To Audiences

Consumer & Industrial

Motor Control Driver (MCD)

TOSHIBA

Toshiba Devices & Storage (Shanghai) Co., Ltd.

2020.7.23

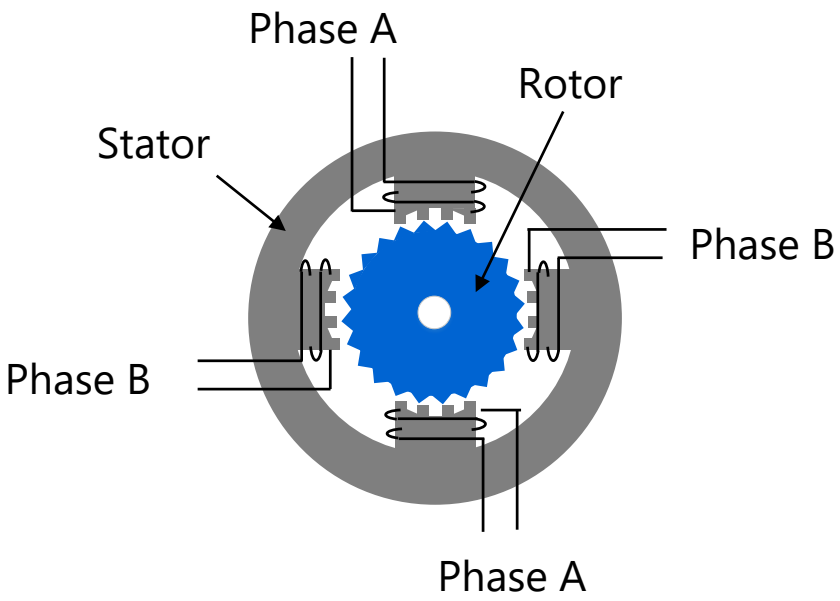
Key Facts

- 180 MCD products
- Over 40 year experience with motor control
- Over 2 billion MCDs shipped
- Toshiba’s original technologies
- Toshiba’s advanced BiCD & CD processes

Stepping Motor

Accurate positioning, low cost, limited speed range

Permanent Magnet type



Advantage

Accurate position control

Affordable price

No positioning sensor required

(Open loop control)

Disadvantage

Limited speed range (risk of stalls)

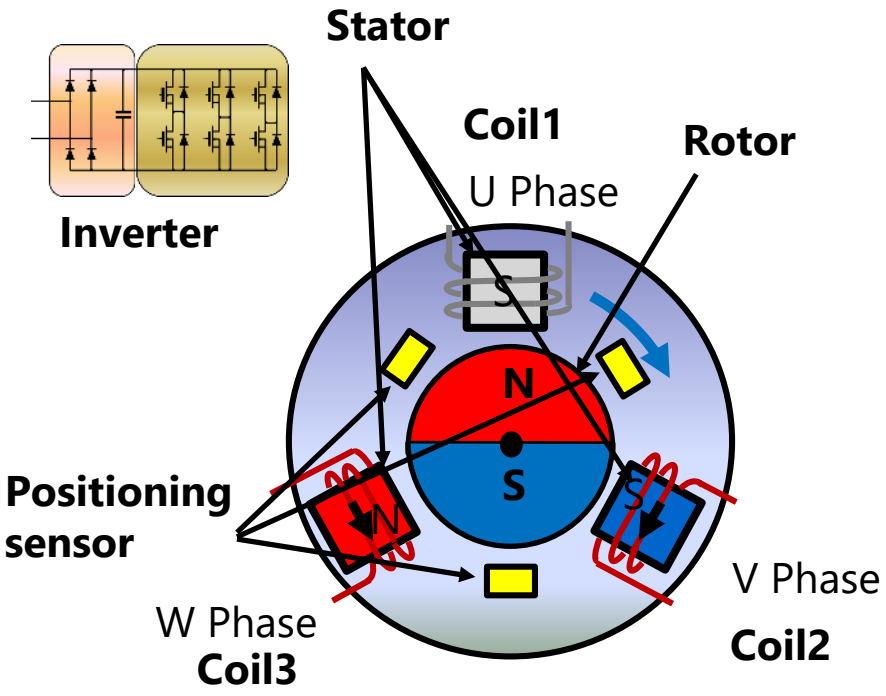
Resonance effect in a certain velocity band

(risk of stalls)

Brushless DC (BLDC) Motor

Higher cost, high efficiency, long lifetime

BLDC (3-slot 2-pole)



It is called **brushless** because brush and commutator are not used compared to brushed motor

Advantage

High speed

High energy efficiency

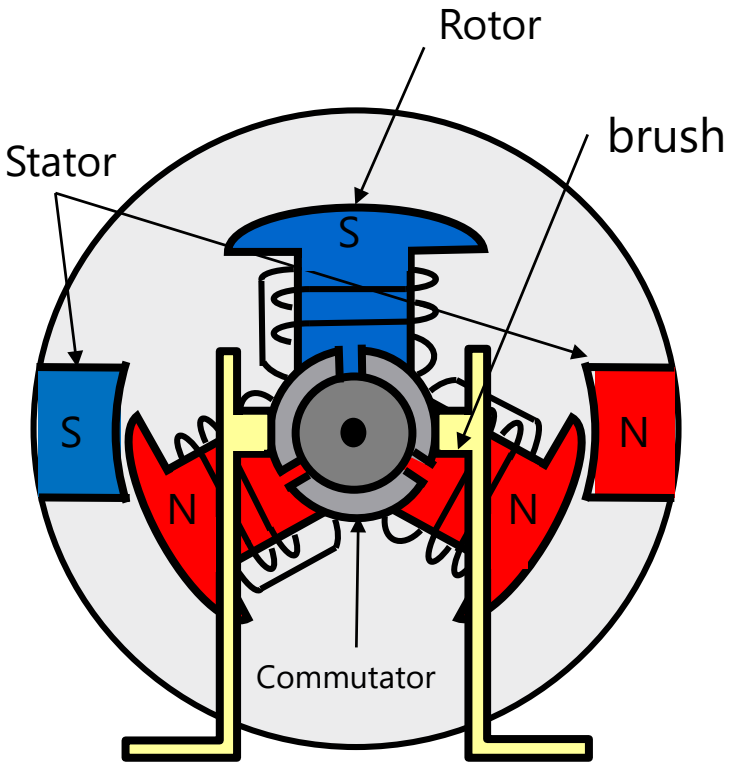
No mechanical contact → Long life, maintenance-free, low noise

Disadvantage

High cost: Rare earth magnet, Hall sensor, more complex control circuit

Brushed DC (BDC) Motor

Low cost, low efficiency, reduced lifetime



Rotor: The part of the motor which is spinning
Stator: The frame of the motor which is not spinning

It is called **brushed**
because current flows to coils
through brushes.

Advantage

Simple controlling results in low cost .

Disadvantage

Brush and electrical noise
Brush deterioration requires periodic maintenance
Reduced energy efficiency

01

Stepping Motor Control

Toshiba original technologies - Product highlights

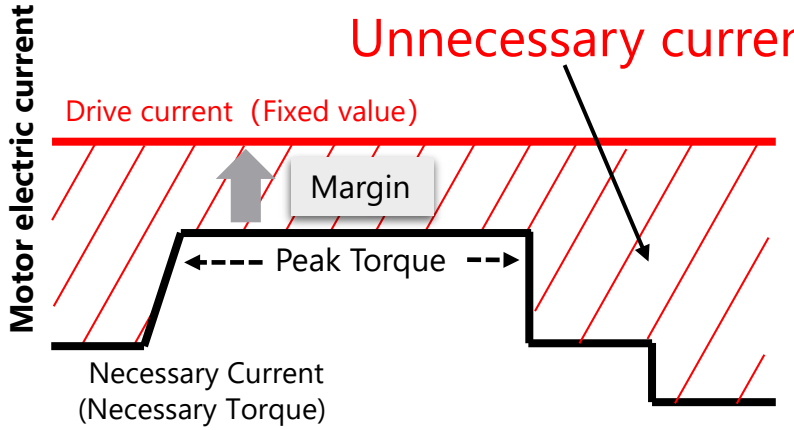
Active Gain Control (AGC) - Adjusting motor current according to torque load

Up to 48% motor current can be reduced

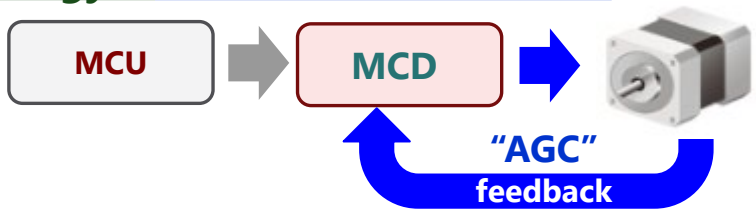
■Conventional control

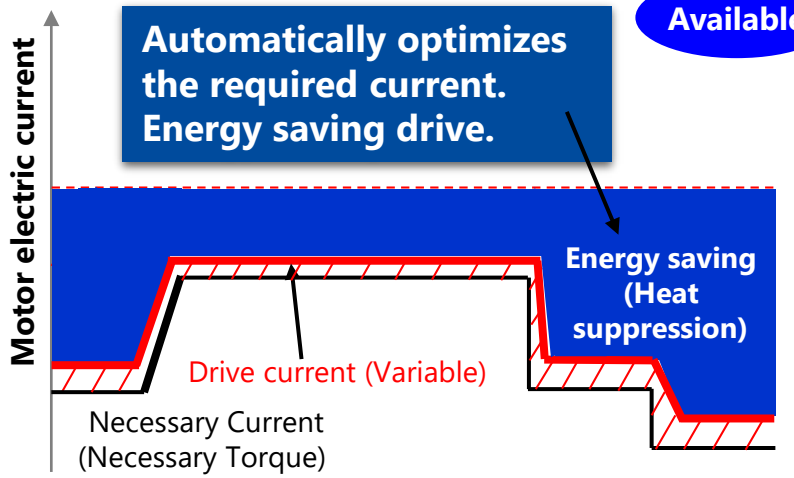
Open loop control

Open loop control requires constant drive with peak current in preparation for motor loss step condition during maximum load.
It is inefficient when load torque is light



