TOSHIBA
Leading Innovation

MOTOR DRIVERS

AGC (Active Gain Control)
Stall Prevention

Stable control is a basic operating requirement for motors used in printers, office appliances and industrial equipment etc. Because of their stable and precise controls, stepper motors are suitable for these applications. However, the highest priority of the stepper motor is to avoid stalls[*1]. Therefore, sufficient current margin is needed at all times to prevent sudden heavy torque changes and to achieve stable operation.

Reduction of the additional current for the torque margin is highly desirable for improving efficiency and suppressing heat generation. This requires complicated current adjustment by real-time monitoring of motor torque and current feedback, using additional sensors and microcontrollers. To solve these problems, Toshiba has developed the AGC architecture. AGC automatically optimizes the motor current depending on the torque needed. It prevents motors from stalling and provides the optimum efficient motor control that cannot be achieved by conventional motor control drivers.

APPLICATIONS

- Office appliances (printers and others)
- Industrial machines (vending machine, CNC machine, dispensing machine and others)
- Banking terminals (ATM, cash dispensers, etc.), Point-of-Sales

FEATURES	ADVANTAGES
Drive current optimization	Optimized current control method for motor operation, i.e. current reduced to actual requirement
Stall prevention	Stable rotation and control

BENEFITS

- Significant heat reduction
- Efficiency increase
- Simplifying optimum current control system without microcontrollers, ADC, and sensors
- Noise reduction

PRODUCT LINEUP

Product number	Output withstand Voltage (V)	Output Current (A)	Control I/F	Package	Other features
TB67S279FTG	50	2.0	Clock	WQFN48 (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
TB67S289FTG	50	3.0	Clock	VQFN48 (7x7mm)	
TB67S285FTG	50	3.0	Serial	VQFN48 (7x7mm)	
TB67S249FTG	50	4.5	Clock	WQFN48 (7x7mm)	

[*1]Stall: A stepping motor rotates synchronizing with pulses. However, its synchronization is lost when overload or a rapid speed change occurs, the motor stops but is still running at peak current. This phenomenon is called 'Stall'.

OPTIMIZE OPERATING CURRENT IN REAL-TIME

System control difference between conventional and AGC architectures.

Conventional

Stepping Motor with open loop control

A maximum constant current is required for a stable motor drive and to avoid step-out. Accordingly, at light load conditions the current efficiency is bad.

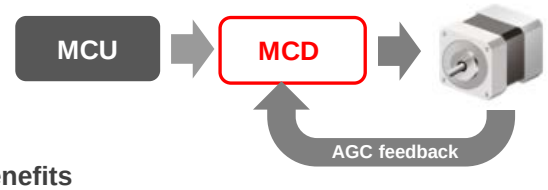
Open loop control

For advanced control, MCU, ADC, and sensing element can be used for current optimization

AGC

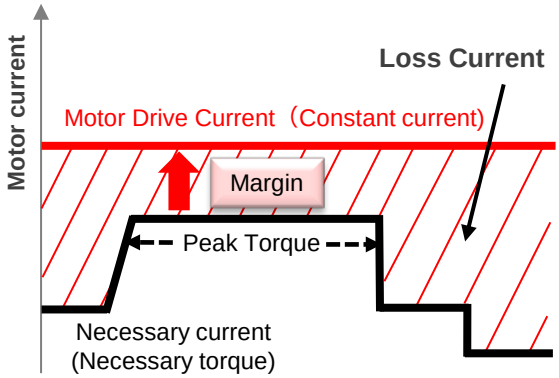
AGC optimizes the motor current dynamically depending on the load torque. Efficient operation is realized by eliminating the additional current needed while keeping a minimum margin to operate efficiently

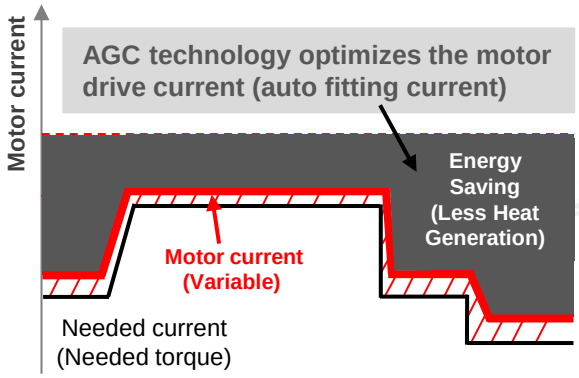
New approach with Active Gain Control



Benefits

Current auto fitting / no step-out
Power consumption reduced by up to 30%
Chip temperature reduction by around 30°C

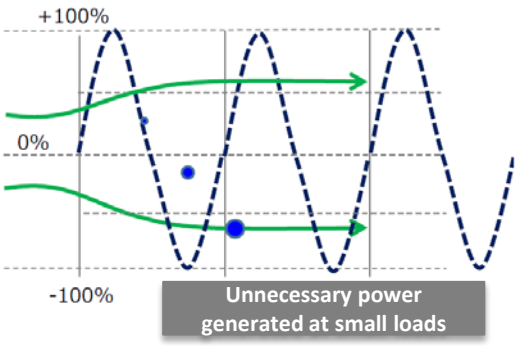




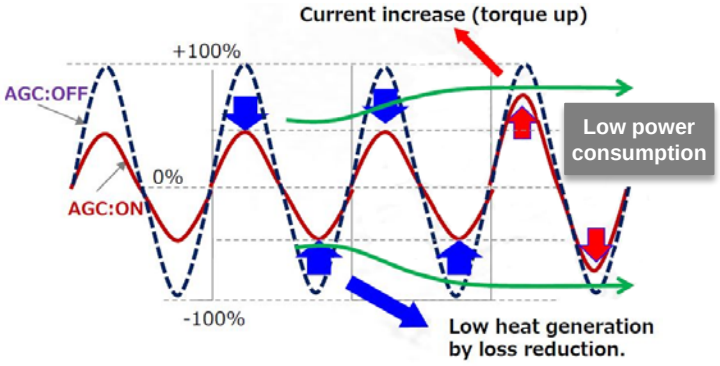
Torque control and motor operation current for stepper motors

When some sort of loads are applied during motor rotation, load torque increases and its volume changes depending on the usage circumstances. Required current for the motor operation also changes by following the load change.

For advanced control, measurement against heat generation is necessary. Surpressing the torque margin, while securing its required value, is necessary. Both add complexity and cost to the system



Measurement against heat generation is unnessary. Load from host control can be reduced



SIGNIFICANTLY REDUCTION OF SYSTEM POWER CONSUMPTION

Conventional		ACG
Excessive power is consumed as waste at the small torque because the motor current is controlled to a constant value under any circumstances.	Heat generation	Motor current is controlled depending on the torque needed. A minimum required current can be controlled even when the torque is small.
Whenever the torque changes, signals from a MCU need to be adjusted to control the motor current.	Need for adjustment	Unnecessary