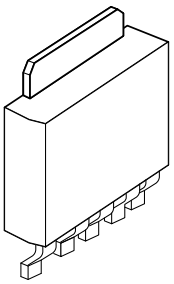
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

# TA48S00AF

## 1A Output Current, Variable Output Voltage and Low Dropout Voltage Regulator with ON/OFF Control Switch

The TA48S00AF consists of small-surface mount type low-dropout regulators with an output current of 1 A (maximum) and an ON/OFF control switch. Control by an EN (ON/OFF) terminal enables the regulator to be operated only when required (output ON). The output voltage can be arbitrarily set by external resistance. Therefore, the TA48S00AF can be used for a wide range of applications. TA48S00AF is suitable for use in the power supply circuits of AV, OA and other digital devices equipped with a stand-by function, and of battery-operated portable data devices of various types, where they will contribute to energy saving.



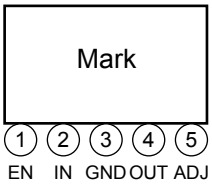
HSIP5-P-1.27B

Weight: 0.36 g (Typ.)

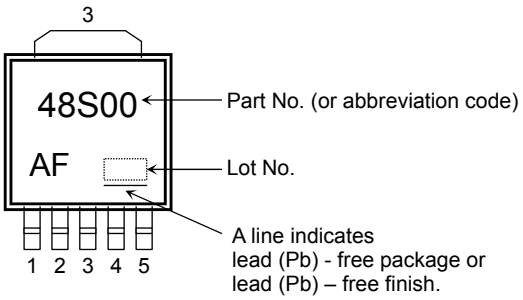
## Features

- Built-in ON/OFF control function (active high)
- Maximum output current : 1 A
- Output voltage : $V_{OUT}$ = 1.5 V ~ 9.0 V
- Reference voltage accuracy : $V_{REF}$ ± 2.5% (@Tj = 25°C)
- Low quiescent current : 850 μA (Typ.) (@$V_{OUT}$ = 3.3 V ,$I_{OUT}$ = 0 A)
- Low standby current (output OFF mode): 0.5 μA (Typ.)
- Low-dropout voltage : $V_D$ = 0.5 V (Max) (@$V_{OUT}$ = 3.3 V, $I_{OUT}$ = 500 mA)
- Protection function : Over current protection / thermal shutdown
- Package type : Surface-mount New PW-Mold5pin

## Pin Assignment




## Marking



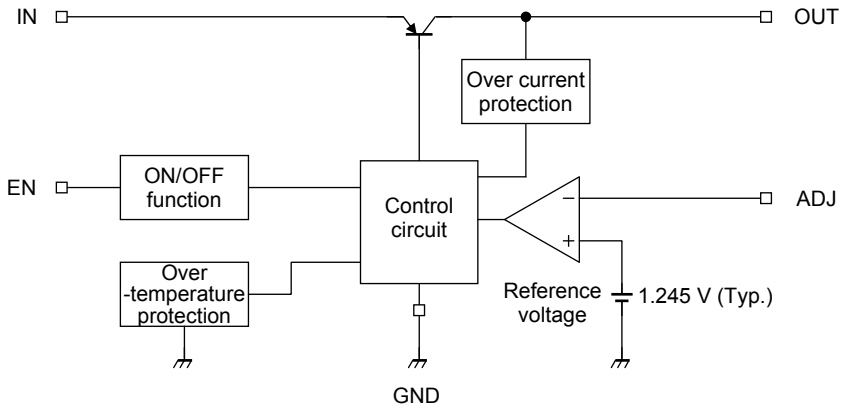
## Pin Description

| Pin No. | Symbol | Description |
|---|---|---|
| 1 | EN | Output ON/OFF control terminal.<br>Output is ON when this pin is set to “High”, OFF when this pin is open or set to “Low”. |
| 2 | IN | Input terminal. Connected by capacitor ($C_{IN}$) to GND. |
| 3 | GND | Ground terminal |
| 4 | OUT | Output terminal. Connected by capacitor ($C_{OUT}$) to GND. |
| 5 | ADJ | Output voltage feedback to regulator. It is connected to an error amplifier with $V_{REF}$=1.245 V (Typ.). |

