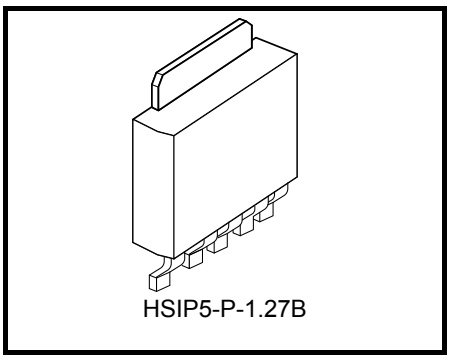
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA48S015AF, TA48S018AF, TA48S025AF, TA48S033AF, TA48S05AF, TA48S09AF

1A 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.

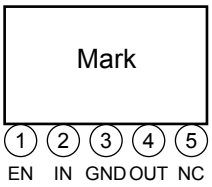


Weight : 0.36 g (Typ.)

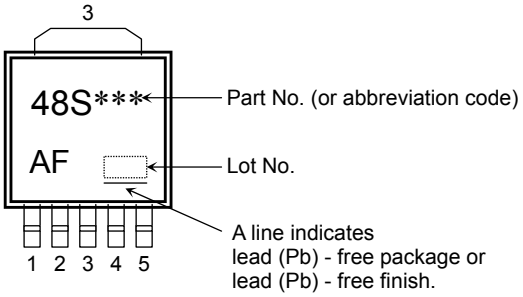
Features

- 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 : 900μA (Typ.))
- Low standby current (output OFF mode): 0.5μA (Typ.)
- Low-dropout voltage : 0.5 V (Max) (@V_{OUT} ≧ 1.8V, I_{OUT} = 500m A)
- Protection function : Over current protection / thermal shutdown
- Package type : Surface-mount New PW-Mold5pin

Pin Assignment



Marking



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

Pin Description

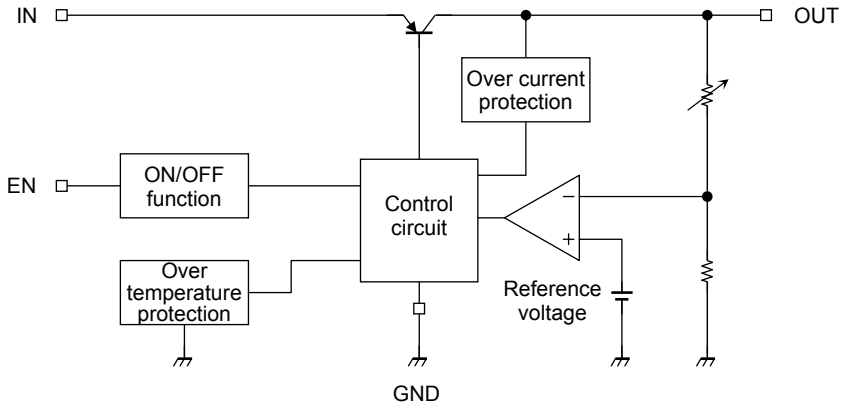
Pin No.	Symbol	Description
1	EN	Output ON/OFF control terminal. Output is ON when this pin is set to “High”, OFF when this pin is open or set to “Low”.
2	IN	Input terminal. Connected by capacitor (C_{IN}) to GND.
3	GND	Ground terminal
4	OUT	Output terminal. Connected by capacitor (C_{OUT}) to GND.
5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

How to Order

Product No.	Package	Package Type and Capacity
TA48S***AF (T6L1,Q) (Note2)	New PW-Mold5pin : Surface-mount	Tape (2000 pcs/reel)

Note 2: 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		$T_{j(opr)}$	-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 3: Do not apply current and voltage (including reverse polarity) to any pin that is not specified.

Note 4: 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(Note4)	—	16.0	V
	$V_{OUT} \geqq 2.5V$		$V_{OUT} + V_D$	—	16.0	

Note 5: 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 (015~018AF) / 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 6: 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

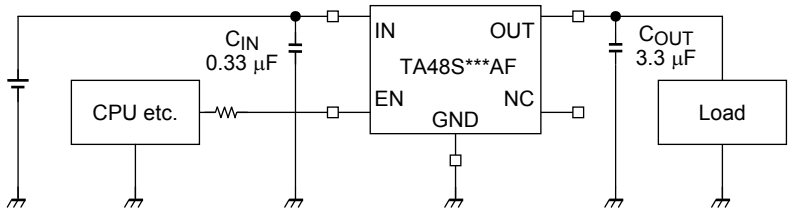
TA48S09AF
Electrical Characteristics
(Unless otherwise specified, $V_{EN} = V_{IN}$, $C_{IN} = 0.33\ \mu F$, $C_{OUT} = 3.3\ \mu F$, $T_j = 25°C$)

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.

