TBD62183A 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 TBD62183A series are high active type.

Type	Description	TBD62183A series
High active	Output is ON by inputting ”H” level to input pin	○
Low active	Output is ON by inputting ”L” level to input pin	—

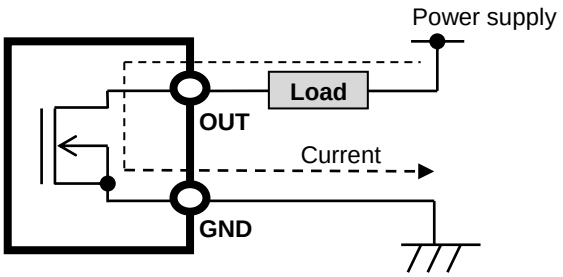
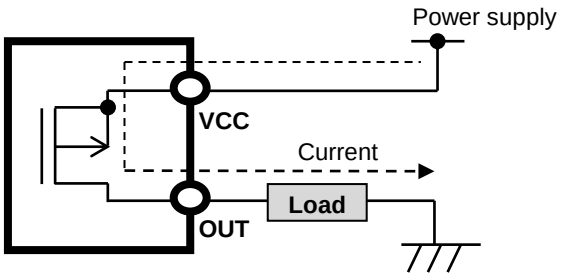
● Output clamp diode

There are two types. The TBD62183A series are built-in type.

Type	Description	TBD62183A series
Built-in	Ideal for drives of motors, relays, and solenoids. (Capable of driving LEDs and adopting to level shift circuits.)	○
Non Built-in	Ideal for LED drive and adoption to level shift circuits. (Incapable of driving motors, relays and solenoids.)	—

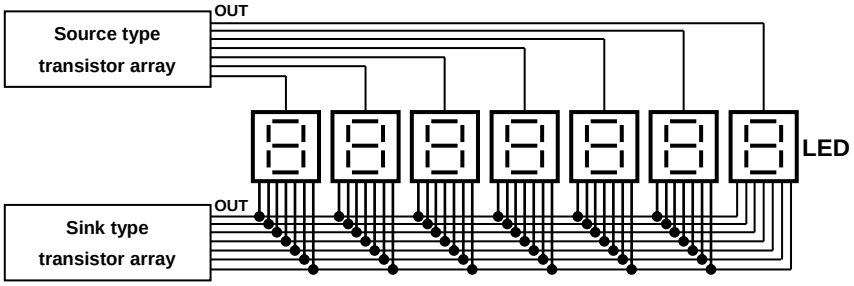
● Output current system

There are two types. The TBD62183A series are sink type. Connecting point of each load is different.

Type	Description	TBD62183A series
Sink type	Output of current sink type (output: pull) 	○
Source type	Output of current source type (output: push) 	—

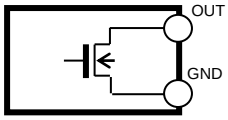
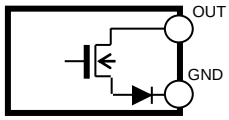
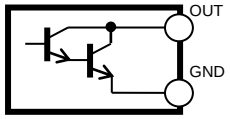
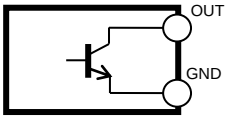
Application example

Dynamic drive control is available by combining transistor arrays of the sink type and the source type.



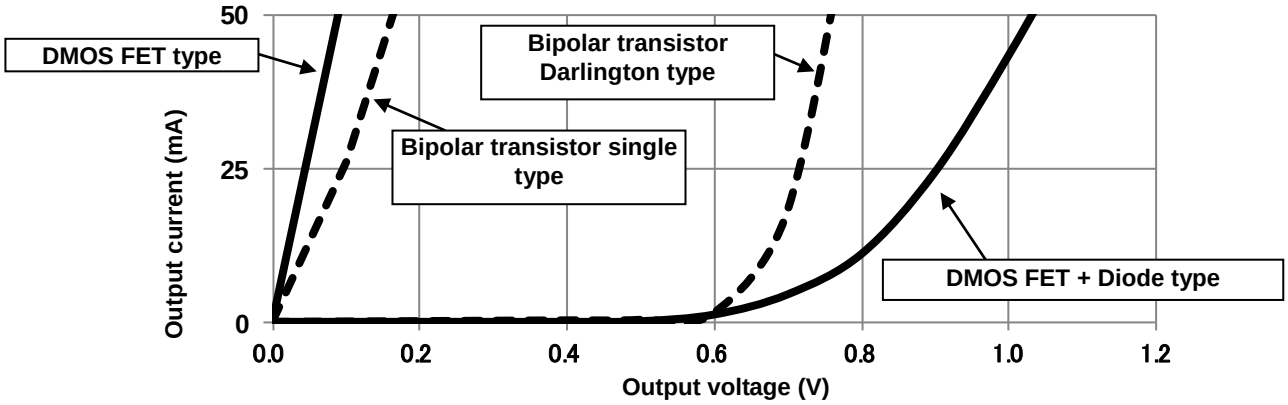
● Construction of output circuit

There are three types. The TBD62183A series are DMOS FET type.