## How to Order

| Product No. | Package | Package Type and Capacity |
|---|---|---|
| TA48S00AF (T6L1,Q) | New PW-Mold5pin : Surface-mount | Tape (2000 pcs/reel) |

## Block Diagram



## Absolute Maximum Rating (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input voltage | | $V_{IN}$ | 16 | V |
| EN Input voltage | | $V_{EN}$ | 16 | V |
| Output current | | $I_{OUT}$ | 1 | A |
| Operating junction temperature | | $T_{j(opr)}$ | -40~150 | °C |
| Junction temperature | | $T_j$ | 150 | °C |
| Storage temperature | | $T_{stg}$ | −55~150 | °C |
| Power dissipation | Ta = 25°C | $P_D$ | 1 | W |
| | Tc= 25°C | | 10 | |

Note 1: Do not apply current and voltage (including reverse polarity) to any pin that is not specified.

Note 2: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

## Thermal Characteristics

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, junction to ambient | $R_{th\ (j-a)}$ | 125 | °C/ W |
| Thermal resistance, junction to case | $R_{th\ (j-c)}$ | 12.5 | °C/ W |

## Operating Input Voltage Range

| Characteristic | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Input voltage | $V_{IN}$ | 2.5(Note2) | — | 16.0 | V |

Note 3: This is the voltage at which the IC begins operating. $V_D$ must be considered when determining the best input voltage for the application.

## Output Voltage Range

| Characteristic | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Output voltage | $V_{OUT}$ | 1.5 | — | 9.0 | V |

## Protection Function (Reference)

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Thermal shutdown | $T_{SD}$ | $V_{IN}$ = 4.3 V | 150 | 170 | — | °C |
| Thermal shutdown hysteresis width | $T_{SD(hys)}$ | | — | 15 | — | °C |
| Peak circuit current | $I_{PEAK}$ | $V_{IN}$ = 5.3 V, $T_j$ = 25°C | — | 1.7 | — | A |
| | | $V_{IN}$ = 8.3 V, $T_j$ = 25°C | — | 2.0 | — | |
| Short circuit current | $I_{SC}$ | $V_{IN}$ = 5.3 V, $T_j$ = 25°C | — | 1.1 | — | A |
| | | $V_{IN}$ = 16 V , $T_j$ = 25°C | — | 0.7 | — | |

Note 4: Ensure that the devices operate within the limits of the maximum rating when in actual use.

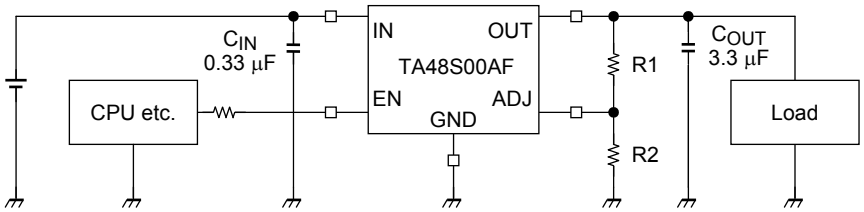
## Electrical Characteristics
**(Unless otherwise specified, $V_{EN} = V_{IN}$, $V_{OUT}$ = 3.3 V, $C_{IN}$ = 0.33 μF, $C_{OUT}$ = 3.3 μF, $T_j$ = 25°C)**

