

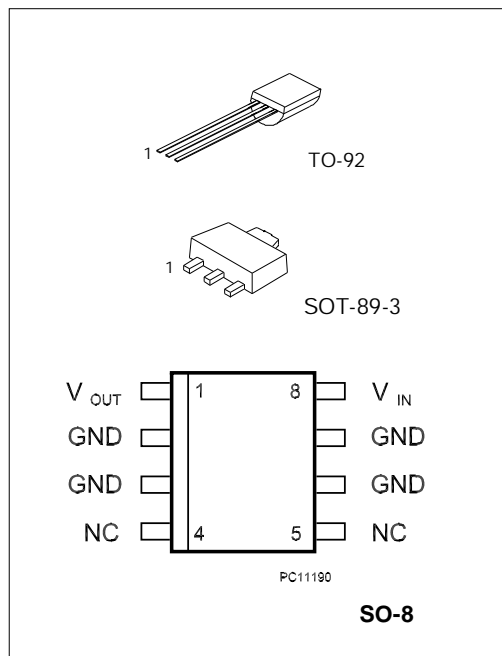
3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

DESCRIPTION

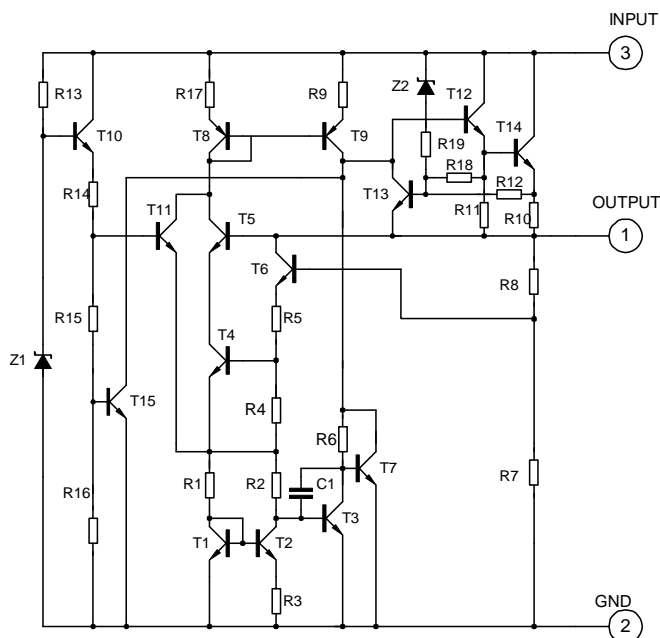
The 78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply up to 100mA.

FEATURE

- *Maximum output current of 100mA
- *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 (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 (note 2) |
| Load Regulation | ΔV_o | $T_j=25^\circ C, I_o=1mA \sim 100mA$ | | 11 | 60 | mV |
| | | $T_j=25^\circ C, I_o=1mA \sim 40mA$ | | 5.0 | 30 | mV |
| Line regulation | ΔV_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 | ΔI_q | $8V \leq V_i \leq 20V$ | | | 1.5 | mA |
| | ΔI_q | $1mA \leq V_i \leq 40mA$ | | | 0.1 | mA |
| Output Noise Voltage | V_N | $10Hz \leq f \leq 100kHz$ | | 40 | | μV |
| 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