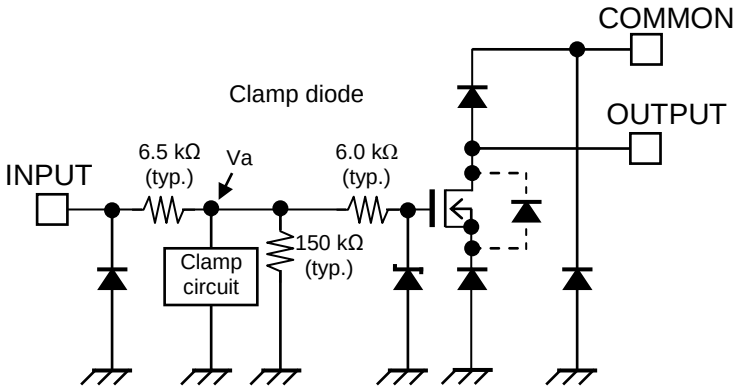
Type	Description	TBD62183A series
DMOS FET type	 Features High current drive is available Loss of low current range is low	—
DMOS FET ＋ Diode type	 Features Output characteristics is similar to Vce (sat) of bipolar transistor Darlington	○
Bipolar transistor Darlington type	 Features High current drive is available	—
Bipolar transistor single type	 Features Loss of low current range is low	—

Characteristics graph of each type (for reference only)

Graph of Output voltage - Output current (for reference only)



Basic circuit



* The accuracy of the internal resistance is ± 30 % (reference value).
* The clamp circuit controls the upper limit of Va (approximately 4 V).

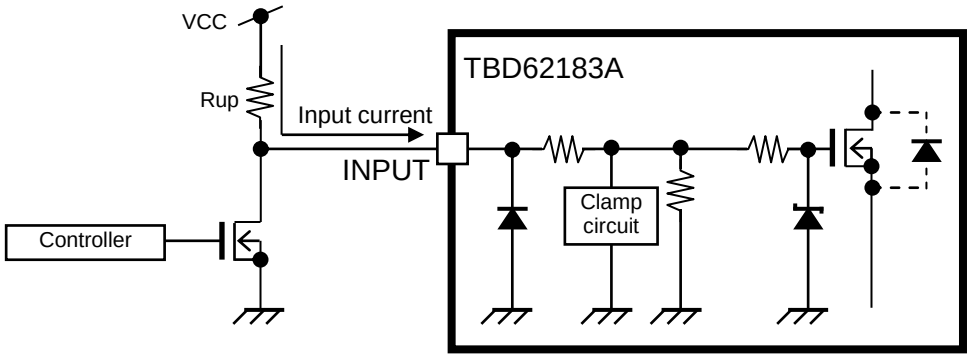
Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purposes.

● Control of output ON/OFF

Outputs of the TBD62183A series are constructed by DMOS FET. ON and OFF of output are controlled according to the applied voltage to the input pin.

Product	VIN (ON)	VIN (OFF)
TBD62183A series	2.8 V to 25 V	0 V to 0.6 V

When the voltage is inputted through the pull up resistor externally, please confirm that it meets the conditions of VIN (ON). In this case, the voltage fall in the external resistor (Rup) should be considered.



● Notes in usage

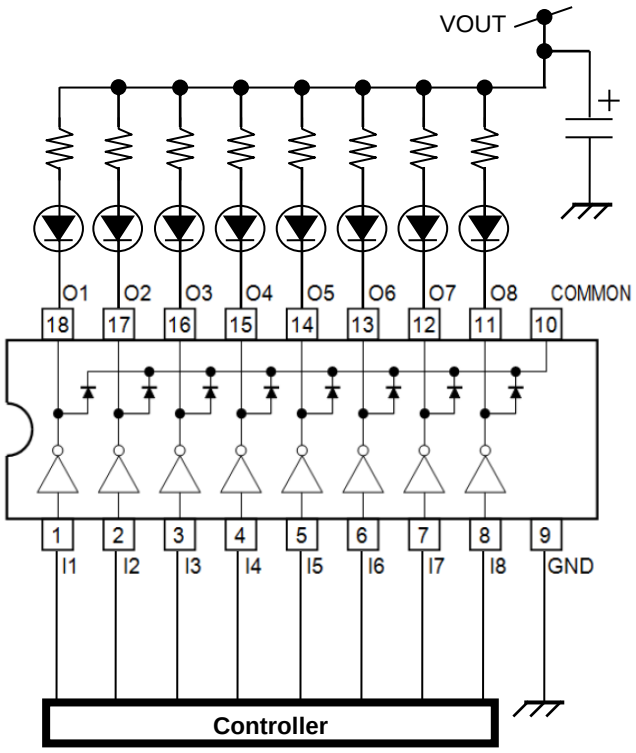
Following treatments are recommended for unusage pins.

