TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

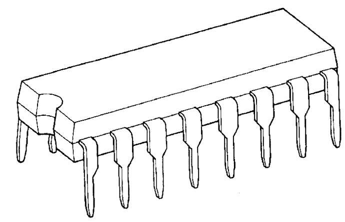
TA7774P/PG, TA7774F/FG

STEPPING MOTOR DRIVER IC

The TA7774P/PG and TA7774F/FG are 2-phase bipolar stepping motor driver ICs designed especially for 3.5- or 5.25-inch FDD head actuator drives.

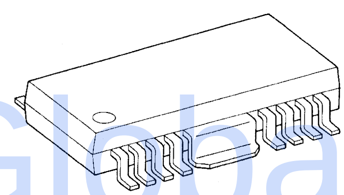
Each IC consists of a TTL-compatible input circuit, dual bridge driver outputs with flyback diodes, a circuit for changing the motor coil drive voltage (i.e., a power-saving circuit) and a stand-by circuit.

TA7774P/PG



DIP16-P-300-2.54A

TA7774F/FG



HSOP16-P-300-1.00

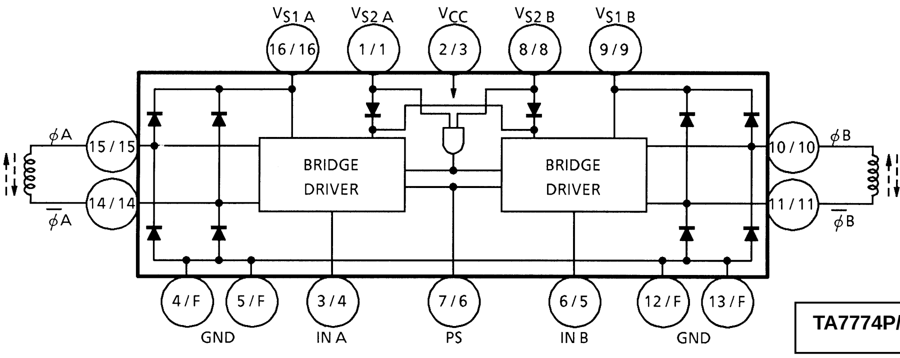
Weight
DIP16−P−300−2.54A : 1.11 g (typ.)
HSOP16−P−300−1.00 : 0.50 g (typ.)

FEATURES

- One-chip 2 phase bipolar stepping motor driver.
- Power saving and stand-by operation are available.
  I stand-by (I_{CC3}) ≤ 115 μA
- Built-in punch-through current restriction circuit for system reliability and noise suppression.
- TTL-compatible inputs
- Surface mount is available with type F.
- Output current up to 0.4 A (peak)

TA7774PG/FG:
The TA7774PG/FG is a Pb-free product.
The following conditions apply to solderability:
*Solderability
1. Use of Sn-63Pb solder bath
   *solder bath temperature = 230°C
   *dipping time = 5 seconds
   *number of times = once
   *use of R-type flux
2. Use of Sn-3.0Ag-0.5Cu solder bath
   *solder bath temperature = 245°C
   *dipping time = 5 seconds
   *number of times = once
   *use of R-type flux

BLOCK DIAGRAM



TA7774P/PG/F/FG

Note: Pins (2), (7), (12), (13) of TA7774F/FG are all NC, and the heat fin is connected to GND.

PIN FUNCTION

PIN No.	SYMBOL	FUNCTIONAL DESCRIPTION
1 / (1)	$V_{S2\ A}$	Low-voltage power supply terminal
2 / (3)	V_{CC}	Power voltage supply terminal for control
3 / (4)	IN A	A-ch forward rotation / reverse rotation signal input terminal
4 / (F)	GND	GND terminal
5 / (F)	GND	GND terminal
6 / (5)	IN B	B-ch forward rotation / reverse rotation signal input terminal
7 / (6)	PS	Power saving signal input terminal
8 / (8)	$V_{S2\ B}$	Stand-by signal input terminal
9 / (9)	$V_{S1\ B}$	High-voltage power supply terminal
10 / (10)	φB	Output B
11 / (11)	$\varphi \overline{B}$	Output $\overline{B}$
12 / (F)	GND	GND terminal
13 / (F)	GND	GND terminal
14 / (14)	$\varphi \overline{A}$	Output $\overline{A}$
15 / (15)	φA	Output A
16 / (16)	$V_{S1\ A}$	High-voltage power supply terminal.

