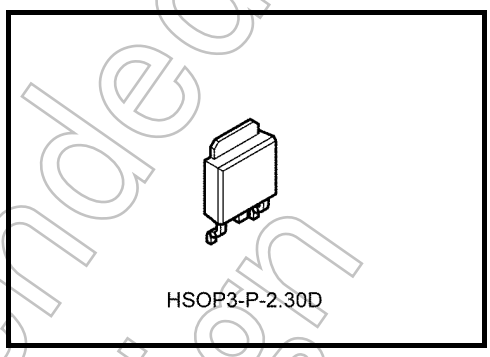
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA48015BF,TA48018BF,TA48025BF TA48033BF,TA4805BF,TA4808BF,TA4809BF

1 A Three-Terminal Low-Dropout Voltage Regulator

The TA48***BF series consists of fixed-positive-output, low-dropout regulators with an output current of 1 A (max) that utilize V-PNP transistors for the output stage. In response to the need for low-voltage and low-power dissipation devices for use in consumer electronics and industrial appliances, the series offers devices with low output voltages:1.5 V, 1.8 V, 2.5 V, 3.3 V, 5 V, 8 V, 9 V

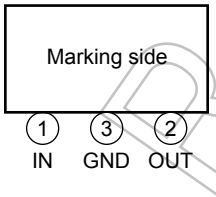


Weight
HSOP3-P-2.30D : 0.36 g (typ.)

Features

- Maximum output current: 1 A
- Low output voltage : 1.5 / 1.8 / 2.5 / 3.3 / 5.0 / 8.0 / 9.0 V
- Output voltage accuracy : V_{OUT} ± 3% (@T_j = 25°C)
- Low standby current : 850 μA (typ.) (@I_{OUT} = 0 A)
- Low starting quiescent current
- Low-dropout voltage : V_D = 0.5 V (max) (@I_{OUT} = 0.5 A)
  (1.1V only for TA48015BF)
- C_{OUT} (reference) : 2.2 μF(multi-layer ceramic type)
- Protection function : Overcurrent protection / overheating protection / SOA
- Package type : Surface-mount New PW-Mold

Pin Assignment

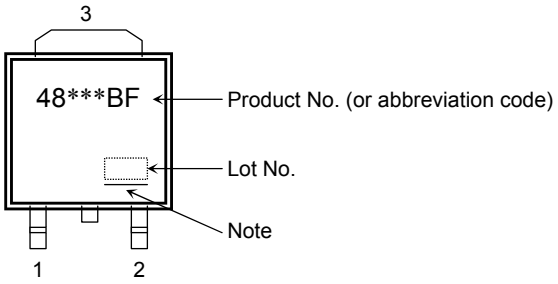


The product(s) in this document (“Product”) contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product into your system, 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.

Start of commercial production
2008-10

Marking

TA48***BF Series



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

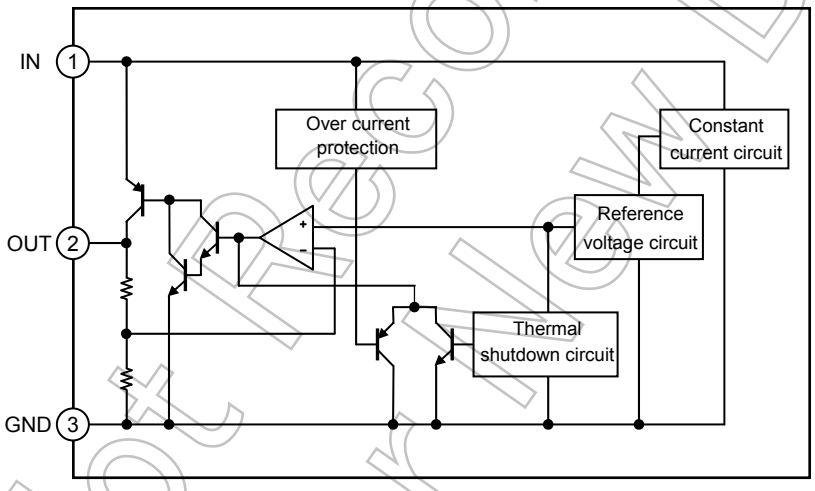
Note1: The "***" part of each product number varies according to the output voltage of the product.

