TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA7291P, TA7291S/SG, TA7291F/FG

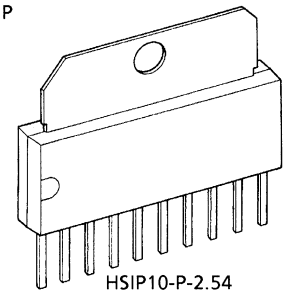
BRIDGE DRIVER

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

FEATURES

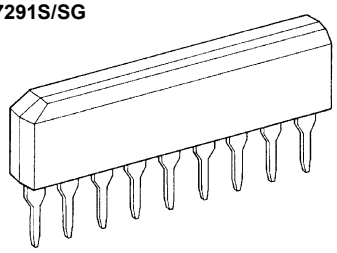
- 4 modes available (CW / CCW / STOP / BRAKE)
- Output current: P type 1.0 A (AVE.) 2.0 A (PEAK)
  S/SG,/ F/FG type 0.4 A (AVE.) 1.2 A (PEAK)
- Wide range of operating voltage: $V_{CC\ (opr.)}$ = 4.5~20 V
  $V_{S\ (opr.)}$ = 0~20 V
  $V_{ref\ (opr.)}$ = 0~20 V
- Build in thermal shutdown, over current protector and punch = through current restriction circuit.
- Stand−by mode available (STOP MODE)
- Hysteresis for all inputs.

TA7291P



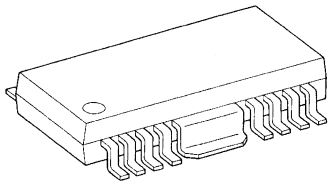
HSIP10-P-2.54

TA7291S/SG



SIP9-P-2.54A

TA7291F/FG

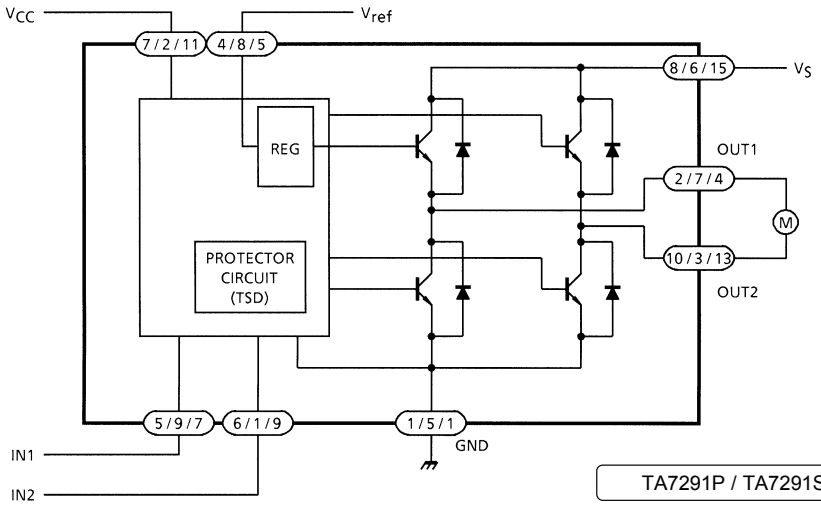


HSOP16-P-300-1.00

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.)

TA7291P, TA7291SG/FG:
TA7291P Sn plated product including Pb.
TA7291SG/FG is Pb free product.
The following conditions apply to solderability:
*Solderability
1. Use of Sn-63Pb solder bath
   *solder bath temperature=230 degrees
   *dipping time=5seconds
   *number of times=once
   *use of R-type flux
2. Use of Sn-3.0Ag-0.5Cu solder bath
   *solder bath temperature=245 degrees
   *dipping time=5seconds
   *the number of times=once
   *use of R-type flux

BLOCK DIAGRAM



TA7291P / TA7291S/SG / TA7291F/FG

PIN FUNCTION

PIN No.			SYMBOL	FUNCTION DESCRIPTION
P	S/SG	F/FG		
7	2	11	V_{CC}	Supply voltage terminal for Logic
8	6	15	V_S	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		OUTPUT		MODE
IN1	IN2	OUT1	OUT2	
0	0	∞	∞	STOP
1	0	H	L	CW / CCW
0	1	L	H	CCW / CW
1	1	L	L	BRAKE

∞: High impedance
Note: Inputs are all high active type

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC			SYMBOL	RATING	UNIT
Supply Voltage			V_{CC}	25	V
Motor Drive Voltage			V_S	25	V
Reference Voltage			V_{ref}	25	V
Output Current	PEAK	P Type	$I_{O\ (PEAK)}$	2.0	A
		S/SG, F/FG Type		1.2	
	AVE.	P Type	$I_{O\ (AVE.)}$	1.0	
		S/SG, F/FG Type		0.4	
Power Dissipation		P Type	P_D	12.5 (Note 1)	W
		S/SG Type		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: $V_{CC\ (opr.)}$ = 4.5~20 V
$V_{S\ (opr.)}$ = 0~20 V
$V_{ref\ (opr.)}$ = 0~20 V
$V_{ref} \leq V_S$