( ): TA7774F/FG

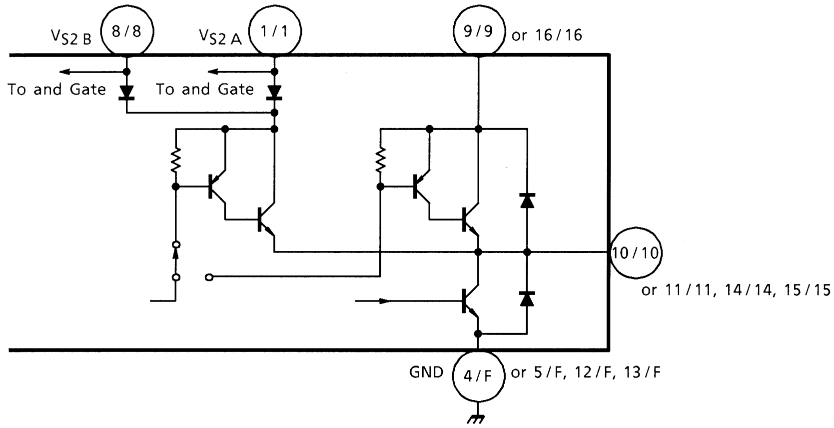
TRUTH TABLE 1

INPUT		OUTPUT		
PS	IN	φ	$\overline{\varphi}$	
L	L	L	H	Enable V_{S1}
L	H	H	L	Enable V_{S1}
H	L	L	H	Enable V_{S2} (power saving)
H	H	H	L	Enable V_{S2} (power saving)

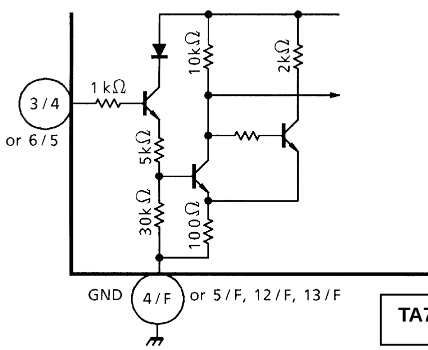
TRUTH TABLE 2

$V_{S2\,B}$	
L	Power off (stand-by)
H	Operation

OUTPUT CIRCUIT

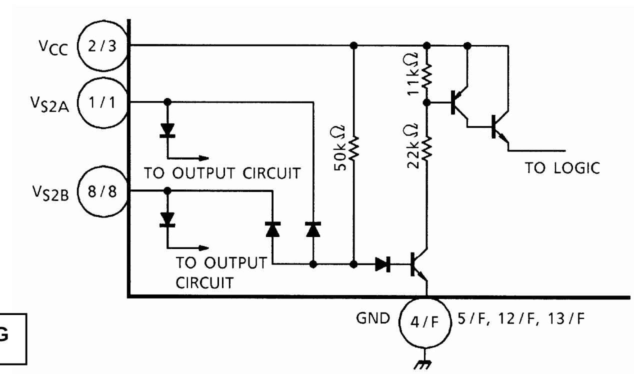


INPUT CIRCUIT IN A, IN B



TA7774P/PG/F/FG

INPUT CIRCUIT $V_{S2\ A}$ or $V_{S2\ B}$



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	7.0	V
		V_{S1}	17.0	
		V_{S2}	~V_{CC}	
Output Current		$I_{O\ (PEAK)}$	±400	mA
		$I_{O\ (START)}$	±350	
		$I_{O\ (HOLD)}$	±100	
Input Voltage		V_{IN}	~V_{CC}	V
Power Dissipation	TA7774P/PG	P_D	1.4 (Note 1)	W
			2.7 (Note 2)	
	TA7774F/FG		1.4 (Note 3)	
Operating Temperature		T_{opr}	−30~75	°C
Storage Temperature		T_{stg}	−55~150	°C

Note 1: No heat sink

Note 2: This value is obtained if mounting is on a 50 × 50 × 0.8 mm PCB 60% or more of which is occupied by copper.

