

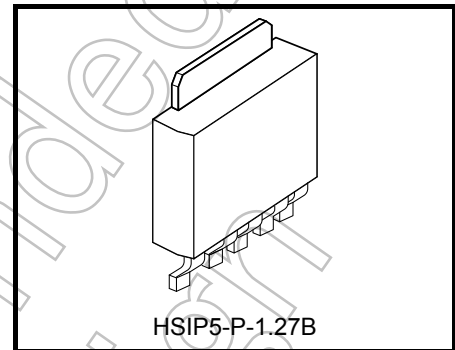
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

## TA48S015AF,TA48S018AF,TA48S025AF, TA48S033AF,TA48S05AF,TA48S09AF

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

The TA48S\*\*\*AF series 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).

Therefore these newly developed regulators are 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. Moreover, the regulators have an output voltage line-up starting from 1.5 V, corresponding to the lower voltage of various devices.

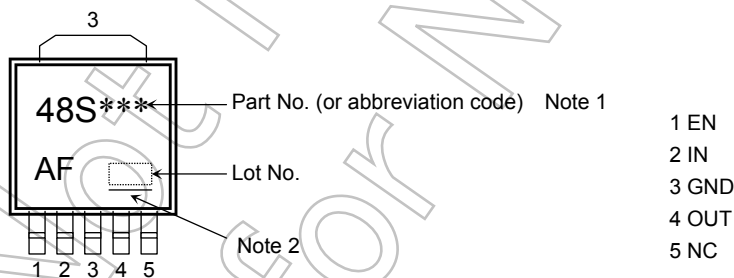


Weight: 0.36 g (typ.)

### Features

- Built-in ON/OFF control function (active high)
- Maximum output current : 1 A
- Low output voltage : 1.5 / 1.8 / 2.5 / 3.3 / 5.0 / 9.0 V
- Output voltage accuracy :  $V_{OUT} \pm 3\%$  (@ $T_j = 25^\circ\text{C}$ )
- Low quiescent current : 850  $\mu\text{A}$  (typ.) (@ $I_{OUT} = 0\text{ A}$ )  
(TA48S09AF : 900  $\mu\text{A}$  (typ.))
- Low standby current (output OFF mode): 0.5  $\mu\text{A}$  (typ.)
- Low-dropout voltage : 0.5 V (max) (@ $V_{OUT} \geq 1.8\text{ V}$ ,  $I_{OUT} = 500\text{ mA}$ )
- Protection function : Overcurrent protection /Thermal shutdown protection
- Package type : Surface-mount 5-pin New PW-Mold

### Pin Assignment / Marking



Note 1: The “\*\*\*” in each product name is replaced with the output voltage of each product.

Note 2: A line under a Lot No. identifies the indication of product Labels.

Not underlined: [[Pb]]/INCLUDES > MCV

Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Start of commercial production  
2005-11

The product(s) in this document (“Product”) contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product into your system, please design the system (1) to avoid such overloads upon the Product, and (2) to shut down or otherwise relieve the Product of such overload conditions immediately upon occurrence. For details, please refer to the notes appearing below in this document and other documents referenced in this document.

## Pin Description

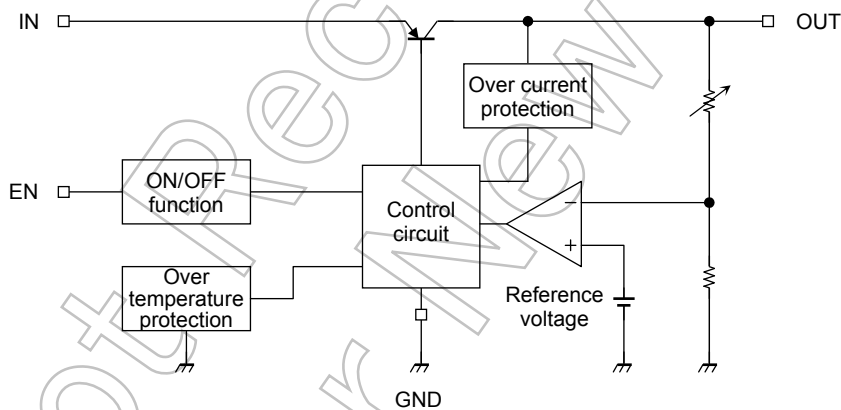
| Pin No. | Symbol | Description  |
|---------|--------|--|
| 1       | EN     | Output ON/OFF control terminal.<br>Output is ON when this pin is set to “High”, OFF when this pin is open or set to “Low”. |
| 2       | IN     | Input terminal. Connected by capacitor (C <sub>IN</sub> ) to GND.  |
| 3       | GND    | Ground terminal  |
| 4       | OUT    | Output terminal. Connected by capacitor (C <sub>OUT</sub> ) to GND.  |
| 5       | NC     | Non-connection   |

## How to Order

| Product No.                  | Package                          | Package Type and Capacity |
|------------------------------|----------------------------------|---------------------------|
| TA48S***AF (T6L1,Q) (Note 3) | 5-pin New PW-Mold: Surface-mount | Tape (2000 pcs/reel)      |

Note 3: The “\*\*\*” in each product number is replaced with the output voltage of each product.

