



LINEAR INTEGRATED CIRCUIT

78LXX

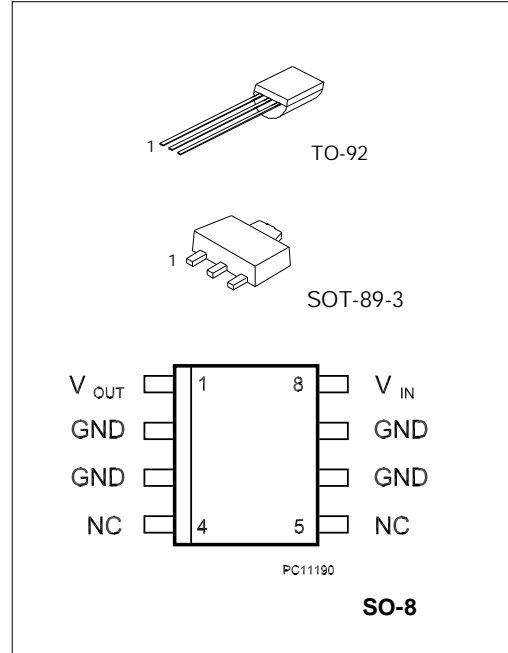
3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

DESCRIPTION

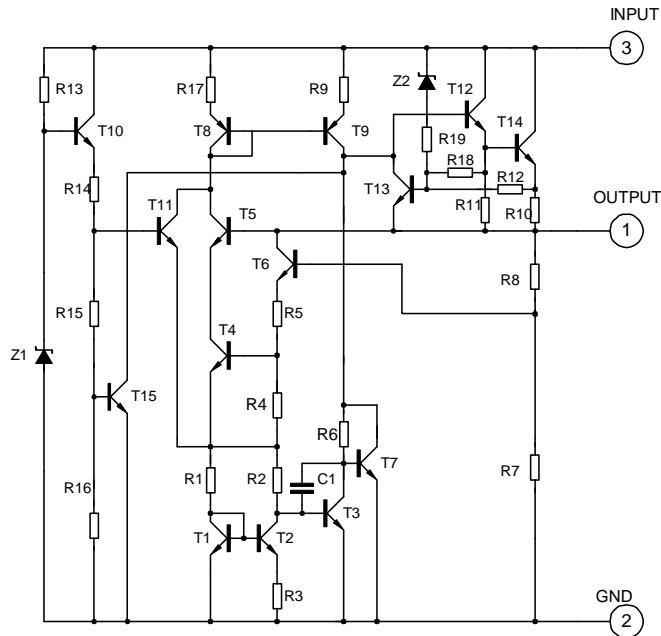
The 78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply up to 100mA.

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





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

| CHARACTERISTICS | SYMBOL | VALUE | UNITS |
|--------------------------------------|------------------|----------|-------|
| Input voltage(for Vo=5,8V) | V _I | 30 | V |
| (for Vo=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°C,C₁=0.33μF,C_o=0.1μF,unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|---|---------------------|---|------|------|------|---------------|
| Output Voltage | V _o | T _j =25°C | 4.8 | 5.0 | 5.2 | V |
| | | 7V≤V _I ≤20V,I _o =1mA~40mA | 4.75 | | 5.25 | V |
| | | 7V≤V _I ≤V _{MAX} ,I _o =1mA~70mA | 4.75 | | 5.25 | V (note 2) |
| Output Voltage(note 3) | V _o | T _j =25°C | 4.9 | 5.0 | 5.1 | V |
| | | 7V≤V _I ≤20V,I _o =1mA~40mA | 4.85 | | 5.15 | V |
| | | 7V≤V _I ≤V _{MAX} ,I _o =1mA~70mA | 4.85 | | 5.15 | V (note 2) |
| Load Regulation | ΔV _o | T _j =25°C, I _o =1mA~100mA | | 11 | 60 | mV |
| | | T _j =25°C, I _o =1mA~40mA | | 5.0 | 30 | mV |
| Line regulation | ΔV _o | 7V≤V _I ≤20V,T _j =25°C | | 8 | 150 | mV |
| | | 8V≤V _I ≤20V,T _j =25°C | | 6 | 100 | mV |
| Quiescent Current | I _q | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔI _q | 8V≤V _I ≤20V | | | 1.5 | mA |
| | ΔI _q | 1mA≤V _I ≤40mA | | | 0.1 | mA |
| Output Noise Voltage | V _N | 10Hz≤f≤100kHz | | 40 | | μV |
| Temperature coefficient of V _o | ΔV _o /ΔT | I _o =5mA | | 0.65 | | mV/°C |
| Ripple Rejection | RR | 8V≤V _I ≤20V,f=120Hz,T _j =25°C | 40 | 49 | | dB |
| Dropout Voltage | V _d | T _j =25°C | | 1.7 | | V |



