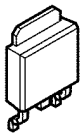
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA78033AF, TA7804AF, TA7805AF, TA7807AF, TA7808AF, TA7809AF

1 A Three-Terminal Positive Voltage Regulator



HSOP3-P-2.30D

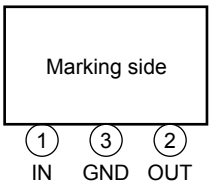
Weight : 0.36 g (typ.)

The TA78***AF series consists of fixed-positive-output voltage regulator ICs capable of sourcing current of up to 1 A.

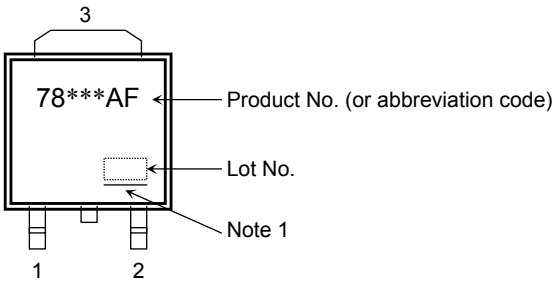
Features

- Maximum output current: 1 A
- Output voltage: 3.3 / 4.0 / 5.0 / 7.0 / 8.0 / 9.0 V
- Output voltage accuracy: V_{OUT} ± 4% (@T_j = 25°C)
- Protection function: overcurrent /overheating /safe operating area(SOA)
- Package type: New PW-Mold

Pin Assignment



Marking



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

Note 2: 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 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.

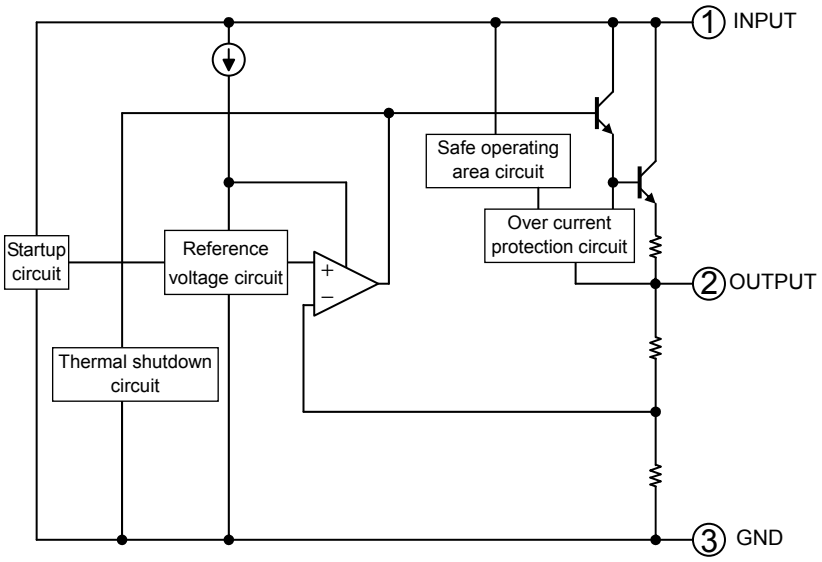
The product(s) in this document ("Product") contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product into your system,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

How to Order (Note 3)

Product No.	Package	Package Type and Capacity
TA78**AF (TE16L1,NQ TA78***AF (TE16L1NQ	New PW-Mold: Surface-mount	Tape (2000 pcs/reel)

Note 3: The "**" in each pro-forma product number is replaced with the output voltage of each product.

Block Diagram



Absolute Maximum Ratings (Ta = 25°C) (Note2)

Characteristic		Symbol	Rating	Unit
Input voltage		V_{IN}	20	V
Output current		I_{OUT}	1	A
Operating Junction temperature		T_{jopr}	−40 to 135	°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

Protection Function (reference) (Note 6)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Thermal shutdown	T_{SD}	$V_{IN} = V_{OUT} + 5$ V	—	175	—	°C
Peak circuit current	I_{PEAK}	$V_{IN} = V_{OUT} + 5$ V, $T_j = 25°C$	—	1.7	—	A
Short circuit current	I_{SC}	$V_{IN} = V_{OUT} + 5$ V, $T_j = 25°C$	—	1.5	—	A

Note 6: Ensure that the devices operate within the limits of the maximum rating when in actual use.

