

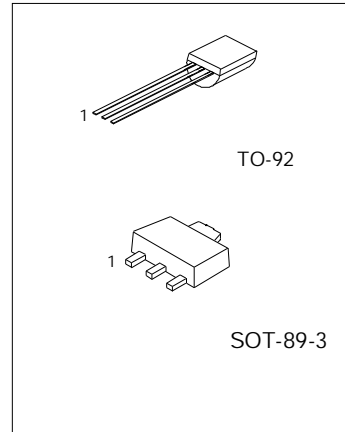
### 3-TERMINAL 0.15A POSITIVE VOLTAGE REGULATORS

#### DESCRIPTION

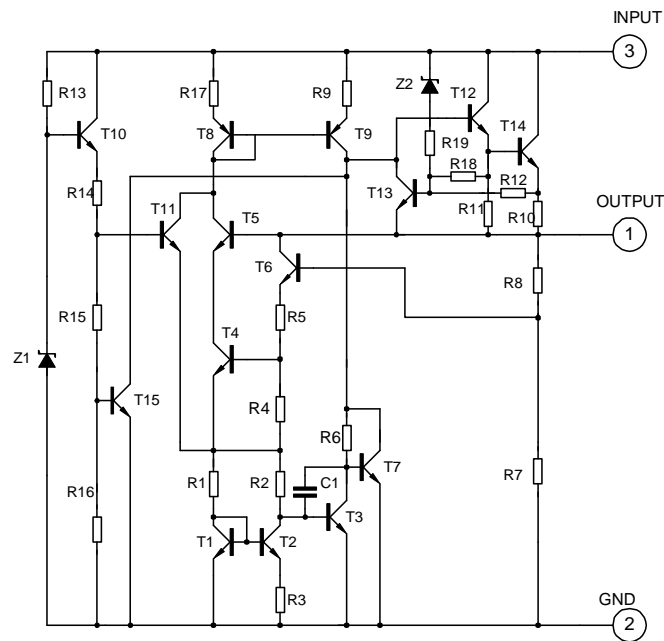
The 78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply up to 150mA.

#### FEATURE

- \*Maximum output current of 150mA
- \*Output voltage of 5V,6V,8V,9V,10V,12V,15V and 24V
- \*Thermal overload protection
- \*Short circuit current limiting



#### BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS** (Operating temperature range applies unless otherwise specified)

| CHARACTERISTICS                      | SYMBOL    | VALUE    | UNITS |
|--------------------------------------|-----------|----------|-------|
| Input voltage(for $V_o=5,8V$ )       | $V_i$     | 30       | V     |
| (for $V_o=12,15V$ )                  | $V_i$     | 35       | V     |
| High power dissipation               | $P_d$     | 700      | mW    |
| Operating Junction Temperature Range | $T_{OPR}$ | -20~+120 | °C    |
| Storage Temperature Range            | $T_{STG}$ | -55~+150 | °C    |

