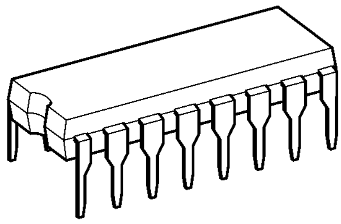
TOSHIBA BiCD Integrated Circuit Silicon Monolithic

TBD62304APG, TBD62304AFNG, TBD62304AFWG

7-ch low active sink type DMOS transistor array

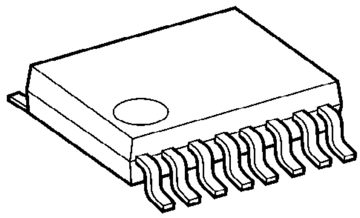
TBD62304A series are DMOS transistor arrays with 7 circuits. Please be careful about thermal conditions during use.

TBD62304APG



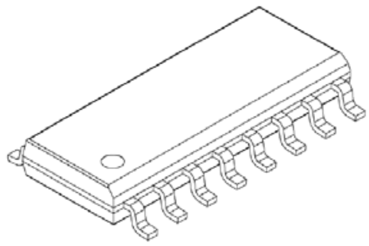
DIP16-P-300-2.54A

TBD62304AFNG



SSOP16-P-225-0.65B

TBD62304AFWG



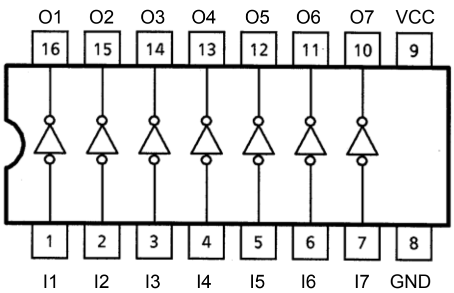
P-SOP16-0410-1.27-002

Weight
DIP16-P-300-2.54A :1.13 g (typ.)
SSOP16-P-225-0.65B :0.07 g (typ.)
P-SOP16-0410-1.27-002 :0.15 g (typ.)

Features

- Built-in 7 circuits
- High voltage : V_{OUT} = 50 V (max)
- High current : I_{OUT} = 500 mA/ch (max)
- Input voltage (output on) : -20 V to V_{CC}-3.5 V
- Input voltage (output off) : V_{CC}-0.4 V to V_{CC}
- Package : PG type DIP16-P-300-2.54A
  FNG type SSOP16-P-225-0.65B
  FWG type P-SOP16-0410-1.27-002

Pin Assignment (top view)

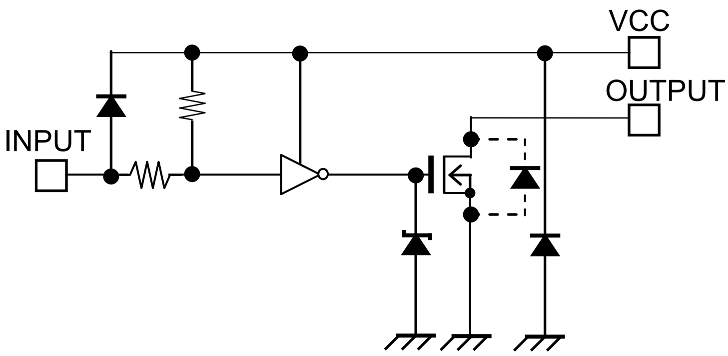


Pin connection may be omitted partially or simplified for explanatory purpose.

Pin Descriptions

Pin No.	Pin name	Function
1	I1	Input pin
2	I2	Input pin
3	I3	Input pin
4	I4	Input pin
5	I5	Input pin
6	I6	Input pin
7	I7	Input pin
8	GND	Ground pin
9	VCC	Power supply pin
10	O7	Output pin
11	O6	Output pin
12	O5	Output pin
13	O4	Output pin
14	O3	Output pin
15	O2	Output pin
16	O1	Output pin

Basic Circuit



Basic circuit may be omitted partially or simplified for explanatory purpose.

