TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA7291P, TA7291S/SG, TA7291F/FG

BRIDGE DRIVER

The TA7291P / S/SG / F/FG are Bridge Driver with output voltage control.

FEATURES

- 4 modes available (CW / CCW / STOP / BRAKE)
- Output current: P type 1.0 A (AVE.) 2.0 A (PEAK) S/SG,/ F/FG type 0.4 A (AVE.) 1.2 A (PEAK)
- Wide range of operating voltage: V_{CC} (opr.) = 4.5~20 V

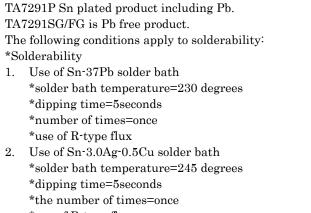
VS (opr.) = 0~20 V

*Please consider the internal loss (Vsat) to operate the IC though minimum V_S is defined zero.

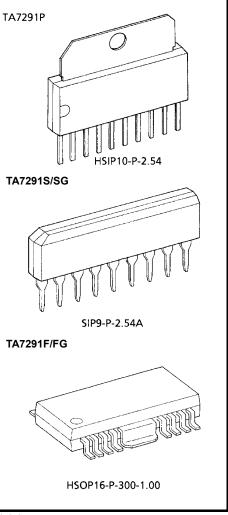
 $V_{ref (opr.)} = 0 \sim 20 V$

- Build in thermal shutdown, over current protector and punch = through current restriction circuit.
- Stand-by mode available (STOP MODE)
- Hysteresis for all inputs.

TA7291P. TA7291SG/FG:



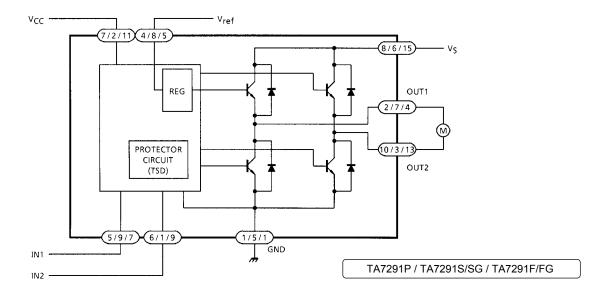
*use of R-type flux



Weight

weight	
HSIP10-P-2.54	: 2.47 g (Typ.)
SIP9-P-2.54A	: 0.92 g (Typ.)
HSOP16-P-300-1.00	: 0.50 g (Typ.)

BLOCK DIAGRAM



PIN FUNCTION

	PIN No.		OVMDOI	
Р	S/SG	F/FG	SYMBOL	FUNCTION DESCRIPTION
7	2	11	V _{CC}	Supply voltage terminal for Logic
8	6	15	VS	Supply voltage terminal for Motor driver
4	8	5	V _{ref}	Supply voltage terminal for control
1	5	1	GND	GND terminal
5	9	7	IN1	Input terminal
6	1	9	IN2	Input terminal
2	7	4	OUT1	Output terminal
10	3	13	OUT2	Output terminal

P Type: Pin (3), (9): NC

S/SG Type: PIN (4): NC

F/FG Type: PIN (2), (3), (6), (8), (10), (12), (14), and (16): NC For F/FG Type, We recommend FIN to be connected to the GND.

FUNCTION

INPUT		OUT	NODE	
IN1	IN2	OUT1	OUT2	MODE
0	0	8	×	STOP
1	0	Н	L	CW / CCW
0	1	L	Н	CCW / CW
1	1	L	L	BRAKE

∞: High impedance

Note: Inputs are all high active type

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC			SYMBOL	RATING	UNIT	
Supply Voltage		V _{CC}	25	V		
Motor Drive Voltage			VS	25	V	
Reference Voltage			V _{ref}	25	V	
Output Current	PEAK	Р Туре	1	2.0	A	
	PEAN	S/SG, F/FG Type	lo (PEAK)	1.2		
	AVE.	Р Туре		1.0		
		S/SG, F/FG Type	IO (AVE.)	0.4		
P Type Power Dissipation S/SG Type F/FG Type			12.5 (Note 1)	w		
		PD	0.95 (Note 2)			
		F/FG Type		1.4 (Note 3)		
Operating Temperature		T _{opr}	-30~75	°C		
Storage Temperature			T _{stg}	-55~150	°C	

Note 1: Tc = 25°C (TA7291P/PG)

Note 2: No heat sink

Note 3: PCB (60 × 30 × 1.6 mm, occupied copper area in excess of 50%) Mounting Condition.