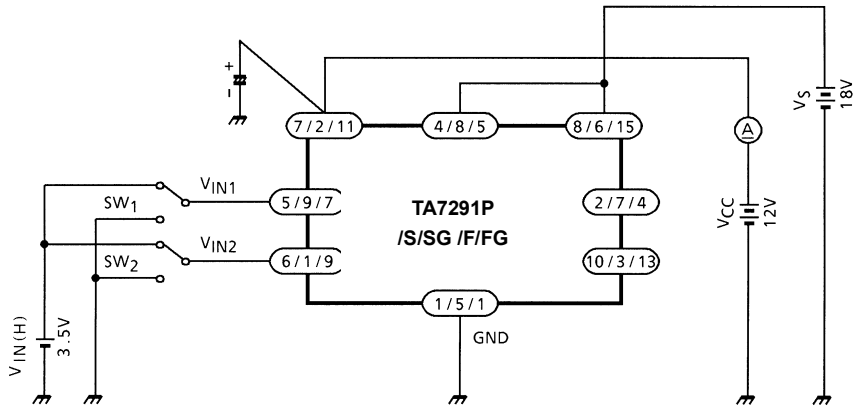
ELECTRICAL CHARACTERISTICS

(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}	1	Output OFF, CW / CCW mode	—	8.0	13.0	mA
			I_{CC2}		Output OFF, Stop mode	—	0	50	μA
			I_{CC3}		Output OFF, Brake mode	—	6.5	10.0	mA
Input Operating Voltage	1 (High)		V_{IN1}	2	T_j = 25°C	3.5	—	5.5	V
	2 (Low)		V_{IN2}			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
Saturation Voltage	P/ S/SG / F/FG Type	Upper Side	$V_{SAT\ U-1}$	3	V_{ref} = V_S, V_{OUT} − V_S measure I_O = 0.2 A, CW / CCW mode	—	0.9	1.2	V
		Lower Side	$V_{SAT\ L-1}$		V_{ref} = V_S, V_{OUT} − GND measure I_O = 0.2 A, CW / CCW mode	—	0.8	1.2	
	S/SG / F/FG Type	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	
		Lower Side	$V_{SAT\ L-2}$		V_{ref} = V_S, V_{OUT} − GND measure I_O = 0.4 A, CW / CCW mode	—	0.9	1.35	
	P Type	Upper Side	$V_{SAT\ U-3}$		V_{ref} = V_S, V_{OUT} − V_S measure I_O = 1.0 A, CW / CCW mode	—	1.3	1.8	
		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/SG / F/FG Type		$V_{SAT\ U-1'}$	3	V_{ref} = 10 V V_{OUT} − GND measure, I_O = 0.2 A, CW / CCW mode	—	11.2	—	V
			$V_{SAT\ U-2'}$		V_{ref} = 10 V V_{OUT} − GND measure, I_O = 0.4 A, CW / CCW mode	10.4	10.9	12.2	
	P Type		$V_{SAT\ U-3'}$		V_{ref} = 10 V V_{OUT} − GND measure, I_O = 0.5 A, CW / CCW mode	—	11.0	—	
			$V_{SAT\ U-4'}$		V_{ref} = 10 V V_{OUT} − GND measure, I_O = 1.0 A, CW / CCW mode	10.2	10.7	12.0	
Leakage Current		Upper Side	$I_{L\ U}$	4	V_L = 25 V	—	—	50	μA
		Lower Side	$I_{L\ L}$		V_L = 25 V	—	—	50	
Diode Forward Voltage	S/SG / F/FG Type	Upper Side	$V_{F\ U-1}$	5	I_F = 0.4 A	—	1.5	—	V
	P Type	Lower Side	$V_{F\ U-2}$		I_F = 1 A	—	2.5	—	
	S/SG / F/FG Type	Upper Side	$V_{F\ L-1}$		I_F = 0.4 A	—	0.9	—	
	P Type	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

