

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

## TA78L05PF,TA78L06PF,TA78L07PF,TA78L08PF TA78L09PF,TA78L10PF,TA78L12PF,TA78L15PF

5 V, 6 V, 7V, 8 V, 9 V, 10 V, 12 V, 15V

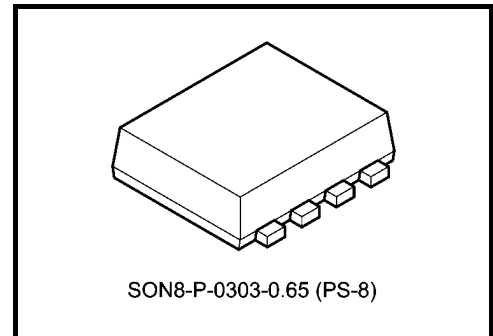
0.15A Positive Voltage Regulators

Housed in a very small and thin PS-8 package, the TA78L\*\*PF series of fixed-voltage monolithic integrated circuit voltage regulators is designed for a wide range of applications. One of these regulators can drive up to 0.15 A of output current. The series offers devices with various output voltages: 5 V, 6 V, 7 V, 8 V, 9 V, 10 V, 12 V, and 15 V.

### Features

- Maximum output current: 0.15 A
- Output voltage accuracy:  $V_{OUT} \pm 4\%$  ( $@T_j = 25^\circ\text{C}$ )
- Protection function: Overcurrent/Thermal shutdown
- Package type: PS-8 is a flat lead, 8-pin package.

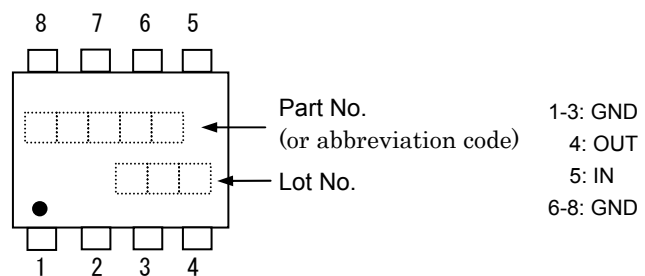
This is smaller and thinner than the previous PW-Mini(SOT-89), with a 47% decrease in height and a 54% decrease in mounting area.



Weight: 0.017 g (typ.)

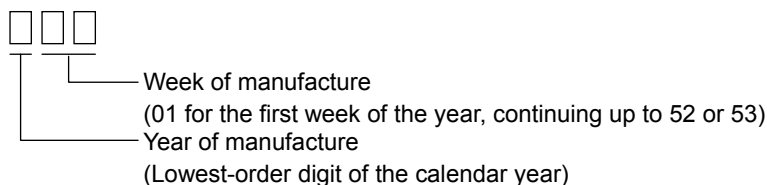
### Pin Assignment/Marking

| Part No.  | Part No.<br>(abbreviation code) |
|-----------|---------------------------------|
| TA78L05PF | 78L05                           |
| TA78L06PF | 78L06                           |
| TA78L07PF | 78L07                           |
| TA78L08PF | 78L08                           |
| TA78L09PF | 78L09                           |
| TA78L10PF | 78L10                           |
| TA78L12PF | 78L12                           |
| TA78L15PF | 78L15                           |



(●) on the lower left of the marking indicates Pin 1.

\* Lot No.: The lot no. consists of three digits. The first digit represents the last digit of the year of manufacture, and the following two digits indicates the week of manufacture between 01 and either 52 or 53.



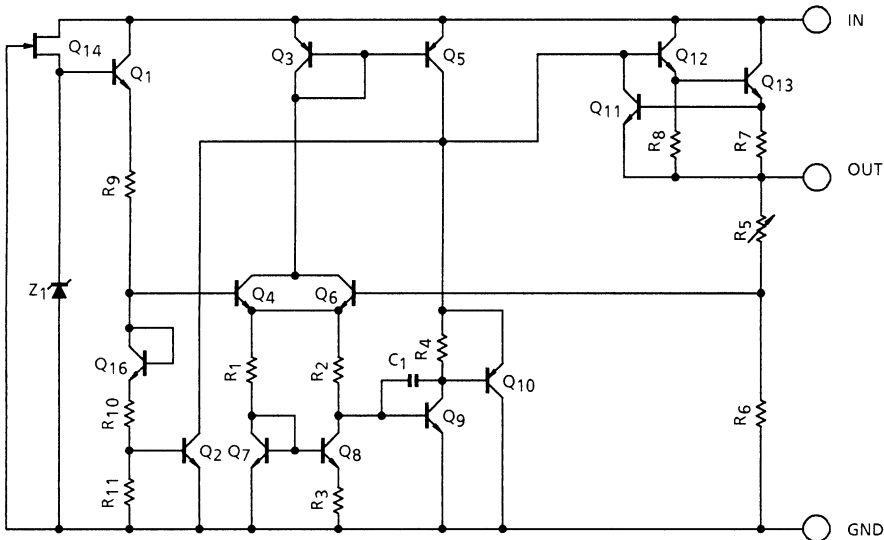
The product(s) in this document ("Product") contain functions intended to protect the Product from temporary small overloads such as minor short-term overcurrent or overheating. The protective functions do not necessarily protect Product under all circumstances. When incorporating Product into your system,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

