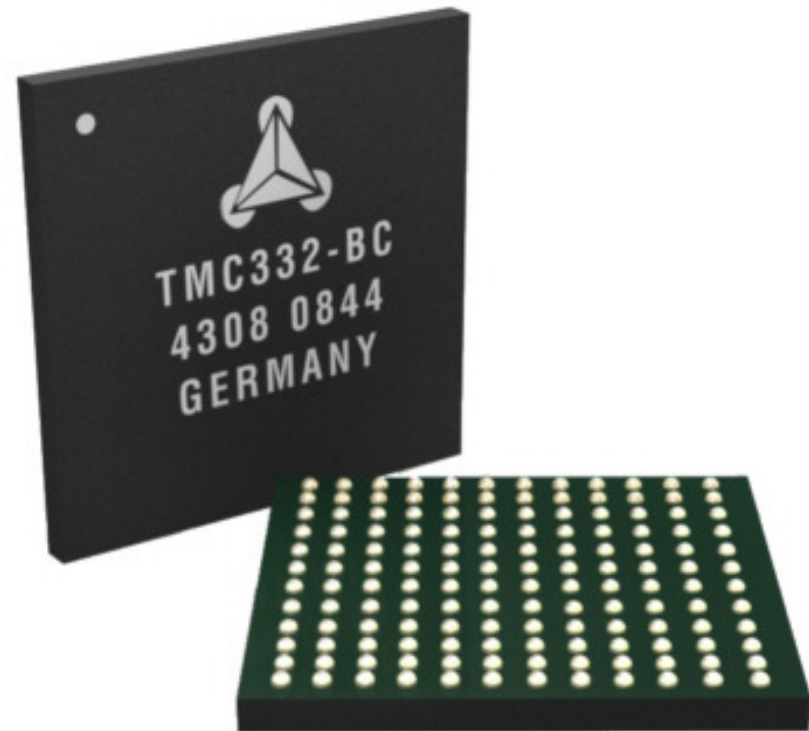




## NEW PRODUCT: TMC332 Sequencer

THE HIGH PRECISION MICROSTEP SEQUENCER  
FOR 2- and 3-phase STEPPER motors

- **PRECISE**
- **SMOOTH**
- **EASY**



## MEGATRENDS:

More and more stepper motors are used in application where **EXTREMELY HIGH RESOLUTION** is required:

- Scanning microscopes
- Long range surveillance cameras
- Astronomical telescopes
- Laser positioning applications



(generally: All applications with an high optical amplification)

- Micropositioning in semiconductor handling and cell technology

(generally: Manipulation of fine structured objects)

- Measuring machines

## **EXTREMELY HIGH RESOLUTION:**

**TRINAMIC has successfully completed "high res" projects  
– especially the ZEISS Imager/Observer focus controller –  
and developed a new, unique modulation scheme:**

# **smoothMod™**

### **What challenges had to be overcome?**

- low PWM frequency but high resolution  
(PWM frequency cannot be increased over certain values)
- silent, equidistant movement
- immediate response for "mechanic look & feel"

