

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC  
**TA78DL05S, TA78DL06S, TA78DL08S, TA78DL09S**  
**TA78DL10S, TA78DL12S, TA78DL15S**

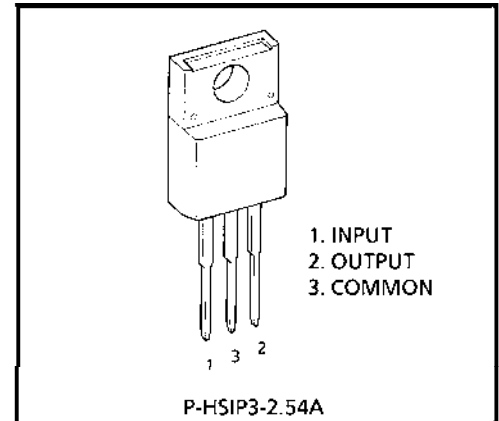
**5 V, 6 V, 8 V, 9 V, 10 V, 12 V, 15 V**

**LOW DROPOUT VOLTAGE REGULATOR.**

The TA78DLx xS series consists of positive fixed output voltage regulator IC capable of sourcing current up to 250 mA.

Due to the features of low dropout voltage and low standby current, these devices are useful for battery powered equipment.

This series includes current limiting, thermal shutdown, overvoltage protection, input fault protection and excessive transient protection circuits internally.

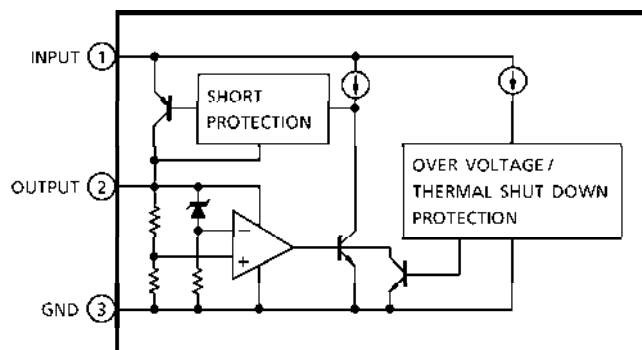


Weight : 1.7 g (Typ.)

**FEATURES**

- Low Standby Current of 500  $\mu$ A Typical.
- Maximum Output Current Up to 250 mA.
- Low Dropout Voltage of Less than 0.6 V (@ I<sub>OUT</sub> = 0.2 A).
- Multi-protection
  - : Reverse Connection of Power Supply, 60V Load Dump, Thermal Shut Down and Current Limiting.
- Metal Fin (Tab) is Fully Covered with Mold Resin. (TO-220 NIS package)

**BLOCK DIAGRAM**



980910EBA2

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**MAXIMUM RATINGS** (Ta = 25°C)

| CHARACTERISTIC           | SYMBOL               | RATING      | UNIT |
|--------------------------|----------------------|-------------|------|
| Operating Input Voltage  | V <sub>IN</sub>      | 29          | V    |
| Input Voltage of Surge   | V <sub>IN</sub>      | 60          | V    |
| Power Dissipation        | P <sub>D</sub>       | (Ta = 25°C) | 2    |
|                          |                      | (Tc = 25°C) | 20   |
| Operating Temperature    | T <sub>opr</sub>     | -40~85      | °C   |
| Storage Temperature      | T <sub>stg</sub>     | -55~150     | °C   |
| Junction Temperature     | T <sub>j</sub>       | 150         | °C   |
| Thermal Resistance       | R <sub>th(j-c)</sub> | 6.25        | °C/W |
|                          | R <sub>th(j-a)</sub> | 62.5        |      |
| Storage Temperature·Time | T <sub>sol</sub>     | 260 (10 s)  | °C   |