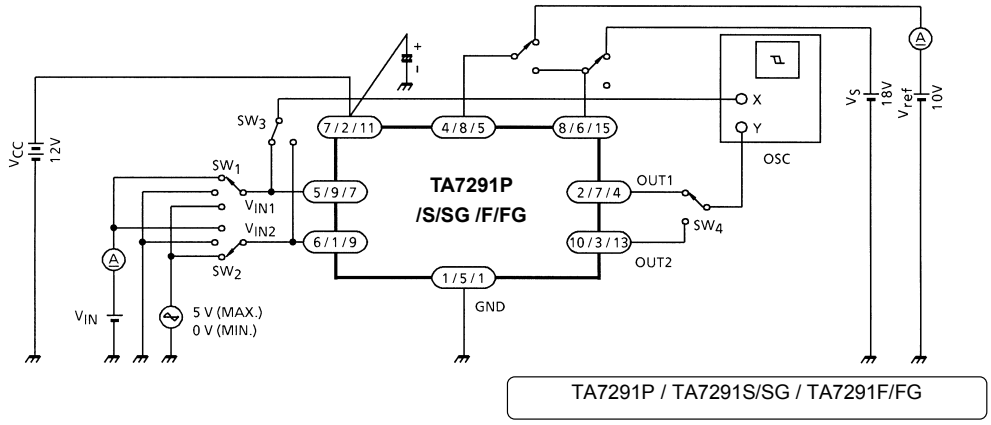
I_{CC1}, I_{CC2}, I_{CC3}



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

TEST CIRCUIT 2

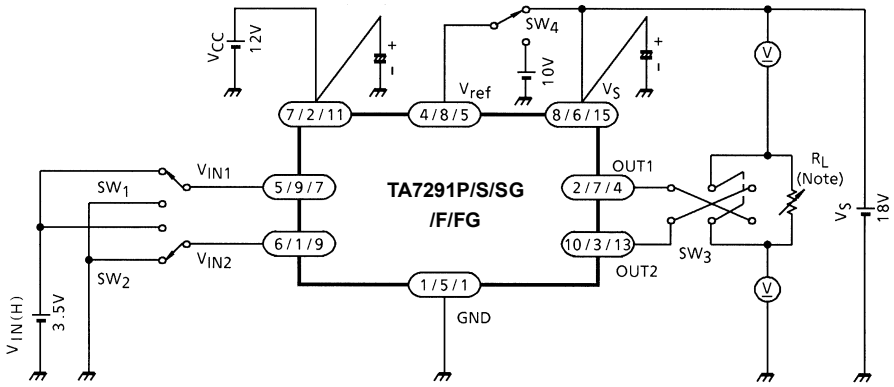
$V_{IN\ 1}$, $V_{IN\ 2}$, I_{IN} , ΔV_T, I_{ref}



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

TEST CIRCUIT 3

$V_{SAT\ U-1,\ 2,\ 3}$ $V_{SAT\ L-1,\ 2,\ 3}$ $V_{SAT\ U-1',\ 2',\ 3',\ 4'}$

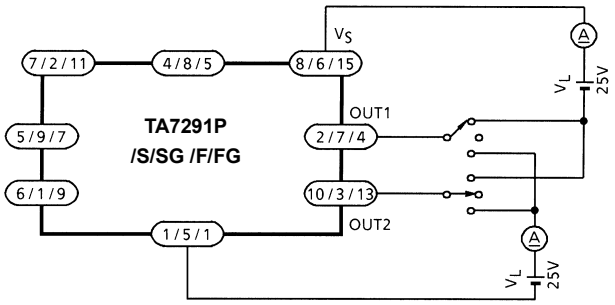


Note: I_{OUT} calibration is required to adjust specified values of test conditions by R_L.
(I_{OUT} = 0.2 A / 0.4 A / 0.5 A / 1.0 A)

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

TEST CIRCUIT 4

$I_{L\ U,\ L}$

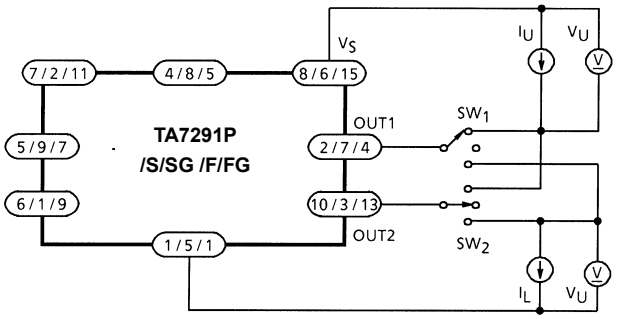


TA7291P / TA7291S/SG / TA7291F/FG

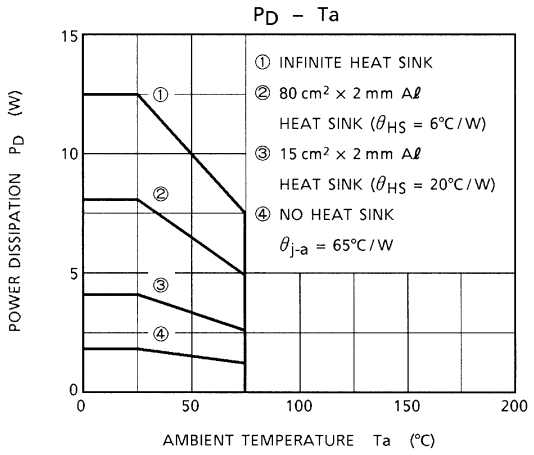
Note: HEAT FIN of TA7291F/FG is connected to GND.