Pin	Treatments
I1,I2,I3,I4,I5,I6,I7	Output is off in the open state because input pin has pull down processing. However, connecting to GND is recommended in order to avoid malfunction by noise.
O1, O2, O3, O4, O5, O6, and O7	Open or GND connection is recommended.
COMMON	Open or connecting to power supply for load is recommended.

Application circuit example

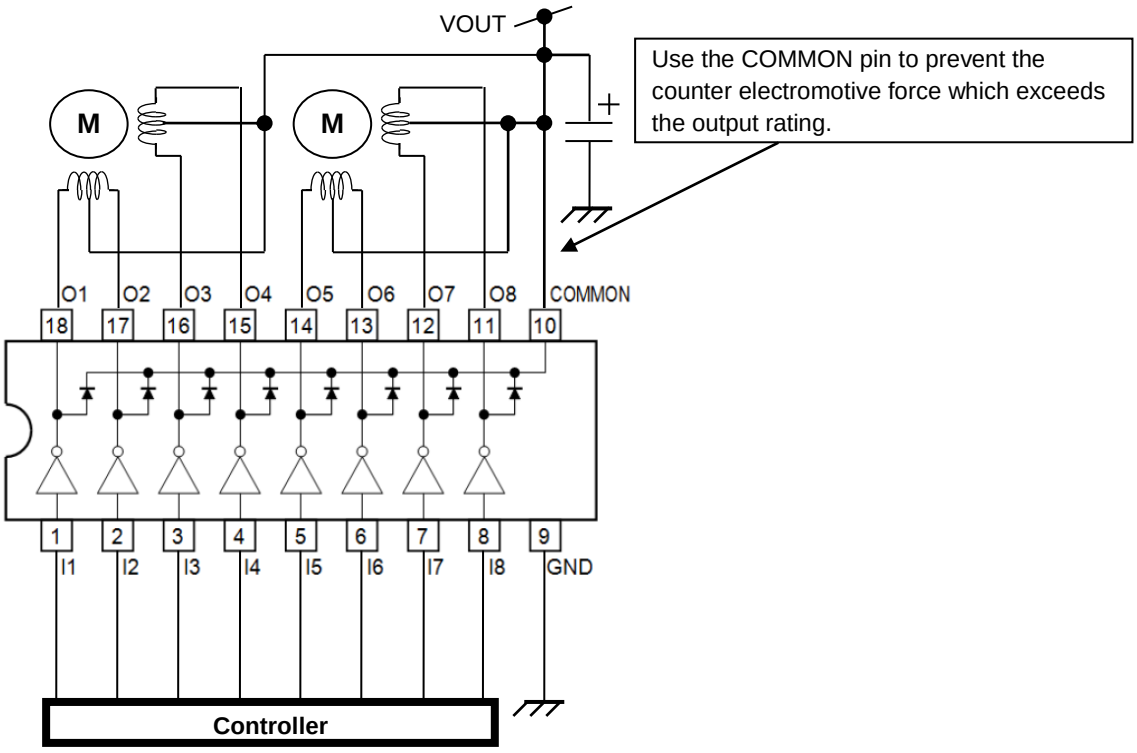
● Drive LED

In case of driving 8 LEDs