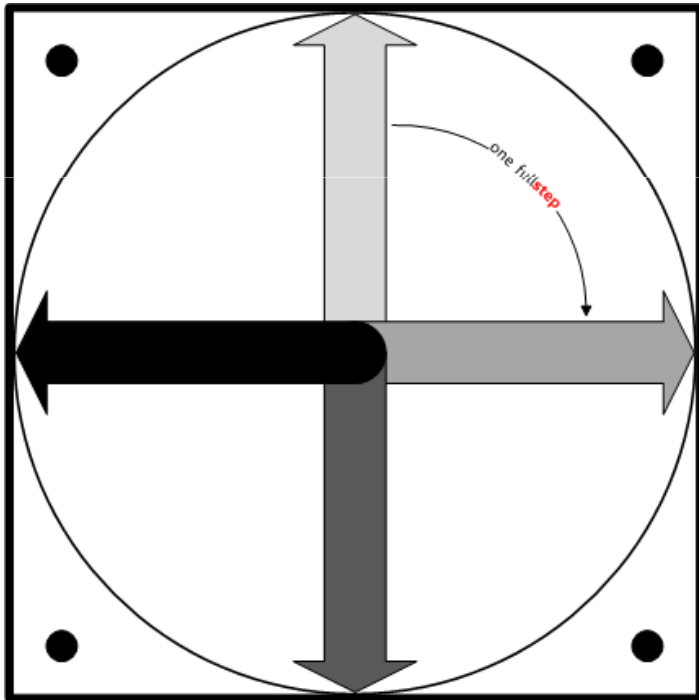


## MICROSTEPPING: COMMON WAY

fullstepping

simplest stepper motor

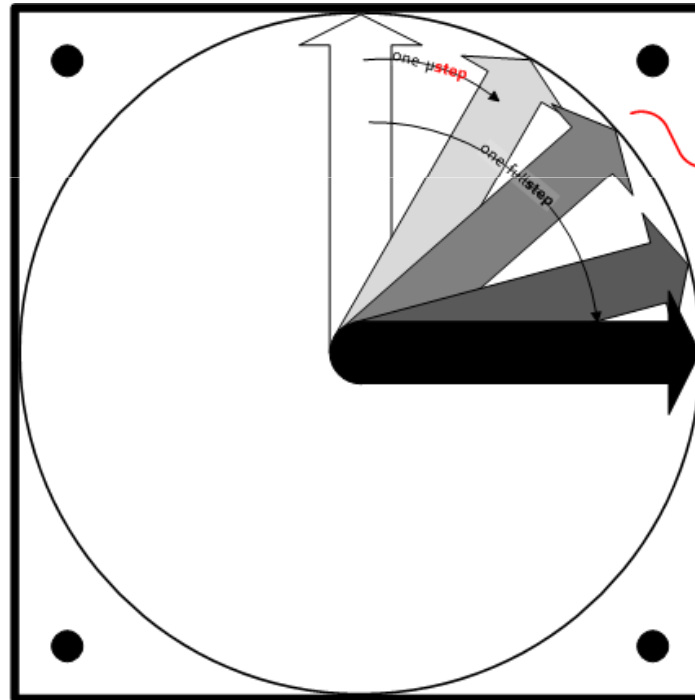
(4 fullsteps per revolution : 90° per fullstep)



4x microstepping

simplest stepper motor

(4 fullsteps per revolution : 90° per fullstep)

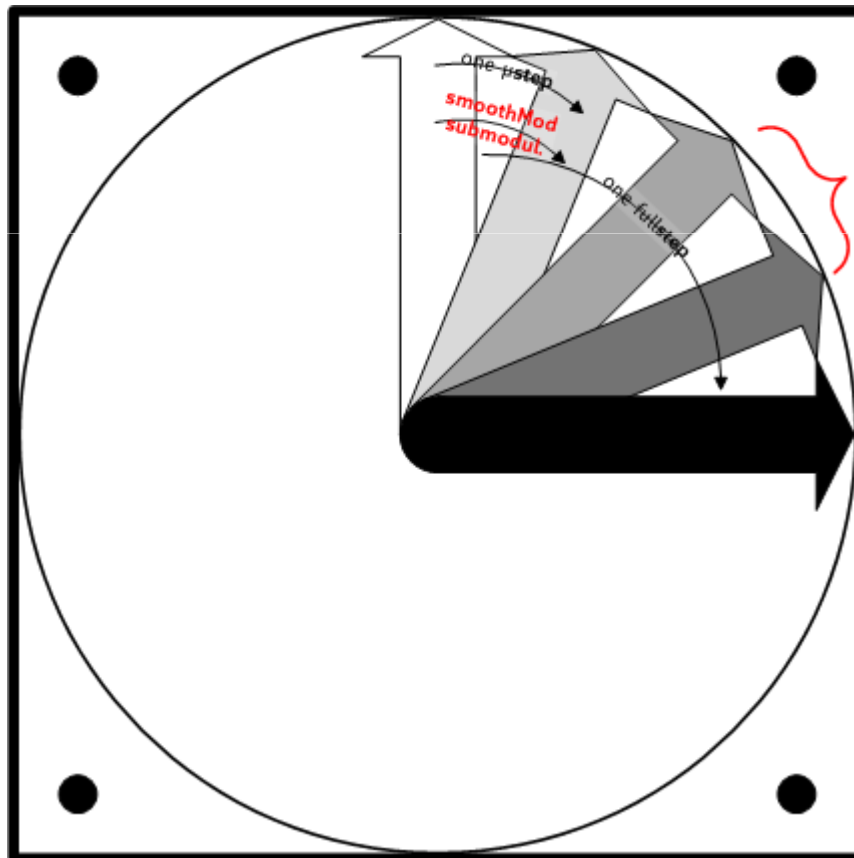


**Microsteps are not equidistant**

- smooth movement
- but no precise positioning

## smoothMod™: How is it done? (1/2)

4x microstepping with TMC332  
simplest stepper motor  
(4 fullsteps per revolution : 90° per fullstep)



