

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

## TA48M025F, TA48M03F, TA48M033F TA48M0345F, TA48M04F, TA48M05F

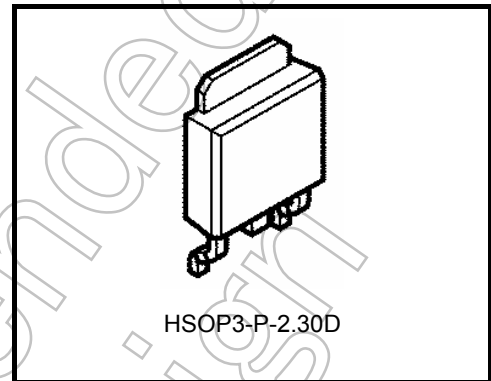
2.5 V, 3 V, 3.3 V, 3.45 V, 4 V, 5 V

### Three-Terminal Low Dropout Voltage Regulator

The TA48M\*\*F series consists of fixed-positive-output, low dropout regulators with an output current of 500 mA (max). In response to the need for low voltage devices, the series offers devices with low output voltages of 2.5 V, 3.3 V etc.

#### Features

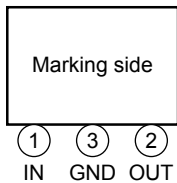
- Maximum output current of 0.5 A
- Low standby current: 800  $\mu$ A (typ.)
- Low dropout voltage: 0.65 V (max) @ $I_{OUT} = 0.5$  A
- Protection function: overcurrent/overheat/overvoltage/reversed power supply connections.
- New PW-Mold package (Surface-mount type)



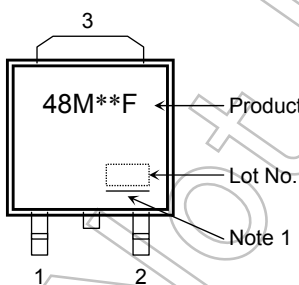
HSOP3-P-2.30D

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

#### Pin Assignment



#### Marking



Note 1: 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.

Note 2: The “\*\*” part of each product number varies according to the output voltage of the product.

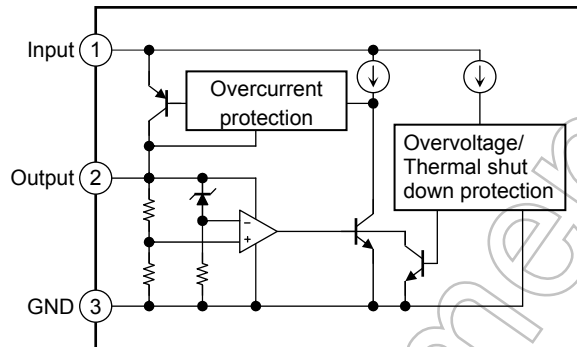
The product(s) in this document (“Product”) contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent, overvoltage, or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product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

## Ordering Method

| Product Name         | Package (Lead Type)        | Packing Form          |
|----------------------|----------------------------|-----------------------|
| TA48M**F (T6L1, SNQ) | New PW-Mold: Surface-mount | Tape (2000 pcs./reel) |

Note: The “\*\*” in each pro-forma product name is replaced with the output voltage of each product.

## Block Diagram



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

| Characteristics                | Symbol        | Rating      | Unit |
|--------------------------------|---------------|-------------|------|
| Input voltage                  | $V_{IN}$      | 29          | V    |
| Output current                 | $I_{OUT}$     | 0.5         | A    |
| Power dissipation              | $P_D$         | (Ta = 25°C) | 1    |
|                                |               | (Tc = 25°C) | 10   |
| Operating junction temperature | $T_{jopr}$    | -40 to 150  | °C   |
| Storage temperature            | $T_{stg}$     | -55 to 150  | °C   |
| Junction temperature           | $T_j$         | 150         | °C   |
| Thermal resistance             | $R_{th(j-c)}$ | 12.5        | °C/W |
|                                | $R_{th(j-a)}$ | 125         |      |

Note: 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   | Min | Typ. | Max | Unit |
|-----------------|----------|-----|------|-----|------|
| Overvoltage     | $V_{IN}$ | 29  | 33   | —   | V    |
| Overheat        | $T_j$    | —   | 175  | —   | °C   |