Note 3: This value is obtained if mounting is on a 60 × 30 × 1.6 mm PCB 50% or more of which is occupied by copper..

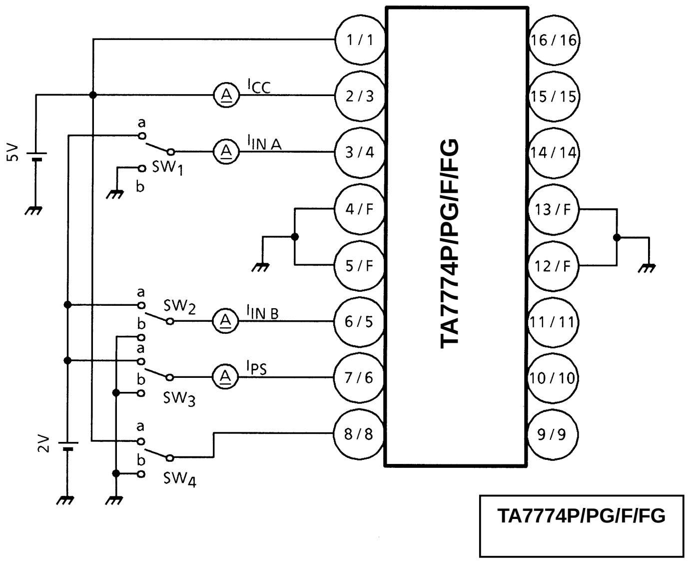
ELECTRICAL CHARACTERISTICS
(Unless otherwise specified, Ta = 25°C, V_{CC} = 5 V, V_{S1} = 12 V, V_{S2A} = 5 V)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Supply Current	I_{CC1}	1	PS: H, V_{S2}: H		—	9	14	mA
	I_{CC2}		PS: L, V_{S2}: H		—	8.5	13	
	I_{CC3}		V_{S2}: L		70	90	115	μA
Input Voltage	$V_{IN\ H}$	—	T_j = 25°C V_{S2}: H	Pin (3), (6)	2.0	—	V_{CC}	V
	$V_{IN\ L}$				GND	—	0.8	
	$V_{PS\ H}$			Pin (7)	2.0	—	V_{CC}	
	$V_{PS\ L}$				GND	—	0.8	
	$V_{S2\ BH}$		T_j = 25°C	Pin (8)	3.5	—	V_{CC}	
	$V_{S2\ BL}$				GND	—	0.4	
Input Current	I_{IN}	1	T_j = 25°C, V_{S2}: H V_{IN} / PS (2 V): sink current	Pin (3), (6)	—	2.6	30	μA
	I_{PS}			Pin (7)	—	2.6	30	
Output Saturation Voltage	$V_{SAT\ 1H1}$	2	PS: L, V_{S2}: H	I_{OUT} = 100 mA	—	0.9	—	V
	$V_{SAT\ 1H2}$			I_{OUT} = 400 mA	—	1.2	1.5	
	$V_{SAT\ 2H1}$	3	PS: H, V_{S2}: H	I_{OUT} = 20 mA	—	1.6	—	
	$V_{SAT\ 2H2}$			I_{OUT} = 100 mA	—	1.8	2.1	
	$V_{SAT\ L1}$		V_{S2}: H	I_{OUT} = 20 mA	—	0.03	—	
	$V_{SAT\ L2}$	2		I_{OUT} = 100 mA	—	0.15	—	
	$V_{SAT\ L3}$			I_{OUT} = 400 mA	—	0.35	0.6	
Diode Forward Voltage	$V_{F\ U}$	4	I_F = 350 mA		—	1.5	—	V
	$V_{F\ L}$				—	1.0	—	
Delay Time	t_{pLH}	—	IN − φ		—	7	—	μs
	t_{pHL}				—	2	—	
Operating Voltage	$V_{CC\ (opr.)}$	—	V_{CC} = ST		4.5	5.0	5.5	V

