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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Home Appl Mobile and Office Equi Industrial A

Brushless

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

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.



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)				
Main Control	Microcontrollers	TMPM380, TMPM384	Multipurpose timer for motor and IGBT control				
		TB67B000HG	Brushless DC motor driver; sine-wave current control				
Indoor Fan Motor	Motor Controllers/Drivers	TB6584FNG/AFNG, TB6551FAG TB6631FNG, TB6634FNG	584FNG/AFNG, TB6551FAG 631FNG, TB6634FNG Brushless DC motor controller; sine-wave current control				
		TB6586FG/AFG/BFG	Brushless DC motor controller				
		TB67B000HG	Brushless DC motor driver; sine-wave current control	Refrigerators, air conditioners			
Outdoor Fan Motor	Motor Controllers/Drivers	TB6584FNG/AFNG, TB6551FAG TB6631FNG, TB6634FNG	Brushless DC motor controller; sine-wave current control	automatic washing machines,			
		TB6586FG/AFG/BFG	Brushless DC motor controller	disnwasners			
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		Air conditionero			
Air Conditioners Outdoor Fan Motors	Motor drivers (Intelligent power devices)	TPD4123K/AK, TPD4144K/AK TPD4135K/AK	Thin package High-voltage, high-current pins and control pins are isolated on the opposite sides of a package.	Air conditioners			
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	BT and Power DSFET Drivers r Compressor Applications		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



POR

1/2 step 1/4 step 1/8 step 1/6 step

ISD

TSD

Vref

Mt

M2

СК

≛ —osc — <u>_</u>

10 MHz 📕

I/O Port

PLL

POR/ VLTD

Regulato

CG

I/O

76

WDT

OFD

ARM

Cortex-M3 CORE

RAM

ROM

DESET

ENABLE

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



VM

BO

BO2

REB

Timer Counter Input

3-Phase PWM Output

3-Phase PWM Output

PWM/PPG

DVO Output

Analog Input

Analog Input

SCLK/SI/SO

TXD/RXD

Encoder Signal Input

H-Bridg

16-bit TIMEB(8 ch

Encoder input(2 ch)

12-bit ADC AMP/CMP(3 ch)

12-bit ADC AMP/CMP(1 ch)

SIO/UART

(4 ch)

PMD

PMD

Vector

Engi

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
- *NANO FLASH is a trademark of Toshiba Corporation.

*ARM and Cortex are registered trademarks of ARM Limited (or its subsidiaries) in the EU and/or countries elsewhere.

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		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	
	Microcontrollers	ТМРМ440	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	
		TB6614FNG	Single-bridge		
		TB6612FNG TB6552FTG/FNG	Dual-bridge		
Lens Drive	Brush motor drivers/	TB6613FTG	8 channels, 6-bit microstepping, dual motor drive, serial interface	Digital still cameras.	
Actuator Drive	Stepping motor drivers	TB6608FNG	8 microsteps, constant-current drive	surveillance cameras,	
		TC78S600FTG/FNG	16 microsteps, constant-current drive, maximum rated voltage: 18 V	camera lenses,	
		TC78H600FTG/FNG TC78H610FNG	Dual-bridge, maximum rated voltage: 18 V	small scanners, mini printers	
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 = 0.8Ω 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 •Two-phase input pulse counter: 2 channels
- 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
- Package: VFBGA142
- 2 units



Abbreviations: PI: Photo Interrupter PE: Photo Encode

Low-Voltage Stepping Motor Drivers (TC78S600FTG/FNG)

The TC78S600FTG/FNG supports half-, guarter-, 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 (lout): 0.8 A max
- Output Ron: 1.2 Ω typ. (high side + low side)
- Microstep control circuit (with a clock input)
- Half-, guarter-, 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 (UVIO)
- 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



(plus two 7-bit microstep controllers) ·Hall Bias Control: 2 units ·Op-amp: 6 channels ·PI-PE interface: 2 channels

·H-switch driver: 7.5 channels

· 10-bit electrical variable resistance (EVR):

