TOSHIBA
Leading Innovation

System Catalog Dec. 2014

Motor Solutions Guide

SEMICONDUCTOR & STORAGE PRODUCTS
http://toshiba.semicon-storage.com/

Premier Energy-Saving Solutions Using Toshiba's semiconductors for Motor Applications

Toshiba's semiconductor devices help reduce the power consumption, reduce the size and thickness, and improve the efficiency of motor applications, contributing to the development of eco-friendly systems.

Now, energy-saving is a global issue.
The requirements for semiconductor devices for home appliance, mobile and industrial applications include high efficiency, fast response, low loss, a high level of safety, and superb environmental performance.
To meet these requirements, Toshiba offers an extensive portfolio of semiconductor devices, including vector control MCUs, high-efficiency, high-current stepping motor drivers with a current rating of up to 5.0 A, motor drivers (intelligent power devices) fabricated using a high-voltage process, and brushless DC (BLDC) motor drivers that help reduce the acoustic noise generated by motors.
Toshiba's semiconductor devices for motor applications help realize the ideal eco-friendly systems.

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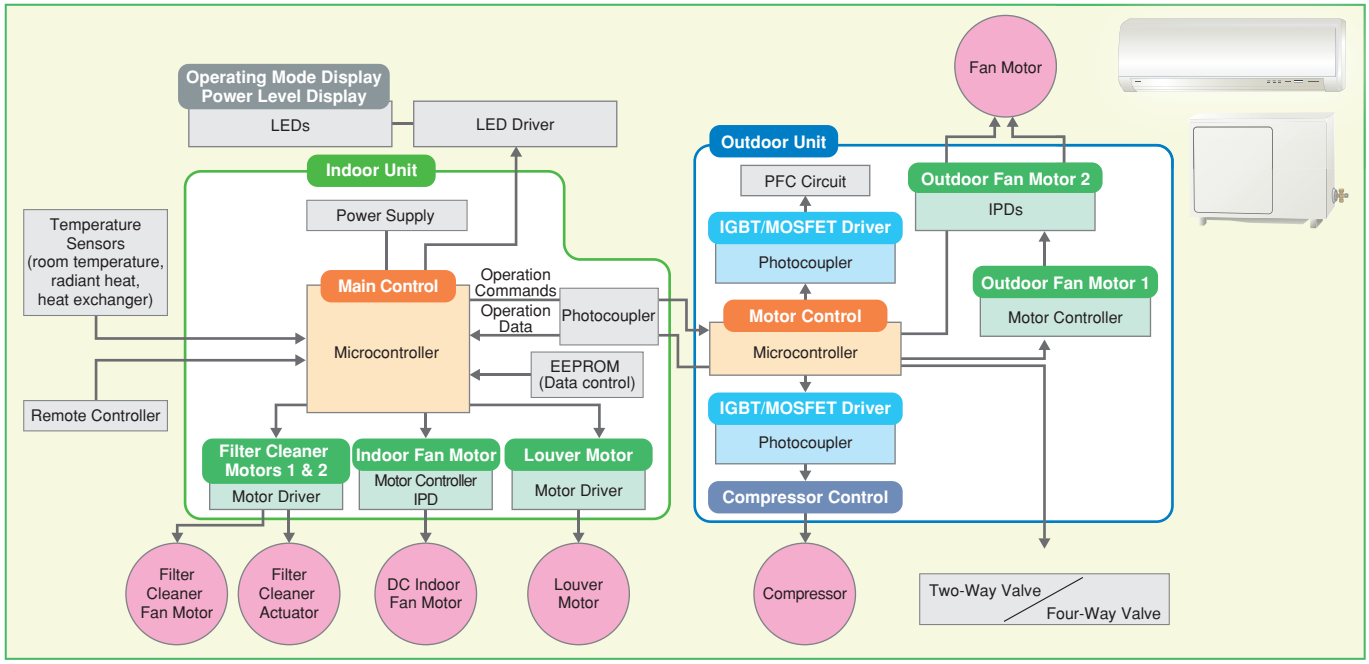
This catalog contains the latest information available as of November 12, 2014.

Home Appliances and Consumer Electronics

Toshiba offers a suite of motor solutions suitable for DC inverter applications that require low power consumption and quiet motor control. Our product portfolio includes motor controllers, motor drivers, microcontrollers with an integrated vector engine, intelligent power devices (IPDs), IGBTs and photocouplers.

Application Example: Air Conditioner



Product Lineup

Applications	Semiconductor	Recommended Devices	Features	End-Product Examples
Motor Control	Microcontrollers	**TMPM370, TMPM372 TMPM373, TMPM374 TMPM375, TMPM376**	Vector Engine (VE) Vector Engine Plus (VE+) (only TMPM375) 3-phase PWM (2 channels for TMPM370 and TMPM376)	Refrigerators, air conditioners, automatic washing machines, dishwashers
Main Control	Microcontrollers	**TMPM380, TMPM384**	Multipurpose timer for motor and IGBT control	
Indoor Fan Motor	Motor Controllers/Drivers	**TB67B000HG**	Brushless DC motor driver; sine-wave current control	
		TB6584FNG/AFNG, TB6551FAG TB6631FNG, TB6634FNG	Brushless DC motor controller; sine-wave current control	
		TB6586FG/AFG/BFG	Brushless DC motor controller	
Outdoor Fan Motor	Motor Controllers/Drivers	**TB67B000HG**	Brushless DC motor driver; sine-wave current control	
		TB6584FNG/AFNG, TB6551FAG TB6631FNG, TB6634FNG	Brushless DC motor controller; sine-wave current control	
		TB6586FG/AFG/BFG	Brushless DC motor controller	
Indoor Louver Motor	Motor Controllers/Drivers	**TB62210FNG, TB62211FNG TC78S600FTG/FNG TB62261FTAG/FTG TB62262FTAG/FTG, TB6608FNG**	Two-phase stepping motor driver	
		TC78H600FTG/FNG, TB6552FTG/FNG TC78H610FNG	Full-bridge driver for a brushed DC motor	
Indoor Filter Cleaner Motor 1	Motor Controllers/Drivers	**TB6585FG/AFTG**	Brushless DC motor driver; sine-wave current control	
Indoor Filter Cleaner Motor 2	Motor Controllers/Drivers	**TB6608FNG, TC78S600FTG/FNG**	Stepping motor driver; 4-bit microstepping	
Air Conditioners Indoor Fan Motors	Motor drivers (Intelligent power devices)	**TPD4151K, TPD4142K**	Thin package High-voltage, high-current pins and control pins are isolated on the opposite sides of a package.	Air conditioners
Air Conditioners Outdoor Fan Motors	Motor drivers (Intelligent power devices)	**TPD4123K/AK, TPD4144K/AK TPD4135K/AK**		
Compressor Control	Motor drivers (Intelligent power devices)	**TPD4135K/AK**		Refrigerators
Compressor Drive Pulsator/Drum Drive	IGBTs	**GT15J341, GT20J341, GT30J121 GT30J341**	Low loss; available in insulated and non-insulated packages	Air conditioners, automatic washing machines, hand dryers
Circulating Pumps	Motor drivers (Intelligent power devices)	**TPD4144K/AK**	Thin package, High-voltage, high-current pins and control pins are isolated on the opposite sides of a package.	Automatic washing machines, dishwashers
IGBT and Power MOSFET Drivers for Compressor Applications	Photocouplers	**TLP155E, TLP152 TLP5751, TLP5214**	Direct drive of an IGBT or a power MOSFET Peak output current: 0.6 A to 4.0 A Small low-cost SO6: 0.6-A output (TLP155E), 2.5-A output (TLP152) Isolation voltage: 5 kVrms rail-to-rail output TLP5751 in SO6L TLP5214 with overcurrent protection features in SO16L	Air conditioners, refrigerators

Toshiba's Unique Technologies

Motor drivers

■ **Sensorless PWM drive:** The back-EMF voltage from the motor coil is sensed and fed back to the commutation signals.

■ **Sine-wave drive:** The motor windings are energized with sine-wave currents to reduce vibration and acoustic noise. Sine-wave PWM control is implemented as a hardware core.

■ **Lead angle control:** Lead angle control and automatic lead angle correction help to improve motor efficiency.

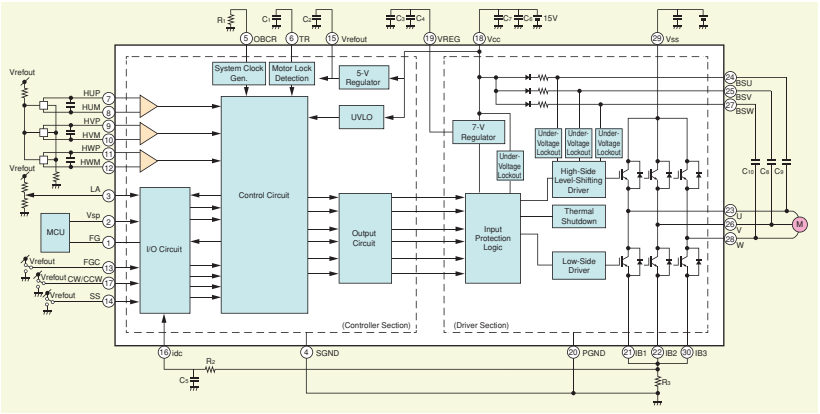
Microcontrollers

■ **Vector control:** The hardware specifically designed for vector control enables sensorless sine-wave drive.

Product Overview

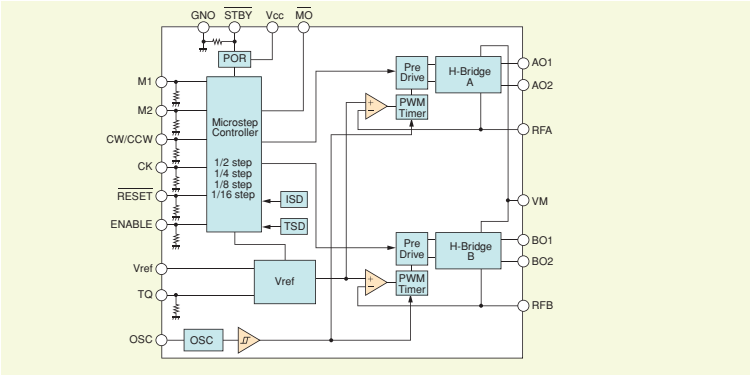
500-V Sine-Wave BLDC Motor Driver (TB67B000HG)

- High-voltage sine-wave driver (500 V/2.0 A, sine- and square-wave drive)
- Lead angle control (via an external input)
- On-chip power supply for Hall sensors and Hall ICs
- On-chip oscillator (external resistor required)
- Motor lock protection
- Current limiter
- Thermal shutdown (TSD)
- Through-hole package: HDIP30



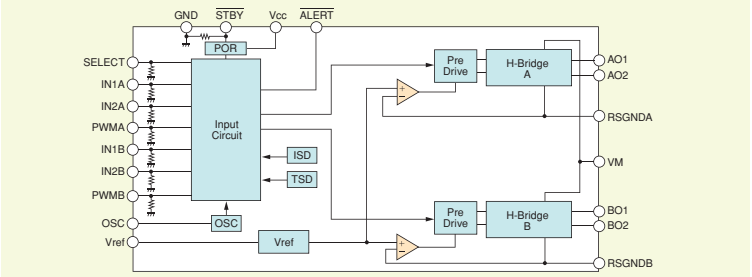
Single-Channel Stepping Motor Drivers (TC78S600FTG/FNG)

- Absolute Maximum Ratings: 18 V/1.0 A
- Harf-, quarter-, 1/8- and 1/16-step drive modes
- Output Ron: 1.2 Ω typ. (high side + low side)
- Clock input control
- Constant-current PWM control
- Standby function
- Small packages: WQFN24, SSOP20



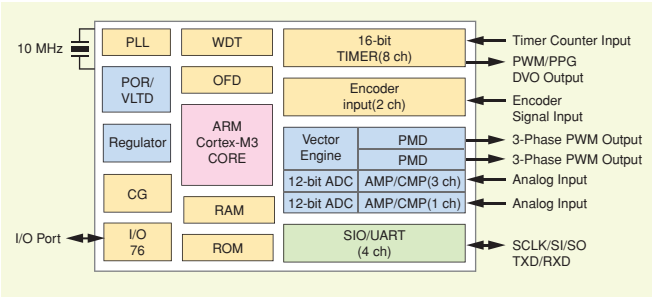
Two-Channel Brushed DC Motor Drivers (TC78H600FTG/FNG)

- Absolute Maximum Ratings: 18 V/1.0 A
- Supports direct and constant-current PWM
- Output Ron: 1.2 Ω typ. (high side + low side)
- Standby function
- Cross-conduction protection
- Small packages: WQFN24, SSOP20



Microcontrollers with Vector Engine (TMPM370FYFG/FYDFG)