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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 | 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, Io=1mA~70mA | 5.7 | | 6.3 | V (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, Io=1mA~70mA | 5.82 | | 6.18 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 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≤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 | 10V≤Vi≤20V, f=120Hz, Tj=25°C | 38 | 46 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |



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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 | Vo | Tj=25°C | 7.7 | 8.0 | 8.3 | V |
| | | 10.5V≤Vi≤23V, Io=1mA~40mA | 7.6 | | 8.4 | V |
| | | 10.5V≤Vi≤VMAX, Io=1mA~70mA | 7.6 | | 8.4 | V (note 2) |
| Output Voltage(note 3) | Vo | Tj=25°C | 7.84 | 8.0 | 8.16 | V |
| | | 10.5V≤Vi≤23V, Io=1mA~40mA | 7.76 | | 8.24 | V |
| | | 10.5V≤Vi≤VMAX, Io=1mA~70mA | 7.76 | | 8.24 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 15 | 80 | mV |
| | | Tj=25°C, Io=1mA~70mA | | 8.0 | 40 | mV |
| Line regulation | ΔVo | 10.5V≤Vi≤23V, Tj=25°C | | 10 | 175 | mV |
| | | 11V≤Vi≤23V, Tj=25°C | | 8 | 125 | mV |
| Quiescent Current | Iq | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔIq | 11V≤Vi≤23V | | | 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 | 11V≤Vi≤23V, f=120Hz, Tj=25°C | 36 | 45 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |



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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 | 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 (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 (note 2) |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 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 |



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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 | T _j =25°C | 11.5 | 12 | 12.6 | V |
| | | 14.5V ≤ V _I ≤ 27V, I _o =1mA~40mA | 11.4 | | 12.6 | V |
| | | 14.5V ≤ V _I ≤ V _{MAX} , I _o =1mA~70mA | 11.4 | | 12.6 | V (note 2) |
| Output Voltage(note 3) | Vo | T _j =25°C | 11.76 | 12.0 | 12.24 | V |
| | | 14.5V ≤ V _I ≤ 27V, I _o =1mA~40mA | 11.64 | | 12.36 | V |
| | | 14.5V ≤ V _I ≤ V _{MAX} , I _o =1mA~70mA | 11.64 | | 12.36 | V (note 2) |
| Load Regulation | ΔVo | T _j =25°C, I _o =1mA~100mA | | 25 | 150 | mV |
| | | T _j =25°C, I _o =1mA~40mA | | 12 | 75 | mV |
| Line regulation | ΔVo | 14.5V ≤ V _I ≤ 27V, T _j =25°C | | 25 | 300 | mV |
| | | 16V ≤ V _I ≤ 27V, T _j =25°C | | 20 | 250 | mV |
| Quiescent Current | I _q | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔI _q | 16V ≤ V _I ≤ 27V | | | 1.5 | mA |
| | ΔI _q | 1mA ≤ I _o ≤ 40mA | | | 0.1 | mA |
| Output Noise Voltage | V _N | 10Hz ≤ f ≤ 100kHz | | 80 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | I _o =5mA | | 1.0 | | mV/°C |
| Ripple Rejection | RR | 15V ≤ V _I ≤ 25V, f=120Hz, T _j =25°C | 36 | 42 | | dB |
| Dropout Voltage | V _d | T _j =25°C | | 1.7 | | V |



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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 | 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 (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 (note 2) |
| Load Regulation | ΔVo | Tj=25°C, Io=1mA~100mA | | 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 |