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Power supply voltage		V_{CC}	−0.5 to 6.0	V
Output voltage		V_{OUT}	50	V
Output current (per ch)		I_{OUT}	500	mA
Input voltage		V_{IN}	−22 to V_{CC}+0.5 (Note4)	V
Power dissipation	PG (Note1)	P_D	1.47	W
	FNG (Note2)		0.78	
	FWG (Note3)		1.25	
Operating temperature		T_{opr}	−40 to 85	°C
Storage temperature		T_{stg}	−55 to 150	°C

Note1: Standalone. When Ta exceeds 25 °C, it is necessary to do the derating with 11.8 mW/°C.
Note2: On PCB (size: 50 mm × 50 mm × 1.6 mm, Cu area: 40 %, single-side glass epoxy). When Ta exceeds 25 °C, it is necessary to do the derating with 6.24 mW/°C.
Note3: On PCB (compliant with JEDEC 2s2p). When Ta exceeds 25 °C, it is necessary to do the derating with 10 mW/°C.
Note4: Do not exceed 6 V

Operating Ranges (Ta = −40 to 85°C, unless otherwise specified.)

Characteristics		Symbol	Test conditions		Min	Typ.	Max	Unit
Power supply voltage		V_{CC}	—		4.5	5.0	5.5	V
Output voltage		V_{OUT}	—		—	—	50	V
Output current (per ch)	PG (Note1)	I_{OUT}	1 circuit ON, Ta = 25 °C		0	—	400	mA
			t_{pw} = 25 ms 7 circuits ON Ta = 85 °C T_j = 120 °C	Duty = 10 %	0	—	400	
				Duty = 50 %	0	—	190	
	FNG (Note2)		1 circuit ON, Ta = 25 °C		0	—	400	
			t_{pw} = 25 ms 7 circuits ON Ta = 85 °C T_j = 120 °C	Duty = 10 %	0	—	300	
				Duty = 50 %	0	—	130	
	FWG (Note3)		1 circuit ON, Ta = 25 °C		0	—	400	
			t_{pw} = 25 ms 7 circuits ON Ta = 85 °C T_j = 120 °C	Duty = 10 %	0	—	390	
				Duty = 50 %	0	—	170	
Input voltage (Output on)		$V_{IN (ON)}$	I_{OUT} = 100 mA or more, V_{OUT} = 2 V		-20	—	V_{CC}-3.5	V
Input voltage (Output off)		$V_{IN (OFF)}$	I_{OUT} = 100 μA or less, V_{OUT} = 2 V		V_{CC}-0.4	—	V_{CC}	V

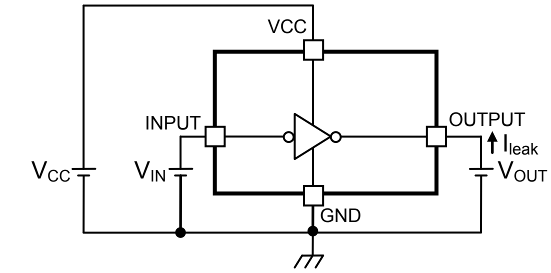
Note1: Stand alone
Note2: On PCB (size: 50 mm × 50 mm × 1.6 mm, Cu area: 40 %, single-side glass epoxy).
Note3: On PCB (compliant with JEDEC 2s2p)

Electrical Characteristics (Ta = 25°C, unless otherwise specified.)

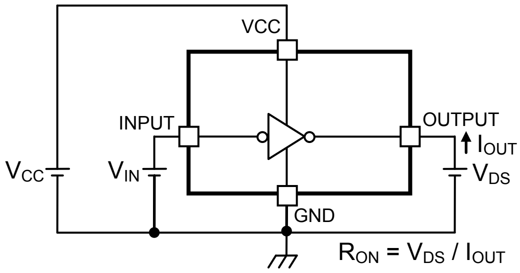
Characteristics	Symbol	Test Circuit	Test conditions	Min	Typ.	Max	Unit
Output leakage current	I_{leak}	1	V_{OUT} = 50 V, Ta = 85 °C V_{IN} = V_{CC} = 5.5 V	—	—	1.0	μA
Output voltage (Output ON-resistance)	V_{DS} (R_{ON})	2	I_{OUT} = 350 mA V_{CC} = 5.0 V, V_{IN} = 0 V	—	0.525 (1.5)	1.14 (3.25)	V (Ω)
			I_{OUT} = 200 mA, V_{CC} = 5.0 V, V_{IN} = 0 V	—	0.3 (1.5)	0.65 (3.25)	
			I_{OUT} = 100 mA V_{CC} = 5.0 V, V_{IN} = 0 V	—	0.15 (1.5)	0.325 (3.25)	
Input current	$I_{IN(ON)}$	3	V_{CC} = 5.5 V, V_{IN} = 0 V	—	-10	-100	μA
			V_{CC} = 5.5 V, V_{IN} = -20 V	—	-100	-200	
	$I_{IN(OFF)}$	4	V_{CC} = V_{IN} = 5.5 V	—	—	1.0	μA
Consumption current (per ch)	$I_{CC(ON)}$	3	V_{CC} = 5.5 V, V_{IN} = 0 V	—	70	200	μA
	$I_{CC(OFF)}$	4	V_{CC} = 5.5 V, V_{IN} = V_{CC}	—	—	1.0	μA
Turn-on delay	t_{ON}	5	V_{CC} = 5.0 V, V_{OUT} = 50 V R_L = 125 Ω C_L = 15 pF	—	0.6	—	μs
Turn-off delay	t_{OFF}			—	0.6	—	