■New technology "Active Gain Control"





Available

Up to 48% motor current can be reduced

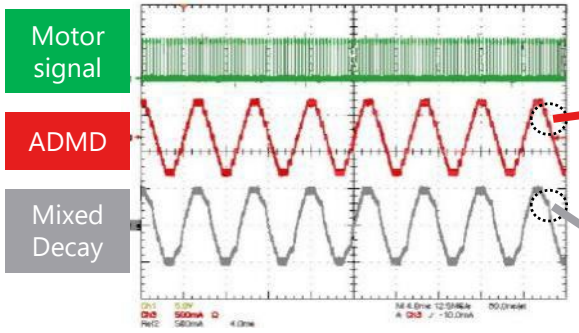
■Advantage

★Automatic optimization + Stall prevention compatibility
=> Energy saving / power saving / heat suppression

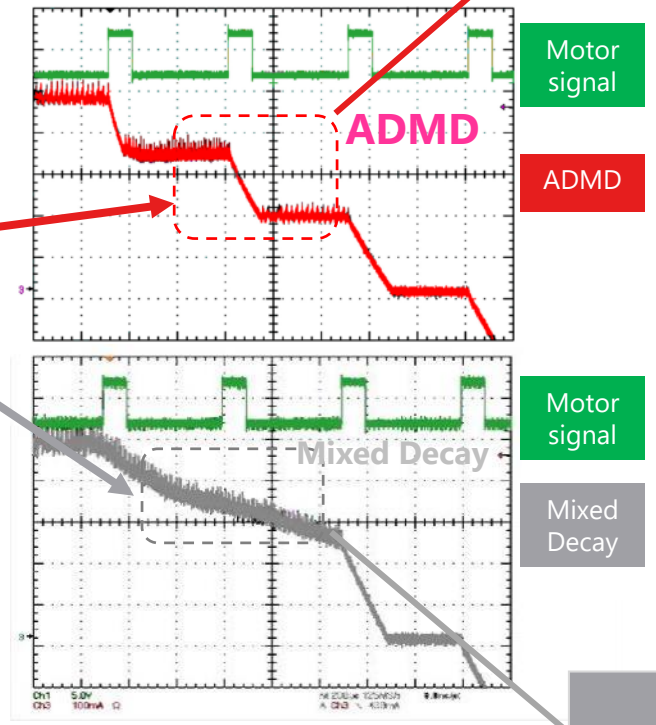
Advanced Dynamic Mixed Decay (ADMD)

Up to 30% higher rotation speed, reduced noise & vibration

- Pseudo sine wave motor current
- Low ripple on motor current

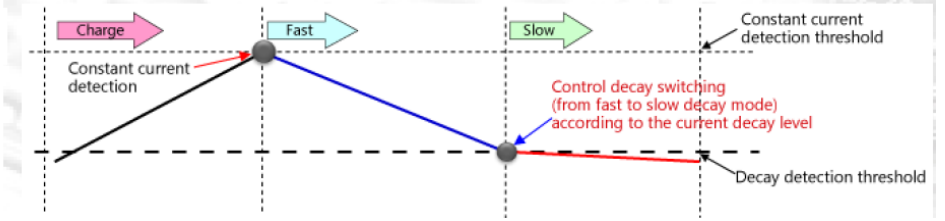


Successful step control, even during high-speed rotation

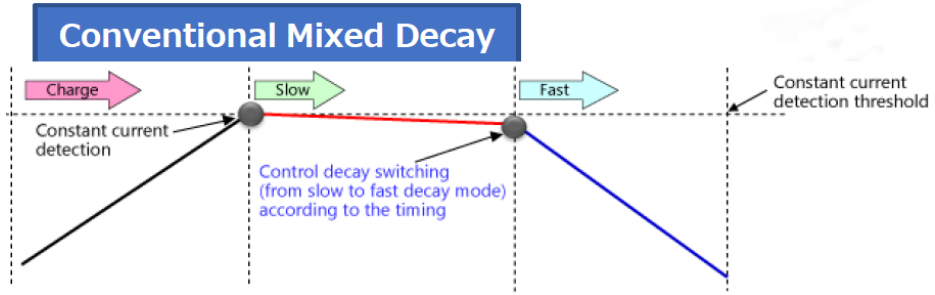


Stall occurs during high-speed rotation

New technology ADMD



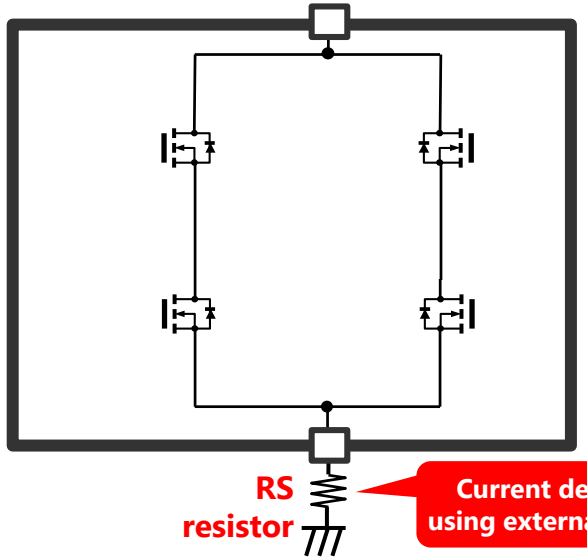
Conventional Mixed Decay



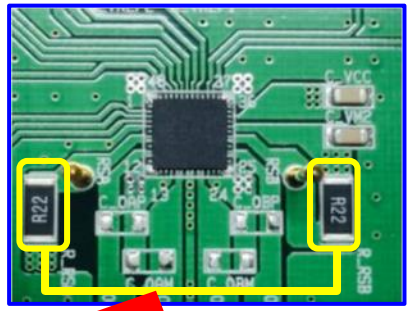
Advanced Current Detection System (ACDS)

Lower cost, smaller footprint, improved constant current accuracy

General System (External resistor RS is necessary)

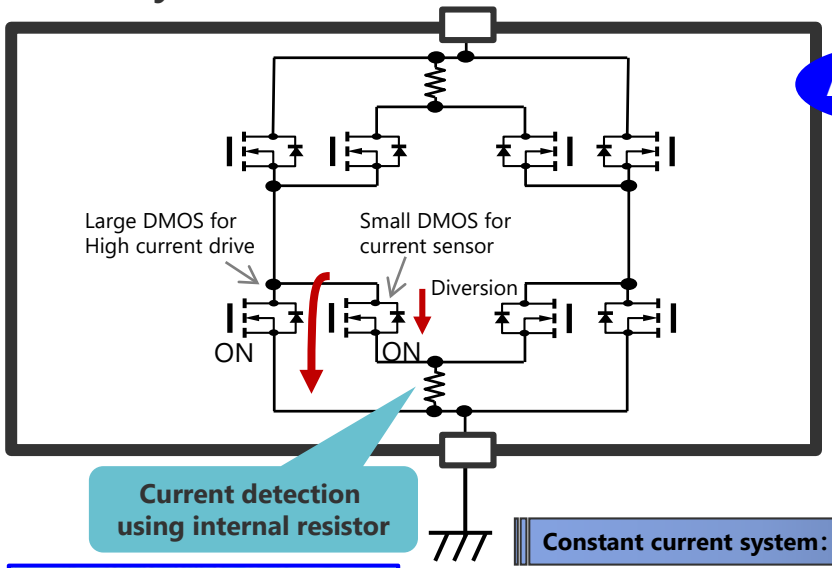


Current detection using external resistor



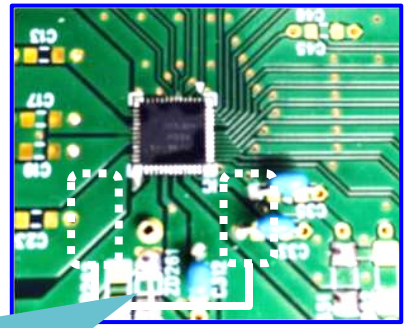
2 large external resistors are necessary

ACDS system (External resistor RS is not necessary)



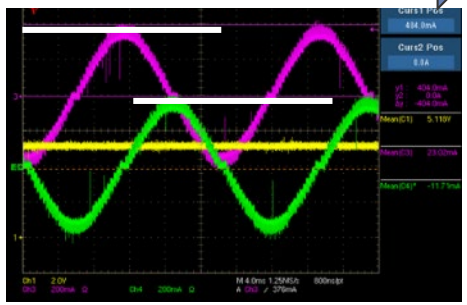
Available

Current detection using internal resistor



No need for external resistors, contributing to cost savings by increasing flexibility in wiring layout

Constant current system: up to ±6%



Available products
・TB67S141/142/149/508

Current detection resistor
up to 2 resistors are necessary
↓
not necessary in new

※reduction in BOM
(Reduction of resistor for large current)

ADMD
Automatic current attenuation function only realized by Toshiba

TB67S128FTG - 50V, 5.0A, 128step (Max.) 1ch Stepping Motor Driver

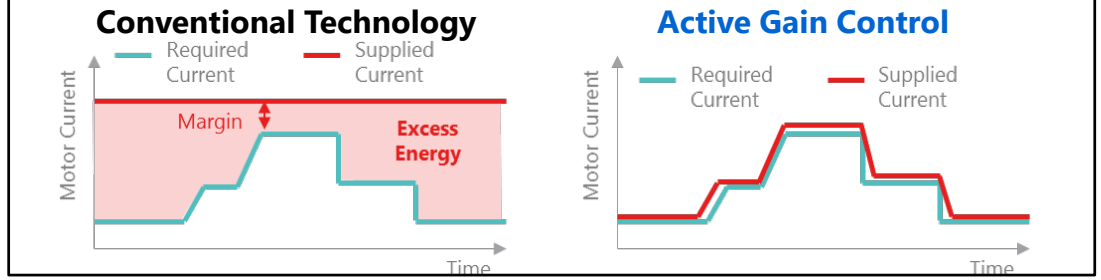
Features

- 128 steps (μStepping)
- Up to 1024 steps via SPI
- Low $R_{DS(ON)}$ (L+H): 0.25Ω (typ.)