TA78033AF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 8.3 V, I_{OUT} = 100 mA	3.168	3.300	3.432	V
		5.8V ≤ V_{IN} ≤ 13.3 V, 5 mA ≤ I_{OUT} ≤ 1 A	3.135	3.300	3.465	
Line regulation	Reg·line	5.8 V ≤ V_{IN} ≤ 13.3 V, I_{OUT} = 500 mA	—	5	50	mV
Load regulation	Reg·load	V_{IN} = 8.3 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	5	50	mV
Quiescent current	I_B	V_{IN} = 8.3 V, I_{OUT} = 5 mA,	—	3	8	mA
Quiescent current change	ΔI_B	5.8 V ≤ V_{IN} ≤ 13.3 V, I_{OUT} = 5 mA	—	—	1.3	mA
Output noise voltage	V_{NO}	V_{IN} = 8.3 V, I_{OUT} = 50 mA 10 Hz ≤ f ≤ 100 kHz	—	50	—	μVrms
Ripple rejection	R.R.	6.3 V ≤ V_{IN} ≤ 13.3 V, I_{OUT} = 50 mA f = 120 Hz	—	67	—	dB
Dropout voltage	V_D	I_{OUT} = 1 A	—	2	—	V
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 8.3 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	±0.33	—	mV/°C

TA7804AF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 9 V, I_{OUT} = 100 mA	3.84	4.00	4.16	V
		6.5 V ≤ V_{IN} ≤ 14 V, 5 mA ≤ I_{OUT} ≤ 1 A,	3.8	4.0	4.2	
Line regulation	Reg·line	6.5 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 500 A	—	10	50	mV
Load regulation	Reg·load	V_{IN} = 9 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	10	50	mV
Quiescent current	I_B	V_{IN} = 9 V, I_{OUT} = 5 mA,	—	3	8	mA
Quiescent current change	ΔI_B	6.5 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 5 mA	—	—	1.3	mA
Output noise voltage	V_{NO}	V_{IN} = 9 V, I_{OUT} = 50 mA 10 Hz ≤ f ≤ 100 kHz	—	50	—	μVrms
Ripple rejection	R.R.	7 V ≤ V_{IN} ≤ 14 V, I_{OUT} = 50 mA f = 120 Hz	—	66	—	dB
Dropout voltage	V_D	I_{OUT} = 1 A	—	2	—	V
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 9 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	±0.4	—	mV/°C

TA7805AF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 0.1 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} = 100 mA	4.8	5.0	5.2	V
		7.5V ≤ V_{IN} ≤ 15 V, 5 mA ≤ I_{OUT} ≤ 1 A,	4.75	5.00	5.25	
Line regulation	Reg·line	7.5 V ≤ V_{IN} ≤ 15 V, I_{OUT} = 500 mA	—	10	50	mV
Load regulation	Reg·load	V_{IN} = 10 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	10	50	mV
Quiescent current	I_B	V_{IN} = 10 V, I_{OUT} = 5 mA,	—	3	8	mA
Quiescent current change	ΔI_B	7.5 V ≤ V_{IN} ≤ 15 V, I_{OUT} = 5 mA	—	—	1.3	mA
Output noise voltage	V_{NO}	V_{IN} = 10 V, I_{OUT} = 50 mA 10 Hz ≤ f ≤ 100 kHz	—	50	—	μVrms
Ripple rejection	R.R.	8 V ≤ V_{IN} ≤ 15 V, I_{OUT} = 50 mA f = 120 Hz	—	64	—	dB
Dropout voltage	V_D	I_{OUT} = 1 A	—	2	—	V
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 10 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	±0.5	—	mV/°C

