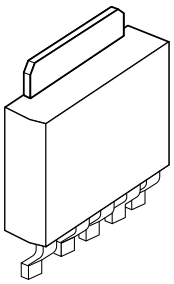
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

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 1.5V, corresponding to the lower voltage of various devices.



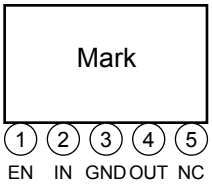
HSIP5-P-1.27B

Weight: 0.36 g (typ.)

Features

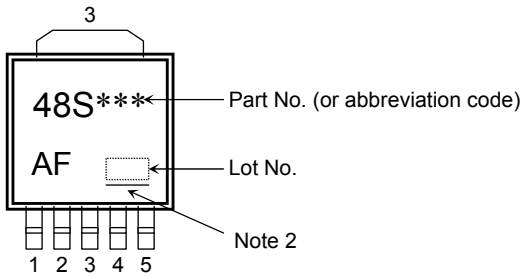
- Built-in ON/OFF control function (active high)
- Maximum output current : 1 A
- Low output voltage : 1.5 / 1.8 / 2.5 / 3.3 / 5.0 / 9.0 V
- Output voltage accuracy : V_{OUT} ± 3% (@Tj = 25°C)
- Low quiescent current : 850 μA (typ.) (@I_{OUT} = 0 A)
  (TA48S09AF : 900 μA (typ.))
- Low standby current (output OFF mode): 0.5 μA (typ.)
- Low-dropout voltage : 0.5 V (max) (@V_{OUT} ≧ 1.8 V, I_{OUT} = 500 m A)
- Protection function : Overcurrent protection /overheating protection
- Package type : Surface-mount 5-pin New PW-Mold

Pin Assignment



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.

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 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Pin Description

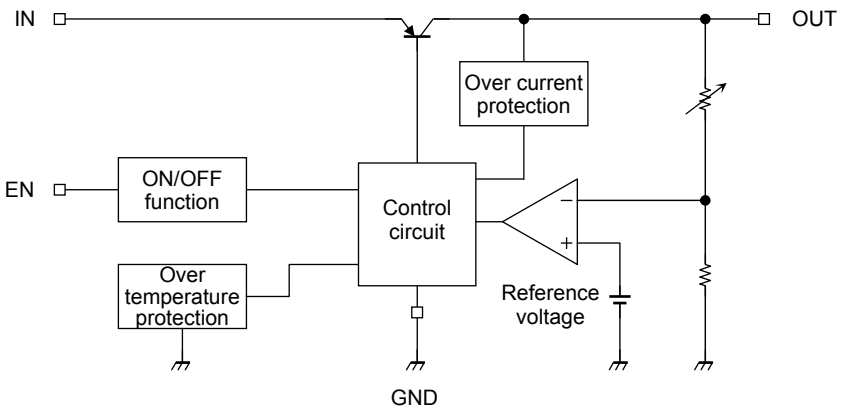
Pin No.	Symbol	Description
1	EN	Output ON/OFF control terminal. Output is ON when this pin is set to "High", OFF when this pin is open or set to "Low".
2	IN	Input terminal. Connected by capacitor (C_{IN}) to GND.
3	GND	Ground terminal
4	OUT	Output terminal. Connected by capacitor (C_{OUT}) to GND.
5	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_{IN}	16	V
EN Input voltage		V_{EN}	16	V
Output current		I_{OUT}	1	A
Operating junction temperature		T_{jopr}	-40 to 150	°C
Junction temperature		T_j	150	°C
Storage temperature		T_{stg}	−55 to 150	°C
Power dissipation	Ta = 25°C	P_D	1	W
	Tc = 25°C		10	

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	$R_{th\ (j-a)}$	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	$V_{OUT} \leqq 1.8V$	V_{IN}	2.5 (Note 6)	—	16.0	V
	$V_{OUT} \geqq 2.5V$		$V_{OUT} + V_D$	—	16.0	