## Block Diagram



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

| Characteristic                 | Symbol            | Rating         | Unit |
|--------------------------------|-------------------|----------------|------|
| Input voltage                  | V <sub>IN</sub>   | 16             | V    |
| EN Input voltage               | V <sub>EN</sub>   | 16             | V    |
| Output current                 | I <sub>OUT</sub>  | 1              | A    |
| Operating junction temperature | T <sub>Jopr</sub> | -40 to 150     | °C   |
| Junction temperature           | T <sub>J</sub>    | 150            | °C   |
| Storage temperature            | T <sub>stg</sub>  | -55 to 150     | °C   |
| Power dissipation              | Ta = 25°C         | P <sub>D</sub> | W    |
|                                | Tc = 25°C         |                |      |

Note 4: Do not apply current and voltage (including reverse polarity) to any pin that is not specified.

Note 5: 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 <sub>th(j-a)</sub> | 125  | °C/W |
| Thermal resistance, junction to case    | R <sub>th(j-c)</sub> | 12.5 | °C/W |

## Operating Input Voltage Range

| Characteristic | Symbol                  | Min             | Typ.                              | Max | Unit |   |
|----------------|-------------------------|-----------------|-----------------------------------|-----|------|---|
| Input voltage  | V <sub>OUT</sub> ≤ 1.8V | V <sub>IN</sub> | 2.5 (Note 6)                      | —   | 16.0 | V |
|                | V <sub>OUT</sub> ≤ 2.5V |                 | V <sub>OUT</sub> + V <sub>D</sub> | —   | 16.0 |   |

Note 6: This is the voltage at which the IC begins operating. V<sub>D</sub> must be considered when determining the best input voltage for the application.

## Protection Function (Reference)

| Characteristic                    | Symbol               | Test Condition  | Min | Typ. | Max | Unit |
|-----------------------------------|----------------------|---|-----|------|-----|------|
| Thermal shutdown                  | T <sub>SD</sub>      | V <sub>IN</sub> = 3.4 V (015 to 018AF) / 3.5 V (025AF) / 4.3 V (033AF) / 6.0 V (05AF) / 10.0 V (09AF) | 150 | 170  | —   | °C   |
| Thermal shutdown hysteresis width | T <sub>SD(hys)</sub> |   | —   | 15   | —   | °C   |
| Peak circuit current              | I <sub>PEAK</sub>    | V <sub>IN</sub> = V <sub>OUT</sub> + 2 V, T <sub>J</sub> = 25°C                                       | —   | 1.7  | —   | A    |
|                                   |                      | V <sub>IN</sub> = V <sub>OUT</sub> + 5 V, T <sub>J</sub> = 25°C                                       | —   | 2.0  | —   |      |
| Short circuit current             | I <sub>SC</sub>      | V <sub>IN</sub> = V <sub>OUT</sub> + 2 V, T <sub>J</sub> = 25°C                                       | —   | 1.1  | —   | A    |
|                                   |                      | V <sub>IN</sub> = 16 V, T <sub>J</sub> = 25°C   | —   | 0.7  | —   |      |

Note 7: Ensure that the devices operate within the limits of the maximum rating when in actual use.

## TA48S015AF

### Electrical Characteristics

(Unless otherwise specified,  $V_{EN} = V_{IN}$ ,  $C_{IN} = 0.33 \mu\text{F}$ ,  $C_{OUT} = 3.3 \mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

| Characteristic                                    | Symbol        | Test Condition   | Min   | Typ.  | Max   | Unit                       |
|---|---------------|--|-------|-------|-------|----------------------------|
| Output voltage                                    | $V_{OUT}$     | $V_{IN} = 3.5 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$  | 1.455 | 1.500 | 1.545 | V                          |
| Line regulation                                   | Reg·line      | $3.4 \text{ V} \leq V_{IN} \leq 6.5 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$                                | —     | 4.5   | 20.0  | mV                         |
| Load regulation                                   | Reg·load      | $V_{IN} = 3.5 \text{ V}$ , $5 \text{ mA} \leq I_{OUT} \leq 1 \text{ A}$                                    | —     | 2     | 20    | mV                         |
| Quiescent current                                 | $I_B$         | $3.4 \text{ V} \leq V_{IN} \leq 6.5 \text{ V}$ , $I_{OUT} = 0 \text{ A}$                                   | —     | 0.85  | 1.70  | mA                         |
|   |               | $3.4 \text{ V} \leq V_{IN} \leq 6.5 \text{ V}$ , $I_{OUT} = 1 \text{ A}$                                   | —     | 10    | 20    |                            |
| Quiescent current (OFF mode)                      | $I_{B(OFF)}$  | $3.4 \text{ V} \leq V_{IN} \leq 6.5 \text{ V}$ , $V_{EN} = 0.4 \text{ V}$                                  | —     | 0.5   | 5.0   | $\mu\text{A}$              |
| Starting quiescent current                        | $I_{Bstart}$  | $V_{IN} = 2.1 \text{ V}$ , $I_{OUT} = 0 \text{ A}$   | —     | 0.7   | 2.3   | mA                         |
|   |               | $V_{IN} = 3.4 \text{ V}$ , $I_{OUT} = 1 \text{ A}$   | —     | 13.0  | 28.5  |                            |
| Output noise voltage                              | $V_{NO}$      | $V_{IN} = 3.5 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$10 \text{ Hz} \leq f \leq 100 \text{ kHz}$      | —     | 52    | —     | $\mu\text{V}_{rms}$        |
| Ripple rejection                                  | R.R.          | $V_{IN} = 3.5 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$f = 120 \text{ Hz}$                             | —     | 67    | —     | dB                         |
| Dropout voltage                                   | $V_D$         | $I_{OUT} = 500 \text{ mA}$   | —     | 0.95  | 1.10  | V                          |
|   |               | $I_{OUT} = 1 \text{ A}$  | —     | 1.9   | —     |                            |
| Output control voltage (ON)                       | $V_{EN(ON)}$  | —  | 2     | —     | —     | V                          |
| Output control voltage (OFF)                      | $V_{EN(OFF)}$ | —  | —     | —     | 0.8   | V                          |
| Output control current (ON)                       | $I_{EN(ON)}$  | $V_{IN} = V_{EN} = 3.5 \text{ V}$  | —     | 15    | 100   | $\mu\text{A}$              |
| Average temperature coefficient of output voltage | $T_{CVO}$     | $V_{IN} = 3.5 \text{ V}$ , $I_{OUT} = 5 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | —     | 0.14  | —     | $\text{mV}/^\circ\text{C}$ |