TA7807AF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 12 V, I_{OUT} = 100 mA	6.72	7.00	7.28	V
		9.5 V ≤ V_{IN} ≤ 16 V, 5 mA ≤ I_{OUT} ≤ 1 A,	6.65	7.00	7.35	
Line regulation	Reg·line	9.5 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 500 mA	—	15	50	mV
Load regulation	Reg·load	V_{IN} = 12 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	15	50	mV
Quiescent current	I_B	V_{IN} = 12 V, I_{OUT} = 5 mA,	—	3	8	mA
Quiescent current change	ΔI_B	9.5 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 5 mA	—	—	1.3	mA
Output noise voltage	V_{NO}	V_{IN} = 12 V, I_{OUT} = 50 mA 10 Hz ≤ f ≤ 100 kHz	—	60	—	μVrms
Ripple rejection	R.R.	10 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 50 mA f = 120 Hz	—	60	—	dB
Dropout voltage	V_D	I_{OUT} = 1 A	—	2	—	V
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 12 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	±0.7	—	mV/°C

TA7808AF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 13 V, I_{OUT} = 100 mA	7.68	8.00	8.32	V
		10.5V ≤ V_{IN} ≤ 16 V, 5 mA ≤ I_{OUT} ≤ 1 A,	7.6	8.0	8.4	
Line regulation	Reg·line	10.5 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 500 mA	—	15	50	mV
Load regulation	Reg·load	V_{IN} = 13 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	15	50	mV
Quiescent current	I_B	V_{IN} = 13 V, I_{OUT} = 5 mA,	—	3	8	mA
Quiescent current change	ΔI_B	10.5 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 5 mA	—	—	1.3	mA
Output noise voltage	V_{NO}	V_{IN} = 13 V, I_{OUT} = 50 mA 10 Hz ≤ f ≤ 100 kHz	—	70	—	μVrms
Ripple rejection	R.R.	11 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 50 mA f = 120 Hz	—	60	—	dB
Dropout voltage	V_D	I_{OUT} = 1 A	—	2	—	V
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 13 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	±0.8	—	mV/°C

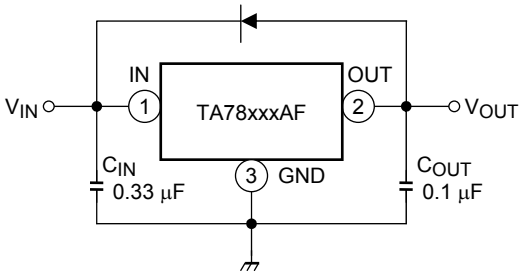
TA7809AF
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 14 V, I_{OUT} = 100 mA	8.64	9.00	9.36	V
		11.5 V ≤ V_{IN} ≤ 16 V, 5 mA ≤ I_{OUT} ≤ 1 A,	8.55	9.00	9.45	
Line regulation	Reg·line	11.5 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 500 mA	—	15	50	mV
Load regulation	Reg·load	V_{IN} = 14 V, 5 mA ≤ I_{OUT} ≤ 1 A	—	15	50	mV
Quiescent current	I_B	V_{IN} = 14 V, I_{OUT} = 5 mA,	—	3	8	mA
Quiescent current change	ΔI_B	12 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 5 mA	—	—	1.3	mA
Output noise voltage	V_{NO}	V_{IN} = 14 V, I_{OUT} = 50 mA 10 Hz ≤ f ≤ 100 kHz	—	75	—	μVrms
Ripple rejection	R.R.	11.5 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 50 mA f = 120 Hz	—	60	—	dB
Dropout voltage	V_D	I_{OUT} = 1 A	—	2	—	V
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 14 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	±0.9	—	mV/°C

Electrical Characteristics for All Products

Generally, the characteristics of power supply ICs vary with temperature.
The ratings at Tj = 25℃assume that a temperature increase has no effect on IC characteristics as ascertained by pulse tests.

