

Description

This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include 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. Each of these regulators can deliver up to 100 mA of output current. The internal limiting and thermal shutdown features of these regulators make them essentially immune to overload. When used as a replacement for a Zener diode-resistor combination, an effective improvement in output impedance can be obtained together with lower-bias current.

Features

- 3-Terminal Regulators
- Output Current Up to 100 mA
- No External Components
- Internal Thermal Overload Protection
- Internal Short-Circuit Limiting

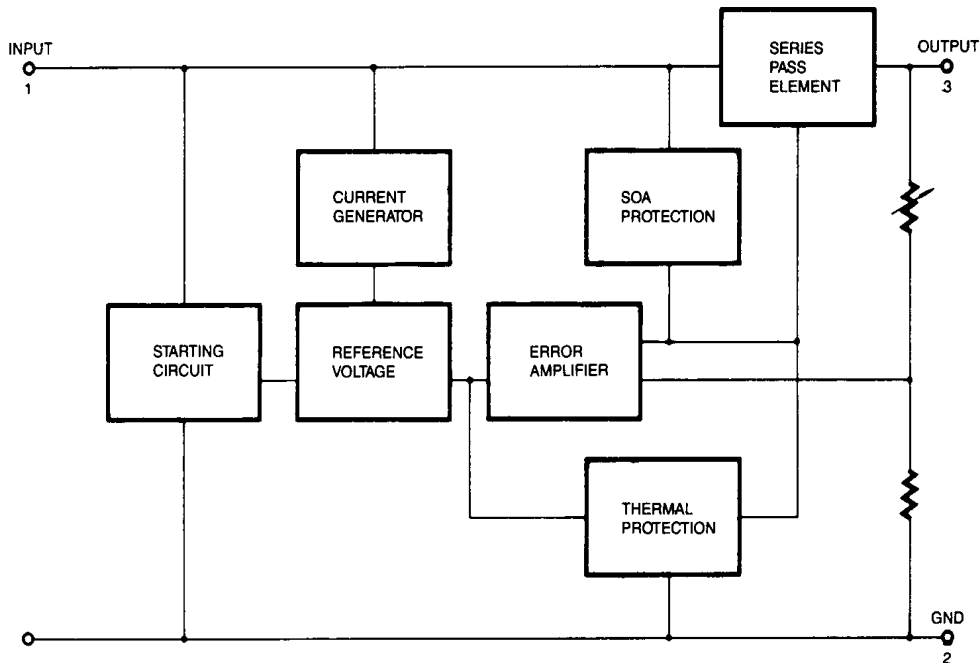


Package TO-92
(top view)



Internal Block Diagram

Package



Absolute Maximum Ratings

over operating temperature range (unless otherwise noted)

| Parameter | Maximum | | | Units |
|---|--------------------------|--------------------------|------------|-------|
| | 78L05A thru 78L10A | 78L12A thru 78L18A | 78L24A | |
| Input voltage | 30 | 35 | 40 | V |
| Operating free-air, case, or virtual junction temperature range | 0 to 150 | 0 to 150 | 0 to 150 | °C |
| Storage temperature range | -65 to 150 | -65 to 150 | -65 to 150 | |
| Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds | 260 | 260 | 260 | |

Recommended Operating Conditions

| Parameter | Min | Max | Units | |
|---|--------|------|-------|---|
| Input voltage, V_I | 78L05A | 7 | 20 | V |
| | 78L06A | 8 | 20 | |
| | 78L08A | 10.5 | 23 | |
| | 78L09A | 11.5 | 24 | |
| | 78L10A | 12.5 | 25 | |
| | 78L12A | 14.5 | 27 | |
| | 78L15A | 17.5 | 30 | |
| | 78L18A | 20.5 | 33 | |
| | 78L24A | 26.5 | 39 | |
| Output current, I_O | | 100 | mA | |
| Operating virtual junction temperature, T_J | 0 | 125 | °C | |

Device Selection Guide

| Device | Output Voltage |
|--------|----------------|
| 78L05A | 5 V |
| 78L06A | 6 V |
| 78L08A | 8 V |
| 78L09A | 9 V |
| 78L10A | 10 V |
| 78L12A | 12 V |
| 78L15A | 15 V |
| 78L18A | 18 V |
| 78L24A | 24 V |

Electrical Characteristics 78L05A

Electrical characteristics at specified virtual junction temperature, $V_I = 10V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L05A | | | Units |
|----------------------|--|--------------|--------|-----|------|---------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 4.8 | 5 | 5.2 | V |
| | $I_O = 1mA$ to 40 mA, $V_I = 7V$ to 20V | 0°C to 125°C | 4.75 | 5 | 5.25 | |
| | $I_O = 1mA$ to 70mA, | | 4.75 | 5 | 5.25 | |
| Input regulation | $V_I = 7V$ to 20V | 25°C | | 32 | 150 | mV |
| | $V_I = 8V$ to 20V | | | 26 | 100 | |
| Ripple rejection | $V_I = 8V$ to 18V, $f = 120Hz$ | 25°C | 41 | 49 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 15 | 60 | mV |
| | $I_O = 1mA$ to 40mA | | | 8 | 30 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 42 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 3.8 | 6 | mA |
| | | 125°C | | | 5.5 | |
| Bias current change | $V_I = 8V$ to 20V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