Recommended Operating Voltage $V_{S1\ (opr.)}$ 12 V ± 10%
$V_{S2A\ (opr.)}$ 5 V ± 10%

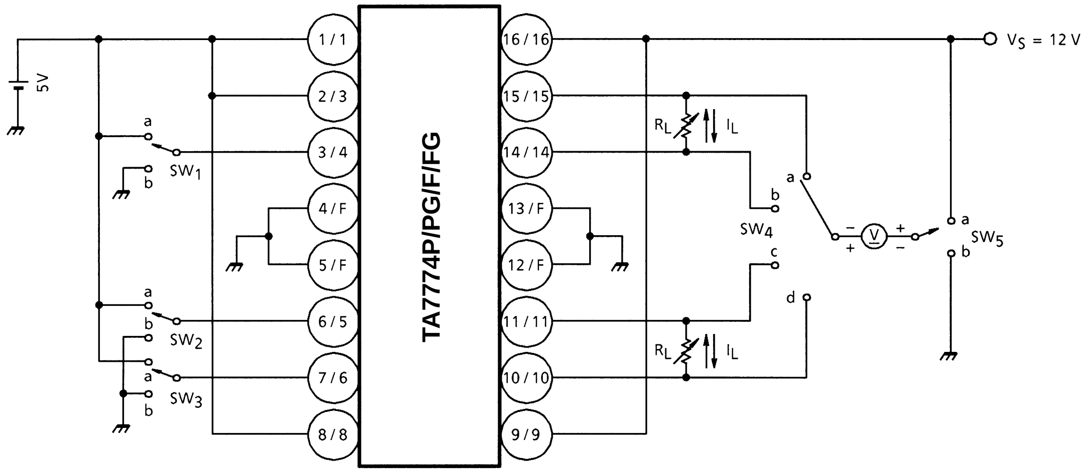
Operating Voltage Restriction $V_{S1} \geq V_{S2A}$

TEST CIRCUIT 1 I_{CC1}, I_{CC2}, I_{CC3}, $I_{IN\ A}$, $I_{IN\ B}$, I_{PS}



ITEM	SW_1	SW_2	SW_3	SW_4
I_{CC1}	b	b	a	a
I_{CC2}	b	b	b	a
I_{CC3}	b	b	—	b
$I_{IN\ A}$	a	—	—	a
$I_{IN\ B}$	—	a	—	a
I_{PS}	—	—	a	a

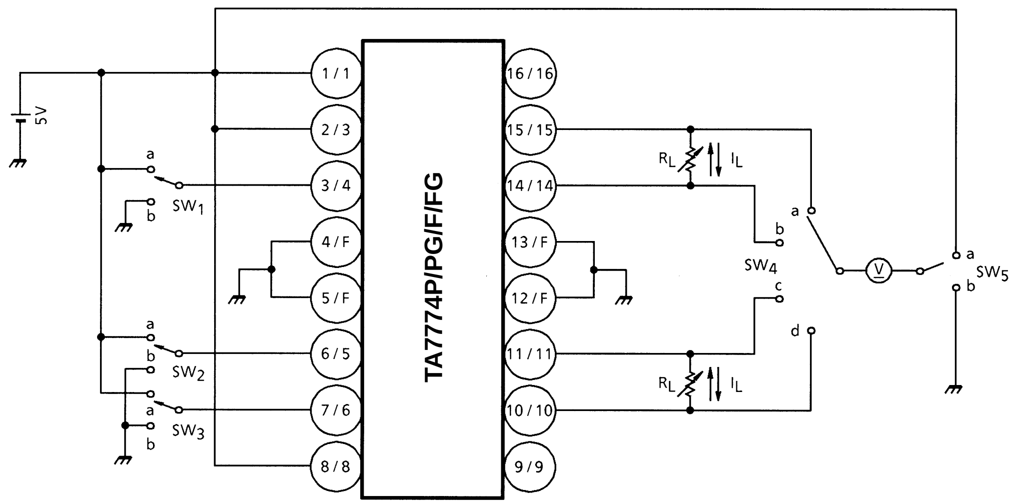
TEST CIRCUIT 2 $V_{SAT\ 1H1}$, $V_{SAT\ 1H2}$, $V_{SAT\ L2}$, $V_{SAT\ L3}$



Note: Calibrate I_L to 0.4 / 0.1 A by R_L.