| Part No.            | Packing Type and Unit for Orders     |
|---------------------|--------------------------------------|
| TA78L**PF (TE85L,F) | Embossed-tape packing: 3000 (1 tape) |

Note 1: In the actual product number, " \*\*" is replaced by the output voltage of the product.

Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

| Characteristics             | Symbol    | Rating     | Unit |
|-----------------------------|-----------|------------|------|
| Input voltage               | $V_{IN}$  | 35         | V    |
| Output current              | $I_{OUT}$ | 0.15       | A    |
| Operating temperature       | $T_{opr}$ | -30 to 85  | °C   |
| Junction temperature        | $T_j$     | 150        | °C   |
| Storage temperature         | $T_{stg}$ | -55 to 150 | °C   |
| Power dissipation (Note 4a) | $P_D$     | 1.3        | W    |
| Power dissipation (Note 4b) | $P_D$     | 0.62       | W    |

Note 2: Do not apply external current and voltage (including negative voltage) to pins other than those specified.

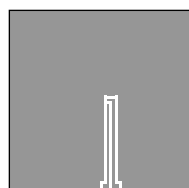
Note 3: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 Resistance

| Characteristics                                       | Symbol        | Rating | Unit |
|-------------------------------------------------------|---------------|--------|------|
| Thermal resistance<br>(junction to ambient) (Note 4a) | $R_{th(j-a)}$ | 97     | °C/W |
| Thermal resistance<br>(junction to ambient) (Note 4b) | $R_{th(j-a)}$ | 202    | °C/W |

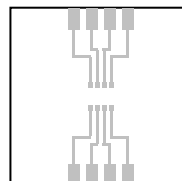
Note 4:

(a) Device mounted on a glass-epoxy board



FR-4  
25.4 × 25.4 × 1.6  
Unit: (mm)  
Cu base thickness  
35 μm

(b) Device mounted on a glass-epoxy board



FR-4  
25.4 × 25.4 × 1.6  
Unit: (mm)  
Cu base thickness  
35 μm

## TA78L05PF

### Electrical Characteristics

( $V_{IN} = 10\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                       |                                                                      | Min  | Typ. | Max  | Unit              |
|---------------------------------------------------|------------------|--------------|----------------------------------------------------------------------|----------------------------------------------------------------------|------|------|------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                                |                                                                      | 4.8  | 5.0  | 5.2  | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                                | 7.0 V ≤ V <sub>IN</sub> ≤ 20 V                                       | —    | 55   | 150  | mV                |
|                                                   |                  |              |                                                                      | 8.0 V ≤ V <sub>IN</sub> ≤ 20 V                                       | —    | 45   | 100  |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                                | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                   | —    | 11   | 60   | mV                |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                    | —    | 5.0  | 30   |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                                | 7.0 V ≤ V <sub>IN</sub> ≤ 20 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 4.75 | —    | 5.25 | V                 |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                    | 4.75 | —    | 5.25 |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                                |                                                                      | —    | 3.1  | 6.0  | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                               |                                                                      | —    | —    | 5.5  |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                                | 8.0 V ≤ V <sub>IN</sub> ≤ 20 V                                       | —    | —    | 1.5  | mA                |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                    | —    | —    | 0.1  |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                           |                                                                      | —    | 40   | —    | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>8.0 V ≤ V <sub>IN</sub> ≤ 18 V, T <sub>j</sub> = 25°C |                                                                      | 41   | 49   | —    | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                     |                                                                      | —    | 2.0  | —    | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                              |                                                                      | —    | −0.6 | —    | mV/°C             |