Electrical Characteristics 78L06A

Electrical characteristics at specified virtual junction temperature, $V_I = 11V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L06A | | | Units |
|----------------------|--|--------------|--------|-----|------|---------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 5.75 | 6 | 6.25 | V |
| | $I_O = 1mA$ to 40 mA, $V_I = 8V$ to 20V | 0°C to 125°C | 5.7 | 6 | 6.3 | |
| | $I_O = 1mA$ to 70mA, | | 5.7 | 6 | 6.3 | |
| Input regulation | $V_I = 8V$ to 20V | 25°C | | 35 | 175 | mV |
| | $V_I = 9V$ to 20V | | | 29 | 125 | |
| Ripple rejection | $V_I = 9V$ to 19V, $f = 120Hz$ | 25°C | 40 | 48 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 16 | 80 | mV |
| | $I_O = 1mA$ to 40mA | | | 9 | 40 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 46 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 3.9 | 6 | mA |
| | | 125°C | | | 5.5 | |
| Bias current change | $V_I = 9V$ to 20V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

Electrical Characteristics 78L08A

Electrical characteristics at specified virtual junction temperature, $V_I = 14V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L08A | | | Units |
|----------------------|---|--------------|--------|-----|-----|-------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 7.7 | 8 | 8.3 | V |
| | $I_O = 1mA$ to 40 mA, $V_I = 10.5V$ to 23V | 0°C to 125°C | 7.6 | 8 | 8.4 | |
| | $I_O = 1mA$ to 70mA, | | 7.6 | 8 | 8.4 | |
| Input regulation | $V_I = 10.5V$ to 23V | 25°C | | 42 | 175 | mV |
| | $V_I = 11V$ to 23V | | | 36 | 125 | |
| Ripple rejection | $V_I = 13V$ to 23V, $f = 120Hz$ | 0°C to 125°C | 37 | 46 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 18 | 80 | μV |
| | $I_O = 1mA$ to 40mA | | | 10 | 40 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 54 | | mV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4 | 6 | mA |
| | | 125°C | | | 5.5 | |
| Bias current change | $V_I = 11V$ to 23V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

Electrical Characteristics 78L09A

Electrical characteristics at specified virtual junction temperature, $V_I = 16V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L09A | | | Units |
|----------------------|---|--------------|--------|-----|------|-------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 8.6 | 9 | 9.4 | V |
| | $I_O = 1mA$ to 40 mA, $V_I = 12V$ to 24V | 0°C to 125°C | 8.55 | 9 | 9.45 | |
| | $I_O = 1mA$ to 70mA, | | 8.55 | 9 | 9.45 | |
| Input regulation | $V_I = 12V$ to 24V | 25°C | | 45 | 175 | mV |
| | $V_I = 13V$ to 24V | | | 40 | 125 | |
| Ripple rejection | $V_I = 15V$ to 25V, $f = 120Hz$ | 0°C to 125°C | 38 | 45 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 19 | 90 | mV |
| | $I_O = 1mA$ to 40mA | | | 11 | 40 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 58 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4.1 | 6 | mA |
| | | 125°C | | | 5.5 | |
| Bias current change | $V_I = 13V$ to 24V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

Electrical Characteristics 78L10A

Electrical characteristics at specified virtual junction temperature, $V_I = 17V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L10A | | | Units |
|----------------------|---|--------------|--------|-----|------|-------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 9.6 | 10 | 10.4 | V |
| | $I_O = 1mA$ to 40 mA, $V_I = 13V$ to 25V | 0°C to 125°C | 9.5 | 10 | 10.5 | |
| | $I_O = 1mA$ to 70mA, | | 9.5 | 10 | 10.5 | |
| Input regulation | $V_I = 13V$ to 25V | 25°C | | 51 | 175 | mV |
| | $V_I = 14V$ to 25V | | | 42 | 125 | |
| Ripple rejection | $V_I = 15V$ to 25V, $f = 120Hz$ | 0°C to 125°C | 37 | 44 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 20 | 90 | mV |
| | $I_O = 1mA$ to 40mA | | | 11 | 40 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 62 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4.2 | 6 | mA |
| | | 125°C | | | 5.5 | |
| Bias current change | $V_I = 14V$ to 25V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