**78L05 ELECTRICAL CHARACTERISTICS**

 ( $V_i=10V, I_o=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

| Characteristic                   | Symbol                  | Test conditions                                 | MIN  | TYP  | MAX  | UNIT          |
|----------------------------------|-------------------------|---|------|------|------|---------------|
| Output Voltage                   | $V_o$                   | $T_j=25^\circ C$                                | 4.8  | 5.0  | 5.2  | V             |
|                                  |                         | $7V \leq V_i \leq 20V, I_o=1mA \sim 40mA$       | 4.75 |      | 5.25 | V             |
|                                  |                         | $7V \leq V_i \leq V_{MAX}, I_o=1mA \sim 70mA$   | 4.75 |      | 5.25 | V<br>(note 2) |
| Output Voltage(note 3)           | $V_o$                   | $T_j=25^\circ C$                                | 4.9  | 5.0  | 5.1  | V             |
|                                  |                         | $7V \leq V_i \leq 20V, I_o=1mA \sim 40mA$       | 4.85 |      | 5.15 | V             |
|                                  |                         | $7V \leq V_i \leq V_{MAX}, I_o=1mA \sim 70mA$   | 4.85 |      | 5.15 | V<br>(note 2) |
| Load Regulation                  | $\Delta V_o$            | $T_j=25^\circ C, I_o=1mA \sim 130mA$            |      | 11   | 60   | mV            |
|                                  |                         | $T_j=25^\circ C, I_o=1mA \sim 40mA$             |      | 5.0  | 30   | mV            |
| Line regulation                  | $\Delta V_o$            | $7V \leq V_i \leq 20V, T_j=25^\circ C$          |      | 8    | 150  | mV            |
|                                  |                         | $8V \leq V_i \leq 20V, T_j=25^\circ C$          |      | 6    | 100  | mV            |
| Quiescent Current                | $I_q$                   |   |      | 2.0  | 5.5  | mA            |
| Quiescent Current Change         | $\Delta I_q$            | $8V \leq V_i \leq 20V$                          |      |      | 1.5  | mA            |
|                                  | $\Delta I_q$            | $1mA \leq V_i \leq 40mA$                        |      |      | 0.1  | mA            |
| Output Noise Voltage             | $V_N$                   | $10Hz \leq f \leq 100kHz$                       |      | 40   |      | $\mu V$       |
| Temperature coefficient of $V_o$ | $\Delta V_o / \Delta T$ | $I_o=5mA$                                       |      | 0.65 |      | $mV/^\circ C$ |
| Ripple Rejection                 | RR                      | $8V \leq V_i \leq 20V, f=120Hz, T_j=25^\circ C$ | 40   | 49   |      | dB            |
| Dropout Voltage                  | $V_d$                   | $T_j=25^\circ C$                                |      | 1.7  |      | V             |

**78L06 ELECTRICAL CHARACTERISTICS**

(VI=12V, Io=40mA, 0&lt;Tj&lt;125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

| Characteristic                | Symbol | Test conditions                 | MIN  | TYP  | MAX  | UNIT          |
|-------------------------------|--------|---------------------------------|------|------|------|---------------|
| Output Voltage                | Vo     | Tj=25°C                         | 5.75 | 6.0  | 6.25 | V             |
|                               |        | 8.5V≤Vi≤20V, Io=1mA~40mA        | 5.7  |      | 6.3  | V             |
|                               |        | 8.5V≤Vi≤VMAX,<br>Io=1mA~70mA    | 5.7  |      | 6.3  | V<br>(note 2) |
| Output Voltage(note 3)        | Vo     | Tj=25°C                         | 5.88 | 6.0  | 6.12 | V             |
|                               |        | 8.5V≤Vi≤20V, Io=1mA~40mA        | 5.82 |      | 6.18 | V             |
|                               |        | 8.5V≤Vi≤VMAX,<br>Io=1mA~70mA    | 5.82 |      | 6.18 | V<br>(note 2) |
| Load Regulation               | ΔVo    | Tj=25°C, Io=1mA~130mA           |      | 12.8 | 80   | mV            |
|                               |        | Tj=25°C, Io=1mA~70mA            |      | 5.8  | 40   | mV            |
| Line regulation               | ΔVo    | 8.5V≤Vi≤20V, Tj=25°C            |      | 64   | 175  | mV            |
|                               |        | 9V≤Vi≤20V, Tj=25°C              |      | 54   | 125  | mV            |
| Quiescent Current             | Iq     |                                 |      | 2.0  | 5.5  | mA            |
| Quiescent Current Change      | ΔIq    | 9V≤Vi≤20V                       |      |      | 1.5  | mA            |
|                               | ΔIq    | 1mA≤Io≤40mA                     |      |      | 0.1  | mA            |
| Output Noise Voltage          | VN     | 10Hz≤f≤100kHz                   |      | 49   |      | μV            |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA                          |      | 0.75 |      | mV/°C         |
| Ripple Rejection              | RR     | 10V≤Vi≤20V, f=120Hz,<br>Tj=25°C | 38   | 46   |      | dB            |
| Dropout Voltage               | Vd     | Tj=25°C                         |      | 1.7  |      | V             |