($V_I=12V, I_O=40mA, 0 < T_J < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|----------------------------------|-------------------------|--|------|------|------|---------------|
| Output Voltage | V_o | $T_J=25^\circ C$ | 5.75 | 6.0 | 6.25 | V |
| | | $8.5V \leq V_I \leq 20V, I_O=1mA \sim 40mA$ | 5.7 | | 6.3 | V |
| | | $8.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 5.7 | | 6.3 | V (note 2) |
| Output Voltage(note 3) | V_o | $T_J=25^\circ C$ | 5.88 | 6.0 | 6.12 | V |
| | | $8.5V \leq V_I \leq 20V, I_O=1mA \sim 40mA$ | 5.82 | | 6.18 | V |
| | | $8.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 5.82 | | 6.18 | V (note 2) |
| Load Regulation | ΔV_o | $T_J=25^\circ C, I_O=1mA \sim 100mA$ | | 12.8 | 80 | mV |
| | | $T_J=25^\circ C, I_O=1mA \sim 70mA$ | | 5.8 | 40 | mV |
| Line regulation | ΔV_o | $8.5V \leq V_I \leq 20V, T_J=25^\circ C$ | | 64 | 175 | mV |
| | | $9V \leq V_I \leq 20V, T_J=25^\circ C$ | | 54 | 125 | mV |
| Quiescent Current | I_q | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔI_q | $9V \leq V_I \leq 20V$ | | | 1.5 | mA |
| | ΔI_q | $1mA \leq I_O \leq 40mA$ | | | 0.1 | mA |
| Output Noise Voltage | V_N | $10Hz \leq f \leq 100kHz$ | | 49 | | μV |
| Temperature coefficient of V_o | $\Delta V_o / \Delta T$ | $I_O=5mA$ | | 0.75 | | $mV/^\circ C$ |
| Ripple Rejection | RR | $10V \leq V_I \leq 20V, f=120Hz, T_J=25^\circ C$ | 38 | 46 | | dB |
| Dropout Voltage | V_d | $T_J=25^\circ C$ | | 1.7 | | V |

78L08 ELECTRICAL CHARACTERISTICS

($V_I=14V, I_O=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|----------------------------------|-------------------------|--|------|------|------|---------------|
| Output Voltage | V_o | $T_j=25^\circ C$ | 7.7 | 8.0 | 8.3 | V |
| | | $10.5V \leq V_I \leq 23V, I_O=1mA \sim 40mA$ | 7.6 | | 8.4 | V |
| | | $10.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 7.6 | | 8.4 | V (note 2) |
| Output Voltage(note 3) | V_o | $T_j=25^\circ C$ | 7.84 | 8.0 | 8.16 | V |
| | | $10.5V \leq V_I \leq 23V, I_O=1mA \sim 40mA$ | 7.76 | | 8.24 | V |
| | | $10.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 7.76 | | 8.24 | V (note 2) |
| Load Regulation | ΔV_o | $T_j=25^\circ C, I_O=1mA \sim 100mA$ | | 15 | 80 | mV |
| | | $T_j=25^\circ C, I_O=1mA \sim 70mA$ | | 8.0 | 40 | mV |
| Line regulation | ΔV_o | $10.5V \leq V_I \leq 23V, T_j=25^\circ C$ | | 10 | 175 | mV |
| | | $11V \leq V_I \leq 23V, T_j=25^\circ C$ | | 8 | 125 | mV |
| Quiescent Current | I_q | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔI_q | $11V \leq V_I \leq 23V$ | | | 1.5 | mA |
| | ΔI_q | $1mA \leq V_I \leq 40mA$ | | | 0.1 | mA |
| Output Noise Voltage | V_N | $10Hz \leq f \leq 100kHz$ | | 49 | | μV |
| Temperature coefficient of V_o | $\Delta V_o / \Delta T$ | $I_O=5mA$ | | 0.75 | | $mV/^\circ C$ |
| Ripple Rejection | RR | $11V \leq V_I \leq 23V, f=120Hz, T_j=25^\circ C$ | 36 | 45 | | dB |
| Dropout Voltage | V_d | $T_j=25^\circ C$ | | 1.7 | | V |

