

## TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

### TA78DL05S, TA78DL06S, TA78DL08S, TA78DL09S TA78DL10S, TA78DL12S, TA78DL15S

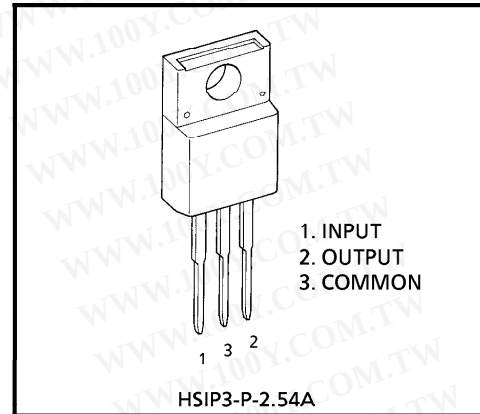
5V, 6V, 8V, 9V, 10V, 12V, 15V

## LOW DROPOUT VOLTAGE REGULATOR.

The TA78DL×S series consists of positive fixed output voltage regulator IC capable of sourcing current up to 250mA.

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.

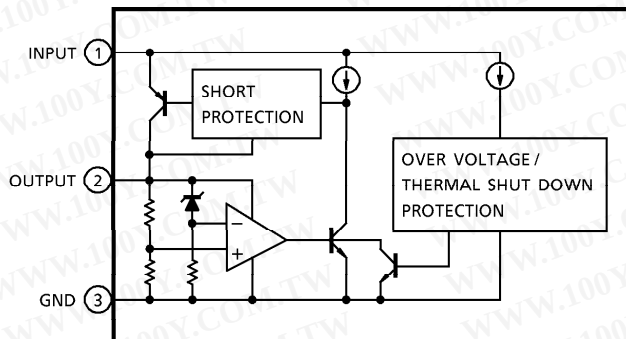


Weight : 1.7g (Typ.)

### FEATURES

- Low Standby Current of 500 $\mu$ A Typical.
- Maximum Output Current Up to 250mA.
- Low Dropout Voltage of Less than 0.6V.
- 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



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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>        | 2         | W    |
|                          |                       | 20        |      |
| Operating Temperature    | T <sub>opr</sub>      | -40~85    | °C   |
| Storage Temperature      | T <sub>stg</sub>      | -55~150   | °C   |
| Thermal Resistance       | R <sub>th (i-c)</sub> | 6.25      | °C/W |
|                          | R <sub>th (j-a)</sub> | 62.5      |      |
| Storage Temperature·Time | T <sub>sol</sub>      | 260 (10s) | °C   |

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## TA78DL05S

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

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

## TA78DL06S

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

| CHARACTERISTIC         | SYMBOL                | TEST CIR-CUIT | TEST CONDITION                                      | MIN. | TYP. | MAX. | UNIT |
|------------------------|-----------------------|---------------|-----------------------------------------------------|------|------|------|------|
| Output Voltage         | V <sub>OUT</sub>      | —             | 6.35V ≤ V <sub>IN</sub> ≤ 26V<br>-40°C ≤ Ta ≤ 85°C  | 5.4  | 6.0  | 6.6  | V    |
| Line Regulation        | ΔV <sub>OUT</sub> (1) | —             | 10V ≤ V <sub>IN</sub> ≤ 17V                         | —    | 2    | 12   | mV   |
|                        |                       |               | 7V ≤ V <sub>IN</sub> ≤ 26V                          | —    | 5    | 36   |      |
| Load Regulation        | ΔV <sub>OUT</sub> (2) | —             | 10mA ≤ I <sub>OUT</sub> ≤ 200mA                     | —    | 17   | 60   | mV   |
| Quiescent Current      | I <sub>CC</sub>       | —             | I <sub>OUT</sub> ≤ 10mA, 7V ≤ V <sub>IN</sub> ≤ 26V | —    | 0.55 | —    | mA   |
| Dropout Voltage        | V <sub>DROP</sub>     | —             | I <sub>OUT</sub> = 50mA                             | —    | 0.15 | 0.3  | V    |
|                        |                       |               | I <sub>OUT</sub> = 200mA                            | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | V <sub>IN</sub>       | —             | —                                                   | 29   | 33   | —    | V    |