**78L08 ELECTRICAL CHARACTERISTICS**

 (VI=14V, I<sub>o</sub>=40mA, 0<T<sub>j</sub><125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

| Characteristic                            | Symbol              | Test conditions   | MIN  | TYP  | MAX  | UNIT       |
|---|---------------------|---|------|------|------|------------|
| Output Voltage                            | V <sub>o</sub>      | T <sub>j</sub> =25°C  | 7.7  | 8.0  | 8.3  | V          |
|   |                     | 10.5V≤V <sub>i</sub> ≤23V, I <sub>o</sub> =1mA~40mA               | 7.6  |      | 8.4  | V          |
|   |                     | 10.5V≤V <sub>i</sub> ≤V <sub>MAX</sub> , I <sub>o</sub> =1mA~70mA | 7.6  |      | 8.4  | V (note 2) |
| Output Voltage(note 3)                    | V <sub>o</sub>      | T <sub>j</sub> =25°C  | 7.84 | 8.0  | 8.16 | V          |
|   |                     | 10.5V≤V <sub>i</sub> ≤23V, I <sub>o</sub> =1mA~40mA               | 7.76 |      | 8.24 | V          |
|   |                     | 10.5V≤V <sub>i</sub> ≤V <sub>MAX</sub> , I <sub>o</sub> =1mA~70mA | 7.76 |      | 8.24 | V (note 2) |
| Load Regulation                           | ΔV <sub>o</sub>     | T <sub>j</sub> =25°C, I <sub>o</sub> =1mA~130mA                   |      | 15   | 80   | mV         |
|   |                     | T <sub>j</sub> =25°C, I <sub>o</sub> =1mA~70mA                    |      | 8.0  | 40   | mV         |
| Line regulation                           | ΔV <sub>o</sub>     | 10.5V≤V <sub>i</sub> ≤23V, T <sub>j</sub> =25°C                   |      | 10   | 175  | mV         |
|   |                     | 11V≤V <sub>i</sub> ≤23V, T <sub>j</sub> =25°C                     |      | 8    | 125  | mV         |
| Quiescent Current                         | I <sub>q</sub>      |   |      | 2.0  | 5.5  | mA         |
| Quiescent Current Change                  | ΔI <sub>q</sub>     | 11V≤V <sub>i</sub> ≤23V   |      |      | 1.5  | mA         |
|   | ΔI <sub>q</sub>     | 1mA≤V <sub>i</sub> ≤40mA  |      |      | 0.1  | mA         |
| Output Noise Voltage                      | V <sub>N</sub>      | 10Hz≤f≤100kHz   |      | 49   |      | μV         |
| Temperature coefficient of V <sub>o</sub> | ΔV <sub>o</sub> /ΔT | I <sub>o</sub> =5mA   |      | 0.75 |      | mV/°C      |
| Ripple Rejection                          | RR                  | 11V≤V <sub>i</sub> ≤23V, f=120Hz, T <sub>j</sub> =25°C            | 36   | 45   |      | dB         |
| Dropout Voltage                           | V <sub>d</sub>      | T <sub>j</sub> =25°C  |      | 1.7  |      | V          |

**78L09 ELECTRICAL CHARACTERISTICS**

(VI=15V, IO=40mA, 0&lt;Tj&lt;125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