Test Circuit

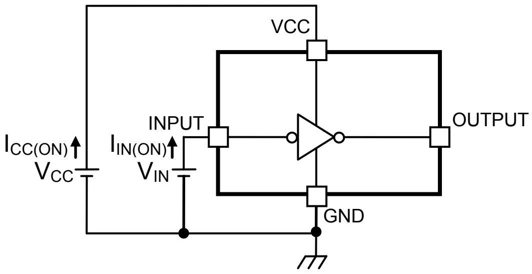
1. I_{leak}



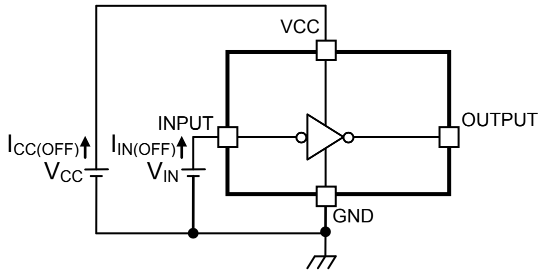
2. V_{DS} (R_{ON})



3. $I_{IN\ (ON)}$, $I_{CC\ (ON)}$

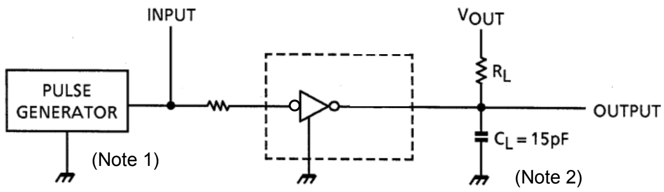


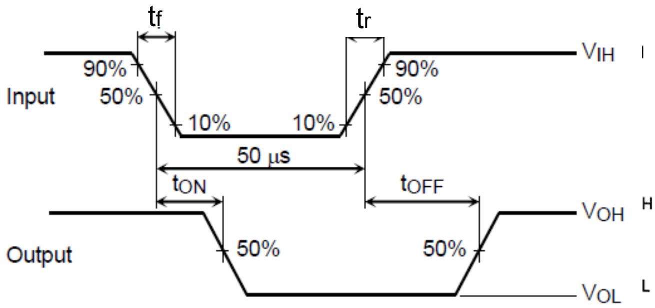
4. $I_{IN\ (OFF)}$, $I_{CC\ (OFF)}$



Test circuits may be omitted partially or simplified for explanatory purpose.

5. t_{ON}, t_{OFF}





Note1: Pulse width 50 μs, Duty cycle 10 %
Output impedance 50 Ω, tr ≤ 5 ns, tf ≤ 10 ns, V_{IH} = 5.0 V

Note2: C_L includes capacitance of the probe and the test board.

