TBD62308A series

Usage considerations

Function of transistor array

There are various kinds of transistor arrays depending on their functions.

Input active level

There are two types. The TBD62308A series are low active type.

Type	Description	TBD62308A
High active	Output is ON by inputting ”H” level to input pin.	–
Low active	Output is ON by inputting ”L” level to input pin.	Available

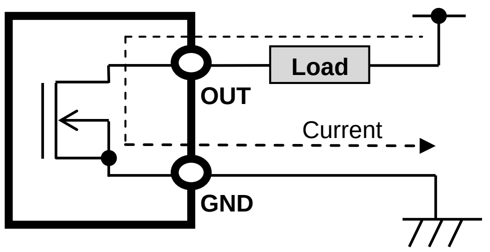
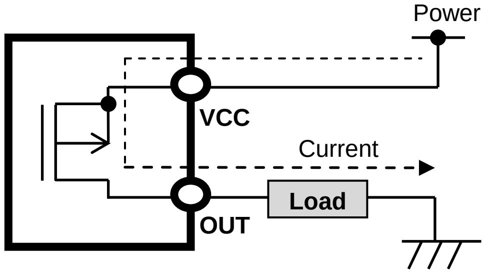
Output clamp diode

There are two types. The TBD62308A series are built-in type.

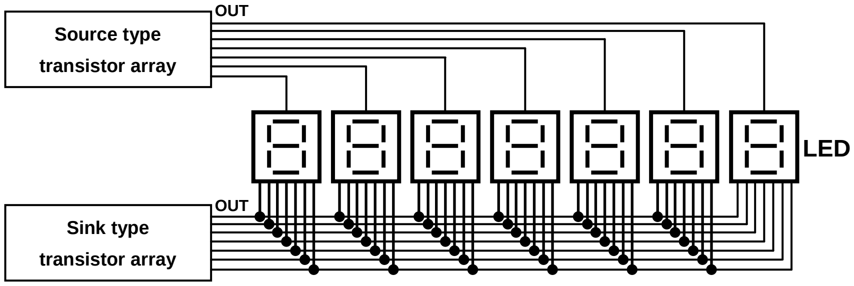
Type	Description	TBD62308A
Built-in	Best for the drive of the motor, the relay, and the solenoid. (Capable of driving the LED and the level shift circuit.)	Available
Non Built-in	Best for the drive of the LED and the level shift circuit. (Incapable of driving the motor, the relay and the solenoid.)	–

Output current system

There are two types. The TBD62308A series are sink type. Connecting point of each load is different.

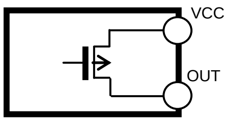
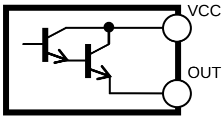
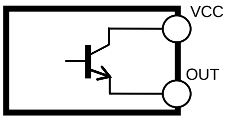
Type	Description	TBD62308A
Sink type	Output of current sink type (output pull)  	Available
Source type	Output of current source type (output push)  	–

Application example
Dynamic drive control is possible by combining transistor arrays of the sink type and the source type.



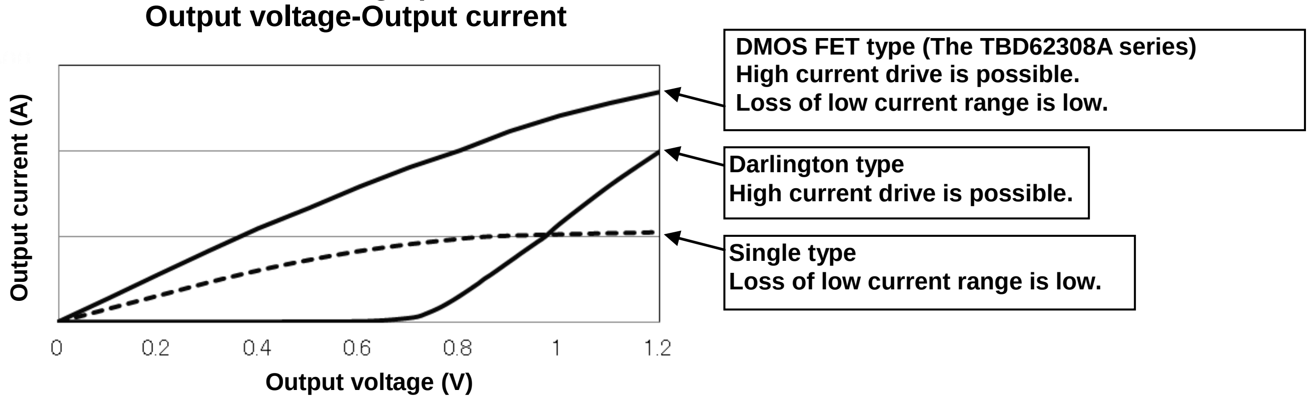
Construction of output circuit

There are three types. The TBD62308A series are DMOS FET type.

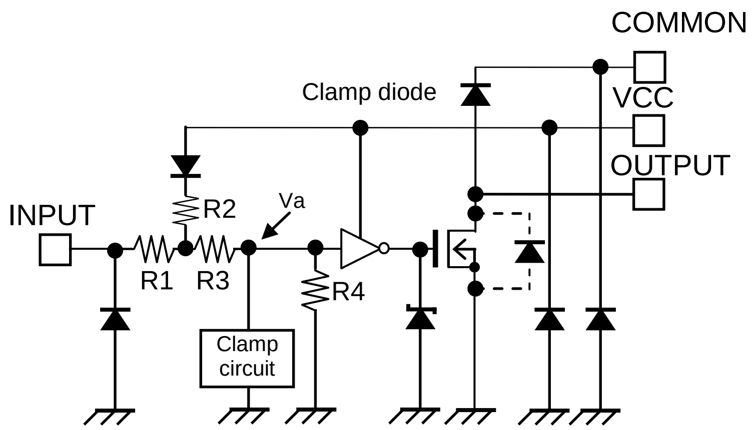
Type	Description	TBD62308A
DMOS FET type	 **Features** **High current drive is possible.** **Loss of low current range is low.**	Available
Bipolar transistor Darlington type	 **Features** **High current drive is possible.**	–
Bipolar transistor Single type	 **Features** **Loss of low current range is low.**	–

Reference: Characteristics graph

Reference graph of
Output voltage-Output current



Basic circuit



* Constant number of internal resistance: R1=0.5kΩ(typ.), R2=40kΩ(typ.), R3=40kΩ(typ.), and R4=560kΩ (typ.)
* The accuracy of the internal resistance are ± 30% (reference value).
* The clamp circuit controls the upper limit of Va. The upper limit of the Va is about 4V.