TEST CIRCUIT 5

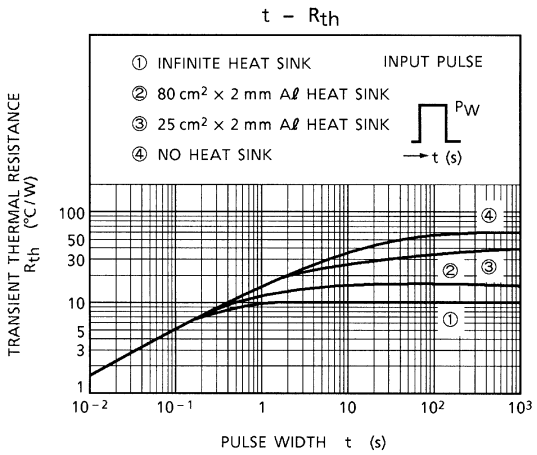
$V_{F\ U-1,\ 2}$ $V_{F\ L-1,\ 2}$



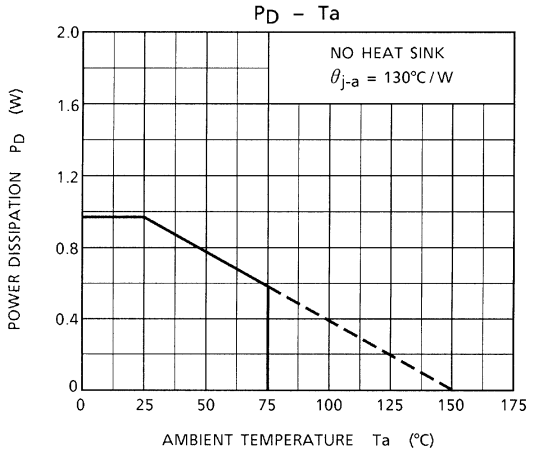
TA7291P



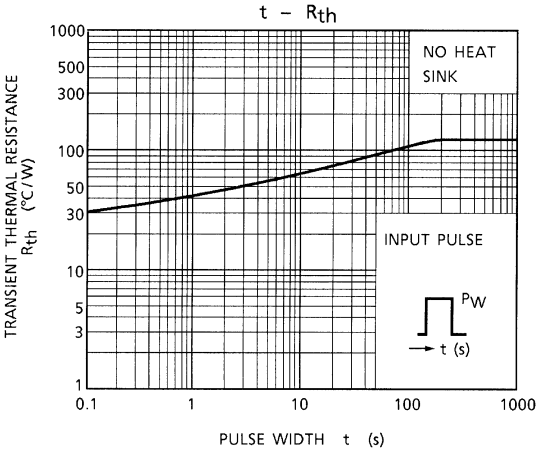
TA7291P



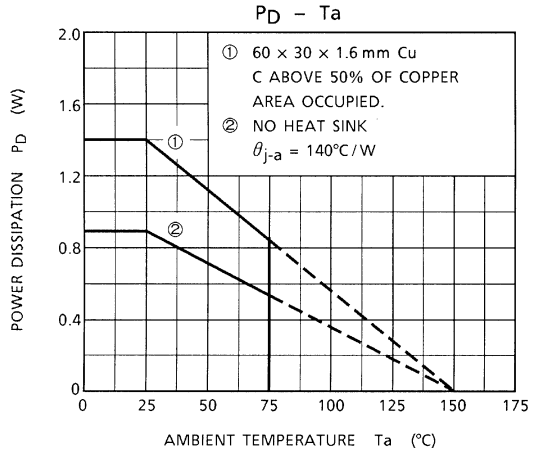
TA7291S/SG



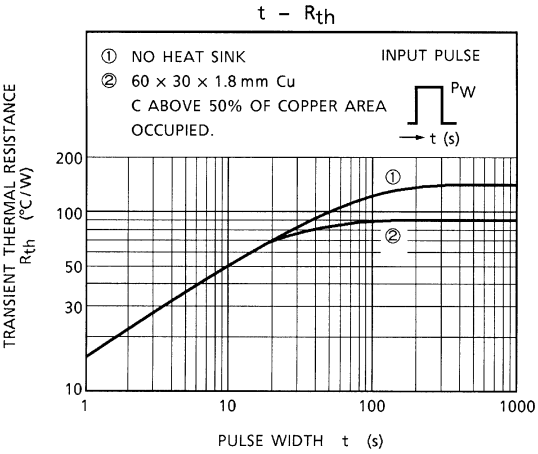
