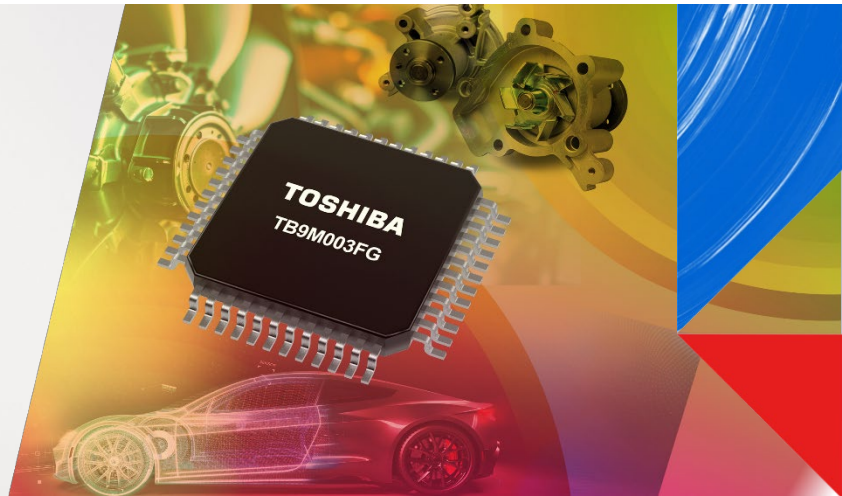# TOSHIBA

SmartMCD™
TB9M003FG

Efficient Field Oriented Control (FOC) of Automotive 30-1000 W BLDC/PMSM Motors

TB9M003 SmartMCD™ uses Toshiba's advanced fifth-generation mixed-signal process technology, combining an Arm® Cortex® CPU with a Vector Engine co-processor and pre-drivers to control external B6 N-channel MOSFETs. The device connects directly to the battery and LIN bus, delivering high levels of performance and integration. Housed in a 9.0mm x 9.0mm thermally enhanced HTQFP48 package, this level of integration enables smaller, simpler and lower cost 30-1000W BLDC/PMSM motor systems. The available ecosystem with the SmartMCD™ PC tool ensures fast time to market. It allows easy parameter configuration, drive control, real-time logging and diagnostics via a high-speed UART.

Applications

- Pumps
- Fans
- Thermal Management Systems (TMS)
- Body Control

Features

- BLDC/PMSM Smart Motor Controller with integrated pre-drivers
- Vector Engine co-processor for Field Oriented Control (FOC)
- Programmable motor driver timing unit
- Integrated encoder block
- 5 V output, up to 100mA
- 12-bit & 10-bit ADCs
- LIN 2.2B with built-in wake-up
- Motor Studio PC tool development environment
- Operating temperature range: Ta= -40°C to +150°C (Grade 0)
- Thermal enhanced package: HTQFP48-0707-0.50

Advantages

- Sensor- and sensor-less operation
- Precise and efficient FOC
- High computation performance
- 1-shunt current measurement
- Trapezoidal & sine-wave commutation mode
- Efficient operation through Advanced slew-rate control
- Attractive software licensing options available for evaluation and mass-production

Benefits

- Quick start-up and configuration of BLDC/PMSM motors
- Performance tuning by real-time data logs & diagnostics
- Optimized system cost due to 1-shunt measurement
- Reduced program code size and CPU offloading when utilizing the Vector Engine
- Quiet and low-vibration motor operation with high speed PWM frequency possible
- Low EMI
- Less components result in less PCB space
- Lower bill of material cost
- Less qualification efforts