## TA78DL08S

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

| CHARACTERISTIC         | SYMBOL               | TEST CIR-CUIT | TEST CONDITION                                                         | MIN. | TYP. | MAX. | UNIT |
|------------------------|----------------------|---------------|------------------------------------------------------------------------|------|------|------|------|
| Output Voltage         | $V_{OUT}$            | —             | $8.35V \leq V_{IN} \leq 26V$<br>$-40^\circ C \leq T_a \leq 85^\circ C$ | 7.2  | 8    | 8.8  | V    |
| Line Regulation        | $\Delta V_{OUT} (1)$ | —             | $12V \leq V_{IN} \leq 19V$                                             | —    | 3    | 16   | mV   |
|                        |                      |               | $9V \leq V_{IN} \leq 26V$                                              | —    | 6    | 45   |      |
| Load Regulation        | $\Delta V_{OUT} (2)$ | —             | $10mA \leq I_{OUT} \leq 200mA$                                         | —    | 22   | 80   | mV   |
| Quiescent Current      | $I_{CC}$             | —             | $I_{OUT} \leq 10mA$ , $9V \leq V_{IN} \leq 26V$                        | —    | 0.6  | —    | mA   |
| Dropout Voltage        | $V_{DROP}$           | —             | $I_{OUT} = 50mA$                                                       | —    | 0.15 | 0.3  | V    |
|                        |                      |               | $I_{OUT} = 200mA$                                                      | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$             | —             | —                                                                      | 29   | 33   | —    | V    |

## TA78DL09S

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

| CHARACTERISTIC         | SYMBOL               | TEST CIR-CUIT | TEST CONDITION                                                         | MIN. | TYP. | MAX. | UNIT |
|------------------------|----------------------|---------------|------------------------------------------------------------------------|------|------|------|------|
| Output Voltage         | $V_{OUT}$            | —             | $9.35V \leq V_{IN} \leq 26V$<br>$-40^\circ C \leq T_a \leq 85^\circ C$ | 8.1  | 9    | 9.9  | V    |
| Line Regulation        | $\Delta V_{OUT} (1)$ | —             | $13V \leq V_{IN} \leq 20V$                                             | —    | 3    | 18   | mV   |
|                        |                      |               | $10V \leq V_{IN} \leq 26V$                                             | —    | 7    | 50   |      |
| Load Regulation        | $\Delta V_{OUT} (2)$ | —             | $10mA \leq I_{OUT} \leq 200mA$                                         | —    | 25   | 90   | mV   |
| Quiescent Current      | $I_{CC}$             | —             | $I_{OUT} \leq 10mA$ , $10V \leq V_{IN} \leq 26V$                       | —    | 0.65 | —    | mA   |
| Dropout Voltage        | $V_{DROP}$           | —             | $I_{OUT} = 50mA$                                                       | —    | 0.15 | 0.3  | V    |
|                        |                      |               | $I_{OUT} = 200mA$                                                      | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$             | —             | —                                                                      | 29   | 33   | —    | V    |

## TA78DL10S

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

| CHARACTERISTIC         | SYMBOL               | TEST CIR-CUIT | TEST CONDITION                                                          | MIN. | TYP. | MAX. | UNIT |
|------------------------|----------------------|---------------|-------------------------------------------------------------------------|------|------|------|------|
| Output Voltage         | $V_{OUT}$            | —             | $10.35V \leq V_{IN} \leq 26V$<br>$-40^\circ C \leq T_a \leq 85^\circ C$ | 9    | 10   | 11   | V    |
| Line Regulation        | $\Delta V_{OUT} (1)$ | —             | $14V \leq V_{IN} \leq 21V$                                              | —    | 4    | 20   | mV   |
|                        |                      |               | $11V \leq V_{IN} \leq 26V$                                              | —    | 8    | 60   |      |
| Load Regulation        | $\Delta V_{OUT} (2)$ | —             | $10mA \leq I_{OUT} \leq 200mA$                                          | —    | 28   | 100  | mV   |
| Quiescent Current      | $I_{CC}$             | —             | $I_{OUT} \leq 10mA$ , $11V \leq V_{IN} \leq 26V$                        | —    | 0.7  | —    | mA   |
| Dropout Voltage        | $V_{DROP}$           | —             | $I_{OUT} = 50mA$                                                        | —    | 0.15 | 0.3  | V    |
|                        |                      |               | $I_{OUT} = 200mA$                                                       | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$             | —             | —                                                                       | 29   | 33   | —    | V    |

