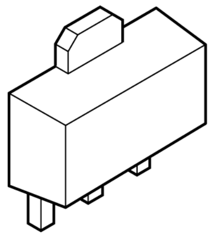
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA48L018F, TA48L02F, TA48L025F, TA48L03F, TA48L033F, TA48L05F

1.8 V, 2 V, 2.5 V, 3 V, 3.3 V, 5 V

Three-Terminal Low Dropout Voltage Regulator with Output Current of 0.15 A

The TA48L**F 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: 1.8 V, 2 V, 2.5 V, 3 V, 3.3 V, 5 V.



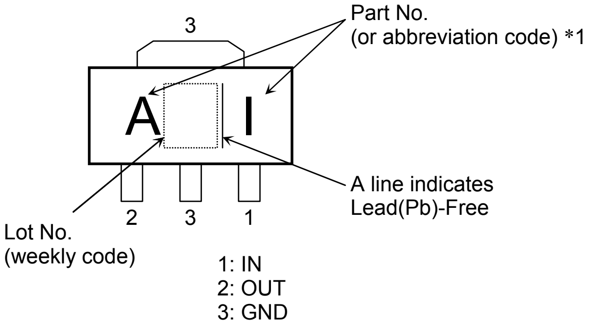
HSOP3-P-1.50

Weight: 0.05 g (typ.)

Features

- Maximum output current: 0.15 A
- Output voltage accuracy: V_{OUT} ± 3% (@T_j = 25°C)
- Low standby current: 400 μA (typ.) (@I_{OUT} = 0 A)
- Low-dropout voltage: V_D = 0.5 V (max) (@I_{OUT} = 100 mA)
- Protection function: overheat/overcurrent
- Package type: PW-Mini (SOT-89) package

Pin Assignment / Marking



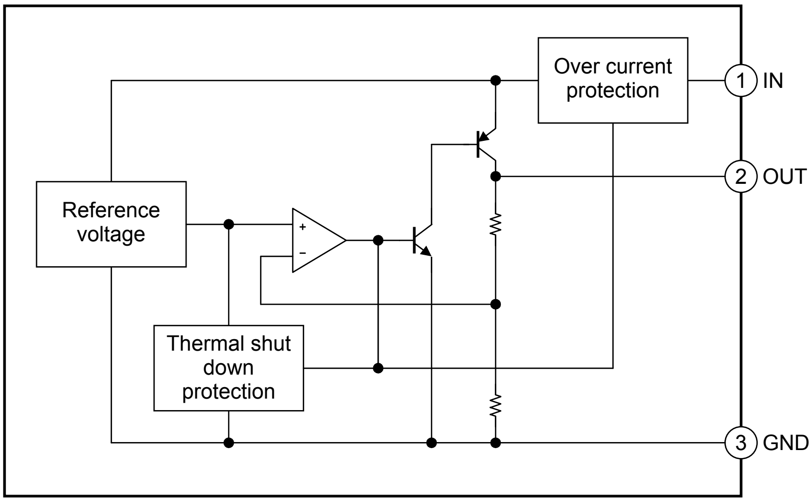
	Part No. (or abbreviation code)	Part No.
*1	AI	TA48L018F
	BI	TA48L02F
	CI	TA48L025F
	DI	TA48L03F
	EI	TA48L033F
	FI	TA48L05F

How to Order

Product No.	Package	Packing Type and Unit for Orders
TA48L**F	PW-Mini (SOT-89) Surface-mount package	On cut tape (TE12L): 100/tape section
TA48L**F (TE12L)		Embossed tape: 1000 pcs/tape

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.

Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Input voltage		V_{IN}	16	V
Output current		I_{OUT}	0.15	A
Operating temperature		T_{opr}	−40 to 85	°C
Junction temperature		T_j	150	°C
Storage temperature		T_{stg}	−55 to 150	°C
Power dissipation		P_D	0.5	W
Thermal resistance	(Junction to ambient)	$R_{th(j-a)}$	250	°C/W

Note 1: External current and voltage (including negative voltage) should not be applied to pins not specified.