Standard Application Circuit



- Place C_{IN} as close as possible to the input terminal and GND. Place C_{OUT} as close as possible to the output terminal and GND. Although capacitor C_{OUT} acts to smooth the dc output voltage during suspension of output oscillation or load change, it might cause output oscillation in a cold environment due to increased capacitor ESR. It is therefore recommended to use a capacitor with small variations temperature sensitivity. 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

- If the input terminal shorts to GND in a state of normal operation, the output terminal voltage becomes higher than the input voltage (GND potential), and the electric charge of a chemical capacitor connected to the output terminal flows into the input side, which may cause the destruction of circuit.
  In these cases, take such steps as a general silicon diode is connected to the circuit, as shown in the above figure

- 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.

- 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.

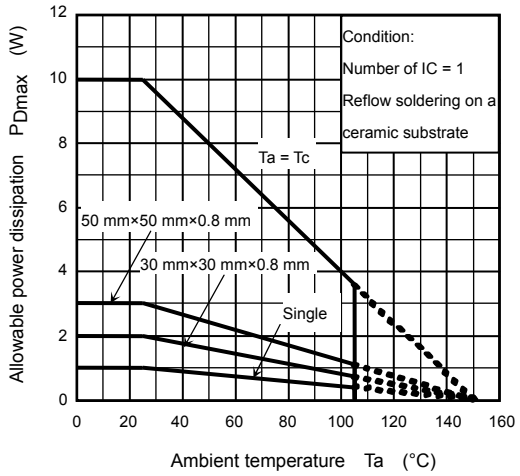
- Overcurrent Protection

  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.

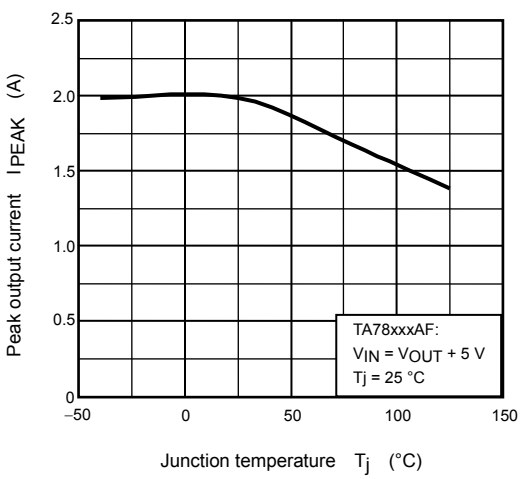
- Overheating Protection

  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.