How to Order

Product No.	Package	Packing Type and Unit for Orders
TA48***BF (T6L1, NQ) (Note2)	New PW-Mold: 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 Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Input voltage		V_{IN}	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 1: Do not apply external current and voltage (including negative voltage) to non-specified pins.

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

Protection Function (reference)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Thermal shutdown	T_{SD}	V_{IN} = 3.4 V (015 to 018BF) / 3.5 V (025BF) 4.3 V (033BF) / 6.0 V (05BF) / 9.0 V (08BF) / 10.0 V (09BF)	150	175	—	°C
Thermal shutdown hysteresis width	T_{SD}(hys)		—	20	—	°C
Peak circuit current	I_{PEAK}	$V_{IN} = V_{OUT}$ + 2 V, T_j = 25°C	—	1.7	—	A
		V_{IN} = 12 V, T_j = 25°C	—	1.8	—	
Short circuit current	I_{SC}	$V_{IN} = V_{OUT}$ + 2 V, T_j = 25°C	—	1.2	—	A
		V_{IN} = 12 V, T_j = 25°C	—	1.3	—	

Note 3: Ensure that the devices operate within the limits of the maximum rating when in actual use.

TA48015BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 3.5 V, I_{OUT} = 0.5 A	1.455	1.500	1.545	V
		3.4 V ≤ V_{IN} ≤ 6.5 V, 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	1.44	1.50	1.56	
Line regulation	Reg·line	3.4 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 0.5 A	—	4.5	20.0	mV
Load regulation	Reg·load	V_{IN} = 3.5 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	2	20	mV
Quiescent current	I_B	3.4 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 0 A	—	0.85	1.70	mA
		3.4 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 1 A	—	10	20	
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	—	75	—	μV_{rms}
Ripple rejection	R.R.	3.5 V ≤ V_{IN} ≤ 6.5 V, I_{OUT} = 50 mA, f = 120 Hz	54	65	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.95	1.10	V
		I_{OUT} = 1 A	—	1.9	—	
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

TA48018BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 3.8 V, I_{OUT} = 0.5 A	1.746	1.800	1.854	V
		3.4 V ≤ V_{IN} ≤ 6.8 V, 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	1.728	1.800	1.872	
Line regulation	Reg·line	3.4 V ≤ V_{IN} ≤ 6.8 V, I_{OUT} = 0.5 A	—	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	
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	—	75	—	μV_{rms}
Ripple rejection	R.R.	3.4 V ≤ V_{IN} ≦ 6.8 V, I_{OUT} = 50 mA, f = 120 Hz	54	66	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.41	0.50	V
		I_{OUT} = 1 A	—	1.6	—	
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

TA48025BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 4.5 V, I_{OUT} = 0.5 A	2.425	2.500	2.575	V
		3.5 V ≤ V_{IN} ≤ 7.5 V, 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	2.4	2.5	2.6	
Line regulation	Reg·line	3.5 V ≤ V_{IN} ≤ 7.5 V, I_{OUT} = 0.5 A	—	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} ≤ 7.5 V, I_{OUT} = 0 A	—	0.85	1.70	mA
		3.5 V ≤ V_{IN} ≤ 7.5 V, I_{OUT} = 1 A	—	10	20	
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	—	95	—	μV_{rms}
Ripple rejection	R.R.	3.5 V ≤ V_{IN} ≤ 7.5 V, I_{OUT} = 50 mA, f = 120 Hz	52	64	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.32	0.50	V
		I_{OUT} = 1 A	—	0.88	—	
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

