

TOSHIBA BIPOLAR DIGITAL IC SILICON MONOLITHIC

# TD62930P, TD62930F

## THREE-CHANNEL SMALL-SIGNAL IGBT GATE DRIVER

The TD62930P and TD62930F are drivers using 5 V-signal input to output the signals required to drive IGBT gates.

TD62930P / F is the most suitable for low-side drive of a miniature IGBT to use for inverter for the household electric appliances mainly.

The outputs are separated into high-side and low-side outputs.

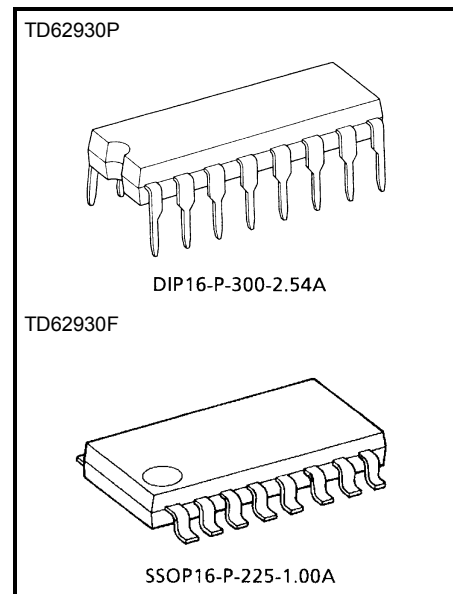
This separation simplifies the IGBT gate on / off timing control.

Two output signals are assigned for one input signal.

The high-side output is high-level for high-level input, and high impedance for low-level input. The low-side output is high impedance for high-level input, and low-level for low-level input.

### FEATURES

- Power supply voltage (absolute maximum rating)  
High-voltage block power supply voltage  $V_{CC} = 30\text{ V}$   
Low-voltage block power supply voltage  $V_{DD} = 7\text{ V}$
- Output current (absolute maximum rating)  
High-side peak current  $I_{OUT} = -0.4\text{ A (max)}$   
Low-side peak current  $I_{OUT} = 0.4\text{ A (max)}$
- Input-output response speed  $t_{pHL}, t_{pLH} \leq 1\text{ }\mu\text{s (max)}$
- Package : DIP16 / SSOP16 (1.00 mm pitch)

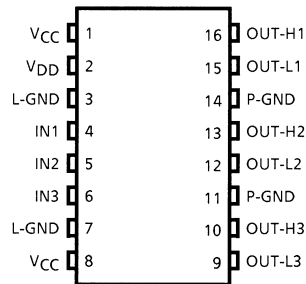


Weight

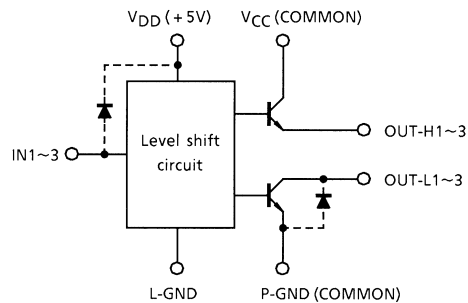
DIP16-P-300-2.54A: 1.11 g (typ.)

SSOP16-P-225-1.00A: 0.14 g (typ.)

**PIN ASSIGNMENT (TOP VIEW)**



**INTERNAL EQUIVALENT CIRCUIT**



**PIN DESCRIPTION**

PIN No.	PIN NAME	FUNCTION
1, 8	V <sub>CC</sub>	30 V supply pins
2	V <sub>DD</sub>	5 V supply pin
3, 7	L-GND	Ground pins for 5 V supply
4, 5, 6	IN1~3	Input pins for 5 V output control signals
11, 14	P-GND	Ground pins for 30 V supply
9, 12, 15	OUT-L1~3	Low-side output pins
10, 13, 16	OUT-H1~3	High-side output pins

## ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	PIN / PACKAGE	SYMBOL	RATING	UNIT
Power Supply Voltage	V <sub>CC</sub>	V <sub>CC</sub>	30	V
Power Supply Voltage	V <sub>DD</sub>	V <sub>DD</sub>	7	V
Input Voltage	IN1~3	V <sub>IN</sub>	-0.5~V <sub>DD</sub> + 0.5	V
Output Voltage	OUT-H1~3	V <sub>OUT</sub> (H)	0~20 (Ta = -20~85°C)	V
			0~30 (Ta = -20~70°C)	
	OUT-L1~3	V <sub>OUT</sub> (L)	-0.5~20 (Ta = -20~85°C)	V
			-0.5~30 (Ta = -20~70°C)	
High-level Output Peak Current	OUT-H1~3	IOPH (Note 1)	-0.4	A / ch
Low-level Output Peak Current	OUT-L1~3	IOPL (Note 1)	+0.4	A / ch
Operating Frequency	IN1~3	f	25	kHz
Power Dissipation	DIP16	P <sub>D1</sub> (Note 2)	1.47 (FREE AIR)	W
	SSOP16	P <sub>D2</sub> (Note 2)	0.78 (ON PCB)	W
Operating Ambient Temperature		T <sub>opr</sub>	-20~85	°C
Storage Temperature		T <sub>stg</sub>	-55~150	°C

Note 1: Output pin current

The pulse width of the output pin current at peak is ≤ 1 μs, 300 pps.

Note 2: When ambient temperature exceeds 25°C

Derate the power dissipation of DIP-type devices at 11.76 mW / 1°C (device only) and

Derate the power dissipation of SMD-type devices at 6.24 mW / 1°C (mounted on the board).

## RECOMMENDED OPERATING CONDITIONS (Unless otherwise specified, Ta = -20 to 70°C)

CHARACTERISTIC		PIN	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Voltage	High level	IN1~3	V <sub>IH</sub>	V <sub>CC</sub> = 15 V, V <sub>DD</sub> = 4.5~5.5 V	3.5	—	—	V
	Low level		V <sub>IL</sub>		—	—	1.0	
Input Current	High level	IN1~3	I <sub>IH</sub>	V <sub>CC</sub> = 15 V, V <sub>DD</sub> = 4.5~5.5 V	—	—	5	mA
	Low level		I <sub>IL</sub>		—	—	-5	
Input Power Supply Voltage		V <sub>CC</sub>	V <sub>CC</sub>		10	15	25	V
		V <sub>DD</sub>	V <sub>DD</sub>		4.5	5.0	5.5	
Output Current		OUT-H1~3	IOH (DC)	V <sub>CC</sub> = 20 V, V <sub>DD</sub> = 4.5 V	—	—	-0.1	A
			IOH (Peak)		—	—	-0.35	
		OUT-L1~3	IOL (DC)	V <sub>CC</sub> = 20 V, V <sub>DD</sub> = 4.5 V	—	—	0.1	
			IOL (Peak)		—	—	0.35	
Operating Temperature			T <sub>opr</sub>	V <sub>CC</sub> = 30 V, V <sub>DD</sub> = 5.5 V	-20	25	70	°C
				V <sub>CC</sub> = 20 V, V <sub>DD</sub> = 5.5 V	-20	25	85	

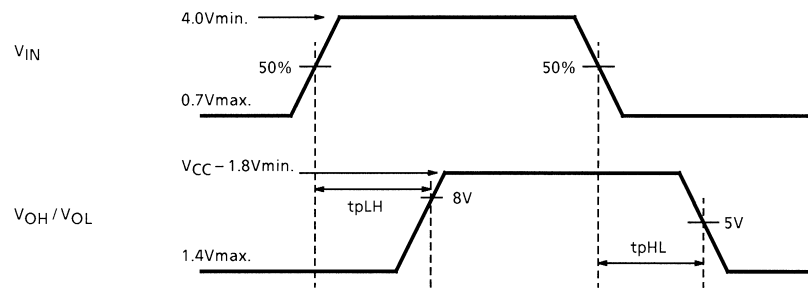
**ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta = -20 to 70°C)**