TA7291S/SG



TA7291F/FG

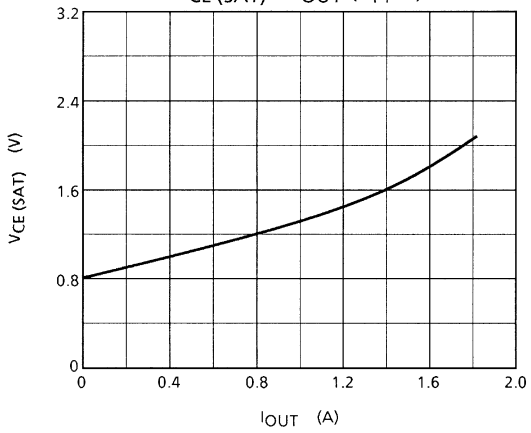


TA7291F/FG



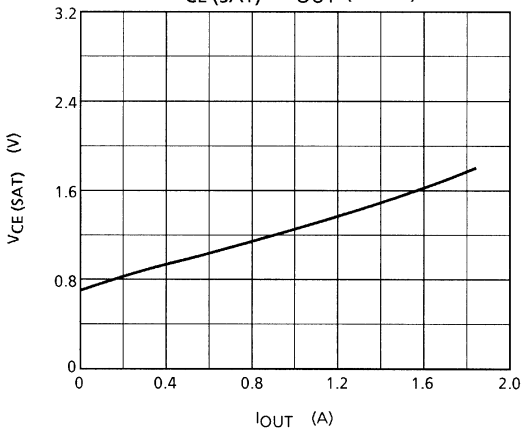
TA7291P

$V_{CE\,(SAT)}$ – I_{OUT} (Upper)

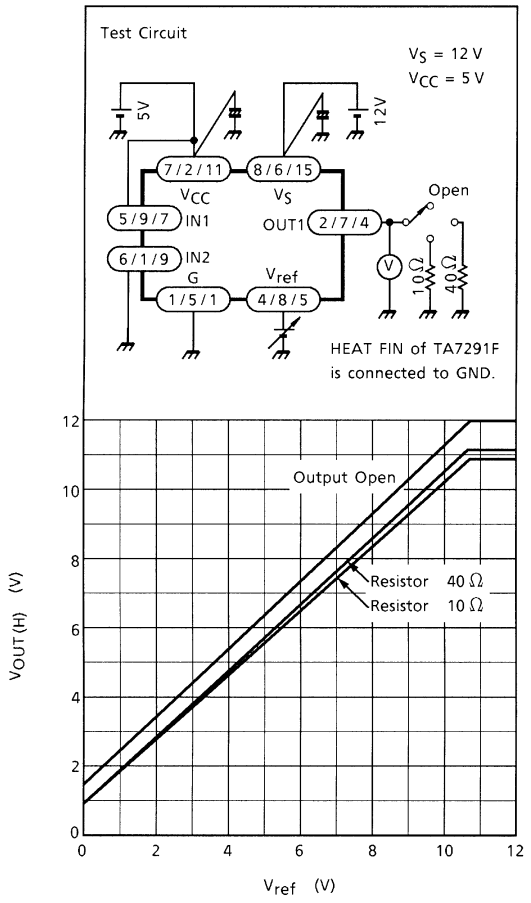


TA7291P

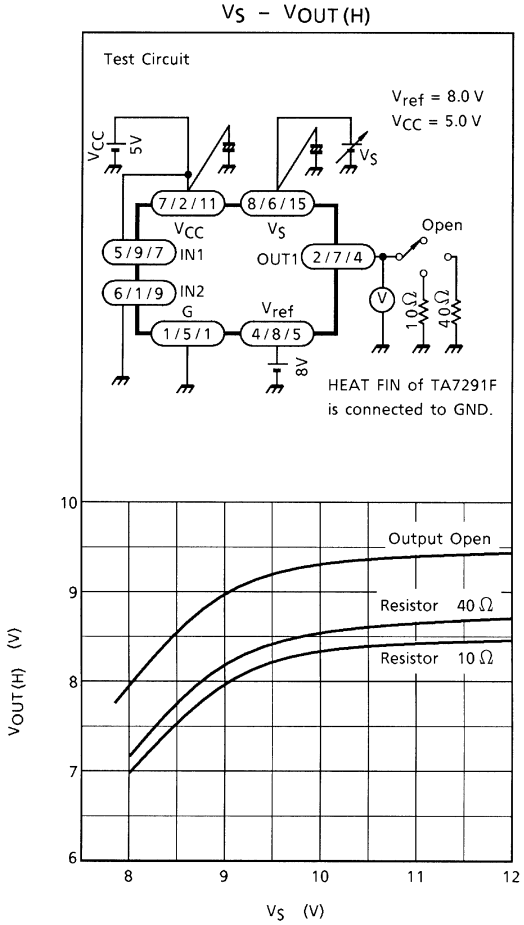
$V_{CE\,(SAT)}$ – I_{OUT} (Lower)