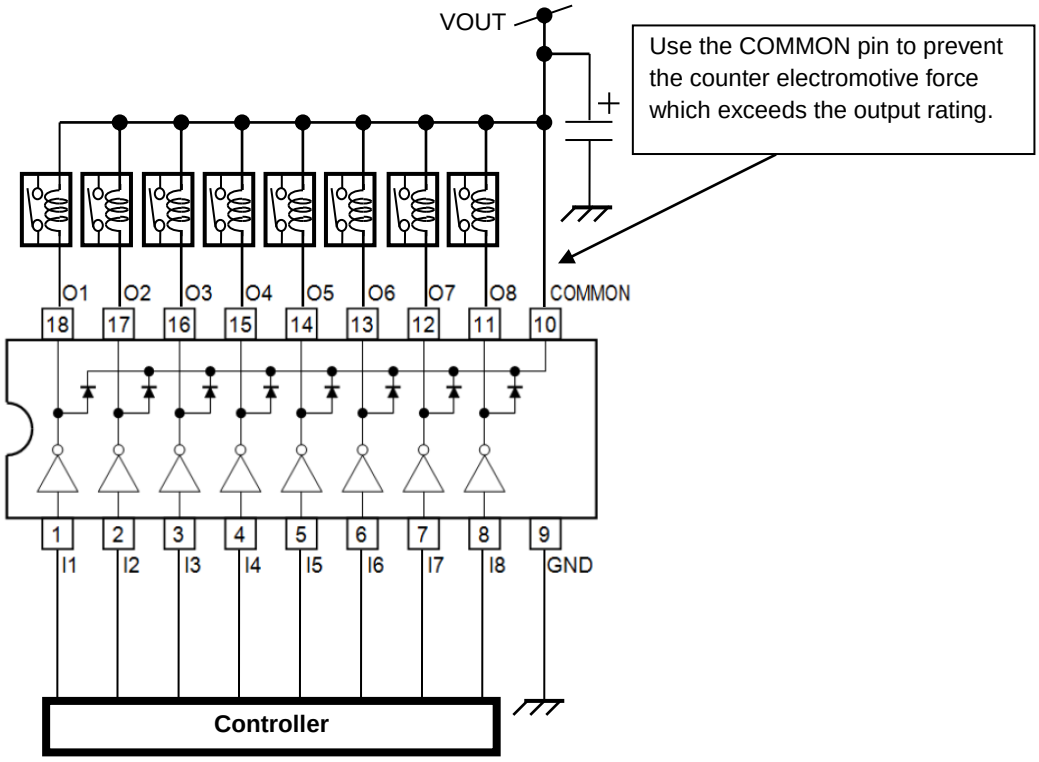
● Drive unipolar stepping motor

In case of driving two unipolar stepping motors



● Drive relay

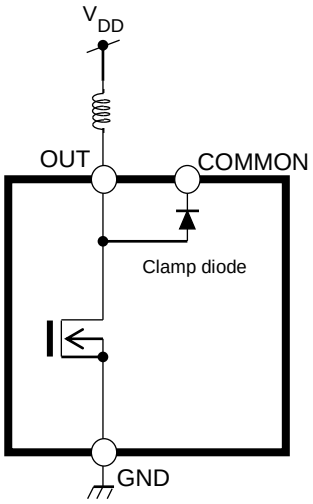
In case of driving 8 relays

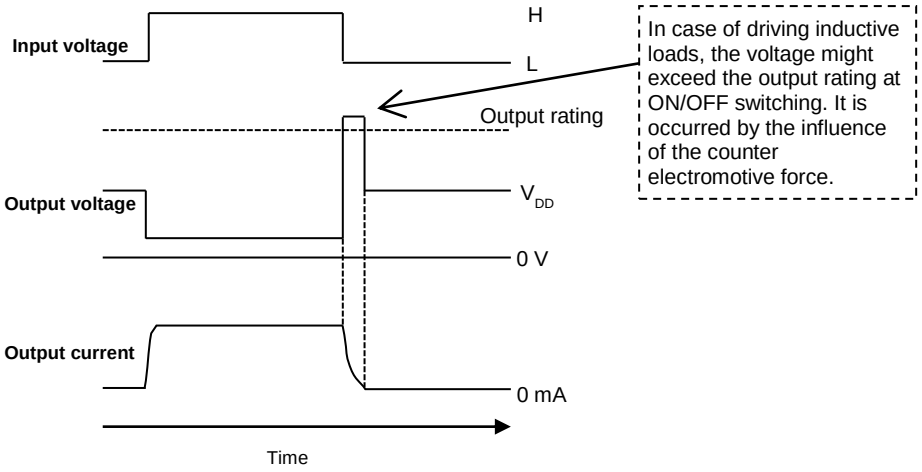


Operation of inductive load

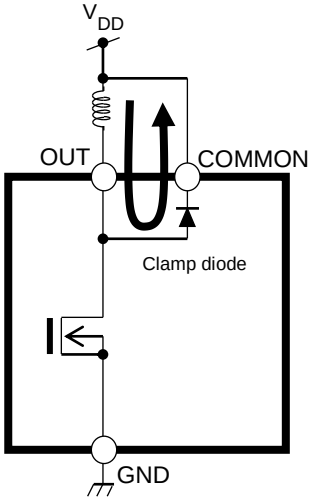
In case of driving inductive loads such as motors and relays, be sure to use the clamp diode in the IC.