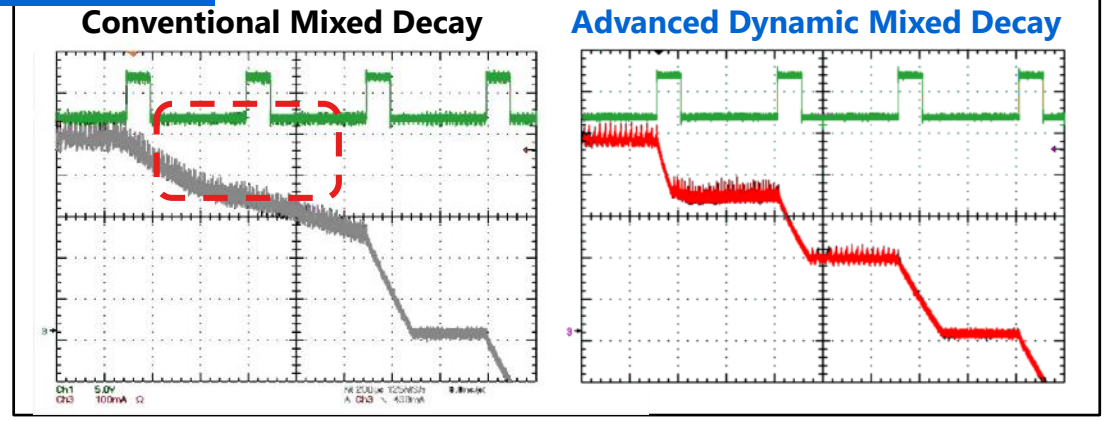
Benefits

- Stall prevention
- Reduced energy consumption & heat generation
- Ultra-silent operation
- High rotation speeds
- Reduced BOM cost and footprint

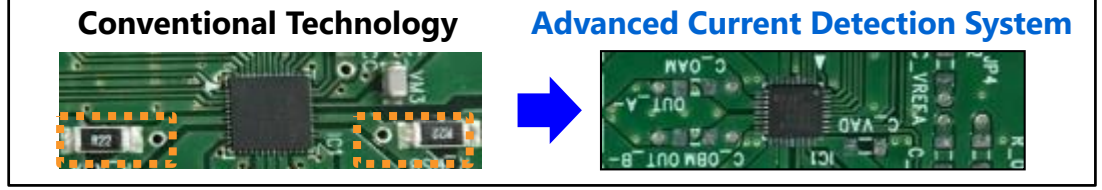
AGC



ADMD



ACDS



Suitable for demanding applications

- Office equipment
- Surveillance cameras
- 3D printers
- ATM and cash dispensers
- Home appliances
- CNC machines

TC78H670FTG - 18V, 2.0A, 1/128 Micro Step (Max.) 1ch Stepping Motor Driver

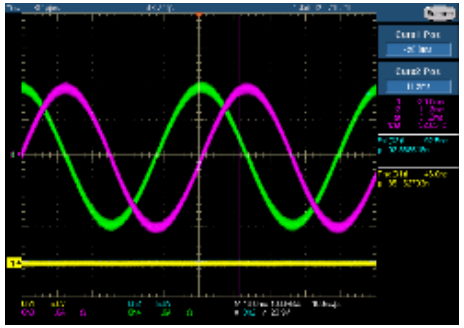
Features

- 128 steps (μStepping)
- Up to 1024 steps via SPI
- High drive current of 2A
- Ultra-low standby current of 0.1μA

Benefits

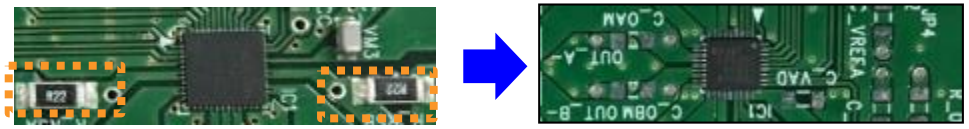
- Cost efficient due to G4 process
- Ultra-silent operation
- Reduced BOM cost and footprint
- Long battery lifetime

1/128 Micro Step



ACDS

Conventional Technology **Advanced Current Detection System**



Package

3mm×3mm

44% smaller

TC78H670FTG

Suitable for space restricted and battery powered applications

- Electronic door locks
- Digital Still Cameras
  Digital Single-Lens Reflexes
- Fiscal printers
- Pico Projectors
- 3D printers
- Surveillance cameras

02

Brushless DC (BLDC) Motor Control

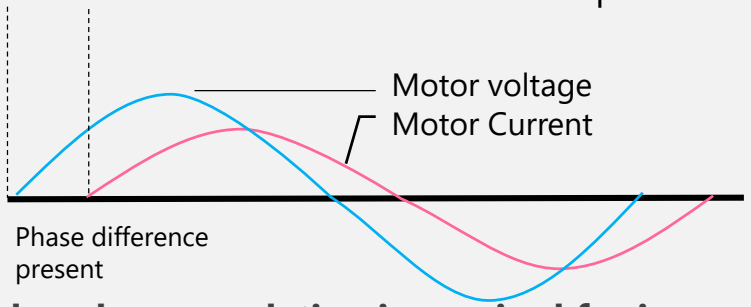
Toshiba original technologies - Product highlights

Intelligent Phase Control

Automatic adjustment of voltage and current phase

Conventional Technology

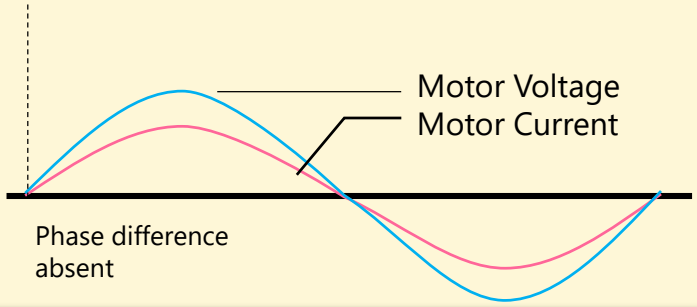
Phase difference arises due to rotation speed and current value.



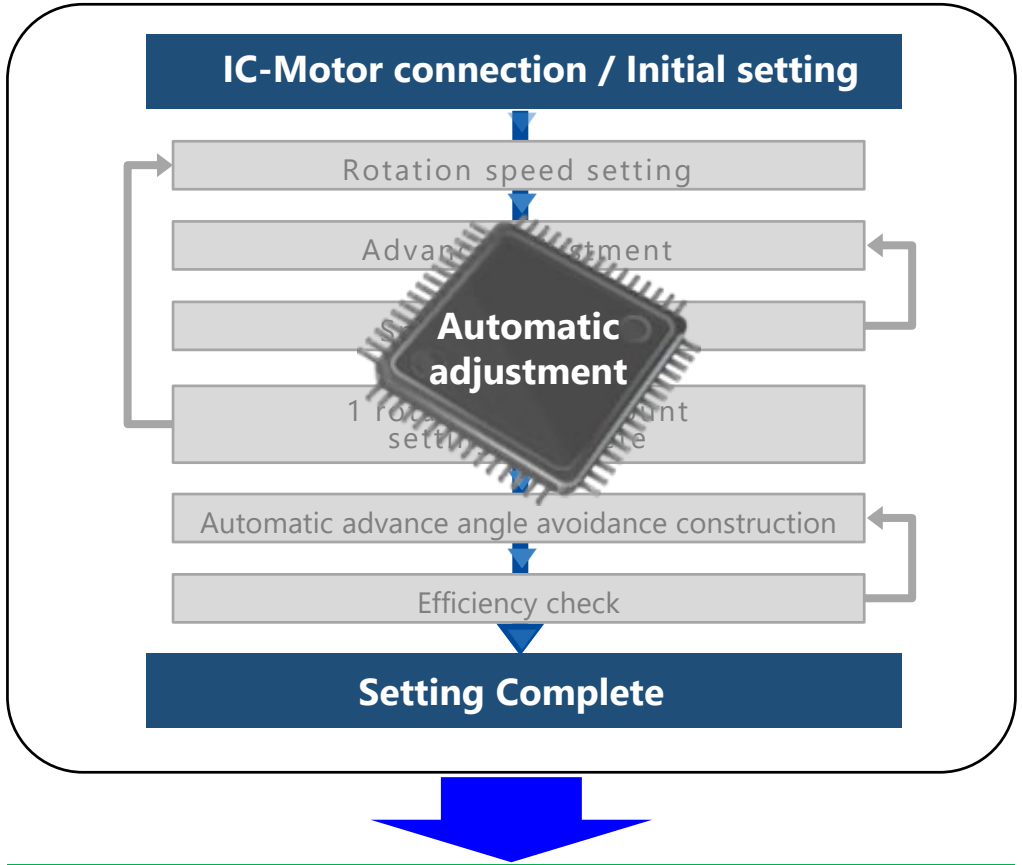
⇒Complex phase regulation is required for increasing efficiency.

New Technology

IC automatically brings current and voltage in same phase.