- Incorporates Toshiba's original Vector Engine (VE) that implements part of the motor vector control function in hardware
- High-performance ARM® Cortex®-M3 core with a clock rate of up to 80 MHz
- High-speed programming into Toshiba's original on-chip NANO FLASH™ memory
- Various analog circuits (comparator, op-amp)
- 12-bit AD converter
- Compliant with the IEC 60730 standard of the International Electrotechnical Commission
- 5-V single power supply



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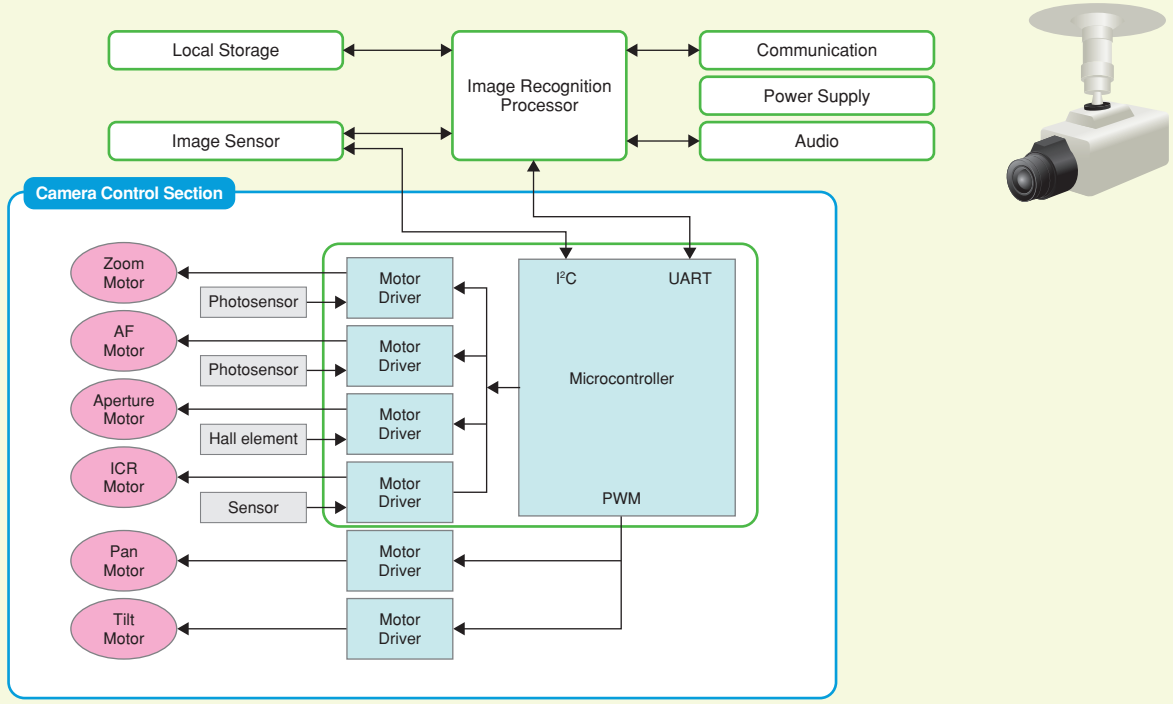
Mobile and Compact Equipment

Toshiba offers a portfolio of semiconductor devices ideal for mobile and compact applications requiring low power consumption and small form factor.

Application Example: Surveillance Camera



Product Lineup

Applications	Semiconductor	Recommended Devices	Features	End-Product Examples
Motor Control	Microcontrollers	**TMPM341** **TMPM342** **TMPM343**	ARM Cortex-M3 core (54 MHz max) 12-bit AD converter, 10-bit DA converter High-resolution programmable pulse generator (PPG) with a 6-ns resolution 2-phase input pulse counter Programmable servo/sequence controller (PSC) (TMPM342, TMPM343) Microstep control and H-switch driver (TMPM342, TMPM343) Analog circuits for various sensors (TMPM342, TMPM343)	Digital video cameras, digital still cameras, surveillance cameras, camera lenses
		TMPM440	ARM Cortex-M4F core (100 MHz max) 12-bit AD converter, 10-bit DA converter Improved performance thanks to multiple computing units (MAC, FPU, PSC)	Digital video cameras, digital single-lens reflex camera, surveillance cameras, home appliances, audio equipment, sensor applications, printers, communications equipment
Lens Drive Actuator Drive	Brush motor drivers/ Stepping motor drivers	**TB6614FNG**	Single-bridge	Digital still cameras, surveillance cameras, network ip cameras, camera lenses, small scanners, mini printers
		TB6612FNG **TB6552FTG/FNG**	Dual-bridge	
		TB6613FTG	8 channels, 6-bit microstepping, dual motor drive, serial interface	
		TB6608FNG	8 microsteps, constant-current drive	
		TC78S600FTG/FNG	16 microsteps, constant-current drive, maximum rated voltage: 18 V	
		TC78H600FTG/FNG **TC78H610FNG**	Dual-bridge, maximum rated voltage: 18 V	
Pan/Tilt Drive	Stepping motor drivers	**TB62269FTG**	32 microsteps, constant-current drive, maximum rated voltage: 40 V, output current: 1.8 A (max)	
		TB62212FTAG/FNG	4-channel H-bridges for driving two stepping motors	

Toshiba's Unique Technologies

Motor drivers

- **Reduced power consumption due to the use of a new process technology:** Products with an LDMOS output stage featuring low power consumption
- **Significantly reduced power loss and heat dissipation from the output stage:** TB62269FTG: Ron = 0.8 Ω typ. (high side + low side)
- **Reduced vibration due to the use of a high-resolution microstep sine-wave driver:** TB62269FTG: 32 microsteps
- **Small packages:** Leadless WQFN packages

Microcontrollers

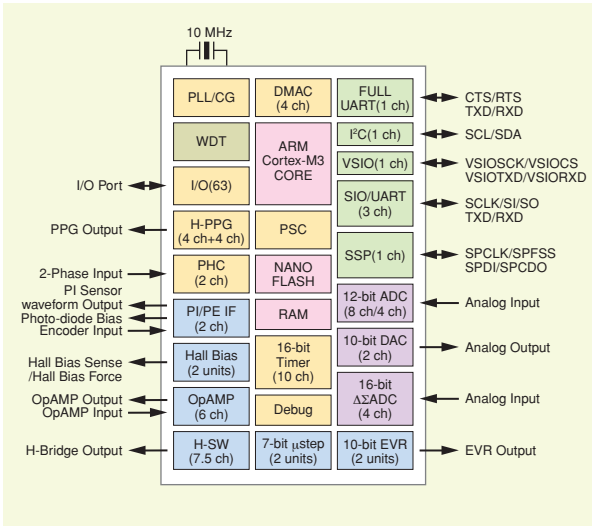
- **Programmable servo/sequence controller (PSC):** MCU with Toshiba's original coprocessor specifically designed for computing operations
- **Ultrasonic-motor control and piezoelectric actuator support:** PPG outputs with 6-ns resolution.

Product Overview

Motor Control Microcontroller (TMPM342FYXBG)

The TMPM342FYXBG incorporates analog circuits required for camera shake correction, lens control and overall system control. The high-performance ARM Cortex-M3 core provides high-speed computation. Additionally, a high-resolution programmable phase generator (PPG) enables smooth and quiet motor operation.

- ARM Cortex-M3 core
  - Supply voltage: 2.7 to 3.6 V (regulated on-chip)
  - Maximum operating frequency: 40 MHz
  - On-chip memory: 256-KB Flash ROM
    32-KB SRAM
- Motor driver
  - Operating voltage: 2.5 V to 5.5 V max (with the driver on)
    3.1 V to 3.5 V (peripheral analog blocks)
- On-chip peripherals
  - PSC: 2 KB (instruction) + 2 KB (data) per unit
  - 16-bit delta-sigma AD converter: 1 unit (4 differential channels)
  - 12-bit AD converters: 2 units (8 channels + 4 channels)
  - 10-bit DA converter: 2 channels
  - DMA controller: 4 channels
  - 16-bit timer: 8 high-speed channels + 10 channels
  - Two-phase input pulse counter: 2 channels
  - H-switch driver: 7.5 channels (plus two 7-bit microstep controllers)
  - Hall Bias Control: 2 units
  - Op-amp: 6 channels
  - PI-PE interface: 2 channels
  - 10-bit electrical variable resistance (EVR): 2 units
- Package: VFBGA142

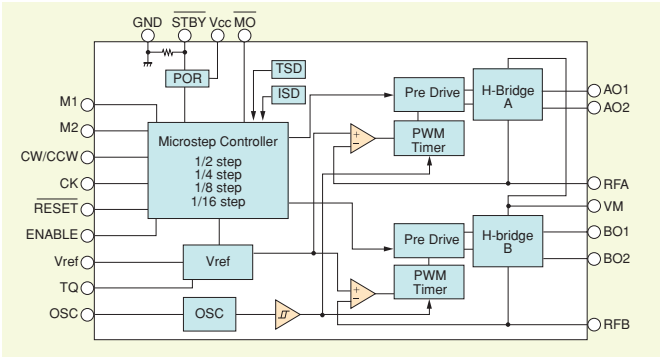


Abbreviations: PI: Photo Interrupter PE: Photo Encoder

Low-Voltage Stepping Motor Drivers (TC78S600FTG/FNG)

The TC78S600FTG/FNG supports half-, quarter-, 1/8- and 1/16-step motor drive modes, and forward/reverse direction control.

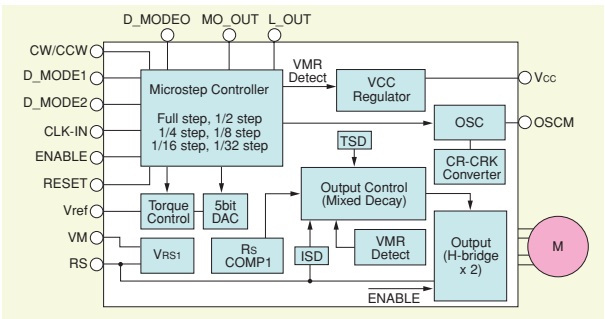
- Motor supply voltage (VM): 15 V max
- Control supply voltage (Vcc): 2.7 V to 5.5 V (operating range)
- Output current (Iout): 0.8 A max
- Output Ron: 1.2 Ω typ. (high side + low side)
- Microstep control circuit (with a clock input)
- Half-, quarter-, 1/8- and 1/16-step drive modes
- Internal pulldown resistors on input pins: 200 kΩ typ.
- Monitor output (MO) pin
- Overcurrent detection (ISD), thermal shutdown (TSD), undervoltage lockout (UVLO)
- Packages: WQFN24, SSOP20



PWM Bipolar Stepping Motor Driver (TB62269FTG)

The TB62269FTG is rated at 40 V/1.8 A. The internal voltage regulator allows control of a motor with a single VM power supply.

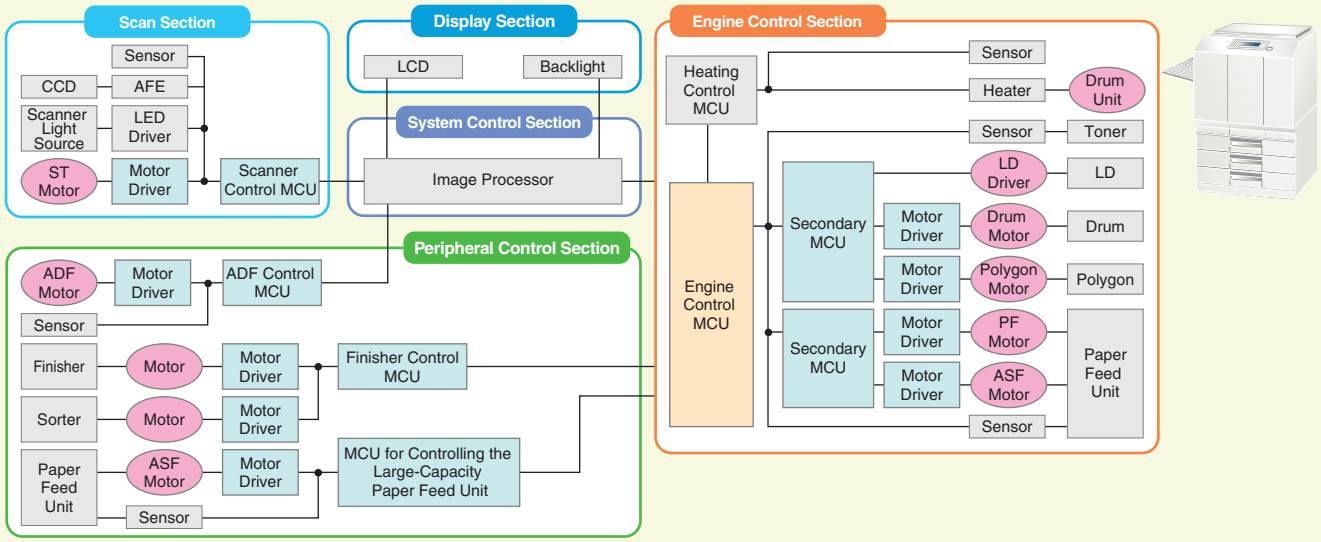
- Single-chip drive control of a bipolar stepping motor
- PWM constant-current drive
- Full-, half-, quarter-, 1/8-, 1/16- and 1/32-step drive modes
- Low output Ron due to a BiCD process: 0.8 Ω typ. (high side + low side)
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Operates with only the VM power supply because of the on-chip Vcc regulator for internal circuitry
- Chopping frequency programmable via external resistor and capacitor
- Package: WQFN48



Office Equipment

Toshiba offers various semiconductor devices for motor applications that embody its unique motor control technologies. These devices make it possible to optimize high-precision, high-speed motor control for office equipment applications.