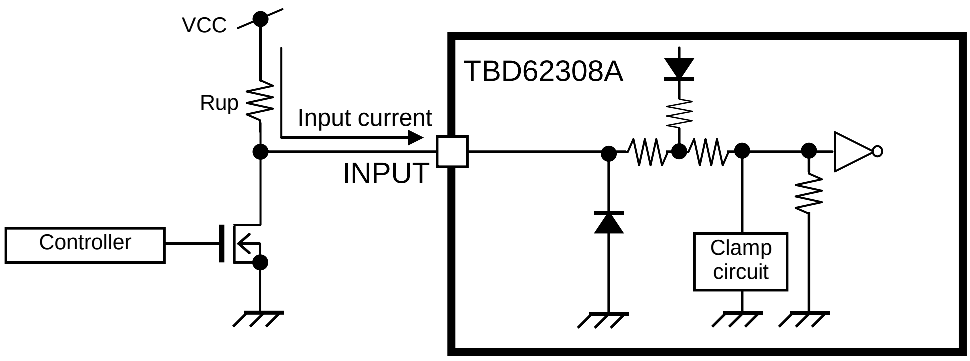
Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purposes.

Control of output ON/OFF

Outputs of the TBD62308A series are constructed by DMOS FET. ON/OFF of output is controlled according to the level of applied voltage to the input pin.

Product	VIN(ON)	VIN(OFF)
TBD62308A series	0V to VCC-3.5	VCC-0.4 to 25V

In case the voltage is inputted through the pull up resistance externally, confirm that it meets the condition of VIN (OFF) on consideration of the voltage fall in the external resistance (Rup).



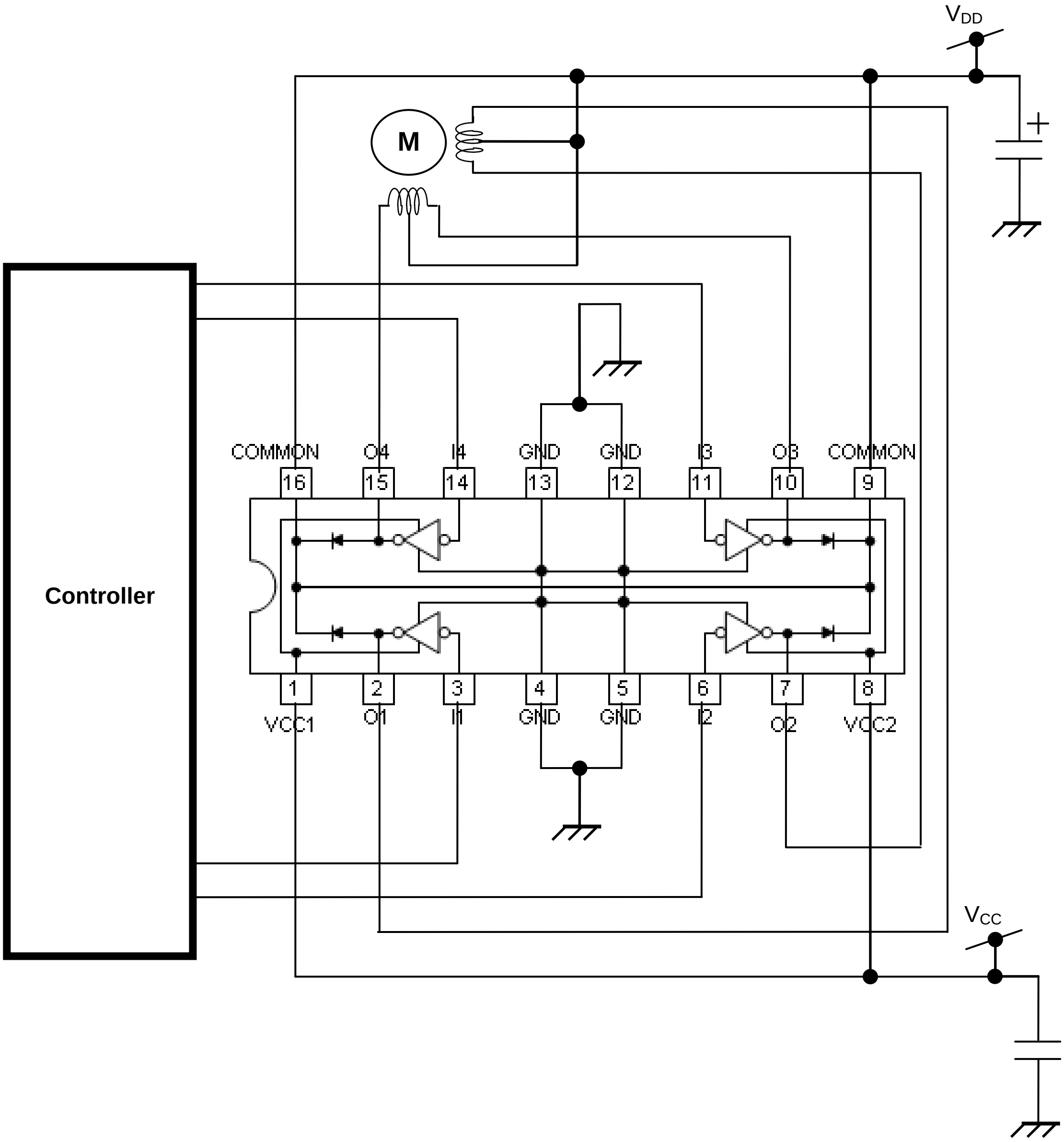
Treatment of terminal for unusage channel

Following treatment for pins of unusage channels is recommended.

Pin	Treatment
I1,I2,I3,I4	Output is off in the open state because input pin has pull up processing. However, it is recommended to connect to VCC to avoid malfunction by noise.
O1,O2,O3,O4	Open or GND connection is recommended.
COMMON	Open or connection to power supply for load is recommended.
NC	Open is recommended.