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## TA78DL12S

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

| CHARACTERISTIC         | SYMBOL               | TEST CIR-CUIT | TEST CONDITION                                                      | MIN. | TYP. | MAX. | UNIT |
|------------------------|----------------------|---------------|---------------------------------------------------------------------|------|------|------|------|
| Output Voltage         | $V_{OUT}$            | —             | $12.35V \leq V_{IN} \leq 26V - 40^\circ C \leq T_a \leq 85^\circ C$ | 10.8 | 12   | 13.2 | V    |
| Line Regulation        | $\Delta V_{OUT} (1)$ | —             | $16V \leq V_{IN} \leq 23V$                                          | —    | 5    | 24   | mV   |
|                        |                      |               | $13V \leq V_{IN} \leq 26V$                                          | —    | 10   | 70   |      |
| Load Regulation        | $\Delta V_{OUT} (2)$ | —             | $10mA \leq I_{OUT} \leq 200mA$                                      | —    | 33   | 120  | mV   |
| Quiescent Current      | $I_{CC}$             | —             | $I_{OUT} \leq 10mA, 13V \leq V_{IN} \leq 26V$                       | —    | 0.8  | —    | mA   |
| Dropout Voltage        | $V_{DROP}$           | —             | $I_{OUT} = 50mA$                                                    | —    | 0.15 | 0.3  | V    |
|                        |                      |               | $I_{OUT} = 200mA$                                                   | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$             | —             | —                                                                   | 29   | 33   | —    | V    |

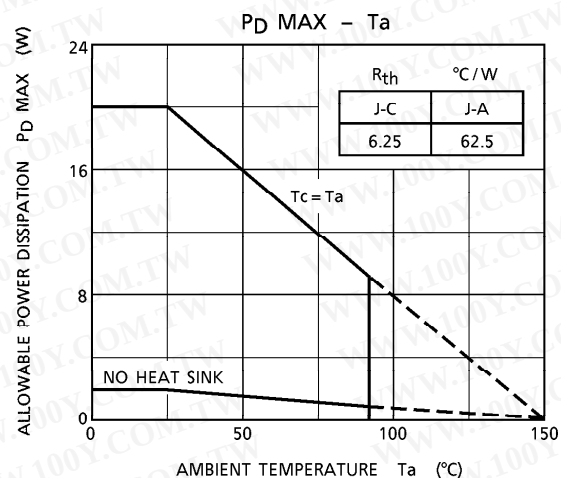
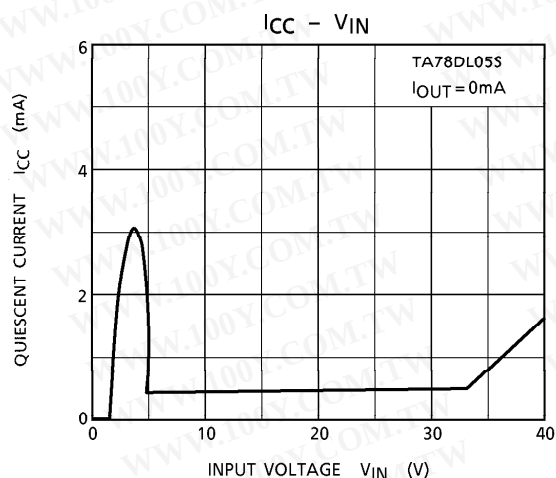
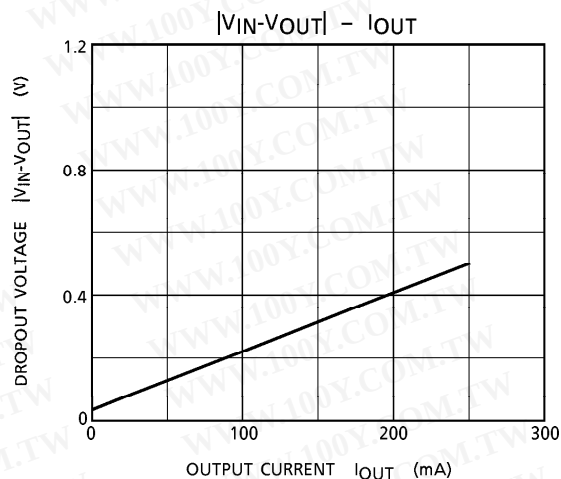
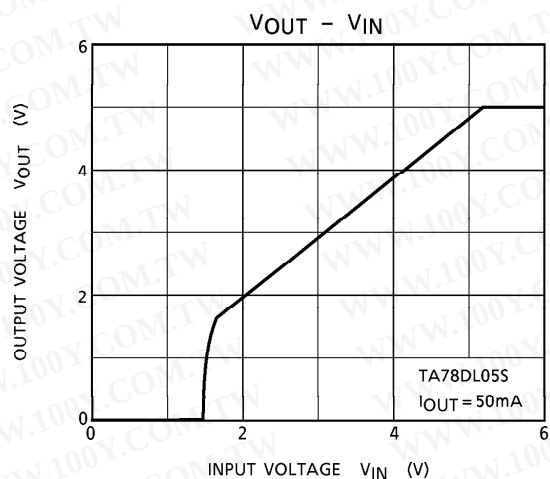
## TA78DL15S