| Characteristic | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Reference voltage | $V_{REF}$ | $V_{IN}$ = 4.3 V | 1.214 | 1.245 | 1.276 | V |
| Line regulation | Reg·line | 4.3 V ≦ $V_{IN}$ ≦ 8.3 V, $I_{OUT}$ = 500 mA | — | 8 | 24 | mV |
| Load regulation | Reg·load | $V_{IN}$ = 4.3 V, 5 mA ≦ $I_{OUT}$ ≦ 1 A | — | 5 | 20 | mV |
| Quiescent current | $I_B$ | 4.3 V ≦ $V_{IN}$ ≦ 8.3 V, $I_{OUT}$ = 0 A | — | 0.85 | 1.70 | mA |
| | | 4.3 V ≦ $V_{IN}$ ≦ 8.3 V, $I_{OUT}$ = 1 A | — | 10 | 20 | |
| Quiescent current (OFF mode) | $I_{B(OFF)}$ | 4.3 V ≦ $V_{IN}$ ≦ 8.3 V, $V_{EN}$ = 0.4 V | — | 0.5 | 5.0 | μA |
| Starting quiescent current | $I_{Bstart}$ | $V_{IN}$ = 2.1 V, $I_{OUT}$ = 0 A | — | 3.3 | 4.0 | mA |
| | | $V_{IN}$ = 3.5 V, $I_{OUT}$ = 1 A | — | 17.0 | 28.5 | |
| Output noise voltage | $V_{NO}$ | $V_{IN}$ = 5.3 V, $I_{OUT}$ = 50 mA, 10 Hz ≦ f ≦ 100 kHz | — | 100 | — | $\mu V_{rms}$ |
| Ripple rejection | R.R. | $V_{IN}$ = 5.3 V, $I_{OUT}$ = 50 mA, f = 120 Hz | — | 63 | — | dB |
| Dropout voltage | $V_D$ | $I_{OUT}$ = 500 mA | — | 0.32 | 0.50 | V |
| | | $I_{OUT}$ = 1 A | — | 0.69 | — | |
| Output control voltage (ON) | $V_{EN(ON)}$ | — | 2 | — | — | V |
| Output control voltage (OFF) | $V_{EN(OFF)}$ | — | — | — | 0.8 | V |
| Output control current (ON) | $I_{EN(ON)}$ | $V_{IN}$ = $V_{EN}$ = 5.3 V | — | 27 | 100 | μA |
| Average temperature coefficient of output voltage | $T_{CVO}$ | $V_{IN}$ = 5.3 V, $I_{OUT}$ = 5 mA, 0°C ≦ $T_j$ ≦ 125°C | — | 0.3 | — | mV/°C |

## Electrical Characteristics Common to All Products

- $T_j$ = 25°C in the measurement conditions of each item is the standard condition when a pulse test is carried out, and any drift in the electrical characteristic due to a rise in the junction temperature of the chip may be disregarded.

## Standard Application Circuit




- Be sure to connect a capacitor near the input terminal and output terminal between both terminals and GND. The use of a monolithic ceramic capacitor (B Characteristic or X7R) of low ESR (equivalent series resistance) is recommended. The IC may oscillate due to external conditions (output current, temperature, or the type of the capacitor used). The type of capacitor required must be determined by the actual application circuit in which the IC is used.

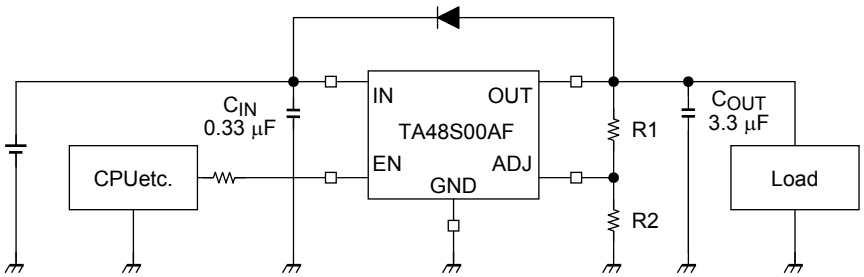
## Setting Output Voltage

- The output voltage is determined by the equation shown below. When you control the output voltage with R1, a recommended value to use for R2 is 5 kΩ. R1 and R2 must be placed as close as possible to each other, and the board trace to the ADJ terminal must be kept as short as possible.