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				
		ТМРМ362	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.				
	Microcontrollers	ТМРМ369	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	printers, audio-visual (AV) equipment, digital equipment, PC peripherals, industrial equipment, networking equipment, office equipment				
Engine Control Section		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					
		TB6568KQ, TB6643KQ	Single full bridge, direct PWM control	Plain paper copiers (PPCs),				
	Brush	TB6569FTG/FG, TB6641FTG/FG	Single full bridge, emergency output, Direct PWM control, Constant-current PWM control					
	Motor Drivers	TB67H301FTG/FNG**	Direct PWM control, Constant-current PWM control, Standby function	card readers,				
		TB67H400AFTG/FNG/FG⁺⁺/HG/NG	Dual full bridge, Constant-current PWM control, Direct PWM control, Parallel control of two channels (Large mode)	bank note recognition machines, etc.				
		TMPM037	ARM Cortex-M0 core (20 MHz max), 1 DMA unit, bit-banding					
		ТМРМ36В	ARM Cortex-M3 core (80 MHz max), multipurpose timer suitable for various motor and IGBT control, PMD, 2 DMA units, remote control preprocessor	Multifunction printers,				
	Microcontrollers	ТМРМ330	ARM Cortex-M3 core (40 MHz max), CEC interface, remote control preprocessor	audio-visual (AV) equipment, digital equipment,				
		ТМРМ361	ARM Cortex-M3 core (64 MHz max), CEC interface, remote control preprocessor, large-capacity memory	PC peripherals, industrial equipment,				
		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	office equipment				
		TB6560AFTG/FG/HQ	Clock input, micro-stepping drive (1/16 step)					
Scanner Peripheral		TB62211FNG, TB62214AFTG/FNG/FG TB62215AFTG/FNG/FG/HQ, TB62262FTAG/FTG	Clock input, micro-stepping drive (1/4 step)					
Control Section	Stepping	TB67S102AFTG/FNG/FG**/HG**/NG	Clock input, micro-stepping drive (1/4 step), ADMD					
	Motor Drivers (Bipolar)	TB62210FNG, TB6562AFG/NG TB62218AFTG/FNG/FG TB62213AFTG/FNG/FG/HQ, TB62261FTAG/FTG/SFG	Phase inputs, micro-stepping drive (1/4 step)	Plain paper copiers (PPCs),				
		TB67S101AFTG/FNG/FG**/HG**/NG	Phase inputs, micro-stepping drive (1/4 step), ADMD	vending machines, ATMs,				
		TB62269FTG	Clock input, micro-stepping drive (1/32 step)	amusement equipment,				
	Stepping Motor Drivers	TB67S141FTG/FG++/HG/NG	Phase input interface, 84 V/3.0 A, micro-stepping drive(1/4 step)	card readers, bank note recognition machines, etc.				
	(Unipolar)	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.					

**: Planned **: Under development

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

**: Planned

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		
		TB67S141FTG/FG**/HG/NG	Phase input interface, 84 V/3.0 A, 1/4 step			
	Stepping	TB67S142FTG/FG**/HG/NG	Clock input interface, 84 V/3.0 A, 1/4 step			
	(Unipolar)	TB67S149FTG/FG++/HG	Clock input interface, 84 V/3.0 A, 1/32 step			
-		TB67S158FTG/NG	80 V/1.5 A, 2 ch			
		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			
	Stepping Motor Drivers (Bipolar)	TB62269FTG	Clock input interface, 40 V/1.8 A, 1/32 step	Currency counters,		
		TB67S213FTAG	Phase input interface, 40 V/2.5 A, 1/4 step	banking terminals, industrial weaving machines,		
		TB67S215FTAG	Clock input interface, 40 V/2.5 A, 1/4 step	sewing machines,		
		TB67S101AFTG/FNG/FG**/HG**/NG	Phase input interface, 50 V/4.0 A, 1/4 step, ADMD	surface-mounting machines,		
		TB67S102AFTG/FNG/FG**/HG**/NG	Clock input interface, 50 V/4.0 A, 1/4 step, ADMD	POS systems, ticket-vending machines.		
		TB67S103AFTG	Serial and clock input interfaces, 50 V/4.0 A, 1/32 step, ADMD	amusement equipment		
Motor Controller		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			
		TB67H301FTG/FNG**	40 V/3.0 A			
	Brush	TB67H302HG	50 V/5.0 A			
	Motor Drivers	TB67H303HG	50 V/10.0 A			
		TB67H400AFTG/FNG/FG**/HG/NG	50 V/4.0 A, 2 ch			
		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)			
	Photocouplers	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)	General-purpose inverters, servo amplifiers, industrial sewing machines		
		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
- \bullet 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)

- \bullet 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

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.