## TA48M025F

### Electrical Characteristics

(unless otherwise specified,  $V_{IN} = 4.5\text{ V}$ ,  $I_{OUT} = 250\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ ,  $C_{IN} = 0.1\ \mu\text{F}$ ,  $C_{OUT} = 10\ \mu\text{F}$ )

| Characteristics       | Symbol     | Test Circuit | Test Condition  | Min   | Typ. | Max   | Unit             |
|-----------------------|------------|--------------|---|-------|------|-------|------------------|
| Output voltage        | $V_{OUT}$  | —            | —   | 2.4   | 2.5  | 2.6   | V                |
|                       |            | —            | $3.5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | 2.375 | 2.5  | 2.625 |                  |
| Line regulation       | Reg.line   | —            | $3.5\text{ V} \leq V_{IN} \leq 16\text{ V}$   | —     | 7    | 18    | mV               |
| Load regulation       | Reg.load   | —            | $5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$   | —     | 45   | 90    | mV               |
| Quiescent current     | $I_B$      | —            | $3.5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 0\text{ mA}$  | —     | 0.8  | 1.4   | mA               |
|                       |            | —            | $3.5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 250\text{ mA}$  | —     | 12   | 25    |                  |
| Output noise voltage  | $V_{NO}$   | —            | $10\text{ Hz} \leq f \leq 100\text{ kHz}$ ,<br>$I_{OUT} = 50\text{ mA}$   | —     | 72   | —     | $\mu\text{Vrms}$ |
| Ripple rejection      | R.R.       | —            | $f = 120\text{ Hz}$ , $3.5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 50\text{ mA}$   | 62    | 72   | —     | dB               |
| Dropout voltage       | $V_D$      | —            | $I_{OUT} = 250\text{ mA}$   | —     | 0.17 | 0.35  | V                |
|                       |            | —            | $I_{OUT} = 500\text{ mA}$   | —     | 0.35 | 0.65  |                  |
| Peak circuit current  | $I_{PEAK}$ | —            | —   | 0.60  | 1.15 | 1.40  | A                |
| Short circuit current | $I_{SC}$   | —            | —   | 0.60  | 1.15 | 1.40  | A                |

## TA48M03F

### Electrical Characteristics

(unless otherwise specified,  $V_{IN} = 5\text{ V}$ ,  $I_{OUT} = 250\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ ,  $C_{IN} = 0.1\ \mu\text{F}$ ,  $C_{OUT} = 10\ \mu\text{F}$ )

| Characteristics       | Symbol     | Test Circuit | Test Condition  | Min  | Typ. | Max  | Unit             |
|-----------------------|------------|--------------|---|------|------|------|------------------|
| Output voltage        | $V_{OUT}$  | —            | —   | 2.88 | 3.0  | 3.12 | V                |
|                       |            | —            | $4\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | 2.85 | 3.0  | 3.15 |                  |
| Line regulation       | Reg.line   | —            | $4\text{ V} \leq V_{IN} \leq 16\text{ V}$   | —    | 8    | 21   | mV               |
| Load regulation       | Reg.load   | —            | $5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$   | —    | 45   | 95   | mV               |
| Quiescent current     | $I_B$      | —            | $4\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 0\text{ mA}$  | —    | 0.8  | 1.4  | mA               |
|                       |            | —            | $4\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 250\text{ mA}$  | —    | 12   | 25   |                  |
| Output noise voltage  | $V_{NO}$   | —            | $10\text{ Hz} \leq f \leq 100\text{ kHz}$ ,<br>$I_{OUT} = 50\text{ mA}$   | —    | 90   | —    | $\mu\text{Vrms}$ |
| Ripple rejection      | R.R.       | —            | $f = 120\text{ Hz}$ , $4\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 50\text{ mA}$   | 60   | 70   | —    | dB               |
| Dropout voltage       | $V_D$      | —            | $I_{OUT} = 250\text{ mA}$   | —    | 0.17 | 0.35 | V                |
|                       |            | —            | $I_{OUT} = 500\text{ mA}$   | —    | 0.35 | 0.65 |                  |
| Peak circuit current  | $I_{PEAK}$ | —            | —   | 0.60 | 1.20 | 1.45 | A                |
| Short circuit current | $I_{SC}$   | —            | —   | 0.60 | 1.20 | 1.45 | A                |