TA48033BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 5.3 V, I_{OUT} = 0.5 A	3.201	3.300	3.399	V
		4.3 V ≤ V_{IN} ≤ 8.8 V, 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	3.168	3.300	3.432	
Line regulation	Reg·line	4.3 V ≤ V_{IN} ≤ 8.8 V, I_{OUT} = 0.5 A	—	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} ≤ 8.8 V, I_{OUT} = 0 A	—	0.85	1.70	mA
		4.3 V ≤ V_{IN} ≤ 8.8 V, I_{OUT} = 1 A	—	10	20	
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	—	115	—	μV_{rms}
Ripple rejection	R.R.	4.3 V ≤ V_{IN} ≤ 8.8 V, I_{OUT} = 50 mA, f = 120 Hz	50	62	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.32	0.50	V
		I_{OUT} = 1 A	—	0.69	—	
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

TA4805BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 7 V, I_{OUT} = 0.5 A	4.85	5.00	5.15	V
		6 V ≤ V_{IN} ≤ 10 V, , 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	4.8	5.0	5.2	
Line regulation	Reg·line	6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 0.5 A	—	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	
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 n oise voltage	V_{NO}	V_{IN} = 7 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	150	—	μV_{rms}
Ripple rejection	R.R.	6 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 50 mA, f = 120 Hz	48	60	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.32	0.50	V
		I_{OUT} = 1 A	—	0.69	—	
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

TA4808BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 10 V, I_{OUT} = 0.5 A	7.76	8.00	8.24	V
		9 V ≤ V_{IN} ≤ 13 V, 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	7.68	8.00	8.32	
Line regulation	Reg·line	9 V ≤ V_{IN} ≤ 13 V, I_{OUT} = 0.5 A	—	12.5	20.0	mV
Load regulation	Reg·load	V_{IN} = 10 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	9.4	30.0	mV
Quiescent current	I_B	9 V ≤ V_{IN} ≤ 13 V, I_{OUT} = 0 A	—	0.9	1.7	mA
		9 V ≤ V_{IN} ≤ 13 V, I_{OUT} = 1 A	—	10	20	
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	2.6	4.4	mA
		V_{IN} = 7.2 V, I_{OUT} = 1 A	—	20.0	28.5	
Output noise voltage	V_{NO}	V_{IN} = 10 V, I_{OUT} = 50 mA, 10 Hz ≤ f ≤ 100 kHz	—	225	—	μV_{rms}
Ripple rejection	R.R.	9 V ≤ V_{IN} ≤ 13 V, I_{OUT} = 50 mA, f = 120 Hz	45	56	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.32	0.50	V
		I_{OUT} = 1 A	—	0.69	—	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 10 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.7	—	mV/°C

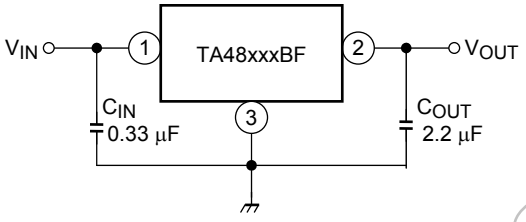
TA4809BF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 2.2 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 11 V, I_{OUT} = 0.5 A	8.73	9.00	9.27	V
		10 V ≤ V_{IN} ≤ 14 V, 5 mA ≤ I_{OUT} ≤ 1 A, 0°C ≤ T_j ≤ 125°C	8.64	9.00	9.36	
Line regulation	Reg·line	10 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 0.5 A	—	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	10 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 0 A	—	0.9	1.7	mA
		10 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 1 A	—	10	20	
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	—	250	—	μV_{rms}
Ripple rejection	R.R.	10 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 50 mA, f = 120 Hz	44	55	—	dB
Dropout voltage	V_D	I_{OUT} = 0.5 A	—	0.32	0.50	V
		I_{OUT} = 1 A	—	0.69	—	
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 for 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.

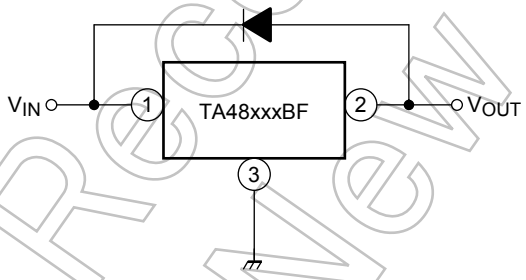
Standard Application Circuit



- 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.



- 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.