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).

Protection Function (reference)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Thermal shutdown	T_{SD} (T_j)	—	—	160	—	°C
Peak circuit current	I_{PEAK}	$V_{IN} = V_{OUT} + 2$ V, $T_j = 25$°C	—	0.27	—	A
Short circuit current	I_{SC}	$V_{IN} = V_{OUT} + 2$ V, $T_j = 25$°C	—	0.27	—	A

Note 3: The maximum ratings should not be exceeded when the IC is actually used.

TA48L018F
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 3.3 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} = 40 mA	1.746	1.8	1.854	V
		2.8 V ≤ V_{IN} ≤ 12 V, 5 mA ≤ I_{OUT} ≤ 100 mA, 0°C ≤ T_j ≤ 125°C	1.71	1.8	1.89	
Line regulation	Reg · line	2.8 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA	—	2	20	mV
Load regulation	Reg · load	V_{IN} = 3.8 V, 5 mA ≤ I_{OUT} ≤ 150 mA	—	18	40	mV
Quiescent current	I_B	2.8 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 0 A	—	0.4	0.8	mA
		2.8 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 100 mA	—	1	5	
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	0.5	1.5	mA
		V_{IN} = 2.1 V, I_{OUT} = 100 mA	—	5	20	
Output noise voltage	V_{NO}	V_{IN} = 3.8 V, I_{OUT} = 40 mA, 10 Hz ≤ f ≤ 100 kHz	—	45	—	μVrms
Ripple rejection	R.R.	2.8 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA, f = 120 Hz	54	72	—	dB
Dropout voltage	V_D	I_{OUT} = 40 mA	—	0.28	0.4	V
		I_{OUT} = 100 mA	—	0.32	0.5	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 3.8 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.3	—	mV/°C

TA48L02F
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 3.3 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 4.0 V, I_{OUT} = 40 mA	1.94	2.0	2.06	V
		3.0 V ≤ V_{IN} ≤ 12 V, 5 mA ≤ I_{OUT} ≤ 100 mA, 0°C ≤ T_j ≤ 125°C	1.90	2.0	2.10	
Line regulation	Reg · line	3.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA	—	2	20	mV
Load regulation	Reg · load	V_{IN} = 4.0 V, 5 mA ≤ I_{OUT} ≤ 150 mA	—	18	40	mV
Quiescent current	I_B	3.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 0 A	—	0.4	0.8	mA
		3.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 100 mA	—	1	5	
Starting quiescent current	I_{Bstart}	V_{IN} = 2.1 V, I_{OUT} = 0 A	—	0.5	1.5	mA
		V_{IN} = 2.1 V, I_{OUT} = 100 mA	—	5	20	
Output noise voltage	V_{NO}	V_{IN} = 4.0 V, I_{OUT} = 40 mA, 10 Hz ≤ f ≤ 100 kHz	—	55	—	μVrms
Ripple rejection	R.R.	3.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA, f = 120 Hz	52	70	—	dB
Dropout voltage	V_D	I_{OUT} = 40 mA	—	0.2	0.35	V
		I_{OUT} = 100 mA	—	0.3	0.5	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 4.0 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.35	—	mV/°C