CHARACTERISTIC		PIN	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Current	High level	IN1~3	I <sub>IH</sub>	V <sub>CC</sub> = 15 V, V <sub>IN</sub> = 5 V	0.1	0.2	0.4	mA
	Low level		I <sub>IL</sub>	V <sub>CC</sub> = 15 V, V <sub>IN</sub> = 0 V	—	0	—	
Output Voltage	High level	OUT-H1~3	V <sub>OH</sub>	V <sub>CC</sub> = 15 V, V <sub>IH</sub> = 5 V, R <sub>LH</sub> = 100 Ω	V <sub>CC</sub> - 4.0	V <sub>CC</sub> - 1.9	V <sub>CC</sub> - 1.0	V
	Low level	OUT-L1~3	V <sub>OL</sub>	V <sub>CC</sub> = 15 V, V <sub>IL</sub> = 0 V, R <sub>LL</sub> = 100 Ω	0.3	0.5	2.5	
Dissipation Current 1		V <sub>DD</sub>	I <sub>DDL</sub>	V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 0 V, Ta = 25°C	—	1.5	3.0	mA
				V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 0 V, Ta = -20~85°C	—	—	3.5	
			I <sub>DDH</sub>	V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 5 V, Ta = 25°C	—	1.8	3.5	
				V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 5 V, Ta = -20~85°C	—	—	4.0	
Dissipation Current 2		V <sub>CC</sub>	I <sub>CCCL</sub>	V <sub>CC</sub> = 30 V, V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 0 V, Ta = 25°C	—	10.2	15.0	mA
				V <sub>CC</sub> = 30 V, V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 0 V	—	—	18.0	
			I <sub>CCCH</sub>	V <sub>CC</sub> = 30 V, V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 5 V, Ta = 25°C	—	7.5	11.0	
				V <sub>CC</sub> = 30 V, V <sub>DD</sub> = 5.5 V, V <sub>IH</sub> = 5 V	—	—	14.0	
Operating Power Supply Voltage		V <sub>CC</sub>	V <sub>CCopr</sub>		10	—	30	V

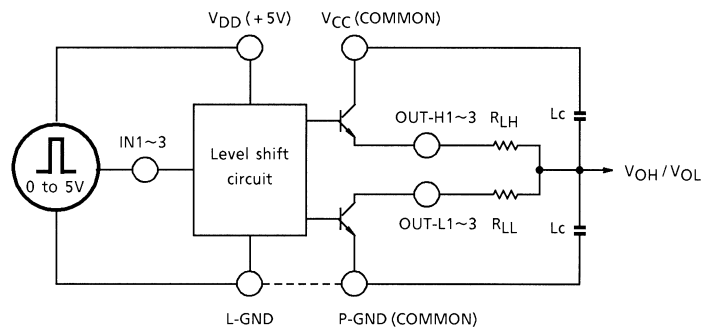
**SWITCHING CHARACTERISTICS (Unless otherwise specified, Ta = -20~70°C)**

CHARACTERISTIC		PIN	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Output Propagation Delay Time	High level	OUT-H1~3	t <sub>PLH</sub>	V <sub>DD</sub> = 5.0 V, V <sub>CC</sub> = 15 V, R <sub>LH</sub> = R <sub>LL</sub> = 100 Ω, V <sub>IN</sub> = 0.7 to 4 V	—	0.25	1.00	μs
	Low level	OUT-L1~3	t <sub>PHL</sub>	V <sub>DD</sub> = 5.0 V, V <sub>CC</sub> = 15 V, R <sub>LH</sub> = R <sub>LL</sub> = 100 Ω, V <sub>IN</sub> = 4 to 0.7 V	—	0.25	1.00	

**SWITCHING WAVEFORM**



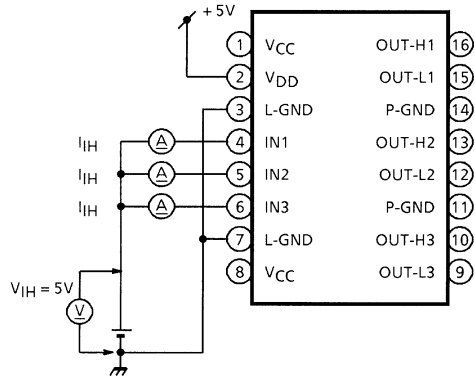
**PROPAGATION DELAY TIME TEST CIRCUIT**



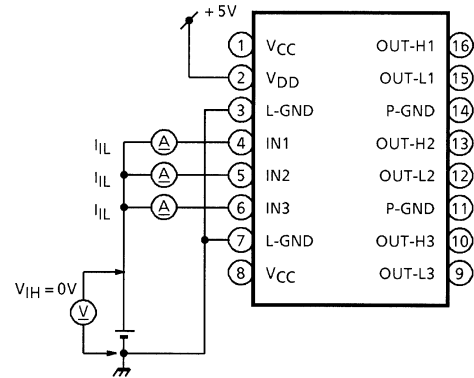
Toshiba recommends connecting load resistors as in the above diagram, utilizing the independence of the high-level and low-level sides of this IC.