## TA78L06PF

### Electrical Characteristics

( $V_{IN} = 11\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                       |                                                                      | Min  | Typ. | Max  | Unit              |
|---------------------------------------------------|------------------|--------------|----------------------------------------------------------------------|----------------------------------------------------------------------|------|------|------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                                |                                                                      | 5.76 | 6.0  | 6.24 | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                                | 8.1 V ≤ V <sub>IN</sub> ≤ 21 V                                       | —    | 50   | 150  | mV                |
|                                                   |                  |              |                                                                      | 9.0 V ≤ V <sub>IN</sub> ≤ 21 V                                       | —    | 45   | 110  |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                                | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                   | —    | 12   | 70   | mV                |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                    | —    | 5.5  | 35   |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                                | 8.1 V ≤ V <sub>IN</sub> ≤ 21 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 5.7  | —    | 6.3  | V                 |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                    | 5.7  | —    | 6.3  |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                                |                                                                      | —    | 3.1  | 6.0  | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                               |                                                                      | —    | —    | 5.5  |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                                | 9.0 V ≤ V <sub>IN</sub> ≤ 20 V                                       | —    | —    | 1.5  | mA                |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                    | —    | —    | 0.1  |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                           |                                                                      | —    | 40   | —    | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>9.0 V ≤ V <sub>IN</sub> ≤ 19 V, T <sub>j</sub> = 25°C |                                                                      | 39   | 47   | —    | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                     |                                                                      | —    | 2.0  | —    | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                              |                                                                      | —    | −0.7 | —    | mV/°C             |

**TA78L07PF**
**Electrical Characteristics**

( $V_{IN} = 12\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                      |                                                                      | Min  | Typ.  | Max  | Unit              |
|---------------------------------------------------|------------------|--------------|---------------------------------------------------------------------|----------------------------------------------------------------------|------|-------|------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               |                                                                      | 6.72 | 7.0   | 7.28 | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                               | 9.2 V ≤ V <sub>IN</sub> ≤ 22 V                                       | —    | 50    | 160  | mV                |
|                                                   |                  |              |                                                                     | 10 V ≤ V <sub>IN</sub> ≤ 22 V                                        | —    | 45    | 115  |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                               | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                   | —    | 13    | 75   | mV                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                    | —    | 6.0   | 40   |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               | 9.2 V ≤ V <sub>IN</sub> ≤ 22 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 6.65 | —     | 7.35 | V                 |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                    | 6.65 | —     | 7.35 |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                               |                                                                      | —    | 3.1   | 6.5  | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                              |                                                                      | —    | —     | 6.0  |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                               | 10 V ≤ V <sub>IN</sub> ≤ 22 V                                        | —    | —     | 1.5  | mA                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                    | —    | —     | 0.1  |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                          |                                                                      | —    | 50    | —    | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>10 V ≤ V <sub>IN</sub> ≤ 20 V, T <sub>j</sub> = 25°C |                                                                      | 37   | 46    | —    | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                    |                                                                      | —    | 2.0   | —    | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                             |                                                                      | —    | −0.75 | —    | mV/°C             |

**TA78L08PF**
**Electrical Characteristics**

( $V_{IN} = 14\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                      |                                                                       | Min  | Typ. | Max  | Unit              |
|---------------------------------------------------|------------------|--------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|------|------|------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | 7.68 | 8.0  | 8.32 | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                               | 10.5 V ≤ V <sub>IN</sub> ≤ 23 V                                       | —    | 20   | 175  | mV                |
|                                                   |                  |              |                                                                     | 11 V ≤ V <sub>IN</sub> ≤ 23 V                                         | —    | 12   | 125  |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                               | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                    | —    | 15   | 80   | mV                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —    | 7.0  | 40   |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               | 10.5 V ≤ V <sub>IN</sub> ≤ 23 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 7.6  | —    | 8.4  | V                 |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                     | 7.6  | —    | 8.4  |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | —    | 3.1  | 6.5  | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                              |                                                                       | —    | —    | 6.0  |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                               | 11 V ≤ V <sub>IN</sub> ≤ 23 V                                         | —    | —    | 1.5  | mA                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —    | —    | 0.1  |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                          |                                                                       | —    | 60   | —    | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>12 V ≤ V <sub>IN</sub> ≤ 23 V, T <sub>j</sub> = 25°C |                                                                       | 37   | 45   | —    | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                    |                                                                       | —    | 2.0  | —    | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                             |                                                                       | —    | −0.8 | —    | mV/°C             |