TA48L025F

Electrical Characteristics

(C_{IN} = 0.33 μF, C_{OUT} = 3.3 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} = 40 mA	2.425	2.5	2.575	V
		3.5 V ≤ V_{IN} ≤ 12 V, 5 mA ≤ I_{OUT} ≤ 100 mA, 0°C ≤ T_j ≤ 125°C	2.375	2.5	2.625	
Line regulation	Reg · line	3.5 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA	—	2	20	mV
Load regulation	Reg · load	V_{IN} = 4.5 V, 5 mA ≤ I_{OUT} ≤ 150 mA	—	18	40	mV
Quiescent current	I_B	3.5 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 0 A	—	0.4	0.8	mA
		3.5 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 100 mA	—	1	5	
Starting quiescent current	I_{Bstart}	V_{IN} = 2.4 V, I_{OUT} = 0 A	—	0.5	1.5	mA
		V_{IN} = 2.4 V, I_{OUT} = 100 mA	—	7	20	
Output noise voltage	V_{NO}	V_{IN} = 4.5 V, I_{OUT} = 40 mA, 10 Hz ≤ f ≤ 100 kHz	—	65	—	μVrms
Ripple rejection	R.R.	3.5 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA, f = 120 Hz	52	70	—	dB
Dropout voltage	V_D	I_{OUT} = 40 mA	—	0.16	0.35	V
		I_{OUT} = 100 mA	—	0.27	0.5	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 4.5 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.45	—	mV/°C

TA48L03F

Electrical Characteristics

(C_{IN} = 0.33 μF, C_{OUT} = 3.3 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 5.0 V, I_{OUT} = 40 mA	2.91	3.0	3.09	V
		4.0 V ≤ V_{IN} ≤ 12 V, 5 mA ≤ I_{OUT} ≤ 100 mA, 0°C ≤ T_j ≤ 125°C	2.85	3.0	3.15	
Line regulation	Reg · line	4.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA	—	2	20	mV
Load regulation	Reg · load	V_{IN} = 5.0 V, 5 mA ≤ I_{OUT} ≤ 150 mA	—	18	40	mV
Quiescent current	I_B	4.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 0 A	—	0.4	0.8	mA
		4.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 100 mA	—	1	5	
Starting quiescent current	I_{Bstart}	V_{IN} = 2.8 V, I_{OUT} = 0 A	—	0.5	1.5	mA
		V_{IN} = 2.8 V, I_{OUT} = 100 mA	—	7	20	
Output noise voltage	V_{NO}	V_{IN} = 5.0 V, I_{OUT} = 40 mA, 10 Hz ≤ f ≤ 100 kHz	—	80	—	μVrms
Ripple rejection	R.R.	4.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA, f = 120 Hz	50	68	—	dB
Dropout voltage	V_D	I_{OUT} = 40 mA	—	0.16	0.35	V
		I_{OUT} = 100 mA	—	0.27	0.5	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 5 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.5	—	mV/°C

TA48L033F
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 3.3 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} = 40 mA	3.2	3.3	3.4	V
		4.3 V ≤ V_{IN} ≤ 12 V, 5 mA ≤ I_{OUT} ≤ 100 mA, 0°C ≤ T_j ≤ 125°C	3.135	3.3	3.465	
Line regulation	Reg · line	4.3 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA	—	2	20	mV
Load regulation	Reg · load	V_{IN} = 5.3 V, 5 mA ≤ I_{OUT} ≤ 150 mA	—	18	40	mV
Quiescent current	I_B	4.3 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 0 A	—	0.4	0.8	mA
		4.3 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 100 mA	—	1	5	
Starting quiescent current	I_{Bstart}	V_{IN} = 3.0 V, I_{OUT} = 0 A	—	0.5	1.5	mA
		V_{IN} = 3.0 V, I_{OUT} = 100 mA	—	7	20	
Output noise voltage	V_{NO}	V_{IN} = 5.3 V, I_{OUT} = 40 mA, 10 Hz ≤ f ≤ 100 kHz	—	85	—	μVrms
Ripple rejection	R.R.	4.3 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA, f = 120 Hz	50	68	—	dB
Dropout voltage	V_D	I_{OUT} = 40 mA	—	0.16	0.35	V
		I_{OUT} = 100 mA	—	0.27	0.5	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 5.3 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.55	—	mV/°C