## TA48S018AF

### Electrical Characteristics

(Unless otherwise specified,  $V_{EN} = V_{IN}$ ,  $C_{IN} = 0.33 \mu\text{F}$ ,  $C_{OUT} = 3.3 \mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

| Characteristic                                    | Symbol        | Test Condition   | Min   | Typ.  | Max   | Unit                       |
|---|---------------|--|-------|-------|-------|----------------------------|
| Output voltage                                    | $V_{OUT}$     | $V_{IN} = 3.8 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$  | 1.746 | 1.800 | 1.854 | V                          |
| Line regulation                                   | Reg·line      | $3.4 \text{ V} \leq V_{IN} \leq 6.8 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$                                | —     | 5.6   | 20.0  | mV                         |
| Load regulation                                   | Reg·load      | $V_{IN} = 3.8 \text{ V}$ , $5 \text{ mA} \leq I_{OUT} \leq 1 \text{ A}$                                    | —     | 2.4   | 20.0  | mV                         |
| Quiescent current                                 | $I_B$         | $3.4 \text{ V} \leq V_{IN} \leq 6.8 \text{ V}$ , $I_{OUT} = 0 \text{ A}$                                   | —     | 0.85  | 1.70  | mA                         |
|   |               | $3.4 \text{ V} \leq V_{IN} \leq 6.8 \text{ V}$ , $I_{OUT} = 1 \text{ A}$                                   | —     | 10    | 20    |                            |
| Quiescent current (OFF mode)                      | $I_{B(OFF)}$  | $3.4 \text{ V} \leq V_{IN} \leq 6.8 \text{ V}$ , $V_{EN} = 0.4 \text{ V}$                                  | —     | 0.5   | 5.0   | $\mu\text{A}$              |
| Starting quiescent current                        | $I_{Bstart}$  | $V_{IN} = 2.1 \text{ V}$ , $I_{OUT} = 0 \text{ A}$   | —     | 0.7   | 2.3   | mA                         |
|   |               | $V_{IN} = 3.4 \text{ V}$ , $I_{OUT} = 1 \text{ A}$   | —     | 14.0  | 28.5  |                            |
| Output noise voltage                              | $V_{NO}$      | $V_{IN} = 3.8 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$10 \text{ Hz} \leq f \leq 100 \text{ kHz}$      | —     | 61    | —     | $\mu\text{V}_{rms}$        |
| Ripple rejection                                  | R.R.          | $V_{IN} = 3.8 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$f = 120 \text{ Hz}$                             | —     | 67    | —     | dB                         |
| Dropout voltage                                   | $V_D$         | $I_{OUT} = 500 \text{ mA}$   | —     | 0.41  | 0.50  | V                          |
|   |               | $I_{OUT} = 1 \text{ A}$  | —     | 1.6   | —     |                            |
| Output control voltage (ON)                       | $V_{EN(ON)}$  | —  | 2     | —     | —     | V                          |
| Output control voltage (OFF)                      | $V_{EN(OFF)}$ | —  | —     | —     | 0.8   | V                          |
| Output control current (ON)                       | $I_{EN(ON)}$  | $V_{IN} = V_{EN} = 3.8 \text{ V}$  | —     | 17    | 100   | $\mu\text{A}$              |
| Average temperature coefficient of output voltage | $T_{CVO}$     | $V_{IN} = 3.8 \text{ V}$ , $I_{OUT} = 5 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | —     | 0.15  | —     | $\text{mV}/^\circ\text{C}$ |

## TA48S025AF

### Electrical Characteristics

(Unless otherwise specified,  $V_{EN} = V_{IN}$ ,  $C_{IN} = 0.33 \mu\text{F}$ ,  $C_{OUT} = 3.3 \mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