| Characteristic                | Symbol | Test conditions              | MIN  | TYP  | MAX  | UNIT          |
|-------------------------------|--------|------------------------------|------|------|------|---------------|
| Output Voltage                | Vo     | Tj=25°C                      | 8.64 | 9.0  | 9.36 | V             |
|                               |        | 11.5V≤Vi≤24V, Io=1mA~40mA    | 8.55 |      | 9.45 | V             |
|                               |        | 11.5V≤Vi≤VMAX, Io=1mA~70mA   | 8.55 |      | 9.45 | V<br>(note 2) |
| Output Voltage(note 3)        | Vo     | Tj=25°C                      | 8.82 | 9.0  | 9.18 | V             |
|                               |        | 11.5V≤Vi≤24V, Io=1mA~40mA    | 8.73 |      | 9.27 | V             |
|                               |        | 11.5V≤Vi≤VMAX, Io=1mA~70mA   | 8.73 |      | 9.27 | V<br>(note 2) |
| Load Regulation               | ΔVo    | Tj=25°C, Io=1mA~130mA        |      | 20   | 90   | mV            |
|                               |        | Tj=25°C, Io=1mA~40mA         |      | 10   | 45   | mV            |
| Line regulation               | ΔVo    | 11.5V≤Vi≤24V, Tj=25°C        |      | 90   | 200  | mV            |
|                               |        | 13V≤Vi≤24V, Tj=25°C          |      | 100  | 150  | mV            |
| Quiescent Current             | Iq     |                              |      | 2.0  | 5.5  | mA            |
| Quiescent Current Change      | ΔIq    | 13V≤Vi≤24V                   |      |      | 1.5  | mA            |
|                               | ΔIq    | 1mA≤Vi≤40mA                  |      |      | 0.1  | mA            |
| Output Noise Voltage          | VN     | 10Hz≤f≤100kHz                |      | 49   |      | μV            |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA                       |      | 0.75 |      | mV/°C         |
| Ripple Rejection              | RR     | 12V≤Vi≤23V, f=120Hz, Tj=25°C | 36   | 44   |      | dB            |
| Dropout Voltage               | Vd     | Tj=25°C                      |      | 1.7  |      | V             |

**78L12 ELECTRICAL CHARACTERISTICS**

 (VI=19V, I<sub>o</sub>=40mA, 0<T<sub>j</sub><125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

| Characteristic                | Symbol          | Test conditions   | MIN   | TYP  | MAX   | UNIT          |
|-------------------------------|-----------------|---|-------|------|-------|---------------|
| Output Voltage                | Vo              | T <sub>j</sub> =25°C  | 11.5  | 12   | 12.6  | V             |
|                               |                 | 14.5V≤V <sub>i</sub> ≤27V, I <sub>o</sub> =1mA~40mA               | 11.4  |      | 12.6  | V             |
|                               |                 | 14.5V≤V <sub>i</sub> ≤V <sub>MAX</sub> , I <sub>o</sub> =1mA~70mA | 11.4  |      | 12.6  | V<br>(note 2) |
| Output Voltage(note 3)        | Vo              | T <sub>j</sub> =25°C  | 11.76 | 12.0 | 12.24 | V             |
|                               |                 | 14.5V≤V <sub>i</sub> ≤27V, I <sub>o</sub> =1mA~40mA               | 11.64 |      | 12.36 | V             |
|                               |                 | 14.5V≤V <sub>i</sub> ≤V <sub>MAX</sub> , I <sub>o</sub> =1mA~70mA | 11.64 |      | 12.36 | V<br>(note 2) |
| Load Regulation               | ΔVo             | T <sub>j</sub> =25°C, I <sub>o</sub> =1mA~130mA                   |       | 25   | 150   | mV            |
|                               |                 | T <sub>j</sub> =25°C, I <sub>o</sub> =1mA~40mA                    |       | 12   | 75    | mV            |
| Line regulation               | ΔVo             | 14.5V≤V <sub>i</sub> ≤27V, T <sub>j</sub> =25°C                   |       | 25   | 300   | mV            |
|                               |                 | 16V≤V <sub>i</sub> ≤27V, T <sub>j</sub> =25°C                     |       | 20   | 250   | mV            |
| Quiescent Current             | I <sub>q</sub>  |   |       | 2.0  | 5.5   | mA            |
| Quiescent Current Change      | ΔI <sub>q</sub> | 16V≤V <sub>i</sub> ≤27V   |       |      | 1.5   | mA            |
|                               | ΔI <sub>q</sub> | 1mA≤V <sub>i</sub> ≤40mA  |       |      | 0.1   | mA            |
| Output Noise Voltage          | V <sub>N</sub>  | 10Hz≤f≤100kHz   |       | 80   |       | μV            |
| Temperature coefficient of Vo | ΔVo/ΔT          | I <sub>o</sub> =5mA   |       | 1.0  |       | mV/°C         |
| Ripple Rejection              | RR              | 15V≤V <sub>i</sub> ≤25V, f=120Hz, T <sub>j</sub> =25°C            | 36    | 42   |       | dB            |
| Dropout Voltage               | V <sub>d</sub>  | T <sub>j</sub> =25°C  |       | 1.7  |       | V             |