## TA48M033F

### Electrical Characteristics

(unless otherwise specified,  $V_{IN} = 5.3 \text{ V}$ ,  $I_{OUT} = 250 \text{ mA}$ ,  $T_j = 25^\circ\text{C}$ ,  $C_{IN} = 0.1 \mu\text{F}$ ,  $C_{OUT} = 10 \mu\text{F}$ )

| Characteristics       | Symbol     | Test Circuit | Test Condition  | Min   | Typ. | Max   | Unit             |
|-----------------------|------------|--------------|---|-------|------|-------|------------------|
| Output voltage        | $V_{OUT}$  | —            | —   | 3.168 | 3.3  | 3.432 | V                |
|                       |            | —            | $4.3 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$5 \text{ mA} \leq I_{OUT} \leq 500 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | 3.135 | 3.3  | 3.465 |                  |
| Line regulation       | Reg-line   | —            | $4.3 \text{ V} \leq V_{IN} \leq 16 \text{ V}$   | —     | 10   | 23    | mV               |
| Load regulation       | Reg-load   | —            | $5 \text{ mA} \leq I_{OUT} \leq 500 \text{ mA}$   | —     | 45   | 105   | mV               |
| Quiescent current     | $I_B$      | —            | $4.3 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$I_{OUT} = 0 \text{ mA}$   | —     | 0.8  | 1.4   | mA               |
|                       |            | —            | $4.3 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$I_{OUT} = 250 \text{ mA}$   | —     | 12   | 25    |                  |
| Output noise voltage  | $V_{NO}$   | —            | $10 \text{ Hz} \leq f \leq 100 \text{ kHz}$ ,<br>$I_{OUT} = 50 \text{ mA}$  | —     | 90   | —     | $\mu\text{Vrms}$ |
| Ripple rejection      | R.R.       | —            | $f = 120 \text{ Hz}$ , $4.3 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$I_{OUT} = 50 \text{ mA}$   | 60    | 70   | —     | dB               |
| Dropout voltage       | $V_D$      | —            | $I_{OUT} = 250 \text{ mA}$  | —     | 0.17 | 0.35  | V                |
|                       |            | —            | $I_{OUT} = 500 \text{ mA}$  | —     | 0.35 | 0.65  |                  |
| Peak circuit current  | $I_{PEAK}$ | —            | —   | 0.60  | 1.20 | 1.45  | A                |
| Short circuit current | $I_{SC}$   | —            | —   | 0.60  | 1.20 | 1.45  | A                |

## TA48M0345F

### Electrical Characteristics

(unless otherwise specified,  $V_{IN} = 5.45 \text{ V}$ ,  $I_{OUT} = 250 \text{ mA}$ ,  $T_j = 25^\circ\text{C}$ ,  $C_{IN} = 0.1 \mu\text{F}$ ,  $C_{OUT} = 10 \mu\text{F}$ )

| Characteristics       | Symbol     | Test Circuit | Test Condition   | Min   | Typ. | Max   | Unit             |
|-----------------------|------------|--------------|--|-------|------|-------|------------------|
| Output voltage        | $V_{OUT}$  | —            | —  | 3.312 | 3.45 | 3.588 | V                |
|                       |            | —            | $4.45 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$5 \text{ mA} \leq I_{OUT} \leq 500 \text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | 3.278 | 3.45 | 3.622 |                  |
| Line regulation       | Reg-line   | —            | $4.45 \text{ V} \leq V_{IN} \leq 16 \text{ V}$   | —     | 12   | 25    | mV               |
| Load regulation       | Reg-load   | —            | $5 \text{ mA} \leq I_{OUT} \leq 500 \text{ mA}$  | —     | 45   | 110   | mV               |
| Quiescent current     | $I_B$      | —            | $4.45 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$I_{OUT} = 0 \text{ mA}$   | —     | 0.8  | 1.4   | mA               |
|                       |            | —            | $4.45 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$I_{OUT} = 250 \text{ mA}$   | —     | 12   | 25    |                  |
| Output noise voltage  | $V_{NO}$   | —            | $10 \text{ Hz} \leq f \leq 100 \text{ kHz}$ ,<br>$I_{OUT} = 50 \text{ mA}$   | —     | 90   | —     | $\mu\text{Vrms}$ |
| Ripple rejection      | R.R.       | —            | $f = 120 \text{ Hz}$ , $4.45 \text{ V} \leq V_{IN} \leq 16 \text{ V}$ ,<br>$I_{OUT} = 50 \text{ mA}$   | 60    | 70   | —     | dB               |
| Dropout voltage       | $V_D$      | —            | $I_{OUT} = 250 \text{ mA}$   | —     | 0.17 | 0.35  | V                |
|                       |            | —            | $I_{OUT} = 500 \text{ mA}$   | —     | 0.35 | 0.65  |                  |
| Peak circuit current  | $I_{PEAK}$ | —            | —  | 0.60  | 1.20 | 1.45  | A                |
| Short circuit current | $I_{SC}$   | —            | —  | 0.60  | 1.20 | 1.45  | A                |