Application Example: Printer



Product Lineup

Applications	Semiconductor	Recommended Devices	Features	End-Product Examples
Engine Control Section	Microcontrollers	**TMPM362**	ARM Cortex-M3 core (64 MHz max), 18 serial channels, Sixteen 16-bit timer channels, Consumer Electronics Control (CEC) interface, remote control preprocessor	Multifunction printers, printers, audio-visual (AV) equipment, digital equipment, PC peripherals, industrial equipment, networking equipment, office equipment
		TMPM369	ARM Cortex-M3 core (80 MHz max), multipurpose timer suitable for various motor and IGBT control, USB, USB Embedded Host, dual AD converter, programmable motor driver (PMD), CAN, EtherMAC	
		TMPM461 **TMPM462**	ARM Cortex-M4F core (120 MHz max), multipurpose timer suitable for various motor and IGBT control, 3 DMA units, 20 serial channels, CEC interface, remote control preprocessor, large-capacity memory	
	Brush Motor Drivers	**TB6568KQ, TB6643KQ**	Single full bridge, direct PWM control	Plain paper copiers (PPCs), printers, fax machines, vending machines, ATMs, amusement equipment, card readers, bank note recognition machines, etc.
		TB6569FTG/FG, TB6641FTG/FG	Single full bridge, emergency output, Direct PWM control, Constant-current PWM control	
		TB67H301FTG/FNG++	Direct PWM control, Constant-current PWM control, Standby function	
		TB67H400AFTG/FNG/FG++**/HG/NG**	Dual full bridge, Constant-current PWM control, Direct PWM control, Parallel control of two channels (Large mode)	
Scanner Peripheral Control Section	Microcontrollers	**TMPM037**	ARM Cortex-M0 core (20 MHz max), 1 DMA unit, bit-banding	Multifunction printers, printers, audio-visual (AV) equipment, digital equipment, PC peripherals, industrial equipment, networking equipment, office equipment
		TMPM36B	ARM Cortex-M3 core (80 MHz max), multipurpose timer suitable for various motor and IGBT control, PMD, 2 DMA units, remote control preprocessor	
		TMPM330	ARM Cortex-M3 core (40 MHz max), CEC interface, remote control preprocessor	
		TMPM361	ARM Cortex-M3 core (64 MHz max), CEC interface, remote control preprocessor, large-capacity memory	
		TMPM461 **TMPM462**	ARM Cortex-M4F core (120 MHz max), multipurpose timer suitable for various motor and IGBT control, 3 DMA units, 20 serial channels, CEC interface, remote control preprocessor, large-capacity memory	
	Stepping Motor Drivers (Bipolar)	**TB6560AFTG/FG/HQ**	Clock input, micro-stepping drive (1/16 step)	Plain paper copiers (PPCs), printers, fax machines, vending machines, ATMs, amusement equipment, card readers, bank note recognition machines, etc.
		TB62211FNG, TB62214AFTG/FNG/FG **TB62215AFTG/FNG/FG/HQ, TB62262FTAG/FTG**	Clock input, micro-stepping drive (1/4 step)	
		TB67S102AFTG/FNG/FG++**/HG******/NG**	Clock input, micro-stepping drive (1/4 step), ADMD	
		TB62210FNG, TB6562AFG/NG **TB62218AFTG/FNG/FG** **TB62213AFTG/FNG/FG/HQ, TB62261FTAG/FTG/SFG**	Phase inputs, micro-stepping drive (1/4 step)	
		TB67S101AFTG/FNG/FG++**/HG******/NG**	Phase inputs, micro-stepping drive (1/4 step), ADMD	
		TB62269FTG	Clock input, micro-stepping drive (1/32 step)	
	Stepping Motor Drivers (Unipolar)	**TB67S141FTG/FG**++**/HG/NG**	Phase input interface, 84 V/3.0 A, micro-stepping drive(1/4 step)	
		TB67S142FTG/FG++**/HG/NG**	Clock input interface, 84 V/3.0 A, micro-stepping drive (1/4 step)	
	Stepping Motor Drivers/ Brush Motor Drivers	**TB62212FTAG/FNG**	Phase inputs, micro-stepping drive (1/2 step) Four on-chip H-bridge channels allow control of either up to four brushed DC motors or up to two stepping motors.	

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Toshiba's Unique Technologies

Motor drivers

- **Reduced power consumption due to the use of a new process:** Products with an LDMOS output stage featuring low power consumption
- **Significantly reduced power loss and heat dissipation from the output stage:** TB62269FTG: Ron = 0.8 Ω typ. (high side + low side)
- **Reduced vibration due to the use of a high-resolution microstep sine-wave driver:** TB62269FTG: 32 microsteps
- **Small packages:** Leadless WQFN packages
- **High-efficiency control of a high-rpm motor:** Advanced Mixed Decay (ADMD) technology

Product Overview

40-V/1.8-A Bipolar Stepping Motor Drivers (TB62261FTG, TB62262FTG, TB62269FTG)

- Full-, half-, quarter-, 1/8-, 1/16- and 1/32-step drive modes
- Low output Ron due to a BiCD process: 0.8 Ω typ. (high side + low side)
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Supports a clock input and a phase-input interface
- Package: WQFN48

84-V/3.0-A Unipolar Stepping Motor Drivers (TB67S141FTG/FG++/HG/NG, TB67S142FTG/FG++/HG/NG, TB67S149FTG/FG++/HG)

- Requires no current-sensing resistor
- Full-, half-, quarter-, 1/8-, 1/16- and 1/32-step drive modes
- Low output Ron due to a BiCD process: 0.25Ω typ.
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Supports a clock input and a phase-input interface
- Package: WQFN48, HSOP28, HZIP25, SDIP24

50-V/4.0-A Two-Channel Brushed DC Motor Drivers (TB67H400AFTG/FNG/FG++/HG/NG)

- Configurable as an 8.0-A single-channel motor driver in Large mode
- Low output Ron due to a BiCD process: 0.49 Ω typ. (high side + low side)
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Package: WQFN48, HTSSOP48, HSOP28, HZIP25, SDIP24

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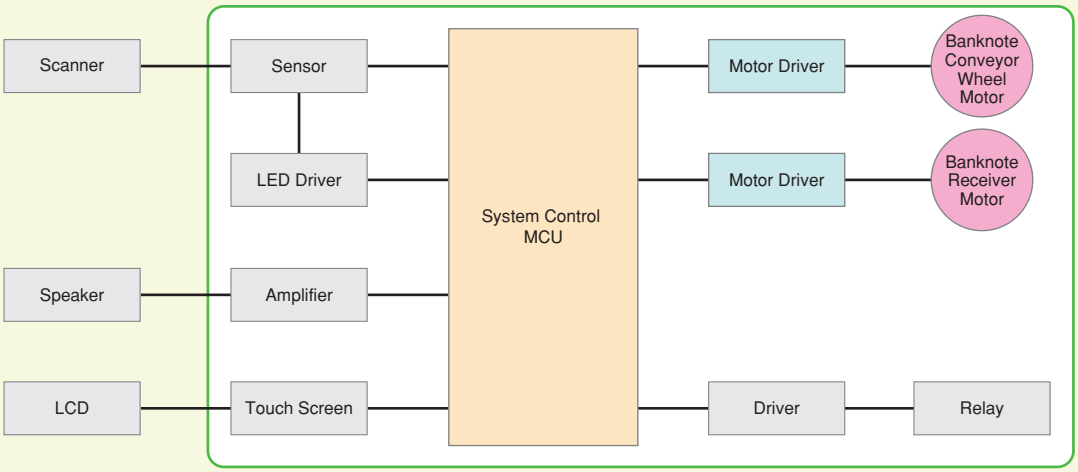
Industrial Applications

Toshiba offers motor solutions for industrial applications that require high current, quick control and high accuracy.

Application Example: Currency Counter



Product Lineup

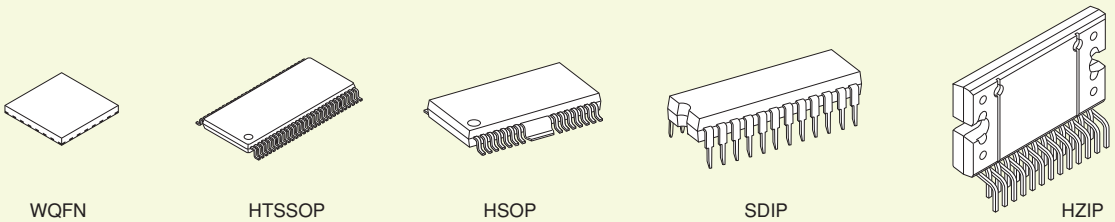
Applications	Semiconductor	Recommended Devices	Features	End-Product Examples
Motor Controller	Stepping Motor Drivers (Unipolar)	**TB67S141FTG/FG++/HG/NG**	Phase input interface, 84 V/3.0 A, 1/4 step	Currency counters, banking terminals, industrial weaving machines, sewing machines, embroidery machines, surface-mounting machines, POS systems, ticket-vending machines, amusement equipment
		TB67S142FTG/FG++/HG/NG	Clock input interface, 84 V/3.0 A, 1/4 step	
		TB67S149FTG/FG++/HG	Clock input interface, 84 V/3.0 A, 1/32 step	
		TB67S158FTG/NG	80 V/1.5 A, 2 ch	
	Stepping Motor Drivers (Bipolar)	**TB62261FTG/FTAG**	Phase input interface, 40 V/1.8 A, 1/4 step	
		TB62262FTG/FTAG	Clock input interface, 40 V/1.8 A, 1/4 step	
		TB62269FTG	Clock input interface, 40 V/1.8 A, 1/32 step	
		TB67S213FTAG	Phase input interface, 40 V/2.5 A, 1/4 step	
		TB67S215FTAG	Clock input interface, 40 V/2.5 A, 1/4 step	
		TB67S101AFTG/FNG/FG++/HG/NG**	Phase input interface, 50 V/4.0 A, 1/4 step, ADMD	
		TB67S102AFTG/FNG/FG++/HG/NG**	Clock input interface, 50 V/4.0 A, 1/4 step, ADMD	
		TB67S103AFTG	Serial and clock input interfaces, 50 V/4.0 A, 1/32 step, ADMD	
		TB67S109AFTG/FNG/HG++	Clock input interface, 50 V/4.0 A, 1/32 step, ADMD	
		TB6600FG/HG	Clock input interface, 50 V/5.0 A, 1/16 step	
	Brush Motor Drivers	**TB67H301FTG/FNG++**	40 V/3.0 A	
		TB67H302HG	50 V/5.0 A	
		TB67H303HG	50 V/10.0 A	
		TB67H400AFTG/FNG/FG++/HG/NG	50 V/4.0 A, 2 ch	
	Photocouplers	**TLP5214, TLP5754**	Direct drive of an IGBT or a power MOSFET Peak output current: 4.0 A, Isolation voltage: 5 kVrms Overcurrent protection (TLP5214), rail-to-rail output (TLP5754)	General-purpose inverters, servo amplifiers, industrial sewing machines
		TLP2345, TLP2348	Direct IPM drive, Supply voltage: 4.5 V to 30 V High speed: 10 Mbps, Small SO6 package, active-high IPM input (TLP2345), active-low IPM input (TLP2348)	
		TLP715, TLP718	Direct IPM drive, Supply voltage: 4.5 V to 20 V Isolation voltage: 5 kVrms, 5-Mbps data rate, active-high IPM input (TLP715), active-low IPM input (TLP718)	

++: Planned **: Under development

Toshiba's Unique Technologies

Motor drivers

- Fabricated using a high-voltage and low on-resistance process: Rated at either 84 V or 50 V and provides high output current
- Synchronous rectification PWM control: Reduces power loss (heat dissipation) during PWM control.
- Various protection features help improve system safety: All motor drivers for industrial applications provide thermal shutdown (TSD), overcurrent detection (ISD) and VM power-on reset (POR).
- Available in multiple packages