Application circuit example

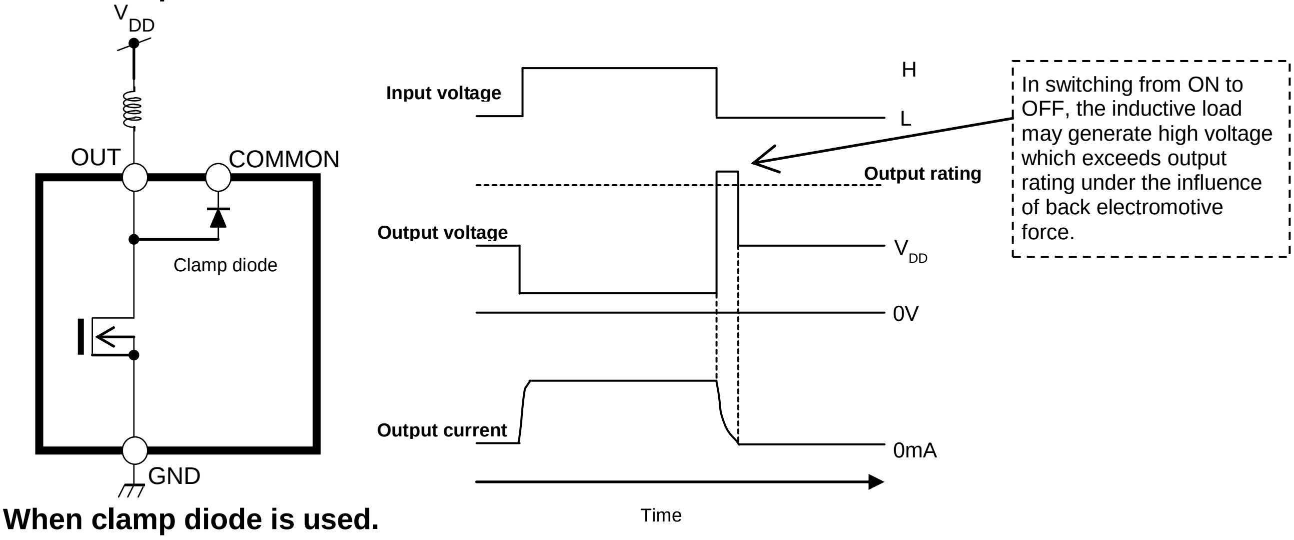
Drive of uni-polar stepping motor (TBD62308APG)



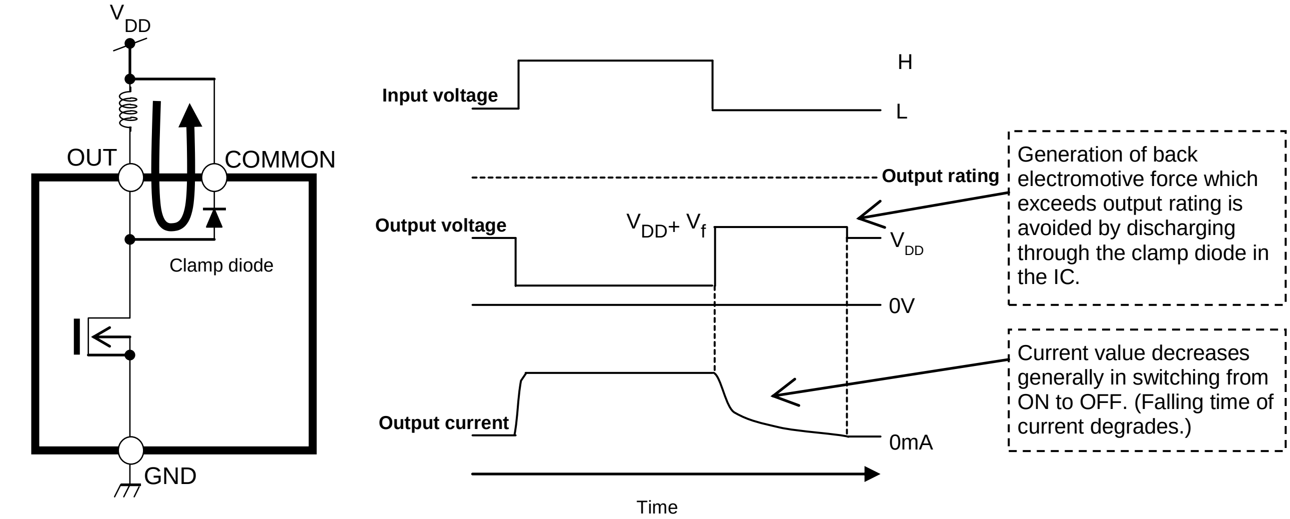
Driving inductive load

In case of driving inductive load such as motor and relay, make sure to use clamp diode of the internal IC.

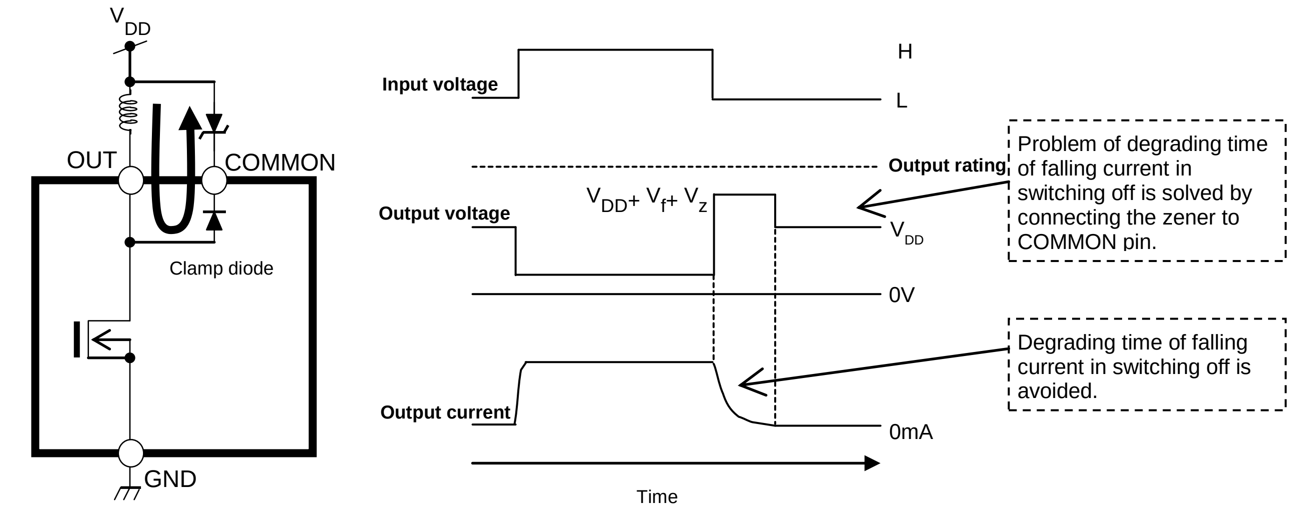
When clamp diode is not used.



When clamp diode is used.



