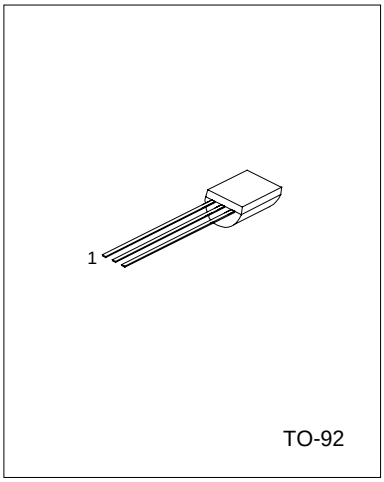
# HK78LXX

## 3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS




1:Output 2:GND; 3:Input

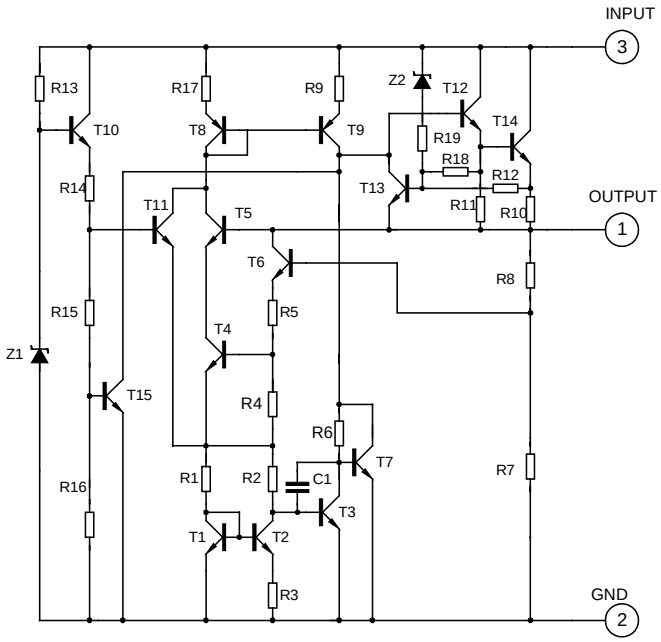
### DESCRIPTION

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 Vo=5,8V)<br>(for Vo=12,15V) | $V_I$<br>$V_I$ | 25<br>35 | V<br>V |
| Operating Junction Temperature Range | $T_{OPR}$ | -20~+120 | °C |
| Storage Temperature Range | $T_{STG}$ | -55~+150 | °C |

## 78L05 ELECTRICAL CHARACTERISTICS

(VI=10V,Io=40mA,0<Tj<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 | 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) |
| Load Regulation | ΔVo | Tj=25°C, $I_O$=1mA~100mA | | 11 | 60 | mV |
| | | Tj=25°C, $I_O$=1mA~40mA | | 5.0 | 30 | mV |
| Line regulation | ΔVo | 7V≤$V_I$≤20V,Tj=25°C | | 8 | 150 | mV |
| | | 8V≤$V_I$≤20V,Tj=25°C | | 6 | 100 | mV |
| Quiescent Current | Iq | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔIq | 8V≤$V_I$≤20V | | | 1.5 | mA |
| | ΔIq | 1mA≤$V_I$≤40mA | | | 0.1 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | | 40 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | -0.65 | | mV/°C |
| Ripple Rejection | RR | 8V≤$V_I$≤20V,f=120Hz,Tj=25°C | 41 | 80 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L06 ELECTRICAL CHARACTERISTICS

(VI=12V,Io=40mA,0<Tj<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≤$V_I$≤20V,$I_O$=1mA~40mA | 5.7 | | 6.3 | V |
| | | 8.5V≤$V_I$≤$V_{MAX}$,<br>$I_O$=1mA~70mA | 5.7 | | 6.3 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C,$I_O$=1mA~100mA | | 12.8 | 80 | mV |
| | | Tj=25°C,$I_O$=1mA~70mA | | 5.8 | 40 | mV |
| Line regulation | ΔVo | 8.5V≤$V_I$≤20V,Tj=25°C | | 64 | 175 | mV |
| | | 9V≤$V_I$≤20V,Tj=25°C | | 54 | 125 | mV |
| Quiescent Current | Iq | | | 3.9 | 6.0 | mA |
| Quiescent Current Change | ΔIq | 9V≤$V_I$≤20V | | | 1.5 | mA |
| | ΔIq | 1mA≤$V_I$≤40mA | | | 0.1 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | | 49 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | 0.75 | | mV/°C |
| Ripple Rejection | RR | 10V≤$V_I$≤20V,f=120Hz,<br>Tj=25°C | 40 | 46 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L08 ELECTRICAL CHARACTERISTICS