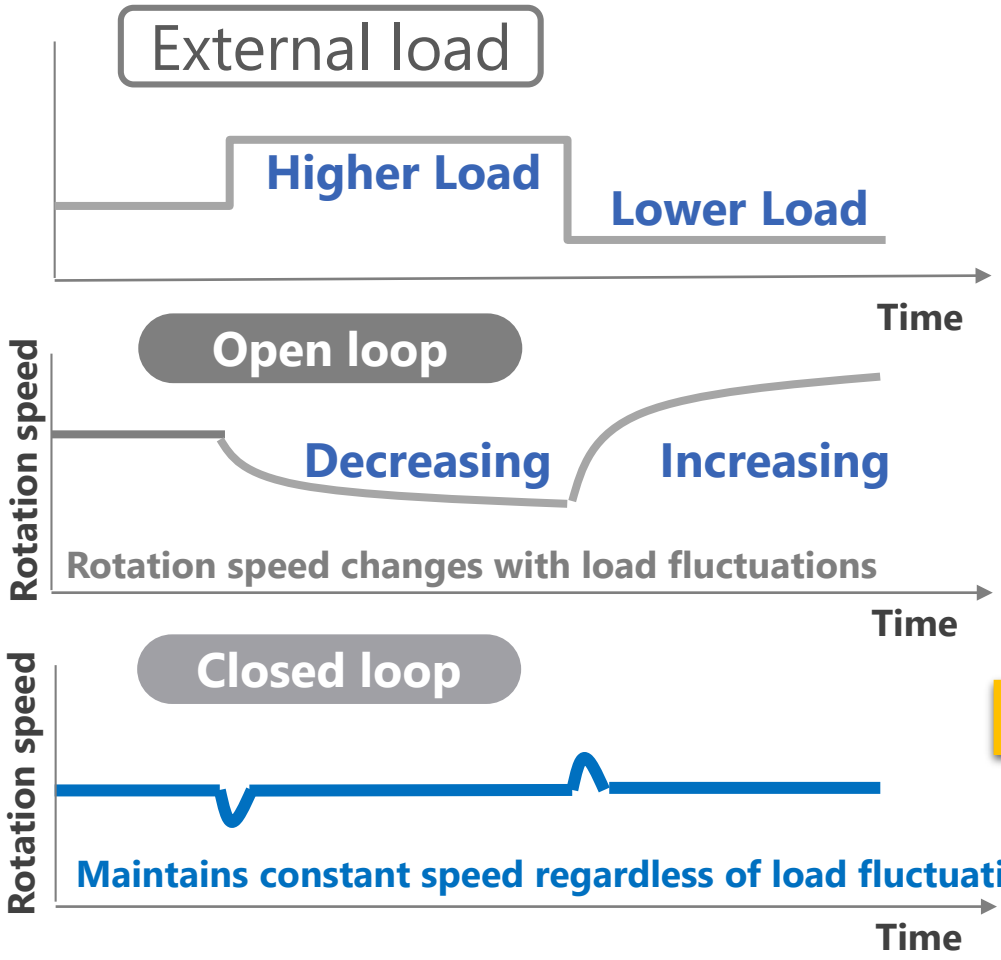
⇒Automatically optimizes phases.
Improves efficiency without any effort!



Adjustments are performed automatically in products with Intelligent Phase Control technology.

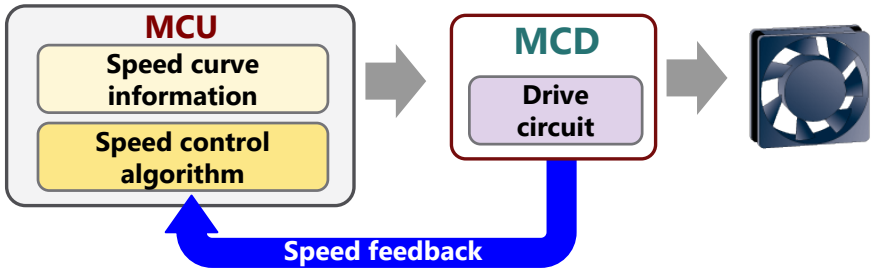
Closed Loop Speed Control

Built-in speed control circuit with speed feedback
Improves rotations speed accuracy by reducing the fluctuations due to voltage and load change



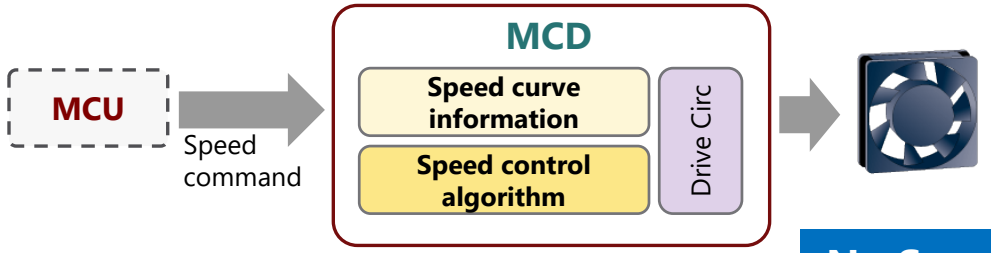
Easy to configure system

Conventional



External MCU and development of control software is required

MCD with built-in Closed loop



Speed control system is built-in MCD, only speed command signal is required.

No Speed control signal required

TC78B027FTG - 18V, Sine Wave 1-sensor Type 3-phase BLDC Motor Pre-Driver

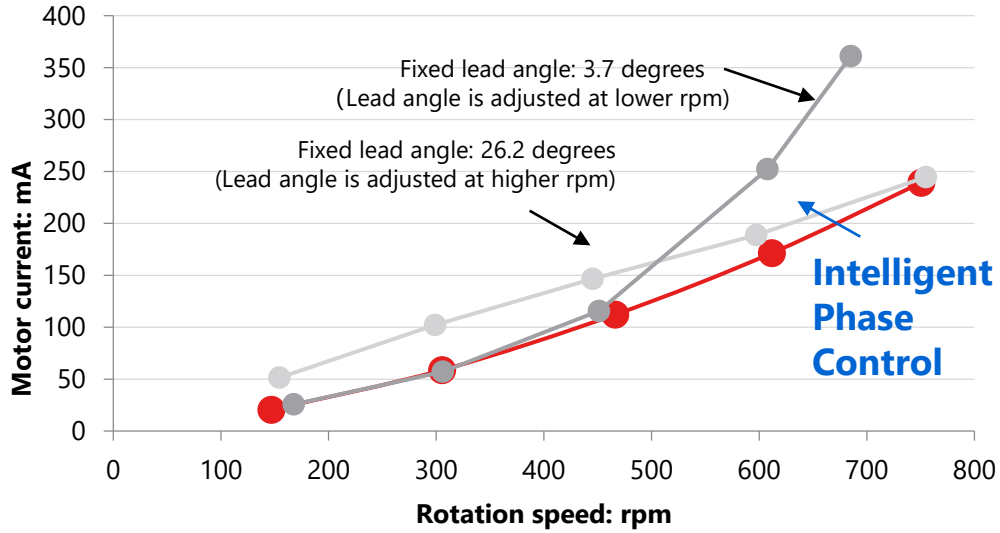
Features

- Integrated NVM-based rotation speed control
- Sine wave drive with 1 or 3 hall sensors
- Adjustable gate drive current

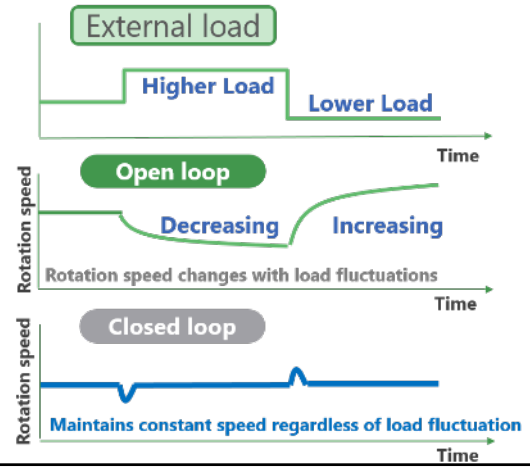
Benefits

- Reduced energy consumption
- Uniform rotation speeds up to tens of thousands RPM
- No MCU required
- Scalable power stage

Intelligent Phase Control



Closed Loop



Suitable for mission critical 12V fan applications

- EV Charging stations
- PC and servers
- Home appliances
- Industrial equipment

TC78B009FTG

30V, 200mA, 3-Phase Sensorless BLDC Pre-Driver

Features

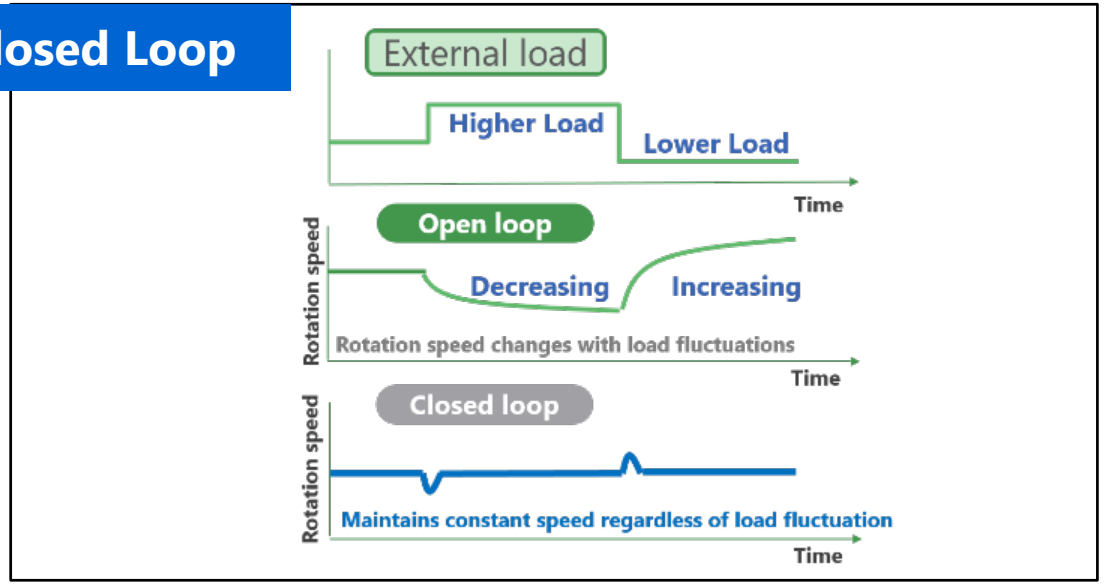
- Integrated NVM-based rotation speed control
- Adjustable gate drive current up to 200mA
- Built-in amplifier for motor current monitoring

