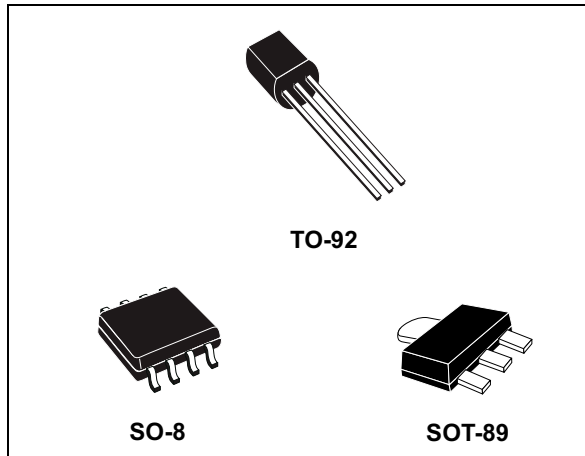


## Positive voltage regulators

Datasheet - production data



### Description

The L78L series of three-terminal positive regulators employ internal current limiting and thermal shutdown, making them essentially indestructible. If adequate heat-sink is provided, they can deliver up to 100 mA output current. They are intended as fixed voltage regulators in a wide range of applications including local or on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power pass elements to make high-current voltage regulators. The L78L series used as Zener diode/resistor combination replacement, offers an improvement along with lower quiescent current and lower noise.

### Features

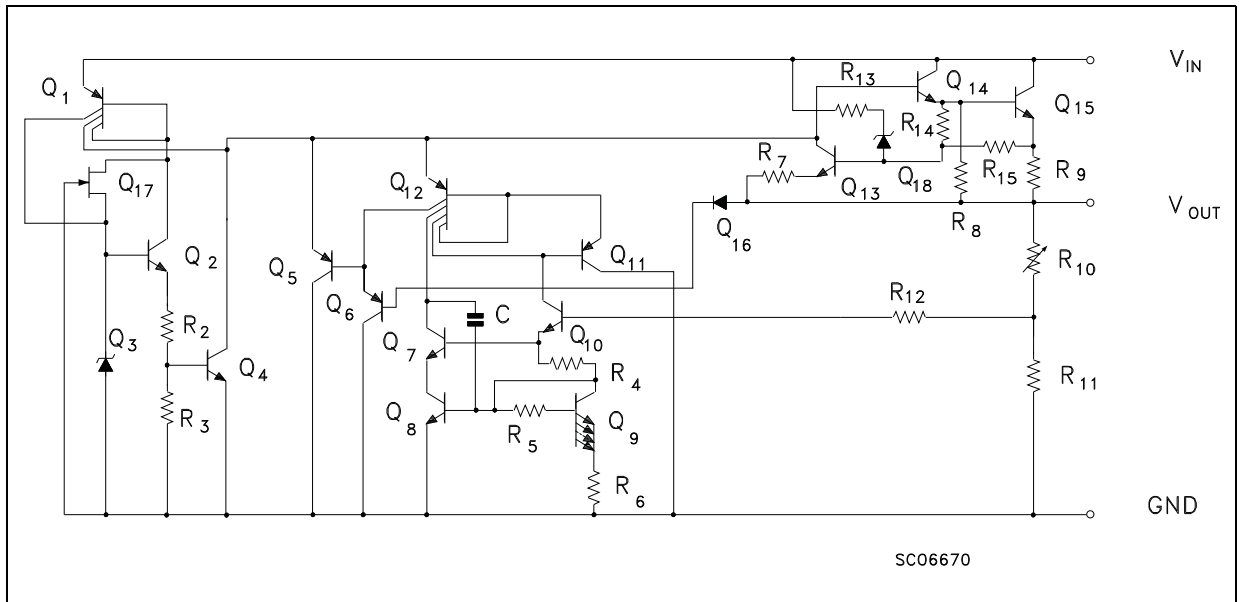
- Output current up to 100 mA
- Output voltages of 3.3; 5; 6; 8; 9; 10; 12; 15; 18; 24 V thermal overload protection
- Short-circuit protection
- No external components are required
- Available in either  $\pm 4\%$  (A) or  $\pm 8\%$  (C) selection

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# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connection (top view, bottom view for TO-92)

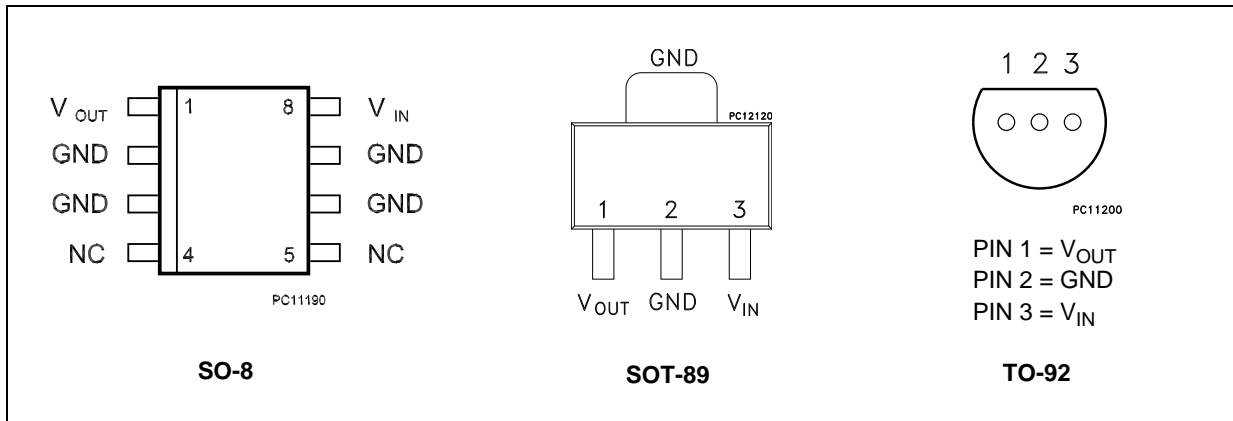
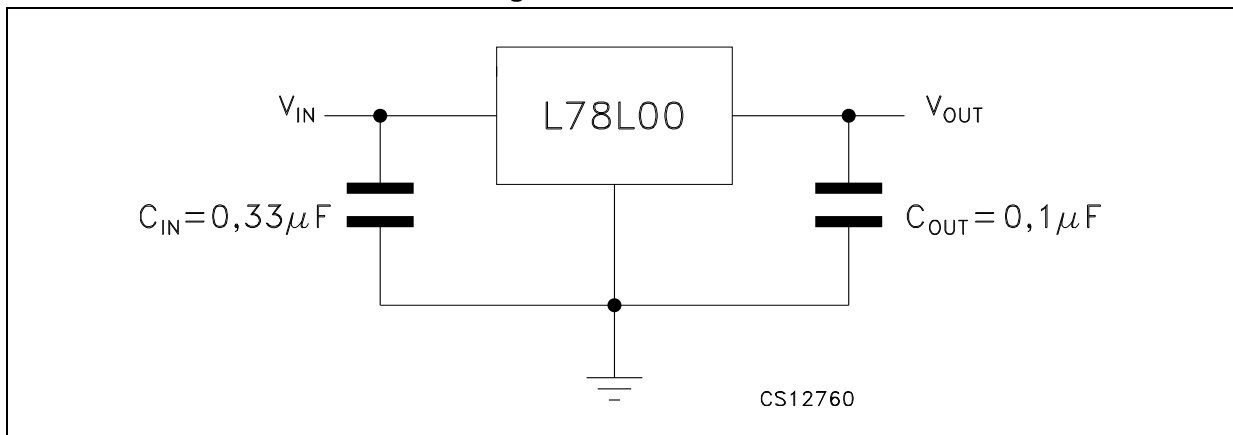


Figure 3. Test circuits



### 3 Maximum ratings

**Table 1. Absolute maximum ratings**

| Symbol    | Parameter                            |                           | Value                             | Unit |
|-----------|--------------------------------------|---------------------------|-----------------------------------|------|
| $V_I$     | DC Input voltage                     | $V_O = 3.3$ to $9$ V      | 30                                | V    |
|           |                                      | $V_O = 12$ to $15$ V      | 35                                |      |
|           |                                      | $V_O = 18$ to $24$ V      | 40                                |      |
| $I_O$     | Output current                       |                           | 100                               | mA   |
| $P_D$     | Power dissipation                    |                           | Internally limited <sup>(1)</sup> | mW   |
| $T_{STG}$ | Storage temperature range            |                           | -65 to 150                        | °C   |
| $T_{OP}$  | Operating junction temperature range | for L78LxxAC /<br>L78LxxC | 0 to 125                          | °C   |
|           |                                      | for L78LxxAB              | -40 to 125                        |      |

1. Our SO-8 package used for voltage regulators is modified internally to have pins 2, 3, 6 and 7 electrically communed to the die attach flag. This particular frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appropriate area of copper on the printed circuit board is available for heat-sinking. The external dimensions are the same as for the standard SO-8.

**Table 2. Thermal data**

| Symbol     | Parameter                                 | SO-8              | TO-92 | SOT-89            | Unit |
|------------|---|-------------------|-------|-------------------|------|
| $R_{thJC}$ | Thermal resistance junction-case (max)    | 20                |       | 15                | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient (max) | 55 <sup>(1)</sup> | 200   | 55 <sup>(1)</sup> | °C/W |

1. Considering 6 cm<sup>2</sup> of copper Board heat-sink.

## 4 Electrical characteristics

Refer to the test circuits,  $T_J = 0$  to  $125$  °C,  $V_I = 8.3$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 3. Electrical characteristics of L78L33C**

| Symbol | Parameter                | Test conditions   | Min.  | Typ. | Max.  | Unit    |
|--------|--------------------------|---|-------|------|-------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C   | 3.036 | 3.3  | 3.564 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 5.3$ to $20$ V                           | 2.97  |      | 3.63  | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 8.3$ V                                   | 2.97  |      | 3.63  |         |
| $DV_O$ | Line regulation          | $V_I = 5.3$ to $20$ V, $T_J = 25$ °C                                  |       |      | 150   | mV      |
|        |                          | $V_I = 6.3$ to $20$ V, $T_J = 25$ °C                                  |       |      | 100   |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                                  |       |      | 60    | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                   |       |      | 30    |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C   |       |      | 6     | mA      |
|        |                          | $T_J = 125$ °C  |       |      | 5.5   | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA  |       |      | 0.2   | mA      |
|        |                          | $V_I = 6.3$ to $20$ V   |       |      | 1.5   |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                               |       | 40   |       | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 6.3$ to $16.3$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 41    | 49   |       | dB      |
| $V_d$  | Dropout voltage          |   |       | 1.7  |       | V       |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C,  $V_I = 10$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 4. Electrical characteristics of L78L05C**

| Symbol | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|---|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C   | 4.6  | 5    | 5.4  | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 7$ to $20$ V                         | 4.5  |      | 5.5  | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 10$ V                                | 4.5  |      | 5.5  |         |
| $DV_O$ | Line regulation          | $V_I = 8.5$ to $20$ V, $T_J = 25$ °C                              |      |      | 200  | mV      |
|        |                          | $V_I = 9$ to $20$ V, $T_J = 25$ °C                                |      |      | 150  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                              |      |      | 60   | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                               |      |      | 30   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C   |      |      | 6    | mA      |
|        |                          | $T_J = 125$ °C  |      |      | 5.5  | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA  |      |      | 0.2  | mA      |
|        |                          | $V_I = 8$ to $20$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                           |      | 40   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 9$ to $20$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 40   | 49   |      | dB      |
| $V_d$  | Dropout voltage          |   |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C,  $V_I = 14$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 5. Electrical characteristics of L78L08C**

| Symbol | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|---|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C   | 7.36 | 8    | 8.64 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 8.5$ to $20$ V                       | 7.2  |      | 8.8  | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 12$ V                                | 7.2  |      | 8.8  |         |
| $DV_O$ | Line regulation          | $V_I = 8.5$ to $20$ V, $T_J = 25$ °C                              |      |      | 200  | mV      |
|        |                          | $V_I = 9$ to $20$ V, $T_J = 25$ °C                                |      |      | 150  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                              |      |      | 80   | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                               |      |      | 40   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C   |      |      | 6    | mA      |
|        |                          | $T_J = 125$ °C  |      |      | 5.5  | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA  |      |      | 0.2  | mA      |
|        |                          | $V_I = 8$ to $20$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                           |      | 60   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 9$ to $20$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 36   | 45   |      | dB      |
| $V_d$  | Dropout voltage          |   |      | 1.7  |      | V       |