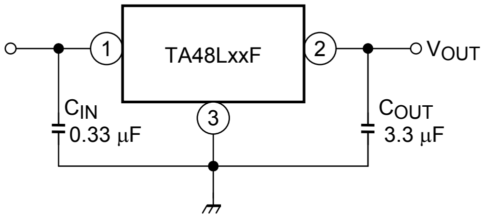
TA48L05F
Electrical Characteristics
(C_{IN} = 0.33 μF, C_{OUT} = 3.3 μF, T_j = 25°C, unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ.	Max	Unit
Output voltage	V_{OUT}	V_{IN} = 7.0 V, I_{OUT} = 40 mA	4.85	5.0	5.15	V
		6.0 V ≤ V_{IN} ≤ 12 V, 5 mA ≤ I_{OUT} ≤ 100 mA, 0°C ≤ T_j ≤ 125°C	4.75	5.0	5.25	
Line regulation	Reg · line	6.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA	—	2	20	mV
Load regulation	Reg · load	V_{IN} = 7.0 V, 5 mA ≤ I_{OUT} ≤ 150 mA	—	18	45	mV
Quiescent current	I_B	6.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 0 A	—	0.4	0.8	mA
		6.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 100 mA	—	1	5	
Starting quiescent current	I_{Bstart}	V_{IN} = 4.5V,I_{OUT} = 0 A	—	0.5	1.5	mA
		V_{IN} = 4.5 V, I_{OUT} = 100 mA	—	7	20	
Output noise voltage	V_{NO}	V_{IN} = 7.0 V, I_{OUT} = 40 mA, 10 Hz ≤ f ≤ 100 kHz	—	135	—	μVrms
Ripple rejection	R.R.	6.0 V ≤ V_{IN} ≤ 12 V, I_{OUT} = 40 mA, f = 120 Hz	50	64	—	dB
Dropout voltage	V_D	I_{OUT} = 40 mA	—	0.16	0.35	V
		I_{OUT} = 100 mA	—	0.27	0.5	
Average temperature coefficient of output voltage	T_{CVO}	V_{IN} = 7.0 V, I_{OUT} = 5 mA, 0°C ≤ T_j ≤ 125°C	—	0.85	—	mV/°C

Electrical Characteristics for All Products

Generally, the characteristics of power supply ICs change according to temperature fluctuations.
The specification T_j = 25°C is based on a state where temperature increase has no effect (assuming no fluctuation in the characteristics) as ascertained by pulse tests.

Standard Application Circuit



Be sure to connect a capacitor near the input terminal and output terminal between both terminals and GND.
The capacitances should be determined experimentally. In particular, adequate investigation should be made so that there is no problem even in high or low temperatures.

Usage Precautions

- 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.

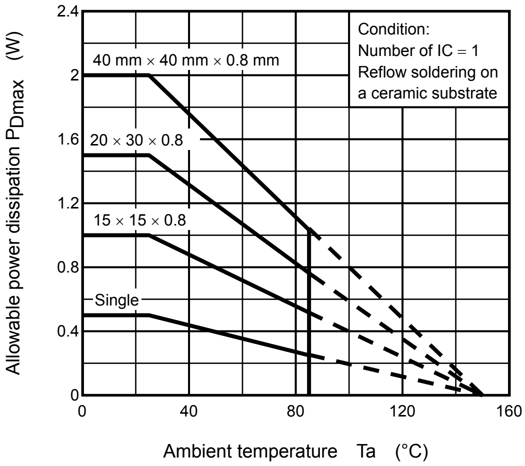
- Overcurrent Protection

  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.

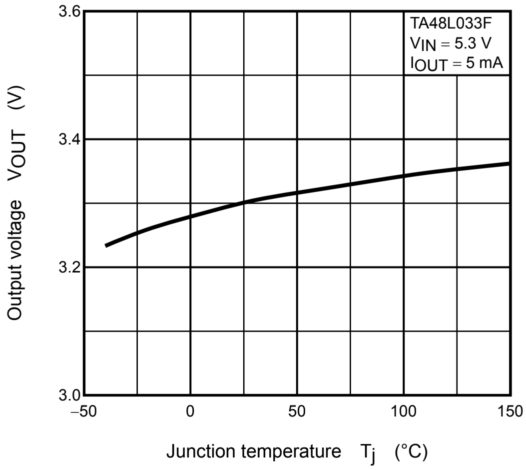
- Overheating Protection

  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.