V_{ref} – $V_{OUT\,(H)}$



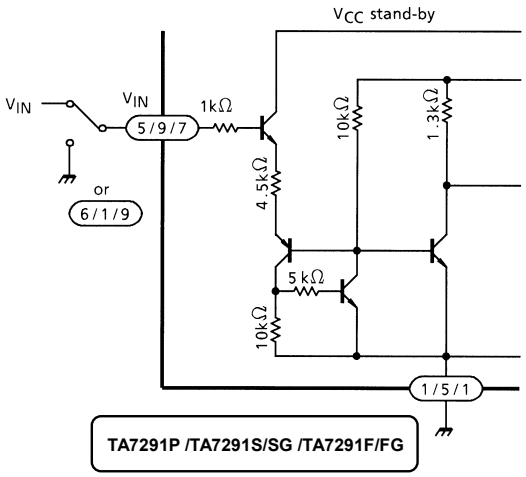
V_S – $V_{OUT\,(H)}$



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 μA (typ.) of source mode input current is required.



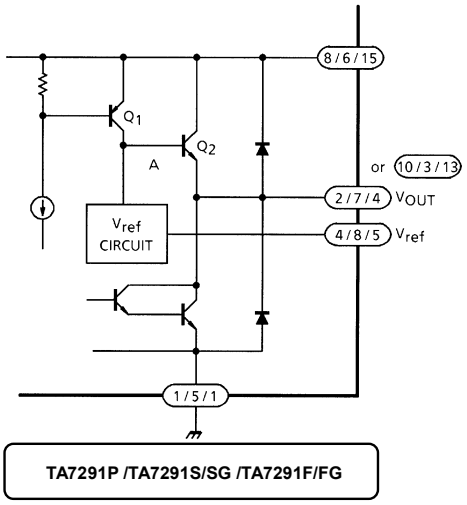
Output circuit

Output voltage is controlled by V_{ref} voltage.
Relationship between V_{OUT} and V_{ref} is

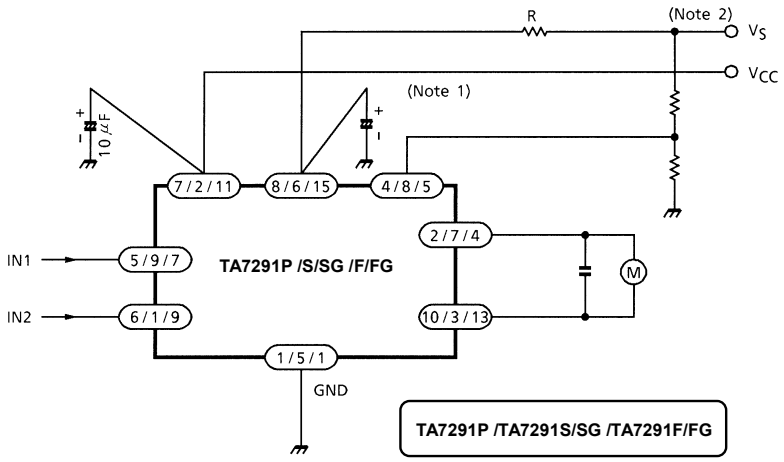
$V_{OUT} = V_{BE} (\approx 0.7) + V_{ref}$

V_{ref} terminal required to connect to V_S terminal for stable operation in case of no requirement of V_{OUT} control.