Refer to the test circuits,  $T_J = 0$  to  $125$  °C,  $V_I = 15$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 6. Electrical characteristics of L78L09C**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 8.28 | 9    | 9.72 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 11.5$ to $23$ V                       | 8.1  |      | 9.9  | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 15$ V                                 | 8.1  |      | 9.9  |         |
| $DV_O$ | Line regulation          | $V_I = 11.5$ to $23$ V, $T_J = 25$ °C                              |      |      | 250  | mV      |
|        |                          | $V_I = 12$ to $23$ V, $T_J = 25$ °C                                |      |      | 200  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 80   | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 40   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6    | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 5.5  | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.2  | mA      |
|        |                          | $V_I = 12$ to $23$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 70   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 12$ to $23$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 36   | 44   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ °C}$ ,  $V_I = 16\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

**Table 7. Electrical characteristics of L78L10C**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit          |
|--------|--------------------------|--|------|------|------|---------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ °C}$   | 9.2  | 10   | 10.8 | V             |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 12.5$ to $23\text{ V}$                                      | 9    |      | 11   | V             |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 16\text{ V}$  | 9    |      | 11   |               |
| $DV_O$ | Line regulation          | $V_I = 12.5$ to $23\text{ V}$ , $T_J = 25\text{ °C}$   |      |      | 230  | mV            |
|        |                          | $V_I = 13$ to $23\text{ V}$ , $T_J = 25\text{ °C}$   |      |      | 170  |               |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ °C}$  |      |      | 80   | mV            |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ °C}$   |      |      | 40   |               |
| $I_d$  | Quiescent current        | $T_J = 25\text{ °C}$   |      |      | 6    | mA            |
|        |                          | $T_J = 125\text{ °C}$  |      |      | 5.5  | mA            |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$  |      |      | 0.1  | mA            |
|        |                          | $V_I = 13$ to $23\text{ V}$  |      |      | 1.5  |               |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ °C}$                                    |      | 60   |      | $\mu\text{V}$ |
| SVR    | Supply voltage rejection | $V_I = 14$ to $23\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ °C}$ | 37   | 45   |      | dB            |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V             |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C,  $V_I = 19$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 8. Electrical characteristics of L78L12C**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 11.1 | 12   | 12.9 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 14.5$ to $27$ V                       | 10.8 |      | 13.2 | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 19$ V                                 | 10.8 |      | 13.2 |         |
| $DV_O$ | Line regulation          | $V_I = 14.5$ to $27$ V, $T_J = 25$ °C                              |      |      | 250  | mV      |
|        |                          | $V_I = 16$ to $27$ V, $T_J = 25$ °C                                |      |      | 200  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 100  | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 50   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6.5  | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 6    | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.2  | mA      |
|        |                          | $V_I = 16$ to $27$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 80   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 15$ to $25$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 36   | 42   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ }^\circ\text{C}$ ,  $V_I = 23\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified

**Table 9. Electrical characteristics of L78L15C**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit          |
|--------|--------------------------|--|------|------|------|---------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ }^\circ\text{C}$   | 13.8 | 15   | 16.2 | V             |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 17.5$ to $30\text{ V}$  | 13.5 |      | 16.5 | V             |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 23\text{ V}$  | 13.5 |      | 16.5 |               |
| $DV_O$ | Line regulation          | $V_I = 17.5$ to $30\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 300  | mV            |
|        |                          | $V_I = 20$ to $30\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 250  |               |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$  |      |      | 150  | mV            |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 75   |               |
| $I_d$  | Quiescent current        | $T_J = 25\text{ }^\circ\text{C}$   |      |      | 6.5  | mA            |
|        |                          | $T_J = 125\text{ }^\circ\text{C}$  |      |      | 6    | mA            |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$  |      |      | 0.2  | mA            |
|        |                          | $V_I = 20$ to $30\text{ V}$  |      |      | 1.5  |               |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ }^\circ\text{C}$  |      | 90   |      | $\mu\text{V}$ |
| SVR    | Supply voltage rejection | $V_I = 18.5$ to $28.5\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$ | 33   | 39   |      | dB            |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V             |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C,  $V_I = 27$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 10. Electrical characteristics of L78L18C**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 16.6 | 18   | 19.4 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 22$ to $33$ V                         | 16.2 |      | 19.8 | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 27$ V                                 | 16.2 |      | 19.8 |         |
| $DV_O$ | Line regulation          | $V_I = 22$ to $33$ V, $T_J = 25$ °C                                |      |      | 320  | mV      |
|        |                          | $V_I = 22$ to $33$ V, $T_J = 25$ °C                                |      |      | 270  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 170  | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 85   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6.5  | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 6    | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.2  | mA      |
|        |                          | $V_I = 23$ to $33$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 120  |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 23$ to $33$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 32   | 38   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ }^\circ\text{C}$ ,  $V_I = 33\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

**Table 11. Electrical characteristics of L78L24C**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit          |
|--------|--------------------------|--|------|------|------|---------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ }^\circ\text{C}$   | 22.1 | 24   | 25.9 | V             |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 27$ to $38\text{ V}$  | 21.6 |      | 26.4 | V             |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 33\text{ V}$  | 21.6 |      | 26.4 |               |
| $DV_O$ | Line regulation          | $V_I = 27$ to $38\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 350  | mV            |
|        |                          | $V_I = 28$ to $38\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 300  |               |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$  |      |      | 200  | mV            |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 100  |               |
| $I_d$  | Quiescent current        | $T_J = 25\text{ }^\circ\text{C}$   |      |      | 6.5  | mA            |
|        |                          | $T_J = 125\text{ }^\circ\text{C}$  |      |      | 6    | mA            |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$  |      |      | 0.2  | mA            |
|        |                          | $V_I = 28$ to $38\text{ V}$  |      |      | 1.5  |               |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ }^\circ\text{C}$                                    |      | 200  |      | $\mu\text{V}$ |
| SVR    | Supply voltage rejection | $V_I = 29$ to $35\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$ | 30   | 37   |      | dB            |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V             |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C (AC)  $T_J = -40$  to  $125$  °C (AB),  $V_I = 8.3$  V,  
 $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 12. Electrical characteristics of L78L33AB and L78L33AC**

| Symbol | Parameter                | Test conditions   | Min.  | Typ. | Max.  | Unit    |
|--------|--------------------------|---|-------|------|-------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C   | 3.168 | 3.3  | 3.432 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 5.3$ to $20$ V                           | 3.135 |      | 3.465 | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 8.3$ V                                   | 3.135 |      | 3.465 |         |
| $DV_O$ | Line regulation          | $V_I = 5.3$ to $20$ V, $T_J = 25$ °C                                  |       |      | 150   | mV      |
|        |                          | $V_I = 6.3$ to $20$ V, $T_J = 25$ °C                                  |       |      | 100   |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                                  |       |      | 60    | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                   |       |      | 30    |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C   |       |      | 6     | mA      |
|        |                          | $T_J = 125$ °C  |       |      | 5.5   | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA  |       |      | 0.1   | mA      |
|        |                          | $V_I = 6.3$ to $20$ V   |       |      | 1.5   |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                               |       | 40   |       | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 6.3$ to $16.3$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 41    | 49   |       | dB      |
| $V_d$  | Dropout voltage          |   |       | 1.7  |       | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ °C}$  (AC)  $T_J = -40$  to  $125\text{ °C}$  (AB),  $V_I = 10\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

**Table 13. Electrical characteristics of L78L05AB and L78L05AC**

| Symbol | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit          |
|--------|--------------------------|---|------|------|------|---------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ °C}$  | 4.8  | 5    | 5.2  | V             |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 7$ to $20\text{ V}$  | 4.75 |      | 5.25 | V             |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 10\text{ V}$   | 4.75 |      | 5.25 |               |
| $DV_O$ | Line regulation          | $V_I = 7$ to $20\text{ V}$ , $T_J = 25\text{ °C}$   |      |      | 150  | mV            |
|        |                          | $V_I = 8$ to $20\text{ V}$ , $T_J = 25\text{ °C}$   |      |      | 100  |               |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ °C}$   |      |      | 60   | mV            |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ °C}$  |      |      | 30   |               |
| $I_d$  | Quiescent current        | $T_J = 25\text{ °C}$  |      |      | 6    | mA            |
|        |                          | $T_J = 125\text{ °C}$   |      |      | 5.5  | mA            |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$   |      |      | 0.1  | mA            |
|        |                          | $V_I = 8$ to $20\text{ V}$  |      |      | 1.5  |               |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ °C}$                                   |      | 40   |      | $\mu\text{V}$ |
| SVR    | Supply voltage rejection | $V_I = 8$ to $18\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ °C}$ | 41   | 49   |      | dB            |
| $V_d$  | Dropout voltage          |   |      | 1.7  |      | V             |



