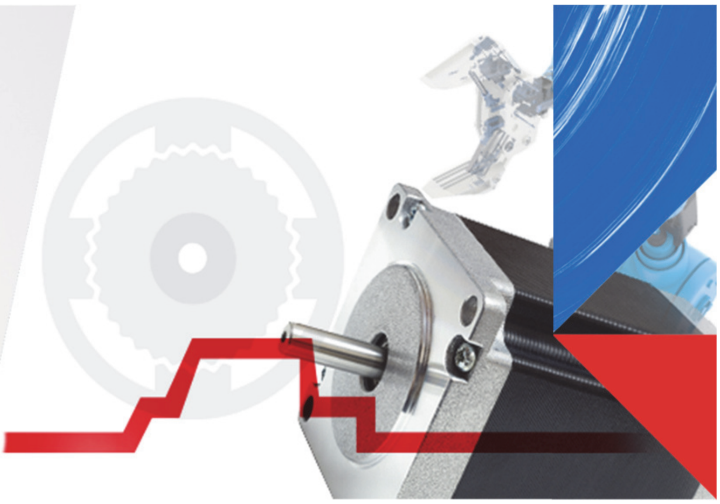
TOSHIBA

MOTOR DRIVER

Active Gain Control



Prevents The Motor from Stalling

Stable control is a basic operating requirement for motors. Due to their sensorless rotor angle control, stepper motors are suitable for a variety of applications, such as cost sensitive positioning systems. However, the highest priority of the stepper motor is to avoid stalls.* Toshiba has developed Active Gain Control (AGC) to automatically optimize the motor current depending on the torque needed. AGC prevents motors from stalling and provides the optimum energy efficient motor control that cannot be achieved by conventional motor control drivers.

Applications

- Office, Point-Of-Sales (POS) and 3D printers
- Industrial machines (textile, vending, CNC, dispensing)
- Robotics
- Cash dispenser (ATM) and ticket machine
- Surveillance camera

Features

- Drive current optimization depending on torque load

Advantages

- Motor current is automatically optimized
- Stable rotation
- Easy to use as no external MCU required

Benefits

- Significant heat reduction in controller and motor
- Increased energy efficiency
- Reduced system complexity and cost
- Noise reduction
- Extended motor lifetime

Product lineup

Product number	Operating Voltage (V)	Output Current (A)	Control I/F	Package	Other features
TB67S279FTG	47	2.0	Clock	VQFN48 (7x7mm)	• AGC - optimized current control method for motor operation • ACDS - a current control method which does not require sense resistor • Built-in error detection functions like thermal shutdown, over current protection, under voltage lockout and motor load open detection • Built-in output function of error detection flag • 128 µStep (TB67S128TG) • Pin compatibility for easy scalability
TB67S289FTG	47	3.0	Clock	VQFN48 (7x7mm)	
TB67S285FTG	47	3.0	Serial	VQFN48 (7x7mm)	
TB67S249FTG	47	4.5	Clock	VQFN48 (7x7mm)	
TB67S128FTG	44	5.0	Clock	VQFN48 (7x7mm)	

*Stall: A stepping motor rotates synchronous to itscontrol pulses. The synchronization may be lost if the torque load is too high or a rapid speed change occurs. In this case, the motor stops but is still running at peak current. This situation is called 'Stall'.

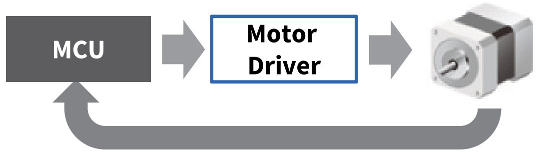
Optimized motor current in real-time

Comparison of conventional approach and Active Gain Control (AGC)

Conventional

With an open loop control, the maximum constant current is applied to the stepper motor in order to avoid stall and step loss. If the torque load is low, a high amount of energy is transformed into heat, which decreases energy efficiency. An MCU, ADC, sensing element and additional connections are needed to optimize the motor current.