TA78DL05S

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified, V<sub>IN</sub> = 14 V, I<sub>OUT</sub> = 10 mA, T<sub>j</sub> = 25°C)

| CHARACTERISTIC         | SYMBOL           | TEST CIR-CUIT | TEST CONDITION  | MIN. | TYP. | MAX. | UNIT |
|------------------------|------------------|---------------|---|------|------|------|------|
| Output Voltage         | V <sub>OUT</sub> | —             | 5.35 V ≤ V <sub>IN</sub> ≤ 26 V<br>-40°C ≤ Ta ≤ 85°C      | 4.5  | 5.0  | 5.5  | V    |
| Line Regulation        | Reg·line         | —             | 9 V ≤ V <sub>IN</sub> ≤ 16 V                              | —    | 2    | 10   | mV   |
|                        |                  |               | 6 V ≤ V <sub>IN</sub> ≤ 26 V                              | —    | 4    | 30   |      |
| Load Regulation        | Reg·load         | —             | 10 mA ≤ I <sub>OUT</sub> ≤ 200 mA                         | —    | 14   | 50   | mV   |
| Quiescent Current      | I <sub>B</sub>   | —             | I <sub>OUT</sub> ≤ 10 mA,<br>6 V ≤ V <sub>IN</sub> ≤ 26 V | —    | 0.5  | 1    | mA   |
| Dropout Voltage        | V <sub>D</sub>   | —             | I <sub>OUT</sub> = 50 mA                                  | —    | 0.15 | 0.3  | V    |
|                        |                  |               | I <sub>OUT</sub> = 200 mA                                 | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | V <sub>IN</sub>  | —             | —   | 29   | 33   | —    | V    |

TA78DL06S

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified, V<sub>IN</sub> = 14 V, I<sub>OUT</sub> = 10 mA, T<sub>j</sub> = 25°C)

| CHARACTERISTIC         | SYMBOL           | TEST CIR-CUIT | TEST CONDITION  | MIN. | TYP. | MAX. | UNIT |
|------------------------|------------------|---------------|---|------|------|------|------|
| Output Voltage         | V <sub>OUT</sub> | —             | 6.35 V ≤ V <sub>IN</sub> ≤ 26 V<br>-40°C ≤ Ta ≤ 85°C      | 5.4  | 6.0  | 6.6  | V    |
| Line Regulation        | Reg·line         | —             | 10 V ≤ V <sub>IN</sub> ≤ 17 V                             | —    | 2    | 12   | mV   |
|                        |                  |               | 7 V ≤ V <sub>IN</sub> ≤ 26 V                              | —    | 5    | 36   |      |
| Load Regulation        | Reg·load         | —             | 10 mA ≤ I <sub>OUT</sub> ≤ 200 mA                         | —    | 17   | 60   | mV   |
| Quiescent Current      | I <sub>B</sub>   | —             | I <sub>OUT</sub> ≤ 10 mA,<br>7 V ≤ V <sub>IN</sub> ≤ 26 V | —    | 0.55 | —    | mA   |
| Dropout Voltage        | V <sub>D</sub>   | —             | I <sub>OUT</sub> = 50 mA                                  | —    | 0.15 | 0.3  | V    |
|                        |                  |               | I <sub>OUT</sub> = 200 mA                                 | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | V <sub>IN</sub>  | —             | —   | 29   | 33   | —    | V    |

**TA78DL08S**

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified,  $V_{IN} = 16\text{ V}$ ,  $I_{OUT} = 10\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ )

| CHARACTERISTIC         | SYMBOL    | TEST CIR-CUIT | TEST CONDITION   | MIN. | TYP. | MAX. | UNIT |
|------------------------|-----------|---------------|--|------|------|------|------|
| Output Voltage         | $V_{OUT}$ | —             | $8.35\text{ V} \leq V_{IN} \leq 26\text{ V}$<br>$-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | 7.2  | 8    | 8.8  | V    |
| Line Regulation        | Reg·line  | —             | $12\text{ V} \leq V_{IN} \leq 19\text{ V}$   | —    | 3    | 16   | mV   |
|                        |           |               | $9\text{ V} \leq V_{IN} \leq 26\text{ V}$  | —    | 6    | 45   |      |
| Load Regulation        | Reg·load  | —             | $10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$   | —    | 22   | 80   | mV   |
| Quiescent Current      | $I_B$     | —             | $I_{OUT} \leq 10\text{ mA}$ ,<br>$9\text{ V} \leq V_{IN} \leq 26\text{ V}$                         | —    | 0.6  | —    | mA   |
| Dropout Voltage        | $V_D$     | —             | $I_{OUT} = 50\text{ mA}$   | —    | 0.15 | 0.3  | V    |
|                        |           |               | $I_{OUT} = 200\text{ mA}$  | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$  | —             | —  | 29   | 33   | —    | V    |