**TEST CIRCUIT**

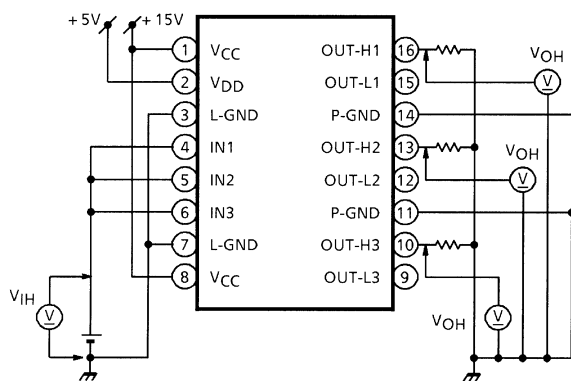
**(1)  $I_{IH}$**



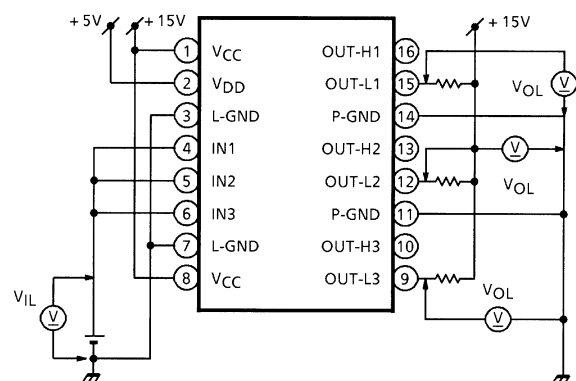
**(2)  $I_{IL}$**



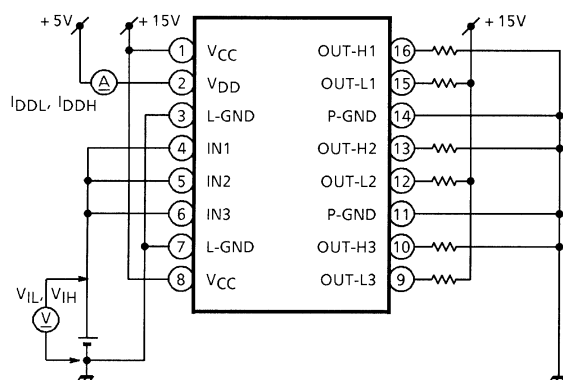
**(3)  $V_{IH}, V_{OH}$**



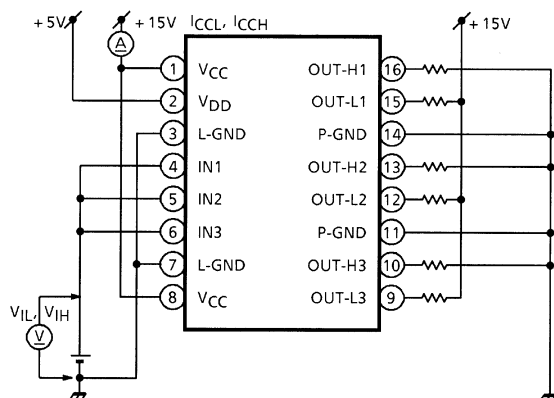
**(4)  $V_{IL}, V_{OL}$**



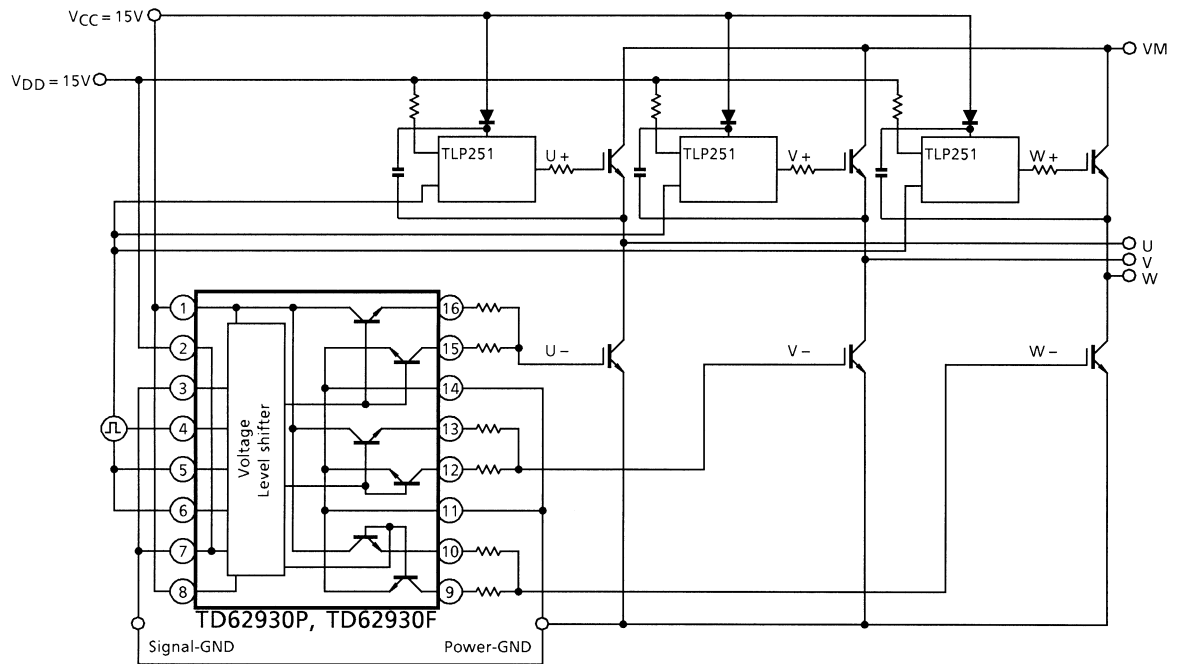
**(5)  $I_{DDL}, I_{DDH}$**



**(6)  $I_{CCL}, I_{CCH}$**



**APPLICATION CIRCUIT**



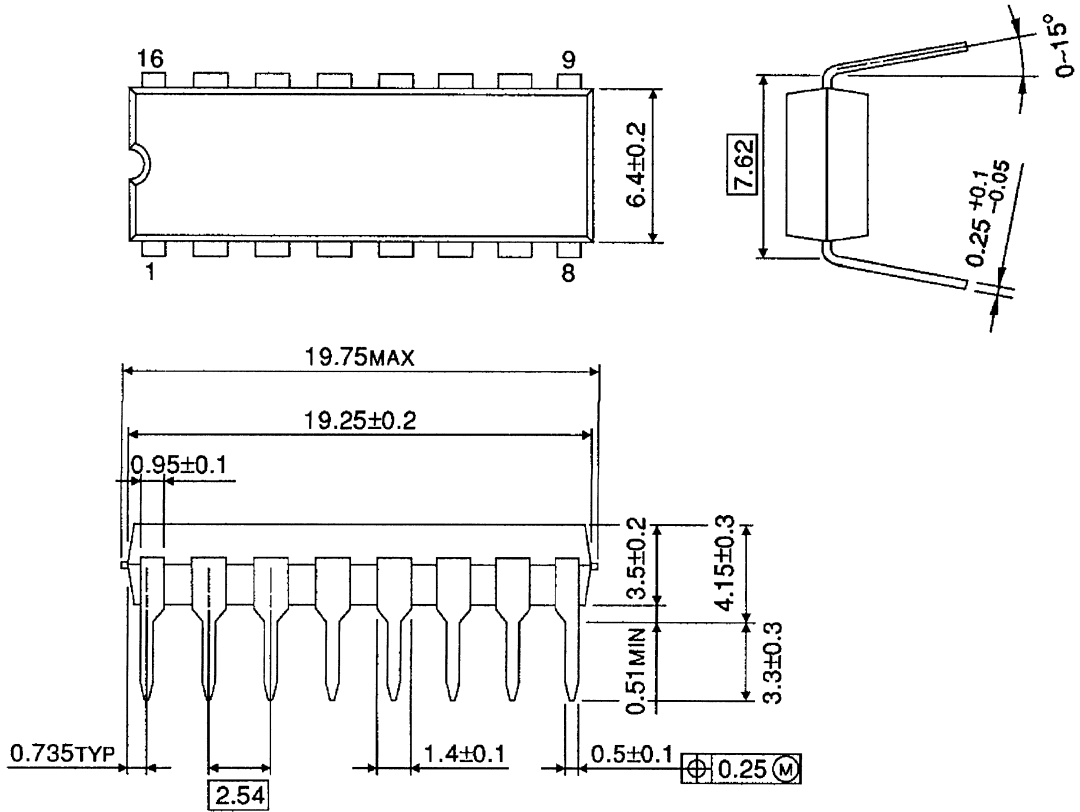
**PRECAUTIONS for USING**

This IC does not integrate protection circuits such as overcurrent and overvoltage protectors. Thus, if excess current or voltage is applied to the IC, the IC may be damaged. Please design the IC so that excess current or voltage will not be applied to the IC. Utmost care is necessary in the design of the output line, VCC and GND (L-GND, P-GND) line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