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

| CHARACTERISTIC         | SYMBOL               | TEST CIR-CUIT | TEST CONDITION                                                      | MIN. | TYP. | MAX. | UNIT |
|------------------------|----------------------|---------------|---------------------------------------------------------------------|------|------|------|------|
| Output Voltage         | $V_{OUT}$            | —             | $15.35V \leq V_{IN} \leq 26V - 40^\circ C \leq T_a \leq 85^\circ C$ | 13.5 | 15   | 16.5 | V    |
| Line Regulation        | $\Delta V_{OUT} (1)$ | —             | $19V \leq V_{IN} \leq 26V$                                          | —    | 6    | 30   | mV   |
|                        |                      |               | $16V \leq V_{IN} \leq 26V$                                          | —    | 12   | 80   |      |
| Load Regulation        | $\Delta V_{OUT} (2)$ | —             | $10mA \leq I_{OUT} \leq 200mA$                                      | —    | 40   | 150  | mV   |
| Quiescent Current      | $I_{CC}$             | —             | $I_{OUT} \leq 10mA, 16V \leq V_{IN} \leq 26V$                       | —    | 0.9  | —    | mA   |
| Dropout Voltage        | $V_{DROP}$           | —             | $I_{OUT} = 50mA$                                                    | —    | 0.15 | 0.3  | V    |
|                        |                      |               | $I_{OUT} = 200mA$                                                   | —    | 0.4  | 0.6  |      |
| Max. Operating Voltage | $V_{IN}$             | —             | —                                                                   | 29   | 33   | —    | V    |

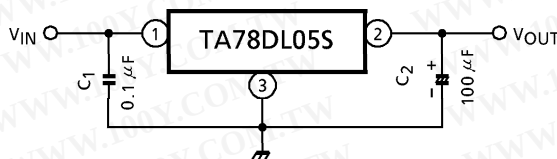
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## APPLICATION CIRCUITS



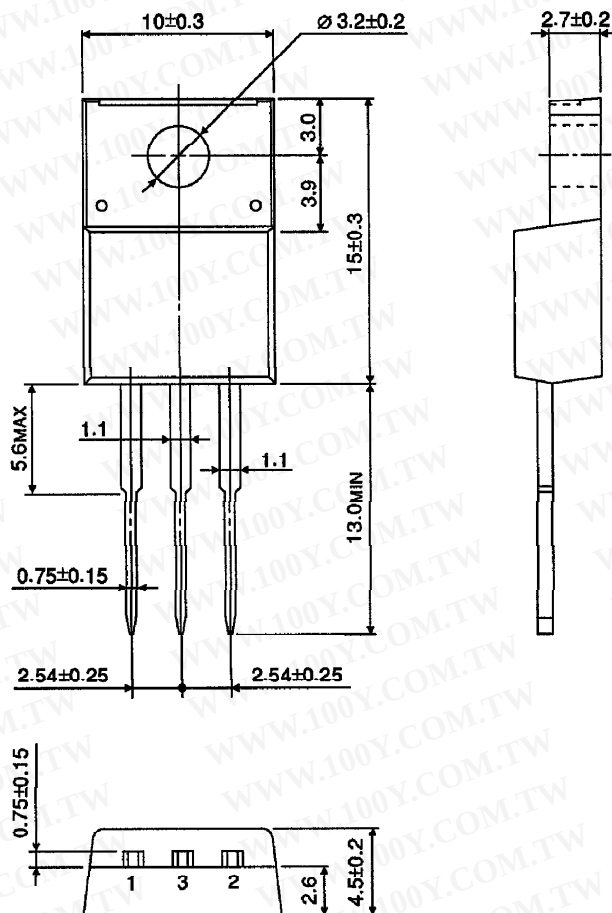
Capacitor  $C_2$  must be guaranteed to operate of the temperature range that the regulator should be operated correctly.

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

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OUTLINE DRAWING  
HSIP3-P-2.54A

Unit : mm



Weight : 1.7g (Typ.)

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