**TA78DL09S**

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified,  $V_{IN} = 16\text{ V}$ ,  $I_{OUT} = 10\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ )

| CHARACTERISTIC         | SYMBOL    | TEST CIR-CUIT | TEST CONDITION   | MIN. | TYP. | MAX. | UNIT |
|------------------------|-----------|---------------|--|------|------|------|------|
| Output Voltage         | $V_{OUT}$ | —             | $9.35\text{ V} \leq V_{IN} \leq 26\text{ V}$<br>$-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | 8.1  | 9    | 9.9  | V    |
| Line Regulation        | Reg·line  | —             | $13\text{ V} \leq V_{IN} \leq 20\text{ V}$   | —    | 3    | 18   | mV   |
|                        |           |               | $10\text{ V} \leq V_{IN} \leq 26\text{ V}$   | —    | 7    | 50   |      |
| Load Regulation        | Reg·load  | —             | $10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$   | —    | 25   | 90   | mV   |
| Quiescent Current      | $I_B$     | —             | $I_{OUT} \leq 10\text{ mA}$ ,<br>$10\text{ V} \leq V_{IN} \leq 26\text{ V}$                        | —    | 0.65 | —    | mA   |
| Dropout Voltage        | $V_D$     | —             | $I_{OUT} = 50\text{ mA}$   | —    | 0.15 | 0.3  | V    |
|                        |           |               | $I_{OUT} = 200\text{ mA}$  | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$  | —             | —  | 29   | 33   | —    | V    |

**TA78DL10S**

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified,  $V_{IN} = 16\text{ V}$ ,  $I_{OUT} = 10\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ )

| CHARACTERISTIC         | SYMBOL    | TEST CIR-CUIT | TEST CONDITION  | MIN. | TYP. | MAX. | UNIT |
|------------------------|-----------|---------------|---|------|------|------|------|
| Output Voltage         | $V_{OUT}$ | —             | $10.35\text{ V} \leq V_{IN} \leq 26\text{ V}$<br>$-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | 9    | 10   | 11   | V    |
| Line Regulation        | Reg·line  | —             | $14\text{ V} \leq V_{IN} \leq 21\text{ V}$  | —    | 4    | 20   | mV   |
|                        |           |               | $11\text{ V} \leq V_{IN} \leq 26\text{ V}$  | —    | 8    | 60   |      |
| Load Regulation        | Reg·load  | —             | $10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$  | —    | 28   | 100  | mV   |
| Quiescent Current      | $I_B$     | —             | $I_{OUT} \leq 10\text{ mA}$ ,<br>$11\text{ V} \leq V_{IN} \leq 26\text{ V}$                         | —    | 0.7  | —    | mA   |
| Dropout Voltage        | $V_D$     | —             | $I_{OUT} = 50\text{ mA}$  | —    | 0.15 | 0.3  | V    |
|                        |           |               | $I_{OUT} = 200\text{ mA}$   | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$  | —             | —   | 29   | 33   | —    | V    |

**TA78DL12S**

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified,  $V_{IN} = 18\text{ V}$ ,  $I_{OUT} = 10\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ )

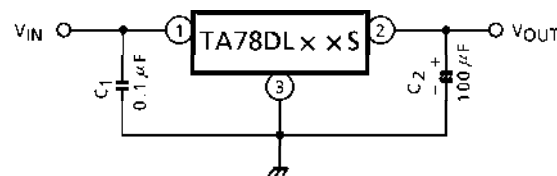
| CHARACTERISTIC         | SYMBOL    | TEST CIR-CUIT | TEST CONDITION  | MIN. | TYP. | MAX. | UNIT |
|------------------------|-----------|---------------|---|------|------|------|------|
| Output Voltage         | $V_{OUT}$ | —             | $12.35\text{ V} \leq V_{IN} \leq 26\text{ V}$<br>$-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | 10.8 | 12   | 13.2 | V    |
| Line Regulation        | Reg·line  | —             | $16\text{ V} \leq V_{IN} \leq 23\text{ V}$  | —    | 5    | 24   | mV   |
|                        |           |               | $13\text{ V} \leq V_{IN} \leq 26\text{ V}$  | —    | 10   | 70   |      |
| Load Regulation        | Reg·load  | —             | $10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$  | —    | 33   | 120  | mV   |
| Quiescent Current      | $I_B$     | —             | $I_{OUT} \leq 10\text{ mA}$ ,<br>$13\text{ V} \leq V_{IN} \leq 26\text{ V}$                         | —    | 0.8  | —    | mA   |
| Dropout Voltage        | $V_D$     | —             | $I_{OUT} = 50\text{ mA}$  | —    | 0.15 | 0.3  | V    |
|                        |           |               | $I_{OUT} = 200\text{ mA}$   | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$  | —             | —   | 29   | 33   | —    | V    |

**TA78DL15S**

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified,  $V_{IN} = 20\text{ V}$ ,  $I_{OUT} = 10\text{ mA}$ ,  $T_j = 25^\circ\text{C}$ )