| Characteristic                                    | Symbol        | Test Condition   | Min   | Typ.  | Max   | Unit                       |
|---|---------------|--|-------|-------|-------|----------------------------|
| Output voltage                                    | $V_{OUT}$     | $V_{IN} = 4.5 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$  | 2.425 | 2.500 | 2.575 | V                          |
| Line regulation                                   | Reg·line      | $3.5 \text{ V} \leq V_{IN} \leq 7.5 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$                                | —     | 6.7   | 20.0  | mV                         |
| Load regulation                                   | Reg·load      | $V_{IN} = 4.5 \text{ V}$ , $5 \text{ mA} \leq I_{OUT} \leq 1 \text{ A}$                                    | —     | 2.9   | 20.0  | mV                         |
| Quiescent current                                 | $I_B$         | $3.5 \text{ V} \leq V_{IN} \leq 7.5 \text{ V}$ , $I_{OUT} = 0 \text{ A}$                                   | —     | 0.85  | 1.70  | mA                         |
|   |               | $3.5 \text{ V} \leq V_{IN} \leq 7.5 \text{ V}$ , $I_{OUT} = 1 \text{ A}$                                   | —     | 10    | 20    |                            |
| Quiescent current (OFF mode)                      | $I_{B(OFF)}$  | $3.5 \text{ V} \leq V_{IN} \leq 7.5 \text{ V}$ , $V_{EN} = 0.4 \text{ V}$                                  | —     | 0.5   | 5.0   | $\mu\text{A}$              |
| Starting quiescent current                        | $I_{Bstart}$  | $V_{IN} = 2.1 \text{ V}$ , $I_{OUT} = 0 \text{ A}$   | —     | 2.2   | 3.5   | mA                         |
|   |               | $V_{IN} = 3.4 \text{ V}$ , $I_{OUT} = 1 \text{ A}$   | —     | 16.0  | 28.5  |                            |
| Output noise voltage                              | $V_{NO}$      | $V_{IN} = 4.5 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$10 \text{ Hz} \leq f \leq 100 \text{ kHz}$      | —     | 82    | —     | $\mu\text{V}_{rms}$        |
| Ripple rejection                                  | R.R.          | $V_{IN} = 4.5 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$f = 120 \text{ Hz}$                             | —     | 65    | —     | dB                         |
| Dropout voltage                                   | $V_D$         | $I_{OUT} = 500 \text{ mA}$   | —     | 0.32  | 0.50  | V                          |
|   |               | $I_{OUT} = 1 \text{ A}$  | —     | 0.88  | —     |                            |
| Output control voltage (ON)                       | $V_{EN(ON)}$  | —  | 2     | —     | —     | V                          |
| Output control voltage (OFF)                      | $V_{EN(OFF)}$ | —  | —     | —     | 0.8   | V                          |
| Output control current (ON)                       | $I_{EN(ON)}$  | $V_{IN} = V_{EN} = 4.5 \text{ V}$  | —     | 22    | 100   | $\mu\text{A}$              |
| Average temperature coefficient of output voltage | $T_{CVO}$     | $V_{IN} = 4.5 \text{ V}$ , $I_{OUT} = 5 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | —     | 0.2   | —     | $\text{mV}/^\circ\text{C}$ |

## TA48S033AF

### Electrical Characteristics

(Unless otherwise specified,  $V_{EN} = V_{IN}$ ,  $C_{IN} = 0.33 \mu\text{F}$ ,  $C_{OUT} = 3.3 \mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

| Characteristic                                    | Symbol        | Test Condition   | Min   | Typ.  | Max   | Unit                       |
|---|---------------|--|-------|-------|-------|----------------------------|
| Output voltage                                    | $V_{OUT}$     | $V_{IN} = 5.3 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$  | 3.201 | 3.300 | 3.399 | V                          |
| Line regulation                                   | Reg·line      | $4.3 \text{ V} \leq V_{IN} \leq 8.3 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$                                | —     | 8.3   | 20.0  | mV                         |
| Load regulation                                   | Reg·load      | $V_{IN} = 5.3 \text{ V}$ , $5 \text{ mA} \leq I_{OUT} \leq 1 \text{ A}$                                    | —     | 3.7   | 20.0  | mV                         |
| Quiescent current                                 | $I_B$         | $4.3 \text{ V} \leq V_{IN} \leq 8.3 \text{ V}$ , $I_{OUT} = 0 \text{ A}$                                   | —     | 0.85  | 1.70  | mA                         |
|   |               | $4.3 \text{ V} \leq V_{IN} \leq 8.3 \text{ V}$ , $I_{OUT} = 1 \text{ A}$                                   | —     | 10    | 20    |                            |
| Quiescent current (OFF mode)                      | $I_{B(OFF)}$  | $4.3 \text{ V} \leq V_{IN} \leq 8.3 \text{ V}$ , $V_{EN} = 0.4 \text{ V}$                                  | —     | 0.5   | 5.0   | $\mu\text{A}$              |
| Starting quiescent current                        | $I_{Bstart}$  | $V_{IN} = 2.1 \text{ V}$ , $I_{OUT} = 0 \text{ A}$   | —     | 3.3   | 4.0   | mA                         |
|   |               | $V_{IN} = 3.5 \text{ V}$ , $I_{OUT} = 1 \text{ A}$   | —     | 17.0  | 28.5  |                            |
| Output noise voltage                              | $V_{NO}$      | $V_{IN} = 5.3 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$10 \text{ Hz} \leq f \leq 100 \text{ kHz}$      | —     | 100   | —     | $\mu\text{V}_{rms}$        |
| Ripple rejection                                  | R.R.          | $V_{IN} = 5.3 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$f = 120 \text{ Hz}$                             | —     | 63    | —     | dB                         |
| Dropout voltage                                   | $V_D$         | $I_{OUT} = 500 \text{ mA}$   | —     | 0.32  | 0.50  | V                          |
|   |               | $I_{OUT} = 1 \text{ A}$  | —     | 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)                       | $I_{EN(ON)}$  | $V_{IN} = V_{EN} = 5.3 \text{ V}$  | —     | 27    | 100   | $\mu\text{A}$              |
| Average temperature coefficient of output voltage | $T_{CVO}$     | $V_{IN} = 5.3 \text{ V}$ , $I_{OUT} = 5 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | —     | 0.3   | —     | $\text{mV}/^\circ\text{C}$ |