## TA48M04F

### Electrical Characteristics

(unless otherwise specified,  $V_{IN} = 6\text{ V}$ ,  $I_{OUT} = 250\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ ,  $C_{IN} = 0.1\ \mu\text{F}$ ,  $C_{OUT} = 10\ \mu\text{F}$ )

| Characteristics       | Symbol     | Test Circuit | Test Condition  | Min  | Typ. | Max  | Unit             |
|-----------------------|------------|--------------|---|------|------|------|------------------|
| Output voltage        | $V_{OUT}$  | —            | —   | 3.84 | 4.0  | 4.16 | V                |
|                       |            | —            | $5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | 3.8  | 4.0  | 4.2  |                  |
| Line regulation       | Reg-line   | —            | $5\text{ V} \leq V_{IN} \leq 16\text{ V}$   | —    | 11   | 28   | mV               |
| Load regulation       | Reg-load   | —            | $5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$   | —    | 45   | 115  | mV               |
| Quiescent current     | $I_B$      | —            | $5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 0\text{ mA}$  | —    | 0.9  | 1.4  | mA               |
|                       |            | —            | $5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 250\text{ mA}$  | —    | 13   | 25   |                  |
| Output noise voltage  | $V_{NO}$   | —            | $10\text{ Hz} \leq f \leq 100\text{ kHz}$ ,<br>$I_{OUT} = 50\text{ mA}$   | —    | 110  | —    | $\mu\text{Vrms}$ |
| Ripple rejection      | R.R.       | —            | $f = 120\text{ Hz}$ , $5\text{ V} \leq V_{IN} \leq 16\text{ V}$ ,<br>$I_{OUT} = 50\text{ mA}$   | 58   | 68   | —    | dB               |
| Dropout voltage       | $V_D$      | —            | $I_{OUT} = 250\text{ mA}$   | —    | 0.17 | 0.35 | V                |
|                       |            | —            | $I_{OUT} = 500\text{ mA}$   | —    | 0.35 | 0.65 |                  |
| Peak circuit current  | $I_{PEAK}$ | —            | —   | 0.60 | 1.25 | 1.50 | A                |
| Short circuit current | $I_{SC}$   | —            | —   | 0.60 | 1.25 | 1.50 | A                |

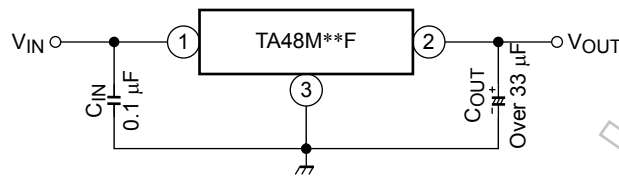
## TA48M05F

### Electrical Characteristics

(unless otherwise specified,  $V_{IN} = 7\text{ V}$ ,  $I_{OUT} = 250\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ ,  $C_{IN} = 0.1\ \mu\text{F}$ ,  $C_{OUT} = 10\ \mu\text{F}$ )