Wide range of operating voltage: $V_{CC (opr.)} = 4.5 \sim 20 \text{ V}$ $V_{S (opr.)} = 0 \sim 20 \text{ V}$ $V_{ref (opr.)} = 0 \sim 20 \text{ V}$ $V_{ref} \leq V_S$

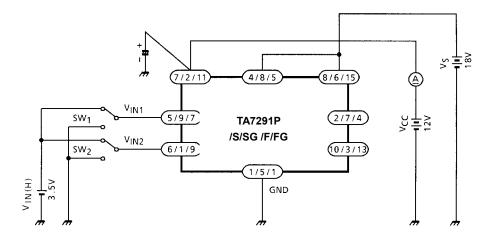
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta = 25°C, V_{CC} = 12 V, V_S = 18 V)

CHARACTERISTIC		SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT	
Supply Current		I _{CC1}		Output OFF, CW / CCW mode	_	8.0	13.0	mA	
		I _{CC2}	1	Output OFF, Stop mode	_	0	50	μA	
		I _{CC3}		Output OFF, Brake mode	_	6.5	10.0	mA	
Input Operating Voltage 1 (High) 2 (Low)		V _{IN1}		T _i = 25°C	3.5	_	5.5	v	
		V _{IN2}	2	1 20 0	GND	—	0.8		
Input Current		I _{IN}		V _{IN} = 3.5 V, Sink mode	—	3	10	μA	
Input Hysteresis Voltage		ΔV_T		—	—	0.7	—	V	
	P/ S/SG	Upper Side	VSAT U-1		$V_{ref} = V_S$, $V_{OUT} - V_S$ measure $I_O = 0.2$ A, CW / CCW mode	_	0.9	1.2	V
Saturation Voltage	/ F/FG Type	Lower Side	VSAT L-1		$V_{ref} = V_S$, $V_{OUT} - GND$ measure $I_O = 0.2 A$, CW / CCW mode	—	0.8	1.2	
	S/SG /	Upper Side	V _{SAT U-2}		$V_{ref} = V_S, V_{OUT} - V_S$ measure $I_O = 0.4$ A, CW / CCW mode	—	1.0	1.35	
	F/FG Type	Lower Side	V _{SAT L-2}	3	$V_{ref} = V_S, V_{OUT} - GND$ measure $I_O = 0.4 A, CW / CCW mode$	_	0.9	1.35	
		Upper Side	V _{SAT U-3}		$V_{ref} = V_S, V_{OUT} - V_S$ measure $I_O = 1.0 \text{ A}, \text{CW} / \text{CCW}$ mode	_	1.3	1.8	
	Р Туре	Lower Side	V _{SAT L-3}		$V_{ref} = V_S, V_{OUT} - GND$ measure $I_O = 1.0 A, CW / CCW mode$	_	1.2	1.85	
Output Voltage (Upper Side)	S/SC / [VSAT U-1'		V_{ref} = 10 V V _{OUT} – GND measure, I _O = 0.2 A, CW / CCW mode	_	11.2	_	
	S/SG / F/FG Type		VSAT U-2'		V_{ref} = 10 V V _{OUT} – GND measure, I _O = 0.4 A, CW / CCW mode	10.4	10.9	12.2	
	B Type		VSAT U-3'	- 3	V_{ref} = 10 V V _{OUT} – GND measure, I _O = 0.5 A, CW / CCW mode	_	11.0	_	V
	Р Туре		VSAT U-4'		V_{ref} = 10 V V _{OUT} – GND measure, I _O = 1.0 A, CW / CCW mode	10.2	10.7	12.0	
Leakage Current Leakage Current Upper Side Lower Side Side		۱ _{L U}	- 4	V _L = 25 V	_	_	50		
			ΙLL		V _L = 25 V	—	_	50	μA
Diode Forward Voltage	S/SG / F/FG Type	Upper Side	V _{F U-1}		I _F = 0.4 A	_	1.5	_	v
	Р Туре	Lower Side	V _{F U-2}	5	I _F = 1 A	_	2.5	_	
	S/SG / F/FG Type	Upper Side	V _{F L-1}	5	I _F = 0.4 A	_	0.9	_	
	Р Туре	Lower Side	V _{F L-2}		I _F = 1 A	_	1.2	_	
Reference Current		I _{ref}	2	V _{ref} = 10 V, Source mode	_	20	40	μA	



TEST CIRCUIT 1

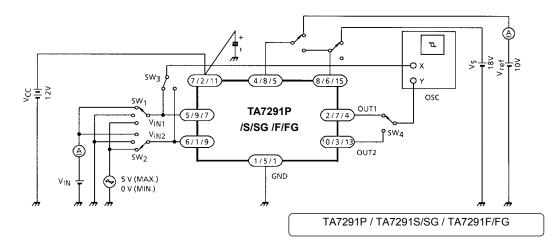
Icc1, Icc2, Icc3



Note: HEAT FIN of TA7291F/FG is connected to GND.

