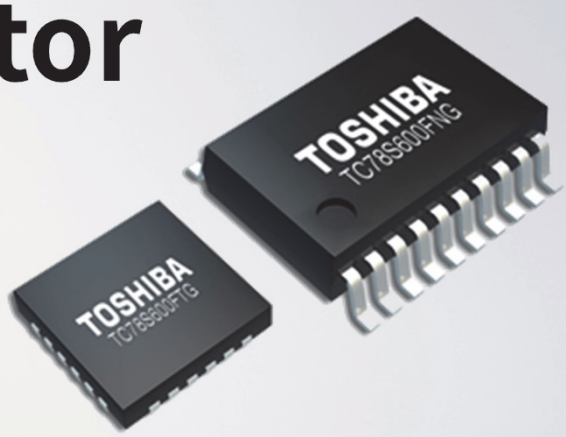
TOSHIBA

MOTOR CONTROL

Stepper Motor Drivers



Improving System Efficiency

Toshiba leverages its unique manufacturing and circuit technologies to offer one of the industry's widest portfolio of next–generation motor driver ICs featuring low power consumption, low noise, high speed and high-precision motor control. Fabricated in Toshiba's 130nm BiCD mixed signal process, the motor drivers improve the motor performance while featuring a small footprint and attractive prices.

Applications

- Industrial applications
- Home appliances
- Textile- and sewing machines
- Surveillance cameras
- 3D printers
- CNC machines
- Packaging machines
- ATM
- Point-Of-Sales (POS) terminals

Features

- Pin and package compatible driver types available
- Wide package lineup
- Multiple control interfaces
- Microstepping technology
- 130nm BiCD mixed signal process
- Advanced Dynamic Mixed Decay (ADMD)
- Advanced Current Detect System (ACDS)
- Active Gain Control (AGC)

Advantages

- Easy replacement by a driver with lower current rating and lower cost
- Surface mount and through hole packages available. Small package sizes and packages for maximum heat dissipation available
- Choice between phase input or clock input driver types
- Step modes down to 1/128 step are available
- Combination of low-voltage control circuitry with high voltage DMOS output drivers provides low R_{on} and small chip size
- Improve efficiency and reduced vibration at high rotation speeds
- Constant current accuracy improvement without external shunt resistors for current measurement
- Optimized motor drive current with lower heat generation and no loss

Benefits

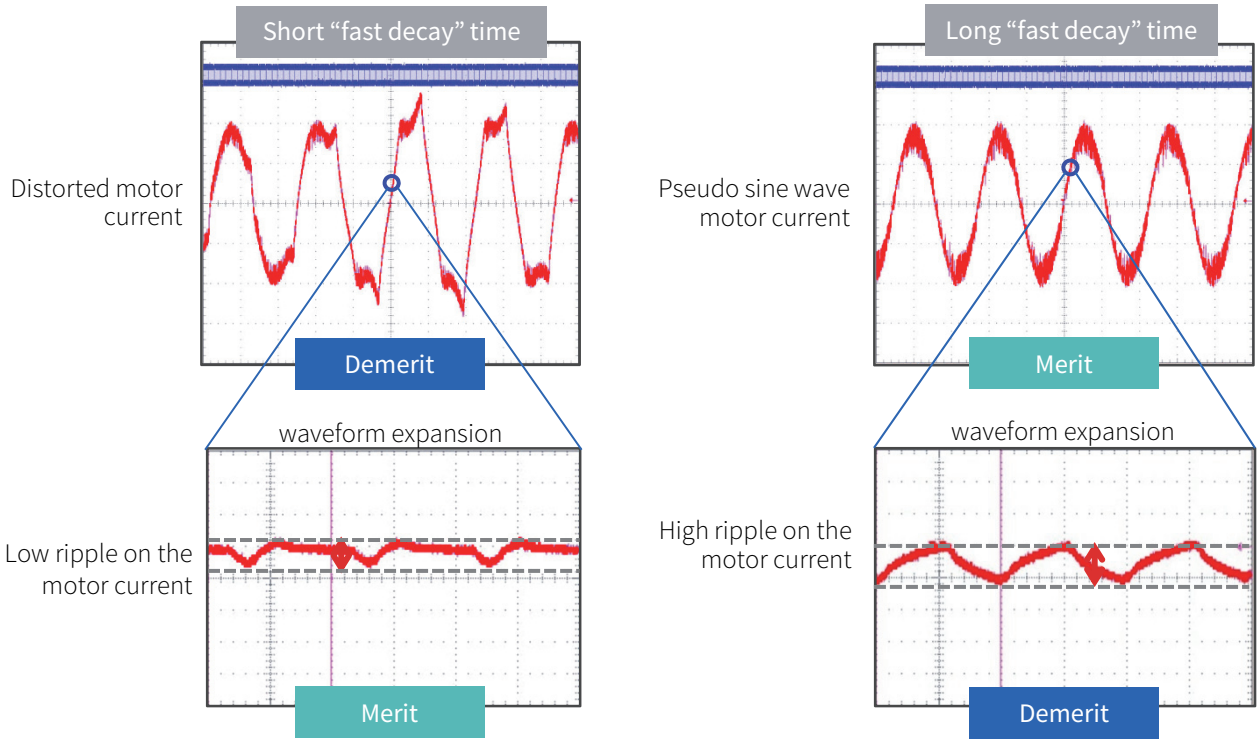
- Reduced board space
- Reduced system cost
- Easy adaption to changed requirements