78L09 ELECTRICAL CHARACTERISTICS

($V_I=15V, I_O=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|----------------------------------|-------------------------|--|------|------|------|----------------|
| Output Voltage | V_o | $T_j=25^\circ C$ | 8.64 | 9.0 | 9.36 | V |
| | | $11.5V \leq V_I \leq 24V, I_O=1mA \sim 40mA$ | 8.55 | | 9.45 | V |
| | | $11.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 8.55 | | 9.45 | V (note 2) |
| Output Voltage(note 3) | V_o | $T_j=25^\circ C$ | 8.82 | 9.0 | 9.18 | V |
| | | $11.5V \leq V_I \leq 24V, I_O=1mA \sim 40mA$ | 8.73 | | 9.27 | V |
| | | $11.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 8.73 | | 9.27 | V (note 2) |
| Load Regulation | ΔV_o | $T_j=25^\circ C, I_O=1mA \sim 100mA$ | | 20 | 90 | mV |
| | | $T_j=25^\circ C, I_O=1mA \sim 40mA$ | | 10 | 45 | mV |
| Line regulation | ΔV_o | $11.5V \leq V_I \leq 24V, T_j=25^\circ C$ | | 90 | 200 | mV |
| | | $13V \leq V_I \leq 24V, T_j=25^\circ C$ | | 100 | 150 | mV |
| Quiescent Current | I_q | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔI_q | $13V \leq V_I \leq 24V$ | | | 1.5 | mA |
| | ΔI_q | $1mA \leq V_I \leq 40mA$ | | | 0.1 | mA |
| Output Noise Voltage | V_N | $10Hz \leq f \leq 100kHz$ | | 49 | | μV |
| Temperature coefficient of V_o | $\Delta V_o / \Delta T$ | $I_O=5mA$ | | 0.75 | | mV/ $^\circ C$ |
| Ripple Rejection | RR | $12V \leq V_I \leq 23V, f=120Hz, T_j=25^\circ C$ | 36 | 44 | | dB |
| Dropout Voltage | V_d | $T_j=25^\circ C$ | | 1.7 | | V |

78L12 ELECTRICAL CHARACTERISTICS

($V_I=19V, I_O=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|-------------------------------|--------|----------------------------------|-------|------|-------|---------------|
| Output Voltage | Vo | Tj=25°C | 11.5 | 12 | 12.6 | V |
| | | 14.5V ≤ Vi ≤ 27V, Io=1mA~40mA | 11.4 | | 12.6 | V |
| | | 14.5V ≤ Vi ≤ VMAX, Io=1mA~70mA | 11.4 | | 12.6 | V (note 2) |
| Output Voltage(note 3) | Vo | Tj=25°C | 11.76 | 12.0 | 12.24 | V |
| | | 14.5V ≤ Vi ≤ 27V, Io=1mA~40mA | 11.64 | | 12.36 | V |
| | | 14.5V ≤ Vi ≤ VMAX, Io=1mA~70mA | 11.64 | | 12.36 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 25 | 150 | mV |
| | | Tj=25°C, Io=1mA~40mA | | 12 | 75 | mV |
| Line regulation | ΔVo | 14.5V ≤ Vi ≤ 27V, Tj=25°C | | 25 | 300 | mV |
| | | 16V ≤ Vi ≤ 27V, Tj=25°C | | 20 | 250 | mV |
| Quiescent Current | Iq | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔIq | 16V ≤ Vi ≤ 27V | | | 1.5 | mA |
| | ΔIq | 1mA ≤ Io ≤ 40mA | | | 0.1 | mA |
| Output Noise Voltage | VN | 10Hz ≤ f ≤ 100kHz | | 80 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | 1.0 | | mV/°C |
| Ripple Rejection | RR | 15V ≤ Vi ≤ 25V, f=120Hz, Tj=25°C | 36 | 42 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

78L15 ELECTRICAL CHARACTERISTICS

($V_I=23V, I_O=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|----------------------------------|-------------------------|--|-------|------|-------|---------------|
| Output Voltage | V_o | $T_j=25^\circ C$ | 14.4 | 15 | 15.6 | V |
| | | $17.5V \leq V_I \leq 30V, I_O=1mA \sim 40mA$ | 14.25 | | 15.75 | V |
| | | $17.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 14.25 | | 15.75 | V (note 2) |
| Output Voltage(note 3) | V_o | $T_j=25^\circ C$ | 14.7 | 15.0 | 15.3 | V |
| | | $17.5V \leq V_I \leq 30V, I_O=1mA \sim 40mA$ | 14.55 | | 15.45 | V |
| | | $17.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$ | 14.55 | | 15.45 | V (note 2) |
| Load Regulation | ΔV_o | $T_j=25^\circ C, I_O=1mA \sim 100mA$ | | 20 | 150 | mV |
| | | $T_j=25^\circ C, I_O=1mA \sim 70mA$ | | 25 | 150 | mV |
| Line regulation | ΔV_o | $17.5V \leq V_I \leq 30V, T_j=25^\circ C$ | | 25 | 150 | mV |
| | | $20V \leq V_I \leq 30V, T_j=25^\circ C$ | | 15 | 75 | mV |
| Quiescent Current | I_q | | | 2.2 | 6.0 | mA |
| Quiescent Current Change | ΔI_q | $20V \leq V_I \leq 30V$ | | | 1.5 | mA |
| | ΔI_q | $1mA \leq V_I \leq 40mA$ | | | 0.1 | mA |
| Output Noise Voltage | V_N | $10Hz \leq f \leq 100kHz$ | | 90 | | μV |
| Temperature coefficient of V_o | $\Delta V_o / \Delta T$ | $I_O=5mA$ | | 1.3 | | $mV/^\circ C$ |
| Ripple Rejection | RR | $18.5V \leq V_I \leq 28.5V, f=120Hz, T_j=25^\circ C$ | 33 | 39 | | dB |
| Dropout Voltage | V_d | $T_j=25^\circ C$ | | 1.7 | | V |