**μsteps are equidistant**

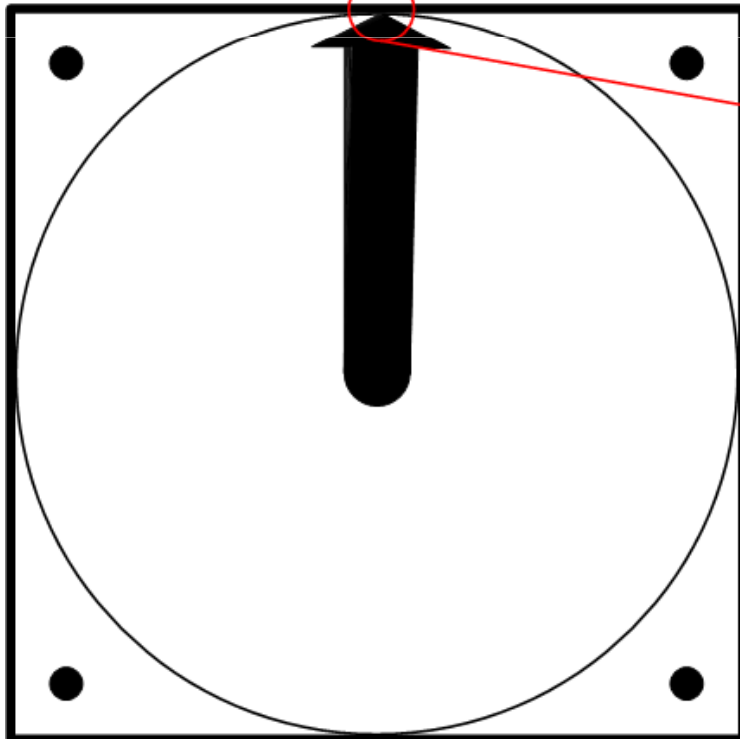
- smoothMod™ submodulation
- very smooth movement
- precise positioning on every μstep

# smoothMod™

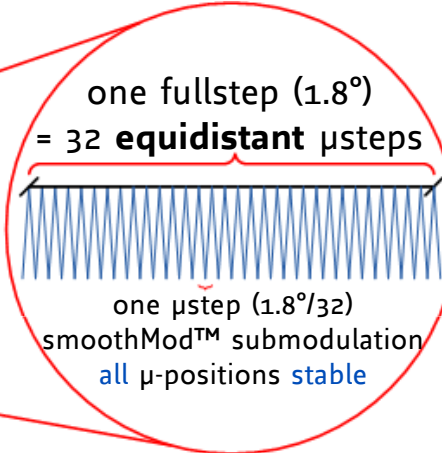
# smoothMod™: How is it done? (2/2)



e.g. 32x microstepping with **TMC332**  
today's standard stepper motor  
(200 fullsteps per revolution : 1.8° per fullstep)



microstepping  
with TMC332



microstepping  
the common way



# smoothMod™



## FEATURES: TMC332 Sequencer

### THE HIGH PRECISION MICROSTEP SEQUENCER FOR smooth motion applications

- 2-phase stepper motor control
- 3-phase stepper motor control
- 51k  $\mu$ steps per revolution  
(for standard 2- and 3-phase motors)
- smoothMod™ sub-modulation  
for scaling quantization compensation

### Modes of operation

- standalone mode  
configuration out of the box
- peripheral mode  
configurable  $\mu$ step width (e.g. 1  $\mu$ step = 5nm or 1 $\mu$ step = 0.007°)