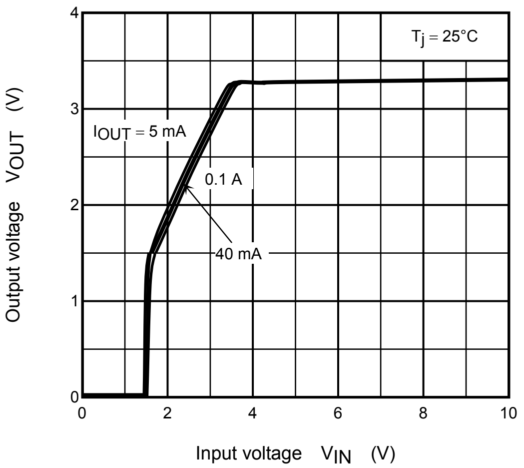
P_{Dmax} – Ta



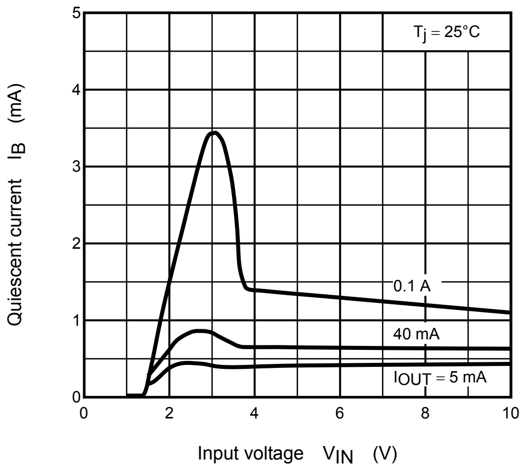
V_{OUT} – T_j



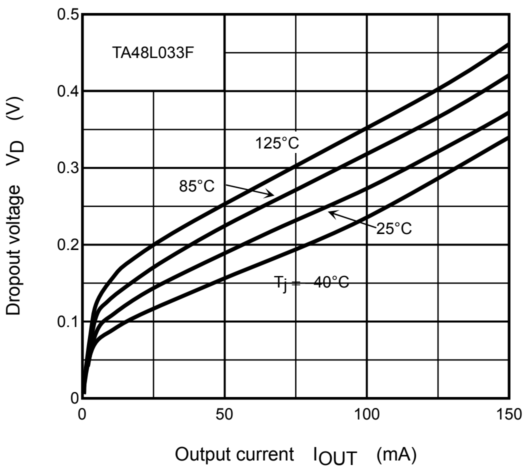
V_{OUT} – V_{IN}



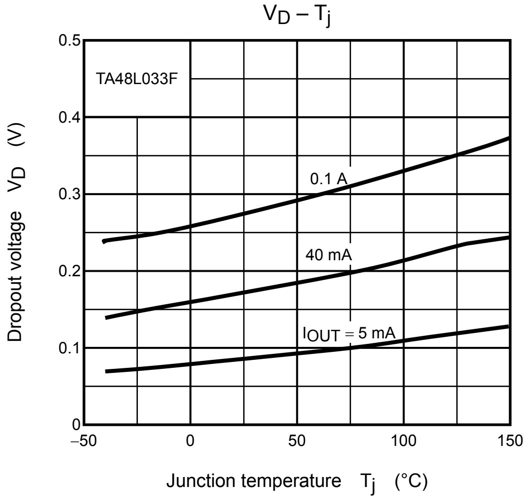
I_B – V_{IN}