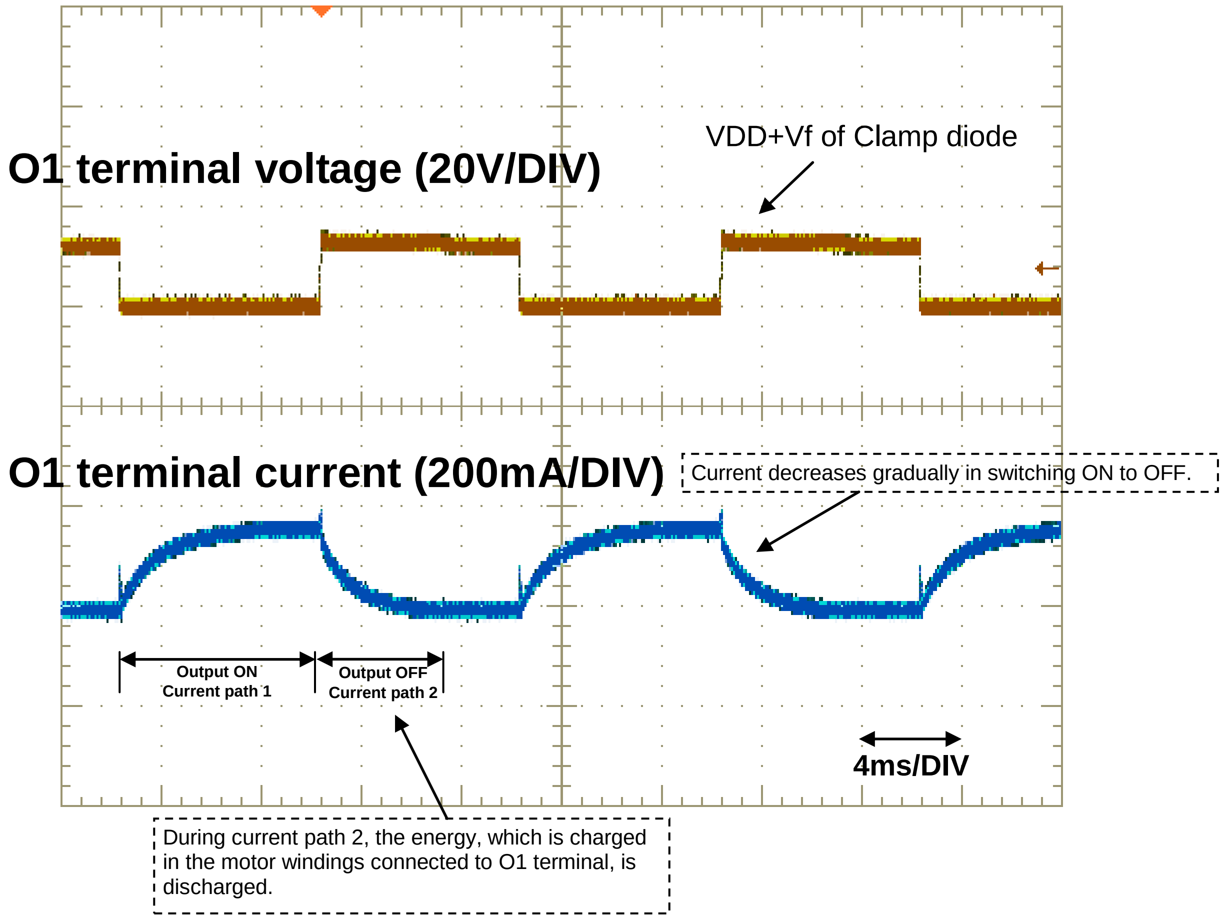
When clamp diode and zener diode are used.



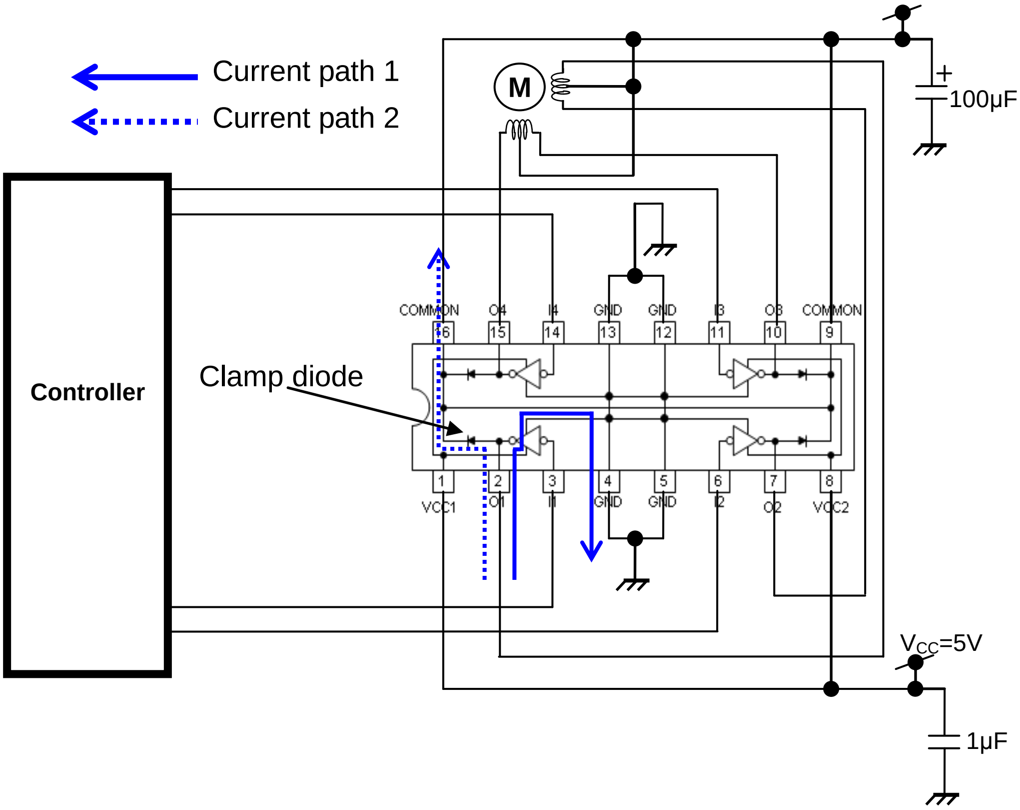
Please select the zener whose voltage specification is as follows; $V_{DD} + V_Z + V_f <$ output rating (50V)