78L18 ELECTRICAL CHARACTERISTICS

($V_I=27V, I_O=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|-------------------------------|--------|----------------------------------|-------|------|-------|---------------|
| Output Voltage | 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 (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 (note 2) |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 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

($V_I=33V, I_O=40mA, 0 < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

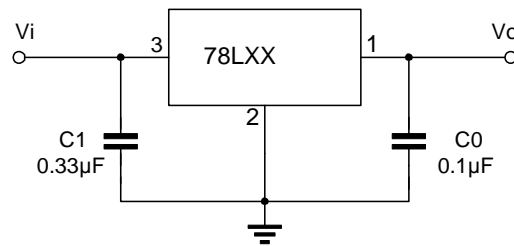
| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|-------------------------------|--------|----------------------------------|-------|-----|-------|---------------|
| Output Voltage | Vo | Tj=25°C | 23 | 24 | 25 | V |
| | | 27V ≤ Vi ≤ 38V, Io=1mA~40mA | 22.8 | | 25.2 | V |
| | | 27V ≤ Vi ≤ VMAX, Io=1mA~70mA | 22.8 | | 25.2 | V (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 (note 2) |
| | | | | | | |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 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.

Fig. 1 78L05/12 Output Voltage vs Ambient Temperature

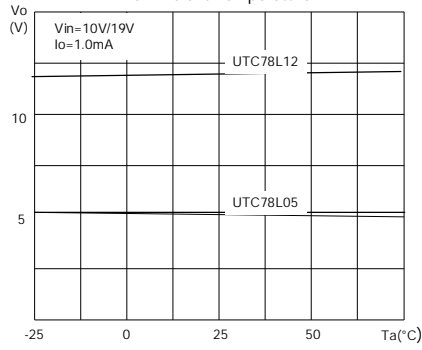


Fig 2 78L05/12 Quiescent Current vs Output Current

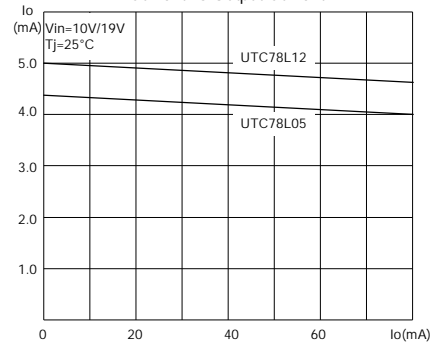


Fig.3 78L05 Quiescent Current vs Input

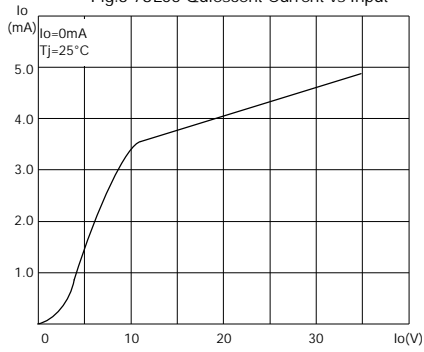


Fig.4 78L05/12/24 Thermal Shutdown

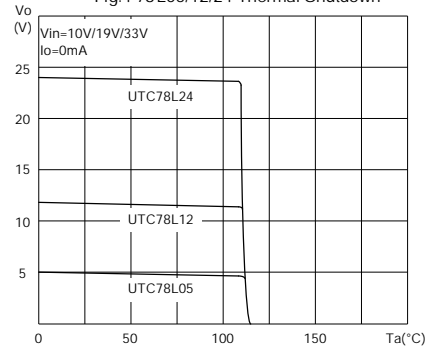


Fig.5 78 L05/12/24 Output Characteristics

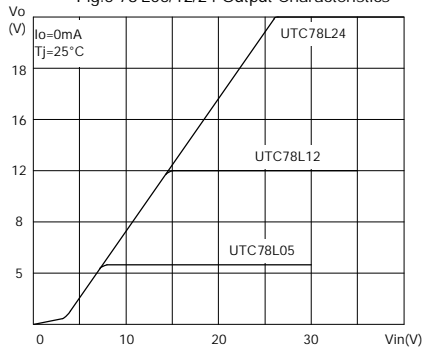
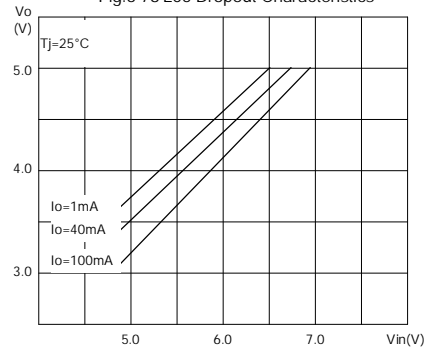
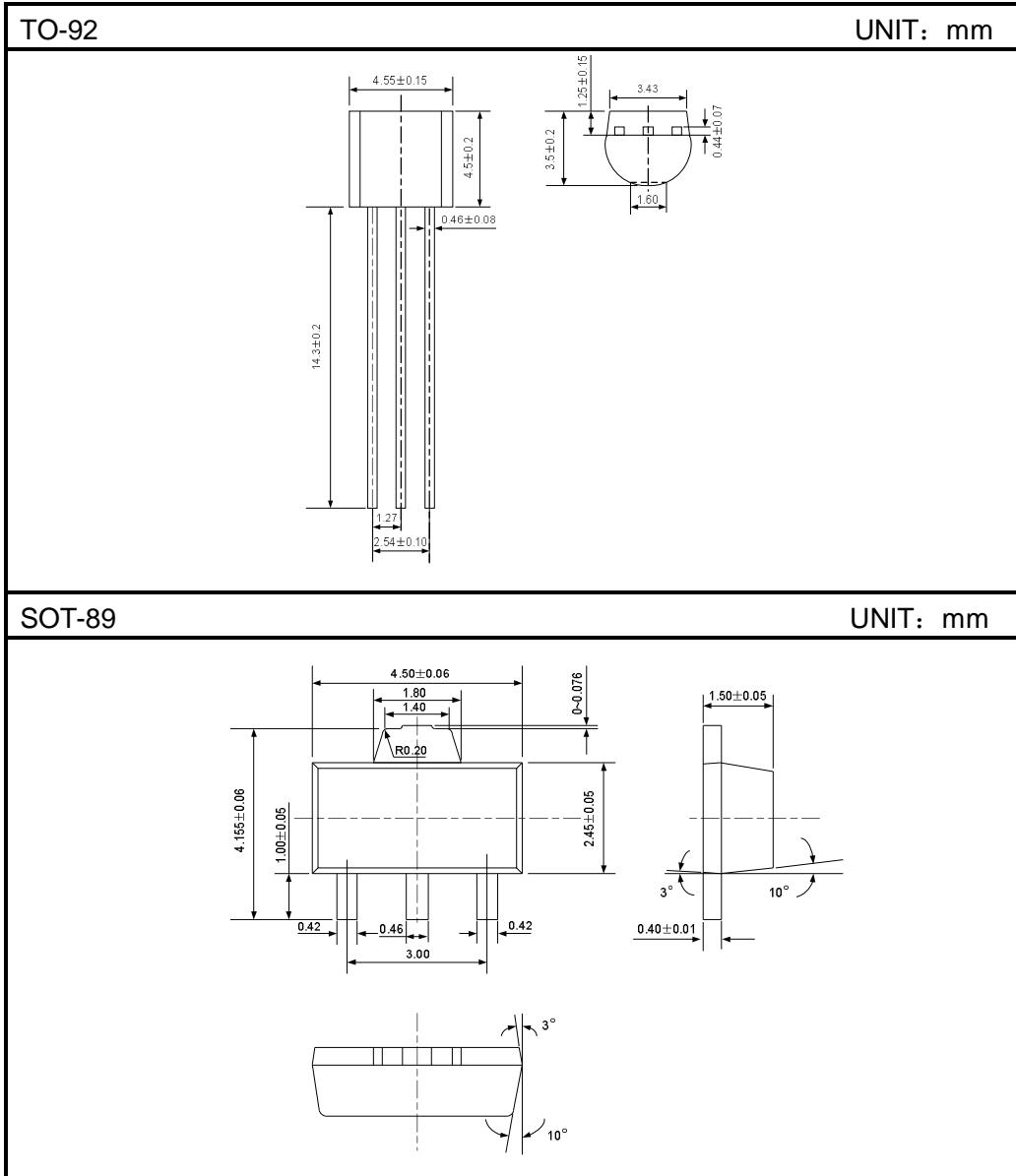