**78L15 ELECTRICAL CHARACTERISTICS**

(VI=23V, Io=40mA, 0&lt;Tj&lt;125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

| Characteristic                | Symbol | Test conditions                  | MIN   | TYP  | MAX   | UNIT          |
|-------------------------------|--------|----------------------------------|-------|------|-------|---------------|
| Output Voltage                | Vo     | Tj=25°C                          | 14.4  | 15   | 15.6  | V             |
|                               |        | 17.5V≤Vi≤30V, Io=1mA~40mA        | 14.25 |      | 15.75 | V             |
|                               |        | 17.5V≤Vi≤VMAX, Io=1mA~70mA       | 14.25 |      | 15.75 | V<br>(note 2) |
| Output Voltage(note 3)        | Vo     | Tj=25°C                          | 14.7  | 15.0 | 15.3  | V             |
|                               |        | 17.5V≤Vi≤30V, Io=1mA~40mA        | 14.55 |      | 15.45 | V             |
|                               |        | 17.5V≤Vi≤VMAX, Io=1mA~70mA       | 14.55 |      | 15.45 | V<br>(note 2) |
| Load Regulation               | ΔVo    | Tj=25°C, Io=1mA~130mA            |       | 20   | 150   | mV            |
|                               |        | Tj=25°C, Io=1mA~70mA             |       | 25   | 150   | mV            |
| Line regulation               | ΔVo    | 17.5V≤Vi≤30V, Tj=25°C            |       | 25   | 150   | mV            |
|                               |        | 20V≤Vi≤30V, Tj=25°C              |       | 15   | 75    | mV            |
| Quiescent Current             | Iq     |                                  |       | 2.2  | 6.0   | mA            |
| Quiescent Current Change      | ΔIq    | 20V≤Vi≤30V                       |       |      | 1.5   | mA            |
|                               | ΔIq    | 1mA≤Vi≤40mA                      |       |      | 0.1   | mA            |
| Output Noise Voltage          | VN     | 10Hz≤f≤100kHz                    |       | 90   |       | μV            |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA                           |       | 1.3  |       | mV/°C         |
| Ripple Rejection              | RR     | 18.5V≤Vi≤28.5V, f=120Hz, Tj=25°C | 33    | 39   |       | dB            |
| Dropout Voltage               | Vd     | Tj=25°C                          |       | 1.7  |       | V             |

**78L18 ELECTRICAL CHARACTERISTICS**

(VI=27V, IO=40mA, 0&lt;Tj&lt;125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