Waveform in driving uni-polar stepping motor

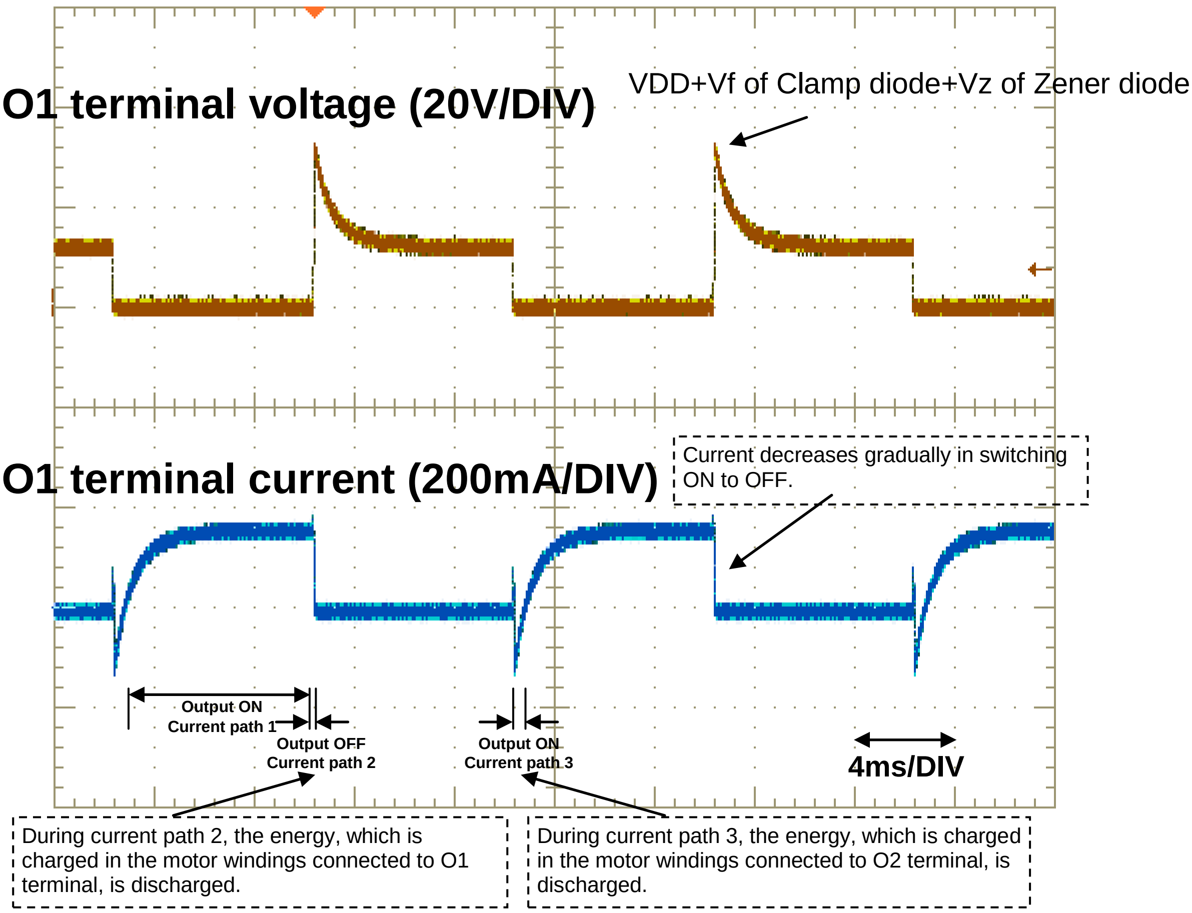
When clamp diode is used.

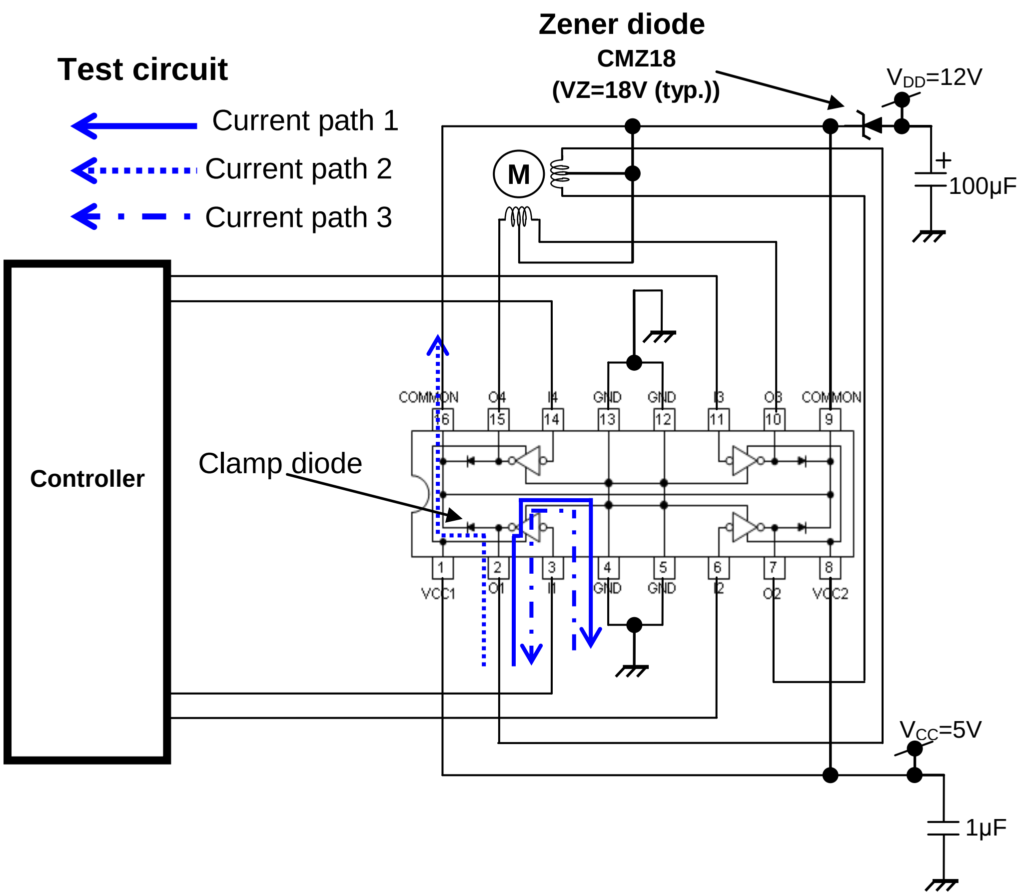


Test circuit



When clamp diode and zener diode are used.





Loss calculation of the IC

In using the IC, take enough margins to configure by referring to the PD-Ta graph after calculating the loss of the IC from below formula. In the condition of a PD-Ta graph, the drive of a maximum current of 1250 mA per 1ch is possible.