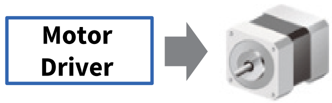
Discrete approach for motor current control



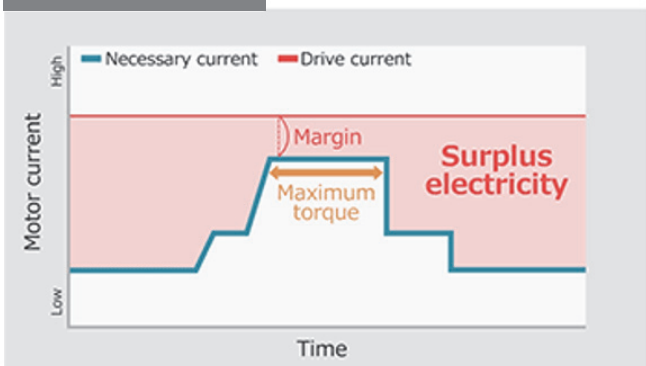
Active Gain Control (AGC)

AGC automatically matches the motor current to the torque load in real time. A configurable current margin is added to avoid stall. By this, the energy efficiency is optimized while minimizing heat generation and stress on the motor. No MCU, DC, sensor or additional connections are required as AGC is fully integrated into the motor driver, hence reducing system complexity and cost.

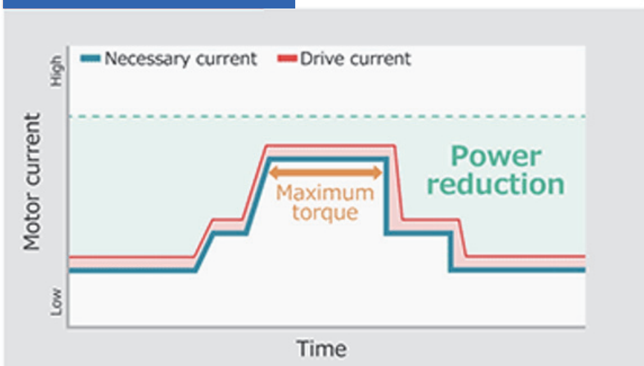
Integrated approach with Active Gain Control



Open-loop control



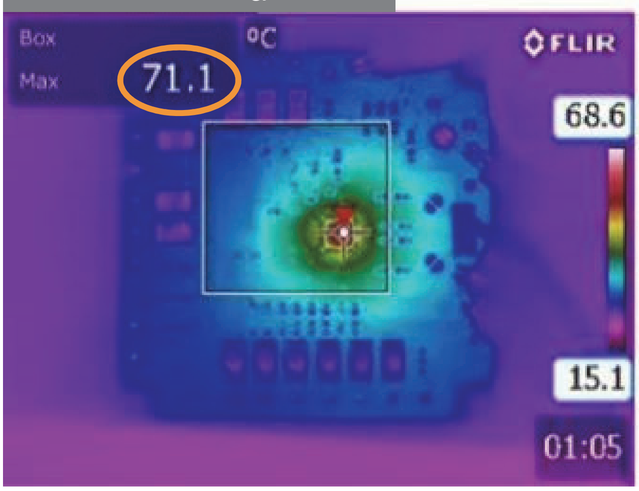
Active Gain Control (AGC)



Significant heat reduction in driver and motor

In addition to the reduced energy consumption, also the heat generation inside the motor driver and motor itself can be significantly reduced. In a Toshiba experiment (see pictures below), the IC temperature could be reduced by 30°C from 71.1°C to just 41.1°C. Furthermore, the reduced heat generation in the stepper motor itself results in less cooling and cost. Less stress on the motor contributes to an extended lifetime of the motor.

Conventional technology



Toshiba Active Gain Control (AGC)