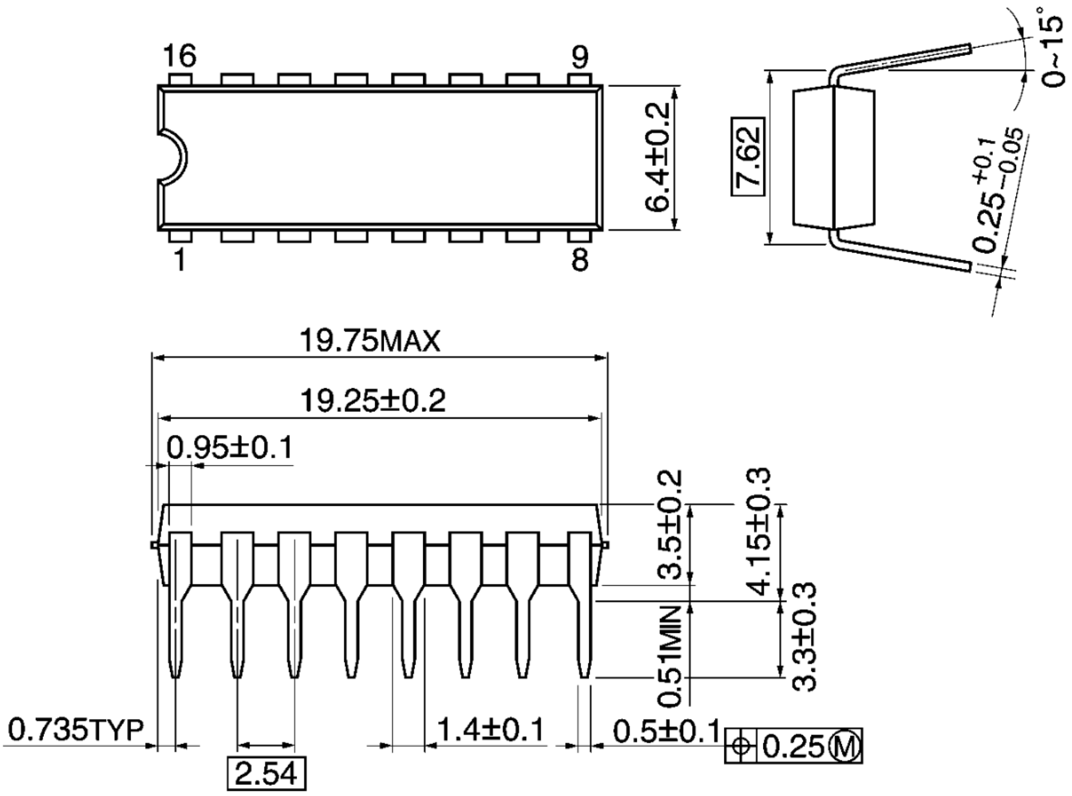
Test circuits and timing charts may be omitted partially or simplified for explanatory purpose.

Precautions for Using

This IC does not incorporate built-in protection circuits for excess current or over voltage.
Therefore, if the short-circuit between adjacent pins or between outputs, the short-to-power or ground fault has occurred, the current or voltage beyond the absolute maximum rating is impressed, and IC may be destroyed. When designing, please consider enough in power supply line, output line, and GND line.
In addition, so as not to continue to flow a current that exceeds the absolute maximum rating of the IC, please insert the appropriate fuse in the power supply line.