**TA78L09PF**
**Electrical Characteristics**

( $V_{IN} = 15\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                      |                                                                       | Min  | Typ.  | Max  | Unit              |
|---------------------------------------------------|------------------|--------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|------|-------|------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | 8.64 | 9.0   | 9.36 | V                 |
| Line regulation                                   | Reg-line         | 1            | T <sub>j</sub> = 25°C                                               | 11.4 V ≤ V <sub>IN</sub> ≤ 24 V                                       | —    | 80    | 200  | mV                |
|                                                   |                  |              |                                                                     | 12 V ≤ V <sub>IN</sub> ≤ 24 V                                         | —    | 20    | 160  |                   |
| Load regulation                                   | Reg-load         | 1            | T <sub>j</sub> = 25°C                                               | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                    | —    | 17    | 90   | mV                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —    | 8.0   | 45   |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               | 11.4 V ≤ V <sub>IN</sub> ≤ 24 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 8.55 | —     | 9.45 | V                 |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                     | 8.55 | —     | 9.45 |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | —    | 3.2   | 6.5  | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                              |                                                                       | —    | —     | 6.0  |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                               | 12 V ≤ V <sub>IN</sub> ≤ 24 V                                         | —    | —     | 1.5  | mA                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —    | —     | 0.1  |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                          |                                                                       | —    | 65    | —    | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>12 V ≤ V <sub>IN</sub> ≤ 24 V, T <sub>j</sub> = 25°C |                                                                       | 36   | 44    | —    | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                    |                                                                       | —    | 2.0   | —    | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                             |                                                                       | —    | −0.85 | —    | mV/°C             |

**TA78L10PF**
**Electrical Characteristics**

( $V_{IN} = 16\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                      |                                                                       | Min | Typ. | Max  | Unit              |
|---------------------------------------------------|------------------|--------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|-----|------|------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | 9.6 | 10   | 10.4 | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                               | 12.5 V ≤ V <sub>IN</sub> ≤ 25 V                                       | —   | 80   | 230  | mV                |
|                                                   |                  |              |                                                                     | 13 V ≤ V <sub>IN</sub> ≤ 25 V                                         | —   | 30   | 170  |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                               | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                    | —   | 18   | 90   | mV                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —   | 8.5  | 45   |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               | 12.5 V ≤ V <sub>IN</sub> ≤ 25 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 9.5 | —    | 10.5 | V                 |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                     | 9.5 | —    | 10.5 |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | —   | 3.2  | 6.5  | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                              |                                                                       | —   | —    | 6.0  |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                               | 13 V ≤ V <sub>IN</sub> ≤ 25 V                                         | —   | —    | 1.5  | mA                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —   | —    | 0.1  |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                          |                                                                       | —   | 70   | —    | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>13 V ≤ V <sub>IN</sub> ≤ 24 V, T <sub>j</sub> = 25°C |                                                                       | 36  | 43   | —    | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                    |                                                                       | —   | 2.0  | —    | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                             |                                                                       | —   | −0.9 | —    | mV/°C             |

**TA78L12PF**
**Electrical Characteristics**

( $V_{IN} = 19\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                      |                                                                       | Min   | Typ. | Max   | Unit              |
|---------------------------------------------------|------------------|--------------|---------------------------------------------------------------------|-----------------------------------------------------------------------|-------|------|-------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | 11.52 | 12   | 12.48 | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                               | 14.5 V ≤ V <sub>IN</sub> ≤ 27 V                                       | —     | 120  | 250   | mV                |
|                                                   |                  |              |                                                                     | 16 V ≤ V <sub>IN</sub> ≤ 27 V                                         | —     | 100  | 200   |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                               | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                    | —     | 20   | 100   | mV                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —     | 10   | 50    |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                               | 14.5 V ≤ V <sub>IN</sub> ≤ 27 V,<br>1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 11.4  | —    | 12.6  | V                 |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                     | 11.4  | —    | 12.6  |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                               |                                                                       | —     | 3.2  | 6.5   | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                              |                                                                       | —     | —    | 6.0   |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                               | 16 V ≤ V <sub>IN</sub> ≤ 27 V                                         | —     | —    | 1.5   | mA                |
|                                                   |                  |              |                                                                     | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                     | —     | —    | 0.1   |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                          |                                                                       | —     | 80   | —     | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz,<br>15 V ≤ V <sub>IN</sub> ≤ 25 V, T <sub>j</sub> = 25°C |                                                                       | 36    | 41   | —     | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                    |                                                                       | —     | 2.0  | —     | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                             |                                                                       | —     | −1.0 | —     | mV/°C             |