TEST CIRCUIT 2

VIN 1, VIN 2, IIN , Δ VT, Iref

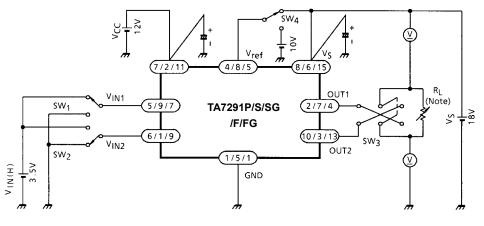


Note: HEAT FIN of TA7291F/FG is connected to GND.

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TEST CIRCUIT 3

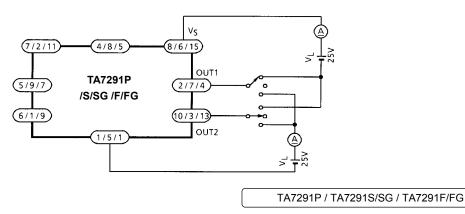
VSAT U-1, 2, 3 VSAT L-1, 2, 3 VSAT U-1', 2', 3', 4'



Note: I_{OUT} calibration is required to adjust specified values of test conditions by R_L. (I_{OUT} = 0.2 A / 0.4 A / 0.5 A / 1.0 A) Note: HEAT FIN of TA7291F/FG is connected to GND.

TEST CIRCUIT 4

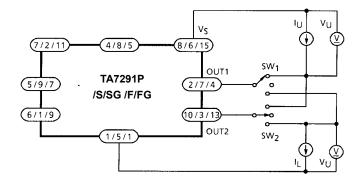
IL U, L



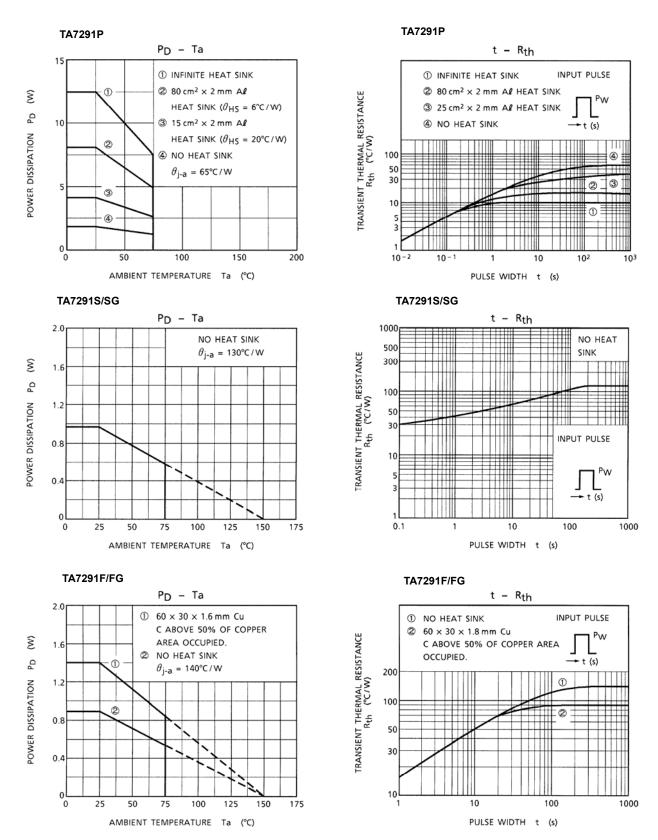
Note: HEAT FIN of TA7291F/FG is connected to GND.

