



Peripheral ICs

Peripheral ICs for Home Appliances

Toshiba offers a complete lineup of peripheral ICs for home appliances in various application fields as shown in the table below.

Timer ICs

Device	Package	Application examples	Operating voltage	Features
TA7326P TA7326F TA7327P	SIP7 SOP8 SIP9	Ni-Cd chargers Ni-MH chargers Air cleaners	4.5 to 6.3 V	Two operating modes (timer, oscillator) Built-in initialization circuit Wide timer setting range (1 to 50 hours) Timing initial adjustment pin (TA7327P only)
TB1004AF TB1010F TB1012F TB1022F	SSOP10	Ni-Cd chargers Ni-MH chargers	4.0 to 6.0 V	Built-in initialization circuit Built-in voltage detection comparator Wide timer setting range (1 minute to 8 hours or more)

IGBT Drivers

Device	Package	Application examples	Operating voltage	Features
TA8316S TA8316AS	SIP7	IH equipment Microwave ovens	16.2 to 19.8 V 7 to 24 V	Direct driving of IGBT gate Built-in protective diode for IGBT gate Built-in 18 V shunt regulator (TA8316S only)

Controller for IH Equipment

Device	Package	Application examples	Operating voltage	Features
TA8331AN	SDIP30	IH rice cookers	5.2 to 6.2 V	Built-in switching power supply control circuit Built-in inverter control circuit for IGBT driver Built-in IGBT driver Various built-in protective circuits

For Temperature Control (Zero Voltage Switches)

Device	Package	Application examples	Operating voltage	Features
TA7606P	DIP14	Heating equipment	5.8 to 6.8 V	Direct driving with AC power supply Built-in zero cross detection circuit Output current (pulse) of 90 mA Built-in protective circuit for sensor open or shorts

Interface Driver for Washing Machines

Device	Package	Application examples	Operating voltage	Features
TB1031N	SDIP30	Washing machines (induction motor)	4 to 6 V	Built-in large-current port (2 ports each for 70, 60 and 50 mA, 4 ports for 30 mA) Direct driving of Triac buzzer, etc. Built-in zero cross detection circuit Built-in buzzer drive circuit Built-in commercial power supply voltage monitoring circuit Simplified software design by combining with the use of an 8-bit microcontroller

PWM Waveform Synthesizer for Inverter Air-conditioners

Device	Package	Application examples	Operating voltage	Features
TC9653AN	SDIP28	Inverter air-conditioners	4.5 to 5.5 V	Built-in PWM waveform synthesis data Frequency resolution of 255 steps Voltage resolution of 64 steps Selection of forward and reverse Built-in data protection circuit

Communication IC for Hot Water Heaters

Device	Package	Application examples	Operating voltage	Features
T6B70AF	SOP16	Hot water heaters	4.5 to 5.5 V	Communications between hot water heater and control unit DC power system communications Built-in pseudo sine wave generation circuit Built-in external analog signal detection/non-detection circuit

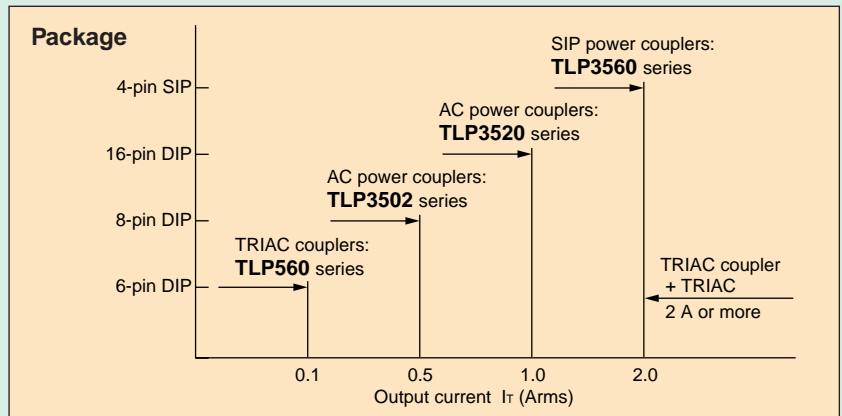


Output Interfaces

Photocouplers

TRIAC Couplers and AC Power Couplers for AC Load Control

Photocouplers are widely used to control AC 100 V/200 V loads by isolating from the DC circuit. Toshiba provides a diverse lineup of photocouplers, enabling users to choose the optimum device over a wide current range from several ten milliamps to several amps.