Increased motor performance:

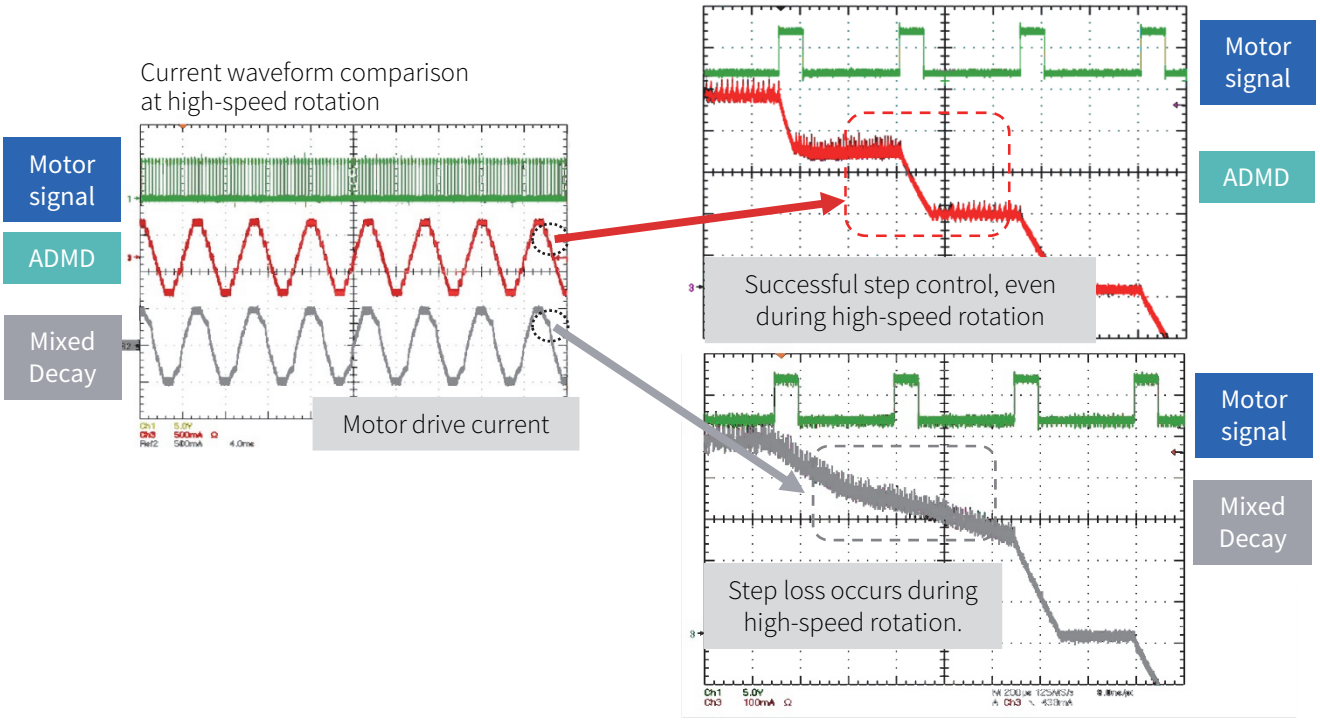
- Low noise and low vibration motor operation
- Reduced current distortion at high-speed
- Improved system reliability and safety
- Reduced heat dissipation
- Improved efficiency

Advanced Dynamic Mixed Decay (ADMD)

The traditional Mixed Decay approach comes with a set of demerits. If the “fast decay” time is short, the ripple on the motor current is low. On the flip side, the current decay ability becomes low, which may result in current distortion due to the magnetic coupling between coils (left picture below). If the “fast decay ” time is long, the current decay capability is improved, so that the motor can be controlled by a pseudo sine wave current. However this comes at the cost of increasing the ripple on the motor current (right picture below).