**TA78L15PF**
**Electrical Characteristics**

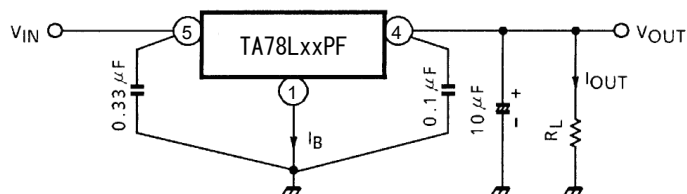
( $V_{IN} = 23\text{ V}$ ,  $I_{OUT} = 40\text{ mA}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_{OUT} = 0.1\text{ }\mu\text{F}$ ,  $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , unless otherwise specified)

| Characteristics                                   | Symbol           | Test Circuit | Test Condition                                                       |                                                                    | Min   | Typ. | Max   | Unit              |
|---------------------------------------------------|------------------|--------------|----------------------------------------------------------------------|--------------------------------------------------------------------|-------|------|-------|-------------------|
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                                |                                                                    | 14.4  | 15   | 15.6  | V                 |
| Line regulation                                   | Reg·line         | 1            | T <sub>j</sub> = 25°C                                                | 17.5 V ≤ V <sub>IN</sub> ≤ 30 V                                    | —     | 130  | 300   | mV                |
|                                                   |                  |              |                                                                      | 20 V ≤ V <sub>IN</sub> ≤ 30 V                                      | —     | 110  | 250   |                   |
| Load regulation                                   | Reg·load         | 1            | T <sub>j</sub> = 25°C                                                | 1.0 mA ≤ I <sub>OUT</sub> ≤ 100 mA                                 | —     | 25   | 150   | mV                |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                  | —     | 12   | 75    |                   |
| Output voltage                                    | V <sub>OUT</sub> | 1            | T <sub>j</sub> = 25°C                                                | 17.5 V ≤ V <sub>IN</sub> ≤ 30 V, 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA | 14.25 | —    | 15.75 | V                 |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 70 mA                                  | 14.25 | —    | 15.75 |                   |
| Quiescent current                                 | I <sub>B</sub>   | 1            | T <sub>j</sub> = 25°C                                                |                                                                    | —     | 3.3  | 6.5   | mA                |
|                                                   |                  |              | T <sub>j</sub> = 125°C                                               |                                                                    | —     | —    | 6.0   |                   |
| Quiescent current change                          | ΔI <sub>B</sub>  | 1            | T <sub>j</sub> = 25°C                                                | 20 V ≤ V <sub>IN</sub> ≤ 30 V                                      | —     | —    | 1.5   | mA                |
|                                                   |                  |              |                                                                      | 1.0 mA ≤ I <sub>OUT</sub> ≤ 40 mA                                  | —     | —    | 0.1   |                   |
| Output noise voltage                              | V <sub>NO</sub>  | 2            | T <sub>a</sub> = 25°C, 10 Hz ≤ f ≤ 100 kHz                           |                                                                    | —     | 90   | —     | μV <sub>rms</sub> |
| Ripple rejection ratio                            | R.R.             | 3            | f = 120 Hz, 18.5 V ≤ V <sub>IN</sub> ≤ 28.5 V, T <sub>j</sub> = 25°C |                                                                    | 34    | 40   | —     | dB                |
| Dropout voltage                                   | V <sub>D</sub>   | 1            | T <sub>j</sub> = 25°C, I <sub>OUT</sub> = 150 mA                     |                                                                    | —     | 2.0  | —     | V                 |
| Average temperature coefficient of output voltage | T <sub>CVO</sub> | 1            | I <sub>OUT</sub> = 5 mA                                              |                                                                    | —     | -1.3 | —     | mV/°C             |

## Electrical Characteristics for All Products

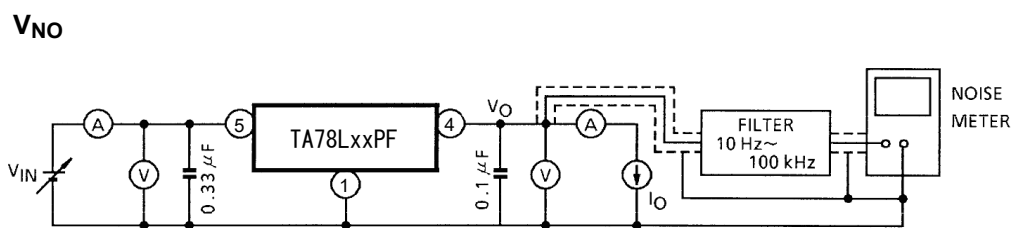
Generally, the characteristics of power supply ICs change according to temperature fluctuations. The specification  $T_j = 25^\circ\text{C}$  is based on a state where temperature increase has no effect (assuming no fluctuation in the characteristics) as ascertained by pulse tests.