| Characteristics       | Symbol     | Test Circuit | Test Condition  | Min  | Typ. | Max  | Unit             |
|-----------------------|------------|--------------|---|------|------|------|------------------|
| Output voltage        | $V_{OUT}$  | —            | —   | 4.8  | 5.0  | 5.2  | V                |
|                       |            | —            | $6\text{ V} \leq V_{IN} \leq 18\text{ V}$ ,<br>$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$ ,<br>$0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ | 4.75 | 5.0  | 5.25 |                  |
| Line regulation       | Reg-line   | —            | $6\text{ V} \leq V_{IN} \leq 18\text{ V}$   | —    | 15   | 35   | mV               |
| Load regulation       | Reg-load   | —            | $5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$   | —    | 50   | 135  | mV               |
| Quiescent current     | $I_B$      | —            | $6\text{ V} \leq V_{IN} \leq 18\text{ V}$ ,<br>$I_{OUT} = 0\text{ mA}$  | —    | 1.0  | 1.4  | mA               |
|                       |            | —            | $6\text{ V} \leq V_{IN} \leq 18\text{ V}$ ,<br>$I_{OUT} = 250\text{ mA}$  | —    | 13   | 25   |                  |
| Output noise voltage  | $V_{NO}$   | —            | $10\text{ Hz} \leq f \leq 100\text{ kHz}$ ,<br>$I_{OUT} = 50\text{ mA}$   | —    | 125  | —    | $\mu\text{Vrms}$ |
| Ripple rejection      | R.R.       | —            | $f = 120\text{ Hz}$ , $6\text{ V} \leq V_{IN} \leq 18\text{ V}$ ,<br>$I_{OUT} = 50\text{ mA}$   | 58   | 68   | —    | dB               |
| Dropout voltage       | $V_D$      | —            | $I_{OUT} = 250\text{ mA}$   | —    | 0.17 | 0.35 | V                |
|                       |            | —            | $I_{OUT} = 500\text{ mA}$   | —    | 0.35 | 0.65 |                  |
| Peak circuit current  | $I_{PEAK}$ | —            | —   | 0.60 | 1.30 | 1.55 | A                |
| Short circuit current | $I_{SC}$   | —            | —   | 0.60 | 1.30 | 1.55 | A                |

## 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

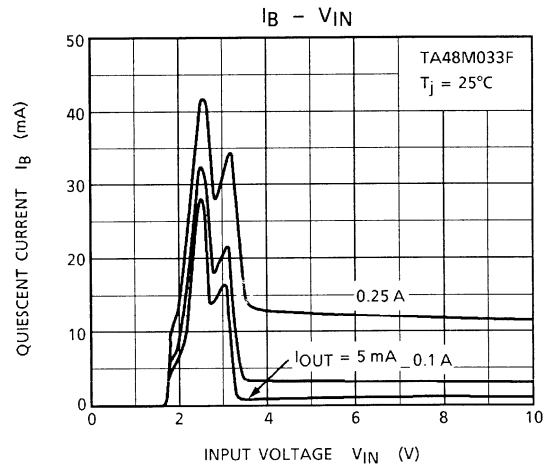
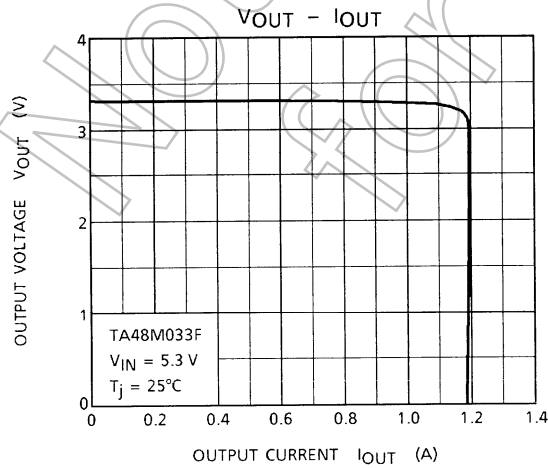
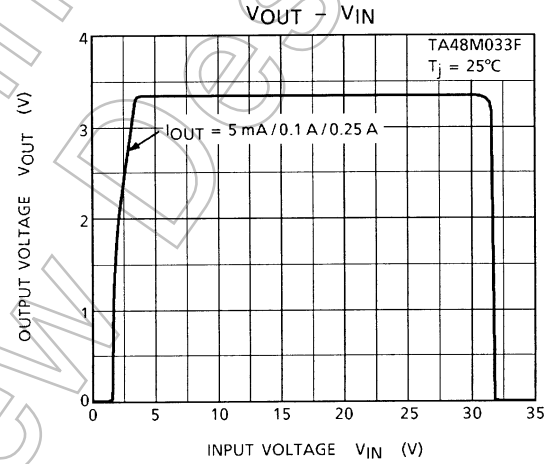
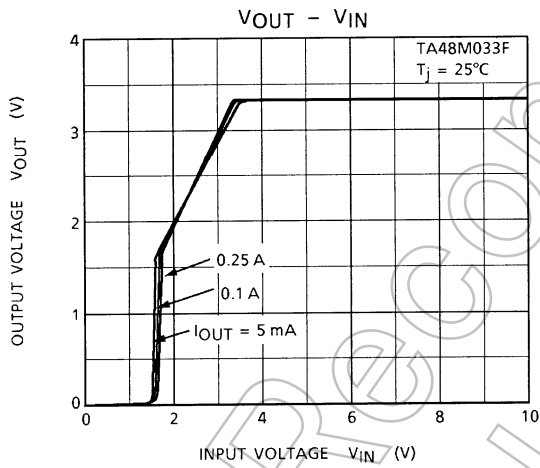
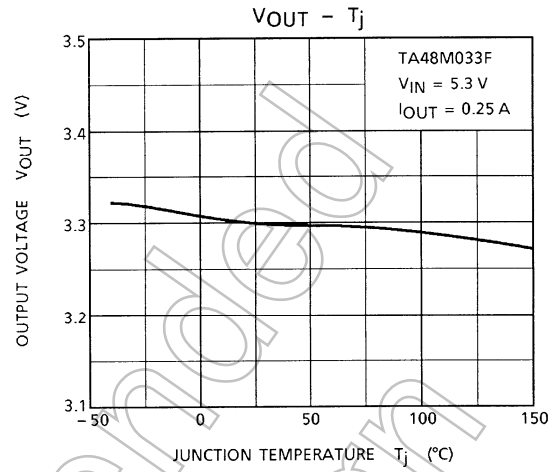
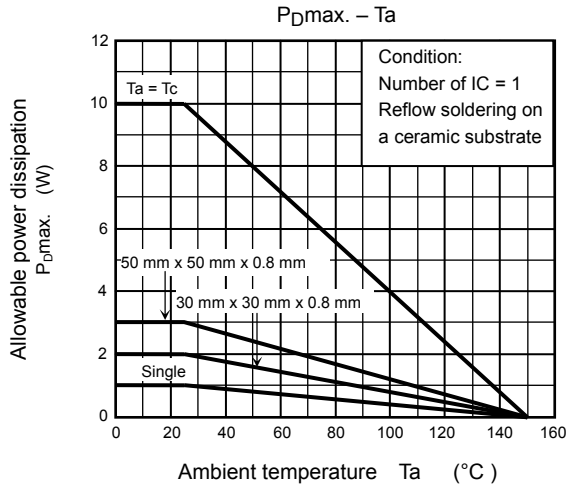
- Low voltage**