Refer to the test circuits,  $T_J = 0$  to  $125$  °C (AC)  $T_J = -40$  to  $125$  °C (AB),  $V_I = 12$  V,  
 $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 14. Electrical characteristics of L78L06AB and L78L06AC**

| Symbol       | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit    |
|--------------|--------------------------|---|------|------|------|---------|
| $V_O$        | Output voltage           | $T_J = 25$ °C   | 5.76 | 6    | 6.24 | V       |
| $V_O$        | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 8.5$ to $20$ V                       | 5.7  |      | 6.3  | V       |
|              |                          | $I_O = 1$ to $70$ mA, $V_I = 12$ V                                | 5.7  |      | 6.3  |         |
| $\Delta V_O$ | Line regulation          | $V_I = 8.5$ to $20$ V, $T_J = 25$ °C                              |      |      | 150  | mV      |
|              |                          | $V_I = 9$ to $20$ V, $T_J = 25$ °C                                |      |      | 100  |         |
| $\Delta V_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                              |      |      | 60   | mV      |
|              |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                               |      |      | 30   |         |
| $I_d$        | Quiescent current        | $T_J = 25$ °C   |      |      | 6    | mA      |
|              |                          | $T_J = 125$ °C  |      |      | 5.5  | mA      |
| $\Delta I_d$ | Quiescent current change | $I_O = 1$ to $40$ mA  |      |      | 0.1  | mA      |
|              |                          | $V_I = 9$ to $20$ V   |      |      | 1.5  |         |
| eN           | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                           |      | 50   |      | $\mu$ V |
| SVR          | Supply voltage rejection | $V_I = 9$ to $20$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 39   | 46   |      | dB      |
| $V_d$        | Dropout voltage          |   |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C (AC)  $T_J = -40$  to  $125$  °C (AB),  $V_I = 14$  V,  $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 15. Electrical characteristics of L78L08AB and L78L08AC**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 7.68 | 8    | 8.32 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 10.5$ to $23$ V                       | 7.6  |      | 8.4  | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 14$ V                                 | 7.6  |      | 8.4  |         |
| $DV_O$ | Line regulation          | $V_I = 10.5$ to $23$ V, $T_J = 25$ °C                              |      |      | 175  | mV      |
|        |                          | $V_I = 11$ to $23$ V, $T_J = 25$ °C                                |      |      | 125  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 80   | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 40   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6    | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 5.5  | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.1  | mA      |
|        |                          | $V_I = 11$ to $23$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 60   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 12$ to $23$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 37   | 45   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C (AC)  $T_J = -40$  to  $125$  °C (AB),  $V_I = 15$  V,  
 $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 16. Electrical characteristics of L78L09AB and L78L09AC**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 8.64 | 9    | 9.36 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 11.5$ to $23$ V                       | 8.55 |      | 9.45 | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 15$ V                                 | 8.55 |      | 9.45 |         |
| $DV_O$ | Line regulation          | $V_I = 11.5$ to $23$ V, $T_J = 25$ °C                              |      |      | 225  | mV      |
|        |                          | $V_I = 12$ to $23$ V, $T_J = 25$ °C                                |      |      | 150  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 80   | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 40   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6    | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 5.5  | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.1  | mA      |
|        |                          | $V_I = 12$ to $23$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 70   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 12$ to $23$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 37   | 44   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ °C}$  (AC)  $T_J = -40$  to  $125\text{ °C}$  (AB),  $V_I = 16\text{ V}$ ,  
 $I_O = 40\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

**Table 17. Electrical characteristics of L78L10AC**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit          |
|--------|--------------------------|--|------|------|------|---------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ °C}$   | 9.6  | 10   | 10.4 | V             |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 12.5$ to $23\text{ V}$                                      | 9.5  |      | 10.5 | V             |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 16\text{ V}$  | 9.5  |      | 10.5 |               |
| $DV_O$ | Line regulation          | $V_I = 12.5$ to $23\text{ V}$ , $T_J = 25\text{ °C}$   |      |      | 230  | mV            |
|        |                          | $V_I = 13$ to $23\text{ V}$ , $T_J = 25\text{ °C}$   |      |      | 170  |               |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ °C}$  |      |      | 80   | mV            |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ °C}$   |      |      | 40   |               |
| $I_d$  | Quiescent current        | $T_J = 25\text{ °C}$   |      |      | 6    | mA            |
|        |                          | $T_J = 125\text{ °C}$  |      |      | 5.5  | mA            |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$  |      |      | 0.1  | mA            |
|        |                          | $V_I = 13$ to $23\text{ V}$  |      |      | 1.5  |               |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ °C}$                                    |      | 60   |      | $\mu\text{V}$ |
| SVR    | Supply voltage rejection | $V_I = 14$ to $23\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ °C}$ | 37   | 45   |      | dB            |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V             |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C (AC)  $T_J = -40$  to  $125$  °C (AB),  $V_I = 19$  V,  
 $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 18. Electrical characteristics of L78L12AB and L78L12AC**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 11.5 | 12   | 12.5 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 14.5$ to $27$ V                       | 11.4 |      | 12.6 | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 19$ V                                 | 11.4 |      | 12.6 |         |
| $DV_O$ | Line regulation          | $V_I = 14.5$ to $27$ V, $T_J = 25$ °C                              |      |      | 250  | mV      |
|        |                          | $V_I = 16$ to $27$ V, $T_J = 25$ °C                                |      |      | 200  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 100  | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 50   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6.5  | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 6    | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.1  | mA      |
|        |                          | $V_I = 16$ to $27$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 80   |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 15$ to $25$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 37   | 42   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ °C}$  (AC)  $T_J = -40$  to  $125\text{ °C}$  (AB),  $V_I = 23\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

**Table 19. Electrical characteristics of L78L15AB and L78L15AC**

| Symbol | Parameter                | Test conditions  | Min.  | Typ. | Max.  | Unit          |
|--------|--------------------------|--|-------|------|-------|---------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ °C}$   | 14.4  | 15   | 15.6  | V             |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 17.5$ to $30\text{ V}$  | 14.25 |      | 15.75 | V             |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 23\text{ V}$  | 14.25 |      | 15.75 |               |
| $DV_O$ | Line regulation          | $V_I = 17.5$ to $30\text{ V}$ , $T_J = 25\text{ °C}$   |       |      | 300   | mV            |
|        |                          | $V_I = 20$ to $30\text{ V}$ , $T_J = 25\text{ °C}$   |       |      | 250   |               |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ °C}$  |       |      | 150   | mV            |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ °C}$   |       |      | 75    |               |
| $I_d$  | Quiescent current        | $T_J = 25\text{ °C}$   |       |      | 6.5   | mA            |
|        |                          | $T_J = 125\text{ °C}$  |       |      | 6     | mA            |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$  |       |      | 0.1   | mA            |
|        |                          | $V_I = 20$ to $30\text{ V}$  |       |      | 1.5   |               |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ °C}$  |       | 90   |       | $\mu\text{V}$ |
| SVR    | Supply voltage rejection | $V_I = 18.5$ to $28.5\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ °C}$ | 34    | 39   |       | dB            |
| $V_d$  | Dropout voltage          |  |       | 1.7  |       | V             |

Refer to the test circuits,  $T_J = 0$  to  $125$  °C (AC)  $T_J = -40$  to  $125$  °C (AB),  $V_I = 27$  V,  
 $I_O = 40$  mA,  $C_I = 0.33$   $\mu$ F,  $C_O = 0.1$   $\mu$ F unless otherwise specified.

**Table 20. Electrical characteristics of L78L18AC**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit    |
|--------|--------------------------|--|------|------|------|---------|
| $V_O$  | Output voltage           | $T_J = 25$ °C  | 17.3 | 18   | 18.7 | V       |
| $V_O$  | Output voltage           | $I_O = 1$ to $40$ mA, $V_I = 22$ to $33$ V                         | 17.1 |      | 18.9 | V       |
|        |                          | $I_O = 1$ to $70$ mA, $V_I = 27$ V                                 | 17.1 |      | 18.9 |         |
| $DV_O$ | Line regulation          | $V_I = 22$ to $33$ V, $T_J = 25$ °C                                |      |      | 320  | mV      |
|        |                          | $V_I = 22$ to $33$ V, $T_J = 25$ °C                                |      |      | 270  |         |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100$ mA, $T_J = 25$ °C                               |      |      | 170  | mV      |
|        |                          | $I_O = 1$ to $40$ mA, $T_J = 25$ °C                                |      |      | 85   |         |
| $I_d$  | Quiescent current        | $T_J = 25$ °C  |      |      | 6.5  | mA      |
|        |                          | $T_J = 125$ °C   |      |      | 6    | mA      |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40$ mA   |      |      | 0.1  | mA      |
|        |                          | $V_I = 23$ to $33$ V   |      |      | 1.5  |         |
| eN     | Output noise voltage     | $B = 10$ Hz to $100$ kHz, $T_J = 25$ °C                            |      | 120  |      | $\mu$ V |
| SVR    | Supply voltage rejection | $V_I = 23$ to $33$ V, $f = 120$ Hz<br>$I_O = 40$ mA, $T_J = 25$ °C | 33   | 38   |      | dB      |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V       |

Refer to the test circuits,  $T_J = 0$  to  $125\text{ }^\circ\text{C}$  (AC)  $T_J = -40$  to  $125\text{ }^\circ\text{C}$  (AB),  $V_I = 33\text{ V}$ ,  $I_O = 40\text{ mA}$ ,  $C_I = 0.33\text{ }\mu\text{F}$ ,  $C_O = 0.1\text{ }\mu\text{F}$  unless otherwise specified.

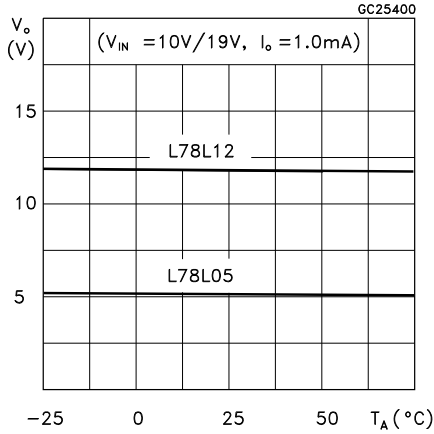
**Table 21. Electrical characteristics of L78L24AB and L78L24AC**

| Symbol | Parameter                | Test conditions  | Min. | Typ. | Max. | Unit            |
|--------|--------------------------|--|------|------|------|-----------------|
| $V_O$  | Output voltage           | $T_J = 25\text{ }^\circ\text{C}$   | 23   | 24   | 25   | V               |
| $V_O$  | Output voltage           | $I_O = 1$ to $40\text{ mA}$ , $V_I = 27$ to $38\text{ V}$  | 22.8 |      | 25.2 | V               |
|        |                          | $I_O = 1$ to $70\text{ mA}$ , $V_I = 33\text{ V}$  | 22.8 |      | 25.2 |                 |
| $DV_O$ | Line regulation          | $V_I = 27$ to $38\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 350  | mV              |
|        |                          | $V_I = 28$ to $38\text{ V}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 300  |                 |
| $DV_O$ | Load regulation          | $I_O = 1$ to $100\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$  |      |      | 200  | mV              |
|        |                          | $I_O = 1$ to $40\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$   |      |      | 100  |                 |
| $I_d$  | Quiescent current        | $T_J = 25\text{ }^\circ\text{C}$   |      |      | 6.5  | mA              |
|        |                          | $T_J = 125\text{ }^\circ\text{C}$  |      |      | 6    | mA              |
| $DI_d$ | Quiescent current change | $I_O = 1$ to $40\text{ mA}$  |      |      | 0.1  | mA              |
|        |                          | $V_I = 28$ to $38\text{ V}$  |      |      | 1.5  |                 |
| eN     | Output noise voltage     | $B = 10\text{ Hz}$ to $100\text{ kHz}$ , $T_J = 25\text{ }^\circ\text{C}$                                    |      | 200  |      | $\mu\text{V5y}$ |
| SVR    | Supply voltage rejection | $V_I = 29$ to $33\text{ V}$ , $f = 120\text{ Hz}$<br>$I_O = 40\text{ mA}$ , $T_J = 25\text{ }^\circ\text{C}$ | 31   | 37   |      | dB              |
| $V_d$  | Dropout voltage          |  |      | 1.7  |      | V               |