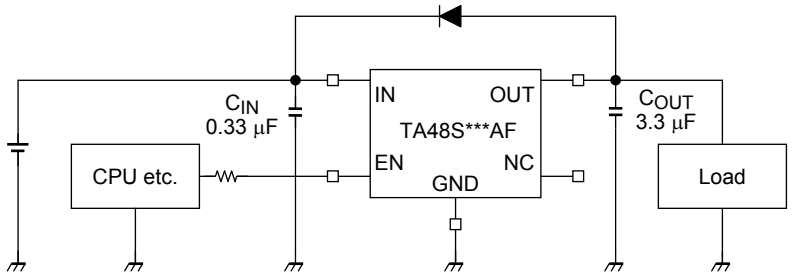
Standard Application Circuit



- 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.

The notice in case of application

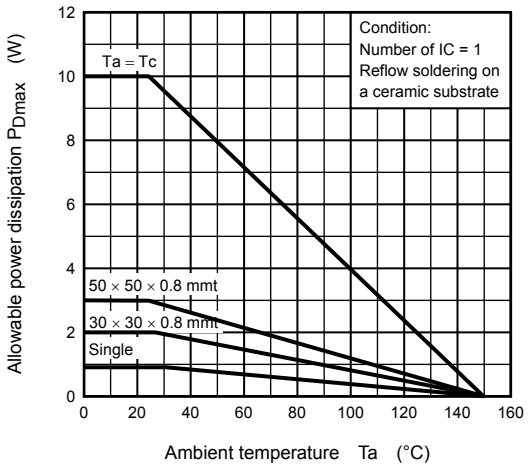
- The IC might be destroyed if a voltage greater than the input terminal voltage is applied to the output terminal, or if the input terminal is connected to GND during operation. To prevent such an occurrence, connect a diode as in the following diagram.



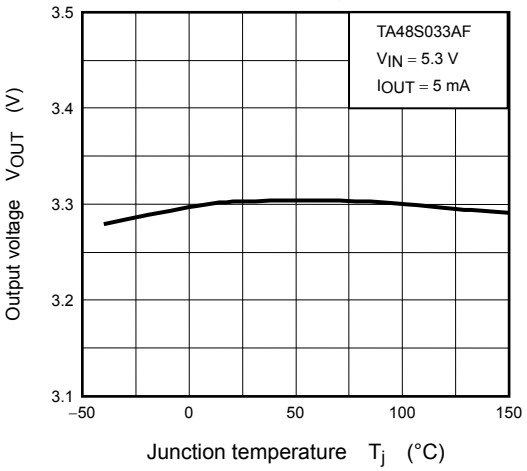
- There is a possibility that internal parasitic devices may be generated when momentary transients cause a terminal's potential to fall below that of the GND terminal. In such case, that the device could be destroyed. The voltage of each terminal and any state must therefore never fall below the GND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