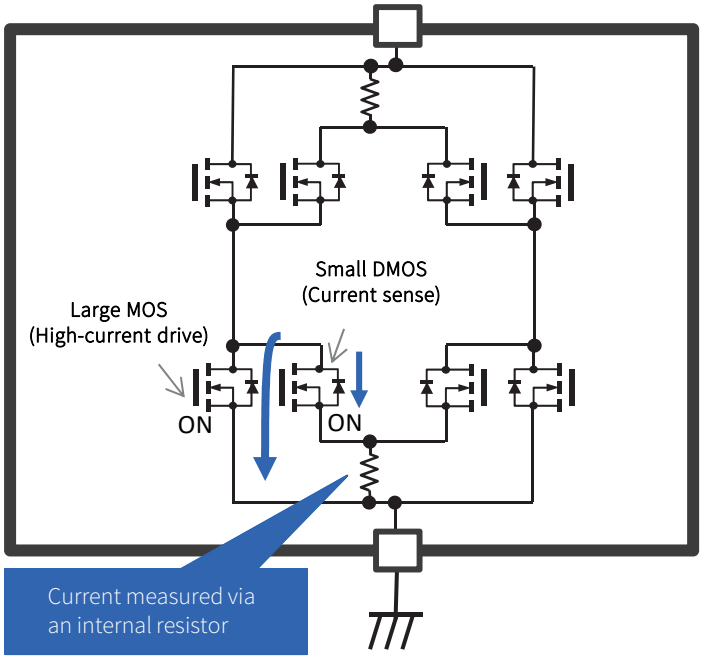


Toshiba’s Advanced Dynamic Mixed Decay (ADMD) technology combines the best of both worlds and realizes pseudo sine wave motor control while reducing the ripple current. By this, the maximum rotation speed can be increased without step loss (see picture below).



Advanced Current Detect System (ACDS)

The Advanced Current Detect System (ACDS) eliminates the need for two external shunt resistors, which considerably reduces board space and system cost considerably. Furthermore the current measurement error is lower than 6%, which is less compared to conventional solutions.

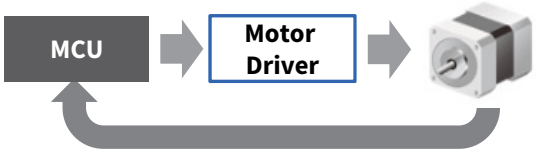


Active Gain Control (AGC)

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

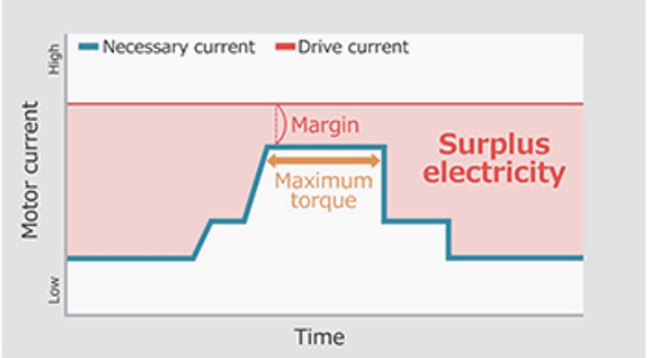


Active Gain Control (AGC)

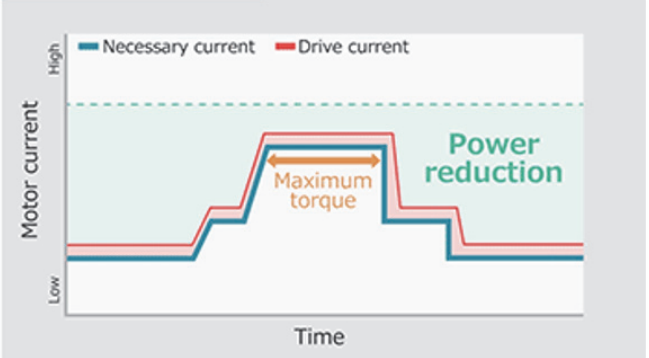
AGC automatically matches the motor current to the torque load in real time. A configurable current margin is added to avoid stall. By this, the energy efficiency is optimized while minimizing heat generation and stress on the motor. No MCU, DC, sensor or additional connections are required as AGC is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