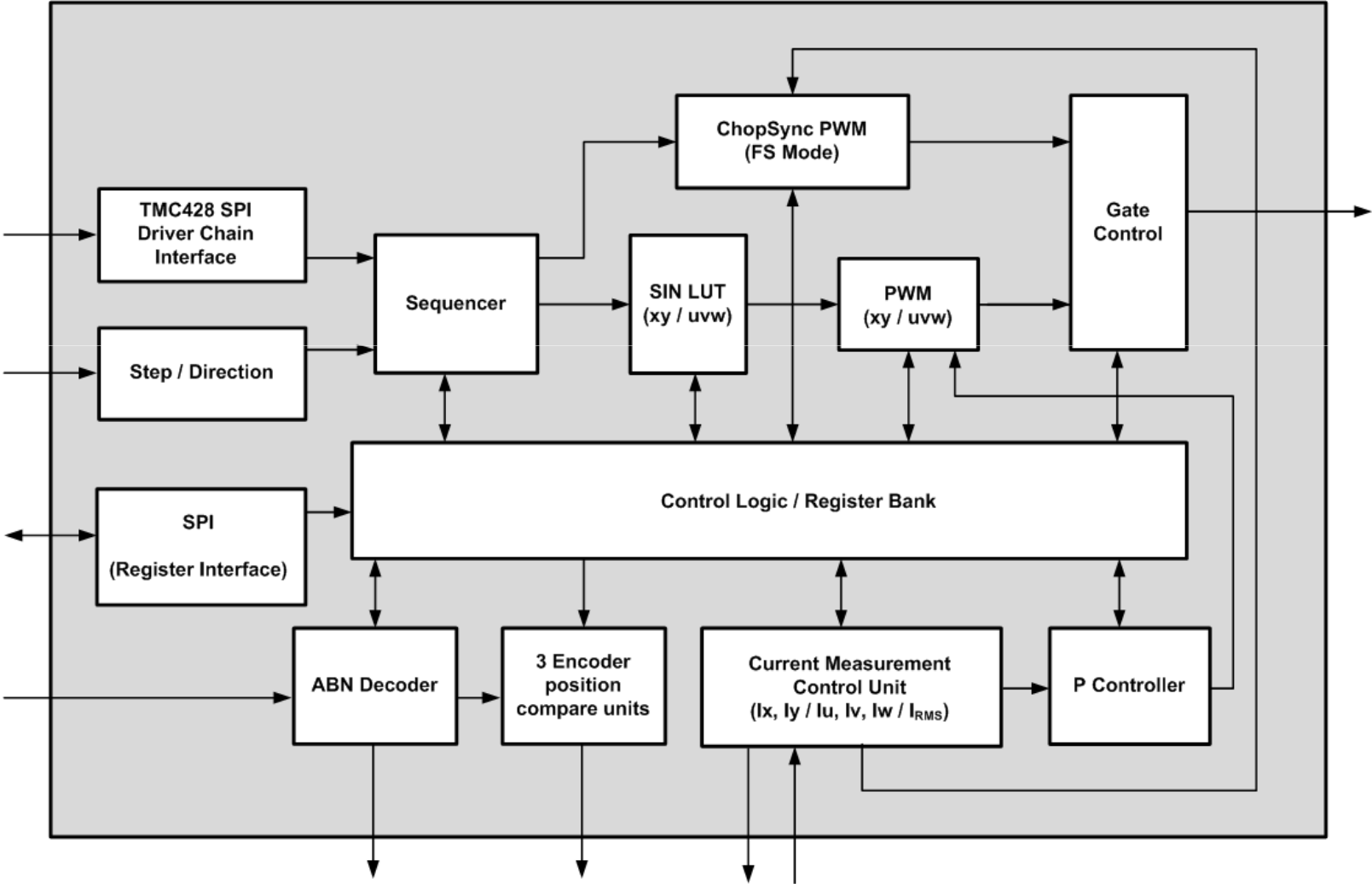


## NEW PRODUCT: TMC332 Sequencer

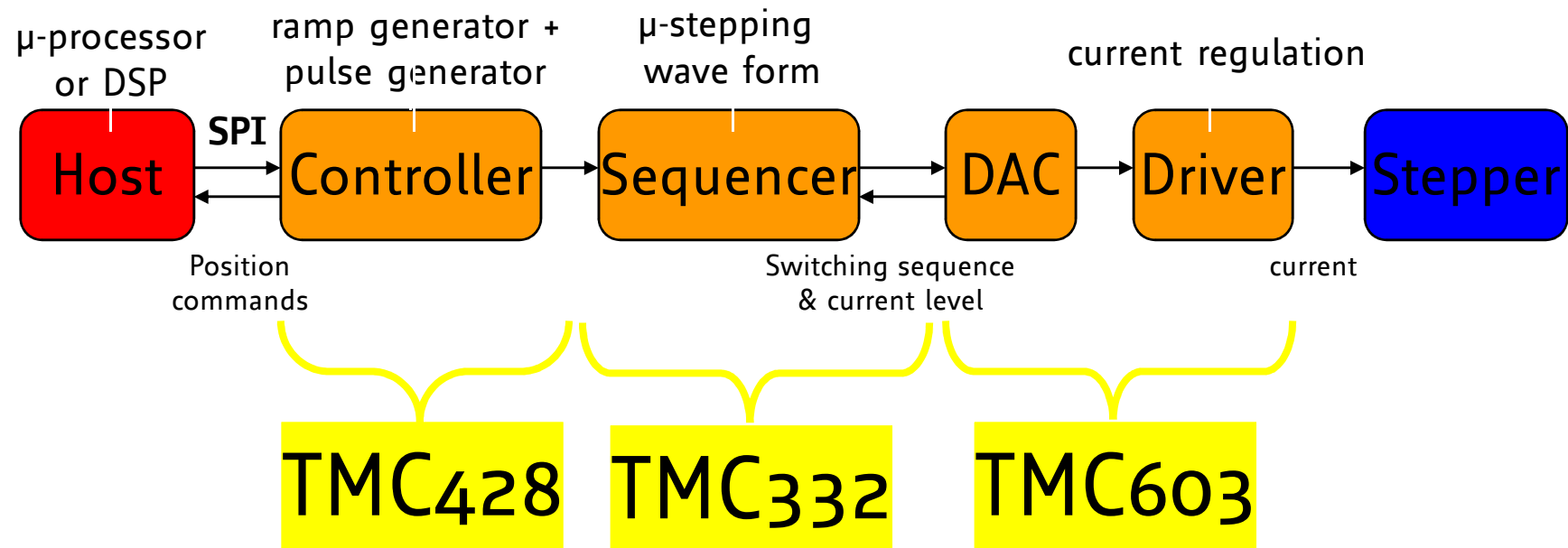