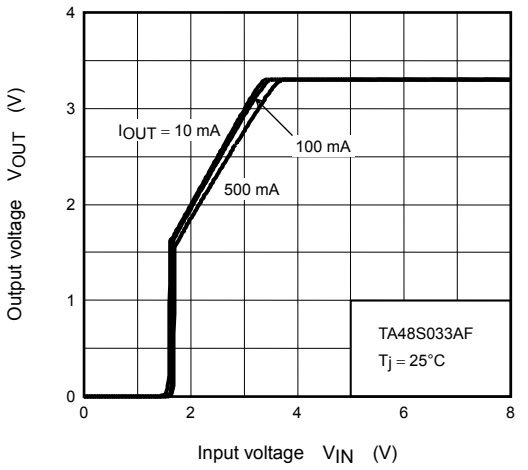
P_{Dmax} – Ta



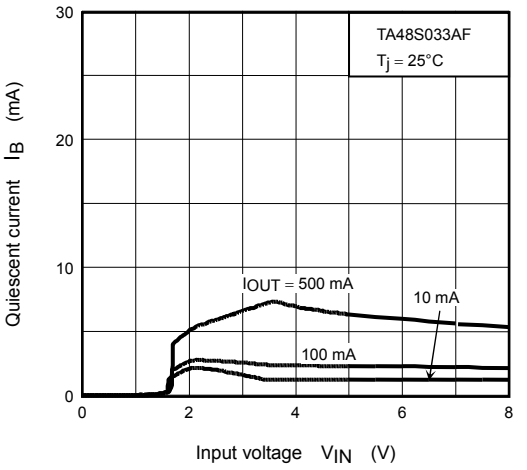
V_{OUT} – T_j



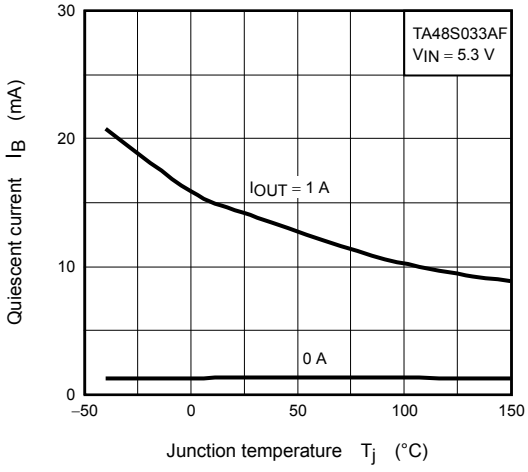
V_{OUT} – V_{IN}



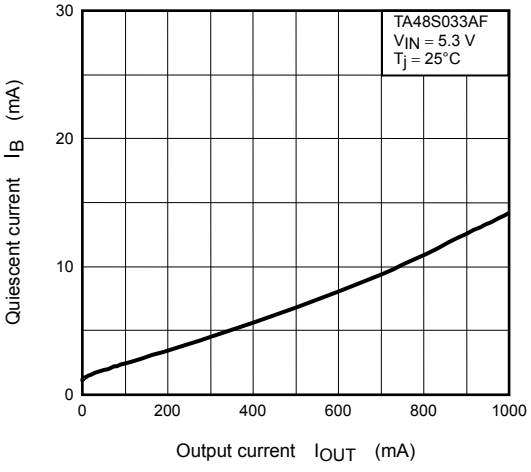
I_B – V_{IN}



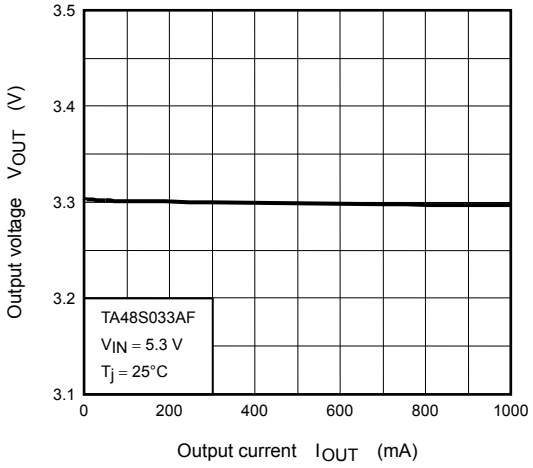
I_B – Tj



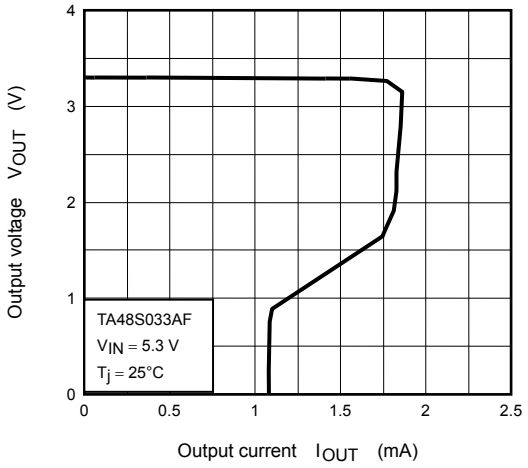
I_B – I_{OUT}



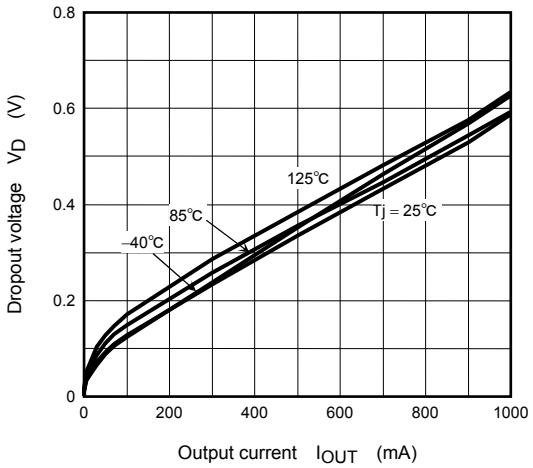
$V_{OUT} - I_{OUT}$