## TA48S05AF

### Electrical Characteristics

(Unless otherwise specified,  $V_{EN} = V_{IN}$ ,  $C_{IN} = 0.33 \mu\text{F}$ ,  $C_{OUT} = 3.3 \mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

| Characteristic                                    | Symbol        | Test Condition   | Min  | Typ. | Max  | Unit                       |
|---|---------------|--|------|------|------|----------------------------|
| Output voltage                                    | $V_{OUT}$     | $V_{IN} = 7 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$  | 4.85 | 5.00 | 5.15 | V                          |
| Line regulation                                   | Reg·line      | $6 \text{ V} \leq V_{IN} \leq 10 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$                                 | —    | 10   | 20   | mV                         |
| Load regulation                                   | Reg·load      | $V_{IN} = 7 \text{ V}$ , $5 \text{ mA} \leq I_{OUT} \leq 1 \text{ A}$                                    | —    | 4.2  | 20.0 | mV                         |
| Quiescent current                                 | $I_B$         | $6 \text{ V} \leq V_{IN} \leq 10 \text{ V}$ , $I_{OUT} = 0 \text{ A}$                                    | —    | 0.85 | 1.70 | mA                         |
|   |               | $6 \text{ V} \leq V_{IN} \leq 10 \text{ V}$ , $I_{OUT} = 1 \text{ A}$                                    | —    | 10   | 20   |                            |
| Quiescent current (OFF mode)                      | $I_{B(OFF)}$  | $6 \text{ V} \leq V_{IN} \leq 10 \text{ V}$ , $V_{EN} = 0.4 \text{ V}$                                   | —    | 0.5  | 5.0  | $\mu\text{A}$              |
| Starting quiescent current                        | $I_{Bstart}$  | $V_{IN} = 2.1 \text{ V}$ , $I_{OUT} = 0 \text{ A}$   | —    | 2.5  | 4.2  | mA                         |
|   |               | $V_{IN} = 4.5 \text{ V}$ , $I_{OUT} = 1 \text{ A}$   | —    | 18.0 | 28.5 |                            |
| Output noise voltage                              | $V_{NO}$      | $V_{IN} = 7 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$10 \text{ Hz} \leq f \leq 100 \text{ kHz}$      | —    | 140  | —    | $\mu\text{V}_{rms}$        |
| Ripple rejection                                  | R.R.          | $V_{IN} = 7 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$f = 120 \text{ Hz}$                             | —    | 60   | —    | dB                         |
| Dropout voltage                                   | $V_D$         | $I_{OUT} = 500 \text{ mA}$   | —    | 0.32 | 0.50 | V                          |
|   |               | $I_{OUT} = 1 \text{ A}$  | —    | 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)                       | $I_{EN(ON)}$  | $V_{IN} = V_{EN} = 7 \text{ V}$  | —    | 40   | 100  | $\mu\text{A}$              |
| Average temperature coefficient of output voltage | $T_{CVO}$     | $V_{IN} = 7 \text{ V}$ , $I_{OUT} = 5 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | —    | 0.45 | —    | $\text{mV}/^\circ\text{C}$ |

## TA48S09AF

### Electrical Characteristics

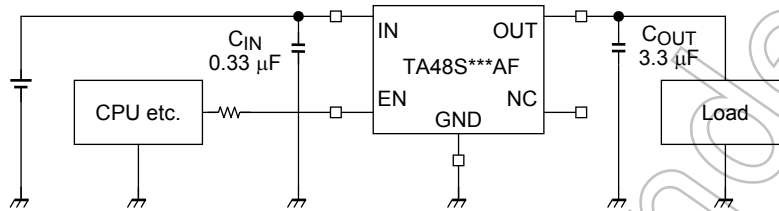
(Unless otherwise specified,  $V_{EN} = V_{IN}$ ,  $C_{IN} = 0.33 \mu\text{F}$ ,  $C_{OUT} = 3.3 \mu\text{F}$ ,  $T_j = 25^\circ\text{C}$ )

| Characteristic                                    | Symbol        | Test Condition  | Min  | Typ. | Max  | Unit                       |
|---|---------------|---|------|------|------|----------------------------|
| Output voltage                                    | $V_{OUT}$     | $V_{IN} = 11 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$  | 8.73 | 9.00 | 9.27 | V                          |
| Line regulation                                   | Reg·line      | $10 \text{ V} \leq V_{IN} \leq 14 \text{ V}$ , $I_{OUT} = 500 \text{ mA}$                                 | —    | 12.5 | 20.0 | mV                         |
| Load regulation                                   | Reg·load      | $V_{IN} = 11 \text{ V}$ , $5 \text{ mA} \leq I_{OUT} \leq 1 \text{ A}$                                    | —    | 9.4  | 30.0 | mV                         |
| Quiescent current                                 | $I_B$         | $10 \text{ V} \leq V_{IN} \leq 14 \text{ V}$ , $I_{OUT} = 0 \text{ A}$                                    | —    | 0.9  | 1.7  | mA                         |
|   |               | $10 \text{ V} \leq V_{IN} \leq 14 \text{ V}$ , $I_{OUT} = 1 \text{ A}$                                    | —    | 10   | 20   |                            |
| Quiescent current (OFF mode)                      | $I_{B(OFF)}$  | $10 \text{ V} \leq V_{IN} \leq 14 \text{ V}$ , $V_{EN} = 0.4 \text{ V}$                                   | —    | 0.5  | 5.0  | $\mu\text{A}$              |
| Starting quiescent current                        | $I_{Bstart}$  | $V_{IN} = 2.1 \text{ V}$ , $I_{OUT} = 0 \text{ A}$  | —    | 2.6  | 4.4  | mA                         |
|   |               | $V_{IN} = 8.2 \text{ V}$ , $I_{OUT} = 1 \text{ A}$  | —    | 20.0 | 28.5 |                            |
| Output noise voltage                              | $V_{NO}$      | $V_{IN} = 11 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$10 \text{ Hz} \leq f \leq 100 \text{ kHz}$      | —    | 205  | —    | $\mu\text{V}_{rms}$        |
| Ripple rejection                                  | R.R.          | $V_{IN} = 11 \text{ V}$ , $I_{OUT} = 50 \text{ mA}$ ,<br>$f = 120 \text{ Hz}$                             | —    | 55   | —    | dB                         |
| Dropout voltage                                   | $V_D$         | $I_{OUT} = 500 \text{ mA}$  | —    | 0.32 | 0.50 | V                          |
|   |               | $I_{OUT} = 1 \text{ A}$   | —    | 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)                       | $I_{EN(ON)}$  | $V_{IN} = V_{EN} = 11 \text{ V}$  | —    | 67   | 100  | $\mu\text{A}$              |
| Average temperature coefficient of output voltage | $T_{CVO}$     | $V_{IN} = 11 \text{ V}$ , $I_{OUT} = 5 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | —    | 0.8  | —    | $\text{mV}/^\circ\text{C}$ |