## PACKAGE DIMENSIONS

DIP16-P-300-2.54A

Unit: mm



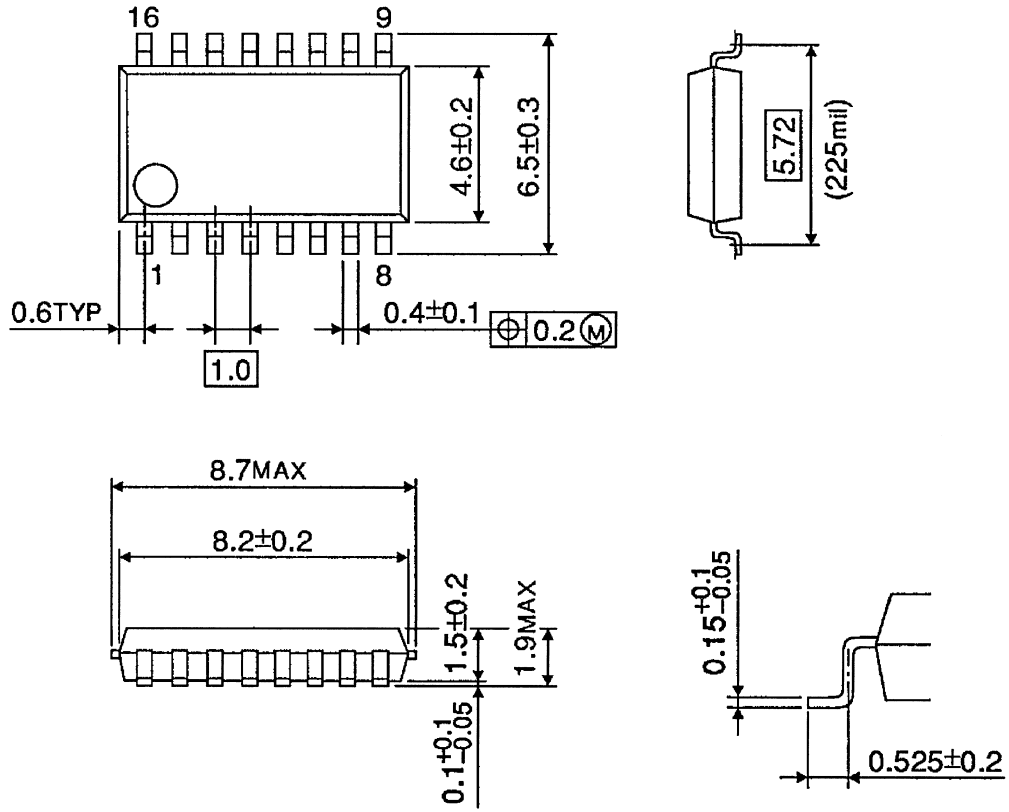
Weight: 1.11 g (typ.)



**PACKAGE DIMENSIONS**

SSOP16-P-225-1.00A

Unit: mm



Weight: 0.14 g (typ.)

## Notes on Contents

### 1. Equivalent Circuits

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

### 2. 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.

### 3. 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 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.
- (5) Carefully select external components (such as inputs and negative feedback capacitors) and load components (such as speakers), for example, power amp and regulator.  
If there is a large amount of leakage current such as input or negative feedback condenser, the IC output DC voltage will increase. If this output voltage is connected to a speaker with low input withstand voltage, overcurrent or IC failure can cause smoke or ignition. (The over current can cause smoke or ignition from the IC itself.) In particular, please pay attention when using a Bridge Tied Load (BTL) connection type IC that inputs output DC voltage to a speaker directly.

**Points to Remember on Handling of ICs**

## (1) 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 consideration the effect of IC heat radiation with peripheral components.

## (2) Back-EMF

When a motor rotates in the reverse direction, stops or slows down abruptly, a current flows 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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