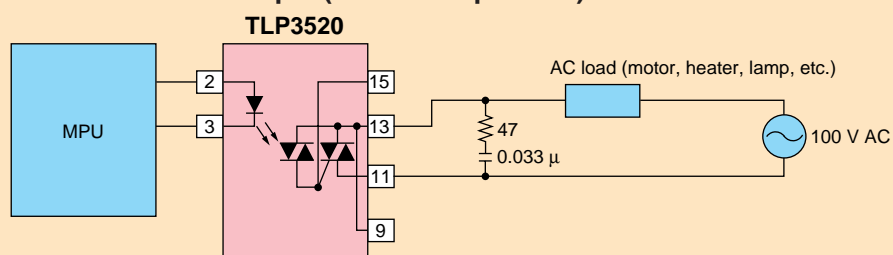


TRIAC Coupler and AC Power Coupler Lineup

Device	Pin configuration	Package	Withstand voltage (kVrms)	Blocking voltage	On-state current (Arms)	Current derating (mA/°C)	Peak one-cycle surge current (A peak)	Trigger LED current		Zero-cross function
								Rank	Max (mA)	
TLP560G (TLP560J)			2.5	400 V (600 V)	0.1	-1.1 @Ta > 25°C	1.2	—	10	No
TLP561G (TLP561J)								IFT7	7	Yes
TLP3502 (TLP3506)			2.5	400 V (600 V)	0.5	-7.2 @Ta > 40°C	5	—	10	No
TLP3503 (TLP3507)								IFT7	7	Yes
TLP3520 (TLP3526)			2.5	400 V (600 V)	1.0	-14.3 @Ta > 40°C	10	—	10	No
TLP3521 (TLP3527)								IFT7	7	Yes
TLP3530			2.5	400 V (600 V)	1.0 (per 1ch)	-14.3	10	—	10	No
					1.4 (per 2ch)					
TLP3560 (TLP3566)			2.5	400 V (600 V)	2.0	-25 @Ta > 40°C	12	—	10	No
TLP3561 (TLP3567)								—	10	Yes

Figures in parentheses () are for a blocking voltage of 600 V ◆ : IFT5 available in 400 V type only

AC Interface Application Circuit Example (Loads of up to 1 A)





Output Interfaces

Transistor Arrays

Toshiba's lineup of transistor array series, which have attained a proven track record as drivers of inductive loads (relays, solenoids and stepping motors), capacitive loads, lamps (LEDs) and other devices, has been further expanded to more effectively respond to user needs. The newest members of this series are the TD62930P and TD62930F IGBT gate driver ICs for general-purpose inverters.

Applications	Functions	Recommended products	
Air-conditioners	Stepping motor	ULN2003AP/AFW	ULN2004AP/AFW
	Relay	ULN2803AP/AFW	ULN2804AP/AFW
	LED	TD62064AP/BP-1/AF/BF	TD62308AP/BP-1/AF/BF
	IGBT gate driver	TD62930P/F	
Oil fan heaters	Level shifter	TD62503P/F/FN	TD62504P/F/FN
	TRIAC coupler	TD62783, 784AP/AFW	ULN2803, 2804AP/AFW
Washer-type toilet seats	Stepping motor	TD62064AP/BP-1/AF/BF	TD62308AP/BP-1/AF/BF
Washing machines	LED	TD62783, 784AP/AFW	ULN2803, 2804AP/AFW
	Level shifter	TD62503P/F/FN	TD62504P/F/FN
	IGBT gate driver	TD62930P/F	
Clothes dryers	TRIAC coupler	TD62783, 784AP/AFW	ULN2803, 2804AP/AFW
Refrigerators	TRIAC coupler	TD62783, 784AP/AFW	ULN2803, 2804AP/AFW
Vacuum cleaners	TRIAC coupler	TD62783, 784AP/AFW	ULN2803, 2804AP/AFW
Water heaters	Relay	TD62387AP/AF/AFN	ULN2803, 2804AP/AFW
	Sensor driver	TD62783, 784AP/AFW	TD62785P/F
Microwave ovens	Lamp, LED	ULN2003AP/AFW	ULN2004AP/AFW
	TRIAC coupler	TD62783, 784AP/AFW	ULN2803, 2804AP/AFW

Brushless Motor Drivers / Gate Drivers

These drivers are optimally suited for use in air-conditioner indoor and outdoor unit fan motors, inverter refrigerators, circulating fan motor drivers, hot water heater motor drivers and solar generators.