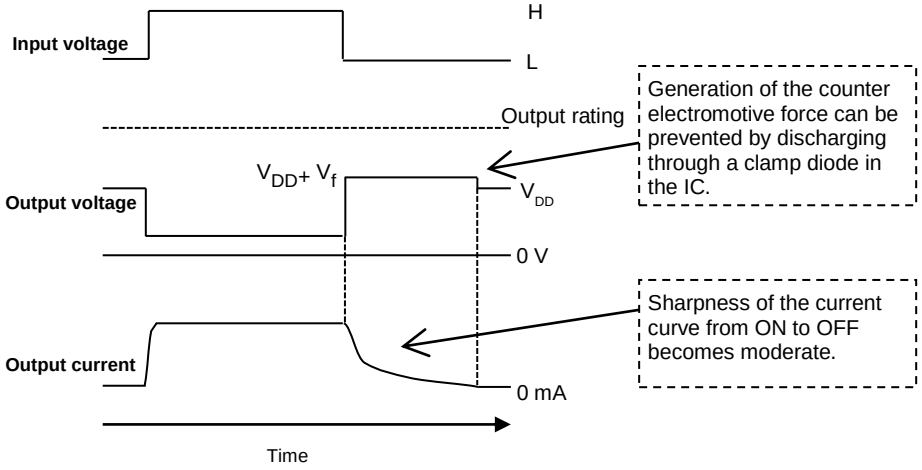
● In case of unusing clamp diode



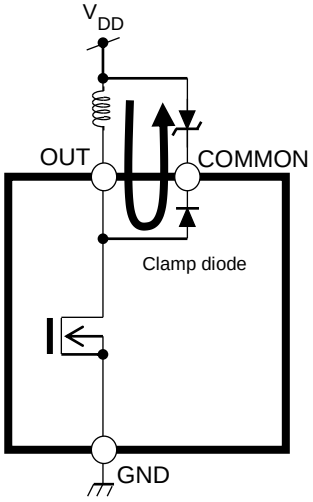


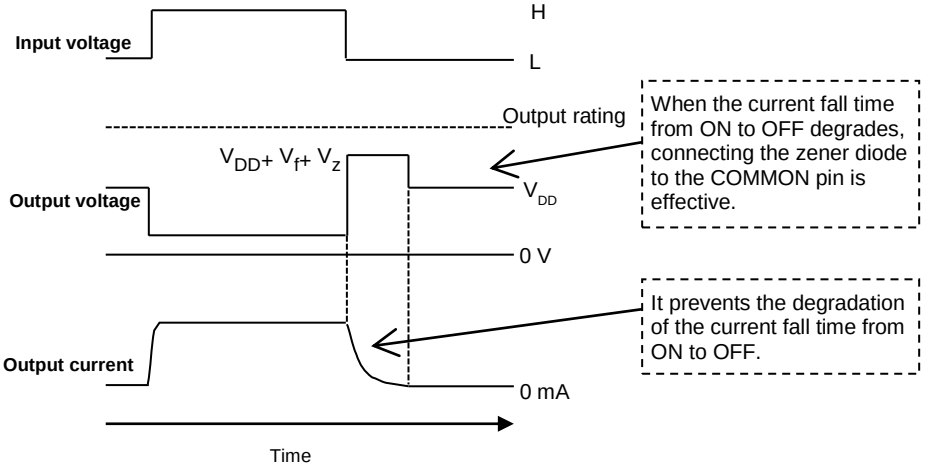
● In case of using clamp diode





● In case of using clamp diode + zener diode





Select the zener that meets the condition as follows; $V_{DD} + V_Z + V_f < 50$ V (output rating)

Loss calculation of the IC

In using the IC, please calculate the loss of the IC from below formula. Then take enough margins in setting by referring to the PD-Ta graph. Within the condition range of the PD-Ta graph, the IC can operate with the current of 45 mA (max) per 1ch.

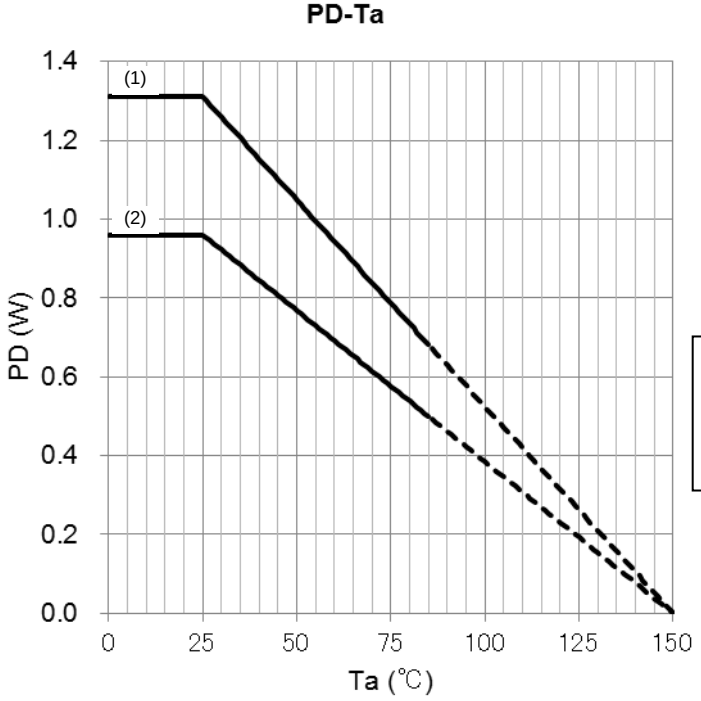
● Loss calculation

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

* RON: Please refer to the electrical characteristics of the technical data sheet.
* ONDuty: Please adopt ON term / cycle.
  However, when ON term is 25 ms or more, please adopt “1” for ONDuty.
* Ch: Number of driving channels