Note 6: This is the voltage at which the IC begins operating. V_D 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_{SD}	V_{IN} = 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	$T_{SD(hys)}$		—	15	—	°C
Peak circuit current	I_{PEAK}	$V_{IN} = V_{OUT}$ + 2 V, T_j = 25°C	—	1.7	—	A
		$V_{IN} = V_{OUT}$ + 5 V, T_j = 25°C	—	2.0	—	
Short circuit current	I_{SC}	$V_{IN} = V_{OUT}$ + 2 V, T_j = 25°C	—	1.1	—	A
		V_{IN} = 16V , T_j = 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, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 3.5 V, I_{OUT} = 500 mA	1.455	1.500	1.545	V
Line regulation	Reg·line	3.4 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 500 mA	—	4.5	20.0	mV
Load regulation	Reg·load	V_{IN} = 3.5V, 5 mA ≤ I_{OUT} ≤ 1 A	—	2	20	mV
Quiescent current	I_B	3.4V ≤ V_{IN} ≤ 6.5V, I_{OUT} = 0 A	—	0.85	1.70	mA
		3.4 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 1 A	—	10	20	
Quiescent current (OFF mode)	$I_{B(OFF)}$	3.4 V ≤ V_{IN} ≤ 6.5 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	—	0.7	2.3	mA
		V_{IN} = 3.4 V, I_{OUT} = 1 A	—	13.0	28.5	
Output noise voltage	V_{NO}	V_{IN} = 3.5 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	52	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 3.5 V, I_{OUT} = 50 mA, f = 120 Hz	—	67	—	dB
Dropout voltage	V_D	I_{OUT} = 500 mA	—	0.95	1.10	V
		I_{OUT} = 1 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 V	—	15	100	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 3.5 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.14	—	mV/°C

TA48S018AF
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 3.8 V, I_{OUT} = 500 mA	1.746	1.800	1.854	V
Line regulation	Reg·line	3.4 V ≤ V_{IN} ≤ 6.8V, I_{OUT} = 500 mA	—	5.6	20.0	mV
Load regulation	Reg·load	V_{IN} = 3.8 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	2.4	20.0	mV
Quiescent current	I_B	3.4 V ≤ V_{IN} ≤ 6.8 V, I_{OUT} = 0 A	—	0.85	1.70	mA
		3.4 V ≤ V_{IN} ≤ 6.8 V, I_{OUT} = 1 A	—	10	20	
Quiescent current (OFF mode)	$I_{B(OFF)}$	3.4 V ≤ V_{IN} ≤ 6.8 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	—	0.7	2.3	mA
		V_{IN} = 3.4 V, I_{OUT} = 1 A	—	14.0	28.5	
Output noise voltage	V_{NO}	V_{IN} = 3.8 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	61	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 3.8 V, I_{OUT} = 50 mA, f = 120 Hz	—	67	—	dB
Dropout voltage	V_D	I_{OUT} = 500 mA	—	0.41	0.50	V
		I_{OUT} = 1 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 V	—	17	100	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 3.8 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.15	—	mV/°C

TA48S025AF
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 4.5 V, I_{OUT} = 500 mA	2.425	2.500	2.575	V
Line regulation	Reg·line	3.5 V ≤ V_{IN} ≤ 7.5 V, I_{OUT} = 500 mA	—	6.7	20.0	mV
Load regulation	Reg·load	V_{IN} = 4.5 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	2.9	20.0	mV
Quiescent current	I_B	3.5 V ≤ V_{IN} ≤ 7.5V, I_{OUT} = 0 A	—	0.85	1.70	mA
		3.5 V ≤ V_{IN} ≤ 7.5V, I_{OUT} = 1 A	—	10	20	
Quiescent current (OFF mode)	$I_{B(OFF)}$	3.5 V ≤ V_{IN} ≤ 7.5 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	—	2.2	3.5	mA
		V_{IN} = 3.4 V, I_{OUT} = 1 A	—	16.0	28.5	
Output noise voltage	V_{NO}	V_{IN} = 4.5 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	82	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 4.5 V, I_{OUT} = 50 mA, f = 120 Hz	—	65	—	dB
Dropout voltage	V_D	I_{OUT} = 500 mA	—	0.32	0.50	V
		I_{OUT} = 1 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 V	—	22	100	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 4.5 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.2	—	mV/°C