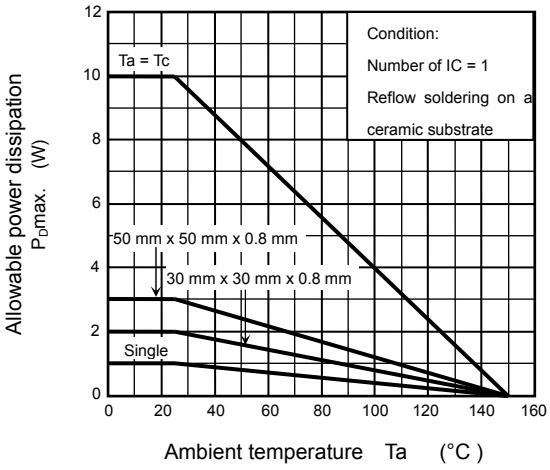
- Overcurrent Protection

  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.

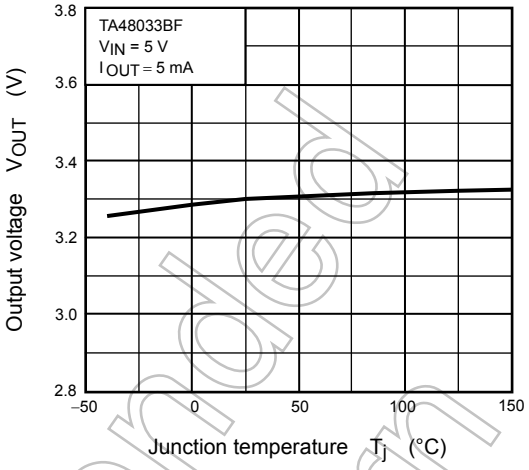
- Overheating Protection

  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.