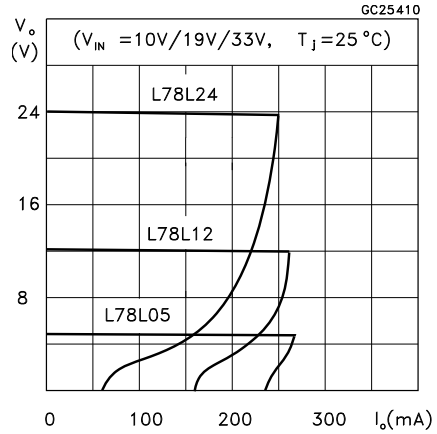


# 5 Typical performance

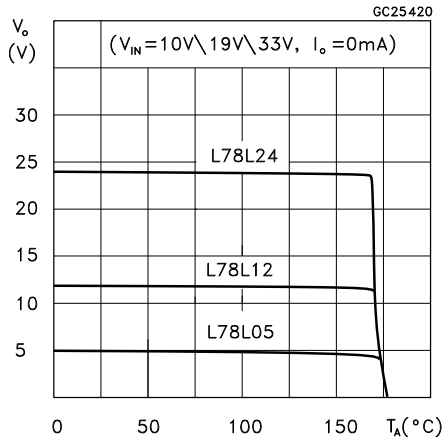
**Figure 4. L78L05/12 output voltage vs. ambient temperature**



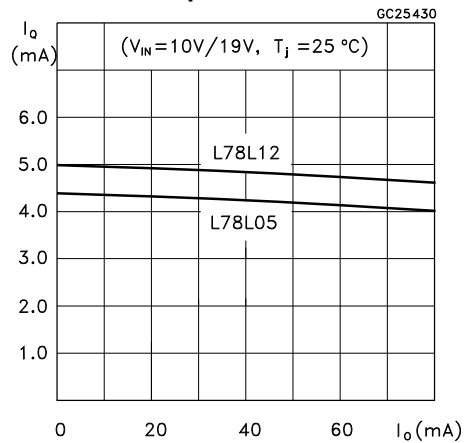
**Figure 5. L78L05/12/24 load characteristics**



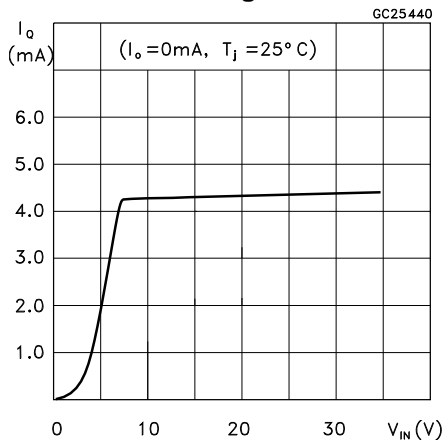
**Figure 6. L78L05/12/24 thermal shutdown**



**Figure 7. L78L05/12 quiescent current vs. output current**



**Figure 8. L78L05 quiescent current vs. input voltage**



**Figure 9. L78L05/12/24 output characteristics**

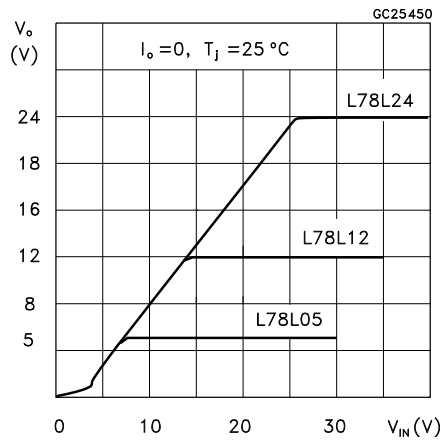


Figure 10. L78L05/12/24 ripple rejection

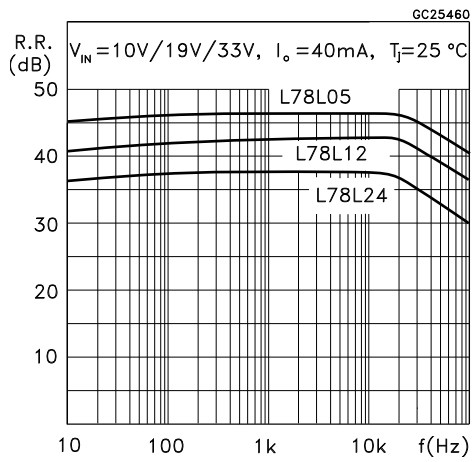


Figure 11. L78L05 dropout characteristics

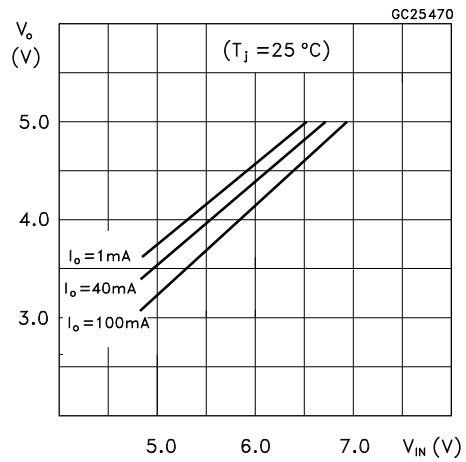
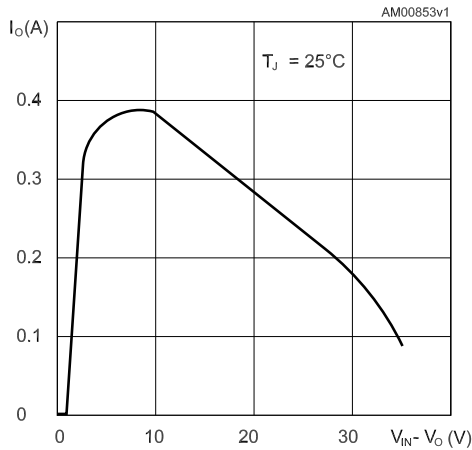