Benefits

- Uniform rotation speeds up to tens of thousands RPM
- No MCU required
- Scalable power stage
- Current monitor allows real time adjustments

Toshiba's unique technology

Closed Loop



Suitable for high-velocity impellers and fan applications

- Servers
- Blowers
- Small pumps
- Cordless and robot vacuum cleaners

03

Brushed DC Motor Control

Product highlights

TB67H450FNG / TB67H451FNG

50V, 3.5A 1ch Brushed DC Motor Driver

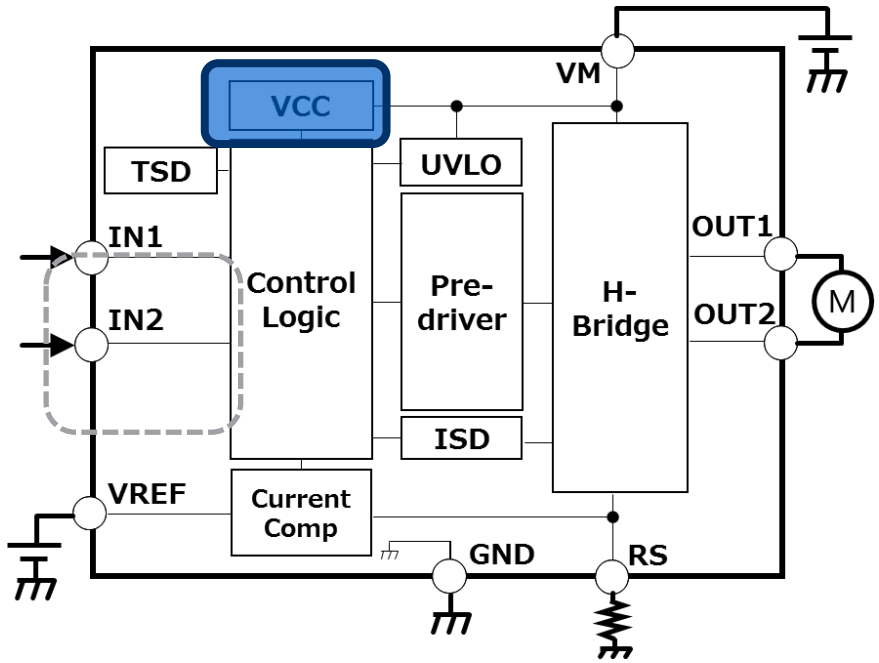
Features

- Ultra-low standby current of only 1μA
- Automatic standby mode
- Wide operating voltage range from 4.5V to 44V
- Industry standard pin out and package

Benefits

- Reduced energy consumption in standby
- Extended battery lifetime
- Allows multi-product sourcing strategies
- Ideal for USB powered devices

Isolated voltage regulator



Suitable for battery and USB powered applications

- Fiscal printers
- EV Charging plugs
- Robot vacuum cleaners
- Home appliances
- Vending machines
- Electronic door locks

H-Bridge Brushed DC Motor Driver Series for 1.8V to 6V Operation

Features

- Low operating current of 0.6mA (typ.)
- Complete shut off in standby → 0μA (typ.)
- Industry standard pin out and package
- 500kHz PWM control and fast output switching

Benefits

- Extended battery lifetime
- Allows multi-product sourcing strategies
- Enables high rotational speeds

TC78H651FNG
TC78H651AFNG

1.6A/2.0A rated 2ch H-Bridge

Using standard Pin out

2 brushed DC motor or 1 stepping motor driver

TC78H653FTG

2A rated 2ch H-Bridge
5A rated 1ch large H-Bridge

Toshiba original Pin out

High drive current at low voltage

Suitable for battery and USB powered applications

- Compact printers
- Digital Still Cameras
- Self-checkout
  Security tags
- Toys
- Electronic door locks
- USB devices

04

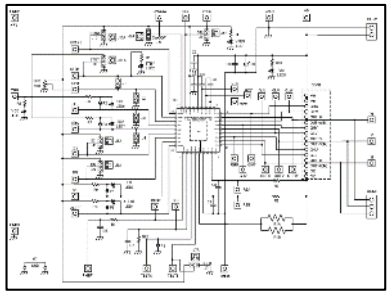
Design Support

Documentation & Application Support

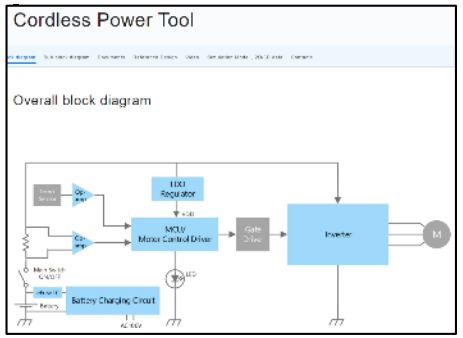
Reference information & Documentation

- Reference designs
- Applications
- FAQ
- Datasheet, Application note and environmental information available on each product web page

Schematic



Applications

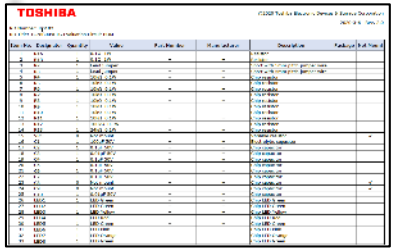


Technical application support in China

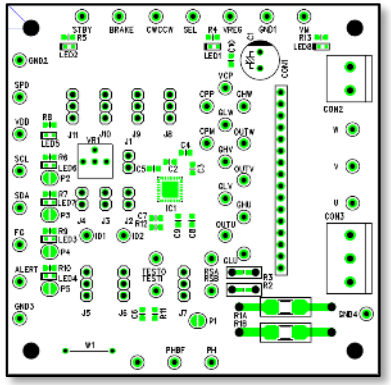
TESH :
Toshiba Devices & Storage (Shanghai) Co.,Ltd
MCD FAE support

TESZ :
Toshiba Devices & Storage (Shanghai) Co.,Ltd
Shenzhen Branch
MCD FAE support

BOM List



PCB Layout



Evaluation Boards

Samples

Available on Mouser web

https://www.mouser.cn/Toshiba/Semiconductors/Power-Management-ICs/Motor-Motion-Ignition-Controllers-Drivers/_/N-41dum?P=1z0zkx4

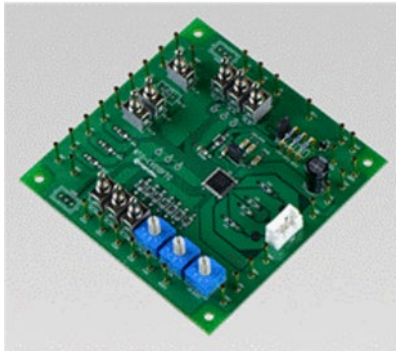
41+ part numbers

Evaluation Boards

Development boards are available in Marutsu, Seeed, MicroE, and Pololu

https://www.marutsu.com/search?q=toshiba&search_button.x=9&search_button.y=8

https://www.digikey.jp/products/en/development-boards-kits-programmers/evaluation-and-demonstration-boards-and-kits/787?k=toshiba



80+ boards are currently available

05

Selection Guide for Motor Drivers

Selection Flow

1) Target Applications

Home Appliances
Office Appliances
Industrial
etc.

2) Types of Motors

AC Motors
DC Motors
etc.

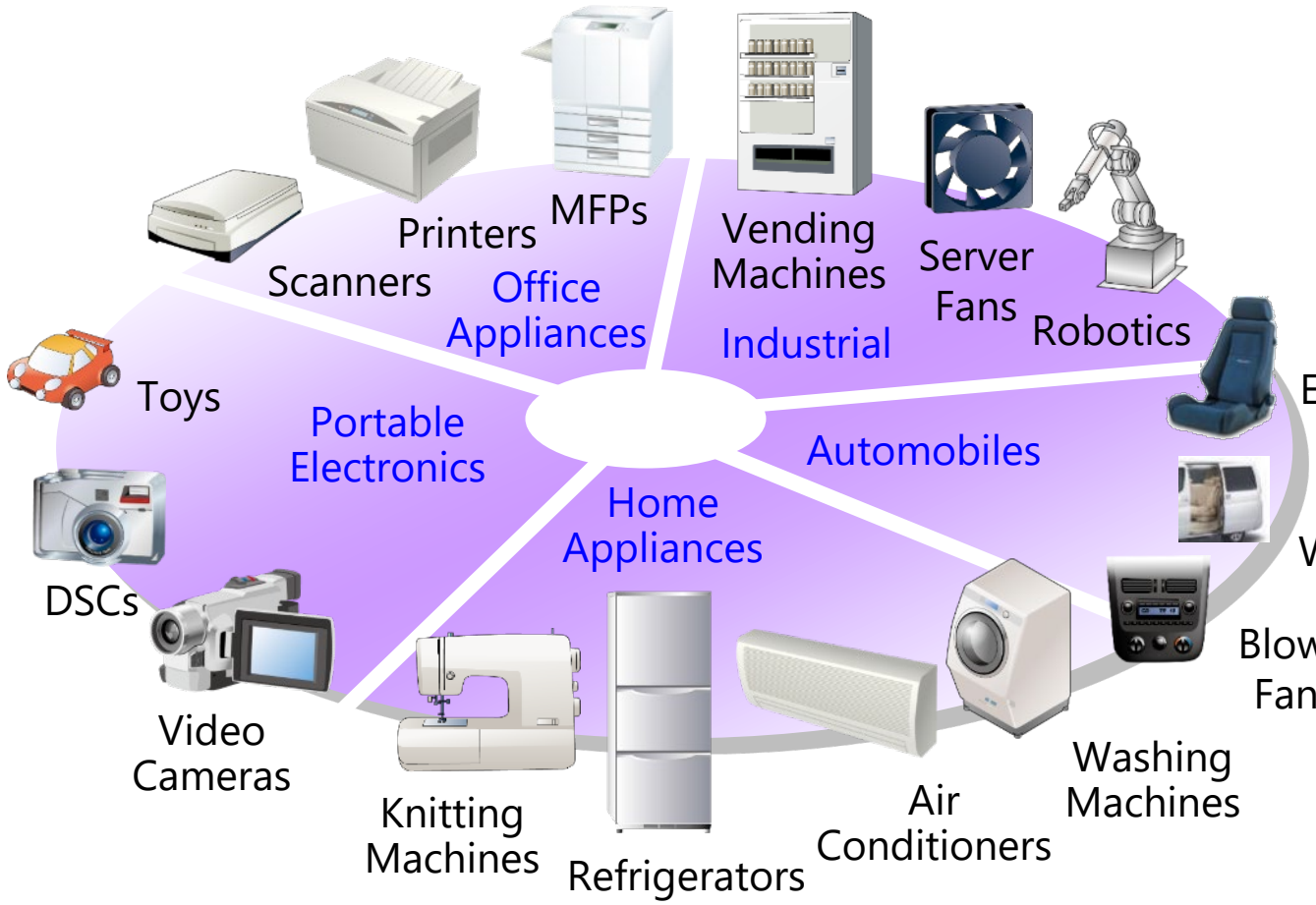
3) Types of Motor Drivers

Brushed DC Motors
Stepping Motors
Brushless DC Motors
etc.