Fig.6 78 L05 Dropout Characteristics

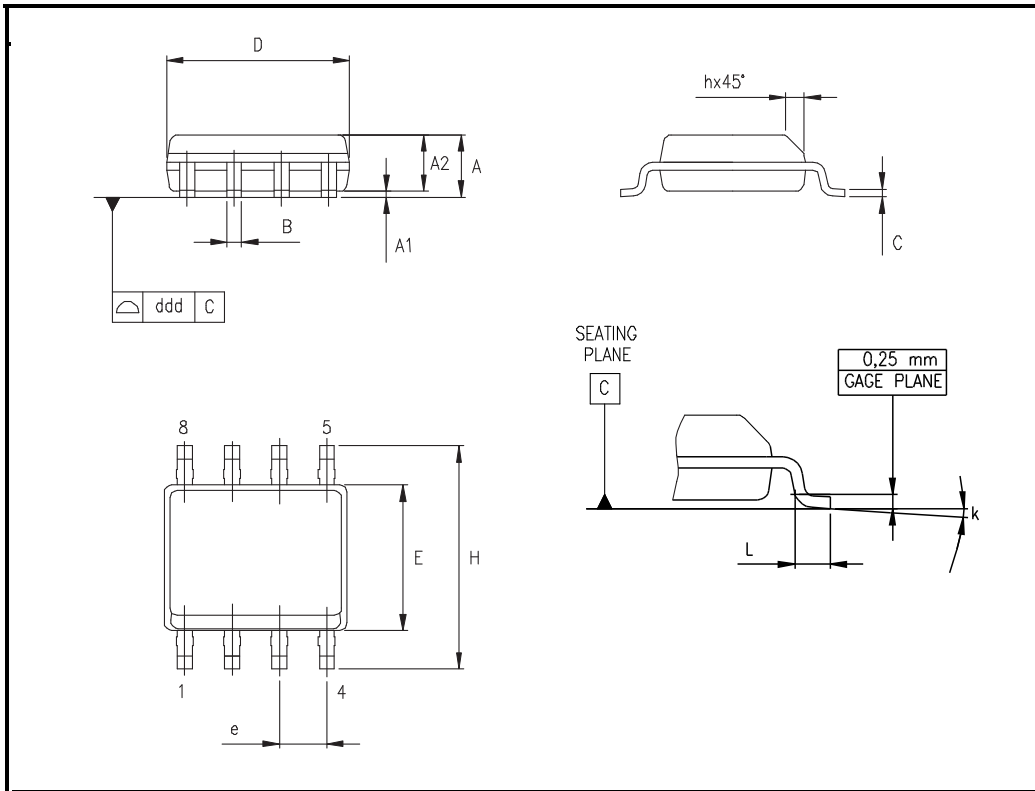


PACKAGE OUTLINE



SO-8

UNIT : mm



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[>>UMW\(友台半导体\)](#)