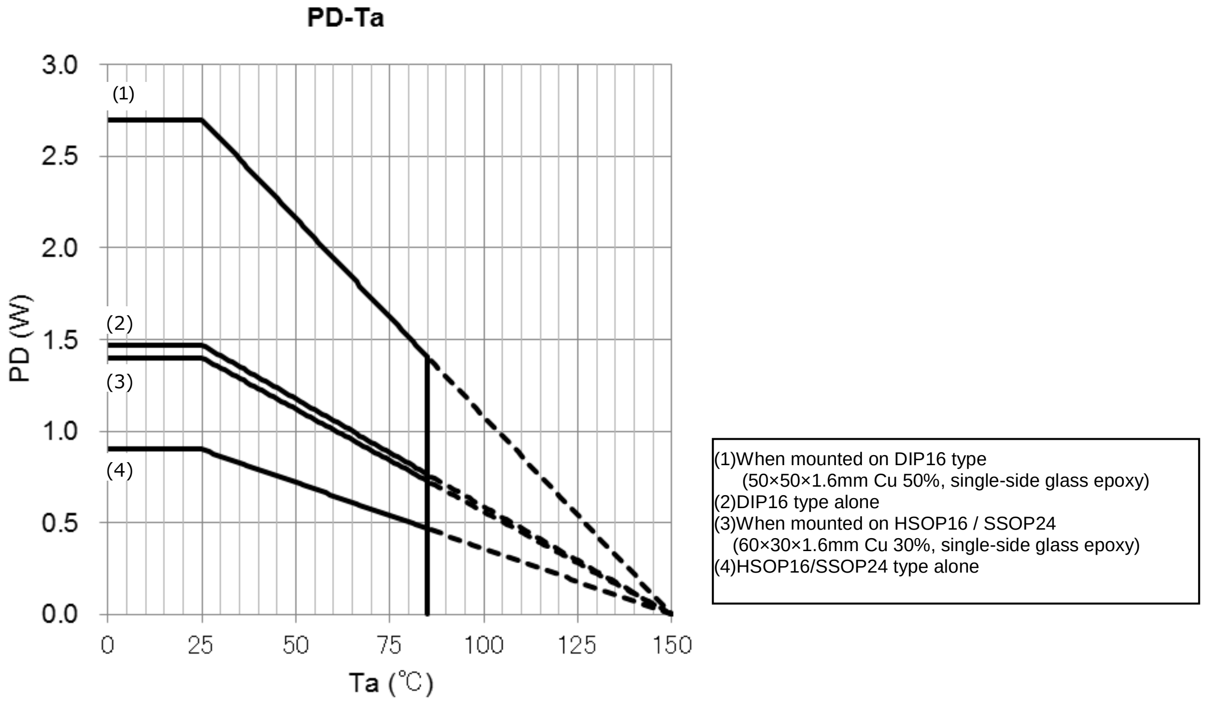
Loss calculation

PD(W) = IOUT(A) × IOUT(A) × RON(Ω) × ONDuty × Ch + VIN(V) × IIN(A) × Ch + VCC (V) × ICC(A) × Ch

*RON	: Please refer to an electrical characteristic of a data seat.
*ONDuty	: Apply ON term/cycle However, when ON term is 25ms or more, apply 1 for ONDuty.
*Ch	: Number of driving channels

PD-Ta graph

Conditions: Absolute maximum rating of the junction temperature (Tj) is 150°C.



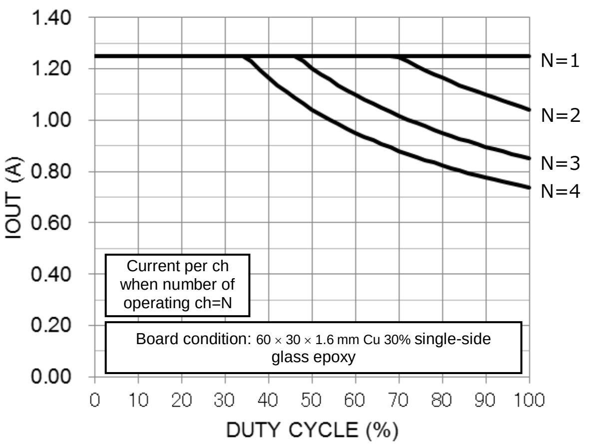
Thermal resistance (for reference)

PG type	: Rth (j-a) =85 °C/W (alone)
PG type	: Rth(j-a) =46 °C /W (When mounted on single-side glass epoxy, 50 × 50 × 1.6 mm Cu 50%)
FG/FAG type	: Rth (j-a) =139 °C /W (alone)
FG/FAG type	: Rth(j-a) =89 °C /W (When mounted on single-side glass epoxy, 60 × 30 × 1.6 mm Cu 30%)

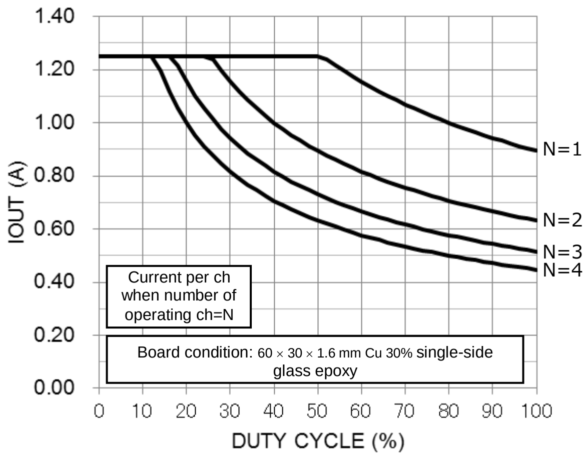
Reference data

*The data is for reference, not guaranteed.

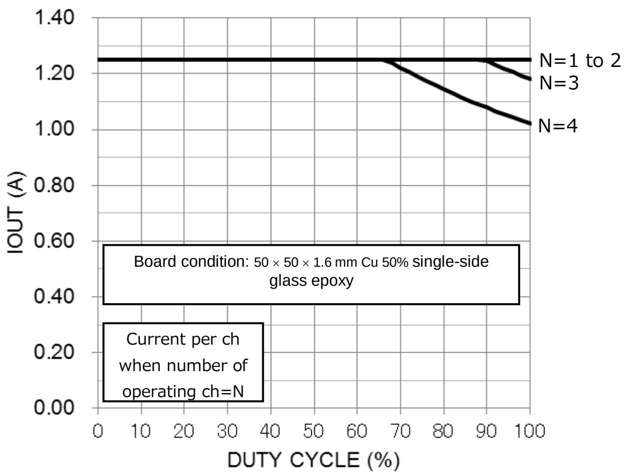
IOUT-DUTY CYCLE
Mounted on the board of TBD62308AFG/FAG
Tj=120°C, Ta=25°C, Pulse width: 25ms or less
VCC=5V, VIN=0V