TA48S033AF
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 5.3 V, I_{OUT} = 500 mA	3.201	3.300	3.399	V
Line regulation	Reg·line	4.3 V ≤ V_{IN} ≤ 8.3 V, I_{OUT} = 500 mA	—	8.3	20.0	mV
Load regulation	Reg·load	V_{IN} = 5.3 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	3.7	20.0	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	—	μV_{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

TA48S05AF
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 7 V, I_{OUT} = 500 mA	4.85	5.00	5.15	V
Line regulation	Reg·line	6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 500 mA	—	10	20	mV
Load regulation	Reg·load	V_{IN} = 7 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	4.2	20.0	mV
Quiescent current	I_B	6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 0 A	—	0.85	1.70	mA
		6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 1 A	—	10	20	
Quiescent current (OFF mode)	$I_{B(OFF)}$	6 V ≤ V_{IN} ≤ 10 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	—	2.5	4.2	mA
		V_{IN} = 4.5 V, I_{OUT} = 1 A	—	18.0	28.5	
Output noise voltage	V_{NO}	V_{IN} = 7 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	140	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 7 V, I_{OUT} = 50 mA, f = 120 Hz	—	60	—	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)	$I_{EN(ON)}$	$V_{IN} = V_{EN}$ = 7 V	—	40	100	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 7 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.45	—	mV/°C

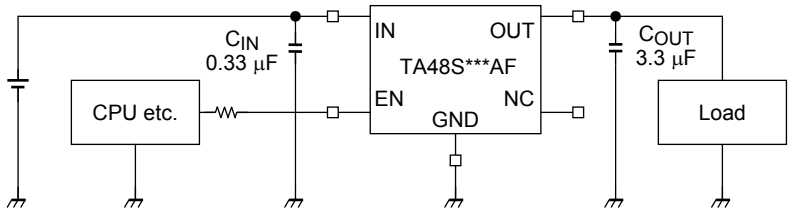
TA48S09AF
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 11 V, I_{OUT} = 500 mA	8.73	9.00	9.27	V
Line regulation	Reg·line	10 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 500 mA	—	12.5	20.0	mV
Load regulation	Reg·load	V_{IN} = 11 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	9.4	30.0	mV
Quiescent current	I_B	10V ≤ V_{IN} ≤ 14 V, I_{OUT} = 0 A	—	0.9	1.7	mA
		10V ≤ V_{IN} ≤ 14 V, I_{OUT} = 1 A	—	10	20	
Quiescent current (OFF mode)	$I_{B(OFF)}$	10 V ≤ V_{IN} ≤ 14 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	—	2.6	4.4	mA
		V_{IN} = 8.2 V, I_{OUT} = 1 A	—	20.0	28.5	
Output noise voltage	V_{NO}	V_{IN} = 11 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	205	—	μV_{rms}
Ripple rejection	R.R.	V_{IN} = 11 V, I_{OUT} = 50 mA, f = 120 Hz	—	55	—	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)	$I_{EN(ON)}$	$V_{IN} = V_{EN}$ = 11 V	—	67	100	μA
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 11 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.8	—	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.

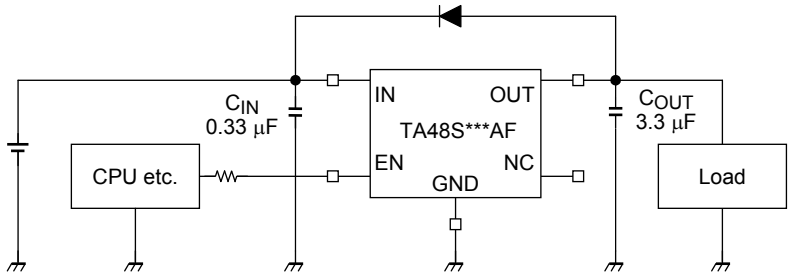
Standard Application Circuit



- 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.

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.