Product Overview

84-V/3.0-A Unipolar Stepping Motor Drivers (TB67S141FTG/FG++/HG/NG, TB67S142FTG/FG++/HG/NG, TB67S149FTG/FG++/HG)

- Requires no current-sensing resistor
- Full-, half-, quarter-, 1/8-, 1/16- and 1/32-step drive modes
- Low output Ron due to a BiCD process: 0.25 Ω typ.
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Supports a clock input and a phase-input interface
- Packages: WQFN48, HSOP28, HZIP25, SDIP24

80-V/1.5-A Dual Unipolar Stepping Motor Drivers (TB67S158FTG/NG)

- Constant-voltage drive
- Low output Ron due to a BiCD process: 0.5 Ω typ.
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Supports a clock input, a serial input and a parallel-input interface
- Packages: WQFN48, SDIP24

50-V/4.0-A Two-Phase Bipolar Stepping Motor Drivers (TB67S101AFTG/FNG/FG++/HG**/NG, TB67S102AFTG/FNG/FG++/HG**/NG, TB67S103AFTG, TB67S109AFTG/FNG/HG++)

- High-efficiency constant-current control (Advanced Dynamic Mixed Decay)
- Full-, half-, quarter-, 1/8-, 1/16- and 1/32-step drive modes
- Low output Ron due to a BiCD process: 0.49 Ω typ. (high side + low side)
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Supports a clock input, a serial input and a phase-input interface
- Packages: WQFN48, HTSSOP48, HSOP28, HZIP25, SDIP24

50-V/5.0-A Bipolar Stepping Motor Drivers (TB6600FG/HG)

- Full-, half-, quarter-, 1/8- and 1/16- step drive modes
- Low output Ron due to a BiCD process: 0.4 Ω typ. (high side + low side)
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Supports a clock input interface
- Packages: HQFP64, HZIP25

50-V/10.0-A Large-Current Brushed DC Motor Driver (TB67H303HG)

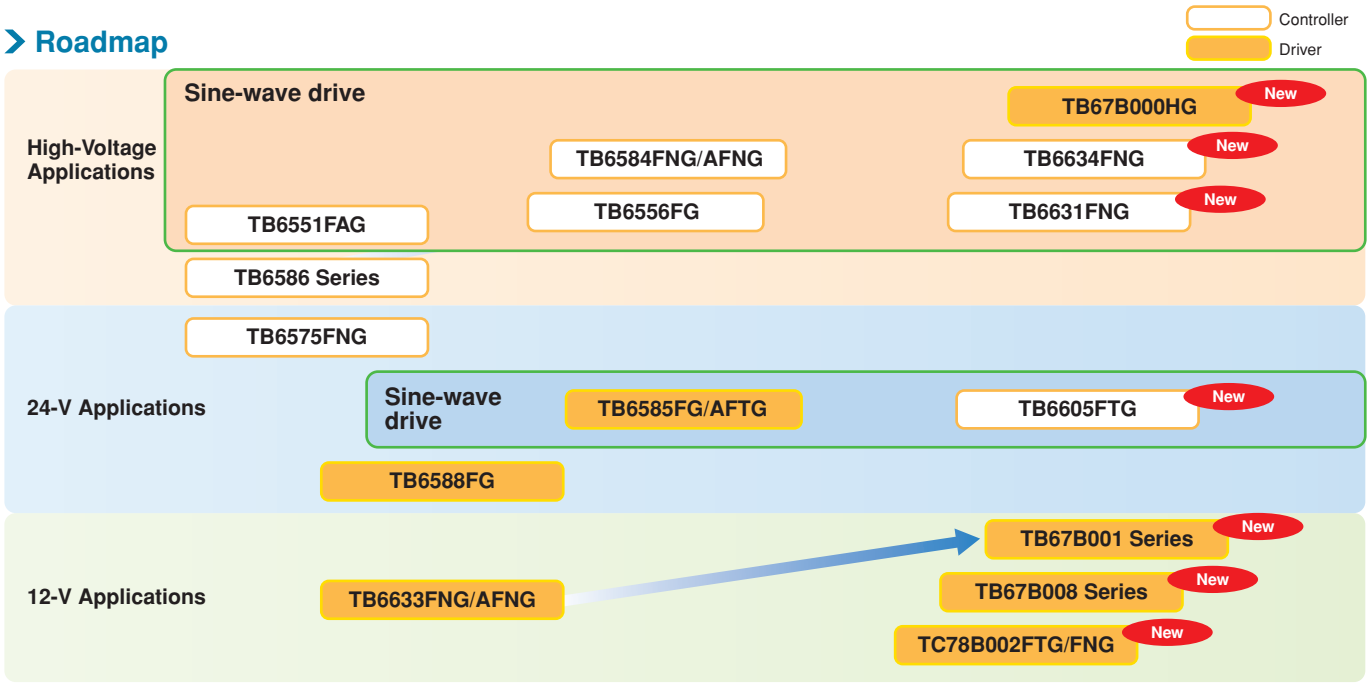
- Low output Ron due to a BiCD process: 0.2 Ω typ. (high side + low side)
- Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Package: HZIP25

++: Planned **: Under development

Brushless Motor Controller and Driver Series

Leveraging sensorless drive and sine-wave drive technologies, Toshiba has been developing a broad array of brushless DC motor drivers ideal for applications that require low power consumption and silent operation.

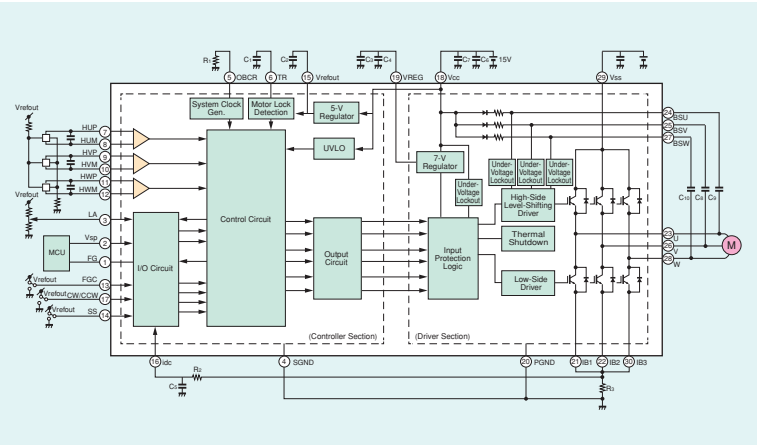
Roadmap



Product Overview

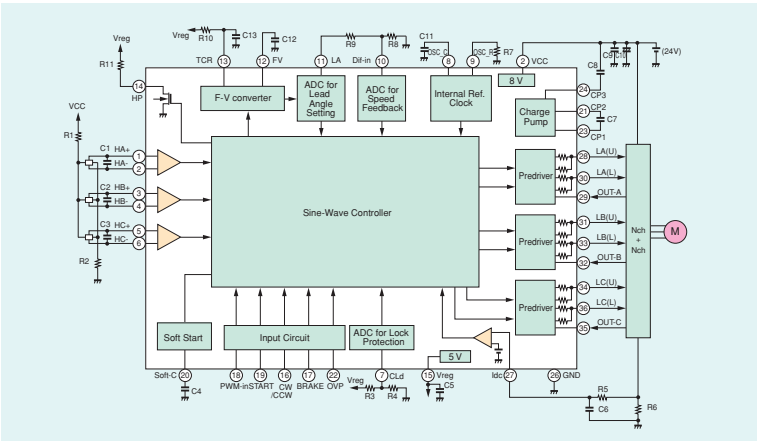
500-V Sine-Wave BLDC Motor Driver (TB67B000HG)

- High-voltage sine-wave driver(Absolute Maximum Ratings: 500 V/2.0 A, sine- and square-wave drive)
- Lead angle control(via an external input)
- Motor speed control via an analog voltage input
- On-chip power supply for Hall sensors and Hall ICs
- Motor lock protection
- Through-hole package: HDIP30



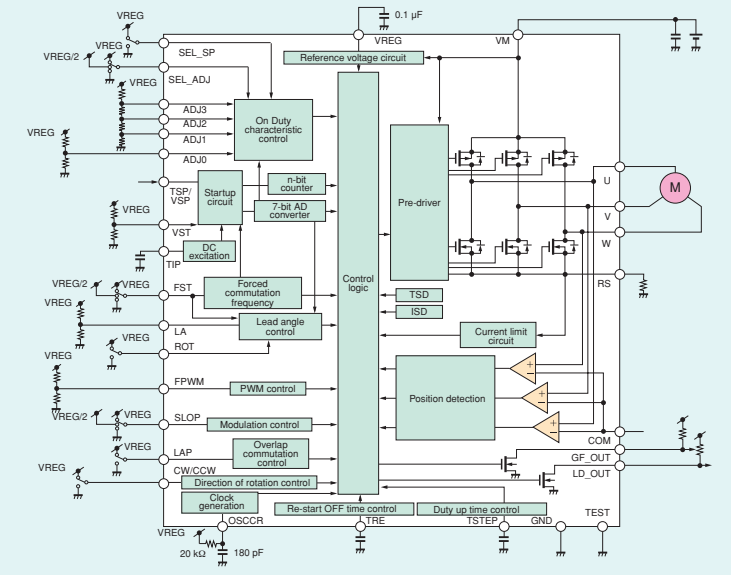
Sine-Wave Three-Phase BLDC Motor Driver (TB6605FTG)

- Ideal for use with a 12-V or 24-V power supply(Absolute maximum rating: 30 V)
- Charge pump: Designed to switch external high-side (n-channel) and low-side(n-channel) FETs
- Auto lead angle control
- Motor speed control via a PWM duty cycle input
- Motor lock protection
- Small package: QFN36



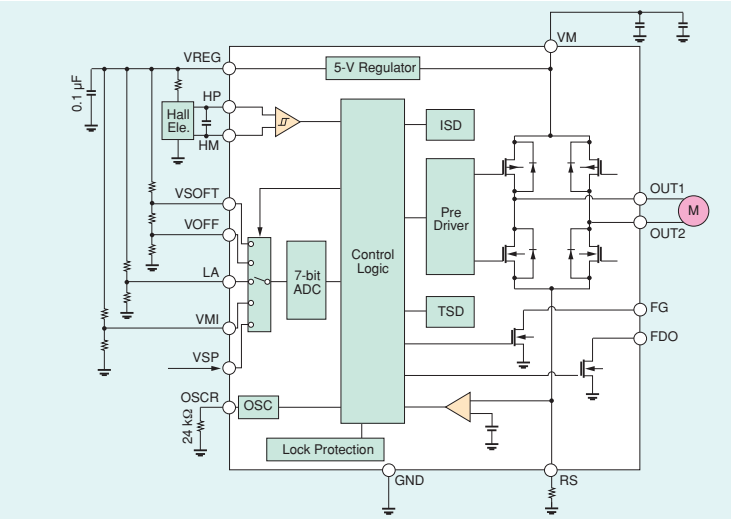
Three-Phase Sensorless BLDC Motor Drivers (TB67B001FTG/AFTG)

- Ideal for use with a 12-V power supply(Absolute maximum rating: 25 V/3.0 A)
- Supports high-rpm motors(even 30-krpm four-pole motors)
- Supports soft-switching trapezoidal commutation
- Supports auto lead angle control
- Motor speed control: Selectable from PWM duty cycle and analog voltage inputs
- Externally adjustable output duty cycle
- Motor lock protection
- Small package: QFN36



Single-Phase Pseudo-Sine-Wave BLDC Motor Driver (TC78B002FTG/FNG)

- Ideal for use with a 12-V power supply (Absolute maximum rating: 18 V/1.5 A)
- Capable of driving a BLDC motor with a sine wave by shaping the commutation waveform
- Motor speed control via an analog voltage input
- On-chip power supply for Hall sensors(and Hall-effect elements)
- Motor lock protection
- Small packages: WQFN16, SSOP16