4) Requirements for the Driver

Voltage
Current
Package
etc.

Applications



Choose the target application for the motor control driver

Selection Guide for Motor Control Drivers

How to narrow down using “keywords”.

Brushed DC Motor	Stepping Motor	Brushless DC Motor
Required voltage [V] (Operational / Maximum)	Required voltage [V] (Operational / Maximum)	Required voltage [V] (Operational / Maximum)
Required current [A] (Nominal / Peak)	Required current [A] (Nominal / Maximum)	Required current [A] (Nominal / Peak)
Types of packages (Insertion / Surface mount)	Types of packages (Insertion / Surface mount)	Types of packages (Insertion / Surface mount)
Control Interface (PWM / Analog control)	Control Interface (Phase / Clock control)	Control Interface (PWM / Analog control)
Required H-Bridges (Single / Multiple)	Required Step Resolution 1/1 step to 1/128 steps	Position Detect With hall Sensors / Sensorless
	Required Motor Types Unipolar / Bipolar	Current Control Trapezoidal / Sinusoidal

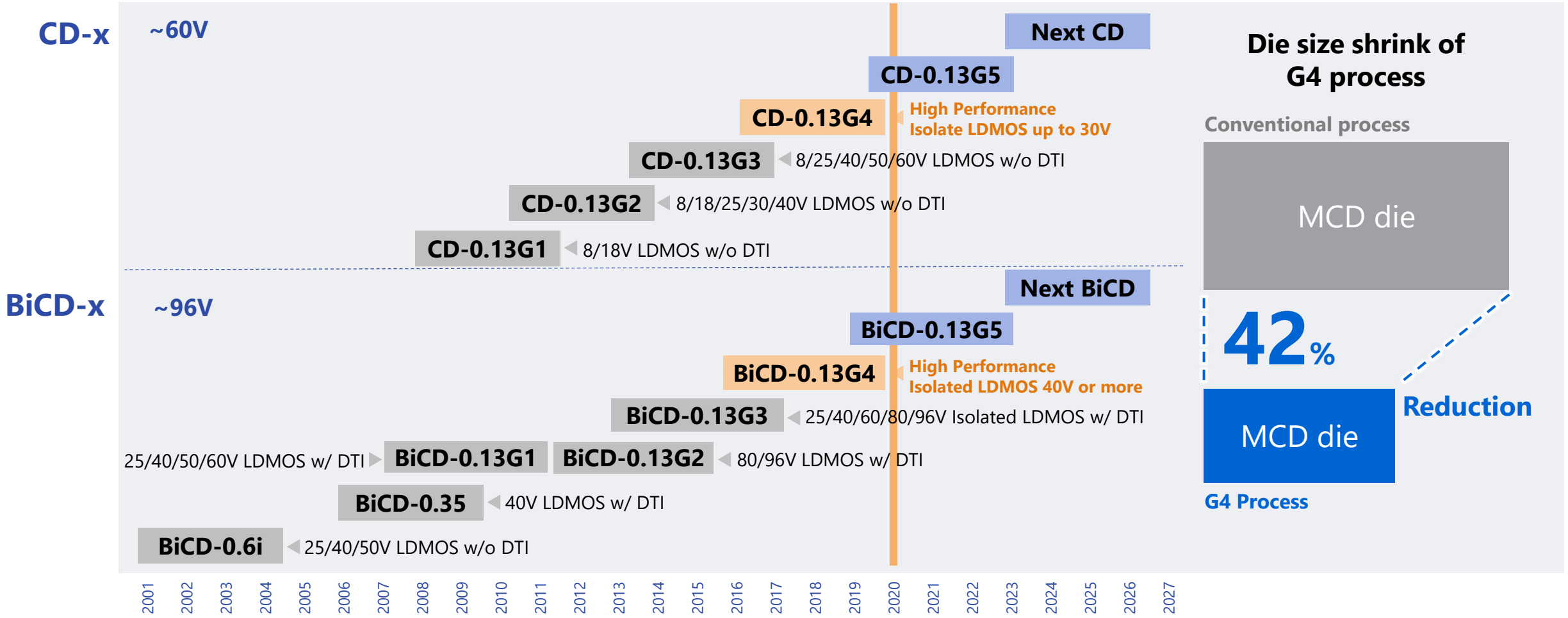
Using these keywords will make it easier to narrow down the best fit device for the customer.

06

Toshiba’s Broad Portfolio and Lineup of Motor Control Drivers

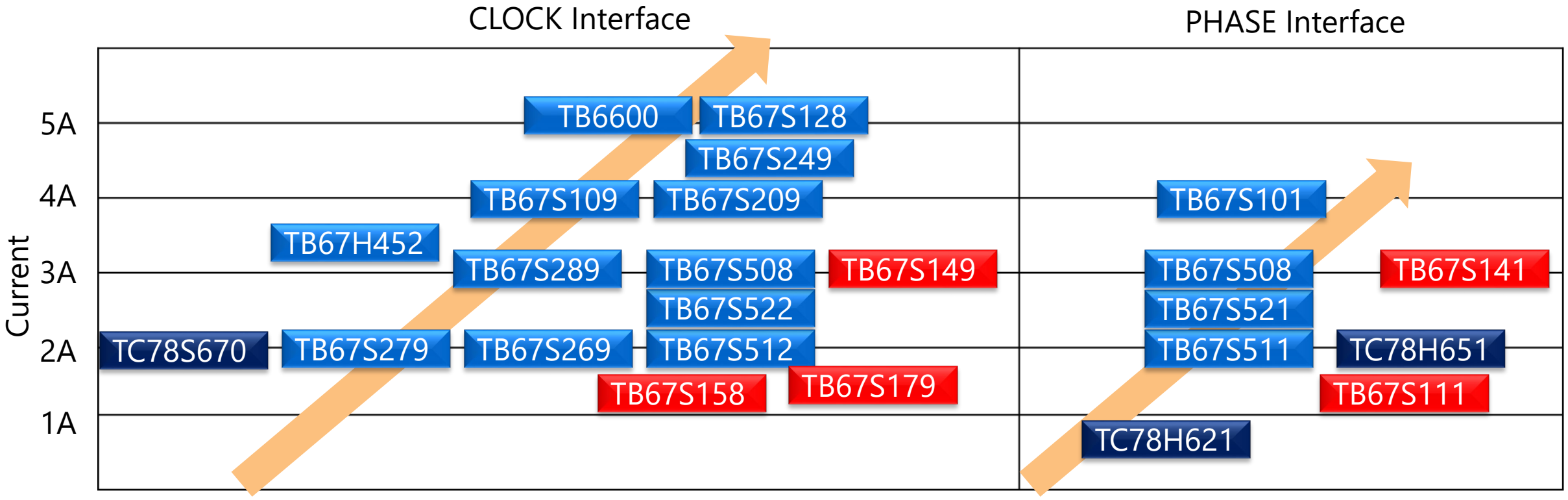
Toshiba's CD and BiCD Process Roadmap

Ultra-low N-ch DMOS $R_{DS(ON)}$ allows high motor voltage and low heat generation



Stepping Motor Driver Product Portfolio

Broad portfolio to cover multiple requirements (voltage, current, and types of motors)



Bipolar stepping motor drivers

High voltage: 40V, 50V

Low voltage: 8V, 18V

Unipolar stepping motor drivers

High voltage: 80V, 84V

Brushless DC Motor Driver Product Portfolio

Broad portfolio to cover multiple requirements (voltage, current, and types of motors)

	3 Phase Motor			1 Phase Motor
	High voltage (Over100V)	Low voltage (24V / 12V)	Low voltage (24V / 12V)	Low voltage (24V / 12V)
	Brushless	Brushless	Sensor-less	Sensor-less
Controller or Pre-driver	TC78B041/042 TB6634	TB6605 TC78B027	TB6675	TC78B006
Driver	TB67B000	TC78B016 TC78B025	TB6588 TB67B001 TB67B008	TC78B002