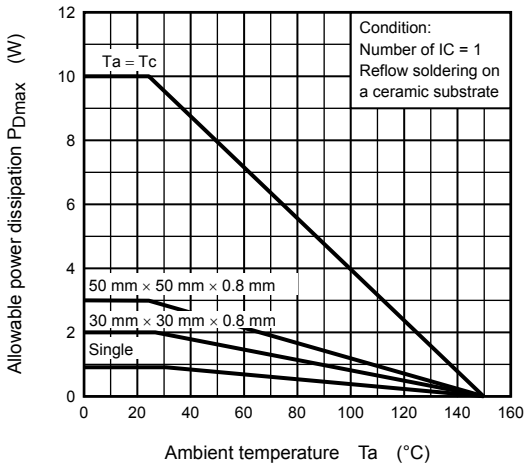
- Overcurrent Protection

  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.

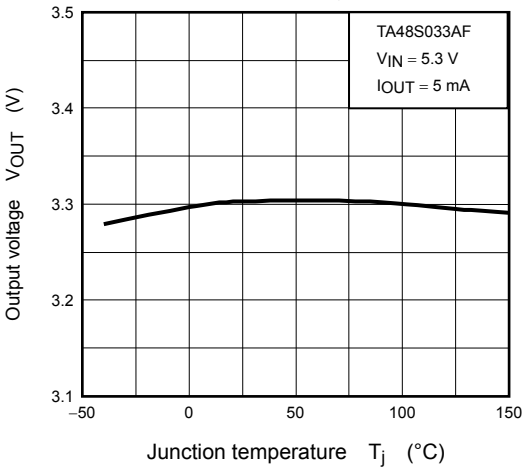
- Overheating Protection

  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.