Product Lineup

Part Number	Function	Absolute Maximum Ratings		Hall Inputs	Commutation	Lead Angle Control	Packages
		Supply Voltage(V)	Output Current(A)				
TC78B002FTG/FNG	Single-phase driver	18	1.5	Hall sensors	Pseudo-sine wave	External input	WQFN16/SSOP16
TC78B006FTG/FNG****	Single-phase predriver	40	External FET	Hall sensors	Pseudo-sine wave	External input	WQFN16/SSOP16
TB6633FNG/AFNG	Three-phase driver	25	1.0	Sensorless	Square-wave	External input	SSOP24
TB67B001FTG/AFTG	Three-phase driver	25	3.0	Sensorless	Square-wave	External input	QFN36
TB67B008FTG/AFTG/BFTG/CFTG	Three-phase driver	25	3.0	Sensorless	Square-wave	External input	WQFN24
TB67B008FNG/AFNG/BFNG/CFNG							SSOP24
TB6588FG	Three-phase driver	50	2.5	Sensorless	Square-wave	External input	HSOP36
TB6585FG	Three-phase driver	45	1.8	Hall sensors	Sine-wave	Auto (current feedback)	HSOP36
TB6585AFTG							QFN48
TB6605FTG	Three-phase predriver	30	External FET	Hall sensors	Sine-wave	Auto (rpm feedback)	QFN36
TB6575FNG	Three-phase controller	5.5	–	Sensorless	Square-wave	External input	SSOP24
TB6586FG/AFG/BFG	Three-phase controller	15	–	Hall IC	Square-wave	External input	SSOP24
TB6551FAG	Three-phase controller	12	–	Hall IC	Sine-wave	External input	SSOP24
TB6556FG	Three-phase controller	12	–	Hall IC	Sine-wave	Auto (current feedback + VSP)	SSOP30
TB6584FNG/AFNG	Three-phase controller	15	–	Hall sensors/ Hall IC	Sine-wave	Auto (current feedback + VSP)	SSOP30
TB6631FNG	Three-phase controller	15	–	Hall sensors/ Hall IC	Sine-wave	Auto ((rpm feedback)	SSOP30
TB6634FNG	Three-phase controller	15	–	Hall sensors/ Hall IC	Sine-wave	Auto (current feedback + VSP)	SSOP30
TB67B000HG	Three-phase driver	500	2.0	Hall sensors/ Hall IC	Sine-wave	External input	HDIP30
TB67Z800FTG	3-channel half-bridge	25	3.0	–	–	–	QFN36

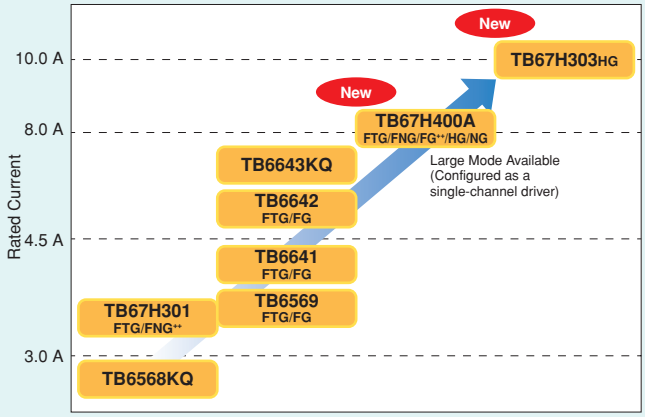
**: Under development

Brushed DC Motor Driver Series

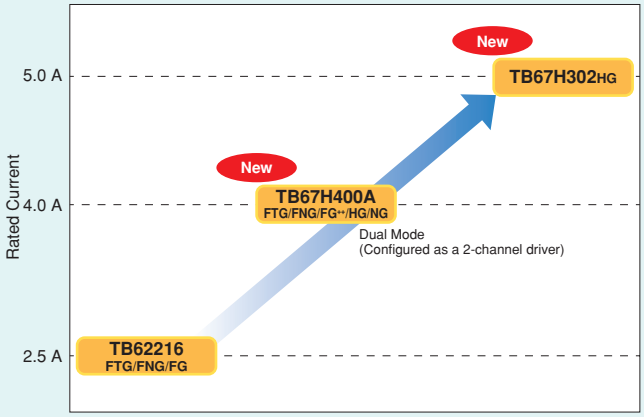
Toshiba offers brushed motor drivers fabricated using a BiCD process that exhibits low on-resistance and thus helps reduce power consumption. Toshiba's product portfolio contains a wide range of brushed motor drivers with extensive supply voltage, output current and channel count options. Toshiba's product offerings include motor drivers that consist of multiple H-bridges that can be combined in a flexible manner according to the types of motors driven (stepping motors and brushed DC motors) and the required current capabilities.

Roadmap

■ Single-Channel Motor Drivers



■ Dual-Channel Motor Drivers



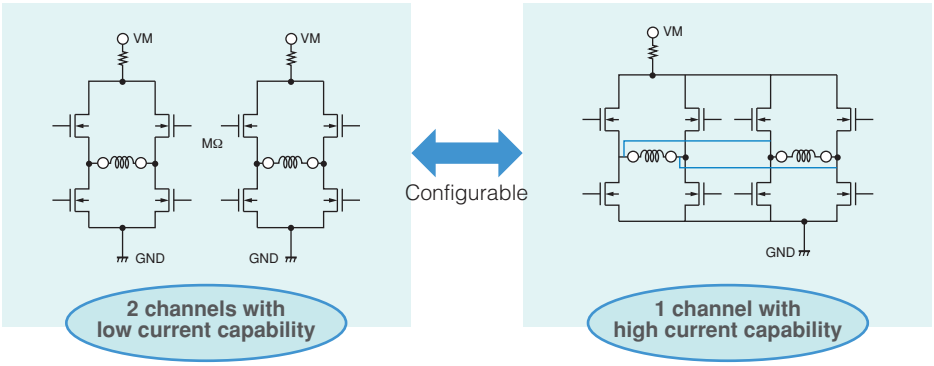
Configurable Motor Drivers

The on-chip H-bridges can be configured according to the types of motors driven (stepping motors and brushed DC motors) and the required current capabilities to suit the needs of various motor applications.

● **Case 1: Switching between different current capabilities**

Using two channels of H-bridges separately

Using two H-bridges in combination as a single channel

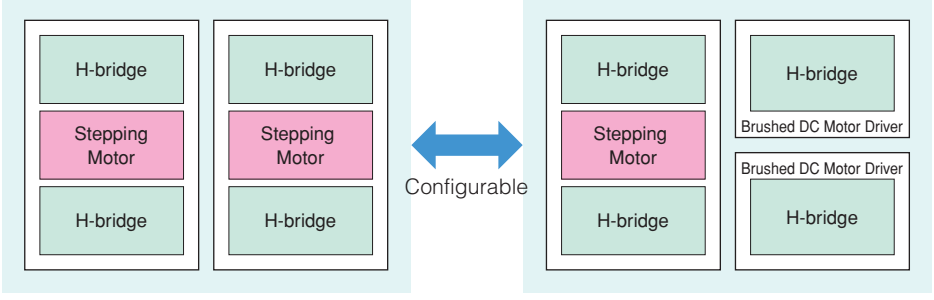


Products with this H-bridge configuration
TB62212FTAG/FNG
TB67H400AFTG/FNG/FG**/HG/NG

● **Case 2: Selecting the types of motors to be driven**

Driving two stepping motors

Driving one stepping motor and two brushed DC motors



Products with this H-bridge configuration
TB62212FTAG/FNG

**: Planned

Brushed DC Motor Driver (TB67H303HG)

The TB67H303HG is a high-efficiency brushed DC motor driver for use with a PWM drive. Incorporating low on-resistance DMOS output drivers, the TB67H303HG can drive a motor rated at up to 50 V/10.0 A.

- Forward, reverse, short-circuit brake and stop; standby mode
- Low output Ron: 0.2 Ω typ. (high side + low side)
- Supply voltage (Vcc) = 50 V, output current (I_{OUT}) = 10.0 A (absolute maximum ratings, peak)
- Various fault detection features: Thermal shutdown (TSD), undervoltage lockout (UVLO), overcurrent detection (ISD)
- Package: HZIP25

PWM Chopper-Type Brushed DC Motor Drivers (TB67H400AFTG/FNG/FG++/HG/NG)

Incorporating two channels of output drivers, the TB67H400A can drive up to two brushed DC motors. It can also be configured into an 8.0-A single-channel motor driver in Large mode. The TB67H400A is rated at 50 V, and 4.0 A (per channel in dual-channel mode) or 8.0 A (in single-channel Large mode).

- Low output Ron: 0.49 Ω typ. (high side + low side)
- Four operating modes: forward, reverse, short-circuit brake, stop (off)
- Various fault detection features: Thermal shutdown (TSD), overcurrent detection (ISD), VM power-on reset (POR)
- Packages: WQFN48, HTSSOP48, HSOP28, HZIP25, SDIP24

Product Lineup

Part Number	Absolute Maximum Ratings		Output Ron (H + L) (Ω)	# Circuits (ch)	Constant-Current PWM Control	Detection Circuits		Packages
	Supply Voltage (V)	Output Current (A)				ISD	TSD	
TB6568KQ	50	3.0	0.55	1	–	Y (Latch)	Y (Latch)	HSIP7
TB6643KQ	50	4.5	0.55	1	–	Y (Latch)	Y (Latch)	HSIP7
TB6559FG	50	2.5	1.3	1	Y	Y (Auto)	Y (Auto)	HSOP16
TB6617FNG	50	2.0	1.4	1	–	Y (Auto)	Y (Auto)	SSOP16
TB6569FTG/FG	50	4.5	0.55	1	Y	Y (Latch)	Y (Latch)	VQFN32/HSOP16
TB6641FTG/FG	50	4.5	0.55	1	Y	Y (Latch)	Y (Latch)	VQFN32/HSOP16
TB6642FTG/FG	50	4.5	0.55	1	–	Y (Latch/Auto)	Y (Latch/Auto)	VQFN32/HSOP16
TB6640FTG/AFTG	40	3.0	1.0	1	Y	Y (Latch/Auto)	Y (Latch/Auto)	WQFN48
TB67H301FTG/FNG++	40	3.0	1.0	1	Y	Y (Latch/Auto)	Y (Latch/Auto)	WQFN24/HTSSOP24
TB67H303HG	50	10	0.2	1	Y	Y (Latch)	Y (Latch)	HZIP25
TB6561NG/FG	40	1.5	1.5	2	–	Y (Auto)	Y (Auto)	SDIP24/SSOP30
TB62216FTG/FNG/FG	40	2.5	1.0	2	Y	Y (Latch)	Y (Latch)	QFN48/HTSSOP48/HSOP28
TB62212FTAG/FNG	40	4.0 (2 ch) 2.0 (4 ch)	2.2	2 4	Y	Y (Latch)	Y (Latch)	QFN48/HTSSOP48
TB67H302HG	50	5.0	0.4	2	Y	Y (Latch)	Y (Latch)	HZIP25
TB67H400AFTG/FNG/FG++/ HG/NG	50	8.0 (1 ch) 4.0 (2 ch)	0.49	1 2	Y	Y (Latch)	Y (Latch)	WQFN48/HTSSOP48/HSOP28/ HZIP25 /SDIP24
TB6552FTG/FNG	15	1.0	1.5	2	–	–	Y (Auto)	WQFN16/SSOP16
TB6593FNG	15	3.2	0.35	1	–	–	Y (Auto)	SSOP20
TB6612FNG	15	3.2	0.5	2	–	–	Y (Auto)	SSOP24
TB6614FNG	15	3.2	0.3	1	–	Y (Auto)	Y (Auto)	SSOP16
TC78H600FTG/FNG	18	1.0	1.2	2	Y	Y (Latch)	Y (Auto)	WQFN24/SSOP20
TC78H610FNG	18	1.0	1.2	2	–	Y (Latch)	Y (Auto)	SSOP16

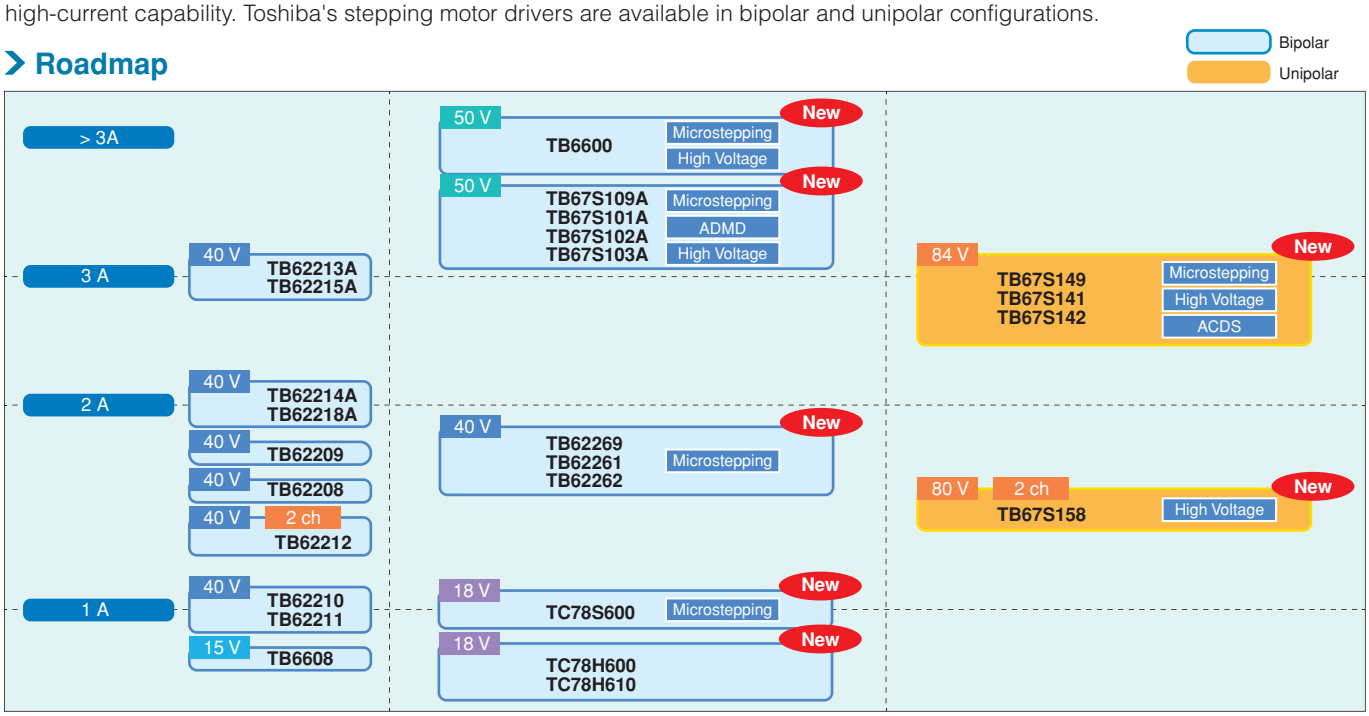
Abbreviations: ISD: Overcurrent detection, TSD: Thermal shutdown

++: Planned

Stepping Motor Driver Series

Toshiba offers an extensive lineup of stepping motor drivers fabricated using a BiCD process that provides high accuracy and high-current capability. Toshiba's stepping motor drivers are available in bipolar and unipolar configurations.