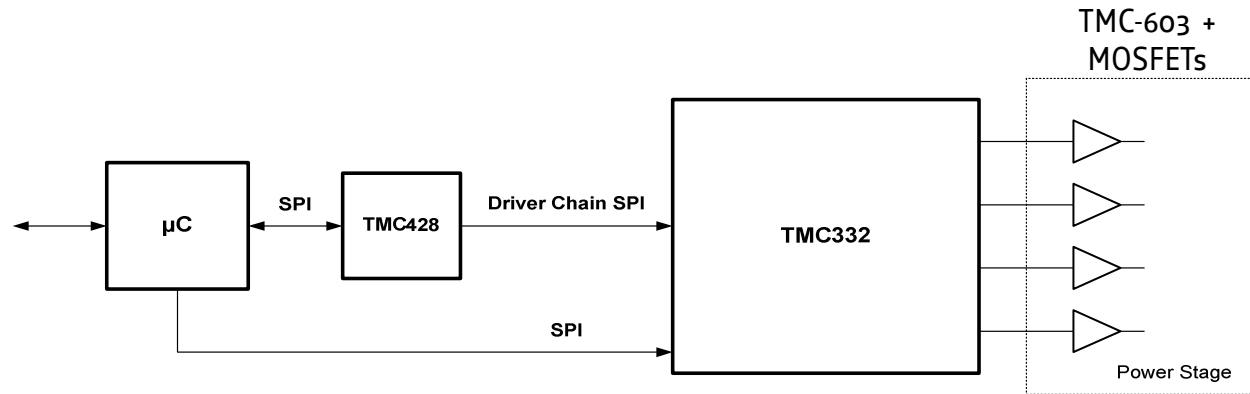
THE **HIGH PRECISION MICROSTEP SEQUENCER**  
FOR **smooth motion applications**