$$V_{OUT} = V_{REF} \times \left( 1 + \frac{R1}{R2} \right)$$

## The notice in case of application

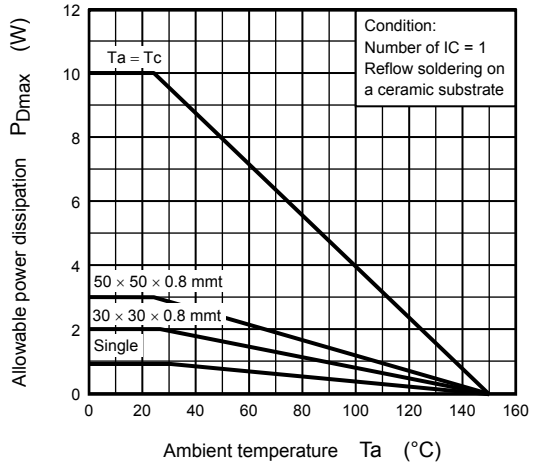
- The IC might be destroyed if a voltage greater than the input terminal voltage is applied to the output terminal, or if the input terminal is connected to GND during operation. To prevent such an occurrence, connect a diode as in the following diagram.



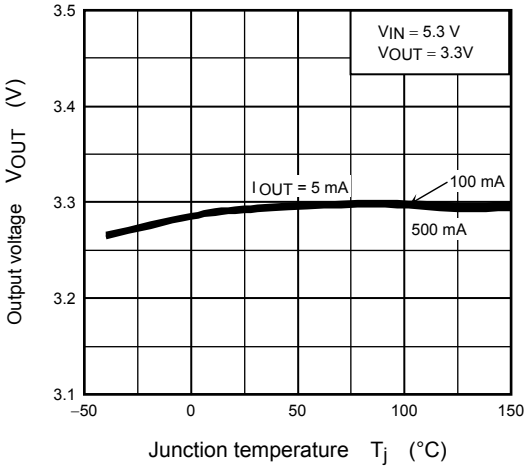

- There is a possibility that internal parasitic devices may be generated when momentary transients cause a terminal's potential to fall below that of the GND terminal. In such case, that the device could be destroyed. The voltage of each terminal and any state must therefore never fall below the GND potential.

- Depending on the load conditions, a steep increase in the input voltage applied ($V_{IN}$) may cause a momentary rise in output voltage ($V_{OUT}$) even if the EN (enable) pin is Low. Treat with care.