Roadmap



Features of Toshiba's Stepping Motor Drivers

Extensive product lineup

Motor type	Multiple interfaces
Unipolar Bipolar	Clocking Parallel
Multiple specs	**Multiple packages**
Voltage/current Ratings	Surface-mount Hole-through

Solutions for customers' needs and issues based on leading-edge technologies

Toshiba's original technologies
- ADMD technology
- ACDS technology
- Fault detection technology

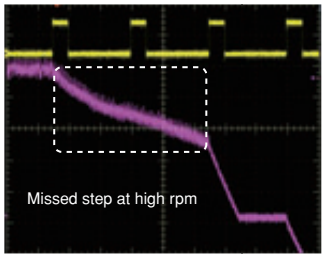
State-of-the-edge technologies
- High-voltage process
- Microstepping technology

Toshiba's Original Technologies

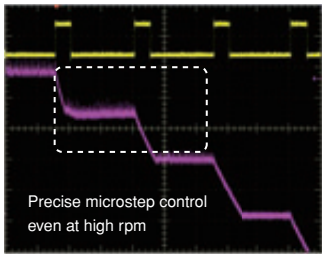
1. Advanced Dynamic Mixed Decay (ADMD) Technology

Toshiba's original ADMD technology tracks input current more closely than the conventional mixed-decay mode, making highly efficient motor control possible at high rpm.

Conventional Mixed Decay



ADMD Technology



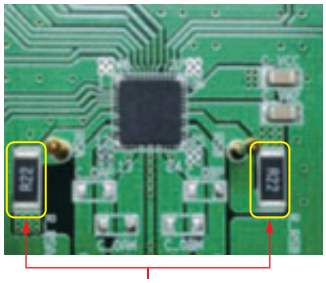
Products incorporating the ADMD technology:
- TB67S101AFTG/FNG/FG++/HG**/NG
- TB67S102AFTG/FNG/FG++/HG**/NG
- TB67S103AFTG
- TB67S109AFTG/FNG/HG++

2. Advanced Current Detect System (ACDS) Technology

Toshiba's original ACDS technology enables motor drive with highly accurate constant current without requiring external current-sensing resistors.

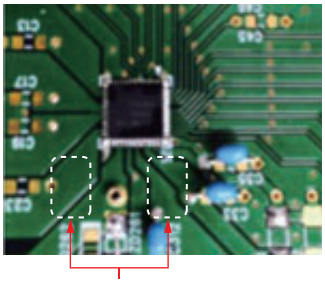
The reduced part count also helps reduce the board area and the bill-of-material (BOM) cost.

Conventional Technology



Two resistors with high electrical ratings are necessary.

ACDS Technology



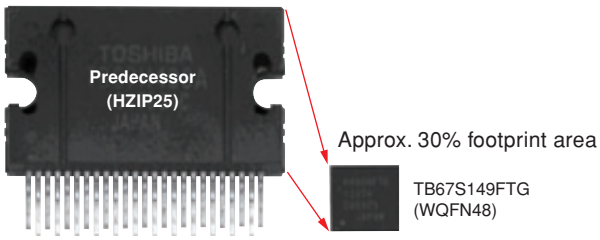
No external resistor is required.

Products incorporating the ACDS technology
- TB67S141FTG/FG++/HG/NG
- TB67S142FTG/FG++/HG/NG
- TB67S149FTG/FG++/HG

++: Planned **: Under development

3. High-Voltage Analog Process Technology

Fabricated using a state-of-the-art high -voltage analog process (130-nm BiCD process), Toshiba's stepping motor drivers combine low-voltage control circuitry with high-voltage DMOS output drivers on the same monolithic structure. Consequently, high-voltage motor drivers rated at 84 V can be housed in the small WQFN48 (7 mm × 7 mm) package, which helps reduce the solution size.



[Products fabricated with the 130-nm BiCD process]
- Maximum rated voltage: 40 V
  TB62261,TB62262,TB62269,TB67S213,TB67S215
- Maximum rated voltage: 50 V
  TB6600,TB67S101A,TB67S102A,TB67S103A,TB67S109A
- Maximum rated voltage: 80 V
  TB67S158
- Maximum rated voltage: 84 V
  TB67S141,TB67S142,TB67S149

4. Package Lineup

Toshiba's stepping motor drivers are available in various package styles, including small surface-mount and through-hole packages, that are suitable for diverse printed circuit boards, assembly methods and system applications.

Product Lineup (Bipolar)

Part Number	Interface	Absolute Maximum Ratings		Stepping Mode	Detection Circuits			Packages
		Output Breakdown (V)	Output Current (A)		POR	ISD	TSD	
TB62211FNG	Clock input	40	1.0	1/4 step	✓	✓	✓	HTSSOP24
TB62262FTAG/FTG	Clock input	40	1.5(FTAG) 1.8(FTG)	1/4 step	✓	✓	✓	WQFN36/WQFN48
TB62209FG	Clock input	40	1.8	1/16 step	✓	✓	✓	HSOP36
TB62269FTG	Clock input	40	1.8	1/32 step	✓	✓	✓	WQFN48
TB62214AFTG/FNG/FG	Clock input	40	2.0	1/4 step	✓	✓	✓	QFN48/HTSSOP48/HSOP28
TB67S215FTAG	Clock input	40	2.5	1/4 step	✓	✓	✓	WQFN36
TB62215AFTG/FNG/FG/HQ	Clock input	40	3.0	1/4 step	✓	✓	✓	QFN48/HTSSOP48/HSOP28/HZIP25
TB6560AFTG/FG/HQ	Clock input	40	2.5(FTG/FG) 3.5(HQ)	1/16 step			✓	QFN48/HQFP64/HZIP25
TB67S102AFTG/FNG/FG****/HG******/NG**	Clock input	50	4.0	1/4 step	✓	✓	✓	WQFN48/HTSSOP48/HSOP28/HZIP25/ SDIP24
TB67S103AFTG	Serial + clock input	50	4.0	1/32 step	✓	✓	✓	WQFN48
TB67S109AFTG/FNG/HG**	Clock input	50	4.0	1/32 step	✓	✓	✓	WQFN48/HTSSOP48/HSOP28/HZIP25
TB6600FG/HG	Clock input	50	5.0	1/16 step	✓	✓	✓	HQFP64/HZIP25
TB6608FNG	Clock input	15	0.8	1/8 step	✓		✓	SSOP20
TC78S600FTG/FNG	Clock input	18	1.0	1/16 step	✓	✓	✓	WQFN24/SSOP20
TB6674PG/FG/FAG	Phase input	24	0.4(PG/FG)) 0.2(FAG)	Full step	✓	✓	✓	DIP16/HSOP16/SSOP16
TB62210FNG	Phase input	40	1.0	1/4 step	✓	✓	✓	HTSSOP24
TB6562ANG/AFG	Phase input	40	1.5	1/4 step		✓	✓	SDIP24/SSOP30
TB62206FG	Phase input	40	1.8	1/2 step	✓	✓	✓	HSOP20
TB62208FTG/FNG/FG	Phase input	40	1.8	1/4 step	✓	✓	✓	QFN48/HTSSOP48/HSOP28
TB62261FTAG/FTG	Phase input	40	1.5(FTAG) 1.8(FTG)	1/4 step	✓	✓	✓	WQFN36/WQFN48
TB62218AFTG/FNG/FG	Phase input	40	2.0	1/4 step	✓	✓	✓	QFN48/HTSSOP48/HSOP28
TB67S213FTAG	Phase input	40	2.5	1/4 step	✓	✓	✓	WQFN36
TB62213AFTG/FNG/FG/HQ	Phase input	40	3.0	1/4 step	✓	✓	✓	QFN48/HTSSOP48/HSOP28/HZIP25
TB67S101AFTG/FNG/FG****/HG******/NG**	Phase input	50	4.0	1/4 step	✓	✓	✓	WQFN48/HTSSOP48/HSOP28/ HZIP25/SDIP24
TC78H610FNG	Phase input	18	1.0	1/2 step	✓	✓	✓	SSOP16
TB62212FTAG/FNG	Phase input	40	1.5 × 2 ch	1/2 step	✓	✓	✓	QFN48/HTSSOP48

Product Lineup (Unipolar)

Part Number	Interface	Absolute Maximum Ratings		Stepping Mode	Detection Circuits			Packages
		Output Breakdown (V)	Output Current (A)		POR	ISD	TSD	
TB67S141FTG/FG****/HG/NG**	Phase input	84	3.0	1/4 step	✓	✓	✓	WQFN48/HSOP28/HZIP25/SDIP24
TB67S142FTG/FG****/HG/NG**	Clock input	84	3.0	1/4 step	✓	✓	✓	WQFN48/HSOP28/HZIP25/SDIP24
TB67S149FTG/FG****/HG**	Clock input	84	3.0	1/32 step	✓	✓	✓	WQFN48/HSOP28/HZIP25
TB67S158FTG/NG	Clock input Parallel input Serial input	80	1.5 × 2 ch	1/2 step	✓	✓	✓	WQFN48/SDIP24

Abbreviations: POR: Power-on reset, ISD: Overcurrent detection, TSD: Thermal shutdown

: Planned *: Under development

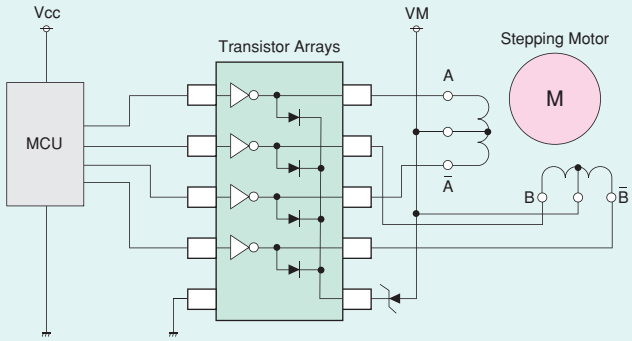
Transistor Arrays

Transistor arrays designed for stepping motor driving applications are available with a variety of functions, circuit counts, voltage and current ratings, packages and so on. Small, surface-mount SSOP packages help reduce the size of end products.