- Classical two wire step/direction interface
- Driver chain step direction interface for TMC428
- Common SPI interface for parameterizing TMC332 and TMC428
  
- Integrated current measurement ADC  
(just a few cheap additional components required)
- Integrated current regulation
  
- Manual or automatic micro-/full step switching for higher speeds

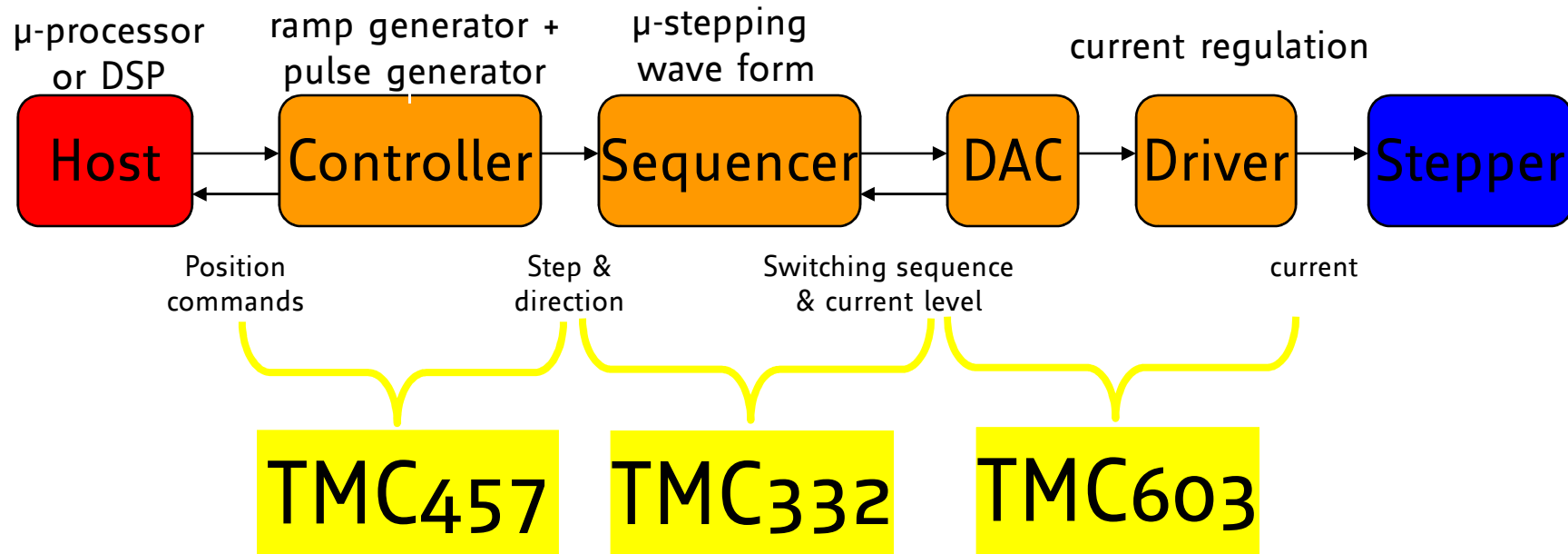
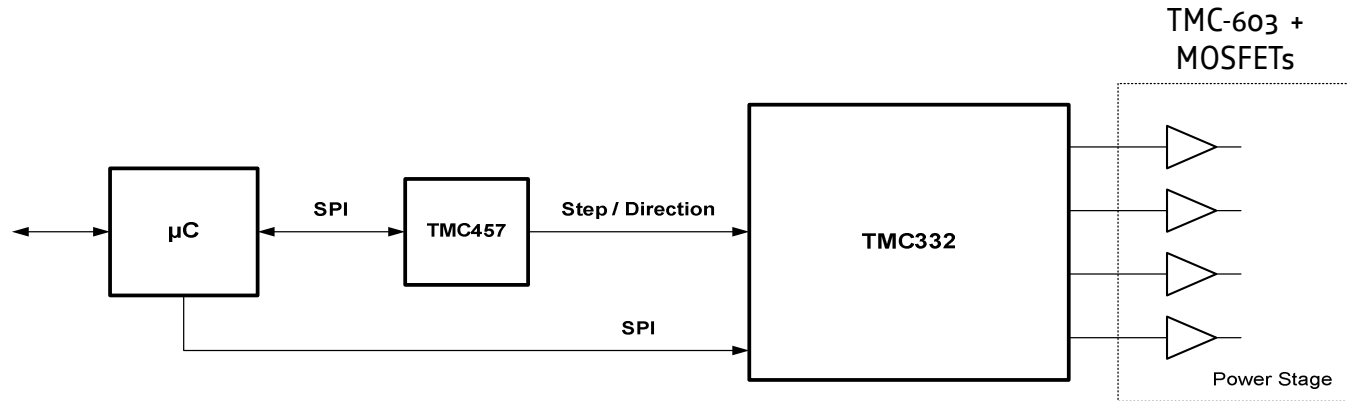
# BLOCK DIAGRAMM: TMC332