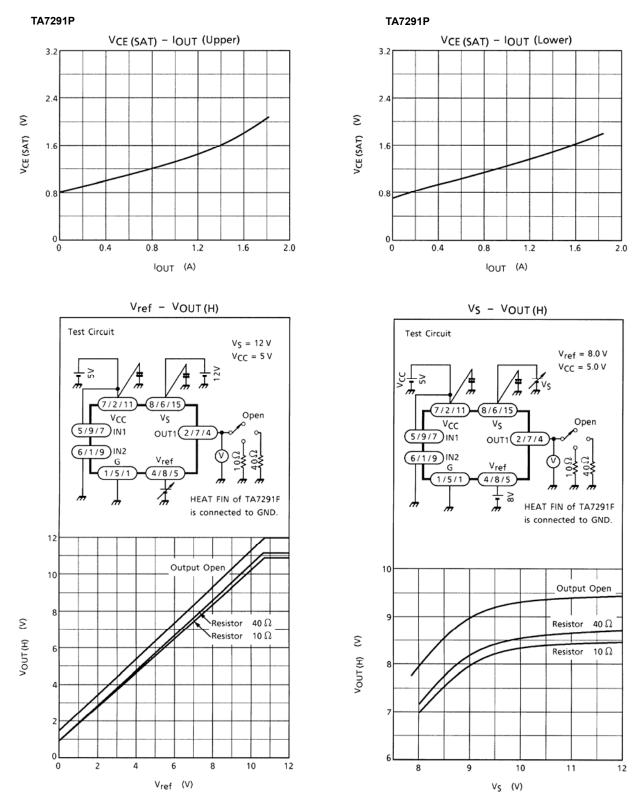
TEST CIRCUIT 5

 $V_{F\,U-1,\,2} \ V_{F\,L-1,\,2}$



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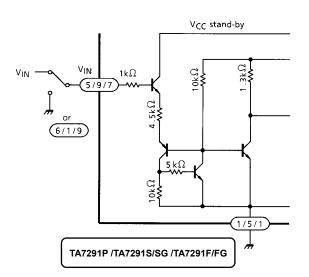




NOTES

Input circuit

Input Terminals of pin (5) and (6) (TA7291P) are all high active type and have a hysteresis of 0.7 V (typ.), $3 \mu A$ (typ.) of source mode input current is required.



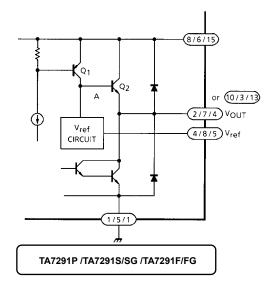
Output circuit

 $\begin{array}{l} Output \ voltage \ is \ controlled \ by \ V_{ref} \ voltage. \\ Relationship \ between \ V_{OUT} \ and \ V_{ref} \ is \end{array}$

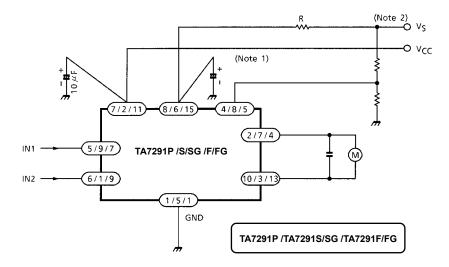
 $V_{OUT} = V_{BE} (\approx 0.7) + V_{ref}$

 V_{ref} terminal required to connect to $V_{\rm S}$ terminal for stable operation in case of no requirement of V_{OUT} control.

$$V_{ref} \le V_S$$



APPLICATION CIRCUIT



Note 1: Experiment to find the optimum capacitor valve.

Note 2: To protect against excess current, current limitation resistor R should be inserted where necessary.

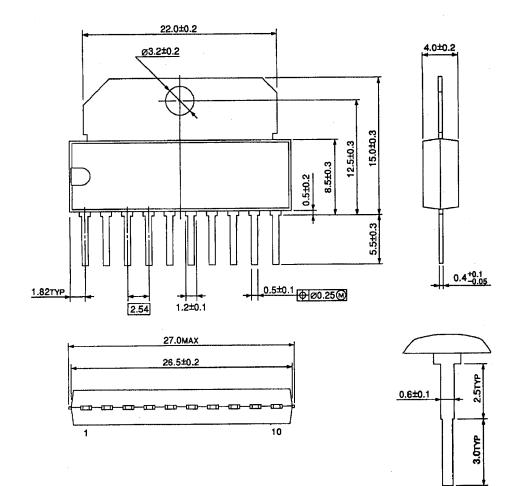
NOTES

- Be careful when switching the input because rush current may occur. When switching, stop mode should be entered or current limitation resister R should be inserted.
- The IC functions cannot be guaranteed when turning power on of off. Before using the IC for application, check that there are no problems.
- Utmost care is necessary in the design of the output, V_{CC}, V_M, and GND lines since the IC may be destroyed by short-circuiting between outputs, air contamination faults, or faults due to improper grounding, or by short-circuiting between contiguous pins.