## Electrical Characteristics Common to All Products

- $T_j = 25^\circ\text{C}$  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.

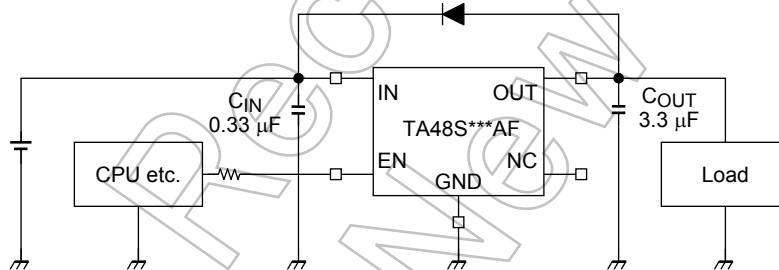
## Standard Application Circuit



- 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.

## Usage Precautions

- 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.
- Low voltage  
Do not apply voltage to the Product that is lower than the minimum operating voltage, or the Product's protective functions will not operate properly and the Product may be permanently damaged.

- Overcurrent Protection

The overcurrent protection circuits in the Product are designed to temporarily protect Product from minor overcurrent of brief duration. When the overcurrent protective function in the Product activates, immediately cease application of overcurrent to Product. Improper usage of Product, such as application of current to Product exceeding the absolute maximum ratings, could cause the overcurrent protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

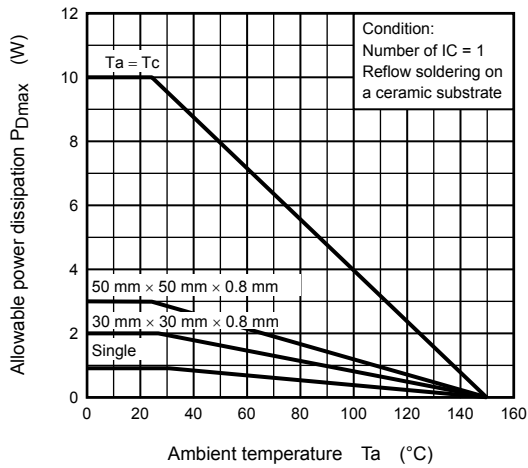
- Overheating Protection

The thermal shutdown circuits in the Product are designed to temporarily protect Product from minor overheating of brief duration. When the overheating protective function in the Product activates, immediately correct the overheating situation. Improper usage of Product, such as the application of heat to Product exceeding the absolute maximum ratings, could cause the overheating protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