## SYSTEM ENVIRONMENT: SPI-Chipset

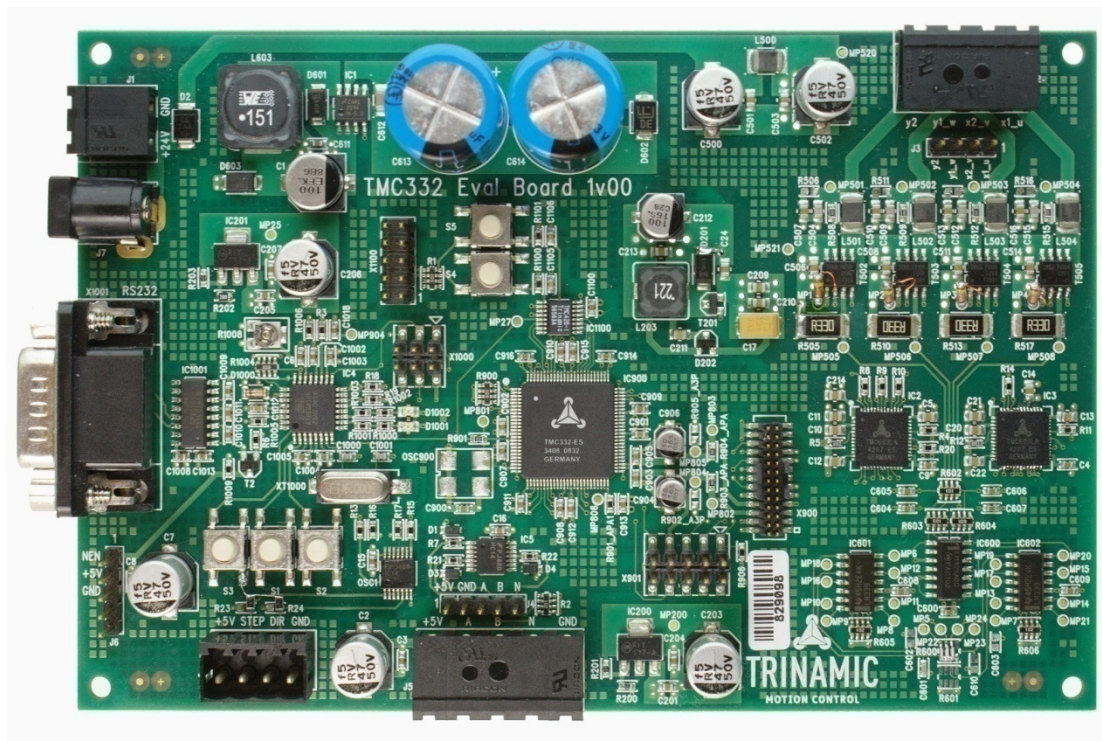


# SYSTEM ENVIRONMENT: STEP&DIRECTION



## EVALUATION: TMC332-EVAL

### EVALUATION BOARD FOR TMC332 SEQUENCER



Host interface:  
RS232

For 2- or 3-phase stepper  
motors  
(up to 2A motor current)

Encoder input

Step/Direction input

## WHAT ARE POSSIBLE CUSTOMERS?

- Customers that want a higher resolution than most controller provide
- Nanotechnology
- Microscopy
- Cell manipulation
- Semiconductor technology, i.e. wafer positioning
- Micromanipulation
- Telescopes

**THANK  
YOU**