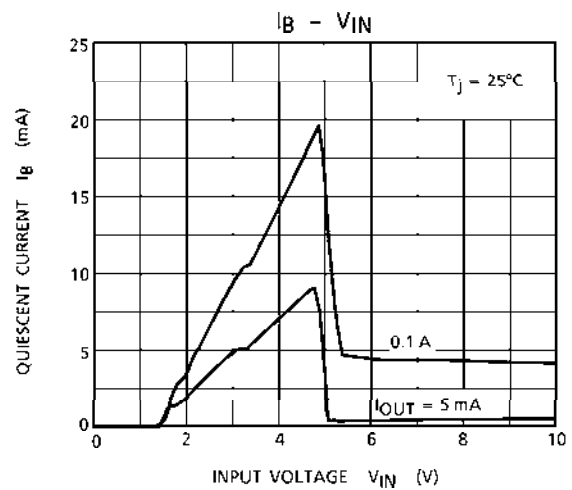
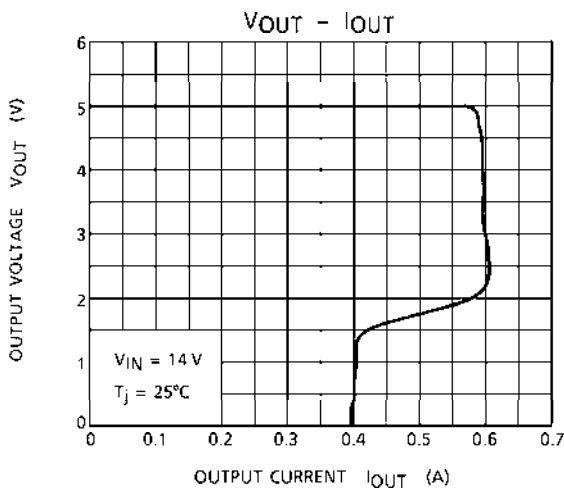
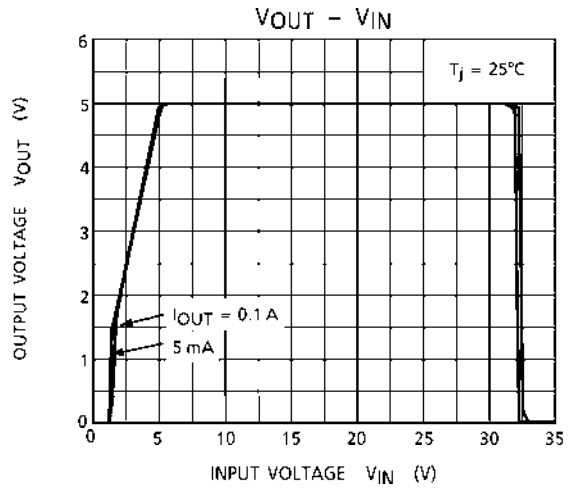
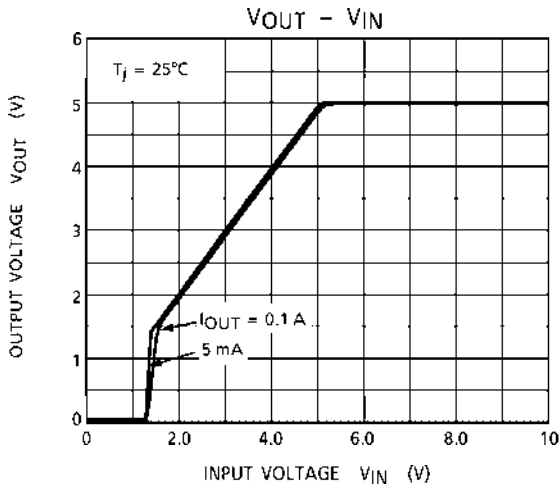
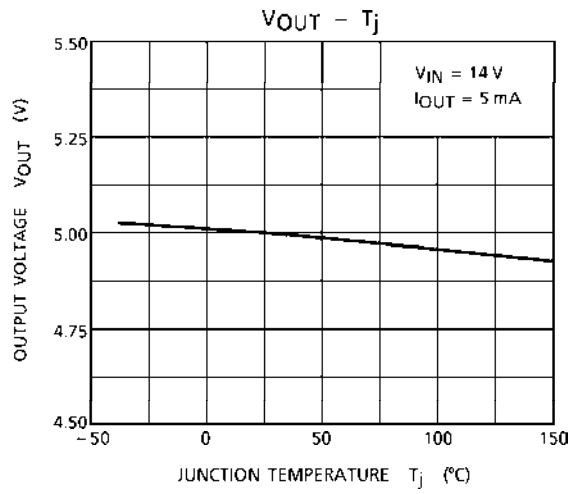
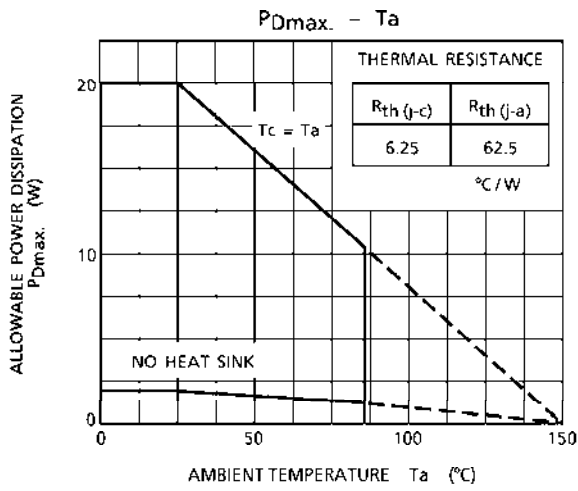
| CHARACTERISTIC         | SYMBOL    | TEST CIR-CUIT | TEST CONDITION  | MIN. | TYP. | MAX. | UNIT |
|------------------------|-----------|---------------|---|------|------|------|------|
| Output Voltage         | $V_{OUT}$ | —             | $15.35\text{ V} \leq V_{IN} \leq 26\text{ V}$<br>$-40^\circ\text{C} \leq T_a \leq 85^\circ\text{C}$ | 13.5 | 15   | 16.5 | V    |
| Line Regulation        | Reg·line  | —             | $19\text{ V} \leq V_{IN} \leq 26\text{ V}$  | —    | 6    | 30   | mV   |
|                        |           |               | $16\text{ V} \leq V_{IN} \leq 26\text{ V}$  | —    | 12   | 80   |      |
| Load Regulation        | Reg·load  | —             | $10\text{ mA} \leq I_{OUT} \leq 200\text{ mA}$  | —    | 40   | 150  | mV   |
| Quiescent Current      | $I_B$     | —             | $I_{OUT} \leq 10\text{ mA}$ ,<br>$16\text{ V} \leq V_{IN} \leq 26\text{ V}$                         | —    | 0.9  | —    | mA   |
| Dropout Voltage        | $V_D$     | —             | $I_{OUT} = 50\text{ mA}$  | —    | 0.15 | 0.3  | V    |
|                        |           |               | $I_{OUT} = 200\text{ mA}$   | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$  | —             | —   | 29   | 33   | —    | V    |

