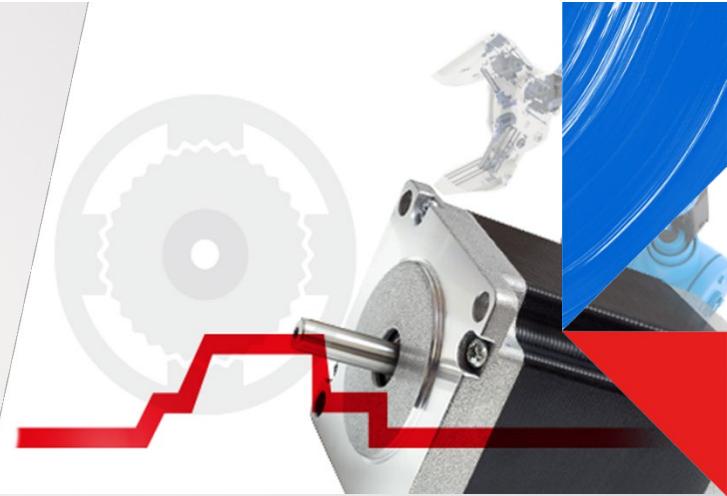


Active Gain Control



Prevents The Motor from Stalling

Stable control is a basic operating requirement for motors. Due to their precise and solid control, stepper motors are suitable for a variety of applications. 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 efficient motor control that cannot be achieved by conventional motor control drivers.

Applications

- Consumer office appliances (printers etc.)
- Industrial machines (vending machines, CNC machines, dispensing machines etc.)
- Banking terminals (ATM, cash dispensers, etc.)
- Point-Of-Sales (POS)

Features	Advantages	Benefits
<ul style="list-style-type: none"> • Drive current optimization • Stall prevention 	<ul style="list-style-type: none"> • Optimized current control method for motor operation, i.e. current reduced to actual requirement • Stable rotation and control 	<ul style="list-style-type: none"> • 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	VQFN48 (7x7mm)	<ul style="list-style-type: none"> ▪ 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 means easy scalability
TB67S289FTG	50	3.0	Clock	VQFN48 (7x7mm)	
TB67S285FTG	50	3.0	Serial	VQFN48 (7x7mm)	
TB67S249FTG	50	4.5	Clock	VQFN48 (7x7mm)	
TB67S128FTG	50	5.0	Clock	VQFN48 (7x7mm)	

*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.

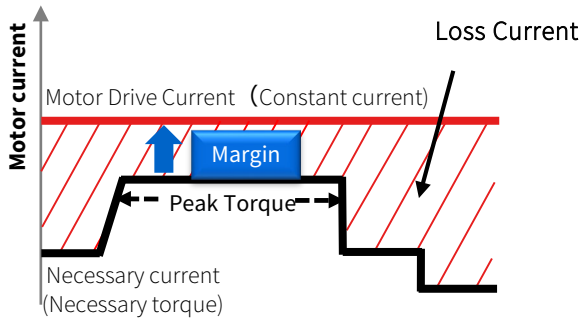
Conventional

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 not good.

Open loop control



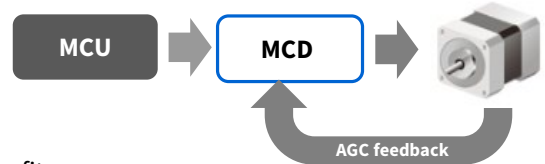
For advanced control, MCU, ADC, and sensing element can be used for current optimization.



AGC

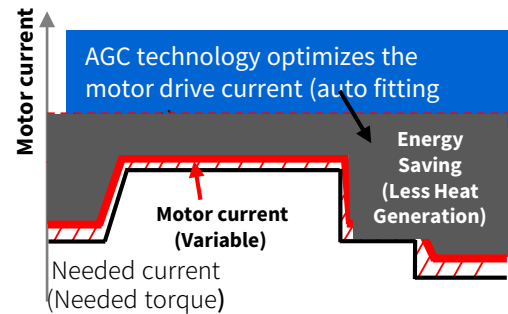
AGC optimizes the motor current dynamically depending on the load torque. Efficient operation is realized by eliminating the additional current needed while keeping a minimum margin to operate efficiently.

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

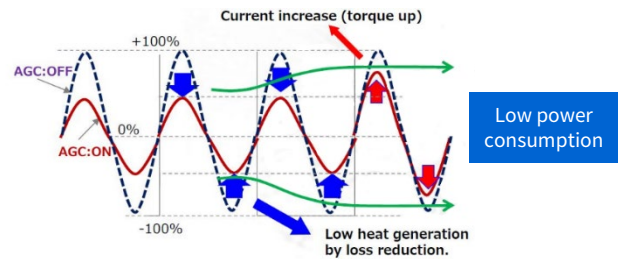
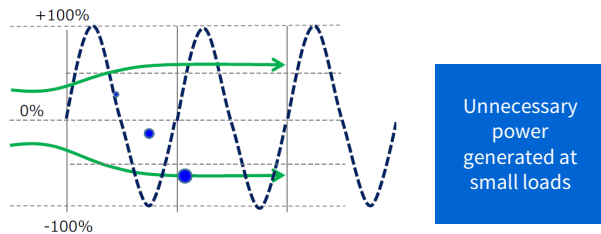


Torque control and motor operation current for stepper motors

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. Suppressing the torque margin, while securing its required value, is necessary. Both add complexity and cost to the system

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



Significant reduction of system power consumption

Conventional		AGC
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