● PD-Ta graph

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



(1) When mounted on FWG type
(75 × 114 × 1.6 mm, Cu 20%, single-side glass epoxy)

(2) When mounted on FNG type
(50 × 50 × 1.6 mm, Cu 40%, single-side glass epoxy)

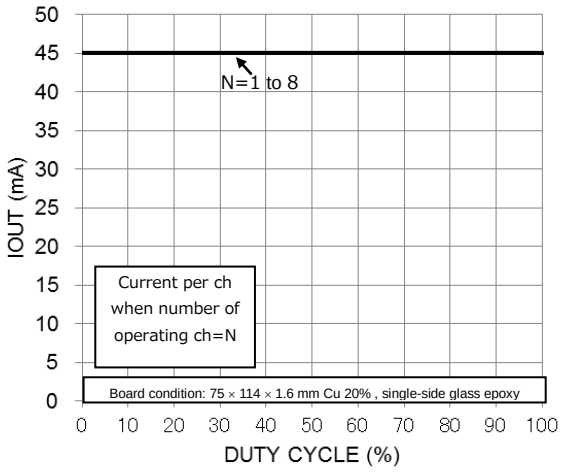
● Thermal resistance

FNG type : Rth (j-a) = 130°C/W (50 × 50 × 1.6 mm, Cu 40%, single-side glass epoxy)
FWG type : Rth (j-a) = 95°C/W (75 × 114 × 1.6 mm, Cu 20%, single-side glass epoxy)

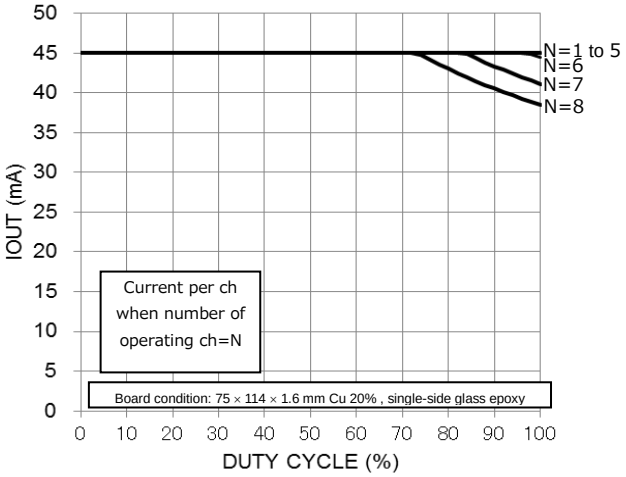
Reference data

* The data is for reference only, not guaranteed.

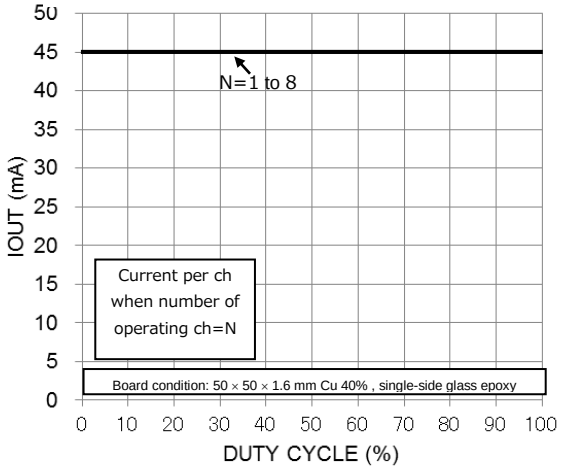
IOUT-DUTY CYCLE
Mounted on the board of TBD62183AFWG
Tj=120°C, Ta=25°C, pulse width: 25ms or less



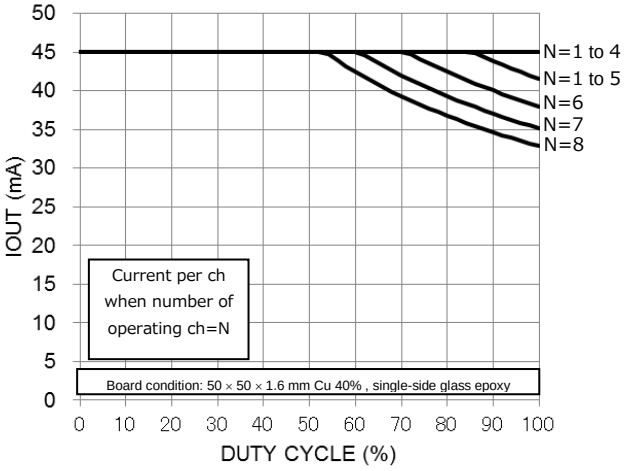
IOUT-DUTY CYCLE
Mounted on the board of TBD62183AFWG
Tj=120°C, Ta=85°C, pulse width: 25ms or less