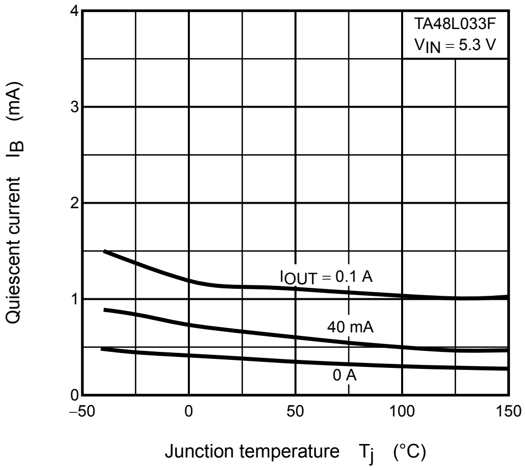
V_D – I_{OUT}



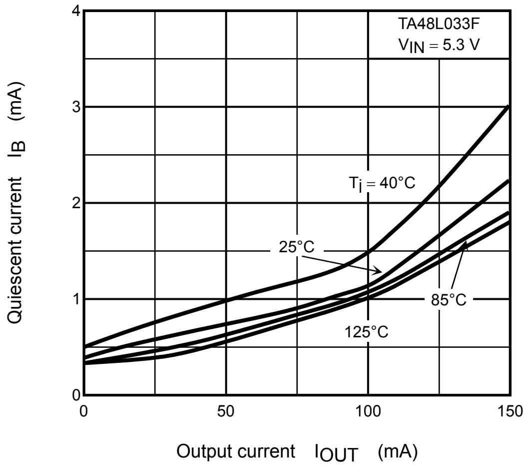
V_D – T_j



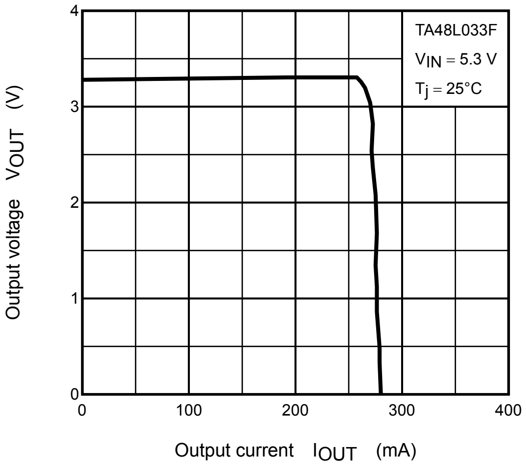
I_B – T_j



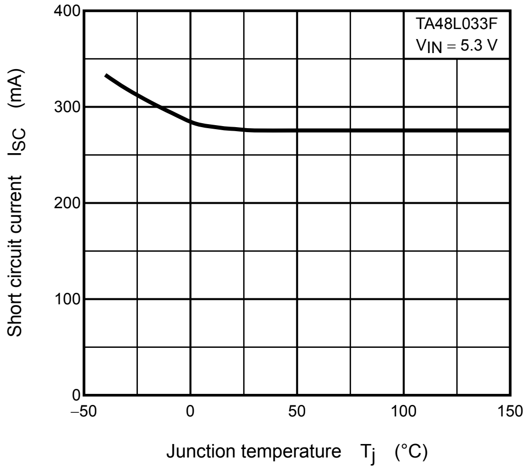
I_B – I_{OUT}