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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 | T _j =25°C | 17.3 | 18 | 18.7 | V |
| | | 21V ≤ V _I ≤ 33V, I _O =1mA~40mA | 17.1 | | 18.9 | V |
| | | 21V ≤ V _I ≤ V _{MAX} , I _O =1mA~70mA | 17.1 | | 18.9 | V (note 2) |
| Output Voltage(note 3) | Vo | T _j =25°C | 17.64 | 18.0 | 18.36 | V |
| | | 21V ≤ V _I ≤ 33V, I _O =1mA~40mA | 17.46 | | 18.54 | V |
| | | 21V ≤ V _I ≤ V _{MAX} , I _O =1mA~70mA | 17.46 | | 18.54 | V (note 2) |
| Load Regulation | ΔVo | T _j =25°C, I _O =1mA~100mA | | 30 | 170 | mV |
| | | T _j =25°C, I _O =1mA~40mA | | 15 | 85 | mV |
| Line regulation | ΔVo | 21V ≤ V _I ≤ 33V, T _j =25°C | | 145 | 300 | mV |
| | | 22V ≤ V _I ≤ 33V, T _j =25°C | | 135 | 250 | mV |
| Quiescent Current | I _q | | | 2.2 | 6.0 | mA |
| Quiescent Current Change | ΔI _q | 21V ≤ V _I ≤ 33V | | | 1.5 | mA |
| | ΔI _q | 1mA ≤ V _I ≤ 40mA | | | 0.1 | mA |
| Output Noise Voltage | V _N | 10Hz ≤ f ≤ 100kHz | | 150 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | I _O =5mA | | 1.8 | | mV/°C |
| Ripple Rejection | RR | 23V ≤ V _I ≤ 33V, f=120Hz, T _j =25°C | 32 | 38 | | dB |
| Dropout Voltage | V _d | T _j =250°C | | 1.7 | | V |



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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.

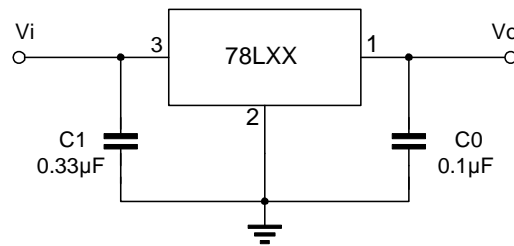
Note 2: Power dissipation < 0.75W.

Note 3: Output voltage of 78LXXA.



78LXX

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.



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

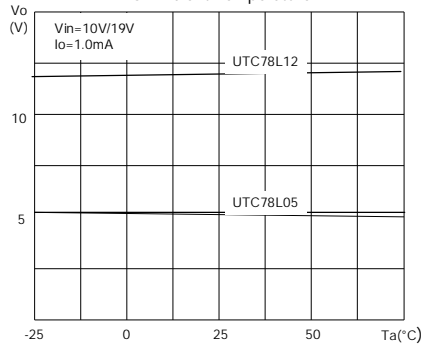


Fig 2 78L05/12 Quiescent Current vs Output Current

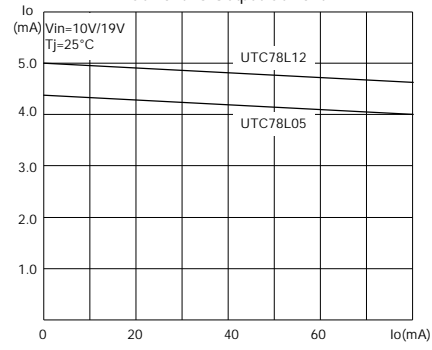


Fig.3 78L05 Quiescent Current vs Input

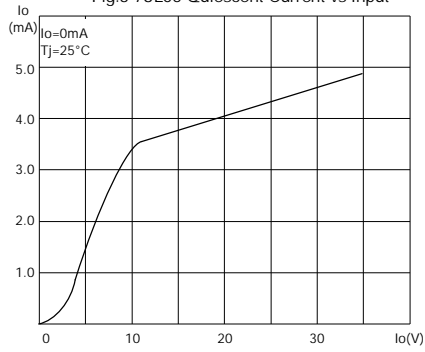


Fig.4 78L05/12/24 Thermal Shutdown

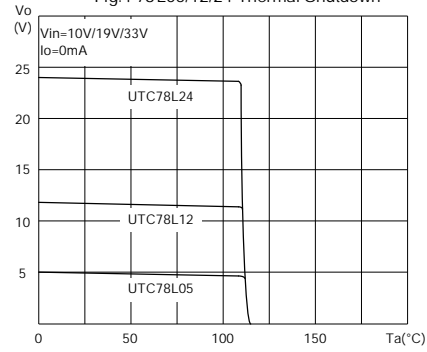


Fig.5 78 L05/12/24 Output Characteristics

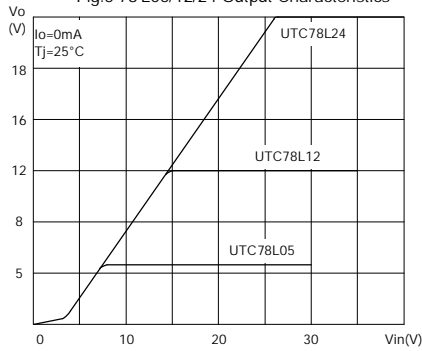
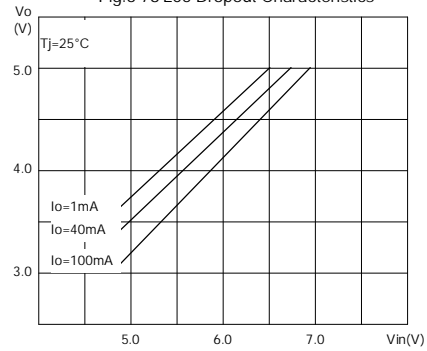