### Test Circuit 1/Standard Application Example

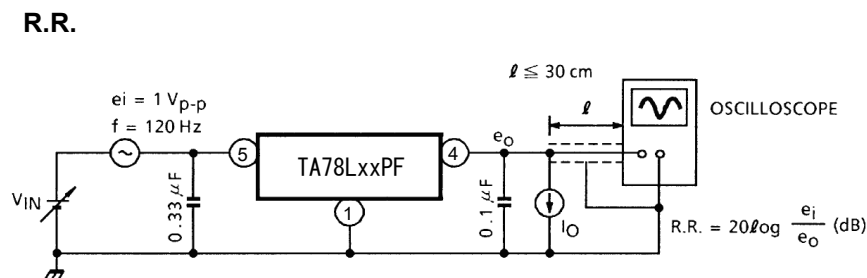


Use capacitors to connect the input terminal and GND and the output terminal and GND. The capacitances should be determined experimentally. In particular, adequate investigation should be made to ensure there is no problem even in high or low temperatures.

### Test Circuit 2

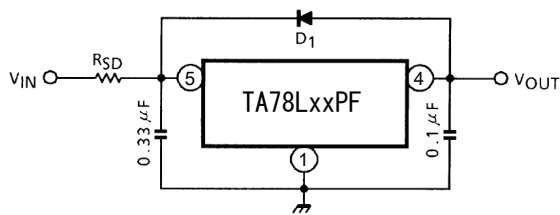


### Test Circuit 3



## Usage Precautions

- If a high voltage in excess of the output voltage (typ. value) of the IC is applied to the output terminal of the IC, the IC may be destroyed. To prevent such application of excessive voltage, connect a Zener diode between the output terminal and GND.



$D_1$  : IC protective diode

When surge voltage is applied to IC output terminal or  $V_{IN} < V_{OUT}$  at the time of power ON/OFF, always connect the high speed swithing diode  $D_1$ .

$R_{SD}$  : Power limiting resistor

If  $V_{IN}$  is too high, always connect  $R_{SD}$  in order to reduce power consumption of IC.