HTQFP48

TB9M003FG functional blocks

- 32bit MCU (Cortex® -M0) Clock @40MHz
- FLASH 64kByte, RAM 4kByte, ECC (SEC, DED)
- Two on-chip oscillators (high- and low-speed)
- Fourth generation Vector Engine co-processor
- 3-Phase motor control pre-driver with built in charge pump
- Advanced encoder block A-ENC32
- Current limiter, battery detector, temp. sensor
- 5V Regulator output, POR, reset output
- LIN or PWM controlled
- 4 x 24 bit PWM channels
- Low power modes & various wake up functions
- SWD on chip debug
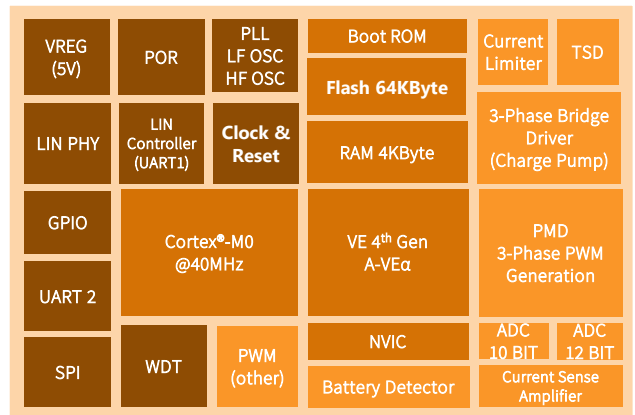
SmartMCD Motor Studio - speed, torque & position control

SmartMCD Motor Studio is an easy-to-use, well-structured, and versatile software solution allowing parameter configuration, drive control, real-time logging and diagnostics via high-speed UART.

- Sine-wave & FOC drive control
- Digital storage oscilloscope
- Real-time data logging & diagnostics
- Dynamic parameter configuration
- Tuning & optimization
- Graphs for up to 4 parameters – target, speed, torque, current
- Scalable and zoomable charts
- Error state indication
- Temperature & DC link voltage real-time monitoring
- Simple sequencer for repeatable test & validation
- Parameter import/export
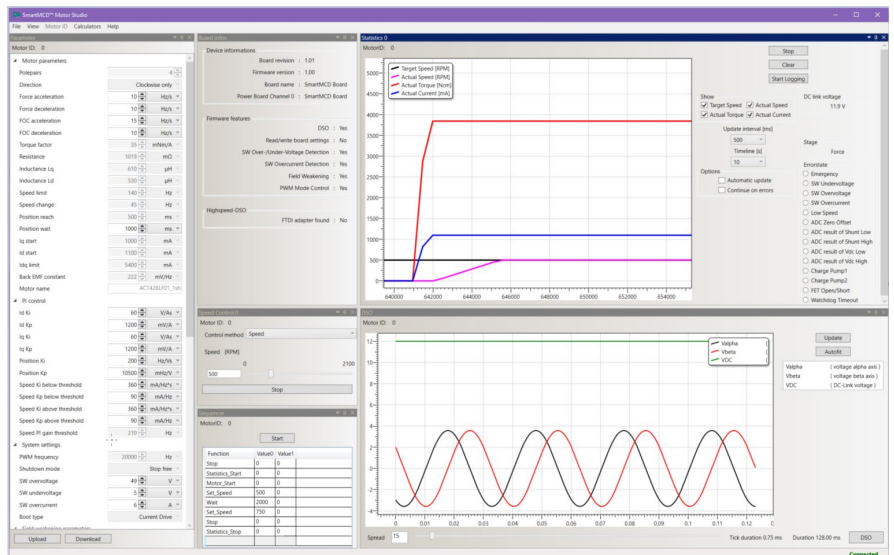
Motor Studio together with the TB9M003FG board from MikroElektronika (MIKROE) allows for a quick and easy system evaluation, motor application development and prototyping.

Development environment

- Arm® Keil® MDK version 5.36 or later
- ARMCLANG (Arm compiler 6) 6.16 or later
- GNU Make 4.2
- SmartMCD™ TB9M003FG board
- Optional inverter boards for various power classes [30-1000 W]
- Device drivers available

SmartMCD™ TB9M003FG board

TB9M003FG technical data

https://toshiba.semicon-storage.com/ap-en/semiconductor/product/automotive-devices/detail.TB9M003FG.html