(VI=14V,Io=40mA,0<Tj<125°C,C1=0.33μF,Co=0.1μF,unless otherwise specified)(Note 1)

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | Tj=25°C | 7.7 | 8.0 | 8.3 | V |
| | | 10.5V≤$V_I$≤23V,$I_O$=1mA~40mA | 7.6 | | 8.4 | V |
| | | 10.5V≤$V_I$≤$V_{MAX}$, $I_O$=1mA~70mA | 7.6 | | 8.4 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C, $I_O$=1mA~100mA | | 15 | 80 | mV |
| | | Tj=25°C, $I_O$=1mA~70mA | | 8.0 | 40 | mV |
| Line regulation | ΔVo | 10.5V≤$V_I$≤23V,Tj=25°C | | 10 | 175 | mV |
| | | 11V≤$V_I$≤23V,Tj=25°C | | 8 | 125 | mV |
| Quiescent Current | Iq | | | 2.0 | 5.5 | mA |
| Quiescent Current Change | ΔIq | 11V≤$V_I$≤23V | | | 1.5 | mA |
| | ΔIq | 1mA≤$V_I$≤40mA | | | 0.1 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | | 49 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | 0.75 | | mV/°C |
| Ripple Rejection | RR | 11V≤$V_I$≤23V,f=120Hz, Tj=25°C | 39 | 70 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L09 ELECTRICAL CHARACTERISTICS

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

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | Tj=25°C | 8.64 | 9.0 | 9.36 | V |
| | | 11.5V≤$V_I$≤24V,$I_O$=1mA~40mA | 8.55 | | 9.45 | V |
| | | 11.5V≤$V_I$≤$V_{MAX}$, $I_O$=1mA~70mA | 8.55 | | 9.45 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C, $I_O$=1mA~100mA | | 20 | 90 | mV |
| | | Tj=25°C, $I_O$=1mA~40mA | | 10 | 45 | mV |
| Line regulation | ΔVo | 11.5V≤$V_I$≤24V,Tj=25°C | | 90 | 200 | mV |
| | | 13V≤$V_I$≤24V,Tj=25°C | | 100 | 150 | mV |
| Quiescent Current | Iq | | | 2.0 | 6.0 | mA |
| Quiescent Current Change | ΔIq | 13V≤$V_I$≤24V | | | 1.5 | mA |
| | ΔIq | 1mA≤$V_I$≤40mA | | | 0.1 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | | 49 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | 0.75 | | mV/°C |
| Ripple Rejection | RR | 12V≤$V_I$≤23V,f=120Hz, Tj=25°C | 38 | 44 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L10 ELECTRICAL CHARACTERISTICS

(VI=16V,Io=40mA,0<Tj<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℃ | 9.6 | 10.0 | 10.4 | V |
| | | 12.5V≤VI≤23V,IO=1mA~40mA | 9.5 | | 10.5 | V |
| | | 12.5V≤VI≤VMAX, IO=1mA~70mA | 9.5 | | 10.5 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C, IO=1mA~100mA | | 20 | 94 | mV |
| | | Tj=25°C, IO=1mA~70mA | | 10 | 47 | mV |
| Line regulation | ΔVo | 12.5V≤VI≤23V,Tj=25°C | | 100 | 220 | mV |
| | | 14V≤VI≤23V,Tj=25°C | | 200 | 170 | mV |
| Quiescent Current | Iq | | | 4.2 | 6.5 | mA |
| Quiescent Current Change | ΔIq | 12.5V≤VI≤23V | | | 1.5 | mA |
| | ΔIq | 1mA≤VI≤40mA | | | 0.1 | mA |
| Output Noise Voltage | VN | 10Hz≤f≤100kHz | | 74 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | 0.95 | | mV/°C |
| Ripple Rejection | RR | 15V≤VI≤23V,f=120Hz, Tj=25°C | 38 | 43 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L12 ELECTRICAL CHARACTERISTICS