- Low voltage

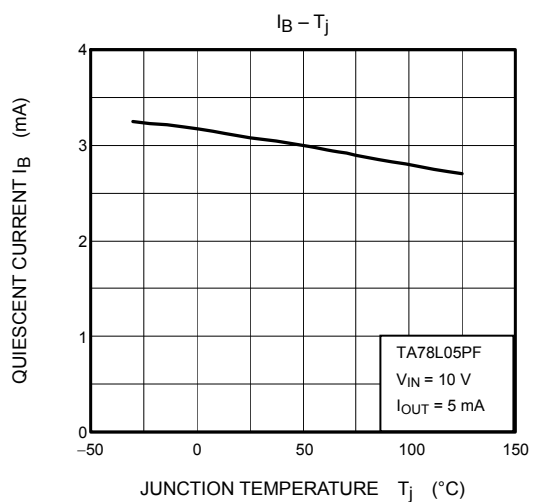
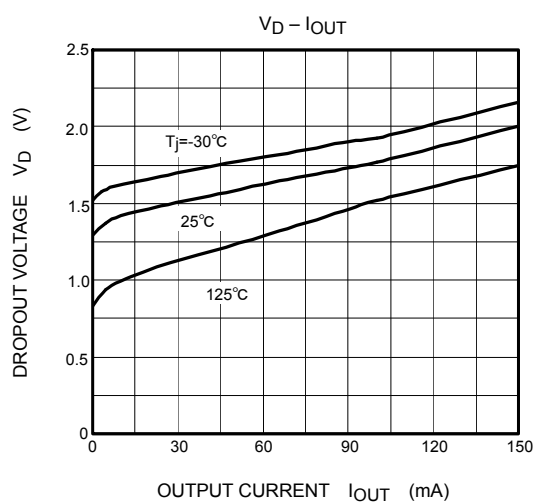
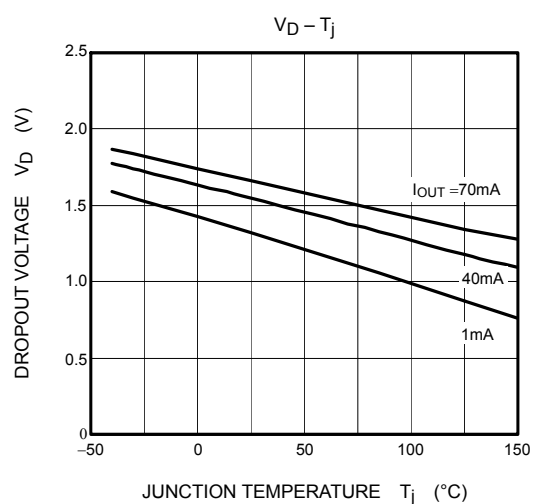
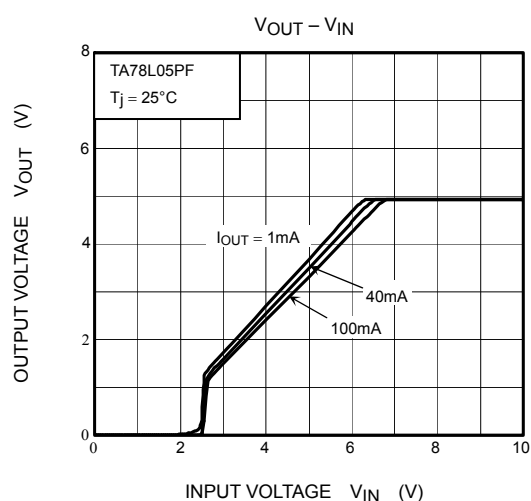
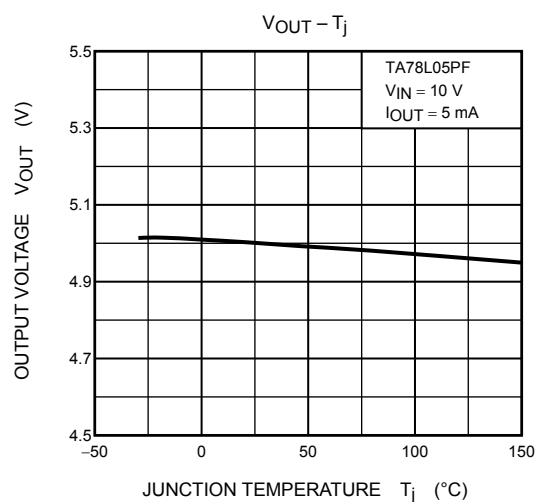
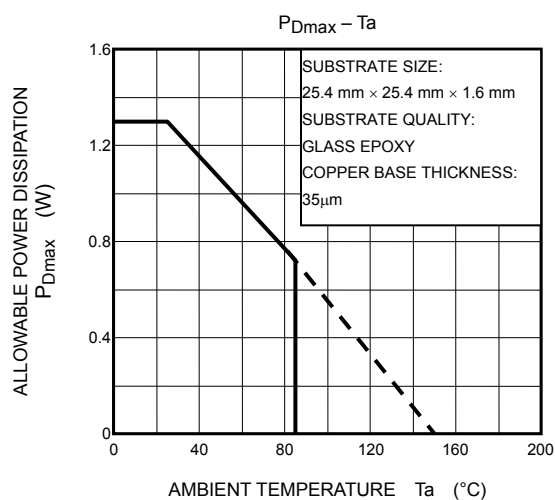
Do not apply voltage to the Product that is lower than the minimum operating voltage, or the Product's protective functions will not operate properly and the Product may be permanently damaged.