ITEM	SW_1	SW_2	SW_3	SW_4	SW_5	I_L (mA)
$V_{SAT\ 1H1}$	a	—	b	a	a	100
	b	—		b		
	—	a		d		
	—	b		c		
$V_{SAT\ 1H2}$	a	—	b	a	a	400
	b	—		b		
	—	a		d		
	—	b		c		
$V_{SAT\ L2}$	a	—	—	b	b	100
	b	—		a		
	—	a		c		
	—	b		d		
$V_{SAT\ L3}$	a	—	b	b	b	400
	b	—		a		
	—	a		c		
	—	b		d		

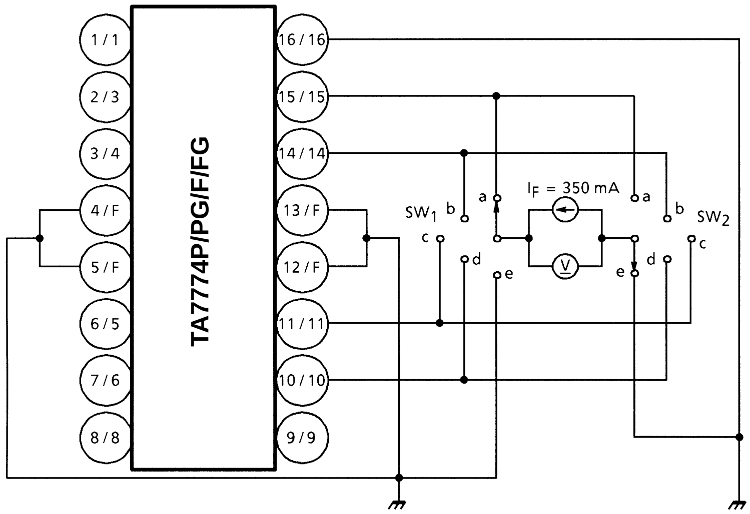
TEST CIRCUIT 3 $V_{SAT\ 2H1}$, $V_{SAT\ 2H2}$, $V_{SAT\ L1}$



Note: Calibrate I_L to 20 / 100 mA by R_L.

ITEM	SW_1	SW_2	SW_3	SW_4	SW_5	I_L (mA)
$V_{SAT\ 2H1}$	a	—	a	a	a	20
	b	—		b		
	—	a		c		
	—	b		d		
$V_{SAT\ 2H2}$	a	—	a	a	a	100
	b	—		b		
	—	a		c		
	—	b		d		
$V_{SAT\ L1}$	a	—	a	b	b	20
	b	—		a		
	—	a		c		
	—	b		d		