> 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 Maxin Supply Voltage(V)	mum Ratings Output Current(A)	Hall Inputs	Commutation	Lead Angle Control	Packages
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	Concertano	s Square-wave Ext	External input	WQFN24
TB67B008FNG/AFNG/ BFNG/CFNG	Three phase driver	20	0.0	06113011633	Oquare wave	External input	SSOP24
TB6588FG	Three-phase driver	50	2.5	Sensorless	Square-wave	External input	HSOP36
TB6585FG	Throo-phase driver	45	1.8	Hall concore	Sino-wavo	Auto	HSOP36
TB6585AFTG	Thee-phase unver		1.0	11411 36113013	Sille-wave	(current feedback)	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



> 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



• Case 2: Selecting the types of motors to be driven



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 (Iout) = 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

	Absolute Max	imum Ratings	Output Pop	# Circuito	Constant-	Detection	n Circuits	
Part Number	Supply Voltage (V)	Output Current (A)	$(H + L) (\Omega)$	(ch)	Current PWM Control	ISD	TSD	Packages
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





> 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.



Products incorporating the ADMD technology:

- TB67S101AFTG/FNG/FG++/HG**/NG
- ·TB67S102AFTG/FNG/FG++/HG**/NG
- •TB67S103AFTG
- TB67S109AFTG/FNG/HG++

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



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

ACDS Technology

Bipolar





Two resistors with high electrical ratings are necessarv

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

**: Planned **: Under development

No external resistor is required.

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,TB67S101Ă,TB67S102A,TB67S103A,TB67S109A
- Maximum rated voltage: 80 V
- TB67S158
- Maximum rated voltage: 84 V
- TB67S141,TB67S142,TB67S149

4. Package Lineup

Predecessor (HZIP25) Approx. 30% footprint area TB67S149FTG (WQFN48)

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)

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

> Product Lineup (Unipolar)

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







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.



> 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.





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

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
- \cdot 12-bit AD converter: 1 unit (with a conversion time of 2.0 μ s)
- ·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

> 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

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
- \cdot 32-bit and 16-bit timers
- $\mathsf{PPG}, \mathsf{HS} \; \mathsf{PPG}, \mathsf{2}\text{-phase input pulse counter}$
- Real-time clock (RTC), timebase timer (TBT), watchdog timer (WDT)
- \cdot Serial interfaces: SIO/UART, Enhanced SIO (ESIO), I^2C
- $\cdot\,\text{Key}$ scan matrix: 8 inputs and 8 outputs

> 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		512	80	4	8	3	59	VFBGA162
TMPM343FEXBG **	50	768	06					
TMPM343F10XBG **		1024	50					
TMPM440FEXBG	100	768	80	1	4	PHC: 2 EPH: 1	228	VFBGA289
TMPM440F10XBG	100	1024						





**: Under development

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

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

	Ratings	Features								
Part Number		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	1		✓	\checkmark	~	1	1		
TPD4142K	500 V/1.0 A	1		✓	✓	~	1	1		
TPD4123K	500 V/1.0 A		~		\checkmark	~	1	1		
TPD4123AK	500 V/1.0 A		~		\checkmark		1	1		
TPD4144K	500 V/2.0 A		~		\checkmark	~	1	1		
TPD4144AK	500 V/2.0 A		~		✓		1	1		
TPD4135K	500 V/3.0 A		~		✓	~	1	1		
TPD4135AK	500 V/3.0 A		~		\checkmark		1	1		

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.

- VCE(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:

 $IF = 10 \text{ mA}, Vcc = 30 \text{ V}, Rg = 10 \Omega, Cg = 25 \text{ nF}, Ta = 25^{\circ}C \\ IF: 10 \text{ mA/div}, Vo: 10 \text{ V/div}, VDESAT: 2 \text{ V/div}, 1 \ \mu \text{s/div}$

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

Generally, the high-level output voltage (VoH) 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

Part Number	TLP5751	TLP5752	TLP5754
Peak current (A)	1.0	2.5	4.0
Vон (V)	Vcc-0.3		
Vol (V)	0.2		
Operating temperature range (°C)	-40 to 110		
tpнL/tpLH (ns)	150		
tpsk (ns)	±80		
Vcc (V)	15 to 30		
BVs (Vrms)	5000		



1: ANODE 2: N.C 3: CATHODE 4: GND 5: Vo(OUTPUT) 6: Vcc



Benefits of the Thin SO6L Package with a Thickness of 2.3 \mbox{mm}



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