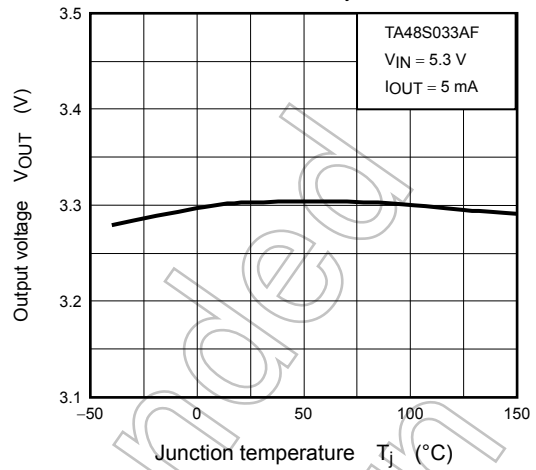
Not Recommended  
for New Design



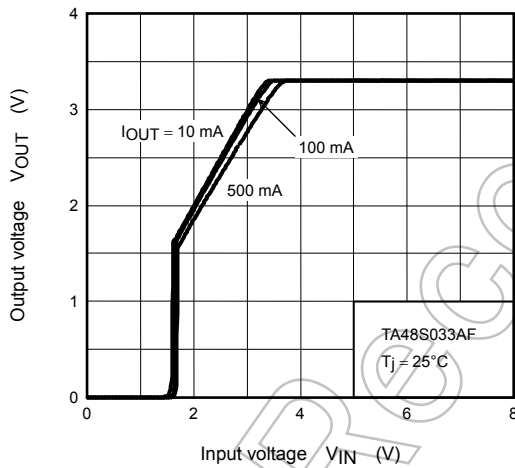
$P_{Dmax} - T_a$



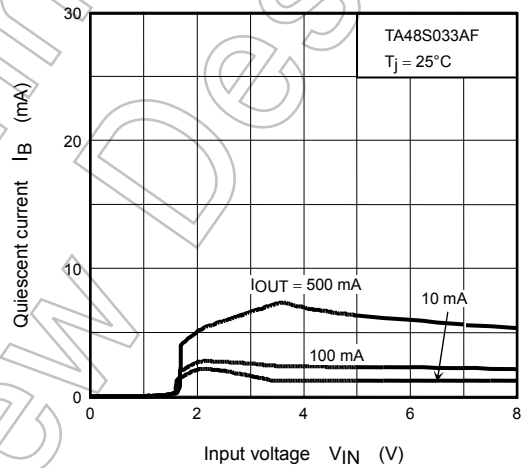
$V_{OUT} - T_j$



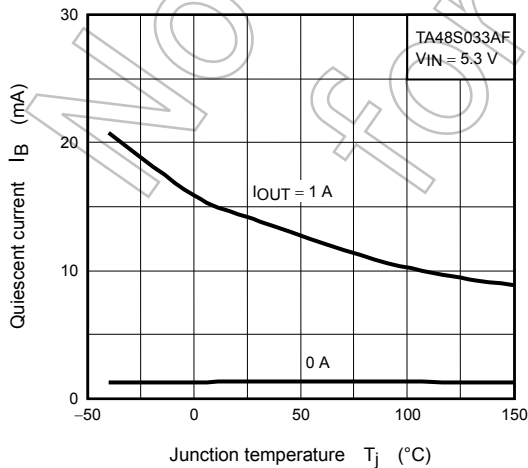
$V_{OUT} - V_{IN}$



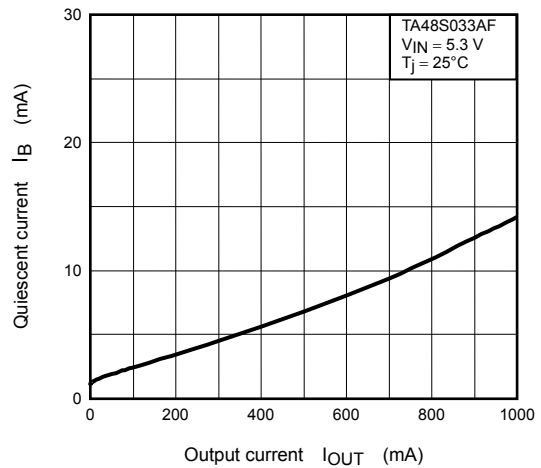
$I_B - V_{IN}$

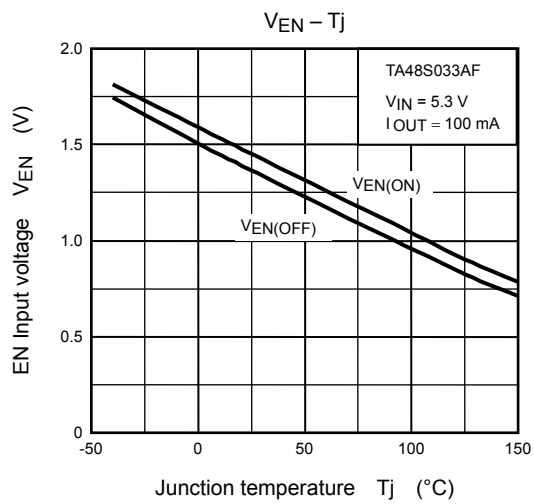
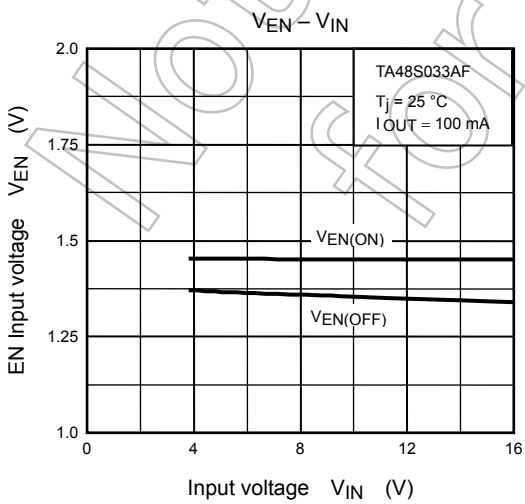