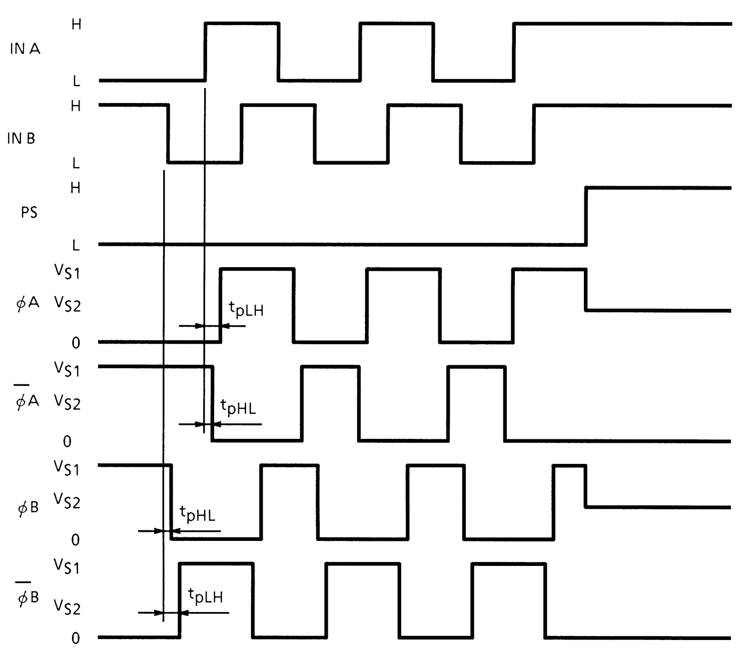
TEST CIRCUIT 4 $V_{F\,U}$, $V_{F\,L}$



MEASURING METHOD

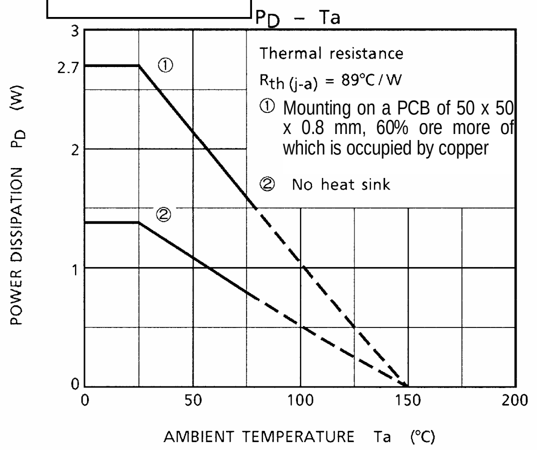
ITEM	SW_1	SW_2
$V_{F\,U}$	a	e
	b	
	c	
	d	
$V_{F\,L}$	e	a
		b
		c
		d

TIMING CHART (2-phase excitation)

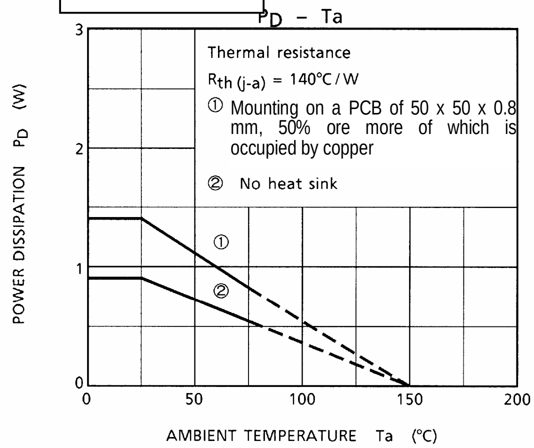


t_{pLH} : 7 μs (Typ.)
t_{pLH} : 2 μs (Typ.)