Figure 12. L78L short-circuit output current



## 6 Typical application

Figure 13. High output current short-circuit protected

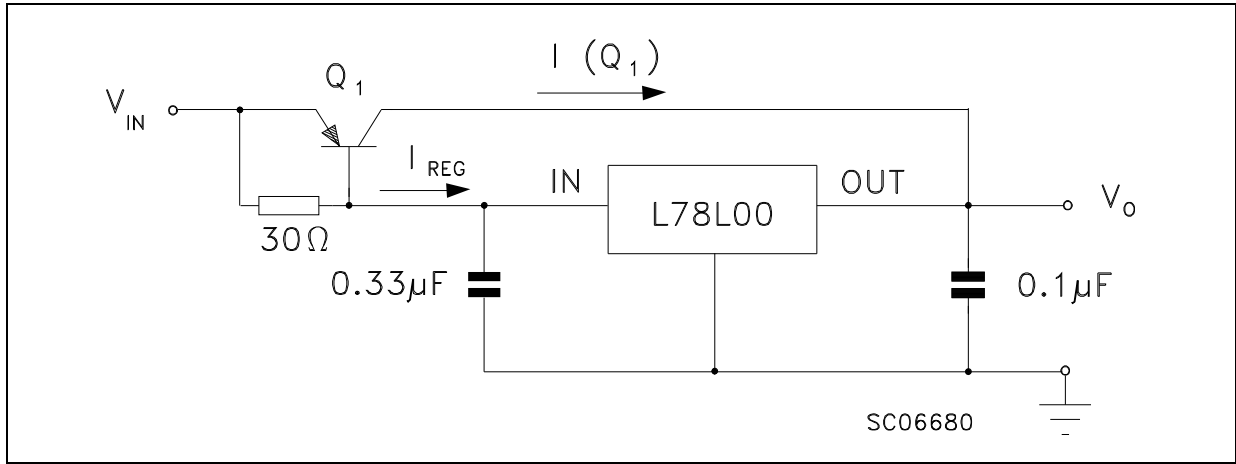


Figure 14. Output boost circuit

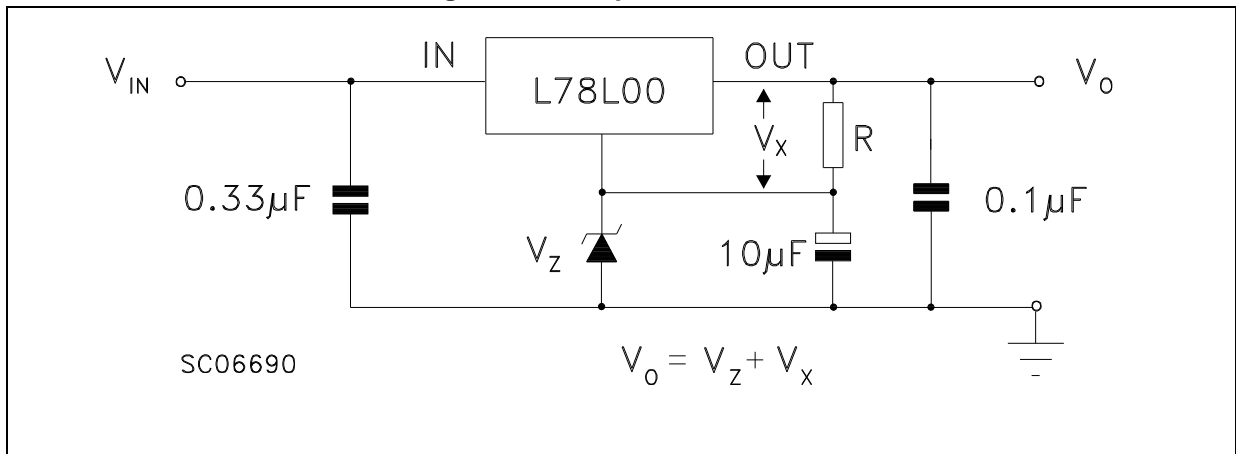


Figure 15. Current regulator

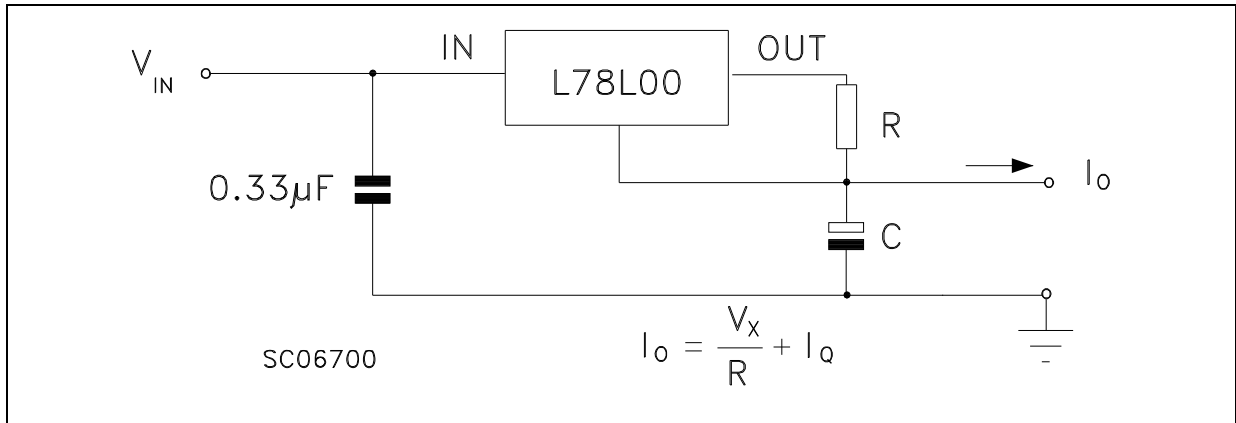
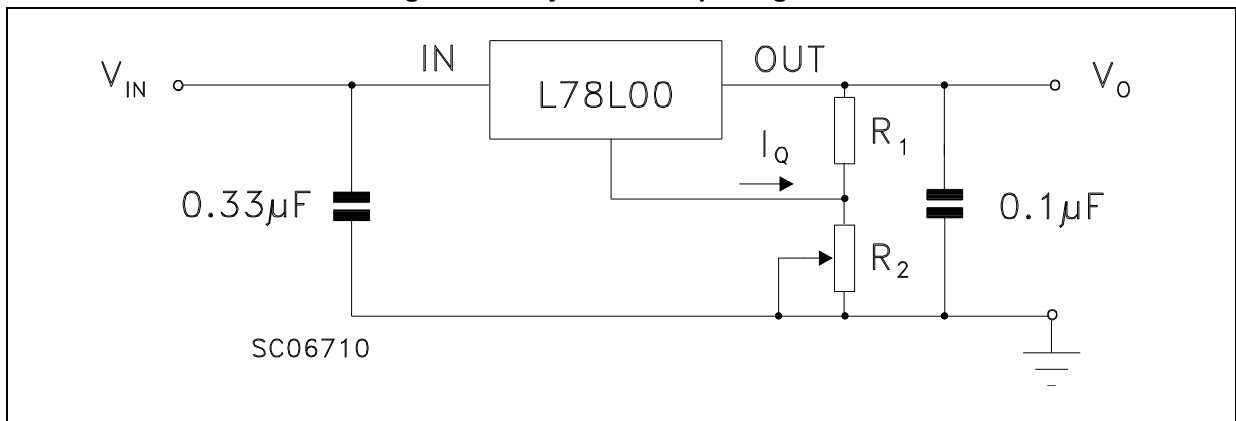


Figure 16. Adjustable output regulator



## 7 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

### 7.1 TO-92 package information

Figure 17. TO-92 package outline

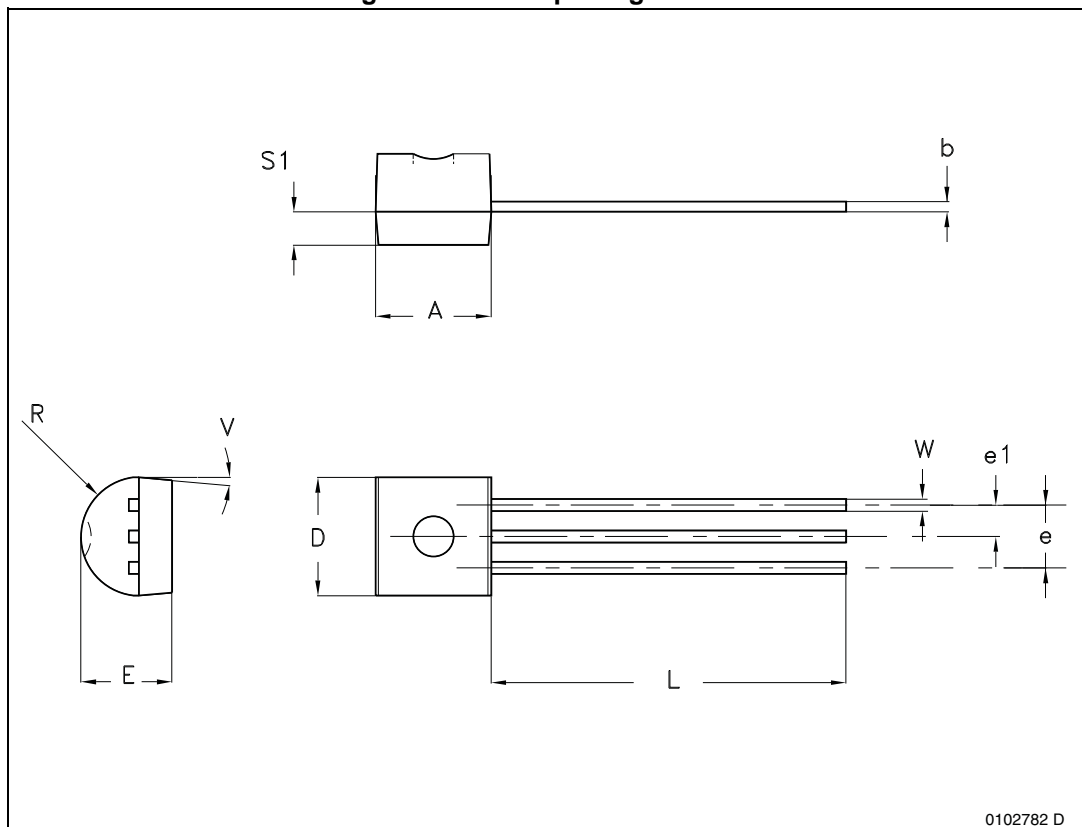


Table 22. TO-92 mechanical data

| Dim. | mm    |      |       |
|------|-------|------|-------|
|      | Min.  | Typ. | Max.  |
| A    | 4.32  |      | 4.95  |
| b    | 0.36  |      | 0.51  |
| D    | 4.45  |      | 4.95  |
| E    | 3.30  |      | 3.94  |
| e    | 2.41  |      | 2.67  |
| e1   | 1.14  |      | 1.40  |
| L    | 12.70 |      | 15.49 |
| R    | 2.16  |      | 2.41  |
| S1   | 0.92  |      | 1.52  |
| W    | 0.41  |      | 0.56  |
| V    |       | 5°   |       |

## 7.2 TO-92 packing information

Figure 18. TO-92 tape and reel outline

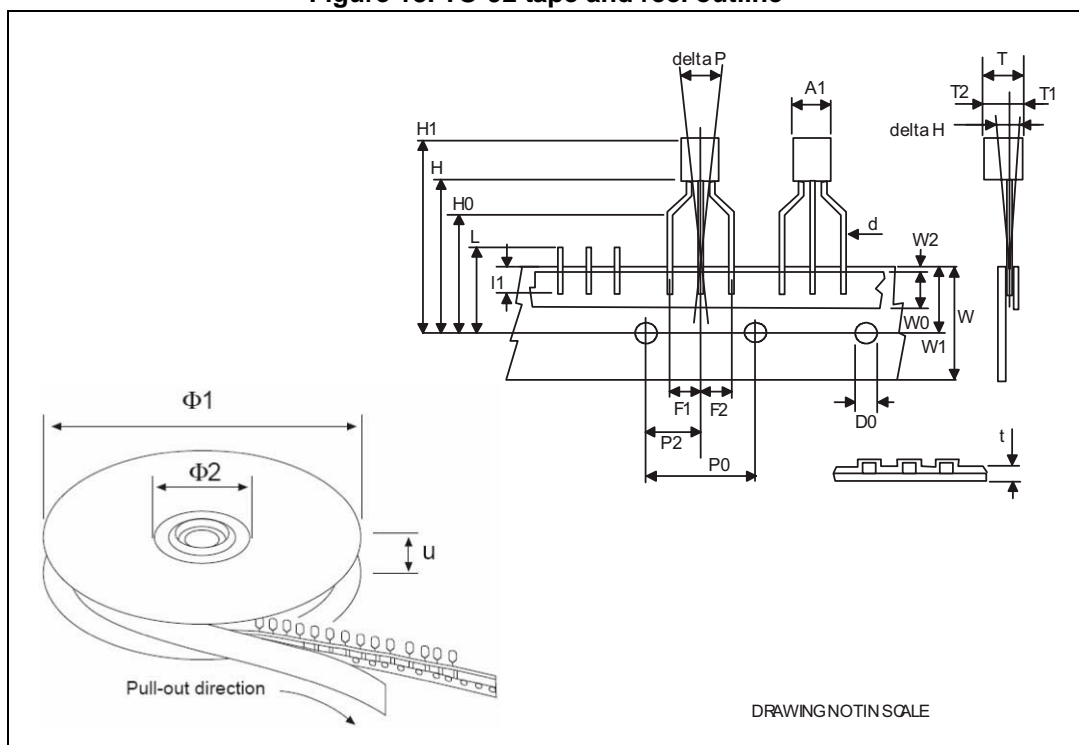


Table 23. TO-92 tape and reel mechanical data

| Dim.    | mm    |       |       |
|---------|-------|-------|-------|
|         | Min.  | Typ.  | Max.  |
| A1      |       |       | 4.80  |
| T       |       |       | 3.80  |
| T1      |       |       | 1.60  |
| T2      |       |       | 2.30  |
| d       | 0.45  | 0.47  | 0.48  |
| P0      | 12.50 | 12.70 | 12.90 |
| P2      | 5.65  | 6.35  | 7.05  |
| F1, F2  | 2.40  | 2.50  | 2.94  |
| F3      | 4.98  | 5.08  | 5.48  |
| delta H | -2.00 |       | 2.00  |
| W       | 17.50 | 18.00 | 19.00 |
| W0      | 5.5   | 6.00  | 6.5   |
| W1      | 8.50  | 9.00  | 9.25  |
| W2      |       |       | 0.50  |
| H       |       | 18.50 | 21    |
| H3      | 0.5   | 1     | 2     |
| H0      | 15.50 | 16.00 | 18.8  |
| H1      |       | 25.0  | 27.0  |
| D0      | 3.80  | 4.00  | 4.20  |
| t       |       |       | 0.90  |
| L       |       |       | 11.00 |
| l1      | 3.00  |       |       |
| delta P | -1.00 |       | 1.00  |
| Ø1      | 352   | 355   | 358   |
| Ø2      | 28    | 30    | 32    |
| u       | 44    | 47    | 50    |