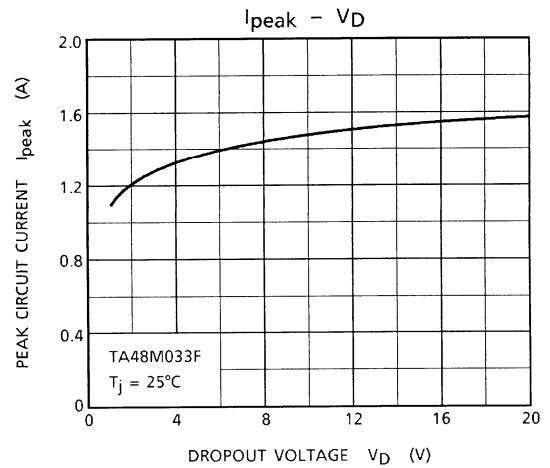
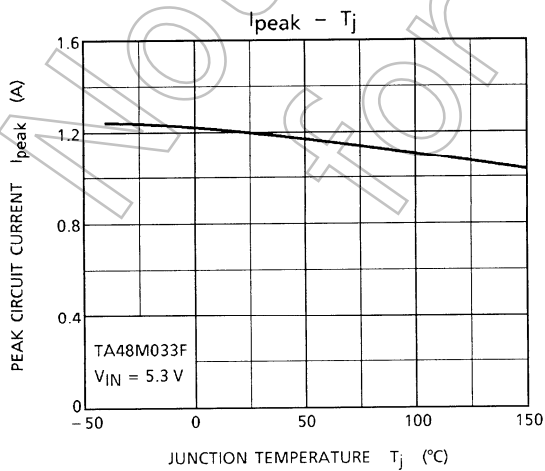
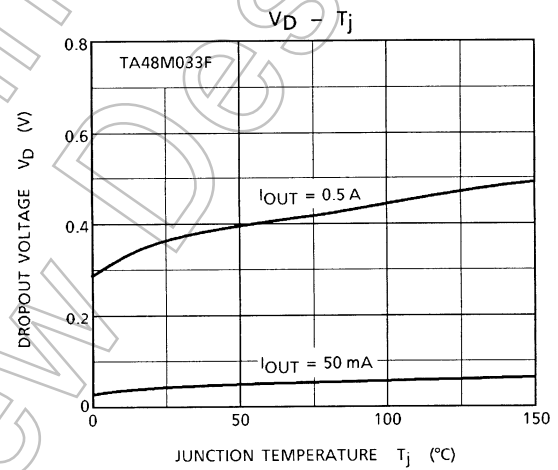
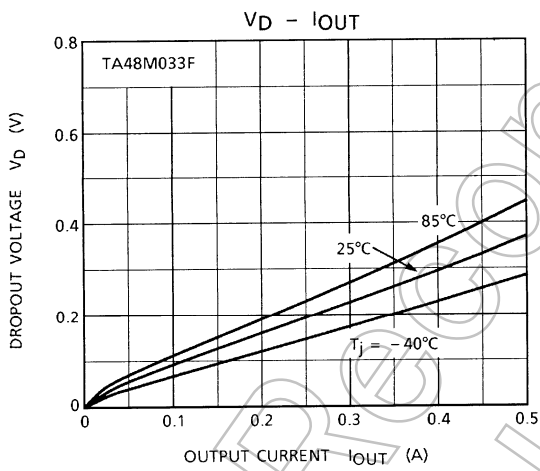
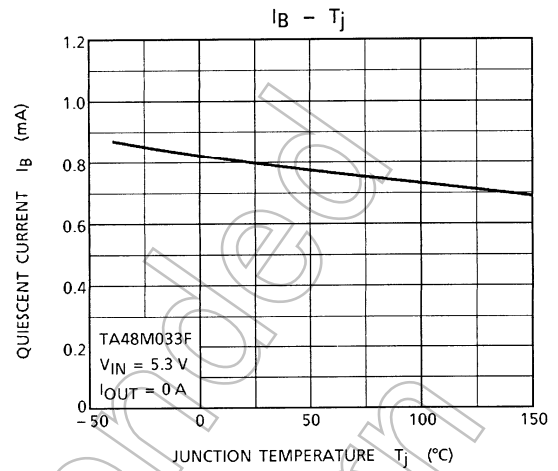
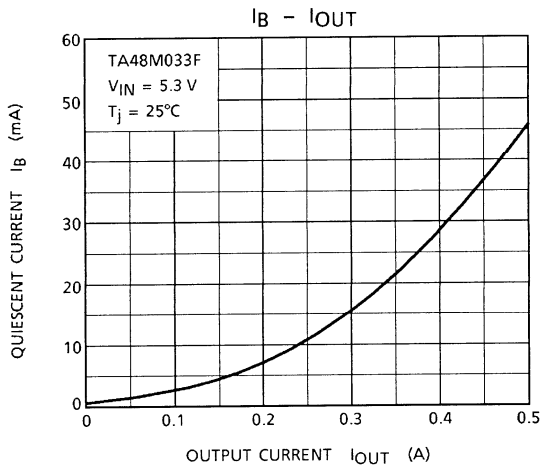
Do not apply voltage to the Product that is lower than the minimum operating voltage, or the Product's protective functions will not operate properly and the Product may be permanently damaged.
- Overcurrent Protection**