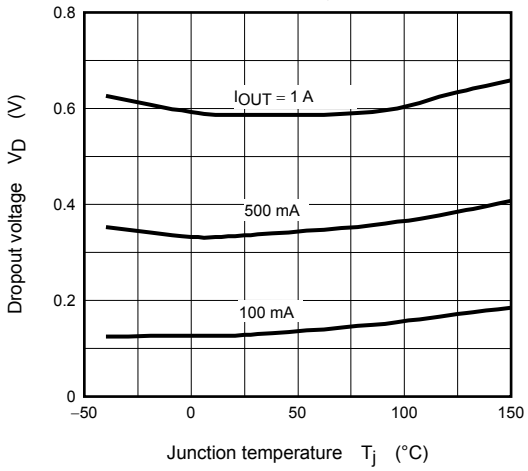
$V_{OUT} - I_{OUT}$



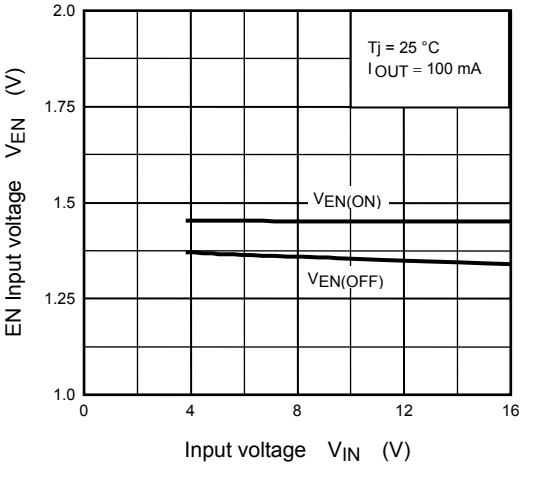
$V_D - I_{OUT}$



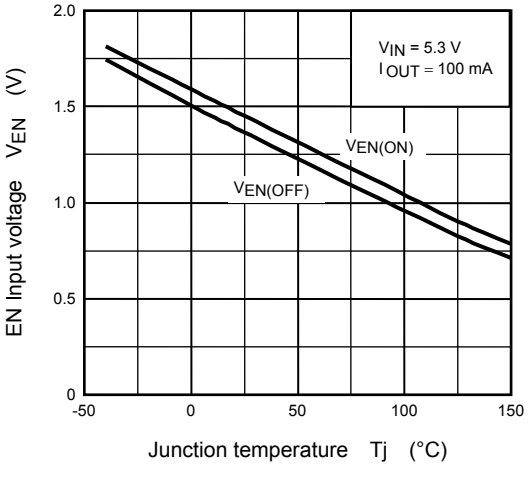
$V_D - T_j$



$V_{EN} - V_{IN}$

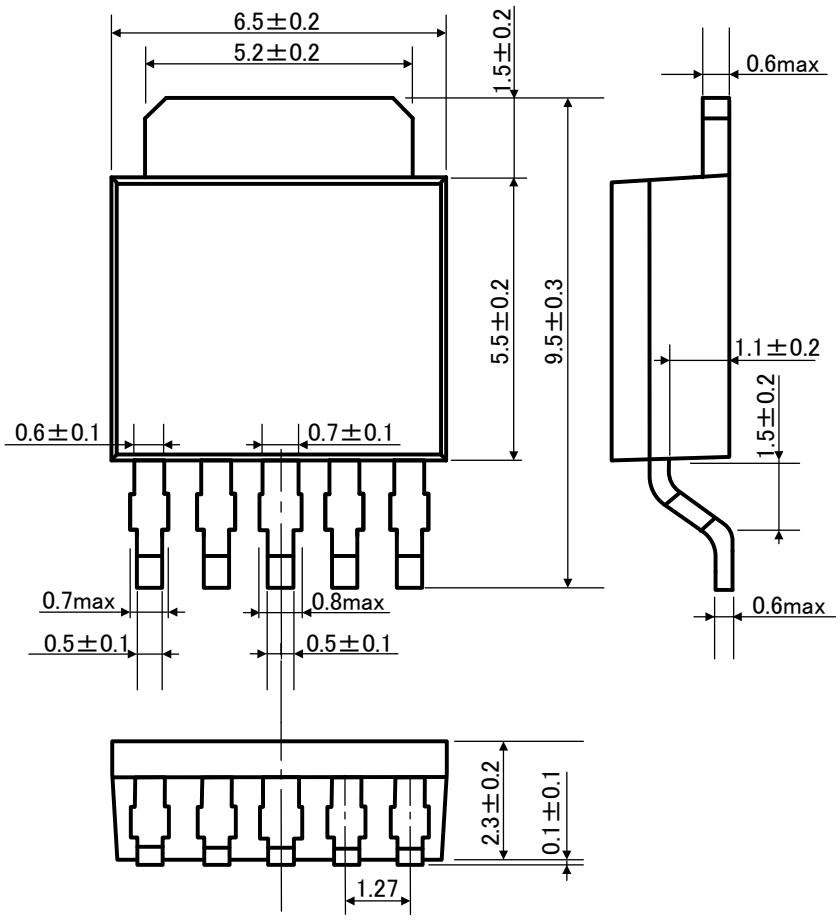


$V_{EN} - Tj$



Package Dimensions

HSIP5-P-1.27B Unit : mm



Weight: 0.36 g (typ.)

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20070701-EN

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