$V_{ref} \leq V_S$



APPLICATION CIRCUIT



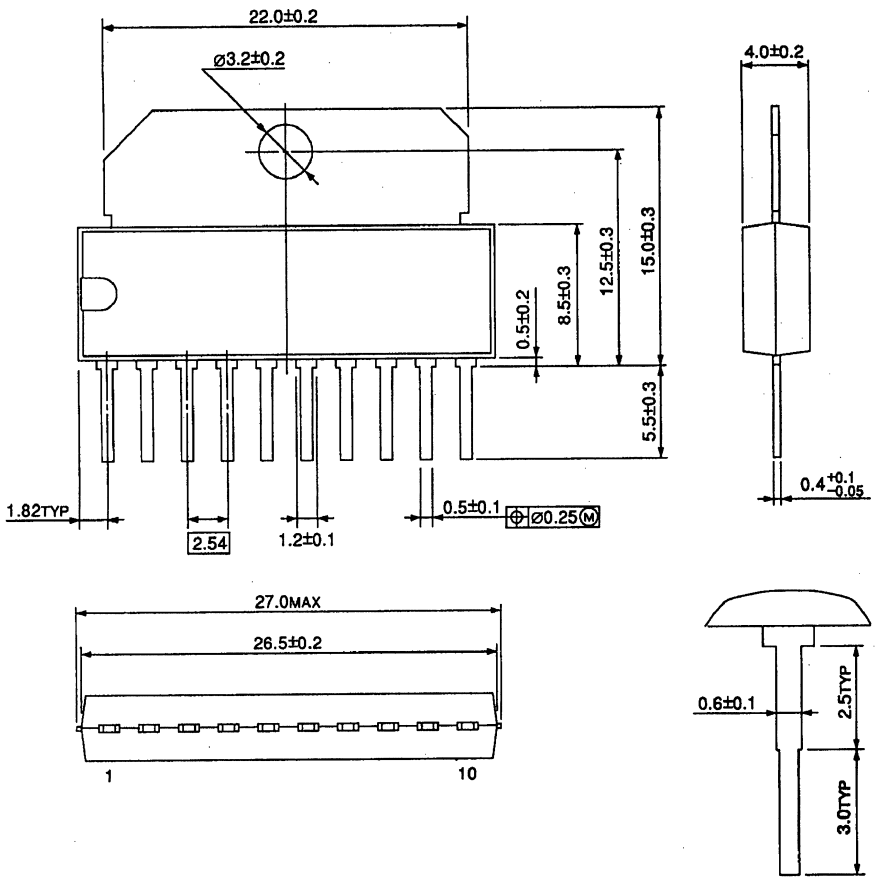
Note 1: Experiment to find the optimum capacitor valve.
Note 2: To protect against excess current, current limitation resistor R should be inserted where necessary.

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 line, V_S, V_{CC} and GND line since IC may be destroyed due to short−circuit between outputs, air contamination fault, or fault by improper grounding.

PACKAGE DIMENSIONS

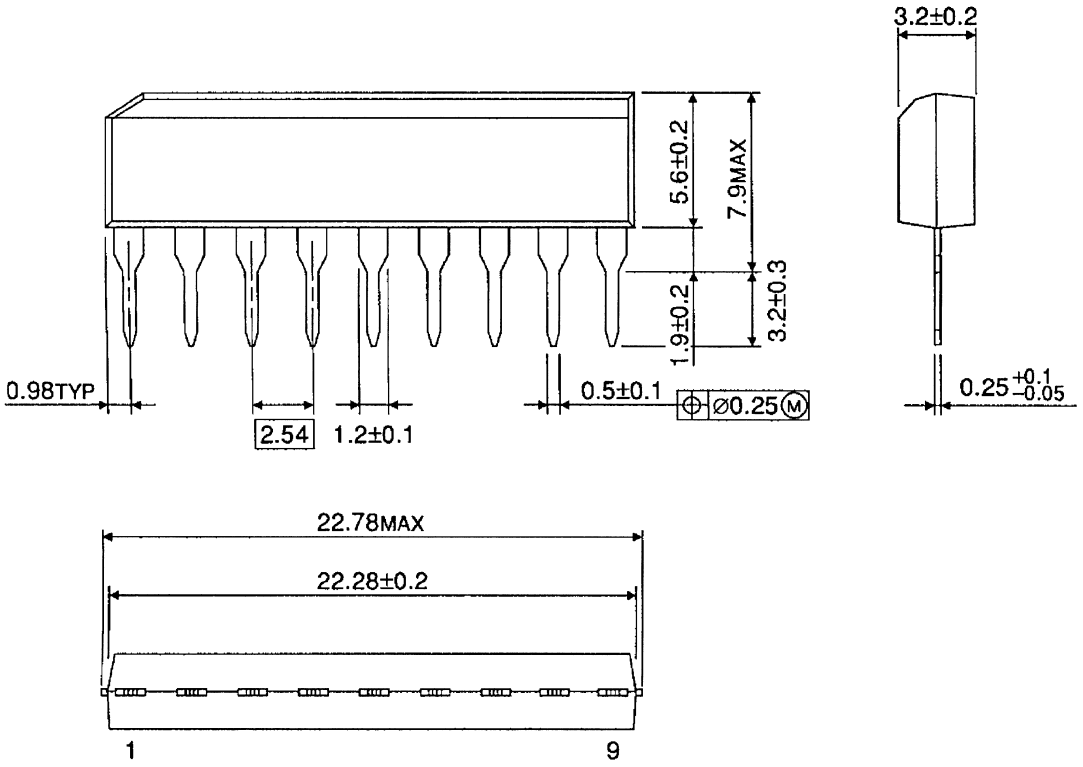
HSIP10−P−2.54 Unit: mm



Weight: 2.47 g (Typ.)