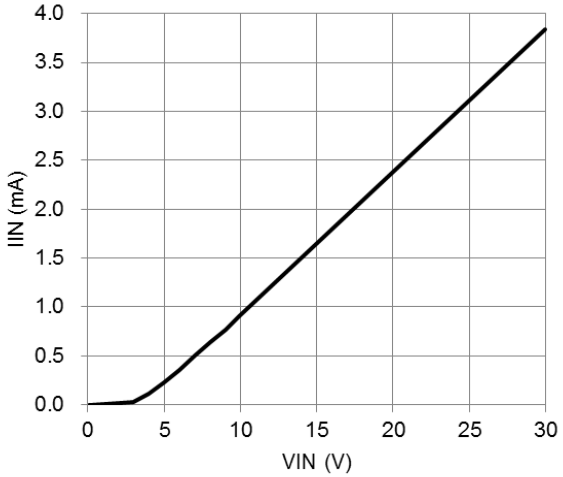
IOUT-DUTY CYCLE
Mounted on the board of TBD62183AFNG
Tj=120°C, Ta=25°C, pulse width: 25ms or less



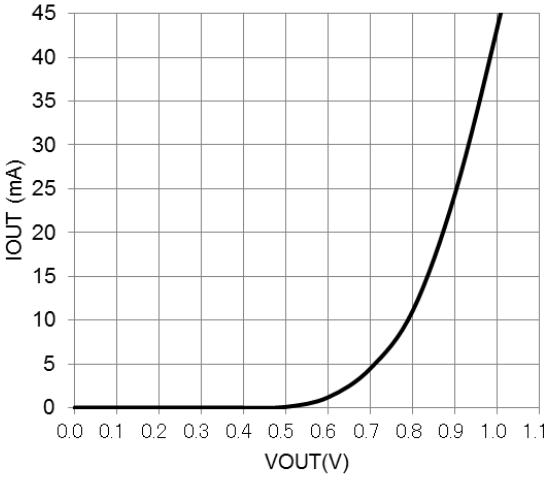
IOUT-DUTY CYCLE
Mounted on the board of TBD62183AFNG
Tj=120°C, Ta=85°C, pulse width: 25ms or less



VIN - IIN
TBD62183A
Ta=25℃, VOUT=2V

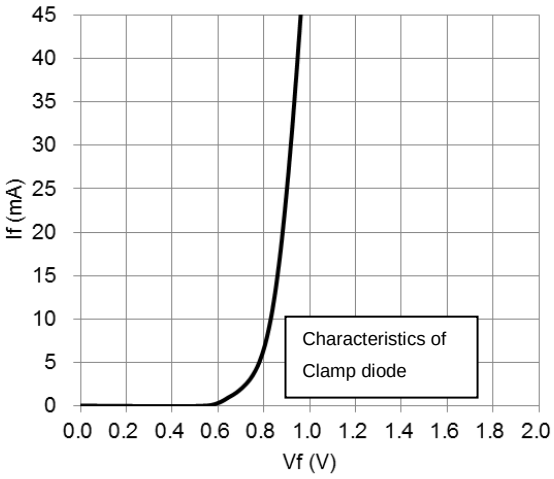


VOUT - IOUT
TBD62183A
Ta=25℃, VIN=5V

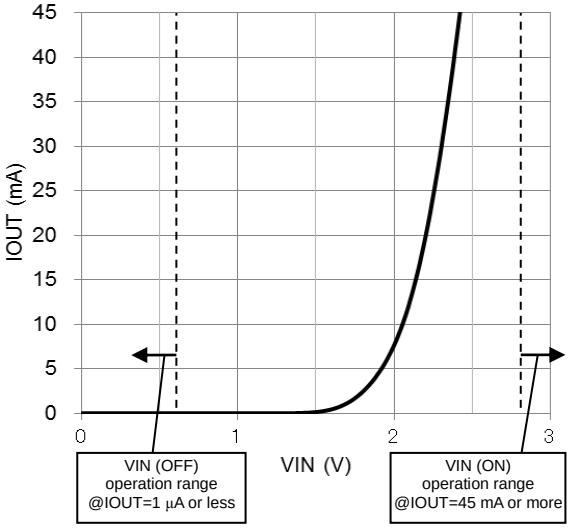


* The data is for reference only, not guaranteed.