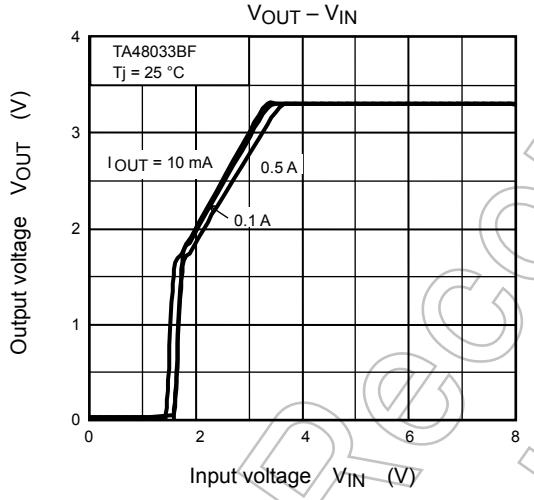
TA48***BF
$P_D$max. – Ta



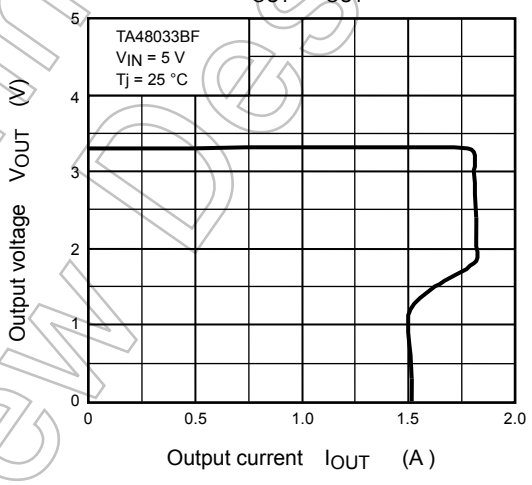
V_{OUT} – Tj



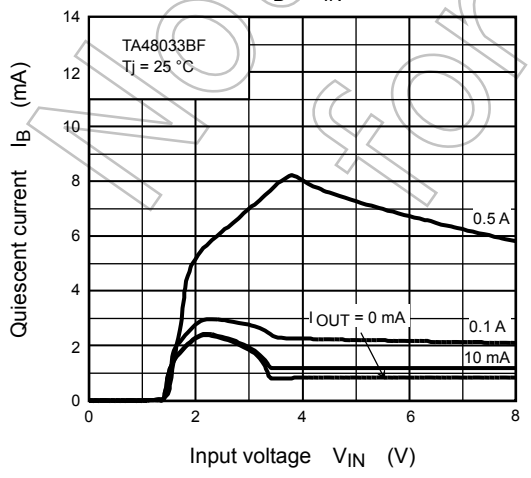
V_{OUT} – V_{IN}



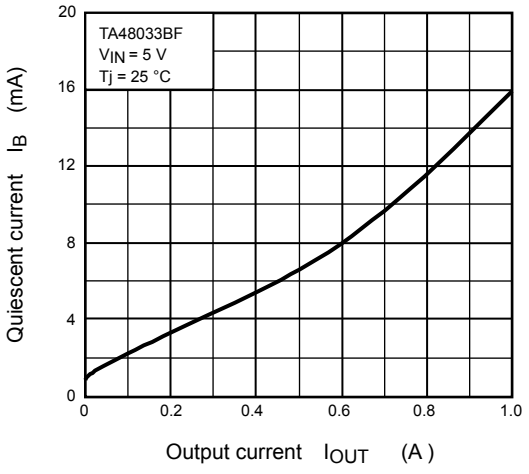
V_{OUT} – I_{OUT}



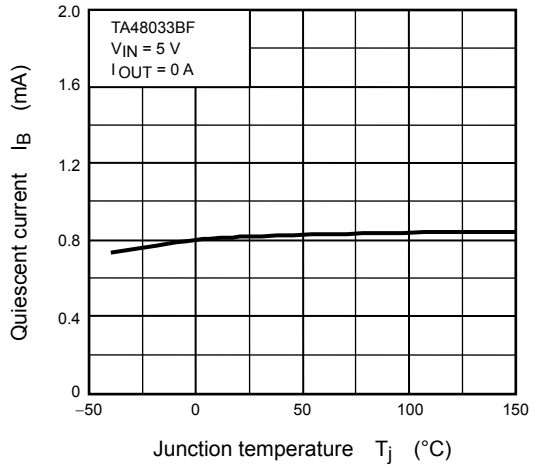
I_B – V_{IN}



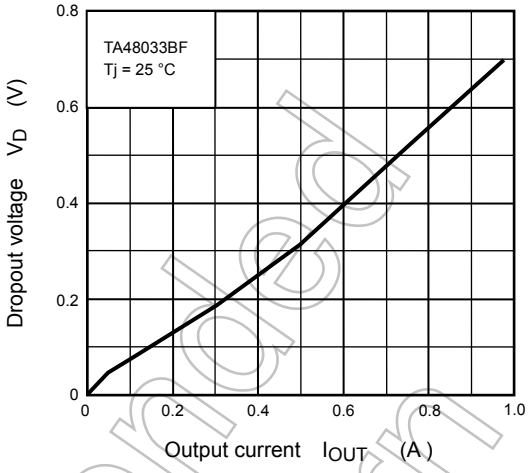
I_B – I_{OUT}