PACKAGE DIMENSIONS

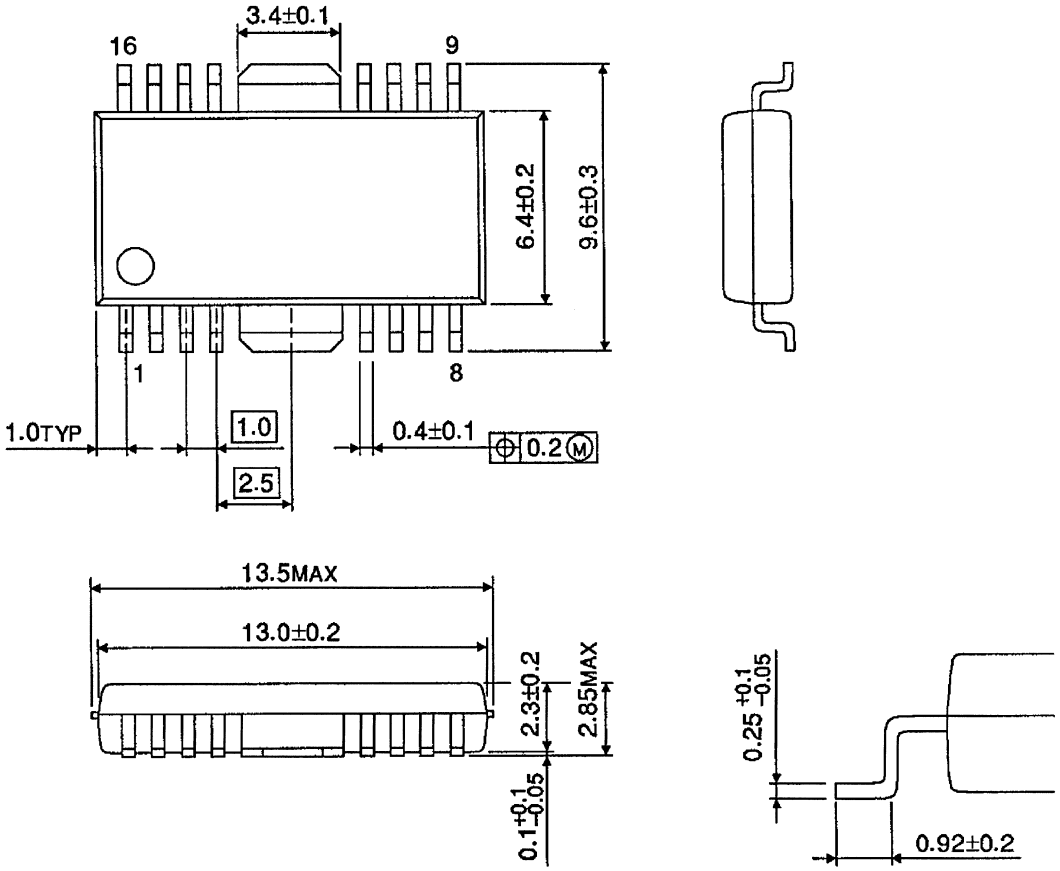
SIP9−P−2.54A Unit: mm



Weight: 0.92 g (Typ.)

PACKAGE DIMENSIONS

HSOP16−P−300−1.00 Unit: mm



Weight: 0.50 g (Typ.)

The notes of contents

1.Block Diagram

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

2.Equivalent Circuit

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

3.Timing charts

Timing charts may be simplified for explanatory purpose.

4.Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values, which must not be exceeded during operation, even for an instant.

If any of these rating would be exceeded during operation, the device electrical characteristics may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed.

Moreover, these operations with exceeded ratings may cause break down, damage and/or degradation to any other equipment. Applications using the device should be designed such that each maximum rating will never be exceeded in any operating conditions.

Before using, creating and/or producing designs, refer to and comply with the precautions and conditions set forth in this documents.

5.Application Circuit

The application circuits shown in this document are provided for reference purposes only. Especially, thorough evaluation is required on the phase of mass production design.

Toshiba dose not grant the use of any industrial property rights with these examples of application circuits.

6.Test Circuit

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

About the handling of IC

Install the product correctly. Otherwise, it may result in break down, damage and/or degradation to the product or equipment.

About over-current protection and a heat protection circuit

These protection functions are intended to avoid some output short circuits or other abnormal conditions temporarily. These protect functions do not warrant to prevent the IC from being damaged.

- In case of the product would be operated with exceeded guaranteed operating ranges, these protection features may not operate and some output short circuits may result in the IC being damaged.

The over-current protection feature is only intended to protect the IC from a temporary short circuit.

Long time short circuit may stress excessively on the IC to be damaged. The systems must be configured so that any over-current condition will be eliminated as soon as possible.

About reverse thermo electromotive

When motor reverses or stops, reverse thermo electromotive of the motor may influence the current to flow to the power.

In case that power does not have the Sink ability, the power pin and the output pin may raise over the rating. Motor's reverse thermo electromotive is different depending on its using conditions and motor's features.

So, make sure that there are not damages of IC, problems of operation, and errors and damages of peripheral circuits by the reverse thermo electromotive.

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030619EBA

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