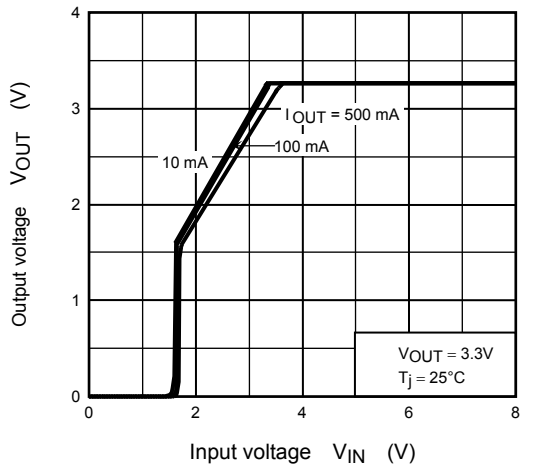
$P_{Dmax}$ – Ta



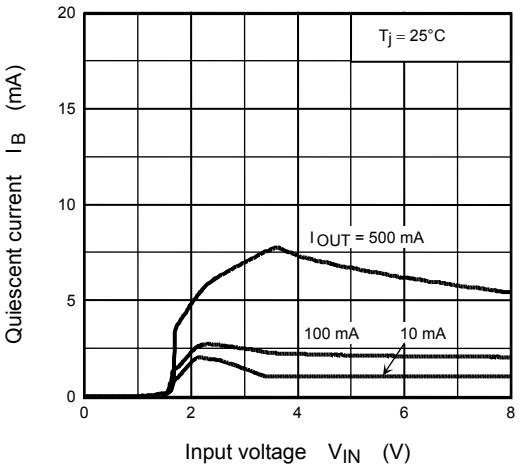

$V_{OUT}$ – $T_j$



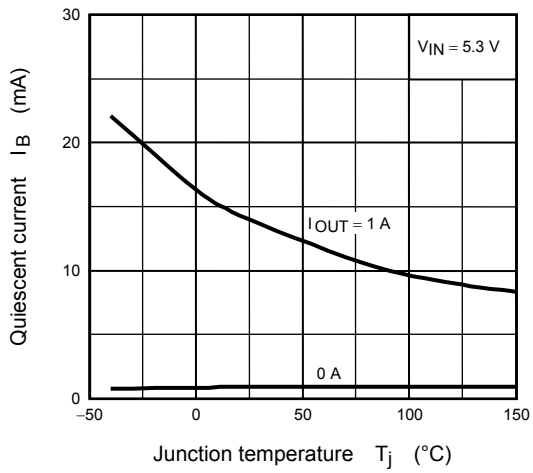

$V_{OUT}$ – $V_{IN}$



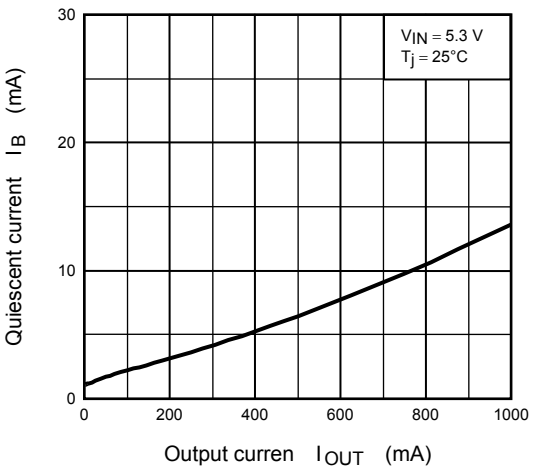

$I_B$ – $V_{IN}$



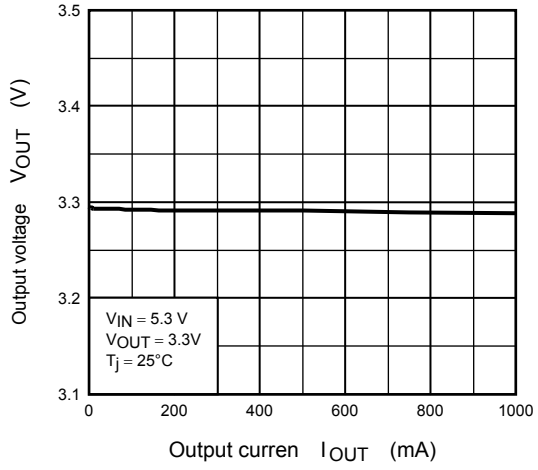

$I_B$ – Tj



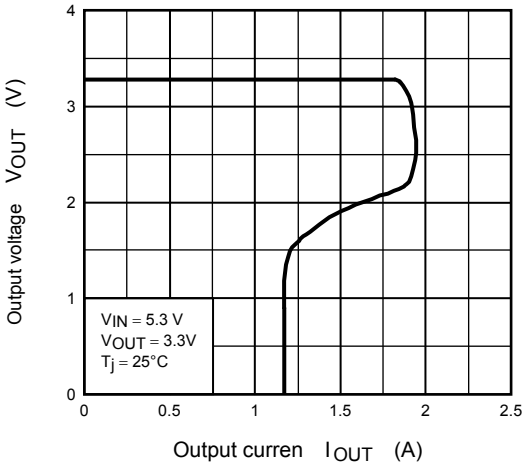

$I_B$ – $I_{OUT}$



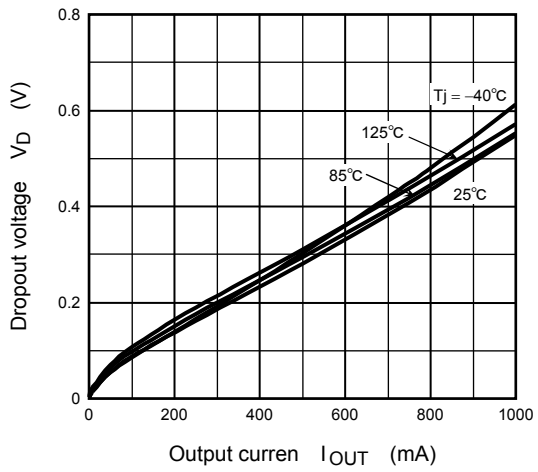