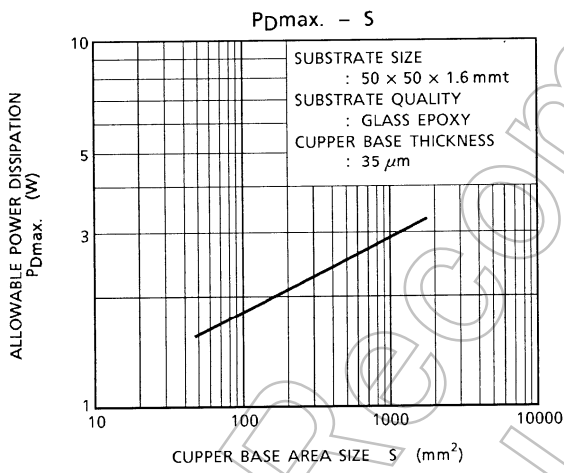
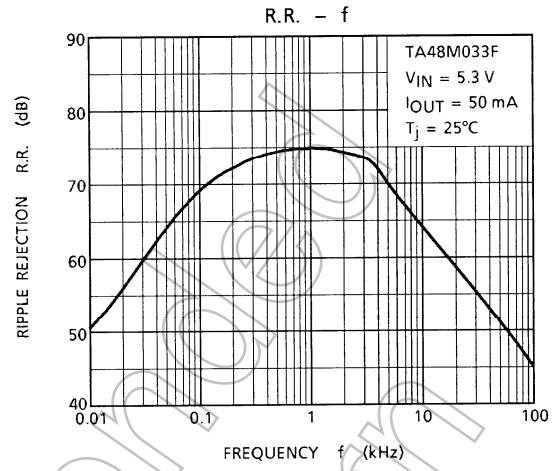
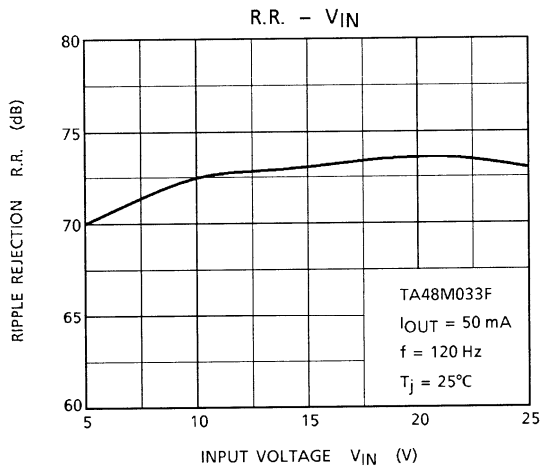
The overcurrent protection circuits in the Product are designed to temporarily protect Product from minor overcurrent of brief duration. When the overcurrent protective function in the Product activates, immediately cease application of overcurrent to Product. Improper usage of Product, such as application 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.
- Overvoltage Protection**