(VI=19V,Io=40mA,0<Tj<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 | 11.5 | 15 | 15.6 | 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) |
| 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 | 6.0 | mA |
| Quiescent Current Change | ΔIq | 16V≤VI≤27V | | | 1.5 | mA |
| | ΔIq | 1mA≤VI≤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 | 37 | 65 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L15 ELECTRICAL CHARACTERISTICS

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

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | Tj=25°C | 14.4 | 15 | 15.6 | V |
| | | 17.5V≤$V_I$≤30V,$I_O$=1mA~40mA | 14.25 | | 15.75 | V |
| | | 17.5V≤$V_I$≤$V_{MAX}$, $I_O$=1mA~70mA | 14.25 | | 15.75 | V (note 2) |
| Load Regulation | ΔVo | Tj=25°C,$I_O$=1mA~100mA | | 20 | 150 | mV |
| | | Tj=25°C,$I_O$=1mA~70mA | | 25 | 150 | mV |
| Line regulation | ΔVo | 17.5V≤$V_I$≤30V,Tj=25°C | | 25 | 150 | mV |
| | | 20V≤$V_I$≤30V,Tj=25°C | | 15 | 75 | mV |
| Quiescent Current | Iq | | | 2.2 | 6.5 | mA |
| Quiescent Current Change | ΔIq | 20V≤$V_I$≤30V | | | 1.5 | mA |
| | ΔIq | 1mA≤$V_I$≤40mA | | | 0.1 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | | 90 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | -1.3 | | mV/°C |
| Ripple Rejection | RR | 18.5V≤$V_I$≤28.5V,f=120Hz, Tj=25°C | 34 | 63 | | dB |
| Dropout Voltage | Vd | Tj=25°C | | 1.7 | | V |

## 78L18 ELECTRICAL CHARACTERISTICS

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

| Characteristic | Symbol | Test conditions | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_O$ | Tj=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) |
| Load Regulation | ΔVo | Tj=25°C, $I_O$=1mA~100mA | | 30 | 170 | mV |
| | | Tj=25°C, $I_O$=1mA~40mA | | 15 | 85 | mV |
| Line regulation | ΔVo | 21V≤$V_I$≤33V,Tj=25°C | | 145 | 300 | mV |
| | | 22V≤$V_I$≤33V,Tj=25°C | | 135 | 250 | mV |
| Quiescent Current | Iq | | | 2.0 | 6.0 | mA |
| Quiescent Current Change | ΔIq | 21V≤$V_I$≤33V | | | 1.5 | mA |
| | ΔIq | 1mA≤$V_I$≤40mA | | | 0.1 | mA |
| Output Noise Voltage | $V_N$ | 10Hz≤f≤100kHz | | 150 | | μV |
| Temperature coefficient of Vo | ΔVo/ΔT | Io=5mA | | -1.8 | | mV/°C |
| Ripple Rejection | RR | 23V≤$V_I$≤33V,f=120Hz, Tj=25°C | 34 | 48 | | dB |
| Dropout Voltage | Vd | Tj=250°C | | 1.7 | | V |

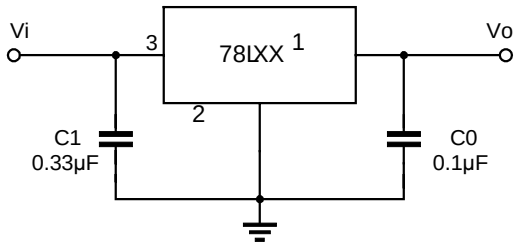
## 78L24 ELECTRICAL CHARACTERISTICS

(VI=33V,Io=40mA,0<Tj<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 (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 | 34 | 45 | | 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 date above respresent pulse test conditions with junction temperatures as indicated at the initiation of test.
Note 2:Power dissipation<0.75W

## TYPICAL APPLICATION




Note 1: To specify an output voltage,substitue 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.