$V_{OUT} - I_{OUT}$



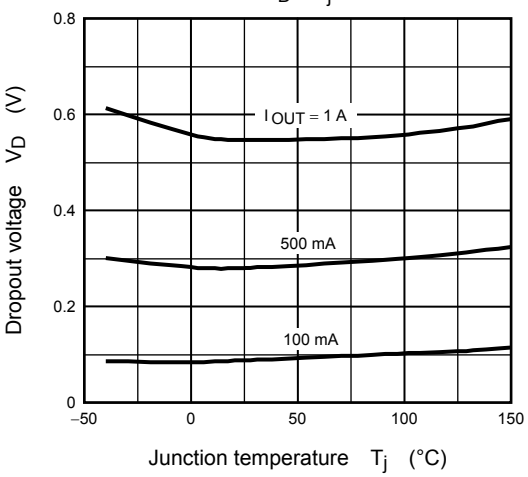

$V_{OUT} - I_{OUT}$



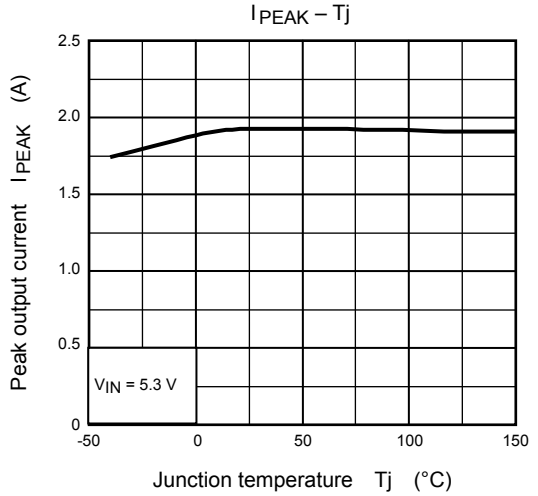

$V_D - I_{OUT}$



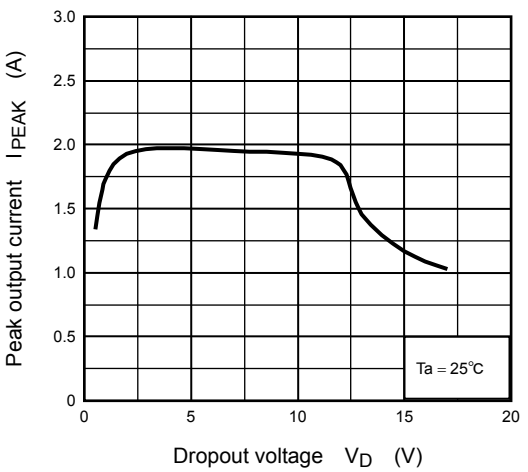

$V_D - T_j$

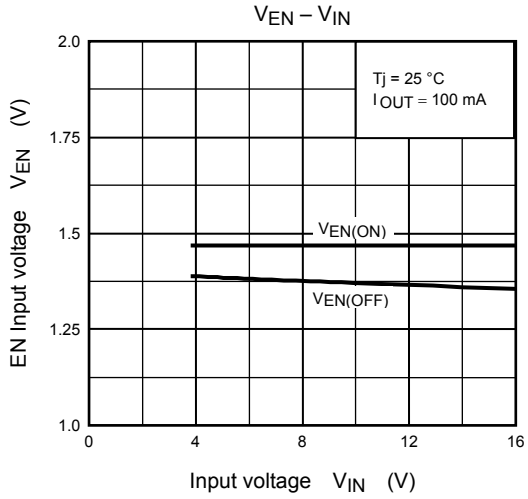


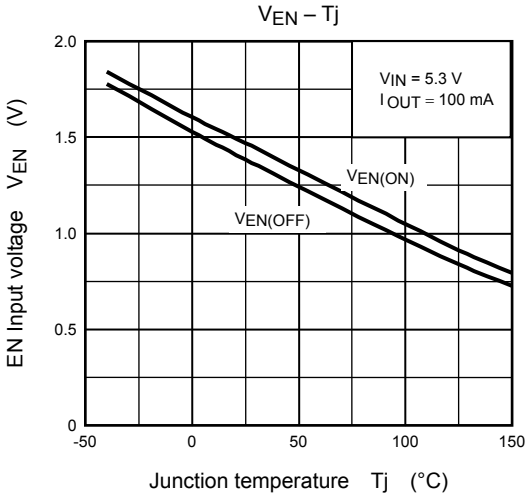

$I_{PEAK} - Tj$




$I_{PEAK} - V_D$

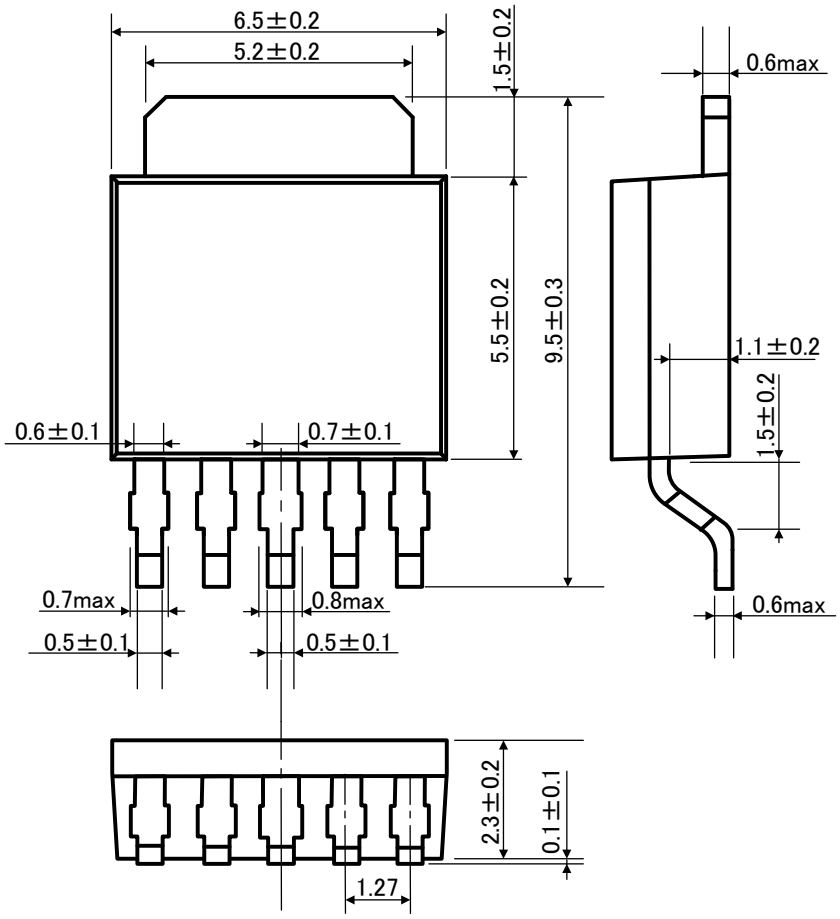



$V_{EN}$ – $V_{IN}$
Tj = 25 °C
$I_{OUT}$ = 100 mA
$V_{EN(ON)}$
$V_{EN(OFF)}$
EN Input voltage $V_{EN}$ (V)
Input voltage $V_{IN}$ (V)
2.0
1.75
1.5
1.25
1.0
0
4
8
12
16


$V_{EN}$ – Tj
$V_{IN}$ = 5.3 V
$I_{OUT}$ = 100 mA
$V_{EN(ON)}$
$V_{EN(OFF)}$
EN Input voltage $V_{EN}$ (V)
Junction temperature Tj (°C)
2.0
1.5
1.0
0.5
0
-50
0
50
100
150

## Package Dimensions

HSIP5-P-1.27B Unit : mm




Weight: 0.36 g (Typ.)

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