Features

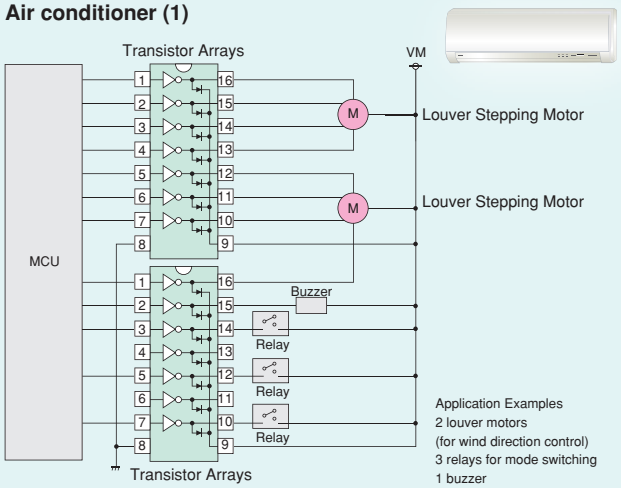
- High-voltage and high-current drive
- Widely adopted in the market because of proven reliability
- Offers a robust product lineup in various packages to meet diverse customer needs

Motor Drive Application Example

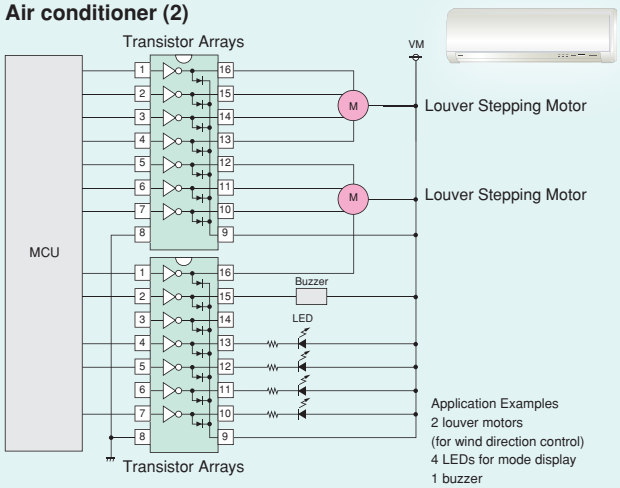


Applications

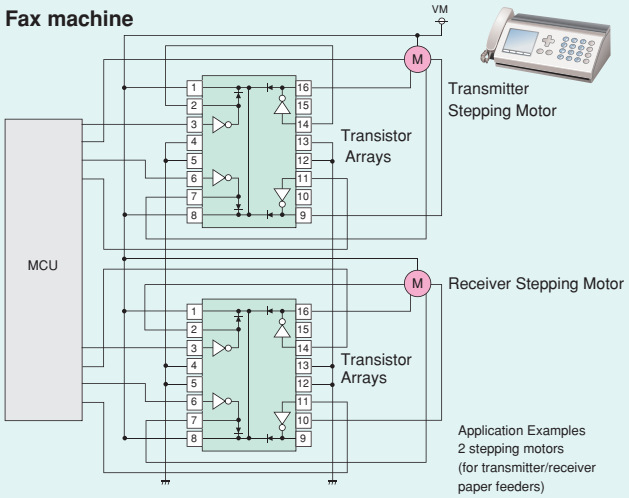
Air conditioner (1)



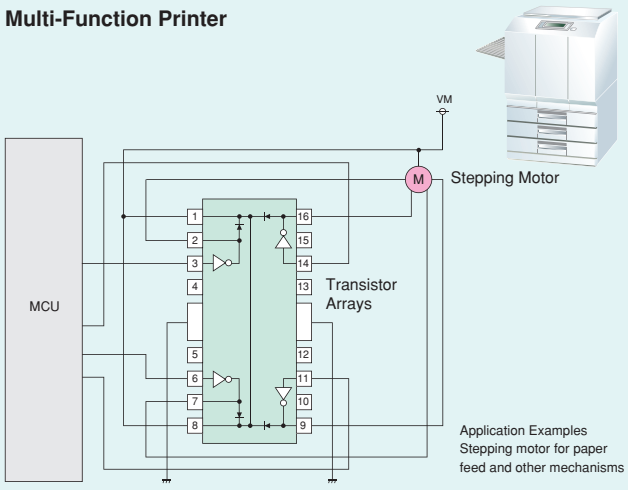
Air conditioner (2)



Fax machine



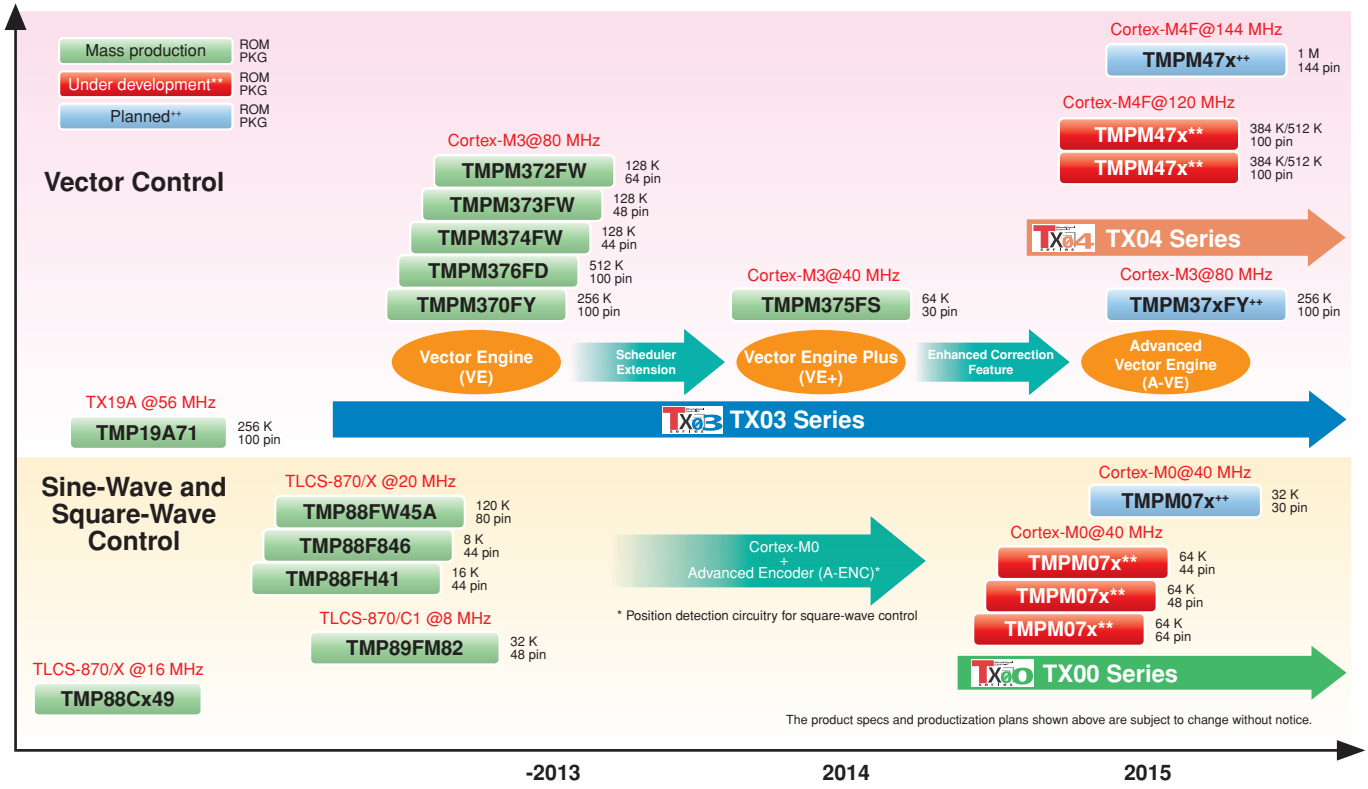
Multi-Function Printer



Microcontrollers Designed for Motor Applications

Toshiba offers PMD microcontrollers that contain programmable motor driver (PMD) specifically designed for inverter control of three-phase motors, reducing the CPU workload for motor control. There are two kinds of PMD microcontrollers: those with an ARM Cortex-M3 core that features an integrated vector engine and those with an 8-bit TLCS-870/X or TLCS-870/C1 core that provides 180° commutation via interrupts raised every 60° electrical of rotation.

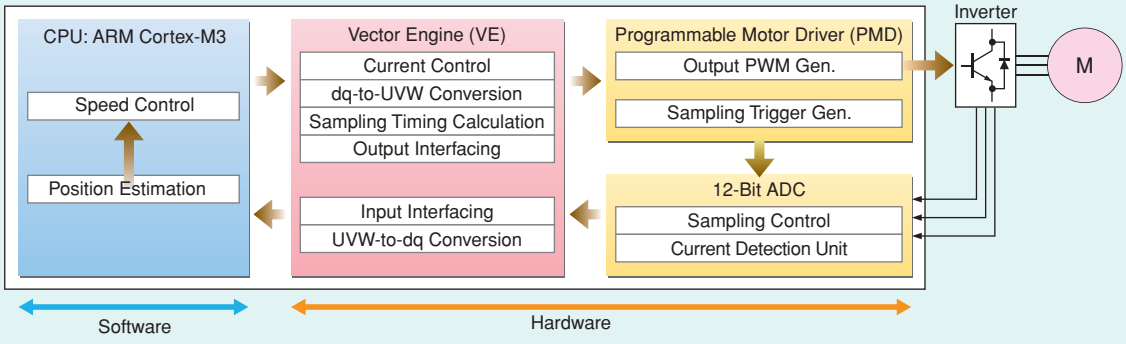
Roadmap



Vector Engine (VE)

The vector engine is a dedicated hardware unit that automatically performs basic vector control operations (such as coordinate transformations, phase transformations and sine/cosine calculations) and a PI algorithm for current control.

Block Diagram of a Motor Control System (Example)



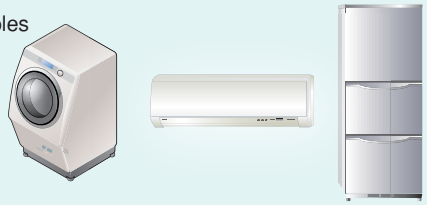
The vector engine is a computation unit designed to perform various operations for motor vector control. It executes 1) routine operations, 2) peripheral interface operations, and 3) a scheduler that controls the sequence of these operations. Since the vector engine has the capability for performing basic vector control operations (such as coordinate transformations, phase transformations and sine/cosine calculations); a PI algorithm for current control; and PMD and high-speed ADC interface operations, it helps to reduce the software workload significantly. On the other hand, speed control and position estimation operations greatly depend on system configurations and the control methods used; thus, these operations can be freely implemented as software.

Microcontroller with Vector Engine (M370 Group)

Features

- Toshiba's original Vector Engine (VE)
  - ・High-speed processing using dedicated hardware
  - ・Completes servo computation routine in 5.0 µs
- Supports a commonly used single 5-V power supply
  - ・Allows the reuse of the conventional platform

Application Examples



Specification Overview

- High-performance ARM Cortex-M3 core with a clock rate of up to 80 MHz
- Vector Engine (VE)
- On-chip analog circuits (comparator, op-amp, encoder input)
- Available in various packages
  (SSOP30, LQFP44, LQFP48, LQFP64, LQFP100 ,QFP100)

TMPM375FSDMG with Vector Engine Plus

- High-performance Cortex-M3 core with low power consumption
- Motor control circuits (PMD, VE, ADC)
- Small package: SSOP30

Cortex-M3 Core

- ・Operating voltage: 4.5 V to 5.5 V
- ・Maximum operating frequency: 40 MHz
- ・Operating temperature: -40˚C to 105˚C
- ・On-chip ROM: 64 KB
- ・On-chip RAM: 4 KB
- ・Debug units: SWD/SWV
- ・On-chip high-speed oscillator

Peripheral Units

- ・Programmable motor driver (PMD): 1 unit
- ・Vector Engine Plus (VE+): 1 unit
- ・12-bit AD converter: 1 unit (with a conversion time of 2.0 µs)
- ・Op-amp (AMP): 1 channel
- ・SIO/UART: 2 channels
- ・Power-on reset (POR)
- ・Low-voltage detection (LVD) circuit
- ・Oscillation frequency detector (OFD)
- ・16-bit timer: 4 channels
- ・I²C/SIO: 1 channel

Evaluation Kit (included with a motor)

IAR System AB

Product Lineup

Part Number	Maximum Operating Frequency (MHz)	ROM (KB)	Motor Controller (ch)	12-Bit AD Converter (Conversion Time)	Encoder Input Logic (ch)	I/O Ports (ch)	Package
TMPM370FYDFG	80	Flash 256	2	22 (2 µs)	2	76	QFP100
TMPM370FYFG	80	Flash 256	2	22 (2 µs)	2	76	LQFP100
TMPM372FWUG	80	Flash 128	1	11 (2 µs)	1	53	LQFP64
TMPM373FWDUG	80	Flash 128	1	7 (2 µs)	1	37	LQFP48
TMPM374FWUG	80	Flash 128	1	6 (2 µs)	1	33	LQFP44
TMPM376FDDFG	80	Flash 512	2	22 (2 µs)	2	82	QFP100
TMPM376FDFG	80	Flash 512	2	22 (2 µs)	2	82	LQFP100
TMPM375FSDMG	40	Flash 64	1	4 (2 µs)	1	21	SSOP30

Microcontrollers with PSC (M340/M440 Group)

Features

- Incorporates a Programmable Servo/Sequence Controller (PSC) that acts as a sub-processor to an Cortex-M3/M4 core-based MCU
  - Runs computational tasks in parallel at high speed
  - Reduces overall power consumption by offloading the CPU from motor servo routines and sequencing operations