### 7.3 TO-92 Ammopack packing information

Figure 19. TO-92 Ammopack tape and reel outline

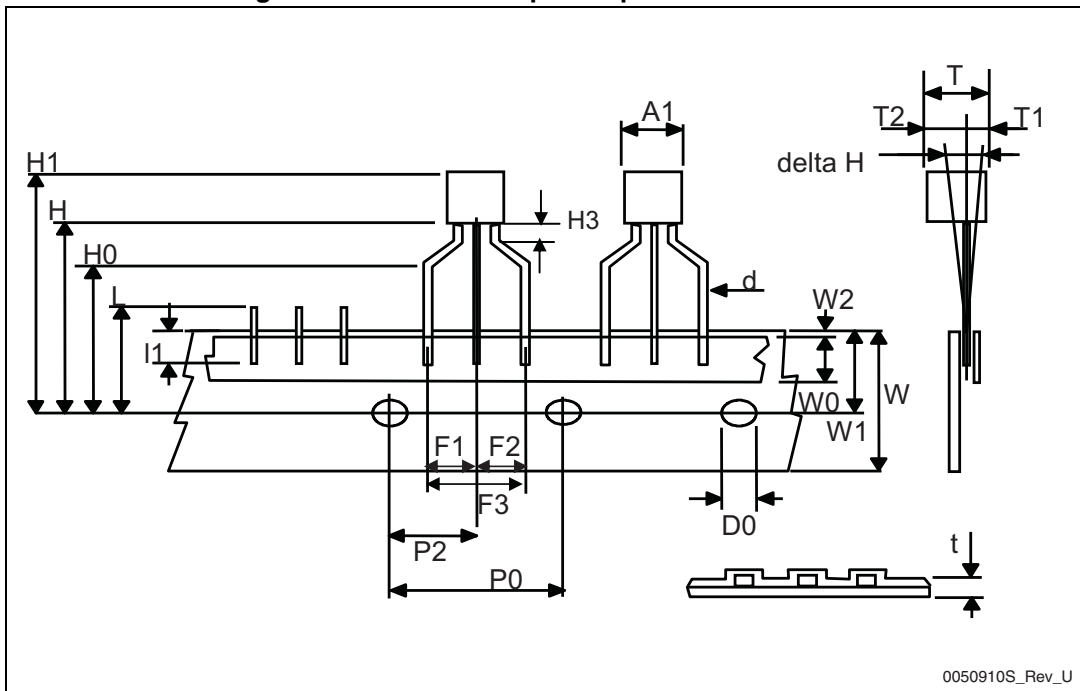




Table 24. TO-92 Ammopack tape and reel mechanical data

| Dim.    | mm    |       |       |
|---------|-------|-------|-------|
|         | Min.  | Typ.  | Max.  |
| A1      |       |       | 4.80  |
| T       |       |       | 3.80  |
| T1      |       |       | 1.60  |
| T2      |       |       | 2.30  |
| d       | 0.45  | 0.47  | 0.48  |
| P0      | 12.50 | 12.70 | 12.90 |
| P2      | 5.65  | 6.35  | 7.05  |
| F1, F2  | 2.40  | 2.50  | 2.94  |
| F3      | 4.98  | 5.08  | 5.48  |
| delta H | -2.00 |       | 2.00  |
| W       | 17.50 | 18.00 | 19.00 |
| W0      | 5.5   | 6.00  | 6.5   |
| W1      | 8.50  | 9.00  | 9.25  |
| W2      |       |       | 0.50  |
| H       |       | 18.50 | 21    |
| H3      | 0.5   | 1     | 2     |
| H0      | 15.50 | 16.00 | 18.8  |
| H1      |       | 25.0  | 27.0  |
| D0      | 3.80  | 4.00  | 4.20  |
| t       |       |       | 0.90  |
| L       |       |       | 11.00 |
| I1      | 3.00  |       |       |
| delta P | -1.00 |       | 1.00  |

### 7.4 SO-8 package information

Figure 20. SO-8 package outline

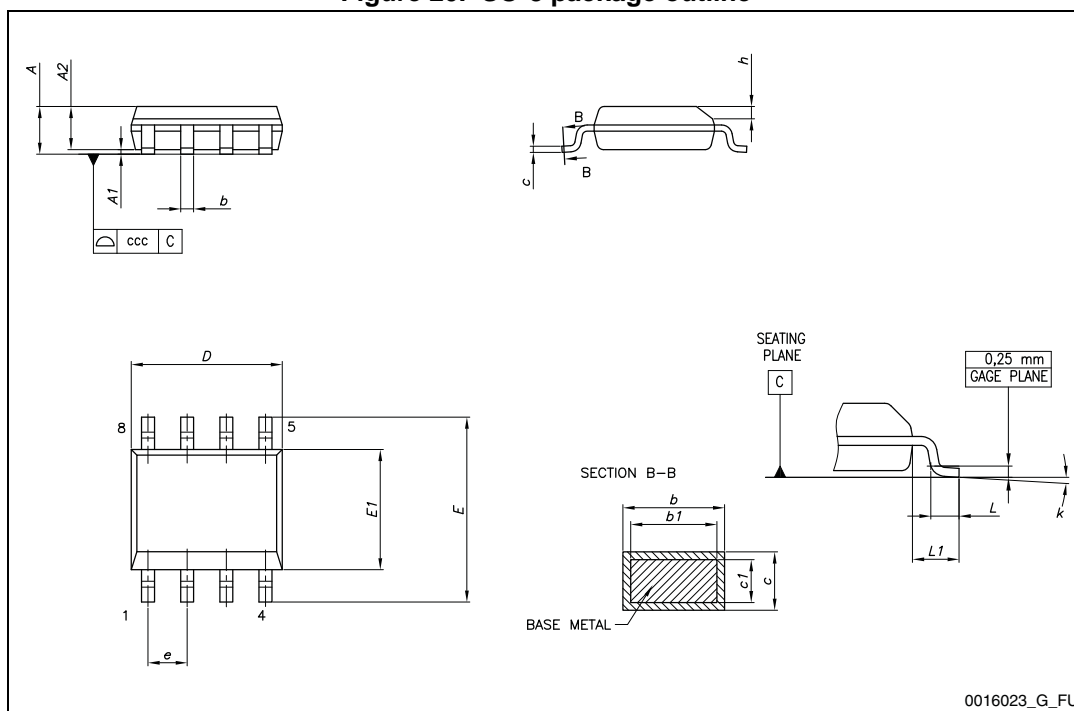
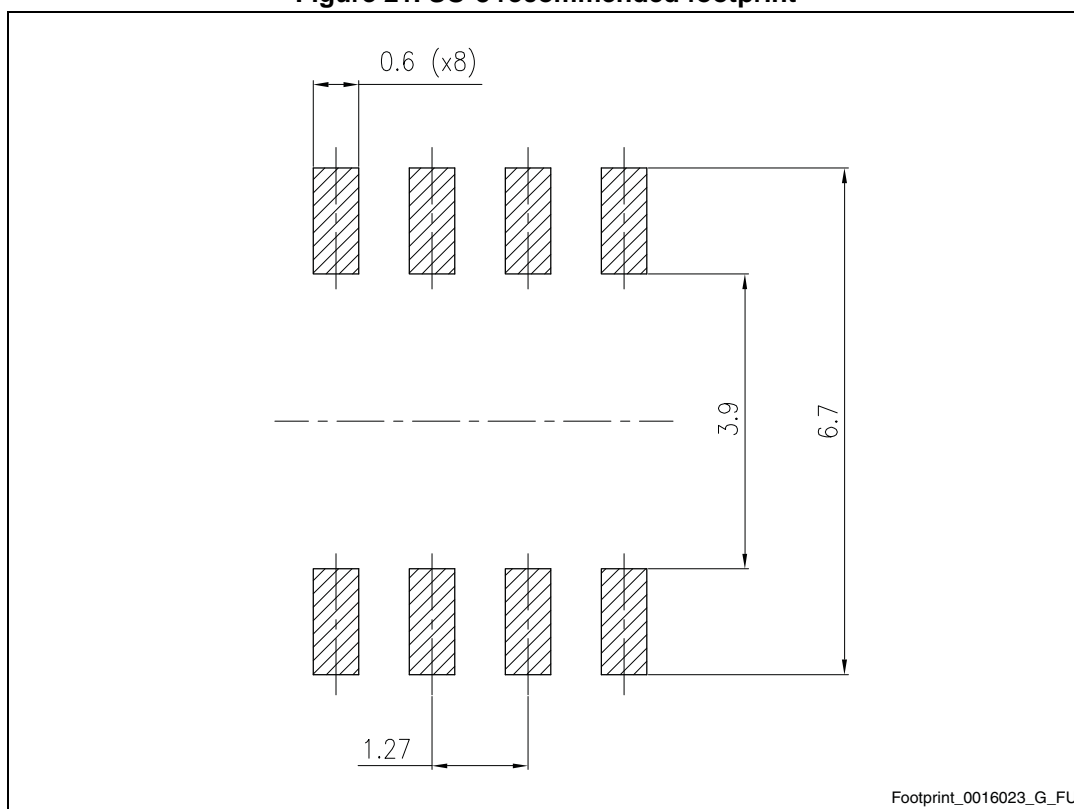


Table 25. SO-8 mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 1.75 |
| A1   | 0.10 |      | 0.25 |
| A2   | 1.25 |      |      |
| b    | 0.31 |      | 0.51 |
| b1   | 0.28 |      | 0.48 |
| c    | 0.10 |      | 0.25 |
| c1   | 0.10 |      | 0.23 |
| D    | 4.80 | 4.90 | 5.00 |
| E    | 5.80 | 6.00 | 6.20 |
| E1   | 3.80 | 3.90 | 4.00 |
| e    |      | 1.27 |      |
| h    | 0.25 |      | 0.50 |
| L    | 0.40 |      | 1.27 |
| L1   |      | 1.04 |      |
| L2   |      | 0.25 |      |
| k    | 0°   |      | 8°   |
| ccc  |      |      | 0.10 |

Figure 21. SO-8 recommended footprint



## 7.5 SO-8 packing information

Figure 22. SO-8 tape and reel outline

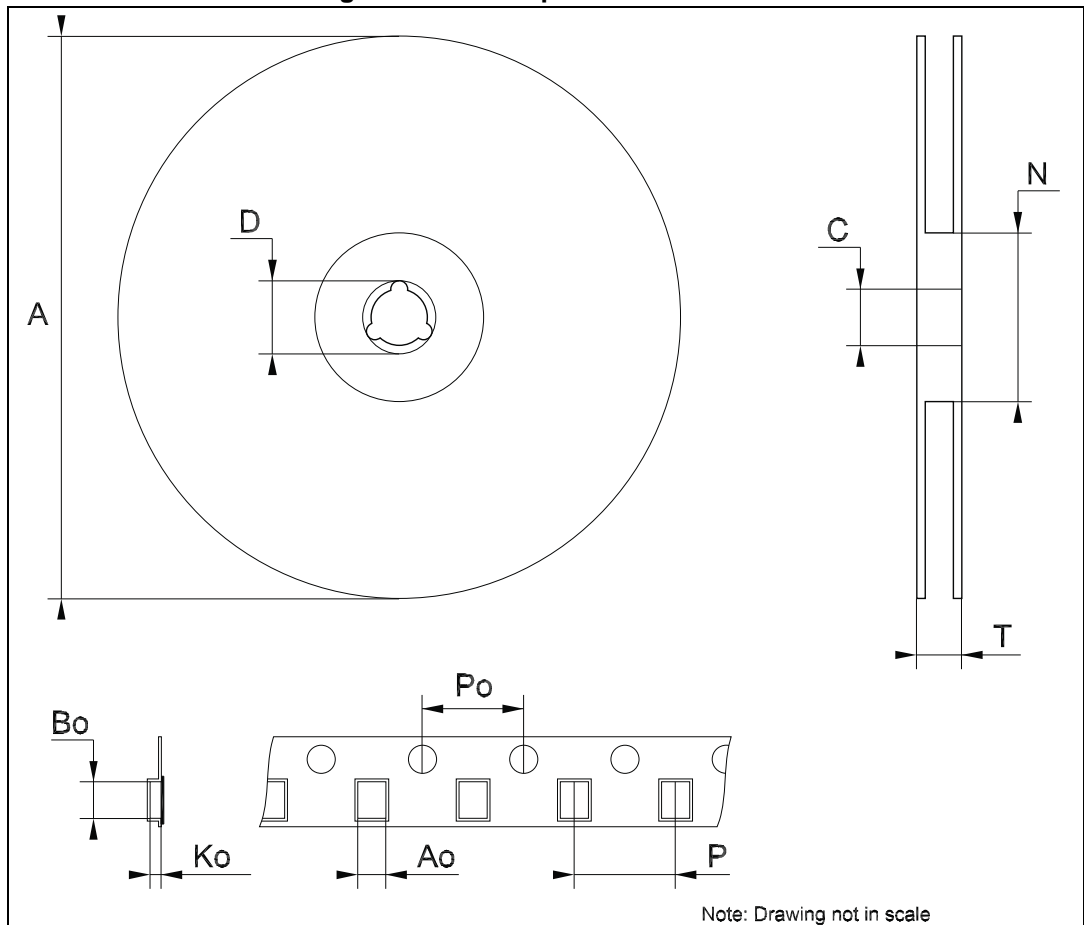


Figure 23. SO-8 tape and reel mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 330  |
| C    | 12.8 |      | 13.2 |
| D    | 20.2 |      |      |
| N    | 60   |      |      |
| T    |      |      | 22.4 |
| Ao   | 8.1  |      | 8.5  |
| Bo   | 5.5  |      | 5.9  |
| Ko   | 2.1  |      | 2.3  |
| Po   | 3.9  |      | 4.1  |
| P    | 7.9  |      | 8.1  |