Controller / Pre-driver

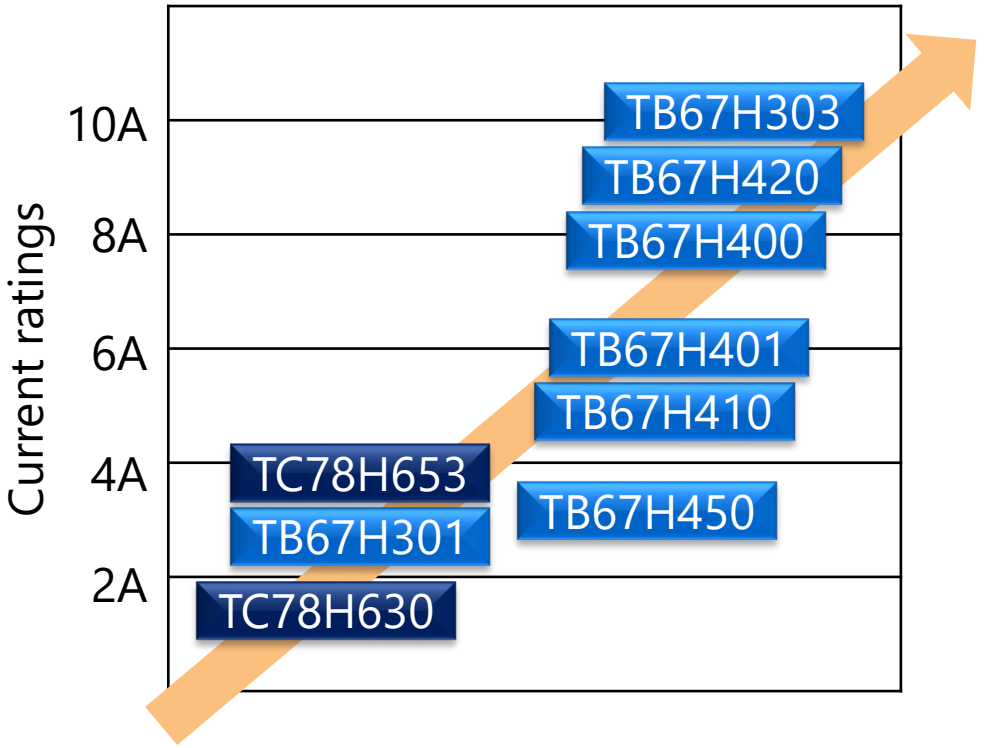
Driver

Controller-> Requires external gate drivers + FETs
Pre-driver-> Requires external FETs
Driver-> Fully integrated

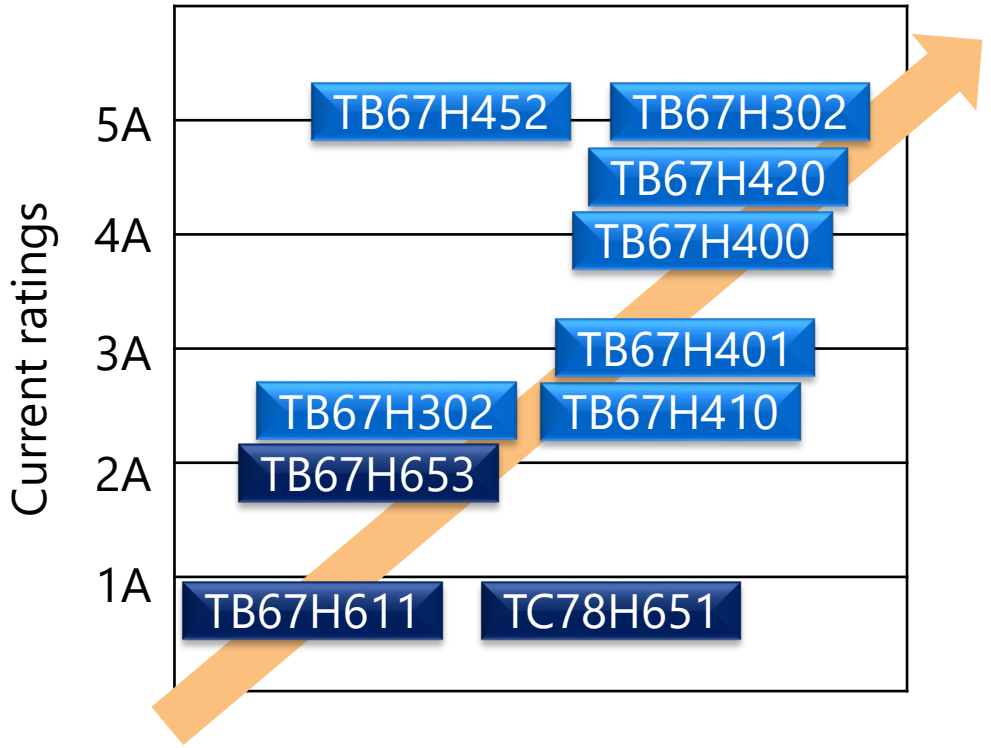
Brushed DC Motor Driver Product Portfolio

Broad portfolio to cover multiple requirements (voltage, current, and types of motors)

For single motor



For multiple motors



Low voltage: 8V, 18V

High voltage: 40V, 50V

Stepping Motor Drivers - CLOCK in Control

*: Under development *: New

Part Number	Motor Type		Interface			Maximum Ratings		Constant Current Cont.	Stepping Mode								Active Gain Control	Single Power Supply	Protection			Temp. Range TA	Package
	Bipolar	Unipolar	Clock	Phase	Serial	Voltage [V]	Current [A]		Full	Half	1/4	1/8	1/16	1/32	1/64	1/128			UVLO (1)	ISD (2)	TSD (3)		
TB62211FNG	●		●			40	1.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP24
TB62214AFTG/FNG/FG	●		●			40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48/HSOP28
TB62215AFTG/FNG/FG/HQ	●		●			40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48/HSOP28/HZIP25
TB62262FTAG	●		●			40	1.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB62262FTG	●		●			40	1.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB62269FTG/FTAG	●		●			40	1.8	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48/QFN32
TB6560AFTG/FG	●		●			40	2.5	●	●	●		●	●								●	-30 to +85℃	QFN48/HQFP64
TB6560AHQ	●		●			40	3.5	●	●	●		●	●								●	-30 to +85℃	HZIP25
TB6600FG/HG	●		●			50	4.5 / 5.0	●	●	●	●	●	●					●	●	●	●	-30 to +85℃	HQFP64/HZIP25
TB6608FNG	●		●			15	0.8	●	●	●	●	●							●		●	-20 to +85℃	SSOP20
TB6615PG		●	●			28	0.4		●	●												-30 to +85℃	DIP16
TB67S102AFTG/FNG	●		●			50	4.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48
TB67S103AFTG	●		●		●	50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48
TB67S109AFTG/FNG	●		●			50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48/HTSSOP48
TB67S128FTG *	●		●			50	5.0	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-40 to +85℃	QFN48
TB67S142FTG/NG/HG		●	●			84	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/SDIP24/HZIP25
TB67S149FTG/FG/HG		●	●			84	3.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48/HSSOP28/HZIP25
TB67S158FTG		●	●			80	3.0 × 1ch		●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S158FTG		●	●	●	●	80	1.5 × 2ch		●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S158NG		●		●	●	80	1.5 × 2ch		●	●								●	●	●	●	-20 to +85℃	SDIP24
TB67S179FTG		●	●			80	1.5	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48
TB67S215FTAG	●		●			40	2.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S209FTG	●		●			50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48
TB67S249FTG	●		●			50	4.5	●	●	●	●	●	●	●			●	●	●	●	●	-20 to +85℃	QFN48
TB67S269FTG	●		●			50	2.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48
TB67S279FTG	●		●			50	2.0	●	●	●	●	●	●	●			●	●	●	●	●	-20 to +85℃	QFN48
TB67S289FTG	●		●			50	3.0	●	●	●	●	●	●	●			●	●	●	●	●	-20 to +85℃	QFN48
TB67S508FTG	●		●	●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S512FTAG	●		●			40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S522FTAG	●		●			40	2.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TC78S122FTG/FNG	●		●			40	2.0 × 2ch	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48
TB67H452FTG	●		●			40	3.5 × 2ch	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TC78S600FTG/FNG	●		●			18	1.0	●		●	●	●	●						●	●	●	-20 to +85℃	QFN24/SSOP20
TB6613FTG	●		●		●	6	0.8	●		●					●				●		●	-20 to +85℃	QON44
TC78S670FTG **	●		●			18	2.0	●	●	●	●	●	●	●	●	●		●	●	●	●	-40 to +85℃	QFN16

Note (1): Under voltage lockout (2): Overcurrent detection (3): Thermal shutdown

Stepping Motor Drivers - PHASE in Control

*: Under development *: New

Part Number	Motor Type		Interface			Maximum Ratings		Constant Current Cont.	Stepping Mode								Active Gain Control	Single Power Supply	Protection			Temp. Range TA	Package
	Bipolar	Unipolar	Clock	Phase	Serial	Voltage [V]	Current [A]		Full	Half	1/4	1/8	1/16	1/32	1/64	1/128			UVLO (1)	ISD (2)	TSD (3)		
TB62208FTG/FNG/FG	●			●		40	1.8	●	●	●								●	●	●	●	-20 to +85℃	QFN48/HTSSOP48/HSOP28
TB62210FNG	●			●		40	1.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP24
TB62212FTAG/FNG	●			●		40	1.5×2ch	●	●	●								●	●	●	●	-40 to +85℃	QFN48/HTSSOP48
TB62213AFTG/FNG/FG/HQ	●			●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48/HSOP28/HZIP25
TB62218AFTG/FNG/FG	●			●		40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48/HSOP28
TB62261FTAG	●			●		40	1.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB62261FTG	●			●		40	1.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB6562ANG/AFG	●			●		40	1.5	●	●	●	●							●		●	●	-20 to +85℃	SDIP24/SSOP30
TB6674FAG	●			●		24	0.2		●										●	●	●	-30 to +85℃	SSOP16
TB6674PG/FG	●			●		24	0.4		●										●	●	●	-30 to +85℃	DIP16/HSOP16
TB67S101AFTG/FNG/NG	●			●		50	4.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48/SDIP24
TB67S105FTG	●				●	50	3.0	●	●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S111PG *		●				80	1.5		●	●								●	●	●	●	-20 to +85℃	DIP16
TB67S141FTG/NG/HG		●		●		84	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/SDIP24/HZIP25
TB67S145FTG		●			●	84	3.0	●	●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S158NG		●		●	●	80	1.5×2ch		●	●								●	●	●	●	-20 to +85℃	SDIP24
TB67S213FTAG	●			●		40	2.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S261FTG	●			●		50	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB67S265FTG	●				●	50	2.0	●	●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S285FTG *	●				●	50	3.0	●	●	●							●	●	●	●	●	-20 to +85℃	QFN48
TB67S511FTAG	●			●		40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S521FTAG	●			●		40	2.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TC78S121FTG/FNG	●			●		40	2.0×2ch	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48/HTSSOP48
TC78H611FNG *	●			●		18	1.1		●	●									●	●	●	-30 to +85℃	TSSOP16
TC78H621FNG *	●			●		18	1.1		●	●									●	●	●	-30 to +85℃	TSSOP16
TC78H651AFNG *	●			●		8	2.0		●	●								●	●	●	●	-40 to +105℃	TSSOP16
TC78H653FTG *	●			●		8	2.0		●	●								●	●	●	●	-40 to +105℃	QFN16