Device	Functions	Summary	Operating power supply voltage (V)	Operating temperature Topr (°C)	Junction temperature Tj (°C)	Permissible dissipation PD (W)	Protective functions				Diagnostic functions				Input/output	Package (pins)		
							Over-current Is (A)	Over-heating Ts (°C)	Over-voltage Vs (V)	Under-voltage (Vcc)	Over-current	Load open	Over-heating	Over-voltage			Under-voltage	
☆ TPD4005K	3-phase bridge DC brushless motor driver (PWM circuit not built in)	V _{CE(sat)} 500 V I _o 2 A V _{CE(sat)} 2.5 V (typ.) @ 1 A	V _{BB} : 320 (max) V _{CC} : 9 to 16	-40 to 85	150	20	Detection voltage = 0.5 V typ.	165 typ.	—	7.5 typ.	DIAG "L"	—	DIAG "L"	—	DIAG "L"	H/H	F-18	
☆ TPD4006K	3-phase bridge (PWM circuit built in) DC brushless motor driver	V _{CE(sat)} 500 V I _o 1 A V _{CE(sat)} 2.2 V (typ.) @ 0.5 A	V _{BB} : 330 (max) V _{CC} : 9 to 16.5	-40 to 85			Detection voltage = 0.5 V typ.	165 typ.	—	7.5 typ.	—	—	—	—	—	—	H/H	F-23
☆ TPD4008K	3-phase bridge (PWM circuit built in) DC brushless motor driver	V _{CE(sat)} 250 V I _o 1 A V _{CE(sat)} 2.2 V (typ.) @ 0.5 A	V _{BB} : 185 (max) V _{CC} : 9 to 16.5	-40 to 85			Detection voltage = 0.5 V typ.	165 typ.	—	7.5 typ.	—	—	—	—	—	—	H/H	F-23
TPD4011K	3-phase bridge (PWM circuit built in) DC brushless motor driver	V _{CE(sat)} 330 V I _o 1 A V _{CE(sat)} 2.3 V (typ.) @ 0.5 A	V _{BB} : 165 (max) V _{CC} : 9 to 16.5	-40 to 85			Detection voltage = 0.5 V typ.	165 typ.	—	7.5 typ.	—	—	—	—	—	—	H/H	F-23
TPD7200F	Half bridge Gate driver	V _s 600 V 0.25 A (source) 0.5 A (sink)	V _{CC} : 10 to 20 V _{DD} : 4.5 to 20	-40 to 85			0.4	—	—	—	7.5 typ.	—	—	—	—	—	L/H	SSOP-20

☆: Under development

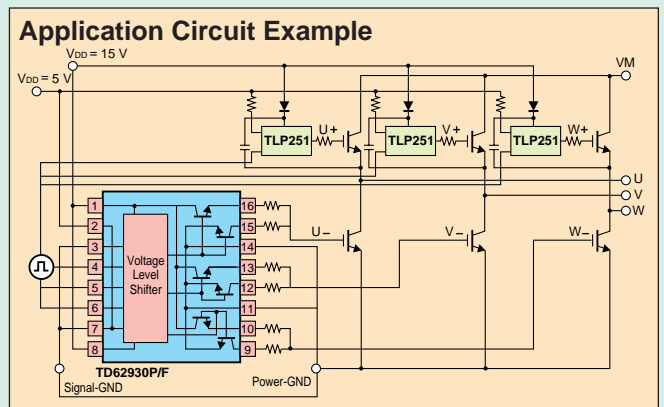
Introduction to 3-channel Small Signal IGBT Gate Driver ICs for General-purpose Inverters: TD62930P, TD62930F

Summary

The TD62930P/F are drivers that output signals required for gate driving of IGBTs by input of a 5 V signal. These are particularly suited for driving of the lower side of small IGBTs used in inverters for home appliances. On/off timing control of IGBT gates is made easy by separate output for the high side and low side for each output. Two outputs are allocated for each input signal, with the high side generating output of a high level and high impedance for high level and low level input, and the low side generating output of high impedance and a low level.

Features

- Power supply voltage (max ratings)
High-voltage section power supply voltage: V_{CC} = 30 V
Low-voltage section power supply voltage: V_{DD} = 7 V
- Output current (max ratings)
High side peak current: I_{OUT} = -0.1 A (min)
Low side peak current: I_{OUT} = 0.1 A (min)
- Input/output response rate: tpHL, tpLH ≤ 1 μs (max)
- Packages: DIP16, SSOP16



Motor Drive Circuits

Toshiba has available various motor controllers and drivers for brush DC motors, 3-phase brushless motors, stepping motors and solenoids. Sensor-less motor ICs (new) are also available.

(Please refer to the Toshiba System Catalog of Semiconductors for Motor Mechatronics for further details.)