Electrical Characteristics 78L12A

Electrical characteristics at specified virtual junction temperature, $V_I = 19V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L12A | | | Units |
|----------------------|--|--------------|--------|-----|------|-------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 11.5 | 12 | 12.5 | V |
| | $I_O = 1mA$ to 40mA, $V_I = 14V$ to 27V | 0°C to 125°C | 11.4 | 12 | 12.6 | |
| | $I_O = 1mA$ to 70mA | | 11.4 | 12 | 12.6 | |
| Input regulation | $V_I = 14.5V$ to 27V | 25°C | | 55 | 250 | mV |
| | $V_I = 16V$ to 27V | | | 49 | 200 | |
| Ripple rejection | $V_I = 15V$ to 25V, $f = 120Hz$ | 0°C to 125°C | 37 | 42 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 22 | 100 | mV |
| | $I_O = 1mA$ to 40mA | | | 13 | 50 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 70 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4.3 | 6.5 | mA |
| | | 125°C | | | 6 | |
| Bias current change | $V_I = 16V$ to 27V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

Electrical Characteristics 78L15A

Electrical characteristics at specified virtual junction temperature, $V_I = 23V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L15A | | | Units |
|----------------------|--|--------------|--------|-----|-------|-------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 14.4 | 15 | 15.6 | V |
| | $I_O = 1mA$ to 40mA, $V_I = 17.5V$ to 30V | 0°C to 125°C | 14.25 | 15 | 15.75 | |
| | $I_O = 1mA$ to 70mA | | 14.25 | 15 | 15.75 | |
| Input regulation | $V_I = 17.5V$ to 30V | 25°C | | 65 | 300 | mV |
| | $V_I = 19V$ to 30V | | | 58 | 250 | |
| Ripple rejection | $V_I = 18.5V$ to 28.5V, $f = 120Hz$ | 0°C to 125°C | 34 | 39 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 25 | 150 | mV |
| | $I_O = 1mA$ to 40mA | | | 15 | 75 | |
| Output noise voltage | $f = 10Hz$ to 100KHz | 25°C | | 82 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4.6 | 6.5 | mA |
| | | 125°C | | | 6 | |
| Bias current change | $V_I = 19V$ to 30V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

Electrical Characteristics 78L18A

Electrical characteristics at specified virtual junction temperature, $V_I = 26V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L18A | | | Units |
|----------------------|--|--------------|--------|-----|------|-------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 17.3 | 18 | 18.7 | V |
| | $I_O = 1mA$ to 40mA, $V_I = 20.5V$ to 33V | 0°C to 125°C | 17.1 | 18 | 18.9 | |
| | $I_O = 1mA$ to 70mA | | 17.1 | 18 | 18.9 | |
| Input regulation | $V_I = 20.5V$ to 33V | 25°C | | 70 | 360 | mV |
| | $V_I = 22V$ to 33V | | | 64 | 300 | |
| Ripple rejection | $V_I = 21.5V$ to 31.5V, $f = 120Hz$ | 0°C to 125°C | 32 | 36 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 27 | 180 | mV |
| | $I_O = 1mA$ to 40mA | | | 19 | 90 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 89 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4.7 | 6.5 | mA |
| | | 125°C | | | 6 | |
| Bias current change | $V_I = 22V$ to 33V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

Electrical Characteristics 78L24A

Electrical characteristics at specified virtual junction temperature, $V_I = 32V$, $I_O = 40mA$ (unless otherwise noted)

| Parameter | Test Conditions* | | 78L24A | | | Units |
|----------------------|--|--------------|--------|-----|------|---------|
| | | | Min | Typ | Max | |
| Output voltage** | | 25°C | 23 | 24 | 25 | V |
| | $I_O = 1mA$ to 40mA, $V_I = 26.5V$ to 39V | 0°C to 125°C | 22.8 | 24 | 25.2 | |
| | $I_O = 1mA$ to 70mA | | 22.8 | 24 | 25.2 | |
| Input regulation | $V_I = 26.5V$ to 39V | 25°C | | 95 | 480 | mV |
| | $V_I = 29V$ to 39V | | | 78 | 400 | |
| Ripple rejection | $V_I = 27.5V$ to 37.5V, $f = 120Hz$ | 0°C to 125°C | 30 | 33 | | dB |
| Output regulation | $I_O = 1mA$ to 100mA | 25°C | | 41 | 240 | mV |
| | $I_O = 1mA$ to 40mA | | | 28 | 120 | |
| Output noise voltage | $f = 10Hz$ to 100 KHz | 25°C | | 97 | | μV |
| Dropout voltage | | 25°C | | 1.7 | | V |
| Bias current | | 25°C | | 4.8 | 6.5 | mA |
| | | 125°C | | | 6 | |
| Bias current change | $V_I = 28V$ to 39V | 0°C to 125°C | | | 1.5 | |
| | $I_O = 1mA$ to 40mA | | | | 0.1 | |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

Ordering Information

| ORDERING NUMBER | PACKAGE | MARKING |
|-----------------|---------|---------|
| 78LXX | TO - 92 | ET78LXX |

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