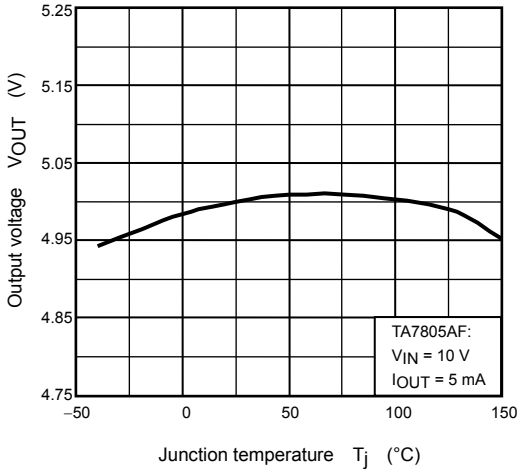
$P_D$max – Ta



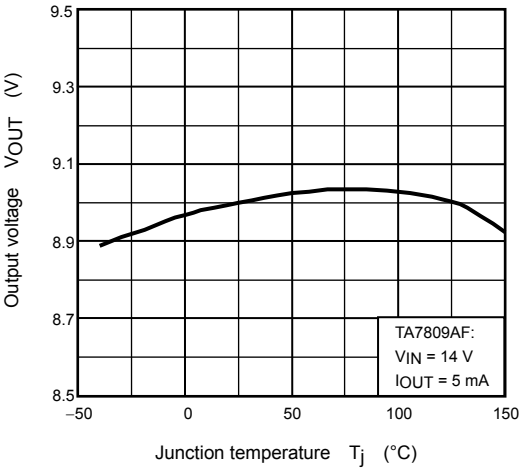
I peak – Tj



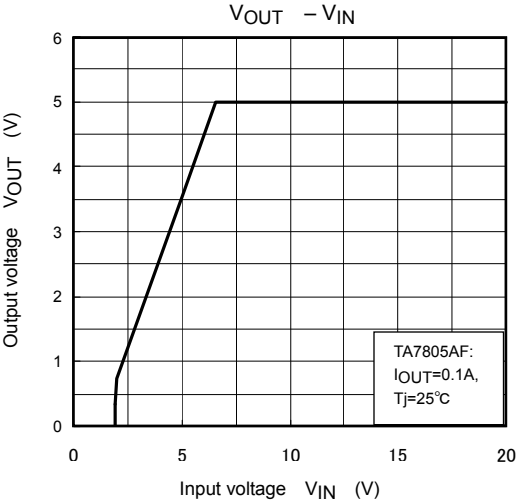
V_{OUT} – Tj



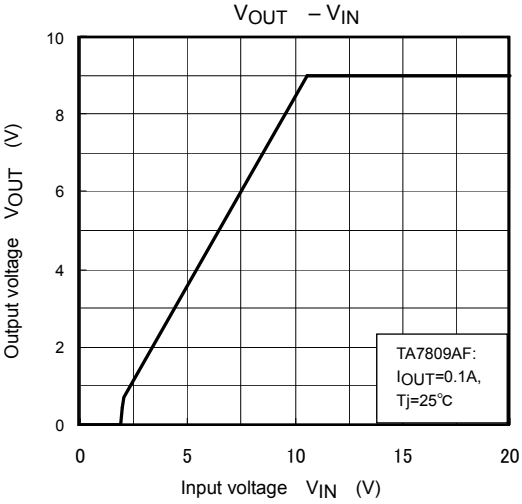
V_{OUT} – Tj



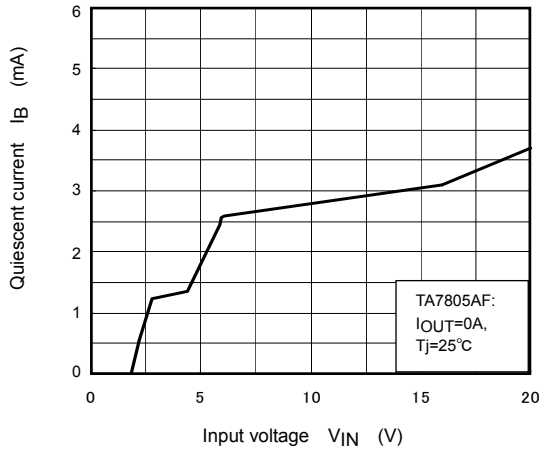