Bipolar stepper motor drivers

Part number	Interface			Ratings		Stepping mode											Temperature range T_A [°C]	Package
	Clock	Phase	Serial	VM (opr) [V]	IOUT (abs) [A]	Full	Half	1/4	1/8	1/16	1/32	1/64	1/128	ADMD	ACDS	AGC		
TB67S101AFNG	-	●	-	10-47	4.0	●	●	●	-	-	-	-	-	●	-	-	-20 to +85	HTSSOP48-P-300-0.50
TB67S101AFTG	-	●	-	10-47	4.0	●	●	●	-	-	-	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S101ANG	-	●	-	10-47	4.0	●	●	●	-	-	-	-	-	●	-	-	-20 to +85	P-SDIP24-0723-1.78
TB67S102AFNG	●	-	-	10-47	4.0	●	●	●	-	-	-	-	-	●	-	-	-20 to +85	HTSSOP48-P-300-0.50
TB67S102AFTG	●	-	-	10-47	4.0	●	●	●	-	-	-	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S103AFTG	●	-	●	10-47	4.0	●	●	●	●	●	●	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S109AFNG	●	-	-	10-47	4.0	●	●	●	●	●	●	-	-	●	-	-	-20 to +85	HTSSOP48-P-300-0.50
TB67S109AFTG	●	-	-	10-47	4.0	●	●	●	●	●	●	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S128FTG	●	-	●	6.5-44	5.0	●	●	●	●	●	●	●	●	●	●	●	-40 to +85	P-VQFN64-0909-0.50* NEW
TB67S249FTG	●	-	-	10-47	4.5	●	●	●	●	●	●	-	-	●	●	●	-20 to +85	P-VQFN48-0707-0.50
TB67S261FTG	-	●	-	10-47	2.0	●	●	●	-	-	-	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S265FTG	-	-	●	10-47	2.0	●	●	-	-	-	-	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S269FTG	●	-	-	10-47	2.0	●	●	●	●	●	●	-	-	●	-	-	-20 to +85	P-WQFN48-0707-0.50
TB67S279FTG	●	-	-	10-47	2.0	●	●	●	●	●	●	-	-	●	●	●	-20 to +85	P-VQFN48-0707-0.50
TB67S285FTG	-	-	●	10-47	3.0	●	●	-	-	-	-	-	-	●	●	●	-20 to +85	P-VQFN48-0707-0.50
TB67S289FTG	●	-	-	10-47	3.0	●	●	●	●	●	●	-	-	●	●	●	-20 to +85	P-VQFN48-0707-0.50
TB67S508FTG	●	●	-	10-35	3.0	●	●	●	-	-	-	-	-	●	●	-	-20 to +85	P-VQFN36-0505-0.50

All devices listed here support: Under Voltage Lockout (UVLO), Over Current Detection (ISD), Over Temperature Detection (TSD), Internal Regulator Output 5V, Single Power Supply. * New Product

Unipolar stepper motor drivers

Part number	Interface			Ratings		Stepping mode											Temperature range T_A [°C]	Package
	Clock	Phase	Serial	VM (opr) [V]	IOUT (abs) [A]	Full	Half	1/4	1/8	1/16	1/32	1/64	1/128	ADMD	ACDS	AGC		
TB67S141FTG	-	●	-	10-40	3.0	●	●	●	-	-	-	-	-	-	●	-	-20 to +85	P-WQFN48-0707-0.50
TB67S141HG	-	●	-	10-40	3.0	●	●	●	-	-	-	-	-	-	●	-	-20 to +85	HZIP25-P-1.00F
TB67S141NG	-	●	-	10-40	3.0	●	●	●	-	-	-	-	-	-	●	-	-20 to +85	P-SDIP24-0723-1.78
TB67S142FTG	●	-	-	10-40	3.0	●	●	●	-	-	-	-	-	-	●	-	-20 to +85	P-WQFN48-0707-0.50
TB67S142HG	●	-	-	10-40	3.0	●	●	●	-	-	-	-	-	-	●	-	-20 to +85	HZIP25-P-1.00F
TB67S142NG	●	-	-	10-40	3.0	●	●	●	-	-	-	-	-	-	●	-	-20 to +85	P-SDIP24-0723-1.78
TB67S145FTG	-	-	●	10-40	3.0	●	●	-	-	-	-	-	-	-	●	-	-20 to +85	P-WQFN48-0707-0.50
TB67S149FG	●	-	-	10-40	3.0	●	●	●	●	●	●	-	-	-	●	-	-20 to +85	P-HSSOP28-0819-0.80
TB67S149FTG	●	-	-	10-40	3.0	●	●	●	●	●	●	-	-	-	●	-	-20 to +85	P-WQFN48-0707-0.50
TB67S149HG	●	-	-	10-40	3.0	●	●	●	●	●	●	-	-	-	●	-	-20 to +85	HZIP25-P-1.00F
TB67S179FTG	●	-	-	10-60	1.5	●	●	●	●	●	●	-	-	-	●	-	-20 to +85	P-VQFN48-0707-0.50

All devices listed here support: Under Voltage Lockout (UVLO), Over Current Detection (ISD), Over Temperature Detection (TSD), Internal Regulator Output 5V, Single Power Supply.