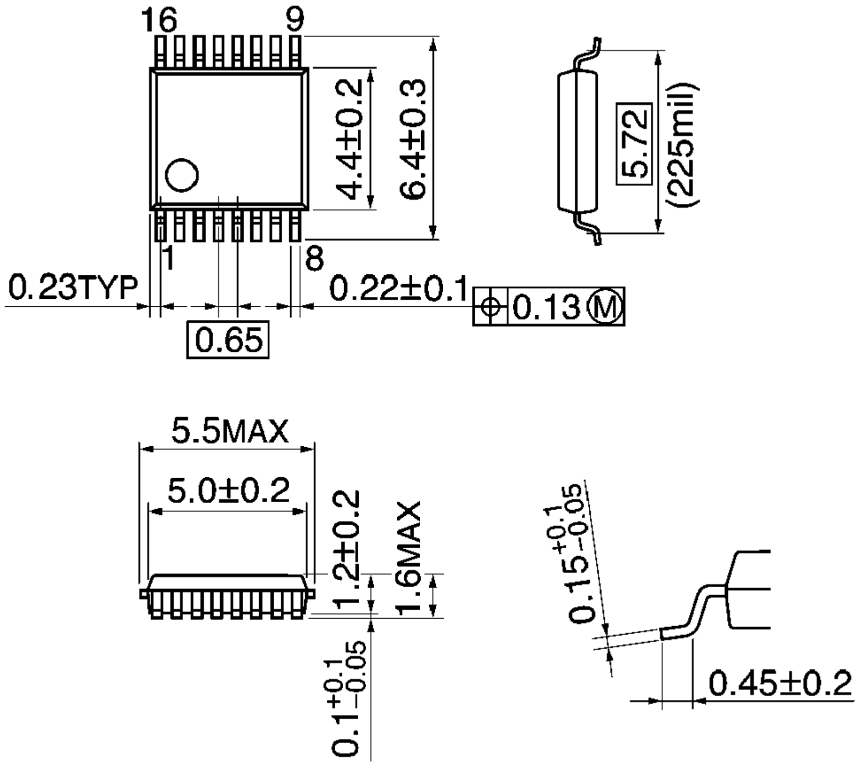
Package Dimensions

DIP16-P-300-2.54A Unit: mm



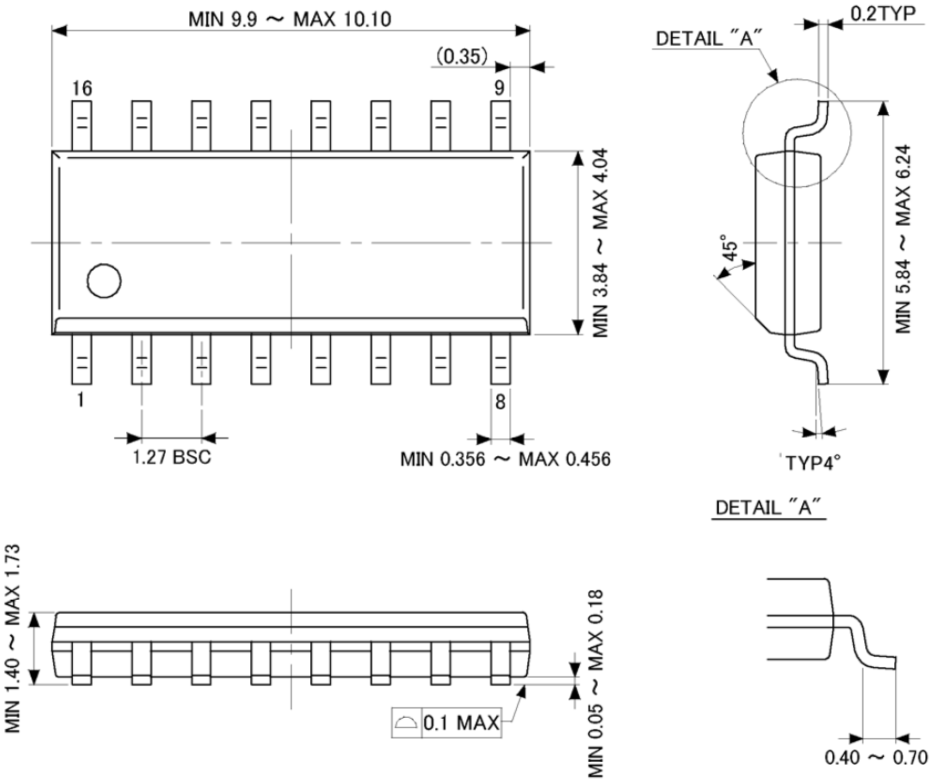
Weight: 1.13 g (typ.)

SSOP16-P-225-0.65B Unit: mm



Weight: 0.07 g (typ.)

P-SOP16-0410-1.27-002 Unit: mm



Weight: 0.15 g (typ.)

Notes on Contents

1. **Pin Connection**
   Pin connection may be simplified for explanatory purpose.
2. **Equivalent Circuit**
   Equivalent circuit may be simplified for explanatory purpose.
3. **Test Circuit**
   Test circuit may be simplified for explanatory purpose.
4. **Timing Chart**
   Timing charts may be simplified for explanatory purposes.

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 device breakdown, damage or deterioration, and may result in injury by explosion or combustion.

(2) 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 device breakdown, damage or deterioration, and may result in injury by explosion or combustion. In addition, do not use any device inserted in the wrong orientation or incorrectly to which current is applied even just once.

(3) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in the case of overcurrent 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 to smoke or ignition. To minimize the effects of the flow of a large current in the case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

(4) 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.

(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 from 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 may cause smoke or ignition. (The overcurrent may 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

Heat Radiation Design

When using an IC with large current flow such as power amp, regulator or driver, design the device so that heat is appropriately radiated, in order not to exceed the specified junction temperature (Tj) at any time or under any 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, when designing the device, take into consideration the effect of IC heat radiation with peripheral components.

Back-EMF

When a motor rotates in the reverse direction, stops or slows abruptly, current flows back to the motor’s power supply owing 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 the absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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