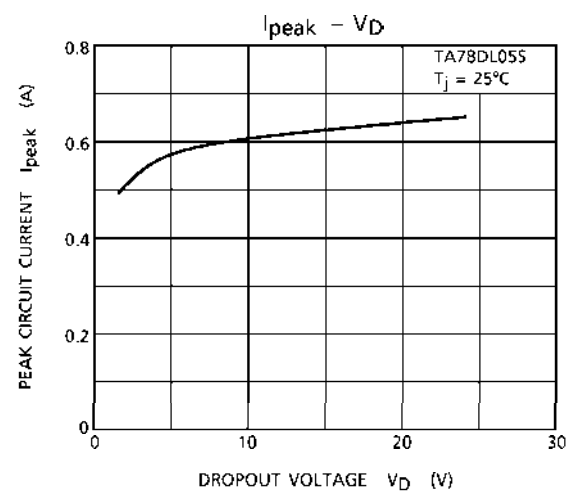
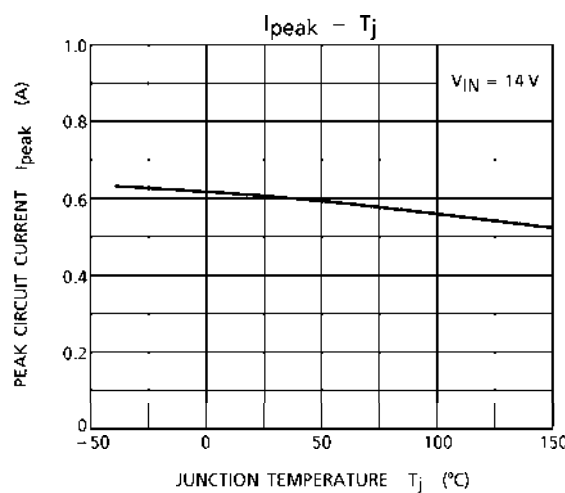
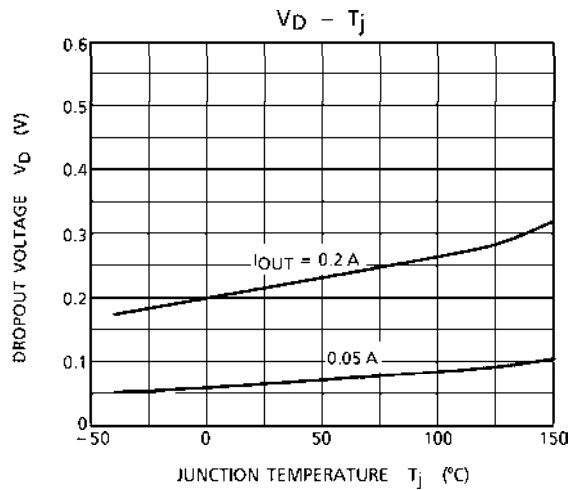
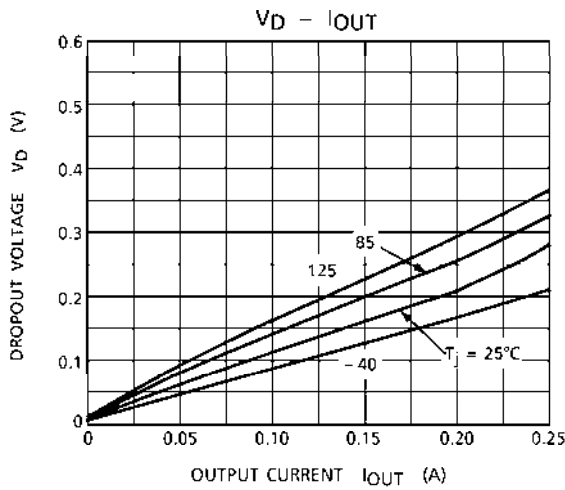
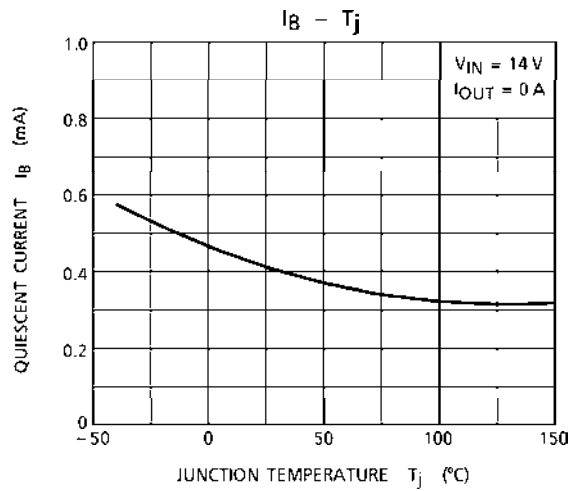
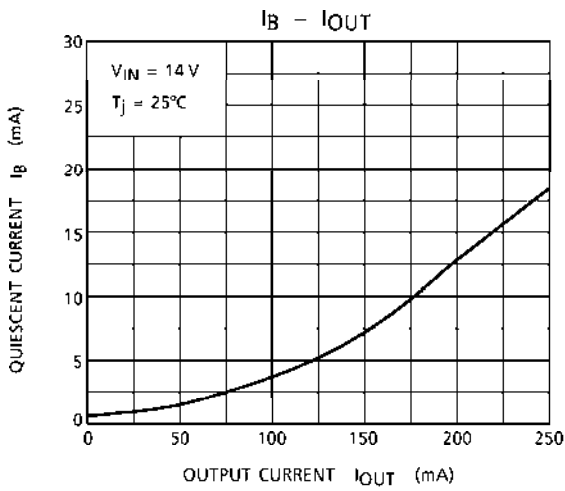
**APPLICATION CIRCUIT**