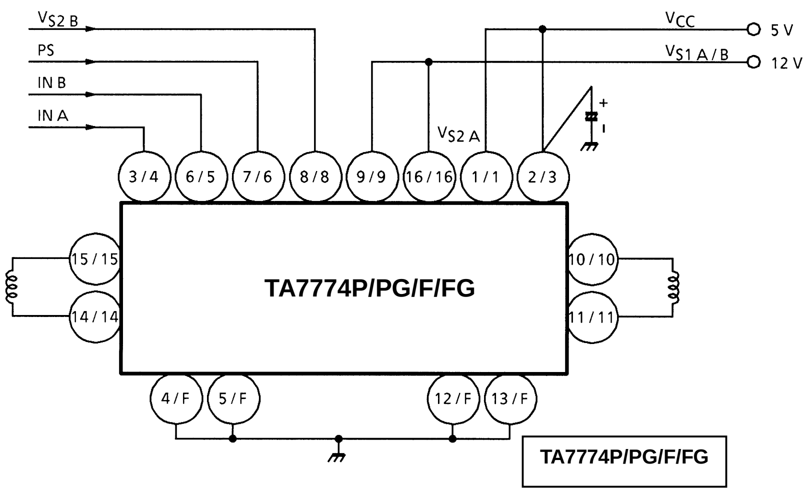
TA7774P/PG



TA7774F/FG



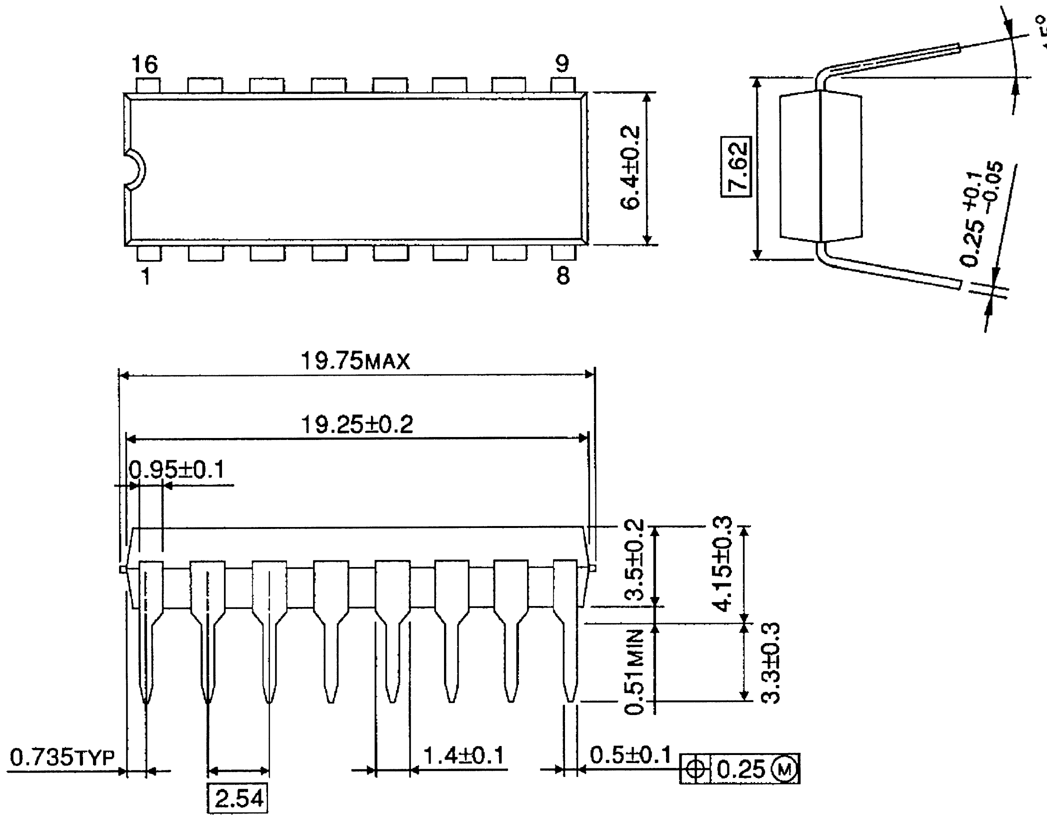
APPLICATION CIRCUIT



Note: Utmost care is necessary in the design of the output, 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.