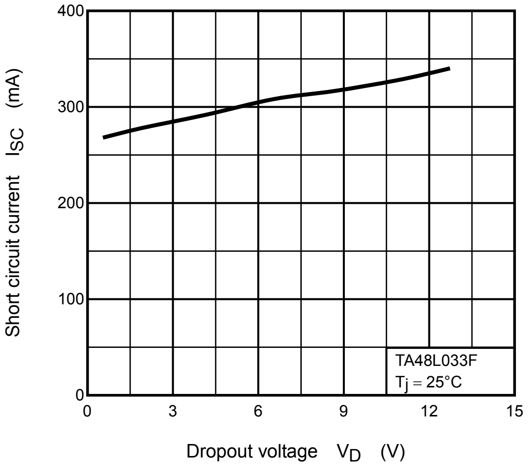
V_{OUT} – I_{OUT}



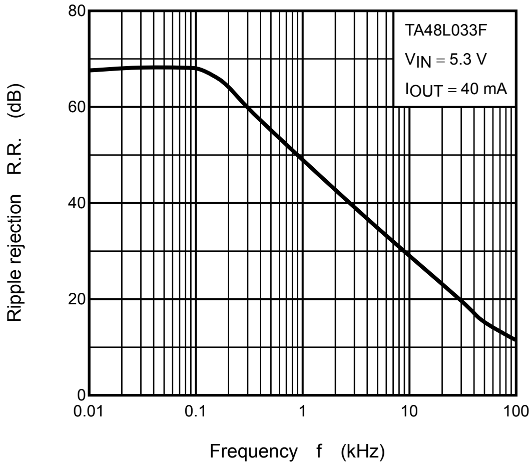
I_{SC} – T_j



I_{SC} – V_D

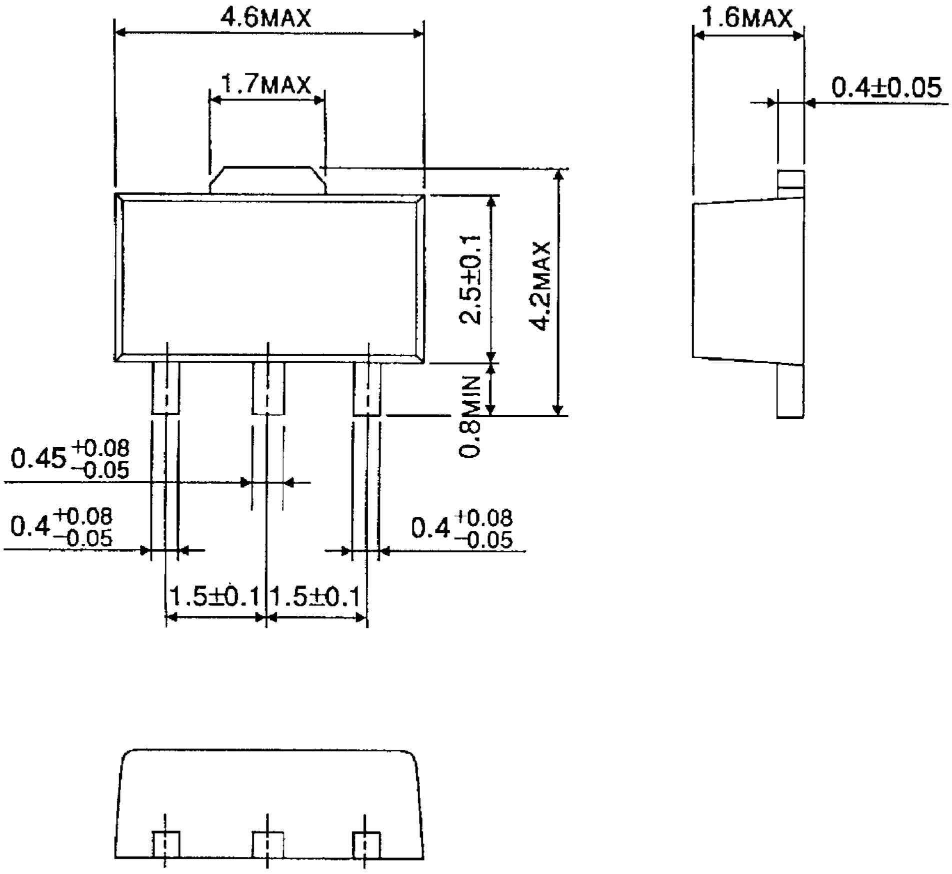


R.R. – f



Package Dimensions

HSOP3-P-1.50 Unit : mm



Weight: 0.05 g (typ.)