| Characteristic                | Symbol | Test conditions              | MIN   | TYP  | MAX   | UNIT          |
|-------------------------------|--------|------------------------------|-------|------|-------|---------------|
| Output Voltage                | Vo     | Tj=25°C                      | 17.3  | 18   | 18.7  | V             |
|                               |        | 21V≤Vi≤33V, IO=1mA~40mA      | 17.1  |      | 18.9  | V             |
|                               |        | 21V≤Vi≤VMAX, IO=1mA~70mA     | 17.1  |      | 18.9  | V<br>(note 2) |
| Output Voltage(note 3)        | Vo     | Tj=25°C                      | 17.64 | 18.0 | 18.36 | V             |
|                               |        | 21V≤Vi≤33V, IO=1mA~40mA      | 17.46 |      | 18.54 | V             |
|                               |        | 21V≤Vi≤VMAX, IO=1mA~70mA     | 17.46 |      | 18.54 | V<br>(note 2) |
| Load Regulation               | ΔVo    | Tj=25°C, IO=1mA~130mA        |       | 30   | 170   | mV            |
|                               |        | Tj=25°C, IO=1mA~40mA         |       | 15   | 85    | mV            |
| Line regulation               | ΔVo    | 21V≤Vi≤33V, Tj=25°C          |       | 145  | 300   | mV            |
|                               |        | 22V≤Vi≤33V, Tj=25°C          |       | 135  | 250   | mV            |
| Quiescent Current             | Iq     |                              |       | 2.2  | 6.0   | mA            |
| Quiescent Current Change      | ΔIq    | 21V≤Vi≤33V                   |       |      | 1.5   | mA            |
|                               | ΔIq    | 1mA≤Vi≤40mA                  |       |      | 0.1   | mA            |
| Output Noise Voltage          | Vn     | 10Hz≤f≤100kHz                |       | 150  |       | μV            |
| Temperature coefficient of Vo | ΔVo/ΔT | IO=5mA                       |       | 1.8  |       | mV/°C         |
| Ripple Rejection              | RR     | 23V≤Vi≤33V, f=120Hz, Tj=25°C | 32    | 38   |       | dB            |
| Dropout Voltage               | Vd     | Tj=250°C                     |       | 1.7  |       | V             |



**78L24 ELECTRICAL CHARACTERISTICS**

(VI=33V, Io=40mA, 0&lt;Tj&lt;125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

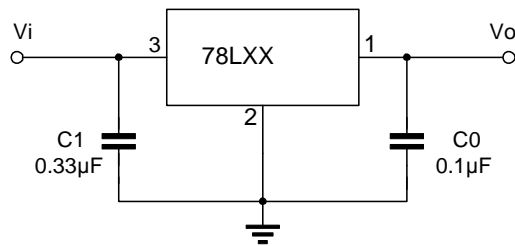
| Characteristic                | Symbol | Test conditions              | MIN   | TYP | MAX   | UNIT          |
|-------------------------------|--------|------------------------------|-------|-----|-------|---------------|
| Output Voltage                | Vo     | Tj=25°C                      | 23    | 24  | 25    | V             |
|                               |        | 27V≤Vi≤38V, Io=1mA~40mA      | 22.8  |     | 25.2  | V             |
|                               |        | 27V≤Vi≤VMAX, Io=1mA~70mA     | 22.8  |     | 25.2  | V<br>(note 2) |
| Output Voltage(note 3)        | Vo     | Tj=25°C                      | 23.5  | 24  | 24.5  | V             |
|                               |        | 27V≤Vi≤38V, Io=1mA~40mA      | 23.25 |     | 24.75 | V             |
|                               |        | 27V≤Vi≤VMAX, Io=1mA~70mA     | 23.25 |     | 24.75 | V<br>(note 2) |
|                               |        |                              |       |     |       |               |
| Load Regulation               | ΔVo    | Tj=25°C, Io=1mA~130mA        |       | 40  | 200   | mV            |
|                               |        | Tj=25°C, Io=1mA~40mA         |       | 20  | 100   | mV            |
| Line regulation               | ΔVo    | 27V≤Vi≤38V, Tj=25°C          |       | 160 | 300   | mV            |
|                               |        | 28V≤Vi≤38V, Tj=25°C          |       | 150 | 250   | mV            |
| Quiescent Current             | Iq     |                              |       | 2.2 | 6.0   | mA            |
| Quiescent Current Change      | ΔIq    | 27V≤Vi≤38V                   |       |     | 1.5   | mA            |
|                               | ΔIq    | 1mA≤Vi≤40mA                  |       |     | 0.1   | mA            |
| Output Noise Voltage          | VN     | 10Hz≤f≤100kHz                |       | 200 |       | μV            |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA                       |       | 2.0 |       | mV/°C         |
| Ripple Rejection              | RR     | 27V≤Vi≤38V, f=120Hz, Tj=25°C | 30    | 37  |       | dB            |
| Dropout Voltage               | Vd     | Tj=25°C                      |       | 1.7 |       | V             |

Note 1: The Maximum steady state usable output current and input voltage are very dependent on the heating sinking and/or lead temperature length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of test.