Application	Motor drive	IC type
Air-conditioners	Fans	3-phase controller/driver
	Compressor	3-phase controller
Refrigerators	Fans	3-phase controller/driver
	Compressor	3-phase controller
	Automatic ice makers	Bridge driver
	Motor dampers	Stepping motor driver
Fan heaters and fans	Fans	3-phase controller/driver
	Actuator drives	Bridge driver
Washer-type toilet seats	Pumps and fans	3-phase controller/driver
	Nozzle loading and unloading	Bridge driver
Electric fans (DC type)	Fans	3-phase controller/driver
Clothes dryers	Main motors	3-phase controller
Vacuum cleaners (DC type)	Main motors	3-phase controller
Solar systems and hot water heaters	Pumps, fans	3-phase controller/driver
	Actuator drives	Bridge driver
Microwave ovens and grills	Table drives, loading mechanisms	Bridge driver
Bread baking appliances	Kneading motors (DC type)	3-phase controller/bridge driver
Oil pumps	Auto-stop pumps	Bridge driver
Baths	Actuators	Bridge driver



3-phase controller

TA7712P, TA7713P

3-phase drivers

**TA7247AP, TA7262P
TA7259P/F, TA8492P**

PWM-type, 3-phase sensor-less controller/driver

**TB6520P+TA8483CP
TB6537P**

Bridge driver

**TA7257P, TA7267BP
TA7291P, TA7288P
TA8409S, TA8428K
TA8429H, TA8440H**

Stepping motor driver

TA7774P/F



Input Interfaces

GaAs Hall Sensors

Application	Package	Device			Remarks
		SMQ	USH	SSIP	
<ul style="list-style-type: none"> ● Brushless motors ● Detection of magnet rotation and displacement 		THS117	THS118	THS119	General use
		THS121	THS122	THS123	High sensitivity
		THS124	THS125	THS126	High input impedance, low offset
		THS128	THS129	THS130	High input impedance

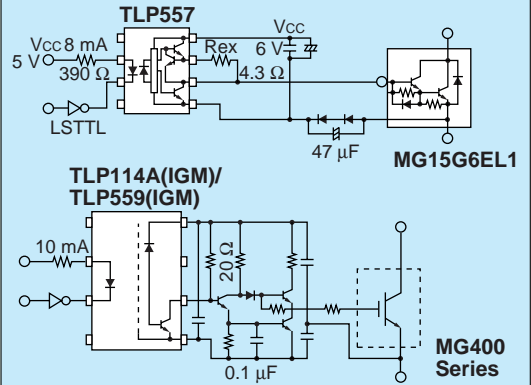


Power Drivers

Driver Couplers

Device	Pin configuration	Output	Features	Response speed (typ.)	Output current	Recommended I _F	V _{CC}	Withstand voltage (at 1 min)
TLP557		Totem pole	Direct G-TR driving, high CMR	1 μs	0.25 A constant current output	8 mA	35 V (max)	2500Vrms
TLP250		Complementary	Direct driving of medium capacity IGBT/power MOS, high CMR	0.2 μs	±2 A peak current output	8 mA	35 V (max)	
TLP251		Totem pole	Direct driving of low capacity IGBT/power MOS, high CMR	0.3 μs	±0.4 A peak current output	8 mA	35 V (max)	
TLP559		Open collector	No base connection, shielded high CMR	0.6 μs	Current transfer ratio	16 mA	30 V (max)	
TLP114A			5-pin mini-flat		20% (min)			3750Vrms

Application Circuit Example



Power Modules for Medium Power Drivers

These drivers are perfect for use as power drivers of 3-phase Hall motors, DC motors, stepping motors and solenoids. As a result of being discrete multi-chip products, they can also be used for large-power applications that cannot be handled with monolithic ICs.

Recommended Models

Applications		S-10	S-12	F-12	
Output channel	Output type	Package type			
		Voltage ratings (V)	60 to 120	60 to 120	60 to 120
		Current ratings (A)	2 to 5	2 to 5	3 to 10
4 ch	Sink driver (N × 4)	MP4013, MP4015, MP4020, MP4021, MP4101, MP4104 / << MP4201, MP4202, MP4209, MP4210 >>		MP4502, MP4506, MP4514	
	Sink driver (N ≠ 4) with built-in bias resistor	MP4024			
	Source driver (P × 4)	MP4009 / << MP4203, MP4208, MP4211 >>		MP4504, MP4508	
	Sink driver Driver with FD (N ≠ 4)		MP4301, MP4303, MP4304 / << MP4401, MP4403, MP4410, MP4411, MP4412 >>	MP4501, MP4513 / << MP4703, MP4711 >>	
	Source driver Driver with FD (P × 4)		MP4305		
6 ch	H-switch driver (N × 2 + P × 2)	MP4005, MP4006 / << MP4207, MP4212 >>		MP4503, MP4507	
	3-phase bridge driver (N × 3 + P × 3)		MP6301 / << MP6403, MP6404 >>	MP6901 / << MP6801 >>	