Application Examples

Specification Overview

- High-performance Cortex-M3 core with a clock rate of up to 54 MHz (M340 Group)
  Cortex-M4F core with a clock rate of up to 100 MHz (M440 Group)
- High-resolution PPG (programmable phase difference of up to ±90°)
- High-speed 12-bit AD converter and 10-bit DA converters
- Housed in a small fine-pitch BGA packages

TMPM440FEXBG/F10XBG with High-Speed NANO-FLASH™-100

- Cortex-M4F core with a clock rate of up to 100 MHz and zero-wait flash access
- Low power consumption due to parallel operation of FPU and PSC
- Various analog functions
  (Three 12-bit AD converters, two 10-bit DA converters)

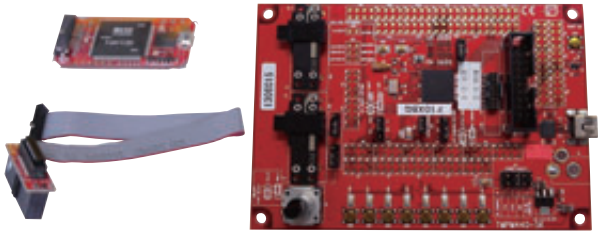
Cortex-M4F Core

- Operating voltage: 2.7 to 3.6 V (regulated by the on-chip DC-DC converter)
- Maximum operating frequency: 100 MHz
- On-chip ROM: 1024 KB/768 KB
- On-chip RAM:80 KB
- Debug units: JTAG/SWD/SWV, Trace4 bit

Peripheral Units

- One PSC unit with 16-KB SRAM
- External bus interface
- 12-bit AD converter
- 10-bit DA converter
- 32-bit and 16-bit timers
  PPG, HS PPG, 2-phase input pulse counter
  Real-time clock (RTC), timebase timer (TBT), watchdog timer (WDT)
- Serial interfaces: SIO/UART, Enhanced SIO (ESIO), I²C
- Key scan matrix: 8 inputs and 8 outputs

Evaluation Kit



IAR System AB

Product Lineup

Part Number	Maximum Operating Frequency (MHz)	ROM (KB)	SRAM (KB)	PSC (ch)	PPG (ch)	PHC (ch)	I/O Ports (ch)	Package
TMPM342FYXBG	40	256	36	1	8	2	63	VFBGA142
TMPM343FDXBG	50	512	80	4	8	3	59	VFBGA162
TMPM343FEXBG **		768	96					
TMPM343F10XBG **		1024						
TMPM440FEXBG	100	768	80	1	4	PHC: 2 EPH: 1	228	VFBGA289
TMPM440F10XBG		1024						

**: Under development

Motor Drivers (Intelligent Power Devices)

Toshiba offers 250-V and 500-V motor drivers fabricated using its unique high-voltage Silicon-On-Insulator (SOI) IC process.

Intelligent Power Devices (IPDs): High-Voltage PWM Brushless Motor Drivers

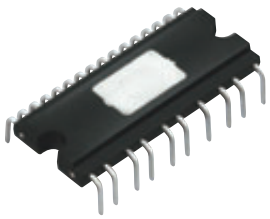
Previously, a variable-voltage switching power supply and other circuits were necessary to drive a BLDC motor. Now, intelligent power devices (IPDs) fabricated using a high-voltage IC process allow the use of mains power to drive a BLDC motor without requiring a step-down voltage converter.
Toshiba's IPDs are housed in the small, thin DIP26 package that provides isolation between control and high-voltage pins to simplify board layout.

Features

- High withstand voltage due to the use of the SOI process and trench isolation structure
- Available with ratings from 250 V/1.0 A to 500 V/3.0 A
- Internal bootstrap power supply for the high-side gate drives

DIP26 Package

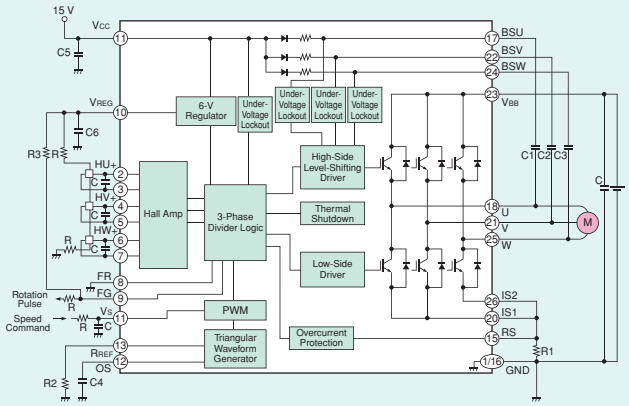
- Package body thickness: 3.8 mm max
- 16 control pins and 10 high-voltage pins are isolated on the opposite sides of the package.
  (The complete isolation of these pins simplifies board trace routing.)
- Improved thermal resistance



DIP26

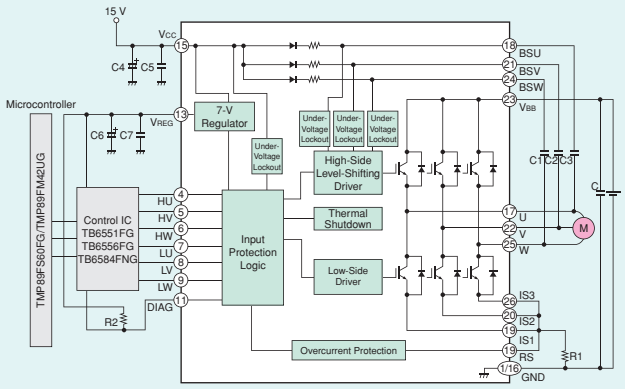
TPD4151K/TPD4142K Block Diagram

- Variable-speed brushless motor drive via the Hall sensor or Hall IC inputs



TPD4123K/TPD4144K/TPD4135K Block Diagram

- Sine-wave drive in combination with a controller
- The TPD4123K, TPD4134K and TPD4135K are pin-compatible and interchangeable according to the motor ratings.



Product Lineup

Part Number	Ratings	Features						
		Hall Sensor/ Hall IC Inputs	6 Inputs	Three-Phase Distribution PWM Circuit	Level Shifter	Overcurrent Protection	Thermal Shutdown	Undervoltage Protection
TPD4151K	250 V/1.0 A	✓		✓	✓	✓	✓	✓
TPD4142K	500 V/1.0 A	✓		✓	✓	✓	✓	✓
TPD4123K	500 V/1.0 A		✓		✓	✓	✓	✓
TPD4123AK	500 V/1.0 A		✓		✓		✓	✓
TPD4144K	500 V/2.0 A		✓		✓	✓	✓	✓
TPD4144AK	500 V/2.0 A		✓		✓		✓	✓
TPD4135K	500 V/3.0 A		✓		✓	✓	✓	✓
TPD4135AK	500 V/3.0 A		✓		✓		✓	✓

Next-Generation IGBT/MOSFET-Drive Photocouplers

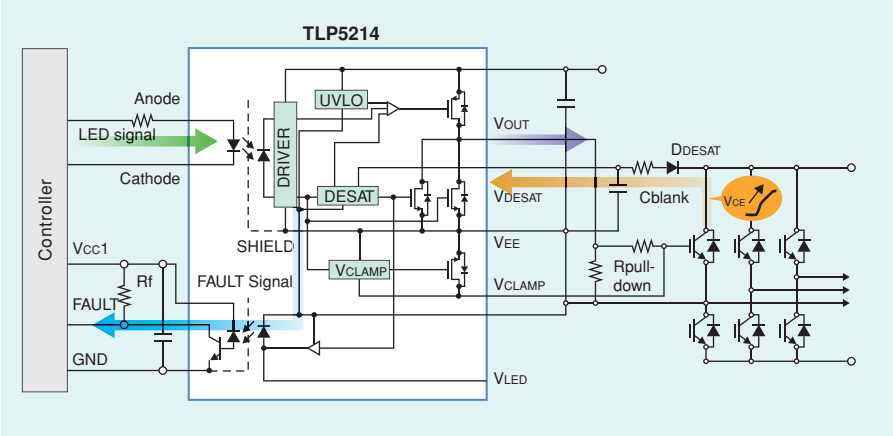
Toshiba offers IGBT/MOSFET-drive photocouplers fabricated using the latest 0.13-μm BiCD process. Overcurrent protection, rail-to-rail output and a thin package with a thickness of 2.3 mm help improve the efficiency and reduce the size of system applications.

IGBT/MOSFET-Drive Photocoupler with Overcurrent Protection (TLP5214)

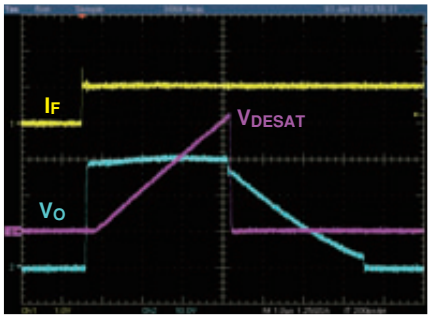
The TLP5214 monitors the saturation voltage, $V_{CE(sat)}$, of an IGBT and shuts down its output when $V_{CE(sat)}$ exceeds 6.5 V typical in the event of an overcurrent condition.
Additionally, the TLP5214 is housed in the thin SO16L package and provides active mirror clamping, rail-to-rail output and other features, reducing the number of external components compared with that previously required. This helps reduce bill-of-material (BOM) costs and board size. Despite the low-profile package, the TLP5214 provides a clearance distance of 8 mm and guarantees an isolation voltage of up to 5 kVrms, making it suitable for applications requiring higher insulation performance.

- $V_{CE(sat)}$ detection and shutdown protect an IGBT/MOSFET in the event of overcurrent.
- The FAULT signal is fed back to the controller at high speed.
- Active mirror clamping prevents IGBT/MOSFET failures due to mirror current.
- A rail-to-rail output reduces power loss.
- Maximum output peak current: 4.0 A
- Propagation delay (tpHL / tpLH): 150 ns max

SO16L



Soft Shutdown Waveform Example

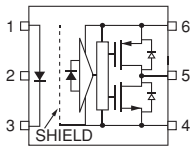


Conditions:
I_F = 10 mA, V_{CC} = 30 V, R_G = 10 Ω, C_G = 25 nF, Ta = 25°C
I_F: 10 mA/div, V_O: 10 V/div, V_{DESAT}: 2 V/div, 1 μs/div

Rail-to-Rail Output Photocoupler for IGBT/MOSFET Drive (TLP575x Series)

Generally, the high-level output voltage (V_{OH}) of an IGBT-drive photocoupler is a few volts lower than the power supply voltage. In contrast, the TLP575x Series in the thin SO6L package provides a full-swing (i.e., rail-to-rail) output from ground to almost the supply voltage. The rail-to-rail output helps reduce the power loss of both the photocoupler and the IGBT during switching. Despite the low-profile package, the TLP575x Series provides a clearance distance of 8 mm and guarantees an isolation voltage of up to 5 kVrms, making it suitable for applications requiring higher insulation performance.

- A rail-to-rail output reduces power loss.
- Maximum output peak current: 1.0 A to 4.0 A
- Propagation delay (tpHL / tpLH): 150 ns max
- Propagation delay skew (tpsk): ±80 ns

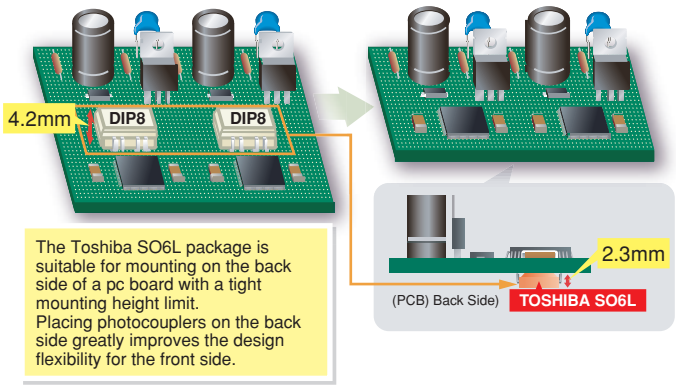


1: ANODE
2: N.C
3: CATHODE
4: GND
5: V_O(OUTPUT)
6: V_{CC}

SO6L

Part Number	TLP5751	TLP5752	TLP5754
Peak current (A)	1.0	2.5	4.0
V_{OH} (V)	V_{CC} –0.3		
V_{OL} (V)	0.2		
Operating temperature range (°C)	–40 to 110		
t_{pHL}/t_{pLH} (ns)	150		
tpsk (ns)	±80		
V_{CC} (V)	15 to 30		
BVs (Vrms)	5000		

Benefits of the Thin SO6L Package with a Thickness of 2.3 mm



The Toshiba SO6L package is suitable for mounting on the back side of a pc board with a tight mounting height limit.
Placing photocouplers on the back side greatly improves the design flexibility for the front side.

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Dec. 2014
SCE0020G

Motor Solutions Guide

OCEAN CHIPS
Океан Электроники
Поставка электронных компонентов

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Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».

AVIC JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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