PACKAGE DIMENSIONS

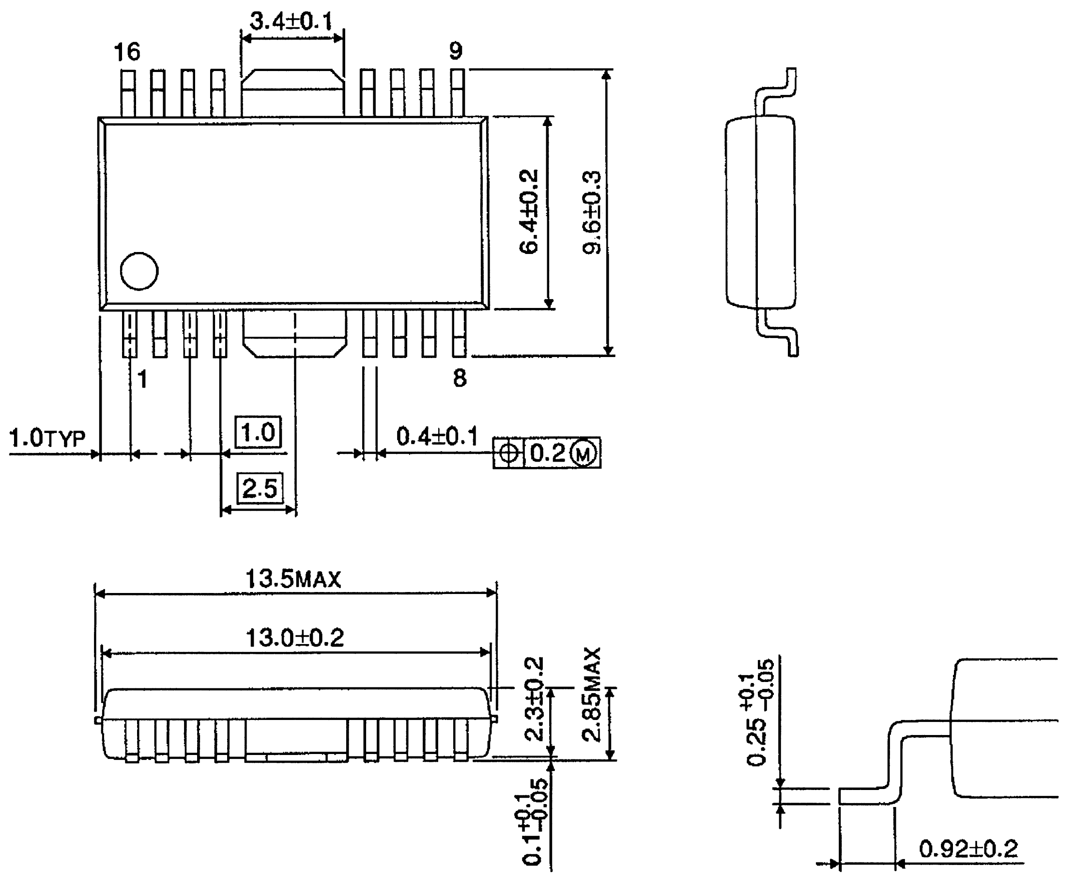
DIP16−P−300−2.54A Unit: mm



Weight: 1.11 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. Maximum Ratings
The absolute maximum ratings of a semiconductor device are a set of specified parameter values that must not be exceeded during operation, even for an instant.

If any of these ratings are exceeded during operation, the electrical characteristics of the device may be irreparably altered, in which case the reliability and lifetime of the device can no longer be guaranteed.

Moreover, any exceeding of the ratings during operation may cause breakdown, damage and/or degradation in other equipment. Applications using the device should be designed so that no maximum rating will ever be exceeded under any operating conditions.

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

5. Application Circuits
The application circuits shown in this document are provided for reference purposes only. Thorough evaluation is required in the mass production design phase.

In furnishing these examples of application circuits, Toshiba does not grant the use of any industrial property rights.

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

Handling of the IC
Ensure that the product is installed correctly to prevent breakdown, damage and/or degradation in the product or equipment.

Over-current protection and heat protection circuits
These protection functions are intended only as a temporary means of preventing output short circuits or other abnormal conditions and are not guaranteed to prevent damage to the IC.

If the guaranteed operating ranges of this product are exceeded, these protection features may not operate and some output short circuits may result in the IC being damaged.

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

Short circuits persisting over long periods may cause excessive stress and damage the IC. Systems should be configured so that any over-current condition will be eliminated as soon as possible.

Counter-electromotive force
When the motor reverses or stops, the effect of counter-electromotive force may cause the current to flow to the power source.

If the power supply is not equipped with sink capability, the power and output pins may exceed the maximum rating.

The counter-electromotive force of the motor will vary depending on the conditions of use and the features of the motor. Therefore make sure there will be no damage to or operational problem in the IC, and no damage to or operational errors in peripheral circuits caused by counter-electromotive force.

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