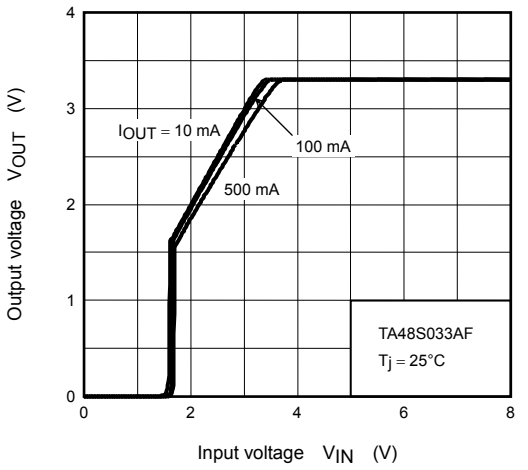
P_{Dmax} – Ta



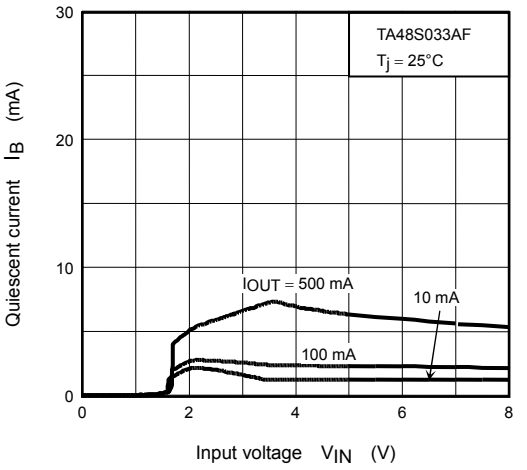
V_{OUT} – T_j



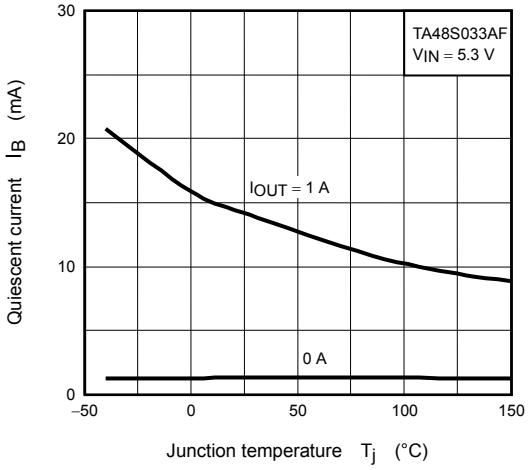
V_{OUT} – V_{IN}



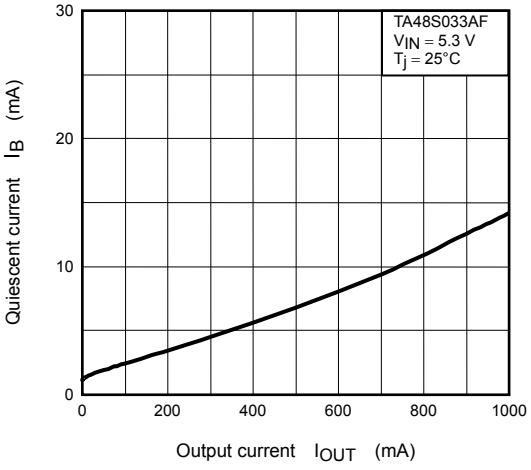
I_B – V_{IN}



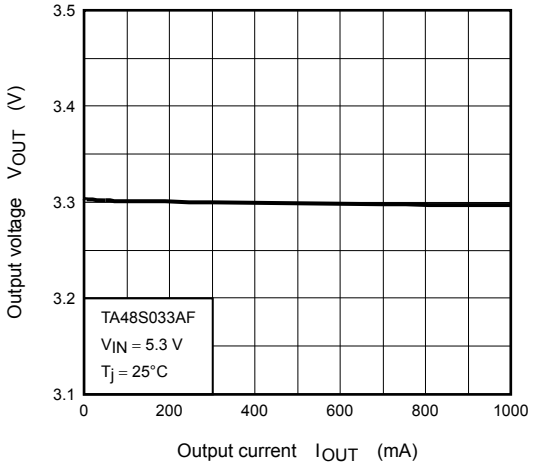
I_B – Tj



I_B – I_{OUT}



$V_{OUT} - I_{OUT}$



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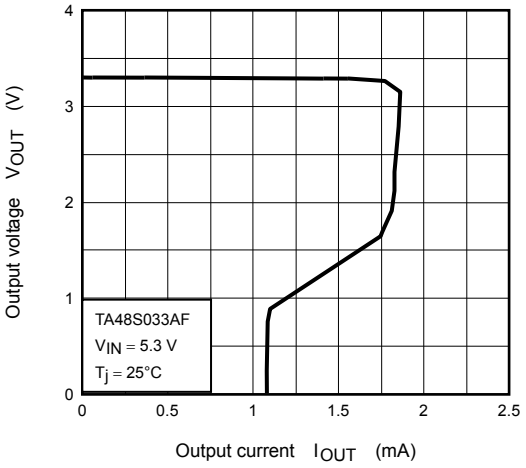
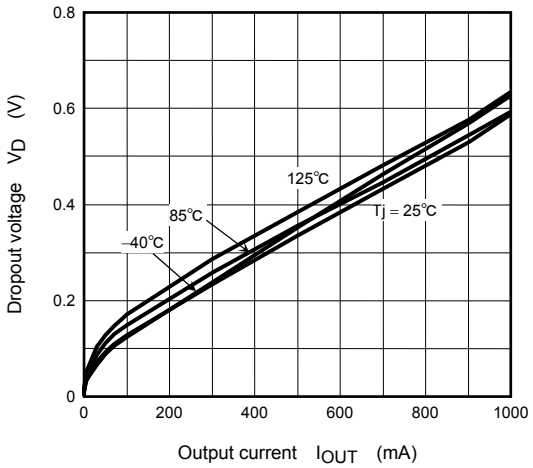
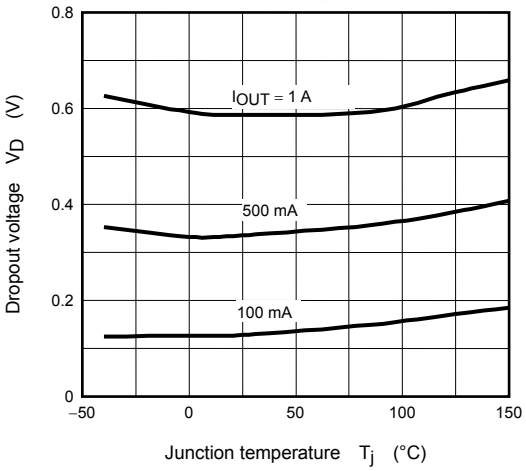