Capacitor  $C_2$  must be guaranteed to operate of the temperature range that the regulator should be operated correctly.

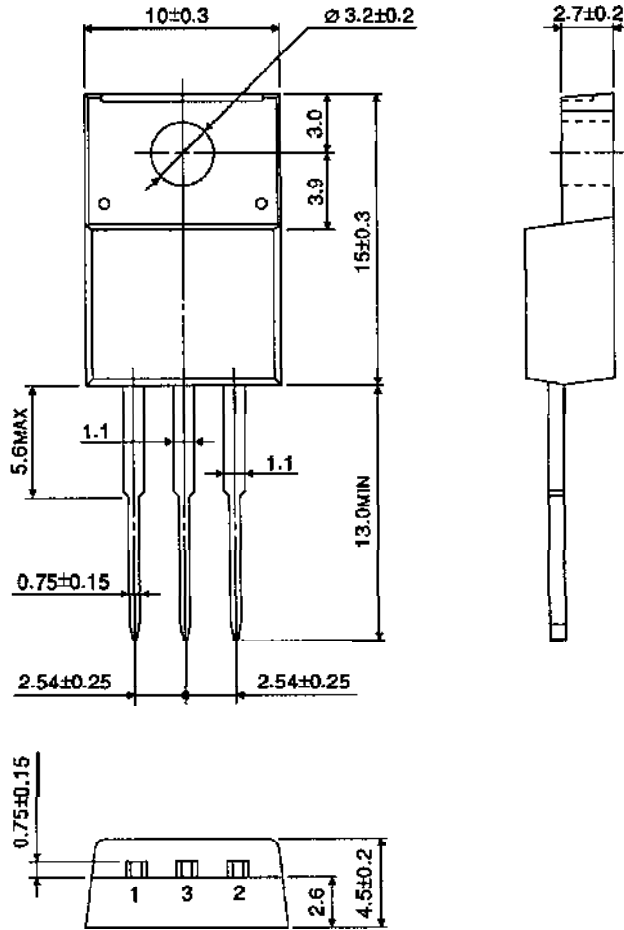
100  $\mu\text{F}$  is a suitable value to suppress the oscillation phenomenon at the output terminal.





**PACKAGE DIMENSIONS**  
P-HSIP3-2.54A

Unit : mm



Weight : 1.7 g (Typ.)