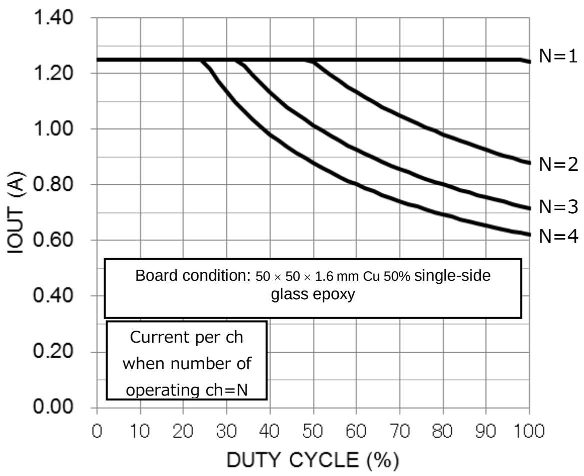
IOUT-DUTY CYCLE
Mounted on the board of TBD62308AFG/FAG
Tj=120°C, Ta=85°C, Pulse width: 25ms or less
VCC=5V, VIN=0V



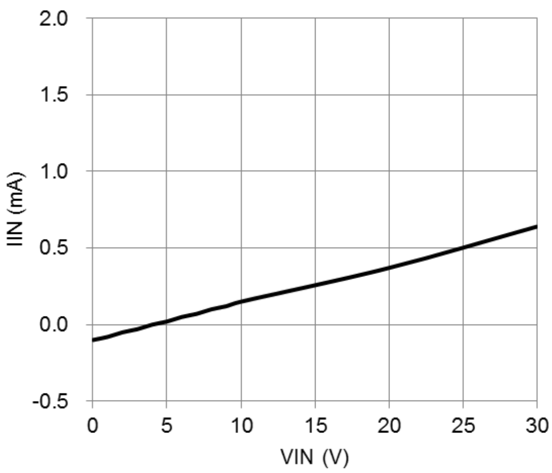
IOUT-DUTY CYCLE
Mounted on the board of TBD62308APG
Tj=120°C, Ta=25°C, Pulse width: 25ms or less
VCC=5V, VIN=0V



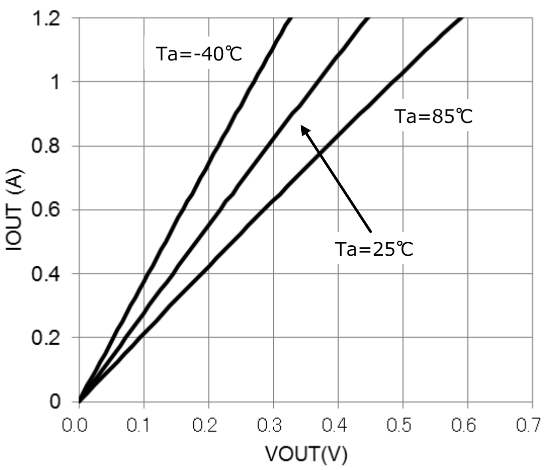
IOUT-DUTY CYCLE
Mounted on the board of TBD62308APG
Tj=120°C, Ta=85°C, Pulse width: 25ms or less
VCC=5V, VIN=0V



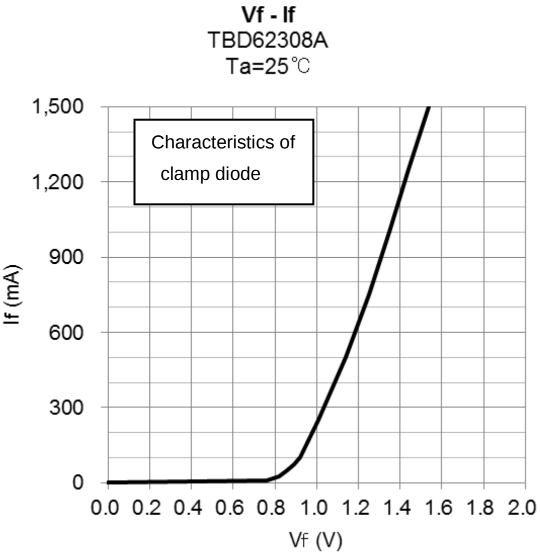
VIN - IIN
TBD62308A
Ta=25℃, VCC=5V

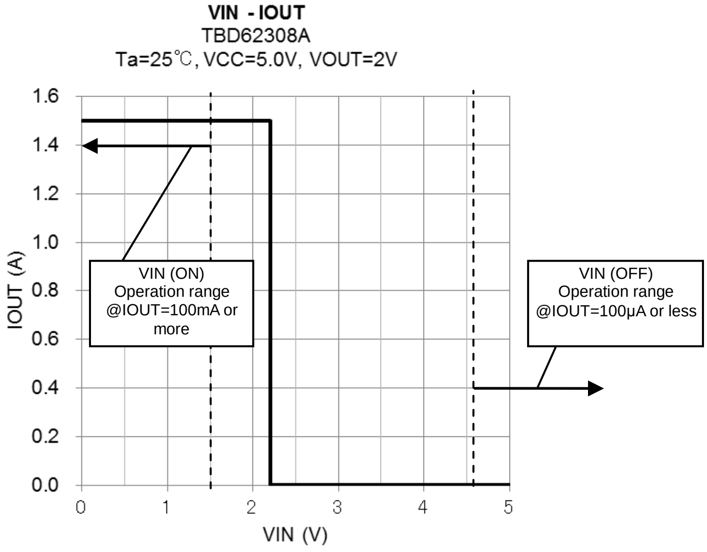


VOUT - IOUT
TBD62308A
VIN=0V,VCC=5V



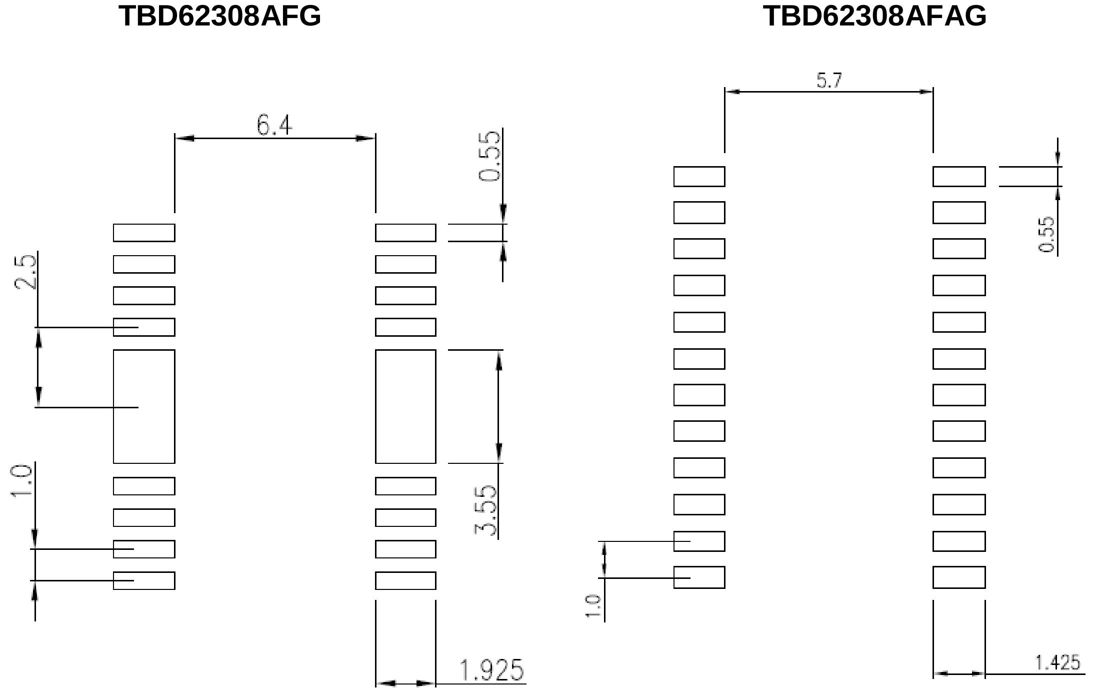
*The data is for reference, not guaranteed.