PACKAGE DIMENSIONS

HSIP10-P-2.54

Unit: mm

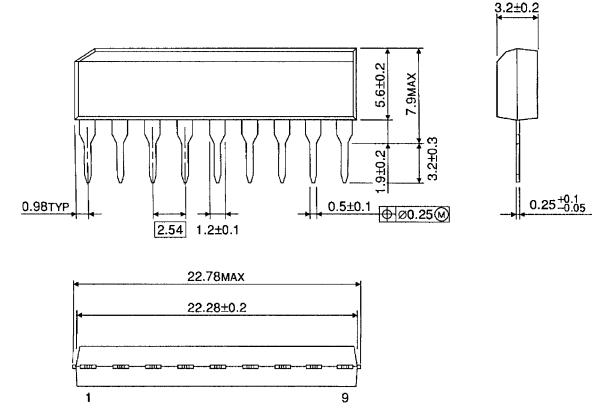


Weight: 2.47 g (Typ.)

PACKAGE DIMENSIONS

SIP9-P-2.54A

Unit: mm

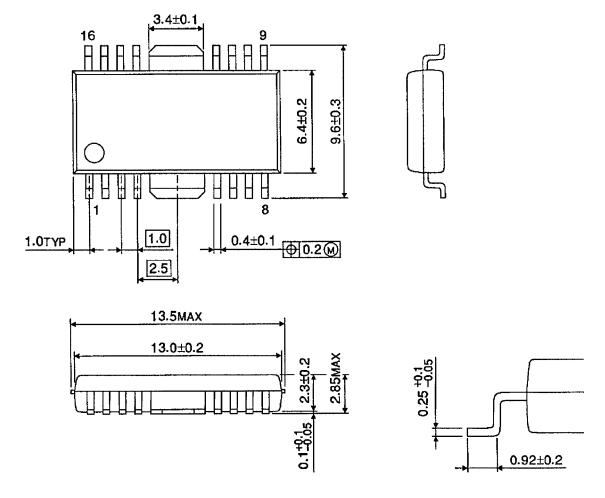


Weight: 0.92 g (Typ.)

PACKAGE DIMENSIONS

HSOP16-P-300-1.00

Unit: mm



Weight: 0.50 g (Typ.)

Notes on Contents

1. Block Diagrams

Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purposes.

2. Equivalent Circuits

The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

3. Timing Charts

Timing charts may be simplified for explanatory purposes.

4. Application Circuits

The application circuits shown in this document are provided for reference purposes only. Thorough evaluation is required, especially at the mass production design stage.

Toshiba does not grant any license to any industrial property rights by providing these examples of application circuits.

5. Test Circuits

Components in the test circuits are used only to obtain and confirm the device characteristics. These components and circuits are not guaranteed to prevent malfunction or failure from occurring in the application equipment.

IC Usage Considerations Notes on handling of ICs

- [1] The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.Exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.
- [2] Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.
- [3] If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. IC breakdown may cause injury, smoke or ignition.
 Use a stable power supply with ICa with builting protection functions. If the power supply is

Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.

[4] Do not insert devices in the wrong orientation or incorrectly. Make sure that the positive and negative terminals of power supplies are connected properly. Otherwise, the current or power consumption may exceed the absolute maximum rating, and exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.

In addition, do not use any device that is applied the current with inserting in the wrong orientation or incorrectly even just one time.

Points to remember on handling of ICs

(1) Over current Protection Circuit

Over current protection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the Over current protection circuits operate against the over current, clear the over current status immediately.

Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the over current protection circuit to not operate properly or IC breakdown before operation. In addition, depending on the method of use and usage conditions, if over current continues to flow for a long time after operation, the IC may generate heat resulting in breakdown.

(2) Thermal Shutdown Circuit

Thermal shutdown circuits do not necessarily protect ICs under all circumstances. If the thermal shutdown circuits operate against the over temperature, clear the heat generation status immediately.

Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the thermal shutdown circuit to not operate properly or IC breakdown before operation.

(3) Heat Radiation Design

In using an IC with large current flow such as power amp, regulator or driver, please design the device so that heat is appropriately radiated, not to exceed the specified junction temperature (T_J) at any time and condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, please design the device taking into considerate the effect of IC heat radiation with peripheral components.

(4) Back-EMF

When a motor rotates in the reverse direction, stops or slows down abruptly, a current flow back to the motor's power supply due to the effect of back-EMF. If the current sink capability of the power supply is small, the device's motor power supply and output pins might be exposed to conditions beyond maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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