The overvoltage protection circuits in the Product are designed to temporarily protect Product from minor overvoltage of brief duration. When the overvoltage protective function in the Product activates, immediately cease application of overvoltage to Product. Improper usage of Product, such as application of voltage to Product exceeding the absolute maximum ratings, could cause the overvoltage protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.





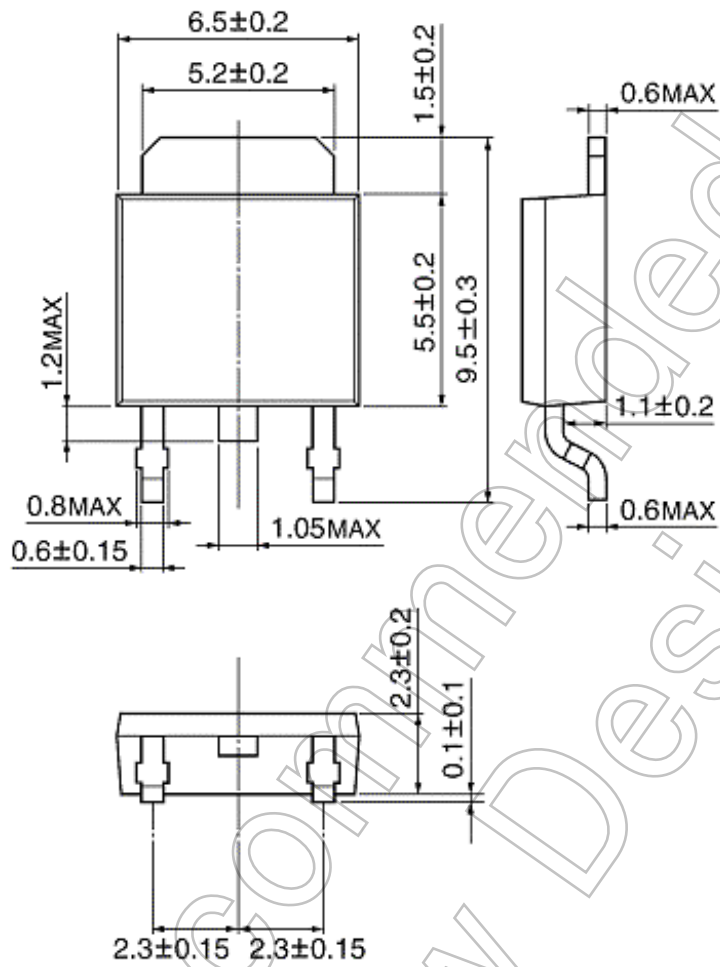


Not for Commercial Design

**Package Dimensions**

HSOP3-P-2.30D

Unit: mm



Weight: 0.36 g (typ.)

Not Recommended for New Design

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