Land pattern dimension (reference)

Unit: mm



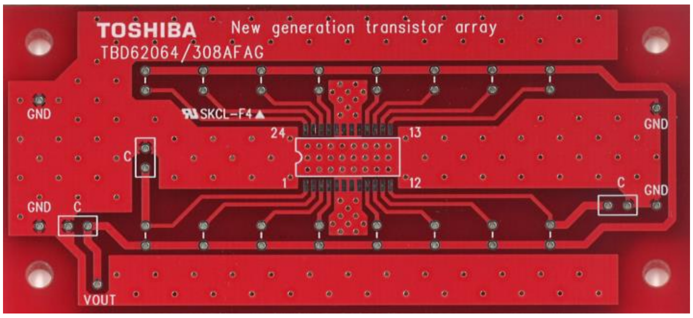
Notes

- All linear dimensions are given in millimeters unless otherwise specified.
- This drawing is based on JEITA ET-7501 Level3 and should be treated as a reference only. TOSHIBA is not responsible for any incorrect or incomplete drawings and information.
- You are solely responsible for all aspects of your own land pattern, including but not limited to soldering processes.
- The drawing shown may not accurately represent the actual shape or dimensions.
- Before creating and producing designs and using, customers must also refer to and comply with the latest versions of all relevant TOSHIBA information and the instructions for the application that Product will be used with or for.

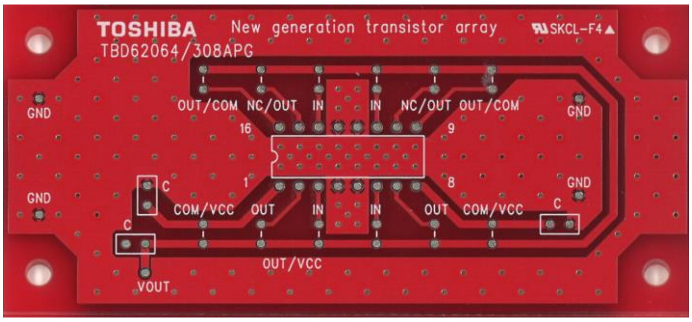
Evaluation board

Drawing

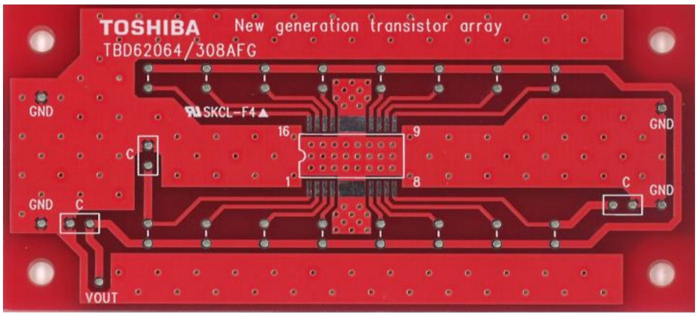
Evaluation board of the TBD62308AFAG



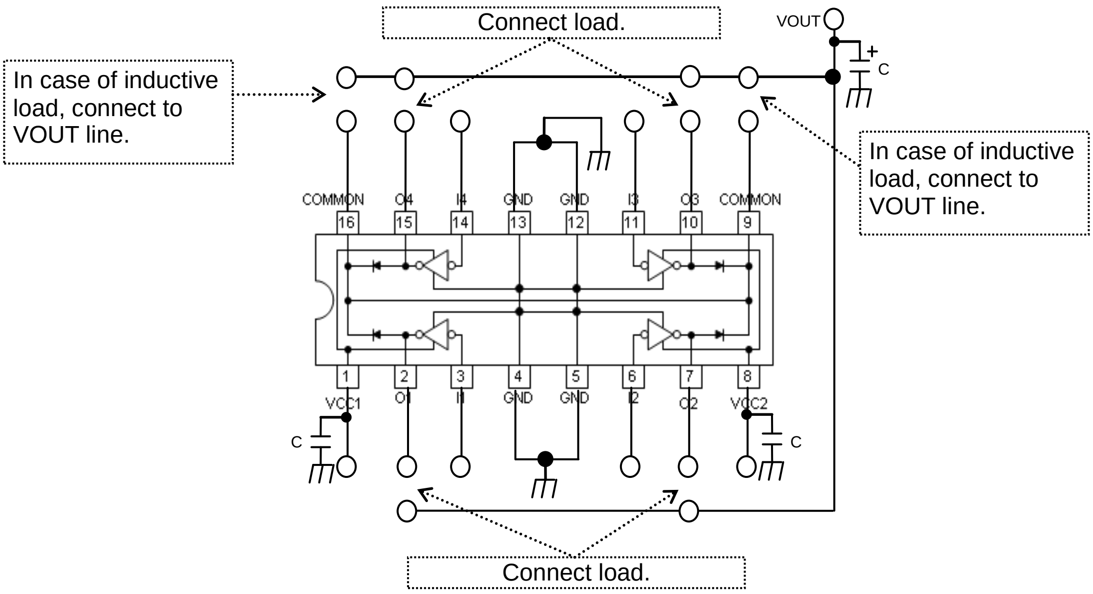
Evaluation board of the TBD62308APG



Evaluation board of the TBD62308AFG



Circuit diagram (TBD62308APG)



Notes on Contents

1. Pin Connection Diagrams

The pin connection diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

2. Basic Circuits

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

3. Test Circuits

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

4. Timing Charts

Timing charts may be simplified or some parts of them may be omitted 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 the device breakdown, damage or deterioration, and may result 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 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.

[3] 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.

[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 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

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.

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 sync capability of the power supply is small, the device's motor power supply and output pins might be exposed to conditions beyond absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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