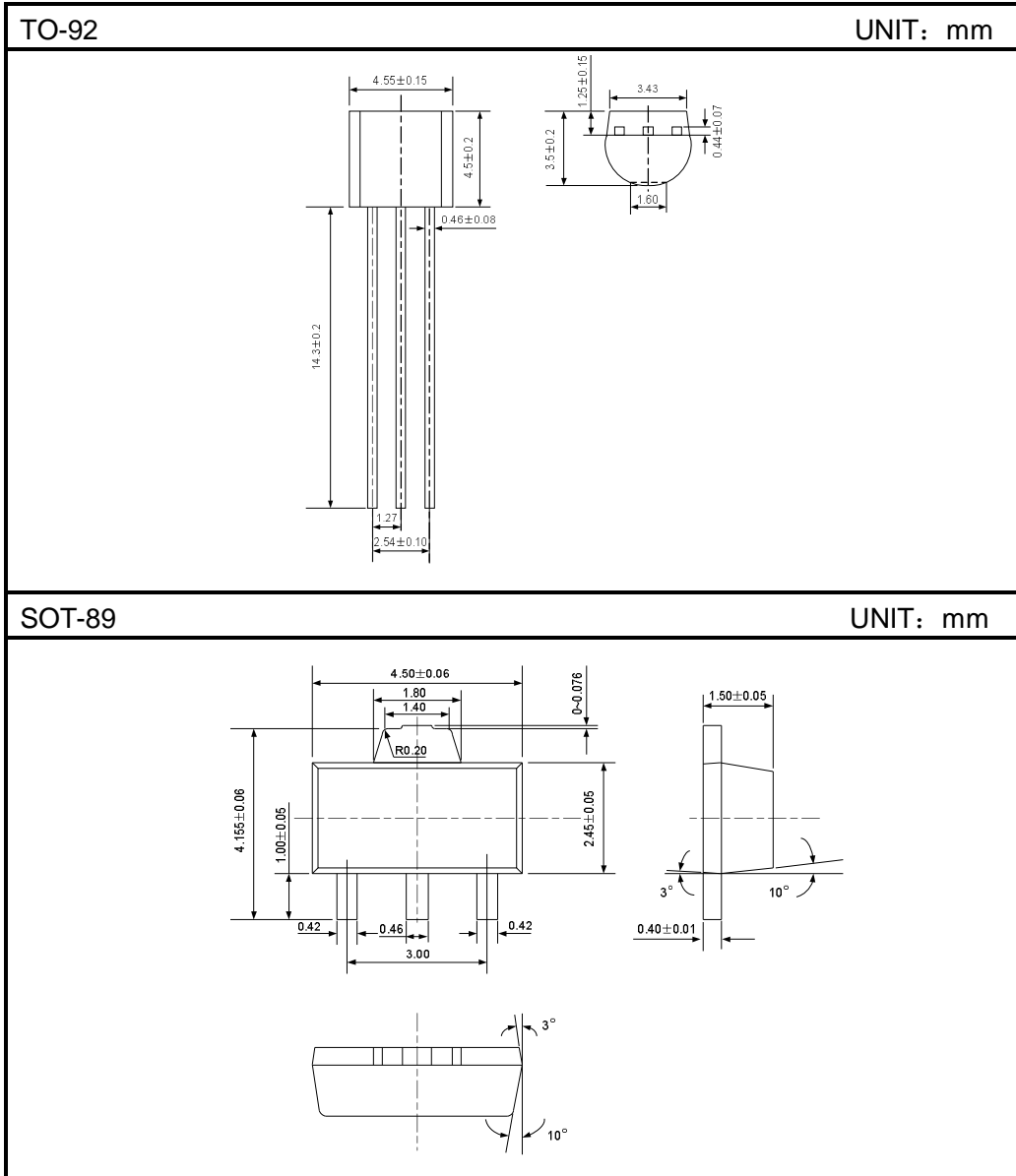
Fig.6 78 L05 Dropout Characteristics



PACKAGE OUTLINE



78LXX





78LXX

SO-8

UNIT : mm