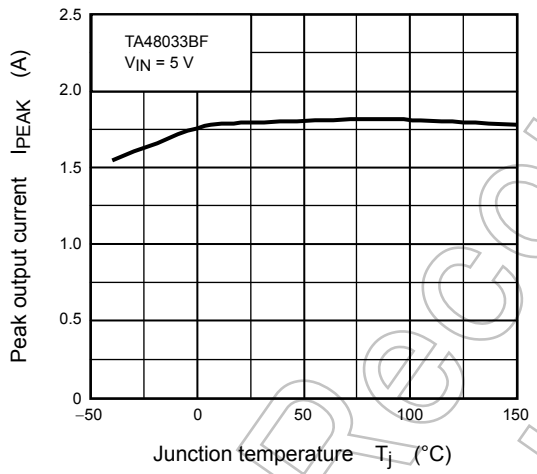
$I_B - T_j$



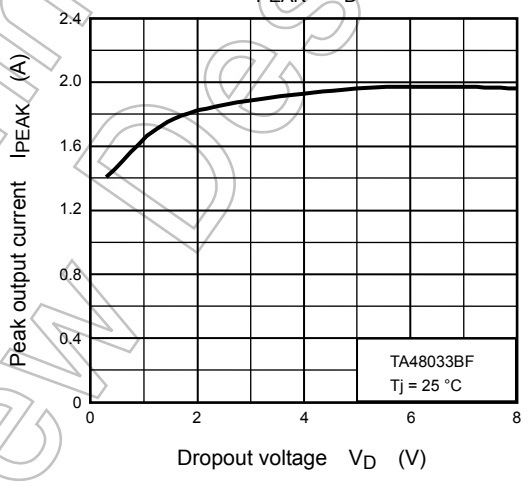
$V_D - I_{OUT}$



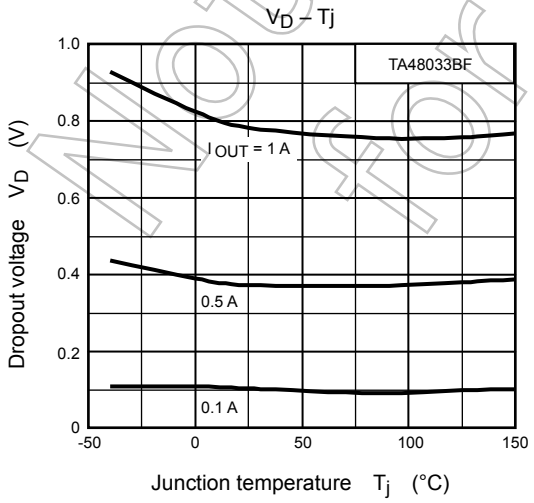
$I_{PEAK} - T_j$



$I_{PEAK} - V_D$

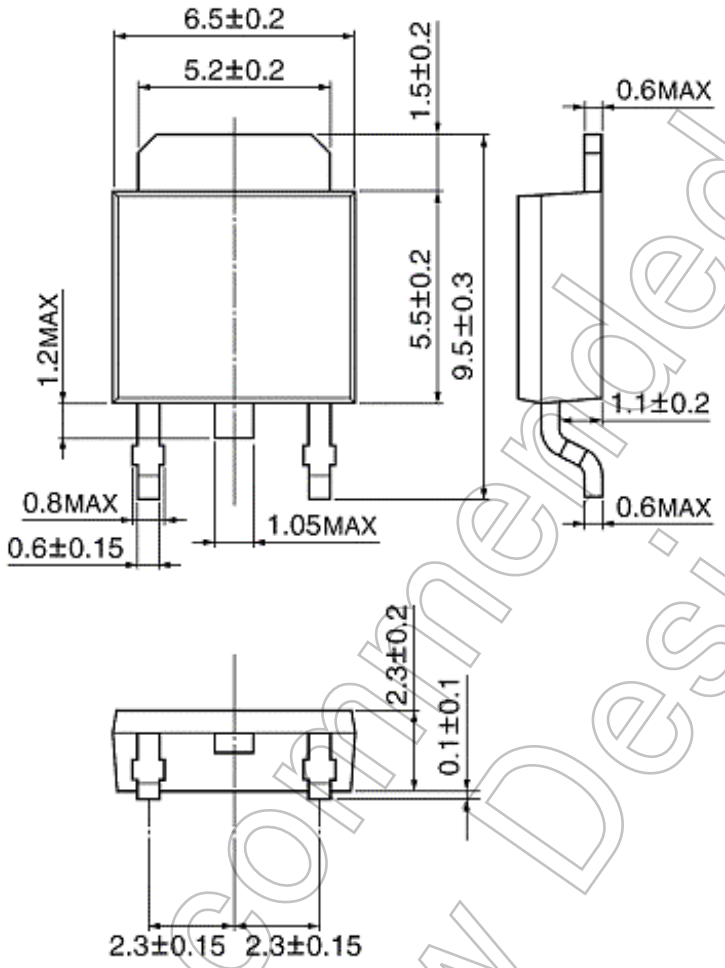


$V_D - T_j$



Package Dimensions (TA48xxxBF)

HSOP-3-P-2.30D Unit: mm



Weight: 0.36 g (typ.)

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