### 7.6 SOT-89 package information

Figure 24. SOT-89 package outline

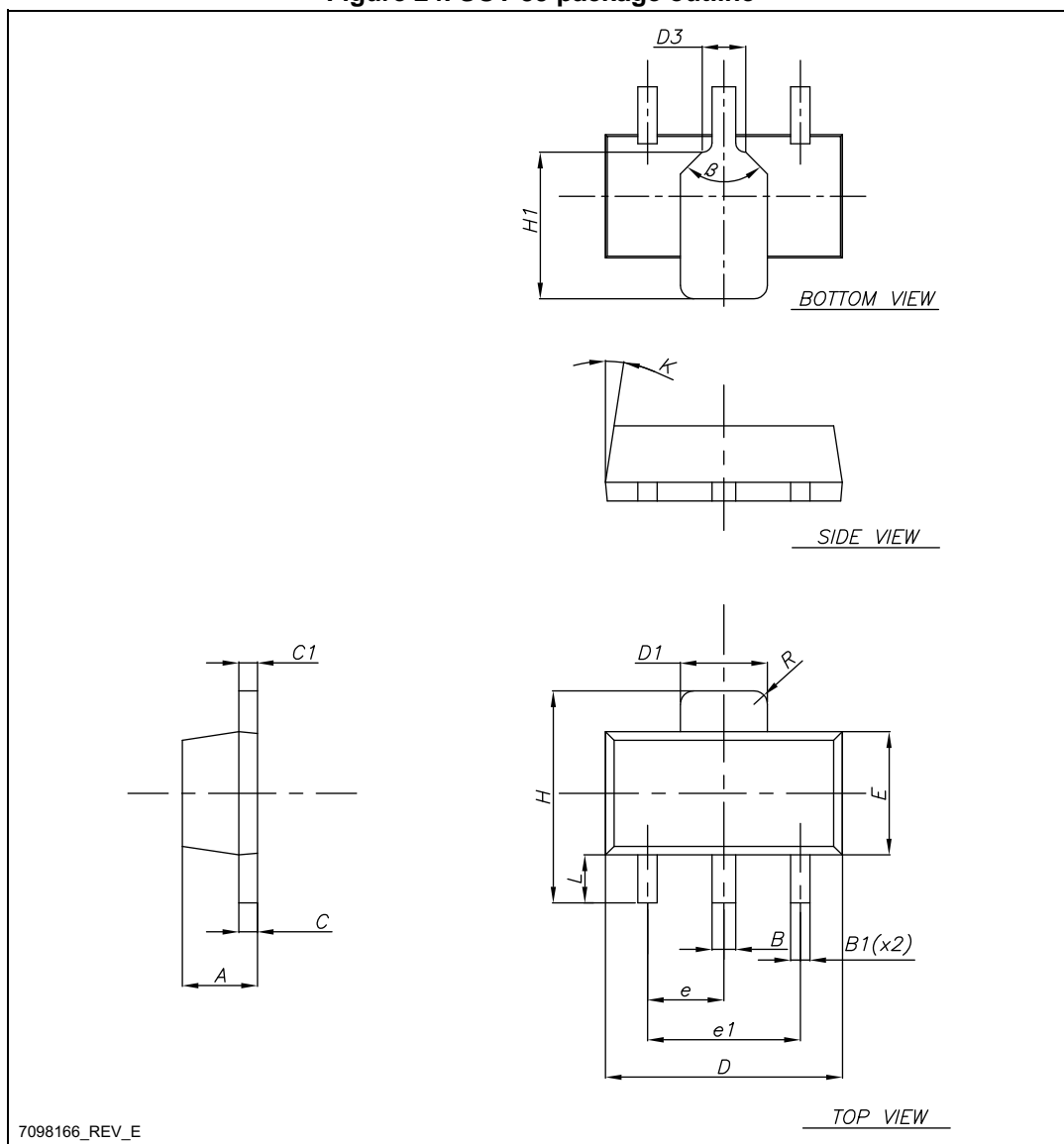
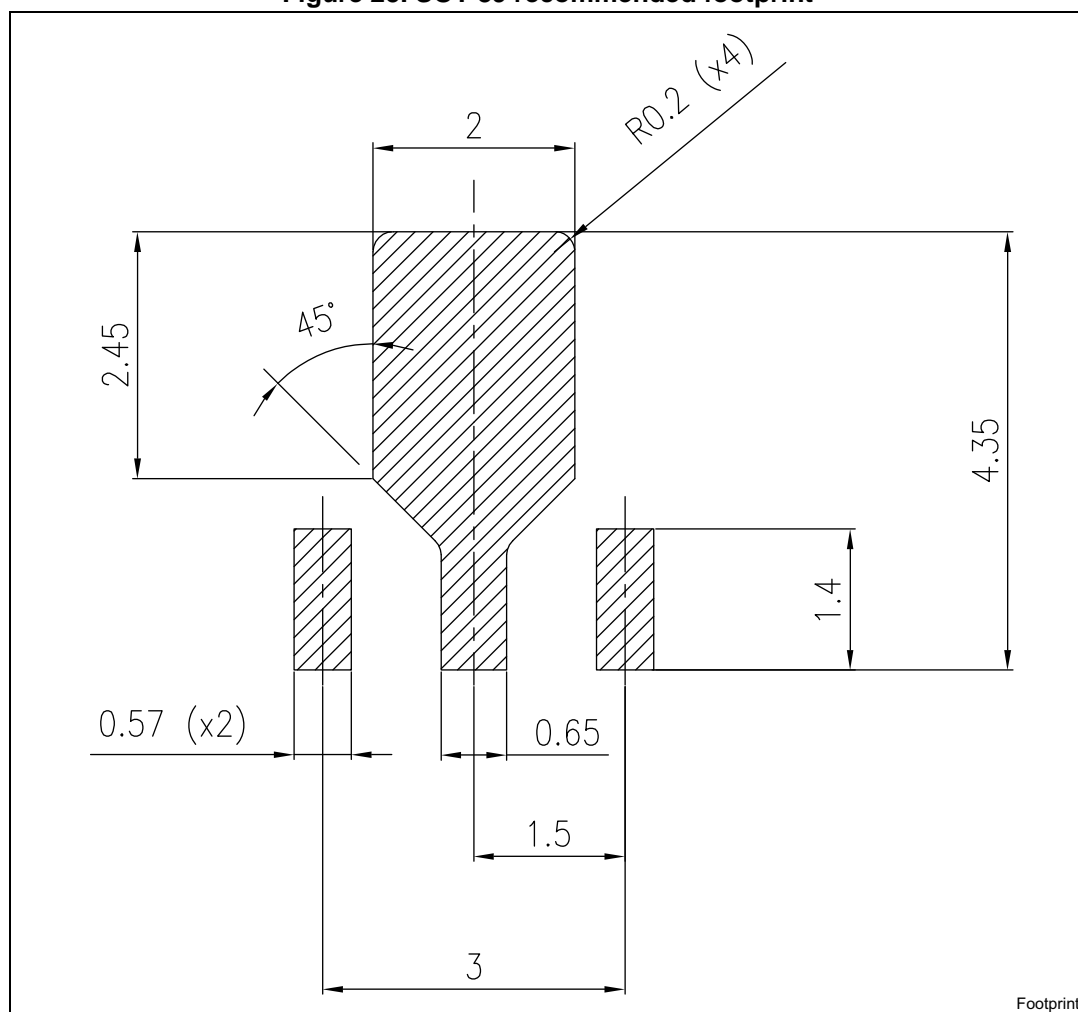


Table 26. SOT-89 mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 1.40 |      | 1.60 |
| B    | 0.44 |      | 0.56 |
| B1   | 0.36 |      | 0.48 |
| C    | 0.35 |      | 0.44 |
| C1   | 0.35 |      | 0.44 |
| D    | 4.40 |      | 4.60 |
| D1   | 1.62 |      | 1.83 |
| D3   |      | 0.90 |      |
| E    | 2.29 |      | 2.60 |
| e    | 1.42 |      | 1.57 |
| e1   | 2.92 |      | 3.07 |
| H    | 3.94 |      | 4.25 |
| H1   | 2.70 |      | 3.10 |
| K    | 1°   |      | 8°   |
| L    | 0.89 |      | 1.20 |
| R    |      | 0.25 |      |
| b    |      | 90°  |      |

Figure 25. SOT-89 recommended footprint



Footprint



## 7.7 SOT-89 packing information

Figure 26. SOT-89 carrier tape outline

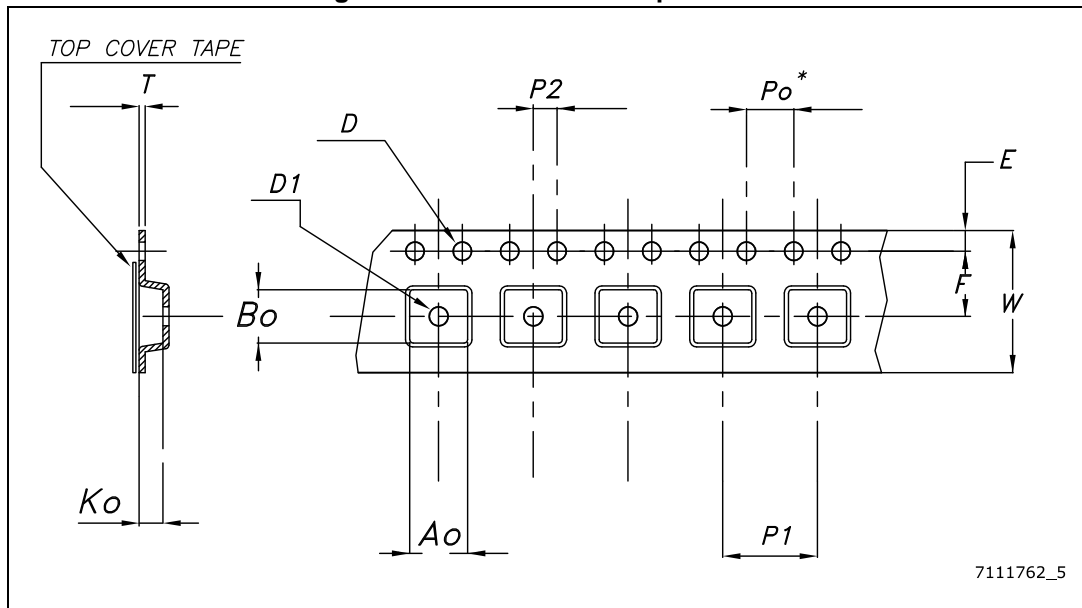


Table 27. SOT-89 carrier tape dimensions

| Dim. | mm.    |           |
|------|--------|-----------|
|      | Values | Tolerance |
| Ao   | 4.91   | ± 0.10    |
| Bo   | 4.52   | ± 0.10    |
| Ko   | 1.90   | ± 0.10    |
| F    | 5.50   | ± 0.10    |
| E    | 1.75   | ± 0.10    |
| W    | 12     | ± 0.30    |
| P2   | 2      | ± 0.10    |
| Po   | 4      | ± 0.10    |
| P1   | 8      | ± 0.10    |
| T    | 0.30   | ± 0.10    |
| D    | Ø 1.55 | ± 0.05    |
| D1   | Ø 1.60 | ± 0.10    |