V_{OUT} – V_{IN}



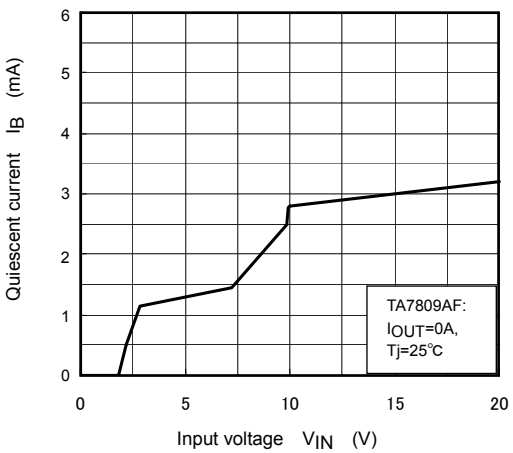
V_{OUT} – V_{IN}



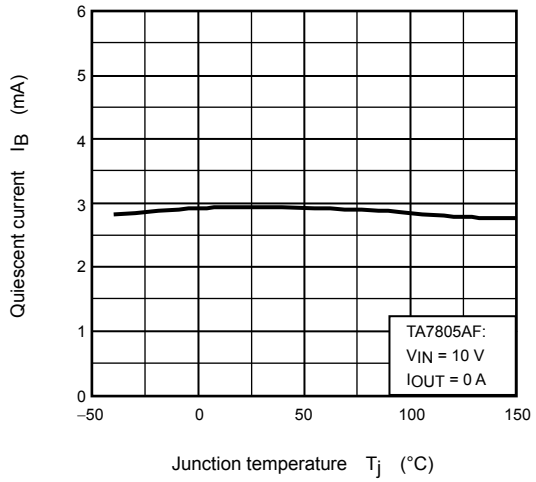
I_B – V_{IN}



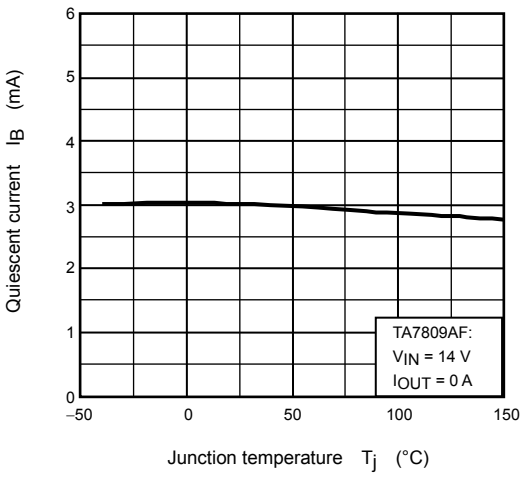
I_B – V_{IN}



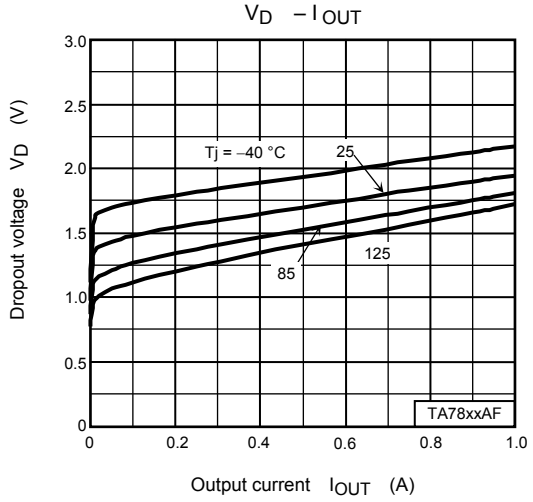