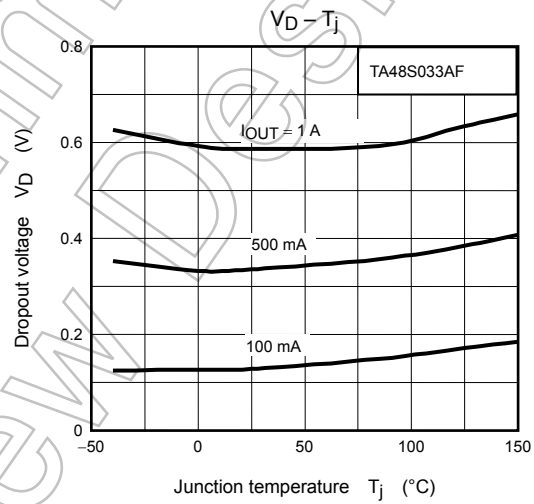
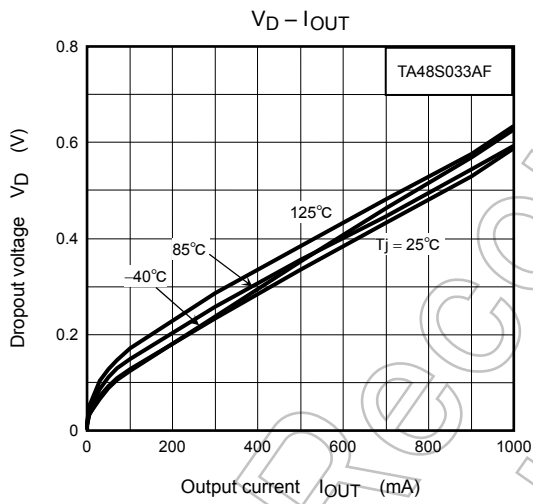
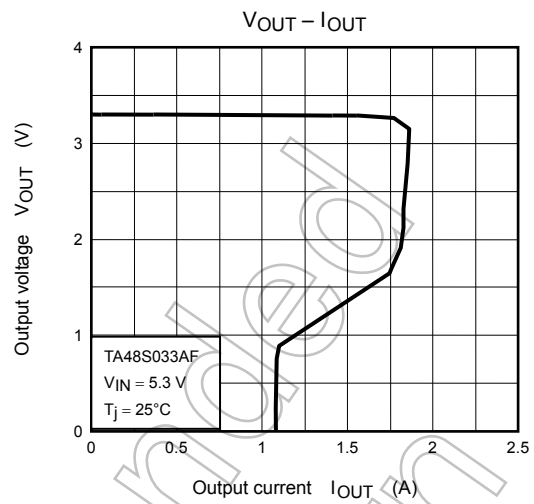
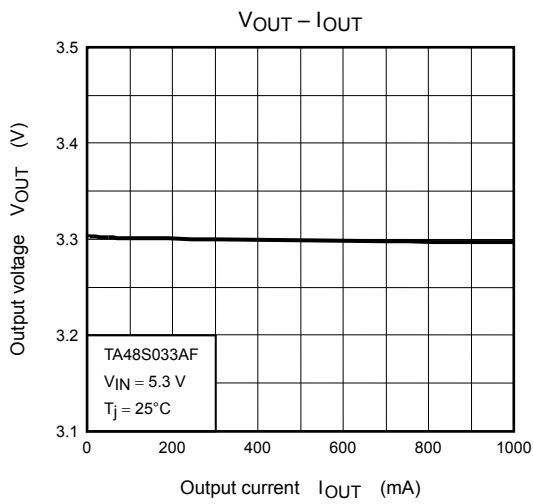


$I_B - T_j$



$I_B - I_{OUT}$

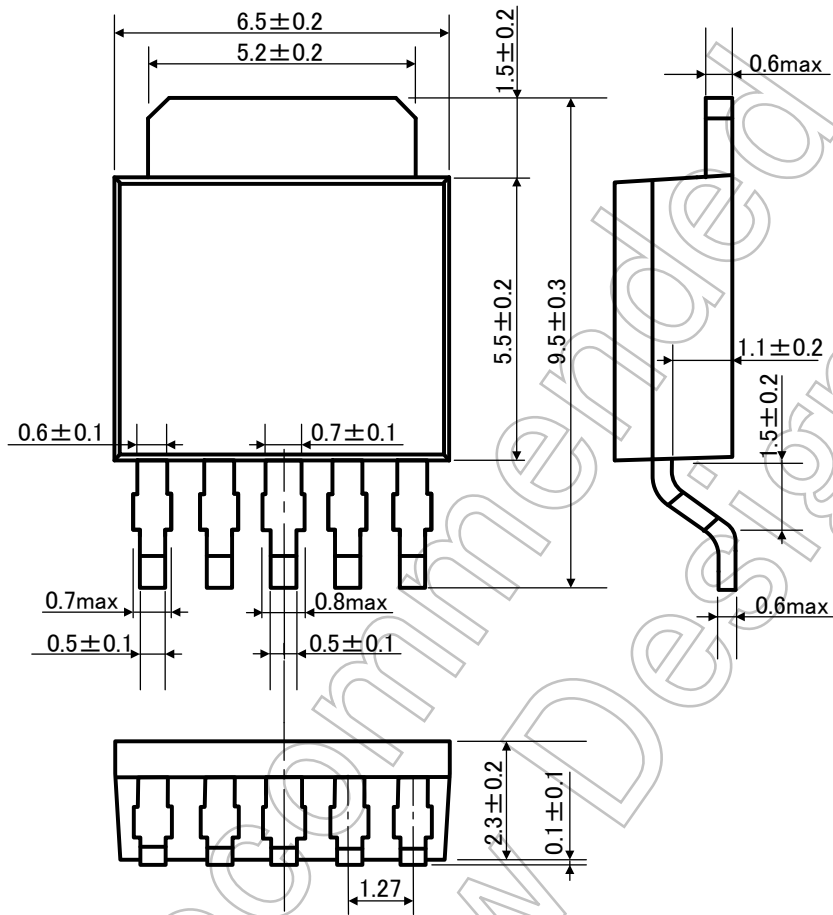




## Package Dimensions

HSIP5-P-1.27B

Unit: mm



Weight: 0.36 g (typ.)

Not Recommended for New Design

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