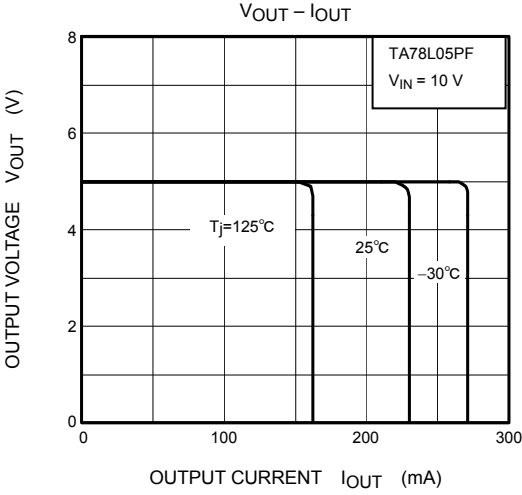
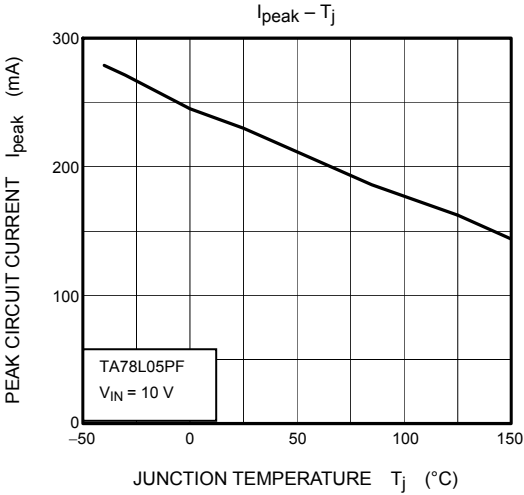
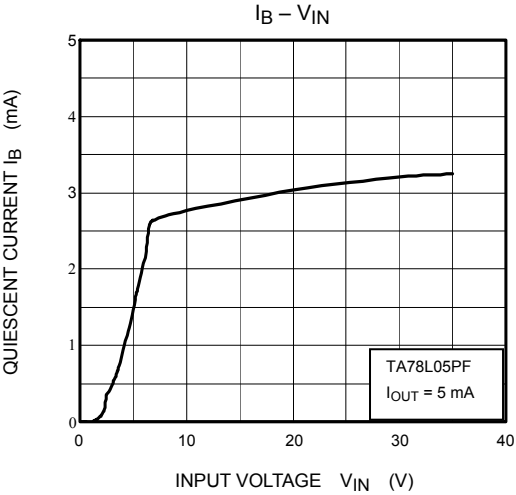
- Overcurrent Protection

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.

- Thermal shutdown Protection

The thermal shutdown circuits in the Product are designed to temporarily protect Product from minor overheating of brief duration. When the thermal shutdown 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 thermal shutdown protection circuit not to operate properly and/or damage Product permanently even before the protection circuit starts to operate.

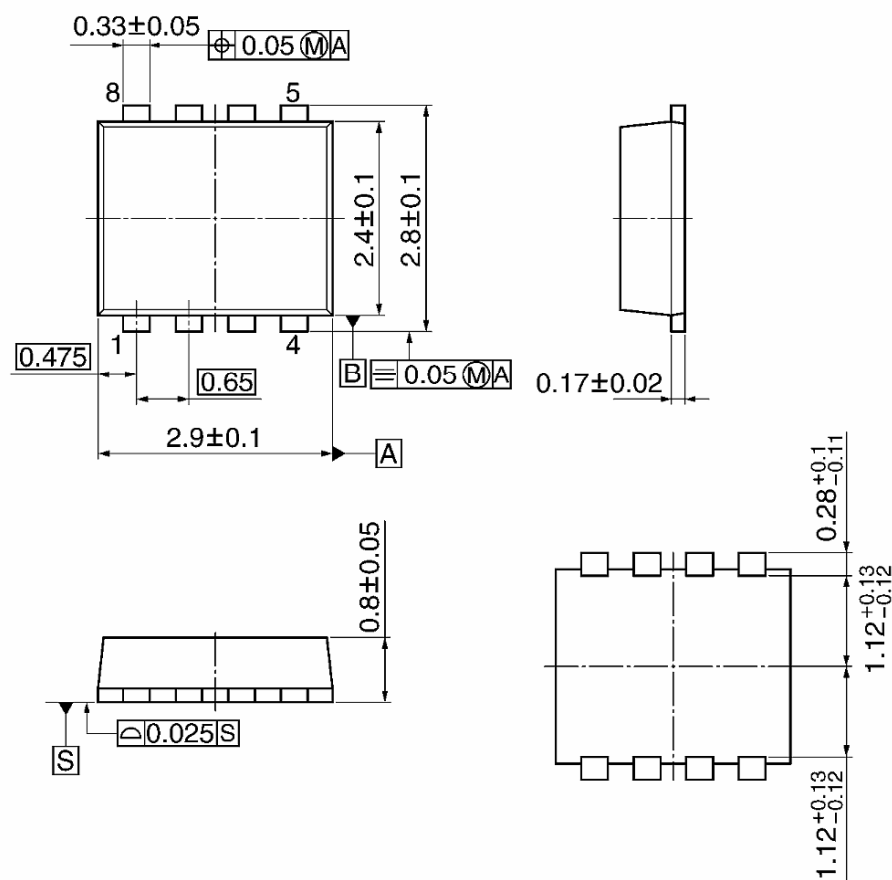




## Package Dimensions

SON8-P-0303-0.65 (PS-8)

Unit: mm



Weight: 0.017 g (typ.)

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