Vf - If
TBD62183A
Ta=25℃



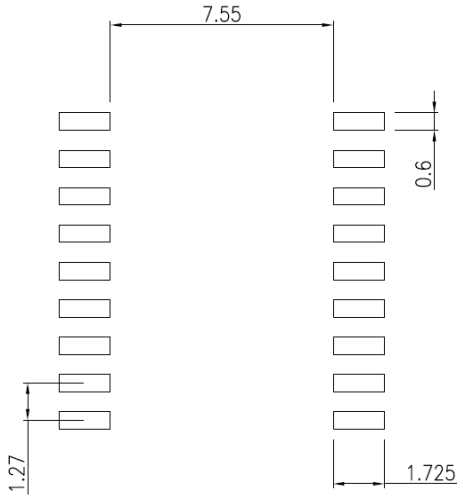
VIN - IOUT
TBD62183A
Ta=25℃, VOUT=2V



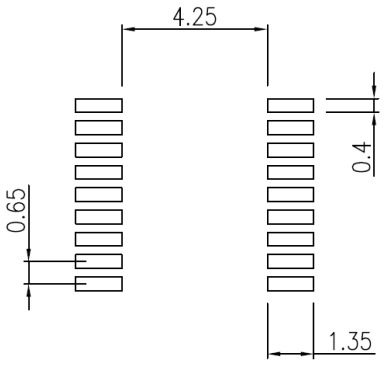
Land pattern dimension (for reference only)

Unit: mm

TBD62183AFWG



TBD62183AFNG



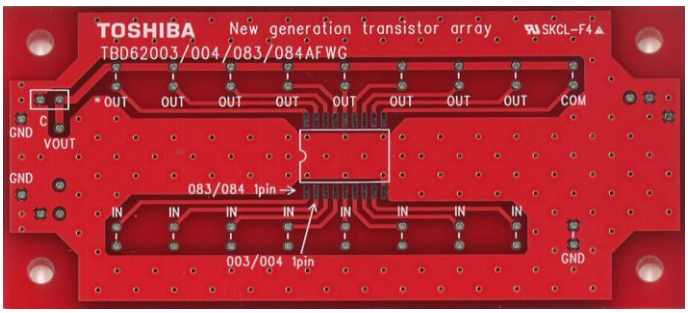
Toshiba does not guarantee the data for mass production. Please use the data as reference data for customer's application.

Note: In determining the size of mounting board, design the most appropriate pattern by considering the solder bridge, the solder connecting strength, the pattern accuracy in making board, and the mounting accuracy of the IC board.

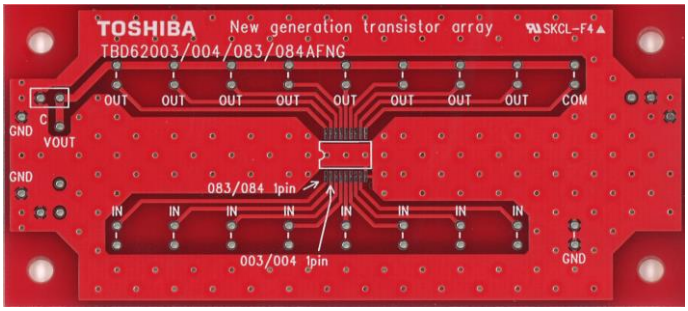
Evaluation board

● Drawing

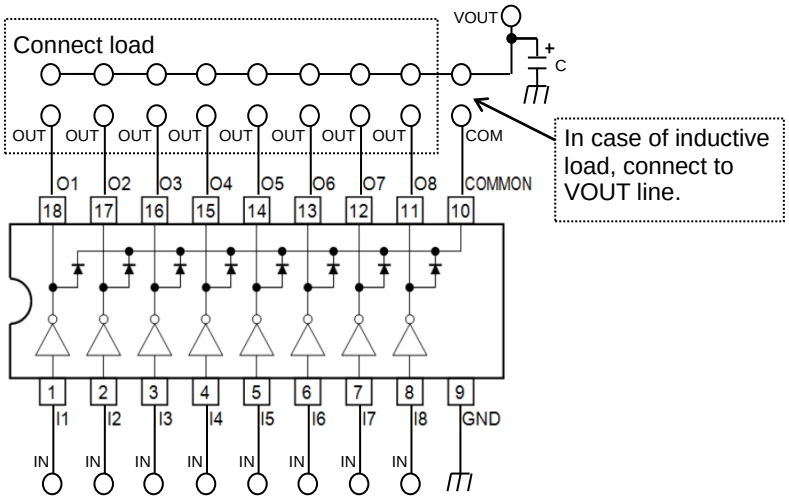
Evaluation board of the TBD62183AFWG



Evaluation board of the TBD62183AFNG



● Circuit



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 sink 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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