I_B – Tj



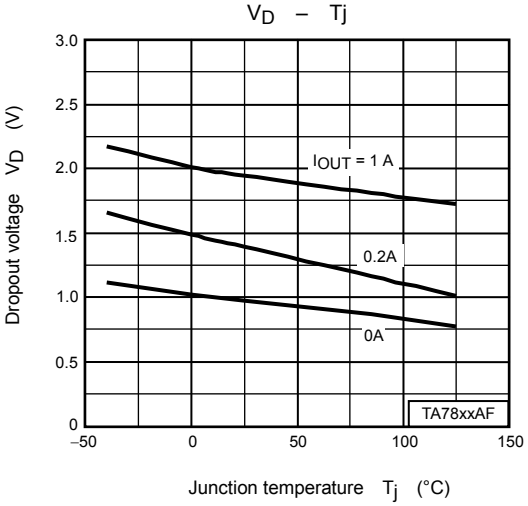
I_B – Tj



V_D – I_{OUT}



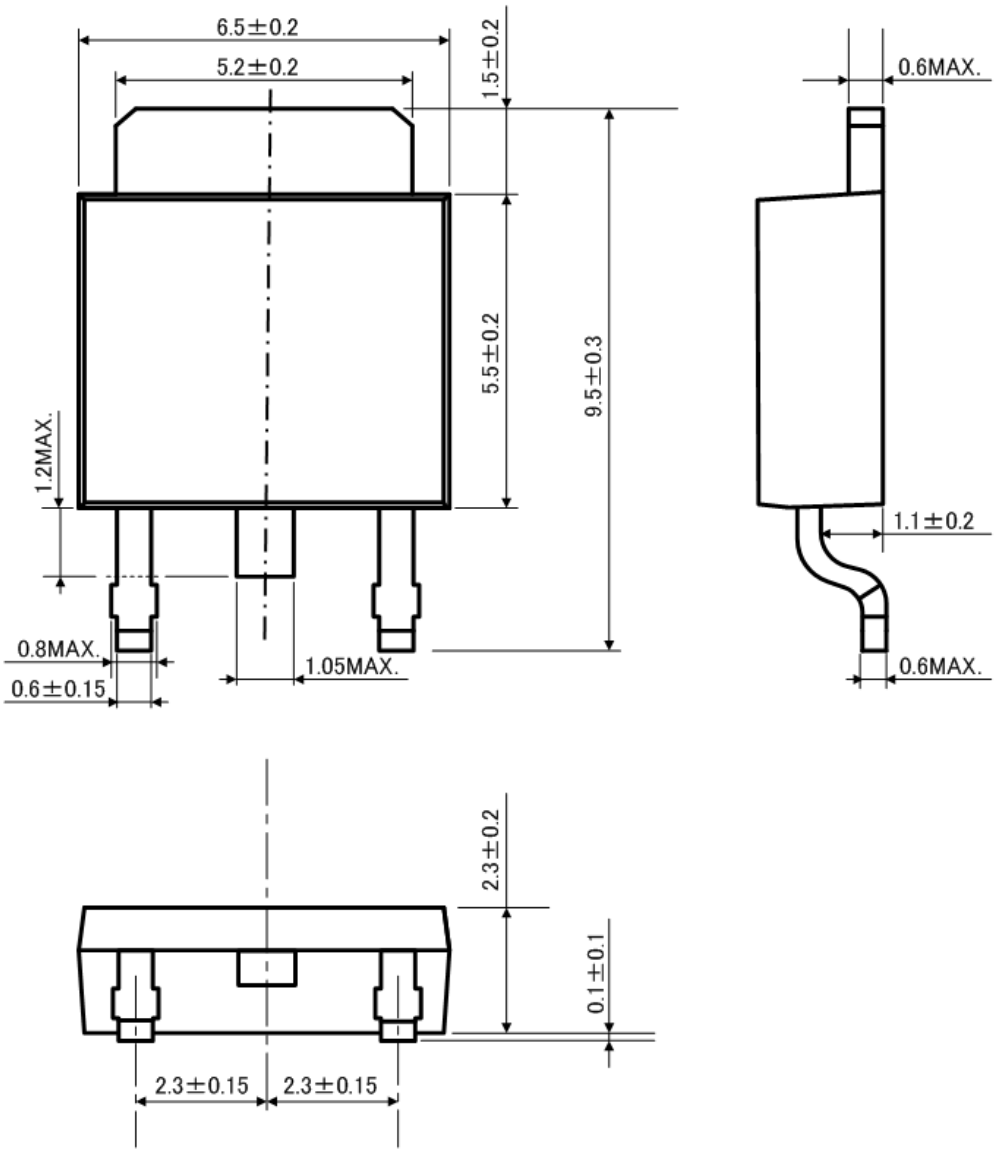
V_D – Tj



Package Dimensions

HSOP-3-P-2.30D

Unit: mm



Weight: 0.36 g (typ.)

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