Note 2: Power dissipation<0.75W.

Note 3: Output voltage of 78LXXA.

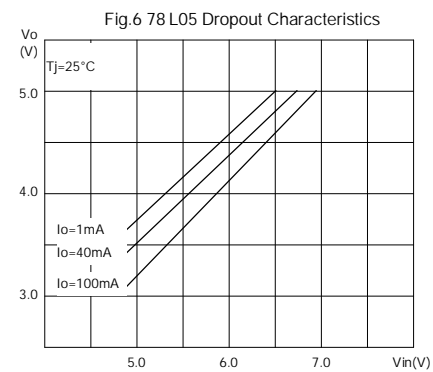
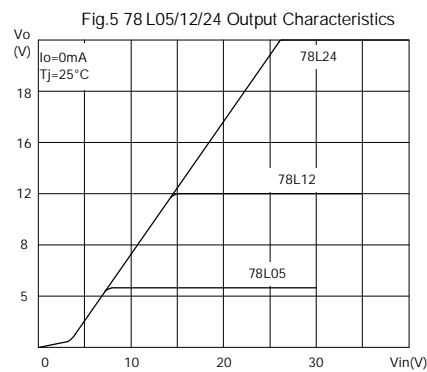
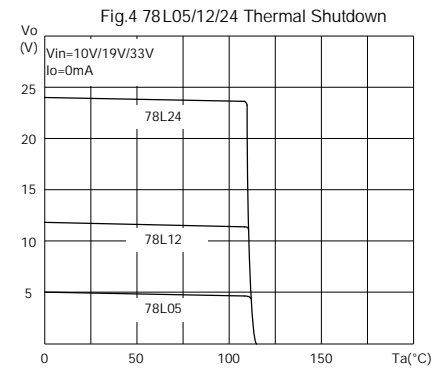
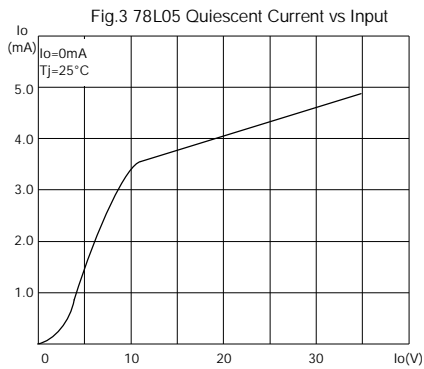
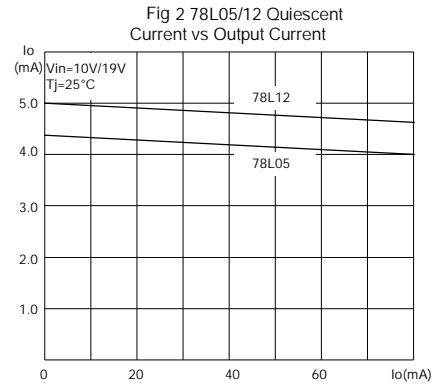
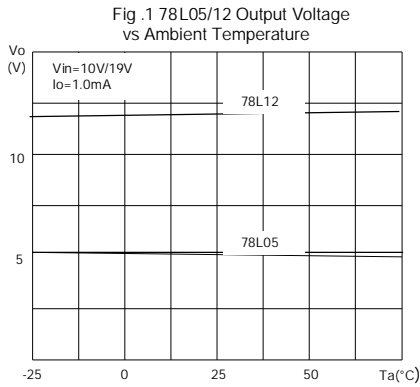
TYPICAL APPLICATION