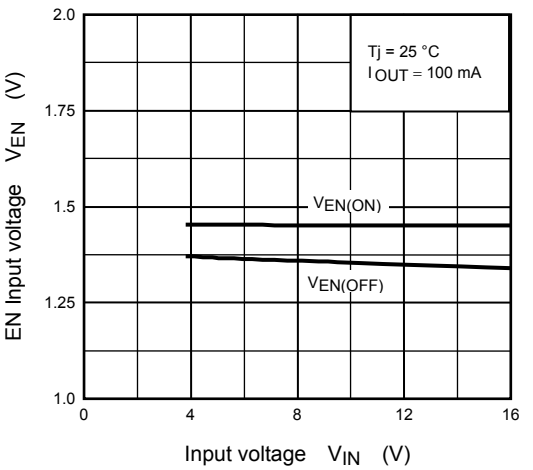
$V_D - I_{OUT}$



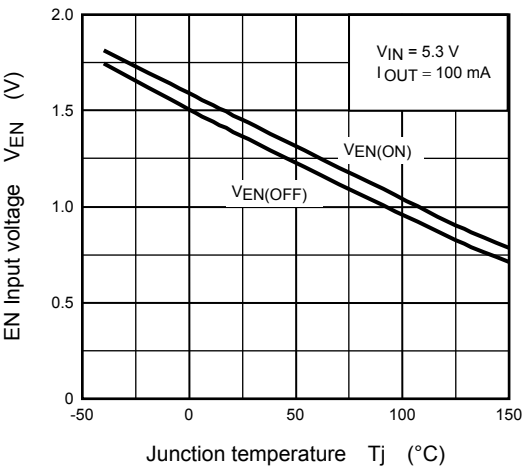
$V_D - T_j$



$V_{EN} - V_{IN}$

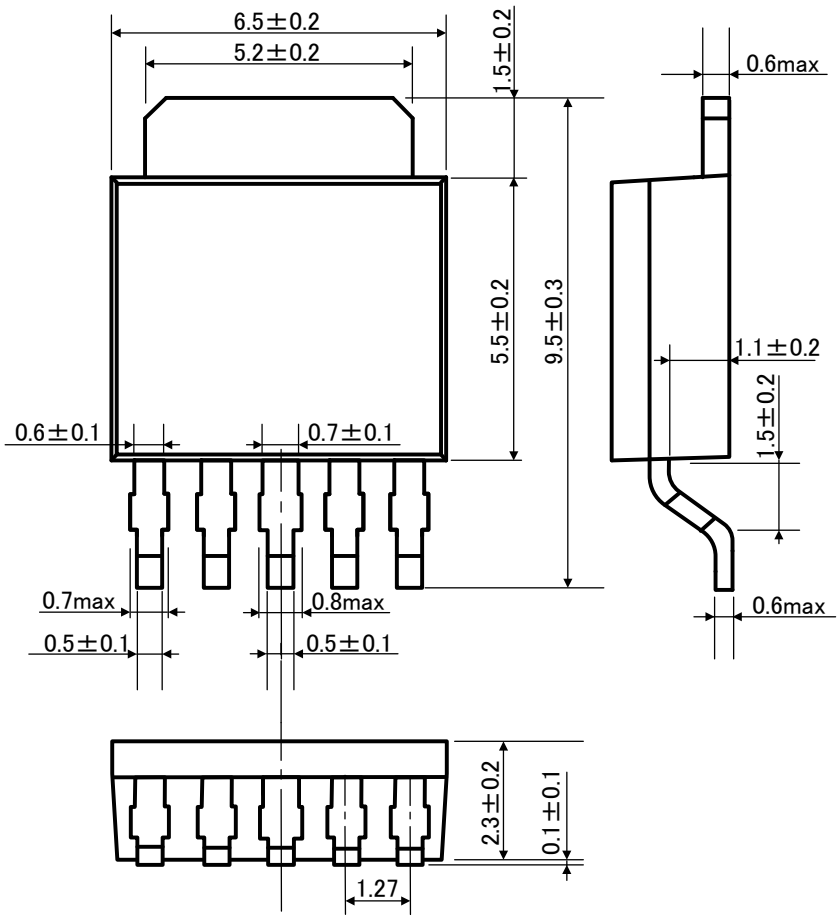


$V_{EN} - Tj$



Package Dimensions

HSIP5-P-1.27B Unit: mm



Weight: 0.36 g (typ.)

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