Note (1): Under voltage lockout (2): Overcurrent detection (3): Thermal shutdown

Brushed DC Motor Drivers

*: Under development *: New ○: Latch ◇: Auto recovery

Part Number		Large Mode	Maximum Ratings		Output Ron	Circuits (Ch)	C.C. PWM	Single Power Supply	Protection			Temp. Range TA	Package
			Voltage [V]	Current [A]					UVLO (1)	ISD (2)	TSD (3)		
TB62212FTAG/FNG		●	40	2.0 / 4.0(4)	2.20 / 1.10(4)	4 / 2(4)	●	●	●	○	○	-40 to +85℃	QFN48/HTSSOP48
TB62216FTG/FNG/FG			40	2.5	1.00	2	●	●	●	○	○	-20 to +85℃	QFN48/HTSSOP48/HSOP28
TB6552FTG/FNG			15	1.0	1.50	2					◊	-20 to +85℃	QFN16/SSOP16
TB6559FG			50	2.5	1.30	1	●	●		◊	◊	-30 to +85℃	HSOP16
TB6561NG/FG			40	1.5	1.50	2		●		◊	◊	-20 to +85℃	SDIP24/SSOP30
TB6568KQ			50	3.0	0.55	1		●	●	○	○	-40 to +85℃	HSIP7
TB6569FG/FTG			50	4.5	0.55	1	●	●	●	○	○	-40 to +85℃	HSOP16/QFN32
TB6612FNG			15	3.2	0.50	2			●		◊	-20 to +85℃	SSOP24
TB6613FTG			6	0.8	1.50	8	●		●		◊	-20 to +85℃	QON44
TB6640FTG/AFTG			40	3.0	1.00	1	●		●	○/◊	○/◊	-40 to +85℃	QFN48
TB6641FG/FTG			50	4.5	0.55	1	●	●	●	○	○	-40 to +85℃	HSOP16/QFN32
TB6642FG			50	4.5	0.55	1		●	●	○/◊	○/◊	-40 to +85℃	HSOP16
TB6642FTG			50	4.5	0.55	1		●	●	○/◊	○/◊	-40 to +85℃	QFN32
TB6643KQ			50	4.5	0.55	1		●	●	○	○	-40 to +85℃	HSIP7
TB67H301FTG			40	3.0	1.00	1	●		●	○/◊	○/◊	-40 to +85℃	QFN24
TB67H302HG			50	5.0	0.40	2	●	●	●	○	○	-30 to +85℃	HZIP25
TB67H303HG			50	10.0	0.20	1	●	●	●	○	○	-30 to +85℃	HZIP25
TB67H400AFTG/FNG/HG/NG		●	50	4.0 / 8.0(4)	0.49 / 0.25(4)	2 / 1(4)	●	●	●	○	○	-20 to +85℃	QFN48/HTSSOP48/HZIP25/SDIP24
TB67H410FTG/NG		●	50	2.5 / 5.0(4)	0.80 / 0.40(4)	2 / 1(4)	●	●	●	○	○	-20 to +85℃	QFN48/SDIP24
TB67H420FTG		●	50	4.5 / 9.0(4)	0.33 / 0.17(4)	2 / 1(4)	●	●	●	○	○	-20 to +85℃	QFN48
TB67H452FTG		●	40	3.5 / 5.0(4)	0.60 / 0.30 (4)	4 / 2(4)	●	●	●	○	○	-20 to +85℃	QFN48
TC78H600FTG/FNG			18	1.0	1.20	2	●		●	○	◊	-20 to +85℃	QFN24/SSOP20
TC78H611FNG			18	1.1	0.80	2			●	○	◊	-30 to +85℃	TSSOP16
TC78H621FNG			18	1.1	0.80	2			●	○	◊	-30 to +85℃	TSSOP16
TC78H630FNG			18	2.1	0.40	1			●	○	◊	-30 to +85℃	TSSOP16
TC78H651AFNG	*		8	2.0	0.22	2		●	●	○	◊	-40 to +105℃	TSSOP16
TC78H653FTG	*	●	8	2.0 / 4.0(4)	0.22 / 0.11(4)	2 / 1(4)		●	●	○	◊	-40 to +105℃	QFN16
TC78S121FTG/FNG		●	40	3.5 / 5.0(1)	0.60 / 0.30 (4)	4 / 2(4)	●	●	●	○	○	-20 to +85℃	QFN48/HTSSOP48
TC78S122FTG/FNG		●	40	3.5 / 5.0(1)	0.60 / 0.30 (4)	4 / 2(4)	●	●	●	○	○	-20 to +85℃	QFN48/HTSSOP48
TB67H401FTG	*	●	50	3.0 / 6.0(4)	0.49 / 0.25(4)	2 / 1(4)	●	●	●	○	○	-20 to +85℃	QFN48
TB67H450FNG	**		50	3.5	0.6	1	●	●	●	○	◊	-40 to +85℃	SOP8

Note (1): Under voltage lockout (2): Overcurrent detection (3): Thermal shutdown (4): Large mode

Brushless DC Motor Drivers and Controllers

*: Under development *: New

Part Number	Phases		Controller	Pre Driver	Driver	Maximum Ratings		Sensor less	Hall Sensor Inputs (Number)	Commutation		Lead Angle Control				Closed Loop	Temp. Range T_A	Package
	3-Phase	1-Phase				Voltage [V]	Current [A]			Square	Sine	External Input	Auto (current FB)	Auto (rpm FB)	Auto (InPAC)			
TB6551FAG	●		●			12	0.002		3		●	●					-30 to +115℃	SSOP24
TB6556FG	●		●			12	0.002		3		●	●	●				-30 to +115℃	SSOP30
TB6575FNG	●		●			5.5	0.020	●		●		●					-30 to +105℃	SSOP24
TB6584FNG/AFNG	●		●			18	0.002		3		●	●	●				-30 to +115℃	SSOP30
TB6585FG/AFTG	●				●	45	1.8		3		●	●	●				-30 to +85℃	HSOP36/QFN48
TB6586FG/AFG/BFG	●		●			18	0.002		3	●		●					-30 to +115℃	SSOP24
TB6588FG	●				●	50	2.5	●		●		●					-30 to +105℃	HSOP36
TB6603FTG	●			●		30	0.02		3		●	●					-30 to +85℃	QFN36
TB6604FTG	●			●		30	0.02		3		●		●				-30 to +85℃	QFN48
TB6605FTG	●			●		30	0.02		3		●	●		●			-30 to +85℃	QFN36
TC78B004FTG *	●			●		31	0.1		3		●		●				-30 to +85℃	QFN40
TB6631FNG	●		●			18	0.002		3		●	●		●			-30 to +115℃	SSOP30
TB6633FNG/AFNG	●				●	25	1.0	●		●		●					-30 to +105℃	SSOP24
TB6634FNG	●		●			18	0.002		3		●	●	●				-30 to +115℃	SSOP30
TB67B000HG	●				●	500	2.0		3	●	●	●					-30 to +115℃	HDIP30
TB67B000FG *	●				●	500	2.0		3	●	●	●					-30 to +115℃	HSSOP34
TB67B001FTG/AFTG	●				●	25	3.0	●		●		●		●			-40 to +105℃	QFN36
TB67B008FNG/AFNG/BFNG/CFNG	●				●	25	3.0	●		●		●		●			-40 to +105℃	SSOP24
TB67B008FTG/AFTG/BFTG/CFTG	●				●	25	3.0	●		●		●		●			-40 to +105℃	QFN24
TB67B054FTG *	●		●			18	0.002		3		●	●	●				-30 to +115℃	QFN32
TB67Z800FTG	●				●	25	3.0										-40 to +105℃	QFN36
TC78B002FTG/FNG		●			●	18	1.5		3	●	●	●					-40 to +105℃	QFN16/SSOP16
TC78B006FNG/AFNG/BFNG/CFNG		●		●		40	0.02		1	●	●						-40 to +105℃	SSOP16
TC78B006FTG/AFTG/BFTG/CFTG		●		●		40	0.02		1	●	●						-40 to +105℃	QFN16
TC78B015FTG *	●				●	25	3.0		1	●		●		●			-40 to +85℃	QFN36
TC78B015AFTG *	●				●	36	3.0		1	●		●		●			-40 to +85℃	QFN36
TC78B016FTG	●				●	40	3.0		3		●	●		●	●		-40 to +105℃	QFN36
TC78B015BFTG/CFTG **	●				●	36	3.0		3	●		●		●			-40 to +85℃	QFN36
TC78B025FTG *	●				●	18	4.0		1	●	●	●		●	●	●	-40 to +105℃	QFN24
TC78B041FNG *	●		●			18	0.002		3		●	●			●		-40 to +115℃	SSOP30
TC78B042FTG *	●		●			18	0.002		3		●	●			●		-40 to +115℃	QFN32
TC78B000AHG **	●				●	600	2.0		3	●	●	●					-30 to +115℃	HDIP30
TC78B000AFG **	●				●	600	2.0		3	●	●	●					-30 to +115℃	HSSOP34
TC78B027FTG **	●			●		18	0.2		1	●	●	●		●	●	●	-40 to +105℃	QFN24

TOSHIBA

Thank you.