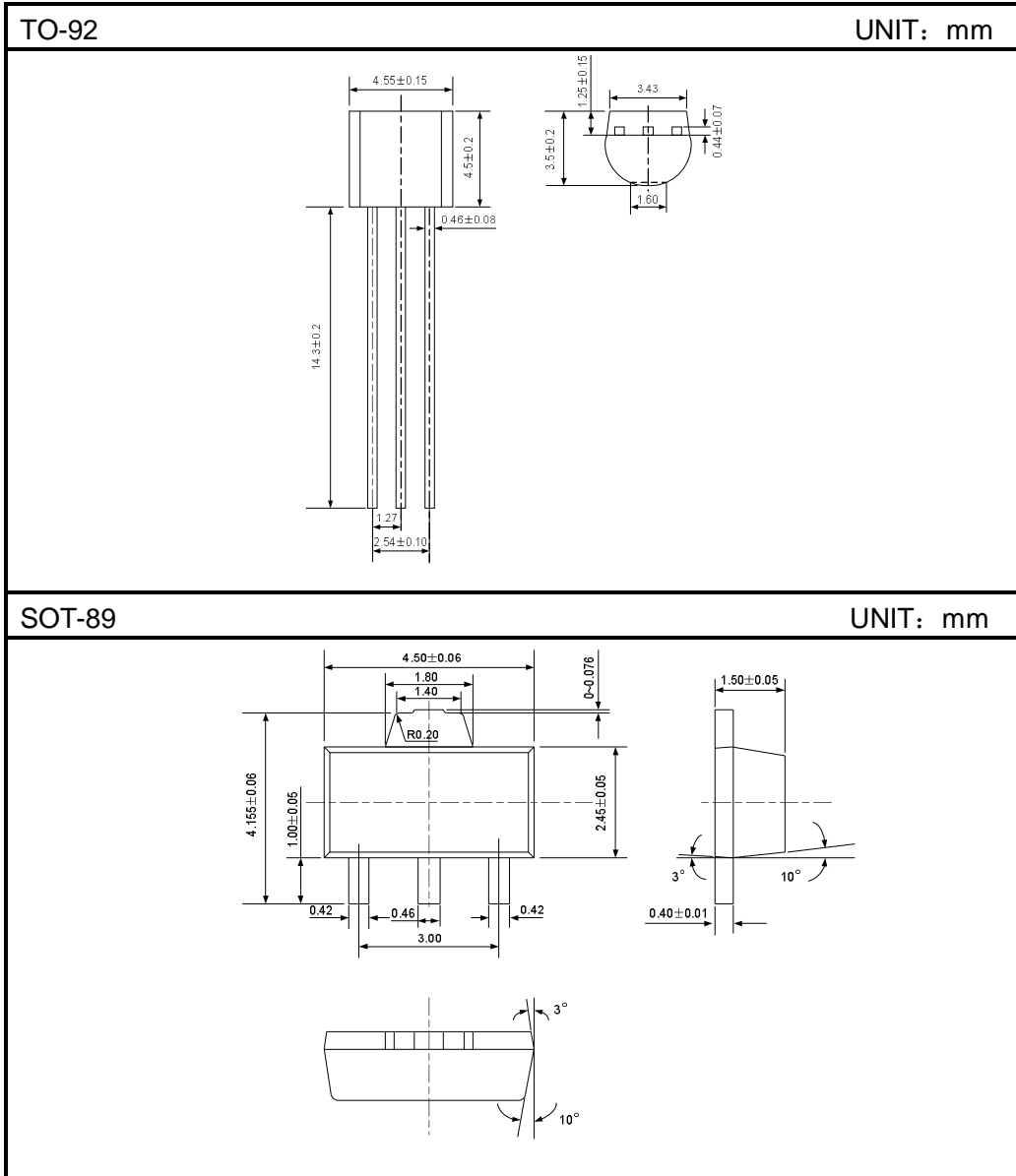
Note 1: To specify an output voltage, substitute voltage value for "XX".

Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

TYPICAL PERFORMANCE CHARACTERISTICS



PACKAGE OUTLINE



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