<< >>: MOSFET product FD: Incorporates flyback diode

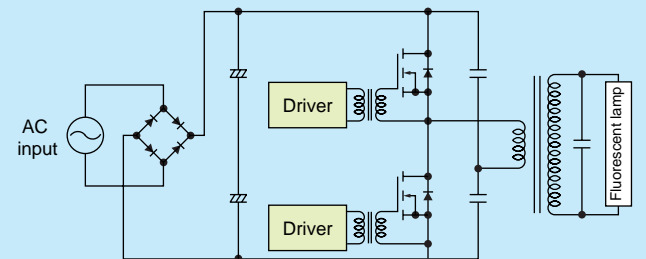
Power Transistor Modules for Large Power Motor Driving (6-in-1)

	SIP-module	Econo-PIM	6-packs	
Bipolar transistors	15 A MP6501A			
IGBT	10 A MP6754	Compound modules with built-in diode bridge	30 A MG30J6ES50	50 A MG50J6ES50
	15 A MP6750			75 A MG75J6ES50
	20 A MP6752			100 A MG100J6ES50

Power MOSFETs

Input	Fluorescent lamp	Peak drain current (reference value) I_{DP}	Device
AC 100 V input	Neoball	0.7 A	2SK2920, 2SK2381, 2SK2835, 2SK3201
	32 W	1.2 A	2SK2679, 2SK2661, 2SK2662
	32 W + 40 W	2.6 A	2SK2679, 2SK2661, 2SK2662
	32 W x 3 lamps	3.5 A	2SK2952, 2SK2542, 2SK2543
	32 W x 4 lamps	4.6 A	2SK2601, 2SK2842, 2SK2916, 2SK2698
AC 200 V input	32 W	0.7 A	2SK2846, 2SK2865
	32 W + 40 W	1.3 A	
	32 W x 3 lamps	1.8 A	2SK2750, 2SK2544, 2SK2545
	32 W x 4 lamps	2.3 A	

Circuit Example



MOSFETs for Air-conditioner External Unit Fan Motor Driving

Device	I_D (A)	V_{DSS} (V)	$R_{DS(ON)}$ (Ω)	Remarks	Package
2SK2662	5	500	1.5	π -MOS V	TO-220 (NIS)
2SK2543	8		0.85		
2SK2545	6	600	1.25		
2SK3130	6	600	1.5	High-speed Di	TO-220 (NIS)

IGBTs for Induction Heating Cooking Appliances and Microwave Ovens

Device	I_C (A)	V_{CES} (V)	$V_{CES(sat)}$ (max)		Package	Remarks
			(V)	I_C (A)		
GT60M303*	60	900	2.7	60	TO-3P (LH)	Single-transistor voltage resonance
GT40T101	40	1500	5.0	40	TO-3P (LH)	
GT30J322*	30	600	2.8	50	TO-3P (IS)	Double-transistor current resonance
GT50J322*	50	600	2.8	50	TO-3P (LH)	

* : Built-in FRD

Discrete IGBT for IH-Microwave Ovens (2) (Application Circuit and Recommended Devices)

Input		Circuit example	IGBT	
AC line	Power		Ratings	Recommended device
AC 100 V	up to 1200 W	Single-transistor voltage resonance 	$V_{CES} = 900$ V $I_C = 60$ A	GT60M303
			$V_{CES} = 1500$ V $I_C = 40$ A	GT40T101
AC 220 V	up to 2200 W	Double-transistor current resonance 	$V_{CES} = 600$ V $I_C = 50$ A	GT60M303 GT30J322 GT50J322

Discrete IGBT for Inverters (Built-in FWD)

Device	I_C (A)	V_{CES} (V)	$V_{CES(sat)}$ (max)		Package	Remarks
			(V)	I_C (A)		
GT5J301	5	600	2.7	5	TO-220NIS	Build-in FWD
GT10J303	10			10		Build-in FWD
GT15J301	15			15		Build-in FWD
GT10J301	10			10	TO-3P (N)	Build-in FWD
GT20J301	20			20		Build-in FWD
GT30J301	30			30		Build-in FWD
GT50J301	50			50	TO-3P (LH)	Build-in FWD