## 8 Ordering information

**Table 28. Order codes**

| Part numbers  |                            |                 |                       |             | Output voltages (V) |
|---------------|----------------------------|-----------------|-----------------------|-------------|---------------------|
| SO-8          | TO-92 (Bag) <sup>(1)</sup> | TO-92 (ammopak) | TO-92 (tape and reel) | SOT-89      |                     |
| L78L33ABD-TR  |                            | L78L33ABZ-AP    |                       | L78L33ABUTR | 3.3                 |
| L78L33ACD13TR | L78L33ACZ                  | L78L33ACZ-AP    | L78L33ACZTR           | L78L33ACUTR | 3.3                 |
| L78L33CD-TR   |                            |                 |                       |             | 3.3                 |
| L78L05ABD13TR | L78L05ABZ                  | L78L05ABZ-AP    | L78L05ABZ-TR          | L78L05ABUTR | 5                   |
| L78L05ACD13TR | L78L05ACZ                  | L78L05ACZ-AP    | L78L05ACZTR           | L78L05ACUTR | 5                   |
| L78L05CD13TR  | L78L05CZ                   |                 |                       |             | 5                   |
|               | L78L06ABZ                  |                 |                       | L78L06ABUTR | 6                   |
| L78L06ACD13TR |                            |                 |                       | L78L06ACUTR | 6                   |
| L78L08ABD13TR |                            | L78L08ABZ-AP    | L78L08ABZTR           | L78L08ABUTR | 8                   |
| L78L08ACD13TR | L78L08ACZ                  | L78L08ACZ-AP    | L78L08ACZTR           | L78L08ACUTR | 8                   |
| L78L08CD13TR  |                            |                 |                       |             | 8                   |
| L78L09ABD13TR | L78L09ABZ                  |                 |                       | L78L09ABUTR | 9                   |
| L78L09ACD13TR |                            | L78L09ACZ-AP    | L78L09ACZ-TR          | L78L09ACUTR | 9                   |
| L78L09CD13TR  |                            |                 |                       |             | 9                   |
|               |                            |                 |                       | L78L10ACUTR | 10                  |
| L78L12ABD-TR  | L78L12ABZ                  | L78L12ABZ-AP    |                       | L78L12ABUTR | 12                  |
| L78L12ACD13TR | L78L12ACZ                  | L78L12ACZ-AP    | L78L12ACZ-TR          | L78L12ACUTR | 12                  |
| L78L12CD13TR  |                            |                 |                       |             | 12                  |
|               |                            | L78L15ABZ-AP    |                       | L78L15ABUTR | 15                  |
| L78L15ACD13TR | L78L15ACZ                  |                 |                       | L78L15ACUTR | 15                  |
| L78L15CD-TR   |                            |                 |                       |             | 15                  |
|               |                            |                 |                       | L78L18ACUTR | 18                  |
| L78L18CD13TR  |                            |                 |                       |             | 18                  |
|               | L78L24ABZ-TR               |                 |                       |             | 24                  |
|               |                            |                 | L78L24ACZ-AP          | L78L24ACUTR | 24                  |
| L78L24CD-TR   |                            |                 |                       |             | 24                  |

1. Available in Ammopak with the suffix "-AP" or in tape and reel with the suffix "TR". Please note that in these cases pins are shaped according to tape and reel specifications.

Table 29. Marking information

| Part numbers  | Marking | Packages | Output voltages |
|---------------|---------|----------|-----------------|
| L78L05ABD13TR | 78L05B  | SO-8     | 5 V             |
| L78L05ABUTR   | 8C      | SOT-89   | 5 V             |
| L78L05ABZ     | L78L05A | TO-92    | 5 V             |
| L78L05ABZ-AP  | L78L05A | TO-92    | 5 V             |
| L78L05ABZ-TR  | L78L05A | TO-92    | 5 V             |
| L78L05ACD13TR | 78L05A  | SO-8     | 5 V             |
| L78L05ACUTR   | 8C      | SOT-89   | 5 V             |
| L78L05ACZ     | L78L05A | TO-92    | 5 V             |
| L78L05ACZ-AP  | L78L05A | TO-92    | 5 V             |
| L78L05ACZTR   | L78L05A | TO-92    | 5 V             |
| L78L05CD13TR  | 78L05   | SO-8     | 5 V             |
| L78L05CZ      | L78L05A | TO-92    | 5 V             |
| L78L06ABUTR   | 8E      | SOT-89   | 6 V             |
| L78L06ABZ     | L78L06A | TO-92    | 6 V             |
| L78L06ACD13TR | L78L06A | SO-8     | 6 V             |
| L78L06ACUTR   | 8E      | SOT-89   | 6 V             |
| L78L08ABD13TR | 78L08B  | SO-8     | 8 V             |
| L78L08ABUTR   | 8G      | SOT-89   | 8 V             |
| L78L08ABZ-AP  | L78L08A | TO-92    | 8 V             |
| L78L08ABZTR   | L78L08A | TO-92    | 8 V             |
| L78L08ACD13TR | 78L08A  | SO-8     | 8 V             |
| L78L08ACUTR   | 8G      | SOT-89   | 8 V             |
| L78L08ACZ     | L78L08A | TO-92    | 8 V             |
| L78L08ACZ-AP  | L78L08A | TO-92    | 8 V             |
| L78L08ACZTR   | L78L08A | TO-92    | 8 V             |
| L78L08CD13TR  | 78L08   | SO-8     | 8 V             |
| L78L09ABD13TR | 78L09B  | SO-8     | 8 V             |
| L78L09ABZ     | L78L09A | TO-92    | 9 V             |
| L78L09ABUTR   | 8H      | SOT-89   | 9 V             |
| L78L09ACD13TR | 78L09A  | SO8      | 9 V             |
| L78L09ACUTR   | 8H      | SOT-89   | 9 V             |
| L78L09ACZ-AP  | L78L09A | TO-92    | 9 V             |
| L78L09ACZ-TR  | L78L09A | TO-92    | 9 V             |
| L78L09CD13TR  | L78L09A | SO-8     | 9 V             |
| L78L10ACUTR   | 8I      | SOT-89   | 10 V            |

Table 29. Marking information (continued)

| Part numbers  | Marking | Packages | Output voltages |
|---------------|---------|----------|-----------------|
| L78L12ABD-TR  | 78L12B  | SO-8     | 12 V            |
| L78L12ABUTR   | 8K      | SOT-89   | 12 V            |
| L78L12ABZ     | L78L12A | TO-92    | 12 V            |
| L78L12ABZ-AP  | L78L12A | TO 92    | 12 V            |
| L78L12ACD13TR | 78L12A  | SO-8     | 12 V            |
| L78L12ACUTR   | 8K      | SOT-89   | 12 V            |
| L78L12ACZ     | L78L12A | TO-92    | 12 V            |
| L78L12ACZ-AP  | L78L12A | TO-92    | 12 V            |
| L78L12ACZ-TR  | L78L12A | TO-92    | 12 V            |
| L78L12CD13TR  | 78L12   | SO-8     | 12 V            |
| L78L15ABUTR   | 8L      | SOT-89   | 15 V            |
| L78L15ABZ-AP  | L78L15A | TO-92    | 15 V            |
| L78L15ACD13TR | 78L15A  | SO-8     | 15 V            |
| L78L15ACUTR   | 8L      | SOT-89   | 15 V            |
| L78L15ACZ     | L78L15A | TO-92    | 15 V            |
| L78L15CD-TR   | 78L15   | SO-8     | 15 V            |
| L78L18ACUTR   | 8B      | SOT-89   | 18 V            |
| L78L18CD13TR  | L78L18  | SO-8     | 18 V            |
| L78L24ABZ-TR  | L78L24A | TO-92    | 24 V            |
| L78L24ACUTR   | 8P      | SOT-89   | 24 V            |
| L78L24ACZ-AP  | L78L24A | TO-92    | 24 V            |
| L78L24CD-TR   | 78L24   | SO-8     | 24 V            |
| L78L33ABD-TR  | 78L33B  | SO-8     | 3.3 V           |
| L78L33ABUTR   | 8A      | SOT-89   | 3.3 V           |
| L78L33ABZ-AP  | L78L33A | TO-92    | 3.3 V           |
| L78L33ACD13TR | 78L33A  | SO-8     | 3.3 V           |
| L78L33ACUTR   | 8A      | SOT-89   | 3.3 V           |
| L78L33ACZ     | L78L33A | TO-92    | 3.3 V           |
| L78L33ACZ-AP  | L78L33A | TO-92    | 3.3 V           |
| L78L33ACZTR   | L78L33A | TO-92    | 3.3 V           |

## 9 Revision history

**Table 30. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 14-Mar-2005 | 9        | Add tape and reel for TO-92.   |
| 15-Mar-2005 | 10       | Add note on Table 3.   |
| 23-Dec-2005 | 11       | Mistake on ordering Table in header.   |
| 12-Sep-2006 | 12       | Order codes updated.   |
| 07-Jun-2007 | 13       | Order codes updated.   |
| 18-Sep-2007 | 14       | Added Table 1 in cover page.   |
| 15-Jul-2008 | 15       | Modified: Table 1 and Table 28: Order codes.   |
| 18-Aug-2008 | 16       | Modified Figure 12 on page 26.   |
| 03-Apr-2009 | 17       | Added: RthJA value for SOT-89 Table 2 on page 5.   |
| 08-Feb-2011 | 18       | Added note Table 26 on page 39   |
| 21-Feb-2012 | 19       | Modified: SOT-89 Figure 2 on page 4.   |
| 14-Aug-2012 | 20       | Updated TOP value for L78L00AC in Table 1 on page 5.<br>Minor text changes.  |
| 07-Sep-2012 | 21       | Added: Table 29: Marking information.  |
| 14-Apr-2014 | 22       | Part numbers L78LxxAB, L78LxxAC, L78LxxC changed to L78L.<br>Removed Table1: Device summary.<br>Updated features and description in cover page, Table 28: Order codes, Table 29: Marking information and Section 7: Package information.<br>Added Section: Packing mechanical data.<br>Minor text changes. |
| 06-Oct-2014 | 23       | Updated Table 28: Order codes and Table 29: Marking information.<br>Minor text changes.  |
| 10-Feb-2015 | 24       | Updated Table 29: Marking information.<br>Minor text changes.  |
| 10-Feb-2016 | 25       | Updated <a href="#">Table 29: Marking information</a> and <a href="#">Section 7.7: SOT-89 packing information</a> .<br>Minor text changes.   |

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